Q. Please provide a sample Hydro final report resulting from an Enterprise Risk Management assessment.

A. Please refer to PUB-NLH-037, Attachment 1 for a sample Enterprise Risk Management Assessment report.

Risk #	Risk Description	Inherent Risk Likelihood 1 to 5	Inherent Risk Impacts 1 to 5	Inherent Risk Rating	Inherent Risk Rating Rationalization	Risk Metrics / Indicators Measure	 Trend	Description of Risk Treatment (Current Year)	Residual Risk Likelihood 1 to 5	Residual Risk Impact 1 to 5	Residual Risk Rating	Rationalization for Residual Risk Ratings	Description of Risk Treatment (Future Years)
HG.001	As a result of an unforeseen severe weather event which interrupts normal operations (e.g.. Hurricane Matthew / Igor, winter storm, lightning, etc.), severe damage may be observed throughout the grid, or in isolated critical sites, potentially resulting in: - environmental emergencies, - safety incidents (employee & public), - loss of key infrastructure, - interruptions in service to customers, and/or - evacuation of work sites and/or surrounding communities. Examples include: Forest fire, hurricanes and other flood events, severe blizzards, frazil Ice, etc.	4	5	20	Safety: N/A Environment: Extended clean up effort Business Excellence: Loss os substantial number of customers, business interruption and deterioration of project schedule and extraordinary effort by unplanned resources People: N/A Community: Medial coverage and damage to public property that entails hardships in localized area Past Events: - Hurricane Matthew (2016) - Hurricane Igor (2010) - Flood of 1983	- # of cancelled or deferred or added work plan activities as result of damage - $ impacts on operating and capital budgets - Loss of generating capacity resulting from events - Forecast of heavy rainfall over a short time period. - Number of severe weather prepardness meetings per year. - Volume of annual water spilled. - Number of annual spill events.	- Increase in the number and impact of extreme weather events over the past 30 years.	In Place: Dam and Dyke Maintenance Register; DSR Reports; PETS internal inspection reports; Dyke Board reports; EPP's for Long Pond, Victoria Dam, and Snook's Arm; LTAP 20-yr capital plan; EMS - Monitoring of weather forecasts - Water management - Vegetation control - Emergency Preparedness Plans - Dam Safety Program (inspection and maintenance) - PM Program for structures; capital improvements (i.e.: Burnt Fuse plug) - Raised the height of PRV-2 by 1 meter - Severe weather prepardness meetings - Collective agreement standby clause - Public notifications - Property insurance which permits for cost recovery relating to phsyical damage and within terms and conditions of Policy. Planned: - Execute 2018 deliverables relating to improving Emergency	3	4	12	Likelihood - might occur under certain circumstances based on history Risk treatments in place reduced the liklihood that a weather event will cause damage, and lower the impact for events that have potential to cause damage.	1. Established high PM compliance for structure and dam maintenance and inspection program 2. Improved Asset Management strategy 3. Improved capital program: 3a. Complete 2019 activities relating to upgrades of Salmon River spillway (capital plan). 3b. Increased funding for the structures rehabilitation program. 3c. Rip Rap Rehabilitation program. 3d. Complete 2019 activities relating to bear brook crossing bridge construction. 4. Monitoring public usage of dams / dykes as roads.
HG.001a	As a result of frazil ice formation on intake trash racks at Hind's Lake, Granite Canal and Upper Salmon water flow through the intake into the penstock may become interrupted potentially resulting in: - Loss of production. - Forced outages. - Extended production unavailability. - Corrective maintenance work from equipment damage. - Negative press coverage - Incurred costs from diving and overtime pay to remove fraxil ice from track ranks. - Non-compliance with fish compensation agreement (Granite Canal)	5	2	10	Safety: N/A Environmental: N/A Business Excellence: Interrupted water flow could results in expensive equipment damage is interruption is abrupt. As well, high financial impact to have dive crew mobilize quickly as well as a crew from Nl Hydro's maintenance department for assistance (ie. overtime). All three plants have been prone to frazil ice annual;ly during the winter months. For this reason each unit has expereicned multiple forced outages in the past, some longer and more costly than others. People: N/A Community: Negative media	* # of forced outage * # of times the units are reduced in capacity to mitigate frazil ice accumulation	* Annual occurance for units ot be forced offline during frazil ice conditions. * NL Hydro are more proactive in catching frazil ice before acculation by use of monitoring equipment however forced outages still occur.	In Place: - Temperature probes at intake to measure water temp. - GCL wind speed, ambient temp and wind direction monitoring. Other sites not equipped with this technology. - Various alarms to notify of site conditions related to delta water temp vs. time. Planned: - Purchase data collection software for Granite Canal to start collecting raw data, specifically during frazil ice events. - Build a frazil ice model consisting of equipment to be installed at all three sites. Consistancy and accuracy of this selected equipment will be front and foremost. - Develop a capital plan for installtion of the equipment (2021 FAD or supplemental) - Install new temperature sensors for more accuracy than currently installed temp probes.	4	2	8	* No immediate technology available to predict frazil ice formation for every site, rather NL Hydro has to trend critical data for each site and then build a model to determine when frazil ice typically forms at those particular sites. Determining the conditions for frazil ice formation at each site could take years depending on if the data collected is consistant.	1. Continue collecting data for trending purposes. Refine frazil ice formation criteria each year after collecting and analyzing data. 2. Execute frazil ice equipment upgrades in the capital program. 3. Develop more rigorous maintenance programs for frazil ice equipment.
