

MORE BY RIVER

KS3 MATHS / GEOGRAPHY

Lesson context, approach and purpose

This lesson is aimed at KS3 students as to develop a deeper understanding of careers at Tideway and to explore the intersections between tunnel construction, logistics, and sustainability. Complementing the *Tunnelworks AR App* resource suite, this resource builds on the career elements embedded into the AR App and worksheet activities, as well as expanding student understanding of operations at Tideway.

During this lesson, students will create a logistics plan, taking on roles within a logistics team. Students will explore resources to develop their understanding of the stakeholders involved with construction projects, the impact of sustainability on project planning and the role of the Tidal Thames on transporting goods and materials used or resulting from the construction of the Thames Tideway Tunnel.

Learning objectives

In this activity and extension, students will learn:

- To design a logistics plan for the Thames Tideway Tunnel.
- To understand the role of the Tidal River Thames in transporting goods and materials.
- To analyse the work of present professionals and the impact of construction projects on individuals, society and the environment.

Curriculum links

Cross-curricular links

The activities in this lesson are ideal for cross-curricular learning in Maths or Geography KS3. Cross-curricular links can be found in the following areas:

Maths

Students should:

- construct and interpret appropriate tables, charts, and diagrams, including frequency tables, bar charts, pie charts, and pictograms for categorical data, and vertical line (or bar) charts for ungrouped and grouped numerical data.
- draw and measure line segments and angles in geometric figures, including interpreting scale drawings.

Geography

Key Aims

Students should:

- collect, analyse and communicate with a range of data gathered through experiences of fieldwork that deepen their understanding of geographical processes.
- interpret a range of sources of geographical information, including maps, diagrams, globes, aerial photographs and Geographical Information Systems (GIS).
- communicate geographical information in a variety of ways, including through maps,

numerical and quantitative skills and writing at length.

Human Geography

Students should:

- understand, through the use of detailed place-based exemplars at a variety of scales, the key processes in: human geography relating to: population and urbanisation; international development; economic activity in the primary, secondary, tertiary and quaternary sectors; and the use of natural resources.
- understand how human and physical processes interact to influence, and change landscapes, environments and the climate; and how human activity relies on effective functioning of natural systems.

Geographical Skills and Fieldwork

Students Should:

- use fieldwork in contrasting locations to collect, analyse and draw conclusions from geographical data, using multiple sources of increasingly complex information.

Lesson objectives are applicable to and incorporate aspects of the following areas of the KS3 Design & Technology 2013 programme of study:

Evaluate

- Analyse the work of past and present professionals and others to develop and broaden their understanding.
- Investigate new and emerging technologies.
- Understand developments in design and technology, its impact on individuals, society and the environment, and the responsibilities of designers, engineers and technologists.

In addition, the activity embeds aspects of the Gatsby Benchmarks of Good Career Guidance.

What you will need:

- More By River Worksheets
- Laptops or desktop computer access for research and creation of the presentation

For the Extension:

- More By River: Extension Worksheets

Preparation

Review the presentation, presenter's notes and worksheets. There are two decide on which content you will include in your teaching, and adjust the timings below to suit your own lesson length, or to spread the content across more lessons.

This lesson is based on a one hour lesson and mixed ability KS3 group.

Time (60 mins)	Teaching activity	Learning activity	Assessment for learning
2 mins	Starter: Introduce the starter activity 'The Tidal Thames'. Students are to complete this independently.	Students should complete the starter activity.	Written work.
5 Mins	Introduce the Thames Tideway Tunnel project using the Tunnelworks video (linked embedded in the presentation). Introduce the lessons learning objectives and feedback answers to the starter.	Students to watch the video and mark answers.	Verbal answers, questioning, discussion.
10 mins	Introduce Challenge 1: Logistics Plan Document. Place students into teams.	Students to read the specification and challenge 1 introduction.	Students to work in groups.
5 mins	Introduce the four job roles and the activity outcomes. Explain the roles and responsibilities of each role.	Students to decide who will take what role in their group.	Verbal answers, discussion. Students to work in groups.
10 mins	Introduce students to the research materials. Ensure that students understand the key terminology such as 'land use', 'stake holder' and the tides using questioning. Encourage students to make an innovative response to the challenges.	Students to work independently to consider which career they would be most suited to.	Verbal answers, discussion.
25 mins	Students to work on their planning documents, using group research and research materials. Encourage students to make a creative response to the challenges.	Students to mark their own starter.	Group Discussion, presentation.
3 mins	Set the completion of the planning documents for the next appropriate lesson.	Students to record homework and expected outcomes.	Written work.
4 mins	Plenary: What is Logistics? Question students on the role and responsibilities of logistics professionals and how this intersects with social and environmental impacts of construction projects	Students to answer questions and contribute to discussion.	Verbal answers, discussion.

