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**TITLE PAGE**

**SANTIAM WATER CONTROL DISTRICT**

**APPLICATION**

**FOR**

**U.S. BUREAU OF RECLAMATION  
2015 WATER AND ENERGY  
EFFICIENCY GRANT**

**Funding Group I  
JANUARY 23, 2015**

**IRRIGATION SYSTEM SCADA AUTOMATION and WATER MEASUREMENT  
IMPROVEMENT PROJECT.**



Santiam Water Control District  
284 E. Water St.  
Stayton, OR 97317

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## Technical Proposal and Evaluation Criteria

### *Executive Summary*

The following is the pertinent information regarding the Applicant:

Date of Application:	January 23, 2015
Name of Applicant:	Santiam Water Control District
City/County:	Stayton, Marion County
State:	Oregon

#### Address and Contact Information:

SANTIAM WATER CONTROL DISTRICT  
284 East Water Street  
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Our project intends to leverage District resources and our long list of supporting entities with the Water Smart Grant funding to automate numerous manual control gates at diversion structures and within the canal system, including automation of the district small hydropower plant. The improvements will include new and improved water measurement capabilities. Remote control gate operation along with remote sensing capability will provide precise system wide management and monitoring for flow control. The project goal is to achieve sustainable water savings, improved management of resources through conveyance improvements (compliance with Section III Eligible Projects - Irrigation Flow Measurement and SCADA and Automation) that will:

- Install automated gates and measurement structures to meter diversion flows and maintain constant levels in district canals and reduce operational spills related to reservoir operations and river fluctuations.
- Operators should be able to quickly and remotely shut off flows into the Main Canal, Salem, Mix and the Butler Ditches if there is a toxic spill in Stayton.
- The existing hydro plant at Site H has frequent shutoff events (approximately 40 per year) due to fluctuations in the quality of power in the grid. The SWCD staff needs to know when this happens, and to have an automatic re-start when the power quality improves. There are also numerous other electro-mechanical sensors/switches (vibration, speeds, etc.) at the hydro plant – any one of which can cause the power plant to shut down. When that happens, staff currently has no way to identify the cause. Automate the districts small hydropower plant to improve operation and energy output.
- Install solar power to operate some gates and SCADA system (renewable energy) to eliminate extension of electrical service and demands on electrical system (carbon neutral installation).

Project will be completed on the District owned facilities in two years with an estimated

*Irrigation Training & Research Center*

completion date of September 30, 2017.

## **BACKGROUND DATA**

The Santiam Water Control District (the "District" or "SWCD") is a municipal corporation formed and acting pursuant to Oregon Revised Statute Chapter 553. The District was formed to assume ownership, operation and management of various facilities constructed and used for the delivery of irrigation water to over 17,000 acres of agricultural land west and northwest of the City of Stayton and to portions of Aumsville, Turner and southeast Salem, Oregon. The Boundaries of the District encompass a total of 31,000 acres Figure 1: Santiam Water Control District Boundary. The multiple purpose District also supplies water for several additional uses including pond and wildlife, fire protection, and domestic delivery to the City of Stayton water treatment plant. The crops grown within the District vary from year to year, mainly dependent on cannery contracts, but typical crops include green beans, grass seed, corn, mint and pasture. The District's source of Water is a combination of live flow from the North Santiam River, which is a tributary of the Willamette River and stored water from the Bureau of Reclamation Detroit reservoir system Figure 2: Detroit Dam North Santiam River Watershed. Water rights are diverted into a network of 114 miles of earthen ditches and canals using two diversions, to the Salem Ditch and the Stayton Ditch (Power Canal) with head gates that are manually operated. The District's main diversion facility has a capacity to divert 1050 cubic feet per second of water and had new fish screens constructed in 2004 at a cost of \$1.8 million dollars. The District's normal diversion rates total 53,000 AF for the irrigation of 17,000 acres and 236,000 AF for hydropower generation, but can divert up to 739,000 additional Acre Feet for future power generation. The City of Stayton has grown, utilizing the canal system as a stormwater conveyance system this has been a problem in the past but recent agreements have presenting an opportunity to utilize the stormflows to replace diverted streamflows through automation of the system. The diversion measurement facilities comply with the law, although measurement capabilities downstream of the Point of Diversion are severely lacking and provide little information or accountability. Much of the delivery system, water control and measurement structures are still utilizing the same technology as when constructed dating back to 1909. While most structures have been rebuilt, it has been normal practice for the District to just replace what already existed rather than investigating or installing new technologies. There is a local societal belief that the Willamette river system has an abundance of water, this believe is a difficult barrier to overcome even though many ecological plans and fisheries experts concur that low flows are an issue. This barrier means flow and efficiency projects are typically underfunded and underrated.

Location maps: Santiam Water Control District within the North Santiam River Basin;