HG.002	As a result of aging powerhouse and generating assets and their corresponding condition, key equipment (e.g.. turbines, generators, anxillary and electrical systems) may fail, potentially resulting in: - forced outages, - unplanned maintenance, - unplanned emergency capital projects, and / or - interruptions in service to customers. Examples include: BDE Penstocks, USL foundation movement, governor component failures, exciter component failures, hydraulic structure gates, critical spare gaps, BDE draft tubes (concrete voids / bull nose), turbine condition, BDE Unit 1 vibration, electronic control issues (primarily on start-up / shut-down), cooler wear / failures. Aging software & operating systems - difficult to obtain computers that are compatible for troubleshooting. OEM support for aging systems is not available due to retirements.	5	3	15	Safety: N/A Environment: N/A Business Excellence: Very high financial impact, project and work schedule extrordinary impacts People: N/A Community: Negative media coverage and loss of trust of stake holders	- Frequency of key equipment failure - Frequency of forced outages	- Monitoring of asset condition - History of key equipment failure	1. Critical spares program 2. Improvements to the capital plan 3. Technical councils improve communications and process consistency between areas. 4. Increased focus on implementation and tracking of annual work plan. 5. Property insurance which permits for cost recovery relating to phsyical damage and within terms and conditions of Policy. 6. Improvements in condition monitoring and predictive maintenance. Some improvements to condition monitoring in BDE in recent years. IR program in place, Transformer monitoring being developed, more detailed condition inspections for penstocks being implemented.	3	3	9	Reduced likelihood, but impact is the same.	1. Further work on critical spares analysis and acquisition. 2. Growth in technical councils. 3. Further work on capital plan, PM program improvements, reliability plan, link between long term and annual work plans. 4. Staff training, staffing analysis for asset management 5. Further improvements in condition monitoring - BDE PH1, USL, etc 6. Explore standing contracts with potential contractors who would be required for potential unforeseen work.
HG.002a	As a result of the deteriorated condition of the Snook Arm generating facility, there is potential for an extended loss of generation from this faciltiilty, potentially resulting in: - forced outages, - unplanned maintenance, - unplanned emergency capital projects - excessive spilling downstream near relocated community - negative press coverage and - increased costs to transfer power over Newfoundland Power lines	3	2	6	Safety: N/A Environment: Clean up required from spill and change in habitate downstream. External regulators involved. Business Excellence: Financial impact, project and work schedule impacts requiring use of unplanned resources People: N/A Community: Negative media coverage and loss of trust of	Unit failures Asset condition based on inspection Public concerns from the Local Service District	Consistent number of failures and concerns. Degrading asset condition.	In Place: Spillway channel improvements PM Inspections DSR Planned: Orientation/training for new operator Ice Monitoring	3	2	6	Minimal changes to risk levels based on activities	Unit will be decommissioned and surroundings returned to acceptable environmental levels.

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HG.002b	As a result of the deteriorated condition and long term loss of generation from the Venam's Bight generating facility, there is potential for serious deterioration of this facility, potentially resulting in: - a contractor or employee safety incident - a serious environmental incident - unplanned significant cost of clean-up and /or	3	3	9	Safety: N/A Environment: Clean up required from spill and change in habitate downstream. External regulators involved. Business Excellence: Financial impact, project and work schedule impacts requiring use of unplanned resources People: N/A Community: Negative media coverage and loss of trust of stake holders	-Overall site condition. -Flow from hole cut in penstock to address intake leakage.	-Continual degradation of the site. -Gradual increase in the flow from the penstock hole. Water started to overshoot the hole. - The November 2017 inspection showed further degradation of the intake access platform, wooded safety rails, access trail bridges, the penstock, rust on the PH roof, and increasing leakage through the intake. The main dam and spillway look to be sound.	In Place: Operational PM inspections / visits Dam inspections Temporary blockage of flow from the intake Visited site to perform a visual inspection to monitor deterioration Planned: Install cinders at the intake to reduce the leakage rate.	3	3	9	Actions are mostly monitoring without addressing the risk.	-Engage Engineering Services and Environmental Services to formally assess the risks and develop a plan for refurbishment or decommissioning plan. - Reconnect with investment evaluation for updated information on the value of energy and interest rates to update the cost benefit analysis.
HG.002c	As a result of deteriorated condition of BDE Penstocks (three leaks on Penstock 1, cracks in Penstock 3 welds), future leaks may occur, potentially resulting in: - forced outages due to failures / leaks - increased cost to supply customers - interruptions in service to customers - interruptions to planned maintenance - unplanned maintenance, - unplanned emergency capital projects - negative press coverage and - impacts to reputational risk with PUB and the public.	4	4	16	Safety: N/A Environment: Clean up required from leak Business Excellence: Financial impact, project and work schedule impacts requiring use of unplanned resources People: N/A Community: Negative media coverage and loss of trust of stake holders	Number of failures	To date there has been three failures in the same general area of penstock 1 within 18 months.	In Place: - More aggressive upgrade work was conducted to improve the structure of the penstock welds on all three penstocks. - Penstock 1 rupture areas were cut out and replaced with new steel, and then reinforcement steel was welded over the patches. - Penstock 1 areas that experienced internal cracks were repaired and upgraded with reinforcement plates. Additional backfill was placed in the area most affected by the stress. Instrumentation is installed to measure strain during penstock operation. Penstocks 2 & 3 were inspected and welds that failed were replaced. Weld repair was extensive and any welds questioned were replaced. Planned:	3	4	12	Uncertainty remains until the condition assessment report is complete and more knowledge of condition is known.	- Capital program developed for refurbishent of Penstocks 1-3 to extend service life 20+ more years - Hatch report submission by June 2019 to lay out rehabilitation program.
HG.002d	As a result of decreasing ground resistance readings from the HLK (75MW) rotor to near critical levels, there lies an incresased risk of failure potentially resulting in: - forced outages due to failure - interruptions in service to customers - interruptions to planned maintenance - unplanned emergency capital projects - premium costs for repair given short notice which will utilimately be paid by the customer - negative press coverage - impacts to reputational risk with PUB and the public.	5	4	20	Safety: N/A Environment: N/A Business Excellence: Financial impact, project and work schedule impacts requiring use of unplanned resources People: N/A Community: Negative media coverage and loss of trust of stake holders Readings up to November 2018 have held relatively stead at 400 to 500 kohms depending on unit	- Megger readings annually	Over the past several years resistance readings have been decreasing signifiacntly to where the current reading is at critical.	In Place: - Generator cleaning with rotor in place. Planned: - Remove rotor from unit for PM9 - Break rotor into quadrants to investigate if a pole has gone to ground - Clean stator and rotor with indistry best standard practices - Winter readiness checks prior to winter season. Checks include megger readings as well as cleaning.	3	4	12	Uncertainty remains since resistance values are low. A disruption can cause the readings to fall below critical.	Operational: - Continue to perform megger readings on unit PM6 annuals. - Continue daily resistance readings from the installed relay and trend to ensure no negative trends are develo[ping. Capital: - 2019/2020 plan to rewind rotor and stator has been formally moved forward. FEED in 2018 and field execution in 2019.
