

**ENVIRONMENTAL AND SOCIAL IMPACT
ASSESSMENT OF ABOUT 20,000 HA IRRIGATION AND
DRAINAGE SCHEMES AT MEGECH PUMP (SERABA),
RIBB AND ANGER DAM**

**ENVIRONMENTAL AND SOCIAL IMPACT
ASSESSMENT OF THE
MEGECH PUMP (SERABA) IRRIGATION
AND DRAINAGE PROJECT**

EXECUTIVE SUMMARY



07 January 2010

Executive Summary

E1 THE STUDY

This report is an Environmental and Social Impact Assessment (ESIA) of the Megech Pump (Seraba) Irrigation and Drainage Project (MPIDP). It was prepared by BRLi (France) in association with Metaferia Consulting Engineers (MCE: Ethiopia).

The project proponent is the Ministry of Water and Energy (MoWE) of the Government of the Federal Democratic Republic of Ethiopia (GoE). The project's international sponsor is the World Bank (WB). MoWE's design consultant for MPIDP is Tahal Consulting Engineers (Israel) in association with Concert Engineering and Consulting Enterprise (CECE: Ethiopia). The Resettlement Action Plan (RAP) consultant is the Snowy Mountain Engineering Corporation (SMEC: Australia).

E2 THE PROJECT

The MPIDP is located in Dembia Woreda, North Gonder Zone, Amhara National Regional State, on the north side of Lake Tana between the Megech River and the port of Gorgora. The project is intended to transform rainfed subsistence agriculture into irrigated smallholder commercial agriculture.

It is proposed that 4,040 ha of the Dembia floodplain should be irrigated by water pumped from the lake into a canal, and then distributed by gravity to approximately 2,000 farming households. This will allow improved cropping in the dry season. Associated drainage and flood protection measures will improve conditions for wet season agriculture.

The scheme will be built and operated by the government through private contractors. The GoE will (i) pay for construction using a World Bank concessionary loan, and (ii) pay the operator the full cost of off-farm operation and maintenance. User fees will be collected from farmers organised into Water Users' Associations (WUAs), with the rate gradually increasing until the full costs of operation and maintenance (O&M) are covered. Key project characteristics are listed in Table E1.

E3 THE ENVIRONMENTAL AND SOCIAL SETTING

E3.1 Overview

The project is located on a floodplain of Lake Tana. The command area is flat, covered by heavy clay soils, underlain by saline groundwater, regularly flooded and inaccessible for half the year. Despite this it is densely populated, with some 12,000 residents involved in a mixed farming system with a high dependency on livestock and on flood recession cropping. Economic and social relations extend outside the command area to the population of the surrounding hills.

Land holdings are small (~1 ha) and fragmented (~6 parcels/household). Social indicators (health, literacy) are low, poverty is high and cultural traditions are strong (ethnicity: Amhara; religion: Ethiopian Orthodox; staple diet: *injera*).

The two main rivers crossing the site (Nededit and Dirma) are important for fish, as is the adjacent Megech River for which a storage dam is planned. The wetlands in and around the site and the lakeshore zone are important for fish, for migratory birds and other wildlife, and for dry-season grazing, but are under pressure due to the increasing human population.

Table E1: Key Project Characteristics

Item	Data
Irrigable area	4,040 ha
Beneficiary population	~ 2,000 households, population ~ 12,000, household size ~ 6 persons
Farm size (existing & proposed)	~ 1.07 ha, fragmented, of which 57% cropped, 33% grazed, 10% other; ~ 1 ha in future, with increased % cropped
Total water demand	30-40 million m ³ /yr (~7,600 m ³ /ha/yr)
Main infrastructure for water supply	1 pumping station (22,750 m ³ /hr), 20.7 km main canal, 59.4 km of secondary and sub-secondary canals, tertiary canals, hydraulic structures including 1 major siphon under the Dirma River, 14 night storage reservoirs
Other infrastructure	Full open drainage system including 17 drainage siphons, 87 km of service and access roads, 44 canal road crossings, flood dykes on 7 km of river
Construction period	24 months (Phase 1), 12 months (Phase 2) plus further 12 months defects liability period
Investment cost (infrastructure only)	ETB 282.21 million ~ USD 21.7 million ~ USD 5,400/ha
EIRR	18.4%
Affordability	On-farm unit water cost: ETB 0.46/m ³ (O&M, excludes capital recovery) Household cash availability after expenses: ETB 0.81/m ³ water

Source: MPIDP Final Feasibility Study (Feb. 2010), Detailed Design Report (July 2010) & draft RAP (Aug. 2010)

E3.2 Beneficiaries and PAPs

The project beneficiaries are intended to be the smallholders living in and using the cultivable land in the command area. These total some 2,000 households. Some command area land and resource users are resident outside the command area; details of their numbers and locations are not available at present.

All land users will be affected by land reallocation needed to create the rectangular basic irrigation units proposed in the layout plan. Irrigation development includes almost all settlements in the command area. Grazing resources will be reduced in favour of irrigated crops. Therefore all residents of the command area must be considered project-affect people (PAPs).

The principal vulnerable groups identified to date are female-headed households and landless women. These tend to be even poorer and more marginalised than the average household or landless person in the area, with almost no decision-making power or effective access to justice.

