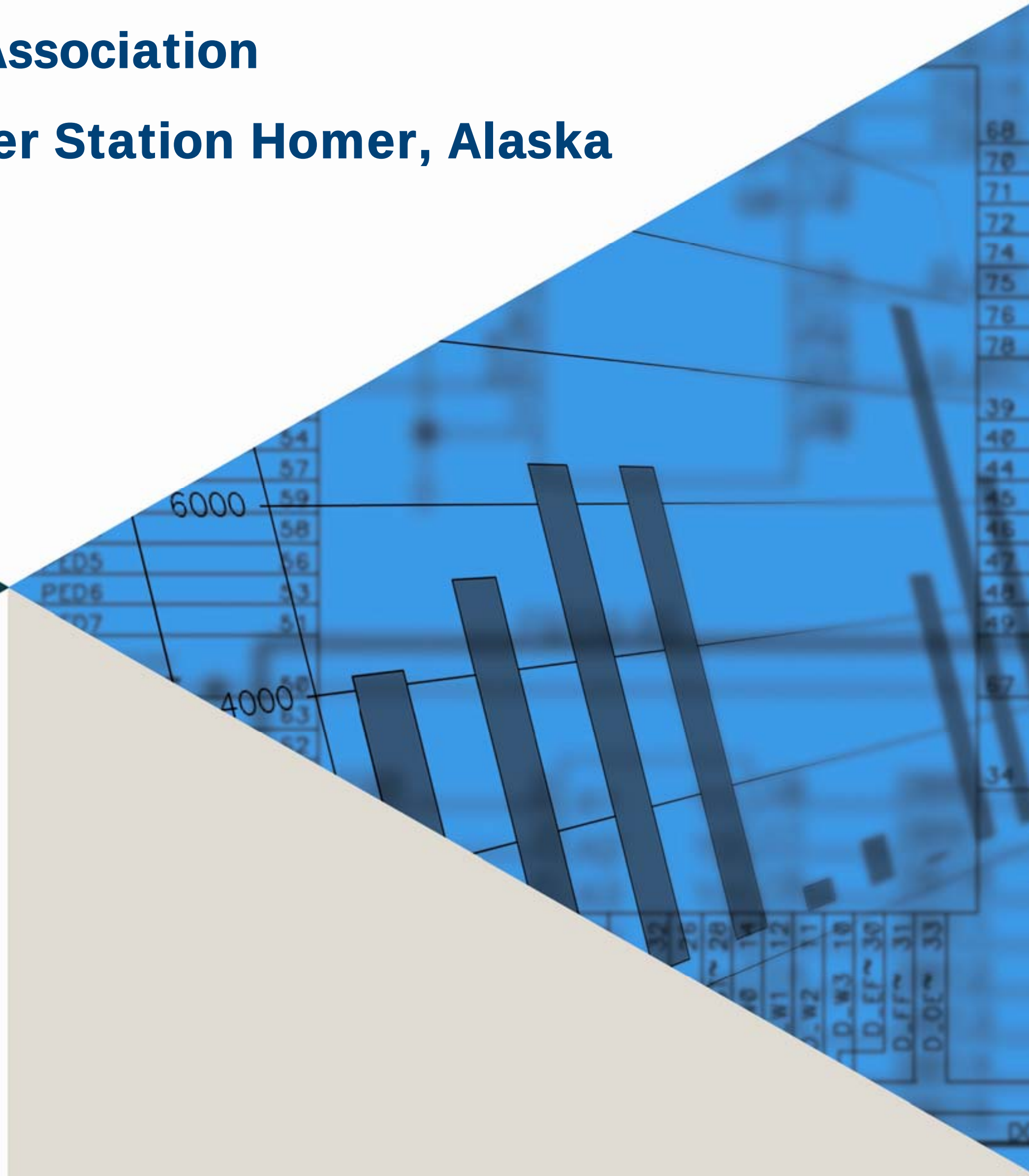
December 22, 2014

Earthquake Probable Maximum Loss

Risk Profile Memorandum

Chugach Electric Association

Bradley Lake Power Station Homer, Alaska



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Executive Summary

The following memorandum summarizes our earthquake risk assessment of the Bradley Lake Project Dam and Power Station located near Homer, Alaska. This memorandum also includes observations from our visit to the site for specific facilities.

The Bradley Lake Hydroelectric Project's major structures and equipment assets include the main dam, tunnels, powerhouse structure, various support buildings, generation equipment, control equipment, plant equipment, and substation equipment.