HG.002e	As a result of decreasing clearances on Unit 7 turbine's primary seal, runner contact with the seal may occur resulting in: - potential failure of equipment - extensive equipment outage for repairs - forced outages due to failure - interruptions in service to customers - interruptions to planned maintenance - upplanned emergency capital projects - premium costs for repair given short notice which will utilimately be paid by the customer - negative press coverage - impacts to reputational risk with PUB and the public.	3	4	12	Environment: N/A Business Excellence: Financial impact, project and work schedule impacts requiring use of unplanned resources People: N/A Community: Negative media coverage and loss of trust of stake holders Potential rubbing of the runner band against the lower primary seal could result in gauling and/or welding of the materials	- Clearances readings - Rotational checks - Verticality check - Vibration monitoring - Capital costs for repair - Downtown for repair - Impact on operating budget - Impact on AWP and resources.	Over last several years clearances between the runner band and lower primary seal have been decreasing. There has been no significant change in unit vibration. Rotation checlks in 2018 confirmed reduced clearance readings at or below critical.	In Place: - Vibration Monitoring Planned: - Continuous monitoring of unit critical readings such as bearing temperatures, vibration and visual checks for abnormal conditions. - FEED for 2019 capital refurbishment program to open seal clearances and replace/refurbish critical components (ie. wicket gate bushings).	3	4	12	With the current risk treatments in place, the risk rating does not change. Until refurbishment in 2019 the risks will remain unchanged. 2018 rotational checks during the PM6 confirmed clearances to be below critical values.	Operational: - Clearance readings and rotational checks to be completed as part of annual PM's. Capital: - 2019 Capital plan includes the dis-assembly and machining of the primary seal to specification.
HG.002f	As a result of issues experienced with stopping and starting GCL unit there lies an increased issue with unit operation, potentially results in: - forced outages due to failed permissive command - interruptions in service to customers - interruptions to planned maintenance - unplanned emergency capital projects - premium costs for repair given short notice which will utilimately be paid by the customer (ie. overtime, call-in, helicopter transportation, etc) - negative press coverage - impacts to reputational risk with PUB and the public.	5	3	15	Safety: N/A Environment: Fish compensation agreement. Business Excellence: Financial impact associated with paying premium time and transportation. Other PM work and project schedules possibly impacted depending on time of year due to use of unplanned resources. People: N/A Community: N/A	- Numer of work orders generated due to issues experienced with stopping and starting GCL.	- Sporatic experiences with start/stop failures. Happens frequently but no clear trend.	In Place: - Operating instruction for unit to remain online unless required to be taken offline (ie. unit is reliable in when in operation) - New ABB programming implemented to repair logic. Fix has been in place sine October. Planned: - Test ABB programming fix during Winter Readiness checks in November.	5	3	15	Impact of unit not having the ability to start and stop does not change. Risk treatment would reduce the likelihood of occurrence.	- 2019 operational plan for GCL controller assessment. - 2020 Capital plan for Phase 1 FEED to replace GCL unit controller. - 2021 Capital plan for Phase 2 to replace the GCL unit controller.

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HG.003	As a result of the unique hazards on site associated with a hydro generation facility, safety incidents may occur on site, potentially resulting in: - injury to or death of employees, - costs to investigate, - regulatory fines or penalties, - damage to staff morale, and/or - customer dissatisfaction. Examples include: High voltage, rotating equipment, working at heights, confined spaces, increased levels of work (contract and internal), asbestos, lead paint, PCB, vehicle travel Safety - HG.003 add sub group(s) for industrial hygine program - Asbestos, dust management, etc	3	4	12	Safety: Injury resulting in medical treatment Environment: N/A Business Excellence: Financial impact, project and work schedule impacts requiring use of unplanned resources People: Inability to recuit employees and inexperienced personnel performing work Community: N/A	- LTIFR - AIFR - Last LT incident	- LTIFR = 0 since 2010. - AIRF ~1 (average over last 5 + years)	In Place: - Coaching of employees - Corporate safety tools - Addressing Safe Workplace Observation Program actions - Increased quantity and quality of Personal Protective Equipment ("PPE") - Increased safety systems - Increased site safety inspections - New weekly vehicle inspection - Safety strategic initiatives in departmental plan -New mandatory glove policy Planned: None	2	3	6	Likelihood and impact are reduced by mitigation measures. The trends show positive performance.	- Continuous safety culture improvements - Safety training
HG.003a	As a result of the presence of Lead Paint at Hydro Generation facilities, personnel may be exposed to lead during work activities, potentially resulting in: - acute / cronic health issues - costs to investigate, - regulatory fines or penalties, - damage to staff morale, and/or - customer dissatisfaction.	2	3	6	Safety: Medical treatment required Environment: N/A Business Excellence: N/A People: Inability to recruit resulting in Inexperienced personnel performing work and lack of training Community: N/A	- lead paint test results - visual presence of red primer - employee baseline and follow-up testing (future)	- All suspected paint samples that have been tested contain lead. - Red primer is common throughout our facilities - no employee testing to date.	In Place: - Informal awareness and improved understanding of the exposure and risks (discussions / e-mail) - Corporate safety tools - Addressing Safe Workplace Observation Program actions - Increased quantity and quality of Personal Protective Equipment ("PPE") - Staff trained on use of new type 1 lead abatement equipment. - Lead paint abatement procedure completed detailing idenfiticaiton of types of lead paint and how to distinguish for safe work Planned: - No remaining work inside of 2018.	1	3	3	Likelihood reduced since personnel are trainined to identify and to perform type 1 abatement. Risk does not change and remains the same.	- Continued training in abatement and use of new lead paint management program
HG.003b	As a result of the presence of dust at Hydro Generation facilities, personnel may be exposed to dust during work activities, potentially resulting in: - acute / cronic health issues, - difficutly breathing, and/or - damage to staff moral	2	3	6	Safety: Medical treatment required Environment: Minor, non permanent environmental damage requiring little clean-up efforts. Is reportable. Minor injury resulting in first aid treatment Business Excellence: N/A People: Inexperienced personnel performing work and lack of training Community: N/A	- air sampling tests	- History of dust contamination on Hydro Generation work sites (ie. SWOPs).	In Place: - Use respirators in dust filled work zones - Contain dust by utilizing shop vacs and specialized equipment when necessary	2	2	4	Likelihood and impact are reduced by mitigation measures.	- Continued used of restpirators - Use of air monitors in critical work zones prior to work activity
