Report No. 34081-PK

Pakistan
Country Water Resources Assistance Strategy
Water Economy: Running Dry

November 14, 2005

South Asia Region

Agriculture and Rural Development Unit
South Asia Region

Document of the World Bank

CURRENCY AND EQUIVALENTS

Currency Unit = Pakistan Rupee
US$ 1 = PKR 59.73 (November 8, 2005)

FISCAL YEAR

July 1 – June 30

ABBREVIATIONS AND ACRONYMS

AJK	Azad Jammu and Kashmir
CAS	Country Assistance Strategy
COD	Chemical Oxygen Demand
DOs	Direct Outlets
FGW	Fresh Groundwater
FOs	Farmer Organizations
GDP	Gross Domestic Product
GoP	Government of Pakistan
HYV	High Yielding Varieties
IBDF	Indus Basin Development Fund
IBDP	Indus Basin Development Project
IBIS	Indus Basin Irrigation System
ICR	Implementation Completion Report
IPCC	Intergovernmental Panel on Climate Change
IRIS	Indus River System Authority
IWMI	International Water Management Institute
IWT	Indus Waters Treaty
KITE	Korangi Industrial and Trading Estate
KWSB	Karachi Water and Sewerage Board
LBOD	Left Bank Outfall Drain
LCC	Lower Chenab Canal
MAF	Million Acre Feet
MTIP	Medium Term Investment Plan
NDP	National Drainage Program
NWFP	North West Frontier Province
O&M	Operation and Maintenance
OED	Operations Evaluation Department
OFWM	On Farm Water Management
OPP	Orangi Pilot Project
PARC	Pakistan Agriculture Research Council
PCR	Project Completion Report
PER	Public Expenditure Review
PID	Provincial Irrigation Department
PIDA	Punjab Irrigation and Drainage Authority
PIM	Participatory Irrigation Management
PMF	Probable Maximum Flood
PPAR	Project Performance Audit Report
SCARP	Salinity Control and Reclamation
SITE	Sindh Industrial Trading Estate
TDF	Tarbela Development Fund
TMA	Tehsil Municipal Administration
WAPDA	Water and Power Development Authority
WSS	Water Supply & Sanitation
WUA	Water Users' Associations

Vice President	-	Praful Patel, SARVP
Country Director	-	John W. Wall, SACPK
Sector Director	-	Constance A. Bernard, SASAR
Sector Manager	-	Adolfo Brizzi, SASAR
Task Team Leaders	-	John Briscoe/Usman Qamar, SASAR

Contents

Tables

Figures

Boxes

PREFACE:

This report is the product of eighteen months of intensive work by Bank staff and an eminent group of Pakistani and foreign consultants. The Bank team consisted of John Briscoe and Usman Qamar (Task Team Leaders), Manuel Contijoch (SASAR); Don Blackmore (Consultant (former Chief Executive Murray Darling Commission)) and Pervaiz Amir. The report benefited greatly from formal reviews and comments by external reviewers (David Seckler, Richard Reidinger, Chris Perry, Saeed Rana, Shams ul Mulk, Frank van Steenbergen, Karin Astrid Siegman, Asif Kazi, Khalid Mohtadullah, Bert Smedema, Shamshad Gohar, Shahida Jamil, and M. N. Bhutta) and World Bank staff (Keith Pitman, Masood Ahmad, Abid Hasan, Shahzad Sharjeel, Dale Lautenbach, Vlado Vucetic, Adolfo Brizzi, Xiaokai Li and Alain Locussol).

The report has been reviewed by senior officials from the Ministry of Water and Power, the Planning Commission, the Economic Affairs Division, the Provinces and WAPDA. Written comments were received from these agencies.

The report has been reviewed in detail by World Bank management and the revised version endorsed by it. A final round of consultations was held in September 2005 with the multi-stakeholder group, including those who had advised during the early stages of this work.

As usual, not all reviewers agreed with all that is written in the report (nor did the authors agree with all that was suggested by the reviewers!). The product is entirely the responsibility of the authors and should not be attributed to the reviewers.

OVERVIEW AND EXECUTIVE SUMMARY

Pakistan is one of the world's most arid countries, with an average rainfall of under 240 mm a year. The population and the economy are heavily dependent on an annual influx into the Indus river system (including the Indus, Jhelum, Chenab Ravi, Beas and Sutlej rivers) of about 180 billion cubic meters of water, that emanates from the neighboring countries and is mostly derived from snow-melt in the Himalayas. Throughout history, people have adapted to the low and poorly distributed rainfall by either living along river banks or by careful husbanding and management of local water resources. One of the greatest of human civilizations – the Indus Valley civilization (Harrapa and Mohenjo Daro) – flourished along the banks of the Indus.

Figure S1:
Pakistan from space

This precarious, low-level balance between man and water was decisively shifted with the advent of large-scale irrigation technology in the 19th century. The Indus irrigation system became the largest contiguous irrigation system in the world. As shown in Figure S1, the desert literally bloomed, with irrigated agriculture providing the platform for the development of the modern economy of Pakistan. This hydraulic economy has faced and surmounted three massive challenges in the last half century.

The first challenge arose because the lines of partition of the Indo-Pak sub-continent severed the irrigated heartland of Punjab from the life-giving waters of the Ravi, Beas and Sutlej rivers. In an unprecedented triumph of water diplomacy, Pakistani engineers, together with their Indian counterparts and the World Bank, negotiated the Indus Waters Treaty, giving Pakistan rights in perpetuity to the waters of the Indus, Jhelum and Chenab rivers, which comprise 75% of the flow of the whole Indus system.

Figure S2: The Indus Water Treaty of 1960

The second challenge was that there was now a mis-match between the location of Pakistan's water (in the western rivers) and the major irrigated area in the east. Again Pakistan's water engineers were up to the task, building the world's largest earth-fill dam, the Tarbela on the Indus, and link canals, which ran for hundreds of miles and carried flows ten times the flow of the Thames River. (Figure S2) To a considerable degree (but not completely) the "heroic stage" of water engineering in Pakistan was now over – as in other countries the major challenges were now those of management. This is the case in all countries (see Figure S3). But in the case of Pakistan, however, the "heroic" era had involved particularly blunt affronts to the living organism that the river represents. The natural flow regime was dramatically altered: rivers which had previously meandered over wide plains were now confined within narrow channels, sediments which had

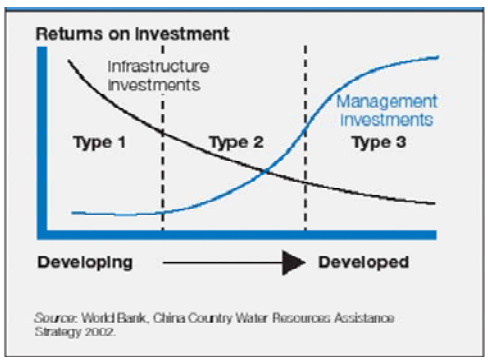

Figure S3: Rates of return on investment on infrastructure and management of water resources

Source: World Bank 2003

previously nourished the delta were trapped, vast quantities of water were disgorged onto deserts, substantial parts of which were of oceanic origin and highly saline. It was this last reality which gave rise to the third major challenge facing Pakistan shortly after Independence. Hundreds of billions of cubic meters of water were now stored in the naturally-deep aquifers of Punjab alone. In many areas water tables had reached the level of the land, giving rise to the twin curse of waterlogging and salinity. In the early 1960s, it appeared that Pakistan was doomed, ironically, to a watery, salty grave.

