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THE WORLD BANK

The Ministry of Agriculture and Water Resources
Project Implementation Unit for Water Infrastructure (PIU-WI)

Fergana Valley Water Resources Management Phase-II Project

Environmental Assessment and Management Plan



Final Report

DATE: 28 March 2016

Prepared by:

Temelsu International Engineering Services Inc.

Tashkent, 2016

The Ministry of Agriculture and Water Resources
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List of Abbreviations

AM	Agricultural Modernization Support Component
ASBP	Aral Sea Basin Program
BAC	Big Andijan Canal
BAIS	Basin Administration of Irrigation Systems
BFC	Big Fergana Canal
BNC	Big Namangan Canal
BOD	Biochemical Oxygen Demand
BWU	Basin Water Union
CACILM	Central Asian Countries Initiative for Land Management
CDW	Collector-Drainage Water
CIS	Commonwealth of Independent States
COD	Chemical Oxygen Demand
GW	Ground water
GWL	Ground water table
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EMMP	Environmental Management and Monitoring Plan
EMP	Environmental Management Plan
ESMP	Environmental and Social Management Plan
FS	Feasibility Study
FV	Fergana Valley
FWRMP	Fergana Valley Water Resources Management Project
HGME	Hydrogeological Meliorative Expedition
HS	Hydraulic Structures
I&D	Irrigation and Drainage
ICWC	Interstate Commission for Water Coordination
IFAS	International Fund for Saving Aral Sea
IMP	Integrated Pest Management
ISA	Irrigation Systems Administration
ISDC	Interstate Sustainable Development Commission
IWRM	Integrated Water Resources Management
MAC	Maximum Allowable Concentration
MAWR	Ministry of Agriculture and Water Resources
MCA	Main Canal Administration
MCM	Million cubic meter
MOM	Management, Operation and Maintenance
NGO	Nongovernmental Organization
NOL	Normal Operating Level of reservoir
O&M	Operation and Maintenance
OP	Operational Policy (World Bank)
PFIs	Participating Financial Institutions
PIU	Project Implementation Unit
PSECA	Pump Stations, Energy and Communication Administration
RGC	Rural Gatherings of Citizens
RRA	Agency for Restructuring of Agricultural Enterprises
SA	Social Assessment
SACC	State Architecture and Construction Committee
SEA	State Environmental Appraisal
SEE	State Environmental Expertise
SLM	Sustainable Land Management
ToR	Terms of Reference
USD	US Dollars
VDW	Vertical Drainage Well
WB	The World Bank
WCA	Water Consumer Association
WI	Water Industry
WT	Water Table

Glossary

Adyr	Foothills
A/meliorative	Term used at reclamation of waterlogged/saline lands
Artesian	Pressure ground water which pinch out from ground, e.g., through pipe, artesian well
Crop ET	Crop evapotranspiration
NBET	Non-beneficial evapotranspiration
Collector	Open canal diverting drainage flow from the field drains to spillway point
Dekhkan	Peasant farm
Horizontal drainage	Open or closed (piped) drainage designed for water table lowering in the field
Water conductivity	Material property (e.g., soil) for permeability (e.g., water)
Shirkat	Collective farm
Permeability	Seepage discharge whereby ground water may pass through the unit width of aquifer's cut per unit of hydraulic gradient. It is a mean water conductivity of total aquifer's cut for that terrain, multiplied to genesis depth
Tuman	District, smallest administrative unit in Uzbekistan
Well	Deep wells system for irrigation
Viloyat	Region, main administrative unit in Uzbekistan comprising several tumans

Units

ha	Hectare
kg	Kilogram
km²	Square kilometer
km³	Cubic kilometer
m.a.s.l.	Meters above sea level
m^2	Square meter
m^3	Cubic meter
MCM	Million cubic meter

EXECUTIVE SUMMARY

FERGANA VALLEY WATER RESOURCES MANAGEMENT PHASE –II PROJECT
Environmental Assessment and Management Plan

INTRODUCTION

Preface

The Fergana Valley is an ancient fertile oasis and most densely populated region of Uzbekistan in Central Asia Agricultural lands are the main source of well-being and employment for people. Water resources available in the Fergana Valley are the Naryn and Karadarya Rivers, which are tributaries of the Syrdarya River, as well as Naryn and Karadarya Rivers' mountain tributaries, and main canals (Big Fergana Canal BFC, South Fergana Canal SFC, Big Andijan Canal BAC and Big Namangan Canal BNC). Water supply in the middle reach of the Syrdarya River mostly depends on flow release by the upstream riparian countries (Kyrgyz Republic and Tajikistan). The deteriorated irrigation and drainage (I&D) infrastructure, together with problems of poor water management and water use inefficiency, cause environmental degradation and decline in agricultural productivity, which may result in social tension.

In this context the Government attaches a high priority to the urgent improvement and rehabilitation /upgrading of the existing I&D system and pump schemes, and strengthening of water sector institutions, based on integrated water resource management (IWRM) concept and holistic development approach to achieve more efficient management of the irrigation and distribution network, and of sustainable irrigation services to support local agricultural producers and communities.

The Government of Uzbekistan has obtained a loan from the World Bank under Fergana Valley Water Resources Management Project – Phase 1 (FWRMP-I). The proceeds from this loan have been used to prepare the second phase of the large-scale rehabilitation of I&D systems in Fergana Valley and implementation of a program on water sector institutional reforms. In order to analyze and address environmental and social impacts associated with the implementation of the FWRMP-II, and identify adequate mitigation and monitoring program and respective costs and responsibilities, the Borrower has developed an Environmental and Social Impact Assessment (ESIA), including an Environmental and Social Management Plan (ESMP), which is in accordance with the requirements of the World Bank Operational Policy 4.01 "Environmental Assessment", and ones of the national legislation, namely, the Book on Environment and Environmental Expertise Procedures in Uzbekistan.

Currently the Environmental Assessment of the FVWRM-II Project is approved by the State Environmental Review (SEE) of the State Committee. The endorsement letter of the SEE is given in Annex 12.

NATIONAL LEGISLATIVE AND REGULATORY FRAMEWORK

The Law "On Environmental Protection" (1992) is the fundamental document regulating environmental protection and management in Uzbekistan. Among the other 120 laws and by-laws on the environmental protection and natural resource management, the most important ones are:

- On Water and Water Use (1993);
- Land Code (1998);
- On National Security (1997);
- On Safety of Hydraulic Structures (1999);
- On Environmental Impact Assessment EIA (2001).

The latter regulates the process of conducting and review of environmental assessment. In accordance with the provisions of this Law, a project proposer is responsible for preparing the EIA report and implementation of mitigation measures. EIA review and approval are the responsibility of the Main Directorate for State Ecological expertise (Glavgosecoexpertiza) under the State Committee for Nature Protection (Goskompriroda). State Ecological Expertise acts in accordance with the provisions of the Regulations of the Cabinet of Ministers No. 491, dated 31.12.2001, which envisage four project categories, depending on anticipated environmental risks assessed as high, moderate, low and local.

In accordance with national legal provisions, the project falls under Category 2 (moderate risk), because the main project activity has been defined as "Reconstruction and reclamation of old irrigated lands on the area over 1,000 ha", and is subject to the environmental assessment.

World Bank Safeguard Policies Triggered for the Project

Environmental Assessment OP 4.01: The project design does not seek to promote expansion of irrigated agriculture, but seeks to improve efficiency of agricultural productivity through the rehabilitation and upgrade of the existing irrigation and drainage network. As a result of improved water management and irrigation service delivery in the project area, the project would have an overall positive impact on the downstream and the environment. The ESIA concludes that the Project will virtually have no significant negative environmental impacts, except for minor disturbances typically occurring during construction and will be mitigated and monitored under the proposed Environmental and Social Management Plan (**Chapters 8 and 9**).

Natural Habitats OP 4.04: Water and surface ecosystems of Fergana Valley represent common hydrographic network with great number of permanently operating water courses, that form large river systems, that are crossed by junction canals, lakes and reservoirs joined by common water feeding source – the Syrdarya River. For the last ten years the project area has been intensively used for agricultural purposes. There are no protected natural zones, or areas that are considered as critical for survival of any types of plants or animals, in the project area and its immediate vicinity. Also the coverage of the project area does not include zones that are considered ecologically unique, except the territory of sub-project "Isfayram – Shakhimardan", where the zone for formation of underground water Chimyon – Avval is located, that has the status of republican significance. The flora and fauna consist almost exclusively from cultivated plants and species. The Podshaota, Chodaksay, Akbusaray Rivers' biocoenosis are included into the group of background waterways, periphyton communities that are characterized by high species diversity and are ecologically progressing. The ESIA revealed that in general water ecosystem in the project area does not suffer from significant anthropogenic pollution. Therefore, OP 4.04 is triggered only to promote monitoring of the positive impact of FVWRMP - II on seasonal accessibility of water resources for servicing agricultural ecosystems.

Pest Management OP 4.09: The project will not support purchase of pesticides and agrochemicals. However, the project may lead to increased use of pesticides and agrochemicals use, which represents threat for agricultural ecosystems and the environment. OP 4.09 is triggered to ensure that these potential risks are properly addressed. The project will provide for capacity building activities on raising awareness and knowledge by delivery of customized training sessions to WUAs, farmers and other target groups. The training modules will cover a wide variety of subjects, with special attention to the Integrated Pest Management (IPM) principles and introduction of biological pest management methods, regulated use of pesticides and other agrochemicals, in particular, definition of allowable norms, specifications, quantities and requirements on their proper storage and utilization. The training outputs will be part of regular project reporting to the Bank, with indication of subjects, locations and attendees. On a longer-term perspective, the project will trace the impacts of the training, using its M&E mechanism. The project will use the IPM, IWRM and Sustainable Land Management (SLM) approaches and methods, and will build on the experience of other similar projects, implemented in the country during the last years. As part of the monitoring program, the project will specifically monitor soil and water quality in the project area, on a range of parameters, including pesticides residuals at demonstration plots (DP), and the monitoring results will be duly reported to the implementing agency and the World Bank.

Involuntary Resettlement OP 4.12: The project envisages construction of supply canals, rehabilitation of canals flowing through settlements, and repair and construction of 3 km of pipeline, and these works are associated with potential damage to perennial plants., and acquisition of land in Podshaota-Chodak sub-project site. In order to address these issues, the client prepared a Resettlement Policy Framework (RPF) and a Land Acquisition Plan (LAP), which envisage mechanisms for risk minimization or mitigation, and compensation of losses in accordance with OP 4.12.

Safety of Dams OP 4.37: Due to the fact that the areas of sub-projects "Savay – Akbura" and "Isfayram – Shakhimardan" of FWRMP-II are located downstream the Andijan reservoir, OP 4.37 is triggered. In accordance with adopted governmental by-law acts and provisions, in 2004 the first draft of the Andijan Reservoir Safety Report was prepared and approved by Expert Council of SI "Gosvodnadzor" for the period of five years, which envisaged measures for the improved safety of operation of the dam node (Annex 8). In 2011, while preparing the second edition of the Safety Report, the Special Committee examined the proposed safety arrangements and concluded on additional measures to reinforce dam concrete, improve mechanical instrumentation, etc. Based on this Safety Report and stakeholder consultation meetings, the following recommendations were provided: (i) conduct on-line workshop on completion of the document "Potential Failure Mode Analysis" (PFMA), taking into account managing principles of the USA Federal Committee on regulations in energy generation (FERC); and (ii) "Gosvodkhoznadzor", with assistance of the PIU under MAWR, will continue its program for inspection of safety by conducting two diagnostic surveys: (a) before project construction and (b) during the last year of project implementation. The respective studies have been conducted and are currently reviewed by the Bank's Dam Safety Specialist for futher guidance.

Projects on International Waterways OP 7.50: The main sources of irrigation supplies in the project area are natural waterways, which are tributaries to the Syr Darya river. The Syr Darya river is an international waterway shared by Kazakhstan, the Kyrgyz Republic, Tajikistan and Uzbekistan. The MAWR prepared a water balance which shows that the project is expected to reduce the reliable annual flow in the Syr Darya basin at the border between Uzbekistan and Tajikistan by 83.9 MCM from 20,582.0 MCM to 20,498.1 MCM. This represents a 0.4 percent reduction of the current annual runoff. Under less favourable scenarios (as described in the attachment), the project impact increases to 0.8 percent and 1.3 percent. The net reduction of flow during the summer months (April – September) is estimated at 0.6 percent, 1.2 percent and 1.8 percent under a project design, medium level and high case scenario, respectively. The riparian countries were notified by GOU, and the responses are expected by mid-April 2016.

Comparison of the National Legislation and Word Bank Operational Policies

Overview. EA analysis and other sources [28] shows that while the basic provisions of the National EA rules and procedures are to some extent similar to the WB requirements, there are several important differences. These differences are related primarily to the following: (a) project environmental screening categories; (b) Environmental Management Plan; (c) EA disclosure and public consultation; and (d) EA reviewing process; (e) applicable environmental standards.

Differences in screening categories. As indicated above (subsection 2.1.2), in Uzbekistan the EIA systems are based on the SEE developed in Soviet times. SEE is regulated by Law (No 73-II.25.05.2000) on Ecological Expertise and by Decree of the Cabinet of Ministers (No 491.31.12.2001) on approval of the Regulation of the State Environmental Expertise. The Regulation stipulates 4 categories for development: Category I (High Risk), Category II (Middle Risk), Category III (Low Risk), and Category IV (Local Impact). Under the WB EA system (OP. 4.01) projects are classified as Category A, Category B or Category C depending upon estimated potential environmental risk. Unlike the WB categorization system, Uzbekistan regulation indicates threshold based on project descriptions. In the case where World Bank and national categorization/EA requirements differ, the more stringent requirement will apply. This refers mostly in the case of deciding about Category C subprojects - the national EA legislation doesn't refer to small scale activities, including rehabilitation and construction of some inter- and on-farm irrigation infrastructures. In these cases the client will apply the WB criteria.

Differences concerning EMP. While the national legislation requires for all projects with potential environmental impacts relevant mitigation measures, it doesn't require a special Environmental Management Plan (EMP), which should specify along with the proposed mitigation activities, a monitoring plan and reporting requirements, institutional arrangements for EMPs implementation as well as doesn't require needed capacity building activities and necessary expenses in this regard. However, for sub-projects that is financed under the Component: Support for the Agricultural Modernization, EMP will be required to be prepared by the borrower to comply with World Bank requirements. The EA includes finances for training PFIs and credit borrowers on preparation of EMP/EMMPs.

Differences with regard to disclosure and public consultation. Conducted analysis shows there is no harmonization between WB and national requirements in this regard. According to national legislation, the EA disclosure and public consultation is mandatory only for category I and II. At the same time, according to the SEE law the public environmental review can be carried out on the initiative of NGOs and citizens in any field and for all types of project categories, which needs to be environmentally justified. Public environmental review can be carried out regardless of the state ecological expertise. Conclusion of public environmental review has recommendatory nature. In the case of WB EA policy, the Sub-borrower is responsible for conducting at least one public consultation for all Category B projects to discuss the issues to be addressed in the EMP or to discuss the draft EMMP itself. The approach to planning the public consultations for the Project would be guided by international best practice embodied by the Bank standards [28,29].

Differences concerning reviewing and approval of EA studies. As mentioned above, the national EA reviewing process relates to the State Environmental Expertize (SEE), while according the WB requirements is a part of the whole EA process. The SEE/SEA seeks to examine the compliance of proposed activities and projects with the requirements of environmental legislation. The mentioned laws stipulate the mandatory cross-sectoral nature of SEE, which shall be scientifically justified, comprehensive, and objective and which shall lead to conclusions in accordance with the law. SEE precedes decision-making about activities that may have a negative impact on the environment. Financing of programs and projects is allowed only after a positive SEE finding, or conclusion, has been issued. In compliance with WB policy, all EAs for sub-projects financed under the Project, particularly under the Component Agriculture Modernization will go through the more stringent review and approval process of the WB.

Applicable Environmental Standards: Sub-projects requiring an EMP will include mitigating actions to assure compliance with environmental standards of performance. If both Uzbek and World Bank standards exist for a particular mitigating measure, the stricter of the two standards will apply. For example, if the environmental issue of concern is —noise, and the World Bank noise standard is stricter than the Uzbek one, the mitigating measure selected should meet the stricter World Bank standard 4.

PROJECT DESCRIPTION

Project Objective

The proposed Fergana Valley Water Resources Management Project Phase 2 (FVWRMP-II) is the second phase of large-scale interventions of the Government of Uzbekistan on rehabilitation and modernization of irrigation and drainage systems of the Fergana Valley and implementation of institutional reforms and agriculture modernization. FWRMP-2 addresses general constraints of the agricultural productivity in Uzbekistan, damage of infrastructure, risks to the environment and population because of low water supply in the Project area, and insufficient capacity to ensure proper water resources management.

The project aims to improve water management and restore irrigation systems in the project area encompassing three regions: Andijan, Fergana and Namangan. The main goal of the FVWRMP-2 is to introduce the most optimal set of measures for rehabilitation and modernization of the existing irrigation systems, based on the principles and conceptual approaches of the IWRM Plan in Fergana Valley, which outlines the ways to achieve more efficient water sector management based on the principles of co-management, environmental sustainability and social equity.

The project goal is fully consistent with the national agricultural policy, which gives the priority direction to rehabilitation and modernization of the existing I&D system in Fergana Valley, better living standards and food security for the population in the region.

Project Components

FVWRMP-II contains the following main components:

Component A: Irrigation Modernization. This component aims at addressing the problems of water shortage in the project areas and includes five subcomponents: (a) rehabilitation of surface irrigation system; (b) modernization of pump stations; (c) rehabilitation and construction of groundwater wells; (d) flood control and bank protection and (e) expand supervisory control and data acquisition (SCADA) in the project area. To enhance the accountability of irrigation management to water users and improve the quality of irrigation service delivery, the project will pilot volumetric Operation and Maintenance (O&M) charges, and managed aquifer recharge.

Component B: Support for Agricultural Modernization. To take full advantage of the improvements in irrigation modernization, this component will support Uzbekistan's efforts to modernize agriculture, promote agricultural diversification and intensification, support cotton harvest mechanization, and strengthen capacities. Subcomponents include (i) support for crop intensification and diversification through capacity strengthening, demonstrations and Farmer Field School (FFS), (ii) assistance to farmers to access lines of credit (including assistance in the preparation of business plans); and (iii) support for cotton harvest mechanization, including capacity strengthening to improve crop husbandry methods.

Component C: Institutional Reforms. This component will provide assistance to the water service providers in the project area to promote and improve efficient and productive use of the on-farm irrigation systems on a sustainable basis, with special emphasis on water and asset management aspects. Subcomponents include (i) water management capacity strengthening of staff from Basin Administration of Irrigation Systems (BAIS), Administration of Irrigation Systems (AIS) and Water Consumer Associations (AWS) and introduction of maintenance and asset management; (ii) promotion of asset management and service oriented management; and (iii) piloting of managed aquifer recharge and volumetric operation and maintenance fees.

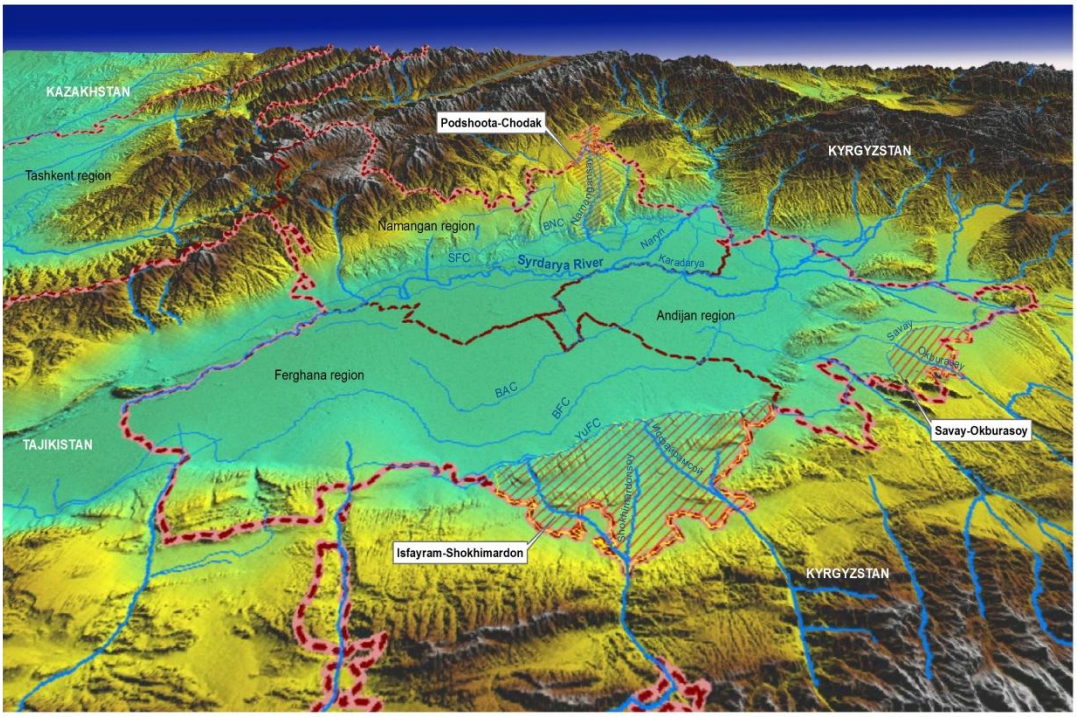
Component D: Project Management, Audit, Monitoring and Evaluation, and Technical Assistance. This component would (i) support the operation of the Project Implementation Unit (PIU), and finance overall project management, as well as technical assistance in such areas as detailed design, contract administration and construction supervision, procurement, financial management, and capacity strengthening; (ii) establish a Monitoring and Evaluation (M&E) system and arrange for data collection and reporting on key performance output and impact indicators through baseline surveys, participatory assessments and mid-term review and final evaluation; (iii) finance services of independent auditors for auditing of project accounts and overall project management; and (iv) prepare a feasibility study and bidding documents for a follow-on investment operation.

Project Location

The Project is entirely located in the Fergana Valley, encompassing three regions: Andijan, Fergana and Namangan area and covers 103,245 hectares. The overall location maps of the project area is illustrated in Figures S.1 and S.2.

Figure S. 1. Project area (regional)

Figure S. 2. The Overall location of FVWRMP-II sub-projects areas in Fergana Valley



The proposed project areas are:

(i) The Podshaota-Chodak project area (29,507 hectares) in Namangan region located in the northeast of the Fergana Valley on the right bank of the Syrdarya River. Administratively, the project area consists of Yangikurban district in its entirety and part of Chodak distric;

(ii) The Isfayram-Shahrimardan project area (54,375 hectares) in Fergana region located in the south of the Fergana Valley. The project area covers the southern part of Isfayram-Shahrimardan ISA.

Administratively, the project area include the entire Fergana and Kuvasai districts, Fergana city, and parts of Kuva, Altiarik and Tashlak districts;

(iii) The Savay-Akburasai project area (19,363 hectares) in Andijan region located in the southeast of the FV. Administratively, the project area is part of Kurgantepa, Jalalkuduk, and Hujaobod and Bulokboshi districts of Andijan region and located on the left bank of Karadarya River.

State of the Environment

The Fergana Valley is characterized by sharp continental climate, hot, dry summer and relatively mild winter. Annual precipitation is 180-330 mm; evapotranspiration is 3-4 times higher than annual precipitation. Project area is located in foothill and piedmont plains; slopes of the ground are mainly steep having some areas with slight slopes. Area belongs to a soil-ameliorative area of minimum outflow of ground water, therefore, does not have the drainage problems, not affected by the secondary salinization, characterized by low water table and low mineralization of ground water. Soil is characterized by the highest productivity in Uzbekistan, which, in combination with favorable climate conditions, contributes to the high agricultural significance of the Project area.

Aquatic and terrestrial ecosystems of the Fergana Valley are represented by common hydrographic network with great number of permanently operating water courses, that form more or less large river systems. The latter are crossed by junction canals, lakes and reservoirs joined by common water feeding source – the Syrdarya River. The main sources of surface water supply of the project area are the Podshaota, Isfairamsai, Shahimardan, Akbura rivers, and Savai canal. Besides, water is pumped from other basins, particularly, from the Naryn River basin through the Big Namangan Canal into Podshaota system, from Andijan reservoir through SFC into Shahimardan–Isfairamsai and Savai-Akburasai systems.

Significant component of water resources is ground water from the wells which are used in most intense periods of vegetation, when there is a shortage of water in surface sources, especially in dry years. Mineralization of irrigation discharge water from the irrigated land is 1-2 g/l that makes it suitable for irrigation. It serves as an additional source of water, and is used for irrigation in areas of formation or discharged into the surface sources and used after mixing with the river flow.

The project area is known for traditional centers of irrigated husbandry, and for the last decade has been extensively used for agricultural purposes: about 86% of land in the Project area is used for agriculture while 14% of area accounts for villages and rural infrastructure. The main crops are gardens with vineyards and winter wheat, occupying 35% and 28% of the area respectively, excluding Savai-Akburasai sub-Project area, where preference is given to cotton (33.6%) and wheat (36.15). Other crops in sub-Project areas are potatoes, vegetables, melons and forage. The larger farms, with total number of 3 044, are the main land users and manage 80-85% of arable land, the rest of the land belongs to 180 thousands of small dekhkan farms.

In the Project area there are no protected natural zones, no areas considered as critical for survival of any types of plants or animals, and no ecologically unique zones. The underground water reserve Chimyon-Avval, located in the territory of the sub-project “Isfayram-Shakhimardan”, has the status of protected natural territory of republican significance. The flora and fauna consist almost exclusively from cultivated species. Biocoenosis of the Chodaksai, Podshaotasai, Akburasai Rivers are part of background watercourses group, periphytic coenosis of which is characterized by high diversity and ecologically progressing. The EA concluded that aquatic ecosystem in the project area does not face significant anthropogenic pollution. Due to anthropogenic factors the Isfairamsai River transforms into transitional satisfactory condition. Decrease in industrial production in the post-Soviet period and decrease in level of agrochemicals consumption have caused certain improvement of the surface water quality.

The social assessment (SA) defined that the population of the three sub-Projects is about 975,804 people. About 30 % of population is classified as rural. Ethnic composition is mixed comprising 81% of Uzbeks, 16% Tajiks and Kyrgyzes, and 3% others. According to the official statistics, about 80% of population is connected to the tap system, although recent surveys data show lower coverage. There are no historical monuments in the Project area.

POTENTIAL PROJECT ENVIRONMENTAL IMPACTS

The potential negative environmental impacts of the proposed project are associated with the implementation of activities under Component A "Irrigation Modernization" and Component B "Support for Agricultural Modernization and Institutional Reforms". These are expected to be temporary and mitigatable, if proper measures are duly applied. Thus, in accordance with the World Bank Operational Policy 4.01, the project has been assigned an environmental category B which envisages partial assessment.

Among the most important environmental benefits of the Project are more efficient use and distribution of water resources and improved efficiency of irrigation systems envisaging reduced water losses, more efficient use of energy, and restoration of natural ecosystems services through improved quality of soil and better hydrology. These effects are expected due to the rehabilitation of canals and their related infrastructure, modernization of pump stations, restoration and construction of new irrigation wells, improved water management due to introduction of SCADA, and flood control and bank protection in the project area. Strengthening capacity of water management institutions will improve efficient and productive use of the inter- and on-farm irrigation systems and quality of irrigation service delivery.

Reduced water losses and improved distribution of irrigation water will also reduce seepage losses from canals and over-supply of irrigation. Project interventions such as establishment of demonstration plots, Farmer Field Schools, capacity building, training and technical assistance for farmers to access credit lines (including preparation of business plans) will allow the farmers and agricultural producers to access the up-to-date technologies and will further contribute to improves water distribution and reduction of unproductive losses water in the fields.

The adverse environmental impacts of the project activities will occur during the implementation of civil works and may include:

- Pollution of surface water with sediments from canal cleaning and construction wastes;
- Temporary disturbance to the terrestrial and aquatic ecosystems due to the implementation of canal cleaning and rehabilitation works
- Impact on flora due to the need to selectively cut trees for site clearing;
- Pollution of soil and water due to accidental spills of fuel, oil or lubricants;
- Impact on soil due to excavation works during canal cleaning;
- Excessive dust, fumes and noise due to the implementation of civil works and use of construction machinery;
- Environmental footprint of affiliated facilities: construction camps, mechanization stations, construction material storage sites, etc.

There may be some social impacts during the construction phase, including construction related traffic increase, temporary impacts on the land use and temporary local employment.

Risks of the construction phase could be effectively mitigated by adherence to common good construction practices, implying:

- Keeping construction vehicles and machinery in good technical condition;
- Fueling, washing, and otherwise servicing vehicles and machinery at the service centers or in the designated locations of the construction site which can obtain operational and accidental spillage of oils and lubricants and does not allow direct water discharge to the natural water bodies;
- Moving vehicles and machinery along the existing or designated access roads to avoid excessive damage of natural vegetation;
- Operating vehicles and machinery within working hours and shutting engines when idle;
- Keeping sub-soil and topsoil separately and using them for backfilling and reinstatement of construction site;
- Keeping construction materials and waste within the construction site and regularly disposing them into the formally designated locations;

- To the extent possible, purchasing inert construction materials (sand, gravel, rock) from licensed operating vendors. If mining by contractor is required, obtaining and observing license terms, and ensuring reinstatement of the used borrow sites;
- Ensuring clear and timely communications on potential negative impacts of construction to local residents, and the establishment of accessible complaint procedures and grievance redress mechanisms;
- Implementation of labor safety rules, with correct and technically justified selection of working sites and their location with the objective for creation of safe and healthy conditions for work;
- Creation of correct sequence for rehabilitation works at collectors of irrigation systems, in such manner that any inconveniences to local users were brought to minimum;
- Proper site fencing and supervised and safe access to working places and inhabited districts during construction;
- Implementation of arrangements for traffic safety;
- Timely cleaning of sites from construction waste and use of authorized disposal sites;
- Creation of water protection zones at new canal sections in accordance with SNiP 2.04.02-97 (Construction Norms and Rules);
- Cleaning and reinstatement of construction sites after completion of construction.

Environmental impacts of the operational phase include overall impact on water resources of the watershed, as well as impact on landscape, flora and fauna, and land use. Among indirect impacts of the restored irrigation network is potential increase in use of pesticides due to the intensification of agricultural activities in better irrigated areas. Such increase carries risks of environmental pollution and threats to human health.

The expected operational impacts can be mitigated by implementing the following measures:

- Proper maintenance of hydraulic structures, pipes and canals throughout operation of the scheme;
- To monitor water abstraction from the determined sources as per the quantities analyzed by the water balance presented below;
- No considerable damage to aquatic life is expected, because meeting of the actual water demand is possible without disruption of its seasonal dynamics. This judgment is confirmed by the water balance analysis before and after the project, which is presented in Chapter 6 of the ESIA;
- No significant impact is expected on fauna and flora in the project area, because the ecosystem functionality will not be violated and no ecosystem fragmentation will occur.

Water Balance Summary

Overall water use efficiency is expected to increase as a result of the project from the current level of 30 percent to 35 percent. This will be achieved through rehabilitation and lining of main canals and related water control infrastructure, rehabilitation of pumping stations and capacity strengthening of water managers and users. In addition, the project will lead to increased withdrawals from the Syr Darya basin, including through groundwater extraction. The improved water supply to the project area will lead to higher levels of water use (including beneficial and non-beneficial crop evapotranspiration – ET and NBET).

As a result of the project interventions, more water will be available for crops, which means an increase in Crop ET and NBET. The post-project Crop ET and NBET in Podshaota-Chodak, Isfayram-Shahimardan and Savay-Akburasay is 71.3, 198.2 and 87.9 MCM, respectively. The annual post-project irrigation supply for Podshaota-Chodak is 185.8 MCM, for Isfayram-Shahimardan 516.4 MCM and for Savay-Akburasay 229.1 MCM. In total, the increase in the irrigation supply for the three project areas combined will be 103.3 MCM. Post project return flows are 114.5, 318.2 and 141.2 MCM, for Podshaota-Chodak, Isfayram-Shahimardan and Savay-Akburasay, respectively. The increase in return flows is 19.5 MCM for the project area combined. The net impact under the project design scenario on water withdrawal from the Syr Darya basin is 83.9 MCM, an estimated 0.4 percent of the average annual runoff of 20,582 MCM at the Uzbek – Tajik border.

Two additional scenarios were developed to estimate the sensitivity of the project to changes in the pre- and post-project water balance. With withdrawals staying the same under each scenario, a high level scenario assumes that efforts to increase efficiency are unsuccessful and that most of the additional withdrawals under the project are lost to drainage. Efficiency would stay at the pre-project level of 30 percent. The impact of the project under this scenario is an increased net withdrawal of 261.1 MCM, or 1.3 percent of the average annual flow. Under a medium scenario, 50 percent of the withdrawal is assumed to be used for NBET, and 50 percent serves to increase drainage. The net project impact in this scenario is 172.5 MCM, or a 0.8 percent reduction of the average annual flow at the Uzbek-Tajik border.

An additional analysis was conducted to estimate the impact of the project on the total cumulative flow between April and September. Considering that an estimated 70 percent of the annual runoff of the Syr Darya at the Uzbek – Tajik border occurs between April and September, the net impact of the project is 0.6 percent, 1.2 and 1.8 percent under the project design–, medium- and high-case scenario, respectively.

To summarize, there will be no adverse environmental impacts on the natural streams as a result of the project. The expected social impact of the operational phase will be economic gains to communities in the coverage area of the three sub-projects.

Groundwater Formation Deposit Chimyon-Avval

The Chimyon-Avval Deposit has the status of a natural protected area of national importance. The water balance presented in ESIA Table P5.5, Annex 5, concluded that no adverse impact is expected to the existing water balance of the Deposit. Since the last inventory in 1990, the extraction of underground water for irrigation has reduced by 377.8 thousand m^3/day, while the project will require increase of groundwater abstraction up to 98.0 thousand m^3/day.

Environmental Aspects of the Technical Assistance under Component B (ii) on assistance to farmers to access credit lines

The project will not provide credit lines for agricultural activities, however, will assist farmers in approaching credit lines and other financial mechanisms available in the project area. This will stimulate various types of agricultural activities which may represent a range of environmental concerns which should be properly assessed and mitigated. The ESIA Annex 2 contains detailed guidelines for screening credit applications, assessing impacts and identifying adequate mitigation and monitoring program. These guidelines are based on similar guidelines which govern credit activities under WB funded Rural Enterprise Support Project – 2, currently ongoing, which resources will also be available for farmers from the project area.

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

The present ESIA report contains an Environmental and Social Management Plan (ESMP), which is designed to ensure that all necessary measures are identified and implemented in order to mitigate possible negative impacts of the construction and operation phase and to comply with the national environmental legislation. The ESMP will be included in tender documents and will become an integral part of the works contracts. The construction contractors will be responsible to carry out all the measures envisaged by the ESMP during the construction. Supervision of the ESMP implementation will be carried out by MAWR PIU.

Capacity for ESMP Implementation

The MAWR will conduct general coordination and supervision for the implementation of FVWRMP-II, and the already existing PIU under MAWR will be responsible for the implementation of the project ESMP of this project. The PIU will establish a designated team (Environmental Monitoring Team, EMT) responsible for ensuring project environmental compliance, and specifically, for monitoring the implementation of measures specified by ESMP. The EMT will consist of the following specialists: (i) environmentalist (general coordination and reporting on ESMP); (ii) inspector of contractors'

compliance (supervision of environmental management status in 3 sub-projects); (iii) representatives of 3 sub – projects responsible for environmental compliance at sites; (iv) institutional expert (monitoring coordination at sites) and (v) expert on dissemination of information and building capacity on advanced agricultural practices.

During the phase of design/bidding EMT will ensure that ESMP is an integral part of bidding documents and contracts. At the stage of construction/operation, the environmental specialist will coordinate the implementation of ESMP. The EMT will report to the PIU on the implementation of the mitigation and monitoring plans and delivery of training program. The PIU will mobilize consultancy services in order to provide necessary training and assistance to the PIU/EMT. Abbreviated environmental management and monitoring plan, with associated costs, is presented in Table S.1 below.

The following parameters will be monitored under ESMP:

- Surface and underground water quality in project area and downstream;
- Environment pollution and salinity from agricultural waste;
- Groundwater level and water logging;
- Impact on flora and fauna;
- Solid waste;
- Loss of fertile soil, erosion of canal embankments during rehabilitation works;
- Sediments at canal tail and location of sediments location at inter-farm canals.

Table S. 1. Main provisions of ESMP and budget

Expense items	Environmental/ social impact	Mitigation or monitoring measures	Respon-sible	Cost $US
Mitigate disruption of terrestrial and aquatic ecosystem	Risks of soil erosion and reduction of ecosystem service /areal	Creation of green belts along sais at the sections of bank strengthening works (procure planting stocks, drought-resisting plants, to prevent soil erosion)	Contractor /PIU	450,000
	Disruption of flora and fauna – environmental damage	Restore trees and plants that would be cut down to access the construction site.	Contractor /PIU	
		Purchase special seeds, farm machinery, fertilizers for households in project farms.	Contractor /PIU	
	Possible inconvenience population and personnel; temporary reduction in farmers' incomes; sanitary threats and safety risks	Carrying out awareness campaigns; Control of noise, dust, exhaust fumes, road watering, water truck; coaching, work is not the growing season; software security tools; measures to protect health and safety. Plan for emergencies.	Contractor /PIU	
Consultants for institutional development, Monitoring/training, including local experts of EMG	None	Consultants, international (2) и local (2), and also local experts of EMG: Constructor inspector and 3 representatives of local administrations in charge of environmental compliance checks on sub-projects and project facilities.		1 841,473
Training on water quality /management and environ-ment protection	None	Training programs, FFS and agricultural extension activities; assistance to access to credit lines, preparation of business plans, etc; Purchase office, field and training extension equipment, stationeries; rentals for training premises, etc.		51,973

Demonstration plots	None	3 demo plots in each sub-project (total 9 plots) for demonstration and replication of best SLM practices, on-farm water management and water allocation schemes, with introduction of IPM, IWRM and M&E tools;	PIU	293,400
Resettlement and compensation costs	None	To ensure timely compensation payments (at full replacement cost) for loss of assets attributable directly to the project	PIU	TBD
	None	Resettlement assistance	PIU	
	None	Provide assistance to improve the displaced- persons livelihoods and standards of living (at least restore to the pre-project levels)	PIU	
Contingencies	Safety and health of workers	a) Implementation of the program to ensure workplace safety. b) The supply of workers by means of safety and instruction. c) Plan of Action in emergency situations		
	Environmental pollution	All waste is classified according categories for utilization: a) scrap metal and old equipment are sold by processors of waste; b) Construction waste is removed in the storage site (or used for other purposes). c) electric equipment containing PCB should be liquidated in accordance with International guidelines [30-32]; d) The use of corrosion-resistant materials in the construction; e) Proper transportation and storage of fuel, filling at 20 m distance from waterways; f) Plan of Action in the case of fuel spill.		
	Property ownership	Compensation for incidental damage to private entities or other emergency situations.		
Compensatory water supply	Risks of disruption the water supply regime and crop yield damages	a) Works in non-vegetative period (if possible); b) Construction of by-pass structures (channel) for uninterrupted water supply.		
Storage of construction materials, fuels and lubricants	Soil and water contamination	a)Preparation of sites for materials storage; b) Reserve fuel tanks; c) Precautions for storage and handling operations.		
Additional EMMP-related studies (particularly related to upgrade/ safety and agricultural extension and provision of incentives)		(1) Arrange construction works within boundaries of existing allotments to reduce land disruptions; (2) Develop new on- farm irrigation systems; (3) To assist in strengthening agricultural extension services; (4) Training program on Agricultural Investment Appraisal, including the preparation of business plans and mobilization of financial resources; etc.	MAWR	TBD
Preliminary total:				**2 582,823**

Source: Prepared by the EA team

CONSULTATIONS AND DISCLOSURE

A public participation and consultation process has been conducted as part of social assessment (SA) and environmental assessment (EA), inter-alia, through in-depth interviews, focus group discussions and stakeholder meetings. Through the field surveys/ investigations and discussions a wide range of recommendations was received with respect to improvement of water management and operations in the three sub-project areas of the FVWRMP – II (details presented in Annexes 3 and 9).

The draft ESAMP has been discussed at the Stakeholder Consultation Workshops held on 12-14 May, 2015, in the premises of the Basin Water Authorities for irrigation systems in Namangan, Andijan and Fergana regions. The consultations have been initiated by the MAWR PIU, with assistance of the TA consultants and ESA team. The participants included representatives of executive Basin Administrations of Irrigation Systems (BAISs) and environmental authorities, as well as local governances, local citizen councils, Water User Associations, women and other related stakeholders. The primary attention was concentrated on obtaining feedback on technical, social and environmental aspects of the Project, especially from beneficiaries of project area. The Workshops Minutes, Agenda and list of participants are presented in Annexes 9-10. Recommendations received during these consultation meetings have been mainly related to the implementation of the technical and environmental interventions of the FWRMP-II, and will be addressed during project implementation. There was a strong consensus that the Phase II project should be implemented as soon as possible to secure the reliable water supply to irrigated croplands and the other water users.

1. INTRODUCTION

1.1. Background

Preface

Government of Uzbekistan has obtained a Credit / Loan from the World Bank under Fergana Valley Water Resources Management Project – Phase I (FWRMP-I). The proceeds from this credit / loan have been used to prepare the second phase of the large-scale activity the envisaged by the Government of Uzbekistan on rehabilitation of I&D systems in Fergana Valley and implementation of program on institutional reforms in existing water sector organizations.

Introduction

Fergana Valley is an ancient fertile oasis and densely populated region, occupies part of three Central Asian countries: Uzbekistan, Tajikistan and Kyrgyz Republic, where 60% of territory accounts for Uzbekistan. Total area of FV is about 2.6 million ha; total population is 14 million of which 66% in rural area.

Water sources: the Naryn and Karadarya rivers and formed by them Syrdarya, as well as their mountain tributaries and main canals (BFC, SFC, BAC and BNC) are mainly intergovernmental sources. Water supply in the middle reach of the river mostly depends on flow release by the upstream riparian countries (Kyrgyz Republic and Tajikistan). There is a very dense irrigation network, characterized by very low efficiency, up to 50-60%. The deteriorated I&D infrastructure combined with problems of poor water management and water use inefficiency, causing environmental degradation and ultimately reduced agricultural productivity, resulting in social tension and related negative consequences. The becoming more frequent dangerous phenomena, such as extreme droughts, increase instability of agricultural production and threaten living standards of rural population.

In this context the Government accords a high priority to the immediate improvement and rehabilitation /upgrading of the existing I&D system and pump schemes and strengthening of water sector institutions, based on IWRM concept and holistic development approach to achieve more effective management of the irrigation and distribution network, and sustainable irrigation services to support local agricultural producers and communities for better crop production and environmental benefits.

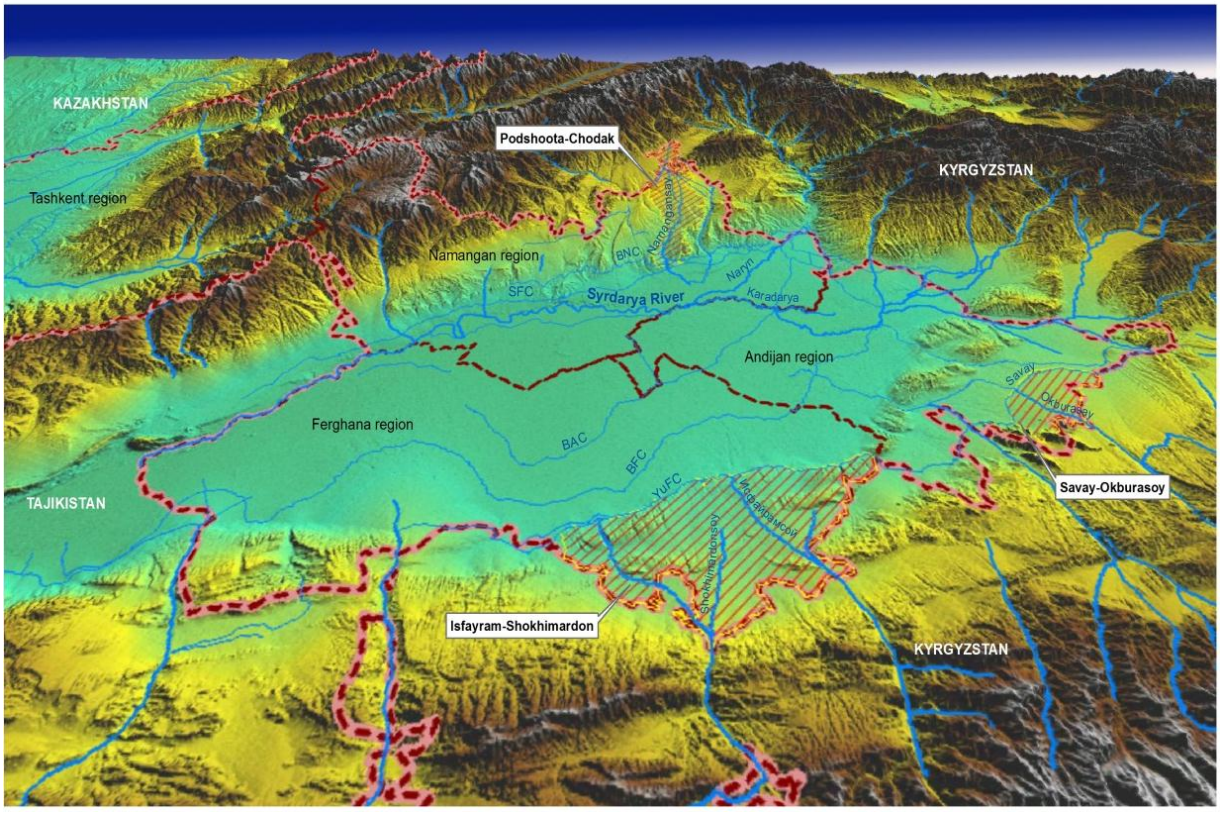
Fergana Valley Water Resources Management Phase-II Project (FWRMP-II) addresses general constraints of the agricultural productivity in Uzbekistan, damage of infrastructure, danger to the environment and population because of low water supply in the Project area, and insufficient capacity for efficient water resources management.

Project area covers three big economic regions of the country in Fergana Valley, namely, Namangan, Andijan and Fergana oblasts. Survey covers area of about 1.8 million ha, where about 8.3 million population lives. At that, 0.19 ha irrigated land account for per 1 rural resident against 0.27 over Uzbekistan. Irrigated lands (922.2 thousand ha) and dry lands (212.2 thousand ha) are major source of livelihood, material wealth and employment of the population. Project area is illustrated in Fig. 1.1-1.2.

FWRMP-II requires the Project environmental impact assessment (EA), according to Operation Strategy (OS 4.01, 1999) of the World Bank and Guidelines envisaged by Book on Environment and Environmental Expertise Procedures in Uzbekistan. This activity has been managed by the Project Implementation Unit (PIU) under the Ministry of Agriculture and Water Resources (MAWR). Uzbekistan is responsible for any environmental issues related to the Project.

Figure 1.1. Project area (regional)

Figure 1.2. Project area (Uzbekistan with valley)



The Project is a Category B project according to the World Bank Operational Policies (OP 4.01), and as a Category 3 (low risk) according to Decree of the Uzbekistan Cabinet of Ministers No 491.31.12.2001: "*On approval of the Regulation of the State Ecological Expertise"*. The rehabilitation and upgrading works of existing infrastructure are not considered to generate significant negative environmental impacts and only minor to negligible negative environmental impacts, the latter can mostly be mitigated through appropriate mitigation measures during the construction (implementation) phase of the Project. In fact, mainly considerable positive environmental impacts are predicted for the Project area, certainly in case the proposed institutional reforms would be implemented during the subsequent phases of project implementation. Currently the Environmental Assessment of the FVWRM-II Project is approved by the State Environmental Review (SEE) of the State Committee (Annex 12).

1.2. Objectives

Project is expected to halt the land and environment degradation caused by mismanagement of the land and water resources, low efficiency of water use, and system of O&M, therefore, it will have generally positive environment impact.

Project supports environmental management and program on improvement of water delivery efficiency, increasing of water supply and improvement of environment quality by upgrading the irrigation infrastructure and improvement of efficiency of use and allocation of water at all levels. Additionally, the Project activities are aimed at supporting of the institutional reforms, restructuring agencies for improvement of irrigation services and capacity development.
Objectives of the Project environmental impact assessment (EA) is revelation and solution of key environmental problems and potential ecological risks related to the Project. Assessment of potential environmental impact is classified as follows:

- *Possible negative Project impact on environment (its impact on stability of natural resources, pest control, international water, etc.);*
- *Environmental impact (external factors) on the Project objectives;*
- *Possible positive Project impact on environment (its impact on crop production, soil and (land) water resources).*
- *Identification of ways to improve the Project in terms of environment by prevention, minimization, mitigation or compensation of any negative impact.*

1.3. Scope and status of this Report

This document represents outputs of **EA** on Project activities formulated by technical team in the final FS report. Report is prepared in accordance with requirements of WB/OS 4.01 Annex B (outline of the EA report).

Chapter 2 represents relevant political, legal and institutional framework for environment and irrigation sector of Uzbekistan. **Chapter 3** provides an oversight of compliance of the Project with World Bank safeguard policies. **Chapter 4** represents description of the Project, according to the final FS (August 2014). Environmental Assessment is given in **Chapter 5. Chapter 6** represents expected positive and negative Project impacts and analyzes alternative Project activities. **Chapter 7** represents emergency situations analysis. The **Environmental Mitigation Plan**, including specifications and finally, the **Environmental Management and Monitoring Plan** (EMMP) is presented in **Chapter 8 and Chapter 9. Chapter 10** describes the consultation activities conducted by the EA team.

In Annex, list of EA participants, bibliography, and technical specifications (the hydraulic structures safety declaration and monitoring indicators) and other relevant information are consecutively presented. **Executive Summary** was prepared as integral part of Environmental Impact Assessment of the Project.

The findings of EA will discussed at the Stakeholders Workshops during 10-14 May 2015 in the three Sub-project areas of FV (Andijan, Namangan and Fergana), with purpose of consensus-building and incorporation of EA and SA results in design and implementation of the Project.

2.LEGAL, POLITICAL, INSTITUTIONAL FRAMEWORK

This Chapter presents the legal, political and institutional frameworks in which the Draft Environmental Impact Statement (FVWRMP, Phase II) was prepared. It also represents the relevant international agreements on environmental protection to which the Republic of Uzbekistan has joined as one of the Parties. In addition, the Chapter reviews the relevant environmental policies of Uzbekistan and the World Bank.

2.1. Environmental Sector

2.1.1. Legal and Political Framework

National Environmental Policy

The national environmental policy aims to make a transition from protecting some individual nature elements to the universal protection of environmental systems, safeguards of optimal human environment parameters and harmonization of relationships with the industrial development mechanisms based on "green economy" principles [6]. The key approaches and priorities to ensure environmental protection and natural resource use and implementation of the international agreements are integrated into the strategies, national programs and sectoral action plans [11-14, 20].

The Environmental Action Program (EAP) for 2013-2017 is aimed at the implementation of environmental measures in terms of environmental support for economic reforms in Uzbekistan and creation of conditions for social and economic development and attainment of sustainable development nationwide. The EAP is implemented in the following main five areas: (i) creation of secure and decent human environment and environmental safety level for the people and state; (ii) greening the industries, improvement of technological processes and nature protection activities; (iii) controlling pollution generated from wastes of production and economic activity; (iv) development of legislation and regulatory frameworks in the area of environment and natural resource use, environmental education and education for sustainable development, and (v) development of regional and international cooperation to strengthen nature protection activities and prevent transboundary environmental pollution.

National Legal Framework

The public management of natural resources and environmental protection in Uzbekistan is based on the system of laws and other sub-laws and regulations. The Law of the Republic of Uzbekistan "On Environmental Protection" (09.12.1992) is the fundamental legal document, which regulates environmental protection and establishes the legal, economic and organizational basis.

Currently, there are more than 120 laws and regulations existing in Uzbekistan aimed at managing the environment and natural resources. The most important of these are as follows:

- "On Environmental Protection" (1992), creating legal, economic and institutional framework for environmental protection, ensuring sustainable development;
- "On Water and Water Use" (1993) providing for rational water management, protection of water resources, prevention and mitigation of negative impacts, and compliance with the national legislation;
- "Land Code" (1998) providing for the basic rules and regulations for land use and stipulating land use rights;
- "On National Security Concept" (1997) containing the main frameworks for attaining the national environmental security;
- "On Protection of Population and Territories from Natural and Man-made Emergencies"
- "On Safety of Hydraulic Structures" (1999);

- "On Environmental Impact Assessment" (2001) requiring a mandatory expert impact assessment on environmental and human health, etc.

Relevant nature protection normative documents issued by government include:

"On approval of the State Environmental Appraisal" (No. 491, 31.12.2001);
"On approval of the State Environmental Monitoring" (No. 49, 3.04.2002);
"On granting the status of Specially Protected Natural Areas of national importance to fresh groundwater formation zones" (No. 302, 26.08.2002);
"On approval of the Procedure on Cadastral Division of the Territory of the Republic of Uzbekistan and Cadastral Numbers of Land Plots, Buildings and Structures" (No. 492, 31.12.2001);
"On measures on radical improvement of land reclamation system" (No UP-3932 29.10. 2007);
"Provision on reservoir water protection zones and other water storages, rivers and main canals and collectors, and also sources of potable and domestic water supply, medical and cultural-health improving purpose in the Republic of Uzbekistan"(No 174. 07.04.1992);
"On approval of order for issue permits for special water use or water consumption" (No 171. 14.06. 2013);
"On approval of provision on the order for issue of permits for drilling wells for water" (No 214. 04.08.2014) and other.

The relevant governmental norms and regulations on protection of natural and water resources, affecting the Project are presented in Table 2.1.

Table 0.1. State Environmental Norms and Standards Affecting the Project

No.	Regulations	Description	Supervising Organization
1.	RD 118.0027719.5-91	Procedure on development and implementation of design standards for maximum permissible discharges into water bodies, including drainage waters	*Uzhydromet*
2.	RD 118.0027714.6-92	Permitting procedure for special water use	*Goskompriroda*
3.	RD 118.0027714.47-95	Guidelines on determining damage to the national economy due to groundwater pollution	*Goskompriroda and Uzbekhydrogeologia*
4.	Interim Guidelines - 1991	Interim Guidelines on groundwater protection management in the Republic of Uzbekistan, 1991	*Goskompriroda and Uzbekhydrogeologia*
5.	RD 118.0027714.24-93	Guidelines on environmental impact assessment (EIA) during site selection, feasibility studies and construction projects (reconstruction, expansion and conversion projects) for businesses and enterprises	State Committee for Architecture and Construction
6.	SNiP 2.04.02-97	External water supply to cemeteries, cattle burial sites, landfills, dumps of drainage facilities and infrastructure, storage of manure and other sources of pollution	Ministry of Health, Sanitary and Epidemiological Service
7.	SNiP 2.03.11-96 and SNiP 3.04.02 – 97	Protection of buildings and structures against corrosion to mitigate the negative impacts on groundwater	*Glavgosexpertiza at GKAS*
8.	SNiP 3.01.01-97 and SNiP 3.05.03-97	Soil protection	*Goskompriroda*
9.	SNiP 2.01.03-96	Construction in seismic areas to reduce seismic load and increase resistance to seismic effects	*Glavgosexpertiza at GKAS*
10.	O'z-DSt 950:2000	National potable water standards	*Goskompriroda* and Ministry of Health
11.	RD 118.0027714.41-94	Procedures on meeting basic requirements and recommendations for using wastewater for irrigation of crops.	*Goskompriroda* and Ministry of Health

2.1.2. Uzbekistan EA Requirements

As mentioned above, the State Environmental Appraisal (SEA) is governed by the laws of the Republic of Uzbekistan "On Environmental Protection", "On Environmental Appraisal", the Regulation of the Cabinet of Ministers of the Republic of Uzbekistan (No. 491 dated 31.12.2001) and other by-laws and regulations. The main responsible organization is the Main Directorate for State Ecological Expertise (*Glavgosecoexpertiza*) of *Goskompriroda*. The Regulation stipulates 4 categories for development:

Category 1 – high risk;
Category 2 – moderate risk;
Category 3 – low risk;
Category 4 – local impact.

For each Category appropriate types of activities are detailed. Annex 2 of this Regulation, in Category 2 (moderate risk) contains item *45 – "Reconstruction and reclamation of old irrigated lands on the area over 1,000 hectares*", which will be applicable to the Project (120,000 ha will be reclaimed, including 103,870 ha of croplands). The Category 3 (low risk) includes item 40 – *"Reconstruction and reclamation of irrigated lands on the area from 100 to 1,000 ha"*.

SEA by *Goskompriroda* covers the following environmental appraisal targets: (i) projects classified under the Categories 1 and 2; (ii) draft state programs, concepts, layouts and development of production capacities; (Iii) city-planning documentation for objects with population above 50 thousand people; (iv) documentation on creation of new types of equipment, technologies, materials, substances and products; (v) draft regulatory technical and methodological documents regulating activities related to natural resource use.

An enterprise or organization is responsible itself for environmental impact assessment and its management while the State Environmental Appraisal conducts the appraisal of the provided EIAs and issues its opinions on them, which is issued on a formal letterhead and signed by the *Goskompriroda* Deputy Chairman. This document is mandatory for opening financing by a bank and another credit facility and should be presented by legal entities and individuals when they implement their projects.

The State Environmental Appraisal timeframes for the types of activities referred to in the Categories 1 and 2 is 30 days. Depending on the project complexity, this period may be prolonged by the *Goskompriroda* Chairman but no longer than for 2 months. An amount of charge for conducting a SEA depends on the Category and type of project activity. For this Category 2 Project, the charge for SEA will equal to 50 minimal salaries.

The Resolution of the Cabinet of Ministers "On approval of provisions on issuance of permits for drilling groundwater wells" (dated August 2014) regulates construction and use of the groundwater wells. The procedure for issuing permits involves the following steps and considers the following aspects: (i) observation of ecological and sanitary norms; (ii) well design engineering parameters; (iii) availability of decision of the state ecological expertise; (iv) requirement to establish sanitary and protection zone (belt) around wells.

2.1.3. International and Regional Agreements

The political basis and legislative framework in the field of environmental management in Uzbekistan include a number of international treaties, laws and regulations of *Oliy Majlis* (the Parliament), decrees and resolutions of the Cabinet of Ministers, ministries and departments.

Global and Regional Agreements

In the context of the global environment, the Republic of Uzbekistan is a Party to three Rio Conventions: the Convention on Climate Change (UNFCCC, 1999) "Convention on Biological Diversity (UNCBD, 1995) and Convention to Combat Desertification (UNCCD, 1994)" together with a number of other international Conventions, Protocols, Agreements, and Memoranda of Understanding in the areas of environmental conservation and sustainable development. Other global agreements to which Uzbekistan is party include:

- *Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (26.05.1993 by legal succession);*
- *The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (accession - 22.12.1995);*
- *Convention on the Protection of the World Cultural and Natural Heritage (ratification - 22.12.1995);*
- *Convention on International Trade in Endangered Species of Wild Fauna and Flora (accession - 01.07.1997);*
- *The Bonn Convention on the Conservation of Migratory Species of Wild Animals (accession - 01.05.1998);*
- *The Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitats (accession - 30.08.2001), etc.*

Transboundary Water and Power Management

In the context of environmental protection at the international level, Uzbekistan is a party to bilateral and multilateral agreements and regional initiatives in the area of environmental management and use of transboundary water resources in the Aral Sea basin. Recently, Uzbekistan has joined two universal international and legal instruments governing the management of rational transboundary water use:

- *Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992);*
- *Convention on the Law of the Non-Navigational Uses of International Watercourses (New York, May 21, 1997).*

Uzbekistan signed a number of intergovernmental agreements as a basis for long-term cooperation and addressing common regional and global problems in the Aral Sea basin that has become another important impetus to strengthen the dialogue and cooperation among the Central Asian countries, including:

- Agreement on joint transboundary water management in the region covered by the established Interstate Coordination Water Commission (ICWC) for the Aral Sea Basin. To regulate water use in Central Asia a number of declarative documents were adopted (February 1992, Almaty);
- Nukus Declaration of Central Asian states and international organizations on the issues of sustainable development of the Aral Sea Basin (09.05.1995) provides full support for international agreements, in particular on transboundary water protection;
- Agreement "On using water and energy resources of the Syrdarya River" between Kazakhstan, Kyrgyz Republic and Uzbekistan (Tajikistan joined in 1999) as of March 17, 1998, etc.

Significant contribution to defining the joint decisions and actions for the implementation of global commitments has been made by newly adopted and prospective sectoral programs and investments in water management and agriculture over the short and medium period [12, 13, and 14].

2.1.4. Institutional Framework

Public Institutions

The Constitution and environmental legislation of the Republic of Uzbekistan define legislative, public and executive bodies, as well as companies and organizations responsible for environmental protection and natural resource use.

The State Committee for Nature Protection *(Goskompriroda)* is the key executive body in charge for environmental protection and natural resources. It reports to *Oliy Majlis* (the Parliament) of the Republic of Uzbekistan directly and is responsible for coordination of activities in the area of environmental protection and natural resources performed by other national public agencies at the central, provincial and district levels. *Goskompriroda's* mandate is provided in the Resolution on State

Committee for Nature Protection of the Republic of Uzbekistan approved by *Oliy Majlis* on April 26, 1996.

Goskompriroda is responsible for the state control in the area of environment and natural resources. It oversees the national system of Protected Areasб can initiate liability/property actions,and administers the Environmental Protection Fund which is being generated out of fees and fines charged for polluting the environment, and supports pollution mitigation measures. Besides, the Committee manages several Research Institutes conducting analysis of issues related to environment and natural resources and undertaking measures to address them to support *Goskompriroda*.

The structure of *Goskompriroda* consists of the central office located in Tashkent with regional and district offices, as well as institutions providing research and development support. The regional offices have the same structure as the national level one. Various departments are responsible for environmental standards, environmental law, international relations, environmental financing, economics, transparency and state environmental supervision.

Enforcement of environmental measures, control functions and responsibility for individual natural areas are entrusted to the number of ministries and institutional players. These include: the Ministry of Agriculture and Water Resources, State Committee for Nature Protection, State Inspectorate of the Republic of Uzbekistan for Safe Works in Industry, Mining and Public Utility Sectors, Ministry of Health, Ministry of Internal Affairs, *Goskomzemgeodezkadastr*, *Uzhydromet*, as well as the Ministry of Economy, Ministry of Finance and the others. These agencies are responsible for ensuring the sustainable public service system, development and implementation of dedicated programs, strategies and action plans in the area of environment and natural resources.

Non-Governmental Institutions

There are 22 national charitable and international foundations and a number of NGOs in Uzbekistan. Currently, the National NGO Association of Uzbekistan, established in 2005, unites over 120 environmental NGOs [29].

The following laws of the Republic of Uzbekistan determine the state support for these institutions, their interaction with public authorities, businesses and other civil society institutions: "On Public Associations" (1992), "On Non-Governmental Non-Profit Organizations" (1999), "On Guarantees for Non-Governmental Non-Profit Organizations" (2006).

In Fergana Valley, there is a broad network of NGOs (Association "For Environmentally Clean Fergana", NGOs: "Ishonch", "Mehrimiz Sizga", "Erdon Suv", "Tosa Suv", "Gulshan", "Orzu", "Khamrokh", "Eco-Tib", "Kelajak Nur", etc.) which deal with issues of nature conservation and biodiversity, water quality, combatting desertification, climate change and environmental education amongst the local population.

2.1.5. Monitoring and Environmental Impact Assessment

Goskompriroda is responsible for conducting the Environmental Impact Assessment and State Environmental Appraisal (SEA). The SEA is carried out for projects and programs which may have possible adverse environmental impact. Within the frames of SEA, *Goskompriroda* approves regulations proposed by the Environmental Committees at various levels.

The responsibility for environmental monitoring is shared across several national governmental agencies and is a subject for overall coordination by *Goskompriroda*. This system is supervised by the Interdepartmental Committee involving six members, under the chairmanship of *Goskompriroda*.

The following are the agencies responsible for the environmental monitoring:

Goskompriroda: Monitoring of sources and surface ecosystem pollution plus coordination of environment related data gathering, management and dissemination;

Uzhydromet: Air pollution, surface waters monitoring (natural watercourses) and background contamination;

Ministry of Agriculture and Water Resources: Monitoring of drainage water (salinity) of main watercourses, groundwater level and water and soil salinity;

Goskomzemgeodezkadastr: Monitoring of soil and land, and soil quality control;
State Committee for Geology: Groundwater monitoring;
Ministry of Health: Sanitary and epidemiological surveillance of the environment;
Ministries, agencies and businesses: Departmental environmental monitoring.

Goskomzemgeodezkadastr coordinates the State Land Cadaster of Uzbekistan, which provides the information required as a basis for setting fees to maintain the nature protection system, and the land tax. Specialized services in charge for supervision and control of natural disasters, industrial accidents and catastrophes perform monitoring and forecast of emergency situations.

1.2. Irrigation and Drainage Sector

2.2.1. Water Management Policy and Reforms

Water Management Policy

The water management policy of the government is aimed at the rational water use and protection of water resources, intensification of guaranteed water delivery and provision of the required services to the society and natural ecosystems by providing resources for reconstruction and O&M of the existing infrastructure.

The main water sector priorities are: (i) water saving in all spheres of consumption and improvement of water quality; (ii) development of water supply systems with good quality potable water; (iii) restoration of soil fertility along with keeping favorable water-salt regime in the root zone; (iv) prevention of water and wind erosion; (v) rational use and protection of vegetation in the foothills and desert and pasture areas, and (vi) mitigation of adverse effects due to environmental crisis in the Aral Sea Region based on the interrelated regional and national approaches.

A transition from the principle of territorial management more flexible two-tier water management with introduction of market relations at all levels of water use has been the most important component of the reforms in the water sector:

- *Resolution of the Cabinet of Ministers dd. June 21, 2003 (No. 290) "On improvement of activities of the Ministry of Agriculture and Water Resources of the Republic of Uzbekistan";*
- *Resolution of the Cabinet of Ministers dd. July 21, 2003 (No 320) "On improvement of water sector management".*

In recent years the country is undertaking significant efforts to improve water use efficiency and diversify agricultural production. When back to early 90s of the last century, about 50% of the irrigated land was used for growing cotton, in the modern conditions, the share of cotton in the irrigated agriculture accounts for around 30%, while the remaining arable land is allocated for grains, food and feed crops being vitally important for the population [5].

Today, Uzbekistan is facing the need to find solutions for sustainable improvement of water productivity and aims its efforts at developing responses and actions to prevent and mitigate the risks of drought and other harmful challenges that threaten the food security and livelihoods of the country.

Legal Framework

Water and nature protection relationships are regulated by a package of laws, adopted immediately after independence (1991), as well as mechanisms for their implementation being stipulated in governmental Resolutions [11,13,14]. The most important legal instrument in the field of water relations is the Law "On Water and Water Use" signed by the President of the Republic of Uzbekistan on May 6, 1993. Later, in December 2009, significant amendments and additions were made to this Law. In recent years, the legislative framework in the area of water and land resource management is being improved constantly.

The basis of water management reform is set in Resolutions of the Cabinet of Ministers on transition from the administrative-territorial management to more flexible basin water resources management,

with the creation of: (i) the Basin Irrigation System Administrations (BAISs); and (ii) Water Consumer Associations (WCAs).

Recently, a number of fundamental laws and decrees of the President of the Republic of Uzbekistan and the Cabinet of Ministers were approved; the following of them are of particular importance :

- Presidential Decree No. F-3077 dated October 5, 2008 *"On establishment of Special Panel to develop proposals on measures to optimize sizes of farm land plots";*
- Presidential Decree dated October 20, 2008 "*On measures to optimize the acreage and increase production of food crops";*
- The Law of the Republic of Uzbekistan No ZRU-240 dated December 25, 2009, effective date 26.12.2009 *"On amendments and additions to some regulations of the Republic of Uzbekistan in connection with deepening of economic reforms in agriculture and water management";*
- Resolution of the President of the Republic of Uzbekistan No 139 dated 21.05.2012. PP-1758 *"On the Program of further modernization, technical and technological revamping of agricultural production in 2012-2016";*
- *"On measures for further reclamation of irrigated lands and improvement of water resources management for the period 2013 – 2017"* (No PP-1958 dated April 19, 2013);
- *"On measures for effective implementation management and financing of drip irrigation system and other water-saving irrigation technologies"* (RCM No. 176, 21.6.2013);
- *Resolution of the Cabinet of Ministers of the Republic of Uzbekistan "On measures to manage activity the Executive Committee under the International Aral Sea Saving Fund"*, and etc.

2.2.2. National Water Management Organizations

In accordance with the current legislation of the Republic of Uzbekistan, the public water management is carried out by the Cabinet of Ministers, Goskompriroda, Uzhydromet, Ministry of Agriculture and Water Resources (MAWR) and the local governments under the leadership of the *Oliy Majlis* Commission.

The state supervision over water use and protection is performed by local management authorities, Goskompriroda, Agency for Supervision of Safety in Industry and Mining, Ministry of Health, Ministry of Agriculture and Uzhydromet in the manner prescribed by the law. The departmental control over land use is performed by Goskomzemgeodezkadastre of the Republic of Uzbekistan.

Ministry of Agriculture and Water Resources

The Ministry of Agriculture and Water Resources (MAWR) is a governmental managerial body on the matters of agriculture and water resources. In its activity, MAWR reports to the Cabinet of Ministers. The Ministry plays a key role in water management and water use (as well as forest resources), and coordinates water resources management. The Main Division of Water Resources under the Ministry of Agriculture of Uzbekistan is responsible for public water use management and water protection. The MAWR has its regional and district branches in charge for managing agriculture and water resources, as well as departments responsible for operation of large-scale irrigation and drainage systems. Figure 2.1 shows the overall MAWR administrative structure at all levels of water management.

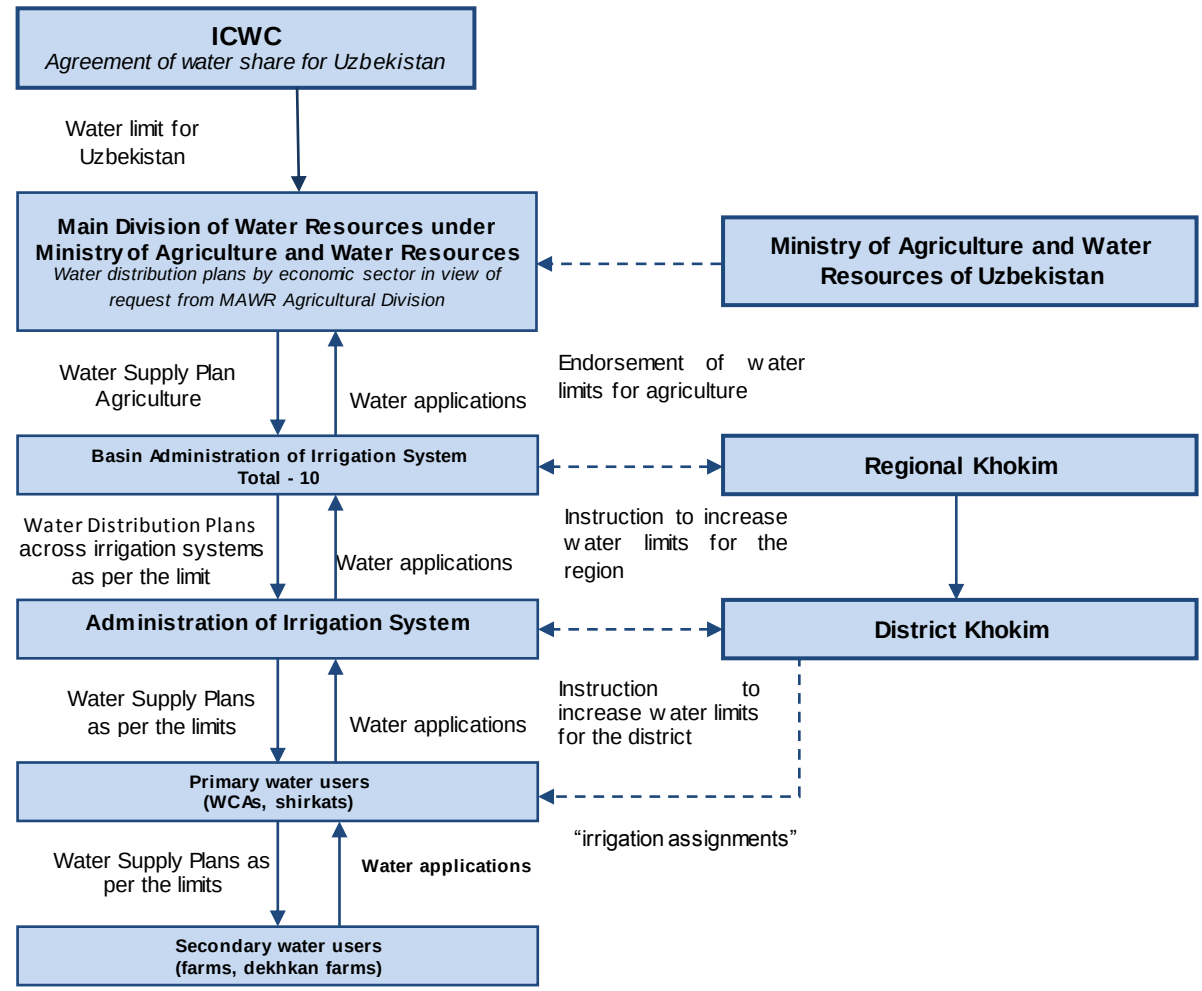
Basin Administration of Irrigation System

Basin Administration of Irrigation System (BAISs) are established in accordance with the Resolution of the Cabinet of Ministers in 2003 on the basis of the existing water management organizations at the central level and their regional branches. Totally there are 10 BAISs established in the country and one institution, the "Main Canal System Authority for Fergana Valley with Unified Dispatch Centre" (MCSA), and 52 branches in charge for irrigation system management (Annex 4, Figure P4.2).

BAISs are responsible for irrigation through the Main Canal Administrations (MCA) and Irrigation System Administrations (ISAs) at the district level, and for drainage through Hydrogeological Melioration Expeditions (HGMEs). BAISs are also directly responsible for HGME at the regional level and the Administrations of O&M Pumping Stations and Energy.

The main objectives of BAISs include the following: (i) targeted and rational water management; (ii) implementation of the single technical policy in the water sector; (iii) organization of uninterrupted and timely water supply to consumers; (iv) sustainable management of water resources in the basin; (v) ensure reliable accounting of water use.

Figure 0.1. Organizational structure of water distribution in Uzbekistan



Source: FS FVWRMP-II, 2014

BAISs provide support for WCA organization and development; participate in the WCA Constituent Assemblies; organize meetings with WCA employees to discuss issues of water allocation, resource management, water saving methods, etc.; and promote MAWR training programs on on-farm irrigation. WCAs receive water on the basis of Contracts (made between BAIS and WCA), which define rights and responsibilities of the both parties with regard to operation of irrigation infrastructure.

Main Canal System Administrations (MCAs) are responsible for management, operation and maintenance of the main canals. MCA/ISA is territorial organizations having overall responsibility for O&M of the main canals or a primary irrigation infrastructure network in the particular sub-basins. These organizations are directly linked with WCAs.

Hydro geological Melioration Expeditions (HGMEs) function in each region under supervision of BAISs. HGMEs and their district branches are responsible for operation and maintenance (O&M) and rehabilitation of main and inter-farm drainage systems (including drainage pumping stations). In addition, they monitor the status of drainage systems, groundwater level, and soil and water salinity.

Initial and secondary water users

Cities, urban and rural communities as social units, farms, family farms, individual farmers, and private sector – all have definite and well identified interests in promotion of efficient water and land resources management. There are many various categories of water users. There is overlapping of interests among these categories; private farmer's haves a garden plots as could an urban dweller employed by the water management organization.

WCAs are the essential component of the institutional reforms and adjustments in the water sector. They are fairly new but vitally important type of non-governmental organizations to manage, operate and maintain the on-farm I&D systems. However, their performance is limited due to a number of challenges associated with the uncertainty of their legal status, lack of qualified personnel, inadequate machinery and equipment, etc., as well as the ability of farmers to pay for I&D services.

To overcome these limitations, the Government initiated (in the period of 2008-2011) the process of optimizing the WCAs, as a result of which they were renamed from Water User Associations to Water Consumer Associations and re-registered as NGOs; their boundaries were revised in accordance with the Presidential Decree No. F-3077 dated October 5, 2008. Currently, there are 1,487 WCAs in Uzbekistan with their total service area of 3,747,900 hectares. Totally, throughout the country, there are 63,775 WCAs members, of which 58,770 are farms with their average service area of 2,520 hectares (Table 2.2).

