Water Risk Filter

Country Overview - Somalia

Water Indicators

Indicator	Value	Description	Source
Overall Basin Risk (score)	3.38	Overall Basin Risk (score)	
Overall Basin Risk (rank)	5	Overall Basin Risk (rank)	
Physical risk (score)	3.20	Physical risk (score)	
Physical risk (rank)	28	Physical risk (rank)	
Regulatory risk (score)	4.62	Regulatory risk (score)	
Regulatory risk (rank)	1	Regulatory risk (rank)	
Reputation risk (score)	2.67	Reputation risk (score)	
Reputation risk (rank)	93	Reputation risk (rank)	
1. Quantity - Scarcity (score)	3.58	1. Quantity - Scarcity (score)	
1. Quantity - Scarcity (rank)	28	1. Quantity - Scarcity (rank)	
2. Quantity - Flooding (score)	3.29	2. Quantity - Flooding (score)	
2. Quantity - Flooding (rank)	91	2. Quantity - Flooding (rank)	
3. Quality (score)	3.26	3. Quality (score)	
3. Quality (rank)	73	3. Quality (rank)	
4. Ecosystem Service Status (score)	1.65	4. Ecosystem Service Status (score)	
4. Ecosystem Service Status (rank)	162	4. Ecosystem Service Status (rank)	
5. Enabling Environment (Policy & Laws) (score)	4.10	5. Enabling Environment (Policy & Laws) (score)	
5. Enabling Environment (Policy & Laws) (rank)	7	5. Enabling Environment (Policy & Laws) (rank)	
6. Institutions and Governance (score)	4.75	6. Institutions and Governance (score)	
6. Institutions and Governance (rank)	3	6. Institutions and Governance (rank)	
7. Management Instruments (score)	4.87	7. Management Instruments (score)	
7. Management Instruments (rank)	1	7. Management Instruments (rank)	
8 - Infrastructure & Finance (score)	5.00	8 - Infrastructure & Finance (score)	
8 - Infrastructure & Finance (rank)	1	8 - Infrastructure & Finance (rank)	
9. Cultural Diversity (score)	1.00	9. Cultural importance (score)	
9. Cultural Diversity (rank)	122	9. Cultural importance (rank)	
10. Biodiversity Importance (score)	3.03	10. Biodiversity importance (score)	

Country Overview - Somalia

Indicator	Value	Description	Source
10. Biodiversity Importance (rank)	120	10. Biodiversity importance (rank)	
11. Media Scrutiny (score)	4.00	11. Media Scrutiny (score)	
11. Media Scrutiny (rank)	6	11. Media Scrutiny (rank)	
12. Conflict (score)	1.51	12. Conflict (score)	
12. Conflict (rank)	189	12. Conflict (rank)	
1.0 - Aridity (score)	3.78	The aridity risk indicator is based on the Global Aridity Index (Global-Aridity) and Global Potential Evapo-Transpiration (Global-PET) Geospatial data sets by Trabucco and Zomer (2009). These data sets provide information about the potential availability of water in regions with low water demand, thus they are used in the Water Risk Filter 5.0 to better account for deserts and other arid areas in the risk assessment.	Trabucco, A., & Zomer, R. J. (2009). Global potential evapo-transpiration (Global-PET) and global aridity index (Global-Aridity) geo-database. CGIAR consortium for spatial information.
1.0 - Aridity (rank)	21	The aridity risk indicator is based on the Global Aridity Index (Global-Aridity) and Global Potential Evapo-Transpiration (Global-PET) Geospatial data sets by Trabucco and Zomer (2009). These data sets provide information about the potential availability of water in regions with low water demand, thus they are used in the Water Risk Filter 5.0 to better account for deserts and other arid areas in the risk assessment.	Trabucco, A., & Zomer, R. J. (2009). Global potential evapo-transpiration (Global-PET) and global aridity index (Global-Aridity) geo-database. CGIAR consortium for spatial information.
1.1 - Water Depletion (score)	2.90	The water depletion risk indicator is based on annual average monthly net water depletion from Brauman et al. (2016). Their analysis is based on model outputs from the newest version of the integrated water resources model WaterGAP3 which measures water depletion as the ratio of water consumption-to-availability.	Brauman, K. A., Richter, B. D., Postel, S., Malsy, M., & Flörke, M. (2016). Water depletion: An improved metric for incorporating seasonal and dry-year water scarcity into water risk assessments. Elem Sci Anth, 4.
1.1 - Water Depletion (rank)	61	The water depletion risk indicator is based on annual average monthly net water depletion from Brauman et al. (2016). Their analysis is based on model outputs from the newest version of the integrated water resources model WaterGAP3 which measures water depletion as the ratio of water consumption-to-availability.	Brauman, K. A., Richter, B. D., Postel, S., Malsy, M., & Flörke, M. (2016). Water depletion: An improved metric for incorporating seasonal and dry-year water scarcity into water risk assessments. Elem Sci Anth, 4.
1.2 - Baseline Water Stress (score)	3.00	World Resources Institute's Baseline Water Stress measures the ratio of total annual water withdrawals to total available annual renewable supply, accounting for upstream consumptive use. A higher percentage indicates more competition among users.	Hofste, R., Kuzma, S., Walker, S., ... & Sutanudjaja, E.H. (2019). Aqueduct 3.0: Updated decision relevant global water risk indicators. Technical note. Washington, DC: World Resources Institute.

Indicator	Value	Description	Source
1.2 - Baseline Water Stress (rank)	55	World Resources Institute's Baseline Water Stress measures the ratio of total annual water withdrawals to total available annual renewable supply, accounting for upstream consumptive use. A higher percentage indicates more competition among users.	Hofste, R., Kuzma, S., Walker, S., ... & Sutanudjaja, E.H. (2019). Aqueduct 3.0: Updated decision relevant global water risk indicators. Technical note. Washington, DC: World Resources Institute.
1.3 - Blue Water Scarcity (score)	4.82	The blue water scarcity risk indicator is based on Mekonnen and Hoekstra (2016) global assessment of blue water scarcity on a monthly basis and at high spatial resolution (grid cells of 30 × 30 arc min resolution). Blue water scarcity is calculated as the ratio of the blue water footprint in a grid cell to the total blue water availability in the cell. The time period analyzed in this study ranges from 1996 to 2005.	Mekonnen, M. M., & Hoekstra, A. Y. (2016). Four billion people facing severe water scarcity. Science advances, 2(2), e1500323.
1.3 - Blue Water Scarcity (rank)	16	The blue water scarcity risk indicator is based on Mekonnen and Hoekstra (2016) global assessment of blue water scarcity on a monthly basis and at high spatial resolution (grid cells of 30 × 30 arc min resolution). Blue water scarcity is calculated as the ratio of the blue water footprint in a grid cell to the total blue water availability in the cell. The time period analyzed in this study ranges from 1996 to 2005.	Mekonnen, M. M., & Hoekstra, A. Y. (2016). Four billion people facing severe water scarcity. Science advances, 2(2), e1500323.
1.4 - Projected Change in Water Discharge (by ~2050) (score)	1.55	This risk indicator is based on multi-model simulation that applies both global climate and hydrological models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP). To estimate the change at 2°C of global warming above 1980-2010 levels, simulated annual water discharge was averaged over a 31-year period with 2°C mean warming. Results are expressed in terms of relative change (%) in probability between present day (1980-2010) conditions and 2°C scenarios by 2050.	Schewe, J., Heinke, J., Gerten, D., Haddeland, I., Arnell, N. W., Clark, D. B., ... & Gosling, S. N. (2014). Multimodel assessment of water scarcity under climate change. Proceedings of the National Academy of Sciences, 111(9), 3245-3250.
1.4 - Projected Change in Water Discharge (by ~2050) (rank)	130	This risk indicator is based on multi-model simulation that applies both global climate and hydrological models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP). To estimate the change at 2°C of global warming above 1980-2010 levels, simulated annual water discharge was averaged over a 31-year period with 2°C mean warming. Results are expressed in terms of relative change (%) in probability between present day (1980-2010) conditions and 2°C scenarios by 2050.	Schewe, J., Heinke, J., Gerten, D., Haddeland, I., Arnell, N. W., Clark, D. B., ... & Gosling, S. N. (2014). Multimodel assessment of water scarcity under climate change. Proceedings of the National Academy of Sciences, 111(9), 3245-3250.

