Baynes Environmental and Social Impact Assessment

Central Level Public Feedback Meeting, Windhoek 25 February 2013

The world's leading sustainability consultancy

ERM

Agenda

18:00 – 18:10	1. Official Opening	MME/NamPower
18:10 – 18:15	1. Introduction and Purpose of the Meeting	E Simon
18: 15 – 19:15	1. Presentation of the Findings of the ESIA	M Everett / E Simon
19:15 – 19:45	1. Questions and Discussion	E Simon
19:45 – 19:55	1. The way Forward	M Everett
19:55 – 20:00	1. Closure	E Simon

Need for Increased Electricity Generation in Angola

Two main drivers that require an increase in the generation of electricity in Angola. These include:

Inadequate regional electricity supply capacity

- Three separate electrical grids
- Southern System only contributes 5.7% of the electricity produced
- Current infrastructure operating at below its installed capacity.

Increasing demand.

- An increase in domestic demand
  - Electrification of urban and peri-urban areas
  - An increase in industrial, mining and housing projects
  - Demand for energy supply in Angola increased by 36% from 2001 to 2005

Need for Increased Electricity Generation in Namibia

Three main drivers that require an increase in the generation of electricity in Namibia. These include:

- Reduced availably of electricity imports from neighbouring countries and the SAPP
- Increasing costs of electricity imports
- An increase in the domestic demand for electricity

Energy Generation alternatives in Namibia

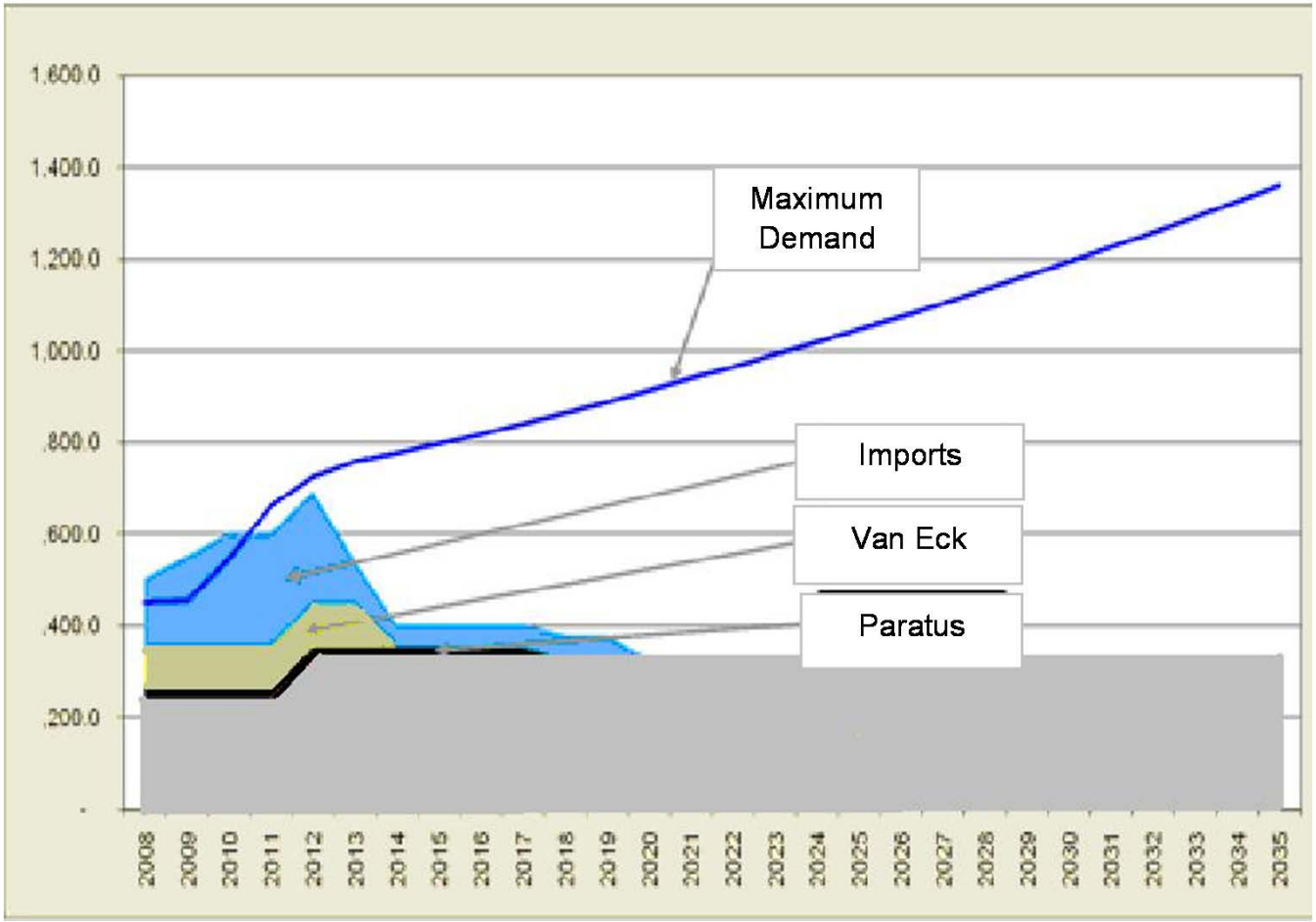
Namibia is reliant on producing an energy mix in order to support its future energy demands.

