



DAMAGE, LOSSES AND NEEDS ASSESSMENT
OCTOBER 2008 TROPICAL STORM AND FLOODS,
HADRAMOUT AND AL-MAHARA, REPUBLIC OF YEMEN



A Joint Assessment of the Government of Yemen, the World Bank, the United Nations International Strategy for Disaster Reduction, the International Federation for the Red Crescent and Cross, supported by the Global Facility for Disaster Risk Reduction

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Acronyms and Abbreviations

ADRA	Adventist Development and Relief Agency International
AADT	Annual average daily traffic
CDHC	Civil Defense Higher Council
CIF	Cleaning and Improvement Fund
CIF	Climate Investment Fund
CBDP	Community Based Disaster Preparedness
DaLA	damage and loss assessment
DLNA	Damage, Loss and Needs Assessment
DEE	Directorate of Environmental Emergency
DRM	Disaster Risk Management
EM-DAT	Emergency Events Database
FACT	Field Assessment and Coordination Team
GALSUP	General Authority for Land, Survey and Urban Planning
GARWSP	General Authority for Rural Water Supply and Sanitation Projects
GCRB	General Corporation for Roads and Bridges
GFDRR	Global Facility for Disaster Reduction and Recovery
GOPHCY	General Organization for the Preservation of Historic Cities
GOY	Government of Yemen
GPS	Government Primary Schools
GDMT	Governorate Disaster Management Teams
GDMU	Governorates Disaster Management Units
GDP	Gross Domestic Product
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
GWh	GWh Giga Watt hour
HBS	Household Budget Survey
HNP	Health, Nutrition, and family Planning
HEB	High Energy Biscuits
IFC	International Finance Corporation
IFRCC	International Federation for Red Crescent and Cross
IRIN	Integrated Regional Information Network
IIEES	International Institute of Earthquake Engineering and Seismology
IMF	International Monetary Fund
IOM	IOM
kV	kilo Volt
LCs	Local Corporations
MEE	Ministry of Electricity and Energy
MOAI	Ministry of Agriculture and Irrigation
MOE	Ministry of Education
MOF	Ministry of Fisheries
MOI	Ministry of Interior
MOLA	Ministry of Local Administration
MOPIC	Ministry of Planning and International Cooperation

MOPWH	Ministry of Public Works and Highways
MCIT	Ministry of Telecom and Information Technology
MOT	Ministry of Transport
MOWE	Ministry of Water and Environment
M&E	Monitoring and Evaluation
MWWLC	Mukalla Water Supply and Wastewater Corporation Local Corporation
MVA	MegaVolt Ampere
MW	Mega Watt
NDMP	National Disaster Management Plan
NDMT	National Disaster Management Team
NDMU	National Disaster Management Unit
NDRMC	National Disaster Risk Management Council
NWSA	National Water and Sanitation Authority
NGO	Non Governmental Organization
OFDA	Office of U.S. Foreign Disaster Assistance
PDHCY	PDHCY Project for the Development of Historical Cities of Yemen
PPCR	Pilot Program for Climate Resilience
PEC	Public Electricity Corporation
PTC	Public Telecommunication Corporation
PWP	Public Works Program
RRF	Reconstruction and Recovery Fund
RNGPS	Registered Non-Government Primary Schools
RMF	Road Maintenance Fund
RED	Roads Economic Decision Model
SFD	Social Fund for Development
SWF	Social Welfare Fund
SWM	Solid Waste Management
TA	Technical Assistance
UN	United Nations
UNEPRT	United Nations Emergency Preparedness and Response Team
OCHA	UN Office of the Coordination and Humanitarian Affairs
UNCHR	United Nations Commission on Human Rights
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UNICEF	United Nations International Children Emergency Fund
UAE	United Arab Emirates
ECLAC	United Nations Economic Commission for Latin America and the Caribbean
UN-ISDR	United Nations International Strategy for Disaster Reduction
US\$	United States Dollar
USAID	United States Aid for International Development
VOC	Vehicle Operating Costs
WB	The World Bank
WFP	World Food Program
WHO	World Health Organization
YR	Yemeni Rial

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Executive Summary

I. The disaster, its toll and the response

The disaster and its toll

Tropical Storm 03B hit Yemen on October 24, 2008. The storm led to severe rain and flooding over the eastern Governorates of Yemen—Hadramout and Al-Mahara—for about 30 hours, resulting in total rainfall of almost 91 mm (versus 5-6 mm in normal periods). The total catchment area of about 2 million hectare collected some 2 billion cubic meter of water. Given the topography of the affected area (mountainous terrain, flat valleys and riverbeds), this large quantity of water in the catchment area led to severe flash floods in the valleys, with water surges exceeding 10 meters in some areas. This area had experienced major floods in 1989 and 1996 but this flood is considered the most devastating and led to one of the worst natural disasters to hit Yemen in more than a decade.

The affected governorates of Hadramout and Al-Mahara were declared disaster areas on October 27, 2008. Wadi Hadramout was the worst hit region, sustaining 67.5% of the total damage and loss, with 16 of its 19 districts reporting damages. Hadramout's coastal areas (Sahel) sustained 28.6% of the total damage and loss, while Al-Mahara sustained 3.9% of the total. Infrastructure was particularly badly hit, with major roads, communications, power, and water supply networks all sustaining major destruction and damage. This meant that access to the affected areas was very difficult in the early period, and in some cases, it took close to one week to reach some of the affected areas, as in Sah and Tarim.

As of October 31, 2008, 73 persons were reported to have lost their lives as a result of the floods, 17 people were missing and scores have been injured. The flooding and heavy rain also caused 2,826 houses and huts in both Governorates to be destroyed and 3,679 houses to be partially damaged. Some 25,000 people were displaced as a result, seeking temporary shelter in mosques and schools or with host families. The impact on agricultural land and people's livelihoods has been particularly devastating. A total of 22,902 Feddans (acres) of cultivated agricultural land and 51,455 Feddans of uncultivated land were damaged in both Governorates due to soil erosion. Public and private irrigation infrastructure also sustained significant damage. In addition, about 550,000 palm trees and 160,000 fruit trees were uprooted. Some 58,500 livestock heads (sheep, goats, camels and cattle) died due to the water surge, and as much as 309,103 honey beehive cells were washed away. Overall, about 700,000 persons—over 50% of the total population in the affected areas—have had their livelihoods destroyed or significantly affected, of which two-thirds live in Wadi Hadramout.

International support for the preparation of a joint Damage, Loss and Needs Assessment and in the Recovery and Reconstruction Efforts

On October 27, 2008, the Government of Yemen (GOY), represented by the Ministry of Planning and International Cooperation (MOPIC), requested the international community's support to assess the damages, losses and post-disaster needs and to join reconstruction and recovery efforts. The World Bank was requested to lead the donor coordination effort in the preparation of a joint Damage, Loss and Needs Assessment (DLNA) covering the infrastructure, shelter and productive sectors, to leverage support from the Global Facility for Disaster Reduction and Recovery (GFDRR) for the preparation of the DLNA, and to prepare an emergency reconstruction operation to rehabilitate and rebuild selected critically damaged infrastructure. The United Nations (UN) was asked to lead the donor coordination effort related to the emergency relief and

humanitarian needs. The World Bank, with GFDRR support, fielded a team of 20 experts to the affected areas, who were joined by representatives from the United Nations International Strategy for Disaster Reduction (UN-ISDR) and the International Federation for Red Crescent and Cross (IFRCC), to work closely with 80 GOY officials in preparing the joint DLNA. The enclosed report is the joint DLNA prepared by the Government of Yemen, the World Bank, the UN-ISDR, and the IFRCC, with support from the GFDRR. The recommendations of the DLNA will serve as the main inputs for a recovery and reconstruction plan.

II. The impact of the disaster

Summary of Damages and Losses

The total value of the disaster effects caused by the October 2008 storm and floods in Yemen is estimated at YR 327,551 million (US\$1,638 million¹—See Table 1). This is equivalent to 6% of Yemen's Gross Domestic Product (GDP), which illustrates the sheer magnitude of the disaster.

Table 1. Summary of Damage and Losses due to the October 2008 Storm and Floods in Yemen

Sector and Sub-Sector	Disaster Effects			Ownership by Sector	
	Damage (YR, mln)	Losses (YR, mln)	Total (YR, mln)	Public (YR, mln)	Private (YR, mln)
Productive	111,468.3	137,629.7	249,098.0	39,406.5	209,691.5
Agriculture, livestock, fisheries	109,937.0	97,305.0	207,242.0	39,406.5	167,835.5
Industry, Commerce and Tourism	1,531.3	40,324.7	41,856.0		41,856.0
Social Sectors	39,983.4	5,536.0	45,519.4	12,843.9	32,675.5
Housing	32,249.4	3,246.2	35,495.6	2,820.1	32,675.5
Education	3,460.0	34.8	3,494.8	3,494.8	
Health	4,274.0	2,255.0	6,529.0	6,529.0	
Infrastructure	22,532.9	6,520.0	29,052.9	24,581.8	4,471.1
Electricity	4,016.0	1,200.2	5,216.2	5,216.2	
Water and Sanitation	6,033.6	679.0	6,712.6	6,712.6	
Transport	11,999.9	4,326.0	16,325.9	11,942.8	4,383.1
Communications	483.4	314.8	798.2	710.2	88.0
Cross Sectoral	976.9	2,904.0	3,880.9	3,642.2	238.7
Environment	35.0	2,904.0	2,939.0	2,939.0	0.0
Public Buildings	941.9	0.0	941.9	703.2	238.7
Total (YR, million)	174,961.5	152,589.6	327,551.1	80,474.4	247,076.7
Million US\$	874.8	762.9	1,637.8	402.4	1,235.4

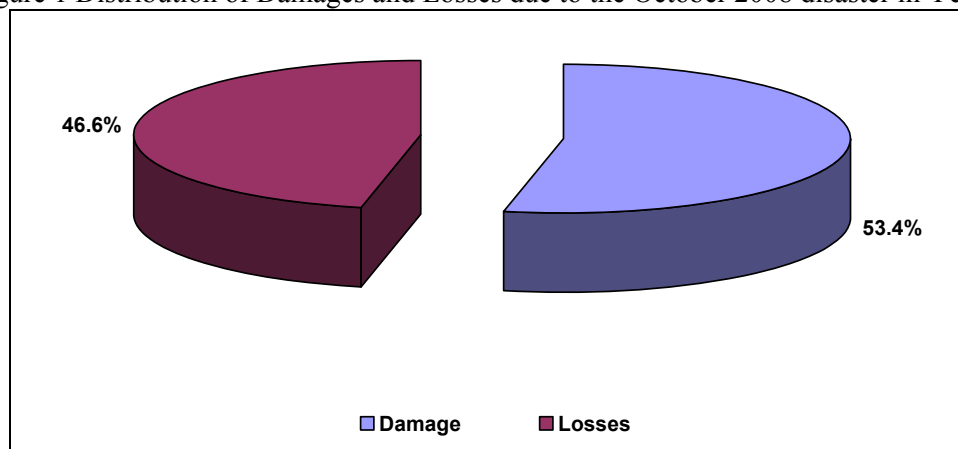
Source: Estimates of the DaLA Assessment Team using information from official and other sources

Of the total disaster effects, an estimated YR 174,962 million (US\$ 874.8 million) refers to the value of the destruction or damage to physical assets existing in the affected areas, and an additional YR 152,590 million (US\$ 762.9 million) represents losses in the flows of the economy that are expected to occur in the country over the next four years as a result of the temporary absence of the destroyed assets (See Figure 1). The relative long duration of these losses is caused by the fact that it is estimated that it would take up to 2012 for the overall recovery and reconstruction of the affected areas. In the case of agriculture—with the largest share of damages and losses, this is explained by the fact that the seedlings for the damaged fruit trees will take 3-4 years before the trees start bearing fruits; the same also holds for the livestock and the agricultural land whose soil was eroded. All losses figures, which take place over the 2008-2012 period, are

¹ A standard exchange rate of YR 200 per US Dollar has been used throughout this assessment report.

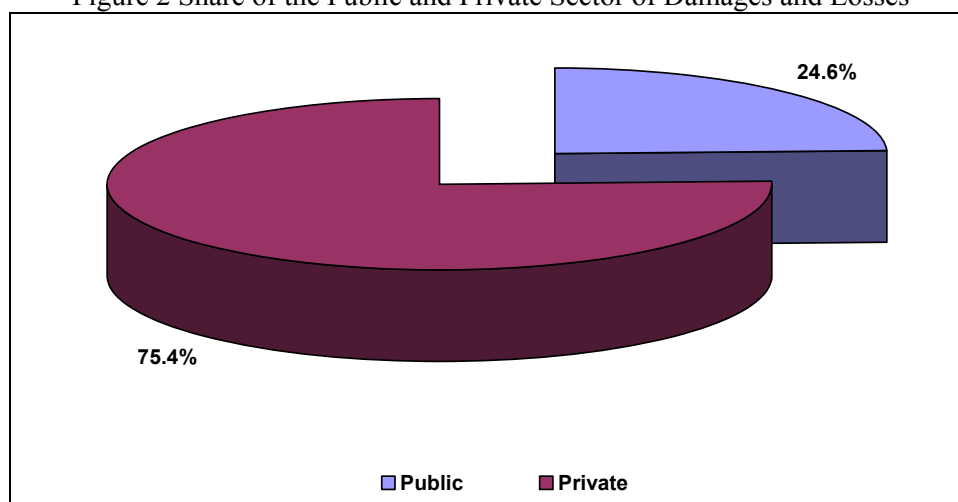
in 2008 prices. The somewhat equivalent distribution between damage and losses reflects the relatively limited industrial development that exists in the affected area.²

Figure 1 Distribution of Damages and Losses due to the October 2008 disaster in Yemen



The share of the private sector of the total value of damage and losses is estimated at 75.4% (YR 247,077 million or US\$1,235.4 million), while the share of the public sector is estimated at 24.6% (YR 80,474 million or US\$ 402.4 million). This is a measure of the damages and losses to each sector and could be viewed as an initial starting point to assess the relative efforts that each sector must bear in the post-disaster recovery and reconstruction activities (See Figure 2). Nonetheless, it is clear that the government would be expected to assist in the funding of several initiatives that follow on damages and losses to the private sector, including inter alia support to the livelihoods of those who lost their job or income and to reconstruction of housing for limited income groups³ among other activities. As such, the Government's share of the reconstruction and recovery costs is likely to significantly increase.

Figure 2 Share of the Public and Private Sector of Damages and Losses



² Had industrial development been higher in the affected areas, especially agro-industry, losses would have largely exceeded damages, as is typical of disasters caused by hydro-meteorological phenomena.

³ Government is already financing parts of the temporary shelter and food provision scheme for a large number of affected persons, in cooperation with international donors and NGOs.

This disaster is, on its own, very significant in terms of the value of damage and losses. This is all the more apparent when compared to recent events that have occurred in other countries, affecting their economies and the livelihoods of people in the affected areas. As shown in Table 2, while the 2008 disaster in Yemen is not the most costly in terms of damage and losses, its magnitude, expressed as the ratio of total damages and losses versus GDP, is the second highest of the below-mentioned cases, only lower than that of Myanmar after cyclone Nargis.

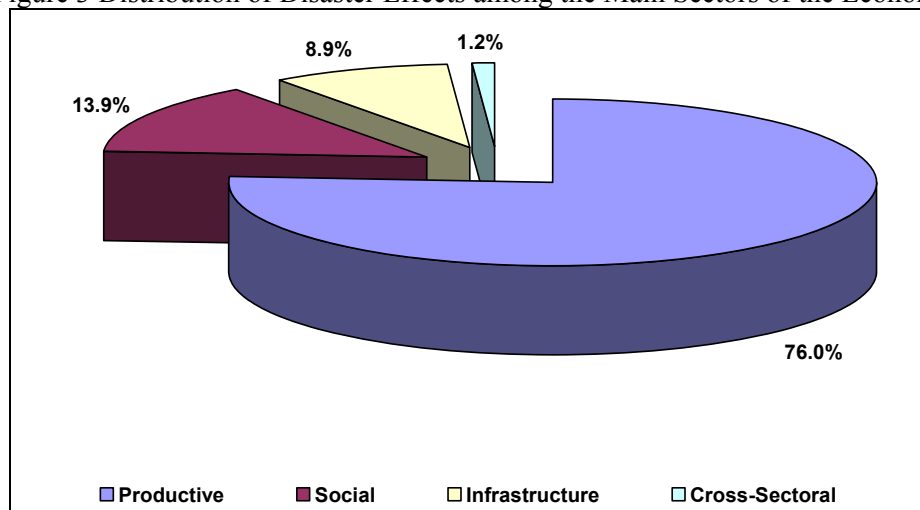
Table 2 Damage, Losses and Magnitude of Similar Recent Disasters

Disaster	Country	Year	Total Effects, million US\$	Magnitude Effects vs. GDP
Cyclone Sidr	Bangladesh	2007	1,640	2.8
Cyclone Season	Madagascar	2008	333	4.0
Cyclone Nargis	Myanmar	2008	4,060	19.7
Storm and Floods	Yemen	2008	1,638	6.0

Source: GFDRR, World Bank

It is worth noting that the recent disaster in Yemen has affected the economy in a very special manner, concentrating its effects on the following sectors of economic activity, presented in order of decreasing importance (See Figure 3): the productive sectors (agriculture, livestock, fishery, industry, commerce and tourism), the social sectors (shelter, education and health), infrastructure (transport, power, water and sanitation, and telecommunications) and several other cross-sectoral activities (the environment, religious facilities and cultural heritage). This fact classifies this event as a productive-social disaster, rather than one in which destruction of infrastructure is the preminent effect. This analysis suggests the sectors where post-disaster efforts for recovery and reconstruction should concentrate on.

Figure 3 Distribution of Disaster Effects among the Main Sectors of the Economy

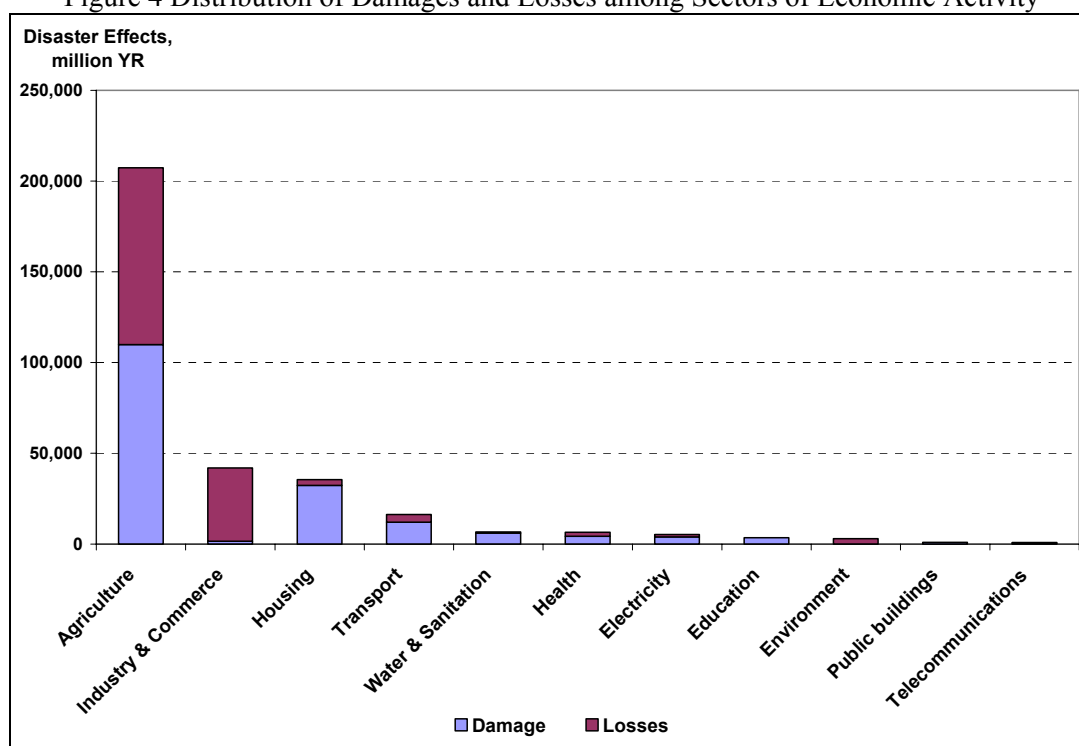


Individual sectors that were most affected in total effects (damage and losses) were, in the order of decreasing importance: agriculture; industry, commerce and tourism; housing; and transport. In terms of destruction of physical assets, agriculture remains the most affected (62.8% of total damages), followed by housing (18.4%) and transport (6.9%). In terms of losses in the economy, agriculture is again the most affected (63.8% of the total losses), followed by industry, commerce and tourism (26.4%), transport (2.8%), and housing (2.1%). Details of this breakdown by sector are shown in Table 3 and Figure 4.

Table 3 Most affected sectors by the October 2008 storm and floods

Sector	Total effects		Total damages		Total losses	
	Value (YR mln)	Percent of total	Value (YR mln)	Percent of total	Value (YR mln)	Percent of total
Agriculture	207,242.0	63.3%	109,937.0	62.8%	97,305.0	63.8%
Industry, Commerce, Tourism	41,856.0	12.8%	1,531.3	0.9%	40,324.7	26.4%
Housing	35,495.6	10.8%	32,249.4	18.4%	3,246.2	2.1%
Transport	16,325.9	5.0%	11,999.9	6.9%	4,326.0	2.8%

Figure 4 Distribution of Damages and Losses among Sectors of Economic Activity



The disaster effects were unevenly distributed with some districts sustaining much more damages and losses than others (See Table 4). Hadramout Governorate was significantly more affected (96.1% of the total disaster effects, including 94.1% of total damages and 98.4% of total losses) relative to Al-Mahara Governorate (with 3.9% of the total disaster effects, including 5.9% of total damages and 1.6% of total losses).

Table 4 Geographic distribution of the disaster effects

	Damages		Losses		Total disaster effects	
	Value (YR,mln)	Percent of total	Value (YR,mln)	Percent of total	Value (YR,mln)	Percent of total
Hadramout Sahel	53,838	30.8%	39,717	26.0%	93,555	28.6%
Hadramout Wadi	110,747	63.3%	110,482	72.4%	221,229	67.5%
Hadramout Total	164,585	94.1%	150,199	98.4%	314,784	96.1%
Al-Mahara	10,377	5.9%	2,391	1.6%	12,767	3.9%
Total	174,962	100.0%	152,589	100.0%	327,551	100.0%

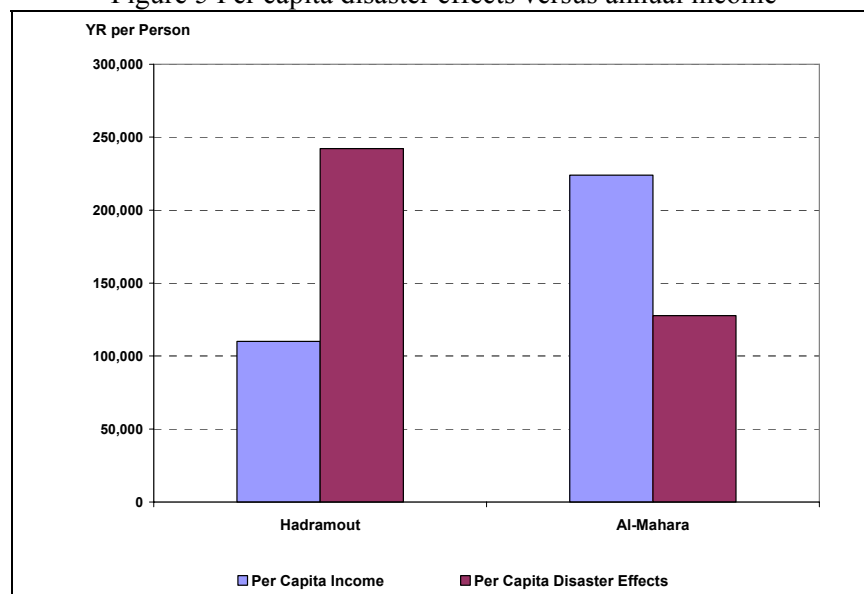
When considering the population living in the affected Governorates (estimated population of 0.1 million in Al-Mahara and 1.3 million in Hadramout), the average per capita damages and losses effects can be estimated. This comparison reveals that the population of Hadramout Governorate

has sustained damages and losses that are equivalent to more than twice their annual average income (220%), while those in Al-Mahara have sustained lower (57%) but still high proportions of their annual income as shown below. Table 5 and Figure 5 below provide a general idea of the negative impact of the disaster on the economy and the well-being of the households.

Table 5 Per capita disaster effects versus annual income

	Disaster Effects, YR/Person	Percent of Annual Income ⁴
Hadramout	242,141	220%
Al-Mahara	127,673	57%

Figure 5 Per capita disaster effects versus annual income



III. Macroeconomic and poverty impact of the disaster

Pre-disaster Macroeconomic and Poverty Context:

Yemen's recent macroeconomic performance has been mixed with weak growth, high inflation contrasted by comfortable current account surpluses. The preceding three years have been marked by weak GDP growth that was barely above the population growth rate of 3% a year, with the oil sector GDP in steady decline. Inflation has been high at about 15% a year led by rising food grain prices. Fiscal balance has been widening to reach -6% of GDP in 2007, with signs of long-term debt sustainability worsening. Yemen has been judged to be in risk of severe debt stress for the last two consecutive years with debt thresholds likely to be breached even in the baseline forecast. High oil prices until recently have boosted external account surpluses with Yemen accumulating US \$ 7 billion of foreign reserves by the end of 2007 equal to about 10 months of imports.

Poverty in Yemen had declined from 40% in 1998 to 35% in 2005 on the strength of prosperity in urban areas that benefited from trade and public spending. Yemen's rural areas, containing 70% of the population, witnessed near stagnation in poverty over the same period. The rapid rise in food grain prices in 2007 had raised doubts whether the reduction in poverty would have been sustained. The partial effect of the rise in food prices likely have reversed the gain in poverty

⁴ Hadramout per capita income YR110,000 and Al-Mahara 224,000 (estimates derived from HBS 2005)

reduction though income growth and policy interventions by doubling of cash transfers and rise in pay of civil servants would have some what offset the adverse effects of food price increases.

The two affected governorates enjoyed reduction in poverty in the past but stood strongly in contrast in terms of magnitude of poverty. Hadramout had 36% of its population as poor whereas Al-Mahara had only 9% of the population as poor. These two governorates belonged in a region where poverty declined between 1998 and 2006 in both rural and urban areas by about 2%.

Table 6 Poverty in Hadramout and Al-Mahara Governorates, 2005-06

	Poverty Incidence	Poverty Gap	Poverty Severity
Hadramout	35.59%	6.67%	1.84%
Al-Mahara	8.85%	1.80%	0.66%
Yemen	34.78%	8.93%	3.32%

Source: Yemen Poverty Assessment, The World Bank, 2007.

Poverty estimates at district level show that highly populous districts also had high incidence of poverty and that between 70% (Hadramout) to 75% (Al-Mahara) of the poor happened to live in areas worst affected by the disaster.

Prior to the disaster, the macroeconomic outlook for the medium-term showed signs of improvement (Table 7) with GDP growth rising, inflation abating, with fiscal deficit and current account deficits remaining manageable and stable. Yemen would have continued to make gains poverty reduction with positive growth in per-capita GDP. This optimism was built on the hope that the government would be willing to tackle the long-standing issues of wasteful fuel subsidies, high wage bill and making steady improvement in governance. The implication of these policy changes called for an average fiscal contraction of 1.5% of GDP per year in the medium term. Even with that strong adjustment effort, Yemen would be running a risk of severe debt-stress.

Table 7 Selected Economic Indicators

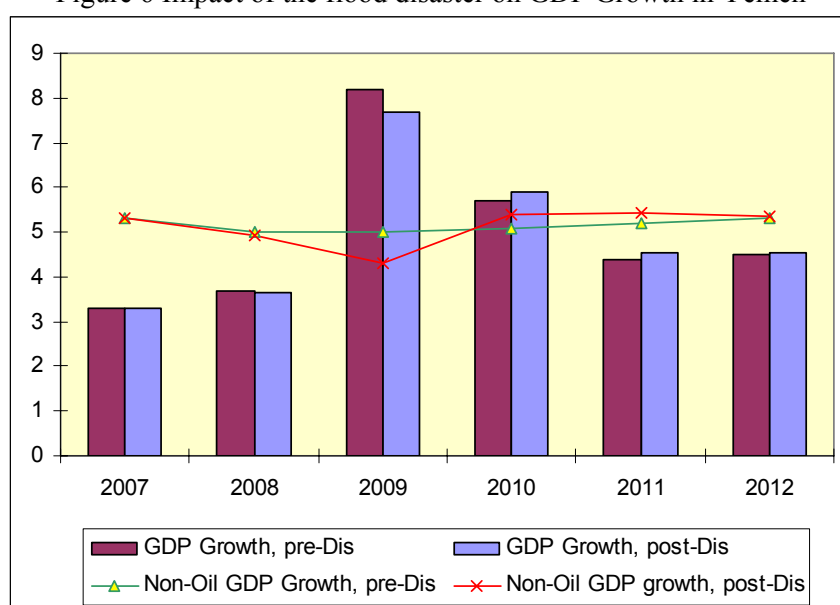
	Prelim.	Projections				
	2007	2008	2009	2010	2011	2012
Production and Prices	<i>(Change in percent)</i>					
Real GDP at market prices	3.3	3.5	8.1	5.3	4.3	4.4
Real non-hydrocarbon GDP	5.0	4.5	5.0	5.1	5.2	5.3
Consumer price index (annual average)	12.5	17.2	14.4	13.1	13.5	13.1
Government finance	<i>(In percent of GDP)</i>					
Total revenue and grants	32.4	39.5	32.8	31.6	29.3	27.5
Total expenditure and net lending	40.3	42.2	37.5	35.6	33.1	30.2
Overall balance (cash basis)	-5.7	-2.7	-4.6	-4.0	-3.9	-2.7
Transfers	3.0	3.2	3.5	3.8	4.1	4.4
Capital expenditure	7.8	7.6	7.9	7.9	7.9	8.0
Social spending			8.1	8.5	8.8	9.2
External sector	<i>(In millions of US dollars, unless otherwise indicated)</i>					
Exports f.o.b.	7,131	9,763	10,178	10,618	10,241	9,842
<i>of Which: hydrocarbon (oil and gas)</i>	6,277	8,833	9,164	9,502	8,980	8,404
<i>of Which: non-hydrocarbon</i>	854	931	1,014	1,116	1,261	1,437
Imports, f.o.b.	-7,212	-7,833	-8,277	-8,686	-9,105	-9,463
Current account (in percent GDP)	-6.1	2.9	2.1	2.3	0.5	-0.3
Medium- and long-term loans, net	234	329	402	473	528	601
Population (in thousands)	22,290	22,978	23,687	24,398	25,130	25,884

Source: Staff Estimates based on IMF Article IV report, October, 2008

Post-Disaster Effects:

The impact on overall GDP growth of Yemen is expected to be small. The two affected governorates were home to about 5% of the population and contributed to about 6% of non-oil incomes. Since the bulk of the losses (95%) occurred in the poorer Hadramout governorate which generated only 60% of the total non-oil income of the two governorates, the overall impact on GDP is small, valued at YR 37 billion in 2009 in comparison to the country’s estimated GDP of YR 5.5 trillion. The growth rates of GDP both overall and non-oil GDP would show a dip in 2009 followed by recovery in the subsequent years (Figure 6). In 2009, compared to the baseline estimates, overall GDP growth rate would be lower by a 0.5 percentage point and the non-oil growth rate would diminish by a 0.7 percentage point. Note however, that this analysis does not account for the income generating effects of reconstruction efforts.

Figure 6 Impact of the flood disaster on GDP Growth in Yemen

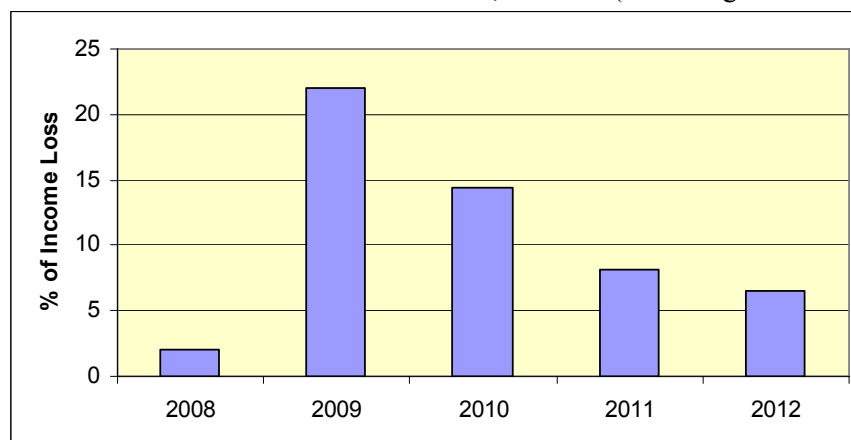


Source: Staff Estimates.

The bulk of the income loss is concentrated in the agriculture, livestock and retail sectors (Table 3). These sectors together account for about 94% of income losses expected to occur over the next four years. It is likely that the real rate of growth in agriculture sector (including livestock) would show a significant decline in GDP growth of about 5 percent in 2009.

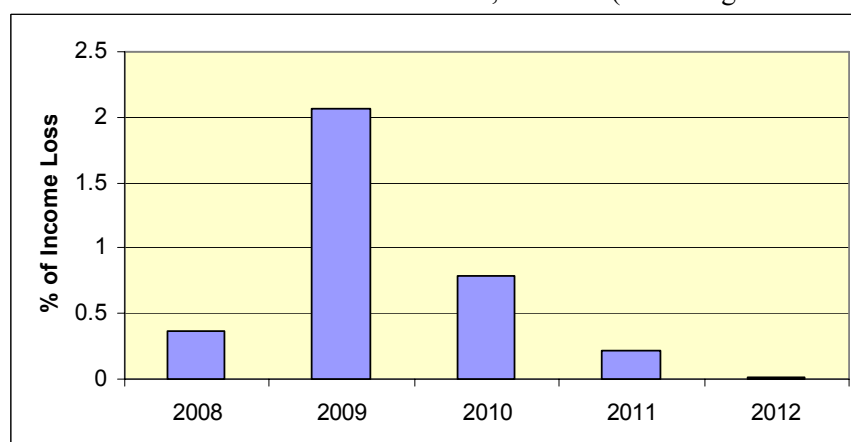
The flood disaster would significantly increase poverty in the affected governorates, particularly the poorer Hadramout governorate. The output or income losses suffered because of the floods peak in 2009 and then diminish in the subsequent years. Figures 7 and 8 show the proportionate loss of income in the two governorates between 2008 and 2012 compared to the baseline.

Figure 7 Income Losses in Hadramout Governorate, 2008-12 (Percentage of baseline income)



Source: Staff Estimates

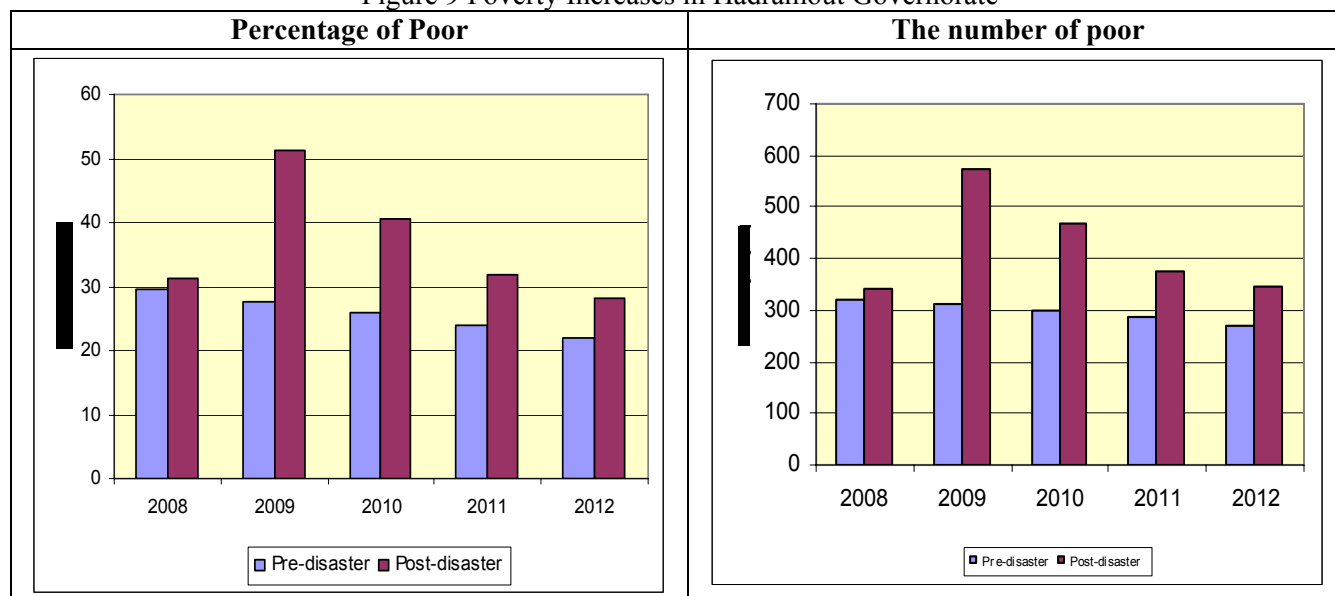
Figure 8 Income Losses in Al-Mahara Governorate, 2008-12 (Percentage of baseline income)



Source: Staff Estimates

As a result of the income losses, the number of poor in Yemen would increase by 265,000 persons or equivalently by 1.1% of population in 2009. This impact effects do not account for any increase in social protection or benefits from job creation during reconstruction activities. The poverty impacts in Hadramout governorate will be acute as shown in the increase in number of poor shown in Figure 9. The percentage of poor would nearly double from 28% to near 51% and the number of poor would double from 310,000 to 575,000 in 2009, the year of peak impact. The poverty gap would increase threefold to 12% in 2009 implying that to return the population to the pre-disaster levels of poverty would require cash transfer of about YR 17 billion under perfect targeting. This is a little less than the Social Welfare Fund (SWF) budget for the entire Yemen in 2006 at around YR 20 billion.

Figure 9 Poverty Increases in Hadramout Governorate



Source: Staff Estimates

The impact of the flood disaster on fiscal budget is expected to be significant mainly because of the need for additional expenditures. Repairing the damages to public infrastructure and providing social protection to the poor who lost incomes because of the flood disaster, would require at minimum US\$ 500 million more in capital and social protection expenditures over the next four years (and the cost is likely to escalate much further as Government undertakes necessary flood protection works and contributes to rebuilding shelter for those rendered homeless by the floods). On average, public capital expenditures have been about US \$ 2 billion in the recent years. With unchanged revenues, the fiscal deficit may have to increase by 1% of GDP for 2009 and 2010 from the baseline of 5% of GDP. Unless additional external financing is secured, the additional expenditures to finance reconstruction and social protection may have to be financed by domestic borrowing.

The flood disaster would enlarge the current account deficit mainly because of import needs of materials for reconstruction. It is estimated that imports could rise by about US\$ 200 million for financing the needs of reconstruction of about US\$1.1 billion. Assuming that the bulk of reconstruction would happen in the next two years, the import requirement would raise about by about US\$100 million a year. On the exports of goods and services, exports of honey may be less by about US\$ 10 million a year for three years until the beehives are built back. As a net result, the current account deficit is likely to widen by about 0.4% of GDP to -2.1% compared to the baseline estimate of -1.7% for 2009.

The inflation effects of the disaster likely to be small and transient. Price indices for November, 2008 – the first post-disaster month – would not be ready until the first week of January, 2009. However, scrutiny of price data for Al-Mahara suggests that important food items such as wheat, rice, etc. have not increased in the aftermath of the disaster because most of these are imported, the disruption to transport services have been minimal due to the rapid restoration of the functioning of roads (on a temporary basis) by the Ministry of Public Works and Highways, and the government and aid agencies have intervened quickly with emergency supplies of food grains to contain any pressure on prices.

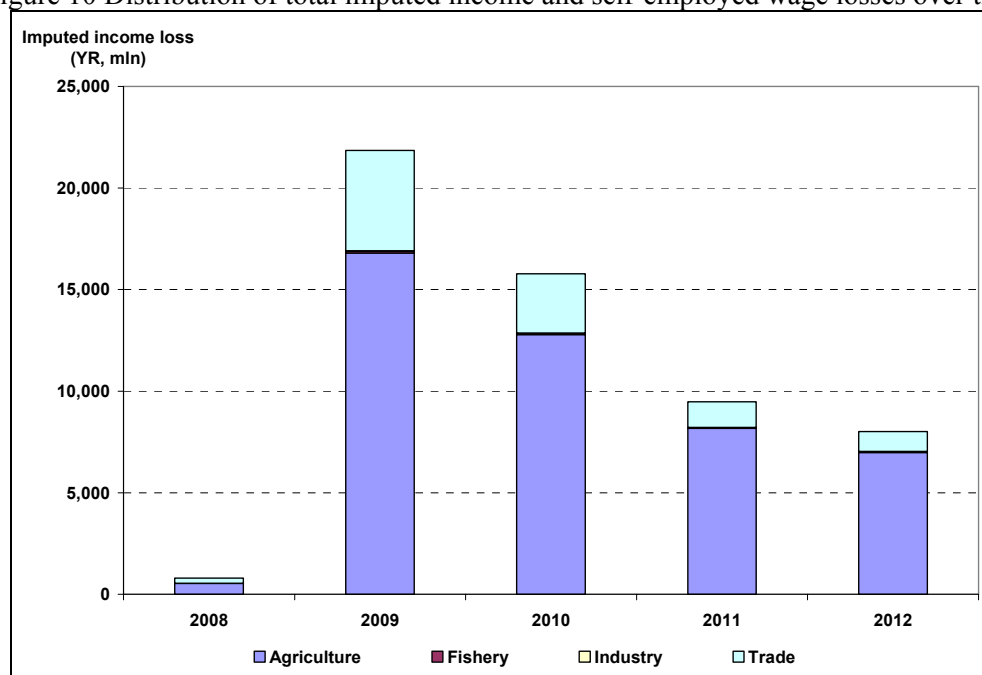
Impact on livelihoods

The physical damages and economic losses to agriculture (including livestock and honey), fisheries, industry and commerce will in turn have a detrimental impact on livelihoods through the loss of income for the self-employed and workers in enterprises affected by the floods for the duration it takes to repair the damages, restore production and for the output to recover to pre-disaster levels. The total imputed income and self-employed wage losses due to the disaster's effects on the different productive sectors are estimated at YR 55,914 million (US\$279.6 million), linked to the loss of an estimated 113,763 person-work-years over the period 2008-2012 (See Table 8). These losses are divided into: YR 45,279 million (US\$226.4 million) in the agriculture sector or 81% of the total; YR 10,340 million (US\$51.7 million) in the trade sector or 18.5% of the total; YR 278.2 million (US\$1.4 million) in the fisheries sector or 0.4% of the total; and lastly YR 16.5 million (US\$0.1 million) for industry, a negligible share of the total. These losses amount in the agricultural sector to 46% of the total output of the affected areas over the period of 2008-2012, and in the retail sector 6% of total output (the losses in the fisheries and manufacturing sectors were negligible, respectively at 0.5% and 0.1%). In terms of geographic breakdown, the bulk of these imputed losses are in Hadramout Governorate (YR 276 million or 98.7% of the total) and the remainder in Al-Mahara Governorate (YR3.6 million or 1.3% of the total). Figure 10 shows the time distribution of these losses by sector over the 2008-2012 period.

Table 8 Total imputed income and self-employed wage losses over the recovery period by sector

Sector	Person work years lost	Imputed income and self-employed wage losses	
		(Million YR)	(Million US\$)
Agriculture	92,179	45,279.2	226.4
Fishery	501	278.2	1.4
Industry	34	16.5	0.1
Trade	21,050	10,339.5	51.7
Total affected areas	113,763	55,913.5	279.6

Figure 10 Distribution of total imputed income and self-employed wage losses over time



IV. Immediate intervention needs

The immediate intervention program meets urgent needs and provides the first opportunity for the affected population to restore livelihoods devastated by the disaster. Immediate needs include: (a) ensuring food security for those who lost their livelihoods and are at risk of hunger; (b) temporary shelter for those who lost their shelter and belongings, in addition to basic needs such as clothing; (c) delivering emergency health care and medication for the affected population; (d) providing clean drinking water and basic sanitation facilities for those whose access to these services was interrupted by the floods; (e) measures to contain critical environmental health problems, prevent epidemics and ensure safety of the population, including disposal of dead animal bodies, pumping and disposal of sewerage and stagnant water, etc; (f) restoring the functioning of critical infrastructure on an emergency/temporary basis to facilitate the operation of emergency relief programs and the delivery of critical services such as health, including critical access roads, water and sanitation, power, and telecommunications services; and (g) continuing the delivery of education services to minimize the disruptions to children and youth. Most elements of this immediate intervention program are already underway through efforts of the Government together with civil society and bilateral/multilateral donor agencies. Table 9 summarizes immediate intervention requirements over six months duration, based on the DLNA estimates and the needs identified or expenditures already incurred by national and international humanitarian agencies.

Table 9 Summary of Immediate Intervention Program Needs

Early Intervention	Million YR	Million US \$
Food security (livelihoods losses)	2,000.0	10.00
Food security (shelter losses)*	351.4	1.76
Temporary shelter	959.8	4.80
Medical, water supply, and Sanitation Facilities*	920.0	4.60
Education Facilities*	154.0	.77
Environmental Protection	78.8	0.39
Emergency restoration of services:		
Critical access roads	173.0	0.87
Power **	250.0	1.25
Water and sanitation	471.2	2.36
Telecommunications	22.0	0.11
Total	5,3802	26.91

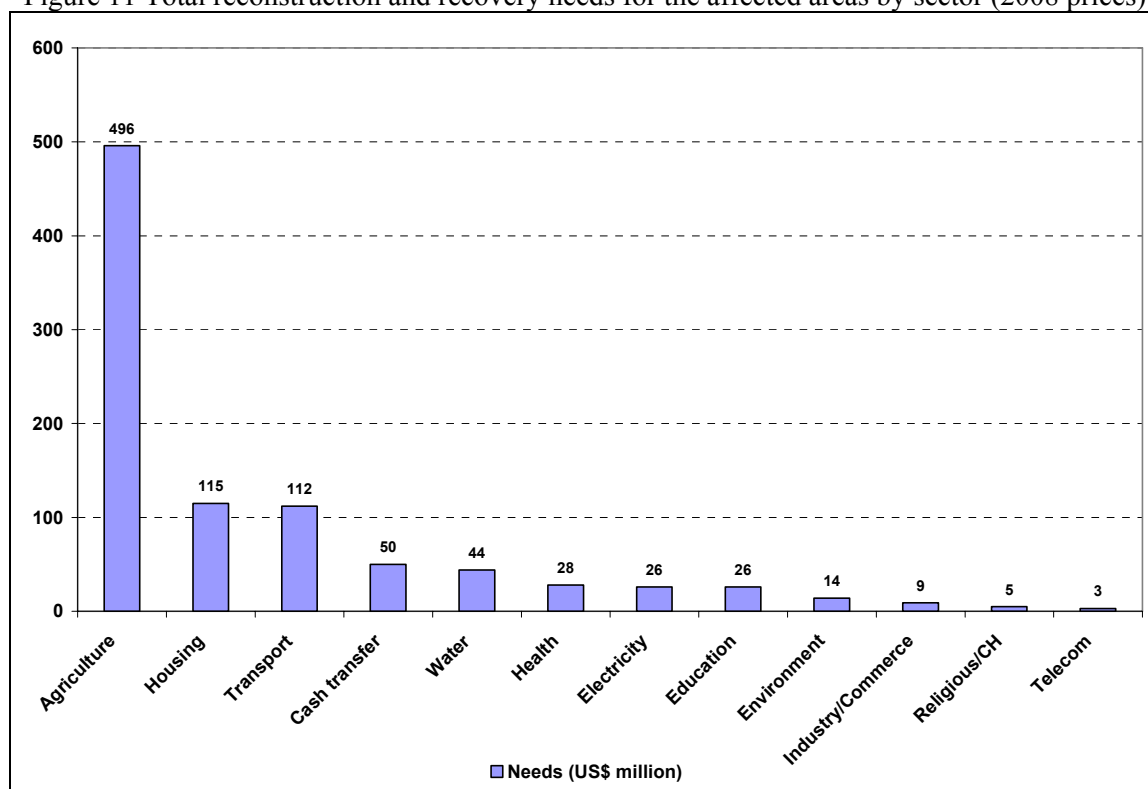
Notes: Estimates are indicative and are based on DLNA team assessment except (*) based on UN estimates in Flood Response Plan (2008). (**) Extrapolated based on YR 125 million requirement for emergency restoration of service in Hadramout Wadi.

V. Reconstruction and recovery needs

The total reconstruction and recovery needs for the two affected Governorates are estimated to amount to YR 185,858 million (US\$ 929 million)—See Figure 11 for a breakdown by sector. Of these, Hadramout's share amounts to YR174,405 million (US\$872 million) and Al-Mahara's share amounts to YR11,452 million (US\$57 million). The largest needs are found in a descending order in: (i) the agriculture sector with YR 99,200 million (US\$ 496 million) needed for reconstruction of damaged public and private infrastructure and recovery of losses; (ii) YR 23,040 million (US\$115 million) for the housing reconstruction program including programs to

restore damaged household assets, clean debris and provide temporary shelter to the affected households; and (iii) YR 22,465 million (US\$ 112 million) for transport, mainly roads' reconstruction. The next most important category is YR10,000 million (US\$ 50 million) needed for a cash transfer program to restore part of the livelihoods losses of the most vulnerable affected households. The remainder of the support needed to those that did or will face livelihood losses as result of the disaster—estimated at YR17,301 million (US\$86.5 million)—would be addressed through a labor-intensive public works program that would be designed to channel to the extent possible temporary jobs in the reconstruction program to affected households.

Figure 11 Total reconstruction and recovery needs for the affected areas by sector (2008 prices)



The total reconstruction and recovery needs by year and by affected Governorate are presented in Table 10. The estimated needs over the recovery period are quoted in 2008 prices and thus do not take inflation into account (physical contingencies are taken into account).

Table 10 Summary of Short, Medium, and Long-Term Recovery and Reconstruction Requirements (2008 prices)

Sector	Hadramout					Al-Mahara					Total Needs in the Affected Areas *	
	2009	2010	2011	2012	Total Needs (million YR)	2009	2010	2011	2012	Total Needs (million YR)	(million YR)	(million US\$)
Agriculture	30,691	30,691	25,701	8,567	95,649	1,109	1,109	999	333	3,551	99,200	496
Crops	25,701	25,701	25,701	8,567	85,669	999	999	999	333	3,331	89,000	445
Fishing	4,948	4,948			9,895	53	53			105	10,000	50
Livestock	43	43			85	58	58			115	200	1
Industry/Commerce	1,830				1,830	6				6	1,836	9
Manufacturing	647				647	0				0	647	3
Retail	1,183				1,183	6				6	1,189	6
Infrastructure	6,733	13,466	11,437	2,030	33,665	741	1,397	1,348		3,485	37,150	186
Electricity	812	1,624	1,624		4,060	240	480	480		1,200	5,260	26
Water	1,734	3,469	3,469		8,672	49	49			97	8,769	44
Transport	4,059	8,118	6,089	2,030	20,295	434	868	868		2,170	22,465	112
Telecom	128	255	255		638	18				18	656	3
Social	9,283	9,283	11,457		30,301	1,097	1,097	1,375		3,569	33,870	169
Education	1,458	1,458	1,944		4,860	99	99	132		330	5,190	26
Health	1,736	1,736	1,394		5,143	175	175	146		497	5,640	28
Housing	6,089	6,089	8,119		20,298	823	823	1,097		2,742	23,040	115
Cross cutting	917	917	1,223		3,058	223	223	298		744	3,802	19
Environment	807	807	1,076		2,691	51	51	68		169	2,860	14
Religious/Cultural	110	110	147		367	173	173	230		575	942	5
Cash transfer	3,983	2,798	1,692	1,430	9,902	61	25	6	6	98	10,000	50
Total Needs (million YR)	53,437	57,155	51,510	12,026	174,405	3,237	3,851	4,026	339	11,452	185,858	929
Total Needs (million US\$)	267	286	258	60	872	16	19	20	2	57	929	

* Not including YR 1,400 million (US\$ 7 million) for needed TA in the transport sector and YR 8,599 million (US\$43 million) of expected additional cost should the resettlement option in Hadramout Governorate be used for reconstruction.

Restoring livelihoods

For the duration it will take to recover to pre-disaster output levels, temporary solutions will be needed to at least partially restore the livelihoods of those affected. This is no simple task since the disaster's effect on livelihoods is expected to be huge, with as much as 113,762 person-work-years estimated to have been or would be lost over the coming four years in agriculture, livestock, fisheries, industry and commerce.

Solutions would include a combination of a labor-intensive public works program, which would create as many unskilled jobs targeted at the affected communities as possible, and a cash transfer program targeted at the most vulnerable. Assuming all livelihood losses are to be addressed via a public works program, the number of work-days that would need to be created is estimated at 13.65 million work-days, spread over the 2008-2012 period. On the basis of a daily wage of YR 2,000 for unskilled labor (as in the Social Fund for Development's workfare program), the livelihoods program would need over the 2008-2012 period an estimated YR 27,303 million (US\$ 136.5 million) in wages for unskilled labor to compensate for all livelihood losses. Based on an average labor content of 40% and an average share of 80% of jobs going for unskilled labor (at YR 2,000 per day) versus 20% for skilled labor (at YR 4,000 per day) in similar programs, the size of the proposed public works program would need to equal YR 102,387 million (US\$512 million) over the 2009-2012 period. Table 11 summarizes the overall livelihoods program requirements for the affected areas.

Table 11 Summary of livelihood program requirements for the affected areas by year (2008 prices)

Total all sectors	Affected Areas					
	2008 *	2009	2010	2011	2012	Total
Temporary jobs to be created	1,607	44,400	32,111	19,318	16,326	113,763
Work-days to be created	192,840	5,328,000	3,853,320	2,318,160	1,959,120	13,651,560
Program wage/payment needs:						
In YR million	385.7	10,656.1	7,706.7	4,636.3	3,918.3	27,303.1
In US\$ million	1.9	53.3	38.5	23.2	19.6	136.5
Livelihoods public works program size (assuming no cash transfers) **						
In YR million	1,446	39,960	28,900	17,386	14,694	102,387
In US\$ million	7.2	199.8	144.5	86.9	73.5	512
Affected areas reconstruction program size						
In YR million		40,330	45,883	46,637	8,530	141,658
In US\$ million		201.7	229.4	144.5	42.6	708.3
Gap between potential livelihoods wages from reconstruction program and livelihood needs						
In YR million	1,446	2,877	--	--	1,975	6,298
In US\$ million	7.2	14.4	--	--	9.9	31.5

* Job and livelihoods losses start in 2008 (November-December) even if the public works program would only be expected to start in 2009.

** Assuming an average wage component in the program of about 40%, with 80% of labor non-skilled (paid YR2,000 per day) and 20% skilled labor (paid YR4,000 per day).

If a cash transfer program were used instead, and assuming perfect targeting, the resources required to achieve the same objective would only amount to YR 27,303 million (US\$ 136.5 million). However, concerns about targeting in light of existing capacity and the leakage effects that such a program could produce end up favoring a public works program, which would allow for geographic targeting and self-screening.

To the extent possible, the post-disaster reconstruction program would be structured so as to target the affected communities by creating temporary unskilled jobs. Yet, after accounting for the estimated labor intensity and the expected ratio of skilled to unskilled labor in the different components of the reconstruction program⁵, it is estimated that a gap of about YR 6,298 million (US\$31.5 million) will remain. This gap would therefore need to be addressed either through a cash transfer program or by adding further components to the works program that are not disaster related (e.g. stone paving of roads). Yet, not all those affected with livelihood losses would be expected to be able to assume unskilled construction jobs (whether due to gender, vulnerability, disability or other considerations). Thus, it is important to simultaneously design a cash transfer component that would be prioritized to households that meet certain pre-determined objective criteria reflecting vulnerability (e.g. female single-headed households, the elderly, disabled heads-of-households, etc). It is thus proposed that the cash transfer program be capitalized with a total of YR 10,000 million (US\$50 million), which would comprise of YR 4,000 million (US\$20 million) for 2009, followed by YR 2,000 million (US\$10 million) per year from 2010 to 2012.

In terms of implementation of the livelihoods program, three existing instruments could serve either to channel the needed assistance to the affected households for the interim recovery period and/or to inform the design of the livelihoods program. These are: (a) the Social Welfare Fund (SWF); (b) the Public Works Program (PWP); and (c) the Social Fund for Development (SFD).

The Social Welfare Fund (SWF) is the government's main social safety net program. It provides targeted cash assistance to the poor and vulnerable groups. While early assessments have found issues that limited the SWF's ability to effectively fulfill its mandate (limited funding and assistance amount, complex procedures, etc) as well as a high mis-targeting ratio, the SWF has in recent years adopted reforms that have led to improved performance. These included completing a comprehensive nationwide survey to verify its beneficiaries' list, developing proxy-means testing methods to rank needy households in an objective way, and relying on postal offices to enable effective and transparent distribution of cash assistance. Thus, it is proposed that the SWF be entrusted with implementing the cash transfer (or grant) component of the program, relying on the newly adopted parameters (proxy-means testing and post offices). Priority can be given to the affected households that were from the onset on the SWF's beneficiary lists.

The Social Fund for Development (SFD)—one the Government's main safety net programs with a focus on medium- and long-term recovery—could also be an effective response instrument to the livelihoods impact of such a disaster, building on its extensive community outreach and mobilization efforts, diversified and innovative activities, and robust Monitoring and Evaluation. Recently, in response to the food crisis, the SFD launched a "Workfare Program" that sponsors labor-intensive works, targeted at Yemen's poorest communities and drawn from their priorities. In such projects, the program pays specific pre-identified amounts by type of work and for daily labor, with the payments tied to outputs. This program is designed to support 8,000-10,000 poor households by paying them, in return for work, the equivalent of their wheat consumption for the duration of 6-12 months. The works covered under this program (debris removal, disposal of the Sayssaban trees that block the Wadi paths, rehabilitation of agricultural land and terraces, stone paving, etc) are ideal labor-intensive works that are suited for the livelihoods crisis at hand and

⁵ The reconstruction component in agricultural sector and the environment (debris removal) is assumed to have a 40% labor component with 80% of jobs to unskilled labor (or 67% of total wages). Reconstruction of housing, health, education and religious facilities is assumed to have a 40% labor component with 50% of jobs for unskilled labor (or 33% of total wages). Infrastructure is assumed to have a 30% labor component with 50% of jobs for unskilled labor (thus 33% of total wages).

which are part of the reconstruction needs in the affected areas. A scaled up version of this program could support 20,000-40,000 affected households for 12-24 months. Whether to rely on the SFD in whole or in part for implementation or to replicate this program for implementation by other entities would need to be decided in light of the Government's preferred approach to the reconstruction and recovery effort and the SFD's current and expected workload.

The Public Works Program (PWP) is also an adequate instrument to avail temporary employment to the affected population via its labor-intensive public works program. The Government may want to entrust some of the rebuilding to the PWP (e.g. rehabilitation of health and educational facilities, restoration of community-based services, flood protection works using gabions, etc) or replicate its main characteristics in the reconstruction and recovery effort. Community-based reconstruction would preferably be relied on. Alternatively, contractual provisions would be made so that the selected contractors offer unskilled and semi-skilled temporary construction jobs to members of the affected communities.

VI. Disaster risk reduction needs

Based on the many lessons learnt from this disaster, a disaster risk reduction strategic framework is recommended. It combines the broad strategic priorities and goals outlined in the National Disaster Management Plan, prepared by the Civil Defense Directorate in 2006, with strategic elements for disaster risk mitigation based on lessons learnt from international experience. The framework for moving from risk to resilience has the following five strategic pillars:

- (i) *Risk identification and assessment* including national multi-hazard risk identification, vulnerability assessment and modeling, and risk identification and assessment for the affected areas in Hadramout and Al-Mahara.
- (ii) *Risk mitigation for reducing exposure to natural hazards* comprised of non-structural measures (flood protection master plan for Wadi Hadramout, storm water drainage plan for Mukalla and other priority urban areas, updating land use plans and building regulations, upgrading construction standards for roads, and building comprehensive systems' databases) and structural measures (flood protection/storm water drainage investment programs for the Wadi and urban areas).
- (iii) *Strengthening and enhancing emergency preparedness* including establishment of early forecasting and warning systems, strengthening and institutionalizing sub-national government's disaster preparedness, and strengthening community-based disaster preparedness.
- (iv) *Institutional capacity building* including establishing a high-level National Disaster Risk Management Council (NDRMC), and strengthening disaster risk management institutions, instruments and capacity.
- (v) *Financing Reconstruction and Recovery and long-term catastrophe risk financing.* This includes the creation and operationalization of the Reconstruction and Recovery Fund (RRF) for the flood affected areas—Hadramout and Al-Mahara, as decreed by the Cabinet on December 2, 2008, to serve as the implementation and coordination instrument of the overall recovery and reconstruction effort. It also includes looking at long-term risk financing options to meet the funding needs that may be required in the aftermath of a future disaster without resorting to major budget reallocations, additional taxation, or external borrowing.

Table 12 summarizes the estimated needs to implement a disaster risk reduction program to strengthen hazard risk identification, mitigation and emergency preparedness in the affected areas and mainstream institutional disaster risk management capacity at the national level.

Table 12 Preliminary Investment Program for Disaster Risk Reduction (US\$ million, 2008 prices)

Program	2009-13	2014-18	Total
1. Risk Identification and Assessment	1.5	TBD	1.5
1a. National Multi-hazard Risk Identification	1		1
1b. Hadramout and Al-Mahara Risk Identification	0.5		0.5
2. Risk Mitigation	53.85	49	102.85
2a. Wadi Flood protection master plan	1		1
2b. Mukalla/urban areas storm water drainage master plans	1		1
2c. Detailed land use plans and building regulations in urban areas	0.6		0.6
2d. Program to upgrade standards of road construction	0.25		0.25
2e. Comprehensive systems' databases	2		2
2f. Wadi Flood protection system	24	24	48
2g. Mukalla/urban areas flood protection systems	25	25	50
3. Strengthening Emergency Preparedness	2.25	TBD	2.25
3a. Establishment of early forecasting/warning systems	1		
3b. Strengthening and institutionalizing sub-national government disaster preparedness	0.75		
3c. Strengthening Community Based Disaster Preparedness	0.5		
4. Institutional Capacity building	1	TBD	1
5. Disaster Risk Financing	1	TBD	1
Total Disaster Risk Reduction Activities	59.60	49	108.60

Notes: The cost estimates provided in this table, based on DLNA team estimates, are indicative.

VII. Summary of total estimated post-disaster needs

The overall post-disaster needs therefore amount to an estimated US\$1,064.51 million, as detailed in Table 13.

Table 13 Total estimated post-disaster needs (US\$ million, 2008 prices)

Program	US\$ million (2008 prices)
Immediate intervention program needs (6 months)	26.91
Reconstruction and recovery program needs (4 years)	929.00
Disaster risk reduction program needs (10 years)	108.60
Total needs	1,064.51

Part A: Impact of the Disaster



Part A of this report presents an estimation of the main effects of the disaster. This includes estimating (i) the value of physical assets that were totally or partially destroyed by the disaster; (ii) the losses in economic flows from the temporary absence of those assets; and (iii) the impact on economic development and social conditions.

The estimate of damage and losses presented below is a compilation of data supplied by a joint assessment team and is broken down by sector. The estimated impact of the disaster includes an assessment of the main macro-economic variables, as well as an analysis of the individual and household-level impacts. This provides a wide-ranging overview of the disaster's effects and impacts, which were used to estimate post-disaster needs, presented in Part B of the report.

Section I: The Disaster

Disasters in Yemen

Located at the southwestern edge of the Arabian Peninsula and bordered by the Arabian Sea and the Gulf of Aden to the south, and Red Sea to the west, the Republic of Yemen has large areas of flat coastal plains and dry highlands. Its unique topography and largely arid weather makes Yemen highly susceptible to desertification and floods.

Yemen is a disaster prone country that faces a number of natural hazards every year, the most important ones being flash floods, earthquake, and land- or rockslides. According to the Emergency Events Database (EM-DAT) approximately 100,000 people are affected annually by disasters triggered by natural hazards in Yemen (see Tables 1-1 and 1-2). Over the last two decades, Yemen has become increasingly vulnerable to natural disasters due to high population growth, poorly controlled urbanization, unplanned and unregulated urban development, and lack of environmental controls. Increased concentration of physical assets and vulnerable population in high-risk areas are leading to increased exposure to adverse natural events. As seen in Tables 1 and 2, floods are the most important and recurring disaster in the country.

Table 1-1 Human toll and damages due to prior disasters in Yemen by year, 1973-2007

Year	Type	Killed	Affected
1973	Flood	60	2,862
1975	Flood	52	50,000
1982	flood/earthquake	1,989	751,500
1989	Flood	63	490,000
1991	flood/earthquake	10	70,039
1993	Flood	31	21,500
1996	Flood	345	243,210
1998	Flood	70	3,240
1999	earthquake/flood	10	59,789
2000	Epidemic	32	289
2001	storm/flood	61	
2002	Flood	53	700
2003	Flood	15	
2005	flood/landslide/epidemic	87	911
2006	Flood	30	2,320
2007	flood/volcano	99	2,633

Source: EM-DAT - <http://www.emdat.be>

Table 1-2 Human toll and damages due to prior disasters in Yemen by event, 1993-2007

Year	Month	Duration (days)	Location	Type	Killed	Affected	Damage (Million USD)
1993	Feb	5	Lahej, Abyan, Aden	Flood	31	21,500	1.5
1996	May	4	Taiz, Hodeida	Flood	7	5,000	10
1996	June	12	Shabwa, Mareb, Hadramout	Flood	338	238,210	1,200
1998	Aug	16	Shihab Valley, Red Sea Port	Flash flood	70	240	NA
1998	March	3	Tihama Valley, Hodeidah	Flood		3,000	NA
1999	Nov	1	Jabal Bahr, Bani Zahir	Earthquake	10	40,039	NA
1999			Socotra archipelago	Flood		19,750	NA
2000	Sept	1	Wadi Hodeidah	Earthquake	32	289	NA
2001	Aug	1	Aden	Storm	17		NA
2001	June		Saada	Storm	13		NA
2002	Aug	1	Hodeidah, Taiz, Hadramout	Flood	28		NA
2002	Jul	2	Raima	Flood	13		NA
2002	Jul	2	Salafiyah	Flood	10		NA
2002	April		Salafiyah, Hadramout	Flood	2	700	NA
2003	June	3	Hajja, Taiz	Flood	15		NA
2005	Feb	10	Hadramout Seiyun, Hodeidah	Earthquake		179	NA
2005	Aug	1		Flash flood	12	6	NA
2005	April	3	Sanaa, Hodeidah	Flash flood	10	715	NA
2005	Dec	1	Al-Dhafeer, Bani Matar	Landslide	65	11	NA
2006	April	2	Dhamar, Hodeidah, Manakha	Flash flood	25	320	NA
2006	Feb	3	Dhamar, Maabar	Flash flood	5	2,000	NA
2007	Aug			Flood	50		NA
2007	March	3	Hadramout, Ibb	Flash flood	36	618	NA
2007	Jan	3	Raima, Dhamar	Flood	7	2,000	NA
2007	Sept		Jabal-Al-Tayr Island	Volcano	6	15	NA

Tropical Storm 03 B

Tropical storm 03B (Deep Depression ARB 2/2008, See Figure 1-1) was first observed on October 19 2008 as an area of low pressure along the south east of Salalah, Oman. It became a deep depression and lost its strength while crossing the Gulf of Aden due to entry of dry air and land interaction as it passed the northeastern coast of Somalia. On 24 October it made its way to the southeastern coast of Yemen⁶. The storm caused severe rain and flooding over the eastern parts of Yemen for about 30 hours, resulting in total rainfall of almost 91 mm (vs. 5-6 mm during normal periods). The total catchment area of about 2 million hectare collected some 2 billion cubic meter of water. Given the topography of the affected area (mountainous terrain, rivers and flat valleys), this large quantity of water in the catchment area led to severe flash floods in the

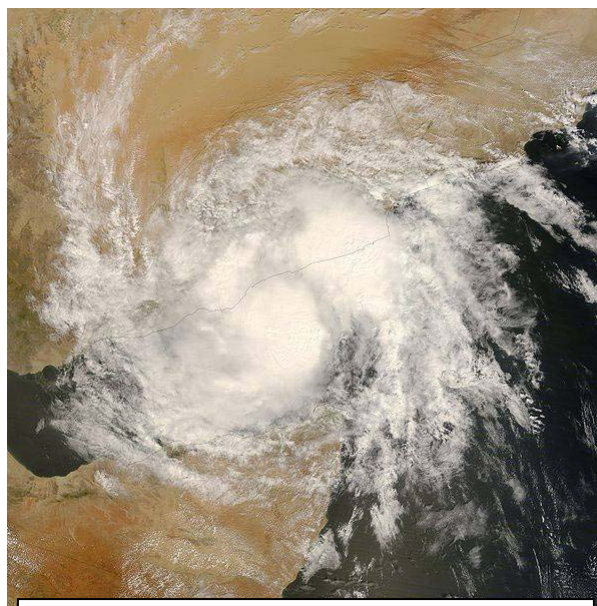


Figure 1-1 Tropical Storm 03B Source: NASA¹

⁶ <http://rapidfire.sci.gsfc.nasa.gov>

valleys, with water surges reaching up to 18 meter in some areas. This area had experienced serious floods in 1989 and 1996 but this flood is considered the most devastating. The flash floods and surging water resulted in one of the largest natural disasters to hit Yemen since the last decade.

