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Master's Thesis

Koman Hydropower Plant rehabilitation, in perspective of Albania transition to EU Standards

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Methodology: After review of literature related to the water management of Albania, highlight main issues of current stage of dams and hydropower plants in the country, what should be done. Describe reasons why the Koman plant is used as an example. Use a dam/power plant similar and available in the Czech Republic. Analyse steps needed to reach EU standards, use knowledge learned from the similar case in Czech Rep.

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I hereby declare that I have independently elaborated the diploma/final thesis with the topic of "Koman Hydropower Plant Rehabilitation in perspective of Albania transition to EU Standards", and that I have cited all the information sources that I used in the thesis and that are also listed at the end of the thesis in the list of used information sources. I am aware that my diploma/final thesis is subject to Act No. 121/2000 Coll., on copyright, on rights related to copyright and on amendment of some acts, as amended by later regulations, particularly the provisions of Section 35(3) of the act on the use of the thesis. I am aware that by submitting the diploma/final thesis I agree with its publication under Act No. 111/1998 Coll., on universities and on the change and amendments of some acts, as amended, regardless of the result of its defence. With my own signature, I also declare that the electronic version is identical to the printed version and the data stated in the thesis has been processed in relation to the GDPR.

In Prague on 21/03/2022 ____Nikoleta Alushi____

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Koman Hydropower Plant Rehabilitation, in perspective of Albania transition to EU standards.

Abstract

This research is made for master's study purposes and contains a professional approach in terms of the water management situation in Albania, in transition to the EU standards. After taken in consideration an engineering structure such as the Koman hydropower plant in the north part of Albania and analysing the existing scientific data, feedback was collected. I have chosen Koman, due to the lack of maintenance and technical support, especially at the dams. Technical and engineering parameters are all mentioned and explained in details along this document. Another focus and very important point is the legal point of view. Since all the operation of the water management situation, from the starting point of the collection of water, to the last outcome which is electrical energy production is based on specific laws, regulations and convents, all of them must be perused and brought attached to the research.

Basically, there are many common points of the legal tools between Albania and EU, because there are a considerable number of EU generated convents that are applied even in Albania, in the environmental and energetic point of view.
However, there are many inner laws, containing the constitution of Albania which control the water management processes in a strategic level, which should be analysed.
The existing EU directives which are still in Power about the dams, new dams, rehabilitations on the dams and so on, are all mentioned in this research and taken into consideration into a possible proposed rehabilitation of the Koman hydropower plant.

There will be also mentioned as a good example of an existing hydropower station in EU, in this case in the Czech Republic. The Dlouhé stráně Hydroelectric Power Station in built and operates in such EU standards and I've included it on my research to simply show a case study of how a hydropower station might be built and functional in the most accurate way and standards.

During and after this analysis is done, the difference between them will lead to the aimed outcomes of this study, in which we will notice and point out the best available practices of water management and electrical energy production from the hydropower plants.

All of the documents, articles, pictures and schemes that I have been using to compile my research, are all mentioned at the reference section.

Key words: Hydropower, Green Energy, Albania, EU Standards, Dams, Rehabilitation.

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1.0 INTRODUCTION

Albania's hydropower stations (HPP) withinside the Drin and Mat River Cascades are a valuable asset for the Albania. They account for over 90% of home power manufacturing and deliver commonly extra than 65% of the Albania's's overall power demand.

On an average year, Albania generates approximately 4.2 GWh of hydroelectricity. These fundamental infrastructure facilities had been inadequately monitored and maintained for greater than 15 years and might present tremendous risks to the country. Both the institutional set-up and the monitoring and physical infrastructure centers had been found in need of extensive improvements. Support for Albania's hydropower dams is needed not only due to the considerable safety risks involved, but additionally to enhance their standard operation and to facilitate in addition integration of the country with the local energy system. Because of the valuable storage capacity of the dams, the country can use its hydro assets to optimize its electricity supply as it integrates withinside the local marketplace.

Albania is a member of the Energy Community of South East Europe (ECSEE), and a chain of deliberate investments will help it to higher participate withinside the energy marketplace of the area. Furthermore, addressing safety risks of the present dams could create valuable alternatives concerning the future operation and ownership of the hydroelectric facilities. Majority of the conclusions in Albania of the equipment/dams and proposed works collectively with the images and drawings are taken, with the approval of KESH, from the Dam Safety Survey for Hydropower Plants Located at the Drin and Mat River Cascades.

Considering the high importance that a possible integration of the actual existing standards of the dam's operation in Albania, in the EU standards, a detailed analysis has been made upon such bases. The European Water Framework Directive (WFD), is a very important tool according to which, the rehabilitation of the Koman hydropower plant should be implemented.

For better having a more clear idea on how an existing hydropower station within EU works, I've brought a concrete example of the Dlouhé stráně Hydroelectric Power Station. Describing its parameters, condition, way of the operations, records and so on. It's better to have some concrete practical example to rely on, in order to realize high quality engineering structures, especially when it comes to the artificial water bodies.

2.0 Objectives and Methodology

2.1 Objectives of the Project

The development target goals of the proposed project are to:

- Safeguard the hydroelectric stations of Albania and
- Enhance their operational performance and integration within the EU Standards.

The proposed project supports the improvement of the Energy Community according with the target goals of the Energy Community APL. The project's most important impact might be to prevent a probable disaster due to a dam failure.

Such a disaster could bring about considerable loss of life and harm to assets of people living in downstream areas. It might additionally cause big and extended fall in hydropower manufacturing that could significantly have an effect on the whole population of Albania and might possibly considerably increase power fees withinside the entire SEE area.

Poor and vulnerable people withinside the area might possibly go through disproportionately from the sort of energy rate increases. In addition, the project might help Albania to maximise its benefits from existing hydropower through enhancing operational practices of existing facilities and permitting greater effective participation withinside the local energy marketplace. The project may also promote private sector investment in hydropower through collecting, organizing, and making available, higher records and research in Albania's's hydropower capacity.

2.2 Methodology of the project

After review of the recommended and the additional literature related to the water management in Albania, I have highlighted the main issues on the current stage of dams and hydropower plants in the country.

I have chosen the Hydropower Plant of Koman in Albania and analysed the current addressed issues that need to be immediately considered for a provided accurate solution. The main issues are considered to be the ones related to dams, such as: dams monitoring system, dams geographical monitoring system, dams alarm system, spillway gate seals etc.

The tools used to realize such rehabilitation are mainly legal frames of the EU, currently in power directives and convents and surely the ones operating within the EU countries. Thus, the selection of the Dlouhe Strane hydropower plant in the Czech Republic, was made upon being built and maintained considering such EU legal frame, and currently in a perfect technical condition.

3.0 Location of the Project

The project will enforce the remedial measures at the HPP at the Drin and Mat river Cascades. The Drin River is the largest river of Albania, with an general watershed of 14 173 km2, whilst the Mat River, with a complete length of approximately 115 km, has a watershed of two 441 km2. The Drin River Cascade includes 3 hydropower stations, specifically Fierze, Koman and Vau I Dejes. These dams had been built withinside the duration of 1967 to 1985. Fierze dam, highest in the river cascade is a 177 m rockfill dam with clay core, with overall active storage of 2700 mil m3 (Demetrios/E1896 V1 Koman).
The reservoir created for the Fierze dam serves as a head pond for the Drin river cascade. Koman dam, 2nd in the cascade is a 115 m high concrete facing rockfill dam with 430 mil m3 of impounded quantity positioned 2 km from Koman village. Vau I Dejes is positioned withinside the decrease a part of the Drin river valley at the distance of approximately 18 km upstream from the town of Skhodra. The HPP includes 3 separate dams. The Mat river cascade includes hydropower stations; Ulza and Shkopeti construct among 1952 and 1963. The Ulza HPP is positioned close to the villages of Ulza and Burrel. It is a 64 m excessive concrete gravity dam with straight axis with impounded volume of 240 mil m3.The created reservoir, is being used as a head pond for the Mat river cascade. The Skhopeti dam is a 50 m high concrete gravity dam with impounded quantity of forty mil m3 (Demetrios/E1896 V1 Koman).

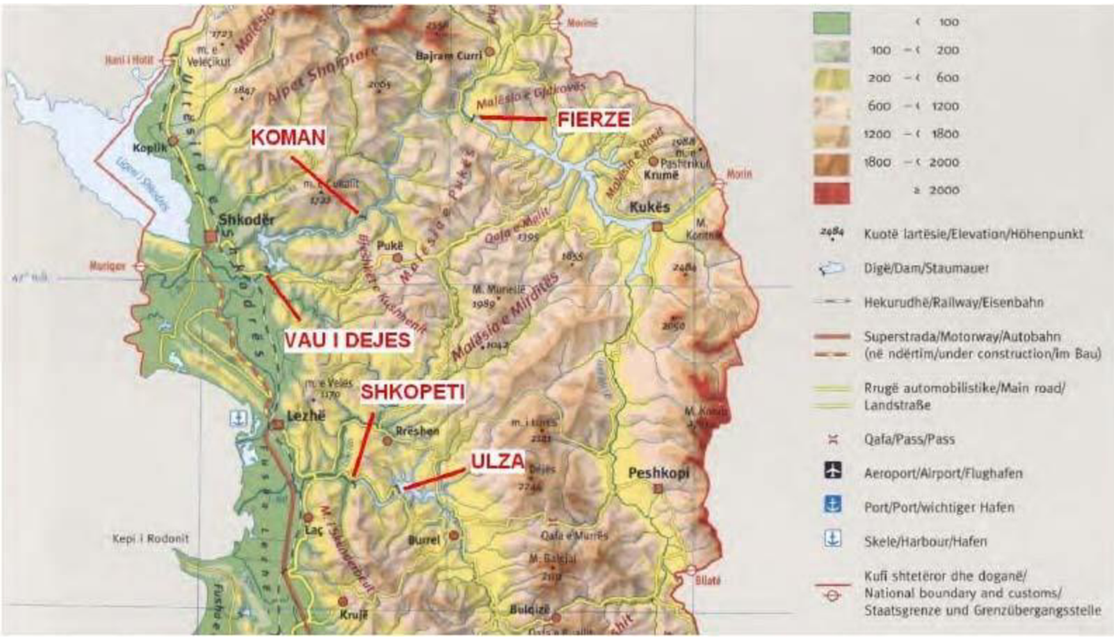


Fig.1 The HPP on Drin and Mat river cascades location

3.1 Description of the Koman Hydro Power Plant

Koman dam located at a distance of 2 km from Koman village, is the middle dam of the Drin Cascade including the Fierze, Koman and Vau I Dejes dams. Koman dam has been constructed in the period of year 1980 to 1988. It is a concrete face rockfill dam with a watertight upstream concrete face slab. Water tightness of the dam foundation has been done by a grout layer. The maximum height of the dam is 100 m and the crest length is 250 m. The crest height is at 185 m and the maximum water level in the reservoir is at 175.5 m. Minimum foundation level is 70 m and maximum dam height above foundation is 115 m. The dam volume is 5 million m3.

The average annual inflow into the reservoir is 9.114 million m3. The reservoir total storage is 430 million m3 and the active storage volume is 200 million m3. The actual maximum water level is 175.5 m, while maximum operation water level is little bit less, i.e. 172 m. Minimum operation water level is 169 m asl. The spillway is used to pass flood flows and consists of 2 intakes with roller/radial gates and adjacent outlet tunnel. Additional releases can be made through the power plant and two diversion tunnels. Crest level of spillway number 3 is at 115 m asl while of spillway tunnel number 4 is at 135 m asl. At maximum level spillway number 3 has total discharge capacity of 1925 m3/s and spillway number 4 1575 m3/s. (Demetrios/E1896 V1 Koman).

The powerhouse (dimension 120m x 24m x 52m) is located at a downstream toe of the dam and has 4 units with a total generation capacity of 600 MW. The plant outflow is 4x180 m3/s. Nominal net head is 96 m. Annual mean energy output is 1500 GWh and plant factor is 29% (Demetrios/E1896 V1 Koman).

The fig. 2 presents layout of the Koman dam (1 – Concrete faced rockfill dam; 2 – power house; 3 – Power water intake; 4 – surge chambers; 5 – the water in a tailrace channel; 6 – Drin River; 7 – tunnel spillway No 4; 8 – tunnel spillway No. 3; 9 – diversion tunnel No 2; diversion tunnel

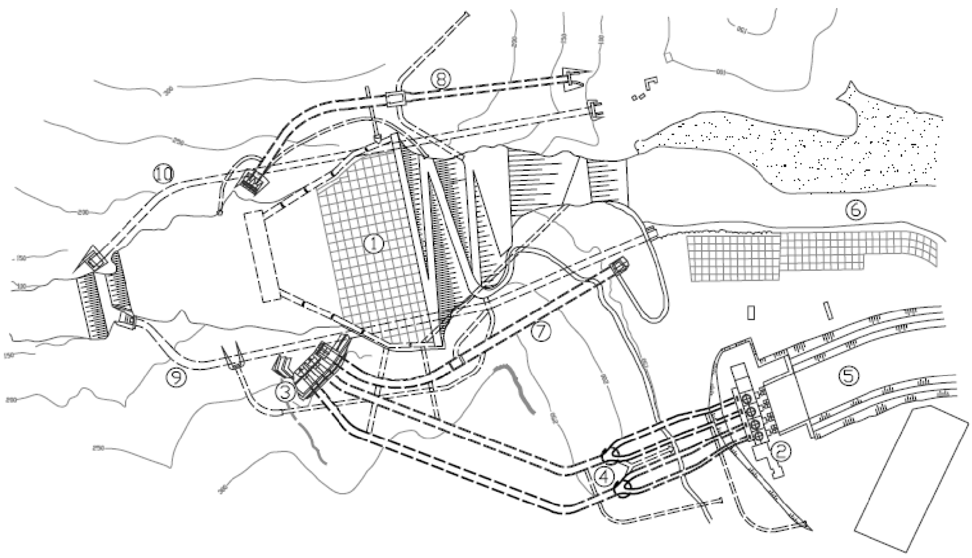


Fig. 2 Layout of Koman HPP (Source: Dam Safety Survey Study)

3.2 Project Components

The project would consist of two main components:

- Physical infrastructure improvements;
- and Technical Assistance.

Component 1: Physical Infrastructure Improvements

Dam Safety Alarm Systems for Drin and Mat River Basins includes the implementation and specification of the water alarm systems in the Drin and Mat River basins, and the specification of a proposed Action Plan of Emergency cases.

Dam Monitoring Systems for Drin and Mat River Basins includes the specification and application of dam monitoring equipment including GPS, and also an imposition of a data acquisition system.
Fierze Dam – The spillway number 3 rehabilitation

- Fierze and Koman Geological Monitoring System- including the application and implementation of landslide alarm systems connected to GPS for the identified potential geological slip spots in the area.
- For Vau i Dejes – Possible needed spillway maintenance and rehabilitations.

Remedial Measures of Medium Priority and Operational Improvements;

- Koman Dam - General rehabilitation of spillway gate seals, as well as frames, cylinders and hydraulic power units.
- Koman Dam - rehabilitation of electromechanical equipment.
- Vau i Dejes Dam - Implementation of Load Frequency Control system to allow for the integration of Albania's electricity system with UCTE.

