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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 857851.

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WORK PACKAGE 5 – 15 PREFEASIBILITY STUDIES

Uganda, Cameroon, Bolivia, Ecuador, Colombia

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Definition and aim of a pre-feasibility study


Washing cloth in Cameroon

A pre-feasibility study is conducted first to sort out relevant alternatives.

(Sorting out not feasible ideas will save time and money).

A pre-feasibility study is a preliminary systematic assessment of all critical elements of the project

- technical solution
- costs
- environmental impacts
- social impacts.

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Structure of the pre-feasibility studies

1 **Introduction**

2 **General regional description**
- Geography,
- Social structure
- Energy consumption
- Climate

3 **General site description**
- Selected river and site location
- Existing studies or projects
- Available mapping

4 **Hydrology**
- Catchment area
- Gauging stations (precipitation, discharge)
- Available data

5 **Layout alternatives**
- Setting of selection criteria
- Setting of alternatives
- Final layout of selected solution

6 **Project description**
- Main data (head, discharge, power, production)
- Components design
- Socio-environmental aspects
- Cost estimation

7 **Feasibility check and risk analysis**
- Legal feasibility,
- Technical feasibility,
- Financial feasibility,
- Environmental feasibility,
- Political feasibility,
- Organisational feasibility,
- Resources related feasibility,
- Socio-Economic feasibility

8 **Conclusions and recommendations**

9 **Drawings**

Irish potatoes selling in Uganda

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Selection Criteria

Best suitable location of intake

- Access road
- Function
- Space available
- Simplicity of civil works necessary
- Geological conditions
- Minimised cost
- Land ownership

Best possible location of powerhouse

- Access road
- Simplicity of civil works necessary
- Geological conditions
- Minimised cost
- Distance to grid/transformer
- Land ownership

Trace of pipeline/channel

- Access road
- Level of difficulty to build
- Geological conditions
- Land ownership

Optimisation of head / power

Minimisation of construction works

Safety

Low maintenance solutions

Minimisation of environmental and social impact

- Reserved flow
- Fish bypassing
- Backwater area
- Water abstraction by local people
- Fisheries by local people
- Washing and leisure activities

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Feasibility check

Feasibility check								
Project:								
	Description	easy	doable	mean	complex	difficult	Justification of the evaluation	
Legal feasibility	Permissions necessary							
	Land ownership							
	Import /export							
Technical feasibility	Accessibility							
	Geological stability							
	Special constructions							
	Grid connection							
Financial feasibility	Investor availability							
	Loans							
	Financing model							
Environmental feasibility	Protected areas							
	Environmental impact							
	Mitigation measures							

Political feasibility	Stakeholder opinion						
	Financial support						
	Cultural and social considerations						
Organisational feasibility	Project ownership						
	Project management						
	Maintenance						
Resources related feasibility	Manpower						
	Construction material						
	Equipment and machinery						
Socio-Economic feasibility	Local population opinion						
	Added value						
	Workplace						

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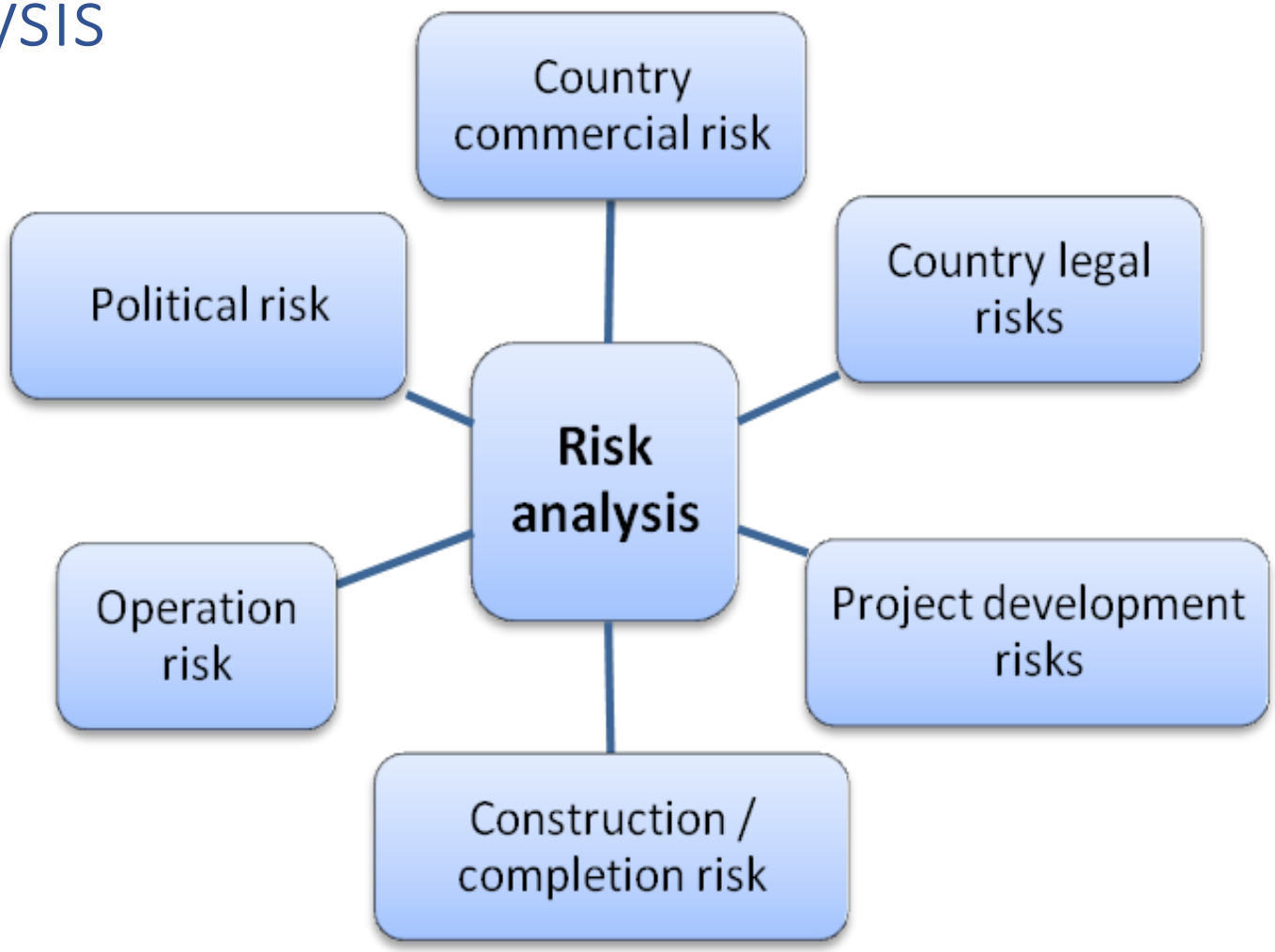
Risk analysis



