

Review of World Bank engagement in the Irrigation and Drainage Sector in Azerbaijan

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Glossary

AIOJSC	Amelioration and Irrigation Open Joint Stock Company
AZN	Azerbaijani New Manat (currency)
“the Bank”	The World Bank
CAS	Country Assistance Strategy of The World Bank
CSU	Central Support Unit for WUA
EECA	Eastern Europe and Central Asia Department of The World Bank
ET	Evapo-transpiration
FPP	Farm Privatization Project
GDP	Gross Domestic Product
GoA	Government of Azerbaijan
Ha	Hectare
I&D	Irrigation and Drainage
IDSMP	Irrigation Distribution System and Management Improvement Project
IFAD	International Fund for Agricultural Development
IFI	International Financial Institutions
IIF	Irrigation Improvement Fund
IMA	Irrigation Management Audit
IMT	Irrigation Management Transfer
IPCC	Inter-governmental Panel on Climate Change
ISF	Irrigation Service Fee
ISP	Irrigation Service Plan
IWRM	Integrated Water Resources Management
Km ²	Square kilometers
LAI	Law on Amelioration and Irrigation
M ³	cubic meters
M&E	Monitoring and Evaluation
O&M	Operations and Maintenance
On-farm	Level of former state or collective farm, which is now often the level of the WUA
PIU	Project Implementation Unit
R&D	Research and Development
Raion	District Government
RID	Raion Irrigation Departments
RIDIP	Rehabilitation and Completion of Irrigation and Drainage Infrastructure Project
RSC	Regional Support Centers
RSU	Raion Support Unit for WUA
SAIC	State Amelioration and Irrigation Committee
SSB	State Supervisory Body
State Program	State Program for Sustainable Development of Amelioration and Water Management for 2008 - 2015
t/ha	Metric tons per hectare
USD	United States Dollars
WTP	Water Users Association Training Plan
WUA	Water Users Association(s)
WUAP	Water Users Association Development Support Project
WSF	Water Users Association Support Fund
WUA Union	Federation or network of Water Users Associations

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Preface and acknowledgements

This Sector Review has been prepared to provide key background information and guidance on medium- and long term development priorities of the irrigation and drainage sector in Azerbaijan, possible innovations and potential areas of financing by the World Bank and other international financing institutions (IFIs). The main audience for this review are irrigation and drainage professionals, rural development specialists, and policy makers in Azerbaijan, World Bank sector and country unit staff and other IFIs and agencies providing assistance to the development of the sector. The review also guides the implementation of the World Bank-financed Water Users' Association Development Support Project (WUAP), which became effective in December 2012 and closes in 2016 as it provides the background for further studies which can be developed with the framework of the WUAP.

The report has been developed under the overall guidance of regional management and the direction of Dina Umali-Deininger, Sector Manager Agriculture in ECA by a task team led by David Meerbach, Senior Water Resources Specialist. The sector review has been written by Douglas Vermillion, Irrigation Institutional Specialist with contributions from Sam Johnson, Water Users Associations Specialist . Internal stakeholders from the Amelioration and Irrigation Open Joint Stock Company and the Project Implementation Unit for the World Bank-financed Irrigation Distribution System and Management Improvement Project and the Water Users Association Development Support Project provided extensive comments. Peer reviewers of report are Joop Stoutjesdijk, Lead Irrigation Engineer, and Susanne Scheierling, Senior Irrigation Water Economist. The team would like to thank all involved for contributing to this sector review.

Chapter 1: Introduction

1.1 Agriculture Today and its Importance

1. Azerbaijan has a population of 8.5 million people, of which about 40% are engaged in agriculture. Thirty-nine percent of its land is in plains and lowlands, 11% is covered by forests and 18% of Azerbaijan is below sea level. Although there are nine sub-climatic zones in Azerbaijan most are within an arid and semi arid landscape. Azerbaijan has 86,600,000 sq. km, of which 55% is arable. 2.9 million ha is under perennials, gardens, vineyards, saplings, tea plantations, pastures and grasslands. 1.8 million ha is cultivated with seasonal crops, of which 1.43 million ha is generally under irrigation. 90% of agricultural yield is produced on irrigated land. During summer water demand for crops such as cotton averages 750 mm. However, due to the hot dry conditions crop water evapo-transpiration (ET) soars, whereas annual precipitation is very low, if not zero. During summer irrigation is essential for profitable agriculture.

2. Table 1 below shows the number of irrigations per season and seasonal irrigation requirements for eight of the main crops in Azerbaijan. The highest water consuming crops are beets and alfalfa (for fodder). The lowest water consuming crop, but the most profitable, is grapes. The irrigation requirements for staple crops like wheat, barley and corn are moderate and with a need for about 4 irrigations per season.

Table 1 Seasonal Recommended Irrigations and Irrigation Requirements for Main Crops

Name of Crop	Recommended Number of Irrigations Per Season	Irrigation Requirement m3/ha*
1. Barley & wheat	4	3,000 – 3,500
2. Beets	6 – 7	5,000 – 6,000
3. Corn	4 – 5	4,000 – 4,500
4. Cotton	4 – 5	4,500 – 5,000
5. Lucerne (= Alfalfa)	7 – 8	7,000 – 8,000
6. Grapes	2 – 3	2,000 – 2,500
7. Tobacco	4 – 5	4,000 – 4,500
8. Vegetables (Tomato)	4 – 5	4,000 – 5,000

Source: WUAP PIU, 2012. m3/ha=cubic meters per hectare.

3. Azerbaijan has adopted a number of reforms since the collapse of the Soviet Union, including transition to a market economy, privatization of state and collective farms, and establishment of Water Users Associations (WUA) for on-farm systems¹. In the 1990's the incidence of poverty in Azerbaijan was 46.7%. With the numerous reforms in the country the incidence of poverty became only 13.2% by 2008. Between 2003 and 2009 the growth rate of the agricultural sector has been at a satisfactory rate, between 3 and 6%. Poverty in rural areas is 15.7%, whereas in urban areas it is 10.8%.

4. As shown in Figure 1 below, agriculture only provides about 7% of GDP (compared to 53% for oil), but it is the largest employer. Since 40% of the population is employed in agriculture in rural areas agriculture is an important sector to develop in order to reduce poverty significantly. The vast majority of production is done on small private landholdings, including not just wheat, cotton and other seasonal crops, but also high-value fruits and vegetables.

¹ On-farm systems are the level at which former state or collective farms were established and at which WUA are now established. They are commonly at the secondary canal level. Off-farm systems are at hydrologic levels above that of on-farm systems.

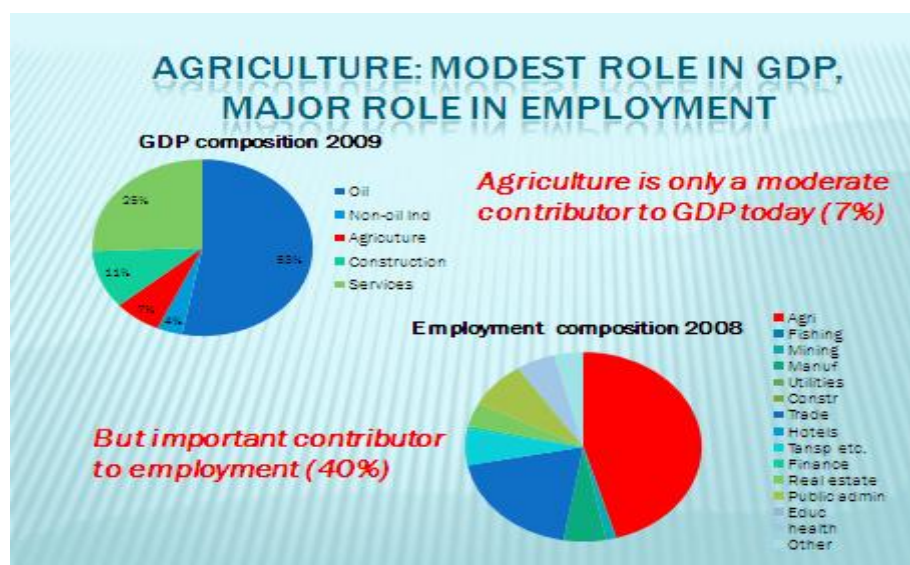


Figure 1. Agriculture: Modest Role in GDP, Major Role in Employment

5. In Azerbaijan today, most productive arable land has been converted to private ownership, although pasture land remains communal in some places. There are a lot of small, fragmented holdings of subsistence and family farms with low productivity, especially in the plains. But there is a high degree of diversification across the country, with fruits (orchards including apples, pears, cherries, and some citrus), vineyards, vegetables, cereals, forage, corn and tea all being grown in different areas. There is also a dairy industry and sheep raising.

6. As shown in Table 2 below, wheat yields in the country are low, only 2 to 2.5 tons per ha (compared to 6 t/ha in Mexico and China). Costs of production average about AZN 250 per ha and without the Government's subsidy of AZN 80 per ha farmers would not make a profit from it. In Azerbaijan's arid climate irrigation is essential, especially for higher value crops such as fruits and vegetables. Unless agriculture for the main seasonal crops becomes more productive and profitable farmers will not be able to pay fully for the cost of irrigation. The main impediments to higher crop yields are poor application of water, poor quality seeds, sub-optimal cultivation practices and inadequate fertilizer.

Table 2. Wheat Yields in Various Raions (2009 data)

Raion	WUA	ISF (AZN/1000 m3)	Wheat (t/ha)	Price (AZN/t)
Imisli	Jafarly	3.0	2.0-2.5	120
Zardab	Golma	1.6	2.3-2.5	150
Ucar	Gazigumlaq	1.75	1.5-2.0	100-120
Kurdamir	Khimisli	1.0	1.4-2.0	150
Kachmaz	Qimilqishlaq	5.07	2.5	150
Shabran	Daveci	1.82	1.5-2.5	100
Siyazen	Siyazen	2.0	1.8-2.5	100-120

AZN 0.80=\$1.00, t/ha = tons per hectare

7. At 1.9 tons per ha, cotton yields are also poor, and as a result, cotton area has declined significantly. In the Ucar Raion the area planted in cotton has declined from 5,000 ha to less than 500 ha. For rainfed wheat these yields would be acceptable but for irrigated wheat these yields are less than half of what could be obtained. In fact, wheat yields per ha are so low that the Government has to pay a subsidy of AZN 80/ha to encourage farmers to produce wheat. Inputs and agricultural machinery services have a 70% subsidy.

8. In order to make wheat and other crops more economically productive for farmers and to enable transitions from low value to higher value crops, with high-value crop processing, farmers need agricultural extension, modern inputs, improved seeds, access to credit and better water management. Agriculture provides food security in an increasingly turbulent climate of extreme weather conditions and, if developed properly, it can provide significant potential for increased exports and import substitution.

1.2 Water, Irrigation and Drainage, and their Importance

9. The average annual supply of surface water resources is 32.2 billion m³, but this varies to as low as 22.6 billion in drought years. Significantly, 70% of surface water comes from outside the country, from Russia, Georgia, Armenia, Turkey and Iran. Renewable groundwater resources are 5.2 billion m³. The mean annual water storage is 5 billion m³. There are 135 water reservoirs with a total storage capacity of 22 billion m³. Average water supplied annually by the Kura River ranges between 10 and 12.2 km³. The amount from the Aras River basin ranges between 7 and 9.4 km³. Water supplied by the Samur River ranges between 0.8 and 1.1 km³. Water resources from Lankaran area rivers range between 0.7 and 1.2 km³ annually.

10. Annual abstraction from water resources in Azerbaijan is about 10 to 12 billion m³, of which approximately 67% is allocated for irrigation. 20 to 25% is used for industry and the rest is for domestic water use. Until the present no water is officially allocated for environmental uses, such as flushing soils to reduce salinity or for allocating water to wetlands.

11. In Azerbaijan effective irrigation and drainage and water resources management is fundamental to ensuring economic development is sustainable. While irrigation takes 75% of water resources utilized, it is becoming increasingly in competition with municipal and rural water supply, industry, transport, energy, fisheries and environmental needs. Total water supplies are sufficient at present, but water scarcity is likely to rise in the future, and both drought and flooding occur in different regions of Azerbaijan, fluctuating significantly from year to year. Due to widespread and severe deterioration of irrigation systems there are high water losses and water distribution is inefficient. Water management problems contribute to poverty. Salinity, drought, water-logging and pollution suppress crop yields, contaminate drinking water and damage infrastructure and homes.

12. Because of poor drainage in many areas, the limited and unequal distribution of water resources in the country has caused saline soils. This has motivated development of extensive irrigation and drainage networks during the 20th century. Salinity is the result of both over-irrigation and a lack of drainage. Rising groundwater tables deposit leached salts in the root zone. Table 3 below shows the extent of salination. An area of 930,000 ha is effected by salinization, of which 319,000 ha is severe. Around 1,270,000 ha have some drainage system, of which 307,000 ha is in unsatisfactory condition.

Table 3 Extent of salinity in irrigated areas

Salinity of Irrigated Area:	Area (ha)
Non-saline	564,700
Slightly saline	406,300
Moderately saline	292,300
Strongly saline	477,600
Very strongly saline	319,000
Total	1,495,200

Source: Azerbaijan Geological Atlas, 2011.

13. Integrated and effective irrigation and drainage management will increase economic development. Future water resources development will involve building storage capacity with more reservoirs; developing additional legislation, regulations and guidelines; developing information management systems; managing river basins and irrigation systems with stakeholder participation; monitoring and regulating water use and water quality, and regulating the sector. In recent years many institutional changes have been underway in different sub-sectors of the water sector. The most notable change has been the development of water users associations (WUAs), which is a long-term challenge requiring support services and an engaged partnership with the Government.

14. Information obtained from field interviews and inspections under the Rehabilitation and Completion of Irrigation and Drainage Infrastructure Project (RIDIP) and the Irrigation Distribution System and Management Improvement Project (IDSMIP) showed that the cost of irrigation water, in accordance with irrigation fees then in operation, constituted only 1% of the cost of production for vegetables and potatoes, 3% of the cost of production for cotton and winter cereals, 4% for fruit crops and 6% for alfalfa. These are significantly below both the actual cost of irrigation and the international average costs of irrigation to farmers relative to cost of production. It is expected that efforts will be made under the Water Users Association Development Support Project (WUAP) to move towards a more needs-based budgeting and setting of service fees.

15. The Government's top priority for the irrigation and drainage sector is to rehabilitate dilapidated irrigation and drainage systems and to do it at a minimal cost to the users while increasing the sustainability of the sector. However, operations and maintenance (O&M) of on-farm irrigation sub-systems is heavily subsidized by the Government. It remains to be seen to what extent the Government will move toward self-financed, self-reliant WUA and irrigation management transfer. Development of long-term arrangements to provide needed support services to WUA from both the public and private sectors are also needed. The value added by the Bank lies mostly in providing the knowledge and expertise in irrigation sector reform, the creation of learning processes, and bringing to the country top quality international expertise, together with some external financing to get needed innovations underway.

1.3 Purpose of this Sector Review and Content of Chapters

16. The objectives of this Sector Review are to:

- 1) Describe key conditions and challenges that the irrigation and drainage sector of Azerbaijan is facing today and will face tomorrow, and

- 2) Identify priorities for investments that the Bank and Government of Azerbaijan could make in order to find solutions for the major challenges that Azerbaijan is facing and will face over the next ten years in its irrigation and drainage (I&D) sector.

17. This Sector Review is written to provide essential background information and to give guidance towards a strategy for irrigation and drainage for the World Bank and the Government of Azerbaijan. The main audience for this review are World Bank sector and country unit staff, irrigation and drainage professionals, rural development specialists, and policy makers in Azerbaijan, and other IFIs and agencies providing assistance to the development of the sector.

18. The Sector Review includes seven chapters and one annex. This first chapter is an overview of agriculture, irrigation and the purpose and content of this report. The second chapter provides a review of the Bank's own strategy and priorities for irrigation and drainage within its portfolio of investments, from the time of its 2004 Strategy until the present. It also includes a short summary of key lessons learned in this sector. The third chapter provides a brief situation analysis for irrigation and drainage in Azerbaijan, including a description of key parameters and changes; a description of rising challenges, needs and opportunities; and an overview of the Government's State Program (SP) for Sustainable Development of Amelioration and Water Management for 2008-2015.

19. The fourth chapter describes the issues of investment and financing of irrigation and drainage priorities for infrastructure development, rehabilitation and modernization, and management. This includes investment priorities for the Government as well as needs for cost recovery by water users for the cost of irrigation and drainage system operations and maintenance. The fifth chapter describes the institutional framework and how it has emerged since independence. It also identifies outstanding issues for further institutional development, both for the Government and for water users associations (WUA). The sixth chapter describes the implications of climate change for the vulnerable irrigation and drainage sector in Azerbaijan. Suggestions are provided for a process to prepare an adaptation strategy for climate change. The seventh chapter identifies 10 key priorities for investments in the irrigation and drainage sector in Azerbaijan. These priorities are based on the views of staff of the World Bank, staff of the AIOJSC (Amelioration and Irrigation Open Joint Stock Company), selected consultants and the author.

Chapter 2: Framework for World Bank Corporate Priorities and Strategy for Irrigation and Drainage and Lessons Learned Internationally

2.1 Priorities and Strategy of The World Bank

20. As elaborated in the 2004 Water Resources Sector Strategy, and as is still the case today, the Bank's criteria for prioritizing its investments include the following:

- (1.) The potential for the investment to reduce poverty;
- (2.) The compatibility of the investment with the client government's priorities;
- (3.) Aspects of the sector needing innovation and international expertise;
- (4.) Investments that contribute to institutional reform and capacity building;
- (5.) Investments that contribute to environmental, financial and institutional sustainability;
- (6.) Increase productivity of water and infrastructure.

21. The above criteria are still relevant to the Bank but the Mid-Cycle Implementation Progress Report for the Water Resources Sector Strategy (2010a) has updated the Bank's criteria to take a more integrated approach to its investments by linking water services more closely to water resources. This means that investments in irrigation will be integrated with improvements in water productivity. Efforts for both mitigating and adapting to increasing climate variability have become key criteria for Bank investments. Hydropower and reservoir projects are gaining increased priority as renewable and low-carbon energy approaches. The Bank will give more attention to both increasing irrigated areas, where possible, and improving water use efficiency.

22. The aim of the Water Resources Sector Strategy has been to provide "strategic directions for World Bank engagement" with its clients. This was motivated by the challenges facing many developing countries as their rising needs for municipal and rural water supplies, water for industry and hydropower, irrigation and environmental uses led to increasing competition for water, deteriorating water quality and related environmental and social problems. These are in the contexts of frequent floods and droughts and bureaucratic fragmentation across many agencies and ministries that are related to water but not to each other in any kind of integrated management framework. This situation is made even more challenging by the fact that 70% of Azerbaijan's water comes from outside the country.

23. The Bank's Sector Strategy included seven main messages. The first is that both the development and management of water resources are essential for poverty reduction and sustainable growth of the economy. The second message follows from the first in that most developing countries need to implement both development and management of water resources infrastructure. Previous investments by the Bank emphasized development of infrastructure while under-emphasizing improvements and innovations in management. Azerbaijan is already underway in implementing rehabilitation and modernization of its deteriorating water infrastructure while also adopting institutional and managerial reforms. Irrigation and drainage systems cannot be fully productive and sustainable with attention given only to rehabilitation and modernization of infrastructure. Development of institutions, financial management, management capacities and support services are also essential. The Bank has been working with AIOJSC to increase their appreciation of the importance of all these essential aspects of an effective I&D sector.

24. The third message of the Strategy was that the main management challenge was to develop pragmatic strategies for water management for client countries that are feasible, if incremental. During the years since the Bank's Strategy was adopted, it has become apparent to all that Integrated Water Resources Management (IWRM) requires resolution of conflicts or competition among different stakeholders and involves a process of optimization amongst trade-offs. It is correct that the strategies are oriented towards principles of Integrated Water Resources Management (IWRM), such as integration,

holism, sustainability, productivity of water, efficiency and equity. But the strategies need not be held hostage to an unrealistic requirement that the entire IWRM framework be applied all at once. Attempts to create effective integrated water resources management (IWRM) institutions in recent years have shown that the changes are too complex to be made in the short term.