Indicator	Value	Description	Source
1.5 - Drought Frequency Probability (score)	4.14	This risk indicator is based on the Standardized Precipitation and Evaporation Index (SPEI). Vicente-Serrano et al. (2010) developed this multi-scalar drought index applying both precipitation and temperature data to detect, monitor and analyze different drought types and impacts in the context of global warming. The mathematical calculations used for SPEI are similar to the Standard Precipitation Index (SPI), but it has the advantage to include the role of evapotranspiration.	Vicente-Serrano, S. M., Beguería, S., & López-Moreno, J. I. (2010). A multiscalar drought index sensitive to global warming: the standardized precipitation evapotranspiration index. Journal of climate, 23(7), 1696-1718.
1.5 - Drought Frequency Probability (rank)	31	This risk indicator is based on the Standardized Precipitation and Evaporation Index (SPEI). Vicente-Serrano et al. (2010) developed this multi-scalar drought index applying both precipitation and temperature data to detect, monitor and analyze different drought types and impacts in the context of global warming. The mathematical calculations used for SPEI are similar to the Standard Precipitation Index (SPI), but it has the advantage to include the role of evapotranspiration.	Vicente-Serrano, S. M., Beguería, S., & López-Moreno, J. I. (2010). A multiscalar drought index sensitive to global warming: the standardized precipitation evapotranspiration index. Journal of climate, 23(7), 1696-1718.
1.6 - Projected Change in Drought Occurrence (by ~2050) (score)	3.00	This risk indicator is based on multi-model simulation that applies both global climate and drought models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP) . A drought threshold for pre-industrial conditions was calculated based on time-series averages. Results are expressed in terms of relative change (%) in probability between pre-industrial and 2°C scenarios.	Frieler, K., Lange, S., Piontek, F., Reyer, C. P., Schewe, J., Warszawski, L., ... & Geiger, T. (2017). Assessing the impacts of 1.5 C global warming–simulation protocol of the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP2b). Geoscientific Model Development.
1.6 - Projected Change in Drought Occurrence (by ~2050) (rank)	67	This risk indicator is based on multi-model simulation that applies both global climate and drought models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP) . A drought threshold for pre-industrial conditions was calculated based on time-series averages. Results are expressed in terms of relative change (%) in probability between pre-industrial and 2°C scenarios.	Frieler, K., Lange, S., Piontek, F., Reyer, C. P., Schewe, J., Warszawski, L., ... & Geiger, T. (2017). Assessing the impacts of 1.5 C global warming–simulation protocol of the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP2b). Geoscientific Model Development.
2.1 - Estimated Flood Occurrence (score)	3.30	This risk indicator is based on the recurrence of floods within the 34-year time frame period of 1985 to 2019. The occurrence of floods within a given location was estimated using data from Flood Observatory, University of Colorado. The Flood Observatory use data derived from a wide variety of news, governmental, instrumental, and remote sensing source.	Brakenridge, G. R. (2019). Global active archive of large flood events. Dartmouth Flood Observatory, University of Colorado.
2.1 - Estimated Flood Occurrence (rank)	93	This risk indicator is based on the recurrence of floods within the 34-year time frame period of 1985 to 2019. The occurrence of floods within a given location was estimated using data from Flood Observatory, University of Colorado. The Flood Observatory use data derived from a wide variety of news, governmental, instrumental, and remote sensing source.	Brakenridge, G. R. (2019). Global active archive of large flood events. Dartmouth Flood Observatory, University of Colorado.

Indicator	Value	Description	Source
2.2 - Projected Change in Flood Occurrence (by ~2050) (score)	3.02	This risk indicator is based on multi-model simulation that applies both global climate and drought models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP). The magnitude of the flood event was defined based on 100-year return period for pre-industrial conditions. Results are expressed in terms of change (%) in probability between pre-industrial and 2°C scenarios.	Frieler, K., Lange, S., Piontek, F., Reyer, C. P., Schewe, J., Warszawski, L., ... & Geiger, T. (2017). Assessing the impacts of 1.5 C global warming–simulation protocol of the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP2b). Geoscientific Model Development.
2.2 - Projected Change in Flood Occurrence (by ~2050) (rank)	22	This risk indicator is based on multi-model simulation that applies both global climate and drought models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP). The magnitude of the flood event was defined based on 100-year return period for pre-industrial conditions. Results are expressed in terms of change (%) in probability between pre-industrial and 2°C scenarios.	Frieler, K., Lange, S., Piontek, F., Reyer, C. P., Schewe, J., Warszawski, L., ... & Geiger, T. (2017). Assessing the impacts of 1.5 C global warming–simulation protocol of the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP2b). Geoscientific Model Development.
3.1 - Surface Water Contamination Index (score)	3.26	The underlying data for this risk indicator is based on a broad suite of pollutants with well-documented direct or indirect negative effects on water security for both humans and freshwater biodiversity, compiled by Vörösmarty et al. (2010). The negative effects are specific to individual pollutants, ranging from impacts mediated by eutrophication such as algal blooms and oxygen depletion (e.g., caused by phosphorus and organic loading) to direct toxic effects (e.g., caused by pesticides, mercury). The overall Surface Water Contamination Index is calculated based on a range of key pollutants with different weightings according to the level of their negative effects on water security for both humans and freshwater biodiversity: soil salinization (8%), nitrogen (12%) and phosphorus (P, 13%) loading, mercury deposition (5%), pesticide loading (10%), sediment loading (17%), organic loading (as Biological Oxygen Demand, BOD; 15%), potential acidification (9%), and thermal alteration (11%).	Vörösmarty, C. J., McIntyre, P. B., Gessner, M. O., Dudgeon, D., Prusevich, A., Green, P., ... & Davies, P. M. (2010). Global threats to human water security and river biodiversity. Nature, 467(7315), 555.

