PDG Para	Issue	Compliance description	Compliance Conclusion
Section 1: Purpose of the guidance			
1~12	**Background**	-	OK
Section 2: Navigation			
13~19	**Background**	-	OK
1- General requirement			
20	On stretches influenced by hydropower developments, the terms of reference of all the hydropower developments shall refer to the same definitions of Highest Operating Level (HOL), Normal Operating Level (NOL), and Lowest Operating Level (LOL).	1. Maximum navigable flow is the 3-years flood accounting for 17,800 m^3/s 2. The minimum navigable flow is 1,495 m^3/s which correspond to a downstream water level of 199.62 m after the completion ot the HPP and taking into account 1m of bed incision (220.62 m before).It is argued that the minimum water level is taken as the water level with 95% assurance rate which need to be checked on the H/Q to insure full compliance.	OK
21	On free-flowing stretches, the terms of reference shall be defined by reference to hydrological statistics specifying Lowest Navigable Level (LNL), Mean High Navigable Level (MNL), and Highest Navigable Level (HNL).		OK
22	The ship locks must be capable of raising transiting vessels from the downstream hydropower development level to the upstream hydropower development or water level, or correspondingly, lower transiting vessels from the upstream hydropower development level to the downstream hydropower development or water level, during all periods of authorized navigation on the Mekong River.		OK
23	The maximum head (difference between Highest Operating Level and Lowest Navigable Level or Lowest Operating Level if there is a backwater effect from a downstream development) of one	The maximum navigable water level difference between the upper and lower reaches of SANAKHAM: 220-199.62=20.38m, therefore it is suitable to use	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
	chamber shall be 30m. Locations that require the ability to traverse a height greater than 30 meters should use two locks in a series (tandem) arrangement.	one single lock.	
2- Dimension and Design Vessels			
24~27	Dimensions and design vessels	-	OK
3- Lockage time and availability			
28	Lockage time shall be a significant factor in determining the design. The objective shall be to develop an overall design that ensures lockage time is kept to a minimum; is consistent with safe operation; and fully takes into account the safe movement of vessels into and out of the locks.	-	OK
29	The total time for a complete lockage (target lock cycle) by the design vessel through each lock complex shall not exceed 30 minutes for a one - step lock and 50 minutes for a two - step "tandem lock". All times are for a design vessel in fully laden condition.	-	OK
30	The emptying/filling system shall be designed to conform to the requirements for maximum transit times and allow for the smooth and safe lockage of any type of boat smaller or equal to the dimensions of the design vessel. Regarding this objective, the design criterion shall be: Max hawser forces ≤ 1‰ x water displacement of the vessel (in tons).	According to regulations of USA's Hydraulic Design Of Navigation Locks (1 May 2006): "Barge tows. For various sizes and numbers of barges in any location in the lock chamber, the hawser stress as extrapolated from a model does not exceed 5 tons. "However, China's Ship lock water conveyance system design specification (JTJ306-2001) stipulates that longitudinal allowable mooring force is 25kN of 500t class ships berth in chamber lock. So we can see Chinese hawser force criteria is more conservative than that of USA, so the design of hawser force is safe according to Ship lock water conveyance system design specification (JTJ306-2001) standard .And also	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
		the hawser force of 500t vessel is obtained from physical test, the maximum hawser force is 16KN, it is less than the allowable force (25KN), so the design is safe.	
31	The locks should be designed to operate at least 12 hour a day, every day of the year. Each lock complex shall be operational at least 98 percent of its scheduled.	Additional explanation has been reflected in rewrited feasibility report. In the later design, operation and management of the ship lock facility, those requirements in the PDG will be well taken into account.	OK
32	Outages related to incidental breakdowns, unscheduled maintenance and other unexpected outages, such as those resulting from collisions, extreme weather conditions, or causes beyond human control shall not exceed 2 percent of the operating time each year.		
33	Service outages for scheduled maintenance shall be on 9 consecutive days (one working week and the two Week-ends) each year, during the same period for the whole Mekong mainstream waterway. The official body in charge of navigation coordination along the Mekong River will be responsible for specifying the dates for servicing.		
34~52	location and alignment、Construction、Service life、Expansion、Chamber equipment、Design, operation, safety and maintenance	-	OK
Section 3:Fish passage			
3.1 Background			

PDG Para	Issue	Compliance description	Compliance Conclusion
53	The Mekong supports the world's largest inland fishery, with an average of approximately 2.6 million tonnes harvested annually from the Lower Mekong Basin (LMB). Fisheries supply 49 - 82 percent of the animal protein consumed in the LMB. The livelihood benefit of the resource, in terms of nutrition, income and employment is critical, particularly for millions of the rural poor, who have few other livelihood options. The Mekong is second only to the Amazon River in terms of biodiversity.	The ESIA has reported procedures for fish sampling, some characteristics of fishing gear used, market research and visiting fishermen. The study area has covered the main area of influence of the project with a clearly map of the sampling sites location. Many kinds of fish passage facilities have been compared and the bypass fish way has been chosen as the fish passage way. The fishery research station will also been built by the Project. And the more studies before the construction of the dam are planned. They will take great part in the protection of fish resource and biodiversity.	OK
54	Migration between spawning and feeding habitats in different locations in the river system is an inherent part of the life history of many commercially important species in the Mekong. If these fish populations cannot complete their natural migrations, breeding is reduced and fish populations decline; in many cases this may lead to a complete loss of migratory fish.	Given the scenario regarding to the fish fauna and the reproductive cycle of the fish species in the area of influence of the future SANAKHAM HPP, with a view to the management and conservation of fish species, it is recommended: 1) to study, monitor and control introductions of species (exotic and allochthonous); 2) to monitor the endemic species of fish in relation to the spatial and temporal abundance variations and reproduction, and; 3) to determine the preferred spawning habitats and initial development, and possible changes that may occur with enterprise. The determination of spawning areas and initial development of the fish species will be critical to the assessment of possible variations in reproductive activity by checking the possible impacts on recruitment with the formation of the reservoir. This information is essential to better understand the population dynamics and consequences of environmental variability, affecting the early stages of fish life and, subsequently, the variability of recruitment, reflected in the stocks of the species	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
55	Fish migration occurs in both an upstream and downstream direction. Upstream migration generally consists of adults, actively swimming to spawning grounds. Downstream migration involves all life history stages, including eggs and larvae which drift in the current, juveniles of limited swimming ability and adult fish. This varies depending on the species concerned.	The EIA has done the investigations which meets the requirement. It will be done at the detailed design stage again to get the further information.	OK
56	Dams and falls are physical barriers across rivers that interrupt fish migrations both upstream and downstream. They also alter flow regimes in the river, which impacts on the capacity of fish to migrate.	It will impact the fishes just like the Falls in nature. But the mitigation measures such as fish way and fishery research station are planned to mitigate the adverse impacts to a minimum level.	OK
57	Not all Mekong fish species will be affected by dams. Grouping Mekong fishes into different behavioural guilds shows the different levels of vulnerability to the effects of dams, as listed below. Table 1 shows fish guilds in the Mekong and the likely impact of mainstream dams on migrations. Highly vulnerable guilds are shaded grey.	It has been done many works in EIA stage, which will be carried out further survey in detailed design stage.	OK
58	The size of the migratory fish resource at risk from dams (guilds 2, 3, 8 and 9 above)on the Mekong mainstream has been estimated at 0.7 - 1.6 million tonnes per year (equivalent to approximately 30 - 60 percent of the annual catch in the Mekong). The analysis also indicates a first sale value for the resource of US$1.4 – 3 billion per year. This is a conservative	Fish resource is very important to the economic and biodiversity. The developer values great importance to the fish resource protection. For example, they plan to build the fish way, using the fish friendly turbine and so on.	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
	estimate, because it does not take into account the economic benefits that flow through the economy from the trade and processing of fish products		
3.2 Guidance on fish passage design and operation			
59	Movement of fish past the barriers may be possible only if effective fish ways can be designed to accommodate the biology and numbers of migratory fishes in the Mekong. On large volumes of migratory fish in the Mekong. Problems are also encountered for downstream migration, mainly because of the mortality of fish passing through turbines and over spillways. Consequently, a number of different options for fish passage upstream and downstream need to be considered for the range of species, volume of migrations and flow conditions encountered at a dam site.	Sanakham Hydropower Project has a small water head difference between its upper and lower reaches, and there is a tributary on the right bank about 1km downstream of the dam site. According to the comparison based on the topographical conditions, the bionic fish passage adopted by Sanakham Hydropower Project is the most suitable engineering measure for fish migration.	OK
60	Fish passage facilities for both upstream and downstream passage must be incorporated into all dams on the mainstream.	Yes, it is incorporated in the Right part of the dam.	OK
61	The developer should provide effective fish passage upstream and downstream. Effective fish passage is usually defined as “providing safe passage for 95% of the target species under all flow conditions.” 2 The success rate for fish passage both upstream and downstream necessary to ensure continued population viability can be refined for the particular species	The bionic fish way was designed and will meet the passage efficiency requirements.	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
	concerned, based on its life history and the number of dams the species may have to pass to complete its life - cycle.		
