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# Introduction

Carlisle has a long history of flooding. The city is situated on the flood plain of the River Eden and three rivers meet in the city. There was a significant flood in 2005 in which 3 people died and more than 1800 properties were flooded.

The aim of this exercise is to use a selection of Ordnance Survey map data in ArcGIS, to analyse how many properties are at risk of flooding.

This exercise has been prepared using ArcMap 10.2.



### **Learning objectives**

By the end of this exercise you will be able to:

- download map data from Digimap Collections
- convert GML data to ArcGIS Personal Geodatabase format
- load data into ArcMap
- style map data
- create a buffer
- select features by attribute and save output
- select features by location and save output
- create effective print outputs

# Download data from Digimap

### **Data Requirements**

- Detailed vector data showing buildings.
- Vector data showing rivers.
- Raster maps for context, at 2 scales (1:250000 and 1:10000).
- 1. Go to Digimap:
- 2. <u>http://digimap.edina.ac.uk/digimap/home</u>
- 3. Login.
- 4. Select Ordnance Survey > Data Download.
- 5. Search for Carlisle.
- 6. Click Draw Rectangle.
- 7. Select an area on the map, similar to the image below.



- 8. Select map products, as shown in image below:
  - a. OS MasterMap topography.
  - b. VectorMap Local Raster.
  - c. 1:250000 Raster backdrop mapping.
  - d. Strategi.

	Product		Allowance
3 0	S MasterMap (1 selected)		
1	Integrated Transport Networ	Info	No limit
1	Topography	Info	(17/100) km <sup>2</sup>
3 8	ackdrop Mapping (2 selected	d)	
	MasterMap 1:1000 Raster	Info	(17/200) tiles
	MasterMap 1:2000 Raster	Info	(17/200) tiles
	1:10 000 Raster	Info	(1/200) tiles
	OS Street View	Info	(1/200) tiles
7	VectorMap Local Raster	Info	(1/200) tiles
	1:25 000 Raster	Info	(1/100) tiles
	VectorMap District Raster	Info	(1/100) tiles
-	1:50 000 Raster	Info	(1/50) tiles
1	1:250 000 Raster	Info	No limit
	MiniScale	Info	No limit
ÐL	and and Height Data (0 selec	ted)	
J V	ector Data (1 selected)		
	VectorMap Local	Info	(1/200) tiles
-	VectorMap District	Info	(1/8) tiles
	Meridian 2 National	Info	No limit
	Meridian 2 Tiles	Info	(1/100) tiles
1	Strategi	Info	No limit

9. Click Add to Basket.

Step 3. Add T	o Basket
Add To Basket	Basket /

- 10. Name your order Carlisle.
- 11. Click Request Download.

Product Name	1. Version	2. Format	3. Layers	Preview	Remove
Strategi	January 2014 V	SHAPE V	N/A	•	Ŵ
1:250 000 Raster	June 2014 ¥	TIFF	N/A	0	Ŵ
/ectorMap Local Raster	Full Colour July 201	TIFF	N/A	6	Ŵ
Topography	May 2014 V	GML2 V	All V	0	Ŵ
ive this download a n	ame:		Requ	est Downk	oad

## Download the data file

Now you will receive 2 emails.

1. Click the link in the SECOND email:

Order name: Carlisle	
The order (ref: 222216) you placed for data fr collection.	rom Digimap on 9 October 2014 at 15:02:13 has been processed and is ready for
To collect your data you need to be logged in please follow the steps near the bottom of th	to Digimap and have agreed to the Copyright Notice. If you are NOT logged in, his email.
To collect your data if you ARE logged in, click	on the following URL or copy and paste it into your web browser:
http://digimap.edina.ac.uk/datadownload/d	ownloadorder?downloadHash=efc2876678d10fee148f5379492t

2. Click the Download button:

der Download			
Order Name	Status	Order Date	Download Size
Carlisle	READY	9-Oct-2014	11.9 MB

- 3. Save the file to your personal drive.
- 4. Click OK.



## Unzip the data file

- 1. Open Windows Explorer.
- 2. Navigate to the Digimap download file.
- 3. Right click the file.
- 4. Select Unzip or Extract. Your options may be different to the image here:

Download carlisle 220196.zip	07/10/2014 11:12 Compressed (zinn
	<b>Open</b> Extract with Express Zip Open in new window
	Extract All

5. Unzip the file to a new folder.

## View download file contents

- 6. There is a sub-folder for each map product you downloaded.
- 7. Contents.txt this details all the map products in your order, plus the coordinates of your download area.
- 8. Citations.txt you can copy and paste the text in this file to your bibliography.