Indicator	Value	Description	Source
3.1 - Surface Water Contamination Index (rank)	73	The underlying data for this risk indicator is based on a broad suite of pollutants with well-documented direct or indirect negative effects on water security for both humans and freshwater biodiversity, compiled by Vörösmarty et al. (2010). The negative effects are specific to individual pollutants, ranging from impacts mediated by eutrophication such as algal blooms and oxygen depletion (e.g., caused by phosphorus and organic loading) to direct toxic effects (e.g., caused by pesticides, mercury). The overall Surface Water Contamination Index is calculated based on a range of key pollutants with different weightings according to the level of their negative effects on water security for both humans and freshwater biodiversity: soil salinization (8%), nitrogen (12%) and phosphorus (P, 13%) loading, mercury deposition (5%), pesticide loading (10%), sediment loading (17%), organic loading (as Biological Oxygen Demand, BOD; 15%), potential acidification (9%), and thermal alteration (11%).	Vörösmarty, C. J., McIntyre, P. B., Gessner, M. O., Dudgeon, D., Prusevich, A., Green, P., ... & Davies, P. M. (2010). Global threats to human water security and river biodiversity. Nature, 467(7315), 555.
4.1 - Fragmentation Status of Rivers (score)	1.89	This risk indicator is based on the data set by Grill et al. (2019) mapping the world's free-flowing rivers. Grill et al. (2019) compiled a geometric network of the global river system and associated attributes, such as hydro-geometric properties, as well as pressure indicators to calculate an integrated connectivity status index (CSI). While only rivers with high levels of connectivity in their entire length are classified as free-flowing, rivers of CSI < 95% are considered as fragmented at a certain degree.	Grill, G., Lehner, B., Thieme, M., Geenen, B., Tickner, D., Antonelli, F., ... & Macedo, H. E. (2019). Mapping the world's free-flowing rivers. Nature, 569(7755), 215.
4.1 - Fragmentation Status of Rivers (rank)	136	This risk indicator is based on the data set by Grill et al. (2019) mapping the world's free-flowing rivers. Grill et al. (2019) compiled a geometric network of the global river system and associated attributes, such as hydro-geometric properties, as well as pressure indicators to calculate an integrated connectivity status index (CSI). While only rivers with high levels of connectivity in their entire length are classified as free-flowing, rivers of CSI < 95% are considered as fragmented at a certain degree.	Grill, G., Lehner, B., Thieme, M., Geenen, B., Tickner, D., Antonelli, F., ... & Macedo, H. E. (2019). Mapping the world's free-flowing rivers. Nature, 569(7755), 215.
4.2 - Catchment Ecosystem Services Degradation Level (tree cover loss) (score)	1.00	For this risk indicator, tree cover loss was applied as a proxy to represent catchment ecosystem services degradation since forests play an important role in terms of water regulation, supply and pollution control. The forest cover data is based on Hansen et al.'s global Landsat data at a 30-meter spatial resolution to characterize forest cover and change. The authors defined trees as vegetation taller than 5 meters in height, and forest cover loss as a stand-replacement disturbance, or a change from a forest to non-forest state, during the period 2000 – 2018.	Hansen, M. C., Potapov, P. V., Moore, R., Hancher, M., Turubanova, S. A. A., Tyukavina, A., ... & Kommareddy, A. (2013). High-resolution global maps of 21st-century forest cover change. science, 342(6160), 850-853.

Indicator	Value	Description	Source
4.2 - Catchment Ecosystem Services Degradation Level (tree cover loss) (rank)	150	For this risk indicator, tree cover loss was applied as a proxy to represent catchment ecosystem services degradation since forests play an important role in terms of water regulation, supply and pollution control. The forest cover data is based on Hansen et al.'s global Landsat data at a 30-meter spatial resolution to characterize forest cover and change. The authors defined trees as vegetation taller than 5 meters in height, and forest cover loss as a stand-replacement disturbance, or a change from a forest to non-forest state, during the period 2000 – 2018.	Hansen, M. C., Potapov, P. V., Moore, R., Hancher, M., Turubanova, S. A. A., Tyukavina, A., ... & Kommareddy, A. (2013). High-resolution global maps of 21st-century forest cover change. science, 342(6160), 850-853.
4.3 - Projected Impacts on Freshwater Biodiversity (score)	1.56	The study by Tedesco et al. (2013) to project changes [% increase or decrease] in extinction rate by ~2090 of freshwater fish due to water availability loss from climate change is used as a proxy to estimate the projected impacts on freshwater biodiversity.	Tedesco, P. A., Oberdorff, T., Cornu, J. F., Beauchard, O., Brosse, S., Dürr, H. H., ... & Hugueny, B. (2013). A scenario for impacts of water availability loss due to climate change on riverine fish extinction rates. Journal of Applied Ecology, 50(5), 1105-1115.
4.3 - Projected Impacts on Freshwater Biodiversity (rank)	168	The study by Tedesco et al. (2013) to project changes [% increase or decrease] in extinction rate by ~2090 of freshwater fish due to water availability loss from climate change is used as a proxy to estimate the projected impacts on freshwater biodiversity.	Tedesco, P. A., Oberdorff, T., Cornu, J. F., Beauchard, O., Brosse, S., Dürr, H. H., ... & Hugueny, B. (2013). A scenario for impacts of water availability loss due to climate change on riverine fish extinction rates. Journal of Applied Ecology, 50(5), 1105-1115.
5.1 - Freshwater Policy Status (SDG 6.5.1) (score)	4.00	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "National Water Resources Policy" indicator, which corresponds to one of the three national level indicators under the Enabling Environment category.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
5.1 - Freshwater Policy Status (SDG 6.5.1) (rank)	6	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "National Water Resources Policy" indicator, which corresponds to one of the three national level indicators under the Enabling Environment category.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
5.2 - Freshwater Law Status (SDG 6.5.1) (score)	4.00	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "National Water Resources Law(s)" indicator, which corresponds to one of the three national level indicators under the Enabling Environment category. For SDG 6.5.1, enabling environment depicts the conditions that help to support the implementation of IWRM, which includes legal and strategic planning tools for IWRM.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.

Indicator	Value	Description	Source
5.2 - Freshwater Law Status (SDG 6.5.1) (rank)	5	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation “National Water Resources Law(s)” indicator, which corresponds to one of the three national level indicators under the Enabling Environment category. For SDG 6.5.1, enabling environment depicts the conditions that help to support the implementation of IWRM, which includes legal and strategic planning tools for IWRM.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
5.3 - Implementation Status of Water Management Plans (SDG 6.5.1) (score)	5.00	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation “National IWRM plans” indicator, which corresponds to one of the three national level indicators under the Enabling Environment category. For SDG 6.5.1, enabling environment depicts the conditions that help to support the implementation of IWRM, which includes legal and strategic planning tools for IWRM.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
5.3 - Implementation Status of Water Management Plans (SDG 6.5.1) (rank)	1	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation “National IWRM plans” indicator, which corresponds to one of the three national level indicators under the Enabling Environment category. For SDG 6.5.1, enabling environment depicts the conditions that help to support the implementation of IWRM, which includes legal and strategic planning tools for IWRM.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
6.1 - Corruption Perceptions Index (score)	5.00	This risk Indicator is based on the latest Transparency International’s data: the Corruption Perceptions Index 2018. This index aggregates data from a number of different sources that provide perceptions of business people and country experts on the level of corruption in the public sector.	Transparency International (2019). Corruption Perceptions Index 2018. Berlin: Transparency International.
6.1 - Corruption Perceptions Index (rank)	3	This risk Indicator is based on the latest Transparency International’s data: the Corruption Perceptions Index 2018. This index aggregates data from a number of different sources that provide perceptions of business people and country experts on the level of corruption in the public sector.	Transparency International (2019). Corruption Perceptions Index 2018. Berlin: Transparency International.
6.2 - Freedom in the World Index (score)	5.00	This risk indicator is based on Freedom House (2019), an annual global report on political rights and civil liberties, composed of numerical ratings and descriptive texts for each country and a select group of territories. The 2019 edition involved more than 100 analysts and more than 30 advisers with global, regional, and issue-based expertise to covers developments in 195 countries and 14 territories from January 1, 2018, through December 31, 2018.	Freedom House (2019). Freedom in the world 2019. Washington, DC: Freedom House.

