R2: Water Flow Regulation

Ecosystem Service Definition
Impact of soil and vegetation on reducing surface run-off, peak flow, and flood extent and depth. Mechanisms include interception, evapotranspiration, infiltration, and physical water flow slowing.

Baseline Methods & Rationale
A relational dataset was produced to map the Carbon Storage ecosystem service baseline within Gloucestershire. The modifier layer from this dataset consists of the intersection of habitats from the Gloucestershire Habitat Inventory with flow pathways generated from a 25m-resolution Digital Elevation Model (European Environment Agency, 2016) of the county. Multiplier values for intersecting and non-intersecting habitats are shown in Table R2.1.

Table R2.1: Multiplier values applied for intersecting and non-intersecting habitats

Habitat Intersects Flow Pathway	Multiplier
Yes	1.4
No	1.0

Opportunity Methods & Rationale
A relational dataset was also produced to map Carbon Storage ecosystem service opportunity.

Flow pathways, flow pathway nodes, and the Water Flow Regulation Baseline layer, were entered into the model. The baseline input was 'inverted' by subtracting each value from the maximum in the dataset. Cost analysis was used to calculate cumulative flood risk of cells intersecting flow pathways from outlet to source. The cumulative flood risk values were split into deciles (10% intervals) to produce a 10-point score used to modify baseline values (Table R2.2).

The line vector data was converted to distinct polygons for each decile using Voronoi polygons, defined from the vertices of the flow pathways. These polygons were then dissolved to produce one polygon per decile, and the polygons rasterised as per the multiplier values in Table R2.2.

Table R2.2: Multiplier values applied for each cumulative flood risk decile

Cumulative Flood Risk Decile	Multiplier
1	1.0
2	1.1
3	1.2
4	1.3
5	1.4
6	1.6
7	1.8
8	2.0
9	2.2
10	2.4

Limitations and Further Development
Flow pathways were generated with a relatively low-resolution digital elevation model (DEM) of 25m (EU Copernicus). Higher resolution datasets are available; however, these are not yet available with full coverage of Gloucestershire and require a much greater amount of computer processing capacity. Further work should make use of updated DEMs as and when full coverage becomes available and computer processing capacity improves.

The flow pathway intersection completed for the baseline layer does not account for position of an intersecting habitat within the catchment. This may be completed through

a cost analysis of the flow pathways from outlet to source; this would act as a proxy for measuring the position of each cell within a pathway from the pathway's outlet.

Climate change is also not factored into the flood risk data used here, but should be considered as flood risk data is updated to include modelled climate change impacts.

References

European Environment Agency, 2016. European Digital Elevation Model (EU-DEM), version 1.1. Available at: https://land.copernicus.eu/imagery-in-situ/eu-dem/eu-dem-v1.1?tab=metadata