Component 2: Technical Assistance and Training

Hydrology Analysis and Water Management.

Considering the KESH and the Drin and Mat river basins, the project concept will offer technical support for the KESH improvement and training to an incorporated water sources control approach, in order to accomplish a proper administration of the Matt and Drin river basins and the optimization of power spreading and water sources administration. Dam safety, water infrastructure, and hydropower are basically about water management.
However, due to the absence of the right maintenace and institutional weakening in Albania,

after the country's transition, the expertise and practices on water management had been disregarded and significant gaps have been created. The project therefore to acquire its targets will even provide technical assistance to:

- Improve the quality and availability of hydrological data, analysis and modeling;
- Study the possibility of changes to operating rules to provide increased economic, environmental and social benefits, and
- Incorporate implications of climate change in terms of hydrological profiles. Some of this analytical work has started during project preparation and will continue during project implementation.

The project will require specialized consultants during its implementation to assist KESH with to assist with procurement, design, and supervision of various contracts.

The elaboration of a Safety of Dams culture within KESH and the institutional consolidation of the Albanian Commission of Large Dams, is a necessity for the sustainability and long-term execution of safety measures.

Albania has considerable uncultivated hydropower potential that when developed would provide additional capacity to the overall country's and regional's electricity system.

Around the Drin river area there seems to be potential for further development, or pumped-storage options. To address the initial upstream costs of feasibility studies this technical assistance component will finance detailed feasibility studies for new hydropower development in Albania.

4.0 Environmental Baseline Conditions

4.1 Physical Environment

The area of Koman Dam, as well as this of the Koman Lake is a mountainous area deeply cut by the Drin River. In the area Koman Dam, Drin River flows at elevation about 80-90 m asl, but both banks abruptly rise to more than 600 m and at some distance from the river the surface elevation raises up to more than 1000 m (Demetrios/E1896 V1 Koman).

4.2 Geology

In geological terms the Drin River cascade dams are situated in so called Mirdita Geological Zone, which is known also as the Zone of Magmatic Rocks or the Ophiolitic Zone. Towards the north, it over-thrusts the Cukali Zone, and partially also the Albanian Alps Zone. The locations and orientations of such faults should be determined (Demetrios/E1896 V1 Koman).

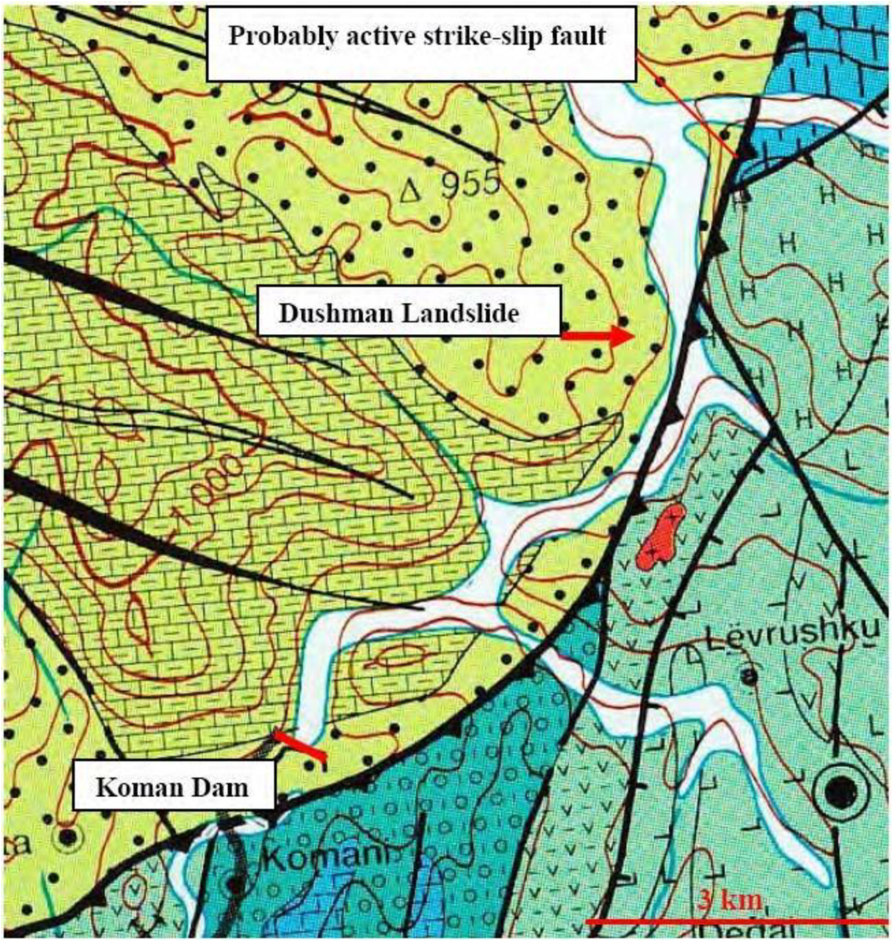


Fig. 8 Geological-tectonic map of Koman Dam site

The magmatic rocks massifs form two belts, one eastern and one western belt, and are mainly of Jurassic age. However, within the zone are the Triassic- Jurassic volcano-sedimentary and the sedimentary formations with a rather wide distribution. In Mirdita region are evolved additionally a few Miocene molasses basins like that of Mati. According to the Geology of Albania (2000), in this region are recognized seismogenic areas: Shkodr-Pec transverse fault and Shkodra-Mati longitudinal region.
The Koman Dam is founded on a complicated anticline structure of limestone, marly limestone, radiolarites and flisch (Fig. 8). The rocks are strongly folded and intensively fractured. The Scutary-Pec strike-slip fault (orientation NE-SW), less than 1 km from the dam site, is probably neotectonically active. Hence, earthquakes may activate movements on major or minor faults interesting the Koman Dam the appurtenant structures (Demetrios/E1896 V1 Koman).

4.3 Surface waters

The watershed of the Drin River has a total area of 19,582 km2, of which 14,173 km2 belong to Drin itself and 5,183 km2 to the Buna. The Drin River is formed by two main branches: the Drin i Bardhe (the white Drin), flowing from Kosovo, and the Drin I Zi (the black Drin), with a catchmant area of 5,885 square km, flowing from FYR of Macecedonia. (Demetrios/E1896 V1 Koman).

The Buna River drains Lake Shkodra, which is fed by rivers originating from Montenegro and Albania; its larger tributary is the Moraça which forms the border.
The Drin River had a mean annual discharge of 680 m3/s during the period 1951- 1985, of which 360 m3/s came from the Drin River itself and 320 m3/s from the Buna River. The overall total discharge is approximately 35 l/s/km² and with a runoff coefficient of 0.74. The reason for generating such high values, are mainly because of the very high yield of the Buna River, which cannot be much exploited – except for navigation. The most important river in the watershed is the Drin River, with the following characteristics:

- Annual discharge volume of 11,100 m³
- A specific discharge of 24.8 l/s/km²
- A ratio from the wettest month December to the driest month August, of 5.7
- On in 10 years high flow: about 13 times the river module
- The storage capacity of Fierze reservoir : 2,700 million m³ (about 25% of annual flow). (Demetrios/E1896 V1 Koman).

4.4 Ground water

Drin River basin is characterized by the presence of hydrogeologicaly very different rocks (Hydrogeological Map of Albania, 1985). Worth mentioning that the most important aquifer of the Drin River basin is related to the carbonate limestone rocks which form some big karst

massifs. They contain big and good quality groundwater resources, mostly discharged by big karst springs. Wide areas are covered by intrusive rocks, which are characterized as locally productive aquifers. Their water-bearing capacity depends on the quantity and character of the fissure.
Moreover, characterized of a big importance, are the deeply incised tectonic faults zone, which often contain important groundwater resources. The effusive, effusive-sedimentary and metamorphic rocks usually have low permeability and their groundwater resources are very limited (Witkowski A, coll. 2013).
Koman Dam area consist mostly of two hydrogeological types of rocks; mainly macro-fissured limestone and marly limestone with relatively important springs with the biggest discharge up to about 10 l/s, and the flish rocks with very low permeability and practically without groundwater.

4.5 Receiving water quality

The surface water quality was studied for some sections of the Drin River before construction of Drin HP cascade, from the Institute of Hydrometereology of Tirana. The Drin River water, as measured in Kukes, Dushaj and Koman, is low mineralized and low hard and regarding the prevailing ions is of Bicarbonate-Calcium type. The water total mineralization varies about 250 to 300 mg/l and the total hardness varies about 9-10° German. There are no measurements of the microcomponents like heavy metals or others. It is tremendously important to measure the concentration of cupper and chrome in rivers and in the Koman lake, since in the study area, have been developed some copper and chrome mines, even thought the last 15 yeas are not operating.

The chemistry study about the groundwater is realized by the former Hydrogeological Enterprise of the Albanian Geological Service. The groundwater of the Koman Dam area is low mineralized and of low hardness; their hydro-chemical type is Bicarbonate- Calcium or Bicarbonate-Magnesium.

4.6 Land pollution

The soils in the region of Koman Dam are gray forest soils. A typical characteristic for the gray forest soils is that they might be located on the middle-mountain belt and they have developed on diverse soilforming rocks. Only the soils below the dam have affected by the construction of the dam before 1985 and by the construction of a service road. The soils in the area are not polluted by toxic substances or waste.

4.7 Air Quality and Sources of Air Emission

Since the construction of Koman Dam the air quality corresponds to the natural conditions of the environment. There is no pollutant transport from other territories. The traffic of motor vehicles is limited and there is not any impact on air purity. The air purity is favored also by the lack of industrial activities beside this of the electricity generation.

4.8 Noise Emission

The investigated site is located far from the urban and industrial activities in basically rural area. The background noise is the natural background of the environment and stays surely below 40 dBA. The baseline sound emissions are abruptly increased only during the short spilling periods, which are associates with particularly high noise level.

5.0 Landscape

The changes in landscape environment in the considered region have already occurred to a large extend by the construction of the Koman Dam and formation of Koman lake. The oak forest cut during and after the construction faze of the dam is partially restored. This was favored by the massive demographic movement of the local population from the villages to the big towns and cities of the western Adriatic lowland of Albania. Lakes are not a foreign element to the mountain, and the artificial lake fits friendly into natural landscape.

5.1 Meteorology

Koman Dam is situated in the North Mediterranean Fore-Mountain Climate Sub-Zone. It encompasses the North Albanian low mountain areas which elevation varies mostly from 600 to 1200 m above sea level. This sub-zone is characterized by relatively uniform thermal regime and of big aerial distribution of precipitation. The following description of the climate elements is based on the data of the nearest to Koman Dam climate station of Tropoja, Kukes and Puka.

5.2 Temperature

Winter in the region is relatively cold and the mean temperatures in January are about -0.3°C – 0.2°C. The mean daily minimum temperature for January is about -3°C to -4°C, and the absolute daily minimum temperature may fall below - 10°C. The mean daily maximal January temperature is about 2°C to 4°C.
During the summer the mean daily monthly temperatures vary over the range 20-22°C at low elevation parts of the area. The mean daily maximum temperature for June and August is about -

25°C to -30°C, and the absolute daily maximum temperature may reach up more than 35°C. The mean daily minimal temperature is about 14°C to 16°C.
Spring is cool, with mean monthly temperature in the central spring months about 9-11°C. During the autumn the mean monthly temperature falls from about 17-18°C during September to about 7-8°C during November.

5.3 Precipitation

The annual amount of the precipitation in the region varies within big limits; for the period 1931-1965 (Climate of Albania) it is 850 mm in Kukes, 1846 mm in Tropoja, 2104 mm in Iballa (near Puka) and 1797 mm in Shkoder. Very characteristic for the climate of Albania is the non-uniform distribution of the precipitation; most of them (about of 70 % of yearly precipitations) fall during the period October – March, while during the summer months (June – August) fall usually less than 10 % of the annual precipitations. The quantity of snow varies on big limits according to the elevation of the measuring are; along the valleys only about 5 to 10 % of the winter precipitation are of snow, while in the areas higher than 1000 m the snow consist about 30 % of the winter precipitations. The maximum daily precipitations in the region according to the location vary from about 100 mm (Kukes) to more than 200 mm (Puke) (Demetrios E1896 V1 Koman).

Storm events are a characteristic of the climate of Albania, but there are not records for all the territory of the country. According to some data of Shkoder Meteorological Station the 15 minutes rainfall is about 30 to 40 mm, the 30 minutes rainfall may reach up to 80 mm, while the rainfall for 1, 2 and 3 hours are registered to be respectively 120 mm, 152 mm and 161 mm.

Table 1 Monthly temp. in °C and monthly precipitation in mm for the Climate Station of Tropoja and Puka

Station	Element	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Average
Tropoja	Temp.	0.2	2.4	6.4	11.6	15.7	19.4	21.6	21.4	18.4	12.6	8.2	3.0	11.7
	Precip.	252	180	120	116	114	78	72	51	93	206	352	212	1846
Puka	Temp.	-0.3	1.0	3.8	9.0	13.6	17.4	20.0	20.4	17.0	11.4	6.6	2.0	10.2
	Precip.	261	216	158	144	142	70	50	42	148	296	304	272	2104

5.4 Wind patterns

The region is characterized of by good aeration conditions. According to the observations made by the Institute of Hydrometeorology of Tirana, the prevailing winds in Shkoder are east and south-east winds over all round the year, while in Kukes the prevailing winds are so called winds of north and south. The mean monthly wind speeds are about 2.0 m/s in Shkoder and 2.8 m/s in Kukes. The biggest wind speeds registered in Shkoder are about 35 to 40 m/s, while those registered in Kukes are about 30-35 m/s. (Koman EIA, 2013)

6.0 Biological Environment

In the area of Koman Dam are present different ecosystems including mountains, rivers, freshwater lake and to a smaller extend also the agricultural environment.

6.1 Flora

The terrestrial vegetation of the area corresponds mainly to the Continental- Central European character with strong participation of some Mediterranean elements. The plant formations of the land area exhibit a variety of forms, as they develop in the low high and high hilly area around the Koman Lake whichelevation increases to the alpine zone.

According to "Gjeografia e Bimeve", Botim i UT, 1985) in Albania, with about 1/15 of the surface of Balkan Peninsula is identified about 50 % of the flora of the Balkan. The Albanian flora counts 3250 species, 489 from which are characteristic for Balkan Peninsula. About 1% of the flora species of Albania are endemic.

Fig. 9 Oak tree forest No. 3 in Koman Dam

Flora and vegetation of this part of Drini watershed is dominated by woodlands of Quercus pubescens and Q.petraea in the upper part (area around Koman lake), dominated by the following associations: Arbutus unedo-Erica arborea, Arbutus unedo+Phillyrea latifolia, Quercus ilex-Myrtus communis, Pistacia lentiscus+Juniperus oxycedrus, Carpinus orientalis+Fraxinus ornus and Carpinus orientalis+Crataegus sp.div (Demetrios E1896 V1 Koman).

