

Staff Report

for the Water and Hydroelectric Operations Committee Meeting of July 17, 2020

TO: Water and Hydroelectric Operations Committee

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DATE: June 10, 2020

SUBJECT: Nevada Irrigation District Internal Compliance Program -
2019 Compliance Risk Assessment Summary Report and
Self Certification

HYDROELECTRIC

RECOMMENDATION:

Review the 2019 Risk Assessment Report and Annual Self-Certification Summary, prepared in accordance with the Nevada Irrigation District Internal Compliance Program, and advance a recommendation to the Board of Directors as appropriate.

BACKGROUND:

As authorized by District Policy 9400, the NID Internal Compliance Program (Section 5.4) requires that an Annual Compliance Review and Risk Assessment be performed. A summary of the results are to be presented to the General Manager and the Board of Directors. The Annual Compliance Risk Assessment and Self Certification is the subject of this agenda item.

Self-Certification Summary

As a North American Electric Reliability Corporation (NERC) Compliance Registry (NCR) Listed Entity, upon NERC notification NID must self-certify its current compliance status with specified NERC Reliability Standards. Self-Certification is an attestation of compliance or non-compliance with specified NERC Reliability Standards for a given time period.

In 2019, NID provided a self-certification of compliance to NERC in accordance with the Western Electricity Coordinating Council (WECC)/NID Compliance Oversight Plan. The next self-certification is due in 2021 for the 2020 compliance year.

Risk Assessment

Organizations with a strong risk management culture have successfully demonstrated that implementation of Internal Risk Controls Systems (IRCS) are integral to anticipate, predict, and govern operational and compliance risk elements. In its effort to implement such an IRCS, the NID Internal Compliance Program requires the NID Reliability Oversight Compliance Committee (ROCC) to commission an annual risk assessment that identifies weaknesses and vulnerabilities in NID hydroelectric reliability, compliance, and security positions.

In late 2019 and early 2020, NID and Grid Subject Matter Experts (GridSME) performed a risk assessment of the NID Hydroelectric Department reliability, compliance and security efforts. The risk assessment focused on the following five major components:

- People and Training
- Operating Environment (such as wildfires)
- Infrastructure and Technology
- Regulatory Environment
- Electricity Market Landscape

Results were documented in a Risk Assessment Report (Report) associated with current existing risks and the mitigation efforts deployed by NID.

Although NID has a low inherent risk to the Bulk Electric System (BES) due to its relatively small amount of electrical generation and its location on the Western Interconnection network topology, NID is not without risk to its organization, community, or BES that is evoked by the regulatory, staffing, equipment and external challenges identified in the 2019 Risk Assessment Report.

During 2019, NID Hydro performed well in mitigation of risks identified in the prior year's risk assessment. Significant achievements included: recruitment of personnel in key areas of need, vegetation management and wildfire mitigation on over 4.4 miles (approximately 26 acres) of conveyance and transmission line facilities, and continued compliance with environmental and electric reliability standards.

With the key risk areas identified in this Report, NID will continue to move forward with risk prioritization, reduction, mitigation and elimination efforts. Staff has chosen to present the Report at the Water and Hydroelectric Operation (WHO) Committee for discussion prior to presenting it to the full Board of Directors.

This item supports District Strategic Goals 1 and 2 by ensuring compliance with the rules and regulations that govern District activities.

BUDGETARY IMPACT:

No budgetary impact.

MJW

Attachments: (1)

- NID 2019 Annual Risk Assessment Report

NID Hydroelectric Department 2019 Annual Risk Assessment

3/5/2019

Grid Subject Matter Experts

This report presents the findings of the annual tabletop risk assessment exercise performed by key NID Hydroelectric Department personnel and GridSME

Contents

- Executive Summary..... 1
- Risk Assessment 2
 - People and Training 2
 - Personnel Safety 2
 - Personnel Training 3
 - Talent Recruitment and Retention 4
 - Succession Planning 5
 - Organizational Culture 5
 - Organizational Structure and Staffing..... 5
- Regulatory Environment 6
 - FERC Regulatory Compliance 6
 - NERC Regulatory Compliance 7
- Operating Environment 13
 - Wildfires and Vegetation Management..... 13
 - Physical Security..... 14
 - Cyber Security 14
 - Supply Chain Risks..... 15
- Infrastructure and Technology 16
 - Aging Infrastructure 16
 - Project Planning 17
 - Electrical Documentation..... 17
 - Spare Parts 17
 - Technology Changes: SCADA and CMMS Replacement 18
 - NID Hydro Portfolio Growth 18
- Electricity Market Landscape 19
 - PG&E Declares Chapter 11 Bankruptcy 19
 - General Wholesale Market Trends 20
- Internal Risk Control System – The Continuous Process 22
- Recommendation and Conclusion 22

Executive Summary

The Nevada Irrigation District's Hydroelectric division ("NID Hydro" or "the Department") faces a variety of risks that could (individually or collectively) threaten the organization's ability to meet its objectives. This report identifies and assesses the most prominent risks, provides an update on status relative to prior years, and offers recommendations for how NID Hydro can mitigate those risks.

The following five categories were identified during the 2019 risk assessment. The themes are generally consistent with prior years, but the ranking has changed.

1. People and Training
2. Operating Environment (e.g., wildfires)
3. Infrastructure and Technology
4. Regulatory Environment
5. Electricity Market Landscape

NID Hydro continues to face significant risks in the People and Training category including a lack of bench strength in certain key areas, talent recruitment and retention, personnel training, and an aging workforce. NID Hydro did achieve 100% employee retention in 2019. However, NID Hydro's ability to train its less experienced employees continues to be a critical risk. If unmitigated, the combination of these personnel risk factors would adversely impact the operations and performance of NID Hydro. Bringing the right people into the organization, training them, building redundancy in a few key areas, and retaining the top performers are fundamental to managing all other risks.

NID Hydro's operating environment presents high inherent risks. The organization's rural and mountainous operating footprint experiences treacherous conditions in the winter followed by long, dry seasons in the summer and fall. This environment coupled with NID Hydro's high-voltage electrical equipment and aging infrastructure creates numerous risks to NID's people and property. In 2019, NID Hydro responded well to these risks, as it experienced no lost time accidents and made a significant positive impact on its vegetation management program. One other external risk NID will need to respond to is cyber threats to its business and critical infrastructure. In recent years, countless municipal governments and industrial control systems have been victim to cyber-attacks.

Prominent regulatory risks facing NID Hydro include the Federal Energy Regulatory Commission (FERC) dam safety requirements, the North American Electric Reliability Corporation (NERC) Reliability Standards, and the associated pace of change and continuous demands of each. The FERC dam safety regulatory oversight continues to increase and managing the volume of work in this area is a challenge. At the very least, the sheer volume of regulation culminates in a significant strain on NID Hydro resources to stay current on regulatory changes and the associated internal compliance programs.

We recommend continue taking steps to close the gaps addressed in this report. The most prominent areas needing attention and meaningful action include recruiting and hiring adequate resources to manage the growing NID Hydro infrastructure and regulatory burdens, training and retaining NID Hydro's people, managing and mitigating operating environment risks including wildfires and cyber security, and maintaining the reliability of an aging infrastructure. There is a multitude of risk factors facing NID Hydro but all are manageable with the right people and right resources.

Risk Assessment

Failing to identify and manage risk prevents organizations from reaching safety, operations, financial, reliability, and compliance objectives. The effective deployment of strong internal controls, systems, and other risk management tools helps organizations identify latent organizational weaknesses, the potential for human behaviors to drift from expectations, and external risk factors. Risk management programs are the foundation to a business resiliency plan. This annual risk assessment represents one of many steps NID Hydro takes to maintain an effective internal control system and mitigate risk.

In December 2019, GridSME met with several key NID Hydroelectric Department (“NID Hydro”) management personnel to discuss and assess current and potential risk factors facing NID Hydro operations. As part of this assessment, GridSME interviewed the Hydroelectric Manager, the Hydroelectric Compliance Administrator, two Senior Hydroelectric System Technicians, the Hydroelectric Generation Superintendent, the Hydroelectric Maintenance Superintendent, and the Senior Engineer – Dam Safety. This risk assessment identified five main risk categories facing NID Hydro listed in priority ranked order below:

1. People and Training
2. Operating Environment (e.g., wildfires)
3. Infrastructure and Technology
4. Regulatory Environment
5. Electricity Market Landscape

A variety of specific risks reside within each category. Interdependencies exist among the risk categories, and certain risks can positively or negatively affect other risks. This risk assessment identifies the risks believed to be most probable or most impactful to NID Hydro.

People and Training

Our risk assessment process identified People and Training to be the most frequent risk discussed by the interviewees, and the most impactful to NID Hydro. Within this category, several risks were identified that could hinder NID Hydro’s ability to recruit, train, and retain the workforce necessary to operate and maintain its hydroelectric infrastructure. These risks include workplace safety, talent recruitment and retention, personnel training, and succession planning.

