

Final

**HISTORIC PROPERTIES MANAGEMENT PLAN COMPLIANCE REPORT
PIT 1 GATEHOUSES OVERHAUL PROJECTS
SHASTA COUNTY**

FERC PROJECT No. 2687



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1. Introduction

In 2014 PG&E contracted with JRP Historical Consulting, LLC (JRP) to prepare a Finding of Effect (FOE) to assist PG&E and the lead federal agency, the Federal Energy Regulatory Commission (FERC) in fulfilling their responsibilities as required by the National Historic Preservation Act (NHPA) of 1966 (as amended) (16 U.S.C., Section 470 (f) and its implementing regulations (36 CFR Part 800), for the Pit 1 River Gatehouses Overhaul Projects (projects). Pit 1 River Gatehouse 1-2-3, and Pit 1 River Gatehouse 9-10-11 are contributors to the Pit 1 Hydroelectric Project Historic District and are subject to an Historic Properties Management Plan (HPMP) that requires work on contributors to the historic district to be performed according to the *Secretary of the Interior's Standards for Rehabilitation of Historic Properties* (SOI Standards).¹ The FOE concluded that the projects would have no adverse to historic properties because design and construction would adhere to SOI Standards, and the State Historic Preservation Officer (SHPO) concurred.² During that consultation effort (FERC_2015_0710_001), PG&E agreed to take measures to ensure that SOI Standards were met during design and construction. These measures consisted of providing cultural resources awareness training of the SOI Standards to workers on the project, having a qualified architectural historian photographically document progress of the project, and provide to the SHPO a final Section 106 compliance report that documents the rehabilitation project pre-construction, during construction, and post-construction. This report fulfills the final reporting requirement by documenting the progress of the project and demonstrating how it complied with SOI Standards.

Pit 1 River Gatehouse 1, 2, 3, and Gatehouse 9, 10, 11 are located on the Fall River in Shasta County, approximately one-mile northwest of the town of Fall River Mills. Pit 1 River Gatehouse 1-2-3, and the Pit 1 River Gatehouse 9-10-11 are components of the Pit 1 Hydroelectric Project that work to divert Fall River water into a tunnel through which it is delivered into the Pit River watershed above the Pit 1 Forebay and Penstocks (**Figure 1**). Pit 1 River Gatehouse 1-2-3, and Pit 1 River Gatehouse 9-10-11 are concrete buildings that PG&E completed in 1922. Architecturally they were designed with elements that mimic the style of the Gothic-revival style edifice, Pit 1 Powerhouse that is still in service today (**Figure 2**). Over time, Pit 1 River Gatehouse 1-2-3, and Pit 1 River Gatehouse 9-10-11 suffered severe degradation, particularly spalling and lost concrete.

¹ Duncan Hay and Michael R. Corbett, *Historic Resources Assessment Report for the Pit 1 Hydroelectric Project, Shasta County, California*, revised draft. Prepared for the Pacific Gas & Electric Company by Dames & Moore, 1992; PG&E, *Pit 1 Hydroelectric Project FERC Project No. 2687 Historic Properties Management Plan*, 2007.

² Julianne Polanco, State Historic Preservation Officer to James S. Nelson, PG&E re FERC_2015-0710-001, August 19, 2015; Julianne Polanco, State Historic Preservation Officer to James S. Nelson, PG&E re FERC_2015_0710_001, July 23, 2015.