25. The Strategy's fourth message is that the Bank will assist countries to develop and maintain their appropriate inventories of hydraulic infrastructure while mobilizing public and private-sector financing, technical expertise and institutional support for their management, all of which are subject to meeting environmental and social standards. This is underway in the Bank's previous projects in I&D in Azerbaijan but there is still a considerable way to go. The fifth message is that, given the rising demands of clients in complex and challenging environments, the Bank will re-engage itself in investments in high reward/high risk infrastructure development and management, but with an added emphasis on key business principles. Such principles will include assessments of impacts of engagement and non-engagement by the Bank, assessment of the rights and risks for stakeholders of such investments (thereby treating such investments as "corporate" projects from the beginning), reward staff that engage in these projects, and having transparent, timely and accountable decision making.

26. The sixth message is that it is right for the Bank to respond positively to rising demands for the Bank's engagement in water resources management. Many clients consider that the Bank has a comparative advantage in water sector development and management because of its experience, its capacities to draw upon international expertise, its status and its ability to increase legitimacy in a politically sensitive context. The seventh message was that it is advisable that the Bank's assistance for water resources management be designed to fit within the government's priorities and circumstances and the Bank's Country Assistance Strategy (CAS), Poverty Reduction Strategy and the Water Resources Sector Strategy. Each of these messages is still relevant to the Bank's intentions and envisioned modalities in Azerbaijan.

27. The Bank's main priority overall is to invest in projects that will reduce poverty. Since 40% of Azerbaijan's work force is in agriculture, which includes most of the country's poor, irrigation and drainage play a prominent role in poverty reduction through expanding the area cultivated, intensifying agricultural production, employing more people and increasing farm income.

28. The Bank is also concerned with sustainability, in a broad sense—environmental, technical, financial, institutional and economic. Bank investments are likely to move towards locally sustainable irrigation and drainage system infrastructure, sustainable local management of irrigation and drainage systems and their sustainable financial management. The multifaceted parameters for making irrigation and drainage systems become sustainable are well known. So it is mainly a challenge of developing and implementing a strategy that is appropriate for suitable application of such parameters within a country.

29. The Bank places priority on those aspects that need innovation in technology, methods and procedures and need international expertise. Client governments recognize that the Bank has a comparative advantage for providing these elements. Also, institutional reform and capacity building are elements where the Bank has the advantage of drawing in the best of international expertise. The Bank wants to support Government priorities insofar as these are generally compatible with Bank priorities.

2.2 International Lessons Learned for Irrigation and Drainage

30. Over the past two decades the Bank has supported I&D development, reform and building management and financial capacities in many developing countries. A number of lessons have been learned about this, including those that follow. Participatory design and construction that enables inclusion of farmers' opinions and local knowledge into the decision-making process during rehabilitation and modernization builds a sense of ownership and responsibility among farmers. Hydraulic boundaries,

not administrative boundaries, are generally the best boundaries for the governance and management of irrigation systems. They also serve to help local governments realize the independent and focused nature of irrigation systems.

31. For participatory irrigation management, it is important that WUAs have officers selected by water users and the associations will adopt basic policies, constitutions, by-laws, O&M Plans or Irrigation Service Plans (ISP), service fees, etc. only with the authorization of water users. WUA need to “govern”. This means that they have adopted a structure and process for governing I&D systems. Governance includes defining what services will be provided, who will provide them and under what terms, fees and methods they will be paid for. WUAs need long-term capacity building and discrete regulation (not direct supervision) by a government agency. Irrigation service fees would be based on the actual and unique cost of managing each irrigation system. Identifying this cost serves to reveal to all water users the actual cost of an irrigation system so that meaningful decisions can be made that lead to efficiency and sustainable infrastructure and management systems. Finally, it is recommended that subsidies to WUA be designed so as to stimulate WUA investment, rather than to discourage it and thereby create dependency. It is in the interest of the Bank to implement projects that adopt these lessons learned.

32. In line with the 2006 Bank strategy for agricultural water management and the EECA report on adapting to climate change, at present the Bank has the following set of priorities for its assistance to the I&D subsector²:

- (1.) Increase the productivity of water and infrastructure;
- (2.) Have a realistic, sequenced approach to cost recovery;
- (3.) Scale up WUAs and ensure they represent all users;
- (4.) Modernize irrigation technology, institutions and management;
- (5.) Increase investment for on-farm drainage, reduction of soil salinity, water savings and flood mitigation;
- (6.) Develop WUA support services;
- (7.) Link improved irrigation systems to modern agricultural technologies;
- (8.) Help I&D enable agriculture to become competitive in international markets;
- (9.) Do research on adaptation to climate change and other priority issues related to enhancing efficiency, effectiveness and sustainability of management of I&D systems.

33. When the Bank invests in the I&D subsector, it generally holds to the following principles in its interactions with clients. First, it balances infrastructure development with the building of management capacities, both those in water users associations, in government agencies and among providers of support services. Second, it emphasizes stakeholder consultations before and during implementation of Bank projects. This is to obtain direct inputs from stakeholders about their needs, local knowledge, assessments and recommendations. Third, the Bank supports making needed innovations and links them with changes in policy and strategy. Fourth, the Bank wishes to build capacity in all aspects of project preparation, implementation and innovation. This may include building capacity in project design and planning, policy-making and strategy, monitoring and regulation, training and so on.

34. The Bank’s current CAS for Azerbaijan places a prominent role for development and management of Azerbaijan’s irrigation and drainage infrastructure because of its importance for employment, farm income and poverty reduction. It also emphasizes the principle of competitiveness of the non-oil sectors. Irrigation and drainage has an important role to play in order to make agriculture become more competitive and to promote employment and income. The recent Bank project, Irrigation Distribution Systems and Management Improvement Project (IDSMIP), has been seen by the Bank and

² See World Bank, Reengaging in Agricultural Water Management (2006) and World Bank, Adapting to Climate Change in Eastern Europe and Central Asia (2010).

the Government as being one of the Bank's most successful projects in Azerbaijan. The rehabilitation and modernization of Azerbaijan's hydraulic infrastructure is a high priority for the Government and it seeks the assistance of the World Bank to support it in addressing this large challenge, especially for those aspects that involve modernization and innovation, both for hardware and "software". These require international expertise that the Bank is well suited to mobilize.

35. The Bank's approach to its clients is one of mutual consultation and negotiated agreements. It considers stakeholder consultations to be important, in order to both understand their needs and recommendations and to build public awareness and support for development programs. Sector policy and strategy are also important to the Bank in that they clarify and legitimize priorities and modalities (the what and how) for the Government. These provide the basis for justifying innovations in technology, management, and institutions. In its work in irrigation and drainage, the Bank intends to balance its support for infrastructure development with capacity building for institutions and management. And in all its work with its clients, the Bank intends to build capacity among client organizations in all aspects of project preparation, implementation and innovation.

Chapter 3: Irrigation and Drainage in Azerbaijan

3.1 Current State of Irrigation and Drainage

36. The total irrigated area in Azerbaijan was 550,000 ha in 1913. This increased to 1.43 million ha by 2010. The country has over 51,755 km of irrigation canals, of which 2,184 km is main canals, 8,014 km is off-farm canals and 41,557 km is on-farm canals. Over one-third of the irrigated area, or 565,000 ha, is irrigated through 931 pump stations, many of which are located along the Kura and Aras rivers. 349,000 ha is served by electrical pumps, 68,000 ha is irrigated with diesel pumps and 148,000 ha is irrigated from 7,352 sub-artesian wells. Some pumping is used for drainage. There are about 118,000 hydraulic structures of various types around the country.

37. There are 29,640 km of collector-drainage networks, both off-farm and on-farm. These provide drainage for 609,000 ha, which is about 45% of irrigated lands. 288,000 ha has open drains (46% of area), 308,000 ha has closed drains (53% of area) and 13,000 ha has vertical drainage facilities. Out of 1,257,048 irrigated ha there are 566,914 ha served by on-farm drains. Drainage water flows to the Caspian Sea through three main collectors, the Main Mil-Mugan, Main Shirvan and Mugan-Salyan collectors. On low-lying land along the Kura and Aras Rivers, on-farm drains are very large and require machinery beyond the capacity of WUAs to purchase. Cleaning these drains is essential for sustainable WUAs, but this is too large a task for most WUAs. The AIOJSC recognizes this and is committed to supporting WUAs by doing maintenance of on-farm drains.

38. Sixty-five percent of the irrigated area is irrigated by surface or gravity flow irrigation, and 35% with lift irrigation. About 55% of the irrigated area has no drainage systems. At the on-farm level 72% of the estimated total canal length is earthen. Only 10% is lined. In 2003, 152,000 ha was irrigated with pressurized irrigation, most of which used sprinklers.³ Nation-wide the percentage of irrigation command area that is actually irrigated varies from 67% in Lenkeran to 97% in Shaki-Zagatala and Shirvan.

39. Of all I&D infrastructure approximately 50% is in a poor state of deterioration and is in urgent need of rehabilitation and/or modernization. Over 450 on-farm systems serving more than one million ha require rehabilitation. Rehabilitation of on-farm systems is the Government's top priority for the I&D sector. Only about 25% of irrigated land has adequate access to irrigation water. Projected investments for on-farm irrigation will not meet the needs to rehabilitate the remaining one million ha, the projected cost of which is \$900 million USD. In 2001 it was found that 15% of irrigated farmland had poor or no access to water, 41% had access with difficulty and only 25.8% of farmland had good access to water.

40. Over the last decade investments in I&D included rehabilitation, expansion of irrigation and drainage networks, organization of WUAs, improvement of O&M, capacity building and support services for WUAs. At the off-farm level it has included rehabilitation of higher-level hydraulic infrastructure. The largest increase in allocations for public funds will be for desilting; chutes, lined canals and pipelines; and for purchasing and maintaining machinery and equipment. These expenditures are estimated to increase by over 1,000% during this period.

41. During this time there has been a parallel increase in public spending for irrigation and drainage and an increase in the value of agricultural production. In 2006 the total amount of public expenditures for I&D was AZN 76,788,361. By 2010 this had increased to AZN 240,473,902—an increase of over more than 313% since 2006. By 2013 it is projected to rise to AZN 521,813,790, with significant funding coming from the State Oil Fund. Between 2006 and 2013 it is projected by AIOJSC that its expenditures for use of State Funds will increase from AZN 13,629,000 in 2006 to AZN 73,411,000 in 2013, an increase of 539%. Between 2000 and 2008 the total area sown in Azerbaijan increased from 1,041,000 ha to 1,500,000, an increase of 44%. During the same period average yields of cereals increased from 2.38

³ Area served with pressurized irrigation has surely increased since 2003, but recent data is not yet available.

tons per ha to 2.79, an increase of 17%. During this same period the average value of crop production per unit of water used increased from 0.16 AZN/m³ to 0.20 AZN/m³, an increase of 25%. (Data from State Statistical Committee.)

42. The value of crop production increased in parallel with increases in unit costs of cement, other materials and equipment for rehabilitation and maintenance of irrigation and drainage systems. Annual inflation in costs of construction materials reached a peak of 20.8% in 2008. Hence, during IDSMIP the cost of rehabilitation per hectare rose from \$300/ha during appraisal to an average of \$460/ha during the project.

43. But rehabilitation and modernization alone will not solve the sector's problems. Given poor drainage, salinization of soils and flooding, there is clearly a need to rehabilitate and expand drainage networks and perform more rigorous O&M of existing irrigation and drainage systems. There is also a need for more flood protection and water storage facilities.

44. The approximate cost of on-farm irrigation is estimated to be \$40-50 USD per hectare for the costs of maintenance and repairs and labor costs of field agents to distribute water. This needs to be assessed in greater detail. Current WUA irrigation service fee (ISF) collected for on-farm water management, operation and maintenance are only about 10% of the estimated amount needed for optimal O&M. There is a high priority need for WUAs to increase their Irrigation Service Fees (ISF) to the point of achieving full cost recovery, which is essential for WUA and irrigation systems to become sustainable. WUAs need to have offices, equipment such as excavators, training and support services. The Government needs to develop the capacity of the newly-formed State Supervisory Board to regulate WUA. And it needs to develop the capacity of the Central and Raion Support Units to identify support services and capacity building needed by the WUA.

45. Irrigated agriculture is the main source of income for the rural poor. It provides not only food security but has considerable untapped potential for export income and substitution of imports. With improvements in management performance of irrigation systems, new technology in some areas (such as drip and sprinkler irrigation), and expansion of drainage areas where water-logging and salinization of soils are threats, the physical and economic productivity of agriculture could flourish. IDSMIP showed that rehabilitation of on-farm irrigation and drainage would bring about a 23% increase in yields and an increase of 5,200 ha in rehabilitated irrigated area, with an economic rate of return for investments in irrigation and drainage rehabilitation of 25%. The investments also led to reductions in salinity and water-logging in project areas. This has been accompanied with shifts to higher value crops. Farmers have shown a willingness to pay more for the cost of the irrigation service—if it is reliable and results in a shift to higher-value crops. Payment for and implementation of full O&M will make results of rehabilitation and modernization both profitable and sustainable.

46. Salinity. Salinity is a serious problem in Azerbaijan. Between 2005 and 2009 Azerbaijani research institutes found that the area of salinized land was very extensive. The area of slightly salinized land is about 406,000 ha. The area of moderately salinized is 292,000 ha, while the area of strongly salinized land was about 480,000 ha and the area of very strongly salinized land was about 320,000 ha. The two main causes of salinization are the relatively high elevation of the Caspian Sea, which restricts drainage from the Kura-Aras plain. Too much irrigation water raises the groundwater table and with poor drainage salts are not well leached from the soils. Also, the common clay content of soils promotes salinity due to the low permeability and restricted effect of rainfall on leaching soils.

47. Reclamation of salinized soils is increasingly becoming in the interest of the Government and the private sector in Azerbaijan, since a significant area of salinized land are government owned, contiguous tracts which are suitable for large-scale commercial agriculture. In order to reclaim lands from salinization, is likely to require soil tillage to increase infiltration rates, periodic leaching of soils by irrigation, a 2 to 3 year period of growing deep rooted crops, such as fodder and wheat, to improve sub-surface soil structures, and improved drainage. The estimated cost for drainage of salinized lands, based

on experience with Bank projects, would be approximately US\$ 1,500-2,000 per hectare, plus the equivalent cost of additional irrigation infrastructure, which makes the total cost about US\$ 3,000-4,000 per hectare. As part of the studies conducted under the Water Users' Association Development Support Project, an analysis and review of existing knowledge about salinity in Azerbaijan and experience with reclamation is planned, in order to compare this with international experience with reclamation, design a reclamation pilot project and draft terms of reference for further feasibility studies and a pilot project.

3.2 Rising Challenges, Needs and Opportunities

48. Azerbaijan faces a massive need for rehabilitation and modernization of its irrigation and drainage infrastructure. This includes main, secondary and on-farm canals, gates, chutes, drop structures, hydro-posts, and so on. Either before or after rehabilitation, on-farm schemes would be transferred to WUA for management and financing.

49. At least 50% of drainage infrastructure needs restorative cleaning and rehabilitation and there is a substantial need for expansion of the drainage area in order to minimize salinity and avoid interference with crop production due to water-logging. Cleaning drains is essential but this is too large a task for most WUAs. At least in the near term, it is expected that AIOJSC will take responsibility to maintain on-farm drains. However, this requires a dedicated AIOJSC budget sufficient for the task. This has not yet materialized.

50. The country frequently experiences extensive flooding (as was the case in June 2010) in rainy season and drought in the dry season. The occurrence of both conditions may be increasing in severity and frequency due to climate change. Azerbaijan intends to build more storage reservoirs over the next decade to help store water to prevent flooding and to use it to irrigate crops in the dry season.

51. It is apparent that the country needs to develop capacities at the national and regional levels to monitor and respond quickly to dynamic water resource conditions in the management of reservoirs and canal systems. There is also a need to monitor the functional condition of I&D infrastructure and its management performance. A key challenge for the sustainability of I&D is for WUA to be assisted to achieve full cost recovery according to the actual cost of O&M and management of each individual system. This will require improvements in the performance of irrigation services, collection of irrigation service fees (ISF) based on the actual cost of irrigation. It will also depend in large part on an increasing trend in the economic productivity of agriculture, through increases in crop yields, changes to high-value crops, introduction of value-added processing activities and better marketing.

52. In the future, as WUA become more financially solvent and stable, there will be a need for WUA to federate to form Unions of multiple WUA at the inter-farm or secondary canal level. WUAP will support building the capacity of WUA to prepare irrigation service plans, budgets and fees based on actual costs and standards for satisfactory irrigation system management. It will also support training, building support services and providing funds to assist WUA to obtain offices and equipment.

53. As can be seen in Chapter 6, climate change is an emerging issue of importance. Azerbaijan is particularly vulnerable to the likely effects of climate change on its water and agriculture sectors, especially because of its pronounced dry period and flooding. This vulnerability is made still greater by the fact that Azerbaijan receives 70% of its water supply from neighboring countries. It is both important and urgent that Azerbaijan prepares a climate change adaptation strategy for its irrigation and drainage sector.

3.3 Recent Initiatives

54. The World Bank has financed three projects so far that have benefitted the I&D sector in Azerbaijan. The Farm Privatization Project (FPP) led and helped shape the process of privatization of state and collective farms. It also involved rehabilitation, pilot transfer of management to water users associations (WUA) and introduction of a new irrigation service fee. In the process of implementing FPP it became apparent that there was a need to have WUA with a non-profit status based on hydraulic boundaries. FPP was followed by the RIDIP, which had a focus on rehabilitation and completion of major off-farm conveyance canals, structures and collector drains. One of the lessons learned from RIDIP was the importance of keeping a Bank-assisted project simple and well-focused and that the design of higher-level infrastructure are consistent with lower-level needs and capacities.



Photograph 1. Rehabilitation of I&D Infrastructure

53. The Irrigation Distribution System and Management Improvement Project (IDSMIP) started in 2004 and had two main components: 1) institutional development of WUA at the on-farm level and 2) rehabilitation at the on-farm level. These were supplemented with an urgent need to rehabilitate the Bahrantape headworks. In 2004 IDSMIP facilitated development of the amended Law on Amelioration and Irrigation (LAI) and re-registering of 207 WUAs in 11 raions. In 2007 participatory rehabilitation of irrigation at the on-farm level was started under IDSMIP. This engaged WUA in a process of consultations and inputs regarding rehabilitation priorities and approvals. 53,000 ha was developed this way. Key results were that these interventions brought about an average increase of 23% in yields, an increase in more than 5,200 ha in irrigated area, and shifts to higher-value crops, such as fruits and

vegetables. The economic rate of return on the IDSMIP investment has been 25%. This confirmed the principle that both components (i.e., infrastructure and institutions) were a necessary and powerful combination. IDSMIP also demonstrated that Irrigation Management Transfer (IMT) is feasible but capacity building and support services for WUAs would be needed for the long term. Also, IDSMIP has shown that productive agriculture and needs-based budgeting are both necessary for full cost recovery to be achieved at the on-farm level. IDSMIP has been followed up by the Water Users Association Development Support Project (US\$140 million), which became effective in December 2011 and will close in 2016. This project will continue the capacity building of WUAs and the rehabilitation of around 80,000 ha of on-farm irrigation schemes, and also includes a sub-component on further research and studies on institutional capacity building in the irrigation and drainage sector.

3.4 State Program (SP) for Sustainable Development of Amelioration and Water Management for 2008-2015

55. The State Program for Sustainable Development of Amelioration and Water Management for 2008-2015, or “State Program”, was issued in February 2006 with the purpose of identifying priorities for development of irrigation and drainage systems in the country from 2008 to 2015. Azerbaijan had been facing major challenges for which sufficient funding and action had not yet been taken. The needs for rehabilitation and development of irrigation and drainage systems, improving management of systems and the sector, improving the ameliorative condition of irrigated lands, flood mitigation, riverbed adjustments and bank protection, and improvement of the scientific and technical basis and human capacities for management of irrigation and drainage systems—were all urgent and important but were not being done fast enough.

56. But with recent improvements in the economy, adoption of the State Program on Poverty Reduction and Sustainable Development in Azerbaijan (2006-2015) in 2005 (which contained aspects for development and improved management of irrigation and drainage systems), issuances of several legal documents for the water sector, increases in the State Budget allocations for the irrigation and drainage sector, an agreement to obtain substantial funding from the State Oil Fund, the Government found it to be timely to adopt the State Program for Sustainable Development of Amelioration and Water Management for 2008 - 2015.