Both scenario and probabilistic-based earthquake risk analyses were performed in this study. The probabilistic analysis includes the risk contribution from all possible earthquake events that could affect the site and the results provided in this study are the annual aggregate losses associated with the 100-year, 250-year, and 500-year return periods. The 100-year, 250-year, and 500-year return periods have 1% (1/100), 0.4% (1/250), and 0.2% (1/500) probability of being exceeded annually.

Our portfolio study also analyzed scenario earthquakes on controlling faults that correspond to 475-year and 2,500 year return period earthquake event. Results are provided in terms of Probable Maximum Loss (PML) defined as the 90th percentile loss for which there is only a 10% chance the loss would be exceeded for the given event. Estimates of business interruption durations are associated with these scenario events are also provided. Insurers commonly base their earthquake property loss reserves and pricing on the 475 year probable maximum loss (PML) estimates.

Table E-1 presents the summary of the earthquake Risk Profile for the Bradley Lake Project.

Table E-1
RISK PROFILE OF THE BRADLEY LAKE PROJECT

<table>
<tr><th colspan="3">ASSET INFORMATION</th></tr>
<tr><td>PORTFOLIO</td><td colspan="2">Bradley Lake Project</td></tr>
<tr><td>ASSETS</td><td colspan="2">Main Dam, Tunnels, Power Plant, various support buildings, generation equipment, control equipment, plant equipment, and substation equipment.</td></tr>
<tr><td>VALUE ($ Million)</td><td colspan="2">Total Portfolio Value: $310</td></tr>
<tr><td>LOSS PERIL</td><td colspan="2">Severe Earthquakes</td></tr>
<tr><th colspan="3">PROBABILISTIC ANALYSIS RESULTS</th></tr>
<tr><td>Probability of Loss Non-Exceedance</td><td>Return Periods</td><td>Annual Aggregate ($ Million)</td></tr>
<tr><td>99.0 %</td><td>100</td><td>13</td></tr>
<tr><td>99.6 %</td><td>250</td><td>18</td></tr>
<tr><td>99.8 %</td><td>500</td><td>34</td></tr>
<tr><th colspan="3">SCENARIO EARTHQUAKE ANALYSIS RESULTS</th></tr>
<tr><td>Event and Return Period</td><td>Probable Maximum Loss ($Million)</td><td>Business Interruption (Months)</td></tr>
<tr><td>Megathrust or Benioff Zone Rupture
MMI 8.8 (IX-) 475 year</td><td>33</td><td>2 to 3</td></tr>
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MMI 9.6 (X-) – 2,500 year</td><td>58</td><td>4 to 8</td></tr>
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Chapter 1 - Introduction

1.1 Purpose

The purpose of this report is to presents the results of the earthquake risk and potential losses to Bradley Lake Project Dam and Power Station located near Homer, Alaska in the event of a major earthquake affecting the area.

The scope of work was structured in two parts. The first part was a site visit to visually assess the condition of the structures, observe important structural characteristics that could affect the performance structures and equipment. The second part was a "Desktop" evaluation and portfolio analysis using our software *Risk Quantification and Engineering (RQE)*® (EQECAT, Inc. 2013). The desktop study reviewed available structural design drawings and documents, consultant reports on seismic performance, and site-specific seismic hazards to provide an estimate of the Probable Maximum Loss (PML).

The PML values for the dam, buildings, foundations and electrical equipment (in terms of replacement cost) were projected, which provides the Bradley Lake Project with updated risk information that can be utilized as input to risk management and insurance decisions.

1.2 Scope of Work

Specific tasks performed during this review included:

1. Supplier engineers visited the Bradley Lake Power Station complex and met with Project operations staff. The engineers toured the facilities and visually assessed the condition of the structures, observed important structural characteristics, and noted obvious deficiencies, if any.
2. Reviewed new or additional design document, drawings, and reports on the site. Specific attention was focused on areas associated with structural

vulnerabilities to earthquake forces. Particular attention was paid to changes in the facility that have taken place since the 2005 visit.

3. Analyzed the facility employing the Supplier's proprietary software Risk Quantification and Engineering (RQE®). The analyses provide estimates of loss using both deterministic and probabilistic methods. The deterministic analysis provides risk in terms of Probable Maximum Loss (PML) percentages based on major earthquake scenarios having a mean recurrence interval of 475 years (Designated the Design Basis Earthquake or DBE) and 2,500 years (Designated the Maximum Credible Earthquake or MCE). The PML percentage were developed for a 475-year Design Basis Earthquake. PML represents a conservative loss estimate associated with a 90% confidence of not being exceeded. The probabilistic analysis provides the 100 year, 250 year and 500-year loss exceedance probability for a stochastic set of earthquake events that could affect the facility.