6.2 Fauna

Fauna of this study area is that typical of the Mediterranean shrubs and forests. A few carnivores from mamals appearing in the area, are: Canis aureus, Vulpes vulpes, Meles meles, Martes foina, Mustela putorius, M. nivalis. A good numberof bat species do occur in this study area, using it as hunting ground and source of water (eg.Myotis myotis, M. blythi, Miniopterus schreibersi, Nyctalus sp, Pipistrellus sp.div. etc). Water reservoirs created by hydropower dams are important feeding sites for the otter (Lutra lutra).

A relatively rich bird community occurs inside of the Mediterranean shrubs and forests, among which there are distinguished woodpeckers (Dendrocopos sp., Picus canus), and passerines (Fringila sp, Carduelis sp., Emberiza sp., Sylvia sp., Sitta sp., Lanius sp., Turdus sp, etc). Many species of aquatic birds seems to appear, such as Podiceps nigricollis, P. cristatus, Tachybaptus ruficollis, Egretta alba, etc.

Regarding the reptiles and amphibians appearing inside the study area, particularly linked with aquatic habitats there are identifies specifically: Emys orbicularis, Natrix natrix, Salamandra salamandra, Hyla arborea, Bufo viridis, B. bufo, and various species of frogs (Rana sp.div.).

In the fresh waters of Drin river there are found various species of fish, such as Salmo trutt, Barbus meridionalis petenyi, Cyprinus carpio, Anguilla anguilla, Perca fluviatilis, Stizostedion lucioperca, etc, of which some are of economic interest for local community living around the lakes area.

7.0 Protected Natural Territories

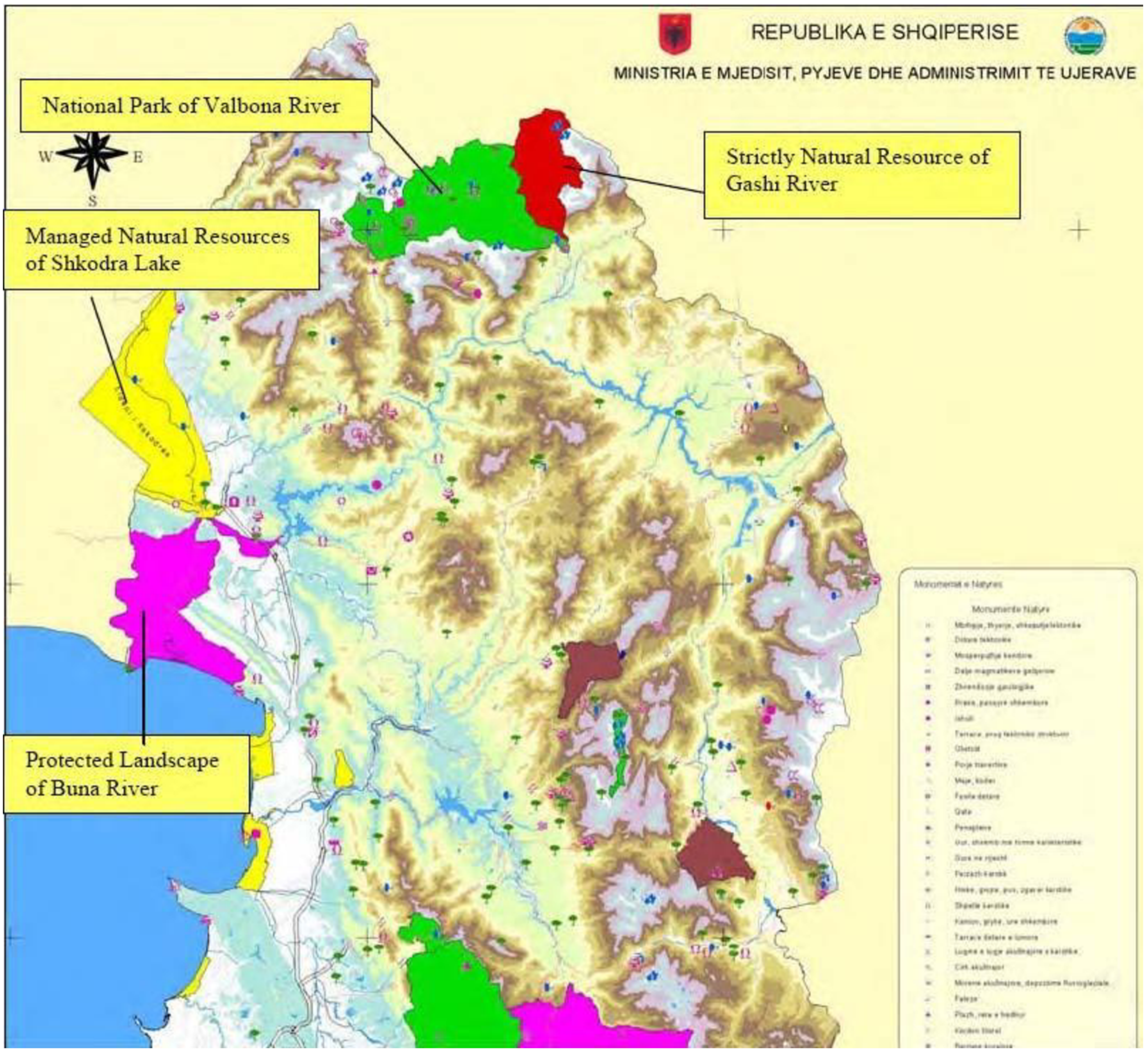


Fig. 10 Map of the protected areas of (North) Albania

Near the Koman Dam area there are not situated special protected areas. As visible on the "Map of the Protected Areas of Albania" (Fig. 10), the Koman Dam is situated far from the protected areas. Although some of them like the "Strictly Natural Resource of Gashi River" and "National park of Valbona River" are situated within the Drin River watershed area. These protected areas are situated upstream to the Koman Dam and could not have any impact by the activity developed to the dam and lake area.

8.0 Socio – Cultural Environment

8.1 Agriculture and Livestock Activity

The population around Koman Dam is rare; there are some small villages scattered on the small valleys of the area. The population of Koman villages is less than 500 inhabitants. The population of the area is decreasing compared to the period prior to transition.

The main economic activity for the local population is agriculture and animal farming. The land has been distributed pursuant to the law No 7501, with each farmer receiving about 1 hectare of arable land, which is sufficient to meet the demands for a family, but quite insufficient with regard to high contentrated level of agriculture.

The lack of the machinery has contributed to the general decay of agriculture.As a result, arable land is frequently used mainly for animal farming.

8.2 Income, Living Standard

The main income for the rural population of the Koman Dam area is by employment in the agriculture sector and remittances from immigrants. Often cutting the trees and selling them for construction purposes is used as by the local people as a way of surviving. The rural population in the region faces a number of problems, such as lack of water supply and sewerage systems and lack of proper road infrastructure. The standard of living of the rural population of this particular mountainous area is becoming even more critical during the

transition period in terms of aggravating poverty in a broader sense. Younger people especially are seeking a better future in the town and in the non-agriculture sectors.

9.0 Current addressed issues of the Koman Hydropower Plant. The concrete components of the hydropower station, which will go under rehabilitation

9.1 Dam Monitoring System

The safety control of a big dam lies at the evaluation of its structural behavior, primary based on the observation of a big set of variables which describe the relations among the actions (gravity, temperature, hydrostatic pressure, etc.) and the corresponding structural responses (stresses, displacements, etc.), considering the properties of the materials used withinside the construction (concrete, embankment, masonry, etc.).
The dam monitoring system is presently in an unsatisfactory condition Most of the existing instruments are no longer working due to the poor maintenance.

Fig.10.1 (Source Leica)

Moreover the recorded data, where existing, were not evaluated regularly. Koman dam has 31 pore water pressure cells (originally proposed 38), one stand pipe piezometer (out of 24 originally installed), five plate displacement gauges (originally 7), and all six steel or concrete strain gages considering still functional. Unfortunately, no measurements were available for review or a rough assessment of their correctness. It is doubtful that these devices are still working. KESH and the consultants for dam safety recommended the dam to be re instrumented, although the existing instruments can also be utilized if it can be shown that the measurements obtained with them are plausible.

All discharges of water downstream of the grout curtain, should be collected and measured. The leakage, primarily the water tightness of the face slab joints has to be monitored as well. At least 4 seepage/ leakage monitoring devices should be installed.
The performance of the grout curtain (pore water strain monitoring) must be checked. This might be achieved by installing 4 extra standpipe piezometers downstream of the grout curtain and

piezometers cells. This will be accomplished by drilling holes from the toe gallery. In addition to mentioned, acellerographs will be installed for seismic loading.
The monitoring records will be systematically kept in a new automatic data acquisition system, making also use of a Geographic Information System (GIS). The recorded data will be reviewed periodically by dam engineers and geologists.

9.2 Dam Geological Monitoring System

The biggest landslide potentially affecting Komani Lake reservoir is Dushman Landslide more than 5 km north of the dam, which seems to be in the position to bring millions of m3 of rocks into the lake, bringing a considerable risk to the dam and probably causing a flood wave. Movement of the landslide can be caused by a very strong earthquake, heavy rainfall and/or rapid snow melt, or high residual pore water conditions following rapid draw down of the reservoir. This is the reason why extended geodetic grid is necessary to monitor the potential landslide.

Fig 10.2 (Source Leica)

The system would consist of a geodetic and hydro-meteorological monitoring of the landslide and of movements along the slip planes. Modern approaches using satellite geodesy and the GPS (global positioning system) would be used. GPS in dam surveying is a complementary method providing additional redundancies and it is not a substitute for traditional terrestrial surveying methods as such. Its use facilitates and speeds up the overall surveying work. The GPS based monitoring will provide data on the long term movements within the area. The
equipment to be installed on the potential landslides may be survey pillars and benchmarks; tiltmeters (for shallow surface observation), inclinometers (for detecting the onset of movement, revealing the precise depth of the slip plane and detection of multiple slip planes), extensometers (for monitoring large movements), etc. The analysis of both dam safety monitoring and geological monitoring data has to be complemented with the hydro meteorological data.
For that reason meteorological stations will be installed. The station will be equipped with thermometer, barometer, hygrometer, anemometer, wind vane and rain gauge.
Automated instrumentation systems will be installed to collect and transmit data (telemetry) from the piezometers, seepage measurement devices, meteorological stations and strong motion instruments to the dam monitoring team and central safety organization.
The installation of monitoring equipment would require shallow drilling (boreholes), and cementing.

9.3 Dam Alarm System

The Dam Water Alarm system currently is inefficient and there is no organization to make rapid response. The Alarm system should be connected with the monitoring equipment and GIS.

The alarm systems have to be designed to warn as quickly as possible operation and maintenance staff working in the HPP and as well all endangered downstream inhabitants in the event of a serious problem with one or more of the existing dams. Alarms should be in the worst case scenario activated, in case of the failure of a dam. Furthermore, on a possible sudden release of large floods or damage to dam structures caused by earthquakes, they should also be activated. The main challenge for an alarm system is getting a timely warning to the people at risk as soon as an alert is indicated. The reliability of the alarm system and the prevention of false alarms are essential for a credible dam alarm system.
The Emergency Action Plan will be defined for the Koman dam. The plan will provide KESH and the government with a guide for identifying, monitoring, responding to and mitigating emergency situations. It will have to define “who does what, where, when, and how” in an emergency situation or any other unusual occurrence affecting the dams.
The full plan will have two parts, internal and external. The internal plan will cover the activities and responsibilities of KESH, as owner of the dams, whilst the external plan has to set out the duties of the GoA and regional civil defense authorities.

9.4 Spillway gate seals

The dam has two spillway systems, one on each dam abutment. They can be closed by radial gates and as well as maintenance roller gates which serve as stop logs. The left spillway (no 3) is in a concrete tower, where the maintenance roller gates with their motor hoists are installed at the top. The radial gates are installed in a chamber on downstream side and are operated by hydraulic cylinders and power units. A similar arrangement is also used for the right spillway (no 4), which is combined with the power intake. The following figures present longitudinal profile of tunnel spillways (1 – spillway intake with maintenance roller gates; 2- pressure tunnel, 3 – spillway gate; 4 – free flow tunnel; 5 - flip bucket; 6 – access gallery; 7 – grout curtain) and the photographs of the intake towers (Demetrios, E1896 v1).

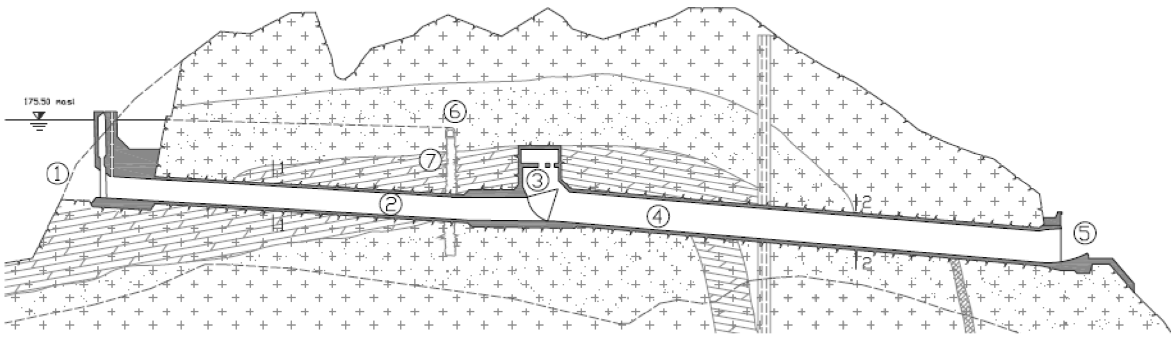


Fig. 3 Longitudinal profile of the tunnel spillway No 4

Fig. 4 Gate tower of the spillway No 4 (1) and power intakes (2)

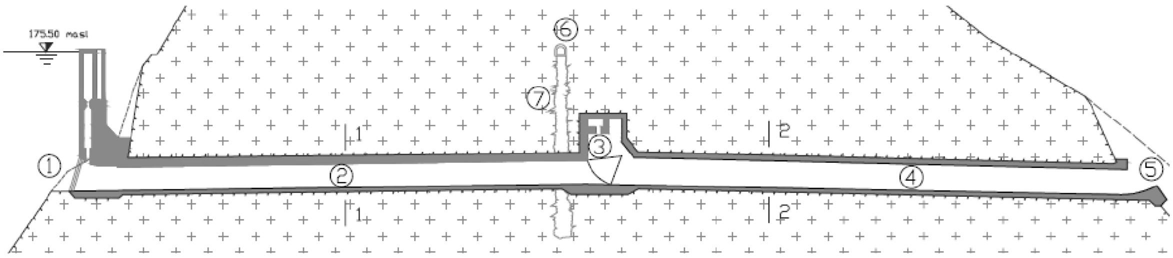


Fig. 5 Longitudinal profile of the tunnel spillway No 3


Fig.6 Intake tower of the spillway No 3

The radial gates are leaking through the whole sealing system, i.e. top, bottom and sides. The seals are very old and have not been replaced since commissioning of the power plant. As the seals are no longer elastic, they may get damaged in the emergency operation. As the result the gate could jam, and it may no longer be possible to fully open or close the gate as desired. The hydraulic cylinders and the power units are in relatively good operation conditions, but still need some repairs. The motor hoists are quite old and they must be either completely repaired or replaced with modern equipment (Demetrios E8196, v1).