Personnel Safety

Several of the interviewees stressed personnel safety as the most important risk facing NID Hydro. Given the remote working environments and unforeseen weather conditions common in the Western Sierras, constantly exposing personnel to these elements presents a significant risk. Because of this, NID Hydro operations and maintenance crews make a concerted effort to prepare in advance of incoming storms, deploy the buddy system whenever possible, and take preventive measures.

It is evident that workplace safety is NID Hydro’s top priority and its safety record speaks to that. However, consistent with prior years, NID Hydro personnel noted that although they possess knowledge and expertise in general industrial workplace safety, deep expertise on electrical safety is limited within the Department. In addition, NID Hydro believes its safety program could be further improved by having a dedicated safety coordinator focused on the industrial and electrical safety aspects of NID Hydro’s operating environment.

Two immediate opportunities to bolster the Department's safety posture is in its electrical safety program. One interviewee suggestion is to include electrical theory in the electrical safety training program to give personnel a deeper understanding of electrical systems and not necessarily a fear-based understanding. Another interviewee suggestion to improve NID's safety program is bolstering and retraining on the organization's lockout/tagout (LOTO) procedures.

Personnel Training

Access to external training continues to be a key risk factor facing NID Hydro and other water agencies in Northern California. In 2019, NID Hydro continued to build its workforce training and development programs. NID Hydro sees a well-trained and prepared workforce as essential to maintaining a culture of safety, its infrastructure, and uninterrupted operations. NID Hydro also recognizes that a well-developed training program must contain both internal and external components. Internal training is necessary to prepare the workforce for the operating environment, procedures, and scenarios unique to NID Hydro. External training is essential to gain exposure to proven industry best practices, external viewpoints, and new developments.

Operations

For its operations personnel, NID Hydro remains heavily dependent on PG&E's hydro operations training program. NID Hydro has a long history of using PG&E's training program to qualify its operators. This training program has been extremely beneficial for NID Hydro and its personnel. Because of this, in 2016, NID Hydro cited the potential loss of an adequate training program as a major risk facing NID Hydro and began taking long-term steps to mitigate this risk since that time.

Absent access to PG&E's training program, NID Hydro would be forced to look for other hydro training programs. Interviewees identified the closest equivalent training program to reside in Colorado, but the quality and the depth of the training is inferior to the PG&E training program. This is a single-contingency risk with considerable downside to NID Hydro. PG&E's likely emergence from Chapter 11 bankruptcy in 2020 could accelerate this risk depending on how the company is reorganized and what it looks like post-bankruptcy.

Accordingly, in 2017, NID Hydro began taking steps to mitigate this risk with a contingency plan. Currently, NID Hydro's contingency plan, should it lose access to PG&E's training, is to send operators to WAPA's Training Center in Boulder, Colorado. However, this training is not as in-depth as PG&E's training and could lead to a training gap for new NID operators. Therefore, NID Hydro is looking at longer-term in-house training development options to reduce the organization's dependency on third-party training.

This is no small effort, and will take years to develop, but is essential should NID Hydro lose access to PG&E's operations training program. NID Hydro has also had preliminary discussions with neighboring water agencies (e.g., Placer County Water Agency, Yuba County Water Agency, Merced Irrigation District, etc.) about forming a training partnership to pool resources and form a shared training program. There is mutual interest in this effort, but resources are scarce across the agencies, and NID Hydro cannot not rely on third parties alone to mitigate this risk.

Maintenance

Currently, the maintenance department (machinists and technicians) relies mostly on external training classes and vendor training programs. In prior years' risk assessments, it was noted that the maintenance department, unlike the operations department, lacks a formal systematic training program, instead relying on a mostly ad hoc approach. In 2017, NID Hydro made a concerted effort to begin developing a structured and systematic training program for the machinists and technicians. This maintenance department training program consists of both third party and internally provided training courses. In 2018 and 2019, NID made a considerable effort in documenting and formalizing this maintenance training program. This program will continue to evolve and mature in 2020 and beyond.

Talent Recruitment and Retention

Consistent with the prior years' risk assessment, talent recruitment and retention remains a significant risk to NID Hydro's continued success. Although employee turnover declined in recent years and 2019 saw almost no turnover, fears remain that NID Hydro is in a weak position to retain and recruit outstanding talent because its wages are consistently below the market and neighboring water agencies. NID Hydro did recruit and hire a top Electrical Technician in 2019. Right away, this person made several positive impacts to operations, maintenance, and safety.

In 2017, NID did make an effort to be more competitive in the labor market with a modest market adjustment to wages. All interviewees still believe Hydro is highly susceptible to employee turnover if wages remain below market averages. One interviewee noted the hydro division has several positions that are as much as \$15 per hour lower than nearby water agencies. A market compensation survey was conducted in 2019 and this will be taken into account during Union MOU negotiations in 2020. At the February 2019 Board or Directors meeting, the NID Board discussed the potential of reducing cost of living adjustments and the potential of salary cuts prior to rate increases was also mentioned. The statement was noted by employees, and had a significant impact on morale, which in turn may have an impact on future recruitment and retention.

The impact of lower pay rates will become more impactful as retirements increase and the workforce age and tenure decline. While personnel nearing retirement are disinclined to leave a job simply for better near-term pay, a younger, well-trained workforce are far more prone to seek immediate pay raises simply by changing employer.

Due to likely retirements and general workforce attrition, NID Hydro is likely to lose a meaningful portion of its workforce over the next half-decade as approximately twenty percent of NID Hydro's workforce is within five years of retirement age. High employee turnover has the potential to exacerbate other risk factors facing NID Hydro as addressed within this report. These include employee safety, personnel training, equipment maintenance, and regulatory compliance. These risks become more difficult to manage, more present, and more impactful when organizations lack skilled, experienced, and well-trained people.

Facing the risk of high employee turnover, organizations should not only develop an employee recruitment and retention strategy, but also institute succession planning. Faced with the real possibility of a twenty percent employee turnover rate, NID Hydro should place more attention on succession planning at all levels of the department. Succession planning is a tool used to develop the right competencies and leadership attributes at all levels of the organization. In addition, a succession plan also

identifies where the lack of bench strength creates single-contingency risks (i.e., surprise departures with no backup).

Should NID Hydro experience increased turnover in the years ahead, which is likely inevitable given retirements, interviewees expressed a concern about NID Hydro's ability to find and recruit experienced and qualified staff. It is believed that the overall workforce is not sufficiently deep in terms of the industrial trades. This external factor places even more emphasis on the importance of well-developed employee retention and succession plans.

Succession Planning

The risk of turnover and a challenging recruiting environment make succession planning a key initiative in maintaining an adequate workforce. The interviewees are all mindful of this need and there are efforts being made to develop the bench strength.

For Hydro Operations specifically, succession planning is a common risk factor mentioned during the interviews. The identification of this risk is an important and necessary first step to mitigating the risk. The risk is two-fold. First, there is a concern that the operations department lacks strong candidates interested in a future leadership role in the department. Second, it is widely believed operators take five years to get their feet under them and move into "experienced" status. Because of the time required for operators to reach "experienced" status, this puts NID Hydro at risk when turnover does occur.

The Hydro Maintenance Department practices back-filling and cross-training to cover vacations. The department is also looking ahead 5 to 10 years and identifying the personnel that will be able to step-up into more experienced and skilled roles. This exercise also influences training program development, which is a critical step in succession planning. To grow its bench strength, NID Hydro must know what skills they need at the next level and the training and on-the-job experience required to get there.

Organizational Culture

NID Hydro possesses a strong culture of safety and compliance, which continues to mature. In 2019, the organization continued to grow that culture but there is still more room for growth. NID Hydro focuses on correcting legacy "shortcut" and "tribal knowledge" behaviors. This is especially important as the organization faces increasing regulatory burden from FERC and NERC, wildfire mitigation and vegetation management challenges, and emerging cyber security threats. The correct mindset, documentation, and procedures are especially important for NID Hydro as external threats and risks continue to escalate. Diligent documentation and the adherence to well-designed procedures is especially important in an invasive regulatory environment. Of course, improvements in this area are dependent on having sufficient resources to execute the procedures and document the work.

Organizational Structure and Staffing

NID Hydro has undergone significant changes in Organizational Structure and Staffing in the last 18 months. NID Hydro was able to recruit a Senior Electrical Systems Technician in mid-2018 and he was hired as a permanent employee in early 2019. The Department also added a Hydroelectric Plant Operator and a Compliance Administrator in 2019.

The Hydro Operations and Maintenance Departments have experienced significant growth in workforce with no associated increase in supervision. The nationally recognized Incident Command System (ICS) suggests that between three and seven subordinates is the appropriate range for supervisors. Five is often

recommended as the optimal number. Without any intermediate supervisors, the Hydroelectric Maintenance Superintendent has direct supervision over eleven subordinates and the Hydroelectric Generation Superintendent has direct supervision over eight subordinates. NID Hydro should reevaluate supervision requirements to ensure adequate oversight of staff work is maintained.

