



TECHNICAL MEMORANDUM 7-13

Fish Stranding Associated with Shutdowns of Narrows 2 Powerhouse Partial Bypass

**Yuba River Development Project
FERC Project No. 2246**

February 2014

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TECHNICAL MEMORANDUM 7-13

EXECUTIVE SUMMARY

In 2013, Yuba County Water Agency (YCWA) conducted an assessment of the relationship between shutdowns¹ of the Narrows 2 Powerhouse Partial Bypass (Partial Bypass) and fish stranding. Assessments occurred in proximity to the Narrows 2 Powerhouse, which is located approximately 400 feet downstream of the United States Army Corps of Engineers' Englebright Dam on the Yuba River. While the study examined stranding of all fish species, it focused on Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*), Central Valley steelhead (*O. mykiss*), and Central Valley fall-run Chinook salmon (*O. tshawytscha*). The relationship between shutdowns of the Partial Bypass and fish stranding was assessed by conducting fish stranding surveys to document the occurrence and condition of any fish found stranded after shutdowns of the Partial Bypass, visual observation events (or visual observations) of fish from the Narrows 2 Powerhouse deck before and after shutdowns of the Partial Bypass,² summarizing historical and current operations of the Partial Bypass, and summarizing incidental observations.³

The Partial Bypass consists of a pipe off the Narrows 2 Powerhouse turbine spiral casing, which discharges⁴ water into the Yuba River through a 36-inch valve located on the downstream face of the powerhouse above the draft tube outlet. The Partial Bypass does not have a gage to directly measure flow through the bypass. YCWA can estimate 15-minute flow through the Partial Bypass using: 1) data from an acoustic velocity meter (AVM) attached to the Narrows 2 Penstock upstream from a bifurcation in the penstock; 2) operator logs of when the Partial Bypass is opened and closed; and 3) records of Narrows 2 Powerhouse generation. Typically, YCWA does not operate the Partial Bypass when the Narrows 2 Powerhouse turbine is in normal operation, so if the Narrows 2 Powerhouse is not generating and the Narrows 2 Full Bypass (Full Bypass) is not open, flow as measured at the AVM equals the flow through the Partial Bypass.

From October 1, 2006 (the Narrows 2 Full Bypass went into operation in January 2007) to December 15, 2013, the Partial Bypass was used 23 times, ranging from less than 1 day up to 37 days of continual use. The Partial Bypass was used most often in January, February, and September. Discharge from the Partial Bypass was normally less than 230 cfs, but was as high as 612 cfs. YCWA's estimates of 15-minute flows through the Partial Bypass, as well as flows

¹ For the purpose of the technical memorandum, a "shutdown" refers to a facility going from some level of operations to no operations. Shutdowns may be "planned" (i.e., scheduled with some advanced planning) or "forced" or "unplanned" (i.e., results from an emergency, such as equipment failure).

² For the purpose of the technical memorandum, a "visual observation event" (also referred to as a visual observation) refers to YCWA's survey by one or more persons of the Yuba River surface in the vicinity of the Narrows 2 Powerhouse taken from the Narrows 2 Powerhouse deck at least 20 minutes prior to performing a fish stranding survey and at least 20 minutes after performing a fish stranding survey. No equipment is needed to perform a visual observation. Visual observation events are required by Study 7.13.

³ For the purpose of the technical memorandum, an "incidental observation" refers to a note by a person, normally during performance of a study. The observation is not the result of a survey, and taken only in passing. While Study 7.13 provided YCWA would report all incidental observations, the Study did not require YCWA to make any incidental observations.

⁴ For the purpose of this technical memorandum, "discharge" means the estimated flow through a facility of flow at a designated location in terms of cubic ft per second (cfs). A discharge may be measured or estimated, and may also be referred to as a "release."

through other associated facilities, from October 1, 2006 through December 15, 2013 are attached to this technical memorandum.

The existing FERC license, and other permits and licenses, do not include any restrictions, including ramping, regarding how YCWA operates the Partial Bypass, as long as instream flow and flow fluctuation requirements of the FERC license are met at the United States Geological Survey (USGS) streamflow gage at Smartsville Gage, which is located approximately 300 feet (ft) downstream of Pacific Gas and Electric Company's (PG&E) Narrows 1 Powerhouse, and the USGS streamflow gage at Marysville Gage, located downstream of the United States Army Corps of Engineers' Daguerre Point Dam.

Over the course of the study period, operational changes that led to shutdowns of the Partial Bypass occurred twice, once on September 8, 2013 and again on October 7, 2013. Both involved transfers of flows from the Partial Bypass to the Full Bypass. During both events, the Narrows 1 Powerhouse operated at approximately 680 cfs. The operational conditions at the Partial Bypass varied from about 30 cfs during Event 1, to just over 200 cfs during Event 2. Fish stranding surveys were conducted immediately after operation of the Partial Bypass ceased. Surveys were conducted along the right bank as oriented downstream. No fish carcasses or stranded live fish were observed during the field surveys following operational changes.

During the September 8, 2013 event, visual observations events from the powerhouse deck resulted in a total of 111 observations, of which 99 were of Chinook salmon and 12 were of fish that could not be identified. All of the fish observations occurred after the Partial Bypass was shut down. Observations of fish occurred as close as 15 ft and as far as 170 ft from the Narrows 2 Powerhouse, however, the majority of observations were made of fish circling between 50 and 150 ft downstream of the powerhouse. Observations during the October 7, 2013 event resulted in a total of 30 observations consisting of observations of 20 Chinook salmon and 10 fish that could not be identified. All but one of the observations occurred after an operational event.⁵ The majority of fish observations occurred within 50 ft of the Narrows 2 Powerhouse, as fish swam into or out of the Full Bypass Pool, however, observations were made as far as 250 ft downstream of the Narrows 2 Powerhouse.

Four incidental observations were recorded. The incidental observations were made during data collection activities for YCWA's Study 7.11. Two occurred prior to initiation of Study 7.13 and included an observation by YCWA operators on October 23, 2012 of a fish carcass on the bank near the pool at the base of the Full Bypass and an observation by Relicensing Participants on October 25, 2012 of a fish carcass on the bank near the Partial Bypass. The other two incidental observations occurred in 2013. The first observation included an observation of a fish carcass near Narrows 2 Powerhouse on October 7, 2013. The second observation involved multiple fish in an isolated pool in the channel near Narrows 2 Powerhouse on October 13, 2013.

⁵ For the purpose of the technical memorandum, an "operational event," is a change in flow of more than 400 cfs, as defined in Study 7.11, *Fish Behavior and Hydraulics Near Narrows 2 Powerhouse and Radio Telemetry Study of Spring- and Fall-Run Chinook Migratory Behavior Downstream of Narrows 2 Powerhouse*. An operational event includes shutdowns, and like shutdowns, an operational event may be "planned" (i.e., scheduled with some advanced planning) or "forced" or "unplanned" (i.e., results from an emergency, such as equipment failure).

The study was performed in conformance to the FERC-approved Study 7.13, *Fish Stranding Surveys Near Narrows 2 Powerhouse Partial Bypass* with one exception. Relicensing Participants agreed that the results would be better presented as a stand-alone technical memorandum. This technical memorandum is the product of that consensus.

The study is complete.

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FISH STRANDING ASSOCIATED WITH SHUTDOWNS OF NARROWS 2 POWERHOUSE PARTIAL BYPASS⁶

Yuba County Water Agency's (Licensee or YCWA) continued operation and maintenance (O&M) of the Yuba River Development Project (Project) has the potential to affect resident and anadromous salmonid fish species in the Yuba River near the Project's Narrows 2 Powerhouse by stranding fish. The powerhouse is located approximately 400 feet (ft) downstream of the United States Army Corps of Engineers' (USACE) Englebright Dam.⁷

Although this study examines stranding of all fish species, it focuses on Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*), Central Valley steelhead (*O. mykiss*), and Central Valley fall-run Chinook salmon (*O. tshawytscha*). Spring-run Chinook salmon and steelhead are listed as threatened species under the federal Endangered Species Act (ESA). Fall-run Chinook salmon is listed as a federal species of concern by the United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS).

1.0 Goals and Objectives

In its March 29, 2013, *Determination on Requests for Modifications to the Yuba River Hydroelectric Project Study Plan*, the Federal Energy Regulatory Commission (FERC or Commission) stated:

YCWA should develop and implement a stranding survey study. YCWA should conduct this study immediately after operations of the partial-bypass cease. To ensure the stranding survey is consistent with generally accepted practices in the scientific community (study criterion 6), YCWA should develop a protocol after consultation with the NMFS, FWS, and California Fish and Wildlife, and include provisions for documenting location of stranded fish, condition of carcass (e.g., gravid, spent, signs of hemorrhage, rigor-mortis, decomposition, or wounds likely inflicted by predators), and include methods for documenting and handling any live

⁶ This technical memorandum presents the results for Study 7.13, *Fish Stranding Associated with Shutdown of Narrows 2 Powerhouse Partial Bypass*, which was included in FERC's March 29, 2013 Study Plan Determination and approved in FERC's June 17, 2013 Study Plan Determination for relicensing of the Yuba River Development Project. There were no modifications to Study 7.13 subsequent to FERC's June 17, 2013 Study Plan Determination.

⁷ Englebright Dam was constructed by the California Debris Commission in 1941 and is about 260 feet high. It is owned, operated and maintained by the United States Army Corps of Engineers and the dam, reservoir and associated recreation facilities are not included as Project facilities in FERC licenses for the Yuba River Development Project. When the California Debris Commission was decommissioned in 1986, administration of Englebright Dam and Reservoir passed to the USACE. The primary purpose of the dam is to trap and contain sediment derived from extensive historic hydraulic mining operations in the Yuba River watershed. Englebright Reservoir is about 9 miles long with a surface area of 815 acres. When the dam was first constructed in 1941, it had a gross storage capacity of 70,000 acre-feet; however, due to sediment capture, the gross storage capacity today is approximately 50,000 ac-ft (USGS 2003).

fish that may be discovered. The stranding survey study and associated survey protocols should be filed with the Commission for approval by May 15, 2013.

Results of the stranding surveys should be included in study report for Study 7.11. Additionally, if results of the stranding survey indicated that operation of the Partial Bypass may be affecting salmonids, YCWA should include a summary of the historical operation of the partial-bypass, including frequency of use, seasonal use data, and typical duration of use.

Costs associated with the implementation of stranding surveys following the operation of the partial-bypass would be marginal and essentially associated with report preparation because a person who could conduct the stranding surveys would already be on-site during operational changes (study criterion 7).

Therefore, the goal of the study was to gain a better understanding of the relationship between shutdowns⁸ of the Narrows 2 Powerhouse Partial Bypass (Partial Bypass) and fish stranding. The objective is to document the occurrence and condition of any fish stranded after shutdowns of the bypass.

2.0 Background

2.1 Narrows 1 and Narrows 2 Facilities

YCWA and Pacific Gas and Electric Company (PG&E) coordinate releases from YCWA's Yuba River Development Project facilities downstream of Englebright Dam and PG&E's Narrows Project⁹ (Narrows 1 Powerhouse) in accordance with the streamflow requirements in Article 33 in the existing license for the Yuba River Development Project. Compliance with Article 33 is measured at the United States Geological Survey (USGS) Streamflow Gage 11418000, *Yuba River Below Englebright Dam, Near Smartsville* (Smartsville Gage), which is located approximately 300 ft downstream of the Narrows 1 Powerhouse; and at USGS' Streamflow Gage 11421000, *Yuba River near Marysville*, which is located downstream of Daguerre Point Dam. Figure 2.1-1 shows facilities near Englebright Dam.