57. The State Program includes 11 priorities for investment from 2008 to 2015. These are listed as follows:

- Priority 1: Rehabilitation & modernization of I&D infrastructure
- Priority 2: Improving protection & maintenance of I&D infrastructure
- Priority 3: Amelioration of irrigable lands
- Priority 4: Expansion of irrigated area & construction of new irrigation schemes
- Priority 5: Riverbank protection & flood prevention
- Priority 6: Legislation, regulations & guidelines
- Priority 7: Economic & effective management of I&D
- Priority 8: Water savings with new technology & management practices
- Priority 9: Management of water storage
- Priority 10: Improving capacity of human resources
- Priority 11: Research on irrigation and drainage

58. Because of the extensive deterioration of I&D infrastructure, the Government considers priority number 1, rehabilitation and modernization, to be its top priority for the sector. This is considered to be a precondition for other priorities, such as those concerning O&M, financial management, additional institutional reform, information systems, etc. However, these are things that are best to be implemented

in parallel with rehabilitation. The Government's State Program does not explicitly state its criteria for prioritization in the sector, but it is apparent from the listing that they include ensuring functionality of existing irrigation and drainage systems commensurate with evolving conditions, expanding irrigated area and adaptation of technology and management to increasing drought and flood conditions.

59. In accordance with the Bank's own criteria for selecting priorities for investment (as described in Chapter 2), the Government's top 5 priorities, with possible lesser investments in 6 through 8 and number 11, are closest to the Bank's priorities. And there is another potential priority that is not explicitly mentioned in the State Program that could be added to the Bank's priorities. That is development of a management information system for integrated water resources management and specific applications within the I&D subsector, such as for asset management, monitoring performance and enabling early warning for and response to floods and droughts.

Chapter 4: Financing Irrigation and Drainage

4.1 Current and Planned Expenditures on Irrigation and Drainage

60. Figure 2 below shows the relatively large proportion of investment in the I&D subsector in Azerbaijan that comes from, and will come from, the State Budget. There is a temporary source of funds to come from the State Oil Fund, which will primarily be used for rehabilitation and modernization. Funding from foreign sources of funds, such as international financial institutions, have been and are projected to be, a relatively modest proportion of overall investment. However, if the International Financial Institutions (IFI) invest in modernization this can be a relatively important share of the investment.

61. Figure 2 shows past expenditures by the GoA (through 2010) and projected expenditures (2011 through 2013), including funds from foreign sources, for irrigation and drainage. This is broken down between three sources, the State Budget (which provides the large majority of funds), the State Oil Fund (which appears to be only temporary, to enable the GoA to catch up with the large amount of rehabilitation) and a small amount of funding from foreign sources, which are mainly IFI. As can be seen capital expenditures for the irrigation and drainage sector have risen sharply since 2006. The largest increase by far is from the State Budget, followed by a temporary boost for several years from the State Oil Fund. Financing from IFI's has increased from AZN 2 million in 2000 to AZN 15 to 20 million in recent years. The share of financing from foreign sources reduced from one third in 2000 to less than 10% in 2009. The State Program includes building 13 new reservoirs, improving drainage on 275,000 ha of land, rehabilitating 246,000 ha of irrigation and drainage systems, developing irrigation on 115,000 ha and constructing several flood control and retention structures. This amount of work is far short of actual requirements.

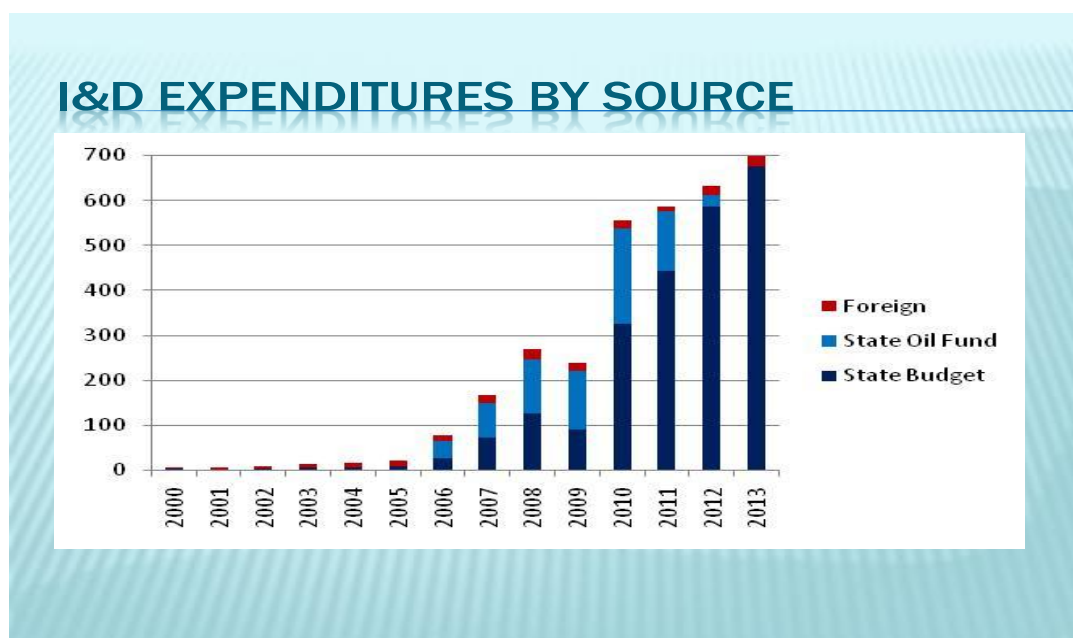


Figure 2. Expenditures on I&D by Source (in million AZN)

62. Table 4 below displays data on actual expenditures by the AIOJSC from the State Budget for years 2006, 2008 and 2010 and planned expenditures for years 2012 and 2013. They represent the extent

to which the State Program is being implemented. So far, between 2006 and 2010, the total budget has increased by more than 300%. Wages and salaries increased by 290%, loan-based or repaid works increased by 326%. Electricity for pumping remained through this period at approximately 30% of the total budget. Expenditures are for routine works such as for desilting, maintenance and some repairs. Investments in rehabilitation and modernization, capacity building and so on are funded from the State Oil Fund and IFT's. It can be seen that the Government has raised each of these line items substantially since 2006, including wages of staff, and it will continue to do so through 2013. The average percentage increase in spending through 2013 is 679% overall. The highest rising budgets were for desilting; chutes, lining and pipelines; machinery and equipment; and repair of structures. While desilting works are extensive, most of it has been done in irrigation canals, only 25% of it has been spent on collector drains although drainage canals represent 35% of total length of irrigation and drainage canals. WUAs have noted that desilting and cleaning of drains are major priorities. It is still not clear whether funds for these projects have been secured through 2013.

Table 4. Selected recent and projected expenditures of AIOJSC from the State Budget

Selected Items	Units	2006*	2008	2010	2012	2013	% Increase
Wages	AZN	13,901,017	32,984,828	40,228,034	47,756,116	49,985,556	360%
Repairs	AZN	15,027,728	32,324,866	49,042,590	125,050,243	137,554,627	915
Cost of desilting	AZN	5,460,748	14,210,876	22,322,565	57,251,236	62,976,360	1,153
No. works on AIOJSC hydraulic structures	#	636,630	1,391,943	2,876,775	26,756,049	29,431,654	462
Chutes, lined canals, pipelines	AZN	1,043,979	2,979,038	4,683,190	9,932,267	10,925,494	1,046
Pump stations	AZN	4,437,371	6,186,399	7,320,804	9,215,875	10,137,463	228
Subartesian wells	AZN	619,629	1,502,974	2,947,783	3,603,629	3,963,992	640
Dam protection against floods & cleaning riverbeds	AZN	2,352,036	4,582,790	6,868,844	15,166,042	16,682,646	709
Electricity	AZN	18,783,223	47,889,465	55,124,417	68,146,988	70,300,422	374
Repair of AIOJSC buildings	AZN	9,340,000	13,335,350	18,810,500	61,224,289	79,555,576	852
Procurement of vehicles	AZN	1,398,000	4,702,500	4,830,000	9,040,000	9,500,000	679
Machinery & equipment	AZN	3,788,000	20,472,400	25,418,400	39,485,000	40,800,000	1,077
OVERALL TOTAL**	AZN	76,788,361	182,563,429	240,473,902	472,627,734	521,813,790	679%

*2006 to 2010 are actual; 2012 & 2013 are projected. **Selected items do not include all items that make up the Overall Total.

63. Since the costs of rehabilitation of on-farm irrigation and drainage systems are estimated to be about \$900 USD per ha, the estimated cost of rehabilitating one million ha is \$900 million USD. In addition, funding will be needed for rehabilitating off-farm drainage systems for approximately 0.61 million ha. Also, funding will be needed for developing new drainage systems to stop water-logging and salinization of soils and to rehabilitate and maintain flood protection works. The main focus of the State Program has been on rehabilitating major irrigation structures. The World Bank and IFAD have focused mostly on rehabilitation of on-farm irrigation systems. Given the emphasis of the Government on off-farm systems, it makes sense for the Bank to remain focused on development and improved management capacities of on-farm systems.

4.2 Financial Management by WUAs and Regional Irrigation Departments

64. AIOJSC capital expenditures dramatically increased from \$5.9 million in 2000 to \$295 million in 2009. The results of these capital expenditures can be seen in the field. The off-farm canals and structures

are in good condition and WUAs now receive reasonable I&D services from the Raion Irrigation Departments (RID). However, RID are not responsible for on-farm systems, which have been in decline since the 1990s. These are now in a dire condition with canals and drains blocked with sediment and a lack of structures for controlling the movement of irrigation water. In addition to rehabilitation, improved on-farm system O&M requires a significant increase in O&M expenditures. Unfortunately, the Government's policy of providing water practically free (around AZN 2.50/ha for 5,000 m³) sends the message that water is cheap and farmers do not need to pay very much for it. In addition, as RID receive very few funds from WUA they do not have a vested interest in ensuring that WUA increase their ISF and manage their water more effectively.

65. Table 5 below shows how much funds in irrigation service fees were collected by WUA from 2000 to 2009 in eight regions in the country, Ganca-qazax, Alazan-Ayricay, Samur-Absera, Mugan-Salyan, Sirvan, Mil, Lankaran-Masalli, and Qarabag. There has been an overall increase in fees collected by 335%. From year to year there were increases and decreases, partly because of droughts or floods. However, the largest increase, in 2008, came in part because of rehabilitation works and good agricultural production.

Table 5. Irrigation Service Fees Collected by WUA

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total % Increase
Fees Collected	742957	813044	1132371	1247753	1351579	1121671	1505003	1724132	2925,197	2487583	
% Increase		9.4%	39.3%	10.1%	8.3%	- 20.4%	34%	14.5%	69.6%	- 17.6%	335%

66. In 1997 the new ISF was established and has since become a two-part fee consisting of a miniscule amount (0.5 AZN/1000 m³) for bulk water supply to the WUA and another part for WUA costs of management, which are variable according to actual scheme costs. It is estimated that the total amount of ISF required for each raion is approximately AZN 5.74 per 1,000 m³ on average.

67. As noted in Table 6 below, at present WUA are paying AZN 0.5/1000 m³ for water from the RID while the real cost of water from RID is closer to AZN 5-10/1000 m³ (with pump systems even more). In addition, WUA require roughly AZN 10-17/1000 m³ for on-farm O&M. Yet, at present WUA members are paying on average less than AZN 2/1000 m³, which is only 1/5th of what is needed for sustainable O&M. This requires a large annual subsidy from the State and has led to a declining condition of the on-farm system. Even the rehabilitated systems are paying less than AZN 3.0/1000 m³. Raion Support Units (RSU) and staff members have to work with WUA leaders and members to educate them to increase their ISF in order to have financially and technically sustainable systems. Unfortunately, WUA members are caught in a vicious cycle, as without increased returns from their crops they find it difficult to increase their ISF.

Table 6. Irrigation Service Fee (ISF) payments: Actual versus needed

Object of Payment	Present Payment (AZN/1000 m ³)	Sustainable Level Required (AZN/1000 m ³)	Increase Required (AZN/1000 m ³)
WUA members for WUA O&M	2.0	10 – 17	8 – 15
WUA to RID for bulk water supply	0.5	5 - 10	4.5 - 9.5

Chapter 5: Evolution of Institutions in Irrigation and Drainage

5.1 Evolution of Government Organizations for Irrigation and Drainage

68. After the breakup of the Soviet Union and the consequent breakup of the approximately 2,000 collective and state farms in the country, on-farm irrigation responsibility was left with a management vacuum with no one taking responsibility for O&M of the on-farm infrastructure. In order to address this problem Decree No. 43 dated March 15, 2001 of the Cabinet of Ministers transferred the infrastructure of the former collective and state farms to the State Amelioration and Irrigation Committee (SAIC, which was subsequently changed to AIOJSC). Under this decree it was also decided that part of the maintenance was to be the responsibility of SAIC with a budget of AZN 1,8 million made available in 2001. This was a token payment compared to the tens of thousands of AZN actually required to properly maintain on-farm irrigation systems.

69. In 2006 the Amelioration and Irrigation Open Joint Stock Company (AIOJSC) was established from the State Amelioration and Irrigation Agency under the Ministry of Agriculture with essentially the governmental roles of providing bulk water supplies to irrigation systems and overseeing the development and management of irrigation and drainage systems in the country. All shares of AIOJSC are state owned. Since the AIOJSC is essentially a state agency by functions and budgets, it is questionable whether it is best to remain a joint stock company or to become a regular ministry of the Government. The main responsibilities of AIOJSC are: (i) to manage water resources; (ii) to provide various sectors of the country's economy, including the agricultural sector, with water; (iii), to distribute and effectively use irrigation water; (iv) to remove drainage water from irrigated lands; (v) to carry out flood protection measures; (vi) to maintain and operate state owned irrigation and drainage systems; and (vii) ensure scientific and technical development of the irrigation and drainage sector. These responsibilities are complimentary to the role of the Ministry of Emergency, which is an executive body responsible for protection of water reservoirs of national importance that are on the balance sheet of the Ministries Water Resource Agency. The Ministry also performs periodic controls of the technical condition of water reservoirs in the country, monitors surface and subsurface water resources, water facilities, hydraulic structures, water supply systems, and general water resources management improvement..

70. According to its Charter, the AIOJSC has the following responsibilities:

- a. Provision of water to users;
- b. Use, maintain and protect surface water facilities;
- c. Mobilize financing for development, rehabilitation and management of I&D systems;
- d. Set water tariffs;
- e. Build capacity of staff and WUA;
- f. Regulation of ameliorative condition of irrigated land;
- g. Regulation of use of water supplied by AIOJSC;
- h. Implement or supervise regional amelioration and water management programs;
- i. Preparing forecasts and projects;
- j. Adopting standards, norms and rules for water management;
- k. Developing and regulating Water Users Associations;
- l. Monitoring operations and maintenance of surface water facilities;
- m. Regulating water management and preventing adverse impacts of floods and droughts;
- n. Arranging water protection zones and river bank protection facilities; and
- o. Ensuring scientific and technical development about irrigation and drainage.

71. In July 2010, AIOJSC had a total of 21,292 staff, of which 4,997 were engineers or other technical staff, 14,999 were field workers, and 1,293 were support staff. Figure 3 shows that AIOJSC has

one Chairman with three deputies. The 1st Deputy is responsible for two departments: 1) Design and Construction, Science and Foreign Relations and 2) Human Resources. The 2nd Deputy is responsible for four departments or sections: 1) Economy, Finance and Wages, 2) Accounting, 3) Internal Auditing and 4) Mechanization, Industry and Maintenance. The 3rd Deputy is also responsible for four departments or sections: 1) Supplies, 2) Irrigation System Operations, 3) Amelioration, Water Resources and WUA Support, and 4) Management of Water Reservoirs and Headworks. Although the vast majority of AIOJSC staff are in the regional and raion offices, the headquarters office of AIOJSC retains substantial decision-making powers over programs, budgets and special projects of regional and raion offices. The Raion Irrigation Departments (RID) are district-level extensions of the AIOJSC, although little decision-making authority has been given to the RID. Raion Support Units for WUA, within the RID, were set up with temporary status and budgets. It appears that there is little appreciation as yet within AIOJSC for the need for RSU to play a long-term role in supporting WUA.

72. The AIOJSC is heavily centralized and some decentralization over planning, budgets and implementation will be needed in the future to Regional Support Centers (RSC) and RID. But this will become possible only with upgrading capacities at these levels. Water use for agriculture, water supply and other uses, needs to become more and more financed by water users. It is time to begin the process of developing an institutional and managerial framework to deal with these sub-sectors in a more integrated manner.

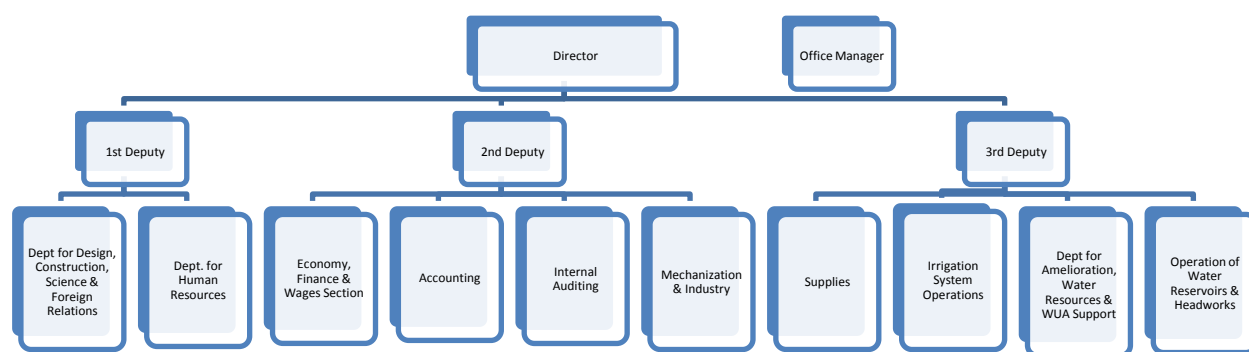


Figure 3. Organizational Chart for AIOJSC

5.2 WUA Legislation and Establishment in Azerbaijan

73. The Law on Amelioration and Irrigation was adopted in June 1996. Article 24 included a provision for farmers to establish water users associations (WUA). Resolution 150 (1996) changed the Law to define the process of transitioning to a system of irrigation service fees (ISF). However, Resolution 97 on the Enactment of the Statute of Paid Water Use Rules and Water Use Tariffs set the percent of ISF retained by WUAs at no more than 25% of the heavily subsidized Raion Irrigation Departments (RID) water rate. This effectively negated the ISF law and in the process led to the financial failure of early WUAs. Eventually, this was recognized as a mistake and the Resolution was retracted.

74. Water Users Associations began to be established in 2000. WUA were created under the direction of the SAIC and then the AIOJSC. Raion Support Units for WUA helped establish WUA and provide training for them. With the changes and amendments to the Law on Amelioration and Irrigation, they became non-profit entities based on hydraulic boundaries. By 2010, 546 WUA had been registered or re-registered with this status.

75. *Farm Privatization Project Pilot WUA* Initial WUA establishment in Azerbaijan was driven by activities funded by the World Bank through the Farm Privatization Project (FPP), under which six Pilot WUAs were created. Normative documents were developed on creation, operation, and legal establishment. These documents were approved by the Agrarian Commission of the Cabinet of Ministers and were adopted by SAIC for the establishment and registration of new WUAs in the country. However, the law provided no detail on how WUAs were to be established or how they would operate. As a result, existing WUAs were established as companies or, to be more specific, limited liability enterprises established in accordance with the Law on Limited Liability Enterprises, dated December 29, 1998. They were not 'associations' at all. They were basically free to undertake any kind of lawful commercial activity. Using this law, under the Model Statute WUAs were organized as private, share-holder associations with the right to distribute profits. The Model Statute clearly stated the WUA Board included the hired staff--Chairman, Hydro-Technician, Accountant and Field Agents. This created a system where hired staff made all the decisions and controlled the WUA with no control by members. FPP also paid salaries from the loan ranging from \$250/month for the Chairman to \$100-\$150/month for the field agents, as well as subsidizing operational costs for the WUA.