Table 0.2. General information about WCAs in Uzbekistan and Fergana Valley (IWMI, 2012) [1]

Regions	WCAs	WCA members		Service area (thousand ha)	WCA members	Farms	Mirab ratio per 1 km	Irrigation canal length (km)	Drainage length (km)
		General	Mirabs						
Fergana Valley, inc.	372	3,498	1,854	835	21,032	17,697	19.1	35,436	19,839
Andijan	109	1,176	752	246	6,479	6,175	13.7	10,307	5,549
Fergana	119	1,327	633	344	8,138	7,791	26.0	16,463	10,373
Namangan	144	995	469	244	6,415	3,731	18.5	8,666	3,917
Uzbekistan	1,487	11,451	5,985	3,748	63,775	58,770	23.4	140,041	91,668

Source: Final FS Report, FVWRMP-II, according to IWMI, 2012

2.2.3. Irrigation and Drainage Management in Fergana Valley

General Management

Three Basin Administrations of Irrigation System (BAIS) are responsible for irrigation and drainage within the boundaries of three administrative regions *(viloyats)* of Fergana Valley: Andijan, Namangan and Fergana:

Region	BAIS	Number of ISA
Andijan	Naryn-Karadarya	5
Namangan	Naryn-Syrdarya	6
Fergana	Syrdarya-Sokh	4

The Main Canal System Administration of Fergana Valley with Unified Dispatch Center (MCSA) supervises water distribution from the main canals (MCs) serving Fergana Valley: BAC, BFC and SFC. All the main canals are managed by Main Canal Administrations (MCA), which are responsible for the canal maintenance and water distribution to ISAs/WCAs in accordance with approved guidelines and instructions issued by BAISs. Each BAIS supervises activities of the regional HGMEs along service areas of the main drainage canals, while the Administrations of O&M Pumping Stations are responsible for O&M of the main irrigation pumping stations, irrigation wells and vertical drainage [3].

[1] Report: WCA Development in Uzbekistan. International Water Management Institute. January, 2012.

The BAIS organizational structures and their branches are illustrated in Annex 3. A brief overview of the Study area covering three sub-projects of FVWRMP-II is given below.

Naryn-Syrdarya BAIS: Podshaota-Chodak ISA

Naryn-Syrdarya BAIS is responsible for water management in the study area and its four Irrigation System Administrations (ISAs) in Namangan region. Podshaota-Chodak ISA is the territorial organization having executive responsibility for O&M of primary I&D infrastructure networks in Yangikurgan, Kosonsoy, Chortak and Chust districts of Namangan region.

The study area is located in the service area of Podshaota-Chodak, which has been selected by the FS team on the basis of multi-criteria analysis with the involvement of all stakeholders. The study area covers Yangikurgan and partially Chodak districts of Namangan region. A map of the project area showing Podshaota-Chodak sub-project is presented in Figure 2.2.

Figure 0.2. Naryn-Syrdarya BAIS map

Naryn Karadarya BAIS: Savay- Akburasai ISA

Naryn-Karadaya BAIS is responsible for water management in the study area and its five Irrigation System Administrations (ISAs) in Andijan region. Savay-Akburasai ISA is a territorial organization having executive responsibility for O&M of primary I&D infrastructure networks in Kurgantepa, Zhalakuduk, Khuzhaabad and Bulakbashy districts of Andijan region.

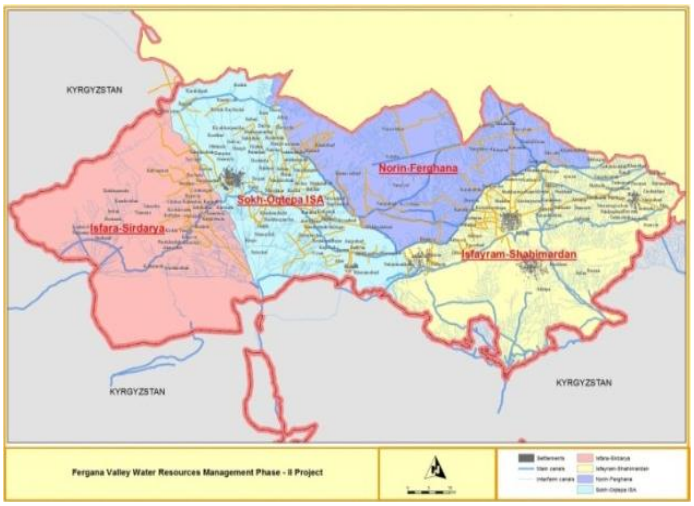
The study area is located in the service area of Savai- Akburasai ISA (Figure 2.3 and Annex 3) which has been selected by the FS team on the basis of multi-criteria analysis with the involvement of all stakeholders. The study area covers Bulungur, Zhambay and Markhamat districts of Andijan region. A map of the project area showing Savay- Akburasai sub-project is presented in Figure 2.3.

Figure 0.3. Naryn-Karadarya BAIS map

Syrdarya-Sokh BAIS –Isfayram-Shakhimardan ISA

BAIS is responsible for water management in the study area and its four Irrigation System Administrations (ISAs) in Fergana region. The study area Isfayram-Shakhimardan ISA is the territorial organization having executive responsibility for O&M of primary I&D infrastructure networks in Fergana, Kuvasai, partly Quva, Altyaryk and Tashlak districts of Fergana region. A map of Isfayram-Shakhimardan ISA shown in Figure 2.4.

Figure 0.4. Syrdarya-Sokh BAIS map



Water Consumer Associations (WCA)

Currently in Fergana valley there are 372 WCA, that unite 17 697 farms and serve 835 thousand ha of irrigated land (Table 2.2). The main role of these WCA is water allocation between water consumers and maintenance of on-farm irrigation network. No regular maintenance of drainage systems is carried out, but urgent repairs after emergency situations is done, and also fees are collected for irrigation services.

The current farming irrigation practices are accompanied with large irrigation water losses during irrigation, water delivery and distribution at the interface of "main canal - WCA - WCA - water users" because of the inconsistencies in water distribution system and water demands of farms. The main cause of this situation is about adverse local conditions and lack of adequate knowledge among farmers/WCAs in the area of modern irrigation methods and on-farm water management practices. In view of inevitability of further water availability decline in the region, the surest way is to reduce irrigation water consumption at the farm level through increasing capacity of WCAs and land users, improving water management, irrigation practices and agricultural technologies.

1.3. Institutional development and capacity building problems

Both irrigation and drainage management institutions suffer from weakness and constraints emanating from either policies which are inappropriate given the conditions in the project area, or from the way prevailing policies are implemented, and a lack of experience, training or knowledge among practitioners, at all levels concerned with irrigation and agricultural activities. The ultimate consequences of this are that crop yields are lower than they would otherwise be, given the prevailing physical conditions; the resources used in operation and management of the irrigation systems are used inefficiently; and water is not used effectively. In other words, the institutional constraints directly result in the costs of achieving sustainable agricultural output being higher than they need to be. In addition, where the institutional and capacity-related weaknesses contribute to physical damage to infrastructure (such as roads and buildings), the weaknesses impose costs outside the agriculture and associated sectors.

Main aspects that can be referred to institutional problems in operation, maintenance and management of irrigation systems are: (i) not corresponding to requirements water allocation; (ii) insufficient control for water discharges; (iii) over irrigation; (iv) insufficient financing; (v) inadequate servicing and (vi) low

priority that is paid to drainage network. There is shortage of operative management documents, strategies and training programs and participation plans, especially women, on advantages of IWRM approaches and principles, and sustainable nature use.

Identified weaknesses with existing institutions. There are several evident problems affecting the state institutions directly engaged in the operation and management of the irrigation and water allocation system: (I) their organisational complexity and the physical infrastructure the organisations are responsible for; (ii) financing constraints; (iii) limitations in the technical and managerial capacities of staff at all levels.

As a whole, number of personnel in organizations staff numbers are sufficient, but throughout the state I&D institutions, there is a shortage of finance for all purposes. As a result there is a shortage of reliable machinery for O&M, not enough funding to maintain and repair structures adequately. Management and supervision are made very difficult by the lack of vehicles and communication equipment, which also results in inefficient use of personnel resources and operation of irrigation system effectively.

Field visits and interviews carried out in the frameworks of ESA studies revealed the following requirements that confirm necessity to support WCA development as efficient organization: (i) insufficient understanding of functions and duties by WCA members, shortcomings in planning, organization of work; (ii) machinery and equipment are in use far beyond their design life, lack of facilities such as workshop, tools, warehouse, etc.; (iii) the fee collection rate is rather low. This is because farmers do not have money to pay and shortfalls in the fee collection results in salaries not being paid; (iv) fluctuation of personnel related to low interest and low qualifications.

Results of social studies show that land users and local communities are aware about problems which face WCA. Some 73% of land users believe that WCA should have the responsibility for maintenance of the drainage and irrigation systems on their own land. The majority of WCA members are ready to pay for on-farm network servicing, if the state will invest rehabilitation of existing infrastructure, in order to provide benefits for agricultural community.

Capacity to respond to project opportunities – The second Phase of FVWRMP includes significant investments into rehabilitation and modernization of irrigation systems infrastructure. The supporting economic analysis is premised on the assumptions that:

- Any construction works are implemented to comply with national (or international) standards and in this connection are applicable for planned purposes and reliable enough for project needs;
- After works are complete, they will be used in an appropriate way. This means that, for example, the farmers will be able to produce the expected yields, given any proposed improvements in the irrigation infrastructure. Correspondingly, it means that say the irrigation system operates as intended and is not permitted to deteriorate unduly.

2.4. Regional Water Management

Uzbekistan being one of the major water consumers in the Aral Sea Basin suffers from water deficit as around 80% of the Amudarya and Syrdarya river flow, as well as local water streams that supply the irrigation sector of the country, originate in the neighboring countries that generates multiple conflicts of interests. The total water demand of Uzbekistan, including Fergana Valley, is being satisfied to a greater extent (82%) from the Syrdarya and Amudarya rivers flowing from the territory of Kyrgyz Republic and Tajikistan.

During Soviet time, the water resources of Central Asia were considered as the resources for the whole Soviet Union; water use and water distribution among Republics was based on achieving the maximum economic benefit for the entire Soviet Union. Having realized a need for the single Automated Management System (AMS) for the Water Management Complex (WMC) in the Aral Sea Basin, the Ministry of Water Management of the USSR established two Basin Water Management Authorities ("BVOs"), i.e. BVO Amudarya and BVO Syrdarya, as well as BVO Kirov Canal (presently Dustlik canal) and BVO Zarafshan (presently Zerdolvodkhoz) as a Soviet plan for better water resources management in

the region. Water sharing among each Republic was established in accordance with water quotas which were approved by USSR Gosplan on the basis of general plans. [3, 26].

After independence, the five Central Asian states aimed their efforts at improvement of the regulating basis and mechanisms of regional cooperation in the area of managing the interstate water resources. With the development in the early 90s of the World Bank-supported Aral Sea Basin Program (ASBP), the Interstate Council for the Aral Sea (ICAS) was established, and the provision was developed on the International Fund for the Aral Sea Saving (IFAS) with the principles of sharing water to be approved on the basis of the "existing water use", based on the schemes of the Integrated Use and Protection of Water Resources. In parallel with setting up the IFAS, the International Commission on Sustainable Development (CSD) was established.

In 1992, the Interstate Commission for Water Coordination (ICWC) was created with its two executive bodies - BVO Amudarya and BVO Syrdarya with the subsequent development of their organizational - legal management structure in 1993. The organizational structure of BVO Syrdarya is given in Annex 4.

Over the past decade, the International Fund for the Aral Sea Saving (IFAS) with the support of the international donor community implemented two Programs to assist the countries in the Aral Sea Basin with a total value of more than USD 2 billion. Starting since 2013, with the support of UN, EU, international and financial institutions, IFAS is implementing the third Program to assist the countries in the Aral Sea Basin that includes more than 300 projects for which it is required to mobilize more than USD 8.5 billion.

Ecological regulation, aimed at maintaining a sustainable interrelationship between communities and natural ecosystems of the basins, also means that internal and external rivers, lakes and other aquatic ecosystems need to be recognized as "water consumers". Environmental requirements to the water resources of Amudarya and Syrdarya currently are defined mainly by sanitary releases , environmental flows, limits for water delivery to river delta and Aral sea, and also by special releases (for Amudarya) into irrigation systems of Uzbekistan (Khorezm and Karakalpakstan), and Turkmenistan (Dashkhovuz).

In accordance with [3, 18] sanitary – ecological releases are provided based on 10% of annual discharge of river natural flow, monitored for multiyear period. For the Syrdarya River sanitary release is envisaged downstream Toktogul reservoir, equal to 100 m^3/sec, and minimal energetic release - 80 m^3/sec; sanitary release downstream Chardara reservoir – 50 m^3/sec. Historical trend shows that downstream Uchkurgan natural river discharge never was less than 100 m^3/sec. Annual limits of sanitary – environmental releases established by ICWC [3] since 1991 they compile on the Syrdarya river is 0.6 km^3; releases are allocated according countries, regions and irrigation systems.

Sanitary – environmental releases for small rivers is regulated based on water balances and water allocation rules and standards of water quality. Environmental flow for the Podshaotasai, Isfairamsai, Shahimardansai and Akburasai rivers are presented in Subsection 7.5. The key priorities for decision makers and for society as a whole should be: (i) observance of ecological discharges from water courses to ensure their long term viability or ability to self-purify; (ii) maintenance of flood discharges and acceptable river water quality; (iii) observance of sanitary releases for the dilution of harmful ingredients, and (iv) satisfaction of river delta demands, etc.

3. WORLD BANK SAFEGUARD POLICIES

3.1. World Bank EA Requirements

The World Bank requires an environmental assessment of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable, and thus improve decision making (OP 4.01, January 1999). The Bank favors preventive measures over mitigatory or compensatory measures, whenever feasible.

The World Bank defines various types of environmental analysis:

- Project-Specific EA (PSEA) to examine specific investment projects;
- Regional EA (REA) may be applied where a number of similar but significant development activities with potentially cumulative impacts are planned within a certain region or e.g. catchment area;
- Sectoral EA (SEA) is used for the design of sectoral investment programs.

According to the World Bank's Operational Policy 4.01 on project environmental assessment, an environmental screening of projects is required to determine the needed degree and type of the environmental assessment. The World Bank classifies proposed projects into categories depending on their type, location, sensitivity, and scales, as well as nature and extent of their potential impacts on the environment.

The following categories, based on the best professional judgment, are applied:

Category A: a full EA is required in the cases where significant adverse impacts are expected - large scale irrigation and drainage works are often fall under the Category A;

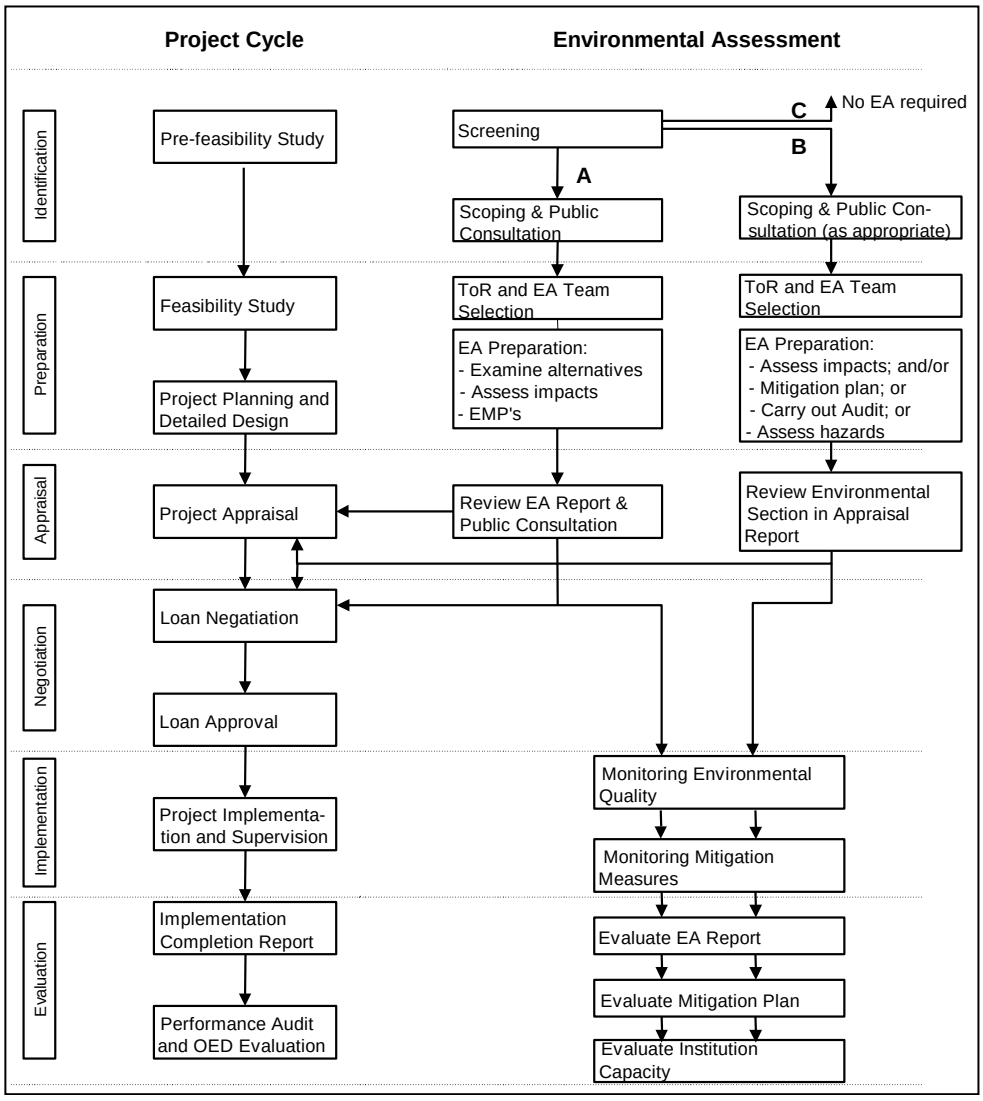
Category B: although a full EA is not required, an environmental analysis should be carried out, as the project may have adverse environmental impacts (which are however expected to be less significant than under Category A);

Category C: no EA or environmental analysis is required for projects without expected adverse environmental impacts.

The main EA phases relate to screening, scoping, EA, and the Environmental Management Plan during and after project implementation - covering mitigation, monitoring and assessment. Figure 3.1 presents multiple steps in the project cycle and show how the various EA phases match with the project preparation process.

Based on the World Bank's criteria, this Project shall be treated under Category B requiring "a partial assessment" because of no adverse impact is anticipated and the Project will address the problems caused due to mismanagement of land and water resources and hence would have an overall positive environmental impact. The Project would trigger OP/BP 7.50 – Projects on International Waterways, as its Sub-projects are located on the small transboundary rivers in the Syrdarya River basin - the international waterway of which Uzbekistan is a riparian country. Also, the Project works are of a rehabilitation nature and would not result in changes of water volume or quality affecting interests of any other riparian country. In addition, there is the existing Water Sharing Agreement among the riparian states that governs both volume and quality of the Syrdarya River waters.

Figure 0.1. World Bank Environmental Assessment and Project Cycle



Source: the World Bank

The findings of this Environmental Assessment (EA) confirm that the proposed Project interventions are expected to have an overall positive environmental impact and that there are no major concerns to be addressed. There will be some temporary and local disturbances due to construction and rehabilitation works, however it is expected that these impacts can generally be mitigated through environmental and social management and monitoring as given in EMMP, which will be the deliverable of this EIA process. Besides, no significant negative impacts are expected from the Project on the volume and quality of the Syrdarya River waters and of its tributaries – so called "small rivers" – the Podshaotasai, Akburasai, Isfayramsai and Shakhimardansai. Therefore, the EA study team confirms that the Project falls under the Category B.

3.2. World Bank Safeguard Policies

Main conclusion on EA (OP 4.01): The project design does not seek to promote expansion of irrigated agriculture, but seeks to improve efficiency of agricultural productivity. As a result of improved water management and irrigation service delivery in the project area, the project would have an overall positive impact on the downstream and the environment. The EA concludes that the Project will virtually have no negative environmental impacts, except for minor hazards that are normal during construction, which will be mitigated under the proposed Environmental Mitigation Plan (**Chapter 8**) and the Environmental Management and Monitoring Plan (**Chapter 9**), including monitoring of the EMP implementation by the Environmental Management Group (EMG).

"Natural Habitat" (OP 4.04): Water and surface ecosystems of Fergana valley represent common hydrographic network with great number of permanently operating water courses, that form more or less large river systems, that are crossed by junction canals, lakes and reservoirs joined by common water feeding source – the Syrdarya river. For the last ten years the project area was intensively used in agriculture, and it does not include any protection natural zones, or areas that are considered as critical for survival of any types of plants or animals. Also the project does not include zones that are considered ecologically unique, except territory of sub-project "Isfayram – Shakhimardan", where the zone for formation of underground water Chimyon – Avval is located, that has the status of protected natural territory of republican significance. The flora and fauna consist almost exclusively from cultural species. The Podshaota, Chodaksai, Akbusarai rivers biocenoses are included into the group of background waterways, periphitone communities that are characterized by high species diversity and are in the stage of ecological progress. The EA revealed that as whole water ecosystem in project area does not face significant anthropogenic pollution. Therefore, OP 4.04 is triggered only to promote monitoring of this positive impact of FVWRMP - II on seasonal accessibility of water resources for servicing agricultural ecosystems.

"Pest Management" (OP 4.09): The project is not intended to support directly or indirectly use of pesticides and agrochemicals. Tendencies for pollution, norms and quantities of pesticides and mineral fertilizers use in project area of Fergana valley for 2010-2014 have been investigated by EA team. The EA noticed that from pesticides in rare cases they use hexachloran, that is fluctuating from 0 (steps) to 0.008 mg/dm^3. Though the quantities for use of pesticides and mineral fertilizers reduced for 3-4 times, the problem of soil pollution with residual quantities of toxic substances remains in force. Therefore, the project will stimulate agricultural activities in project area, and this may lead to increase of agrochemical use in future, and that may represent threat for agricultural ecosystems and cause ecological risks. OP 4.09 is triggered for solution of all potential risks. Project Component "System Modernization" will support capacity building activities by raising awareness, knowledge and training or WCA, farmers and other target groups. The training modules will cover a variety of subjects, with special attention to the biological control methods, use of pesticides and other agrochemicals, in particular, definition of allowable norms, specifications, quantities and requirements on their proper storage and utilization. The training outputs will be part of regular project reporting to the Bank, with indication of subjects, locations and attendees. On a longer-term perspective, the project will trace the impacts of the training, using its M&E mechanism. The project will use the IPM, IWRM and SLM approaches and methods, and experience obtained within frameworks of the WB projects, implemented in the country during last years. Within monitoring frameworks the project will follow up soil and water quality, including changes of pesticides residuals at separate demonstration plots (DP), and the monitoring results will be duly reported to the implementing agency and the World Bank.

"Involuntary Resettlement" (OP 4.12): The project frameworks envisage the construction of supply canal, rehabilitation of canal, that is flowing through settlements, carrying out of repairing works and construction of 3 km of pipeline is related to the risk for damage to multiyear plantings. For that purpose within ESA frameworks the documents on Resettlement Policy Framework (RPF) and land acquisition plan for sub-project Podshaota – Chodak had been prepared, that envisage mechanisms for

risk minimization and compensation of losses in accordance with OP 4.12, and will be executed by the project.

"Dam Safety" (OP 4.37): Dam safety policy is triggered for the projects, funded by the World Bank, that are being operated downstream of existing dams. Due to the fact that the areas of sub-projects "Savay – Akbura" and "Isfayram – Shakhimardan" of FWRMP-II are located downstream Andijan reservoir OP 4.37 had been triggered. In accordance with adopted governmental by-law acts and provisions, in 2004 the first edition of Andijan Reservoir Safety had been compiled and approved by Expert Council of SI "Gosvodnadzor" for the period of five years, with execution of arrangements on promotion of trouble – free operation of dam node (Annex 8). In 2011 while preparing the second edition of Safety Declaration, the Special Committee carried out the survey of those arrangements results and revealed details regarding concrete dam safety, mechanical instrumentation and etc. On the basis of this report and stakeholder consultation meeting with it had been recommended to organize on-line workshop on completion of main document: "Potential Failure Mode Analysis" (PFMA), with the use of managing principles of the USA Federal Committee on regulations in energy generation (FERC). "Gosvodkhoznadzor", with assistance of the PIU under MAWR, will continue its program for inspection of safety by conducting two diagnostic surveys:before project construction and during the last year of project implementation.The respective studies have been conducted and are currently reviewed by the Bank's Dam Safety Specialist for futher guidance.

"Projects on International Waterways" (OP 7.50): The Syrdarya river, while being international waterway, does not flow through project area. I.e., the project area is not located on international waterways, but it is linked to them through main canals - SFC, BNC, BFC and the others.

The EA underlines that the project will increase efficiency of the water use and management that enhance positive impact on sustainability of agricultural production and the environment. The water balance shows that the project is expected to reduce the reliable annual flow in the Syrdarya at the border between Uzbekistan and Tajikistan by 83.9 MCM from 20,582.0 MCM to 20,498.1 MCM. Overall water use efficiency after FVWRMP-II is expected to increase as a result of the project from the current level of 30 percent to 35 percent. This will be achieved by various interventions including rehabilitation and lining of main canals and related water control infrastructure, rehabilitation of pumping stations and capacity strengthening of water managers and users. In conclusion the net reduction of flow during the summer months is estimated at less than 1 percent. Thereby, the project interventions would not pose any negative impact on the Syrdarya River basin. Based on the very small reduction of river flow, no negative stream impacts are expected.

3.3. The Comparison of National and Water Bank Environment Assessment Requirements

Overview. EA analysis and other sources [28] shows that while the basic provisions of the National EA rules and procedures are to some extent similar to the WB requirements, there are several important differences. These differences are related primarily to the following: (a) project environmental screening categories; (b) Environmental Management Plan; (c) EA disclosure and public consultation; and (d) EA reviewing process; (e) applicable environmental standards.

Differences in screening categories. As indicated above (subsection 2.1.2), in Uzbekistan the EIA systems are based on the SEE developed in Soviet times. SEE is regulated by Law (No 73-II.25.05.2000) on Ecological Expertise and by Decree of the Cabinet of Ministers (No 491.31.12.2001) on approval of the Regulation of the State Environmental Expertise. The Regulation stipulates 4 categories for development: Category I (High Risk), Category II (Middle Risk), Category III (Low Risk), and Category IV (Local Impact). Under the WB EA system (OP. 4.01) projects are classified as Category A, Category B or Category C depending upon estimated potential environmental risk. Unlike the WB categorization system, Uzbekistan regulation indicates threshold based on project descriptions. In the case where World Bank and national categorization/EA requirements differ, the more stringent requirement will apply. This refers mostly in the case of deciding about Category C subprojects - the national EA

legislation doesn't refer to small scale activities, including rehabilitation and construction of some inter- and on-farm irrigation infrastructures. In these cases the client will apply the WB criteria.

Differences concerning EMP. While the national legislation requires for all projects with potential environmental impacts relevant mitigation measures, it doesn't require a special Environmental Management Plan (EMP), which should specify along with the proposed mitigation activities, a monitoring plan and reporting requirements, institutional arrangements for EMPs implementation as well as doesn't require needed capacity building activities and necessary expenses in this regard. However, for sub-projects that is financed under the Component: Support for the Agricultural Modernization, EMP will be required to be prepared by the borrower to comply with World Bank requirements. The EA includes finances for training PFIs and credit borrowers on preparation of EMP/EMMPs.

Differences with regard to disclosure and public consultation. Conducted analysis shows there is no harmonization between WB and national requirements in this regard. According to national legislation, the EA disclosure and public consultation is mandatory only for category I and II. At the same time, according to the SEE law the public environmental review can be carried out on the initiative of NGOs and citizens in any field and for all types of project categories, which needs to be environmentally justified. Public environmental review can be carried out regardless of the state ecological expertise. Conclusion of public environmental review has recommendatory nature. In the case of WB EA policy, the Sub-borrower is responsible for conducting at least one public consultation for all Category B projects to discuss the issues to be addressed in the EMP or to discuss the draft EMMP itself. The approach to planning the public consultations for the Project would be guided by international best practice embodied by the Bank standards [28,29].

Differences concerning reviewing and approval of EA studies. As mentioned above, the national EA reviewing process relates to the State Environmental Expertize (SEE), while according the WB requirements is a part of the whole EA process. The SEE/SEA seeks to examine the compliance of proposed activities and projects with the requirements of environmental legislation. The mentioned laws stipulate the mandatory cross-sectoral nature of SEE, which shall be scientifically justified, comprehensive, and objective and which shall lead to conclusions in accordance with the law. SEE precedes decision-making about activities that may have a negative impact on the environment. Financing of programs and projects is allowed only after a positive SEE finding, or conclusion, has been issued. In compliance with WB policy, all EAs for sub-projects financed under the Project, particularly under the Component Agriculture Modernization will go through the more stringent review and approval process of the WB.

Applicable Environmental Standards: Sub-projects requiring an EMP will include mitigating actions to assure compliance with environmental standards of performance. If both Uzbek and World Bank standards exist for a particular mitigating measure, the stricter of the two standards will apply. For example, if the environmental issue of concern is —noise, and the World Bank noise standard is stricter than the Uzbek one, the mitigating measure selected should meet the stricter World Bank standard 4.

4. PROJECT DESCRIPTION

This chapter summarizes the Project description and its geographic, environmental and social content.

4.1. General

Based on the interactive planning and multi-criteria analysis of the IWRM Plan the Feasibility Study identified the most vulnerable irrigation systems and three irrigation systems were selected for proje ct interventions, namely Podshaota-Chodak, Isfayram-Shakhimardan and Savay- Akburasai, as the most high-priority areas in terms of the need to improve water supply, rehabilitate and modernize the infrastructure and improve irrigation services (Table 4.1). In addition, the "economic internal rate of return" (IRR) was another important criterion for selecting the project area that shows the level of return on the investments.

Table 4.1. Selected Sub-project Irrigation System Areas

	Sub-project	Area, ha		Region	District
		total	Arable land		
1	Podshaota-Chodak	33,271	29,507	Namangan	Yangikurgan and partly Chartak
2	Isfayram-Shakhimardan	63,280	54,375	Fergana	Fergana, Kuvasai, partly Quva, Altyark and Tashlak
3	Savay- Akburasai	23,411	19,363	Andijan	partly Kurgantera, Jalkuduk, Khudzhaabad and Bulakbashy

The total project impacted area is around 120,000 ha of them 103,245 ha are arable lands.

4.2. Project Area

The project area is located in Fergana Valley - a vast intermountain depression surrounded with mountain ranges of the Western Tien-Shan and Pamir. Elevations of the terrain in the Valley vary from 300-400 m above sea westward and 900-1000 m eastward.

Podshaota-Chodak system is located in the northeast of Fergana Valley, on the right bank of the Syrdarya River. The sub-project area borders with Kyrgyz Republic on the north, with Kasansai district on the west and Chartak district of Namangan region on the east, and is confined with the Big Namangan Canal on the south.

Isfayram-Shakhimardan system occupies the southern part of the Valley on the right bank of the Syrdarya River. Kyrgyz Republic is to the south of the project area, Sokh Oktepa ISA is located to the west and Shakhrikhansai ISA to the east.

Savay- Akburasai system occupies the south-eastern part of Fergana Valley and is limited to the north with Shakhrikhansai, borders with Kyrgyz Republic on the south, and on the west and east - with farms of Andijan region.

The overall location maps of the study area within the Aral Sea Basin and Fergana Valley is illustrated in Figures 1.1 and 1.2.

4.3. Project Goals and Objectives

The main goal of the FS FVWRMP Phase II Project is to select the most optimal set of measures for reconstruction and modernization of the existing irrigation systems, based on the principles and conceptual approaches of the Integrated Water Resources Management (IWRM) Plan in Fergana Valley, which outlines the ways to achieve more efficient water sector management based on the principles of co-management, environmental sustainability and social equity.

The expected outcomes of the Project are as follows:

(i) physical rehabilitation and modernization of the main and inter-farm canals and their infrastructure;
(ii) implementation of more advanced and efficient technological processes;
(iii) implementation and compliance with the updated and efficient operational procedures;
(iv) reformed and restructured institutions for improved and sustainable irrigation services;
(v) improved water management at all levels of the irrigation distribution network; and
(vi) capacity building to support changes in the management system.

The proposed project activity will ensure achievement of 6 development goals of the IWRM Plan: (i) better water availability; (ii) higher water supply efficiency; (iii) improved water consumption efficiency; (iv) improved water management and operation of the system; (v) reduced vulnerability to changes in the river flow caused by climate change and variability in the upper river reaches, and (vi) improvement of the environment.

The project goal is fully consistent with the national agricultural policy which gives the priority direction to rehabilitation and improvement of the existing I&D system in Fergana Valley, better living standards and food security for the population in the region.

4.4. Project Components

The project includes four components that comprise a package of priority investment measures for rehabilitation and modernization of the irrigation infrastructure, improved water management and water use, institutional improvements for sustainable irrigation services and higher efficiency of water use at WCA and farm level.

FVWRMP-II contains the following main components:

Component A: Irrigation Modernization. This component aims at addressing the problems of water shortage in the project areas and includes five subcomponents : (a) rehabilitation of surface irrigation system; (b) modernization of pump stations; (c) rehabilitation and construction of groundwater wells; (d) flood control and bank protection and (e) expand supervisory control and data acquisition (SCADA) in the project area. To enhance the accountability of irrigation management to water users and improve the quality of irrigation service delivery, the project will pilot volumetric Operation and Maintenance (O&M) charges, and managed aquifer recharge.

Component B: Support for Agricultural Modernization. To take full advantage of the improvements in irrigation modernization, this component will support Uzbekistan's efforts to modernize agriculture, promote agricultural diversification and intensification, support cotton harvest mechanization, and strengthen capacities. Subcomponents include (i) support for crop intensification and diversification through capacity strengthening, demonstrations and Farmer Field School (FFS), (ii) assistance to farmers to access lines of credit (including assistance in the preparation of business plans); and (iii) support for cotton harvest mechanization, including capacity strengthening to improve crop husbandry methods.

Component C: Institutional Reforms. This component will provide assistance to the water service providers in the project area to promote and improve efficient and productive use of the on-farm irrigation systems on a sustainable basis, with special emphasis on water and asset management aspects. Subcomponents include (i) water management capacity strengthening of staff from Basin Administration of Irrigation Systems (BAIS), Administration of Irrigation Systems (AIS) and Water Consumer Associations (AWS) and introduction of maintenance and asset management; (ii) promotion

of asset management and service oriented management; and (iii) piloting of managed aquifer recharge and volumetric operation and maintenance fees.

Component D: Project Management, Audit, Monitoring and Evaluation, and Technical Assistance. This component would (i) support the operation of the Project Implementation Unit (PIU), and finance overall project management, as well as technical assistance in such areas as detailed design, contract administration and construction supervision, procurement, financial management, and capacity strengthening; (ii) establish a Monitoring and Evaluation (M&E) system and arrange for data collection and reporting on key performance output and impact indicators through baseline surveys, participatory assessments and mid-term review and final evaluation; (iii) finance services of independent auditors for auditing of project accounts and overall project management; and (iv) prepare a feasibility study and bidding documents for a follow-on investment operation.

4.5. Physical Options

The list of physical project options is shown in Table 4.2; locations of infrastructure which will be subjected to reconstruction, as well as new facilities scheduled for construction are shown in the location map (Figure 1.2).

Table 4.2. Project activities by component (physical options)

Activities	Project area		
	Podshaota-Chodak	Isfayram-Shakhimardan	Savay-Akburasai
Component A: **Irrigation Modernization**			
Sub-component A-1 Rehabilitation of surface irrigation system			
1. Rehabilitation of main and inter-farm canals	+	+	+
2. Reconstruction of structures on inter-farm canals	+	+	+
Sub-component A-2 Modernization of pumping stations			
1. PS modernization	+	+	+
2. Construction of new PS	-	+	-
Sub-component A-3. Rehabilitation and construction of groundwater wells			
Construction of *groundwater wells* for irrigation	+	+	-
Sub-component A-4. Flood control and bank protection			
Bank protection of small mountain rivers	+	-	-
Sub-component A-5. Expand supervisory control and data acquisition (SCADA)			
Implementation of SCADA technology	+	-	+
Sub-component A-6 Pilot studies			
1. Volumetric Operation and Maintenance (O&M) charges	-	-	+
2. Managed aquifer recharge	-	+	-
Component B: **Support for Agricultural Modernization**			
Sub-component B-1 Assistance to farmers to access lines of credit line			
1. On-farm water management and efficiency improvement measures (drip irrigation and plastic tube irrigation, etc)	+	+	+
2. Wells with solar battery pumps	+	+	-
3. Improving productivity of field and horticultural crops, etc	TBD	TBD	TBD
4. Support for cotton harvest mechanization	TBD	TBD	TBD

The selected physical interventions regarding issues of surface irrigation system and construction of groundwater wells, and all being part of Project **Component A**, are set out in **Table 4.3**, together with a summary of underlying limitations, disadvantages and advantages.

Table 4.3. Physical options of project activities, possible limitations, advantages and disadvantages

Project targets	Rehabilitation/ construction	Incl. Sub-projects			Limitations	Advantages	Disadvantages	Comments
		Podshaota-Chodak	Isfayram-Shakhimardan	Savay-Akburasai				
I. Irrigation infrastructure								
1. Main and inter-farm irrigation canals	Rehabilitation (km)	111.5	78.1	93.8	Requires many interruptions in the irrigation water supply to water users	Reduction of seepage canal losses from canals and corresponding reduction of drainage load	High costs, organizational difficulties with implementation in the existing system	Local application is possible in the areas with canal seepage
	New construction (km)	-	-	3	Temporary withdrawal (during construction) of about 3 ha of arable land, cutting 27 trees	Improved water supply and addressing the issue of irrigation water shortage	Difficulties in implementation (densely populated areas, unauthorized tree planting)	In some areas the minimum removal of plantings (with the permission and consent of *Khokimiyat* and community)
2. Hydro structures on inter-farm canals	Rehabilitation	286	99	289	Requires relatively short interruptions in the irrigation water supply to water users	Opportunity to improve revenue management and reduce operational losses of irrigation water	Requires capital investments and costs	Measures are required to improve water management
3. Irrigation wells	New construction (pcs.)	105	138	-	Restricted energy consumption and radial energy blackouts in the project area	Improved water supply from groundwater	High construction and operation costs, depending on the power supply system	Construction of new wells should be justified considering all the circumstances and agreed with *Goskompriroda*
4. Pumping stations	Rehabilitation (шт.)	9	1	2	Create interruptions in the irrigation water supply to water users	Improved water supply, increased reliability and stability of water delivery	Requires capital investments and costs	Rehabilitation should be justified, taking into account the wear extent and opportunities for further operation
	New construction (pcs.)	-	1	-		Improved water supply, increased reliability and stability of water delivery	Requires capital investments and costs	Construction should be justified, taking into account the need to increase water availability

Project targets	Rehabilitation/ construction	Incl. Sub-projects			Limitations	Advantages	Disadvantages	Comments
		Podshaota-Chodak	Isfayram-Shakhimardan	Savay-Akburasai				
II. Flood control and bank protection								
1. Bank protection	Rehabilitation (km)	4.5	-	13.4	Work can only be done in low water, when mountain river transforms into stream	Prevention of bank erosion and floods, destruction of bridges, roads, buildings and other infrastructure	Complex rehabilitation of mountain river sites in densely populated areas	Bank protection requires caution near the buildings and settlements
2. Kandioyn debris basin	Reconstruction with transformation into reservoir (million m^3)	3	-	-	Limited period of works (can carried out on the dry bottom)	Loss prevention due to floods and mudslides, increased water availability through accumulation of seasonal flow	Requires capital investments and costs	Justification and site selection for construction in hazardous areas
III. System modernization								
1. Manageable aquifer replenishment	New construction	-	+	-	The country lacks experience in groundwater management	Increased water supply through groundwater replenishment from excess winter runoffs	Requires capital investments and costs	Study potential areas for groundwater management
2. Creation of SCADA system	New construction	-	-	+	Requires staff training	Indirect impact on the growth of crop yields through better water management	Requires skilled personnel and capital investments	Site selection, equipment selection, and etc. should be studied before creating SCADA
3. Drip irrigation	New construction	+	+	+	Requires staff training	Reduced field water losses	Requires skilled personnel and capital investments	Select sites with the highest water deficit
4.Solar battery pumps	New construction	+	+	-	Requires staff training	Environmentally friendly reducing energy costs	Requires skilled personnel and capital investments	

4.6. Agricultural Modernization Interventions

Physical interventions alone will not solve the problems in the Project Area. Substantial strategic, policy, institutional, agricultural modernization and general Project support issues at all levels, from central government downwards, have to be addressed, all being part of Project Components B and C. Most of these, if not all, are outside the direct scope of this environmental assessment study.

The main objective of the Component B is to promote agricultural diversification and intensification, support cotton harvest mechanization, and strengthen capacities. The overall purpose of this Component is to provide technical assistance and facilitation support for farmers, private companies, WCAs and local communities to plan, implement and management of investments.

The following interventions are included in this component:

- Establishment of Demonstration Plots (in each subproject) to apply and disseminate the best on-farm agricultural and irrigation technologies, IPM approach and practices based on participatory and extension tools (field days, harvest presentations, etc.) at all levels of the irrigation systems.;
- Organizing and operation of Farmer Field Schools (FFS), which would play the role of training facility for implementation of training and extension activitie sand integration of advanced technologies into existing agricultural farming;
- Strengthening capacity of farmers and WCAs and other agricultural enteprises;
- Assistance and facilitation support for farmers, WCAs and local producers to access lines of credit (including assistance in the preparation of business plans) to plan, implement and management of investments. As expected, it will provide financing in the form of grants to access lines of credit, considered by national target groups as priority for scaled-up climate resilience agricultural activity.
- Support for cotton harvest mechanization, including capacity strengthening to improve crop husbandry methods.

4.7. Institutional Options

The set of activities under the Component C «Institutional Reforms» includes the following: (i) trainings for BAISs, ISAs, WCAs and farmers, (ii) demonstration plots, (iii) Farmer Field Schools (FFS), (iv) strengthening of WCA physical and technical capacities, (v) regional and international study tours.

Target group training

As part of FVWRMP-II, a Development and Training Group (DTG) will be created, which will assess training needs of the target groups and prepare training materials. Some possible topics of trainings and their respective target audiences are listed in Table 4.4.

Table 4.4. List of training topics and training modules

Training audience	Topics/Modules
Field staff: ▪ Hydraulic inspectors; ▪ Inspectors; ▪ Observers; ▪ Maintenance men	1. Water use efficiency monitoring in irrigation system 2. Filling logs on a technical condition of infrastructure and observations (gauging stations, discharges, water supply for irrigation) 3. Control (regulation) of waterworks 4. Construction, cleaning, inspection, performance monitoring of wells
Field staff: ▪ Hydraulic Engineer; ▪ Drainage Engineer; ▪ Hydro metering Engineer; ▪ Foreman	1. Design of hardware measuring tools, analysis and water use efficiency 2. Inventory of channels, reservoirs, waterwoks and gauging stations 3. Equipping gauging stations and waterwoks with water sensors to monitor water level 4. Measurement of water flow rates using a current meter 5. Gauge tools calibration, waterworks calibration

	6. Development of Q = F (H) and Q = F (Z) curves. 7. Water distribution.
BAIS, ISA and HGME staff: ▪ Heads of Departments; ▪ Full time employees	1. Priority setting and objective definition to improve water use efficiency. 2. Establishment of monitoring procedure to track performance of the irrigation system. 3. Development of water use plan for the system. 4. Planning and implementation of water distribution. 5. Using a database for planning water resources management. 6. Development of O&M plan
SCADA Operators	Training in operation and maintenance of SCADA system
WCA: Manager, WCA Council Members; WCA members (farmers)	1. WCA establishment and development 2. Improvement of managerial and administrative skills
WCA Accountant; WCA Audit Council Members; WCA Manager	WCA financial management
WCA technicians and Rural Council	Water resources management

4.8. Environmental and Social Options

From environmental point of view, the Project will be located in the area which has been intensively cultivated for a long period of time; its flora and fauna consists exclusively of cultivated species with little variety. A groundwater formation zone - Chimiyon-Avval in Fergana region has a status of the protected natural area of national importance that is fixed in the RCM No. 302 dd. 2002 (see Chapter 2).

The study area is located in one of the most densely populated regions of Uzbekistan. Currently, the total population of the project area is 975 804 people with average population density – 385 people/km². More than 30 % of the population lives in the rural areas. The social context is described in more detail in the separate Social Assessment report reviewed and cleared by the Bank.

5. CURRENT STATE OF ENVIRONMENT

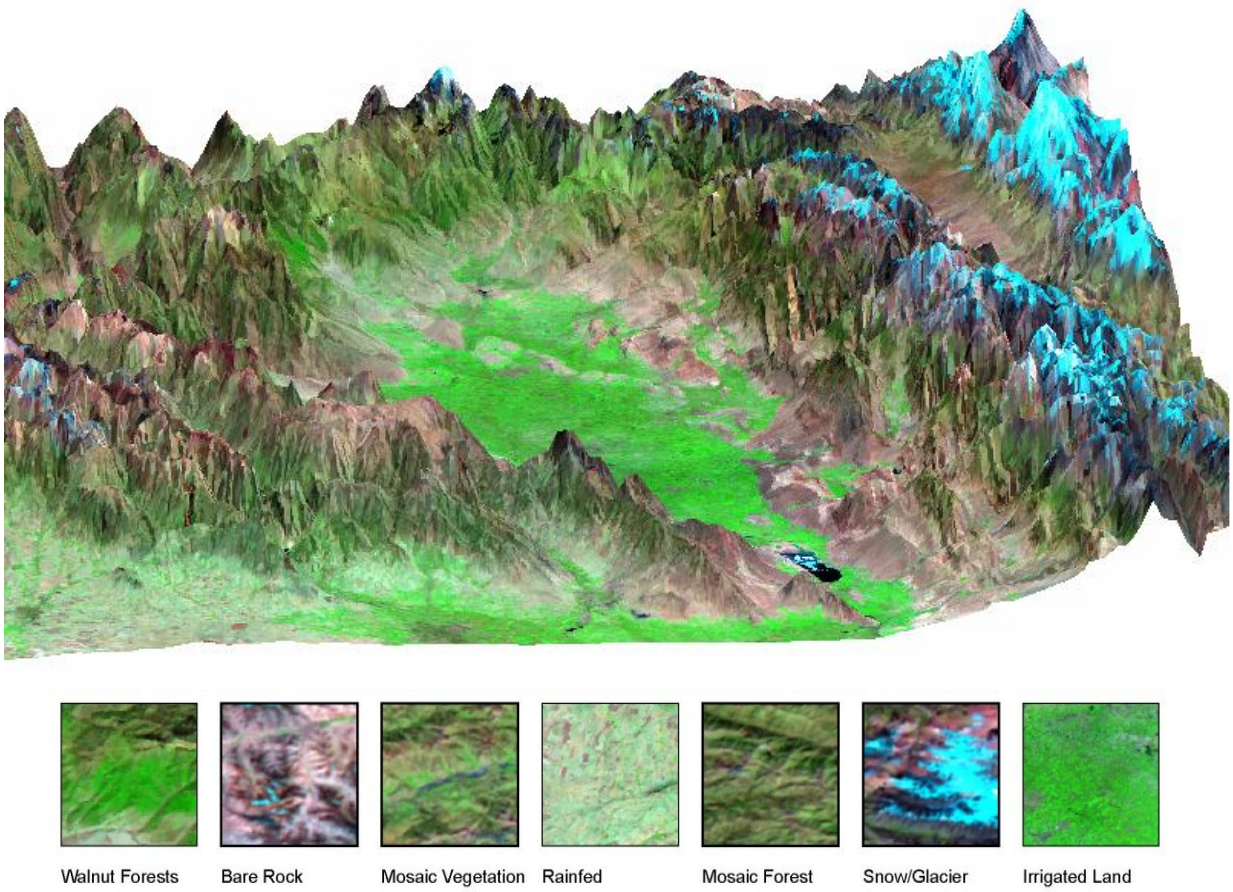
This chapter provides a wealth of information about the environment status in Fergana Valley and the study area. This chapter describes and assesses the relevant physical, biological and socio-economic conditions.

5.1. General background

5.1.1. Biophysical resources

Fergana Valley is an intermountain depression stretching 300 km length and 170 km width, surrounded with mountain ranges, with the only one narrow passage to the west, through which the Syrdarya River carries water away from the valley (Figure 5.1). From the north, the valley faces high ridges of the Kuramin and Chatkal ranges, from the east - the Fergana and Atoynak ranges and from the south – the Alay and Turkestan ranges. Many years ago Fergana Valley was a shallow bay of the ancient Sarmat Sea, as evidenced with marine sedimentary rocks and fossilized shells sometimes occurring on the slopes. As many as 6,500 rivers flow down from the slopes of the Fergana depression with the total length of 2,800 km. The river network density varies from 0.28 to 0.95 km/km^2.

Figure 5.1. Fergana Valley landscape map



Source: Dr. C.V.Ji, ADB, 2009

Climate

Orographic insularity of Fergana Valley and height variations add a wide variety to the climate. Protection with mountain ranges determines some weather stability in winter and lower daytime temperatures in summer. The average temperature in July and January ranges from + 25.5 to + 27°C and -2.5 to -2.7°C, respectively. A long frost-free period (about 210-220 days) and the sum of active temperatures (about 4,500°C) provide for cultivation of heat-loving crops - cotton, grapes, peaches, etc. Many-year average annual rainfall rate varies from 182 mm/year (Fergana) to 756 mm/year (Naugarzan), 70-80% of which comes in October-April. Evaporation from water surface is 1,166 mm. Fergana Valley, especially its open western part, has intense wind regime with irregular distribution during a year. In spring, the invasion of air masses to the valley disrupts the normal mountain-valley air circulation; this time the winds often bring some dust storms causing erosion not only of virgin, but of irrigated soils as well. Specifically severe wind activity is typical for Kokand area where strong wind *("kokandets")* is observed for 53 days in a year.

In the last decade, a significant trend of more frequent droughts, especially in summer and autumn seasons has become noticeable. When in the 80-90s of the last century there was a drought observed on an average 2 times in 10 years, for the period of 2000 – 2012 the extreme meteorological drought was recorded four times (2000, 2001, 2008 and 2011).

Physical & geographic and natural & climatic specifics of Fergana Valley contribute to formation of mudflows, floods and erosion processes. Because of high river network density, steep slopes increase their risk, particularly at the foothills. Around 40% of all floods in Central Asia are accounted for Fergana Valley. The key climate data are given in Annex 5.

Geology and hydrogeology

The geological structure of Fergana Valley is extremely complex. The mountainous rim is a powerful in folded block up lift of Paleozoic sandstones, shale's, limestones, conglomerates, gneisses, and volcanic tuffs. The foothill and advanced ridges of the ranges are composed of Mesozoic-Cenozoic sedimentary rocks (conglomerates, sandstones, limestone's, clays, and siltstones). They were buried on the plains under a thick layer of Quaternary sediments. *Adyr* ridges are stacked of no segmented Quaternary sediments of upper neogene-lower quaternary sediments represented with conglomerates, pebbles, gravel; in the Southeast Fergana they are overlapped with some loess layers.

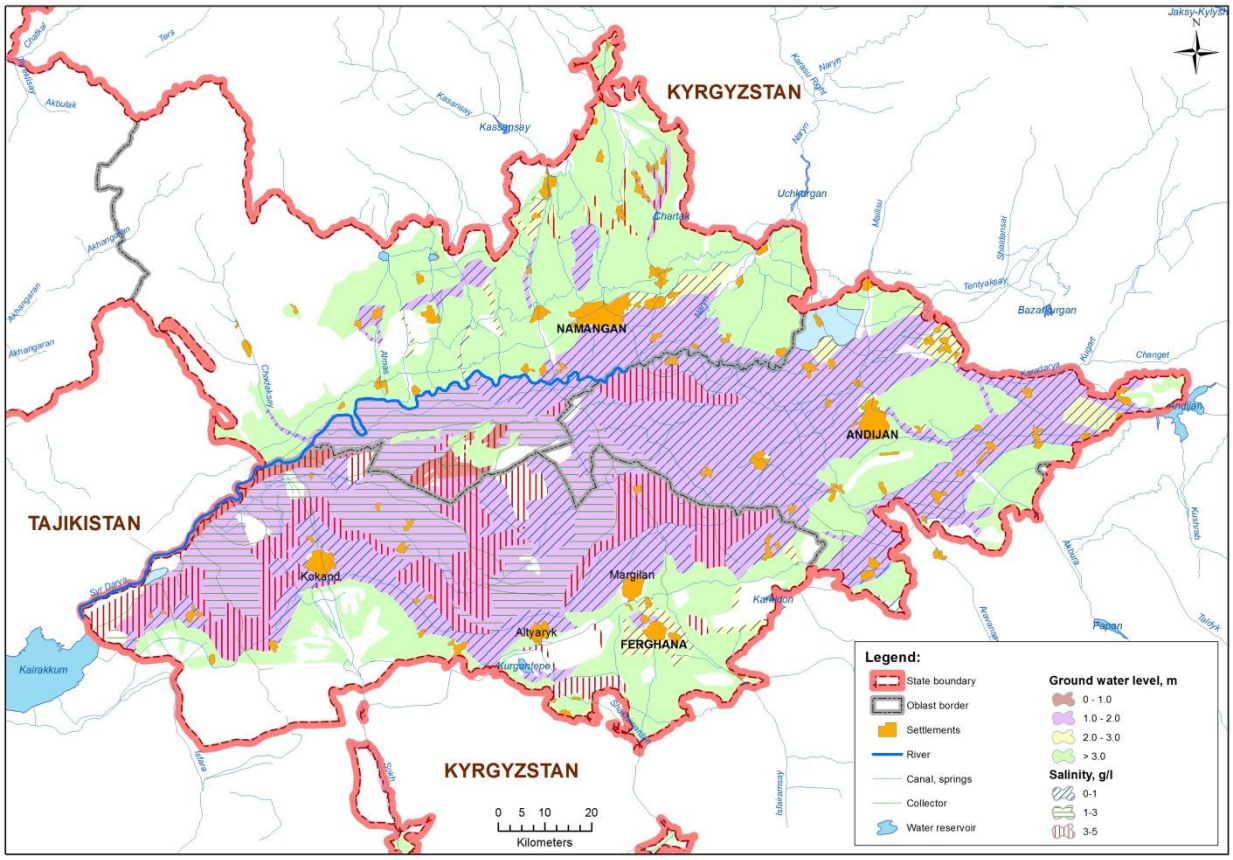
In terms of importance, a sub-zone of lower *Adyrs* is the most interesting one; this is a flat area of alluvial cones and inter-cone settlings stacked with Quaternary sediments. The deposits are alluvial-proluvial formations of ancient and modern alluvial cones covered in some areas with a layer of alluvium layer brought from the river valleys. Stratigraphically, Quaternary sediments are subdivided into Sokh, Tashkent, Golodnostepsky and Syrdarya complexes. Thickness of these deposits is increasing from a few meters near the mountains up to 300 m in the depressions. The maximum thickness is observed in the center of the depressions (600-700 m) and closer to sides it is reducing to 50-100 m.

The orographic specifics of Fergana Valley have caused a wide variety of hydro geological factors. Given the slopes in the area, the level of GW occurrence, GW salinity, soil exposure to salinity, and water availability, Fergana Valley is subdivided into 10 hydro geological zones (Annex 5).

Groundwater

Groundwater has different depth and salinity depending on the hydrogeological factors (Figure 5.2). Currently, around 30% of the land suffers from high levels of salinity and groundwater, which are mainly confined to the central part of Fergana Valley. Sources of GW supply are high seepage losses from the upstream lands (Burgundy massive in Kyrgyz Republic and *Adyr* lands in Fergana region).

Figure 5.2. Ground water table and salinity in Fergana Valley



Source: IWMI, 2009.

Soils

Historically, the soils of Fergana Valley are the most productive in Uzbekistan. The soil cover is diverse owing to different soil formation conditions. The western and central part of the valley is characterized with desert conditions with little precipitation. Humus and low productive desert s oils are formed here – desert-sand, gray-brown, *takyrs*. With higher altitude and precipitation, some highly fertile soils of sierozem zones are formed - light, typical and dark sierosems. The humus content in light sierozems ranges from 0.8 to 1.5%, as for dark sierosem and meadow oasis soils it varies from 3.0 to 4.0 %.

The soil texture is associated with the history of soil formation and redistribution of sediments. On the upper and peripheral parts of the alluvial cones, gravel-pebble horizons are covered with fine earth layer of low capacity (up to 1 m). In the lower parts of alluvial cones and in the depressions, the soil profile increases over 1 m, and greater layering with a predominance of heavy loam and clay sites can be found.

Water erosion dominates in the foothill and mountain areas because of the steep slopes and relief roughness. The total area of irrigated land affected with the irrigation erosion is up to 85,194 ha, including 47,699 ha of medium eroded and 10,088 ha of severely eroded lands.

Soil salinity distribution has a certain pattern: salinity increases towards alluvial cone periphery and inter-cone depressions. Non-saline and slightly saline soils (71%) are dominating; the rest is saline and require leaching with different water rates. Predominantly saline soles and wetlands are confined to the central part of Fergana Valley.

5.1.2. Water resources

Surface Water

The Naryn River, the Karadarya River and Syrdarya River formed by them, as well as mountain tributaries, so-called small rivers are the main sources of surface water resources of Fergana Valley. Water resources of the Syrdarya Basin are very limited and are estimated at 24,62 km^3 during years with 90% of water availability.

The river flow is characterized with substantial irregularity of seasonal and lon-term flow. In view of snow-glacial nature of the annual flow regime formation, the maximum flow falls in spring and summer, and the minimum - in autumn and winter. As for the long-term regime, there can be alternation of dry and water abundant years. The dry years occur every 4-7 years, and have protracted nature (up to 6 years), while the water abundant years - in every 6-10 years with their duration of 2-3 years, but more likely they occur sporadically. The river flow in the Syrdarya Basin in dry years (90% of water availability) is 9.7 km^3 less than during a year with average water availability. The flow of the major basin rivers at different water availability (50%, 75% and 90%) and variation ratios characterizing the flow variability are given in Table 5.1.

Table 5.1. Annual Syrdarya River Flow of Various Probability, km^3

River – river station	Water availability			C_v
	50%	75%	90%	
Naryn – Toktogul + tributary inflow	13.76	11.75	10.18	0.23
Fergana Valley rivers	11.61	9.69	8.22	0.25
Chirchik, Angren, Keles	6.59	7.11	5.95	0.27
Mid-stream rivers	0.36	0.31	0.27	0.21
Total, before Chardara reservoir	34.32	28.86	24.62	

Source: GEF/WB Water and Environment Management project. Sub-component A1, National Report RU, 2001

Overall annual surface inflow to Fergana Valley 17.1 to 33.5 million m^3 (average flow is 25 million m^3), of which 30% is a share of small rivers (Table 5.2).

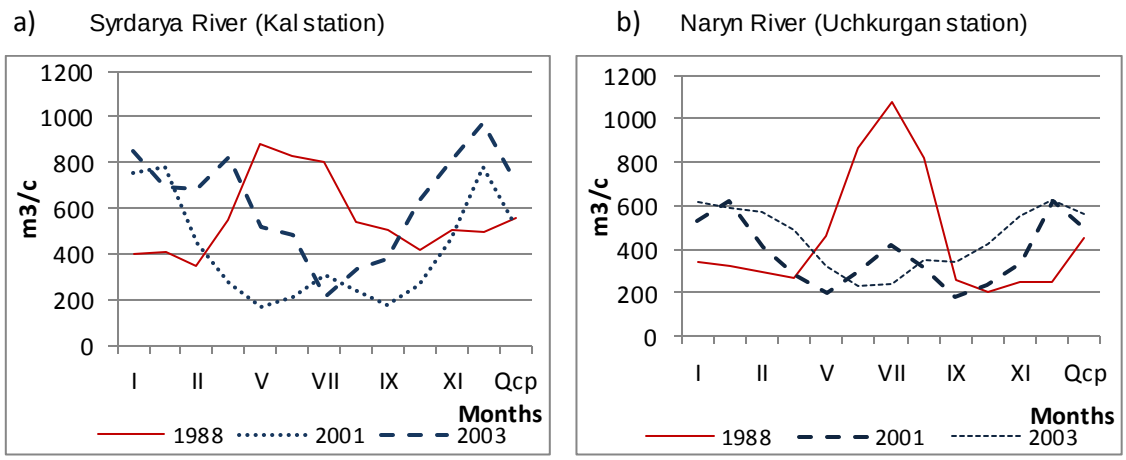
Table 5.2. Total surface inflow to Fergana Valley, km^3/year

River/ Station	The highest annual flow	Average annual flow	The least annual flow
Karadarya (Kampyrravat)	5.6	3.8	1.7
Naryn (Uchkurgan)	18.3	13.3	9.9
Small mountain river inflows	9.6	7.7	5.5
Total	33.5	25.0	17.1

Source: GEF/WB Water and Environment Management project. Sub-component A1, National Report RU, 2001

Water sources of Fergana Valley are of transboundary nature in general. Availability of reservoirs and imbalance between irrigation and hydropower interests cause violations of the natural hydrological regime of the transboundary rivers. At present, the Naryn and Syrdarya Rivers can be called as "anti-rivers": their maximum flow is observed in December-March, and the minimum flow - in July-August. The runoff of natural floods accumulated in the Toktogul Reservoir is discharged in winter to generate electricity when the neighboring Kyrgyz Republic has increasing electricity demand. Figures 5.3 a) and 5.3 b) illustrate the nature of the average monthly water discharge during years with different water availability (2001 - low-water year, 2003 – water-abundant year and 1988 when the Toktogul Reservoir was used for irrigation purposes. In 1988, the reservoir operation in the irrigation mode did not distort the river flow regime - the maximum discharges accounted for spring-summer, and the minimum – for autumn-winter periods.

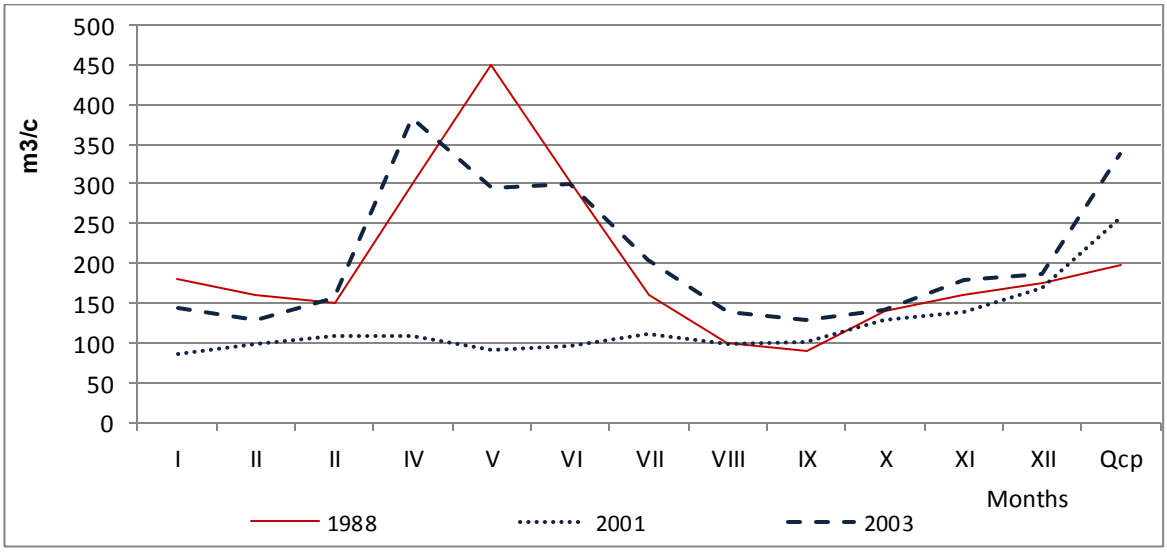
Figure 5.3. Average monthly river discharge in Syrdarya and Naryn Rivers (m^3/sec)



Source: State water cadastre. Annual data on surface water mode and resources of earth. Volume. IV. Uzhydromet,RUz.

The Naryn and Karadarya Rivers form at their confluence the Syrdarya River, so the flow regime of these rivers determines the nature of the Syrdarya River flow. In dry 2001, the minimum discharges from the Syrdarya (Kal village) were (163 m^3/sec) in May and increased only in November reaching the peak in February (782 m^3/sec). In water-abundant 2003, the high-water discharge peak was observed in December (970 m^3/sec), and the minimum one - in July (211 m^3/sec). The character of the natural annual flow in the Karadarya River (Uchtepe village cross-section) for the period of 1999-2004 did not change and remained the same as in 1988-1991 (Fig. 5.4). In 2001, the abnormally low-water year, the monthly average discharge was smooth, with a slight peak in summer.

Figure 5.4. Annual river flow of Karadarya River (m^3/sec)



Source: State water cadastre. Annual data on surface water mode and resources of earth. Volume IV. Uzhydromet, RUz.

Underground water

Underground water is formed in all geological complexes and has a widespread distribution.

The total groundwater volume in Fergana Valley is around 6.5 million m^3, accounting for 38.6% of all available groundwater reserves in Uzbekistan. The largest underground deposit is confined to the Sokh River Basin. A number of deposits have the status of protected areas, including Chimyon Avval deposit that located on the territory of the Isfairam-Shahimardan sub-project. The assessment of potential impacts on the groundwater reserves due to the construction of new wells is provided in Chapter 6 below. The analyses concluded that the overall replenishment, represented by inflow of groundwater reserves of 1,250.6 thousand m^3/day, exceeds the overall groundwater consumption, including the

anticipated consumption from the new irrigation wells, by 85.6 m^3/day. This proportion is found environmentally sustainable and will not represent any risk to the aquifers levels and capacity. Underground water is mainly used for potable water supply and irrigation, and in some parts of the Basin it is the only source of irrigation water.

Surface water quality

To assess water quality and environmental status of the surface waters, hydro chemical and hydro biological data were used taken from the *Uzhydromet* observation network and the information issued in the "Annual Survey of Surface Water Quality" (2009-2013), and the "National Reports on Environment and Natural Resources Use in the Republic of Uzbekistan" (2008, 2013). Water quality was assessed against the established indicators: (i) MAC - maximum allowable concentrations, (ii) WPI - water pollution index, (iii) hydrobiological indices for quality and environmental status classification of natural waters: SI - saprobity index, BPI - biotic periphytic index and MBI - modified biotic index (Annex 5).

Hydro chemical water quality characteristics. Oxygen regime in all watercourses of Fergana Valley is satisfactory - average values of dissolved oxygen are 10-12 mgO_2/l and organic matter content is low. The average values of BOD_5 in the Syrdarya, Naryn, Karadarya Rivers is 1.31-4.5 mgO_2/l that corresponds to MAC 0.44-1.5. The mountain rivers have lower values of BOD_5 (0.61- 1.44 mgO_2/l) that generally do not exceed the MAC. The average COD values are in the range of 2.94-9.81 mgO_2/l (do not exceed the MAC values), the average concentration of nitrate-nitrogen varies from 2.1 to 9.7 mg/liter, ammonia-nitrogen - 0.09 to 0.24 mg/l, and also do not exceed MAC, in general. The average concentrations of nitrite-nitrogen often exceed MAC in the rivers: Syrdarya, Naryn, Isfayramsai, and range from 0.6 to 3.5 MAC.

Salinity levels of the majority of watercourses are below 1 g/l (below MAC). Salinity is slightly high (above 1g/l) in the Isfayramsai River and South Fergana Canal, where the salt concentrations in certain months reach 1.13-1.56 mg/l (1.1-1.5 MAC). The increased salinity in these watercourses occurs in late fall and winter, and in early spring.

Polluting ingredients. In recent years, there are no DDT, HCCH and petroleum products detected in surface waters; detergents are not detected as well or present in concentrations well below MAC. Also, the concentration of heavy metals dropped below MAC - copper, chromium (hexavalent). Their recorded maximum concentrations are in the range of background values indicative for watercourses in the upper watershed.

In recent years, the overall level of surface water pollution in Fergana Valley has decreased. According to *Uzhydromet*, water pollution source values fell below 1 that characterizes the water quality as of class II and means clean water.

Hydrobiological characteristics. The hydrological information is the final link that allows to go from the fact statement about pollution to the evaluation of biological effects.

As for watercourses being not a subject to or slightly subjected to man-induced pollution, they are characterized with water biocenosis, typical for clean natural water, i.e., their original genepool corresponds to the natural undisturbed background. The natural background mainly consists of north-alpine and mountain cryophilic species, so-called "common species". When man-induced pollution takes place, aquatic communities change their structure; "common species" are replaced with eurybiontic species typical for polluted waters.

Periphyton biocenosis (marine growth) and zoobenthos are indicative in watercourses of Fergana Valley serving as a priority for quality characteristics of river environmental status.

Basic watercourses. The first group of basic watercourses includes the Chadaksai, Gavasai, Sumsar, Tereksai, Koksu rivers, as well as a mountain area of the Kassansai and Podshaotasai rivers. Their bottom sediments, thickness and surface water have a natural look, without visual signs of pollution. The bottom is composed of stone-pebble-sand, water is clear, colorless or with a blue tint. During the year, the water temperature is generally low. The watercourses have the highest water quality (I-II class),

their average SI values – 1.05-1.52, PBI and MBI indices vary within 7-10 points, and their environmental status is defined as a background one.

Periphyton communities in this group of watercourses are characterized with high species diversity, mosaic distribution on the rocky substrates and are in a state of environmental progress. In diatom complex, x-o, o-s saprobic north-alpine, alpine and cryophilic algae species dominate, including *Diatoma hiemale, D.hiemale var.mesodon*, *Didymosphenia geminata*, *Ceratoneis arcus*, C.arcus varamphioxys, *Cymbelle Stuxbergii, Synedra Goulardii, Achnanthes linearis* and etc.

These zoo-benthic communities have good quantitative and qualitative development and are presented with x-o, o- saprobic oxyphilous, cryophilic, mountain species: stoneflies of *Eucaonopsis, Amphinemura*, *Filchneria, Agnetina* genera; mayflies of *Iron, Rhitrogena, Ameletus, Baetis, Ecdyonurus* genera; caddis flies of *Agapetus, Dinarthrum, Mystrophora, Rhyacophyla* genera; midges of *Blepharocera, Eriocera, Dicranota* genera; chironomids and childbirth of *Diamesa, Boreoheptagena* and etc. Benthic communities are characterized with a complex environmental structure and branched nutritional chain.

The second group of basic watercourses includes: the Kasansai (piedmont section) Margilansai (above Vuadyl village), Isfayramsai (above and below Kuvasai town), and Naryn rivers. Water quality in these rivers corresponds to the transitional class II-III. The average SI values – 1.47-1.89, PBI and MBI indices vary within 5-8 points, their background state is transforming into transitional satisfactory state.

Their periphyton communities have dominating green filamentous algae of *Ulothrix, Cladophora, Spirogyra* genera. In some individual sections (e.g. the Margilansai – Vuadyl village, the Naryn River) the red alga *Bangia atropurpurea* can be seen quite often. In diatom complex, along with x-o, o-saprobic algae species specific for the first group of basic watercourses, eurybiontic o, o-in-and-mesosaprobic species of algae are predominant, for example, *Achnanthes affinis, Diatoma elongatum var. tenuis, D.vulgare var.productum, Cymbella affinis, Cocconeis placentula var.euglip ta, C.pediculus, Gomphonema olivaceum, Navicula gracilis, Fragilaria crotonensis*, and etc.

In zoobenthos, along with mountain-saprobic species, some in-mesosaprobic eurybiontic species of mayfly of Baetis genus (*B.transiliensis, B.gracilis*), *Caenis (C.hissari)*, caddis worm of *Hydropsyche* genus *(H.ornatula, H.gracilis)*, midges of *Dicranomyia* genus, chironomids of *Orthocladius, Eukiefferiella* genera, oligochaetes from *Naididae* line can be found.

Thus, the mountain and foothill river sections in Fergana Valley do not experience any significant man-induced pollution and their biocenosises have the background environmental status. Their water quality corresponds to class I and II (pure and clean water) or transitional class II-III (clean - moderately polluted water). Water in the upper parts of the Syrdarya and Karadarya rivers confined to the lowland areas is moderately polluted and has III-II and III quality classes. Its environmental status is ranked as "satisfactory" (Annex 5).

Underground water quality

In recent years, some growth trend of water salinity and total hardness of groundwater with respect to the background of their content is observed in Fergana Valley, often as a result of irrigation. The data of groundwater status survey show no changes in the regional scale, however there are some qualitative changes in the dry residue and total hardness. The quality of the individual water deposits is deteriorating due to industrial pollution, particularly in the alluvial cone periphery (Sokh deposit).

Air Polution

The level of air pollution is assessed using an integrated index - climatic potential of air pollution - taking into account the propensity of the area to pollution. According to the Environmental Assessment of the Republic of Uzbekistan (2007), the highest content of nitrogen dioxide in the air is detected in Fergana city -1.3, -1.5 MAC, the exceedance of annual average ammonia concentrations in Fergana and Andijan cities is from 1.3 to 2,8 MAC. In the rest area, the level of pollution with that ingredient does not exceed 1 MAC. The current pollution with phenol is noticed in the cities with

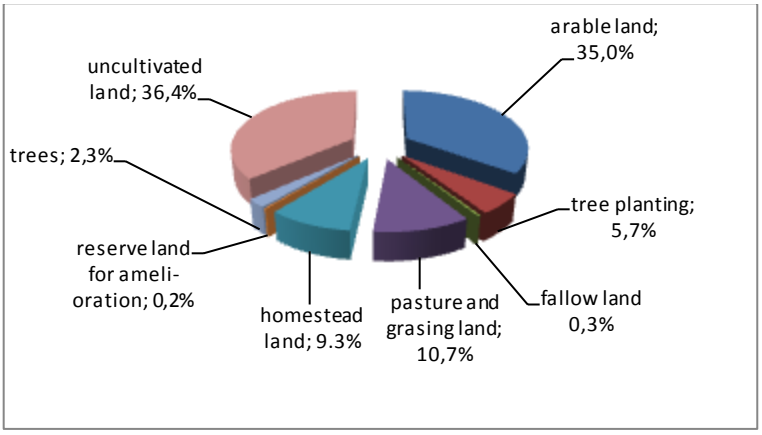
businesses that use hydrocarbon feedstock in their processes (Fergana - 1.3 MAC) Land Resources and Land Use.

5.1.3. Land Resources and Land Use

Land use

Totally, land resources of Fergana Valley comprise around 1.85 million ha (4.4% of the total country area). Arable land makes up to 1.17 million ha (63.4%). Of them, 35% is cropland, 10.7% is hayfields and pastures, 10% is forests and woods/bushes, and 9.3% is household land. Lands under reclamation and used for various reasons make around 0.5% of arable land (Figure 5.5).

Figure 5.5. Key land use categories

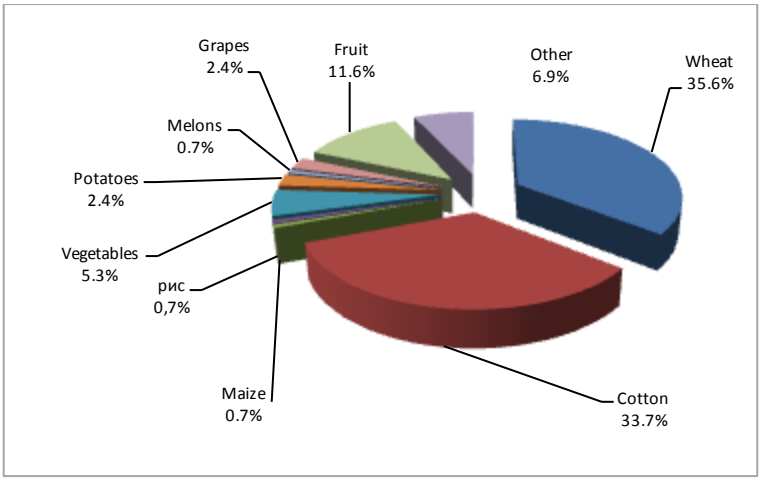


Source: Agricultural sector of Uzbekistan. Statistic Report, 2013

The cropland comprising 0.65 million hectares (35% of land fund) is the most valuable and multifunctional land category and is a principal means of agricultural production. Wheat and cotton are the main crops allocated with 35.6% and 33.7% of irrigated cropland, followed by orchards and vineyards on 14% of the area, vegetables, potatoes and melons occupy 8.4% (Figure 5.6).

The main land users are farmers with the right of long-term land lease, and dekhkan having their land plots in private ownership. There are 18,427 farms in Fergana Valley; they lease 864.3 thousand hectares of land, with an average farm land area of 46.9 hectares. There are more than 1.47 million dekhkan farms, which own 167.5 thousand ha (average farm size is 0, 11 ha). Agrofirms - voluntary associations of farmers providing assistance to farmers in marketing and processing their products were created in order to improve economic efficiency of the agricultural production.