E4 KEY ENVIRONMENTAL AND SOCIAL ISSUES AND IMPACTS

The proposed project has been assessed in accordance with applicable Ethiopian guidelines and funding agency safeguard policies. It is intended to have major *positive* socio-economic impacts. These are listed in Table E2. This study focuses on identifying and mitigating potential *negative* impacts associated with project construction and operation. A number of negative impacts typical of irrigation schemes will not occur on this project (Table E3). Remaining key potential negative impacts are listed in Table E4 and discussed in the following text, by project phase. Potential solutions are summarised in Section E5 and listed in Table E5.

Table E2: Planned and Anticipated Positive Impacts during Project Operation

Planned
Increased cropping intensity on some 4,000 ha due to the provision of dry season irrigation water
Increased crop yields due to improved drainage, inputs and crop husbandry
Increased crop diversity due to an improvement of land capability by irrigation and drainage and improved access to seeds and markets
Improved livestock husbandry and productivity
Increased and stabilised household incomes from agriculture for some 2,200 farm households
Increased secondary economic activities - agriculturally-related goods and services - and associated local employment, including for scheme operation and maintenance
Improved institutional capacity of government organisations responsible for water management and agricultural development at regional, woreda and kebele levels
Improved road access, with many associated benefits
Social development, particularly due to the establishment and operation of democratic, gender-sensitive and transparent water management organisations at different levels
Reduced impacts from flooding
Anticipated, subject to implementation of relevant community development and ecosystem conservation measures
Improved adult literacy in command area due to adult literacy programmes
Improved health for command area households due to multiple health initiatives, combined with improved literacy, women's status, road access and household incomes
Improved status and quality of life of women in the command area due to multiple community development initiatives especially provision of domestic water supplies, increased household incomes, adult literacy, improved health, better access to fuel and inclusion in community decision-making mechanisms
Conservation of fish and wildlife in command area and associated rivers due to establishment of habitat protection and fishery management mechanisms and increased environmental awareness
Restoration of lakeshore ecosystem functions adjacent to command area due to lakeshore restoration programme

Source: Consultant

Table E3: Negative Impacts Unlikely to Occur

Construction	Operation
Air pollution (except dust) <i>Rural area, good air quality, dispersed emissions (vehicles, stationary equipment), low density of receptors</i>	Limitations on irrigation water supply (but see Chapter 6 Cumulative Effects) <i>Water source is Lake Tana and project is relatively small</i>
Unreasonable noise <i>Rural area, night working unlikely, low density of receptors</i>	Poor irrigation water quality <i>Lake Tana water is of good quality for irrigation</i>
Hazards to public from use of explosives <i>Limited requirement for excavation of hard rock, rural area, use is regulated</i>	Disruption of downstream flow regimes <i>By itself, the project will not have significant effects on Lake Tana's hydrology (but see Chapter 6 Cumulative Effects)</i>
Slope destabilisation and landslides <i>Area is low-elevation or flat and not susceptible to mass movements (but is susceptible to surface soil erosion)</i>	Disruption of downstream water users <i>Downstream users (between the project and the lake) depend on water from the lake for dry-season agriculture, not from the project rivers</i>
Loss of forest habitat <i>No forests in area</i>	Changes in local climate <i>The project is unlikely to have any significant effect on local climate</i>
Price inflation of staples during construction <i>Labour force will be relatively small and unskilled labour will be local</i>	Earthquake damage to structures <i>The project structures are small and simple and the area is not considered at risk of severe earthquakes</i>
	Influx of outsiders due to better access and uncontrollable induced development <i>All land in the PCA is allocated and surveyed, resources are intensively used, and outsiders are highly unlikely to be permitted entry to this system</i>

Source: Consultant

Table E4: Key Potential Negative Impacts if Not Mitigated

Construction Impacts	
<ul style="list-style-type: none"> • Disruption of habitat of economically important or globally unique fishes • Potential impacts on known & unknown cultural heritage • Disruption of access by new canals and drains • Accidents and health impacts during construction 	<ul style="list-style-type: none"> • Rapid social and economic change due to land reallocation and scheme construction • Difficulties in administering the complex land redistribution process, with possible social resistance • The social impact and cost of village irrigation and potential settlement reorganisation
Operation Impacts	
<ul style="list-style-type: none"> • Potential delays in irrigated agriculture development • Difficulties with in-field soil & water management • Secondary salinisation of soils • Erosion and sedimentation • Flooding and inadequate flood protection • Inadequate pest management and increased use of hazardous pesticides • Agricultural impacts on water quality • Ongoing impacts on globally important birds and fishes • Cultural constraints preventing rapid social and economic change • Impacts on women, especially increased workloads • Socio-economic impacts of the transformation of livestock husbandry 	<ul style="list-style-type: none"> • Health impacts, especially continuing malaria and an increase in schistosomiasis • Inadequate or delayed provision of essential agricultural services and inputs including research, knowledge, credit, crop storage and processing, and links to markets • Inadequate or delayed provision of essential social services, especially health, water and sanitation, also education, road maintenance, electricity and telecommunications • Difficulties in product sales due to market inelasticity • Lack of affordability by farmers • Price reductions in local markets due to market inelasticity and associated impacts on rain-fed producers • Constraints on access due to new channels and to inadequate road maintenance • Cumulative effects on the quality and volume of water in Lake Tana

Source: Consultant

E4.1 Construction

Ecological

- Enlargement (excavation and dyking) of the Dirma and Nedit River channels will reduce available feeding and breeding habitat for catfish (*Clarias*) and Tilapia. It will not result in any direct loss of spawning habitat of migratory fishes of the genus *Labeobarbus* which are unique to the Lake Tana basin, scientifically and economically important, and under threat. However migrations could be affected by changed channel profiles, water depths, and by obstructions such as culverts, fords, and siphons.

