

Working DRAFT

CNA Project Glossary

Term	Definition
Abutment	That part of the valley side against which the dam is constructed. An artificial abutment is sometimes constructed, as a concrete gravity section, to take the thrust of an arch dam where there is no suitable natural abutment. The left and right abutments of dams are defined with the observer viewing the dam looking in the downstream direction, unless otherwise indicated (FEMA 2004a).
Acceptability [of a plan]	The workability and viability of an alternative plan with respect to acceptance by state and local entities and the public and compatibility with existing laws, regulations, and public policies (P&G 1.6.2(c)(4)).
Acceptable risk	A risk is acceptable when its probability of occurrence is so small, its consequences are so slight, or its benefits (perceived or real) are so great that individuals or groups in society regard them as insignificant and adequately controlled (IWR 2017-R-03). [Contrast “acceptable risk” with “tolerable risk.”]
Acre-foot	A unit of volumetric measure that would cover one acre to a depth of one foot. It is equal to 43,560 cubic feet (FEMA 2004a).
Advantage	A difference between the attributes of two alternatives (Suhr 1999).
Adverse consequences	Negative impacts that may result from the failure of a dam. The primary concerns are loss of human life, economic loss (including property damage), lifeline disruption, and environmental impact (FEMA 2004a).
ALARP	As low as reasonably practicable. The concept that risk reduction beyond a certain level may not be justified if further risk reduction is impracticable or the cost is grossly disproportionate to the risk reduction (Reclamation 2011).
Alternative plan	A set of one or more management measures functioning together to address one or more planning objectives. Alternative plans should be significantly differentiated from one another (IWR 96-R-21).
Appurtenant structure	Ancillary features of a dam such as outlets, spillways, powerplants, tunnels, etc. (FEMA 2004a).
Asset management	In the context of the CNA, a program in which the California Department of Water Resources Division of Operations and Maintenance uses a risk-informed approach to inform decisions about managing facilities of the State Water Project.
Attribute	In the context of <i>Choosing by Advantages</i> , a characteristic or consequence of one alternative (Suhr 1999).
Baseline condition	The agreed-upon definition of the current, existing condition of the system under study at the beginning of the analysis period.
Breach	An opening through a dam that allows the uncontrolled draining of a reservoir. A controlled breach is a constructed opening. An uncontrolled breach is an unintentional opening caused by discharge from the reservoir. A breach is generally associated with the partial or total failure of the dam (FEMA 2004a).
Channel	A general term for any natural or artificial facility for conveying water (FEMA 2004a).

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Comprehensive Needs Assessment (CNA)	A project by the California Department of Water Resources (DWR) in which DWR is identifying major dam safety needs and improvements of the Oroville Dam Complex to maintain dam safety standards and ensure the reliability of the facility. The CNA project began in early 2018 and is scheduled for completion in May 31, 2020. The expected deliverable of the CNA will be a portfolio of alternative plans that meet the project’s objectives.
Consequence	The outcome of an event affecting objectives; may be expressed quantitatively or qualitatively (Maxwell and Franssen, 2012). Potential loss of life or property damage downstream of a dam caused by floodwaters released at the dam or by waters released by partial or complete failure of the dam (FEMA 2004a). <i>See also</i> Adverse consequences.
Constraint	In the context of the CNA, this term includes four types of requirements and restrictions: <ul style="list-style-type: none"> • Positive non-violable constraints (“shall”). • Negative non-violable constraints (“shall not”). • Positive violable constraints (“should, but...”) • Negative non-violable constraints (“should not, but...”)
Criterion	A test, means of judging, a standard of judging; any established law, rule, principle, or fact by which a correct judgment may be formed (IWR 96-R-21).
Dam	An artificial barrier that has the ability to impound water, wastewater, or any liquid-borne material, for the purpose of storage or control of water (FEMA 2004a).
Dam failure	Catastrophic type of failure characterized by the sudden, rapid, and uncontrolled release of impounded water or the likelihood of such an uncontrolled release. It is recognized that there are lesser degrees of failure and that any malfunction or abnormality outside the design assumptions and parameters that adversely affect a dam’s primary function of impounding water is properly considered a failure. These lesser degrees of failure can progressively lead to or heighten the risk of catastrophic failure. They are, however, normally amenable to corrective action (FEMA 2004a).
Dam safety	The art and science of ensuring the integrity and viability of dams such that they do not present unacceptable risks to the public, property, and the environment. It requires the collective application of engineering principles and experience, and a philosophy of risk management that recognizes that a dam is a structure whose safe function is not explicitly determined by its original design and construction. It also includes all actions taken to identify or predict deficiencies and consequences related to failure, and to document, publicize, and reduce, eliminate, or remediate to the extent reasonably possible, any unacceptable risks (FEMA 2004a).
Design water level	The maximum water elevation, including the flood surcharge, that a dam is designed to withstand (FEMA 2004a).
Drawdown	The difference between a water level and a low water level in a reservoir within a particular time. Used as a verb (to draw down), it is the lowering of the water surface elevation (FEMA 2004a).
Efficiency	The extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the nation’s environment (P&G 1.6.2(c)(3)).