Regulatory Environment

Regulatory risks facing NID Hydro continue to build with FERC Dam Safety and NERC Critical Infrastructure Protection (CIP) as the biggest contributors in 2019. The fallout from the February 2017 Oroville Emergency Spillway incident has greatly increased regulatory scrutiny in this area, and dramatically increased the demands on NID Hydro. Complying with regulatory requirements is mandatory, but keeping up with changes, maintaining sufficient documentation, and responding to regulator inquiries demands significant attention and resources. In addition, effective January 1, 2020, new NERC CIP requirements became enforceable. These new requirements involve technical cyber controls that require constant attention and expertise. Consequently, the risk of misstep poses operational, financial, and reputational risks to NID.

In addition to FERC and NERC, NID Hydro is regulated by the California Legislature, the California Energy Commission (CEC) (e.g., rules regarding how traditional hydroelectric power generation will be treated or viewed by load-serving entities and in the energy markets), the California and Federal Environmental Protection Agencies (EPA), and the Occupational Safety and Health Administration (OSHA), among others.

All forms of regulatory compliance place a heavy burden on NID Hydro and stretches its resources thin. The organization can expect the burden to increase in the years ahead. Maintaining compliance requires the organization's full attention, as well as a system of documented processes, procedures, and internal controls. Most importantly, the regulatory burden requires NID Hydro to build and sustain a culture of compliance lived daily by its people. The organization leverages this annual risk assessment to inventory and assess the organization's regulatory compliance burden and assess whether sufficient resources exist to meet that burden. Based on this risk assessment, GridSME believes that NID Hydro's resource capacity to meet the organization's regulatory compliance burden is not sufficient due to three primary drivers. These three drivers include:

1. Increased FERC oversight and scrutiny;
2. A growing infrastructure footprint (addressed in the Infrastructure and Technology section below); and
3. An evolving NERC compliance burden, specifically related to CIP cyber control requirements.

FERC Regulatory Compliance

Perhaps the biggest regulatory risk facing NID today includes decisions or initiatives at FERC, such as reliability, security initiatives, dam safety, environmental, compliance, and re-licensing. FERC scrutiny and oversight dramatically increased in 2017. At nearly the same time as the Oroville Dam spillway failure in February 2017, FERC's scrutiny of NID Hydro's activities began to increase. FERC reacted in an extreme manner and now requires NID Hydro to notify the Commission before performing a maintenance event, no matter the nature of the activity. In the past, NID Hydro would identify a maintenance need and address the issue, as soon as possible. Now, NID Hydro must notify FERC, and allow FERC to review and ask questions during a 60-day review window. This not only slows down reaction time to operations and maintenance needs, it also consumes administrative resources and requires those resources to react very

quickly to minimize FERC review delays. Given the increased FERC scrutiny, record keeping and document retention are more important than ever before.

Specifically, FERC has focused much of its attention on probable spillway failure assessments. Since early 2017, six NID Hydro spillways have come under review, each requiring significant attention from NID Hydro resources. Most notably, the Scott's Flat spillway requires major repair (or replacement) and NID Hydro resources have been allocated to that project. The culmination of regulatory reaction and aging infrastructure has placed a significant strain on NID Hydro operations, maintenance, and administrative resources to keep-up with regulator demands and increased project workload. NID Hydro added an Associate Engineer temporary position in 2019 who has made significant contributions, but the Department is still thin on resources in this area. NID Hydro lacks depth and bench strength behind its Senior Engineer of Dam Safety. Resources in this area are especially important as NID continues its FERC relicensing efforts.

NERC Regulatory Compliance

Compliance and reliability risks associated with the NERC Reliability Standards, the Western Electricity Coordinating Council (WECC) Regional Standards, and their collective enforcement, continues to have the full attention of NID Hydro. To address its NERC obligations, NID Hydro's Internal Compliance Program (ICP) directs the organization to perform a risk assessment annually. NERC and WECC are very focused on identifying and reducing risks to the Bulk Electric System (BES) and recommend that registered entities conduct regular risk assessments.

As the power grid evolves (e.g., increased intermittent renewable generation, the proliferation of storage, the retirement of many conventional generators, changing distribution system characteristics, ever-increasing cyber threats), NERC and the Regional Entities (e.g., WECC) work diligently to keep pace. This results in an ever-changing set of Reliability Standards constantly in-flux. NID Hydro's registration as a Generator Owner (GO) and Generator Operator (GOP) makes applicable and enforceable 268 Reliability Standard Requirements and sub-Requirements.¹ That presents 268 opportunities to "trip-up" and experience a compliance event, such as a compliance exception or compliance violation.

Complying with the currently enforceable Standards and Requirements is a significant undertaking. Adding to that burden are changes to the Reliability Standards and associated Requirements. Table 1 and Figure 1 below depict the total number of changes since NID Hydro's registration in 2014. From NID's registration until now, there have been 1,128 cumulative changes to the Requirements applicable to NID Hydro's GO and GOP functional registrations. Years ago, NERC began talking about achieving a "steady state" with the Reliability Standards. As seen in Table 1 below, the Standards were hardly in a steady state until 2018 when activity did, at least temporarily, slow. 2018 saw a dramatic decrease in the number of Standard changes compared to prior years. However, activity picked up again in 2019 and so far in 2020 with more changes expected.

¹ A NERC Reliability Standard contains one or more individual Requirements and sub-Requirements applicable to certain NERC functional registrations, such as a GO or GOP.

	2014	2015	2016	2017	2018	2019	2020 <i>scheduled²</i>
Requirements that became Enforceable	68	70	134	120	5	21	53
Requirements that became Inactive	114	99	222	118	27	47	30
Total Changes	182	169	356	238	32	68	83
Total Cumulative Changes	182	351	707	945	977	1,045	1,128

Table 1: NERC Reliability Standard Requirement Changes, GO & GOP

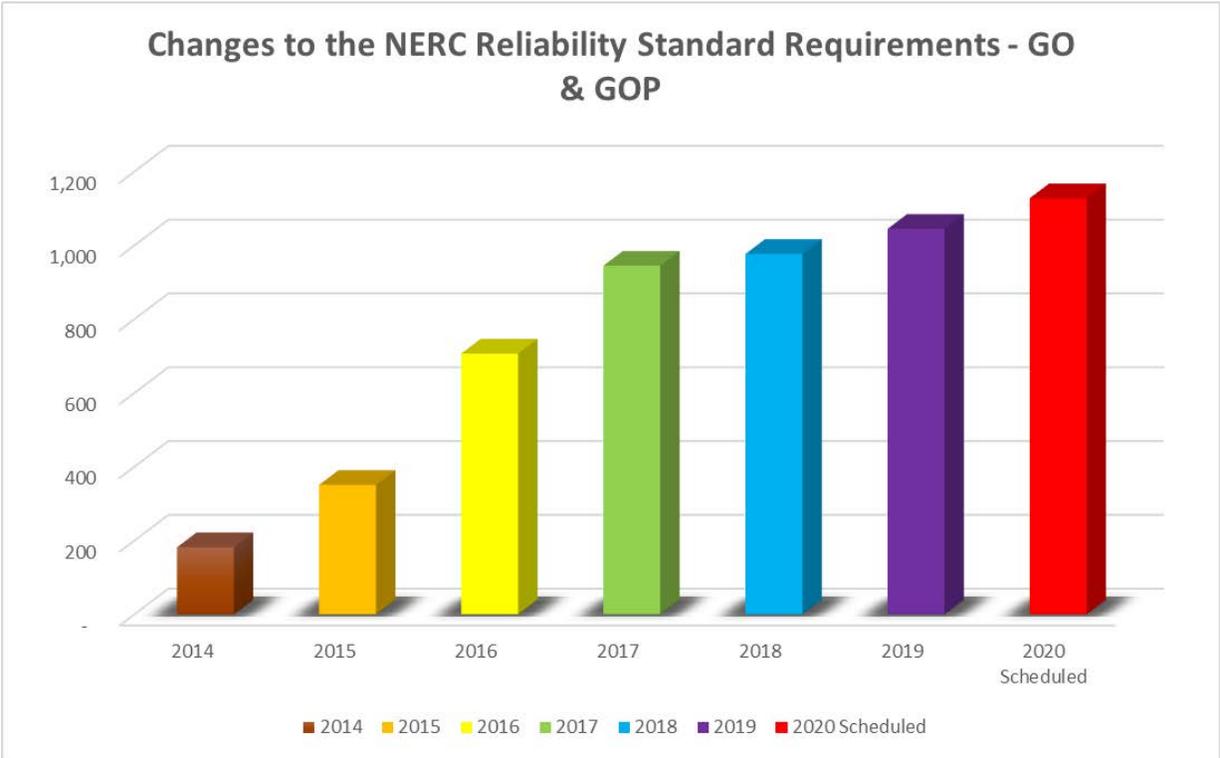


Figure 1: Cumulative Changes to NERC Reliability Standard Requirements

Specific NERC regulatory risks identified and discussed during our risk assessment include:

- The volume and constant changes to the NERC Reliability Standard Requirements
- Rate-of-change of the NERC Reliability Standard Requirements
- NERC Standard revisions with short compliance windows (e.g., VAR-501-WECC-3 in 2017)
- Standard Requirements ambiguity and lack of clear guidance from NERC and WECC, in some cases

² Requirement changes already scheduled in 2020 as of March 4, 2020.