Figure 5.6. Crop pattern of the irrigated agricultural lands



Source: State Committee "Uzgeodescadastre" of R.Uz, 2014

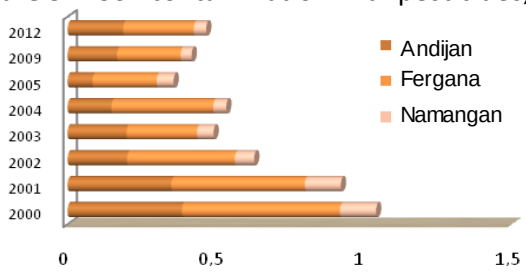
Soil productivity on the irrigated arable land is ranked at 100-point scale of soil quality. About 68% of irrigated lands of Fergana Valley has average and good fertility, up to 26.5% of land area is classified as average fertility soils [*Goskomzemgeodezkadastr*, 2012]. The differentiation of irrigated land by soil bonitet is given in Annex 5.

Crop yields in Fergana Valley are higher than the national average 1.3 - 1.5 folds. Dekhkan farms are one of the most effective forms of management; they produce a very large share of gross food products.

5.1.4. Use of agrochemicals

According to the reports provided by the Monitoring and Evaluation consultants under the FVWRMP-1, as well as the official reports of the State Committee for Nature Protection [35,36], the general tendency is declining use of agrochemicals (pesticides and fertilizers) in agriculture by 3-4 times over the past 10-12 years. Such decline is explianed by raised awareness of more advanced methods of pest managements, and also by the fact that use of agrochecmicals is found less economically attractive compared to biological methods. The rate of mineral fertilizers and pesticides used to control pests and diseases of agricultural crops in the project area of Fergana Valley for 2010-2014 is illustrated in Annex 5.

Figure 5.7. Soil contamination with pesticides, g/kg



A level of soil contamination with DDT in observed areas of Fergana Valley is 4-6 MAC. Organophosphate pesticides (FOP), herbicides and defoliants in soils of the surveyed areas were not found.

A positive factor for the regulatory use of pesticides, herbicides, fertilizers is effective control of the quality of agricultural products used in domestic and foreign markets, and the widespread development of biological methods of plant protection. The country cooperates and greatly benefits from the international assistance through the programs supported by UNEP, WHO, FAO, OECD and EU, which are aimed at improved and efficient pest management, and prevention, minimization and management of the associated risks.

Proposed mitigation measures are presented below in Chapter 8 and in the EMMP.

5.1.5. Biological Resources

Flora and Fauna

Terrestrial vegetation of Fergana Valley is mainly represented with cultivated species. Floodplain forests (riparian forests), as well as the ecosystem of natural steppes has virtually disappeared as a result of agricultural activities. Pistachios and almonds grow in the foothill areas, there are deciduous and juniper forests. Fields are mainly planted with cotton and wheat, and to lesser extent - a variety of vegetables. Orchards and vineyards are spread across the entire valley. Plantations of trees (elm, mulberry and poplar) are growing along the roads and settlements. Different types of saltwort are common in Central Fergana on the marginal lands that are not used in agricultural production.

For the Fergana Valley, 38 species o animals and 34 species of plants are included in the Red Book. Among them: Turkestan Catfish, Turkestan Sculpin, Said Aliyev Krugolovka, Turkestan white stork, peregrine falcon, and others. The abandoned agricultural lands, canal banks and overgrown canals are significant local and limited habitats for birds, nutrias and muskrats. Wolves, foxes, jackals, hares inhabit *Adyrs* and foothills of the Pamir-Alay mountain system. Small ruminants and cattle graze on the pastures.

There are no rare endemic and endangered species and wetlands in project impact area.

Protected Areas

The following Protected Areas (PA) are established in Fergana Valley as per the Provisions of No. 178 and 179 of the Cabinet of Ministers dated April 13, 2004:

- Naryn River Water Protection Zones in Namangan region;
- Karadarya River Water Protection Zones in Namangan and Andijan regions;
- Syrdarya Water Protection Zones in Andijan and Fergana regions;

Based on the Law "On the Protected Areas" (03.12.2004) the following “State Nature Monuments” (SNM) were created:

- Mingbulak SNM (1991; 1,000 ha) for conservation of flora and fauna in Namangan region and SNM in Chust area (1991; 96 ha);
- GPM Yazyavan Chullari in Yazyavan area (1994; 1,962 ha) to preserve the unique natural sandy desert site with desert habitats.

The above protected areas and natural monuments are outside the project’s area of impact.
There are no state reserves on the flatland of the valley for the reason of lack of areas with undisturbed natural ecosystems.

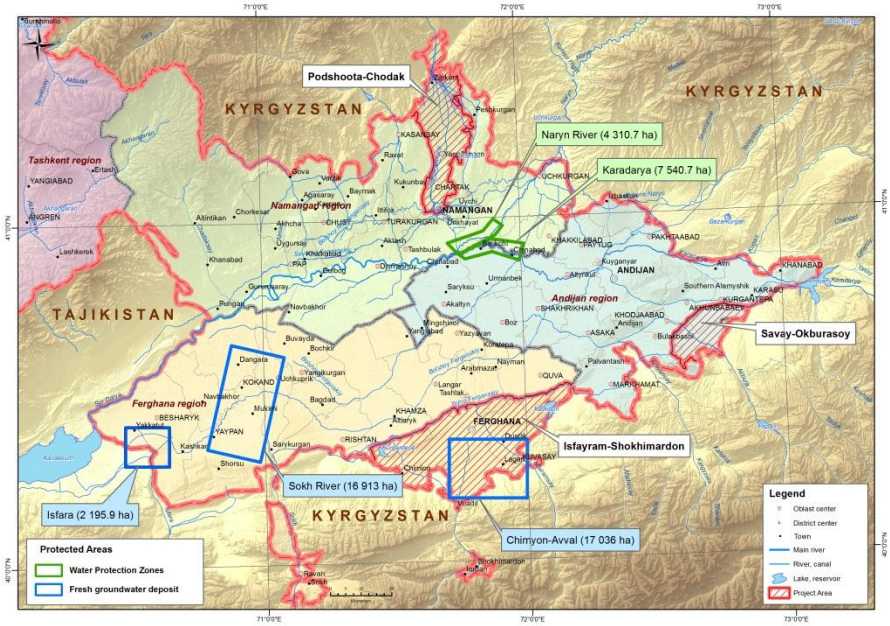
According to Decree of the Cabinet of Ministers No. 302 of 2002 areas of formation of underground waters are given the status of protected areas (Table 5.3). The overall location of protected areas in FV is presented in Figure 5.8. The protected areas and natural monuments are outside the project’s area of impact.

Table 5.3. Area of formation of fresh groundwater with the protected status

No	Province or region	Deposits	Area, ha	Significance
1	Namangan	Olmos-Varzik; Iskovot-Peshku	22,664.8; 49,677.2	*Regional*
		Sub-total:	72,332.0	
2	Namangan	Naryn	5,685	*National*
3	Naryn (Kyrgyz Republic)	Osh-Aravan	35,294	
4	Fergana	Chimiyon-Avval, Sokh	17,036; 16,913	
		Sub-total:	74,928	
5	Fergana	Isfara	2,195.9	*Local*
		Total:	149,465.9	

Source: IWRM Plan Report, FS FVWRMP-II, 2013

Figure 5.8. Protected Areas in Fergana Valley



Source: Prepared by EA team, based on SCNP and Hydroingeo data.

5.1.6. Social Resources

Fergana Valley is the most populated region of the country, where about 8.3 million people live, including more than 60% of them in the rural areas. In 2012, the population density was estimated at 481 person/ km^2, as compared with 66 persons/km^2, throughout the entire country. Among regions, the highest density is observed in Andijan region – 631 persons/km^2, followed by Fergana and Namangan regions with 485 persons/km^2 and 325 persons/km^2, respectively. Over the past five years, the population density has increased by 10% in general.

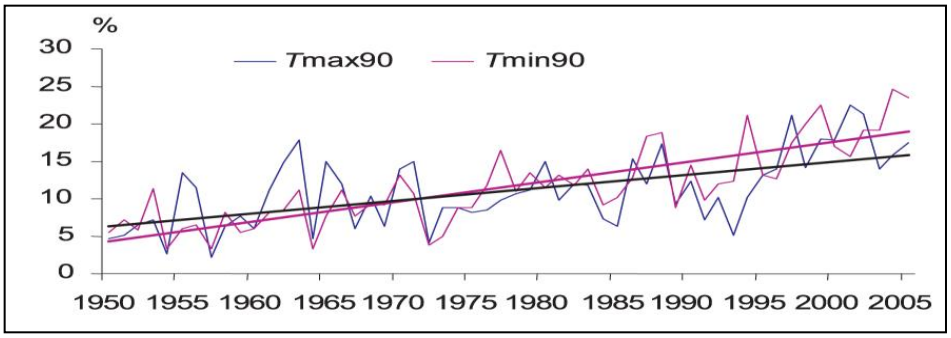
The total workforce in the three economic areas of the valley is around 4.9 million people, i.e. almost 59.1% of the total population. Approximately 3.5 million (72.5%) people are economically active, including about 935,000 of them employed in agriculture and forestry.

5.1.7. Climate Change

Air temperature rise

In recent decades, Fergana Valley, as well as the whole country, experiences a statistically significant rise in air temperatures and increased number of days with high air temperature. During the period of 1978-2007 relative to the period from 1951 to 1980, the number of days with air temperatures above + 40^{0}C in the foothills increased by 10-12%, and the number of days with air temperatures below -15^{0}C in the mountain areas reduced by 28-48%. The minimum air temperature rises more intensively than the maximum one. The average rate of maximum temperature rise (ΔT/10 years) since 1951 was 0.22^{0}C and of minimal – 0.36^{0}C. The estimated indices of temperature extremeness (percentage of time from Tmax and Tmin above their 90% quintiles) have positive trends indicating that extreme climate is intensifying (Figure 5.9) [1].

Figure 5.9. Change of extreme maximum and minimum air temperatures in Fergana Valley



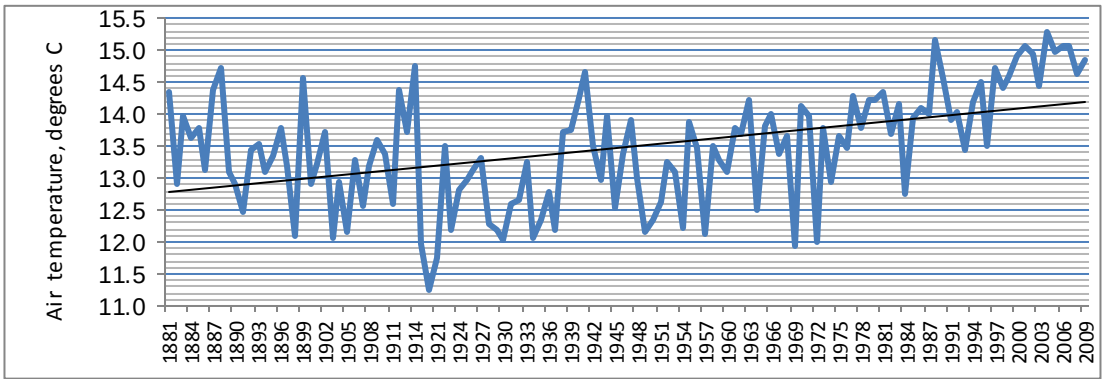
Source: UNEP, 2008. The Second National Communication of Uzbekistan on FCCC, Tashkent

The retrospective analysis of the air temperature changes completed by EA consultants showed some temperature rise in the desert and foothill areas of Fergana Valley by 0.5 – 1.7^{0}C for the period of observations according to the data from weather stations Fergana, Andijan and Namangan. The sharp rise in temperature has been observed since the beginning of the 50s of the last century, as evidenced by the trend line of the mean annual air temperature curve as per Fergana weather station for the two periods of observations - 1881-2010 and 1950-2010 (Figure 5.10).

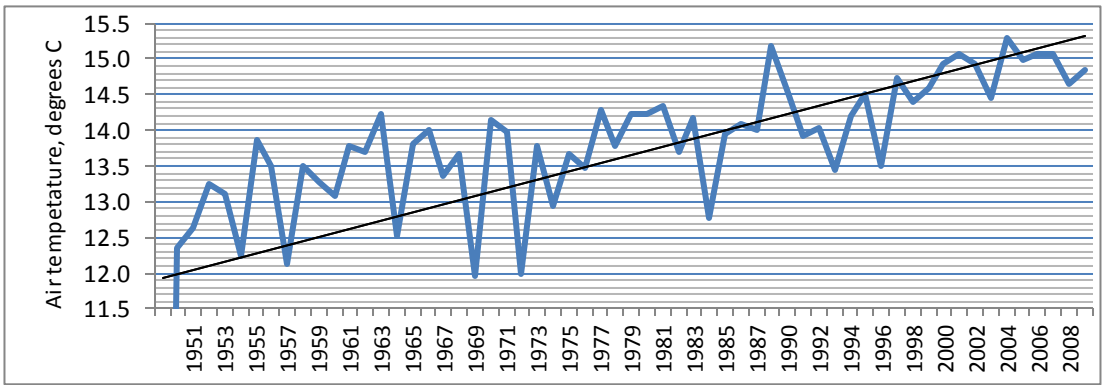
Similar trends were obtained by EA consultants from the foothill Namangan weather station (889 m above sea level). From 1933 to 2010 the average increase in annual temperature was 0.065^{0}C each 10 years, and from 1950 to 2010 – 0.15^{0}C.

Figure 5.10. Trend of air temperature changes by period of observations:

a) 1881-2010



b) 1950-2010



Source: Analysis of EA consultants according to Uzhydromet

Precipitation Trends

According to the Hydro-meteorological Service [1, 22] in the Republic of Uzbekistan some slight increase in annual precipitation rate is observed. The EA consultants assessed the changes in annual precipitation rates using the data from Fergana, Namangan and Andijan weather stations for the period of 1950-2010, that demonstrated a slight increase in rainfall rates in the plain part of Fergana and absence of any trend in the foothill area (Namangan, Andijan) (Annex 5). Some changes in rainfall patterns were more concerned about anomalous phenomena (rainfalls, number of days with heavy precipitation provoking natural catastrophic events such as mudflows and landslides.

5.2. Podshaota-Chodak Irrigation System

5.2.1. Physical resources

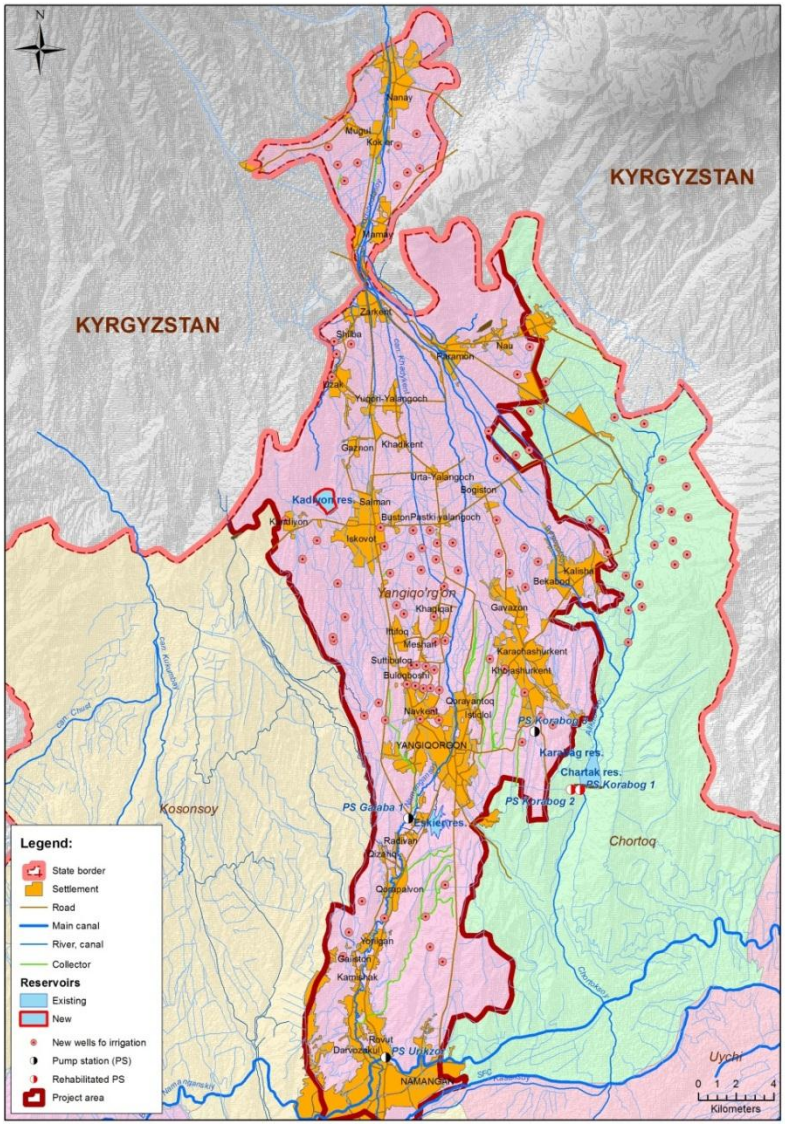
Location

Podshaota-Chodak system is located in the northeast of Fergana Valley, on the right bank of the Syrdarya River. The project area borders with Kyrgyz Republic on the north, with Kasan sai district on the west and Chartak district of Namangan region on the east, and is confined with the Big Namangan Canal on the south. Administratively, these are the lands of Yangikurgan and partly Chartak districts of Namangan region. The project area is shown on the Figure 5.11.

Climate

The territory of Podshaota Irrigation System is characterized with arid and extremely continental climate. Some differences can be observed depending on height point: in the upper basin, the temperature is slightly below and the frost-free period is shorter while precipitation is greater than in the lower part.

Figure 5.11. Sub-project zone in Phodshoota-Chodak system



The average monthly air temperature in summer ranges between 25.5-27.7^{0}C, the average temperature in the coldest month (January) is -0.2^{0}C. Moisture in the form of rainfall is 196 mm/year, evaporation is 1170 mm/year. Precipitation falls unevenly throughout the year (84% in IX-IV months). The relative humidity varies from 74-83% in winter to 49-56% in summer (Table 5.4).

Table 5.4. Climatic data of Namangan weather station

Data	Av. annual	Months											
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Air temperature,^{o}C	14.3	-0.2	2.4	8.5	16.2	21.4	26.3	27.7	25.5	20.6	13.8	7.3	1.5
Relative humidity,%	64	80	74	68	59	53	56	49	54	57	62	73	83
Precipitation, mm	196	18	27	28	24	20	12	4	2	3	14	21	24
Evaporation, mm	1170	16	25	56	106	156	185	202	175	127	74	33	16

Source: Uzhydromet, 2013

The retrospective analysis provided by the EA team based on Namangan station data, shows the temperature rise by 0.5^{0}C for the period of observations from 1935 to 2010. More intense temperature rise began in 1951. During this period, the average annual temperature has increased by 0.9^{0}C. However, no trend of change in average annual precipitation was found for the period of available observation.

The number of days with temperatures below -15^{0}C reduced in the mountain areas by 28-48% for the period of 1978-2007, as compared to 1951-1980. The number of days with high temperatures (above + 40^{0}C) also increased in the foothills by 10-12%.

Geology and hydrology

The project system is located within the foothill erosion-accumulating plain and ridge-undulating plain of the foothills. Lowland (beyond *Adyr*) sloping plains and mountain slopes occupy rather small area.

The piedmont part of the river basin is composed of sedimentary rocks of Mesozoic and Cenozoic period (conglomerates, sandstones, limestones, clays, siltstones). On the plains they are buried under a thick layer of Quaternary sediments represented with alluvial-proluvial formations of the modern alluvial cones and loess sediments on the upper tier terraces. Quaternary sediments (gravel, crushed stone, sand, loam, sandy loam, rare clays) make up the plains and fill intermountain and inter-*Adyr* depressions. The granulometric distribution of the sediments varies in the direction from the mountains to the plain, becoming more fine-grained. Thickness of these deposits is increasing in the same direction from a few meters near the mountains up to 300 m in the depressions. As for hydrogeology, this area is classified as zone 2 (Annex 5), characterized with natural inflow and outflow of groundwater, and in part- to the zone of intensive external inflow of fresh water and slightly saline groundwater.

Soils

The project area attributes to the seirozem formation conditions. The soil cover is represented with a group of automorphic soils – light, typical and partly dark sierozem that have developed without GW effects. Semi-hydromorphic and hydromorphic soils - meadow and meadow-sierozem with the GW depth of 2-3 m and 1-2 m, occupy small areas.

The soils are composed of medium and heavy loams. Soil plots with small thickness on steep slopes are confined to the non-irrigated part of the project area. Soils are subject to water erosion, washed out to low and medium extent. The potential soil fertility is 80-90 points; the existing fertility has dropped down to 54-55 points due to erosion, low humus content and nutrients, and partly due to soil compaction, poor crop management.

5.2.2. Water Resources

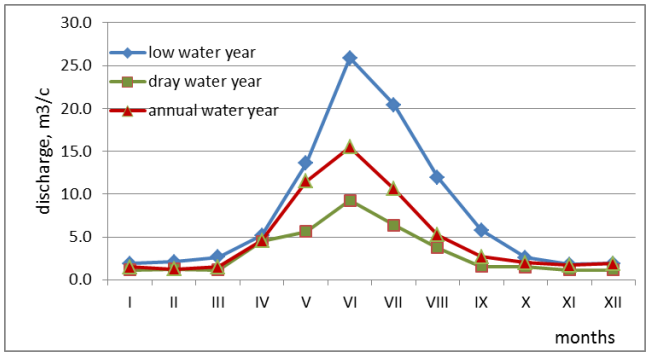
Surface water resources

Water resources of the system are presented with the flow of the transboundary Podshaota River and its tributaries. Water supply source origins from meltwater from glaciers and snow from in Chatkal ridge mountains, and numerous streams. In Zarkent area, the river flows out of the mountains and is divided into a number of small rivers comprising a cone - Namangansai, Chartaksai, Begovatsai and other smaller rivers. The length of the river is 130 km and its catchment area is 443 km^2. Currently, the entire flow is used for irrigation so the river does not reach the Syrdarya bed.

According to the stage gauge data at the confluence of the Tostu River, the average annual river flow is 196,680,000 m^3/year; the flow is subject to significant fluctuations both during the year (80% of the flow comes in April-September) and in various years depending on water availability. For example, in June 1975 the flow rate was 9.08 m^3/sec, and in 1968 - 26.30 m^3/sec.

The highest flow rate (16.1 m^3/sec) was observed in June, and during water abundant year (1968) in the same month it amounted to 26.3 m^3/sec. In February, there was a minimal flow rate (Figure 5.12). The flow peak occurs 1.5-2 months earlier than the maximum water demand for crop irrigation.

Figure 5.12. Podshaota River discharge hydrograph during years with various water availability



The historical trend of the Podshaotasai River flow can be found in Annex 5.

The lands of Yangikurgan and Chartak districts of Namangan region of Uzbekistan are irrigated from the river, as well as the lands in Kyrgyz Republic. In accordance with the water abstraction procedure established in 1980, Kyrgyz Republic can use 36% of the river flow, while Uzbekistan - 64%. However, despite the Agreement, in dry years Kyrgyz Republic satisfies their needs in full, and Uzbekistan receives the remaining water. Currently, Kyrgyz Republic is building an irrigation canal to bypass Uzbekistan that will lead to the higher water scarcity in the lower part of Uzbek basin even in water-abundant years. In such circumstances, (especially in view of climate change) it becomes problematic to supply water in the required volumes, and growing the guaranteed agricultural production turns to be a challenge.

A comparison of the available water resources versus water demand and actual water intake illustrates the low water availability of lands and significant water deficit in summer period - July-September.

Reservoirs

The river flow in the Podshaota River Basin is regulated with reservoirs and debris basins that due to winter rainfall and mudflows accumulate 65.1 million m^3 of water (Table 5.5).

Table 5.5. Water reservoirs and debris basins in the Podshaota River Basin

No.	Reservoir	Capacity, million m^3	No.	Debris basin	Capacity, million m^3
1	Zarkent	12.5	1	Ulanbulok	1.5
2	Chartak	23.0	2	Kandiyon	2.3
3	Eskier	18.5	3	Kizsai	2.3
4	Karamurut	1.0			

Source: Analysis of EA consultants according to Uzhydromet

Underground water

Groundwater of Quaternary deposits have the great practical importance for irrigation of the agricultural fields. The volume of groundwater together with springs is about 26.63 million m^3 (2008-2012), which satisfies water demand for 20%.

Water deficit

Water deficit varies depending on water availability of a year while significantly increasing in dry years. The significant share of water shortage is observed in summer period (June-August). Due to the overall water deficit, BAIS sets water limits as per projected water sources every year. Table 5.6 shows the water demand for irrigation and the established limits of available water resources.

Table 5.6. Average annual water demand and water limits (2007-2011), million m^3

	Demand, million m^3	Limit, million m^3	Deficit, %
Podshaota-Chodak	182.43	94.13	48

Source: FS FWRMP-II, 2014

Thus, due to cutdown of the demand for irrigation, BAIS allocated for irrigation 52% of the required volume only in 2007-2011.

Water Resources Transferred from Other Basins

To cover the water deficit, water is pumped into the Podshaota basin from the other basins, particularly from the Naryn River by the Big Namangan Canal (BNC). At the moment, they irrigate with pumping from BNC almost 50% of the irrigated lands (9,095 ha) in Chartak district and around 4% of the irrigated lands (4,100 ha) in Yangikurgan district, that is the average water volume makes 19.89 million m^3 (2008-2012 data) comprising 15% of the total demand for irrigation.

Irrigation infrastructure

A well-developed infrastructure of irrigation canals is in place to deliver water to the consumers. Currently, 30 inter-farm canals and 739 waterworks are operated. The total length of the inter-farm canal network is 338.4 km (including 174 km of them are lined canals) and of on-farm canal network - 540.4 km (including 0.5 km of lined canals). Some part of the lands (downstream Zarkent waterworks) are irrigated by small canals from the river bed directly, and upstream Zarkent waterworks - by irrigation canals: Hadikent, Karan, Yon, Gaznon, Uzak and their branches (Picture 5.1).

Many long length canals are in poor condition and require restoration of concrete lining, bank stabilization or cleaning from sediments (Picture 5.1). As a result of their long-term operation and lack of maintenance, the network carrying capacity is 50-55 %.

Picture 5.1. Canal status a) Yon, b) Kichik, c) Karan, d) Gaznon *(picture of EA consultants*)

a)  b)  c)  d) 

The pumping stations of Yangikurgan district (18) and Chartak district (11) pump water from canals and reservoirs to the irrigation system to irrigate the upper plots of 10,460 ha located in the project area. The pumping equipment of many pumping stations has outgone its service life and their performance is 45-55%.

To meet the water demand, a network of vertical drainage wells is used for irrigation. More than 150 wells over 100 meters deep are operated in Yangikurgan district along. As a rule, the wells are used during the most intensive vegetation period to compensate the lack of surface water resources. In dry years, water supply from wells is significantly higher.

Mudflow canals and Kandiyon debris basin

The system includes 5 mudflow canals (Podshaotasai, Bekabadsai, Bulokbashisai, Iskovatsai and Namangansai). Their water intakes do not actually require engineering-type or reconstruction. Due to passage of mudflows, the bottoms and banks of the most canals are hollowed-out. The Kandiyon debris basin requires reconstruction as its bowl is already silted to the mark of 487.25 m.

Drainage

The irrigated lands are located in the natural groundwater drainage area and do not require any artificial drainage. The drainage water is discharged from the irrigated fields by a system of inter-farm drains 178 km long. The entire drainage water is discharged to the surface waters thus replenishing the surface flow of the rivers and after being diluted with the river water is reused for irrigation. The drainage water salinity rate is 1.08-1.16 g/l (Table 5.7).

Table 5.7. Volume, salinity and drainage flow discharge

District	Drainage flow volume, million m^3	Incl., (million m^3)		Drainage flow salinity rate g/l	Drainage flow discharge, million m^3		
		From wells	From drainage flow		To surface watercourses	To irrigation	Outside irrigation contour
Podshaota-Chodak							
Chartak	70.62		70.62	1.08	70.62		
Yangikurgan	17.99	1.57	16.42	1.16	17.99		

Source: reports of Naryn-Syrdarya ISA, 2013

Water table and soil salinity

The groundwater table is deeper than 3 m on the prevailing area, in some other parts the groundwater table is at the level of 1-2 m (1.4%). The groundwater salinity is generally below 1 g/l (fresh groundwater). Soil salinity is virtually zero throughout the sub-project area owing to the natural specifics and soil non-susceptibility to salinization. The low salinity area of the irrigated lands is 0.5-0.8% (Annex 5).

Surface Water Protected Areas

There are no Protected Areas on surface waters in the project Podshaota system.

5.2.3. Land Resources and Land Use

The total sub-project area covers nearly 33,300 hectares, of which 80.7% is managed by 782 farms, with the average farm plot size 34.34 ha, while 46,638 dekhkan farms cultivate 19.3% of the area. The average dekhkan plot size is 0.14 ha.

The total crop area is 29,506 ha. In general, the crop density in the sub-project area is 88.7% (Table 5.8 and Figure 5.13).

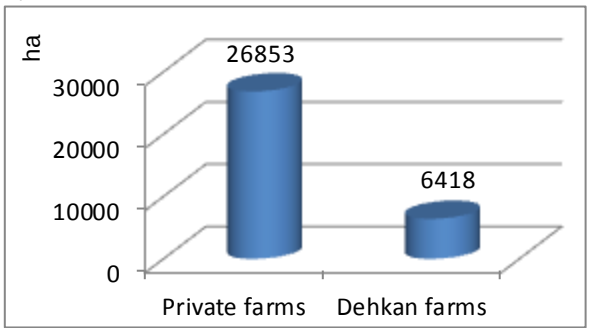
Table 5.8. Farming pattern in Podshaota-Chodak sub-project

Name	Unit	Farm type		Total
		Farms	Dekhkan farms	
Total service area	Ha	26,853	6,418	33,271
	%	80.7	19.3	100
Number of farms	pcs.	782	46,638	47,420
	%	1.7	98.3	100
Average farm size	Ha	34.34	0.14	0.70
Total crop area	ha	23,872	5,634	29,506
	%	80.9	19.1	100
Crop density	%	88.9	87.8	88.7

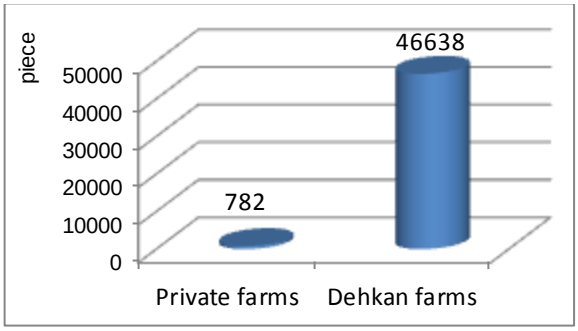
Source: Analysis of EA consultants according to FS FWRMP-II, 2014

Figure 5.13. Land use structure: (a) area and (b) number of farms

a) area



b) number

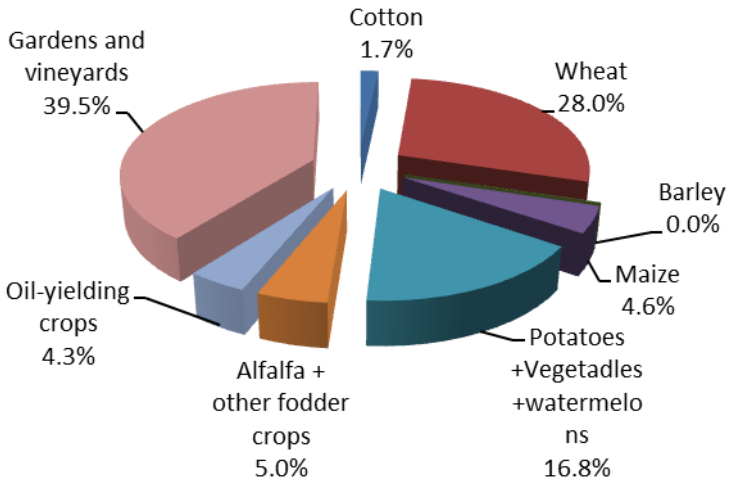


Source: Analysis of EA consultants according to FS FWRMP-II, 2014

As it can be seen in the Figure 4.13, the dekhkan farms are most numerous however they own 1/5 of the total land only.

Orchards and vineyards are the dominating crops in the land use structure (39.5%), winter wheat (28%), vegetables, melons and potatoes (16.8%) (Figure 5.14).

Figure 5.14. Crop pattern on irrigated lands of the Podshaota-Chodak sub-project



Source: Analysis of EA consultants according to FS FWRMP-II, 2014

The crop pattern in farms and dekhkan farms is quite different - dekhkan farms do not grow cotton and allocate more areas for food crops (orchards, vineyards, vegetables, potatoes).

Agrochemicals

The overall trend of declining use of chemicals - pesticides, herbicides and fertilizers in agriculture is attributable for the sub-project area as well. It may only be a problem of soil contamination with some residual agricultural chemicals. Annex 5 provides details of the rates of mineral fertilizers and pesticides used to control pests and diseases on agricultural crops in the project area.

5.2.4. Biological Resources

Flora and fauna

Ground vegetation is represented by cultivated species grown on the irrigated lands of farmers and dekhkan farms. These are annual crops - vegetables, melons, wheat, cotton and perennial plantations - vineyards, fruit and ornamental species and bushes. On the Chatkal range slopes, where the Podshaota River springs form, plantations of walnut, apple, cherry plum, and pistachio are widespread.

Wolves, foxes, and hares inhabit *Adyrs* and foothills. Small ruminants, cattle, poultry are common livestock.

Protected Areas of Environmental Importance

There are no Protected Environmental Areas in the project area.

5.2.5. Social Resources

Affected population and farms. The project area is a home for 235 139 people, 31.7% of them live in the rural areas. The population is mostly engaged in irrigated agriculture and livestock management More detailed information is provided in the Social Impact Assessment Report dated 16 February 2016 [37] .

5.3. Isfayram-Shakhimardan Irrigation System

5.3.1. Physical Resources

Location

The Isfayram-Shakhimardan Irrigation system occupies the southern part of the valley on the right bank of the Syrdarya River. The Kyrgyz Republic is to the south of the project area, Sokh-Oktepa ISA is in the west and Shakhrikhansai ISA in the east. The project area covers the south part Isfayram-Shakhimardan ISA. Administratively, it includes Fergana and Kuvasai districts, partly Quva, Altyaryk and Tashlak districts of Fergana region. The project area is shown on the map (Figure 5.15).

Climate

The project area is characterized with extreme continental arid climate with hot summers and mild winters. The average coldest month temperature (January) is around -2.5°C; the average temperature in July is about +27°C (the absolute maximum is +46°C). The average annual precipitation rate is around 180 mm of rainfall with evaporation of 1092 mm. The most humid period is from November to May, when 70-80% of annual precipitation falls out. The average annual wind speed varies in the range of 1.5-2.6 m/sec (the maximum speed is 35-40 m/sec). Both the frost-free period (220-230 days) and sum of positive temperatures (4,500-4,700°C) create good conditions for the growth of many heat-loving crops, however the crops require irrigation due natural moisture deficit. The key climate indicators of Fergana weather station are shown in Table 5.9.

Figure 5.15. Isfayramsai-Shakhimardan sub-project area

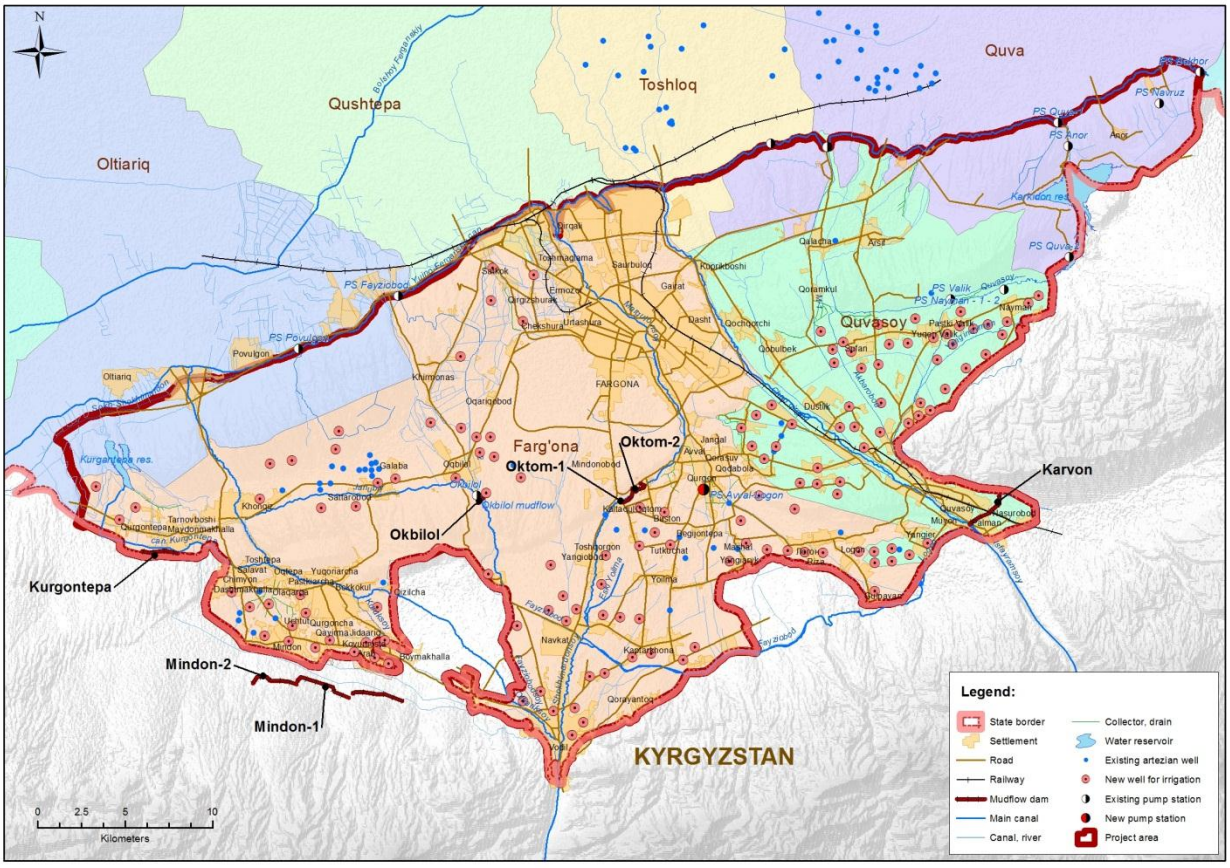


Table 5.9. Climate data of Fergana weather station

	Av. annual	Months											
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Air temperature, ^{o}C	12.4	-2.4	0.8	7.7	15.5	20.6	25.0	26.9	25.2	19.8	12.7	5.6	0.4
Relative air humidity,%	63	81	79	70	59	52	44	45	51	56	66	75	81
Precipitation, mm	182	19	23	30	20	17	9	5	2	3	13	22	19
Evaporation, mm	1092	15	23	52	97	149	182	189	164	111	67	30	15

Source: Uzhydromet, 2013

Climate change. The climate of this sub-project area is changing in the direction of warming as common for the whole Fergana Valley. The number of days with temperatures below -15^{0}C reduced in the mountain areas by 28-48% for the period of 1978-2007 as compared to 1951-1980. The number of days with high temperatures (above + 40^{0}C) also increased in the foothills by 10-12%.

The retrospective analysis completed by the EA team based on Fergana station data, shows that temperature rise by 1.4^{0}C for the period of observations from 1891 to 2010. More intense temperature rise began in 1951. During this period, the average annual temperature has been increasing by 0.57^{0}C every decade. However, the trend of change in average annual precipitation rate was found as quite insignificant and upwards.

Geomorphology and hydrology

Isfayram-Shakhimardan project system is located within the foothill erosion-accumulating and ridge-undulating plain of the foothills. The geomorphological structure represents a surface of combined alluvial cones of the Isfayramsai and Shakhimardan Rivers complicated with tectonic uplifts elongated from north to east and separated with depressions (Chimyon-Avval, Yarmazar, Kuvasai depressions). The geological structure includes a thick layer of Quaternary sediments composed of the upper and middle parts of the modern alluvial cone, as well as the periphery cones of South Fergana rivers, which cover Mesozoic and Cenozoic sedimentary rocks (conglomerates, sandstones, limestones, clays, siltstones). The entire project area is composed of the upper Quaternary sediments of Golodnaya Step complex. The sediments in depressions are buried under sandy-loamy deposits of 0.3 to 11 m capacity. The total thickness of sediments of Golodnaya Step complex is more than 100 m.

As for hydrogeology, the area is classified as zone 7 (Annex 5) with steep slopes and chacterized by the natural conditions for groundwater inflow and outflow, and do not require artificial drainage. Small areas on the bottoms of narrows are located in the zone of intensive and hindered fresh groundwater inflow and outflow (a thinning zone). The groundwater recharge is ensured from irrigation water inflow seepage, groundwater cross flow and thinning from the upstream irrigated lands.

Soils

The project area is located in a desert and transition zone from the desert to sierozem belt, and in the sierozem belt (light and partly typical sierozem). The desert area is formed of grey-brown, somewhere skeletal, medium and shallow soils underlain with gravel of 0.2-0.5 m and 0.5-1.0 m deep, with very poor composition of nutrients and humus. The gray-brown and gray-desert soils are formed in the transition zone from the desert to sierozem belt. In the area of groundwater thinning, the soils are meadow, meadow-gray, strong, medium and shallow underlain with gravel of varying depths.

Due to natural conditions the soils of project area are not subject to salinity, irrigation erosion and are slightly washed-off.

5.3.2. Water Resources

Surface water resources

The flow of the Isfayramsai and Shakhimardan Rivers is the main source of water for this system. The pumped groundwater and drainage water supplement the system water resources. To increase water supply, they pump water with pumping stations from other basins.

Both the Isfayramsai and Shakhimardan Rivers is Transboundary Rivers which originate in the Kyrgyz Republic and flow into the Syrdarya River. The annual river flow and seasonal trends are summarized below (Table 5.10), historical trends are given in Annex 5.

Table 5.10. Annual flow and flow rate of Isfayramsai and Shakhimardan Rivers

20-year data	Apr-Sept flow, % of annual	Annual flow (million m^3)			Annual flow (m^3/sec)			Trend (m^3/sec)	
		Max	Min	Ave-rage	Max	Min	Ave-rage	Summer (Apr-Sept)	Winter (Oct-Mar)
Isfayramsai	70%	866.7	491.6	647.41	48.2	9.98	20.46	-2.82	-0.09
Shakhimardan	65%	370.3	241.0	299.28	19.45	4.93	9.46	-1.34	-0.09

Source: State water cadastre. Annual data on surface water mode and resources of earth. T.IV. Uzbekistan. Uzhydromet

The main part of the Isfayramsai and Shakhimardan river flow comes in the growing season - April-September (70% and 65%, respectively). In water-abundant years, the average annual flow is 20-30% above the average annual flow, and in dry years it is proportionally lower as regards to the norm.

Water Resources Transferred from Other Basins

To cover water deficit in the Isfayramsai-Shakhimardan system, water is pumped from Andijan reservoir by the South Fergana Canal in the volume of around 134.2 million m^3 (2008-2012) to irrigate the lands of Kuvasai, Quva, Altyaryk, Tashlak and Fergana districts.

Underground water

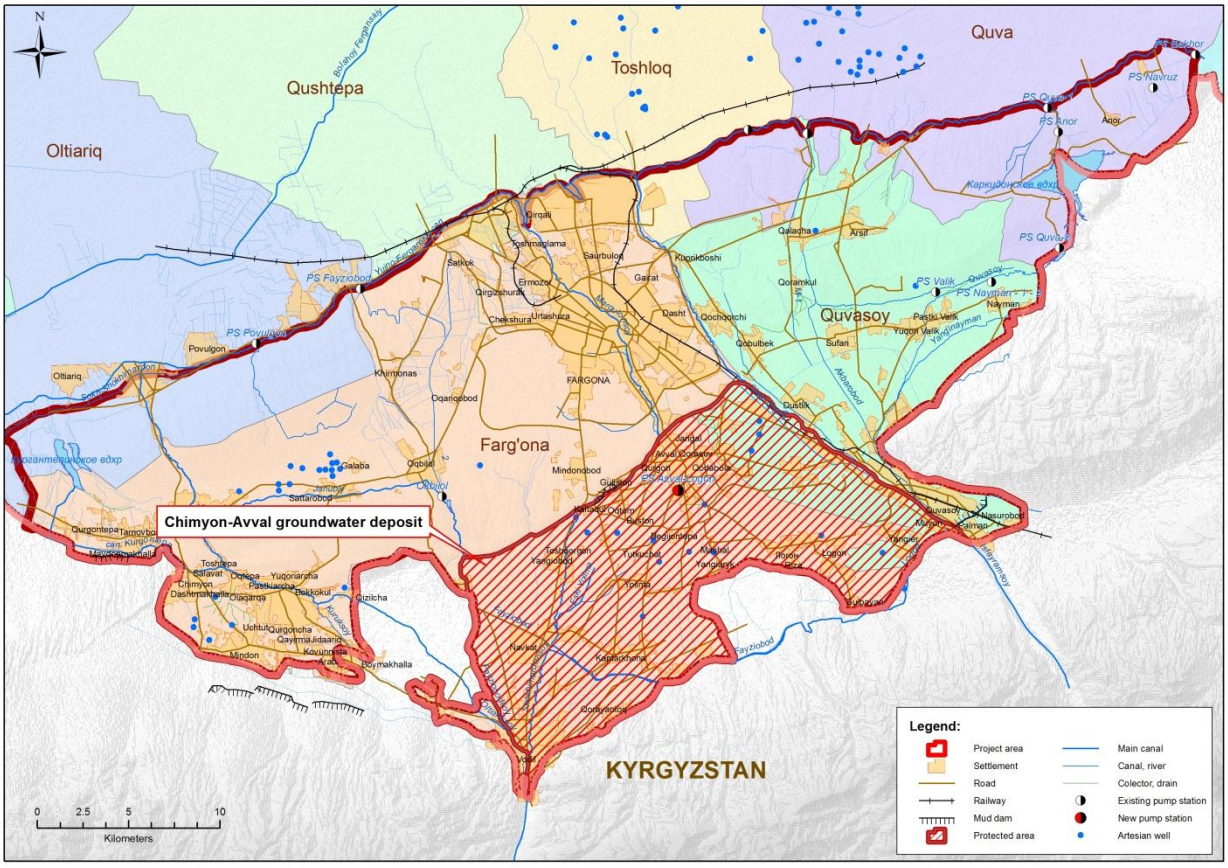
Chimyon-Avval groundwater deposit located in the sub-project area is formed within Chimyon-Avval depression and confined to the Quaternary deposit thickness at the alluvial cone of the Isfaramsai, Shakhimardan rivers and temporary streams like Khodzhagair, Khalilsai and others (Figure 5.16).

The average available reserves of this deposit constitute 1,266.0 thousand m^3/day (14.3 m^3/sec). As of 01.01.05, the available reserves were approved by industrial category in the volume of 827.8 thousand m^3/day. Water quality of underground deposits below 100-130 meters deep (518.4 thousand m^3/day, 6.0 m^3/sec), correspond to the State Standard (GOST) "Drinking Water" with dissolved solids of 0.35 g/l and total hardness 6.0-7.5 mg/eq/l. The hardness of upper horizons 100 m deep is higher. With the overall capacity of the reserve being 1,266.0 thousand m^3/day, and the recharge rate being 1,250.0 thousand m^3/day, the expected consumption for the project purposes, including new irrigation wells, will constitute 1,165.0 thousand m^3/day, which is 93,2% of the replenishment, and 92,0% of the overall reserve volume.

The groundwater regime is seasonal and formed under the influence of long-term hydrological river regime and their runoff redistribution from the irrigation network. The maximum groundwater level is recorded in July and August and the minimum - in February and March in the area of groundwater formation (in Chimyon-Avval depression). The amplitude of fluctuations in the multi-section reaches about 5 m. In the transit zone of groundwater deposit (Yarmazar depression) the groundwater level is the highest in December-February, and the lowest in June-August. The amplitude of fluctuations is from 0.8 to 2.5 m. In the area of groundwater discharge, at the merged alluvial cones, the maximum level occurs in August and September, the minimum - in December-February. The amplitude of fluctuations is 0.4-1.9 m.

According to Isfayram-Shakhimardan ISA, the groundwater volume (including spring water) used in the project area averages to 59.4 million m^3 (2008-2012).

Figure 5.16. Chimyon-Avval groundwater deposit



Protected surface water areas

The groundwater formation deposit Chimyon-Avval is located in the project area and has status of protected natural area of national importance (RCM No. 302 dated 2002).

Water deficit

Due to water deficit, BAIS sets the water limits annually that means they regulate capacities of water sources, respectively. Table 5.11 shows the water demand for irrigation and the established limits of available water resources to irrigate lands of Isfayram-Shakhimardan system.

Table 5.11. Average annual water demand and water limits (2007-2011), million m^3

	Water demand, million m^3	Limit, million m^3	Water deficit, %
Isfayram-Shakhimardan	737.07	473.3	36

Source: FS FWRMP-II, 2014

Thus, due to cutdown of the demand for irrigation, the system is allocated 64% of the required volume only, so the water deficit is 36%.

Irrigation infrastructure

The project areas are irrigated with a system of inter-farm canals having a total length of 370.4 km, of which 169.5 km are lined canals, 45 km are concrete irrigation flumes and 201.1 km of canals is unlined. The total length of the canals in poor technical condition is 242.1 km, including 113.7 km of lined canals, 29.31 km of flumes and 105 km of unlined canals. In addition, water intake facilities of some canals are located in Kyrgyz Republic that makes it difficult to use them.

The network of on-farm canals is the weakest link in the irrigation system, where water losses reach up to 70% of the total loss volume. The on-farm irrigation network has all the typical problems of semi-engineering systems (unlined earthen bed, poorly equipped waterworks, existing structures, poor O&M) – resulting in high water losses.

Mudflow protecting dams

There are 6 mudflow protecting dams – debris basins in the project area, the main purpose of which is to protect the lands from floods during mudflows. They are operated just partially since they have been destroyed due to natural factors and human activities. Their purpose and length are shown in Table 5.12.

Table 5.12. Debris basins in project area

Debris basins	Length, km	Dam purpose
Oktom-I, Oktom-II	2.2	Protects Fergana city
Okbilol	0.3	Protects the adjoining areas and irrigation network from mudflows
Karvon	3.0	
Mindon-I, Mindon-II	2.8	Protects the Arabtepa canal

Source: FS FWRMP-II, 2014

Pump stations

There are 22 pumping stations (PS) in the project area that provide water for 18,306 hectares of irrigated lands. The largest of these is the Isfayram-Shakhimardan PS with capacity of 4.0 m^3/sec, which serves 5,000 hectares pumping water to a height of 180 m. The pumping stations were built in the period of 1970-1994 and their expired service life has more than negative effect on the functional reliability of pumps and related equipment.

Irrigation wells

Irrigation wells, which are commonly used during the most intensive vegetation periods due to lack of surface water sources, are the important component of Isfayram-Shakhimardan system. Water supply from wells increases significantly in dry years. New irrigation wells will be replenished from the groundwater deposits located in the project area. The total average ground water reserves constitute 1,266.0 thousand m^3/day, with the average replenishment rate being 1,250.0 thousand m^3/day. Project consumption of 0.98 thousand m^3/day is 77.4% of the overall reserves and 78.4% of the average recharge. The detailed water balance is presented in Annex 5, Table P5.5

According to ISA data, 303 wells built in 1971-1991 are in poor condition, including 222 wells in Fergana district, 67 wells in Kuvasai district and 14 wells Altyaryk district.

Drainage

The predominant part of lands has a natural groundwater outflow and does not require any drainage activities. The drainage of excess GW accumulated on the narrow bottoms is performed with the help of water collection and drainage network. The drainage water collected from the sub-project districts is discharged into rivers and used for irrigation within the contour. The drainage flow salinity from the irrigated fields is within 1 g/l that allows to classify this water as fresh (Table 5.13).

Table 5.13. Drainage water volume, salinity and discharge

District	Drainage volume, million m^3	Incl., (million m^3)		Drainage flow salinity rate g/l	Drainage flow discharge, million m^3		
		From wells	From drainage flow		To surface watercourses	To surface watercourses	Outside irrigation contour
Isfayram-Shakhimardan							
Kuvasai	8.21	8.21		-	-	8.21	-
Quva	235.61	35.91	199.7	0.94	221.51	14.1	-
Altyaryk	140.63	18.58	122.1	1.0	130.03	10.6	-

District	Drainage volume, million m^3	Incl., (million m^3)		Drainage flow salinity rate g/l	Drainage flow discharge, million m^3		
		From wells	From drainage flow		To surface watercourses	To surface watercourses	Outside irrigation contour
Tashlak	161.05	16.33	144.7	1.0	157.55	3.5	-
Fergana	9.28	9.28	-	-	-	9.28	

Source: Report of Syrdarya-Sokh ISA, 2013

Water table and soil salinity

The groundwater table is deeper than 2-3 m on the prevailing area, in some other parts, the groundwater table is at the level of 1-2 m (7-8%). The groundwater is fresh and slightly saline with salinity rate within 0-1 g/l and 1-3 g/l. Soil salinity is virtually zero throughout the sub-project area owing to the natural specifics. The low salinity area comprises 1-2% (Annex 5).

5.3.3. Land Resources and Land Use

The total sub-project area covers approximately 63,300 hectares. All in all, 1,647 farms with the average farm size of 32.2 hectares cultivate 5,2958 ha (83.7% of the area). The remainder land (16.3%) is used by dekhkan farms accounting for 99,622 ones. Thus, the dekhkan farms are most numerous with their land plot size around 0.1 ha. The total sub-project cropland area is about 54,400 ha; the crop intensity is 85.9% (Table 5.14).

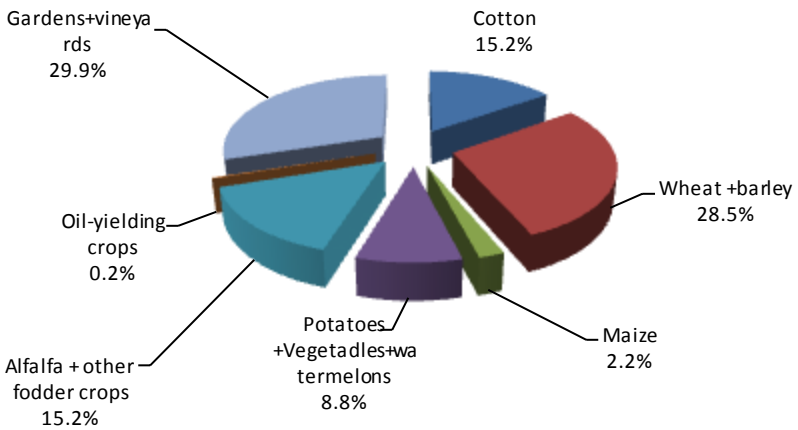
Orchards and vineyards (29.9%) are dominating in the irrigated areas followed with wheat (28.5%), cotton (15.2%), alfalfa and feed crops (15.2%). Dekhkan farms do not grow cotton and allocate more areas for potatoes, vegetables, melons and grain maize. The crop pattern of the irrigated lands in Isfayram-Shakhimardan sub-project is shown in Figure 5.17.

Table 5.14. Farming pattern in Isfayram-Shakhimardan sub-project

Name	Unit	Farm type		Total
		Farms	Dekhkan farms	
Total service area	ha	52,958	10,322	63,280
	%	83.7	16.3	100.0
Number of farms	pcs.	1,647	99,622	101,269
	%	1.63	98.3	100.0
Average farm size	ha	32.2	0.10	0.62
Total crop area	ha	46,390	7,995	54,375
	%	85.3	14.7	100
Crop density	%	87.6	77.5	85.9

Source: Analysis of EA consultants according to FS FWRMP-II, 2014

Figure 5.17. Crop pattern on irrigated lands of the Isfayram-Shakhimardan sub-project



Source: State water cadastre. Annual data on surface water mode and resources of earth. T.IV. Uzbekistan. Uzhydromet

Agrochemicals

The overall trend of declining use of chemicals - pesticides, herbicides and fertilizers in agriculture is attributable for the sub-project area as well. It may only be a problem of soil contamination with some residual agricultural chemicals. Annex 5 provides details of the rates of mineral fertilizers and pesticides used to control pests and diseases on agricultural crops in the project area.

5.3.4. Social Resources

Affected population and farms

The project area is a home for 594 139 people, 24.4 % of them live in the rural areas. The population is mostly engaged in irrigated agriculture and livestock management.

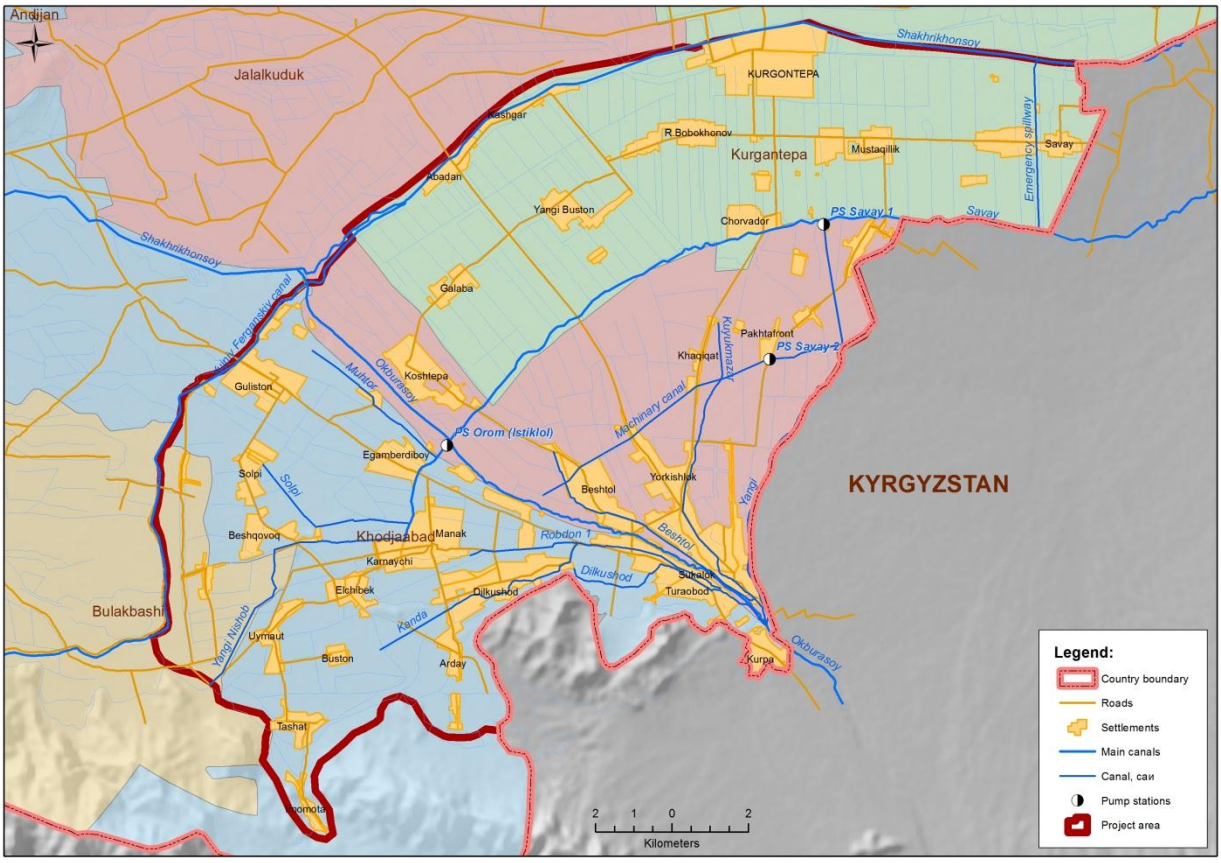
5.4. Savay- Akburasai Irrigation System

5.4.1. Physical Resources

Location

The *Savay- Akburasai* system occupies the south-eastern part of Fergana Valley and is confined with the Shakhrikhansai in the north, borders with Kyrgyz Republic in the south, and with the farms of Andijan region in the west and east. Administratively, it includes some part of Kurgantepa, Zhalakuduk, Khuzhaabad and Bulokbashy districts of Andijan region. The project area map is shown in the Figure 5.18.

Figure 5.18. Sub-project area in Savay- Akburasai Irrigation system



Climate

The area of Savay- Akburasai system is characterized with extreme continental arid climate. Average summer temperatures range within 25.3-27.4^{0}C and maximum average reach 30.3-32.9^{0}C. The air temperature in January - the coldest month of the year is -0.4^{0}C. The total rainfall is 252 mm/year that is 3-4 times below evaporation – 1,039 mm/year. Precipitation falls unevenly throughout the year (84% comes during IX-IV months). The relative humidity varies from 79-88% in winter to 48-57% during summer. The key climate indicators of Andijan weather station are shown in Table 5.15.

Table 5.15. Climate data of Andijan weather station

	Av. annual	Months											
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Air temperature, ^{o}C	13.8	-0.4	1.8	8.3	16	21	25.9	27.4	25.3	20	13	6.8	1.1
Relative air humidity,%	68	87	82	73	62	56	48	51	57	61	68	79	88
Precipitation, mm	252	21	37	34	27	25	11	4	3	4	22	33	32
Evaporation, mm	1039	12	20	47	95	142	175	182	159	111	58	26	13

Source: Uzhydromet, 2013

Climate change

The climate of this sub-project area is changing in the direction of warming as common for the whole Fergana Valley. The number of days with temperatures below -15^{0}C reduced in the mountain areas by 28-48% for the period of 1978-2007 as compared to 1951-1980. The number of days with high temperatures (above +40^{0}C) also increased in the foothills by 10-12%. A retrospective analysis completed by the EA consultants to see changes in the air temperature based on the data from Andijan and Namangan weather stations shows the temperature rise trend by 1.7^{0}C (Andijan) and 0.5^{0}C (Namangan) for the period of observations from 1891 to 2010, respectively.

However, the trend of average annual precipitation change was not confirmed by a series of available observations. Due to global warming there could be such dangerous calamities as mudflows and landslides provoked with the high river network density and steep slopes. By 2030-2050, it is expected that the number of mudflows will increase by 19-24%, and by 2080 - 12-13%.

Geomorphology and hydrology

The system covers the foothill erosion-accumulating and ridge-undulating plains combined with alluvial cones of the Akbura and Aravansai rivers. The geological structure includes Quaternary alluvial-prolluvial sediments of the modern alluvial cones of Tashkent and Golodnaya Step complexes.

As for hydrogeology, the sub-project area is classified as zone 10 (Annex 5). Since the area is mostly mountainous with steep slopes, it has its natural conditions for groundwater outflow thus easing the problem of drainage and soil salinity. Small areas on the bottoms of narrows are located in the zone of intensive fresh groundwater inflow and hindered outflow (a thinning zone). The groundwater recharge is ensured from irrigation water inflow seepage, groundwater cross flow and thinning from the upstream irrigated lands.

Soils

The project area is located in the zone of grey soils, where typical grey soils, as well as complexes of typical grey soils with grey-meadow soils are developed in the areas of groundwater deposits at 2-3 m below the surface. The soil texture is composed of medium and heavy loams, often underlain with gravel of 0.5-1.0 deep. The soils are not saline however subject to water and irrigation erosion and are slightly washed-off in some areas.

5.4.2. Water Resources

Surface water resources

The Savay- Akburasai irrigation system consists of two major mountain rivers – the Akburasai and Aravansai, as well as Savay canal supplied with water from the Andijan reservoir. The entire flow is formed in Kyrgyz Republic. Additional source of water resources for the systems are ensured through groundwater supply from wells, as well as water pumping from other basins with pumping stations.

The annual Akburasai river flow at Tuleken gauging station at 50% water availability is 675 million m^3, with 90% water availability - 543 million m^3. The river flow is regulated with Papan reservoir located on the territory of Kyrgyz Republic. The reservoir is designed for over-year river flow regulation and has useful capacity of 240 million m^3. It was built for development of irrigated agriculture in Kyrgyz Republic and Uzbekistan, and supply water to Osh town. Some unused Akbura river flow is discharged into the Shakhrikhansai canal that flows through a culvert under the Savay canal and SFC.

The Aravansai River should be considered together with the Abshirsai River since the irrigation systems of these rivers are interrelated and connecting. The flow is formed in Kyrgyz Republic. The annual flow at 50% of water availability is 447 million m^3 and at 90% - 354 million m^3. The unused flow is discharged into the Shakhrikhansai canal that flows through a culvert under SFC. The historical trend of Akburasai and Aravansai river flows is given in Annex 5 while Table 5.16 shows the total annual runoff and flow rate for the period of 1963-1997.

Table 5.16. Annual runoff and flow rate of Akburasai and Aravansai Rivers

River	Apr-Sept flow, % of annual	Annual flow (million m^3)			Annual flow (m^3/sec)			Trend (m^3/sec)	
		Max	Min	Ave-rage	Max	Min	Ave-rage	Summer (Apr-Sept)	Winter (Oct-Mar)
Akburasai	75	880.7	446.6	641.00	46.89	7.08	20.24	-2.46	-4.43
Aravansai	60	349.4	153.5	232.75	13.36	5.29	7.37	-4.68	-0.58

Source: State water cadastre. Annual data on surface water mode and resources of earth. T.IV. Uzbekistan. Uzhydromet

Water Deficit

Due to water deficit, BAIS sets the water limits annually depending on capacities of water sources. Thus, due to cutdown of the demand for irrigation, the system is allocated 70% of the required volume only, so the water deficit is 30% (Table 5.17).

Table 5.17. Average annual water demand and water limits (2007-2011), million m^3

	Water demand, million m^3	Limit, million m^3	Water deficit, %
Savay- Akburasai	363.77	254.33	30

Source: FS FWRMP-II, 2014

Water Resources Transferred from Other Basins

To cover the water deficit in Savay- Akburasai system, they transfer water by means of pumping stations from the Andijan reservoir (by the South Fergana Canal - SFC). For this purpose several pumping stations and their cascades were built that lift water from the SFC and distribute it throughout the irrigated lands. To irrigate Kurgantepa, Dzhalalkuduk, Khuzhaabad, Bulokbashy and Marhamat districts of Andijan region, around 41.55 million m^3 of water was pumped from the SFC in 2008-2012.

Irrigation infrastructure

The interstate main Savay canal was built in 1930-1933 with the total length of 55.9 km (28.5 km runs through Kyrgyz Republic). The channel flow rate at the mouth is 20 m^3/sec. Two small mountain rivers: the Taldysoy and Mashrabsoy flow into the canal in Kyrgyz Republic and bring lots of sediments. The

Savay channel crosses the Akburasoy river through a culvert at 46.39 km. Both sides at the culvert were washed out repeatedly with flood waters of the Akburasai river. The canal concrete lining is in poor condition – the lining is destroyed along the entire canal bed; an earthen bed section is in poor condition as well, the cannel sections are severely deformed and silted up, the design parameters are missing (Picture 5.2).

Picture 5.2. a) Savay canal section; b) Bank protection, the Akburasai river

Pumping station

There are 2 pumping stations – Savay PS and Orom PS located in the project area. Having been built in 1970-1975, the pumping stations undergone severe wear out and do not provide the required volume of water for irrigation that negatively affects agricultural productivity. Employment and income rates among farmers from the areas served with these pumping stations are declining.

Drainage

The drainage infrastructure is absent because of the natural groundwater outflow. The lands are not affected by salinity. Some surface discharges from the irrigated fields are collected in drains and discharged into surface waters; the discharged water salinity is 0.55-0.95 g/l so water is classified as fresh, suitable for crop irrigation (Table. 5.18).

Table 5.18. Drainage water volume, salinity and discharge

District	Drainage volume, million m^3	Incl., (million m^3)		Drainage flow salinity rate g/l	Drainage flow discharge, million m^3		
		From wells	From drainage flow		To surface watercourses	For irrigation	Outside irrigation contour
Savay- Akburasai							
Bulokbashy	35.99	1.51	34.48	0.79			35.99
Zhalakuduk	152.58	0.36	152.22	0.70	152.58		
Khuzhaabad	3.72	0.05	3.67	0.86			3.72
Kurgontepa	148.93	1.64	147.29	0.74	136.62	12.31	

Source: report of Naryn-Karadarya ISA, 2013

Water table and soil salinity

The groundwater table is deeper than 2-3 m on the prevailing area, in some other parts, the groundwater table is at the level of 1-2 m (5-10%). The groundwater is fresh and slightly saline with salinity rate within 0-1 g/l and 1-3 g/l. Soil salinity is virtually zero throughout the sub-project area owing to the natural specifics. The low salinity area comprises less than 1% of the irrigated lands (Annex 5).

5.4.3. Land resources and Land Use

The total sub-project area covers approximately 23,400 hectares and is distributed among 32,278 farming entities with the average farm size of 0.73 hectares. Among them, 615 are farms which cultivate 19,913 ha (85.1% of the agricultural lands). The average farm size is 32.4 ha. The rest are dekhkan farms (31,672) and they cultivate 3,500 ha (14.9% of the agricultural area). A dekhkan farm size is 0.11 ha. The total sub-project cropland area is around 19,700 with the crop intensity of 84,3% (Table 5.19).

Table 5.19. Crop pattern of Savay-Akburasai system

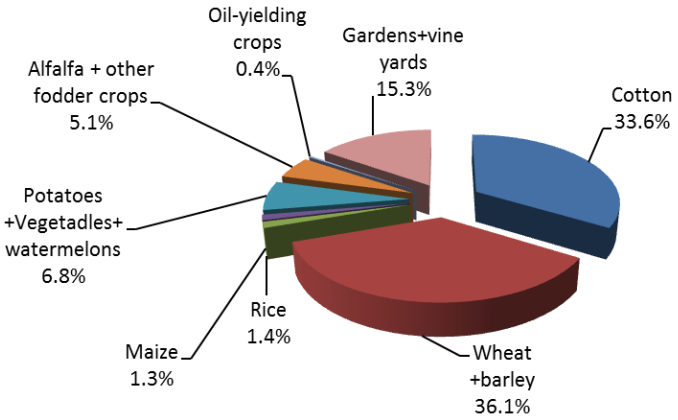
Name	Unit	Farm type		Total
		Farms	Dekhkan farms	
Total service area	ha	19 913	3 498	23 411
	%	85.1	14.9	100.0
Number of farms	Pcs	615	31 672	32 287
	%	1.90	98.1	100
Average farm size	ha	32.4	0.11	0.73
Total crop area	ha	16 580	3 160	19 740
	%	84.0	16.0	100
Crop density	%	83.3	90.3	84.3

Source: FS FWRMP-II, 2014

Farmers mainly grow cotton (33.6%), wheat (36.1%) and orchards/vineyards (15.3%) (Figure 5.19).

Dekhkan farms do not grow cotton, 34.4% of their lands is used for orchards, 31.2% - vegetables and 23.1% - wheat, while the rest area is used for other crops.

Figure 5.19. Crop composition of Savay- Akburasai sub-project



Source: Analysis of EA consultants according to FS FWRMP-II, 2014

Agrochemicals

The overall trend of declining use of chemicals - pesticides, herbicides and fertilizers in agriculture is attributable for the sub-project area as well. It may only be a problem of soil contamination with some residual agricultural chemicals. Annex 5 provides details of the rates of mineral fertilizers and pesticides used to control pests and diseases on agricultural crops in the project districts.

5.4.4. Social resources

Affected population and farms

The project area is a home for 146 526 people, 48.4 % of them live in the rural areas. The population is mostly engaged in irrigated agriculture and livestock management.

6. ASSESSMENT OF ENVIRONMENTAL IMPACTS

This chapter presents the forecast and assessment of possible positive and negative project impacts, identifies mitigation measures to control the negative impacts and indicates the residual impact that will not be eliminated by the proposed measures; it also suggests some case studies on enhancing the environment.

6.1. Impacts by physical intervention type (physical options)

The scopes of selected physical interventions by each sub-project as proposed in the Final Feasibility Report are summarized in Table 6.1, below.

Table 6.1. Physical interventions of three sub-projects

Activities	Total	Incl., by sub-projects		
		Podshaota - Chodak	Isfayram-Shakhimardan	Savay-Akburasai
Reconstruction of main and inter-farms canals (km)	284.1	111.5	78.8	93.8
Reconstruction of structures on inter-farms canals (pcs.)	674	286	99	289
Construction of new wells (pcs.)	243	105	138	0
Modernization of pumping stations (pcs.)	12	9	1	2
Construction of new pumping stations (pcs.)	1	0	1	0
Bank protection (km)	17.9	4.5	0	13.4
Reconstruction of Kandiyon debris basin (million m^3)	3	3	0	0
SCADA system development		-	-	+
Regulated water table replenishment		-	+	-
Drip irrigation		+	+	+
Wells with solar battery pumps		+	+	-

As it can be seen from the Table 6.1, the key interventions are aimed at reducing losses from the canals, improving water distribution and increasing water availability. The most ambitious of them are reconstruction of irrigation canals and their structures, and construction of new irrigation wells.

The environmental impacts expected from all physical and agricultural interventions and mitigation measures are summarized in Table 6.2.

As shown in Table 6.2, the canal rehabilitation (improvement of anti-seepage lining, removal of sediments and overgrown aquatic vegetation) will have a positive environmental impact. It will be manifested in increased water volume and improved access to water, reduced water transportation losses and enhanced water supply to the lands. Construction/rehabilitation of the hydraulic structures (water outlets, gaging devices and others) will have irrigation and production benefits through reduced operational losses of irrigation water, improved water distribution and water use accounting. Further positive impact is expected from the construction of a new irrigation canal in the Podshaotasai system with anti-seepage lining (in the pipeline). It will increase the volume and access to surface water resources, although this impact will be local, but still it will address the problem of water deficit in this part of the project sub-project area.

Modernization of 12 PSs in the three sub-projects and construction of PS in the Isfayram-Shakhimardan system will provide complementary water supply to the upstream areas. Construction of new irrigation wells will complement water delivery by canals up to the tail sections of the irrigation systems and make water sufficient and accessible for the croplands.

Table 6.2. Project environmental impact by activity type

Physical options	Activity type (rehabilitation and/or new construction)	including on sub-Projects			Environmental impact		Mitigation
		Podshaota-Chodak	Isfairam-Shahimardan	Savai-Akburasai	Positive impact	Negative impact	
I. Irrigation Modernization							
1. Irrigation infrastructure							
1. Irrigation canals	New construction	Canal 3 km from tail race of Eskier reservoir	-	-	Increasing of available water resources and reduction of water shortage at the sites	3 ha of agricultural land will be temporarily disturbed over the route of canal being constructed and 27 trees will be cut	Construction safety measures, recovery of tree plants, utilization of wastes, demolished concretes and camlets and metal scraps, watering the soil for reducing the dust, working during the day for avoiding the noise, etc.
	Rehabilitation: a) rehabilitation of membranes, b) rehabilitation of earth channel (km)	115.5	78.8	93.8	A) Decrease in seepage contributes to reduction of overflow and environmental problems B) Raising of canal capacity, provides timeliness of water delivery in required volume and Increasing of available water resources	Temporary and local disruption due to rehabilitation, removal of unauthorized trees and shrubs throughout rehabilitation of earth channel	Utilization of wastes, demolished concretes and canalets and metal scraps, watering the soil for reducing the dust, working during the day for avoiding the noise, etc and rehabilitation safety measures
2. Hydraulic structures on canals	New construc-tion (hydro-posts, water outlets, (nr.)	286	99	289	Indirect impact by raising of water allocation efficiency (reduction of organizational losses water, water record and control)	Temporary and minor local disruption due to executed works	Utilization of wastes, metal scraps, watering the soil for reducing the dust and construction safety measures
Pump stations	Modernization (nr.)	9	1	2	Increasing of available water resources and timely water supply in required quantity	Temporary and minor local disruption due to executed works	Utilization of wastes, metal scraps, watering the soil for reducing the dust, construction and rehabilitation safety measures
	New construction	-	1	-	Increasing of available water resources	Temporary and minor local disruption due to construction	Utilization of wastes, metal scraps, watering the soil for reducing the dust, etc; construction safety measures

Physical options	Activity type (rehabilitation and/or new construction)	including on sub-Projects			Environmental impact		Mitigation
		Podshaota-Chodak	Isfairam-Shahimardan	Savai-Akburasai	Positive impact	Negative impact	
Wells for irrigation	New construction (nr.)	105	138	-	Increasing of available water resources	Reduction of groundwater resources; Temporary and minor local disruption due to construction	Using of groundwater aquifer only with the permission of the State Committee for Nature Protection and subject to the agreement of the Committee of Geology and Mineral Resources
2. Flood control and bank protection							
Strengthening of river bank	Rehabilitation (km)	4.5 (Namangan-sai)	-	13.4 (Akburasai)	Prevention of bank erosion and protection of agricultural land from flood	Minimal impact as works will be conducted during low water when sai transforms into streamlets	Rehabilitation safety measures
Debris basins	Rehabilitation with transfer into reservoir	Kandiyon (3 mln.m^3)	-	-	Increasing of available water resources owing to accumulation of water during mudflow	Temporary and minor local disruption due to executed works Negative impact isn't expected (see section 6.2)	Rehabilitation safety measures Выполнение работ в межень
3. Upgrading of system							
Creation of SCADA system	New construction	-	-	+	Indirect impact on increase in productivity by more efficient water resources management	Temporary and minor local disruption due to executed works	Construction safety measures
Controlled recharge of aquifer	New construction		+		Increasing available water resources owing to recharge of aquifer's excessive winter flow	Risks of violation of conductivity of river basins. Lack of experience and scientific research does not establish quantitative exposure	A specific EIA/EMP to be undertaken by designers, to assess impacts and potential benefits and risks., and determine adequate mitigation measures.