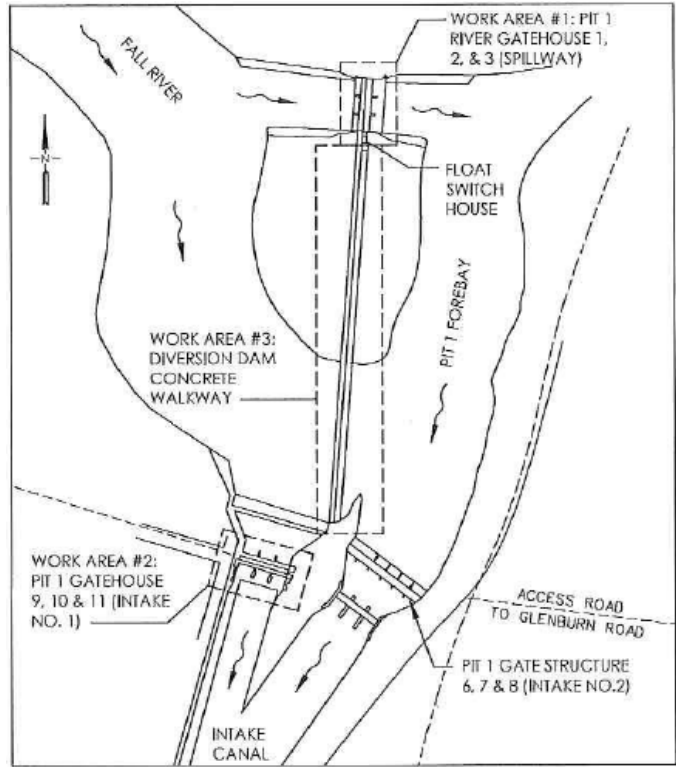


Figure 1: Pit 1 Gatehouses and Dam Overhaul Project components.



Figure 2: Pit 1 Powerhouse. Other components of the Pit 1 Hydroelectric System are architecturally unified around this highly stylized Gothic Revival edifice.

In preparation of this compliance report, JRP documented pre-construction conditions of Gatehouse 1-2-3 and Gatehouse 9-10-11 in April 2014, and performed two site visits to each gatehouse during construction and a final site visit to each gatehouse when construction was completed. JRP also provided guidance to PG&E and its engineers and contractor during construction about ways to ensure that the project met SOI Standards. James Nelson, Senior Cultural Resource Specialist in PG&E's Chico office, was a strong project advocate who consulted with the SHPO about ways to eliminate adverse effects, and provided critical education about Section 106 compliance to the PG&E team. PG&E Project Manager, Jason Gibson, embraced working toward meeting SOI Standards, and sought input from the cultural resources team throughout the project.

Glenn Evans of AST, Inc. was the contractor for the project. AST, Inc. has expertise and experience working on historic concrete buildings and structures including Hat Creek Powerhouse 1, another NRHP-eligible PG&E powerhouse. Vincent Wu of Baseline Designs, Inc. served as project engineer and collaborated extensively with PG&E and AST, Inc. to meet the structural and functional needs of the project in a manner that adhered to SOI Standards. PG&E's dedication to complying with the SOI Standards resulted in a project that not only met the Standards for Rehabilitation, but exceeded them and accomplished a restoration that will preserve these two important contributors to the Pit 1 Hydroelectric Historic District for many years to come.

2. Pre-construction Conditions

2.1. Intake 1 / Gatehouse 9-10-11

PG&E constructed Intake 1 / Gatehouse 9-10-11 in 1922, and modified it in 1946-47 when they added another separate set of gates to the Fall River diversion. As originally built, Gatehouse 9-10-11 also served as a local road bridge (**Figures 3 and 4**), but the 1946-47 modification required altering the south end of the structure which terminated the bridge (**Figure 5**).



Figure 3: Pit 1 Gatehouse 9-10-11 under construction, circa 1922. Fort Crook Museum Photograph Archive, Fall River Mills.



Figure 4: Pit 1 Gatehouse 9-10-11 (distant in center of photograph) before 1941 when it also served as a road bridge. PG&E Photographs Archives, Photograph 4005.



Figure 5: Gatehouse 9-10-11, April 2014, prior to restoration. Structure ceased serving as a bridge in 1946-47 when south end (left) was modified.

Pit 1 Gatehouse 9-10-11 consists of three radial gates and a concrete hoist house that formerly also served as the road bridge. In 2014 the concrete structure was heavily deteriorated on all sides of the hoist house (**Figures 6 and 7**). In some locations, spalling had obliterated the horizontal impressions left on the concrete by board forms used when the structure was constructed. The northeast corner of the hoist house had extensive concrete deterioration around and above an open arched doorway leading to a walkway spanning the structure (**Figure 8**). Spalling was also extensive on the south side of the structure, particularly across the side walls of the bridge deck and the exterior edges of the four structural walls that frame the radial gates (**Figures 9 – 11**). The decorative front-gable pinnacles that cap each of the structural walls at even intervals along the side walls of the bridge deck were heavily deteriorated, showing substantial deterioration on the south side. Stone bridge approaches on the west side once had gable roof details atop end posts but they had almost entirely deteriorated (**Figure 12**). Many of the glass panes in the multiple-light metal sash windows of the hoist house were broken. Previous patching attempts using inappropriate materials compounded the deteriorated condition of the gatehouses by adding another layer of degraded, peeling material to the exterior surfaces of the buildings.