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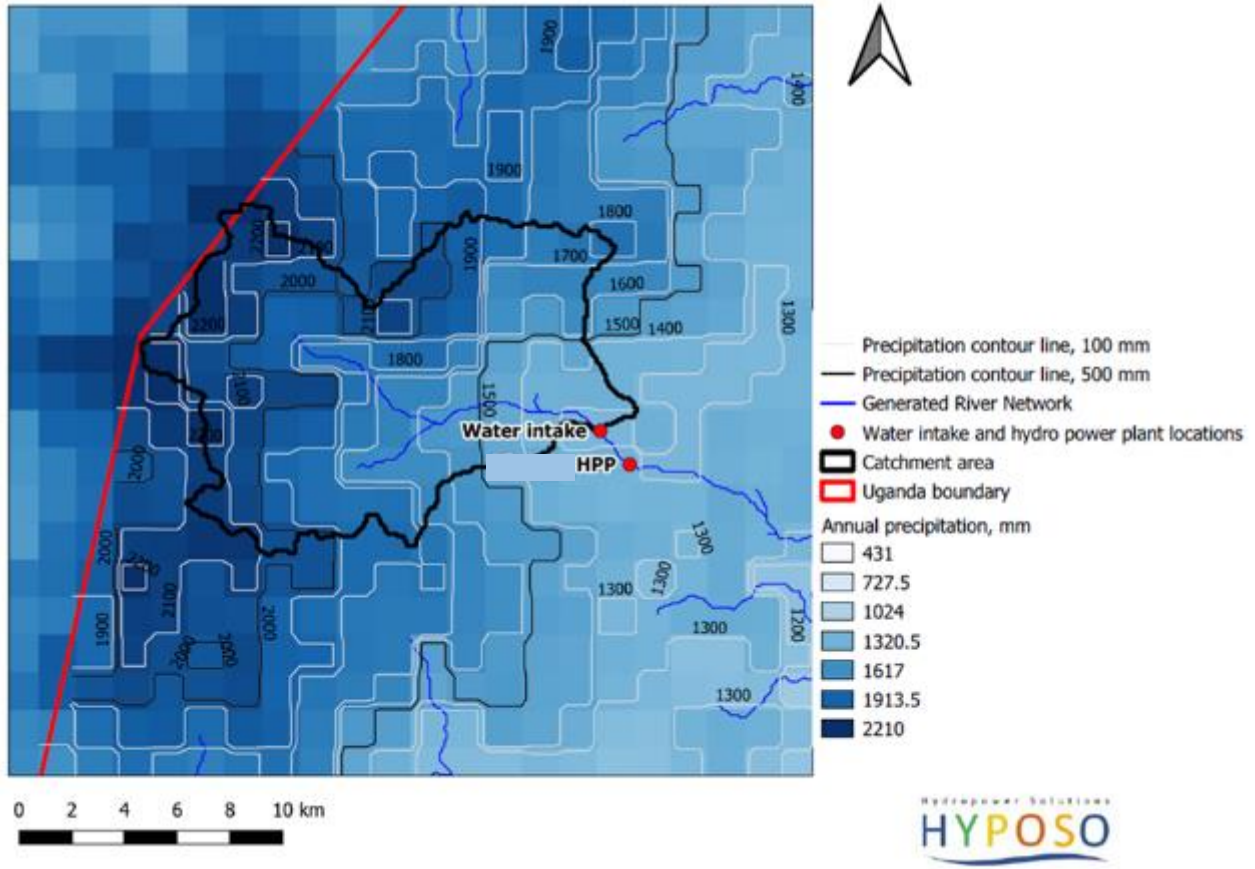
Uganda

Precipitation



The mean annual precipitation in the catchment (152,15 km²) is estimated at 1800 mm.

