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IRRIGATION TRAINING & RESEARCH CENTER

Flathead Indian Irrigation Project

Lower J and Revais Canal Modernization

U.S. Bureau of Indian Affairs
Branch of Irrigation & Power

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LOWER J AND REVAIS CANAL MODERNIZATION

Overall Existing Conditions and Operation

Figure 1 shows the existing layout of the Lower J, Revais, and Revais Pump Canals. The existing operations of the three canal systems are as follows:

- Up to 35 CFS is diverted from the Jocko River into the Lower J Canal.
- Water in the Lower J Canal services multiple adjacent fields before it is pumped via the Revais Pump (100 HP single speed pump) approximately 70 ft. in elevation to help supplement the Revais Pump Canal.
- Excess flow in the Lower J Canal is spilled back to the river via a waste structure just upstream of the pump station.
- Up to 15 CFS is also diverted into the Revais Canal from Revais Creek during the early part of the irrigation season. By the beginning of July the diverted flow rate into the Revais Canal has significantly decreased and by August is almost non-existent.
- The Revais Canal supplies water to adjacent fields before spilling into the Revais Pump Canal.
- During the late part of the irrigation season, the current Revais Pump cannot meet the full irrigation demand for the water users on the Revais Pump Canal.
- Excess flows at the Revais Pump Canal spill to the Jocko River.

It appears that not much attention is given to the Lower J and Revais Canal systems by FIIP personnel. Apparently the ISO assigned to the area only spends about one or two hours per week managing the canal systems.

Since there is plenty of water in the Jocko River, the Lower J Canal operates as a flow-through system because the spill in the canal returns to the river. It is assumed that in the future, releases to the Jocko River will decrease and therefore less flow will be available. FIIP will want to have better control of the three canal systems without having to devote more time to management of the systems.

Figure 2 shows the conceptual modernization changes to the Lower J, Revais, and Revais Pump Canals.