With equal doses of good thinking, good planning and good luck, this problem is now not beaten (nor will it ever be) but controlled and managed, to a degree that no one foresaw fifty years ago. The good thinking was the application of water science and economics by many of Pakistan's best and brightest in conjunction with many of the best water minds in the world. The "solution" was not the obvious one of lining canals and putting less water on the land but of increasing the use of groundwater, thus both increasing evapotranspiration, drawing down the groundwater table and leaching much of the salts down and out of the root zone. The good thinking and good planning were classic "public goods". The "good luck" driver of this revolution was the modest but transforming tubewell and diesel engine, bought and managed by millions of farmers for the simple reason that this decentralized "on-demand" source of water enabled them to greatly increase their crop yields and incomes.

So the modern history of water development and management in Pakistan is one in which the glass can be seen as more than half full. But, as this Report will show, the glass can also be viewed as much more than half empty too. Once again, the survival of a modern and growing Pakistan is threatened by water.

The facts are stark.

Sobering Fact #1: Water Stress. Pakistan is already one of the most water-stressed countries in the world (Figure S4), a situation which is going to degrade into outright water scarcity (Figure S5) due to high population growth.

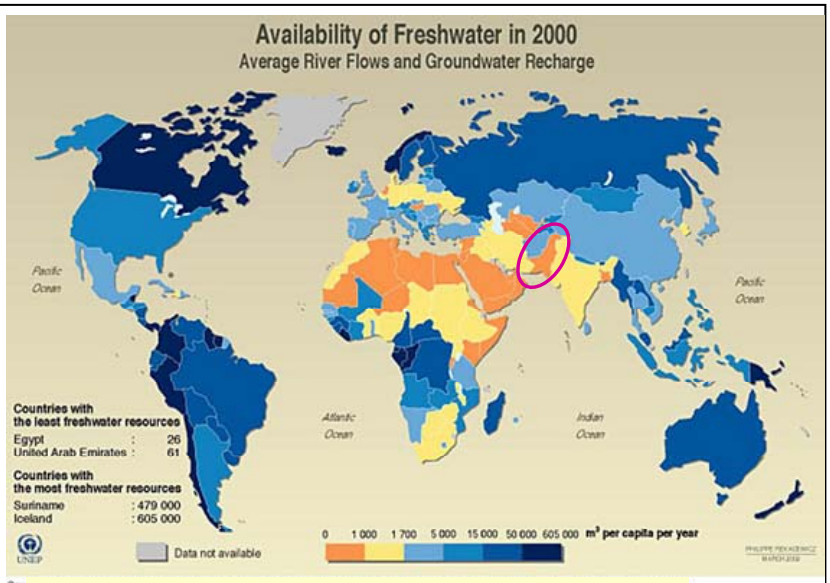

Figure S4: One of the worlds most water-stressed countries

Source: www.UNEP.org

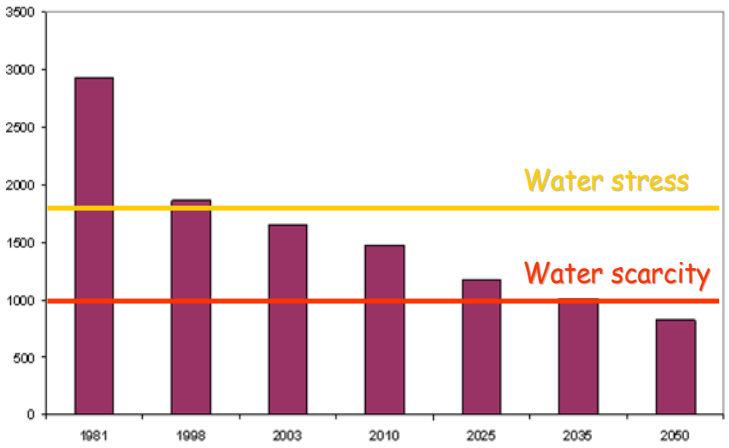

Figure S5: Declining per capita availability of water in Pakistan (cubic meters per capita per year)

Sobering Fact #2: There is no additional water to be injected into the system. There is no feasible intervention which would enable Pakistan to mobilize appreciably more water than it now uses. Arguably, as shown graphically in Figure S6, overall use for irrigation needs to decline so that there are adequate flows into the degrading delta.

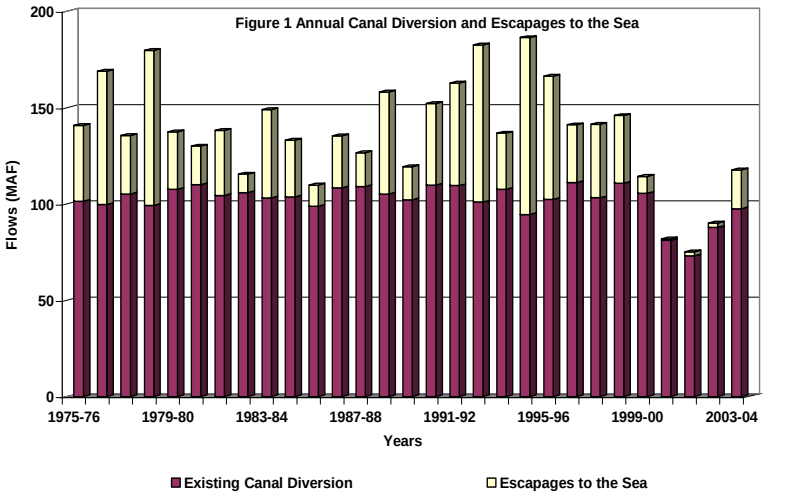

Figure S6: Annual Canal Diversions and "Escapages to the Sea"

Source:: World Bank 2003

Sobering Fact #3: A high risk water environment. Pakistan's dependence on a single river system means it has little of the robustness that most countries enjoy by virtue of having a multiplicity of river basins and diversity of water resources. While India (for example) might be able to muddle through because it has many rivers and if something goes wrong in one place the effect is cushioned by opportunities in other places, this is a luxury which Pakistan does not have. If the water/sediment/salt system of the Indus Basin goes badly wrong, that's it. There is no latitude for error.

Sobering Fact #4: Large-scale degradation of the resource base. There is abundant evidence of wide-scale degradation of the natural resource base on which the people of Pakistan depend. Salinity remains a major problem, with some aspects partially controlled but others – including the fate of the approximately 15 million tons of salt which are accumulating in the Indus Basin every year, and the ingress of saline water into over-pumped freshwater aquifers – remain only dimly-understood threats. And the delta, deprived of the water and silt which built and sustained it, is degrading rapidly, with large human and environmental consequences. Simultaneously, there is large-scale uncontrolled pollution of surface and groundwater from the increasing quantities of pesticides and fertilizers used in agriculture and by rapidly growing cities and industries. Major cities have inadequate sewage treatment plants. Many are either non-functional or working poorly. And there is only one industrial common effluent treatment plant working in the whole of the country. The result, as illustrated in Figure S7, is the presence of heavily degraded surface water around all cities and towns.