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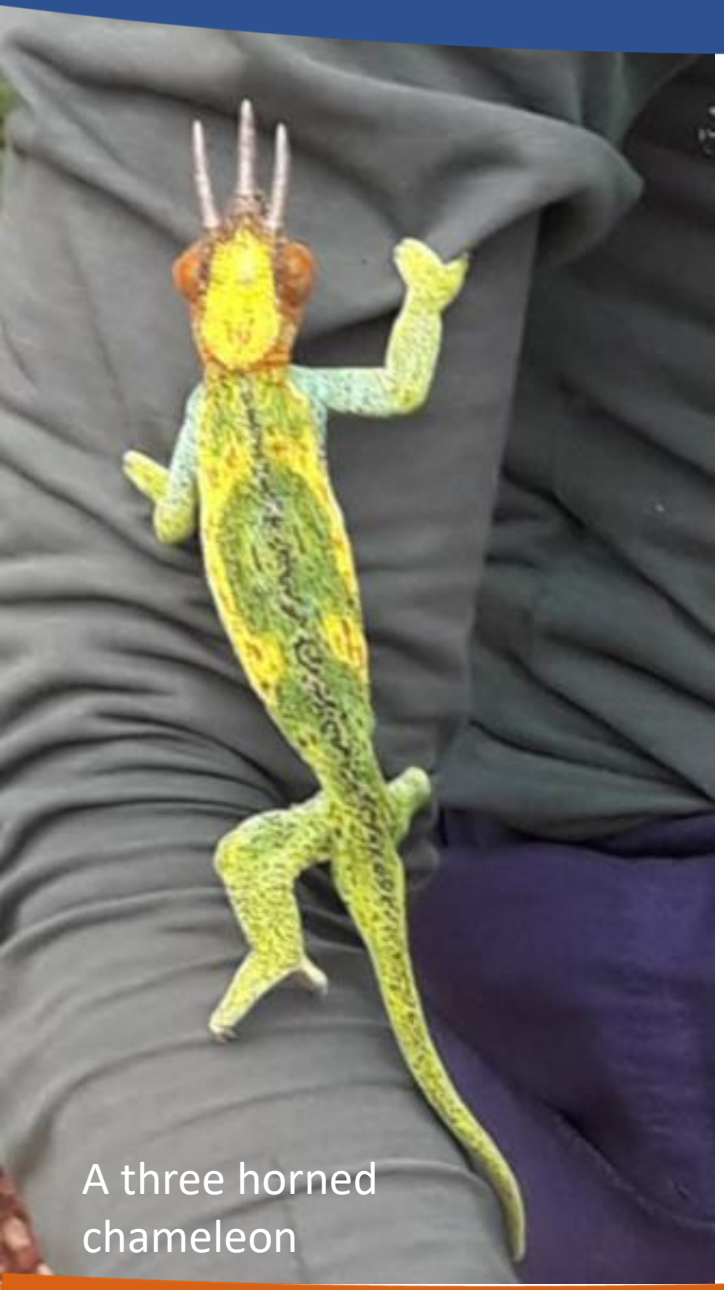
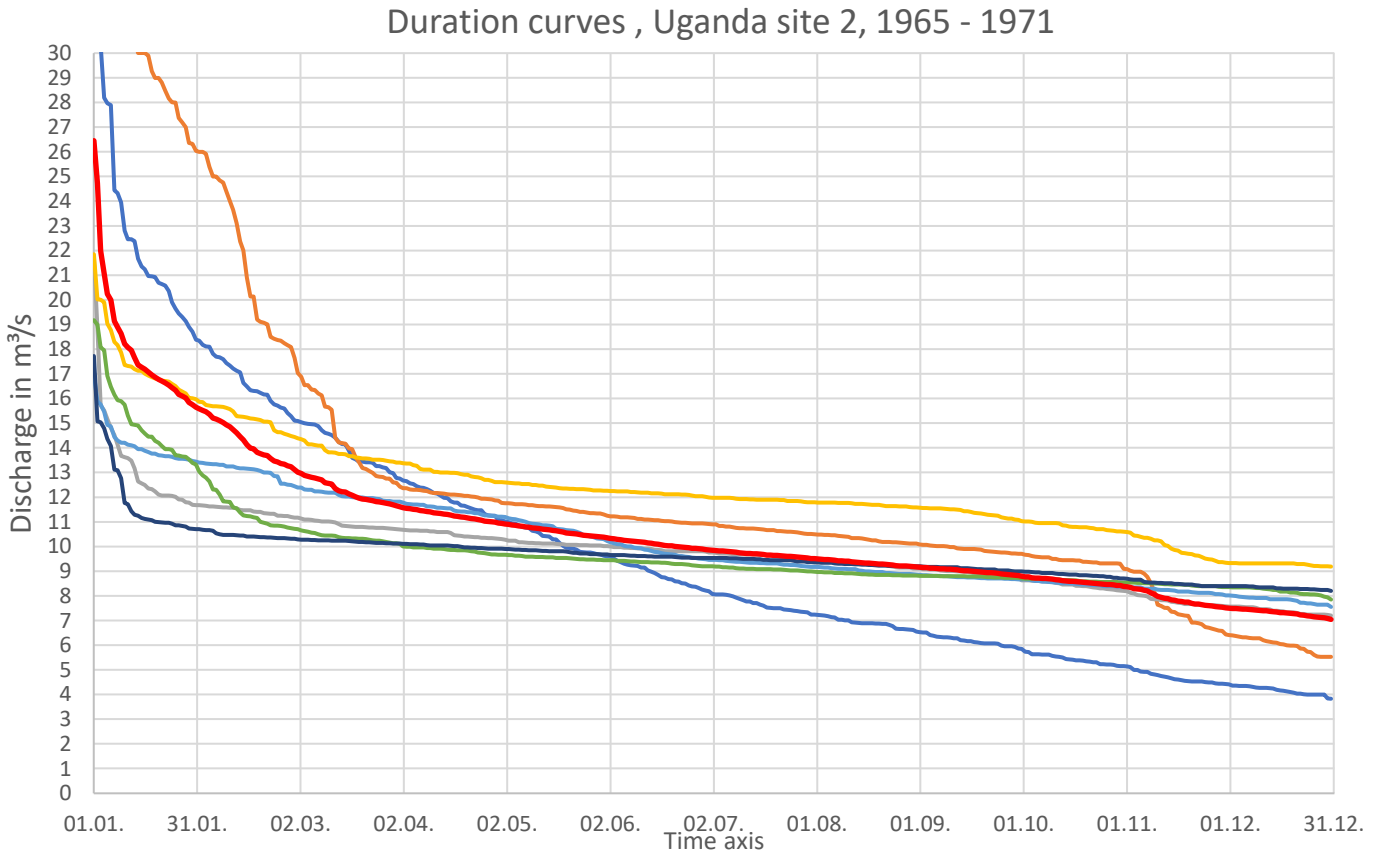


A three horned chameleon

Uganda

Flow duration curve



The mean flow is calculated with approximately 10 m³/s.

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Uganda

Typology: mean head, run of river, diversion

Main data:

Rated head: 125 m

Rated flow: 9,00 m^3/s

Period of exceedance is approximately 200 days

River gradient: 6,25 %

Overall efficiency: 80% (estimated)

Rated power: 9 MW

Annual electricity generation: approx. 60 GWh/a

Capacity factor: 0,67

Total investment cost: 18.645.000 €

Specific investment cost: 0,31 €/kWh or 2.071 €/kW

Comment: Excellent mean head project, intake solution is crucial, hydrology tbc.

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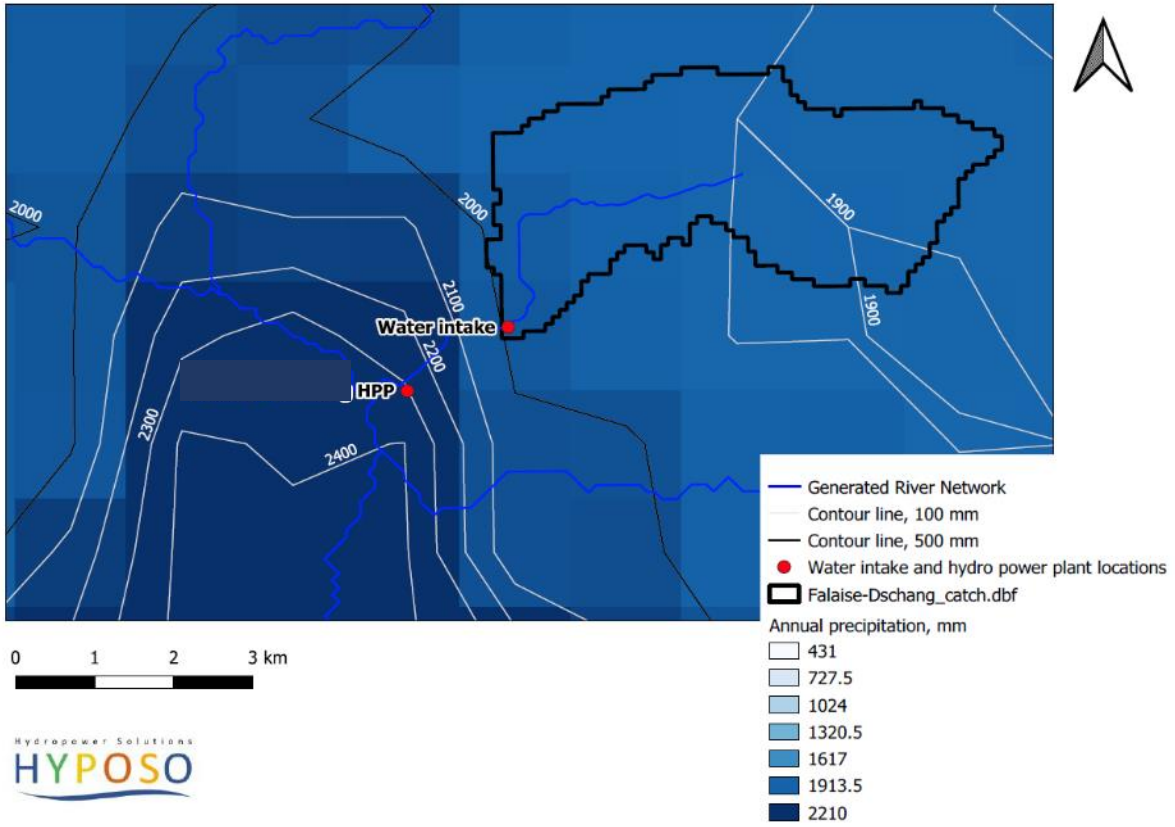
Cameroon