62	Where fish passage rates are unlikely to be adequate to maintain viable populations, the developers must develop and propose mitigation options as one element of compensation programs for lost fisheries resources.	Fish passage observation station is proposed in the Report on Fish Passage Facilities for Sanakham Hydropower Project for monitoring the performance of the fish passages and the observation station can also be used to conduct ecological hydraulics and aquatic organism experiments.	OK
63	Consideration should be given to multiple systems at each site to cater for the large number of species and high biomass, especially given the variable flow regime and lack of biological knowledge on behavior of migrating species.	It was a systematic project to fish passage. The bionic fish way, fish passage observation station and monitoring plan was designed to work together, which must cater for the migrating species. The developer values more importance on it at the same time.	OK
64	The planning and design of the fishways should be fully integrated into the dam design concept from the earliest stages of planning. Many aspects of dam design need to be integrated with fish behaviour and fish passage facilities, including the dam axis; abutments; training walls; gate design; hydro draft tubes; and sill level in tailwaters. These elements need to be designed to ensure fish are guided to the fishways by creating flows that are laminar and parallel with the river centreline and by minimising lateral and rolling flows. Numeric and physical models of the dam and adjacent river are necessary to accurately predict flow patterns, and hence dam and fish passage design.	The layout of fishways of the SANAKHAM HPP fully considers the relationship between the layout of the dam structures and the fishways, and they are integrated and do not conflict with each other and do not cause any influence or interference. At the design stage of the SANAKHAM HPP, a special hydraulic model test has been made to accurately predict the water flow pattern as the basis for the design of the fish passage. In the design of the fishway of the SANAKHAM HPP, the successful Chinese fishway cases were fully investigated, and the data of internationally successful fishway were collected and the experience was fully incorporated into the fishway design of SANAKHAM HPP.	OK
65	Developers are encouraged to utilise best international practice in	Given the fish expertise, the developer must and will employ the core expert	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
	fish passage design and be aware of the outputs of the MRC Fisheries Programme and ensure that a "core expert group" is retained.	group to help carry out all kinds of fish protection activities.	
66~71	Biological/ecological	In the design process of the fishway of SANAKHAM HPP, according to the above requirements, the target types, physique, quantity, and season of the fish were demonstrated and determined. The fishway of SANAKHAM HPP is a mimic natural passage. The designed fish size is about 60cm on average and the bottom of the fishway is 5m wide. The fish passage is close to the natural river and can meet the fish size required by the Guidance. The swimming ability test of fish will be carried out at the subsequent stage, and the fishway design will be further detailed on the basis of the test results.	OK
72~74	Hydrology	The operating water level, entrances and exits of the fishway of the SANAKHAM HPP are all provided in accordance with the above requirements. The fishway of the SANAKHAM HPP is a mimic natural bypass channel where the environment is closest to the natural river state. This can minimize fish injury and entrapment.	OK
75~80	Hydraulic environment	In accordance with the topographic conditions of SANAKHAM and the project layout, the mimic natural fishway is arranged on the terrace of right bank, where a total of two fishway entrances are arranged. One is arranged near the estuary of the Nanmu Hong River, a tributary of the Mekong River, and the other is arranged near the upstream of the estuary of the Nanmu Hong River in the mainstream of the Mekong River. Both entrances of the fishway are located in areas with obvious water flow attraction, and the fish attraction effect is reliable. In addition, a water replenishing facility is provided at the entrance of the fish, and water is diverted from the reservoir to the water replenishment point to increase the effect of the jet-flow to attract fish. The above design satisfies the requirements for the entrance of fishway in the	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
		Guidance. In order to better guide the fish into the entrance of the fishway, an electric fish screen is arranged downstream of the SANAKHAM HPP. One side of the electric screen section is located about 10m upstream of the right bank of the mimic natural fishway entrance, and the other is fixed at the downstream training wall of the powerhouse/dam. They meet the requirements in the Guidance. The fishway exit is arranged away from the flood sluice, and the ascending/upgoing fish can safely enter the reservoir area without being brought back to the downstream by the flood sluice.	