⁸ For the purpose of the technical memorandum, a "shutdown" refers to a facility going from some level of operations to no operations. Shutdowns may be "planned" (i.e., scheduled with some advanced planning) or "forced" or "unplanned" (i.e., results from an emergency, such as equipment failure).

⁹ The 13.5 MW Narrows 1 Powerhouse, part of the Narrows Project (FERC Project No. 1403), is owned and operated by PG&E. The powerhouse is a one-unit facility commissioned on December 29, 1942. The project withdraws water from Englebright Reservoir, and has a maximum flow capacity of 730 cfs. The FERC license for this project expires in January 2023.

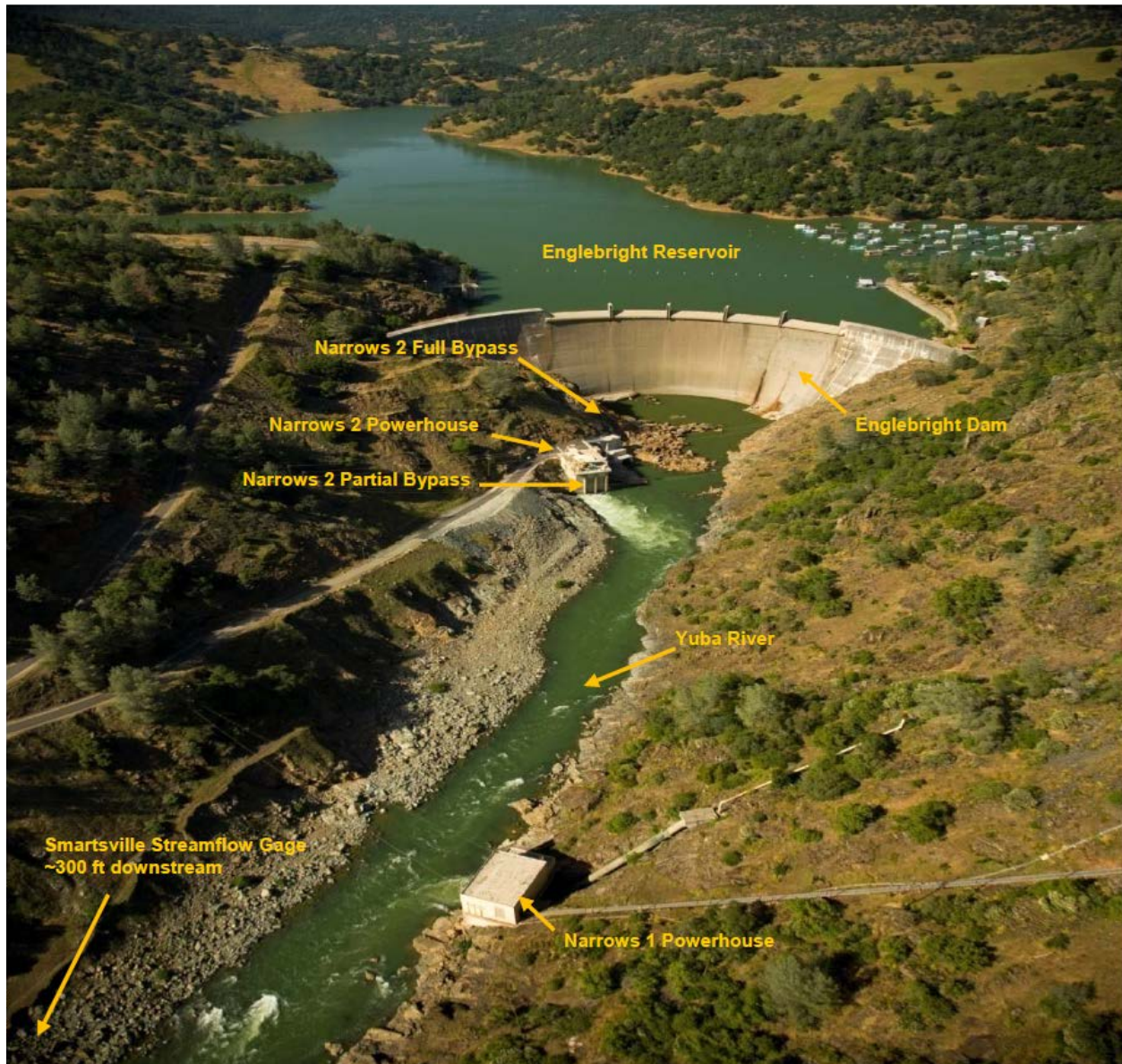


Figure 2.1-1. Locations of Narrows 2 Powerhouse, Narrows 2 Partial Bypass, Narrows 2 Full Bypass and Narrows 1 Powerhouse on the Yuba River in relation to Englebright Dam, and measurement of flows through the facilities.

The Narrows 2 Powerhouse is an indoor powerhouse consisting of one vertical axis Francis turbine (Figure 2.1-2) with a capacity of 55 megawatts at a head of 236 ft and flow capacity of 3,400 cubic ft per second (cfs). The powerhouse receives water from Englebright Reservoir via the Narrows 2 Powerhouse penstock, which has a maximum flow capacity of 3,400 cfs. The powerhouse includes two facilities for bypassing flow around the turbine; the first is the Narrows 2 Full Flow Bypass (Full Bypass), and the second is the Partial Bypass.

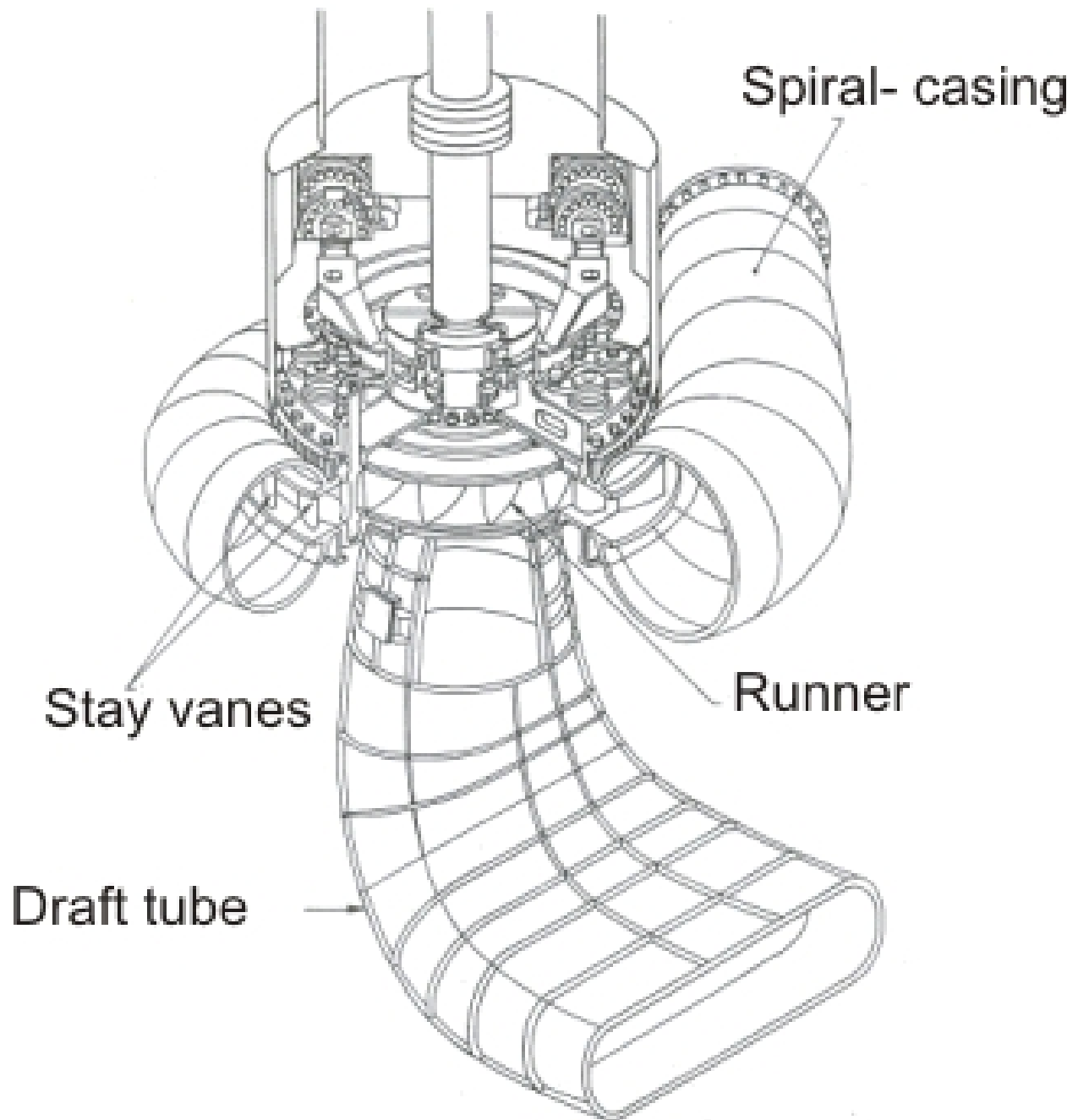


Figure 2.1-2. Schematic of a typical Francis turbine showing the spiral-casing, runner, and draft tube. The penstock connects to the spiral-casing.

Flow to the Narrows 2 Powerhouse, Full Bypass and Partial Bypass is provided from a single penstock (the Narrows 2 Penstock) that bifurcates above spiral case. One of the bifurcated branches conveys water to the Narrows 2 Powerhouse and Partial Bypass through the spiral case,

and the other branch conveys water to the Full Bypass. The Partial Bypass¹⁰ is a pipe off the Narrows 2 Powerhouse turbine spiral casing, which can discharge¹¹ up to 650 cfs at full head into the Yuba River through a 36-inch (in) valve located on the downstream face of the powerhouse above the draft tube outlet (Figure 2.1-3). The Full Bypass¹² is a 72-in fixed-cone valve and penstock branch off the Narrows 2 Penstock, which can discharge up to 3,000 cfs of water at full head into the Yuba River immediately upstream of the Narrows 2 Powerhouse. The Narrows 1 Powerhouse is capable of discharging up to 730 cfs. Water that passes through the draft tube enters the river subsurface.



Figure 2.1-3. Operation of the Partial Bypass at Narrows 2 Powerhouse.

YCWA records flow at 15-minute intervals through the Narrows 2 Penstock using an acoustic velocity meter (AVM) attached to the penstock upstream from the bifurcation, and retains flow data in its HYDSTRA database. Flow in the penstock downstream of the bifurcation is not directly measured. Rather, YCWA estimates flow through the Narrows 2 Powerhouse, Partial Bypass and Full Bypass based on: 1) recorded flow at the AVM; 2) operator logs of when the Full and Partial bypasses are opened and closed; and 3) records on Narrows 2 Powerhouse generation. Narrows 1 Powerhouse flow data are available from PG&E (YCWA does not measure flow through the Narrows 1 Powerhouse). In addition, YCWA obtains Smartville flow data from PG&E.

