

MICRO-HYDROPOWER

MAJÉ CHIMÁN, PANAMA



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OUTLINE

- Assessment Trip
- Objectives and Constraints
- Design Components
- Conclusions
- Questions



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ASSESSMENT TRIP



Picture by Google Maps



THE COMMUNITY

- Wounan Tribe
- Community Structure
- Past Projects
- Economy
- Education



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EXISTING SYSTEM

- 110 kW Diesel Generator
- 114 Houses
- Transportation of Diesel Fuel



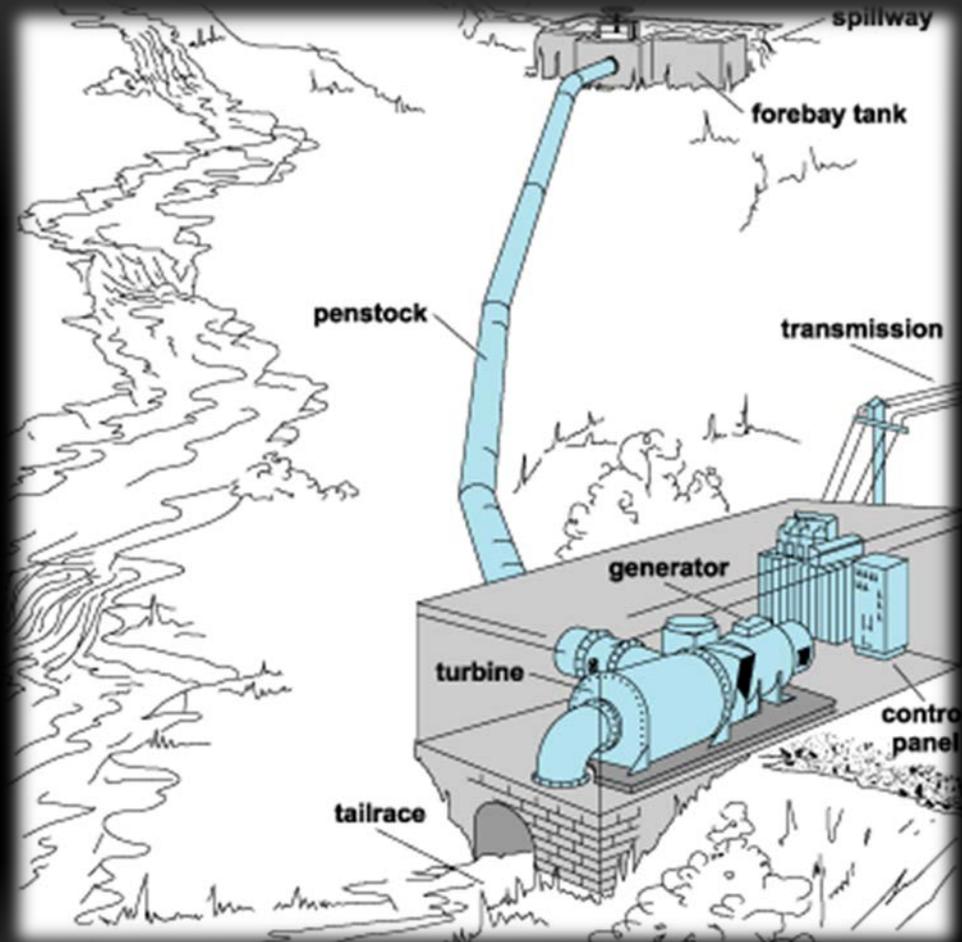
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HYDROPOWER

- Inlet
- Forebay
- Penstock
- Turbine
- Generator
- Transmission



www.accessscience.com



DATA COLLECTION

- Salto Falls
- Chorro Falls



Taken by Ty Losinski



Taken by Community Member



DATA COLLECTION

- Velocity Measurements
- Cross-Sectional River Data
- Abney Level Readings
- GPS Coordinates
- Community Surveys



Taken by Kelli Whelan

PROPOSED SITE

- 90 Feet in Height
- 7 Miles from Maje
- Flow Rate of 35 ft³/sec
- 103 kW Calculated in Panama
 - Power=Flow*Head*Efficiency