Figure 6: Pit 1 Gatehouse 9-10-11, April 2014. Note concrete spalling on exterior façade.



Figure 7: North side, Pit 1 Gatehouse 9-10-11, April 2014.



Figure 8: Detail view of concrete spalling on northeast corner of Pit 1 Gatehouse 9-10-11, April 2014.



Figure 9: Pit 1 Gatehouse 9-10-11, April 2014. Note concrete spalling along exterior of former bridge deck.



Figure 10: Pit 1 Gatehouse 9-10-11, April 2014.



Figure 11: Pit 1 Gatehouse 9-10-11, April 2014. Note extensive degradation and peeling along interior retaining walls of former road deck.



Figure 12: Remaining bridge approaches on west side of Pit 1 Gatehouse 9-10-11, April 2014. Note deteriorated ornamental end caps on stone approaches.

2.2. Gatehouse 1-2-3

By April 2014 Pit 1 Gatehouse 1-2-3 had suffered severe deterioration since it was originally constructed in 1922. The gatehouse displayed areas of significant concrete spalling, particularly on ornamental pinnacles with small front gables that rise above the roofline atop concrete buttresses. Three of the pinnacles on the west side and the one on the southeast corner were so heavily deteriorated that they barely retained their original form. Concrete was heavily spalled at and beneath the sills on the west side. Many of the window panes were broken and / or replaced with opaque plexi-glass panes and the building had been subject to graffiti vandalism. Furthermore, large metal sheets had been affixed to the west side of the gatehouse, covering all three window bays, and a wooden shed roof – painted bright blue – had been added to the top of the small adjacent float house (**Figures 13 – 15**).



Figure 13: Pit 1 Gatehouse 1-2-3, April 2014. Note covered window bays, broken window panes, and heavily deteriorated window sills and ornamental pinnacles.



Figure 14: Pit 1 Gatehouse 1-2-3 at right and Float House at left, April 2014. Note roof addition on Float House and replaced window panes on gatehouse.



Figure 15: Pit 1 Gatehouse 1-2-3, April 2014. Note significant spalling of ornamental concrete pinnacles at roofline, and at and below sills, covered windows and deteriorating tin roof.

2.3. Significant Features of Gatehouse 1-2-3 and Gatehouse 9-10-11

Character-defining features of an historic property are those features that “enable it to convey its historic identity.”³ Prior to project completion, Pit 1 Gatehouse 1-2-3 and Pit 1 Gatehouse 9-10-11 had suffered extensive deterioration of character-defining features, and were in danger of losing substantial historic integrity of design and materials. The following **Table 1** lists the character-defining features of each gatehouse.

Gatehouse 1, 2, 3	Gatehouse 9-10-11
Footprint & dimensions	Footprint & dimensions of hoist house
Reinforced concrete construction	Structural walls
Board-formed concrete finish	Arched openings on north side at walkway
Multiple-light metal sash windows	Reinforced concrete construction
Glass window panes	Board-formed concrete finish
Concrete buttresses	Multi-light metal sash windows
Front gable pinnacles	Glass window panes
Concrete piers	Door on east side
Gable standing-seam tin roof	Ornamental front-gable pinnacles
	Road deck
	Road deck approach (west side)
	Concrete piers
	Radial gates
	Pipe railings

Table 1: Character-defining features of Pit 1 Gatehouse 1-2-3 and 9-10-11

³ US Department of the Interior, National Park Service, “National Register Bulletin: How to Apply the National Register Criteria for Evaluation,” (NPS, 1997), 46.

3. Secretary of the Interior's Standards

The *Secretary of the Interior's Standards for the Treatment of Historic Properties* (SOI Standards) provides guidance on the preservation and protection for cultural resources listed in or eligible for listing in the National Register of Historic Places. Four types of treatments, Preservation, Rehabilitation, Restoration, and Reconstruction, comprise the SOI Standards. Rehabilitation is the treatment required by the HPMP for the Pit 1 Hydroelectric Plant Historic District. Rehabilitation is defined as “the act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its historical, cultural, or architectural values.”⁴ The SOI Standards for Rehabilitation (*Standards for Rehabilitation*) are:

1. A property will be used as it was historically or be given a new use that requires minimal change to its distinctive materials, features, spaces, and spatial relationships.
2. The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces, and spatial relationships that characterize a property will be avoided.
3. Each property will be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.
4. Changes to a property that have acquired historic significance in their own right will be retained and preserved.
5. Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a property will be preserved.
6. Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture, and, where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.
7. Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.