- Critical Infrastructure Protection Reliability Standard CIP-003 for low impact BES Cyber Systems that now require the implementation, monitoring, and execution of technical internal controls
- Protection and Control Reliability Standard PRC-005: new Standard revisions, staying current on maintenance time requirements, and generating adequate evidence of maintenance activities
- Management of the PG&E Coordinated Functional Registration (CFR) agreement

Risk of Compliance Violations

A compliance violation often results in penalties that could (by law) reach \$1 million per violation per day. In reality, actual penalties for compliance violations do not approach this level, but are material nonetheless. Table 2 below provides examples of penalties levied in 2019 by FERC, NERC, and the Regional Entities for violations of GO and GOP-applicable Reliability Standards.

Examples of NERC Penalties Levied in 2019

Reliability Standard Violated	Reliability Standard Name	Nature of Violation	Penalty Amount
CIP-002 through CIP-011	Cyber Infrastructure Protection	The registered entity (RE) was found in violation of 127 CIP requirements, caused by lack of managerial oversight, process deficiencies, inadequate training and lack of internal controls.	\$10,000,000
COM-002 IRO-001 EOP-006 IRO-005	Coordination, Communication, and Emergency Preparedness	The RE was fined for five violations of certain Operations & Planning Standards related to two unrelated events occurring in October 2017.	\$2,300,000
CIP-007 and CIP-010	Critical Infrastructure Protection (CIP)	The RE was fined for violations of two CIP Standards because it failed to apply certain required protections to its servers, which are Critical Cyber Assets within its medium and high impact BES Cyber Systems.	\$2,100,000
CIP-004 to CIP-011	Critical Infrastructure Protection (CIP)	The RE was fined for 12 violations of the CIP Standards discovered during a FERC audit stemming from issues with personnel training, configuration change management and vulnerability assessments, and information protection.	\$1,000,000
CIP-004 to CIP-011	Critical Infrastructure Protection (CIP)	The RE was fined for 13 violations of the CIP Standards discovered during an audit. NERC cited organizational weakness in processes and procedures that, for example, resulted in a lack of documentation, inadequate physical access controls, undocumented communication access to its high and medium impact BES Cyber Systems, and mismanagement of ports and services.	\$1,000,000
CIP-002 to CIP-011	Critical Infrastructure Protection (CIP)	The RE was fined for 21 violations of the CIP Standards self-reported by the entity. SERC cited the entity's unpreparedness for the CIP v5 Standards, including a lack of management oversight, controls, training, and documentation.	\$775,000

Reliability Standard Violated	Reliability Standard Name	Nature of Violation	Penalty Amount
TOP-001	Transmission Operations	The RE experienced a server failure and the failover to a backup server was unsuccessful. This affected the operator's ability to perform a Transmission Network Analysis (TNA) because there were no alarms to alert the operator.	\$450,000
CIP-007 CIP-010	Critical Infrastructure Protection (CIP)	The RE was fined for five violations of the two CIP Standards discovered during an audit. For its BES Cyber Assets, the RE failed to develop baseline configurations and test against those configurations prior to deployment in a production environment. WECC cited a lack of strong internal controls related to configuration and change management.	\$378,000
PRC-005	Protection System, Automatic Reclosing, and Sudden Pressure Relaying Maintenance	The RE was fined for 215 violations of PRC-005, including instances of noncompliance involved monthly, quarterly, annual and/or periodic tests for thirty-six batteries at eight generating plants.	\$375,000
CIP-004 CIP-007 CIP-010 CIP-011	Critical Infrastructure Protection (CIP)	The RE was fined for 10 violations of the four CIP Standards discovered in preparation for an audit. These violations came about as the entity transitioned from CIP v3 to v5 and were the result of insufficient management oversight, a lack of internal controls, and poorly documented and followed processes and procedures.	\$301,000
FAC-003	Vegetation Management	The RE was fined for a violation of FAC-003 related to a momentary interruption on its 345 kV line due to a four-foot encroachment of the Minimum Vegetation Clearance Distance (MVCD).	\$120,000

Table 2: Examples of 2019 Reliability Standard Violations and Penalties

Often, compliance violations are far more than the amount of the NERC penalty. Violations also require entities to allocate considerable resources to report, negotiate, and mitigate the non-compliance event. Other indirect costs to compliance violations include reputational costs, increased regulatory scrutiny

(e.g., more frequent spot checks and a shorter audit cycle), and a less forgiving regulator during future compliance events.

For NID, a recent example of a NERC compliance challenge occurred as the result of a Standard revision, VAR-501-WECC-3, that became enforceable on July 1, 2017. This revised Standard included a new Requirement that requires a GO replacing its excitation system to also install a Power System Stabilizer (PSS) within 180 days of excitation system replacement. This Standard came into effect very quickly (approved by FERC just two months prior) and required NID Hydro to immediately update its maintenance and capital investment plans. These changes also necessitated the expenditure of a material amount of capital, and the addition of an outage in the first quarter of 2018 to activate the PSS capability on the Dutch Flat #2 unit. NID successfully responded to this new Standard Requirement and installed the PSS capability at Dutch Flat #2 in February 2018. However, this installation came at a cost to its other standard maintenance obligations due to limited staff resources.

In 2019, NID did not experience any NERC self-reports or notice of potential violations. Looking ahead to 2020, a few of the currently known key NERC compliance activities this year include:

- Respond to WECC's biennial self-certification request for COM-002 and PRC-005
- Annual review and sign-off of NID's BES Cyber System identification review and CIP Senior Manager (CSM) approval.
 - Completion must occur by August 31, 2020 but recommend performing by May 31, 2020
- New CIP-003-7 (January 1, 2020) and CIP-003-8 (April 1, 2020) Standards become enforceable and require documented physical and cyber controls, including management of Transient Cyber Assets (TCA) and Removable Media (RM).
 - Ongoing monitoring and management of TCA/RMs is critical
- Implement a PER-006 Personnel Training
- Continued management and execution of the PRC-005 Protection System Maintenance Program
- Verification of PRC-025 compliance for the new Chicago Park relays before October 1, 2019
- Addressing the new PRC-026-1 Standard for Relay Performance During Stable Power Swings
- To comply with PRC-027, perform a Protection System Coordination Study for Chicago Park and Dutch Flat 2 before October 1, 2020
- Updating procedure and attestation documentation for scheduled Standard and Requirement revisions
- Compliance with CAISO generator modeling and data submittal requirements response for Dutch Flat 2 due August 30, 2020; non-NERC jurisdiction but CAISO Tariff-enforceable
- Updating and executing a revised Coordinated Functional Registration (CFR) with PG&E

In addition to the activities that are known and predictable, there are many routine reporting and administrative activities that NID Hydro will continue to perform. Further, it is probable that 2020 will also see regulatory inquiries, additional Reliability Standards changes, and O&M events that require compliance responses.

In particular, the increasing technical nature of CIP requirements on low impact BES Cyber Systems, which NID owns, requires diligent management and oversight. As of early 2020, the low impact CIP requirements include the continuous management of a TCA/RM program. What this means is each external Cyber Asset needs to be scanned and evaluated for the existence of malicious code before it can be connected to

Chicago Park and Dutch Flat 2's BES Cyber Systems. In addition, the NID SCADA network firewalls should be monitored and periodically evaluated for vulnerabilities. These are new activities required of NID. The performance of which will be especially challenging for the Department after a key IT resource left NID in early 2020.

The speed-of-change, the constant need to monitor NERC activity, and the importance of taking timely action culminate in a significant inherent risk to NID Hydro's compliance program. To address this ever-present risk, in 2014, NID Hydro implemented a formal Internal Compliance Program (ICP) carried-out by the Reliability Oversight Compliance Committee (ROCC), which meets quarterly to review recent NERC developments, review activities, and plan action items for the upcoming quarter(s). However, given the many other demands placed on NID Hydro resources, few of the ROCC members are able to dedicate significant time to NERC activities. NID Hydro also experienced turnover in the Compliance Administrator position in early 2019, which will present a new challenge for NID Hydro. The organization has taken resources from other assignments and needed to outsource a significant portion of the compliance activities in an effort to ensure compliance is maintained.

Operating Environment

While facing numerous and potentially significant inherent risks, NID Hydro continues to make a concerted effort to actively manage its risk profile. Organizations with strong risk management cultures and well-designed and implemented internal controls can effectively anticipate and mitigate risk. Given the size and complexity of NID Hydro's operations, the consequences of unmanaged risk can be catastrophic.

The annual risk assessment identified a variety of risks that reside within the Department's equipment and technology infrastructure and threats from external forces. To maintain the reliability of its aging infrastructure, NID Hydro implemented a Capital Improvement Plan in 2017 to strengthen the planning and capital budgeting process for major projects anticipated over the next 5 to 10 years. If not well-planned and executed, these projects have the potential to adversely affect NID Hydro's ability to meet its operating and financial objectives. By systematically and thoroughly planning projects, NID Hydro gives itself the opportunity to identify and mitigate risks early. Long-term strategic planning also allows NID Hydro to respond to evolving risks throughout a project's lifecycle. The addition of the Deer Creek Powerhouse and associated South Yuba Canal adds another significant piece of infrastructure that must be maintained and operated.