4. In addition to estimates of property damage associated with the dam, buildings and inventories, estimates were provided for business interruption (BI) and contingencies. BI durations were based on the estimated damage states to property excluding the impact on lifelines external to the Bradley Lake complex.

5. Provided a brief letter report updating our 2005 study and summarized our analyses and findings.

1.3 Report Outline

Chapter 2 presents appropriate background information on earthquake risk and discusses the site specific soils conditions.

Chapter 3 describes the portfolio of properties and its distribution and presents the analysis methodology.

Chapter 4 presents and discusses the earthquake analysis results.

Chapter 5 shows selected references.

1.4 Approach for the Analysis

The general approach for the earthquake analysis included:

- Determined the location of each site based on computations of latitude and longitude from the supplied addresses and/or latitude and longitude information.
- Determined the soil type for each site based on information contained in EQECAT, Inc.'s database of soil conditions.
- Assigned the structures and equipment to one of the typical structure and equipment types contained in EQECAT, Inc.'s software packages.
- Determined the probabilistic loss estimates for the portfolio by utilizing EQECAT, Inc.'s software packages.

Chapter 2 - Area Seismicity

2.1 General Conditions

The Bradley Lake Hydroelectric project site is located in the Chugach Mountains of the Kenai Peninsula, Alaska, approximately 10 kilometers east of the head of Kachemak Bay and 40 kilometers northeast of Homer. The area near Homer is located in an area where the Pacific lithospheric plate begins to subduct beneath the North American plate and is bounded to the north by the Aleutian Trench. The entire coastal region of Alaska and the Aleutians has experienced great earthquake activity in the past.

Alaska has the highest frequency of earthquakes of any State in the United States (Wesson, et al., 2007). In southern Alaska, earthquakes occur in a broad, arcuate belt that extends from the Kenai Peninsula through the Alaska Peninsula and the Aleutian Islands (Figure 1). Earthquakes generally become deeper from south-to-north across the belt and are related to the northward subduction of the Pacific tectonic plate beneath southern Alaska. The Pacific plate subducts southern Alaska (North American plate) along the Alaska-Aleutian trench at a rate of about 6 cm/year (Sella et al., 2002). These plates are in frictional contact along a megathrust fault plane that dips northward from the Alaska-Aleutian trench. The megathrust fault is responsible for much of the seismicity offshore of southern Alaska and the Alaska Peninsula (Figure 2-1). At depths greater than about 40 kilometers, deep earthquakes occur in the subducted Pacific plate as part of its disintegration process in the Earth's mantle.

The subduction zone, referred to as the Benioff Zone, dips northwest from the Aleutian Trench and is approximately 50 kilometers beneath the Bradley Lake site. Historically, eight earthquakes ranging from 7.4 to 8.5 Richter magnitude have occurred within 800 kilometers of the site. The largest earthquake to affect the project site historically was the March 27, 1964 Prince William Sound earthquake. This moment magnitude (M) 9.2 earthquake ruptured the Alaska-Aleutian megathrust fault over a distance of 800 kilometers and is one of the three largest earthquakes to occur worldwide since the beginning of instrumental recording in the late 1800's (Wesson et al., 2007). Anchorage was devastated by the earthquake. Landslides and liquefaction were widespread. According to the U.S. Geological Survey, the earthquake caused more land-surface deformation than any previously recorded earthquake. The earthquake generated a massive tsunami that reached 33 meters high at places in Port Valdez, Alaska. The earthquake and tsunami claimed 131 lives and caused an estimated $2.3 billion in property damage (in current dollars) according to the U.S. Geological Survey. Other great earthquakes (M≥8.0) occurred farther west along the Alaska-Aleutian megathrust fault in the years 1938, 1946 and 1957.

The following sections provide summary information on the nearby faults believed capable of generating earthquakes that could affect the site and summarize our assessment of the probable severity of ground shaking and other site hazards, in the event such earthquakes occur (Alaska Power Authority Vol.4). In addition to ground shaking, hazards evaluated included liquefaction, lateral spreading, landsliding, and compaction.

2.2 Active Faults

An active fault is defined as one for which either there is a historical record of earthquake activity or evidence that movement has occurred within the last 11,000 years. Future movement on these faults is considered probable. The faults that will most likely affect the site are briefly discussed in the paragraphs below:

Bradley Lake is located on the overriding crustal block above the subduction zone and between several faults that have documented Holocene or historic surface ruptures. Because of the active tectonic setting, activity is probable on several faults near the site. Two faults of regional extent occur at or near the site; The Border Ranges Fault and Eagle Range Fault. In addition, the site is crossed by two large local faults, called the Bradley River Fault and the Bull Moose Fault, as well as number of probable smaller faults.