The Disaster Toll

The heavy rain and flooding caused by the storm 03B seriously affected Hadramout and Al-Mahara governorates, which were declared disaster areas on October 27, 2008. The Wadi Hadramout region was the worst off area as a result of the disaster, having sustained 67.5% of the total damage and losses (16 of the 19 districts reported damages, with the most affected areas being Sah, Som, Tarim, Al-Qatn and Hawra). Hadramout’s coastal areas (called Sahel) sustained 28.6% of total damage and losses, while Al-Mahara sustained 3.9% of the total. Infrastructure was particularly badly hit; major roads, communication facilities, power, and water distribution networks all sustained major destruction and damage. This meant that access to the affected areas was very difficult at the beginning; in some cases, it took Government and relief efforts close to one week to reach some disaster affected areas such as Sah.

As much as 73 persons were reported to have lost their lives as a result of the floods, 17 people were missing and scores have been injured (See Table 1-3). The flooding and heavy rain also caused 2,826 houses and huts in both Governorates to be totally destroyed and 3,679 houses to be substantially or partially damaged. Some 25,000 people were displaced, living in temporary shelters (schools, mosques and public buildings) or with host families. The impact on agricultural land and people’s livelihoods has been particularly devastating. A total of 22,902 Feddans (acres) of cultivated agricultural land and 51,455 Feddans of uncultivated land were damaged in both Governorates due to soil erosion. Public and private irrigation infrastructure sustained significant damage. Close to 550,000 palm trees and 160,000 fruit trees were uprooted. About 58,500 livestock heads (sheep, goats, camels and cattle) died due to the water surge, and as much as 309,103 honey beehive cells producing the famed Hadrami honey were washed away. In Wadi Hadramout alone, over 14,500 acres of cultivated agricultural land suffered from soil erosion, destroying crops and rendering the land uncultivable; over 500,000 palm trees were uprooted; 50,000 livestock heads perished; and over 260,000 beehives were destroyed. Overall, about 700,000 persons (over 50% of the affected areas’ population), have had their livelihoods destroyed or significantly affected, and of these about two-thirds live in Wadi Hadramout.

Table 1-3 Deaths and missing persons due to tropical storm 03B

	Hadramout	Al-Mahara
Deaths/ Missing	68 deaths, 12 missing	5 deaths, 5 missing

Source: OCHA, Situation Report No. 4, Nov 7, 2008

Heavy rains also affected six other governorates: Marib, al-Jawf, Shabwa, Lahj, Taiz, and Saada where floodwater isolated many villages and destroyed three schools, secondary highways, and bridges. Two deaths were reported in Hodeidah and Al-Jawf.

Early Warning

The Government of Yemen used local and national radio and TV warnings to relay bulletins from the Civil Aviation and Meteorological Authority. The bulletins warned about possible storm but the intensity and extent of flash flood was not predicted. No other formal mechanism of early warning and evacuation at the community level was used. Many affected areas did not receive a timely warning. The field visits revealed that people warned each other informally via gunshots

and mobile phones. Flood-receiving areas warned the settlements situated downstream about the possibility of flood in next few hours. In many communities in Wadi Hadramout, a single mobile call received one or two hours before the flash flood saved hundreds of lives.

The Immediate Response

National Response

On October 27th, 2008, the GOY declared the governorates of Hadramout and Al-Mahara disaster areas. The President decided to allocate YR 20 billion (US\$ 100 million), to be raised through borrowing, for emergency funding and established a high level committee chaired by the Prime Minister and an operational level Emergency Committee chaired by the Deputy Prime Minister for Internal Affairs to coordinate relief and rehabilitation efforts. Subsequently, the Deputy Prime Minister called all the UN agencies, international NGOs, and embassies to participate in high level task force on the crisis response and identified the following areas as urgent needs – food, tents, blankets, and utensils, prevention of infectious diseases, water pumps, mobile health units, and electricity generators.

International Response

A number of international relief organizations responded to the disaster immediately. Table 1-4 provides a brief summary of international response.

Table1-4 Immediate response from international organizations

International Agency	Response
WHO US\$100,000 in emergency funds was made available.	Medical kits for 30,000. Supported the Ministry of Public Health and Population to: i) enhance disease surveillance systems, outbreak investigation and control systems, ii) immunization campaigns (measles and polio), iii) control of vector born diseases (malaria), iv) support a campaign to prevent transmission of communicable diseases and v) provision of medical supplies and medicines
UNCHR	Shelter/ non-food items for 500 families (3,500 people)
UNICEF	Relief items (water tanks, blankets, hygiene kits, and water purification tablets to 2,500 families (17,500 people). Measles and Polio campaign, and Vitamin A administration with the Ministry of Health
WFP	Food packets including dates and High Energy Biscuits (HEB) for approximately 20,000 people.
IFRC Turkish Red Crescent \$10,000 to Yemen Red Crescent	Allocated CHF 219,800 to support Yemen Red Crescent Society in delivering humanitarian assistance
The Mohammed Bin Rashid Al Maktoum Foundation, Dubai	Dispatched relief supplies, electricity generators, and water pumps by air and road
Islamic Relief and Oxfam \$100,000 for relief efforts for water and sanitation activities	Allocated for preventing waterborne diseases and purifying water as a matter of priority
Adventist Development and Relief Agency International (ADRA)	Medical supplies, food, and non-food items to a few specific villages/towns in Tarim district. ADRA is also interested in recovery/ rehabilitation, particularly of re-establishing livelihoods, but will wait for more information about the needs.
USAID/OFDA provided \$349,000	\$50,000 were provided to WFP for the transport of emergency food and non-food items and \$299,000 were allocated to UN agencies to support transportation of food and emergency relief supplies.

Source: Information based on UN Office of the Coordination and Humanitarian Affairs (OCHA) reports on Integrated Regional Information Network (IRIN) and may not contain names of all international agencies and countries providing support for the relief efforts.

Many countries pledged relief supplies and funds to Yemen, including Saudi Arabia (US\$100 million), UAE (relief items such as food and tents and US\$35 million for housing reconstruction), Kuwait (relief items), Germany (Euro 150,000), Japan (relief items such as tents, blankets, plastic sheets, sleeping mats, water purifiers, etc.), Italy (Euro 150,000 for IFRC coordinated relief works), and Singapore (US\$20,000 worth of emergency relief supplies through the Arab Association of Singapore and Mercy Relief).

On October 27, 2008, the Government of Yemen (GOY), represented by the Ministry of Planning and International Cooperation (MOPIC), requested the international community's support to assess the damages, losses and post-disaster needs and to join reconstruction and recovery efforts. The World Bank was requested to lead the donor coordination effort in the preparation of a joint Damage, Loss and Needs Assessment (DLNA) covering the infrastructure, shelter and productive sectors, to leverage financial and technical support from the Global Facility for Disaster Reduction and Recovery (GFDRR) for the preparation of the DLNA, and to prepare an emergency reconstruction operation to rehabilitate and rebuild selected critically damaged infrastructure. The United Nations (UN) was asked to lead the donor coordination effort related to the emergency relief and humanitarian needs. The enclosed report is the DLNA, prepared jointly by the GOY, the World Bank, the United Nations International Strategy for Disaster Reduction, and the International Federation for Red Crescent and Cross, with support from the GFDRR. The recommendations of the DLNA will serve as the main inputs for a recovery and reconstruction plan.

Existing rapid assessments of the impact of the storm and floods and the development needs were conducted by international agencies including by MF Spain, the UN agencies, and IFRC. Table 1-5 summarizes the earlier assessments.

Table 1-5 Prior assessments by international agencies

Agency/ Date	Assessment areas	Main points
MF Spain October 29 th	Assessment in and around Mukalla	Concluded that at this point, there will be no MF intervention. Noted that there is a risk of waterborne diseases, diarrhea, and cholera outbreaks, malaria and dengue.
UN agencies (WFP, UNHCR, UNICEF, WHO and IOM) and one representative of ECHO October 27 - 30 th	Rapid assessment findings to the UN Emergency Preparedness and Response Team (UNEPR) to provide the basis for possible CERF requests and a flash appeal	Flood response plan includes a list of projects to cover the needs in the food, water and sanitation, health and nutrition, shelter and non-food items, camp management, protection and education sector. Some initial early recovery needs in the livelihood sector are also included
IFRC	A Field Assessment and Coordination Team (FACT) was deployed for the assessment	Report briefly assesses the flood situation and outlines the relief strategy in the following sectors: temporary shelter support, recovery, health (water and sanitation), relief goods, and capacity building.

Social and Economic Background of the Affected Areas

Background

The governorates of Hadramout (estimated population of 1,300,000) in the Eastern Plateau and Al-Mahara (estimated population of 100,000) on the border with Oman were both affected by the October rains and floods, the worst of their kind in the area in at least a decade (See Table 1-6 for the demographic characteristics of the affected areas). The bulk of the damage and loss – human toll, livelihoods, agriculture, and infrastructure – was reported in Hadramout, specifically Wadi Hadramout. Almost all districts in the Wadi Hadramout area were hit, including Seiyun, Tarim, Shibam, Al-Qatn and Hawra, all located within close proximity of each other. The heaviest hit were the towns of Sah, al-Som, Tarim, al-Qatn, and al-Hawra (Wadi al-Ayn) which suffered human losses, the destruction of thousands of mud brick houses, and the washing away of soil from large swaths of agricultural land. Areas of coastal (Sahel) Hadramout and Al-Mahara were also affected. In the case of Hadramout in particular, these floods have dealt a heavy blow to its residents and economy, which suffers from the fourth highest incidence of urban poverty in the country (31%), a figure that is 11% higher than the national average for Yemen.

Table 1-6 Demographic characteristics of Hadramout and Al-Mahara governorates

	Hadramout	Al-Mahara
Population 2008 (estimated)	1,300,000	100,000
Population 2004 (census)	1,028,556	88,594
Percent of Yemen's population	5.2%	0.5%
Capital city population 2004	Al-Mukalla (Sahel) 176,943 Seiyun (Wadi) 48,037	Al Ghayda 13,475
Total number of households 2004	124,809	13,933
Average number of individuals in house 2004	8.2	6.4
Percent of households owning agricultural land	10.80%	6.20%
Illiteracy rate 2004 (Female/Male)	46.5%(F); 17.8% (M)	62.5% (F); 27.8% (M)
Incidence of poverty 2006 (Urban/Rural)	31.45% (U); 39.17% (R)	11.4% (U); 6.29% (R)
Beneficiaries of Social Welfare Fund 2006	54,132	12,479

Population

Yemen ranks 151st out of 177 countries on the 2005 Human Development Index. There has been an increase in average life expectancy (up from 41.6 years in 1970 to 60.6 in 2003). Similarly, there has been a significant increase in enrollment rates in basic education (up from 3 million in 1996 to 4.1 million in 2004). However, there are many remaining areas of concern including high fertility rates (population growing at over 0.5 million people per annum), infant mortality (82 per 1000 births in 2004), maternal mortality, malnutrition (18 percent of the population or about 3 million people) particularly children under 5 years of age, and low female literacy rates (28.5 percent in 2002). Nearly 50% population of Yemen is below 15 years.

Poverty

Yemen is the poorest country in the Middle East region, with an estimated 35% of the total population (7 million) living below the national poverty line of 85 US cents per capita per day by 2006⁷. 73% of the population of Yemen lives in rural areas where most of the poverty (poverty

⁷ Household Budget Survey, The World Bank, 2005-06.

and extreme poverty⁸) is concentrated. Geographical location, along with lack of education and large household size contributes to the risk of being poor. Majority of the poor population is located in six governorates of Sana'a, Taiz, Ibb, Hodeidah, Dhamar, and Hadramout.

The regional dimensions of poverty differ considerably⁹. There are large intra-governorate differences in the incidence of poverty. Poverty varied between 5.4 percent and 71 percent in 2005-06 among governorates. Poverty is the highest in the rural part of Amran governorate (71 %) and the lowest in Al-Mahara and Sana'a City governorates. In general, rural areas in all governorates have higher poverty rates than urban areas and the gap between urban and rural areas is wider when using distribution sensitive indicators. Tables 1-7 and 1-8 below summarize the urban rural divide as well as differences between governorates in poverty, and Figure 1-2 shows the poverty map of Yemen.

Table 1-7 Poverty in urban and rural areas in Yemen

	Incidence of poverty			Poverty Gap Index			Severity of Poverty Index		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Overall Poverty	20.6	40.8	35.2	4.6	11.2	9.4	1.5	4.3	3.6
Food Poverty	4.3	16.2	12.9	0.8	3.5	2.7	0.2	1.1	0.9

Source: Household Budget Survey, The World Bank, 2005-06

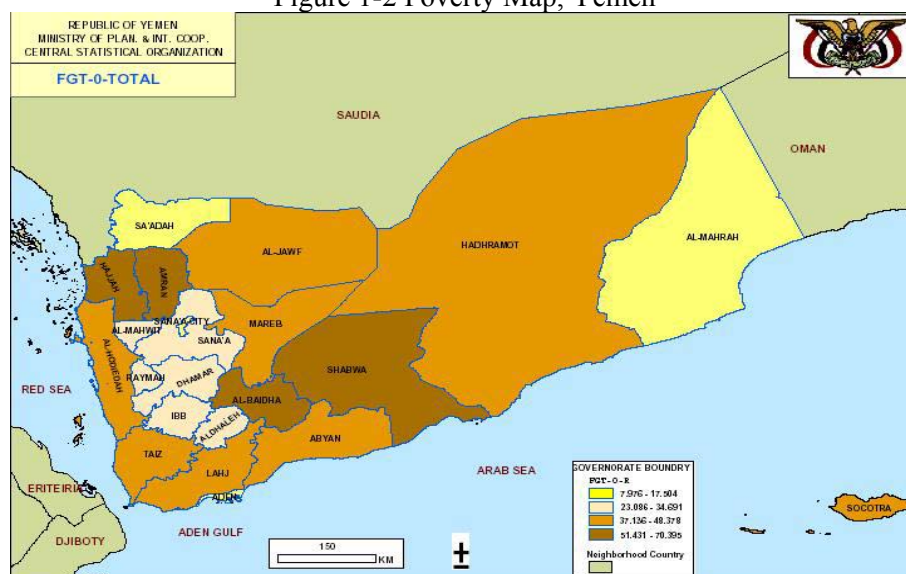
Notes: (i) Poverty lines used are household specific. These average to YR 5,334 per capita per year for the overall poverty line and YR 3,663 for food poverty; (ii) Poverty refers to the percentage of poor, poverty gap is the per-capita percentage deficit of expenditure of the poor from the poverty line, and severity of poverty is the poverty gap with weights equal to each poor person's income deficit from poverty line.

Table 1-8 Poverty Measurements (percent) by Governorate, for 2005-2006

	Incidence of poverty			Poverty Gap Index			Severity of Poverty Index		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Hadramout	31.45	39.17	35.59	4.97	8.15	6.67	1.21	2.39	1.84
Al-Mahara	11.4	6.29	8.85	2.78	0.81	1.8	1.12	0.2	0.66

Source: UNDP based on HBS 2005-06.

Figure 1-2 Poverty Map, Yemen



Source: Central Statistical Organization.

⁸ Extreme poverty is defined as the condition when household expenditures are below the food poverty line.

⁹ The World Bank Yemen Poverty Assessment Report, June 2007

Section II: Estimation of Damage and Losses

Methodology

Damage and Loss Assessment

The methodology for damage and loss assessment (DaLA) developed originally by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) in the early 1970s was used in the damage and loss assessment¹⁰. This methodology has been continuously expanded and updated over the past three decades, and in recent years has been simplified and customized for application in different regions of the world. It has been applied by the World Bank and other international organizations in numerous cases of recent disasters, and provides a satisfactory framework to identify and quantify the socio-economic and environmental impact of disasters.

Under the DaLA framework, the assessment of damage provides the basis for estimating reconstruction requirements, and the estimation of losses provides an indication of the reduction or decline in economic activity and in personal and household income arising from disasters, which is used for the estimation of needs to achieve full recovery of economic activities at the macro-economic level and at the level of individual persons or household.

Conceptual Framework

The DaLA methodology is based in the utilization of the system of national accounts of the affected country as a means for valuation of the damage and the losses caused by the disaster. In the simplest terms, the DaLA methodology provides for the estimation of the destruction of assets caused by the natural event that caused the disaster, the changes in the flows of the economy caused by the temporary absence of the destroyed assets, and the modifications in the performance of the affected economy. In addition, it also provides the basis for assessing the negative impact on personal or household income and overall well-being.

- Damage is defined as the monetary value of fully or partially destroyed assets. It is initially assumed that assets will be replaced to the same condition – in quantity and quality – that they had prior to the disaster.
- Losses are defined as the changes in the flows of goods and services that will not be forthcoming in the affected area until the destroyed assets are rebuilt, over the span of time that elapses from the occurrence of the disaster and the end of the recovery and reconstruction period. Losses include production of goods and services that will not be obtained; higher costs of operation and production, and the cost of the humanitarian assistance activities.
- Total disaster effects are the addition of damage and losses.

Macro-economic effects are defined as the manner in which the disaster modifies the performance of the main macro-economic aggregates in the affected country or region. These

¹⁰ Handbook for Estimating the Socio-Economic and Environmental Impact of Disasters, Economic Commission for Latin America and the Caribbean, United Nations, second version, 2003.

effects arise from the damage and losses caused by the disaster. Macro-economic effects represent a different view of disaster impact – as they describe the impact of the disaster on the functioning of the economy and the resulting macro-economic imbalances – and are therefore not added to the sum of damage and losses to avoid double accounting.

Main macro-economic effects include the impact on the level and growth of the gross domestic product of the country or region affected by the disaster; the modification of the normal pattern and structure of the balance of trade and payments due to increased imports and lower exports of goods and services arising from the disaster; and the corresponding impact on the fiscal sector that may occur due to lower revenues and higher expenditures of the government due to the disaster.

The post-disaster macro-economic analysis also includes an examination of the impact on gross investment to take into consideration the investments to be made during the reconstruction, the examination of possible inflation stemming from the effects of the disaster, and negative impacts on employment and income at the personal and household or family level.

As mentioned earlier, estimations were made through the application of the damage and loss assessment methodology developed in the 1970s by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) ¹¹, that has been updated, expanded, systematically customized and simplified for application in different regions of the world (See Box2-1).

Box 2-1 The estimation of damage and losses - The ECLAC Methodology

For the estimation of the effects and impact of the floods disaster in Yemen, United Nations Economic Commission for Latin America and the Caribbean (UN-ECLAC) methodological tool developed in the early 1970s was used. This methodology has been strengthened, simplified and customized over the years for application in different areas of the world. The tool enables the assessment of disaster impacts on the overall economy of the affected country as well as on family or household levels, and constitutes a basis for defining the needs for recovery and reconstruction following any disaster. The assessment provides for the estimation of: Damage as the replacement value of totally or partially destroyed physical assets, constructed to the same standards that prevailed before the disaster; Losses in the flows of the economy that arise from the temporary absence of the damaged assets; and The resulting impact on post-disaster economic performance, with special reference to economic growth, the fiscal position and the balance of payments.

Objectives of the Assessment

The assessment of damage and losses after disasters is essential for the estimation of financial needs for recovery and reconstruction. Priorities are defined in terms of the most affected sectors of the economy, geographical areas of the country and population groups to be attended during recovery and reconstruction.

In addition, the assessment enables an estimation of the capacity of the affected government to undertake on its own the different components of the recovery and reconstruction programs, as well as the estimation of requirements of international cooperation when the domestic capacity is

¹¹ Handbook for Estimating the Socio-Economic and Environmental Impact of Disasters, Economic Commission for Latin America and the Caribbean, 2003.

insufficient to meet post-disaster needs. Furthermore, the assessment of damage and losses provides a quantitative basis to monitor progress in the execution of post-disaster programs.

Assessment Principles and Procedures

The DaLA relies on the estimation of disaster effects in each and all sectors of the affected economy. Once all sectors have been assessed in terms of damage and losses, the results are aggregated to obtain the total amount of disaster effects ensuring that no double accounting and/or gaps exist.

The above enables the analysis of the impact of damage and losses on the functioning of the affected economy, using the forecasted performance for the current year – and in some cases for several subsequent years – if the disaster had not occurred. In addition, estimates are made of the decline in personal or household income arising from the estimated losses in all sectors.

From there, estimates are derived of the financial needs for ensuring recovery and reconstruction, based on public policies designed to mitigate the negative impact of the losses on production as well as on a preliminary strategy for reconstruction that takes into consideration the possibility of “building back better” the destroyed or damaged assets, within financial constraints. Furthermore, estimates can be made of special needs to reduce the long-term exposure or impact of future disasters, as part of a disaster risk management program.

The procedure used in the 2008 Yemen assessment involved many steps and activities, beginning with the collection of baseline information and of data on damages provided by the government through different line ministries and offices, as well as the Statistical Institute, and governments of the affected Governorates. Immediately after, the DaLA assessment teams carried out plausibility reviews of the data, including triangulation and independent verification of the data, through special field visits and surveys in the affected areas.

Baseline data was time-normalized across the various sector of the economy to provide the best possible reference for the analysis. This included desk reviews of information and the identification of information gaps and the possible sources for filling them, as brief field surveys of selected affected areas where extensive consultations were held with *inter alia* local government officials, community leaders and representatives, non-governmental organizations, villagers, business owners and other stakeholders. In addition to the above, a special sample survey of industrial and trade shops – including those in the informal sector – was undertaken in cooperation with private sector associations to obtain information on their special damage, losses and needs.

Summary of Damages and Losses

According to the joint assessment, the total value of the disaster effects caused by the October 2008 storm and floods in Yemen is estimated to reach YR 327,551 million or US\$1,638 million equivalent¹² (See Table 2-1). This amount is equivalent to 6% of Yemen's Gross Domestic Product (GDP), comparable to annual development expenditures by the Government, which illustrates the important magnitude of the disaster.

Table 2-1. Summary of Damage and Losses due to the October 2008 Storm and Floods in Yemen

Sector and Sub-Sector	Disaster Effects			Ownership by Sector	
	Damage (YR, mln)	Losses (YR, mln)	Total (YR, mln)	Public (YR, mln)	Private (YR, mln)
Productive	111,468.3	137,629.7	249,098.0	39,406.5	209,691.5
Agriculture, livestock, fishery	109,937.0	97,305.0	207,242.0	39,406.5	167,835.5
Industry, Commerce and Tourism	1,531.3	40,324.7	41,856.0		41,856.0
Social Sectors	39,983.4	5,536.0	45,519.4	12,843.9	32,675.5
Housing	32,249.4	3,246.2	35,495.6	2,820.1	32,675.5
Education	3,460.0	34.8	3,494.8	3,494.8	
Health	4,274.0	2,255.0	6,529.0	6,529.0	
Infrastructure	22,532.9	6,520.0	29,052.9	24,581.8	4,471.1
Electricity	4,016.0	1,200.2	5,216.2	5,216.2	
Water and Sanitation	6,033.6	679.0	6,712.6	6,712.6	
Transport	11,999.9	4,326.0	16,325.9	11,942.8	4,383.1
Communications	483.4	314.8	798.2	710.2	88.0
Cross Sectoral	976.9	2,904.0	3,880.9	3,642.2	238.7
Environment	35.0	2,904.0	2,939.0	2,939.0	0.0
Public Buildings	941.9	0.0	941.9	703.2	238.7
Total (YR, million)	174,961.5	152,589.6	327,551.1	80,474.4	247,076.7
Million US\$	874.8	762.9	1,637.8	402.4	1,235.4

Source: Estimates of the DaLA Assessment Team using information from official and other sources

Of the total disaster effects, an estimated YR 174,962 million (US\$ 874.8 million) refers to the value of the destruction or damage to physical assets existing in the affected areas, and an additional YR 152,590 million (US\$ 762.9 million) represents losses in the flows of the economy that will occur in the country in the next four years as a result of the temporary absence of the destroyed assets (See Figure 2-1). The relative long duration of these losses is caused by the fact that it will take such a time period for the overall recovery and reconstruction of the affected areas, and the somewhat equivalent distribution between damage and losses reflects the relatively limited industrial development that exists in the affected area.¹³

The share of the private sector of the total value of damage and losses is estimated at 75.4% (YR 247,077 million or US\$1,235.4 million), while the share of the public sector is estimated at 24.6% (YR 80,474 million or US\$ 402.4 million). This is a measure of the damages and losses to each sector and could be viewed as an initial starting point to assess the relative efforts that each sector must bear in the post-disaster recovery and reconstruction activities (See Figure 2-2).

¹² A standard exchange rate of YR 200 per US Dollar has been used throughout this assessment report.

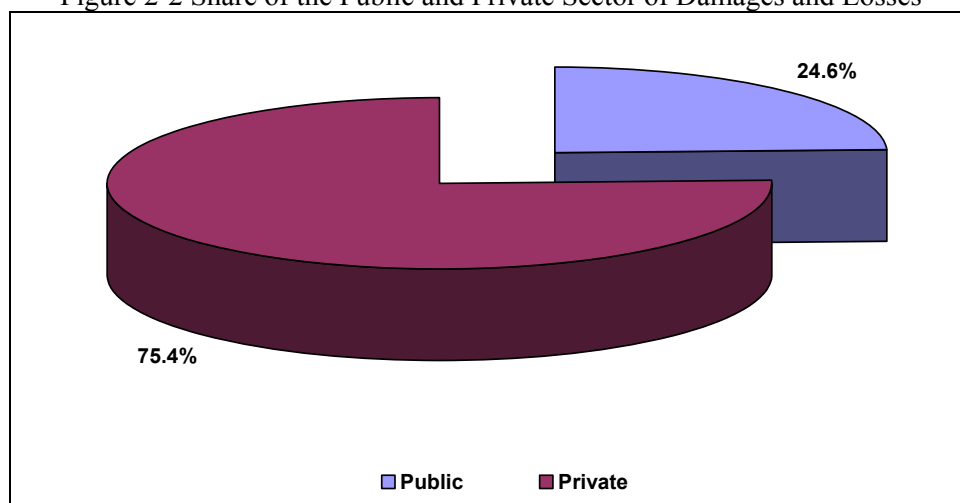
¹³ Had industrial development been higher in the affected areas, especially agro-industry, losses would have largely exceeded damages, as is typical of disasters caused by hydro-meteorological phenomena.

Nonetheless, it is clear that the government would be expected to assist in the funding of several initiatives that follow on damages and losses to the private sector, including inter alia support to the livelihoods of those who lost their job or income and to reconstruction of housing for limited income groups¹⁴ among other activities. As such, the Government’s share of the reconstruction and recovery costs is likely to significantly increase.

Figure 2-1 Distribution of Damages and Losses due to the October 2008 disaster in Yemen



Figure 2-2 Share of the Public and Private Sector of Damages and Losses



This disaster is, on its own, very significant in terms of the value of damage and losses. This is all the more apparent when compared to recent events that have occurred in other countries, affecting their economies and the livelihoods of people in the affected areas. As shown in Table 2-2, while the 2008 disaster in Yemen is not the most costly in terms of damage and losses, its magnitude, expressed as the ratio of total damages and losses versus GDP, is the second highest of the below-mentioned cases, only lower than that of Myanmar after cyclone Nargis.

¹⁴ The Central Government is already financing parts of the temporary shelter and food provision scheme for a large number of affected persons, in cooperation with international donors and NGOs.

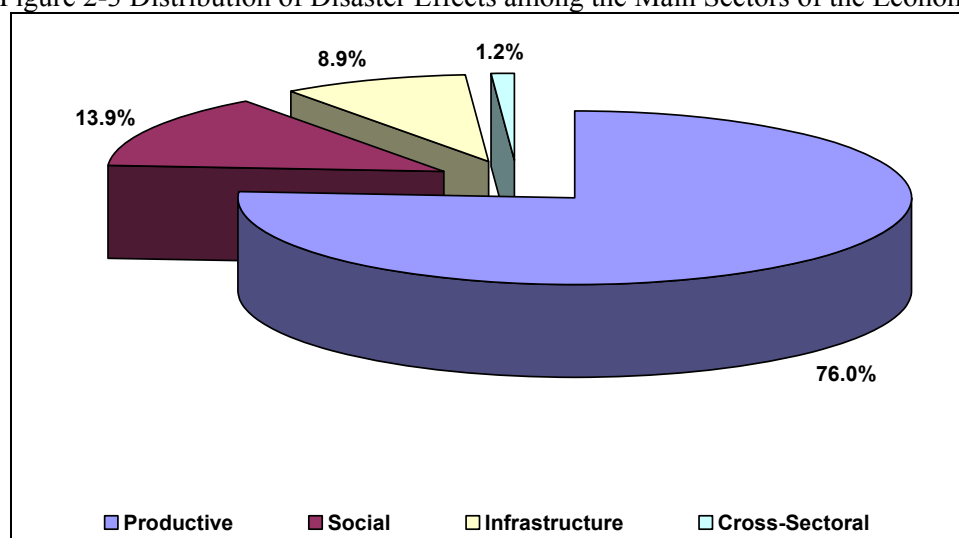
Table 2-2 Damage, Losses and Magnitude of Similar Recent Disasters

Disaster	Country	Year	Total Effects, million US\$	Magnitude Effects vs. GDP
Cyclone Sidr	Bangladesh	2007	1,640	2.8
Cyclone Season	Madagascar	2008	333	4.0
Cyclone Nargis	Myanmar	2008	4,060	19.7
Storm and Floods	Yemen	2008	1,638	6.0

Source: GFDRR, World Bank

It is worth noting that the recent disaster in Yemen has affected the economy in a very special manner, concentrating its effects on the following sectors of economic activity, presented in order of decreasing importance (See Figure 2-3): the productive sectors (agriculture, livestock, fishery, industry, commerce and tourism), the social sectors (shelter, education and health), infrastructure (transport, power, water and sanitation, and telecommunications) and several other cross-sectoral activities (the environment, religious facilities and cultural heritage). This fact classifies this event as a productive-social disaster, rather than one in which destruction of infrastructure is the preeminent effect. This analysis suggests the sectors where post-disaster efforts for recovery and reconstruction should concentrate on.

Figure 2-3 Distribution of Disaster Effects among the Main Sectors of the Economy



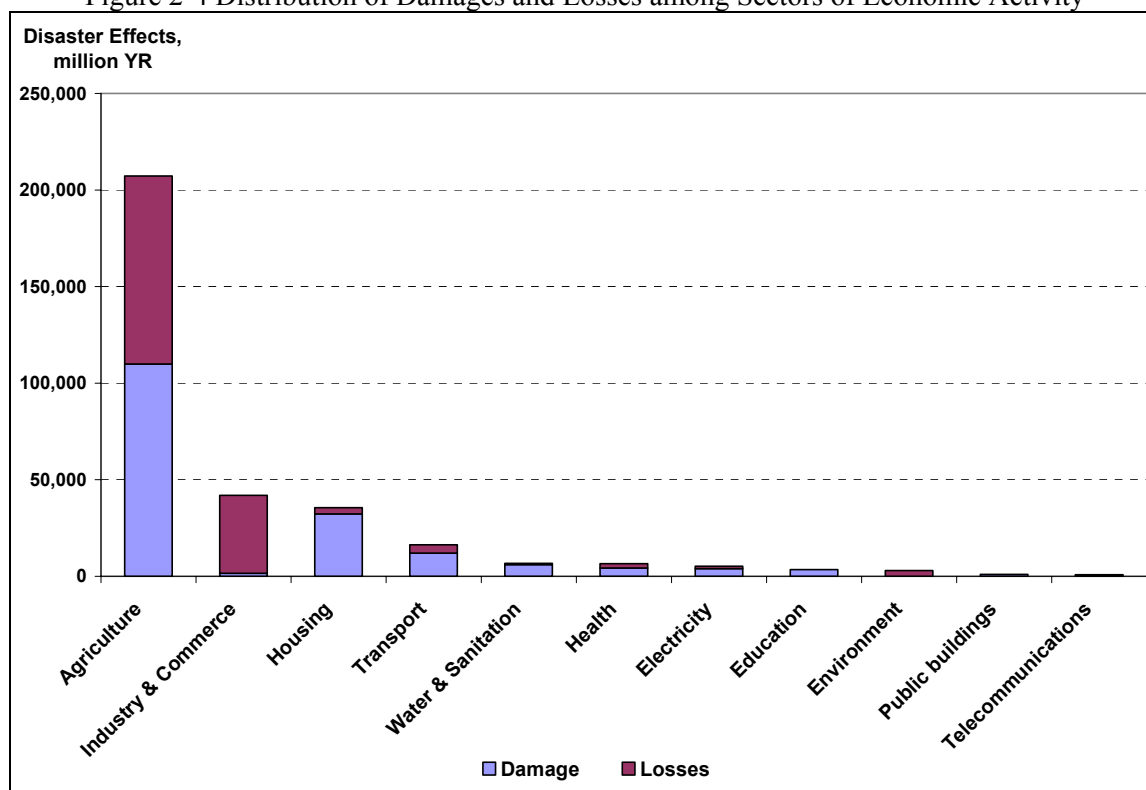
Individual sectors that were most affected in total effects (damage and losses) were, in order of decreasing importance: agriculture; industry, commerce and tourism; housing; and transport.

In terms of destruction of physical assets, agriculture remains the most affected (62.8% of total damages), followed by housing (18.4%) and transport (6.9%). In terms of losses in the economy, agriculture is again the most affected (63.8% of the total losses), followed by industry, commerce and tourism (26.4%), transport (2.8%), and housing (2.1%). Details of this breakdown by sector are shown in Table 2-3 and Figure 2-4.

Table 2-3. Most affected sectors by the October 2008 storm and floods

Sector	Total effects		Total damages		Total losses	
	Value (YR mln)	Percent of total	Value (YR mln)	Percent of total	Value (YR mln)	Percent of total
Agriculture	207,242.0	63.3%	109,937.0	62.8%	97,305.0	63.8%
Industry, Commerce, Tourism	41,856.0	12.8%	1,531.3	0.9%	40,324.7	26.4%
Housing	35,495.6	10.8%	32,249.4	18.4%	3,246.2	2.1%
Transport	16,325.9	5.0%	11,999.9	6.9%	4,326.0	2.8%

Figure 2-4 Distribution of Damages and Losses among Sectors of Economic Activity



The disaster effects were unevenly distributed with some districts sustaining much more damages and losses than others (See Table 2-4). Hadramout Governorate was significantly more affected (96.1% of the total disaster effects, including 94.1% of total damages and 98.4% of total losses) relative to Al-Mahara Governorate (with 3.9% of the total disaster effects, including 5.9% of total damages and 1.6% of total losses).

Table 2-4. Geographic distribution of the disaster effects

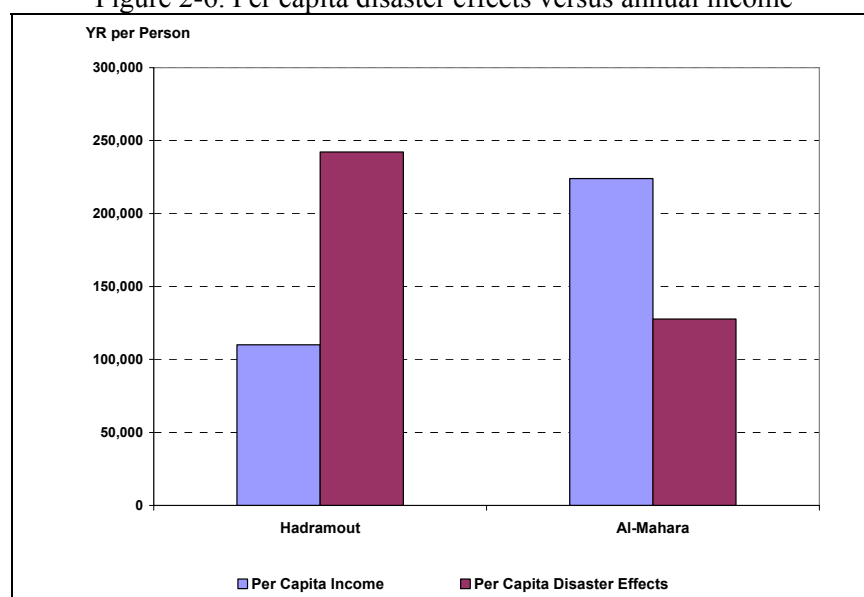
	Damages		Losses		Total disaster effects	
	Value (YR,mln)	Percent of total	Value (YR,mln)	Percent of total	Value (YR,mln)	Percent of total
Hadramout Sahel	53,838	30.8%	39,717	26.0%	93,555	28.6%
Hadramout Wadi	110,747	63.3%	110,482	72.4%	221,229	67.5%
Hadramout Total	164,585	94.1%	150,199	98.4%	314,784	96.1%
Al-Mahara	10,377	5.9%	2,391	1.6%	12,767	3.9%
Total	174,962	100.0%	152,589	100.0%	327,551	100.0%

When considering the population living in the affected Governorates (estimated population of 0.1 million in Al-Mahara and 1.3 million in Hadramout), the average per capita damages and losses effects can be estimated. This comparison reveals that the population of Hadramout Governorate has sustained damages and losses that are equivalent to more than twice their annual average income (220%), while those in Al-Mahara have sustained lower (57%) but still high proportions of their annual income as shown below. Table 2-5 and Figure 2-6 below provide a general idea of the negative impact of the disaster on the economy and the well-being of the households.

Table 2-5. Per capita disaster effects versus annual income

	Disaster Effects, YR/Person	Percent of Annual Income¹⁵
Hadramout	242,141	220%
Al-Mahara	127,673	57%

Figure 2-6. Per capita disaster effects versus annual income



¹⁵ Hadramout per capita income YR110,000 and Al-Mahara 224,000 (estimates derived from HBS 2005)

Damages and Losses by Sector

Productive Sectors

Agriculture (Crops and Livestock) and Fisheries

Pre-Disaster Situation¹⁶

Approximately, 73 percent of the Yemen's population (22 million) lives in the rural areas. The incidence of rural poverty remained at about 40 percent while the urban poverty fell to 21 percent. Most of the Yemen's poor (about 84 percent) live in the rural areas and depend, directly or indirectly, upon agriculture for their livelihood. Indeed poverty is a rural phenomenon and most of the poorest people in Yemen are the landless and the farmers working under rain-fed conditions. Agriculture, however, accounts for only 15 percent of the GDP, partly due to low agricultural productivity and widespread underemployment. The relative share of agriculture has declined from 25 percent of GDP in 1990.

In Yemen, agriculture is handled by the two separate ministries. The Ministry of Agriculture and Irrigation (MOAI) is responsible for crops and livestock sub-sectors whereas the Ministry of Fisheries (MOF) is responsible for fisheries. Overall, there are 21 Governorates in Yemen. These two ministries have local offices in each Governorate to implement Government policies at the local level.

In 2007, the value of crop production was estimated to be YR 5,070 billion (about US\$25 billion) which is about 80 percent of farm production. Livestock activities account for another 20 percent of farm production and are a major source of cash income for small farmers and the landless households. Unlike crop production, livestock is handled primarily by rural women. In 2007, fisheries production was estimated to be YR 57 billion (about US\$0.3 billion), mostly artisanal fishing, and about one-third of it is exported.

The October 2008, floods affected mainly two Governorates, Hadramout and Al-Mahara (out of a total of 21 Governorates). Hadramout Governorate accounts for about 3.4 percent of the farm households (out of a total of 1.18 million farm households) and 3.2 percent of the cropped area (out of a total of 1.48 million acres). On the other hand, Al-Mahara Governorate accounts for about 0.3 percent of the farm households and 0.2 percent of the cropped area. However, both

¹⁶ The damage and loss assessment for crops, livestock and fisheries is based on the information provided by the officials from the Government of Yemen as well as Governorates of Hadramout and Al-Mahara. During the assessment, the Bank Team worked closely with, among others, Mr. Ahmed Muhsen Al-Ashlah, Deputy Minister of the Ministry of Agriculture and Irrigation; Mr. Omar Karama Mohiur, Director General, Agriculture Office, Wadi Hadramout; Mr. Mohammed Faraj Ben Abdoun, Director General, Agriculture office, Coastal Hadramout; Mr. Ali Abdulkarim Al-Fadeel, Director of Al-Mahara Rural Development Project; Mr. Ahmed Alawi Kheisan, Wadi Hadramout Project; Mr. Ahmed Al-Ardhi, Agriculture Office, Al-Qatn, Wadi Hadramout; Mr. Saleh Shaghdarh, Groundwater and Soil Conservation Project; Mr. Salem Ba-Shoab, Groundwater and soil Conservation Project; and Mr. Salem Noman, General Secretary, Local Council and Vice Governor, Al-Mahara governorate.

Governorates are important players in the fisheries sub-sector. Out of a total of 174363 ton of artisanal annual fish production and 77581 fishermen (mainly men), Hadramout and Al-Mahara Governorates account for about 20 percent and 40 percent, respectively.

Damage and Loss Assessment

The overall damage and loss due to flood has been estimated separately for the crops, livestock and fisheries sub-sectors. This was necessary not only because of two separate ministries (MOAI and MOF) but also because of different production assets, infrastructure, production activities and population involved in these sub-sectors. The production losses are occurring over a period of 4 years, which is due to the fact that the seedlings for the damaged fruit trees will take 3-4 years before the trees start bearing fruits, and the same applies for livestock, particularly camel, cattle, sheep and goats.

Crop Sub-sector

Agriculture (crops and livestock) is an important sector of the Yemen economy. It accounts for about 15% of the GDP. Approximately 53% of the population depends on agriculture for its livelihood. Almost 40% of the rural households are considered food insecure. Even though 72% of the population is rural, 84% of the poor live in the rural areas. In the last 8 years of prosperity, rural Yemen has been bypassed. As a result, the disparities between the rural and urban population have been increasing. About 49% of the cropped area (1.48 million acres) depends on irrigation (wells, spate, streams, dams and tanks) and the remaining 51% is rain-fed. Overall, agriculture in Yemen is characterized by low productivity and inefficient water management.

Damages: The cropped area in Yemen has increased by almost 38% from 1.07 million acre in 2003 to 1.48 million acre in 2007. Overtime, the cropping pattern has changed in favor of cereals, forage crops and Qat. In 2007, these three crop groups accounted for 60%, 10% and 10% respectively of the cropped area. In addition, vegetables (seasonal crops) and fruits (perennial crops or trees) are very important in terms of their value. However, the flood affected areas of Hadramout and Al-Mahara do not grow Qat.

Productive and profitable agriculture depends on irrigation. Overall, 49% of the cropped area is irrigated in Yemen. However, in Hadramout almost 90% of the cropped area is irrigated whereas in Al-Mahara it is 61%. Clearly, any damage to the irrigation infrastructure and the irrigation network in these two Governorates will have a devastating impact on agriculture production, household income and the livelihood of rural population. High value crops are generally grown on irrigated land. In this context, it is important to keep in mind that 90% of natural water resource in Yemen is used for irrigation. Depletion of groundwater (which is also used for irrigation through open and piped tube wells) is likely to pose a major threat to agriculture in Yemen in the future. The share of cropped area that depends on tube-well irrigation was 30% in Yemen, 33% in Hadramout and 41% in Al-Mahara in 2007.

The overall damage to the crop sub-sector is divided into five categories i.e. soil, irrigation infrastructure (mainly in the public sector), irrigation network, agriculture buildings and machinery, and perennial fruit trees (see Tables 2-7 to 2-12 for details). The damage estimates are based on quantities of the damaged assets (such as agricultural area, irrigation equipment, agricultural machinery, buildings and perennial fruit trees) and the corresponding farm gate prices for tradeables such as equipment or replacement cost for the non-tradeables such as perennial fruit trees or irrigation infrastructure. The damage estimates are summarized below in Table 2-6.

Table 2-6 Summary of the damage to the crop sub-sector

Damage Category	Damage	
	YR, mln	% Share
Soil Erosion	31,751	31
Irrigation Infrastructure	39,225	38
Irrigation Network	9,099	9
Agri. Buildings/Machinery	8,826	9
Perennial Crops	13,066	13
Total	1,01,967	100

The largest damage has been to the irrigation infrastructure (38% of total damage for the crop sub-sector) which has been developed by the public sector. Repair of this damage to irrigation infrastructure should also be the responsibility of the public sector. Irrigation infrastructure consists of diversions, canal intake structures, reservoirs and wadi protection structures. Unless the eroded soil is rehabilitated, the irrigation infrastructure is repaired and the irrigation network is replaced, it will be very difficult to recover and rehabilitate the crop sub-sector in the flood affected areas. In other words, the future income of farming households, who depend on crops sub-sector for their income and livelihood, will be seriously affected.

Table 2-7 Flood damage due to soil erosion

Governorate	Planted Soil			Unplanted Soil			Damage due to Soil Erosion (YR, mln)
	Area (F)	Unit Cost (R/F)	Total Cost (YR, mln)	Area (F)	Unit Cost (R/F)	Total Cost (YR, mln)	
Had Wadi	14,585	600,000	8,751	41,216	350,000	14,426	23,177
Had Sahel	7,521	600,000	4,513	7,039	350,000	2,464	6,977
Hadramout Total	22,106	600,000	13,264	48,255	350,000	16,890	30,154
Al-Mahara Total	796	600,000	477	3,200	350,000	1,120	1,597
Total	22,902	600,000	13,741	51,455	350,000	18,010	31,751

Notes:

1. F stands for "Feddan" which is approximately equal to one acre
2. R/F means Yemeni Rials per Feddan
3. Yr, mln means million Yemeni Rials

Table 2-8 Flood Damage to Irrigation Infrastructure

Governorate	Diversions			Canal Intake			Reservoirs			Wadi Protection			Damage to Irrigation Infrastructure (YR, mln)
	Num	Unit Cost (R)	Total Cost (YR, mln)	Num	Unit Cost (R)	Total Cost (YR, mln)	Num	Unit Cost (R)	Total Cost (YR, mln)	Cubic Meter	Unit Cost (R)	Total Cost (YR)	
Had Wadi	219	10,000,000	2,190	4830	2,000,000	9660	40	6,000,000	240	530,1116	10,000	5,301	17,391
Had Sahel	140	10,000,000	1,400	9126	2,000,000	18252	20	6,000,000	120	201,932	10,000	2,019	21,791
Hadramout Total	359	10,000,000	3,590	13956	2,000,000	27912	60	6,000,000	360	732,048	10,000	7,320	39,182
Al-Mahara Total¹	0	10,000,000	0	6	2,000,000	12	5	6,000,000	30	88	10,000	1	43
Total	359	10,000,000	3,590	13962	2,000,000	27924	65	6,000,000	390	732,136	10,000	7,321	39,225

1. In addition, an irrigation dam under construction (in Al-Ghayda district) has also been damaged and the estimated damage is reported to be R 200 million.

Table 2-9 Flood Damage to Irrigation Network

Governorate	Conveyance Pipes				Improved Irrigation				Open Channels				Damage to Irrigation Network (YR, mln)
	Meter	Unit Cost (R)	Total Cost (YR, mln)	Area (F)	Unit Cost (R)	Total Cost (YR, mln)	Meter	Unit Cost (R)	Total Cost (YR, mln)	Unit Cost (R)	Total Cost (YR, mln)		
Had Wadi	107,372	3,000	322	1,031	230,000	237	523,801	10,000	5,238	5,797			
Had Sahel	10,503	3,000	32	3,540	230,000	814	244,646	10,000	2,446	3,292			
Hadramout Total	117,875	3,000	354	4,571	230,000	1051	768,447	10,000	7,684	9,089			
Al-Mahara Total	0	3,000	0	0	230,000	0	1,006	10,000	10	10			
Total	117,875	3,000	354	4,571	230,000	1051	769,453	10,000	7,694	9,099			

Table 2-10 Flood Damage to Agricultural Buildings and Machinery

Governorate	Open Wells			Tube Wells			Pumps			Engines			Agricultural Equipment			Agricultural Buildings			Damage to Agricultural buildings and machinery (YR, mln)
	Num	Unit Cost (R)	Total Cost (YR, mln)	Num	Unit Cost (R)	Total Cost (YR, mln)	Num	Unit Cost (R)	Total Cost (YR, mln)	Num	Unit Cost (R)	Total Cost (YR, mln)	Num	Unit Cost (R)	Total Cost (YR, mln)	Num	Unit Cost (R)	Total Cost (YR, mln)	
Had Wadi	420	700,000	294	284	5,000,000	1,420	620	700,000	434	3,000,000	1,905	149	1,000,000	149	1,864	500,000	932	5,134	
Had Sahel	343	700,000	240	162	5,000,000	810	131	700,000	92	3,000,000	336	16	1,000,000	16	66	500,000	33	1,527	
Hadramout Total	763	700,000	534	446	5,000,000	2,230	751	700,000	526	3,000,000	2,241	165	1,000,000	165	1,930	500,000	965	6,661	
Al-Mahara Total	478	700,000	335	0	5,000,000	0	478	700,000	335	3,000,000	1,434	61	1,000,000	61	0	500,000	0	2,165	
Total	1241	700,000	869	446	5,000,000	2,230	1,229	700,000	861	1,225	3,000,000	3,675	226	1,000,000	226	1,930	500,000	965	8,826

Table 2-11 Flood Damage to Perennial Crops

Governorate	Date Palm Trees			Citrus Trees			Other Fruit Trees			Damage to Perennial Crops (YR, mln)
	Num	Unit Cost (R)	Total Cost (YR, mln)	Num	Unit Cost (R)	Total Cost (YR, mln)	Num	Unit Cost (R)	Total Cost (YR, mln)	
Had Wadi	519,116	20,000	10,382	5,791	30,000	174	113,689	10,000	1,137	11,693
Had Sahel	28,069	20,000	561	11,066	30,000	334	47,688	10,000	477	1,372
Hadramout Total	547,185	20,000	10,943	16,857	30,000	508	161,377	10,000	1,614	13,065
Al-Mahara Total	0	20,000	0	0	30,000	0	72	10,000	1	1
Total	547,185	20,000	10,943	16,857	30,000	508	161,449	10,000	1,615	13,066

Table 2-12 Flood Damage to the Crop Sub-Sector

Governorate	Soil Erosion (YR, mln)	Irrigation Infrastructure (YR, mln)	Irrigation Network (YR, mln)	Agricultural Buildings and Machinery (YR, mln)	Perennial Crops (YR, mln)	Total (YR, mln)
Had Wadi	23,177	17,391	5,797	5,134	11,693	63,192
Had Sahel	6,977	21,791	3,292	1,527	1,372	34,959
Hadramout Total	30,154	39,182	9,089	6,661	13,065	98,151
Al-Mahara Total	1,597	43	10	2,165	1	3,816
Total	31,751	39,225	9,099	8,826	13,066	101,967

Loss: The overall loss refers to the potential production loss from the seasonal crops (one season) as well as from the perennial fruit trees over a period of several years till the new fruit trees start bearing fruit. The seasonal crops include cereals (mainly sorghum and wheat), vegetable (mainly onions) and forage crops. On the other hand, the perennial fruit trees include date palm, citrus and other fruit trees. The production loss estimates are based on the lost crop output due to the floods (one season for seasonal crops and the number of years till the trees start bearing fruits for the perennial fruit trees) and the farm gate prices. The details are provided in Tables 2-14 to 2-16 and the loss estimates are summarized below in Table 2-13:

Table 2-13 Summary of the losses to the Crop Sub-Sector

Year	Loss	
	YR, mln	% Share
2008	1,056	2
2009	21,719	29
2010	19,609	26
2011	17,498	23
2012	15,036	20
Total	74,918	100

Total production losses for the crop sub-sector are estimated to be YR 74.9 billion, out of which only 10% due to the seasonal crops and the remaining 90% due to the perennial fruit trees. Due to damage to the fruit trees, production losses will be spread over 4 years from 2009 to 2012. These losses, however, can be minimized if farmers replace the dead fruit trees with modern varieties of seedlings for fruit trees that start bearing fruits sooner than the traditional varieties. Furthermore, all the crop production losses are in the private sector.

Table 2-14 Production Loss from Seasonal Crops due to Floods

Governorate	Cereals			Vegetables			Forage Crops			Total Loss ¹ (YR, mln)	Production Loss (YR, mln)			
	Area (F)	Unit Cost (R)	Total Cost (YR, mln)	Area (F)	Unit Cost (R)	Total Cost (YR, mln)	Area (F)	Unit Cost (R)	Total Cost (YR, mln)		2008 ²	2009 ³	2010 ⁴	Total
Had Wadi	6,682	120,000	802	2,935	370,000	1,086	8,701	100,000	870	2,758	690	2,758	1,379	4,827
Had Sahel	2,343	120,000	281	1,586	370,000	587	3,844	100,000	384	1,252	313	1,252	626	2,191
Hadramout Total	9,025	120,000	1,083	4,521	370,000	1,673	12,545	100,000	1,254	4,010	1,003	4,010	2,005	7,018
Al-Mahara Total	0	120,000	0	486	370,000	180	310	100,000	31	211	53	211	106	370
Total	9,025	120,000	1,083	5,007	370,000	1,853	12,855	100,000	1,285	4,221	1,056	4,221	2,111	7,388

1. Sum of the total cost for cereals, vegetables and forage crops.

2. 25% of the total loss

3. 50% of the total loss times 2 (two seasons)

4. 25% of the total loss times 2 (two seasons)

Table 2-15 Production Loss from Perennial Fruit Trees due to Floods

Governorate	Date Palm ¹ Trees	Citrus ²			Other fruits ³			Production Loss (YR, mln)				Total				
		Yield/Tree (Kg)	Price (R/Kg)	Value (YR, mln)	Trees	Yield/Tree (Kg)	Price (R/Kg)	Value (YR, mln)	2009	2010	2011		2012			
Had Wadi	519,116	30	150	2,336	5,791	150	200	174	113,689	300	300	10,232	12,742	12,742	10,406	48,632
Had Sahel	28,069	30	150	126	11,066	150	200	332	47,688	300	300	4,292	4,750	4,750	4,624	18,874
Hadramout Total	547,185	30	150	2,462	16,857	150	200	506	161,377	300	300	14,524	17,492	17,492	15,030	67,506
Al-Mahara Total	0	30	150	0	0	150	200	0	72	300	300	6	6	6	6	24
Total	547,185	30	150	2,462	16,857	150	200	506	161,449	300	300	14,530	17,498	17,498	15,036	67,530

1. On average, it takes 3 years for the new tree to start bearing fruits (2 Years for modern varieties and 4 years for the traditional ones)

2. On average, it takes 4 years for the new tree to start bearing fruits

3. On average, it takes 4 years for the new tree to start bearing fruits

Table 2-16 Production Loss in the Crop Sub-sector due to Floods

Governorate	Production Loss (YR, mln)					
	2008	2009	2010	2011	2012	Total
Had Wadi	690	15,500	14,121	12,742	10,406	53,459
Had Sahel	313	6,002	5,376	4,750	4,624	21,065
Hadramout Total	1,003	21,502	19,497	17,492	15,030	74,524
Al-Mahara Total	53	217	112	6	6	394
Total	1,056	21,719	19,609	17,498	15,036	74,918

Livestock Sub-sector

The livestock sub-sector in Yemen is important not only because it contributes to GDP but also because it generates regular cash income and is a source of livelihood for the landless and small and marginal farming households. The livestock sub-sector is also dominated by rural women. In 2007, there were 17,003 thousand heads of sheep (both sheep and goat, each about 50 percent), 1,495 thousand heads of cattle (cows) and 366 thousand heads of camel. Almost 10% of the cropped area is allocated to grow forage crops in order to feed these animals. Cattle account for about 60% of total milk production in Yemen. Sheep, goats and cattle are the major source of meat, and each accounts for about one-third of meat production. Camels are also a source of milk and meat, the relative share of which is very small.

Damages: The overall damage to the livestock sub-sector consists of animal deaths that were caught in the high flood water surge and died: 3,413 camels (90% in Wadi Hadramout); 54,988 sheep (actually both sheep and goats, 85% of which in Wadi Hadramout); and 71 cattle (70% in Wadi Hadramout). Almost 309,000 beehive cells were destroyed and 85% of them were in Wadi Hadramout. Available estimates indicate that almost 50% of the beehive cells were destroyed in these Governorates. Consequently this affected the livelihood of about 6,000 households that specialize in producing honey. The damage estimates for the livestock sub-sector are based on the number of dead animals or honey beehive cells destroyed and the market price at the farm level. The details are provided in Table 2-18 and the damage estimates are summarized below in Table 2-17.

Table 2-17 Summary of the Damage to the Livestock Sub-Sector

Livestock	Number of Deaths	Damage	
		YR, mln	% Share
Camel	3,413	682	9
Sheep	54,988	825	11
Cattle	71	7	Negligible
Beehive Cells	309,103	6,182	80
Total	367,575	7,696	100

Table 2-18 Flood Damage to the Livestock Sub-Sector

Governorate	Camel Deaths			Sheep Deaths			Cattle Deaths			Beehive Cells			Total (YR, mln)
	Num	Price (R)	Value (YR, mln)	Num	Price (R)	Value (YR, mln)	Num	Price (R)	Value (YR, mln)	Num	Price (R)	Value (YR, mln)	
Had Wadi	3,066	200,000	613	46,708	15,000	701	50	100,000	5	263,230	20,000	5,265	6,584
Had Sahel	250	200,000	50	7,664	15,000	115	0	100,000	0	43,313	20,000	866	1,031
Hadramout Total	3,316	200,000	663	54,372	15,000	816	50	100,000	5	306,543	20,000	6,131	7,615
Al-Mahara Total	97	200,000	19	616	15,000	9	21	100,000	2	2,560	20,000	51	81
Total	3,413	200,000	682	54,988	15,000	825	71	100,000	7	309,103	20,000	6,182	7,696

The largest damage (80% of the total to the livestock sub-sector) was to the honey beehive cells and hence its impact on honey production and exports and the income of honey producers. Since livestock activities are handled by the landless or poor farming households, primarily by women, it has important implications for likely increase in rural poverty and gender. Furthermore, all the livestock activities are in the private sector.

Loss: The overall loss refers to the potential production loss from the dead honey bees and the animals over a period of several years till the young ones grow and start producing honey, milk or meat. Therefore, the production loss estimates for the livestock sub-sector are based on loss in livestock output (milk, meat and honey) over a period of 4 years (2009 to 2012) that is attributes to floods and the farm gate prices. The details for estimating the potential production loss are provided in Tables 2-20 to 2-25 and the loss estimates are summarized below in Table 2-19.

Table 2-19 Summary of the losses to the Livestock Sub-Sector

Year	Loss	
	YR, mln	% Share
2009	13,747	62
2010	7,854	36
2011	196	1
2012	194	1
Total	21,991	100

Based on assumptions, the dead animals (except honey bees) are divided into young at the time of floods, adult males (for meat) and adult females (for milk). The production losses are concentrated in 2009 and 2010, mainly because bees start producing honey relatively quickly. Furthermore, all the production losses are in the private sector and have important implications for the likely increase in rural poverty and gender. Almost 85% of the total production loss over a period of 4 years is due to loss of honey. The production of honey is limited but the quality of honey is very good. Almost one-third of total honey production is exported to consumers in rich neighboring countries that are prepared to pay very high prices for honey. However, there are problems of consistency in data from different sources.

Table 2-20 Production Categories of Dead Livestock

Governorate	Dead Livestock				Camel ¹		Sheep ²		Cattle ³		Beehive Cells
	Camel	Sheep	Cattle	Beehive cells	Female	Male	Female	Male	Female	Male	
Had Wadi	3,066	46,708	50	263,230	1,380	307	18,683	9,341	20	10	263,230
Had Sahel	250	7,664	0	43,313	112	25	3,066	1,533	0	0	43,313
Hadramout Total	3,316	54,372	50	306,543	1,492	332	21,749	10,874	20	10	306,543
Al-Mahara Total	97	616	21	2560	44	10	246	123	8	4	2,560
Total	3,413	54,988	71	309,103	1,536	342	21,995	10,997	28	14	309,103

1. Consists of 45% young, 45% females for milk and 10% males for meat

2. Consists of 40% young, 40% females for milk and 20% males for meat

3. Consists of 40% young, 40% females for milk and 20% males for meat

Table 2-21 Production Loss due to Dead Camels

Governorate	Meat (Male) ¹			Milk (Female) ²				Production Loss (YR, mln)				
	# of Camel	Price (R/camel)	Value (YR, mln)	# of Camel	Annual Milk Prodn (L)	Price (R/L)	Value (YR, mln)	2009	2010	2011	2012	Total
Had Wadi	307	200,000	61	1,380	630	200	174	174	235	174	174	757
Had Sahel	25	200,000	5	112	630	200	14	14	19	14	14	61
Hadramout Total	332	200,000	66	1,492	630	200	188	188	254	188	188	818
Al-Mahara Total	10	200,000	2	44	630	200	6	6	8	6	6	26
Total	342	200,000	68	1,536	630	200	194	194	262	194	194	844

1. At the end of 1 year

2. At the end of 4 years

Table 2-22 Production Loss due to Dead Sheep (Goat and Sheep)

Governorate	Meat (Male) ¹			Milk (Female) ²				Production Loss (YR, mln)		
	# of Sheep	Price (R/sheep)	Value (YR, mln)	# of sheep	Annual Milk Prodn (L)	Price (R/L)	Value (YR, mln)	2009	2010	Total
Had Wadi	9,341	20,000	187	18,683	270	200	1,009	1,009	1,196	2,205
Had Sahel	1,533	20,000	31	3,066	270	200	165	165	196	361
Hadramout Total	10,874	20,000	218	21,749	270	200	1,174	1,174	1,392	2,566
Al-Mahara Total	123	20,000	2	246	270	200	13	13	15	28
Total	10,997	20,000	220	21,995	270	200	1,187	1,187	1,407	2,594

1. At the end of 1 year

2. At the end of 2 years

Table 2-23 Production Loss due to Dead Cattle

Governorate	Meat (Male) ¹			Milk (Female) ²				Production Loss ³ (YR, mln)			
	# of Cattle	Price (R/cattle)	Value (YR, mln)	# of cattle	Annual Milk Prodn (L)	Price (R/L)	Value (YR, mln)	2009	2010	2011	Total
Had Wadi	10	100,000	1	20	300	200	1.2	1	2	1	4
Had Sahel	0	100,000	0	0	300	200	0	0	0	0	0
Hadramout Total	10	100,000	1	20	300	200	1.2	1	2	1	4
Al-Mahara Total	4	100,000	0.4	8	300	200	0.5	1	1	1	3
Total	14	100,000	1.4	28	300	200	1.7	2	3	2	7

1. At the end of 1 year

2. At the end of 3 years

3. Figures are rounded to the nearest decimal

Table 2-24 Production Loss due to Dead Beehive Cells

Governorate	Honey				Production Loss (YR, mln)		
	Beehive Cells	Seasonal Yield per cell (Kg)	Price of honey (R/kg)	Value (YR, mln)	2009 ¹	2010 ²	Total
Had Wadi	263,230	4	5,000	5,265	10,530	5,265	15,795
Had Sahel	43,313	4	5,000	866	1,732	866	2,598
Hadramout Total	306,543	4	5,000	6,131	12,262	6,131	18,393
Al-Mahara Total	2,560	4	5,000	51	102	51	153
Total	309,103	4	5,000	6,182	12,364	6,182	18,546

1. Lost production in 2 seasons (1 year)

2. Lost production in 1 season (half year)

Table 2-25 Production Loss in the Livestock Sub-sector due to Floods

Governorate	Production Loss (YR, mln)				
	2009	2010	2011	2012	Total
Had Wadi	11,714	6,698	175	174	18,761
Had Sahel	1,911	1,081	14	14	3,020
Hadramout Total	13,625	7,779	189	188	21,781
Al-Mahara Total	122	75	7	6	210
Total	13,747	7,854	196	194	21,991

Fisheries Sub-sector:

The fisheries sector is important for the Yemen economy. It is an important source of foreign exchange, livelihood and protein. In 2007, there were 128 fish cooperatives, 77,581 fishermen and 20,787 fishing boats. Total fish production in Yemen was 214,918 tons; out of which 174,363 ton (81% of total) was artisanal fishing. Out of the total artisanal fish production, Hadramout and Al-Mahara accounted for 41% and 21% respectively. Anchovies account for 28% of artisanal fish production and 98% of it is produced in Al-Mahara. Total fish exports were 81,021 ton (38% of total production) in 2007. The respective shares of Hadramout and Al-Mahara in total fish exports were 28% and 6%. Over 50% of the fish was exported to the countries in the Arab league region. Clearly, both Hadramout and Al-Mahara Governorates are important for fish production and exports in Yemen.

Damages: The overall damage to the fisheries sub-sector consists of damage to fishing boats, engines, fishing equipment, cages and traps and dried sardines. Unlike the crop and livestock sub-sectors, Al-Mahara accounts for the largest share of damage to the fisheries sub-sector. Furthermore, damage to the fisheries sub-sector is much smaller as compared to the crops and livestock sub-sectors and all the damage is in the private sector. The damage estimates are based on the value of damaged fisheries items (such as boats and engines) and the fish itself. The details are provided in Table 2-27 and the damage estimates are summarized below in Table 2-26.

Table 2-26 Summary of Damages to the fisheries Sub-Sector

Fisheries Item	Damage	
	YR, mln	% Share
Boats	45	16
Engines	100	36
Equipment	89	33
Traps/Cages	31	11
Dried Sardines	10	4
Total	275	100

Hadramout accounted for about 35% of the total damage to the fisheries sub-sector and the remainder in Al-Mahara Governorate. The maximum toll was to boat engines (36%) and fishing equipment (32%).