Cultural Heritage

- The project involves earthworks and permanent land take in an area with a significant level of known cultural heritage, and surface evidence of unknown physical cultural heritage (archaeological remains such as stone tools made by Early Man). A limited ground-based cultural heritage investigation is to be carried out by the responsible Ethiopian authority (ARCCH) prior to construction. Further action will depend on the findings of this official survey.

Access

- The project involves constructing nearly 1,000 km of channels - canals and drains, of various sizes. The BoQ provides for 44 crossings on the main and secondary canals. Careful placement of these will be essential to maintain existing social and economic relations and allow the movement of livestock. Additional bridges and crossings may be necessary over both the canals and the drains to avoid disruption of local movement patterns and facilitate scheme operation.

Health and Safety

- Health, safety and environmental protection (HSE) standards on construction projects in Ethiopia tend to be below best international standards, resulting in avoidable accidents and injuries to workers and localised environmental damage. International financing of project construction and operation provides an opportunity to raise HSE standards.
- The public as well as workers are at risk from major civil engineering projects in Ethiopia such as the MPIDP, particularly local women through sexually transmitted diseases.

Rapid Change and Social Disruption

- Construction will be a major civil engineering exercise with a direct impact on some 12,000 people in the command area. Social preparation and group formation at household level is necessary to avoid (a) social resistance, and (b) impoverishment due to disruption of existing fragile production systems and livelihoods.

Land Loss, Land Reallocation and Consolidation, and Compensation

- The project's infrastructure - canals, drains, roads and flood dykes - will have a large footprint, occupying some 309 ha in total, some 7.5% of the command area. Farmers losing land to the project will require (a) crop compensation, (b) alternative land nearby, and (c) measures to ensure no loss of income/livelihood during the transition period to the new system. Since all land in the command area has already been allocated, this implies proportionate adjustment of all holdings by ~ 7.5%, reducing the average holding size within the command area to ~1.0 ha. This exercise, which is now being initiated, will be complex and socially challenging. The responsible land administration organisation (ANRS BoEPLAU) requires increased resources and capacity to undertake this exercise in keeping with Ethiopian law and Bank policy requirements.
- Following the 2005 land allocation exercise, at present each household has about 6 parcels of land of varying quality. Consultations with farmers indicate significant social resistance to the reorganisation of land if it involves land consolidation, since farmers might not receive land of equivalent quality and production risks will increase¹. This is a very sensitive topic and will require time, resources, technical knowledge and a high level of farmer participation to resolve.

Irrigation in Villages

- The proposed irrigation and drainage layout includes settlements, which cover some 10% of the irrigable area. The scheme development concept is that all irrigable soils within the command area should be developed, therefore settlements should be reorganised to maximise the irrigation opportunities on land around homesteads. Construction of irrigation and drainage channels within settlements is associated with a number of social and operational challenges including land acquisition, channel maintenance, interrupted access, safety and, most importantly, health. It is potentially a complex exercise involving both some displacement (loss of housing) and re-arrangement of plot boundaries. Social resistance is possible. Taking a longer view, village reorganisation would provide an opportunity for improved settlement planning and upgrading (water supplies, electricity lines, etc.).

Employment

- The project will require labour for construction. Local benefits would be maximised and some of the negative impacts of construction mitigated if local residents, especially the most severely project-affected people (PAPs), are given priority for recruitment².

¹ As reported in the MPIDP draft Feasibility Studies (May & November 2009).

² As implemented successfully on the internationally-funded New Naga Hammadi Barrage Project in Egypt.

E4.2 Operation

Skills, Technologies and Labour for Scheme Uptake

- The project relies on a knowledge-, inputs- and labour-intensive model of production at the field and household level. This model is untested under the environmental and social conditions prevailing in the command area. Small-scale trials have been initiated.

Soil, Water and Land Management

- The in-field design requires the construction of ~13 km of ridges and furrows by each farmer every year at the beginning of the dry season for irrigated row crops, and (presumably) the creation of 5-6 km of broadbeds at the beginning of each wet season for traditional broadcast crops. This will require significant resources (labour, draught power, specialised ploughs) in specific time periods, and as yet is not a proven technology in the command area (see above). Applied research to identify start-up irrigation extension packages has been initiated.
- The soils in the command area are almost all vertisols, clays which expand when wet and become impermeable. The groundwater is saline at shallow depth. Incorrect water management at farm level (due to lack of skills and knowledge) and inadequate drainage (due to poor drain maintenance) could result in a rise in the water table, and consequently secondary salinisation of the topsoil.
- Vertisols are highly erodible, even on gentle slopes as in the command area. Gullying is possible and could threaten the new infrastructure. Drainage channels will slump and lose capacity. Surface water application to flush salts could cause in-field erosion.
- The catchments adjacent to the command area (the Dirma River and its tributaries, Nededit River) are in poor watershed condition with low productivity and significant surface and other forms of erosion. Sediment will continue to affect watercourses and infrastructure downstream unless watershed conditions are greatly improved.