Refurbishing of the spillway gates presents technically most challenging task. In order inspect the gates and seals properly and to change the seals, first roller maintenance gates have to be repaired or complemented by stop logs. The hydro dam experts together with KESH concluded that in order to install stop logs the Koman lake level (upstream lake) has to be lowered by 10m. The lowering of Koman gate and the work on the installation will last about 10 days. The lowering of the lake will interrupt the electricity production in the Fierze HPP (upstream dam) as the power intake will be stopped during that period. Fierze Lake has the larges storage and therefore can withhold water for much more than 10 days, as such is normal during the maintenance of the plant. Total active storage of Fierze reservoir is 2700 million m3, while active storage of Koman Lake is 200 million m3 and Vau I Dejes Lake 250 million m3. Difference between maximum and minimum operation level on Fierze dam is 58 meters (Dmetrios E1896, v1).

The level of the water for the Koman HPP might be too low for the electricity generation when the water level is lowered, due to the difference of 6.5 m, between minimum and maximum operation of the lake. The Vau I Dejes reservoir will have to take the additional water, and release it during these 10 days as a part of normal generation activities. The difference between maximum and minimum operation level for Vau I Dejes Dam is 14.5 m. The amount of water released from Koman Lake, with normal operation of Vau I dejes HPP according to KESH who base the conclusion on the hydro dam experts report Dam Break and Flood Wave Analysis for the Drin River Cascade, will not endanger either operation or the safety of the Vau I Dejes HPP and either downstream settlement. The rough numbers, which need to be confirmed through feasibility study, indicate that to lower Koman lake by using solely power plant outflow (600 m3/s) after closure of Fierze dam would require only 4.5 days. In these conditions, Vau I Dejes HPP could as well operate normally, without necessity to overuse spillway discharges and endanger downstream settlements. Never the less the analysis of hydrometeorological cycle is done in order to recommend the best time of the year for the work, to minimize load of HPP Vau I Dejes.

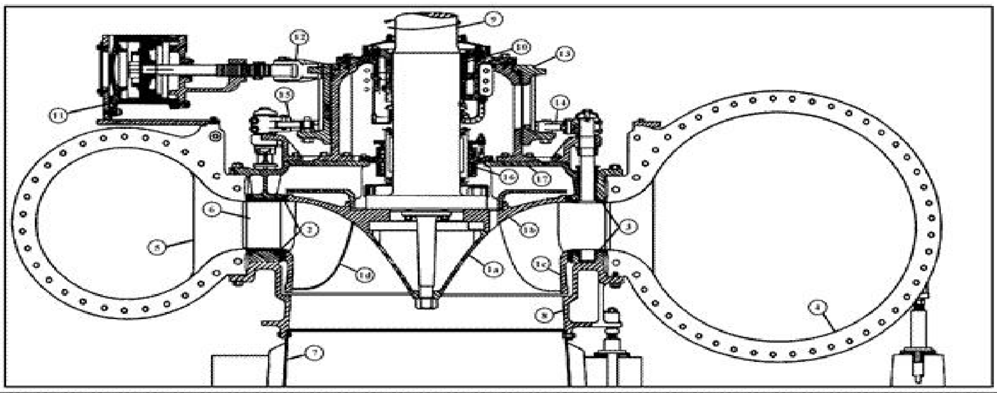
The activity on the spillway gates seals and the supporting mechanism will entail transportation of the parts, grinding, postheating, welding, dismantling, sandblasting, cementing, reinforcing, painting, reassembling, etc.

9.5 Electromechanical equipment

Works on the electromechanical equipment primarily relate to refurbishment of turbines, generator and auxiliary systems. The Koman dam uses Francis turbine.The works on the turbine will include rehabilitation of turbine intake and water accelerant system. Turbine runner receives water from intake swirl and as the swirl accelerates water transfers energy to the runner that is connected to the generator. The runner rehabilitation includes rehabilitation of runner cone, crown, band, bucket hub and blades.

Other parts of the turbine that will require rehabilitation are: wearing rings, facing plates, stay vane, wicket gate and gate operating ring, wicket gate link and arm, draft tube, turbine shaft and guide bearing, and head cover. Runner blade servomotor and wicket gate servomotors will be replaced. Fig.7 shows schematics of Francis turbine with the identified parts. On the generators, rehabilitation work includes change of generator breaking system, mainly breaking and jacking cylinders, refurbishing of both rotor andstator, re-wiring, upgrading cooling system and turbine generator shaft.

The activities will entail dismantling, transportation of the parts, grinding, welding, sandblasting, coating, testing, reassembling, lubricating, etc. In order to avoid the disruption of the operation of the hydropower station which might have non favorable financial consequences for the entire country, the activities shall be preformed but one by one, and not in parallel on turbines and generator.



PARTS LIST FOR FRANCIS AND KAPLAN TURBINE DRAWINGS

1	Turbine Runner	7	Draft Tube
1a	Runner Cone	8	Discharge Ring
1b	Runner Crown (Francis)	9	Turbine Shaft
1c	Runner Band (Francis)	10	Turbine Guide Bearing
1d	Runner Bucket (Francis)	11	Wicket Gate Servomotors
1e	Runner Hub (Kaplan)	12	Servomotor Connecting Rod
1f	Runner Blade (Kaplan)	13	Wicket Gate Operating Ring or Shift Ring
2	Wearing Rings or Seal Rings (Francis)	14	Wicket Gate Link
3	Facing Plates or Curb Plates	15	Wicket Gate Arm
4	Spiral Case or Scroll Case	16	Packing Box or Stuffing Box (Mechanical Seals)
5	Stay Vane	17	Head Cover
6	Wicket Gate	18	Runner Blade Servomotor (Kaplan)

Fig.7 Schematic and parts of Francis turbine

10.0 The legal framework

Environmental Legislation and Safeguards Procedures

Activities that should be carried out under the Albanian Dam Safety Project will comply with both the current Albanian Environmental Regulations and World Bank's Safeguards Policies. For this reason, the Environmental Impact Assessment is going to be prepared and based on the World Bank outline of the Environmental Assessment including Environmental Management Plan. The scope of this EIA, entails as well all information required by Albanian Law on EIA, more specifically information required for the summary environmental assessment document.

10.1 Word Bank Safeguards Procedure

The Bank assesses every project against its safeguard policies. The Bank's environmental screening could classify projects as category A (significant adverse environmental impacts), Category B (potential adverse environmental impacts less adverse than the one of category A) and category C (likely to have minimal or no adverse environmental impacts). The environmental screening of the
project components determined that the project could be classified as category B. The Environmental Assessment done confirmed it as the project will not have significant, irreversible, cumulative or long-term adverse impacts. Actually, a considerable number of positive impacts of the proposed project were identified by the EA, while there were only minor negative impacts that could easily be successfully prevented or reduced through application of appropriate preventive actions or mitigation procedures. (Philip Dann, coll. 2019)

The anticipated environmental and social impacts of Physical Infrastructure Investments in the proposed project trigger this safeguard policy. Due to the non- irreversible impacts anticipated adverse, and because they can be prevented or reduced through appropriate preventive actions or mitigation measures, the project should be classified a Category "B". Meaning that it will require only partial environmental assessment under this policy. In order to ensure that that these issues will be efficiently recognized, described and addressed, EAs are prepared for individual sub-projects (dams). This EA, with its EMP ensuring that recommended preventive actions and mitigation measures will be taken, satisfies this Bank safeguard (Philip Dann, coll. 2019).

The project component involving improvement measures for the safety and regulation of the Dams in Drin and Mat river cascades triggers this safeguard policy. The EIA, however, does not address this policy issue as the Bank's dam safety specialist performed a separate dam safety assessment in order to ensure project compliance with this safeguard policy.

10.2 Albanian Environmental Legislation

Environmental legislation is governed by the Law on Environmental Protection No. 8934, dated September 5, 2002. This Law regulates the national and local policies on environmental protection. This law also defines the requirements for the preparation of environmental impact assessments and strategic environmental assessments, requirements for allowing the realization of the activities that might affect the environment, prevention and reduction of environmental pollution, environmental norms and standards, environmental monitoring and control, responsibilities of the governmental structures with regards to environmental issues, position of the general public and sanctions imposed for law violation (Albania_ECE.CEP.183_Synopsis).

The EIA law, Number 8990, has been approved on January 23, 2003.It defines the rules, methods and time limits for figuring out and assessing the direct or oblique influences of projects or activities at the environment. The Law establishes the stairs essential to put in force EIA methods: presentation of the application, initial review, selection and categorization criteria, public hearing and consultation, access to information, responsibilities and rights of different bodies. The list of activities that should be subject to the Profound and Summary EIA process are also provided under the law(Albania_ECE.CEP.183_Synopsis).
A Profound (advanced) EIA is completed for projects with considerable potential impacts, as indexed in Appendix 1 of the Law, those projects indexed in Appendix 2 which the Ministry of Environment, Forestry and Water Administration (MOEFWA) considers may have a considerable effect at the environment (primarily based totally on records provided through the proposer on the time of application, withinside the manner detailed in Appendix three of the Law), and activities which might be to be applied in a protected location of the Republic of Albania.

A Summary (outlined) EIA is done for projects that may have less significant potential impacts which still require an expert assessment of their impacts. They consist of projects indexed in Appendix 2 of the Law on EIA, and any modifications or rehabilitations of projects indexed in Appendix 1. It is supported through several Decisions of the Council of Ministers and Guidance issued through the MOEFWA. The MOEFWA is the legal competent authority for requesting, reviewing and approving EIA documentation.

10.3 Assessment of the project proposal according to Albanian regulation

According to the Law on EIA which identifies Activities that go through Profound/advanced Process of Impact Assessment on Environment, the investments defined under the Albanian Dam Safety Project, do now no longer require to go through Profound EIA process. Related to the project, the Appendix 1 defines that the Profound EIA is wanted best for the development of latest hydro energy plants.
According to Appendix 2 of the Law on EIA (LAW Nr. 12/2015), which identifies activities that go through Summary Process of Impact Assessment on Environment, the investments defined under the Albanian Dam Safety Project, do now no longer require to go through the environmental impact assessment EIA procedure. Moreover, in line with article four of the Law on EIA, which states that modifications or rehabilitations of projects indexed in appendix 1 shall go through precis procedure of. As the Appendix 1 is asking for EIA for the construction of hydro plants, the summary EIA is required for any changes or rehabilitation of existing hydro power plants.

10.4 The Water Framework Directive

The international water debate has been very extensive since the last decade of the Twentieth century. Among the problems discussed, big dams occupies a distinguished role at the list. In 1998, the World Commission on Dams (WCD) become established to study the improvement and effectiveness of large dams, to evaluate options for water assets and energy development and to increase internationally suitable standards, recommendations and standards for planning, design, appraisal, construction, operation, monitoring, and decommissioning of dams. The WCD commenced its work in May 1998, and released its report Dams and Development: A New Framework for Decision-Making in November 2000. This document has generated a extensive and far-accomplishing debate over water resources management and improvement in general, and over dams in particular. Although this document has been interpreted by some as an anti-dams report, it actually does now no longer oppose the WFM. (WFM 2000/60/EC)

Parallel to the WCD procedure, the European Water Framework Directive (WFD) become being negotiated. This Directive pursuits to set up a framework for the safety of all waters (inland surface waters, transitional waters, coastal waters and groundwater). To this end, the Directive obliges Member States to prevent similarly deterioration, enhance and repair the status of aquatic ecosystems. The maximum crucial end result of its implementation might be the success of the best status of waters by 2015. In order to obtain that end result, MS are obliged to prevent deterioration of the status of water bodies (WFM 2000/60/EC).

Though each instruments are distinctive in nature: the WCD guidelines are non-legally binding whilst the WFD is binding, there are certain parallels among those instruments. The WCD proposed a framework for alternatives evaluation and decision-making procedures for water and power resource improvement, along side a set of criteria and guidelines for planning, design, construction, operation and decommissioning of massive dams. The WFD is a comprehensive legal document which aims to establish the framework for motion withinside the subject of water policy. The WFD intents to put an end to the cutting-edge fragmentation of European rivers. Accordingly, it covered particular provisions coping with physical modifications, including dams, which can endanger the achievement of appropriate water status (WFM 2000/60/EC).

This phase intends to make a quick evaluation of the results of the WCD guidelines and of the WFD for current dams and deliberate dams in Europe. It compiles the primary findings of 3 different sections which examine the results of the WFD and of the WFD Common Implementation Strategy (CIS) Guidances for brand new dams in Europe and the synergies among the WCD results and the WFD provisions.

One of the primary conclusions of the WCD Report is that dams have made an essential and significant contribution to human improvement, and the advantages derived from them were substantial but, in too many cases, an unacceptable and frequently needless fee has been paid to secure those blessings in particular in social and environmental terms. Having analysed all influences of dams, the WCD proposed an alternative manner ahead concerning public acceptance, comprehensive alternatives evaluation and the mitigation of the negative impacts of latest and existing dams. (WFM 2000/60/EC). The WCD proposed a rational and logical framework for figuring out whether or not or now no longer to construct a dam.

The Commission indicated on the outset that enhancing improvement results requires an expanded foundation for decision-making that displays a complete understanding of advantages, impacts, and risks in regards to water and electricity. It recognized 5 core values consistent with the evolving international improvement agenda: equity, efficiency, participatory decision-making, sustainability and accountability. These values are embraced withinside the strategic priorities and recommendations of the WCD record.

The WCD indicated that the Strategic Priorities and Best Practice Guidelines had been concepts to manual decisions, instead of strict policies for compliance. The strategic priorities offer recommendations for a brand new way ahead this is based on accomplishing equitable and sustainable improvement thru a procedure that efficaciously integrates social, financial and environmental concerns into decision-making on massive dams and their options (WFM 2000/60/EC).

The guidelines describe in widespread terms a way to examine options and plan and enforce dam projects to satisfy the Commissioní́s standards. They also are advisory equipment to guide decision-making and need to be taken into consideration in the framework of current international steering and current exact practice. In the opinion of the WCD, making use of those could result in a extra and sustainable final results in the future.

10.5 The WFD and dams: synergies with the WCD recommendations

The Collins English Dictionary (Second Edition 1988) defines a dam as a barrier of concrete, earth, etc., built across a river to create a body of water, as for a domestic water supply. A dam is a physical alteration that produces adjustments withinside the hydromorphological situations and physico-chemical situations concerning changes to fauna and modifications in primary organic productiveness of related ecosystems. Confronting those impacts with the WFD environmental objectives, it's far logical that this Directive covered particular provisions at the safety of water bodies going through physical changes. These provisions cowl current and new adjustments to the physical characteristics of a surface water body or changes to the extent of bodies of groundwaters (LAW Nr. 12/2015).