Differentiation

Easier	Harder
Students are to produce a career display on logistics management, using Carnwath Road Riverside and Tideway as a case study.	Students to present a group presentation and slideshow to stakeholders.

Presentation Notes

Screen	Notes
	Screen 1.2 Ask students to review quick starter statements and provide answers.
	Screen 1.3 Click the link to watch the introductory video [link to video] and find out more about the Thames Tideway Tunnel.
	Screen 1.4 Use this screen to introduce the students to the Tideway of the River Thames, using the diagram to explain the fluctuations in river height. Note also that tides are caused both by the sun and moon's gravitational pull. As the graph rises, this represents water flowing towards Carnwath Road Riverside, and as it falls, water is flowing away. This flow can effect navigation as well as the speed of barge movement. A barge being navigated against the tide will travel at half the speed that it would normally travel moving with the tide.
	NEW ANIMATION – see appendix B

Screen	Notes
	<p>Screen 1.5 Use this screen to introduce the location of Carnwath Road Riverside. Drive sites are construction sites which service the tunnel, and are where tunnel boring machines are launched. The drive sites are also where tunnel segments and materials are exchanged in and out of the tunnel. A main feature of each drive site is its wharf, where machinery and tunnel lining segments are brought to the site by barge, and where spoil (waste materials) are removed from the site and transported downstream for re-use.</p>
	<p>Screen 1.6 Use this screen to introduce the tunnel and its three sections. Note how the tunnel moves through three distinct layers of earth: clay, sand and chalk. This transition requires the use of three different tunnel boring machines, equipped for the ground conditions of each rock.</p>
	<p>Screen 1.7 Use this screen to introduce the challenge, and its outcomes. Put your students into groups and ask them to choose a role, based on the individual briefs for each role. Explain that the document should include at least a page from each team member, as well as an introduction.</p>
	<p>Screen 1.8 Introduce the research materials: 'land use map', 'meet the stakeholders', 'tide charts' and 'more by memos'. Ensure that students understand the key terms: land use, tide charts and 'stakeholders'. Students should be aware that they are writing to stakeholders.</p>
	<p>Screen 1.9 Introduce the idea of 'stakeholders'. Ask students to identify the needs of the two examples. Ask students how these needs could be met. Meeting with stakeholders to understand their needs and involve them within decision making is called 'stakeholder engagement'. Large projects will often have a stakeholder engagement strategy.</p>

Screen	Notes
	<p>Screen 1.10 Use this map to help orientate students on the location of the site. Pull out some key features of the area, as well as explaining the key. Students should consider how the different areas and their occupants could be effected by construction vehicle movements A, B and C. Explain to students that the map is also a simplified version of the area and should not be used for navigating. The map was simplified in order to ensure and age appropriate level of challenge and for scaling to a single worksheet.</p>
	<p>Screen 1.11 Use this screen to give some final presentation tips. Ask students to suggest their own tips for writing and effective plan. Emphasize that this is a 'professional' document – they are representing a major infrastructure project!</p>
	<p>Screen 1.12 Refer students to further resources and the AR App at the Tideway website. Suggest students speak to their careers advisor for any STEM careers opportunities that they can partake in.</p>

Extension: Evaluation

The included extension includes a second lesson where students present their report with a group presentation and slideshow deck.

Starter	
1	<p>Each plan should be marked according to the activity brief. The best presentation should:</p> <ul style="list-style-type: none"> • Meet the needs of all stakeholders • Include a detailed plan that includes routes for worker movements, routes for construction vehicles movement, and a plan for barge movements • Include additional research e.g. detailed research of local public transport • Consider ideas for building stakeholder relationships <p>The report can be submitted digitally or as a handwritten document. Spelling and grammar should be considered as well as presentation skills.</p>
Extension	<p>Each presentation should be marked according to the activity brief. The best presentation should:</p> <ul style="list-style-type: none"> • Meet the needs of all stakeholders • Include a detailed plan that includes routes for worker movements, routes for construction vehicles movement, and a plan for barge movements • Include additional research e.g. detailed research of local public transport • Consider ideas for building stakeholder relationships. <p>In addition, the presentation should be clear and professional in tone, considering the intended stakeholder audience.</p>

Ideas for using these resources flexibly

The resources used in these activities can be used flexibly depending on your learning needs or curricular goals.