76. *SAIC Established WUAs* As the only process for registering WUAs in the country the FPP developed process was adopted by SAIC for the establishment and registration of new WUAs. At the same time, SAIC recognized the FPP model was neither sustainable, as farmers cannot afford large salaries, nor was it replicable, as the GoA could not afford to invest vast sums into each of the WUAs (more than 600). Yet, SAIC realized it was in their best interest to have strong WUAs to improve on-farm irrigation management and to ensure adequate collection of fees.

77. SAIC started work on creating a large number of WUAs in 2000 and, given the limited amount of staff and financial resources invested, results were impressive. By September 2002 a total of 552 WUAs had been legally established in 44 raion, with 387,000 members and a total command area of 644,000 ha. Yet, without any special training for SAIC staff, WUAs created ended up looking somewhat like the Collective and State Farms they replaced. WUA Chairmen replicated the role of the former Chairman of the Collective and State Farms, with no interest in a participatory association operated and governed by its members. SAIC staff placed most of their efforts on helping WUA complete registration forms, as well as signing contracts with SAIC for water delivery. Once registered there was no formal training for WUAs and SAIC had no staff to monitor WUA performance and work with WUA staff to ensure they operated the system properly.

78. *IDSMP Re-registered WUAs* During the preparation of the World Bank funded Irrigation and Drainage System Management Improvement Project (IDSMP) it was clear that Azerbaijan did not have an adequate and appropriate legal framework for the establishment and sustainable operation of WUAs. Legislative inadequacies include the following:

- Absence of provisions permitting transfer of on-farm systems to WUAs, either for in use or ownership;
- Absence of clear and appropriate provisions for tariff setting, which allow WUAs to determine their own tariffs for O&M of the on-farm systems, free of government interference;
- Lack of clear legal provisions that confer substantive and secure rights to WUAs in respect of the supply of irrigation water to them; and
- Lack of provisions that confer necessary legal rights on WUAs, enabling them to access, and when required, use land that does not belong to them (where this is necessary for O&M of the scheme).

79. Under IDSMP, in response to the inadequate legal basis, the Law on Amelioration and Irrigation (LAI) was amended, including the introduction of a new chapter on WUAs. This chapter, which contains 15 articles, provides for the establishment of WUAs as a particular type of legal entity, describes their

purpose and tasks, contains provisions on WUA members rights and obligations, details procedure for WUA establishment, describes democratic, internal institutional arrangements for WUAs as well as providing for establishment of a WUA Regulatory body. Other amendments to the LAI provide for the transfer of irrigation infrastructure to WUAs on a 20 year basis and the ‘bulk’ supply of irrigation water to them on the basis of long-term contracts. LAI law makes it clear that WUAs are to set their own ISF.

80. Once the revised LAI was approved by Parliament in April 30, 2004, it was necessary to rewrite WUA charters, change their organizational structure and elect Management Boards and Representatives. With the formation of Central Support Units (CSUs) for WUA in Baku and Nakhchivan and Raion Support Units (RSUs) for WUA in all the Raion Irrigation Department (RID) offices, as well as agreement with the Ministry of Justice on the process for de-registering old WUAs and re-registering new WUAs, this process started in 2005, as indicated in Table 6 below. Re-registration was first implemented in the 11 IDSMIP project raions. Presentations were made to local government as well as WUAs to explain the amended LAI and new WUA structure. The process was effectively completed in the entire country by January 2010 as detailed in Table 7.

Table 7. Pre-IDSMIP WUAs and Re-Registered WUAs under Amended LAI (January 2010)

		WUA Before IDSMIP			Re-Registered WUA During IDSMIP		
Raions	Area (ha)	Number of WUA Established	Area of WUA (ha)	Average Area per WUA (ha)	Number of WUA Established	Area of WUA (ha)	Average Area per WUA (ha)
Project	452,644	232	349,698	1,507	212	440,069	2,126
Non-Proj	887,327	353	410,585	1,163	334	880,428	2,636
TOTAL	1,339,971	585	760,283	1,299	546	1,320,497	2,418

81. The number of WUAs did not change significantly but the size of the average WUA almost doubled. This increase helped to ensure that WUAs had economy of scale required to be financially sustainable. The speed at which this process was completed demonstrated the value of support units like RSUs for developing WUAs.

5.3 Key Challenges and Needs for Capacity Building of WUAs

82. Many SAIC (now AIOJSC) staff members assumed that once WUAs were formed that was the end of the need for SAIC’s or AIOJSC’s involvement. However, WUA formation was just the first step in a long process of developing sustainable WUAs. Under IDSMIP the CSUs and RSUs played a major role. Given that none of the staff had experience with such participatory farmer associations, a Technical Assistance (TA) contract was signed and a TA team started working at AIOJSC in Baku. Their major role was to develop training modules to train CSU, RSU and WUA staff members and to train the CSU and RSU trainers that were to train WUAs. In total, 16 training modules were developed. These included training in training-of-trainers, WUA development, WUA governance and administration, monitoring and evaluation, financial management, preparation of O&M plans, rehabilitation and on-farm water management.

83. During 2005 and 2006, using these modules the TA team trained 403 CSU and RSU staff members in 43 courses. In 2007 and 2008 the CSU trained 118 participants in 19 raions. RSUs prepared a WUA Training Plan (WTP) that was implemented by RSU staff members. Training carried out in 2007-

2008, and the number of participants, are summarized in Table 8 below. During 2007-2008 RSU staff members organized 907 training sessions for 8,248 trainees. In all, under IDSMP over 15,000 participants have been trained.

Table 8. Training Sessions & Participants Organized by RSUs in Project Raions (2007-08)

	Q1-2007		Q2-2007		Q3-2007		Q4-2007		Q1-2008		Total		Part/ Ses
	Ses	Part	Ses	Part	Ses	Part	Ses	Part	Ses	Part	Ses	Part	
Total	449	3696	230	2243	62	521	165	1779	1	9	907	8248	9

Ses = Sessions Part = Participants

84. Under the amended LAI, Article 30-14 provides that State supervision of WUAs is to be undertaken by a Body of Executive Power of the Republic of Azerbaijan, which is defined in Article 9 as becoming a State Supervisory Body within SAIC, which was changed to the Amelioration and Irrigation Open Joint Stock Company (AIOJSC) in late 2005). The State Supervisory Body (SSB) has been the subject of much debate but to date has yet to be established. The role of the SSB is to ensure that WUAs are operating in accordance with the LAI. The SSB would provide a means of recourse for WUAs if WUA leadership is operating illegally or violating WUA governance procedures. The annual return and accounts filed by WUAs to the SSB acts as a formal indicator of WUA performance. Data from these documents is to be entered in an electronic database. It will provide a means for comparing WUA performance and regulating WUAs. It is planned that the SSB will be established as a unit under one of the AIOJSC Departments—probably the Department of Water Resources. The SSB needs a small number of staff, mostly part-time, with a full time archivist and database specialist to maintain the records and WUA database. Formation of the SSB provides legal protection for WUAs and WUA members and its establishment is needed without delay.

85. In addition to adding a new Chapter in the LAI on WUAs, amendments were made to other articles, relating to water supply and infrastructure transfer. The amended articles relating to water provide a system of annual and long-term water contracts. These articles have worked very well and as a result WUAs have security of water supply that they never had before. However, the article related to long-term (20-year) infrastructure agreements has not been fully implemented. Under the Water Users Association Development Support Project (WUAP) the project developed a Rehabilitation Agreement that includes: (i) 20-year Transfer Agreement, (ii) Repayment Agreement and (ii) system for clear involvement of WUAs in the rehabilitation contracting and implementation process. This agreement will be signed by all WUAs that qualify for rehabilitation. Their systems will not be rehabilitated until they sign the Rehabilitation Agreement.

86. WUAs are established at the on-farm system level on 95% of the irrigated area in Azerbaijan. It has been observed that the WUAs act not in a participatory way with their members but as relatively independent organizations that do not involve members, whether male or female, in problem assessment, generating recommendations or in making decisions. Members are seen as passive beneficiaries of the irrigation system. The Bank recently completed a study on enhancing the role of women in irrigation management through the WUAs. It was found that women are primarily involved in domestic responsibilities, although these include responsibility for household gardens, including water application for them. Hence, they do have an interest in the quality, quantity, timeliness and reliability of irrigation delivery to the household plots. They also do work on the farms.

87. It remains to be seen whether the performance of irrigated agriculture and WUAs can be improved by greater participation of women in the WUA. If the answer is yes, it needs to be further

investigated what form such participation could take to be socially acceptable and what needs to be done to support this. However, this question could also be asked about male farmers since not all of them participate in WUA governance matters. It appears that training and involvement of women in WUA affairs, if accepted locally, might have potential benefits for making WUA become more responsive to the water users, especially to the extent that water distribution and delivery to household plots is demand oriented.

5.4 Support services needed by WUAs and how these could best be provided

88. Under IDSMIP it became apparent that the CSU in Baku was too far from the RSUs and WUAs in the raions and as a result did not provide adequate leadership and guidance for WUA support, as envisioned. This was especially obvious concerning the need to expand WUA support to non-project raions. In order to address this weakness, under WUAP four Regional Support Centers (RSCs) are to be created in order to bring together RSUs in the different regions and to provide a better link with the PIU WUA Coordinator. (see Figure 4).

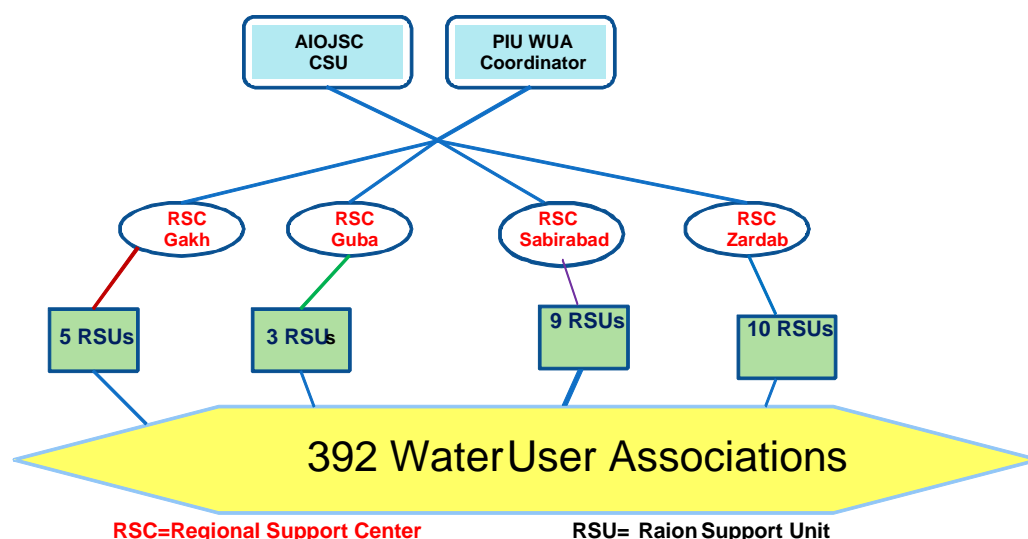


Figure 4. Organization of Support System for WUA

89. RSCs are to work closely with their respective RSUs in order to ensure that there is a well planned training program and a system for tracking support activities and identifying specific local support requirements. Each RSC will have a Regional WUA Coordinator and there will also be a PIU WUA Coordinator. This will ensure better linkage between the PIU and the WUA support program and also improve the system for tracking WUA Support Funds to be allocated under WUAP, as well as provide a better system for monitoring and evaluation (M&E) that has been weak in IDSMIP.



Photograph 2. De-silting and cleaning drains

90. One of the major rehabilitation requirements for WUAs, especially in the low-lying irrigated areas off the Aras and Kura Rivers, is to de-silt and re-establish the on-farm drains. In contrast to on-farm drains in the north, on-farm drains in the raions in this area are as large as many off-farm drains and therefore require equipment far in excess of that available to WUAs. Under WUAP the WUA Support Fund will assist about 90 WUAs to purchase excavators for cleaning canals and drains. However, these are small excavators and have insufficient capacity to clean these large drains. Cleaning these drains requires drag lines and large excavators--equipment only available with the AIOJSC Drainage Department. However, historically the Drainage Department only maintains off-farm drains and does not maintain on-farm drains. Under IDSMIP a major part of the rehabilitation work involved these large drains. This is also the case with rehabilitation under WUAP. Yet, unless a system for de-silting these drains is established, these drains will fill with sediment and the rehabilitation expenditure will be wasted. This is a major support requirement and requires that AIOJSC re-evaluate its policy with respect to on-farm drain maintenance in order to establish a system for supporting WUAs in maintaining these drains.

91. In the oil sector Azerbaijan has long had a prominent role for the private sector. In the irrigation sector, developed by government, changes in rural society and the economy are opening up needs and opportunities for private sector investment and involvement in rehabilitation, modernization of technologies, extension of existing irrigation and drainage canals, and development of tertiary networks. Decentralized responsibilities, empowerment of WUAs, potential introduction of new management and financing arrangements, and market-driven changes in agriculture are also opening up opportunities for the private sector. There is a growing likelihood that public private partnerships will develop in order to share responsibilities, manage risks, and create appropriate incentives.

92. The private sector could potentially become involved in four functions: investment (financing and design); governance (regulation and control); operations, maintenance and management; and agriculture and on-farm water management. In most countries (except Latin America), irrigation and drainage has been developed by the public sector and it is the public sector that is now promoting PPP. Investment and

O&M are the main areas where PPP is emerging. The most common arrangements are delegation of public services (such as to WUAs) rather than management contracts, because of their longer-term nature, comprehensive treatment of I&D aspects and the transparent and shared responsibilities for risk.

93. There are three core recommendations for advancing PPPs in the irrigation and drainage sector in Azerbaijan: The first is to aim at improving service delivery for operations, maintenance and management by inviting private sector service providers into on-farm and off-farm irrigation management through public service delegation contracts. The second recommendation is to identify key risks for the private sector and to design risk mitigation in ways that will attract private sector entities to enter into the sector. The third recommendation is that the Bank take an active and long-term role in developing PPP in irrigation and drainage through such assistance as:

- Assistance to prepare feasibility studies for PPP options;
- Assistance with negotiation and finalization of PPP arrangements;
- A study to identify options and pilot projects for innovative PPP arrangements;
- Provision of financing for projects involving PPP;
- Underwriting of noncommercial risk guarantees (with IFC and the Multilateral Investment Guarantee Agency [MIGA]) on management contracts.

Chapter 6: Climate Change and How it May Be Included Within the Bank's Priorities for the Irrigation and Drainage Sector in Azerbaijan

6.1 Current views on Climate Change and Implications for Azerbaijan

94. In the Fourth Assessment Report of the Inter-governmental Panel on Climate Change (IPCC), the Working Group II produced a section on likely impacts, vulnerability and needs for adaptation as a result of expected future climates. In its assessment of likely effects in the Caucasus and Central Asia it made the following predictions. Freshwater availability is expected to decline in the future in contrast to rising populations and diversification of the economy, which means likely increases in competition for water and increasing shortages. Crop yields may decrease by 20 to 30% due to droughts, floods and other extreme weather conditions. High temperature periods and drought will increase heat stress for some crops (as well as farm families) and increase water quality problems, such as algal blooms in reservoirs. Increased high precipitation events will create increasing soil erosion, damage to crops and more water-logging, which will restrict the ability of farmers to cultivate. Over time this could create areas where there is hunger and malnutrition.

95. The IPCC and the Stern Report made the following conclusions about the impending effects of climate change on water supply and demand, human habitats and livelihoods, and food security for the region in which Azerbaijan is located. These findings are summarized in the points below.

1. Sharp increases in intensity, variability, and unpredictability of precipitation. The severity and frequency of flooding and drought are already increasing.
2. Water supplies are already decreasing in arid and semi-arid areas.
3. Less snowfall and earlier snowmelt in watersheds upstream will cause higher flows earlier in the season, lower flows later and decreases in annual flows.
4. Vulnerability to climate change is highest where rainfall and stream flow occur primarily in only a few months of the year and water supply varies a lot, as is the case in Azerbaijan.
5. Infrastructure design based on historical water supply averages becomes less important than extreme conditions.
6. Because of lower water flows, warmer water and lower water quality, there is a growing need to treat and recycle water. This will require major improvements in water treatment, which is likely to make water become more expensive.
7. Climate change will reduce groundwater recharge and lower water tables.
8. Climate change is reducing the area of wetlands. This will result in losses of bio-diversity and disruption of environmental functions previously provided.
9. Climate change will intensify competition and conflict between water users in river basins and aquifers from local to international levels. This is especially possible in Azerbaijan where most water used (70%) originates from outside the country.
10. The number of people at risk from inland flooding will be much higher than the number of people at risk from rising sea levels.
11. Crop yields from rainfed agriculture could reduce 20 to 30% by 2020.
12. Climate change will increase other stresses related to water, such as changes in land quality and use, population, urbanization, and deforestation.

96. In a study conducted by the Bank it has been predicted that climate change will result in rising temperatures of +1.0 to +2°C in the winter and increases of +1.5 to +3°C in the already hot summer months.⁴ Average temperatures in Azerbaijan have already increased by an average of .5° in recent decades. (World Bank, 2010b)

97. Azerbaijan is expected to be in the upper middle range of countries worldwide that are to experience climate extremes. In the South Caucasus Region where Azerbaijan is located climate change is predicted to bring about a general warming of temperatures in both summer and winter. Glaciers and snow packs in the region's mountains are melting rapidly and this is increasing the risk of frequency and severity of floods in the winter and droughts in the summer. However, it is predicted that there will be more warming in the summer than in the winter. It is predicted that temperatures will increase by an average of 1.6°C to 2.6°C by 2050. There will be more frequent and more intense heat waves in the summer time.

98. Warmer temperatures also reduce the share of precipitation that falls as snow in the mountains or upriver from Azerbaijan. This is a natural mechanism for storing water that in times past has been gradually released during spring and summer. More concentrated rainfall and a decline in snowfall in the mountains will result in less water retention, less gradual release and less recharge of aquifers because saturated soil conditions from intense rainfall will lead to more surface runoff.

99. There will be more "precipitation intensity", which means more rainfall occurring in shorter periods of time that are more far apart, which will cause more flooding. There will be more variability in timing of events and greater intervals between rain events. This increase in precipitation intensity is likely to have substantial implications for the need for or viability of water storage reservoirs, flood management and sanitation.

100. There will be changes in hydrology, with greater fluctuations in water supply and less predictability. The timing of seasons will be less defined. There is a prediction for a 25% decrease in water availability between the 1970's and middle of this century. The water level of the Caspian Sea is expected to drop by a full six meters by the end of this century, mainly due to increased evaporation of its waters but also less inflow from the Volga River.

101. The South Caucasus Region is highly vulnerable to drought because of the already high rainfall variability between years and high reliance on snowmelt. Also, Azerbaijan has a heavy economic and labor dependence on agriculture. It has little hydro-meteorological monitoring and inadequate poor water management planning and response systems. Relative to other countries in the Eastern Europe and Central Asia region, Azerbaijan is relatively sensitive to climate change effects, is moderately vulnerable to exposure to climate changes and is relatively weak in its capacity to adapt promptly and appropriately. This is partly because of inappropriate or dilapidated infrastructure left over from the Soviet times.

102. In summary, climate changes most likely to be experienced by Azerbaijan include:

- a) Increased incidences of both droughts in the summer and floods in the winter;
- b) A net decrease in availability of surface water and likely declines in aquifer water tables;
- c) Less spring and summertime precipitation;
- d) Increasing salinization, desertification and soil degradation;
- e) Declines in yields for vegetables, potatoes and cereal crops due to water shortages and excessive heat in lowland areas;
- f) Net losses in agricultural production and income;
- g) Increased frequency of crop failures because of droughts;
- h) Despite predictions of milder winters, it is expected that there will be more frosts that will destroy tree crops, vineyards and other fruit crops due to the loss of heat-retaining humidity in the air;

⁴ Marianne Fay, Rachel I. Block and Jane Ebinger, Editors. 2010. Adapting to Climate Change in Eastern Europe and Central Asia. Washington, DC: The World Bank.

