

**Placer County Water Agency  
Middle Fork American River Project  
(FERC No. 2079)**

**SUPPORTING DOCUMENT C  
Proposed Project Betterments/Improvements**



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**CONTENT**

Supporting Document C (SD C) contains a description of the Proposed Project Betterments/Improvements for Placer County Water Agency's (PCWA's) Middle Fork American River Project (MFP or Project). Draft summaries of the information contained in this document were developed prior to the submittal of the Pre-Application Document (PAD) and distributed to the resource agencies and other stakeholders for review and comment in June 2006. In addition, PCWA presented descriptions of the Proposed Project Betterments/Improvements at several Plenary and Technical Working Group meetings in 2006 and 2007. Information about the Proposed Project Betterments/Improvements was discussed early in the relicensing process to assist stakeholders with identification of potential resource issues and development of the technical study plans included in SD H of this PAD.

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## 1.0 OVERVIEW

In preparation for the relicensing of the MFP, PCWA conducted an assessment to identify potential modifications or additions (betterments) to existing Project facilities that would improve operations of maintenance of the Project, and result in an increase in net or peak generation. As a result of this assessment, PCWA identified three potential Project betterments to include in the Pre-Application Document (PAD). These include:

- Hell Hole Reservoir Seasonal Storage Increase
- French Meadows Powerhouse Capacity Upgrade
- Ralston Powerhouse Capacity Upgrade

PCWA intends to further evaluate these three potential Project betterments/improvements during relicensing with respect to their engineering and economic feasibility and the protection, mitigation and enhancement measures that may be necessary to address potential effects on environmental and cultural resources. The specific Project betterments to be included in the License Application will be determined after reviewing the results of on-going engineering, economic, cultural, and environmental studies in relationship to potential future license conditions. The description of the potential betterments included in the PAD is based on the preliminary engineering conducted during the initial assessment. More detailed definition of each betterment will be available as the ongoing evaluation refines the design of each betterment. Two of the proposed betterments, the Hell Hole Seasonal Storage Increase and the French Meadows Powerhouse Capacity Upgrade, will require new power water rights permits. The Ralston Powerhouse Capacity Upgrade may require a new water rights permit.

In the following sections of this document a description of each proposed betterment is provided. Each description includes the location of modified or new facilities, construction procedure and schedule, and associated routine maintenance and operation activities.

## 2.0 HELL HOLE RESERVOIR SEASONAL STORAGE INCREASE

### 2.1 OVERVIEW AND PURPOSE

The purpose of this betterment would be to seasonally increase the storage capacity of Hell Hole Reservoir. This betterment would utilize a portion of the existing flood control pool, above the present normal maximum operating water level, to store additional water during the spring and summer after the peak of the runoff period. An approximate 9,750-12,000 acre-feet (ac-ft) increase in seasonal storage in the reservoir would be achieved by installing 8-10 foot-high crest gates on the existing dam spillway. The crest gates would be raised when needed to increase reservoir storage. Operation of the crest gates would also seasonally increase the reservoir's inundation area within the existing flood pool by approximately 37 acres.

In years when either French Meadows or Hell Hole reservoirs would have spilled, this betterment would allow the MFP to capture additional water in storage in Hell Hole Reservoir which can later be used to increase net annual energy generation. In all but the driest years, this betterment would also allow the MFP to shift the timing of some generation from the spring run-off period to the summer peak energy demand period. While the shift in the timing of the generation will not increase total annual MFP generation, it will increase the benefit of the Project by increasing generation during the peak energy demand period.

## **2.2 PROJECT FACILITIES**

This betterment requires facility modifications or new Project facilities at Hell Hole Dam, French Meadows Powerhouse, Hell Hole - Middle Fork Tunnel Gatehouse, and the South Fork Long Canyon Diversion to accommodate the seasonal increase in maximum operating water surface elevation.

### **2.2.1 Modifications to Existing Project Facilities**

This betterment would require the following modifications to existing Project facilities. The location and footprint of each facility modification is shown on Maps SD C-1a and C-1b.

- Hell Hole Dam Spillway - install 8-10 foot-high crest gates on the existing concrete spillway. These hinged gates, when raised would increase the Hell Hole Reservoir maximum operating water surface elevation from 4,630 feet to 4,638 feet or 4,640 feet (depending on the height of the gates installed). A schematic drawing and example of these gates are shown as Figures SD C-1 and SD C-2.
- Hell Hole Dam - install 2 foot-high parapet walls on each end of the existing dam to maintain minimum freeboard requirements, if 10 foot-high crest gates are installed.
- French Meadow Powerhouse - install a 4 foot-high parapet wall at the powerhouse to avoid inundation from wave action when the reservoir is at its maximum water surface elevation.
- Hell Hole - Middle Fork Tunnel Gatehouse - install a 4 foot-high parapet wall around the gatehouse to avoid inundation from wave action when the reservoir is at its maximum water surface elevation.
- South Fork Long Canyon Diversion Dam - install 3 foot-high crest gates on the diversion dam or a check valve at the drop inlet to avoid the backflow of water from the Hell Hole - Middle Fork Tunnel into South Fork Long Canyon Creek when Middle Fork Powerhouse is not operating.

### **2.2.2 New Project Facilities**

This betterment would also require construction of the following new project facilities. The location and footprint of these new facilities is shown on Maps SD C-1a and C-1b.

- Hell Hole Dam Spillway Crest Gates Control Building - construct a small control building adjacent to the spillway to provide power for operations of the spillway crest gates.
- Hell Hole Dam Spillway Crest Gates Control Building Powerline - construct a short spur line (approximately 525 feet) from the control building to an existing powerline (the French Meadows Powerhouse and Switchyard, Hell Hole - Middle Fork Tunnel Gatehouse, Dormitory Facility, Operators Cottages, and Hell Hole Powerhouse Communications Line/Powerline). This powerline would provide power for spillway crest gate operations.
- South Fork Long Canyon Diversion Dam Generator Building - construct a control building with a generator to provide power for operation of the crest gate.

### **2.3 MFP OPERATIONS WITH HELL HOLE SEASONAL STORAGE INCREASE**

The following describes how operation of the spillway crest gates at Hell Hole Dam will modify MFP water management and energy production.

#### **2.3.1 Increased Storage and Peaking Generation in Spill Years**

In spill years, the Hell Hole Spillway Crest Gates would be raised on the descending limb of the hydrograph (near the end of runoff period) to capture additional water for storage in Hell Hole Reservoir. Although the timing of the peak runoff varies annually, typically the crest gates in spill years would be raised in the spring and store additional water behind the gates until approximately mid- summer after the reservoir level has fallen below the spillway elevation. Operation of the crest gates will store an additional 9,750-12,000 ac-ft of water in years when spills would otherwise occur (depending on spillway crest gates configuration). The additional water will increase total annual MFP energy generation. The additional generation would be scheduled to occur during the summer peak energy demand season.

#### **2.3.2 Increased Peaking Generation in Non-spill Years**

In non-spill years, the crest gates would typically be raised in the spring and would remain raised until approximately mid- summer after the reservoir level has fallen below the spillway elevation to store water that otherwise would be released during the runoff period for generation. In most non-spill years, with the exception of dry and critically dry years, the additional storage allows a portion of the generation typically produced during the runoff period (reservoir fill) to prevent reservoir spill, to be deferred until the summer peak energy demand period. While the revised timing of the generation will not increase total annual MFP generation, it will increase generation during the peak energy demand period. Based on the hydrologic record, in approximately 75% of the years of operation, the spillway crest gates are expected to operate, increasing seasonal storage.

