ARGYLL AND BUTE COUNCIL **COMMUNITY SERVICES COMMITTEE**

EDUCATION **15 DECEMBER 2022**

CREATION OF HIGH QUALITY STEM CURRICULUM MATERIALS

1.0 EXECUTIVE SUMMARY

1.1 The purpose of this report is to provide an update to elected members on the outcome of a funding bid to the UK Government Community Renewal Fund (UK CRF).

1.2 Argyll and Bute Council's Digital Learning team were awarded £100,000 through the grant to commission the creation of high quality Science, Technology, Engineering and Maths (STEM) materials.

1.3 The STEM materials – called the Curiosity Labs - were custom designed around areas of future economic growth across Argyll and Bute.

1.4 The Curiosity Labs materials are comprised of 69 documents for experiments (including presenter notes and worksheets), 10 custom videos specifically produced for Argyll and Bute and 25 PowerPoint presentations to support teachers in delivery of the materials.

1.5 A number of bespoke items were designed to support the STEM materials and manufactured using the latest 3D and laser printing technology.

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2.0 INTRODUCTION

2.1 Argyll and Bute Council's Digital Learning team was awarded £100,000 through the UK Government Community Renewal Fund (UK CRF).

2.2 The funding was used to commission the creation of high quality Science, Technology, Engineering and Maths (STEM) materials.

2.3 Following a robust procurement exercise the Glasgow Science Centre was awarded a contract to create the STEM materials for £78,100. The remaining grant was used to purchase equipment, technology and complete a comprehensive evaluation of the project.

2.4 The STEM materials – called the Curiosity Labs - were custom designed around areas of future economic growth across Argyll and Bute - Cyber Security, Renewable Energy, Engineering & Physics and Biology & Marine Science.

2.5 The Curiosity Labs materials are comprised of 69 documents for experiments (including presenter notes and worksheets), 10 custom videos specifically produced for Argyll and Bute and 25 PowerPoint presentations to support teachers in delivery of the materials.

2.6 To enhance the learning experience for pupils a number of bespoke items were designed to support the STEM materials. These items were manufactured using the latest 3D and laser printing technology (a sample selection of these are shown in section 4).

3.0 RECOMMENDATIONS

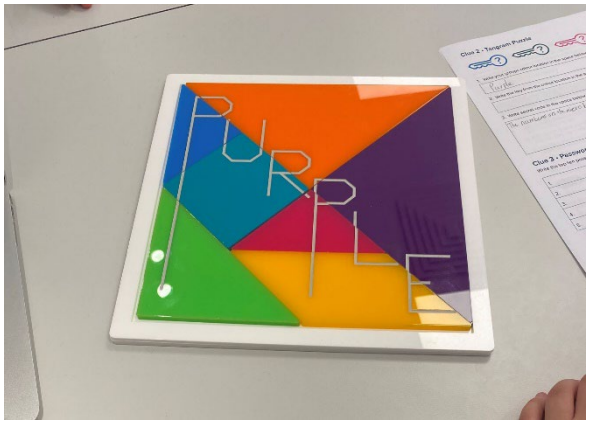
It is recommended that the Community Services Committee:

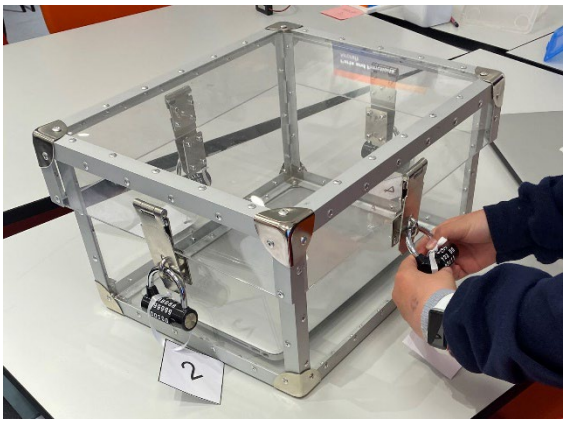
3.1 Recognise the benefits the STEM materials, which have been created, will provide to the pupils and employers in this area.