Indicator	Value	Description	Source
6.2 - Freedom in the World Index (rank)	3	This risk indicator is based on Freedom House (2019), an annual global report on political rights and civil liberties, composed of numerical ratings and descriptive texts for each country and a select group of territories. The 2019 edition involved more than 100 analysts and more than 30 advisers with global, regional, and issue-based expertise to covers developments in 195 countries and 14 territories from January 1, 2018, through December 31, 2018.	Freedom House (2019). Freedom in the world 2019. Washington, DC: Freedom House.
6.3 - Business Participation in Water Management (SDG 6.5.1) (score)	4.00	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation “Business Participation in Water Resources Development, Management and Use” indicator, which corresponds to one of the six national level indicators under the Institutions and Participation category.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
6.3 - Business Participation in Water Management (SDG 6.5.1) (rank)	6	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation “Business Participation in Water Resources Development, Management and Use” indicator, which corresponds to one of the six national level indicators under the Institutions and Participation category.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
7.1 - Management Instruments for Water Management (SDG 6.5.1) (score)	5.00	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation “Sustainable and efficient water use management” indicator, which corresponds to one of the five national level indicators under the Management Instruments category. For SDG 6.5.1, management instruments refer to the tools and activities that enable decision-makers and users to make rational and informed choices between alternative actions.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
7.1 - Management Instruments for Water Management (SDG 6.5.1) (rank)	1	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation “Sustainable and efficient water use management” indicator, which corresponds to one of the five national level indicators under the Management Instruments category. For SDG 6.5.1, management instruments refer to the tools and activities that enable decision-makers and users to make rational and informed choices between alternative actions.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.

Indicator	Value	Description	Source
7.2 - Groundwater Monitoring Data Availability and Management (score)	5.00	This risk indicator is based on the data set by UN IGRAC (2019) to determine the level of availability of groundwater monitoring data at country level as groundwater management decisions rely strongly on data availability. The level of groundwater monitoring data availability for groundwater management is determined according to a combination of three criteria developed by WWF and IGRAC: 1) Status of country groundwater monitoring programme, 2) groundwater data availability for NGOs and 3) Public access to processed groundwater monitoring data.	UN IGRAC (2019). Global Groundwater Monitoring Network GGMN Portal. UN International Groundwater Resources Assessment Centre (IGRAC).
7.2 - Groundwater Monitoring Data Availability and Management (rank)	1	This risk indicator is based on the data set by UN IGRAC (2019) to determine the level of availability of groundwater monitoring data at country level as groundwater management decisions rely strongly on data availability. The level of groundwater monitoring data availability for groundwater management is determined according to a combination of three criteria developed by WWF and IGRAC: 1) Status of country groundwater monitoring programme, 2) groundwater data availability for NGOs and 3) Public access to processed groundwater monitoring data.	UN IGRAC (2019). Global Groundwater Monitoring Network GGMN Portal. UN International Groundwater Resources Assessment Centre (IGRAC).
7.3 - Density of Runoff Monitoring Stations (score)	4.14	The density of monitoring stations for water quantity was applied as proxy to develop this risk indicator. The Global Runoff Data Base was used to estimate the number of monitoring stations per 1000km2 of the main river system (data base access date: May 2018).	BfG (2019). Global Runoff Data Base. German Federal Institute of Hydrology (BfG).
7.3 - Density of Runoff Monitoring Stations (rank)	32	The density of monitoring stations for water quantity was applied as proxy to develop this risk indicator. The Global Runoff Data Base was used to estimate the number of monitoring stations per 1000km2 of the main river system (data base access date: May 2018).	BfG (2019). Global Runoff Data Base. German Federal Institute of Hydrology (BfG).
8.1 - Access to Safe Drinking Water (score)	5.00	This risk indicator is based on the Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (UNICEF/WHO) 2019 data. It provides estimates on the use of water, sanitation and hygiene by country for the period 2000-2017.	WHO & UNICEF (2019). Estimates on the use of water, sanitation and hygiene by country (2000-2017). Joint Monitoring Programme for Water Supply, Sanitation and Hygiene.
8.1 - Access to Safe Drinking Water (rank)	1	This risk indicator is based on the Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (UNICEF/WHO) 2019 data. It provides estimates on the use of water, sanitation and hygiene by country for the period 2000-2017.	WHO & UNICEF (2019). Estimates on the use of water, sanitation and hygiene by country (2000-2017). Joint Monitoring Programme for Water Supply, Sanitation and Hygiene.
8.2 - Access to Sanitation (score)	5.00	This risk indicator is based on the Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (UNICEF/WHO) 2019 data. It provides estimates on the use of water, sanitation and hygiene by country for the period 2000-2017.	WHO & UNICEF (2019). Estimates on the use of water, sanitation and hygiene by country (2000-2017). Joint Monitoring Programme for Water Supply, Sanitation and Hygiene.

Indicator	Value	Description	Source
8.2 - Access to Sanitation (rank)	4	This risk indicator is based on the Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (UNICEF/WHO) 2019 data. It provides estimates on the use of water, sanitation and hygiene by country for the period 2000-2017.	WHO & UNICEF (2019). Estimates on the use of water, sanitation and hygiene by country (2000-2017). Joint Monitoring Programme for Water Supply, Sanitation and Hygiene.
8.3 - Financing for Water Resource Development and Management (SDG 6.5.1) (score)	5.00	This risk indicator is based on the average 'Financing' score of UN SDG 6.5.1. Degree of IWRM Implementation database. UN SDG 6.5.1 database contains a category on financing which assesses different aspects related to budgeting and financing made available and used for water resources development and management from various sources.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
8.3 - Financing for Water Resource Development and Management (SDG 6.5.1) (rank)	1	This risk indicator is based on the average 'Financing' score of UN SDG 6.5.1. Degree of IWRM Implementation database. UN SDG 6.5.1 database contains a category on financing which assesses different aspects related to budgeting and financing made available and used for water resources development and management from various sources.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
9.1 - Cultural Diversity (score)	1.00	Water is a social and cultural good. The cultural diversity risk indicator was included in order to acknowledge that businesses face reputational risk due to the importance of freshwater for indigenous and traditional people in their daily life, religion and culture. This risk indicator is based on Oviedo and Larsen (2000) data set, which mapped the world's ethnolinguistic groups onto the WWF map of the world's ecoregions. This cross-mapping showed for the very first time the significant overlap that exists between the global geographic distribution of biodiversity and that of linguistic diversity.	Oviedo, G., Maffi, L., & Larsen, P. B. (2000). Indigenous and traditional peoples of the world and ecoregion conservation: An integrated approach to conserving the world's biological and cultural diversity. Gland: WWF (World Wide Fund for Nature) International.
9.1 - Cultural Diversity (rank)	122	Water is a social and cultural good. The cultural diversity risk indicator was included in order to acknowledge that businesses face reputational risk due to the importance of freshwater for indigenous and traditional people in their daily life, religion and culture. This risk indicator is based on Oviedo and Larsen (2000) data set, which mapped the world's ethnolinguistic groups onto the WWF map of the world's ecoregions. This cross-mapping showed for the very first time the significant overlap that exists between the global geographic distribution of biodiversity and that of linguistic diversity.	Oviedo, G., Maffi, L., & Larsen, P. B. (2000). Indigenous and traditional peoples of the world and ecoregion conservation: An integrated approach to conserving the world's biological and cultural diversity. Gland: WWF (World Wide Fund for Nature) International.
10.1 - Freshwater Endemism (score)	4.48	The underlying data set for this risk indicator comes from the Freshwater Ecoregions of the World (FEOW) 2015 data developed by WWF and TNC. Companies operating in basins with higher number of endemic fish species are exposed to higher reputational risks.	WWF & TNC (2015). Freshwater Ecoregions of the World.