- i) There may be a longer growing season that allows for increased cropping intensity;
- j) Warm-weather tree crops such as figs and nuts may become more common the the plains with potential increases in yields for grapes, olives and citrus fruits;
- k) Increased potential for vegetables like tomatoes and peppers and apples in hilly or mountainous areas although erosion and landslides may increase in steep areas;
- l) Tree crops may become more vulnerable to storms and pest attacks;
- m) Pests may become more widespread due to their greater potential to survive mild winters;
- n) Livestock will have increased heat stress and disease in the summer but have less cold in the winter. It is not yet clear what are the implications of climate change for forage and grasslands;

6.2 An Approach Toward Adapting Azerbaijan's Irrigation & Drainage Sector to Climate Change

103. Major challenges brought about by global climate change require increasingly rapid and cross-sectoral production of information and responses. To develop a strategy to adapt to climate change, governments will need to go through a process of identifying vulnerabilities to climate change, selecting options for adaptation, and implementing and evaluating an adaptation strategy. This is a five-step process. Five steps through which the Government of Azerbaijan (GoA) could proceed in order to prepare an appropriate adaptation strategy for water management in anticipation of climate change are suggested. The five steps are: 1) Assess vulnerability, 2) Prepare a supportive institutional framework for dealing with climate change adaptation, 3) Identify, assess and select appropriate elements of an adaptation strategy, 4) Implement the adaptation strategy, and 5) Monitor, evaluate and adjust the strategy as needed.

Step 1: Assess vulnerability

104. There is an urgent need for each country to better understand how severe will be the coming effects of climate change. There is a need to assess human and environmental vulnerability in different geographical settings to such things as marginality, risk, sensitivity, adaptability, resilience and fragility. The challenge is to understand what is happening and what will be likely to happen in specific countries as a basis for preparing action plans. Assessing vulnerability requires the following four steps:

1. Identifying what information is needed;
2. Identifying climate-related vulnerabilities for water, the socio-economy and health;
3. Estimating the effects of climate change scenarios on water supply and demand;
4. Determining needs and capabilities of stakeholder groups.

Step 2: Prepare institutional framework

105. Countries need to assess the extent to which their policy, legal, regulatory and organizational framework is suitable for identifying and responding in appropriate and timely ways to vulnerabilities to climate change. This could include all sectors with water-related vulnerabilities and with roles to help. It could include setting up a framework to enable effective development and implementation of an adaptation strategy. This may include such things as enabling cross-sector problem solving and negotiation, developing alternative dispute resolution processes, having organisations and procedures that can deal with climate change problems, such as water users associations, river basin organizations, water supply commissions, and drainage boards that involve stakeholders in governance matters. And it will include setting up effective and timely processes of decision making, implementation and adjustment.

Step 3: Identify, assess and select elements of an adaptation strategy

106. In this step the adaptation strategy is formulated. The objective is to find all necessary and feasible means to reduce vulnerability to climate change. This can be done in five ways, by:

1. Preventing or minimizing negative effects,
2. Strengthening resilience to stress,
3. Preparing to reduce negative effects,
4. Responding quickly to extreme events,
5. Facilitating recovery after extreme events.

107. After all pertinent elements of an adaptation strategy have been identified, stakeholders prioritise, operationalise how elements will be implemented, and schedule implementation. Special attention will be needed to ensure protection of the poor and most vulnerable members of society.

Step 4: Implement the adaptation strategy

108. With coordination between sectors, high-level political commitment, and direction and representative participation of stakeholders, the adaptation strategy is implemented. Public awareness and capacity building will be essential.

Step 5: Monitor, evaluate and adjust the strategy

109. Successful implementation will require a comprehensive and timely monitoring and evaluation of implementation of the adaptation strategy. This must be well connected to an authoritative decision-making body that is able to make rapid decisions about revising the adaptation strategy.

Chapter 7: Priorities for Irrigation and Drainage in Azerbaijan

110. It ought to be considered what the agricultural and I&D sectors of Azerbaijan will be like in 10 to 15 years if nothing more is done for irrigation and drainage. Population will increase from 8.5 million today to more than 10 million within 15 years, with consequent rising demands for food, employment and income. Climate changes will mean more severe and more frequent flooding and droughts at different times of the year. Without investments in rehabilitation and modernization, crop yields and cropping intensity will decline. It may be difficult for the GoA to continue indefinitely its large subsidies for basic seasonal crops like wheat and cotton. The amount of water storage will decline and Azerbaijan's farmland will become more vulnerable to drought and flooding without more reservoirs. Cropping intensity will reduce due to drought in the second season. Salinization of soils and drying of wetlands will increase, bringing loss of arable land and loss of the environmental benefits of wetlands. Area irrigated will shrink significantly as both irrigation and drainage systems deteriorate dramatically. Today, only about 25% of irrigated land has adequate access to irrigation water. If no major initiatives for rehabilitation and modernization were to occur over the next 10 to 15 years, the land having "adequate access" to irrigation water would drop substantially, further reducing farm employment and income. The country would fail to reach needed widespread increases in yields and in shifts to higher-value crops. All these eventualities are unacceptable, so several initiatives need to be adopted and disseminated, beginning as soon as possible.

111. Priorities for investment by the Bank in the irrigation and drainage sector in Azerbaijan are based on a convergence between Government and Bank priorities. They are based on an appreciation for the need to develop all aspects of irrigation and drainage that are important to make irrigation systems and agriculture productive, efficient, equitable, sustainable and oriented so as to reduce poverty. They involve both technical, agricultural, managerial, financial and institutional aspects.

112. This chapter describes 11 key priority topics (A through K) that the authors of this Sector Review believe should be addressed over the next 10 years. One matter that cuts across several of the priorities is the importance that the Bank and the Government place on applying the methods and positive results of the World Bank-financed projects in Azerbaijan and elsewhere for the establishment, development and strengthening of Water Users Associations in other irrigated areas in the country. This also addresses priorities identified in the State Programme on the Sustainable Development of Amelioration and Water Management for 2008-2015 as well as the needs for developing on-farm irrigation networks.

113. The priorities are grouped into three categories: Policy and Legal Reforms, Effective and Sustainable Investments in Irrigation and Drainage Systems, and Building Capacity in the Sector. The following priorities are listed within these categories. Clearly, rehabilitation and modernization of irrigation and drainage networks are the top priorities. However, the others are considered to be complementary priorities. Without advancement in each of these priorities the sector will not reach its optimal levels of performance.

7.1 Policy, Strategy, Legal and Institutional Reforms

Priority A: Legislation, Regulations and Guidelines

114. There is an important need for a broader discussion on the future directions of I&D within the framework of the management of the country's water resources. This should include adopting certain principles that are clearly needed in the I&D sector of Azerbaijan but which are not yet widely understood and accepted in the sector. An example is the need to understand and adopt a policy intended to reduce the future need for rehabilitation through improved maintenance at a satisfactory standard. In the beginning this could be a series of discussions at a higher level than the AIOJSC that would, hopefully, result in a "white paper" or series of principles and criteria upon which to design policy, laws and regulations for the irrigation and drainage sector.

115. There is a need for an institutional review of the AIOJSC and the approximately 140 agencies that are dependent upon the AIOJSC. The number of RIDs and other agencies dependent upon the AIOJSC does not appear to have changed since independence. This suggests that there is an important need for institutional reform as the AIOJSC increasingly evolves into becoming a service provider for an ever increasing number of WUAs across the country. Linked to this is the question, worth considering, if a joint stock company is the correct legal form for a government organization that is largely funded from the State budget and provides a public service. There is a need to prepare a detailed strategy with action plans to, among other things, help the Government to determine the most appropriate legal form and roles for the AIOJSC.

116. Since the AIOJSC is, for all intents and purposes, a state entity of the Government of Azerbaijan, it may be necessary to restructure it into a proper state entity, such as a state committee or ministry. Also, it may be appropriate to strengthen the regional offices of the AIOJSC or, in other words, decentralize some functions to the regional and raion levels. This is so that the latter may be enabled to take over some functions that are currently under the responsibility of the central AIOJSC, but could be more appropriately and efficiently managed by the regional or raion offices.

117. The structure of AIOJSC is mostly the same as in Soviet times, with two or three agencies per rayon specialized in different amelioration activities. The structure could be streamlined and a full review of this would be justifiable. In addition, there could be room for some participation of representatives of water users in governance, for example, through membership of water users on the management board of restructured regional entities, so as to promote transparency, accountability and empowerment of water users and a partnership relationship between the AIOJSC and WUA.

118. The current AIOJSC management style is of a centralized, administrative nature. It has a traditional engineering focus on construction and rehabilitation, without much concern for quality O&M. A change in thinking and approach toward the sector is needed, with a focus on managing water more effectively through a leaner and more service-oriented modality. The strategy and human resources analysis could include assessments of the need for restructuring of the AIOJSC.

119. Legislative changes would be needed, in the form of a new amelioration and irrigation law, to put such reforms into place. Other reforms that could be appropriate at that time relate to a clearer and more practical and transparent basis for tariff setting for bulk irrigation water supplies. It will also be necessary to review the provisions on WUA at the same time, perhaps developing the existing provisions a little further and possibly providing for some form of compulsory membership and payment of an area-based fee by all landholders within the service area in order to strengthen the WUA financially and guarantee budgets. The success in raising the ISF will depend upon improvements in water productivity.

120. It would be good if each WUA and WUA Union or Federation develops its own locally-appropriate set of by-laws or internal regulations. These would guide the WUA or WUA Union in the locally-specific arrangements, rules, procedures and sanctions related to its mission. This will relate to application of the rights, authority, responsibilities and procedures for the WUA's internal operating procedures. The development of the internal regulations is not just an academic exercise; it takes advantage of the learning experience of the WUA in determining what local rules and practices work.

121. The roles of the State Supervisory Body are to: 1) assess compliance with policy, law and regulations; 2) advise on immediate actions to be taken by the WUA, 3) possibly assign sanctions against the WUA, 4) identify and recommend needs for capacity building and 5) identify and recommend needs for support services. It will be important that the new State Supervisory Body becomes effective in ensuring compliance with Government policies and regulations. But this would be less oriented toward punishment and more toward consultations and recommendations, building capacity, accountability and providing incentives. It will also be important that the SSB does not directly "supervise" or attempt to micro-manage and intervene in the internal affairs of the WUA, unless it is requested to assist by the WUA. It will be important that the SSB develops an effective monitoring system and methods for

regulation and responses to assessments. This could include recommendations with priority rankings where compliance by the WUA is expected within designated time periods, subject to rewards or sanctions. There is a need to develop operational guidelines for the SSB.

122. The next reform that needs to take place relates to irrigation and drainage management within the context of water resources management. The current water code is out-dated. The Soviet Union had state committees or ministries of amelioration and ‘water economy’. These ministries were responsible for the management of water relating to economic activities such as the construction of dams, flood protection and irrigation. They mainly built and operated infrastructure. All planning was done centrally on the basis of the central plan and there was no need for specific mechanisms for water resource management or planning, as is known today. The amelioration ministries collected limited data relating to the operation of their structures. There was no river basin planning.

123. The AIOJSC is the heir of the Ministry of Amelioration and Water Economy of the Soviet Socialist Republic of Azerbaijan. Under the existing water code it is, responsible for irrigation and drainage management, but it has not fully engaged in comprehensive integrated water resources management. As competition for water, and as flooding and drought increases, there are growing tensions between different water users, yet there is no comprehensive management of water resources. The various functions in water resources management of AIOJSC, the Ministry of Emergency Affairs and the Ministry of Ecology and Natural Resources (which focuses on pollution control measures) need to be further clarified.

124. Therefore, there is a need to develop a Law for Integrated Water Resources Management in order to enable a more rational and coordinate way for integrated water resources management, and cope with increasing floods, drought and inter-sector competition for water. In the future more water will be needed for water supply and sanitation of growing urban populations, industry, hydro-power, storage, fish production, and environmental needs such as flushing salts from soils and replenishing wetlands. Clearly, there will be a need for a national body to coordinate across sectors as well as river basin authorities and stakeholder coordinating committees.

125. All these policy and institutional reforms and elaborations on the respective roles, responsibility, authority and financing mechanisms of sector organizations could be considered as high priorities because they provide guidance and the necessary authority for the AIOJSC, WUA and other organizations to function as needed. It would be best for work on policy and institutional development to proceed as soon as possible because they are a pre-requisite for other innovations that are needed.

Priority B: Development of a Strategic Plan with Specific Action Plans

126. Although the State Program identifies priorities it does not provide a solid background analysis and rationale for the priorities mentioned. There is a need for a comprehensive Strategic Plan or Master Plan for the Irrigation and Drainage sector that provides a multi-criteria prioritization, justification, methodology and analysis of all investments proposed and specific modalities for implementation. This Strategic Plan would use the analysis to prioritize investments relative to each other so as to guide decisions about items to be selected when funding for all activities is not available. There are other items that are not mentioned in the State Program that may be included in a Strategic Plan, such as the prospect of climate change and what actions for adaptation need to be taken. The Strategic Plan would provide a step-wise strategy for going in the direction that the country needs for the medium and long terms.

127. As with policy and institutions, the Strategic Plan and commensurate Action Plans are likewise pre-requisites to the innovations that will follow. The plans provide the timing, sequencing and specification of resources needed. The reason to have a single Strategic Plan for the I&D sector is to provide justifications and modalities for all priority actions to be taken in the sector.

7.2 Promoting Effective and Sustainable Investments in Irrigation and Drainage Systems

Priority C: Participatory Rehabilitation and Modernization of Irrigation Infrastructure

128. Since 50% of I&D infrastructure is severely deteriorated and 25% of irrigated area has inadequate access to water, the top priority for the Government in the I&D sector is rehabilitation and modernization of irrigation schemes at both on-farm and off-farm levels. This is considered as a precondition for subsequent management improvements. The Bank also considers this to be a priority for its strategy in Azerbaijan. The Government will provide the majority of funding for rehabilitation at both the off-farm and on-farm levels.

129. Given the Bank's comparative advantage in mobilizing international expertise in modern irrigation and drainage technology and techniques, it makes sense for the Bank to place its emphasis during WUAP on modernization and rehabilitation. Modernization can be organized into phases. The first phase would be establishment of WUA (where this is still needed or where re-establishment or realignment of borders and members is needed), management transfers and development of capacity of AIOJSC. This can be followed by participatory rehabilitation and modernization, further capacity building, and development of a practical strategy for providing support services. It is also recommended that farmers repay a significant share of the cost of rehabilitation and modernization so as to instill a common sense of responsibility to maintain the system in the future.

130. Given the likely effects of climate change on drought and the fact that most of Azerbaijan's water resources originate in other countries, it makes sense to include in modernization of design of I&D structures the introduction of water savings technologies at off and on-farm levels. Only 10% of on-farm canals are lined and losses are high. It may be possible for the Bank to work with the GoA by focusing on aspects of rehabilitation that concern modernization while the GoA focuses on standard rehabilitation activities. It is also possible that, for on-farm schemes, the Bank may provide assistance with the GoA's target to rehabilitate schemes at this level, which will have an estimated cost of US \$750/ha. However, this may be placed first within the context of developing the WUA so that it will drive such innovations by its own management methods and by individual members at the farm level. The officers and members of WUAs need to be guided to take such initiatives as adopting water saving technologies and practices consistent with their own priorities. The raion office staff could take the initiative to identify with the WUAs what are their priorities for support services, how they should be provided, by whom and under what terms and conditions. Training will need to be provided to enable WUA officers to understand the changing water supply and demand environment so that they better understand the importance of such water saving technology and practices. This should all be considered to be part of the process of building capacity in the WUA, which will be done in WUAP.

131. Where needed, it would be useful to introduce and pilot test new technologies for water control and distribution at the off-farm level and perhaps advanced machine-driven methods for doing canal lining (such as has been developed in Spain). Azerbaijan can draw on international expertise in identifying where modernization is needed for such structures and methods as: off-farm gates along main and inter-farm, new structures and methods to improve water saving, more efficient methods for lining canals, information and automatic control systems, and possibly drip and sprinkler irrigation for high-value fruits and vegetables. External technical assistance may be needed for hydraulic flow and regulatory structures and sediment control structures at all levels. And there may be a need to determine whether, in some cases, it makes sense to modernize pump or pressure systems or simply repair them. Under the WUAP it is planned that field demonstrations for introduction of innovative irrigation and drainage technology and methods will be done in core raions. This is being funded under Component 1 of WUAP in the sub-component for institutional capacity building studies and pilots.

132. Rehabilitation and modernization of irrigation infrastructure and support equipment and machinery are considered by the GoA, WUA and the World Bank as top priorities for the sector. No

improvements in management and productivity of irrigation can be made until rehabilitation and modernization have been carried out. A participatory approach is needed in order to develop a sense of ownership and responsibility for the sustainability of irrigation systems among water users. Participatory rehabilitation and some modernization, with development of WUA, were supported previously under IDSMIP and will continue with WUAP.

Priority D: Participatory Rehabilitation, Modernization and Development of Drainage Systems

133. Fifty-five percent of irrigated area in Azerbaijan has no drainage. Expanded drainage would not only improve yields on irrigated land but would serve to reclaim salinized land. In Azerbaijan drainage is most problematic in the raions of Zardab, Imishli, Saatli, Sabirabad, Beilagan, and all low-lying raions served directly by the Araks and Kura Rivers. There is a need to identify criteria for prioritizing where drainage is needed and conducting a situational assessment of where repairs, rehabilitation, modernization or development of new drainage systems are needed. In some places there is a need to re-design collector drain sizes and spacing between them.

134. There is a need for increased funding to repair, rehabilitate and extend new drainage systems, especially collector drains. This is a high priority for the Government inasmuch as Azerbaijan is prone to water-logging and flooding in many areas. In some places there is a need to either extend existing drainage systems or to construct new ones. Under Component 2 of the WUAP (On-farm I&D rehabilitation), the Bank is likely to support a study to identify the priority locations, extent and importance of need for development of drainage systems. The Bank can help identify which aspects of drainage require international expertise and innovative technology. As with irrigation, rehabilitation and modernization of drainage systems is also a top priority and will lead to both maintaining, expansion and protection of the irrigated area.

Priority E: Protection and Maintenance of On-farm I&D Infrastructure

135. There is little disagreement between farmers, WUA officers, the AIOJSC or the World Bank that maintenance of on-farm irrigation systems cannot be done adequately unless each WUA has an excavator in order to handle both routine canal cleaning and emergencies. Motorcycles are needed by the field agents, who travel between 10 and 20 kms per day and often need to travel to locations on short notice. WUAs have urgent needs for offices and supplies, such as computers and mobile phones.

136. WUAs also need to develop an effective method to assess and prioritize maintenance needs. This probably would include introduction of asset management, which includes an asset inventory, assessment of functionality of structures, periodic monitoring and planning maintenance, repair, rehabilitation or replacement responses.

137. Most investment in irrigation and drainage is in construction, routine maintenance or rehabilitation. But there is a “black box” of potential investment between routine maintenance and rehabilitation that can be referred to as incidental repairs and improvements. These are periodic repairs and improvements in gates, drop structures, canals, sediment escapes, flow measurement devices and other structures. If these are not repaired when the problems are small they will become large and costly expenses requiring rehabilitation. This can be considered as a kind of proactive, minor and incremental form of rehabilitation. If it were the objective of the GoA to reduce the need for rehabilitation over time by lengthening the functional life of structures, then it could make sense to introduce a program with incentives aimed to make investments in incidental repairs and improvements when needed.

138. If it were decided that a program of incidental repairs and improvements could be established, at least as a trial in selected raions, the Government could establish a fund financed by the State Budget and the Bank. The Fund could be called something like the “Irrigation Improvement Fund” (IIF) and would be used for small-scale, incremental investments that are larger than what WUA can afford to handle by themselves. Loans and conditional grants could be channeled to WUA under Government support to

enable WUA to gain experience and a credit history, to obtain excavators and other necessary equipment, to obtain special training, or to make incidental repairs and improvements. Criteria for allocation of grants could be such things as would motivate WUA to move toward greater sustainability and self reliance, such as the share of total investment that is proposed to be invested by WUA members, the extent to which the WUA has been achieving a satisfactory standard of MOM, etc.

139. This could have the following steps. Step 1 would be the mobilization of funds by the Government and international financial institutions) for annual allocation in the initial years. Step 2 would be preparation and agreement on the operating principles and procedures for the IIF. Criteria would be identified for enabling the WUA to become eligible to receive grants from the Fund. Other criteria could be identified for actual selection of WUAs to receive grants. Step 3 is the preparation of simple grant proposals by participating WUAs. Step 4 would be a review and selection of proposals by the IIF Committee. Step 5 is the implementation of improvements under each grant. And Step 6 is, over time, the transition of the IIF into a revolving fund after grant funds would eventually become loans to be repaid to the Government. If the eligibility and selection criteria included such things as prior implementation of an acceptable standard of maintenance, acceptable collection rate of the ISF and satisfactory results from an Irrigation Management Audit (IMA), then they could serve to strengthen the incentives for the WUA to achieve good levels of performance.