### **2.3.3 Other Operation Effects**

Operation of the crest gates at Hell Hole Dam Spillway will temporarily increase the water surface elevation and reservoir impoundment area by up to 37 acres. This increased inundation will occur along the entire reservoir shoreline, but will be proportionally larger at the eastern end of the reservoir. The increased area of inundation is above the reservoir's historical normal maximum operating water surface elevation (current elevation of the spillway crest) but is within the maximum historic inundation zone that has occurred in the reservoir during spill events. However, under the proposed project betterment the frequency and duration of inundation would increase compared to historical conditions.

The crest gates at the South Fork Long Canyon Diversion Dam will be operated at the same time and for approximately the same duration as the crest gates at the Hell Hole Dam Spillway. The water surface elevation at the South Fork Long Canyon Diversion Pool will be increased by approximately 3 feet during operation of the diversion spillway crest gate.

## **2.4 CONSTRUCTION AND MAINTENANCE OF BETTERMENT FACILITIES**

A description of construction activities and the proposed construction schedule is included in Table SD C-2. This table also describes modifications to existing operations required during construction, planned testing and maintenance of these facilities and temporary or permanent habitat loss due to construction or operation of the betterment facilities.

### **2.4.1 Temporary or Existing Facilities Used During Construction**

Construction of the proposed betterment would require use of the following temporary or existing Project facilities. The location and footprint of these facilities is shown on Maps SD C-1a and C-1b.

#### Roads at Hell Hole Dam

A temporary road from the existing access point on the dam crest to the spillway construction area and adjacent construction staging area would be constructed. The existing roadway on the dam crest would be used as a staging area for construction on the parapet wall (if required). All the proposed construction areas and staging areas are located at sites previously disturbed by original Project construction and would be accessed from an existing Project road.

#### Existing Parking Area at South Fork Long Canyon Diversion

The existing parking area adjacent to the diversion dam would be used for construction staging and will provide direct access to the construction work area on the diversion dam crest. The staging and construction work area would be accessed from an existing Project road.



## **2.4.2 Temporary MFP Operational Changes during Construction**

No temporary operation changes are required to construct this betterment. Modification of existing facilities and construction of new facilities at the Hell Hole Dam and French Meadows Powerhouse would be completed in the summer and fall when the reservoir level has been lowered by normal operations.

Installation of the crest gate at South Fork Long Canyon Diversion Dam would occur in the summer and fall after flows in South Fork Long Canyon have decreased and diversion is taken out-of-service (typically after July 1).

Similarly, installation of the parapet walls at French Meadows Powerhouse, Hell Hole - Middle Fork Tunnel Gatehouse, and Hell Hole Dam would not interfere with ongoing operation of the MFP.

## **2.5 PERMITS AND APPROVALS REQUIRED**

Diversion and off stream storage of water at Hell Hole Reservoir is currently limited by water rights permits (see SD B, Detailed Existing Project Description, Section 5.2). Permits 13855 to 13858 provide for maximum storage of 208,400 ac-ft at Hell Hole Reservoir from November 1 to July 1. A new water right permit would be required to increase the maximum storage permitted at Hell Hole Reservoir.

State or federal permits that may be required for construction of this betterment include:

- California Department of Fish and Game (CDFG) - Streambed Alteration Agreement
- U.S. Army Corps of Engineers - Clean Water Act Section 404 Permit
- U.S. Army Corps of Engineers - Rivers and Harbors Act Section 10 Permit
- Regional Water Quality Control Board - 401 Certification or Waiver
- California State Water Resources Control Board - Construction Storm Water Discharge (NPDES) Permit
- United States Department of Agriculture - Forest Service (USDA-FS) - Road use permits

Other construction permit requirements and FERC permits or approvals will be determined during construction planning.

## **3.0 FRENCH MEADOWS POWERHOUSE CAPACITY UPGRADE**

### **3.1 OVERVIEW AND PURPOSE**

The purpose of this betterment would be to increase the generating capacity of the existing French Meadows Powerhouse from 15.3 MW to approximately 30 MW. Generating capacity would be increased by adding a second powerhouse immediately adjacent to the existing powerhouse. The existing French Meadows Powerhouse is

only able to utilize approximately one-half of the maximum hydraulic capacity of the French Meadows - Hell Hole Tunnel. The addition of a second unit would allow the maximum hydraulic capacity of the tunnel to be used to transport more water over a shorter period of time from French Meadows to Hell Hole reservoirs thereby increasing the MFP's peaking generation capabilities. The additional powerhouse will have a maximum hydraulic capacity of approximately 400 cfs and a rated capacity of approximately 15 MW. Actual minimum and maximum hydraulic capacity and rated capacity of the turbine will be determined following completion of ongoing engineering studies.

The new powerhouse would also increase the capability of the MFP to supply electrical grid support services. The new generating unit could be operated simultaneously or independently of the existing generating unit. The existing PG&E 60-kV French Meadows - Middle Fork Transmission Line will be used to interconnect the new powerhouse with the PG&E transmission system.

### **3.2 PROJECT FACILITIES**

This betterment requires facility modifications or new Project facilities at the French Meadows - Hell Hole Tunnel Intake and Portal; French Meadows Powerhouse, Switchyard and Penstock; and the Middle Fork Powerhouse Upper Switchyard.

#### **3.2.1 Modifications to Existing Project Facilities**

This betterment would require the following modification of existing Project facilities. The location and footprint of each modified facility is shown on Map SD C-2.

- French Meadows - Hell Hole Tunnel Intake Trash Rack - possible replacement of the existing cylindrical trash rack with a larger trash rack to reduce head losses and allow greater volume of water to flow into the tunnel.
- French Meadows Powerhouse Switchyard - expand the existing switchyard to include additional buswork, transformers, and electrical switching equipment necessary to convey the additional power generated at the new powerhouse.
- Middle Fork Powerhouse Upper Switchyards - upgrade the transformers and switchgear at the existing 60kV switchyard at Middle Fork Interbay to handle the additional power transfer.

#### **3.2.2 New Project Facilities**

This betterment would also require construction of new Project facilities. The location and footprint of each new facility is shown on Map SD C-2.

- French Meadows Powerhouse - construct a second powerhouse with installed generating capacity of approximately 15 MW immediately adjacent to the existing powerhouse.

- French Meadows Powerhouse Penstock - construct a second 6 foot-diameter penstock with butterfly valve, parallel to the existing penstock, to provide water to the new powerhouse.
- Additional Surge Capacity Facility - develop additional surge capacity through construction of a surge shaft, a surge shaft and tank, or surge pipeline located above the French Meadows - Hell Hole Tunnel Portal, or by installation of a bypass valve in the new powerhouse.
- French Meadows - Hell Hole Tunnel Surge Shaft or Pipeline Road - construct an approximately 0.25 mile long new Project road from the existing Forest Road 14N09A to the surge shaft or pipeline construction work area.