⁴ Kay D. Weeks and Anne E. Grimmer, *Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings* (National Park Service, Heritage Preservation Services: Washington D.C., 1995) 61.

8. Archeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.
9. New additions, exterior alterations, or related new construction will not destroy historic materials, features, and spatial relationships that characterize the property. The new work shall be differentiated from the old and will be compatible with the historic materials, features, size, scale and proportion, and massing to protect the integrity of the property and its environment.
10. New additions and adjacent or related new construction will be undertaken in such a manner that, if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

4. Design & Construction Challenges

This section is organized around discussion of the elements of project design and construction that presented the greatest challenges for complying with SOI Standards. Each subsection discusses the specific challenge, how PG&E resolved the challenge, and includes photographs taken by JRP during site visits.

4.1. Concrete Removal & Restoration

One of the biggest components of the project was the removal of what amounted to 15,000 pounds of cementitious material from the deteriorated gatehouse buildings. The most deteriorated material was typically found to occur along a relatively inconsistent plane in the older vintage concrete structures. This was caused in part by poor mixing and placement techniques at the time of original construction, and partly caused by the almost assured occurrence of patching efforts that had been performed over time. Generally, carbonation and freeze/thaw conditions soften exposed surfaces in a process that occurs from the exterior exposure working inward. Time and continued environmental exposure tend to intensify and accelerate this scenario as pH values of the material degrade seasonally which, in-turn reduce the structures' ability to withstand the continued environmental offense.⁵

The contractor describes the degraded concrete removal process as “dental removal,” meaning the process of determining the point where non-viable materials end and sound materials begin. After performing small test penetrations at places where the material was suspected of being severely degraded, the removal process began. Removal of degraded materials occurred in stages, with the gentlest first, as required by SOI Standards. The stages for the dental removal were:

- “Hand scraping and scaling.” Hand scrapers first, then small mechanical needle scalers were utilized to remove coatings and dissolved in-place concrete sections. This is a very low impact activity that has no negative impact to any viable, vintage materials.
- “Low pressure abrasion” (35-45 psi). Abrasive blasting, utilizing a very sharp furnace slag abrasive was tested among 4 others and ultimately selected to remove dissolved concrete where small needle scalers could not reliably reach the substrate. The low pressure (low velocity) of the sharp aggregate allowed extreme control and detail application of the technique.
- “Strake Cutting.” Where structural columns and girders were severely degraded along a deeper plane, strake cuts were made with a small, hand held diamond saw. The strake

⁵ Description of pre-construction conditions contributed to by Glenn Evans, AST, Inc., contractor for the project.

cuts are longitudinal cuts that are made from the surface, extending through the very poor material and extend into the structure only deep enough to encounter viable material. This technique creates a weakened and well defined plane of removal. A small hand held tool is then able to peel away the poor material and expose viable substrate with no negative impact to the parent structure.⁶

JRP observed both gatehouses during their respective phases of dental removal of degraded material. In places where the concrete was substantially degraded, architectural detail was lost during the process of concrete removal (**Figure 16**). Great care was taken to restore the original architectural details and appearance of board forms in the concrete. **Figures 17** and **18** show the upper level of Gatehouse 9-10-11 after the deteriorated concrete was removed, and once the architectural details had been reconstructed. **Figures 19** and **20** show the heavily deteriorated arched opening at Gatehouse 9-10-11 after dental removal of deteriorated concrete and after reconstruction. One of the pinnacles at the roofline of Gatehouse 1-2-3 was intact enough to be used as a mold to fabricate new pinnacles to replace those lost to deterioration (**Figures 21 – 22**). Hand-crafted wood forms were used extensively throughout the project to reconstruct original architectural details (**Figure 23**).