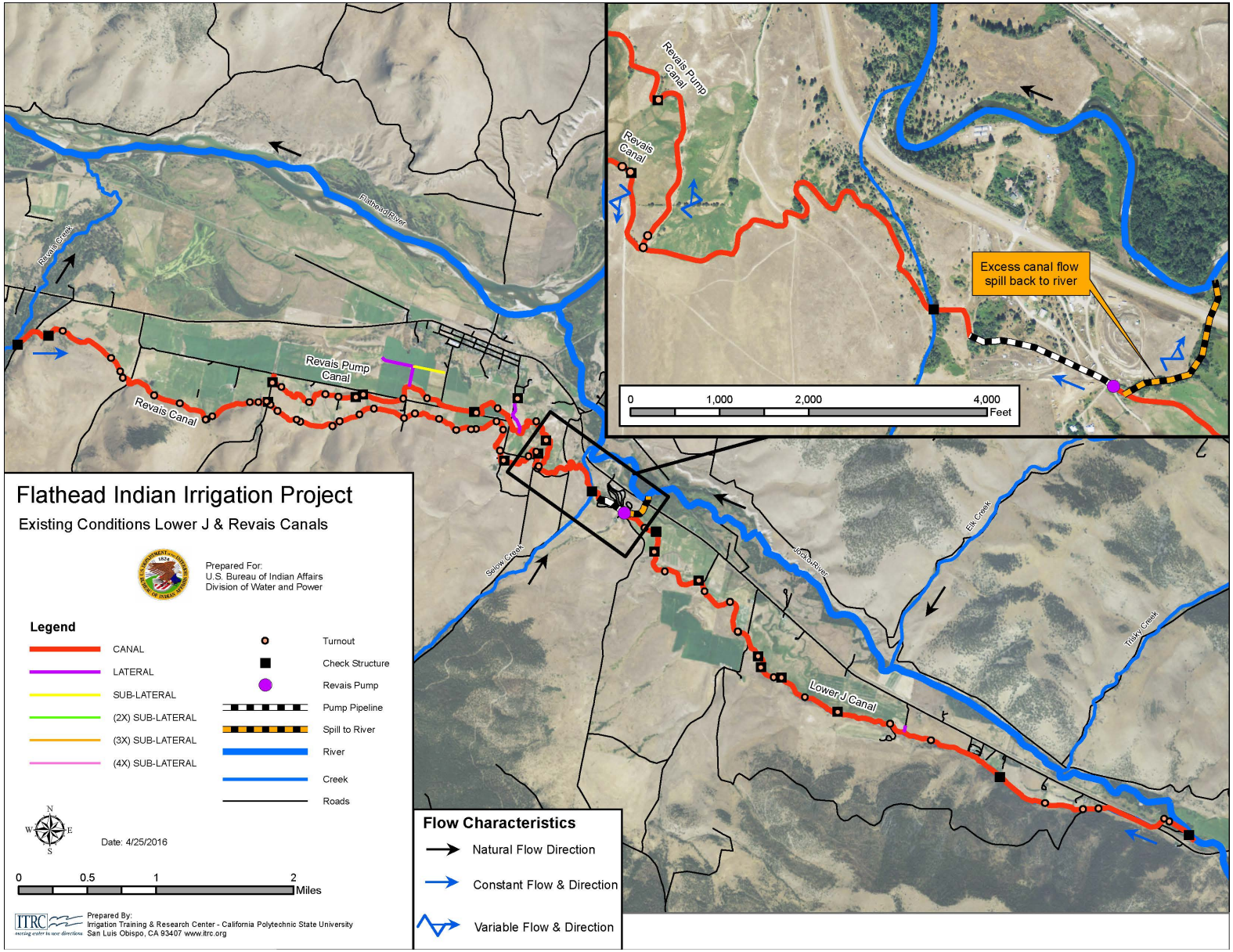

Figure 1. Existing layout and control of the Lower J and Revais Canals

Overall Modernization Changes

The modernization changes to the Lower J, Revais, and Revais Pump canals will focus on:

- Better flow measurement
- Increasing the pump flow to better meet the irrigation demands on the Revais Pump Canal
- Improving water level control to provide better service to farmers
- Easing management and operations for FIIP personnel

Figure 2 shows the overall conceptual modernization changes made to the Lower J and Revais Canals. The modernization changes include:

1. Improved flow measurement will be provided at the head of the Lower J Canal.
2. Multiple changes will be made to the Revais Canal:
    a. A new automatic trash screen will be installed upstream of the pumping plant.
    b. The existing Revais Pump will be replaced with a new pump to increase the supplemental flow to the Revais Pump Canal from 10.5 CFS to 15 CFS.
    c. A new flow measurement flume will be constructed downstream of the pump discharge.
3. The existing check structures along the three main canals will be modified/replaced with long-crested weirs (LCW) for improved water level control.
4. SCADA will be incorporated to remotely monitor:
    a. Key flow rates and water levels
    b. The Revais Pump characteristics