The remote and rural nature of NID Hydro's operating environment presents many inherent risks. These include personnel safety, severe weather, physical security of the infrastructure, wildfires, and vegetation management. This was made evident in 2017 and 2019 as extremely wet winters and springs took their toll on the terrain in and around NID Hydro's footprint. In addition, the growing threat of cyber-attacks on the U.S. power grid and those generators connected to it presents an ever-present risk to NID Hydro.

Wildfires and Vegetation Management

Although NID Hydro's infrastructure was fortunate to avoid wildfires in recent years, the risk of sustained damage from one or more wildfires is ever-increasing with each passing year. In addition, and as demonstrated by PG&E's equipment, perhaps the biggest risk is NID Hydro's equipment starting a wildfire. The wilderness surrounding NID Hydro's infrastructure poses two risk factors. The first is the ever-present wildfire risk during the annual dry season in the summer and fall. The second risk factor is vegetation

management to both mitigate the risk of igniting a wildfire and to minimize the impact to NID facilities if a wildfire occurs in the nearby area.

Vegetation management remains very important and very challenging. The interviewees identified this as an area where NID Hydro made significant progress in 2019. Heading into the year, the Department had identified several critical vegetation management projects. The Department was diligent in identifying maintenance areas, sourcing vendors, managing the third-party coordination and approval process, and then scheduling and performing the work. Examples of vegetation management needs include areas around and under transmission lines, switchyards, powerhouses, penstocks, and flumes.

As many of NID Hydro's projects reside on federal land, this creates unique challenges for maintaining the vegetation. To carry out an effective vegetation management program (like was performed in 2019), NID Hydro must navigate federal and state rules and regulations. Some of its infrastructure resides on land owned by the Bureau of Land Management (BLM), and some owned by the Forest Service. Both BLM and Forest Service approval and compliance is a continuous obstacle for NID Hydro and slow to overcome. Although obvious needs exist to cut-back and proactively manage vegetation around its infrastructure, NID Hydro must be diligent about the process to gain timely approvals and cooperation from third parties. This creates just as much of an administrative burden for NID Hydro as it does a maintenance burden. Having sufficient workforce resources to timely identify, manage, and address vegetation risks is critical for NID Hydro.

In addition, the treacherous terrain and access barriers pose significant challenges to staying on top of NID Hydro's vegetation management efforts. In addition, seasonal factors often limit when most vegetation management field activities are performed. The culmination of all these factors require prudent monitoring and management of the areas surrounding NID Hydro's infrastructure. This is easier said than done. Even with diligent vegetation management practices, it is almost inevitable that a wildfire will threaten NID Hydro's infrastructure.

Physical Security

Given NID Hydro's remote infrastructure, it has experienced many threats to its physical security and this is not likely to change. To address this risk, Hydro has taken many steps to improve the physical security of its infrastructure. This includes installing all new lock cores in 2016 and card readers in the powerhouses in 2019.

Although not part of NID Hydro's NERC compliance footprint, the Scotts Flat Dam presents a unique physical security situation. In August 2017, NID installed fencing and a gate across a portion of the top and along the edge of the Scott's Flat Spillway to safeguard the District against regulatory concerns as well as public health & safety hazards. During a Special Board Meeting on November 17, 2017, the Board of Directors required that the gate at Scotts Flat be opened. This has presented a unique set of physical security threats to the District's operations that must be mitigated and must not be allowed to spread to NERC registered facilities. Staff is currently working to develop a fencing plan that will be acceptable to the Federal Energy Regulatory Commission, the California Division of Safety of Dams and the Board of Directors.

Cyber Security

Cyber-attacks on public agencies, industrial control systems, and the power industry are becoming more prevalent. The power grid is now a prominent and high value target. Whether it is enemy state and

terrorist motivations, monetary gain (e.g., ransomware), or simply “because I can” motivations, cyber-attacks are a real threat to the security of power grid operators and power generators. Examples of cyber-attacks in recent years include the Iranian “hactivist” group intruding a New York dam’s SCADA system in 2013, the December 2015 hack of Ukraine’s power grid, which caused a major blackout, and the second, even more sophisticated December 2016 cyber-attack on Ukraine’s power grid. More recently in early 2020, a natural gas compressor station was the victim of a spear-phishing attack that spread from the organization’s business network and compromised its control system impacting operations and causing significant financial damage.

Consistent with prior years’ risk assessment, NID Hydro interviewees are very mindful of the cyber risks facing the industry and NID Hydro’s infrastructure. Recent cyber-attacks on critical infrastructure throughout the world have made the risk very apparent. There is no doubt that nations hostile to the U.S. and independent malicious hackers are targeting the cyber assets that generate electricity and operate the power grid. The inoperability of these assets directly translates to downtime and downtime costs money. Hydro assets are certainly a target, not only because of their contributions to power grid operations, but also because of the magnitude of destruction possible if the assets were compromised and misused.

NID Hydro’s SCADA upgrade completed in 2019 presents new inherent security risks to NID Hydro. The upgrade also presents an opportunity to design and install effective internal controls that protect the assets from cyber threats. NID Hydro must continue developing and implementing new policies, processes, and procedures that address certain key activities that are fundamental to securing the Department’s critical infrastructure. These activities include:

1. Access management;
2. Change management;
3. Backup and disaster recovery;
4. Network monitoring, logging, and review;
5. Patch management; and
6. Periodic cyber vulnerability assessments.

Performing these activities is especially challenging for NID given the limited resources within the Department and the NID organization. The activities listed above requires a diverse skillset, broad experience, discipline, and focus. NID is currently short the (staff) resources required to maintain a secure operating environment and hardened infrastructure. Currently, NID Hydro relies solely on the Grass Valley Information Technology (IT) department, which lost a key resource in early 2020, as mentioned in the NERC Regulatory Compliance section above.

To ensure it has adequate and redundant staffing around SCADA system network management and cyber security, NID Hydro will need to recruit and hire personnel with this experience and skillset or outsource these functions. This is an area that NID Hydro should look closely at and evaluate the most cost-effective long-term solution to manage its SCADA system.

Supply Chain Risks

Cyber security risks in the utility supply chain is receiving increased focus and attention. On May 1, 2020, President Donald Trump signed an executive order (EO) halting the installation of bulk-power system (BPS) equipment "designed, developed, manufactured, or supplied, by persons owned by, controlled by, or

subject to the jurisdiction or direction of a foreign adversary." The EO seeks to mitigate well-known and long-standing cyber security supply chain risks. There is no doubt that cyber supply chain risks pose a real threat to the reliable operation of the U.S. power grid. The industry has been discussing how to address this risk since 2016 when FERC directed NERC to "develop a new supply chain risk management standard that addresses risks to information systems and related bulk electric system assets."

NERC's response to FERC's directive is the Critical Infrastructure Protection (CIP) standard CIP-013-1 that addresses cyber supply chain risks. CIP-013 goes into effect on October 1, 2020, but only applies to medium and high impact BES Cyber Systems, which means almost all generators are excluded, as well as the distribution system.

While CIP-013-1 is clearly not applicable to NID, it is unclear whether the May 1st EO is applicable and what NID should do in response. At the time this Risk Assessment report is published, it is unknown what, if any, direct impact the EO will have on NID. While it is likely that no immediate action is required, NID Hydro should use the EO as motive to perform an overall assessment of its assets' cyber security posture.

Evaluating NID Hydro's supply chain risk is certainly an important activity and should be performed. However, that should not be the priority for NID Hydro until it first implements and continuously monitors more foundational cyber security controls. A framework for fundamental cyber security controls is the [Center for Internet Security \(CIS\) Top 20 Critical Security Controls \(CSC\)](#). This is a great starting point for an organization to evaluate the state of its cyber security posture. It is worth noting that cyber supply chain risk management controls are not present on the "Top 20 Critical Security Controls (CSC)" list. This is not to say that supply chain risk management is not extremely important for the reliable operation of critical infrastructure, just that there are many other fundamental controls that should be implemented first and foremost.

When NID Hydro is ready to turn its attention to supply chain cyber risk management; a few resources are listed below that offer guidance.

- [North American Transmission Forum \(NATF\) CIP-013-1 Implementation Guidance](#)
- [Cyber Security Supply Chain Risk Management Plans Implementation Guidance for CIP-013-1](#)
- [NIST Best Practices in Cyber Supply Chain Risk Management](#)
- [DOE Cyber Security Procurement Language for Control Systems](#)
- [NERC FAQ Supply Chain – Small Group Advisory Sessions](#)

Infrastructure and Technology

For multiple reasons, NID Hydro's infrastructure and technology present high inherent risks. First, the age of the infrastructure requires constant maintenance. Because of this, NID has heightened its focus and efforts in several areas, including project planning, computerized maintenance management system, electrical documentation, spare parts, and its technology. The second driving risk factor is NID's planned addition of the Deer Creek Powerhouse (DCPH) Project to its portfolio in 2020.

