



## **Operations and Maintenance Plan**

**Scaling up climate resilient flood risk management in Bosnia and Herzegovina**

**Output 1. Fully integrated impact-based Flood Forecasting and EWS facilitates timely preparation and response**

Under the Output 1, the 20-year operation and maintenance of the expanded hydro-meteorological observation equipment procured by the project will be secured by the Water Agencies, HMIs and HPPS companies that have the dedicated staff and associated budget allocations for continued maintenance and operation of monitoring and early warning system. The corresponding letters of commitment have been submitted (See Annex 13). Under the project, the existing institutional arrangement for the operation and maintenance of the existing and expanded hydrometric monitoring network will be undertaken including required manpower, capacity, material and financial resources for long-term management. The strategic plan, methodologies, guidelines, manuals and finance resource plans for the operation and maintenance of the optimised hydrometric network will be updated/developed to meet the needs of the O&M expanded network. The project is also developing the long-term financing mechanisms for the maintenance of the hydrometric network (sub-activity 1.1.4) which will include public and private sector financing. Under the project the training of staff will ensure that the capability and competences are established (see sub-Activity 1.1.3).

Under Output 1, the Water Agencies, and HMIs have also committed to data management, update of hazard and risk maps and risk zoning to be developed under Activity 1.2. This will include long-term operations and maintenance of key systems and equipment that will be developed and will require long-term maintenance such as the hazard and risk modelling software and systems, and the FFEWS to be developed. Under Activity 1.3. As far as possible, the software to be used in hazard and risk modelling will aim to use software that is currently being used by the WAs and HMIs, for which licences and annual maintenance is already established, to minimize cost and maximise the chances of sustainability of the systems. In addition, the project will include extensive capacity building which will encompass system operation and maintenance of relevant staff.

Table 1 below, shows the 20-year O&M costs for the expanded hydrometric network, the FFEWS and the modelling and mapping that will be developed by the project.



**Output 2. Non-structural flood risk reduction measures and nature-based solutions mainstreamed in sectoral policies and plans and effectively contribute to protection of people and livelihoods from climate-induced flood risk**

The project will support implementation of 8 non-structural flood protection measures in high-risk areas. Non-structural measures will include: floodplain reconnection, selective bed raising/riffle creation, wash lands, wetland creation, two-stage channels, re-meandering straightened rivers, land and soil management activities to retain / delay surface flows, woody debris dams on streams and tributaries, flood plain woodland, re-forestation, agro-forestry, creation or re-instatement of a ditch network to promote infiltration (swales, interception ditches, etc), in-channel vegetation management growth to maximise channel roughness. The project will include community-based EbA as part of the solution, which will be particularly important to reduce the impact of torrential floods. The project will scale up successful EBA approaches piloted by the UNDP/SCCF Vrbas River project.

Implementation of these measures will be co-financed between the GCF and WAs while the O&M costs will be covered by the respective WAs. The type and costs of the required O&M activities have been defined by a qualified engineer for each measure during the project design. The type of O&M activities for the non-structural measure include removal of sediments and control of vegetation in the riverbeds. Letters of commitments for O&M costs over 20 years period have been provided by WAs. At the inception phase O&M Plan for the 8 sites adaptation measures will be reviewed and the related costs re-confirmed. Once these measures are carried out, the municipal authorities will become responsible for their maintenance. Detailed costing and type of works needed for O&M of these sites is provided in the table 2 below.