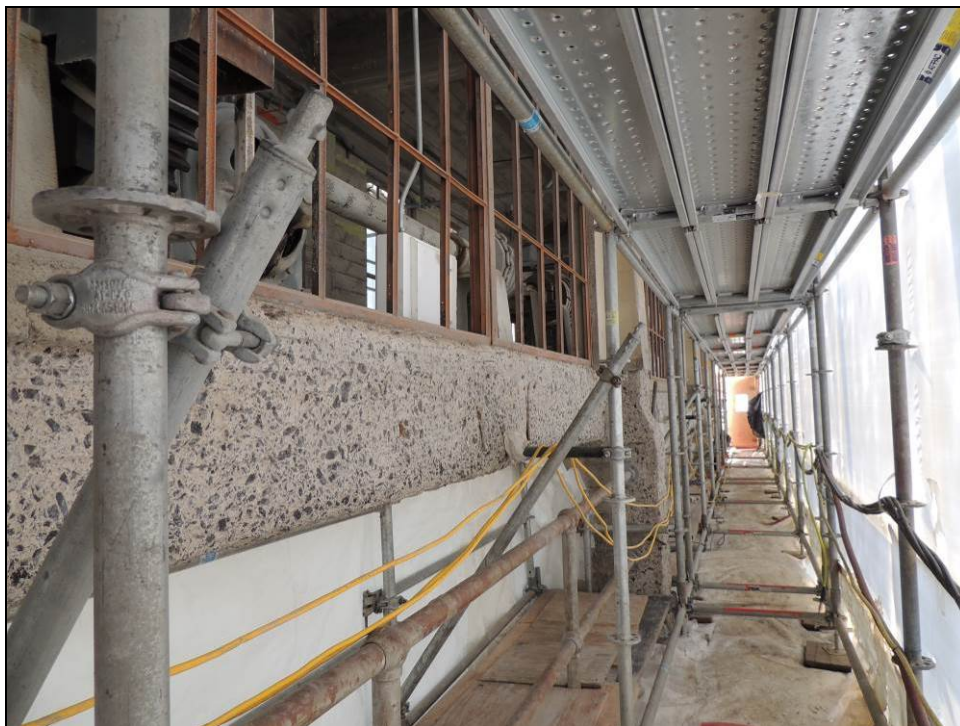


Figure 16: Deteriorated concrete removed from upstream side Gatehouse 1-2-3; glazing removed from steel sash windows, November 18, 2015.

⁶ Description of process provided by Glenn Evans, AST, Inc., contractor for the project.



Figure 17: Section of upper level of Gatehouse 9-10-11 that has been subject to dental removal of degraded concrete, May 19, 2016.



Figure 18: Section of upper level of Gatehouse 9-10-11 nearing completion of reconstruction (see **Figure 16**), May 19, 2016.



Figure 19: Heavily degraded column on east end of upstream side of Gatehouse 9-10-11 after dental removal of deteriorated concrete, May 19, 2016.



Figure 20: Reconstructed column (see **Figure 18**) on east end of upstream side of Gatehouse 9-10-11, August 16, 2016.



Figure 21: Ornamental pinnacle at Gatehouse 1-2-3 after deteriorated concrete removed at left; intact pinnacle at Gatehouse 1-2-3 used for mold at right.



Figure 22: Wood form used to reconstruct ornamental pinnacles and railing details at Gatehouse 9-10-11, May 18, 2016.