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Emergency spillway	Auxiliary spillway. A secondary spillway designed to be operated infrequently, possibly in anticipation of some degree of structural damage or erosion to the main spillway occurring during operation (FEMA 2004a).
Erosion	The wearing away of a surface (bank, streambed, embankment, or other surface) by floods, waves, wind, or any other natural process (FEMA 2004a).
Evaluation	The quantification and judgment of the significant effects or contributions of an individual alternative plan. Evaluation is a two-part process: assessment (quantification) and appraisal (judgment) (IWR 96-R-21).
Event	An occurrence or change of a particular set of circumstances (Maxwell and Franssen, 2012). In the context of dam safety, an event could be a hydrologic event, a seismic event, an operational event, or some other event that could lead to failure of the dam to perform as expected.
<i>f-N</i> diagram	A chart composed of individual <i>f-N</i> pairs, where each pair typically represents one potential failure mode, or in the case of total risk, the summation of all potential failure modes. On the <i>f-N</i> diagram, <i>f</i> represents the annualized failure probability over all loading ranges. <i>N</i> represents the estimated life loss or number of fatalities associated with an individual failure mode, or the weighted equivalent number of fatalities associated with the summation of failure modes (Reclamation 2011).
Factor	In the context of <i>Choosing by Advantages</i> , an element, or a component, of a decision; a container for criteria, attributes, advantages, and other types of data (Suhr 1999).
Failure	The failure of a component to meet its intended function. [Subject to change]
Failure mode	A potential failure mode is a physically plausible process for dam failure resulting from an existing inadequacy or defect related to a natural foundation condition, the dam or appurtenant structure design, the construction, the materials incorporated, the operations and maintenance, or aging process, which can lead to an uncontrolled release of the reservoir (FEMA 2004a).
Feasible	Doable, taking into consideration all the relevant factors, e.g., technical, economic, financial, environmental, social, political, and/or institutional (IWR 96-R-21).
Flood	A temporary rise in water surface elevation resulting in inundation of areas not normally covered by water. Hypothetical floods may be expressed in terms of average probability of exceedance per year such as one-percent-chance flood, or expressed as a fraction of the probable maximum flood or other reference flood (FEMA 2004a).
Flood Control Outlet (FCO)	In the context of this project, Oroville Dam's main gated, controlled spillway.
Flood hydrograph	A graph showing, for a given point on a stream, the discharge, height, or other characteristic of a flood with respect to time (FEMA 2004a).
Flood routing	A process of determining progressively over time the amplitude of a flood wave as it moves past a dam or downstream to successive points along a river or stream (FEMA 2004a).
Flood storage	The retention of water or delay of runoff either by planned operation, as in a reservoir, or by temporary filling of overflow areas, as in the progression of a flood wave through a natural stream channel (FEMA 2004a).