Energy mix includes:

- Kudu Gas
- Arandis coal
- Diesel peaking power stations
- Lower Orange River (small) hydropower stations
- Ruacana additional turbine
- Wind Energy
- Solar Energy
- Baynes hydropower

Hydropower is selected as part of the energy mix with which to reduce this dependency on energy import, as a result of the constraints and limitations associated with other base load fuel types and alternative energy sources.

Namibia's Power generation needs



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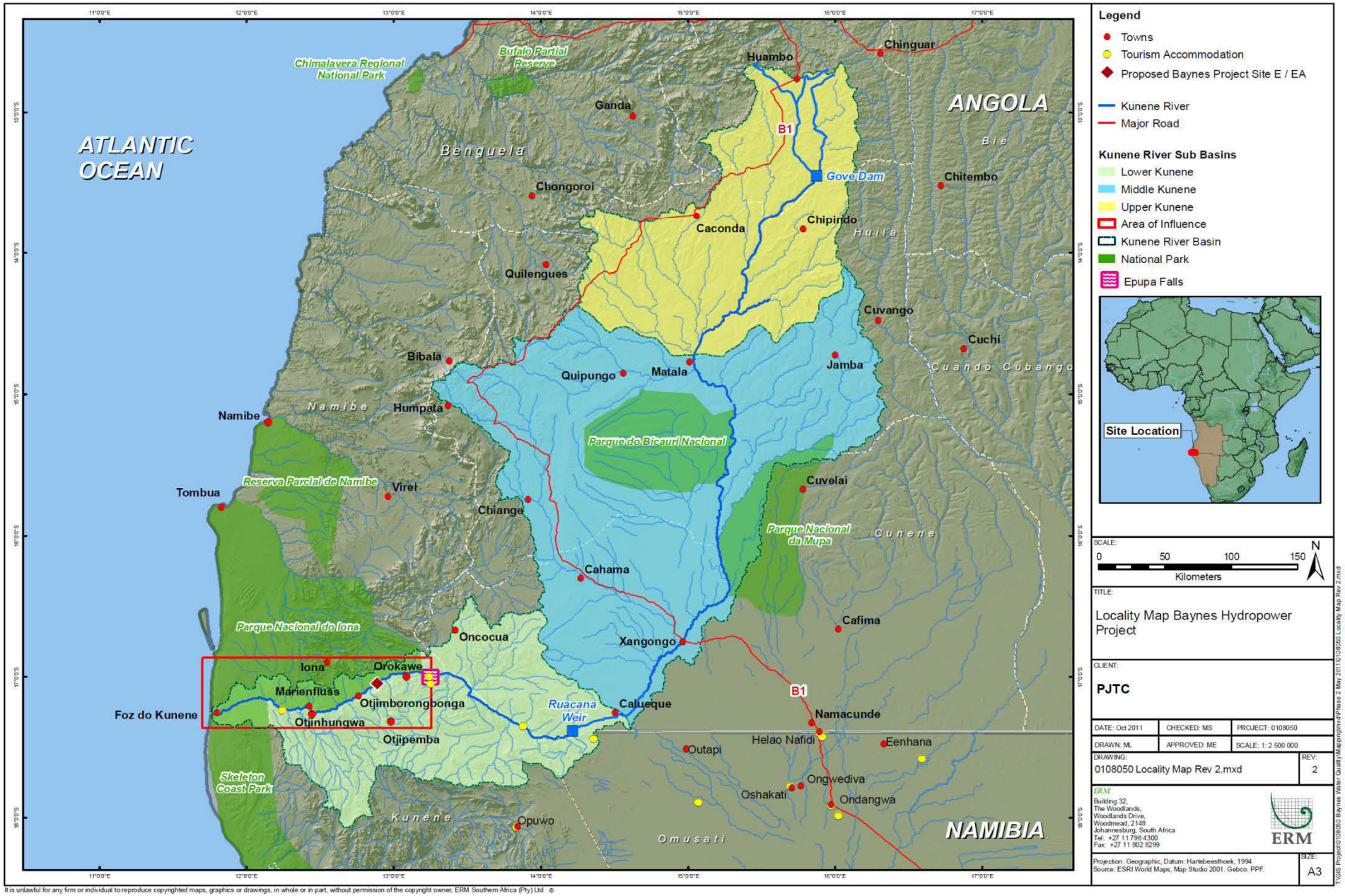


Principal Project Characteristics

Project Facility	Description
Main Dam	
Dam Type	Concrete Faced Rockfill Dam (CFRD)
Crest Elevation	587.00m
Reservoir	
Upstream Water Level	
Normal Maximum	580.00m
Reservoir Volume	2,57 x 10^9 m^3
Downstream Water Level	
Normal Maximum	394.00m
Flooded Areas	
Concerning the FSL	58.15 km^2
Powerhouse	
Number of Generating Units:	5
Energy Studies	
Gross Head:	186.00m
Installed Capacity:	600 MW