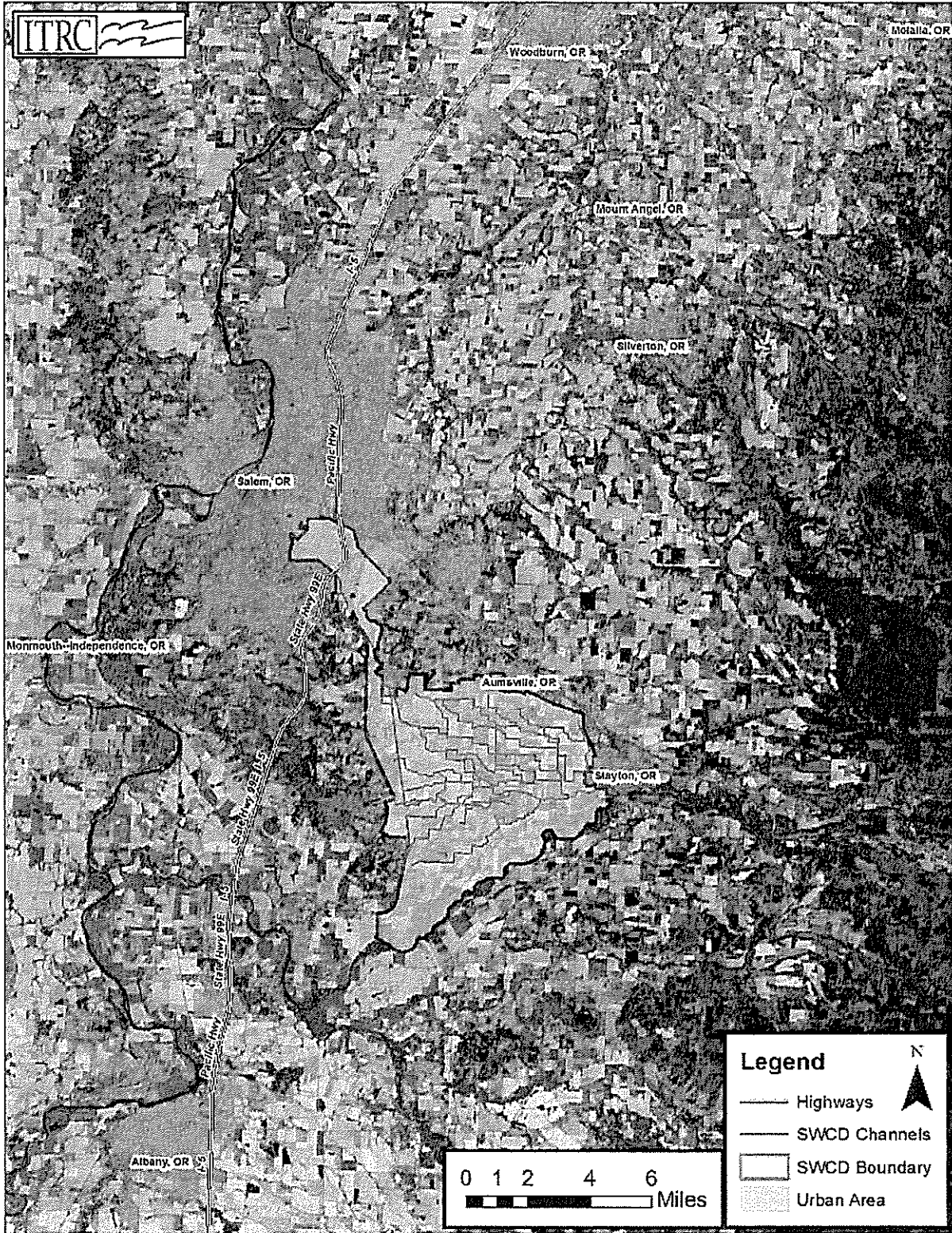


Figure 1: Santiam Water Control District Boundary

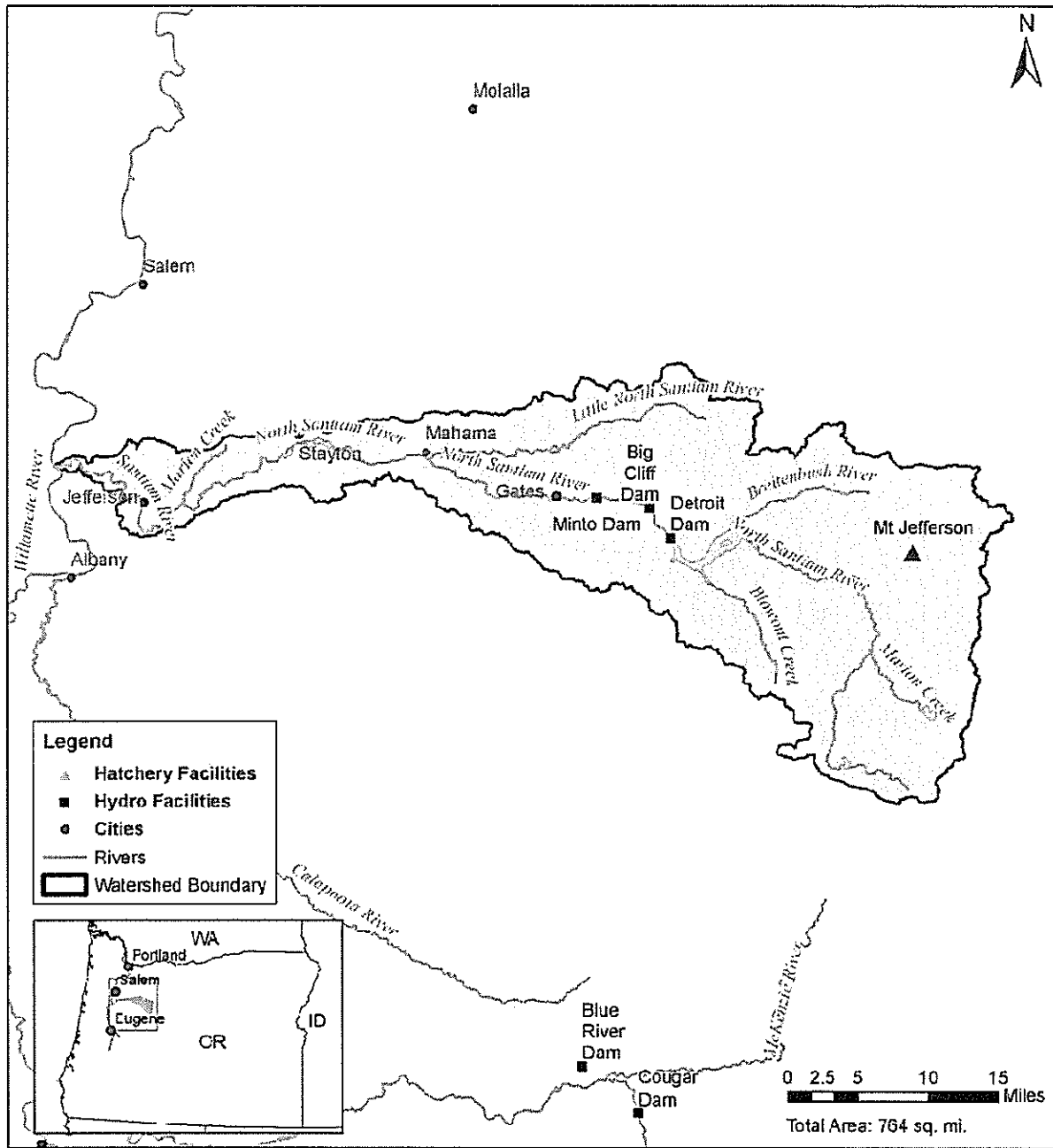


Figure 2: Detroit Dam North Santiam River Watershed

In addition to its constructed canals the District also utilizes several downstream creeks and streams as conveyance by feeding North Santiam River water rights into them. These waterways include McKinney, Porter, Perrin, Marion, and Mill, the latter two being on the water quality limited 303D list for temperature issues. The water delivered to these streams is considered a separate source of water feeding specific lands; any additional water over the amount needed to serve these specific lands would be considered administrative spills. The connection to local streams provides a pathway for the District's canals to serve as drainage pathways during the winter months providing a secondary benefit to the encompassed lands.

The District completed a water conservation plan in 2007. It is the last comprehensive look at system demographics water usage and crop data. Our 2007 water conservation plan estimates the average administrative spills at 9% the district is currently in the process of updating our plan but have had our engineers AMEC Foster Wheeler (AMEC) generate an independent report Project No. 1-61M-123510 titled "Flow Reduction from Headgate Automation of Salem Ditch and Stayton (Power) Canal October 17, 2014" attached as exhibit A

In 2014 The District received a small state NRCS grant to implement phase 1 of the automation project. By design, Phase 1 is expected to function as:

- An introductory system. Providing a "soft" transition and a familiarization period for district personnel, the board of directors and other stakeholders that have proven successful in the past.
- The foundation of a future, expanded SCADA system. The system will be designed to accept several additional, future SCADA sites (Phase 2).