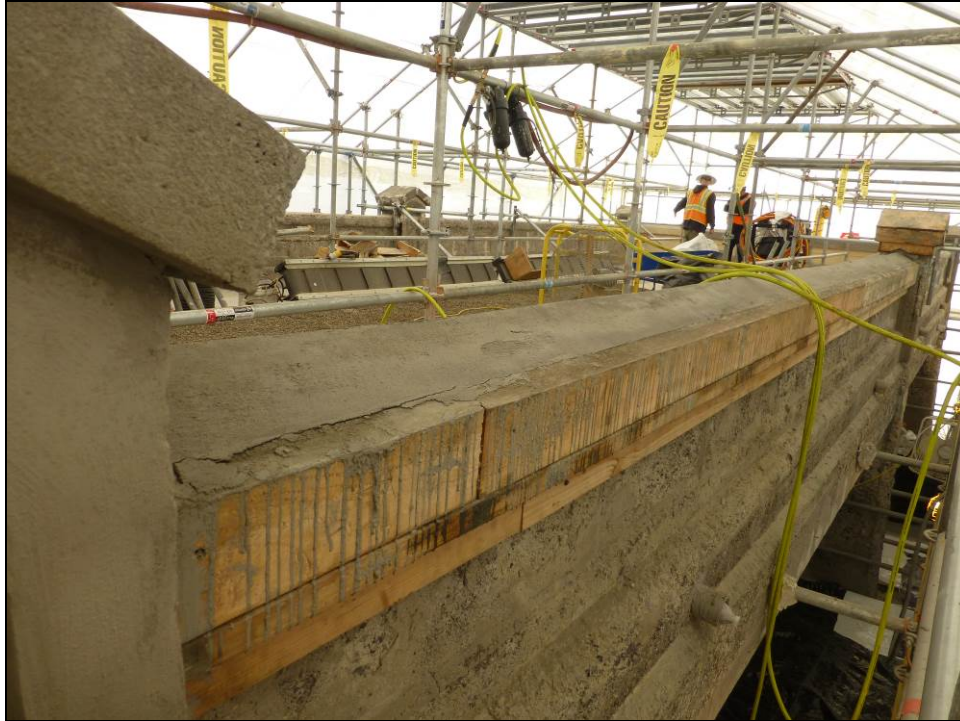


Figure 23: Additional wood forms used to reconstruct architectural detail on railings, May 18, 2016.

During dental removal of deteriorated concrete, both gatehouses lost some of the board form impressions left on the building from original construction, which are character-defining features of these concrete buildings. The contractor had performed trial sections to select the best method to restore this detail. The chosen method created indentations that were textured and painted which succeeded in creating the desired effect of restoring the visual appearance of horizontal features in the exterior surface (**Figure 24**). **Figures 25** and **26** show an area of Gatehouse 1-2-3 that had lost some of its board form impressions during previous patching efforts and after project completion. By taking the time to carefully execute this approach, PG&E's efforts exceeded the SOI Standards for Rehabilitation, and adhered more closely to the more stringent Standards for Restoration.



Figure 24: Trial area where AST has applied indentations to restore the horizontal appearance of board-form impressions in the concrete, January 27, 2016.



Figure 25: North side Gatehouse 1-2-3, April 2014. Note loss of texture already present on lower half of the exterior wall.



Figure 26: Gatehouse 1-2-3, site visit May 18, 2016 following completion of restoration effort. Note reconstructed board form impressions and ornamental pinnacle.

4.2. Structural Reinforcement

Gatehouse 1-2-3 required structural reinforcing across the building from east to west. Alternatives for structural reinforcement considered were: sinking the hardware on the exterior of the building below the wall plane, and then filling to preserve the smooth exterior surface; using large bars that would need exterior hardware visible on the exterior and placed within the ornamental pinnacles; and installing brackets to the interior of the building. The alternative that was selected affixed the necessary hardware entirely to the inside of the building, and did not introduce any visual intrusion to the exterior, nor did it reduce the integrity of any of the character-defining features of the building (**Figure 27**). This solution met the structural needs of the building, and complied with SOI Standards.



Figure 27: Reinforcing bars installed at interior of Gatehouse 1-2-3 do not penetrate the building to the exterior, January 27, 2016.

4.3. Windows

During the design phase of the project, PG&E considered installing plexi-glass windows in the original steel window sashes, an action that does not comply with the SOI Standards. Through consultation with JRP and the Office of Historic Preservation (OHP), PG&E selected laminated glass with a black film applied to the inside of the lowest two rows of windows on the west side of Gatehouse 1-2-3 to obscure the equipment that operates the gates from public view (**Figures 28 and 29**). Vandals using rocks or guns had broken most of the window panes leading PG&E to cover the entire window panels with sheets of metal (see **Figure 13**). Use of laminated glass window panes provides adequate security to allow the windows to be uncovered once again thereby restoring the historic appearance of the building. The result meets SOI Standards by using a material that is similar in appearance to the original glass windows. When viewing Gatehouse 1-2-3 from close range, the black film mounted on the inside of the windows does not prevent the laminated glass from reflecting light in a manner that allows the material to still read like glass to an observer. The steel sashes were painted green which is consistent with the steel sash windows at Pit 1 Powerhouse (**Figures 30 and 31**).



Figure 28: Pit 1 Gatehouse 1-2-3, May 19, 2016. Note that laminated glass windows provide security while allowing visibility through building. Also note reflection of light off rows with black film at far right.



Figure 29: Interior of Gatehouse 1-2-3 showing equipment that black film applied to window panes hides from public view on the upstream side, May 18, 2016.



Figure 30: Gatehouse 9-10-11, final site visit, August 16, 2016. Note laminated glass window glazing allows view through building in keeping with the original design.



Figure 31: East side Gatehouse 1-2-3. Note green window sashes. Green is consistent with the color of the window sashes at Pit 1 Powerhouse, the powerhouse these gatehouses serve.