Overview: ESIA Feedback

- Summary of Environmental and Social baseline
- Key impacts – Bio-physical
- Key impacts – Socio-economic
- Key Impacts – Archaeological and Cultural Heritage
- Public consultation and disclosure
- Development of Social and Environmental Management Plan (SEMP)
- Conclusions

Principal Highlights of Environmental Baseline

Hydrology:

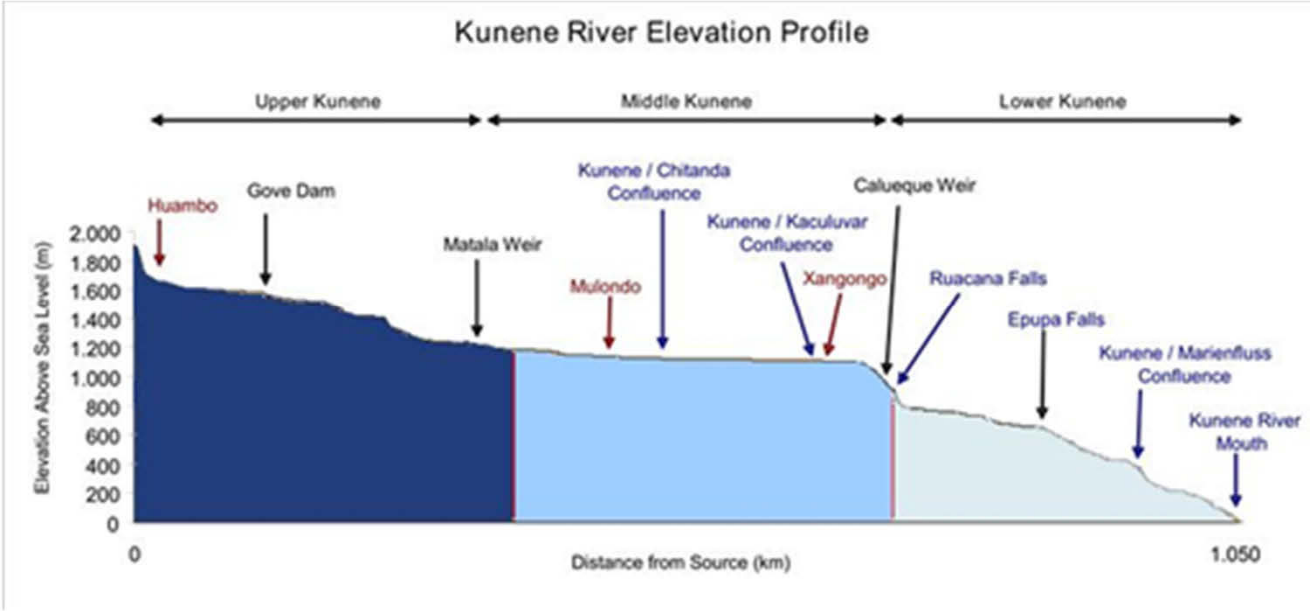
Upper Kunene River

- MAR: 75% - 90% of total volume of river flow
- MAP ~ 1,300mm
- 90% annual rainfall falls in 5 month rainy period (Dec – April). Main season February and March
- 4 to 5 month dry season (May – September)

Hydrology

Lower Kunene River

- < 50mm rainfall per annum at the river mouth; 350mm per annum inland
- Total contribution of Lower Kunene to total flow in the Kunene River: < 5%
- Seasonal (ephemeral) tributaries
  - Contribute very little to MAR
  - Function as ground water aquifers



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Lower Kunene River Characterization