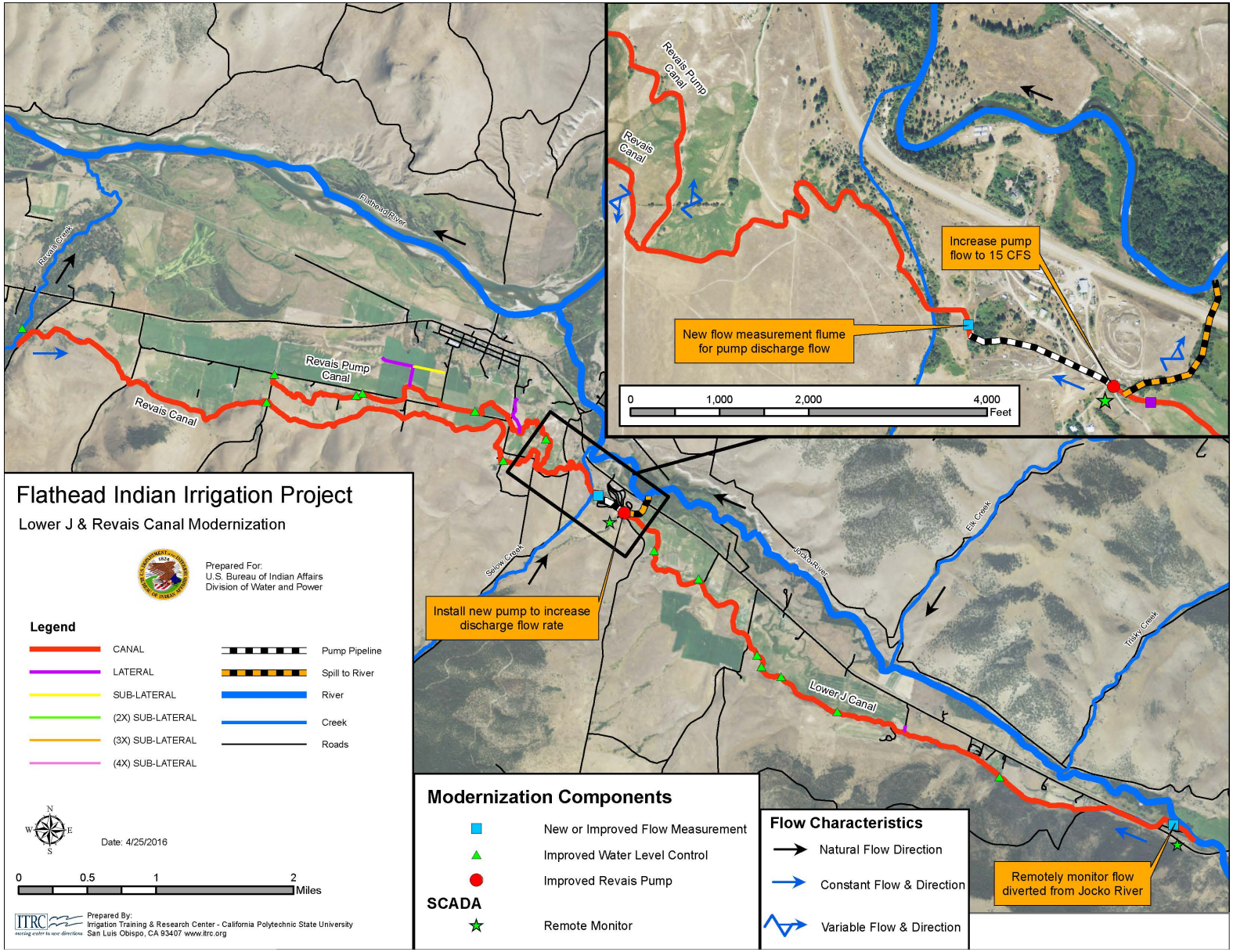

Figure 2. Conceptual modernization changes for the Lower J, Revais, and Revais Pump Canals

Head of the Lower J Canal

Figure 3 shows the existing conditions at the Lower J Canal diversion on the Jocko River.

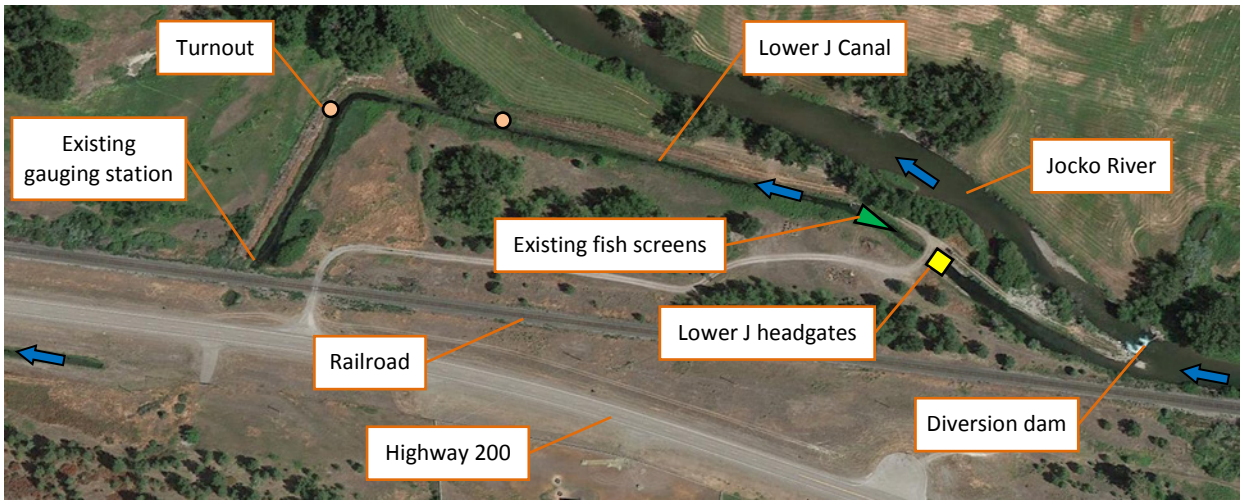

Figure 3. Existing conditions at the Lower J Canal diversion on the Jocko River

An existing diversion dam (see Figure 4) raises the upstream water level in the Jocko River for water to reach the Lower J Canal headgate (see Figure 5). A small bypass gate that is in poor condition is located next to the canal headgate.