81~84	Operation	The fishway of the SANAKHAM HPP adopts a mimic natural bypass passage. One of the entrances is located in the Nanmu Hong River, a tributary downstream of the dam. The water quality in the fish passage is similar to that of the natural river, which can meet the requirements in the Guidance. The design flow in the fishway meets the need to guide the fish. The entrance of the fishway is provided with gate and water replenishment facilities to adjust the flow velocity.	OK
85~89	Monitoring and evaluation	In the fishway design of the SANAKHAM HPP, a fishway operation and fish monitoring plan is developed, and the monitoring costs are included in the project cost (investment).	OK
Section 4:Sediment transport and river morphology			
90~119	Background; Reservoir sedimentation; Strategies to sustain reservoir capacity; Mitigating downstream sediment starvation; Managing sediment in a cascade of dams	-	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
120	Developers should design mainstream dams to pass fine suspended sediment and coarse bed-load material in a way that most closely mimics the natural timing of sediment transport dynamics in the river.	Designed as a power station in river channel, Sanakham HPP will generate power with the inflowing water and the reservoir has no regulation and storage capacity. Therefore, operating mode of the reservoir is proposed on the basis of the reservoir area condition and the water-sediment characteristics. Luang Prabang hydrometric station is taken as the key station for survey of inflow flood (generally the duration for flood running from the Luang Prabang hydrometric station to Sanakham dam site is 1~2 days). The peak flood discharge at Sanakham damsite in case of a 3-year flood occurred at Luang Prabang hydrometric station is 15400 m^3/s. According to the sediment characteristics of Mekong River, the sediment volume is mainly concentrated in the wet season, especially when flood occurs, when the incoming flow is more than rated flow 5801 m^3/s, bottom hole, sediment flushing gate and the flood gate opened gradually, reservoir water level maintains at 220m; when the discharge is greater than 15400 m^3/s, gradually increase the gate opening and reduce the reservoir water level, If incoming flow is higher than the 3-year frequency flood discharge of 17,800m^3/s, all gate should be opened, the flood passing and sediment discharging are basically approached to the natural channel, the sediment is prevented from depositing in the reservoir, and partial sediment in the reservoir will be carried away at the same time. According to Preliminary DG of LMB Mainstream Dams, water level shall be lowered to transport sand and flush partial sediment in the reservoir area according to the sediment monitoring after the power station putting into operation. Detail design is shown in the report of "SEDIMENT MANAGEMENT". Refer to Fig.1 in Attachment.	OK
121	Dams and intake structures should be designed to minimize the deposition and entrainment of sediment near the dam ensures long-term safe operation. Particular care should be taken to avoid sediment eposition that poses risks for the safe working of	The powerhouse of Sanakham Hydropower Project is located at the middle of the river. There are 5 bays of flood-discharge sluices arranged on the right bank, of which, 4 bays are the bottom outlet with a breast wall. The opening size is 12.5m×16m (width × height), the inlet invert elevation is 192.0m. The	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
	the flood passage capacity of the dam.	other open-type bay is arranged for discharging floating debris, with an opening size of 12.5m×22m (width × height) and an inlet invert elevation of 198.0m. There are 13 bays of flood-discharge sluices arranged on the left bank, all of which are open type, with an opening size of 15m×22m (width × height) and an inlet invert elevation of 198.0m. A silting sill is arranged in front of the inlet of the powerhouse, and a sediment flushing outlet is arranged at the inlet gate pier to discharge the silt in front of the inlet. According to the results of the model test, the sediment flushing effect is very good, and the sediment deposition in front of the dam is limited, which will not affect the normal operation of the f flood-discharge sluices and the ship lock, and there is no sediment deposition in front of the powerhouse inlet.	
122	Owners / operators should develop and implement a sediment monitoring program. This would routinely monitor reservoir sedimentation, particularly for deposition at the head of the reservoirs during the operation phase, and take and adjust mitigation actions when needed.	Overall design report of sediment monitoring system have been complied, show in the report of "Overall design report of sediment monitoring system". Details regarding techniques, devices and survey frequency are include in the report, The total expense for sediment monitoring is also adjusted.	OK
123	All planned sediment management strategies should be thoroughly evaluated and subject to independent expert review for their likely effectiveness and impact prior to implementation at the developer's expense.	Sediment management report has been complied, Detail design of sediment management strategies is shown in the report of "SEDIMENT MANAGEMENT".	OK
Site Selection and Design			
124	Developers should consider alternative dam sites at the feasibility stage (within the general location),with a view to select sites whose natural attributes, combined with the hydraulics of the river flow at the site best facilitate passage of sediment.	In the feasibility study, two damsites (upper damsite and lower damsite) have been studied and compared. The upper damsite is located in a relatively smooth and straight section, and the lower damsite is situated in a curved section. Taking into account the water and sediment dynamics, as well as	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
125	Natural channel features such as bends upstream of the proposed dam sites should be reviewed in the design stage. The potential of such bends to focus the bed load on the inside of the bend during high flow periods, and thereby reduce sediment problems at the proposed turbine intake locations should be considered. Dam layouts, including the location of the turbine intakes, low level outlet and spillway gates should be planned accordingly.	characteristics of water and sediment movement in a bend section, sediment is prone to deposit at a convex bank, which would be unfavourable for sand transport. From the sediment point of view, the straight upper damsite is favourable flood and sediment discharge; while the lower damsite in a bend would inferior to the upper damsite in flood and sediment discharge. However, a rational project layout can solve the sedimentation problem. As demonstrated by the physical model test, with the proposed layout plan at the lower damsite, circulating flow in the bend would be dramatically weakened under the normal operating condition. Though there would be small amount of sediment accumulation in the approach channel, the bottom elevation of the upper approach channel is relatively low, which is the requirement for navigation during the construction period. So little sediment accumulation would not threat the navigation process, and further with the sand flushing operation of the reservoir, the sediment buildup in front of the dam can be limited within a permissible range. The proposed lower damsite for Sanakham Project is the outcome of comprehensive consideration of the project layout, water energy utilization, construction arrangement, as well as technical and economical comparison. ➢ In geology, both the upper and lower damsites can satisfy the geological requirements for building a 60m-high concrete gravity dam; ➢ As for the project layout, a second ship lock line can be laid out at the lower damsite to make use of the saddle on the left bank, so that the second ship lock construction would not interfere with the first ship lock operation. And the fish pass to be arranged on the right bank has the merit of the Nam	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
		Hueang River in the downstream. Relatively low artificial slopes would be excavated out on the two gentle slopes along the lower damsite axis. ➢ In the construction viewpoint, the left bank at the lower damsite is flat and gentle, and a terrace lies on the right bank, which would be favourable for construction layout. The lower damsite valley is relatively wide, so a staged diversion plan would narrow the river channel to a smaller magnitude. And the lower damsite is nearer to the quarry site at Basau. ➢ From the energy aspect, the lower damsite will enjoy 0.28m higher head compared to the upper damsite. ➢ The model test has justified that, with an appropriate layout plan, flood discharge and sediment flushing problem can be properly solved. After completion of the project with 13 flood sluices on the left side and 5 flood sluices on the right side, the river reach at the damsite would have been shifted from a curved channel to a bifurcated channel. When all the flood sluices are fully opened for flood and sand discharge under different-frequency floods, the discharge ratio of the left branch to the right branch is 2.13~2.76. Sediment movement test also suggests that, most inflow sediment will be mainly discharged downstream through the left 13 flood sluices, and the remaining amount will be discharged through right 5 sluices. Thanks to the large discharging capacity of the dam, proper coordination of the left and right flood sluices could effectively decrease the elevation of the sediment buildup in the reservoir area near the dam front, which will create a fair condition for water intake, sand prevention, riverbed stability in the ship lock upstream and necessary water depth for navigation purpose.	