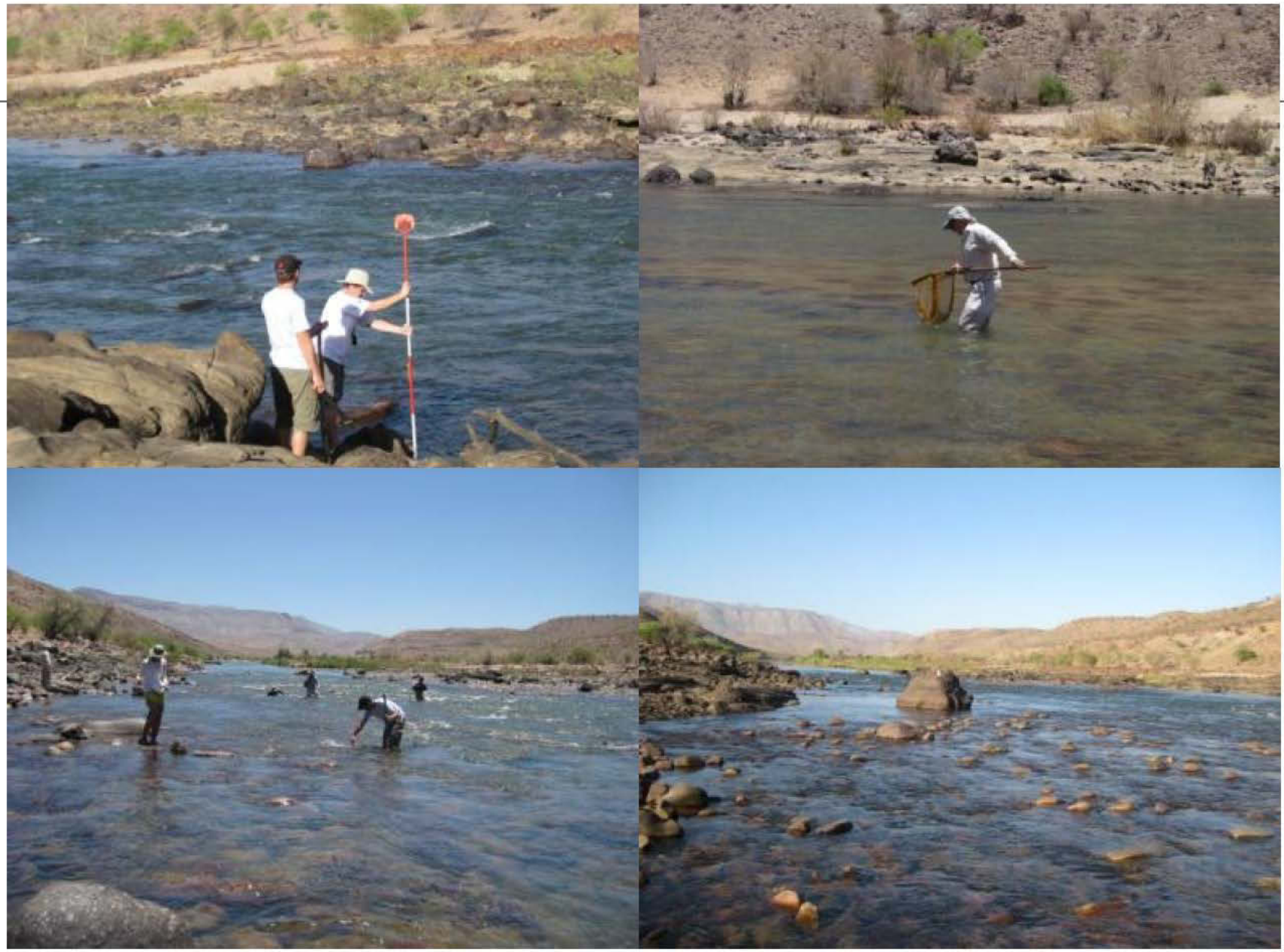
- Soils of poor quality: restricts landuses
- High wilderness and conservation value.
- Sense of Place invaluable for eco-tourism
- Supports far western part of Mopane savanna - known for its high diversity of floral species
- High proportion of endemics and species with protected status expected to occur in the general Kunene River area

Lower Kunene River Characterization (*Cont.*)

- Kunene River the only perennial system in the Namib ecoregion; provides habitat to absolute majority of fish biodiversity of the ecoregion
- 6 endemic fish known from ecoregion, 2 IUCN red listed fish species occur
- Unique aquatic habitat are the perennial springs along the edges of the Kunene valley
- System not impacted by exotic fish
- Kunene River catchment generally undeveloped:
  - Nutrient loads from catchment are therefore low
  - Water quality generally good, and potable

Study Area Characterization for Environmental Flow Assessment (EFA)

- Lower Kunene River: harsh environment means fairly low biodiversity and resistant to flow fluctuations from Ruacana HPP
- Present Ecological State (PES) of river downstream of Ruacana HPP is B-category, ***viz***. slightly modified from Reference Condition
- Relatively minor impact of Ruacana HPP on river ecology:
  - Wet season flows are largely unaffected by Ruacana HPP
  - Ruacana reservoir has small storage capacity relative to MAR
  - Does not attenuate wet season floods, nor delay onset of wet season through storage of early season flows
- Kunene River mouth
  - Operates as a river mouth as opposed to an estuary
  - bio-geographical limit of a number of marine and freshwater tropical species
  - Plays critical role as an oasis in extremely harsh Namib Desert



Principal Highlights of Social Baseline

Study Area Characterization

- Area on both sides of Kunene River sparsely populated
- Nearest towns considerable distance away from the Baynes Site:
  - Orokawe closest to proposed dam wall site
  - Okangwati closest settlement
  - Opuwo closest town in Namibia
  - Erora and Ombongo closest settlements in Angola.
- Primary landuse: utilised by Himba for livestock rearing
- Himba skilled cattle herders subsisting successfully in very harsh environment - success closely linked to unique culture and social organization
- OvaHimba classified by IFC as Indigenous Peoples

Study Area Characterization *Cont.*

- Literacy rates low
- Few services available in Project Area
- Housing in inundation area exclusively traditional housing structures
- Within inundation area:
  - 6 households (5 on Namibian side and 1 on Angolan side)
  - 12 cattle posts (8 on Namibian side and 4 on Angola side)