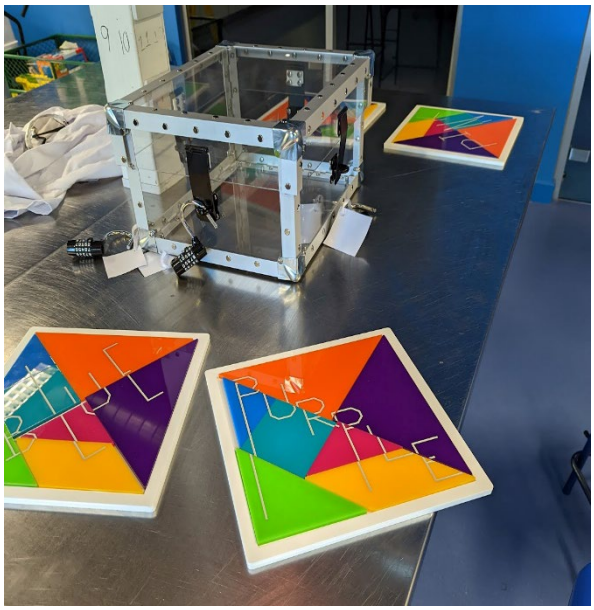
4.0 DETAIL

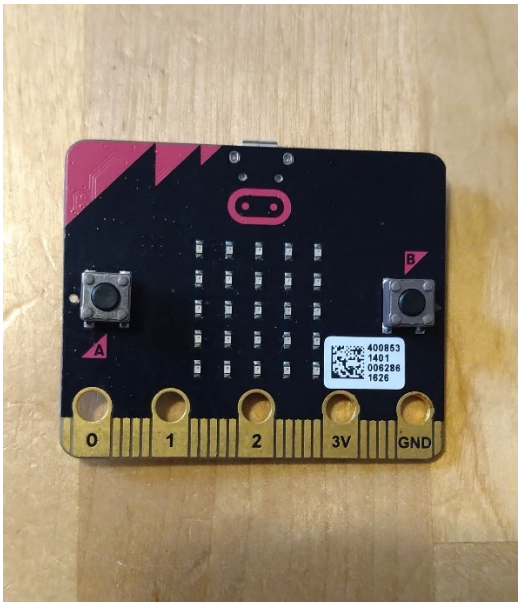
4.1 Cyber Security:

The custom made tangram puzzles and lock box (pictured below), are part of an escape room style activity where pupils must complete a series of linked puzzles in order to access a laptop secured within the lock box. The tangrams reveal the location of ‘keys’ which are entered into pre-programmed micro:bits which, in turn, reveal the combination for the padlocks on the lock box. Once pupils are able to access the laptop they must crack the password to beat the escape room. These tasks are carried out in teams but with all teams working towards the final goal.









4.2 **Engineering and Physics:**

The worksheet for rocket design (pictured below) is to be completed by pupils to record flight data from rockets that they have designed and constructed using reusable PVC or cardboard tubes for the bodies along with additional paper, card or plasticine. Rockets are launched using compressed air and pupils can record the speed of the rocket with a radar gun.

Argyll and Bute **Curiosity Lab**

Engineering & Physics

Worksheet 2

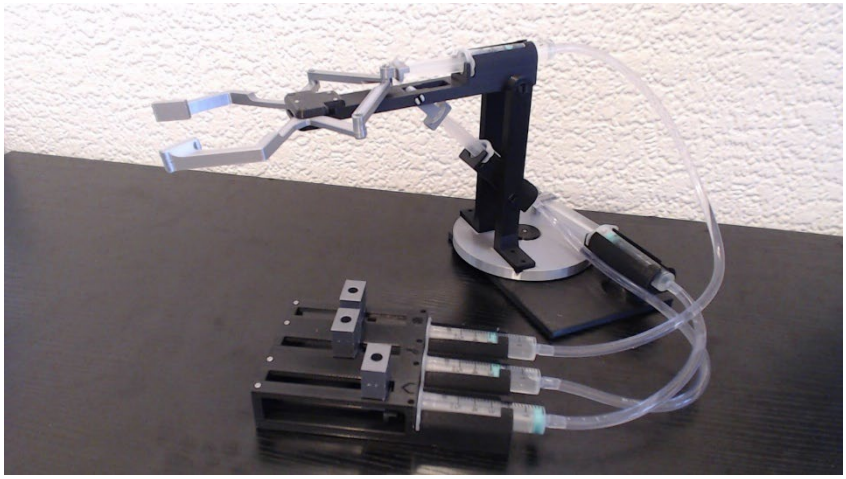
Rocket Launcher

You are going to be designing and launching rockets.
You will be building three rockets to test.