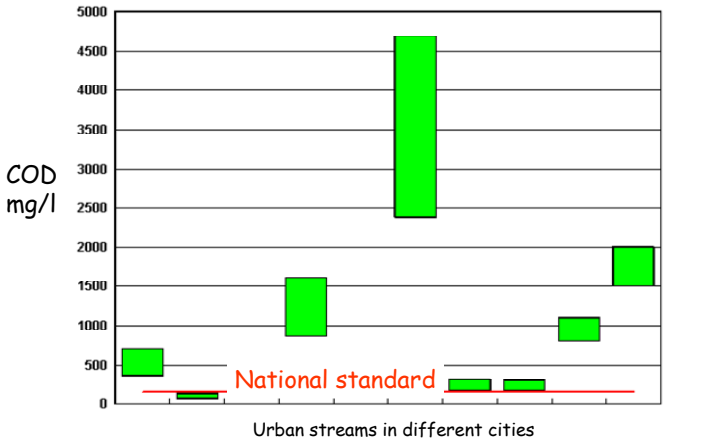

Figure S7: The quality (Chemical Oxygen Demand) of urban streams

Source: Zachariah 2005

Sobering Fact #5: Groundwater is now being over-exploited in many areas, and its quality is deteriorating. Over the past 40 years, the exploitation of groundwater, mostly by private farmers, has brought enormous economic and environmental benefits. A laissez-faire approach could be appropriate during this era. Groundwater now accounts for almost half of all irrigation requirements. Now, although, there is clear evidence that groundwater is being over-exploited, yet tens of thousands of additional wells are being put into service every year. In the *barani* areas of Balochistan, farmers are pumping from depths of hundreds of meters and in the sweet water areas of the Indus Basin, depletion is now a fact in all canal commands. Furthermore, there are serious and growing problems with groundwater quality, a reality that is likely to get worse because there are 20 million tonnes of salt accumulating in the system every year. Pakistan has thus entered an era in which laissez-faire becomes an enemy rather than a friend. There is an urgent need to develop policies and approaches for bringing water withdrawals into balance with recharge, a difficult process which is going to require action by government and by informed and organized users. Since much groundwater recharge in the Indus Basin is from canals, this requires an integrated approach to surface and groundwater. There is little evidence that government (or donors, including the World Bank) have re-engineered their capacity and funding to deal with this great challenge. And here delay is fatal, because the longer it takes to develop such actions, the greater would become the depth of the groundwater table, and the higher would be the costs of the "equilibrium" solution.

Sobering Fact #6: Flooding and drainage problems are going to get worse, especially in the lower Indus Basin. The natural state of heavily-silt laden rivers (like the Indus) is to meander. This is because as silt builds up in their beds, the rivers seek lower lands and change their courses. This creates havoc with human settlements and so, throughout the world, such rivers have been trained and confined by embankments within relatively narrow beds. But as with everything watery, solving one problem gives rise to another. In this case, the bed keeps getting higher and higher, and soon the river is, as in the lower parts of Sindh, above the level of the land. (To some degree the trapping of silt in upstream reservoirs alleviates this particular environmental hazard.) Over time, the likelihood of

embankment breaching increases, as do the problems of drainage from flooded lands. When this coincides with unfavorable tidal conditions, the consequences can be disastrous.

Sobering Fact #7: Climate change. The Indus basin depends heavily on the glaciers of the western Himalayas which act as a reservoir, capturing snow and rain, holding the water and releasing it into the rivers which feed the plain. It is now clear that climate change is already affecting these western glaciers in a dramatic fashion (far more seriously, for example, than in the damper Eastern Himalayas). While the science is still in its infancy, best estimates (Figure S8) are that there will be fifty years of glacial retreat, during which time river flows will increase. This – especially in combination with the predicted flashier rainfall -- is likely to exacerbate the already serious problems of flooding and draining, especially in the lower parts of the basin, in the next few decades. But then the glacial reservoirs will be empty, and there are likely to be dramatic decreases in river flows– as shown in Figure S8, conceivably by a terrifying 30% to 40% in the Indus basin in one hundred years time.

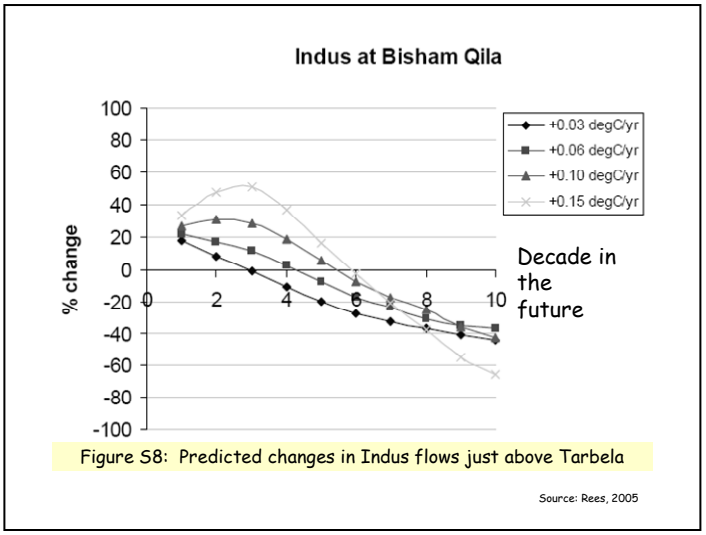

Figure S8: Predicted changes in Indus flows just above Tarbela

Sobering Fact #8: An inadequate knowledge base. The Indus Basin is a single, massive, highly complex interconnected ecosystem, upon which man has left a huge footprint. When a dam or barrage is constructed the water and sediment cycles are changed dramatically. When water is diverted onto deserts, the water and salt balances seek new equilibriums. In a system so massive and complex, the generation and smart use of knowledge are the keys to adaptive management. But there has been very little investment in Pakistan in building this knowledge base and the accompanying institutional and human systems. The past twenty years should have been ones of massive investment in knowledge about this ecosystem. But the reverse has happened, and even the once-renowned Pakistan water planning capability has fallen into disrepair. The country is literally flying blind into a very hazardous future.

Sobering Fact #9: Much of the water infrastructure is in poor repair. Pakistan is extraordinarily dependent on its water infrastructure, and it has invested in it massively. Due to a combination of age and what has aptly been called the "Build/Neglect/Rebuild" philosophy of public works, much of the infrastructure is crumbling. This is true even for some of the major barrages, which serve millions of hectares and where failure would be catastrophic. There is no modern Asset Management Plan for any of the major infrastructure.

Sobering Fact #10: The quality of project implementation is poor. Pakistan is justifiably proud of its outstanding achievement in building the Indus Basin Replacement Works. In the intervening years, the quality of project implementation has declined substantially. Today, implementation of water sector projects in Pakistan is characterized by inefficiencies, completion delays and time and cost overruns. Factors that affect implementation include: weak implementation planning and management, litigation related to land acquisition, non-compliance with agreed resettlement and rehabilitation programs, lack of attention to environmental issues, delays in procurement, delays in preparation of accounts and carrying out audits, and the lack of preparation for transition from construction to operations.

Sobering Fact #11: The system is not financially sustainable. There are three basic questions relevant to the financing of infrastructure – who pays? how much is paid? and how is the money used? In terms of "who pays", there are many reasons why a substantial portion of the costs of public works which provide individual services (such as irrigation water) should be paid for by those who get the service. But in Pakistan users of canal water pay a very small part of the bill, which is basically paid by the taxpayer. In terms of "how much is paid", the answer is: much less than the presently configured institutions require for rehabilitation and maintenance of the assets and for operations. The result is that most infrastructure is in poor repair. In terms of "how is the money used" the answer is that first call is for payment of heavily overstaffed bureaucracies, whose productivity is low and whose appetite leaves insufficient funds for system maintenance and operation. This reality gives rise to a vicious circle, in which users are not willing to pay for poor and unaccountable services, which means that insufficient funds are available for operations and maintenance, which results in the decline of service quality and whereupon users are even less willing to pay….

Sobering Fact #12: Pakistan has to invest, and invest soon, in costly and contentious new large dams. When river flow is variable, then storage is required so that the supply of water can more closely match water demands. Relative to other arid countries, Pakistan has very little water storage capacity. Figure S9 shows that whereas the United States and Australia have over 5,000 cubic meters of storage capacity per inhabitant, and China has 2,200 cubic meters, Pakistan has only 150 cubic meters of storage capacity per capita. And Figure S10 shows the storage capacity available in some of the major arid basins in the world. The dams of the Colorado and Murray-Darling Rivers can hold 900 days of river runoff. South Africa can store 500 days in its Orange River, and India between 120 and 220 days in its major peninsular rivers. By contrast, Pakistan can barely store 30 days of water in the Indus basin.

