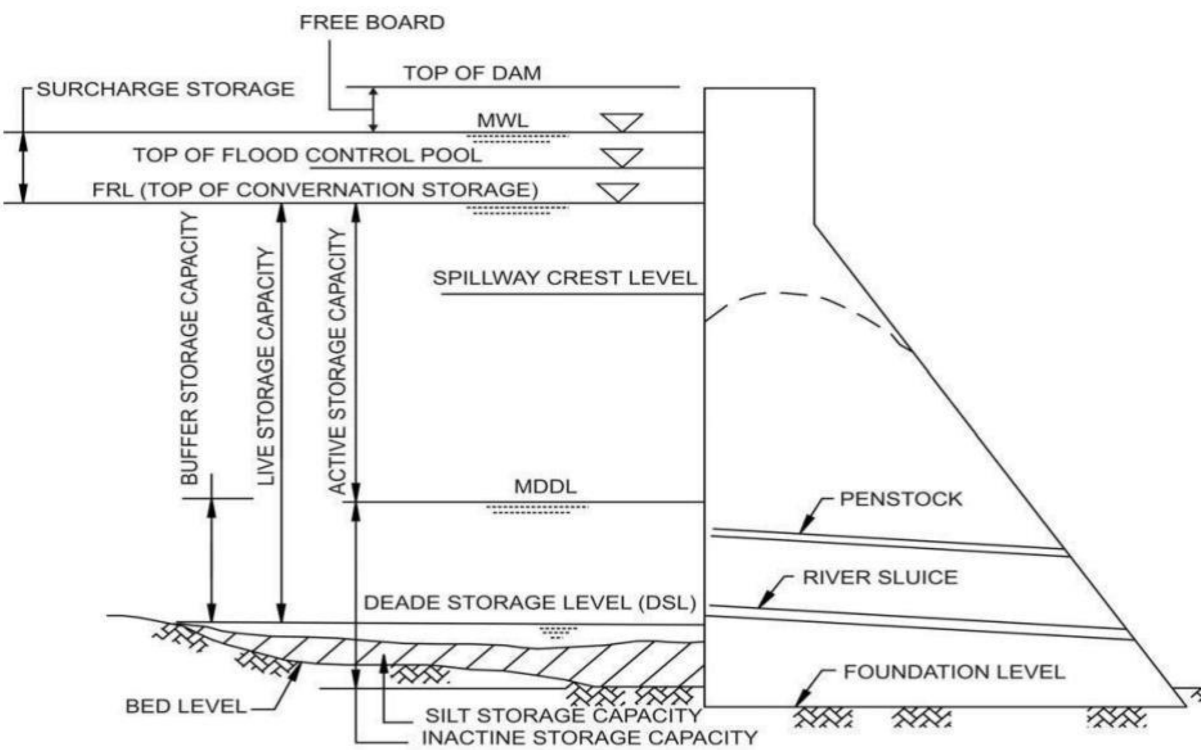
4.1 RESERVOIR TYPE AND SITE SELECTION

Water storage reservoirs may be created by constructing a dam across a river, along with suitable appurtenant structures. reservoirs are also meant to absorb a part of flood water and the excess is discharged through a spillway

Reservoirs are of two main categories: (a) Impounding reservoirs into which a river flows naturally, and (b) Service or balancing reservoirs receiving supplies that are pumped or channelled into them artificially. In general, service or balancing reservoirs are required to balance supply with demand. Reservoirs of the second type are relatively small in volume because the storage required by them is to balance flows for a few hours or a few days at the most. Impounding or storage reservoirs are intended to accumulate a part of the flood flow of the river for use during the non-flood months



4.1.1 FUNCTIONS OF THE RESERVOIRS

1. Human consumption and/or industrial use:

2. Irrigation: usually to supplement insufficient rainfall.

3. Hydropower: to generate power and energy whenever water is available or to provide reliable supplies of power and energy at all times when needed to meet demand.

4. Pumped storage hydropower schemes: in which the water flows from an upper to a lower reservoir, generating power and energy at times of high demand through turbines, which may be reversible, and the water is pumped back to the upper reservoir when surplus energy is available. The cycle is usually daily or twice daily to meet peak demands. Inflow to such a reservoir is not essential, provided it is required to replace water losses through leakage and evaporation or to generate additional electricity. In such facilities, the power stations, conduits and either or both of the reservoirs could be constructed underground if it was found to do so.

4. Flood control: storage capacity is required to be maintained to absorb foreseeable flood inflows to the reservoirs, so far as they would cause excess of acceptable discharge spillway opening. Storage allows future use of the flood water retained.

5. Amenity use: this may include provision for boating, water sports, fishing, sight seeing. Formally, the Bureau of Indian Standards code IS: 4410 (part 6)1983 “

4.1.2 types of reservoirs:

1. Auxiliary or Compensatory Reservoir: A reservoir which supplements and absorbed the spill of a main reservoir.

2. Balancing Reservoirs: A reservoir downstream of the main reservoir for holding water let down from the main reservoir in excess of that required for irrigation, power generation or other purposes.

3. Conservation Reservoir: A reservoir impounding water for useful purposes, such as irrigation, power generation, recreation, domestic, industrial and municipal supply etc.

4. Detention Reservoir: A reservoir where in water is stored for a relatively brief period of time, past of it being retained until the stream can safely carry the ordinary flow plus the released water. Such reservoirs usually have outlets without control gates and are used for flood regulation. These reservoirs are also called as the Flood Control Reservoir or Retarding Reservoir.

5. Distribution Reservoir: A reservoir connected with distribution system a water supply project, used primarily to care for fluctuations in demand which occur over short periods and

as local storage in case of emergency such as a break in a main supply line failure of a pumping plant.