In the case of existing dams, the WFD has introduced the concept of heavily modified water bodies (HMWB). Those are bodies of water:

❖ physically altered by human activity;
❖ substantially changed in character; and
❖ designated .

As developed by the CIS Guidance on Designation of HMWB, these tests require consideration whether restoration measures required to achieve good ecological status have a significant adverse effect on the activity (use) and whether there are other means of undertaking the activity. The most common physical alteration include dams and weirs, which disrupt the river continuum and cause alterations of the hydrological and hydraulic regime. If it's far probable that the water

body will fail to obtain proper ecological status because of hydromorphological changes then a variety of alternatives exist for objective setting (LAW Nr. 12/2015).
The conditions that have to be met are:

- ❖ All practicable steps are taken to mitigate the adverse impact on the status of the body of water;
- ❖ The reasons for modifications are of overriding public interest and/or the benefits to the environment and To society of accomplishing the environmental goals are outweighed through the advantages of the brand new modifications or changes to human health, to the protection of human safety or to sustainable development;

  ❖ The useful goals served through those changes or alterations of the water body can not for motives of technical feasibility or disproportionate value be carried out through different means, which can be a considerably higher environmental option;
- ❖ It does not permanently exclude or compromise the achievement of the environmental objectives in other bodies of waters within the same river basin district and is consistent with the implementation of other Community legislation; and
- ❖ It is guaranteed at least the same level of protection as the existing Community legislation (LAW Nr. 12/2015).

These are very restrictive conditions. In order to prove that they are met, many tests must be passed. As the text of the WFD does not provide a clear guidance on how to carry out these test, one of the Annexes of the WATECO Guidance developed under the Common Implementation Strategy has elaborated a methodology to carry out the tests following seven steps:

- ➢ Step 1- Identifying and characterising the new modification/activity
- ➢ Step 2.- Assessing the impact of new modification/activity on water status
- ➢ Step 3- Identifying practical measures to mitigate the adverse effects
- ➢ Step 4- Identifying the broader impacts on water bodies
- ➢ Step 5- Assessing the reasons for the new modification/activity
- ➢ Step 6- Comparing the benefits of the new modification/activity with the benefits of avoiding deterioration of water status
- ➢ Step 7- Comparing with alternatives that serve the same beneficial objectives.

There are many similarities between the legally binding requirements and guidance provided by WATECO with the WCD strategic priorities and guidelines, specifically Strategic Priority 2: Comprehensive Options Assessment. In addition, Strategic Priority 1: Gaining Public Acceptance is mirrored in the horizontal CIS Guidance on Public Participation. Another important and legally binding requirement which refers to the obligation not to impact other bodies of water within the same river basin district is equal to Strategic Priority 4: Sustaining Rivers and Livelihoods and to Strategic Priority 7: Sharing Rivers for Peace, Development, and Security (LAW Nr. 12/2015).

The protection of water status within river basins as required by the WFD will provide economic benefits by contributing towards the protection of fish population, including coastal fish populations. The WFD requires to include those areas designated for the protection of economically significant aquatic species in the register of protected areas to be completed by 22

December 2004; e) Strategic Priority 7 and its guideline are included in the WFD preamble, articles 3(4), article 13 (2) and Annex 2.3 16. As a framework Directive, the WFD does not give answers to all and some of its requirements must be complied with following the provisions of the acquis communitaire.

The acquis communitaire shows also parallels with the WCD recommendations:

- ❖ Directives for public participation in certain environmental plans and programmes, Directive on Strategic Environmental Impact Assessment, Directive on Public Access to Environmental Information are in line with Strategic Priority 1;
- ❖ Directives 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment, on Environmental Impact Assessment are legally binding while Guidelines 4 and 5 of the WCD report are only recommendations;
- ❖ Guidelines 17 and 18 are based on SIA and on EIA.
- ❖ The SIA and EIA Directives require to carry out consultations with Member States affected by a plan, programme or project subject to them that may have a transboundary impact as Strategic Priority 7 recommends; As analysed synergies between the WFD and the WCD do exist. This is not surprising since the WCD work built on existing and recognized principles and conventions of international law and on previous similar report. Some of the WCD recommendations are already part of the of the acquis communitaire.

Although the recommendations were not specifically considered during the WFD adoption process, negotiators from the European Commission, Member States and the European Parliament were aware of the WCD work and final report which inevitably was in the minds of those negotiators.

The WCD report should always be considered as guidance since the WCD itself recognized that their recommendations must be adapted to each country or regional context. Some of the criticism levied against the WCD guidelines, in particular in terms of their complexity, thus appears unwarranted. The WCD recommendations are a valuable tool whose intention is to aid in making decision processes rational, equitable, fair and sustainable. In the EU, many of the WCD recommendation are already integrated into decision-making but some of the WCD guidelines could strengthen the provisions of the WFD.

10.6 The Water Framework Directive: Implications for New Dams

Directives are the most common form of EC legislation. They set out a result, which Member States are to achieve but leave it to the Member States to decide how that result will be reached.

This section intends to analyse the implications of the relevant Water Framework Directive (WFD) provisions, including preamble and annexes, for new dams. For the purpose of the analysis, a new dam project must be understood as a dam planned after the entry into force of the WFD and whose construction has not started yet, as well as future dam projects. The scope of the analysis is the construction of those dams whose characteristics may compromise the achievement of the WFDís objectives. This section focuses on the identification of those legal requirements applicable to new dam projects as a result of the entry into force of the WFD (22 December 2000). To carry out the intended analysis, we will focus first in the WFD provisions having a direct incidence at the time of developing a new dam project in Europe. Secondly, it will present in a table format a brief analysis of the WFD provisions that have implications for future dam projects (LAW Nr. 12/2015).

10.6.1 The WFD and new dam projects

In order to identify and analyse the most relevant provisions of the WFD for new dam projects, it is necessary to understand what a dam is and what are its main impacts in a river basin. Therefore, a dam blocks a river producing impacts on the physical, chemical and geomorphological characteristics of a basin involving alterations to fauna and changes in primary biological productivity of associated ecosystems.
The WFD establishes a common approach, objectives, basic measures and common definitions of ecological status of aquatic ecosystems.

10.6.2 The WFD objectives

One of the main goals of the WFD is to prevent further deterioration and protect and enhance the status of aquatic ecosystems and wetlands directly depending on the aquatic ecosystems. In order to achieve its goals, the most important element of the Directive is the setting and achievement of the environmental objectives by 2015 in all bodies of water (surface and groundwater), and possibly additional specific objectives that apply to protected areas as defined from other legislation. The environmental objectives consisting on the achievement of a good and non-deteriorating status for all waters (surface and groundwater) are legally binding. The non-deterioration obligation is in force since 22 December 2000 when the WFD entered into force.

For surface waters, good status is determined by a good ecological and good chemical status.

For groundwater, good status is determined by its quantitative status and its chemical status.

Nevertheless, article 4 also provides for certain exceptions to the binding environmental objectives when all the conditions that it specifies are met. Article 4(4) provides for an extension of the deadline to achieve good water status up to a maximum of two further updates of the river basin management plan except when natural conditions do not allow that status to be achieved by that date. Article 4(5) allows Member States to achieve less stringent environmental objectives, when is proved that water bodies are so affected by human activity or their natural condition is such that the achievement of the environmental objectives would be infeasible or disproportionately expensive. In both cases, no further deterioration in the status of the affected water bodies is permitted. In addition, the extension of deadlines and the possibility of achieving less stringent objectives is only allowed when:

- all the established conditions are met;

- it does not permanently exclude or compromise the achievement of the environmental objectives in other bodies of waters within the same river basin district and is consistent with the implementation of other Community legislation; and
- it is guaranteed at least the same level of protection as the existing Community legislation.

Article 4(6) allows temporary deterioration in the status of water bodies when it is the result of circumstances of natural cause or force majeure which are exceptional or could not reasonably have been foreseen when:

- All the conditions that establishes are met;
- It does not permanently exclude or compromise the achievement of the environmental objectives in other bodies of waters within the same river basin district and is consistent with the implementation of other Community legislation; and
- It is guaranteed at least the same level of protection as the existing Community legislation.

Finally, the most relevant provision for the purpose of this study as we will see below is the objective derogation provided in article 4(7). This objective derogation allows Member States to fail achieving good groundwater status, good ecological status or, where relevant, good ecological potential or to prevent deterioration in the status of surface water or groundwater when it is the result of new modifications to the physical characteristics of a surface water body or alterations to the level of bodies of groundwater. This provision also allows a failure to prevent deterioration from high status to good status of a body of surface water when results from new sustainable human development activities.

In both cases, this objective derogation is permitted when:

- All the conditions that establishes are met;
- It does not permanently exclude or compromise the achievement of the environmental objectives in other bodies of waters within the same river basin district and is consistent with the implementation of other Community legislation31; and
- It is guaranteed at least the same level of protection as the existing Community legislation (LAW Nr. 12/2015).

10.6.3 The WFD objectives and their implications for new dams

A dam is considered to be a physical alteration which realizes changes in the hydromorphological conditions and physico-chemical conditions. Though the hydromorphological quality elements are not used directly in the determination of ecological status, they could be the cause of failure to achieve good or high biological status. Therefore, building a dam in a body of water whose current status allows it to achieve good ecological status by 2015 could endanger the attainment of such a result. In addition, it could also produce a deterioration in the ecological status of that body of surface water and impact on the groundwater status (quantitative status) of a body of groundwater when that groundwater body is connected to the surface body of water where the dam is built. Therefore, the construction of a dam can compromise the achievement of good ecological status, good groundwater status and the prevention of further deterioration and then, it would be a breach of the WFD.

The European waters are already very fragmented. The WFD tries to put an end to this situation. Being a sustainable development legal instrument, the WFD has included a provision: the objective derogation, allowing to execute a project such as a dam that modifies the physical characteristics in such a way that provokes a failure to achieve good groundwater status, good ecological status or, where relevant good ecological potential or to prevent deterioration in the status of surface or groundwater bodies. However, this possibility is very restrictive in order not to make of the WFD an ineffective instrument and Member States will have to prove that all the required conditions are met. Otherwise, there will be a breach of the WFD.

The conditions that have to be met are:

- All practicable steps are taken to mitigate the adverse impact on the status of the body of water;
- The reasons for those modifications are of overriding public interest;
- The advantages objectives served by those modifications or alterations of the water body cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option;
- It does not permanently exclude or compromise the achievement of the environmental objectives in other bodies of waters within the same river basin district and is consistent with the implementation of other Community legislation; and
- It is guaranteed at least the same level of protection as the existing Community legislation.

These are very restrictive conditions. In order to prove that they are met, many tests must be passed. As the text of the WFD does not provide a clear guidance on how to carry out these test, one of the Annexes of the WATECO Guidance developed under the Common Implementation Strategy has elaborated a methodology to carry out the tests following seven steps:

- Step 1 - Identifying and characterising the new modification/activity There are two categories of modifications that may give raise to a derogation:
    - A modification to the physical characteristics of the water body, but without modifying the chemical and ecological dimensions of good water status.
    - A modification resulting from new sustainable development activities, although this can only be used for obtaining a derogation when surface waters go from high to good status.

The following questions must be answered:

1. What are the main characteristics of the modification or new activity?

2. What are the beneficial objectives served by the modification or new activity?
3. Is the new activity sustainable?
4. What is the coherence between the proposed modification/activity and existing sustainable plans and strategies?

- Step 2 - Assessing the impact of new modification/activity on water status It is only if the new modification/activity has an impact on water status that a derogation is needed. The implementation of this assessment can be done in two stages:
- Assess the new pressures related to the new modification/activity
- Assess the impact of these pressures in terms of likely changes in ecological quality or quantity of water A procedure for obtaining derogation should be initiated if the proposed new modification/activity has a negative impact on water status and if the new activity is sustainable.

In the case of a dam project that would have a negative impact on water status that procedure should be initiated. But before authorising the construction of such a dam, the following steps must be carried out in order to know whether all conditions required will be met.

- Step 3 - Identifying practical measures to mitigate the adverse effects. Whether those steps are practical or not will depend on them being both technically and financially feasible. The implementation of this identification will include:
    - Define a range of practical mitigation measures based on their:
    - Technical feasibility within the timeframe considered
    - Financial feasibility, based on their cost vs. available financial resources
    - Analyse the likely impact of these mitigation measures on the status of the concerned water body (quantity, quality, ecology)
    - Assess the total costs of mitigation measures
    - The objective derogation can only be justified if all practical mitigation measures have been taken.

- Step 4 - Identifying the broader impacts on water. For example, it will require understanding the impact of installing a water supply dam in the upstream part of a river on the water status of the rivers estuary, 50 kilometres downstream. This identification will require:
    - Assess the likely impact of the new modification/alteration/activity on the status of other water bodies within the same river basin district before mitigation measures
    - Assess the likely impact of the new modification/activity with mitigation

- Step5 - Assessing the reasons for the new modification/activity

Can over-riding public interest be invoked as a reason for the new modification/activity? The concept of over-riding public interest is not defined in the Directive. Similarly to what is specified in the Habitats Directive, it may cover issues of human health and human safety or other imperative reasons of social or economic nature.

Key elements to make that concept practical are:

❖ Ensuring that the new modification/activity is primarily to fulfil public interests, i.e: not solely in the interest of private companies or individuals;
❖ The interest must be over-riding and it must be a long-term interest;
❖ The proposed new modification/activity aims at protecting fundamental values for citizenís lives and society.

The implementation of this assessment will require analysing the following:

❖ Assess whether the new modification/activity fulfils a public service obligation;
❖ Assess whether the new modification/activity is in societyís long-term interest;
❖ Assess whether it aims at protecting fundamental values for citizens and society.

The analysis will need to be in proportion with the importance of the new modification/activity in terms of its economic impact, its impact on the quality of waters and of the environment and on sustainable development. If the new modification/activity is not justify by over-riding public interest, then article 4(7) cannot apply except if the benefits of achieving the Directiveís objectives are outweighed by the benefits of the new modification/activity to human health, human safety or sustainable development.

- Step 6 - Comparing the benefits of the new modification/activity with the benefits of avoiding deterioration of water status The implementation of this test will require:
- Investigate issues similar to those considered in analysing the sustainability statusî of new activities
    - Assess the foregone benefits resulting from the failure to achieve the environmental objectives of the Directive If the benefits of new modification/activity outweigh the forgone benefits from improved water status.

- Step 7 - Comparing with alternatives that serve the same beneficial objectives Can alternatives serve the same beneficial objectives with a significantly lower environmental impact? This analysis is similar to that carried out for designating heavily modified waters bodies. The implementation of this test will require:
    - Identify the alternative options that provide the same beneficial objectives. A wide range of cost-effective options should be considered, and not only infrastructure development that may be easier to analyse;
    - Compare the environmental impact of the new modification with that of alternatives;
    - Estimate the cost of the new modifications versus that of alternatives options. If the new modification has no alternative with significantly

lower environmental impact, then a derogation based on Article 4(7) can be sought.