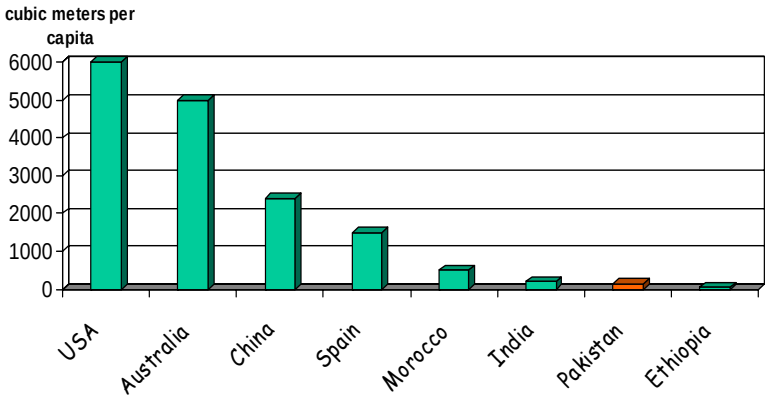

Figure S9: Storage per capita in different semi-arid countries

Source: World Bank analysis of ICOLD data

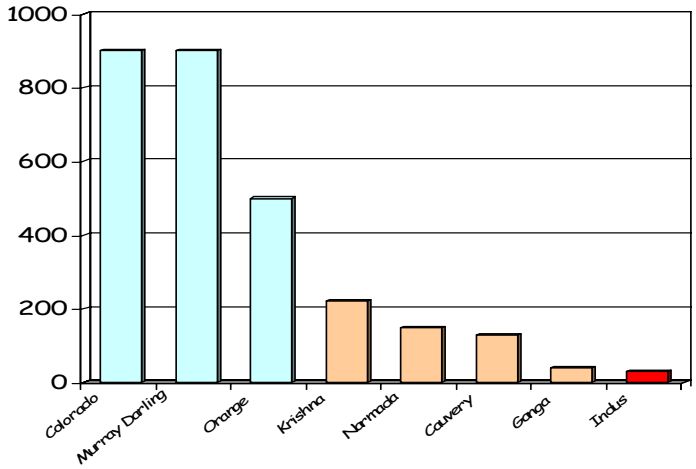

Figure S10: Days of average flow which reservoirs in semi-arid countries can store in different basins

Source: World Bank analysis of ICOLD and GDRC data

As shown in Figure S11, each million acre feet (MAF) of storage capacity lost means one MAF/year less water that can be supplied with a given level of reliability. And, as shown in Figure S12, there is an urgent need for storage just to replace the capacity that has (as predicted) been lost to sedimentation. Given the high silt loads from the young Himalayas, Pakistan's two large reservoirs are (as predicted at design) silting relatively rapidly.

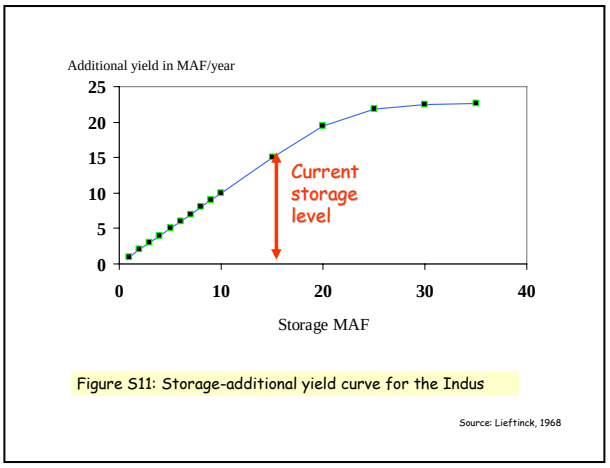

Figure S11: Storage-additional yield curve for the Indus

Source: Lieftinck, 1968

Sobering Fact #13: Poor governance and low trust. Conceptually the simplest task for water managers in the Indus Basin is to move water in a predictable, timely manner to those who need it and have a right to it. Pakistan has among the best water engineers in the world. And yet this task is done less and less satisfactorily, less in the light of day and more behind an opaque curtain in which, as always, monopoly + discretion - accountability = corruption. The result is inequitable distribution of water, poor technical performance and a pervasive environment of mistrust and conflict, from the provincial level to the water course. The water bureaucracy has yet to make the vital mental transition (depicted in Figure S3) from that of builder to that of manager.

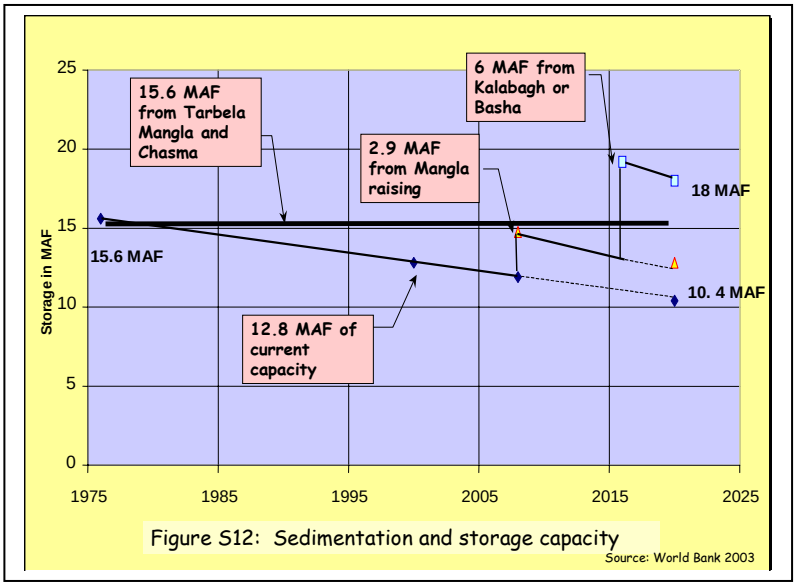

Figure S12: Sedimentation and storage capacity

Source: World Bank 2003

Sobering Fact #14: Water productivity is low. Large parts of Pakistan have good soils, abundant sunshine and excellent farmers. And yet crop yields, both per hectare and per cubic meter of water, are much lower than international benchmarks, and much lower even than in neighboring areas of India (Figure S13). The quality of water service plays an important role in this: yields from reliable, self-provided groundwater are twice those of unreliable and inflexible canal supplies.

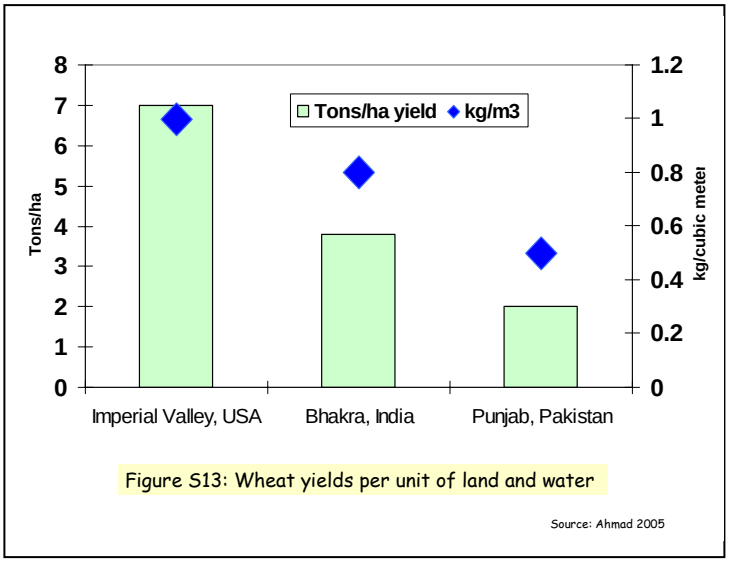

Figure S13: Wheat yields per unit of land and water

Source: Ahmad 2005

In water matters, the cup is always half empty, but it is also half, or, in the case of Pakistan, at least a quarter, full. In confronting these awesome challenges, Pakistan has considerable strengths, too.