PDG Para	Issue	Compliance description	Compliance Conclusion
126	The dam should be designed to allow for sediment routing (pass-through) and periodic drawdown to enhance sediment flushing. Sediment bypass channels and sediment traps may be considered as additional strategies for sediment management.	Two-dimensional Sediment Numerical Simulation of Sanakham HPP have been carried out, during the design the project layout have considered the calculation results, “As the calculating results of the model, the sediment traps can effectively intercept coarse sediment from entering the turbine”. After independent review by CNR, according to opinions of the review experts, basic information about hydrology, sediment, etc. has been updated, and the project layout has been adjusted. The research institutes have be commissioned to recalculated the plane two-dimensional sediment mathematical model of the project area and three-dimensional sediment mathematic model according to the latest results. According to Preliminary DG of LMB Mainstream Dams, water level shall be lowered to transport sand and flush partial sediment in the reservoir area according to the sediment monitoring after the power station putting into operation. Detail design is shown in the report of "SEDIMENT MANAGEMENT".	OK
127	Developers should employ the best possible technology for sediment investigation and modelling of sediment transport in 3-dimensional flow environments to assess how sediment deposition (and downstream erosion) problems can be minimized. In this respect: i. Mobile bed physical hydraulic models should be used (ideally at feasibility, but if not at the detailed design stage) because of their strength in simulating the complex nature of the hydraulic performance and flow passage past the dams and critical structures. ii. One focus in modelling should be minimizing deposition at or near the spillway gates, and on minimizing entrainment of sediment through the turbines (in addition to hydraulic modelling of fish passages, as noted previously in section 3, paragraph 64).	During FS design,1D,2D sediment mathematical model and mobile bed physical hydraulic models have been carried out. after Independent evaluation by CNR, according to the Expert opinion, Suspended load sampling was carried out at Sanakham HPP on 1 May 2015 - 30 Apil 2016, show in the main report of "Hydrology and sediment". The result of CNR is coarser, Considering the uncertainty of the sediment gradation and the expert's opinion, CNR sampling result is adopted during the design. According to the result, one-dimensional model and two-dimensional model has been corrected, and adds the parameter sensitivity analysis, show in the report of " Reservoir Sedimentation and Backwater" and “Two-dimensional Numerical Simulation and Calculation Report of Reservoir Sedimentation”. After independent review by CNR, according to opinions of the review experts, basic information about hydrology, sediment, etc. has been updated, and the project layout	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
	iii. Physical hydraulic modelling with mobile bed simulation should also be used to clarify locations where scour and deposition will be most severe, and to identify practical mitigation solutions. iv. Detailed scenarios for reservoir sediment deposition and scour should be developed in the detailed design phase, based on an understanding of factors such as the extent of the flooded areas of the future reservoirs, their seasonal fluctuations, and presence of bed rock outcrops and the influence of tributaries. v. An approximate assessment of the depth of the deposits at the head of the reservoirs should be established. vi. Predicted locations where future development of mid-channel islands and future changes to the river thalwegs will occur should be identified.	has been adjusted. Physical model test have been commissioned to be conducted by Sichuan university, the work is in process now. After the work is completed, a research report will be provided. Sediment tour gauging are carrying out in Sanakham station, Test item include sediment concentration and grading.	
128	Appropriate gates should be incorporated into the dam design to allow sediment passthrough and periodic sediment flushing: i. The dam design should include not only bottom gates to pass/flush the sediment, but also releases from mid-level gates (or spillways) and to allow dilution of the highly concentrated bottom waters that are released. ii. Large bottom gates need to be included in the dam design for pass-through of density currents and flushing of coarse sediment. Bottom gates should be located as low in the dam as possible, as wide as possible, and in sufficient number. iii. Fail-safe provisions, such as stop logs or additional gates, for dewatering the structures immediately upstream and immediately downstream of the bottom gates should be provided, in order for cleanout in the event of blockage.	The Sanakham Hydropower Project has the characteristics of “small head difference between upstream and downstream reaches” and “large flood discharge flow”. Therefore, the flood release structure is of the layout “14 bays of flat-bottom open-type flood-discharge sluices + 4 bottom outlets”. The powerhouse of Sanakham Hydropower Project is located at the middle of the river. There are 5 bays of flood-discharge sluices arranged on the right bank, of which, 4 bays are the bottom outlet with a breast wall. The opening size is 12.5m×16m (width × height), the inlet invert elevation is 192.0m. The other open-type bay is arranged for discharging floating debris, with an opening size of 12.5m×22m (width × height) and an inlet invert elevation of 198.0m. There are 13 bays of flood-discharge sluices arranged on the left bank, all of which are open type, with an opening size of 15m×22m (width × height) and an inlet invert elevation of 198.0m. A silting sill is arranged in front of the inlet of the powerhouse, and a sediment flushing outlet is arranged at the inlet	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
		gate pier to discharge the silt in front of the inlet. According to the results of the model test, the sediment flushing effect is very good, and the sediment deposition in front of the dam is limited, which will not affect the normal operation of the f flood-discharge sluices and the ship lock, and there is no sediment deposition in front of the powerhouse inlet. The flood-discharging sluices are provided with upstream bulkhead stoplogs, service gates and downstream bulkhead stoplogs.	
dam operation			
129	Use of the bottom flow gates should be optimized to pass coarse sediment in both dry and wet seasons, also taking into account the need to avoid sediment problems with operation of turbine intakes.	With a sediment barrier at the intake upstream, the top elevation of 208m could prevent bed load from approach to the power intake, and sediment accumulation at the intake front would be mainly composed of suspended load. Considering that the intake bottom level is relatively lower, sand outlets are arranged underneath, whose inlet bottom elevation would be further lower than that of the intake. Ahead of each flood period, to prevent gates from being blocked up be sediment, sand outlet gates should be opened in the flood period for sand flushing. In the dry season, based on sediment monitoring data, sand outlet gates shall be opened irregularly for flushing sand. Proper operation of the sand outlets to prevent sediment silting in front of the sand outlets could spare sediment's adverse effects on the power plant's operation safety.	OK
130	Seasonal drawdown of the reservoir to minimum operating levels and opening of gates to allow sediment pass-through should be carried out when sediment concentrations and sediment transport rates are high (e.g. passing of suspended sediment from the start of, or early in the flood season before larger flood flows to limit settlement in the reservoir).	Designed as a power station in river channel, Sanakham HPP will generate power with the inflowing water and the reservoir has no regulation and storage capacity. Therefore, operating mode of the reservoir is proposed on the basis of the reservoir area condition and the water-sediment characteristics. Luang Prabang hydrometric station is taken as the key station for survey of inflow flood (generally the duration for flood running from the Luang Prabang hydrometric station to Sanakham dam site is 1~2 days). The peak flood discharge at Sanakham damsite in case of a 3-year flood occurred at Luang	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
		Prabang hydrometric station is 15400 m^3/s. According to the sediment characteristics of Mekong River, the sediment volume is mainly concentrated in the wet season, especially when flood occurs, when the incoming flow is more than rated flow 5801 m^3/s, bottom hole, sediment flushing gate and the flood gate opened gradually, reservoir water level maintains at 220m; when the discharge is greater than 15400 m^3/s, gradually increase the gate opening and reduce the reservoir water level, If incoming flow is higher than the 3-year frequency flood discharge of 17,800m^3/s, all gate should be opened, the flood passing and sediment discharging are basically approached to the natural channel, the sediment is prevented from depositing in the reservoir, and partial sediment in the reservoir will be carried away at the same time. According to Preliminary DG of LMB Mainstream Dams, water level shall be lowered to transport sand and flush partial sediment in the reservoir area according to the sediment monitoring after the power station putting into operation. Detail design is shown in the report of "SEDIMENT MANAGEMENT". Refer to Fig.1 in Attachment.	