Principal Highlights of Social Baseline

Study Area Characterization *Cont.*

Other Landuses in vicinity of Project Area

- Iona National Park (Angola)
- Skeleton Coast National Park (Namibia)
- 2 registered communal conservancies (Marienfluss and Orupembe; Namibia)
- Tourism (on Namibian side of Kunene River) relatively common although small scale
- Uncontrolled development taken place in vicinity of Epupa

Archaeological Landscape

Highly sensitive archaeological landscape (43 archaeological sites identified) ~ 70% related to traditional settlement arrangements of Himba including graves

Key Impacts - Bio-physical

Terrestrial Habitats

- Direct loss of terrestrial habitats and vegetation: ~5,900 ha of land will be inundated
- Vegetation most affected by inundation includes:
  - ***Combretum imberbe – Salvadora persica*** riverine forests within the reservoir footprint
  - ***Adenolobus garipensis – Euphorbia virosa*** bushlands along canyon slopes.
- Operation of dam will reduce or eliminate annual riparian flooding downstream
  - A loss of riparian vegetation in river's floodplain.
  - likely that downstream riparian habitat will undergo changes in species composition, vegetation density, etc.

Key Impacts - Bio-physical

Wildlife

- Habitat loss and disturbance the primary impacts on terrestrial wildlife during the construction phase.
- Inundation of reservoir will result in drowning of some mammals
  - The reservoir will fill slowly which should avoid large scale direct loss
  - Mortality due to drowning is likely to be most prevalent in ground dwelling and feeding mammals (mainly rock/crevice dwelling species and burrow dwelling species.
- Most herptiles and invertebrates within reservoir footprint will be lost

Key Impacts - Bio-physical

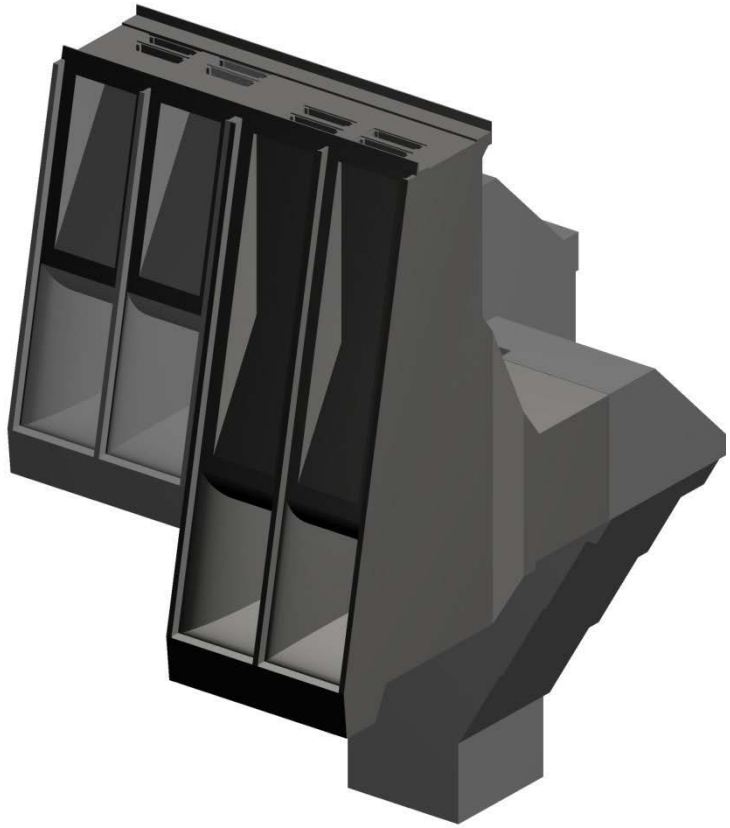
Aquatic Ecology and the Water Environment

- The full supply level of the impoundment is 580m - so as not to impact on the Epupa Falls upstream.
- Loss of 15 perennial spring ecosystems in the inundation area,
- Project will create a new water environment within the impoundment
- Rheophillic fishes with strong preferences for rocky substrate, fast flowing habitats can be expected to disappear from reservoir in favour of those species with limnophillic floodplain habitat preferences.
- Flow alterations will impact on both the abundances and diversity of fish and macroinvertebrates in the Namib Ecoregion downstream
- The PES of the river downstream of the dam will change from a B (slightly modified from the Reference Condition) to a D (largely modified from the Reference Condition).