140. Without obtaining an acceptable standard of routine maintenance and incidental repairs for on-farm irrigation sub-systems investments in rehabilitation and modernization will not achieve their desired effects for sustained functional life. Therefore, routine maintenance is just as high a priority as rehabilitation and modernization.

7.3 Building Capacity for Management and Innovation in the Sector

Priority F: Economic and Effective Management of Irrigation & Drainage

141. The quality of management, operations and maintenance (MOM) in Azerbaijan's irrigation systems varies considerably, especially between high value agriculture irrigated by sprinklers and drip lines and surface irrigation for staple crops in the plains. Irrigation systems have deteriorated rapidly, largely because of lack of maintenance. It appears that there is a lack of attention to following any minimum and measureable standard for O&M. Implementing routine maintenance at an acceptable standard, including minor and incidental repairs and improvements that may be needed, would keep irrigation performance at a sustained acceptable standard and would forestall the need for rehabilitation. A minimum and measureable Standard for Satisfactory Irrigation System Management needs to be defined, operationalized and put into use for needs-based budgeting and for an incentive as a pre-condition for an irrigation system to become eligible for rehabilitation.

142. The standard should be applied for satisfactory management, operations and maintenance of irrigation systems. Each irrigation system is different, including, potentially, its objectives, so it is not recommended to specify and standardize the intensity or nature of operations or maintenance activities across all systems. The concept of identifying a "Standard for Satisfactory Irrigation System Management" should be one where the standard can be identified and operationalized at the level of an irrigation system but be based upon principles, criteria and conditions specified at a higher level. It starts from the intended objectives for performance outcomes and then specify what types, levels and intensity of MOM (and possibly modernization) would be required to achieve those outcomes. The Standard for Satisfactory Irrigation System Management (or MOM) would be based not only on intended outcome objectives but also the level of costs and availability of structures, staff and expertise needed to achieve the objectives.

143. The Standard for Satisfactory Irrigation System Management would become a widely understood concept as would the methodology for defining it at the system level. There would be “sub-standards” for performance objectives or achievement:

- 1) For management (irrigation system plan, irrigation service fee, collection rate, meetings, records and reports);
- 2) For operations (efficiency, equity, timeliness, reliability, etc.); and
- 3) For maintenance (maintenance intensity versus intensity of need, functional condition of structures and canals, etc.). Justifications should be provided for each standard adopted.

144. The standard(s) identified for a given irrigation system would be converted into irrigation service plans and needs-based budgets. The standard could become a basis for asset management and for planning and prioritizing assistance from the government. In order to introduce needed incentives for irrigation departments and water users associations to invest more in irrigation management, achievement of the standard (which could be evaluated by inspections by outsiders) could be used as an eligibility criteria for allocation of funds for rehabilitation, extension of canals or modernization.

145. Establishment of a measurable standard of acceptable operations and maintenance is an essential part of preparation and implementation of irrigation service plans (ISP) and needs-based budgets (NNB) that are based on satisfactory standards of maintenance. At present, it is estimated that the current level of the ISF is only 10% of what is required. It is essential to base O&M on such standards. Although in the details of targeting and making assessments of the Standard of Satisfactory Irrigation System Management (including O&M, financial management, etc.), there may be “gray areas” or qualitative judgments involved, over time experience in a given location will make such targeting and assessments reflect the realities of satisfactory O&M for that location.

146. It will be important that training of WUA officers and staff and RSU staff in all aspects of I&D governance, management, financing and support services continue periodically for the long term. Periodic updates of training materials and development of additional training materials will be needed. It is likely that additional or updated training manuals and materials will be needed for emerging topics such as, water savings, Irrigation Management Audits (IMA), an Irrigation Improvement Fund, development of internal regulations or by-laws of WUA, creating a WUA federation, asset management, support services, and so on.

147. As important as training programs is the provision of pragmatic, field-based, target-oriented management consultations to facilitate optimization of WUA management, operations and maintenance. In the future it could greatly increase the effectiveness of AIOJSC and its regional centers (RSC) if AIOJSC could develop a practice of conducting “management consultations” with WUA and WUAF, wherein trained management consultation experts from AIOJSC would visit a WUA periodically to identify management challenges (technical, financial, institutional), facilitate finding solutions and check back for further consultations. These are periodic visits by RSU staff to each WUA for the purpose of having irrigation management consultations with WUA officers and staff in order to examine problems in the field and discuss solutions. The RSU staff relays experiences and ideas from other WUA in the raion and helps the WUA prepare action plans, monitoring plans, proposals for the IIF, plans for accessing appropriate support services, and so on.

148. Another innovation that would appear to fit the needs of Azerbaijan is the process of periodic Irrigation Management Audits of WUAs for technical, financial and institutional aspects of performance. This could be done yearly or bi-annually by staff of the SSB and RSU/CSU who visit each WUA and assess such things as the WUA’s legal status, existence and settlement of disputes, elections of WUA leaders, appropriateness of Irrigation Service Plans (ISP) and their implementation (especially quality of operations and maintenance), rate of the Irrigation Service Fee (ISF) and means of collection and use of funds, use and results of any grants from the Irrigation Improvement Fund, and so on. Results of the IMA

could be linked to identification of needs for support services, regulatory issues and eligibility for assistance from the IIF.

149. There is a lack of support service providers for WUA. During the Soviet period the government provided support and controlled markets. With the present emerging market conditions WUA need potential support for such services as agricultural extension, crop processing, marketing, irrigation operations, repair and rehabilitation, legal assistance, financial management and reporting, and so on. The Bank could provide a useful role in financing a study to identify what kinds of support services are needed by WUA and what are the water users' objectives for such support. The study could help identify existing and likely future providers of support and find ways and means to prepare and motivate entities to provide needed support. This study should include a search for Public-Private Partnerships that could provide services to WUA and WUAF. Such partnerships could involve both the WUA (to identify and commission services needed), a private sector entity (to provide services on a pay-for-service basis), and the government (to regulate and, if necessary, provide technical or financial assistance).

150. It is recommended that a study be implemented under WUAP to determine, under specified conditions, what is the optimum area and number of members that should be served by one WUA and also by one WUAF. The underlying question to be answered is, What criteria should determine the optimal size of a WUA or WUAF? These might include such factors as local management intensity required by the system, degree of uniformity or diversity of crops, social homogeneity or heterogeneity, technical challenges, and so on.

151. As is the case with developing countries worldwide, in Azerbaijan, the government bureaucracies responsible for agriculture and/or irrigation and drainage have developed rigid seniority systems with procedures, budgets and organizational behavior that largely prevent efficient, responsive and needs-based management systems from emerging. It could be considered as a high priority to introduce modern incentive systems and accountability mechanisms into the AIOJSC, into RID, into WUA and into the relationships between these organizations. It is recommended that a study be done on how to introduce incentives and accountability mechanisms into the WUA and AIOJSC to better ensure high levels of irrigation system management performance, including performance for irrigation or conveyance efficiency, agricultural and economic productivity per unit of water delivered, cost efficiency, equitable distribution, quality of maintenance, and so on.

152. Any management innovations identified from research and development could be pilot tested through the AIOJSC with possible assistance from the World Bank's WUAP project. The Bank considers essential management innovations to be both important and urgent in order to enable Azerbaijan to rise to a needed higher standard of efficient, effective and sustainable management and to stop the patterns of rapid deterioration.

153. It is recommended that an analysis be done and a way be found for how to make capacity building in the irrigation and drainage sector of Azerbaijan become a periodic, repeating and long-term phenomenon that is not just dependent on international assistance. Staff in AIOJSC, RSC and WUA are always changing. New staff need to be trained. There is also a need for people to realize that conditions and challenges are constantly changing, as are the needs for building new capacities.

Priority G: Water Savings with Innovations in Technology and Management

154. Ninety percent of agriculture is irrigated. The ET rate soars in the summer and there is nearly zero precipitation. And yet competition for water is rising. Achievement of water savings in irrigation is an important priority for Azerbaijan and the World Bank. There is a need to identify and prioritize ways and means to introduce changes in technology and management procedures at the level of off-farm gates and canals that would improve water conveyance and distribution efficiency. A method should be developed

to prioritize locations of gates, canals and other structures where water saving technologies and management procedures can save the most water. These methods would be introduced through training and on-site consultations by AIOJSC expert staff.

155. With the support of international experts some research could be conducted by universities and the AIOJSC to identify best designs for off-farm and on-farm gates and canals, including the lining of canals. The Bank has already helped finance assistance of experts in irrigation technology from the California Polytechnic Institute and others for an assessment of environmental needs for water. Some field assessments could also be done to identify how and where most water losses occur at the on-farm level. Assessments could also be done that identify how water application in the field needs to be improved for each type of crop so as to eliminate over-use or waste of water. The AIOJSC and international experts could develop guidelines and training modules about how to minimize water losses or wastage at off-farm, on-farm (i.e., WUA) level and on the level of individual fields. Under Component 1 of the Water Users Association Project (WUAP), it is anticipated that demonstration projects will be implemented in core raions to promote innovation in methods for water savings. This may include on-farm water management, irrigation O&M practices and possibly innovative technologies for gates and canal lining.

156. Selecting and introducing new water saving technologies and practices is important in order to prepare for a future of rising frequency of droughts and competition for water with other uses than irrigation. Its importance will rise after rehabilitation. But water savings is an important criteria for selecting new technologies under a program of modernization.

Priority H: Improving the Capacity of Human Resources for Irrigation & Drainage

157. There is a need to prepare an up-to-date, future-oriented human resources plan for the I&D sub-sector. This could be part of the master plan proposed above. However, before this can be done an overall policy and strategy for the sub-sector may need to be prepared to provide clarity about objectives, priorities and modalities. Once this becomes clear the Government can then commission an assessment of current and emerging needs for capacities, recruiting, training and advanced degrees, both for the AIOJSC at the central level and for the RID (especially if some functions are decentralized). Another element of a human resources plan would include introduction of accountability and incentive mechanisms to encourage staff to achieve high work performance. It is suggested that a policy working group be set up to develop a policy and strategy for the subsector, which would include a plan to develop human resources for the future. This group could be linked to research and development efforts, development of legislation and regulations for the sub-sector and to modernization and capacity building efforts.

158. During discussions with the Heads of the Departments of AIOJSC they stated that AIOJSC has no technical staff with up-to-date international irrigation, drainage, environmental and water resources management training. At present staff members do not have the language skills required to acquire modern knowledge via the internet. In order to help the AIOJSC make the transition to the new roles expected of it, including interacting with and supporting WUAs, the World Bank could consider funding scholarships to send young Azeri engineers abroad for bachelor's and master's degrees. These individuals could be sent to different countries such as the Netherlands, France, USA, UK, Canada and Australia, so as to obtain the latest training in irrigation, hydrology, drainage, river training, environmental engineering and water resources management. Probably the most relevant degrees from foreign centers of excellence would be in such topics as:

- Modern Irrigation and Drainage Techniques
- River Training and River Basin Management
- Environmental Engineering
- Management Information Systems
- Integrated Water Resources Management

- Community and institutional development.

159. Under the sub-component for institutional capacity building studies and pilots, under Component 1 of WUAP, a study on institutional and human resource requirements for the irrigation and drainage sector will be conducted.

160. Under WUAP there will be short-term training courses in priority specific topics could also be useful for capacity building in the irrigation and drainage sector and occasional study tours to places with advanced approaches towards irrigation and drainage technology and management (such as California in the USA). As WUAs develop and mature their need for training also grows and this will continue as officers and staff are replaced and as new challenges emerge. Under the Bank's WUA Support Project (WUAP) the 16 training modules will be revised and new modules for On-farm Irrigation Management and Asset Management will be developed. It is expected that more than 30,000 participant days of training will be provided, primarily for WUA officers and staff.

Priority I: Optimizing convergence between AIOJSC and the Agriculture Ministry

161. The Bank will promote movement toward an optimal convergence between the AIOJSC and the Ministry of Agriculture for irrigated agriculture. The Bank and AIOJSC should consider irrigation and drainage as a supporting sector relative to agriculture, so that the initiatives for rehabilitation and modernization, institutional reforms, irrigation management improvements and capacity building of the AIOJSC and WUA should be planned and implemented within the priorities of the agriculture sector.

162. Agricultural objectives such as expansion of higher value crops, intensification of agriculture and improvement of crop yields per unit of land and water, improved on-farm water management, development of extension and advisory services, and so on should each shape the priorities and modalities of the irrigation and drainage sector. In recent years the Government has shifted more toward a strategy of intensification than extensification of agriculture in Azerbaijan. Intensive cultivation of high-value vegetables and fruit would yield far higher economic productivity per hectare than staple crops. But it also requires significant investments in capital, fertilizers, labor and credit. Many farmers grow alfalfa to also raise and feed cattle, sheep and poultry. Another agricultural strategy is to increase production of high-value, drought tolerant crops such as grapes, figs, olives and nuts for the summer months and cereals and vegetables as winter crops. The Government is promoting development of crop processing facilities and businesses in the country and would like to export crops with qualities and prices that are competitive abroad. It would also like to increase agricultural extension services that are needed to enable farmers to shift to high-value crops and intensify production. The Government recognizes that farmers will need credit facilities to intensify agriculture and there are outstanding legal issues about small farms. It is also understood in the Ministry of Agriculture that irrigation rehabilitation, modernization, extension and development of new irrigation are all important for agricultural objectives.

163. Future investments in I&D will have less risk and be more productive if I&D investments are coordinated with agricultural strategy. It is recommended that the AIOJSC and Agriculture Ministry form a coordinating committee that meets regularly to monitor progress in I&D and agriculture, discuss lessons learned, issues and challenges, to plan joint activities such as pilot projects and field demonstrations and to coordinate policies and initiatives.

Priority J: Research and Development for Irrigation & Drainage

164. There are several potential high-priority topics for which research and development (R&D) are needed. This includes applied research on demonstration plots or at the on-farm irrigation level. Such topics might include:

- 1) R&D on priorities for improving I&D management efficiency and effectiveness at off-farm levels;
- 2) R&D on water savings technologies at off-farm levels;
- 3) R&D on management practices for water savings at off-farm levels;
- 4) R&D for how to develop an optimum irrigation service plan;
- 5) R&D to improve needs-based budgeting, scheme-specific WUA ISF and financial management;
- 6) R&D on optimizing the use of government subsidies for the I&D sector;
- 7) Study on the drainage sector and drainage practices and technology;
- 8) Prepare an updated master plan for irrigation and drainage;
- 9) Prepare a strategic plan for adaptation to likely climate changes;
- 10) Prepare a study that prioritizes I&D investments in accordance with key criteria;
- 11) International study tours to countries with pertinent experience in I&D reform and institutional development.

165. It would be worthwhile to finance some research with pilot testing at the on-farm level. The following are some priority topics.

- 1) Land preparation methods at the individual farm level that promote water savings;
- 2) Water application methods at the individual farm level that promote water savings;
- 3) Crop cultivation methods for new high-value crops
- 4) Pragmatic costing of on-farm irrigation O&M
- 5) Preparation of budgets and fees for on-farm irrigation
- 6) Performance assessment for on-farm irrigation management
- 7) Identification of support service needs and options for suppliers.

166. These research and development priorities are consistent with those identified under Components 1 and 2 of the WUAP project. Research and development may be coordinated by a policy working group for the I&D sector. Different types of stakeholder representatives could be invited to attend some of the policy working group meetings to give their views and recommendations on what are the key issues to be addressed through research and development. Experts in the universities could be included in the policy working group to provide expert recommendations. It is expected that WUAP will help support identification of needed innovations and practical methods for items 2, 5 and 6. A demonstration project could be done with use of subsidies to stimulate investment by WUA in repairs and improvements to on-farm infrastructure. The likely extent of modernization and innovation needed in the I&D sector research and development is significant. Specific research questions and development, testing and application of innovations may be prioritized and implemented incrementally as funds become available.

167. It is recommended that the Government establish a fund from which to finance small-scale research and development projects on innovations needed in the I&D sector. Universities and other research organizations could submit proposals that would be reviewed and selected by the policy working group. The Bank and other donors could also contribute to this fund.

Priority K: Need to Develop a Strategy to Adapt Proactively to Climate Change

168. Given Azerbaijan's vulnerability to climate change and its dependence on neighbouring countries for 70% of its water, it is essential that Azerbaijan soon prepare a climate adaptation strategy and plan for the I&D sector. This could be something added to a subsequent project that could be funded, in part, by international financial institutions (IFI).

169. Improving the productivity of land currently under cultivation is more economical and attractive than expanding the area cultivated. The most rational approach to coping with climate change for irrigated agriculture might be to determine what is the socially acceptable level of risk for water supply, crops and

income and then to identify the most cost-effective measures to achieve this level. Given the rising uncertainties and unpredictabilities, the challenge is to address the question of, What strategy should be taken given that we cannot predict the future?—rather than, What is the best way to optimize a future that we expect? (World Bank, 2010b)

170. More specifically, there are a number of measures that Azerbaijan could include in an adaptation strategy, for which the Bank or other IFI may want to support.⁵ These range from small to large actions.⁶ They are likely to include the following aspects.

- 1) Identification and generation of awareness among farmers about stages during crop growth when irrigation is most needed, giving irrigation at critical growth stages only, thereby reducing unnecessary use of irrigation water at other times (which implies an increasingly important need for extension that deals with irrigation and on-farm water management as well as agriculture);
- 2) More extensive experimental research and adoption of sprinkler and drip irrigation technology and methods, to reduce water consumption for agriculture;
- 3) “Just-in-time” application of irrigation water on fruit crops can prevent frost damage during essential flowering periods;
- 4) Experimentation with and adoption of crops that are more water stress tolerant and more water efficient;
- 5) Forecasting weather conditions and water availability and monitoring drought conditions;
- 6) Promotion of water harvesting techniques, storage and reduction of run-off;
- 7) Watershed management in cooperation with upstream neighboring countries;
- 8) Substantial expansion of drainage and flood mitigation facilities;
- 9) Adoption of new irrigation designs and technologies for water savings and flood prevention;
- 10) Find methods to use or reuse marginal, sub-optimal or moderately polluted water;
- 11) More reservoirs for water storage;
- 12) Adjust timing for planting, inputs, irrigation and harvest that are more appropriate for changing weather patterns;
- 13) Adoption of integrated water resources or river basin management practices with treaties or agreements between neighboring countries over water supply and use;
- 14) Preparation of a climate change adaptation strategy for water resources.

171. The advent of climate change brings many challenges that require urgent action. Table 9 below displays a list of 24 potential actions that could be taken pro-actively to adapt water sectors to the impending effects of climate change. In the table, the column on the right indicates what types of potential actions could be taken on these challenges. Technical assistance from consultants and NGOs, stakeholder consultations, community organizing, and involvement of water users associations and the government will all be needed. A key challenge will be how to mobilize sufficient support for a program of adaptation before it becomes too late to make a difference. Specific potential actions are given within each step. The GoA may want to consider adopting such a strategy.

⁵ William R. Sutton, Rachel I. Block, and Jitendra Srivastava. 2010. *Adaptation to Climate Change in Europe and Central Asia Agriculture*. Washington, DC: The World Bank.

⁶ Marianne Fay, Rachel I. Block and Jane Ebinger, Editors. 2010. *Adapting to Climate Change in Eastern Europe and Central Asia*. Washington, DC: The World Bank.