Record the speed each of your rockets travelled and describe each flight path in the table below.

Rocket design	Did you launch this rocket?	Max. speed (mph)	Describe the flight path
1			
2			
3			

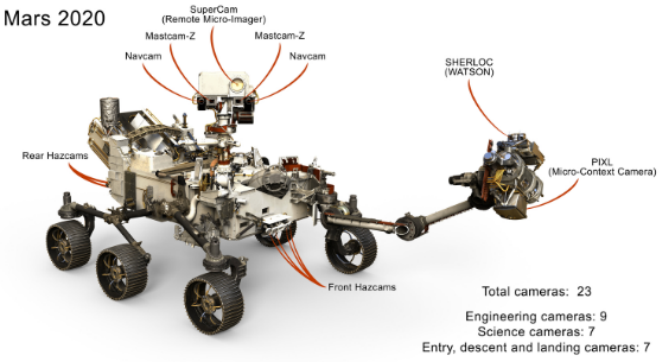
This custom designed hydraulically controlled robotic arm has been created for pupils to test and identify the skills required to be able to operate remote controlled machines. The arm is operated using sliders on a control unit. These sliders cause water to be pushed to different sections of the arm, which, in turn, cause the arm to turn, extend or grip. This arm is used in combination with an activity examining the use of robots in space.



Below is an example slide from the Engineering and Physics module. The activity associated with this slide looks at the problems of navigating Martian environments with robots controlled from Earth. Pupils will use a Lego Mindstorms EV3 robot to simulate this process while also being introduced to programming.

Programming

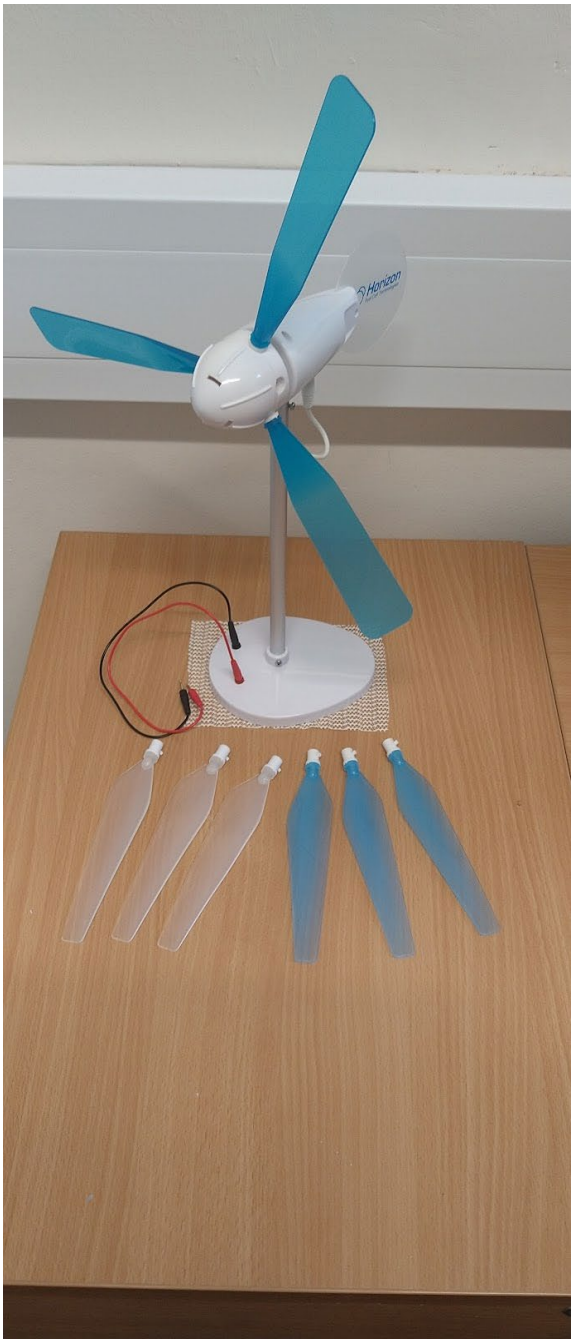
- Engineers on Earth send instructions to rovers.
- 5-20 min for a radio signal to travel from Earth to Mars.
- Rovers have cameras which they use to detect and avoid hazards (Hazcams).