DRAFT

Floodplain	An area adjoining a body of water or natural stream that may be covered by floodwater. Also, the downstream area that would be inundated or otherwise affected by the failure of a dam or by large flood flows. The area of the floodplain is generally delineated by a frequency (or size) of flood (FEMA 2004a).
Formulation	The process of building plans that meet planning objectives and avoid planning constraints (IWR 96-R-21).
Gate	A movable barrier for the control of water (FEMA 2004a).
Goal	A broad purpose (IWR 96-R-21).
Hazard	A situation that creates the potential for adverse consequences such as loss of life, property damage, or other adverse impacts. Impacts in the area downstream of a dam are defined by the flood waters released through spillways and outlet works of the dam or waters released by partial or complete failure of the dam. There may also be impacts upstream of the dam due to backwater flooding or landslides around the reservoir perimeter (FEMA 2004b).
Inflow design flood (IDF)	The flood hydrograph used in the design or evaluation of a dam, its appurtenant works, particularly for sizing the spillway and outlet works, for determining maximum height of the dam, freeboard, and flood storage requirements. The upper limit of the IDF is the probable maximum flood (FEMA 2004b).
Instrumentation	An arrangement of devices installed into or near dams that provide for measurements that can be used to evaluate the structural behavior and performance of the structure (FEMA 2004a).
Intake	Placed at the beginning of an outlet-works waterway (power conduit, water supply conduit), the intake establishes the ultimate drawdown level of the reservoir by the position and size of its opening(s) to the outlet works. The intake may be vertical or inclined towers, drop inlets, or submerged, box-shaped structures. Intake elevations are determined by the head needed for discharge capacity, storage reservation to allow for siltation, the required amount and rate of withdrawal, and the desired extreme drawdown level (FEMA 2004b).
Inundation map	A map showing areas that would be affected by flooding from releases from a dam's reservoir. The flooding may be from either controlled or uncontrolled releases or as a result of a dam failure. A series of maps for a dam could show the incremental areas flooded by larger flood releases (FEMA 2004a).
Level of risk	The value of the risk estimate (FERC RIDM, Ch. 2).
Likelihood	Probability; chance (Merriam-Webster Dictionary [online]).
Lives lost (or loss of life)	An estimate of the number (or percentage) of people exposed to the hazard that lose their lives (Reclamation/USACE Best Practices, Chapter III-1).
Low level outlet	Bottom outlet. An opening at a low level from a reservoir generally used for emptying or for scouring sediment and sometimes for irrigation releases (FEMA 2004a).
Measure	An elemental building block of an alternative plan; a feature or activity that can be implemented at a specific location and point in time to address one or more planning objectives (IWR 2017-R-03).

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Measurement	Also called assessment. A description of the duration, location, and magnitude of a plan effect as precisely as possible. Measurement can be quantitative or qualitative (IWR 96-R-21).
Metric	A standard of measurement (Merriam-Webster Dictionary [online]).
Objective	A statement of the intended purposes of the planning process; a statement of what an alternative plan should try to achieve. (IWR 96-R-21) For the CAN, an objective can be, but does not have to be, a “SMART” objective (specific, measurable, achievable, relevant, and time-oriented).
Opportunity	Any situation that causes, creates, or presents the potential for an uncertain positive consequence (IWR 2017-R-03).
Outlet works	A dam appurtenance that provides release of water (generally controlled) from a reservoir (FEMA 2004b).
Peak flow	The maximum instantaneous discharge that occurs during a flood. It is coincident with the peak of a flood hydrograph (FEMA 2004a).
Period of analysis	The period of time over which any alternative plan would have significant beneficial or adverse effects (PGL 96-01). The same period of analysis must be used for each plan considered in a study (IWR 96-R-21).
Plan	See <i>Alternative plan</i> .
Plan formulation	The process of combining management measures to build alternative plans that meet planning objectives and avoid planning constraints (IWR 96-R-21).
Planning	The deliberate social or organizational activity of developing an optimal strategy for solving problems and achieving a desired set of objectives (IWR 96-R-21).
Planning objective	A clear statement of one purpose of the study (IWR 96-R-21).
Potential failure mode (PFM)	A specific chain of events leading to a dam failure (i.e., an uncontrolled release of water). A PFM should be developed without regard to likelihood (Blackett, Undated).
Potential failure modes analysis (PFMA)	The process of developing and describing fully all potential failure modes of a specific dam (or other facility) through a facilitated discussion (FERC 2017).
Probable maximum flood (PMF)	The flood that can be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in a region (AMS 2012).
Project management plan (PMP)	The document that describes how the project will be executed, monitored, and controlled (PMI 2013).
Quantitative risk analysis	Quantitative risk analyses focus on potential failure modes that have been identified as credible and significant. Event trees and fault trees are developed, loading functions are developed, conditional probability of failure for each potential failure mode is determined, releases and inundation are computed and described, consequences are estimated, and risk estimates are calculated (FERC RIDM, Ch. 2).
Redundancy	Duplication of critical components of a system with the intention of increasing reliability of the system, usually in the case of a backup or fail-safe (USACE 2014, per IRB request).