### **3.2.3 Non-Project Facilities Modified During Construction**

An approximately 0.75 mile long portion of Forest Road 14N09A from it's intersection with Forest Route (FR) 2 to the beginning of the new French Meadows-Hell Hole Tunnel Surge Shaft or Pipeline Road will be temporarily improved to provide access for construction materials, equipment and personnel. A small temporary construction staging and work area may be established near the intersection of 14N09A and FR2.

### **3.3 MFP OPERATION WITH FRENCH MEADOWS POWERHOUSE CAPACITY UPGRADE**

The following describes how operation of the French Meadows Powerhouse Capacity Upgrade will modify MFP water management and energy production.

The exiting French Meadows Powerhouse operates to transfer water from French Meadows to Hell Hole Reservoir to maintain balanced storage volumes in both reservoirs. The upgraded powerhouse will be operated to continue balanced storage but increase peaking power generation and the availability of electrical grid support services.

#### Increased Peaking Generation

The increased transfer rate resulting from operation of both powerhouses would decrease the time required to complete transfers and allows power generation to be scheduled during the hours of peak energy demand.

#### Increased Availability of Electrical Grid Support Services

When either unit is not operating or is operating at less than full capacity, PCWA can place the units on standby (ready to operate) or available for regulation (operating at less than full output). This allows PCWA to provide generating capacity to managers of the electric power grid as a means to following short term changes in overall regional energy demand.

### **3.4 CONSTRUCTION AND MAINTENANCE OF BETTERMENT FACILITIES**

A description of construction activities and the proposed construction schedule is included in Table SD C-2. This table also describes modifications to existing operations during construction, planned testing and maintenance of these facilities, and temporary or permanent habitat loss due to construction or operation of the betterment facilities.

#### **3.4.1 Temporary or Existing Facilities Used During Construction**

Construction of the proposed betterment would require use of the following temporary or existing project facilities. The location and footprint of these facilities is shown on Map SD C-2.

##### Construction Staging Area at French Meadows - Hell Hole Tunnel Gatehouse

The existing disturbed area adjacent to the tunnel gatehouse would be used for construction staging for modification of the French Meadows - Hell Hole Tunnel Intake Trash Rack. This area is accessed by an existing Project road.

##### Construction Staging and Work Areas for French Meadows - Hell Hole Tunnel Surge Shaft/Tank or Pipeline and Road

Two staging areas and a construction work area would be cleared and used temporarily at the site of the French Meadows - Hell Hole Tunnel Surge Shaft or Pipeline. A staging and construction work area would also be cleared and used temporarily for construction of the French Meadows - Hell Hole Tunnel Surge Shaft or Pipeline Road. All of these temporary use areas would be accessed via FR 14N09A and a new Project road (see new facilities).

##### Construction Staging and Work Areas for French Meadows Powerhouse Penstock

Two construction staging areas would be cleared adjacent to the French Meadows - Hell Hole Tunnel Portal for temporary use during construction. A temporary construction work area would also be cleared parallel to the existing French Meadows Powerhouse Penstock. All temporary use areas would be accessed by an existing Project road.

##### Construction Staging and Work Areas for French Meadows Powerhouse and Switchyard

Two previously disturbed areas adjacent to the existing French Meadows Powerhouse would be temporarily used for construction and staging of the second powerhouse. A third area along the French Meadows Powerhouse Road would be cleared for temporary use as construction staging. The disturbed area adjacent to the existing powerhouse would also be used as the construction work area for the new powerhouse and switchyard. All areas would be accessed by an existing Project road.

### Construction Staging and Work Area for Middle Fork Powerhouse Upper Switchyard

Construction staging and work will occur within the existing boundary of the Middle Fork Powerhouse Upper Switchyard.

#### **3.4.2 Temporary MFP Operational Changes during Construction**

The existing French Meadows Powerhouse will be able to continue operations during construction of the betterment facilities except during modifications to the tunnel intake trash rack and during tie-in of new facilities including the surge shaft/tank or surge pipeline, and the new penstock. The planned outage and temporary loss of water transfer capability from French Meadows Reservoir to Hell Hole Reservoir may require a short-term revision to the normal schedule of reservoir water transfers at these times.

#### **3.5 PERMITS AND APPROVALS REQUIRED**

This betterment would require a new water right permit to allow for an increase in the permitted direct diversion rate from French Meadows Reservoir to Hell Hole Reservoir.

State or federal permits that may be required for construction of this betterment include:

- California Department of Fish and Game - Streambed Alteration Agreement
- U.S. Army Corps of Engineers - Clean Water Act Section 404 Permit
- U.S. Army Corps of Engineers - Rivers and Harbors Act Section 10 Permit
- Regional Water Quality Control Board - 401 Certification or Waiver
- California State Water Resources Control Board - Construction Storm Water Discharge (NPDES) Permit
- USDA-FS - Road use permits

Other construction permit requirements and FERC permits or approvals will be determined during construction planning.

### **4.0 RALSTON POWERHOUSE CAPACITY UPGRADE**

#### **4.1 OVERVIEW AND PURPOSE**

The purpose of this betterment is to improve the operating efficiency of the Middle Fork - Ralston System by increasing the hydraulic capacity of Ralston Powerhouse to match Middle Fork Powerhouse throughput, plus accretions at Middle Fork Interbay. Actual minimum and maximum hydraulic capacity and upgraded capacity of the turbine will be determined following completion of ongoing engineering studies.

This betterment would allow the MFP to maximize peaking generation during periods of high energy demand thereby increasing the overall benefit of the MFP. This betterment would only require upgrades to electrical and mechanical equipment within the Ralston Powerhouse.

## **4.2 PROJECT FACILITIES**

### **4.2.1 Modifications to Existing Project Facilities**

This betterment would require modification of equipment within the existing Ralston Powerhouse. The location of the Ralston Powerhouse and the footprint of associated construction laydown areas adjacent to the powerhouse and switchyard are shown on Map SD C-3.

Modifications within the powerhouse may include:

- Turbine - upgrade of turbine components and other ancillary equipment
- Control Systems - replacement and upgrade of powerhouse control systems
- Transformer - upgrade main transformer cooling system

Modification of the Ralston Powerhouse turbine-generator would result in an increase in its nameplate capacity from 79.3 MW to a capacity of up to 96 MW at a net head of 1,214 feet and rated flow of 1,050 cfs. Actual minimum and maximum hydraulic capacity and upgraded capacity of the turbine will be determined following completion of ongoing engineering studies.

### **4.2.2 New Project Facilities**

No new project facilities are required.

## **4.3 MFP OPERATION WITH RALSTON POWERHOUSE CAPACITY UPGRADE**

The following describes how operations of the capacity upgrade to Ralston Powerhouse will modify MFP water management and energy production.

Increased hydraulic efficiency at the Ralston Powerhouse will relieve the constraint it imposes on peaking generation because its current hydraulic capacity is less than available flow from the Middle Fork - Ralston Tunnel and Middle Fork Powerhouse. During simultaneous operation of both powerhouses their operation must be balanced so that the combined discharge of the Middle Fork Powerhouse and inflow from the Middle Fork American River as conveyed through the Middle Fork - Ralston Tunnel, does not exceed the hydraulic capacity of the Ralston Powerhouse. Currently balancing may result in reduction in the operation of the units at the Middle Fork Powerhouse. Increasing the hydraulic capacity of the Ralston Powerhouse will allow both powerhouses to operate a full output increasing the combined energy output. Since simultaneous operation of both powerhouses is scheduled to occur during periods of peak energy demand, annual peaking energy output would be increased.