Flooding and Flood Protection

- The proposed drainage and flood protection measures will greatly reduce the frequency and severity of flooding of the command area, if well maintained. Nevertheless, on average every 10 years the flood dykes will be over-topped (via safe spillways into surrounding land). Therefore new housing and infrastructure should be flood-resistant or only built in flood-safe locations

Pest Management and Pesticides

- Irrigation and crop intensification will change crop pest and disease patterns and intensify the need for better crop protection to maintain higher yields and quality. Unless very tightly regulated, pesticide use is likely to increase, with associated risks to human health, wildlife and water quality, including Lake Tana.

Water Quality

- Intensive commercial agriculture, unless organic, depends on high inputs of agrochemicals (fertilisers, pesticides). If used incorrectly, as is probable unless the weak regulatory regime and low level of farmer skills and equipment are upgraded, water quality will be affected with potentially serious impacts on human health and ecological values.
- The shallow groundwater (<8 m depth) in the command area is medium to highly saline with one known pocket of very high salinity. Mostly it is not suitable for either irrigation or domestic water supply.
- Channels in settled areas, especially open drains, are likely to be used for the disposal of solid and liquid wastes and for defecation. This will create a health risk, especially to small children.

Ecological

- The loss of habitat caused by channelisation of the main rivers will affect the lake fishery to some degree, specifically by reduced recruitment of catfish and Tilapia and by reduced Labeobarbus recruitment if migration to spawning sites is affected by structures and other changes to channels. Additional negative impacts on fish could occur as a result of (i) changed hydrology of the wetlands, (ii) reduced seasonally-flooded area, and (iii) pesticide runoff in drainage waters. If development of the scheme and construction of the Megech gravity project reduce informal abstraction from the Dirma River, the migratory Labeobarbus species might benefit.
- The wetlands along the Dirma River and lakeshore are important for international migratory birds, including at least three at-risk species, and especially in the dry season. Although the three main wetlands adjacent to the command area will be retained, some impacts on bird habitat will occur due to altered water regimes, channelisation, further increases in grazing pressure, and agricultural impacts on water quality.

- The lakeshore wetland zone provides a significant opportunity for a win-win conservation and livelihoods initiative, focusing on restoration of lakeshore vegetation (papyrus) and local management.

Cultural Constraints to Change

- The religious calendar, which includes a very large number of religious holidays and strict periods of fasting, may affect the availability of labour for the time-critical tasks essential for efficient crop production in modern irrigation systems. Other social factors such as gender differentiation of tasks (household, crop husbandry, livestock husbandry) and authority (decision-making is male-dominated) may affect both labour availability and the speed of social change.

Gender

- In the command area women work harder and die earlier than men. Although almost all the command area population is poor and vulnerable, women are likely to be the group most severely affected by the project due to (i) further increases in work loads, and (ii) possible exclusion from participation in new management structures due to patriarchal cultural norms. Equally, the project could provide a major opportunity for women if it incorporates gender-related components to reduce women's work loads, improve female literacy and social status, and generate household income.

Livestock

- Livestock, especially cattle, are essential for the existing mixed farming system and provide many practical, productive, economic and cultural services. However, existing feed resources and livestock health care are inadequate. The project concept relies on a major reduction in the area available for grazing in the command area and proposes fodder production and mechanisation as alternative technologies. This transformation in livestock husbandry and its socio-economic roles is likely to cause substantial short to medium term problems for a large number of households, unless it is extremely carefully planned, supported and phased.

Health

- Malaria is endemic in the area. The project is likely to change the pattern of malaria infections during the year, with an extension into the dry season.
- Schistosomiasis is endemic in the area. The project has the potential to increase the risk of infections by creating additional habitat for the snail vector and increasing exposure of the population, especially children, to water.
- The project will increase the risk of helminth infections within the irrigated area, and probably the risk of HIV/AIDS transmission at market centres.
- By itself, the project will not change the incidence of other existing serious health problems (worm infestations, trachoma, acute respiratory tract infections, diarrhoeas, etc).
- Farmers cannot be productive if they are not healthy. The project creates an opportunity to improve health conditions, but this will require both capital and operational investment in preventive and curative health care services, domestic water supplies, and sanitation and hygiene awareness. It will also require good maintenance of the planned service and access roads.

Access

- The entire scheme depends on access to the main road network for the supply of goods and services necessary as inputs and, even more importantly, for timely export of produce to markets. The scheme will have two points of access to the main road network, firstly a proposed gravel road to Guramba and thence to Kola Diba and the paved road network, and secondly to Gorgora. If one route is interrupted by erosion or flood damage the other could still be used.