Indicator	Value	Description	Source
10.1 - Freshwater Endemism (rank)	51	The underlying data set for this risk indicator comes from the Freshwater Ecoregions of the World (FEOW) 2015 data developed by WWF and TNC. Companies operating in basins with higher number of endemic fish species are exposed to higher reputational risks.	WWF & TNC (2015). Freshwater Ecoregions of the World.
10.2 - Freshwater Biodiversity Richness (score)	1.58	The underlying data set for this risk indicator comes from the Freshwater Ecoregions of the World (FEOW) 2015 data developed by WWF and TNC. Count of fish species is used as a representation of freshwater biodiversity richness. Companies operating in basins with higher number of fish species are exposed to higher reputational risks.	WWF & TNC (2015). Freshwater Ecoregions of the World.
10.2 - Freshwater Biodiversity Richness (rank)	176	The underlying data set for this risk indicator comes from the Freshwater Ecoregions of the World (FEOW) 2015 data developed by WWF and TNC. Count of fish species is used as a representation of freshwater biodiversity richness. Companies operating in basins with higher number of fish species are exposed to higher reputational risks.	WWF & TNC (2015). Freshwater Ecoregions of the World.
11.1 - National Media Coverage (score)	4.00	This risk indicator is based on joint qualitative research by WWF and Tecnoma (Typsa Group). It indicates how aware local residents typically are of water-related issues due to national media coverage. The status of the river basin (e.g., scarcity and pollution) is taken into account, as well as the importance of water for livelihoods (e.g., food and shelter).	WWF & Tecnoma (TYPSA Group)
11.1 - National Media Coverage (rank)	7	This risk indicator is based on joint qualitative research by WWF and Tecnoma (Typsa Group). It indicates how aware local residents typically are of water-related issues due to national media coverage. The status of the river basin (e.g., scarcity and pollution) is taken into account, as well as the importance of water for livelihoods (e.g., food and shelter).	WWF & Tecnoma (TYPSA Group)
11.2 - Global Media Coverage (score)	4.00	This risk indicator is based on joint qualitative research by WWF and Tecnoma (Typsa Group). It indicates how aware people are of water-related issues due to global media coverage. Familiarity to and media coverage of the region and regional water-related disasters are taken into account.	WWF & Tecnoma (TYPSA Group)
11.2 - Global Media Coverage (rank)	4	This risk indicator is based on joint qualitative research by WWF and Tecnoma (Typsa Group). It indicates how aware people are of water-related issues due to global media coverage. Familiarity to and media coverage of the region and regional water-related disasters are taken into account.	WWF & Tecnoma (TYPSA Group)

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Indicator	Value	Description	Source
12.1 - Conflict News Events (RepRisk) (score)	1.00	This risk indicator is based on 2018 data collected by RepRisk on counts and registers of documented negative incidents, criticism and controversies that can affect a company's reputational risk. These negative news events are labelled per country and industry class.	RepRisk & WWF (2019). Due diligence database on ESG and business conduct risks. RepRisk.
12.1 - Conflict News Events (RepRisk) (rank)	153	This risk indicator is based on 2018 data collected by RepRisk on counts and registers of documented negative incidents, criticism and controversies that can affect a company's reputational risk. These negative news events are labelled per country and industry class.	RepRisk & WWF (2019). Due diligence database on ESG and business conduct risks. RepRisk.
12.2 - Hydro-political Risk (score)	2.03	This risk indicator is based on the assessment of hydro-political risk by Farinosi et al. (2018). More specifically, it is based on the results of spatial modelling by Farinosi et al. (2018) that determined the main parameters affecting water cross-border conflicts and calculated the likelihood of hydro-political issues.	Farinosi, F., Giupponi, C., Reynaud, A., Ceccherini, G., Carmona-Moreno, C., De Roo, A., ... & Bidoglio, G. (2018). An innovative approach to the assessment of hydro-political risk: A spatially explicit, data driven indicator of hydro-political issues. Global environmental change, 52, 286-313.
12.2 - Hydro-political Risk (rank)	121	This risk indicator is based on the assessment of hydro-political risk by Farinosi et al. (2018). More specifically, it is based on the results of spatial modelling by Farinosi et al. (2018) that determined the main parameters affecting water cross-border conflicts and calculated the likelihood of hydro-political issues.	Farinosi, F., Giupponi, C., Reynaud, A., Ceccherini, G., Carmona-Moreno, C., De Roo, A., ... & Bidoglio, G. (2018). An innovative approach to the assessment of hydro-political risk: A spatially explicit, data driven indicator of hydro-political issues. Global environmental change, 52, 286-313.
Population, total (#)	14317996	Population, total	The World Bank 2018, Data , hompage accessed 20/04/2018
GDP (current US$)	6217000000	GDP (current US$)	The World Bank 2018, Data , hompage accessed 20/04/2018
EPI 2018 score (0-100)	0.00	Environmental Performance Index	
WGI -Voice and Accountability (0-100)	2.86	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: https://ssrn.com/abstract=1682132

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Indicator	Value	Description	Source
WGI -Political stability no violence (0-100)	2.96	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: https://ssrn.com/abstract=1682132
WGI - Government Effectiveness (0-100)	0.48	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: https://ssrn.com/abstract=1682132
WGI - Regulatory Quality (0-100)	0.96	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: https://ssrn.com/abstract=1682132
WGI - Rule of Law (0-100)	0.00	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: https://ssrn.com/abstract=1682132
WGI - Control of Corruption (0-100)	0.48	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: https://ssrn.com/abstract=1682132

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Indicator	Value	Description	Source
WRI BWS all industries (0-5)	0.46	WRI Baseline Water Stress (BWS)	Gassert, F., P. Reig, T. Luo, and A. Maddocks. 2013. "Aqueduct country and river basin rankings: a weighted aggregation of spatially distinct hydrological indicators." Working paper. Washington, DC: World Resources Institute, December 2013. Available online at http://wri.org/publication/aqueduct-country-river-basin-rankings.
WRI BWS Ranking (1=very high)	137	WRI Baseline Water Stress (BWS)	Gassert, F., P. Reig, T. Luo, and A. Maddocks. 2013. "Aqueduct country and river basin rankings: a weighted aggregation of spatially distinct hydrological indicators." Working paper. Washington, DC: World Resources Institute, December 2013. Available online at http://wri.org/publication/aqueduct-country-river-basin-rankings.
Baseline Water Stress (BWS) - 2020 BAU (1=very high)	83	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2020 Optimistic (increasing rank describes lower risk)	74	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2020 Pessimistic (increasing rank describes lower risk)	84	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.

Country Overview - Somalia

Indicator	Value	Description	Source
Baseline Water Stress (BWS) - 2030 BAU (increasing rank describes lower risk)	84	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2030 Optimistic (increasing rank describes lower risk)	85	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2030 Pessimistic (increasing rank describes lower risk)	84	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2040 BAU (increasing rank describes lower risk)	86	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2040 Optimistic (increasing rank describes lower risk)	87	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2040 Pessimistic (increasing rank describes lower risk)	87	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.