Hopeful Fact #1: A well-established tradition and system of water entitlements. Pakistan has an unusually long- and well-established tradition of water entitlements. At the international level, Pakistan's rights to water from the Indus Basin system are unambiguously defined in the Indus Waters Treaty. The 1991 Water Accord is a major achievement, which establishes clear entitlements for each province to surface waters. Implicit in the Water Accord, too, is a set of water entitlements at the canal command level (established on the basis of historic use). In large areas of the system, these entitlements serve as the basis for allocation of water among canal commands. There are also well-established rules for further distributing water to the distributary and outlet levels. Below the outlets, the *warabandi* is a proxy (appropriate in its era) to a water right, in which a farmer has a right to time, a surrogate for water. The existence of such well-established entitlements means that Pakistan can now focus on: putting in place a similar system for the surface systems that do not currently have such established entitlements; extending the entitlement system to cover any new water that might be mobilized; formalizing entitlements for environmental flows (including to the delta); and moving towards a similar definition of entitlements for groundwater, and, above all, administering this system in a more transparent, participatory manner.

Hopeful Fact #2: Pakistan has largely avoided the trap of subsidizing electricity for groundwater pumping. One of the obvious ways governments around the world address the problem of agricultural distress is to subsidize inputs. In many countries, electricity for irrigation pumping is heavily subsidized. This policy greatly exacerbates the underlying problem, which is making sure that groundwater pumping does not exceed recharge, and that the water table is not too deep. To date, this policy has been followed only in Balochistan, with disastrous effects both on the water table and on the financial state of the utility, and for pumping from public wells in Sindh. At present, the political pressure for "free power" has been muted because the water table is shallow and most pumps are diesel powered. The Federal and Provincial governments should be applauded for their stance to date and should continue to strongly resist pressures to move towards free power for irrigation in the future.

Hopeful Fact #3: There is much scope for increasing water productivity. The flip side of current low water productivity is that Pakistan can get much more product – crop, jobs and income – per drop of water. As shown in Figure S14, reduced water supplies in the irrigated areas have little detrimental impact on production (at least in the short run), in part because groundwater is available to make up the difference in the short run, in part because waterlogging and salinity are reduced, and in part because limited water supplies are

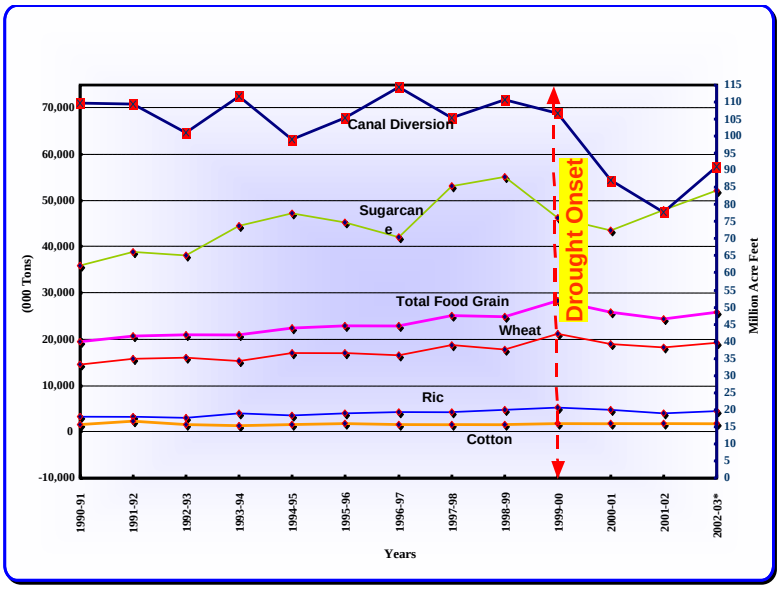

Figure S14: Crop production and drought

Source: World Bank 2003

used more carefully when there are shortages. But the bottom line is that this shows that it is quite possible to substantially increase production with existing supplies of water. A second, very important, factor is the emergence of a new class of progressive farmers, who are shifting to high-value crops (which produce far more income and jobs per unit of water), introducing new crops and agricultural technologies, and putting unprecedented pressures on the irrigation departments to become more accountable and efficient.

Hopeful fact #4: High returns from previous major water infrastructure. Pakistan benefited immensely from the major water infrastructure built in the Indus Basin. As shown in Figure S15, the benefits from Tarbela substantially exceeded those which were predicted at the time of construction. Through forward and backward linkages in the economy, the total benefits were probably about twice those of the direct power and irrigation benefits. It is also certain that, as has been shown for the Bhakra project in Indian Punjab (Figure S15), it was the poor who, through the operation of labor markets, were probably the greatest beneficiaries of these investments. It is important to note that although much of the discussion of such projects is in terms of agriculture, in fact it is the power benefits which are often greatest (Figure S15). And here, too, as shown in Figure S17, Pakistan lags behind its neighbors – 86% of the 50,000 mw of Pakistan's economically-viable hydropower potential has yet to be developed.