4.4. Doors

The contractor stripped the two original wood doors at Gatehouse 9-10-11 (**Figures 32** and **33**) and refinished them with a clear coat (**Figures 34** and **35**). The work was carried out in accordance with the SOI Standards and conducted in a manner that is very sensitive to the historic architecture of the building.



Figure 32: Original door on east side of Gatehouse 9-10-11, stripped, May 19, 2016.



Figure 33: Original door on west side of Gatehouse 9-10-11, stripped, May 19, 2016.



Figure 34: Original door on east side of Gatehouse 9-10-11, stripped and coated with a clear coat, August 16, 2016.



Figure 35: Original door on west side of Gatehouse 9-10-11, stripped and coated with a clear coat, August 16, 2016.

4.5. Roof – Gatehouse 1-2-3

The original standing-seam metal roof on Gatehouse 1-2-3 was a high-copper content tin roof that required coating to seal toxic components. The standing-seam tin roof was retained and coated with an Amerlock 400 AL primer and Amershield VOC topcoat in an appropriate metallic color. The raised seams are an important character-defining feature of this structure, and coating the existing roof allowed for preservation of that feature (**Figure 36**).



Figure 36: Detail of a coated raised-seam tin roof, Gatehouse 1-2-3, January 27, 2016.

4.6. Stone Guide Walls, Gatehouse 9-10-11

Prior to project construction the stone guide walls that served as bridge approaches when Gatehouse 9-10-11 was originally constructed were in a heavy state of deterioration and had lost some of their original architectural features (see **Figure 12**). PG&E had knowledge of the source of the local stone quarry and procured the same type of stone used during original construction for reconstruction of the walls (**Figures 37** and **38**). These stone approaches are critical character-defining features of this building because they help convey the gatehouse's historic function as a road bridge. The effort to locate the local stone and reconstruct this architectural feature also exceeded the requirements of the SOI Standards for Rehabilitation and more closely conforms with the Standards for Restoration.



Figure 37: Reconstructed stone approach on west end of Gatehouse 9-10-11, August 16, 2016.



Figure 38: Reconstructed stone approach on west end of Gatehouse 9-10-11, August 16, 2016.

5. Complete Projects

The projects have been carried out in a manner that has been very conscientious about the historic fabric and character of the buildings, and in conformance with the agreement with SHPO to adhere to the SOI Standards. The projects exceeded the SOI Standards for Rehabilitation in many ways and the outcome is a restoration of two buildings that are important contributors to the Pit 1 Hydroelectric Historic District. The results are beautiful to behold, and will serve as a point of pride for PG&E for many years to come (**Figures 39 – 49**).



Figure 39: Gatehouse 1-2-3, May 18, 2016.



Figure 40: Gatehouse 1-2-3, May 18, 2016.



Figure 41: Gatehouse 1-2-3, May 18, 2016.



Figure 42: Gatehouse 9-10-11, August 16, 2016.



Figure 43: Gatehouse 9-10-11, August 16, 2016.



Figure 44: Detail of reconstructed architectural detail at northeast corner of Gatehouse 9-10-11, August 16, 2016.



Figure 45: Former Bridge Deck. Note reconstructed stone guide walls at Gatehouse 9-10-11, August 16, 2016.



Figure 46: Gatehouse 1-2-3 as seen from Glenburn Road, August 16, 2016.



Figure 47: Gatehouse 9-10-11 as seen from Glenburn Road, August 16, 2016.



Figure 48: View of Gatehouse 1-2-3 from the roof / former road deck of Gatehouse 9-10-11. Camera facing north, August 16, 2016.



Figure 49: View of canal and Pit 1 Tunnel Intake from the roof / former road deck of Gatehouse 9-10-11. Camera facing south, August 16, 2016.

6. Preparers' Qualifications

Stephen Wee and Heather Norby of JRP Historical Consulting, LLC, consulted closely with Glenn Evans of AST, Inc. throughout the course of this building rehabilitation/restoration program. JRP also performed several site visits at critical stages of the project, and prepared this project monitoring report.

Mr. Wee, a principal and president of JRP with 40 years of experience conducting architectural history studies, holds an M.A. in History from the University of California, Davis. He specializes in water resources history of the American West.

Ms. Norby holds an M.A. in History from the University of California, Berkeley. She has been an architectural historian with JRP since 2008 conducting historic survey studies, and preparing other cultural resources compliance documentation.