The site will most likely be affected by earthquakes originating on the Benioff Fault Zone. In addition, Bradley River Fault and the Bull Moose Fault are likely capable of generating independent earthquakes and are also capable of rupture in response to events on the adjacent larger faults. Possible Richter magnitudes for earthquakes on the Benioff Fault

Zone and crustal faults can be as high as 7.5. In addition, a great earthquake called the "Megathrust" event could occur along the subduction zone with a magnitudes of 9.45. A tectonic map of the area shows the location of the site with respect to the above faults and subduction zone (Figure 2-1).

2.3 Intensity of Shaking

While magnitude describes the energy release of an earthquake, intensity describes the effects of shaking in terms of damage at a particular location. Intensity is governed by the magnitude of an earthquake, the distance from the site to the fault rupture, and local geologic conditions. Even a small or moderate earthquake may generate strong ground shaking, but the region affected by this shaking will be substantially less than that generated by a major earthquake. The 1931 Modified Mercalli Intensity (MMI) Scale (Appendix B) is commonly used to measure intensity. The scale comprises 12 categories of ground motion intensity, from I (not felt, except by a few people) to XII (total damage). The MMI Scale is somewhat subjective; it is dependent on personal interpretations and, to some extent, on the quality of construction in the affected area. The Richter magnitude is a quantitative measure of energy released at the epicenter of an earthquake while intensity is a more qualitative measure of shaking at the location of interest.

The site is located in an area of high earthquake risk. The intensity of shaking at the site was evaluated using Peak Ground Acceleration (PGA) values determined for a return period of 475-years on a firm soil site class. The 475-year PGA at the site on firm soils as 0.4g. Table 2-1 lists the 475-year PGA on firm soil as well as estimates of Modified Mercalli Intensity (MMI) values for the site.

The MMI used in this study to determine appropriate loss estimates for the facility considers each known active fault in the region and its potential for earthquakes of varying magnitude. MMI is projected for the site, considering the effects of an event that, on the average, is expected to occur once every 475 years, on any of these faults. Although a 475-year event is not the strongest event that could ever occur in an area, it is a reasonable estimate of the strongest shaking likely to occur at a site during the life of an engineered structure and is used as the basis for structural design in modern building codes.

2.4 Seismic Stability of Site Soils

According to the information in the design reports, the power plant site is underlain by rock at shallow depth and covered by a veneer of soil. The powerhouse is founded upon fractured rock.

Based on available soils reports and published geological and seismological information, we believe ground shaking is the primary hazard for the site since such shaking causes 90% of earthquake-related damage. Other types of seismic hazards are less likely for this site as discussed below.

Ground fault rupture is unlikely to affect the powerhouse or dam sites. The Bradley Lake and Bull Moose Faults both cross the intake tunnel alignment between the dam and the powerhouse. “The largest potential displacements, up to 3 meters(10 feet) have been postulated by some investigators on these faults; the probability is very small for this case.”

The liquefaction potential is low and does not present a significant hazard to the powerhouse, dam or intake tunnels.

Landslide hazards are limited in the site area because of the previous removal of most unconsolidated material by glacial scour. Potential minor slides are restricted to the area around Bradley Lake and the Bradley River Gorge. These areas do not affect any of the project facilities.