We can say that this methodology developed in the WATECO Guidance follows a logical framework to take a decision similar in many points to the logical framework recommended by the WCD. If steps 3 to 7 are not passed, a dam cannot be built since not only it will be a breach of the WFD but also it could be an environmental damage under the proposal for a Directive on environmental which when passed would trigger its liability regime. (LAW Nr. 12/2015).

All Member States have established legal procedures to allow the construction of a dam. Generally, a dam promoter will obtain a licence after submitting specific documentation, proving certain conditions are met and carrying out an environmental impact assessment. In such a case, the process specified in Annex III of the WATECO Guidance or a very similar one should be opened. As the RBMP must include identification of instances, the process to prove it conditions are met should be opened to public participation.

Action plan for spill prevention, control and counter measures for kesh's facilities

The action plan for spill prevention, control and countermeasures is simple to carry out. A copy of the plan will be maintained at the site and another copy will be maintained by EMU. The key elements of the Plan are:

- General facility information
- Facility layout drawing
- Procedures for spill prevention and control
- Procedures for response to oil spills
- Procedures for detection and notification for oil spills
- Procedures for inspection and recordkeeping
- Training of facility personnel

10.6.4 General facility information

The facility information will help in quickly identifying the location of the spill and help in developing a site-specific response plan. The EMU will continually collect all facility information in a database developed in Microsoft Excel or Microsoft Access which will allow the EMU to quickly access the data when required and track the overall success of the program.

The facility information will be reviewed at least once every year to make sure all information is correct and up to date.

10.6.5 Facility layout drawing

All facilities will maintain an updated layout drawing at the site. One copy of the layout drawing will be located in the EMU office. The layout drawing will include the following information:

- Location of the transformers
- Identification of fences, secondary containments, offices in the facility
- Contour of the land
- Direction of flow of rainwater and oil in case of a spill
- Route for vehicle entry and exit from the facility
- Nearest source of water for fire fighting
- Distance and location of nearby water bodies

The drawing should also include the electrical capacity, physical dimensions and the maximum oil holding capacity of the transformers. Each tank and transformer should be identified with an identification number.

10.6.6 General procedures for spill prevention and control

General procedures for spill prevention are as follows:

- Facilities personnel shall maintain electrical equipment in good working order, including periodic painting, thus providing corrosion control. It's required to mow down the grass and the bush all around and within the Facility to 7 m away from facility's fence line. (This 7 m of clean zone is for service of free moving vehichles in emergency situations.) The facility fence line needs to be maintained and its height should not to be less than 1.7 m (according to “Safety and technical utilization of electrical equipment and installation Regulation”). Facility personnel must control and eliminate oil spills and leaks during repair and maintenance processes.
- If no concrete containment exists under transformer, we recommend that no less than 25 cm of gravel be placed under the transformer and this gravel surface must be 1 m outside of the transformer's perimeter. The Facility will have to continually remove the contaminated soil under transformers and replace the contaminated materials with clean gravel. Waste oil sludge, gravel and soil have to be placed in closed metalcontainers and be stored for further treatment in a waste treatmentfacility. These containers have to be marked with a label that says “Hazardous Waste” and the weight of the containers and the date it was filled should be written on the label. Facility personnel are responsible for

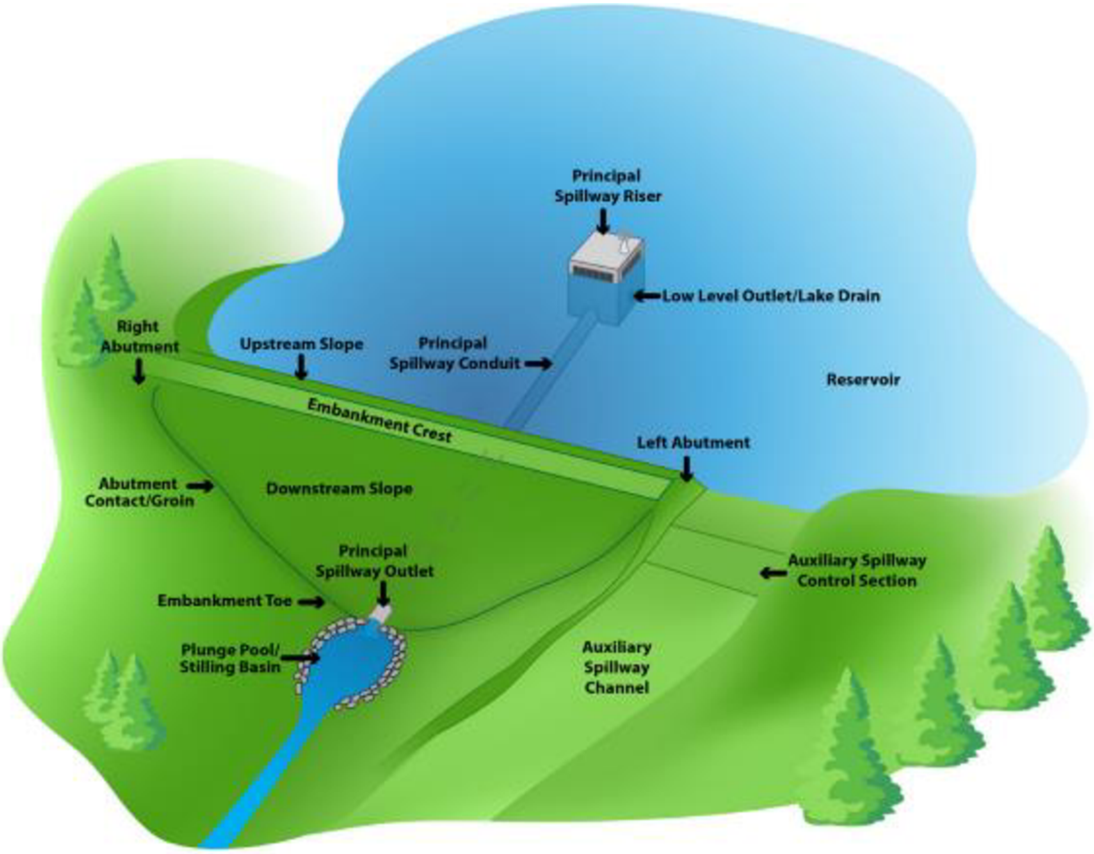
implementation and ongoing implementation of the SPCC plan.

- Each employee has to be familiar with:

    - transformer instructions (capacity, manufactured date, oil type),
    - procedures for responding to oil spills,
    - oil flow,
    - prevention measures for oil spills.

- The fueling operations should be regularly inspected by facility personnel and should be operated in a manner consistent with good management practices, which requires a provision for containing spilled oil. The small volume keys oil should be changed without oil analysis. Oil cleaning or oil analysis work must be completed according to the “Safety and technical utilization of electrical equipment and installation Regulation”, published inyear 1977.

If it's difficult to avoid oil spills caused from older equipment pails can to be used to catch drippage during oil transformers change. Also, it'srecommended that you use sand, rags, wood sawdust, etc. to avoid soil contamination from oil spills.



10.6.7 Spill detection and notification

Detection:

Large leaks are rare, but they can be occur. It should be noted, however, that substantial leakage would cause significant ecological damage to the environment, and consequently human health, flora and fauna damage through contamination of surface water and groundwater, and soil and air. It's easier to prevent spills and eliminate spills. Spill detection and notification is very important because small spills could be followed by major spills, which could be avoided. The facility personnel could discover seepage or a spill during filling operations and supplying and changing oil process. These spills should be stopped and contained in the manner described in this spill control plan.

Notification:

- Minor spills are to be recorded regularly on the "Register of Identifying Pollutionand Emergency Situations", including:
- Occurrence description, location and cause of occurrence,
- Time of discovery,
- Recording when the spill started and when the spill had been cleaned upand how long the spill lasted,
- Operations undertaken to mitigate / eliminate pollution or emergency situation,
- Responsible persons participating in the process,
- Date and time of informing Facility's Director and the EMU,

All KESH facilities must report the monthly environmental information requested to the EMU in KESH. In case of major spills they should be immediately reported the Facility Director, the EMU in KESH and if it's necessary notify the local fire authority, local government authority and the community. This notification should be made by telephone immediately if a significant spill occurs, followed bya report on the spill and the response actions taken.

10.7 Procedure for response to oil spills

10.7.1 Procedures addressing small spills

- Spills are likely to occur around insulators or fittings in the transformerscases, under the pipe joints and discharge valves, in oil tanks, etc.

Facility personnel shall carefully and continually observe and contain the oilspills.

- Facility personnel shall wipe up small leaks from tanks, transformers or oil pipes at the time of discovery. These actions shall be according to “Safety and technical utilization of electrical equipments and installationsRegulation”.

Facilities personnel should record the spillage immediately on discovery.

10.7.2 Procedures addressing major spills

- Facility personnel should immediately evacuate the facility and assemblein a designated shelter area as necessary.
- The community near the station where the oil is expected to flow shouldbe immediately informed and evacuated if necessary.
- The spill should be immediately reported to Police Fire Station, and localauthority.
- The EMU and Facility Director should be informed immediately.
- Necessary actions should be taken for avoiding contact with the oil spill, the oil flow and transformers burnout, etc. PPE such as head protection, safety shoes, gloves, work clothes, goggles and face shields should to be used during the process.

10.7.3 Procedure for inspection and recordkeeping

Regular inspection of equipment, pipes and equipment that store, transport or use oil, is necessary to prevent and control oil spills. The following inspection frequency is recommended:

Monthly inspection by the responsible person of the facility for environmental problems related with environment pollution. The records of inspection should be maintained on the “Environmental Information Register”, including the details of the inspection and dates. The Monthly Inspection Report must sent to the EMU in KESH every month. The EMU reports to Director for environmental performance of KESH facilities every three months.

Annual inspection by EMU: This inspection will be made to control the environmental conditions at KESH facilities, to determine the actions needed for improving the environmental performance, and to review the SPCC plan with respect to actual facility operation including monthly facility inspection forms. The inspection may be coincidental with annual refresh training of the facility personnel on SPCC plan.

10.7.4 Training of facility personnel

Training of facility personnel in utilizing the SPCC plan is essential for proper implementation of the Plan. It is recommended that all facility personnel undergo an initial training during initial implementation of the Plan and thereafter refresh training on an annual basis. The EMU specialists in collaboration with the Director familiar with facility environmental problems will develop the training materials. The Facility Director can also provide this training with guidance from the EMU.

The maintenance and repair group who work on electrical equipment that contains oil should be trained specifically on how to prevent spills and how to respond to spills when they occur.

“The Environmental Information Register” should include:

Environmental training and instructions, (the training date, name of instructor who prepared training and the signature of the trained employee).

Employee’s occupational health issues,

Environmental monthly information.

10.8 Action plan for preparation and withstanding emergency situations

Emergency situations that required implementation of EAP are:

- Fire
- Natural disasters (floods, high winds)
- Earthquake

According to European Norm EN 50110-1 everyone must remember that the best rules and procedures haven't any value if all employees working in, with or near electrical equipments don't completely know and don't rigorously follow up them.

The causes of fires may be:

- Natural
- Technical
- Carelessness
- Criminal intention

The major causes of fires include disposal of smoking materials, overloaded electrical outlets, misuse of space heaters, short connections, mishandling flammables, improper storage of combustibles, etc.

Materials must not obstruct sprinkler heads or be piled around fire extinguishers, or around fire alarm pull station locations.

Dispose of all trash as soon as possible in trash cans or dumpsters. Waste materials must never be piled in corridors or stairwells while waiting removal.

If any evidence is found of frayed, cracked or otherwise damaged wiring or electrical outlets, the equipment affected should be immediately taken out of service until repairs can be made.

Electrical extension cords are to be used only by authorized persons under proper and approved conditions. They should never be passed wire through doorways, never hidden under rugs or other places that can move or crush.

Space heaters, coffee makers, and all other appliances with exposed heating elements should never be left unattended while in operation, shall not be placed under desks or in other enclosed areas. They should be unplugged after each use and stored only after they are cool enough to touch (Albania_ECE.CEP.183_Synopsis).

Ensure that such appliances are operated away from combustible materials such as files, curtains, trash containers, etc.

With proper care and use, emergency situations will not occur.

Natural causes of emergencies include rainfalls that may bring floods, and may cause erosion. Erosion can also occur from poor maintenance, damage and incorrect actions in handling dams, discharging doors, draining ditches, embankments along rivers etc. Everyone should take necessary precautions, in case flood situations develop everybody must be prepared.

We can avoid ditches becoming blocked by continually cleaning and allowing water to flow freely into the ditch.

If the reservoir's drainage doesn't function, it needs to be pumped, unblocked or excavated to allow free water flow.

Attention is required for the maintenance of embankments along the rivers. This is a very important element to stop floods.

Some additional problems that can cause erosion include trees planted on or near drainage areas or dams, mountainous debris building up, etc. These situations also need attention. A temporary solution to erosion or landslides include the use of more soil, stones, gravel or sand bags to stabilize the sliding or erosion.

Earthquakes may damage people, buildings, electro energetic and telephone systems, and may bring fires, explosions and surface separation.

10.9 Emergency Plans and withstanding procedures based on environmental management system (EMS)

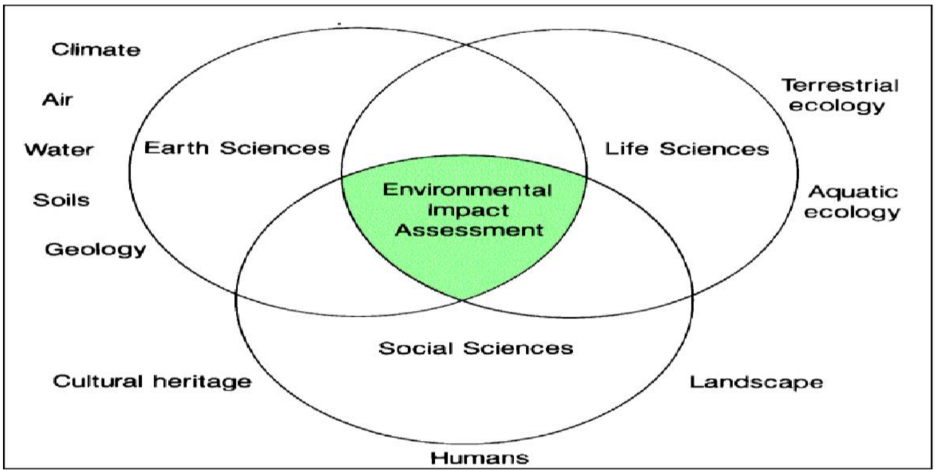
- The KESH Environmental Management Unit (EMU) has the overall responsibility for this Emergency Action Plan and this includes the following:

- Developing and maintaining a written Emergency Action Plan for regular and after hours work conditions;
- Notifying law enforcement authorities, and the Director of KESH in the event of an emergency affecting one of our facilities;
- Taking security measures to protect employees;
- Integrating the Emergency Action Plan with any existing general emergency plan covering the building or work area occupied;
- Distributing procedures for reporting emergencies, describing initial actions for employees to take to protect themselves and others, the location of safe exits, and evacuation routes for each employee;
- Conducting drills to acquaint employees with emergency proceduresand to judge the effectiveness of the plan;
- Training designated employees in emergency response such as the use of fire extinguishers, the application of first aid and evacuation ofemployees to the proper place, etc ;
- Ensuring that equipment is placed and in storage rooms or desks for protection and security;
- Maintaining records and property as necessary;
- Ensuring that our facilities meet all regulations and legal requirements.