¹⁰ The Partial Bypass was built as part of the original design when the Narrows 2 Powerhouse was constructed.

¹¹ For the purpose of this technical memorandum, “discharge” means the estimated flow through a facility of flow at a designated location in terms of cubic ft per second (cfs). A discharge may be measured or estimated, and may also be referred to as a “release.”

¹² The Full Bypass was installed in 2006 and began operation in January 2007.

2.1.1 Flow Transition Among Facilities

Operations of the Partial Bypass, as well as the Full Bypass and Narrows 2 Powerhouse, are not constrained by the FERC license, other than the conditions in Article 33, as the compliance of which is measured at the Smartsville and Marysville gages, or any other permit or license - only by the capabilities of the facilities and their safe operations. This section describes typical flow transitions among the facilities.¹³

Emergency condition responses and planned release changes are coordinated between the turbine flows and bypass flows of the two facilities. Transitions between Narrows 2 Powerhouse and Narrows 1 Powerhouse are normally a change-over (i.e., transition)¹⁴ operation and not an emergency. The transition between Narrows 2 Powerhouse and the Full Bypass can be performed in response to an emergency when a forced outage occurs, a normal operation as part of shutdown of the powerhouse, or as preparation for transitioning to the Narrows 1 Powerhouse. The following is a description of standard operational practices for emergency conditions and changeovers; that is not to say that the facilities have not or cannot be operated differently on occasion, only that normal operations are generally as described below.

2.1.1.1 Transition Between Narrows 2 Powerhouse and Narrows 1 Powerhouse

If the Narrows 2 Powerhouse is operating, the Narrows 1 Powerhouse is not operating, and releases below the dam are to be reduced so that PG&E can begin to generate electricity at the Narrows 1 Powerhouse, then PG&E first synchronizes the Narrows 1 Powerhouse unit to the electric grid, while reducing draft from Narrows 2 Powerhouse to compensate for increased releases from the Narrows 1 Powerhouse. As the Narrows 1 Powerhouse load is increased, releases from the Narrows 2 Powerhouse are decreased and the Full Bypass is opened to the flow rate, if any, that is needed to supplement the Narrows 1 Powerhouse release. If the required supplement is less than approximately 230 cfs, then the Partial Bypass is used instead of the Full Bypass. To reach the full flow of Narrows 1 Powerhouse, YCWA estimates that this transition can take between 10 and 30 minutes.

If the Narrows 1 Powerhouse is operating, the Narrows 2 Powerhouse is not operating, and releases below the dam are to be increased, then the transition of releases from the Narrows 1 Powerhouse to the Narrows 2 Powerhouse occurs in reverse of the process described in the preceding paragraph. Beginning with full flow of Narrows 1 Powerhouse, YCWA estimates that this transition can take between 10 and 30 minutes.

2.1.1.2 Transition Between Narrows 2 Powerhouse and Narrows 2 Full Bypass

If the Narrows 2 Powerhouse is operating and a Narrows 2 Powerhouse shutdown occurs because of a forced outage (i.e., unit trip), then the Narrows 2 Powerhouse turbine wicket gates

¹³ With regards to operations of Narrows 1 Powerhouse, this description is generic. For a detailed discussion of Narrows 1 Powerhouse operations, the reader is requested to contact PG&E.

¹⁴ For the purpose of this technical memorandum, a “change-over” or “transition” refers to decreasing or increasing the discharge from one facility in coordination with decreasing or increasing flows in another facility. A change-over may include a shutdown of one facility.

are closed automatically and there is an automatic opening of the Full Bypass. The opening is started after a 3-minute safety delay during which time a horn is sounded at the exterior of the Full Bypass to warn persons in the area of an imminent release through the Full Bypass. This operation is automated and does not require any manual actions. Once a Narrows 2 Powerhouse outage is cleared, the Narrows 2 Powerhouse unit is synchronized to the electrical grid, then the Full Bypass is closed in increments synchronized with increased load and resulting releases through the powerhouse. YCWA estimates the time from when an outage occurs to the time the Full Bypass is fully opened to the desired level typically is about 5 minutes (i.e., 2 minutes after the warning horn stops). In some cases, such as a momentary transmission line outage, the operators are able to fully restore flow through Narrows 2 Powerhouse before the automatic system begins flow through the Full Bypass.

If the Narrows 2 Powerhouse is operating and a planned powerhouse shutdown occurs, the transition of releases from the Narrows 2 Powerhouse to the Full Bypass occurs as described above for a forced outage, except that the transition is done manually and takes longer (i.e., 10 to 15 minutes).

Typical Operations

Discharge can occur from the Narrows 1 and Narrows 2 powerhouses based on: water demand; market conditions; capacity and condition of the turbines, generators and bypasses; transmission line conditions; and a desire to minimize Englebright Reservoir elevations and Yuba River flow fluctuations for the protection of fisheries and other reasons. Table 2.1-1 provides a summary of the typical historical flow ranges through the Narrows 2 Powerhouse, the Partial Bypass, the Full Bypass and the Narrows 1 Powerhouse.¹⁵ There are a great many combinations of potential conditions that could require different operating conditions than those indicated in Table 2.1-1, but a complete description of all of them would be confusing and difficult to explain. YCWA needs to retain flexibility of operations, based on experience and familiarity with the equipment, safety, and protection of environmental resources.

¹⁵ Because of the higher efficiency of the Narrows 1 Powerhouse at lower flows and the fact that releases through the Narrows 1 Powerhouse result in energy generation that qualifies for California Renewable Portfolio Standard (RPS) credit and revenue and PG&E is required to meet a certain percentage of its total generation through RPS, PG&E prefers at certain times and under certain energy market conditions to run Narrows 1 Powerhouse and to bypass flows at the Narrows 2 Powerhouse. PG&E receives all power generated by both powerhouses and PG&E's payments to YCWA under the existing PG&E/YCWA power purchase contract are not affected by the relative amounts of power generated by the two powerhouses. Therefore, YCWA has agreed with PG&E's decisions regarding the coordinated operation of the two powerhouses, and probably will continue to do so through April 30, 2016. These coordinated operations may change after April 30, 2016, when the term of YCWA's existing power purchase contract with PG&E ends. The extent of any change is unknown at this time.

Table 2.1-1 Current typical distribution of flow under normal operations (i.e., excluding brief change-over periods) among Narrows 1 Powerhouse, Narrows 2 Powerhouse (generation only), Narrows 2 Partial Bypass and Narrows 2 Full Bypass. Normally, for Narrows 2 Powerhouse, Partial Bypass and Full Bypass, only one operates at a time, excluding brief change-over periods.

Range of Flow Releases to Yuba River (cfs)	Narrows 1 Powerhouse Release (generation and bypass) (cfs)	Narrows 2 Powerhouse Release (generation) ² (cfs)	Narrows 2 Partial Bypass ² (cfs)	Narrows 2 Full Bypass ² (cfs)
Up to 730	150 - 730	0	≤230	>230 cfs Used to Supplement Narrows 1 Powerhouse Flow to Meet Minimum Flows Requirements in Article 33
730 - 900	150 - 730	0	≤230	>230 cfs Used to Supplement Narrows 1 Powerhouse Flow to Meet Minimum Flows Requirements in Article 33
900 - 1,630 ¹	Up to 730	700 – 1,630	Typically not used	Used When Narrows 2 Powerhouse not available
1,630 - 3,400 ¹	Up to 730	700 - 3,400	Typically not used	Used When Narrows 2 Powerhouse not available
3,400 - 4,130	Up to 730	2,670 – 3,400	Typically not used	0
> 4,130	Up to 730	3,400	Typically not used	0

¹ The use of the Narrows 1 Powerhouse in this range is dependent on a number of economic and generator factors and can vary from no flow to the maximum Narrows 1 Powerhouse generation capacity. In this range, Narrows 2 Powerhouse alone or Narrows 1 Powerhouse with Narrows 2 Powerhouse may operate.

² The typical operating flow ranges of Narrows 2 facilities are limited by long-term reliability considerations, such as vibration and cavitation of runners; and are as follows: the Narrows 2 Powerhouse between 700 and 3,400 cfs (with physical capacity to release as low as 600 cfs); the Partial Bypass between 0 and 230 cfs (with physical capacity to release as high as 650 cfs); and the Full Bypass between 150 and 3,000 cfs.

Since installation of the Full Bypass, the Partial Bypass typically has been used only for a few specific reasons, which include: 1) maintenance on the Full Bypass when generation is not possible; 2) obtaining safe foot access upstream of the Full Bypass when generation is not possible; and 3) supplemental flow releases less than or equal to 230 cfs as described in Table 2.1-1. Except for transitional periods, YCWA does not operate either the Full or Partial bypasses when Narrows 2 Powerhouse is operating (i.e., water is passing through the turbine and generating electricity) and, except in rare instances, does not operate both bypasses at the same time.

3.0 Methods

The study included six steps: 1) obtain necessary permits/approvals to perform the study; 2) perform fish stranding surveys; 3) perform visual observation¹⁶ events of fish behavior from Narrows 2 Powerhouse deck; 4) describe operations during fish stranding monitoring; 5) summarize historical Partial Bypass operations since construction of the Full Bypass; and 6) conduct data quality assurance/quality control.

¹⁶ For the purpose of the technical memorandum, a “visual observation event” (also referred to as a visual observation) refers to YCWA’s survey by one or more persons of the Yuba River surface in the vicinity of the Narrows 2 Powerhouse taken from the Narrows 2 Powerhouse deck or similar location at least 20 minutes prior to performing a fish stranding survey and at least 20 minutes after performing a fish stranding survey. No equipment was needed to perform a visual observation. Visual observation events were required by Study 7.13.

3.1 Study Area

The study area is the right (oriented downstream) bank of the Yuba River channel from the Narrows 2 Powerhouse downstream to a distance of approximately 250 ft (Figure 2.1-1).

3.2 Study Period

As the study focuses primarily on anadromous fishes, fieldwork occurred from June to December 2013. This is the period when anadromous fishes were likely to be in the vicinity of the Narrows 2 Powerhouse.

3.3 Permits

YCWA consulted with NMFS regarding the necessity of permits for handling fish during study 7.13 surveys. A 4(d) authorization was not possible due to the schedule of the study, and NMFS considered it unnecessary for the scope of the study.¹⁷ Therefore, YCWA did not obtain permits or handle stranded live fish. This meant that if YCWA observed a live, stranded fish, YCWA was not able to handle the fish to place it in the river. The FERC-approved study did not include any requirements for YCWA to notify NMFS or Cal Fish and Wildlife if a live, stranded fish was observed or otherwise to coordinate fish rescue, if needed.

3.4 Fish Stranding Surveys

Immediately after each operation of the Partial Bypass ceased¹⁸ (i.e., zero flow through the bypass began), YCWA conducted searches for stranded fish along the right bank (oriented downstream, or north bank) of the Yuba River from the Narrows 2 Powerhouse downstream for approximately 250 ft to the downstream margin of discharge from the Partial Bypass. The primary objective of this step was to visually determine the presence or absence of stranded fish in edgewater, backwater, perched habitats, and on exposed bars in the study area. The study did not require surveys prior to or during operations of the Partial Bypass or other Project facilities.