*Table 2: 20-Year O&M costs for Output 2*

Activity	O&M Description	Source of Finance	Total	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
2.2	AVPJ - Rehabilitation of the right defensive embankment on the Krupa River in Višići settlement. O&M - Vegetation control on the banks	Water Agency for Adriatic River Basin, Mostar	123,841	5,624	5,681	5,737	5,795	5,853	5,911	5,970	6,030	6,090	6,151	6,213	6,275	6,338	6,401	6,465	6,530	6,595	6,661	6,727	6,795
2.2	AVPJ - Flood deposit removal and rehabilitation of damaged banks of the Neretva River at the Struge-Čapljina section O&M - Removal of sediments	Water Agency for Adriatic River Basin, Mostar	86,689	3,937	3,976	4,016	4,056	4,097	4,138	4,179	4,221	4,263	4,306	4,349	4,392	4,436	4,481	4,525	4,571	4,616	4,663	4,709	4,756
2.2	AVPJ - Flood deposit removal and rehabilitation of damaged banks of the Neretva River at the Struge-Čapljina section O&M - Vegetation control in the riverbed, riverbank and 5m from the banks	Water Agency for Adriatic River Basin, Mostar	37,152	1,687	1,704	1,721	1,738	1,756	1,773	1,791	1,809	1,827	1,845	1,864	1,882	1,901	1,920	1,939	1,959	1,978	1,998	2,018	2,038
2.2	AVPJ - Completion of flood protection line in urban areas (Sava River Basin) - Gračanica River Spreča - cross entity river O&M - Removal of flood deposit and sediments	Water Agency for Adriatic River Basin, Mostar	455,117	20,669	20,876	21,085	21,296	21,509	21,724	21,941	22,160	22,382	22,606	22,832	23,060	23,291	23,524	23,759	23,996	24,236	24,479	24,724	24,971
2.2	AVPJ - Completion of flood protection line in urban areas (Sava River Basin) - Gračanica River Spreča - cross entity river O&M - Vegetation control in the riverbed, riverbank and 5m from the banks	Water Agency for Adriatic River Basin, Mostar	195,050	8,858	8,947	9,036	9,127	9,218	9,310	9,403	9,497	9,592	9,688	9,785	9,883	9,982	10,082	10,182	10,284	10,387	10,491	10,596	10,702
2.2	AVPJ - Completion of flood protection line in urban areas (Sava River Basin) – Maglaj O&M - Removal of flood deposit and sediments	Water Agency for Adriatic River Basin, Mostar	63,716	2,894	2,923	2,952	2,981	3,011	3,041	3,072	3,102	3,133	3,165	3,196	3,228	3,261	3,293	3,326	3,359	3,393	3,427	3,461	3,496
2.2	AVPJ - Completion of flood protection line in urban areas (Sava River Basin) – Maglaj O&M - Vegetation control in the riverbed, riverbank and 5m from the banks	Water Agency for Adriatic River Basin, Mostar	27,307	1,240	1,253	1,265	1,278	1,291	1,303	1,316	1,330	1,343	1,356	1,370	1,384	1,397	1,411	1,426	1,440	1,454	1,469	1,483	1,498
2.2	AVPJ - Completion of flood protection line in urban areas (Sava River Basin) – Lukavac O&M - Removal of flood deposit and sediments	Water Agency for Adriatic River Basin, Mostar	273,070	12,402	12,526	12,651	12,777	12,905	13,034	13,165	13,296	13,429	13,563	13,699	13,836	13,974	14,114	14,255	14,398	14,542	14,687	14,834	14,982
2.2	AVPJ - Completion of flood protection line in urban areas (Sava River Basin) – Lukavac O&M - Vegetation control in the riverbed, riverbank and 5m from the banks	Water Agency for Adriatic River Basin, Mostar	117,030	5,315	5,368	5,422	5,476	5,531	5,586	5,642	5,698	5,755	5,813	5,871	5,930	5,989	6,049	6,109	6,171	6,232	6,295	6,357	6,421
2.2	JUVS - Construction of a bank revetment on the left bank starting from the New -Japanese Bridge in Doboj tow ards dow nstream at a length of approximately 1,5 km. O&M - Removal of flood deposit and sediments	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	69,885	3,174	3,206	3,238	3,270	3,303	3,336	3,369	3,403	3,437	3,471	3,506	3,541	3,576	3,612	3,648	3,685	3,722	3,759	3,796	3,834
2.2	JUVS - Construction of a bank revetment on the left bank starting from the New -Japanese Bridge in Doboj tow ards dow nstream at a length of approximately 1,5 km. O&M - Vegetation control in the riverbed, riverbank and 5m from the banks	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	29,951	1,360	1,374	1,388	1,401	1,415	1,430	1,444	1,458	1,473	1,488	1,503	1,518	1,533	1,548	1,564	1,579	1,595	1,611	1,627	1,643
2.2	JUVS - Construction of protective structures in Dobor settlement: O&M - Removal of flood deposit and sediments	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	126,161	5,730	5,787	5,845	5,903	5,962	6,022	6,082	6,143	6,204	6,266	6,329	6,392	6,456	6,521	6,586	6,652	6,718	6,786	6,854	6,922
2.2	JUVS - Construction of protective structures in Dobor settlement: O&M - Vegetation control in the riverbed, riverbank and 5m from the banks	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	54,069	2,456	2,480	2,505	2,530	2,555	2,581	2,607	2,633	2,659	2,686	2,712	2,740	2,767	2,795	2,823	2,851	2,879	2,908	2,937	2,967
2.2	JUVS - Regulation of the canal of the Gomjenica River in the area of the City of Prijedor from the confluence with the Sana River and upstream at a length of approximately 4 km. O&M - Removal of flood deposit and sediments	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	111,081	5,045	5,095	5,146	5,198	5,250	5,302	5,355	5,409	5,463	5,517	5,573	5,628	5,685	5,741	5,799	5,857	5,915	5,975	6,034	6,095
2.2	JUVS - Regulation of the canal of the Gomjenica River in the area of the City of Prijedor from the confluence with the Sana River and upstream at a length of approximately 4 km. O&M - Vegetation control in the riverbed, riverbank and 5m from the banks	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	47,606	2,162	2,184	2,206	2,228	2,250	2,272	2,295	2,318	2,341	2,365	2,388	2,412	2,436	2,461	2,485	2,510	2,535	2,561	2,586	2,612
2.2	Technical and bioengineering EBA measures w ithin Jošavka river basin	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	217,989	9,900	9,999	10,099	10,200	10,302	10,405	10,509	10,614	10,720	10,827	10,936	11,045	11,156	11,267	11,380	11,494	11,609	11,725	11,842	11,960