The District has hired Irrigation and Training & Research Center Cal-Poly to design the SCADA, Measurement and gate automation components additionally they will prepare a detailed SCADA plan for use by a Contracted System Integrator.

## TECHNICAL PROJECT DESCRIPTION

Supervisory Control and Data Acquisition (SCADA) is a valuable tool that has the potential to improve many aspects of water management. The proposed SCADA system will integrate specific combinations of hardware and software to provide remotely accessed, real-time monitoring and control of a key point in the SWCD system, as well as some local automatic control capabilities. It is expected that this implementation will enhance SWCD's capacity for water management by:

*Improving diversion flow control and service reliability* – A control algorithm will automatically adjust the position of an existing sluice gate to maintain a relatively constant target flow rate into the district.

*Increased flexibility* – Remote control enables district operators to react instantly to changing field conditions.

*Increased operational safety* – Integrated alarming systems can automatically notify district operators of issues before they become problems.

*Increased work efficiency* – Less time will be devoted to monitoring field visits so that district staff can focus on other tasks.

*Enhanced data analytics* – Historical records and trending promote better-informed management decisions and modernization prioritization.



*moving water in new directions*

**IRRIGATION TRAINING & RESEARCH CENTER**

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Date: January 21, 2015

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## **Santiam Water Control District SCADA System Outline**

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### ***Preface***

*The scope of work and project cost estimates provided in this document assumes SWCD will elect to contract with Sierra Controls or another company of equal abilities and experience for the integration services.*

### ***Background***

Santiam Water Control District (SWCD) manages surface water for a variety of purposes including agricultural irrigation deliveries, industrial demands and urban storm water drainage near the city of Stayton, OR. As part of a long-term strategic plan, SWCD has contracted with the Irrigation Training and Research Center (ITRC), seeking to enhance its operational capabilities through the commissioning of a Supervisory Control and Data Acquisition (SCADA) system.

SCADA can be described as specific combinations of hardware and software at canal structures and an office base station that facilitate remote monitoring and/or control from a distance. In some cases this may also include automatic control, among numerous other capabilities (e.g., automatic alarming notification systems). SCADA is a practical investment for more complex systems that may:

- Currently require constant operator intervention or intensive management
- Include numerous, manually controlled and distant sites
- Present risk to public safety
- Have few available, simpler alternatives for modernization

It is anticipated that the SCADA system will address the following SWCD operational concerns:

- It is important to reduce flows into the Salem Ditch during periods of rainfall, because the city's storm water enters the Salem Ditch and can flood out the downstream sections of the Salem Ditch. However, it is also important to maintain a 30 CFS flow to the NorPak processing plant, which is located upstream of Site 5 within the city limits of Stayton.
- The district needs to begin a good program of documenting flows and water quality (primarily temperature) at the inlets and outlets to the district. This will require monitoring and archiving of flow and water quality data.
- It is desirable to be able to maintain a constant flow rate into the district, even though the Santiam River levels vary over time.
- Within the canal system, there are some key points that are difficult to control. It would

be good to have better flow rate and water level control at those points.

- Operators should be able to quickly and remotely shut off flows into the Main Canal, Mix Ditch and the Butler Ditch if there is a toxic spill in Stayton.
- The existing hydro plant at Site H has frequent shutoff events (approximately 40 per year) due to fluctuations in the quality of power in the grid. The SWCD staff needs to know when this happens, and to have an automatic re-start when the power quality improves. There are also numerous other electro-mechanical sensors/switches (vibration, speeds, etc.) at the hydro plant – any one of which can cause the power plant to shut down. When that happens, staff currently has no way to identify the cause.

**Phase 1**

In cooperation with SWCD, ITRC is currently working on the first phase of the SWCD SCADA system. *Phase 1* includes four remote monitoring sites, automation of the Power/Stayton Canal Diversion site, and the commissioning of an office base station.

By design, *Phase 1* is expected to function as:

- An introductory system. Providing a “soft” transition and a familiarization period for district personnel, the board of directors and other stakeholders has proven successful in the past.
- The foundation of a future, expanded SCADA system. The system will be designed to accept several additional, future SCADA sites (*Phase 2*).

The sites, general functions and descriptions are provided in **Table 1**.

**Table 1. Phase 1 SCADA system summary**

No.	Location (Name)	Devices Or Structures	Automatic Flow Control	Remote Manual Control	Remote Monitoring	HMI** Server
1	Power/Stayton Canal Diversion	One automated gate, three manual gates	<input type="checkbox"/>	<input type="checkbox"/>		
2	Site 8	Rated Section			<input type="checkbox"/>	
3	Site 7b	Rated Section			<input type="checkbox"/>	
4	Salem Ditch Spill	Rated Section			<input type="checkbox"/>	
5	Main Canal Heading	Rated Section			<input type="checkbox"/>	
6	Office Base Station					<input type="checkbox"/>

\*\*Human-Machine-Interface (HMI)

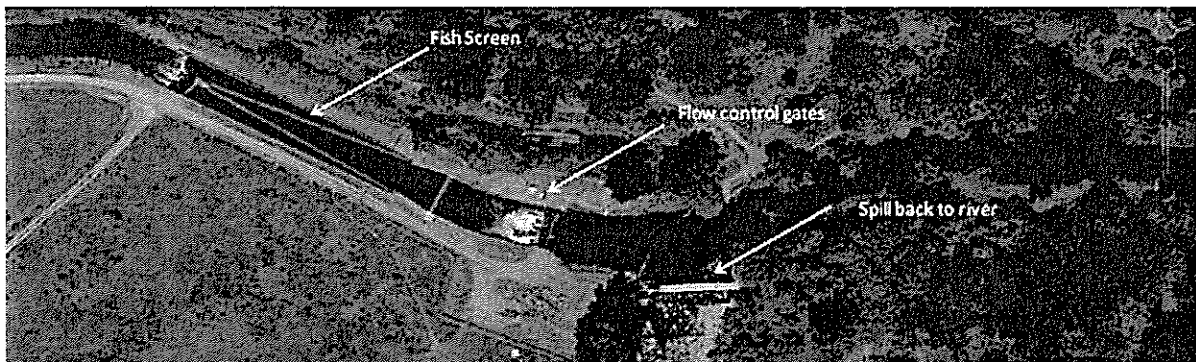
The total project cost for Phase 1 is estimated at \$150,000 not including the Alternate Bid Item and design.

### **Power/Stayton Canal Diversion, Fish Screen**

One of the diversion four sluice gates will be automated to maintain a water level immediately downstream of the fish screen, which will provide a known flow over the rubble dam. With only one automated gate, it is expected that some human intervention will be needed periodically to maintain the automatic control capability through the adjustment of the non-automated gates in certain conditions such as a large change in the target flow rate or river stage.