Field crews consisted of two persons experienced in fish identification. Surveyors began on the bank adjacent to the Partial Bypass and continued slowly downstream, searching the shoreline for stranded fish. Particular attention was given to the area of the bank previously wetted by flows from the Partial Bypass and in spaces between large boulders. Although snorkeling of deeper pools of perched water (>1-2 ft) removed from the flowing water was called for by the FERC-approved study, no pools of this type were found during the surveys, so snorkeling was not used.

If stranded fish were found, the FERC-approved study required that the following data be recorded for each stranded fish species:

¹⁷ NMFS agreed that permits were not necessary for this study.

¹⁸ The study did not require YCWA to operate the Partial Bypass for study purposes. The bypass was operated during the study period only under normal operations.

- The number of fish (i.e., counted if possible, but if more than 15 fish, estimated abundance).
- Size of fish (i.e., by measuring each individual fish if YCWA held the necessary permits to handle fish, or if more than 15 fish were found, estimating the number and size of fish in size bins of 0 to 49 millimeters (mm), 50 to 99 mm, 100 to 149 mm, 150 mm to 199 mm, and larger than 200 mm).
- If the fish was dead, condition of the carcass (i.e., gravid, spent, signs of hemorrhaging, rigormortis, state of decomposition, and wounds likely inflicted by predators). Deceased fish were marked (i.e., tail removed) and returned to the water to prevent them from being re-documented during future surveys.
- Location of stranding, including Global Positioning System (GPS) coordinates, distance from main channel and Narrows 2 Powerhouse, estimated vertical height above the water surface in the main channel, depth of water at stranding location, and dominant/subdominant substrate around the stranding location.
- Water temperature at the location of the stranded fish if it was found in water, or the temperature of the water in the main channel nearest to any stranded fish.
- Photographs of where stranding occurred to document the dimensions, general habitat features, and degree of isolation from the main channel. The degree of isolation and ability of fish to return to the main river were visually assessed based on fish size (i.e., body depth) and the depth, continuity, and direction of flow between the standing location and the main channel.

The following metrics were recorded for each survey:

- Average combined flow from Narrows 2 Powerhouse, Full Bypass, and Partial Bypass (and spill over Englebright Dam, if occurring) during the period of at least an hour prior to shut down of the Partial Bypass, and continues the hour after shutdown.
- The time the Partial Bypass ceased operating.
- The times the survey began and ended.
- Average combined flow being released through the Narrows 2 Powerhouse and Full Bypass (and spill over Englebright Dam, if occurring) during the fish stranding survey (i.e., Partial Bypass not operating)
- Weather conditions during the survey.

3.5 Visual Observations Events of Fish Behavior

As requested by NMFS, prior to and after performing each fish stranding survey, staff performing the surveys spent at least 20 minutes on the Narrows 2 Powerhouse deck visually observing the river surface near the powerhouse. No special equipment was required for the visual observations. If fish were observed, staff recorded the estimated size of the fish, its

location in relation to the powerhouse, and its behavior. Staff recorded the species of fish if they were certain of the identity.

3.6 Operations

YCWA compiled a list of each Partial Bypass shutdown during the study. Data included for each shutdown included 15-minute flow data combined for the Narrows 2 Powerhouse, Partial Bypass, and Full Bypass for the 24 hours prior to the shutdown and the first 24 hours after the Partial Bypass ceased operating. The 15-minute data were summarized and provided to relicensing participants.

3.7 Historical Operations of the Partial Bypass

YCWA included a summary of the historical operations of the Partial Bypass from October 1, 2006 to December 15, 2013. The Full Bypass began operations in January 2007. Specific information included a summary of the historical operations of the Partial Bypass, including frequency of use, seasonal use data, and typical duration of use.

3.8 Data QA/QC

All collected and entered data were reviewed for accuracy. Data sheets were reviewed at the end of each field day by the lead field scientist to ensure all required data cells were populated appropriately. Finalized datasheets were entered into Microsoft Excel or Access database and then reviewed for entry accuracy. Database quality assurance and quality control (QA/QC) consisted of a technician reading off the original datasheet information to a second technician affirming appropriate database entry. Only finalized data were analyzed and presented within this technical memorandum.

4.0 Results

The Partial Bypass ceased operations on two occasions in 2013, which triggered the Study 7.13 fish stranding surveys. No stranded fish were observed as a result of field surveys for Study 7.13. However, four incidental observations¹⁹ of note were made outside of Study 7.13 stranding survey events. The incidental observations were made during data collection activities for YCWA's Study 7.11, *Fish Behavior and Hydraulics Near Narrows 2 Powerhouse* (YCWA 2014). A detailed account of these events are presented in Section 4.6 of this technical memorandum.

¹⁹ For the purpose of the technical memorandum, an "incidental observation" refers to a note by a person, normally during performance of a study. The observation was not the result of a survey, and was taken only in passing. While Study 7.13 provided YCWA would report all incidental observations, the Study did not require YCWA to make any incidental observations.

4.1 Fish Stranding Surveys

The Narrows 2 Partial Bypass was turned off twice during the study period, triggering Study 7.13 surveys, once on September 8, 2013 and again on October 7, 2013. Both events were followed by transfers of flow to the Full Bypass.

September 8, 2013 – Event 1

On September 8, 2013, the Narrows 2 Powerhouse underwent an operational change from the Partial Bypass to the Full Bypass at 7:29 a.m., triggering a fish stranding survey. The weather was clear and water temperature was 12 degrees centigrade (°C). The average combined flow from the Narrows 2 Powerhouse, Full Bypass, and Partial Bypass was 44 cfs in the hour prior to shut down of the Partial Bypass and averaged 39 cfs for the hour after shutdown. Discharge from the Partial Bypass was 44 cfs prior to the change. The fish stranding survey was conducted from 7:45 a.m. until 8:00 a.m. The river right bank was surveyed from the Narrows 2 Powerhouse to 100 ft upstream of the Narrows 1 Powerhouse. No fish carcasses or live stranded fish were found.

October 7, 2013 – Event 2

On October 7, 2013 a fish stranding survey was triggered when a transfer of flow from the Partial Bypass to the Full Bypass was made at 2:01 p.m. The weather was clear and water temperature was 12°C. The average combined flow from the Narrows 2 Powerhouse, Full Bypass, and Partial Bypass was 212 cfs in the hour prior to shutdown of the Partial Bypass and averaged 227 cfs for the hour after shutdown. Discharge from the Partial Bypass was 212 cfs prior to the change. The fish stranding survey was conducted from 2:06 until 2:16 p.m. The river right bank was surveyed from the Narrows 2 Powerhouse to 100 feet upstream of the Narrows 1 Powerhouse. No fish carcasses or live stranded fish were found.

4.2 Visual Observation Events of Fish Behavior

Visual observations of Chinook salmon and unidentified species were made from the powerhouse deck before and after each Partial Bypass shutdown event.

Surveys for study 7.13 did not include surveying the pool at the base of Englebright Dam. However, snorkel surveys for study 7.11, in 2012, did not document any Chinook salmon in this pool. Habitat surveys for study 7.11 reported that a minimum discharge of 1,570 cfs from the Narrows 2 Powerhouse is necessary to create surface connectivity to this pool, and more flow would be needed to provide access for fish. A brief discharge of 1,868 cfs from the Full Bypass raised pool levels to elevations over 293 ft, completely inundating the boulder separating the two pools. A detailed presentation of this information is available in Technical Memorandum 7.11/7.11a.

September 8, 2013 – Event 1

Field staff arrived onsite and immediately began surface observations at 6:40 a.m. Observations continued until 9:40 a.m. Water clarity decreased dramatically during the operational change to the Full Bypass, but was rated as “good” prior to and following the operational event. All of the fish observations occurred after the Partial Bypass was shut down. A total of 111 observations were made of which 99 were of Chinook salmon and 12 were of fish that could not be identified. Length estimation was difficult because fish were swimming in a large group past observers, who prioritized accurate enumeration of the group over length estimates. However, five of the observations were grouped into three size bins with fish represented in each size class (Table 4.2-1). For the 106 observations not grouped into size bins, all were of fish estimated to be at least 40 centimeters (cm) long.

Table 4.2-1. Summary of combined surface observations during the visual observation events on September 9 and October 1, 2013.

Fish Species	Length (cm)				Total
	<40	40-70	>70	Unknown	
Chinook Salmon	0	1	2	96	99
Unknown	2	0	0	10	12
Total	2	1	2	106	111

A total of 96 fish was observed swimming in the pool directly downstream of the Narrows 2 Powerhouse (Figure 4.2-1). Schooling was the primary behavior exhibited by this group. Other behaviors observed included splashing (11 fish) and jumping (4 fish). Observations of fish occurred as close as 15 ft and as far as 170 ft from the Narrows 2 Powerhouse deck; however, the majority of observations were of fish circling between 50 and 150 ft downstream of the powerhouse.

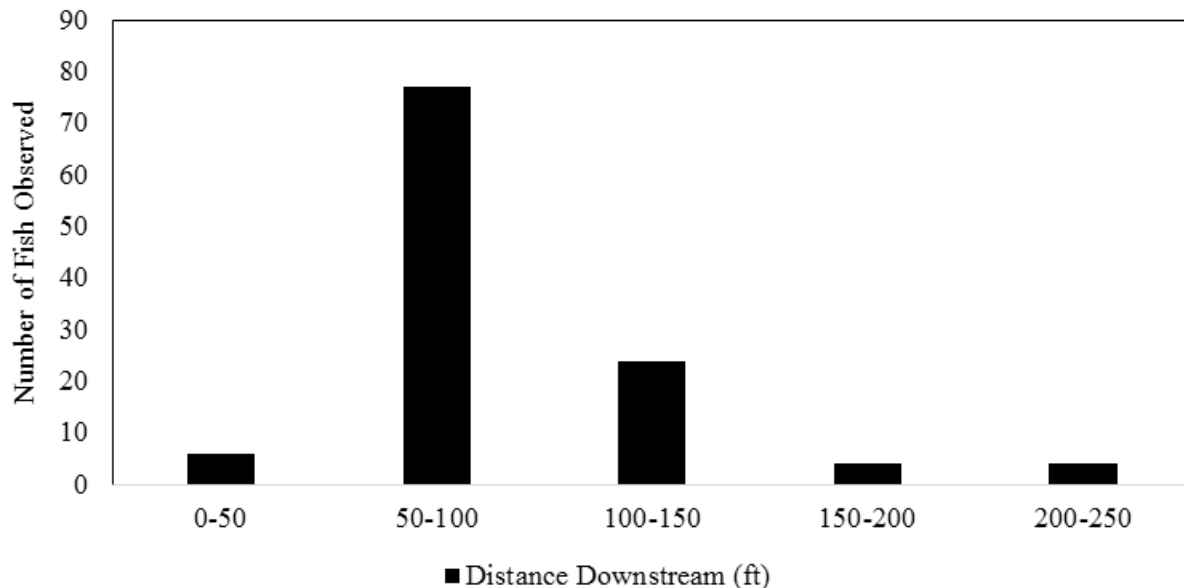


Figure 4.2-1. Number of fish observed by distance downstream from the Narrows 2 Powerhouse deck on September 8, 2013.