Taken by J. Cole



DESIGN OBJECTIVES

Objective Name	Priority Rating	Method of Measurement	Objective Direction	Target
System Cost	High	Total System Cost	Minimize	\$150,000
Ease of Installation	Low	Cost of Professional Labor	Minimize	\$15,000
Maintenance	Medium	Cost and Time	Minimize	10% of System Cost
Environmental Impacts	Low	Turbidity Measurements Down Stream	Minimize	10% Increase of Current Turbidity
Power Generation	High	Available Watts in Community	Maximize	100 kW



DESIGN CONSTRAINTS



Constraint	Method of Measurement	Limit
Safety	Number of Injuries/Deaths	0
Available Head	Surveying and Head Loss Calculations	90 Feet
Water	Measure the Zapatero River Flow Rate	35 cfs
Location	Distance From Community	7 Miles
Transportation Timeframe	Time in which materials can be transported to site	3 Months/year

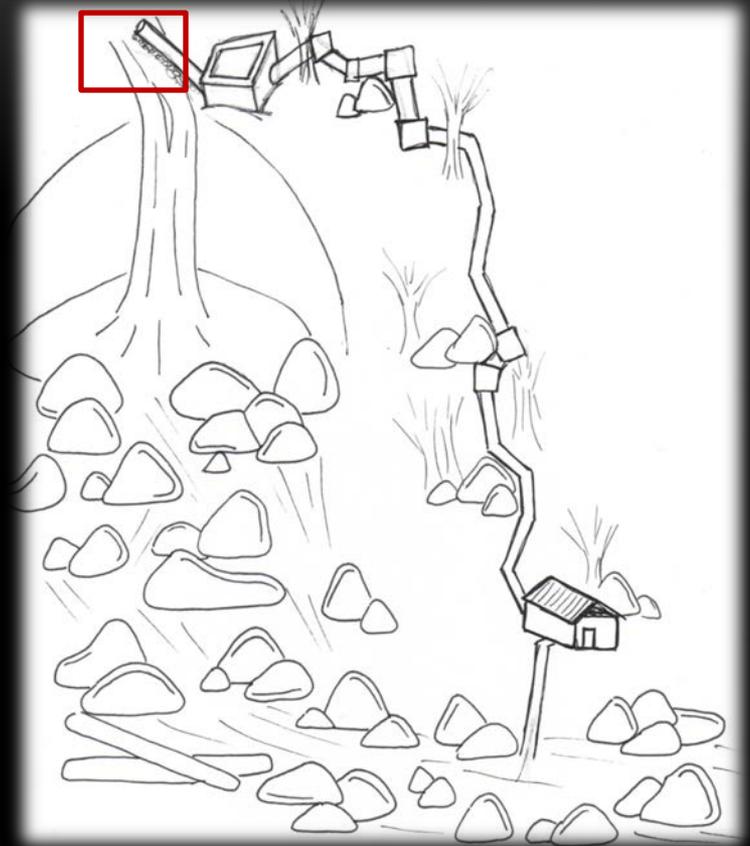


INLET STRUCTURE

- Diverts 17.5 ft³/sec
- Rock Gabion



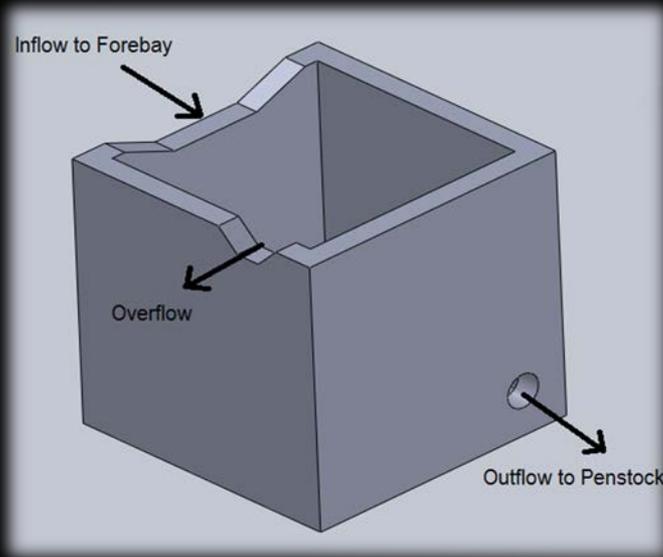
www.nirmaljoshi.wordpress.com



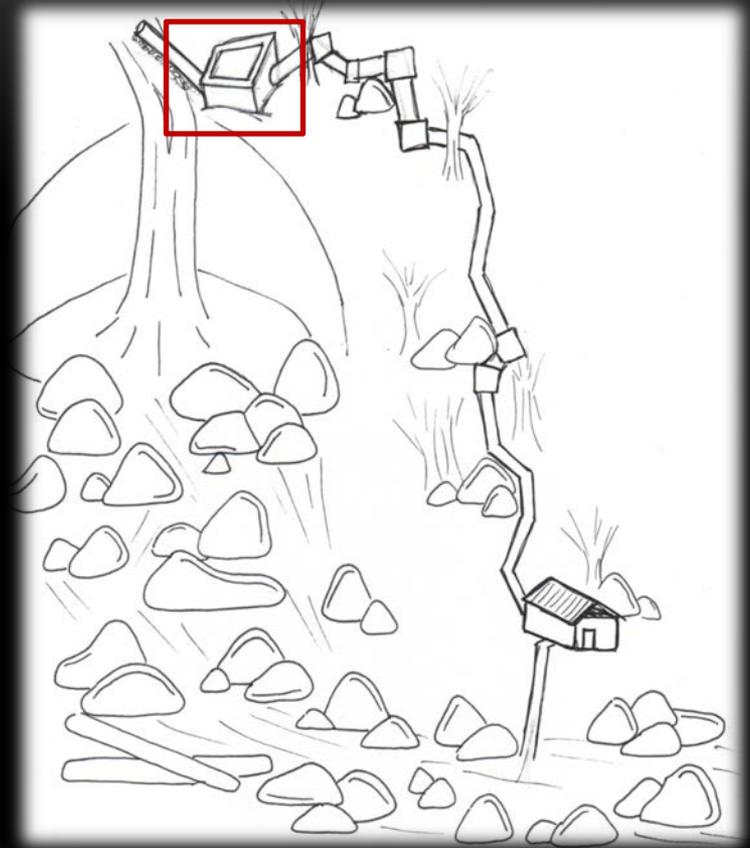
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FOREBAY DESIGN

- Regulates Flow
- Concrete Structure
 - 12 x 12 x 12 feet
- Overflow Channel



Created by Christine Matlock



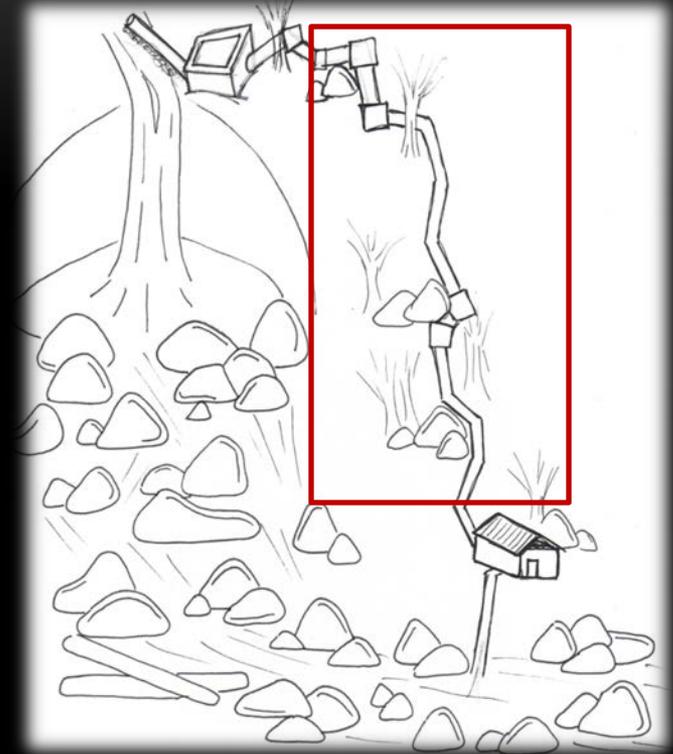
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PENSTOCK