Site Hazard Estimates

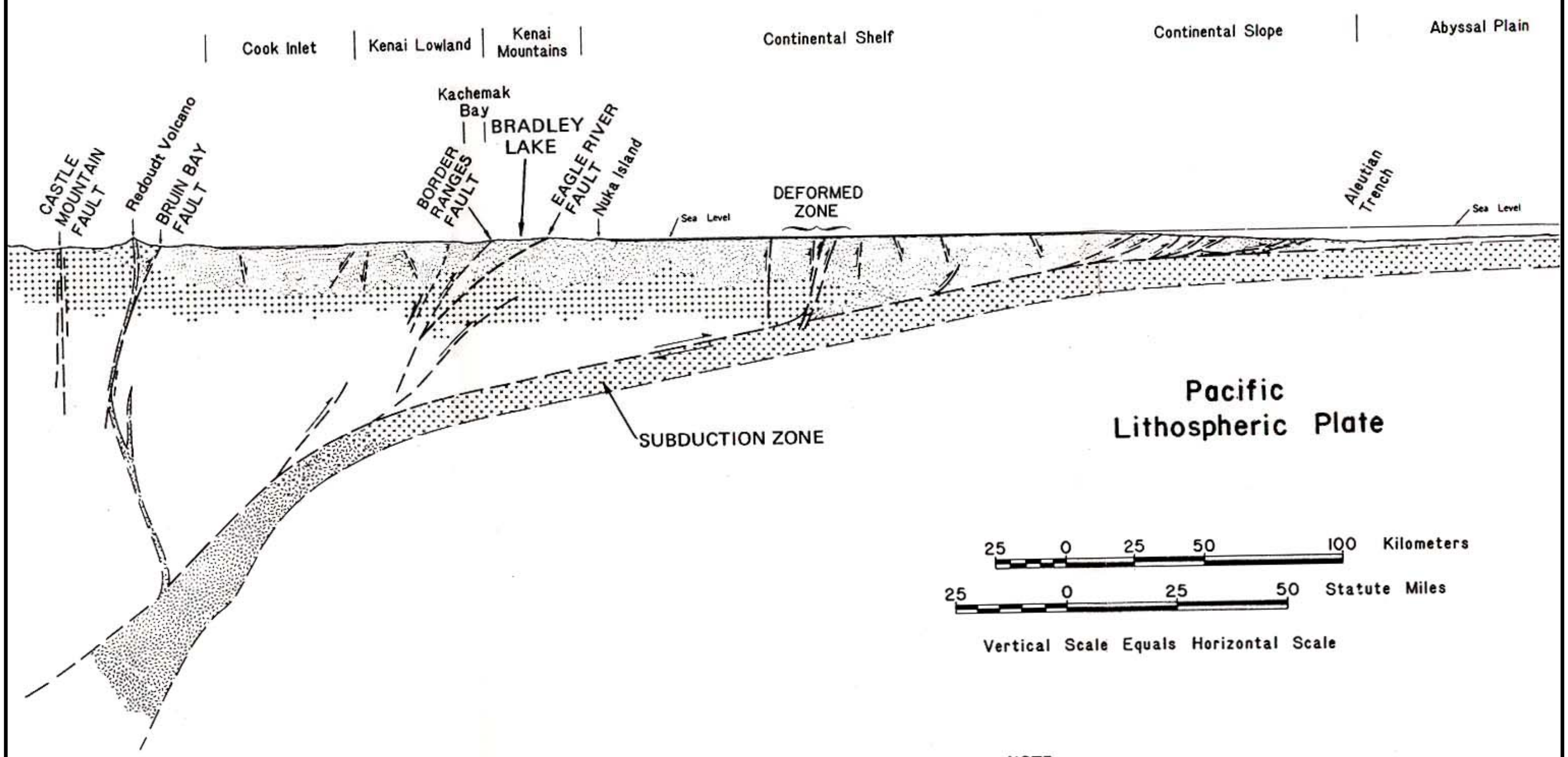
Peak ground acceleration values at the project site were obtained from the latest available U.S. Geological Survey (USGS) ground motion hazard database for Alaska (Wesson et al., 2007). The Bradley Lake dam site is located nearly central to a 0.1° x 0.1° grid of PGA values that is provided by the USGS (Wesson et al., 2007) for Alaska. The site PGA values were therefore calculated as the average of the four closest gridpoint values. The site PGA values were converted to intensity using the PGA-MMI correlation equation of Atkinson and Kaka (2007).

The USGS PGA values are calculated at the NEHRP B/C boundary, or the boundary between NEHRP site classifications of “rock” and “very dense soil and soft rock”. The shear wave velocity (Vs) of this boundary zone is 760 meters per second. This would appear to be appropriate for the dam site at which bedrock is characterized as “graywacke and conglomerate” in a USGS bedrock geologic map of the area (Bradley, et al., 1999). Note that “greywacke” is characterized as a texturally immature sedimentary rock that contains angular grains and rock fragments set in a fine clay matrix. The site PGA/MMI values are summarized in Table 2-1.

Table 2-1
PGA AND MMI ESTIMATES FOR THE
BRADLEY LAKE POWER PLANT SITE NEAR HOMER, ALASKA

Site	475-year PGA (g)	Expected MMI (475-year)	2,500-year PGA (g)	Expected MMI (2,500-year)
Bradley Lake Power Plant	0.424	8.8 (IX-)	0.679	9.6 (X-)

Figure 2-1: Lower Cook Inlet Region Schematic Tectonic Model (From Alaska Power Authority (ND) Chapter3)



NOTE:
Lithologies and structures that are not exposed at the surface are inferred.