October 7, 2013 – Event 2

On October 7, 2013, surface observations began at 12:25 p.m. and continued until 4:00 p.m. Water clarity decreased dramatically during the changeover to the Full Bypass, but was rated as “good” prior to and following the operational event. All but one of the observations occurred after the operational event. Overall, a total of 30 observations were made, of which 20 were of Chinook salmon and 10 were of fish not identified to be any species. Of the 30 observations, length estimates were possible for 16 fish. Fish were grouped into 3 length bins with the majority of fish (n=7) estimated between 40 and 70 cm in length (Table 4.2-2).

Table 4.2-2. Summary of surface observations during the visual observation event on October 7, 2013.

Fish Species	Length (cm)				Total
	<40	40-70	>70	Unknown	
Chinook Salmon	0	7	4	9	20
Unknown	5	0	0	5	10
Total	5	7	4	14	30

A total of 13 fish was observed swimming upstream into the thalweg between the Full Bypass outlet pool and the main channel; one was observed swimming downstream out of the same pool and two were observed swimming in the current. Two other fish were observed swimming in the main channel approximately 250 ft downstream of the Narrows 2 Powerhouse. Other behaviors observed included splashing (11 fish). The location of fish observations was generally within 50 ft of the Narrows 2 Powerhouse, as fish swam into or out of the pool below the Full Bypass (Figure 4.2-2).

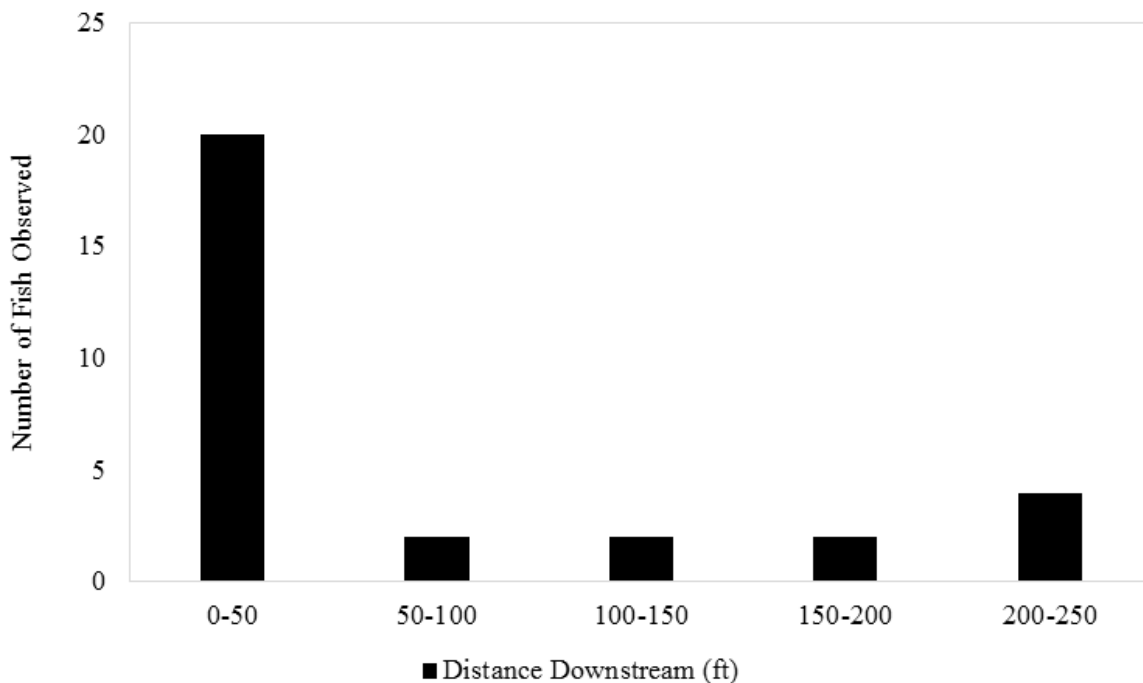


Figure 4.2-2. Number of fish observed by distance downstream from the Narrows 2 Powerhouse deck on October 7, 2013.

4.3 Operations

Transfers of flow from the Partial Bypass to the Full Bypass were the only type of operational change made in relation to the two Partial Bypass shutoff events during the study. Narrows 1 Powerhouse operated at approximately 680 cfs for the full 48 hour period including each study event. A summary of each operational change is provided below.

September 8, 2013 – Event 1

Prior to the operational change, the Partial Bypass operated at approximately 40 cfs during the 4 hour period before the operational change to the Full Bypass (Figure 4.3-1). Full Bypass flow decreased to about 31 cfs over the 4 hours following the shutdown. From 24 hours before to 24 hours after the operational change, the Narrows 1 Powerhouse remained at a near-constant discharge of 685 cfs. The Smartsville Gage remained stable around 760 cfs during this time.

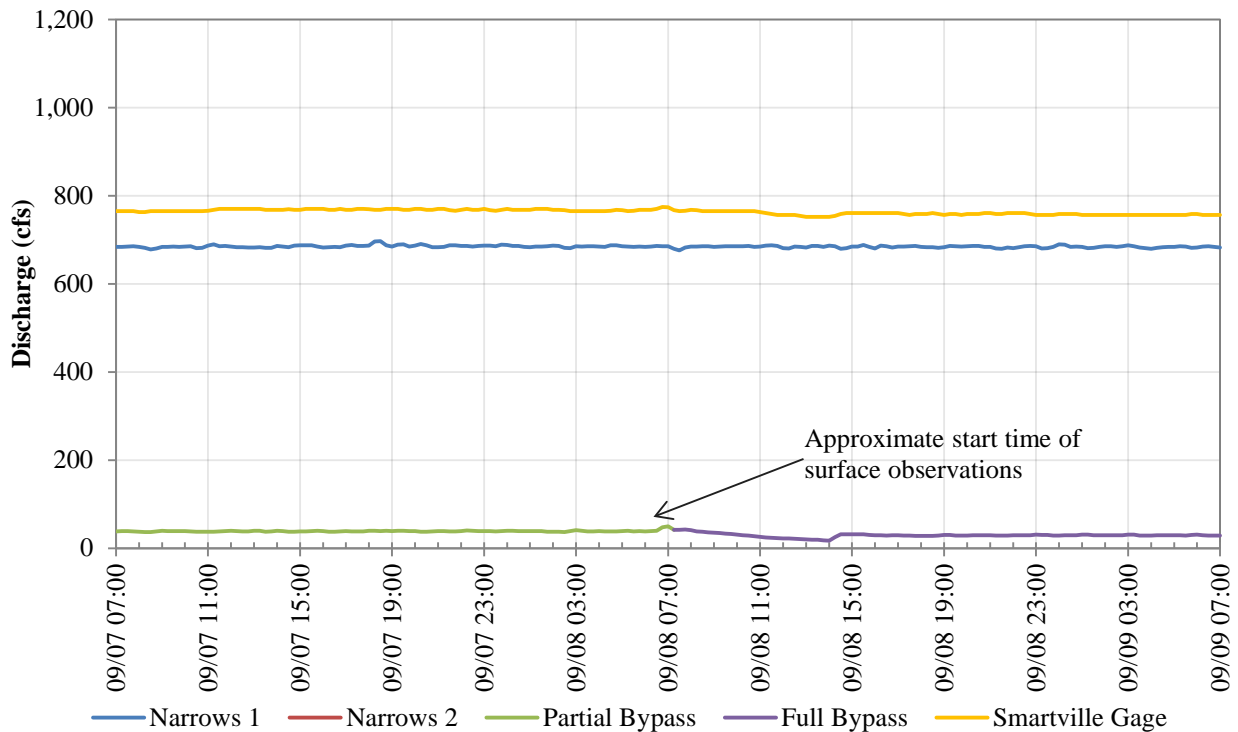


Figure 4.3-1. Fifteen-minute discharge data at the Partial Bypass, Full Bypass, Narrows 1 Powerhouse, and Smartsville Gage from 7:00 AM September 6, 2013 to 7:00 AM September 8, 2013. The Narrows 2 Powerhouse did not operate during this period, and spills over Englebright Dam did not occur.²⁰

²⁰ In this figure, Narrows 1 Powerhouse and Smartsville gage data are from PG&E, and the Partial and Full bypass data are based on flow data in the penstock AVM and YCWA operators' log books.

October 7, 2013 – Event 2

The Partial Bypass operated at approximately 205 cfs during the 4 hours preceding the operational change over to the Full Bypass (Figure 4.3-2), which continued to operate at 231 cfs for the following 4 hours. From 24 hours before to 24 hours after the operational change, the Narrows 1 Powerhouse remained at a near-constant discharge of 675 cfs. The Smartsville Gage increased about 30 cfs after the operational change to about 940 cfs.

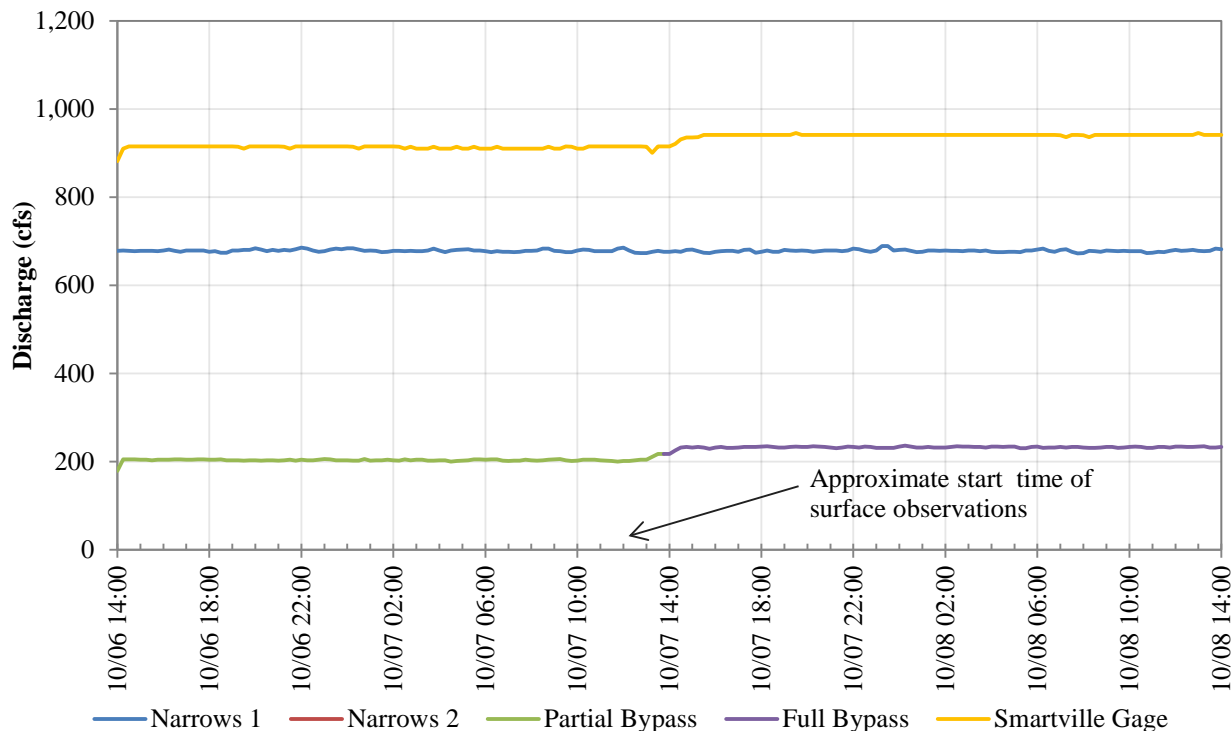


Figure 4.3-2. Fifteen-minute discharge data at the Partial Bypass, Full Bypass, Narrows 1 Powerhouse, and Smartsville Gage from 2:00 p.m. October 6, 2013 to 2:00 p.m. October 8, 2013.²¹ The Narrows 2 Powerhouse did not operate during this period, and spills over Englebright Dam did not occur.