Country Overview - Somalia

Indicator	Value	Description	Source
Total water footprint of national consumption (m3/a/cap)	0.00	WFN Water Footprint Data	Mekonnen, M.M. and Hoekstra, A.Y. (2011) National water footprint accounts: The green, blue and grey water footprint of production and consumption, Value of Water Research Report Series No. 50, UNESCO-IHE, Delft, the Netherlands.http://www.waterfootprint.org/Reports/Report50-NationalWaterFootprints-Vol1.pdf
Ratio external / total water footprint (%)	0.00	WFN Water Footprint Data	Mekonnen, M.M. and Hoekstra, A.Y. (2011) National water footprint accounts: The green, blue and grey water footprint of production and consumption, Value of Water Research Report Series No. 50, UNESCO-IHE, Delft, the Netherlands.http://www.waterfootprint.org/Reports/Report50-NationalWaterFootprints-Vol1.pdf
Area equipped for full control irrigation: total (1000 ha)	50.00	Aquastat - Irrigation	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Area equipped for irrigation: total (1000 ha)	200.00	Aquastat - Irrigation	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
% of the area equipped for irrigation actually irrigated (%)	0.00	Aquastat - Irrigation	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Electricity production from hydroelectric sources (% of total)	0.00	World Development Indicators	The World Bank 2018, Data , hompage accessed 20/04/2018
Total internal renewable water resources (IRWR) (10^9 m3/year)	6.00	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Total internal renewable water resources (IRWR) (10^9 m3/year)	8.70	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Water resources: total external renewable (10^9 m3/year)	6.00	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13

Country Overview - Somalia

Indicator	Value	Description	Source
Total renewable water resources (10^9 m3/year)	14.70	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Dependency ratio (%)	59.18	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Total renewable water resources per capita (m3/inhab/year)	1363.00	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
World happiness [0-8]	4.98	WorldHappinessReport.org	World Happiness Report, homepage accessed 20/04/2018

Country Aspects

1. PHYSICAL ASPECTS

1.1. WATER RESOURCES

1.1.1. WATER RESOURCES

Water resources in Somalia are dominated by surface water. The two perennial rivers in Somalia are the Juba and Shabelle rivers. The Juba-Shabelle basin, with a total area of 810,427km2, covers about one-third of Ethiopia, one-third of Kenya and one-third of Somalia. Over 90 per cent of the flow originates in the Ethiopian highlands. The mean annual runoff at the border between Ethiopia and Somalia is 5.9km3 for the Juba river at Luuq, and 2.3km3 for the Shabelle river at Belet Weyne. The downstream discharge at the Shabelle river is decreasing rapidly, due to losses from seepage, evaporation, overbank spillage due to a low channel capacity and water abstractions before the flow usually ends in the wetlands beyond Sablaale. Although the Shabelle river is technically a tributary of the Juba, it is very rare that flow from the Shabelle ever reaches the Juba, and often the Shabelle ceases to flow in the lower reaches during the early part of the year.

Destructive floods have affected the Juba and Shabelle basin since the beginning of the century – especially in 1946, 1961, 1981, and 1997/1998. Usually the floods follow heavy rains in the upper basin in Ethiopia, with the Lower Juba floodplain being the worst affected area. As the Shabelle river is embanked at the lower part, it is very difficult to predict the location of the floods. Sedimentation in the riverbed and siltation of the irrigation canals are also contributing to in-channel floods.

In the north, along the Gulf of Aden, there is a mountainous zone with rugged relief which is subject to torrential flows, causing considerable erosion. The land slopes down towards the south, and the south-flowing watercourses dissipate in the Haud plateau. Groundwater potential is restricted because of limited potential for recharge.

Internally produced water resources are 6km³/year, of which 5.7km3 and 3.3km3 are surface water and groundwater respectively, with an overlap between the two estimated at 3km3. Total renewable water resources in Somalia are 14.2km3/year. However, due to floods, not all resources can be captured.

There are no dams on the Juba and Shabelle rivers within Somalia, and pre-war flood-control measures (which include off-stream reservoirs, flood relief canals) have fallen into disrepair. There is off-stream storage at Jowhar (0.2km3), upstream of the greater part of the irrigated lands and downstream of the Jowhar sugar estate, which collapsed in the mid-1990s. A second off-stream storage reservoir in the Shabelle at Duduble, upstream of Jowhar, which would store 0.13-0.2km3 was proposed in the late 1980s, but was never built. At Baarhere, on the Juba river, a major water development project was also proposed, in the 1980s. Plans for this project included facilities for hydropower, water control and irrigation for about 1,750km2 of land.

According to the Western Agricultural Economics Association (WAEA) (2008), the water resources of Somalia are characterised by nine river basins, but only the Juba and Shabelle rivers in the southern part of the country are the dominant perennial rivers. Other rivers and streams have surface water only after high rainfall events and normally drain into either the Indian Ocean or the Gulf of Aden, due to their flashy nature. However, there is high storage potential for sub-surface dams from these streams. Two-thirds of the catchments of the Juba and Shabelle rivers originate in the Ethiopian highlands, with some parts in Kenya, and over 90 per cent of their runoff originating from outside the country.

Groundwater resources are restricted and fragmented because of the limited recharge – which is due to the hot and arid climate and the highly variable rainfall. In the northern regions, some subsurface flows in the wadis are tapped for domestic and small irrigation use. Water resources monitoring networks collapsed immediately after the civil war in 1991, and information on trans-boundary water resources does not exist. Most of the rural population rely on either surface water that is collected during the rainy season for storage, or brackish and saline water tapped from the bottom of seasonal streams, which leads to serious health problems that affect the human population. More studies are needed for exploration of the groundwater potential. There is not sufficient information on soil formations and hydrogeology to support further studies. The Food and Agriculture Organization and Somalia Water and Land Information Management (FAO SWALIM) have started to collect basic data on strategic groundwater sources (WAEA, 2008).

Water resources have an extensive and pervasive influence in the economy of Somalia. Much of the social, economic and environmental system is conditioned by an uneven distribution of resources and the stress put on water resources through competing demands. Due to weak water resources institutions, the majority of the water resources systems have deteriorated due to lack of proper catchment management practices – which lead to erosion and sedimentation, change of river morphology and diversion of water courses for irrigation purposes, all of which create major conflicts over Somalia's limited water resources (WAEA, 2008).

There are no large-scale storage reservoirs and dams within Somalia, but off-stream storage existed in the pre-war era, at Jowhar (200 million m³), upstream from the greater part of the irrigated lands and downstream of the Jowhar sugar estate. This has augmented irrigation water during the dry season. Currently the reservoir has been filled up with silt, overgrown by vegetation and people have settled in the base (WAEA, 2008).

There is currently no hydropower generated in Somalia, with only old feasibility studies carried out in the 1980s as part of plans for a dam in Bardhere, which could have generated hydropower in the middle section of the Juba River. The dam could have also provided maximum water control and storage in the Juba Valley irrigation projects further downstream, like the Marere Sugarcane Project (MSP). The country today relies heavily on diesel generator for energy its demands, as it did before the war (WAEA, 2008).

1.1.2. WATER USE

Total water withdrawal is estimated at 3.298km3/year (2003), of which agriculture (irrigation and livestock) accounts for 99.5 per cent. In the rural areas municipal water supply is derived from surface dams, boreholes, shallow wells and springs, often distributed by donkey carts to households. During the dry season groundwater is the main supply for municipal and livestock use and is only supplemented by surface water when and where it is available.

Agricultural water abstractions are mainly limited to partially controlled irrigation schemes in the river basins. Of the abstractions for agriculture, livestock accounts for around 0.03km3/year. Under the present conditions, surface water withdrawal amounts to around 96 per cent, and groundwater withdrawal to 4 per cent of the total water withdrawal. In the dry season, as the water resources become scarce, competition between the resources is high and groundwater supplies are often severely stressed.

United Nations Development Project (UNDP) (2003) estimated that about 69 per cent of the 9 million Somalis lived in rural areas. The pastoral nature of the rural dwellers requires them to constantly search for water and grassland. With an average growth rate of 3 per cent, there is increasing pressure on available resources both for domestic and pastoral uses.

1.2. WATER QUALITY, ECOSYSTEMS AND HUMAN HEALTH

Environmental water-related problems concern shortage of water, use of contaminated water, overgrazing, salinization, waterlogging, recurrent drought and severe floods. The coastal waters are degraded by the illegal cleaning of tanks and fishing, mostly by foreign fleets. The uncontrolled cutting of acacia and juniper forests for the export of charcoal and firewood is damaging the rangelands. From 1997 to 2003, it is estimated that charcoal production increased by 70 per cent.