Institutional

- Ethiopia has no significant experience of successful large-scale, modern smallholder irrigation³. The proposed management model involves (i) the MoWE and its regional and woreda-level counterparts as owner of the pumping station, the primary and secondary canal systems, the off-farm drainage system and the flood control measures, (ii) a private sector organisation (Private Sector Participation (PSP) contractor) paid by GoE to operate and maintain the off-farm components of the scheme and provide support to farmers, (iii) Irrigation Water Users' Associations to operate the tertiary and on-farm irrigation and drainage systems and pay a fee for water to GoE through the operator to cover the operator's O&M costs, and (iv) MoARD and its regional and woreda-level counterparts to be the service providers, either directly or through commercial service and input organisations that would be established in the project area. This arrangement is experimental and carries many risks, particularly those relating to (a) cost recovery, (b) effective O&M of the on-farm systems, and (c) the quality and availability of knowledge services and the many other inputs necessary for sustainable and productive irrigated agriculture.
- As yet details of some of the measures necessary for successful operation of the scheme, including establishment and operation of all the 'software' - the organisations required to provide agricultural inputs, services and links to the markets as well as the essential non-agricultural services (water supplies, literacy, health etc.) - and some important project components such as livestock husbandry - are not available.

Economic

- Economic analysis of the scheme at feasibility level indicates that although recovery of the capital investment in irrigation infrastructure will not be affordable at household level, farmers will be able to pay the full cost of off-farm O&M after the transition period to full production.
- Marketing is a key issue in relation to the success of the scheme. Local markets are small, with the principal opportunities being seen in import substitution, especially for rice, and exports, especially of niche products such as pulses and oilseeds.
- Due to market inelasticity, the increased production from the command area is likely to affect the prices and saleability of similar produce from other producers nearby, with potentially significant negative impacts on profits and incentives for production. This will apply, in particular, to perishable crops subject to damage during transport such as tomatoes and some other fresh vegetables.
- Modern small-scale irrigation schemes depend on non-agricultural as well as agricultural and financial services for their success, in particular improved provision of health, domestic water, adult literacy, roads, electricity and telecommunications. At present the quality and coverage of these services in and around the project area is low. They need to be improved but are dependent on government budgets. Additional investment in the project area would divert funds from other needy areas and increase inequality. Therefore it is important that alternative funding and delivery mechanisms for these essential services are found and implemented (for example, as part of the operator's contractual duties).

Cumulative Effects

- Water abstraction for the scheme will marginally reduce the net water volume available in Lake Tana (because of consumptive use by crops). In itself, this will not affect downstream water users on the Blue Nile, but when combined with other existing and planned water abstractions from the Lake Tana sub-basin, it will contribute to probable significant impacts on water availability in dry years.
- Unrestricted operation of the Tana-Beles water transfer will have a major effect on lake water levels in future dry years, with impacts on navigation and tourism, wetlands, and lakeshore farmers.

Transboundary Effects

- The MPIDP will not have any significant hydrological effect downstream at the border with Sudan because the contribution of the Lake Tana sub-basin to total flow in the Abbay River (Blue Nile) in Ethiopia is very low. However, when combined with the numerous other abstraction and water regulation projects planned for the overall Abbay Basin, the MPIDP will have measurable cumulative effects on dry season flows at the border.

Alternatives

- Large-scale gravity irrigation of the project area is not possible since all water from the planned Megech Dam will be allocated to areas upstream of the Megech (Seraba) command area.

³ The Koga Irrigation Project has run into many problems and is only just starting operations.

- Pressurised irrigation would use less water and create lower risks of salinisation, but is an expensive and complex technology unlikely to be practical under foreseeable social and market conditions for smallholders.
- Small-scale irrigation of the area already exists and could be improved and extended at relatively low cost, but with potential impacts on some fish species due to water abstractions from the rivers.
- Agricultural productivity and living standards in the command area could be significantly improved without large-scale irrigation by providing (i) farm to market road access, safe domestic water, rural electricity, better health services and universal literacy, together with (ii) improving crop and animal husbandry techniques, supplies and services such as cultivation practices, field drainage, flood protection, crop protection, fertiliser availability, seeds, credit, crop processing and storage, marketing, improved breeds, and veterinary care. These improvements and services will be required both with and without the project if sustainable socio-economic development is to be achieved in the project area.

E5 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

Solutions to the key impacts outlined above are summarised in Table E5, based on a standard impact assessment approach of (i) avoid, (ii) minimise, (iii) compensate, and (iv) enhance. The table also indicates responsibilities for the various measures. Full details are provided in the main text.

Table E5: Outline of ESMP - Key Mitigation Measures

Potential Impact	Key Mitigation Measures	Responsibility
Construction		
<i>Direct impacts on fish habitat</i>	(i) ensure main cross-drainage structures and road crossings allow fish passage, (ii) avoid drainage of existing main wetlands on Dirma River	MoWE
<i>Potential impacts on known and unknown cultural heritage</i>	(i) ground-based survey prior to construction, (ii) earthworks supervision by archaeologist, (iii) chance find procedures in tender documents, (iv) keep stakeholders informed	MoWE, ARCCH, PSP contractor
<i>Disruption of access by new canals and drains</i>	(i) construct additional crossings as needed	PSP contractor
<i>Health and safety hazards and potential environmental pollution during construction</i>	(i) incorporation of specific HSE provisions in the tender documents, (ii) provision of both financial incentives and compliance mechanisms in the tender documents, (iii) provision of HSE supervision resources, (iv) STD and HIV/AIDS awareness and prevention campaigns for both workers and local residents, targeted at high-risk groups	MoWE, ANRS BoH
<i>Loss of land and other assets</i>	(i) intensive efforts to establish functioning IWUAs, (ii) detailed participatory planning in advance of construction involving all affected land users to cover (a) land acquisition and reallocation, (b) compensation amounts and procedures, (c) construction procedures and timing, and (d) arrangements to minimise disruption of seasonal agricultural activities, (iii) advance notice of all construction activities	MoWE, PSP contractor, BoEPLAU
<i>Social dislocation and social resistance due to land reallocation and agricultural disruption</i>	(i) detailed participatory planning and social preparation (see above), (ii) support for most vulnerable affected households	MoWE, PSP contractor, BoEPLAU
<i>Disruption and health hazards of irrigation in settlements</i>	(i) exclude settled areas from first phase of development	MoWE