Name	Date modified	Туре	Size
🕌 mastermap-topo_622764	13/10/2014 17:20	File folder	
📙 raster-250k_622762	13/10/2014 17:21	File folder	
🎉 strategi_622761	13/10/2014 17:54	File folder	
🎉 vml-raster_622763	13/10/2014 17:06	File folder	
citations_orders_224553.txt	13/10/2014 16:59	Text Document	2 KB
contents_order_224553.txt	13/10/2014 16:59	Text Document	3 KB

# **Convert OS MasterMap data**

The OS Master Map data we downloaded from Digimap is in GML format. We can import data in this format to ArcMap but the data will be much easier to work with if we convert it to an ArcGIS database.

We will use Productivity Suite. If your college or university has an ArcGIS licence, they can get Productivity Suite free of charge. Talk to your lecturers and IT staff to check if it's installed.

Alternatively, you can download a 30 day trial version, see link below.

1. Download and install the software from this link: http://www.esriuk.com/software/arcgis/productivitysuite/download

This ESRI software has an OS Data Converter tool.

2. **Open Productivity Suite > OS Data Convertor**, seen in this image:



3. Introduction screen - Click Next.

/ Introduction	OS Data Converter Tool			
Profile				
Data To Process	Create an ESRI Geodatabase Data Holding from your Ordnance Survey data. The	n maintain your		
Source Data	Data Holding by applying Change-only Update data when you receive it.			
Output Options	Work with Independent, Topological MasterMap or AddressBase data and maintai	n a comprehensive.		
Converting Options	flexible Data Holding with full Change History, including changes to both features and attribution.			
Processing Options				
Concluding Actions				
Processing	Initialization info:			
Processing Complete	<ul> <li>ProductivitySuite Help System; Initialized</li> </ul>			
	<ul> <li>ProductivitySuite: Licenced</li> </ul>			
	<ul> <li>ESRI Product: ArcInfo</li> </ul>			

- 4. Profile Selection screen –leave Create New Profile selected.
- 5. Click Next.

At the end of the conversion process you can save the settings you have made as a profile to apply to future conversions, if you wish.

/ Introduction	Profile Selection	
Profile Data To Process Source Data Output Options Converting Options Processing Options Processing Actions Processing Processing Complete	Select an option you want to use   Create new Profile   Profiles File:  Profile Name:	

Select Data Screen – here we identify the type of data we will convert:

- 6. **OS MasterMap Topography** is the default product selection. Leave this selected. Note that there are other data options available (e.g. Vector Map Local data, available from Digimap).
- 7. Click **Select All.** The conversion will create a database feature class for each option checked.
- 8. Click Next.

✓ Introduction	Select Data To Convert
/ Profile / Data To Process	Select Data Category
Source Data Output Options	Category: OS MasterMap Topography 💌
Converting Options Processing Options	OS MasterMap Topography Options
Concluding Actions Processing Processing Complete	Image: Select All       Image: Select All         Image: Select All       Image: Select All

Select Source data - now we need to select our data file or folder.

9. Click **Add Folder.** Our OS MasterMap download can consist of more than one GML file in the download folder, so Add Folder is the right option.

Introduction	Select Source Data	
/ Profile / Data To Process	0	Add File(s)
Source Data	-	Add Folder
Output Options		
Converting Options		× Remove
Processing Options		C Defect
Concluding Actions		Refresh
Processing		
Processing Complete		
		View Type List of Items ✓ Sort Items (2) Z↓

- 10. Navigate to your Digimap download file.
- 11. Click the **mastermap-topo** folder.
- 12. Click **OK**.



13. Check the right folder is listed in the Select Source Data window.

#### 14. Click Next.

✓ Introduction	Select Source Data	
✓ Profile ✓ Data To Process ✓ Source Data	nap data - workshop version\Download_carlisle_220196\mastermap.topo_609800	Add File(s)
Output Options		-
Converting Options		× Remove
Processing Options		
Concluding Actions		Refresh
Processing		
Processing Complete		
		View Type List of Items

Output options – here we select the type of database we want and create our geodatabase.

- 15. Click the drop down arrow.
- 16. Select Personal Geodatabase.