10.9.1 Summary of Environmental Impact Assessment

Report on Summary Environmental Assessment has to be compiled by licensed natural and juridical persons, selected, contracted and paid by proposer, in this case KESH.

The request for approval of the project with prepared Report on Summary Environmental Assessment, the proposer (KESH) should submit to the Regional Environmental Agency (REA) of the region where the project will be implemented. Within the five days, the REA should either accept or reject the project classification. REA after inspection in the field of data presented in the report shall consult with local government units, with those of urban and tourism development and prepare in written its own justified opinion in favour of the approval or refusal of the project as well as propose conditions to be placed in the approval documentation and forward these conditions to MoEFWA within twenty calendar days from the day of request acceptance for review. The Minister of Environment shall establish the review commission which proposes the decisions.



Environmental declaration/ decision contains:

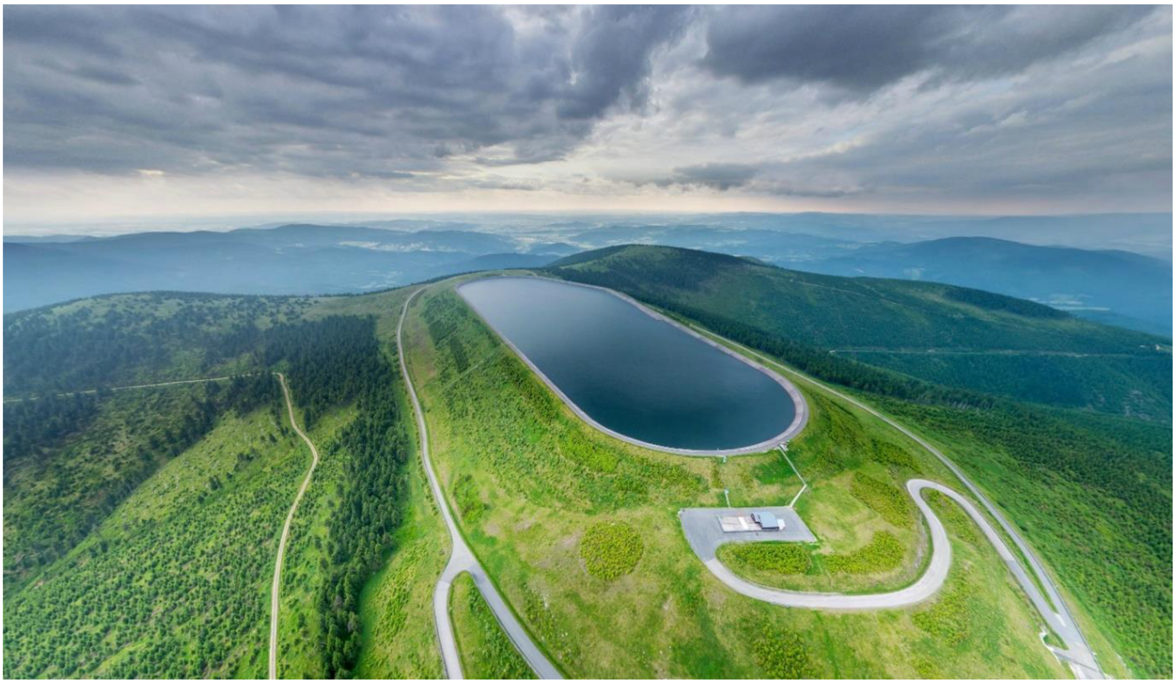
- Norms of discharges of expected pollutes in air, water and land;
- Compulsory measures based on best available techniques of construction put into use of the project;
- Compulsory measures for protection of air, water land, biodiversity and to prevent the pollution transferal from one component of the environment to another;
- Requirements for monitoring of discharges determining measurements methodology, their frequency, assessment procedure and publication of results;
- Conditions on limiting the trans-border pollution above the permitted levels;
- Additional measures to prevent surpassing of the quality norms of environment;
- The requirement of reporting and comparing determined impacts during preparation of the report with real effects of project implementation.

In addition to Law on EIA, Republic of Albania has a special Regulation on the Participation of the Public in the Process of EIA, operating since 2004.

11.0 A perfect example of a hydroelectric power station in the Czech Republic

The Dlouhé stráně Hydroelectric Power Station

The Dlouhé stráně Hydroelectric Power Station is located in Moravia, close to Loučná nad Desnou withinside the district of Šumperk. It prides itself with 3 superlatives: it has the biggest reversing water turbine in Europe, 325 MW; it has the biggest head of all power stations withinside the Czech Republic, 510.7 m; and it has the biggest established capacity within the Czech Republic, 2 x 325 MW (CEZ Group).



The power station fulfils static, dynamic and compensatory features in the energy system. The static feature lies in changing the excess strength withinside the machine into top-load strength - at intervals of surplus electricity withinside the system, specifically at night, water is pumped from the decrease to the accelerated storage reservoir; and throughout the on-top intervals, whilst there may be a shortage of energy, the power station's turbines generate electricity. The dynamic feature of the hydroelectric power station manner functioning because the system's output reserve, producing the regulating output and electricity, and taking part in the frequency law of the system. The compensatory operation enables the voltage regulation in the power station.

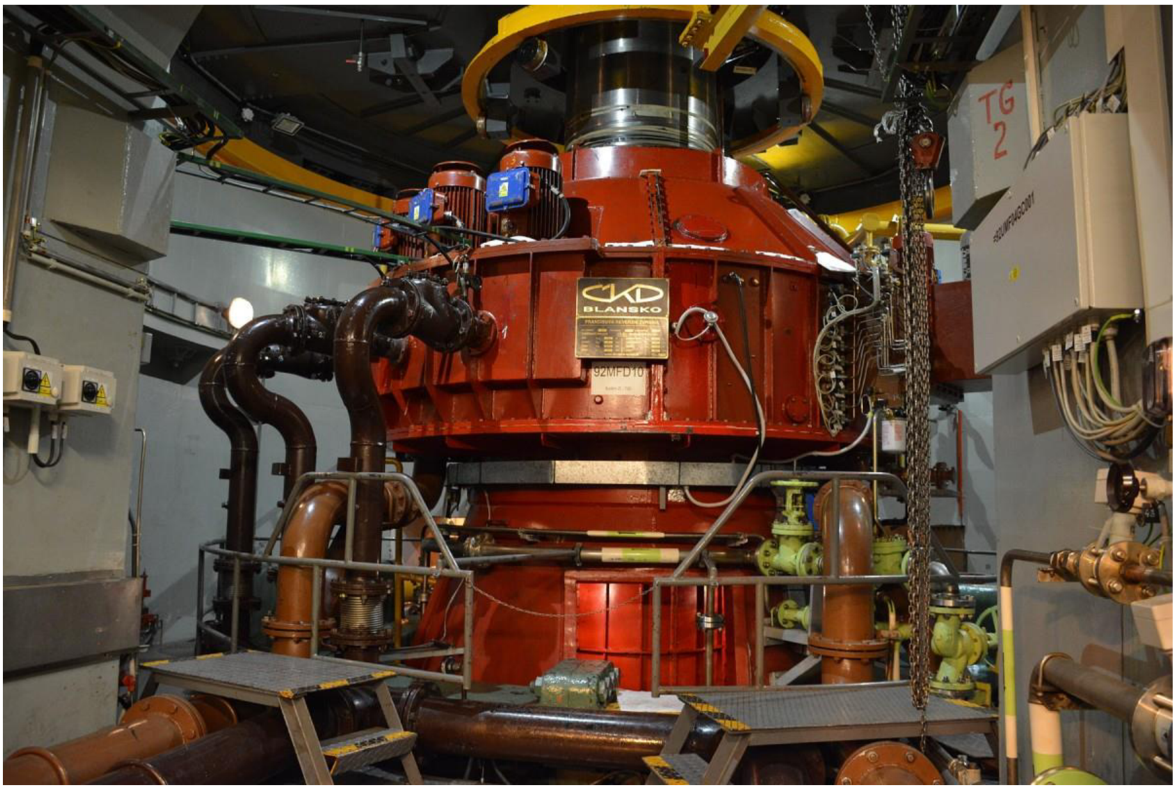
Construction at the power station started in May 1978. But in the early 1980's, the significant bodies determined to preserve up the project. In 1985, the layout was modernized, and after 1989, it was decided to finish the project. The power station became designed as an underground hydroelectric power station. Both turbine units are positioned beneathneath the ground, in a 87.5 m x 25.5 m x 50 m cavern. Next to the turbine chamber, is a transformer chamber (115 m x 16 m x 21.7 m). It consists of unit three-phase transformers, 22 kV switching rooms and different equipment.

The increased storage reservoir is linked with the underground energy station through penstocks, 1,547 m and 1,499 m long, every feeding one turbine set. The lower reservoir is in the Divoká Desná River. Its overall capability is 3.4 million m3 of water; it has a 56 m excessive dam, and its water level fluctuates through 22.2 m. The elevated reservoir is located on top of the Dlouhé stráně mountain, 1,350 m above sea level. Its overall ability is 2.72 million m3.

The station is contains with reversing turbine units, each of them rated at 325 MW. The reversing turbine's output is 312 MW within the garage pumping operation, and more than 325 MW inside the turbine operation (CEZ Group).

The management building and the control room are located at the surface, along side the outgoing traces.

Dlouhé Stráně pumped storage hydro power plant	
Generating capacity	2 x 325 MW
Year of commissioning	1996
Turbine type	Reversing Francis turbine FR 100



Picures by: ČEZ

12.0 Conclusion

Albania is geographically such a small country, in the same time with a huge capacity of water resources, which leads to a high considerable amount of produced electricity power. About 90% of the electricity in Albania, is generated from hydropower. Just for a clear visualisation, below is attached a table showing the total energy production and consumption of Albania:

Electricity	total	Albania per capita
Own consumption	5.11 bn kWh	1,800.73 kWh
Production	7.14 bn kWh	2,515.38 kWh
Import	1.83 bn kWh	643.82 kWh
Export	1.87 bn kWh	658.62 kWh

However, when it comes to the Albanian's integration into the existing or even the new EU Standards regarding the functionality of a Hydropower Plant, maintenance, or even from the beginning in the building phase, there's an intensive work ahead to be done.

While European engineering structures are currently so much advanced and provided with an accurate system of maintenance, monitoring structure and are being under investments every time something technical needs to be changed, modified or rehabilitated. Even though the technical parameters are the same between both of the hydropower plants of Koman in Albania and Dlouhe Strane in the Czech Republic and the production of the electrical energy is in such considerable level in both of cases, still the outcomes in Albania need to be under improvements for a long time.

The risk assessment and avoidance must be taken in accordance to the Directives that are being implemented within the EU. Addressing the current immediate issues that are analysed in this project proposal, there's an immediate need of rehabilitation in the dam monitoring systems, dam geological, dam alarm system etc. In case of an environmental disaster such as earthquake for example, many fatal consequences could happen, counting here the flood of the whole location (country, village), houses and properties nearby, which could deeply affect the people's lives and environmental habitats around.

Following the Water Framework Directive, Directive on Strategic Environmental Impact Assessment, Directive on Public Access to Environmental Information are in line with Strategic Priority prior to building new dams or prior to their possible rehabilitation, (specifically the Koman HPP's dams), and through creating and implementing emergency actions plans, I believe that the conditions and quality of the Hydropower Plant of Koman and generally the HPPs in Albania could be highly improved.

13.0 Appendix

Schematic drawings of the Koman HPP

Below, a few technical schemes will be shared. They show how each structure is built and every part of it is explained by the numbers below each respective picture. It'll make the understanding process easier through showing every mechanism of the whole engineering structure of the Koman Hydropower Plant.

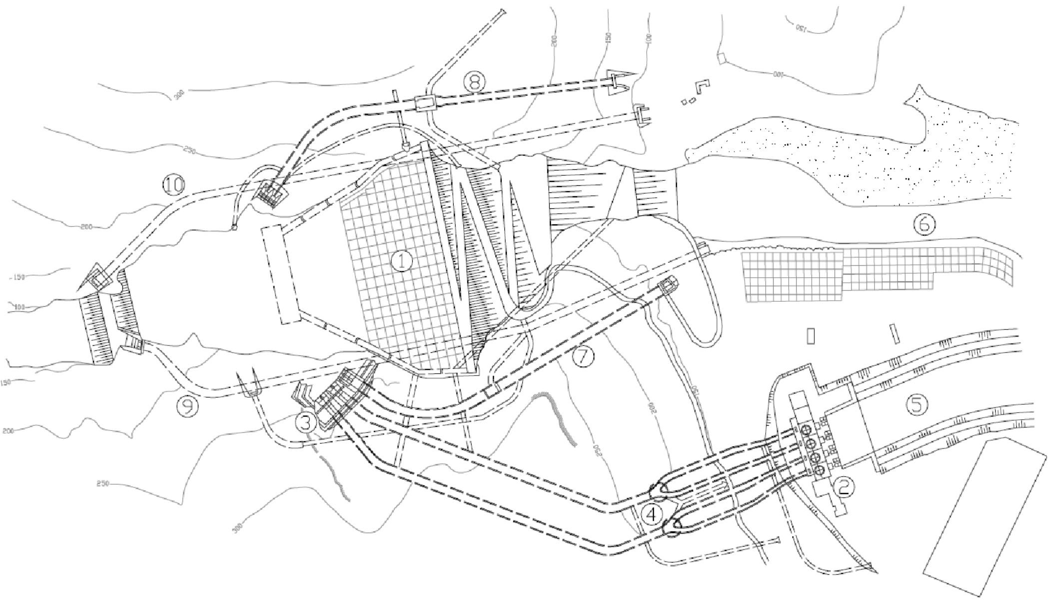


Fig. 10: Layout of Koman HPP. ⊔: Concrete faced rockfill dam, ⎯: power house, ⊔: power waterway intake, ∣ : surge chambers, : tailwater channel, ∣∣: Drin River, ∣∣: tunnel spillway No. 4, ∣∣: tunnel spillway No. 3, □: diversion tunnel No. 2, ⎺: diversion tunnel No. 1