The Cameras on the Mars 2020 Perseverance Rover - Credit: NASA

4.3 **Renewable energy:**

The wind turbine (pictured below) will be used to explore how to generate electricity from wind power. Pupils can experiment with the pitch (angle setting) of turbine blades and find out the optimum number of blades for generating electricity. Nine blades, with three types of profiled blade based on NASA aeronautics and one type of poly-propylene sheet blade, provide the opportunity to find the perfect balance of wind resistance, weight and angle.



Glasgow Science Centre designed and commissioned a bespoke mini dam (pictured below). The aim of the dam is for pupils to test the three water outlet locations on the model. They must determine which location is the most efficient location for a turbine to be used in the generation of hydroelectric power. To achieve this pupils will record stream length, duration of flow, and water speed (using the custom made pendulum flow metre).

The Hydrogen Cell powered vehicle (pictured below) introduces students to the hybrid technology that is fuelling today's automotive revolution. The hydrogen powered vehicle demonstrates a complete, clean-energy system with solar to hydrogen power generation. Powered by electricity from sunlight, the reversible fuel cell illustrates the principles of water electrolysis, separating hydrogen from water and then recombining these elements to create power in an extremely efficient process. What's more, the vehicle can steer independently to avoid running into obstacles.

Below is an example of the presenter notes describing links to the Curriculum for Excellence.

Argyll and Bute **Curiosity Lab**

Renewable Energy
Energy, Wind Turbines, & Hydrogen

Learning Intention:

Pupils will explore energy and renewable energy. They will learn how renewable energy technologies generate electricity, investigate wind turbines, and explore hydrogen gas as an energy store and alternative fuel.

Curriculum for Excellence Experiences & Outcomes:

Presenter Notes

By considering examples where energy is conserved, I can identify the energy source, how it is transferred and ways of reducing wasted energy. **SCN 2-04a**

By investigating how friction, including air resistance, affects motion, I can suggest ways to improve efficiency in moving objects. **SCN 2-07a**

I can extend my knowledge and understanding of engineering disciplines to create solution. **TCH 2-12a**

When I engage with others, I can respond in ways appropriate to my role, show that I value others' contributions and use these to build on thinking. **LIT 2-02a**

I can show my understanding of what I listen to or watch by responding to literal, inferential, evaluative and other types of questions, and by asking different kinds of questions of my own. **LIT 2-07a**

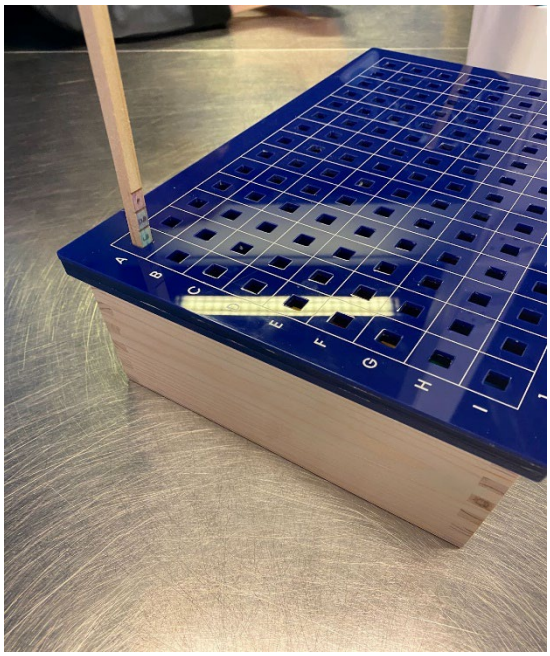
Through research and discussion, I have an appreciation of the contribution that individuals are making to scientific discovery and invention and the impact this has made on society. **SCN 2-20a**