Key Impacts - Bio-physical

Stratification of reservoir

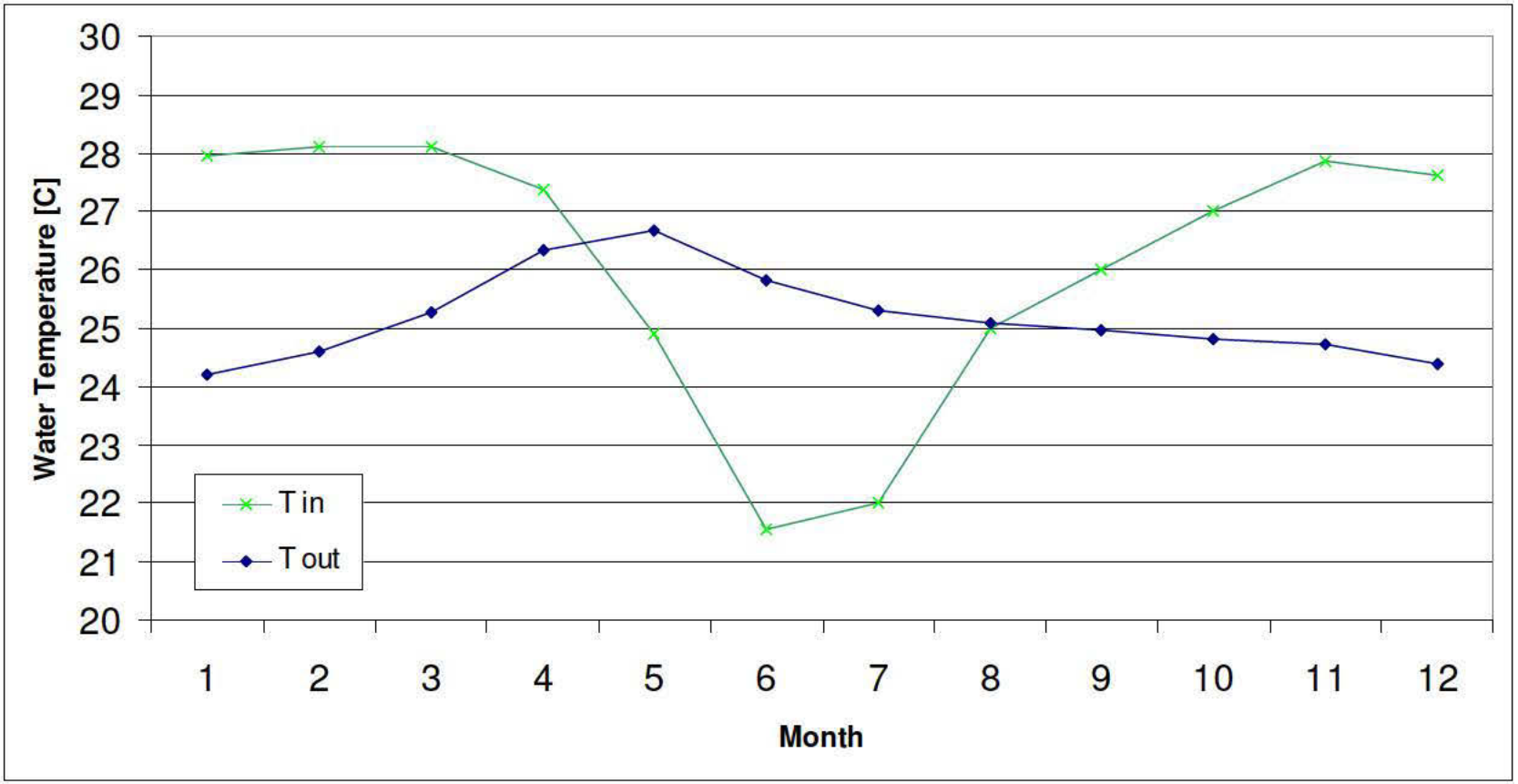
- The Baynes Reservoir will show stratification most of the year
- Seasonal vertical temperature stratification will range by ± 3°C in January, by ± 6°C in May and ± 4°C in September.
- Hypolimnion: may accumulate low temperature, low dissolved oxygen (DO) water.
- Two multi-level offtakes provides ability to blend cooler water from the hypolimnion with warmer water within the epilimnion at elevations above 500m, thereby controlling to some extent the release water temperature.



Downstream temperature impacts

- The effect of the reservoir will be to dampen the fluctuations in water temperature that occur in the Kunene River.
- The magnitude of this temperature difference is estimated from model results:
  - to range from 4°C above to 4°C below the ambient temperature.
  - These results are for an offtake operating condition that is not optimised.
- Similar, but less severe, impacts can therefore be expected with a blended release schedule.
- Model results indicate there could be a 1 to 2°C improvement (decreased impact) when an optimised blending schedule is developed.

Downstream temperature impacts (*Cont.*)



Downstream temperature impacts (*Cont.*)

- Model results indicate that the temperature effects of release waters will be felt all the way to the Kunene mouth, albeit at lesser levels further downstream from the dam.
- Thermal changes within this range:
- will impact on fish species
  - (eg. cold water discharges during the summer can cause reduced growth rates, productivity, fertilization and hatching success of the exposed fish and aquatic invertebrate assemblages.
  - Warm water discharges leading up to and during the winter, can stimulate spawning and hatching during unfavourable conditions.
- May impact on the breeding and growth, and consequently, the populations of aquatic invertebrates, particularly the large freshwater prawn ***M. vollenhovenii***. This should be confirmed through studies on the temperature tolerance of this species.