Potential Impact	Key Mitigation Measures	Responsibility
<i>Employment of outsiders</i>	(i) identify and categorise PAPs, (ii) include most severely-affected PAPs onto lists for recruitment priority, (iii) require contractor to give priority to PAPs on lists supplied, (iv) close monitoring	MoWE, Kebeles, BoEPLAU, PSP contractor
Operation		
<i>Delayed uptake due to inadequate skills, labour, technologies</i>	Carry out a full-scale farm level trial for at least one full agricultural year before implementation of the on-farm aspects of the scheme (at least one full basic irrigation unit (2 ha) on each soil type with local farmers and their normal equipment)	MoWE, BoARD, ARARI
<i>Inadequate skills for practical in-field soil & water management</i>	(i) include precise land levelling in capital costs, (ii) intensive farmer knowledge and skills development by research-backed extension agents, farmer field schools (FFS), etc., (iii) facilitation of access to improved equipment (e.g. broadbed makers)	MoWE, BoARD, ARARI, PSP contractor
<i>Secondary salinisation of soils</i>	In addition to above measures, (i) payment for water on a volumetric basis, not by area, (ii) strict enforcement of drain maintenance both on and off-farm, (iii) close monitoring of (a) groundwater levels and (b) drainage and groundwater salinity	MoWE, BoARD, ARARI, MoWE, PSP contractor, WUAs
<i>Erosion & sedimentation</i>	In addition to above measures (i) effective drainage channel maintenance, (ii) maintenance of vegetation and promotion of vetiver, (iii) consider extension of watershed management projects ⁴ to Dirma and Nedit catchments	MoWE, BoARD, ARARI, PSP contractor, WUAs
<i>Continuing impacts from floods</i>	(i) develop flood management plans for adoption by IWUAs	MoWE, Woreda, PSP contractor
<i>Inadequate pest management and improper use of pesticides</i>	(i) develop an IPM programme (through a Phase 2 PMP design exercise) and implement it (including beekeeping component), (ii) adult literacy classes, (iii) close monitoring of pesticide knowledge, attitudes and practice (KAP)	BoARD, PSP contractor, ANRS BoE
<i>Agricultural impacts on water quality</i>	(i) consider promoting sustainable/ conservation/ organic agriculture, (ii) promote integrated pest management (IPM), (iii) channel drainage water from fields through wetlands	PSPcontractor, BoARD
<i>Ongoing impacts on globally important fishes and birds</i>	Fish: (i) seasonal research, (ii) support for kebele fishery management programme, (iii) aquaculture trial in command area, (iv) environmental awareness campaign, and (v) contribution to of a lake-wide fisheries management programme Birds: (i) seasonal bird counts, (ii) conservation of wetland habitats, (iii) lakeshore conservation and restoration programme, (iv) accession to Ramsar Convention, (v) environmental awareness	BoARD, BDU, AAU, PSP contractor BoEPLAU, EWNHS, EPA, Woreda, lakeshore Kebeles
<i>Cultural constraints to social and economic change</i>	(i) adult literacy classes, (ii) education to higher grades, (iii) electrification, (iv) all-weather road access, (v) economic betterment (objective of project)	BoE, EEPCo, Woreda, PSP contractor

⁴ E.g. TBIWRDP, SLMP.

Potential Impact	Key Mitigation Measures	Responsibility
<i>Impacts on women</i>	(i) construction and maintenance of safe domestic water supply points close to housing, (ii) promotion of homestead fuelwood supplies, (iii) rural electrification, (iv) careful access and child safety planning if settlements are developed and reorganised for irrigation, (v) incorporation of women's quota or other mechanism to ensure participation in WUA decision-making, (vi) provision of micro-credit / income generation programmes for women, (vii) adult literacy classes for women, (viii) upgrading of institutional capacity to support women, (ix) upgrading of health services (see below)	MoWE, BoH, BoE, EEPCo, Woreda, PSP contractor
<i>Impacts of transformation of livestock husbandry system</i>	(i) inclusion of practical, implementable programme to reduce livestock numbers in the command area whilst maintaining household incomes and the availability of draught animals in the project, (ii) use land between flood control bunds as pasture, (iii) mechanisation	PSP contractor, ARARI, BoARD
<i>Health issues, especially continuing malaria and an increase in schistosomiasis and helminths</i>	(i) upgrading of health services (health posts) in command area, (ii) improvement of preventive, diagnostic and curative measures in command area for (a) malaria, (b) schistosomiasis, (c) helminths, and (d) other diseases, (iii) management of scheme to reduce vectors, (iv) provision of safe domestic water supplies to all households, (v) sanitation and hygiene campaigns to change behaviour (knowledge, attitude, practice)	MoWE, BoH, PSP contractor, Woreda
<i>Access</i>	(i) include maintenance of the Kola-Diba - Guramba - command area road in the operator's contract	MoWE, PSP contractor
<i>Reduced project benefits due to ineffective provision of essential agricultural services and inputs including research, knowledge, credit, crop storage and processing, and links to markets</i>	(i) clarify project management structure to ensure effective delivery of <i>all</i> agricultural services and inputs necessary for scheme success, (ii) incorporate service delivery into PSP contractor's contract as a requirement, with commercial incentives	MoWE, BoARD, ARARI, operator
<i>Reduced project benefits due to inadequate provision of essential social services, especially domestic water, health and adult literacy, also road maintenance, electricity and telecommunications</i>	(i) develop a comprehensive plan for sustainable provision of all the non-agricultural services necessary for sustainable socio-economic development of the command area based on agriculture	MoWE, ANRS line agencies, Dembia Woreda, PSP contractor
<i>Unaffordable O&M costs</i>	(i) write off the capital investment, (ii) phase in full O&M cost recovery gradually in relation to accurate assessments of farm profitability	MoWE