131	For periodic flushing of fine sediment and flushing of coarse bed material: i. All sediment flushing should be planned and carried out in coordination with the operators of other dams in the cascade. ii. Flushing of fine sediments should be routinely carried out every year. Less frequent flushing may result in consolidation of fine materials on the reservoir bed, making future flushing efforts technically difficult and costly. iii. Where it is possible to manage coarse and fine sediments separately,	Sediment management strategies include: Dam operation for sediment discharging, sediment flushing measures, time selection of sediment flushing and Eco-friendly flushing for sediment, etc. Sediment discharging and flushing shall combine with the operation situations of the upstream station. When the upstream power station operates sediment flushing, and the monitored incoming sediment concentration from Sanakham HPP is high, the gate of Sanakham HPP shall be opened for sediment discharging, to prevent the sediment discharged from the upstream power station depositing in the Sanakham reservoir area. It is recommended to establish a coordinated operating mechanism between upstream and downstream power stations, to real-time	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
	flushing of coarse sediment should be carried out after flushing of fine material considering 'environmentally friendly flushing' techniques described in paragraphs that follow later in this section. iv. For the most effective flushing of coarse bed material, the reservoir should be drawn down to the maximum extent, at least every 2 to 5 years. Sediment monitoring (as described later in this Section) should be used to decide the frequency.	communicate the operation situations of the power stations and facilitate the operating scheduling of all cascade power stations. According to Preliminary DG of LMB Mainstream Dams, water level shall be lowered to transport sand and flush partial sediment in the reservoir area according to the sediment monitoring after the power station putting into operation. The above content is shown in "SEDIMENT MANAGEMENT".	
132	Where hydraulic flushing is not possible, or effective, alternatives to removing sediments accumulated in the reservoir should be considered including mechanical removal by dredging in critical areas, or in combination with the use of sediment traps.	Sediment management report has been complied, Detail design of sediment management strategies is shown in the report of "SEDIMENT MANAGEMENT". Sediment management strategies include: Dam operation for sediment discharging, sediment flushing measures, time selection of sediment flushing and Eco-friendly flushing for sediment, etc. Declare the sedimentation treatment measures of different character and different position. For the parts with poor flushing effect such as sediment barrier and approach channel, artificial or mechanical dredging measures shall be taken to clear the deposits. The physical model test shows that there will be sediment deposition on the upper left guide wall side of the power intake due to local backflow, and sediment deposition will occur on the guide wall side of the upstream and downstream approach channel, but it will not affect the safe operation of the power station and the navigation channel generally. However, the monitoring of sediment deposition in front of the dam should be strengthened. In case sedimentation occurred and may affect the safe operation of the power station and the navigation channel, if the hydraulic scouring has no effect, manual dredging should be carried out under the condition of lowering the reservoir water level to remove the deposited coarse sediments to ensure the safe operation of the project.	OK
133	Bottom-gates should be opened regularly to prevent accumulation of	The gate opening mode will be presented before the reservoir impoundment taking into	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
	sediment directly behind the gates. This is to ensure that gates can be opened in an emergency and to prevent excessive accumulation behind the dam wall that could endanger structural stability.	account following factors like the discharge capacity of outlets, hydrological data, sand flushing requirements and downstream energy dissipaters.	
Eco-friendly flushing for sediment			
134	The sediment concentration of water released during flushing operations should be controlled and monitored to prevent negative impacts on downstream ecology (high sediment concentrations can lead to fish mortality and smothering of spawning areas – see also Section 5 on environmental flows).	Sediment management strategies include: Dam operation for sediment discharging, sediment flushing measures, time selection of sediment flushing and Eco-friendly flushing for sediment, etc. Which are shown in "SEDIMENT MANAGEMENT". Spawning period shall be avoided when flushing sediment, in doing so, and impact on the downstream fish spawning due to sediment flushing of the reservoir will be avoided. Monitoring of the outflow sediment concentration shall be strengthened during flushing sediment, and the gate shall be adjusted to control the outflow volume and sediment concentration according to the monitoring results during sediment flushing. The flowing-out sediment concentration shall be not allowed to exceed the maximum sediment concentration allowing fish to survive at the downstream channel.	OK
135	A maximum allowable downstream sediment concentration should be established based on ecological assessments. An initial limit can be based on the natural maximum sediment concentrations occurring during the flood season.	Because the sediment tests by the Hydrological Station in the territory of Laos in the Mekong River are used with tour gauging method, the annual test times for sediment are less; while the test times in the upstream Chiang Sean Hydrological Station are relative more, with annual sediment tests over 50 times. Due to less test times, the maximum annual sediment concentration may be failed to be tested. According to the actual testing information of the station, the maximum daily average sediment concentration is 2.78kg/m^3, which occurred on August 14, 1972 at Chiang Sean Hydrological Station; The maximum sediment concentration of the downstream Chiang Khan Hydrological Station by actual test is 2.44kg/m^3, which occurred on August 12 1974. As the Chiang Sean station is upstream 620km away from the Sanakham HPP, and the Chiang Khan station is downstream 20km away from the Sanakham HPP, the characteristics of the sediment in the river reaches can refer to the	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
		concentrations of the Chiang Sean and Chiang Khan Hydrological Station.	
Monitoring and management			
136	Monitoring and mitigation is needed that would include monitoring for (i) deposition of sediment at the head of each reservoir, and (ii) the scour of sediment that will occur initially downstream of dams.	Overall design report of sediment monitoring system have been complied. Additional details regarding techniques, devices and survey frequency are included in the report. The section measurement for the whole reservoir area should be carried out once in the early storage period of the reservoir, which should be taken as the initial data of the reservoir fixed section, and then the section observation of the reservoir area should be implemented once every year after the operation of the reservoir. Oriented to the main sediment problems of the reservoir, the main items of the sediment observation are as follows to monitor and analyze the impact of sediment deposition: 1. Monitoring water and sediment in/out the reservoir (including: sediment volume, sediment concentration and sediment gradation of the inflow station and outflow station); 2. Monitoring of water surface line in front of the dam and at the tail section of the reservoir; 3. Monitoring of sediment deposition in the reservoir area; 4. Monitoring of sediment deposition in the project area; 5. Monitoring of downstream river course; 6. Monitoring of bank deformation in the reservoir area.	OK
137	Annual topographic and bathymetric surveys should be undertaken, and the results mapped, to establish rates of sediment accumulation or scour.		OK
138	Deep holes in the reservoir reach that were previously present in the river bed should be monitored, to establish rates of infilling.		OK
139	River banks along the new flood level line should be monitored to establish rates of erosion. Reaches associated with formation of (1) new mid-channel islands at the head of reservoirs, and (2) positions where tributary sediment deposits start intruding into reservoirs should be emphasized, as there may be scour associated with changes in these reaches.		OK
140	The developers / owner should be responsible to provide river bank erosion control with structures such as gabions if needed, for situations affected by changes in river channel position in the reservoir zones. See also paragraph 119 that relates to government consideration to have dam owners to set aside contingency funds, in case additional expenditures for bank protection works are needed to arrest problems attributed to the operation of the dam – or to provide an undertaking in the Concession Agreement to ensure that sufficient financial resources are available for such work.	Water level fluctuation of the upstream and downstream caused by impounding and operation scheduling and discharging clear water may have a certain impact on the stability of the bank slope of the upstream and downstream channels. a perfect sediment monitoring system is designed for Sanakham HPP, with the monitoring concentration specifically for deformation of the bank slope in the system. After putting into operation of the power station, especially the early years of operation, monitoring the bank slopes at upstream and downstream shall be strengthened. When found instability occurs in partial bank slope, engineering measures such as block protection, gabion protection shall be taken. Specific measures shall be determined according to the actual situations	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
		of the instability of the bank slope, and it is recommended that the Employer shall reserve certain of emergency treatment fees annually as the treatment fees of bank slope instability. shown in the report of "SEDIMENT MANAGEMENT".	