Table 2-27 Flood Damage to the Fisheries Sub-Sector

Governorate	Boats (YR, mln)	Boat Engines (YR, mln)	Fishing Equipment (YR, mln)	Traps and Cages (YR, mln)	Dried Sardine (YR, mln)	Total (YR, mln)
Had Wadi ¹	-	-	-	-	-	-
Had Sahel	21	30	30	16	-	97
Hadramout Total ²	21	30	30	16	-	97
Al-Mahara Total ³	24	70	59	15	10	178
Total	45	100	89	31	10	275

1. There are no fisheries in Hadramout Wadi.

2. Consists of, among others, damage to 123 small boats and 178 small engines

3. Consists of, among others, damage to midsize 60 boats and 140 engines

Losses: The overall loss refers to the potential production loss from damaged boats and related fishing equipment. The production loss estimates are based on the number of fishing boats damaged during the floods, average annual fish production (depending on the size of fish boat) and the average fish price received by the fishermen. Unlike perennial trees or animals, potential loss in the fisheries sub-sector can be reduced by financing and putting into operation the damaged boats and related fishing equipment relatively quickly. Therefore, the production loss in the fisheries sub-sector deals only with 2 months in 2008 and 12 months 2009. The potential loss in Hadramout is 58% of the total loss, mainly because the number of fishing boats damaged was higher in Hadramout. The details of potential production loss are provided in Table 2-29 and the loss estimates are summarized below in Table 2.28:

Table 2-28 Summary of the losses to the fisheries Sub-Sector

Year	Loss	
	YR, mln	% Share
2008	57	14
2009	339	86
Total	396	100

Table 2-29 Production Loss from the Fisheries Sub-sector

Governorate	Fish Catch				Production Loss (YR, mln)		
	No. of damaged boats	Annual Fish Catch/ boat (Ton)	Avg. fish price (R/Ton)	Value (YR, mln)	2008 ⁴	2009 ⁵	Total
Had Wadi ¹	-	-	-	-	-	-	-
Had Sahel	123 ²	6	265000	196	33	196	229
Hadramout Total	123 ²	6	265000	196	33	196	229
Al-Mahara Total	60 ³	9	265000	143	24	143	167
Total	183	7	265000	339	57	339	396

1. there is no fish production in Hadramout Wadi

2. Small boats

3. mid-size boats

4. Fish catch for 2 months

5. Fish catch for 12 months

The overall production loss in the fisheries sub-sector is not only very small but can be reduced even further if the Government puts in place a recovery strategy quickly. Since fishermen are generally poor,

the production losses and a likely recovery strategy will have important implications for poverty reduction.

Agro-Industry Linkages:

Depending on the commodity, degree of perishability and processing needs, over 50% of the farm produce enters the market or sold to the agro-industry. In this context, the main commodities that have agro-industry linkages are cereals, vegetables, fruits, milk, meat and honey. The estimated potential production losses due to floods for these commodities over a period of 4 years (2009 to 2012) are: 6,320 tons of cereals; 100,140 tons of vegetables; 49,240 tons of dates; 10,120 tons of citrus fruits; 193,700 tons of other fruits; 212 tons of meat; 15.8 million liters of milk; and 3,710 ton, of honey. In the absence of processing and marketing of these commodities, there will be a substantial loss in terms of value added lost, unemployment created and household income lost. In other words, this will have substantial adverse implications for the rural economy as well as for the livelihood of rural population in Yemen.

Summary of Damage and Loss:

The overall damage, loss and damage plus loss estimates by crops, livestock and fisheries sub-sectors are summarized in Tables 2-31 to 2-33 respectively and the breakdown of damage and loss distribution is shown in Table 2-30. As shown below, the crops sub-sector accounts for the largest share of damage and loss (93% of damage, 77% of loss and 85% of the total damage and loss for crops, livestock and fisheries sub-sectors) due to floods:

Table 2-30 Damages and losses distribution between sub-Sectors

Sub-Sector	Damage (%)	Loss (%)	Damage and Loss (%)
Crop	93	77	85
Livestock	7	23	14
Fisheries	<1	<1	<1
Total	100	100	100

Table 2-31 Estimated Flood Damages to the Crop, Livestock and Fisheries Sub-Sectors

Governorate	Damage (Million R)				Shares (%)				Share of the private sector %		
	Crops ¹	Livestock ²	Fisheries ³	Total	Crops	Livestock	Fishers	Total	Crops	Livestock	Fisheries
Had Wadi	63,192	6,584	0	69,776	62	86	0	63	72	100	100
Had Sahel	34,959	1,031	97	36,087	34	13	35	33	38	100	100
Hadramout Total	98,151	7,615	97	105,863	96	99	35	96	60	100	100
Al-Mahara	3,816	81	178	4,075	4	1	65	4	99	100	100
Total	101,967	7,696	275	109,938	100	100	100	100	62	100	100

1. Includes damage to soil, irrigation infrastructure, irrigation network, agriculture buildings and machinery and perennial crops.

2. Includes damage due to death of camels, sheep, cattle and bee lives.

3. Includes damage to fishing boat, engines, equipment, cages/traps and dried sardines

Table 2-32 Estimated Production Loss due to Floods in the Crops, Livestock and Fisheries Sub-sectors

Governorate	Loss (Million R)				Shares (%)				Private sector share of loss
	Crops	Livestock	Fisheries	Total	Crops	Livestock	Fishers	Total	
Had Wadi	53,459	18,761	-	72,220	71	85	0	74	100
Had Sahel	21,065	3,020	229	24,314	28	14	58	25	100
Hadramout Total	74,524	21,781	229	96,534	99	99	58	99	100
Al-Mahara Total	394	210	167	771	1	1	42	1	100
Total	74,918	21,991	396	97,305	100	100	100	100	100

Table 2-33 Estimated Damage and Loss due to Floods in the Crops, Livestock and Fisheries Sub-sectors

Governorate	Damage			Loss			Damage and Loss	
	YR, mln	Share (%)	Private sector share (%)	YR, mln	Share (%)	Private sector share (%)	YR, mln	Share (%)
Had Wadi	69,776	63	75	72,220	74	100	141,996	69
Had Sahel	36,087	33	40	24,314	25	100	60,401	29
Hadramout Total	105,863	96	63	96,534	99	100	202,397	98
Al-Mahara Total	4,075	4	99	771	1	100	4,846	2
Total	109,938	100	64	97,305	100	100	207,243	100

Source: World Bank Staff estimates based on information provided by the Government

Since the crop sub-sector involves the largest number of farming households, the floods had a significant impact on the farming households involved in crop farming. The damage and loss to the livestock sub-sector was about 14% of the total damage and loss in the crops, livestock and fisheries sub-sectors. The production loss in the livestock sub-sector was higher (23%) than the corresponding damage (7%), mainly because it takes longer before animals start producing milk and meat.

As far as geographical location is concerned, Wadi Hadramout accounts for 63% of the total damage, 74% of the total loss and 69% of the total damage and loss. Clearly, any recovery and reconstruction effort must give a high priority to the crop and livestock sub-sectors in Wadi Hadramout. As shown in Table 2-34, some districts in either Governorate are affected more than others. The districts that have been most affected by the floods are Sah, Tarim, Hawra, Wadi Al-Ain, Al-soum, Al-Qatn and Seiyun. All of these districts are located in Hadramout. For example, Sah district in Wadi Hadramout appears to have suffered significantly more damage as compared to the other districts. Furthermore, almost 70% of the poor in Hadramout Governorate live in flood affected districts. As such, in the absence of appropriate mitigation measures that are implemented relatively quickly, rural poverty is likely to increase.

Finally, while all (100%) of the production losses are in the private sector, only 64% of all the damages are in the private sector. The remaining damages are accounted for by the damages to the irrigation infrastructure, which is in the public sector.

Table 2-34 Districts with the Largest Flood Damage

Subsector	Damage categories	District	Governorate
Crops	Planted soil erosion	Sah	Hadramout
	Unplanted soil erosion	Tarim	Hadramout
	Diversions	Hawra/Wadi Al-Ain	Hadramout
	Canal intakes	Hawra/Wadi Al-Ain	Hadramout
	Reservoirs	Sah	Hadramout
	Wadi Protection	Hawra/Wadi Al-Ain	Hadramout
	Pipes	Al Soum	Hadramout
	Improved irrigation	Al-Qatn	Hadramout
	Open channels	Al-Qatn	Hadramout
	Open Wells	Sah	Hadramout
	Tube wells	Al-Qatn	Hadramout
	Pumps	Al Soum	Hadramout
	Engines	Al Soum	Hadramout
	Agricultural equipment	Tarim	Hadramout
	Agricultural buildings	Sah	Hadramout
	Date Palm Trees	Sah	Hadramout
	Citrus Trees	Seiyun	Hadramout
Other Fruit Trees	Al Soum	Hadramout	
Livestock	Camel	Sah	Hadramout
	Sheep	Sah	Hadramout
	Cattle	Al-Qatn	Hadramout
	Beehives	Hawra/Wadi Al-Ain	Hadramout
Fisheries	Boats	Al-Ghayda	Al-Mahara
	Boat Engines	Al-Massila	Al-Mahara
	Fishing Equipment	Hawf	Al-Mahara
	Cages/Traps	Al-Ghayda	Al-Mahara

National Food Balances

Yemen depends on imports to meet a large share (as much as 85%) of its food requirements. Consequently, the country is subject to the risks and uncertainties of global fluctuations in the food market and prices. It has been estimated that in 2008 domestic food prices increased by 37%, mainly in response to global increase in food prices. However, the GOY compensated consumers (mainly in urban areas) through food subsidies or salary increases. This led to an increase in government expenditure but did not provide the necessary incentives to the farmers to increase productivity and production.

In 2007, the estimated domestic cereal production was only about 1 million tons whereas cereal imports were over 2.5 million tons. All the rice is imported and 75% of cereal requirements are imported. Almost 90% of dairy needs (butter, cheese, milk etc) are imported. The country is generally self sufficient in vegetable production. On balance, the country is a net exporter of fruits and fish. The main agricultural commodities that are exported are onion, dates, lemon and honey.

Overall, the floods did not seem to have significant adverse impact of national food balances or food supply or national food security. However, households in Hadramout and Al-Mahara Governorates who lost their homes and stored food stocks due to floods have been seriously affected. Furthermore, farming households who have lost their food crops in the field will have limited food supply to meet their household food needs. These households need to be given food as part of a food safety-net program until

at least the next food crop is harvested. However, those farming households who have lost their soil due to soil erosion or their irrigation network will continue to face problems with food security until these problems are addressed. Finally, those households who have lost their jobs in industry or commerce will face problems to meet adequate food needs.

Economic and Social Impacts

Macroeconomic Impact: The macroeconomic impact of floods in the agricultural and fisheries sub-sectors falls into three broad categories: impact on agricultural GDP, balance of payments and fiscal budget. The estimated production loss in 2008 is too small to have a significant impact on agricultural GDP. However, agricultural GDP is likely to decline in 2009 and 2010 due to potentially large production losses. Similarly, the balance of payments (BOP) is likely to be affected adversely due to an increase in food imports and decrease in agricultural exports (particularly onion, dates, lemon and honey). Finally, the fiscal deficit is likely to increase due to an increase in expenditure in the form of food safety net and essential humanitarian needs as well as expenditure related to early recovery and reconstruction.

Socio-Economic Impact: The socio-economic impact of floods in the agricultural and fisheries sub-sectors can be classified into four broad categories: food supply, employment, income and availability of agricultural inputs. Food supply in Wadi Hadramout will decline if the eroded soil, damaged irrigation infrastructure and damaged irrigation network are not repaired quickly. This will particularly reduce the food for flood affected farming households. However, this is likely to have a minimal impact on the national food security since the country depends heavily on food imports even in normal times.

Before the floods, unemployment in the country was close to 16%. Following the floods, agricultural production, agro-industrial production and activities related to commerce in the rural areas in Hadramout and Al-Mahara Governorates are likely to decline. This will increase unemployment even further. Given limited opportunities for increased employment, the agricultural wages will remain low (at present, average wages in the agricultural, rural non-farm and urban sectors are YR700, YR1,000-1,200, and YR1,500-2,000 per day for men. Average wages for women for comparable jobs are generally much lower (less than 50% of wages for men). This is likely to reduce household income as well as rural livelihood opportunities. Due to extensive damage to houses due to floods, many of these households lost stocked seeds, fertilizer and other agricultural inputs. This is likely to increase cost of production for crops in the forthcoming season.

The main impact of the disaster (due to an increase in unemployment, decrease in household income and reduction in livelihood opportunities) will be to increase rural poverty. The overall poverty rate is 35% in Yemen, which encompasses a 40% poverty rate in rural areas and 21% in urban areas. Clearly, rural poverty is twice as much as urban poverty. Floods are likely to increase rural poverty even higher than 40%, particularly in Hadramout and Al-Mahara Governorates. This is typical of the poverty impact on any disaster in terms of production loss, reduced labor demand, and reduced family income. In order to minimize the adverse impact on poverty, the Government of Yemen must put in place safety-net, recovery and reconstruction programs in the flood affected areas as soon as possible.

Finally, the flood will also have an adverse impact on the environment due to increased soil erosion, soil contamination, dead animals and loss of vegetation, particularly damage to the perennial fruit trees. The rural population will face the serious consequences of adverse environmental impact on top of the macroeconomic and the socio-economic impact of floods.

Industry, Commerce, Services and Tourism

Summary¹⁷

The tropical storm and floods that hit Hadramout and Al-Mahara governorates on October 23-25, 2008, have had significant effects on private sector firms active in industry/manufacturing, retail and wholesale trade, and other services including inter alia warehousing, real estate and financial services. Production and trade came to a halt as a result of the direct effect of the floods and the heavy rains; access roads were damaged and the movement of goods and workers affected, public and private power generators were damaged and electricity transmission lines cut, premises and equipment were destroyed or significantly affected, inventories, finished goods and production inputs were either washed away or faced with water damage. Small and medium enterprises in industry, commerce and the services sector were the hardest hit, especially in Hadramout.

The estimated physical damages and the losses associated with the decline in industrial production and sales of goods and services for the estimated recovery period were assessed based on the damages reported by the enterprises to the Chambers of Industry and Commerce in Hadramout Al-Sahel, Hadramout Al-Wadi and Al-Mahara, as well as a survey and site visits of a small sample of firms. In Hadramout, the damages to firms in the industrial sector were assessed at YR540 million and the losses YR430 million, whereas no industrial enterprises in Al-Mahara reported being affected. In the commerce and other services sector, the damages to firms in Hadramout were assessed at YR986 million and the losses YR105 million. In Al-Mahara, the damages, mostly to warehouses, were assessed at YR24 million and the losses YR6 million. As such, in the affected areas, enterprises active in industry, commerce, and other services that were directly affected by the floods have incurred total damages amounting to YR1,531 million and losses amounting to YR559 million.

Yet, by and large, the most significant impact is the expected losses to industrial, commerce and service sector firms, which did not witness direct flood damages but which will incur losses as a result of the declining output of the agricultural sector (including fisheries, livestock and honey beehives) until recovery to pre-disaster levels. Retail and wholesale traders selling agricultural, livestock and fish products, and honey, as well as agro-processing industries are expected to incur major losses to their margins for the expected duration of recovery, estimated at 2-4 years. These losses are estimated YR39,735 million.

By contrast, the tourism sector was insignificantly affected by the disaster. The number of international tourists visiting Hadramout Governorate (an already small number at 38,090 in 2007) had already been declining prior to the disaster following a series of security incidents including the attacks on the Belgian tourists in the Wadi January 2008 and the US embassy. Any expected decline in international visitors is expected to be outweighed by a temporary increase in relief and aid workers and representatives of donor agencies whose duration of stay tends to be quite longer than the tourist average of 2-3 nights in Hadramout. By contrast, Yemeni visitors who comprise the bulk of tourism in Hadramout are not expected to decline in numbers but rather are anticipated to continue growing at the same trend as previous years, with any expected drop in tourism outweighed by an increased presence of Government officials and relief organizations from elsewhere in the country.

¹⁷ The assessment was undertaken in collaboration with Omar Bagarsh, President of the Chamber of Commerce and Industry, Hadramout Sahel, whose organization led the damage assessment and survey implementation and liaised with the Chambers of Commerce of Wadi Hadramout and Al-Mahara. Baseline information and sector issues for the tourism assessment were provided by the Ministry of Tourism and a tourism development strategy for Mukalla as Gateway to the Hadramout (2008). A large number of site visits and discussions with private investors/business owners were conducted in the affected areas in Hadramout Sahel, Wadi and to a lesser extent Al-Mahara.

As for the extractive sector, the Ministry of Oil reported damages to some installations, but the damage report was not made available to the assessment team at the time of writing. As such the damages and losses to the oil sector will be reported separately. In terms of the economic losses from the impact of the disaster, the delayed extraction of such a finite reserve as oil would not be considered as a loss to the economy since the reserves themselves are not affected nor will the disaster affect the price (which has also hit historically low prices with the financial crisis). The impact on oil sector workers of work interruption during the repair period is also expected to be minor given that the repairs would likely take place swiftly as installations are typically insured. The important effect would be the drop in Government revenues due to the temporary decline in oil production, which could have important implications on public spending and investment at a time of crisis.

Pre-Disaster Situation

It is estimated that in 2008, there are 28,206 establishments in Hadramout and Al-Mahara that are active in manufacturing and in commerce and services (categories include retail and wholesale, hotels and restaurants, transport, warehousing and communications, financial services and real estate), which are estimated to employ 99,727 workers. The breakdown by Governorate of the number of establishments and employees is shown in Tables 2-35 and 2-36 below. Hadramout has 91% of the total number of establishments and 91.6% of the total number of workers in the affected areas in the above sectors while Al-Mahara has 9% of the total number of establishments and 8.4% of the total number of workers in the affected areas. The estimated number of workers in the tourism sector is inferred from the labor force in hotels and restaurants at 6,639 persons, of which the large majority (89%) are found in Hadramout.

Table 2-35 Industry, commerce and services establishments, Hadramout and Al-Mahara, 2008

	Hadramout		Al-Mahara		Affected areas	
	2004	2008	2004	2008	2004	2008
Industry	3,321	3,811	163	187	3,484	3,998
Commerce and services, including:	18,893	21,848	2,041	2,360	20,934	24,208
Trade, retail and wholesale	15,880		1,724		17,604	
Hotels and restaurants	1,623		211		1,834	
Transport, warehouses, communication	503		9		512	
Financial services	801		83		884	
Real estate	86		14		100	
Total establishments	22,214	25,659	2,204	2,547	24,418	28,206

Assumptions and data sources: Total establishments in 2008 derived from the 2004 establishment census with an annual growth rate of 3.5% for manufacturing and 3.7% for retail and services.

Table 2-36 Labor force estimate in industry, commerce and services, Hadramout and Al-Mahara, 2008

	Hadramout		Al-Mahara		Affected areas	
	Number	%	Number	%	Number	%
Industry	16,422	7.8%	854	4.7%	17,276	7.6%
Commerce and services, including:	74,968	35.7%	7,483	41.4%	82,451	36.1%
Trade, retail and wholesale	48,684	23.2%	5,176	28.6%	53,860	23.6%
Hotels and restaurants	5,896	2.8%	744	4.1%	6,639	2.9%
Transport, warehouses, communication	15,695	7.5%	1,436	7.9%	17,131	7.5%
Financial services	1,050	0.5%	107	0.6%	1,157	0.5%
Real estate	3,643	1.7%	21	0.1%	3,664	1.6%
Total labor force estimate	210,054	100%	18,093	100%	228,147	100%

Assumptions and data sources: Persons engaged in each sector in each Governorate derived from multiplying the ratio of total persons employed in Yemen in 2004 (from the economic census) to total workers in establishments in Yemen in 2004, multiplied by total workers in establishments in each Governorate (establishment census 2004), adjusted at the annual labor force growth rate of 3.5%.

The economic census categorizes establishments as follows: small (1-4 workers), medium (5-9 workers) and large (10+ workers) enterprises. Most establishments, however, in the two affected Governorates are small and medium sized enterprises employing 9 or fewer people, with a few large enterprises that employ 10 or more workers but which were for the most part unaffected. The average number of workers in the industrial sector is 4.3 persons per establishment and in retail and services 3.4 workers per establishments.

Industry Damage and Loss Assessment

From a total of 3,998 industrial establishments in both affected Governorates, 96 reported to the Chambers of Commerce and Industry severe or partial damage due to the floods, all of which are found in Hadramout. The majority of industrial establishments reporting damages (77%) were in the Hadramout Al-Sahel area and the remainder in the Wadi area (See Table 2-37). It is unclear whether this is due to the prevalence of industrial enterprises in the Sahel area of Hadramout, whereas the Wadi has a concentration of agricultural activities, and/or due to underreporting in the Wadi. Both explanations are plausible. Damages include destroyed or significantly affected premises, damaged inventory and production inputs, destroyed or damaged equipment, which have caused work interruptions for several weeks. Physical damage to the premises, infrastructure, equipment and inventory of industrial establishments that reported damages is estimated at YR 539.435 million (US\$ 2.697 million). The estimated average recovery period is calculated at two months, during which the affected enterprises would restock on material, repair damaged equipment and repair/rebuild affected premises. It is estimated that these establishments employ 475 persons.

Besides sustaining damage to their assets, the affected industrial enterprises will be forced to stop production for various periods, including due to the electricity cuts (for those connected to the grid), damage to private generators, and destroyed/damaged equipment and premises. By the time of the mission between November 22 and December 3, 2008, many industrial enterprises were still not back to production due to damage to equipment and premises. Most expected that this interruption would last for about two months, which was used as the period for loss calculation until output recovers. The loss of output is therefore estimated at YR 430 million (\$2.15 million).

Table 2-37 Damages and losses to industrial establishments in Hadramout and Al-Mahara

Governorate/ Area	Est. total establishments industry 2008	Est. persons engaged in industry, 2008	Est. gross output industry, 2008 (YR, mln)	Reported affected establishments	Est. value of damage to industry (YR, mln)	Est. losses to industry (YR, mln)
Hadramout Al-Sahel	NA	NA	NA	74	510.039	
Hadramout Al-wadi	NA	NA	NA	22	29.396	
Hadramout Governorate	3,811	16,422	91,002	96	539.435	430.0
Al-Mahara Governorate	187	854	16,774.56	0	0	0
Hadramout & Al-Mahara Governorates	3,811	17,276	107,776.56	96	539.435	430.0

Assumptions and data sources: Output in each Governorate is derived as a ratio of total manufacturing output in Yemen (4.34% in Hadramout and 0.8% in Al-Mahara, in 2006, and increased at the average annual growth rate of manufacturing output of 25%). Number of affected establishments from reported damages to the Chambers of Commerce and Industry. Data on affected workers derived from the survey of a sample of affected enterprises (carried out by the assessment team and chamber of commerce). Incomplete damage value figures were derived using the average value for other affected establishments within the same category and damage type. Losses were derived from the gross output at the Governorate level based on the ratio of affected to total establishments.

The main categories of enterprises affected were carpentry workshops, building material plants, car workshops, and metal workshops. About 39% of affected enterprises reporting damages were workshops (steel, car, and carpentry), 43% were building material plants, and the rest in several other categories. About 38% of manufacturing establishments reported full damages to premises, equipment and/or inventories and 57 % reported partial damages.

Commerce and Services: Damage and Loss Assessment

From a total of 24,208 commerce and services establishments in both affected Governorates, 318 reported to the Chambers of Commerce and Industry severe or partial damage due to the floods. About 84% of affected establishments were in Hadramout (62% in Al-Sahel and 38% in the Wadi) and the rest (16%) in Al-Mahara (See Table 2-38). As with industry, it is unclear whether this is due to the prevalence of enterprises in Al-Sahel or underreporting in the Wadi (both are plausible). It is also likely that there would be more instances of home-based enterprises in the Wadi, which would have reported damages under the shelter sector and whose losses would be captured under the agricultural sector. Damages include destroyed or significantly affected premises, damaged inventory, goods and service equipment, which would cause sales or service delivery interruptions for several weeks. Physical damages to commerce and services establishments reporting damage is estimated at YR 991.930 million (USD4.96 million). The average recovery period is estimated at two months, during which affected enterprises restock on goods and repair or rebuild affected premises. It is estimated that these establishments employ 1,466 workers of which an estimated 1,312 in Hadramout and 154 in Al-Mahara.

Table 2-38 Damages and losses to commerce and service establishments in Hadramout and Al-Mahara

Governorate/ Area	Est. total establishments retail and services, 2008	Est. persons engaged in retail and services, 2008	Est. total gross output retail and services, 2008 (YR, mln)	Reported affected retail and services establishments	Est. value of damage, retail and services (YR, mln)	Est. losses to retail and services (YR, mln)
Hadramout Al-Sahel	NA	NA	NA	165	773.102	
Hadramout Al-wadi	NA	NA	NA	101	212.453	
Hadramout Governorate	21,848	74,968	47,101.16	266	985.555	105.0
Al-Mahara Governorate	2,360	7,483	8,682.24	52	6.375	24.0
Hadramout & Al-Mahara Governorates	24,208	82,451	55,783.40	318	991.930	129.0

Assumptions and data sources: Output in each Governorate derived as a ratio of total retail and trade output in Yemen (4.34% in Hadramout and 0.8% in Al-Mahara, in 2007, and increased at 32%, the average output growth rate for the previous three years. Number of affected establishments from reported damages to the Chambers of Commerce and Industry. Affected workers derived from the survey of a sample of affected establishments (carried out by the assessment team and chamber of commerce). About 200 self-employed vendors, mostly along Mukalla's waterfront whose textile-covered stands and inventories were damaged, are not reported in the establishments' figures, but are reported in the damages, losses and affected workers figures. Losses derived from the gross output at the Governorate level based on the ratio of affected to total establishments.

Besides sustaining damage to their assets, the affected enterprises will be forced to stop their sales or service delivery for the period it takes to restock on goods and repair equipment and premises. By the time of the mission between November 22 and December 3, 2008, several enterprises were still not back in business. On average, the expected interruption period was estimated at two months, which was used as the period for calculation of losses until the business recovers to pre-disaster levels. The loss of output is therefore estimated at YR 129 million (\$0.65 million).

The main kinds of business affected were retail shops, warehouses, supermarkets, gas stations, and food outlets. About 64% fell into the supermarkets and retail shops category, 11% were warehouses, and 9% gas stations, restaurants, bakeries and other services. In addition, 32% of retail and services establishment reported full damage to their premises and/or stocked goods and 68 % reported partial damages.

Table 2-39 summarizes the damages and losses to manufacturing, commerce and services establishments directly damaged by the floods in Hadramout and Al-Mahara.

Table 2-39 Damages and losses to manufacturing, commerce and services establishments directly damaged by the floods in Hadramout and Al-Mahara

		Manufacturing	Retail and other services	TOTAL
Hadramout	Gross output (YR, mln)	91,002	47,101	138,103
	Total establishments	3,811	21,848	25,659
	Establishments affected	96	* 266	362
	Avg recovery period (years)	0.2	0.2	
	Damages (YR, mln)	539.4	985.6	1,525
	Losses (YR, mln)—2008	206.4	105	311.4
	Losses (YR, mln)—2009	223.6	-	223.6
	Losses (YR, mln)—Total	430	105	535
Mahara	Gross output (YR, mln)	16,775	8,682	25,457
	Total establishments	187	2,360	2,547
	Establishments affected	-	52	52
	Avg recovery period (years)	-	0	
	Damages (YR, mln)	-	6.4	6
	Losses (YR, mln)—2008	-	24	24
	Losses (YR, mln)—2009	-	-	-
	Losses (YR, mln)—Total	-	24	24
Affected areas	Gross output (YR, mln)	107,777	55,783	163,560
	Total establishments	3,998	24,208	28,206
	Establishments affected	96	318	414
	Avg recovery period (years)			
	Damages (YR, mln)	539.4	991.9	1,531.3
	Losses (YR, mln)—2008	206.4	129	335.4
	Losses (YR, mln)—2009	223.6	-	223.6
	Losses (YR, mln)—Total	430	129	559

* Establishments not including informal vendors whose stocks of goods were washed away

Industry and Commerce: Losses due to declining agricultural output

By and large, the most significant impact is the expected losses to industrial, commerce and service sector firms, which did not witness direct flood damages but which will incur losses as a result of the declining output of the agricultural sector (including fisheries, livestock and honey beehives) until recovery to pre-disaster levels. Retail and wholesale traders selling agricultural, livestock and fish products, and honey, as well as agro-processing industries are expected to incur major losses to their margins for the expected duration of recovery, estimated at 2-4 years. These losses are estimated at YR39,735 million (US\$198.67 million). Tables 2-40 and 2-41 detail the methodology used to derive these losses and their estimated distribution over time, as a function of the losses in output in the agricultural sector.

Table 2-40 Industry and commerce production and sales losses due to declining agricultural output in Hadramout and Al-Mahara

	Primary production loss	Retention by producer		Market losses and unit prices (YR)			Industry and commerce Loss	
		%	Value	Losses	Producer price	Market price	Margin	Value added loss
<u>Agriculture:</u>								
Cereals	1,895.3	50	947.6	947.6	171.0	225.0	54.0	299.3
Vegetables	3,242.8	25	810.7	2,432.1	18.5	28.0	9.5	1,248.9
Forage	2,248.8	75	1,686.6	562.2	2.5	3.8	1.3	281.1
Date palm	9,503.3	10	950.3	8,553.0	150.0	210.0	60.0	3,421.2
Citrus	1,953.2	10	195.3	1,757.8	200.0	280.0	80.0	703.1
Others	56,085.8	10	5,608.6	50,477.2	300.0	390.0	90.0	15,143.2
Sub-total	74,929.0			64,729.9				21,096.7
<u>Livestock:</u>								
Milk	2,960.5	50	1,480.3	1,480.3	200.0	300.0	100.0	740.1
Meat								
Cattle	2.8	20	0.6	2.2	1,515.0	1,970.0	455.0	0.7
Goat/ sheep	440.0	20	88.0	352.0	1,540.0	2,000.0	460.0	105.1
Camel	68.0	10	6.8	61.2	1,000.0	1,300.0	300.0	18.4
Honey	18,546.0	5	1,854.6	35,237.4	5,000.0	10,000.0	5,000.0	17,618.7
Sub-total	40,563.3			37,133.1				18,483.0
<u>Fishery:</u>	396.0			396.0	345.0	480.0	135.0	155.0
Total	97,342.3							39,734.7

Source and assumptions: Agricultural production losses based on Government reports and site visits to selected affected areas; retention ratios and producer (farm-gate) prices derived from discussions with local experts and focus groups; market prices from market price monitoring reports and discussions with experts.

Table 2-41 Time distribution of industry and commerce production and sales losses in the affected areas

Year	Losses to the agriculture Sector (YR, mln)				Food process & sales losses (YR, mln)
	Crops	Livestock	Fisheries	Total	
2008	1,056.0		57.0	1,113.0	454.5
2009	21,719.0	13,747.0	339.0	35,805.0	14,621.0
2010	19,609.0	7,854.0		27,463.0	11,214.6
2011	17,498.0	196.0		17,694.0	7,225.4
2012	15,036.0	194.0		15,230.0	6,219.2
Total	74,918.0	21,991.0	396.0	97,305.0	39,734.7

Source and assumptions: Time distribution follows that of the agricultural sector and fisheries losses.

Tourism Damage and Loss Assessment

The disaster's impact on the tourism sector was deemed to be minor. The number of international tourists visiting Hadramout Governorate—38,090 in 2007, which is a small number—had been declining prior to the disaster following a series of security incidents including most notably the attacks that killed two Belgian tourists and two Yemenis in Hadramout in January 2008 and the US embassy attacks. These incidents led several governments and organizations to issue strong warnings to their nationals and staff against travel to Yemen and Hadramout. This affected the sales of tourism packages to international

visitors and led to cancellation of reservations in some cases, which affected the current tourism season. Any expected decline in international visitors is also expected to be outweighed by a temporary surge in relief and aid workers and representatives of donor agencies whose duration of stay tends to be quite longer than the tourist average of 2-3 nights in Hadramout. By contrast, Yemeni visitors—the largest tourist group in Hadramout—are not expected to decline in numbers due to the floods but rather continue visiting the area at the same rate as in previous years, with an increase owing to the stepped-up presence of Government officials and local relief organizations. Using conservative estimates (a drop of 20% in international visitors due to the disaster, after taking into account the increase in aid and relief workers and donor organizations, and a net increase of 2.5% in Yemeni visitors), the net disaster effect on tourism turns out to be negligible, with the total loss estimated at YR 31 million (mainly in 2009). Table 2-42 provides the pre-disaster situation and estimated post-disaster effect.

Table 2-42 Tourism sector pre-disaster situation and post-disaster estimated effect

Year	2004	2005	2006	2007	2008 (before floods)	2008 (after floods)
Yemen--Arrivals foreign	273,732	336,070	382,332	379,000	379,000	
Arrivals:						
Hadramout Sahel--Yemeni	92,325	152,103	164,682	178,301	193,047	197,873
Hadramout Sahel--Foreign	7,967	22,000	22,146	17,717	14,173	11,339
Hadramout Sahel--Total	100,292	174,103	186,885	196,018	207,220	209,212
Hadramout Wadi--Yemeni	62,646	58,046	57,249	56,463	55,688	57,080
Hadramout Wadi--Foreign	11,247	24,215	25,467	20,374	16,299	13,039
Hadramout Wadi--Total	73,893	82,261	82,716	76,837	71,987	70,119
Hadramout--Yemeni	154,971	210,149	221,931	234,764	248,735	254,953
Hadramout--Foreign	19,214	46,215	47,670	38,090	30,472	24,378
Hadramout--Total	174,185	256,364	269,601	272,855	279,207	279,331
Bed nights:						
Hadramout Sahel--Yemeni	170,333	315,410	588,244	636,536	689,177	706,407
Hadramout Sahel--Foreign	17,934	43,000	47,046	37,560	30,048	24,038
Hadramout Sahel--Total	188,267	358,410	635,290	666,462	704,549	711,320
Hadramout Wadi--Yemeni			114,498	112,926	111,375	114,160
Hadramout Wadi--Foreign			50,934	40,747	32,598	26,078
Hadramout Wadi--Total	147,786	164,522	165,432	153,673	143,973	140,238
Hadramout Total	336,053	522,932	800,722	810,378	829,244	829,612
Length of stay:						
Hadramout Sahel--Yemeni	1.84	2.07	3.57	3.57	3.57	3.57
Hadramout Sahel--Foreign	2.25	1.95	2.12	2.12	2.12	2.12
Hadramout Sahel--Total	1.87	2.06	3.4	3.4	3.40	3.40
Hadramout Wadi--Total	2	2	2	2	2.00	2.00
Hadramout Total	1.93	2.04	2.97	2.97	2.97	2.97
Average spending (YR):						
Yemeni			12000	14000	16000	16000
Foreign			26000	28000	28000	28000
Total spending (million YR):						
Hadramout Sahel--Yemeni			7,059	8,911	11,027	11,303
Hadramout Sahel--Foreign			1,223	1,052	841	673
Hadramout Sahel--Total			8,282	9,963	11,868	11,976
Hadramout Wadi--Yemeni			1,374	1,581	1,782	1,827
Hadramout Wadi--Foreign			1,324	1,141	913	730
Hadramout Wadi--Total			2,698	2,722	2,695	2,557
Hadramout Total			10,980	12,685	14,563	14,532
Losses (YR, mln)						31

Assumptions and data sources: 2004-2006 statistics on arrivals, bed nights, length of stay from Ministry of Tourism statistics and average spending from operators' survey (Source: Brizzi, Gianni: Mukalla tourism development strategy,

2008, Mimeo); 2007 arrivals figures from Ministry of Tourism. Estimated 2007 and 2008 foreign arrivals to Hadramout based on assumption of 20% drop per year following security incidents. Arrival of Yemenis estimated at same rate as previous year. Post-floods, estimated drop of 20% for foreign visitors after factoring increase in international aid workers and 2.5% increase in Yemeni visitors accounting for influx of aid workers and government officials.

Summary Damage and Loss Assessment

Table 2-43 summarizes the damages and losses to the industry, commerce and service sectors, including a year-by-year distribution of the losses. The total damages amount to YR 1,531 million (3.7% of the total disaster effects), while the total losses amount to YR 40,324.7 million (96.3% of the disaster effects).

Table 2-43 Time distribution of total damages and losses to industry, commerce and services in the affected areas

Year	Industry, Commerce & Services Damages (YR, mln)	Industry, Commerce & Services losses due to direct flood damage (YR, mln)	Industry & Commerce losses due to drop in agricultural output (YR, mln)	Total tourism losses (YR, mln)	Total damages and losses (YR, mln)
2008	1,531.3	335.4	381.7	0	2,248.4
2009	NA	223.6	16,521.10	31	16,775.7
2010	NA	0	11,539.60	0	11,539.6
2011	NA	0	6,068.70	0	6,068.7
2012	NA	0	5,223.60	0	5,223.6
Total	1,531.3	559	39,734.70	31	41,856.0
			40,324.70		

Social Sectors

Housing

Summary¹⁸

The housing sector has suffered extensive damages caused by the tropical storm 3B. Some 2,826 houses were totally destroyed (including 1,483 houses in Wadi Hadramout, an estimated 154 houses in Hadramout Sahel, and 45 houses and 1,164 huts in Al-Mahara Governorate). Some 3,679 houses were partially damaged in both Hadramout and Al-Mahara Governorates. As a result, a significant number of persons were displaced, including 23,382 persons (4,129 households) in Wadi Hadramout alone. The total value of damage to shelter in both Governorates is estimated at YR 32,348.6 million (US\$ 161.7 million), whereas the total value of losses from rubble removal, the cost of temporary shelter and lost rental income is estimated at YR 3,246.1 (US\$ 16.23 million). The total disaster effects (damages and losses) are thus estimated at YR 35,594.7 million (US\$ 177.973 million). The bulk of the disaster effect on shelter took place in Hadramout Wadi, where an estimated 85.5% of the total damages took place, followed by Al-Mahara with 7.4% and Hadramout Al-Sahel with 7.1% of total damages. The districts of Sah, Hawra/Wadi Al-Ayn, Al-Qatn and Tarim in Wadi Hadramout were particularly badly hit, with the number of destroyed houses ranging from 232 houses in Hawra to 561 houses in Tarim. It is thus clear that rebuilding destroyed shelter, whether on site or in another location, and repairing partially damaged houses will constitute of the most important components of the reconstruction process. The rebuilding of demolished or significantly damaged houses is expected to ensure that the new settlements and houses are properly proofed against similar future natural hazard events whether through appropriate location and/or improved construction quality.

Pre-disaster Situation

According to the 2004 census, Hadramout and Al-Mahara governorates, respectively with 124,809 and 13,933 households, comprised 4% and 0.4 % of the total number of households in Yemen. According to the census, close to 52 percent of the households in the governorate of Hadramout reside in rural areas. Of the 46 percent that reside in urban areas, a large concentration of the population is clustered around Mukalla, which comprised of 231,205 inhabitants in 2004. In Al-Mahara Governorate, close to 60 percent of the population resides in the rural areas. In 2004, Hadramout Governorate had 142,145 dwellings while Al-Mahara had 12,862 dwellings. Table 2-44 presents the population, households and dwellings of each Governorate broken down by urban versus rural.

¹⁸ This assessment was based on reports prepared by the Governorates of Hadramout and Al-Mahara including the Departments of Technical Affairs, Public Works and Highways and District Local Councils. The assessment was jointly undertaken with the following GOY officials: Ahmed Al-Junaid, Deputy Governor for Hadramout Wadi Affairs; Fahd Al-Minhaly, Deputy Governor for Technical Affairs, Hadramout Sahel; Mohamed Al-Amoudy, Directorate of Technical Affairs, Hadramout Sahel; Ahmed Al-Haddad and Ahmed Al-Sokouty, respectively Director and Deputy Director, Mukalla Local Economic Development Department, and Mohamed Al-Kaf, Social Fund for Development, Hadramout Wadi.

Table 2-44 Number of dwellings, households and population by urban/rural and by governorate, 2004

Governorate	Urban						Rural						Total					
	Dwellings		Households		Population		Dwellings		Households		Population		Dwellings		Households		Population	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Ibb	54,192	17.3	52,069	17.1	374,833	17.6	259,492	82.7	253,183	82.9	1,757,028	82.4	313,684	100.0	305,252	100.0	2,131,861	100.0
Abyan	15,538	26.3	15,793	26.8	111,519	25.7	43,446	73.7	43,040	73.2	322,300	74.3	58,984	100.0	58,833	100.0	433,819	100.0
Sanaa City	262,154	98.1	250,199	98.2	1,707,586	97.7	4,971	1.9	4,667	1.8	40,248	2.3	267,125	100.0	254,866	100.0	1,747,834	100.0
Al-Baida	14,044	20.1	13,639	20.2	108,053	18.7	55,774	79.9	53,933	79.8	469,316	81.3	69,818	100.0	67,572	100.0	577,369	100.0
Taiz	88,642	22.6	81,655	22.2	535,980	22.4	304,262	77.4	286,077	77.8	1,857,445	77.6	392,904	100.0	367,732	100.0	2,393,425	100.0
Al-jawf	7,236	12.8	8,020	13.6	58,062	13.1	49,230	87.2	51,008	86.4	385,735	86.9	56,466	100.0	59,028	100.0	443,797	100.0
Haja	17,314	9.3	17,838	9.1	139,578	9.4	169,586	90.7	177,134	90.9	1,339,990	90.6	186,900	100.0	194,972	100.0	1,479,568	100.0
Al-Hodeidah	120,830	32.9	112,760	32.3	761,057	35.3	246,919	67.1	236,549	67.7	1,396,495	64.7	367,749	100.0	349,309	100.0	2,157,552	100.0
Hadramout	66,540	46.8	59,787	47.9	475,855	46.3	75,605	53.2	65,022	52.1	552,701	53.7	142,145	100.0	124,809	100.0	1,028,556	100.0
Dhamar	25,908	13.0	25,002	13.3	185,946	14.0	173,069	87.0	162,763	86.7	1,144,162	86.0	198,977	100.0	187,765	100.0	1,330,108	100.0
Shabwa	9,670	18.2	8,821	16.6	74,157	15.8	43,412	81.8	44,244	83.4	396,283	84.2	53,082	100.0	53,065	100.0	470,440	100.0
Saada	13,039	16.0	14,022	16.4	107,018	15.4	68,529	84.0	71,455	83.6	588,015	84.6	81,568	100.0	85,477	100.0	695,033	100.0
Sanaa	3,657	3.2	3,504	3.0	25,419	2.8	112,119	96.8	113,948	97.0	893,796	97.2	115,776	100.0	117,452	100.0	919,215	100.0
Aden	97,408	100.0	90,667	100.0	589,419	100.0	0	0.0	0	0.0	0	0.0	97,408	100.0	90,667	100.0	589,419	100.0
Lahej	9,832	8.6	9,314	8.9	62,595	8.7	104,882	91.4	95,699	91.1	660,099	91.3	114,714	100.0	105,013	100.0	722,694	100.0
Mareb	3,984	14.2	3,887	13.9	31,857	13.4	24,029	85.8	24,141	86.1	206,665	86.6	28,013	100.0	28,028	100.0	238,522	100.0
Al-Mahweet	4,679	7.1	4,649	6.7	36,023	7.3	60,849	92.9	64,464	93.3	458,534	92.7	65,528	100.0	69,113	100.0	494,557	100.0
Al-Mahara	5,226	40.6	5,808	41.7	37,247	42.0	7,636	59.4	8,125	58.3	51,347	58.0	12,862	100.0	13,933	100.0	88,594	100.0
Amran	18,750	18.9	19,373	18.2	149,476	17.0	80,408	81.1	87,359	81.8	728,310	83.0	99,158	100.0	106,732	100.0	877,786	100.0
Al-Daleh	8,454	13.8	8,332	13.9	62,246	13.2	52,640	86.2	51,562	86.1	408,318	86.8	61,094	100.0	59,894	100.0	470,564	100.0
Raima	620	1.2	577	1.0	3,830	1.0	49,862	98.8	55,744	99.0	390,618	99.0	50,482	100.0	56,321	100.0	394,448	100.0

Source: Government of Yemen (2004) Population Census

The housing stock in Hadramout and Al-Mahara governorates primarily comprises of individual houses of one to two stories. In the rural areas of Al-Mahara governorate, mud huts made of straw roof and mud walls are prevalent. The main building materials used in the construction of houses in the rural areas are stone, cement blocks and mud. In the rural areas of Hadramout, the construction material used for buildings typically comprises of a combination of mud and reeds for structure and cement blocks as foundations. In urban areas, the main building materials are mostly cement blocks and stone. In Al-Mahara governorate, in the rural areas, the housing structure primarily comprise of huts and in the coastal areas, the housing structures mostly comprise of stone structures (See Table 2-45).

Table 2-45 Main building material of buildings in Yemen by urban and rural, 2004

Building material category (as judged from the outside)	Urban		Rural		Total	
	Number	%	Number	%	Number	%
1 Stone	180,891	28.4	1,246,322	61.0	1,427,213	53.3
2 Cement blocks	257,124	40.4	299,967	14.7	557,091	20.8
3 Mud	55,533	8.7	219,459	10.7	274,992	10.3
4 Reeds and similar organic	7,114	1.1	138,622	6.9	145,736	5.4
5 Reinforced concrete	72,959	11.4	47,485	2.3	120,444	4.5
6 Brick	24,232	3.8	18,502	0.9	42,734	1.6
7 Tin sheet	19,518	3.1	19,246	0.9	38,764	1.4
8 Wood	12,554	2.0	6,192	0.3	18,746	0.7
9 Other	3,941	0.6	42,291	2.1	46,232	1.7
10 Unknown	3,155	0.5	4,133	0.2	7,288	0.3
Total	637,021	100.0	2,042,219	100.0	2,679,240	100.0

Source: CSO Yemen, www.cso-yemen.org based on the 2004 final census results in World Bank (2008)

In terms of infrastructure, a typical house in Hadramout and Al-Mahara governorates has access to electricity and water connections. However, in terms of sanitation, households generally tend to have septic tanks outside their house, which is cleaned periodically by the local authorities against a fee.

Damage and Loss Assessment

Damages:

The housing damage that occurred due to Tropical Storm 3B can be attributed to a combination of excessive rain and flooding. A total of 2,826 houses were totally destroyed. These include 1,483 houses in Wadi Hadramout, an estimated 154 houses in Hadramout Sahel¹⁹, and 45 houses and 1,164 huts in Al-Mahara Governorate. Some 3,679 houses were partially damaged in both Hadramout and Al-Mahara Governorates. A large proportion of the structure suffered partial damages in the forms of cracks and leaks. As a result, a significant number of persons were displaced, including 23,382 persons (4,129 households) in Wadi Hadramout alone. The total value of damage to shelter in both Governorates is estimated at YR 32,348.6 million (US\$ 161.7 million).

Spatial distribution of the damages to housing: In the Hadramout Sahel region, the houses that suffered maximum damage mostly comprised of a combination of mud and stone structures. Most of these houses suffered collapses due to weak roof. In the Hadramout Sahel region, an estimated 638 structures experienced damages, of which 134 were estimated to be fully damaged and 504 were estimated to have sustained partial damages. The structures that were fully damaged include fully demolished houses and houses that have sustained severe structural cracks and problems and which have become uninhabitable and will require demolition. The houses that suffered partial damages and those that suffered small damages such as cracks and leaks are houses that could be repaired and are

¹⁹ Initial damage figures reported by district councils in Hadramout Sahel, based on claims registered without (as of yet) follow-up inspections, were deemed exaggerated. Thus, Hadramout Governorate Technical Affairs Department initiated the inspection of reported cases. The estimates used in this assessment are based on the inspection-based results of the first three districts in Hadramout Sahel and were extrapolated to the remaining districts to determine a ratio of actual to reported cases (a methodology agreed with the Local Government).

thus deemed habitable. The districts that suffered damages include Al-Mukalla Rural, Mukalla city, Ghail Bawazir, Al-Shihr, Al-Dess Alsharkiya, Maifa Broom, Alredh qseier and Ghail Binyamin. The districts of Hagger and Dawan suffered minor damages. The total cost of damages is estimated to be close to YR 1,217.1 million (US\$6.085 million), of which structures sustaining full damages are close to YR 1,054.7 million (US\$5.273 million) and structures sustaining partial damages are YR 162.4 million (US\$0.812 million). The value of the damages to fully destroyed structures has taken into account the value of salvageable materials such doors and windows that were removed by households for reuse in future construction. The average salvage value is estimated to be close to YR 60,000 (US\$300) per structure. Besides structural damages, households also suffered damages in terms of household goods, which amounted to YR 1,084.6 million (US\$5.423 million).

In Hadramout wadi, most of the structures that sustained damages were made of traditional mud bricks with stone foundations. The damages that occurred to the structures were caused by a combination of excessive rain and flooding. For example, in districts like Sah and Tarim, the villages that were impacted included housing structures that collapsed to excessive rain and water damages from floods that rose to close to 5 ft in height. The traditional houses built of mud could not sustain prolonged exposure to water and collapsed after the water level exceeded the height of their stone foundation, which therefore eroded the mud brick construction. The districts in Hadramout Wadi that sustained extensive damages were: Sah, Tarim, Al Qatn, Hawra/Wadi Al-Ayn, Shibam, Al-Soum and Seiyun. The total number of houses that were damaged was close to 2,354 structures, of which 1,483 houses collapsed or are beyond repair and 871 structures sustained partial damages. The total cost of damages is estimated at YR25,102.0 million (US\$125.51 million), of which full damages are estimated at YR 23,444.2 million (US\$117.221 million) and partial damages are estimated at YR 1,657.8 million (US\$8.29 million). The damage value for fully damaged structures takes into account the cost of salvageable materials like doors and windows that would be reused for future construction by the households. The average salvage value was estimated at YR 60,000 (US\$300) per structure. Besides structural damages, households also suffered damages in terms of household goods, which were estimated at YR 2,565.6 YR (US\$12.83 million).

In Al-Mahara Governorate, the majority of the houses sustained partial damages. Some 1,164 mud huts suffered serious damages due to excessive rains. Mud huts, commonly made up of mud, straw and wooden poles, have no protection against rains and as such could not withstand the sustained rain for about two days due to the storm. Apart from the huts, a total of 2,349 houses were affected in Al-Mahara governorate. The districts of Hasween, Sayhut and Al-Massila were the worst affected in the Al-Mahara governorate. Out of these, 45 houses were fully destroyed, 1,986 suffered serious damages (but not to the extent of demolition) and 318 houses suffered small cracks/leaks due to the storm. A large majority of the houses suffered roof damages due to the heavy rains. The total cost of damages is estimated to be YR 2,377.1 million (US\$11.69 million). The damages to the fully destroyed houses are estimated to be YR 180 million (US\$0.9 million), after deducting the cost of salvageable materials estimated at approximately YR 50,000 (US\$250) per house. The majority of the mud huts suffered serious damages estimated at YR 103.948 million (US\$0.519 million). The cost of rebuilding or repairing mud huts is estimated to be YR 150,000 (US\$750) in Sayhut and YR 82,000 (US\$410) in Al-Massila district. The remaining houses suffered partial damages estimated at YR2,049.6 million (US\$10.248 million). The average cost of repairing a partially damaged house was assumed as YR 1 million (US\$5,000) per house, and the cost of repairing small cracks and leaks is assumed as YR 0.2 million (US\$1,000) per house. Damages were also incurred to household goods, which amounted to approximately YR 45.78 million (US\$0.23 million).

Tables 2-46 to 2-48 provide the detailed breakdown of shelter damages by region.

Table 2-46 Damages to shelter, Hadramout Sahel

Total damaged houses	Fully damaged houses		Partially Damaged Houses		Total damage value to structures (YR,mln)	Value of damaged household goods (YR,mln)	Salvage value (YR,mln)	Total damage value (YR,mln)	Households displaced	Persons displaced
	Num	Value (YR,mln)	Num	Value (YR,mln)						
638	134	1,054.7	504	162.4	1,217.1	1,084.6	8.0	2,293.7	1,914 *	13,398 *
Total	134	1,054.7	504	162.4	1,217.1	1,084.6	8.0	2,293.7	1,914 *	13,398 *

* Figures of displaced households in Hadramout Sahel have not yet been confirmed. These figures are estimated on the basis of 3 households or units per damaged structure and an average household size of 7.

Table 2-47 Damages to shelter by district, Hadramout Wadi

District	Total damaged houses		Fully damaged houses		Partially Damaged Houses		Value of damaged household goods (YR, mln)	Salvage Value (YR, mln)	Total Damage Value (YR,mln)	Households displaced	Persons displaced
	Num	Value (YR,mln)	Num	Value (YR, mln)	Num	Value (YR, mln)					
Al Soum	99		48	697.7	51	88.6	83.0	2.9	866.4	1,031	1,255
Seiyun	86		18	310.2	68	140.2	31.1	1.1	480.4	140	1,000
Shibam	193		38	603.6	155	294.5	65.7	2.3	961.5	53	364
Sah	357		317	4,607.6	40	69.5	548.4	19.0	5,206.5	599	3,013
Hawra/Wadi Al Ayn	363		232	3,372.1	131	227.7	401.4	13.9	3,987.3	321	2,180
Al Qam	523		269	4,273.1	254	482.6	465.4	16.1	5,205.0	1,019	5,304
Tarim	733		561	9,668.8	172	354.7	970.5	33.7	10,960.3	1,829	9,354
Total	2,354		1,483	23,444.2	871	1,657.8	2,565.6	89.0	27,578.6	4,129	23,382

Table 2-48 Damages to shelter by district, Al-Mahara Governorate

District	Total Damaged Houses		Total damaged huts		Fully damaged houses		Partially damaged houses		Houses w minor cracks/leaks		Total house damage value (YR,mln)	Value of damaged HH goods (YR,mln)	Salvage Value (YR,mln)	Total Damage Value (YR,mln)	HH displaced	Persons displaced
	Num	Value (YR,mln)	Num	Value (YR,mln)	Num	Value (YR,mln)	Num	Value (YR,mln)	Num	Value (YR,mln)						
Houf	20	0	0	0	0	0	20	0	0	0	20	0	0	20		
Ghayda	537	0	0	0	0	537	537	0	0	0	537	0	0	537		
Hasween	454	0	0	0	17	68	437	0	0	0	505	8.5	0.9	512.7		
Qishn	290	0	0	0	0	114	114	176	35.2	149.2	0	0	0	149.2		
Sayhut	578	125	18.8	18.8	20	80	291	291	142	28.4	418.2	12.5	1	429.7		
Menaar	226	0	0	0	0	0	226	226	0	0	226	0	0	226		
Massila	1408	1039	85.2	85.2	8	32	361	361	0	0	478.2	24.8	0.4	502.6		
Total	3,513	1,164	103.9	103.9	45	180	1,986	1,986	318	63.6	2,333.5	45.8	2.25	2,377.1		337

Losses:

The losses that were sustained in the housing sector are mostly attributed to the loss of rental income, the cost of demolition and debris removal from the fully damaged houses and the cost of temporary housing for the displaced families. A large share of losses can be attributed to the cost of temporary shelters to host the displaced families. Of the 23,382 displaced persons in Wadi Hadramout, nearly 15,000 people are living in temporary shelters (the rest are doubling up with relatives). The total losses accrued due to the cost of the temporary shelters are estimated at YR 2,820.1 million (US\$14.1 million). Several homeowners also lost income from the damage to rental structures, especially in Seiyun and Al-Qatn districts in the Wadi Hadramout area, in Mukalla, Ghail Bawazir and Al-Shihr districts in Hadramout Sahel, and in Hasween and Sayhut districts in Al-Mahara. The total loss of rental income from Hadramout and Al-Mahara governorates was estimated to amount to YR 10.6 million (US\$0.053 million). The final category of losses comprises of the removal of debris and rubble for the fully/significantly damaged houses that require demolition; this is estimated to cost YR 415.5 million (US\$2.08 million). Several villages in the Hadramout wadi have sustained extensive damages for which cleaning efforts are expected to be extensive. Areas like Sah have already started to commence the clean-up process. Tables 2-49 to 2-51 present a breakdown of the losses by area.

Table 2-49 Shelter-related losses, Hadramout Sahel

Losses	No. of people	No. of structures	Total (YR,mln)	2008	2009	2010
Rental income foregone			1.72	0.86	0.86	
Households in shelter	330		59.4	29.7	29.7	
Rubble removal		134	40.2	20.1	20.1	
Total Loss			101.3	50.66	50.66	

Table 2-50 Shelter-related losses, Hadramout Wadi

Losses	No. of people	No. of structures	Total (YR,mln)	2008	2009	2010
Rental income foregone			8.37	4.19	4.19	
Households in shelter	15,000		2,700	1,350	1,350	
Rubble removal		1,483	370.75	185.4	185.4	
Total Loss			3,079.12	1,589.6	1,589.6	

Table 2-51 Shelter-related losses, Al-Mahara Governorate

Losses	No. of people	No. of structures	Total (YR,mln)	2008	2009	2010
Rental income foregone			0.5	0.1	0.3	0.1
Households in shelter	337		60.7	30.3	30.3	
Rubble removal		45	4.5	2.3	2.3	
Total Loss			65.7	32.7	32.9	0.1

Finally, Table 2-52 presents the total disaster effects (both damages and losses) on the shelter sector due to the effect of the Tropical Storm and floods.

Table 2-52 Total estimated disaster effects (damages and losses) to the shelter sector

	Damages		Losses	
	(YR, mln)	(US\$, mln)	(YR, mln)	(US\$, mln)
Estimation of Damages				
a) Houses Fully Destroyed				
Number of houses and huts	2,826			
Estimated value of damage	24,782.8	123.914		
b) Houses Partially Destroyed				
Number of houses	3,679			
Estimated value of damage	3,869.8	19.349		
c) Household Goods	3,696.0	18.480		
d) <u>Less</u> salvaged parts	(99.3)	(0.5)		
Total estimated damages	32,249.4	161.24		
Estimation of Losses				
a) Rental income foregone			10.6	0.053
b) Cost of demolition and rubble removal			415.5	2.077
c) Cost of temporary housing scheme			2,820.1	14.100
Total estimated losses			3,246.2	16.231
Total estimated disaster effects	YR35,495.6 million (US\$177.5 million)			

Education²⁰

Summary

The total value of damages in the education sector in Hadramout and Al-Mahara governorates caused by Tropical Storm 03B, which landed in Yemen between October 23-25, 2008, is estimated to be about YR3,460 million (US\$17.3 million equivalent), and comprised of YR 3,240 million (US\$16.2 million) in Hadramout and YR 220 million (US\$1.1 million) in Al-Mahara. Losses to the sector have been estimated at about YR 35 million (about US\$0.2 million equivalent). The damage to physical facilities reported is for public basic and secondary education schools as estimated by the Ministry of Education and its education departments at governorate level and as adjusted in light of the field verification jointly carried out by Government representatives and the World Bank assessment mission.

Pre-Disaster Situation

The Ministry of Education (MOE) is responsible for formal primary and secondary education in Yemen. In 2006, of the total population of children in school age of about 9.54 million only about 6.69 million are enrolled in primary and secondary education country-wide. About 2.75 million children of school age do not have access to education. The male student population country-wide was about 60 percent and the average number of students per classroom was about 31. About 50 percent of school enrollment was in rural areas. Of the total enrollment about 93 percent were in primary and about 7 percent were enrolled in secondary education institutions in the country and most of the secondary school enrollment is concentrated in urban areas. The number of basic education teachers was about 104,314 of whom only about 118 were non-Yemeni. The total number of secondary schools country-wide was 323 of which only 10 were non-governmental. The total secondary school enrolment was about 525,459 of whom about 2.4 percent were enrolled in non-governmental schools. Primary education is provided mainly by the Government and non-government organizations (private sector and NGOs) but it remains essentially publically financed. About 98.2 percent of schools are Government primary schools (GPS), accommodating about 97.3 percent of total enrollment. Registered non-Government primary schools (RNGPS) represent about 1.8 percent of the total primary schools and the number of enrolled students represents about 2.7 percent of the total. The MOE manages secondary education (grades 6-9), vocational training and tertiary education.

The number of primary and secondary education public schools in Hadramout and Al-Mahara governorates and corresponding enrollment are presented in Table 2-53. The main purpose of presenting this data is to compare on a district by district basis the pre-event and post-event conditions and identify the districts that require priority consideration. In the absence of data, however, the decision to prioritize districts should be made based on the number of totally damaged schools as in those districts there may not be alternatives to facilitate school space to restore the service.

²⁰ This assessment was based on reports prepared by the Ministry of Education and the Governorates of Hadramout and Al-Mahara. The assessment was jointly undertaken with the following GOY officials: Mohamed Al-Sharafi, Hussein Abu Al-Ghaith, Saleem Saeed Bakir, Abdalla Lotf and Mohamed Taher Ali representing the Ministry of Education and the branch offices in Hadramout Sahel, Hadramout Wadi and Al-Mahara.

Table 2-53 Education sector data in the affected areas

Governorate/ Region	Hadramout-Sahel	Hadramout-Wadi	Hadramout	Al-Mahara
Number of Primary & Secondary Schools	81	148	229	38
Total Enrollment	N.A.	N.A.	N.A.	N.A.
Boys Enrolled in School	N.A.	N.A.	N.A.	N.A.

School attendance after the flood event was interrupted by about one month, except in the most affected areas where schools suffered total damage. To the date of the flood damage assessment no arrangements were reported for resuming school attendance in the most affected areas.

Damage and Loss Assessment

The Tropical Storm 03B caused total or partial destruction of public schools, based on information provided by the MOE, estimated at about YR 3460 million (US\$ 17.3 million) in today's prices, while the estimate for losses is about YR 11.6 million (about US\$0.06 million). The total number of schools that suffered physical damage is 267 of which 46 schools were totally damaged (17.2%) and will require replacement. The worst affected districts were in Wadi Hadramout where about 59% of the total damage occurred. In this area most of the damage (about 51%) was concentrated in the districts of Al-Qatn, Seiyun, Sah, Al-Soum and Tarim (Table 2-54). In these districts, a total of 20 schools suffered total damage and the affected student population is about 6,000 for whom alternative facilities will have to be provided. These facilities consisted of traditional architecture (adobe bricks used as bearing wall structure with wooden roof overlain with mud brick sealed with a plaster coating). The remaining schools were partially damaged and most of them will require only repairs. These facilities would require minor interruption of classes as they can be used. The collapse of school buildings was apparently due to the flood waters wetting the bottom mud bricks and thus weakening the structural walls, which lost the strength to support the upper sections of the structure. The partial damage to school buildings was primarily caused by the excessive rainfall precipitation which the roof plaster seal could not drain off rapidly enough thus allowing substantial leakage through wall joints that also damaged the structure but not to the point of total collapse.

Table 2-54 Damages in the Education Sector (YR Million)

Governorate/District	Num Totally Damaged	Num Partially Damaged	Totally Damaged (YR, mln)	Partially Damaged (YR, mln)	Total Damage (YR, mln)
Al-MAHARA					
Al Ghayda	6	6	83	14	97
Sayhut	2	5	20	25	45
Al Massila	1	6	8	18	26
Qishn	1	2	15	8	23
Manaar	2	4	16	8	24
Hasswin	0	3	0	5	5
Total Al-Mahara	12	26	142	78	220
HADRAMOUT					
HADRAMOUT Wadi					
Al-Qatn	6	21	279	83	362
Seiyun	0	29	0	256	256
Wadi Al Ain	0	18	0	74	74
Shibam	0	19	0	104	104

Hariteh	0	9	0	18	18
Amd	0	3	0	12	12
Regit	0	9	0	43	43
Tarim	3	8	156	40	196
Sah	6	4	536	45	581
Al Soum	5	8	346	37	383
Sub-total Had Wadi	20	128	1,317	712	2,029
HADRAMOUT					
Sahel					
Al Mukalla	3	13	300	74	374
Al Raidah	0	5	0	5	5
Al Qail	3	7	269	13	282
Hazawil	1	0	32	0	32
Al Shihr	0	8	0	14	14
Sirar	1	0	32	0	32
Al Garrah	0	1	0	2	2
Aqeb	0	1	0	1	1
Al Naga'ab	0	2	0	2	2
Shazawah	1	0	32	0	32
Hajer	0	6	0	8	8
Tamhah	0	1	0	1	1
Al Diss	3	3	275	13	288
Ma'adi	0	1	0	1	1
Broom	0	7	0	5	5
Ghail Binyamin	2	12	119	13	132
Sub-total Had Sahel	14	67	1,059	152	1,211
Total Hadramout	34	195	2,376	864	3,240
SUMMARY					
TOTALS (YR Million)	46	221	2,518	942	3,460
TOTALS (US\$ M.)			12.59	4.71	17.3

Losses in the education sector refer to additional expenditures, such as the provision of temporary schooling facilities described above, and such expenditures are estimated to be needed for three years after the disaster while all the damaged schools are restored to normal operating conditions. Losses also takes into account the additional cost of doubling-up schools for conducting two shifts and for which teacher overtime pay may be incurred. The losses also include the cost to clear up the rubble left by the 46 totally collapsed structures in the affected areas. The annual cost of rental space per school totally lost is estimated at about YR240,000 and it was assumed that it would take about two years of rental. In the absence of a detailed bill-of-quantity for school repairs, it was assumed an average cost of about YR 500,000 per school. The cost of over-time pay of teachers involved in doubling-up teaching was assumed about YR 4,000 per month per teacher for a period of three years. In the first year it was assumed that all teachers participating in doubling-up would benefit from the over-time pay, but the number of teachers would be reduced every subsequent year as the number of schools are repaired and reconstructed. The cost of removing rubble of totally damaged schools was assumed to be about YR 10,000 per school and done under the same contract for the removal of rubble of residential houses in the same area to benefit from economies of scale. Table 2.55 presents the losses by district and region.

Table 2-55 Losses in the Education Sector (YR Million)

Governorate/District	1 st Year	2 nd Year	3 rd Year	Total
AL-MAHARA				
Al-Ghayda	1.6	1.6	1.6	4.8
Sayhut	0.4	0.4	0.4	1.2
Al-Massila	0.2	0.2	0.2	0.6
Qishn	0.2	0.2	0.2	0.6
Mana'a	0.4	0.4	0.4	1.2
Hasswin	--	--	--	--
Total Al-Mahara	2.8	2.8	2.8	8.4
HADRAMOUT				
HADRAMOUT Wadi				
Al-Qatn	1.6	1.6	1.6	4.8
Seiyun	--	--	--	--
Wadi Al Ain	--	-	--	--
Shibam	--	--	--	--
Hariteh	--	--	--	--
Amd	--	--	--	--
Regit	--	--	--	--
Tarim	0.8	0.8	0.8	2.4
Sah	1.6	1.6	1.6	4.8
Al Soum	1.3	1.3	1.3	3.9
Sub-total Wadi	5.3	5.3	5.3	15.9
HADRAMOUT Sahel				
Al Mukalla	0.8	0.8	0.8	2.4
Al Raidah	--	--	--	--
Al Qail	0.8	0.8	0.8	2.4
Hazawil	0.3	0.3	0.3	0.9
Al Shihr	--	--	--	--
Sirar	0.2	0.2	0.2	0.6
Al Garrah	--	--	--	--
Aqeb	--	--	--	--
Al Naga'ab	--	--	--	--
Shazawah	0.2	0.2	0.2	0.6
Hajer	--	--	--	--
Tamhah	--	--	--	--
Al Dis	0.8	0.8	0.8	2.4
Ma'adi	--	--	--	--
Broom	--	--	--	--
Ghail Binyamin	0.4	0.4	0.4	1.2
Sub-total Sahel	3.5	3.5	3.5	10.5
Total Hadramout	8.8	8.8	8.8	26.4
SUMMARY				
TOTALS (YR Million)	11.6	11.6	11.6	34.8
TOTALS (US\$ Million)	0.06	0.06	0.06	0.18

Health, Population and Nutrition

Summary ²¹

A disaster of this kind has significant immediate effects on the health of the population, particularly in the worst affected areas. Initial concerns focus on treating storm-related injuries, preventing outbreaks of disease, addressing mental health issues relating to shock and bereavement, and providing basic health services. Out of 152 health facilities in the two affected governorates, Hadramout and Al-Mahara, 20 facilities were totally damaged and should be replaced, while 132 were partially damaged and thus will only require repairs. The most affected districts were Sah, Al-Qatn, Seiyun, and Tarim in Wadi Hadramout where 16 out of 105 health facilities were totally damaged requiring replacement. The total value of damages in the health, nutrition, and family planning (HNP) sector in the affected governorates of Hadramout and Al-Mahara is estimated to be about YR 4,274 million (US\$21.4 million) of which YR 2,731 million (US\$13.66 million equivalent) in damage to facilities and about YR 1,543 million (about US\$7.72 million equivalent) of the total damages were to medical equipment and furniture. The damage to physical facilities reported is for public health facilities, as estimated by the Ministry of Health and its health department at governorate level and as adjusted during the field verification jointly carried out by Government representatives and the World Bank assessment mission. The total value of losses to the health is estimated at YR 2,255 million (about US\$11.28 million equivalent), and reflect the additional costs of treatment for disaster-related illnesses.