HG.003c	As a resault of the presence of asbestos at Hydro Generation facilities, personnel may be exposed to asbestos during work activities, porentially resulting in: - acute / cronic health issues - costs to investigate, - regulatory fines or penalties, - damage to staff morale, and/or - customer dissatisfaction.	2	3	6	Safety: Cronic illness if exposed. Environment: Extended clean up effort to mitigate. Business Excellence: Cost of clean-up. Deterioration in project/work schedule due to time required for abatement measures. People: N/A Community: N/A	- Asbestos abatement - Use of specialized equipment and technical when working with and around Asbestos containing materials	- History of Asbestos in gaskets - Asbestos survey completed in the past by external consultant has shown multiple areas where Asbestos is present and type of Asbestos	In Place: - Notification to employees entering zones where asbestos is exposed and potentially can become air born easily - Equipment purchased to allow internal personnel to perform lead abatement on low level lead paint abatement (ie. non-airborn) Planned: - None	2	3	4	Likelihood and impact are reduced by mitigation measures.	- Safety strategic initiatives in departmental plan
HG.004	As a result of challenges in coordinating work across internal departments and contractors, capital project execution may not meet schedule, budget and the requirements expectations, potentially resulting in: - additional resource drain to complete, - delays in other planned capital work, - cost overruns, and/or - internal conflicts.	4	3	12	Safety: N/A Environment: N/A Business Excellence: Changes in projects schedules which require efforts of non planned resources People: N/A Community: N/A	- Monthly capital metrics - Project delivery metrics - Annual work plan S curves	- History of project delivery	In Place: - Improved communication between Engineering Services, Project Management and Work Execution planning department. - Project change management process. - Integrated work plan delivery. - Planners are in place within Corporate teams and in field locations to ensure coordination. - Master outage schedule and regular meetings to track progress against detailed outage schedule.	2	3	6	Reduced likelihood, but impact is the same. A lot of progress in this area in the last two years. Changes in personnel could reduce the recent gains.	- Hire of Project Coordinator. - Education of roles and responsibilities within the Asset Management organizational Structure. - Materials Management Professional training for construction coordinator and planners / scheduler

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HG.005	As result of issues with water management, it is necessary to spill water quickly, potentially resulting in: - downstream danger to the users of the watershed area, and/or - lost revenues. - environmental damage - damage to assets. Details: Competing metrics, knowledge of reversoirs vs control. Changes related to interconnection including relationship parameters. Interface with NLSO.	3	4	12	Safety: Injury to public if in area if not informed early enough Environment: Extended clean up effort and reporting with involvement from external regulators Business Excellence: Potential loss of customers, large interruption in AWP which requires extraordinary effort from unplanned resources and large financial impact to remediate and return site to service People: N/A Community: Negative media coverage and loss of stakeholder trust	- Reservoir Levels - Extreme weather and rainfall frequency - Spill frequency - Public complaints / inquiries	- Extreme weather event patterns - Increase in the number of spill events - Rainfall patterns - Increase in public inquires / complaints	In Place: - Weather forecasting - Improved water management practices / awareness - Improved communications with people in the field - workshop sessions, to improve cross role understanding - Incremental gate openings - Consistent monitoring of reservoir levels, weekly water management meetings - Two new hires in area of dam safety - Public Safety around Dams program. Implemented in highest risk areas. Planned: - Possible realignment of responsibilities between water managment personnel with production.	2	4	8	Reduced likelihood, but impact is the same.	1. Public Safety around Dams - increased public awareness through signs, fencing and booms). 2. Engagement in future realignment to ensure success. 3. Education for new personnel on water management concepts and site specific geographical aspects.
HG.005a	As a result of closing White Bear, MSD 6, 7, 8 can potentially overtop and create an hazard for the habitation downstream in the spill area, potentially resulting in: - Lost revenue, - Alteration of habitate in flood area, and/or - Negative public perception.	4	3	12	Safety: N/A Environment: Extended clean-up effort required and involvement from external regulator Business Excellence: Formal investigatio by external regulator and financial penalities and fines People: N/A Community: Loss of stakeholder trust and media attention	- Equipment operational trending	- New employees unfamilar with process and area with regards to limitations and special operational characteristics	In Place: - Formal training of wateer supply system Planned: - None	3	3	9	Liklihood is reduced but still posisble given turnover with newer less experienced employees	- Continuous training
HG.006	As a result of non compliance with safety regulations, incidents or conditions onsite may occur, potentially resulting in: - fines and penalties being incurred - additional attention paid to Hydro by the regulator involved - unfavorable media coverage resulting in reputational damage - costs to investigate incidents in certain cases - damage to staff morale - customer / public complaints Examples: employee injury, medical treatment, safety system PMs (fire extinguishers, hoses, etc). regulatory training, vehicles - driving behaviour,	3	4	12	Safety: Potential for injury to staff on site by not following safety regulations Environment: N/A Business Excellence: Financial impact from potential lawsuits from not following proper procedures People: Inability to recruit based on safety record and critical regulatory training not completed Community: loss of stakeholder trust and negative media coverage	- Safety audit results - Frequency of non-compliance with safety regulation - Public Complaints (SWOP) - Vehicle tracking devices (SWOP)	- Consistantly good safety audit results - Consistantly good compliance to safety regulations - Cyclical pattern of public complaints regarding vehicle incidents. - one visit from Service NL to CAT resulting in several minor directives. - recent third party complaints (intake boat launch, Snook's spillway, NS spillway, HLK bridge (2013)	In Place: - Safety related regulatory training programs and training database - Safety and Environment Coordinator to identify regulatory and other items requiring attention - Safety Programs / commitment. - Safety Inspections. - Emergency response plans - PSAD reviews and capital investments - Conduct safety related training - Filling the safety and training officer vacancy Planned: - Emergency response plan revisions and table top exercises	3	3	9	Liklihood is reduced, but in the same range.	- Implement SMS - Future work for PSAD