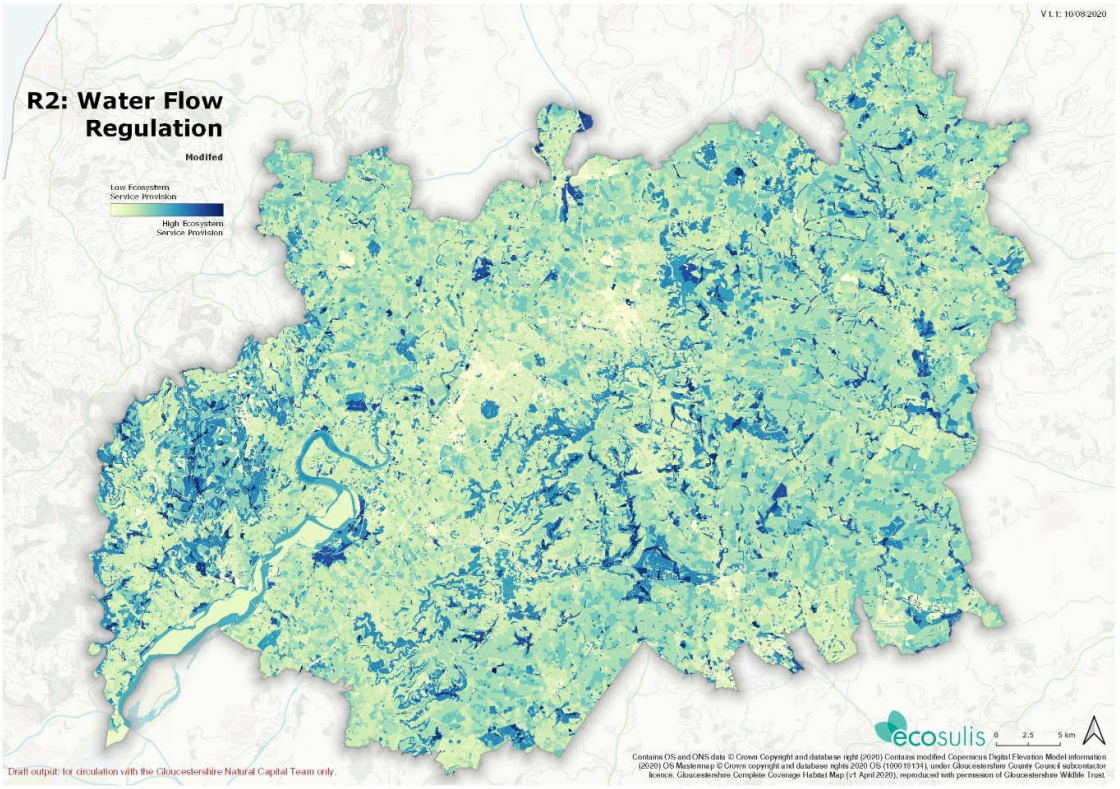

Figure R2.1: Water Flow Regulation Baseline (relational)

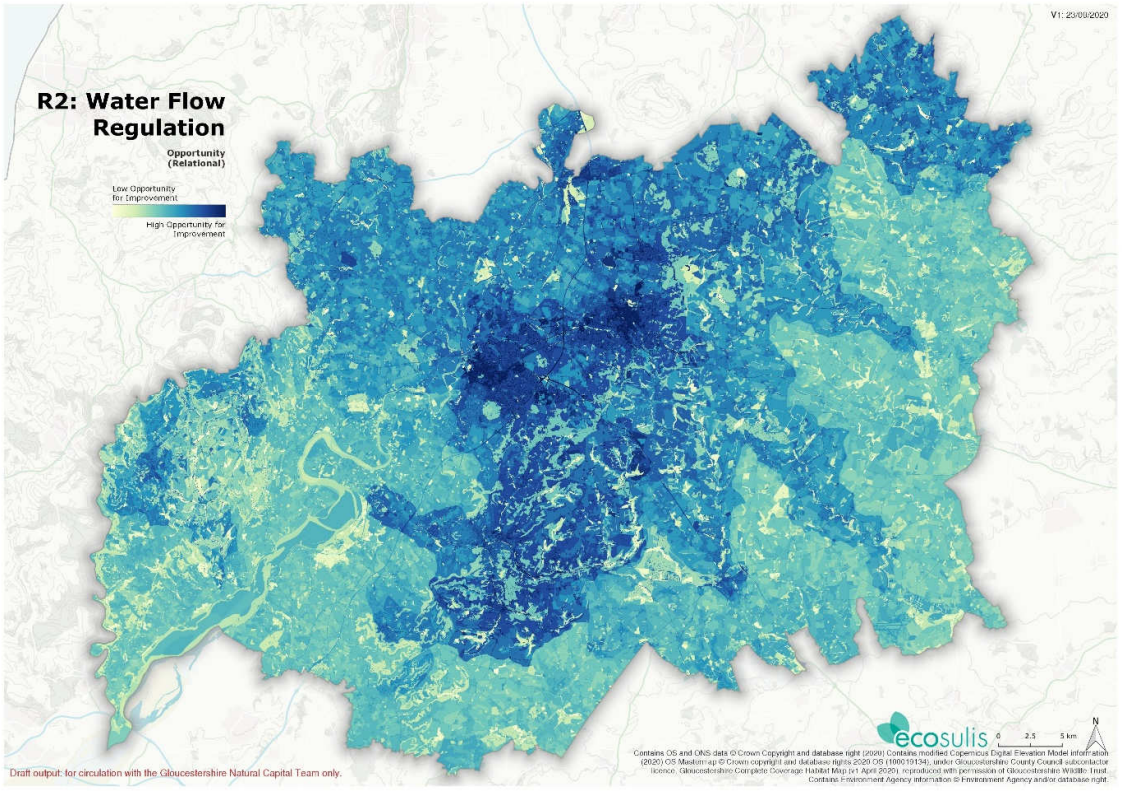

Figure R2.2: Water Flow Regulation Opportunity (relational)