6. Impounding or Storage Reservoir: A reservoir with gate-controlled outlets wherein surface water may be retained for a considerable period of time and released for use at a time when the normal flow of the stream is in sufficient to satisfy requirements.

7. Multipurpose Reservoir: A reservoir constructed and equipped to provide storage and release of water for two or more purposes such as irrigation, flood control,power generation, navig ation, pollution abatement, domestic and industrial water supply,fish culture, recreation, etc.

4.1.3 FACTORS GOVERNING THE SELECTION OF SITE FOR THE RESERVOIR

IS: 13216 - 1991 “Code of practice for geological exploration for reservoir sites”, that discusses the relevant aspects

(a) Water tightness of the basins

(b) Stability of the reservoir rim

(c) Availability of construction material in the reservoir area

(d) Silting

(e) Direct and indirect submergence of economic mineral wealth

(f) Seismo-techtonics These aspects are determined through investigations carried out by surface and sub- surface exploration of proposed basin during the reconnaissance, preliminary investigation, detailed investigation, construction and post-construction stages of the project. The two basic stages of investigation: reconnaissance and preliminary investigations are explained below: Reconnaissance In the reconnaissance stage, the objective of investigation is to bring out the overall geological features of the reservoir and the adjacent area to enable the designers, construction engineers and geologists to pinpoint the geotechnical and ecological problems which have to be tackled. The scale of geological mapping for this stage of work need not be very large and the available geological maps on 1:50,000 or 1: 250,000 scales may be made use of. It is advantageous to carry out photo geological interpretation of aerial photographs of the area, if available. If a geological map of the area is not available, a traverse geological map should be prepared at this stage preferably using the aerial photos as base maps on which the engineering evaluation of the various geotechnical features exposed in the area should be depicted. A topographical index map on 1: 50 000 scales should be used at this stage to delineate the areas which would require detailed study, subsequently. To prevent an undesirable amount of leakage from the reservoir, the likely zones of such leakage, such as major dislocations and pervious or cavernous formations running across the divide of the reservoir should be identified at this stage of investigation for further detailed investigations.Major unstable zones, particularly in the vicinity of the dam in tight gorges, should be identified at this stage for carrying out detailed investigations for the stability of the reservoir rim. The locations for suitable construction material available in the reservoir area should be pin pointed at this stage so that after detailed surveys such materials can be exploited for proper utilisation during the construction stage prior to impounding of reservoir.The rate of silting of the reservoir is vital for planning the height of the dam and working out the economic life of the project. Since the rate of silting, in addition to other factors, is dependent on the type of terrain in the catchment area of the reservoir, the major geological formations and the ecological set up should be recognized at this stage to enable a more accurate estimation of the rate of silting of the reservoir. For example, it should be possible to estimate at this stage that forty percent of the catchment of a storage dam project is covered by Quaternary sediment and that this is a condition which is likely to a yield a high silt rate or that ninety percent of the catchment of another storage dam project is composed of igneous and metamorphic rocks and is likely to yield a relatively low sediment rate. This information will also be useful in examining whether or not tributaries flowing for long distances through soft or unconsolidated formations, prior to forming the proposed reservoir, can be avoided and if not, what remedial measures can be taken to control the silt load brought by these tributaries. The impounding of a reservoir may submerge economic/strategic mineral deposits occurring within the reservoir area or the resultant rise in the water table around the reservoir may cause flooding, increased seepage in quarries and mines located in the area and water logging in other areas. It is, therefore, necessary that the economic mineral deposits, which are likely to be adversely affected by the reservoir area, are identified at this stage of the investigation. For example, if an underground working is located close to a proposed storage reservoir area, it should be identified for regular systematic geo-hydrological studies subsequently. These studies would establish whether the impoundment of the water in the reservoir had adversely affected the underground working or not. References should also be made to various agencies dealing with the economic minerals likely to be affected by the impoundment in the reservoir for proper evaluation of the problem and suitable necessary action. A dam and its reservoir are affected by the environment in which they are located and in turn they also change the environment.

Impoundment of a reservoir sometimes results in an increase of seismic activity at, or near the reservoir. The seismic activity may lead to microtremors and in some cases lead to earthquakes of high magnitude. It is, therefore, necessary to undertake the regional seismotechtonic study of the project area. The faults having active seismic status should be delineated at this stage. Simultaneous action to plan and install a network of seismological observatories encompassing the reservoir area should also be taken. Preliminary Investigation The object of preliminary investigation of the reservoir area is to collect further details of the surface and subsurface geological conditions, with reference to the likely problems identified during the reconnaissance stage of investigation by means of surface mapping supplemented by photo geological interpretation of aerial photographs, hydro geological investigations, geophysical investigations, preliminary subsurface exploration and by conducting geo-seismological studies of the area. On the basis of studies carried out during the reconnaissance stage it should be possible to estimate the extent of exploration that may be required during the preliminary stage of investigation including the total number of holes required to be drilled and the total number and depth of pits, trenches and drifts as also the extent of geophysical surveys which may be necessary. For exploration by pits, trenches, drifts and shafts guidelines laid down in IS 4453: 1980 Name of IS code should be followed. The potential zones of leakage from the reservoir and the lateral extent of various features, such as extent of aeolian sand deposits, glacial till, land slides, major dislocations or pervious and cavernous formations running across the divide, should be delineated on a scale of 1: 50000. The geo-hydrological conditions of the reservoir rim should be established by surface and sub-surface investigation as well as inventory, as a free ground water divide rising above the proposed level of the reservoir is a favourable condition against leakage from the reservoir. The level of water in a bore hole should be determined as given in IS 6935: 1973. The extension of various features at depth, wherever necessary, is investigated by geophysical exploration and by means of pits, trenches, drifts and drill holes. For example, the resistivity survey should be able to identify water saturated zones

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