- PVC – 18 Inch Diameter
 - 670 Feet Long
- Headlosses
- Thrust Blocks and Anchoring



Taken by Andrea Walvatne



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HOUSING STRUCTURE

- Location
- Materials
- Tail Race



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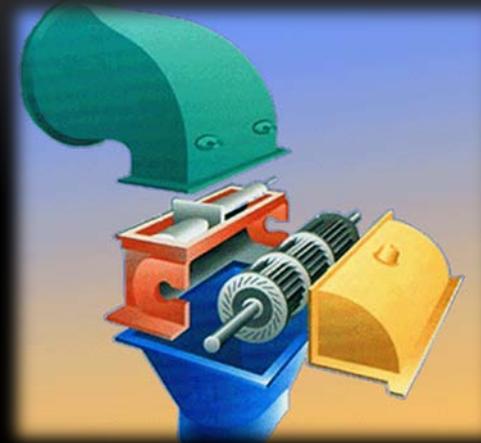
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TURBINE AND GENERATOR

- Cross Flow Turbine
 - 32 Inches in Diameter
- Gearing System
- Synchronous Generator
 - 78 kilowatts



www.members.tripod.com



www.canyonhydro.com

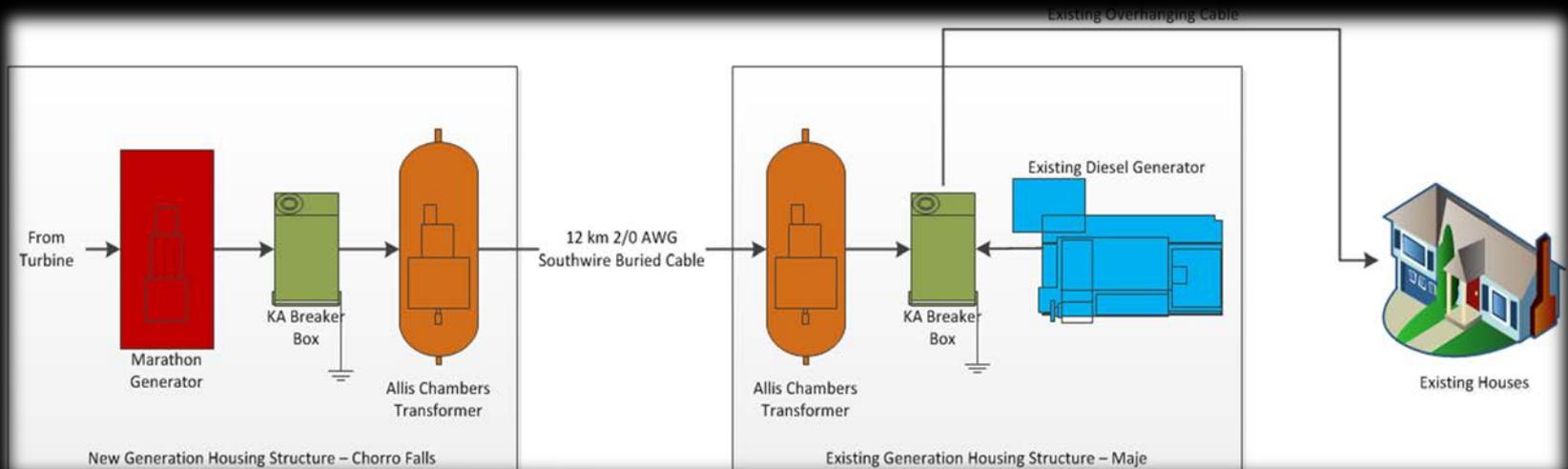


POWER TRANSMISSION

- Transformer
- Buried Cable
- Emergency Switch



www.electrical-engineering-portal.com



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OVERALL COST ESTIMATE

Category	Total Cost
Mobilization	7,600
Inlet/Forebay	2,000
Penstock	37,200
Housing	3,900
Generator /Turbine	276,800
Power Distribution	96,700
Total Cost	\$ 445,400
Including 5% tax	\$ 467,700