The head differential across the fish screen will also be measured, to automatically trigger a cleaning cycle of the fish screen cleaning system once the differential surpasses a user-defined set point.

This site will have a single radio tower and antenna, to serve both Site 1A and Site 1.



**Figure 1. Site 1 overview**

### **Remote Flow Monitoring Sites**

SWCD has installed and commissioned inexpensive remote monitoring stations for the purpose of water level and water temperature measurement at 15-minute intervals for the following sites:

- Site 8
- Site 7b
- Salem Ditch spill
- Main Canal heading

The water level and water temperature data is accessible and downloadable through a third-party web service. However, the goal is to use existing rated sections to facilitate flow measurement at each site. After downloading historical data files, additional manual analysis

would be required to relate the recorded water levels to flow rates by applying site-specific head-discharge equations. Although functional, this system requires manual data manipulation and is inefficient.

The *Phase 1 – Alternate Bid Item* is the integration of the existing measured data into the greater SWCD-owned SCADA system. The proposed Alternate Bid Item will automatically calculate, display, and archive flow rates for each site. Additionally, the SCADA system provides automatic high flow/water level alarming and data trending. It is anticipated that this Alternate Bid Item will increase the accessibility and value of the data retrieved from the remote flow monitoring sites.

### ***Phase 2 SCADA Outline***

#### ***General Sequence of Actions***

The general sequence for the *Phase 2* Santiam Water Control District (SWCD) Supervisory Control and Data Acquisition (SCADA) project is grouped into two categories – *Sequence A* and *Sequence B*. The ITRC scope of work for *Sequence A* is provided in the **Attachment**.

#### ***Sequence A***

1. Contract with ITRC to develop a new *Phase 2* SCADA plan with specifications, PLC control kernels for all automated sites and a refined project budget. The specifications will include anticipated operations, hardware, software and integration requirements for the proposed sites listed in **Table 2**. The *Phase 2* budget within the new SCADA plan will be refined from the planning budget provided in **Table 3**. The planning budget is envisioned to be in the range of \$950,000 to \$1,000,000 for initial costs (construction, materials and labor) with an additional \$100,000 to \$150,000 for long-term maintenance and service agreements.
2. Contract with a company to perform radio tests using Schneider Electric MDS spread spectrum radios. SWCD has already defined the approximate locations, and this document provides some additional information. The results of the radio testing such as required antenna tower heights and antenna details for good wireless communication shall be included in the *Phase 2* SCADA plan.

Once the available project budget has been defined, the *Phase 2* SCADA plan will be revisited with *Sequence B*.

#### ***Sequence B***

1. Contract with ITRC to help with coordination, planning and implementation. Depending on the available budget, some prioritization of SCADA sites may be required.
2. Hold a meeting with SWCD, the proposed integrator, and ITRC to finalize the distribution of tasks and responsibilities.

3. Contract with the integration company.
4. Complete civil and utility power work.
5. Complete installations, automation, and training:
  - a. Integrator comes on-site to terminate devices, install sensors, networking, HMI and RTU installation/configuration, some programming (if applicable), and district staff training.
  - b. ITRC conducts a site visit for automation implementation, quality control recommendations, and district staff training.

### ***Summary***

**Table 2** defines some of the details that will be included in the new *Phase 2* SCADA plan and were used to develop the project planning budget, on a site-by-site basis. The office HMI and equipment specifications will also be included in the new *Phase 2* SCADA plan. It is assumed that one person from ITRC will visit the district to discuss the finalized SCADA plan in person.

**Table 2. Phase 2 proposed site descriptions and functions**

Site***	Automated?	Flow measurement location(s)	Special	on d 2's	be art
1A - Head of Salem Ditch (not including measurement of water level at rated	Y	N 4 <sup>th</sup> Ave and NorPak	<i>Additional options will be discussed.</i>	Y	Y
NorPak Weir	Crude		The gate position can be changed remotely. Also, if the u/s level drops below the weir, the gate will automatically close.	N	Y
5 – Butler Head	Y	New Replogle flume downstream	Remote and rapid complete closure possible via SCADA	N	Y
6 – Mix Head	Y	Rated gate	Remote and rapid complete closure possible via SCADA	N	Y
3 – Flow monitoring	N	Likely SonTek side- looker		N	N
1 – Power/Stayton Canal Diversion	Y	Rated rubble structure	Adding more sensors and actuators to an existing RTU from Phase 1	N	Y
H – Hydro Plant on Power Canal	Y – but by the integrator, not ITRC (not a hydraulic control problem)	n/a	The plant will automatically restart when line voltages, etc. have re-stabilized.	n/a	n/a
2 - Entrance to Main Canal; spill from Power Canal to river	Y	Rated section in Main Canal	The old gates will need to be replaced	N	Y
7 – upstream of private hydro; bifurcation u/s of hydro (Facility “A”)	N	Gate itself	The gate will be instrumented (gate position, level sensors) to remotely monitor the flow. The gate will NOT have an electric actuator	N	N
7 – downstream of hydro. Spill to river and re-start of Main Canal (Facility “B”)	Y	The automated flow control gates will be rated	A spill long-crested weir (to the river) will hold the level. Conduit from flow control gates will go to 7 – Facility “A”	N	Y
8 – New flow measurement device for Site 1A	N			N	N
Various flow monitoring	N	New Replogle flumes or weirs		N	N
Base Station			Transition to redundant HMI servers, rack, mobile access, etc.		

\*\* Before implementation, this kernel must be merged with an outside program shell, and the specific gate characteristics must be known.

\*\*\*With one exception (at NorPak weir), automated gates will be for flow control. In some cases, they will maintain a water level over/in a rated section, flume, or weir

ITRC developed a planning budget for Phase 2 as shown in Table 3.

Table 3. Phase 2 SCADA project planning budget

ITRC Phase									\$63,700
Site	Sierra Controls Integration - RTU, sensors, wiring, radio, install and implementation	Number of actuators	Actuator cost	Gate replacement?	Gate Cost (est. \$4000 per gate)	Item to be constructed	Construction	Other	
1A - Head of Salem Ditch (not including measurement of water level at rated section)	\$35,000	1	\$12,000						
8 - Rated Section	\$30,000					Weir under bridge	\$20,000		
NorPak Weir	\$35,000	1	\$8,000			New LCW	\$40,000		
5 - Butler Head	\$35,000	1	\$8,000	Y	\$4,000	Replogle Flume	\$15,000		
6 - Mix Head	\$35,000	1	\$8,000	Y	\$4,000	New gate section	\$15,000		
3 - Flow monitoring	\$20,000					Modified section	\$15,000		
1 - Power Canal Diversion	\$10,000	3	\$48,000		\$12,000				
H - Hydro Canal	\$25,000								
2 - Entra spill from river	\$35,000	3	\$48,000	Y	\$12,000				
7 - upstr hydro; bi hydro (Fi)	\$18,000	1		Y	\$4,000	Long crested weir u/s of hydro, gate installation	\$30,000		
7 - downstream of hydro. Spill to river and re-start of Main Canal (Facility "B")	\$35,000	1	\$8,000	Y	\$4,000	Long crested weir, gate installation	\$30,000		
Flow measurement various (3 total)	\$60,000						\$40,000		
Base Station	\$50,000					Antenna tower	\$10,000		
ITRC Implementation and testing								\$60,000	
Subtotals	\$423,000		\$140,000		\$40,000		\$215,000	\$60,000	\$878,000
<b>Total</b>									<b>\$941,700</b>