Section 5:Water quality and aquatic ecology			
5.1 Background			
141~142	Background	-	OK
143	Impacts on dams on riverine water quality and aquatic ecology are interrelated. The degree and significance of the impacts depends on many factors, especially the volume of the reservoir impoundment in relation to river flows, water retention times and the depth of the impoundment and the patterns of land use in catchments.	Retention time according to the runoff calculation and the content of reservoir and get the depth profile by measuring of the river topography. The water retention time of reservoir is about 1 days.	OK
144	The focus of this guidance is the current proposals for a series of low‐head dams that would span part of, or the entire mainstream channel in the Lower Mekong Basin. The changes to water quality in the long reservoirs that will be formed behind these dams(mainly in the existing river channel) may be less than changes that might occur in large, deeper storage dams, such as those in the Lancang‐Mekong portion of the basin in China. This is due to the short retention time of the water in the proposed impoundments of the mainstream dams in the lower basin (expected to be in the range of about four days). But it also depends on the amount of mixing that occurs between water column above and below the dead water levels and the number of dams	It will supply the natural habitats where the area is not affected by the inundation that includes the stretch above the reservoir, tributaries not been inundated and the mainstream reaches down the dam. For the river stretches down the dam, the reduction in nutrient and sediment loads will happen in the initial stage of impoundment because the sediment is intercepted by the dam and it will lose some habitats and possible reduction on the primary productivity of the river. But in the reservoir area, considering the increasing of nutrient and sediment, the primary productivity will increase. SANAKHAM HPP is a low-head dam, operated as a Run-off River (ROR) scheme. According the regulation rules of sediment, when it operates normally, the backwater is low and its implication on blocking the sediment is weak, especially the upstream dams intercepting masses of sands. Most of suspended load in fine particle (nearly 80%) will	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
		flow into the downstream through the turbine. There is little sediment left in the reservoir. So the primary productivity decreases in the reservoir and increases in the river reach down the dam.	
145~146	Background	-	OK
147	Water quality is one of the environmental factors to be considered as part of the projectspecific EIAs. Water quality parameters to be considered are generally cited in national regulations and include temperature, concentration of dissolved oxygen, PH, phosphorus, nitrogen, biological oxygen demand and fecal coliform bacteria concentrations.	There will be a new monitoring plan in the operation phase, including the water quality parameters such as temperature, concentration of dissolved oxygen, PH, phosphorus, nitrogen, biological oxygen demand and fecal coli form bacteria concentrations.	OK
148	Overall the water quality and the ecological heath of the Lower Mekong River Basin in its present unregulated state ranges from high to good quality (See MRC Technical Paper no. 19 and MRC Technical Paper no. 20). The MRC Procedures on Water Quality and the associated Technical Guidelines that are currently under development express the wish of Member Countries to maintain acceptable/good water quality of the Mekong River. The Technical Guidelines will provide criteria and thresholds to determine acceptable/good water quality considering the protection of human health as well as aquatic life. These standards would provide valuable guidance to assess river flows including run - of - river impoundments.	The water quality ongoing monitoring plan has been applied the Laos standards in the phase of FS because the technical guideline on the water quality has not officially published now. Water quality monitoring plan is one part of EMMP which has emphasized in EMMP	OK
149	Stagnant water in impoundments behind dams can lead to a stratification of the water in the reservoir during parts of the year, with cold water at the bottom and warmer water at the top. In deeper impoundments the temperature difference can be as	The bulk of the vegetation in the reservoir area is cut, cleared and burnt before impoundment. Monitor the water quality monthly taking at least the temperature, PH and dissolved oxygen each one meter in the water column before the dam for	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
	much as 510 degrees Celsius. This stratification phenomenon generally occurs during the dry season and lasts until the onset of the wet season. The measured average dissolved oxygen concentration in the running water of the Mekong mainstream is in the range from 5.5 - 8.5 mg/l (1985 - 2005 data). Generally, lower oxygen concentrations can be observed in stagnant water during the dry season with high temperatures, but very low and anoxic conditions rarely occur unless the water is stratified such as in a deep impoundment	check the possible occurrence of thermal or chemical stratification. And it will adjust the regulation rules of the reservoir according to the monitoring results if it is stratified, and it will be over until to find that it will never develop stratified in reservoir. Add the measurement of fish passage in order to protect the biodiversity and reducing risk of establishment of the invasive and pest species.	
150	Another aspect of reservoir water quality is temperature alteration and variation which may affect fish species. Cold water released from the impoundment may affect organisms (e.g. affect fish species negatively and also pose the potential for thermal shock of irrigated crops if very cold water is withdrawn for irrigated agriculture with no provision for warming during conveyance).		OK
151	Subject to designs, the mainstream reservoirs proposed in the Lower Mekong Basin may have weak, large - scale turbulence associated with the flow of water through the reservoirs (rapid transit time for all reservoirs, speed of movement in the range 0.1 to 1 m/s). This would enhance the likelihood of mixing from surface to bottom and impacts on dissolved oxygen concentrations. Developers would need to verify the expected conditions in the EIAs that are prepared for each project.	The water quality ongoing monitoring plan has been applied the Laos standards in the phase of FS because the technical guideline on the water quality has not officially published now. Water quality monitoring plan is one part of EMMP which has emphasized in EMMP	OK
152	Aquatic biodiversity and biodiversity in the riparian zones can be affected by impoundments for a range of reasons. The	The bulk of the vegetation in the reservoir area is cut, cleared and burnt before impoundment.	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
	impoundment may block migration routes and lead to fragmentation of habitats (as discussed in Section 3). The hydrological changes and water quality changes may change habitats and the basis for ecosystems. The changes in hydrology, water quality and ecological conditions can change the ecological balance and pave the way for invasive and pest species affecting the biodiversity negatively.	Monitor the water quality monthly taking at least the temperature, PH and dissolved oxygen each one meter in the water column before the dam for check the possible occurrence of thermal or chemical stratification. And it will adjust the regulation rules of the reservoir according to the monitoring results if it is stratified, and it will be over until to find that it will never develop stratified in reservoir.	
155	It widely recognized that the allocation of water for hydropower operations must take into account other beneficial uses of water. Today there is increasing recognition that modifications to river flows also need to be systematically balanced with the maintenance of essential water‐dependent ecosystems. These ecosystems include not just river fauna and flora, but also the floodplains and wetlands watered by floods, groundwaterdependent ecosystems replenished through river seepage, and where applicable, estuaries. Flow assessments are becoming integrated with other tools such as EIA and water allocation planning for guiding decisions on sustainable water resource developments (balancing economic, social and environmental considerations) in hydropower development.	Make an integrated planning to conserve water resources and its environmental, social and economic benefits in Environmental management plan in the operation phase. Release the environmental flows according to the world bank methods. So as to avoid the reduction in fish, vegetables, vegetation, animal forage, firewood, timber for other uses and water supply for people, livestock and other uses from direct and indirect changes in the amount, quality of downstream river stretches. Develop an ongoing program of water quality monitoring including the phases of preconstruction, construction and operation.	OK
156	Compensation and mitigation programs can also be developed on the basis of specific consideration of downstream issues, which are often different to upstream issues. Downstream impacts relate not only to the reduction in water flows, but also the associated transformation to the aquatic environment induced by the dam operation, including any daily and seasonal	The bulk of the vegetation in the reservoir area is cut, cleared and burnt before impoundment. Monitor the water quality monthly taking at least the temperature, PH and dissolved oxygen each one meter in the water column before the dam for check the possible occurrence of thermal or chemical stratification. And it will adjust the regulation rules of the reservoir according to the monitoring	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
	fluctuations in water levels. 13 Downstream issues that may form part of the compensation and mitigation programs for riverine resource losses may include reduction in fish, vegetables, vegetation, animal forage, firewood, timber for other uses and water supply for people, livestock and other uses from direct and indirect changes in the amount, quality, and timing of flows.	results if it is stratified, and it will be over until to find that it will never develop stratified in reservoir.	