Soil erosion in the form of sheet, rill, river bank and gully erosion is extensive and has an impact on agricultural land. Soil erosion has also been accelerated due to land that has been left fallow. Substantial areas have been salinized and waterlogged by irrigation. Persistent crop pests are common and affect the quantity and quality of the harvest. Indicators of health have not shown any improvement for the population during the last few years. Farm labour is affected by malaria and tuberculosis, which are the two main human diseases. There is also a high incidence of malaria during the wet season when farm labour is needed. Tuberculosis is common among the pastoralist and agro-pastoralist communities.

Health facilities are concentrated in the urban centres, but water resources are very limited. In Hargeisa the population has on average 7L of water per day, and many people have much less than that. In Mogadishu the water supply is affected by saltwater intrusion from the sea because of extensive groundwater pumping. In some rural areas the construction and rehabilitation of water supplies has resulted in more people and livestock in the area, which has degraded the rangelands.

While people in agro-pastoral communities may or may not understand the health hazards posed by consumption of dirty water, they do lack obvious mechanisms for improving the quality of water they consume. There is also a general perception that disease and death are pre-determined and unavoidable. Most communities have little knowledge of water-related diseases and modes of transmission, hence awareness training is required. The most common water-related diseases are diarrhoea (especially in children under five years), typhoid, malaria and trachoma, common amongst people living in the vicinity of springs (SWALIM-UNICEF, 2007).

Sanitation facilities have a high number of users since no piped sewerage systems exist. In addition, migration from rural areas has placed added pressure on the few facilities found in peri-urban areas where migrants are settling. To some extent, temporary facilities have become permanent investments. To maintain these facilities, local organizations and the humanitarian community de-sludge using vacuum tankers. However, de-sludging in this case does not avoid water table contamination because infiltration is not stopped as in a septic tank. On average, it is estimated that 51 per cent of the urban population has access to sanitation facilities. Few latrines are equipped with septic tanks and two-thirds of these are not managed. In areas where displaced people have settled, almost no sanitation facilities exist. This forces most to resort to open defecation on the periphery of peri-urban areas and refugee camps (United States Agency for International Development (USAID), 2009).

2. GOVERNANCE ASPECTS

2.1. WATER INSTITUTIONS

A platform for the coordination of international aid to Somalia is provided by the Somalia Aid Coordinating Body (SACB). The SACB was created in 1994 and partners include donor governments, United Nations (UN) agencies and international and local non-governmental organizations (NGOs). The aim of the SACB is to share information and to develop strategies for aid in the sectors of health and nutrition, food security and rural development, water/sanitation and infrastructure, education and governance, and economic recovery. The UN development aid in Somalia is coordinated by the Office for Coordination of Humanitarian Affairs (OCHA). Food security at a household level has been monitored since 1995 by the Food Security Assessment Unit (FSAU) through regular assessments of vulnerability and food economy baseline studies.

The overall responsibility for agricultural development in northwest Somalia rests with the Ministry of Agriculture. A strategic plan for agricultural rehabilitation and development for 2001 and 2003 was developed with assistance from the International Rescue Committee (IRC). The goal of the strategic plan was to ensure household food security by ensuring an equitable allocation of resources, improving crop production and capacity building within the Ministry of Agriculture. The ministry of Water and Mineral Resources is responsible for the management of freshwater resources and for water withdrawal. In northeast Somalia, the Ministry of Pastoral Development and Environment is responsible for natural resource management, including the use of forest and surface water and groundwater resources. It developed the strategic plan for sustainable natural resource management for 2002-2004.

Before the onset of civil war in early 1991, the main institution in charge of water resources management in Somalia was the Ministry of Water and Mineral Resources (MWMR) through the National Water Centre (NWC). Exploitation of domestic water supplies was the responsibility of the Water Development Agency (WDA), while the ministry of Agriculture planned and operated water for agricultural activities in the Shabelle River. For the Juba River, development was the responsibility of the Ministry of National Planning and Juba Valley Development. Institutional arrangements of water resources management showed fragmentation, without a clear divide between the functions of national and local agencies. With the outbreak of civil war in 1991, much of the water infrastructure in Somalia was destroyed and social services such as health, education, water and sanitation were seriously affected (SWALIM-UNICEF, 2007).

According to WAEA (2008), before the civil war, the Water Development Agency (WDA) was the major public institution responsible for rural and urban water development and management. After decades of struggle and conflict with private wells' owners and armed militia, UNICEF has managed to establish urban water supply systems for certain major urban centres through Public Private Partnership (PPP). Revenue collection is done through PPP utility managers and utilised for system maintenance and expansion, however, the high migration rates to urban centres due to the conflict have lead to high pressure on the groundwater resources for these urban centres.

2.2. WATER MANAGEMENT

Canal committees and water use associations exist in some areas, but there is no clear pattern of water allocation rights and fees. Canal committees exist on most of the small irrigation schemes with hand-dug canals. These schemes are better maintained compared to the large-scale irrigation schemes, which were maintained by former governments. Lack of sustainable irrigation management is also due to the fact that the land is irrigated by people who have no previous experience of irrigation.

Water, electricity and transport are examples of private sectors that work well, but are only accessible for those who can afford to pay for them. There are no subsidies for agriculture and irrigation.

According to SWALIM-UNICEF (2007), Somalia's location in an extremely water-scarce area means the environmental, social and economic development of the country is, to a large extent, dependent on improved water security gained through effective management of water resources. Water resources in Somalia are limited both in quantity and quality, with frequent droughts and floods further worsening the water security situation in the country. Much still needs to be done in rural populations to be able to meet the Millennium Development Goal 7, Target 10, which is "to reduce by half the proportion of people without sustainable access to safe drinking water."

According to USAID (2009), since 1991 – when Siad Barre's government fell – Somalia has been a largely stateless society. Parts of the country such as Somaliland, Puntland, Galmudug, Maakhir and Southwestern Somalia are internationally "unrecognized" autonomous regions. The remaining areas, including the capital Mogadishu, are divided into smaller territories ruled by competing warlords. Although the north of Somalia has some functioning government institutions, conflict prevails in many parts of south-central Somalia. Instability and natural disasters have forced many Somalis to abandon their rural homes for peri-urban areas. However, rural flight is due not only to conflict, but is also part of a larger trend of permanent urbanization as rural Somalis seek better economic opportunities.

Somalia's water supply and sanitation (WSS) sector hardly exists outside of the relatively stable Somaliland and Puntland regions. The remaining two-thirds of the country (south-central Somalia), including rural areas, is devoid of any real WSS institutional organization or oversight. Most Somalis obtain water from boreholes and shallow wells (USAID, 2009).

Shallow wells are typically located within settlements where the water quality is often polluted due to nearby latrines seeping their contents into the groundwater. This causes frequent outbreaks of water-related diseases such as cholera and diarrhoea. The latest estimates suggest that less than 29 per cent of the total population in Somalia has access to a clean, sustainable water source (USAID, 2009).

Before the civil war, urban WSS was managed by the public sector, but the systems were financially stressed and water supply systems in many cities were inadequate, even before the breakout of conflict. Now, most WSS infrastructure either is damaged or has been poorly maintained during and after the conflict, rendering it inoperable. The continuing conflict and lack of organized governance have resulted in a virtual absence of public funding for the WSS sector except through limited allocations in Somaliland and Puntland. In these areas, most funding for WSS is provided through the UN and other humanitarian donors (USAID, 2009).

In the absence of a central government, a local private sector has developed to fill the void in services. Entrepreneurs throughout the country are building cement catchments, drilling private boreholes, or shipping water from public systems in the cities. Remarkably, some water supply operations have shown a slight improvement over pre-war conditions, suggesting that 'local knowledge for local problems' may be more true than not. Somaliland and Puntland have attempted to re-organize their urban water sectors and have established basic local level WSS agencies and domestic PPP to manage water sector development. Private sector participation has enabled some investment in basic water infrastructure expansion, but the domestic private sector is severely constrained. Typically, if a PPP exists, than a private operator manages services under a long-term concession (USAID, 2009).