Physical options	Activity type (rehabilitation and/or new construction)	including on sub-Projects			Environmental impact		Mitigation
		Podshaota-Chodak	Isfairam-Shahimardan	Savai-Akburasai	Positive impact	Negative impact	
II. Support of Agriculture Modernization							
Drip irrigation	New construction	+	+	+	Reduction of water losses and water requirement	Temporary and minor local disruption due to construction	Construction safety measures
Wells with solar powered pumps	New construction	+	+	-	Increasing of available water resources owing to abstraction of ground water, saving of energy resources	Temporary and minor local disruption due to construction	Construction safety measures
Cotton harvest mechani-zation	units	+	+	+	Reduction of manual labor; increased intensification/ mechanization and more timely harvesting; improving quality of cotton fiber and farmer benefits	compacting the earth from over use of the machine on the field (esp. wheeled tractors, not the track tractors)	supply and use of appropriate type and size equipment
Bee-keeping (credits)	units	+	+	+	Increase of yields through pollination of flowers	none	none
Growing of vegetable and other food crops (seeds, intensive gardens, etc)		+	+	+	Use of intensive technologies and seeds increases yields per hectare, which reduces cropping area.	water pollution, soil contents in using pesticide; human health hazards and ecological damage due to the use of pesticides	Training in safe pesticide use and handling; introduction of IPM; monitoring of health indicators, and quality of soil and water for the concentration of pesticides; Monitoring impact on pollinator population
Rural business (service)		+	+	+	advice and training on good environmental practices	none	none

The overall ground water deposits are assessed as 17.808,00 thousand m^3/day. Out of this, the overall reserves of the Chimyon-Avval deposit is 1,266.0 thousand m^3/day, and the recharge rate is 1,250.00 thousand m^3/day. The overall project consumption constitutes 0.98 thousand m^3/day. Both overall project consumption, and the consumption specifically from the Chimyon-Avval represent an environmentally sustainable correlation which will not cause any risk to the deposits and to the ground water level. The water balance for the Chimyon-Avval ground water deposits represented in Table P5.5, Annex 5, demonstrates that the replenishment exceed the estimated consumption by 0.85 m^3/day.

Reconstruction of Kandiyon debris basin and its transfer into the reservoir will provide additional water resources through mudflow accumulation and will have a positive impact on the environment through improved water supply and prevention of possible damage from floods and mudslides. The Kandiyon mud/debris basin has been originally created for the purpose of minimizing mud flows and preventi on of related damages which can be caused downstream. Such mudflows occur in spring, in the period of heavy precipitations, and in summer the basin usually dries up. The reconstruction of the Kandiyon basin and its transfer into the water reservoir will provide additional resources of irrigation water, and will not have any adverse downstream impacts, since there are no natural ecosystems downstream which would be dependent on the mudflows.

Bank protection will have a positive environmental impact through preventing the bank erosion of the riverine ecosystems and protection the damage of agricultural crops due to mudflow. The civil works on bank protection/rehabilitation will be conducted in summer time, when the small rivers naturally almost dry up. Thus, there will be no active flow during the implementation of the civil works, sediment transportation downstream is not expected.

In order to enhance reliable water management and improve the quality of irrigation service delivery Component A includes the following measures and studies:

a) Implementation of SCADA technology to measure water flow rate (short-term outputs)

It is proposed to install equipment to monitor water flow rate at all major waterworks of Savay-Akburasai system. The SCADA system should provide: (i) improved operational efficiency providing accurate and timely information on flow rates and water levels; (ii) More rapid reaction on the emerging problems; (iii) timely processing of information allowing to make better operational and strate gic decisions; (iv) control will not depend on junior staff knowledge with respect to satisfactory control level.

b) Technical assistance to MAWR in development of long-term Managed Aquifer Recharge (MAR) Strategy

Large-scale management of water resources in the second half of the XX century and later geopolitical changes which resulted in the emergence of the Independent States in the 90s, significantly altered the hydrology of transboundary rivers and caused debates on the water use in the downstream cou ntries. Studying international experience of other regions of the world (India, Australia, China, the USA) which also faced the problems of water scarcity for irrigation suggests that Managed Aquifer Recharge (MAR) Strategy can be applicable for Fergana Valley (Annex 8).

Given the lack of local experience in Uzbekistan, the International Water Management Institute (IWMI) proposes to implement the phased implementation of MAR in Fergana Valley [7], first piloting it in one of the three project areas, namely Isfairam-Shahimardan project area in the Fergana Region.

Research conducted by IWMI found out that water resource in Fergana Valley available for MAR range from 13 to 17% of the total water inflow to the Valley. As a result of implementing MAR approach in Fergana Valley, more than 500 thousand hectares (55% of the irrigated land area) could be transferred into conjunctive use of surface and groundwater that would reduce the return flow into the river by 30% (1 billion m^3 /year) and generate 500 million m^3 of available water resources in the service area of the main canals. Implementation of MAR and use of groundwater on a large-scale area could reduce the winter Syrdarya River flow at the exit from Fergana Valley by 1.5 billion m^3/year and, therefore, increase the summer flow proportionally. In the small river basins of Fergana Valley, free underground reservoirs

have capacity of more than 3 billion m^3/year. They can be used to store excess runoff of small rivers and reduce the return flow to the Syrdarya [7].

MAR approach is a long-term process, which is proposed to be initiated under this project. During the 6-year period, a broad range of stakeholders will be demonstrated with the opportunities to store the excess surface runoff in the aquifers to be used in summer. A demonstration site will be created within one of the sub-projects while for the other two recommendations will be made on GWR implementation technology.

As for some negative environmental impact of the project interventions, all physical options will be followed with temporary and local disturbances for the communities due to construction and use of access roads, earthworks, concrete and other construction works. However, the negative environmental impact of these activities will be insignificant and can be mitigated through the appropriate precautions described below in Sub-section 6.4 and in Chapter 8.

6.2. Impacts of Sub-project Locations

The Project interventions will largely be undertaken in or around existing irrigation infrastructure and along existing irrigation and drainage network lines (inter-farm canals and structures lines). In most parts of the sub-project areas, a combination of physical interventions and agricultural measures will be applied. Expected main positive and negative impacts of the physical Project interventions per identified hydrogeological zones are presented in Table 6.3. These zones are described below in Annex 5.

For all project zones the positive environmental impacts are mainly increased available water resources and efficiency of irrigation that will result in reduced water losses and irrigation services delivery. For Podshaota and Savay-Akburasai systems the interventions will furthermore increase the available water resources and banks protection of small rivers, which includes both restoring degraded river banks and engineered reinforcement with concrete, with overall length of restored banks being 12 km. The negative environmental impacts are mostly of a temporary and local nature and are due to construction works. It is expected that the negative environmental impacts can mostly be mitigated by appropriate construction safeguards.

As noted above, the downstream area is likely to experience a temporary and minor change of water, resulting from the small-size modernization and rehabilitation works. Although the Project Area is not located directly on a trans-boundary water course, the rivers Podshaota, Isfayramsai, Shahimardan and Akburasai are tributaries of the transboundary Syrdarya river. No significant long-term impact of the Project interventions on the downstream area, or Syrdarya river is expected (see also **Chapter 8**).

The physical infrastructure, such as the irrigation structures, underground wells and pump stations will be constructed and modernized in line with government regulations norms CN&R 3.07.03-97 and CN&R 2 06.01.97. The location of new structures will be selected in such a way that the environmental and social impacts will be minimal. The construction contracts will include environmental clauses for the Contractors to implement the works in an environmentally sound way. The above-mentioned government regulations norms and guidelines provided below, and in **Chapter 8** and in the EMMP (**Chapter 9)** will be the guidelines for the Contractors to prepare site-specific environmental management plans and construction safeguards. It is assumed that the contracts will be awarded to capable contracting firms that are experienced to prepare site-specific environmental management plans and carry out these out in line with the requirements.

The source of irrigation water and salt balance will frequently be tested. Results of these quality tests must prove that the irrigation water is suitable as raw water to be used for irrigation and domestic needs.

All possible measures should be taken during the detailed design to avoid encroachment in irrigated and other agricultural lands, private buildings and houses. Concrete or steel pipes should be used for crossing.

Table 6.3. Expected environmental impacts per zone

Sub project	Location	Physical option description	Environment Impact		Mitigation
			Positive environmental impacts	Negative environmental impacts	
Component A. Irrigation Modernization					
Podshaota -Chodak	Zone 2: The northern part of the study area (mainly Yangikurgan rayon) on right bank of Syrdarya river	Construction of 3 km new canal, 286 structures, 105 wells for irrigation, modernization of 9 PS, rehabilitation of 111.5 km; Reconstruction of Kandioyn debris basin (3 mln. m^3), Namangansai bank protection (4.5 km)	Increasing of available water resources and efficiency of irrigation; reduction losses of irrigation water mudflow protection	Temporary and local disruption due to construction works.	Restoration of trees planting Construction safeguards
Isfayram-Shakhimardan	Zone 7: Southern part of ISA upper South Fergana Canal	Construction of 1 PS, 138 wells for irrigation, and 99 structures; Managed Aquifer Recharge pilot study	Reduction of irrigation water losses and increasing of available water resources; improved water supply	Temporary and local disruption due to construction works.	Restoration of trees planting Construction safeguards
Savay-Akburasai	Zone 10: Western part of FV on left bank of Karadarya, Savai and Akburasai rivers.	Construction of 289 structures, modernization of 2 PS, protection of 13,4 km Akburasai bank. Creation of SCADA system	Increasing of the available water resources and improved water supply; mudflow protection	Temporary and local disruption due to construction works.	Construction safeguards
Component B. Support for Agriculture Modernization					
Podshaota -Chodak Isfayram-Shakhimardan Savay-Akburasai	Zones: 2, 7, 10	Cotton harvesting combine	Reduction of manual labor; increased intensification/ mechanization and more timely harvesting, and quality of cotton fiber; improving farmer benefits	Soil compaction, etc	Use of advanced harvesting machinery and technologies in accordance with local norms on the number and size of machinery
		Drip irrigation	Reduction of water losses and increasing of crop yields	Temporary and local disruption due to construction works.	Construction safeguards
		Bee keeping,	Improved pollination of flowers and increasing of yields	none	none
		Rural business (service)	Advice and training on good practices	none	Educate farmers, farm and local communities.
		Growing of vegetable and other food crops (seeds)	Use of intensive technology increases yields per hectare, which reduces cropping area.	none	Introduction of IPM and training activities
	Downstream	No interventions envisaged	Temporary increased water discharges	Temporary increased salt discharges, but insignificant to Syrdarya loads	

6.3. Impacts during Project Implementation and Mitigation

Project rehabilitation and construction works is usually small in scale and do not require any special environmental precautions. Nevertheless, some environmental vigilance is required to control the environmental risks of accidental damage and prevent environmental impacts to the maximum extent possible. It is the responsibility of both the representatives of Client and Contractor responsible for the construction supervision. In order to avoid negative environmental impacts, the following issues should be addressed:

- Pollution of groundwater and surface water by discharging fuel, oil and lubricants;
- Health of workers and local population in connection with the construction, transportation and operation of equipment;
- Transportation of wastes formed on the construction sites, and as a result of cleaning the earthen canal bed;
- Temporary ecological disturbance to arable lands and trees on the construction sites along canals and collectors in and outside (downstream of irrigation system) of the Project area.

The project environmental impact assessment and mitigation measures are listed below.

6.3.1. Water resources

During construction or rehabilitation of irrigation systems, pumping stations and other hydraulic structures on the canals, the water sources may be polluted with cleaning products and wastes from construction sites. To prevent contamination of surface and groundwater, some measures should be undertaken to protect it against possible contamination sources. This will require to:

- Comply with the requirements and regulations of rehabilitation and use of modern technologies during works;
- Comply with the requirements of modern construction and reconstruction technologies for hydraulic structures;
- Ensure the operational methods of construction material quality control in parallel with the regulatory methods;
- Ensure quality control of laying soil and concrete during construction of hydraulic structures;
- Maintain as-build documentation for all types of construction and installation works during construction of hydraulic structures;
- Divert surface runoffs from the sites;
- Timely clean construction sites from construction waste, and store the sediments taken out in the places only as identified by the regulatory authorities;
- Clean the irrigation system after repair and restoration works.

The measures to protect all types of water resources from possible pollution sources should be taken during the rehabilitation and construction works. Any inadvertent leakage of fuel and oils from the tanks at construction sites, as well as improper handling lubricants during maintenance are the most likely pollution sources of surface water and groundwater during the project activities. Environmental issues related to water resources during construction/rehabilitation works are considered to be insignificant. And yet, the appropriate measures on waste management should be undertaken to prevent inadvertent entry of pollutants into the water sources.

6.3.2. Land resources

Soil contamination with sediments, construction waste and lubricants can be the main environmental impact on land resources during rehabilitation and construction. Appropriate facilities should be provided for collecting and storing the construction wastes and sediments to reduce negative environmental impact.

Soils may be susceptible to the same contamination sources which have been mentioned in relation to water resources, namely the improper handling of solid and liquid wastes and unacceptable maintenance of equipment, particularly when replacing oil and filling fuel. Appropriate measures should

be taken to prevent leaks and seepage into surface water and groundwater resources at gas stations and during transportation.

The soil protection measures should be in place in accordance with the norms of RUz 3.01.01-97 and 3.05.03-97. During construction of new wells, the organic topsoil suitable for further use should be removed and temporarily stored separately from the rest of the earthen materials. After completing the well installation, the organic top layer will be placed on top of the backfill material properly sealed and restored for agricultural use.

6.3.3. Traffic, ambient air, noise and dust

Some temporary environmental impacts of rehabilitation and construction works on the irrigation infrastructure can take place due to machinery use for repair and restoration, and include increased traffic, dusting, exhaust fumes, noise and vibration from machinery.

Heavy truck movement to transport construction materials will temporarily increase during project implementation. Other temporary environmental problems associated with the use of excavators, cranes, compressors and other equipment during construction and will include: (i) noise and dust from construction sites, and (ii) safety of workers and residents.

The measures should be taken to ensure strict observance of safety rules at major intersections, main roads, community streets, and near constructed facilities. Temporary or permanent traffic lights at the most appropriate crossroads should be installed by Contractors, under the control of project management team. Traffic police will be strengthened in the communities during the rehabilitation/construction period and a warning system should be in place to strengthen the measures of caution among pedestrians, especially school students.

Reduction of dust generation during operation and transportation shall be provided through watering the constructed facilities and roads. The construction facilities should be located as far as possible away from the housing to minimize noise and vibration. After completion of the works, all construction sites and passages should be cleaned.

6.3.4. Terrestrial and aquatic flora and fauna

Irrigation wells will be constructed to supply water to the irrigation network. In this connection, turbidity of surface waters will increase and have temporary impact on aquatic fauna (especially fish) and flora. Also, rehabilitation of earthen canal beds (cleaning from vegetation and sedimentation) will temporarily affect the habitat of aquatic flora and fauna.

Throughout the rehabilitation of earthen canal beds, trees and shrubs will be cut down. This cannot be avoided, as a buffer zone should be provided along the canal and plantings emerged there as a result of unauthorized initiative of the local population. These are mainly planting of poplar and brambles.

Construction of a new 3-km canal in Podshaotasai system will involve cutting 27 trees found along the route of the canal bed, and also some temporary disturbance (during construction) of agricultural arable lands (3 hectares) will take place. Construction and rehabilitation of irrigation wells may disturb arable lands, but if the project activities are undertaken in between the vegetation period, when the fields are harvested, the crops will not be disturbed.

Bank protection of the Namangansai and Akburasai will not entail any violation of the natural habitats of both terrestrial and aquatic flora and fauna as well as rehabilitation works will be carried out during the period of a minimum flow when a mountain river turns into a small stream, and the works will be performed on one and the other bank by turn.

Reconstruction works of hydro structures on the canals and pumping stations will not have any negative impact if comply with all the required rehabilitation and construction precautions.

Appropriate measures to restore the flora habitats, such as land leveling on the irrigation fields after construction and restoration works and planting trees or shrubs on the canal dams, will be implemented

by Contractors in accordance with respective provisions of construction contracts to which the project ESMP will be an integral part. In addition, the Contractors will produce specific management plans where the details of the implementation of such restoring measures will be specified.

6.3.5. Solid and liquid waste management

During repair and rehabilitation activities, the following types of wastes can be generated:

- Sediment wastes from the mechanical canal bed cleaning that would consist of aquatic vegetation and organic matter;
- Waste of damaged concrete materials after renovated canal lining;
- Excavation waste from the preparation of sites for construction of hydraulic structures, canal expansion and deepening;
- Waste of damaged concrete materials after renovated hydraulic structures.

The Contractor should familiarize with recommendations, and follow them, while employing companies, registered/having rights for conducting activities on waste materials processing; and also for secondary use, all wastes should be processed.

Construction/upgrade contracts should provide to perform engineering in accordance with standard instructions on waste utilization and storage. The Contractor is responsible for waste utilization and should follow the requirements of the instructions. For the fine and solid waste treatment, prior utilization, the Contractor should hire only the licensed operator. The Contractor disposes all waste upon the recommendation of District Sanitary & Epidemiological Service. No waste should be discharged into the basins. In case of using of new landfills, the Contractor should obtain permission from khokimiyat. The Civil Engineer is responsible for compliance with the requirements waste utilization who is assisted by the Engineer on Monitoring (PMO) and the Security Specialist (SS).

6.3.6. Safety and healthy work conditions

Construction and rehabilitation methods of work can create hazardous situations for workers and population of the nearby communities. Healthy working environment should be created, and provisions on security and protection should be in place. Fencing of construction facilities and bridges along the ditches should be provided. Traffic control, alarm system and lighting should be placed according to the local regulations. If necessary, safe bypass roads and passages for pedestrians and animals should be built (Chapter 3, Table 3.1). Additional security measures are detailed in Chapter 8 - Environmental Management and Monitoring Plan.

6.4. Impacts by Project Components

6.4.1. Component A – Irrigation Infrastructure Improvement

The expected impacts of the Project on the environment will be mainly from the physical interventions that target the rehabilitation and upgrading of irrigation infrastructures, construction of pump stations and freshwater boreholes, and enhancing the flood control and bank protection and other measures. These impacts will be visible and felt both during the construction and operation phase of the interventions, but during each phase, the impacts will be of a different nature.

During the construction phase, the impacts on the environment will be mostly of a temporary and local nature, and will be associated with the movement and operation of excavation and construction vehicles and machinery, and people. In the first place one should think of increased traffic on rural roads (creating dust, noise, vibration, and safety concerns), impacts associated with drilling, excavation, and construction activities (concrete linings, hydraulic structures). Environmental impacts can be expected near and from worker camps too.

During the operation phase of the Project, the interventions start to become effective. It means that rehabilitation/construction and modernization of irrigation systems will reduce water losses, and this will facilitate to reduction of problems of water shortage and waterlogging in ravine bottoms. In project area, as it is expected, implementation of interventions on Component A, will create favorable possibilities for achievement of higher level of agricultural production and increase of rural population living standards.

6.4.2. Component B – Support for Agricultural Modernization

The Agricultural Modernization (AM) activities related to promote crop intensification and diversification and assistance to access lines of credit will deal with medium-to-small loans which are expected to be used for agricultural inputs and implements, equipment and trading activities with a minimal environmental impact. The project will not finance pesticides.

The most common end-users of loans under the WB RESP-II project are closely linked to the AM component of the FVWRMP-II activities, therefore borrowers will receive some guidance on their usage. The participating financial institutions (PFIs) for RESP-II are the commercial banks and leasing companies for the mid-size credit line and leasing services.

The FVWRMP-II Component AM (Support for Agricultural Modernization) would join to Rural Finance component of RESP-II, which provide co-financing of renewable energy and energy efficiency technologies together with the GEF Project. The package of eligible measures presented below is expected to raise interest of potential beneficiaries for agricultural investment, grant opportunities under the RESP-2 Rural Finance component and other alternative sources (e.g. global finance funds – GEF-7, Climate Adaptation Fund, Green Economy, and internal and external sources). It will promote the environmental sustainability of the sub-projects financed under the credit line. The grant-funding proposals will be more attractive and that enhance the likelihood of success of these investments.

Eligible investments of the AM component of FVWRMP-II are expected to primarily contribute to: (a) crop diversification, climate-resilient seed varieties, and seed system support measures, (b) on-farm water resource management and efficiency improvement measures, (c) improvement of vegetation cover and land degradation control through agro-forestry and soil protection measures, (d) promotion of stability and sustainability of piedmonts/mountain ecosystems and livelihoods, (e) conservation agriculture, (f) energy efficiency improvements (e.g., insulation, lighting, etc.), and (g) expansion of renewable energy sources, particularly for those communities in remote water shortage areas.

Agro-processors would have potential environmental impacts from solid and liquid waste emissions, smoke, airborne particles and gaseous discharges, transport and machinery noise. Agricultural and rural enterprises and activities can also indirectly result in negative environmental effects. These would need to be mitigated to EMMP based on the EMF guidelines (Annex 2) [29].

Agricultural enterprises

Potential benefits and impacts for several major agricultural producers and enterprise groups summarized in Table 6.4. Good practice mitigation measures are described below.

Analysis shows that the major potential impacts associated with the agricultural enterprise categories include water and air quality deterioration, loss of biodiversity and impacts on biophysical resources, including vegetation cover losses and soil erosion. The most biophysical benefit is the storage and using of agricultural chemicals, including fuel and lubricants that supports much of the rural economic activity (soil, water, forests, and mineral resources).

As a the rural economy grows, the enable environmental regulations and resources that provide the basis for this development must be enforced, mobilized, maintained and managed.

Table 6.4. Potential Benefits and Impacts: Agricultural Enterprises

Broad Category	Benefits	Potential Impacts	Level of Significance of Impact
Agro-processing	Provision of secondary production to local farmers, thus providing a guaranteed market for farm produce and providing them with a steady income. Opportunities for export markets. Provision of jobs.	Water pollution; safety and health; biophysical and cultural losses through location	Moderate
Market refurbishment or new market structure		Poor location disrupting people and perhaps important biophysical and cultural resources	Low
Transportation system (people and goods)	Provision of improved access to markets and services; lower cost goods and services; improved rural economic and social conditions	Air pollution	Low
Agricultural equipment hire	Improved productivity, small business development	Soil erosion and soil compaction as result of farm mechanization	Low – moderate
Irrigation system	Improved productivity	Desertification and depletion of water resources	Moderate – high
Other agribusiness	Improvement of supply chain, resulting in stabilized markets and farm income. Provision of structure to ensure comprehensive farm inputs resulting in improved production and stabilized incomes. Provision of jobs.	Variety of minor impacts although aquaculture could result in damage to aquatic ecosystems, particularly the loss of endemic fish species	Moderate-High (aquaculture) and Low – Mod. for other activities
Agrotourism, ecotourism	Provision of jobs; input to the tourist industry which, if developed, provides additional jobs and leads to community prosperity	Location:.biophysical losses, aesthetics Construction impacts water pollution	Low – moderate

Source: FVWRMP-I. EIA report, 2009, RESP-II, 2011, etc [28.29]

Farm inputs

These impacts apply to both small and medium scale farms. A summary of the benefits, potential impacts and their level of significance is given in Table 6.5.

The major potential impacts associated with the agricultural inputs relate to water and soil quality, soil erosion, salinization and resource loss. Livestock rearing in large numbers and in closed conditions, results in a concentration of animal waste that can contaminate both groundwater and surface waters. Tractors and land preparation can promote erosion, particularly if tractors are too heavy and cause soil compaction, and if fields are ploughed (with or without the contour) and left for long periods before sowing. Introduction of SLM and IPM technologies would provide a good opportunity to disseminate tools and best practices to improve soil and water quality and prevention of irrigated croplands (Table 6.5).

Table 6.5. Summary of Benefits and Potential Environmental Impacts: Farm Inputs

Input	Benefits	Potential Impacts	Level of Significance of Impact
Seed	Production; increased farm income; improvement of rural economy; contribution towards national security	Water and soil contamination through chemical inputs	Low-moderate
Pedigree seed	Increased production; increased farm income; rural economy improved; contribution towards national food security	Biodiversity loss; chemical inputs	Moderate-high
Fertilizer	Increased production; increased farm income; rural economy improved; contribution towards national food security	Water pollution	Moderate-high
Pedigree animals	Fewer animals required for same production; or, improved production and higher quality product for marketplace; improved farm income; rural economy improved; stock available for export and increasing foreign exchange	Risk of agrobiodiversity loss, increased use of pesticides and pharmaceuticals	Low-moderate
Animals for finishing	Improved farm income; rural economy improved; contribution towards national food	Overgrazing; forest degradation	Moderate-High
Land preparation (tractor and machinery hire)	Increased production; increased farm income; rural economy improved; contribution towards national food security	Soil erosion	Moderate-high
Tractors	Reduces labor burden on farm family; improves farm efficiency; improves profits and rural economy	Soil compaction and erosion	Moderate-high
Other farm implements	Reduces labor burden on farm family; improves farm efficiency; improves profits and rural economy	None	None
Small equipment	Reduces labor burden on farm family	None	None
Fencing materials	Reduce boundary disputes; containment of livestock; improved management of livestock, protection of forest resources	Social barriers; no risk of disruption of wildlife routes; as fencing will be located within villages	Low
Primary processing equipment	Value added stays in rural areas leading to improved local economy through provision of jobs; improved farm income; reduction in transportation costs and fossil fuel consumption	Water pollution	Moderate
Veterinary services	Healthy livestock, improved production and farm incomes	Hormones and chemicals in meat	Moderate

Source: FVWRMP-I.EIA report, 2009, RESP-II, 2011, etc. [28.29]

Pest Control

As stated above, using of pesticides is a common practice in the country, and hence it may occur indirectly under the FVWRM-II components that provide support to farmer farms and local agribusiness. Although no pesticide products will be directly financed under FVWRM-II, use of pesticides might be increased indirectly due to extension of agricultural activities in the project area.

The project will not support the purchase of pesticides. Analysis [36, 37] show that current system of pest control and overall Governments policy in handling dangerous pesticides is sufficiently strong. After independence, Government has taken initiative to reduce application of hazardous agricultural chemicals and pesticides and develop sound environment to improve pest management in late 1990's. In 2000 was approved a law "About protection of agricultural plants from pests, disease and weed" (No 116-II dated August 31, 2000), which formed the framework for laws on pesticide use and plant

protection in Uzbekistan. In 1999 Government set up special commission for controlling use of pesticides and chemicals (State Chemical Commission, SCC), whose main role is to control through registration and banning chemicals and pesticides used in Uzbekistan. Commission comprises from various ministries and agencies, including Goscompriroda, Republican Center for Epidemiology and number of research institutes under MAWR and scientific institutions and services. General control on type of pesticides and chemicals are regulated by the above special SCC, and Republican Center for Epidemiology produces various handbooks on safe use of pesticides and chemicals, and special manuals for application and handling every registered pesticides. Any unregistered pesticides are forbidden to use. Agrochemical Service is responsible for regular supervision of the correct use of pesticides. The State Chemical Commission also regularly monitors the use of pesticides and agrochemicals and reports to the SCNP.

For the first time methods of integrated pest management (IPM) have been initiated by the WB Cotton Improved Project (1995-2002), which supported the production and distribution of insect predators and increase the use of pest management that integrates biological, chemical and cultural practices, improving application chemical pesticides, and IPM training materials; MAWR subsequently expanded this program.

Hazardous products include pesticides listed in Class I(a) and I(b) of the World Health Organization (WHO) *Classification of Pesticides by Hazard and Guidelines to Classification* (Geneva: WHO, 1994-95); materials listed in the UN *Consolidated List of Products Whose Consumption and/or Sale have been Banned, Withdrawn, Severely Restricted, or not Approved by Governments* (New York: UN, 1994); and other materials that are banned or severely restricted in the borrower country because of environmental or health hazards.

During the period 2007-2011 the country registered 295 types of pesticides, out of which 82 registered in the list of pesticides in 2011, and the list of banned and severely restricted pesticides are appended below at Annex 5.

Support for cotton harvest mechanization

The AM sub-component of the FVWRMP-II will be in a position to advise farmers on the proper handling and application of pesticides and fertilizers, and advice in effective cotton cultivation techniques and harvesting combines to increase mechanization of agricultural works (see Chapter 8 and Annex 2).

The SA FVWRMP-II states that in the past, under the kolkhoz system, cotton was picked up with mechanical cotton harvesters in the subproject areas. Nowadays, observed majority of farmers wants to return to mechanization practices in cotton production. According to them, the major advantages of such mechanization will be lower costs of production due to reduced expenditure, higher incomes along with the reduction in harvesting time and workload, etc.

SA underlines that "*almost all farmers argue that it is impossible to restart mechanization practices unless the current situation with deterioration of irrigation services and water supply improves significantly. Machinery is efficient on the cotton fields under a set of conditions including the standard height of cotton plants, as well as timely weeding and planting. However, mechanical cotton harvesters cannot be used as the cotton plant doesn't grow to the required height because of the water shortage. Moreover, a farmer cannot afford such expensive machinery as a cotton harvester. The farmers think that, for example, local leasing stations (MTPs) should be provided with such machinery in a centralized way. Most farmers think positively of leasing of cotton harvesters and are ready to pay for it*". In order to prevent soil compaction and any social tension among the farmers, it is important to establish a well defined and justified schedule of the use of harvesting machinery, which would meet farmers' demand and ensure compliance with local technical regulations governing maximum weight, machine density and duration of interrupted use of such machinery.

Potential Cumulative Impacts

Assuming that all mitigation of the Component B is carried out on all sub-projects for which financing is provided, there will still be residual effects, that when considered in total, could have an overall significant effect on the environment.

The project including the Component B is not expected to produce major environmental impacts. However, some investments from the loan proceeds may involve environmental issues related to, for example, rehabilitation of I&D systems, waste management at farms, agro-enterprises, and location or site preparation for facilities or agricultural techniques.

Cumulative effect is important in spatial terms, as indicated above, and also over time. For instance, a loan for seed purchase in itself has no negative impact, and in fact, has much the opposite with an increased production and return to the farmer. However, the same loan provided for more than two years in a row could promote poor crop and land management and disrupt a relatively current good agricultural management system characterized by long rotations. By avoiding a crop rotation program the farmer can deplete the fertility and organic content of his soil and further promote soil erosion. Over time there would be a cumulative effect.

In order to prevent the risk of adverse cumulative environmental effects, a brief environmental analysis will be made of the portfolio every year by the PIU environmental specialist and reported to the relevant authorities in the SCNP and the World Bank. The guidelines of the Cumulative Impact Assessment is presented in Annex 13.

Responsibility

The project implementing agency will require that every loan application submitted under the Agricultural Modernization Component, and every proposal submitted under the Irrigation Modernization Component include an environmental assessment of the program proposed. Guidelines for such assessments will be in conformity with Bank requirements is given in Annex 2 [28, 29],

The Bank environmental guidelines require financial intermediaries to undertake environmental screening of the sub-project:

a) To screen for potential environmental problems against a checklist, and to categorize and quantify the risk against pre-determined charts.
b) To call for an environmental impact assessment for any proposal that indicates more than minimal levels of risk.
c) To screen credit applications for potential impacts on significant physical cultural resources.

It is envisaged that the loan officer (or an environmental specialist) will make decisions on environmental and safeguard compliance, providing that there are no complex environmental issues involved in the proposal. In the case of complex environmental issues that are beyond the experience of the loan officer, the PFI will request assistance from the PIU to advise the PFIs on the scope of an environmental mitigation plan for the application to the PFI. In any case of doubt, the PFI should consult with the MAWR.

Environmental Risk

Overall, the environmental risk is low to moderate, with due attention to the possibility of cumulative impacts. The project will benefit from the institutional capacity and agricultural extension and scaling up of SLM and IPM practices. The project's information and advisory service activities will continue to promote the adoption of improved and environmentally sound technologies, provide training and advice on SLM and IPM techniques, and improved water resource management and irrigation services

The rural finance activities related to PFIs will deal with fairly small loans which are expected to be used for agricultural inputs and implements, equipment and trading activities with a minimal environmental impact. Members of PFIs involved in lending will also be provided with training on the potential environmental impact of sub-projects and on mitigation measures. Mid-size credits for agro-processors and other agribusinesses through qualifying PFIs will be required to include mitigating measures, if

appropriate.

Compliance with the EMF guidelines [29] will be monitored by the PIU environmental specialist and supervised by the World Bank.

6.4.3. Component C - Institutional Reforms

The proposed interventions under this Component focus on institutional strengthening and training and include the establishment of the Implementation Support Team and about 5-ha demonstration plots, setting up Farmer Field Schools and income generating activities, strengthening of state water institutions, establishing and supporting Water User's Associations, a Farmer and WUA Support Centre, and improve Management and Operation & Management (Table 6.7). All these activities are to improve and enhance the impacts of the Component A interventions, and have thus indirect impacts on the environment. The Project will not provide or support large-scale provision of agro-chemicals (fertilizers and pesticides).

Table 6.6. Summary of overall impact of Project's institutional interventions

Existing Constraints	**Interventions / suggestions**
Within scope of project	
Lack of application of water and land best practices and advanced technologies	Demonstration plots and Farmer Field Schools, and training program for water management institutions, and local communities.
Poor inter-farm water management and monitoring	Building capacity of state water institutions and training courses of targeted groups
Lack of farmer knowledge and experience to crop protections, diversification and management of pests, diseases and weeds	Demonstration plots & Farmer Field Schools, supply of agricultural production inputs
Lack of knowledge in development of the alternative sources of water resources and drought management	Building capacity of scientific water/groundwater institutions on УПВГ approaches and demonstration of sustainable water resources management in FV.
Lack of consulting and informational services	Demonstration plots & FFS, establishment of Farmer and WUA Support Centre
Outside scope of project	
Ineffective WCAs	Introduction by government of the WCA-specific law (in draft) would provide a better legal basis for fully functional WCAs. Project will support of WCA development in the selected sub-projects
Unreliable input supplies	Further opening of the market to private business would be beneficial.
Controls on cropping patterns	Recently Government Degrees (see Chapter 3) and support of farmers farms would have a positive effect
Lack of marketing and processing facilities.	Project promote (i) assistance in making traditional knowledge base of the small private farming and households in growing fruits and vegetables through demonstration of the best practices and drip irrigation for more domestic value adding activities; (ii) work very closely with institutions at all levels from oblast khokimiats down to makhalya committees and Assemblies of Rural Citizens.
Existing Constraints	Interventions / suggestions

Community support through establishment of demonstration plots and creation of the Farmer Field School (FFS) will impose an indirect impact on the environment. The FFS will increase knowledge and raising awareness of farmers and dekhkans on farming techniques, environmental safety practices, water management, equipment use, proper handling of pesticides and fertilizers, etc. to avoid inefficient water and land use and minimize soil erosion, salinity and waterlogging problems.

6.4.4. Component D – Project management, audit, monitoring and evaluation, technical assistance

This Component includes works that are to support the physical and Project interventions that target to reduce the waterlogging and salinity problems in the Project Area. Direct environmental impacts of this Component are not expected.

6.5. Long-term impact and mitigation measures

6.5.1. Land Occupation

The Social Assessment of the Project [SA Study; Dec2014-Apr.2015] indicates that displacement of people due to Project implementation will not be necessary. To minimize the impact, all the Project facilities have been designed as far as possible along the existing irrigation network and line structures such as roads. The rehabilitated vertical wells will be located around the agricultural fields to minimize environmental and social impacts. Construction of infrastructure required for the project will not conflict with other types of the existing infrastructure, such as roads, rural infrastructure, either during construction or for a longer period of time.

6.5.2. Historical and cultural monuments and landscape

No historical or cultural monuments were found in the project area. The location of structures to be constructed will be selected to minimize any disturbance of the surrounding landscape and existing rural architecture.

6.5.3. Impacts Caused by the Project Infrastructure Operation

In general, operation of the irrigation infrastructure does not imply any significant risks.

The project envisages some measures to control corrosion in order to mitigate the negative impact on groundwater. Anti-seismic measures aimed at reducing seismic load and increasing resistance to the seismic impact will also be provided by the project.

Other preventive measures related to health of personnel operating the Project facilities imply the strict observance of safety rules and regulations for operation of I&D infrastructure. The personnel involved in the O&M will receive a special training.

Full-scale monitoring of hydraulic structures and their status will be provided to ensure their safe operation, including dam survey, checking the dam for cracks, erosion, subsidence, corrosion, vertical retreat and horizontal movements, as well as the state of mechanical equipment, etc. The Safety Declaration for Hydraulic Structures in Uzbekistan is provided Annex 5.

6.6. Overall project impact during Phase II

It is important that project: (i) ensures timely water supply in the right volume to the agricultural area of around 103,622 ha; (ii) provides a livelihood for more than 489,000 people. The EA confirms that the project does not really have any significant negative environmental impacts, except for some environmental hazards that are common during construction and will be mitigated within the frameworks of the proposed Environmental Management Plan.

The overall project impact will relief the problems caused by the water deficit thus contributing to higher crop yields, increased local population income, poverty reduction in the rural areas. This will be implied not only by technical activities of rehabilitation and construction of irrigation infrastructure, but also improved water management at all levels. The latter will be addressed through capacity building of Water Consumer Associations, trainings of professionals from BAISs, ISAs and WCAs, training of WCA members of the entire local community.

Other efforts to address the problems will include the demonstration plots to improve land productivity and efficient management of water resources at the farm level, as well as pilot studies that would

provide a wide range of stakeholders the possibility of efficient control and management of scarce water resources. It is assumed to propose the pilot studies as an example of water management approached in the future.

The overall project positive impact is summarized in Table 6.7.

Table 6.7. Summary of overall positive impact of the Project

Project activities	Impact
Component A: Irrigation Modernization	
Rehabilitation of main and inter-farm canals and their structures	Increased volumes and improved access to water resources, reduction of losses due to seepage during water transportation, lower operating losses during water distribution, reduced water logging and better water availability
Construction of new canal	Increased water supply to irrigated land through using groundwater, better conditions for growing crops thanks to timely water supply in the right volume
Construction and rehabilitation of pumping structures	
Construction of new wells and their use for irrigation	
Bank protection and flood control	
Bank protection of the Namangansai and Akburasai	Preventing bank erosion and protecting croplands from flooding
Reconstruction of Kandiyon debris basin and its transfer to reservoir	Improved water supply to lands through accumulation of water in the reservoir during mudflows and prevention of possible damage due to floods and mudflows
System Modernization	
SCADA system development	Higher crop yields thanks to improved water resources management
Regulated replenishment of groundwater aquifers	Ensuring stable and timely irrigation in summer during the highest water deficit, increased water supply to the lands with excessive groundwater recharged from winter runoff
Component B: Agricultural Modernization	
Drip irrigation	Reduced water losses during irrigation, water saving and higher crop yields
Wells with solar battery pumps	Improved water supply and energy saving
Cotton harvest mechanization	Mechanization of harvesting and reduction of manual labor
Bee-keeping (credits)	Increase of yields through pollination of flowers
Growing of vegetable and other food crops (seeds, intensive gardens, etc.)	Use of intensive technology increases yields per hectare, which reduces cropping area.
Rural business (service)	Advice and training on good environmental practices
Component C: Institutional Reform	
Trainings for WCA staff	Increased water use efficiency through improved O&M and water resources management
Demonstration plots, farmer field schools	Increased land productivity, increased water productivity thanks to introduction of improved irrigation and farming practices
Component D: Project management, audit, monitoring and evaluation, and technical assistance	
Design and construction supervision, project impact monitoring	Increased sustainability of project outcomes

6.7. Impacts related to climate change

There is a broad agreement [IFPRI,2009; the World Bank,2009, etc.] that Uzbekistan is among countries most vulnerable to climate change due to high sensitivity of its arid arable lands, high density of population, high demand for water and growing concern about food security and ecosystem conservation.

As indicated in Chapter 5, increase of climate change, extreme draughts cause significant impact on environment and agricultural production as a whole on Fergana valley and on three sub-project territories, and these processes will be strengthening in future.

The existing water shortage for irrigation in future will create disastrous levels. Atmospheric droughts are especially dangerous with extremely high temperatures and low air humidity in the combination with water shortage for irrigation of land. Strengthening of water stress impact, especially in critical phases of plants growth and development, causes depression of plantings, shortage and/or death of yield on big territories. Orchards and vineyard are especially sensitive to water shortage and are reacting by loss of yields. Unreliable water supply for irrigation and deterioration of soil properties aggravate problems of low water availability in rural areas. The project will improve the efficiency of the management and use of available water resources, therefore, country' climate change adaptation potential will also improve.

The expected positive impacts of climate change for perspective are linked with the increase of frost-free period duration (for 8-15 days) and sum of air active temperatures (for 5-10%). These changes for long term perspective will represent favorable possibilities for (i) extension areas of south Asian heat – loving species to north-east on the northern mountainous framing of Pamir-Alay and Tyan-Shan; (ii) possibility for extension of areal for cultivation to the north for average – and late maturation crops; (iii) multiple land use under various crops; and (v) improvement of condition for livestock wintering and lambing in the conditions of distant pastures and etc. [22].

Analysis of Alternatives

The country makes significant effort in finding the ways of increasing the efficiency of the use of water resources, improvement of agro- and ecosystem services, in particular in the drought prone and highly salinized areas. Several programs have been adopted, which considered diversification of agricultural production, introduction of water saving and resource saving technologies, development of drought responses etc. The project design has been developed based on the conclusions of these above analysis.

In particular, the project design has been selected so that to allow for the increase of the water efficiency by 5%, which is believed to be a realistic target for an uphill gravity open-canal irrigation system. Specifically, under Component 1 supporting irrigation modernization, the improvement of irrigation infrastructure such as canal lining and control structures and facilities, shall reduce water withdrawals by reducing the efficiency of conveyance. The overall water balance demonstrates this expected decrease in quantitative terms. Under Component 2 which will support agriculture modernization, water saving techniques for field irrigation as well as modern agricultural practices will be introduced and demonstrated. Under Component 3 on institutional reforms and developing water management capacity, the project aims at improving capacity in system operation focusing on the decrease in operational water losses leading to the respective decrease in water withdrawals. In addition, volumetric measurement of irrigation water and introduction of payment for irrigation services will provide an incentive for farmers to reduce water consumption. Another important aspect specifically addressed under Component 2 of the project, relates to crop diversification and aims at reducing the water demanding crops, mainly cotton which constitutes only 15% of the project area. The other crop supported by the project, is wheat, which, being a winter crop, relies on winter precipitation and does not represent a concern in terms of water demand. This effort is in line with a national effort by GOU to reduce the cotton area by 400,000ha. Thus, the ESAMP builds on the chosen design and considers two alternatives: with and without project.

This Chapter considers alternatives for the proposed Project interventions in terms of their potential environmental impact, which are mainly the situation "Without Project" and describe environmental impact for each alternative – situations "With Project" and "Without Project".

Proposed Project activities which are presented in Chapter 3 are considered as Project alternatives, i.e. selected three sub-Projects in which the technical Project activities will be implemented. Two Project alternatives are described:

Alternative 1: "Without Project" – ecological consequences are presented in section 6.9 below.

Alternative 2: "With Project" – activities described in Chapter 3, environmental impact described in Chapter 6. Further consequences are described in section 6.10.

Both alternatives have been analyzed by the EA team. Analyses allowed to calculate expected changes, e.g., land productivity, water supply and related to these changes in crop products in 3, 5, 8 and 10 years' time. Assessment of shortfall and surplus of crop yield is based on relationship "*water supply – crop yield*", obtained as a result of surveys and experimental data (Uzbek Cotton Institute, Sredazgiprovodkhlopok, Irrigation Institute of Kyrgyz Republic, etc.), handbooks and manuals [24].

During assessment of the possible change in ameliorative conditions of irrigated lands the results of monitoring conducted by oblast HGMEs of Fergana Valley were used (maps of the water table and ground water salinity, soil salinization). Then, initial data and results of prognosis were summarized in digital "GIS maps" based on which area's size has been defined. Crops evapotranspiration in existing and prospective level on predicted climate indicators was calculated under program CROPWAT, water balance at field level was calculated taking account of actual and design efficiency of irrigation system.

Assessment of technical intervention efficiencies are based on the rules and guidelines, approved for design and construction of water management objects. For assessment of the situations "Without Project" and "With Project" the EA specialists compiled water balances and schematization of water-salt balance items in the three sub-project areas, based on the available documents of the FVWRMP-II, HGME, BAIS, MAWR agricultural departments, and analytical review, assessments and projects, including the IWMI research report[2], and outcomes and expert judgments of EA team. In order to prognosis of soil fertility the analysis of trend and rates of change in soil properties under impact of agro technical techniques has been provided with using the available guidelines and manuals [10].

6.8. "Without Project" Situation

General

In situation "Without Project" no upgrading, rehabilitation and construction of new irrigation infrastructure (main canals, PSs, irrigation wells, hydraulic facilities on canals, etc.) are expected in the Project area. Inadequate operation and maintenance of irrigation systems will lead to further deterioration of technical state and reduction of efficiency of existing irrigation infrastructure, pump stations and wells for irrigation will further continue to break down, not ensuring guaranteed and timely water supply to irrigation lands.

On-farm practices of farmers and dekhkans will stay at the current level with outdated farming techniques and irrigation technologies. Lack of experience and skills of land users and weak access to up-to-date resources of water saving technologies will contribute to increase in erosion processes, deterioration of soil properties, reduction of soil fertility and increase of irrigation water deficit.

Predicted climate warming will cause growth in crops evapotranspiration and growth in water demand for irrigation. Expected change of evapotranspiration, provided by EA team based on CROPWAT program, are presented in Table 6.8.

Table 6.8. Expected change of evapotranspiration for the long-term period (2030 – 2050)

	Distribution of evapotranspiration per months, mm													Change	
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	year	mm	%
Namangan (Podshaota-Chodak)															
Norm	27	31	58	99	149	189	206	183	133	83	44	30	1232		
2030	28	32	61	100	153	193	210	187	137	86	46	31	1263	32	2.6
2050	29	34	63	105	157	201	219	196	140	89	48	32	1314	82	6.6

[2] IWMI (2011-2013) "Fergana valley water resources management improvement on the example of irrigation system Isfayram – Shakhimardan" Project "Sustainable management of underground water in arid and subjected to salinity districts – comparative analysis – Tunisia and Central Asia", Phase 2.

	Distribution of evapotranspiration per months, mm													Change	
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	year	mm	%
Fergana (Isfairam-Shahimardan)															
Norm	15	23	52	97	149	182	189	164	111	67	30	15	1093		
2030	16	24	54	100	153	185	193	167	114	69	31	15	1121	28	2.6
2050	16	24	56	102	156	192	200	174	117	71	32	16	1156	64	5.8
Andijan (Savai-Akburasai)															
Norm	13	21	49	93	148	180	183	157	108	63	27	15	1055		
2030	14	22	51	95	151	184	187	160	110	64	28	15	1081	26	2.4
2050	14	22	52	98	154	191	194	167	114	66	29	16	1118	63	6.0

Source: Calculations of EA Consultants based on the Uzhydroment (2008, 2012, 2014) data, etc.

Analysis shows that the evapotranspiration and accordingly the irrigation water requirements are to grow by 2.4-2.6% in 2030 and 5.8-6.6% in 2050. Due to lack of irrigation water the yield losses will increase for wheat by 11-13% by 2030, for cotton - by 4-7% by 2050. Increasing of crop yield losses because increased the extreme weather (atmospheric drought, heavy rains, hail, high temperatures) [1, 22].

6.8.1. "Without Project" Situation: Podshaota-Chodak

Water balance in project area

The existing water demand for irrigation in the Podshaota-Chodak project area is estimated at 182.43 million m^3, but the available water resources are 149.2 million m^3 (Table 6.9).

In the situation "Without Project" reduction of water availability will be continued, and irrigation water deficit will increasing due to further deterioration and wear and tear of infrastructure, lack of modern technologies for water use and water savings, and challenges, related to climate variability and drought. Significant water losses on irrigated fields around 4 763 m^3/ha (see Table 6.15) will be increased water demand and imbalance between demand for water and volumes of accessible water.

The results of balance estimations show that accessible water resources is 149.2 mln.m^3, including about 122.2 mln. m^3 of surface water and 27 mln. m^3 of underground water (Table 6.9). Total losses of water from canals, irrigated fields and irrigation escapes are 102.4 mln. m^3 (70% of water used), and only 30% is for yield production (evapotranspiration).

Scheme of the water balance in a situation "Without Project" (Figure 6.1a) illustrates the distribution and quality of irrigation and waste flow, and their impact on surface water sources. The losses of water from canals and irrigated fields with volume of 75.9 mln. m^3 are derived beyond sub-project territory, and runoff from irrigated fields in the volume of 26.5 mln. m^3 flow to Big Namangan Canal (BNC).

Table 6.9. Water balance in Podshaota-Chodak project area "Without Project"

Balance articles	Accessible water resources	
	Volume, mln. m^3	Mineralization, g/l
INFLOW		
Accessible water resources	149.2	0.78
including underground water	27.0	0.35
OUTFLOW		
Infiltration from canals	56.7	0.79
Infiltration from irrigated fields	19.2	1.11
Total infiltration losses	75.9	0.87
Irrigation escapes	26.5	1.11
Evaporation by watering	2.4	
Evapotranspiration	66.0	
Total outflow	149.2	
BALANCE	0.0	

Source: Calculations of EA specialists, based on available data of HGME, BAIS and FS FVWRMP –II, 2015

Groundwater table and land salinization

As mentioned above, the project area is characterized by intensive natural inflow and outflow of groundwater, and the lack of problems associated with soil salinization and waterlogging. For that reason groundwater table is stably deep (more than 3-5 m from surface) and does not have any impact on land improvement. Exceptions are the local sites in ravines floors, where fresh ground water table is maintained at 1-2 m from surface soil.

Absence of the Project activities and decrease in available water will lead to lowering of water table in these areas and to growing of demand in irrigation, thus to further growth in irrigation water deficit.

As the irrigated land in Podshaota-Chodak is not affected by secondary salinization, refusal of the Project by no means will impact on land salinization.

Soil Fertility

Without-Project interventions, progressing of soil erosion and reduction of soil properties will cause further land degradation and will reduce soil fertility (as assessed with the Bonitet Fertility Index).

The expected changes in soil fertility of irrigated lands after 3, 5, 8 and 10 years' time are given in Table 6.10.

Table 6.10. Change in soil fertility "Without Project" in Podshaota-Chodak project area

Fertility			Existing	Change in fertility:			
Description	Point			3 years	5 years	8 years	10 years
Low	0-20	ha	0	0	207	443	620
		%	0	0	0.7	1.5	2.1
Medium and below medium	44.8	ha	19527	20655	20861	21452	21806
		%	66.2	70	70.7	72.7	73.9
Good and very good	76.1	ha	9980	8852	8439	7613	7082
		%	33.8	30	28.6	25.8	24.0
Area total:		ha	29507	29507	29507	29507	29507
Average point			55.4	54.2	53.4	52.2	51.4

Source: Analysis of EA consultants

The analysis shows that in the Without-Project situation after 10 years the average fertility of irrigated soils will decrease by 4 points and that 29% of area with good and very good fertility will have been transferred into medium and low fertility soils (32-40 score). In terms of crop yield, reduction of soil fertility in 3, 5 and 8 years will imply shortfall of winter grains' yield (wheat, barley) by 0.07 -0.27 t/ha. Shortfall of raw cotton will be 0.05 - 0.16 t/ha respectively. Yield decline in combination with unfavorable marketing conditions, structural price formation and fixed overheads will lead to increased farm non-profitability.

6.8.2. "Without Project" Situation: Isfairam-Shahimardan

Water balance in project area

The existing water demand for irrigation in sub-project area is estimated at 737.07 mln. m^3, but the available water resources are 453.8 mln. m^3 (64% of water demand) (Table 6.11).

The scheme of water balance (Figure 6.2a) illustrates the allocation and quality of water losses formed from irrigation, and their impact on surface water sources. Water losses from canals and irrigated fields making 230.9 mln. m^3, serve as feeding for Chimyon Avalk underground water deposit, formed on sub-project territory. Runoff from irrigated fields with volume of 80.5 mln. m^3 and mineralization 0.96 g/l is escaped through Margilansai to SFC.

Table 6.11. Water balance in Isfayram – Shakhimardan project area "Without Project"

Balance articles	Accessible water resources	
	Volume, mln. m^3	Mineralization, g/l
INFLOW		
Accessible water resources	453.8	0.69
including underground water	59.0	0.35
OUTFLOW		
Infiltration from canals	172.4	0.69
Infiltration from irrigated fields	58.5	0.96
Total infiltration losses	230.9	0.76
Irrigation escapes	80.5	0.96
Evaporation by watering	7.3	
Evapotranspiration	200.9	
Total outflow	453.8	
BALANCE	0.0	

Source: Calculations of EA specialists, based on data of HGME, BAIS, FS FVWRMP –II, 2015

Water Table and Soil Salinization

As mentioned above, the project area is characterized by the intensive inflow and outflow of groundwater and lack of problems related to salinization and waterlogging. Water table consistently deep (more than 3-5 m from the surface and 1-2 m in lower sites).

Absence of the project activities will lead to reduce of water table in lower sites of project areas and to growing of demand in irrigation, thus to further growth in irrigation water deficit.

As land is not affected by secondary salinization, refusal of the Project by no means will impact on land salinization.

Soil Fertility

Without-Project interventions, progressing of the erosion of low and medium thickness soils, underlying by pebbles from 0.2-0.5 to 0.5-1.0 m, will cause further land degradation and will reduce soil fertility (as assessed with the Bonitet Fertility Index).

The expected changes in soil fertility of irrigated lands after 3, 5, 8 and 10 years' time are illustrated in Table 6.12**.**

Table 6.12. Change soil fertility "Without Project" in Isfairam-Shahimardan project area

Fertility			Existing	Change in fertility:			
Description	Point			3 years	5 years	8 years	10 years
Low	0-20	ha	964	1210	1430	1815	2035
		%	1.8	2.2	2.6	3.3	3.7
Medium and below medium	38.6	ha	32432	36025	37950	41085	43340
		%	59.0	65.5	69.0	74.7	78.8
Good and very good	71.4	ha	21604	17765	15620	12100	9625
		%	39.3	32.3	28.4	22.0	17.5
Area total:		ha	55000	55000	55000	55000	55000
Average point			51.0	48.6	47.0	44.6	43.0

Source: Analysis of EA consultants.

Analysis shows that in situation "Without Project" reduction of land with good and very good soil fertility is expected. The average fertility of irrigated soils in the project area will decrease by 8 points and will make 43 points. For this period 55% of area with good and very good soil fertility will pass into the category of soils with medium and below medium fertility (20 to 60 points). In terms of crop

products, reduction of fertility in 3-5 and 8 years' time for situation "Without Project" will imply shortfall of winter grains yield (wheat, barley) to 0,14 - 0.48 t/ha respectively. Shortfall of raw cotton will be 0.09 - 0,32 t/ha. During the drought, in conditions "Without Project", full loss of crop harvest is possible.

6.8.3. "Without Project" Situation: Savai-Akburasai

Water balance in project area

The existing water demand for irrigation in the sub-project are evaluated in 363.77 mln. m^3, though accessible water resources is 225.0 mln. m^3 or 70% of water demand (Table 6.13).

Table 6.13. Water balance in Savay - Akburasai project area "Without Project"

Balance articles	Accessible water resources	
	Volume, mln. m^3	Mineralization, g/l
INFLOW		
Accessible water resources	225.0	0.70
including underground water	0.5	0.35
OUTFLOW		
Infiltration from canals	85.5	0.70
Infiltration from irrigated fields	29.0	0.78
Total infiltration losses	116.5	0.72
Irrigation escapes	39.9	0.78
Evaporation by watering	3.6	
Evapotranspiration	99.6	
Total outflow	225.0	
BALANCE	0.0	

Source: Calculations of EA specialists, based on data of HGME, BAIS, FS FVWRMP –II, 2015 and the others

The scheme of water balance (Figure 6.3a) illustrates the allocation and quality of water losses formed from irrigation, and their impact on surface water sources. Infiltration of 116.5 mln. m^3 water losses from canals and irrigated fields are derived beyond sub-project territory. Irrigation runoff 39.9 mln. m^3 with mineralization 0.78 g/l is used for irrigation inside contour, and/or derived beyond project territory.

Water Table and Salinization

As indicated above, the project area is characterized by the lack of problems, related to soil salinization and waterlogging. Water table consistently deep (more than 3-5 m from the surface and 1-2 m in lower sites).

Absence of the project activities will lead to reduce of water table in lower sites of project areas and to growing of demand in irrigation, thus to further growth in irrigation water deficit. As land is not affected by secondary salinization, refusal of the Project by no means will impact on land salinization.

Soil Fertility

Without-Project interventions, progressing of soil erosion, soil compaction and reduction of soil properties will cause further land degradation and will reduce soil fertility (as assessed with the Bonitet Fertility Index).

The expected changes in soil fertility of irrigated lands after 3, 5, 8 and 10 years' time are illustrated in Table 6.14.

In situation "Without Project" reduction land with good and very good soil fertility by 5 points for 10 years is expected. During this period 29% of area with good and very good fertility will pass into the category of land with medium and below medium fertility (20-60 points). In terms of crop products, reduction of fertility in 3, 5, 8 and 10 years' time "Without Project" will imply shortfall of winter grains

yield (wheat, barley) by 0.09 – 0.30 t/ha respectively. Shortfall of raw cotton will be 0.06 – 0.20 t/ha. During the low water year, in conditions "Without Project", full loss of crop harvest is possible.

Table 6.14. Change of soil fertility "Without Project" in Savai-Akburasai project area

Fertility			Existing	Change in fertility:			
Description	Point			3 years	5 years	8 years	10 years
Low	0-20	ha	0	97	136	232	349
		%	0.0	0.5	0.7	1.2	1.8
Medium and below medium	44.3	ha	9575	10359	10901	11734	12083
		%	49.5	53.5	56.3	60.6	62.4
Good and very good	72.4	ha	9788	8907	8326	7397	6932
		%	50.5	46.0	43.0	38.2	35.8
Area total:		ha	19363	19363	19363	19363	19363
Average point			58.5	57.0	56.0	54.5	53.5

Source: Analysis of EA consultants

6.9. "With Project" Situation

6.9.1. "With Project" Situation: Podshaota-Chodak

Water balance in project area

Proposed physical improvements of irrigation infrastructure in sub-project area are aimed to increase of water use efficiency and improvement of water allocation, access and services for satisfaction of growing demand for water and increase of agricultural productivity.

Project Component "Modernization of the system" will contribute to increase water efficiency at the farm level. The estimated field water balance, executed by EA consultants, confirmed that 864 m^3/ha of water will be saved by reducing non-productive losses in the fields, which corresponds to about 1 irrigation event (Table 6.15).

Table 6.15. Existing and expected water balance at field level in Podshaota-Chodak project area

	Evapotranspi-ration	Infiltration	Surface discharge	Evaporation during irrigation	Total loss in field	Precipitation	Shortage of water
Podshaota-Chodak							
Existing	5947	1905	2620	238	4763	1550	9163
Project level	5947	1560	2145	195	3899	1550	8296

Source: calculations of EA team based on the MAWR, Uzhydroment (2008, 2012, 2014) data, etc.

In Table 6.16 presented water balance in a situation "With Project", prepared by taking into account the implementation of project interventions in the Podshaota-Chodak sub-project area.

In the situation "With Project" it is not expected to have impact of project measures on surface water quality. The share of water losses for infiltration from canals, irrigated fields and irrigation runoff will decrease from 70% to 65% towards total intake, that will increase water outflow for yield creation (evapotranspiration) up to 90.9 mln. m^3.

Table 6.16. Water balance in Podshaota-Chodak project area

Balance articles	Accessible water resources	
	Volume, mln. m^3	Mineralization, g/l
INFLOW		
Accessible water resources	185.8	0.72
Including underground water	54	0.35
OUTFLOW		
Infiltration from canals	63.2	0.73
Infiltration from irrigated fields	23.1	1.10

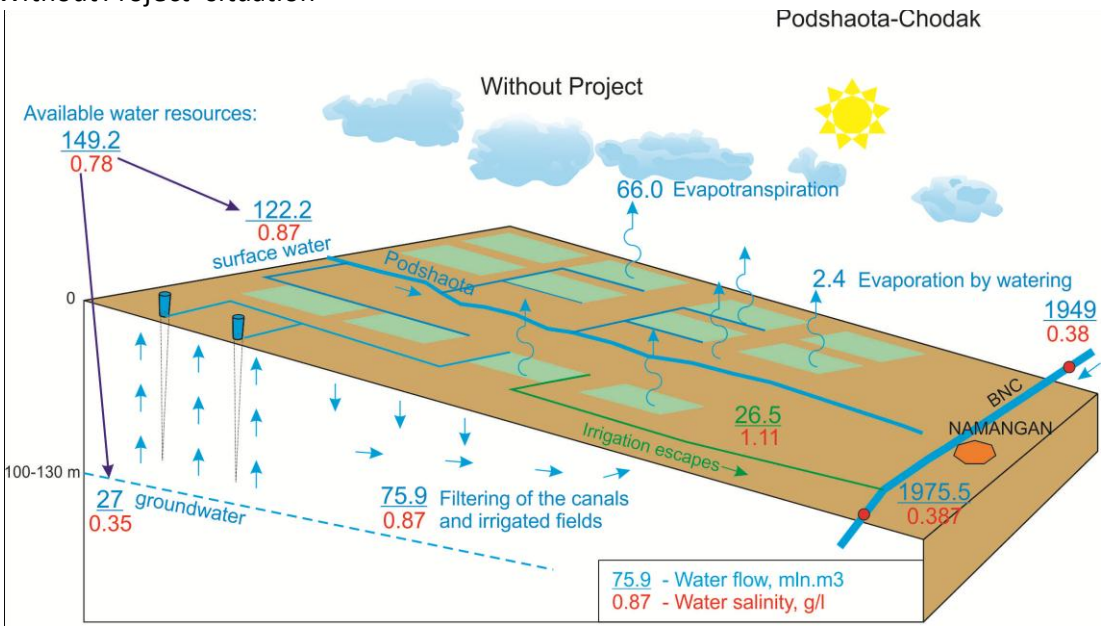
Balance articles	Accessible water resources	
	Volume, mln. m^3	Mineralization, g/l
Total infiltration losses	86.3	0.83
Irrigation escapes	31.7	1.10
Evaporation by watering	3.2	
Evapotranspiration	90.9	
Total outflow	185.8	
BALANCE	0.0	

Source: Calculations of EA specialists, based on data of HGME, BAIS, FS FVWRMP –II, 2015 and the others

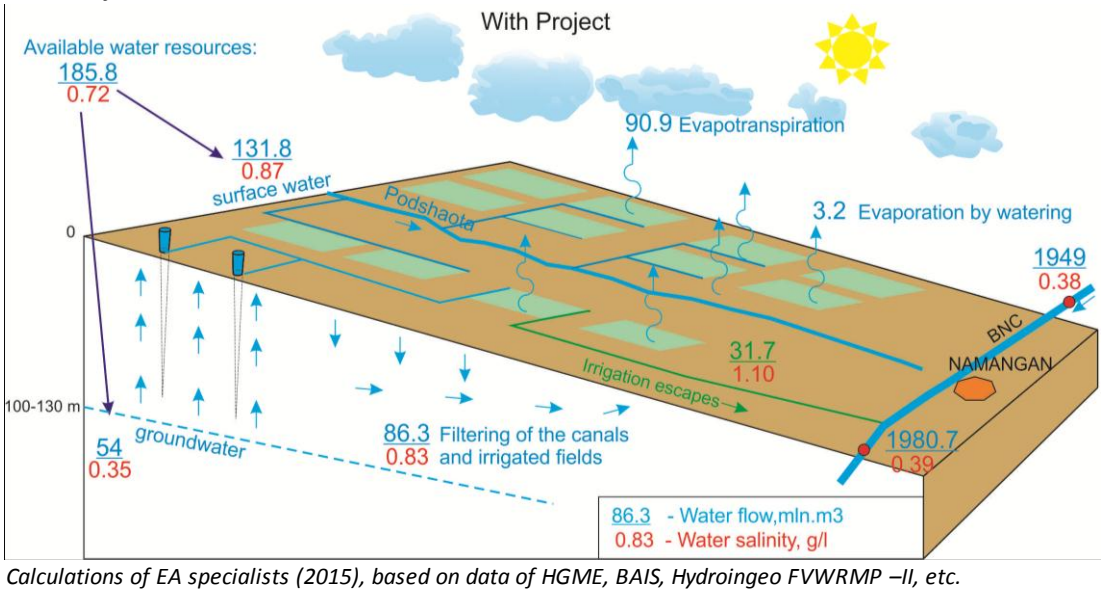
Infiltration water losses from canals and irrigated fields are forming 86.3 mln. m^3, and due to low salinity (0.83 g/l) may be used as a sub-irrigation within project area. The formed irrigation outflow (31.7 mln.m^3) from Podshaota-Chodak system is not exceed 3% of total flow of BNC. The insignificant change of water mineralization (from 0.38g/l to 0.387 g/l) should be considered as positive ecological impact of project measures on water quality in the BNC (Figure 6.1.b).

Figure 6.1. Water balance scheme in Podshaota-Chodak project area

a) "Without Project" situation



b) "With Project" situation



Source: Calculations of EA specialists (2015), based on data of HGME, BAIS, Hydroingeo FVWRMP –II, etc.

Underground water

In the situation "With Project" it is not expected to have impact of project measures on underground water quality. Underground water is formed on irrigated areas on more highest landscapes in neighboring Kyrgyz Republic, therefore project measures will not provide negative impact on underground water deposits quality.

The calculations show that additional underground water intake from new wells for irrigation will be approximately 27.22 mln. m^3. Construction and operation of new wells will be carried out in accordance with Provision on the order for issue of permits for drilling wells by the norms of Goscompriroda and Uzbekhydrogeology. It is not possible to assess impacts of intake on underground water stock, due to lack of information about inflow items of underground water balance, formed beyond Uzbekistan, and about the intakes of all consumers. Detailed assessment of underground water balance will be conducted within detailed design studies.

Soil Fertility

Proposed technical and institutional activities, foreseeing capacity building of the land users (Farmer Field Schools, demonstration plots, and other consultancy services) are directed on improvement of farm practices on better water and land management.

Expected change in soil fertility in situation "With Project" is given in Table 6.17.

Table 6.17. Expected change of soil fertility in "With Project" situation

Sub-Project	Fertility by stages, point				Change in fertility, point		
	existing	in 3 years	in 5 years	in 10 years	in 3 years	in 5 years	in 10 years
Podshaota-Chodak	55	56	58	61	1	3	6

Source: Calculations of EA team according to handbook on land assessment

It is expected that under impact of the Project activities in 3, 5 and 10 years' time, fertility on average in the sub-Project area will be risen up to the "good" category (61 points).

Crop Yields

Expected yields of major crops after project implementation is presented in Table 6.18.

Table 6.18. Expected change in crop yield (t/ha)

Crop	Existing			"With Project"			Benefit		
	Farmers	Dekhkans	Average	Farmers	Dekhkans	Average	Farmers	Dekhkans	Average
Cotton	3.0	-	3.0	3.5	-	3.5	0.5	-	0.5
Wheat	4.7	6.2	4.9	5.5	7.3	5.8	0.8	1.1	0.9
Potato	14.3	26.7	18.2	16.9	31.5	21.5	2.6	4.8	3.3
Vegetable	19.2	33.3	23.5	22.7	39.3	27.7	3.5	6.0	4.2
Vine	7.7	10.9	8.5	9.1	12.9	10.0	1.4	2.0	1.5
Fruit	4.9	10.1	6.1	5.8	11.9	7.2	0.9	1.8	1.1

Source: Calculations of EA team, according to Handbook on land assessment, based on MAWR data, etc.

According to calculations, increase of cotton yield will be 0.5 t/ha, wheat – 0.9 t/ha, including 0.8 t/ha in farmers and 1.1 t/ha in dekhkans households. Productivity of potato and vegetables in average will be increased to 3.3-4.2 t/ha (farmers to 2.6-3.5 t/ha, dekhkans to 4.8-6.0 t/ha). Desirable increase in productivity of gardens and vineyards is 1.1-1.5 t/ha.

6.9.2. "With Project" Situation: Isfairam-Shahimardan

Water balance of project area

Implementation of arrangements on Component "System Modernization" will facilitate increase of water use efficiency at the farms level 726 m^3/ha of water will be saved for the account of non-

productive losses reduction on irrigated fields. This is confirmed by calculations of field water balance, executed by EA consultants (Table 6. 19).

Table 6.19. Existing and project water balance at the field level

	Evapotranspiration	Infiltration	Surface discharge	Evaporation at irrigation	Total loss in field	Precipitation	Shortage of water
Isfairam-Shahimardan							
Existing	5782	1600	2200	200	4000	2090	7692
Project level	5782	1310	1801	164	3274	2090	6966

Source: Calculations of EA Consultants, based on MAWR, Uzhydroment (2008, 2012, 2014) data, etc.

As a result, aggregate impact of activities (technical, institutional, managerial) on increase of water supply to land will be 15-20 % that allows having the increase of crop yield by 12%.

Water balance in a situation "With Project" that prepared by taking into account the implementation of project interventions in Isfayram-Shakhimardan project area is presented in Table 6.20.

Table 6.20. Water balance in project area Isfayram-Shakhimardan "With Project"

Balance articles	Accessible water resources	
	Volume, mln. m^3	Mineralization, g/l
INFLOW		
Accessible water resources	516.4	0.67
Including underground water	95	0.35
OUTFLOW		
Infiltration from canals	175.6	0.67
Infiltration from irrigated fields	64.1	0.94
Total infiltration water losses	239.7	0.85
Irrigation escapes	88.1	0.94
Evaporation by watering	8.0	
Evapotranspiration	252.7	
Total outflow	516.4	
BALANCE	0.0	

Source: Calculations of EA specialists, based on data of HGME, BAIS, FVWRMP –II, 2015,etc.

Irrigation runoff (88.1 million m^3) discharged from the sub-project area (with mineralization of 0.94 g/l) will not increase the water salinity in Margilansai and SFC (see Figure 6.2.b). This is positive impact of the project (Figure 6.2 b).

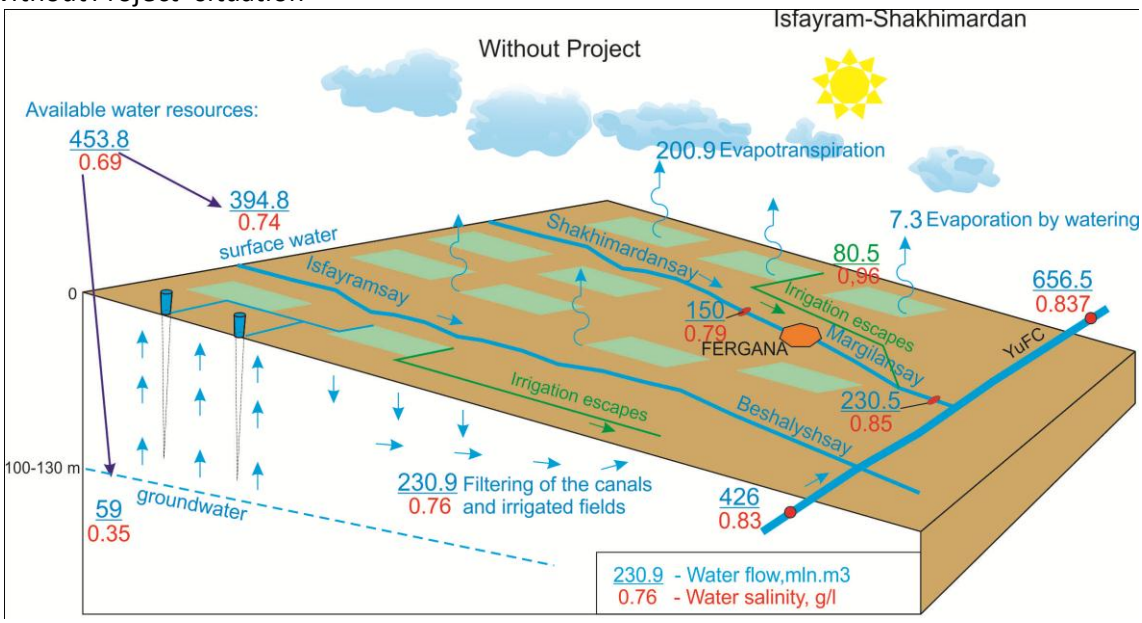
Underground Water

The assessment of water abstraction impact on change reserves of Chimyon-Avval deposit has been calculated by using water balance method (Table P5.5. Annex 5). According to expert judgment of Uzbekhydrogeology, in the situation "With Project" the increasing of groundwater abstraction to 35.77 million m^3/year (98.0 thousand m^3/day) due to construction of wells the negative impact on the Chimyon-Avval deposit reserves will not expected. Since the last inventory of deposit resources (1990), the extraction of underground water for irrigation has reduced by 377.7 thousand m^3/day (see Sub-section 5.3.2). In this regard, there is no reason to expect that the increasing of groundwater abstraction to 98.0 thousand m^3/day will lead to the depletion of deposit resources or a marked reduction in the level of groundwater [26].

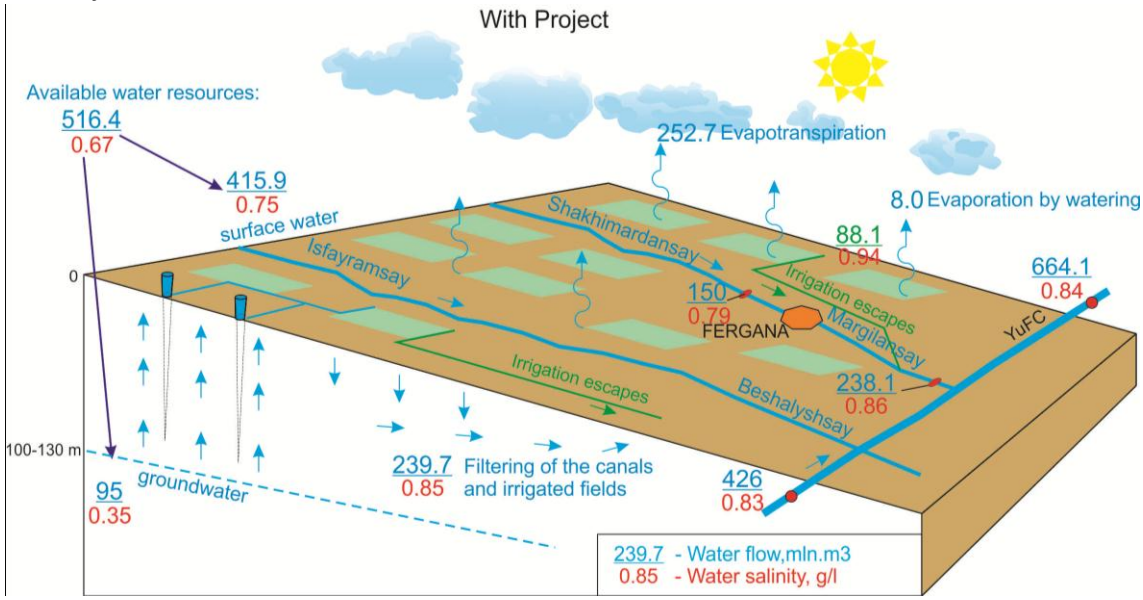
The results of the water balance of Chimyon-Avval groundwater deposit in the situation « *With Project* presented in the Annex 5.

Figure 6.2. Water balance scheme in Isfayram-Shakhimardan project area

a) "Without Project" situation



b) "With Project" situation



Source: Calculations of EA specialists (2015), based on data of HGME, BAIS, Hydroingeo FVWRMP –II, etc.

Soil Fertility

Proposed technical and institutional activities, foreseeing capacity building of the land users (through training programs, Farmer Field Schools, demonstration of innovative methods and water saving technologies, etc.) are directed on improvement of farm practices on better water and land management.

Expected change in soil fertility in situation "With Project" is given in Table 6.21.