- 17. Now we need to create the geodatabase.
- 18. Click the container icon with the red star:

Storage Type:	Personal Geodatabase	*
Geodatabase locat	ion: 이	
		0 0

19. Click the yellow folder with the plus sign, to create a folder connection to your Digimap data folder.

Surcresse	onal G	eodatal	base As				-				(	ж
Look in:		older C	onnections	 _	仓	- 🖻	5 8	3	Ē	Ш¥	6	9
C:\Pro	gram	Files		 					-	-		
C:\Use	ers\Vin	∧Deskt	ор									
C:\Use	ers\Vi	Down	loads									
E:\												
E:\lee	ls dig	imap es	sentials									
E:\Wir	d Far	ms										
H:\viv												
H:\viv	wnlo	ads										
H:\viv	wnlo	ads										
H:\viv	wnlo	ads										•
H:\viv	wnlo	ads						]		Si	ave	

- 20. Navigate to the Digimap data folder.
- 21. Click on the folder to select it.
- 22. Click OK.



23. Type a name for your geodatabase in the file name – we suggest mmap\_topo\_carlisle.24. Click Save.

kin: 🛅	Download_carlisle_224553	• 4	2	•	8	P	Ũ	6	9
mastermap raster-250k strategi_62 vml-raster_	s-topo_622764 _622762 2761 622763								
ime:	mmap_topo_carlisle						Sa	ive	

- 25. Prefix type some letters as a prefix it doesn't matter what.
- 26. Click Next.

/ Introduction	Output Options
/ Profile / Data To Process	Output Storage
Source Data	Storage Type: Personal Geodatabase
/ Output Options	Geodatabase location: New!
Converting Options	7.\  ker Sunnot\Trainina\Geo\Training evercises\Flood evercise Carlisle\D
Processing Options	
Concluding Actions	Status: 😑 Database will be created Create 🏖 😭
Processing	
Theesang complete	Table Name Prefix: OS

Converting options screen:

- 27. Click Check for and remove duplicates.
- 28. Click Next.

✓ Introduction	Converting Options
✓ Profile ✓ Data To Process	CoU Options
✓ Source Data	Change-only Update
✓ Output Options	Save old versions of features in Archive datasets
✓ Converting Options	Change-only Update preview
✓ Processing Options	Delay Change-only Lindate changes
Concluding Actions	
Processing	Loading Options
Processing Complete	Erase any existing data in the datasets      Check for old versions of features      Check for and remove duplicates      Manage Load On Database (for use with large or national loads)      Annotation Reference Scale: 1000

29. Processing options screen (no image shown) – click Next.

30. Concluding actions screen. If you wish you can save your profile to reuse it in future.

31. Click **Finish** to start the conversion.

✓ Introduction	Concluding Actions	
✓ Profile ✓ Data To Process ✓ Source Data	Profile Options	
✓ Output Options	Profiles File:	-
✓ Converting Options ✓ Processing Options	Profile Name:	
✓ Concluding Actions		
Processing Processing Complete	Where Next?  Process this Profile  Start Condition: New	
	Save Profile and Exit     Save Profile and Restart	

32. You should receive a Processing Complete screen.

✓ Introduction	Processing Result
Profile Data To Process Source Data	The process was successfully completed Result:
Output Options Converting Options Processing Options Concluding Actions Processing Processing Complete	The process was successfully completed Errors: 0 Warnings: 0

33. Click **Close** to exit Productivity Suite.

### Locate your Geodatabase

- 1. Open Windows Explorer or My Computer.
- 2. Navigate to your Digimap data folder.
- 3. Check your geodatabase is there it has a suffix of MDB:

mastermap-topo_609800	07/10/2014 11:50	File folder	
raster-250k_609798	07/10/2014 11:50	File folder	
strategi_609797	07/10/2014 11:50	File folder	
streetview_609799	07/10/2014 11:50	File folder	
terrain-50-dtm_609796	07/10/2014 11:50	File folder	
citations_orders_220196.txt	07/10/2014 11:07	Text Document	2 KB
contents order 220196.txt	07/10/2014 11:07	Text Document	6 KB
mmap topo carlisle.mdb	09/10/2014 11:20	Microsoft Access	245,088 KB

# Load data into ArcMap

Let's start loading our data into ArcMap.

### Set coordinate system

First, we should set our data frame coordinate system.

- 1. Open ArcMap.
- 2. Select New Maps > Blank Map > OK.
- 3. Select View on the toolbar.
- 4. Select Data Frame Properties.