Aging Infrastructure

Although the industry has seen well-maintained hydro generation facilities perform reliably for a nearly century, NID Hydro's infrastructure does present a significant risk for multiple reasons. First and most obvious, older equipment is more susceptible to reliability issues, and requires more frequent maintenance intervals. Second, drawings of older equipment are often found to be inaccurate, which

makes for difficult and time-consuming troubleshooting efforts. Third, the nature of the older equipment means troubleshooting is labor intensive, as compared to modern generation plants that are mostly digital. The culmination of these factors presents a major risk to NID Hydro's financial health should the availability and reliability of its equipment be compromised.

Consistent with prior years' risk assessments, interviewees expressed an appreciation for the organization's commitment to reinvesting in and maintaining its infrastructure. The NID Hydro personnel greatly appreciate the organization continuously investing capital in infrastructure maintenance and improvement projects. When a proposed project's benefit exceeds its cost, project funding is obtained.

Project Planning

To keep pace with the aging infrastructure, maintaining NID Hydro's historical reliability levels requires constant investment, project planning, and execution. Absent a well-planned and executed maintenance program supported by a CMMS, the continued high availability of NID Hydro's generation assets is doubtful. The size of NID Hydro's infrastructure and the high volume of projects necessitates thorough and focused planning. NID Hydro's maintenance program has a risk assessment process fundamentally built into it. NID Hydro personnel are adept at identifying infrastructure risks and maintenance or replacement solutions to address those risks. Given the continuous high volume of projects on NID Hydro's docket, project planning must be thorough, focused, and well-orchestrated. To address this need, in 2017, NID Hydro transitioned away from an ad hoc planning process and instituted a formal planning process that considers in input and risk assessment from maintenance and operations crews to support long-range project planning needs. NID Hydro refers to this as its Capital Improvement Plan.

The Capital Improvement Plan was implemented in an effort to proactively develop detailed and focused project plans. The process identifies the total life-cycle cost of each asset, and maps project schedules, staffing workload, and costs over the next 5 to 10 years. With this initiative, NID Hydro intends to increase the maturity of its project planning process so that projects are proactively identified and planned in detail. As part of the Capital Improvement Plan process, a review takes place at least annually prior to the annual NID Hydro budget season.

Electrical Documentation

Inadequate electrical system documentation remains a risk to NID Hydro's ability to maintain and troubleshoot its infrastructure. This risk is a function of the infrastructure's age, since few as-built drawings were retained (decades ago), and what was obtained is sometimes found to be inaccurate. In 2017, NID Hydro began taking steps to address this risk by hiring a contractor to review, validate, and update electrical documentation at the Bowman PH. In 2018, new electrical drawings were drafted for Chicago Park Powerhouse following the 2017 relay replacement and upgrade. This risk certainly deserves a continued focus and effort to further mitigate downside for the remainder of NID Hydro's portfolio.

Spare Parts

In prior years, interviewees identified the availability of spare parts as a potential threat to the reliability of the hydro operations. Many system parts have long lead times and are high dollar items. These same parts, if they fail, present single-contingency risks that could leave NID Hydro's major equipment inoperable for long periods of time. This makes spare parts inventory management a difficult and expensive proposition. Hydro is constantly faced with evaluating the cost-benefit trade-off of stocking expensive, long lead-time spare parts. In 2017, NID Hydro improved its risk profile in this area by

purchasing redundant protection relays for Chicago Park Powerhouse, and a backup exciter for Chicago Park and Dutch Flat #2 Powerhouse. Still, interviewees noted that avoidable risks remain in this area, and NID Hydro should continue to closely monitor the health and downside risk of its spare parts inventory. For example, NID Hydro does not have backups for the Rollins protective relays, and should a device fail, the unit would be out-of-service until a replacement can be ordered and installed.

Spare Parts Inventory Decision Matrix	Lead Time	
	Short	Long
Inexpensive	Consider purchase	Purchase
Expensive	Do not purchase	Further analysis required

Table 3: Spare Parts Purchase Decision Matrix

Technology Changes: SCADA and CMMS Replacement

In 2017, NID Hydro and its vendor began a complete replacement of its SCADA system and the project was completed in 2019. This SCADA system upgrade reduces NID’s technology and operations risk but introduces new security risks, which is discussed further in the Operating Environment-Cyber Security subsection above.

NID’s computerized maintenance management system (CMMS), Lucity, identified as a risk in prior years, is inadequate for the needs of NID Hydro operations and maintenance requirements. Given the age of the infrastructure, extensive maintenance activities, and high project volume, NID Hydro is planning to upgrade its CMMS to Sedaru in 2021. The upgrade is an important tool for documentation and record-keeping purposes, which has never been more important given the current FERC and NERC regulatory environments. The new CMMS will provide increased functionality including unlimited data collection capability, database structure that limits asset data functionality, asset management tracking and reporting, full visibility of spare parts inventory, and purchase history, including vendor, date, and amount.

NID Hydro does still lack a dedicated warehouse, which presents difficulty for personnel to manage inventory and mitigate single-contingency events. NID does have plans to build a new Hydro field office that will include a formal, dedicated warehouse to securely store and manage its inventory.

NID Hydro Portfolio Growth

NID Hydro’s footprint is expected to increase in 2020 with the acquisition of the Deer Creek powerhouse from PG&E. The Deer Creek acquisition is a strategic and critical project for NID Hydro. Owning this asset ensures NID Hydro remains in control of a critical conduit of the District’s water supply. However, this acquisition will further stretch NID Hydro’s existing resources and require NID Hydro to hire new positions.

In addition, NID is evaluating the possible construction of two new powerhouses. One at the Loma Rica Water Treatment Plant and a second powerhouse at the existing Rollins Dam. In a short time period, NID Hydro’s portfolio could grow from 7 to 10 powerhouses. This growth will place new demands on all NID Hydro resources. Not only do more assets require additional regulatory compliance obligations (e.g., FERC, EIA, CPUC), it also requires additional obligations with the California Independent System Operator (CAISO). CAISO processes and requirements require attention and expertise, often within a short time period. This CAISO burden only increases with each additional generation resource with very little scalability across the portfolio.

Colfax Hydro Headquarters

Given the growing infrastructure footprint, the ever-increasing need to maintain the aging infrastructure, and the heightened regulatory burden, NID Hydro's staffing and inventory needs are increasing. This has already manifested itself with the hiring of new positions in recent years and is likely to continue with the Deer Creek acquisition. The Colfax Hydro field office is quickly running out of available space to house its growing workforce, tools, and equipment. In addition, NID Hydro lacks a formal and adequately sized warehouse. In 2018, NID Hydro located and acquired a site for a future NID Hydro field office building. Planning and design work for the new site began in 2019 and will continue in 2020 with groundbreaking expected soon thereafter.

Electricity Market Landscape

PG&E Declares Chapter 11 Bankruptcy

On January 29, 2019, saddled with approximately \$20 billion in liabilities from recent wildfires its equipment started, PG&E declared Chapter 11 bankruptcy. Under bankruptcy, the utility has analyzed the sale of certain assets and liabilities and the potential reform of its business model. It has also quietly explored its options to unwind some of its above-market power purchase agreements (PPA).³ The utility disclosed it has 387 PPA's that total approximately \$42 billion in future payments – not a liability on its balance sheet, but certainly an amount the utility would like to restructure and reduce. Among the PPA's are many with renewable generators signed during the early part of the last decade or prior with solar generators. Prices for solar PV has dropped dramatically, leaving PG&E in a poor position to compete with Community Choice Aggregators (CCA) for customers.

As a PPA counterparty to PG&E, these developments grabbed NID Hydro's attention in 2019. Since filing for bankruptcy, PG&E has not challenged or tried to terminate its above-market PPA's. It did renegotiate certain PPAs with developers of projects under contract but yet to be built. Under pressure from state lawmakers and regulators, PG&E gave generators some comfort in August 2019 by pledging to honor its PPAs.⁴ Since that pledge, the issue has died down and it appears NID's PPA's are not at risk. Furthermore, were PG&E to terminate PPA's during the bankruptcy proceeding, there are two factors working in NID's favor. First, FERC has attempted to interject in the bankruptcy process when it comes to handling PPA's. This is likely to be in generators' favor as unilaterally amending or repealing PPA's undermines the integrity of wholesale electricity markets. Second, NID Hydro's portfolio energy profile and PPA price is more favorable to PG&E than most contracts in PG&E's portfolio. In addition to its energy output, PG&E monetizes ancillary services, resource adequacy, and environmental attributes from NID Hydro's resources. Considering that PG&E does still need to procure renewables and zero-greenhouse gas (GHG) resources to serve its load and meet state requirements and given NID Hydro's diverse profile attributes relative to intermittent renewables, PG&E attempting to restructure NID Hydro's PPA's appears to be a low risk. However, should PG&E choose to challenge NID's PPA's, the District will be facing significant legal costs and potentially significantly reduced revenues. NID must protect itself and continue monitoring the bankruptcy proceedings.