Potential Impact	Key Mitigation Measures	Responsibility
<i>Under-funding of costs of compensation and resettlement, agricultural research, extension services & farmer training, equipment, environmental & social measures, etc.</i>	(i) review the overall project concept and implementation plan to ensure that funds are available for <i>all</i> measures required for project success, agricultural and non-agricultural	MoWE
<i>Market inelasticity affecting economics of entire project</i>	(i) focus on import substitution and niche export markets	BoARD, PSP contractor
<i>Cumulative effects on quality and volume of water in Lake Tana</i>	<p>Lake water quality: (i) see water quality measures (above), (ii) in long term, improve condition of Dirma and Nedit catchments by applying watershed management measures proven to be successful by the TBIWRDP, SLM and other projects</p> <p>Lake water volume: (i) establish and build the capacity of the responsible river basin organisation (RBO) - the Abbay Basin Authority, ABA, (ii) establish and use comprehensive water resources management mathematical model of the Lake Tana basin, (iii) transfer control of Lake Tana water levels and management from EEPCo to ABA</p>	<p>MoARD</p> <p>MoWE</p>

Source: Consultant

E6 MONITORING AND MANAGEMENT

E6.1 Monitoring

The project will establish both compliance and effects monitoring plans. The compliance monitoring mechanisms will ensure that the various project organisations are implementing the provisions of the ESMP effectively and on time. The effects monitoring mechanisms will check on the impacts which the project is having on the physical, biological and social environment, by regular measuring if indicators. The results will be fed back to project management for evaluation.

In relation to the ESMP, key factors to be monitored relate to the major risks - physical (secondary salinisation), biological (water quality, fish (especially Labeobarbus migration) and birds (use of wetlands), and social (incomes, health, gender issues, and status of vulnerable households).

E6.2 Management

The project's management framework is experimental. On-farm it relies on the establishment of effective IWUAs under new legislation currently in preparation. IWUA creation and operation one of the tasks of the PSP contractor who will also operate and maintain the off-farm infrastructure (pumping station, canals, main drains), and collect fees from the IWUAs on behalf of government. Agricultural and non-agricultural services will be provided by government departments, mainly at woreda level, and the private sector.

This model is high risk; in particular, it lacks a defined mechanism and firm budgets for coordinated delivery of all the many agricultural and non-agricultural services and inputs which are essential for the scheme's success. International experience has demonstrated that irrigation projects without strong, well-resourced and centralised management are unlikely to result in rapid uptake of infrastructure-based economic opportunities, especially in accelerated time scales as envisaged for MPIDP. Consequently it is strongly recommended that consideration be given to creating a unitary authority for scheme management. Logically, this could be done most easily by expanding the role, powers and resources of the PSP contractor.

E7 COSTS

Estimated costs for implementation and monitoring of the project's ESMP are summarised in Table E6 and total USD 2.03 M over 8 years. A number of measures have no cost except for management time and therefore are excluded from the table.

The costs of other measures identified in this ESIA as being important for the project's environmental and social success and sustainability are also noted in the table. Some are capital investments (e.g. roads, safe water supplies), others are running costs (e.g. support to WUAs, agronomic research). By far the largest item (USD 3.2 M) is the cost of precise land levelling on 4,040 ha, an item considered by this study to be important for enabling effective soil and water management at farm level on the project area's difficult soils.

Some cost items are outside the scope of this study, but the costs of technical assistance to support preparation of the necessary details have been included. This refers to (i) some public health measures, (ii) livestock husbandry, (iii) mechanisation, (iv) pest management, (v) beekeeping, and (vi) additional community development activities.

Full details are given in Section 8.7 and in the main text.