- 5. Click the **Coordinate System** tab.
- 6. Select Projected Coordinate Systems > National Grids > Europe > British National Grid.
- 7. Click Apply.
- 8. Click OK.



### Save your ArcMap document

- 1. Click File > Save.
- 2. Choose a suitable folder.
- 3. Name your document.
- 4. Click Save.

Q Save As					×
Save in:	Download_	carlisle_224553	•	3 🤌 📂 🛄 🗸	
(Pa)	Name	*	-	Date modified	Туре
Recent Places Desktop Libraries Computer	<ul> <li>masterma</li> <li>raster-250i</li> <li>strategi_62</li> <li>vml-raster</li> </ul>	p-topo_622764 &_622762 2761 _622763		14/10/2014 10:22 13/10/2014 17:21 13/10/2014 17:54 13/10/2014 17:06	File folde File folde File folde File folde
	•	ш			Þ
INELWORK	File name:	carlisle.mxd		-	Save
	Save as type:	ArcMap Document (*.	nxd)	-	Cancel

### Add OS MasterMap data

- 1. Click the Add Data button or File > Add Data..
- 2. Navigate to your Digimap data folder.
- 3. You may need to connect to the folder. Click the Connect to folder button and select the



- 4. Double click the geodatabase you just created, mmap\_topo\_carlisle.mdb.
- 5. Select **OSArea** (you may have a different prefix, depending on what you added in conversion).
- 6. Click Add.



### Add Strategi data

Now let's add some of the Strategi vector data - we only want the rivers.

7. Click Add Data



- 8. Go back to the Digimap folder.
- 9. Double click the Strategi folder:



- 10. Click rivers\_line.shp.
- 11. Click Add.



### Add 1:250000 raster map

Next, let's add in a small scale raster map for context.

- 1. Click Add Data
- 2. Go back to the Digimap folder.
- 3. Double click the **raster-250k** folder.
- 4. Select ny.tif.
- 5. Click Add.

6. If you get a Build Pyramids message - say YES.

Add Data								1	×
Look in:	raster-250k_609798	• 4		m	•	8	E	Ū,	6
250k_raster my.tif os_open_co	_gaz_2014.txt onditions.txt								
Name:	ny.tif						,	Add	
Snow of type:	Datasets, Layers and Results		_	 _	•	l	Ca	ancel	

# Style data

### Symbolise our OS MasterMap data

Our OS MasterMap data does not look as it does in Digimap, or on the OS website. ArcGIS loads data in random colours.

Productivity Suite supplies some layer files that will symbolise the map data to look more like the OS cartography. We have provided these files for you to use today.

Let's apply one to the Area layer.

- Right click **OSArea** in the Table of Contents.
- Select **Properties.**
- Select the **Symbology** tab.
- Click the **Import** button at top right of the tab, as shown in the image below:

Symbology	Fields	Definition Query	Labels	Joins & B	elates	Time	нтм	L Popu
atures usi	ng the s	ame symbol.			Im	port	]	
		1						

• Click the yellow folder icon next to Layer:

Import Symbology	
Import symbology definition from another	her layer in the map or from a layer file:
Import symbology definition from an A	rcView 3 legend file (*.avl):

- Navigate to the folder **TopographyLayerFiles**.
- Double click on the folder.
- Click the file OSMMAreas Feat Code Desc Group.lyr.
- Click Add.



- What do you want to import? **Complete Symbology definition.**
- Click OK.



- Check Value Field is **FEATCODE**.
- Click OK.



- You should now see the box on the Symbology tab populated with different symbols for different types of Area feature.
- Click Apply.
- Click OK.

ieneral	Source Se	ection Displ	ay Symbology	Fields Defin	nition Query	Labels	Joins & Relat	es T	ìme	HTML Popup
how:		-					- 26-ld-	Inc		
Feature	S	Draw C	ategones usin	ig unique vali	ues combi	ning up t	o s neids.	Imp	Oft	
Categori	ies	Value Fi	elds		Color	Ramp			_	
Uniqu	le values	FeatCo	de		·				•	
- Uniqu Mate	b to sumbole	DescGr	roup							
Quantiti	es	none		100						
Charts										
Multiple	Attributes	Symbol	Value		abel		Count			
			call other value	(9)	all other valu	(99)				
			<heading></heading>	F	EATCODE	DESCG	RO	1		
			10217, Unclas	sified 1	0217, Uncla	ssified	?		1	
N. Landa			10210, Tidal W	/ater; 10210, 1	0210, Tidal	Water	?			
	(Y	A	10203, Tidal W	/ater; 10203, 1	0203, Tidal	Water	?		*	
			10193, Structu	re: 10193, Ra 1	0193, Struct	ture	?			
	-5		10187, Structu	re 1	0187, Struct	ure	?	-		
	3 5		Add )	/ahuan i	Damawa	Remain		hanne	-	
		Aug Au	raiues / nuu v	diues	Teniove	riemov		valice	su ·	