## **4.4 CONSTRUCTION AND MAINTENANCE OF BETTERMENT FACILITIES**

A description of construction activities and the proposed construction schedule is included in Table SD C-4. This table also describes planned testing and maintenance

of these facilities and temporary or permanent habitat loss due to construction or operation of the betterment facilities.

#### **4.4.1 Temporary or Existing Facilities Used During Construction**

The existing disturbed area adjacent to the Ralston Powerhouse will be used for construction staging. All construction work areas will be within the existing powerhouse. The location and footprint of these areas is shown on Map SD C-3.

#### **4.4.2 Temporary MFP Operational Changes during Construction**

The Ralston Powerhouse would be taken out-of-service during completion of the powerhouse upgrade. The operation of other MFP facilities would continue normally except for flows from the Middle Fork Powerhouse. This water would either be passed over the Middle Fork Interbay Dam or flow through the Middle Fork Ralston Tunnel and bypass the Ralston Powerhouse turbine. In either mode of operation these flows would not be used for generation resulting in a loss in annual and peak generation during construction.

#### **4.5 PERMITS AND APPROVALS REQUIRED**

If the upgrade to the Ralston Powerhouse results in hydraulic capacity in excess of 1,000 cfs, a new water right permit would be required for the amount of flow in excess of 1,000 cfs.

State or federal permits that may be required for construction of this betterment include:

- Regional Water Quality Control Board - 401 Certification or Waiver
- California State Water Resources Control Board - Construction Storm Water Discharge (NPDES) Permit
- USDA-FS - Road use permits

Other construction permit requirements and FERC permits or approvals will be determined during construction planning.

**TABLES**



**Table SD C-1. Project Facilities and Temporary Construction Areas Associated with MFP Proposed Betterments/Improvements.**

**Hell Hole Reservoir Seasonal Storage Increase**

<b>Hell Hole Dam</b>
<b>Modified Facilities</b>
Hell Hole Dam Spillway Crest Gates
Hell Hole Dam Parapet Walls
<b>New Facilities</b>
Hell Hole Dam Spillway Crest Gates Control Building
Hell Hole Dam Spillway Crest Gates Control Building Powerline
<b>Temporary Construction and Staging Areas</b>
Hell Hole Dam Spillway Crest Gates Construction Road
Hell Hole Dam Spillway Crest Gates Construction Work Area
Hell Hole Dam Spillway Crest Gates and Control Building Construction Staging Area
Hell Hole Dam Parapet Wall Construction Staging and Work Area
Hell Hole Dam Spillway Crest Gates Control Building Construction Work Area
Hell Hole Dam Spillway Crest Gates Control Building Powerline Construction Work Area
Hell Hole Dam Spillway Crest Gates Control Building Powerline Construction Staging Area
<b>Hell Hole-Middle Fork Tunnel Gatehouse</b>
<b>Modified Facilities</b>
Hell Hole - Middle Fork Tunnel Gatehouse Parapet Wall
<b>Temporary Construction and Staging Areas</b>
Hell Hole-Middle Fork Tunnel Gatehouse Parapet Wall Construction Staging and Work Area
<b>French Meadows Powerhouse</b>
<b>Modified Facilities</b>
French Meadows Powerhouse Parapet Wall
<b>Temporary Construction and Staging Areas</b>
French Meadows Powerhouse Parapet Wall Construction Staging and Work Area
<b>South Fork Long Canyon Diversion</b>
<b>Modified Facilities</b>
South Fork Long Canyon Diversion Dam Crest Gates
<b>New Facilities</b>
South Fork Long Canyon Diversion Dam Crest Gates Generator Building
<b>Temporary Construction and Staging Areas</b>
South Fork Long Canyon Diversion Dam Crest Gates and Generator Building Construction Staging and Work Area

**French Meadows Powerhouse Capacity Upgrade**

<b>French Meadows Reservoir</b>
<b>Modified Facilities</b>
French Meadows - Hell Hole Tunnel Intake Trash Rack
<b>Temporary Construction and Staging Areas</b>
French Meadows - Hell Hole Tunnel Intake Trash Rack Construction Staging Area
French Meadows - Hell Hole Tunnel Intake Trash Rack Construction Work Area
French Meadows - Hell Hole Tunnel Intake Trash Rack Construction Road
<b>French Meadows Powerhouse</b>
<b>Modified Facilities</b>
French Meadows Powerhouse Switchyard
<b>New Facilities</b>
French Meadows Powerhouse

**Table SD C-1. Project Facilities and Temporary Construction Areas Associated with MFP Proposed Betterments (continued).**

**French Meadows Powerhouse Capacity Upgrade**

<b>French Meadows Powerhouse (continued)</b>
French Meadows Powerhouse Penstock
French Meadows - Hell Hole Tunnel Surge Shaft/Tank
French Meadows - Hell Hole Tunnel Surge Pipeline
French Meadows - Hell Hole Tunnel Surge Shaft or Pipeline Road
<b>Temporary Construction and Staging Areas</b>
French Meadows Powerhouse/Switchyard Construction Work Area
French Meadows Powerhouse/Switchyard Construction Staging Areas
French Meadows Powerhouse Penstock Construction Work Area
French Meadows Powerhouse Penstock Construction Staging Areas
French Meadows - Hell Hole Tunnel Surge Shaft/Tank or Pipeline Construction Staging Areas
French Meadows - Hell Hole Tunnel Surge Shaft/Tank Construction Work Area
French Meadows - Hell Hole Tunnel Surge Pipeline Construction Work Area
French Meadows - Hell Hole Tunnel Surge Shaft or Pipeline Road Construction Staging and Work Area
<b>Non-Project Facilities Modified During Construction</b>
Forest Road 14N09A
Forest Road 14N09A Construction Staging and Work Area
<b>Middle Fork Powerhouse</b>
<b>Modified Facilities</b>
Middle Fork Powerhouse Upper Switchyard

**Ralston Powerhouse Capacity Upgrade**

<b>Ralston Powerhouse</b>
<b>Modified Facilities</b>
Ralston Powerhouse
<b>Temporary Construction and Staging Areas</b>
Ralston Powerhouse Construction Staging Area

Table SD C-2. Hell Hole Reservoir Seasonal Storage Increase Construction, Operation, and Maintenance Summary.