Pre-Disaster Situation

District-based information on health indicators is not available to better assess the flood event impact at that level as the extent of damages varies from district to district. The national averages, however, could be used to monitor such indicators in the affected areas ex-post to have a better measure of the Storm impact on health. This measure is important as in many districts several health centers and health units were totally damaged that will require replacement. Summary indicators are given in Table 2-56, below.

Table 2-56 Key National Health Indicators

Indicators	National	Urban	Rural
Neonatal mortality	37	29	40
Infant mortality rate (per 1,000 live births)	69	55	73
Under five mortality rate (per 1,000 live births)	78	57	86
Children aged 12-23 months receiving measles vaccines (%)	65	80	59
Children with diarrhea	34	29	35
Children with diarrhea receiving ORT (%)	87	90	86
Total fertility rate (per woman)	5	4	6
Women aged 15-49 receiving skilled antenatal care (%)	47	68	39
Women aged 15-49 receiving assistance at delivery (%)	36	62	26
Women delivering in a health facility (%)	24	40	17
Households using improved drinking water sources (%)	59	74	52
Households using improved sanitation facilities (%)	52	92	34

²¹ This assessment is based on reports prepared by the Ministry of Health and Population and Hadramout and Al-Mahara Governorates. The assessment was jointly undertaken with the following GOY officials: Alabd Bamoussa, and XXX representing the Ministry of Health and the branch offices in Hadramout Sahel, Hadramout Wadi and Al-Mahara.

Source: Yemen Ministry of Health 2006 MICS.

In the Storm affected area there is a multi-tiered health care system consisting of health units and health centers and hospitals whose location and number are based on population density. Health care personnel at each level include physicians, nurses, and other health professionals. General hospitals are located in the main urban centers but rural hospitals are located in smaller size urban areas with outreach to the nearby rural communities serving two or more nearby districts. This is important to note as several rural hospitals in the most affected districts were totally damaged while the damage to general hospitals in major urban centers was mostly in medical equipment and furniture caused by rainwater infiltration rather than flooding as was the case with the rural hospitals. Each district hospital offers a range of primary and specialty services. In addition to the hospital, the district health centers have a disease surveillance unit which collects and integrates data from the health units.

The highest level of the health care system consists of a national network of private and public medical college hospitals and specialized referral hospitals. Such facilities are generally located in Sana'a, the capital city, and the major secondary cities within the urban centers. Outside of the major urban centers, the rural hospitals are usually clinics with minimal bed capacity for in-patient care.

Damage and Loss Assessment

The Tropical Storm 03B caused total or partial destruction of public facilities worth YR 2,731 million (US\$ 13.66 million equivalent) and damage to medical equipment and furniture worth YR 1,543 million (US\$7.22 million). The estimate for losses is about YR2255 million (about US\$11.28 million equivalent). The damage assessment is based on information provided by the governorate health departments as adjusted upwards by the assessment mission to take into account contingencies not considered in preliminary government estimates. The cost estimate is a measure of the cost to repair or replace the damaged facilities at today's prices and for replacing to the same conditions as before the flood event. A detailed account of damages by district and governorate is given in Table 2-57 given below.

Table 2-57 Damage to Health Facilities

Governorate/ District	Type	Total	Totally damaged	Partially damaged	Totally damaged (YR,mln)	Partially damaged (YR,mln)	Total structure damage	Furniture & Equipment
AL-MAHARA								
Al Ghayda	GH	1	0	1	0	2	2	1
	HC	1	0	1	0	9	9	2
	HU	5	0	5	0	25	25	5
Hat	HC	1	0	1	0	1	1	0
Sheen	HC	1	0	1	0	3	3	1
Sayhut	GH	1	0	1	0	9	9	5
Geshen	GH	1	1	0	129	0	129	105
Manaar	HU	3	1	2	17	8	25	5
Hasswin	HU	3	0	3	0	10	10	2
Al Massila	HU	2	0	2	0	9	9	1
Hawf	GH	1	1	0	22	0	22	4
Total Al-Mahara		20	3	17	168	76	244	131
HADRAMOUT								
HADRAMOUT Sahel								
Al Mukalla	HQ	1	0	1	0	6	6	2
	GH	2	0	2	0	35	35	8

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	HC	1	1	0	25	0	25	5
	HU	6	0	6	0	30	30	5
Dowan	DQ	1	0	1	0	7	7	0
Ghail Bawazir	HU	2	0	2	0	14	14	2
Al Shihhr	HU	1	0	1	0	2	2	0
Hajar	DQ	1	0	1	0	2	2	0
	HU	2	0	2	0	5	5	1
El Diss (Generator)	HU	1	0	1	0	4	4	1
Socotra	HU	1	0	1	0	7	7	1
Ghail Binyamin	HU	1	0	1	0	7	7	1
Al Dhalrah	HU	4	0	4	0	8	8	2
Yablath	HU	2	0	2	0	4	4	1
Bloom HU	HU	1	0	1	0	8	8	2
Subtotal Sahel		27	1	26	25	139	164	31
HADRAMOUT Wadi								
Seiyun	HQ	5	0	5	0	23	23	15
	GH	1	1	0	476	0	476	400
	HC	4	0	4	0	18	18	5
	HU	7	0	7	0	17	17	5
	Inst.	1	0	1	0	5	5	2
	Strs	4	0	4	0	18	18	15
Wadi Al Ain	GH	1	0	1	0	10	10	4
	HC	1	0	1	0	3	3	1
	HU	11	0	11	0	44	44	8
Harida	GH	1	0	1	0	23	23	16
	HU	4	0	4	0	14	14	8
Shibam	GH	1	0	1	0	34	34	30
	HC	2	0	2	0	11	11	8
	HU	7	0	7	0	41	41	10
Al-Qatn	GH	1	1	0	475	0	475	400
	HC	3	0	3	0	37	37	7
	HU	7	0	7	0	62	62	12
Al Ebber	HC	1	0	1	0	12	12	2
	Strg	3	0	3	0	31	31	6
Sah	GH	1	1	0	475	0	475	285
	HC	2	1	1	90	44	134	40
	HU	10	4	6	80	13	93	17
Al Soum	HC	2	0	2	0	27	27	5
	HU	6	3	3	45	4	49	9
Tarim	GH	1	0	1	0	61	61	47
	HC	3	1	2	18	11	29	5
	HU	9	3	6	58	9	67	12
Amd	HC	1	0	1	0	5	5	2
	HU	5	1	4	26	3	29	5
Subtotal Wadi		105	16	89	1,743	580	2,323	1,381
Total Hadramout		132	17	115	1,768	719	2,487	1,412
SUMMARY								
TOTAL (YR Million)		152	20	132	1,936	795	2,731	1,543
TOTAL (US\$ Million)					9.68	3.98	13.66	7.72

Damage to the physical structure includes destruction of supplies, windows, doors, water pumps, electric generators, and septic tanks. It should be noted that totally damaged structures was due to their location in flood prone areas and to the use of traditional architecture consisting of mud brick structures and wooden roofs overlain with mud bricks sealed with plaster.

Losses in the health sector refer to additional expenditures, such as treatment of injuries and increased morbidity rates. The Storm increased the incidence of diarrhea, respiratory tract infection, eye infection, various skin diseases, and fever. Most of these were caused by a shortage of clean drinking water.

The Government with the support of UN agencies and some donors was prompt in deploying medical personnel to affected areas. Initially, medical personnel from public facilities in neighboring districts were sent. They were followed by nationally formed medical teams. In addition, NGOs, Development Partners, and other organizations also provided medical teams. The Government with WHO assistance deployed six mobile health teams, launched an emergency malaria control program, disposal of animal carcasses in accordance with WHO guidelines, and established disease surveillance systems. The expenditures for these services, which should be continued while the lost health facilities are replaced, have been accounted for in the estimate of health sector losses.

The Storm impact on health security has been substantial given the losses in provision of adequate food supplies—due to the destruction of standing crops and vegetable gardens, livestock, household food stocks and assets, and livelihoods that poor households depend on to purchase food—and increased vulnerability of infants, young children, and pregnant and lactating women to malnutrition and micronutrient deficiencies, especially since their nutritional requirements are relatively high. The situation is more critical in the poor districts where the pre-disaster nutritional status of children was poor, as noted in visual observations during the field assessments. Many people have sustained physical trauma and mental setbacks; although health workers were deployed to some seriously affected communities to provide counseling, it is impossible to quantify these associated losses at this time in terms of resources and financing to address the longer-term needs. The WHO initiated a training program for health workers to counsel mentally ill patients and this program should be continued for a longer period of time and to cover a wider area. There are other associated costs that have not been quantified such as reduced productivity, the effects on reproductive health, increased snake bites, long term disability, increased morbidity, and other longer-term effects of under-nutrition and mental stigma.

The initiatives started in the relief stage that concentrated on measures to prevent and control outbreaks of disease should be continued albeit gradually decreasing with time. A basic disease surveillance system was established in the Storm-affected areas, and fortunately no outbreaks have been reported which could be attributed to successful early interventions. A detailed assessment of estimated losses by governorate and district is given in Table 2-58 given below.

Table 2-58 Losses to Health Facilities

Governorate/ District	Type	Total	Totally Damaged	Partially Damaged	Yr1 (YR, mln)	Yr2 (YR, mln)	Yr3 (YR, mln)	Total (YR, mln)
AL-MAHARA								
Al Ghayda	GH	1	0	1	50	30	10	90
	HC	1	0	1	10	5	5	20
	HU	5	0	5	10	5	5	20
Hat	HC	1	0	1	10	5	5	20
Shehen	HC	1	0	1	10	5	5	20
Sayhut	GH	1	0	1	50	30	10	90

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Geshen	GH	1	1	0	80	40	15	135
Manaar	HU	3	1	2	30	10	5	45
Hasswin	HU	3	0	3	30	10	5	45
Al Massila	HU	2	0	2	20	10	5	35
Hawf	GH	1	1	0	50	30	10	90
Total Al-Mahara		20	3	17	350	180	80	610
HADRAMOUT								
HADRAMOUT Sahel								
Al Mukalla	HQ	1	0	1	20	20	10	50
	GH	2	0	2	10	5	5	20
	HC	1	1	0	10	5	5	20
	HU	6	0	6	30	10	5	45
Dowan	DQ	1	0	1	0	0	0	0
Ghail Bawazir	HU	2	0	2	10	5	5	20
Al Shihir	HU	1	0	1	10	5	5	20
Hajar	DQ	1	0	1	0	0	0	0
	HU	2	0	2	10	5	5	20
El Diss (Generator)	HU	1	0	1	10	5	5	20
Socotra	HU	1	0	1	10	5	5	20
Ghail Binyamin	HU	1	0	1	10	5	5	20
Al Dhalrah	HU	4	0	4	20	10	5	35
Yablath	HU	2	0	2	10	5	5	20
Bloom HU	HU	1	0	1	10	5	5	20
Subtotal Sahel		27	1	26	170	90	70	330
HADRAMOUT Wadi								
Seiyun	HQ	5	0	5	20	20	10	50
	GH	1	1	0	70	45	15	130
	HC	4	0	4	40	20	10	70
	HU	7	0	7	10	5	5	20
	Inst.	1	0	1	0	0	0	0
	Strs	4	0	4	0	0	0	0
Wadi Al Ain	GH	1	0	1	50	30	10	90
	HC	1	0	1	10	5	5	20
	HU	11	0	11	10	5	5	20
Harida	GH	1	0	1	50	30	10	90
	HU	4	0	4	10	5	5	20
Shibam	GH	1	0	1	50	30	10	90
	HC	2	0	2	20	10	5	35
	HU	7	0	7	10	5	5	20
Al-Qatn	GH	1	1	0	70	45	15	130
	HC	3	0	3	30	20	10	60
	HU	7	0	7	10	5	5	20
Al Abr	HC	1	0	1	10	5	5	20
	Strg	3	0	3	0	0	0	0
Sah	GH	1	1	0	70	40	15	125
	HC	2	1	1	20	10	5	35
	HU	10	4	6	10	5	5	20
Al Soum	HC	2	0	2	10	5	5	20
	HU	6	3	3	10	5	5	20
Tarim	GH	1	0	1	50	30	10	90
	HC	3	1	2	30	20	10	60
	HU	9	3	6	10	5	5	20
Amd	HC	1	0	1	10	5	5	20

	HU	5	1	4	10	5	5	20
Subtotal Wadi		105	16	89	700	415	200	1,315
Total Hadramout								
SUMMARY								
TOTAL (YR,mln)		152	20	132	1,220	685	350	2,255
TOTAL (US\$,mln)					6.10	3.43	1.75	11.28

Notes:

- (a) The costs of treating increased number of patients (include cost of treatment only, YR 10,000/patient/yr for GH, YR 3,000/patient/yr/ HC, and YR1,000/patient/yr/HU). These do not include the cost of caring and the cost of medical personnel attending them. The cost estimation has been made based on consultation with key informants.
- (b) In estimating the cost of medical teams, the salaries of the medical personnel have not been included. These are direct costs for transport, accommodation and food.
- (c) The cost of temporary rental of space and deploying mobile medical units to the most affected districts where hospitals and health centers were totally lost and where there are no nearby health facilities could be readily accessed (YR 1.2 million/fac/yr).
- (d) The cost of providing counseling to persons traumatized by the flood event (5% of population in affected area at YR 10,000/person/yr). And
- (e) The cost of increased surveillance and disease transmitting vector control (a total of YR 100 million).

Infrastructure

Power

Summary²²

Despite the magnitude of the disaster, its impact on the power sector could be considered rather limited, at least when compared to the agriculture or transport sectors. The total value of the damage to the assets owned by the Public Electricity Corporation in urban areas and by local governments in rural areas is assessed at approximately YR 400 million or around US\$ 20 million. The damage is largely confined to the medium and low voltage distribution lines and related transformers located in the coastal areas, while other infrastructure such as grid substations, major transmission lines, and power plants were not directly damaged by the floods.

The main affected areas are Tarim and Sah in Hadramout Wadi, Wadi Saqm and Redat AlMagara in Hadramout Sahel, and Al-Ghayda, Sayhut and hasswin in Al-Mahara, which is the least affected of the three areas. The major items destroyed include about 170 km of medium voltage distribution lines (11kV and 33kV) and 200 km of low voltage distribution lines (400kV and below). About 6,000 sets of meters and service wires connected to households were also damaged, as the floods washed away houses, distribution poles and wires; 62 transformers located in the distribution networks were damaged as well.

Losses for the electricity sector in the flood affected areas include the loss of revenues based on the difference between forecasted demand pre- and post-disaster to reflect the drop in consumption as well as the post-disaster higher production cost to supply service to customers. These losses amount to YR1.2 billion (US\$60 million); of these, 95.6% were in Hadramout and 4.4% in Al-Mahara.

Pre-Disaster Situation

The electricity sector in Yemen: Yemen's Public Electricity Corporation (PEC) and local governments are responsible for providing electricity services, respectively in urban and rural areas. The PEC is a vertically integrated public governmental institution operating all over Yemen in generation, transmission and distribution. The overall generating capacity in 2007 was 1150 MW; its annual generated GWh was 5500 in 2007 and it delivered around 4000 GWh to 1.3 million customers. The PEC has its own generation plants and units and it also buys electricity from private companies which own and operate generation units through a power purchase agreement (known as emergency power rental arrangements). This energy is transmitted through the electricity company network, and the electricity is sold to residential customers at a block

²² The assessment was prepared jointly with Hashim Al-Abbasi (Ministry of Electricity/PEC Al-Mahara), Fouad Waked (PEC, Hadramout Wadi), Abdulkader Basaleh (PEC, Hadramout Sahel), and Jamal Abdulaziz (PEC). Shortly after the floods struck Yemen, the PEC completed a report on flood damages and mobilized efforts to immediately restore service. The reports cover a preliminary estimate of damages in the power sector, a short-term plan to rehabilitate damaged infrastructure, and, in some, long term reconstruction plan for the affected regions. The Wadi Hadramout region reports were the most comprehensive with details on the damages and needs. All three regional reports focused mainly on the PEC network. Information on the rural electrification network was limited. The damage, loss and needs assessment was conducted based on the reports and information gathered from PEC representatives in the three regions and the assessment team site visits and discussions including with the Ministry of Electricity and other key stakeholders.

tariff structure while it is at a fixed tariff for other type of customers. In Yemen, two main grids exist covering the main human settlements along a north-south axis and including Sana'a and Aden governorates and another 8-10 separate grids cover remote areas including the flood affected governorates of Hadramout and Al-Mahara. Local governments provide services only in the distribution sub-sector in rural areas through small Diesel generator units and through an isolated limited distribution network with usually a fixed tariff per kWh. The initial investment in rural electrification is usually done by the PEC, then it is handed to the local government. More recently, local governments have over taken the creation of some rural networks.

The electricity sector in flood affected areas of Hadramout and Al-Mahara: Electrically, Hadramout is divided into two separate networks Hadramout Sahel (Coastal zones) and Hadramout Wadi (the inland valley). Thus, the assessment addresses these two areas and Al-Mahara separately and reports on three areas. For generation, diesel units ranging from 0.4 to 6 MVA are used in power stations, many units are over 20 years old and are derated; thus, the available power is below 80% of the installed power. For transmission, most of the transmission levels are 33KV and 11 KV, except for 18 km of 132 KV transmission lines in Hadramout Sahel, with overhead lines with wooden poles of 14, 11, 9 and 8 meters. The PEC branch of Hadramout Wadi, the most affected area by the floods, has 63,164 customers. It sold 207.3 GWh in 2007, has 4 power stations, 2 owned by the PEC and 2 privately owned by Aggreko, with a total capacity of around 70 MW. The PEC branch of Hadramout Sahel has 79,345 customers in 2008; it sold 406 GWh, it has an installed capacity of 140 MW and an actual capacity of 72.5 MW. Al-Mahara, by far the smallest of the three areas in population, sold 19 GWh in 2007 to 11,250 customers; its generation capacity is about 12.5 MW and it has an actual capacity of 5.5 MW. No private generation exists in Al-Mahara. Information about local generation was hard to get but was estimated based on data available and discussions with officials.

Damage and Loss Assessment

Despite the magnitude of the disaster, its impact on the power sector could be considered rather limited, at least when compared to the agriculture or transport sectors. The total value of the damage to the assets owned by the Public Electricity Corporation in urban areas and by local governments in rural areas is assessed at approximately YR 4,000 million or around US\$ 20 million.

There were no major damages in the generation sector except for a few units in Wadi and Sahel, and in Al-Mahara, one 2.25MW unit was damaged by heavy rains and could be brought back to operation. The bulk of the damages was to the medium and low voltage distribution lines and related transformers located in the coastal areas. Specifically, a large number of 11 KV transmission lines, distribution lines and transformers were swept away by floods. Other infrastructure such as grid substations, major transmission lines, and power plants was not directly damaged by the floods.

The main affected areas in Hadramout El Wadi are Tarim and Sah; in Hadramout Sahel these are Wadi Saqm and Redat AlMagara, and in Mahara—the least affected of the three regions—these are Al-Ghayda, Sayhut and hasswin were affected. About 170 km of medium voltage distribution lines (11kV and 33kV) and 200 km of low voltage distribution lines (400V and below) have been destroyed and need to be replaced. About 6,000 sets of meters and service wires connected to households were also damaged, as the floods washed away houses, distribution poles and wires. In addition, 62 transformers located in the distribution networks were damaged as well. The extent of the damage was highest in Hadramout Wadi with an estimated cost of YR 2,100 million or US\$10.5 million. The total length of transmission lines swept by the flood approaches 150 km.

Tables 2-59 and 2-60 summarize the major items destroyed and the value of the damages, organized by sector (urban versus rural) and Governorate/region.

Table 2-59 Damage caused by the floods in affected regions

	Hadramout Wadi	Hadramout Sahel	Mahara
Generators	3*2 MW	2*2.5 MW	1*2.2MW
33 kV line	100 km	10 km	
11 kV lines	45 km	18 km	5 km
11/0.4 transformers	54	3	5
Wooden poles	3000	1500	
Meters & boxes	5580	1200	N/A

Table 2-60 Damages to electricity sector in the flood-affected areas, million YR

Damage items	Hadramout-Wadi		Hadramout-Sahel		Mahara		Total Damage
	Urban	Rural	Urban	Rural	Urban	Rural	
a) Power plants							
Diesel power generators	0	50	200	90	220	<u>40</u>	600
Other	<u>10</u>		<u>10</u>		<u>4</u>		24
b) Transmission & distribution system							0
Transmission Lines	880	300	220	40	140	<u>20</u>	1,600
Distribution lines	300	150	200	20	120	<u>20</u>	810
Transformers	120	30	70	100	40	<u>40</u>	400
c) Transmission & Distribution grids (Protection, meters, accessories)	150	50	100	20	20	<u>10</u>	350
d) Others (buildings, equipments)	40	<u>10</u>	150	20	<u>10</u>	<u>2</u>	232
Total	1,500	590	950	290	554	<u>132</u>	4,016

Notes: Urban (Public Electricity Corporation); Rural (Rural Electrification)
Underlined figures based on World Bank assessment team estimates

Immediate actions taken by the PEC. Immediately after the flood disaster, the PEC started damage assessment and commenced temporary repair works while shifting its labor force and inventories from the unaffected areas to the affected areas. During the temporary repair works, the PEC gave priority to the recovery of service to households and water supply facilities, street lights, hospitals, and shelters to meet immediate humanitarian needs. In continuing the temporary repair of the distribution lines, the PEC's immediate problem is shortage of capital to purchase necessary materials. The repair required the rerouting of some line around the damaged areas as well as reducing line capacities from two lines to one line in some areas, the fact that October/November and the following few months are a low season in terms of demand has helped in satisfying the demands of most customers. The speed of recovery differs from one region to the other the curves below show how Hadramout Wadi and Sahel are recovering, while the information for Al-Mahara is not available. In addition, information on recovery activities in the rural electrification managed by local governments were not available and are mostly estimated.

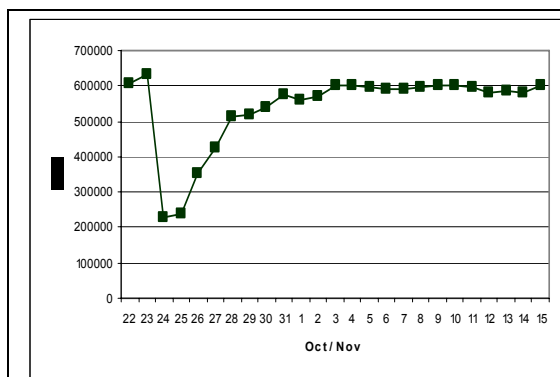


Figure 2-7 Energy recovery in Hadramout Wadi

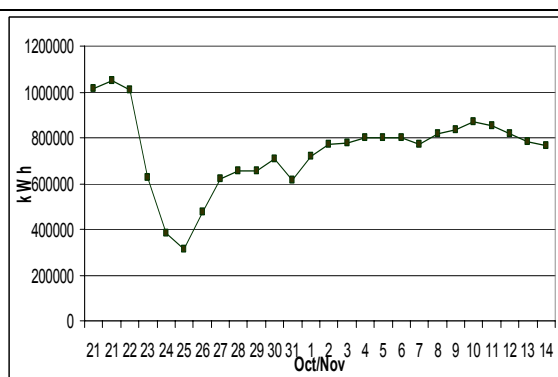


Figure 2-8 Energy recovery in Hadramout Sahel

Losses: losses for the electricity sector in the areas affected by the floods were assessed based on the loss of revenues based on forecasted demand due to drop in consumption as well as the higher production cost to supply service to customers. These losses, detailed in Table 2-61, amount to YR1.2 billion (US\$60 million) of which, 95.6% were in Hadramout and 4.4% in Al-Mahara.

Table 2-61 Losses calculations for the flood affected areas

	Wadi			Sahel			Mahara		
	Res	Other	Rural	Res	Other	Rural	Res	Other	Rural
Estimation of lower revenue for electricity sales per sector									
Forecasted electricity demand, MWh	181,900	39,590	850	374,500	53,500	950	18,725	2,100	90
Post-disaster electricity demand, MWh	163,710	35,631	765	318,325	45,475	807.5	15,000	1,900	70
Decline demand during short recovery, MWh	1,763.18			8,043.555			800		
Total Decline in demand first year, MWh	23,997.18			72,386.055			4,745		
Sales rate in sector, RY/KWh	10	17	25	10	17	18	10	17	25
Average cost of kWh sold (YR)	10.6			10			10		
Estimated losses of revenue, YR *	254,370,108			723,860,550			47,450,000		
Estimation of higher production costs									
Pre-disaster production costs, YR/KWh	15-20								
Post-Disaster production costs, YR/KWh	15.3-20.3								
Increase unit production costs, YR/KWh	0.3								
Estimated losses over recovery period, YR	49,113,000	10,689,300	229,500	95,497,500	13,642,500	242,250	4,500,000	570,000	21,000
Losses due to increase in prod cost	60,031,800			109,382,250			5,091,000		
Total losses for each governorate/area YR	314,401,908			833,242,800			52,541,000		

* Loss of revenues excludes cost of generation

Water Supply and Sanitation

Summary²³

The damages and losses in the water supply and sanitation sector can be considered to be relatively limited compared with other sectors. Prior to the flooding event, adequate and clean water service was available to more than 90% of the population of the affected areas. Preliminary estimates of the overall damage reach about YR6 billion while operational losses at about 721million. Most of the damage appears to have affected the water supply facilities more than the (rather limited) wastewater facilities. The primary impact of the floods on water supply and sanitation facilities was in the urban areas of the coast (Sahel) of Hadramout Governorate, with the Mukalla area showing the largest damages (about YR3.3 billion). These damages have occurred in the main water transmission lines from the well fields in wadi crossings, and to lesser degree within the towns. Significant damage was also observed in the water supply systems in the rural areas of the Hadramout Wadi (about YR0.78 billion). The damage in urban areas consists of some 30km of pipes washed away or broken (with pipes of 700 mm of diameter to 2 in), 4 wells destroyed, many electric lines dislocated from the well fields. In wastewater, the damage affected 4 lifting stations, hundreds of manholes and sewers lines damaged by overflowing with mud-carrying floodwaters. In rural areas, the floods have destroyed some 200 km of water supply pipes and at least 9 wells and attached facilities. Most of the damaged systems have been repaired – albeit on a temporary basis - except where entire neighborhoods or villages have been destroyed and its populations have moved elsewhere. However, most of these repairs will need to be redone in more permanent basis with additional measures to avoid a repeat of these damages in the future.

Pre-Disaster Situation

Urban water supply and Sanitation. The water supply in the larger towns of Hadramout (Hadramout Wadi and Hadramout Sahel) is provided by two autonomous utilities (the Mukalla Water Supply and Wastewater Corporation Local Corporation—MWWLC—and the Seiyun Water Supply and Sanitation Local Corporation). In Al-Mahara governorate, urban water supply and sanitation is the responsibility of the National Water and Sanitation Authority (NWSA). In all cities, the water supply systems consisted of wells, transmission lines, reservoirs, and underground distribution network. Water coverage in most urban centers in the affected areas was quite extensive (over 90% connection rate) with about 65,000 house connections in the MWWLC and about 38,000 connections in the Seiyun Local Corporation (LCs) areas (see Table below). In Al-Mahara Governorate, the urban water supply connections are estimated to be around 5,000 connections. Both LCs in Hadramout had relatively good operational performance with

²³ This assessment was done in cooperation with the water and wastewater local corporations in Mukalla and Seiyun and representatives of the rural water agency (GARWSP) in the affected areas. Participants are Awad Ghanzal and Mohamed Hassan Al-Kaf (Mukalla Local Water and Wastewater Corporation), Mohamed Al-Saqqaf (Seiyun Local Water and Wastewater Corporation) and Abdulkader Hanash (Ministry of Water and Environment, Sana'a, covering Al-Mahara). Information was gathered from the Mukalla and Seiyun Water and wastewater Local Corporations and the National Water and Sewerage Authority (for Al-Mahara) and the local offices of the General Authority for Water and Sanitation Projects. Information available on rural water supply was somewhat limited, especially the physical damages and impacts of the floods on a number of distant villages (about a quarter of the rural systems). The assessment team conducted site visits to assess damages in Mukalla, Ghail Bawazir, Seiyun, Tarim, and Sah areas.

unaccounted for water at around 28%. Water consumption in both LCs was estimated at 80 liters per capita per day in 2006 and the collection rate well above 80% in all branches.

Table 2-62 Urban Water Supply Pre-Disaster Performance Indicators

Local Corporation	Sahel Mukalla (*)	Wadi				
		Seiyun	Shibam	Qatn	Tarim	Sah
Annual Revenues	1,430 million	20 million	6 million	7 million	10 million	1.4 million
Num connections	65,000	15,000	6,800	6,700	9,400	1,100
Collection Rate	96%	98%	80%	80%	98%	NA

(*) Mukalla LC includes some 24000 wastewater connections.

Rural Water Supply. In both Governorates, the responsibility for rural water supply rests with the General Authority for Rural Water Supply and Sanitation Projects (GARWSP). There are also many large multi-village systems built by charitable organizations (see Box). The management of all these water systems is entrusted to water user associations formed by the local beneficiaries, which operate the systems and collect fees from the customers. Water tariffs in rural water systems range between YR 100-180 per m³ (higher than tariffs in urban utilities).

Wastewater. Among the affected areas, limited wastewater collection service existed in Mukalla with a new system under construction in Ghail Bawazir and the extension of the Mukalla network (under a current World Bank credit, 3700-YEM). The wastewater system is also the responsibility of the LCs. The number of wastewater connections in the MWWLC was about 24,000 connections while in Seiyun LC it was estimated to be at less than 400 connections. Wastewater in Mukalla and elsewhere is not treated at the present - and discharged to the sea through a 1 km sea outfall (a new treatment plant is currently under construction – expected to be completed in early 2009). The urban residents who are not connected to a collection network commonly use cesspits.

Damage and Loss Assessment

Overall, the damage in the water and sanitation sector is relatively smaller than in their sectors. The damage and losses to this sector are summarized in Table 2-63. More than 85% of the damage appears to be in urban areas. Given the low level of wastewater coverage, the damage to wastewater facilities is estimated at YR 1,414 million (US\$7.07 million), which represents about 24% of the total damages. For water supply, the damages in the urban areas are 3.5 times the damages in the rural areas. Total losses, estimated at YR721 million (US\$3.6 million), were mostly present in the urban water sub-sector. The losses were estimated for each town and village over the baseline, taking into account the length of time water was interrupted; the losses also include the costs of temporary water supplied by tankers, the cost of additional disinfection, emergency power to pump water (where power lines were destroyed, additional cost for laborers and reduced revenues.

Table 2-63 Damage and Losses in the Water Supply and Sanitation Sector

Sector	Damage	Loss	Total	Total
	Riyal millions			US\$ millions
Rural	1,059	66	1,125	5.63
Urban Water	3,559	612	4,171	20.86
Urban Wastewater	1,414	43	1,414	7.07
Total	6,033	721	6,710	33.55

Urban Water Supply.²⁴ Most urban centers suffered from the interruption of the water supply for at least one week because of the breakage of the transmission lines crossing wadis. The short term aim of the local institutions was to reestablish damaged drinking water supply systems and to carry out health protection measures (disinfection of the wells and distribution of UNICEF-provided chorine tables to affected households in the rural areas). Most of the systems that were repaired in the immediate aftermath of the floods need to be re-constructed and upgraded. The major damages happened in the coastal cities with an estimated amount of YR 3,323 million (US\$16.61 million), with losses at about YR574 million (US\$2.87 million).

In MWWLC, three wells are reportedly damaged, and six transmission pipe bridges have collapsed, disrupting the supply for over 50% of the Mukalla residents. As an interim measure, households in affected areas have reverted to communal use of water and the LC has provided water through tankers. The LCs in the affected areas is likely to have experienced an increase in their operational and maintenance expenses due to immediate repair work.

The impact of the floods has been minimized due to the efficient response of the LCs. Emergency repairs to continue the provision of service to affected people appear to have been managed rather effectively. The LCs used materials available to them in the stores to do the emergency repairs and in the case of Mukalla LC, some pipes were imported from neighboring Saudi Arabia within 10 days of the event.

In Hadramout Wadi, the most affected towns were Tarim and Sah with some parts of town completely devastated to the point that the LC will not consider re-building the network in those locations as the Government is planning to move these households to other locations. In Al-Mahara, the damages were considered much lower than the other regions.

Table 2-64 Damages and Losses in Water Supply in urban Areas- by region (YR million)

Water Supply			Damages	Losses
	Urban	Hadramout Wadi	196	38
		Hadramout Coast	3,323	574
		Al-Mahara	40	NA
		Total	3,559	612

²⁴ Assumptions related to the damage in the urban areas: Data on existing assets (capacity of production unit, pipe network) are incomplete. Unit costs are based on information provided by LCs and complemented by assumptions and comparisons made by the assessment team. Assumptions related to the losses: It is assumed that one-month revenue was lost to the LC; revenues would return to pre-floods level after 1 month. The losses also include the amount of water lost due to breakage of transmission lines (costed at about YR 60 per m3 based on volumes estimated by LCs), the cost of additional labor and heavy equipment used for repairs, additional disinfection costs (network and wells).

Rural Areas.²⁵ While it was not possible to assess damage to all rural water supplies in detail since information to damage in some districts was not available – as the rural water agencies had not completed the survey of all their systems, the assessment team was able to estimate the overall damage and losses from a sample from the information presented by the local agencies and visits to a limited number of locations. A visit to Wadi Ain provided a measure of the devastation in the rural areas (see Box below for a brief description of the pre and post disaster).

Box 2-2 Rural water System in Wadi Ain – Hadramout Wadi

The water system in Wadi Ain was built with charitable donation some 5 years ago. It consisted of a spring catchment (with 25 l/sec discharge) and two transmission lines (15 and 26 km), two main reservoirs (1000m³ capacity each) and distribution network to 38 villages for some 12,000 people. As a result of the floods, the two main transmission lines (passing in the wadi) were swept away leaving the villages without water. Before the floods, the per capita consumption was about 5 m³ for every two months. The tariff for each m³ was YR20 for a consumption of less than 5m³ and YR100 for over this lifeline consumption. The system is managed by a water user association of 9 members and a staff of 9 people. Fortunately, the General Authority for Water and Sanitation Projects had dug a well of 250 m depth (7 l/sec) some 6 months ago which could be put to emergency use. The pump consumes 100 liter of diesel per day and water is delivered to the villages one day in three. The replacement cost of the 41 km pipe (4 in diameter) is estimated at YR63 million (assuming about YR1500 per m)

The supply of piped water in the affected rural areas was disrupted for a couple of weeks (and sometimes longer) mainly due to breakage of main transmission lines from wells, distribution networks and also from electricity outages, as water is sourced from deep wells by pumping. Some ten pumps and wells were damaged by the floods in the rural areas. Quick repair work was undertaken to maintain some level of water supply. Temporary repair has now been largely completed.

Table 2-65 Rural Water Supply: Existing systems and damaged infrastructure

Area	Population	No. of Systems	No. of Wells damaged	No. of Pumps damaged	Length of pipes damaged	No. of pump house damaged
Hadramout Sahel	71,900	28	7	5	60 km	5
Hadramout Wadi	15,500	45 (186 villages)	2 (out of 69 wells)	8	142 km	8
Al-Mahara		9	0	0	3	0

The damages and losses in the rural areas are highest in Hadramout wadi area at YR775 million (US\$ 3.86 million) and YR49 million (US\$0.25 million) respectively. The information from Al-Mahara is relatively limited. As mentioned earlier, the rural areas have not been completely

²⁵ Assumptions related to Rural Water Supply: Cost of cesspits and pit latrines in urban and rural areas have been accounted separately under the housing analysis and are not included in this assessment.

surveyed as many villages are in remote areas and staff of GARWSP had not been able to reach them.

Table 2-66 Damages and Losses in Water Supply in rural areas- by region (YR million)

Water Supply			Damages	Losses
	Rural	Hadramout Wadi	775	49
		Hadramout Coast	252	17
		Mahara	32	
		Total	1,059	66

*Wastewater.*²⁶ There is no significant coverage of sewerage in the affected areas (except in Mukalla and parts of Sheheir and Ghail Bawazir). In the other areas, sanitation was provided by on-site systems (cesspits and latrines). Damage to these facilities is comparable to the destruction and partial damage of building. The damages on on-site sanitation facilities were estimated as part of the housing damage assessment. Damage to sanitation facilities and infrastructure was most significant in Mukalla and to a lesser extent in the other coastal cities.

In MWWLC, three wells are reportedly damaged, and six transmission pipe bridges have collapsed, disrupting the supply for over 50% of the Mukalla residents. As an interim measure, households in affected areas have reverted to communal use of water and the LC has provided water through tankers. The LCs in the affected areas is likely to have experienced an increase in their operational and maintenance expenses due to immediate repair work.

Table 2-67 summarizes the damages and losses to the water and wastewater sectors, divided by urban versus rural and by Governorate and region.

²⁶ Urban sanitation: Information on damage to urban sanitation is limited. Damage assessment for urban sanitation in Mukalla is limited to information received from the MWWLC on damage to segments of the existing networks (including house connections, manholes and mains). Cost for sanitation (cesspits) in urban areas is covered under housing. Unit costs are based on assumptions made by the water and sanitation assessment team based on information received from local authorities.

Table 2-67 Damages and losses to the water and wastewater sector

			Damages (million YR)	Losses (million YR)
Water Supply	Urban areas	Hadramout Wadi		
		Shibam	15.4	9.6
		Al-Qatn	33.6	7.5
		Tarim	86.9	4.3
		Seiyun	2.1	3.9
		Sah	58.3	12.4
		Sub-Total Wadi	196.2	37.7
		Hadramout Sahel		
		Mukalla	1,236.1	473.2
		Other coastal cities	2,088.0	102.0
		Sub-Total Sahel	3,323.7	575.2
		Al-Mahara	40.0	
	Rural areas	Hadramout Wadi	775.6	48.8
Hadramout Sahel		252.2	17.3	
Al-Mahara		31.9	NA	
Wastewater	Urban Areas	Hadramout Sahel		
		Mukalla	940.0	
		Other coastal cities	474.0	
		Sub-total Sahel	1,414.0	
Water Wastewater		Hadramout Wadi	971.8	86.5
		Hadramout Sahel	4,989.8	592.5
		Al-Mahara	71.9	0
		Total	6,033.5	679.0

Transport

Summary²⁷

The total damages to the roads sub-sector are estimated at YR 11,658 million (US\$58.3 million), which comprise regional, urban and rural roads. The damages to regional roads are estimated at YR 8,622 million (US\$43.11 million), which consist of damages of YR 7,881 (US\$39.4 million) in Hadramout and YR 741 million (US\$3.7 million) in Al-Mahara. The damages to urban roads are estimated at YR 1,982 million (US\$ 9.99 million), while the damages to rural roads are estimated at YR 1,054 million (US\$ 5.03 million) and are spread throughout the affected areas. Damages to the road transport sector (motor vehicles), based on reports received, are estimated at YR 255.65 million (US\$ 1.28 million). In terms of seaports, only the Port of Nishtun reported damages to buildings, the quayside, the light house and equipment, amounting to a total of YR 85.5 million (US\$ 0.42 million). No damages were reported in airports. As such, the total damages reported to the transport sector amount to YR11,999.15 (US\$60 million).

The losses in the road sector accrue mainly to the road users in the form of higher vehicle operating costs (operation losses) and delay costs (time losses) in the time period until road services have been restored to the pre-disaster level, as well as the losses to the Government to restore the functioning of roads on a temporary basis (restoration losses) until reconstruction efforts are completed. Losses due to higher vehicle operation cost were estimated at YR3,873 million (US\$19.365 million), while losses of time were estimated at YR 279 million (US\$1.395 million). Losses to the Ministry of Public Works and Highways (MOPWH)'s General Corporation for Roads and Bridges (GCRB) and the different branch offices to restore, on an emergency basis, the traffic were estimated at YR 173 million (US\$0.865 million). As such, the total losses were estimated at YR 4,325 million (US\$21.625 million).

Pre-Disaster Situation

Roles and Responsibilities in the Road Sector: Over the past 20 years the Yemen road sector has created a large network of modern paved roads linking main cities and Governorates. This paved network has grown from only about 4,500 km before the unification to about 12,500 km in 2008, almost a tripling of the network size. Few countries have been able to achieve similar growth. Major achievements have also taken place in the urban areas where most large cities now have an extended paved road network. In addition, recently major upgrading has taken place in larger municipalities by widening the entry roads from two lanes to six or more lanes over large distances dramatically increasing the size of the paved areas without the paved network length

²⁷ This assessment was based on reports prepared by the Ministry of Public Works and Highways (MOPWH) for the regional roads and by the Governorates of Hadramout and Al-Mahara including Departments of Technical Affairs for Hadramout Sahel, Deputy Governor for Wadi Affairs, Public Works and Highways branch offices, and District Local Councils. The assessment was jointly undertaken with the following GOY officials: Abdel-Wahab Al-Hakem, Deputy Minister for Public Works and Highways; Ahmed Al-Junaid, Deputy Governor for Hadramout Wadi Affairs; Fahd Al-Minhaly, Deputy Governor for Technical Affairs, Hadramout Sahel; Taha Al-Mihbashi, MOPWH; Mubarak Motaafi, Director of Public Works and Highways branch, Hadramout Sahel; Alwi Akeel, Director, MOPWH Hadramout Wadi; Hamoud, Director, General Corporation for Roads and Bridges, Hadramout Sahel; Abdalla Al-Sharafi, MOPWH, Hadramout; Hassan Hamed, Director of Roads, MOPWH, Hadramout Sahel; and Mohamed Al-Amoudy, Directorate of Technical Affairs, Hadramout Sahel.

increasing. These changes have had a major impact on the population and the economy of Yemen, improving connectivity and communications between centers of activity, reducing road transport costs and promoting internal and external trade and public transport.

The organization of the road sector and its main institutions has also radically changed in the past decades. After moving from the Ministry of Transport to the Ministry of Construction the road sector is now firmly embedded in the Ministry of Public Works and Highways (MOPWH), which has gradually taken firm control of the sector and is responsible for all aspects of road sector management including expenditure programs for maintenance and development. A Road Maintenance Fund and Rural Access Program have also been established and developed under MOPWH, showing adaptation to the changes and needs in the sector. In addition, private road construction and maintenance companies and engineering firms have developed over the last decade.

The MOPWH besides being responsible for the highways, is also responsible for all rural roads, and to a large extent the ministry is also responsible for implementation of paved roads in urban areas as well as urban planning (exceptions are the major cities such as Sana'a and Aden). The Minister has delegated most operational matters for the roads, the public works, and the housing and urban planning sectors to his First Deputy Minister while retaining direct responsibility for the General Corporation for Roads and Bridges (GCRB) as Chairman (the main road construction parastatal), the Road Maintenance Fund (set up to be responsible for financing and implementing all road maintenance activities in the road sector including emergency maintenance) and the Rural Access Program (supported by multilateral and bilateral donors) for fast track development of rural accessibility.

MOPWH has four large directorates: (i) Administration and Finance; (ii) Housing and Urban Planning; (iii) Public Works; and (iv) Roads. The Roads Directorate is mainly responsible for new construction projects that are 100% locally funded. Project implementing units (PIUs) have been established and are responsible for foreign funded investments under the Ministry.

As is apparent from the above, the responsibilities for the road sector are somewhat fragmented but the sector seems to be functioning well. The use of PIU's and the establishment of a Road Maintenance Fund have improved implementation performance considerably and been a key factor in marshalling foreign financial support. The technical and other staffs of these units are better paid than what the regular civil service pay scale can offer, and are subject to frequent follow up by donors. This leads to better performance and shorter project implementation periods.

Condition of the Road Network: As of 2007, Yemen had about 84,000 km of roads of which 12,500 km, or about 15%, were paved. Of this extensive road network, the unpaved roads are essentially tracks, trails and earth roads in a very poor condition, allowing travel only under exhausting conditions at extremely low speeds and high vehicle operating costs (VOC). These roads, parts of which are often not passable in case of rain, do not provide reliable access to services and markets to the rural population. However, a sizable part of these roads are included in long term, poorly budgeted, upgrading projects and are slowly being widened and paved. The better performing projects have foreign funding support and implemented under the Rural Access Program. Table 2-70 summarizes the status of the network.

Table 2-70 Status of the Road Network

Road Type	Existing Network	Under Construction	Total
International	3,000	300	3,300
Main	3,000	1,600	4,600
Secondary	5,700	9,300	15,000
Rural	800	500	1,300
Total	12,500	11,700	24,200
Other earth roads	60,000	0	60,000
Total	72,500	11,700	84,200

The size of Yemen's paved road network is now at about the level that could be expected given the country's level of economic development. If one compares the density of paved roads per capita with the national income per capita for about one hundred countries, Yemen comes out to be slightly above average. This is the result of the rapid pace of road construction in the past decade, which has allowed Yemen to catch up with the average.

There are major geographical variations in paved road density as is the case in most countries. In terms of road density per population, probably the most significant figure, East Yemen has about 10 times the road density of West Yemen. Given the commonly acknowledged contribution of roads and access to economic and social development, this explains to some extent the fact that poverty is to a large degree concentrated in the Western Governorates. However, in terms of road density per 1,000 square km, Hadramout, Al-Mahara and Al Jawf are the bottom three governorates in Yemen, explaining also the extent of uninhabitable areas in these three governorates and the concentration of population along wadis.

The two affected Governorates of Hadramout and Al-Mahara have a high density of paved roads per 1,000 population. Al-Mahara has, by far, the highest road density in Yemen, with 9.6km per 1,000 population, with its paved road network amounting to 975.4 km. Hadramout has the third highest paved road density with 2km per 1,000 population, with a total network of 2,301.825 km—the longest of any Governorate in Yemen (See Table 2-71).

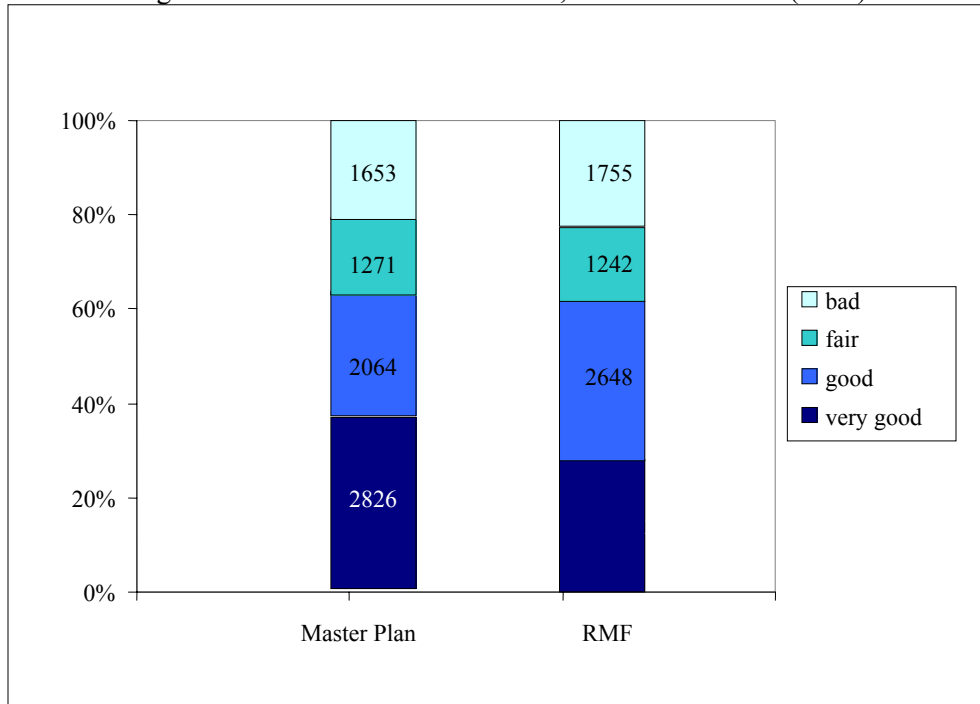
Table 2-71 Paved road network and road density by Governorate

Governorate	Length of paved roads (2007)	Road density (km per ,000s population)
Sana'a Municipality & Governorate	1,845.25	0.6
Aden	191	0.3
Hadramout	2,301.85	2.0
Taiz	770.825	0.3
Ibb	602.2	0.3
Hodeidah	807.3	0.3
Dhamar	516.6	0.4
Al-Baida	501.2	0.8
Shabwa	686.2	1.4
Hajja	379.5	0.2
Amran	397.1	0.4
Lahj	446.5	0.6
Abyan	629.4	1.4
Saada	675.7	0.9
Al-Dhali	65.42	0.1
Al-Mahweet	244.9	0.5
Mareb	655.4	2.5
Al-Mahara	975.4	9.6
Al-Jouf	179.4	0.4
Raima	185.7	0.4
Total Yemen	13,056.845	0.6

Source: Ministry of Public Works and Highways

With about 62% of all paved roads in good or very good condition, Yemen's paved road network is in better condition than in most comparator countries for which condition data are available. This is mainly the result of the young age of many Yemeni roads. In most other countries, the network is suffering from old age and inadequate maintenance. This is a fate that unfortunately awaits Yemen's network if maintenance expenditures are not stepped up.

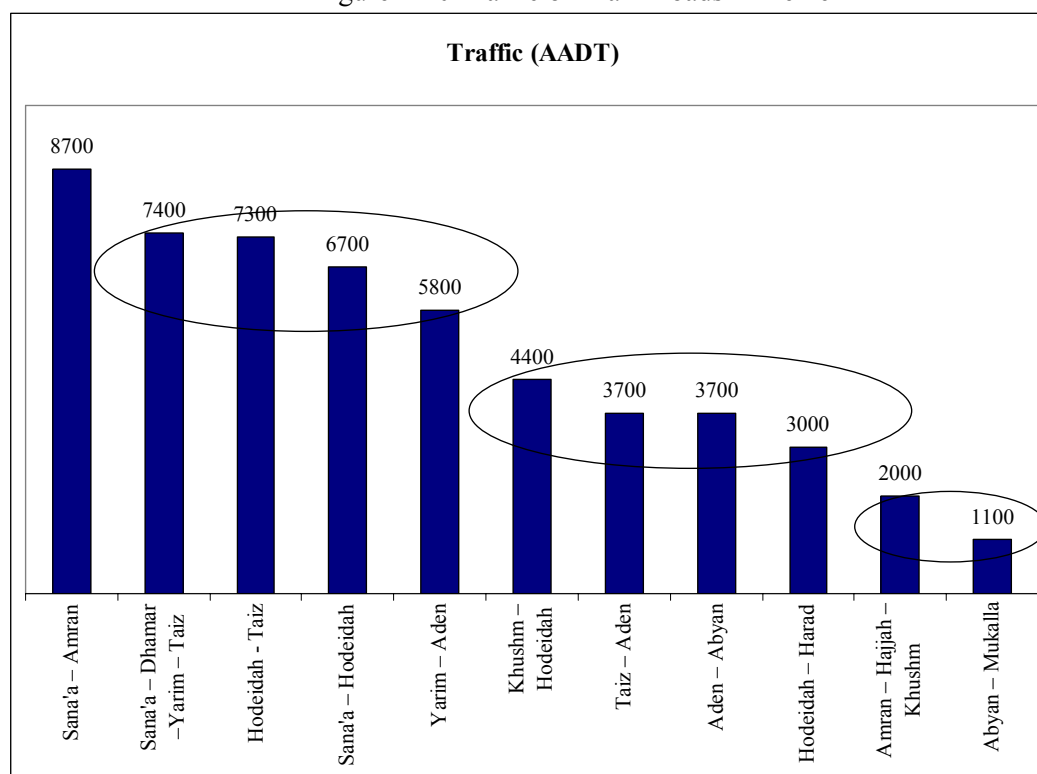
Figure 2-9 Road Network Condition, Different Sources (2007)



Vehicle Fleet: With about 27 vehicles (private cars and commercial vehicles) per 1000 inhabitants, Yemen has a larger vehicle fleet in relation to its total population than comparable countries. It is also significant that, in relative terms, Yemen’s vehicle fleet is almost two thirds of the fleet of Egypt, despite Egypt’s much higher per capita income. This is the sign of a relatively high demand for road transport, which agree with the substantial traffic flows on major transport corridors. Yemen’s vehicle fleet seems, however, to be growing only slowly. The total fleet was about 572,000 vehicles in 2007 compared to about 315,000 in 1985 and 510,000 in 1995. This represents an average growth of about 2.7% on the long term and only about 1% in the past twelve years, somewhat consistent with the slower GDP per capita growth in the recent past. It should be noted, however, that there are wide discrepancies in data mainly because of inadequate procedures for removing vehicles from the registry when scrapped.

Average traffic exceeds 5000 vehicle/day on many of the primary roads in Yemen’s highly populated western area. This traffic level is substantial in absolute terms and justifies that road network quality be a constant concern given the difficult terrain and congestion levels. This calls for a careful appreciation of network density and capacity. In the east of Yemen, however, except for the Hadramout valley and the road links out of Mukalla, annual average daily traffic (AADT) is rarely above 1000 vehicle/day.

Figure 2-10 Traffic on main Roads in Yemen



Expenditures in the Road Sector: Annual budget expenditures on the road sector are around 1.6% of GDP, which is on the high side as most countries in the world spend 1% of GDP or less on road expenditures. Also when compared to countries in the Middle East and North Africa, Yemen spends more on roads per capita and as a percentage of GDP than Egypt, Algeria and Morocco. It is uncertain but likely that there is an imbalance in allocations of expenditures among primary, secondary, and tertiary roads and that in particular the allocations for wide high standard entry roads to towns and cities need to change to be economically optimal.

However, the allocation of funds to road maintenance is insufficient, as with only about US\$ 25 million spent on road maintenance in 2007, Yemen fares badly compared to other countries, especially when maintenance expenditures are expressed as a share of total expenditures. Yemen spends probably less than a quarter of what it should spend on emergency, routine and periodic maintenance to keep its paved network in satisfactory condition and critical remaining rural (and urban) earth roads passable at all times.

Other Emergency Related Sector Issues: A key strength of the current organizational set-up is that all intercity roads, whether national highways, secondary or governorate roads and tertiary (rural access roads) are administered by the same road organization (MOPWH) allowing economies of scale, efficient use of scarce human resources, consistent technical standards, and optimal allocation of available funding for maintenance and investments between categories of roads. On the other hand, MOPWH is also involved in urban roads development as the main arteries within urban areas and urban bypass roads are managed and implemented by MOPWH under the road budget. This causes local pressures on MOPWH to use higher road standards (6 lanes plus multilane service roads on either side in many cases) as the costs for these standards and subsequent maintenance expenditures are not shouldered by the governorate or district development budgets.

MOPWH and the RMF have also the flexibility of using a public corporation (GCRB) for road related works. This is very useful in areas of the country where private contractors are not interested in undertaking road works or where such works undertaken by the private sector is very costly due to remoteness and related concerns. The use of GCRB's services in cases of emergencies is also a necessity in most cases where there is little or no time for transparent competitive bidding and road damages cause connectivity problems or traffic safety concerns. The current annual framework agreement between RMF and GCRB for routine and emergency road maintenance allows GCRB to either deploy staff and equipment or subcontract emergency works efficiently, provided that RMF quality assurance arrangements are adequate.

However, GCRB remains administratively dependent on MOPWH as the Minister of Public Works and Highways by law is also the Chairman of GCRB. GCRB receives no financial support from the Government, although its vast network of road camps and sole sourced contracts from the Government constitute an implicit subsidy. Eighty percent of the profit as well as taxes are turned over to the Ministry of Finance, which does not provide much incentive for commercial operation. Steps are being taken to review GCRB's role and the possible establishment of one or more commercial road corporations more independent of the Government with managerial and financial autonomy.

This, of course, would not preclude the continuation of direct award of emergency and regular maintenance works to GCRB, under good quality assurance arrangements. In the case of this emergency, consideration should be given to the use of GCRB or other public corporations to start addressing critical repairs of safety concern to road users for retroactive financing by the RMF and/or donors.

Damage and Loss Assessment

Damages:

Each physical damage on paved regional and rural roads, Irish crossings and bridges has been recorded in a spreadsheet, part of which is attached in Annex 1-A to show level of detail of the recorded damages. The data presented are based on an assessment by MOPWH and District officials and the Mission only reviewed a sample of the key damages through a field trip to the major roads affected. MOPWH staff should be given credit for compiling extensive damage data with a costing based on estimation of quantities needed for repairs and prevailing contract rates in the area. Also other information received from technical staff in the District administrations was very useful in assessing damage and losses in monetary terms. Below is a summary cost table with clarifications to the way the data have been compiled and presented.

Damages to Roads: The damages on the regional road network can be classified in six types:

1. Washout/erosion of one or both sides of the road caused by inadequate slope protection structures. In some cases the whole road has been damaged and traffic rerouted;
2. Damages to and blockages of single or multi-cell box culverts and pipe culverts causing consequential local damages to the road;
3. Part or full damage to Irish crossings (cement concrete drifts across the river bed);
4. Damages to bridges and bridge abutments;
5. Minor damages to road pavement and shoulders due to soaking of the pavement and subsequent loss of load bearing capacity requiring asphalt patching and shoulder rehabilitation; and,
6. Damages and blockages of roads due to rock fall and slides caused by extensive rain. Such damages may have caused subsequent damages to road pavements and side drains.

On longer road sections damaged during the storm one will find that several of the above types of damages are present in succession. The inspections of damages also revealed that on several damaged road sections poor construction and or design have contributed to the extent of damages. The presence of effective debris traps upstream could have prevented or significantly reduced clogging of culvert and road damages.

Table 2-72 below provides more details as to the location of road damages by road corridor, the overall value of damages and additional needs (over and above those to restore the damages). The damages to regional roads are estimated at YR 8,622 million (US\$43.11 million). These include damages of YR 7,881 (US\$39.4 million) in Hadramout and YR 741 million (US\$3.7 million) in Al-Mahara.

The damages to rural roads are estimated at YR 1,054 million (US\$ 5.03 million). The reported lengths of damages are extensive (1,500km) and the damages are spread all over the Sahel and in the Wadi area. In the absence of field visits to the damaged rural roads due to the limited timeframe of the assessment, it is believed that the damages are localized and quite frequent but not continuous on the full lengths reported by the authorities. The damages have caused a general reduction in mobility and accessibility and increased travel time, mainly because of heavy rain and not so much because of the flood. The rain has caused rock fall and slides and washed out any remaining gravel on the sub-grade.

The damages to urban roads are estimated at YR 1,982 million (US\$ 9.99 million).

Table 2-72 Details of Damages, Losses and Needs in the Road Sector

Sources: MOPWH, GCRB, District and Governorate officials

Damages to Road Transport: The owners of motor vehicles have also reported damages as the flood washed away vehicles or flooded the engine and passenger compartments causing full or partial damage. The reports received from the governorates are also included in Table 2-73 and totals YR 255.65 million or US\$ 1.28 million, which means an average loss per vehicle of almost YR 100,000 or US\$5,000. This seems high, but quite a lot of trucks were included in the number of vehicles reported lost and could explain this.

Table 2-73 Damages to Vehicle Fleets

	Damaged Vehicles	Costs [YR million]
Al-Mahara	21	10.65
Hadramout Al Sahel	145	145
Hadramout Al Wadi	100	100
Total	266	255.65

Damages to the Seaport Sub-Sector.: Only the port of Nishtun in Al-Mahara reported suffering damages to buildings (YR 25m), the quayside (YR50m), light house (YR10m) and equipment (YR0.5m). The total is YR 85.5 million or US\$ 0.42 million.

Damages to the Airport Sub-Sector.: No airports in the affected areas reported damages as a result of the floods. In the days after the floods, the functionality of the Mukalla (Riyan) and

Seiyun airports proved to be a critical factor in enabling emergency assistance to reach the affected population.

Table 2-74 below provides a summary of the damages in the transport sector, additional proposed needs and the costs of opening all blocked roads for traffic after the storm. The damage costs to roads are on the order of US\$ 58 million, while possible upgrading of the road network through the provision of more bridges and realignments of roads to reduce vulnerability in the future could cost another US\$ 50+ million of which about US\$14 million would be related to the Riyan – Hadramout road and other roads in the Hadramout Al Wadi. However, such additional investments should be subject to scrutiny and possibly also feasibility and preliminary engineering studies to determine if the additional investments are technically and economically justified.

Table 2-74 Summary of Damages, Losses and Needs in the Transport Sector

Category	Extent of damages [m]	Damage Costs [US\$ million]	Possible Add. Needs [US\$ mill.]
Regional Roads	59,174	43.00	53.05
Urban Roads	36,112	10.00	
Rural Roads	N/A	5.30	0.55
Total Roads	Min. 95,286 m	58.30	53.60
Vehicle Fleet	266 vehicles	1.28	
Port of Nishtun	Infrastructure	0.42	
TOTAL Transport		US\$60.0 m	US\$53.60 m

Sources: MOPWH, GCRB, Port Authority, District and Governorate officials

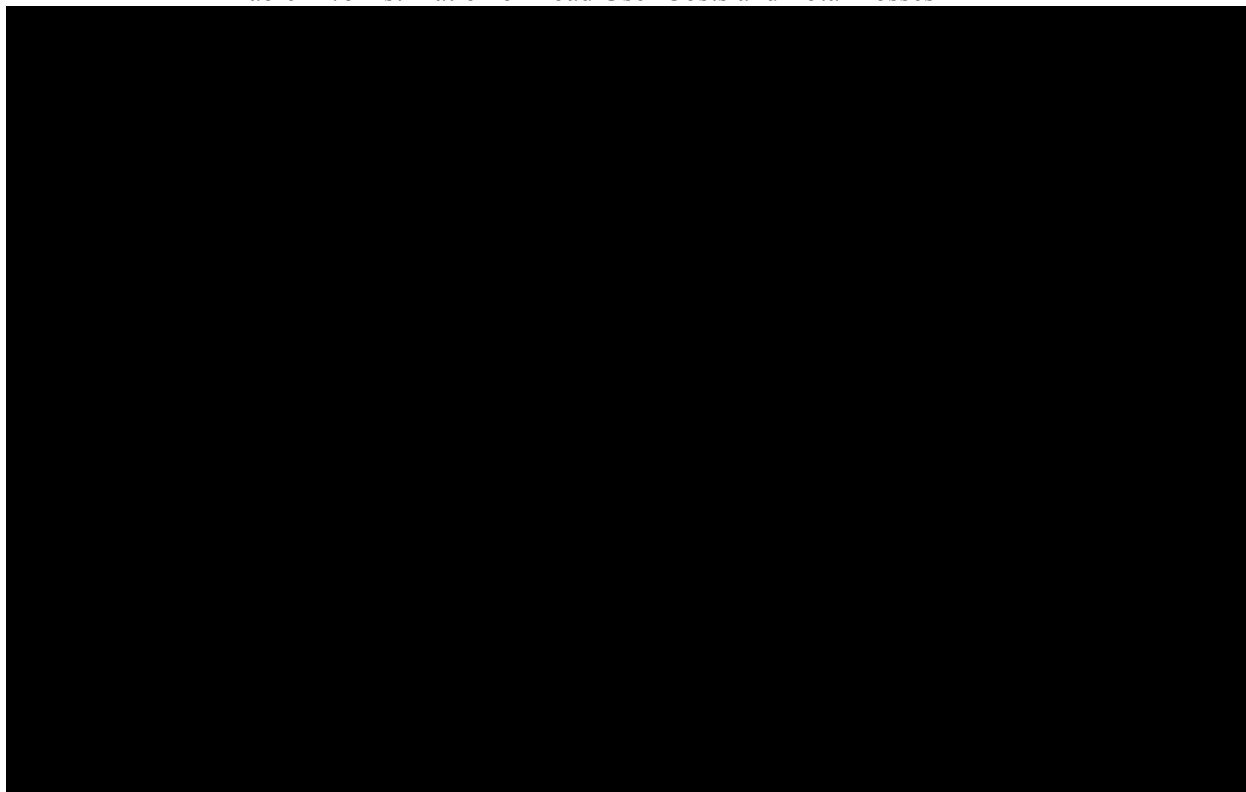
Losses:

The losses in the road sector accrue mainly to the road users in the form of higher vehicle operating costs (operation losses) and delay costs (time losses) in the time period until road services have been restored to the pre-disaster level. This can take a long time as proper designs are required before tender documents are prepared. Then the repair works are tender and contract(s) awarded before contractors can mobilize. Given the experience with the tendering process in Yemen, it is safe to assume that the current temporary passages and detour roads will have to serve the traffic for a minimum of 18 months possibly 36 months before all damages have been repaired to a satisfactory standard. In addition, there are the losses accrued due to the Government’s expenditures to restore traffic on the affected roads on an emergency basis, usually through detours, until the reconstruction efforts are completed.

The average annual daily traffic (AADT)²⁸ on the key road links in the network have been estimated based on various studies in the area undertaken by international consultants (Dar Al Handasah for Mukalla Master Plan and Africon for the Mukalla to Seiyun highway maintenance study). GCRB and local MOPWH offices have assisted in providing traffic data on links not covered by studies. Table 2-75 has the average AADT for each road link and the length of detour roads and affected road lengths where road roughness has increased as a result of the storm. The AADT has been split into various vehicle categories (cars, utility vehicles, buses and trucks) based on experience and classified traffic counts from road feasibility studies in Yemen.

²⁸ Annual Average Daily Traffic (AADT), the total volume of vehicle traffic in both directions of a highway or road for a year divided by 365 days; is a useful and simple measurement of how busy a road is.

Table 2-75 Estimation of Road User Costs and Total Losses



Sources: MOPWH, GCRB, District and Governorate officials

Losses calculated using the Roads Economic Decision Model (RED) by the World Bank (see Annex 1-C).

Annex 1-B has a table with other basic characteristics and economic costs related to the road vehicle fleet in Yemen. These parameters were used in computing the average vehicle operating cost (VOC) for the pre-disaster situation as well as for the current conditions where long sections have high road roughness causing increased fuel consumption, wear and tear on the vehicles and slower vehicle speeds. The various detour roads and sections of roads with temporary gravel surfacing on key highways affected by the flood have been given an average road roughness as for gravel roads with poor standards. This is because of the lack of regular maintenance of gravel and earth roads. The classified traffic (see Annex 1-C for details) and a road roughness index²⁹ of 3 were used for the pre-disaster situation (paved road in good condition) and an index of 12 was used for the current road condition comparable to a poor (rough) rural road. The above assumptions compares well with data used in pre-feasibility studies for rural roads in Yemen.