158	The monitoring program for water quality and aquatic ecology (identified in environmental flow assessment or as part of the EIA) must be designed in compliance with national standards and maintain appropriate communication with concerned local governments, municipalities and agencies and downstream communities. This is important to enable stakeholders to provide essential feedback on whether: that targets specified in the monitoring program (e.g. for water quality, wetlands protection, river morphology, impacts on fish habitat, etc.) are being achieved; the agreed - upon flow regime is being provided, in this case recognizing the run - of-river nature of the mainstream projects, the fact there may be peaking operation and taking into account the position of the dam in the potential cascade; and the operation of the reservoir and water releases downstream needs to be modified in the light of the observed responses.	Make an integrated planning to conserve water resources and its environmental, social and economic benefits in Environmental management plan in the operation phase. Release the environmental flows according to the world bank methods. So as to avoid the reduction in fish, vegetables, vegetation, animal forage, firewood, timber for other uses and water supply for people, livestock and other uses from direct and indirect changes in the amount, quality of downstream river stretches. Develop an ongoing program of water quality monitoring including the phases of preconstruction, construction and operation.	OK
159	Governments may also give consideration to requiring the dam owner to set aside contingency funds for additional water quality management measures, which may be identified as necessary based on the results of the water monitoring programme.		OK

PDG Para	Issue	Compliance description	Compliance Conclusion
5.2 Guidance on water quality and aquatic ecology			
160	The following section provides preliminary guidance on water quality and aquatic ecology for developers proposing mainstream dams in the Lower Mekong	-	OK
161~165	General requirements	-	OK
166	The monitoring systems need to be designed to facilitate the optimization of hydropower operation with respect to water quality and ecological health. The MRC Water Quality Monitoring Network and Ecological Health Monitoring Network can provide the general trends and status of the water quality and ecological health, whereas monitoring of impacts of hydropower operations need to have targeted and localized monitoring systems.	The water quality monitoring plan for the construction period and operation period has been formulated in the feasibility study design of SANAKHAM HPP, including the monitoring of drinking water, production and living wastewater treatment, surface water quality, etc. The monitoring frequency and items meet the requirements of the Guidance. The feasibility study design incorporates the water quality monitoring and monitoring system into the environmental management plan of the SANAKHAM HPP, and the monitoring costs are included in the project cost (investment).	OK
167	The water quality monitoring and monitoring programme normally required as part of the Environment Management Plan should be funded by the developer for the construction phase, and by the owner for the duration of the concession period.		OK
168~172	Environmental Flow assessment and provision	The SANAKHAM HPP is a run-of-river HPP and no regulation capacity is designed. As the outflow is the same as the natural inflow, no unstable or drastic changes in downstream flow will be generated.	OK
173	The developer and operator should ensure the environmental flow considerations are adequately reflected in the operating policies for the reservoir and sediment management strategy. Good practice is to adaptively manage the downstream releases from the dam based on continuous review of the monitored results in	1. Environmental flows should be monitored in environment monitoring plan section. 2. In the environmental impact section，it considers synthetically various aspects requirements of design phase, power generation, navigation, flood	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
	accordance with the environment management and monitoring plan (EMMP) for the operation phase, or its equivalent.	control, sediment, slope stability in upstream and downstream and to minimize the impacts on the reservoir tail and so on. Setting the operation mode of operation of SANAKHAM HPP according to early work. According to the environmental monitoring results, it shall be adjust drainage of environmental flow timely.	
174	The monitoring arrangements for environmental flows should be integrated with the overall environment monitoring system for the operations stage of the project that comprehensively incorporates impact monitoring of all parameters (e.g. sediment monitoring, impact on wetlands, impact on fisheries habitat, impact on river morphology and water quality, and socio - economic aspects related to these effects, etc.).	The monitoring of sediment, wetlands monitoring, fish habitat monitoring, rivers condition monitoring, water quality monitoring, discharged environmental flow monitoring and socio-economic surveys should be included in environment monitoring plan section.	OK
175	For the well - being of the natural aquatic downstream environment, the monitoring should provide an independent review of the flow release regime, including releases down the fish ladder and releases during daily cycling of the turbines for peak or daily generation and the daily water level changes. This should be reported, and submitted to government to check annually to ensure compliance with approved operating ranges.	The monitoring results of environmental flows that include fish way discharge water, peak load power generation turbine discharge water or power vent water day and daily water level changes should be reported to review annually to the Lao government in environment monitoring plan section.	OK
Section 6: Dam Safety			
176~185	Background	-	OK
186	The following section provides preliminary guidance for developers proposing mainstream dams on the Lower Mekong to ensure a consistent approach to safety of dams.	-	OK

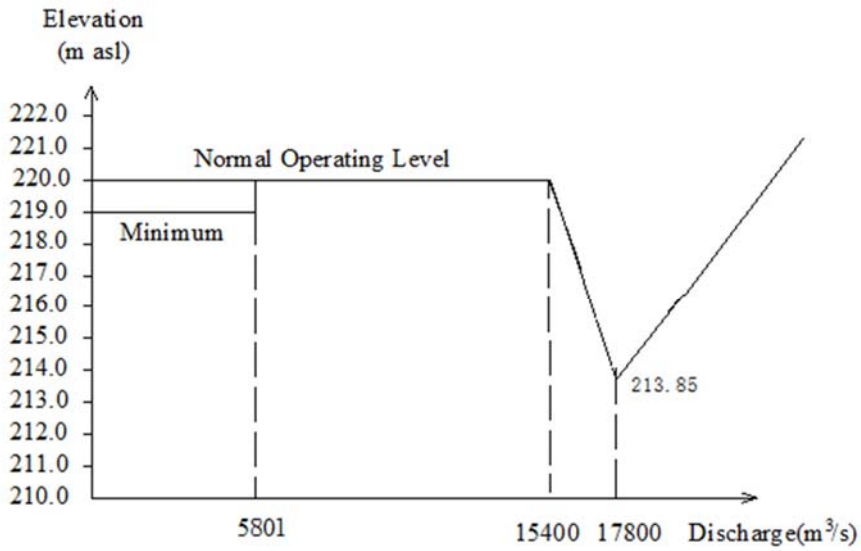
PDG Para	Issue	Compliance description	Compliance Conclusion
187	Developers should base the approach to safe design, implementation and operation of proposed mainstream dams: i. Relevant national standards that impact on different aspects of dam safety; ii. International best practice, as embodied the World Bank Operational Policy 4.37 on the Safety of Dams; iii. Periodic Technical Bulletins on the Safety of Dams issued by the International Commission on Large Dams (ICOLD) through the ICOLD Committee on Dam Safety(CODS).	The following standards are used or referenced: (1) Preliminary Design Guidance for Proposed Mainstream Dams in the Lower Mekong Basin (2) Lao Electric Power Technical Standards (3) ICOLD, Bulletin on Dam Safety Management, 2005 (4) ICOLD, Bulletin 59, Dam Safety -Guidelines, 1987 (5) ICOLD, Bulletin 130, on Risk Assessment in Dam Safety Management: A Reconnaissance of Benefits, Methods and Current Applications, 2005 (6) World Bank, Operational Policy 4.37 (7)International standard：ACI、ASTM、US Army Corps of Engineers、 United States Bureau of Reclamation，etc.	OK
188	All aspects of the World Bank Operational Policy (OD/GP 4.37) for the safety of dams should be reflected by developers and operators, including required reviews by an independent panel of experts of the investigation, design and construction of the dam and start of operations and sub-plans: (i) a construction supervision plan (ii) a quality assurance plan (iii) an instrument plan (iv) an operation and maintenance (O&M) plan (v) an emergency preparedness plan (EPP)	1. The updated feasibility study report includes plans as follows: (i) a construction supervision plan (ii) a quality assurance plan (iii) an instrument plan (iv) an operation and maintenance (O&M) plan, and (v) an emergency preparedness plan (EPP). 2. The developers will modify and perfect these plans in accordance with the World Bank Operational Policy (OD/GP 4.37) during the period of construction or operation. 3. The risk of over sedimentation at U/S for sluice gate can be avoided by opening the sluice gate frequently.	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
		4. The result of calculation shows that If one or two discharge sluices don't discharge, there is still freeboard for dam crest. In those cases, overtopping will not happen.	