- Right click the OS Area layer.
- Select Zoom to Layer.
- Your map data should be symbolised, for example see the image below. NOTE: to add building numbers/names, we would need to add our Annotations layer from our Personal Geodatabase. You don't need to do that now.



• Click on the plus sign next to OSArea in the Table of Contents, to open and view the legend.

Table Of	Contents
S: 🔒 🕯	😂 🖳 🗄
🖂 🎒 La	ayers
	] rivers_line
□ 🗹	OSArea
	FEATCODE, DESCGROUP
	10021, Building
	10053, General Surface
	10054, General Surface
	10056, General Surface
	10062, Glasshouse
	10076, Historic Interest
	10089, Inland Water
	🖂 10093, Landform
	🖂 10096, Landform
	🔄 10099, Landform
	10111, Natural Environment
	10119, Path
	10123, Path
	10167, Rail
	10172, Road Or Track
	10183, Roadside
	10185, Structure
	10187, Structure
	10193, Structure
	10203, Tidal Water
	10210, Tidal Water
	10217, Unclassified
÷	] ny.tif

Next, we will look at our rivers data.

- We will select a smaller area of the rivers map data and create a new file of that selection.
- We will also style our rivers data.

## Select smaller rivers area

Our rivers layer covers all of Great Britain. Remember the rivers are Strategi data – this is always provided for the whole of GB from Digimap.

Let's select a smaller area of the rivers layer. Our map will draw faster with a smaller area.

- 1. First, right click on **ny.tif** in the Table of Contents.
- 2. Select **Zoom to Layer.**

We will use the **ny.tif** layer as a guide for selecting the rivers.

Your map window should look similar to this image – you can see the ny.tif file, the rivers around it and the small area of OS MasterMap data in the centre.



- 3. Click Selection on the toolbar.
- 4. Click Select by Rectangle.



- 5. Click on your map window.
- 6. Draw a box over **ny.tif**.
- 7. You should see all the data within that box highlighted in blue on your map, like this image:



8. Now click List By Selection in the Table of Contents.



You will see that features have been selected from rivers AND OS MasterMap.

- 9. Right click rivers\_line.
- 10. Click Create layer from selected features.



11. Now click List by Drawing Order in the Table of Contents:



- 12. You will see a new layer in the Table of Contents rivers line selection.
- 13. Right click rivers line selection.
- 14. Click **Data > Export data –** we will save the selection as a new file.
- 15. Click the yellow folder icon.

kport Da	ta 🔣
Export:	All features
Use the s	same coordinate system as:
O this la	yer's source data
) the d	ata frame
the fe (only)	ature dataset you export the data into a geodataba <mark>se).</mark>
Output f	eature dass:
C:\Use	rs\\fv\Downloads\Download_carlisle_217565\meridian2_atic 🛗

- 16. Choose a folder to save the new file.
- 17. Name the new file, for example **rivers\_selection.**
- 18. Ensure that the **file type is Shapefile.**
- 19. Click Save.



- 20. Click OK.
- 21. Add exported map data as a layer? Say Yes.

You will have a new rivers layer in your map.

22. You can remove or uncheck the other rivers layers.

Table Of Contents		
🗽 🏮 🧇 📮 🗄		
🖃 🥌 Layers		
□ I rivers_selection	n	
🖃 🔲 rivers_line sele	ction	
	B	Сору
🖃 🔲 rivers_line	×	Remove
-	m	Open Attribute Table

Finally, we still have features selected. Let's clear them.

- 23. Click **Selection** on the top toolbar.
- 24. Click Clear Selected Features.

### Style our rivers data

We could go to the Digimap help pages and try and find a layer file for our Strategi rivers data (remember we used a layer file to style our OS MasterMap Area). Or the Ordnance Survey website might have one.

Alternatively, we can use the layer's attribute data to quickly style this layer. Let's try that.