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Reliability	<p>(1) The probability that the system under consideration is in a non-failure state (Hashimoto, T., et al., 1982).</p> <p>(2) The likelihood of successful performance. Mathematically, reliability = 1 – P of unsatisfactory operation (USACE 2014, per IRB request).</p>
Reservoir regulation procedure	<p>Rule curve. The compilation of operating criteria, guidelines, and specifications that govern the storage and release function of a reservoir. May also be referred to as operating rules, flood control diagram, or water control schedule. They are usually expressed in the form of graphs and tabulations, supplemented by concise specifications and are often incorporated in computer programs. In general, they indicate limiting rates of reservoir releases required or allowed during various seasons of the year to meet all functional objectives of the project (FEMA 2004a).</p>
Residual risk	<p>The amount of existing, future, or historical risk that remains or might remain after a plan has been implemented (IWR 96-R-21).</p>
Resiliency	<p>The ability to avoid, minimize, withstand, and recover from the effects of adversity, whether natural or manmade, under all circumstances of use (USACE 2014, per IRB request).</p>
Risk	<p>A measure of the probability and consequence of uncertain future events. It is often reduced to the simple equation:</p> $Risk = Consequence \times Probability$ <p>(IWR 2017-R-03)</p>
Risk analysis	<p>The use of available information to estimate the risk to individuals or populations, property, or the environment from hazards. Risk analyses generally contain the following steps: scope definition, hazard identification, and risk estimation. The risk analysis process involves the scientific characterization of what is known and what is uncertain about the present and future performance of the dam system under examination (FERC RIDM, Ch. 1).</p>
Risk assessment	<p>The process of considering the results from a quantitative or qualitative estimated risk analysis of an existing dam or project, along with other factors related to a safety decision. These factors can include the dam safety case, social/economic impacts, environmental impacts, constructability, and potential to do harm. The risk assessment is conducted to determine a recommended course of action (which may involve considering a range of options) for mitigating or accepting the risks related to a specific dam or project or with regard to a specific dam safety issue or operational concern on that project (FERC RIDM, Ch. 3, citing FEMA 2015).</p>
Risk attitude	<p>Whether a decision maker is risk neutral, risk averse, or risk seeking (Goda and Hong 2006).</p>
Risk communication	<p>The open, two-way exchange of information and opinion among risk analysts, their stakeholders, and various publics about risks (IWR 2017-R-03).</p>
Risk identification	<p>A qualitative process of listing potential failure modes as sequences of events or combinations of conditions which are considered necessary for dam failure to occur (Bowles, et al. 1999).</p>
Risk-informed	<p>The explicit recognition of uncertainty and the use of risk performance metrics in an analytic-deliberative process; decision-making under uncertainty (IWR 2017-R-03).</p>