SOURCE:
Woodward Clyde Consultants, 1978, Offshore Alaska Seismic Exposure Study

Chapter 3 – Asset Description and Methodology

This chapter describes the assets and the methodology used to determine the potential earthquake loss exposure to the Bradley Lake Hydroelectric Plant located near Homer, Alaska.

3.1 RQE Earthquake Modeling Methodology

This section gives an overview of analysis methodology, which EQECAT, Inc. has integrated into the RQE software to assess portfolio risk exposure to earthquakes.

Natural Catastrophe (NatCAT) modeling is the process of using computer-assisted calculations to estimate losses that could be sustained due hurricanes, earthquake, floods and other similar events. NatCAT modeling has developed over the past few decades to be the standard methodology utilized in the insurance industry to analyze potential losses and is at the confluence of many disciplines including actuarial science, engineering, meteorology, seismology and computer science. NatCAT models utilize a class of computer programs called geographic information systems (GIS). GIS allow the storage, manipulation, analysis, and management, of the very large quantities of geographical and other data required by NatCAT simulation models.

Natural catastrophic events have low probabilities of occurrence and high consequences, and there have not been the large numbers of actual loss events affecting the built infrastructure that would be required for actuarial analysis of these perils. Therefore simulation modeling has been developed, using the known sciences of seismology to allow modeling of the many more events that are possible, but have not yet been observed.

3.1.1 Model Components

Natural catastrophe simulation models are developed using four model components: hazard, assets at risk, vulnerability, and damage which are described here.

3.1.1.1 Hazard Model

First, the hazard component of the model describes three basic attributes of the hazard. These are the location of events, their frequency of occurrence, and their severity. Hazard models are developed using available historical information from inventories and catalogs of actual historical events. The historical record for earthquakes is only about a century long in the United States, with the most modern scientific observations and measurements having been made in the last half of the twentieth century.

Synthetic earthquakes events are generated using scientific parameters observed in past historical events. For earthquakes, locations, magnitude, focal depth, various fault-rupture characteristics, and soil conditions, are important modeled parameters. For each of these variables, the model uses probability distributions that describe the range of values each variable may have to construct synthetic events. These probability distributions are used to produce thousands of scientifically possible simulated events with varying severities and frequencies called a stochastic event set. These large stochastic event sets provide a more realistic representation of the full range of potential earthquakes that could happen, but have not yet been observed in our limited historical observation period.

3.1.1.2 Portfolio Definition – Assets at Risk

Second, assets at risk are an essential component of catastrophe models. The risk model requires defining of the portfolio of properties at risk. It is basically putting together all the relevant information of the assets including location, values at risk, structural types.

The Bradley Lake Hydroelectric Project consists of a concrete-faced, rock filled (CFRD) dam, 125 feet high and 610 feet long. A 13-foot diameter, concrete-lined power tunnel, 18,610 feet in length, and steel lined penstock, transports water from the tunnel intake located at Bradley Lake to a powerhouse at sea level. The powerhouse contains two generators capable of providing in excess of 60 megawatts each. The plant began operation in 1991. The Plant provides power to Project participants City of Seward, Chugach Electric Association, Golden Valley Electric Association, Homer Electric Association, and Anchorage Municipal Light & Power.

The major structures and equipment assets at the site includes: Main Dam, Tunnels, Power Plant, various support buildings, generation equipment, control equipment, plant equipment, substation equipment.

The inventory of assets at risk are managed in GIS data bases and describe the basic asset attributes of location, value, construction types, age of construction, and inventory and non structural commodities to allow the estimation of potential damage to structures and their contents. Damage is primarily a function of construction and associated attributes. Model computations are performed in the hazard module to estimate how the local hazard intensity (ground shaking, etc.) varies over the areas where assets are at risk for each simulated event.

3.1.1.3 Vulnerability

Third, is the model vulnerability component. Damage to structures and contents varies with the intensity of the forces from earthquake shaking. Damage also varies with other asset characteristics such as type of construction, age, etc. Vulnerability functions account for variability by assigning a probability distribution bounded by 0% and 100% with a prescribed mean value and standard deviation. Vulnerability analysis relies on three sources of data: first, past catastrophic loss experience and insurance claims data; second, engineering design analysis; and third, engineering judgment and opinion.

Vulnerability functions (i.e., relationships between the damage levels and levels of ground shaking at the site) are assigned for each site. Vulnerability functions account for variability by assigning a probability distribution bounded by 0% and 100% with a prescribed mean value and standard deviation. Vulnerabilities for the classes of assets were assumed in the model.