Location	Hell Hole Dam	Hell Hole - Middle Fork Tunnel Gatehouse	French Meadows Powerhouse	South Fork Long Canyon Diversion
<b>Modifications to Existing Project Facilities or New Project Facilities</b>	<p><b>Modifications to Existing Facilities</b></p> <ul style="list-style-type: none"> <li>Install 8-10 foot-high Spillway Crest Gates with vertical abutment blocks at Hell Hole Dam.</li> <li>Install 2 foot-high parapet walls on the Hell Hole Dam crest (for 10 foot-high crest gates only).</li> </ul> <p><b>New Facilities</b></p> <ul style="list-style-type: none"> <li>Construct a metal control building for power and control of the Hell Hole Dam Crest Gates.</li> <li>Construct a powerline from the existing French Meadows Powerhouse and Switchyard, Hell Hole - Middle Fork Tunnel Gatehouse, Dormitory Facility, Operators Cottage, and Hell Hole Powerhouse Communications Line/Powerline to the Hell Hole Dam Spillway Crest Gates Control Building.</li> </ul>	<p><b>Modifications to Existing Facilities</b></p> <ul style="list-style-type: none"> <li>Install a 4 foot-high parapet wall at the Hell Hole - Middle Fork Tunnel Gatehouse.</li> </ul> <p><b>New Facilities</b></p> <p>None.</p>	<p><b>Modifications to Existing Facilities</b></p> <ul style="list-style-type: none"> <li>Install a 4 foot-high parapet wall at the French Meadows Powerhouse.</li> </ul> <p><b>New Facilities</b></p> <p>None.</p>	<p><b>Modifications to Existing Facilities</b></p> <ul style="list-style-type: none"> <li>Install a 3 foot-high crest gate on the South Fork Long Canyon Diversion Dam or a check valve at the South Fork Long Canyon Diversion Drop Inlet.</li> </ul> <p><b>New Facilities</b></p> <ul style="list-style-type: none"> <li>Construct a control building with generator adjacent to the South Fork Long Canyon Diversion Dam to power and control the crest gate.</li> </ul>
<b>FERC Project Boundary Revision</b>	<ul style="list-style-type: none"> <li>None. All facilities will be constructed within the existing FERC Project Boundary.</li> </ul>	<ul style="list-style-type: none"> <li>None. All facilities will be constructed within the existing FERC Project Boundary.</li> </ul>	<ul style="list-style-type: none"> <li>None. All facilities will be constructed within the existing FERC Project Boundary.</li> </ul>	<ul style="list-style-type: none"> <li>None. All facilities will be constructed within the existing FERC Project Boundary.</li> </ul>
<b>Long-term Operational Changes</b>	<ul style="list-style-type: none"> <li>The betterment is expected to change MFP operations in 75% of the years of operation as follows:</li> <li>In spill years operations of the crest gates would allow storage of an additional 9,750 ac-ft to 12,000 ac-ft (depending on configuration). The additional water will increase to total annual MFP generation and peaking generation.</li> <li>In non-spill years (except critical dry years) operation of the crest gate will allow some generation to be deferred from the reservoir fill period to the summer peak energy demand period.</li> <li>In years when additional storage occurs, the reservoirs maximum operating water surface elevation (WSE) will increase from 4,630 ft. to approximately 4,638 ft. or 4,640 ft. and the maximum reservoir inundation may be temporarily increased by up to 37 acres. The increased inundation area would occur along the entire reservoir shoreline but would be proportionally larger at the eastern end.</li> </ul>	<ul style="list-style-type: none"> <li>None.</li> </ul>	<ul style="list-style-type: none"> <li>None.</li> </ul>	<ul style="list-style-type: none"> <li>The crest gate will prevent backflow of water from the Hell Hole Reservoir to the South Fork Long Canyon Diversion through the Hell Hole - Middle Fork Tunnel when additional storage is captured at Hell Hole Reservoir.</li> </ul>
<b>Short-Term operational Changes</b>	<ul style="list-style-type: none"> <li>None. Construction will occur during the summer and fall after the reservoir surface has been lowered by normal operations.</li> </ul>	<ul style="list-style-type: none"> <li>None.</li> </ul>	<ul style="list-style-type: none"> <li>None.</li> </ul>	<ul style="list-style-type: none"> <li>None. Construction will occur during the summer and fall after the flows have declined and the diversion ceases to operate.</li> </ul>

Table SD C-2. Hell Hole Reservoir Seasonal Storage Increase Construction, Operation, and Maintenance Summary (continued).

Location	Hell Hole Dam	Hell Hole - Middle Fork Tunnel Gatehouse	French Meadows Powerhouse	South Fork Long Canyon Diversion
<b>Project Maintenance Changes</b>	<ul style="list-style-type: none"> <li>The spillway gate will be operated and inspected annually. This will occur after the Hell Hole Reservoir water surface has receded below the spillway elevation.</li> </ul>	<ul style="list-style-type: none"> <li>None.</li> </ul>	<ul style="list-style-type: none"> <li>None.</li> </ul>	<ul style="list-style-type: none"> <li>The crest gate will be operated and inspected annually. This will occur after water surface has receded below the spillway elevation.</li> </ul>
<b>Construction Activities</b>	<ul style="list-style-type: none"> <li>Install post-tensioned anchors through existing spillway into underlying bedrock.</li> <li>Install the spillway gate and abutment blocks on the existing spillway crest.</li> <li>For the 10 foot-high gate option, raise the dam crest shoulders to provide adequate freeboard against wave action by either building up the dam crest or constructing a parapet wall on each dam shoulder.</li> <li>Construct metal control building on slab foundation adjacent to the existing spillway.</li> <li>Install wood poles and communication and powerline to control building.</li> <li>Implement sediment and erosion control practices during construction to protect water quality.</li> <li>Employ best management practices to protect resources.</li> </ul>	<ul style="list-style-type: none"> <li>Construct the parapet wall on the reservoir side of the existing gatehouse.</li> <li>Implement sediment and erosion control practices during construction to protect water quality.</li> <li>Employ best management practices to protect resources.</li> </ul>	<ul style="list-style-type: none"> <li>Construct the parapet wall on the reservoir side of the existing generator deck at the French Meadows Powerhouse.</li> <li>Implement sediment and erosion control practices during construction to protect water quality.</li> <li>Employ best management practices to protect resources.</li> </ul>	<ul style="list-style-type: none"> <li>Install the crest gate on the existing spillway crest or check valve at the drop inlet. Installation will occur during low flow conditions and not required draw down of the diversion pool.</li> <li>Construct a generator building adjacent to the north end for the diversion dam (crest gates only).</li> <li>Implement sediment and erosion control practices during construction to protect water quality.</li> <li>Employ best management practices to protect resources.</li> </ul>
<b>Construction Schedule</b>	<ul style="list-style-type: none"> <li>The construction period is expected to be four months and would occur during the fall.</li> </ul>	<ul style="list-style-type: none"> <li>The construction period is expected to be one month and would occur during the snow free period.</li> </ul>	<ul style="list-style-type: none"> <li>The construction period is expected to be one month and would occur during the snow free period.</li> </ul>	<ul style="list-style-type: none"> <li>The construction period is expected to be four months and would occur during the fall.</li> </ul>
<b>Construction Access Roads</b>	<ul style="list-style-type: none"> <li>Construction equipment and materials will arrive at the site via Mosquito Ridge Road (FR 96), Ralston Ridge Road (FR 23 and 25), FR 2, the Hell Hole Dam and Powerline Road (Project road), and the southern spillway access point.</li> <li>Construct a temporary road from the dam crest to the spillway crest gates construction staging and work areas. This road would be constructed on the extended area of the dam spillway.</li> </ul>	<ul style="list-style-type: none"> <li>Construction equipment and materials will arrive at the project site via Mosquito Ridge Road (FR 96), Ralston Ridge Road (FR 23 and 25), FR 2, and the French Meadows Powerhouse Road (Project road).</li> </ul>	<ul style="list-style-type: none"> <li>Construction equipment and materials will arrive at the project site via Mosquito Ridge Road (FR 96), Ralston Ridge Road (FR 23 and 25), FR 2, and the French Meadows Powerhouse Road (Project road).</li> </ul>	<ul style="list-style-type: none"> <li>Construction equipment and materials will be transported to the site via Mosquito Ridge Road (FR 96) and Ralston Ridge Road (FR 23 and 25).</li> </ul>
<b>Construction Work and Staging Areas</b>	<ul style="list-style-type: none"> <li>The construction work area will include the existing dam spillway and dam crest and a small area on the north side of the spillway.</li> <li>Construction of new or modification of existing roads will not be required.</li> </ul>	<ul style="list-style-type: none"> <li>Construction staging will occur within the construction work area at the existing gatehouse.</li> <li>Construction of new or modification of existing roads will not be required.</li> </ul>	<ul style="list-style-type: none"> <li>None. All construction staging and work will occur within the enclosure of the French Meadows Powerhouse.</li> <li>Construction of new or modification of existing roads will not be required.</li> </ul>	<ul style="list-style-type: none"> <li>The existing parking area directly adjacent to the Diversion Dam will be used for construction staging and access to the construction site.</li> <li>Construction of new or modification of existing roads will not be required.</li> </ul>