189	Developers, owners and operators should reflect the relevant International Commission on Large Dams (ICOLD) Dam Safety Bulletins in the project design, as well as the approach to project construction and operation.	1. The relevant International Commission on Large Dams (ICOLD) Dam Safety Bulletins have been referred in the project design for feasibility studies, and they will be reflected as well as in the construction and operation stages.	OK
190	In particular, developers /owners /operators should prepare and implement a Dam Safety Management System (DSMS) that reflects ICOLD guidance on establishing a systems approach to the management of dam safety. This starts from design and continues through to operation. The DSMS incorporates the production of an annual report on dam safety during the operation phase that is submitted to governments and made public.	The initial plan of DSMS has been included in the revised feasibility study report, and the detail documentations will be formulated and carried out at construction and operation stage.	OK
191	Developers and operators should ensure there is full and effective consultation with local communities and local government authorities and all concerned organizations and agencies, especially with regard to the emergency preparedness plan (EPP). The EPP should include a communication strategy to reach and involve all concerned and affected people (i) in preparation of the EPP, and (ii) in training or capacity building to implement the EPP, and (iii) responding to any issues concerning annual Dam Safety	The project management plan of Updated feasibility report has made sure of the requirement as follows: When making the plan during the period of construction and operation, developers and operators should ensure there is full and effective consultation with local communities and local government authorities and all concerned organizations and agencies, as well as making a set of effective communication strategies, especially in the emergency plan.	OK

PDG Para	Issue	Compliance description	Compliance Conclusion
	reports.		
192	Developers and owner/operators should be responsible to check for periodic updates of the World Bank Operational Policy (OD/GP 4.37) as well as updates, or new Technical Bulletins on the Safety of Dams issued by the International Commission on Large Dams ICOLD). At minimum, this check for updates should be routinely done in preparation of the annual Dam Safety report.	Reference Standard of Updated feasibility report has required that developers and owner/ operators should inquiry periodic updates of the World Bank Operational Policy (OD/GP 4.37) as well as updates, or new Technical Bulletins on the Safety of Dams issued by the International Commission on Large Dams ICOLD).	OK
193	Developers and owners should be responsible for all cost associated with implementing all aspects of this guidance on the safety of dams. Developers / owners / operators should clearly detail all such costs in the project budgets for the design, implementation and operation stages.	These costs have been clearly specified in the project budget.	OK

ATTACHMENT:

Diagram of Sanakham HPP OWL versus Discharge



Note: 15400 m^3/s in the diagram represents the peak flood discharge at Sanakham damsite in case of a 3-year flood occurred at Luang Prabang hydrometric station

Fig.1 Operation Mode

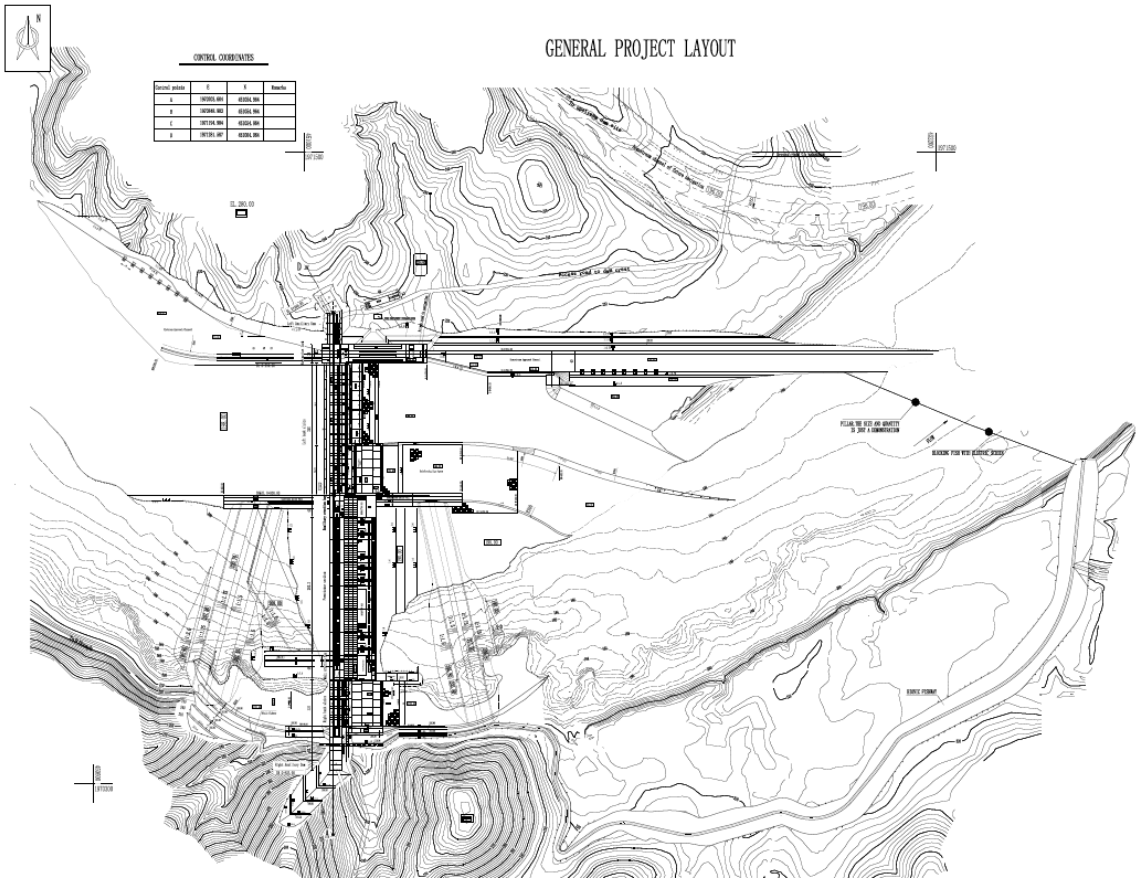


Fig.2 Project Layout