Based on information provided, the equipment and the equipment values were divided into either plant equipment, substation equipment, control equipment or a support equipment category. Some of these equipment categories were more susceptible than others to damage from the applied earthquake forces.

Building types, construction, year of construction, number of stories, and other attributes were selected and applied in the computer analyses.

Please refer to Appendix A for a description of the potential earthquake vulnerabilities and any associated recommendations.

3.1.1.4 Damage Estimate

Lastly, the model damage component estimates the damage to the assets at risk that are sustained as a result of the local hazard intensity of each simulated event. Damage is estimated by the relationship between the local hazard intensity at the each asset location and the vulnerability of the asset. The probabilistic distributions of ground shaking at the site were combined with vulnerability functions to estimate the probability of damage for each earthquake event. Based on this data and on the ground shaking intensity and its uncertainty, the expected damage and its uncertainty are computed for the assets.

Damage to each asset for each of the stochastic events is estimated and aggregated along with the frequency of each event. The damages at the site are combined probabilistically to develop the damage distribution. This process accounts for correlations in damage levels between the structure types. In this way, a large database of damage is developed for all events that can cause damage to the asset portfolio.

These databases of damage and frequency are used to develop probability distributions of event driven losses. The individual damage estimates for each possible event are probabilistically aggregated to estimate overall expected (annual) damage and damage non-exceedance values. The aggregate annual damage represents the aggregate of the annualized damages from all relevant probabilistic events. It is a common measure of the hazard severity in the region of interest.

These probabilities can also be expressed as return periods. For example, a given loss level in dollars expected from an earthquake with an annual non-exceedance probability of 99% (or a return period of 100 years) is expected to be exceeded one year out of every 500. An event with an annual non-exceedance probability of 99.8% (or a return period of 500 years) is a less probable event with larger expected damage.

Chapter 4 - Earthquake Analysis Results

This chapter presents the results of our earthquake analysis for the Bradley Lake Power Plant site. Section 4.1 presents the estimated combined earthquake losses for all the Project assets.

4.1 Earthquake Risk Analysis Results

A probabilistic risk analysis considers all earthquake events in the *RQE* probabilistic earthquake hazard databases that could affect the site. Damage and loss results are generated for all applicable events. These results are combined and processed to provide probabilistic results. The resulting information provides input to the insurance decision process. A probabilistic loss analysis provides estimates of damage for a range of different time periods.

Deterministic earthquake scenarios are also provided. Estimated losses are provided for two scenario events with return periods 475 and 2,500 years in Tables 4-1 and 4-2. These events are ruptures on the Megathrust or Benioff falut zones and for various crustal faults very close by the site.

In addition to the estimated building and equipment losses (direct property losses), Tables 4-1 and 4-2 also includes an estimated loss shown as a contingency for cleanup and recovery. Since it will be important to restore an earthquake-damaged facility to normal operations as soon as possible, the additional cost of the post-event clean-up is estimated as 10% of the total expected direct property loss. Roads, the airstrip and harbor structures are not insured property and no estimate of costs to repair earthquake damage to these assets is provided, even though repairs may be required to these facilities to allow repairs of the main dam and power plant.

An additional cost consideration, which must be taken into account, is the post-earthquake demand surge factor. Following a large regional earthquake event, many businesses throughout the affected area will require the same types of labor and supplies as needed to repair the buildings and equipment. It is reasonable to assume that premium wages and difficulties in committing and scheduling skilled repair personnel will be encountered after a major regional earthquake. In the loss table, this additional cost was added to the total direct loss.

Demand surge represents the expected rise in the cost of construction materials and services following a major earthquake. Although from experience, it is clear that such a surge is likely and can be significant, it is not clear that the surge effect can be determined reliably. As such, potential loss results are presented with demand surge as a line item so that judgment can be used in determining the appropriate level of loss for planning purposes.

4.2 Property Damage

Examining Tables 4-1 and 4-2, it can be seen that the 475-year portfolio loss is estimated to be approximately $33.0 million and the 2,500-year portfolio loss is estimated to be approximately $58 million. For a breakdown of these numbers between the estimated building losses, dam losses, tunnel losses, plant equipment losses, substation equipment losses and contingency please refer to the two tables. Insurers commonly base their property loss reserves and pricing on the 475 year probable maximum loss (PML) estimates.

As a comparison, the 500-year probabilistic loss for the site is estimated to be approximately $34 million. Similar 250 year and 100 year probabilistic losses for the site are approximately $17.7 million and $12.7 million.