## Site Descriptions

### Site 1A – Beginning of Salem Ditch

There is one old sluice gate at this location. SWCD plans to install a Rotork actuator with sufficient torque to move the gate frequently with a high upstream water level. The gate always operates in free flow mode. AMEC has the canal dimensions, roughness, etc. between Site 1A and Site 8 (discussed later) so that ITRC can model the control. The district will run power from Site 1 to service Site 1A.

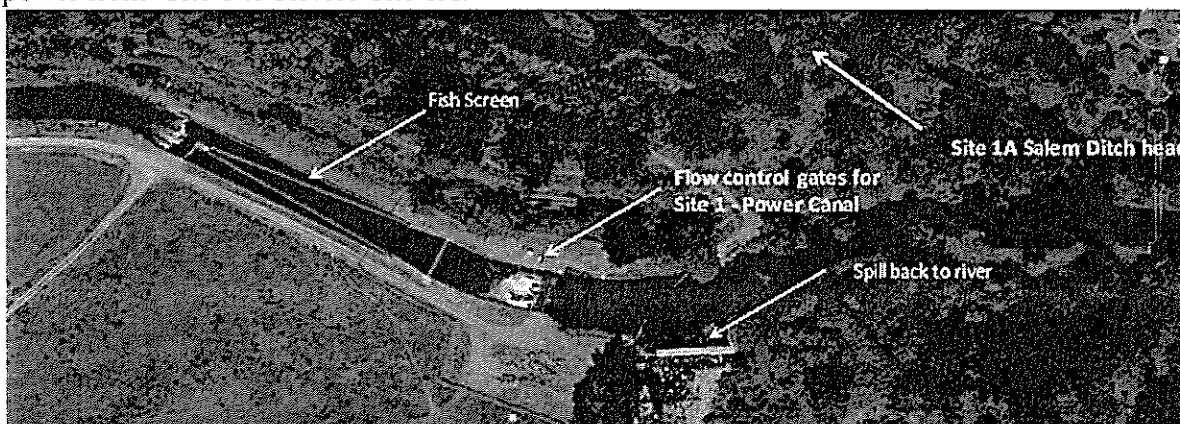


Figure 2. Site 1A overview

There will be two modes of operation at Site 1A:

1. **No Rain** – The PLC will receive the flow rate measurement at the new weir, to be located on North 4th Ave just upstream of the bridge. The PLC at Site 1A will modulate the sluice gate to maintain a target flow rate of about 125 CFS.
2. **Rain** – The PLC at Site 1A will also receive a flow rate estimate (via the office base station) from at least one (perhaps multiple) distant location(s) in the Salem Ditch. If the flow rate at any of the location(s) exceeds the respective maximum flow set-points (operator selectable), the flow rate at Site 1A will automatically reduce the flow rate through the gate at Site 1A to attempt to maintain a 30 CFS flow at a downstream location. Site 1A will remain in this control mode until it is manually switched back to the “No Rain” mode. It will be essential for the district to make a firm decision regarding the “rain” location early in the development of the SCADA specifications, to avoid add-on costs to the development of the specifications. Of course, changes could always be made in future years, but SCADA specifications are very “specific”, as is the programming that will be done by ITRC for this particular site. The ITRC cost assumes doing this one time for well-defined locations.

Because Site 1A is completely surrounded by trees, and because it is very close to Site 1, there will be no radio at Site 1A. Instead, the district will trench conduits for power, signal wires and radio cable to Site 1. There will be a separate PLC for Site 1 control, but both sites will share a common radio and antenna that is physically located at Site 1.



### **Site 8 – Rated Section in Downtown**

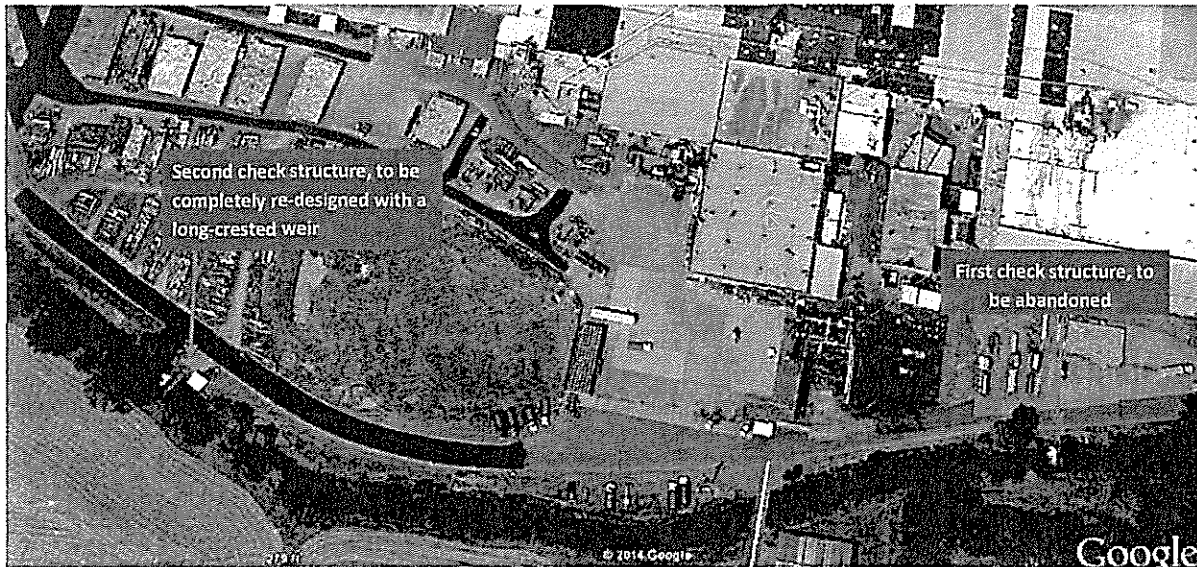
Typical flow will be approximately 125 CFS, but the flow will need to drop to as low as 0-30 CFS during certain rain events. Because the existing rating station site is so broad and shallow, it will be difficult to rate it for the very low flows. Therefore, it is recommended to construct a weir just upstream of the North 4th Avenue bridge to measure the flow. It will also be a simpler flow measurement (water level only) with a quicker reaction time to a change at Site 1A.