CONSTRUCTION

- Course of 2 Year Period
- Labor
- Environmental Impacts



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ALTERNATIVES

- Diesel Generator
 - Continuous Fuel Cost
 - \$127,000/year
- Solar Power
 - Insufficient Power
 - \$171,000
- Connect to Existing Grid
 - Unknown Usage Fees
 - \$192,000



Taken by J. Cole



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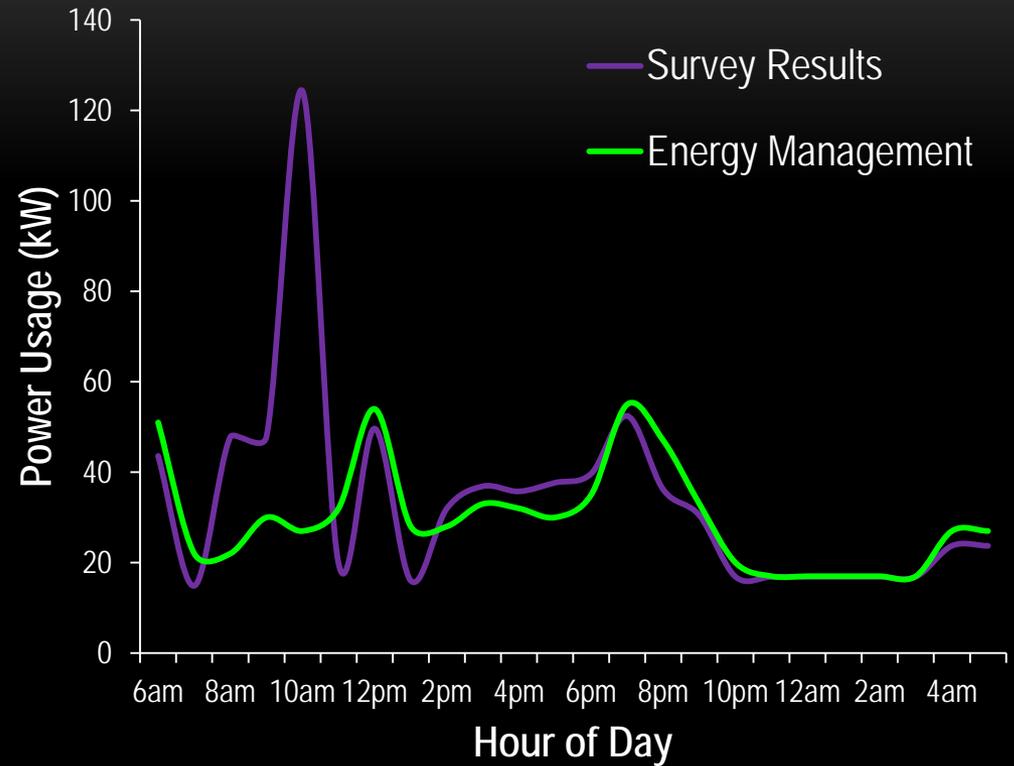


ENERGY SAVINGS

- Usage Schedules
- Laundromat
- Employing Batteries
- Prioritize Power



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SOCIAL IMPACTS

- Life Style Change
 - Daily Chores
 - Education
 - Healthcare
- Eco-Tourism
- Cultural Shift



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FEASIBILITY

- Outside Funding Source
- Professional Consultant
- Maintenance Capacity



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FINAL RECOMMENDATIONS

“Micro-hydropower is a renewable and sustainable option but also an expensive power source.”



Taken by J. Cole



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- J. Cole



QUESTIONS?



Taken by Kelli Whelan