Road users are currently also suffering time losses as the average travel speed across damaged roads is slow. In many places the road is following the river bed at a speed of no more than 10 km/h. An average of 20 km/h was used for the current condition on the 51.5 km of damaged sections, a travel time of about 2 hours and 34 minutes compared to 51.5 minutes for an average speed of 60 km per hour, a total delay of $154 - 51.5 = 1$ hour 42.5 minutes per vehicle. With an average AADT of 2000 vehicles and two years (750 days) before restoration of services, road user would suffer delays of about $1,500,000 * 100 = 150$ million minutes or 2.5 million hours per vehicle. With an average occupancy of 2 per vehicle including driver, time cost of 25 cents an

²⁹ International Roughness Index (IRI), measures the “bumpiness” of a road—the total anticipated vertical movement a vehicle would experience over a given stretch of road, usually expressed in meters/kilometer; the lower the value, the smoother the ride.

hour (Annex 1-B) the total time delay cost would be about US\$1.25 million. Only those damaged sections were included where the road users are relocated to temporary roads, the shoulder or into the wadi. On many road sections damages are not affecting travel speed or incurring higher VOC, and the lengths of these road sections have not been included in the calculation of road user losses due to delays or increased VOC. The average daily wage for workers as presented in Annex 1-B has been used as basis for calculating the actual delay costs using also the actual traffic volumes on each damaged section rather than the average. The delays were computed from the road roughness levels and their effects on speed rather than the simplified assumptions above. Annex 1-C shows the details of the calculations and the time costs add up to US\$ 1.4 million, and the total VOC costs over two years are expected to be on the order of US\$ 19 million. For rural roads, the traffic volumes are generally very low, and losses to users due to higher VOC and travel time have been neglected as the roads were assumed to be earth roads with very high roughness to start with.

The government also shouldered costs in making all roads passable after the storm subsided. The GCRB offices in Hadramout and Al-Mahara have used their equipment fleet and subcontracted works to the private sector to restore connectivity urgently in a matter of days. These costs are available and have been included in the losses. The losses have been aggregated for each major road link in the network, as the recording of the costs by GCRB was not undertaken for each damage location separately. Also the city of Mukalla and other cities in Wadi Hadramout have recorded expenditures of clean-up and repairs to urban streets and they have been included in the total losses.

A large number of wadi crossings had to be cleared in a short time and the volume of material covering the road in most places was extensive. For these reasons the excavated material was deposited upstream and downstream of the crossing creating blockages that will have to be removed during the reconstruction of the Irish crossings. Excavations in many places went far deeper than the current new wadi bed levels, to find a firm load bearing support for the vehicles. Reconstruction would have to take proper account of the new location of the wadi bed and design the Irish replacement crossings accordingly to allow some degree of self-cleaning of the crossings.

The total losses are presented in Table 2-75 and broken down on each road corridor. Losses due to higher vehicle operation cost were estimated at YR3,873 million (US\$19.365 million), while losses of time were estimated at YR 279 million (US\$1.395 million). Losses to the Ministry of Public Works and Highways (MOPWH)'s General Corporation for Roads and Bridges (GCRB) and the different branch offices to restore, on an emergency basis, the traffic were estimated at YR 173 million (US\$0.865 million). As such, the total losses were estimated at YR 4,325 million (US\$21.625 million). The breakdown of losses by type and by Governorate is shown in the following table.

Table 2-76 Breakdown of losses by type and Governorate

	Hadramout	Al-Mahara	Total
Operation losses			
(YR million)	3,495	378	3,873
(US\$ million)	17.477	1.888	19.365
Time losses			
(YR million)	251	28	279
(US\$ million)	1.255	0.14	1.395
Restoration losses			
(YR million)	159	14	173
(US\$ million)	0.795	0.07	0.865
Total losses			
(YR million)	3,905	420	4,325
(US\$ million)	19.527	2.098	21.625

Telecommunication

Summary³⁰

The damages caused by the flood were in the transmission optical network systems, fixed line telephone systems, and transmission digital microwaves and towers. The percentage of damage to the optical cables was about 98%, 65% to the fixed line cables, 40% to digital microwaves and towers, 15% to poles, and 80% to the sub-exchanges cabins. About 20 km of fiber optic cables and 80 km of fixed line cables were either damaged or totally cut off, especially as these lines were buried in the road medians that were cut off by the floods in the wadi crossings. Some 557 telephone poles were washed away and 127 exchange cabins were damaged. The total estimated damage to the telecom sector is YR483.329 million (US\$2.42 million). The total estimated losses of the utility company and the main resellers of the service such as internet cafes and telephone cabins (call services) are YR 314.820 million (US\$1.574 million), of which YR 226.865 million (US\$1.134 million) in losses to the public sector and YR 87.955 million (US\$0.44 million) for the private sector.

Pre-Disaster Situation

Geography and Challenges: With a total area of 550,000 square kilometers, Yemen is divided to five natural regions, namely, mountains, hills, coastal, desert, and islands. About 70% of the people live in the rural areas scattered in some 70,000 communities with about 35 persons per square kilometer. The natural division and population density combined with the difficult terrains are the main challenges the telecom sector is facing. However, by using advance technology, the telecommunication has made great progress in linking the 21 governorates to each other with telecommunication services. The major challenges the sector is facing to develop efficient telecommunication services in the rural areas where about 70% of the Yemeni population live

Administrative Framework. Up to about eight years ago and before the emergence of the first private mobile phone company in 2003, namely Spacetel, the telecommunication sector was a monopoly of the Ministry of Telecommunication now called the Ministry of Telecom and Information Technology (MCIT). The MCIT is mainly divided to two main authorities, the General Authority for Postal services and the Public Telecommunication Corporation (PTC). In brief, the telecommunication sector consists of the Ministry of Telecommunication and Information Technology who is responsible for implementing national regulation, drawing policies, sector reforms, sector organization and supervision, fostering investment and adopting standards and technical specifications of the networks and equipment, etc. The other part is the Public Telecommunication Corporation which is 100% owned by the government. PTC is a financially and administratively independent body responsible for the operation and development of the national telecommunication network and services. While the PTC is the main responsible body for the operation of the fixed line network system, the Ministry is responsible for issuing license for service provision in the sector.

Current Status of the Sector. Much progress has been made in the telecommunication services through the use of digital telephony, fiber optic cables, digital microwave systems and space

³⁰ This assessment was based on the reports prepared by the Ministry of Telecommunications and Information Technology (MCIT) and its branch offices in Hadramout Sahel, Hadramout Wadi and Al-Mahara. This assessment was carried out jointly with Abdulgader Al-Shamiri (MCIT Sana'a), Ali Al-Aidaros (MCIT, Sahel), Ali Baraja (MCIT, Wadi) and Hamid Al-Rawhani (MCIT, Mahara).

telecommunication stations for national and international telecommunications, as well as submarine fiber cables for international communications. These services are reliable and cover the 21 governorates with mobile and automatic telephony and internet services. The total number of customers enrolled in the different services provided is fixed telephone lines 1.2 million; mobile phone 4.2 mil; Internet Dial Up 0.25 mil; Internet ADSL0.015 mil. There are four operators providing mobile phone services and these are MTN Yemen (GSM), Sabafone (GSM), Y Company (GSM), and Yemen Mobile using CDMA system. Internet services are provided by two main players, The Public Telecommunication Corporation and the Yemen Company for International Telecommunication. The Public Telecommunication Corporation is sole provider of the international telecommunication service through its subsidiary TeleYemen.

Damages:

Following the flood, the Ministry of Telecom and Information Technology created an emergency committee and an operations room to specifically response and deal with the damages caused by the flood to the local and international communication links in the two governorates that were badly hit by the flood, Hadramout and Al-Mahara. The damages caused by the flood were in the transmission optical network systems, fixed line telephone systems, and transmission digital microwaves and towers. The percentage of damage to the optical cables was about 98%, 65% to the fixed line cables, 40% to digital microwaves and towers, 15% to poles, and 80% to the sub-exchanges cabins. About 20 km of fiber optic cables and 80 km of fixed line cables were either damaged or totally cut off. Because they were buried and running parallel or in the median, the damage was caused mainly by the destroyed concrete slabs used for surface bridges crossing the wadis; 557 telephone poles were simply washed away; 127 exchange cabins were damaged due to fallen houses and poles, drowning, and flooding. The total estimated damage to the telecom sector is YR483.329 million (US\$2.42 million)—See Table 2-77.

Table 2-77 Damages to the telecommunications sector (million YR)

Description	Fiber optic cables (million YR)	Copper line cables (million YR)	Buildings & Others (million YR)	Total damages (million YR)
Sahel Hadramout	59.080	115.235	34.824	209.139
Wadi Hadramout	94.960	161.220	0	256.18
Total Hadramout (1)	154.040	276.455	34.824	465.319
Total Al-Mahara (2)	13.600	3.410	1.000	18.01
Total Affected areas (1+2)	167.640	279.865	35.824	483.329

Losses:

As a result of the damage, about 50% of the local and long distance communication within the affected areas and with the rest of Yemen stopped as the various cables, microwave towers and fiber-optic links failed. About 80% of the damage was recovered and the services were returned to normal within two weeks time following the flood. The total estimated losses of the utility company and the main resellers of the service such as internet cafes and telephone cabins (call services) are YR 314.820 million (US\$1.574 million), of which YR 226.865 million (US\$1.134 million) in losses to the public sector and YR 87.955 million (US\$0.44 million) for the private sector—See Table 2-78.

Table 2-78 Losses to the telecommunications sector (million YR)

Losses	Sahel Hadramout		Wadi Hadramout		Al-Mahara		Total
	No	YR million	No	YR million	No	YR million	YR million
Private Sector							
Internet cafes *	35	3.430	20	1.960	5	490	5.888
Phone centers **	708	61.950	176	15.400	54	4.725	82.075
Sub-total private		65.380		17.360		5.215	87.955
Public Sector							
Local calls (7 days)	NA	47.050	NA	30.858	NA	4.863	82.771
Int'l calls	NA	68.921	NA	45.462	NA	7.711	122.094
Recovery costs	NA	18.000	NA	4.000	NA	0	22.000
Sub-total public		133.971		80.320		12.574	226.865
Total losses		199.351		97.680		17.789	314.820

* 14 days interruption at YR7,000 per day in losses.

** 7 days interruption at YR12,500 per day in losses.

Cross-Sectoral Issues

Religious Facilities and Cultural Heritage

Summary³¹

The damage to religious buildings and property in the two governorates of Hadramout and Al-Mahara is estimated to be approximately YR 341 million (US \$1.7 million). Flood caused serious damages to the places of religious worship in over 14 districts. Meanwhile, damage to cultural heritage buildings and monuments are estimated to total about YR 600 million (US\$ 3 million). No losses are incurred. In the case of religious facilities, the time losses for the population from commuting to other nearby facilities are negligible due to the high frequency of mosques in the affected areas. As for cultural heritage, no direct losses are incurred since no fees are charged for entry into the affected facilities. Losses incurred from a drop in tourism revenues as a result of the floods are accounted for separately under the productive sectors, and the direct contribution of the flood-affected cultural heritage facilities is negligible.

Pre-disaster Conditions

Religious facilities: In Hadramout and Al-Mahara governorates, a large number of religious facilities are available at village and city level, averaging 50 people for smaller mosques (*Masjid*) and 500 to 1000 people for the larger mosques (*Jama*). The mosques also serve as centers for community activity and village governance. In small villages, mosques are also the only platform for the community to discuss developmental issues. The large majority of mosques are built and donated by private parties. Usually small shops or other commercial facilities are attached to the mosques to generate maintenance funds. On the government's side, the Ministry of Endowment and Guidance is in charge of maintenance of bigger mosques and staffing mosques with Imams.

Cultural Heritage: The entire valley or Wadi of Hadramout offers immense tourism potential due to its unique natural, architectural and urban landscape comprising of mud buildings in the backdrop of fertile valley and barren hills. The Hadramout Wadi is very special from an architectural and urban point of view and many of its towns and villages are considered national cultural heritage. Many non-governmental and governmental organizations are working in the Wadi to encourage its sustainable development and historic preservation.

The Wadi is home to the old walled city of Shibam, a UNESCO World Heritage site since 1982 that is also called "Manhattan of the Desert". Shibam is an ancient city characterized by vertical construction in mud. The city is surrounded by an earth wall and has many tall buildings also made up of earth (the tallest being eight stories high). Currently, about 3,000 residents live in 427

³¹ The assessment was based on reports prepared by Hadramout and Al-Mahara Local Governments, including Awqaf (religious endowment) offices and technical affairs departments, as well as the GOPHCY and GTZ for cultural heritage. The assessment was undertaken jointly with local and central government authorities and representatives of donor agencies, including: Ahmed Al-Junaid, Deputy Governor for Hadramout Wadi Affairs; Fahd Al-Minhaly, Deputy Governor for Technical Affairs, Hadramout Sahel; Abdullah Zaid Ayssa, Chairman, GOPHCY; Abdalla Al-Daylami, Manager, Social Fund for Development; Abdullah Bawazeer, Local Councilor, Mukalla, Hadramout; Head of the Awqaf office in Hadramout Sahel; Omar Hallaj, Team Leader, GTZ, PDHCY; Hedi Saliba, Advisor, GTZ, PDHCY; Katja Schafer, Expert, GTZ, PDHCY; and Mohamed Al-Kaf, Social Fund for Development, Hadramout Wadi.

houses in Shibam. Historically, the city was planned on a hill to combat the recurrent floods in the region and has a traditional water drainage system, which keeps the floods away from the city. Human settlements in the wadi are linked together through a common environmental, social, and economic fabric. Thus, areas around Shibam (Siheel, Khumayyer, and Shgayyah) are also considered for historic preservation.

Since Shibam was classified as a world heritage site, many governmental and non-governmental organizations-run programs are helping restore and conserve the area. The General Organization for the Preservation of Historic Cities (GOPHCY) and the Project for the Development of Historical Cities of Yemen (PDHCY), in collaboration with the GTZ, run a number of building restoration and community development programs in and around Shibam. In 2005, a Historic Monuments Fund was established by the Social Fund for Development for historic preservation and community development.

The entire wadi is grappling with rapid urbanization, haphazard development, lack of infrastructure, poorly maintained housing stock, lack of economic opportunities, and out-migration of population. In the Shibam district, only one-third of the population resides currently, while the others have moved to nearby cities in search of employment.

Many historic mud palaces, forts, and shrines are also found in the region. Most of these historic palaces are old and dilapidated and in need of urgent repair. During the socialist government, most historic palaces were publicly owned and were used as residential quarters. After the union of northern and southern Yemen, the historic palaces were returned to their owners in ruined state, who do not have sufficient funds to restore and maintain these palaces.

Damage and Loss Assessment

Religious facilities:

The damage to religious buildings and property in the two governorates of Hadramout and Al-Mahara is estimated to be approximately YR 341 million (US \$ 1.7 million). Some 29 mosques were fully damaged, 100 mosques were partially damaged and 45 mosque-related facilities and equipments (Imam house, Madrassa, Ablution area etc.) suffered damages due to floods. About 90% of fully damaged and more than 50% of partially damaged mosques are located in Hadramout Wadi. Hadramout Wadi suffered the highest damage (approximately YR 217 million or US\$ 1.1 million), followed by Al-Mahara governorate (approximately YR97 million or US\$0.5 million) and Hadramout Sahel (approximately YR 27 million or US\$0.14 million). In terms of losses, no staff losses were reported. It was also assumed that the time losses for the population from commuting to other nearby facilities are negligible due to the high frequency of mosques in the affected areas.³²

The flood has affected religious facilities in over 14 districts. Approximately 7,500 people no longer can use their religious worship place. Another 100 religious places need minor renovation. Although religious facilities are typically financed by the community, and managed/operated by the community or by the government, the diminished financial capacity of flood-affected

³² Hadramout Sahel estimates for fully destroyed mosques based on actual costs and verified in field visits; partially damaged mosques (roof cracks and leaks) assumed at YR600,000 per mosque. Hadramout Wadi estimates for fully destroyed big mosques (Jama'a) assumed at YR10,000,000 (YR 25,000 per sqm for 400 sqm average); Fully destroyed small mosques assumed as YR3,600,000 (for average 144 sqm); Partially damaged big mosques at YR3,000,000 per mosque and small mosques at YR1,000,000 per mosque.

communities will lead to a strain in restoring on their own their religious facilities in the absence of outside support.

Table 2-80 Damage to Religious Assets

Governorates/ Districts	Fully Destroyed		Partially Destroyed		Damaged Equipments & Related Facilities		Total
	Number	Damage (million YR)	Number	Damage (YR million)	Number	Damage (million YR)	Damage (million YR)
Hadramout Sahel							
Mukalla	1	2	3	1.8	0	0	3.8
Ghail Bawazir	0	0	4	2.4	0	0	2.4
Shihr	1	20	2	0.8	0	0	20.8
Sub-total Sahel	2	22	9	5	0	0	27
Hadramout Wadi							
Qatn	8	60.8	9	12.5	7	24	97.3
Hawra- Wadi Ain	8	54.4	3	2	0	0	56.4
Amd	0	0	8	5	0	0	5.0
Seiyun	0	0	22	11	0	0	11.0
Tarim	8	28.8	2	4	0	0	32.8
Harida	0	0	1	0.5	0	0	0.5
Al-Soum	2	7.2	7	7	0	0	14.2
Sub-total Wadi	26	151.2	52	42	7	24	217.2
Total Hadramout	28	173.2	61	47	7	24	244.2
Al-Mahara							
Ghayda	1	20	9	9	0	0	29
Houf	0	0	2	2	0	0	2
Hasween	0	0	24	24	0	0	24
Sayhut	0	0	4	4	38	38	42
Total Al-Mahara	1	20	39	39	38	38	97
Total (YR million)	29	193.2	100	86	45	62	341.2
Total (US\$ million)	29	0.966	100	0.43	45	0.31	1.71

Sources and assumptions: Number of facilities damaged provided by Office of Endowment and Guidance in Hadramout Sahel; Deputy Governor for Hadramout Wadi Affairs; and Ministry of public works office in Al-Mahara. The value of the damages was calculated by the assessment team including Government officials, Social Fund for Development and Mukalla Local Economic Development Department, based on the size of mosque, extent of damages, and reconstruction efforts required.

Cultural Heritage:

Damage to cultural buildings and monuments are estimated to total about YR 600 million (US\$ 3 million). Approximately 27 historical buildings and sites were affected by the flood, out of which 14 are under public ownership and 13 are under private ownership. The total damage to publicly-owned historical buildings and sites is approximately YR 362 million (US\$1.8 million). The total damage to privately-owned historical buildings and sites is approximately YR 238 million (US\$1.2 million). It is important to note that several historical buildings are likely to have been poorly maintained and the floods have exacerbated the situation.³³ Table 2-81 below summarizes

³³ Hadramout Wadi estimates for damage to partially damaged houses in Shibam at YR300,000 per house (each house contains 4 to 5 families and is on average 5 to 6 stories tall); damage to partially damaged smaller castles assumed at YR 2 million and bigger castles at YR20-40 million. For Al-Mahara, the estimated damage values to the different sites were provided by the Ministry of public works office and could not be verified through field visits (nor their pre-disaster state).

information for each district. Losses incurred as a result from a consequent drop in tourism are calculated under the productive sectors, and the likelihood that damage to these cultural heritage facilities has had a direct effect on tourism is negligible. There are no direct losses associated with these facilities as there are no fees charged on entry to cultural heritage sites.

Table 2-81 Damages to Cultural Heritage Sites

	Site	Damage (YR)*	Ownership
HADRAMOUT WADI			
Shibam	Repairs to 272 partially damage houses (within wall city)	81.6	Private
	Repairs to 27 partially damage houses (outside wall city)	8.1	Private
	Urgent repairs to Moosa dam and canals within heritage site	10.0	Public
	Restoration of water drainage system	60.0	Public
	Restoration of western wall of City gate building	10.0	Private
Sub-total Shibam		169.7	
Seiyun City	Castle	10.0	Public
	Western Gate surrounding the city	8.0	Public
	Northern Gate	10.0	Public
	Ibn Obed Allah cultural center	5.0	Private
Outside Seiyun City	Ali Bin Sallah Al-Qoeti Castle (Al-Qutun)	6.0	Private
	Cemetery and Shrine- Prophet Salleh	4.0	Private
	Al-Hadadin Fort (Al-Qutun)	2.0	Private
	Koot Al Nakhr Castle	2.0	Private
Sub-total Seiyun		47.0	
Tarim	Al-Mihdar Mosque	20.0	Public
	Abdul-Rehman Bin Sheikh Castle (Idd)	24.0	Private
	Asha Castle	20.0	Private
	Al-Ranad Castle	40.0	Public
	Hamtoot Castle	2.0	Private
	Al-Salem Castle	2.0	Private
	Al-Qubba Castle	2.0	Private
	Library	2.0	Public
Al-Ahqaf Manuscript Library	2.0	Public	
Sub-total Tarim		114.0	
Total Hadramout Wadi		330.7	
AL-MAHARA			
Houf	Local Administration Building	30.0	Public
Qishn	Bin Afrir Sultan Palace	100.0	Public
Sayhut	Historical site – Daheirag	20.0	Public
Massila	2 Historical sites- residential quarters and related facilities	70.0	Private
Manaar	Historical Market	50.0	Public
Total Al-Mahara		270.0	
Total (YR million)		600.7	
Total (US\$ million)		3.004	

Source: For historic sites in the Wadi, Deputy Governor of Hadramout Wadi Affairs; GOPHCY, PDHCY and GTZ assessment of damages to historical buildings including Shibam; Public Works department for Al-Mahara. Damage value calculated jointly with GOPHCY and GTZ based on type of repair required,

and per unit reconstruction / repair costs in different areas, and will require a more detailed assessment to produce more precise estimates.

Box 2-3 Impact on Shibam and surrounding areas

The Wadi bed in front of Shibam is considered to be one of the most dangerous flood collective points in Hadramout Wadi, as the width of this point is 140 meters only that raises flood level to several meters and speed to more than 3000 cubic meters per second. Based on the rapid assessment conducted by the GOPHCY, Shibam was spared from major damages from the flood due to its current flood protection system and because the magnitude of flood was reduced as it received floods two times at the interval of 6 hours. However, rains (which continued for more than 36 hours) and floods affected 272 houses and western wall of City Gate building within the old walled city, and 27 houses outside the walled city. Majority of the damage was caused by roof cracks and leaks due to rain, and foundation settlement due to flood. Many drains and sewerage system openings within the old walled city were blocked by the silt and increased flood damage. Foundations of many old houses remain moist and permanent damages to the houses may be evident after some time.

Flood caused major damage to the existing water drainage system, sewerage treatment plant, electricity columns, water supply lines, as well as irrigation canal. Traditional flood protection system for the city was seriously damaged, including damages to main irrigation canal, bunds, secondary canals, and stone construction (that was designed to lessen the speed of flood).

Environment

Summary

The impact of the storm and floods on the environment has been significant and multi-faceted, including effects on coastal zones and marine environments and likely effects on water quality and environmental health. In particular, the solid waste management (collection and disposal sector) has suffered significant damages and losses. Damage to solid waste management equipment is estimated at YR 35 million (US\$0.175 million). Significant losses have accumulated due to the need to collect and dispose to safe disposal sites of municipal solid waste that was washed away by the floods, the sediment from eroded soil and surfaces, debris and washed away rocks, uprooted vegetation including a large number of palm tree trunks, other debris including hazardous material (broken glass, sharp metals, etc), and a large number of animals whose dead carcasses have been washed away and/or buried in the rubble. Losses are estimated at YR 2,904 million (US\$14.5 million), not including YR 415.5 million (US\$2.08 million) in estimated cost of demolition and disposal of the building rubble from the collapsed shelter. It was a serious environmental disaster and the ensuing clean-up that is required poses enormous pressure on the waste disposal services. Rapid intervention and sustained monitoring are especially needed to ensure that no environmental or health problems and diseases are caused by contamination of water resources, stagnant water pools, decomposing dead animals, and coastal and marine environment-related problems.

Pre-Disaster Situation

Pre-disaster conditions were difficult to determine since there is lack of information as to the situation prior to the floods. Both Hadramout and Al-Mahara Governorates do not have their independent assessment of their natural resources.

The Environment Resource Base: Yemen, located on the southern coast of the Arabian Peninsula, is characterized by five major land systems, one of which is the dissected region of the Yemen High Plateaus and the Hadramout-Mahara Uplands, with altitudes up to 1,000 m. The country's total land area is about 55.5 million hectares. About 3% of the land, or 1.6 million hectares, can be used for agriculture, but only about 1.2 million hectares are actually cultivated (the main crops are cereals, fruits and vegetables, fodder and Qat). Mainly rangelands and some forest area cover 40% of the land area. Other land, mostly desert, constitutes the remaining 57% of the total area.

The country's coastline extends to more than 2,000 km and its coastal and marine ecosystems, with extensive mangroves, coral reefs, and sea-grass areas, are of major economic importance for fisheries and tourism. Fisheries resources are important and the combined surface and deep water catch is about 80,000 metric tons per year. Renewable freshwater is very scarce. Freshwater available to the country is 2,100 million cubic meters per year. The resource is mainly groundwater and its over-exploitation is one of Yemen's major problems. Overall, environmental problems in Yemen are caused by three key factors: (i) population growth, (ii) poverty and (iii) institutional weakness.

The population in Hadramout and Al-Mahara are highly reliant on natural resources such as fishing and agriculture. Their sustainable use is linked to public health, food security, and economic and social benefits including cultural values and traditional livelihoods. In addition to fisheries and agriculture, tourism is increasing as a source of income in Hadramout. Therefore, the population is particularly vulnerable to environmental change, decreasing productivity of the

coastal ecosystem, extreme weather events and natural catastrophes such as heavy rains and floods.

State of the Environment: Yemen's natural resources, including oil and gas which constitute 85% of export revenues, are the basis of the national economy. The depletion or degradation of these resources represents not only a loss of the country's national capital but undermines the sustainability of its economy.

Water Depletion, Pollution and Supply: Yemen is facing a water crisis, in terms of depletion of water resources, water pollution and water supply. National policies and regulatory frameworks for water allocation, conservation and drilling are especially weak. Surface water is regulated by customary practice, modified by the impact of Government projects. Groundwater, with few exceptions, is currently unregulated and it is being mined in many areas. Countrywide, it is estimated that current withdrawals of water for all purposes are over 130 percent of renewable resources. In general, critical aquifers are expected to reach the end of their useful life within twenty years. The depletion and degradation of Yemen's groundwater resources represents a disinvestment of the country's natural resource base and are unsustainable in the long-term.

Water quality is also deteriorating. Shallow aquifers, especially in urban areas, are becoming polluted and coastal aquifers are subject to saline intrusion. Groundwater contamination is pervasive and poses a serious health threat for those dependent on water from private tankers and neighborhood wells in urban areas. Water resources are contaminated primarily by industrial and residential waste, seepage of waste water, low pressure and cross connections. In addition, groundwater used in public water supplies is not filtered.

Wastewater: Access to sewerage services is provided only to a limited percentage of the urban population in Sana'a, Taiz, Hodeidah, Ibb and Dhamar. Much of the urban population depends on individual septic tanks, some of which are emptied by trucks operated by the districts or private companies. And although the major cities have wastewater treatment facilities, a portion of wastewater collected by trucks is disposed of untreated in nearby Wadis, which eventually seep into aquifers or the sea.

In Hadramout and Al-Mahara, wastewater is mostly disposed of in on-site septic tanks or leaching pits. Only parts of Mukalla and two other coastal cities have sewerage collection systems, but sewage is currently discharged untreated into the sea (a sewage treatment plant is currently under construction).

Solid Waste: Until 1999, solid waste management (SWM) was the responsibility of the Ministry of Public Works, and cleaning services were implemented by the branch offices. The Local Authorities Law no. 4 of 2000 devolved responsibilities for public services to the newly created authorities. Cleaning Law No. 4 of 1999 decentralized SWM and allowed localities to collect revenues to be used to support solid waste collection and disposal operations on a cost recovery basis. Prime Ministerial Decree No. 20 of 1999 created Cleaning and Improvement Funds (CIF) at the Governorate level, which are replenished with several fees and surcharges for use in cleaning and city improvement purposes. Despite the devolution of SWM responsibilities to the local level and establishment of dedicated funding, waste collection and disposal services, generally speaking, suffer from a lack of operational guidelines, inadequate operation and maintenance services, poor condition of fleet and equipment, a dearth of trained technical and managerial staff, and absent monitoring and evaluation.

Inadequate solid waste management is a serious problem in the cities as well as in small towns and villages. Waste collection is especially poor in low-income neighborhoods, where most of the waste is dumped into wadis, streets and open dumps. In many cases, accumulated refuse and the stagnant water resulting from the clogging of drainage systems, serve as breeding grounds for rats and insects, contributing to health hazards.

Municipal solid waste disposal is a major concern. The capacity of the existing landfill has long been exceeded; waste presently reaches an elevation of five to ten meters above design level. Spontaneous combustion results in constant fires, widespread smoke, and odors. Moreover, the top of the landfill is dangerously close to high voltage power lines. The fence also has been destroyed allowing access to the landfill scavengers and animals. The critical conditions of the landfill provoked residents living nearby to block access of disposal trucks to the field. Refuse is now disposed of on public land that had been previously zoned for recreational use.

There are many gaps in the regulatory framework. For example, there are no provisions for national or local regulation of solid waste collection and disposal. In some cases, municipalities have established informal arrangements to enforce appropriate refuse disposal.

There are two Local Government-operated dump sites in Mukalla and Seiyun, and one site in Al-Mahara. According to the information received, the quantity of solid waste generated in 2006 was 74,144 tons in Mukalla and Seiyun, and 10,722 tons in Al-Mahara.

Hazardous waste: The volume of hazardous waste produced in Yemen is estimated at about 36,000 tons per year and the quantity of bio-hazardous waste is estimated at 57 tons. There is no regular separation of medical, toxic and domestic waste, which causes considerable local impacts, particularly on groundwater. Types of hazardous wastes include hospital waste, waste oil, industrial waste, pesticides, photographic waste, and pharmaceutical waste. The main industrial sources of hazardous waste are textiles, food processing, cement, plastics, chemicals and petrochemicals. Some industries incinerate their solid hazardous waste in open pits, while others dump it in open dump sites or in municipal landfills where supervision is inadequate. Liquid hazardous waste is often disposed of into the sewerage system or discharged into the surroundings without any treatment. Often, chemicals from laboratories, blood banks, and x-ray departments as well as used oil and oily sludge are discharged directly into sewerage systems or disposed locally in the soil. Little attention is given to medical waste management, and such practices can lead to transmitting of infectious diseases such as Hepatitis B and C or even HIV, according to the Ministry of Health and Population.

To this context, it is expected that a percentage of hazardous waste generation in Yemen is generated in Hadramout and Al-Mahara, due to the presence of hospitals, some industries and workshops.

Damage and Loss Assessment

The floods had significant impacts, causing damages and losses to the environment including animals and vegetation. There are also possible effects on the marine environment and protected areas. There are also possible health hazards resulting from stagnant water ponds and possibly deteriorated water quality. A detailed assessment of the effects on the environment, including environmental health and other aspects that will only appear at a later stage, is needed to identify the effects due to the floods.

Damages:

The solid waste management system has been affected, suffering damages to building and equipment. The Cleaning and Improvement Fund (CIF) in Mukalla/Hadramout Sahel reported damages to its equipment estimated at YR 35 million (US\$0.175 million). No reports of damage to equipment were received from the CIF in Seiyun. Restoring the functioning of solid waste management services is essential to support the rehabilitation and reconstruction program.

Losses:

Debris and waste: The storm and floods produced in Hadramout Sahel, Hadramout Wadi and Al-Mahara a considerable amount of: building rubble from the destroyed buildings and significantly damaged structures that are bound to be demolished; sediment and debris from the eroded soil and surfaces and washed away rocks that are affecting Wadi courses, agricultural land, and public spaces; uprooted vegetation including a large number of palm tree trunks that have accumulated in Wadi courses and by box culverts and flood channels in the Wadis and along the main roads; and other debris including inter alia hazardous material (broken glass, sharp metals, etc). The storm and floods also washed away a large number of animals, whose dead carcasses have been distributed along the flood paths in Wadis and in public spaces, in addition to those that have been buried under the rubble. Finally, the storm and floods also redistributed municipal waste (that was ready for collection) across roads, public spaces and into people's houses. It was a serious environmental disaster and the ensuing clean-up that is required poses enormous pressure on the waste disposal services. The disaster has exposed the weakness of the Cleaning Authorities.

Table 2-79 Damages and losses to the environment

Sector and Subsector	Disaster Effects			Ownership by Sector	
	Damage	Losses	Total	Public	Private
Equipment destroyed	35.0		35.0	35.0	
Collection/disposal of: ³⁴					
Dead animals		0.7	0.7	0.7	
Municipal solid waste		32.3	32.3	32.3	
Sediment deposits agricultural land		1,561.5	1,561.5	1,561.5	
Sediment deposits Wadis/public spaces		1,140.0	1,140.0	1,140.0	
Uprooted/damages trees		158.7	158.7	158.7	
Stagnant water		5.8	5.8	5.8	
Hazardous waste		5.0	5.0	5.0	
Total,	35.0	2,904.0	2,939.0	2,939.0	0.0

* From street to disposal site, excluding YR415.5 million included as rubble disposal in the housing sector.

The overall losses have been assessed based on the damages to agricultural land, sediment deposits on Wadis/public spaces, uprooted/damaged trees, dead animals, municipal solid and hazardous waste and stagnant water, and are estimated to amount to YR 2,904.0 million (US\$14.502 million). The disposal of rubble due to demolished shelter was estimated at YR415.5 million (US\$2.078 million) and is included in the shelter assessment. The losses are

³⁴ Assumptions are: 15.6 million cum of sediment deposits on agricultural land (5cm layer on overall damaged surface area) at YR100 per cum for disposal from street/curb side to disposal site; 3.8 million cum of sediment deposits on Wadis requiring dredging and disposal to disposal site at YR300 per cum; 50% of 725,491 trees to be disposed of using small trucks with rental value of YR70,000 per day; pump trucks rental value of YR96,000 per day; lump sum for hazardous waste.

estimated to follow the same geographic distribution as agricultural sector losses with Al-Mahara's share at 4%, Hadramout Wadi at 63% and Hadramout Sahel at 33%.

The Mukalla CIF reports that the amount of municipal waste that needs to be collected amount to 120 tons in coastal areas, requiring due to its dispersal an additional cost of YR 32.3 million (US\$0.16 million). The local authorities in Hadramout Wadi report that the estimated cost of disposal of dead animals in the Wadi is YR 0.725 million (US\$0.0038 million). Additionally, the removal from street side to a safe disposal site of sediment deposits on agricultural land (assumed as a 5cm layer on the damaged land area) and Wadis/public spaces has been estimated at YR 2,701.5 million. The removal of uprooted/damaged tree trunks, especially palm trees, is also important as many of these have clogged flood protection channels, especially along the main roads (it is estimated that about 50% of uprooted trees would need to be removed and the rest would be recycled, used or left in place); it is estimated to require YR158.7 million. Finally, estimated amounts were also included for pumping stagnant water and for disposal of hazardous waste.

In particular, many pools of stagnant water were encountered during field visits in Hadramout, and these can be a major health hazard. This problem was also confirmed by the local authorities and Ministry of Health. Malaria and dengue are among the main dangers of stagnant water, which can become a breeding ground for mosquitoes that transmit these diseases. If this situation is left unattended, it could lead to a potential environmental disaster.

If not properly managed, wastes may pose a risk to human health as well as ecological functions. Appropriate waste management is a key to the environmental rehabilitation of the affected areas. Storage and recycling of building rubbles should be given a top priority not only to clear the transport network and to improve living environment, but also to provide an opportunity to reduce recovery cost through recycling of debris, as well as avoiding impacts on the environmental conditions.

Possible Effects on the Marine Environment: The environment in coastal areas is likely to have been significantly affected. According to local authorities in Mukalla, there has been some contamination of coastal areas along 350 km of the shoreline of Hadramout. Along the coast of Al-Mahara, a ship carrying oil products reportedly sank, causing leakage along the coastline. Moreover, the most possible serious threat to the coastal environment stems from the amounts of natural and man-made materials that were dragged into the sea by the floods. This waste ranges from oil to silt and debris. The main risk is that this debris may be causing secondary damage to the coastal environment by being continually pounded into delicate ecosystems by normal wave action. However, baseline and damage information are not available to identify damages and losses.

Possible damages to the Protected Areas: There are two protected areas located within the affected area of Hadramout: Sharmat Jathmoon for turtles and Broom Beer-Ali for mangroves. Baseline and damage information for those two protectorates are not available to be able to assess the damages and losses.

Possible deterioration of Water Quality: Following the floods, the local authorities in Hadramout and the authorities overseeing urban and rural water tested water sources in Hadramout's various districts after some the water resources in the area were feared to be contaminated by remnants of dead animal carcasses that were taken by floods. According to the information provided by the Local Water Supply and Sanitation Corporation for the Wadi and Desert regions, the baseline indicators align with the Yemeni Water Quality Guidelines. Samples taken after the floods have

shown contamination of two water wells in Sah with fecal coli form and nitrates. This indicates the presence of matter due to sewage, animals and/or agriculture. The potential health hazards that may result from such contamination include dysentery, typhoid fever and hepatitis A. The nitrate traces which were also found in both water wells are a naturally occurring chemical that is left after the decomposition of animal or human wastes. The Local Water Supply and Sanitation Corporation reported that it has already treated both wells using chlorine. Continued monitoring of water resources is critical after such a disaster to ensure that the water is not contaminated.

Section III: Economic and Social Impacts:

Macroeconomic and Poverty Impact of the Floods

Summary

The October 2008 flood disaster in Yemen compounds the macroeconomic problems that Yemen is facing already. After the food grain price crisis until the first half of 2008, the unexpected sharp fall in oil prices in the second half of 2008, global recession and financial market melt down, the flood disaster struck Yemen in October, 2008 at a particularly weak juncture. The overall damages and losses from the flood disaster are estimated at US \$1.6 billion in 2008 prices, about 6% of GDP and comparable to annual development expenditure of the government. The cost of rebuilding damaged public infrastructure alone, estimated at US\$ 375 million (based on damage values) in the two governorates, is nearly twice as much as the average annual net flow of all aid that Yemen receives at US \$200 million. This cost is also expected to further increase when the Government's contribution to rebuilding destroyed shelter and the additional costs associated with "building-back-better" are factored in.

Though the disaster would have left a small adverse impact on non-oil GDP (one percent of non-oil GDP) in 2009 – the peak year of adverse impacts- there would be significant localized effects on poverty and significant additional claim on government's social protection and capital budgets for the next four years. In Hadramout governorate the number of poor could nearly double to 585,000 in 2009 rendering 51 percent of the population poor. Under perfect targeting, returning the governorate to pre-disaster poverty would require about US \$85 million, nearly the same as the outlay on Social Welfare Fund budget outlay for the entirety of Yemen in any recent year. The floods have had transient impact on local inflation this year. The impact on balance of payments would also be marginal amounting to less than US\$ 100 million a year in increased imports over the next two years and some drop in quantity of honey exports partly offset by higher value not exceeding US\$ 10 million for the next year.

Pre-disaster Macroeconomic and Poverty Context

Yemen's recent macroeconomic performance has been mixed with weak growth, high inflation contrasted by comfortable current account surpluses. The preceding three years have been marked by weak GDP growth that was barely above the population growth rate of 3 percent a year, with the oil sector GDP in steady decline. Inflation has been high at about 15 percent a year led by rising food grain prices. Fiscal balance has been widening to reach -6 percent of GDP in 2007, with signs of long-term debt sustainability worsening. Yemen has been judged to be in risk of severe debt stress for the last two consecutive years with debt thresholds likely to be breached even in the baseline forecast. High oil prices until recently have boosted external account surpluses with Yemen accumulating US \$ 7 billion of foreign reserves by the end of 2007 equal to about 10 months of imports.

Poverty in Yemen had declined from 40 percent in 1998 to 35 percent in 2005 on the strength of prosperity in urban areas that benefited from trade and public spending. The rural areas of Yemen had witnessed near stagnation in poverty over the same period containing 70 percent of the population. The rapid rise in food grain prices in 2007 had raised doubts whether the reduction in poverty would have been sustained. The partial effect of the rise in food prices likely have reversed the gain in poverty reduction though income growth and policy interventions by doubling of cash transfers and rise in pay of civil servants would have some what offset the adverse effects of food price increases.

The two governorates that have been affected by the floods enjoyed reduction in poverty in the past but stood strongly in contrast in the magnitude of poverty. Hadramout had 36 percent of its population as poor whereas Al-Mahara had only 9 percent of the population poor. These two governorates belonged in a region where poverty declined between 1998 and 2006 in both the rural and urban areas by about 2 percentage points.

Table 3-1 Poverty in Hadramout and Al-Mahara Governorates, 2005-06

	Poverty Incidence	Poverty Gap	Poverty Severity
Hadramout	35.59	6.67	1.84
Al-Mahara	8.85	1.80	0.66
Yemen	34.78	8.93	3.32

Source: Yemen Poverty Assessment, The World Bank, 2007.

Poverty estimates at district level (Annex 2 Table A1 and Table A2) show that highly populous districts also had high incidence of poverty and that between 70% (Hadramout) to 75% (Al-Mahara) of the poor happened to live in areas worst affected by the disaster.

Prior to the disaster, the macroeconomic outlook for the medium-term (Table 3-2) showed signs of improvement with GDP growth rising, inflation abating, with fiscal deficit and current account deficits remaining manageable and stable. Yemen would have continued to make gains poverty reduction with positive growth in per-capita GDP. This optimism was built on the hope that the government would be willing to tackle the long-standing issues of wasteful fuel subsidies, high wage bill and making steady improvement in governance. The implication of these policy changes called for an average fiscal contraction of 1.5% of GDP per year in the medium term. Even with that strong adjustment effort, Yemen would be running a risk of severe debt-stress.

Table 3-2 Selected Economic Indicators

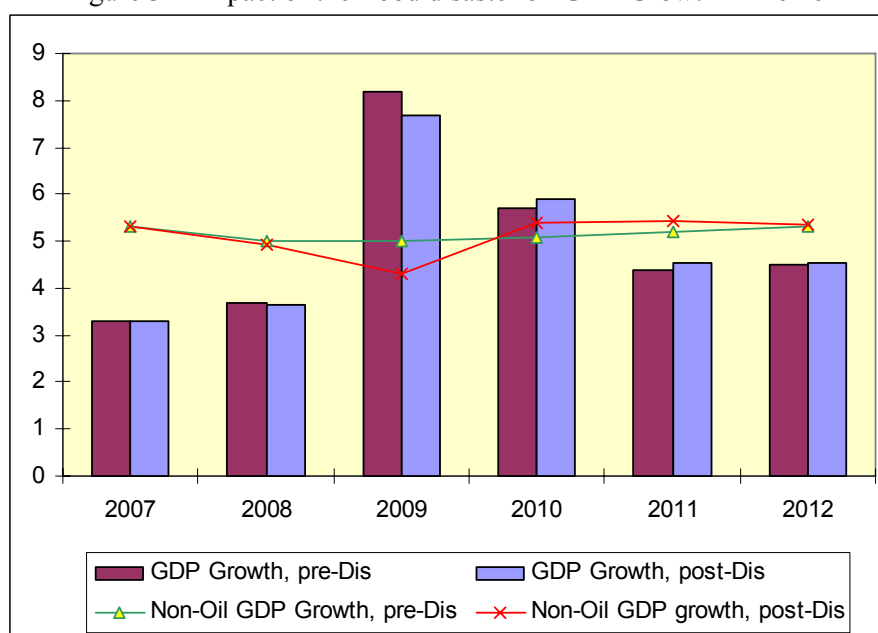
	Prelim.	Projections				
	2007	2008	2009	2010	2011	2012
Production and Prices	<i>(Change in percent)</i>					
Real GDP at market prices	3.3	3.5	8.1	5.3	4.3	4.4
Real non-hydrocarbon GDP	5.0	4.5	5.0	5.1	5.2	5.3
Consumer price index (annual average)	12.5	17.2	14.4	13.1	13.5	13.1
Government finance	<i>(In percent of GDP)</i>					
Total revenue and grants	32.4	39.5	32.8	31.6	29.3	27.5
Total expenditure and net lending	40.3	42.2	37.5	35.6	33.1	30.2
Overall balance (cash basis)	-5.7	-2.7	-4.6	-4.0	-3.9	-2.7
Transfers	3.0	3.2	3.5	3.8	4.1	4.4
Capital expenditure	7.8	7.6	7.9	7.9	7.9	8.0
Social spending			8.1	8.5	8.8	9.2
External sector	<i>(In millions of US dollars, unless otherwise indicated)</i>					
Exports f.o.b.	7,131	9,763	10,178	10,618	10,241	9,842
of Which: hydrocarbon (oil and gas)	6,277	8,833	9,164	9,502	8,980	8,404
of Which: non-hydrocarbon	854	931	1,014	1,116	1,261	1,437
Imports, f.o.b.	-7,212	-7,833	-8,277	-8,686	-9,105	-9,463
Current account (in percent GDP)	-6.1	2.9	2.1	2.3	0.5	-0.3
Medium- and long-term loans, net	234	329	402	473	528	601
Population (in thousands)	22,290	22,978	23,687	24,398	25,130	25,884

Source: Staff Estimates based on IMF Article IV report, October, 2008

Post-Disaster Effects

The impact on overall GDP growth of Yemen is expected to be small. The two affected governorates were home to about 5 percent of the population and contributed to about 6 percent of non-oil incomes. Since the bulk of the losses (95 percent) occurred in the poorer Hadramout governorate which generated only 60 percent of the total non-oil income of the two governorates, the overall impact on GDP is small valued at YR 37 billion in 2009 in comparison to the country's estimated GDP of YR 5.5 trillion. The growth rates of GDP both overall and non-oil GDP would show a dip in 2009 followed by recovery in the subsequent years (Figure 3-1). In 2009, compared to the baseline estimates, overall GDP growth rate would be lower by 0.5 percent points and the non-oil growth rate would diminish by 0.7 percent point. Note however, that this analysis does not account for the income generating effects of reconstruction efforts.

Figure 3-1 Impact of the flood disaster on GDP Growth in Yemen

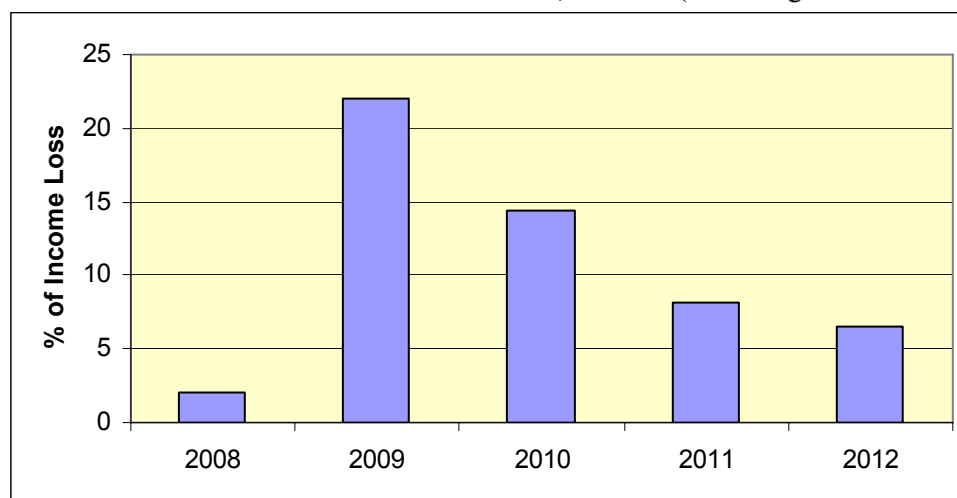


Source: Staff Estimates.

The bulk of the income loss is concentrated in the agriculture, livestock and small scale manufactures sectors (Table 3-3). These sectors together account for about 94 percent of income losses expected to occur over the next four years. It is likely that the real rate of growth in agriculture sector (including livestock) would show a significant decline in GDP growth of about 5 percent in 2009. Annex table A3 shows detailed income losses by originating sector by year from 2008 to 2012.

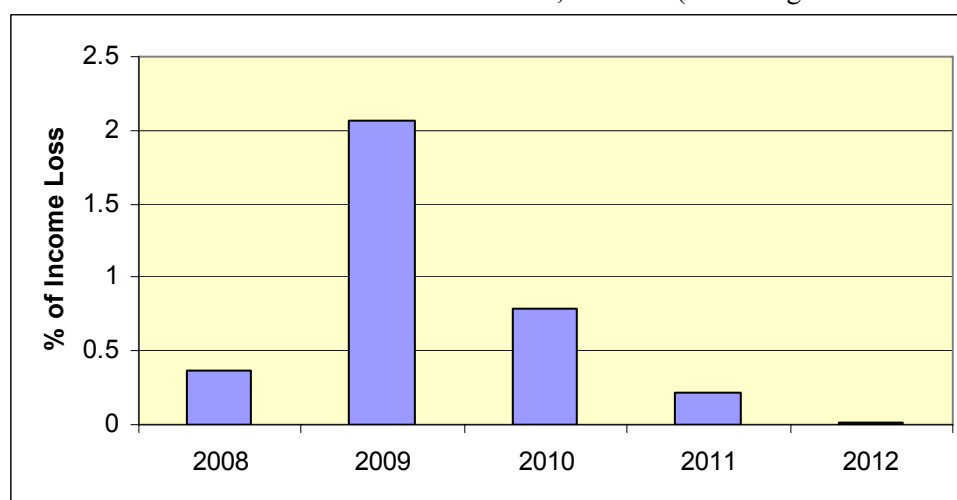
The flood disaster would significantly increase poverty in the affected governorates, particularly the poorer Hadramout governorate. The output or income losses suffered due to the floods peak in 2009 and then diminish in the subsequent years. Figures 3-2 and 3-3 show the proportionate loss of income in the two governorates between 2008 and 2012 compared to the baseline.

Figure 3-2 Income Losses in Hadramout Governorate, 2008-12 (Percentage of baseline income)



Source: Staff Estimates

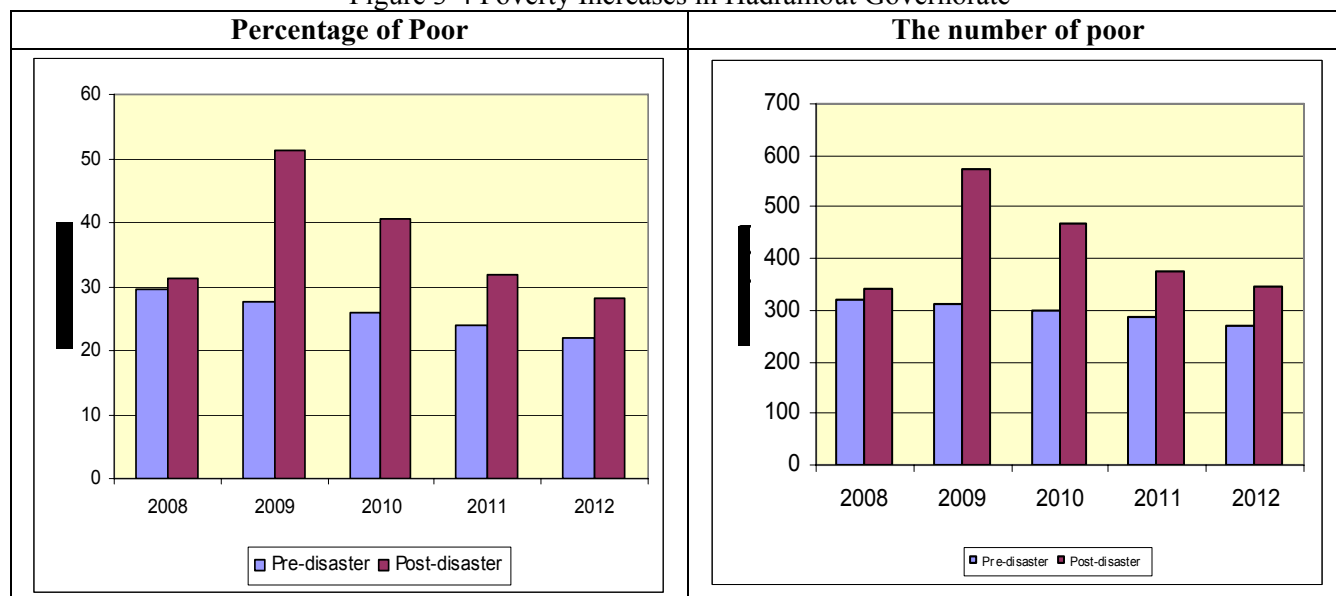
Figure 3-3 Income Losses in Al-Mahara Governorate, 2008-12 (Percentage of baseline income)



Source: Staff Estimates

As a result of the income losses, the number of poor in Yemen would increase by 265,000 persons or equivalently by 1.1 percent of population in 2009. This impact effects do not account for any increase in social protection or benefits from job creation during reconstruction activities. The poverty impacts in Hadramout governorate will be acute as shown in the increase in number of poor shown in Figure 3-4. The percentage of poor would nearly double from 28 percent to near 51 percent and the number of poor would double from 310,000 to 575,000 in 2009, the year of peak impact. The poverty gap would increase threefold to 12 percent in 2009 implying that to return the population to the pre-disaster levels of poverty would require cash transfer of about YR 17 billion under perfect targeting. This is a little less than the Social Welfare Fund (SWF) budget for the entire Yemen in 2006 at around YR 20 billion.

Figure 3-4 Poverty Increases in Hadramout Governorate



Source: Staff Estimates

The impact of the flood disaster on fiscal budget is expected to be significant mainly because of the need for additional expenditures. Repairing the damages to public infrastructure and providing social protection to the poor who lost incomes because of the flood disaster, would require at least US\$ 500 million more in capital and social protection expenditures over the next four years (and the cost is likely to escalate much further as Government undertakes necessary flood protection works and contributes to rebuilding shelter for those rendered homeless by the floods). On average, public capital expenditures have been about US \$ 2 billion in the recent years. With unchanged revenues, the fiscal deficit may have to increase by 1 percent of GDP for 2009 and 2010 from the baseline of 5 percent of GDP. Unless additional external financing is secured, the additional expenditures to finance reconstruction and social protection may have to be financed by domestic borrowing.

The flood disaster would enlarge the current account deficit mainly because of import needs of materials for reconstruction. It is estimated that imports could rise by about US\$ 200 million for financing the needs of reconstruction of about US\$1.1 billion. Assuming that the bulk of reconstruction would happen in the next two years, the import requirement would raise about by about US\$100 million a year. On the exports of goods and services, exports of honey may be less by about US\$ 10 million a year for three years until the beehives are built back. As a net result, the current account deficit is likely to widen by about 0.4 percent of GDP to -2.1 compared to the baseline estimate of -1.7 percent for 2009.

The inflation effects of the disaster likely to be small and transient. Price indices for November, 2008 – the first post-disaster month – would not be ready until the first week of January, 2009. However, scrutiny of price data for Al-Mahara suggests that important food items such as wheat, rice, etc. have not increased in the aftermath of the disaster because most of these are imported, the disruption to transport services have been minimal due to the rapid restoration of the functioning of roads (on a temporary basis) by the Ministry of Public Works and Highways, and the government and aid agencies have intervened quickly with emergency supplies of food grains to contain any pressure on prices.

Impact to Livelihoods and Income

Summary

The physical damages and economic losses to agriculture, including livestock and honey beehives, fisheries, industry and commerce will in turn have a major detrimental impact on livelihoods through the loss of income for the self-employed and workers in the different enterprises affected by the floods for the duration it takes to repair the damages, restore production and for the output to recover to pre-disaster levels. The total imputed income and self-employed wage losses arising from the damages and losses to the different productive sectors are estimated at YR 55,914 million (US\$279.6 million), due to the loss of an estimated 113,763 person-work-years over the period 2008-2012. These losses are divided as follows: YR 45,279 million (US\$226.4 million) in the agriculture sector or 81% of the total; YR 10,340 million (US\$51.7 million) in the trade sector or 18.5% of the total; YR 278.2 million (US\$1.4 million) in the fisheries sector or 0.4% of the total; and lastly YR 16.5 million (US\$0.1 million) for industry, a negligible share of the total. These losses amount in the agricultural sector to 46% of the total output of the affected areas over the period of 2008-2012, and in the retail sector 6% of total output (the losses in the fisheries and manufacturing sectors were negligible, respectively at 0.5% and 0.1%). In terms of geographic breakdown, the bulk of these imputed losses are in Hadramout Governorate (YR 276 million or 98.7% of the total) and the remainder in Al-Mahara Governorate (YR3.6 million or 1.3% of the total).

Losses to livelihoods:

The methodology to calculate the imputed income and self-employed wage losses arising from the damages and losses to each productive sector comprises of calculating the ratio of production lost to each sector as the ratio of the sector's losses (from the assessment) to the gross sector output (from the national accounts). The analysis is broken down by Governorate and by year for the duration of the assumed recovery period for each sector. The same ratio of production lost to the disaster in a given year is assumed to translate into loss of employment for an equal share of sector workers for the same year. The total imputed income and self-employed wage losses are calculated by multiplying the lost worker-years by the annual average wage income. Wage income data was derived from the 2005 Household Budget Survey and assumed to be the same in real terms in 2008 (and thus inflated at the Consumer Price Index). The average annual wage across all sectors in each of the two Governorates (YR27,607 per worker in Hadramout and YR36,397 in Al-Mahara in 2005) was used instead of the breakdown of wages by sector as the latter did not yield reliable figures for Al-Mahara and for the agriculture sector in Hadramout.

The total imputed income and self-employed wage losses arising from the damages and losses to the different productive sectors are estimated at YR 55,914 million (US\$279.6 million), which is the outcome of an anticipated loss of 113,763 person-work-years over the period between 2008 and 2012. In terms of geographic breakdown, the bulk of these imputed losses are in Hadramout Governorate (YR 276 million or 98.7% of the total) and the remainder in Al-Mahara Governorate (YR3.6 million or 1.3% of the total). Tables 3-3 and 3-4 summarize the total imputed income losses by sector and by affected Governorate, and Figure 3-5 shows the losses over time. Tables 3-5 to 3-7 provide a detailed overview of imputed livelihood losses in Hadramout, Al-Mahara and for the total affected areas.

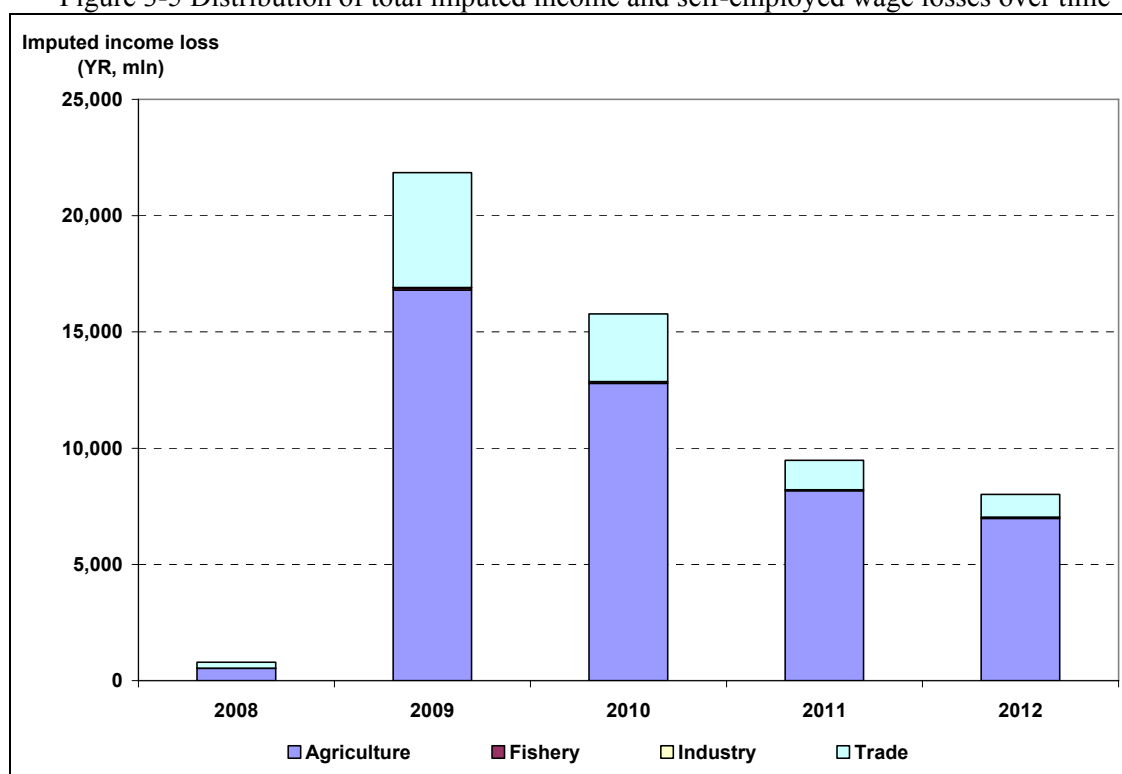
Table 3-3 Total imputed income and self-employed wage losses over the recovery period in the affected areas by sector

Sector	Person work years lost	Imputed income and self-employed wage losses	
		(Million YR)	(Million US\$)
Agriculture	92,179	45,279.2	226.4
Fishery	501	278.2	1.4
Industry	34	16.5	0.1
Trade	21,050	10,339.5	51.7
Total affected areas	113,763	55,913.5	279.6

Table 3-4 Total imputed income and self-employed wage losses over the recovery period for all sectors by affected area

Region	Person work years lost	Imputed income and self-employed wage losses	
		(Million YR)	(Million US\$)
Hadramout	112,654	55,196.8	276.0
Al-Mahara	1,109	716.6	3.6
Total affected areas	112,654	55,196.8	276.0

Figure 3-5 Distribution of total imputed income and self-employed wage losses over time



Such imputed losses are in reality higher than the actual losses of income to workers and livelihoods, given that both Governorates had a relatively high rate of unemployment pre-disaster.³⁵ Yet, they are a useful indicator of the magnitude of the disaster effect on livelihoods and the implications that it could have on the population of the affected areas. The reality is that a very large number of wage earners in the affected areas, and especially Hadramout, will have a

³⁵ Hadramout (23.5%) and Al-Mahara (28.5%), according to the HBS 2005.

much lower income over the next four years. Such situation, if left unaddressed, could lead to such consequences as accelerated rural-to-urban migration, a decline in nutrition, and even a famine.

Agriculture (and livestock) sector: The total imputed income and self-employed wage losses arising from the damages and losses to the agricultural sector are a staggering YR 45,279 million (US\$226.4 million), arising from an estimated 92,179 lost persons-work-years over a four-year recovery period. It is also thought that the floods are likely to have directly affected up to 100,000 households that earn a living from the ownership or sharecropping of agricultural land, livestock and/or honey beehives. The damages to cultivated land in Hadramout alone encompassed 22,106 Feddans out of a total cultivated land area in Hadramout that is equivalent to 47,000 Feddans. Thus, if 47% of the cultivated land area has been damaged, one could assume that an equivalent share of all the agricultural workers in the Governorate will be out of the job until the land is recovered. The number of workers in the sector is also arguably higher than that inferred from the HBS to account for the seasonal workers that work during harvest time (a one-to-one ratio with year-round workers in accordance with the experts and farmers met), the tradition of family-based farming and the large number of owners of livestock and honey beehives that do not own agricultural land.

Trade sector: The total imputed income and self-employed wage losses arising from the damages and losses to the trade sector are YR 10,340 million (US\$51.7 million), arising from an estimated 21,050 lost persons-work-years over a four-year recovery period. These anticipated losses in livelihoods owe mainly to the effect of the drop in the agricultural sector output on retail and wholesale trade jobs. As such, an accelerated recovery of the agricultural sector would trigger a commensurate recovery of the trade sector and the restoration of retail and wholesale jobs.

Fisheries sector: The total imputed income and self-employed wage losses arising from the damages and losses to the fisheries sector are YR 278.2 million (US\$1.4 million), arising from an estimated 501 lost persons-work-years over a two-year recovery period. In the coastal areas of Hadramout and Al-Mahara, fishing is undoubtedly an important source of livelihood, especially since about half of Yemen's fish production is from the combined coastal areas of the two affected areas. The imputed income and wage losses figure is, however, relatively limited. This is due to an expected rapid recovery of the sector to its pre-disaster output levels. Nonetheless, simply on the basis of the number of boats that have been damaged (100 mid-sized boats with 6-9 fishermen on average and 150 small boats with 2-4 fishermen on average), it could be estimated that some 500-1,500 fishermen will have been affected by the floods, depending on the percentage of damaged boats that were fully operational at the pre-disaster time.

Industry sector: The total imputed income and self-employed wage losses arising from the damages and losses to the industrial sector are negligible at YR 16.5 million (US\$0.1 million), manifested in an estimated 33 lost persons-work-years over a one-year recovery period. With 96 establishments (mostly small workshops) that reported being affected in Hadramout, the number of affected workers could be estimated at between 200-400 workers, with an average recovery period of 1-3 months for the majority and 4-12 months for a few enterprises that were particularly badly hit (especially workshops, warehouses and building material plants that were located within Wadi courses).