4.4 Historical Operations of Partial Bypass

The Partial Bypass operated intermittently from October 1, 2006 to December 15, 2013. (Table 4.4-1). Partial Bypass operation ranged from less than 1 day up to 37 days of continual use. The Partial Bypass was times used most often in January, February, and September; seasonal use could be characterized as winter and late summer but the bypass has operated in all seasons. Discharge from the Partial Bypass can be as high as 650 cfs but typical operations do not exceed 230 cfs. However, when discharges greater than 650 cfs at the Partial Bypass were reported

²¹ In this figure, Narrows 1 Powerhouse and Smartsville gage data are from PG&E, and the Full and Partial bypasses data are based on flow data in the penstock AVM and YCWA operators' log books.

(Table 4.4-1), it was typically during an operational change where flow is ramped down and transferred from one facility (i.e., Full Bypass) to the Partial Bypass. The reported discharge may be correct for the entire Narrows 2 facility, but operations are reported for only one facility. Therefore, the reported discharges of greater than 650 cfs were excluded from the minimum, maximum, and mean columns in Table 4.4-1, but still were utilized for calculation of event durations. It is possible that these changes in release facilities occur during periods with flows lower than 650 cfs through the Partial Bypass, but since 650 cfs is the maximum reported release capacity of the Partial Bypass, it is used as a threshold.

Table 4.4-1. Summary of historical operations of the Partial Bypass from WY 2007 to WY 2013.

Date		Duration ¹ # days (hours)	Discharge (cfs) ²		
Start	Stop		Minimum	Maximum	Mean
12/30/2006	12/30/2006	1 (<1)	429	429	429
12/31/2006	1/1/2007	2 (23)	69	495	245
1/29/2007	2/9/2007	12 (258)	175	225	181
9/5/2007	9/5/2007	1 (8)	274	477	343
12/23/2007	1/3/2008	11 (267)	37	105	40
1/23/2008	1/28/2008	6 (119)	131	160	152
2/14/2008	2/22/2008	9 (199)	202	326	205
2/28/2008	4/4/2008	37(857)	92	612	204
9/23/2008	9/30/2008	7 (136)	170	203	186
11/17/2008	12/23/2008	37 (858)	83	156	127
12/23/2008	12/30/2008	8 (160)	61	100	90
1/22/2009	2/22/2009	32 (739)	20	63	33
3/25/2009	3/26/2009	2 (24)	124	130	127
9/1/2009	9/11/2009	11 (123)	163	366	229
9/1/2010	9/1/2010	1 (5)	387	432	416
9/30/2010	9/30/2010	1 (4)	311	321	316
1/19/2012	1/21/2012	3 (48)	58	264	67
1/30/2012	2/14/2012	16 (353)	47	63	54
2/14/2012	3/14/2012	30 (691)	42	61	46
9/21/2012	9/21/2012	1 (3)	375	394	384
10/25/2012	10/25/2012	1 (4)	319	330	323
8/31/2013	9/8/2013 ³	9 (189)	37	58	39
9/24/2013	10/7/2013 ³	14 (310)	42	217	95
Median		136 hrs	124 cfs	225 cfs	181 cfs
Minimum		1 hr	20 cfs	58 cfs	33 cfs
Maximum		858 hrs	429 cfs	612 cfs	429 cfs
Number of Events		23 (total of 5,379 hrs (224.1 days) over 7 years)			

¹ Duration displayed in days with total hours in parenthesis

² Discharge greater than 650 cfs excluded from min/max/mean, but included in duration.

³ Event monitored during this study.

YCWA’s estimates of 15-minute flows through the Partial Bypass, as well as flows through other associated facilities (i.e., Narrows 2 Powerhouse (for generation), Full Bypass, Narrows 1 Powerhouse, Englebright Dam spills and Smartsville gage) from October 1, 2006 through December 15, 2013 are included in Attachment 7.13A to this technical memorandum. Data are provided in both Microsoft® Excel (*.xlsx) and Data Storage System (*.dss) formats.

4.5 Incidental Observations

Four incidental observations were made outside of Study 7.13 stranding survey events. These incidental observations were made during data collection activities for YCWA’s Study 7.11, *Fish Behavior and Hydraulics Near Narrows 2 Powerhouse*. Two occurred prior to initiation of

Study 7.13 and included an observation by YCWA operators on October 23, 2012 of a fish carcass on the bank near the Bypass Pool and an observation by Relicensing Participants on October 25, 2012 of a fish carcass on the bank near the Partial Bypass. The other two incidental observations occurred in 2013. The first observation was of a fish carcass near Narrows 2 Powerhouse on October 7, 2013. The second involved multiple fish in an isolated pool in the channel near Narrows 2 Powerhouse on October 13, 2013. Each of these observations is described below.

YCWA staff or its relicensing consultant have not observed any other fish carcasses or live fish on stream banks in the vicinity of the Narrows 2 Powerhouse, nor has any Relicensing Participant provided to YCWA any other documented occurrences of fish carcasses or live fish on stream banks in the vicinity of the Narrows 2 Powerhouse.²²

October 23, 2012 Incidental Observation

Opportunistic fish observations at Narrows 2 Powerhouse recorded by YCWA employees and consultant staff occurred sporadically between December 20, 2011 and November 6, 2012. During these opportunistic observations, a fish carcass was observed on October 23, 2012 on the bank south of Narrows 2 Powerhouse (Figure 4.5-1). Resource agencies' staffs were not on site all day. No additional information about the species, time, condition of the fish, or its exact location were available.

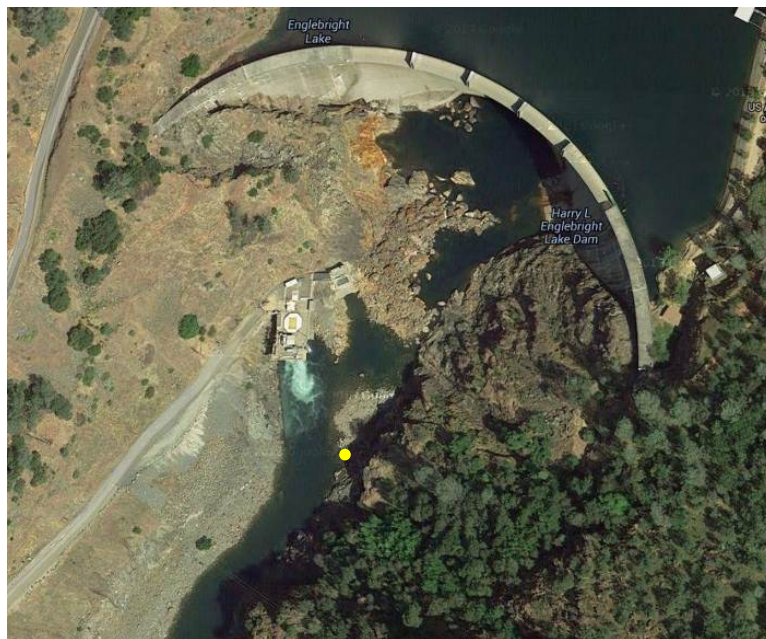


Figure 4.5-1. General location of the fish carcass in relation to the Narrows 2 Powerhouse and Englebright Dam (yellow dot).

²² In a November 1, 2013 e-mail to FERC, NMFS reported an adult Chinook salmon carcass was found on the bank in “October, 2012;” and another one in “late September or early October, 2013.” YCWA believes, though it cannot be sure, that these are the same as the October 25, 2012 and October 7, 2013 incidental observations describe below. In the same e-mail, NMFS reports fish were observed in a pool on October 11, 2013. That incidental observation is also described below.

Operational changes did not occur within 24 hours of the observation (Figure 4.5-2). The Full Bypass was operating before and after the observation at approximately 375 cfs and was the only point of discharge at Narrows 2 Powerhouse, while the Narrows 1 Powerhouse operated near 625 cfs. Discharge at the Smartsville gage was approximately 1,000 cfs during this period.

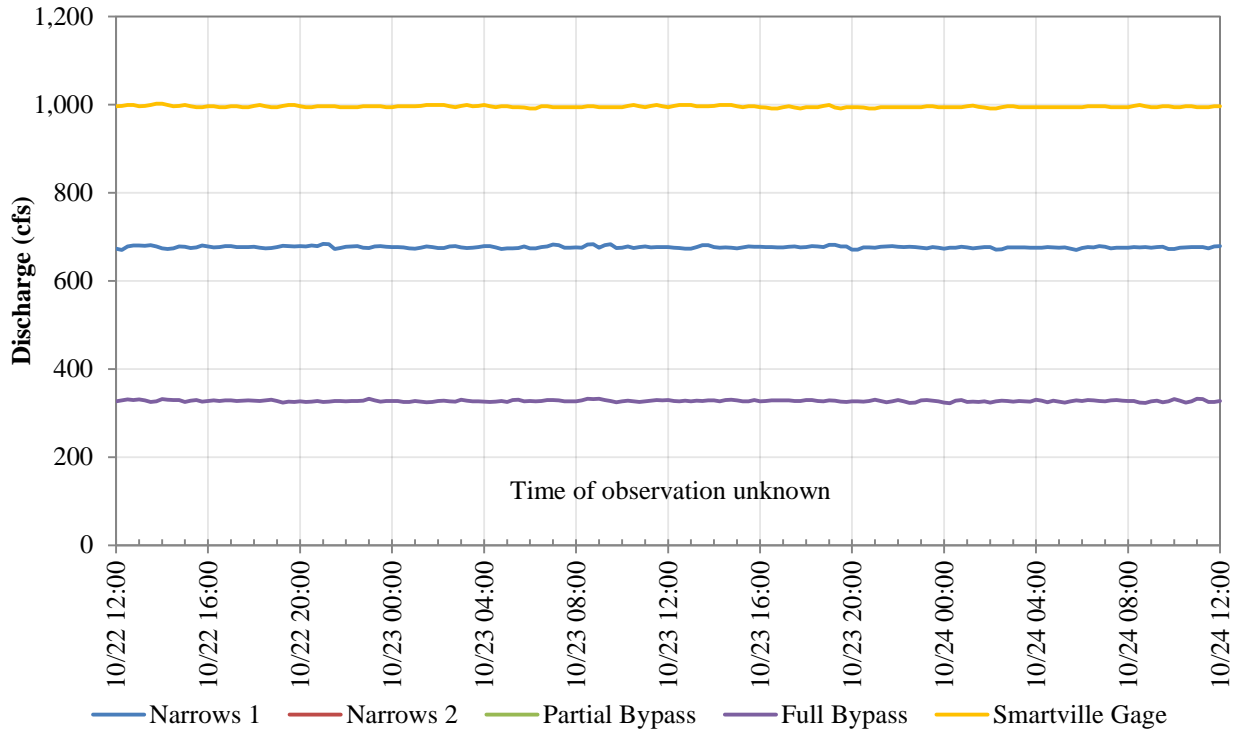


Figure 4.5-2. Fifteen-minute flows data at the Full Bypass, Narrows 1 Powerhouse, and Smartsville Gage from 12:00 p.m. on October 22, 2012 to 12:00 p.m. on October 24, 2012.²³ The Narrows 2 Powerhouse and the Partial Bypass did not operate during this period, and spills over Englebright Dam did not occur.