HG.007	As a result of key equipment becoming obsolete, it may be difficult or impossible to procure spare parts in a timely manner in the event of an operational failure, potentially resulting in: - unplanned costs to replace equipment, - extended unavailability of key infrastructure, and/or - potential service interruptions. Examples: Old computer technology, CAT, BDE, Star Lake, (Granite is approaching), Atlas governor controls approaching, Paradise River unit controls, software updates are irregular, exciter controls, PLCs, CAT Governor valves, spare parts of older versions (eg firmware),	4	3	12	Safety: N/A Environment: N/A Business Excellence: Potential financial impact from fees associated with repairing obselete equipment and extraordinary efforts required to source repair parts. People: N/A Community:	- Frequency and severity of obsolete equipment failure and service interruption (forced outages) - Number of projects in the capital plan to replace obsolete equipment - Vendor notifications of equipment in or approaching obsolesence. - parts identified as obsolete through critical spare inventory procurement.	- obsolete equipment failure had increased in recent years, but has decreased in recent months.	In Place: - Completion of readiness work in anticipation of potential equipment failures, including the preloading of software for electronic spares to improve successful future replacement of failed components. - Have refurbished some electronic spares (exciter cards). - Planned replacement based on obsolescence dates and expected equipment reliability levels. - Capital program identifies required upgrades. - Critical spares assessment and gap closure plan. Planned: - Continually update capital plan based on new condition based information. - Critical spares review and aquisition.	3	3	9	Liklihood is in the same range, but at the lower end of the scale. Impact has not changed other than mitigation measures will reduce the duration of an event.	- Tracking of electronic hardware and software versions. - Continually update capital plan based on new condition based information. - Critical spares review and acquisition.

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HG.007a	As a result of obsolete and aging electronic equipment at the Star Lake facility (1998), increased or longer forced outages (18MW) may occur, potentially resulting in: - unplanned costs to replace equipment (competition with Exploits assets for funding), - extended production unavailability, - potential service interruptions.	3	3	9	Safety: N/A Environment: N/A Business Excellence: Potential financial impact from fees associated with repairing obselete equipment and extraordinary efforts required to source repair parts. People: N/A Community: N/A Had two failueres with spares available. Without an old computer (386) from an employee, the spare AVR would not have been usable to replace the failed in-service component.	- number of failures of obsolete equipment - funding for capital plan	AVR and governor controller failures in last 3 years. Increased competation with Exploits assets for funding.	In Place: Critical spares at site Planned: Annual Inspection	2	3	6	Liklihood is in the same range. Impact has not changed	Replacement of unit controls, AVR, governor controls, etc in the capital plan.
HG.008	As a result of insufficient training or expertise due to rural retention challenges, more incidents may occur on site as a result of human error or lack of understanding of key protocol, potentially resulting in: - environmental and/or safety incidents, - unintentional damage to key equipment, and/or - interruptions in service to customers. - IAWP not being completed Details: - Gap in expectations for OT between managment and workers - Limitations of collective agreements to get work done - shift changes, identifying the right people for training / exposure (OT), selecting the right people for the job (overtime), etc. - Challenge of managing / engaging people, - Challenge to fill vacancies in a timely manner - execute AWP based on full complement - lack of timing and efficiency for training funds approval	4	3	12	Safety: Inexperience leading to on site injuries and potentially injuries involving lost time Environment: Inexperience in environmental regulations for NL Hydro leading to issues requiring cleanup or outside regulator involvement Business Excellence: N/A People: N/A Community: Negative media coverage	-Severity and frequency of safety incidents - Operational incidents associated with less experienced staff - Percentage of employees fully qualified for their position - Involuntary turnover - Sick leave rates - Voluntary turnover	- AIFR average of 1MT for past 5+ years. - Operational (human error) mistakes are rare. - Reduced percentage largly due to decreased focus on training - Increasing percentage of retirements over the past few years (at least 7 in 2017 including 3 supervisors). - People in key postitons eligible in next 3 years (managers, supervisors, experienced operators,	In Place: - Safety training conducted through the year with a heavy focus during the non-maintenance season. - Increasing the use of peer mentoring and coaching. - More focus on training plans. - Support individuals to attain qualifications (informal). - Formalized apprenticeship program. Planned: - Formalize training plans (trade related), with creative solutions - Succession planning (pilot projects) - Proposed sick leave managment initiative - Work within the process to fill vacancies as quickly as possible.	4	3	12	Training access has been worse, recent increase in retirements and longer times to fill vacancies. Back to residual risk from a reduced risk level.	- Continue with existing programs, and evolve as required regarding qualifications and mentoring / coaching / training to ensure competence.
HG.009	As a result of fire (within the plant or a wildfire that encroaches on Hydro facilities), key equipment (e.g.. turbines, generators, dams/dykes, ancillary and electrical systems) may fail and/or access to the effected site may be effected, potentially resulting in: - forced outages, - unplanned maintenance, - environmental emergencies, - safety incidents, - loss of key infrastructure, - costs to investigate, - interruptions in service to customers, and/or - evacuation of work sites and/or surrounding communities.	3	4	12	Safety: Potential injuries to on site personnel Environment: Environmental damage requiring clean up effort Business Excellence: People: N/A Community: Negative media coverage Previous forest fire across the tailrace in 1986. Increse in vegetation from natural growth around the facility.	- Frequency and severity of fires involving Hydro assets - Compliance with fire safety regulations (PM) - Number of priority 1 and 2 fire risk recommendations from FM Global - Forest fire index - Number of forest fires in the country, and proximity to our operations - Stage in the lifecycle of surrounding forests	Recent forest fire near muskrat falls (spring 2017). Forest fires in western Labrador in (2015), Forest fires in BC this year (2017), and in northern Alberta last year (2016). The number of priority FM Global fire recommendations have been decreasing. Old growth forest near BDE assets,	In Place: - Activate fire plan protocols - Emergency response plan - Vegetation Management Program - Property insurance which permits for cost recovery relating to physical damage and within terms and conditions of Policy. - Contact internal risk department around standards for forest fire prevention / fire breaks in our indusrtry and similar industries. Planned:	3	4	12	Improvements to plant equipment protection, counteracted by maturing and expansion of vegetation around sites and lines	- Continual improvement of asset protection through implementing FM Global recommendations and other fire risk reduction strategies - Expansion of the annual vegetation management program.