Table SD C-2. Hell Hole Reservoir Seasonal Storage Increase Construction, Operation, and Maintenance Summary (continued).

Location	Hell Hole Dam	Hell Hole - Middle Fork Tunnel Gatehouse	French Meadows Powerhouse	South Fork Long Canyon Diversion
<b>Disposal Sites</b>	<ul style="list-style-type: none"> <li>None.</li> </ul>	<ul style="list-style-type: none"> <li>None.</li> </ul>	<ul style="list-style-type: none"> <li>None.</li> </ul>	<ul style="list-style-type: none"> <li>None.</li> </ul>
<b>Personnel Housing</b>	<ul style="list-style-type: none"> <li>Construction will be completed by a small construction crew. Temporary housing may be located at the Hell Hole Dormitory Facility.</li> </ul>	<ul style="list-style-type: none"> <li>Construction will be completed by a small construction crew. Temporary housing may be located at the Hell Hole Dormitory Facility.</li> </ul>	<ul style="list-style-type: none"> <li>Construction will be completed by a small construction crew. Temporary housing may be located at the Hell Hole Dormitory Facility.</li> </ul>	<ul style="list-style-type: none"> <li>Construction will be completed by a small construction crew. Temporary housing may be located at the Hell Hole Dormitory Facility.</li> </ul>
<b>Acres of Short-term Construction Related Habitat Loss</b>	<ul style="list-style-type: none"> <li>None. The construction staging and work areas will be located in areas already disturbed within the existing dam spillway and dam crest.</li> </ul>	<ul style="list-style-type: none"> <li>None. The construction staging and work areas will be located in areas already disturbed.</li> </ul>	<ul style="list-style-type: none"> <li>None.</li> </ul>	<ul style="list-style-type: none"> <li>Approximately 0.4 acres will be used for the construction staging and work area. An existing parking area, approximately 0.3 acres in area will be used for the construction staging area. The remaining 0.1 area will be temporarily disturbed and may include aquatic habitat if the check valve is installed.</li> </ul>
<b>Acres of Permanent Habitat Loss</b>	<ul style="list-style-type: none"> <li>Approximately 0.1 acres of terrestrial habitat will be occupied by the spillway control building.</li> <li>Approximately 37 acres will be temporarily inundated in years when additional storage is captured. The temporary inundation area will occur within the reservoir's existing maximum inundation area (inundation area during spill events).</li> <li>The 37 acres of temporary inundation area results from an increase of 8-10 feet in the maximum operating WSE of the reservoir.</li> </ul>	<ul style="list-style-type: none"> <li>None. The parapet wall will be constructed within the cleared area of the existing gatehouse.</li> </ul>	<ul style="list-style-type: none"> <li>None. The parapet wall will be constructed on the existing French Meadows Powerhouse deck.</li> </ul>	<ul style="list-style-type: none"> <li>Approximately 0.1 acres of terrestrial habitat will be occupied by the generator building.</li> <li>Operation of the crest gate would slightly increase the diversion pool inundation area.</li> </ul>

Table SD C- 3. French Meadows Powerhouse Capacity Upgrade Construction, Operation, and Maintenance Summary.

Location	French Meadows Reservoir	French Meadows Powerhouse	Middle Fork Powerhouse Upper Switchyard
<b>Modifications to Existing Project Facilities or New Project Facilities</b>	<p><b>Modifications to Existing Facilities</b></p> <ul style="list-style-type: none"> <li>May replace the existing trash rack on the French Meadows - Hell Hole Tunnel Intake with a trash rack of increased surface area to reduce head losses.</li> </ul> <p><b>New Facilities</b></p> <ul style="list-style-type: none"> <li>None.</li> </ul>	<p><b>Modifications to Existing Facilities</b></p> <ul style="list-style-type: none"> <li>Expand the existing switchyard and install additional buswork, transformers and electrical switching equipment.</li> </ul> <p><b>New Facilities</b></p> <ul style="list-style-type: none"> <li>Construct a second powerhouse which will include a Francis-type turbine and associated turbine generator, main transformer, control equipment, draft tube and discharge.</li> <li>Construct a second 6 foot-diameter steel penstock parallel to the existing French Meadows Powerhouse Penstock. The second penstock will be interconnected to the existing penstock at the French Meadows - Hell Hole Tunnel portal with a steel wye and include a butterfly valve.</li> <li>Construct facilities to provide tunnel surge capacity during operations. Facilities may include a surge shaft, a surge shaft and tank, or a surge pipeline as part of the French Meadows - Hell Hole Tunnel or a bypass valve in the new powerhouse. Further engineering studies will determine the facilities required.</li> <li>Construction of any facilities to provide survey capacity other than the bypass valve will require construction of a new approximately 0.25 mile long project road and upgrade of approximately 1 mile of Forest Road 12N09A for construction site access and future facility maintenance.</li> </ul>	<p><b>Modifications to Existing Facilities</b></p> <ul style="list-style-type: none"> <li>Upgrade the existing Middle Fork Powerhouse Upper Switchyard with additional buswork, transformers and switchgear.</li> </ul> <p><b>New Facilities</b></p> <ul style="list-style-type: none"> <li>None.</li> </ul>
<b>FERC Project Boundary Revision</b>	<ul style="list-style-type: none"> <li>None. The facilities will be located within the existing FERC Project Boundary.</li> </ul>	<ul style="list-style-type: none"> <li>All facilities will be located within the existing FERC Project Boundary except for a portion of the access road required for construction of the surge shaft/tank or surge pipeline options to provide tunnel surge capacity.</li> </ul>	<ul style="list-style-type: none"> <li>None. All facilities will be located within the existing FERC Project Boundary.</li> </ul>
<b>Long-term Operational Changes</b>	<ul style="list-style-type: none"> <li>Increased water volume and velocity will occur through the Middle Fork - Hell Hole Tunnel Intake and Tunnel when both French Meadows Powerhouses are operated at greater than approximately 50% capacity.</li> </ul>	<ul style="list-style-type: none"> <li>Water transfer from French Meadows Reservoir to Hell Hole Reservoir can be increased from approximately 400 cfs to a maximum of 800 cfs.</li> <li>Peaking energy generation will increase when both French Meadows Powerhouses are operated at approximately 50% capacity or greater during periods of peak energy demand.</li> <li></li> <li>During periods when either powerhouse is in standby or partial load operation the MFP will be able to offer electrical grid support services to the energy grid.</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>
<b>Short-term/Temporary Operational Changes</b>	<ul style="list-style-type: none"> <li>A short term outage of the French Meadows - Hell Hole Tunnel will be required during modification of the trash rack. Installation of the trash rack will occur during the late fall or early winter when the reservoir water surface elevation (WSE) is normally low. Construction will take place using a barge and divers.</li> </ul>	<ul style="list-style-type: none"> <li>Short term outage of the French Meadows - Hell Hole Tunnel and French Meadows Powerhouse will be required during cut-in of the second penstock and completion of tunnel surge facilities (if required).</li> </ul>	<ul style="list-style-type: none"> <li>Short term outage may be required during installation and testing of the upgraded equipment. This may temporarily effect operation of the French Meadows and Middle Fork Powerhouses.</li> </ul>
<b>Project Maintenance Changes</b>	<ul style="list-style-type: none"> <li>None.</li> </ul>	<ul style="list-style-type: none"> <li>The French Meadows Powerhouse additional generation unit and associated facilities will undergo annual inspection and maintenance including powerhouse inspection and testing.</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>