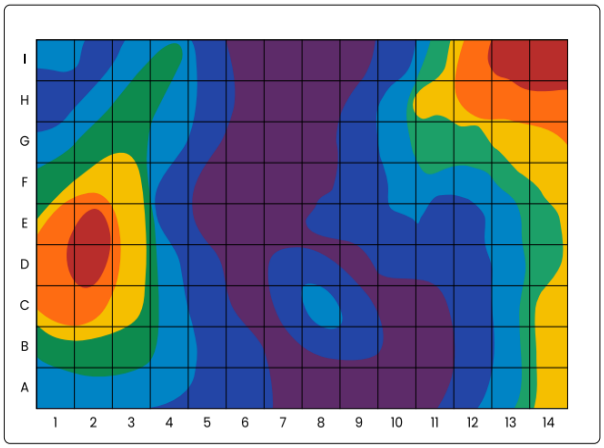
I am investigating different careers/occupations, ways of working, and learning and training paths. I am gaining experience that helps me recognise the relevance of my learning, skills and interests to my future life. **HWB 2-20a**

4.4 **Marine science and biology:**

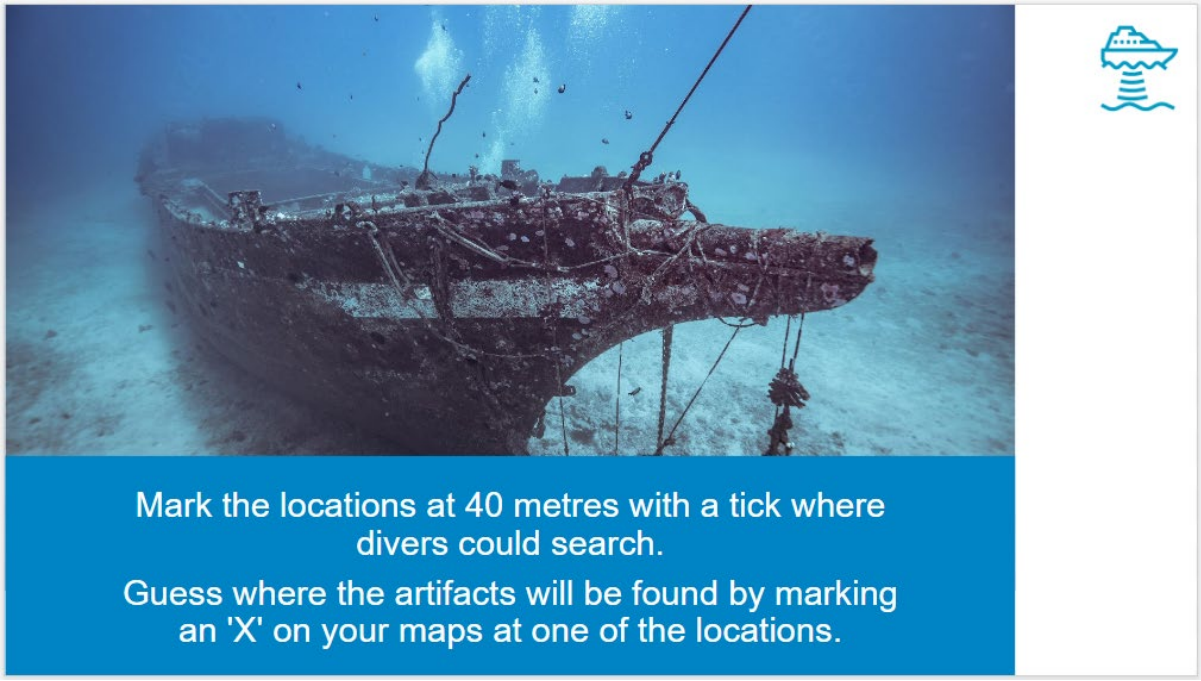
This bespoke hydrographic surveying project (below) lets pupils create a 2D map of the ocean floor by surveying the terrain contained within the hydrographic survey model. The aim of this activity is to explore how maps of the ocean floor are generated via hydrographic surveying. Once pupils have produced a map of the ocean floor they

must then plot safe sailing routes, mark points of interest for divers, and plot a safe submarine route.