Table 3-5 Impact on livelihoods and income losses by sector and by year in Hadramout Governorate

	Baseline	2008	2009	2010	2011	2012	Total
Agriculture							
Gross Output million YR (BL: 2007)	29,076	35,422	36,974	38,627	40,388	42,265	
Production losses, million YR		1,036	35,323	27,276	17,681	15,218	96,534
Ratio of Production lost		0.029	0.96	0.706	0.438	0.360	
Number of workers (BL: 2004)	29,119	33,934	35,258	36,633	38,061	39,546	183,432
# Of Work-Years Lost		993	33,683	25,868	16,662	14,239	91,444
Avg annual wage income, YR (BL 2005)	331,284	489,969	489,969	489,969	489,969	489,969	
Annual imputed income and self-employed wage losses, million YR		486.3	16,503.7	12,674.3	8,164.0	6,976.6	44,804.9
million US\$							224.0
Fishing							
Gross Output million YR (BL: 2007)	16,374	16,684	14,262	12,150	10,316	8,729	62,141
Production losses, million YR		3	104	66	31	26	229
Ratio of Production lost		0.0%	0.7%	0.5%	0.3%	0.3%	0.4%
Number of workers (BL: 2004)	12,184	14,199	14,753	15,328	15,926	16,547	
# Of Work-Years Lost		2	107	83	48	49	290
Avg annual wage income, YR (BL 2005)	331,284	489,969	489,969	489,969	489,969	489,969	
Annual imputed income and self-employed wage losses, million YR		1	52	41	23	24	142
million US\$							0.7
Industry							
Gross Output, million YR (BL: 2007)	143,487	172,693	177,858				350,550
Production losses, million YR		206	224				430
Ratio of Production lost		0.1%	0.1%				0.1%
Number of workers (BL: 2004)	11,530	13,437	13,961				
# Of Work-Years Lost		16	18				34
Avg annual wage income, YR (BL 2005)	331,284	489,969	489,969				
Annual imputed income and self-employed wage losses, million YR		8	9				16
million US\$							0.1
Trade							
Gross Output, million YR (BL: 2007)	67,891	88,267	98,989	111,253	125,308	141,442	565,258
Production losses, million YR		850	17,630	11,233	5,266	4,446	39,424
Ratio of Production lost		1.0%	17.8%	10.1%	4.2%	3.1%	7.0%
Number of workers (BL: 2004)	46,259	53,909	56,011	58,196	60,465	62,823	
# Of Work-Years Lost		519	9,975	5,876	2,541	1,975	20,886
Avg annual wage income, YR (BL 2005)	331,284	489,969	489,969	489,969	489,969	489,969	
Annual imputed income and self-employed wage losses, million YR		254	4,888	2,879	1,245	968	10,234
million US\$							51.2
TOTAL ALL SECTORS							
# Of Work-Years Lost		1,530	43,783	31,827	19,251	16,263	112,654
Annual imputed income and self-employed wage losses, million YR		749.5	21,452.4	15,594.1	9,432.3	7,968.5	55,196.8
million US\$		3.7	107.3	78.0	47.2	39.8	276.0

Table 3-6 Impact on livelihoods and income losses by sector and by year in Al-Mahara Governorate

	Baseline	2008	2009	2010	2011	2012	Total
Agriculture							
Gross Output million YR (BL: 2007)	2,524	3,075	3,210	3,353	3,506	3,669	
Production losses, million YR		77	482	187	13	12	771
Ratio of Production lost		0.025	0.150	0.056	0.004	0.003	
Number of workers (BL: 2004)	2,528	2,946	3,061	3,180	3,304	3,433	15,925
# Of Work-Years Lost		74	460	177	12	11	734
Avg annual wage income, YR (BL 2005)	436,764	645,974	645,974	645,974	645,974	645,974	
Annual imputed income and self-employed wage losses, million YR		47.7	296.9	114.6	7.9	7.3	474.3
million US\$							2.4
Fishing							
Gross Output million YR (BL: 2007)	3,616	3,685	3,150	2,684	2,278	1,928	13,725
Production losses, million YR		2	76	48	23	19	167
Ratio of Production lost		0.0%	2.4%	1.8%	1.0%	1.0%	1.2%
Number of workers (BL: 2004)	2,691	3,136	3,258	3,385	3,517	3,655	
# Of Work-Years Lost		2	78	61	35	36	211
Avg annual wage income, YR (BL 2005)		645,974	645,974	645,974	645,974	645,974	
Annual imputed income and self-employed wage losses, million YR		1	50	39	22	23	136
million US\$							0.7
Industry							
Gross Output, million YR (BL: 2007)	6,869	8,268	8,515				16,783
Production losses, million YR		0					0
Ratio of Production lost		0.0%					0.0%
Number of workers (BL: 2004)	552	643					
# Of Work-Years Lost		0					0
Avg annual wage income, YR (BL 2005)		645,974					
Annual imputed income and self-employed wage losses, million YR		0					0
million US\$							0.0
Trade							
Gross Output, million YR (BL: 2007)	6,371	8,283	9,289	10,440	11,759	13,273	53,045
Production losses, million YR		3	140	89	42	35	310
Ratio of Production lost		0.0%	1.5%	0.9%	0.4%	0.3%	0.6%
Number of workers (BL: 2004)	4,341	5,059	5,256	5,461	5,674	5,895	
# Of Work-Years Lost		2	79	47	20	16	164
Avg annual wage income, YR (BL 2005)		645,974	645,974	645,974	645,974	645,974	
Annual imputed income and self-employed wage losses, million YR		1	51	30	13	10	106
million US\$							0.5
TOTAL ALL SECTORS							
# Of Work-Years Lost		77	617	285	67	63	1,109
Annual imputed income and self-employed wage losses, million YR		50.0	398.6	184.0	43.4	40.7	716.6
million US\$		0.2	2.0	0.9	0.2	0.2	3.6

Table 3-7. Impact on livelihoods and income losses by sector and by year in the affected areas

	Baseline	2008	2009	2010	2011	2012	Total
Agriculture							
Gross Output million YR (BL 2007)	31,600	38,497	40,184	41,981	43,895	45,934	
Production losses, million YR		1,113	35,805	27,463	17,694	15,230	97,305
Ratio of Production lost		0.029	0.891	0.654	0.403	0.332	
Number of workers (BL: 2004)	31,647	36,880	38,319	39,813	41,366	42,979	
# Of Work-Years Lost		1,066	34,143	26,045	16,675	14,250	92,179
Annual imputed income and self-employed wage losses, million YR		533.9	16,800.6	12,788.8	8,171.9	6,983.9	45,279.2
million US\$							226.4
Fishing							
Gross Output million YR (2007)	19,991	20,368	17,412	14,834	12,595	10,657	75,866
Production losses, million YR		4	179	114	53	45	396
Ratio of Production lost		0.0%	1.0%	0.8%	0.4%	0.4%	0.5%
Number of workers (2004)	14,875	17,335	18,011	18,713	19,443	20,201	
# Of Work-Years Lost		4	185	144	82	85	501
Annual imputed income and self-employed wage losses, million YR	0	2	103	80	46	48	278
million US\$							1.4
Industry							
Gross Output, million YR (2007)	150,356	180,960	186,373				367,333
Production losses, million YR		206	224				430
Ratio of Production lost		0.1%	0.1%				0.1%
Number of workers (2004)	12,082	14,080	13,961				
# Of Work-Years Lost		16	17				33
Annual imputed income and self-employed wage losses, million YR	0	8	9				16
million US\$							0.1
Trade							
Gross Output, million YR (2007)	74,262	96,550	108,278	121,693	137,067	154,715	618,303
Production losses, million YR		853	17,770	11,322	5,307	4,482	39,735
Ratio of Production lost		0.9%	16.4%	9.3%	3.9%	2.9%	6.4%
Number of workers (2004)	50,600	58,967	61,267	63,657	66,139	68,719	
# Of Work-Years Lost		521	10,055	5,923	2,561	1,991	21,050
Annual imputed income and self-employed wage losses, million YR	0	256	4,939	2,909	1,258	978	10,340
million US\$							51.7
TOTAL ALL SECTORS							
# Of Work-Years Lost		1,607	44,400	32,111	19,318	16,326	113,763
Annual imputed income and self-employed wage losses, million YR		799.5	21,851.0	15,778.0	9,475.7	8,009.2	55,913.5
million US\$		4.0	109.3	78.9	47.4	40.0	279.6

Social Impact

Loss of shelter as the main concern ³⁶

In the aftermath of the floods, thousands of Hadramis found themselves homeless, their homes having been subjected to either total destruction or partial damage. According to the assessment, 1,662 mud-brick houses and 1,164 huts were destroyed, 3,679 houses were partially damaged, and over 25,000 people were rendered homeless, including about 23,400 in Wadi Hadramout alone. The relief effort that ensued and the area's strong family networks and ties eased the humanitarian situation at hand. Tents were distributed through aid agencies and the government; affected peoples were moved to existing structures such as schools and mosques; and a large number of the affected were invited to stay at the homes of relatives or in houses that are owned by Hadramis living abroad and that were at the time of the floods vacant. The latter solution was seen by many as the preferred one, in harmony with the area's social customs. The setting up of tents was deemed inappropriate shelter by many of the local residents. While tents were set up, they remain empty. Some, however, were used by some of the marginalized communities in the area.

During a visit to a school in Tarim that also serves as a shelter, a large group of women talked about their strenuous living conditions, with 30-40 people crammed into each classroom. With approximately 350 homeless residents living in the school, the women expressed their dismay at the uncertainty of their living situation. Some raised issues of privacy, in particular the sharing of bathrooms with men (though not at the same time) as affecting women's psychosocial wellbeing. In this particular school, the families occupied the lower floor while on the upper floor classes were being held mornings and afternoons.

The families mentioned housing as their main priority, having had their houses destroyed and rendered uninhabitable by the floods in Wadi Hadramout, and were expecting the government to erect new homes in safe areas for them within the next few months. During the discussions, the school headmaster, whose house – as well as most houses in the community – was also destroyed, talked about the need to move the entire community to a safe area that would not be subject to future destruction by floods. A local association of which he is a member provided the government with two proposals of desirable locations. Although some of the houses in the community were still standing (in particular those made of cement bricks as opposed to the traditional mud-bricks), and villagers were still living there, the community as a whole expressed a desire to move to the new location.

In the Hadramout Sahel areas as well as in Wadi Al-Massila in Al-Mahara, several communities hit by the floods and rains were visited. Damage was seen in some of the houses, which are of poor construction, mainly caused by the torrential rains. In several of these areas – inhabited by Bedouin or marginalized communities – tents were set up and mosques were used as shelter. Most residents are now back living in their homes, many of which have cracks in the roofs.

Loss on livelihoods as the second concern

Second only to housing, the loss of livelihoods was raised by all consulted as a critical issue for

³⁶ Contributors to and persons consulted in this section include: Mohamed Sawlan, International Federation for Red Crescent and Cross; Taher Bin Hussein Al-Attas, Head of Al-Ra'fa NGO; Mohamed Al-Kaf, Ra'fa NGO; Ahmed Al-Haddad and Ahmed Al-Sokouty, respectively Director and Deputy Director of Mukalla Local Economic Development Department.

those living in the flooded areas. Given the high poverty levels in Hadramout, the diversification of income sources has long been an important coping strategy for residents. Poverty indicators show the district of Tarim, which was severely affected by the floods, as one of the poorest in Yemen, with about 50% of the total population as poor. The main sources of livelihood in the area are agriculture, construction, civil service, and handicrafts (Varisco 2005). Additionally, remittances from Hadrami migrants abroad provide an important source of income and have contributed to the booming construction sector in such cities as Mukalla.

Most families encountered derive some income from agriculture, with irrigated agriculture having traditionally been the main occupation in Wadi Hadramout. There are four main groups of people involved in agriculture: (1) those who own land and cultivate it for both family consumption and sale on the market. These farmers mainly rely on their land as a source of income; (2) those who own land but do not produce enough food to sustain their household's consumption, in turn having to rely on other sources of income to fill the gap; (3) tenants or sharecroppers who lease the land either from landowners or from the government through a share-cropping agreement; and (4) landless agricultural workers who neither own the land nor have rights to it and who rely on income from wages in agricultural and non-agricultural activities.

According to the Yemen poverty assessment (World Bank, 2007), 18% of rural households in the governorate own land, compared to 4% of urban households, far below the national average of 57.9% and 8.5% respectively. This would suggest that a large portion of those working in agriculture are tenants or landless agricultural workers. In the traditional system of sharecropping on date plantations, for instance, farmers keep 2/3 of the product and the remaining 1/3 goes to the landowner. All additional costs – wage labor, diesel and other costs – are borne by farmers. Additionally, most farmers do not own tractors or other agricultural machinery, and renting those is an extra cost.

The main irrigated crops are sorghum, clover and wheat. In addition to being sold on the market, sorghum stalks serve as local cash crop for animal fodder. Mud bricks for construction purposes are also made from leftover chaff. Dates and citrus are also produced in the area, and the region is known for some of the world's best honey. All of those encountered reported having suffered agricultural damage and losses in the form of crop losses, damage to agricultural land, destruction of beehives, livestock deaths, irrigation machinery losses, destruction of wells, and loss of palm and other trees. Additionally, some complained of the increased price of foods. While a few have started replanting their lands, others who have also had their land's top soil completely destroyed have not had the means to do so. When asked about accessing credit to restart their activities, some residents were not keen to do so as they felt that the floods were not of their doing.

A majority of rural households in Hadramout – 80% – own goats and sheep, as do about 25% of urban households. Animal production contributes by 28% to the total agricultural production income for the agricultural sector in Yemen. Each household has about 15-20 sheep and goats, which are tended by the women and children. This is an important source of livelihood, in particular for those farmers whose land does not produce enough food to sustain their families. Some 55,000 sheep, goats, camels and cattle reportedly drowned as a result of the water surge.

Construction work is another important source of income for residents with a large proportion of working men reported to be working in the sector. This work tends to involve some level of skill, in particular to implement traditional modes of construction. Low skill-income earning activities seem to be the common source of income for a large number of the urban poor, entailing activities that are labor-intensive and that do not require formal training or education.

In the coastal areas of Hadramout and Al-Mahara, fishing is an important source of livelihood. In the communities visited in Al-Massila, poor areas with no access to schools or health clinics, men cover an important distance to go fishing everyday, which is their main source of income supplemented by small income generating activities such as leasing cars or transporting bricks. Women and children also draw a small income from fishing in these areas. Many of these individuals reported having lost nets and fishing boats, and loss of income in the period following the rains and floods.

Gender considerations

Entire families contribute to agriculture, with women and men working in the fields and women and girls taking care of goats and sheep. While women are most often found in the fields, those consulted – women working in agricultural fields and girls tending to goats – do not consider their efforts to be productive work or contribution to the household income. Their husbands and other men in the family are considered to be the breadwinners. In discussing the effects of the flood on their livelihood, they mentioned damage to agricultural land and losses of harvest and livestock, but also emphasized the differentiated sources of income – including relatives living abroad sending remittances – and the pooling of resources between several households in a family to cover expenses.

Outside of agriculture, women – particularly the poor – are involved in small scale income generating activities such as henna decoration, knitting, food processing, and basket weaving.

As mentioned earlier, the floods have affected women in several ways, particularly those who have been uprooted from their homes and communities. Issues of privacy came up during discussions, as well as women's anxiety related to no longer being in control of their homes. The International Federation for Red Crescent/Cross (IFRCC) has highlighted many of these issues and is considering providing psychosocial support to women in the affected areas.

Children

Most of the children encountered seemed healthy and well fed. During a visit to the health clinic in Sah, several families encountered who did not report illnesses related to the floods. However, at the school in Tarim, mothers mentioned cases of diarrhea affecting children in the aftermath of the floods, but those seem to have dissipated. There have been reports of a few cases of malaria in areas where there were stagnant pools of waters and piles of rubbish and dead animals around houses. According to the IFRCC, health facilities are functioning with a limited capacity, and a field hospital was erected in Seiyun (financed by the UAE).

In terms of schooling, most families reported their children attending school again, although it is clear from discussions that school was interrupted for some time after the floods. Moreover, that 45 schools in the Wadi Hadramout the area are still being used to house many of the homeless, suggests some disruption to regular schooling, including the likely cramming of students in the available classrooms. In Sah, the girls' school was destroyed, and tents were reportedly being set up (by UNICEF) to serve as temporary schools for girls.

In one area that suffered massive destruction of houses, some households – including children – continued to live in the few houses that remained standing. These areas were filled with debris and waste, presenting a danger to those households and particularly to the children living in the area. The area's sanitation conditions could not immediately be assessed.

Community and Family

Family structures are quite large in Wadi Hadramout area as well as in Al-Mahara, providing yet another coping mechanism against external shocks. Many of the families encountered live as a nuclear core within a larger household. These families consist of the parents, their sons and their spouses and children. One of the headmasters in a school in Tarim, whose house was destroyed by the floods, had been living in the house with four other nuclear families, all of whom are closely related. The same was true for most of the individuals consulted in Sah and Tarim. This structure is a way for families to share daily consumption and financial arrangements.

Strong social networks and social cohesion continue to characterize the communities living in these areas, with the exception of Bedouins and marginalized communities whose social networks are considered weaker. In discussions with community members, most people acknowledged the support of the community during the floods. In the midst of the floods, residents' efforts to notify and help get people out of their homes was also noted, in particular the use of loudspeakers at mosques, cell phones, and gunfire as a way to warn people of the impending dangers. Families and neighbors supported each other by providing shelter, food and clothing to their communities. Phone calls were made to Hadramis in Saudi Arabia to request shelter in their empty homes. The clean-up effort supposedly involved entire families, with the men discarding the heavy materials while women were active in cleaning the smaller debris.

Families not living or not known to the villagers reported having had difficulties with the community as was the case for one of the families encountered at a health clinic in Sah. Being from the hillsides outside of Sah, one of the women complained about how difficult it was for her family to find help and support because they did not belong to the village. The same feelings were expressed by several families in Al-Massila and Hadramout Sahel. These families reported having moved to these areas approximately ten years ago, but to have received little support from the communities.

Relief organizations

According to the local council and IFRCC, support was provided to the affected areas by dozens of organizations, including the IFRCC, which channeled goods and assistance from the UAE, Kuwait, and Turkey, as well as numerous charities in the area, including Islamic charities. The IFRCC has focused its support in two of the most affected areas of Wadi Hadramout. One NGO, called Al-Ra'fa (affiliated with Dar Al-Mostafa religious center), alone took the responsibility of providing food to 11,000 persons living in shelters for a six-month period, as well as operating six free clinics. The UN is also very active in providing relief.

Part B: Recovery and Reconstruction



Part B of this report presents the estimated recovery and reconstruction needs to restore the livelihoods of the affected individuals and households and the output of enterprises back to pre-disaster levels and to rebuild back the destroyed physical infrastructure assets and restore the services to their pre-disaster functioning level. The estimation of the recovery and reconstruction needs takes into account the principle of “build-back-better,” to ensure that the damaged assets that are rebuilt could withstand similar disasters in the future.

The estimated recovery and reconstruction needs are subdivided into three categories: (i) urgent actions under an immediate intervention program, which encompasses the first six-months period; (ii) reconstruction and recovery needs over the short and medium-term, spanning an estimated four years for reconstruction and recovery to pre-disaster level; and (iii) disaster risk management needs, to reduce the vulnerability and risk of occurrence of a similar disaster in the future.

The recovery and reconstruction needs would serve as the basis for the preparation, by the GOY, of a detailed Recovery and Reconstruction Plan as the basis for the implementation.

Section IV. Immediate Intervention

The immediate intervention program is based on meeting urgent needs and will provide the first opportunity for the affected population to restore lives, devastated by storm 03B. The immediate needs include: (a) ensuring food security for those who lost their livelihoods and are at-risk of hunger; (b) temporary shelter for those who lost their shelter and belongings, as well as clothing, etc; (c) delivering emergency health care and medication for the affected population; (d) providing clean drinking water and basic sanitation facilities for those whose access to these services was interrupted by the floods; (e) measures to contain critical environmental health problems, prevent epidemics and ensure safety of the population, including disposal of dead animal bodies, pumping of sewerage and stagnant water, spraying the worst affected areas, etc; and (f) restoring the functioning of critical services and infrastructure on an emergency basis to facilitate the operation of emergency relief programs, including health care services, critical access roads, water and sanitation, power, and telecommunications services, together with education to minimize the disruptions to children and youth. Most of the elements of the immediate intervention program are already underway through a combination of efforts from the Government, Non-Government Organizations (NGOs), and bilateral/multilateral donor agencies. The immediate intervention program timeframe is four to six months.

The following section outlines the program to take care of immediate needs, while building a foundation for overall recovery.

Food Security Needs

Food security needs for those families that have lost their livelihood in the agriculture, livestock and fisheries sector due to the floods are estimated at YR 2,000 million (US\$10 million) over a duration of six months until the next harvest in April 2009 (See Table 4-1 below). The food needs include rice, wheat, flour, beans, sugar, oil and salt. The main aim of this intervention is to significantly reduce hunger-related malnutrition and mortality levels among the affected population in both the governorates.

Table 4-1 Estimated Needs to ensure Food Security in Agriculture Sector

Strategy	Crops Sub-Sector		Livestock Sub-Sector		Fisheries Sub-Sector		Total	
	YR, mln	US\$, mln	YR, mln	US\$, mln	YR, mln	US\$, mln	YR, mln	US\$, mln
Food security	1,200	6	400	2	400	2	2,000	10

Source: DLNA team estimate

In addition, the UN's assessment of food security needs for a six-month duration until April 2009 in assistance to the estimated 25,000 affected people that have lost their shelter and all their belongings and have thus become highly food-insecure until the next harvest in April 2009 amounts to US\$1,757,800 and has been included in the Yemen Flood Response Plan (2008).

Temporary Shelter Needs

A critical component of the immediate intervention program is to provide temporary shelter to the families that have lost their houses, including houses that have been significantly damaged and their occupancy has become life-threatening. Currently, displaced families have sheltered either in schools (a temporary solution), have moved in with relatives or into empty houses of Hadramis living overseas that have availed their units for their community members.

It is estimated that as much as 4,579 households or about 26,527 persons (based on an average household size of seven) were displaced or may need to be displaced due to the significant damage that their housing structures has incurred. The number of displaced people in Hadramout Wadi alone is 23,382 persons, of which about 15,000 lived in shelters. In Hadramout Sahel, the figure, which is derived from the estimated number of fully damaged housing units as discussed with the local authorities, is in line with the figures reported by a specially constituted local NGO, called Popular Committee for Emergency Relief of Flood Victims and involving the leadership of the business community, that counted households in temporary shelters (mosques and schools).

Table 4-2. Estimated displaced persons by region

	Households displaced	Persons displaced
Hadramout Sahel	402	2,814
Hadramout Wadi	4,129	23,382
Al-Mahara	48	331
Total	4,579	26,527

Notes: the displaced household figure in Hadramout Sahel is estimated on the basis of three households/ units per affected structure.

As noted in the social impact assessment, crowding out in temporary in shelters or living in tents lacking privacy and with shared sanitary facilities is contrary to the customs and mores of the traditional society of Hadramout and Al-Mahara, which implies that a large share of the flood victims will have most likely been accommodated by their relatives and community members. As such, a seemingly viable and appropriate solution is to provide affected families with the option of rental housing for temporary shelter needs until their housing is rebuilt. In Hadramout Sahel, especially in Mukalla where much construction activity is taking place with remittances from workers abroad, there are likely enough vacant housing units that could be rented for the displaced households. In the Wadi, the available housing stock is likely to be tighter. For the displaced families that live with relatives, support should be provided to cover their expenses. Overall, it is estimated that the temporary shelter program would need to span an average period of about 18 months. This is the estimated time to rebuild damaged housing units and includes preparation of the disaster vulnerability and hydrological studies needed to inform decision-making as to whether and where to resettle affected communities, as well as the needed surveys, land acquisition (as may be needed) and housing construction. The overall temporary shelter program is estimated to cost YR 2,8210.1 (US\$14.1 million) for the 18 months. As such, the immediate intervention program's share of the temporary shelter program is estimated at YR959.82 million (US\$4.799 million).

Table 4-3 Immediate intervention needs for temporary shelter

Needs	Cost (in million YR)	Cost (in million US\$)
Temporary shelter for 6 months	959.82	4.799

Source: DLNA team estimate

Medical Facilities, Water Supply, and Sanitation Needs

The following immediate intervention measures are required to prevent the outbreak of epidemics and to ensure access to medical, clean water, and sanitation facilities:

- Disease surveillance;
- Procurement of medicines, safe delivery kits, medical equipment and electric generators;

- Provision of disinfection equipments for all wells that are prone to possible contamination (this requires a comprehensive inspection and testing/monitoring program of water quality);
- Identification and procurement of emergency mobile water treatment equipment for each major city;
- Provision of additional sanitation facilities for families staying in schools/shelter camps; and
- Capacity building in first aid, disaster response, disaster preparedness, health promotion, and collective and individual hygiene.

Information on the key health indicators is not available at district level but the extent of the damage in several districts is so extensive that early intervention to provide primary and preventive health services is critical. The situation is further aggravated by the substantial damage that took place in the sources and distribution networks of potable water, which increases the risk for the potential of water-borne diseases. Emergency medical support provided with the assistance by the country teams of the World Health Organization (WHO) and UNICEF under the humanitarian stage needs to be continued, which includes the provision of drinking water storage tanks strategically located. Some of the hospitals and health centers in the worst affected districts are totally damaged and are in need of immediate replacement, as they are the only source of medical care service to those living in rural areas. Priority should be given in the early recovery strategy to include replacement of damaged health and medical equipment, as well as provision of essential public health services to the most vulnerable groups such as maternal health and other reproductive health services, newborn health services, immunization, strengthening communicable disease surveillance and health promotion.

The Government with the support of UN agencies and some donors was prompt in deploying medical personnel to the affected areas. Six mobile health teams were deployed, programs were launched for emergency malaria control and disposal of animal carcasses, and disease surveillance systems were established (fortunately no outbreaks of epidemics were reported). These initiatives started in the relief stage that concentrated on measures to prevent and control outbreaks of disease should be continued while the lost health facilities are replaced albeit gradually decreasing with time. The estimated cost for such medical facilities together with emergency water treatment and sanitation facilities is, according to the UN 2008 Flood Response report, YR 920 million (US\$4.6 million).

Table 4-4 Immediate intervention needs of the health sector

Needs	Cost (in million YR)	Cost (in million US\$)
Medical, water supply and sanitation facilities	920	4.6

Notes: Based on UN estimates (2008 Flood Response).

Educational Facilities Needs

Temporary schools consisting of tents and rental space, if readily available at reasonable cost, are needed in the immediate term to enable resuming classes as soon as possible and thus reduce the disruption to the students. It should be noted that there are districts in Wadi Hadramout such as Sah, Al Soum and Al Qatn, where a substantial part of the housing stock was also lost to the flood waters and there may not be suitable housing for rent while the totally destroyed schools are replaced. In such places, consideration should be given to using tents that could be recovered from temporary shelters elsewhere and which may no longer be in use. Also needed is the replacement of education material and needed school furniture damaged by the floods to enable

resumption of schooling activities. Expedient procurement procedures should be used for the supply of school furniture and educational material. Also consideration should be given to the construction of temporary sanitary facilities for the use of school children and coordination with UNICEF and WHO activities related to both education and health aspects for such children. The estimated cost for the immediate intervention to restore education services is, according to the UN 2008 Flood Response report, YR 154 million (US\$0.77 million).

Table 4-5 Immediate intervention needs of the education sector

Needs	Cost (in million YR)	Cost (in million US\$)
Education facilities	154	0.77

Notes: Based on UN estimates (2008 Flood Response).

Finally, in preparation for the reconstruction program, it is recommended that the Government engages the participation of the Social Fund for Development (SFD) and the Public Works Project (PWP) to inspect in detail the partially damaged schools in preparation for immediate start of the repair works using rapid procurement and construction procedures.

Emergency restoration of services Needs

The immediate intervention program also includes emergency restoration for critical services on a temporary basis to facilitate the flow of emergency relief and the delivery of basic water supply, sanitation and health services. This includes the temporary rerouting of the main regional roads around the destroyed Irish crossings to facilitate traffic including for the flow of emergency aid, which was implemented by the General Corporation for Roads and Bridges (GCRB). In addition, the Water Supply and Sanitation Corporations undertook to rapidly replace water supply and sanitation trunk lines that were demolished by the floods, to restore the supply potable water which was interrupted for a large share of residents in the affected areas (including for 50% of Mukalla's population), and prevent an outbreak of health problems. Similarly, the Public Electricity Corporation (PEC) branches carried out rapid repairs to restore power supply to critically affected areas, to ensure among other things that key facilities such as hospitals continue to function. Finally, key repairs to the telecommunications network were carried out to restore the service, which is critical for coordinating aid delivery. The immediate intervention needs are estimated at about YR916.2 million (US\$4.59 million).

Table 4-6 Immediate intervention needs for restoration of critical services

Needs	Cost (million YR)	Cost (million US\$)
Critical access roads	173.0	0.87
Power	250.0	1.25
Water and sanitation	471.2	2.36
Telecommunications	22.0	0.11
Total	916.2	4.59

Notes: Estimates based on actual expenditures for roads by the General Corporation for Roads and Bridges, the local Water Supply and Sanitation Corporations and the Public Telecommunications Corporation. For power, needs extrapolated on the basis of YR 125 million requirement for emergency restoration of service in Hadramout Wadi.

Environmental Protection Needs

Critical immediate intervention needs for environmental protection include YR 0.7 million reportedly needed by the Wadi Hadramout local authorities urgently to dispose of remaining dead animal bodies, an estimated YR 5.8 million to pump stagnant waters from densely populated areas to prevent outbreaks of diseases and epidemics, an estimated YR 37.3 million to collect and

dispose of the municipal solid waste and hazardous material that was dispersed throughout urban areas by the floods, and YR 35 million to repair the damages to equipment owned by the Mukalla Cleaning and Improvement Fund (CIF) to enable it to adequately address the emergency needs in environmental protection. Thus the total estimated immediate intervention needs amount to YR 78.8 million (US\$0.394 million).

Table 4-7 Immediate intervention needs for environmental protection

Needs	Cost (in million YR)	Cost (in million US\$)
Carcass removal, Wadi	0.7	0.004
Pumping stagnant water	5.8	0.026
Municipal and hazardous waste collection and disposal	37.3	0.185
Emergency repair of equipment	35.0	0.175
Total	78.8	0.394

Source: DLNA team estimate

Even though the effort to collect and safely dispose of rubble and debris would need to start as soon as possible, the magnitude of the resources required (estimated at YR415.5 million of rubble from shelter and YR 2,860.2 million for sediments, debris and tree trunks) implies that the bulk of this effort will be part of the early recovery program. Yet, a rapid assessment needs to be undertaken to determine critical locations in which debris removal is required on an urgent basis for such purposes as preventing contamination of groundwater resources and the exacerbation of health problems.

Summary of Immediate Intervention Requirements

The following is a summary of immediate intervention requirements over a duration of 4-6 months, based on the DLNA estimates and the needs identified by national and international humanitarian agencies.

Table 4-8 Summary of Immediate Intervention

Early Intervention	Million YR	Million US \$
Food security (livelihoods losses)	2,000.0	10.00
Food security (shelter losses)	351.4	1.76
Temporary shelter	959.8	4.80
Medical, water supply, and Sanitation Facilities*	920.0	4.60
Education Facilities*	154.0	.77
Environmental Protection	78.8	0.39
Emergency restoration of services		
Critical access roads	173.0	0.87
Power **	250.0	1.25
Water and sanitation	471.2	2.36
Telecommunications	22.0	0.11
Total	5,380.2	26.91

Notes: Estimates are indicative and are based on DLNA team assessment except (*) based on UN estimates in Flood Response Plan (2008). (**) Extrapolated based on YR 125 million requirement for emergency restoration of service in Hadramout Wadi.

Section V. Recovery and Reconstruction Requirements

Recovery and Reconstruction Strategy

Effective recovery and reconstruction requires a comprehensive strategy that ensures that the Government, the affected communities and concerned entities “build back better” and drives sustainable economic recovery by, inter alia, reducing exposure over the long-term to disaster risks and enhancing disaster risk capacity and coping abilities.

Experience shows that recovery and reconstruction programs are more successful when physical reconstruction of damaged assets and employment generation are linked. This enables the affected communities to participate in housing and small-scale infrastructure reconstruction and thus allows access to resources needed for their livelihood restoration, and incorporates hazard risks and vulnerability concerns in reconstruction activities and future development plans. In fact, utilizing local resources, both physical and non-physical, is key to capacity building and long term sustainability of the affected regions. Finally, and most importantly, transparency and effective targeting in allocating assistance to the affected households and regions are also factors to ensure sustainable results from recovery efforts.

The recovery and reconstruction program consists of two elements: (i) Economic and Livelihood Recovery, including recovery of productive sectors; and (ii) Reconstruction and upgrading of damaged infrastructure.

Component 1: Economic and Livelihood Recovery

Short-term measures that facilitate income recovery for individuals must be complemented by activities that promote community-wide economic recovery. The revival of the local economy and the creation of livelihood opportunities should also include support to the development of micro and small enterprises including informal operators, introduction/strengthening of microfinance services and local business development services, and promotion of the involvement of affected communities and individuals in the reconstruction program. In particular, livelihood recovery interventions should include:

- Provision of temporary employment for those who lost their jobs or livelihoods through labor-intensive public works schemes and participation in the reconstruction activities;
- Distribution of cash grants to the poorest and most affected households to attenuate the impact of the disaster on already vulnerable households;
- Provision of a mix of grants and (low-interest) credit to rebuild/repair the damaged houses and replace damaged household goods;
- Distribution of cash or in-kind grants to agricultural and non-farm sectors to replace tools, equipment and stocks, rebuild workplaces, and re-start production (seeds, etc);
- Provision of (low-interest) credit to affected persons in the agricultural and non-farm sectors to restore and upgrade productivity;
- Provision of skills development and vocational training programs to induce local economic recovery and development; and
- Development of capacity for disaster recovery planning, including comprehensive awareness and information campaigns.

Component 2: Infrastructure Reconstruction

Reconstruction/rehabilitation of the physical assets that were damaged by storm 03B includes private and public facilities (housing, education, health, public buildings and cultural heritage), infrastructure (water and sanitation, power, roads and transport infrastructure, telecommunications, agriculture sector-related infrastructure such as irrigation, embankments, etc) as well as debris removal. The construction of flood protection measures needed to prevent the occurrence of such disasters in the future is not included in this section; instead, it constitutes part of the disaster risk reduction/management needs, presented in the following section.

The overall approach for infrastructure reconstruction is twofold: (a) to provide opportunities to help affected populations regain socioeconomic stability, and: (b) to introduce and mainstream new standards and upgrading that will help protect them against future disasters. The reconstruction program will build upon early recovery infrastructure activities, developing these into more sustainable investments, while creating opportunities for the private sector to strengthen its capacity. The expenditure on reconstruction of damaged assets would be used, to the extent possible, to create job opportunities by utilizing local resources (both material and small and medium enterprises), employing the affected populations (to enable them to generate means for livelihood) and building their capacity, and creating a multiplier effect on recovery in the local economy.

Introduction of quality control and improved construction standards for the construction will ensure increased resilience to face possible future natural hazards. For this purpose, the reconstruction needs including necessary siting and design improvements have been estimated through discussions with Government officials and experts and field visits to selected damaged assets (including the entire damaged regional road network, critical damages to the water, sanitation, power and telecommunications network, the hardest hit settlements in terms of loss of shelter, and selected damaged health and education facilities). In some instances, decisions such as whether to realign some destroyed road sections, relocate damaged facilities, or resettle heavily affected communities will require further hydrological studies and surveys to inform decision-makers. In such cases, estimates have been presented on the basis of on-site (improved) reconstruction and resettlement and to do so, a factor of 150% of the damage value was taken to estimate the improved reconstruction needs (which would include the necessary preparation of studies, designs, land acquisition and off-site infrastructure improvements as may be needed, and the improved construction standards). Clearly, there will be a need to undertake further in-depth assessments of the required reconstruction needs; required assessments, if any, are explained in each respective section.

The following sections present Recovery and Reconstruction Interventions for each of the assessment sectors, as well as the needs for livelihood restoration and proposed approaches.

Recovery and Reconstruction Needs by Sector

Productive Sectors

Agriculture

Summary

The total needs to finance early recovery, medium-term recovery and reconstruction for the crops, livestock and the fisheries sub-sectors are YR 99,200 million (US\$496 million). These needs have been estimated to consist of in-kind grants for about YR 4,000 million (US\$20 million) to provide critical agricultural inputs such as improved seeds and seedlings to the marginal and small farmers for promoting medium-term recovery; low interest credit to farmers and fishermen including YR 15,200 million (US\$76 million) in short-term credit to promote early recovery and YR 15,000 million (US\$75 million) in credit over the medium-term to promote medium-term recovery; and YR 65,000 million (US\$325 million) in the form of public investment to finance the reconstruction and rehabilitation of public infrastructure such as flood protection and irrigation infrastructure (not including another US\$49 million in flood protection investments for disaster risk reduction, which were accounted for in the Disaster Risk Management section).

These needs are the most critical needs to help promote recovery and build critical infrastructure for the affected households and geographical areas, and especially Wadi Hadramout. These needs are only about 50% of the total estimated damage and loss for the crop, livestock and fisheries sub-sectors. Given that rural poverty is about 40% (even higher in the flood affected areas), the Government must put in place a safety net, recovery and reconstruction program at the earliest (starting now). Otherwise, rural poverty is likely to increase in the flood affected areas due to likely increase in unemployment and reduction in household income.

Recovery and Reconstruction Needs

The estimated recovery and reconstruction needs for the crop, livestock and fisheries sub-sectors are designed to promote quick recovery, “build back better” the damaged public sector irrigation infrastructure and finance the repair of existing flood protection embankments for the flood affected areas, primarily Wadi Hadramout (the construction of needed new embankments is listed in the Disaster Risk Management section). The following are the needs broken down by sub-sector (See Table X):

Crop Sub-sector

The overall needs for the crop sub-sector are estimated to be US\$445 million (See Table X). These needs are divided into three categories: (i) early recovery needs in the form of low interest loans (less than YR1 million per household) to finance the purchase of agriculture inputs, machinery and irrigation equipment are about US\$50 million; (ii) medium-term recovery needs in the form of low interest loans (greater than YR1 million per household) to finance the purchase of agriculture inputs, machinery and irrigation equipment as well as free distribution of improved varieties of seedlings for fruit trees are about US\$70 million; and (iii) reconstruction needs to finance land leveling and grading and the repair of the public irrigation infrastructure are about YR 65,000 million (US\$325 million). Every effort must be made to use labor from the local community for land leveling, land grading and irrigation infrastructure so that part of the funds

are pumped back into the affected communities in order to provide much needed employment and household income.

Livestock Sub-sector

The recovery (both early and medium-term) needs for the livestock sub-sector are estimated to be YR10,000 million (US\$50 million). This would be in the form of low interest loans (US\$50 million) to finance the purchase and raising of camels, sheep, cattle and honey beehive cells. Since the livestock sub-sector does not require any reconstruction, the total needs are only about 12% of the total needs for the crop sub-sector. Since the livestock sub-sector has important implications for gender and reduction in poverty, the Government should consider giving it a high priority during the recovery phase.

Fisheries Sub-sector

The overall early recovery needs for the fisheries sub-sector are only about YR 200 million (US\$ 1 million), equivalent to 0.2% of the total needs for the crop sub-sector. As in the case of crops and livestock sub-sectors, early recovery needs would be met through low interest loans (US\$1 million) to finance the purchase or repair of boats, engines, fishing equipment and cages/traps by the fishermen to enable them to re-start their livelihoods as soon as possible.

Table 5-1 Estimated Needs to Promote Recovery and Reconstruction in Agriculture Sector

Strategy	Crops Sub-Sector		Livestock Sub-Sector		Fisheries Sub-Sector		Total	
	Mill YR	Mill US\$	Mill YR	Mill US\$	Mill YR	Mill US\$	Mill YR	Mill US\$
Early Recovery ¹	10,000	50	5,000	25	200	1	15,200	76
Medium-Term Recovery ²	14,000	70	5,000	25	0	0	19,000	95
Reconstruction ³	65,000	325	0	0	0	0	65,000	325
Total	89,000	445	10,000	50	200	1	99,200	496
Of which, Hadramout ⁴	85,669	428.3	9,895	49.5	85	0.4	95,649	478
Of which, Al-Mahara ⁴	3,331	16.7	105	0.5	115	0.6	3,551	18

1. December 2008 to June 2009

2. December 2008 to December 2010

3. January 2009 to December 2011

4. Hadramout and Al-Mahara’s shares of the recovery and reconstruction needs were estimated in line with their share of the damages in each sub-sector: Hadramout’s shares of damages in the crops, livestock, and fisheries sub-sectors were respectively 96.3%, 98.9% and 42.3%; Al-Mahara’s shares were respectively 3.7%, 1.1% and 57.7%.

Considerations in the implementation of reconstruction and recovery program

Any program that would be financed by the GOY or development partners needs to give priority to the agricultural sector in the most affected area, namely Wadi Hadramout. This program, inter alia, must include flood protection (public sector), irrigation infrastructure (public sector), land leveling/erosion control (private sector), low interest loans to farmers and input grants to small and marginal farmers. The Fund for the Promotion of Agriculture and Fisheries should also be used to promote agriculture and fisheries in the flood affected Governorates.

Based on the World Bank-financed project following the 1996 floods, the use of gabions for flood protection has not only been a low-cost labor intensive solution but also very effective. In future recovery and reconstruction programs, the use of gabions should be encouraged in all areas where stones are readily available. Finally, the Government should also consider rehabilitating the now abandoned 1,000 acre state farm in the middle of Wadi Hadramout and distributing all the land to landless and sharecropper farmers. This will not only provide alternative livelihood opportunities

to a large number of recipient landless farming households but will also increase agricultural production.

Need for Accelerated Program Implementation

Given that floods have caused serious damages and are likely to cause substantial economic losses in the future, there is a need for an accelerated implementation of the proposed program of early recovery, medium-term recovery and reconstruction, including disaster risk management.

The implementation strategy requires (i) agreement among various government agencies about the scope of the proposed program as well as implementation responsibilities, including the use of NGO and private sector contractors; (ii) agreement on the time line for implementation; (iii) development and implementation of an appropriate monitoring and evaluation (M&E) systems to make sure that the progress and performance of the program is regularly monitored and evaluated at mid-term and on completion; and (iv) the recovery and reconstruction needs of sectors which have close linkages with the crop, livestock and fisheries sub-sectors must also be addressed simultaneously.

As indicated earlier, rural poverty in the flood affected areas (particularly Wadi Hadramout) is generally higher than 40%. In the absence of implementation of appropriate programs mentioned above, the affected population is likely to face increased poverty, increased food insecurity and adverse livelihood problems in the future. The stakes are too high to be ignored by the policy makers at both the Central and the Governorate levels.

Industry, Commerce, and Tourism

The reconstruction needs for industry, commerce and services establishments that reported to the Chambers of Commerce and Industry having been affected by the floods through damaged premises, inventories, equipment and stocked goods are estimated at YR 1,836 million (US\$9.18 million). These include YR 647 million (US\$ 3.23 million) for manufacturing and YR 1,189 million (US\$5.95 million) for retail. Hadramout's share of the reconstruction needs is YR 1,830 million (US\$9.15 million) or 99.7% of the total and Al-Mahara YR 6 million (US\$0.03 million). These reconstruction needs are anticipated to be spread over two years. In 2008, the small and micro-enterprises and vendors/retailers faced with partial damages and requiring repairs and restocking on goods (60% of the total damage value) would be expected to resume production or sales after addressing the disaster effects. In 2009, the remaining affected establishments would be expected to resume production/sales after completing more significant repairs to premises and equipment (some 30% of the total) or after acquiring new premises and equipment (some 10% of the total).

Different types of interventions are recommended. To get enterprises to start production again requires funds to repair/replace premises and equipment, purchase goods or produce new outputs to replace damaged inventories. Such funds could be provided through a mix of soft loans and micro-credit to the enterprises with Government's support focused on the micro and small enterprises and retailers who do not have the means to return to business without support. New land would need to be acquired to relocate the businesses located in flood-prone areas (such as building material plants, gas stations, etc) and the building of new premises would be needed.

To enable the recovery of affected retail establishments that are expected to incur significant losses due to the decline in agricultural and fisheries output requires accelerating the recovery and reconstruction program related to the agricultural and fisheries sector. During the interim period, it is critical to put in place a recovery program focused on enabling a rapid restoration of livelihoods of the affected people, especially workers and the self-employed in the agriculture, fisheries, retail and manufacturing sectors who will have lost their job or much of their income. This program would be on a temporary basis until the output of the affected sectors recovers to pre-disaster levels.

Table 5-2 Reconstruction needs for industry and commerce

Year	Industry needs (YR, mln)	Commerce needs (YR, mln)	Industry & Commerce reconstruction needs (YR, mln)
2008	323.7	595.1	918.8
2009	323.7	593.8	917.5
Total	647.4	1,188.9	1,836.3

Social Sectors

Housing

The total estimated reconstruction needs to rebuild fully destroyed shelter and repair partially damaged houses in the affected areas amounts to YR 17,449.2 million (US\$87.2 million). This figure is based on the assumption of building fully damaged houses on the same site (no resettlement), but takes into account better construction standards to improve flood resilience (increased height of the stone foundation, better roofing materials and reinforced mud structure walls). Reconstruction needs are assessed based on new housing construction costs for units that are proportional with although of lesser value than the existing destroyed stock. Reconstruction of one unit is assumed to require YR8.2 million in the Wadi area, YR5.8 million in the Sahel area except for Mukalla YR7.2 million, and YR2.5 million for a house in Al-Mahara and YR0.4 million to replace a destroyed hut with a 24m² unit. Hadramout's share of this total is YR 14,783.3 million (US\$ 73.9 million) or 85% of the total, which is needed to rebuild an estimated 1,483 fully damaged houses and repair 871 partially damaged houses in the Wadi and rebuild an estimated 134 fully damaged structures and repair 504 partially damaged structures in the Sahel area. Al-Mahara's share of the total is YR 615.3 million (US\$ 3.1 million) or 15% of the total which is needed to rebuild 45 fully damaged houses and 1,164 replacement of destroyed huts, and repair 2,304 houses with partial or minor repairs.

Taking into account a resettlement option, the total estimated reconstruction needs to rebuild fully destroyed shelter and repair partially damaged houses in the affected areas increases to YR 26,048.6 million (US\$130.2 million). To estimate additional resettlement costs over the value of new unit construction, the cost of serviced land acquisition in each affected district in Hadramout Governorate was factored in based on experts' estimates. An additional margin of 50% was added in the case of Wadi Hadramout to reflect off-site infrastructure and overall village community resettlement needs. Clearly, the requirements for and cost of resettlement could only be determined based on the outcomes of the hydrological study of the Wadi, which would identify the communities in serious risk of recurrent floods that would need to be resettled, and which would map available, safe resettlement sites that exist nearby.

Additional estimated needs include YR 415.5 million (US\$2.1 million) for debris removal of the collapsed units, YR 1,880.1 million (US\$ 9.4 million) for the temporary shelter program until construction of the new houses is completed (the average here is assumed at 12 months in addition to the six months in the immediate intervention program), and YR 3,294.8 million (US\$ 16.5 million) in grants for the families to acquire household assets in lieu of their destroyed belongings.

As such, the overall reconstruction and recovery program needs in the housing sector would amount to YR 23,039.6 million (US\$115.2 million) under the no resettlement option (with Hadramout's share at 88%), and as much as YR 31,639 million (US\$ 158.2 million) if resettlement were required (with Hadramout's share rising to 91% in this case). It is important to note that the assessment does not advocate the option of resettlement, nor should it be the default option that the Government envisages. Besides the fact that resettlement tends to be a very costly and complex process (especially to put in place complete infrastructure and a set of public facilities from scratch), it is likely to have many serious implications such as disconnecting households from their livelihood sources and dislocating communities that lived in the same

places in the Wadi for centuries. In addition, resettlement would sever the existing social fabric of the communities, unless if entire communities are resettled, which itself would exponentially increase the costs. As such, resettlement should be treated only as the option of last resort, and only based on the findings and recommendations of the hydrological study of the Wadi.

Ultimately, before developing any reconstruction plans for new housing, the Government would need to consult with the affected families on their preferred options for housing including resettlement. This should be done in a consultative process at the community level. Efforts should also be made to consider aspects like local architecture, use of local labor in reconstruction process and setting up a reconstruction committee that would oversee the task for reconstruction at the district level.

Table 5-3 presents the total housing reconstruction and recovery needs for the affected areas (Hadramout and Al-Mahara Governorates), based on a no resettlement and resettlement option. Table 5-4 presents a detailed breakdown of housing reconstruction needs by area (Hadramout Wadi, Sahel and Al-Mahara), also based on the two scenarios of no resettlement and resettlement. Ultimately, the option of reconstruction on site was used in the overall assessment of the reconstruction and recovery program post-floods.

Table 5-3 Total housing reconstruction and recovery needs in the affected areas (with and without resettlement)

	Option 1 (reconstruction on site)	Option 2 (reconstruction with resettlement)
Reconstruction of fully damaged houses (in YR, million) (in US\$)	13,579.4 67.9	22,178.8 110.9
Repair of partially damaged houses (in YR, million) (in US\$)	3,869.8 19.3	3,869.8 19.3
1. Reconstruction and repair program (in YR, million) (in US\$)	17,449.2 87.2	26,048.6 130.2
2. Debris clean up program (in YR, million) (in US\$)	415.5 2.1	415.5 2.1
3. Temporary shelter program* (in YR, million) (in US\$)	1,880.1 9.4	1,880.1 9.4
4. Household asset recovery program (in YR, million) (in US\$)	3,294.8 16.5	3,294.8 16.5
Total reconstruction and recovery program needs (in YR, million) = 1+2+3+4 (in US\$)	23,039.6 115.2	31,639.0 158.2
Of which Hadramout (in YR, million) (in US\$)	20,297.9 101.5	28,897.3 144.5
Of which Al-Mahara (in YR, million) (in US\$)	2,741.7 13.7	2,741.7 13.7

Table 5-4 Total housing reconstruction needs by affected area (with and without resettlement)

	Option 1 (reconstruction on site)	Option 2 (reconstruction with resettlement)
Hadramout Wadi		
Reconstruction of fully damaged houses (in YR, million)	12,160.6	20,654.0
(in US\$)	60.8	103.3
Repair of partially damaged houses (in YR, million)	1,657.8	1,657.8
(in US\$)	8.3	8.3
Total reconstruction and repair program (in YR, million)	13,818.4	22,311.8
(in US\$)	69.1	111.6
Hadramout Sahel		
Reconstruction of fully damaged houses (in YR, million)	803.5	909.5
(in US\$)	4.0	4.5
Repair of partially damaged houses (in YR, million)	162.4	162.4
(in US\$)	0.8	0.8
Total reconstruction and repair program (in YR, million)	965.9	1,071.9
(in US\$)	4.8	5.4
Al-Mahara		
Reconstruction of fully damaged houses/huts (in YR, million)	615.3	615.3
(in US\$)	3.1	3.1
Repair of partially damaged houses (in YR, million)	2,049.6	2,049.6
(in US\$)	10.2	10.2
Total reconstruction and repair program (in YR, million)	2,664.9	2,664.9
(in US\$)	13.3	13.3
Affected areas		
Reconstruction of fully damaged houses/huts (in YR, million)	13,579.4	22,178.8
(in US\$)	67.9	110.9
Repair of partially damaged houses (in YR, million)	3,869.8	3,869.8
(in US\$)	19.3	19.3
Total reconstruction and repair program (in YR, million)	17,449.2	26,048.6
(in US\$)	87.2	130.2

Important considerations in the planning and implementation of housing reconstruction

1. To launch the process of planning for reconstruction and resettlement, a detailed study of hydrologic and hydraulic characteristics of the affected areas should be conducted as soon as possible. The study should assess the probabilities and risks of occurrence of future flooding events in the wadi, which would serve as the foundation for decisions as to whether or not to resettle affected communities. The study will also help to ensure that reconstruction does not occur in flood-prone areas. It would also recommend the early warning systems to be installed and the awareness campaigns needed to organize the communities and evacuate critical areas under emergency scenarios.
2. It would also be useful in the short-term to start prequalifying local architects, engineers and contractors who are qualified to participate in the housing reconstruction process (in the design, supervision and construction stages) taking into account local considerations. Following which, detailed plans for housing could be developed with various options for the households to choose from. Finally, it would also be critical to define the costs of the

- various housing options including possible cost-sharing arrangements between households and the Government (including possibilities for a sweat equity contribution).
3. The preservation of traditional architecture, especially the use of mud bricks, albeit with some improvements, should be assigned priority as part of the design of new houses. The use of such material is suitable for the local climatic conditions. Adobe is a good thermal mass material holding heat in the winter and cool temperatures in the summer. Wadi Hadramout is bestowed with unique cultural heritage that has been practiced for centuries and efforts should be made to preserve the architecture in the region, which represents one of its main appeals for the tourism industry and is a key component to the socio-cultural identity of the region. However, buildings located in areas that could come in contact with some flood/storm water should be designed with sound masonry foundations, structural frames and protection of the mud bricks to preserve its structural integrity. Similar measures should be considered for the design of roof structures to prevent leakage and ensure structural stability. Housing located in areas exposed to frequent flooding should be either be relocated away from such flood-prone areas or protected with flood diversion structures were feasible.
 4. The affected communities should be directly involved in the reconstruction process to the extent possible. This should be done in two phases. In the first phase, communities are consulted over their needs, priorities and preferences for their settlement/housing reconstruction. In the second phase, communities are organized to enable them get involved in the process from design choices offered for housing construction to actual reconstruction. Such a process would ensure community buy-in for the proposed reconstruction and would minimize the risks of rejection of unsatisfactory housing solutions, as has been observed in several other countries when consultation of the affected population in the reconstruction was lacking and as reportedly took place in Dhamar following an earlier disaster.
 5. During the settlement planning and housing reconstruction process, all efforts should be made to ensure that communities are not disconnected from their sources of livelihoods. Many households in Wadi Hadramout work in agriculture. As such, relocating their human settlements to a remote site that lacks direct access (or which has difficult and costly access) to their agricultural lands would adversely affect their livelihoods, and could predictably lead to the failure of the reconstruction effort as communities eventually abandon the new housing to move back closer to their livelihood sources.
 6. It is advisable to set up for each affected district/settlement a local reconstruction oversight committee that comprises of local representatives from elected councils, the agencies responsible for public works, land, survey and urban planning, water and sanitation, electricity and other concerned entities, as well as from local NGOs and community representatives. The committees, which would meet on a monthly basis, would review plans, authorize and coordinate reconstruction efforts in the affected areas, and review the progress of works.
 7. It is important to set up one entity that would be responsible for the implementation of housing reconstruction, including contracting the housing reconstruction effort (to contractors or the households based on the option selected) and M&E efforts. This entity would bring together expertise from and coordinate the inputs of the various related public entities such as Public Works and Highways (the housing sector), General Authority for Land, Survey and Urban Planning (the land, survey and urban planning

- sectors) and Local Government, as well as have representatives from the different related practices (housing, architecture) and communities (NGOs, CBOs).
8. Finally, as the reconstruction effort gets launched, it would be important to prepare over the medium-term a comprehensive land-use plan that regulates future construction activities in Wadi Hadramout per the recommendations of the hydrological study (and since a sizeable proportion of the affected housing was located in the flood plains). Similarly for Mukalla, it would be important to enforce the implementation of the land use recommendations made under the revised Mukalla city master plan of 2007 and to prepare a storm water drainage master plan.

Options for Housing Reconstruction

The following are various options that could be considered for the reconstruction of shelter in the affected areas. Among the key aspects that need to be taken into account before developing housing reconstruction plans is the fact that only some 10% of builders in Hadramout have expertise in mud architecture. A well-designed mud house could take an average 2-3 years to build compared to a stone/cement house which could in theory take only six months to construct. Also, the rapid launching of some pilot construction efforts could serve to inform future construction such as by retrofitting designs.

Option 1—Use of private contractors for construction: Under this option, the entity(ies) in charge of organizing housing reconstruction (e.g. the Reconstruction Fund) would directly hire private contractors to build housing in designated sites based on pre-determined/pre-approved designs and plans. The advantage of this option is that it can deliver the housing units quickly and would benefit from economies of scale. The disadvantages are: (i) in the absence of adequate oversight, construction quality may be compromised; (ii) in the absence of sufficient consultation with the communities, mass standardized housing solutions may result and are likely to be rejected by the communities. To prevent such a situation, upfront involvement of the affected households, and intensive monitoring by the local authorities and the affected communities will be required.

Option 2—Contract supervision by the affected households: Under this option, housing plans and designs would be developed upfront by local architect(s) and would be pre-approved by the entity overseeing the reconstruction. The affected households would choose the design that suits their needs and would employ contractors from pre-qualified lists. Households could also provide as needed sweat equity for reconstruction. Provisions in the program would also require contractors to avail a certain portion of the labor content (unskilled or skilled jobs) to those who lost their livelihoods. The advantage is that it provides affected households with choices over the design and construction process, and some income supplement to those whose livelihoods were affected. The disadvantage is that this approach will require intensive supervision and may extend the time for the completion of reconstruction projects. Involvement of local NGOs in the organization and supervision process would be recommended.

Option 3—Cash transfers for rebuilding by the affected households: Under this option, affected households would be provided with cash (grants, soft loans or a combination thereof) with which to rebuild their houses. The households would choose the design and contractors for rebuilding. The advantage of this option is that it enables households to decide on their needs and priorities and use rational choices towards the development of their housing (whether incrementally or in one go). This option would also suit households that may receive remittances from family or community members living abroad and which they could be used to co-finance/supplement their housing reconstruction projects. Under this scenario, policymakers are sometimes concerned that households might use the cash windfall for other uses such as personal expenditure (although

others may perceive this as the affected households' right to choose amongst their priorities). To address this concern, households could be provided the cash in a number of tranches (say three) that are released against construction progress, such as completion of the foundations, erection of the first floor or the structural elements, and then the completion of the house (this three-step process was used in Egypt's Ibni Beitaq program under the national housing program). While this may incentivize households to use the funds in housing construction in order to access the next tranches, it would also require a heavier administrative oversight function, since each house would require three inspections.

Education

Summary

The education sector reconstruction needs have been estimated at about YR 5,190 million (US\$26 million), to rebuild and repair damage to physical facilities for public basic and secondary education schools. Hadramout's share of the needs is YR 4,860 million (US\$24.31 million) or 96.3% of the total, while Al-Mahara's share is YR 330 million (US\$ 1.65 million). The needs were estimated in two stages, immediate (to be addressed in the first year) and medium-term (to be implemented in the first three years after the flood event) to address urgently permanent restoration of services.

Reconstruction needs

To restore educational facilities, it is urgently needed to repair partially damaged school buildings and to start the process to replace the totally damaged facilities. Priority should be given to the districts where most schools were totally lost as in these areas even private building and houses suffered substantial damage and there may not be enough vacant premises available for rent while new facilities are being constructed. Also special consideration should be given to reconsidering the design standards and choice of construction materials as the school buildings that collapsed were those constructed using the traditional architectural standards consisting of mud brick construction without structural members. Other buildings in the same areas exposed to the flood waters constructed of concrete blocks did not sustain any major physical damage and appear to be safe for inhabitation.

The Ministry of Education should plan the reconstruction of totally damaged schools taking into consideration the location of such schools away from flood and landslide prone areas. Also, better design standards, sound structural design, and durable construction material, currently used in the newly constructed schools, albeit at a higher construction cost, should be considered. Engineering, architectural and hydrological investigations are needed to inform decision-making as to whether to rebuild on site or relocate the destroyed facilities and/or whether to use different building materials or introduce improved construction standards of traditional architecture such as higher stone beds (which, all else equal, would be the preferred approach to retain the traditional architectural character of the Wadi).

The total needs are estimated at about YR 5,190 million (US\$ 26 million) and are presented in Table 5-5 below. The estimate of needs was made by adding a margin of 50% to the estimate of damages as a provision for changes in design and construction materials, and engineering. It is also assumed that such works would be carried out in the ensuing three years period. The estimates of damages were based on information provided by the Ministry of Education at the governorate offices, validated through field assessment of a sample of damaged facilities. Yet, the cost estimates of damages are approximate as these were based on visual observations (not actual measurements and detailed bill of quantities), the size of the school building, current unit prices of school construction in the area, and using equivalent replacement criteria (similar design and materials). The needs would be higher than estimated if a number of facilities would need to be relocated, in order to include the cost of land acquisition (where public land is not available), and off-site and on-site infrastructure that may be needed. It should be noted that the high demand for reconstruction in all sectors in the affected areas may also contribute to higher unit prices than those experienced in the recent past.

Table 5-5 Needs in the Education Sector (YR Million)

Governorate/District	1 st Year	2 nd Year	3 rd Year	Total
Al-Mahara				
Al-Ghayda	43.7	43.7	58.2	145.6
Sayhut	20.3	20.3	27.0	67.6
Al Massila	11.7	11.7	15.6	39.0
Qishn	10.4	10.4	13.7	34.5
Manaar	10.8	10.8	14.4	36.0
Hasswin	2.3	2.3	3.0	7.6
Sub-total	99.2	99.2	131.9	330.3
Hadramout Wadi				
Al Qatn	162.9	162.9	217.2	543.0
Seiyun	115.2	115.2	153.6	384.0
Wadi Al Ain	33.3	33.3	44.4	111.0
Shibam	46.8	46.8	62.4	156.0
Harida	8.1	8.1	10.8	27.0
Amd	5.4	5.4	7.2	18.0
Regit	19.4	19.3	25.8	64.5
Tarim	88.2	88.2	117.6	294.0
Sah	261.5	261.5	348.6	871.6
Al Soum	172.3	172.3	229.8	574.4
Sub-total	913.1	913.0	1,217.4	3,043.5
Hadramout Sahel				
Al Mukalla	168.3	168.3	224.4	561.0
Al Raidah	2.3	2.3	3.0	7.6
Al Qail	126.9	126.9	169.2	423.0
Hazawil	14.4	14.4	19.2	48.0
Al Shihr	6.3	6.3	8.4	21.0
Sirar	14.4	14.4	19.2	48.0
Al Garrah	0.9	0.9	1.2	3.0
Aqeb	0.5	0.5	0.5	1.5
Al Naga'ab	0.9	0.9	1.2	3.0
Shazawah	14.4	14.4	19.2	48.0
Hajer	3.6	3.6	4.8	12.0
Tamhah	0.5	0.5	0.5	1.5
Al Diss	129.6	129.6	172.8	432.0
Ma'adi	0.5	0.5	0.5	1.5
Broom	2.3	2.3	3.0	7.6
Ghail Binyamin	59.4	59.4	79.2	198.0
Sub-total	545.2	545.2	726.3	1,816.7
SUMMARY				
TOTALS (YR Million)	1,557.3	1,557.2	2,076.3	5,190.8
TOTALS (US\$ Million)	7.8	7.8	10.4	26.0

Health

Summary

The total value of needs in the health sector in Hadramout and Al-Mahara governorates affected by the Storm is estimated to be about YR 5,640 million (US\$ 28.2 million) including YR 4,097 million (US\$20.5 million) to rebuild/repair damaged structures in a more flood-resilient way and about YR 1,543 million (US\$7.7 million) to procure damaged medical equipment and furniture. Hadramout's share of the needs is YR5,143 million (US\$25.72 million) or 91.2% of the total, while Al-Mahara's share is YR 497 million (US\$ 2.49 million). The needs were estimated to be addressed in two stages, immediate (in the first year after the flood event) and medium term (within three years after the flood event), to address urgently needed primary health services and tertiary health services, respectively.

Reconstruction needs

An assessment of needs was carried out based on a field assessment of damages, identification of immediate needs and needs that would require at least three years upon securing financing and procure services for implementation. The total estimated reconstruction needs amount to about YR 5,640 million (US\$ 28.2 million) including YR 4,097 million (US\$20.5 million) to rebuild and repair damaged structures in a more flood-resilient way and about YR 1,543 million (US\$7.7 million) to procure damaged medical equipment and furniture. The Table below presents an assessment of needs by districts and governorates. Relief efforts provided by the Government, the army, UN agencies, other donors, NGOs, and relief agencies included temporary provisions of outreach health services, medical supplies, and emergency medical and nursing staff, and were accounted for in the immediate intervention program. The needs in the health sector do not cover the provision of essential food, potable water and shelter required for preventive health, as these are covered in other sector assessments.

The assessment of health sector needs covers mainly the reconstruction of damaged facilities, and reestablishment of health services facilities, medical equipment and supplies lost to the flood event. The cost of facilities to be replaced and repaired is based on today's prices plus a 50% allowance for improvements in design, construction materials and engineering services. Detailed cost estimates should be made at the detailed design stage when local conditions are better determined. The cost estimate excludes the cost of land acquisition particularly if the new facilities are to be relocated in areas away from flood prone sites. The cost estimate is based on concrete block and reinforced concrete frame structures. Where necessary, it may be needed to consider modern building materials and techniques to avoid future damages, especially since the structures based on reinforced concrete frames and concrete block walls did not suffer structural damage and only the furniture and equipment subject to flooding were damaged.

The health sector needs estimate, however, excludes the cost of meeting specific nutritional needs for immediate and long-term requirement in affected districts and the health surveillance programs. These have been accounted for in the immediate intervention program over a duration of 4-6 months, and if a longer timeframe is needed, will require additional budgetary allocations. Supplements containing both macro- and micronutrients (vitamin A, zinc, and iron foliate) were incorporated into the national immunization days for polio eradication (carried out nation-wide in November 2008) and may be included in the programmed measles campaign planned for early January 2009. Consideration should be given to plan similar programs for provision of additional micronutrients to children under five and the pregnant and lactating mothers such as micro-

nutrient powder in single-dose sachets for a longer period, possible for the next three years, until the health services are fully re-established in the affected areas.

Table 5-6 Health Facilities Needs

Governorate/ District	Type	Total	Totally Damaged	Partially Damaged	Yr1 (YR Million)	Yr2 (YR Million)	Yr3 (YR Million)	Total (YR Million)
AL-MAHARA								
Al-Ghayda	GH	1	0	1	1.4	1.4	1.2	4.0
	HC	1	0	1	5.05	5.05	5.4	15.5
	HU	5	0	5	13.75	13.75	15.0	42.5
Hat	HC	1	0	1	0.45	0.45	0.6	1.5
Shehen	HC	1	0	1	1.85	1.85	1.8	5.5
Sayhut	GH	1	0	1	6.55	6.55	5.4	18.5
Geshen	GH	1	1	0	110.55	110.55	77.4	298.5
Manaar	HU	3	1	2	13.75	13.75	15.0	42.5
Hasswin	HU	3	0	3	5.5	5.5	6.0	17.0
Al Massila	HU	2	0	2	4.55	4.55	5.4	14.5
Hawf	GH	1	1	0	11.9	11.9	13.2	37.0
Sub-Total		20	3	17	175.3	175.3	146.4	497.0
HADRAMOUT SAHEL								
Al Mukalla	HQ	1	0	1	3.7	3.7	3.6	11.0
	GH	2	0	2	19.75	19.75	21.0	60.5
	HC	1	1	0	13.75	13.75	15.0	42.5
	HU	6	0	6	16	16	18.0	50.0
Dowan	DQ	1	0	1	3.15	3.15	4.2	10.5
Ghail Bawazir	HU	2	0	2	7.3	7.3	8.4	23.0
Al Shahr	HU	1	0	1	0.9	0.9	1.2	3.0
Hajar	DQ	1	0	1	0.9	0.9	1.2	3.0
	HU	2	0	2	2.75	2.75	3.0	8.5
El Dis (Generator)	HU	1	0	1	2.3	2.3	2.4	7.0
Socotra	HU	1	0	1	3.65	3.65	4.2	11.5
Ghail Binyamin	HU	1	0	1	3.65	3.65	4.2	11.5
Al Dhalrah	HU	4	0	4	4.6	4.6	4.8	14.0
Yablath	HU	2	0	2	2.3	2.3	2.4	7.0
Broom	HU	1	0	1	4.6	4.6	4.8	14.0
Sub-Total		27	1	26	89.3	89.3	98.4	277.0
HADRAMOUT WADI								
Seiyun	HQ	5	0	5	17.85	17.85	13.8	49.5
	GH	1	1	0	414.2	414.2	285.6	1114.0
	HC	4	0	4	10.6	10.6	10.8	32.0
	HU	7	0	7	10.15	10.15	10.2	30.5
	Inst.	1	0	1	3.25	3.25	3.0	9.5
	Strs	4	0	4	15.6	15.6	10.8	42.0
Wadi Al Ain	GH	1	0	1	6.5	6.5	6.0	19.0
	HC	1	0	1	1.85	1.85	1.8	5.5
	HU	11	0	11	23.8	23.8	26.4	74.0
Harida	GH	1	0	1	18.35	18.35	13.8	50.5
	HU	4	0	4	10.3	10.3	8.4	29.0
Shibam	GH	1	0	1	30.3	30.3	20.4	81.0
	HC	2	0	2	8.95	8.95	6.6	24.5
	HU	7	0	7	23.45	23.45	24.6	71.5
Al Qatn	GH	1	1	0	413.75	413.75	285.0	1112.5
	HC	3	0	3	20.15	20.15	22.2	62.5

	HU	7	0	7	33.9	33.9	37.2	105.0
Al Abr	HC	1	0	1	6.4	6.4	7.2	20.0
	Strg	3	0	3	16.95	16.95	18.6	52.5
Sah	GH	1	1	0	356.25	356.25	285.0	997.5
	HC	2	1	1	80.3	80.3	80.4	241.0
	HU	10	4	6	50.35	50.35	55.8	156.5
Al Soum	HC	2	0	2	14.65	14.65	16.2	45.5
	HU	6	3	3	26.55	26.55	29.4	82.5
Tarim	GH	1	0	1	50.95	50.95	36.6	138.5
	HC	3	1	2	15.55	15.55	17.4	48.5
	HU	9	3	6	36.15	36.15	40.2	112.5
Amd	HC	1	0	1	3.25	3.25	3.0	9.5
	HU	5	1	4	15.55	15.55	17.4	48.5
Sub-Totals		105	16	89	1,735.85	1,735.85	1,393.8	4,865.5
SUMMARY								
TOTAL (YR,mln)		152	20	132	2,000.45	2,000.45	1,638.6	5,639.5
TOTAL (US\$,mln)					10.00	10.00	8.19	28.20

Providing safe drinking water is critical, and provision of wastewater and solid waste disposal remain major problems to address preventive health effectively. These needs are addressed under separate sector assessments. Also provision of adequate staff to continue timely delivery of basic health care services is also important at this stage of recovery. Fortunately, there were no reported casualties among health personnel, and teams have been mobilized from unaffected neighboring districts, contributing to the quick overall recovery of the services in response to the disaster. The response has been a joint effort by the public sector, the army, and individual philanthropists, together with staff from relief agencies and bilateral donors.