Table SD C- 3. French Meadows Powerhouse Capacity Upgrade Construction, Operation, and Maintenance Summary (continued).

Location	French Meadows Reservoir	French Meadows Powerhouse	Middle Fork Powerhouse Upper Switchyard
<b>Construction Activities</b>	<ul style="list-style-type: none"> <li>Remove the existing trash rack, modify the foundation and install the expanded trash rack using a support barge and divers.</li> <li>Implement sediment and erosion control practices during construction to protect water quality.</li> <li>Employ best management practices to protect resources.</li> </ul>	<ul style="list-style-type: none"> <li>Excavate and construct powerhouse foundation and discharge channel. Excavation will be accomplished by drilling and blasting. Spoils will be removed to the Hell Hole Staging Area for disposal.</li> <li>Construct penstock saddle and anchor blocks, and install the 6 ft. diameter penstock.</li> <li>Install a steel wye at the French Meadow - Hell Hole Tunnel Portal to interconnect the new penstock.</li> <li>If required, improve approximately 0.75 miles of the Hell Hole Off-Highway Vehicle (OHV) (FR 14NO9A) trail from FR 2.</li> <li>If required, construct an access road to the surge shaft and tank construction site from the Hell Hole (OHV) trail (FR 14NO9A).</li> <li>If required, construct the surge shaft by boring or drilling and blasting. Remove spoil material to the Hell Hole Staging Area for disposal.</li> <li>If required, construct foundation blocks and install surge pipeline.</li> <li>Construct the new switchyard adjacent to the existing French Meadows Powerhouse Switchyard.</li> <li>Remove snow from the Ralston Ridge Road (FR 23 and 25), FR 2, and the French Meadows Powerhouse Road (Project road) during the winter as needed.</li> <li>Implement sediment and erosion control practices during construction to protect water quality.</li> <li>Employ best management practices to protect resources.</li> </ul>	<ul style="list-style-type: none"> <li>As required, construct new foundations or modify existing equipment foundations and spill containment.</li> <li>Install upgraded transformers and switchgear.</li> </ul>
<b>Construction Schedule</b>	<ul style="list-style-type: none"> <li>The construction period is expected to be four to five months and would occur during the fall and early winter.</li> </ul>	<ul style="list-style-type: none"> <li>The construction period is expected to be 12-16 months and would utilize the snow free period to the maximum extent possible.</li> <li>Construction materials and equipment will be transported to the powerhouse and penstock sites via Ralston Ridge Road (FR 23 and 25), FR 2, French Meadow - Hell Hole Tunnel Portal Road (Project road), and the French Meadows Powerhouse Road (Project road).</li> <li>Construction materials and equipment will be transported to the surge tank site via the Hell Hole OHV trail (FR 14NO9A) from FR 2 and the new access road to the construction site.</li> <li>Temporary road closures or traffic control may occur on portions of the Mosquito Ridge Road, Ralston Ridge Road, FR 2, and the Hell Hole OHV trail (FR 14NO9A).</li> <li>Construction work areas will be established at the site of the new surge shaft and tank.</li> </ul>	<ul style="list-style-type: none"> <li>The construction period is expected to be two to three months and would occur during the summer and fall.</li> </ul>
<b>Construction Access Roads</b>	<ul style="list-style-type: none"> <li>Construction materials and equipment will be transported to the construction site via Mosquito Ridge Road (FR 96) and the French Meadows - Hell Hole Tunnel Gatehouse Road (Project road).</li> <li>A temporary road will be constructed on the reservoir bottom from the French Meadows - Hell Hole Tunnel Gatehouse area to a temporary construction staging area at the waters edge.</li> </ul>	<ul style="list-style-type: none"> <li>Construction materials and equipment will be transported to the construction site via Mosquito Ridge Road (FR 96), Ralston Ridge Road (FR 23 and 25), FR 2 and the French Meadows Powerhouse Road (Project road).</li> </ul>	<ul style="list-style-type: none"> <li>Construction materials and equipment will be transported to the switchyard construction site via Mosquito Ridge Road (FR 96) and the Middle Fork Interbay Dam and Powerhouse Road (Project road).</li> </ul>

Table SD C- 3. French Meadows Powerhouse Capacity Upgrade Construction, Operation, and Maintenance Summary (continued).