Figure 4. Existing diversion dam on the Jocko River for the Lower J Canal

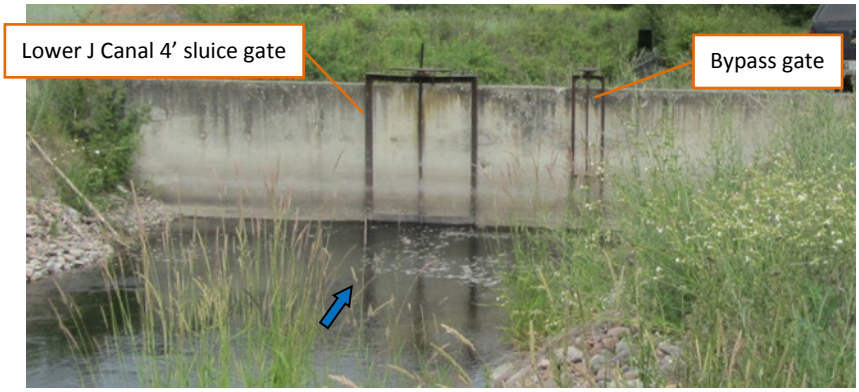

Figure 5. Lower J Canal headgate. It is unknown what the small gate is used for.

An open concrete box is located immediately downstream of the Lower J Canal headgate. Water then enters a 5 ft. wide by 3.5 ft. tall arched corrugated metal pipeline, which discharges into the canal.

Figure 6. Open concrete box directly downstream of the Lower J Canal headgate wall. Photo from HKM 2008 report (HG-8).

An existing fish screen (see Figure 7) is located approximately 100 ft. downstream of the canal headgate.

Figure 7. Existing fish screen in the Lower J Canal located approximately 100' downstream of the canal headgates. Photo from HKM 2008 report (MSC-17).

A gauging station for flow measurement is located near the railroad and highway crossings. Based on historical flow data provided from the tribes, the maximum flow rate diverted into the Lower J Canal is approximately 35 CFS.

Two individual farmer turnouts are located between the existing fish screen and the gauging station.

Improved Flow Measurement at Head of Lower J Canal

The improvements made at the head of the Lower J Canal will focus on improved flow measurement options. Short-term and long-term flow measurement options are presented.

Short-Term Option

The short-term, immediate option would be to use the existing sluice gate characteristics to measure the flow rate. The field measurements are then compared to a table that relates the headloss and gate opening to the flow rate. The measurements are made by:

1. Determining the headloss across the canal headgate by measuring down from the existing concrete headwall to:
    a. The upstream water surface in the river
    b. The downstream water surface in the existing open concrete box
2. Measuring the net opening height of the sluice gate. This assumes that the true "zero" point of the gate is known. See Appendix A for further information about determining the "zero" point of a gate.

Long-Term Option

The long-term option would be to construct a permanent flow measurement structure downstream of the canal headgate. Figure 8 shows the approximate location for a new flow measurement structure in the Lower J Canal. The changes would include:

1. A new flow measurement structure such as a flow measurement flume or Cipoletti weir will be constructed approximately 250 ft. downstream of the existing fish screen. The type of structure will depend on:
    a. The available headloss across the existing canal headgate and fish screen
    b. The amount of sediment that enters the canal
2. The flow rate through the new flow measurement structure will be remotely monitored via SCADA.