HG.010	As a result of access roads to hydraulic plants and associated structures being impassible, excessive delays may be incurred responding to maintenance and operational issues, potentially resulting in: - environmental emergencies, - safety incidents (employee & public), - loss of key infrastructure, - loss of production, and /or - interruptions in service to customers,	5	3	15	Safety: Roads impassable and potential risks to personnel attempting to cross damaged areas Environment: Environmental damage requiring clean up Business Excellence: Potential costly financial impact to restore access and extraordinary efforts required from unplanned resources to carry out scope of repairs People: N/A Community: Negative media coverage and loss of public/stakeholder trust - Hurricane Matthew 2016 - caused significant damage to access to the BDE, USL, GCL and SLK	- # of annual road washouts - $ impacts on operating and capital budgets - Loss of generating capacity resulting from not being able to access generating stations. - Frequency of business interruption warnings (hurricane, winter/ ice storm, etc.) - number of times environmental requirements can not be met due to access issues (GCL fish compensation structure stop log installation, fuel tank PMs, etc)	- Increased frequency and severity of weather events causing access issues to our facilities over the past 5 years. - Increased use of helicopter to access site for maintenance and response. - a few instances in the past few years were there were delays in installing GCL stop logs due to access issues.	In Place: - Severe weather prepardness meetings - heightened awareness - Provisions for standby - Increased culvert size Planned: - Improve culvert and ditch maintenance - Working with Department of Forestry under cost sharing to repair SLK access road and look at posisblity of implementing more robust design in high risk areas	3	3	9	Impact is the same, however the liklihood is reduced due to a heightened awareness in advance of sever weather events.	1. Further improvements to culvert and ditch maintenance. 2. Review culvert sizing for future culvert work. 3. Improve the approach and increase funding for vegetation management. 4. Working with external government agencies to share costs on road upgrades.

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HG.010a	As a result of unstable slope and shoreline conditions along the cat arm access road between the intake intersection and the powerhouse, the road may become impassable, potentially resulting in: - safety incidents (employee & public), - environmental emergencies, - emergency capital work, - loss of infrastructure, and / or - interruptions in service to customers,	2	5	10	Safety: Road washouts making roads impassable or dangerous to utilize Environment: N/A Business Excellence: Financial impact to repair damaged areas from rock falls People: N/A Community: N/A Several rock falls in this area annually - especially during freeze / thaw cycles. Some rocks have been very large and damaged the road on impact. No one has been injured to date,	- # and severity of rock falls. - $ impacts on operating and capital budgets	- Generation has not been affected to date. - The number and severity of rock falls appear to be increasing. - debris continues to accumulate in ditches. - large cost increase and schedule delay to one capital project (shoreline protection).	In Place: 1 Geotechnical assessments performed. 2 Mitigating operational measures recommended by the study are in-place (gate, barricades, stopping to listen for rock falls before proceeding, and restricting traffic after heavy rainfalls) 3. More detailed CAT road slope stability assessment into a permanent solution. Planned: 1. LIDAR survey of high risk area	2	5	10	Risk treatment to date does not have a significant impact on the levels fo liklihood or impact. It will take a major change to improve the risk levels.	1. Finance perminent solution. 2. Implement permanent solution 3. Follow-up monitoring and assessments as required.
HG.011	As a result of aging infrastructure and corresponding asset condition, dams / dykes and other civil structures may fail, potentially resulting in: - forced outages, - unplanned maintenance, - unplanned emergency capital projects, - interruptions in service to customers, - flooding of downstream areas, and /or - negative impact on stakeholders. Increasing expectations from provincial government including pending legislative requirements. Examples: Rip Rap deteriorating condition - HLK Main Dam (HD-1), North Salmon Dam (SD-2), Long Pond Intake Dam (LD-1) CAT Dams (4, 6 & 7) in 2012 Hinds Lake Power Canal. Continuous monitoring / loss of liner material. History of sloughing on Burnt Side Hill Canal	2	5	10	Safety: N/A Environment: Major impact with extended duration requiring full scale response Business Excellence: High financial impact and loss of gneration to customers for extended periods of time People: N/A Community: Media attention and serious damage to public property Potential for catastrophic failure if not identified and corrected in a timely manner. Some critical dams are in remote locations so a pending failure may not be identified in a timely manner.	- # of new issues identified through dam survalence, and ergineering inspections. - # of re-occuring issues identified through dam survalence and enginering inspections. - Time to complete issues identified above. - % of DSR and engineering actions completed by the initial planned completion date.	- Some DSR issues are not being addressed within the recommended timelines due to high $ value operating project costs and competing for limited funds. - consistant / cyclical level of re-occuring issues or items not completed in the timeline required.	In Place: Dam and Dyke Maintenance Register; DSR Reports; PETS internal inspection reports; Dyke Board reports; EPP's for Long Pond, Victoria Dam, and Snook's Arm; LTAP 20-yr capital plan; EMS 1. Vegetation control 2. Increased focus on water management and Dam Safety 3. Emergency Preparedness Plans 4. Dam Safety Program (inspection and maintenance) 5. Property insurance which permits for cost recovery relating to phsyical damage and within terms and conditions of Policy. 6. Stock pile material at LD1 and LD2. Planned: 1. Execute 2017 deliverables relating to improving Emergency Preparedness / Response Plans - Ensure bridge to CERP 2. Revise standard operating instructions, relating to spills 3. Annual meetings with public stakeholders on potential spills 4. Water management activities transfer to BDE Operations	2	5	10	Likelihood - is lower, but still in the same range. Impact is the same.	1. Continual improvement of Asset Management strategy 2. Continual improvement of capital program as it relates to Dam assets. - 2019 activities relating to upgrades of Salmon River spillway (capital plan) 3. Conduct table top exercises of the Emergency plans