No national or municipal institutions exist to handle sanitation, much less sewerage in Somalia. There is also no way for a sanitation service provider to recoup costs if one were to exist. For instance, Mogadishu's operational sewerage system is only a fraction of its pre-war sewerage network. In the absence of a public sector provider, individual collectors have assumed the role and recover costs by charging households directly. Waste from the few functioning sanitation facilities and the waste gathered by the collectors are commonly deposited in wadis and landfills without consideration of public health or environmental degradation (USAID, 2009).

Water supply in the urban sub-sector

Public water service is only operational in Somaliland and Puntland. Most operational water companies are local investor-owned operations with local business people as shareholders. Some companies have performed better than expected (with Boroma, Bosasso and Jowhar leading). Where water companies provide service, government authority over water planning, policy, and regulation remains virtually nonexistent (USAID, 2009).

These investor-owned water companies do not typically function well without considerable outside donor assistance. However, one company has had success in transitioning from a municipal agency to a public-private partnership. Jowhar, a town of 40,000 in Southern Somalia, is served through a management company named “Farjanno”, which operates under a concession from the regional Middle Shabelle Authority and includes representatives of key clans. Farjanno has provided water services throughout much of the civil war and other newer PPPs have been able to reproduce similar arrangements with success. Similar arrangements were successfully facilitated in 2000 in Bossaso, Northeast Somalia (“Puntland”); in 2003 in Galkayo, Puntland and Borama, Northwest Somalia (“Somaliland”) and most recently in Garowe, Puntland in 2005. All companies are operating successfully (USAID, 2009).

Water supply in the rural sub-sectorWater supply in the rural sub-sector

Somalia is a water-scarce country and precipitation variability appears to be increasing. Many of its regions have experienced severe droughts followed by severe flooding. In both cases, rural populations are particularly vulnerable because of their limited resources or adaptive capacity. In addition, brutal conflicts have erupted in localized areas as water scarcity has increased. Multiple humanitarian agencies have had to implement major water trucking operations and other measures to provide water to drought-affected communities on more than one occasion. When drought conditions have subsided, humanitarian agencies, NGOs, and the donor community significantly scale up UNICEF’s Water, Sanitation and Hygiene (WASH) efforts to improve access to water through boreholes in rural areas. However, rural efforts are limited due to security problems caused by the ongoing conflict.Somalia is a water-scarce country and precipitation variability appears to be increasing. Many of its regions have experienced severe droughts followed by severe flooding. In both cases, rural populations are particularly vulnerable because of their limited resources or adaptive capacity. In addition, brutal conflicts have erupted in localized areas as water scarcity has increased. Multiple humanitarian agencies have had to implement major water trucking operations and other measures to provide water to drought-affected communities on more than one occasion. When drought conditions have subsided, humanitarian agencies, NGOs, and the donor community significantly scale up UNICEF’s Water, Sanitation and Hygiene (WASH) efforts to improve access to water through boreholes in rural areas. However, rural efforts are limited due to security problems caused by the ongoing conflict.

In most of the rural communities, traditional Somali law and Sharia law continue to be upheld. The ownership of land and water is based on traditional Somali social structure where each clan is associated with a particular territory.In most of the rural communities, traditional Somali law and Sharia law continue to be upheld. The ownership of land and water is based on traditional Somali social structure where each clan is associated with a particular territory.

In Somalia there are no uniform constitutional and legal rules governing social or economic behaviour, except for a 1971 law governing the WDA. In Somaliland, a draft water Act and a Water Policy were prepared in 2004. In the areas where public administration has been established, advances have been made in restoring the former juridical system. In most of the rural communities, however, traditional Somali law (xeer) and the Islamic Sharia law continue to be upheld. The ownership of land and water is based on the Somali social organization where each clan is associated with a particular territory. The law says that water is public property but allows appropriation and usage is acquired by administrative permits.In Somalia there are no uniform constitutional and legal rules governing social or economic behaviour, except for a 1971 law governing the WDA. In Somaliland, a draft water Act and a Water Policy were prepared in 2004. In the areas where public administration has been established, advances have been made in restoring the former juridical system. In most of the rural communities, however, traditional Somali law (xeer) and the Islamic Sharia law continue to be upheld. The ownership of land and water is based on the Somali social organization where each clan is associated with a particular territory. The law says that water is public property but allows appropriation and usage is acquired by administrative permits.

According to USAID (2009), UNICEF provided support to the Ministry of Water and Mineral Resources in Somaliland in the development of a Water Policy, National Water Strategy and a Water Act. The Somaliland government has endorsed the 2004 Water Act.According to USAID (2009), UNICEF provided support to the Ministry of Water and Mineral Resources in Somaliland in the development of a Water Policy, National Water Strategy and a Water Act. The Somaliland government has endorsed the 2004 Water Act.

Pre-war National Water PolicyPre-war National Water Policy

Prior to the imposition of colonial rule, each Somali clan was an independent entity, which owned water sources and exercised grazing rights (Puntland State Agency for Water Energy and Natural Resources, (PSAWEN), 2001). During the colonial and UN Trust Territory period (1880-1960), some systems were started to supply only the small, ruling and wealthy elite of the towns. Since the 1960s, traditionally dug wells and reservoirs have been constructed and then controlled by individual families along lineage groups or clans. Drilling of boreholes began on a large scale in the 1970s, under the authority of different government agencies (SWALIM-WAC, 2009).Prior to the imposition of colonial rule, each Somali clan was an independent entity, which owned water sources and exercised grazing rights (Puntland State Agency for Water Energy and Natural Resources, (PSAWEN), 2001). During the colonial and UN Trust Territory period (1880-1960), some systems were started to supply only the small, ruling and wealthy elite of the towns. Since the 1960s, traditionally dug wells and reservoirs have been constructed and then controlled by individual families along lineage groups or clans. Drilling of boreholes began on a large scale in the 1970s, under the authority of different government agencies (SWALIM-WAC, 2009).

A national water committee was formed comprising various ministries and general managers of the autonomous WDA and the National Range Agency. People wishing to construct a borehole required their approval beforehand to ensure that strategic and environmental concerns were addressed. There were four autonomous centres in the water sector — Mogadishu, Hargeisa, Kismayo and the WDA — responsible for rural water supply, while responsibility for urban water supply was given to regional authorities. In 1978, the responsibility for the urban water supply was transferred to WDA (SWALIM-WAC, 2009).A national water committee was formed comprising various ministries and general managers of the autonomous WDA and the National Range Agency. People wishing to construct a borehole required their approval beforehand to ensure that strategic and environmental concerns were addressed. There were four autonomous centres in the water sector — Mogadishu, Hargeisa, Kismayo and the WDA — responsible for rural water supply, while responsibility for urban water supply was given to regional authorities. In 1978, the responsibility for the urban water supply was transferred to WDA (SWALIM-WAC, 2009).

<h2>2.3.WATER POLICY AND LEGAL FRAMEWORK2.3.WATER POLICY AND LEGAL FRAMEWORK

3. GEOPOLITICAL ASPECTS

The Shabelle river is partially regulated upstream in Ethiopia by the Melka Wakana 153 MW hydroelectric project which was completed in 1988. In addition, dams on two branches downstream were introduced which together control 40 per cent of the catchment area and around 50 per cent of the discharge. Further water development projects are ongoing in the Shabelle river on the Ethiopian side at Gode, but the capacity and implications for water management in Somalia are as yet unknown. There are no recorded agreements between the countries for shared water resources.

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