Location	French Meadows Reservoir	French Meadows Powerhouse	Middle Fork Powerhouse Upper Switchyard
<b>Construction Work and Staging Areas</b>	<ul style="list-style-type: none"> <li>An existing cleared area adjacent to the French Meadows - Hell Hole Tunnel Gatehouse will be used for construction staging.</li> </ul>	<ul style="list-style-type: none"> <li>Temporary construction staging and work areas will be established off of FR 14N09A above the existing French Meadows-Hell Hole Tunnel Portal if surge facilities are required.</li> <li>Temporary construction staging and work area will be established at the intersection of FR2 and Forest Road 14N09A.</li> <li>Temporary construction staging areas will be established adjacent to the existing French Meadows-Hell Hole Tunnel Portal.</li> <li>A construction staging area will be established on the shoulder of the French Meadows - Hell Hole Tunnel Portal Road near the tunnel portal.</li> <li>A temporary construction work area will be established parallel to the existing penstock for construction of the new second penstock.</li> <li>Temporary construction staging and work areas will be established adjacent to the existing French Meadows Powerhouse and along the French Meadows Powerhouse Road.</li> <li>A construction staging area will be established on the shoulders of the French Meadow Powerhouse Road near the powerhouse.</li> </ul>	<ul style="list-style-type: none"> <li>Construction staging and work will occur within the existing Middle Fork Powerhouse Upper Switchyard.</li> </ul>
<b>Disposal Sites</b>	<ul style="list-style-type: none"> <li>None.</li> </ul>	<ul style="list-style-type: none"> <li>Disposal of excavated materials will occur at the Hell Hole Staging Area near the dormitory.</li> </ul>	<ul style="list-style-type: none"> <li>None.</li> </ul>
<b>Personnel Housing</b>	<ul style="list-style-type: none"> <li>Temporary housing for the construction crew will be located at French Meadows administrative site or the Hell Hole Dormitory Facility.</li> </ul>	<ul style="list-style-type: none"> <li>Construction personnel will either be housed in a temporary work camp to be established adjacent to the Dormitory Facility or a temporary work camp established at the administrative site at French Meadows.</li> </ul>	<ul style="list-style-type: none"> <li>Construction personnel will be housed in Foresthill or Auburn and travel to the construction site.</li> </ul>
<b>Acres of Short-term/Temporary Habitat Loss</b>	<ul style="list-style-type: none"> <li>None. The construction staging area will be located in an existing cleared area adjacent to the French Meadows - Hell Hole Tunnel Gatehouse.</li> </ul>	<ul style="list-style-type: none"> <li>Approximately 0.66 acres at the surge shaft and tank construction work area.</li> <li>Approximately 0.25 acres at the intersection of FR2 and Forest Road 14N09A.</li> <li>Approximately 1.1 acres at the penstock construction work area.</li> <li>Approximately 0.2 acres at the French Meadows - Hell Hole Portal Road construction staging area.</li> <li>Approximately 0.8 acres at the French Meadows Powerhouse construction work area.</li> </ul>	<ul style="list-style-type: none"> <li>None.</li> </ul>
<b>Acres of Permanent Habitat Loss</b>	<ul style="list-style-type: none"> <li>Minimal. A small amount of benthic habitat will be lost at the new trash rack foundation.</li> </ul>	<ul style="list-style-type: none"> <li>Approximately 1 .0 acres along Forest Road 14N09A.</li> <li>Approximately 0.8 acres at the French Meadows Powerhouse Road construction staging area.</li> <li>Approximately 0.15 acres would be occupied by the pump storage powerhouse.</li> <li>Approximately 0.2 acres would be occupied by the new penstock.</li> <li>Approximately 0.3 acres would be converted to permanent road.</li> <li>Approximately 0.2 acres would be occupied by the new French Meadows Powerhouse Switchyard.</li> </ul>	<ul style="list-style-type: none"> <li>None.</li> </ul>



**Table SD C-4. Ralston Powerhouse Capacity Upgrade Construction, Operation, and Maintenance Summary.**

Location	Ralston Powerhouse
<b>Modifications to Existing Project Facilities or New Project Facilities</b>	<p><b>Modifications to Existing Facilities</b></p> <ul style="list-style-type: none"> <li>Mechanical and electrical systems within the existing powerhouse would be upgraded.</li> </ul> <p><b>New Facilities</b></p> <ul style="list-style-type: none"> <li>None.</li> </ul>
<b>FERC Project Boundary Revision</b>	<ul style="list-style-type: none"> <li>None. The proposed facility upgrade is within the current FERC Project Boundary.</li> </ul>
<b>Long-term/Operational Changes</b>	<ul style="list-style-type: none"> <li>Increased peak generating capacity during simultaneous operation of Middle Fork and Ralston Powerhouses.</li> </ul>
<b>Short-term Temporary Operational Changes</b>	<ul style="list-style-type: none"> <li>The Ralston Powerhouse will be temporarily taken out of service during the upgrade.</li> <li>If operation of the Middle Fork Powerhouse occurs during the Ralston Powerhouse construction outage, water released would flow to Ralston Afterbay, either through the Middle Fork - Ralston Tunnel and Ralston Powerhouse Bypass or the Middle Fork American River.</li> </ul>
<b>Project Maintenance Changes</b>	<ul style="list-style-type: none"> <li>None.</li> </ul>
<b>Construction Activities</b>	<ul style="list-style-type: none"> <li>Modify and/or replace existing equipment within the existing powerhouse.</li> </ul>
<b>Construction Schedule</b>	<ul style="list-style-type: none"> <li>The construction period is expected to be 4 - 6 months beginning in late summer.</li> </ul>
<b>Construction Access Roads</b>	<ul style="list-style-type: none"> <li>Construction materials and equipment will be transported to the site using Mosquito Ridge Road (FR 96) and Ralston Ridge Road (FR 23).</li> </ul>
<b>Construction Work and Staging Areas</b>	<ul style="list-style-type: none"> <li>The construction work area will be limited to the area within the existing Ralston Powerhouse enclosure.</li> <li>A construction staging area will be established on the shoulder of Ralston Ridge Road immediately adjacent to the existing Ralston Powerhouse enclosure.</li> </ul>
<b>Disposal Sites</b>	<ul style="list-style-type: none"> <li>No disposal site is required. Equipment and material removed from the powerhouse will be disposed off-site.</li> </ul>
<b>Personnel Housing</b>	<ul style="list-style-type: none"> <li>Construction will be completed by a small work crew. Construction personnel are expected to travel daily to the project site from Foresthill, Auburn, and other nearby communities.</li> </ul>
<b>Acres of Short-term Temporary Habitat Loss</b>	<ul style="list-style-type: none"> <li>No terrestrial or aquatic habitat will be lost during construction.</li> <li>The construction work area is within the existing Ralston Powerhouse enclosure.</li> <li>The construction staging area, located on the shoulder of the Ralston Ridge Road is already disturbed.</li> </ul>
<b>Acres of Permanent Habitat Loss</b>	<ul style="list-style-type: none"> <li>None. The proposed facility upgrade is within the existing powerhouse.</li> </ul>

**FIGURES**

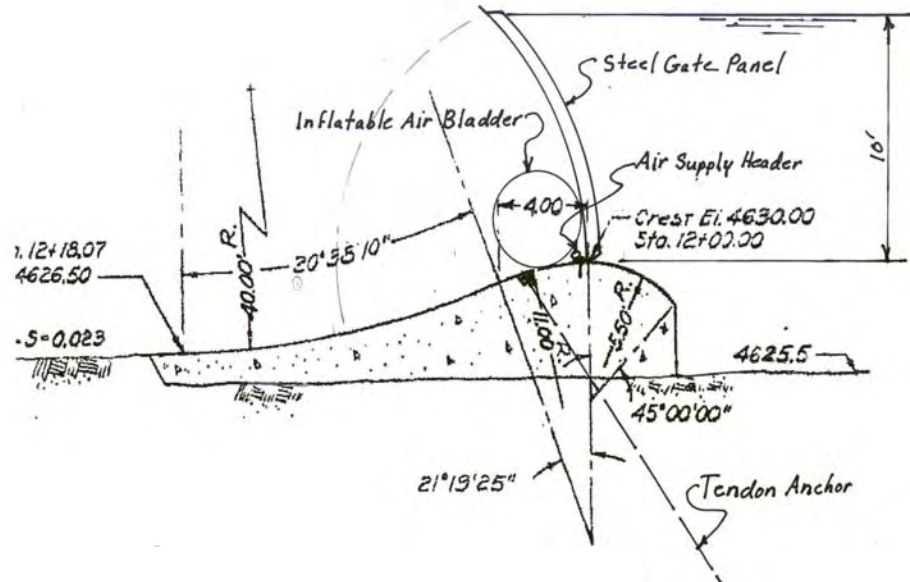


Figure SD C-1. Proposed Spillway Crest Gates - Schematic



Figure SD C-2. Proposed Spillway Crest Gates - Example

**MAPS**