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Risk management	In the Corps framework, the application of policies, preferences, and values to the outcomes of risk assessment (IWR 2017-R-03).
Risk register	A project management tool for documenting and managing the risks of a project (IWR 2017-R-01). As used in this definition, “project” has the meaning defined in the PMI PMBOK: “A temporary endeavor undertaken to create a unique product, service, or result. The temporary nature of projects indicates that a project has a definite beginning and end.”
Risk source	An element which alone or in combination has the intrinsic potential to give rise to the risk (Maxwell and Franssen 2012).
Robustness	The ability of the component to continue to operate correctly across a wide range of operational conditions, with minimal damage, alteration, or loss of functionality, and to fail gracefully outside of that range (USACE 2014, per IRB request).
Scoping	Identifying the problems and opportunities, and describing the planning study’s context, i.e., without-plan condition, objectives and constraints, decision criteria, and sources of uncertainty (IWR 2017-R-03).
Screening	A discriminating thought process during which things are examined methodically and separated into groups of “drop” and “consider further.” It is a form of decision-making based on well-defined and agreed-upon criteria (IWR 96-R-21).
Selection	The decision on whether to include or exclude a given plan from further consideration. In the Corps’ water resources planning framework, it means selecting the best plan from among the alternative plans (IWR 96-R-21).
Semi-quantitative risk analysis (SQRA)	A description of risk based on estimates of likelihood categories and consequence categories for each potential failure mode. In SQRA, life risk is typically portrayed on a risk matrix chart (FERC RIDM, Ch. 2).
Sensitivity analysis	An analysis in which the relative importance of one or more of the variables thought to have an influence on the phenomenon under consideration is determined (FEMA 2004a).
Spillway	A structure over or through which flow is discharged from a reservoir. If the rate of flow can be controlled by mechanical means, such as gates, it is considered a controlled spillway. If the geometry of the spillway is the only control, it is considered an uncontrolled spillway (FEMA 2004b).
Spillway chute	A steeply sloping spillway channel that conveys discharges at super-critical velocities (FEMA 2004a).
Spillway crest	The lowest level at which water can flow over or through the spillway (FEMA 2004a).
Spillway design capacity	The maximum spillway outflow which a dam can safely pass with the reservoir at maximum level (FEMA 2004b).

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Stakeholder	An individual or organization with an interest in a project. Reclamation (2014) provides one approach to stakeholder identification and categorization: <ul style="list-style-type: none"> • Primary stakeholder: any person or organization ultimately affected, either positively or negatively, by project actions. • Secondary stakeholder: any person or organization indirectly affected by project actions. • Influencer: any person or organization with significant influence over the conduct of a project proponent’s actions. (An influencer can also be a primary or secondary stakeholder.)
State Water Project (SWP)	A water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants extending more than 700 miles. Planned, constructed, and operated by the California Department of Water Resources (DWR), the SWP is the nation’s largest state-built, multi-purpose, user-financed water project. The primary purpose of the SWP is water supply (DWR State Water Project website).
Task	In the context of the CAN project, a task is one of the six technical tasks that comprise the CAN. They focus on these areas: (1) spillway alternatives; (2) reservoir operations; (3) Flood Control Outlet reliability; (4) possible contributions from a low-level outlet; (5) embankment stability; and (6) instrumentation. For clarity and consistency, when the word “task” refers to one of these six focus areas, it is capitalized (“Task”).
Tolerable risk	An unacceptable risk whose severity has been reduced to a point where it is tolerated (IWR 2017-R-03).
Transferred risk	A reduction in risk at one point in time or space for one kind of event or activity that increases risk at another time or space for the same event or activity (IWR 2017-R-03).
Watershed	The area drained by a river or river system or portion thereof. The watershed for a dam is the drainage area upstream of the dam (FEMA 2004a).
With-plan condition	The condition that is expected to prevail in the planning area in the future if a particular plan is implemented.
Without-plan condition	The condition expected to prevail in the planning area in the future if no plan is implemented to solve the problem. Every alternative plan is compared to the same future without-plan condition (IWR 96-R-21).

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