³ Mullin, Robert, Sangree, Hudson. (2019, January 29). PG&E Wants to Undo Contracts, Revamp Biz in Bankruptcy. Rtoinsider.com.

⁴ St. John, Jeff. (2019, September 9). PG&E Pledges to Honor Renewable Contracts in Bankruptcy Plan. Greentechmedia.com.

General Wholesale Market Trends

PG&E's bankruptcy filing was a reminder of the importance of understanding and monitoring the CAISO wholesale electricity markets. Intermittent renewables (e.g., solar) continued to proliferate on the CAISO system. Wholesale energy prices remained relatively low and the well-discussed "duck curve" shape of intraday prices continued. The first quarter of 2019, February in particular, did experience a sharp increase in wholesale electricity prices due to natural gas transport constraints, which has been an ongoing challenge for several years. Prices bottomed out in May 2019 around \$20 per MWh, in part due to a heavy hydro year and slowly rebounded as the year went on with average energy prices approaching \$40 per MWh in December.

Intermittent renewable penetration and natural gas constraints continued to increase the intraday volatility of wholesale electricity market prices. The installed cost of intermittent renewables, namely photovoltaic (PV) solar, and energy storage technologies, namely lithium-ion batteries, continue to decline as well. The abundance of solar PV in California is suppressing midday wholesale electricity market prices many days of the year and driving down PPA prices across the country, particularly in California. The United States imposed a 30% Section 201 import tariff in January 2018 on imported solar PV panels. In the short-term, this put some upward pricing pressure on new power contracts for solar and slowed project development, but the tariff has overall not seemed to slow down solar PV development.

In addition to generally low but volatile wholesale electricity market prices, distributed generation (e.g., rooftop solar), behind-the-meter battery storage technologies, and the evolution of CCA's are reducing most utilities' (e.g., PG&E and municipal utilities) load profile. These factors are resulting in shrinking loads, declining wholesale electricity market prices, localized over-generation situations, and an increase in generator curtailments. The culmination of these factors has led to a very saturated and highly competitive electricity market. Many power generators are eagerly searching for power off-takers (i.e., buyers) in both the long-term and the near-term. Although average prices remain low, price volatility continues to increase. Another favorable trend for flexible and dispatchable generation are higher average ancillary service (e.g., spinning reserves, regulation up, and regulation down) prices, which remained strong in 2019. Off-takers are eager to add resources to their portfolio that are renewable and carbon-free, as well as dispatchable and flexible. Hydro resources with storage capacity and the ability to shape intraday production is the perfect resource for California's energy future.

Chicago Park and Dutch Flat #2 are both under long-term power contracts with PG&E with contract expiration approximately 13 years out. NID Hydro's smaller plants face expiring contracts in the next few years, and these electricity market forces will shape the future economics of those projects. These market forces have put downward pressure on NID Hydro's long-term revenue generation potential. The changing power grid dynamics could incentivize NID Hydro to operate some of its hydro resources under different operating profiles in the future, including a more flexible and dispatchable profile. Figure 2 below presents 2019's average hour-by-hour CAISO day-ahead (DA), fifteen-minute market (FMM), and five-minute market (5MM) wholesale electricity prices in the Northern California area. As can be seen, the disparity between high and low prices continues to increase with the lowest pricing consistently experienced in the middle of the day (i.e., peak solar PV generation). Figure 3 shows energy and ancillary service prices by month in 2019, illustrating the price spikes in February at the NW Sumas, PG&E Citygate, and SoCal Citygate natural gas hubs. To California, these natural gas price spikes are reminders of the need to reduce its dependency on gas to serve baseload and peaking energy needs. Such gas price spikes present a great opportunity for hydro to increase its role and importance in California's energy portfolio. NID Hydro is

contemplating how, and by how much, it can vary its generators' production and water flows intraday, provide ancillary services, and shift more generation and water flow into peak demand and price hours.

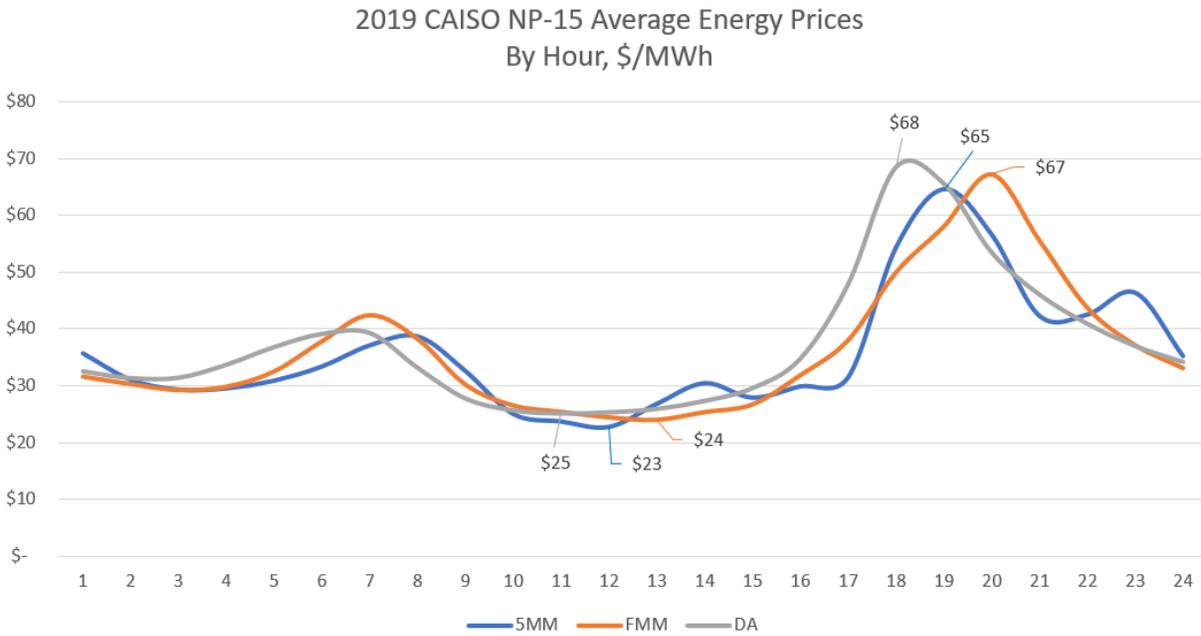


Figure 2: CAISO North Path 15 (NP-15) 2019 Average Electricity Prices by Hour

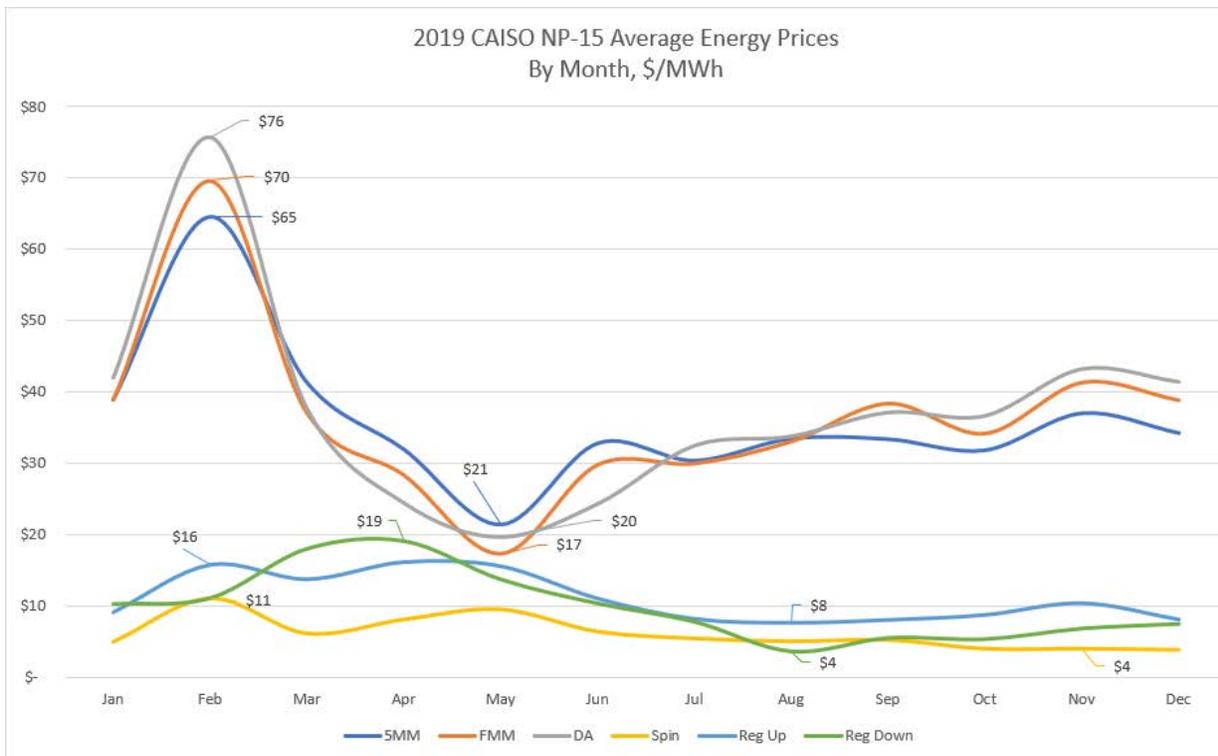


Figure 3: CAISO NP-15 2019 Average Electricity Prices by Month

Hydro generation has many advantages over traditional fossil fuel generation and intermittent renewable generation – the two technologies that shape wholesale market prices today. These advantages are presented in Table 4 below.