It is expected that under impact of the Project activities in 10 years' time fertility on average in the sub-Project area will be raised to 5 points and will advance to the "medium" category.

Table 6.21. Expected change of soil fertility in situation "With Project"

Sub-Project	Fertility by stages, point				Change in fertility, point		
	Existing	in 3 years	in 5 years	in 10 years	in 3 years	in 5 years	in 10 years
Isfairamsai-Shahimardan	51	52	53	57	1	2	5

Source: calculations of EA team according to handbook on land assessment

Crop yields

Expected yields of major crops after the implementation of project activities is presented in Table 6.22.

Table 6.22. Desirable change in crop yield (t/ha) in the farmers and dekhkan farms, t/ha

Crop	Existing level			"With Project" situation			Benefit		
	Farmers	Dekhkans	Average	Farmers	Dekhkans	Average	Farmers	Dekhkans	Average
Cotton	2	-	2	2.4	-	2.4	0.4	-	0.4
Wheat	5.7	5.8	5.7	6.7	6.8	6.7	1.0	1.0	1.0
Potato	18.3	22.7	21	21.6	26.8	24.8	3.3	4.1	3.8
Vegetable	23.8	29.7	27.2	28.1	35.0	32.1	4.3	5.3	4.9
Vine	10.3	18	14.9	12.2	21.2	17.6	1.9	3.2	2.7
Fruit	7.7	13.3	8.2	9.1	15.7	9.7	1.4	2.4	1.5

Source: Calculations of EA team according to Handbook on land assessment

Consequently, desirable increase of cotton productivity will be 0.4 t/ha, wheat – 1.0 t/ha, both in farmers' households, and in dekhkans' households. Productivity of potato and vegetables in average will be increased to 3.8-4.9 t/ha (farmers to 3.3-4.3 t/ha, dekhkans to 4.1-5.3 t/ha). Increase in productivity of gardens and vineyards expected to be up to 1.5-2.7 t/ha.

6.9.3. "With Project" Situation: Savai-Akburasai

Water balance in project area

Implementation of these technical improvements within frameworks of FWRMP-II project will allow to increase water availability for 6-8% and does not require changing the mode of general releases in the situation "With Project" in the Savay-Akburasai sub-project area. SCADA system introduction will facilitate more efficient accessible water resources management, monitoring and water use, and related to this corresponding economic and environmental benefits.

Capacity building of WCAs and farmers open access to innovative technology and create enable conditions for water saving and water-use efficiency at farm level. Due to reducing unproductive losses of irrigation water on the fields will be saved 387 m^3/ha. This is confirmed by calculations of the water balance of the field, made by consultants EO (Table 6.23).

Table 6.23. Existing and estimated water balance at the field level in Savai-Akburasai

	Evapotranspi-ration	Infiltration	Surface discharge	Evaporation during irrigation	Total loss in field	Precipitation	Shortage of water
Existing	4210	854	1174	107	2134	2240	4104
Estimated	4210	699	961	807	1747	2240	3717

Source: Calculations of EA Consultants, based on MAWR, Uzhydroment and other data.

Water balance in project area of Savai-Akburasai is presented in Table 6.24.

In the situation "With Project" it is not expected to have impact of project measures on surface water quality. The share of water losses from canals, irrigated fields and irrigation runoff will decrease from 70% to 65% towards total intake, that will increase water outflow for yield creation (evapotranspiration) up to 112.1 mln. m^3.

Infiltration losses from canals and irrigated fields (106.3 mln.m^3) and irrigation outflows from fields (39.1 mln.m^3), classified as fresh water, both used within irrigation contour, and partially beyond project zone (Figure 6.3.b) will not provide negative impact on environment.

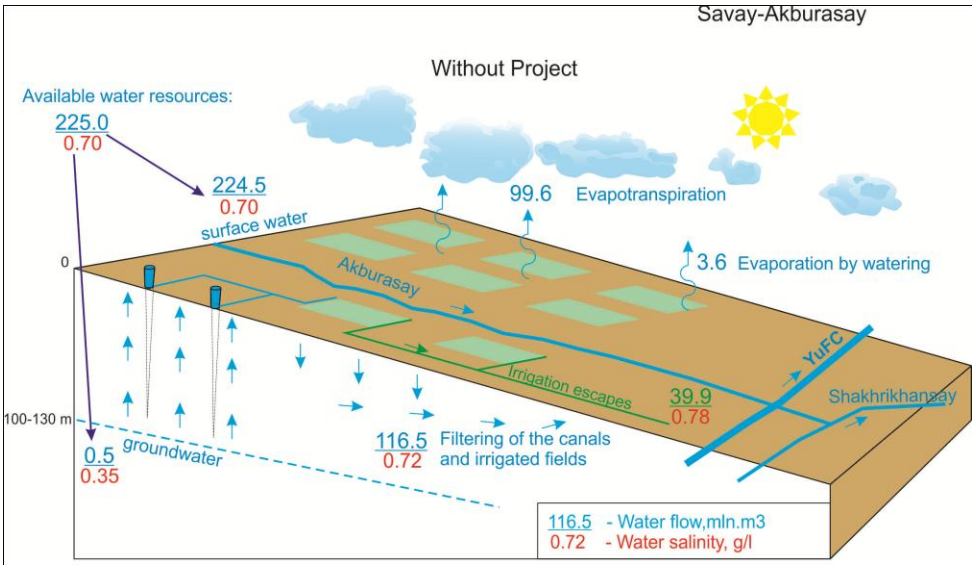
Table 6.24. Water balance in project area Savai-Akburasai "With Project"

Balance articles	Accessible water resources	
	Volume, mln. m^3	Mineralization, g/l
INFLOW		
Accessible water resources	229.1	0.70
Including underground water	0.5	0.35
OUTFLOW		
Infiltration from canals	77.9	0.70
Infiltration from irrigated fields	28.4	0.78
Total infiltration water losses	106.3	0.72
Irrigation escapes	39.1	0.78
Evaporation by watering	3.6	
Evapotranspiration	112.1	
Total outflow	229.1	
BALANCE	0.0	

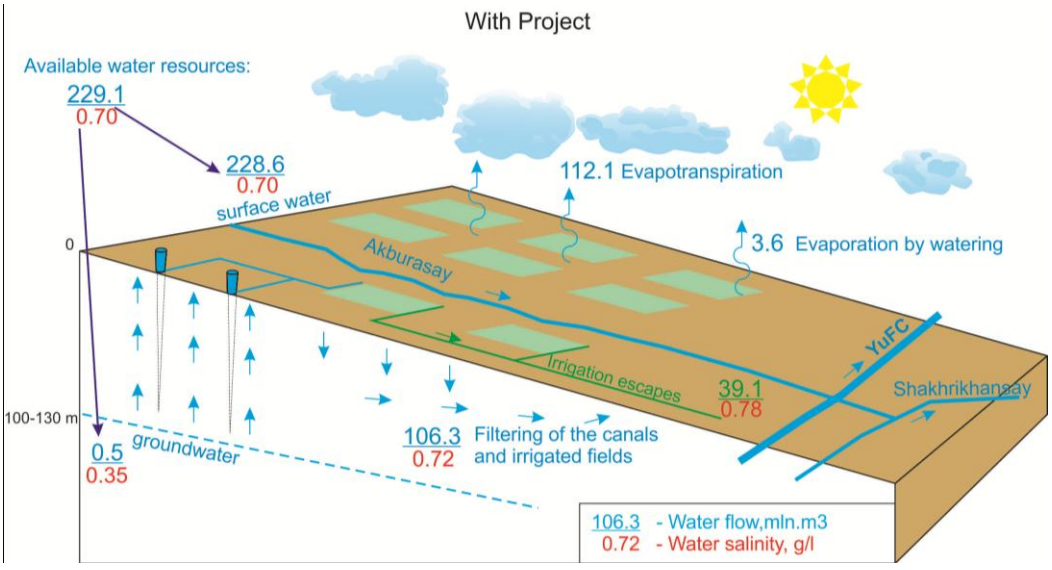
Source: Calculations of EA specialists, based on data of HGME, BAIS, FVWRMP –II, 2015,etc.

Figure 6.3. Water balance scheme in Savai-Akburasai project area

a) "Without Project" situation



b) "With Project" situation



Source: Calculations of EA specialists (2015), based on data of HGME, BAIS, Hydroingeo FVWRMP –II, etc.

Soil Fertility

As a result of efficient and reliable project interventions, fertility of irrigated soil in Savai -Akburasai sub-project area will be gradually increase. The expected change of soil fertility in the situation "With Project" is given in Table 6.25.

Table 6.25. Prognosis of soil fertility in "With Project" situation

Sub-Project	Fertility by stages, point				Change in fertility, point		
	Existing	in 3 years	in 5 years	in 10 years	in 3 years	in 5 years	in 10 years
Savai-Akburasai	59	60	62	65	1	3	6

Source: calculations of EA team according to handbook on assessment land

It is expected that under impact of the Project activities in 10 years' time fertility on average in the sub-Project area will be raised to 6 points, and will advance to the "good" category (65 points).

Crop Yields

Expected productivity of main crops for the short-term after the Project implementation is presented in Table 6.26.

Table 6.26. Expected change in crop yield (t/ha)

Crop	Existing productivity			Productivity "With Project"			Benefit		
	Farmers	Dekhkans	Average	Farmers	Dekhkans	Average	Farmers	Dekhkans	Average
Savai-Akburasai									
Cotton	3	-	3	3.5	-	3.5	0.5	-	0.5
Wheat	6.5	7.3	6.5	7.7	8.6	7.7	1.2	1.3	1.2
Potato	19.3	21	20.7	22.8	24.8	24.4	3.5	3.8	3.7
Vegetable	19.3	33.3	31.8	22.8	39.3	37.5	3.5	6.0	5.7
Vine	11.2	16.1	12.1	13.2	19.0	14.3	2.0	2.9	2.2
Fruit	7.2	14.4	10	8.5	17.0	11.8	1.3	2.6	1.8

Source: calculations of EA team according to handbook on land assessment

Analysis shows that desirable increase of cotton yield will be 0.5 t/ha, wheat – 1.2 t/ha, including farmers – 1.2 t/ha, dekhkans – 1.3 t/ha. Productivity of potato and vegetables will be increased in average of 2.2-5.7 t/ha (farmers to 3.5 t/ha, dekhkans to 3.8-6.0 t/ha). Increase in productivity of gardens and vineyards expected to be up to – 1.8-2.2 t/ha.

6.10. Water Balance with respect to the Andijan reservoir before and after project

Andijan reservoir

Dam safety policy is triggered for the projects, funded by the World Bank, that are being operated downstream of existing dams: if the project funded by the World Bank depends upon productivity (operation and maintenance) of existing dam; or if failure or incorrect management of existing dam may lead to serious damage of funded by the Bank projects. OP 4.37 is triggered due to the fact that sub-project "Savai – Akburasai" and "Isfayram-Shakhimardan" area is located downstream Andijan dam. Due to FWRMP-II the rules for reservoir operation should not be reviewed, and design of FWRMP-II does not require changing of mode for general releases in the both sub-project areas.

Andijan reservoir had been constructed in the eastern part of Fergana valley on the Karadarya River, at the border of Uzbekistan and Kyrgyz Republic, and is located 75 km upstream of the city of Andijan. Rim of reservoir is located mainly on the territory of Kyrgyz Republic and is formed by the Karadarya river

floodplain and its two tributaries: Yassy and Kurshab. Dam site is located not far from Kampyrravat ravine with exit of the Karadarya river into Fergana valley (see Annex 8).

Reservoir was accepted into permanent operation in April 1984. The reservoir has irrigation destination with multiyear flow regulation of the Karadarya river, and is assigned for guaranteed water supply to Shakhrihansai, Andijansai and Savay main canals on the left bank of the Karadarya river and into the right bank canal for irrigation of the Republic of Uzbekistan lands.

The administration for Andijan reservoir operation is subordinated to RO "Uzvodremexpluatatsia". The mode for reservoir operation is defined by Main Administration for Water Resources of the MAWR of the Republic of Uzbekistan. The rules for the waterworks facility structures operation were compiled in 1983 by the institute "Uzgipromeliovodkhoz" (currently LLC UzGIP). There is operation schedule till the year of 2016.

Water balance of the Andijan reservoir before and after project

The present situation, before FVWRMP-II

Due to water shortage in sub-project Savay – Akburasai and Isfayramsai – Shahimardan, the transfer of fresh river flow is carried out from Andijan reservoir through Shakhrihansai and South Fergana Canal (SFC). For that purpose pumping stations are lifting water from SFC and are supplying it into mentioned above sub – project areas for irrigation. Annually the intake from Andijan reservoir is about 176 mln.m^3 (for period 2008-2012). Total volume of the used for irrigation water resources in both sub–project areas is 727 mln.m^3/ha. In existing conditions the ratio between evapotranspiration and abstraction water is 30%.

The water balance shows that the project is expected to reduce the reliable annual flow in the Syrdarya at the border between Uzbekistan and Tajikistan by 83.9 MCM from 20,582.0 MCM to 20,498.1 MCM. The details of assessment the outputs of water balance is summarized below in Table 6.27 with respect to the Andijan reservoir before and after the Project.

Table 6.27. Water Balance before and after Project

Elements of the Water Balance	Podshaota-Chodak	Isfayram-Shahrimardan	Savay-Akburasoy	Total
Before Project (MCM/year)				
Reliable annual flow in Syr Darya downstream of project area				**20 582**
Actual crop evapotranspiration (ETc) and non-beneficial evapotranspiration (NBET)	49.3	149.9	74.4	273.6
Total irrigation demand (supply)	149.2	453.8	225	828
Overall efficiency (Water used as Crop ET at Plant level /total irrigation supply	30%	30%	30%	30%
After Project (MCM/year)				
Reliable annual flow in Syr Darya downstream of project area				**20 498,1**
Actual crop evapotranspiration (ETc) and evapotranspiration (NBET)	71.3	198.2	87.9	357.5
Total irrigation demand (supply)	185.8	516.4	229.1	931.3
Overall efficiency (Water used as Crop ET at Plant level /total irrigation supply	35%	35%	35%	35%

Source: FS Consultants based on ISA data; Feasibility Report, WB, 2015

Current annual crop evapotranspiration (Crop ET) and non-beneficial evapotranspiration (NBET) is 273.6 MCM per year for the three project areas combined, including in Podshaota-Chodak, Savay-Akburasai and Isfayram-Shahimardan are 49.3, 149.9 and 74.4 MCM, respectively. In total, the annual irrigation supply to the three project areas is 828.0 MCM and current total annual return flows from the project areas into the surface watercourses are 554.4 MCM for the three project areas combined.

Situation after FVWRMP-II

On improvement of water resources management FVWRMP-II will be based on Safety Declaration for Main Hydraulic Structures of the Republic of Uzbekistan (Protocol № 2/1 dated May 30, 2014) and the second edition of Andijan Reservoir Safety Declaration, approved by Expert Council of SI "Gosvodnadzor" for the period of five years (Protocol № 2 dated 19.09.2011), with the execution during that period of a number of measures on improvement of technical conditions and promotion of trouble – free operation of dam node.

Overall water use efficiency after FVWRMP-II is expected to increase as a result of the project from the current level of 30 percent to 35 percent. This will be achieved by various interventions including rehabilitation and lining of main canals and related water control infrastructure, rehabilitation of pumping stations and capacity strengthening of water managers and users. In addition, the project will lead to increased withdrawals from the Syrdarya, including through groundwater extraction. The improved water supply to the project area will lead to higher levels of water use (including beneficial Crop ET and NBET). Because of efficiency improvements, return flows from the project area will decline.

Analysis shows that as a result of the project interventions, more water will be available for crops to use, which means an increase in Crop ET and NBET. In total, the increase in the irrigation supply for the three sub-project areas combined will be 103.3 MCM. The total reduction in return flows is 19.5 MCM for the project area combined. The net impact of the project on water withdrawal from the Syrdarya basin is 83.9 MCM.

In conclusion, according to the water balance calculation, the net impact on the Syrdarya river will be a decreased average annual discharge, which is expected to be 20,498.1 MCM for the post-project situation, a 0.4 percent reduction of the current discharge. The net reduction of flow during the summer months is estimated at less than 1 percent.

Two additional scenarios were developed to estimate the sensitivity of the project to changes in the pre- and post-project water balance. With withdrawals staying the same under each scenario, a high level scenario assumes that efforts to increase efficiency are unsuccessful and that most of the additional withdrawals under the project are lost to drainage. Efficiency would stay at the pre-project level of 30 percent. The impact of the project under this scenario is an increased net withdrawal of 261.1 MCM, or 1.3 percent of the average annual flow. Under a medium scenario, 50 percent of the withdrawal is assumed to be used for NBET, and 50 percent serves to increase drainage. The net project impact in this scenario is 172.5 MCM, or a 0.8 percent reduction of the average annual flow at the Uzbek-Tajik border.

An additional analysis was conducted to estimate the impact of the project on the total cumulative flow between April and September. Considering that an estimated 70 percent of the annual runoff of the Syr Darya at the Uzbek – Tajik border occurs between April and September, the net impact of the project is 0.6 percent, 1.2 and 1.8 percent under the project design–, medium- and high-case scenario, respectively. To summarize, there will be no adverse environmental impacts on the natural streams as a result of the project. The expected social impact of the operational phase will be economic gains to communities in the coverage area of the three sub-projects.

For the execution of OP 4.37, within detailed design of the FVWRMP-II, the update of the report on Dam Safety Declaration of 2011 will be carried out in accordance with approved work plan and schedule. Then, the teams of the Bank and MAWR, together with responsible organization (Gosvodkhoznadzor), with assistance of the PIU consultants, they will hold joint on-line workshop on completion of main document: "Potential Failure Mode Analysis" (PFMA). The results of workshop will by synthesized in the report that will be submitted to the Bank and PIU. Gosvodkhoznadzor, with assistance of the PIU of

MAWR, will conduct the program of safety inspection and provide two diagnostic survey: (i) before construction of project and (ii) second survey during the last year of project implementation.

6.11. Impact on Syrdarya River and Small Rivers

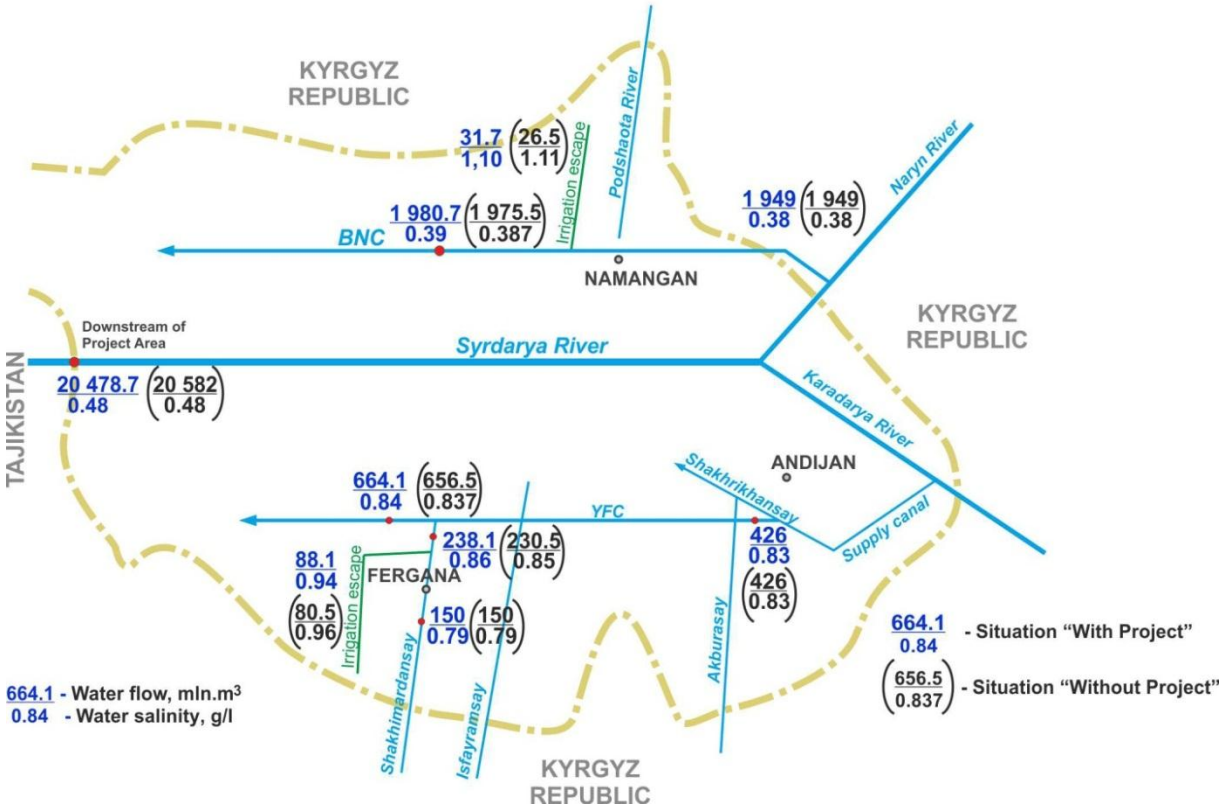
Environmental flow for the rivers is envisaged in accordance with the environmental requirements to to maintain the viability of the water bodies. For the small rivers of sub-project area annual regulating-environmental releases/flow account for: the Podshaotasai River – 19.7 million m^3, the Isfairamsai River – 64.7 million m^3, the Shahimardansai River – 30.0 million m^3 and the Akburasai River – 64.1 million m^3. Increase in ground water intake for irrigation during vegetation in situation «With Project» will ensure the reduction of irrigation water deficit and the maintaining of ecological releases. This is proved by the hydrographs of the rivers' runoff and the environmental flows (see Annex 5).

Comparative analysis of the water-salt regime changes in the situation pre- and post-Project is illustrated in Figure 6.4.

According to the classification [17], the surface water with a salinity of 1 g/l is estimated as fresh or brackish one suitable for irrigation and domestic purposes. Salinity of return water from irrigated areas varies from 0.7-0.8 g/l (Savai-Akburasai system) to 1.08-1.16 g/l (Podshaota-Chodak system). Thereby, irrigation water discharged into small rivers can not visibly impact on change in water salinity due to due to low mineralization and its small volume. Partly irrigation water is taken down for irrigation, in some districts (Fergana and Kuvasai) is fully used within the irrigation line, and partly discharged beyond the irrigated line. Irrigation water discharged into the surface watercourse is mixed with the river flow, and also used for irrigation. No impact as a result of the Project activities on Syrdarya is expected because the surface watercourse flowing down from the irrigated territory, does not reach the Syrdarya, being taken down for the irrigation (Figure 6.4).

Thereby, the project interventions would not pose any negative impact on the Syrdarya River basin. Based on the very small reduction of river flow in the summer months, no negative stream impacts are expected.

Figure 6.4. Line scheme of Project impacts on the Syrdarya river flow (in the situation "With Project" and "Without Project")



6.12. Proposed option

As seen from the previous Sections, in situation “Without Project” water supply and soil fertility will continue to be reduced. As shown in Chapter 6, this impact is utterly opposite in situation “With Project”. There is no doubt that recommended option is “With Project”.

7. EMERGENCY SITUATIONS ANALYSIS

That Chapter presents requirements on environment management and monitoring for such types of projects in Uzbekistan. It is reflected on possible emergency situations, that may occur in the result of natural disasters, such as earthquakes and mud flows.

7.1. Types of situations

Project zone is predisposed to natural disasters, such as earthquakes or abnormal weather conditions and floods. This may in the result lead to mud flows, causing victims, settlements destruction and damage to hydraulic structures, roads, arable lands and other objects. Mud flow processes in Fergana valley, occurring in the result of intensive precipitation and fast melting of snow in nearby mountains often were destructive. According some reports, these events are almost annual. From the number of fixed mud flows in Central Asia 40% are referred to Fergana valley. By the years 2030-2050 the increase in the number of mud flows is expected for 19-24% and by 2080 for 12-13%.

7.2. Mitigation

In order to mitigate these extraordinary situations in Fergana valley they constructed the structures, such as mud flow storage and derivation channels. In the project zone irrigation canals, structures, derivation and crossing canals may undergo to possible extraordinary situations. Impact may not only brings physical damage and damage to structures, but also facilitate distribution of infection diseases.

The Feasibility Study does not address the possible impact of the fore-mentioned emergency situations and specific measures proposed to counteract or mitigate such impacts. One of the project outcomes will be improved safety of irrigation infrastructure maintenance and these measures will improve the physical structure and bring enhanced management, operation and maintenance, taking into account some potential emergencies. The engineering process will also take into account the security aspects such as protection of structures with respect to external threats, as well as impacts that the structures may have on the third parties based on acceptable physical design and construction and adequate O&M activities.

Additional mitigation measures in the project next phase of detailed design may include assessment of high risk zones and structures, that may be exposed to damage from flooding; modification of proposed design if necessary; measures on emergency supply with potable water; campaigns on mitigation inflectional diseases distribution.

8. ENVIRONMENTAL MANAGEMENT PLAN

8.1. Mitigation Plan

The most of the mitigation measures are to address adverse environmental impacts which are associated with temporary and local disruption caused by construction and rehabilitation works. These mitigation measures will be mandatory for Contractors' implementation, and duly supervised by the PIU. The indicative costs for the implementation of mitigation measures will be part of bidding documents, and construction contracts will accommodate adequate budget.

Adverse impacts at construction phase

During the construction phase there will be a risk of some negative influences on the environment, such as surface and ground water pollution, degradation of lands and landscape, land erosion, which may be a result of excavated/extracted earth, improper removal/placement of the disposed soil and construction waste, leakage of fuels and lubricants and other materials during the construction, use of temporary construction sites, temporary pollution of air, noise and vibration caused by excavation works, dense transport schedule during the construction, potential impacts on the vegetation cover, and generation of construction and domestic wastes.

These impacts will be mitigated through application of good environmental management practices, such as preservation of fertile topsoil removed during excavation works, dust suppression, proper collection and disposal of wastes, duly operation of vehicles and machinery, etc.

The other aspects that will need to be addressed and mitigated during the project implementation are as follows:

- Impacts associated with Managed Aquifer Recharge: since the detailed activities will be defined at a later stage, based on the results of specific studies, details of potential impacts and respective mitigation measures will be analyzed and defined in a separate EIA/EMP to be developed then;
- maintenance of ground water levels and aquifer capacity: this ESAMP concluded that the estimated consumption of ground water will not cause any damage to the established water balance. The MAWR/PIU will ensure that the new irrigation wells are constructed and operated in accordance with, and under close monitoring by, the SCNP, and follows the provisions of this ESAMP;
- river bank restoration: any potential risks of water pollution for those parts which will be converted natural river banks into engineered surfaces, will be mitigated by measures, including prevention of fuel leakage into the water, fuelling and keeping construction machinery at a distance from the water bodies, prevention of wastes disposal into the water etc.;
- health and welfare of workers, and sanitary and hygienic conditions will be ensured: training of the personnel on safety rules during both the construction and operation phase; fencing and providing emergency signals and lighting on construction sites and workers facilities; provision of sanitary and hygienic facilities at the construction sites and camps; ensuring presence of medical personnel and required medicines on site;
- chance finds procedures: no historical and cultural objects and landscape were identified during the safeguard studies. However, in case of any chance finds in the project area, all works have to be immediately stopped, and the PIU shall inform relevant national authorities and request guidance on further handling the chance finds. Works can resume after the chance finds are safely removed by and under close supervision of relevant national authorities.

The impacts on nestling birds are not expected due to the fact that nestling areas located in the vicinity of households and not near the civil works location.

Impacts and recommended mitigation related to potential increase of the use of pesticides

Increased use of pesticides can lead to pesticide residue (including heavy metals) build up in the soil. Pesticides and fertilizers can migrate to both surface waters and groundwater resulting in contamination of these two sources and leading to damaged aquatic ecosystems and threatened health to downstream users. As stated above, using of pesticides is a common practice in the country, and hence it may occur indirectly under the Project component activities. Although FVWRM-II will not support the purchase of pesticides, use of pesticides might be increased indirectly due to extension of agricultural activities in the project area.

The primary aim of pest management is to manage pests and diseases that may negatively affect production of crops so that they remain at a level that is under an economically damaging threshold. Integrated Pest Management consists of the judicious use of both chemical and nonchemical control techniques to achieve effective and economically efficient pest management with minimal environmental contamination. IPM therefore may include the use of: i) mechanical and physical control; ii) cultural control; iii) biological control, and iv) rational chemical control.

The World Bank refers to IPM as a mix of farmer-driven, ecologically based pest control practices that seek to reduce reliance on synthetic chemical pesticides. It involves (a) managing pests (keeping them below economically damaging levels) rather than seeking to eradicate them; (b) relying, to the extent possible, on non-chemical measures to keep pest populations low; and (c) selecting and applying pesticides, when they have to be used, in a way that minimizes adverse effects on beneficial organisms, humans, and the environment. Where feasible, an effective IPM strategy will attempt to use alternatives to pesticides. This might include a range of biological, mechanical and physical, and cultural alternatives or approaches [29].

The FVWRMP-II envisages application of the principles of Integrated Pesticides Management (IPM), which combine biological, cultural, physical and chemical methods to control pests, diseases and weeds. The objective of the Pest Management in the project is to promote environmentally sound (hygienic, cultural, and biological or natural) control mechanisms and the judicious use of chemicals in pest control and effectively monitor pesticide use. It is recommended to observe strictly norms of reagent use, terms and ways of application of separate forms. Workers should be towards the direction of wind blowing so that dispersion was carried away aside from them. It is also recommended that cabins of tractors should be hermetic with supply of the cleared air. For the prevention of pollution of the soil and water chemical tests of the soil concerning the content of pesticides will be carried out.

The project will support agricultural activities and strengthen the capacity and skills of farmers and local producers in the project area to minimize risks and threats, associated with the use of pesticides and other agrochemicals in the future. In order to prevent any harmful effects in the transportation and use of pesticides, it is important to promote use of existing national (and international) guidelines which provide enough practical information. There are a number of safety precautions that required for mainstreaming in farmer practices and should be considered when manufacturing, transport, application, storage and handling of pesticides (Table 8.1).

In the case of stable organochlorine compounds (polychloropinen, polychlorine camphene, hexochloran, etc.) in topsoil (up to 30 cm) is not recommended to grow carrots, root - and tuber crops meant for food and forage. Thus, compliance with measures for prevention and protection from / crops and forage crops from contamination by pesticides, which can then be present in animal products (milk, butter, meat, etc.) is essential.

The Project will support capacity-building and agricultural extension activities by raising awareness, knowledge and training for responsible agencies, farmers and other target groups. The training modules will cover a wide range of issues, with particular attention to the use of biological methods, regulation of specifications and standards of pesticides and other agrochemicals, with using the experience and lessons learned WB projects, and others.

Table 8.1. Pesticide/Fertilizer Control Strategy

Likely Hazard Scenario	Recommended Control Strategy
Spillage	Ensure all storage areas and/or facilities are secure and appropriate. Ensure all fertilizer products can be contained within the storage area and/or facility selected Provide appropriate equipment and materials to clean up a spillage
Transportation and delivery of goods	Cover any loads of fertilizer products whilst in transit Ensure that deliveries of fertilizer products are made at appropriate times Do not accept any containers of fertilizer products that are damaged and/or leaking. Ensure that any spillages that occur during delivery are cleaned up appropriately.
Drift of dust from storage areas and/or facilities	Keep fertilizer products covered and/or sealed Clean up spillages promptly Keep "in use" stocks to the minimum required Staff responsible for storage areas and/or facilities to will ensure that the drift of dust beyond the perimeter is kept to a minimum.
Storage areas - Floors	Keep floor surfaces swept clean of fertilizer to prevent tracking by people and/or vehicles beyond the perimeter. Sweep up and dispose of spillages in a timely and appropriate manner
Cross contamination of product	Keep each fertilizer product will in a separate storage container and/or position within the facility and/or area.
Confusion of Product	Maintain an accurate storage manifest/register. Keep products and blends are segregated at all times. Ensure all storage bays and bins are clearly labeled. Ensure all storage, loading and blending plant and equipment is cleaned from all residues when changing from one product to another. Do not store product in bags that are not correctly stamped
Occupational Health and Safety	Contact between fertilizer products, people and livestock will be minimized.
Risk Assessments	Risk Assessments are required to be conducted on the procurement, storage and handling of fertilizer products.
Contact with people and livestock	Managers will develop, implement and monitor the effectiveness of hazard management procedures All persons using fertilizer products are to adhere to the hazard management procedures and adopt safe working practice and ensure that direct contact with fertilizer and the inhalation of fertilizer dust is minimized. Managers are to ensure that staff is made aware of any national and industry regulations which have to be observed.
Personal Protective Equipment	Staff must be provided with appropriate PPE when using fertilizer products.
Lack of appropriate warning safety signage and information	Managers must ensure that appropriate safety warning signs and/or information is displayed/ available regarding nature of hazards and risk control measures.
Poor housekeeping and/or routine maintenance	All staff is responsible for implementing sound housekeeping practices in storage areas and arranging regular routine maintenance for all equipment used.
Defective &/or unserviceable plant & equipment	Conduct regular inspection & testing of equipment and infrastructure to identify what maintenance requirements
Incorrect or inappropriate mixtures of product	Fertilizer blends to be prepared using the right raw materials in the appropriate proportions. All products will be loaded into spreaders etc., in the right condition to the right weight.
No training	Staff will undertake appropriate training.
Lack of appropriate records &/or documentation	All relevant records and documentation to be kept and maintained egg. training records, risk assessments, maintenance schedules, recipes for fertilizer blends, MSDS's etc.

Source: The WB, 2015 [29]

Implementation of pest management activities under the Project would entail education, training and communication that are defined in a Pest Management Operational Plan (PMOP). Such activities will be implemented as part of the project EMP and will accordingly address the aspects indicated in Table 9.1

above. The National Coordination Units (PIU, RRA) and Financial Institutions (PFIs) will be responsible for communicating the content of the PMOP to farmers and Investment recipients. The Plan will also ensure that all farmers have access to information on relevant crop pests and diseases, potential IPM strategies regarding pest control, current list of registered and banned pesticides and information kits would be developed (in local languages) for safe use, handling, storage and disposal of pesticides and the consequent environmental and health related impacts of improper use of these pesticides Each sub-projects will prepare a Pest Operational Plan, based on the outline of a Pest Operational Plan provided in Annex 2.

The responsibilities for the implementation of the Environmental Mitigation Plan will be assigned as follows:

(a) Project Implementation Unit (PIU)

The PIU bears overall responsibility for the environmental compliance of the project. In ensuring so, the PIU will have a full time Environmental Specialist who will be responsible for the day-to-day supervision of the project environmental management, close follow up with Contractors and Construction Supervision Consultants (CSC) on the implementation of their specific tasks as indicated in the EMMP (see Table 9.1 below). When preparing bidding documents, the PIU will ensure that environmental requirements and EMMP as well as an indicative budget are clearly stipulated in the bidding package. The PIU will require duly reporting from contractors and CSCs, as well as internally within the PIU from the staff assigned to the implementation of specific components and activities. The PIU will report one quarterly basis to the World Bank on project environmental compliance.

(b) Construction Supervision Consultants

CSC will be responsible for the day-to-day monitoring of civil works, including environmental monitoring. Such monitoring will be undertaken against the monitoring plan and parameters presented below in Chapter 9. The CSC will also consult and guide Contractors on their environmental compliance, promptly identify any issues and follow up on their addressing.

(c) Contractors

Contractors will be responsible for the implementation of the mitigation measures which are specified in the EMMP (Table 9.1 below) which shall be an integral part of their respective contracts. The construction contracts shall accommodate sufficient budget required for the implementation of the mitigation measures. The Contractor is also responsible for obtaining all necessary environmental permits and licenses which might be required for specific activities under construction contracts (such as setting up construction camps, etc. Before the commencement of civil works, the Contractor shall prepare specific management plans to be cleared by CSC and approved by the PIU, as follows:

- Hazardous Waste Management Plan;
- Waste Management Plan;
- Labor Safety Plan;
- Flora and Fauna Protection Plan (including revegetation measures, seasonal limitations to civil works etc.)

Contractors shall follow guidance of the CSC and report in a due manner to the CSC and the PIU Environmental Specialist.

8.2. Environmental Monitoring Plan

The Monitoring Plan of the project activities is summarized below in Table 10.1. The responsibility for the environmental monitoring is shared among the PIU, CSC, Monitoring & Evaluation (M&E) Consultants and respective state agencies in accordance with their mandates. It is proposed to establish an Environmental Monitoring Group (EMG) which would have a required level of expertise. The project will provide support to specialized government institutions for environmental monitoring in the project area, which will ensure the stability and sustainability of the project after its completion.

Monitoring and Evaluation Indicators

The general list of parameters / indicators for monitoring of the EMMP:

- The quality of surface water and groundwater in the project area and downstream;
- Groundwater level and waterlogging;
- The impact / influence on flora and fauna;
- Solid waste management;
- Loss of soil on land erosion embankment canal during rehabilitation works;
- Soil fertility;
- Sediments at the channel end point and on pumps located on the inter-farm canals;
- State of water protection area around the construction and rehabilitation sites;
- Handling of soil during its removal to stockpiling area;
- Handling of waste, including fuel, lubricants and construction debris;
- Quality of air (dust, emissions) near the site;
- Transport movement and safety control;

Additional details on required monitoring system are given in Table 8.2.

Table 8.2. Indicators of environmental monitoring during the Project implementation

Issue	Responsible organization	Indicators	Location and frequency
Ecological threats on/ near work sites	PIU/EMU	Spill of fuel and oil, dust formation, air pollution by machinery, disposal of construction materials, road-transport damage	Site Quarterly
Ecological protection and strengthening	PIU/EMU, SPNC	Disruption of water and land ecology; habitat, creation of green belts along sais in the shore protection sites and broadening of multi-purpose trees	Site Quarterly
Soil pollution	PIU/EMU, Uzgiprozem, HGMEs, and WCAs	Mobile and gross NPK, humus content, SOM, nitrates, nitrites, ammonium, phosphate, pesticides, etc.	Project area, twice a year
Quality of surface water	PIU/EMU, HGMEs, Uzhydromet	Mineralization of surface water, hardness, BOD, COD, nitrate, nitrite, ammonium, phosphate, pesticides, oil products, phenol	Project area, twice a year

Required Equipment

Analysis shows that operating resources existing in country are insufficient to support proposed field observations for collection and analysis of data, and needs in dissemination of information, therefore, additional equipment is required. List of required tools/equipment for proposed monitoring is summarized in Table 8.3.

Table 8.3. Required equipment for water and soil monitoring

Name	EMU at PIU	Podshaota-Chodak	Isfairam - Shahimardan	Savai-Akburasai	Total	Price (USD)	Total (USD)
I. Computer equipment							
1. Computer, monitor, UPS	1	1	1	1	4	1,000	4,000
2. Laser printer 1022	1	1	1	1	4	500	2,000
3. Stationery and spare parts					3.5		17,500

Name	EMU at PIU	Podshaota-Chodak	Isfairam - Shahimardan	Savai-Akburasai	Total	Price (USD)	Total (USD)
II. Field and laboratory equipment							
1. Photometer NOVA 60A with test set, Germany		1	1	1	3	5000	15,000
2. Test set and standard solutions to photometer NOVA 60A		15	15	15	45	180	8,100
3. Portable measuring device electrical conduit/pH		3	3	3	9	300	2,700
4. GPS		1	1	1	3	200	600
III. Equipment for training							
5. Training equipment (camera, flipchart, board, etc.)		1	1	1	3	1000	3,000
Total							43,900
Contingencies (7%)							3,073
TOTAL							46,973

Responsible organizations - partners

As stated in Chapter 3 monitoring of soil and water salinity, water table and drainage, water use and water allocation performed specialized hydrogeological reclamation expedition (HGME) of the BAIS MAWR. Councils of farmers, WCAs and other local organizations will support in on-farm water use monitoring. Monitoring of groundwater regime in the Fergana Valley is carried out by the Geological expeditions of the State Committee on Geology and Mineral Resources. Monitoring the quality of surface water and air pollution is performed Uzhydromet. Environmental monitoring is performed at the analytical inspection of the State Committee for Environmental protection (SCNP). Monitoring the quality of drinking water is carried out by regional offices of the Ministry of Health.

Environmental Monitoring of the AM component

The following activities are required for Environmental Monitoring of the Agricultural Modernization component implementation:

- Review of the credits selected for the random sampling will be based on the environmental screening sheet provided by the PFIs on each loan. The review should include a visit to the activity site, an interview with the applicant, and a consultation with the regional environmental authorities.
- Based on the credit activity reports, site visits, and information from local environmental authorities, the PIU environmental specialist will analyze environmental situation by province to determine whether purchases under FVWMP-II credit lines has increased, potentially creating cumulative impact. If this occurs, RESP-II may suspend lending.
- The PIU environmental specialist will review plans for training and advisory services to ensure that sustainable agricultural practices for farmers and agro-business personnel are included, and that environmental due diligence for PFI staff is addressed.

The PIU environmental specialist will work in cooperation with the project M&E specialist to integrate monitoring of EMMP implementation into the overall project M&E design.

9. ENVIRONMENTAL MANAGEMENT PLAN MATRIX. CAPACITY BUILDING

Table 9.1. Environmental Management and Monitoring Plan (EMMP)

Mitigation Plan				Monitoring Plan		
Activities /issues	Possible environmental impact	Mitigation measures	Responsibility	Monitoring parameters	Methods and frequency	Respon-sibility
Project implementation (1-7 years)						
Stage before construction/mobilization						
Inclusion of requirements for health and labor care at project sites	Impact on health: - sanitary threats (PS buildings and equip-ment, lack of personal hygiene facilities) - threat to personnel health	Rehabilitation of personal hygiene facilities (shower rooms, toilets, etc); instructions on safety aids and promotion with safety; Elaboration of Work plan on labor protection and safety aids	Design Engineer (DE) and specialist on safety (SS)	Bidding documents and detailed design (inclusion of requirements on sanitation and safety aids)	One time check of design and bidding documents	Project Manager (PM) and safety specialist (SS)
EMMP inclusion into bidding documents and contract	Lack of EMMP means that ecological issues are not considered	EMMP is obligatory condition of bidding documents; Contractor prepares Site-specific Environmental Management Plans based on MAWR rules and EMMP.	Project Manager and safety specialist	Bidding and contractual documents (EMMP inclusion)	One time check of bidding and contract documents	Design Engineer (DE) and specialist on safety (SS)
Selection of Contractor, with selection criteria including environmental management capacity and environmental expertise	Reduction of risk for non-observance of EMMP requirements	Preparation of evaluation sheet for comparison of contractors and selection of most suitable contractor	Project Manager and safety specialist	Evaluation of bidding documents (scores of contractors)	One time check of observation	PM and SS
Measures for the dam safety of the Andijan reservoir	Risks to sub-projects, operating below the existing dam	Perform safety inspections and conduct diagnostic tests of dam	Gosvodnadzor PIU MAWR	Government financing	(i) pre-project; (ii) at 7th year of the project	PIU MAWR
Stage of construction						
Public awareness raising	Possible reduction of farmers incomes due to changes in irrigation water supplies	Campaign on public awareness on construction works plan and possible impact on water supply	Project Manager and safety specialist	PIU documents. Reports and register ob holding public consultations	One time check	PM and SS

Mitigation Plan				Monitoring Plan		
Activities /issues	Possible environmental impact	Mitigation measures	Responsibility	Monitoring parameters	Methods and frequency	Respon-sibility
Introduction instructions of Contractor	Reduction risks for proper EMMP execution	Permit for Contractor work after EMMP approval	Safety Specialist (SS) and Civil Engineer (CE)	PIU instructions before works commencement	One time check	SS
Cutting of trees at the plots for rehabilitation/construction	Ecological damage	Cutting is carried out only after approval and permit of Goscompriroda/Khokimiyat	Contractor, Goscompriroda, SS and CE	Number of trees subject to cutting	One time check of permit for cutting	SS and CE
Preparation of construction site and conservation of landscape	Disturbance of surface soil layer, agricultural lands	Minimization of breakdowns during the period of works, conservation of surface layer, where it is possible	Contractor and CE	Works at sites, observation, recommendations	Selection checks and monthly inspections	SS and CE
Works on reconst-ruction / const-ruction during vegetative period	Risks for breakdown of water supply mode and reduction of yields	Works in non-vegetative period (if possible); Construction of by-pass structures (canal) for uninterrupted water supply	Contractor and CE	By-pass structures, water supply mode		SS and CE
Promotion of safety and presser-vation of workers health	Risks of possible accidents and loss of working capacity	Program on working place safety. Workers are supplied by labor safety and instructed. Action plan in extraordinary situations.	Contractor	Regular control and supervision of the Contractor's EM activities; Reporting	Selection and monthly checks	Contractor, CE and SS
Storage and handling with construction materials and F&L	A) Pollution of soil and water in the result of F&L spill	(a) Proper transportation, storage and handling operation works; (b) Preparation of sites for materials storage; (c) Stock of tanks for F&L, d) filling at 20 m distance from waterways, e) Action plan in case of F&L spill and other	Contractor and Supervision Engineer (SE)	Action plan in case of unforeseen situations. Storage sites of materials, storage of F&L and etc.	Initial, selection and monthly checks	Contractor, CE and SS
Carrying out of works at construction sites	Possible inconveniences for population and personnel due to dust, noise and air pollution by machinery.	(a) Water spraying at site and roads; (b) Tank lorries for water transport-tation; (c) Control for exhausting gases emission and fuel quality, noise in source, conditions of silencers, bafflers and exhausting pipes at vehicles, protection of workers with individual means.	Contractor	Control of roads, damages and inconveniences for population	Selection monthly checks	Contractor, CE and SS
Transportation of equipment and materials on existing roads	Risks relates with place of work and road – transportation damage	Selection of routes on the basis of cargo transport loading, by-pass roads, repair of damaged roads, traffic management.	Contractor	Roads, availability of damages and inconveniences for population	Selection monthly checks	Contractor, CE and SS
Cleaning and	Risks for damage to	Utilization in accordance with waste categories	Contractor, SS,	Temporary and designed	Visual survey of sites	Contractor,

Mitigation Plan				Monitoring Plan		
Activities /issues	Possible environmental impact	Mitigation measures	Responsibility	Monitoring parameters	Methods and frequency	Respon-sibility
removal of debris and construction waste	environment with incorrect disposal of debris	rules: scrap metal and old equipment are sold by processors of waste; landfills should be buries and surface restored and liquidation of electric equipment in accordance with International guidelines [30-32]	Oblecoexpertisa	sites for waste disposal	based on Goseco-expertise standards	CE and SS
Canal lining repair, replacement of pumps and motors	No, with corresponding utilization	Construction waste and sites for storage (or used after grinding for other purposes); pumps are sold for scrap metal or other purposes	Contractor /PIU	Working sites	Monthly and selection surveys	Contractor, CE and SS
Ecosystems preservation and protection	Risks of soil erosion and decrease of water and surface ecosystems functions and services /areal	Creation of green belts from wooden plantings, along sais at the sections of bank strengthening works, and extension of multipurpose trees in the adjacent households	Contractor	Assessment of demand and recommendations	One time check of execution	EMT, SCNP
Solid and liquid domestic waste utilization	Soil and water pollution with domestic waste	Solid and liquid waste is disposed from working sites to the places approved by PE and Goscompriroda	Contractor	Working sites and DP	External control, monthly checks	Contractor, CE and SS
Ground and surface water quality control	Risk of impact on downstream areas	a) The use of corrosion-resistant materials in the construction; b) Proper transportation and storage of fuel; c) filling at 20 m distance from waterways; d)Plan of Action in the case of fuel spill; e) instruction and audit	PIU, Contractors with assistance of BAIS and Uzhydromet	Monitoring indicators (see in Table 10.2)	Quarterly reporting	EMG + HGME, Uzhydromet
Managed Aquifer Recharge	Possible risks for infrastructure and habitat.	Detailed design will include comprehensive studies and separate EIA/EMP.	Contractor /PIU/Designer	Set of indicators for impact on environment, social safety and effectiveness	Inspection on location, SEA, M&E and reporting	Contractor, CE and SS, EMT, SCNP, Gidroingeo
Protection and security of Chimyon-Avval deposits	The deterioration of groundwater quality	a) Device containers for fuels and lubricants above the earth's surface, b) monitoring and precautions for use; c) prohibition of discharge of petroleum products on the ground.	PIU, Contractors with assistance of BAIS and Gidroingeo,	Monitoring indicators (see in Table 10.2)	Quarterly reporting	EMG + HGME Gidroingeo,
Rehabilitation and closure of construction sites	Risk of ecology deterioration, aesthetics and safety of settlements	a) Removal of all waste and polluted soil; b)Replacement of soil surface layer and restoration of growth c) Contractor's environmental management responsibilities will be governed by specific clauses of respective contracts	Contractor	All construction sites /camps, storage sites and temporary landfills	After completion of works. Till final payment	Contractor, SE, CE and SS

Mitigation Plan				Monitoring Plan		
Activities /issues	Possible environmental impact	Mitigation measures	Responsibility	Monitoring parameters	Methods and frequency	Respon-sibility
Inspection and acceptance of construction works till object transfer		Objects transfer after inspection and signing act of acceptance – transfer by serving personnel	Contractor, PM, SS	All working sites, temporary landfills and places of waste disposal	Inspection after works completion till final payment	Contractor, SE, CE and SS
Operation and Maintenance (O&M) Stage (8-th year and further)						
Irrigation infrastructure regular technical maintenance	O&M improved possibilities	Organization of programs on technical maintenance (TA). Check of correct TA; Preparation and dissemination of manuals booklets, training	Contractor, BAIS, MAWR	Operated equipment in accordance with expected project results	Semi-year and annual reporting	BAIS
O&M structures (Kandiyon dam and other structures)	Risk for occurring of emergency situations	Adequate maintenance, timely repair	BAIS, ISA, PIU	Monitoring of dam body, outlets conc-rete structures etc.	Inspections on monitoring	BAIS, ISA, EMT, PIU
Land productivity maintenance and conservation	Deterioration of water and soil quality due to lack of experience and skills of farmers	Increase of irrigation efficiency at farm level; extension of manuals and training modules for water savings (see Chapter 4 and 10).	HGME, BAIS, leasehold farms	Water quality, organic substance of soils and crop yields monitoring, etc.	Seasonal sampling and analysis	HGME, BAIS, MAWR
The use and control of pesticides	Contamination of soil, surface water and groundwater	Precautions, observance of sanitary rules and hygienic standards for their use, storage and transport of pests.	Farmer farms	Water quality, soils and crop yields monitoring, etc.	Sampling and analysis by seasons.	HGME, BAIS, MAWR
Protection and security Chimyon-Avval deposits	The deterioration of groundwater quality due to mismanagement	a) Reduction of seepage losses in irrigation fields b) compliance with rules and regulations of storage and use of fertilizers and pesticides	MAWR, PIU Farmer farms	Water quality monitoring	Sampling and analysis 1 times a year	MAWR Gidroingeo
Public awareness	Prevention of risks for diffuse and pointed pollution and ecological damage	Implementation of measures on EMMP	MAWR, SCNP Uzhydromet	Measures on informing	Accepted monitoring system, Reporting	MAWR, SCNP, Uzhydromet
Implementation of safety aids plan	Risk of industrial injuries and possible losses of working ability	Implementation of plan for labor protection and safety aids	Responsible for safety aids, BAIS	Quantitative monitoring of accidents and injuries	Monthly report	BAIS
Maintenance of sanitary conditions and cleanness at sites	Deterioration of sanitary conditions in PS buildings and other structures; Risks of environment pollution	- Waste disposal at special sites for processing or secondary use, and maintenance of toilets depending upon category, according requirement of sanitary – epidemic stations	Responsible for O&M, BAIS	Monitoring on waste utilization and sanitary conditions	Regular inspections	Administratio n on O&M, BAIS
Support of EMG	Improved EMMP execution	Training, assistance, audit of local and international consultants	PIU		Monitoring missions	PIU

NOTE: The estimated costs for the identified mitigation measures are presented in Tables 9.3 and 9.4 below.

Capacity Building; Agricultural Training

Capacity building program on environmental management (EM) for training of the PIU/EMG staff, WCAs, farmers and agricultural producers will be implemented under the Project's institutional component. Several training modules will be on ecological issues, procedures and methods of EMMP implementation. The proposed training modules are presented in Table 9.2.

Table 9.2. Recommended training program on environmental management

No.	Training module	Duration (days)	Trainees/ Division	Proposed training premises /Centre
1	Environmental impact assessment (EIA), including targets, impacts, EMMP,etc	5	SPNC and its division	Fergana-Andijan-Namangan, SPNC
2	Environmental Monitoring and Reporting	3	SPNC, HGMEs, MAWR	Fergana-Andijan-Namangan HGME
3	Environmental law, policy, regulations and institutional reforms	3	SPNC, MAWR	Fergana-Andijan-Namangan SPNC, BAISs
4	Economic assessment and costs/benefit analysis	3	MAWR, BAISs, TA and Oblselvodhozes in FV	Fergana-Andijan-Namangan Oblselvodhoz
5	Soil conservation and protection, including laboratory training, GIS mapping	3	Soil Science Institute, UZGIP, MAWR	Tashkent Fergana-Andijan-Namangan HGME
6	Basics and principles of IWRM; water allocation, management and experience and learning lessons	3	MAWR, BAISs, HGMEs, IWMI	Fergana-Andijan-Namangan HGME
7	Aquifer recharge management: best practices, experience, methods and technologies and their efficiency and acceptability.	5	IWMI, UzHydroingeo, Geological expeditions in FV MAWR, BAISs	Fergana-Andijan-Namangan BAIS/HGME
8	Agricultural and water reforms, WCAs motivation, operation and management	3	BAISs, WCAs, Farmers Council	Fergana-Andijan-Namangan ISA, HGME
9	Integrated Pest Management. Dose (rate), guidance, precaution measures and pesticide handling	3	Plant protection services, MAWR	Fergana-Andijan-Namangan BAIS, Oblselvodhoz
10	Agricultural Investment Appraisal, including preparation of business plans, rural business related to farming services and inputs	5	MAWR and its divisions Ccommercial banks, leasing companies,etc	MAWR, BAISs and its divisions
11	Mobilizations of financial resources (internal, external and innovations); IFS	5	MAWR, UZGIP Uzhydromet	Fergana-Andijan-Namangan BAIS
12	Climate change adaptation and mitigation	5	Uzhydromet, MAWR, UZGIP,	Fergana-Andijan-Namangan BAIS
13	Socio-economic surveys and gender analysis	5	Tahlil, NGOs of FV	Fergana-Andijan-Namangan

Sustained Agricultural Extension

Analysis shows that existing organization responsible for the agricultural extension within Fergana Valley is not sufficient and need to be strengthened to provide the required extension services, especially in the field of water management and irrigation service delivery, scaling up of IPM and SLM technologies, climate change adaptation and mobilizations of finance resources, including advisory services and training on preparation business plans, financing of agricultural inputs and investments, and technical aspects, including agriculture conservation, agronomy, pesticide handling and other.

In this context, the agricultural extension activities were initiated to enhance the newly independent farmers, WCAs and agricultural producers to gain the full benefit from the Project, i.e. dissemination of innovations, improved technologies, effective participation of local stakeholders, and improved skills and empowerment for decision making in IWRM, IPM and environmental protection and enhancement. Component 2 will promoted the complementary training program to strengthening capacity of the responsible institutions, divisions, WCAs, farmers, agricultural producers and affected communities. Although the EMG is expected to have the agricultural extension/training expert, this is insufficient to cover the Project needs in agricultural training. Corresponding budget should be envisaged in the total Project costs.

Additional measure related to EMMP

- to assist in strengthening of agricultural extension services within respective organizations, research institutes and centers at the project areas;
- development of complementary training program on Agricultural Investment Appraisal, including the preparation of business plans, financing of agricultural production (agrotechnics, storage, processing), agricultural-related services and investments;
- to facilitate the mobilization of financial resources (internal, external, and innovation), including preparation of (i) climate resilience rural development plans, (ii) project proposal for submission to global financial Facilities: GEF -7, Climate Adaptation Funds, Green Economy Funding, etc.
- expansion of advanced technologies and practices on approach and tools of IPM, agriculture conservation and preventive measures, including rain water harvesting, etc;
- encouraging the use of high-yielding and heavy-producing valuable food crops (cereals, vegetables, fruit trees) and food items (bee-keeping, aquaculture) and greenhouse for vegetable, flowers, etc.

9.1. Measures after Project Completion

Once all Project interventions have been completed (after 7 years) the improved irrigation systems are expected to operate. To sustain the Project outputs the main mitigation measures will then be operation and maintenance of the irrigation infrastructure, where necessary with participation of the user groups (WCAs, farmer councils). It is expected that considerable further effort will be needed to inform the users through awareness and training campaigns. In addition, efforts will be needed to promote farming diversity and environmental protection and enhancement. Responsibility for these after-Project measures will be with the MAWR and its regional institutions, as well as with the *Goskompriroda*, and WCAs. As the Project funds will have been exhausted by then, all funding for these activities is to come from government, and where possible WCAs. Responsibility for monitoring of the after-Project interventions is among others with MAWR, its regional branches, HGME, WCAs, and local NGOs.

The EMMP will provide members of WUAs and local governance with information on the soil and water conditions in the Project Area. The EMMP will be adjusted and refined were and when necessary, together with the main involved organizations.

9.2. Costs

Costs for environmental management will be included in contracts of the Contractor.

Expected costs for implementation of measures and monitoring on EMMP, including contribution of the EMU (including taxes, social bonuses, etc.), participating institutions, monitoring equipment and training costs, are given in Table 9.3 and 9.4.

Table 9.3. Cost estimate for implementation of monitoring system on EMMP

Activity	Man-month	Rate (USD) (1)	Total Staff (USD)	Travel and per diem (USD)	Total estimated costs (USD)
1. Environmental Conservation and protection					450,000
2. Environmental Monitoring Group (EMG)					
Environmental Monitoring Consultant, international	60	15,500	930,000	15,000	945,000
Institutional and training Consultant, international	60	1,200	72,000	15,000	87, 000
Inspector of the Contractor. Verification of ecological compliance at sites	30	1,000	30,000	10,000	40,000
Representative of authorities from “Podshaota”. Verification of environmental compliance at sites	30	500	15,000	5,000	20,000

Activity	Man-month	Rate (USD) (1)	Total Staff (USD)	Travel and per diem (USD)	Total estimated costs (USD)
Representative of authorities from "Savai-Akbura". Verification of environmental compliance at sites	30	500	15,000	5,000	20,000
Representative of authorities from Isfairam-Shahimardan. Verification of environmental compliance at sites	30	500	15,000	5,000	20,000
Institutional expert. Coordination of overall environmental monitoring	30	15,500	465,000	10,000	475,000
Expert on agricultural extension/training. Coordination of training program	30	750	22,500	5,000	27,500
Participating agencies (SPNC, HGMEs, WCAs)			120,000	40,000	160,000
Sub-total					1 794,500
3. Equipment (Table 8.3)					46,973
4. Training programs (Table 9.2)					51,950
5. Demonstration plots					239,400
TOTAL					**2 582,823**

(1) With account of taxes, social bonuses, insurance, etc.

Table 9.4. EMMP main provisions and budget

Expense items	Environmental/ social impact	Mitigation or monitoring measures	Respon-sible	Cost $US
Mitigate disruption of terrestrial and aquatic ecosystem	Risks of soil erosion and reduction of ecosystem service /areal	Creation of green belts along sais at the sections of bank strengthening works (procure planting stocks, drought-resisting plants, to prevent soil erosion)	Contractor /PIU	450,000
	Disruption of flora and fauna – environmental damage	Restore trees and plants that would be cut down to access the construction site.	Contractor /PIU	
		Purchase special seeds, farm machinery, fertilizers for households in project farms.	Contractor /PIU	
	Possible inconvenience population and personnel; temporary reduction in farmers' incomes; sanitary threats and safety risks	Carrying out awareness campaigns; Control of noise, dust, exhaust fumes, road watering, water truck; coaching, work is not the growing season; software security tools; measures to protect health and safety. Plan for emergencies.	Contractor /PIU	
Consultants for institutional development, Monitoring/training, including local experts of EMG	None	Consultants, international (2) и local (2), and also local experts of EMG: Constructor inspector and 3 representatives of local administrations in charge of environmental compliance checks on sub-projects and project facilities.		1 841,473
Training on water quality /management and environ-ment protection	None	Training programs, FFS and agricultural extension activities; assistance to access to credit lines, preparation of business plans, etc; Purchase office, field and training extension equipment, stationeries; rentals for training premises, etc.		51,973

Demonstration plots	None	3 demo plots in each sub-project (total 9 plots) for demonstration and replication of best SLM practices, on-farm water management and water allocation schemes, with introduction of IPM, IWRM and M&E tools;	PIU	293,400
Resettlement and compensation costs	None	To ensure timely compensation payments (at full replacement cost) for loss of assets attributable directly to the project	PIU	TBD
	None	Resettlement assistance	PIU	
	None	Provide assistance to improve the displaced- persons livelihoods and standards of living (at least restore to the pre-project levels)	PIU	
Contingencies	Safety and health of workers	a) Implementation of the program to ensure workplace safety. b) The supply of workers by means of safety and instruction. c) Plan of Action in emergency situations		
	Environmental pollution	All waste is classified according categories for utilization: a) scrap metal and old equipment are sold by processors of waste; b) Construction waste is removed in the storage site (or used for other purposes). c) electric equipment containing PCB should be liquidated in accordance with International guidelines [30-32]; d) The use of corrosion-resistant materials in the construction; e) Proper transportation and storage of fuel, filling at 20 m distance from waterways; f) Plan of Action in the case of fuel spill.		
	Property ownership	Compensation for incidental damage to private entities or other emergency situations.		
Compensatory water supply	Risks of disruption the water supply regime and crop yield damages	a) Works in non-vegetative period (if possible); b) Construction of by-pass structures (channel) for uninterrupted water supply.		
Storage of construction materials, fuels and lubricants	Soil and water contamination	a)Preparation of sites for materials storage; b) Reserve fuel tanks; c) Precautions for storage and handling operations.		
Additional EMMP-related studies (particularly related to upgrade/ safety and agricultural extension and provision of incentives)		(1) Arrange construction works within boundaries of existing allotments to reduce land disruptions; (2) Develop new on- farm irrigation systems; (3) To assist in strengthening agricultural extension services; (4) Training program on Agricultural Investment Appraisal, including the preparation of business plans and mobilization of financial resources; etc.	MAWR	TBD
Preliminary total:				**2 582,823**

At preliminary Project total cost USD 211 million, cost for implementation EMMP will be USD **2.583** million, or 1.22 % of all Project costs. Cost for EMMP excludes all mitigating measures, which will be part of contract of the Contractors, and costs for sustained agricultural extension/ trainings, as well as approximately USD 450,000 for environment conservation (for creation of green plants along sais in shore protection sites).

10. CONSULTATION AND DISCLOSURE

Consultation activities carried out during the Environmental Assessment study are presented in **Annex 3**. Through the field surveys/ investigations and discussions a wide range of recommendations were received on how to improve water management and operations in the three sub-project areas of the FWRMP –II. Participants of the dialogues and local meetings were represented by two broad categories: (i) water users, especially farmers and dekhkans, and involvement of social structures, such as WCA's and Citizens Assemblée's; and (ii) water management specialists from BAISs, ISAs, Agricultural departments and other responsible organizations. However, there was a strong consensus that the Phase II project should be implemented as soon as possible to secure the reliable water supply to the irrigated lands and the other water users.

The impact analyses were carried out during the April-June, October-December 2014 period. The EA report and draft executive summary were drafted in March 2015. Both documents have been made available in Russian to facilitate transfer of knowledge to and discussion of findings with regional and national organizations involved or affected by the project. The EA and SA findings and recommendations will be thoroughly discussed during Stakeholder Workshops in May 2015 (May 11 in Namangan, May 12 in Andijan, and May 14 in Fergana).

The final EA study report and its Executive summary report, in English and Russian, will be placed in the World Bank Info Shop, made available at the World Bank office in Uzbekistan and will be widely disseminated within Uzbekistan.

Brief review of stakeholder dialogs / comments

Consulting activities carried out during Environmental Assessment are presented in **Annex 3**. Three important Consultation Stakeholder workshops (CSW) had been organized and hold by the environmental and social assessment team (ESA) during the period from May 12 to May 14, 2015 in three sub-project areas (May 12 in Namangan, May 13 in Andijan and May 14 in Fergana). The objective of CSWs is to discuss the results of ESA reports on assessment of project intervention impacts and recommended Environmental Management and Monitoring Plan (EMMP). The primary attention was concentrated on obtaining feedback on technical, social and environmental aspects of the Project, especially from beneficiaries of project area. Workshop Agenda, protocol and list of participants are given in **Annex 9**.

Many questions were raised regarding technical measures, outlining that further consultations would be required on information of target groups on these aspects of project. Chairman of Yangikurgan Makhallya Committee supported priority measures on rehabilitation and modernization of irrigation system and approved introduction of drip irrigation. He expressed concern regarding losses/reduction of orchards yield due to sharp water shortage, especially during summer months.

The concern was expressed that water shortage causes significant losses of agricultural land productivity, especially on higher slopes. Taking into account difficulties in the work of WCAs it was proposed to include into Phase-II rehabilitation of on-farm network and to accelerate signing of necessary documents for start up of activities in project area. The PIU representative marked that indeed WCAs are facing great difficulties due to shortage of funds, knowledge and experience, therefore, strengthening of capacities and their capabilities are included in the Component 2 "System Modernization".

Some participants indicated on possible damages, that may be brought by the project to farms, ownership and orchards. The PIU representative clarified that if damage would be unavoidable, then corresponding compensation will be allocated in accordance with existing Government provisions.

The participant of the workshop from Tashkent asked to clarify impact of technical interventions on environment of the Podshaota-Chodak sub-project. Mrs. G. Khasankhanova replied that water resources of Podshaota-Chodak system are characterized by good quality of surface water (river flow mineralization is up to 1 g/l) and intensive inflow and outflow of fresh groundwater; processes of waterlogging and soil salinity are not observed. The results of EA, executed according to ToR, confirm the positive impact of technical interventions on environment of the sub-project, only partial temporary negative impacts are observed during the construction and operation of sites. EA team used the review, analytical reports, monitoring and assessment materials of MAWR divisions and other institutions (Hydroenergo, IWMI, TIIM and the others), obtained and used within framework of IWRM Plan /FS preparation.

It should be noted, that The farmer from Chartak district indicated on the necessity for solution of the problem with improvement of electric power in Khazratshokh village, he asked assistance from Pumping Stations Administration, and to include construction of well in their village.

The women – personnel of regional Ameliorative expedition, marked the necessity for procurement of laboratory equipment. Mrs. G. Khasankhanova replied that PEUM envisages purchase of field and laboratory equipment, and devices for monitoring and evaluation of water quality, soils, and also equipment for training of the personnel of HEM under PIU, AIS, WUA and the others.

The workshop participants from district administrations and State Committee on Nature Protection asked to reduce the time required for project preparation, as the requirement in measures is very high. The PIU representative replied that the World Bank and the Government are also insisting on acceleration of preparation and timely agreement and approval of necessary documents in the established order.

11.ANNEXES

ANNEX 1. List of References

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ANNEX 2. Environmental Review Procedure Guidelines for Agricultural Modernization Support and Institutional Components

2.A. Environmental Review Procedure Guidelines for Agricultural Modernization Support and Institutional Component

Overview

Each sub-loan/lease proposal will undergo an environmental review procedure, as follows:

Credit applicants: complete the form [28] to identify possible environmental impacts of proposed activities, identify and agree to undertake mitigation measures if appropriate. The credit application form includes a checklist [28] to identify environmental risks. In all cases where an environmental assessment report or environmental monitoring plan are required, these are to be prepared by the credit applicants and, where relevant, submitted to the Goskompriroda (or its Agents), and the EIA report and monitoring plans are to be provided with the credit/grant application.

PFIs: screening of applications including for environmental impacts, ensuring required permits have been obtained. Request RRA to carry out field site visits for on site environmental screening (specifically, for sub-projects classified as category B) to verify the environmental data provided by applicants, assist in identification of mitigation measures, and confirm that the environmental category is appropriate and that the EMP is adequate:

PIU/RRA: monitor compliance with EMP; provide advice on specific issues that may arise including EA/EMP preparation assistance to category B projects through site visits; monitor for cumulative impacts; provide training on environmental due diligence to PFIs; provide training and information on sustainable agricultural practices via advisory services component

Environmental screening for small credit applications

The Environmental Screening Checklist shall be prepared by PFIs and MPFIs for small-size credits up to US$10,000 equivalent. Sample Environmental Screening Checklist form [28] should be included in the credit application form. The loan officer of the PFI screens applications against the environmental checklist and assigns the environmental category [28]. Most small credits to will fall under Category C, requiring no further action beyond screening. In case of questions regarding environmental impact or appropriate category, the PFI contacts the environmental specialist of the RRA for advice and assistance. If mitigation measures are needed, these are agreed with the applicant and reflected in the credit application. The results of the environmental screening are recorded on the application and maintained with the credit file.

Environmental screening for medium credit applications (greater than US$10,000)

The potential sub-borrower shall complete Environmental Screening Checklist [28]. It is expected that the majority of mid-size credit sub-projects will fall into category B.

The PFI will screen each sub-project against the environmental checklist [28] to define the environmental category of the sub-project, review the proposed mitigation measures, and ascertain that all required permits have been obtained and are valid. For sub-projects classified as Environmental Category B, the RRA environmental specialist will visit the applicant and project site to conduct a simple EA and identify mitigation measures. The PIU/RRA specialist will complete the field visit checklist [28]. The applicant will reflect the checklist findings and recommended mitigation measures in the application package. When the RRA visit or initial screening reveals high or significant risks, the applicant will hire a consultant to prepare a full EIA and management plan. The cost of the EIA can be included in the credit amount.

In cases when possible adverse impacts are discovered during the Field Site Visit, the Environmental Screening and Field Site Visit Checklists are submitted to the Goskompriroda, which issues a preliminary environmental statement listing potential environmental concerns and mitigation measures and determines whether an environmental assessment (EA) is required. If permits from the Goskompriroda are needed, these are to be obtained by the borrower and submitted to the PFI with the sub-project proposal. The credit application package

must include guidelines and instructions to the borrower. The Goskompriroda shall issue environmental permits, if required. The procedure for issuing permits includes: (i) state ecological expertise, and (ii) stakeholder consultation in the decision-making process.

During the project implementation, the PFI should ensure that the environmental mitigation measures are implemented. In the case of non-compliance, the PFI (with assistance of RRA environmental consultant as needed) will investigate the nature and reason(s) for noncompliance, and a decision is taken about what is needed to bring a sub-project into compliance, or whether financing should be suspended.

Sub-project Categories

Sub-projects assessed as Category A, (high environmental risks). No Category-A sub-projects will be financed by the project.

Sub-projects assessed as Category B, (moderate environmental risks) may require Secondary Screening during appraisal, and are expected to require a basic EA and mitigation and monitoring arrangements. Annex 1 [28] provides examples of Category A, B and C sub-projects. For expansion of existing facilities or where change of technology is proposed, an environmental audit may be required, depending on the nature of the sub-project.

Sub-projects assessed as Category C, (sub-projects having no significant environmental issues) require no Secondary Screening.

Secondary Screening

In some cases, a Secondary Screening may be conducted to establish the veracity of the environmental data provided by the sub-project proponent. Secondary Screenings will be done on a random sample basis, or at the request of the PFI as part of sub-project appraisal. The completed Secondary Screening form [28] will be entered in the project files.

Secondary Screening during site inspection includes updating and physical verification of all data provided in the credit application:

- Confirm actions taken since submittal of the credit application
- Environmental data provided by the applicant is correct
- No potential environmental issues have been ignored
- The environmental category classification is appropriate
- Environmental management and monitoring plan is adequate
- EIA report has been completed (where required)
- Statutory environmental permits have been received and are adequate
- Stakeholder consultations are complete [28]
- Confirm that no land aquistion is to be financed, nor resettlement triggered.

In cases where Secondary Screening substantially modifies any of the above, the Environmental Screening Category and the Environmental Management Plan may need to be revised. The sub-project must not be financed by the PFI until the revisions have been accepted and checked by the RRA. Secondary Screenings would not typically be performed.

Rejection of sub-project

If the sub-project is rejected on environmental grounds after an unsatisfactory site visit, an improved environmental proposal may be submitted by the proponent, and re-appraised as above. Re-appraisal should be restricted to one improved proposal, and the proponent should not expect to make multiple applications on the basis of continuous marginal improvements to the scheme. Re-appraisal should be at the discretion of the PFI, and consulted with the RRA. More detailed information is given in [28].

Environmental Monitoring

If the credit application is accepted for funding, environmental monitoring will be required for Category B projects in compliance with the environmental management plan (EMP) agreed in the screening procedure. The extent of project monitoring will be dependent on the nature, scale and potential impact of the sub-project. Monitoring may require the services of environmental specialists or a company with laboratory and analytical facilities (for complex environmental problems) or inspection by the local government environmental officer. Environmental monitoring is the responsibility of the RRA.

Reporting by the PFIs and the PIU/RRA

Credit line PFIs are required to submit quarterly reports to the RRA on the credits financed using WB funds in accordance with uniform reporting formats as prescribed by the Project and agreed by the World Bank. That report would have a section on environment.

The PIU/RRA will address in physical progress report section of the regular quarterly Financial Management Reports (FMRs) that are to be provided to the Bank. The PIU/RRA will address environmental aspects of the financed sub-projects and the related documents (i.e., environmental management plans and mitigation measures) in its routine reporting to the World Bank and during the periodic supervision missions

2.B. Institutional Issues and Implementation Arrangements

A main output of the EA is the institutional strengthening plan for improving the capability for environmental management. This plan is based on the findings of field surveys and public consultations. The following institutional strengthening activities related to the environmental management and monitoring are recommended:

strengthening the PIU/RRA capacity by hiring of an Environmental Monitoring Specialist (EMS);
environmental training programme for PIU/RRA/PFIs, farmers/WCAs and training in coordination with other agencies;
agriculture extension and awareness raising programme for key stakeholder groups.

Environmental Monitoring Specialist (EMS)

The PIU/RRA will be responsible for implementation of FVWRM-II in compliance with the Environmental Management Framework [29]. The PIU/RRA will hire Environmental Monitoring Specialist specifically responsible for environmental monitoring of the Project interventions and its impacts. The EMS will be in charge of overall coordination and reporting on the EMP, inspection of environmental compliance at worksites, advising project participants on environmental questions, coordination the overall environmental monitoring at project level, and coordination of the agricultural extension programme.

The EMS will report directly to the PIU/RRA/MAWR. The EMS will be responsible to implement the monitoring plan. EMS will prepare and submit a concise quarterly reports to the attention of the PIU/RRA on the most important issues related to the EMP. The format of the report will be prepared by the EMS and approved by the PIU/RRA/MAWR.

Training programme

A training program targeting the PIU/RRA/PFIs, WCAs, farmers and other stakeholders will be implemented in the framework of the Project's institutional component. Some of the training modules will specifically be dedicated to environmental issues and to procedures and methods for the implementation of the EMF. The training provided under FVWRM- II will be expanded and deepened through the RESP-II and other donor-supported projects.

Sustainable Agricultural Extension

Analysis shows that the current agricultural extension, if existing at all, within Project area is weak and needs strengthening particularly in IWRM to be able to provide the required extension assistance to WCAs. It is therefore recommended to include in the Project the agriculture extension component which will enable WCAs and farmers to gain the full benefit from the Project, i.e. dissemination of improved technologies, effective participation of local stakeholders during the design and construction works, improved skills and empowerment for decision making in IWRM and environmental protection and enhancement. This component will build capacity of oblast and rayon institutions and NGOs, particularly WCAs and small farmers. Additional extension services and demonstration of environmentally sustainable technologies and agricultural practices will be provided under the FVWRM-II Project.