- 1. Right click rivers\_selection.
- 2. Select Open Attribute Table.
- 3. Look at the **Legend** field. It gives the type of river, e.g. main, minor, secondary. We can use these entries to create a different style for each type of river.
- 4. **Close** the Attribute table.
- 5. Right click **rivers\_selection.**
- 6. Select **Properties > Symbology.**
- 7. On the left, select **Categories >Unique Values.**
- 8. Click on **Value Field** drop down.
- 9. Select LEGEND.

General	Source	Selection	n Display	Symbology	Fields	Definition Que
Show: Features Categories Unique values Unique values, many Match to symbols in a		s s, many pols in a	Draw cate Value Field CODE LEGEND	egories usin	g uniqu	e values of c
Charts Multiple	e Attribu	tes	NAME	-		other

10. Now click **Add all values**, under the box.

General	Source	Selection	Display	Sy	mbology	Fields	D
Show: Features Categories Unique values Unique values, many Match to symbols in a Quantities Charts Multiple Attributes		tes	raw cal alue Fiel EGEND /mbol	d Value <all ot<="" th=""><th>ies usin</th><th>g uniqu s&gt;</th><th></th></all>	ies usin	g uniqu s>	
		, Y A	d All Va	lues	Add V	alues	1

- 11. The box should be populated with different symbols for different river types, as shown in the image below.
- 12. Click Apply > OK.

eneral Source Select	ion Displa	y Symbology	Fields	Definition Query	Labels Jo	oins & Relates	Time	HTML Popup
iow:	Draw ca	ategories usin	ig unique	values of one	e field.		nport	
reatures	Value Fie	4d		Color	Ramo	0.4		
- Unique values - Unique values, many	LEGEND							
Match to symbols in a	Symbol	Value		Label		Count		
harts		call other value	624	call other val	Ies>	0		
ultiple Attributes		<heading></heading>	20	LEGEND		1999		
	Main River, Lower		Main River, L	Main River, Lower 38				
		Main River, Mi	ddle	Main River, M	Aiddle	100		
		Main River, So	urce	Main River, S	Source	41		
	Minor River     Secondary River, Lower		Minor River	Minor River 1421 Secondary River, Lower 149		+		
			Secondary R					
		Secondary Riv	er, Source	Secondary R	iver, Source	250		
7 74								
1 free	Add All V	alues Add \	/alues	Remove	Remove	All Advar	nced •	
					01			

- 13. Unhappy with the styles? For example you may want to make the main rivers a thicker line.
- 14. Click any symbol next to an entry in the Table of Contents try Main River, Lower.

🖃 🎒 Layers
rivers_selection
— <all other="" values=""></all>
LEGEND
— Main River, Lower
- Main River, Middle
- Main River, Source
- Minor River
- Secondary River, Lower
<ul> <li>— Secondary River, Source</li> </ul>

- 15. The **Symbol Selector box** should appear.
- 16. Select a colour and a line thickness, for example blue and width of 2.
- 17. Click OK.

Type here to se	arch	- 🧕 🔊 🗄	Current Symbol
earch: 💿 /	All Styles	C Referenced Styles	
ESRI			· · · · · · · · · · · · · · · · · · ·
_		_	Е
Highway	Highway Ramp	Expressway	Color:
			Width: 🛛 🔁
Expressway Ramp	Major Road	Arterial Street	Edit Symbol
		+	Save As Reset
Collector Street	Residential Street	Railroad	
		##000##000	
River	Boundary, National	Boundary, State	
			Style References

- 18. Repeat with other layers until you are happy with the map.
- 19. Right click rivers selection in the Table of Contents.
- 20. Select Save As Layer File.
- 21. Save the LYR file in the Digimap data folder you can use the layer file in the future to apply the same style to Strategi data note the layer file contains the style, not the actual data.

q	Data	, D M
0	Save As Layer File	- PA V
	Create Layer Pack	Save As Layer File
r	Properties	Save this laver as a file (saves the
7, Rail	d Or Track	layer definition not the data)
3. Roa	idside	

## Query our data

Question: How many buildings in Carlisle are at risk of flooding?

To answer this, we need to:

- 1. Define an AT RISK area around the rivers, within which buildings could potentially flood.
- 2. Query how many buildings lie within the AT RISK area.

### 1. Buffer the river centreline

Let's say that any property within 100m of the river will be considered "AT RISK" from flooding.

We can use the river centreline and create a 100m buffer around it.