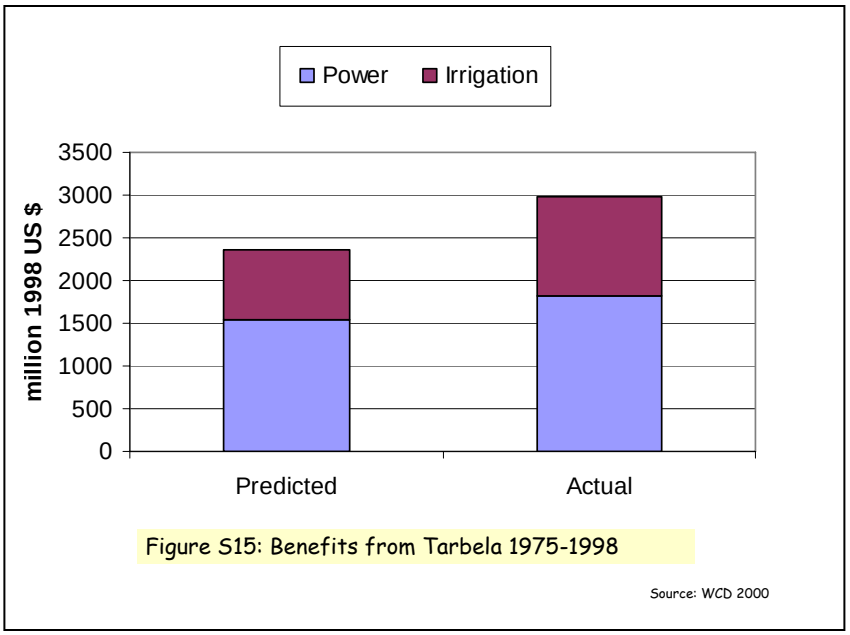

Figure S15: Benefits from Tarbela 1975-1998

Source: WCD 2000

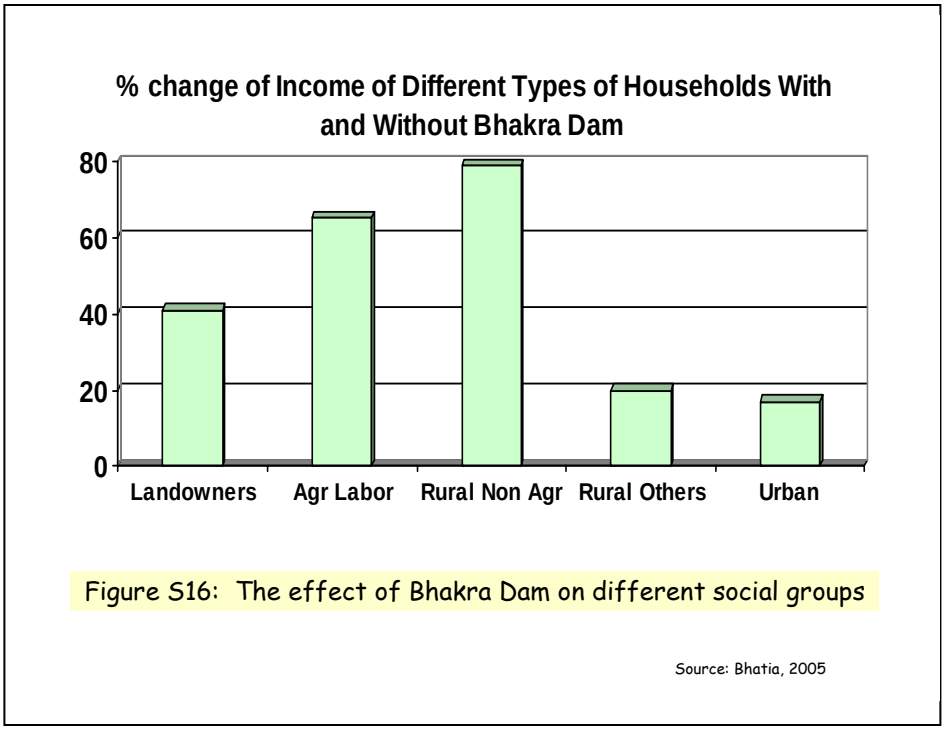

Figure S16: The effect of Bhakra Dam on different social groups

Source: Bhatia, 2005

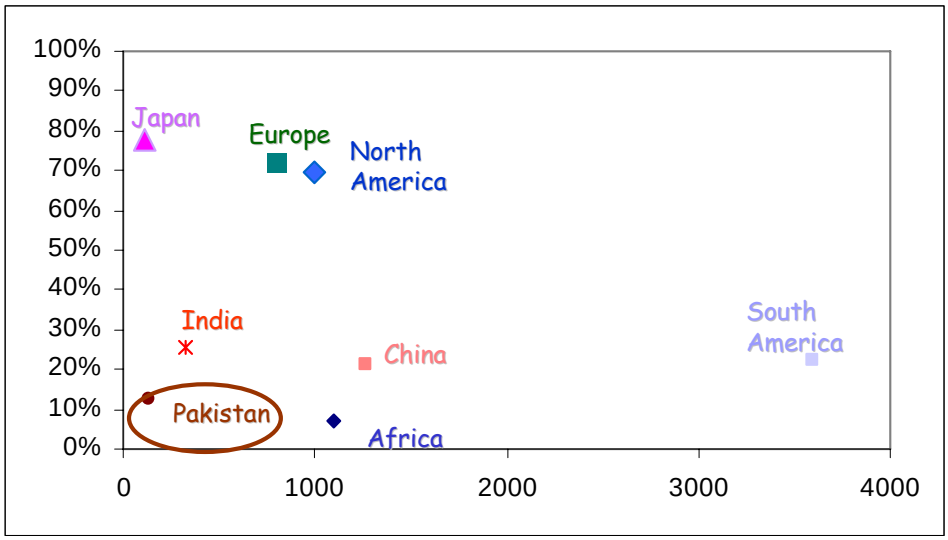

Figure S17: The development of economically-feasible hydropower potential in Pakistan in international context

Source: World Bank 2003

Hopeful Fact #5: Pakistan has overcome major water challenges in the past. Pakistan has a remarkable history of successfully confronting major water challenges. It has enormous human capacity to confront this next round of challenges, which can be pooled in four major categories.

Challenge 1 is to develop a world-class knowledge-based capacity for adaptive resource management and service delivery.

The sustainable management of a huge, inter-linked and very complex natural resource base is probably the single most challenging long-term task for Pakistan and requires the development of world-class capacity in three related areas. First are the natural sciences. Adaptive management of the Indus Basin system requires high levels of knowledge and understanding of a series of linked basic natural processes, the more important of which include: the behavior of the glaciers as climate change proceeds; the fate of the large amounts of salt being mobilized; the qualitative and quantitative dimensions of the aquifer systems in the Indus Basin and in the other parts of the country; the evolution and behavior of the ecosystems of the delta; and the impact of changed sediment loads on river morphology. Second are the engineering sciences. The plumbing for the world's largest contiguous irrigation system has underpinned much of Pakistan's development. Pakistan has long been a world leader in hydraulic engineering, and it is going to have to renew this capacity so that a new generation can maintain and modernize the water transmission and distribution systems. The third leg of the intellectual stool are the social sciences. Because at the end of the day government is going to have to design institutions and instruments, which will ensure that the actions of the millions of people who live in and off of the natural and engineered water systems are in consonance with the requirements of those systems. Pakistan, accordingly, needs to build a strong natural, engineering and social scientific cadre capable of working with all users in defining the problem, developing solutions, monitoring, assessing and adjusting. This is a capacity which requires a wide range of disciplines – those necessary for understanding climate, river geomorphology, hydraulic

structures, surface and groundwater hydrology, limnology, water chemistry, sediment management, hydraulics, soil sciences, terrestrial and coastal ecosystems, agronomy, plant physiology, industrial organization, conflict management, politics, economics and financing. In the past Pakistan has relied heavily on outside knowledge, especially in sciences. Now Pakistan needs to develop its indigenous capacity and make a major push to establish and nurture a new set of institutions that will provide the scientific, technical and policy support for the management of increasingly scarce water. Experience in other countries shows that if this is not done there will be serious economic, social and environmental consequences.

Challenge 2 is a financially feasible approach to maintaining and modernizing existing infrastructure and building needed new water infrastructure.

The water economy of Pakistan depends fundamentally on a gigantic and complex hydraulic infrastructure system. There are now a set of related challenges which have to be addressed – how to maintain what has been built, what major new system-wide infrastructure needs to be built, what infrastructure needs to be built for populations who have not been served and for environmental protection, and how to build institutions that will manage the resource effectively in the looming era of scarcity. First is rehabilitation and maintenance. Many elements of the vast hydraulic system are now reaching the end of their design lives, and have to be rebuilt. There is an enormous backlog of deferred maintenance. Most recent irrigation and water supply "investments" from donors, including the World Bank, have been for the rehabilitation of poorly maintained systems. There is no systematic Asset Management Plan at either the Federal or Provincial level which describes the condition of the assets, the requirements for replacement, rehabilitation (or retirement) and operations and maintenance and the associated costs, and the proposals for financing of these costs. Development of such plans is a high priority.