- An alternate use for *Meet the Stakeholders* could include asking students to write a specification for a logistics plan. Students could produce a list of considerations and priorities for local people.
- An alternate use for the *Land Use Map* is to mark a route for trucks A, B and C, and assign each student or group of students with stakeholder roles. Ask students to describe the advantages or disadvantages of each route.
- Each logistics team role can be used separately. Alternate students could be assigned a role to work as independently, or use one team role for the whole class, as a careers link to land use, human geography or fluvial systems.

You may also choose to use **More by River** as a quick drop-down lesson using the work planning and management of moving spoil around London as the context to mathematical reasoning.

Part 1 Lesson Plan PPT

Screen	Notes
	Introduction Screen
	Screen 1.2 Use this screen to introduce learning objectives
	Screen 1.3 Click the link to watch the introductory video [link to video] and find out more about the Thames Tideway Tunnel.
	Screen 1.4 Show animated infographic
	Screen 1.5 Introduce the Challenge to students. Explain that tenders have been invited from companies and three have been received. Explain that their task is to consider the tenders and decide which proposal would be less disruptive for other people in the area.

Part 1 Lesson Plan PPT

Screen	Notes
	<p>Screen 1.6 Introduce the Challenge to students.</p> <p>Explain that tenders have been invited from companies and three have been received. Explain that their task is to consider the tenders and decide which proposal would be less disruptive for other people in the area.</p>
	<p>Screen 1.7 Introduce Acme Boating Company</p>
	<p>Screen 1.8 Introduce Big Boat Brigade</p>
	<p>Screen 1.9 Introduce Charlie's Clever Carriers</p>
	<p>Screen 1.10 Class discussion and opportunity to judge the bids.</p>

Part 1 Lesson Plan PPT

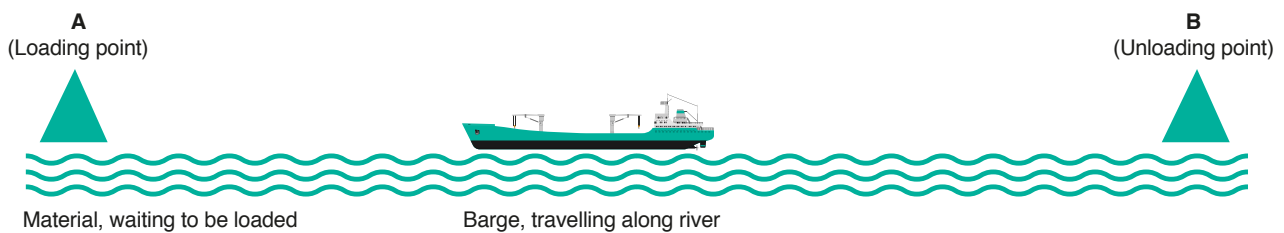
Screen	Notes
	<p>Screen 1.11 Students to prepare their case as to which contractor they would propose awarding the contract to.</p>
	<p>Screen 1.12 Refer students to further resources and the AR app at Tideway website. Suggest students speak to their careers advisors for any STEM career opportunities that they can partake in.</p>

MORE BY RIVER

Introduction

Each contractor needs to be able to ship material from point A to point B. The material arrives at A in loads of 1000 tons each hour and needs to be shipped to B asap. It can be stored at A temporarily but there is a charge per ton per hour after the first hour.

The river is tidal and at low tide only smaller boats can use it. Remember that low tide occurs at different times each day.



The Acme Boating Company is going to use four boats, each of which can carry 1000 tons. Each takes three hours to load, get the material from A to B, unload and return. Their boats can operate at high and mid tide but not at low tide so cannot travel for six out of the 24 hours in a day.



The Big Boat Brigade is proposing using one boat, which can carry four thousand eight hundred tons. It can also do the round trip in three hours but this larger vessel cannot sail for eight out the 24 hours in a day. The boat needs more crew than the Acme boats, but not four times as many.



Charlie's Clever Carriers is proposing using smaller boats, which can operate even at low tide, but each one only carries 500 tons. Being smaller and lighter they can do the round trip in two hours. Charlie (short for Charlotte) has four such boats.



Acme Boating Company	Big Boat Brigade	Charlie's Clever Carriers
<p>Can they do the job? Show your working.</p>	<p>Can they do the job? Show your working.</p>	<p>Can they do the job? Show your working.</p>
<p>Other reasons for or against.</p>	<p>Other reasons for or against.</p>	<p>Other reasons for or against.</p>

Final decision, with reasons.