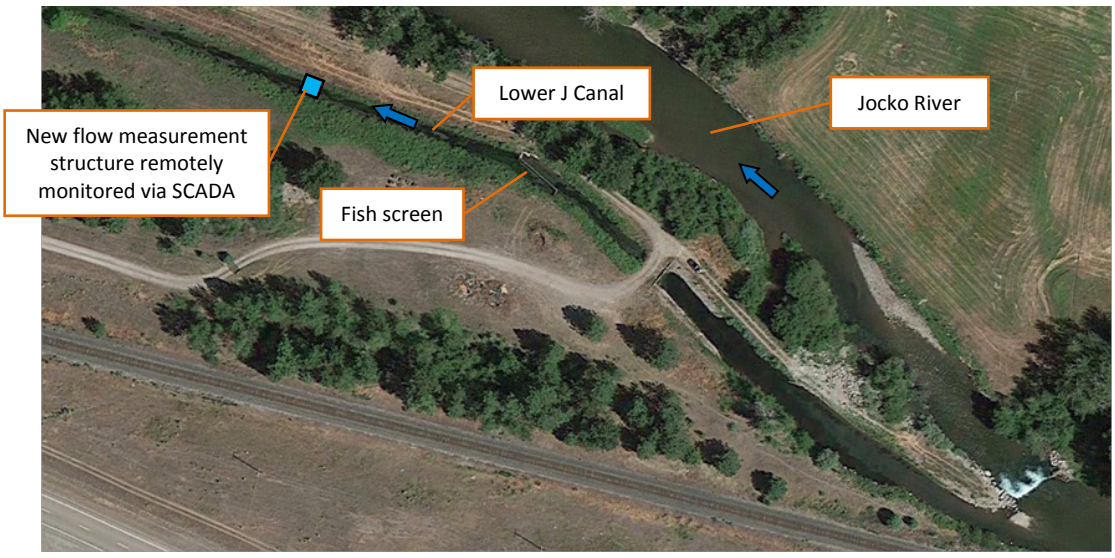

Figure 8. Improvements at head of Lower J Canal

Revais Pump Improvements

Figure 9 shows an aerial image showing the existing Revais Pump System.

Figure 9. Aerial view of the existing Revais Pump System

After Revais Creek flows are depleted in mid-summer, approximately 800 acres on the Revais Canal System (or also known as the Dixon Bench) must be supplied from Lower J Canal. A maximum of 10.5 CFS is pumped from the Lower J Canal up to the Revais Pump Canal. The pump is operated only when the water supply from Revais Creek is less than the irrigation demand. Figure 10 shows the existing components of the Revais Pump.

Figure 10. Revais Pump House (top left), Revais Pump (top right), three stage pump impellers (bottom left), and downstream of the pump discharge pipeline into the Revais Pump Canal (bottom right). Two bottom photos from HKM 2008 report.

The characteristics of the existing Revais Pump are:

- 100 HP motor (3 phase) vertical induction motor
- Three identical 12" impellers in series
- Maximum 10.5 CFS discharge flow
- 18" discharge pipeline (1,250 ft. long)
- 78 ft. of vertical lift (from the BIA Operation And Maintenance Guidelines Manual)

Any excess flow in the Lower J Canal spills over an 11.5 ft. weir structure (see Figure 11). The spill structure also maintains the water level for a single turnout located approximately 900 ft. upstream. The excess flow then passes through two 24" diameter culverts (see Figure 12) before discharging to an existing wash that leads back to the Jocko River.

Figure 11. Existing Lower J Canal spill structure just upstream of Revais Pump

Figure 12. New propeller meters to be installed in Lower J Canal spill culvert pipes. Photo from HKM 2008 report.

Modernization Changes

During a site visit to FIIP in April 2016, farmers expressed their concerns that the current Revais Pump cannot supplement enough water to meet the full irrigation demand to the water users on the Revais Pump Canal. It is believed that another 5-10 CFS is needed to satisfy the water users.

Figure 13 shows the modernization changes to the Revais Pump System, which include:

1. An automatic trash screen will be installed in the Lower J Canal approximately 50 ft. upstream of the Revais Pump to capture debris and trash.
2. The existing Revais Pump will be replaced with a new pump in order to increase the flow rate capacity supplied to the downstream Pump Canal. The new Revais Pump will have the following approximate characteristics:
    a. 15 CFS
    b. 89 ft. TDH
    c. 205 Input HP to motor
    d. Inverter duty premium motor
    e. VFD controller used for slow start option, even if not used for control
    f. It is assumed that the existing 18" diameter discharge pipeline will be utilized. This increases the pump output power but prevents a whole new discharge pipe from needing to be installed. Otherwise a 24" diameter pipeline would be needed.
3. A new flow measurement flume will be installed approximately 50 ft. downstream of the terminus of the pump discharge pipeline.
4. The pump discharge flow through the flume as well as other pump characteristics will be remotely monitored via SCADA.