Precipitation



The mean annual precipitation in the respective catchment ranges at 1900 mm per year

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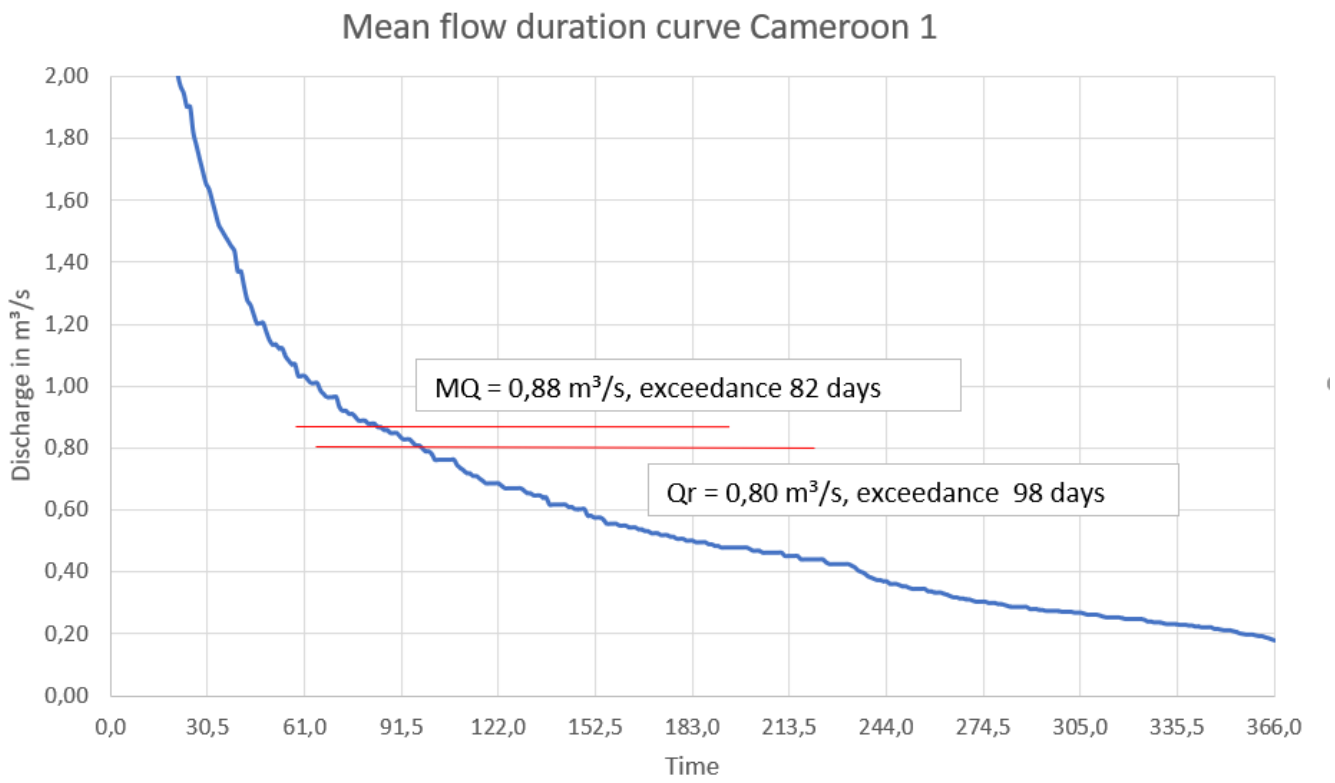
Cameroon

Flow duration curve



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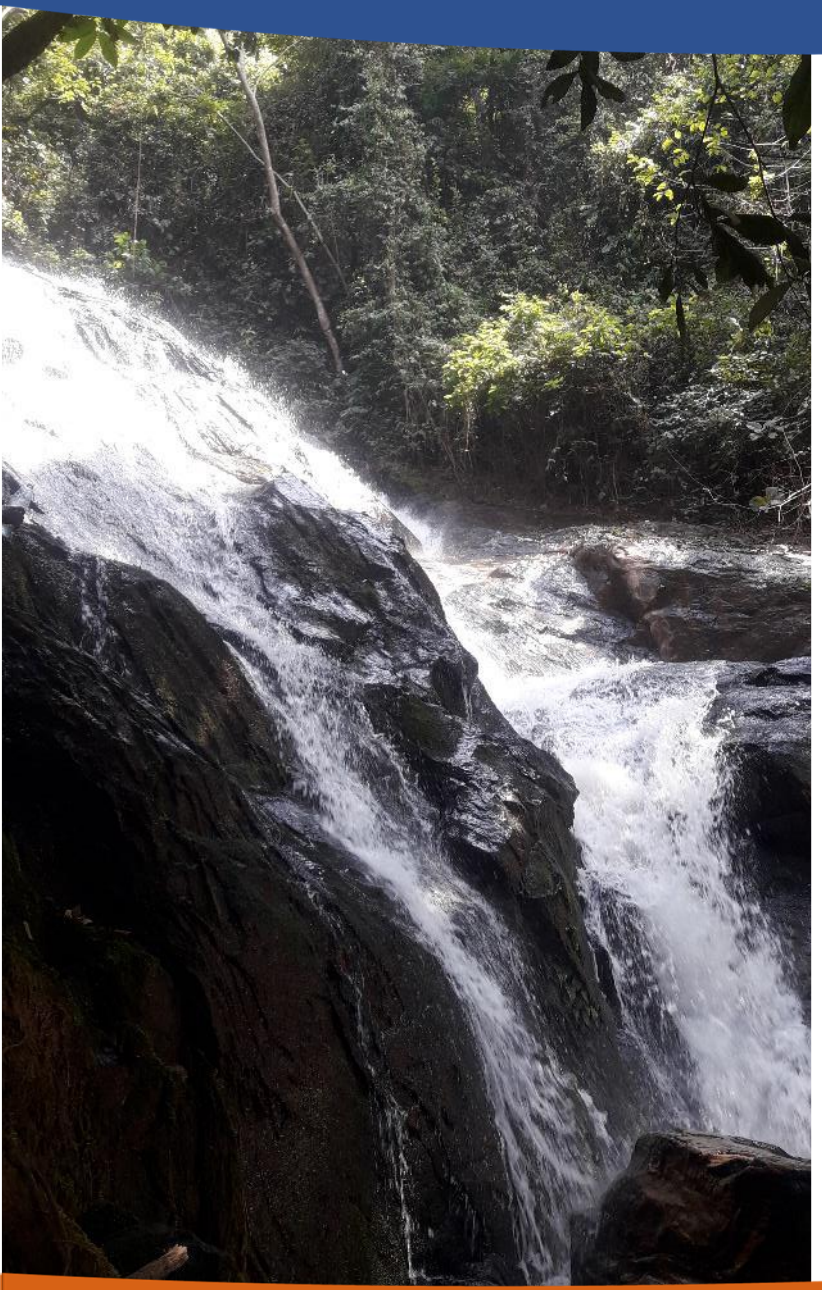