HG.012	As a result of environmental incidents or conditions onsite, non compliance with environmental regulation may occur, potentially resulting in: - fines and penalties being incurred - additional attention paid to Hydro by the regulator involved - unfavorable media coverage resulting in reputational damage - costs to investigate incidents in certain cases - damage to staff morale - customer dissatisfaction and complaints Examples: oil spills, fuel dips / exemptions	3	4	12	Safety: N/A Environment: Environmental damage requiring clean up effort to restore Business Excellence: Financial impact to restore site People: N/A Community: Loss of trust from internal personnel and stakeholders PRV oil spill in 2016. 4 reportable spills YTD Aug 25th 2017.	- Environmental audit results - Frequency of non-compliance with environmental regulation - number of reportable spills - EMS target completion	- History of environmental audits - Patterns in non-compliance - SWOP regarding cuilverts on cabin lawn, NSS, Snook's, - Increased reporting of non-reportable spills. - Leak from grader where it was parked on private land (public complaint).	In Place: - EMS - ISO 14001 system, including Internal compliance audits and follow up - Environment Coordinator to identify regulatory and other items requiring attention - Oil detection system installed at PRV Planned: - Address public complaints relating to culverts and grader oil leak.	2	3	6	In place and planned treatments will reduce likhood as well as impact by having proper procedures, equipment and response methods in place	- Remediate minor environmental regulatory items as identified. - identify other sites where the PRV oil detection system is required. - Identify all sites with oil leaks and prepare plan to mitigate leakage
HG.012a	As a result of the used spare generator main transformer stored at Cat Arm without containment, an oil spill may occur, potentially resulting in: - fines and penalties being incurred - additional attention paid to Hydro by the regulator involved - unfavorable media coverage resulting in reputational damage - costs clean-up and to investigate the incident	2	4	8	ENV: 4 (b&d) There is a history of leaks with this transformer that go unrepaired for an extended period of time. The containment is insufficient for the frequency of personnel visits to this site. There is staining of the ground where the containment has been drained of water in the past.	- Awareness level of hazards - visual and tested condition of the transformer	- A leak was recently repaired. - Presence of stained rocks in near the discharge of the water drain.	In Place: - Recent transfromer repairs Planned: - Contact Engineering Services why containment was not part of the execution plan when the transformer was replaced.	2	4	8	Transfrormer leaks recently repaired.	Identify and implement satisfactory containment and leak detection solutions.
HG.012b	As a reuslt of insufficinet oil containment for the PRV T1 transformer, an oil spill may occur, potentially resulting in: - fines and penalties being incurred - additional attention paid to Hydro by the regulator involved - unfavorable media coverage resulting in reputational damage - costs clean-up and to investigate the incident	2	4	8	ENV: 4 (b&d) Potential for an oil spill. No containment. The transformer was taken out of service due to condition. History of leaks idnetified by FM on this transformer.	- Awareness level of hazards - visual and tested condition of the transformer	- N/A	In Place: - Created visibility during the revent ERM review Planned: - Discuss the situation with TRO (Asset Owner) regarding the requirement to keep this used transformer as a spare. If required, discuss options to provide adequate spill containment. - Add to weekly operations inspections	2	4	8	Minimal activity to date to reduce the actual risk.	Identify and implement satisfactory containment and leak detection solutions or dispose of the transformer

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HG.013	As a result of comunications systems (cell, landline, satallite, VHF, microwave, internet, etc) widespread failure, response to issues may be delayed, potentially resulting in: - extended customer outages - increased impact of safety incidents - delayed response to oil spills	2	1	2	Cell service interruption for ~5 hours in August of 2017. An event that has virtually no impact. Quadruple redundancy of modes of communication.	- Number of service interruptions	- One significant event. Minimal impact on operations. - Frequent communications interruptions at PRV and SLK.	In Place: Alternate forms of communication are available.	2	1	2	Very little we can do to change the situation. Existing redundancy in place is sufficient.	No plans - grow with technology
HG.013a	As a result of comunications systems (cell, landline, satallite, VHF, microwave, internet, etc) failure, loss of visibility of production information between a remote plant and ECC could occur, potentially resulting in: - unknowingly operating units without control (no alarms returned) - costs (including overtime, and travel) associated with having to staff plants. - delayed response to oil spills and-or - lost production	3	2	6	Multiple occurances in 2017 of lost communication in Paradise River and Granite Canal that required the sites to be staffed and operated locally. On one occurance, we were unaware of a lost communications event at paradise river unitl 2 days after it started.	- Number of interruptions to communications at remote generating stations - Number of interruptions to communications at staffed generating stations.	Multiple occurances in 2017 of lost communication in Paradise River and Granite Canal that required the sites to be staffed and operated locally. On one occurance, we were unaware of a lost communications event at paradise river unitl 2 days after it started.	In Place: Multiple communication paths Discussions on notification of communication failures. Planned: Discuss options with NWS for notification when levels of redundancy are reduced or at risk.	3	2	6	Recently identified risk. Minimal activity to reduce the risk to date.	