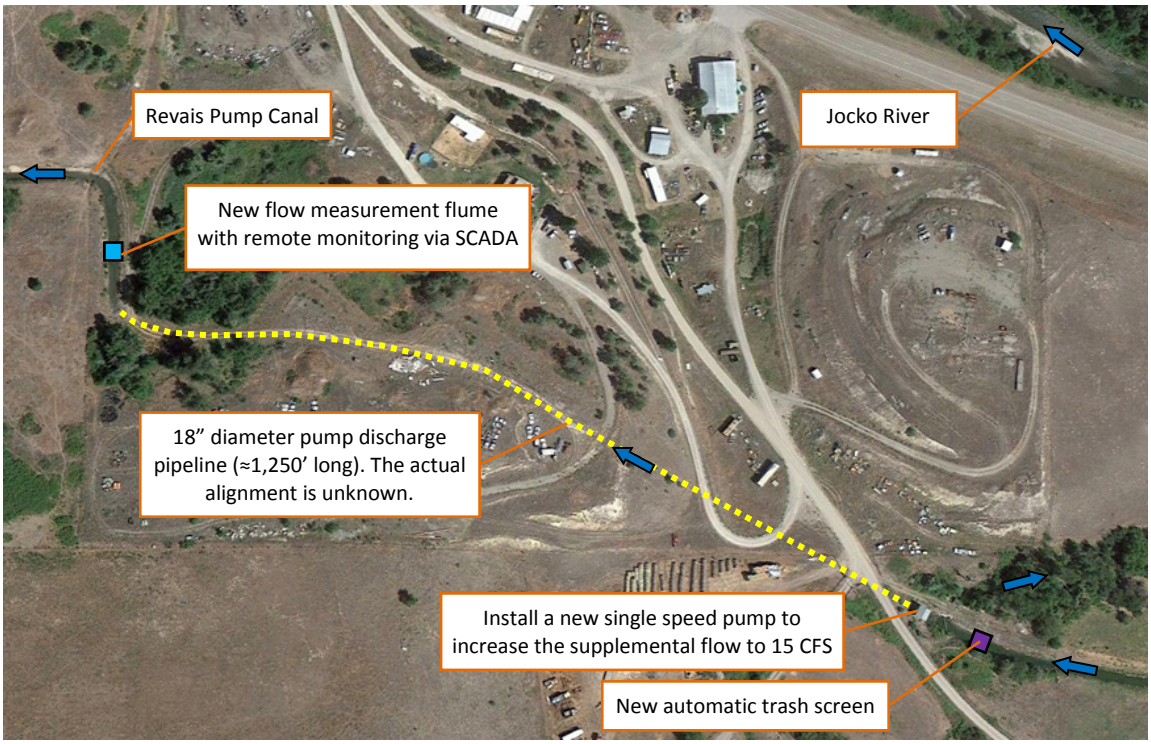

Figure 13. Modernization changes near the Revais Pump

Improved Water Level Control

Figure 2 indicated approximate locations for possible improved water level control. Though a very low priority, improving the water level control along the Lower J, Revais, and Revais Pump Canals would:

- Provide better service to the farmers
- Ease management for operators

The existing check structures would be replaced with new long-crested weirs (LCWs) similar to the one shown in Figure 14.

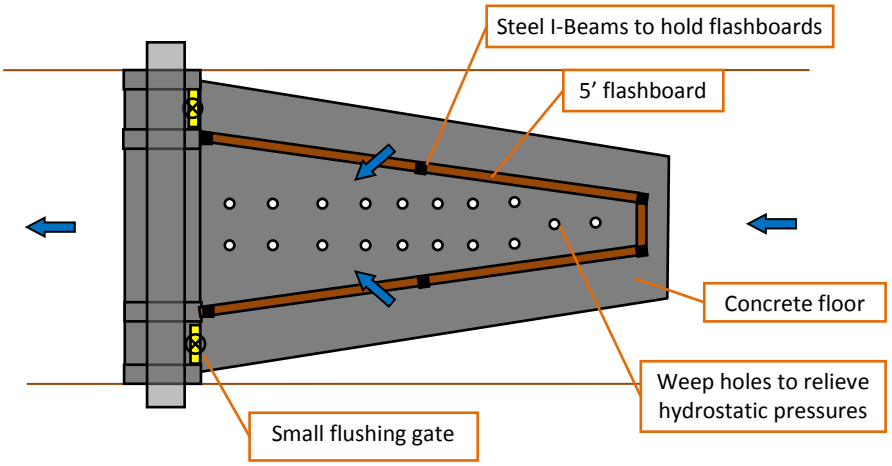

Figure 14. Example of new LCW structure (not to scale)