Cameroon

Typology: High head, run of river, diversion

Main data:

Rated head: 495 m

Rated flow: 800 l/s

Period of exceedance: 89 days

River gradient: 35 %

Overall efficiency: 80% (estimated)

Rated power: 3,14 MW

Annual electricity generation: 15,7 GWh

Capacity factor: 0,58

Total investment cost: 8.481.000 €

Specific investment cost: 0,54 €/kWh or 2.700 €/kW

Comment: Excellent high head project, challenging pipeline trace

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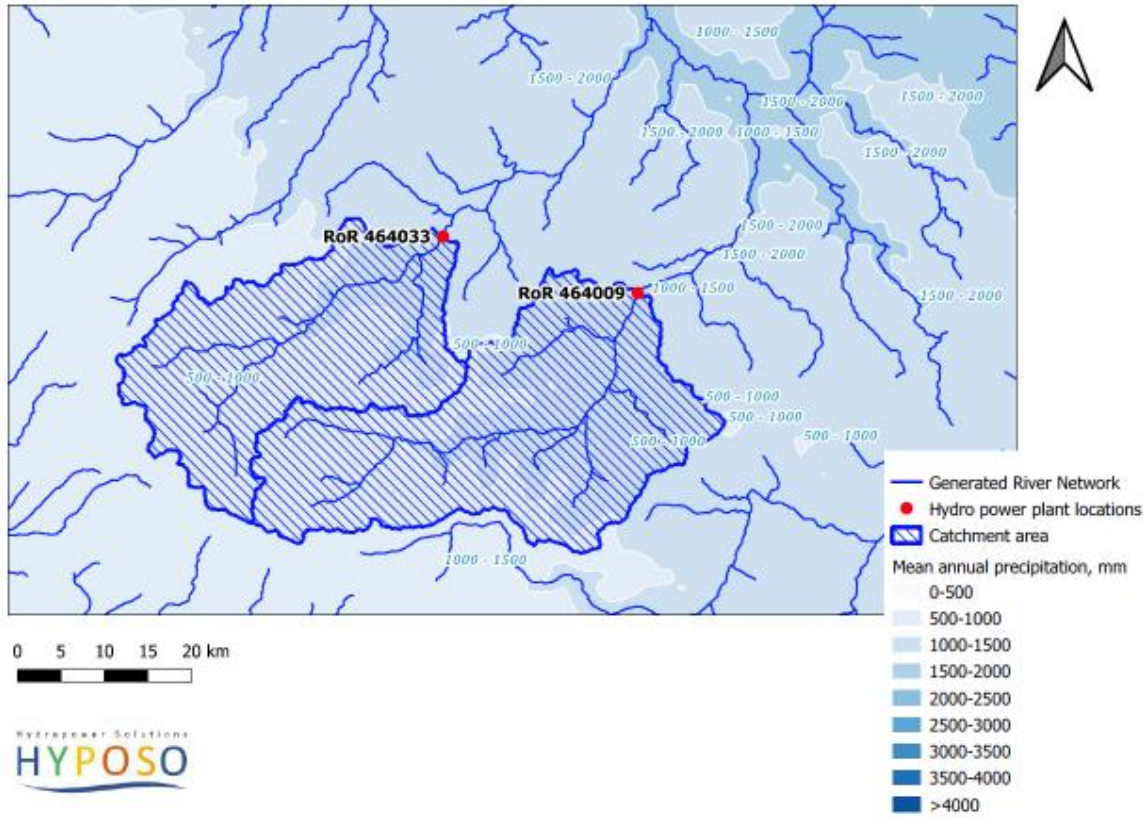
Bolivia

Precipitation



The mean annual precipitation in the respective catchment ranges at 850 mm per year

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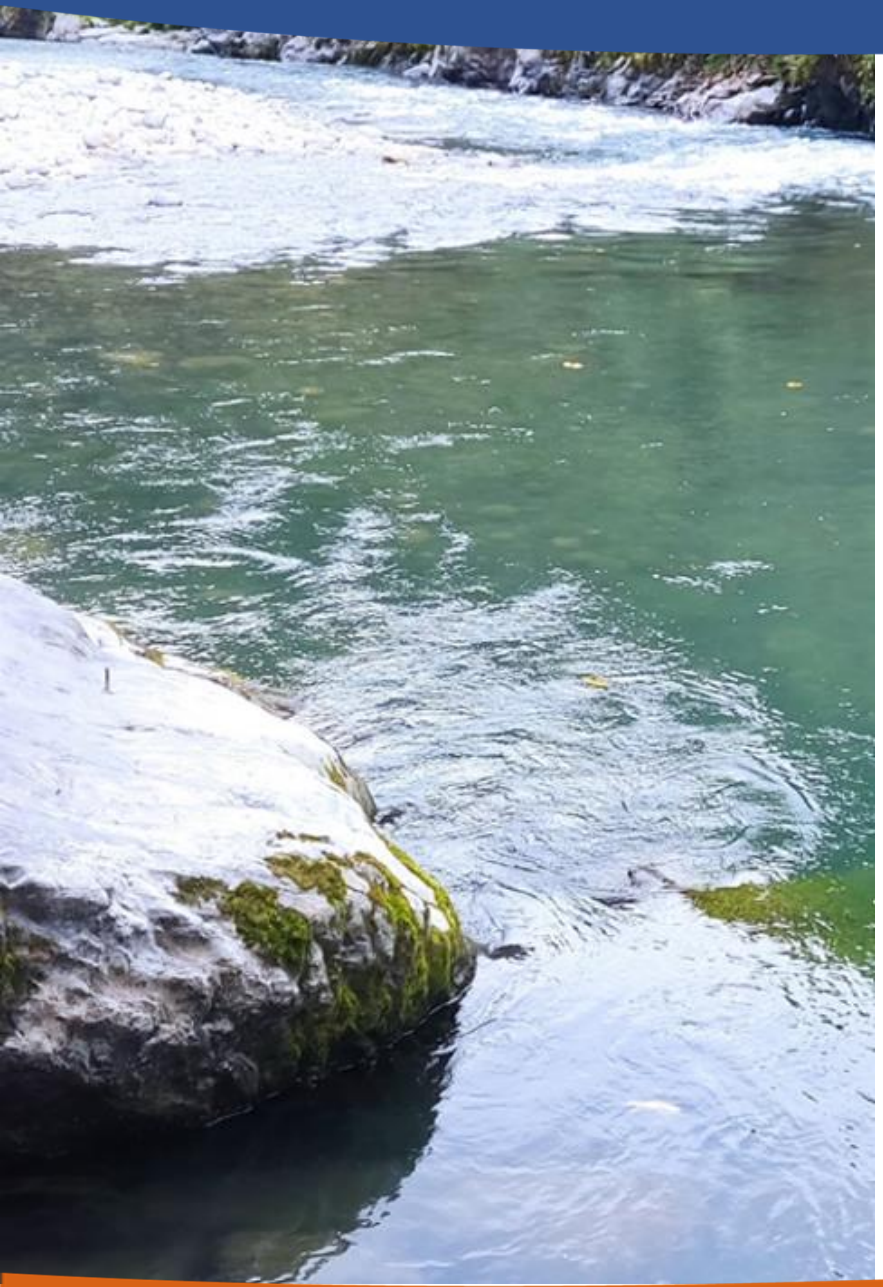

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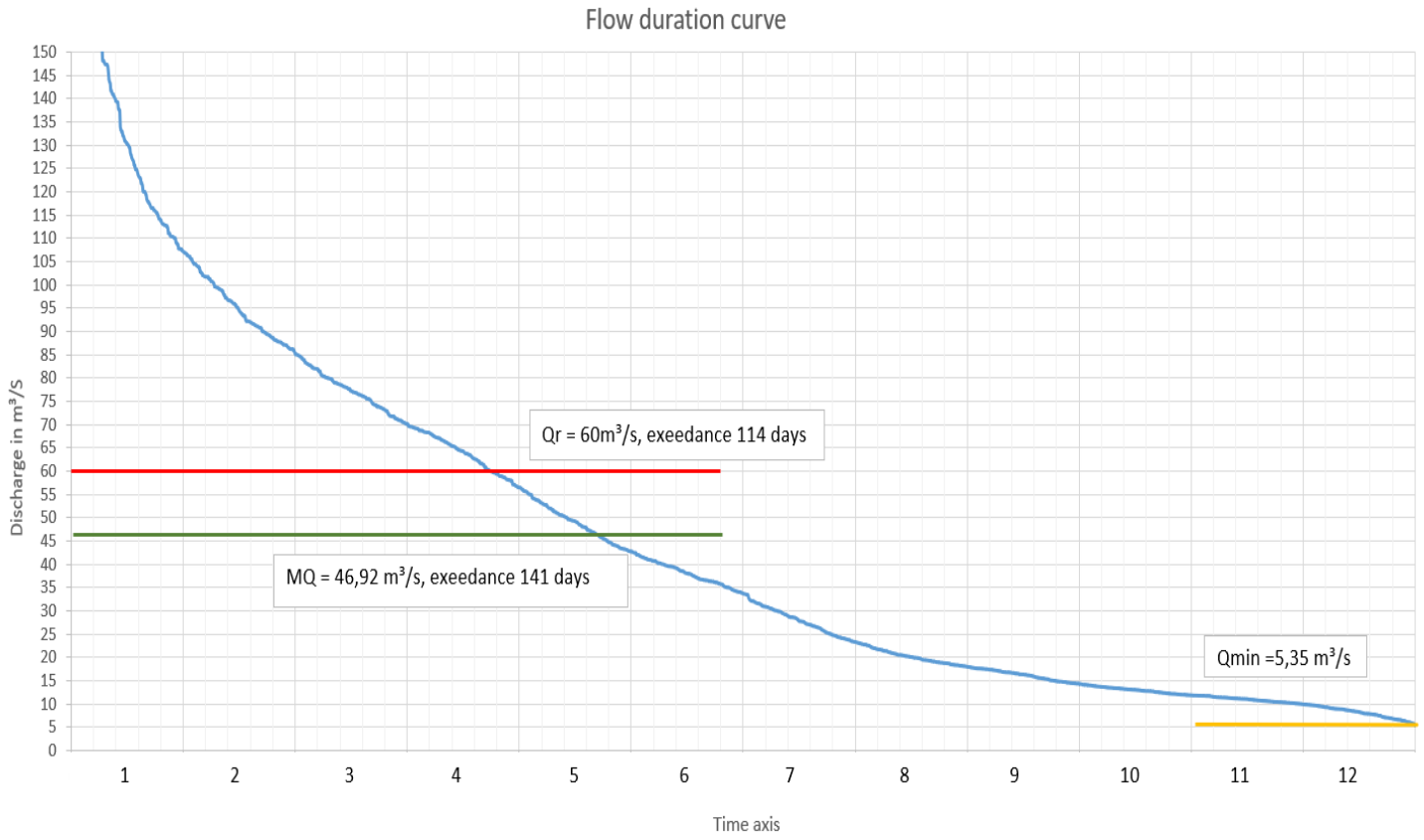
Bolivia

Flow duration curve



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Bolivia

Typology: Mean head, storage, dam

Main data:

Rated head: 73,2 m

Rated flow: 70 m³/s

Period of exceedance: 114 days

River gradient: 1,2 %

Overall efficiency: 80% (estimated)

Rated power: 40 MW

Annual electricity generation: 228 GWh

Capacity factor: 0,65

Total investment cost: 333.000.000 €

Specific investment cost: 1,46 €/kWh or 8.325 €/kW

Comment: Interesting mean head storage project

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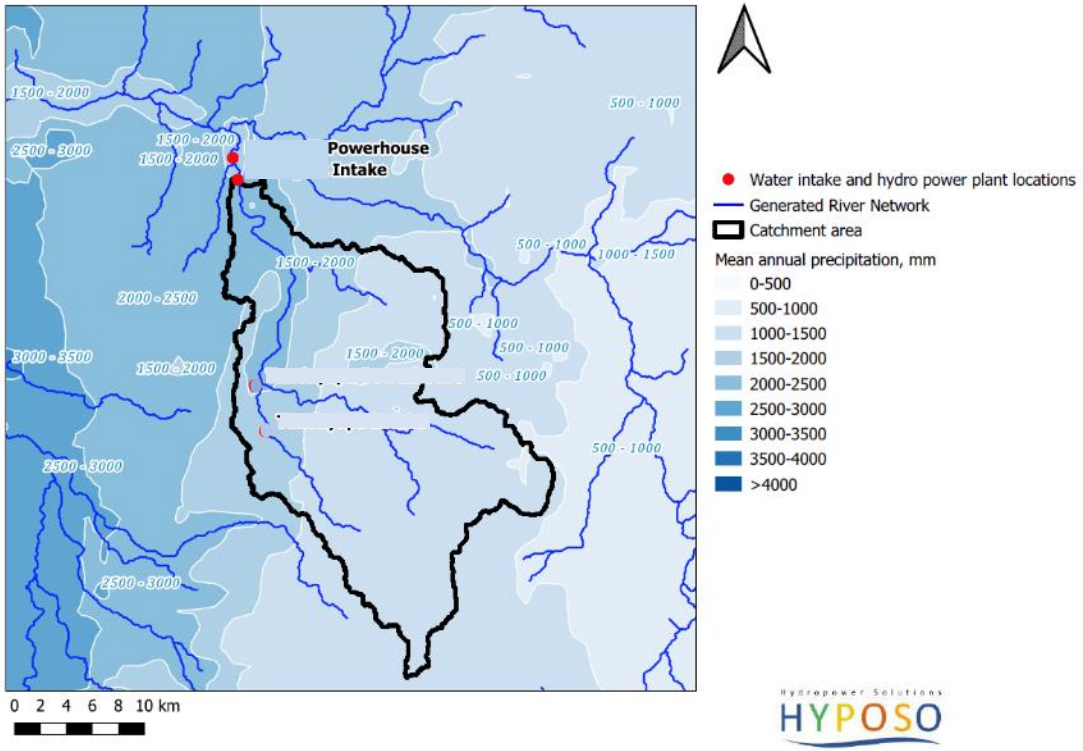
Ecuador

Precipitation



The mean annual precipitation in the respective catchment ranges at 1500 mm per year

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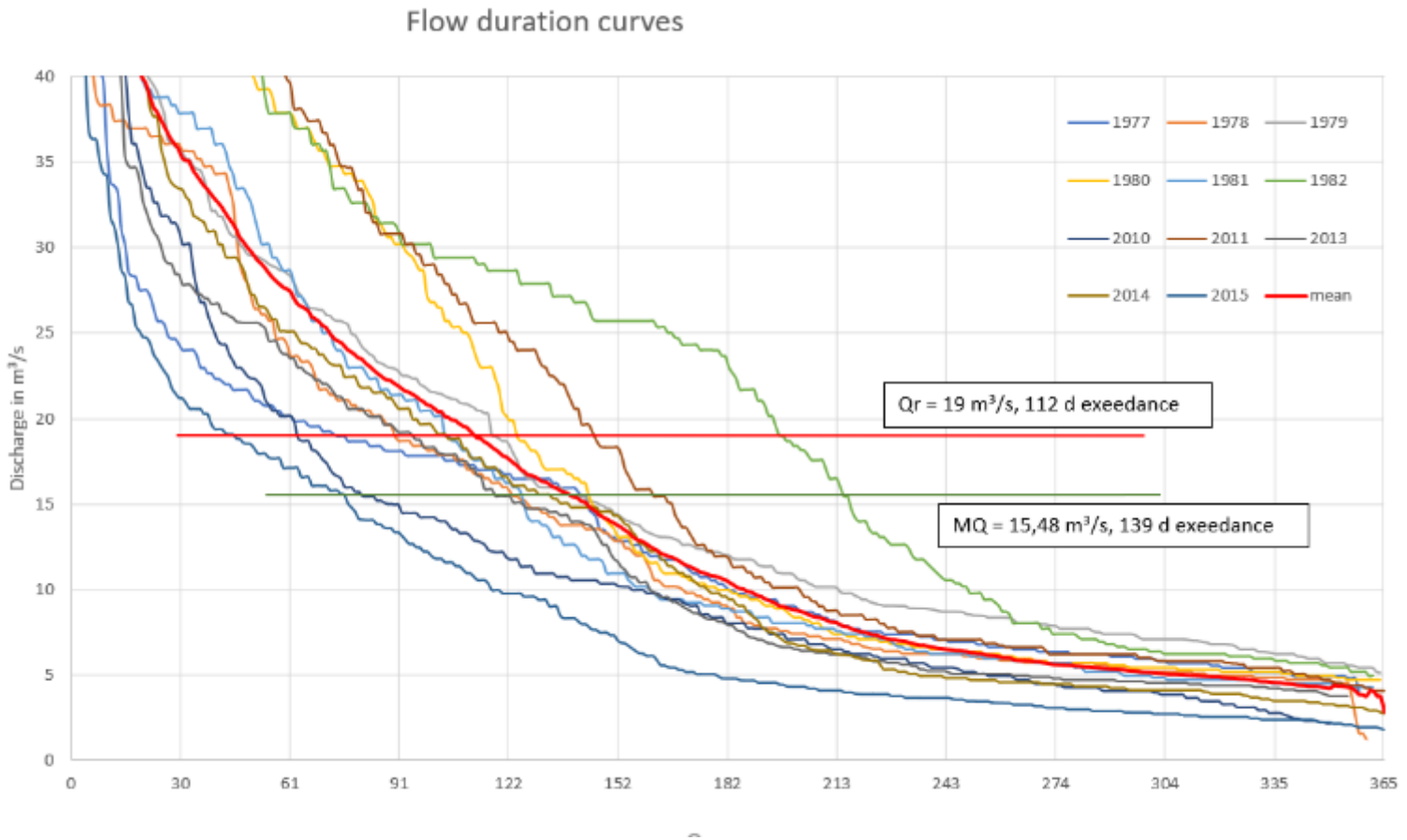
Ecuador

Flow duration curve



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Ecuador

Typology: High head, run of river, diversion

Main data:

Rated head: 172,3 m

Rated flow: 19 m³/s

Period of exceedance: 112 days

River gradient: 2,36 %

Overall efficiency: 80% (estimated)

Rated power: 25,7 MW

Annual electricity generation: 119,5 GWh

Capacity factor: 0,53

Total investment cost: 59.000.000 €

Specific investment cost: 0,49 €/kWh or 2.296 €/kW

Comment: Very interesting high head project

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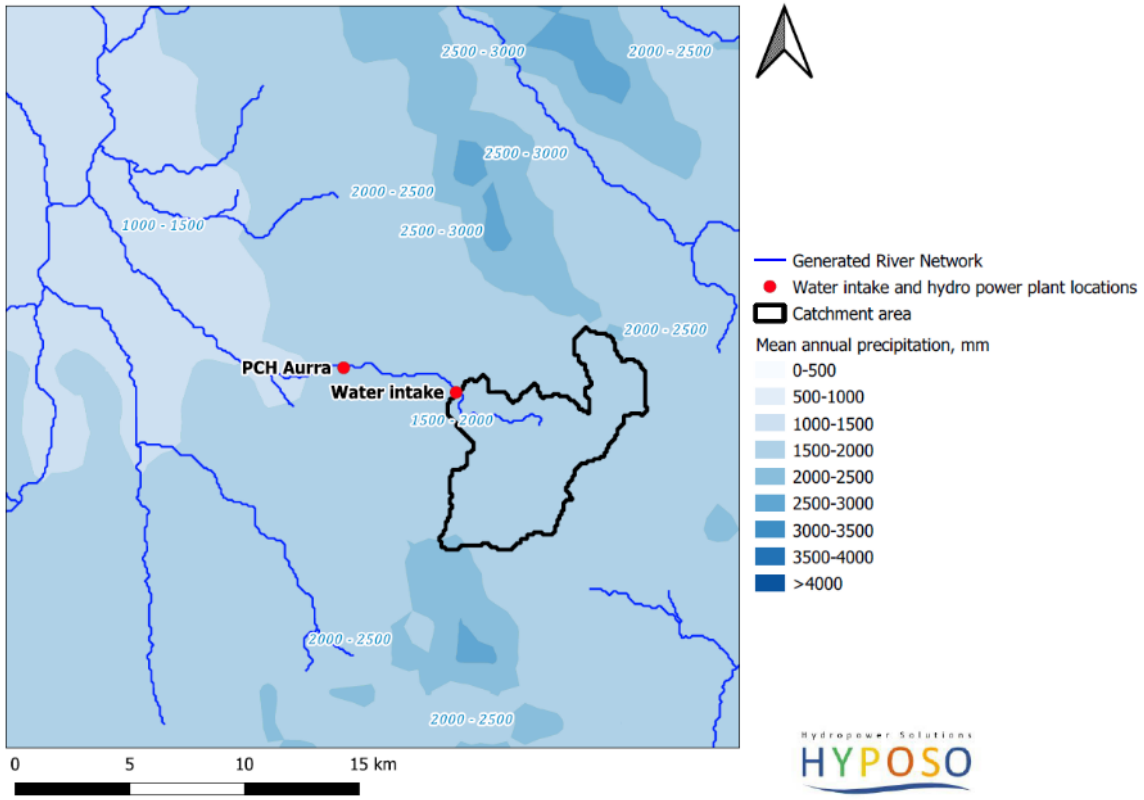
Colombia

Precipitation



The mean annual precipitation in the respective catchment ranges at 1750 mm per year

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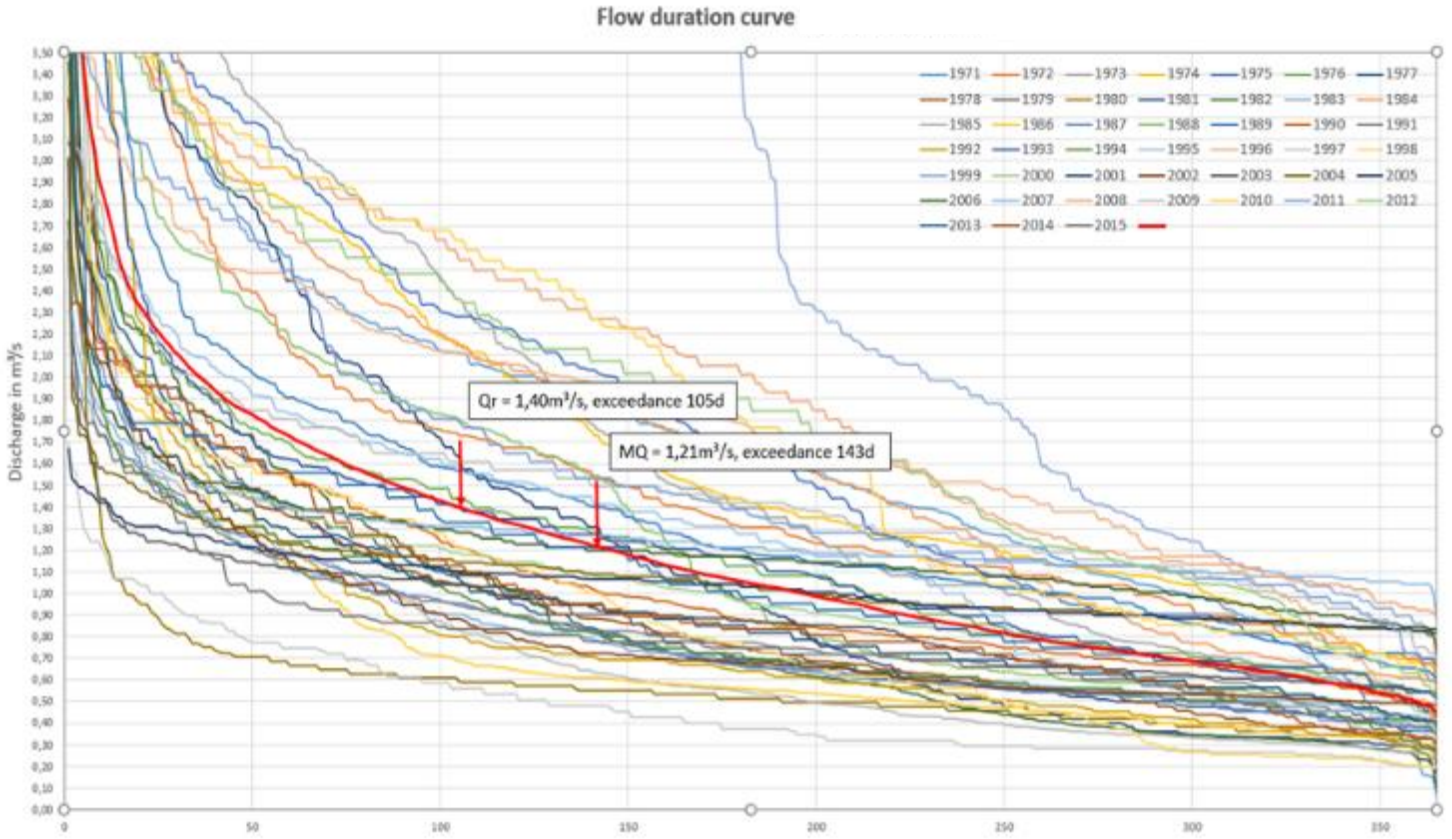
Colombia

Flow duration curve



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Colombia

Typology: High head, run of river, diversion

Main data:

Rated head: 1368,7 m

Rated flow: 1,4 m³/s

Period of exceedance: 105 days

River gradient: 20 %

Overall efficiency: 80% (estimated)

Rated power: 15,4 MW

Annual electricity generation: 86 GWh

Capacity factor: 0,65

Total investment cost: 25.300.000 €

Specific investment cost: 0,29 €/kWh or 1.643 €/kW

Comment: Very interesting high head project

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Conclusions

- The great majority of the sites is economically very attractive
- The projects investigated are already quite well developed
- The further on project development needs local contact persons – these persons are available and reliable
- Although all plants will be grid-connected, there will be some local electricity consumption to be covered
- All projects will respect and meet local needs of the population
- If these needs are met on an adequate level, the population will support the projects
- It is recommended to get local communities as partners
- Due to the fact that most of the plants will exploit excellent natural potential the cost will be relatively low
- Responsible hydropower exploitation will support the next generations

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