HG.014	As a result of a loss of all employees in a shop in a short period of time (over a few months), a loss of corporate knowledge in equipment specific issues, troubleshooting, approaches to maintenance activities, and/or managing the business. Examples: Lotto 6-49 shop groups, a vehicle crash with multiple key personnel, biohazard (virus, food, etc), leaving for other work opportunities (ie, Alberta boom, local mega projects, early retirement etc) or combinations of drivers.	1	4	4	- Brinco plane crash - Often times when large percentage of crew travels together combined with rate of road incidents provincially. - Geography of assets - Current and past retention issues	- Vehicle related SWOPS - Provincial acident rates - Economic situation of province and other jurisdictions - employe turn-over rates - time to fill vacant positions	- High number of vehicle accidents provincially in 2017 - National ecomomy is largely in recession. - Turn over rates are relatively consistant and relatively high in some shops. - Some vacancies have taken a long time to fill (ie machinist)	None	1	4	4	No risk treatment activity	- Travel policy to reduce risk impact
HG.015	As a result of an expended period of time with low rainfall (drought), reservoir levels could lower to the point where production is limited and insufficient to maintain customer requirements	1	4	4	Extended dry periods is not common in the Newfoundland Coastal Climate	- Reservoir Levels - Number of times with low rainfall	- Reservoir levels have been relatively high in recent years, though lower than normal this recent fall season.	None	1	4	4	No risk treatment activity this year	- Connection to the North American Grid to provide alternate sources of generation
HG.016	As a result of change in ownership Star Lake (Exploits Assets) from province owned to Hydro owned (regulated asset) the budget approval process would change, potentially resulting in delays or gaps in funding (capital and Operating budget) approval.	2	3	6	Safety: N/A Environment: N/A Business Excellence: May result in financial impact. Current capital proposal system does experience delays from time to time. People: N/A Community: N/A	- Current capital budget process for Hydro Generation	- Approval for capital budgets in the past couple of years have been ok however there are some instances where the process was delayed and ultimately resulted in project schedule changes	In Place: - Schedule deadlines set out at the beginning of each year for submission of feed alighment documents to regulatory for the following year capital budget review by PUB - Experienced professional enigneering developing capital budget proposals Planned: None.	2	3	6	No risk treatment activity this year.	- Formal schedule procedure created and sent out to all involved in PI
HG.017	As a result of Integration to the North American grid, changes to our operating environment could change resulting in: - How we conduct maintenance (timing and tactics) - Having to follow new regulatory requirements (NERC) - Reservoir operation - Equipment wear and tear changes.	3	4	12	Safety: N/A Environment: N/A Business Excellence: Deterioration in project/work execution schedule, scope or quality resulting in significant effort to redeploy existing resources. People: N/A Community: N/A	None	None	In Place: - New corporate department created for outage planning. Resource Production & Planning department - New NLSO department creates for system operation Planned: - Continued development of comminication between corporate department and BDE Operations	3	4	12	- Department is newly created within the last 12 months. - Communication between BDE Operations and new department still in process of development.	- Employees involved become more familiar with procedured and processes involved.
HG.017a	As a result of Integration to the North American grid, changes to Water Management will potentially occur to maximize export profit, potentially resulting in: - Reservoirs operated at extreme high levels to hold back water when prices are low. - Reservoirs oeprated at extreme low levels to sell as much as possible when prices are high - insufficient water reserves to meet island demand through dry periods.	3	3	9	Safety: N/A Environment: N/A Business Excellence: Deterioration in project/work execution schedule, scope or quality resulting in significant effort to redeploy existing resources. People: N/A Community: N/A	- Reservoir historical levels - Historical severe weather events	- Severe weather events becoming more common making it more difficult to control reservoir storage levels with current practices in place.	In Place: - New corporate department for Water Management & Production Scheduling. Planned: - Continued development of comminication between corporate department and BDE Operations	3	3	9	- Department is newly created within the last 12 months. - Communication between BDE Operations and new department still in process of development.	- Employees involved become more familiar with procedured and processes involved.
HG.017b	As a result of Integration to the North American grid, changes to available outage time to complete maintenace could be reduced and at different times of the year, potentially resulting in: - Shorter than traditional outages - Changes is resource requirements through the year (permanent and temp) without budget - OT impacts - Labour unrest - Contractors not being availability when required,	3	4	12	Safety: N/A Environment: N/A Business Excellence: Deterioration in project/work execution schedule, scope or quality resulting in significant effort to redeploy existing resources. People: N/A Community: N/A	- AWP changes made throughout calendar years	- AWP have had significant changes made multiple times in 2018 due to shortened outage durations and unforeseen events.	In Place: - New corporate department created for outage planning. Resource Production & Planning department - New NLSO department creates for system operation Planned: - Continued development of comminication between corporate department and BDE Operations	3	4	12	- Department is newly created within the last 12 months. - Communication between BDE Operations and new department still in process of development.	- Employees involved become more familiar with procedured and processes involved.

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HG.018	As a result of Integrating workforces between Hydro Generation and Exploits Generation (and/or other Nalcor entities) with different contract terms, labour disturbances could occur potentially resulting in: - work stoppages - communication breakdown - lack of transfer of knowledge of assets - safety incidents - equipment damage - loss of production - delays in returning equipment to service	2	2	4	Safety: N/A Environment: N/A Business Excellence: N/A People: Unable to recruit/retain employee positions in BDE Community: N/A	- Work performance while working togethger on various projects	None	In Place: None Planned: - Planned and agreed communication	2	2	4	Have not have the opportunity to work with front line crews at Exploits	- Continued communication
HG.019	As a result of not being able to meet fisheries agreements at Hydro Generation Facilities (SLK, CGL, BDE), fish could die, potentially resulting in: - fines - harm to corporate public image	2	3	6	Safety: N/A Environment: Possible environmental damage with involvement from regulators Business Excellence: Moderate financial impact People: N/A Community: Negative media coverage	- Compliance reports	None	In Place: - Preventative maintenance program for monitoring flows - Various reporting structures including Environmental Effects Monitoring (EEM) and complicance reports. Planned: - None	2	3	6	No changes	None
HG.020	As a result of oil leaking from Hydro Generatrion Units or equipment, oil could be released to the environemnt causing a reportable spill and potentially resulting in: - damage to the environment - environmental non-compliance - fines. - damage to the corporate brand (PRV Sept 2016)	4	4	16	Safety: N/A Environment: Extended clean-up effort with possible environmental damage with involvement from regulators Business Excellence: Financial impact and formal investigation by external regulator People: N/A Community: Negative media coverage and loss in public trust	- Number of hydro carbons (litres) collected during manual skimming operations	None	In Place: - Sump inspections - Sump skimming when hydro carbon presence noted visuall during inspection Planned: - Development of an oil loss management procedure - Development of an inventory to log oil leaks and track progress of repairs - Installation of automatic skimmer in BDE sump 1 to allow for continuous skimming - Planned inspections of sumps during unit annuals	3	2	6	Procedures, equipment and tracking is newly developed in 2018 without chance to formally try out and determine the functionality.	- Installtion of automatic skimmers in remaining BDE sumps - Refurbish BDE sump level control system - Continuous monitoring oil leaks and oil loss management