4.3 Business Interruption and Time Element

The estimates of potential business interruption provided are based on the expected level of dam, building and equipment damage.

In the event of any significant size earthquake that could affect the Bradley Lake site damage inspections and engineering safety inspections would likely be required. Engineering and safety inspections could take two to three months to complete.

Engineering design documents indicate that several types of damage should be expected. Settlement of up to 3.5 feet of the 10 feet of reservoir freeboard at the main rock filled dam may occur. Although this is not considered a safety concern, it is likely that draw down of the reservoir may be required for inspections inspection and/or repairs. This, however, may not be limiting to plant operations but could impact reservoir and generation capacity once the plant is returned to service.

The intake tunnel crosses the Bradley and Bull Moose crustal faults, each of which are believed to be capable of independent earthquake generation. In addition, they are capable of rupture in response to events on adjacent, larger crustal faults. Movement along these faults could occur with offsets of up to ten feet. Fault movement across the intake tunnels would require dewatering and repairs to the tunnel.

Damage could also occur to the powerhouse and foundations. This would most likely be repairable cracking to foundations and damage to exterior building fascia and glazing.

Damage to substation circuit breakers, switches and transformer ceramics and leakage of SF6 insulation could also result in brief limitations to plant operations.

Table 4-1
EARTHQUAKE LOSS ESTIMATE FOR A 475-YEAR RETURN BASIS EARTHQUAKE

Category[1]		Replacement Values ($ millions)	Probable Maximum Loss (%)	Projected Losses[2] ($ millions)
1)	Buildings	$55.2	10.9%	$6.0
2)	Main Dam	$77.7	14.1%	$11.0
3)	Tunnels	$122.1	5.3%	$6.4
4)	Plant Equipment	$136.2	2.3%	$3.2
5)	Substation Equipment	$12.3	16.5%	$2.0
6)	Subtotal Direct Property Loss [(Sum 1 thru 5)]			$28.6
7)	Contingency for Cleanup and Recovery [6) x 0.1][3]			$4.3
	Total Project Loss [Sum of 6) & 7)][4]			**$32.9**

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[1] A total Property value of was provided to EQECAT

[2] Equals values x PML

[3] Contingency assumed at 15% of total direct property loss.

[4] The Total Projected Loss does not include a monetary loss estimate for business interruption.

Table 4-2
EARTHQUAKE LOSS ESTIMATE FOR A 2,500-YEAR RETURN BASIS EARTHQUAKE

Category [5]	Replacement Values ($ millions)	Probable Maximum Loss (%)	Projected Losses [6] ($ millions)
1) Buildings	$55.2	19.3%	$10.7
2) Main Dam	$77.7	24.9%	$19.4
3) Tunnels	$122.1	9.3%	$11.3
4) Plant Equipment	$136.2	4.1%	$5.6
5) Substation Equipment	$12.3	29.4%	$3.6
6) Subtotal Direct Property Loss [(Sum 1 thru 5)]			$50.6
7) Contingency for Cleanup and Recovery [6) x 0.1] [7]			$7.6
Total Project Loss [Sum of 6) & 7)] [8]			**$58.2**

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[5] A total Property value of was provided to EQECAT

[6] Equals values x PML

[7] Contingency assumed at 15% of total direct property loss.

[8] The Total Projected Loss does not include a monetary loss estimate for business interruption.

Table 4-3
EARTHQUAKE BUSINESS INTERRUPTION ESTIMATE

Category [9]	**475 yr EQ Estimated Repair Duration[10] (Months)**	**2,500 yr EQ Estimated Repair Duration (Months)**
1) Buildings	1-2	2-3
2) Main Dam	1-2[11]	3-6
3) Tunnels	2-3	4-8[12]
4) Plant Equipment	1<	1-2
5) Substation Equipment	1-2	2-3
Estimated Business Interruption Duration	**2 to 3**	**4 to 8**

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[10] Assumes loss occurs at a time of year when weather permits heavy construction activities. For an event that occurs during fall or winter months, or where there is significant earthquake damage to road and harbor infrastructure, the recover durations may be 3 to 5 months longer

[11] Settlement of up to 3.5 feet in the rock filled dam and damage to the concrete fascia slabs is not considered to be limiting to operations. Engineering and safety inspections of up to 2 to 3 months are assumed. Reduction in reservoir levels for inspections could significantly reduce power production capacity.

[12] Fault offset of up to 10 feet that could occur in two places across the intake tunnels could result in an extended operations interruption.

Chapter 5 – References

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