Table 9 Potential Elements of a Climate Change Adaptation Strategy for Azerbaijan

#	Actions	Support to facilitate actions
-- STEP 1: ASSESS VULNERABILITY --		
1	Collect & analyze geophysical, hydro-meteorological, environmental, socio-economic, institutional data for vulnerability assessment & early warning system	Assist governments to design, introduce & build capacity for disaster response by setting up monitoring & early warning systems
2	Identify areas where need for adaptation is significant	Assess priority areas of vulnerability
3	Strengthening hydro-meteorological information and disaster management	Prepare a comprehensive information system with real-time data & warnings
4	Set up an early warning system to enable rapid adaptation to emergency or extreme events	Assist governments & institutes to prepare an early warning system
-- STEP 2: PREPARE AN INSTITUTIONAL FRAMEWORK --		
5	Adopt new laws, regulations and guidelines needed to support an adaptation strategy	Assist governments to prepare & adopt legal & regulatory framework needed for adaptation
6	Establish viable basin organizations to manage water for multiple types of users under increasing water supply extremes and variability [<i>This may include basin, watershed aquifer & water users associations.</i>]	Help design & introduce IWRM organizations & procedures that are appropriate for adapting to climate change
7	Build capacity of new IWRM organizations to enable them to implement effectively the country's adaptation strategy	Assist in preparation and implementation of capacity building strategy & events
8	Increase use of economic incentives & disincentives to motivate water conservation (metering, volumetric pricing, credits) [<i>Pricing & disincentives may be difficult to impose.</i>]	Help design & apply new economic & institutional incentives & disincentives to encourage water conservation & efficient use
9	Facilitate establishing forums to negotiate & resolve disputes over water & adaptation strategies [<i>Can provide more rapid & frequent resolution of water disputes</i>]	Help design, introduce & build capacity in institutions, support negotiation & conflict resolution among stakeholders
10	Enhancement of negotiated water access or use rights among stakeholders	Help develop an effective process for negotiation of water use rights among water users
-- STEP 3: IDENTIFY, ASSESS & SELECT ELEMENTS OF AN ADAPTATION STRATEGY --		
11	Raise awareness & enhance advocacy of stakeholders (especially the vulnerable poor) about climate change	Help design & implement awareness & stakeholder consultations
12	Research on options for adaptation, including identifying tools to facilitate appraisal of options	Help governments develop & implement water sector strategies to adapt to climate change
13	Prepare adaptation strategies to be adjusted periodically, with sustained support of donors & experts	Assess needs & options for timely adaptation, including developing tools to assess options
14	Preparation of contingency plans for multiple new risks	Help clients develop contingency plans
-- STEP 4: IMPLEMENT THE ADAPTATION STRATEGY --		
15	Reduce water demand with changes in tillage & drought-tolerant crops, crop calendars, new irrigation & on-farm water management methods, reduce areas planted [<i>Has high potential</i>]	Developing institutions & management systems for water delivery systems. Improve water use efficiencies at irrigation system & on-farm levels

#	Actions	Support to facilitate actions
	<i>but is difficult due to multiple stakeholders.]</i>	
16	Promote traditional practices for sustainable water use [Potential exists, need receptive government & groups]	Help promote re-adoption of traditional water management practices that ensure sustainability
17	Introduce participatory methods for IWRM for water re-allocation, adaptation & trans-boundary management [Need to develop risk mitigation, flexibility & adaptability]	Help governments develop & adopt methods for applying IWRM to adapt to climate change
18	Increase storage capacity with additional reservoirs & dams [Locations are increasingly few & costly]	Feasibility assessments, environmental & social impact assessments & studies on storage
19	Expand water storage for rain and runoff [Small scale]	Introduce small water storage technologies
20	Limit exposure to flood damage with early warning forecasting, regulations, zoning, insurance & relocation	Limit flood damage through regulations, management, information & response measures
21	Improve disaster response through new organizations & procedures, disaster services, seed & grain storage, credit & sale of capital [Pro-active approach needed]	Help clients identify probabilities, locations & timing of disasters & build disaster mitigation capacity & assistance
22	Build capacity to carry out environmental & social impact assessments	Do environmental/social impact assessments of adaptation strategies & build capacities for these
-- STEP 5: MONITOR, EVALUATE & ADJUST THE STRATEGY --		
23	Set up monitoring & evaluation system for adaptation strategy	Assist governments & institutes to design a comprehensive but practical M&E system
24	Set up procedure to review findings of M&E & procedure to make rapid adjustments in adaptation strategy	Help arrange inter-ministerial arrangement to enable rapid adjustments in adaptation strategy

172. The Bank, other IFIs and colleagues in Azerbaijan could discuss how the Bank and the Government and people of Azerbaijan could best collaborate to prepare an optimal strategy for adapting in a timely way to forthcoming changes in climate. This may become a priority for the GoA and it may shape the priorities for modernization. This may include development of reservoirs to significantly increase water storage capacity within the country and I&D technologies to save water use.

7.4 Summary

173. Chapter 7 of this Sector Review includes 43 recommendations for the I&D sector in Azerbaijan. These are summarized in Table 10 below. Of these recommendations, 21 are to be implemented, at least in part, under the WUAP project that is now getting underway. An additional 11 recommendations might be included within WUAP but are not explicitly mentioned to be part of it. Recommendations not included in WUAP are mostly related to high level or sensitive issues.

Table 10. Recommendations in Sector Review

No.	Recommendation	Sector Review Priority	Para. # of Recommendation	Included in WUAP
1	High-level policy discussions & white paper	A	114	No
2	Institutional review & possible reform of AIOJSC	A	115 - 117	No
3	Change of management culture in AIOJSC	A	118	No
4	Reform of water tariff system	A	119	No

No.	Recommendation	Sector Review Priority	Para. # of Recommendation	Included in WUAP
5	Preparation of by-laws for WUA and WUAF	A	120	Possibly
6	Capacity building of SSB	A	121	Yes
7	Develop Law for Integrated Water Resources Management	A	122-124	No
8	Need for national water resources coordinating body	A	124	No
9	Need for I&D Strategic or Master Plan	B	126	Possibly
10	Need for I&D Action Plans to support recommendations	B	127	Possibly
11	Establishment/reorganization of WUA	C	129	Yes
12	Capacity building of WUA	C	129	Yes
13	Irrigation management transfer	C	129	Yes
14	Participatory rehabilitation	C	129	Yes
15	Partial repayment of rehabilitation costs	C	129	Yes
16	On-farm irrigation modernization (as an emphasis for Bank)	C	129	Yes
17	Identify support services needed & how to be provided	C	130	Yes
18	Modernization of off-farm irrigation technology, including new water control, distribution and canal lining	C	131	Possibly
19	WUA need MOM equipment & facilities, including excavators, offices & supplies, including computers & cell phones	C E	132 135	Yes
20	Study on needs for drainage rehabilitation, modernization, extension & development of new drainage systems	D	133 - 134	Yes
21	RID field staff need motorcycles to be effective	E	135	No
22	Each WUA needs an excavator for maintenance	E	135	Yes
23	WUA need improved method to prioritize maintenance needs, including asset management	E	136	Yes
24	Establish an Irrigation Improvement Fund to promote timely incidental repairs and improvements	E	137 - 139	Possibly
25	Introduce Satisfactory Standard for Irrigation System Management	F	141-145	Possibly
26	Adoption of Irrigation Service Plans, needs-based budgets & Irrigation Service Fees	F	144, 145, 148	Yes
27	Irrigation Management Audits should be initiated to identify support service needs & provide guidance to WUA	F	146, 148	Yes
28	Periodic, repeating training in all important aspects of I&D governance, management, financing and support services	F	146	Yes
29	Repeating, periodic management consultations by RSU staff	F	147	Yes
30	There is a need to build provision of support services to WUA through Public-Private Partnerships	F	149	Possibly
31	Study on optimal size of WUA and WUAF	F	150	Yes
32	Study on incentives & accountability mechanisms for WUA & AIOJSC	F	151	Possibly
33	Introduction of water saving technologies and practices	C G	130 154-156	Yes
34	Need study and new human resources plan for I&D sector	H	157	Yes
35	Mobilization of support for international short-term training & degree programs in needed areas of expertise	H	157-159	Yes
36	Conduct study tours to areas of advanced irrigation and drainage management practices	H	159	Yes
37	Need to update and add additional training modules on I&D	H	160	Yes
38	Joint planning & cooperation between AIOJSC & Min. of Agriculture	I	161	Partly
39	11 potential topics are suggested for research at the off-farm level	J	164	Yes
40	7 potential topics are suggested for research at the on-farm level	J	165	Yes
41	Set up a policy working group to select and oversee research	J	166	No

No.	Recommendation	Sector Review Priority	Para. # of Recommendation	Included in WUAP
	projects			
42	A fund should be set up for small-size grants to finance research and development projects for I&D, to be funded by the Government, the Bank and other donors	J	167	Partially
43	Prepare a national strategy for how the I&D sector should adapt to climate change (as part of the I&D Strategic Plan)	K	168-171	Yes

Conclusion

174. Clearly, Azerbaijan needs to conduct a major program of rehabilitation and modernization of its irrigation and drainage systems. But this will only have the desired, sustained effects on increases in productivity per unit of land and water if a strong program of improved operations and maintenance; better cost recovery; necessary policy, legal and institutional development; stronger WUA; new water savings technologies and methods; and improvements in human resources capacities are all developed together, through a long-term program of investments. The irrigation and drainage sector requires that all these aspects develop together. This will require long-term commitment and mobilization of resources by the government and well-selected assistance from The World Bank and other donors and international technical assistance agencies. The bulk of investments for rehabilitation and modernization will come from the GoA, with substantial assistance coming from the State Oil Fund at least for several years. Assistance from the Bank would be focused mainly on capacity building, modernization and introduction of appropriate management innovations.

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Annex 1: Text for State Program for Sustainable Development of Amelioration and Water Management for 2008-2015

I. Introduction

Azerbaijan is a land with complex topography and natural climate conditions and long traditions of irrigated farming. Out from its 8660 thousand ha of available land, only 54.9% (4759 thousand ha) is suitable for agricultural use. Majority of this land (2915.4 ha) is under perennial plantings (orchards, vineyards, seedlings, tea plantations), pastures and haylands. Total of 1843 thousand ha is used as a fallow land.

Agricultural production in Azerbaijan was mainly based on irrigated land. Irrigated land is a source of 85-90% of current agricultural production. Cotton, tobacco, vegetables and other profitable crops are exclusively grown on irrigated land.

Agricultural land is mainly located in plain and arid region with warm climate and low precipitation. Hot summer months and winter months without much rain do not allow generation of enough water reserves in soil. As a result, crop husbandry in 78% of 1.843 million ha of fallow land requires artificial irrigation and corresponding amelioration and irrigation activities. Currently the country has 1.433 thousand ha irrigated land. 126,000 ha of total irrigated land is under occupation.

Irrigated land has been provided with well designed amelioration and irrigation facilities. Complex amelioration activities have been implemented in 609 thousand ha of this land, 288 thousand ha has been provided with open, 309 thousand ha with covered and 13 thousand ha with vertical drainage network. 51,7 thousand km of irrigation channels, 29,6 thousand km of collector-drainage networks and corresponding 118 thousand hydro-technical facilities and 931 pumping station have been constructed in the irrigated area.

Azerbaijan is located in arid zone and therefore the country's water reserves are scarce. Surface water resources are 32,2 bln m³ decreasing to 22,6 bln m³ in dry years. Only 10 bln m³ or 30% of water reserves is generated in country's own area, the rest 70% is generated in neighbouring countries. Ground water resources are 5,2 bln m³ with around one third of it in use.

To prevent disproportion river flows and to ensure effective consumption of water resources by the country's economy 135 river reservoirs and 16 river headworks had been constructed and 7199 sub-artesian wells had been drilled to meet the demand for irrigation and household water supply using the ground waters. For the purposes of river flooding and mudflow protection for cultivated and residential areas 113 km of stonecrete and concrete walls, and 1644 km of sandbags had been constructed.

The country's agrarian reforms commencing in 1996 included amelioration and irrigation reforms as well. Law on Amelioration and Irrigation was passed in 1996 and the Water Code of the Republic of Azerbaijan in 1997.

Taking into account that effective and efficient consumption of water resources required application of modern irrigation equipment and technologies and improved water systems and its management practices and based on the requirements of the market economy, gradual introduction of paid water services started in 1997 and establishment of local Water Users Associations was initiated by the water users. In accordance with the revised Amelioration and Irrigation Law, Associations are currently being re-registered as Water Users Unions. 450 Association has been already re-registered as Water Users Unions, 21 Unions are prepared for re-registration. Activities in this direction are ongoing.

Following the liquidation of collective and state farms in the course of reforms, on-farm irrigation and collector-drainage networks remained abandoned, making its maintenance difficult and which caused the

Cabinet of Ministers of the Republic of Azerbaijan to issue special decision in 2000 on taking such networks into state custody. As a result of inventory taking under this decision, 24,9 thousand km from 82,3 thousand km of on-farm irrigation and collector-drainage networks deemed unsuitable for operation and 35 thousand km of irrigation channels and 22,4 thousand of collector-drainage networks, 82,9 thousand hydro-technical facilities, 151 pumping stations, 1196 sub-artezian wells and other on-farm amelioration and irrigation facilities were transferred to the balance of Amelioration and Irrigation Open Joint Stock Company.

Part of them was rehabilitated through the state budget financing in the past period. These networks are currently being repaired and cleaned as a part of maintenance and capital repair activities. However, these works only partially meet the existing demand and additional activities in this area are necessary.

Thus some essential issues remain to be addressed in the area of protection, maintenance and development of existing amelioration systems.

2930 km of various diameter metal, asbestos and polyethylene pipes of water supply systems for winter pastures being operated for the long time (40-50 years) became obsolete and deteriorated, some parts of metal pipes suffered from corrosion. Water supply systems of winter pastures are in need of rehabilitation and reconstruction.

One third of country's irrigated land is irrigated using mechanical method, pumping stations and subartezian wells. In addition, drainage waters from 224 thousand of land located below the sea level are removed using water well pumps, which require annual consumption of 800-900 million kw/hour of power and 8-10 thousand tons of diesel fuels. Energy expenses in average constitute 30-35% of AIOJSC's costs.

Lack of power supply in recent years caused a number of problems in operations of pumping stations. Lack of power supply of pumping stations resulted in water supply failures and worsened ameliorative condition of lands. Interrupted and low voltage water supply badly affects pumping and power equipment and cable system.

Successful foreign and domestic policy pursued by the President of Azerbaijan Ilham Aliyev led to strengthened positions of the country at international arena and continued growth of economy.

Growth of population and resulting increase in demand for food products, as well as for raw products in various sectors of the economy requires effective use of the country's water resources and improving existing water supply.

Improving existing situation along with institutional measures requires improving sector management, strengthening amelioration and irrigation facilities, improving ameliorative condition of irrigated systems and lands, carrying out urgent construction and rehabilitation activities necessary for the sector's future development, taking measures to address adverse impact of flooding and mudflows, riverbed adjustment and bank protection activities in Kura river's delta, increasing scientific base of amelioration and irrigation management and attracting additional investments necessary to implement above mentioned activities.

Considering essential and leading role of amelioration and water management in the country's economic growth, and particularly in the agricultural development, development of *State Program on Sustainable Development of Amelioration and Water Management in the Republic of Azerbaijan for 2008-2015* became necessary to implement actions arising from the Decree #372 dated February 23, 2006 of the President of the Republic of Azerbaijan on the *Measures to Pursue Future Development of and Increase Investments to the Sector, as well as Improving Amelioration and Water Management*.

II. Program Objectives and Key Directions

State Program on Sustainable Development of Amelioration and Water Management in the Republic of Azerbaijan for 2008-2015 (hereinafter referred to as the State Program) has been developed in line with the provisions of the Laws of the Republic of Azerbaijan *on Amelioration and Irrigation, on Safety of Hydro-Technical Facilities* and the *Water Code*, Presidential Decrees on effectiveness of these laws, decisions and resolutions of the Cabinet of Ministers, *Development Concept of Amelioration and Water Management for 1996-2010* based on other water sector regulations, *State Program on Social and Economic Development of Regions in the Republic of Azerbaijan (2004-2008)* approved by the Presidential Decree #24 dated February 11, 2004 and takes into account amelioration and water management facilities suggested for inclusion into the *State Program on Poverty Reduction and Sustainable Development in Azerbaijan (2006-2015)*, developed at the request made in the Presidential Resolution #853 dated June 20, 2005.

State Program identifies future directions of the development and actions to ensure sustainable development of amelioration and water management, which are among leading sectors of the country's economy.

The State Program provides for implementation of the following urgent amelioration and water management measures:

- improvement of amelioration, irrigation and water management legislation;
- improvement of water reserves management;
- protecting and sustaining existing amelioration and water management facilities, improving their maintenance, increasing sector's material-technical base ;
- improving ameliorative condition of irrigated lands;
- construction and reconstruction activities necessary for the sector's future development;
- preventing adverse impact of flooding and mudflows by means of construction of bank protection facilities;
- effective consumption of water resources and use of equipment and application of equipment and technology ensuring water savings;
- strengthening scientific base of amelioration and water management;
- increasing HR capacity;
- financing and economic effectiveness of amelioration and irrigation activities.

1. Improvement of water resources management

Country's transition to the market economy and establishment of new owners as a result of agrarian reforms lead to essential transformation of relations in the areas of water facilities use and protection. A number of new laws and regulations have been developed and adopted to govern these relations.

Future effective performance in the area requires improvement of institutional and water resources management and strengthening public control over water use and protection.

As the land reform is mostly completed, paid water use shall be increased and public importance facilities and other facilities, excluding reservoirs, headworks, main and inter-farm channels, collectors, embankments, pumping stations and sub-artesian wells shall operate on self-finance basis for the purposes of ensuring more effective and efficient consumption of water resources and fully meeting the water demand of economy and population, as well as for meeting economic interests of the state.

At the same time, in order to protect rights and interests of water users and land owners, establishment of Water Users Unions covering all irrigated land is envisioned, in accordance with the existing legislation.

For the purposes of applying integrated water resource management principles, gradual introduction of basin management principles is planned for individual water management systems.

Currently there are some tensions and problems concerning the joint use of trans-border water resources. These problems need to be addressed and resolved at corresponding level by means of negotiations. Management of water resources of the country's trans-border rivers is in line with *Convention on Use and Protection of Trans-border Water Streams and International Lakes*.

As problems related to the water supplies intensifies in XXI all around the globe, as well as in Azerbaijan and importance of this sector increased in the context of water shortage, it's important to remove repetitions in the area of water resources use and protection and to execute integrated public policy.

Improved water resources management and strengthened public control over its use and protection will create favorable conditions for full water supply to all economy sectors and scientific-technical and economic development in the area of amelioration and water management using modern scientific achievements and technologies based on market economy.

2. Retaining and protecting existing amelioration and water management facilities, ensuring technical safety, improving operation and strengthening material-technical base

Large-scale reconstruction activities performed for a long time resulted in development of large and complex amelioration and irrigation facility distributing and regulating water flows in the country.

Currently 15,5 thousand km of irrigation channels out of operated 51,7 thousand, 7,1 thousand km of collector drainage network out of 29,6 thousand km, 42 thousand various hydro-technical facilities out of 118 thousands, 2100 sub-artezain wells out from 7119, 235 pumping station out of 931 needs reconstruction and better operation regime. Number of reconstructed and rehabilitated facilities does not fully cover the demand and as such shall be increased several times.

Floating pumping stations development and repair plant, operating from 1954, is obsolete and deteriorated and is in urgent need for reconstruction and replacement with the plant allowing capital repair of floating pumps without actually taking them out from water. A number of technical and organizational measures and reconstruction of relevant workshops of Ali-Bayramli mechanical repair plant is needed in order to increase production of horizontal and deepwater pumps largely used by the industry, and to ensure that capital repair of ameliorative equipment meets modern requirements.

Hydro-melioration faculty of Azerbaijan Construction Institute (currently named as Azerbaijan Architecture and Construction University), which is responsible for training of hydro-technical engineers for this sector, has been merged with other faculties.

Activities to improve labor and social conditions of engineering-technical staff and workers of the industry have been almost stopped. Most of the equipment owned by the AIOJSC already passed its useful life. Most of excavating equipment needs to be substituted and spare parts needs to be procured for broken equipment.

In accordance with the established norms in average 20-25% of the equipment, pump engines, special machines and mechanisms, pipes and ets. used in water management facilities shall be replaced on annual basis. Most of them is not manufactured in our country.

Excavating equipment and special vehicles owned by the AIOJSC is planned to be fully renewed in the next three years. Part of this was procured using the state budget financing in 2007. The rest is expected to be procured in 2008-2010.