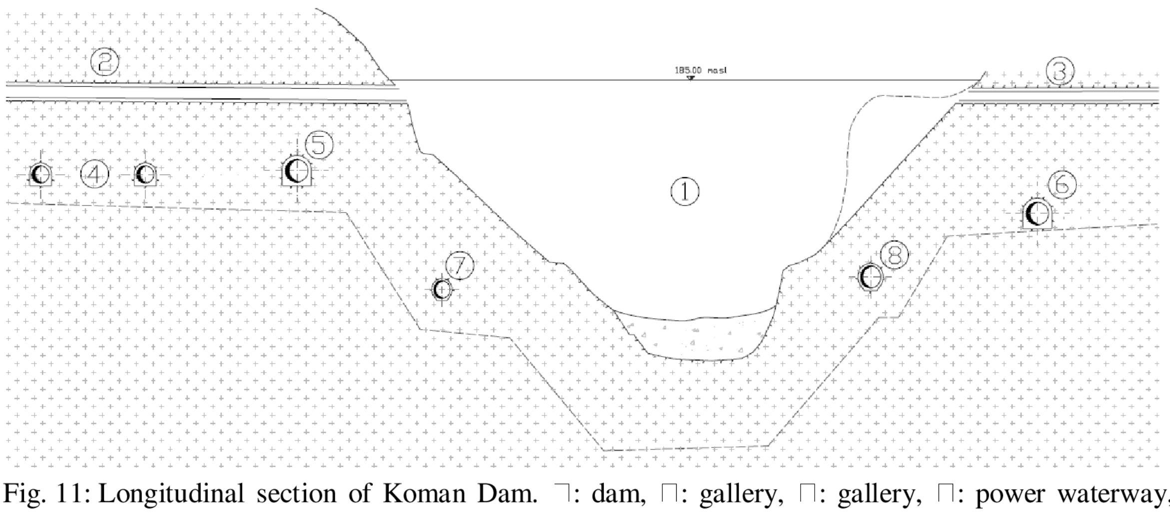


Fig. 11: Longitudinal section of Koman Dam. ⌉: dam, ⊓: gallery, ⊓: gallery, ⊓: power waterway, ⌉: tunnel spillway No. 4, ⊔: tunnelspillway No. 3, ⊔: diversion tunnel No. 2, ⎯: diversion tunnel No. 1

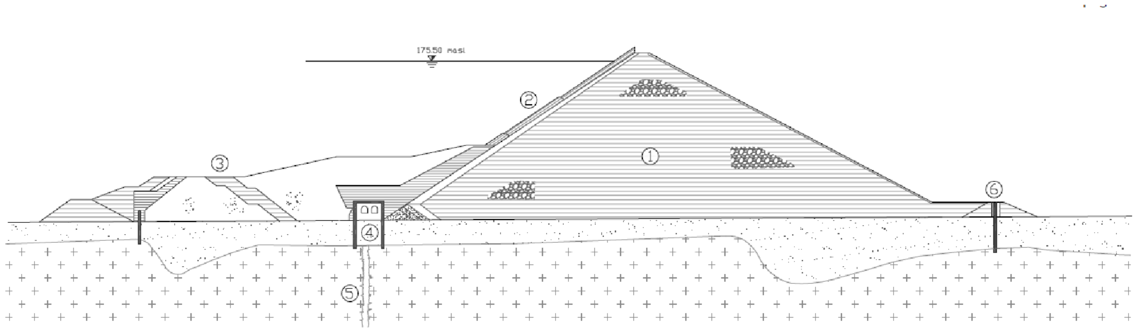


Fig. 12: Cross section of Koman Dam. □: rockfill dam, □: concrete slabs, □: previous upstream coffer dam, □: control galleries, : groutcurtain, : previous downstream coffer dam

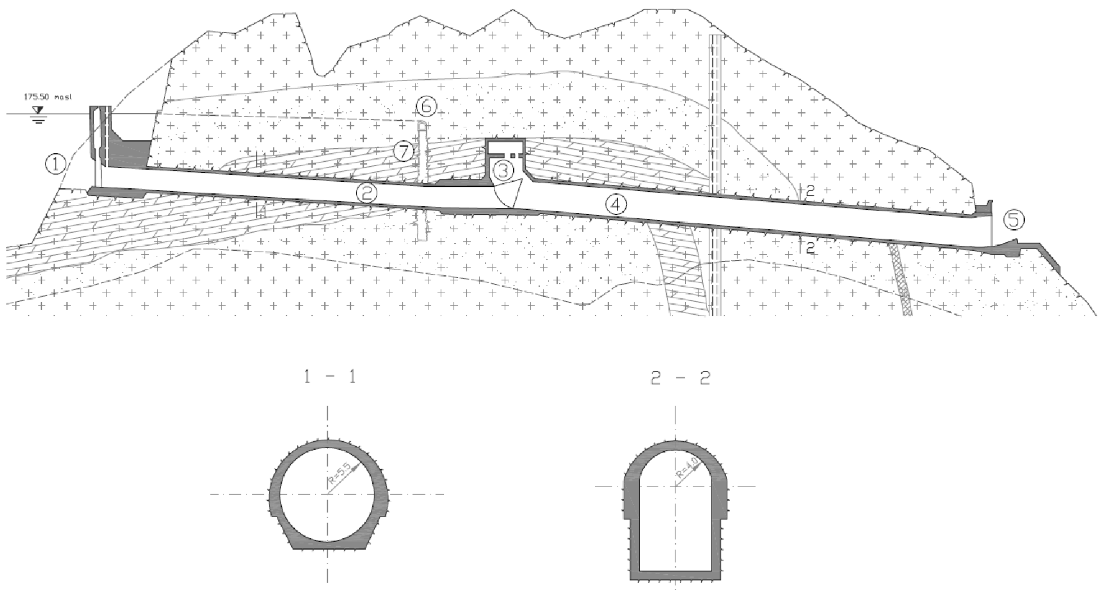


Fig. 13: Longitudinal profile of tunnel spillway No. 4. □: spillway intake, □: pressure tunnel, □: spillway gate, □: free flow tunnel, □: flipbucket, □: access gallery, □: grout curtain

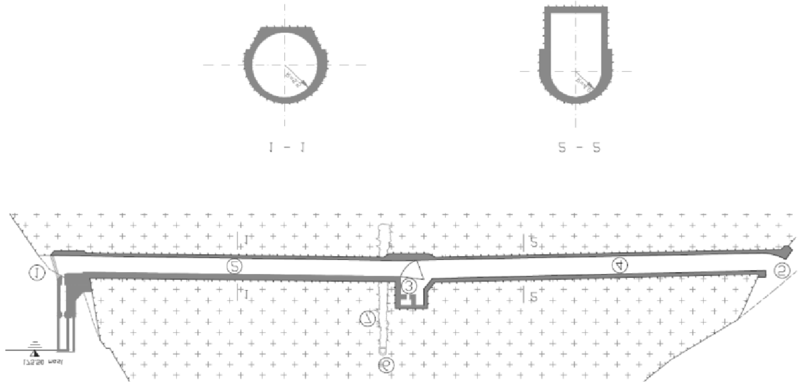


Fig. 14: Longitudinal profile of spillway tunnel No. 3. □: spillway intake, □: pressure tunnel, □: spillway gate, □: free flow tunnel, □: flipbucket, □: access gallery, □: grout curtain

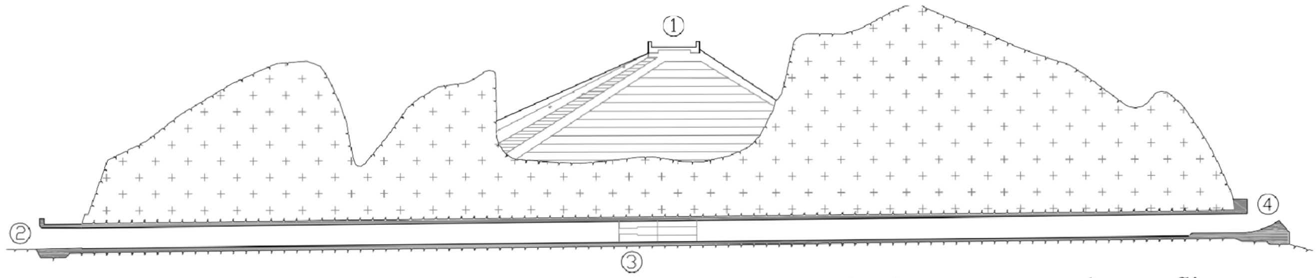


Fig. 16: Longitudinal profile of diversion tunnel No. 2. □: dam, _: intake, _: concrete plug, _: flip bucket

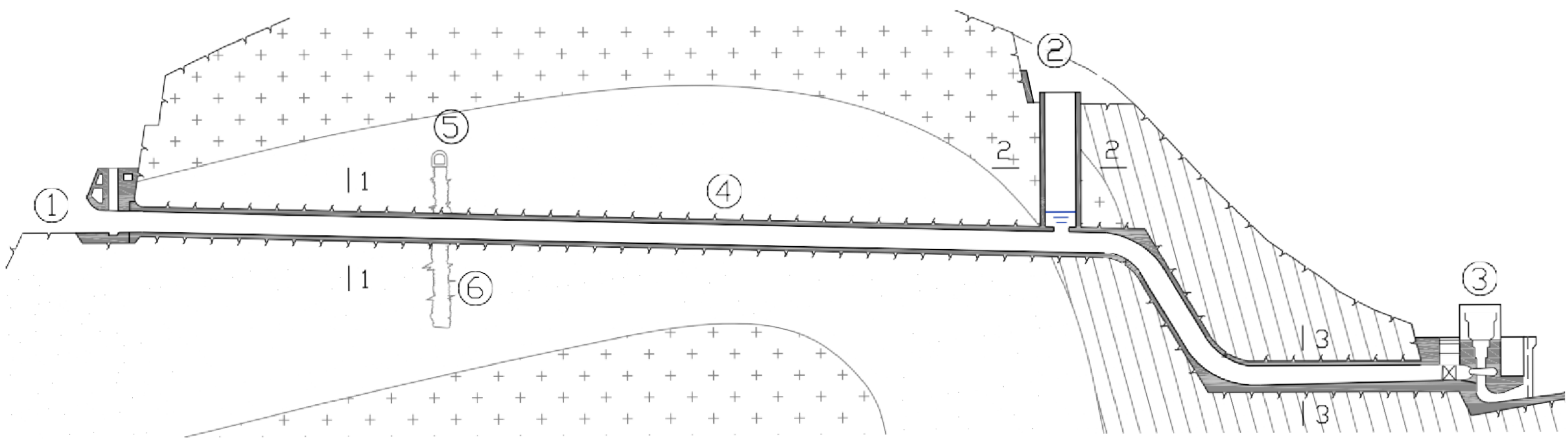
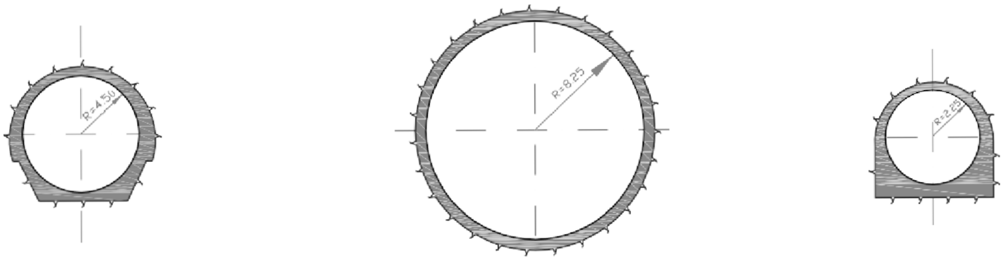


Fig. 17: Longitudinal profile of power waterway. □: power waterway intake, □: surge chamber, □: power house, □: pressure tunnel, □: access gallery, □: grout curtain.



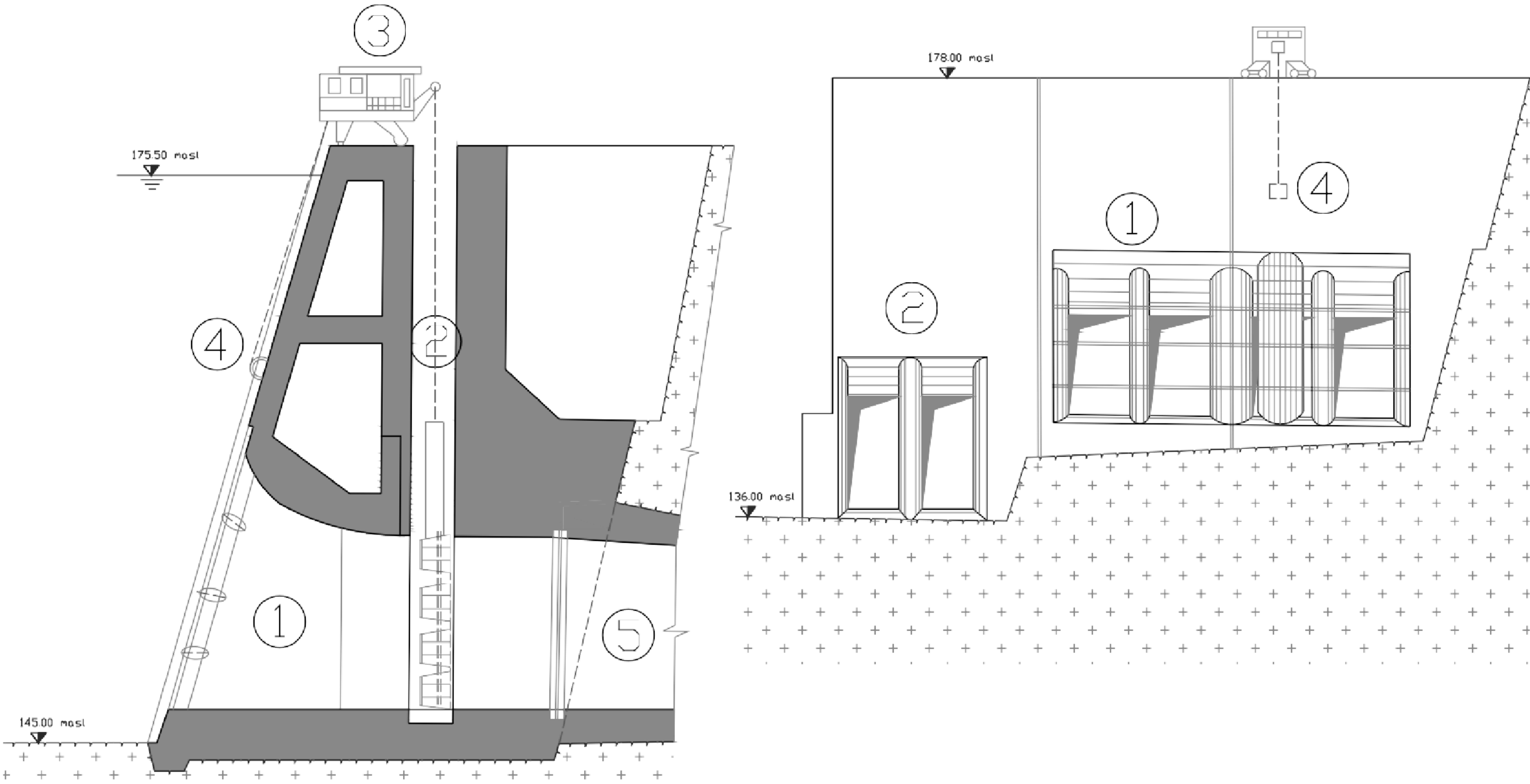


Fig. 18: ①: power waterway intake, ②: stop log shaft,

③: gantry crane, ④: trash rack cleaning equipment,

⑤: power waterway.

14.0 References:

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