

Name:

Student ID No.:

1) Estimating the Gross Annual Mean Flow in Caaf Water at Lynn Spout:

a) Estimated catchment area by counting grid squares ($1 \text{ km} \times 1 \text{ km}$):

b) Estimated annual rainfall intensity by examining the rainfall map:

c) Estimated gross annual mean flow by the area-intensity method:

2) Correlate the flow in Caaf Water with another catchment

a)

- i. Estimated gross annual mean flow in River Garnock at Dalry

(by the area-intensity method):

Calculate the proportion of the gross flow that remains as nett mean flow:

 %

- ii. Estimated gross annual mean flow in River Garnock at Kilwinning:

Calculate the proportion of the gross flow that remains as nett mean flow:

 %

- b) Choose whether you think the data from River Garnock at Dalry or at Kilwinning better represents Caaf Water

i.

- ii. Explain your choice, giving advantages and disadvantages of each.

- iii. Use your chosen source of correlation data to adjust the gross flow estimate for Caaf Water to give an estimate of its nett mean annual flow and also estimates of Caaf Water's Q95, Q70, Q50, Q10, Q5

Enter all your estimates in this table:

Flow (<input type="text"/>)	
Nett Mean estimate	<input type="text"/>
Q95	<input type="text"/>
Q70	<input type="text"/>
Q50	<input type="text"/>
Q10	<input type="text"/>
Q5	<input type="text"/>

3) Estimate the design flow for your hydro scheme

a) The Water authority requires compensation flow equivalent to Q.95.

How much is this?.

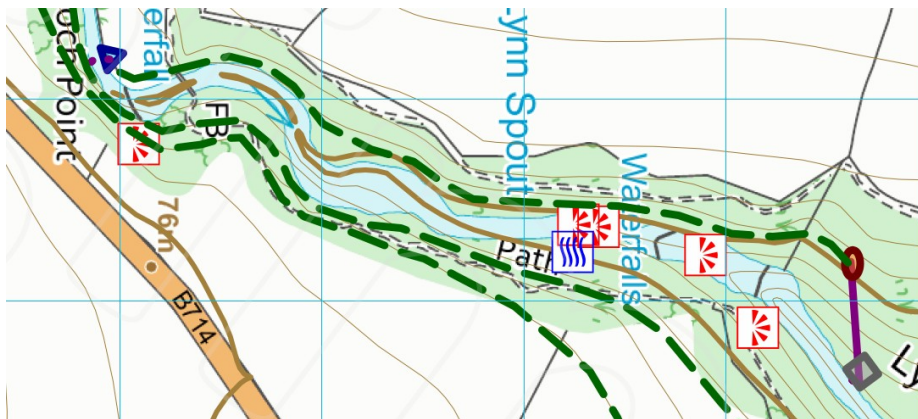
b) Decide what percentage of the time the scheme should be operated at full rated power

 %

and select your design flow accordingly.

c) Explain your choice.

- 4) Identify the key components of the hydro scheme and estimate the gross head available from the contour map.
- a) Identify the key components of the scheme associated with the map symbols below



i.



ii.



iii.



iv.



v.



- b) Using the contour map, estimate the gross head available for each of the 3 proposed scheme layouts, A, B, & C

A:

B:

C:

- c) Pick one of the 3 schemes

☐ A

☐ B

☐ C

- d) Explain your choice giving its advantages and disadvantages compared to the other 2 schemes.:

- e) Calculate the **gross** hydraulic power available:

- f) Given the path lengths on the map, your own estimates of gross head and your choice of scheme, calculate the length of pipe needed:

5) Select a pipe diameter and use it to estimate the head losses in the chosen scheme and thus the nett head

a) Pipe diameter

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b) Pipe flow speed

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c) Dynamic Head

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d) Head losses

i. Setting loss

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ii. Friction loss

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iii. Turbulence loss

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iv. Trash rack loss

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v. Total head loss

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vi. Nett head available

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vii. Percentage (%) head loss %

e) Calculate the nett hydraulic power

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f) Justify your choice of pipe diameter

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6)

a) Choose the number of generator pole pairs

b) Calculate the generator's synchronous speed

c) Choose a gear or belt-drive speed-up ratio

d) Calculate the turbine speed

e) Calculate the turbine's rated power

f) Calculate the turbine's specific speed

g) Choose the turbine type

h) Explain your choices

7) Conclusions and any other comments: