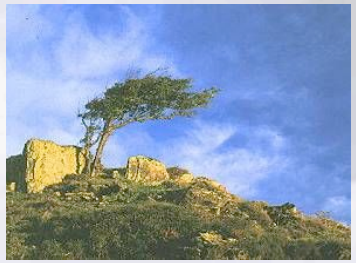


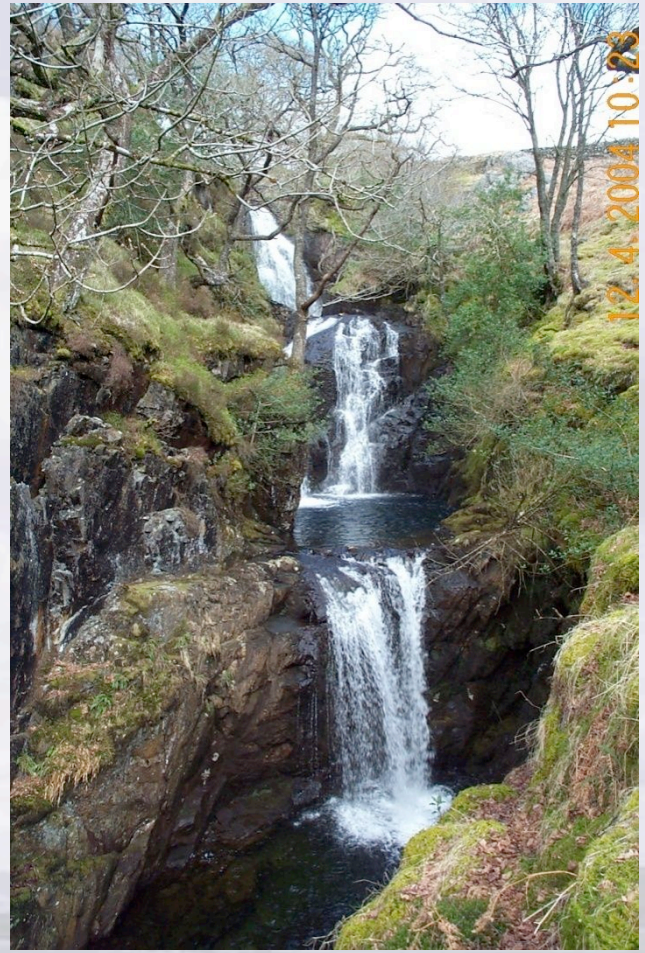
Micro Hydro Power
Conception to Completion

Nick Bard

20th August 2008

Contents

- RD Energy Solutions
- Introduction to Hydro
- Development Process
- Key Issues



rd ENERGY SOLUTIONS

RD Energy Solutions

- All renewables consultancy and installation
  - Biomass
  - Solar
  - Large and small wind
  - Hydro
  - Heat pumps
- BRE Accreditation

renewable devices

Small Scale Hydro

- Small Hydro <10MW
- Mini Hydro < 1MW
- Micro Hydro < 100 kW
- Pico Hydro < 1 kW

- Run of River/Storage
- On/off grid

- Efficient
- Long lasting
- Low running costs
- Low environmental impacts

renewable devices

Power from Water

$$P = \eta g H Q$$

P = Power (kW)

η = Efficiency

g = Acceleration due to gravity (m2/s)

H = Head (m)

Q = Flow (m3/s)

$$P = 7 \times H \times Q$$

3 Requirements

- Flow
- Head
- Determination

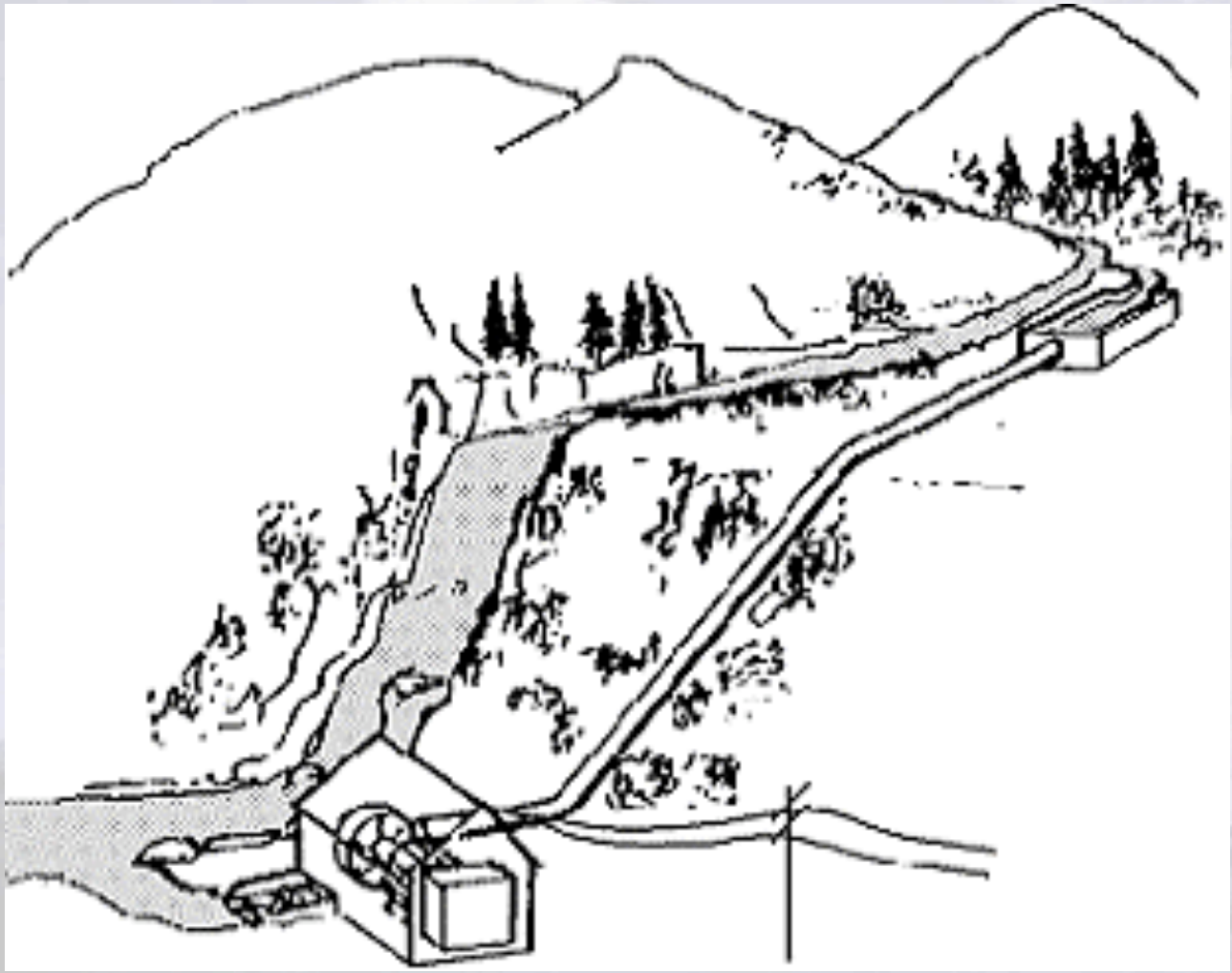
rd ENERGY SOLUTIONS

Layout

- Layouts
  - High Head
    - Penstock
    - Canal and Penstock
  - Low Head
    - Mill Lade
    - Barrage/Weir
- Components
  - Intake
  - Canal
  - Penstock
  - Powerhouse
  - Tailrace

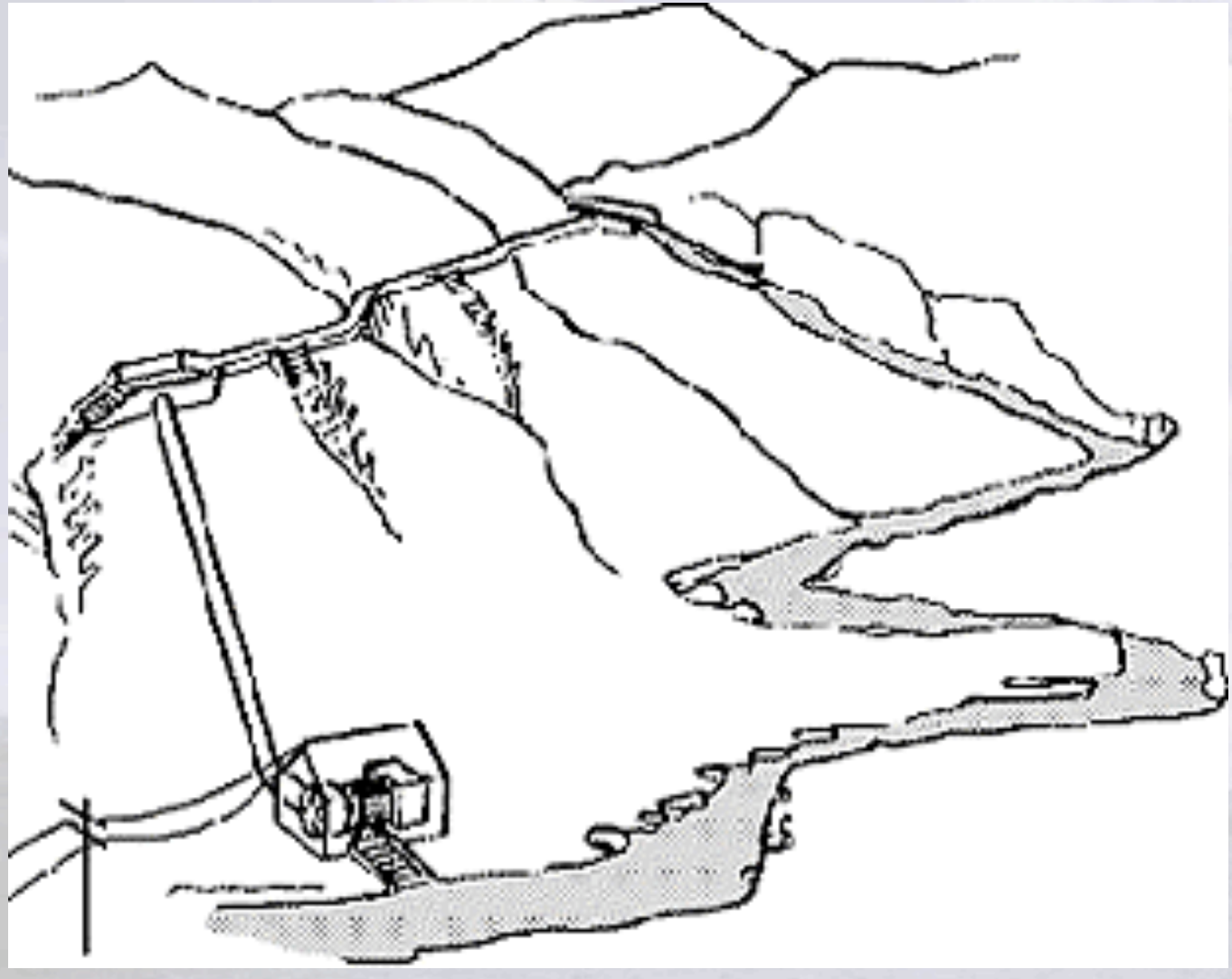
rd ENERGY SOLUTIONS

Penstock



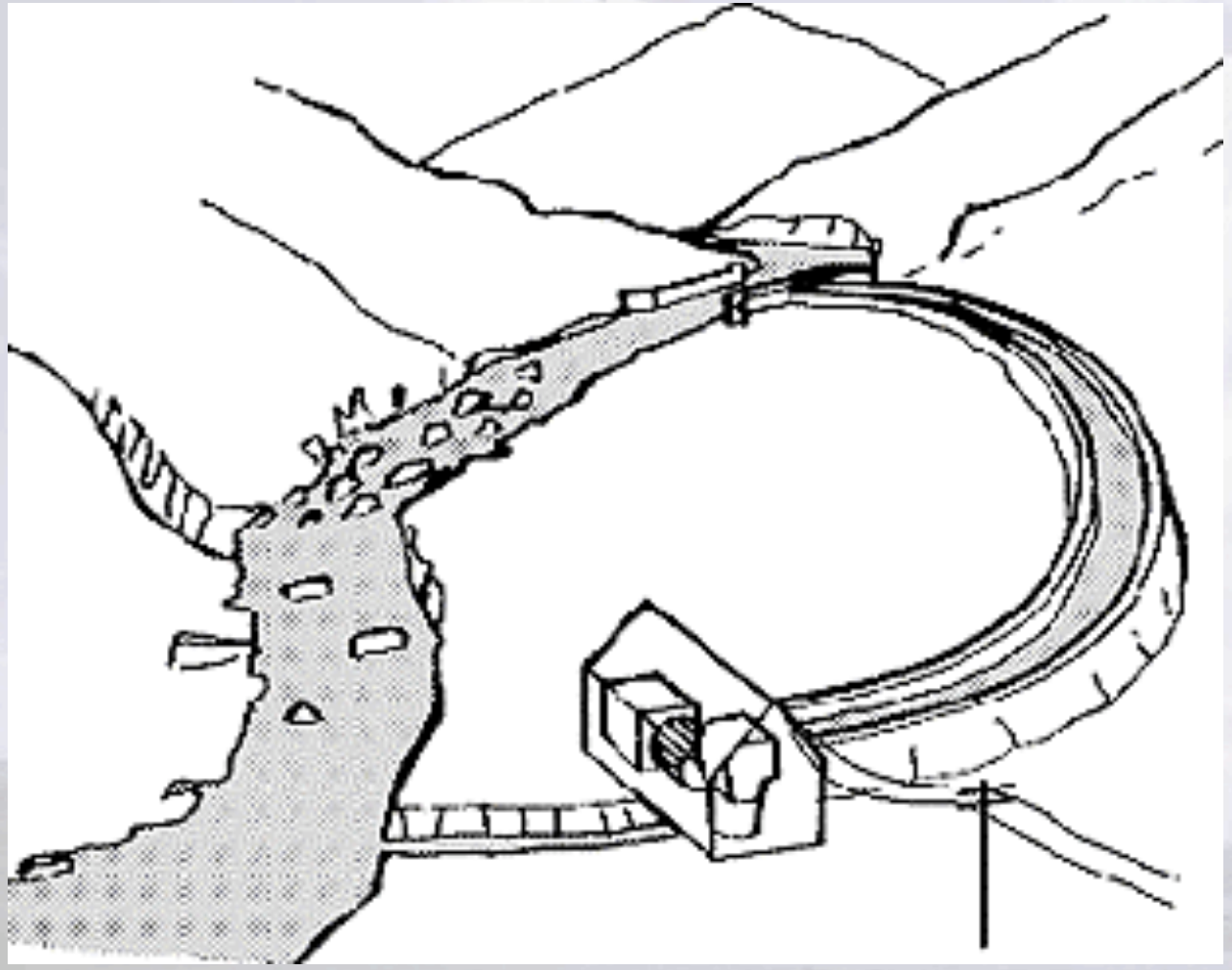
rd ENERGY SOLUTIONS

Canal and Penstock



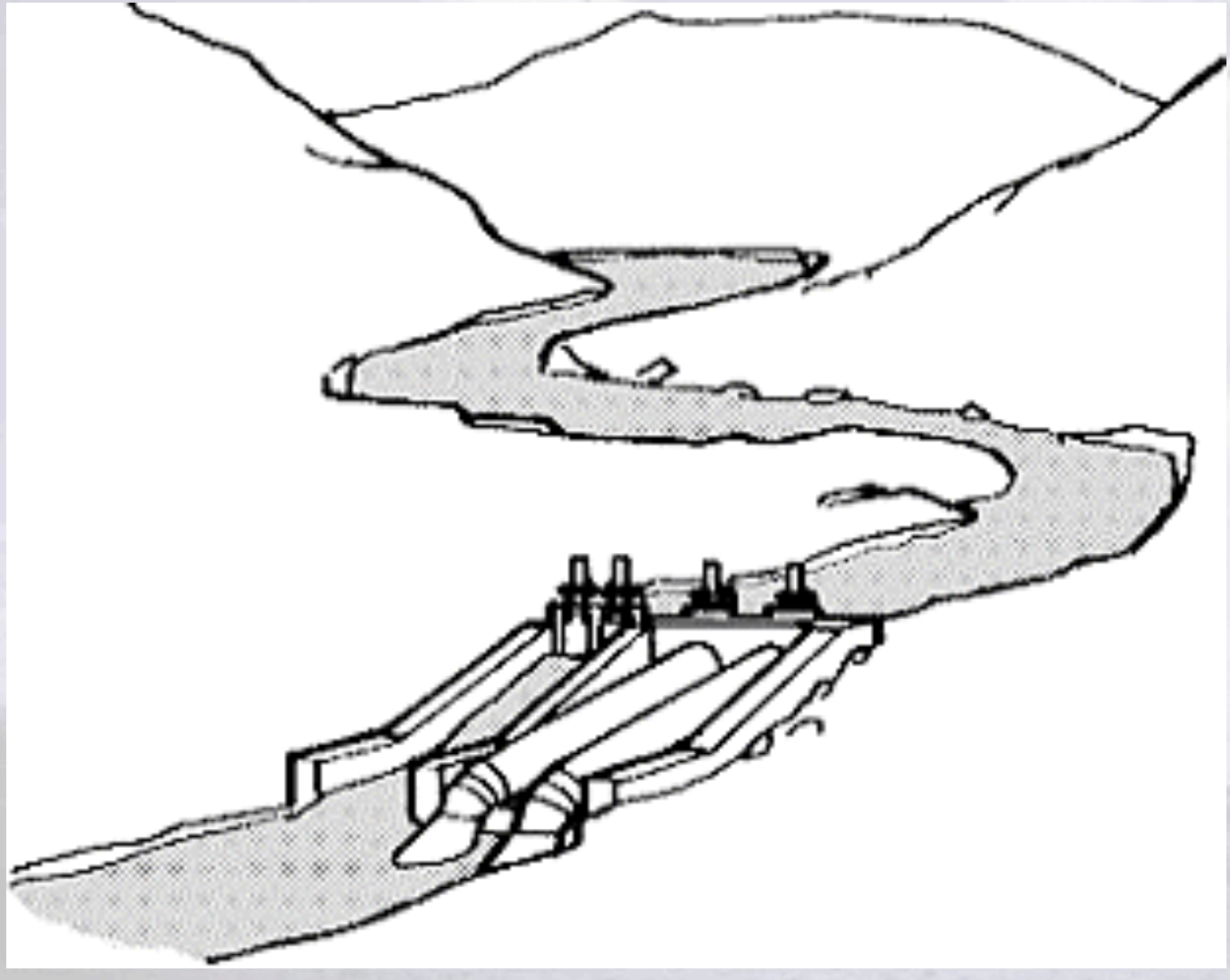
rd ENERGY SOLUTIONS

Mill Lade



ENERGY SOLUTIONS

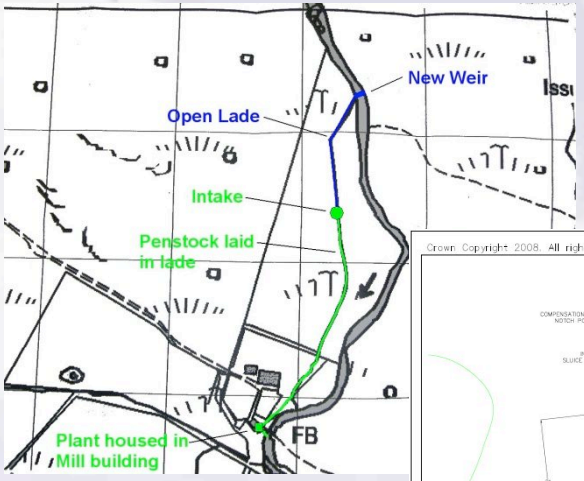
Barrage/Weir

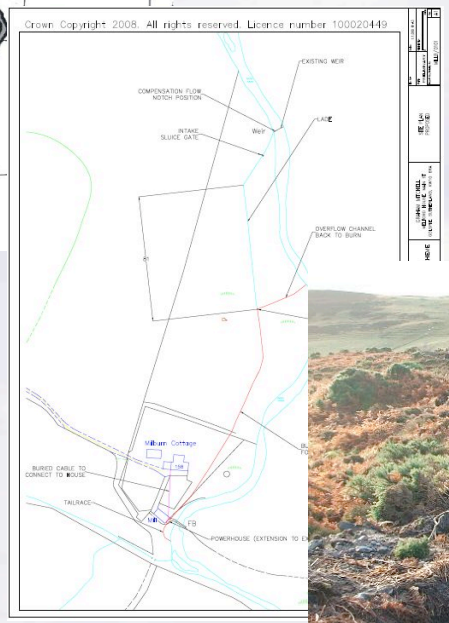


rd ENERGY SOLUTIONS

The Process

- Site Selection
- Pre-Feasibility
- [Feasibility]
- Design
- Consents
- Procurement
- Construction
- Operation



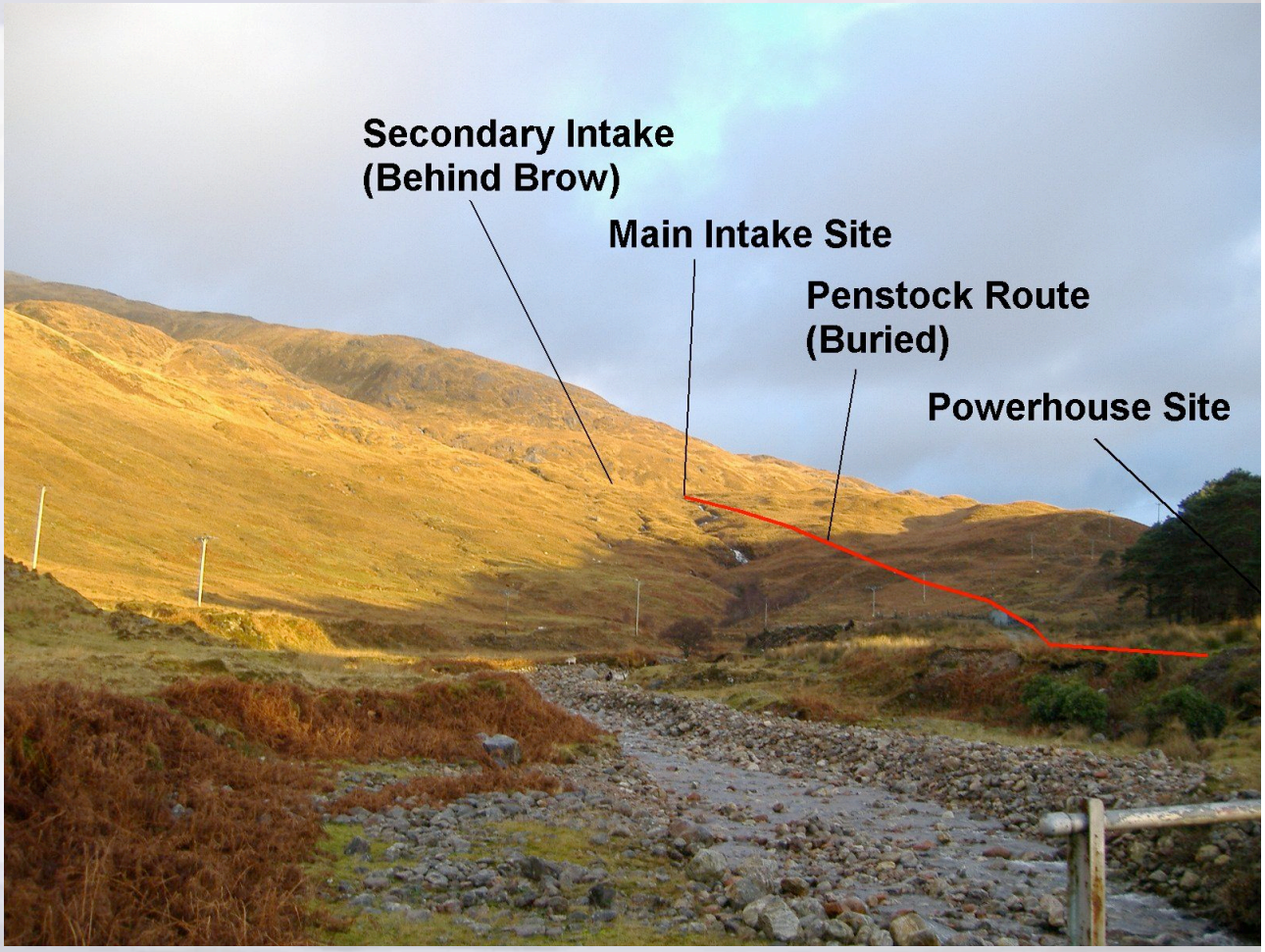


- Timescale – At least 2 years
- DIY Potential

rd ENERGY SOLUTIONS

Site Selection

- Head
- Flow
- Slope
- Storage
- Access
- Topology
- Terrain
- Grid
- On-Site Load
- Existing Infrastructure
- Environmental Factors
- Ownership



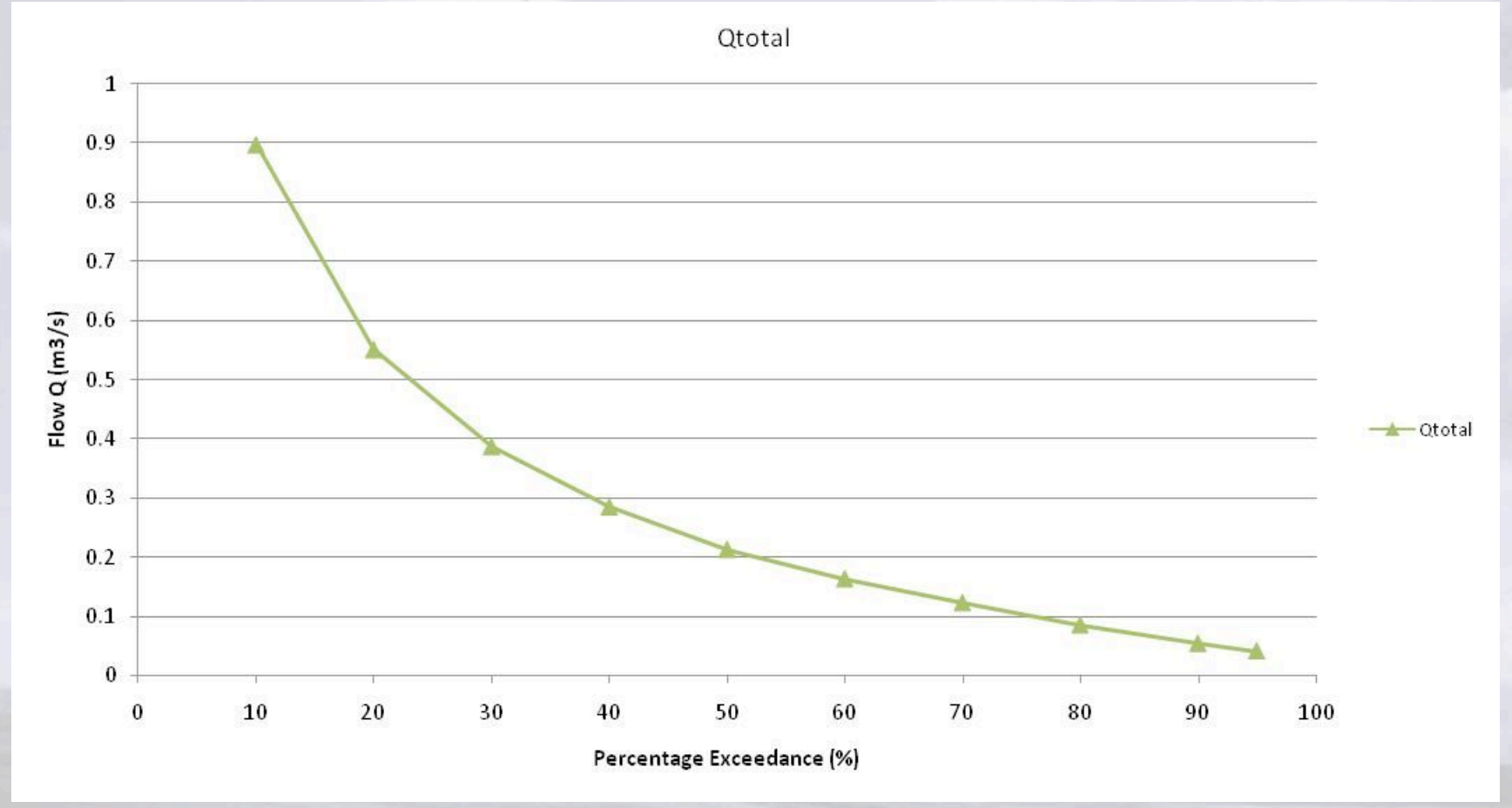
rd ENERGY SOLUTIONS

Feasibility

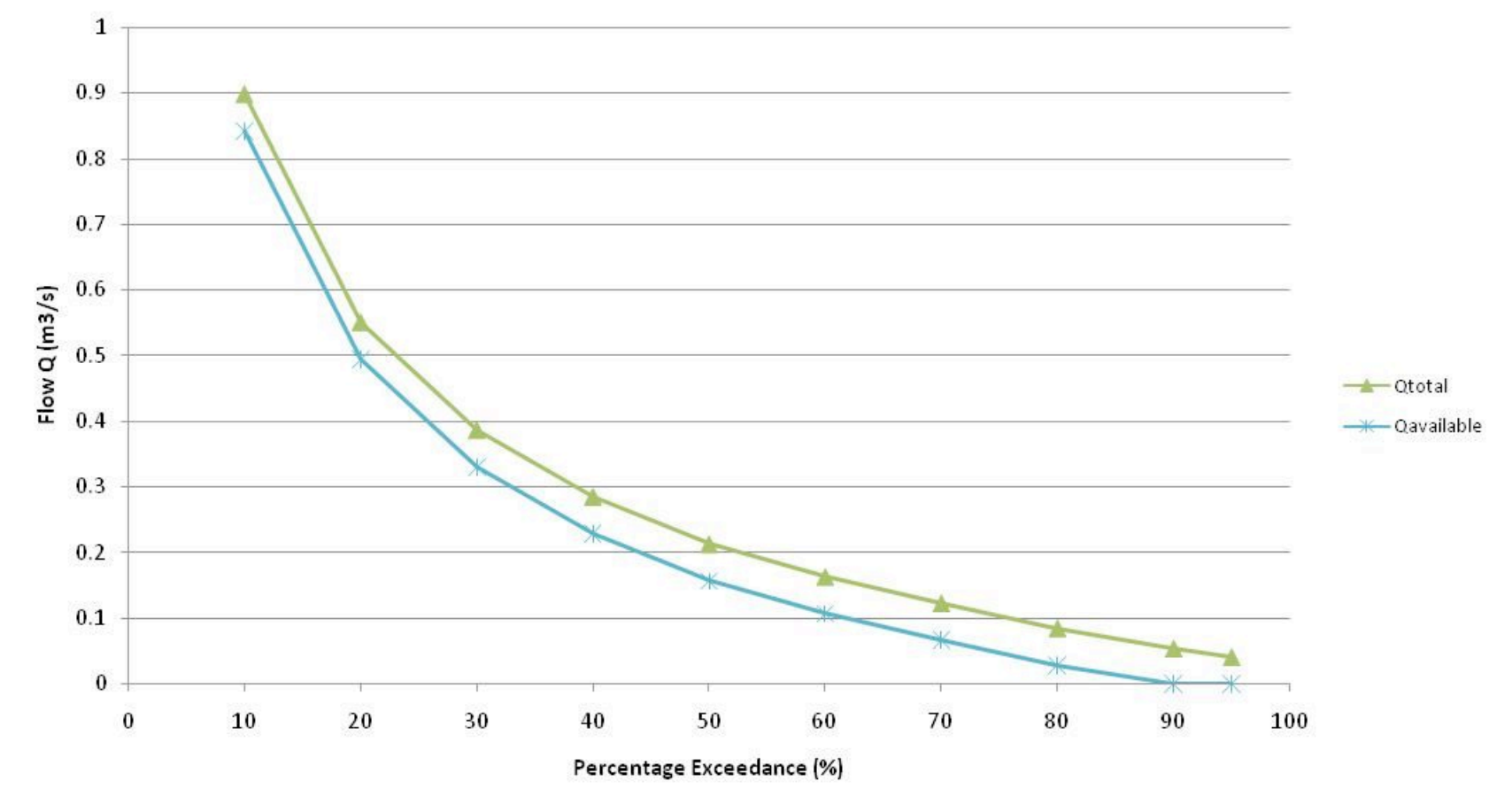
- Head
  - Measurement
- Flow
  - Measurement
- Design Options/Layout
- Turbine Type
- Preliminary Specifications
- Energy Yield
- Environment

rd ENERGY SOLUTIONS

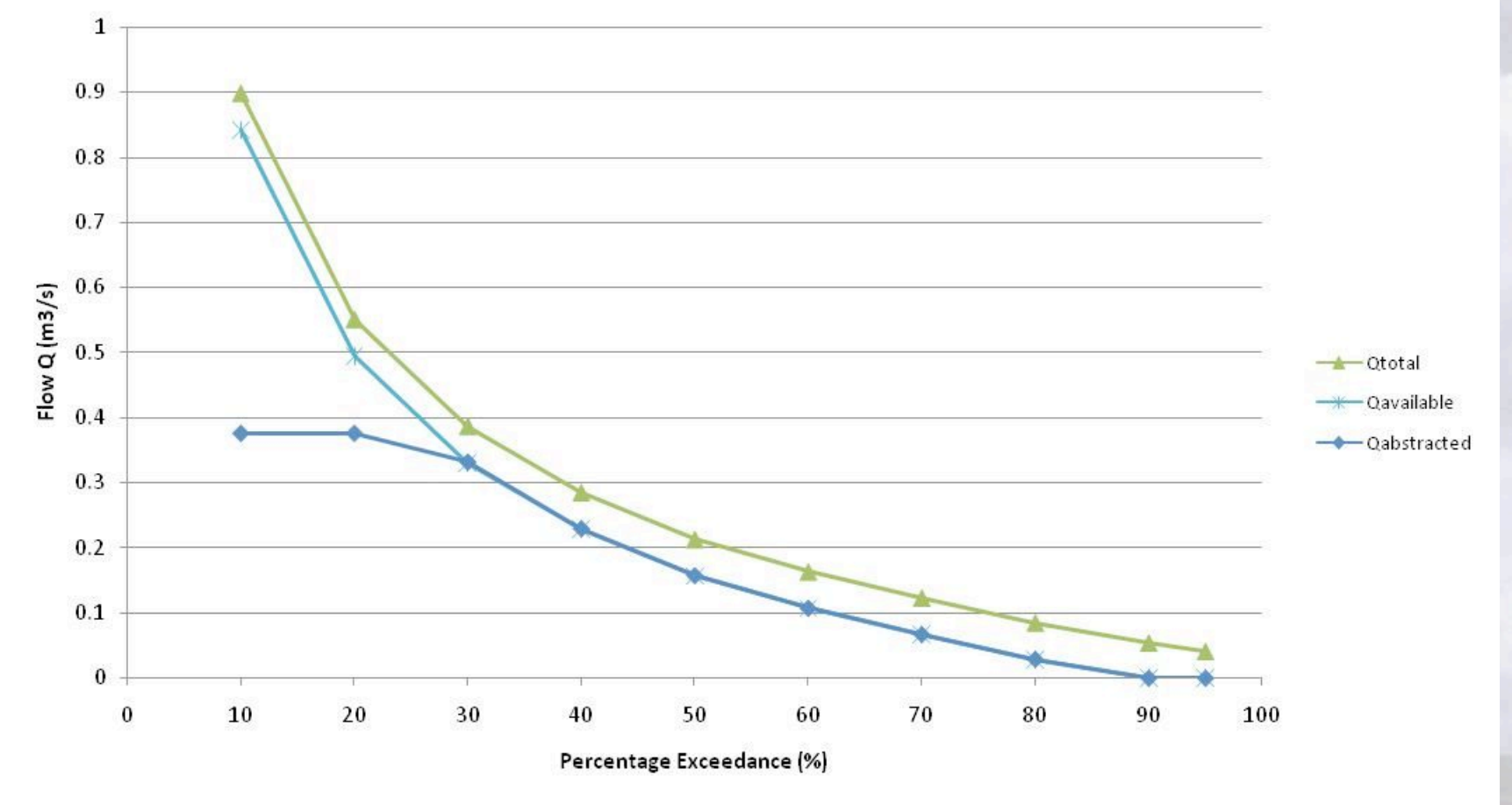
Flow Duration Curves



Flow Duration Curves

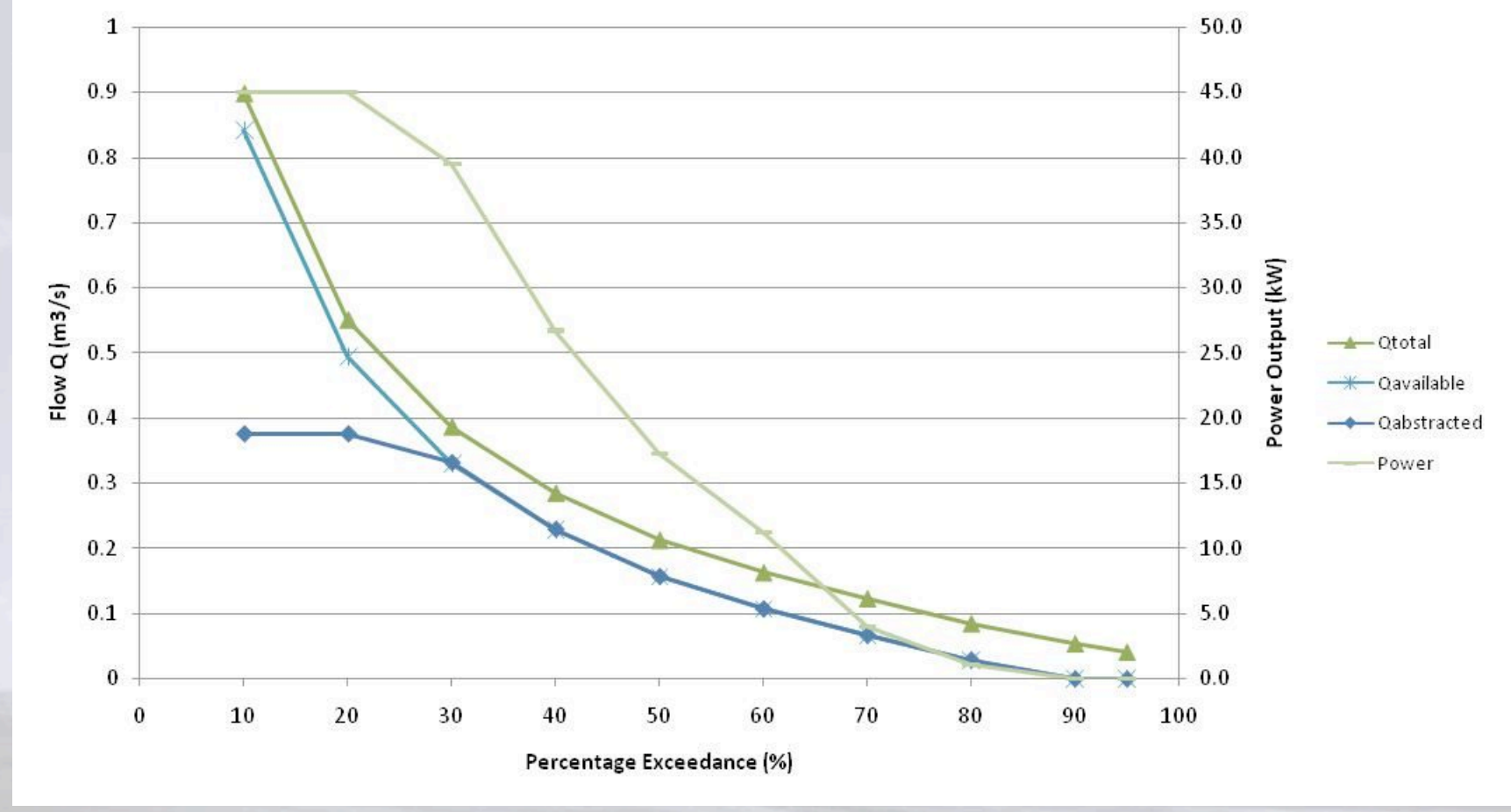


Flow Duration Curves



renewable devices

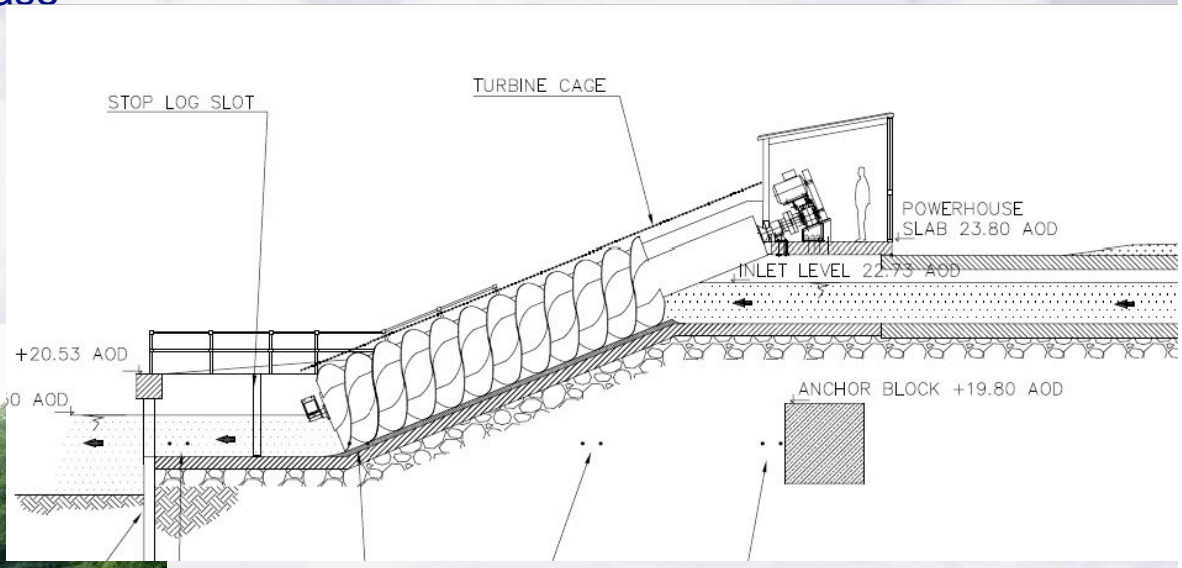
Flow Duration Curves



renewable devices

Design

- Sizing Considerations
  - G83/G59 – 3.7 or 10 kW per phase
  - Double ROC – 50 kW
  - CAR Licence – 100 kW
  - Existing Infrastructure/grid
  - Standard turbine/pipe
- Maintenance
- Environment
- Budget
- Drawings
- Specs

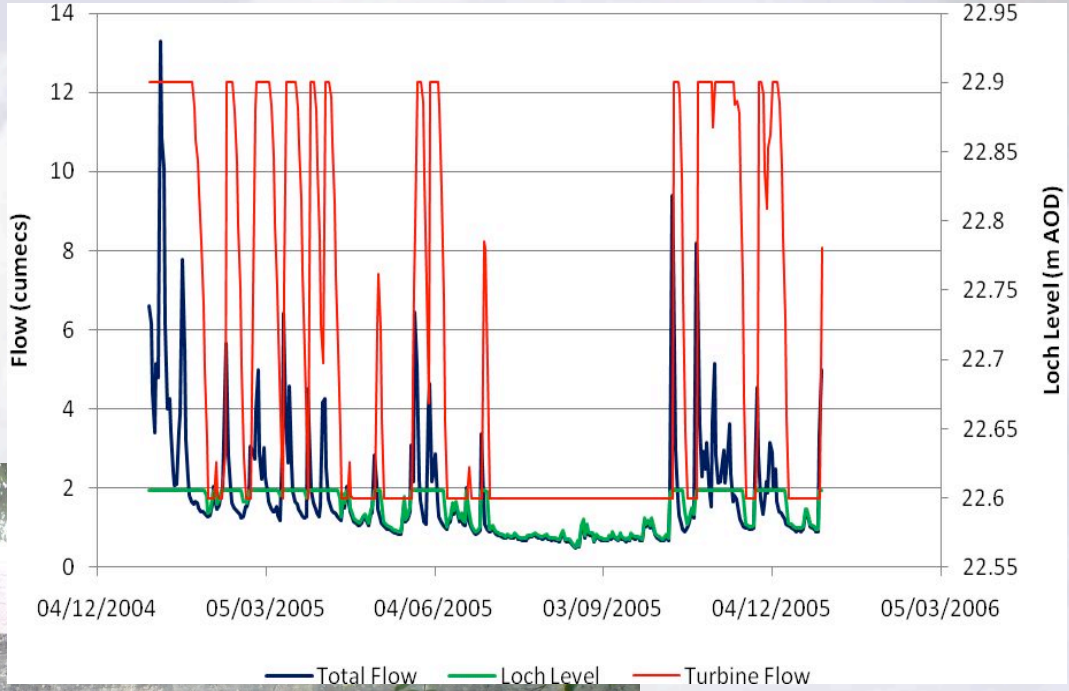


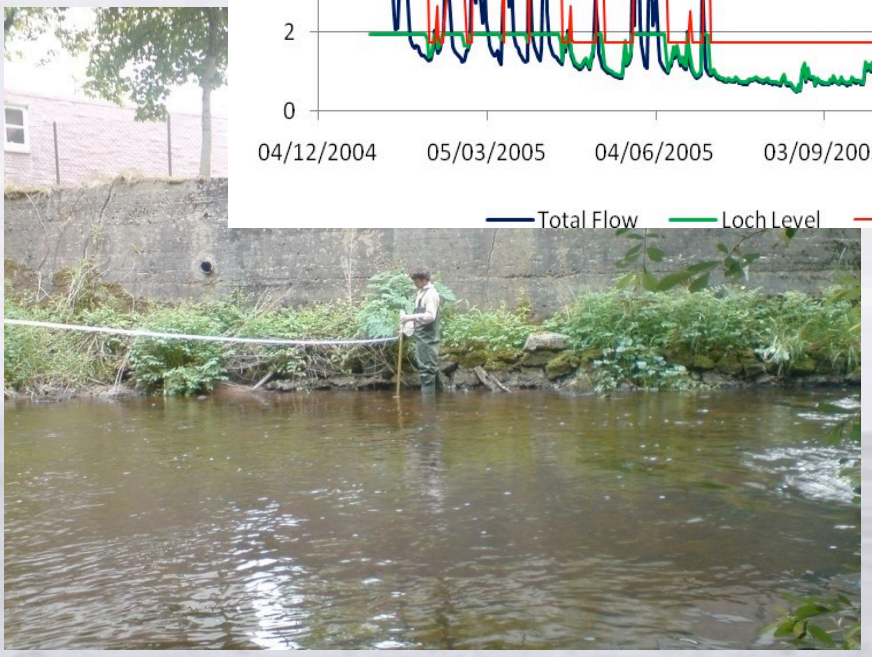
ENERGY SOLUTIONS

Consents

- Grid Connection Offer
- CAR Licence
- Planning Consent

- Environmental Statement
- Early Consultation





rd ENERGY SOLUTIONS

Procurement

- Dependent on:
  - Approach & budget
    - Rolls Royce v Skoda, 2nd Hand
  - Funding
  - Scale
- Turnkey solution/separate contracts
- Leadtime
- PPA
- VAT @ 5%

renewable devices

Construction

- Potential for DIY and cost saving
- Timing important
- Solvable Problems

renewable devices

Operation

- Maintenance contract/DIY
- Lead times on revenue
- Revenue components
  - Power
  - ROC
  - LEC
  - REGO

renewable devices

Key Issues

- Grid Connection
- Early Consultation
- Finance
  - Grants
  - Debt
- Power/ROC Prices

rd ENERGY SOLUTIONS

Thank You

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rd ENERGY SOLUTIONS