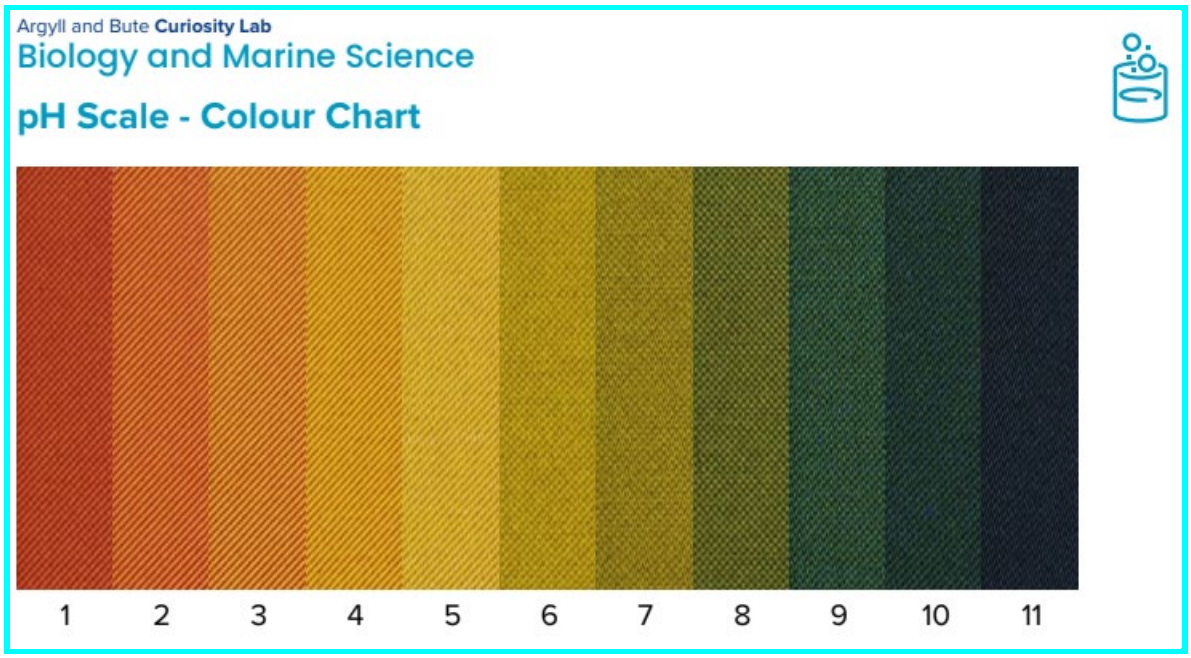




Below are two examples of slides from the Marine Science and Biology module. The first slide is used in conjunction with the above activity. The second slide is used in the introduction of an animal tracking activity where pupils assume the roles of scientist and ocean wildlife and use micro:bits (and it's on-board radio transceiver) to simulate animal tracking in the wild.



The pH colour chart will be used to introduce pupils to what acids and alkalis are, where they are used in everyday life, and how they relate to the ocean and climate change. Pupils will have access to pH papers which they can use to test solutions of various household substances.



5.0 CONCLUSION

5.1 This report presents details of the high quality STEM materials that have been created as a result of the UK CRF grant.

5.2 The materials will be made available to teaching staff across Argyll and Bute.

5.4 The materials will be of benefit to children and young people in Argyll and Bute whilst showcasing future career opportunities in local growth sectors.

5.5 The STEM materials have undergone a robust evaluation by an external company and fully align to Curriculum for Excellence. The evaluation concludes: *"Over the course of the evaluation process, we have been consistently impressed with the quality of the learning materials produced by the Glasgow Science Centre for the Curiosity Labs Project. Over a hundred teaching components have been created across the four areas of Cyber Security, Renewable Energy, Engineering & Physics and finally Biology & Marine."*

5.6 During trials of the STEM materials preliminary feedback from learners has been extremely positive.

6.0 IMPLICATIONS

6.1 Policy None

6.2 Financial None

6.3 Legal None

6.4 HR None

6.5 Fairer Scotland Duty: None

6.5.1 Equalities - protected characteristics None

6.5.2 Socio-economic Duty None

6.5.3 Islands None

6.6 Climate Change None

6.7 Risk None

6.8 Customer Service None

Douglas Hendry - Executive Director with responsibility for Education

Councillor Yvonne McNeilly - Policy Lead for Education

For further information contact:

Wendy Brownlie, Head of Service: Education (Learning and Teaching)
Oban Education Office, Oban
Telephone: 01369 707118
Email: wendy.brownlie@argyll-bute.gov.uk

Gary Clark, Digital Lead
Argyll House, Dunoon
01369 708520
Email: gary.clark@argyll-bute.gov.uk

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