Key Impacts - Bio-physical

Limnology

- Productivity in the reservoir will be nitrogen-limited
- Nutrient loading into the proposed reservoir will cause the reservoir to be ***oligotrophic*** (clear, low productivity).
- However, until lake matures and reaches a more stable condition, it is likely to be ***eutrophic*** (nutrient rich and productive in terms of aquatic plant or animal life) due to the release of nutrients from the flooded riparian zone, which contains limited vegetation.
- Once such flushing has occurred, phosphorus and nitrogen loading rates will stabilise and water quality will improve.

Key Impacts - Bio-physical

Aquatic Ecology and the Water Environment

- Flow release scenarios that were evaluated as part of EFA study were based on proposed operation of the Baynes HPP in terms of downstream releases.
- Of the thirteen scenarios evaluated, only three limit the predicted drop in ecological category to one category (B to C).
- These three scenarios were, however discounted as they rendered the dam uneconomical, ie an Internal Rate of Return (IRR) of less than 10%.
- Scenario NP5 (50 m^3s^{-1} compensation flows, plus spills) was selected as best mitigation that could be achieved while still delivering a 10% IRR.

Key Impacts - Bio-physical

Aquatic Ecology and the Water Environment

- Drop in the ecological state of the river from a B-category to a D-category.
- D-category is widely considered to represent the lower limit of degradation allowable under sustainable development.
- This impact is based on assumption that during periods of low flow (< 50 m^3s^{-1}), environmental flow releases will take priority to electricity generation.
- The assumption made therefore was that during periods of low flow, no power would be generated.

Key Impacts - Bio-physical

Kunene mouth:

- There are three possible physical issues of concern with regards to river inflow reduction in the Kunene River Mouth, namely:
  - Mouth closing as a result of decreased seasonal baseflows;
  - Increase in salinity penetration resulting from a decrease in seasonal baseflows; and
  - Infilling of the river channel as a result of a decrease in, or loss of, resetting flood events which cause increased sedimentation.

Key Impacts - Bio-physical

Kunene mouth:

- Mouth closing:
  - Closure of Kunene River mouth is only likely to occur if river inflow below 10 m^3s^{-1} occurs for extended periods (weeks to months) at a time.
  - Analysis of EF releases indicates that probability of such flows occurring are less than 2% of the time, and then only for short periods.
  - Mouth closure is therefore not considered to be an issue of concern
- Salinity penetration
  - Limited to its lower reaches (200m to 500m from the mouth).
  - Operation of HPP will likely create a condition where the system would fluctuate between fresh and brackish in its lower reaches (500m to 1,000m of the Kunene River mouth) - particularly during low flows and drought conditions.

Key Impacts - Bio-physical

Kunene mouth (*Cont.*)

- Large floods crucial in maintaining the long-term dynamic equilibrium with respect to the sediment regime in the Kunene River Mouth.
  - It is surmised that an overall reduction in intermediate flows will cause the average extent of marine sediment intrusion to be only slightly further upstream than at present.
  - Physical changes to flow regime will likely affect the volume of the river mouth basin and the extent of freshwater wetland vegetation in this area, likely impacting on the flora and fauna of the river mouth region

Key Impacts - Bio-physical

Climate Change

- Impact of climate change on river flow in the region is uncertain
- Projected increase in rainfall over the upper Kunene catchment ~20%, mainly during the summer months
- Evaporation will change due to variations in temperature, which is projected to increase in Angola
- Potential for water stress as a result of human demands in the middle Kunene Basin, particularly during periods of low flow will likely pose a higher risk to the Baynes HPP.

Key Impacts - Bio-physical

Greenhouse Gasses

- Emission of greenhouse gases (GHG) from the reservoir due to decaying vegetation and carbon inflows from the catchment.
- Provided that vegetation is at least partially cleared prior to inundation, greenhouse gas emissions would be relatively low.

Key Impacts – Socio-economic

Key socio-economic impacts include:

- Loss of Land and Natural Resources
- Disruption to Social Networks and Rapid Cultural Change;
- Loss of Cultural Heritage
- Pressure on Social Infrastructure
- Disturbance due to Dust, Noise and Safety Hazards from Traffic
- Impact on the Local Economy
- Impacts on Fishing

Key Impacts – Socio-economic

Loss of Land and Natural Resources

- Loss of valuable grazing land
- The grazing in area of inundation and especially close to Orokawe forms part of the main grazing area of the permanent households
- Also regarded in both Angola and Namibia as an emergency grazing area.

Key Impacts – Socio-economic

Disruption to Social Networks and Rapid Cultural Change and Loss of Cultural Heritage

- Influx of 2,000 to 3,000 construction workers and work seekers
- Potential impacts on the Himba:
  - breakdown of local leadership structures;
  - a related rangeland crisis with potential to collapse the herding economy in the area;
  - increase in sexually transmitted disease,
  - loss of power and status of Himba woman; and
  - disintegration of social cohesion and lawfulness.

Key Impacts – Socio-economic

Pressure on Social Infrastructure

- Influx of large numbers of people - greater strain on these already limited facilities and infrastructure.
- Current infrastructure (road networks, services provision to the construction workforce, health and education facilities) inadequate to serve the needs of the project
- New access roads will need to be built and self-contained facilities (health, education) and services (including electricity, water, sanitation and solid waste) will need to be provided for construction workforce.