Table E6: Indicative Costs (USD '000)

Environmental & Social Measures		Other Items	
Pre-construction			
Various measures	40	Land acquisition, compensation etc.	See RAP
		Other measures	165
<i>Sub-total</i>	<i>40</i>	<i>Sub-total</i>	<i>165</i>
Construction (3 yrs)			
Various measures, mainly support for groups, women and adult literacy	382.5	Precise land levelling	3,232
		Upgrade Kola Diba - Guramba track & other roads	345
		Provide safe domestic water	245
		Other measures	528
<i>Sub-total</i>	<i>382.5</i>	<i>Sub-total</i>	<i>4,422</i>
Operation (5 yrs)			
Various measures, mainly support for groups, income generation, women, fisheries, energy and habitat restoration	1,605	Various measures (mainly agricultural)	1,004
<i>Sub-total</i>	<i>1,605</i>	<i>Sub-total</i>	<i>1,004</i>
TOTAL	2,027.5	TOTAL	5,591

Source: Consultant

E8 CONCLUSIONS

E8.1 Compliance with Bank Safeguard Policies

Subject to full resourcing and effective implementation of the measures identified in this report, the project is considered to be in compliance with World Bank safeguard policies 4.01 Environmental Assessment, 4.04 Natural Habitats, 4.09 Pest Management, and 4.11 Physical Cultural Resources.

The ESIA study team did not identify any sector of the local population who should be termed "indigenous people" in the sense implied by the Bank's policy 4.10 Indigenous People, and therefore this policy does not apply. Similarly, there are no forests in the area and the project does not involve a dam, so policies OP 4.36 Forests and OP 4.37 Safety of Dams do not apply.

Compliance with the Bank's policy on Involuntary Resettlement (OP 4.12) is the subject of a separate consultancy to prepare a Resettlement Action Plan (RAP) consistent with the Bank's policy and Ethiopian legislation.

Compliance with policy OP 7.50 Projects on International Waterways will be handled by MoWE through Nile Basin consultative processes.

E8.2 Feasibility and Risks

The project is a bold attempt to transform agricultural production methods and yields and at the same time radically change living conditions in a very poor and socially conservative rural society living in a difficult physical location with sensitive ecological values. This approach carries with it a number of risks, economic, institutional, social and biophysical.

Major potential risks of which the project's sponsors should be aware include:

- Ecological: negative impacts on globally threatened fish and migratory birds.
- Physical: groundwater rise and secondary salinisation.
- Economic: market inelasticity.
- Social: slow uptake of benefits due to 'cultural resistance'.
- Organisational: slow uptake of benefits due to inadequate delivery of essential agricultural and non-agricultural inputs and services.

Water availability and climate change are not risks for this particular project.

There is no previous experience of successful implementation of large scale, modern, commercial smallholder irrigation in the Ethiopian highlands, and therefore these risks are significant. At the same time, existing living conditions are unacceptable, the environment is under high stress, and change is imperative.

With respect to the various risks: (i) mitigation and offset measures can mitigate impacts on wildlife; (ii) the technical difficulties of maintaining soil quality will be significant. However, this and other technical challenges concerning soil and water management are likely to be easier to resolve than the social and institutional challenges, especially those relating to land reallocation, reorganisation of settlements, farmer skills and resources for commercial irrigated agriculture, labour availability, on-farm maintenance, service provision and marketing, the service delivery model, impacts on women, impacts on the non-beneficiary population outside the command area, and social change.

E9 RECOMMENDATIONS

The assessment indicates that **two strategic actions** should be taken to help ensure the project's feasibility and enhance its sustainability:

- (i) Review the project's framework to confirm that mechanisms and funds have been identified for sustainable delivery of *all* the services and inputs essential for uptake of the economic opportunities created by dry season water availability, including the necessary social investments (safe water, health, literacy, lighting, etc) as well as agricultural services and supplies.
- (ii) Recognise the regional nature of some of the impacts and sustainability issues, and initiate responses at this level (specifically: health, wetland protection and recovery, fisheries management, IPM and agrobiodiversity, and cumulative effects).

E10 NEXT STEPS

A checklist of 7 key actions considered necessary in the Pre-Construction Phase is given in Table E7 (for details see the corresponding sections of the impact analysis, Chapter 5 and ESMP, Chapter 8).

Table E7: Recommended Priority Actions

No.	Action	Comment
1	Ensure that the project implementation concept and implementation mechanisms cover <i>all</i> the services and inputs necessary for success (agricultural, social, non-irrigation infrastructure) and for the protection of non-beneficiary producers from price shocks (flooded markets).	ENIDP Components 2 and 3 cover some of these actions.
2	Re-visit the concept of full irrigation development within existing settled areas in the light of (i) the impacts and health hazards associated with this activity, and (ii) the possibility of later, phased village reorganisation.	
3	Ensure that the tender documents include comprehensive HSE, labour welfare and social provisions, that the BoQ includes some HSE pay items as incentives, that the HSE enforcement and compliance mechanisms are clear, and that the supervision consultant is resourced and tasked for HSE compliance.	See relevant sections of this ESIA, including the recommendations at Annex 10
4	Establish a formal regional working group chaired by the ANRS BoH to follow up the findings of the Rapid Health Appraisal.	See Annex 7
5	Establish a formal working group chaired by ANRS BoARD to follow up the recommendations of the Phase 1 PMP.	See Annex 8
6	Initiate a regular seasonal bird count in the Dembia Plain, commencing in the dry season 2010-11.	
7	Accelerate establishment and capacity build-up of the ABA Lake Tana sub-office, including the development of firm lake level operating rules which cannot be over-ridden by EEPCo.	

Source: Consultant