2.C. Pest Management Operational Plan

Table 2.C. Pest Management Operational Plan Outline

Impact/pest pesticide threat & risk	Desirable Mitigation Measures	Potential Implementation tools	Indicative Expected result	Indicative Monitoring indicators	Responsibility / Key actors
Pollution of water resources	Control, manage and supervise pesticide use by farmers	Awareness of proper application and disposal of pesticides and oversight	Farmers trained in sound application and disposal methods	Number of farmers trained, Training records	PIU/RRA, PFIs SCNP,MAWR Uzhydromet EMS
	Proper disposal of pesticide containers by resellers/farmers	Pesticide container collection and disposal plan/arrangements in place by farmers	Pesticide container disposal plan being implemented by farmer	Number of farmers/ resellers aware of pesticide container disposal needs	
Improper use of pesticides by farmers and farm workers	Educate farmers and farm workers on proper use of pesticides and pesticide use hazards	Pesticide hazards and use guide leaflet for the project (include simple pictorial presentations)	Proper use of pesticides by farmers and farm workers	Number of cases of pesticide poisoning occurring under the project	
	Control and supervision of pesticide use on farms by farmers	Awareness of proper application and disposal of pesticides and oversight	Farmers trained in application and disposal of pests	Number of farmers trained, Training records	
Poisoning from improper disposal of pesticide containers	Educate farmers, farm workers and local communities on health hazards associated with use of pesticide containers	Pesticide hazards and use guide leaflet for the project	Farmers, farm workers, local communities educated on pesticide use	Number of cases of pesticide poisoning ;	
				Number of farmers returning empty pesticide containers	
	Properly dispose pesticide containers	Pesticide container disposal procedures known by farmers	Pesticide container cleaning and implemented	resellers trained in proper cleaning of pesticide containers	
Impact on post-harvest losses due to pests	Framers have adequate and proper storage facilities Farmers monitor incidence of post-harvest pests	Post-harvest loss reduction based on IPM techniques under implementation Post-harvest loss reduction plan based on IPM techniques in place	Post- harvest losses avoided or minimized. Applied pesticides registered in conformity with IPM principles.	Number of farmers trained in IPM techniques for post- harvest storage; Number and condition of storage facilities. Number of cases of post- harvest pests	
	Confirm status and integrity of pesticides at storage gate prior to use	Inspection of pesticides at farm/storage gate prior to use on random basis		Records of pesticides applied kept by farmers	
Abuses in pesticide use	Ensure status and integrity of pesticides purchased and used under project	All pesticides kept in the original wellabeled pesticide containers prior to use	Only approved and registered pesticides used under project	List of pesticides used in line with Uzb list of registered and approved pesticides	
		No decanting of pesticides under this project by farmers	Banned pesticides avoided	Cases of pesticides found in non-original containers	
		Random inspection of pesticides at farm gate prior to use	Expired pesticides avoided Integrity of pest guaranteed at farm gate level	Inspection records r pesticides at farm te prior to use	
General health and safety of farmers/crops	Farmers educated to adopt Good Agricultural Practices (GAP) based	IPM techniques with emphasis on cultural and biological forms of	Compliance with best Pest/ pesticide management	Number of farmers trained in IPM techniques;	

and environmental hazards	upon IPM techniques; and do not use chemical pesticides unless advised by Government regulations	pest control		Number of farmers implementing IPM on their farms	
				Frequency of chemical pesticides usage	
	Provide PPEs to Farmers/ farm using personal protection equipment (PPE)	Health and safety policy for farm work	Farmers and accompanying dependents (children) protected against pesticide exposure in the fields	Quantities and types of PPEs are easily available under the project	
	Educate farmers/ farm workers in the proper use of pesticides	Pesticide hazards and use leaflet for the project (include simple pictorial presentations)	Farmers know and use pesticides properly; pesticide hazards and use guide leaflet or flyers produced	Number of farmers trained in pesticide use;	
				Number of farmers having copies of the pesticide hazard and use guide flyers;	
	Train farmers to properly dispose obsolete and unused pesticides	Obsolete and unused pesticide disposal arrangements made by farmer	obsolete and unused pesticide disposal arrangements implemented	Relationship between pesticide supply and usage	
	Educate farmers to obtain or purchase quantities of required pesticides and to avoid long term storage of pesticides	Pesticide use farmer plan	Pesticides needed are purchased; long term storage of pesticides by farmers avoided	Relationship between pesticide supply and usage	
	Farmers trained and aware of emergency response to pesticide accidents and poisoning	Framer emergency response plan in place	Pesticide accidents and emergencies managed under the project	Number of pesticide accidents and emergencies	

2.D. Environmental SCREENING CHECKLIST FORMS for Support of Agricultural Modernization Component

Environmental Screening Checklist forms shall be prepared by credit applicants and shall be included in the credit application forms. This is a sample screening checklist that is recommended by the team of experts for use during the preparation of credit guideline and manual under Rural Finance Component.

FORM 1 - ENVIRONMENTAL SCREENING CHECKLIST
(To be completed by credit applicant)

1. Sub-project name:
_____

2. Brief Description of Sub-project:
_____
_____
_____

***2.1 Nature of the activity*:**
_____
_____
_____

2.2 Cost: _____

2.3 Physical characteristics (description of items to be financed):
_____

2.4 Site area (# of hectares) and location:
_____

*2.5 Property ownership:*_____

2.6 Existence of ongoing operations? (yes/no) _____

*2.7 Plans for Expansion?*_____

*2.8 New construction?*_____

3. Which of the following inputs would be financed? Indicate with a check below which inputs or investments would be financed, the potential impact (if known), and whether mitigation measures have been identified.

Table A-2.1 Farm Inputs Screening Checklist

Input	Will be Financed	Potential Impact	Mitigation Measures Identified?	
			Yes	No
Seed		None		
Pedigree seed		Biodiversity loss: Yes___ _No_____ Chemical inputs: Yes___ No_____		
Fertilizer		Water pollution: Yes__ _ No_____		
Pedigree animals		None		
Animals for finishing		Overgrazing: Yes_____No___ Forest degradation: Yes____ No___		
Land preparation (tractor and machinery hire)		Soil erosion: Yes_____No_____		
Tractors		Soil compaction and erosion: Yes_____No____		
Other farm implements		None		
Small equipment		None		
Irrigation equipment and irrigation maintenance		Water extraction and salinization Yes_____No_____		
Primary processing equipment		Water pollution: Yes_____No_____		
Veterinary Services		Hormones and chemicals in meat: Yes____No___		

Table A -2.2: Agricultural Enterprise Screening Checklist

Broad Category	Will be Financed	Potential Impact			Mitigation measures	
			Yes	No	Yes	No
Agro-processing		water pollution, safety and health biophysical and cultural losses through location				
Medium Size Poultry and Livestock operations		Odor, waste management, animal and zoonotice disease control				
Market refurbishment or new market structure		Construction impacts Disturbance of important biophysical or cultural resources				
Agriculture equipment hire or purchase		Soil erosion and soil compaction as result of farm mechanization				
Irrigation systems		Desertification and depletion of water resources				
Other agribusiness		Variety of minor impacts although aquaculture could result in damage to aquatic ecosystems, particularly the loss of endemic fish species				
Agrotourism, ecotourism		biophysical losses; construction impacts water pollution				

4. For the environmental impacts that were indicated above with a check, describe the mitigation measures that will be included during the construction (C) or operational (O) phase of sub-project or both (B).

Table A- 2.3: Environmental Mitigation Plan

Environmental impact (What is to be mitigated)	Sub-project Phase (C, O or B)	How and where will it be mitigated	Responsibility and cost

FORM 2 – ENVIRONMENTAL SCREENING CHEKLIST
(To be completed by PFI)

1. Sub-project name: _____

2. Environmental Category (A, B or C), based on sub-project application form:
_____

(For Category B sub-projects, the PFI will refer the screening to the RRA)

3. Environmental assessment required (for B sub-projects): ___Yes/____No

4. What environmental issues raised by the sub-project:
_____
_____
_____

5. If an environmental assessment is required, what are the specific issues to be addressed?
_____
_____
_____

6. What is the time frame and estimated cost of conducting the environmental assessment?
_____
_____
_____

7. Date referred to RRA: _____

ANNEX 3. Consultation log

Date	Location	Stakeholders	Participants	Issues discussed
Tashkent				
March 2014	Tashkent	PIU Manager – B. Yusupov, A. Kuilibaev – procurement specialist, M. Norboev – I&D specialist	Regional Manager of Temelsu – S. Velioglu, Specialist of FWRMP Phase 1– B Boz, deputy Director of EA – G Khasankhanova	Technical, ecological and social aspects of Project.
August 2014	Tashkent	Director NBT – A. Nazarov, coordinator from IKS – M. Ruziev, Chief Designer of sub-Project "Podshaota-Chodak" – G. Harina, Chief Designer of sub-Project "Savai-Akburasai" – B. Yagudin	Specialist of FWRMP Phase 1– B. Boz, deputy Director of EA – G. Khasankhanova, Director of NBT – A. Nazarov, coordinator from IKS – M Ruziev, Director of Centre Tahlil – Y. Asminkin, Chief Designers of EA, A. Kuilibaev, R. Ibragimov, S. Rudnev	Technical, ecological and social aspects of Project.
September 2014	Tashkent	PIU Manager – B. Yusupov	Regional Manager Temelsu – S Velioglu, Specialist of FWRMP Phase 1 – B Boz, deputy Director of EA – G Khasankhanova, specialists PIU	Technical, ecological and social aspects of Project.
October 2014	Tashkent	PIU Manager – B. Yusupov	Specialist of FWRMP Phase 1 B. Boz and deputy Director of EA G Khasankhanova, Director of SA/Director of Centre Tahlil, Y Asminkin	Discussion on progress of EA surveys including technical and organizational issues
October-Nov 2014	Tashkent	Chief Designer of sub-Project "Podshaota-Chodak" – G. Harina, Chief Designer of sub-Project "Savai-Akburasai" – B. Yagudin	T. Hamzina, R. Ibragimov, S. Rudnev, etc. experts of EA team	Discussion on technical activities and their impact on sub-Projects, Project materials.
December 2014	Tashkent	PIU Manager – B. Yusupov	Regional Manager of Temelsu – S. Velioglu, Specialist of FWRMP Phase 1 – B. Boz, deputy Director of EA – G. Khasankhanova, Director of SA/Director of Centre Tahlil – Y. Asminkin	Discussion on progress in conducting of EA surveys, including technical and organizational issues.
December 2014	Tashkent	EA Director – G. Khasankhanova	M. Gaipov, Director of Institute Ferganagiprovodhoz , consultants of EA surveys (T Hamzina, R Ibragimov)	Discussion on technical and ecological issues on sub-Project "Isfairam-Shahimardan".
Fergana, Andijan, Namangan				
16.04.2014	Fergana	BAIS Syrdarya – Sokh A. Kuzybaev and M. Bairov 1-deputy Head of ME	Specialist of FWRMP Phase 1 B. Boz and deputy Director of EA G. Khasankhanova	Technical, ecological and social aspects of Project. Data and materials.
16.04.2014	Fergana	Deputy chairperson of Oblast department of SPNC. A. Avlierov, etc.	Specialist of FWRMP Phase 1 B. Boz and deputy Director of EA G. Khasankhanova	Ecological aspects of Project. Data and materials, regulating framework, etc.
16.04.2014	Fergana	Head of ISA Isfairam-Shahimardan Y. Ahrorov, Director Institute Ferganagiprovodhoz M. Gaipov, etc.	Specialist of FWRMP Phase 1 B. Boz and deputy Director of EA G. Khasankhanova and specialists of ISA M Sobirov. A Isabaev, F Halbekov	Technical and ecological aspects of sub-Project. Data and materials according to TOR.
17.04.2014	Andijan	BAIS Naryn-Karadarya 1-deputy Head S Ergashev and manager Water inspection of Oblast SPNC D Umarov (8374-2370432, +99891-4958818)	Staff of BAIS: M. Zainobidinov, M Hidoyatov, manager of Andijan hydrogeological stations S Soliev, specialist of FWRMP Phase 1 B Boz and deputy Director of EA G Khasankhanova	Technical and ecological aspects of sub-Project. Data and materials according to TOR.

Date	Location	Stakeholders	Participants	Issues discussed
18.04.2014	Namangan	BAIS Naryn-Syrdarya deputy chairperson S Mehmonov and deputy Head of ISA A. Hoshimov	specialist of FWRMP Phase 1 B. Boz and deputy Director of EA G. Khasankhanova	Technical and ecological aspects of sub-Project. Data and materials according to TOR.
25.06.2014	Fergana, Project sites	Head of BAIS Syrdarya-Sokh A. Topivoldiev, Head of ISA Isfairam-Shahimardan – Y. Ahrorov	Head of PS A. Umarov, Head of Kuvasai section of ISA, S. Abduraimov, hydraulic engineer WCA A. Koraboev, farmer A. Hamdamov. specialists of EA S Hamzin and R Ibragimov	Familiarization with objectives of Project. Discussion in BAIS. Visit to Project sites
26.06.2014	Fergana	Deputy Head oblast division SPNC Mamatov M.,	Specialists of oblast division SPNC: Turdiboev D., Mamanazarov M., D Umarov, specialists of EA S Hamzin and R Ibragimov	Discussion on ecological issues, future impact of Project activities on environment
26.06. 2014	Andijan, Project sites	Naryn-Karadarya BAIS - first deputy Head Ergashev S, Savai-Akburasai ISA - Head A Abdullaev	Yusupov A. – Head of PS, M. Hidoyatov. - Head of division of water use, G. Bakirov - hydraulic engineer, M. Yakubov.- Head of site, S Hamzin and R Ibragimov – specialists of EA	Familiarization with objectives and tasks of Project. Discussion on present issues and execution of works under Project. Visit to Project sites
27.06.2014	Namangan, Project sites	Naryn-Syrdarya BAIS, - 1-deputy Head S Mehmonov, Head Podshaota-Chodak ISA - I Eminov, Head of raivodkhoz N. Hudoibenrdiev	Specialists: Taifinov S. - inspector of hydrostructures, Turapov O. – hydrologist, Shokirov K. – hydraulic engineer, specialists of EA S Hamzin and R Ibragimov	Familiarization with objectives and tasks of Project. Discussion on present issues and execution of works under Project. Visit to Project sites
28.06.2014	Yangikurgan, Project sites	Yangikurgan raivodkhoz, Head of raivodkhoz N Hudoibenrdiev	N Hudoiberdiev. specialists of EA, S Hamzin and R Ibragimov	Visit to Project sites (Namangansai, Iskovatsai, PS Urikzor, Galaba)
22.04.2015	Fergana, Syrdarya-Sokh BAIS	BAIS Syrdarya – Sokh, Deputy Chair - J. Saymatov Head of ISA Isfairam-Shahimardan - Y Ahrorov	S. Khamzin and R. Ibragimov – specialists of EA team	Discussions on EA findings and preparation of Stakeholder Workshop (list of target groups, organizations and logistic issues)
23.04.2015	Andijan, Naryn-Karadarya BAIS	Naryn-Karadarya BAIS - Head of Irrigation & Hydraulic facilities department – Kh. Uraimov Head of Department – S. Khafizov	S. Khamzin and R. Ibragimov – specialists of EA team	Discussions on EA findings and preparation of Stakeholder Workshop (list of target groups, organizations and logistic issues)
24.04.2015	Namangan, Naryn-Syrdarya BAIS	BAIS Naryn-Syrdarya, Deputy Chair – S. Mehmonov	S. Hamzin and R. Ibragimov – specialists of EA team	Discussions on EA findings and preparation of Stakeholder Workshop (list of target groups, organizations and logistic issues)

ANNEX 4. Organizational Charts

Figure P4.1: Organizational structure of national water organizations

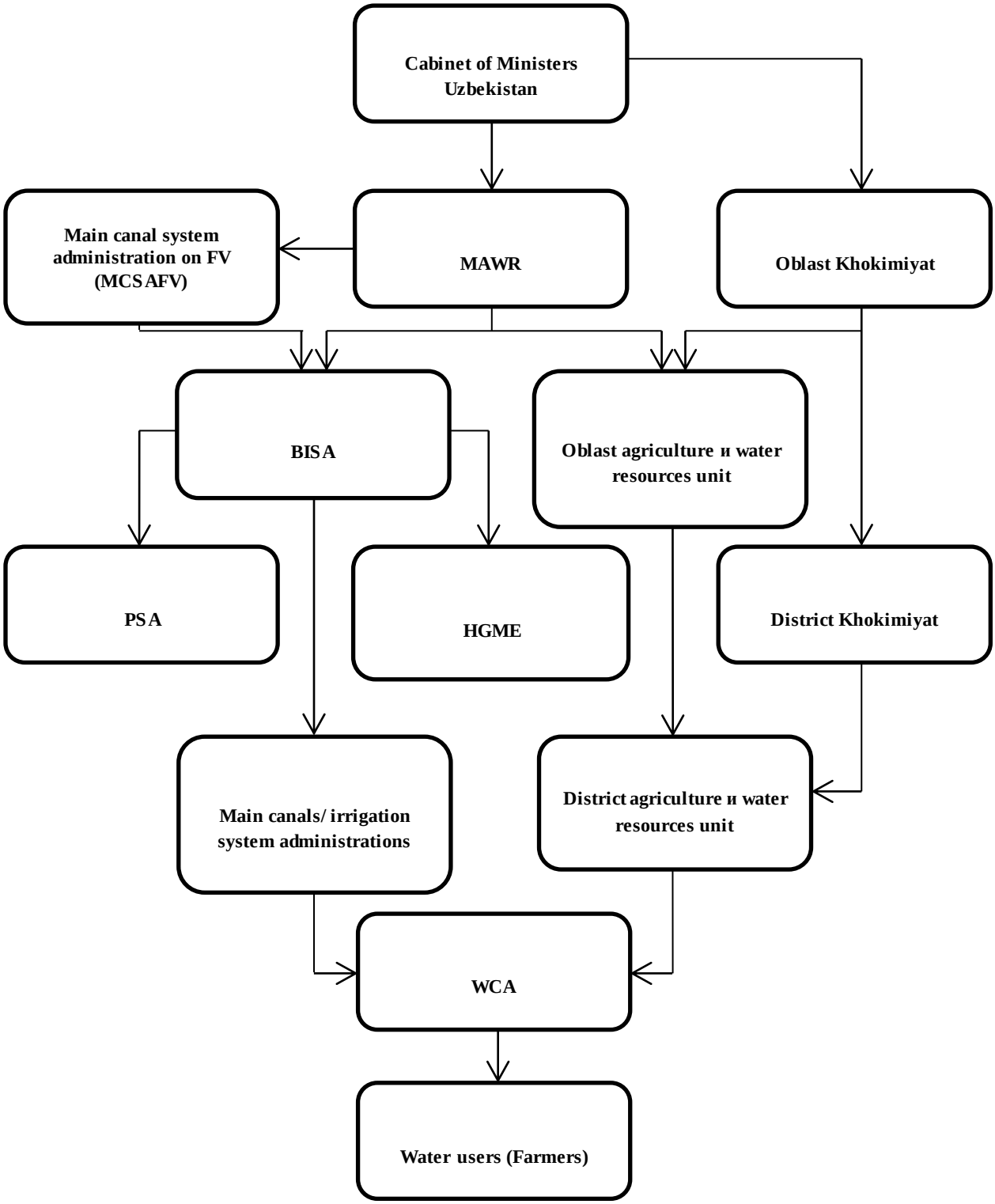


Figure P4.2: Organizational structure of MAWR

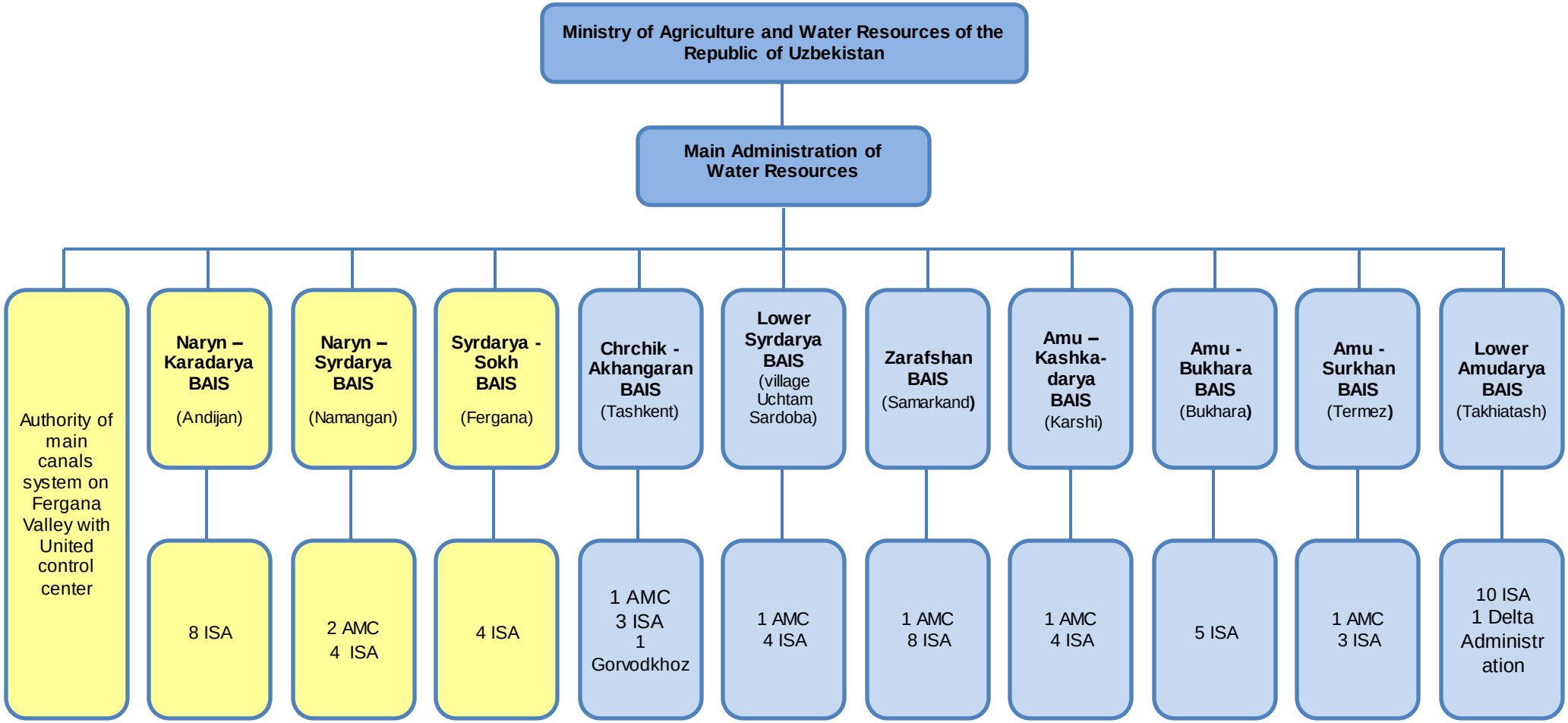


Figure P4.3: Organizational structure of BAIS

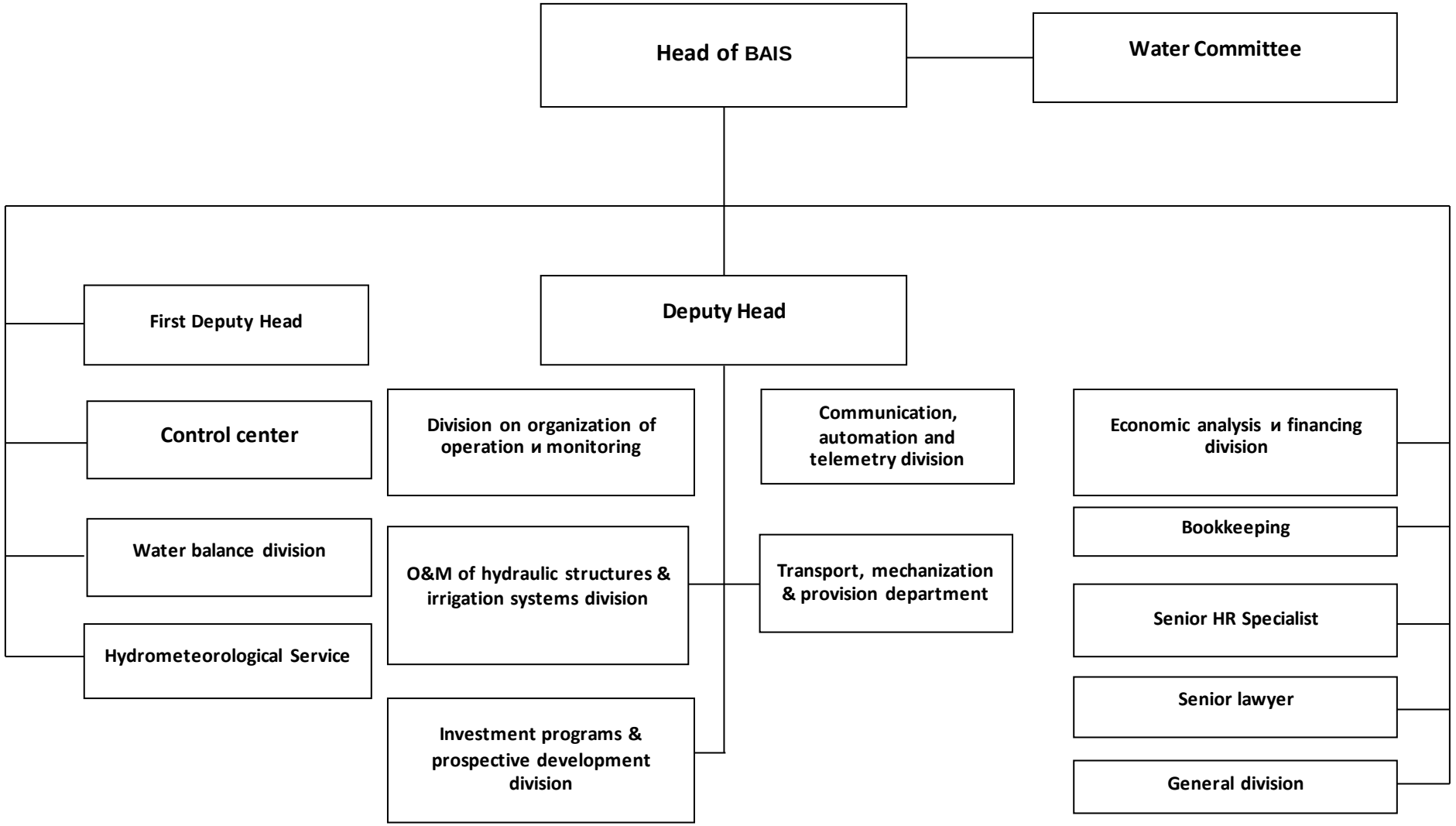


Figure P4.4: Organizational structure of MCA

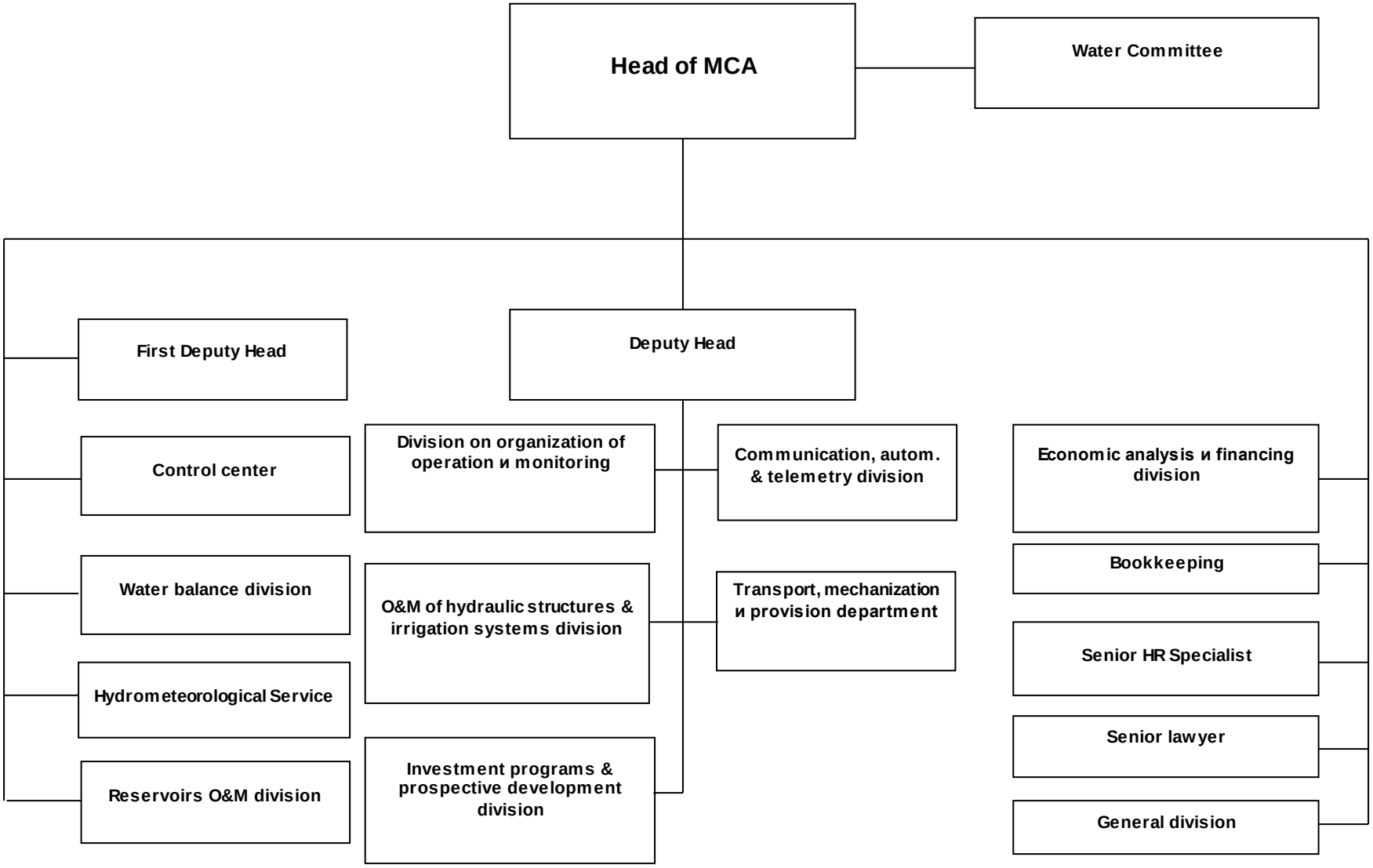
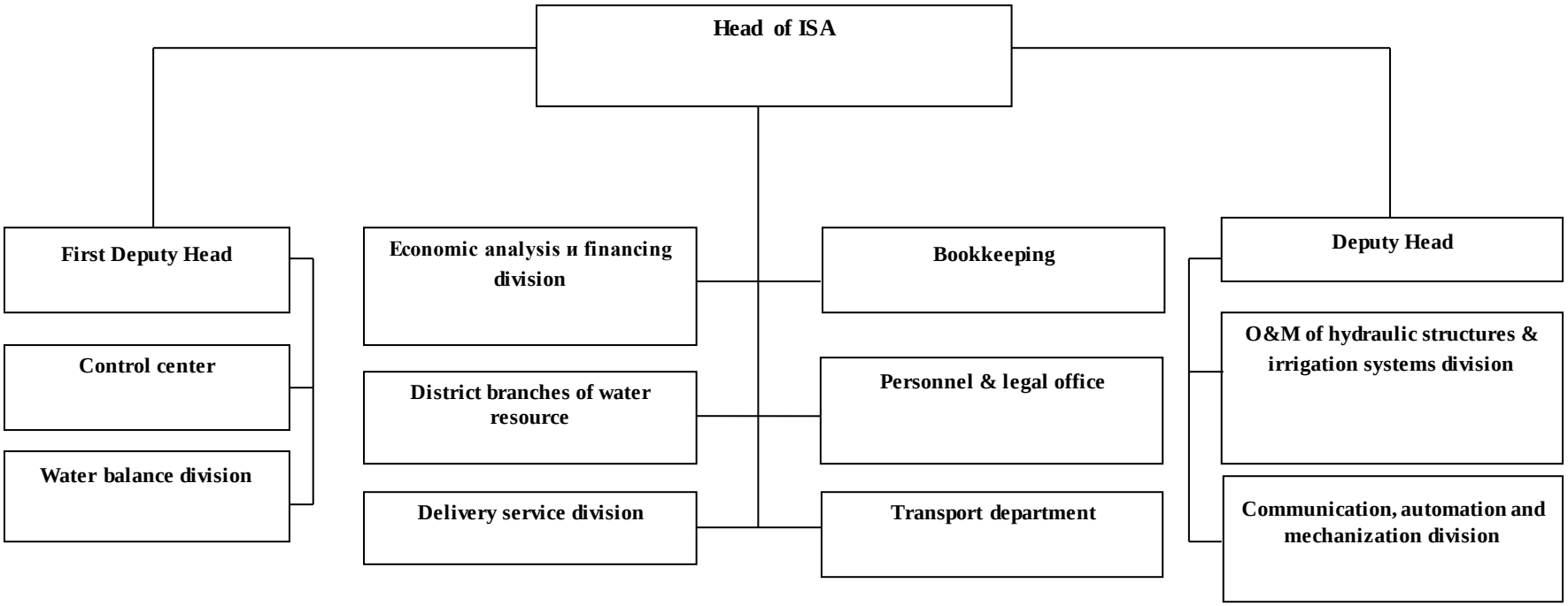


Figure P4.5: Organizational structure of ISA



ANNEX 5. Supporting tables

Table P 5.1. Climate indicators

Weather station	Year	Months											
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1. Average monthly and annual precipitation, mm													
Fergana	172	20	18	27	19	18	10	5	3	2	12	20	18
Kokand	109	13	11	17	12	11	7	3	2	1	8	13	11
Andijan	261	31	33	45	28	23	13	8	3	3	21	28	25
Namangan	189	23	21	30	22	21	9	6	2	3	15	18	19
Kasansai	328	27	30	52	47	40	28	19	5	5	22	27	26
2. Relative air humidity, %													
Fergana	63	81	79	70	59	52	44	45	51	56	66	75	81
Andijan	66	83	80	71	62	53	46	50	56	60	68	77	84
Namangan	62	78	76	69	59	51	43	47	53	55	61	71	79
Kasansai	58	67	68	66	60	56	47	45	48	50	58	63	66
3. Air temperature, hail													
Fergana	13.2	-2.4	0.8	7.7	15.5	20.6	25.0	26.9	25.2	19.8	12.7	5.6	0.4
Andijan	13.3	-2.7	0.9	8.0	15.8	21.4	25.5	26.9	24.9	19.9	13.1	5.6	0.3
Namangan	13.5	-2.5	0.8	8.8	16.3	21.4	25.5	26.9	25	20.2	13.3	6.1	0.4
Kasansai	12.4	-1.7	0.8	6.6	13.8	18.8	22.9	25.4	24.0	19.0	12.8	5.7	0.9
4. Days with strong wind (>15 m/s) during vegetation													
Fergana					3.4	4.2	4.6	4.2	1.5	0.8			
Kokand					8.1	7.3	4.9	3.0	3.2	3.0			

Source: Directory on climate RoU

Table P5.2. Assessment of surface water quality

A) Integral assessment of surface water quality (2009 – 2013)

Observation station	Water pollution index (WPI)/class				
	2009	2010	2011	2012	2013
Syrdarya, Namangan within Kal village	1.15/ III	0.97/II	0.78/ II	0.91/II	0.84/ II
The Naryn River, mouth	1.23/ III	0.99/ II	0.92/ II	1.15/ III	0.71/ II
BFC, Kanibadam	0.58 /II	0.61/ II	0.55/ II	0.99/ II	0.88/II
SFC, Fergana	0.71/ II	0.56 /II	0.65/ II	0.61/ II	0.84 /II
Karadarya, Andijan	0.56 /II	0.47 /II	0.60 /II	0.61/II	0.65/ II
Karadarya, Uchtepe village	0.87 /II	1.35/ III	0.98/ II	1.24/ III	0.88/ II
The Isfairamsai River, Above Kuvasai	0.76/ II	0.64/ II	0.73/ II	0.71/ II	0.81/ II
The Isfairamsai River, Below Kuvasai	1.01/ III	0.60/ II	0.66/ II	0.70/ II	0.94/ II
The Margilansai River, Vuadyl village	0.60/ II	0.63/ II	0.64/ II	0.66/ II	0.63
The Margilansai River, above Fergana	0.61/ II	0.61/ II	0.69/ II	0.60/ II	0.74/ II
The Margilansai River, below Fergana	0.73/ II	0.66/ II	0.72/ II	0.67/ II	0.77/ II

Source: Yearbooks on surface water quality in area of Uzhydromet's activity, 2009-2013, Uzhydromet

B) Normal annual values and turndown of formal saprobity-biotic indexes on ecological status of water bodies

Monitoring point	Formal indexes value			Ecological status value
	SI	BPI	MBI	
the Chadaksai River- above village Julasai	**1.25** (1.11-1.38)	**8.16** (8-9)	**9**	AB (F)
the Gavasai River - above village Gavasai	**1.19** (1.07-1.32)	**8.5** (8-9)	**9.5** (9-10)	AB (F)
the Sumsar River - above above mine	**1.52**	**8**	-	AB (F)
the Tereksai River - above Tereksai village	**1.05**	**10**	-	AB (F)
the Kosonsai River - above junction with the Tereksai River	**1.41**	**8**		AB (F)
the Kosonsai River - above village Kzyltokai	**1.47** (1.43-1.52)	**7**	**8.5** (8-9)	AB (F)
the Kosonsai River – Alabuka village	**1.59** (1.54-1.64)	**6**	**6.5** (6-7)	AB - AB(F)
the Kosonsai River - above Kosonsai	**1.56** (1.52-1.60)	**6**	-	AB - AB(F)
the Naryn River - 3 km above Uchkurgan	**1.61** (1.30-1.90)	**6.26** (6-8)	**6.5** (6-7)	AB - AB(F)

the Naryn River - 0.6 km above mouth	**1.76** (1.61-2.05)	**5.92** (5-8)	**5.62** (5-7)	AB - AB(F)
the Karadarya River- above spillway Andijan	**1.82** (1.67-1.96)	**5.37** (5-6)	**5.2** (4-7)	AB
Syrdarya - Kal village	**1.90** (1.74-2.03)	**5.00** (5-6)	**5.1** (4-6)	AB
the Koksu River - mouth	**1.33** (1.01-1.63)	**8.95** (7-10)	**8.3** (7-10)	AB (F)
the Margilansai River - above Vuadyl village	**1.58** (1.43-1.88)	**5.8** (5-7)	**7.1** (5-9)	AB (F)
the Margilansai River - above Fergana	**1.77** (1.6-2.04)	**5.5** (5-6)	**6.0**(5-7)	AB
the Margilansai River – below Fergana	**1.87** (1.69-2.4)	**5.11** (4.5-6)	**4.6** (4-6)	AB
the Isfairamsai River - above Kuvasai	**1.63** (1.28-1.95)	**6.25** (6-8)	**7.2** (6-8)	AB – AB (F)
the Isfairamsai River – below Kuvasai	**1.89** (1.43-2.16)	**5.3** (5-8)	**6.5** (5-7)	AB – AB (F)

Source: Yearbooks on surface water quality in territory of Uzhydromet's activity, 2009-2013, Uzhydromet

Table P5.3. Salinization of irrigated land in sub-project areas

Sub-Project/district	Year	Irrigation area, ha	Nonsaline		Slightly saline	
			ha	%	ha	%
Podshaota-Chodak						
Yangikurgan	2012	19462	19298	99.2	0.164	0.8
	2013	19463	19299	99.2	0.164	0.8
Chartak	2012	26823	26700	99.5	0.123	0.5
	2013	26817	26694	99.5	0.123	0.5
Isfairam-Shahimardan						
Kuvasai	2012	15186	15186	100	0	0
	2013	15186	15186	100	0	0
Fergana	2012	33018	32521	98	497	2
	2013	33175	32996	100	497	2
Savai-Akburasai						
Bulokboshi	2012	10571	10486	99	85	1
	2013	10571	10491	99	80	1
Jalakuduk	2012	23463	23463	100	0	0
	2013	23463	23463	100	0	0
Hujaabad	2012	11358	11358	100	0	0
	2013	11368	11368	100	0	0
Kurgantepa	2012	27210	27210	100	0	0
	2013	27209	27209	100	0	0

Source: reports of Naryn-Karadarya, Naryn-Syrdarya and Syrdarya-Sokh ISAs, 2013

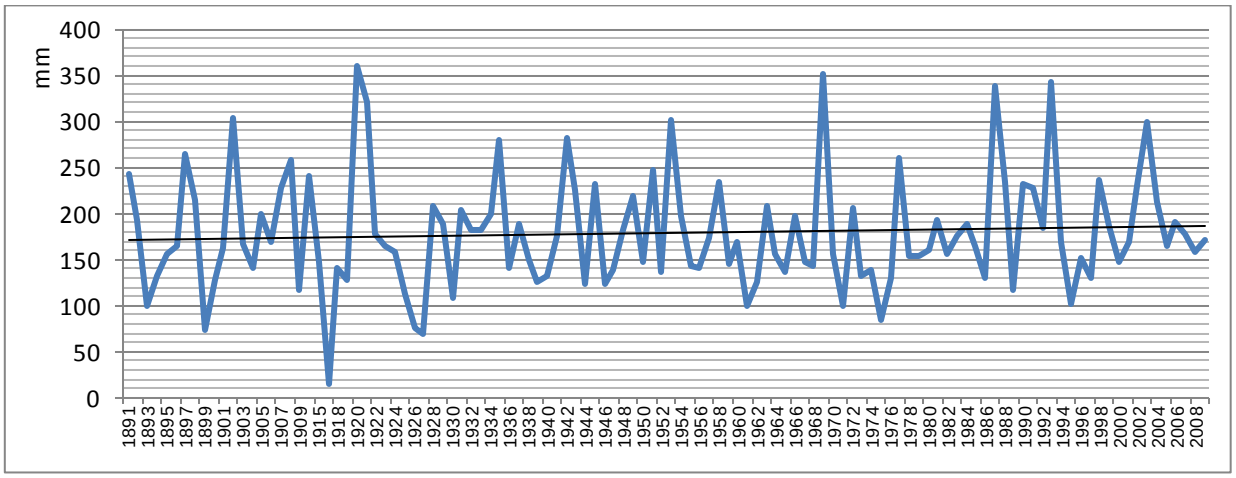
Table P5.4. Differentiation of irrigated land by bonitet

Bonitet		Andijan		Namangan		Fergana		Total	
Class/Characteristics	ratio	ha	%	ha	%	ha	%	ha	%
I - low	0-20	311	0.1	6.422	1.8	0	0	6.733	0.8
II – below medium		52.924	22.7	122.594	33.5	45.486	19.5	221.364	26.5
III - medium	41-60	84.991	36.5	93.348	25.5	88.383	37.6	266.721	32.0
IV - good	61-80	88.402	38.	133.423	36.4	80.098	34.0	301.923	36.2
V- very good	81-100	6.050	2.6	10.425	2.8	20.926	8.9	37.401	4.5
Total			100	366.212	100	235.252	100	834.143	100

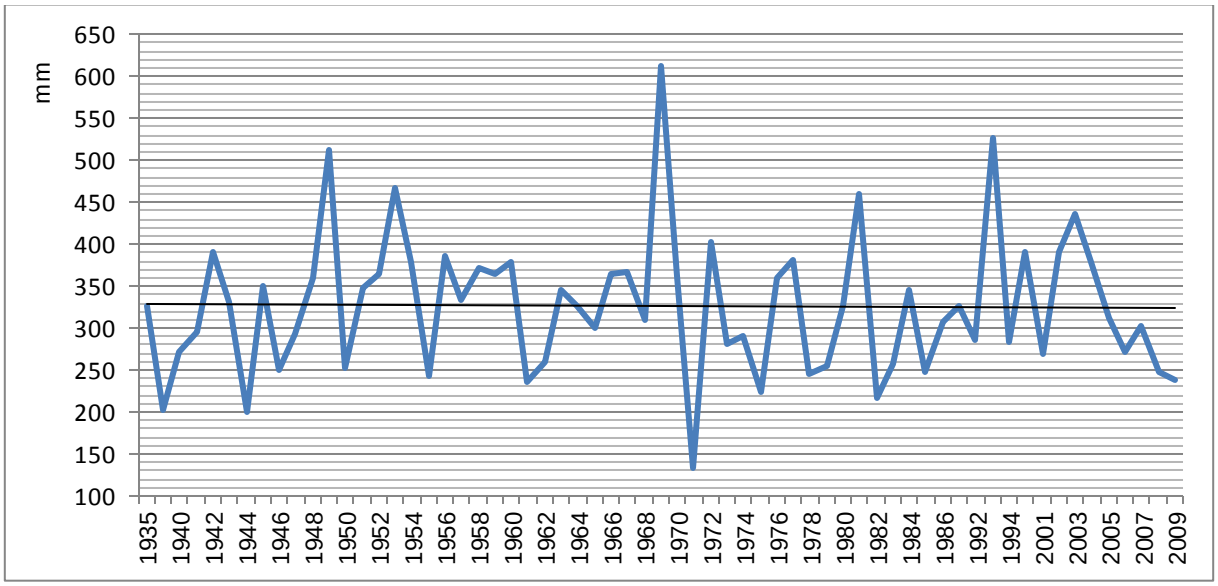
Source: FS FWRMP-II

Figure P5.1. Trends of annual precipitation according to weather stations

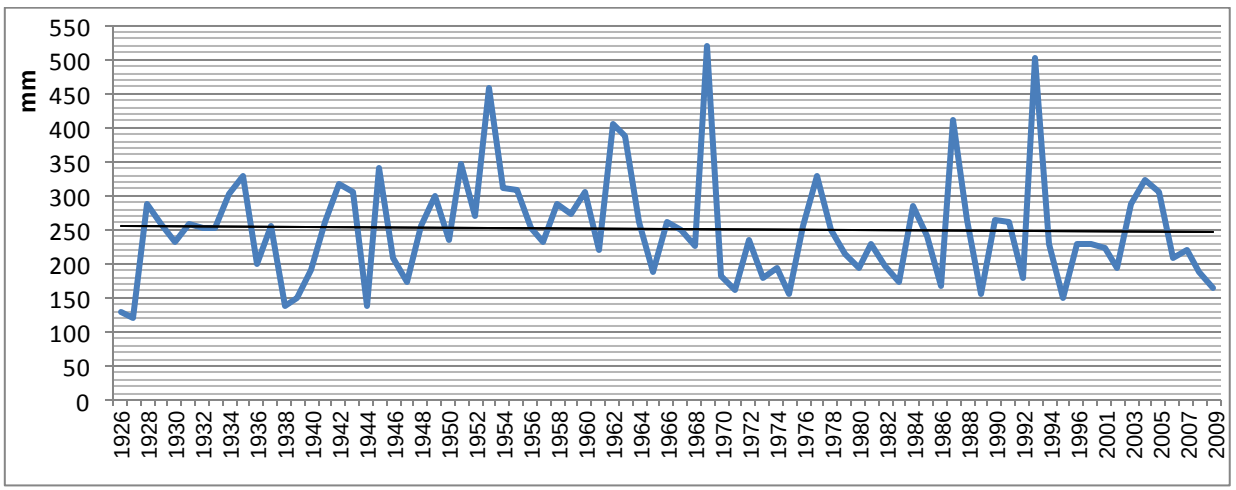
Fergana



Kasansai



Andijan

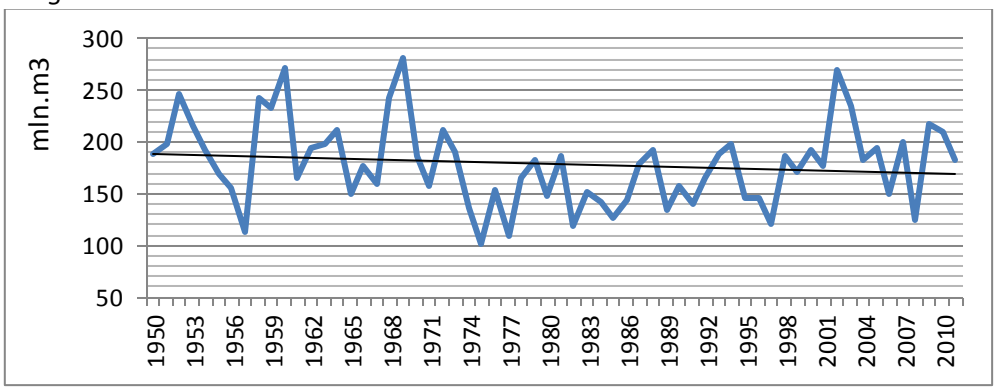


Source: Analysis of EA consultants according to Uzhydromet (2010)

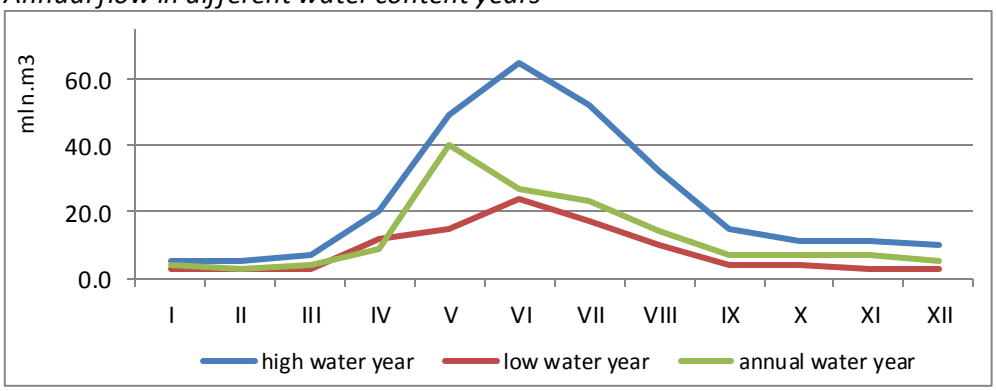
Figure P5.2. River flow change in long-term and within a year

a) The Podshaota River

Long-term trend

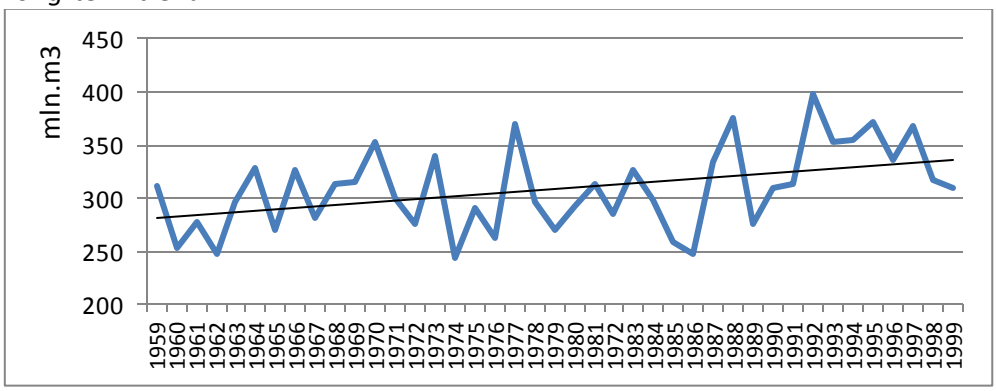


Annual flow in different water content years

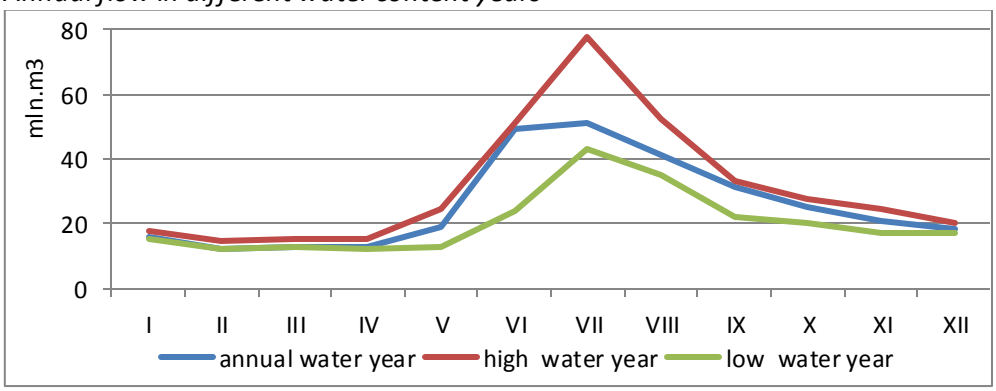


b) The Shahimardan River

Long-term trend

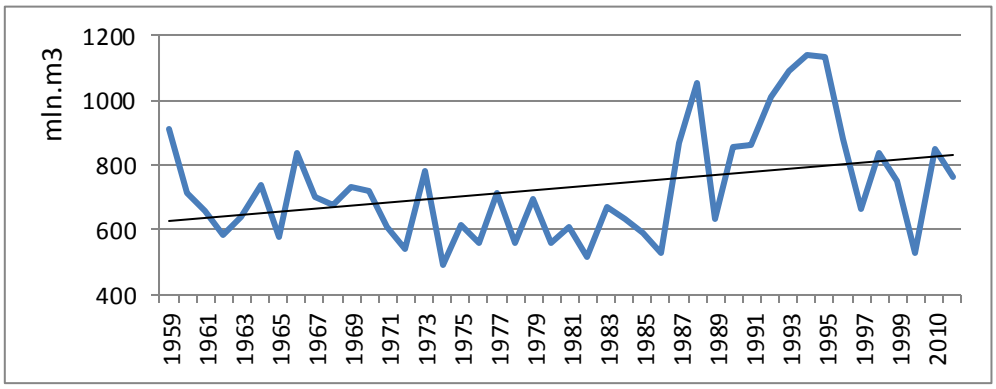


Annual flow in different water content years

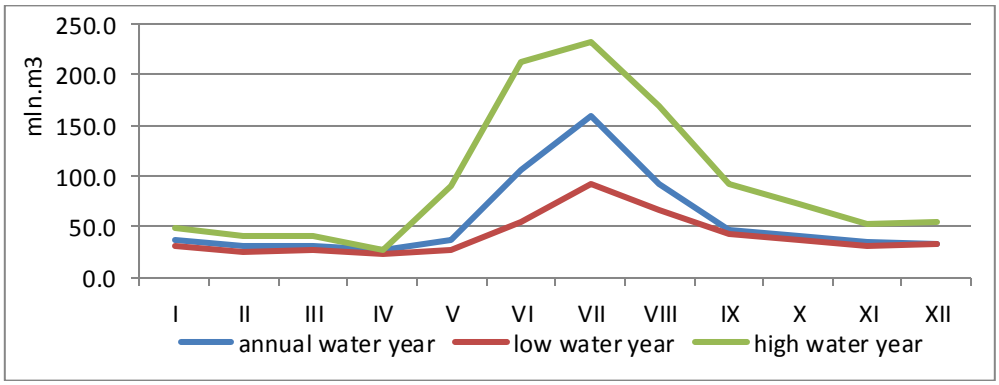


c) The Isfairamsai River

Long-term trend

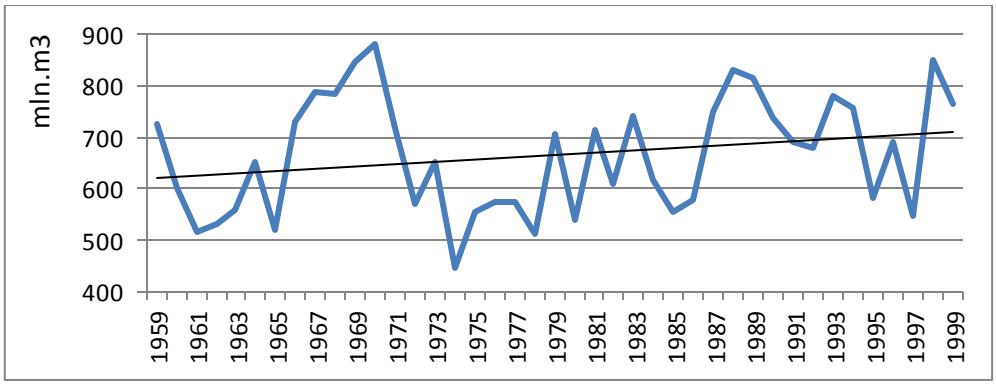


Annual flow in different water content years

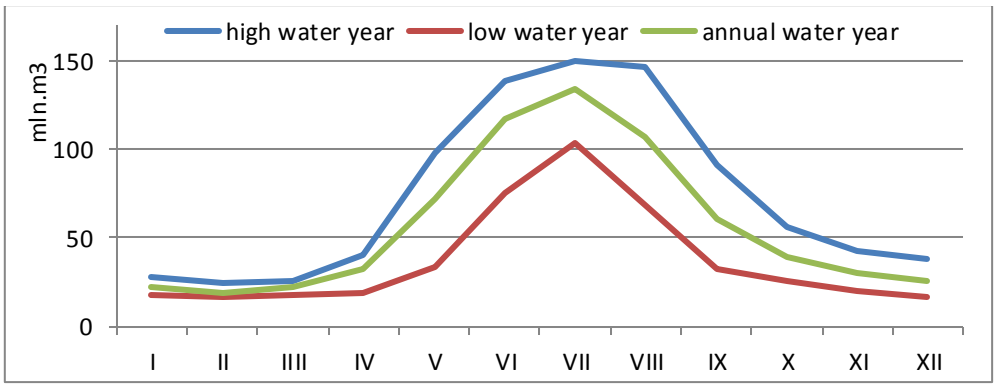


d)The Akburasai River

Long-term trend



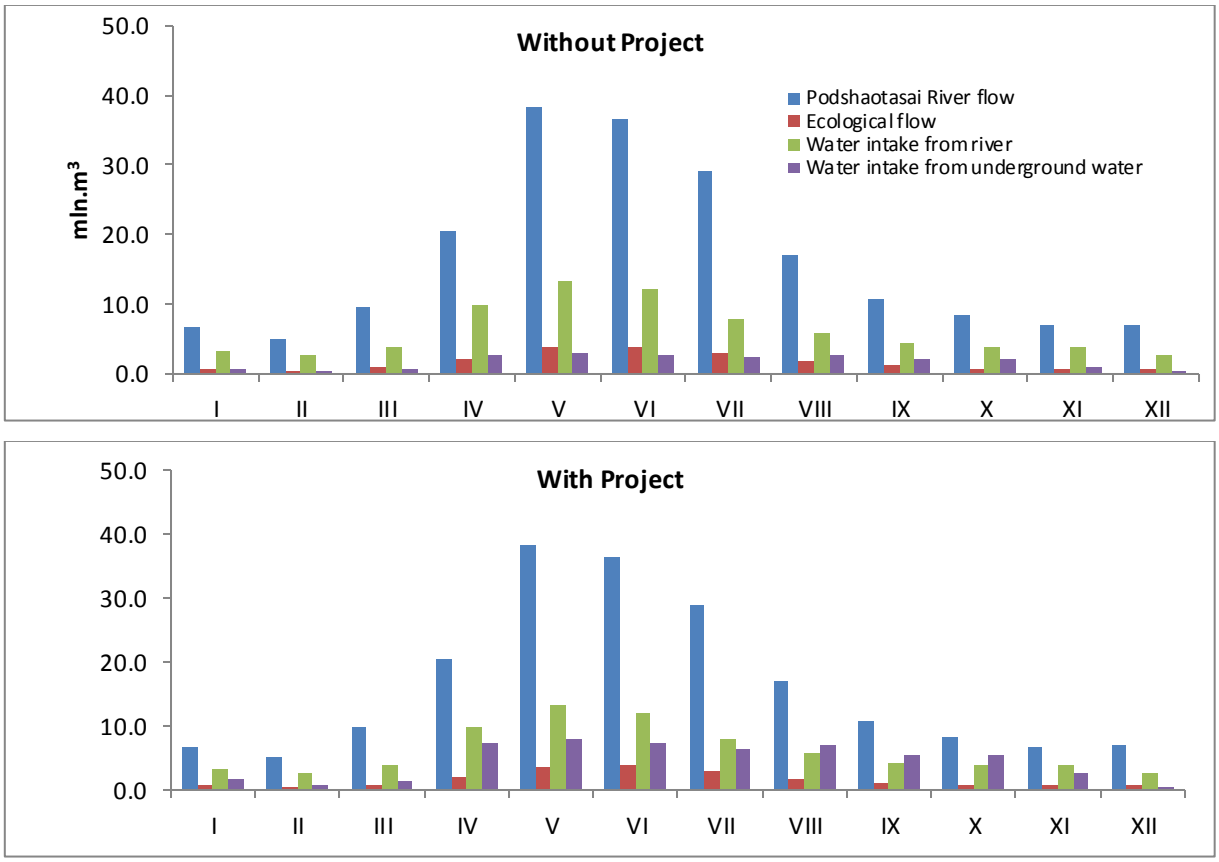
Annual flow in different water content years



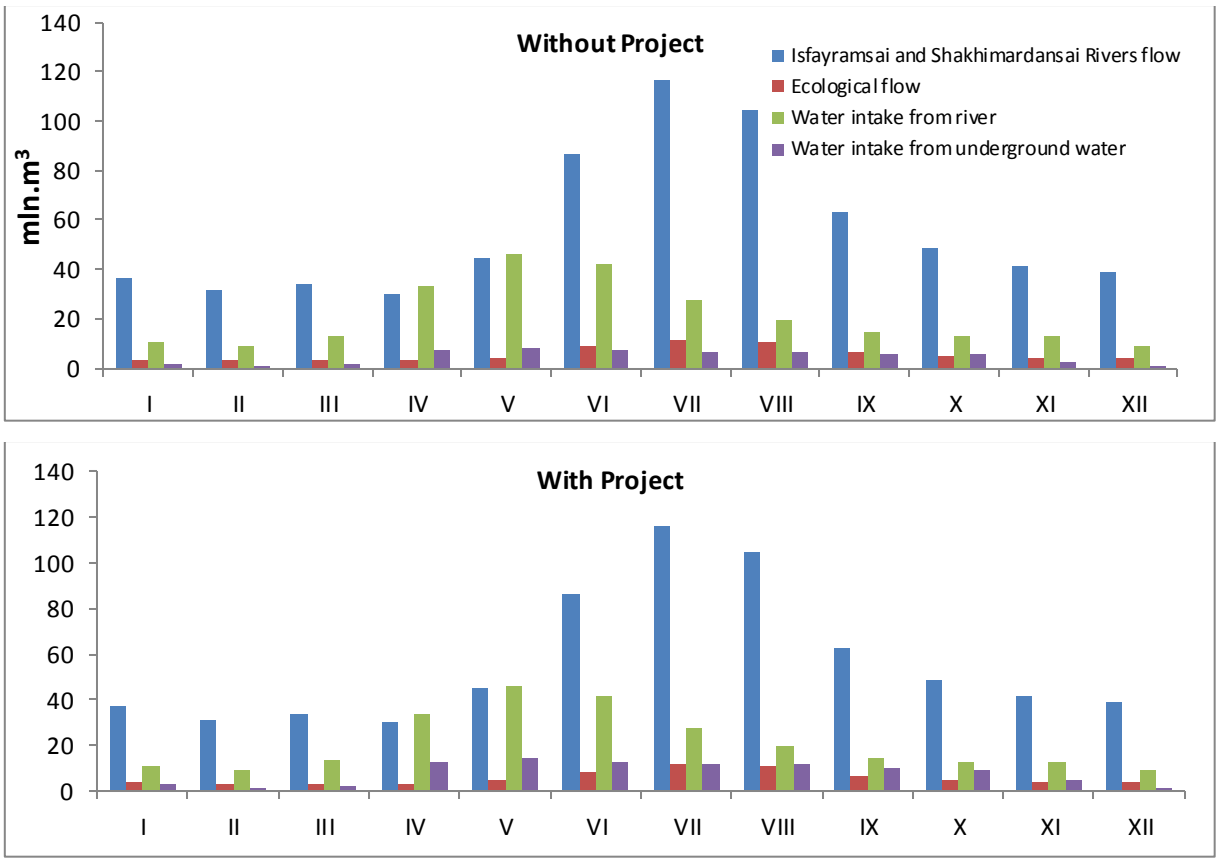
Source: Analysis of EA consultants according to Uzhydromet

Figure P5.3. Hydrographs of the rivers' runoff and the regulating releases

a) Podshaotasai River



b) Isfayramsai and Shakhimardansai Rivers



c) Akburasai River

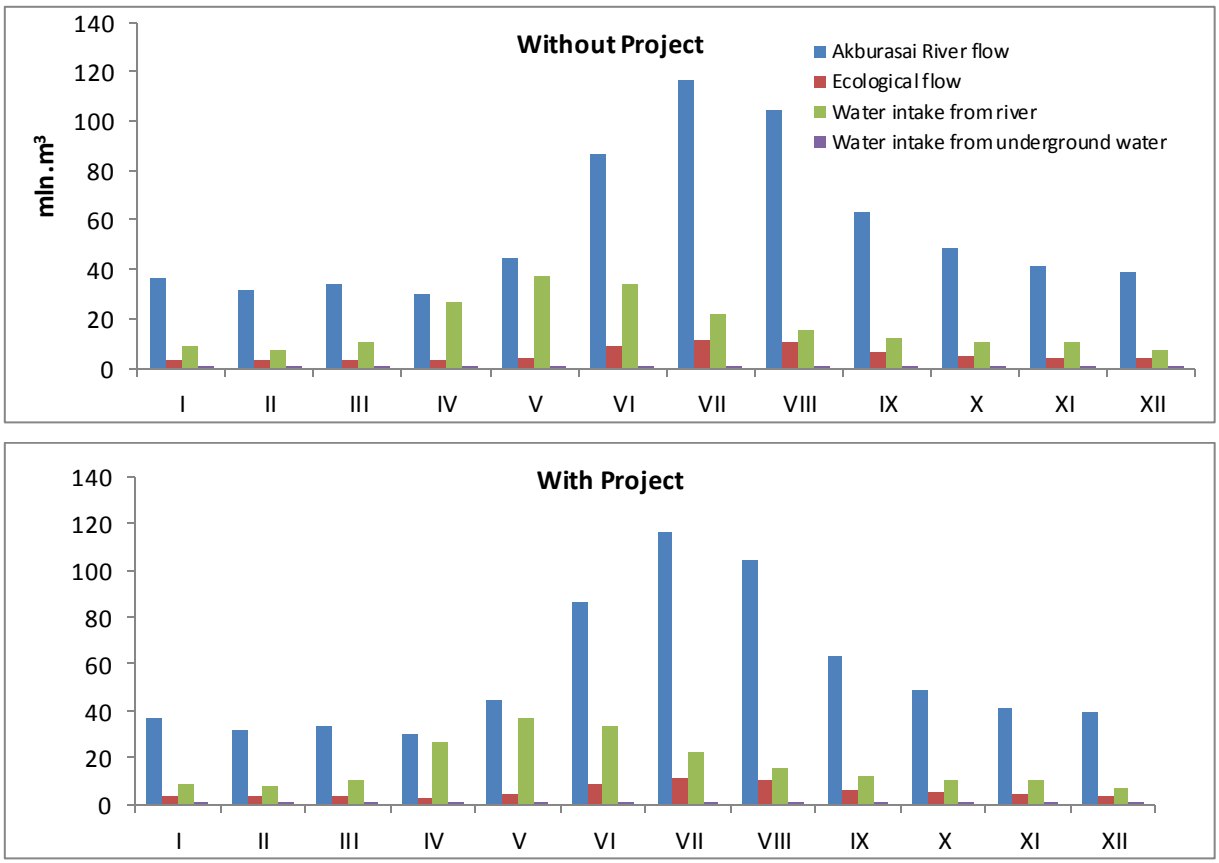


Table P5.5. Water Balance of the Chimyon-Avval underground water deposit, thousand m^3/day (situation "With Project")

Balance elements	month												
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
INFLOW													
1. Water Infiltration:													
1.1. from irrigation canals	168.7	249.1	45.2	480.8	460.2	6868.5	961.2	925.5	428.0	153.4	63.4	158.5	434.3
1.2. from fields of irrigation	31.5	46.5	85.0	89.8	85.9	1282.2	179.5	172.8	79.9	28.6	11.8	29.6	81.1
1.3. infiltration of precipitation	28.0	24.9	38.6	44.3	18.9	93.3	0.0	0.0	0.0	17.1	10.0	27.0	18.2
1.4. from river and stream/sais	518.4	518.4	518.4	518.4	518.4	5184.0	518.4	518.4	518.4	518.4	518.4	518.4	518.4
2. Underground inflow	198.7	198.7	198.7	198.7	198.7	1987.0	198.7	198.7	198.7	198.7	198.7	198.7	198.7
Total Inflow	945.4	1037.6	885.8	1332.0	1282.1	15415.0	1857.8	1815.3	1225.0	916.3	802.4	932.2	1250.6
OUTFLOW													
1. Water Intake (abstraction) from wells of different purposes:	535.5	568.5	584.5	1139.8	968.9	13668.0	1349.2	1443.2	1488.7	1141.6	681.3	470.4	979.5
1.1. vertical drainage wells	32.6	47.8	38.5	42.1	36.5	459.9	37.9	34.5	44.7	43.9	50.1	0.0	37.7
1.2. wells for irrigation	86.8	60.0	129.9	581.7	433.1	8048.3	811.9	909.3	928.1	681.6	201.2	54.3	475.3
1.3. boreholes for drinking, domestic and industry water supply	416.1	460.7	416.1	516.0	499.3	5159.9	499.3	499.3	516.0	416.1	430.0	416.1	466.5
2. Outflow of ground water in Isfayramsai unloading zone	30.2	30.2	30.2	30.2	30.2	302.0	30.2	30.2	30.2	30.2	30.2	30.2	30.2
3. Underground outflow	155.5	155.5	155.5	155.5	155.5	1555.0	155.5	155.5	155.5	155.5	155.5	155.5	155.5
Total outflow	721.2	754.2	770.2	1325.5	1154.6	15525.0	1534.9	1628.9	1674.4	1327.3	867.0	656.1	1165.2
Change of ground water deposit	224.2	283.4	115.7	6.5	127.5	-110.0	322.9	186.5	-449.5	-411.1	-64.7	276.1	85.4
Relative error, inflow %	23.7	27.31	40.56	0.49	9.95	-0.71	17.38	10.27	-36.69	-44.86	-8.06	29.62	6.83
Relative error, outflow, %%	31.09	37.58	68.23	0.49	11.04	-0.71	21.04	11.45	-26.84	-30.97	-7.46	42.09	7.3

Source: Estimated by the Uzbekhydrogeology specialists, 2015

Table P5.6. Hydrogeological areas of Fergana Valley

Area	Location	Characteristics
1	North-west of FV, Shahimardansai Namangan ISA	Mainly mountain with steep slopes. Hydrogeological parameters are not monitored. Shortage of irrigation water - 19.03% as compared to demand
2	North of FV on right bank of Syrdarya, Podshaota-Chodak ISA	Level and mineralization of ground water, soil salinization are low, no drainage problems as natural GW outflow is provided. Water supply is insufficient for irrigation, additional water supply from BNC and NFC by pump stations cascade. Water deficit in Podshaota-Chodak ISA is 34.84%, Naryn Namangan ISA - 19.03%, Naryn Hakulobod ISA - 23.55%, and Karadarya-Mailisai ISA - 27.88%
3	Central part of FV, Isfara-Syrdarya ISA, Zardarya ISA, Ulugnar-Mazgilsai ISA and Karadarya-Mailisai ISA	Level and mineralization of ground water are medium on most of the territory. Along borders with area 2 soil salinity is low, in western part - high soil salinization, there are areas of high WT. Surface slope is slight to medium in most part with some area of steep slopes. Drainage flow is discharged into Syrdarya. Irrigation is mainly by gravity from SFC, BFC, BAC and Ahunbabaev canal, as well as supported by pumps from Syrdarya. Water deficit in Isfara-Syrdarya ISA is 31.72%, Zardarya ISA - 18.66%, Ulugnar-Mazgilsai ISA - 33.25% and Karadarya-Mailisai ISA - 27.88%
4	Lower middle part of FV on left bank of Syrdarya, Naryn - Fergana ISA, Sokh-Aktepe ISA and Isfara-Shahimardan ISA	High rate with average (maximum) indicators of WT and mineralization, small part of territory in central and eastern area with low indicators. Many areas with high WT and mineralization resulted from inflow from surrounding mountain area. Soil salinity is medium. Surface slope is slight to medium in most part with some steep slopes. Drainage flow is discharged into Syrdarya. Irrigation is mainly by gravity from Sokhsai, Isfairamsai, SFC, BFC and BAC by pumps. Water deficit is high - 29.81%
5	South-west of FV, Isfara-Syrdarya ISA partly Sokh-Aktepe ISA.	Mainly mountain with steep slopes. Hydrogeological parameters are not monitored. Irrigated is land very limited. Water deficit in Isfara-Syrdarya ISA - 31.72% and Sokh-Aktepe ISA - 33.44%
6	South of FV, Sokh-Aktepe ISA, partly Naryn-Fergana ISA and Isfairam-Shahimardan ISA	Similarly to areas 3 and 4 have average (maximum) indicators of WT and mineralization on most part. Groundwater inflow from Kyrgyz Republic affects WT and mineralization. Salinization of land is mainly low with small zone of medium. Surface slope is medium to slight with some steep slopes. Irrigation is mainly by gravity from Sokhsai and Shahimardansai, as well as by pumps from SFC. Water deficit is high -29.81%
7	South of FV, Isfairam-Shahimardan ISA	Mainly mountain, hydrogeological parameters are not monitored. Water deficit is 29.81% as compared to irrigation water demand norm. Water is deficit high - 29.81%
8	Western part of FV on left bank of Karadarya, Shahrihansai ISA and Andijan ISA	Low level and mineralization of ground water in north-eastern part and medium level (maximum) in south-eastern part. Soil salinization, unknown, however, there are some areas with low salinity and high mineralization of GW. Medium or high mineralization of GW is met in southern part and resulted from inflow from surrounding mountain districts of eastern side. Surface slope is mainly steep with some slight slopes area and many medium slope zones. Irrigation is mainly by gravity, as well as by pumps from Karadarya, main canals Shahrihansai and Andijan. Water deficit is high – 31.04%
9	Western part of FV on left bank of Karadarya, Shahrihansai ISA and Andijan ISA.	Average (maximum) indicators of WT and mineralization in most part. Some zones with high WT and mineralization; these zones are mainly met in southern part. Soil salinity is unknown. Area is surrounded by mountain area with hindered GW outflow that leads to rising of the level and mineralization of WT. Surface slope is mainly medium with some steep and slight slope area. Irrigation is mainly by gravity from Shahrihansai. Aravansai and Akburasai, as well as by pumped irrigation from SFC. Water deficit is high - 31.04%
10	Western part of FV on left bank of Karadarya, Savai-Akburasai ISA	Level and mineralization of ground water is low, though there are areas in north-eastern part with medium (maximum) level. Soil salinization is unknown. Surface slope is mainly steep with large reasonable gradient area and partly with slight slope. Irrigation is mainly by gravity from Savai, Aravansai and Akburasai canals, as well as by pumped irrigation from Savai main canal. Water deficit is very high - 32.08%

Source: FS FWRMP-II, 2015; FS FWRMP-I, Temelsu, 2009.

