Water Resources Engineering and Management

(CIVIL-466, A.Y. 2024-2025)

5 ETCS, Master course

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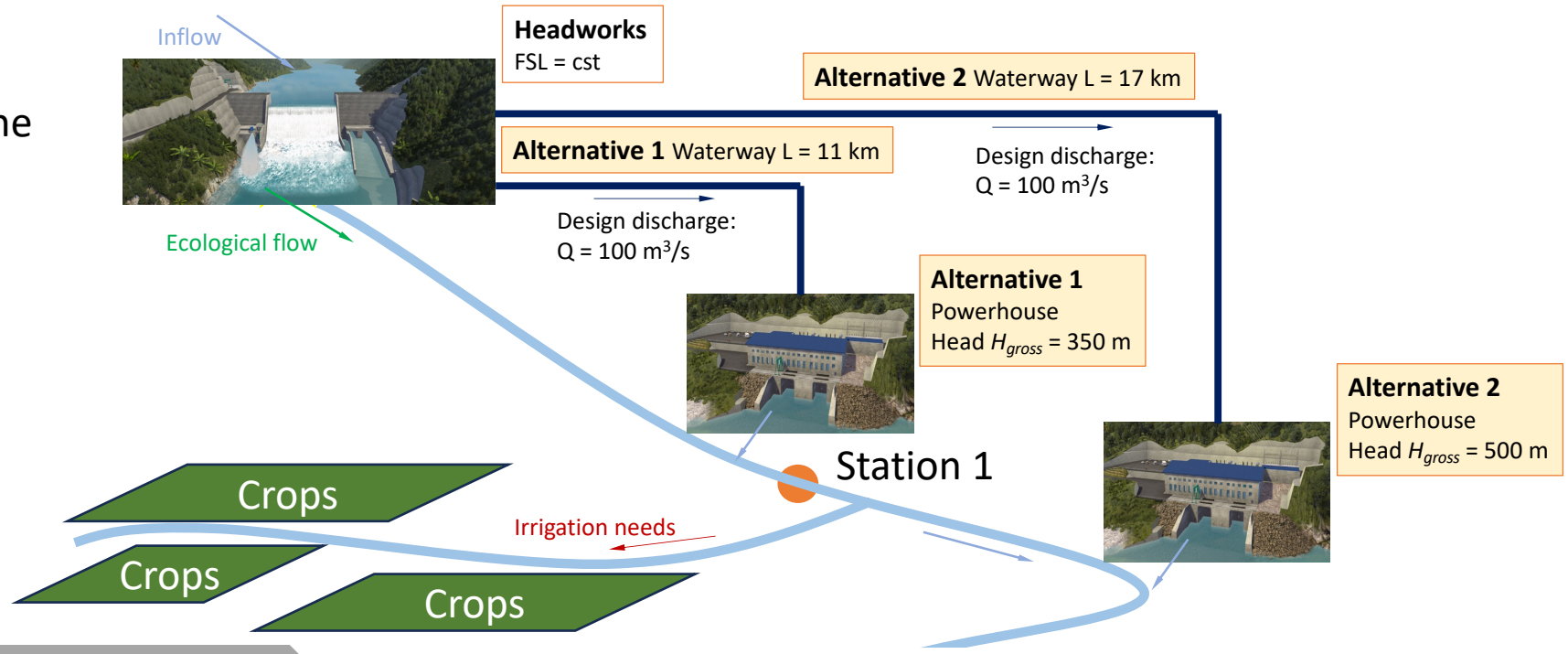
Practical Work : Case study hydropower optimal water allocation and financial study

Project description

To the purposes of analyzing the two project alternatives form an ecological vs energetic efficiency point of view, we will run today numerical simulations to build the Pareto frontier and assess the goodness of the proposed allocation wit hrespect of their distance from the frontier. This will be done for each of the project alternative, i.e. two and then for both the wet and the dry year periods.

GOALS:
- Use the data produced in Week 1 and 2 in order to run the GUI hydropower and determine the global efficiency plot to compare the solutions



Available data and description

In order to run the GUI hydropower in Matlab, the following data are available

- 30 years River flow data sequences for the incoming flow at station 1 divided in wet and dry years (from Week 1);
- Minimal flow release for both the wet and the dry years (Week 1 and today from GUI). Should you no be confident in your data, then use the files wetQ.csv and dryQ.csv

- Crop water needs expressed as proportional fraction of the of the incoming flow for both the wet and the dy period (from Week 2). Assume the same fraction for all dry months (i.e., about 30% of incoming flow) and for the wet ones (i.e., about 10% of incoming flow);
- Adopt a proportional flow release as ecological flow equal to 10% of the incoming flow to be released in all months;

- Technical data of turbine hydromechanic charateristics besides the Power vs turbinated flow curves for both alternative 1 and 2 (files provided).

	Q_{max} [m^3/s]	Q_{min} [m^3/s]	Maintenance [% operating days/wet period]	Maintenance [% operating days/dry period]
Data	100	20	4	6

- Weighted Usable Area for main young and adult fish species (file provided). Use the same curve just with different thresholds.

	Threshold_young [m^3/s]	Threshold_adult [m^3/s]
Data	10	25

Project tasks (Week11 – 05/05/2025)

PLATEFORME DE CONSTRUCTIONS HYDRAULIQUES

Your tasks today:

Open Matlab and load the GUI Hydropower. Make sure your input file data are in the same folder where the GUI files are:

1) Run the GUI twice for the dry period case, one by imposing an additional minimal flow equal to the Q_{347} (95% quantile of flow duration curve of dry period flows) and one without it. Always activate the proportional flow releases and make sure you include the 10% (corresponding to alternative 1, 10% ecol flow) and the 40% one (corresponding to alternative 2, 10% ecol flow proportional + 30% irrigation). For both solutions export the efficiency plot and compare the solutions
2) Run the GUI twice for the wet period case, one by imposing an additional minimal flow equal to the Q_{347} (95% quantile of flow duration curve of wet period flows) and one without it. Always activate the proportional flow releases and make sure you include the 10% (corresponding to alternative 1, 10% ecol flow) and the 20% one (corresponding to alternative 2, 10% ecol flow proportional + 10% irrigation). For both solutions export the efficiency plot and compare the solutions
3) Answer the following questions: a) What is the approximate average annual energy production for the two alternatives either when including the additional minimal flow or without it; b)corresponding env efficiency for the same cases?; c) Is there some case where it could make sense to transition to a non-proportional redistribution?; d) Does this analysis allow to derive a general conclusion about the best strategy?