- 1. We will use our **rivers selection** layer.
- 2. Open the Buffer tool
  - a. **Geoprocessing**  $\rightarrow$  **Buffer** (note: this function can also be found in ArcToolbox  $\rightarrow$ Analysis Tools  $\rightarrow$  Proximity  $\rightarrow$  Buffer).
  - b. Set the input features to rivers selection (your file name might be different).
  - c. **Output Feature Class** click the yellow folder next to this.
  - d. Save the new buffer file in your Digimap data folder.
  - e. Name it **river\_buffer100.**
  - f. Set the Linear Unit to **100** and the units to Meters.
  - g. Click OK.

Input Features			
rivers_selection			🛨 🖻
Output Feature Class			
C:\Users\Viv\Downloads\Download_carlisle_217565\river_bu	ffer 100.shp		6
Distance [value or field]			
	100	Meters	-
C Field			
Side Type (optional)			
FULL			-
End Type (optional)			
ROUND			
Dissolve Type (optional)			
NONE			-
Dissolve Field(s) (optional)			
FID			

3. A new layer will be created and added to your map.

Let's zoom in to the city centre.

- 4. Right click the layer **OSArea.**
- 5. Click **Zoom to Layer.**
- 6. Uncheck **ny.tif** in the Table of Contents.



7. You should be able to see a buffer zone around all the rivers, similar to this image.

## 2. Calculate the number of buildings in the buffer

Now let's calculate the number of buildings that lie within the buffer we have just created.

This is a 2 stage process.

- 1. First we will select all the features that are buildings, in our OSArea layer.
- 2. Right click **OS Area.**
- 3. Select Open Attribute Table.
- 4. Scroll along until you find the field DescGroup. Scroll down and you will see features described as Building.
- 5. Now let's select all those features.
- 6. Click the arrow at the top left.
- 7. Click Select by Attribute.



- 8. Double click **DescGroup** it is added to our query in the bottom box.
- 9. Single Click = the equal sign.
- **10.** Single click **Get Unique Values.**
- 11. Double click Building.

We now have a query that we can run.

- 12. Click Apply.
- 13. **Close** the Select by Attributes query box.

Method :	Create a ne	w selection	-
[Theme] [CalcArea] [Change] [DescGrou [DescTem	[qu ]		•
= < > > < < ?• (	> <u>Like</u> = <u>And</u> = <u>Or</u> () <u>Not</u>	'Building' 'General Feature; Road Or Track' 'General Surface' 'General Surface; Road Or Track' 'General Surface; Structure'	- -
Is SELECT * F	ROM OSArea	Get Unique Values Go To:	
[DescGroup	o] = 'Building		^
			*

14. **Close** the Attribute Table.

You should see some building features highlighted in blue on your map to show they are selected.

If you zoom in, you should be able to see that some of your buildings lie within the buffer, as seen in this image. We want to know how many.



- **15.** Choose **Selection > Select by Location** from the top toolbar.
- 16. Selection method choose select from the currently selected features in:

Select features from one or more target layers based on their location in relation to the features in the source layer.	
select features from	
relact features from	
add to the currently selected features in	
remove from the currently selected features in	
select from the currently selected features in	

- 17. Target Layer Select OSArea.
- 18. Set source layer to **riverbuffer100** (this is our outline feature we want to see what is within it).
- 19. Set Spatial Selection Method: intersect the source layer feature.
- 20. Press Apply > OK.

elect By Location	23
Select features from one or more target layers based on their location in relation to the features in the source layer.	
Selection method:	
select from the currently selected features in	•
Target layer(s):	
☐ river_buffer 100 ☑ OSArea	
Qnly show selectable layers in this list     Source layer:	
💠 river_buffer100	•
Use selected features (0 features selected) Spatial selection method for target layer feature(s):	
intersect the source layer feature	•
Apply a search distance	
700.000000 Meters ~	

21. The features that match our search criteria will now have been selected and will appear blue on the map.



Let's save our selected features as a Shapefile.

1. Switch table of contents to List by Selection.



2. In our map, 563 features are selected –**NOTE:** you will probably have a different number, as you will not have downloaded exactly the same area of OS MasterMap data.

Table Of Contents		4 ×
🎭 🥥 🧶 🕄		
<ul> <li>Selected</li> </ul>		
📀 OSArea	☑ ☑ 563	
<ul> <li>Selectable (no features selected)</li> </ul>		
🚸 rivers_selection	0 🖸 🖬	2
🚸 river_buffer100	M 🖸 0	
Not Selectable		
♦ ny35ne.tif		
my45nw.tif		
Iny.tif		

- 3. Right click the OSArea layer.
- 4. Click Create layer from Selected Features.
- 5. Return to List by Drawing order we should have an extra layer called **OSArea selection.**

- 6. Right click **OSArea selection**.
- 7. Select Data > Export Data.
- 8. Export All features.
- 9. Select the same coordinate system as the layer's source data.
- 10. Save the data in our Digimap data folder with the name **BuildingBuff100.**
- 11. Ensure you select **Shapefile** as the file type.
- 12. Add data to the map as a layer when prompted.
- 13. Remove the other layer, OS Area selection:



14. Clear the selected features (they are still selected in memory): **Selection > Clear Selected Features**.



## Export your map

We have done some basic analysis. Let's make a map that we can export and include in a document, to represent the houses that are at risk of flooding in Carlisle.

Our map needs to show:

- River line
- River buffer
- The buildings within the buffer
- Background mapping for context

## Display the right data

- 1. Zoom to a scale of 1:10000.
- 2. Check these boxes in the Table of Contents:
  - BuildingBuff100.
  - Rivers\_selection.
  - River\_buffer100.
  - Ny.tif the 1:250000 raster data.
- 3. Uncheck everything else in the Table of Contents.



How does our map look? It should look similar to the image below.



- 1. Problem our background raster map (1:250000 raster, ny.tif) is too small a scale we need a more detailed map.
- 2. Click Add Data
- 3. Go back to the Digimap folder.
- 4. Double click the **VML-Raster** folder:



- 5. Double click the NY folder.
- 6. Ctrl-click to select the TIF files.
- 7. Click **Add.**
- 8. Say YES to Build Pyramids.

Add Data			×
Look in:	ny 🔻	🏝 🏠 🐻   🏢 ◄   😂   🖆	
ny35ne.tif			
Name: Show of type:	ny35ne.tif; ny45nw.tif Datasets, Layers and Results	← Can	ld cel

9. Uncheck ny.tif (the smaller scale, 1:250000 data) in the Table of Contents.

### Styling

- 1. River\_buffer100 we could change the colour to blue.
- 2. Click the symbol under river\_buffer100 in the Table of Contents.

Table Of Contents	
See 🔍 🤤 😓 🛛	
🖃 🎒 Layers	
BuildingBuff100	
OSArea selection	
rivers_selection	
river_buffer100	
OSArea	

- 3. The Symbol Selector box will open.
- 4. Select a blue colour.
- 5. Click OK.
- 6. Now let's make the buildings stand out more.
- 7. Repeat the steps above to change the symbol for BuildingBuff100 choose a bright colour, for example red.
- 8. Finally, let's try labelling the rivers\_selection layer.
- 9. Right click rivers\_selection.
- 10. Click Label features.
- 11. You should be able to see a label on the River Eden. To change the size, right click and select Properties > Labels and play around with the options.

### Our new map is clearer.



### **Export your map**

You can export your map in various formats, including image formats (jpg/tiff/png) or a pdf.

### Layout view

ArcMap has 2 views, Data and Layout. To produce a print map, we must switch to the Layout view. The buttons are in the bottom left hand corner of the map window.



- 1. Switch to Layout View.
- 2. Click the Insert menu on the toolbar:

Inse	ert Selection Geo	proc
9	Data Frame	
Title	Title	1
A	Text	1
	Dynamic Text	
	Neatline	T
E	Legend	
ň	North Arrow	
	Scale Bar	
1:n	Scale Text	
	Picture	
	Object	

- 3. Insert a Legend, North Arrow, Title and Scale Bar.
- 4. Click **File > Export Map.**
- 5. Click Save as Type and select a format try TIF.
- 6. For guidance with formats and output options, see this ArcGIS help page:

http://resources.arcgis.com/en/help/main/10.1/index.html#//00sm00000004000000

#### **Data View**

In **Data View**, then the legend, scale bar etc will not be printed. You will just get a snapshot of the visible map.

In this view you get the option to create a World file. This can be useful as it contains the geographic coordinates of your map.

A World file allows you to add the image back into ArcMap and it will appear in the correct geographical position.

# **Further steps**

What else could you do with this project?

- 1. Create or look for more accurate flooding data, perhaps from the Environment Agency.
- 2. Download and add Digital Terrain Model data to your map to get a clearer understanding of the terrain.
- 3. Download and add Environment Land Cover data, to get a picture of activity in surrounding areas.