The Program envisages the following actions aimed at protecting and retaining existing amelioration and water management facilities, improving systems' operation, increasing sector's material and technical base:

- Allocating financing for operation and maintenance of amelioration and irrigation systems and replacing fixed assets with new ones;
- Strengthening material and technical aspects based on the industry's scientific research and design institutes, manufacturing enterprises, organizations providing civil works and maintenance services;
- Re-development of steelmaking, cast iron, mechanical repair and other shops of Floating Pumping Stations Development and Repair Plant and Ali Bayramli Mechanical Repair Plant;
- Introducing automated management system for pumping stations and sub-artezian wells.

The Program covers demand based annual financing for operation and maintenance of amelioration and irrigation systems and replacement of fixed assets. This financing will allow to properly operate and maintain amelioration and irrigation systems and hydro-technical facilities and, thus, will result in increased yields of agricultural crops cultivated in irrigated areas, increased volumes of overall production, as well as better water supply to winter pastures, more reliable and large-scale bank protection and riverbed adjustment activities, prevention of adverse impact of flooding and mudflows.

In addition, Program envisages state financing for strengthening of material-technical base of the industry, reconstruction of individual workshops of Floating Pumping Stations Development and Repair Plant and Ali Bayramli Mechanical Repair Plant, automation of jet and displacement pumping stations and sub-artezian wells. Complex set of measures was developed and is being implemented to ensure effective and efficient use of allocated funding.

3. Improving ameliorative condition of irrigated lands.

Ameliorative condition of irrigated land is improved by rehabilitation and reconstruction of existing amelioration and irrigation facilities and construction and commissioning of new amelioration facilities.

The State Program envisages the following actions aimed at the improvement of ameliorative condition of irrigated land:

- necessary repair and cleaning works aimed at keeping collector-drainage network in good working condition, as a part of maintenance activities.
- construction and reconstruction of collector-drainage networks to decrease the level of ground waters;
- reconstruction of Mil-Garabagth collector;
- freshening saline soil

These actions will result in a removal of drainage waters from 150 thousand ha ϕ ky ϕ in Mil-Garabagh zone and improved ameliorative condition of 112 thousand ha leading to increased agricultural production.

4. Construction and reconstruction activities aimed at industry's future development

New stage of reconstruction activities in amelioration and water management sector started in 1993 under close supervision and assistance of our National Leader. Foreign investments in our country were firstly directed at amelioration and water management.

Construction of Main Mil-Mughan collector's second section totaling 52,7 km had been financed by the Islamic Development Bank and with commissioning in 2000, and commissioning of siphon constructed at the intersection of the collector with Aras river under the World Bank financed Azerbaijan: Rehabilitation and Completion of Irrigation and Drainage Infrastructure Project (Irrigation 1) took place in 2002. Construction of the collector's 3rd section with overall length of 31 km, reconstruction of 71,2 km inter-farm collector and construction of 24 km roads along the collector was completed in 2006. Completion of the collector's 3rd section allowed to improve ameliorative condition of 60 thousand ha irrigated land in Sabirabad, Saatly and Imishli and to open new shorter automobile road between Saatli and Kurdamir.

Rehabilitation of the first 50 km section of Samur-Absheron Channel and Samur Headworks and reconstruction of 187 km inter-farm drains was completed in 2007 under the above-mentioned Project. Project completion will result in improved water supply to 49.7 thousand ha irrigated land in Gusar, Khachmaraz and Guba and better satisfaction of the demand of people, industrial and agricultural sector in Baku and Sumgayit for potable water, process water and irrigation water.

Construction of first 37,5 km section and second 29,7 km section of Khanarkh channel, covered under the Project and financed by the Islamic Development Bank was completed in 2003 and September 2006 respectively.

Construction of Khanarkh channel was mainly targeted at improvement of irrigation in 62.6 thousand ha land, including 10.4 ha in Gusar, 40.6 ha in Khachmaz, 11.4 thousand ha in Davachi, and provision of water supply to Jeyranbatan reservoir during the rehabilitation of the first 50 km section of Samur-Absheron Channel.

Lending Agreement was signed between the Islamic Development Bank, Saudi Development Fund and OPEC Fund providing for the financing for the construction of 36 km Valvalachay-Takhtakorpu Channel, covered under the Project. Channel construction is mainly aimed at provision of SAC water to Takhtakorpu water reservoir via gravity flow and therefore improving water supply in Baku, Sumgayit and Absheron Peninsula and to ensure maximum effective use of the country's river water resources.

Following the request of the President of Azerbaijan, Mr. Ilham Aliyev, starting in 2006 State Oil Fund have been allocating financing for activities related to joint engineering and construction of hydropower plant and Takhtakorpu water reservoir with total reservoir capacity of 268 million m³ and engineering and construction of the 111.5 km Takhtakorpu-Jeyranbatan channel. Currently Fund is financing ongoing works related to construction of embankments for the water reservoirs and other works.

The World Bank financed the Azerbaijan Irrigation Distribution System and Management Improvement Project (Irrigation-2) started in 2004.

The Project provides for rehabilitation of Bahramtepe headworks covering 180 thousand ha of irrigated land and rehabilitation of irrigation-distribution systems in around 56 thousand ha in 11 rayons (Sabirabad, Saatly, Imishly, Baylagan, Aghjabedi, Zardab, Goranboy, Khachmaz and Babek and Sharur rayons of Nakchivan AR).

In 2004 Government of Azerbaijan and Asian Development Bank signed the Lending Agreement to finance Flood Mitigation Project and financing was allocated for construction of 28 km of embankments for 23 rivers in 12 raions. The Bank's grant financing covered development of the feasibility study and project implementation started in 2005.

Project will result in flood and mudflows protection for 80 thousand ha land and 5 towns and 43 villages with total population of 215,000.

After the visit of our National Leader, Mr. Heydar Aliyev, to Nakchivan AR in 2002 and following his request to commission the Vaykhir water reservoirs, works to complete the construction were ongoing since 2003 and completed in 2005.

Construction of Vaykhir water reservoir aimed at irrigation of new 6.9 thousand lands and improving water supply to existing 9,9 thousand ha of irrigated land in Babek, Sharur and Julfa rayons. In addition, construction of the water reservoir enabled commissioning of hydropower plant with 4.5 MW capacity.

Construction of 4,23 km section of Yuxhari Mil channel to meet the irrigation water demand of IDPs settled in Sharami plainland of Fizuli rayon and construction of Gargachay river headworks and 8 km channel to improve water supply for IDPs temporarily residing in Lachin winter pastures of Aghjabedi raion was financed by SOCAR and completed in 2005.

Significant funding allocated from the state budget allowed to carry out bank protection activities to protect from flooding and mudflows in Kura-Aras and mountainous rivers and to remove emergency condition of amelioration facilities and to construct 19.6 km river embankments in 2003-2005. Currently these works are ongoing.

Construction works are ongoing in Goychay headworks, Ali-Bayramli sections of Main Shirvan Collector, Jogazchay water reservoir in Gazakh rayon, Qirmizi qesebe channel's main headworks in Guba rayon, Yukhari Shirvan channel, Goytepe water reservoir in Jalilabad rayon and Tovuzchay water reservoir in Tovuz rayon in order to remove emergency condition of water management facilities.

45, 90 and 180 sub-artezian wells were drilled and commissioned respectively in 2005, 2006 and 2007 to improve irrigation of cultivated areas and to provide water supply to population. Currently these works are ongoing.

This year preparation of design and cost estimate documentation started for construction and rehabilitation works in respect of the last 3,7 km section of the 1st turn of Shamkir Machine Channel in Shamkir rayon, Yuxari Mil channel in Baylagan rayon, Dasharkh channel in Tartar rayon, Neftchala main channel and pumping station in Baylagan, Jayirli water reservoir and 14 km channel of Alijan river in Sheki rayon, Jandar channel in Aghstafa rayon and Aghsu machine branch of Yuxari Shirvan channel and pumping station in Aghsu rayon, and for the reconstruction of Akusha channel in Salyan rayon and Axhtachi-Arabgubali channel in Kurdamir rayon and riverbed adjustment for Kura river near Salyan town.

In addition, design and tender documentation is being developed for the construction of water reservoir on Shamkir river in order to improve water supply in Shamkir, Samukh, Goranboy and Khanlar raions, and Feasibility Study is being implemented for the construction of Kura-Mughan channel aimed at irrigation of land in Saatly and Sabirabad raions.

Construction and reconstruction of amelioration and water management facilities will be done in two stages. The first stage will cover completion of unfinished construction of essential facilities and starting the construction of facilities, for which engineering has been development (2008-2010) and the second stage will cover development and implementation of new projects in order to further increase irrigated land (2011-2015).

The first stage will cover completion of reconstruction of Samur-Absheron irrigation system; completion of construction of unfinished amelioration and water management facilities, including Ayrichay and Tovuzchay water reservoirs and Shamkir machine channel; initiating construction of Shamkirchay, Takhtakorpu and Azachay water reservoirs and Ashagi Shirvan channel, reconstruction of Mil-Garabagh collector, repair and rehabilitation of Bahramtepe headworks and Yukhari Garabagh channels; activities to decrease level of ground waters and river flood protection activities.

Reconstruction of Samur-Absheron Channel and construction of Takhtakorpu water reservoir is expected to result in doubled water supply to Baku, improved water supply of 150 thousand ha of irrigated land in northern regions and will ultimately lead to increased productivity of agricultural crops in the mentioned areas and 1.5 - 2 times increase of production level.

Construction of Ashagi Shirvan Channel will allow irrigation of 150,000 ha of land in Shirvan region (including 22,500 ha of new irrigated land) and reconstruction of Yukhari Garabagh channel will allow for improved water supply in 100 thousand ha of irrigated land in Saatly and Sabirabad rayons leading to significant growth of crop production in these areas. As a result of this activities, 160 pumping stations on Kura river will be removed resulting in savings of 2.5 million manat equivalent for power supply and 1.9 million manats for diesel fuel.

Decreasing the level of ground waters will create favorable conditions for agricultural crop production in 64,000 ha land.

Use of internal water facilities for irrigation, energy and other purposes will be based on comprehensive programs, while use of trans-border water resources will be governed by relevant intergovernmental agreements. The second stage will cover construction and reconstruction of facilities, for which design documentation has been prepared, as well as initiation of engineering and construction activities for new facilities.

5. Construction of embankments to prevent adverse impact of flooding and mudflow

Azerbaijan is among regions with highest exposure to natural disasters in the world. The country has 154 flood generating rivers. 61 from them are the most dangerous. Mudflows, flooding, landslides result in significant loss to the country's economy each year. Mudflows and flooding are the most dangerous because of scale and destruction capacity. Each year around 200 residential settlements of 30 administrative regions with population of more than 1.5 million, 250,000 ha cultivated areas, 500 kms of railways and 1,500 kms of motor roads, 180 kms of electricity lines, 265 kms of gas pipelines, hundreds of kms of irrigation channels, hydro-technical facilities and etc. suffer from adverse impact caused by flooding and mudflows of mountainous and sub-mountainous rivers.

Flood and mudflows protection measures have been implemented for a long time based on schemes and projects approved by the Amelioration and Irrigation Open Joint Stock Company. River embankment construction, shore protection, riverbed adjustments works are implemented, concreted, stonecrete, wire and fascine dams are constructed and operated.

In 1970-80s in upper sections of mountainous and sub-mountainous rivers 22 km stonecrete dams were constructed and in the middle sections 23 km of protection dams were assembled from reinforced concrete components. 478 km of earth filled embankments were constructed in Gargachay, Khachinchay, Tuyranchay, Guchaychay, Girdimannchay, Aghsuchay, Injechay and others. In addition, annual maintenance works carried out by the AIOJSC cover 7-8 mln m³ of cleaning and riverbed adjustment works for mountainous rivers and construction of stonecrete, concrete, arched and fascine embankment dams. Each year around average 3 mln m³ earth works are carried out to increase the level and strengthen existing embankments on Kura and Aras rivers.

However, those actions do not fully cover the demand, riverbeds of flood generating rivers are getting filled with sediments and as a consequence, Ismayilli, Oghuz, Gabala, Sheki, Zagatala, Balakan, Goychay, Aghsu, Gusar rayons and Nakchivan and Ordubad towns of Nakchivan AR became constantly exposed.

Sea level rising of the Caspian during the past 20 years resulted in flooding of Kura water and Ana Kura - the main water carrying branch in the river's delta - became silt up and lost its water carrying capacity.

To address this matter works have been arranged covering river mud cleaning in Ana Kura – Kura river's main water carrying branch, enlarging the riverbed and extending and strengthening earth filled embankments on both banks of the Kura's section from Caspian Sea to Salyan town. These works need to be continued and completed.

The State Program provides for the following measures aimed at prevention of adverse impact of flooding and mudflows:

1. Construction of 31 km concrete and 37 km stonecrete embankments in mountainous rivers, 50 km earth-filled embankments in lowland rivers, total of 68 km of concrete and stonecrete and 50 km of earth fill embankments.
2. Establishment of warning systems in flood generating areas. As a result of preventive measures and construction of new embankments, 15 administrative raions and 32 residential settlements of Nakchivan Autonomous Republic, thousands of hectares of cultivated area, hundreds of kilometers of motor roads and railways, electricity lines, gas pipelines, irrigation channels, collectors, hydro-technical facilities and other communications receive protection from adverse impact of flooding and mudflows.

Preparing feasibility studies for and implementation of set of measures to prevent adverse impact of flooding and mudflows is expected to be financed from the government funding or foreign concessional loans.

6. Effective consumption of water resources and introduction of equipment and technologies for water savings

Country's scarce water resources require effective and efficient use of existing water resources and introduction of modern water saving equipment and Technologies.

Inadequate technical condition of on-farm irrigation and collector-drainage networks further contributes to the importance of this matter.

Improvement of technical condition of on-farm networks requires construction of concrete base in irrigation channels with earth base at the channel opening and introduction of modern water saving irrigation equipment and technology, taking into account new management methods.

The State Program provides for the following activities to ensure effective consumption of water resources:

- Reconstruction and rehabilitation of existing irrigation systems in order to minimize water losses;
- Introduction of modern irrigation equipment and Technologies (artificial raining, drop irrigation), installation of water meters at irrigation channels and schedule distribution of irrigation water;
- Automation and computerization of irrigation systems;- continuing stock-taking of water management facilities;
- Establishing water protection zones within water facilities and strengthening supervision of usage regime.

Measures to be implemented will enable more effective consumption of water by means of reduction of water losses and will result in increased productivity coming from full water supply of crops.

7. Increasing scientific provision of amelioration and water management sector

In the context of emerging market economy, amelioration science plays an essential role in maintenance, construction and reconstruction of amelioration and water management facilities and development of up-to-date systems and technologies.

The Program requires activities to be based on extensive application of modern technologies and technical achievements and advanced experience of developed countries and comparing and choosing most economically sound options.

Considering the requirements of newly established relations in the country's water sector, scientific-research institutes are expected to provide scientific recommendations and technical documentation aimed at better engineering, operational and environmental reliability of amelioration and water management facilities undergoing design, construction, reconstruction and maintenance activities.

Scarce water resources of the country require scientific and research activities regarding the establishment of up-to-date irrigation networks to ensure effective and efficient consumption of water resources, and evaluation, forecasting and protecting water resources from pollution using untraditional water sources (ground waters, collector-drainage, sewage and wastewater) for irrigation of agricultural crops.

The Program includes the following activities:

- Scientifically and practically important fundamental and applied research activities generating economic returns;
- International level training of scientific staff and scientific research;
- Arranging scientific-research activities on competitive basis, in accordance with the requirements of
market economy and new management system;
- Experience sharing and peer connections with foreign scientists;
- Conferences devoted to amelioration and water management issues;
- Submission of statistical data and information on amelioration and water management, conducting
corresponding research.

It is expected that fundamental researches will receive government funding, while applied researches will be self-financed and performed at the request in accordance with the requirements of market economy.

8. Building HR capacity

The State Program provides for the following measures aimed at the improvement of social conditions of amelioration and water management workers:

- High level training of qualified hydro-technical engineers, technicians, welders, turners, shovel, tractor and crane operators and engineers for pumping stations operators;
- Technical and organizational activities to improve working conditions and increase performance of engineering-technical staff, workers and servants employed by the industry.

9. Financing and economic performance of amelioration and irrigation activities

Implementation of activities requested by the State Program on Sustainable Development of Amelioration and Water Management for 2008-2015 required participation of relevant central and local executive authorities and other institutions (attachment).

Program activities are planned to be financed from the state budget, State Oil Fund, foreign investments and other sources.

Establishment of Water Users Unions is based on the requirements of Amelioration and Irrigation Law reflecting international practice and recommendations of international experts. Main objectives of these unions are to manage amelioration and irrigation systems in their use and to provide land users with well organized, effective and fair water supply services.

Easy to operate on-farm amelioration and irrigation systems will be gradually transferred to WUU's use, taking into account their operation and maintenance capacities. However, formerly owned by collective and state farms, afterwards abandoned for certain time and thus heavily deteriorated on-farm systems are not planned to be transferred to Unions currently at their early stage of development lacking required material-technical base. This could result in further deterioration of systems, increased water losses and significant troubles in water supply.

The Program provides for rehabilitation and repair of on-farm systems using the state financing and reflecting the advanced experience of other countries (Mexico, Turkey, Albania, Egypt, Kirgizstan) and transferring them to Unions in fully working condition. This will result in increased effectiveness, reliability and sustainability of irrigation systems and will ensure self-financed operation and sustainable development of Unions. These activities were initiated on approximately 40-45 ha in 11 raions under the Irrigation 2 Project, financed through the concessional loan provided by the World Bank. Currently irrigation-distribution systems are being rehabilitated in Goranboy, Sabirabad, Guba and Sharur, covering the area of one WUA Union per rayon.

National tariff setting policy for paid water services comprises stimulation of material interest for effective and efficient water use, adequate accounting for used water, recovery of public expenditure on water supply and encouraging water supply investments in the order prescribed by the legislation.

Water supply tariffs are being developed considering existing social and economic situation in the country and relevant experience of other countries. Unlike previous years, currently tariff for water supply services is based on actual volume of supplied water, as is the case in United States, Mexico, Turkey, Iran, Egypt, Japan and other countries. This resulted in increased financial incentive for waters users to use water effectively and efficiently.

Besides the improvement of water management facilities and technical condition of corresponding water meters, and ensuring adequate accounting of consumed water, the program provides for improvement of regulations on paid water services and the tariff for paid water services.

Result:

1. Maintenance and repair activities under the State Program may result in proper repair and cleaning of irrigation and collector-drainage networks and 30% reduction of annual water losses. As a result, ground water level will decrease and lands with good ameliorative condition will increase, which in turn will lead to 25-30% increase in crop production and will allow to address water scarcity in the country. Provision of requested volume of energy, fuel and lubricants will allow to achieve full water supply for 465 ha of mechanically irrigated land thus generating 20-25% increase in production. In general, it will create favorable conditions for implementation of activities supporting cotton, wheat, tobacco and vegetable production in individual administrative

regions, as requested in the State Program on Social and Economic Development of Regions in the Republic of Azerbaijan (2004-2008).

2. Implementation of Program's construction and reconstruction activities in 2008-2015 will result in the construction of 16 water reservoirs with total capacity of 772 million m³ and 825 km irrigation channels, commissioning of 43,400 ha new irrigated land, complex reconstruction works in around 21,500 ha irrigated land, improved water supply in more than 382 thousand ha irrigated land and improved ameliorative condition of 256,000 ha, reconstruction of irrigation and collector-drainage networks in 365 thousand ha, construction of 118 thousand line meters of embankments, including 68 thousand line meters of concrete embankments, protection of residential settlements and thousands of hectares of agricultural crop areas against flooding and mudflows, which will allow thousands of hectares area to be used as suitable land.

Activities will result in increase in agricultural crop production of 50-60% in areas with improved water supply (average annual increase of 462 thousand tons), 100% in areas with improved ameliorative condition (average annual increase of 660 thousand tons), 1-2 times increase in areas with reconstructed irrigation and collector-drainage infrastructure (average annual increase of 724 thousand tons) and production of more than 300 tons from new 43,4 thousand ha area and area to be totally reconstructed (21,5 thousand ha) (in total, each year more than 2 million tons in average).

Construction of new water reservoirs will allow to regulate the course of a river and thus to achieve significant reduction in the flow of unused waters into the Caspian Sea.

In addition to the above-mentioned, it shall be noted that, while ameliorative activities are of economic importance, they also represent a social issue. These activities are also important in social and economic development of regions.