October 25, 2012 Incidental Observation

During a Relicensing Participant field event on October 25, 2012, Cal Fish and Wildlife personnel found an adult Chinook salmon carcass head down in a crevice on the right bank about 70 ft downstream of the Narrows 2 Powerhouse (Figure 4.5-3). When found, the fish was about 3 to 5 ft above the river water surface and 15 ft from the water’s edge. The fish, identified as a female that was still gravid, measured 88.9 cm FL and weighed 7.39 kilograms (kg) and had a girth of 43.1 cm (S. Hoobler, pers. comm., 2014). The carcass was relatively fresh and had a silver/blue color. The adipose fin was not clipped. (Figure 4.5-3.) The carcass was removed from the site by Cal Fish and Wildlife staff.

²³ In this figure, Narrows 1 Powerhouse and Smartsville gage data are from PG&E, and the Full Bypass data are based on flow data in the penstock AVM and YCWA operator’s log books.



Figure 4.5-3. Sean Hobbler of Cal Fish and Wildlife holding an adult Chinook salmon carcass found in the crevice he is kneeling in on October 25, 2012. Photo taken by John Wooster of NMFS.

The carcass was discovered around 12:30 p.m., about 30 minutes after an operational change from the Partial Bypass to the Full Bypass. Discharge from the Narrows 2 facilities remained similar before, during, and after the operational change (Figure 4.5-4). The Smartsville Gage reported approximately 1,000 cfs during a 24-hour period before and after the operational change, with about 325 cfs from the Narrows 2 facility, and 675 cfs from the Narrows 1 Powerhouse.

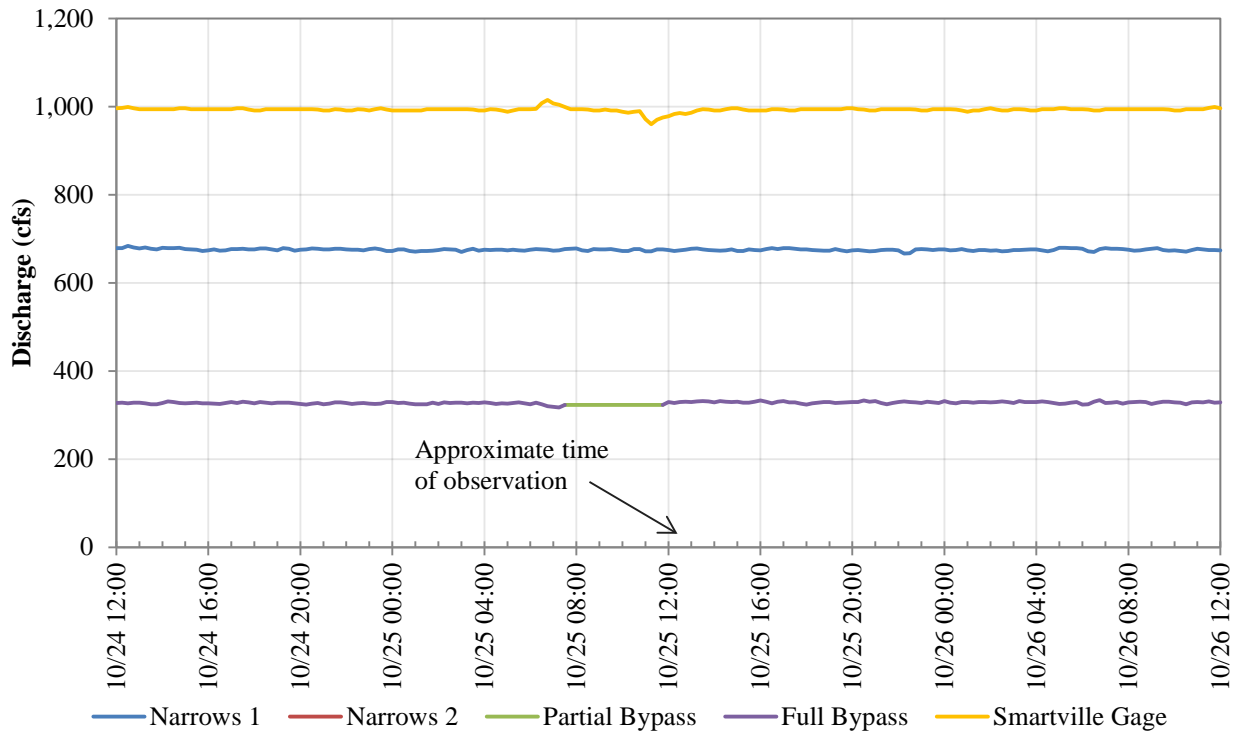


Figure 4.5-4. Fifteen-minute discharge data at the Partial Bypass, Full Bypass, Narrows 1 Powerhouse, and Smartville Gage from 12:00 p.m. on October 24, 2012, to 12:00 p.m. on October 26, 2012.²⁴ The Narrows 2 Powerhouse did not operate during this period, and spills over Englebright Dam did not occur. The time the fish carcass was observed is shown.

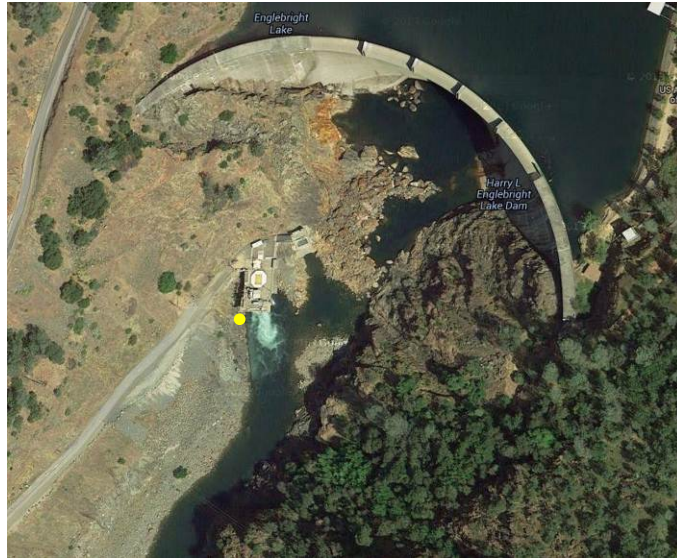
October 7, 2013 Incidental Observation

YCWA issued an e-mail to Relicensing Participants advising them that increased downstream water demand would result in a flow transition at around 2:00 p.m. from the Narrows 2 Partial Bypass to the Narrows 2 Full Bypass, and that YCWA’s consultant staff were mobilizing to conduct visual observations and DIDSON™ monitoring, as required by the FERC-approved Study 7.11 and to perform a fish stranding survey after the Partial Bypass was shut down for Study 7.13. YCWA issued the notice within an hour of determining that the transition would occur.

At approximately 12:15 p.m. on October 7, 2013, YCWA’s consultant staff arrived at Narrows 2 Powerhouse in anticipation of performing the studies. The weather conditions were clear and sunny. Resource agencies’ staffs were not on site that day.

As staff prepared to perform the studies, they observed a fish carcass on the north bank of the Yuba River approximately 15 ft downstream from the face of the Narrows 2 Powerhouse (Figure 4.5-5 A through D).

²⁴ In this figure, Narrows 1 Powerhouse and Smartville gage data are from PG&E, and the Full Bypass data are based on flow data in the penstock AVM and YCWA operators’ log books.



A) General location of the fish carcass in relation to the Narrows 2 Powerhouse and Englebright Dam (yellow dot).



B) Specific location of the fish carcass before it was handled by staff.



C) Physical position of the fish carcass before it was handled by staff.



D) Photograph of the fish carcass positioned by staff for the photo.

Figure 4.5-5. Series of photos cataloging the location and position of the fish carcass found on October 7, 2013.

Staff approached the carcass and found the carcass head first in a crevice under several angular rocks. Staff estimated that the carcass was approximately 2 ft from the water's edge and approximately 1.5 ft above the water surface. The dominant substrate at the location was bedrock and the subdominant substrate was angular cobble sized rock. Water temperature in the river in the vicinity of the carcass was 12°C. YCWA operations staff said the discharge from the Partial Bypass was 200 cfs when staff first observed the carcass.

Because the fish was dead, staff then handled the carcass and determined it was a gravid female Chinook salmon, 68 cm FL, and showed no obvious signs of recent spawning activity (e.g., no signs of tail abrasion). Staff described the carcass as fresh, and reported it showed no rigor mortis, no bloating, no obvious smell of decay, and a clear eye.

Staff removed the carcass and cut off the tail to be sure it would not be counted during the Study 7.13 survey. The carcass was placed in the flowing river. After the Narrows 2 Partial Bypass was shut down, staff performed the Study 7.13 survey. Discharge and operations information for this observation were presented in Section 4.3 (Figure 4.3-2).

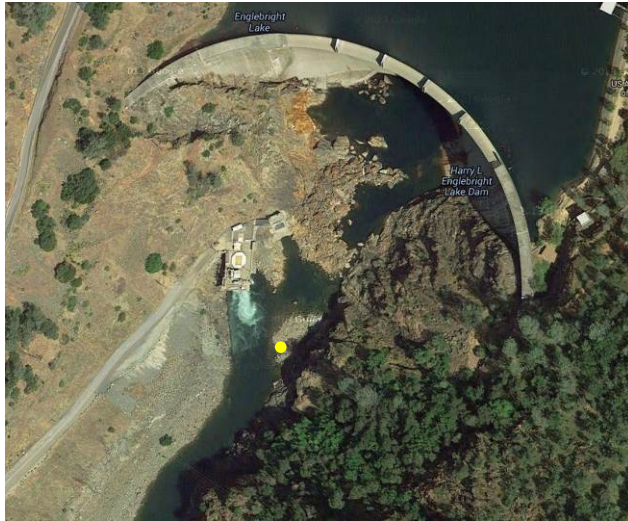
October 11, 2013 Incidental Observation

YCWA issued an e-mail to Relicensing Participants advising them that changes in downstream water demand would necessitate a transition of flow around noon from the Full Bypass to Narrows 2 Powerhouse, and that YCWA's consultant staff were mobilizing to conduct visual observations and DIDSON™ monitoring, as required by the FERC-approved Study 7.11.²⁵ YCWA issued the notice within an hour of determining that the transition would occur.

At approximately 11:30 a.m. on Friday, October 11, 2013, YCWA's consultant staff arrived at Narrows 2 Powerhouse in anticipation of performing visual observations and DIDSON™ monitoring. The weather conditions were clear and sunny. Resource agencies' staffs were not on site that day.