NorPak Site

**Figure 3. Site 8 overview**

There are two check structures at this location because there are two inlets to the processing plant. The processing plant may be willing to abandon one of the inlets, and consolidate everything into the downstream inlet. That check structure is a combination of short flashboards and four manual sluice gates. Sand accumulation at the processing plant inlet screens is a concern. The processing plant operator wants something very simple.



**Figure 4. NorPak site overview**

The new structure will be a combination of a long-crested weir (LCW), plus a sluice gate on a lowered concrete path and floor in the center of a downward-pointing structure. Normally, the sluice gate will be open to flush sand through the structure. It will NOT be automated to move frequently. The recommended length of the LCW is 140' (70' on each side).

PLC automation will be very simple and will only be actuated if the water level drops below the crest of the LCW. There will be one pressure transducer located upstream and one pressure transducer downstream of the weir for both flow measurement (through the gate and over the weir) and gate control. When the water level upstream of the LCW drops to 0.2' below the LCW crest, the sluice gate will be automatically closed – just leaving a 0.1' gap or so at the bottom.

With a head of 0.44' at 125 CFS flow over the weir, and a sluice gate trigger of 0.2' below the crest, the result is a total fluctuation in head of less than 0.7' between extremes. It will also provide excellent capacity for larger storm flows.

When the sluice gate closes, almost all of the flow will pass over the long-crested weir, or be diverted into the processing plant. When the low-flow condition passes, the sluice gate can be raised through manual remote from the office or on-site.

The depth of water upstream of the LCW will be used to indicate the flow rate passing this point. It is envisioned that this will be the only, or one of two, site(s) for which the flow rate estimate will be passed to the head of the canal for adjustment of the flow rate at Site 1A.

### **Site 5 – Entrance to the Butler Ditch**

The head of the Butler Ditch has a meter gate – a circular plate on a circular culvert. The flow rate is approximately 10 CFS. Storm water enters the ditch about 1300' downstream. A Replogle flume will be installed downstream of the culvert discharge. The gate will be automated to maintain a target flow rate on the new Replogle flume. It will also be set up to be rapidly and completely closed remotely in the event of a toxic spill upstream.



**Figure 5. Site 5 overview**

### **Site 6 – Entrance to the Mix Ditch**

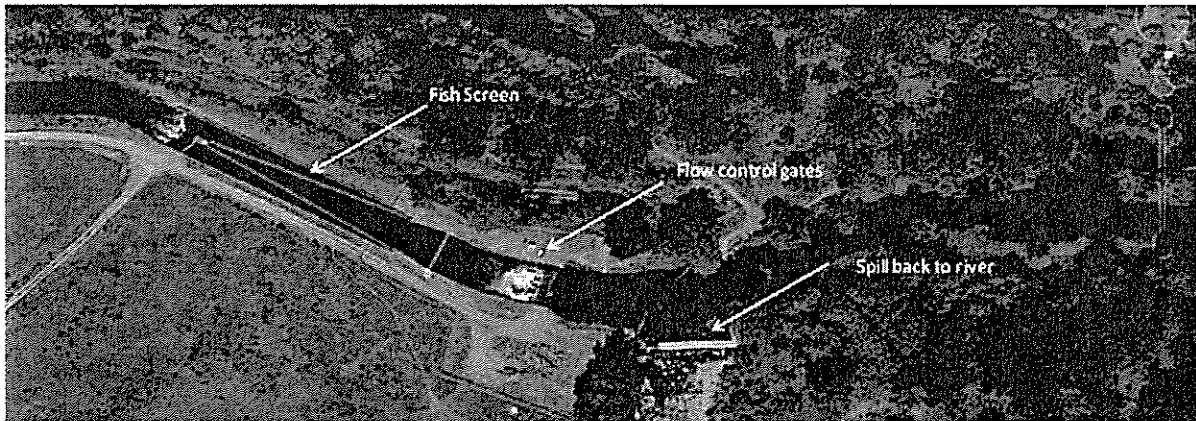
Evidently, this site will be completely rebuilt, and will likely use a rated gate for automated flow measurement (up to about 5 CFS) and control. It will also be set up to be rapidly and completely closed remotely in the event of a toxic spill upstream.

### **Site 3 – Flow Monitoring Site**

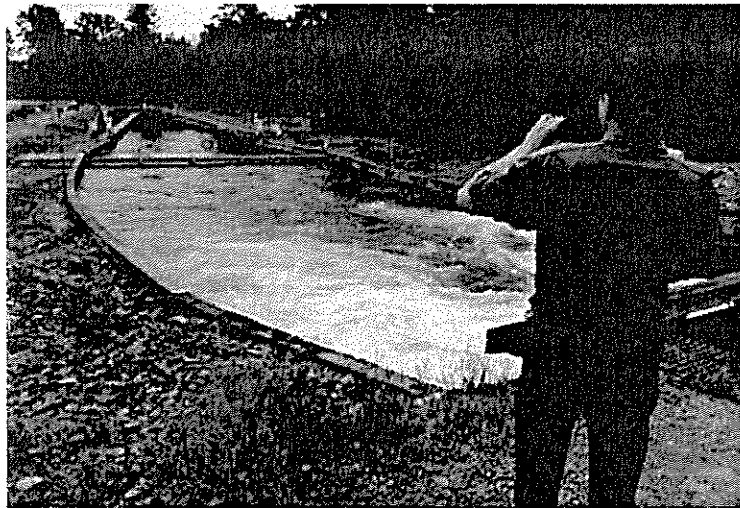
The specific location is undefined, and the measurement technology is also undefined at this stage. Both flow rate and temperature will be monitored. It will likely consist of a SonTek side- looking meter, using a bridge as a structure. Likely, the inlet conditions will need to be shaped to provide conditioned flow.

### **Site 1 – Power/Stayton Canal Diversion**

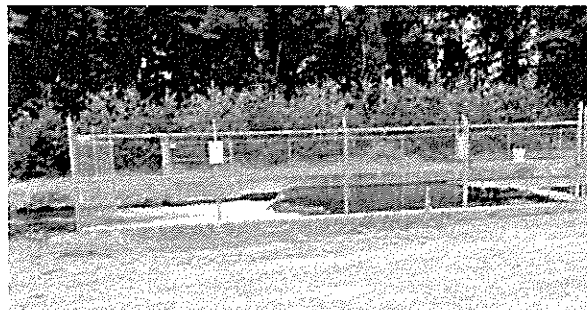
Building off of the *Phase 1* implementation, the remaining three sluice gates will be automated for flow control. This site will have a single radio tower and antenna, to serve both Site 1A and Site 1.