Table P5.7. Application of fertilizers and pesticides for 2010-2014

District	2010	2011	2012	2013	2014	2010		2011	2012	2013	2014
Nitrogen, ton								***Phosphoric, ton***			
Podshaota-Chodak											
Yangikurgan	1392	1415	1887	1769	1028	522		322	580	495	159
Chartak	1708	1925	4878	1664	1357	433		416	380	338	302
Isfairamsai-Shahimardan											
Fergana	2958	2843	2656	3024	2826	825		543	563	1032	552
Kuvasai	790	673	564	718	669	338		158	160	187	156
Kuva	3076	3136	3094	3231	2918	787		544	666	517	497
Altyaryk	3302	3395	3508	3511	3414	1042		878	1067	749	786
Tashlak	2568	2594	2802	2648	2362	585		509	514	444	543
Savai-Akburasai											
Jalakuduk	2482	2846	3427	3267	3312	529		722	564	443	767
Hujaabad	842	982	1107	1126	1163	164		193	242	175	225
Potash, ton								***Herbicide, kg/ha***			
Podshaota-Chodak											
Yangikurgan	0	3	19	8	2	556		1625	1109	1604	2242
Chartak	1	75	35	59	90	132		280	141	385	506
Isfairamsai-Shahimardan											
Fergana	13	46	68	73	166	264		350	385	289	432
Kuvasai	1	11	15	9	28	620		656	788	685	633
Kuva	16	28	67	108	205	266		380	356	431	381
Altyaryk	13	70	82	142	208	370		451	433	358	4269
Tashlak	17	23	34	76	158	249		325	301	339	347
Savai-Akburasai											
Jalakuduk	13	111	82	78	174	63		66	125	107	129
Hujaabad	1	40	61	54	80	65		55	40	44	47

Source: data of MAWR's district departments, 2013

Table P5.8. Water supply, gas supply and medical services to the population

Administrative districts of sub-Project	Hospital beds per 10000 people	Medical institutions per 10000 people	Centralized water supply, %	Natural gas provision, %
Podshaota-Chodak				
Yangikurgan	775	28	73.7	73.5
Chartak	963	33	83.5	76.2
Isfairamsai-Shahimardan				
Fergana	127	23.4	75.9	57
Kuvasai	172	28.9	76.2	93.2
Kuva	163	33.1	75.3	89.0
Altyaryk	201	38.5	71.9	75.4
Tashlak	96	31.9	72	82.7
Savai - Akburasai				
Kurgantepa	141.5	30.3	79.0	56.2
Djalalkuduk	158	30.5	79.9	53.3
Hujaabad	168	30.4	82.6	68.1
Bulokboshi	165	35.5	82.4	78.9

Source: Report on IWRM Plan. SHELADIA Associates Inc. (USA) in association with NBT (Uzbekistan) and IKS (Uzbekistan), 2014

Table P5.9. List of pesticiedes registered in Uzbekistan

Registration expiry date: 31.12.2011

S/Nb	Name of the chemicals	Origin of the production	Type of chemicals	Names of the tested crops
1	Regent 20% k.s.	BASF Agro BV - Switzerland	Fipronil	Potatoes, mulberry, potato
2	Atilla 5% k.e. (R)	Agrokim Ltd - Uzbekistan	Lyambdachigalotrin	Cotton, vine, mulberry, cotton, vine,
3	Bagira 20% k.e.	Agrokim Ltd - Uzbekistan	Imidakloprid	Cotton
4	Dalprid 200 u/l v.k.	Dalston Associated SA - Panama	Imidakloprid	Cotton
5	Pilarking 20% k.e.	Pilar Agree Saens Corp. - Canada	Imidakloprid	Cotton, apple, patato,tomato, tobacco, pasture
6	Dalmetoat 40% k.e.	Dalston Associated SA - Panama	Dimetoat	Cotton
7	Pilarmektin 1,8% k.e.(R)	Pilar Agree Saens Corp. - Canada	Abamektin	Cotton, tomato, rose, vine
8	Uzmayt 30% s.p. (R)	JV Close Corporation Elektrokhimzavod - Uzbekistan	Propargit	Cotton
9	Uzmayt 57% k.e.(R)	JV Close Corporation Elektrokhimzavod - Uzbekistan	Propargit	Cotton,apple
10	Pilardelta 2,5% k.e. (R)	Pilar Agree Saens Corp. - Canada	Deltametrin	Mulberry, pasture, tobaco, apple
11	Camelot 20% s.p.	Agrokim Ltd - Uzbekistan	Azetamiprid	Cotton, mulberry
12	Lanser 75% r.p.	United Phosphorus - India	Azephat	Cotton
13	Orten 75% r.p.	Arista Life Saens SAS - France	Azephat	Tobaco
14	Urell-D 55% k.e.	United Phosphorus - India	Zipermetrin+chlorpiriphos	Cotton, apple,
15	Zipi Plus 55% k.e.	Agrotrade - Bulgary, Agrorus - Russia	Zipermetrin+chlorpiriphos	Cotton, apple,
16	Ortus 5% S.K.	Nikhon NoKhiaku - Japan	Phenproksimat	Cotton
17	Pillarstar 10% k.e.	Pilar Agree Saens Corp. - Canada	biphentreen	Cotton, apple,
18	Preparation №30 76% petroleum emulsion	PhGUP VNII ChSZR - Russia	petroleum oil	Cotton, apple, pear, cherry, cherry-tree, plum, decorative plants, currants, raspberries, citrus, vine, decorative plants
19	Segra 80% s.p. (fine-dyspersated)	Agrokim Ltd - Uzbekistan	sulfur	Cotton
20	Sumition 50% k.e.	Sumitomo Chemical - Japan	Phenitrotion	Wheat
21	Superkill	Agrephar AS - Belgium	Zipermetrin	Cotton, apple, vine, tomato, cucumber, cabbage, potato, soy, lucerna, wheat
22	ZIPI 25% k.e.(R)	Agrotrade - Bulgary, Agrorus - Russia	Zipermetrin	Cotton, apple, vine, tomato, cucumber, cabbage, potato, Cruciferae's culture, sugar-beetsoy, lucerna, maize, pasture, water-melon, melon, carrot, wheat
23	Phastak 10% s.k.(R)	BASF Agro BV - Switzerland	Alphazipermetrin	Cotton, pasture, potato,
24	Phaskord k.e. 100 g.l. (R)	Close corporation Shelkovo Agrochim - Russia	Alphazipermetrin	Cotton, mulberry, wheat, pasture
25	Phenkill 20% k.e. (R)	United Phosphorus - India	Phenvalerat	Cotton, apple, vine, currants, potato, cabbage, rape, lucerne, perennial plants, maiz, wheat, barley, carrot, melon, pasture, natural growth
26	Impact 25% c.k	Keminova A/S - Denmark	Phlutriaphol	Apple, winter wheatvine
27	Pilacur 25% k.e.	Pilar Agree Saens Corp. - Canada	Tebukonazol	Wheat, vine
28	Consul 12,5% k.c.	BASF - Germany	Epoksikonazol	Winter wheat

29	Segra 80% s.p. (fine-dyspersated)	Agrokim Ltd - Uzbekistan	sulfur	Vine
30	Pholikur BT 22,5 k.e.	Baer KropSaens - Germany	Tebukonazol +Triadimephon	Wheat, rice, vine
Chemicals for seed processing before sowing				
31	Dalucho 70% c.p.	Dalston Associated SA - Panama	imidakloprid	Cotton
32	Blumovit v.g/	privately owned enterprise Amari Orxid Farma - Uzbekistan	bacterium+antagonist+ humus+microelement	Cotton
33	Dalbron 12% p.	Dalston Associated SA - Panama	bronopol	Cotton
34	Dalvaks 34% v.c.k.	Dalston Associated SA - Panama	Karboksin-tiram	Cotton
35	Sidigard 3% k.c	Paridgat Adgensys - India	Diphenokonazol	Winter wheat
36	Dorilin 10%	IHRV under AS, Uzbekistan	Copolymer fibers of nitron with nitrolignin and copper sulfate	Cotton
37	Zirh 36%	Close joint-stock company "Avgust", Russia	Bronopol	Cotton
38	Kisan, 30%	"United Phosforus", India	2 -(tiocyanometiltio) benzotiasol	Cotton
39	Medal 35%	"Paridjat Adjensis", India	Triametoksam	Cotton
40	Lancer 80%	"United Phosforus", India	Acefat	Cotton
41	Dalwtfat 80%	"Dalston Associated SA", Panama	Acefat	Cotton
42	Orten 75%	"Arista life Science SAS", France	Acephan	Cotton
43	Pahta 42%	OOO"Ecokimyokurilishkhizmat ", Uzbekistan	Mono, di, trietanolamines	Cotton
44	Polysand 62.5%	Chemical and polymer institute under AS, Uzbekistan	Oxadikcil	Cotton
45	Premis 2.5%	"BASF AgroBV", Switzerland	Triconasol	Wheat
46	Sumy-8 2% FLO	"Sumitomo Chemical", Japan	Dinoconasol - M	Winter wheat, spring wheat
47	Topsin-M 70%	"Nippon Soda", Japan	Triophfanatmetil	Winter wheat
48	Himoya 10%	OOO"Ecokimyokurilishkhizmat ", Uzbekistan	Polychloriodine	Cotton
49	Himoya - C 31.5%	OOO"Ecokimyokurilishkhizmat ", Uzbekistan	Polychloriodine +2 acetatethanolamine	Cotton
50	Emmisar 250 g/l	Close joint-stock company "Shelkovo Agrokhim", Russia	Bronopol	Cotton
51	Vidat L 24%	"Dupon" USA	Oxamil	Tomato for hothouse
52	EZO 10%	OOO "Euriteam" Uzbekistan - Germany	Exoprol	Cucomber for hothouse
53	Lepidocid, p/ BA-3000 EA/mg	Institut of microbiology under Academy of Scince, Uzbekistan	Bacillus thuringiensis var. kur-staki strain U56	Tomato
54	AMIR 50%	"Parijat Agentcis" India	Acetochlor	Cotton
55	Arsenal 25% (R)	BASF, Germany	Imasapir	Land for no-agricultural needs
56	Aasirius 40%	OOO "Agrokhim" Uzbekistan	Bispiribak natrium	Rice
57	Biozin 360+22.2g/l	OOO"Ecokimyobioservis", Uzbekistan	Dicamba + chlorsulfuron	Winter wheat
58	Biostar 75%	OOO"Ecokimyobioservis", Uzbekistan	Tribenuronmetil	Winter wheat
59	Dalstar 75%	"Dalston Associated SA", Panama	Tribenuronmetil	Winter wheat

60	Dalzak 7,5%	"Dalston Associated SA", Panama	Fenocsaprop-p-etil+antidot	Winter wheat
61	Lastik 70 g/l	Close joint-stock company "Avgust", Russia	Fenocsaprop-p-etil+antidot	Winter wheat
62	Puma super 7.5%	"Bayer KropScience", Germany	Fenocsaprop-p-etil+antidot	Winter wheat, spring wheat
63	Dalzlak super	"Dalston Associated SA", Panama	Fluasiphop - butil	Cotton
64	Flusilad super 12,5%	"Singenta", Switzerland	Fluasiphop - butil	Soy, white beet, table beet, mangel, carrot, onion of all generation, sunflower, cotton, tomato, cabbage, cucumbers, horticultural crops, vineyard, citrus plants
65	Fuzilad forte 15%	"Singenta", Switzerland	Fluasiphop - butil	Cotton, white beet, apple-tree, vine, tomato
66	Dalzlak extra 104 g/l	"Dalston Associated SA", Panama	Galaxiphop-R-metil	Cotton
67	Raundal 360 g/l	"Monsanto" USA	Gliphosat	Fields for grain-crops, land for no-agricultural needs
68	Grandstar 75%	"Dupon" USA	Tribenutronmetil+triphensulphuronmetil	Winter wheat
69	Ovsugen extra 140 + 35 g/l	Close joint-stock company "Shelkovo Agrokhim", Russia	phenoxaprop-p-etil+antidot	Winter wheat
70	Pantera 40 g/l	(Uniroyal chemical) Registrations Ltd. UK	Quisalophop - tephuril	Cotton, sugar-beet
71	Samuray 33%	"Parijat Avencis" India	Pendimetalin	Cotton, maize, potatoes, onion, carrot
72	Cefat 25%	Joint venture "Electrochimsavod" Uzbekistan	Cvinclorac	Rice
Defoliants and Desiccant				
73	Dalron super SK	"Dalston Associated SA", Panama	Tidiasuron (360 g/l) + diouron (180 g/l)	Cotton middle-fibre
74	Yanichar SK	Close joint-stock company "Shelkovo Agrokhim", Russia	Tidiasuron (360 g/l) + diouron (180 g/l)	Cotton middle-fibre
75	Mezon, 53%	IONH, uzbekistan	Chlorat natrium	Cotton middle-fibre
76	Reglon Super 15%	"Singenta", Switzerland	Dicvat	Cotton middle-fibre
77	Super HMD j	IO-NH, Uzbekistan	365 g/l chloriat magniy + 4.5 g/l phosphat etanoplamin	Cotton middle-fibre
Growth Regulators				
78	Dalpiksi 5%	"Dalston Associated SA", Panama	Mepicvat-chlorid	Cotton
79	PIKS 5%	BASF, Germany	Mepicvat-chlorid	Cotton
80	Uztikc 5%	Joint venture "Electrochimsavod" Uzbekistan	Mepicvat-chlorid	Cotton
81	D-4-2 4%	"Protech" Uzbekistan	Natural protein and peptide	Cotton
82	Stimulator T 2.5 g/l	Biochemical Instutite under AS, Uzbekistan	Di-iodine-ociphen-oci di-phenilanin	Cotton

Source: Handbook: List of pesticides and agrochemicals permitted for use in agriculture in Republic of Uzbekistan (2007).

Table P5.10. List of chemical protectants, included into the register of forbidden and limited on application the active and non-active ingredients

#	Name of preparation or reactant	CAS No.	Registration date	Registration period validity	Reason of forbidden or limitation
1.	DDT and metabolites. 1.1-di-(4-chlorophenol) 2.2.2 trichloroethane (pesticide)	50-29-3	28.02.2001	Permanently	High-persistent pesticide, with full-blown cumulative behavior
2.	Hexachloran (sum of isomers GCCH) 1.2.3.4.5.6.- Hexachloro-cyclohexane(pesticide)	608-73-1	28.02.2001	Permanently	Stable in external environment, with carcinogenic, embryotoxic action, cumulative behavior. High level of products pollution
3.	2.4.5-T (dynoxol TCF)* (pesticide)	93-76-5	28.03.2002	Permanently	Teratogen, carcinogen, mutagen. Stable in external environment
4.	Aldrin ** (pesticide)	309-00-2	28.03.2002	Permanently	Highly toxic, Stable in external environment
5.	Captaphol * (pesticide)	2425-06-1	28.03.2002	Permanently	Carcinogenic, Stable in external environment
6.	Chlordan ** (pesticide)	57-74-9	28.03.2002	Permanently	Stable in external environment
7.	Chlordimeform * (pesticide)	6164-98-3	28.03.2002	Permanently	Mutagen, Carcinogenic, Stable in external environment
8.	Chlorbenzilat * (pesticide)	510-15-6	28.03.2002	Permanently	Oncogenic, Stable in external environment
9.	Heptachlor ** (pesticide)	76-44-8	28.03.2002	Permanently	Highly toxic, Carcinogenic, Stable in external environment
10.	Deldrin ** (pesticide)	60-57-1	28.03.2002	Permanently	Virulent toxic agent, Stable in external environment
11.	Dinoseb and it's salts * (pesticide)	88-85-7	28.03.2002	Permanently	Highly toxic, Teratogen, Stable in external environment
12.	1.2 – Dibromethane * (pesticide)	106-93-4	28.03.2002	Permanently	Oncogenic, Stable in external environment
13.	Fluoroacetamide * (pesticide)	640-19-7	28.03.2002	Permanently	Highly toxic, Stable in external environment
14.	Hexachlorobenzene ** (pesticide)	118-74-1	28.03.2002	Permanently	Highly cumulative, Stable in external environment
15.	Lindan * compound	58-89-9	28.03.2002	Permanently	Highly cumulative, Oncogenic, Stable in external environment
16.	Mercury compounds * phenol		28.03.2002	Permanently	Highly toxic, Stable in external environment
17.	Pentachloro-phenol * phenol	87-86-5	28.03.2002	Permanently	Full-blown skin-resorptive action, Stable in external environment
18.	Monocortophos * (dangerous formulation)	6923-22-4	28.03.2002	Permanently	Highly toxic, Stable in external environment
19.	Metamydophos * (dangerous formulation)	10265-92-6	28.03.2002	Permanently	Stable in external environment
20.	Phosphamydon * (dangerous formulation)	13171-21-6	28.03.2002	Permanently	Stable in external environment
21.	Methyl-parathyon * (dangerous formulation)	298-00-0	28.03.2002	Permanently	Highly toxic, Teratogen, embryotoxic, Stable in external environment
22.	Parathyon * (dangerous formulation)	56-38-2	28.03.2002	Permanently	Highly toxic, Stable in external environment
23.	Endrin ** (pesticide)	77-20-8	21.10.2005	Permanently	Highly toxic, Stable in external environment
24.	Mirex ** (pesticide)	2385-85-5	21.10.2005	Permanently	Carcinogenic, Stable in external environment
25.	Toxaphen ** (pesticide)	8001-35-2	21.10.2005	Permanently	Highly toxic, Carcinogenic

Note: * the most dangerous chemical compounds, forbidden and limitation of which is approved by the Rotterdam convention; ** the most dangerous chemical compounds, forbidden and limitation of which is approved by the Stockholm convention.
Decision to include these preparations to the given "Register" was accepted on the sittings of State Chemical Commission (Goshimkimissiya) on 28 March 2001, 28 March 2002, 21 October 2005.
Source: List of chemical protectants, included into the register of forbidden and limited on application the active and non-active ingredients (Tashkent, 2007).

ANNEX 6. Water Quality Standards

Table P6.1. Surface water quality standards

A) Maximum allowable concentration (MAC) of pollutants

Ingredients and indicators	Limiting harmful index	Maximum allowable concentration mg/l (mg/dm^3)
BOD_5	general requirements	3.0 mgO_2/ l
COD	general requirements	15 mgO_2/ l
Ammonium salt (NH_4^+)/ammonium nitrogen	toxicological	0.5 / 0.39
Nitrate ions (NO_3^-)/nitrite nitrogen	sanitary-toxicological	40 /9.0
Nitrite ions (NO_2^-)/nitrite nitrogen	toxicological	0.08 / 0.02
Oil and oil products	fishery	0.05
Phenols	fishery	0.001
Synthetic surface-active substance	toxicological	0.1
Iron (trivalent)	organoleptic	0.5
Copper (Cu^{2+})	toxicological	0.001
Zinc (Zn^{2+})	toxicological	0.01
Chrome (trivalent)	organoleptic	0.5
Chrome (hexavalent)	sanitary-toxicological	0.001
Nickel (Ni^+)	toxicological	0.01
Cobalt (Co^{2+})	toxicological	0.01
Lead (Pb^{2+})	sanitary-toxicological	0.03
Arsenic (As^{3+})	toxicological	0.05
Mercury (Hg^{2+})	sanitary-toxicological	0.0005
Cadmium (Cd^{2+})	toxicological	0.005
Fluorine ions (F^-)	sanitary-toxicological	0.75
Cyanides	toxicological	0.05
DDT	toxicological	absent
HCH	toxicological	absent
Benzol	toxicological	0.5
Methanol	toxicological	0.1
Formaldehyde	sanitary-toxicological	0.01
Potassium (cation)	sanitary-toxicological	50.0
Calcium (cation)	sanitary-toxicological	180.0
Magnesium (cation)	sanitary-toxicological	40.0
Sodium (cation)	sanitary-toxicological	120.0
Sulfates (anion)	sanitary-toxicological	100.0
Chlorides (anion)	sanitary-toxicological	300.0
Mineralization	general requirements	1000.0
Suspended substances	general requirements	< 0.75 mg/l
Dissolved oxygen	general requirements	Winter (under ice) > 4.0; Summer > 6.0

Source: Uzhydromet, 2013

B) Water pollution index (WPI)

Water quality class	Descriptive text	BPI value	BPI value change in % to define water quality trend
I	Very clean	less or equal to 0.3	100
II	Clean	over 0.3 to 1.0	over 50
III	Moderately contaminated	over 1.0 to 2.5	over 30
IV	Contaminated	over 2.5 to 4.0	over 25
V	Muddy	over 4.0 to 6.0	over 20
VI	Very muddy	over 6.0 to 10.0	over 15
VII	Extremely muddy	over 10.0	over 10

Source: Uzhydromet, 2013

C) Saprobity index (SI)

Water quality class	Quality of water	SI Values
I	Very clean	**< 1.0**
II	Clean	**1.1 – 1.5**
III	Moderately contaminated	**1.6 – 2.5**
IV	Contaminated	**2.6 – 3.5**
V	Muddy	**3.6 – 4.0**
VI	Very Muddy-	**> 4.0**

Source: Uzhydromet, 2013

D) Biotic periphytic index (BPI)

Water quality class	Quality of Water	BPI value	Ecological state of biocoenosis	Code of ecological state
I	Very clean	**10-9**	Background (model)	**AB (F)**
II	Clean	**8-7**	Background (good)	**AB (F)**
III	Moderately contaminated	**6-5**	Satisfactory	**AB**
III-IV	Transition class	**4.5**	Transition state	**AB-Ab**
IV	Contaminated	**4**	Unsatisfactory	**Ab**
V	Muddy	**3-2**	Poor	**Ab**
VI	Very Muddy-	**1-0**	Unacceptable	**ab**

Source: Uzhydromet, 2013

Decipher of letter denotations on ecological state:
AB (F) – background ecological state at which biocoenosis is in metabolic (A) and ecological (B) progress and represented by complex of species corresponding to background (F) undisturbed regional genepool;
AB – satisfactory ecological state;
AB-Ab – transition ecological state related to visible change in ecological (species) composition of biocoenosis;
Ab – unsatisfactory ecological state, utter degradation of base ecological (species) composition (b);
ab – absolutely unacceptable ecological state, full biocoenosis degradation.

ANNEX 7. Aquatic recharge management. Best practices

(Materials of IWMI research report No.51 Ground water recharge management: solution of problem of water resources deficit in Fergana Valley)

Main objective of Managed Aquatic Recharge (MAR) is temporary shrinkage of surface flow in groundwater aquifers for its use in critical periods of water shortage for irrigation. For the last decades in many countries growth in population and measures on making of an economic profit led to depletion of ground water reserves. This induced the authorities and farmers to search alternatives for addressing a problem

India

Uncontrolled use of ground water in dry and semi-dry regions of India led to depletion of ground water reserves, especially in the west of country. It is expected that by 2018 about 36% of territory in India will experience serious water resources deficit due to depletion of ground water. At the same time, there is a potential for increase in ground water supply in country. Annual precipitation is 4 thousand km^3, for recharge of aquifer available 872 km^3 water from precipitation. In Site plan on artificial ground water supply in India identified 448.76 thousand km^2 (14% of country's territory) possible spreading GWRM.

Ground water will be supplied by collection of water from surface of 3.925 million cities and villages roofs, 37 thousand infiltration basins, 110 thousand dams, 48 thousand mines and wells, 26 thousand closed ravines and panniers and 2.7 thousand springs in hilly area

China

Intense use ground water also led to a number of ecological problems in north of China related to excessive water pumping. In 48 % of rural area six provinces reduction of water table is registered. 2 approaches are adopted to solve a problem: water saving directed on saving 50mm/year that will lead to reduction abstraction ground water for irrigation and GWRM.

2 methods of GWRM are applied: inexpensive technologies and groundwater reservoirs. The first method includes small dykes on watercourses, bypass canals, pits and basins, flow turning to reserve land designated for accumulation of excess water during flood. 7 regions are revealed where might be used inexpensive technologies. They belong to alluvial fan of piedmont of Taihang Mountain where regional ground water is supplied. Sources water might be treated municipal flow, excess surface water.

Since recently, more advanced technologies for refilling of ground water - pumping water in wells in basins the Futuo River and the Zia River has started to be applied. Multi-purpose groundwater reservoirs are built by construction of underground dykes with cementation or clay walls

Australia

Uncontrolled ground water supply, directed on utilization of water resources, takes place in many cities of Australia. Most widespread type of GWRM is the use of the same well for pumping and abstraction water (storage in aquifers and return). From 1980th farmers have been conducting experiments on water diversion from Angas and Bremer rivers into irrigation wells.

USA

Methods dispersion water resources with use channel and off-channel basins are widely applied for accumulation of excessive surface water. Biggest in state system underground shrinkage of water resources is built and operated. Project underground storage Granite Reef is system dispersion surface water comprising 7 basins on 150ha. System is built in dry bed the Salt River and supply is made by water from the Salt, Colorado rivers and small volume of drainage water. Such systems are built in other states. Private water firm Vidler manages a complex of dispersion water of 1123 m^3/year near Phoenix city with purpose of shrinkage of water for its selling in future. Ground water supply points represent basins formed in abandoned agricultural lands with low infiltration.

ANNEX 8. Dam Safety (Operational Policy and Op 4.37)

P8.1. Dam Safety (Operational Policy and OP 4.37): Andijan Reservoir

1) Brief explanation about OP WB 4.37 on the projects funded by the World Bank, being operated downstream of existing dams

Existing dams: OP 4.37 is triggered if the project funded by the World Bank depends upon productivity (operation and maintenance) of existing dam; or if failure or incorrect management of existing dam may lead to serious damage of funded by the Bank projects.

2) Assessment and measures undertaken before project appraisal

OP 4.37 is triggered due to the fact that sub-project "Savai – Akburasai" and "Isfayram-Shakhimardan" area is located downstream Andijan dam. Due to FWRMP-II the rules for reservoir operation should not be reviewed, and design of FWRMP-II does not require changing of mode for general releases in the both sub-project areas (see Section Situation "With Project").

On the basis of the Law of the Republic of Uzbekistan "On hydraulic structures safety" and Resolution of the Cabinet of Ministers of the Republic of Uzbekistan (№ 499 dated 16.11.1999), and in accordance with "Provision of Declaration of Safety of Hydraulic Structures", in 2004 the first edition of Andijan Reservoir Declaration of Safety had been compiled, that was approved by Expert Council of SI "Gosvodnadzor" for the period of five years (Protocol № 2 dated 26.10.2005), with the execution during that period of a number of arrangements on improvement of technical conditions and promotion of safe operation of dam node.

In 2011 the second edition of Andijan Reservoir Declaration of Safety had been compiled, that was approved by Expert Council of SI "Gosvodnadzor" for 5 year (Protocol № 2 dated 19.09.2011). Summarized conclusions of Expert Committees on Declaration of Safety of main hydraulic structures of the Republic of Uzbekistan, including Andijan reservoir, were approved in 2014 by Expert Council of SI "Gosvodnadzor" (Protocol № 2/1 dated May 30, 2014).

While compiling second edition of Declaration on Safety in 2011, the special Committee carried out survey of Andijan reservoir structures technical conditions, checked the availability of rules and instructions on equipment operation and maintenance, technical documentation, and a number of issues had been revealed regarding concrete dam safety, mechanical instruments and etc.

The main designer of the project was the institute "Sredazgiprovodkhlopok" of the Ministry of Water Resources of the USSR. The administration for Andijan reservoir operation is subordinated to RO "Uzvodremexpluatatsia". The mode for reservoir operation is defined by Main Administration for Water Resources of the MAWR of the Republic of Uzbekistan. The rules for the waterworks facility structures operation were compiled in 1983 by the institute "Uzgipromeliovodkhoz" (currently LLC UzGIP). There is operation schedule till the year of 2016.

3) Measures to be undertaken between project appraisal and its efficiency analysis

For the execution of OP 4.37, within frameworks of that study development on ESA/FVWRMP-II, the update of the report on Dam Safety Declaration of 2011 will be carried out in accordance with approved work plan and schedule. Then, the teams of the Bank and MAWR, together with responsible organization (Gosvodkhoznadzor), with assistance of the PIU consultants, they will hold joint on-line workshop on completion of main document: "Potential Failure Mode Analysis" (PFMA). The results of workshop will by synthesized in the report that will be submitted to the Bank and PIU.

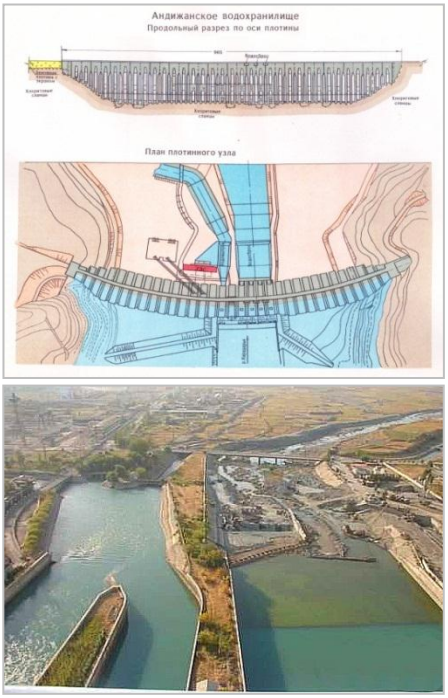
Gosvodkhoznadzor, with assistance of the PIU of MAWR consultants, will conduct the program of safety inspection and provide two diagnostic survey: (i) before construction of project and (ii) second survey during the last year of project implementation.

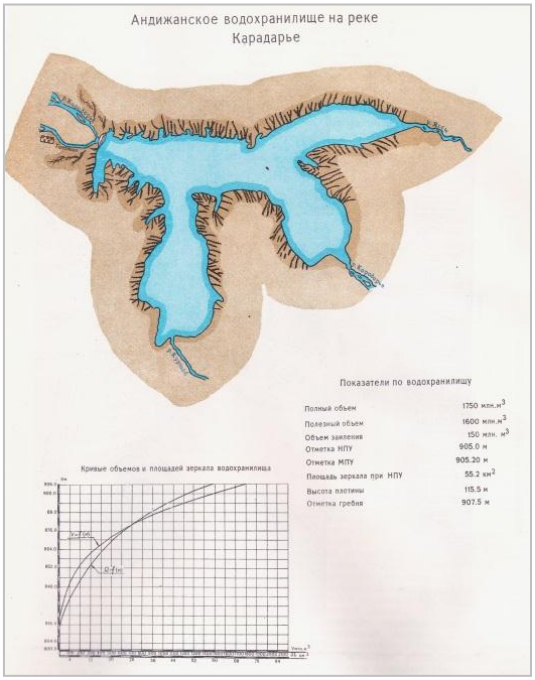
4) Brief assessment of Andijan reservoir/dam

Andijan reservoir had been constructed in the eastern part of Fergana valley on the Karadarya river, at the border of Uzbekistan and Kyrgyz Republic, and is located 75 km upstream of the city of Andijan. Rim of reservoir is located mainly on the territory of Kyrgyz Republic and is formed by the Karadarya river floodplain and its two tributaries: Yassy and Kurshab (Figure 1). Dam site is located not far from Kampyrravat ravine with exit of the Karadarya river into Fergana valley.

Andijan reservoir was accepted into permanent operation in April 1984 with total capacitance of 1900 mln. m^3, useful – 1750 mln. m^3. The reservoir has irrigation destination with multiyear flow regulation of the Karadarya river, and is assigned for guaranteed water supply to main canals: Shakhrihansai, Andijansai and Savay on the left bank of the Karadarya river and into the right bank canal for irrigation of the Republic of Uzbekistan lands.

Figure P8.1. Longitudinal profile, Plan and View from dam to Downstream of Andijan reservoir





Resource: Irrigation of Uzbekistan, Volume 2, 1970

Reservoir dam is concrete massif – buttress dam, the length on the crest is 875 m; maximal height 119.7 m, it consists from 33 sections and two abutment piers. The dam foundation is paleozoic metamorphic metamorphic slates, capacity of more than 1500 m, with dip azimuth 240-270°, dip angle 60-70°. Rocks at dam foundation are characterized by low water permeability, the value of specific saturation is from 0.1 rare 0.1…0.01 l/min. The value of infiltration coefficient is 0.0001 m/day. Dam maximal height is 115.5 m, length on the crest is 965 m, laying of upper and lower slopes is 0.5, mark of the dam top is 907.5 m. According its length the dam is divided by temperature - sediment sutures into 33 sections and two abutments. The dam sections are hollow with the width of 25 m.

The earth dam is adjoined to left bank abutment with the length 165 m**,** height 28.5 m; slopes: upper — 3.0, lower — 2.5. The dam is made from pebble fractions with central loamy core. Upper slope is fixed by reinforced concrete plates with thickness 30 cm. The role of aquifuge in the dam body is done by concrete core (diaphragm), maintained above concrete pipe of cement gallery, from which the cement – ground curtain is made at the depth of 30.0 m. along the whole length of earth dam.

Estimated discharge of openings into approach channel is 230 m^3/sec, and for escape of surplus water into the Karadarya river— 1700 m^3/sec. Water discharge through culvert is conducted only during summer period, with discharge of water consumption exceeding discharge of HPS equal to 136 m^3/sec.

Hydroelectric power plants are included into dam node: HPS-1, with capacity 140 MVt and HPS-2, with capacity 50 MVt, operated according irrigation schedule.

The reservoir was accepted into permanent operation in April 1984 with total capacitance of 1900 mln. m^3, useful – 1750 mln. m^3. The reservoir can draw down to zero. Therefore it has no dead storage, and storage for siltation is accepted as 150 mln. m^3. First filling of reservoir till the mark NPG (906.0 m) was in 1981. The first draw down of reservoir to zero in 1982 had shown that working openings of the 1-st tier section 21 were silted by suspended sediments approached the body of dam, and it was difficult to open while carrying out repair works. Since those times there was no complete reservoir draw down. Waterways of the 1-st tier section 16 were operated last time in 1997. In this connection there is threat for blockage by sediments of the section intake portal, and as a consequence loss of dam node capacity with low water horizons in the reservoir. According the data of bathymetric survey of reservoir bed conducted by Bathymetric Center under RO "Uzvodremexpuatatsia" in 2003 the volume of siltation was 255.2 mln. m^3 , and that makes 13% of total storage, including 160.2 mln. m^3 of net storage (9%).

The results of survey of reservoir facilities complex, including technical conditions of mechanical and crane equipment of all dam tiers, power supply of dam node structures, and also analysis of the results of natural surveys according geodesic data on dam conditions are put into the Act Survey of Andijan reservoir hydraulic structures on the Karadarya river in the Republic of Uzbekistan (on July 15-17, 2011, Khanabad).

The following parameters were stated for the moment of reservoir structures technical conditions survey (July 15, 2011, 16-00 hrs.):

- water horizon mark	- 898.54 m
- water volume	- 1500 mln. m^3
- inflow	- 206 m^3/s
- discharge into lower race	- 476 m^3/s
including:	
- into Karadaya	- 260 m^3/s
- including through HPS-II	*- 60 m^3/s*
- into Approach channel	- 216 m^3/s
- including through HPS-I	*- 182 m^3/s*
- through outlet	*- 34 m^3/s*
Drainage water discharge	-3.73 l/s
Including through earth dam	- 2.5 l/s.

Hydraulic structures of dam node are: concrete dam, water discharge works, spillway works, hydropower stations – HPS-1 and HPS-11, and earth dam. Class of main structures is 1, site seismicity is 9 balls.

The set of field surveys is carried out at Andijan reservoir dam for its conditions, including:

a. *Geodesic surveys, including measurements of horizontal relative vertical shifts of dam sections by direct and reversed plumb lines, hydrostatic levels and optical method;*
b. *Observations for tensed – deformed dam condition by inserted transformers of static instrumentation;*
c. *Hydraulic observation at spillway sections;*
d. *Seismic observations for shifts, accelerations of dam with registration on computer.*

Currently technical facilities, that are in disposal of Reservoir Operation Administration, allow to obtain in operative manner the assessment of the structure conditions. Observations according static instrumentation, measurements of dam sections horizontal shift by hydrostatic levels and head piezometers are carried out each 10 days and nights. All types of geodesic surveys are carried out both as by traditional method as well as by automatic method. In order to increase accuracy and quality of measurements it is necessary to execute the work on survey on cable communications by static instrumentation.

On the basis of carried out survey the Committee had given the following conclusions and proposals:

- Andijan Reservoir Operation Administration is subordinated to RO "Uzvodremexpuatatsia". Reservoir operation mode is defined by Water Management Administration of MAWR of the Republic of Uzbekistan.
- The dam node for capacity of 1900 mln. m^3 together with HPS-I, with capacity of 140 MVt had been constructed during the period from 1963 to 1984. Dam HPS-II (small), with capacity of 50 MVt had been constructed during the period from 2000 to 2010 for maximal discharge of 70 m^3/sec.
- While designing according SNIP and currently on KMK the class of dam node main structure remained -1. Site seismicity is 9 balls.
- The replacement of old freight/passenger elevator with lifting capacity 1000 kg had been done for the new one. Currently they carry out commencement works.
- For the occasion of electricity switch off at the dam there is Diesel power station DPS AD-3OC, but its capacity is not enough. The reserved line of energy supply from massif "Tashakhur" is in the stage of construction.
- Due to the long age of operation (30 and more years) mechanical and crane equipment of all dam tiers needs upgrading, and also current and capital repairs. In this connection the Operation Administration has forecast schedule for execution of repair works for the period of 2012-2016, and for modernization it is necessary to launch tender for procurement of equipment in the established order.
- In order to analyze dam structures conditions they automatized field surveys for sensors of geodesic, infiltration and seism metric instrumentation. The criteria of various instrumentation readings safety are being elaborated.
- The protection zone of dam node has enclosure with perimetral signalization, there is automatic system of early notice and warning of population in downstream inhabited points on emergency situations occurring at dam node.
- According the data of visual survey all structures of dam node are in satisfactory conditions and are applicable for further operation.

ANNEX 9. Stakeholder Consultation Workshops – Program, Participants and Question/Responses

Environmental and Social Assessment
Consulting workshops of stakeholders

Workshops Protocol

Objective: The main objective of consultations is to inform all interested parties from the number of organizations, institutions, non-government organizations, representatives of communities, farmers and vulnerable groups of population in project territory on the results of ecological and social studies, assessment of project measures and recommendations on plans of environmental management, mitigation of possible negative effects of environmental and social impact, plan of interested parties participation in project implementation and monitoring of project actions, and to receive their responses f or such measures.

Organization: In accordance with ToR the responsible for organization of consulting workshops are the teams on environmental and social assessment.

Participants: The list of participants is attached below. In each of three sub-project zones 40-45 representatives of various target groups of the Project were invited to the workshops, in total in conclusive consultations 153 persons took part. 8 participants from Tashkent were represented by specialists of PIU, MAWR, representatives of academic organizations of WRA sector and the team of EA and SA. 24 women took part in the consultations, mainly "maslakhatchi" - collaborators of NGO "Committee of Uzbekistan Women" representing women councils under makhallya committees and rural gatherings of citizens, and also collaborators of district and regional khokimiyats, BAIS and HGME.

Program: The program of consulting workshops is given below in Table. 10.1. Workshops in each of three sub-projects were opened by opening statement of BAIS managers, on which command area the sub-project will be implemented, and also by greetings of authorized persons from regional and district khokimiyats of Namangan, Andijan and Fergana regions. As introduction information also they were listening the speech of the PIU for WI responsible collaborator (Mr. Norbayev M.) who submitted to participants attention brief review on proposed within FS preparation technical arrangements for FVWRMP – Phase II, including specifics and contents of proposals for technical interventions, options of investments and next steps on agreement and execution of project measures.

Table P 10.1. Program of consulting workshops on three sub-projects FVWRMP Phase-II

May 12, 2015. Namangan Sub-project Podshoata –Chodak	
09.00 - 09.30	**Registration of participants**
09.30 - 09.50	**Opening of the workshop. Opening speech:** Mr. U. Mekhmonov, Deputy head of Naryn-Syrdarya BAIS Mr. M. Norbaev, PIU for WI, Tashkent, MAWR
09.50-10.10 10.10-10.30	Project preparation and Feasibility Study (FS) (Assignment A) for «Fergana Valley Water Resources Management Project, Phase-II (FVWRMP-II): Azim Nazarov, Deputy Team Leader, Sheladia Associates Inc. (USA) in association with NBT (Uzbekistan) and IKS (Uzbekistan). **Questions of workshop participants**
10.30 - 11.00	**Coffee break**

11.00 - 11.30 11.30 – 11.45	Environmental assessment: Issues of environment, project impact, management of ecological risks, environmental management plan, mitigation and monitoring. Mrs. Gulchekhra Khasankhanova, EA Team Leader **Questions of workshop participants**
11.45 - 12.15 12.15 - 12.30 12:30 – 12:45 12:45 – 13:00	Social assessment: Social issues, project benefits and risks, action on promotion of OP 4.12: Mr. Yakov Asminkin, SA Team Leader **Questions of workshop participants** Presentation of participation plan draft. Elaboration of recommendations on promotion of participation in the project of all interested parties.
13.00 – 13.30	General discussion, elaboration of recommendations. Sizing up. **Closing of the workshop**
13.30 - 14.30	**Lunch**
14:30 – 16:00	Time for discussions and consultations with some specialists
May 13, 2015. Andijan. Sub-project Savay – Akbura	
09.00 - 09.30	**Registration of participants**
09.30 - 09.50	**Opening of the workshop. Opening speech:** Mr. Shukhratbek Ergashev, First Deputy Head of Naryn-Karadarya BAIS Mr. M. Norbaev, PIU for WI, Tashkent, MAWR
09.50-10.10 10.10-10.30	Project preparation and Feasibility Study (FS) (Assignment A) for «Fergana Valley Water Resources Management Project, Phase-II (FVWRMP-II): Azim Nazarov, Deputy Team Leader, Sheladia Associates Inc. (USA) in association with NBT (Uzbekistan) and IKS (Uzbekistan). **Questions of workshop participants**
10.30 - 11.00	**Coffee break**
11.00 - 11.30 11.30 – 11.45	Environmental assessment: Issues of environment, project impact, management of ecological risks, environmental management plan, mitigation and monitoring. Mrs. Gulchekhra Khasankhanova, EA Team Leader **Questions of workshop participants**
11.45 - 12.15 12.15 - 12.30 12:30 – 12:45 12:45 – 13:00	Social assessment: Social issues, project benefits and risks, action on promotion of OP 4.12: Mr. Yakov Asminkin, SA Team Leader **Questions of workshop participants** Presentation of participation plan draft. Elaboration of recommendations on promotion of participation in the project of all interested parties.
13.00 – 13.30	General discussions, elaboration of recommendations. Sizing up. **Closing of the workshop**
13.30 - 14.30	**Lunch**
14:30 – 16:00	Time for discussions and consultations with some specialists
May 14, 2015. Fergana. Sub-project Isfayram- Shakhimardan	
09.00 - 09.30	**Registration of participants**
09.30 - 09.50	**Opening of the workshop. Opening speech:** Mr. A. Rakhmatillaev, Head of Syrdarya – Sokh BAIS Mr. M. Norbaev, PIU for WI, Tashkent, MAWR
09.50-10.10 10.10-10.30	Project preparation and Feasibility Study (FS) (Assignment A) for «Fergana Valley Water Resources Management Project, Phase-II (FVWRMP-II): Azim Nazarov, Deputy Team Leader, Sheladia Associates Inc. (USA) in association with NBT (Uzbekistan) and IKS (Uzbekistan). **Questions of workshop participants**
10.30 - 11.00	**Coffee break**
11.00 - 11.30 11.30 – 11.45	Environmental assessment: Issues of environment, project impact, management of ecological risks, environmental management plan, mitigation and monitoring. Mrs. Gulchekhra Khasankhanova, EA Team Leader **Questions of workshop participants**

11.45 - 12.15 12.15 - 12.30 12:30 – 12:45 12:45 – 13:00	Social assessment: Social issues, project benefits and risks, action on promotion of OP 4.12: Mr. Yakov Asminkin, SA Team Leader **Questions of workshop participants** Presentation of participation plan draft. Elaboration of recommendations on promotion of participation in the project of all interested parties.
13.00 – 13.30	General discussions, elaboration of recommendations. Sizing up. **Closing of the workshop**
13.30 - 14.30	**Lunch**
14:30 – 16:00	Time for discussions and consultations with some specialists

List of workshop participants in the Namangan, May 12, 2015

No	Name	Position
1	A.Ahmedov	Khokimiyat of Namangan region, specialist of agriculture secretariat
2	A. Hoshimov	Khokimiyat of Yangikurgan district, Deputy Khokim
3	A. Hasanov	Goskompriroda, Namangan region
4	I. Toshmatov	Goskompriroda, Yangikurgan district, Head
5	Abdurahmanov	Goskomzemkadastr, Namangan region
6	S. Mamatov	SANIIRI, Deputy Director
7	S. Mehmonov	Naryn-Syrdarya BAIS, First Deputy Head
8	S. Kamolov	Naryn-Syrdarya BAIS, Head SRB
9	G. Huzhamov	Naryn-Syrdarya BAIS, Head of IT and GIF
10	H. Ubajdullaev	Naryn-Syrdarya BAIS, Head of TMAAT
11	R. Zhabbarov	Naryn-Syrdarya BAIS, Main specialist of SRB
12	I. Nazrullaev	Naryn-Syrdarya BAIS, Main specialist of TMAAT
13	A. Bojmirzaev	Naryn-Syrdarya BAIS, Key specialist of SRB
14	V. Ohunmirzaev	Naryn-Syrdarya BAIS, Main specialist of IT and GIF
15	M. Sunaeva	Naryn-Syrdarya BAIS, Main specialist of SRB
16	B. Kutpiddinov	Naryn-Syrdarya BAIS, specialist
17	Zh. Zhabborov	Naryn-Syrdarya BAIS, specialist
18	D. Abdullaeva	Naryn-Syrdarya BAIS, specialist
19	T. Kirgizboev	Naryn-Syrdarya BAIS, specialist
20	N. Tujchiboev	Naryn-Syrdarya BAIS, specialist
21	R. Rahmatullaev	NSE and AB, Head IChB Yangikuran district
22	M. Ismatillaev	Podshoata-Chodak ISA, Deputy Heada
23	A. Akbarov	Podshoata-Chodak ISA, Head SRB
24	K. Turdiev	Podshoata-Chodak ISA, Yangikuran district, Head of department
25	N. Hudajberdiev	Podshoata-Chodak ISA, Yangikuran district, Head of department
26	M. Zhalolov	Podshoata-Chodak ISA, Head of Hydro site, Yangikurgan district
27	H. Ahmadzhonov	Podshoata-Chodak ISA, Head of department, Chartak district
28	Hodzhaev	Podshoata-Chodak ISA, Chartak district, Head of department of vertical drainage
29	A. Appokov	Podshoata-Chodak ISA, Chartak district, Head of department Hydro site
30	S. Kalandarova	Podshoata-Chodak ISA, Lead engineer
31	Z. Rizvanova	HGME, Namangan region
32	Z. Ahmedova	HGME, Namangan region
33	M. Turgunova	HGME, Namangan region

34	A. Hasanova	HGME, Namangan region
35	R. Jusupov	Yangikurgan district, Chairman RGC
36	N. Aliboev	Yangikurgan district, RGC "Dustlik", resident
37	O. Berdijorov	Yangikurgan district , WCA "Navkent bulogi", Chairman
38	B. Otahonov	Yangikurgan district , WCA "Iskovot Obi Hayot", Chairman
39	H. Jergashev	Yangikurgan district , WCA "Shark Yulduzi", Chairman
40	Z. Bajdodoev	Chartak district, Head of WCA
41	I. Kurbonov	Chartak district, Head of WCA
42	J. Hamroev	Yangikurgan district, Manager of farm
43	K. Pulatov	Yangikurgan district, Manager of farm
44	I. Mansurov	Chartak district, Manager of farm
45	G. Khasankhanova	EA Team leader
46	Ja. Asminkin	SA Team leader
47	M. Narbaev	PIU-WI
48	S. Khamzin	Specialist EA
49	R. Ibragimov	Specialist EA

List of workshop participants in the Andijan, May 13, 2015

No	Name	Position
1	Kosimov Sohibzhon	Khokimiyat of Bulakboshi district, Deputy Khokim
2	Mahatova Irodahon	Khokimiyat of Andijan region, Main specialist
3	Ismoilov Bobur	Khokimiyat of Kurgantepa district, Main specialist
4	Kushmadov Ilhomzhon	Khokimiyat of Khuzhaabad district, First Deputy Khokim
5	Zhumaev Abror	Khokimiyat of Bulakboshi district, specialist
6	Nazhimova Zarifa	Khuzhaabad district, Committee of Woman
7	Jergashev Vohidzhon	Representative of MAWR RUz
8	Umarov Dilshodbek	Goskompriroda of Andijan region, Head of Water Inspection
9	Shoudinov Doston	Goskompriroda, Khuzhaabad district
10	Shokirov Bahodirzhon	Goskompriroda of Andijan region, Inspector
11	Aripov Salohiddin	Goskompriroda, Jalakuduk district
12	Imoilov Isokzhon	Goskomzemgeodezkadastr, Andijan region
13	Abdurazzokov Sherzodbek	HGME, specialist
14	Tujchiev Alisher	NSEAB, specialist
15	Jergashev Shuhratbek	Naryn-Karadarya BAIS, First Deputy Head
16	Rahmonov Nodirbek	Naryn-Karadarya BAIS, Lawyer
17	Komilov Mavlonbek	Naryn-Karadarya BAIS, Head of department
18	Uraimov Husanboj	Naryn-Karadarya BAIS, Head of department
19	Gajnutdinova Al'bina	Naryn-Karadarya BAIS, Head of department
20	Zajnobiddinov Mansurbek	Naryn-Karadarya BAIS, Sector manager
21	Madibaev Nodirbek	Naryn-Karadarya BAIS, Sector manager
22	Hidojatov Muhammadsodik	Naryn-Karadarya BAIS, Main specialist
23	Holmatov Alisher	Naryn-Karadarya BAIS, Main specialist
24	Muhammadamin Dilhumor	Naryn-Karadarya BAIS, specialist
25	Jergasheva Parizodhon	Naryn-Karadarya BAIS, specialist
26	Zokirova Lola	Naryn-Karadarya BAIS, specialist
27	Ahlitdinov Dostonbek	Naryn-Karadarya BAIS, specialist
28	Jakubbekov Mashhurbek	Savay-Akburasai ISA, Head
29	Abdullaev Abrorbek	Savay-Akburasai ISA, First Deputy Head
30	Umarov Murodzhon	Savay-Akburasai ISA, Head of department
31	Bakirov Gofirzhon	Savay-Akburasai ISA, Head of department

32	Nazarov Bahromzhon	Savay-Akburasai ISA, Head of department
33	Jusupov Rahmonzhon	Savay-Akburasai ISA, specialist
34	Kuzibaev Shohruh	Savay-Akburasai ISA, specialist
35	Hafizov Sardor	Savay-Akburasai ISA, specialist
36	Mirzaahmedov Alisher	Head of Savay canal department
37	Kurbonov Adhamzhon	RGC "Kushtepa", Jalakuduk district
38	Sotivoldieva Dilfuza	RGC "Kurgantepa", Kurgantepa district
39	Hasanov Abduhalim	WCA "Madiyorov", Khuzhaabad district
40	Holberdiev Tuhtasin	WCA "Vodij gidroteh", Jalakuduk district
41	Sotivoldiev Madamin	WCA "Istikbol suv bul", Kurgantepa district
42	Mirzaev Dilmurod	WCA "Jurapolvon", Bulakboshi district
43	Hozhisultonov Sh.	"Istikbol", Kurgantepa district, Manager of farm
44	Abdullaeva S.	Kurgantepa district, Deputy manager of farm
45	Rahmonov Abdukodir	"Jergash Rahmon er" farm, Bulakboshi district
46	Mirolimov Alizhon	"Mirolim Ota" farm, Khuzhaabad district
47	G. Khasankhanova	EA Team leader
48	Ja. Asminkin	SA Team leader
49	M. Narbaev	PIU-IW
50	S. Khamzin	Specialist EA
51	R. Ibragimov	Specialist EA

List of workshop participants in the Fergana, May 14, 2015

No	Name	Position
1	A.Zikrijaev	Khokimiyat Fergana district, First Deputy Khokim
2	U.Umaraliev	Khokimiyat Kuvasai district, specialist
3	Zh. Madjarova	Khokimiyat, Kuvasai , RGC Pashona
4	O. Shamsutdinova	Committee of Woman
5	Z. Zhuraev	MAWR RUz
6	B.Hamidov	Goskomzemkadastr, Fergana region, Main specialist
7	S. Amirov	Goskompriroda, Fergana region
8	B. Topivoldiev	Goskompriroda, Fergana district
9	R. Isroilov	Goskompriroda, Kuvasai
10	G.Bojpulatov	Oblselvodkhoz, Head of department
11	M. Gaipov	Ferganagiprovodhoz, Director
12	A.Holikov	NSEAB, First Depuyu Head
13	Zh.Kamolov	NSEAB, Head of department PTO
14	Zh.Sajmatov	Syrdarya-Sokh BAIS, First Deputy Head
15	A. Kuziboev	Syrdarya-Sokh BAIS, Water balance specialist
16	H.Akbarov	Syrdarya-Sokh BAIS, Water balance specialist
17	G.Holmatov	Syrdarya-Sokh BAIS, Head of department
18	A.Azizov	Syrdarya-Sokh BAIS, Water balance specialist
19	D. Mamadalieva	Syrdarya-Sokh BAIS, Main specialist
20	A.Tozhaliev	ISA Isfajram-Shahimardan, Deputy Head
21	Sh. Mirzaev	ISA Isfajram-Shahimardan, Water balance specialist
22	S. Abduraimov	Kuvasai, Water Resources Department, Head
23	F. Ahmadaliev	Kuvasai, Pump Stations Department, Manager
24	H. Nasimov	Kuvasai, Pump Stations Department, specialist
25	M.Bakirov	HGME, Fergana region, First Deputy Head
26	Abdulahatov	HGME, Fergana district, Head of department
27	Z. Ishankulova	HGME, Laboratory
28	G. Toshpulatova	HGME, Laboratory
29	S. Odilova	HGME, Laboratory

30	G. Aminzhonova	HGME, Laboratory
31	D. Hamdamova	HGME, Laboratory
32	M. Fahritdinov	Water Department, Tashlak district, Head
33	B. Turgunov	Pump Stations Department, Tashlak district, Head
34	Sh.Zhumaev	UNES, Fergana district, Head of department
35	O.Shokirov	UNES, Fergana district, specialist
36	F.Tolipov	RGC "Kaptarhona", Chairman
37	A.Mannosov	RGC "Novkent", Chairman
38	Zh. Nazirov	RGC "Avval", Chairman
39	B. Jerkaboev	RGC "Okbilol", Chairman
40	M. Sobirov	RGC "Kalacha", Chairman
41	A. Nabiev	RGC "Lashkar", Chairman
42	H. Shukurova	RGC "Logon", Consultant of Chairman
43	S. Ahmadzhonov	RGC "Ahror mirob Muminzhon", Chairman
44	B. Mirzasharipov	RGC "Isfajram", Chairman
45	H. Sobirov	RGC "Valik", Chairman
46	O. Toshtemirov	WCA "S. Zoirzhonobod", Chairman
47	S. Zokirov	WCA "Zamin Usmanobod", Chairman
48	D. Jakubov	WCA "Far Nurmamat Kuchkarboj", Chairman
49	I. Madaminov	WCA "Tursunali Madaminov", Chairman
50	A. Boltaboev	WCA "Okbilol Abdumalik", Chairman
51	A. Otaboev	WCA "Mindon Turobzhon Sattorov", Chairman
52	A. Davronov	WCA "Polmon Obihajot", Chairman
53	A. Rahmonjorov	WCA "Jukori Mujan", Chairman
54	V. Kamchinov	WCA "Valik Najman", Chairman
55	S. Mirzaliev	WCA "Husanboj Olimov", Chairman
56	M. Nazarov	WCA "Chashmai Sufon", Chairman
57	Je. Samarov	WCA "Kuchkorchi Urmion", Chairman
58	Zh. Urazova	Urta Najman settlement, Consultant
59	G. Khasankhanova	EA Team leader
60	Ja. Asminkin	SA Team leader
61	M. Narbaev	PIU-IW
62	S. Khamzin	Specialist EA
63	R. Ibragimov	Specialist EA

A. Review of presentation on studies for environmental assessment - Mrs. G. Khasankhaniova

In the beginning of presentation it had been noted that large scale projects, such as FVWRMP, Phase -II require elaboration of environmental and social assessment, that had been implemented in accordance with requirements of policy/guidelines of the World Bank and the Republic of Uzbekistan. One of those requirements is carrying out consultations with interested parties with the objective for obtaining from them the response for planned arrangements for undertaking joint decisions. Dr. G. Khasankhanova familiarized participants with objectives and tasks of ecological study and submitted project arrangements and their distribution in project territories. Then the results of ecological studies had been presented in sub-project areas in the context of environment current conditions, from the view point of water and land resources use, biological diversity, social resources, and also problems related to water shortage and low water availability, deterioration of I&D infrastructure and irrigation services, and their impact on environment. The main approaches on project impacts assessment had been described (including according location, types of arrangement during the period of construction, operation) and summed up the results of positive and negative impacts, that the project might have, and also proposed mitigation measures and the plan of environmental management and project monitoring had been submitted (EMP). DR. Khasankhanova gave detail clarification on sources and

data used, and answered to all questions. Due to the absence of specialists from Feasibility Study team, all questions related to technical arrangements partially were addressed to the representative of the PIU for WI and BAIS specialists. In conclusion, the participants thanked for EA constructive contribution and support in execution of FVWRMP, Phase-II.

A. Review of presentation on studies for social assessment – Mr. Yakov Asminkin

During presentation the approach of the World Bank to selection of projects with priorities not influencing for reduction of low wealth, and also main objectives of social assessment, sources and methods for data collection were set forth. Project components had been described towards socio-economic problems, according policy/guidelines of the World Bank on social assessment and aspects for resettlement. Then the results of social studies had been presented, that described situation in sub-project zones from the view point of demography, employment, influence of agricultural activities on population wealth, problems related to irrigation water shortage and other problems of agricultural producers (including dekhkan/household farms). Besides, more general recommendations were highlighted, related to such concepts as approach on the basis of participation, involvement of dekhkan/household farms in water resources management and co-financing of WUA activities, problems of infrastructure related to the project (including conditions of I&D networks, problems of absence of necessary number of water measuring and regulating structures, irregularities with energy supply and etc., issues for assets ownership, issues of WUA development and the others. The last part of presentation was concentrated on compensation mechanisms, issues of monitoring and evaluation of project actions, and aspects and levels of information exchange/participation, highlighted in the terms of society participation. The questions and proposals addressed to social assessment team were mainly related to land acquisition. Y. Asminkin answered to all questions and informed participants on the progress for preparation of resettlement plan/land acquisition and mechanisms of compensation, that within the project would be carried out in accordance with the requirements of the World Bank OP 4.12. In the end of presentation Mr. Y. Asminkin thanked the participants and proposed to ask questions if any, or to give comments.

B. Key questions/comments of participants and responses:

1. Sub-project Podshoata - Chodak

May 12, 2015 Namangan **Naryn – Syrdarya BAIS**

Q1: **R. Yusupov**, Chairman of rural gathering of Yangikurgan district citizens. The project envisages complex of technical arrangements, that provide positive effect and benefits for natural environment and increase of agricultural land productivity and rural population incomes. On what area the systems of drip irrigation will be created? These measures on water savings are important for farmers and dekhkans, as water deficit, especially during summer months, leads to significant damage of yields, loss of orchards.

R1: **G. Khasankhanova**. Within the component “System Modernization” it is envisaged to introduce drip irrigation on the area of 100 ha. Besides, demonstration plots will be created for distribution of advance practices and technologies, and trainings will be carried out for farmers, dekhkans, WUAs, ISA and etc.

Q2: **M. Jalolov**, Podshoata-Chodal ISA, Head of hydraulic section of Yangikurgan district. Will reconstruction of on-farm network be included into Phase-II?

R2: **M. Norbaev**. PIU for WI. Acting WUAs face big difficulties due to shortage of funds, knowledge and experience. The project component “System Modernization” envisages measures on potential increase and strengthening WUA capacity, with the objective for improvement of efficiency and quality of provided by them services.

Q3: **S. Mamatov**, SANIIRI, Deputy Director. Project envisages complex of technical arrangements, including construction of new wells. What impacts on environment are expected from those measures?

R3: **G. Khasankhanova**. The results of EA witness about positive impact of technical arrangements on project territory through increase of irrigated lands water availability, there are only partial temporary negative impacts during period of construction and objects operation, that will be considered by the Contractor. The Podshoata-Chodal system water resources are famous for their quality (river flow mineralization is up to 1 g/l), there is provided intensive inflow and outflow of fresh groundwater, the processes of water logging and soil salinity are not observed. EA team used the review, analytical reports, monitoring and evaluation materials of MAWR divisions and other institutions (Hydroenergo, IWMI, TIIM and the others), obtained and used within Consultancy services for Project preparation and FS preparation.

Q4: **I. Mansurov**, farmer from Chartak district. There are problems with electric power in the village Khozratshokh, wells are necessary. Let PSA help us. Will those wells be included in the list of works of the subject project?

R4: **M. Norbaev**, PIU for WI. The construction of 105 new wells is included into the list of works. Their location will be determined at the stage of detailed design. Location of those wells was presented in EA presentation.

Q4: **O. Berdiyorov**, Chairman of WUA "Navkent bulogi". We would like faster implementation of the subject project arrangements.

R5: **M. Norbaev**. We also would like it and hope for faster beginning of project implementation, as the need in measures is very high.

Q6: **A. Khoshimov**, Deputy Khokim of Yangikurgan district. WE support that project. This project is rather important for Namangan region. Is there any possibility to reduce the time required for project preparation? This is rather important for farmers and, especially for citizens of both districts, that are served by Podshoata – Chodak system.

R6: **M. Norbaev**, PIU for WI. I understand your concern. The World Bank and the Government are also insisting on acceleration of preparation and timely agreement and approval of necessary documents in the established order.

The following persons took part in the discussions:

1) **A. Khasanov**. Regional Department of Goscompriroda. I familiarized with the project. These are the lowest water availability districts of Namangan region. The project has great use, there no negative aspects. Project measures will improve land and environment conditions. Thanks a lot for your work.
2) **A. Appokov**. Podshoata – Chodak ISA. Chartak division. The project is very important for all of us. Mud flow storage is required for Chartak district. I ask to include this to the project next stage.
3) **M. Norbaev**, PIU for WI. In accordance with adopted regulations and programs on water savings, the areas under drip irrigation should be increased for 20%. We should deal with those issues.
4) **N. Khudayberdiev**, Podshoata – Chodak ISA. Proposal on mud flow storage is really necessary, it should be further developed and included in Phase-III. While preparing Feasibility Study several options of technical arrangements were submitted for consideration, including on introduction of drip irrigation on the area of 2000 ha. Though, in accepted option only 100 ha are planned for drip irrigation, but also other important technical arrangements are included.

Q7: **I. Nazrullaev**, Chief Specialist of Naryn-Syrdarya BAIS. What mechanisms of compensation are envisaged in the project within land acquisition plan for damage to state buildings?

R7: Y. Asminkin. The prepared within social assessment Resettlement Policy Framework envisages mechanisms of compensation for all possible impacts, related to temporary and permanent land acquisition, and described all possible categories of citizens, entrepreneurs, farmers and etc., that have the right for damage compensation, in case if there is any. Usually, according conditions of loan agreements, any damage to state ownership is removed by the state itself and is considered as its contribution to the project. No damage is envisaged within that project to state owned buildings.

2. Sub-project Savay - Akbura

May 13, 2015 Andijan Naryn – Karadarya BAIS

Q1: **A. Kholmatov**, Chief Specialist, Naryn-Karadarya BAIS. The project includes complex of technical arrangements on reconstruction of irrigation canals and structures. How the works will be carried out in water protection zones along canals?

R1: **G. Khasankhanova**. All the works and project arrangements on reconstruction of main and interfarm canals and structures will be carried out in accordance with approved construction norms (SNIIP) and requirements of State Committee on Nature Protection (Goscompriroda). Ecological types of works will be included into Contractor's contracts during the period of construction and operation of infrastructure objects, the PIU will carry out supervision for observance of requirements and monitoring of project works execution.

Q2: **A. Mirzaakhmedov**, Head of hydraulic section Savay-2. Great deal of work had been done on environmental assessment of project arrangements, aimed at reconstruction of main and interfarm canals and structures. On-farm structures also need reconstruction. What types of works will be carried out at on-farm level?

R2: **G. Khasankhanova**. The project does not envisage reconstruction of on-farm network. Though, on the component "System Modernization" for the first time they will introduce the technology of SCADA system in order to increase efficiency of operation and for monitoring of discharge at main hydrotechnical structures. Also the support will be provided on WUA strengthening (equipment, measuring devices, vehicles) and improvement of on-farm water use by introduction of drip irrigation systems and other arrangements.

Q3: **A. Mirzaakhmedov**, Head of hydraulic section Savay-2. Will new canal be constructed?

R3: **M. Norbaev**, PIU for WI. No, the project envisages canal rehabilitation.

Q4: **S. Kasymov**, First Deputy Khokim of Bulakboshi district. When the project will start and how long is its duration? How water will be allocated during the period of construction?

R4: **M. Norbaev**, PIU for WI: The duration of the project is 7 years. The works will be carried out during non-irrigation period.

R4(2): **M. Yakubbekov**, Head of Savay-Akbursai ISA. During the period of consdtruction temporary bypass canals will be constructed.

Q5: **G. Bqakirov**, Department Head of Savay-Akburasai ISA. Are there any ways to help WUA in construction of Djalal – Kuduk canall?

R5: **Sh. Ergashev**, First Deputy Head of Naryn-Karadarya BAIS.: No. It is necessary to look for own possibilities.

Q6: **M. Yakubbekov**, Head of Savay-Akbursai ISA. This project is very important and necessary for farmers and population served by Savay-Akbura system. My question is concerning trees along canals, should they be cut during the period of construction and operation?

Q7: **A. Mirzaakhmedov**, Head of hydraulic section Savay-2. Will the project compensate cutting trees along Savay canal?

R6,7: **Y. Asminkin**. According OP 4.12 the loss of any types of plantings, buildings and etc., the owner of which can be detected, is subject to unconditional compensation, even if such type of buildings and plantings have been produced against the legislation of the Republic of Uzbekistan in "red" zones of irrigation systems alienation.

Q8: **Sh.Ergashev**, First Deputy Head of Naryn-Karadarya BAIS. Will it be taken into account dismantling/removal of productive structures along canals ?

R8: **Y.Asminkin**. Yes, damage to any structures, including located in canal protection zone and belonging to private persons or enterprising structures will be completely compensated. As I have already said during presentation, one of the key tasks, including for specialists involved in resettlement plans preparation, is the selection and proposal of options envisaging minimal impact on citizens ownership.

Q9: **Sh. Ergashev**, First Deputy Head of Naryn-Karadarya BAIS. Resettlement of households will be compensated from project funds or that will be done by the state?

R9: **Y. Asminkin**. Resettlement Policy Framework envisages that all funds necessary for compensation of any type of damage will be put in project budget. The World Bank envisages special and obligatory for any project mechanisms for information of persons that will be subject to impact, on expected impacts and mechanisms for compensation of damage. All terms for carrying out such work on information are fixed in the document of Resettlement Policy Framework.

The following persons participated in discussions:

1) **G. Bakirov**, Savay-Akburasai ISA, Head of Department. We are thankful to you for the work done and replies to the questions, regarding issues on land acquisition and compensations. That project is rather necessary to all water users. Current problems related to deterioration of irrigation canals and structures, wear and tear of equipment and water shortage limit possibilities of ISA on promotion of irrigation services, operation and maintenance of infrastructure. All farmers, households and WUA personnel should be familiarized with rules and procedures on land acquisition and order of compensation.

2) **Sh. Ergashev**, First Deputy Head of Naryn-Karadarya BAIS. Today we familiarized with results of environmental and social assessment, that will help us in the work with rural communities and public organizations of our province. It is necessary to publish urgently in local newspapers and magazines information about objectives and tasks of the Project FVWRM, Phase-II, about results of environmental and social assessment, discussed at consulting workshop, in order all citizens are informed about the project and can apply to us with all questions.

3) **Y. Asminkin**. We would be very thankful if the local authorities could publish information of such type for familiarization more broad number of specialists, farmers and dekhkans about forthcoming Project. From our side we are ready to submit all necessary information for press release.

3. Sub-project Isfayram - Shakhimardan

May 14, 2015 Fergana **Syrdarya – Sokh BAIS**

Q1: **J. Madyarova**, Kuvasai Khokimiyat /rural gathering of citizens Paskhona. Thank you very much, I was listening to you very attentively. The project is needed for everybody, the major part of agricultural produce is in our district, water shortage is the main problem, orchards vineyards and other crops are drying without water. Will the wells for irrigation be built in Kuvasai?

R1: **G. Khasankhanova**. The project envisages construction of 138 new wells for irrigation, there location is shown on the map of my presentation. Within Feasibility Study general requirements in additional wells had been revealed, their justified location on project territory, including Kuvasai town, will be carried out at the stage of project detail design.

Q2: **Kh. Shukurova**, Chairman of Rural Gathering Advisor of Logon village on female issues. WE have another problem. Our village faces the problems of impoundment and groundwater level raising due to excess irrigation on upper located areas. Why groundwater is not derivedоды? What should be done in order to improve living standards for population?

R2: **M. Norbaev**, PIU for WI. The arrangements to combat impoundment, waterlogging of territories due to excess water use on upper located areas are carried out by Syrdarya-Sokh BAIS subdivisions and khokiniyat of Fergana region with support of specialized departments and Amelioration Fund. Within Phase-I of the subject project they carry out complex of technical arrangements for derivation of waste water by construction of interceptor collectors and drainage. Implementation of those measures will improve the situation and will remove risks of impoundment in your village and adjacent to it areas.

Q3: **Y. Akhrorov** Head of Isfayram-Shakhimardan ISA. How the cost of cut trees and demolition of premises/structures will be compensated?

R3: **Y. Asminkin**. Cost of premises subject to demolition will be established on the basis of employed by Goszemgeocadastre bodies independent evaluation organizations, which should carry out

evaluation of structures cost according market prices. Compensation of trees cost will be carried out on the basis of calculations, that include type of each tree, its age, terms of fruiting, yields and incomes obtained for the last 3 years, and also cost on new seedlings, time necessary for the beginning of fruiting (if the plot is allocated instead of withdrawn one) and other factors.

Q4: **S. Abduraimov**. Kuvasai Water Management Department Will the cost of rehabilitation works be compensated, after the damage to reconstructed structures?

R4: **Y. Asminkin**. In case if Contractor brings damage to reconstructed by him objects, removal of damage will be done for the account of Contractor.

The following persons participated in discussions:

1) **A. Tojaliev**, Deputy Head of Isfayram-Shakhimardan ISA. Thank you for your work on assessment of project arrangements in Isfayram-Shakhimardan system. We were working closely with Feasibility Study specialists and teams on environmental and social assessment. We are thankful for your work and submission of final version of technical arrangements, and also measures on support of WUA and training. Reconstruction of pumping station (PS) Isfayram and construction of PS Avaal-lagan are extremely important for improvement of water availability at upper marks and increase of farmers and rural population incomes.
2) **A. Kholikov**, First Deputy Head of Regional Administration for PS Operation. I also support all speakers and propose to put into protocol recommendation on approval of conclusions and recommendations of environmental and social assessment executed according accepted option of technical arrangements.

After completion of consulting workshops in all three sub-project zones the teams of environmental and social assessment had discussions with WUA representatives, gatherings of rural citizens, BAIS responsible managers and khokimiyats of project districts.

ANNEX 10. Photoes

Podshaota-Chodak Sub-Project


Dyke of debris basin Kandiyon


Section of En canal


Inverted siphon damaged by mudflow


Bank protection site over Namangansai


Bank protection site over Namangansai


Repair works at PS Urikzor


Registration of consulting workshop participants (May 12, 2015, Namangan)


Discussion of EA results
(N. Khudayberdiev, AIS Podshaota-Chodak)


Participants of consulting workshop
(May 12, 2015, Namangan)

Isfairam-Shahimardan Sub-Project


Corroded section of discharge pipeline M-1 canal


Mudflow canal in southern border of Kaptarhona settlement


Canal Arabtepasai dry.
Water intake into canal in Kyrgyz Republic territory


Panorama. Gardens suffering from shortage of irrigation water (well No.183)


Registration of consulting workshop participants
(May 14, 2015, Fergana)


Discussion of EA results
(H. Shukurova, Advisor on female issues, Rural gathering of citizens Logon)


Participants of consulting workshop
(May 14, 2015, Fergana)

Savai - Akburasai Sub-Project


Bank erosion in Savai canal


Collapse of bank in Akburasai


Collapse of bank in Akburasai


Structures (Kambarata hydrosystem).
Water intake into Beshtol, Robdon, Yangi canals


Road bridge over Akburasai


Akburasai's bed is deepened by mudflow


Pedestrian bridge over Akburasai


Repair works at Orom PS (Istiklol)


Registration of consulting workshop participants
(May 13, 2015, Andijan)


Discussion of EA results
(A. Mirzaakhmedov, Head of Savay Canal Section)


Participants of consulting workshop
(May 13, 2015, Andijan)

ANNEX 11. Colophon

Project Name	Fergana Valley Water Resources Management Phase-II (FWRMP-II), Uzbekistan
Project Financing Agency	World Bank
Project Focal Person	
Research Support	Environmental Assessment
Research Financing Agency	
Focal Person of the Study	
Beneficiary	Ministry of Agriculture and Water Resources
Beneficiary Focal Person	Projects Implementation Unit B. Yusupov (piu-diwip@buzton.com)
Consultant	Temelsu International Engineering Service Inc. 06550 Cankaya, Ankara, TURKEY
Research Director	Mehmet Sina Velioglu
Deputy Research Director	Gulchekhra Khasankhanova (g.khasankhanova@mail.ru)
EMM Project No.	

ANNEX 12. The Endorsement Letter of the SEE

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«19» 10 2015 yil № 18/13323

ЗАКЛЮЧЕНИЕ

Государственной экологической экспертизы

По объекту: ОВОС реализации проекта «Управление водными ресурсами в Ферганской долине Фаза-II (ПУВРФД-II)» (проект ЗВОС).

Заказчик: Группа реализации Проекта по водохозяйственным объектам (ГРП-ВХО)

Разработчик: «Temelsu International Enginering Services Inc»

Менеджеру проекта
ЮСУПОВУ Б.М.

копии: Председателю Ферганаоблкомприроды
МИРЗАЕВУ А.К.
Председателю Наманганоблкомприроды
САЪДУЛЛАЕВУ А.К.
Председателю Андижаноблкомприроды
МАМАТОВУ М.Н.

На государственную экологическую экспертизу представлены материалы первого этапа оценки воздействия на окружающую среду реализации проекта «Управление водными ресурсами в Ферганской долине Фаза-II (ПУВРФД-II)».

Правительство Республики Узбекистан получило от Всемирного банка кредит по Проекту «Управление водными ресурсами в Ферганской долине, Фаза-I» (ПУВРФД-1). Финансовые средства этого кредита будут использованы для подготовки Фазы II Проекта - крупномасштабной деятельности по реабилитации ирригационно-дренажных систем в Ферганской долине и выполнению программы институциональных реформ в водохозяйственном секторе.

Рассматриваемый отчет «Заявление о воздействии на окружающую среду и План управления» представляет результаты экологической оценки проектных мероприятий, сформулированных в ТЭО ПУВРФД-П. Задачи экологической оценки состоят в том, чтобы определить пути улучшения ПУВРФД-П по отношению к окружающей среде и предложить План мероприятий, предотвращающих, смягчающих, минимизирующих или компенсирующих возможные неблагоприятные воздействия со стороны проекта.

Проектная территория расположена в Ферганской долине, одном из наиболее интенсивно культивируемых регионов Узбекистана, где сельскохозпроизводство базируется на орошаемом земледелии, обслуживаемое мощной ирригационной системой. Главной проблемой в Ферганской долине является нехватка водных ресурсов, нестабильное водоснабжение, ухудшающаяся ирригационная и дренажная инфраструктура, что в сочетании с низкой эффективностью использования водных ресурсов, обусловливают потерю урожая и недобор сельскохозяйственной продукции.

Для проектных интервенций в рамках ТЭО выбраны три оросительные системы в Наманганской, Андижанской и Ферганской области - «Подшаота- Чодак», «Исфайрам-Шахимардан» и «Савай-Акбурасай», как самые высокоприоритетные, с точки зрения потребности восстановления и модернизации инфраструктуры и повышения водообеспеченности.

Водные ресурсы проектных систем составляет сток трансграничных рек Подшаотасай, Исфайрамсай, Акбурасай и Аравансай, а также канал Савай, питающийся из Андижанского водохранилища Шахимардан. Для покрытия дефицита воды в системе осуществляется переброска стока из Андижанского водохранилища через ЮФК и БНК.

Межхозяйственная оросительная сеть почти наполовину проложена в земляном русле, бетонная облицовка на многих участках требует реабилитации. Внутрихозяйственной оросительной сети присущи все проблемы полуинженерных систем (земляное русло, плохо оборудованные ГТС, ЭиО на низком уровне).

В связи с интенсивным использованием земли дикая флора и фауна практически отсутствует. Наземная растительность представлена в основном культурными видами. Различные типы солянки распространены в Центральной Фергане на маргинальных землях, не используемых в сельскохозяйственном производстве. Фисташка и миндаль растут на предгорных участках, есть лиственные и можжевеловые леса. Поля занимают в основном хлопчатник, пшеница, и разнообразные овощные культуры. Фруктовые сады и виноградники распространены по всей долине, вдоль дорог и в населенных пунктах высажены вяз, шелковица и тополь. Естественная фауна представлена грызунами, птицами, рептилиями, насекомыми и пауками. Заболоченные и заброшенные сельскохозяйственные угодья, берега каналов и заросшие каналы служат ограниченной средой обитания для птиц, нутрии и ондатры.

Проектная площадь не включает какие-либо охраняемые природные зоны, или площади, которые считаются критическими для выживания каких-либо видов растений или животных. Также проект не включает зоны, считающиеся экологически уникальными, за исключением территории суб-проекта «Исфайрам-Шахимардан», где находится зона формирования месторождения подземных вод Чимен-Аввал со статусом охраняемой природной территории республиканского значения. Биоценозы рек Подшаотасай, Чодаксай, Акбурасай входят в группу фоновых водотоков, перифитонные сообщества которых характеризуются высоким видовым разнообразием и находятся в состоянии экологического прогресса.

Результаты экологической оценки мероприятий ТЭО ПУВРФД. Экологическая оценка включила оценку потенциальных будущих воздействий (а) от технических мероприятий, (б) воздействия, связанные с местоположением проекта, (в) воздействия в период реализации проекта и (г) долгосрочные воздействия.

«Заявление о воздействии на окружающую среду и План управления» предлагает План экологического управления и смягчающих мер по возможным негатив-

ным воздействиям на окружающую среду. Часть смягчающих мер относится к временным и местным нарушениям из-за строительно-реабилитационных работ. Контракты Подрядчика, подготовленные группой ТЭО, будут включать статьи по охране окружающей среды, в соответствии с обязательствами Подрядчика по экологическому управлению.

Экологические воздействия проектных мероприятий (реабилитация каналов, насосных станций, водовыпусков, водоизмерительных устройств), внедрение системы SCADA обеспечат снижение потерь воды и повышение водообеспеченности земель, улучшение водораспределения и учет водопользования. Берегоукрепительные работы предотвратят эрозию берегов и защиту сельхозугодий от селей и других опасных явлений.