As part of the change, flow through the Narrows 2 Full Bypass was increased from 400 cfs to 990 cfs. The increased flow inundated a gravel bar on the southern edge of the river between the Full Bypass pool and the main channel of the river. Then, over the next 5 minutes, flow was changed from the Full Bypass to the Narrows 2 Powerhouse, at which point flow from the Full Bypass ceased completely. Staff observed that the change-over had left a pool, approximately 30 ft by 10 ft wide, on the edge of the gravel bar (Figure 4.5-6 A through D).

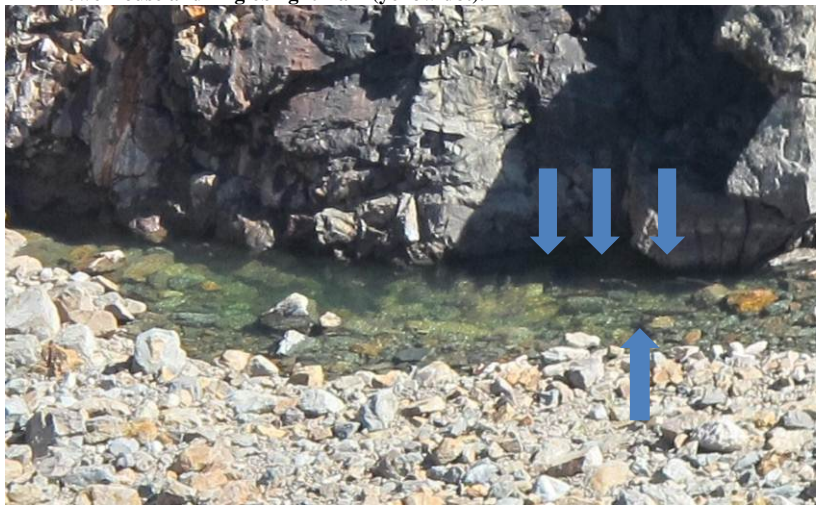
²⁵ The transition did not trigger a Study 7.13 stranding survey because use of the Narrows 2 Partial Bypass was not involved.



A) General location of the fish observed in the pool in relation to the Narrows 2 Powerhouse and Englebright Dam (yellow dot).



B) Specific location of observed fish, flow in the river was approximately 990 cfs with all water being released from the Narrows 2 Powerhouse (generation).



C) The blue arrows indicate four fish that can be seen in the pool.



D) Photograph of the pool when the flow in the river was approximately 990 cfs, with all water being released from the Narrows 2 Full Bypass. The area of the pool shown in photos b and C is indicated by the blue arrow.

Figure 4.5-6. Series of photos cataloging the pool in which the fish were observed on October 11, 2013. The photos were taken from the Narrows 2 Powerhouse deck looking south across the Yuba River.

On the morning of October 10, 2013, the Full Bypass was releasing approximately 230 cfs and PG&E’s Narrows 1 Powerhouse was releasing approximately 680 cfs (Figure 4.5-7). Starting shortly after 1:15 p.m., releases from the Full Bypass were increased to approximately 350 cfs by 1:45 p.m., PG&E’s Narrows 1 Powerhouse releases remained at approximately 680 cfs and no flow was passing through the Partial Bypass. At approximately 7:00 a.m. on October 11, 2013 flows through the Full Bypass were increased first to 400 cfs, and at 10:15 a.m. flows were further increased until they reached approximately 1,050 cfs at 10:30 a.m. Between 10:30 and 10:45 a.m., the Narrows 2 Powerhouse began generating at flows of approximately 990 cfs, releases from the Full Bypass were stopped, and releases from the Narrows 1 Powerhouse were reduced to 130 cfs. This operations mode was maintained until just after 1:00 p.m. on October 13, 2013, at which time flows through the Narrows 2 Powerhouse began to be reduced to approximately 400 cfs by 2:00 p.m. and releases from PG&E’s Narrows 1 Powerhouse were increased to approximately 670 cfs. By 2:15 p.m., releases through the Narrows 2 Powerhouse were stopped, and flow through the Full Bypass had been increased to approximately 400 cfs. These releases from the Full Bypass and PG&E’s Narrows 1 Powerhouse continued beyond 5:00 p.m. on October 14, 2013. As stated above, staff observed fish in the pool at approximately 12:05 p.m. on October 11, 2013.

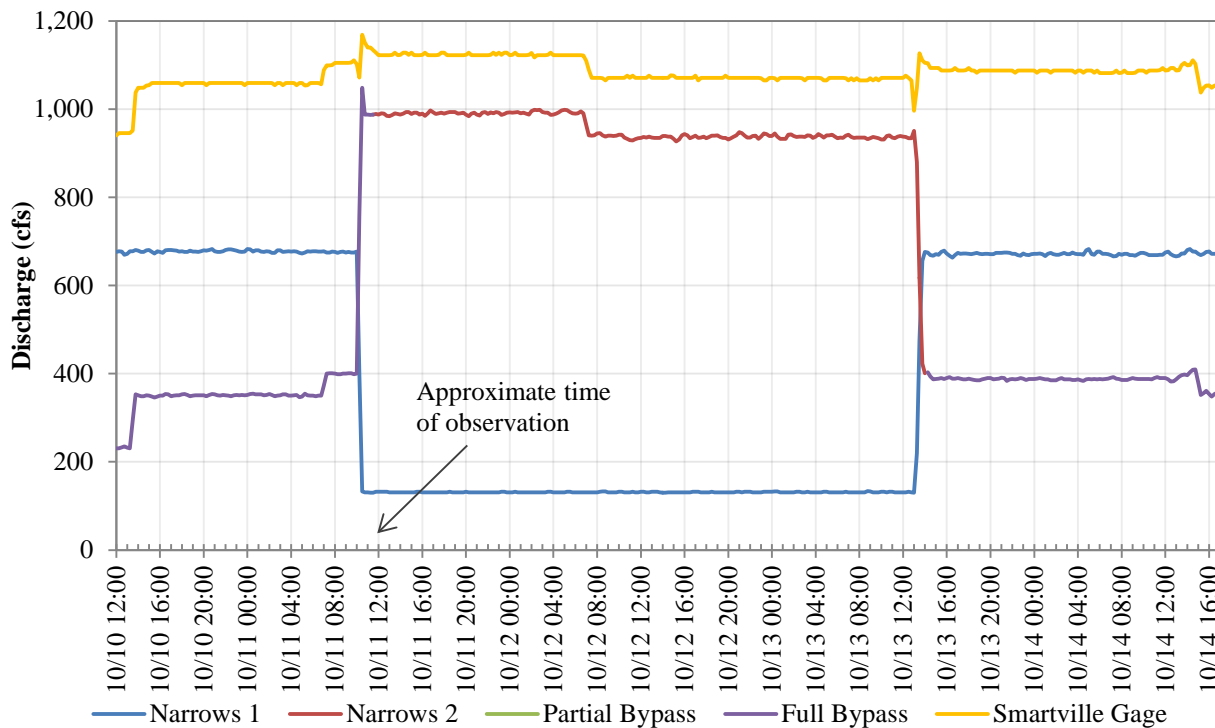


Figure 4.5-7. Fifteen-minute discharge data at the Narrows 2 Powerhouse, Full Bypass, Narrows 1 Powerhouse, and Smartville Gage from 12:00 p.m. October 10, 2013 to 12:00 p.m. October 14, 2013.²⁶ The Partial Bypass did not operate during this period, and Englebright Dam did not spill. The time the fish were observed in the pool is shown.

²⁶ In this figure, Narrows 1 Powerhouse and Smartville gage data are from PG&E, and the Full Bypass and Narrows 2 Powerhouse data are based on flow data in the penstock AVM, powerhouse generation records and YCWA operators’ log books.

5.0 Discussion

The goal of study 7.13 was to gain a better understanding of whether environmental conditions created by shutdown of the Partial Bypass contribute to the incidence of fish stranding. To address this goal, YCWA developed a protocol to survey the area for stranded fish during Partial Bypass operation changes in 2013 with the primary objective of documenting the physical condition and behavior of potentially stranded fish.

No stranded fish were observed following the two shutdowns of the Partial Bypass during the study, and fish were observed in the vicinity of powerhouse, as has been found in other relicensing studies (e.g., Study 7.11).

Three incidental observations of fish carcasses and one incidental observation of fish in an isolated pool were reported.

In response to a FERC letter dated November 25, 2013, on December 26, 2013, YCWA filed with FERC a letter providing information regarding the above September and October 2013 incidental observations. In its letter, YCWA proposed to: 1) removal of gravel bar across from the Full Bypass within 3 months of FERC's approval and after obtaining all necessary permits and approvals; and 2) if during the course of Study 7.11a fieldwork, currently scheduled for 2014, YCWA's consultant staff observes any fresh fish carcasses or live stranded fish, YCWA will notify NMFS, Cal Fish and Wildlife and FERC via e-mail within 24 hours; and if during the course of its normal work at the Narrows 2 Powerhouse area, YCWA's Operations staff observes any fresh fish carcasses or live stranded fish, YCWA will notify NMFS, Cal Fish and Wildlife and FERC via e-mail within 24 hours. The activities proposed by YCWA in its November 25, 2014 letter would occur under the existing license.

6.0 Study-Specific Consultation

YCWA consulted with NMFS regarding permits for handling stranded fish for Study 7.13. Both parties agreed that acquiring permits would not be possible under the schedule described in the study plan and that fish would not be handled as part of the study.

7.0 Variances from FERC-Approved Study

The study was performed in conformance to the FERC-approved Study 7.13, *Fish Stranding Surveys Near Narrows 2 Powerhouse Partial Bypass* with one exception. Relicensing Participants agreed that the results would be better presented as a stand-alone technical memorandum. This technical memorandum is the product of that consensus.

8.0 Attachments to this Technical Memorandum

This technical memorandum includes one attachment:

- Attachment 7-13A: Narrows 1 and Narrows 2 Hydrology [1 Microsoft® Excel (*.xlsx) file: 10.9 MB; and 1 Data Storage System (*.dss) file: 8.28 MB.

9.0 References Cited

Hoobler, S. 2014. California Department of Fish and Wildlife. Phone conversation. Joel Passovoy. Fisheries Biologist - HDR Engineering. Data regarding a Chinook salmon at Narrows 2 Powerhouse on October 25, 2012. February 2014.

United States Geological Survey (USGS). 2003. Open-File Report 03-383. Bathymetric and Geophysical Surveys of Englebright Lake, Yuba-Nevada Counties, California, 2003.

Yuba County Water Agency. 2014. Technical Memorandum 7.11/7.11a Fish Behavior and Hydraulics Near Narrows 2 Powerhouse and Radio Telemetry Study of Spring- and Fall-Run Chinook Migratory Behavior Downstream of Narrows 2 Powerhouse. Yuba County Water Agency. Marysville California.

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Attachment 7-13A

Narrows 1 and Narrows 2 Hydrology

Attachment 7-13A consists of one Digital versatile disk (DVD) containing files of 15-minute hydrology data related to Narrows 2 Powerhouse, Partial Bypass, Full Bypass, Narrows 1 Powerhouse, Englebright Dam spill and Smartsville streamflow gage. Due to size and format of the data, they cannot be uploaded to FERC's e-Library system. YCWA will file Attachment 7-13A on DVD with FERC.

A copy of the DVD can be obtained by contacting:

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