Second is the urgent need for construction of major new storage on the Indus. There is probably no more contentious an issue in Pakistan today. In part, this is for legitimate and necessary reasons (such as the resettlement of substantial numbers of people), partially for legitimate but resolvable reasons (lack of transparency about how this would affect the actual allocation of waters among the provinces and to the delta) and partially the discussion of dams has become a vehicle for a host of remotely- or un-related political grievances. A curiosity is that the most vehement opposition to new dams comes from Sindh, when in fact it is the downstream riparian who is typically the greatest beneficiary of the enhanced regulation which comes with new storage. (For this reason, in other countries lower riparians will often pay for upstream storage.) The requirements for government are obvious – there needs to be a totally transparent and verifiable implementation of the 1991 Water Accord, and reasonable quantities of water need to be guaranteed and delivered to the delta (as was discussed as part of the Indus Treaty negotiations). Equally important is a well-designed plan for paying for the costs of this storage, with the very large hydropower potential offering possibilities for raising substantial amounts of private financing.

Third, there are needs for large investments in meeting the needs of those who do not have water and sanitation services in cities, towns and villages.

Fourth, Pakistan has been accumulating an "environmental debt" by not investing in municipal and industrial wastewater. It is clear that this has to change, and that it is going to take large amounts of investments.

Fifth and finally, Pakistan has to walk on two legs – investing simultaneously in infrastructure and in developing the institutions required for the sustainable management of increasingly-scarce water.

The resource requirements for all of these priorities are very large. Government faces three essential tasks. First, to set priorities for the short and medium term. Second, to define the principles which

will govern what proportions of the initial and recurrent costs are paid by taxpayers and by users. Third, government has to ensure that the limited financial resources are used very efficiently. This is obviously not happening in the "business-as-usual" model at present. It is going to mean exploring a whole set of mechanisms for introducing competition, for paying for output not inputs, and for increasing accountability.

Challenge 3 is to put in place a modern set institutional framework, with the key task being the development and application of instruments which will motivate sustainable, flexible and productive use of water.

The agrarian economy of Pakistan accounts for about 25% of GDP and employs about half of the labor force. While the transition to an urban and industrial economy can and must continue, agriculture will remain central for the well-being of large numbers of people. Better water management is a key constraint to improving agricultural productivity and generating jobs. Over the past several decades, farmers have largely taken the problem into their own hands, and "solved it" by sinking hundreds of thousands of tubewells which provide just-in-time water for their crops. To a substantial degree the main function of the canal systems has been to recharge the groundwater – about 80% of groundwater abstractions in Punjab come from recharge from canals. The survival of the water economy over the last several decades has largely been despite rather than because of the State – it has been the tapping of the unmanaged groundwater by millions of farmers, by towns and villages and industries that have pulled the economy through. It is clear that this era of "productive anarchy" is now coming to an end, since groundwater is now being over tapped in many areas (including both the Indus Basin and Balochistan and other non-Indus areas). This poses two very major challenges to the State. First, surface water supply systems are going to resume their previous high importance, and need to be managed much more accountably and effectively. Second, groundwater will have to be managed – for related reasons of quantity and quality – much more aggressively than has been the case in the past.

It is also obvious that the needs for water are changing substantially, as a result of agricultural diversification, urbanization, industrialization, recognition of environmental needs, climate change and the evolution of the natural resource base. Since there will be, if anything, less rather than more water, it means that the new water economy is going to have to be one which is much more flexible, in which a key will be the voluntary reallocation of water from those who need it less to those who need it more.

It is going to require a very different type of state machinery at both Federal and Provincial levels to meet these challenges. In constructing this "new water state", the focus must be primarily on instruments which govern the relationships of different users with the water, and with each other. The logical organizational architecture then is that which is required to manage the instruments and order the relationships between the parties. Some of the key elements of the "new water state" will be:

- Introducing accountability, efficiency, transparency and competition into the surface water supply business. This will mean unbundling the business into bulk, transmission and distribution enterprises, with relations among the parts governed by contracts which specify the rights and responsibilities of both parties. While it will not be easy to enforce such contracts, experience shows that this can stimulate improved accountability and service quality. This will mean moving away from a monolithic service model below the distributaries (with Farmers' Associations competing "for the market" with the irrigation department) and into the canal commands (where a variety of forms of public-private partnerships can provide an alternative to the irrigation department). In many cases, professionals from the Irrigation Departments would be encouraged to form private businesses for the provision of such services, thus ensuring that their skills are not lost, and that they do not see the changes as purely a loss of security. The bulk business (operation of dams and barrages) would probably remain in state hands, but with many major functions (such as operation of power plants)

concessioned out to private operators. A similar institutional architecture would pertain for the drainage infrastructure.

- In such a system (which would take place as a sequenced and prioritized process over many years) the government would, gradually, play a very different role. It would corporatize the state owned operating units and develop new capacities to do the economic regulation. The government would also be far more active in groundwater management, where it has been largely absent. This would mean developing a new legal and regulatory framework for co-managing groundwater with user associations. It would mean developing the sophisticated natural resource management capacity required for management of the water and land systems.
- A center-piece of these systems, both surface and ground water, would be improving the administration of a well-established system of water entitlements. What is now needed is finalization of the agreement on environmental flows into the Delta (a process that is underway) and then implementation of the Accord in a transparent manner, audited by an auditor who is, and is perceived to be, neutral. The same system then needs to be "drilled down" to the canal commands within the provinces (where entitlements are mostly well established but not transparently administered). And so on down all the way to the users' associations and eventually to the farmers. There is broad agreement among most water professionals in Pakistan that this improved administration is quite feasible and that it would increase efficiency, allow flexibility in adapting to scarcity and reduce conflict and install trust in the system.
- A similar, and even more difficult, process is essential for the management of groundwater quantity and quality, since groundwater reservoirs are already being mined in the *barani* and sweet water areas. Again, this will take a well thought-out, pragmatic, patient and persistent strategy. The central elements will be heavy involvement of users, substantial investments in modern water and agricultural technology, and the State playing a vital role as developer of the enabling legislation, and regulator and provider of knowledge and decision support systems.

Challenge 4 is to trace a principled and pragmatic path for implementing this reform agenda over the coming decades.

In the eyes of many the idea of such a modern, accountable "Pakistan water system" is panglossian, given the deteriorating performance in recent decades and the broader challenges of governance. The glass is, of course, always half empty. But it is half full too. Pakistan has a stronger base for doing this than most other developing countries, and there are some important signs that the need for change is being understood, there are political leaders who are starting to grapple with these realities, and the government and private sector leaders are taking the important first steps down this long and winding road.

Pakistan is fortunate, too, in that it is not the first country in the world to face this (daunting) set of challenges. The experiences of other countries suggest that there are a set of "rules for reformers" in undertaking such a transition. These rules include:

- Initiate reform where there is a powerful need and demonstrated demand for change.
- Involve those affected, and address their concerns with effective, understandable information.
- If everything is a priority, nothing is a priority -- develop a prioritized, sequenced list of reforms.
- Pick the low-hanging fruit first – nothing succeeds like success.
- Keep your eye on the ball – don't let the best become the enemy of the good.
- Be aware that there are no silver bullets.
- Don't throw the baby out with the bathwater.

- Treat reform as a dialectic, not mechanical, process.
- Understand that all water is local and each place is different – one size will not fit all.
- Be patient, persistent and pragmatic.
- Ensure that reforms provide returns to politicians who are willing to make changes.
- Recognize that water, unlike electricity or telecommunications, is "far from a simple commodity"

Water is far from a simple commodity
Water's a sociological oddity
Water's a pasture for science to forage in
Water's a mark of our dubious origin
Water's a link with a distant futurity
Water's a symbol of ritual purity
Water is politics, water's religion
Water is just about anyone's pigeon
Water is frightening, water's endearing
Water's a lot more than mere engineering
Water is tragical, water is comical
Water is far from the Pure Economical.
Kenneth Boulding

How the World Bank might be a more effective development partner.