Criteria	Existing Hydro	Intermittent Renewables	Natural Gas
Capacity Factor	✓	X	✓+
Effective Load Carrying Capability (ELCC)	✓	X	✓+
Ability to Offer Ancillary Services	✓	X	✓
Dispatchable	✓	X	✓
Project Viability & Financing	✓	X	✓
Renewable	✓ ⁵	✓	X
Zero-GHG	✓	✓	X

Table 4: Hydro Advantages vs. Competing Generation Technologies

For these reasons, hydro is a good renewable and zero-GHG electricity supply partner to California’s municipal utilities and its growing population of CCA’s. In 2019, NID Hydro was successful in re-contracting the Combie South Powerhouse, entering into a PPA for power sales from Deer Creek, and entering a partnership agreement with NCPA for Scheduling Coordinator and control center services for the Combie South and Deer Creek Powerhouses.

The evolution of electricity markets is important to monitor for another reason. In the mid-2010s, Northern California experienced an exceptional and prolonged drought, followed by two near-record precipitation years. It is evident that NID Hydro will not always be able to rely on snowpack for power generation. Historically, drought conditions had minimal financial impact on NID Hydro because of the structure of its power contracts. Those power contracts incentivize and compensate NID’s generators based on mechanical availability. However, as the current power contracts begin to expire and NID Hydro re-contracts its power under market-driven and quantity-based structures (i.e., per MWh basis), drought conditions could pose a significant financial risk to NID Hydro.

Internal Risk Control System – The Continuous Process

Risk management is a mixture of art and science. NID Hydro is making a concerted effort to implement a variety of policy and procedure-level controls throughout the department. This is evident with the ICP and ROCC activities performed by NID Hydro personnel, enhanced CIP policies and controls, as well as this annual risk assessment process. NID Hydro’s proactive efforts to implement cyber security policies and controls over its new SCADA system is also evidence of a maturing internal control environment.

Recommendation and Conclusion

To mitigate the impact and minimize the likelihood of the inherent risks facing the NID Hydroelectric Department, the Department should continue to mature its risk management program. Based on the risks

⁵ Assuming RPS-eligible small hydro less than 30 MWs.

identified in the risk assessment tabletop exercise and summarized in this Risk Assessment report, a summary of the recommendations for risk mitigation are shown in Table 5.

To mitigate the impact and minimize the likelihood of the inherent risks facing NID Hydro, the organization should continue with its efforts to improve the maturity of its risk management program. Disciplined and strategic organizations take proactive steps to identify and manage risk. For example, strategic organizations often begin with the single-contingency risks that have potentially devastating impacts on the organization and develop control measures to mitigate those risks. Fundamental to this is a documented management system that enables the organization to identify, control, and monitor its risk elements. To do so effectively requires a systematic approach to catalog risks and the associated internal controls that actively manage those risks. Ideally, these internal controls reside at all levels of the organization. They are deployed not only as control activities by front line managers and personnel, but also as management control measures to monitor, communicate, and assess risks throughout the organization. The culmination of these risk management practices results in an organization with a strong control environment originating with a strong “tone at the top.”

Category	Ongoing Risk Reduction Measures	Key Recent Activities and Updates
People and Training	<ul style="list-style-type: none"> ▪ Support and promote external training opportunities for staff ▪ Internally develop and/or externally locate an alternative hydro operations training program, including more on-the-job training ▪ Continue research and development of a hydro maintenance training program, including more on-the-job training ▪ Support the formal compensation review and recommended wage and benefit adjustments ▪ Coordinate asset management program needs with organizational structure and staffing needs. ▪ Continued focus on succession planning in all areas of NID Hydro 	<ul style="list-style-type: none"> ▪ Most focus on external training has been centered on dam safety. Four operations staff were formally trained in dam inspection by the Association of Dam Safety Officials in 2019. ▪ A market compensation was performed in the first quarter of 2019, which will be considered during Union MOU negotiations in 2020.
Regulatory Environment	<ul style="list-style-type: none"> ▪ Filled the Hydro Compliance Administrator position in 2019 ▪ Continue growing staff competencies and bench strength around regulatory compliance. Areas include reliability, NERC/FERC, dam safety, and environmental compliance ▪ Revise and update the CFR between NID and PG&E to appropriately allocate changing responsibilities 	<ul style="list-style-type: none"> ▪ The Board of Directors approved a temporary engineer position for Dam Safety support as a temporary solution to staffing needs ▪ Replaced the low-level outlet valve at Rollins Dam ▪ Implemented updated and expanded policies and plans for CIP-003 v7/8 and EOP-004 v4 ▪ Updated PRC-005 Protection System Maintenance Program

Category	Ongoing Risk Reduction Measures	Key Recent Activities and Updates
	<ul style="list-style-type: none"> ▪ Scope, plan, and budget the FERC implementation compliance requirements. ▪ Continue diligent execution of NID’s PRC-005 Protection System Maintenance Program. 	<p>documentation, including the Master Equipment List.</p>
Operating Environment	<ul style="list-style-type: none"> ▪ Initiate identification of NID’s non-dam infrastructure at-risk of extreme weather and/or seismic activity damage and incorporate mitigations and/or repairs into maintenance plan ▪ Continue vegetation management efforts around NID facilities ▪ Evaluate adequacy of current resources dedicated to management of Hydro’s current and future IT and SCADA system ▪ Develop operational model to include regulatory and customer system requirements with operational strategy to support potential future energy market pricing opportunities and flexible dispatch contract requirements 	<ul style="list-style-type: none"> ▪ Engaged a safety training consultant with considerable focus on hydroelectric operations ▪ Multiple contracts for vegetation management were issued and completed in 2019. Additional contracts are planned for 2020. ▪ Implemented vegetation control adjacent to Infrastructure, where permitted, and continued navigating Federal permit processes for future vegetation control projects
Infrastructure and Technology	<ul style="list-style-type: none"> ▪ Capital Investment Program (CIP) – Continue to implement, evaluate and revise the CIP process to improve efficiency and effectiveness of major project execution ▪ Enhance asset management program risk assessment procedures to support project prioritization, planning, and budgeting. ▪ Incorporate methods of physical and cyber security hardening ▪ Implement plans identified in the communication infrastructure study to provide improved, efficient, and effective control and operations ▪ Continue efforts to improve and maintain a healthy inventory of spare parts ▪ Continue effort to identify PG&E Drum Spaulding system risk assessment and engage in efforts to improve infrastructure and supply reliability for NID. 	<ul style="list-style-type: none"> ▪ Implemented the Capital Improvement Plan process. ▪ SCADA upgrade for Chicago Park, Dutch Flat #2, and Rollins completed in 2018; Deer Creek and Scotts Flat completed in 2019. ▪ Building needs study complete. Property for new Hydroelectric Department Field Office purchased. Facility design underway. ▪ Updates to Chicago Park and Bowman Powerhouses’ drawings are complete. Combie South Powerhouse in progress. ▪ New CMMS software has been purchased and is in the development phase ▪ Installed a fire suppression system in the Chicago Park Powerhouse ▪ Revised, updated, and/or validated electrical system documentation (e.g. as-built drawings) and implement electrical document change policy

Category	Ongoing Risk Reduction Measures	Key Recent Activities and Updates
Electricity Market Landscape	<ul style="list-style-type: none"> ▪ Continue corrosion control monitoring of penstocks ▪ Continue to monitor and actively participate in PG&E bankruptcy proceedings. ▪ Research and develop power market optimization options for NID’s small plants to transition to upon current contracts’ expiration ▪ Evaluate potential new technologies and/or strategies that allow more efficient operations in an evolving market and maximize hydropower’s positive impact to NID and the community ▪ Coordinate energy marketing strategies with NID sustainability policy efforts. 	<ul style="list-style-type: none"> ▪ Strategy for power sales developed. Request for Information sent to potential buyers. Results received in 2019 and one new contract awarded with Northern California Power Agency (NCPA) ▪ Capital improvement projects to add metering and telemetry completed. ▪ Alternative technologies such as battery storage, solar, pumped storage, net zero energy, and others under investigation and in coordination with sustainability policy.

Table 5: Summary of Risk Mitigations by Category

In accordance with the Nevada Irrigation District Internal Compliance Program, this 2019 Risk Assessment Report was commissioned by the Nevada Irrigation District Reliability Oversight Compliance Committee (ROCC), and its results shall be presented to the Nevada Irrigation District General Manager and Board of Directors.

Greg Jones, ROCC Managing Director of Compliance

Date