## **Annex XIII b – Operations and Maintenance Plan**

GREEN CLIMATE FUND FULL PROPOSAL

### **Output 3. Climate-proof flood protection measures scaled-up through new and improved national and local investment frameworks increasing resilience of the most vulnerable groups to climate induced flooding**

The project will support implementation of 10 structural flood protection measures in high-risk areas.

Implementation of these measures will be co-financed by EiB loan while the O&M costs will be covered by the respective WAs. The type and costs of the required O&M activities have been defined by a qualified engineer for each infrastructure during the project design. The type of O&M activities for the structural measures includes vegetation control in riverbeds and banks. Letters of commitments for O&M costs over 20 years period have been provided by WAs. At the inception phase O&M Plan for the 10 sites adaptation measures will be reviewed and the related costs re-confirmed. Once these measures are carried out, the municipal authorities will become responsible for their maintenance. Detailed costing and type of works needed for O&M of these sites in provided in the table 3 below.

Table 3: 20-Year O&amp;M costs for Output 3

O&M Description	Source of Finance	Total	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Rehabilitation of the Vrbanja River bed in Banja Luka - Removal of flood deposit and sediments	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	<b>360,322</b>	16,364	16,528	16,693	16,860	17,029	17,199	17,371	17,545	17,720	17,897	18,076	18,257	18,440	18,624	18,810	18,998	19,188	19,380	19,574	19,770
Rehabilitation of the Vrbanja River bed in Banja Luka - Vegetation control in the riverbed, riverbank and 5m from the banks	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	<b>154,424</b>	7,013	7,083	7,154	7,226	7,298	7,371	7,445	7,519	7,594	7,670	7,747	7,824	7,903	7,982	8,062	8,142	8,224	8,306	8,389	8,473
Revitalization of Borna channel in Gradiska Municipality - Removal of flood deposit and sediments	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	<b>84,424</b>	3,834	3,872	3,911	3,950	3,990	4,030	4,070	4,111	4,152	4,193	4,235	4,278	4,320	4,364	4,407	4,451	4,496	4,541	4,586	4,632
Revitalization of Borna channel in Gradiska Municipality - Vegetation control in the riverbed, riverbank and 5m from the banks	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	<b>36,182</b>	1,643	1,660	1,676	1,693	1,710	1,727	1,744	1,762	1,779	1,797	1,815	1,833	1,852	1,870	1,889	1,908	1,927	1,946	1,966	1,985
Upgrading of Bosna River dykes in Modrica IV settlement in Modrica Municipality - Removal of flood deposit and sediments	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	<b>1,174,636</b>	53,346	53,880	54,419	54,963	55,513	56,068	56,628	57,195	57,767	58,344	58,928	59,517	60,112	60,713	61,320	61,934	62,553	63,178	63,810	64,448
Upgrading of Bosna River dykes in Modrica IV settlement in Modrica Municipality - Vegetation control in the riverbed, riverbank and 5m from the banks	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	<b>503,416</b>	22,863	23,091	23,322	23,556	23,791	24,029	24,269	24,512	24,757	25,005	25,255	25,507	25,762	26,020	26,280	26,543	26,808	27,076	27,347	27,621
Flood protection of the settlement Bare, City of Doboj - Removal of flood deposit and sediments	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	<b>615,413</b>	27,949	28,229	28,511	28,796	29,084	29,375	29,669	29,965	30,265	30,568	30,873	31,182	31,494	31,809	32,127	32,448	32,773	33,100	33,431	33,766
Flood protection of the settlement Bare, City of Doboj - Vegetation control in the riverbed, riverbank and 5m from the banks	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	<b>263,748</b>	11,978	12,098	12,219	12,341	12,465	12,589	12,715	12,842	12,971	13,100	13,231	13,364	13,497	13,632	13,769	13,906	14,045	14,186	14,328	14,471