Key Impacts – Socio-economic

Impact on the Local Economy

- Temporary and potentially small local economic benefit from the dam should be seen as secondary to the threat of the large construction workforce and the contact between this workforce and the local community.

Key Impacts - Archaeological and Cultural Heritage

- Archaeological assessment”
  - 43 archaeological sites.
  - Of these sites, 65% attributable to recent Ovahimba settlements on the basis of culturally specific features.
  - Seven sites either confirmed or suspected grave sites.
- Himba place considerable importance on ancestral gravesites
- Inundation of ancestral graves or exhumation of such graves is unacceptable to the Himba

Public Consultation & Disclosure

- Meetings at the ***local level*** specifically, have included:
  - Scoping meetings
  - A report back on the ESIA Scoping Phase with community and their leaders
    - To specifically elaborate the key issues that were identified during the Scoping Phase
    - To explain way forward in terms of the activities of study team during the ESIA phase of the assessment;
  - A field trip to the Orokawe area to show extent of inundation area
    - Attended by traditional leaders, some regional councillors and regional council staff.
    - The extent of the inundation area was demarcated with whitewash stones to visually demonstrate the extent of the inundation area.

Public Consultation & Disclosure

- Local leadership were taken on a visit to the von Bach and Hardap Dams to ensure the local leadership were familiar with the nature of large dams, prior to the discussion of any proposed mitigation measures;
- Mitigation Discussion Meeting at Opuwo.
  - Attended by Himba chiefs from both Angola and Namibia.
  - Mitigation measures and costs were discussed separately
  - Community requested an opportunity to meet on their own to formulate a response to the proposals.
  - Following this meeting, a spokesperson then presented the decision of the community, namely that consent by the local community is being withheld at this time.

Development of SEMP

- An Social Environmental Management Plan (SEMP), currently in draft form, has been prepared as a separate, stand-alone volume as part of the ESIA process
- It includes numerous proposed mitigation measures, and an analysis of the institutional requirements for their implementation. The mitigation measures concern:
  - Design issues (pre-construction);
  - A Site Preparation Plan;
  - Construction Management Plan;
  - Employment and Workforce policies;
  - Community Health, Social and Security Plan;
  - A Reservoir Management Plan; and
  - A Resettlement Planning Framework.

Mitigation Measure	Basis of cost calculation	Estimated cost. (N$)
Mitigation Implementation and Control Task Force (MICTF)	The task force will be required for the year before construction start as well as for the entire period during construction.	2 600 000
Social and Environmental Management Consultant (SEM)	A team of development specialists/ sociologists/environmental managers @ a rate of N$ 100 000/month average over 8 years inclusive of disbursements and travelling.	9 600 000
Compensation for the loss of use of land in both countries	5800 ha purchased at a rate equal to commercial farmland and placed in a trust account for use as specified for the benefit of the Ovahimba community	5 015 000
Resettlement of households in immediate vicinity of the construction site	Provide for 7 permanent households to be resettled inclusive of 2 new boreholes with solar installations for water.	1 000 000
Holistic range and livestock management project	A five year project inclusive of 5 staff members, vehicles and fuel and maintenance.	5 200 000
Approximately 5 new boreholes	At an average of N$ 350 000 per borehole assuming a hit rate of 30% on drilling in the area.	3 500 000
Relocation of cultural heritage and burial sites	The basis of this is not yet clear but a budget of about N$ 3 000 000 is to be allowed	3 000 000
TOTAL COST OF MITIGATION OF SOCIAL IMPACTS		**29 915 000**

Conclusions

Constraints

- Absence of macro-scale planning of associated infrastructure (access roads and transmission lines)
- Lack of technical information related to construction activities

Conclusions

- With full and proper implementation of the mitigation measures detailed in the ESIA and SEMP, the bio-physical and socio-economic impacts of the construction and operation of the Baynes HPP may be ameliorated to a large extent.
- However, several post-mitigation impacts will remain as either significant or not currently well enough understood, to fully comprehend the implications of a hydropower development on the Kunene River.
- Consent by the local community is still withheld, despite fair mitigation measures and associated costs being accepted by the two governments.
- External reasons and conditions contribute to the position taken by the Himba. However, the door has not been closed as is evident through the decision of the local community to be open for further negotiations.

Conclusions

- While the socio-economic impacts are recognized as significant, and notwithstanding the context of the project and its national importance, it is now imperative that the Governments commence with negotiations with the Himba, with the objective of reaching binding contractual agreements which would lead to free, informed and prior consent for the construction of the project.
- The project proponent must do everything in its power to obtain such agreements before involuntary resettlement is considered.
- Due process has been followed throughout the preparation of the ESIA, and recognising that final negotiations between the two governments and the Himba are outstanding, such a step may be considered, provided that all approved mitigation measures related to the socio-economic impacts on the Himba, as reflected in the draft SEMP, are retained and implemented.