Строительные работы в рамках проекта восстановления обычны и незначительны по масштабам, а также не требуют особых экологических предосторожностей. Планом Экологического управления и мониторинга предусмотрены меры по предупреждению и контролю риски случайного экологического ущерба и предотвращению экологические воздействия в максимально возможной степени.

Воздействия проекта на нижерасположенные площади нижнего течения, как количественно, так и качественно ожидаются несущественными. Какие-либо воздействия на реку Сырдарья - международный водоток, не предполагаются, потому что поверхностные источники, стекающие вниз с проектной территории, являются небольшими водными источниками, и разбираются на орошение, не достигая р. Сырдарья.

Таким образом, экологическая оценка подтверждает, что реализация Проекта управления водными ресурсами Ферганской долины - Фаза II может оказывать положительные экологические воздействия. Несмотря на это **временные негативные экологические воздействия возможны во время строительных работ.**

Учитывая то, что «**Подрядчик**» будет определен на тендерной основе, **до начала реализации проекта** для сохранения и защиты окружающей среды в установленном законодательством порядке необходимо разработать и представить на Государственную экологическую экспертизу проект Заявления о воздействии на окружающую среду (проект ЗВОС) намечаемых работ.

В проекте ЗВОС разработанном «Подрядчиком» должны быть освещены следующие вопросы:

- влияние на атмосферный воздух вблизи проектных участков (пыль, выхлопные газы от ДВС техники, загрязняющие вещества от работы БСУ, АБЗ и ДСЛ если таковые имеются);
- загрязнение поверхностных и грунтовых вод отходами производства и потребления;
- влияние на состояние водоохранных зон вокруг строительных и реабилитационных участков;
- влияние погрузочно-разгрузочных работ на участках выемки и временного складирования;
- образование отходов производства и потребления с указанием их мест временного размещения и путей их дальнейшей утилизации или захоронения;
- водопотребление и водоотведение на строительных участках и временных базах строителей;

- разработка плана-графика проведения поэтапной технической и биологической рекультивации нарушенных земель согласованного территориальными комитетами по охране природы;

- информация о вынужденной вырубке и корчевке многолетних древесных насаждений должна быть согласована с территориальными областными комитетами по охране природы в установленном законодательством порядке с указанием суммы компенсационных платежей;

- для исключения негативного воздействия на динамические характеристики поверхностных и грунтовых вод, работы по реабилитации мостов и других ирригационных сооружений с большими расчетными расходами необходимо производить с учётом рекомендаций специалистов гидрологов и гидрогеологов;

- сравнительный анализ состояния окружающей среды до и после реализации проектируемых работ.

Экологическая экспертиза проекта показала, что представленные материалы соответствуют требованиям, предъявляемым природоохранным законодательством к первому этапу оценки воздействия на окружающую среду. Предложенные проектом технические и технологические решения по управление водными ресурсами в Ферганской долине Фаза-II не вызывают возражений с экологических позиций, так как они направлены на улучшение экологической обстановки в регионе и рациональное использование природных ресурсов.

Государственная экологическая экспертиза Госкомприроды Республики Узбекистан **согласовывает** проект Заявления о воздействии на окружающую среду реализации проекта «Управление водными ресурсами в Ферганской долине Фаза-II (ПУВРФД-II)».

Заключение государственной экологической экспертизы о допустимости реализации проекта не подменяет и не отменяет необходимость получения соответствующих разрешительных документов в установленном законодательством порядке.

Ферганскому, Наманганскому, Андижанскому областным комитетам по охране природы **не следует допускать** реализацию проектных решений **без** получения **положительного заключения «Подрядчиком» на проект ЗВОС** «Управление водными ресурсами в Ферганской долине Фаза-II (ПУВРФД-II)».

И.о. заместителя председателя **О.Эгамбердиев**

Бекмуратов Б.
тел.236-13-05

ANNEX 13. Brief Guidance for the Cumulative Impact Assessment

Prepared by the FVWRM-II EIA based on the IFC Good Practice Handbook Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (International Finance Corporation, the World Bank Group) and other guidelines and related manuals.

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List of Acronyms

CIA	Cumulative Impact Assessment and Management
DAI	Direct Area of Influence
ESIA	Environmental and Social Impact Assessment
ESMS	Environmental and Social Management System
GN1	IFC Guidance Note 1
GPH	IFC Good Practice Handbook
IBRD	International Bank for Reconstruction and Development (World Bank)
IFC	International Finance Corporation
MDB	Multilateral Development Bank
RCIA	Rapid Cumulative Impact Assessment and Management
SEA	Strategic Environmental Assessment
VEC	Valued Environmental and Social Component

Preface

This guidance provide the overall approach for Cumulative impact assessment to prevent the risk of adverse cumulative environmental effects of the Projects in agricultural and water sectors.

These guidelines should complement the IFC CIA Good Practice Handbook and other guidance's and manuals [6,9] by providing a detailed process for considering cumulative effects. The specific purpose of this guideline is to assist the PIU environmental specialist and practitioners to systematically address cumulative impacts at various stages of the project implementation. It could also be useful to decision makers, statutory consulters and other agencies involved in the planning and SEA processes. The guideline consist of two parts: (i) the background and context for cumulative effects assessment; and (ii) guiding principles for CEA are outlined.

Introduction

Many environmental problems, such as loss of open spaces or increase in air pollution result from the cumulative effects of human activities. Other well- known examples of cumulative effects are acid rain, climate change and loss of biodiversity. Cumulative effects are the combined impacts of a single activity or multiple activities. The individual impacts from a single development may not be significant on their own but when combined with other impacts, those effects could become significant.

Consequently, although the environmental and social impact assessment (ESIA) process is essential to assessing and managing the environmental and social impacts of individual projects, it often may be insufficient for identifying and managing incremental impacts on areas or resources used or directly affected by a given development from other existing, planned, or reasonably defined developments at the time the risks and impacts are identified. Cumulative impacts are contextual and encompass a broad spectrum of impacts at different spatial and temporal scales, and their effects have been defined as "the net result of environmental impact from a number of projects and activities"[4,9].

The Good Practice Handbook that is used for preparation of this brief guidance is based on IFC's experience in applying its Performance Standards and is non prescriptive in its approach. It should be used in conjunction with the Performance Standards, their Guidance Notes, and the World Bank Group Environmental, Health, and Safety Guidelines, which contain basic requirements and good international practices to be followed when designing, developing, and/or implementing projects. This document is not intended to duplicate requirements under the existing IFC Sustainability Framework. Its purpose is to provide practical guidance to companies investing in emerging markets to improve their understanding, assessment, and management of cumulative environmental and social impacts associated with their developments.

1. What is Cumulative Impact Assessment and Management, and Why is it Needed?

1.1 What are Cumulative Impacts?

Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity (collectively referred to in this document as "developments") when added to other existing, planned, and/or reasonably anticipated future ones. For practical reasons, the identification and management of cumulative impacts are limited to those effects generally recognized as important on the basis of scientific concerns and/or concerns of affected communities. [3]

Cumulative effects assessment is a systematic procedure for identifying and evaluating the significance of effects from multiple activities. The analysis of the **causes, pathways** and **consequences** of these impacts is an essential part of the process.

[3] Affected communities are defined as local communities directly affected by the project (Performance Standard 1, paragraph 1).

These three elements define the complex cause-effect relationship that is central to cumulative effects assessment:

- **Identifying sources** - the multiple activities that cause potential impacts or environmental change;
- **Considering processes** - pathways of impacts between the sources and receptors and the linkages among these impacts;
- **Effects -** analysis of the attributes of these effects - whether such impacts are additive, antagonistic or synergistic.

Examples of cumulative impacts include the following:

- Effects on ambient conditions such as the incremental contribution of pollutant emissions in an airshed.
- Increases in pollutant concentrations in a water body or in the soil or sediments, or their bioaccumulation.
- Reduction of water flow in a watershed due to multiple withdrawals.
- Increases in sediment loads on a watershed or increased erosion.
- Interference with migratory routes or wildlife movement.
- Increased pressure on the carrying capacity or the survival of indicator species in an ecosystem.
- Wildlife population reduction caused by increased hunting, road kills, and forestry operations.
- Depletion of a forest as a result of multiple logging concessions.
- Secondary or induced social impacts, such as in-migration, or more traffic congestion and accidents along community roadways owing to increases in transport activity in a project's area of influence.

Multiple and successive environmental and social impacts from existing developments, combined with the potential incremental impacts resulting from proposed and/or anticipated future developments, may result in significant cumulative impacts that would not be expected in the case of a stand-alone development.

1.2. What Is Cumulative Impact Assessment and Management?

CIA is the process of (a) analyzing the potential impacts and risks of proposed developments in the context of the potential effects of other human activities and natural environmental and social external drivers on the chosen VECs over time, and (b) proposing concrete measures to avoid, reduce, or mitigate such cumulative impacts and risk to the extent possible.

The key analytical task is to discern how the potential impacts of a proposed development might combine, cumulatively, with the potential impacts of the other human activities and other natural stressors such as droughts or extreme climatic events. VECs are immersed in a natural ever-changing environment that affects their condition and resilience. VECs are integrators of the stressors that affect them. For example, periodic extremes of precipitation (droughts or floods), temperature (extreme cold or heat), or fluctuations in predators all affect the condition of biological VECs. Today and into the future, global warming (climate change) can be expected to have substantial impacts on the condition of VECs.

Box 1 . Valued Environmental and Social Components (VECs)

CIAs are complex, and cost time and money. For a CIA to be effective in supporting good overall environmental and social risk management, its scope must be properly defined. Because it is unrealistic to think that every environmental and social aspect that can be subject to cumulative impacts can be appropriately factored into a CIA, it is good practice to focus the assessment and management strategies on Valued Environmental and Social Components (VECs[a]).
What are VECs?

VECs are environmental and social attributes that are considered to be important in assessing risks; they may be:

- physical features, habitats, wildlife populations (e.g., biodiversity),
- ecosystem services,
- natural processes (e.g., water and nutrient cycles, microclimate),
- social conditions (e.g., health, economics), or
- cultural aspects (e.g., traditional spiritual ceremonies).

While VECs may be directly or indirectly affected by a specific development, they often are also affected by the cumulative effects of several developments. VECs are the ultimate recipient of impacts because they tend to be at the ends of ecological pathways. Throughout this handbook the acronym VECs refers to sensitive or valued receptors of impact whose desired future condition determines the assessment end points to be used in the CIA process.

Ecological scoping is used to identify how impacts can be studied and predicted. VECs should reflect public concern about social, cultural, economic, or aesthetic values, and also the scientific concerns of the professional community (Beanlands and Duinker 1983). It is important that VECs build from existing definitions of valuable environmental and social components described in the Performance Standards (e.g., critical habitat in Performance Standard 6 and critical cultural heritage in Performance Standard 7). For VECs related to biodiversity, GN6 provides explicit guidance on natural and critical habitat values.

How do VECs influence the CIA process?

CIA is inherently future-oriented. The concern for assessment of cumulative impacts is driven by the need to understand the conditions of VECs that are expected to result from the combination of development impacts and natural forces. For instance, to what extent will a terrestrial habitat be fragmented beyond its ecological functionality by the cumulative impacts of multiple linear infrastructure developments?

Good CIA focuses on understanding whether cumulative impacts will affect the sustainability or viability of a VEC as indicated by the predicted condition of the VEC. Consequently, the significance of cumulative impacts is judged in the context of thresholds or limits of acceptable change, within which the VEC condition is considered to be acceptable but beyond which further change in condition is not acceptable. If such thresholds are not established, the significance of cumulative impacts cannot be determined. Step 5 in Section 2 better describes the importance of defining thresholds for assessing the significance of cumulative impacts and designing effective management strategies.

Defining thresholds for VECs

The viability or sustainability of VECs, whether ecological, biological, or related to human communities, is their capacity to endure—i.e., for the ecosystem, community, or population to remain diverse and productive over time. This is reflected in the definition of *sustainable use* in the Convention on Biological Diversity: using the "components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of future generations."
Project-initiated CIA[1] or RCIA has six objectives:

1. Assess the potential impacts and risks of a proposed development over time, in the context of potential effects from other developments and natural environmental and social external drivers on a chosen VEC.
2. Verify that the proposed development's cumulative social and environmental impacts and risks will not exceed a threshold that could compromise the sustainability or viability of selected VECs.
3. Confirm that the proposed development's value and feasibility are not limited by cumulative social and environmental effects.
4. Support the development of governance structures for making decisions and managing cumulative impacts at the appropriate geographic scale (e.g., airshed, river catchment, town, regional landscape).
5. Ensure that the concerns of affected communities about the cumulative impacts of a proposed development are identified, documented, and addressed.
6. Manage potential reputation risks.

Assessment of cumulative impacts should employ information from a variety of instruments including, regional and local environmental, social and resource studies, programs and/ or planning documents; strategic, sectoral, and regional assessments; project impact assessments, cumulative impact assessments, and targeted studies on specific issues.

1.3. Under What Conditions Should a CIA Be Conducted?

Cumulative impact assessment and management is appropriate whenever there is concern that a project or activity under review may contribute to cumulative impacts on one or more Valued Environmental and Social Components (VECs).

This concern may be preexisting or a consequence of the potential cumulative impacts of the development and other projects or actions, human activities, or exogenous factors (e.g., natural drivers). CIA is also appropriate whenever a given development is expected to have significant or irreversible impacts on the future condition of one or more VECs that also are, or will be, affected by other developments. The other developments may already exist, be reasonably predictable, or be a mix of existing and reasonably anticipated developments. In circumstances where a series of developments of the same type is occurring, or being planned, the need for CIA can be fairly obvious[4]. For example:

- When a series of agricultural developments occur that will cumulatively impact land use patterns, having cumulative impacts on downstream water availability (from withdrawal of water for irrigation), on downstream water quality, or on local community livelihoods.
- when a series of hydroelectric developments occur within the same river or within the same watershed with cumulative impacts in common on flora and fauna, on downstream water availability or quality, on watershed sediment dynamics, on navigation, on local communities' livelihoods, or on adjacent land uses because of increased access from associated roads; or

Good CIA practice is not limited to assessing the impacts of developments of the same type. For example, CIA might be needed for the development of a mine in association with increased access from road construction that will bring further induced development (perhaps in association with developments in adjacent forest management, hydroelectric power developments, agriculture or other activities, all of which may affect local communities, wildlife, or water availability and quality).

1.4 What Are the Expected Outcomes of CIA?

The expected outcomes of a good CIA can be summarized as follows (Section 2 provides greater detail):

- Identification of all VECs that may be affected by the development under evaluation.
- In consultation with stakeholders, agreement on the selected VECs the assessment will focus on.
- Identification of all other existing and reasonably anticipated and/or planned and potentially induced developments,[5] as well as natural environmental and external social drivers that could affect the selected VECs.
- Assessment and/or estimation of the future condition of selected VECs, as the result of the cumulative impacts that the development is expected to have, when combined with those of other reasonably predictable developments as well as those from natural environmental and external social drivers.
- Evaluation of the future condition of the VECs relative to established or estimated thresholds of VEC condition or to comparable benchmarks.
- Avoidance and minimization, in accordance with the mitigation hierarchy, of the development's impact on the VECs for the life of the development or for as long as the impacts continue to be present.
- Monitoring and management of risks to VEC viability or sustainability over the life span of either the development or its effects, whichever lasts longer.[6]

[4] Cumulative impacts can occur (a) when there is "spatial crowding" as a result of overlapping impacts from various actions on the same VEC in a limited area, (e.g., increased noise levels in a community from industrial developments, existing roads, and a new highway; or landscape fragmentation caused by the installation of several transmission lines in the same area) or (b) when there is "temporal crowding" as impacts on a VEC from different actions occur in a shorter period of time than the VEC needs to recover (e.g., impaired health of a fish's downstream migration when subjected to several cascading hydropower plants).

[5] As identified in diverse sources such as sectoral project inventories, regional or resources development plans, and watershed management plans, among others.

[6] Interactions with government and third parties should be included in risk management actions.

- Provision of project-related monitoring data to governments and other stakeholders for the life of the development, and material support for the development of collaborative regional monitoring and resource management initiatives.
- Continuous engagement and participation of the affected communities in the decision-making process, VEC selection, impact identification and mitigation, and monitoring and supervision.

Because cumulative impacts often result from the successive, incremental, and/or combined [7] impacts of multiple developments, responsibility for their prevention and management is shared among the various contributing developments. Because it is usually beyond the capability of any one party to implement all of the measures needed to reduce or eliminate cumulative impacts, collaborative efforts will likely be needed. Governments can play a significant role in ensuring environmental and social sustainability by providing and implementing enabling regulatory frameworks that guide and support the appropriate identification and management of cumulative impacts and risks.

1.5 How Does CIA Compare with Other Environmental and Social Risk Management Tools?

CIA is one of several tools to consider as part of an overall process of environmental and social risk assessment and management. These tools, identified in Table 1, have been developed to inform decision-making processes in different project development and/or sector planning contexts.

Table 1. Tools for environmental and social risk assessment and management

Environmental and Social Impacts Assessment (ESIA)	Applies to the potential impacts of a particular development proposal Done in the context of a well-defined development proposal for which the construction and operational details of the development alternatives are known May include an assessment of the project's contribution to a well-known accumulated impact and propose standard mitigation measures (e.g., greenhouse gas emissions, airshed pollution, depletion of wild fish stocks)
Strategic Environmental Assessment (SEA)[8]	Relates to potential impacts of government-wide or sector-wide policies, plans, or programs Anticipates how instruments such as policies that are not specifically tied to a particular physical development may result in a variety of impacts at different times and places
Regional or Sectoral Impact Assessment	sesses the impacts of the potential developmental future of a geographic region or of an overall sector or industry (sometimes referred to as regional or sectoral SEA)
Cumulative Impact Assessment and Management (CIA)	Assesses the ecological and social impacts that determine the status of environmental components and affected communities (VECs) Requires consideration of past, present, and future projects and natural drivers that affect them Assessment reflects the geographical and temporal context in which the effects are aggregating and interacting (e.g., airshed, river catchment, town, landscape)

Unlike government agencies, a private sector developer or project sponsor has no control over the actions undertaken by other developers that affect similar VECs, and therefore it is unlikely to have much leverage to influence any mitigation actions by third parties. However, when faced with cumulative impacts and risks, private sector developers or project sponsors may engage in a simpler RCIA process (see Appendix 3 for an annotated RCIA Terms of Reference) instead of a full CIA. An RCIA follows the same logical and analytical framework as a CIA, but the analysis is based on a desk review of readily available information and previous environmental and social assessments. Very focused new baseline data on VECs may be needed, and additional new stakeholder engagement may also be necessary (see Step 3 in Section 2).

[7] Combined impacts can be either *additive* (e.g., equal to the sum of individual effects), *synergistic* (e.g., total effect is greater than the sum of the individual effects), or *antagonistic* (e.g., individual effects counteract or neutralize each other).

[8] See World Bank, OP 4.01, footnotes 11 and 12.

2. What Is the Process for Implementing a CIA?

Assessment of accumulated impacts may draw on information from a variety of sources including regional environmental, social, and resource studies and programs; strategic, sectoral, and regional environmental assessments; project environmental assessments; CIAs from similar situations; and targeted studies on specific issues.

The following six-step process and the appendices that follow lead users of this handbook from the scoping phase to the management phase, providing key questions to consider along the way. Additional relevant guidance may exist in the Performance Standard Guidance Notes.

Keep in mind that the process for CIA must be flexible; the steps may not proceed in sequence and may need to be implemented iteratively, with some steps revisited in response to the results of others. For example, in the issue identification (scoping) step, consideration of potential effects is often repeated, with the findings and analysis refined each time, until a final list of issues is produced.

Step 1: Scoping Phase I - VECs, Spatial and Temporal Boundaries

Objectives:
Identify and agree on VECs in consultation with stakeholders.
Determine the time frame for the analysis.
Establish the geographic scope of the analysis.

Questions to answer:
Whose involvement is key?
Which VEC resources, ecosystems, or human values are affected?
Are there concerns from existing cumulative impacts?

This step is critical to successful CIA because it establishes the scope of the analysis of cumulative impacts. Critical to the success of scoping is that it appropriately characterizes the context for the analysis (i.e., context scoping, as identified by Baxter et al. 2001). If not already done, identification of the key participants should be completed early in this step and updated as needed as the overall process proceeds. Best practice involves an open, participatory, transparent, and meaningful consultation with affected communities and other relevant interested parties as early in the scoping phase as possible. As described in Section 3, this is one of the major challenges associated with a CIA process. For a description of an ideal arrangement of stakeholder roles and responsibilities, please refer to Table 3 in that section.

The output of scoping includes identification of the VECs for which cumulative impacts will be assessed and managed, and the spatial and temporal boundaries for the assessment. Information to consider in establishing the scope of CIA includes the following:

- VECs known or suspected to be affected by the development (based on prior sectoral assessments or the project's ESIA).
- Known cumulative impact issues within the region.
- Concerns for cumulative impacts identified in consultation with stakeholders, including potentially affected communities (these may exist at distance from the planned development).
- Regional assessments prepared by governments, multilateral development banks (MDBs), and other stakeholders.
- CIAs prepared by sponsors of other developments in the region.
- Information from NGOs.

Appendix 1 contains an illustrative list of potential VECs identified for each IFC Performance Standard.

Boundaries for the analysis need to encompass the geographic and temporal extent of impacts (from other past, present, and predictable future developments) that influence VEC condition throughout the

time period during which project impacts will occur. This scope is likely to extend beyond a project's direct area of influence (DAI) as typically defined in ESIA (see Box 2).

Box 2. Rules of Thumb - How to Set Geographical and Temporal Boundaries[a]

The suggested *rules of thumb* to determine the *geographic boundaries* for the analysis are as follows:

a. Include the area that will be directly affected by the project or activity (DAI - in the traditional ESIA sense).
b. List the important resources (VECs) within the DAI.
c. Define if these VECs occupy a wider area beyond the DAI.[b]
d. Consider the distance an effect can travel, and other impacts the VEC may be exposed to within its range.

The proposed basic *rules of thumb* to determine the *temporal boundaries* for the assessment are as follows:

i. Use the time frame expected for the complete life cycle of the proposed development.
ii. Specify whether the expected time frame of the potential effects of proposed development can extend beyond (I).
iii. Use the most conservative time frame between (I) and (III).
iv. Using professional judgment to balance between overestimating and underestimating, and make sure to document the justification or rationale.
v. Exclude future actions if (i) they are outside the geographical boundary, (ii) they do not affect VECs, or (iii) their inclusion cannot be supported by technical or scientific evidence.

[a] After CEQ 1997.

[b] As an example, for biodiversity components, see the definition of discrete management unit in Performance Standard 6 and related guidance in GN6, which emphasizes the importance of defining an ecologically relevant boundary. CIA boundaries should be defined by the area occupied by the VEC. The spatial context for CIA can be a mosaic rather than a single area.

This is typically an iterative process in which the first boundaries are often set by educated guess but incrementally improved as new information indicates that a different boundary is required for the analysis. Boundaries are expanded to the point at which the VEC is no longer affected significantly or the effects are no longer of scientific concern or of interest to the affected communities. For example, in the case of biodiversity values, habitat ranges or migration pathways are often used as boundary-defining variables. By contrast, if landscape fragmentation is at stake in a transportation project, the likely extension of secondary and tertiary roads, along with population growth, are well-established risk factors to consider. In any case, the CIA should explain the basis for the final delineation of the geographic and temporal boundaries. VECs for which the project will have no direct or indirect impact do not need to be the subject of CIA. Priority should be given to those VECs that are likely to be at the greatest risk from the development's contribution to cumulative impacts.

Through an evaluation of the regional cumulative impact, the scoping stage of CIA should not only establish the dimensions of the cumulative impact study (VECs of concern, spatial and temporal assessment scales) but also assess how well cumulative impacts have already been identified and analyzed. If the condition and trends of VECs are already known and the incremental contribution of the development to cumulative impacts can be established quickly, then the emphasis for CIA should be placed on cumulative impact management rather than impact assessment.

Step 2: Scoping Phase II - Other Activities and Environmental Drivers

Objectives:

Identify other past, existing, or planned activities within the analytical boundaries.
Assess the potential presence of natural and social external influences and stressors (e.g., droughts, other extreme climatic events).

Questions to answer:

Are there any other existing or planned activities affecting the same VEC?
Are there any natural forces and/or phenomena affecting the same VEC?

The purpose of this step is to identify the totality of stresses that determine the condition of VECs selected for CIA. Estimation of the magnitude of impacts will likely occur in step 4. What is important in Step 2 is identification of the sources of stress—past developments whose impacts persist, existing developments, and foreseeable future developments, as well as any other relevant external social and/or environmental drivers (e.g., wildfires, droughts, floods, predator interactions, human migration, and new settlements). Box 3 provides an example. In making this determination, the key question is simply what environmental and social factors may influence the condition of the VEC. In most cases, these factors should be known.

Box 3. Cumulative Impacts of Climate and Hydropower

The ESIA for a hydropower development that would provide peaking power predicted no significant impacts on lakes immediately downstream of the development. The ESIA analysis was based on the recent midterm flows in the river system.

A separate CIA properly took into account the contribution of the natural driving force of longer-term climatic variation in water availability reflected in the long-term records. Modeling analysis of lake levels in the region, based on the long-term precipitation patterns showed that there could be a sharp decline in water levels during extended periods of drought that historically had occasionally lasted for periods of 10 to 20 years. The project effects at such times would significantly worsen an already difficult situation for some of the affected communities, as during such extended droughts the shorelines of downstream lakes receded considerable distances. While only a fraction of the drop in lake level would be attributable to the project impact this additional impact was considered unacceptable.

The analysis highlighted the need for mitigation measures that could manage the lake levels during such periods, providing a net benefit to the downstream communities and their fisheries during extended droughts. Had the CIA not properly taken into account the natural driving impact of climate cycles on the hydrological regime, the company might have been held accountable at some point for the unacceptable impacts.

An important part of this step is determining an appropriate strategy for identifying stresses that result from activities other than the proposed development. Detailed identification of other projects, activities, or actions that are likely to have significant impacts and can play an important role in the management of cumulative impacts is appropriate. However, in environments affected by a large number of small developments, creating an inventory of all sources may not be the best approach; some form of statistically stratified estimation of all development types involved may be appropriate. It may be helpful to classify developments according to common characteristics of their impacts. The amount of detail required is determined by what is needed to credibly estimate the types and intensity of impacts that influence the condition of the selected VECs.

In addition to other human activities, natural drivers that exert an influence on VEC condition should be identified and characterized. Natural environmental processes—for example, drought or flooding—have significant impacts on a variety of environmental and social components. Project impacts that discharge pollutants to lakes or rivers, or that withdraw water for industrial or agricultural purposes are likely to be more significant during periods of drought. The fire regime in forested areas is a major driver that shapes social, ecological, and economic systems. For the purposes of CIA, identification of such processes is not a question of new research, but is based on existing knowledge of the ecology and/or natural dynamics of the selected VECs.

Guidance for identifying reasonably predictable projects recommends reference to local, regional, or national development plans and generally recommends that a short time horizon be considered (e.g.,

three to four years in the European Union) owing to uncertainty about longer- term developments.[9] Where development plans are not available, guidance recommends that emphasis be given to identifying other projects in the planning stage or formal approval process (e.g., through preparation of ESIA documents or permit submissions). This short- term view does not provide certainty regarding which developments will actually occur. The CIA should clearly justify the reasoning behind the temporal boundary used for the assessment, as well as all the different developments and external stressors included in the analysis (see Box 4).

Box 4. Strategic Approach to Assessing Multiple Small Developments (Scoping)

CIA may be relevant and considered appropriate even if a project is expected to have only a small impact, whenever the project will contribute to the cumulative impact or be at risk from the cumulative effects of existing projects, or a large number of other reasonably predictable projects.

A regional CIA approach was taken to assess cumulative effects for a region that is the traditional territory of numerous aboriginal groups and which is characterized by extensive unconsolidated sands with dune complexes, open grasslands, patches of trees and shrubs with several game species including species that are rare, threatened, or endangered; and numerous areas of historical spiritual significance. The dominant activities within the region included a high density of gas wells (approximately 70 percent of the area was leased for exploration) and widespread livestock grazing. The development of a significant number of additional gas wells was highly likely, so rather than a well-by-well approach a regional CIA was undertaken.

The CIA was done in three phases: baseline assessment; impacts and trends identification; scenario analysis and recommendations. Aggregation of impacts by livestock grazing and gas well development was facilitated by treating both as surface disturbances. The underlying objectives of the baseline assessment (Step 3 in this handbook) were to identify activities that have the greatest potential for surface disturbance impacts on ecological integrity and sustainability, and to identify key issues and concerns with biological, economic, and social VECs.

Whenever there is potential for a large number of similar developments a regional analysis should be considered. This is not, however, the responsibility of an individual proponent. This strategy, if pursued, requires the engagement of other proponents and government agencies to develop a coordinated and/or pooled analysis.

** for results of this analysis please refer to Box 5*

In cases where no data are available from third parties about existing or planned developments, the developer may promote the benefits of CIA to third parties and encourage them to provide information on existing developments and future plans; obtain whatever data government authorities have regarding existing and planned developments; and, in the absence of specific information about projects and their impacts, use generic information about the other projects, their inputs, and their effects for typical developments of similar size.

In addition to other projects, actions, or activities that are known to be under development or identified in planning documents, good practice also considers future developments that are likely to be induced by the project under consideration. If experience has shown that projects of the same type as the one being assessed cause further associated development to occur, then such developments are reasonably predictable. Because induced development is not identified on the basis of specific development plans, scenario analysis may be an appropriate approach for examining the potential cumulative impacts that could be associated with such development. Each scenario must be possible. The objective of scenario analysis is not to predict a most likely future but to help to assess the consequences of uncertainty, so that the need for cumulative impact management under different future conditions can be anticipated.

[9] For a good logical framework of how to define other developments, including certain reasonably anticipated, and/or hypothetical ones, refer to Box 10 of World Bank 2012.

Step 3: Establish Information on Baseline Status of VECs

Objectives:
Define the existing condition of VEC.
Understand its potential reaction to stress, its resilience, and its recovery time.
Assess trends.

Questions to answer:
What is the existing condition of the VEC?
What are the indicators used to assess such condition?
What additional data are needed?
Who may already have this information?

A common concern among developers is the level of effort, time, and resources required to collect adequate data for appropriately assessing cumulative impacts. The availability of relevant data is critical for the success of a CIA, and the methodology to be used to determine VEC baseline conditions should be defined as early as possible.

Generally speaking, data requirements should be determined early on during the scoping phases of the CIA process. A developer may use existing information when such information provides a sufficient basis for a complete assessment of cumulative impacts. However, if during the scoping phases a developer determines that the existing information contains significant gaps that prevent the performance of an adequate assessment of cumulative impacts, it should obtain the information needed using internationally recognized methodologies.

Typically, the new baseline data to be collected for a CIA will not be as detailed as that generated during an ESIA, because of the larger area covered and/or changes in the type of data required for the different scale of the assessment. Data that are needed focus on the most important VECs. Collection of new baseline data tends to be limited and targeted to indicators that would allow determination of any changes in VEC conditions. For instance, during an ESIA, intensive and detailed field surveys of soil, vegetation, and fauna may be required in order to assess direct impacts of a given development on biodiversity and land use. In contrast, because CIA may require expanding the geographical boundary to thousands of hectares, the analysis may rely on satellite imagery or existing vegetation or fauna studies on broader scales.

In some cases, the collection of data for some VECs, such as water quality, air quality, and noise levels, provides a baseline condition that integrates the collective effects of all existing developments and exogenous pressures. For example, to assess the cumulative ambient air quality impacts of a proposal to site a fossil-fueled power plant in a given airshed, a developer may need to collect data on the existing ambient air quality while calculating future impacts where additional power plant capacity is anticipated to be installed in the same airshed.

Other illustrative examples: (a) the construction of an irrigation project that would alter the volume and timing of watershed flows into an estuary, which may require the collection of additional data to assess the cumulative change in flow regime at the estuary and resulting impacts where other proposals would have similar effects, or (b) an expansion of the geographical and temporal scales of data collection, in order to assess the cumulative impacts of a proposed activity on the natural resource base that indigenous peoples, pastoralists, forest dwellers, or other communities depend upon for their livelihoods.

Baseline (historical) information on the condition of VECs establishes the "big picture" context for thinking about changes in VEC condition, can help developers avoid the pitfalls associated with shifting baselines (Pauly 1995), and can be used in a variety of ways. As described in further detail in Step 5, threshold levels (tipping points), at which a VEC's response to additional impacts may change abruptly, are often not known with any degree of certainty. A simple analysis of the overall change in condition

relative to a baseline can at least provide some indication of the change that has already occurred; however, this analysis must be approached with caution if the baseline condition is recent and thus possibly representative of an already shifted baseline.

If sufficient information is available to establish the natural range of variation in a given VEC condition, it can be used for comparison with the estimated future state developed in Step 4 and when assessing significance in Step 5. When compared with information about the past time trend in development pressures (part of the analysis in Step 4), it may also provide some insight into VEC sensitivity to stresses. Good indicators of condition are important. Historical trend analysis should be approached with some caution because some indicators can be very stable, essentially hiding impact responses. Consistent use of indicators is important (Berube 2007).

Step 4: Assess Cumulative Impacts on VECs

Objectives:
Identify potential environmental and social impacts and risks.
Assess expected impacts as the potential change in condition of the VEC (i.e., viability, sustainability).
Identify any potential additive, countervailing, masking, and/or synergistic effects.

Questions to answer:
What are the key potential impacts and risks that could affect the long-term sustainability and/ or viability of the VEC?
Are there known or predictable cause-effect relationships?
Can these impacts and risks interact with each other?

Analysis of cumulative impacts on VECs involves estimating the future state of the VECs that may result from the impacts they experience from various past, present, and predictable future developments (see Box 5). The objective is to estimate the state of VECs as it results from the aggregated stresses that affect them. In this context, in addition to the stresses imposed by developments, the assessment should encompass the potential range of environmental variation that may influence VEC condition and not be based solely on expected average conditions (e.g., change in climate patterns and/or predictability).

Box 5. Strategic Approach to Assessing Multiple Small Developments (Analysis)

The analysis for the regional CIA done for the multiple small gas developments referenced in Box 4 developed three alternative GIS-based land use scenarios: business as usual; enhanced development; and conservation. Rather than focusing on a fixed prediction about the most likely future impacts, emphasis was placed on developing a set of plausible accounts of cumulative change under each scenario. This approach allowed decisions to be based not only on past trends, but also on potential future trends, which may include a number of surprises.

Core biodiversity hot spots with a high priority for conservation were identified. Under the conservation scenario, regional biodiversity hot spots would be maintained as protected areas. This would be done by limiting the number of new gas wells in such areas. Production would be maintained, however, through increased use of directional drilling near the biodiversity hot spots.

In CIA, impacts are measured not in terms of the intensity of the stress added by a given development but in terms of the VEC response and, ultimately, any significant changes to its condition. The methods used for analysis are specific to the characteristics of the VEC (e.g., different methods are appropriate for analysis of impacts on physical, environmental, biotic, and social VECs, and their resilience). A wide spectrum of methods has been used for CIA (see Box 6 for an illustrative case); these methods generally can be characterized as impact models, numerical models, spatial analysis using geographical

information systems (GIS), and indicator-based approaches.[10] Some specific examples and references are listed below in References.

Box 6. RCIA of Hydro Impacts on American Eel

The American eel is a species that spawns in the Sargasso Sea and migrates to freshwater rivers and lakes to grow and mature. When mature it migrates downstream and returns to the Sargasso Sea. In a northern segment of its range this large, long-lived species declined substantially following construction of hydropower dams and is now listed as endangered.

Human activities that affect the species include harvesting by fisheries, hydropower developments (inhibition of upstream migration, mortality during downstream migration), barriers to migration by other water control dams, habitat alteration, changes in water quality and contaminants. Natural drivers that impact the species include: changes in the food web, parasites, and potential changes in ocean currents associated with climate change.

To develop a rapid estimate of the impact of the mortality caused by hydro developments during downstream migration a RCIA was developed in the form of a quantitative spreadsheet model for one watershed in the region where 11 hydropower developments were located on the main stem of the river, other developments were located on tributary rivers. Without a detailed inventory of the distribution of eel habitat in the watershed or specific studies of eel mortality at the individual stations, the model was designed to permit scenario analysis to explore scenarios of habitat distribution (simply the proportion of habitat in the watershed located in areas between the different developments) and estimates of the mortality rate for eels passing through stations of similar size and design drawn from the scientific literature. The model simply estimated the survival rate for the population of mature eels that would migrate downstream for spawning as a result of the cumulative mortality from the 11 main stem developments. Although a better estimate of impact could be obtained with a detailed habitat survey in the watershed, analysis of all developments, not just those on the main stem, revealed that under reasonable assumptions of habitat distribution, the survival rate would be less than 10 percent, an unsustainable impact.

- Thresholds (Berube 2007; Bonnell and Storey 2000; Canter and Atkinson 2010; Damman 2002; Deverman 2003; Dube 2003; Schultz 2010; Seitz, Westbrook, and Noble 2011; Spaling et al. 2000; Squires, Westbrook, and Dube 2010; Therivel and Ross 2007; Tricker 2007; Weclaw and Hudson 2004) .
- Visual amenity analysis (Brereton et al. 2008).

As discussed previously, CIA analysis is futures oriented. The impact of the project is not assessed as the difference between the expected future condition of VECs and that of a past baseline condition. It is assessed as the difference between the estimated future condition of VECs in the context of the stresses imposed by all other sources (projects and natural environmental drivers) and the estimated VEC condition in the context of the future baseline plus the development under evaluation.[11] Of concern is not just estimation of the development's impact, but estimation of the future condition of VECs in the context of all stresses—which is the cumulative impact—and can be evaluated in reference to an established threshold level of acceptable condition, if known, or in reference to a past baseline.

The estimate of the cumulative project impact, together with ESIA results, indicates the need for project-specific mitigation. By contrast, the estimated overall cumulative impact indicates the need for mitigation to be implemented by the various project owners or proponent parties to ensure that their respective contributions to the overall condition of the VECs is coherent and/or compatible with what is

[10] For a good overview, see Box 18 and Table 4.1 of "Sample Guidelines: Cumulative Environmental Impact Assessment for Hydropower Projects in Turkey." World Bank, 2012. https://www.esmap.org/node/2964.
In CIA it is critical to not confuse past and future baselines (Berube 2007).

mandated or required by government-led—or government-agreed—regional cumulative impact management initiatives, or as a minimum compliant with ambient quality standards for the desired use.

A key part of the assessment step is estimation of the effectiveness of project mitigation and other cumulative impact management measures to reduce impacts, and this is done iteratively between Steps 4, 5, and 6.

Step 5: Assess Significance of Predicted Cumulative Impacts

Objectives:
Define appropriate "thresholds" and indicators.
Determine impact and risk magnitude and significance in the context of past, present, and future actions.
Identify trade-offs.

Questions to answer:
Do these impacts affect the sustainability and/or viability of the resource and/or VEC?
What are the consequences and/or trade-offs of taking the action versus no action?

Significance determination is a normal component of ESIA and CIA and occurs near the end of the assessment process. Significance is typically evaluated after project mitigation measures are factored in.

Determination of significance can be difficult and it is often controversial. Any potential cumulative impact that warrants additional mitigation and/or monitoring beyond that identified in the ESIA should be considered significant. A key good practice for the appropriate determination of impact significance and overall agreement among affected communities and other relevant stakeholders is to strengthen mitigation measures and monitoring programs, focusing on expected probable cumulative impacts.

In the ESIA process, components of impact significance (magnitude, spatial scale, duration, frequency) are typically factors in deciding whether mitigation is necessary. Consequently, the evaluation of significance and the design of management and/or mitigation are in reality iterative. The significance of a cumulative impact is evaluated not in terms of the amount of change, but in terms of the potential resulting impact to the vulnerability and/or risk to the sustainability of the VECs assessed. This means evaluating cumulative impacts in the context of ecological thresholds. Determining ecological thresholds for biological and social VECs has proven to be difficult. In many cases, such thresholds may not be clearly identified until they are actually crossed, at which point recovery may take a long time with considerable cost or may simply not be possible. Consequently, a precautionary approach that explicitly considers uncertainty in ecological and sociological relationships is essential when thresholds of acceptable VEC condition are being established.

Current practice indicates that determination of thresholds is an essential component not only for the assessment of significance of cumulative impacts but also for the design of management strategies. To be able to determine the significance of cumulative impacts, some limits of acceptable change in VEC condition are needed to which incremental effects can be compared. In practice, if the cumulative impacts of all combined developments on a VEC do not exceed a limit or threshold, the development would be considered acceptable. A threshold can be the maximum concentration of a certain nutrient in a body of water beyond which an algal bloom will occur, the concentration of pollutant in an airshed beyond which health of nearby communities could be adversely affected, or a maximum amount of linear infrastructure in a landscape before visual impacts become unacceptable.

In reality, however, since such thresholds are not widely defined or available, the CIA is often hindered. As described in the World Bank's "Sample Guidelines for Cumulative Environmental Assessment for Hydropower Projects in Turkey" (World Bank 2012) and in Hegmann et al. (1999), there is not always an objective technique for determining thresholds and professional judgment must usually be relied upon. Good practice implies making attempts to estimate thresholds for VECs studied, and applying the mitigation hierarchy to manage those impacts that may result in exceeding predicted thresholds.

An alternative is to identify the limits of acceptable change, in consultation with the scientific community and the affected community. This approach focuses on the identification of VEC conditions that are deemed acceptable to stakeholders. The advantage of this approach is that once acceptable VEC conditions have been agreed upon, the appropriate combination of levels of use and management strategies required to sustain those conditions can be determined. Similarly, when carrying-capacity levels or specific thresholds cannot be determined, trend analysis can be very helpful to determine whether a desired VEC condition or limit of acceptable change for a VEC is likely to be achieved or whether unacceptable VEC conversion and/or degradation is likely to occur.

Finally, in the absence of defined thresholds or in the face of an inability to determine limits of acceptable change, practitioners should first acknowledge this lack or inability as part of the CIA process, and use their best efforts to suggest appropriate thresholds or limits, based on available scientific evidence and in consultation with stakeholders, government agencies, and technical experts.

Step 6: Management of Cumulative Impacts - Design and Implementation

Objectives:

Use the mitigation hierarchy.
Design management strategies to address significant cumulative impacts on selected VECs.
Engage other parties needed for effective collaboration or coordination.
Propose mitigation and monitoring programs.
Manage uncertainties with informed adaptive management.

Questions to answer:

How can cumulative impacts be avoided, minimized, and/or mitigated?
How can the effectiveness of proposed management measures be assessed?
What are the triggers for specific adaptive management decisions?

The management measures needed to prevent cumulative impacts will depend on both the context in which the development impacts occur (i.e., the impacts from other projects and natural drivers that affect the VECs) and the characteristics of the developments impacts. Since cumulative impacts typically result from the actions of multiple stakeholders, the responsibility for their management is collective, requiring individual actions to eliminate or minimize individual development's contributions. At times, cumulative impacts could transcend a regional threshold and therefore collaboration in regional strategies may be necessary to prevent or effectively manage such impacts. Where cumulative impacts already exist, as in the examples described in Box 7, management actions by other projects may be needed to prevent unacceptable cumulative impacts.

Box 7. Shared Responsibility for Management of Cumulative Impacts

Significant cumulative effects on a predatory wildlife species resulting from existing forest harvesting, mines, oil and gas operations, and recreational activities (managed by the government) were revealed when the CIA for a new mine proposal was completed. The proposed management response was the creation of a "carnivore compensation program" to be jointly supported by the new mine, the dominant forestry company in the area, some oil and gas interests, and the government.

In another case, concern for the cumulative effects of the biochemical oxygen demand from the discharge of a proposed pulp mill together with the discharges of existing mills resulted in a requirement for a joint monitoring program implemented by the operators of the existing mills together with the operators of the new mill. In addition, should dissolved oxygen drop below a specified limit, immediate corrective action is required to be taken jointly by the parties (The rivel and Ross 2007).

Management of cumulative impacts therefore, does not rest solely with developments that come later in the development sequence. Ignoring possible cumulative impacts during project development carries the risk of having unanticipated constraints imposed at a later time. The analysis phase of the project CIA may indicate the need and/or potential for additional mitigation measures beyond those identified in the project ESIA. The design of such additional mitigation measures for the development, if needed, is an early part of the work in this step of managing cumulative impacts. Iteration of the analysis (Step 4), significance evaluation (Step 5), and management (mitigation) design (this step) may be needed.

If specific project mitigation that will prevent unacceptable cumulative impacts can be identified and implemented, then the developer may not need to initiate collaborative engagement of others in impact management. When prevention of unacceptable cumulative impacts by project mitigation alone is not possible, collaborative engagement in regional management strategies will be necessary.
Specific actions that may be needed to effectively manage cumulative impacts include the following:

- Project design changes to avoid cumulative impacts (location, timing, technology).
- Project mitigation to minimize cumulative impacts, including adaptive management approaches. [12]
- Mitigation of project impacts by other projects[13]
- Collaborative protection and enhancement of regional areas to preserve biodiversity (McKenney and Kiesecker 2010, etc).
- Collaborative engagement in other regional cumulative impact management strategies.
- Participation in regional monitoring programs to assess the realized cumulative impacts and efficacy of management efforts.

The first two points are clearly the responsibility of the project, the third point is the responsibility of other project proponents to address their contribution to cumulative impacts (some of which may be discovered during the project CIA process), and the last three points involve collaborative engagement with other stakeholders, including project proponents, government agencies, affected communities, conservation groups, and expert groups. Ultimately, governments should establish cumulative impact assessment frameworks that provide mechanisms to identify parties and contributors to the CIA process, including VECs selection and impact management processes (see Box 8).

[12] Adaptive management strategies are not a panacea. A common misunderstanding that has emerged in some ESIA practice is that adaptive management is primarily a post-hoc response to developing management responses after problems emerge. In fact, it is a well-developed and rigorous discipline for experimental management used for reducing uncertainty about how to manage effectively. Consequently, adaptive management is not appropriate if impacts may not be reversible. In addition, it is best employed to assess management strategies to which VECs are responsive over a relatively short term.

[13] Hydro-Quebec found this to be particularly important in CIA practice (Berube 2007).

Box 8. Mitigation of Panama Hydroelectric Developments

Together with international and local lenders and other MDBs, IFC is financing the development of two cascading hydropower projects on the Chiriqui Viejo River in Chiriqui Province in western Panama. These projects are situated in the upper reaches of the watershed above approximately a dozen other cascading projects being constructed or planned for development by other private sector sponsors. An RCIA was conducted with the support of the lenders group. Results from the RCIA indicated that in addition to the barrier effect caused by the dams, dikes, and levees, the reduced downstream flows between the different projects could significantly impair aquatic habitat connectivity in the dewatered segments and jeopardize the ultimate viability of the mountain mullet, a catadromous fish currently present in the river.

Because these two projects are the highest in the watershed, the natural movement of spawning fish downstream and juveniles upstream would first be impacted by several projects under construction in the lower reaches of the river. Lack of mitigation of this barrier effect by projects downstream from the IFC-financed projects would likely compromise the viability of juvenile and adult fish populations in the higher sections of the river.

To address this situation, these two projects have taken a two-tiered approach:

First, they have developed a comprehensive downstream ecological flow management plan that will ensure that these two projects release enough water in the dewatered segments downstream, to maintain not only aquatic habitat connectivity, but also enough usable habitat for key indicator fish and invertebrate species.

They are working with the group of lenders, other project sponsors, and the responsible government agencies in Panama to tackle not only connectivity but also other cumulative issues (e.g., sediment load) at a watershed level. These solutions are still being negotiated but include fish hatcheries, as well as catch-and-release of juvenile and adult fish to repopulate the stream in the dewatered segments upstream from the different dams.

3. What are the Challenges to Implementation of CIA? How can These Challenges Be Overcome?

This final section recognizes that the application of this six-step process entails many challenges, as does the implementation of an effective strategy to manage cumulative impacts and risk for multiple projects, actions, and activities. This section provides some key recommendations to consider when trying to overcome such challenges.

The well-described economist's "Tragedy of the Commons" explored by Hardin (1968) illustrates the many challenges that assessment and management of cumulative impacts may face. Some examples:

- Information on proposed developments may be limited by commercial considerations.
- Identifying and describing "predictable future development" and "external natural and social stressors" in sufficient detail to assess their social and environmental impacts and effects can be fraught with difficulty.
- Stakeholders may assign different priorities to VECs.
- VEC baseline conditions and acceptable thresholds are often unavailable because of lack of data or agreed scientific methodologies.
- Attribution of impacts is a process dominated by uncertainties, and getting individual project sponsors to accept responsibilities and impact management is not always a straightforward task.
- Exercising leverage over government and over other developers can be an overwhelming task for private developers, which often may produce negligible results.
- Engaging stakeholders in discussing strategic cumulative impacts, when the discussion is promoted by a specific developer sponsor, tends to be confusing and could be counterproductive.
- Project sponsors may not share data collaboratively or define mitigation strategies jointly.

CIA requires interactions with numerous organizations and individuals from government, third parties, affected communities, and other stakeholders. Numerous groups have an interest in CIA because of its

wider geographic scope and focus on impacts from multiple developments. But what should their role be in a project-level CIA? The type of interactions that project proponents should have with interested parties will vary, depending on the development and its location. In locations where third parties are organized (e.g., farmer or industry association) and concerned about environmental impacts, third parties may become very involved in some parts of the assessment (e.g., scoping, provision of data, development of mitigation) or in ongoing management actions. Also, in locations where governments have established regional planning processes and means of managing natural resources regionally, they too may become actively involved in parts of the assessment (scoping, provision of data, determination of significance of impacts) or in implementation of management actions (e.g., regional monitoring program).

Deciding why, when, and how to interact with government(s), third parties, and affected communities is not straightforward; it requires considerable thought and expertise. To determine the appropriate type and scope of interactions requires an understanding of constraints on both governance and participants' capacity.

3.1 Recommendation 1: Clarify Roles and Responsibilities

A wide range of roles and responsibilities are possible. The principles and purpose for involving different parties in CIA or RCIA should not change, no matter what the circumstances of government, third parties, or affected communities are. The principles are *meaningful engagement of affected communities, involvement and collaboration with governments,* and *interaction with third parties.* At a minimum, interactions with government, third parties, and affected communities should accomplish the purposes that relate to a client's project-specific CIA or RCIA. The ideal roles and responsibilities of different parties and the purpose of these roles/responsibilities are listed in Table 3. See also Box 9.

Box 9. Regional Collaboration in CIA

Various groups have been working in different contexts to establish collaboration between developments for regional CIA. For example, collaborative initiatives have been developed in Australia with regard to impacts of the coal mining industry, including strategic and regional planning led primarily by government; information exchange—networking and forums; pooling of resources to support CIA initiatives and programs; and multistakeholder and regional monitoring (Franks, Brereton, and Moran 2010; Franks et al. 2010). These approaches vary in complexity, with each demanding a different degree of maturity in the collaborative relationship. Given the expected challenges of conducting CIA in emerging market contexts, collaboration among project proponents offers the prospect of attaining efficiencies through information sharing and joint management approaches that should improve CIA quality, thereby reducing risks associated with unmanaged cumulative impacts while being more cost-effective. Such collaborative efforts represent one thrust in the early development of enabling frameworks for CIA.

As illustrated in Table 2, significant gaps typically exist between the actual governance context for a development and the ideal roles and responsibilities shown in Table 3. Gaps in roles and responsibilities need to be explicitly identified and handled by different management strategies in a CIA or RCIA.

Typical governance what to do? Context

Table 2. Cia governance gaps

No policy or legal framework for CIA	Identify and use any sources of partial information about policy or regulatory limits to development (e.g., policy statements, strategic or sectoral assessments, national and/ or regional development actions plans and targets, including those referenced under international agreements and conventions); use sustainability, irreplaceability, and vulnerability as proxies to define acceptable limits for all policy and regulatory gaps. Technical expertise will be needed to understand and apply sustainability and vulnerability concepts in CIA.
No regional planning or collaborative resource management mechanisms	Share CIA/RCIA purpose, process, and requirements with government and third parties early on and discuss their participation in CIA/RCIA (including implications and benefits of participating in this process); discuss environmental and social permitting requirements with government authorities and ensure ESIA and CIA/RCIA will provide the government with the information it needs for decision making; assess the level of involvement feasible for the government and third parties and reach agreement with them about their participation and their roles and responsibilities; encourage the participation of government, third parties, and representatives of affected communities in scoping, review of CIA/RCIA findings, proposed management strategies, and impact monitoring.

Table 3. Roles and responsibilities of participants in cia under ideal governance conditions

ROLES AND RESPONSIBILITIES BY PARTY	SCALE	PURPOSE
Government • Establish policy and legal framework for resource management and cumulative impact management. • Establish and lead regional planning structures and collaborative mechanisms for managing and mitigating (e.g., aggregated offset strategies) resource developments and cumulative impacts. • Implement permitting process that considers cumulative impacts of all developments and pressures, and conforms to values and limits, given regional plans and national frameworks. • Design and conduct CIA study of geographic area which includes the baseline (historical) conditions and predicts the future baseline, based on the carrying capacity of the VECs • Issues approvals to individual private sector projects to be developed on the basis of this information. • Lead development and implementation of regional cumulative impact monitoring program that analyzes development pressures and impacts at regional scale and compares results to values and/or acceptable limits for resource development.	National, sub-national, regional, and/or local.	Defines values and acceptable limits for resource development. Defines locations for acceptable types and limits of developments. Identifies contribution of each development to cumulative impacts in region, gives public and proponent assurance that proposed developments are within acceptable limits set by legal framework and regional plans and processes. Gives information on state of VECs in region and assurance that cumulative impact values and development objectives are being met; provides database for project-level CIA, and makes sure this information is freely and publicly available.
Private Sector Project Proponent • Design and conduct CIA (or RCIA) study of the incremental impacts of the project building on the CIA study conducted by the government. • Monitor and manage cumulative impacts and risks related to the development for its life span. • Provide project-level cumulative impact monitoring data to regional cumulative impact monitoring program. • Support regional planning structures and collaborative mechanisms for managing cumulative impacts to prevent their limits from being reached; actively participate as needed in collaborative systems with government, private sector, and public.	Regional, local, and/or site.	Gives financial institutions and decision makers information about cumulative impact for evaluating the project. Conforms to CIA commitments and/or permit conditions; manages development to prevent it from causing VECs to reach limits. Gives the government project-related cumulative impact data it needs to manage the uncertainty of impact predictions and prevent VECs from reaching limits. Enables effective monitoring and management of cumulative impacts at appropriate scale; supports collaborative multistakeholder solutions for CIA.

Table 3. Roles and responsibilities of participants in cia under ideal governance conditions *continued*

ROLES AND RESPONSIBILITIES BY PARTY	SCALE	PURPOSE
Third Parties (existing and future developments and/or resource users) • Similar to proponent, but covering existing or future developments • Assess and manage cumulative impacts of existing developments. • Assess and manage cumulative impacts of any future developments; prepare ESIA and CIA for permit decision makers if needed. • Collect and provide data for regional cumulative impact monitoring program. • Participate in regional planning structures and collaborative, mechanisms for managing CIA at regional or larger scales.	Regional, local, and/or site.	• Provides project proponents and other developers, decision makers, and regional monitoring program with details about impacts of existing developments. • Provides proponent and other developers, government, and other stakeholders with details about proposed developments (i.e., project description, impact analysis, ESIA/CIA). • Provides project-level data needed for regional cumulative impact monitoring program. • Enables effective regional management of cumulative impacts; supports collaborative, multistakeholder process.
Affected Communities and Public • Public participates in value setting for policy and/or legal frameworks and regional resource management plans. • Affected communities participate in CIA of individual projects. • Public participates in collaborative management of cumulative impacts.	Regional, local, and/or site.	• Ensures regional resource development limits and conditions reflect public values. • Allows values of affected people to be reflected in scoping and valuation of project-level CIAs. • Fosters public ownership of cumulative impact management objectives and results.

3.2 Recommendation 2: Establish and Maintain a Constructive Relationship

Establishing and maintaining a constructive relationship with government and other stakeholders over the life of a project is an integral part of CIA or RCIA. Table 4 provides specific details about the place for and objectives of interactions. However, limitations in capacity can inhibit governments and other stakeholders from participating as needed in a proponent's CIA or RCIA process. Where government capacity is low, interactions should occur at a minimum in those areas identified in Table 4; but where capacities are greater it is useful to increase the number and/or scope of such interactions.

Table 4. Interactions with stakeholders in cia

PARTIES	PLACES IN CIA PROCESS REQUIRING INTERACTIONS WITH PARTIES		OBJECTIVES OF INTERACTIONS
	Minimum	Ideal	
Government	Assessment - scoping, baseline data collection, review of impact findings Management - collection and review of cumulative impact monitoring data	Government leading collaborative CIA program of planning, permitting, monitoring, and managing cumulative impacts	Provide project proponent with government standards, data, views, expertise, concerns, and validation for assessment; facilitate government role in collaborative monitoring and management
Third Parties	Assessment - informed about CIA study and results Management - informed about cumulative impact monitoring and management program and relevant results	Provide information about existing and proposed projects; participate in collaborative mitigation, monitoring, and management	Provide proponent with third- party information needed for CIA; promote third-party participation in collaborative monitoring and management
Affected Communities and the Public	Assessment - scoping Assessment of Significance Management - collection and review of cumulative impact monitoring data	As many steps in the CIA process as possible—e.g., data collection, formulation of mitigation, ongoing monitoring	Include values and concerns of affected people in CIA; gain public support and insights during project planning and operations

Conclusions

While the expanded geographical and temporal scope of CIA (relative to ESIA) is often a challenge, the most significant challenge to performing and implementing a good CIA process lies in its multistakeholder nature. To facilitate the assessment and management of cumulative impacts, practitioners have called for, and in some developed countries governments are now beginning to develop, regional enabling frameworks for CIA. Such frameworks would support CIA by:

- Creating transparent mechanisms for disclosing available information on proposed developments;
- Establishing regional thresholds for VEC condition;
- Making available information on current states and trends in VEC condition;
- Making available information on the impacts of existing developments;
- Possibly providing regional modeling tools; and
- Developing a framework for regional cumulative impact mitigation and monitoring.

However, these frameworks are generally not well advanced or widely available yet.

The creation of a regional enabling framework for CIA is beyond the capacity of individual proponents. However, good practice for cumulative impact assessment and management includes supporting the development of such frameworks. This may take several forms: working to engage other parties in the CIA or RCIA process; sharing the results of the project CIA or RCIA including recommendations for project-specific and regional management actions needed by others to effectively manage cumulative impacts; and supporting the implementation of collaborative approaches to cumulative impact management through information exchange networking, pooling resources for implementation of shared management initiatives, and participation in multistakeholder and/or regional monitoring. Even when a project-specific CIA is not required, good environmental management practice supports regional efforts to assess and manage cumulative impacts. This would include making project ESIA reports and project impact monitoring results available to others who are working to manage cumulative impacts within the regional context.

Furthermore, because the basic logic framework for ESIA and CIA is essentially the same [14] and they share many common standard tools and analytical methods, the key strategy needed in addressing the expanded scope of CIA is to ensure four conditions:

- The CIA team has adequate qualifications and skills.
- The budget for the proponent's CIA is specified and included in the project budget with the amounts allocated appropriate for the likely scope and level of detail of the CIA.
- The assessment schedule is appropriate, given the augmented scope and complex multistakeholder context.
- The best and most up-to-date available information is used and expert opinion is consulted.

Preliminary estimates of monitoring and mitigation costs may be developed early on in project development, but the full costs will likely need to be reassessed once the CIA or RCIA is complete.

It is critical to the success of CIA or RCIA, as applicable, that the individual project mitigation and, where needed, regional cumulative impact management strategies be implemented as designed. At the same time, estimates of cumulative impacts are often uncertain. The management approach to implementation thus needs to be adaptive, monitoring both the impacts and the effectiveness of management approaches, and adjusting the management to ensure avoidance of unacceptable cumulative impacts. As with management of impacts identified in ESIA, this works best when management of cumulative impacts is integrated into company business plans and strategies.

[14] See Appendix 2, Basic Logic Framework for CIA.

APPENDIXES

Appendix 1. Examples of Indicators for Assessing Incremental Project Impacts and Cumulative Impacts

The following table provides examples of endpoints or indicators typically used on standard ESIAs vis-a-vis those that would be recommended or used in a CIA. The second column represents indicators of incremental change while the third column refers to those that would reflect cumulative impacts over selected VECs. The last column makes reference to the applicable IFC Performance Standard for the impact type.

PROJECT ASPECT	INDICATOR OF INCREMENTAL IMPACT (ESIA)	INDICATOR OF CUMULATIVE IMPACT (CIA)	PERFORMANCE STANDARD
Additional wage employment opportunities	• Incremental numbers of employed and unemployed, participation rates of affected population • Incremental value of subsistence income, wage, and other income to population	• Number, size, skill levels of regional labor force • Measures for shifts in livelihood and sustainability of livelihoods	1, 2
Addition of a pollutant to the environment (air, water)	• Concentration of the pollutant in the emission and/or discharge • Concentration relative to discharge standard • Load from the project • Characterization of the spatial emission and/or discharge plume from the project	• Concentration of the pollutant in the receiving environment • Concentration relative to ambient standard • Total loading (from all sources) of the pollutant • Characterization of the spatial pattern of the concentration of pollutants in the downstream environment	3
Additional incidents of disease, alcohol and drugs problems, and crime	• Number of additional incidents of sexually transmitted diseases, alcohol and drug problems; crime rates • Incremental changes to demands on health, social, and policing services	• Total number of incidents, proportion of population affected • Measures for community and regional health and wellness; safety and security	4
Loss of Land (land alienation)	• Area and/or proportion of land lost, damaged, or inaccessible because of the project • Incremental change in benefits of affected land users (e.g., lost agricultural production, subsistence use)	• Total land area available, value of land use benefits • Total population affected • Measures for sustainable livelihood and poverty	5

PROJECT ASPECT	INDICATOR OF INCREMENTAL IMPACT (ESIA)	INDICATOR OF CUMULATIVE IMPACT (CIA)	PERFORMANCE STANDARD
Conversion or degradation of natural and critical habitat	• Area and/or proportion of natural and critical habitat converted and/or degraded because of the project • Incremental change in habitat quality and/or condition	• Total area of lost habitat • Change in rates of habitat loss • Measures of habitat fragmentation	6
Regulation of downstream flows Reduction, modification, and/ or fragmentation of riparian and aquatic habitats	• Percent reduction of downstream flows as compared to average annual flows • Percent reduction of wetted-perimeter or of usable habitat in the impacted river reaches • Connectivity from the river reaches upstream and downstream of the dam or weir	• River ecological integrity, including natural flow regimes (e.g., quantity, quality, seasonal variability, and predictability) • Viability of migratory fish populations	1,6
Addition of mortality to a wildlife population	• Direct mortality caused by project operations over time • Percentage of local population (or range) lost with relation to global and/or regional population numbers (or range)	• Change in rates of regional and/or global population decline • Measures of population (or range) fragmentation	6

Appendix 2. Basic Logic Framework - Lessons from CIA Practice

CIA shares the same basic analytical process of an ESIA, and thus it involves the following steps:

- Choose a set of development alternatives and variants to assess.
- Choose endpoints (VECs) for comparative analysis of the development alternatives, and the terms in which performance of each alternative will be expressed (indicators).
- Assess the expected impact of each development alternative in terms of each VEC's indicators.
- If no alternative performs adequately, redesign one or more alternatives (e.g., mitigation measures) with the express intention to improve performance.
- Examine the results of analysis, weight the impacts on VECs, and synthesize the results of analysis into an information package for decision makers.

The experience of CIA practitioners reveals that good practice in CIA has the following characteristics.[15]

Process Management:

- Ideally, regional CIA is conducted by the government prior to issuing approval (a concession, a license, etc.) for private sector developments, or the government will have established a CIA framework to support and enable good CIA practice by private sector developers;
- If the government or some other authority designated by the government has not conducted a regional CIA then the project proponent should take into account the findings and conclusions of related and applicable plans, studies, or assessments to develop a process of CIA; and
- The CIA may be linked to the ESIA and is begun early enough in project development that consideration of cumulative impacts can inform risk-based decision making about project design.

Consultation and Collaboration:

- Consultation with affected parties is transparent, meaningful, and ongoing. Information about the proposed development should be provided to affected parties, including the results of the CIA. Where possible, collaboration is established with other developers and government regulators to facilitate joint efforts for cumulative impact management; and
- The results of the CIA, including the details of any future scenario used to explore the consequences of uncertainty, are made available to others working in the area to support future CIAs or regional CIA frameworks.

Scoping:

- Even though initially all relevant VECs must be evaluated for the CIA to be robust, only some VECs are selected for analysis based on their importance, existing concerns, and/or likelihood of significant cumulative impacts.
- Scoping establishes the environmental context for CIA, including the following:
  - Definition of clear temporal and spatial boundaries and documentation of the rationale.
  - Identification of other developments that affect the chosen VECs, including other types of development that have different but important effects on the selected VECs.
  - Identification of natural drivers that affect the condition of VECs.
  - Identification of variation in natural environmental processes that will affect the cumulative impacts.
  - Consideration of jurisdictional issues and overlapping legislation.

Analysis:

- Assumptions and uncertainties regarding cumulative impacts are clearly stated.
- Thresholds, limits, and/or targets for VEC condition and/or status are defined and the rational for their designation clearly documented.
- Determination of significance is adapted to each VEC.

[15] Burris and Canter 1997; McCold and Holman 1995; Baxter, Ross, and Spaling 2001; Cooper and Sheate 2002; Antoniuk 2002; Kennett 2002; Duinker and Greig 2006, 2007; Berube 2007; Therivel and Ross 2007; Canter and Ross 2010; Franks, Brereton, and Moran 2010; Franks et al. 2010; Cooper 2011; Gunn and Noble 2011; IFC Performance Standard 1.

- Analysis of cumulative impacts is done in the context of the project, other existing future developments (i.e., those in the planning stage and others that are reasonably predictable and natural environmental drivers.
- Analysis may be limited to a single future projection of reasonably predictable future developments; however, in this scenario the analysis includes assessment of cumulative impacts over the possible range of environmental variation.
- When appropriate, alternative development scenarios are used to assess the potential environmental and social risks during the lifetime of the project.
- The analysis of different cumulative impacts is done at a spatial and temporal scale that is appropriate for the particular VEC and/or cumulative impact (for example, some wildlife species range over a large area and will be affected by projects throughout the area; diversions and/or withdrawals of water from rivers may have cumulative impacts at considerable distances from a proposed project, where the watercourse converges with other rivers that are similarly affected).
- Analysis and conclusions are based on the scale of measurement appropriate to the impact being assessed. Thus, for example, biophysical impacts are analyzed and reported quantitatively, although conclusions may be summarized qualitatively.
- The difference between a past baseline of observed condition, if known, and the future analytical baseline (of predicted state without the project) is clarified.
- Identification of the project contribution to cumulative impacts is based on a comparison of the predicted environmental condition resulting from other existing and future developments (the future baseline) and the environmental condition that results when the project impacts are added to the future baseline.
- Consideration of the significance of cumulative impacts may be done either (a) in regard to the change in environmental (VEC) condition relative to a past or present baseline, or (b) relative to an established threshold and/or objective for VEC condition.

Impact Management:

- Effects monitoring needed to assess the realized cumulative impacts is clearly defined and implemented. Monitoring recommendations may extend beyond what will be done by the proponent to identify coordinated monitoring by other developers and stakeholders.
- In addition to mitigation of the proposed project's impacts, multiparty regional mitigation and/or management (e.g., additional mitigation of other developments, offsets, management programs) that may be needed to effectively manage cumulative impacts is also identified and support from other stakeholders (governments, developers and communities) is sought to implement it, if it exists; or if no such agency exists, by a collaborative initiative established by the various proponents—see Franks, Brereton, and Moran 2010; Franks et al. 2010).
- The project's monitoring of cumulative impacts is used to update its management system and drive future management of impacts.
- Ideally, the government updates the CIA report to incorporate the results of the project monitoring program to inform future decision making.

Appendix 3. Standard Annotated ToR for an RCIA

Terms of Reference for < *the project* >

1. Introduction

These terms of reference (ToR) describe the requirements for rapid cumulative impact assessment and management for < *the project* >
< Provide background description of project purpose and location>

2. IFC Requirements for CIA

Performance Standard 1 defines the project area of influence to encompass "cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned, or reasonably defined developments at the time the risks and impact identification process is conducted." Performance Standard 1 offers some context to limit the cumulative impacts to be addressed to "those impacts generally recognized as important on the basis of scientific concerns and/or concerns from Affected Communities" and provides examples such as "incremental contribution of gaseous emissions to an airshed; reduction of water flows in a watershed due to multiple withdrawals; increases in sediment loads to a watershed; interference with migratory routes or wildlife movement; or more traffic congestion and accidents due to increases in vehicular traffic on community roadways."

Even though Performance Standard 1 does not expressly require, or put the sole onus on, private sector clients to complete a CIA, it states that the impact and risk identification process "will take into account the findings and conclusions of related and applicable plans, studies, or assessments prepared by relevant government authorities or other parties that are directly related to the project and its area of influence" including "master economic development plans, country or regional plans, feasibility studies, alternatives analyses, and cumulative, regional, sectoral, or strategic environmental assessments where relevant." Furthermore, it goes on to state, "the client can take these into account by focusing on the project's incremental contribution to selected impacts generally recognized as important on the basis of scientific concern or concerns from the Affected Communities within the area addressed by these larger scope regional studies or cumulative assessments."

Similarly, Performance Standard 1 GN1 states that "in situations where multiple projects occur in, or are planned for, the same geographic area... it may also be appropriate for the client to conduct a CIA as part of the risks and impacts identification process." However, it clearly recommends that this assessment should (a) "be commensurate with the incremental contribution, source, extent, and severity of the cumulative impacts anticipated," and (b) "determine if the project is incrementally responsible for adversely affecting an ecosystem component or specific characteristic beyond an acceptable predetermined threshold (carrying capacity) by the relevant government entity, in consultation with other relevant stakeholders."

Therefore, although the total cumulative impacts due to multiple projects should be typically identified in government-sponsored assessments and regional planning efforts, to comply with Performance Standard 1, IFC clients are expected to ensure that their own assessment determines the degree to which the project under review is contributing to the cumulative effects.

3. Objective

The RCIA analysis has two objectives:

- To determine if the combined impacts of: the project, other projects and activities, and natural environmental drivers will result in VEC condition that may put the sustainability of a VEC at risk (i.e., exceed a threshold for VEC condition which is an unacceptable outcome); and
- To determine what management measures could be implemented to prevent unacceptable VEC condition, this may include additional mitigation of the project being assessed, additional mitigation

of other existing or predictable future projects, or other regional management strategies that could maintain VEC condition within acceptable limits.

4. Conduct of the RCIA

<In the following sections add additional text as needed to provide specific characteristic of the RCIA ToR that are known at the time the ToR are issued. For example, where it is already known that there are regional concerns for the conditions of one or more VECs, these concerns should be identified.> IFC's Good Practice Handbook, "Cumulative Impact Assessment and Management Guidance for the Private Sector in Emerging Markets" describes a six-step process that should be used in conducting a CIA for *<the project>.*

- Scoping phase I — VECs, spatial and temporal Boundaries
- Scoping phase II — Other activities and environmental drivers
- Establish information on baseline status of VECs
- Assess cumulative impacts on VECs
- Assess significance of predicted cumulative impacts
- Management of cumulative impacts — design and implementation

The following ToR sections provide a brief outline of the work to be undertaken in conducting the RCIA for *<the project>.* Refer to the CIA GPH for additional guidance regarding conduct of the following steps.

4.1 Scoping Phase I — VECs, Spatial and Temporal Boundaries

Tasks:

- Identify the VECs to include in the RCIA.
- Identify the spatial boundaries of the RCIA.
- Identify the temporal extent of the RCIA.

Note:

- VECs to include are those that would be affected by the project. Thus VECs for which an impact was deemed insignificant in the ESIA are not to be included in the CIA.
- If the number of VECs is too large to conduct an analysis of all, then priority for analysis should be given to those for which there is existing regional concern, as reflected in the regional baseline information (see section 4.3).

4.2 Scoping Phase II — Other Activities and Environmental Drivers

Tasks:

- Identify other existing and reasonably predictable projects and human activities that do/would affect the VECs to be included in the RCIA.
- Identify natural environmental drivers that also impact the condition VECs identified in section 4.1.

Note:

- Developments that could be reasonable expected to be induced by the projects are considered to be reasonably predictable.
- Where there is a significant potential for further development, but not specific development proposals in place, a scenario of potential development may be considered.

4.3 Establish Information on Baseline Status of VECs

Tasks:

- Collect available information on the impacts of the other activities and natural drivers on the condition of the VECs.
- Collect available information on trends in VEC condition.
- Collect available information on regional thresholds for VEC condition.

Note:

- If regional thresholds for VEC condition have not been established, they may have to be estimated based on estimates from other regions. When feasible, the estimation should be peer reviewed.

4.4 Assess Cumulative Impacts on VECs

Tasks:

- Establish indicators for expression of VEC condition. This may already be reflected in the information collected on VEC baseline status (in Section 4.3). If not, then indicators will need to be established that can be estimated from the baseline information.
- Estimate the "future baseline" for condition of the VECs—i.e., the condition of VECs as affected by the other projects, human activities, and natural drivers.
- Estimate the project impact on VEC condition. This estimation is done with the effects of planned project mitigation included.
- Estimate the cumulative impact on VECs—the total impact on the VECs when the impacts of the development are combined with the future baseline.

Note:

- A wide variety of methods have been used for CIA analysis, methods chosen for the analysis should be chosen to be compatible with the information available for the analysis and that can provide, whenever possible, a quantitative estimate of cumulative impact.
- If qualitative estimates of cumulative impact are to be developed, they should be based on the consensus estimate of a panel of experts rather than on the opinion of an individual expert.

4.5 Assess Significance of Anticipated Cumulative Impacts

Task:

- Assess the significance of the foreseen cumulative impacts on the VEC.

Note:

- When the cumulative impact on VEC condition will approach, be near to, or exceed a threshold, the impact is significant.
- The analysis may reveal that significant cumulative impacts will exist without the project.

4.6 Management of Cumulative Impacts — Design and Implementation

Tasks:

- Identify, when necessary, additional project mitigation (beyond that identified in the project ESIA) to reduce an estimated unacceptable cumulative impact on a VEC to an acceptable level (iteration with the tasks described in Sections 4.4 and 4.5 will be necessary to assess the value of such additional mitigation). This should represent effective application of the mitigation hierarchy[16] in environmental and social management of the specific project contributions to the expected cumulative impacts.
- If necessary, identify the potential, or need for, additional mitigation of other existing or reasonably predictable future projects.
- Identify the potential for other regional strategies that could maintain VECs at acceptable conditions.
- Undertake best efforts to engage, enhance, and contribute to a multistakeholder collaborative approach for the implementation of management actions that are beyond the capacity of the project proponent.

4.7 Stakeholder Engagement

Stakeholder engagement[17] is critical to the success of RCIA. Engagement should start early in the process, i.e., in Scoping (Sections 4.1, 4.2) and continue throughout the RCIA process. It will be essential

[16] Defined in Performance Standard 1 as the strategy to first anticipate and avoid impacts on and risks to workers, the environment, and/or affected communities, or minimize impacts and risks where avoidance is not possible. Acceptable options for minimizing will vary; they include abating, rectifying, repairing, and/or restoring. Residual impacts must be compensated for and/or offset. It is important to emphasize that offset is the last resource option that should be used to compensate for residual impacts of a given action or project; it should not be used to manage cumulative impacts on a selected VEC. However, regional offset of cumulative impacts could still be possible a s part of a collaborative CIA mitigation process led by the government or a coalition of developers.

[17] For further guidance, please refer to IFC published documents on good practice and guidance on stakeholder engagement, participatory monitoring, and grievance mechanisms:

to collect the information needed for the RCIA analysis and likely also to secure cooperation in implementation of mitigation of the impacts of other projects, and or identification and design of regional cumulative impact management strategies that may be needed to avoid unacceptable cumulative impacts.

Stakeholder engagement should be designed and implemented to:

- clarify stakeholder roles and responsibilities in the RCIA process, and to
- establish and maintain a constructive relationship with government and other stakeholders.

The second point is essential when additional mitigation is needed for other projects. Engaging in assigning blame for cumulative impacts is likely to be counterproductive. Cumulative impacts are, by their multiparty nature, a collective responsibility and in this regard maintaining a constructive relationship will be essential.

- www.ifc.org/HB-StakeholderEngagement
- www.ifc.org/GPN-Grievance
- http://www1.ifc.org/wps/wcm/connect/topics ext content/ifc external corporate site/ ifc+sustainability/publications/publications gpn socialdimensions wci 1319578072859
- www.ifc.org/HB-WaterFootprint
- http://www1.ifc.org/wps/wcm/connect/topics ext content/ifc external corporate site/ ifc+sustainability/publications/publications handbook doingbetterbusiness wci 1319576642349

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