Moderately affected facilities need to be reactivated through financing of the necessary repairs and the provision of medical equipment, clean water, and electrical generators. Where facilities have been severely affected, reconstruction—especially in the most affected districts in wadi Hadramout indicated above—should follow established health and safety standards. The emergency medical teams must also have access to transport facilities and communication technology. The road rehabilitation and reconstruction program should give priority to the damaged roads in these priority districts greatly affected by the flood event.

Infrastructure

Power

The power sector reconstruction needs are estimated at YR 5,260 million (US\$26.3 million) to rehabilitate and repair the damaged generation, transmission and distribution infrastructure to better standards. These include YR 2,500 million (US\$12.5 million) for Hadramout Wadi, YR1,560 million (US\$7.8 million) for Hadramout Sahel, and YR 1,200 million (US\$ 6 million) for Al-Mahara.

Short and medium-term priorities (1-3 years)

Following the temporary resumption of power supply to the affected areas, which was carried out on an emergency basis, short- and medium-term priorities include the repair and rehabilitation of the existing generation sets, transmission and distribution lines, and service connections that were damaged by the floods. The system reconstruction needs, including the retrofitting needed to mitigate against future disasters, are detailed in the Tables below. Additional investments may also be required to supply power to the new settlements in which housing will be rebuilt for the affected communities in case of resettlement. These needs can only be assessed after the hydrological and feasibility studies have been carried out and resettlement sites, if any, have been selected.

Table 5-11 Estimated short- and medium-term needs of the power sector (YR million)

	Wadi (million YR)		Sahel (million YR)		Al-Mahara (million YR)	
	Generation	T&D	Generation	T&D	Generation	T&D
System repair and retrofitting to mitigate future disasters	300	2,200	400	1,160	500	700
Total needs	2,500		1,560		1,200	

Table 5-12 Estimated needs of the power sector versus damages by area (YR millions)

	Damages (million YR)	Reconstruction needs (million YR)
Hadramout Wadi	2,090	2,500
Hadramout Sahel	1,240	1,560
Al-Mahara	686	1,200
Total	4,016	5,260

Source: DNA team estimates based on information from PEC and rural electricity

Long-Term Priorities (3+ years)

To address the current energy deficit and the anticipated demand growth in the affected areas, the medium voltage distribution network and the transmission network will eventually need to be strengthened and expanded. In particular, the PEC has identified the construction of new 132 KV transmission lines in Hadramout Wadi, to be positioned along the hills adjoining the wadi, as a priority project. However, the estimated cost of such a project is prohibitively expensive (the first estimates exceed US\$ 150 million). Moreover, the PEC also notes the importance of launching the long planned-for construction, on a new green-field site located outside of the city, of a new power generation plant for Al-Ghayda city to replace the current very old power plant located in

the middle of the urban area. The studies for this new 20MW station, to be built over two phases, have already been completed. According to the PEC, a first phase of 10MW, including station infrastructure and transmission network strengthening, is estimated to cost US\$12 million, while the second phase would cost US\$6 million, i.e. for a total of US\$18 million. The thinking is that replacing the damaged generation set in the current station would be a short-sighted measure that would postpone the relocation of the station to a more appropriate site from an environmental standpoint and the building of a more efficient (and more cost effective over the long term) plant. Ultimately, the decision over the necessity of these two large investment projects within the next two years would need to be based on a review of medium- to long-term demand forecast of the affected areas as well as generation capacity, as current demand alone may not justify such costly investments.

Recovery and Reconstruction Requirements

Based on the information gathered from the PEC and the findings from site surveys, recovery and reconstruction needs for the next two to three years can be summarized as follows:

- Rehabilitation and repair of the damaged power infrastructure in particular the distribution system, with the needed retrofitting to mitigate against future disasters; and
- Procurement of materials, equipment, and components in replacement of already used material that was “borrowed” from other existing projects, and would help reestablish regional operational capability.

Additionally, the upgrading and expansion of the power infrastructure will eventually be needed to improve access and reliability of electricity supply and to promote economic development in the flood-affected areas.

That the floods took place following the peak summer season made it relatively easier to quickly restore service to over 90% of customers. It is advisable that full restoration of the generation, transmission and distribution capacity to pre-disaster levels be carried out prior to the summer season were electricity demand is at its peak. One approach that could be used in reconstruction would be for donors to procure the required equipments and materials with the PEC handling the construction activities.

Water Supply and Sanitation

The reconstruction needs in the water supply and sanitation sector are estimated at YR 8,770 million (US\$ 43.85 million). These comprise of YR 5,029 (US\$25.15 million) in the urban water sub-sector, YR 1,346 million (US\$6.73 million) in the rural water sub-sector, YR 2,194 million (US\$10.97 million) in the wastewater sector, and YR 200 million (US\$ 1 million) in a series of measures to avert or minimize the impact of similar disasters in the future. Hadramout's share of the reconstruction needs is YR 8,672 million (US\$43.36 million) or 98.9% of the total while Al-Mahara's share is YR 97 million (US\$0.49 million).

The needs assessment takes into account the following two considerations: (i) restoring service to pre-flood conditions, and (ii) upgrading of reconstruction to address future similar events. The total reconstruction needs for the damaged water supply and sanitation systems are summarized in the Table below. In particular, the design of all pipes crossing wadis ought to be reviewed and the pipes rebuilt with improvements (retrofitted with adequate low-cost protection) in order to reduce future vulnerabilities and avoid similar destruction during heavy flooding.

Table 5-14 Reconstruction needs in the water supply and sanitation sector

		Reconstruction Needs	
		(million YR)	(US\$ million)
Water Supply			
Urban	Hadramout Wadi	237	1.19
	Hadramout Coast	4,742	23.71
	Al-Mahara	50	0.25
Rural	Hadramout Wadi	1,061	5.31
	Hadramout Coast	252	1.26
	Al-Mahara	33	0.17
Wastewater			
Urban	Hadramout Coast	2,194	10.97
Other	Affected areas	200	1.00
Total		8,770	43.85

The following measures would help avert or minimize the impact of similar events in the future:

- Procurement of emergency mobile water treatment equipment for each major city;
- Provision of disinfection equipment for all wells prone to possible contamination;
- Procurement of power generators for key water installations (after a needs assessment);
- Provision of portable bacteriological and chemical field testing equipment to the various institutions, along with adequate training;
- Study of the possibility of identifying new well fields in closer proximity to cities and villages to avoid the risk of major disruptions along long transmission routes; and
- Capacity building of the communities and local water supply and sanitation corporations in Mukalla, Seiyun and elsewhere in post-disaster management for water supply and sanitation and coping in the emergency response period during other natural disasters.

The estimated cost for such measures is YR 200 million (US\$ 1 million), roughly split between Hadramout and Al-Mahara based on their population weight (93% versus 7%).

Implementation Arrangements

In urban areas, the two local water supply and sanitation corporations and NWSA for Al-Mahara would be in charge of the reconstruction efforts. They have already satisfactorily managed the emergency repairs and restored service within few days of the event. They have clearly the knowledge and human capacity to carry out the reconstruction efforts. In rural areas, the local offices of the GARWSP have proven very capable to address the immediate needs of the population in the affected areas. Similarly, the water user associations have mobilized the local capacity and resources to quickly address the immediate aftermath of the floods. They should be in charge of the reconstruction efforts as their knowledge of the problems and solutions will be a guarantee for avoiding similar damages in the future.

Transport

Summary

The total reconstruction needs for the transport sector have been estimated at YR 22,464 million (US\$112.32 million). These include YR 19,210 million (US\$ 96.05 million) for regional roads in both Governorates, YR 2,000 million (US\$10 million) for urban roads, and YR 1,170 million (US\$5.85 million) for rural roads, in addition to YR 85.5 million (US\$0.43 million) for the port of Nishtun. Hadramout's share of the reconstruction needs is YR 20,295 (US\$ 101.48 million) or 90.3% of the total while Al-Mahara's share is YR 2,170 million (US\$10.85 million). These needs do not take into account the value of improved construction for urban roads especially in Mukalla (which are very likely to be needed), as these could not be assessed in the absence of a storm water drainage master plan. An additional YR 1,400 million (US\$7 million) will be needed for related technical assistance (preparation of feasibility studies, designs and tender documents, and construction supervision).

Reconstruction needs for the transport sector:

The total reconstruction needs for the transport sector have been estimated at YR 22,464 million (US\$112.32 million), of which 85.5% for regional roads, 8.9% for urban roads, 5.2% for rural roads, and 0.4% for the Port of Nishtun. These reconstruction needs include estimates of needed improvements at several critical junctures of the regional roads in the affected areas that are badly damaged or destroyed at each recurrent flood event (the scope and extent of which would need to be confirmed through feasibility studies). The reconstruction needs, however, are only restricted to the damage value in the case of urban roads, since the assessment of improvement needs is not possible in the absence of a storm water drainage master plan. Similarly, given the extensive length of the rural roads over which damages are spread out, the extent of additional improvement needs would need to be revised after a detailed assessment is completed.

Table 5-7 summarizes the reconstruction needs for the transport sector by category, and provides a breakdown between the restoration cost (equivalent to the value of the damages) and additional improvement needs (in line with the build-back-better approach, and which have been estimated only for the regional and rural roads). Table 5-8 provides the location of road damage by corridor, the overall value of damages and additional needs (over and above those to restore the damages).

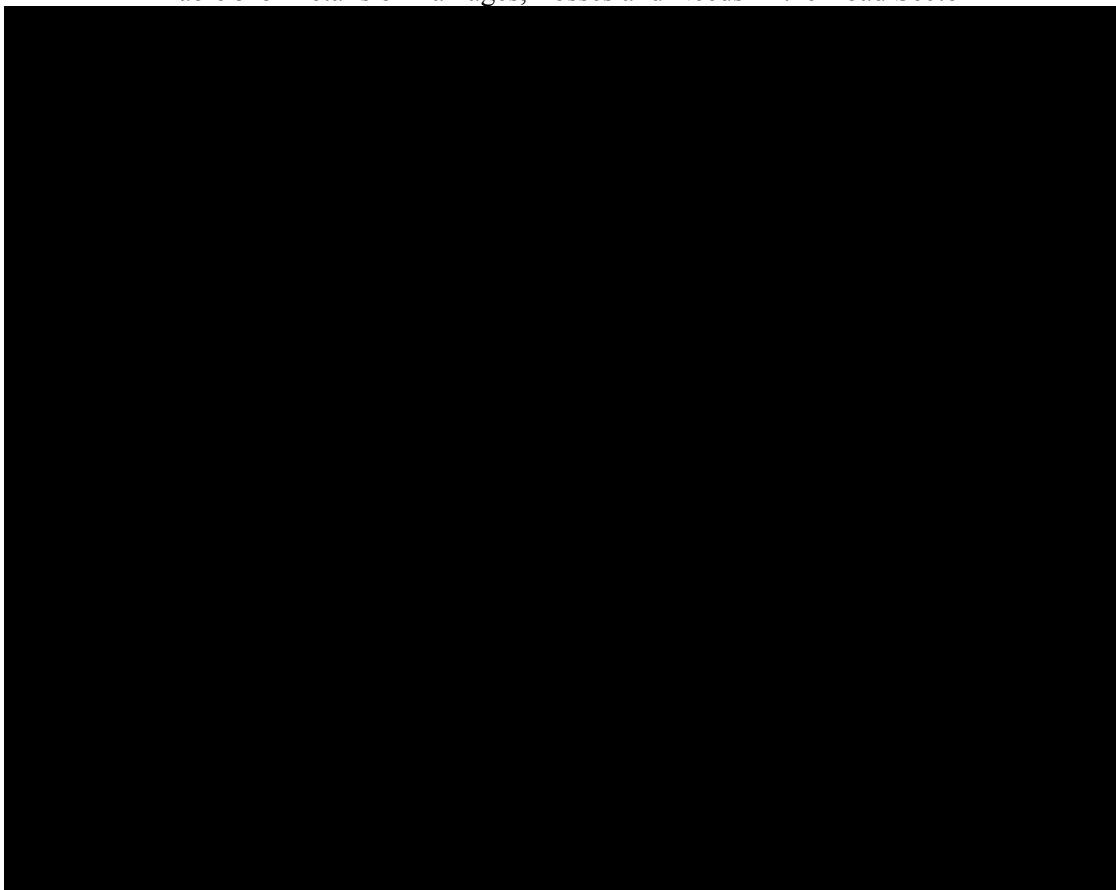
Table 5-7 Summary of Reconstruction Needs in the Transport Sector

Category	Extent of damages [m]	Restoration costs [US\$ million] *	Additional Needs [US\$ million] *
Regional Roads	59,174	43.00	53.05
Urban Roads	36,112	10.00	
Rural Roads	Unclear	5.30	0.55
Total Roads	Min. 95,286 m	58.30	53.60
Port of Nishtun	Infrastructure	0.42	
TOTAL Transport		58.72	53.60
TOTAL Transport needs			112.32

Sources: MOPWH, GCRB, Nishtun Port Authority, District and Governorate officials

* Restoration costs equal the value of damages, while additional needs refer to improvements in the design and/or realignment to ensure more flood-resilient roads.

Table 5-8 Details of Damages, Losses and Needs in the Road Sector



Sources: MOPWH, GCRB, District and Governorate officials

Regional roads

The reconstruction needs for regional roads in both Governorates are estimated at YR 19,210 million (US\$ 96.05 million). The packaging of projects for reconstruction/repairs and contracting should be considered. One way of splitting the repair works on regional roads would be to package the damages into one package for the Sahel area (Bir Ali-Mukalla-Al Ghayda road including the “60 street” road in Mukalla). This would amount to US\$ 19 million in restoration costs and another US\$35-40 million in proposed improvements to upgrade to higher standards of protection (bridges mainly subject to studies). This would leave a package of US\$ 24 million in road repairs for the Wadi area and the road from Riyan to Ben Aifen in Hadramout. There are reported needs for additional protection works on two locations on these roads at a potential additional cost of up to US\$ 14 million subject to feasibility studies. There are undoubtedly other ways of packaging the repair works into smaller contracts if desirable.

The regional highways along the coast from Bir Ali, through Mukalla to Al Ghayda have reported damages in the order of US\$ 19 million and additional needs for upgrading of at-level crossings with bridges estimated to US\$ 35 million (Table 5.8). The high costs to repair damages and address additional needs are related to the very wide road widths on some of these highways within and close to urban areas. Before the repairs or additional investments are undertaken on these roads, it is advisable to carry out studies to determine, among others, the need for these wide wadi crossings to be restored, or if narrower and more modest wadi crossings could be implemented initially. Also, in the case of the “60m street” in Mukalla, studies would also need to be undertaken to inform decisions on upgrading of the Irish crossings to bridges. One option to

repair damages to the wide Celebration Road built for the 15th celebration of the unification of North and South Yemen could be to limit it to a reduction of the length of the road, and a U-turn facility at the end where the flood damages occurred.

The important Al-Riyan – Ben Aifan highway is providing the only connection between the coast and Wadi Hadramout. It is one of the only two “life lines” critical for trade between Hadramout and the rest of Yemen, the other being the Ben Aifan – Marib (Al Abr) highway. Both of these roads are under threat as the damages on some sections are extensive and any small local flood could be very disruptive. The repairs to damages on these two roads should have high priority and be implemented on a fast track basis.

One 6 km long section of the Al-Riyan – Ben Aifan highway located in a wadi was almost totally washed away by the flood. A reconstruction is foreseen on this section. However, the possibility of relocating the road away from the wadi, partially or fully, should be investigated before reconstruction starts to determine viability technically and economically, and to minimize resettlement and environmental impact.

A similar concern was noted on a shorter section on the important 53 km long road link to Sah from Al Gharf located between Seiyun and Tarim. This road serves several large towns and on one location the old Irish crossing was washed away at a bend in the river posing a threat to the approach road. There is also a depression and small lake in the location of the old crossing, and it does not seem to be the ideal location for a new crossing, whether bridge or improved concrete drift. Relocating the crossing away from the current location should also be investigated to determine economic and technical viability and to minimize any environmental impacts before reconstruction can start. However, there is also an urgent need to improve the detours now offered to trucks and light vehicles as only 4-wheel drive vehicles can use the short direct detour close to the old crossing. This could be done by the General Corporation for Roads and Bridges (GCRB) on a fast track basis.

On the road between Al Gharf and Tarim there is a 200 m long, wide dual carriageway bridge under construction. This is part of the widening of the highway under construction between Seiyun and Tarim. The bridge was fully submerged by the flood and a lot of palm trees got entangled in the partly finished superstructure. This caused some erosion of the approach roads, in particular on the north-eastern end. There were discussions on a possible extension of the bridge. It is not clear that this would improve the situation much. The bridge is located at quite an angle to the river flow, while the very thick columns with cap beams are lined up perpendicular to the bridge axis. This is unusual, and it is unclear how the bridge would work in the case of extensive flooding without overtopping. It is suggested that the design of the bridge and any extensions or modifications to it should be subject for further studies to improve flow, reduce erosion attacks on the north-eastern upstream embankments, and reduce the trapping of debris. Since the bridge is under construction, it was suggested that such studies and any additional works should be carried out under the ongoing construction contract.

Urban roads

The reconstruction needs for urban roads have been estimated at this stage only at the restoration value of damages to these roads, which are assessed at YR 1,982 million (US\$ 9.99 million). Damages on urban roads could not be surveyed except for the city of Mukalla. The main damages there seems to be caused by a grossly inadequate urban storm water drainage system and any large flood would pose a threat in the future to the area of the city were the large damages were reported (except for the coastal roads towards Bir Ali). However, in the absence of an urban storm water drainage master plan, it is difficult to assess the actual reconstruction needs in this

case. The damages and needs to the streets and urban areas observed have to be assessed in the context of such a master plan, as the needs are expected to exceed the cost of the damage repairs, and would affect the extent of repairs to be undertaken in the short term.

Most urban roads affected by the flood have been covered by a thick layer of silt and debris brought by the river as the area was inundated. This dusty environment is a health hazard and need to be addressed urgently. The cost of this cleaning up of urban roads could be considered in the context of the overall urban rehabilitation after the storm as the damages are spread on many towns, except for Mukalla where the urban storm water drainage study is a necessary first step before heavy investments can be made in street repairs. Finally, these urban roads are part of the assets and are under the control of local government.

Rural roads

The reconstruction needs for rural roads are estimated at YR 1,164 million (US\$5.82 million), comprised of the restoration value of damage to these rural roads at YR 1,054 million (US\$ 5.03 million) and additional improvements estimated at YR 110 million (US\$0.55 million). Given the nature of the work (mainly rock fall and slides and other blockages to be excavated) and the spread of the damage over a network length of 1,500km, they lend themselves to contracting out to local contractors and as may be needed the GCRB on a performance basis. Such rural roads are not covered by the Road Maintenance Fund (RMF) maintenance allocations for emergencies, but the RMF could organize contracting and follow up. And since repairs of such roads often take a long time, priority should therefore be given to these roads under a recovery program.

Recovery and Reconstruction Requirements

The calculations of damages have been carried out with the assumption that the restored facilities would rectify any design and construction deficiencies observed, and extend lengths of culverts, adding more box culvert cells if required, and provide adequate protection of road structures under the assumption that the restored road and Irish crossings should be able to withstand floods of the same magnitude. The cost of damages and cost of minimum reconstruction requirements are therefore the same.

In addition, the MOPWH and local officials have provided cost estimates of improvement to the damaged roads at some locations as presented in Annex 1. The improvements are of two types: (i) upgrading Irish crossings to bridges capable of taking historical flows, and (ii) relocating the road alignment away from the wadi to a better location less exposed to flood damages. Both would reduce the risks and future vulnerability, but at a cost. It is also worth noting that the rest of the road network in Wadi Hadramout area does not have the levels above the wadi bed and structures to withstand floods of the magnitude recently observed. Spot investments in the network to reduce risks at specific locations should therefore be carefully considered as weaknesses in the network generally may prevent such investments from reducing risks of road closure during floods.

What has not been considered is a slope stability assessment of the road network as many of the slopes in cut have not been adequately cleared and rock fall and slides are common in many areas during and after heavy rain even without floods. It is therefore important to review this aspect by specialized firms and identify high risk areas, before bringing down loose material and pieces of rock on exposed road sections in a controlled manner before heavy rain causes slides and more damage and hazard to traffic.

Short-term Interventions (6-12 months)

Several types of activities are considered critical at this stage. Some would have to start immediately using, where possible, funding from ongoing projects with contingencies available or uncommitted funds or retroactive financing. The critical early interventions in the road sector are all technical assistance (TA) to prepare design and tender documents for packages of roads to be rehabilitated on a fast track basis. In addition, the design should include for some critical work to be undertaken using forced account/direct contracting by the GCRB but with adequate quality control. The rationale in this case is that there are some regional roads in a state of disrepair that causes serious risks to motorists (especially the several instances of 7m wide two-lane undivided highways where one lane has collapsed and the erosion threatens the collapse of the other lane, while the road is still being used for traffic), where it would not be advisable from a safety perspective to wait for the competitive contracting of these urgent repairs.

The TA should also include several feasibility studies with preliminary engineering to determine viability and technical standards of bridges to possibly replace some of the Irish crossings, and to identify new road alignments away from flood prone wadis. Once these feasibility studies are finalized and there are clear recommendations on what to do where under the expected funding constraint in the sector, further TA can be awarded to prepare detailed designs and tender documents for implementation under the reconstruction program.

Funding may be available for the Mukalla–Al Ghayda highway under an ongoing road program by one of the regional development funds. The below proposal for intervention has therefore separated the regional road projects in two groups: (a) one for the Bir Ali-Mukalla –Riyan-Al Ghayda highway corridor, and (b) one for the Hadramout Wadi, including the Riyan-Ben Aifen highway corridor with access roads. The intention would be that the proposed set of interventions in these two groups covers all activities necessary to address all restoration and upgrading needs as a result of the storm.

Depending on the funding available from donors, the number of contracts for civil works may differ from what is indicated in the proposed program below. All contracts for civil works should be awarded, advance payments made, and works should be in progress at the end of the 12 month period for early reconstruction interventions.

Table 5-9 Summary of Short-term Interventions

Proposed Interventions	Implementation / Financing	Costs (US\$ million)
1. TA: Slope erosion study to identify actions to reduce risks and vulnerability	MOPWH/RMF Donors	0.4
2. TA: Design and tender documents on fast track basis for several works packages to restore regional roads to pre-disaster level of service.	MOPWH Donors Existing projects	0.5
3. TA: Identification and preparation of package of urgent repair works suitable for forced account contracting (e.g. GCRB)	MOPWH Existing Donor-financed projects	Covered in above
4. TA: Construction supervision services (typically 3.5% of construction cost)	MOPWH Donors	3.9
5. Works: Start without design/tender and finish repair work on critical damages in the network posing a severe risk to traffic that cannot wait for design and tendering	MOPWH/GCRB Donor retroactive financing	2.5
6. Works: Tender, award contracts and start work for several packages of works to restore regional roads to pre-disaster level of service (except packages for forced account and for further feasibility study)	MOPWH Donors	30.0
7. TA: feasibility studies for any improvements to the road network to reduce future vulnerability and improve levels of service.	MOPWH Donors	1.0 (minimum)
8. TA: Tender documents for repairs to selected critical Urban Roads in Mukalla and affected cities	Local Gov Donors	0.25
9. Works: Tender and award contracts on a fast track basis for one or more packages of works to restore urban roads to pre-disaster level of service	Local Gov Donors	5.0
10. TA: Storm water drainage master plan for Mukalla with design and tender documents of priority flood protection and road reconstruction interventions	Local Gov Donors	0.75
11. TA: Tender documents for repairs to Rural Roads in the wadi and along the coast	MOPWH/RMF	0.1
12. Works: Contract repairs to Rural Roads in the Wadi and along the Coast	MOPWH/RMF Donors	5.85
13. TA: Tender documents for repairs to Nishtun Port	MOT/ Arabian Sea Port Corp	0.1
14. Works: Contract repairs to Nishtun Port	MOT/ Arabian Sea Port Corp	0.43
Total		50.78
Of which TA (studies, tender docs and supervision)		7.0
Of which works (first batch)		43.78

* Simplified designs using line diagram rather than plan/profile drawings, and standard technical drawings for retaining walls, protection works, Irish crossings and box culverts, etc.

Medium Term Interventions (1 – 3 years)

The medium term interventions would basically be a seamless continuation of the short-term interventions started but not completed in the first 12 months. In addition, packages of works would be contracted for restoration and improvement works for which studies, detailed design and tender documents were prepared and completed within the first year.

Table 5-10 Summary of Medium-term Interventions

PROPOSED INTERVENTIONS	Implementation/ Financing	Costs (US\$ million)
13. Works: Slope stabilization improvement works on the sections of the road network with highest risks for slides and rock fall during heavy rains	MOPWH Local Gov Donors	TBD
14. TA: Construction supervision of slope stabilization works (3.5% of construction cost)	MOPWH Donors	TBD
15. Works: Tender, award contracts and start work for several packages of regional road works (based on outcomes of feasibility studies)	MOPWH Donors	64.0
16. Works: Tender and award contracts for packages of urban roads works (based on outcome of storm water drainage master plan)	Local Gov Donors	5.0 (minimum)
17. Works: Continuation of construction works on regional, urban and rural roads started in the short-term and award of further contracts based on funds availability	MOPWH Local Gov Donors	TBD (continuation of above)
Total (not including slope stabilization and additional urban road network needs)		69.0 (minimum)

Telecommunication

The reconstruction needs for the telecommunications sector are estimated at YR 656.29 million (US\$ 3.28 million), including YR 483.33 million (US\$ 2.42 million) in damage restoration value and YR 172.96 million (US\$ 0.86 million) in improvements to construct a back-up transmission system to ensure a disaster-resilient telecommunications system. The costs associated with the immediate restoration of the service were included in the immediate intervention program.

Specifically, the Public Telecommunications Corporation needs to construct transmission system as a back-up to the existing fiber optics cables that would comprise microwave towers connecting coastal Hadramout with the Wadi. The estimated cost of this backup system is YR 172.96 million (US\$0.86 million), as detailed in the Table below.

Table 5-13 Telecommunications back-up system needs

Description	Cost (million YR)
SDH 2+1 connectors (7 links) for Mukalla-Seiyun	95.24
SDH 1+1 connectors (1 link) Mukalla-Fowah	13.61
PDH 1+1 connectors (5 links):Sah-Seiyun mountain (2 links); Ras Huwairah-Dawan (1 link); Mukalla-Ghail (1 link); Mukalla-Shihr (1 link)	35.61
126 E1 collector systems (2 MUX); Mukalla (1 MUX); Seiyun (1 MUX)	9.20
63 EI collector systems (2MUX): Mukalla (1 MUX); Fowah (1 MUX)	6.30
Network Management System in Mukalla	13.01
Total: back-up micro-wave system	172.96

Cross-cutting sectors

Religious Facilities and Cultural Heritage

The reconstruction needs to damaged religious buildings and property in the flood affected areas are estimated at YR 341 million (US \$1.7 million), comprising of YR 244 million (US\$ 1.22 million) in Hadramout and YR 97 million (US\$0.485 million) in Al-Mahara. The reconstruction needs for cultural heritage property are estimated at about YR 600 million (US\$ 3 million), of which YR 331 million (US\$ 1.67 million) in Hadramout and YR 270 million (US\$1.35 million) in Al-Mahara.

Religious Facilities

Contributions from private Gulf-based or Yemeni philanthropy and communities will most likely prove to be an importance source of support the reconstruction of religious facilities. Yet, it is important to evaluate the reasons of flood damage, and identify as needed suitable sites away from the floodplains for the reconstruction of fully destroyed mosques as well as assess the use of flood resistant structures and materials (including water proof ceilings and foundations) prior to proceeding to reconstruction and repair.

Cultural Heritage

The following are important short and medium/long-term considerations that would need to be taken into account in the rehabilitation and conservation of heritage sites and buildings:

Short and Medium Term Considerations

- For the rehabilitation of cultural heritage sites that were affected by the floods, expertise is needed to ensure that the reconstruction and repair efforts do not take away from the value of such historical assets. Fortunately, the GTZ, which has been providing technical assistance to the Government of Yemen on cultural heritage issues, has already started financing repairs to some partially damaged houses within the historic city of Shibam. For the other historic sites, a detailed damage assessment by experts will be an essential first step to determine whether structural damage has occurred, to estimate the approach to and cost of reconstruction efforts, and identify initial measures to stabilize the site and prevent further damage.
- Protecting affected historical sites from further damage will be important. Such damage could occur from existing moisture (from the rain) in outer walls, foundations and roofs, and other activities. There is a need to ensure that the drains within and near such sites are de-silted and working properly for future storm water drainage. In addition, there is an immediate need for improved site protection, conservation, and management.
- Site closure for restoration work, where necessary, would have a negative impact on the communities living near and benefiting from tourism to the sites. Although tourist flows are currently low for other non-disaster reasons, interventions would still be needed to protect potentially affected communities and ensure they participate in and benefit from the restoration of the sites.
- For the historic city of Shibam and neighboring areas, apart from the repairs to damaged houses, important infrastructure repairs and maintenance works are also needed. These

include improving water supply (reactivating the emergency line from the Jujeh water source), maintaining the main canal and bunds near the dam, restoring the city wall and the ring road, maintaining the sewerage system, improving the sewerage system of Siheel to take sewerage away from residential areas, and connecting Shibam and Siheel with alternate electric connection options.

- In sites of considerable cultural heritage value (which most of the Wadi Hadramout is), the tendency to rapidly build in reinforced concrete as part of post-disaster repairs should be resisted, as the emergence of such structures could have a negative irreversible effect on the historic urban and architectural fabric of the Wadi, which in turn would affect its tourism appeal and affect the livelihoods of the communities. Moreover, construction in concrete in the historic sites such as Shibam, and which could block the natural drainage system and increase soil moisture, should be disallowed.

Long Term Priorities

- As mentioned elsewhere in this assessment, a hydrological study is critical to map the occurrence of the different flood events in the affected areas, with Wadi Hadramout as a priority, in order to identify flood-prone areas and enable the design of a comprehensive flood protection and management system for the Wadi. The results of this study would need to be implemented over the long-terms, including most importantly the enforcement of the disaster prone areas as non-buildable zones and the maintenance of the natural and to-be-built flood protection system.
- A conservation plan for Wadi Hadramout in general, and for such key areas as Shibam, should be prepared in conjunction with GOPHCY. The plan should detail mechanisms to restore, conserve, and sustainably develop the cultural heritage of the region. The plan should also include ways to protect mud architecture in the wadi including incentives for conservation and innovation, and detailed implementation steps.

Environmental Protection

The recovery needs for environmental protection are estimated at YR 2,860.2 million (US\$14.3 million), which include the removal from street side to a safe disposal site of sediment deposits on agricultural land, the clean up of silted roads and public spaces in cities, dredging of deposited sediment in Wadis including removal of sayssaban trees that obstruct storm water flow, and the removal of uprooted tree and palm trunks that have clogged flood protection channels. The needs are estimated to be divided in accordance with the share of each Governorate of the total damages (94.1% for Hadramout and 5.9% for Al-Mahara), leading Hadramout's share to be YR 2,691 million (US\$13.46 million) and Al-Mahara's share to be YR 169 million (0.85 million). Over the long-term, additional resources are needed for capacity building/strengthening and environmental awareness building that would contribute to disaster risk reduction.

Table 5-15 Environmental recovery needs

Sector and Subsector	Recovery needs	
	YR million	US\$ million
Collection/disposal of:		
Sediment deposits agricultural land	1,561.5	7.8
Sediment deposits Wadis/public spaces	1,140.0	5.7
Uprooted/damaged trees	158.7	0.8
Total,	2,860.2	14.3

The sediment deposits over time in the natural wadis, combined with a lack of maintenance and the uncontrolled growth of the Sayssaban trees have altered the flood and storm water drainage functions of the wadis, which further exacerbated the damages caused by the recent disaster. The fast growing Sayssaban trees blocked watercourses and diverted floodwater into villages. Left unmanaged, these shrubs formed dense impassable thickets and also invaded cultivated fields and irrigated farms. A critical element therefore of the environmental reconstruction and recovery effort is to assess the existing state of the Wadis within the scope of a hydrological study in order to define the detailed scope of needed efforts and future maintenance and preventive measures.

An assessment of the disaster's impact on coastal zones and biodiversity, including a biodiversity survey to establish damage to flora and fauna and existing habitats, is needed especially for the protected areas. This would inform the preparation of biodiversity management and recovery plans to help to revitalize the impacted biodiversity.

Over the long-term, further environmental protection efforts are needed:

- Environmental awareness building to raise community awareness and environmental education in the aim of reducing the impact on the environment during the post-disaster recovery and reconstruction phase, strengthening local stakeholders' understanding of disaster risk reduction, and improving local government communication capacity.
- Strengthening environmental management at the national and local level, especially the environmental protection agency and local Governments, in environmental assessment, monitoring, enforcement, clean-up and overall management.
- Integrated Coastal Zone Management: The disaster highlighted the vulnerability and increased exposure of coastal areas. Hadramout and Al-Mahara Governorates require expert assistance in the area of coastal zone management including for building

appropriate local technical capacity, preparing and enforcing coastal zone management plans including for disaster risk reduction.

Livelihoods

The disaster's effect on livelihoods is expected to be huge; the estimated losses amount to as much as 113,762 person-work-years in agriculture, livestock, fisheries, industry and commerce. For the duration it will take to recover to pre-disaster output levels, temporary solutions will be needed to partially restore the livelihoods of those affected. These would include a combination of a labor-intensive public works program, which would create as many unskilled jobs targeted at the affected communities as possible, and a cash transfer program. Assuming the entire livelihood losses would be addressed through such a public works program, the number of work-days that would need to be created is estimated at 13.65 million work-days, spread over the 2008-2012 period. On the basis of a daily wage of YR 2,000 for unskilled labor (as in the Social Fund for Development's workfare program), the livelihoods program would need over the 2008-2012 period an estimated YR 27,303 million (US\$ 136.5 million) in wages for unskilled labor to compensate for all livelihood losses. Based on an average labor content of 40% and an average ratio of 80% for unskilled labor (at YR 2,000 per day) to 20% in skilled labor (at YR 4,000 per day) in similar programs, the size of the proposed public works program would need to amount to YR 102,387 million (US\$512 million) over the 2008-2012 period (mainly 4 years from 2009 to 2012). Table 5-16 summarizes the overall livelihoods program requirements for the affected areas, while Tables 5-17 to 5-19 provide the details respectively for Hadramout, Al-Mahara and the affected areas, as linked to the estimated sectoral job losses.

Table 5-16 Summary of livelihood program requirements for the affected areas by year

Total all sectors	Affected Areas					Total
	2008	2009	2010	2011	2012	
Temporary jobs to be created	1,607	44,400	32,111	19,318	16,326	113,763
Work-days to be created	192,840	5,328,000	3,853,320	2,318,160	1,959,120	13,651,560
Program wage/payment needs:						
In YR million	385.7	10,656.1	7,706.7	4,636.3	3,918.3	27,303.1
In US\$ million	1.9	53.3	38.5	23.2	19.6	136.5
Livelihoods public works program size (assuming no cash transfers) *						
In YR million	1,446	39,960	28,900	17,386	14,694	102,387
In US\$ million	7.2	199.8	144.5	86.9	73.5	512
Affected areas reconstruction program size						
In YR million		40,330	45,883	46,637	8,530	141,658
In US\$ million		201.7	229.4	144.5	42.6	708.3
Gap between potential livelihoods wages from reconstruction program and livelihood needs						
In YR million	1,446	2,877	--	--	1,975	6,298
In US\$ million	7.2	14.4	--	--	9.9	31.5

* Assuming an average wage component in the program of about 40%, with 80% of labor non-skilled (paid YR2,000 per day) and 20% skilled labor (paid YR4,000 per day).

Clearly, if a cash transfer program were used instead, and assuming perfect targeting, the resources needed would only amount to YR 27,303 million (US\$ 136.5 million). However, concerns about targeting and the leakage effects expected in such a cash transfer program in light of existing capacity end up favoring a public works program, which would allow for geographic targeting and self-screening.

To the extent possible, the post-disaster reconstruction program would be structured so as to target the affected communities by creating temporary unskilled jobs. Yet, after accounting for the estimated labor intensity and the expected ratio of skilled to unskilled labor in the different components of the reconstruction program³⁷, it is estimated that a gap of about YR 6,298 million (US\$31.5 million) will remain. This gap would therefore need to be addressed either through a cash transfer program or by adding further components to the works program that are not disaster related (e.g. stone paving of roads). Clearly, not all those affected with livelihood losses would be expected to be able to assume unskilled construction related jobs (whether due to gender, vulnerability, disability or other considerations). As such, it is important to simultaneously design a cash transfer component that would be prioritized to households that meet certain pre-determined objective criteria reflecting vulnerability (e.g. female single-headed households, the elderly, disabled heads-of-households, etc). It is thus proposed that the cash transfer program be capitalized with a total of YR 10,000 million (US\$50 million), which would comprise of YR 4,000 million (US\$20 million) for 2009, followed by YR 2,000 million (US\$10 million) per year from 2010 to 2012.

Table 5-17 Livelihood program requirements for Hadramout by year and by loss sectors

	Hadramout					
	2008	2009	2010	2011	2012	Total
Agriculture						
# Of Work-Years Lost	993	33,683	25,868	16,662	14,239	91,444
Livelihood program wage/payment needs (YR million) *	238.2	8,084.0	6,208.2	3,999.0	3,417.3	21,946.7
Fishing						
# Of Work-Years Lost	2	107	83	48	49	290
Livelihood program wage/payment needs (YR million) *	0.5	25.7	20.0	11.4	11.9	69.5
Manufacturing						
# Of Work-Years Lost	16	18				34
Livelihood program wage/payment needs (YR million) *	3.9	4.2				8.1
Trade						
# Of Work-Years Lost	519	9,975	5,876	2,541	1,975	20,886
Livelihood program wage/payment needs (YR million) *	124.5	2,394.1	1,410.2	609.8	474.0	5,012.7
TOTAL ALL SECTORS						
# Of Work-Years Lost	1,530	43,783	31,827	19,251	16,263	112,654
Annual imputed wage or self-employed income losses, million YR	749	21,452	15,594	9,432	7,969	55,197
Livelihood program wage/payment needs (YR million) *	367.1	10,508.0	7,638.4	4,620.2	3,903.2	27,036.9
Livelihood program wage/payment needs (US\$ million)	1.8	52.5	38.2	23.1	19.5	135.2
As percent of annual wage or self-employed income losses	49%	49%	49%	49%	49%	49%

* Based on an average wage of YR 240,000 per year for the overall livelihoods program (i.e. YR20,000 per month or 10 work-days on average per month at the average wage of YR2,000 per day for unskilled labor.

³⁷ The reconstruction component in agricultural sector and the environment (debris removal) is assumed to have a 40% labor component with 80% of jobs to unskilled labor (or 67% of total wages). Reconstruction of housing, health, education and religious facilities is assumed to have a 40% labor component with 50% of jobs for unskilled labor (or 33% of the total wages). Infrastructure is assumed to have a 30% labor component with 50% of jobs for unskilled labor (thus 33.3% of the total wages).

Table 5-18 Livelihood program requirements for Al-Mahara by year and by loss sectors

	Al-Mahara					
	2008	2009	2010	2011	2012	Total
Agriculture						
# Of Work-Years Lost	74	460	177	12	11	734
Livelihood program wage/payment needs (YR million)	17.7	110.3	42.6	2.9	2.7	176.2
Fishing						
# Of Work-Years Lost	2	78	61	35	36	211
Livelihood program wage/payment needs (YR million)	0.4	18.7	14.6	8.3	8.6	50.7
Manufacturing						
# Of Work-Years Lost	0					0
Livelihood program wage/payment needs (YR million)	0.0					0.0
Trade						
# Of Work-Years Lost	2	79	47	20	16	164
Livelihood program wage/payment needs (YR million)	0.5	19.0	11.2	4.9	3.8	39.4
TOTAL ALL SECTORS						
# Of Work-Years Lost	77	617	285	67	63	1,109
Annual imputed wage/self-employed income losses, million YR	50	399	184	43	41	717
Livelihood program wage/payment needs (YR million)	18.6	148.1	68.3	16.1	15.1	266.3
Livelihood program wage/payment needs (US\$ million)	0.1	0.7	0.3	0.1	0.1	1.3
As percent of annual wage or self-employed income losses	37%	37%	37%	37%	37%	37%

* Based on an average wage of YR 240,000 per year for the overall livelihoods program (i.e. YR20,000 per month or 10 work-days on average per month at the average wage of YR2,000 per day for unskilled labor.

Table 5-19 Livelihood program requirements for the affected areas by year and by loss sectors

	Affected Areas					
	2008	2009	2010	2011	2012	Total
Agriculture						
# Of Work-Years Lost	1,066	34,143	26,045	16,675	14,250	92,179
Livelihood program wage/payment needs (YR million)	255.9	8,194.3	6,250.8	4,001.9	3,420.0	22,122.9
Fishing						
# Of Work-Years Lost	4	185	144	82	85	501
Livelihood program wage/payment needs (YR million)	0.9	44.4	34.5	19.8	20.5	120.2
Manufacturing						
# Of Work-Years Lost	16	18				34
Livelihood program wage/payment needs (YR million)	3.9	4.2				8.1
Trade						
# Of Work-Years Lost	521	10,055	5,923	2,561	1,991	21,050
Livelihood program wage/payment needs (YR million)	125.1	2,413.2	1,421.4	614.6	477.8	5,052.0
TOTAL ALL SECTORS						
# Of Work-Years Lost	1,607	44,400	32,111	19,318	16,326	113,763
Annual imputed wage/self-employed income losses, million YR	799	21,851	15,778	9,476	8,009	55,913
Livelihood program wage/payment needs (YR million)	385.7	10,656.1	7,706.7	4,636.3	3,918.3	27,303.1
Livelihood program wage/payment needs (US\$ million)	1.9	53.3	38.5	23.2	19.6	136.5
As percent of annual wage or self-employed income losses	48%	49%	49%	49%	49%	49%

* Based on an average wage of YR 240,000 per year for the overall livelihoods program (i.e. YR20,000 per month or 10 work-days on average per month at the average wage of YR2,000 per day for unskilled labor.

Implementation of the livelihoods program

Three existing instruments could serve either to channel the needed assistance to the affected households for the duration in which their former businesses or activities recover to their pre-disaster output and/or to inform the design of the livelihoods program. These are: (a) the Social Welfare Fund (SWF); (b) the Public Works Program (PWP); and (c) the Social Fund for Development (SFD).

The **Social Welfare Fund (SWF)**, established in 1996, is the government's main social safety net program. The SWF provides targeted cash assistance to the poor and vulnerable groups. Until recently, SWF cash assistance was YR1,000 per eligible beneficiary and an additional YR200 per dependent, not exceeding YR2,000 (US\$ 10) per household per month or YR 24,000 (US\$ 120) per year. These amounts were doubled after the food crisis. Eligible beneficiaries fall in 15 categories that are structured in two types: (i) groups eligible for permanent assistance without time limitation (orphans, widows and divorced women with and without children, the fully and partially disabled, the poor, and the elderly); and (ii) groups eligible for temporary assistance renewed yearly for up to a maximum of three years (the temporarily disabled whether fully or partially, and families with a head-of-household who is either missing, imprisoned or recently discharged from prison). Targeting follows a two stage process. The first stage is geographic targeting (total number of cases to be afforded each year in light of the existing budget, which itself is divided among governorates as a function of their share of population, incidence of poverty and caseload in former assistance program). In the second stage, the Governorate distributes the amount received to eligible beneficiaries who are required to submit proof of status and lack of income or earning potential (including birth and marriage certificates, proofs of age and disability among many other documents).³⁸

Early assessments of the SWF (including van der Walle 2002) found problems that limited the program's ability to effectively fulfill its mandate. These include the limited size of the program budget which thus only covers a small portion of eligible groups, the small assistance amount per household per month and its limited impact on people's livelihood. This meant difficulty in reaching out to eligible groups, especially in remote rural areas with a high incidence of poverty but where access is difficult. Program administration was also complex due to onerous documentation requirements and difficulties related to targeting, screening, and distribution of cash assistance amounts, which are exacerbated by a small share of the budget earmarked for program administration (5%). The Household Budget Survey of 2005 revealed that mis-targeting was in the range of 40 percent.

In recent years, the SWF has adopted several reforms that have led to improved performance. Most importantly, it has recently completed a comprehensive nationwide survey to verify its current beneficiaries' list, which adds up to 1.6 million households. This served to remove the undeserving and double-dipping cases from the initial beneficiary lists. To further improve targeting, the SWF is in the process of developing proxy-means testing methods to rank needy households in an objective way. The SWF also started relying on postal offices to enable effective and transparent distribution of cash assistance. All these factors have contributed to improved SWF performance.

It is therefore proposed that the SWF be entrusted to implement the cash transfer (or grant) component of the program, relying on the newly adopted parameters (proxy-means testing and post offices). Priority can be given to the affected households that were from the onset on the

³⁸ Van der Walle, D (2002)

SWF (permanent and temporary) beneficiary lists. Distribution of the cash assistance—whether via a lump sum per household and/or a regular monthly payment for the estimated recovery period (1-3 years)—would be undertaken via post offices in the districts where such facilities are found, coupled with provisions for mobile distribution offices by the nearest district post office to neighboring non-served areas. This system should prove effective in light of prevailing population settlements, which are clustered along the Wadi Hadramout (the main affected area).

The **Social Fund for Development (SFD)**—one the Government’s main safety net programs with interventions typically focusing on medium- and long-term recovery—could also be an effective instrument in responding to the livelihoods impact of such a disaster. The strengths of the SFD are its extensive community outreach and mobilization efforts, diversified and innovative activities, and a robust Monitoring and Evaluation (M&E) program. Recently, in response to the food crisis, the SFD experimented with a “Workfare Program” that focuses on the individuals/households and with a short-term perspective. The program sponsors labor-intensive works, drawn from community priorities, to the poorest communities in Yemen, which are identified based on the recently completed poverty mapping in 2007. The program pays specific pre-identified amounts for types of works and for daily labor working in such projects, which typically range from USD50,000 to 100,000 per project. Daily labor varies from unskilled to skilled labor and ranges from YR2,000 to YR4,000 (USD10-20 per day), and the payment for different work quantities is tied to outputs. Table 5-20 below provides the payment rate used by the Workfare Program for selected types of works that align with the current post-disaster reconstruction program and Table 5-21 provides the different daily labor wages by type of skill.

Table 5-20 Workfare program sample of projects

Items of Work	Unit	Unit Price (US\$)
Road clearance (equipment)	t.m	1.5
Clearing/excavation of irrigation ditches	t.m	0.65
Road leveling (manual)	m2	0.75
Soil excavation	m3	2.75
Hard rock excavation	m3	20
Soft/ semi-hard rock excavation	m3	7.5
Soil embankment	m3	2
Stone masonry buildings (Joom)	m3	40
Stone masonry buildings with mortar	m3	50
Coating irrigation channels with stone and mortar	m2	20
Paving with squared stone (mortar-less)	m2	16
Paving with squared stone and mortar	m2	22
Building Gabion walls (30*30 stone with plastic-coated metal grille)	m2	45
Removing sayssaban trees with oil injection	daily	5.5

Table 5-21 Workfare program daily labor wages

Items of Work	Unit	Unit Price (YR)
Skilled Jobs	daily	4,000
Semi-skilled jobs	daily	3,000
Unskilled jobs	daily	2,000

This experimental program, designed in response to the food crisis, is intended to support 8,000-10,000 poor households by paying them, in return for work, the equivalent of their wheat consumption for the duration of 6 to 12 months. The program is currently being evaluated for the purposes of informing a scaling up (which many donors including the European Union are

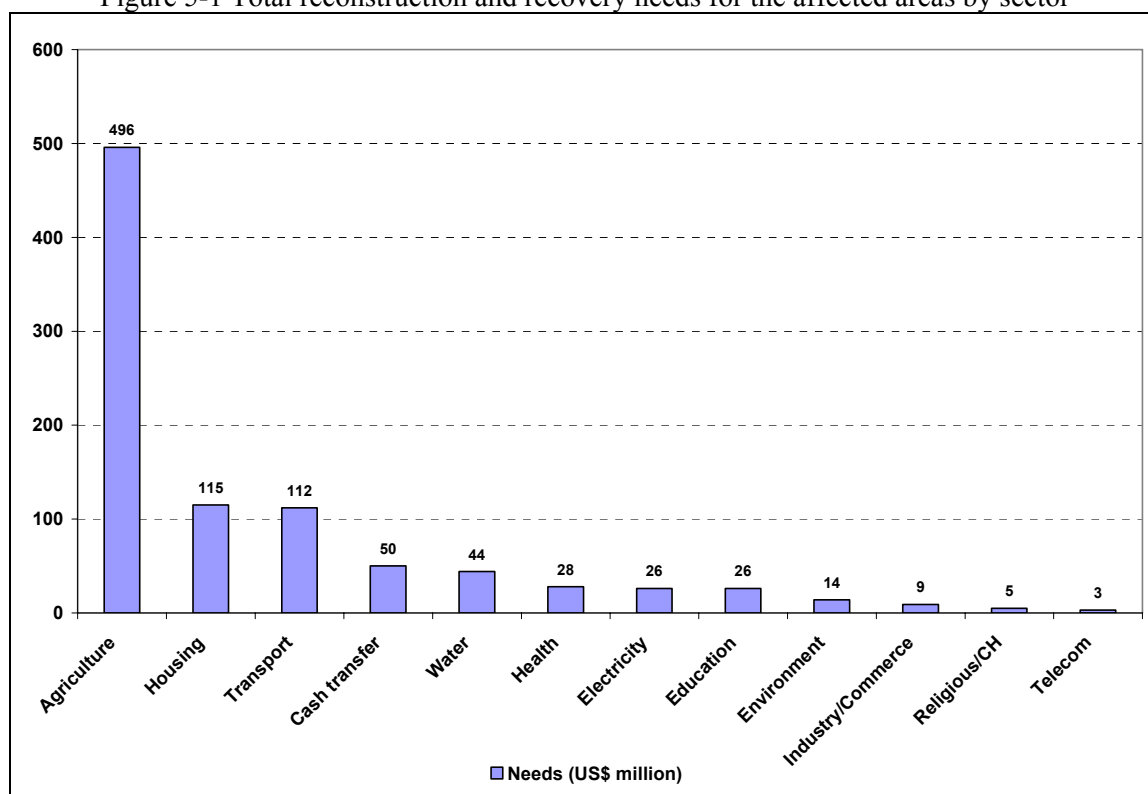
interested in supporting). Even though the evaluation has not yet been completed and the SFD management may prefer to wait for its outcome prior to scaling up, the current disaster is a critical situation that warrants the immediate scaling up of the “Workfare program.” The works covered under the pilot program, including debris removal, disposal of the Sayssaban trees that block the Wadi paths, rehabilitation of agricultural land and terraces, stone paving, etc, are ideal labor-intensive works that are suited for the livelihoods crisis at hand and are needed in the affected communities. A scaled up version of this program could support 20,000-40,000 affected households for the duration of 12-24 months. Whether to rely on the SFD in whole or in part for implementation or to replicate the workfare program for implementation by other entities would need to be decided in light of the Government’s preferred approach to the reconstruction and recovery effort (the set up of a Fund to oversee the overall effort has already been decided but its parameters remain to be defined) and the SFD’s current and expected workload.

Finally, the **Public Works Program (PWP)** is also an adequate instrument to avail temporary employment to the affected population via its labor-intensive public works construction program. The Government may want to entrust some of the rebuilding effort to the PWP (which may include rehabilitation of health and educational facilities, restoration of community-based services, etc) or replicate the program’s main characteristics in the reconstruction and recovery effort. Should PWP be entrusted with part of the rebuilding effort, as would be advisable (unless if a bottleneck is expected due to a significant increase in its workload vis-à-vis its capacity), contractual provisions would be made so that PWP contractors offer unskilled and semi-skilled construction opportunities to members of the affected communities. The PWP could also be entrusted with overseeing the rebuilding of other labor-intensive works such as flood protection using gabions, stone paving, debris removal or other similar works that can provide employment opportunities to agricultural and other laborers who are temporarily out of the job until their employers or activities recover to their pre-disaster output level. Close supervision would be needed to ensure the program meets the required objective.

Summary of Recovery and Reconstruction Needs

The total reconstruction and recovery needs for the two affected Governorates amount to YR 185,858 million (US\$ 929 million); of these, Hadramout's share amounts to YR174,405 million (US\$872 million) and Al-Mahara's share amounts to YR11,452 million (US\$57 million). The largest needs are found in a descending order in: (i) the agriculture sector with YR 99,200 million (US\$ 496 million) needed for reconstruction of damaged public and private infrastructure and recovery of losses; (ii) YR 23,040 million (US\$115 million) for the housing reconstruction program including programs to restore damaged household assets, clean debris and provide temporary shelter to the affected households; and (iii) YR 22,465 million (US\$ 112 million) for transport, mainly roads' reconstruction. The next most important category is YR10,000 million (US\$ 50 million) needed for the cash transfer program to restore part of the livelihoods losses to the most vulnerable affected households. The remainder of the support needed to the households that have or will face livelihood losses as result of the disaster, which is estimated at YR17,301 million (US\$86.5 million), would be addressed through a labor-intensive public works program that would be designed to channel to the extent possible temporary jobs in the reconstruction program to affected households. Figure 5-1 presents the total needs by sector.

Figure 5-1 Total reconstruction and recovery needs for the affected areas by sector



The total reconstruction and recovery needs by year and by affected Governorate are presented in Table X. The assumptions for the time distribution of reconstruction and recovery needs are as follows:

- Infrastructure reconstruction: 20% in 2009 (year 1) due to the procurement process time requirements; and 40% for each of 2010 and 2011 (years 2 and 3). Exceptions are the

- road transport sub-sector in Hadramout, assumed to follow: 40% in year 2; 30% in year 3, and; 10% in year 4 to account for the complexities of realignment away from Wadis, and the water and telecommunications sector in Al-Mahara due to their small amount.
- The social and cross-cutting sectors: 30% in 2009 (year 1) which balances the urgency of rapid intervention with complex decision-making related to resettlement needs of housing or facilities; 30% in year 2, and; 40% in year 3.
 - Recovery in the agricultural sector expected to take place over a two-year period (which would still necessitate a subsequent lag to prepare the land, grow the trees, etc, until pre-disaster output levels are attained).
 - Reconstruction in the agriculture sector: 30% for each of the first three years (2009, 2010 and 2011), followed by 10% in 2012.
 - Reconstruction in the industry and commerce sectors to take place fully in year 1 (2009).

Table 5-22 Summary of Short, Medium, and Long-Term Recovery and Reconstruction Requirements

Sector	Hadramout					Al-Mahara					Total Needs in the Affected Areas *	
	2009	2010	2011	2012	Total Needs (million YR)	2009	2010	2011	2012	Total Needs (million YR)	(million YR)	(million US\$)
Agriculture	30,691	30,691	25,701	8,567	95,649	1,109	1,109	999	333	3,551	99,200	496
Crops	25,701	25,701	25,701	8,567	85,669	999	999	999	333	3,331	89,000	445
Fishing	4,948	4,948			9,895	53	53			105	10,000	50
Livestock	43	43			85	58	58			115	200	1
Industry/Commerce	1,830				1,830	6				6	1,836	9
Manufacturing	647				647	0				0	647	3
Retail	1,183				1,183	6				6	1,189	6
Infrastructure	6,733	13,466	11,437	2,030	33,665	741	1,397	1,348		3,485	37,150	186
Electricity	812	1,624	1,624		4,060	240	480	480		1,200	5,260	26
Water	1,734	3,469	3,469		8,672	49	49			97	8,769	44
Transport	4,059	8,118	6,089	2,030	20,295	434	868	868		2,170	22,465	112
Telecom	128	255	255		638	18				18	656	3
Social	9,283	9,283	11,457		30,301	1,097	1,097	1,375		3,569	33,870	169
Education	1,458	1,458	1,944		4,860	99	99	132		330	5,190	26
Health	1,736	1,736	1,394		5,143	175	175	146		497	5,640	28
Housing	6,089	6,089	8,119		20,298	823	823	1,097		2,742	23,040	115
Cross cutting	917	917	1,223		3,058	223	223	298		744	3,802	19
Environment	807	807	1,076		2,691	51	51	68		169	2,860	14
Religious/Cultural	110	110	147		367	173	173	230		575	942	5
Cash transfer	3,983	2,798	1,692	1,430	9,902	61	25	6	6	98	10,000	50
Total Needs (million YR)	53,437	57,155	51,510	12,026	174,405	3,237	3,851	4,026	339	11,452	185,858	929
Total Needs (million US\$)	267	286	258	60	872	16	19	20	2	57	929	

* Not including YR 1,400 million (US\$ 7 million) for needed TA in the transport sector and YR 8,599 million (US\$43 million) of expected additional cost should the resettlement option in Hadramout Governorate be used for reconstruction.

Section VI: Disaster Risk Management Requirements

Country Risk Profile

As noted earlier, floods are the most important and recurrent natural disaster in Yemen, followed by land or rockslides, earthquakes, volcanoes, sand storms, extreme temperatures, epidemics, and drought. The most recent major floods occurred in 1996 and 2000. While regular flooding has traditionally been beneficial to agricultural practices in Yemen, high magnitude flooding of the sort recently witnessed in Hadramout and Al-Mahara leads to major losses of lives and property and destruction of infrastructure and livelihoods. The destruction is exacerbated by the absence or poor maintenance of flood protection measures. Yemen also faces an increased desertification process, which is leading to the loss of land productivity, water erosion, saline water intrusion, and coastline erosion.³⁹ Apart from the manmade factors, arid climate, natural erosion process, barren landform, and recurrent disasters are all increasing land degradation.

In addition to the natural hazards, Yemen faces increased climatic variability due to global climate change and unsustainable land use practices. The trend towards increased desertification, water scarcity, and degradation of agricultural land is therefore likely to continue. These factors may lead to a rise in future losses from natural disasters. And although Yemen is a disaster prone country, disaster risk awareness, mitigation and reduction have not (yet) been mainstreamed into the country's core disaster management agenda and strategy. There is an equally great need for the country to urgently start devising and implementing major preparedness interventions and capacity building efforts.

Currently the institutions responsible for the management of urban areas are not well equipped to respond to the exponential growth of the cities, in light of Yemen's average urbanization rate of about 5% per annum. Public and private investment in urban development projects usually does not consider the risk of natural hazards, and city planning and enforcement institutions are mostly ineffective in reducing disaster risk to the vulnerable population. This coupled with increasing human toll⁴⁰ poses a daunting economic burden on the Yemeni government, when called upon to clean up and rebuild after many frequent and recurrent disasters.

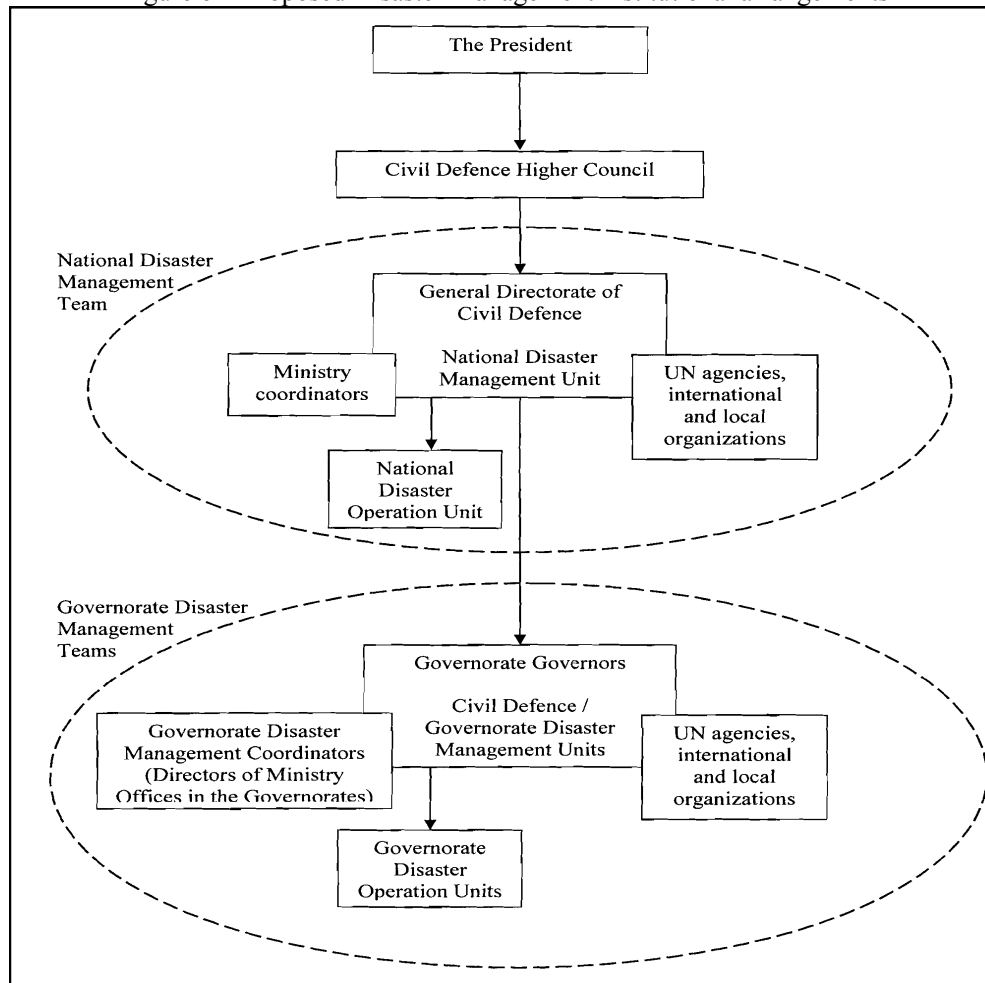
Existing institutional arrangements for disaster risk management and reduction

In the face of disaster events that have been growing both in number and size in the recent past, the Government of Yemen, with support from the UN agencies, has put in place an institutional arrangement for disaster risk management, in the aim of coordinating and managing the aspects related to disaster preparedness, response and mitigation. This arrangement, whose legal basis is found in the Civil Defense Law of 1997, is outlined in the National Disaster Management Plan, a draft of which was prepared in 2006 by the Ministry of Interior's Civil Defense Department with support from the UN agencies (See Figure 6-1).

³⁹ Ministry of Agriculture and Irrigation, The National Action Plan to Combat Desertification, 2000

⁴⁰ As per the World Disaster Report, 2008, the number of people killed in Yemen due to natural hazards has increased 10% over the last two decades.

Figure 6-1 Proposed Disaster Management institutional arrangements



Source: National Disaster Management Plan, draft document, 2006

Under this arrangement, the main institutions involved are as follows:

- **Office of the President:** The President of the Republic has full authority to provide assistance to the affected people during disasters, either directly or through the Civil Defense Higher Council (CDHC) and the National Disaster Management Team (NDMT).
- **Civil Defense Higher Council (CDHC):** This body is to be convened in the event of a national disaster or as requested by the President. It is chaired by the President or, as delegated, by the Minister of Interior. The CDHC mandate is to provide policy direction and approve plans for disaster preparedness and response, recommend integration of disaster management with national development plans, and adopt measures for disaster prevention, mitigation and rehabilitation. The CDHC has the authority to declare and, as appropriate, end an emergency situation due to a disaster. Other functions include: (i) annual review of national disaster management policy and strategic plan; (ii) annual report to the Prime Minister, through the Ministry of Interior, on national disaster management activities; (iii) oversight of the work, decisions and priorities of the National Disaster Management Unit (NDMT) and approval of relevant work plans; (iv) annual review of the National Disaster Management Plan (NDMP); (v) provision of technical and policy advice and resource support to the National Disaster Management Unit (NDMU) during response operations; and (vi) assigning of disaster management responsibilities related to ministries and other entities.
- **The National Disaster Management Unit (NDMU), in the Ministry of Interior's Civil Defense Directorate:** The NDMU, as the designated entity for coordinating disaster management activities in Yemen, is responsible for providing support to the GOY and local communities in providing disaster

and emergency management services. It is a permanently staffed unit within the Ministry of Interior's Directorate of Civil Defense. Other functions include: collecting disaster-related information, identifying baseline data for use in disaster preparedness and response activities, and developing an information database on past disasters in Yemen; preparing national disaster management plans and procedures and outlining plans for Governorates; monitoring international developments and proposing measures for incorporation in the national disaster management system; administering and providing secretariat support to the NDMT; monitoring hazards in the region and warning of developments that may affect Yemen; acting as contact point for initial reports of emergencies and disasters; organizing and leading multi-sector damage and needs assessment teams during response whenever necessary; developing and conducting public information and awareness programs in cooperation with other relevant agencies; and developing disaster management training programs.

- **National Disaster Management Team (NDMT):** The NDMT, appointed by the Ministry of Interior, comprises of the NDMU and focal points/coordinators in related ministries, agencies and other stakeholders (National Seismological Observatory, Civil Aviation and Meteorology Authority, Maritime Affairs Authority, Desert Locust Monitoring and Control Center, General Directorate of Animal Resources, Yemen Red Crescent Society, UN agencies, local and international organizations, and other entities designated by the Ministry of Interior). The NDMT is responsible for development and implementation of disaster management plans and procedures for preparedness, response, and rehabilitation and reconstruction activities. It also provides technical assistance to other ministries and acts as a forum for exchange of information and mutual assistance.
- **Governorates:** Governorates are the key administrative units for disaster management. The Directorate of Civil Defense establishes **Governorates Disaster Management Units (GDMU)** that are responsible for local emergency and disaster management activities. GDMUs serve as an interface between the NDMT in Sana'a and **Governorate Disaster Management Teams (GDMT)** and provide guidance and policy advice on disaster mitigation, preparedness, and response and recovery matters. Additional functions of GDMT may also include: Coordination of surveys of affected areas and assessment of the results; coordination of the commitment of local resources to provide the most effective response to identified needs; recommendations on the content, scale and timing of the requests for national support, with the related logistical information needed for effective delivery. The GDMT, comprised of local representatives of key governmental and non-governmental agencies likely to be involved in disaster management activities, as well as community representatives, are mandated to assist the GDMU.

Issues related to the institutional arrangements:

The institutional arrangements for disaster risk management in Yemen are, however, far from being coherently organized on the ground. In addition to the Ministry of Interior's efforts, there are at least two other ongoing efforts/initiatives in the area of disaster risk management. First, the **Ministry of Water and Environment (MOWE)'s Directorate of Environmental Emergency (DEE)** is also active in disaster risk management. The DEE was designated as the GOY's representative to the UN's international strategy for disaster risk reduction and has represented the GOY in several international activities and forums. However, the resources that are at the DEE's disposal are very limited, which prevents it from playing an active role.

The second issue pertains to **local governments'** mandate in disaster risk management and reduction, as stipulated in the Local Authorities Law No. 4 of 2000. The Law greatly expanded the responsibilities of local authorities including in disaster risk management and reduction among many responsibilities in policymaking, planning and implementation that were devolved to the local level. Yet, the reality is that implementation was not commensurate with the law for several reasons including lack of resources, continued control by the central line ministries through their branch offices, etc. Since 2007, there has been an increasing momentum in support of greater decentralization. The **Ministry of Local Administration (MOLA)** completed a draft decentralization strategy and proposed revisions to Law No. 4 of 2000, which would allow for greater fiscal and political decentralization. In addition, Governors were for the first time in Yemen elected in May 2008. As such, there needs to be greater involvement at the local government level in disaster risk management and reduction to align with Yemen's decentralization policy and ensure that plans and policies are formulated at the level that is closest to the communities and thus can have a realistic chance of being implemented.