Rehabilitation of the Lijesanj and Grab Rivers beds, City of Doboj - Removal of flood deposit and sediments	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	<b>244,623</b>	11,110	11,221	11,333	11,446	11,561	11,676	11,793	11,911	12,030	12,150	12,272	12,395	12,519	12,644	12,770	12,898	13,027	13,157	13,289	13,422
Rehabilitation of the Lijesanj and Grab Rivers beds, City of Doboj - Vegetation control in the riverbed, riverbank and 5m from the banks	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	<b>104,838</b>	4,761	4,809	4,857	4,906	4,955	5,004	5,054	5,105	5,156	5,207	5,259	5,312	5,365	5,419	5,473	5,528	5,583	5,639	5,695	5,752
Rehabilitation of channels network in area of PS Đurići (Tinja-Tolisa) - Removal of flood deposit and sediments	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	<b>107,153</b>	4,866	4,915	4,964	5,014	5,064	5,115	5,166	5,217	5,270	5,322	5,376	5,429	5,484	5,538	5,594	5,650	5,706	5,763	5,821	5,879
Rehabilitation of channels network in area of PS Đurići (Tinja-Tolisa) - Vegetation control in the riverbed, riverbank and 5m from the banks	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	<b>45,923</b>	2,086	2,106	2,128	2,149	2,170	2,192	2,214	2,236	2,258	2,281	2,304	2,327	2,350	2,374	2,397	2,421	2,446	2,470	2,495	2,520
Rehabilitation and raising of dyke on the GOK channel in the City of Bijeljina - Removal of flood deposit and sediments	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	<b>340,276</b>	15,454	15,608	15,764	15,922	16,081	16,242	16,404	16,568	16,734	16,902	17,071	17,241	17,414	17,588	17,764	17,941	18,121	18,302	18,485	18,670
Rehabilitation and raising of dyke on the GOK channel in the City of Bijeljina - Vegetation control in the riverbed, riverbank and 5m from the banks	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	<b>145,833</b>	6,623	6,689	6,756	6,824	6,892	6,961	7,030	7,101	7,172	7,244	7,316	7,389	7,463	7,538	7,613	7,689	7,766	7,844	7,922	8,001
Construction of channel (Selište - Dašnica) - Removal of flood deposit and sediments	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	<b>115,700</b>	5,255	5,307	5,360	5,414	5,468	5,523	5,578	5,634	5,690	5,747	5,804	5,862	5,921	5,980	6,040	6,100	6,161	6,223	6,285	6,348
Construction of channel (Selište - Dašnica) - Vegetation control in the riverbed, riverbank and 5m from the banks	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	<b>49,586</b>	2,252	2,274	2,297	2,320	2,343	2,367	2,390	2,414	2,439	2,463	2,488	2,512	2,538	2,563	2,589	2,614	2,641	2,667	2,694	2,721
Construction of the Lateral channel in west part of Prijedor - Removal of flood deposit and sediments	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	<b>301,370</b>	13,687	13,824	13,962	14,102	14,243	14,385	14,529	14,674	14,821	14,969	15,119	15,270	15,423	15,577	15,733	15,890	16,049	16,209	16,371	16,535
Construction of the Lateral channel in west part of Prijedor - Vegetation control in the riverbed, riverbank and 5m from the banks	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	<b>129,159</b>	5,866	5,924	5,984	6,044	6,104	6,165	6,227	6,289	6,352	6,415	6,479	6,544	6,610	6,676	6,743	6,810	6,878	6,947	7,016	7,087
Cleaning of areas near canals and dykes in north RS - Removal of flood deposit and sediments	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	<b>173,356</b>	7,873	7,952	8,031	8,112	8,193	8,275	8,357	8,441	8,525	8,611	8,697	8,784	8,872	8,960	9,050	9,140	9,232	9,324	9,417	9,511
Cleaning of areas near canals and dykes in north RS - Vegetation control in the riverbed, riverbank and 5m from the banks	Ministry of Agriculture, Forestry and Water Management of Republika Srpska	<b>74,296</b>	3,374	3,408	3,442	3,476	3,511	3,546	3,582	3,618	3,654	3,690	3,727	3,764	3,802	3,840	3,879	3,917	3,956	3,996	4,036	4,076
<b>Totals</b>		<b>5,024,676</b>	<b>228,197</b>	<b>230,479</b>	<b>232,784</b>	<b>235,112</b>	<b>237,463</b>	<b>239,838</b>	<b>242,236</b>	<b>244,658</b>	<b>247,105</b>	<b>249,576</b>	<b>252,072</b>	<b>254,592</b>	<b>257,138</b>	<b>259,710</b>	<b>262,307</b>	<b>264,930</b>	<b>267,579</b>	<b>270,255</b>	<b>272,958</b>	<b>275,687</b>