An important objective of this Report is to help define the water elements of the framework (known as the Country Assistance Strategy) which will govern the relationship between the World Bank and Pakistan for the period 2006-2010. This is an iterative process, in which there have already been many discussions involving the Federal and Provincial Governments, the Bank's Country Management and the Bank's Pakistan Water Team. While the final agreement on water will only be decided jointly with the other elements of the CAS, the contours of this agreement are already broadly clear.

The Federal and Provincial governments and the management of the World Bank all agree that water management is one of the central development challenges facing Pakistan, and that it is an area where the Bank has a long history and a strong comparative advantage. This is in broad agreement with the findings of a major poll of a wide variety of South Asian stakeholders (Figure S18), which concluded that infrastructure, education and governance were the three areas which were both of high national importance and where the Bank was perceived to have a comparative advantage.

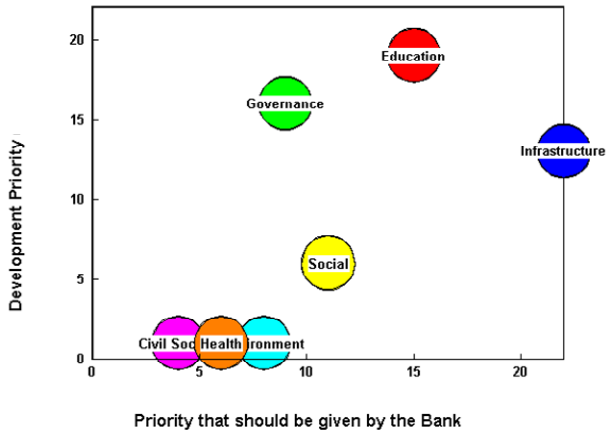

Figure S18: The "global poll" results for South Asia

Source: World Bank 2002

There is, therefore, a general agreement that there will be a major increase in Bank lending for water-related activities, with the indicative overall figures shown in Figure S19.

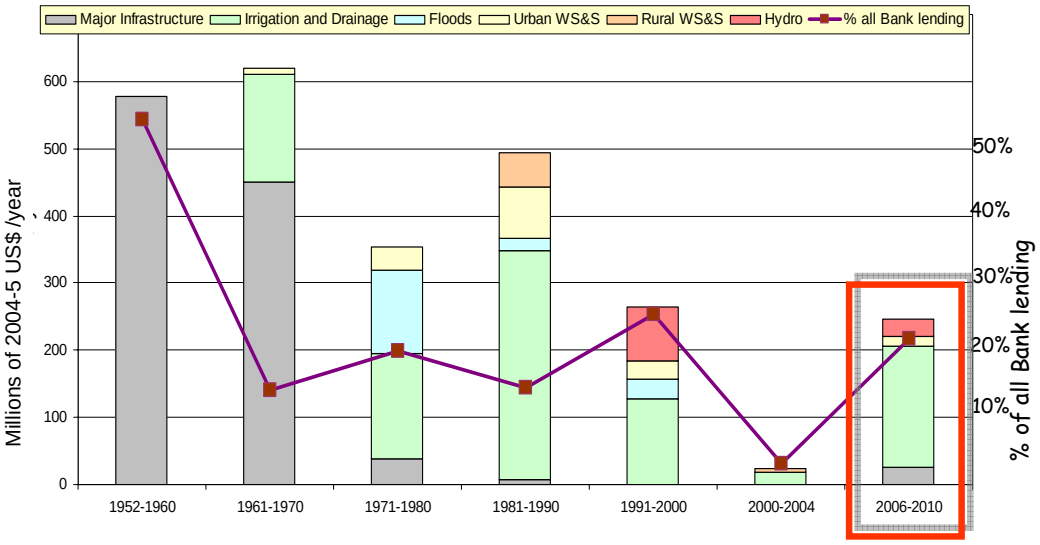

Figure S19: World Bank Lending to Pakistan for Water-related Sectors – Past and Prospective

Source: World Bank 2004

This would mean that water-related lending for Pakistan would increase about 10 fold from the 2000-2004 period, and account for about $1 billion in the coming four years. World Bank support would be based on "principled pragmatism" recognizing that reforms and investments must proceed in parallel and the best should not be allowed to become the enemy of the good. Broadly speaking, Bank assistance would support four pillars of the water sector, as described below:

Pillar 1: Asset Development and Management

Pakistan has a large endowment (with an estimated replacement value of US$60 to 70 billion) of water resources infrastructure, most owned and managed by the provinces, and much now quite old. Bank-funded projects will make major investments in rehabilitation of some critical assets (including barrages) and will help put in place Asset Management Plans which will set priorities for asset rehabilitation and maintenance, make explicit the requirements for public and user financing, and develop efficient institutional arrangements for rehabilitating and maintaining this infrastructure. The Bank will also continue its support for: developing and implementing a drainage and salt management strategy, other investments – including small dams, minor irrigation and groundwater management – in *barani* areas outside the Indus Basin, as well as for improving livelihoods and safety in coastal areas.

One major issue that is likely to emerge in the 2006-2010 CAS period is possible Bank engagement in developing and co-financing major new Indus Basin storage and hydro, if and when the Government makes such a decision. The Government is actively addressing some of the major issues which have been raised about a new dam on the Indus, including transparent implementation of the 1991 Water Accord and environmental flows into the delta. In discussions with the Government it has been agreed that the Bank could be involved, with the usual provisions that any such project met the Bank's normal technical, economic, social and environmental standards, and that these investments were part of an overall program which included institutional reforms and investments at federal, provincial, canal command and farm levels to ensure better use of water.

Pillar 2: Water Resources Management

The Bank expects to support development of capacity at the provincial and federal levels for improving water and associated natural resource management. For surface water supplies, a major emphasis will be building on Pakistan's platform of defined water entitlements, making the administration of these more transparent and accountable, from the inter-provincial to the user levels. For groundwater, the Bank will support the development of the government's capacity for knowledge generation, policy generation and management. A major emphasis will need to be on developing a better understanding of salinity and formulation of salt management strategies; groundwater recharge; and flood flows. For both surface and groundwater there will be an emphasis on incorporating environmental issues (including water quality, wetlands and environmental flows). An important element of Bank support will be training of a new generation of multi-disciplinary water resources specialists and support for multi-disciplinary centers of excellence for water resources, natural and social sciences.

Pillar 3: Service Delivery

The Bank expects to be heavily engaged in provincial- and city-level efforts to improve the quality, efficiency and accountability with which water supply, sanitation and irrigation services are delivered. The Bank will emphasize the development of frameworks which encourage the entry of new players (including community organizations, and the small- and large-scale private sector), the use of contracts which specify the rights and obligations of providers and users and benchmarking for all water services. The Bank will emphasize the modernization of infrastructure – including canal re-modeling and the use of measuring devices, which are integral for moving to a more flexible, accountable, transparent and monitorable service delivery paradigm.

Pillar 4: On-farm Productivity

The Bank will continue to invest in the on-farm services (land leveling, watercourse lining, and introduction of new technologies through private-public partnerships) which are essential for agricultural diversification and for improving the amount of crop, income and jobs produced per drop of water.

The Bank anticipates providing such support through its various lending instruments, including budgetary support for policies and prior actions that address key issues (Development Policy Lending) as well as through specific investment lending for infrastructure and institutional reforms. Finally, given the major scientific, policy and implementation challenges ahead, the Bank, with partial support from the Government of the Netherlands, will mount a major program for providing analytic and technical support to the federal and provincial governments.

Paraphrasing Akhter Hameed Khan, the great Pakistani reformer[1], it might be said that the Bank's involvement in water in Pakistan has been one in which the Bank "has chased the rainbow of well-functioning institutions and dreaded the nightmare of further institutional decay…. and that only the boldest among us can say that we may not be similarly engaged tomorrow"[2].