Needs Assessment for Disaster Risk Management and Reduction

The key lessons learned and needs identified from the recent flood response include the following: (i) mainstreaming disaster risk reduction and mitigation across sectors and down to the lower levels of governance, namely to local authorities (Governorates and districts); (ii) further strengthening and institutionalizing disaster preparedness; (iii) strengthening the flood warning program; (iv) mobilizing adequate response resources for improving provision of basic facilities and relief during floods, and providing search and rescue equipment to local Government teams and other partners; (v) strengthening local communication systems through provision of modern, disruption-free communication equipment to disaster management focal points; (vi) community training in interpretation of early warning signals and in following evacuation protocols and requirements, through sustained public information and behavioral change/sensitization campaigns; (vii) taking stock of deficiencies in key flood risk mitigation infrastructure such as flood protection in wadis, irrigation channels, and flood-proofing the houses; and (viii) mapping floodplains to protect natural water courses.

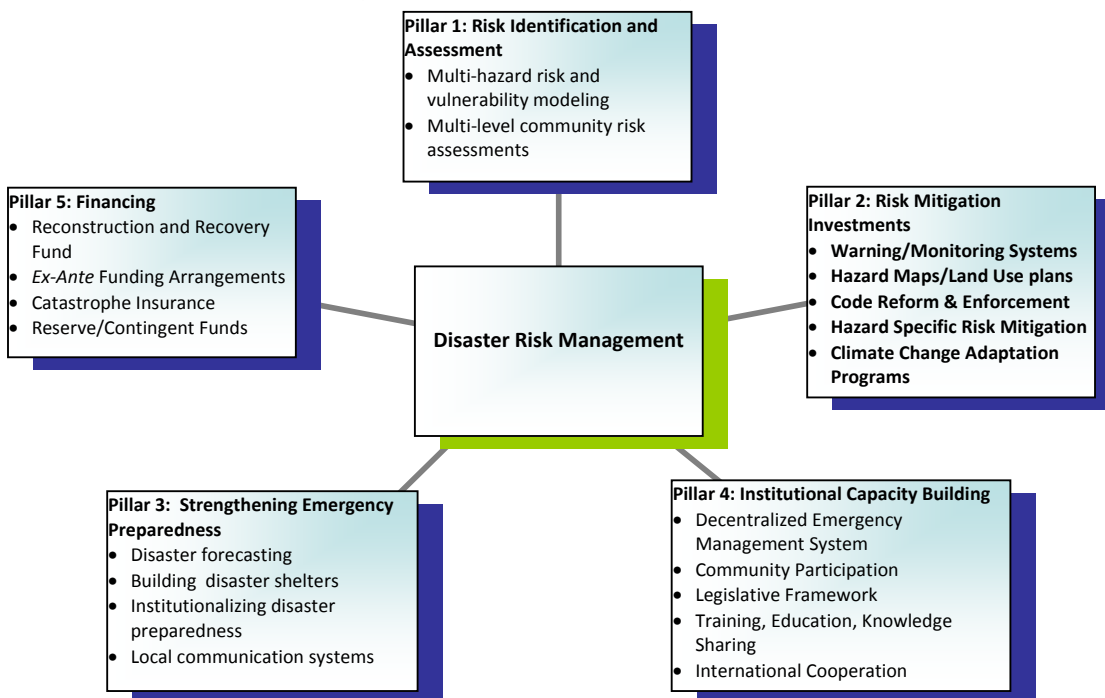
Proposed Risk Mitigation Strategic Framework and Action Plan - Moving from Risk to Resilience

The following section outlines a recommended disaster risk reduction framework (Figure 6-2) that combines the broad strategic priorities and goals outlined in the NDMP (2006) and strategic elements for disaster risk mitigation based on the lessons learnt from international experience.⁴¹ The two underlying principles of this framework are that: (i) the losses of life and the economic impact of disasters can be reduced through advance planning and investment; and (ii) the strategic framework and action plan should be both affordable and delivery-efficient. The framework has the following five strategic pillars:

- (vi) Risk identification and assessment;
- (vii) Risk mitigation for reducing exposure to natural hazards;
- (viii) Strengthening and enhancing emergency preparedness;
- (ix) Institutional capacity building; and
- (x) Financing Reconstruction and Recovery and long-term catastrophe risk financing.

⁴¹ Based on World Bank Disaster Risk Management Series No. 9 “ Preventable Losses - Saving Lives and Property “

Figure 6-2 Disaster Risk Management Framework



Pillar 1: Risk Identification and Assessment

1a. National Multi-hazard Risk Identification, Vulnerability Assessment and Modeling

A national study for hazard risk identification, modeling and mapping in Yemen funded by the GFDRR is about to be launched with support from the World Bank; its results would be expected in early 2009. In addition, the National Geological Authority has recently started preparing some risk assessment maps for Yemen's coastal areas in coordination with the Civil Defense Directorate. In light of the renewed urgency for an institutionalized disaster risk management policy and framework and inter-agency coordination which was mandated by the recent disaster in Hadramout and Al-Mahara, it is critical that the National Study be "housed" with the proposed institutional framework for disaster risk management and encompass all ongoing efforts such as by the Geological Authority.

Such a risk identification and assessment is critical for assessing risk of various hazards including floods. It would assess the disaster risk of the different regions of Yemen and prepare detailed risk maps for the governorates, including an estimate of the losses associated with the country's hazard risk exposure, the probability of loss exceedance, and identification of geographical areas where the risk is concentrated. This study would enable access to information about the probability of hazards and the extent of damage to be created if they occurred, which is critical to plan for and contain the damage in the event of a disaster. This study would also enable the development and strengthening of a national policy for disaster risk management, and strengthen the capacity to track, collate, monitor and disseminate information on phenomena and activities known to trigger disaster events. The estimated cost for the completion and dissemination of a comprehensive risk assessment study is about US\$1 million.

1b. Hadramout and Al-Mahara Risk Identification and Assessment

One or more detailed hydrological, hydraulic and geological studies are needed in Hadramout and Al-Mahara governorates to map periodic flood events (5-, 10-, 25-, 100- and 500-year) and assess the risk of landslides. Priority would be given to map the risks in Wadi Hadramout, as the worst affected area of the recent disaster.

The results of these studies would be used to design a flood management and protection system for the different affected areas, especially in the Wadi, and would be integrated in the land use master plans, which would be the regulatory basis to authorize development or prevent building in risk-prone areas declared non-buildable.

The reconstruction planning of affected areas in Hadramout and Al-Mahara lacks hydrological and hydraulic information to enable the proper design of infrastructure to be rebuilt. For instance, the design of the rehabilitation of damaged highways and roads in these two governorates, which are located along or across wadis, lacks the critical hydrological and hydraulic data for catchment areas that affect such roads. Likewise, the impact of the storm and floods on the stability of slopes, rock and soil has not been assessed. The substantial amount of sediment transported by the storm and floods is evidence of the major soil erosion taking place in the upper reaches of the catchments, and points to a potentially significant impact on the stability of slopes within the catchment area and in the vicinity of populated areas built at the foothills of such vulnerable slopes. Thus, these detailed studies are critical to develop criteria for design consideration for the roads, buildings in populated areas, agricultural areas, and infrastructure in general as well as for the design of flood protection measures in Wadi Hadramout and other wadis to protect populated areas at risk.

The principal outputs from these studies for Hadramout and Al-Mahara would be: (i) flood and landslide hazard risk atlases; (ii) application of catastrophic risk modeling for hazard risk management; and (iii) recommended methodology and hydraulic design considerations for the design of roads, housing in urban and rural areas, agricultural areas, and for the detailed design of flood protection measures to protect critical flood- and landslide-prone populated areas in Hadramout and Al-Mahara governorates. The estimated cost for the completion of these studies is about US\$0.5 million.

Pillar 2: Risk Mitigation for Reducing Exposure to Natural Hazards

Protecting all areas from all natural disasters is neither feasible nor economically viable. Yet, to prevent major economic loss, a risk mitigation strategy can be targeted at areas/sectors that are both populated and vulnerable, and would thus include urban areas, agricultural lands, and key infrastructure. Strengthening the resilience of regions involves a combination of structural and non-structural measures that are critical, feasible and affordable to mitigate physical damage. The priorities for intervention should consider risk to lives, property, livelihoods, facilities and services, and the sustainability of actions. The following are the recommended measures:

Non-Structural Measures

2a. Flood Protection master plan for Wadi Hadramout

A flood protection master plan, based on the outcomes of the detailed hydrological, hydraulic and geological study, is critically needed for Wadi Hadramout. The master plan would: recommend key flood protection infrastructure for vulnerable areas in the Wadi (flood/storm water control and diversion structures, embankments, sedimentation traps, etc); identify areas that are flood-prone or vulnerable to other risks (especially landslide) and which should be protected and where development should not be permitted; identify areas that are safe from hazard risks and which could serve for (re)settlement purposes; etc. The estimated cost for such a study (which would not address the flood/storm water drainage needs of urban areas) is US\$1 million.

2b. Storm water drainage master plan for Mukalla and other urban areas

A storm water drainage master plan is critically needed for Mukalla—whose infrastructure was badly hit in the recent disaster—and other vulnerable cities in Hadramout and Al-Mahara (a rapid assessment would determine priority areas). The master plan would mainly recommend key storm water drainage and flood protection infrastructure to channel flash flood and storm water away from the heavily populated areas (open and closed flood channels, box culverts, embankments, sedimentation traps, etc), and identify at the city level areas that are vulnerable to flood and landslide risks where development should not be permitted. The cost for studies in Mukalla and two other (smaller) priority urban areas would be estimated at about US\$1 million.

2c. Updating land use plans and building regulations in urban areas

Detailed land use plans and building regulations should be prepared or where they exist updated in accordance with the findings of the storm water drainage plans. These detailed land use plans and building regulations would demarcate areas where development is permissible and regulate the characteristics of such development. In the case of Mukalla, where the city master plan was recently updated in 2008, the preparation of detailed land use plans is the timely step that follows the master plan, whereas the building regulations would need to be updated. However, as noted from previous planning experiences in Yemeni cities, what is critical is enforcement. As such, a decree would need to be enacted by the Local Council and be implemented by all local agencies. The estimated cost for the preparation of these detailed plans and regulations for Mukalla and two other priority urban areas would be estimated at US\$0.5 million. Support for the enforcement entities in the form of equipment and training would require an additional US\$0.1 million.

2d. Program for upgrading the standards of construction for roads

The road network, particularly wadi roads, serves as a lifeline during floods and needs to be upgraded to proper levels, with proper provision for drainage. Piecemeal repair and restoration of roads after each flood or natural disaster event is neither cost effective nor suitable for a country such as Yemen facing increasing climate risks. The standards for the road network need to be upgraded and made mandatory for all roads built in the future. Such technical assistance to upgrade the road construction standards would be based on the outcomes of the vulnerability and risk assessment. Roads should also be made multipurpose where possible. The needs for such assistance and training for engineers responsible for the design and supervision of construction of roads at both central and local government levels are estimated at US\$0.25 million.

2e. Comprehensive systems' databases

As part of the disaster risk reduction needs of the water, wastewater and power sectors, it is recommended to establish comprehensive databases for the water/wastewater and the electricity system that cover power generation/water supply, transmission, distribution and demand in a way that encompasses both urban and rural areas (i.e. the PEC and the Local Water and Wastewater Corporations in urban areas, and the Rural Water and Electrification systems). The estimated needs to establish these databases are US\$2 million and one-year period to complete.

Structural measures

Long-term structural flood protection interventions would have to be considered in the light of the hydrological study for the affected areas. In particular, there may be ways to reduce the flood risks considerably by widening critical sections of the wadis that are narrow and are causing a blockage (often due to sedimentation deposits or illegal construction). Addressing such critical bottleneck sections may be easier and less expensive than protecting all productive areas and roads from being inundated and eroded every once in a while.

2f. Wadi Flood Protection Program

There is a critical need to finance the repair of existing damaged flood protection structures and embankments and to finance the construction of new flood protection structures at the appropriate locations, particularly in Wadi Hadramout. The program will include dredging of the Wadi especially downstream to enhance capacity and reduce flood, removal of obstructing vegetation such as sayssaban trees from the Wadi bed, prevention of planting trees in the flood canals and removal of all obstacles that block rain water. The estimated needs for financing the construction of flood protection structures under this activity are US\$48 million.

2g. Urban Area Flood Protection Program

There is a need to finance the construction of new storm water drainage and flood protection structures (open and closed channels, box culverts, etc) as well as rehabilitate a few existing ones which have been blocked either by lack of maintenance or illegal construction. Priority would be given to the city of Mukalla, where the infrastructure was badly hit. Priority investments would need to target vulnerable locations in the densely populated districts, such as the central districts that comprise Old Mukalla (Al-Shaheed, Al-Salam, etc). The

needs for a first phase of priority investments in Mukalla have been estimated at US\$30 million, and another US\$20 million would be earmarked for other priority urban areas, making the total US\$50 million.

Pillar 3: Strengthening and Enhancing Emergency Preparedness

3a. Establishment of Early Forecasting and Warning Systems

There is a need to put in place functional “early warning systems” in vulnerable areas to collect, analyze and disseminate necessary information to citizens, especially in Wadi Hadramout. This is essential to make sure that the impact of such disasters is minimized in the future. The cost is estimated at about US\$1 million for a detailed study (building on existing studies, including the one undertaken by the Civil Defense Directorate) and the procurement of a basic system.

3b. Strengthening and institutionalizing governorate/district level disaster preparedness

This entails the following activities: (i) supporting and building the capacity of the various sub-national disaster management entities to develop and implement disaster management plans, and mobilize adequate response resources; (ii) development of evacuation protocols and plans to guide local populations in the event of disasters; (iii) community training in evacuation protocols and requirements and sensitization campaigns through mass communication tools; (iv) provision of modern, disruption-free communication equipment to key disaster management focal points at the district level; and (v) provision of search and rescue equipment to the Governorate and district levels (following a needs assessment study). For Hadramout and Al-Mahara Governorates, these interventions would require an estimated US\$0.75 million.

3c. Strengthening Community Based Disaster Preparedness

The current disaster is a good example of community coordination in the face of disasters in Yemen. Many affected people described community efforts in saving lives by informing each other of the incoming floods, proving that disaster vulnerability reduction is most effective at the community level. Any disaster risk management strategy will therefore be incomplete without strengthening Community Based Disaster Preparedness (CBDP). Other disaster prone countries such as Bangladesh, Philippines, Cambodia and India have already invested in CBDP.

The GOY, in partnership with NGOs, academia and bilateral/multilateral agencies, should engage in CBDP by identifying vulnerable communities (based on national vulnerability mapping) and providing resources for establishing, maintaining, and training village or district-level disaster management committees. In light of this disaster, Wadi Hadramout should be given priority in starting the CBDP work. The local committees should aim at the following major activities:

- **Community Risk Mapping:** Making communities aware of the risks they face through a community participation process.
- **Community Disaster Response Plan:** Developing a Disaster Response Plan with community participation which includes the responsibilities of each resident during an emergency and a clear action plan and set of activities to be followed including the early warning system, emergency contacts, safe evacuation procedures, first aid, etc. Local committees should also take lead in implementation of emergency works.

Box 6-1 The importance of Community Based Disaster Preparedness (CBDP)

- Communities in disaster affected areas are not only the real sufferers but also the first responders.
- Communities in high risk areas have often developed their own coping mechanisms and strategies to reduce the impact of disasters. It is important to appreciate such local knowledge and resources and build on them in order to improve the capacity of people to withstand the impact of disasters.
- Ownership of disaster reduction should not be stripped from local people who would be left even more powerless in case external intervention does not occur.
- Disaster reduction activities should be based on participatory approaches involving local communities as much as possible, considering them as proactive stakeholders and not passive recipients of aid.
- Involvement and participation of communities ensures collective coordinated action in emergencies.

- Building community leadership and a chain of trained community cadres through participatory approach can help harness the resilience and resourcefulness of the community to cope.
- Solution is sustainable if it comes from people themselves rather than thrusting upon them.
- Furthermore it is not only the ‘big’ disasters that destroy life and livelihoods. Accumulated losses from small floods, droughts and landslides can exceed the losses from big disasters and contribute significantly to increased vulnerability at the local level. These disasters attract little media attention and communities are often left on their own to cope with the destruction. This provides another reason to invest in CBDP.

Source: Ajinder Walia, The Australian Journal of Emergency Management, Vol. 23 No. 2, May 2008

The cost of pilot CBPD activities in the ten most affected districts is estimated at US\$0.5 million.

Pillar 4: Institutional Capacity Building

As discussed earlier, Yemen has taken and continues to take several proactive steps in enhancing institutional capacity for disaster management. These include drafting the first National Disaster Management Plan; a draft framework was completed by the Civil Defense Directorate with UNDP support in 2006, and it is currently being “operationalized”. Some effort has also taken place in forming disaster management units under the leadership of the Civil Defense Directorate, although at this stage mainly at the national level. However, as noted earlier, there is a great need for further inter-agency coordination, the development of a coherent institutional framework for Disaster Risk Management (DRM) at the national level and most importantly at the local level (in line with the principle of decentralization enshrined in the Law on Local Authorities No. 4 of 2000), and to mainstream disaster risk reduction as part of the policies, plans and investment programs of line ministries/agencies and local governments.

4a. Establish a National Disaster Risk Management Council (NDRMC)

Following a major disaster, most countries review their existing institutional mechanisms in order to identify gaps and areas of improvement in DRM and risk reduction practices. In Colombia, the Armero volcanic eruption in 1985, and in India, the effect of the Latur earthquake in 1993, the Orissa super cyclone in 1999 and the Gujarat earthquake in 2001, have all led to a redesign of institutional arrangements. Following the 2003 earthquake in Bam, Iran (See Box) began putting in place a comprehensive system of inter-ministerial working groups and task forces to address the hazard risks facing its people. After a series of earthquakes and floods between 2002 and 2004, Algeria and Morocco are currently improving their institutional systems and developing planning frameworks that integrate risk reduction concerns. Following the Indian Ocean tsunami in 2004 and the Kashmir earthquake in 2005, most Asian countries have started enhancing their institutional arrangements for disaster risk reduction. Recognizing the cross-sectoral nature of action needed in preparedness planning and response, and more so in mitigation, the proposed setup often takes the form of an inter-ministerial national council or a coordinating board. Such multi-agency bodies were also set up at the province/governorate, district, city, and village levels, especially since CBDP requires an enabling and supportive institutional framework.

Box 6-2 The setup of a Disaster Risk Management institutional framework in Iran

Iran has made a considerable investment in institutional arrangements to enhance its national disaster risk reduction platform. An Executive Secretariat of the Hyogo Framework was set up under the overall supervision of the Interior Ministry’s Natural Disaster Task Force. The work of the Secretariat includes:

1. Strengthening 23 Preparedness Working Groups: Iran strengthened the activities and enhanced the role of Preparedness Working Groups created in 2003 within the framework of the National Relief and Rescue Comprehensive Plan, which is based on the third National Development Program (Article 44) and approved by Cabinet. Preparedness includes data collection, research, planning, establishing management structures, training, and securing resources. The Working Groups operate at the local, provincial and national levels with sub-groups on operations, prevention and training, which support the Preparedness Working Groups.
2. Creating a National Working Committee in 2005: Membership includes: Ministry of Interior, Iranian Red Crescent, NGOs, Municipality of Tehran, President’s Office, Social Committee of the Parliament, National Disaster Research Institute of Iran, National Iranian Broadcasting Organization, Disciplinary Forces,

<p>Ministry of Energy, Basij Organization, Housing Foundation, Meteorological Organization, International Institute of Earthquake Engineering and Seismology (IIEES), Tehran Disaster Mitigation and Management Organization, Environmental Organization, Ministry of Housing and some other organizations. The Committee has prepared a “National Policy on Natural Disaster Prevention and Risk Reduction”.</p> <ol style="list-style-type: none"> 3. Establishing a National Platform for Disaster Risk Reduction: Consisting of more than 30 members including line ministries, academic and research institutions, implementing agencies and NGOs. 4. Creating a High Level Council on Disaster Management, chaired by the President of the Republic: The Council is responsible for risk reduction issues at the time of disaster response, recovery and reconstruction. 5. Establishing nine specialized working groups in 2005 within the Ministry of Interior and on different aspects of disaster risk reduction, including: earthquake and landslide; rangeland revival and coping with drought; flood prevention; reducing air pollution; storm and hurricane hazards; rescue and relief; loss compensation; and health care. 6. Preparation of a 10-year plan for implementing the Hyogo Framework. <p>Source: GFDRR</p>

In Yemen, the Civil Defense Higher Council (CDHC) was created under the Civil Defense Law of 1997 with important prerogatives in the area of civil defense and disaster management. Yet, its organization and mandate arguably need to be updated to reflect today’s priorities and needs. In particular, it is important to reflect: (a) the importance of disaster risk reduction and mitigation (as opposed to the focus on preparedness and response that appears to be the main focus of the current CDHC); and (b) the primacy of the role of local government in DRM in line with the decentralization policy of Yemen, which came into effect by Law in 2000 (after the Civil Defense Law of 1997) and was especially boosted since 2007 with the preparation of a national decentralization strategy and the election for the first time of Governors in 2008.

It is proposed that an inter-ministerial committee be established as the apex body overseeing the formulation and implementation of DRM policies and plans and the mainstreaming of DRM and disaster risk reduction within the activities of line ministries and agencies. This body, proposed to be labeled National Disaster Risk Management Council (NDRMC), could either be a newly set up body or an evolution of an existing body such as CDHC to reflect the objectives, membership, mandate and priorities anticipated of such a body. The NDRMC would comprise of all relevant ministries and line agencies (it would draw on the expertise of related agencies, directorates and departments including those noted below), including:

- Ministry of Planning and International Cooperation (MOPIC, including the Central Statistical Organization);
- Ministry of Interior (MOI, including the Civil Defense Directorate);
- Ministry of Public Works and Highways (MOPWH);
- Ministry of Agriculture and Irrigation (MOAI, including relevant authorities and centers);
- Ministry of Water and Environment (MOWE, including the DEE);
- Ministry of Local Administration (MOLA);
- Ministry of Transport (including the Civil Aviation and Meteorological Authority);
- Ministry of Oil and Mineral Resources (including National Seismological Observatory and National Geological Authority); and
- General Authority for Land, Survey and Urban Planning (GALSUP).
- Membership of non-governmental entities from the private sector and civil society should also be encouraged (e.g. Yemen Red Crescent Society).

The NDRMC would need to be chaired at the highest level of Government, namely by the Prime Minister or alternatively at the Deputy Prime Minister level.⁴² Several ministries could provide a viable institutional home for the NDRMC on account of their actual responsibilities (e.g. MOPIC due to its national investment planning and international cooperation role, MOLA as the main entity supporting the decentralization agenda,

⁴² This may need to be the case as the Prime Minister, on account of many responsibilities, may devolve the council’s leadership to one of the Deputy Prime Ministers. There are currently three Deputies to the Prime Minister, responsible for Economic Affairs (also the Minister of Planning and International Cooperation), Security and Defense Affairs (also the Minister of Local Administration), and Internal Affairs (without ministerial portfolio, but who headed the GOY Rescue and Relief Committee in response to the Hadramout and Al-Mahara storm and floods).

, MOPWH which is responsible for infrastructure and housing, and MOI as the responsible entity for civil defense).

Most importantly, and in order to be operational, the NDRMC would require a very competent technical secretariat, staffed with full-time qualified staff. The Secretariat would be responsible for providing technical assistance to and coordinating among the different ministries and agencies, preparing draft DRM policies and proposed plans for implementation, leading post-disaster damage, loss and needs assessment, etc.

4b. Strengthening DRM-related institutions, instruments and capacity

This includes strengthening the capacity of institutions and staff (through training) involved in the DRM agenda including the above-listed central government ministries and agencies, and local government designated entities and staff. In addition to disaster risk reduction activities, capacity strengthening is also needed in the area of damage, loss and needs assessment through the DALA methodology, following the first training carried out in Mukalla in November 2008 to central and local government officials. A partnership with an educational institution (e.g. university) to mainstream DRM and DALA training would be particularly important to ensure the sustainability of such efforts. Finally, it is also important to establish a multi-hazard vulnerability mapping, information, and database unit at an appropriate institutional location within the GOY, which would be affiliated to or which could serve as the Technical Secretariat of the NDRMC. Such a unit would also serve to coordinate the various existing efforts located within the Civil Defense Directorate, the DEE, the National Seismological Center, the Yemen Geological Authority, the GALSUP, etc.

Support for Components 4a and 4b is estimated to require about US\$1 million in technical assistance over a three-year period.

Pillar 5: Financing Reconstruction and Recovery and Long-Term Catastrophe Risk Financing

5a. Short-term—Reconstruction and Recovery Fund (RRF) for the affected areas:

In response to the recent disaster in Hadramout and Al-Mahara, the Government of Yemen is seeking to mobilize the necessary financing for the reconstruction and recovery effort, estimated to require 3-4 years, through a combination of governmental and non-governmental funds, as well as through support from the international community. Following the completion of this joint Damage, Loss and Needs (DLNA) assessment, the preparation of a Reconstruction and Recovery Plan will be initiated. At the same time, based on the DLNA, an international call for funds will be issued by the MOPIC to secure the funding gap needed for recovery and reconstruction of the affected areas to restore the livelihoods, infrastructure and services to their pre-disaster level.

Cognizant of the need to put in place an efficient and transparent implementation mechanism, the Cabinet has approved on December 2, 2008, the creation of a fund, called “Reconstruction and Recovery Fund (RRF) for the flood affected areas: Hadramout and Al-Mahara,” which would be mandated with the following responsibilities:

- Preparing the Reconstruction and Recovery Plan in accordance with the findings and recommendations of the joint DLNA, and in close coordination with local governments and the affected communities in the affected areas;
- Administering the funds entrusted to it by the GOY and the different donors for recovery and reconstruction efforts;
- Coordinating the implementation of the overall reconstruction and recovery effort in the affected areas, by and among the various implementing entities (local governments, line ministries, central agencies, existing Project Implementation Units—PIUs—such as the SFD and the PWP, civil society NGOs, CBOs, directly implemented donor-funded activities), and in working with the different GOY entities and the affected communities;
- Overseeing the implementation of the overall reconstruction and recovery effort in the affected areas, especially ensuring compliance with the requirements of the GOY and the different donors on

fiduciary (financial management, procurement and anti-corruption) and safeguards (social and environmental) issues, and ensuring the fund's expenditures meet the targets and achieve the outcomes for which they were allocated;

- Establishing priorities in accordance with the joint DLNA and the Reconstruction and Recovery Plan and allocating financing accordingly;
- Approving reconstruction and recovery activities in accordance with the DLNA and the Reconstruction and Recovery Plan;
- Monitoring and Evaluation (M&E) of the implementation of reconstruction and recovery efforts; and
- Reporting on implementation progress to the GOY and the donor community;

While the details and operating procedures related to the RRF are currently being developed, the following are principles that have been established or which emanate from best practices and are recommended to be integrated:

Objectives of the RRF: The RRF aims to quickly and efficiently provide grant resources directly to or to the benefit of the affected population in Hadramout and Al-Mahara for:

- Early recovery activities, helping affected communities and households to get back on their feet through a process that bridges the gap between humanitarian relief and longer-term reconstruction; and
- Recovery and reconstruction activities, integrating appropriate DRM measures to reduce future vulnerability.

The YRRRF will provide a platform for recovery that is:

- Government-led, but coordinated with the different donors in line with the priorities set in the joint DLNA, and ongoing recovery and reconstruction planning;
- Based, as may be feasible, on a single funding mechanism that strengthens, rather than exhausts, the GOY's implementation and coordination capacity;
- Able to rapidly mobilize resources from different entities and donors, in support of various implementing partners targeted according to their comparative advantages; and
- Defined by a clear mandate that complements, rather than competes with other private, state, bi- and multilateral initiatives.

Duration: The Fund's operation is expected to span 4-5 years to finance both early and medium-term recovery investments and reconstruction activities, as well as implement measures reducing disaster risk and vulnerability, in line with DLNA and the Recovery and Reconstruction Plan. The RRF could eventually evolve into a permanent instrument of the GOY as part of the response to future disasters in Yemen.

Governance and Management Structure: The proposed governance structure of the RRF involves a multi-stakeholder *Board of Directors* or Oversight Committee, which sets policy priorities, approves reconstruction and recovery plans, oversees implementation progress, and to which reports the RRF management periodically. Such a Board of directors would be chaired by the Prime Minister or his designee, and would include the following key Government stakeholders or their designees: the Deputy Prime Minister for Economic Affairs/Minister of Planning and International Cooperation, the Deputy Prime Minister for Security Affairs/Minister of Local Administration, the Deputy Prime Minister for Internal Affairs, the Minister of Finance, the Minister of Agriculture and Irrigation, the Minister of Public Works and Highways, the Minister of Interior, the Minister of Water and Environment, the Governors of Hadramout and Al-Mahara, and the Chairman of GALSUP. The Board should also include representatives from related non-government agencies, including from civil society and ideally also from the donor community.

The management of the RRF will depend on its modus operandi, and specifically whether it will implement through a mix of in-house and delegated implementation capacity (e.g. the SFD) and would thus function as a PIU (and would thus require procurement, financial management, social and environmental safeguards, M&E capacity, and technical staff) or if it would simply function as a Fund whose role is simply to review and approve proposals for funding submitted by the different implementing partners and oversees their progress and achievement of stated objectives (i.e. it would have a small staff). It is important to note that most funds

in Yemen (e.g. Cleaning and Improvement Fund, Road Maintenance Fund) function in accordance with the first model.

If the first model is followed, the Fund's management will be akin to a PIU, except in this case, the magnitude of the reconstruction and recovery effort dictates a combination of implementation capacity in-house and by other entities. As such, the Fund will need to have a very competent and highly experienced Managing Director (familiar with donor requirements) and will also need capacity in procurement, financial management, social and environmental safeguards, M&E, and technical sector staff in the main areas of implementation/supervision (including agriculture and irrigation, flood protection, public works, housing, etc). The Fund will establish presence in the two affected Governorates, with multiple branches, and will work closely with the Governorate and district authorities.

If the second model is followed, the RRF will need a combination of a *Technical Board* and a *Fund Secretariat*. The Technical Board will exercise a direct supervisory role on the Fund on behalf of the Board of Directors or Oversight Committee (which would thus meet once per year or so to approve major policy decisions and the annual work plan). The Technical Board would review and approve the different proposed funding priorities and targets in line with the joint DLNA and the Recovery and Reconstruction Plan, procedures for grant implementation, and monitoring. The Technical Board's arm for day to day operation would be a small, professional Secretariat that would:

- Prepare the initial review and recommendation on grant proposals for Technical Board consideration, and possibly make decisions up to a certain funding threshold;
- Work proactively to encourage grants in line with strategic priorities;
- Draft Grant Agreements;
- Ensure compliance with appropriate fiduciary and safeguards procedures;
- Monitor implementation through grants recipient reports and targeted field evaluation, including adherence to implementing policies and overall performance against objectives;
- Administer the funds, including the timely transfer of grant monies to recipients;
- Manage an administrative budget;
- Provide support to planning, and monitoring incorporation of appropriate DRM measures into recovery and reconstruction programs as a whole;
- Facilitate periodic public/stakeholder review of the RRF; and
- Operate a publically accessible and accountable grievance procedure for RRF activities.

Activation and Disbursement Mechanism: The Fund would be activated by the GOY based on the results of the joint DLNA and in anticipation of the formulation of a Disaster Recovery and Reconstruction Plan. One of the principal mechanisms to mobilize funds will be through a call for funds by the GOY with support and technical assistance from the donor community and from the GFDRR, which would work with its partners to raise contributions to the RRF. Disbursement could start taking effect within a month from receiving the first funds, by financing early recovery and some reconstruction activities.

Priority setting: In the initial phase, the Board of Directors (if the first fund model is followed) or the Technical Board (if the second fund model is followed) would guide funding priorities based on the findings of the joint DLNA. Once the Reconstruction and Recovery plan has been completed and approved, the program of grant activities will be structured accordingly. The Fund will have a flexible structure allowing some activities/grants to be pre-programmed according to set priorities (and if necessary direct approaches to implementing agencies).

Eligible activities: Activities financed by, or grants made available through the RRF would be used for:

- Restoring livelihoods, means of production and economic activities, essential services, and social capital, including economic reintegration of vulnerable groups;
- Rebuilding and restoring physical assets, including for restoration of economic activities and social capital and for the reduction of disaster risk and vulnerability;
- Supporting capacity building for longer-term reconstruction, disaster management and risk reduction; and

- Related technical assistance, including developing and implementing integrated recovery strategies, preparing detailed recovery and reconstruction plans, inclusion of appropriate risk and vulnerability reduction measures, and strengthening M&E and coordination.

Implementation/financing criteria: In addition to their alignment with reconstruction and recovery priorities set forth in the joint DLNA and the Reconstruction and Recovery Plan, and feasibility considerations (implementing capacity, timeframe, etc), priority in the activities implemented or the projects financed by the Fund would be based on the following criteria:

- **Community-Driven:** Activities implemented or projects financed must be needs-based, with clear evidence of the buy-in of the affected communities wherever appropriate;
- **Targeting and Coverage:** Prioritized activities should have simple and effective targeting mechanisms to ensure that they reach the intended beneficiaries, and should give priority to the poorest and most affected communities and to interventions that reach a maximum number of affected households;
- **Sustainability:** Reconstruction and recovery activities implemented or financed through the RRF must demonstrate a contribution to reducing disaster risk/mainstreaming disaster risk reduction, and support to poverty reduction and sustainable development;
- **Environmentally and socially appropriate:** Projects must comply with GOY and donors' safeguard policies. Activities posing unacceptable environmental or social risks should not be implemented or accepted for funding; and
- **Implementation capacity:** Demonstrated implementation capacity and inter-agency cooperation should be emphasized and promoted through the reconstruction and recovery effort.

Technical assistance to the GOY to establish the RRF, provide initial support to its operation and the preparation of the Reconstruction and Recovery Plan would require an estimated US\$0.75 million.

5b. Long-term—Catastrophic risk financing:

A well-designed risk financing program enables a disaster-prone country to avoid major economic disruptions following natural disasters by meeting its post-disaster funding needs without resorting to major budget reallocations, additional taxation, or external borrowing. In addition to Government-led solutions such as establishing funding reserves or contingent capital funds, risk financing instruments are increasingly in demand given the increased vulnerabilities and uncertainties associated with climate change.

Catastrophe risk financing of disaster events: The possibility should be explored of buying risk coverage against catastrophic and rare events, although the implications of the recent financial crisis on the capital markets are likely to have a negative effect at least in the short-term. Such insurance would inject liquidity immediately after the disaster and enhance coping capacity, as well as providing hazard-contingent budget support. Depending on the peril, the insurance arrangements follow parametric or index-based triggers. For Yemen, the coverage should include weather-related events (flood, earthquake, cyclone, etc.).

Yemen Climate Change Resilience Fund: Aware of the anticipated impacts of climate change and the need to start establishing national and local adaptation options, Yemen recently launched an effort to work on addressing climate change risks and improving resilience capacity. The link and need for coordination between disaster risk reduction and climate resilience exists at different levels, not least because the increased occurrence of natural disasters is one of the observed impacts of climate change.⁴³ Yemen is seeking international support to develop climate resilience programs, including from the recently created Pilot Program for Climate Resilience (PPCR) under the Climate Investment Fund (CIF). The establishment of a dedicated multi-sectoral climate resilience fund at the national level to support the implementation of

⁴³ Linking climate modeling and forecasting with disasters' early warning systems is important to optimize data and forecasting tools in light of the resource and capacity constraints. Better institutional coordination among the sets of agencies responsible for climate change adaptation and disaster risk reduction will allow for integration of knowledge and elaboration of integrated response plans. Finally, the development of a climate resilience strategy will include short and long term adaptation options in various sectors (water, agriculture, urban development, coastal zone management and fisheries among others), which need to be reconciled with disaster response management plans at the national and local levels.

adaptation options in the most vulnerable sectors is currently under discussion. If and when established, such a fund would over the long-term further support addressing of the impacts of extreme weather events.

A first phase technical assistance program to support the GOY to assess the options and prepare for the long-term catastrophe risk financing and establish better links to the climate change efforts would be estimated to cost US\$0.25 million.

Summary of Disaster Risk Management Requirements

The following table summarizes the estimated needs to implement a disaster risk management and reduction program that is focused on strengthening hazard risk identification, mitigation and emergency preparedness in the affected areas and on mainstreaming institutional DRM capacity at the national level.

Table 6-1 Preliminary Investment Program for Disaster Risk Reduction (US\$ million)

Program	2009-2013	2014-2018	Total
1. Risk Identification and Assessment	1.5	TBD	1.5
1a. National Multi-hazard Risk Identification	1		1
1b. Hadramout and Al-Mahara Risk Identification	0.5		0.5
2. Risk Mitigation	53.85	49	102.85
2a. Wadi Flood protection master plan	1		1
2b. Mukalla/urban areas storm water drainage master plans	1		1
2c. Detailed land use plans and building regulations in urban areas	0.6		0.6
2d. Program to upgrade standards of road construction	0.25		0.25
2e. Comprehensive systems' databases	2		2
2f. Wadi Flood protection system	24	24	48
2g. Mukalla/urban areas flood protection systems	25	25	50
3. Strengthening Emergency Preparedness	2.25	TBD	2.25
3a. Establishment of early forecasting/warning systems	1		
3b. Strengthening and institutionalizing sub-national government disaster preparedness	0.75		
3c. Strengthening Community Based Disaster Preparedness	0.5		
4. Institutional Capacity building	1	TBD	1
5. Disaster Risk Financing	1	TBD	1
Total Disaster Risk Reduction Activities	59.60	49	108.60

Notes: The cost estimates provided in this table, based on DLNA team estimates, are indicative.

ANNEXES

Annex 1: Transportation

Annex 1-A. Detailed Table of Damages and Costs

Annex 1: Detailed Table of Damages and Costs for Roads and Bridges										
ROADS & BRIDGES	Total	Road	Damage	Damage	Damage	Damage	Area	Damages	Improvem.	Additional
Name	Length	Width	Location	Length	Width	Type	affected	Costs	Proposal	Needs
	(km)	(m)	(km)	(m)	(m)		m2	(YR mill)	(YR mill)	(YR mill)
Regional roads and bridges										
<i>Mukalla-Bir Ali road</i>	119		40 6+300	400	1	5	400	7.32	0.00	0.00
			40 7+300	100	2	1,3	200	0.28	0.00	0.00
			40 7+600	40	30	2	1,200	57.65	1014.00	956.35
			40 10+800	50	6	2	300	96.00	0.00	0.00
			40 12+800	120	30	3	3,600	71.01	1352.00	1280.99
			40 16+200	30	20	2	600	5.18	0.00	0.00
			40 17+000	200	40	3	8,000	287.48	1352.00	1064.52
			40 19+500	200	40	3	8,000	314.31	1325.00	1010.69
			12.3 35+500	200	8	3	1,600	75.38	500.00	424.62
			12.3 41+100	100	12	1	1,200	8.07	0.00	0.00
			12.3 km43-45	200	1.5	5	300	4.16	0.00	0.00
			12.3 55+600	200	12	1	2,400	9.06	0.00	0.00
			12.3 km56-119	150	1.5	5,6	225	6.24	0.00	0.00
Total for Road	119			1,990				942.13	5543.00	4737.17
<i>Al-Rayan – Ben Aifan</i>	231		16+000	500	10	3	5,000	312.00	1000.00	688.00
			24+000	450	3	1	1,350	124.80	0.00	0.00
			24+500	450	3	1	1,350	280.80	0.00	0.00
			25+000	450	10	1	4,500	280.80	0.00	0.00
			34+000 to 40+000	6,000	10	1	60,000	1060.00	0.00	0.00
		10	40+000 to 77+000	450	1.5	5,6	675	32.00	0.00	0.00
			77+000	100	10	1	1,000	55.99	0.00	0.00
			172+000	345	5	1,5	1,725	23.77	0.00	0.00
			178+000	60	2	3	120	4.68	0.00	0.00
			186+000	300	2	5	600	14.55	0.00	0.00
			194+000	100	2	5	200	5.41	0.00	0.00
Total for Road	231			9,205				2194.80	1,000	688
<i>Mukalla-Shoheir-Shihr</i>	53		Boeish	350	40	1,3	14,000	260.00	3380.00	3120.00

ROADS & BRIDGES										
Name	Total Length (km)	Road Width (m)	Damage Location (km)	Damage Length (m)	Damage Width (m)	Damage Type	Area affected m2	Damages Costs (YR mill)	Improvem. Proposal (YR mill)	Additional Needs (YR mill)
		40	33+000	100	40	3	4,000	624.00	0.00	0.00
			53+300	50	12.3	3	615	6.98	0.00	0.00
Total for Road	53			500				890.98	3380.00	3120.00
60 Street Road	13		Ambikha	24	8	4	192	245.00	0.00	0.00
		60		240	30	2,5	7,200	155.57	0.00	0.00
				800	50	1,5	40,000	789.24	0.00	0.00
Total for Road	13			1,064				1189.81	0.00	0.00
Almashad-Dawan	60		00+200	150	10	1,3	1,500	46.39	0.00	0.00
			05+800	50	10	3,6	500	23.20	0.00	0.00
			16+100	300	2	6	600	60.06	0.00	0.00
			20+600	150	1.5	5	225	3.99	0.00	0.00
			23+900	150	3	5	450	3.99	0.00	0.00
		10	26+400	300	10	5	3,000	9.98	0.00	0.00
			29+600	150	1.5	5,6	225	2.35	0.00	0.00
			30+500	150	1.5	3	225	0.96	0.00	0.00
			33+800	150	1.5	5	225	2.40	0.00	0.00
			39+300	100	1.5	3	150	1.12	0.00	0.00
			40+400	400	10	5	4,000	89.86	0.00	0.00
Total for Road	60			2,050				244.30	0.00	0.00
Hawra-Azzaher	37		00+100	150	10	3	1,500	40.54	0.00	0.00
			00+450	1200	3	5	3,600	39.94	0.00	0.00
			2+650	770	3	1,5	2,310	28.41	0.00	0.00
			09+500	50	10	3,6	500	1.47	0.00	0.00
			13+800	50	3	3	150	8.99	0.00	0.00
			14+500	50	10	5	500	14.98	0.00	0.00
			15+000	230	3	3,6	690	64.02	0.00	0.00
			16+150	120	10	1	1,200	6.91	0.00	0.00
		10	18+800	120	10	1	1,200	102.41	0.00	0.00
			26+500	430	3	1,5	1,290	17.45	0.00	0.00
			28+000	300	10	1	3,000	219.65	0.00	0.00
			28+900	50	10	1	500	10.00	0.00	0.00

ROADS & BRIDGES		Total	Road	Damage	Damage	Damage	Area	Damages	Improvem.	Additional
Name	Length	Width	Location	Length	Width	Damage Type	affected	Costs	Proposal	Needs
	(km)	(m)	(km)	(m)	(m)		m2	(YR mill)	(YR mill)	(YR mill)
			31+000	150	10	5	1,500	104.83	0.00	0.00
			31+300	150	2	5	300	3.39	0.00	0.00
			34+600	120	2	5	240	3.39	0.00	0.00
			35+000	250	10	1	2,500	104.83	0.00	0.00
			36+100	100	2	5	200	2.00	0.00	0.00
			36+400	120	10	1	1,200	9.60	0.00	0.00
Total for Road	37			4410				782.81	0.00	0.00
<i>Ben Aifan-Alabr</i>	<i>129</i>		00+050	25	15	2	375	5.47	0.00	0.00
			00+700	50	4	3	200	19.53	0.00	0.00
			2+000	120	2	5	240	12.59	0.00	0.00
			5+000	640	4	3	2,560	48.64	0.00	0.00
			8+000	200	2	5	400	11.85	0.00	0.00
		10	10+000	40	2	5	80	1.61	0.00	0.00
			23+000	170	2	5	340	8.00	0.00	0.00
			33+000	100	2	5	200	3.30	0.00	0.00
			39+000	170	2	5	340	6.50	0.00	0.00
			53+000	200	2	5	400	1.89	0.00	0.00
			56+000	700	2	5	1,400	30.35	0.00	0.00
Total for Road	129			2,415				149.73	0.00	0.00
<i>Sayoun - Ben Aifan</i>	<i>66</i>	20	15+000	20	15	2	300	15.01	0.00	0.00
		10	23+00 to							
			65+000	350	3	5	1,050	29.45	0.00	0.00
		10	60+000	40	3	5	120	17.22	0.00	0.00
Total for Road	66			410				61.68	0.00	0.00
<i>Alkhashaa - Rakhi</i>	<i>65</i>		00+100	30	10	1	300	5.13	0.00	0.00
			05+000	350	2	5	700	17.18	0.00	0.00
			07+000	420	2	5	840	17.47	0.00	0.00
			08+500	300	2	5,2	600	12.48	0.00	0.00
		10	09+000	180	3	1,5	540	10.54	0.00	0.00
			10+000	120	2	5	240	5.10	0.00	0.00
			11+000	150	2	5	300	6.31	0.00	0.00
			13+000	150	10	1	1,500	41.18	0.00	0.00

ROADS & BRIDGES		Total	Road	Damage	Damage	Damage	Area	Damages	Improvem.	Additional
Name	Length	Width	Location	Length	Width	Damage Type	affected	Costs	Proposal	Needs
	(km)	(m)	(km)	(m)	(m)		m2	(YR mill)	(YR mill)	(YR mill)
			13+2000	200	2	5	400	8.48	0.00	0.00
			14+000	600	2	5	1,200	25.44	0.00	0.00
			31+000	150	10	1	1,500	41.18	0.00	0.00
			31+000	1700	2	5	3,400	36.04	0.00	0.00
			35+000	100	10	1	1,000	24.71	0.00	0.00
			35+000+	1700	2	5	3,400	36.04	0.00	0.00
			60+000	200	10	3	2,000	49.42	0.00	0.00
Total for Road	65			6,350				336.70	0.00	0.00
<i>Sayoun – Tarim</i>	<i>34</i>		22+000	50	21	4,6	1,050	249.60	0.00	0.00
		27	30+200	150	27	6	4,050	2028.00	0.00	0.00
			00 -36 km	200	10	6,5	2,000	59.04	0.00	0.00
Total for Road	34			400				2336.64	0.00	0.00
<i>Tarim – al Saum</i>	<i>54</i>		02+700	80	2.5	5,1	200	5.53	0.00	0.00
			03+200	50	10	6	500	3.00	0.00	0.00
			03+650	100	10	6	1,000	3.00	0.00	0.00
			04+100	70	1.5	5	105	10.54	0.00	0.00
			04+600	50	10	6	500	3.00	0.00	0.00
			05+000	160	3	1,5	480	10.42	0.00	0.00
			05+200	900	10	6	9,000	5.00	0.00	0.00
		10	05+800,							
			05+500	900	2	5	1,800	38.14	0.00	0.00
			09+000	300	10	6	3,000	4.00	0.00	0.00
			Km10-15	3100	1	5	3,100	101.92	0.00	0.00
			22+200	500	10	6	5,000	5.00	0.00	0.00
			23+200	600	1.5	5	900	32.96	0.00	0.00
			25+200	1500	1.5	5	2,250	62.40	0.00	0.00
			26+900	50	3	5	150	8.31	0.00	0.00
			29+900	200	10	6	2,000	3.00	0.00	0.00
			41+400	200	10	6	2,000	3.00	0.00	0.00
Total for Road	54			8,760				299.23	0.00	0.00
<i>Road of Prophet Hood</i>	<i>45</i>		04+400	100	10	6	1,000	2.00	0.00	0.00
		10	10+100	100	10	6	1,000	2.00	0.00	0.00

ROADS & BRIDGES		Total	Road	Damage	Damage	Damage	Area	Damages	Improvem.	Additional
Name	Length	Width	Location	Length	Width	Damage	affected	Costs	Proposal	Needs
	(km)	(m)	(km)	(m)	(m)	Type	m2	(YR mill)	(YR mill)	(YR mill)
			13+00	50	10	2	500	48.67	0.00	0.00
Total for Road	45			250				52.67	0.00	0.00
<i>Al Adlos – Rasib</i>	64		21+000	70	4	3	280	28.48	0.00	0.00
		10	22+000	70	4	3	280	28.48	0.00	0.00
				400	2	5	800	16.00	0.00	0.00
Total for Road	64			540				72.96	0.00	0.00
<i>Al Gharf – Sah</i>	53		11+500	100	10	6	1,000	2.00	0.00	0.00
			14+200	150	10	6	1,500	3.00	0.00	0.00
			15+000	50	10		500	0.00	640.00	640.00
			18+000	150	10	6	1,500	3.00	0.00	0.00
			28+000	300	10	1	3,000	5.00	750.00	745.00
			31+600	300	10	1	3,000	69.60	750.00	680.40
			37+700	50	2	5	100	6.05	0.00	0.00
		10	38+200	30	2	5	60	1.46	0.00	0.00
			38+500	600	10	5	6,000	54.30	0.00	0.00
			39+800	300	2	5	600	8.00	0.00	0.00
			40+500	1100	3	1,5	3,300	74.04	0.00	0.00
			41+500	800	2.5	5	2,000	57.60	0.00	0.00
			42+200	250	3	5	750	33.46	0.00	0.00
			48+000	120	3	1,5	360	28.16	0.00	0.00
			51+000	500	2	5	1,000	43.20	0.00	0.00
Total for Road	53			4,800				388.87	2140.00	2065.40
<i>Al Aleeb - Al Rahaba</i>	23	10	23 to 00	400	3	3	1,200	40.74	0.00	0.00
Total for Road	23			400				40.74	0.00	0.00
Sub-Total Hadramout	1,046			43,544			-	9984.04	12063.00	10610.57
<i>Al Ghaydah – Nashlon</i>	54		64+000	150	2	5	300	8.00	0.00	0.00
			104+000	50	10	2	500	10.50	0.00	0.00
		8	122+200	200	2	2	400	23.96	0.00	0.00
			128+700	20	3	2	60	34.25	0.00	0.00
			143+600	30	10	3	300	20.48	0.00	0.00
			157+800	30	10	1	300	10.10	0.00	0.00

ROADS & BRIDGES											
Name	Total Length (km)	Road Width (m)	Damage Location (km)	Damage Length (m)	Damage Width (m)	Damage Type	Area affected m2	Damages Costs (YR mill)	Improvem. Proposal (YR mill)	Additional Needs (YR mill)	
Total for Road	54			480				107.29	0.00	0.00	
<i>Al-Ghaydah – Hawf</i>	120		03+000	80	10	1	800	30.13	0.00	0.00	
		10	62+000	30	10	1	300	20.80	0.00	0.00	
			64+000	40	10	1	400	16.80	0.00	0.00	
Total for Road	120			150				67.73	0.00	0.00	
<i>Sayhout – Nashtoon</i>	170	12.3	08+000 to 1666+000	15000	3	2,3,5	45,000	566.15	750.00	183.85	
Total for Road	170			15,000				566.15	750.00	183.85	
Sub-Total Mahara Gov.	344			15,630				741.16	750.00	183.85	
TOTAL Regional Roads	1,390			59,174				10725.20	12813.00	10794.42	
Urban roads and bridges											
Name	Total Length (km)	Road Width (m)	Damage Location (km)	Damage Length (m)	Damage Width (m)	Damage Type	Area affected m2	Damages Costs (YR mill)	Improvem. Proposal (YR mill)	Additional Needs (YR mill)	
HADRAMOUT											
<i>Costal Ibn Sinaa Bridge (Vegetable Market)</i>				800	120		96,000	253.04	0.00	0.00	
<i>Celebration Area Enterance</i>				200	3		600	2.09	0.00	0.00	
<i>Old Fwah Enterance</i>				20	5		100	6.00	0.00	0.00	
<i>Front of 196 Apartment</i>				700	20		14,000	26.20	0.00	0.00	
<i>Alkssarh Enterance</i>				40	18		720	0.30	0.00	0.00	
<i>Bawazeer / Massjed Alrhmah</i>				300	18		5,400	10.15	0.00	0.00	
<i>Aqbet Embekha</i>				300	3		900	2.70	0.00	0.00	
<i>Front of Agriculture Building</i>				25	6		150	2.48	0.00	0.00	
<i>60 Street / Cornish</i>				60	6		360	88.02	0.00	0.00	
<i>Fwah/ Raboat Almohandseen? Half Moon</i>				23	7		161	0.52	0.00	0.00	
<i>Alghalelah Road</i>				1400	7		9,800	34.79	0.00	0.00	
<i>Solide Waste Road</i>				2000	7		14,000	41.45	0.00	0.00	
<i>Alghaweyzy Road</i>				1400	7		9,800	31.26	0.00	0.00	
<i>Alahqaf / Malab Baradem</i>				300	18		5,400	8.58	0.00	0.00	
<i>Alsgon intersection / Alghalelah bridge</i>				500	10		5,000	63.00	0.00	0.00	
<i>Alkeetab road & bridge</i>				36	22		792	16.00	0.00	0.00	
<i>Aldees road</i>				1155	23		26,565	19.00	0.00	0.00	
<i>Alestesmar road</i>				1520	16		24,320	66.80	0.00	0.00	

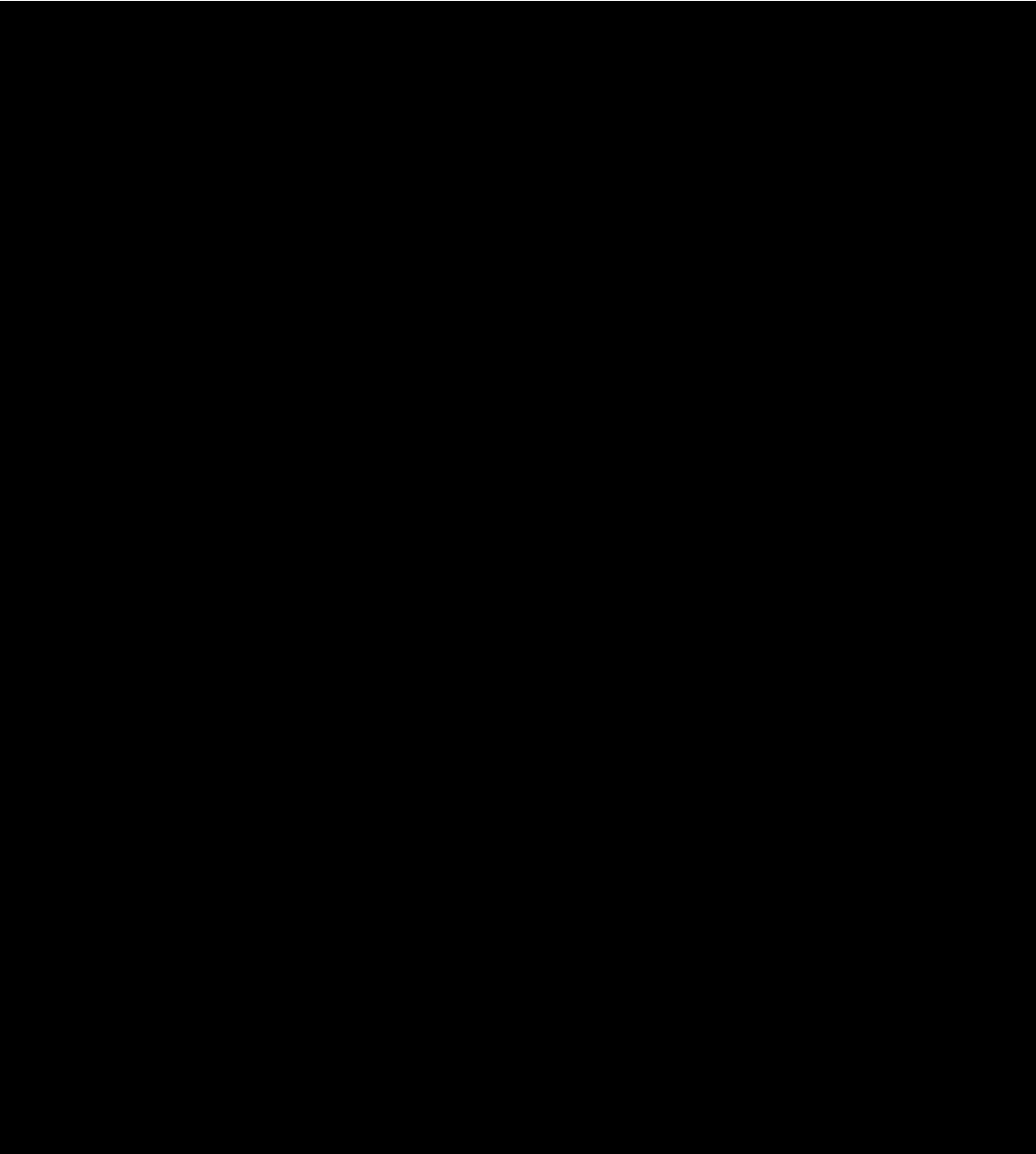
ROADS & BRIDGES										
Name	Total Length (km)	Road Width (m)	Damage Location (km)	Damage Length (m)	Damage Width (m)	Damage Type	Area affected m2	Damages Costs (YR mill)	Improvem. Proposal (YR mill)	Additional Needs (YR mill)
Bajmaan Road				372	10		3,720	5.95	0.00	0.00
Khour Al Mukalla				300	6		1,800	50.00	0.00	0.00
Almawess road				500	18		9,000	14.56	0.00	0.00
Khalef Road				1,500	6		9,000	20.73	0.00	0.00
Folk Area / Aleass				700	7		4,900	27.35	0.00	0.00
Airport road				80	15		1,200	89.80	0.00	0.00
Aleyoun Bridge				100	13		1,300	110.00	0.00	0.00
Totals Hadramout								990.76	0.00	0.00
Syoum				1,904				79.73	0.00	0.00
Trim				3,160				142.28	0.00	0.00
Alkotton				4,955				233.08	0.00	0.00
Shibam				1,666				98.92	0.00	0.00
Saah				4,380				128.00	0.00	0.00
Alsuom				785				68.84	0.00	0.00
Wadi Alayen Wa Hworh				2,789				122.28	0.00	0.00
Hrydah				833				60.30	0.00	0.00
Amad				729				26.28	0.00	0.00
Hegr Alsayar				580				31.62	0.00	0.00
Total Mahara								991.31	0.00	0.00
<i>Sub-total</i>				36,112				1982.07	0.00	0.00
Rural roads and bridges										
Name	Total Length (km)	Road Width (m)	Damage Location (km)	Damage Length (m)	Damage Width (m)	Damage Type	Area affected m2	Damages Costs (YR mill)	Improvem. Proposal (YR mill)	Additional Needs (YR mill)
HADRAMOUT										
Al Mukalla Rural Roads				300,000	6			210.00	0.00	0.00
Dust Road in Alshher, Aldiess, Alrydah				200,000	6			140.00	0.00	0.00
alKawz Branch, 2km long			alKawz Branch, 2km long	1,700	10	5	17,000	1.19	0.00	0.00
Mashtaa Branch	7		10 Branch	1,500	10		15,000	1.05	0.00	0.00

ROADS & BRIDGES	Total	Road	Damage	Damage	Damage	Damage	Area	Damages	Im provem .	Additional
Name	Length	Width	Location	Length	Width	Type	affected	Costs	Proposal	Needs
	(km)	(m)	(km)	(m)	(m)		m2	(YR mill)	(YR mill)	(YR mill)
Alaynat Branch			Alaynat 10 Branch	200	10		2,000	0.14	250.00	249.86
Hadramout Awaldi Rural Roads				500,000				350.00	0.00	0.00
Totals Hadramout								702.38	250.00	249.86
Ghaida				40,000				28.00	0.00	0.00
Manar				55,000				38.50	0.00	0.00
Houf				23,000				16.10	0.00	0.00
Kushn				212,000				148.40	0.00	0.00
Sayhut				85,000				59.50	0.00	0.00
Masylah				80,000				56.00	0.00	0.00
Hasween				8,000				5.60	0.00	0.00
Total Mahara								352.10	0.00	0.00
<i>Sub-total</i>	7			1,506,400				1054.48	250.00	249.86
TOTAL	7			1,542,512				3036.55	250.00	249.86
Grand Total	1,397			1,601,686				13761.75	13063.00	11044.28

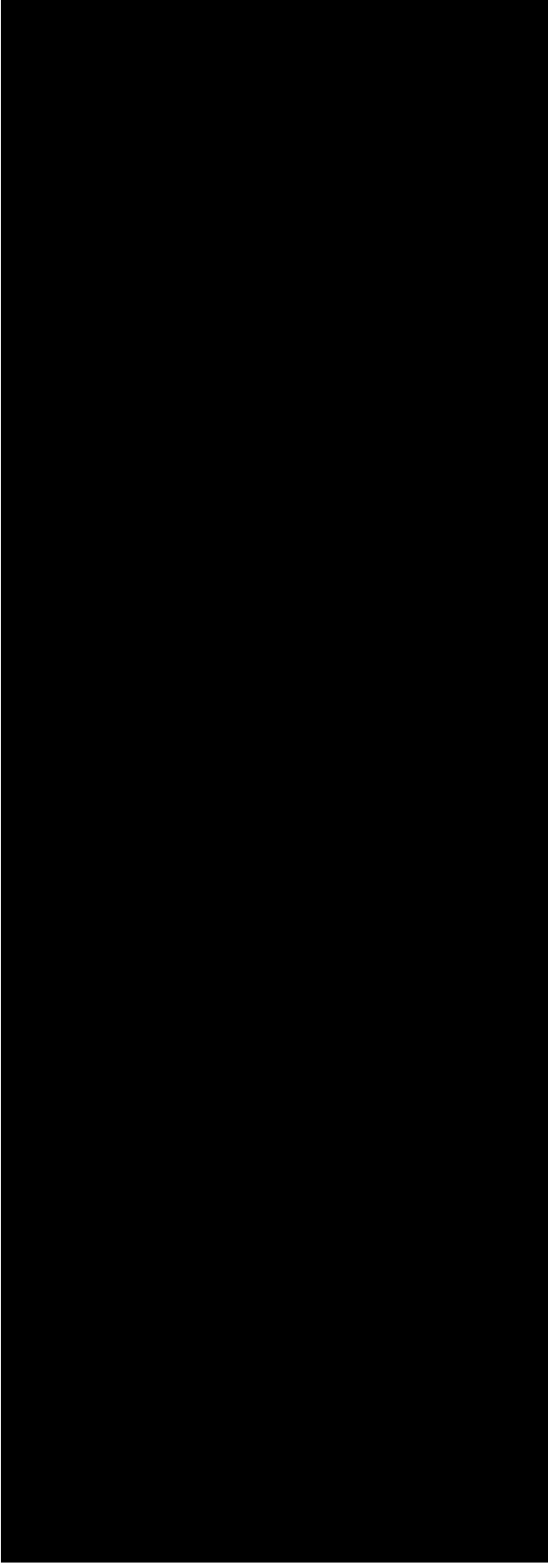
The damages on the regional road network can be classified into six main types:

1. Washout/erosion of one or both sides of the road caused by inadequate slope protection structures.
In some cases the whole road has been damaged;
2. Damages to and blockages of single or multi-cell box culverts and pipe culverts causing consequential local damages to the road;
3. Part or full damage to Irish crossings (cement concrete drifts across the river bed);
4. Damages to bridges and bridge abutments;
5. Minor damages to road pavement and shoulders due to soaking of the pavement and subsequent loss of load bearing capacity requiring asphalt patching;
6. Damages and blockages of roads due to rock fall and slides caused by extensive rain. Such damages may have caused subsequent damages to road.

Annex 1-B. Basic Characteristics and Economic Costs of Road Vehicle Fleet



Annex 1-C: Calculations of Losses to Road Users using World Bank RED model.*)



*) The Roads Economic Decision Model (RED) developed by the World Bank is setup on a series of Excel workbooks and performs an economic evaluation of road investments options using the consumer surplus approach. It is customized to the characteristics of low-volume roads where: a) there is high uncertainty of the assessment of the model inputs, particularly the traffic and condition of unpaved roads; and b) the importance of vehicle speeds for model validation.

Annex 2: Poverty

Table A1. Poverty in Hadramout Governorate, 2005-06 (percentage of poor)

District	Flood Impact	Poverty	Number of poor
Al Qatn	High	0.290	18,645
Sah	High	0.196	4,737
Tarim	High	0.524	52,758
Al Soum	High	0.303	3,838
Dawan		0.250	10,937
Wadi Al Ain	High	0.209	5,950
Broom		0.384	6,646
Shibam	High	0.398	19,423
Seiyun	High	0.423	43,347
Al Shihr		0.365	26,818
Ghail Benyamin		0.336	9,441
Ghail Bawazir		0.440	21,466
Al Mukalla		0.359	6,013
Rumah		0.195	1,240
Thamud		0.208	916
Al Qof		0.238	511
Zamakh and Manwakh		0.188	283
Hagr As Sai'ar		0.221	547
Al Abr		0.229	765
Al Raidah and Qosair		0.210	9,495
Ad Diss		0.372	8,580
Rekhyah		0.141	1,229
Amd		0.175	3,511
Al Dhlia'ah		0.233	4,348
Yabauth		0.357	3,521
Hajr		0.464	11,860
Houdaibo		0.220	7,467
Glnsya wa Abdul Qory		0.329	3,330
Harida		0.034	643
Al Mukalla City		0.178	32,806

Source: Yemen Poverty Assessment, The World Bank, 2007.

Table A2. Poverty in Al-Mahara Governorate, 2005-06
(percentage of poor)

District	Total population	Flood Impact	Poverty	Number of Poor
Al Massila	10,404	High	0.097	1,008
Hasswin	11,130		0.166	1,844
Al Ghayda	27,404	Medium	0.064	1,742
Sayhut	11,746		0.084	985
Qishn	11,441		0.062	706
Shahan	3,152	Low	0.139	438
Hat	2,786		0.027	75
Hawf	5,143		0.169	871
Manaar	5,388		0.082	442

Source: Yemen Poverty Assessment, The World Bank, 2007.

Table A3. Incomes Losses by Sector, 2008-12

YR Million 2008 prices		Both Governorates Output Loss					Both Governorates Income Loss				
Sector	VA ratio	2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
Agriculture											
Crops	0.52806	1113	35805	27463	17694	15218	605	19008	14502	9344	8036
Fishing	0.82400	1056	21719	19609	17498	15030	558	11469	10355	9240	7937
Livestock	0.52806	57	339	0	0	0	47	279	0	0	0
		0	13747	7854	196	188	0	7259	4147	104	99
Infrastructure											
Electricity	0.32585	0	0	0	0	0	0	0	0	0	0
Water	0.32585	0	0	0	0	0	0	0	0	0	0
Transport	0.59179	0	0	0	0	0	0	0	0	0	0
Telecom	0.77020	0	0	0	0	0	0	0	0	0	0
Social											
Education	0.37567	0	12	12	12	0	0	4	4	4	0
Health	0.37567	0	1220	685	350	0	0	458	257	131	0
Housing	0.89723	1620	1624	2	0	0	1453	1457	2	0	0
		0	0	0	0	0	0	0	0	0	0
Industry and Commerce											
Manufacturing	0.39063	0	0	0	0	0	0	0	0	0	0
Retail	0.55239	206	224	0	0	0	81	87	0	0	0
Tourism	0.55239	982	17770	11322	5307	4455	543	9816	6254	2932	2461
		0	31	0	0	0	0	17	0	0	0
Cross cutting											
Environment											
Public Buildings											
Total		2733	38801	28251	18056	15218	2681	30848	21020	12411	10497