**Figure 6. Site 1 overview**



**Figure 7. Entrance to the Power Canal and the fish screens**



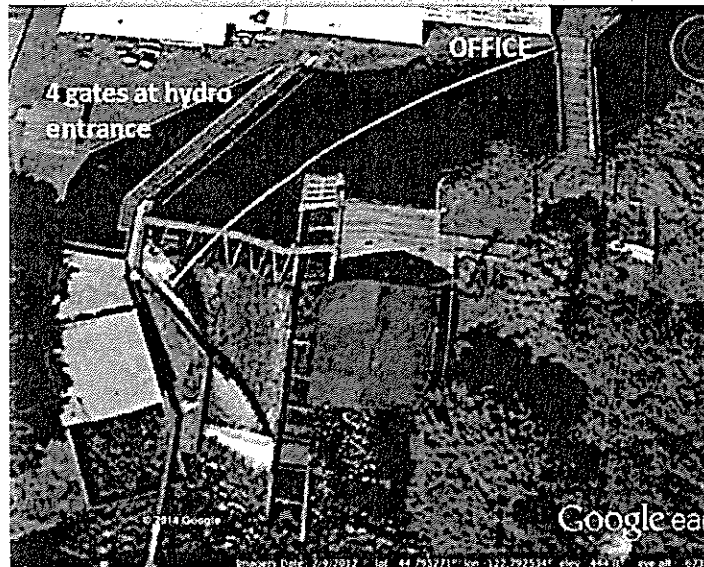
**Figure 8. Rock dam on downstream end of fish screen at entrance to the Power Canal. Flow control gates are upstream.**

### **Site H – Hydro Plant on the Power Canal**

The old hydro plant at Site H does not have any need for water level control or measurement, but the SCADA system will improve operations in two ways:

1. The power plant shuts down automatically about forty times per year due to fluctuations in the quality of power in the grid. The district would like to automatically re-start the plant once the grid power quality improves. There is no need, evidently, to provide new electric power conditioners, panels, etc. Rather, a few parameters such as voltages will be measured. The staff already knows the equipment that they want.
2. There is a variety of electro-mechanical sensors/switches (for vibration, speeds, etc.) at the hydro plant – any one of which can cause the power plant to shut down. When that happens, the staff has no idea why the plant shut down. These should be converted and then sensed/recorded by the SCADA system, with appropriate alarms and notifications.

An instrumentation building already exists, and it is a short distance to the office. Therefore, radios will not be needed here.

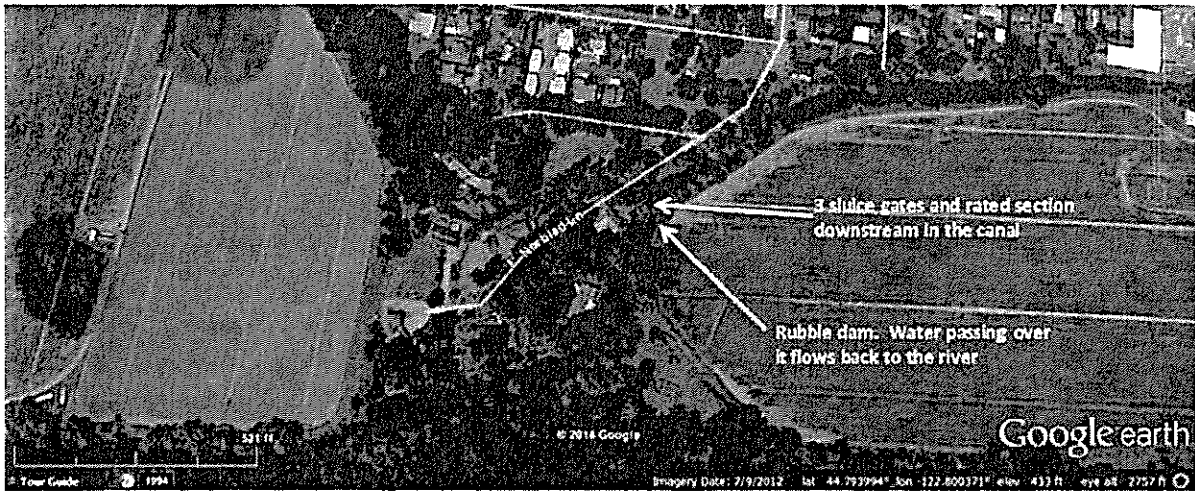


**Figure 9. Most of the water of the Power Canal flows through the hydro plant. Side spill (over six pleated long-crested weirs) and the hydro flows merge downstream in a continuation of the Power Canal**

### **Site 2 – Entrance to the Main Canal from the Power Canal**

This structure has three old sluice gates that control the flow into the majority of the district. Excess flow passes over a rubble dam and continues to the river. There is a good rated section downstream of the three sluice gates.

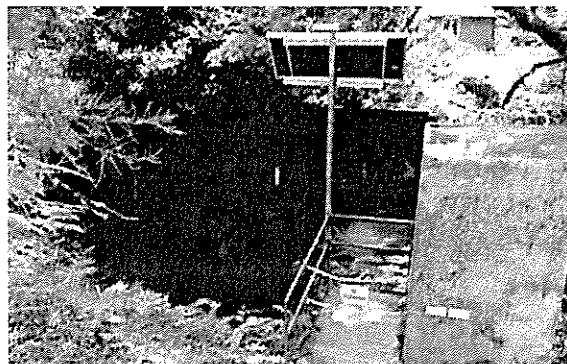
It is recommended that the rubble dam be raised by 1-2' to reduce the sensitivity of the flow control – and thereby reduce the gate movements.



**Figure 10. Site 2 overview**



**Figure 11. Three sluice gates at Site 2, looking upstream. Rubble dam is to the right (not shown in photo)**



**Figure 12. Rated section downstream of the three gates at Site 2**

### **Site 7 – Measurement, Flow Control, and Water Level Control**

Site 7 is a combination of two facilities: “A” and “B”.

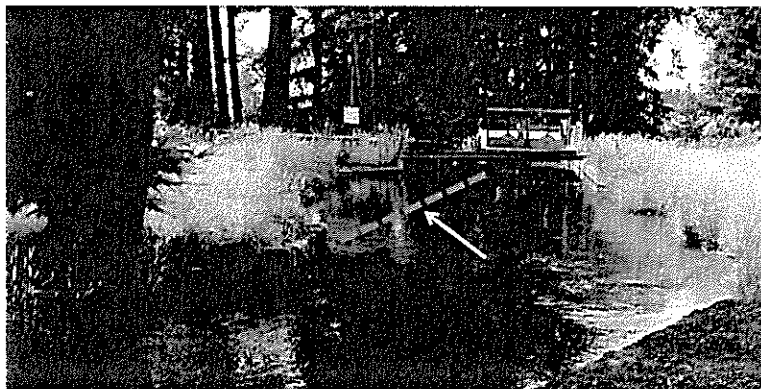
#### ***Facility “A”***

Facility “A” is located immediately upstream of a private hydro plant, where a canal is supplied with 40-50 CFS. There are two goals here:

1. Improved water level control into the hydro plant (using a long-crested weir side bypass)
2. Improved flow control into the lateral canal



**Figure 13. Looking upstream at the Main Canal. Flashboards are under the bridge, and are intended to control 50 CFS to a lateral canal. This site needs sluice gates in a well-designed cross section. The sluice gate(s) will be manual.**



**Figure 14. Site 7 – Looking downstream at the private hydro plant on the right; small spill boards on the left (which merge with the hydro water). There are several feet of drop immediately behind the spill boards. A long-crested weir is needed on the left-hand side to provide better water level control for the 50 CFS lateral upstream of this location (about 50’ upstream of the bridge in the foreground).**

### ***Facility “B”***

Facility “B” is located in the Main Canal, several hundred feet downstream of the hydro plant and its spill. At this location, extra flow goes to the river. Currently, there is no flow control structure there. The water level in the canal upstream of this bifurcation point will need to be raised to provide sufficient flow rate control. A new structure will be installed to control and measure flow. Also, the water level in the Main Canal will be controlled at this point with a LCW spill to the river.

Conduit will be run from the hydro plant (private, with no district monitoring) to convey both electricity and communications cables. The two sluice gates will be automated for flow control, in a good new structure. The radio will be above the hydro plant, at a higher elevation.



**Figure 15. Site 7 – Facility “B”**

### **Various Remote Monitoring Sites (8-10)**

These are usually at the tail ends of ditches. They were not visited, but likely a weir or Replogle flume will be installed at each. Flow rate and water temperature will be monitored.

### **Office Base Station**

There will be an existing commercial-grade workstation (desktop computer, monitor, etc) that functions as the Human-Machine Interface (HMI) server. The existing HMI server will also be remotely-accessible to the Integrator and ITRC for remote support purposes. These devices, including an existing automated alarm notification system will be installed during *Phase 1*.

In *Phase 2*, the HMI server software will be transitioned to two dedicated, redundant industrial servers. The existing workstation will kept for continued use as an interface for district personnel. This transition will minimize server downtime and will be required to support the proposed *Phase 2* expansion. Access via smart phones and mobile tablets is also proposed within *Phase 2*.



### ***SCADA Plan Assumptions***

The *Phase 2* SCADA plan cost assumes that ITRC will provide the control kernel for all of the automated sites. During the field visit, the possibility of having district staff do the programming for simple flow control sites (such as at the Mix Ditch or the Butler Ditch or the heading of the Main Canal) was discussed. In fact, the first discussion assumed that ITRC would do no control programming.

As the discussions progressed, however – especially regarding the head of the Salem Ditch – it became apparent that there could be a fair amount of complexity in the programming. So the conversation shifted towards having ITRC provide the control code.

The SCADA plan would cost about \$7000 less if ITRC does not provide control code and tags for eight (8) of the sites. However, ITRC recommends that ITRC do the programming for those sites as part of this SCADA plan because:

- The programming forces ITRC to make sure that the sensors that are specified are compatible and complete for control.
- If ITRC does the programming, ITRC also develops an interface dictionary for data and sensors that must be passed between the outer shell and ITRC's control kernel. This is very helpful to the integrator when the integrator develops a bid; the integrator knows how many signals and of what type need to be passed from the PLC to the office, how many ports are needed in the PLC, and how much outer shell programming will be needed.

### ***Notes on Integrator***

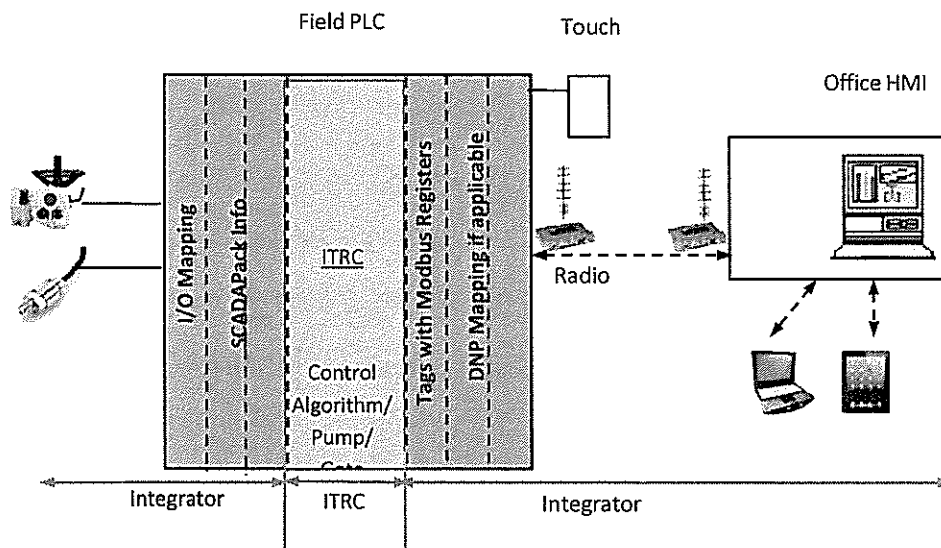
#### **Integrator Selection**

Integration firms provide hardware and software installation and configuration services for SCADA projects including but not limited to sensor installation, radio networking and even automated reporting. ITRC has worked with many different integration companies over the years. Very few are able to provide excellent work, maintain accessibility for long-term support, and have the experience to efficiently implement water infrastructure SCADA projects. In our experience many integrators can provide less expensive cost estimates up front; the majority of them falls short of expectations and end up being the most expensive in the long run.

One integration firm, Sierra Controls (SCS), has proven to be successful in the irrigation district sector and has had over 5 years of ongoing projects with ITRC. Throughout this time, ITRC and SCS have developed standard practices which typically result in less costly SCADA specifications – for example, extremely detailed specifications of HMI graphics and content are not necessary when working with SCS. Conversely, should ITRC need to provide very detailed specifications for most aspects of the integration work, it would likely result in an additional expense of \$25,000 for the SCADA plan. There would also be additional work in the implementation; for example, ITRC would likely need to write the

ISaGRAF outer shell program for the PLCs at the control sites, which would cost about \$20,000 extra (although if Sierra Controls is selected, it would charge for this work). ITRC also would need to spend more time troubleshooting, answering questions, doing field verification and calibration, and quality control (a major item) during implementation.

Furthermore, the ITRC and SCS relationship has afforded other advantages – the programming of the PLCs is divided into two independent units. ITRC provides a proprietary password-protected automatic control “kernel”, for sites with automatic control (this is not accessible to the district or to the integrator), and SCS provides the remainder of the programming as shown in **Figure 16**; the programming for sites without automatic control are the sole responsibility of SCS.



**Figure 16. Division of responsibilities between ITRC and Integrator**

This methodology has been developed so that long-term support is more effective – the integrator created and has access to all of the necessary programming – and reduces costs by minimizing ITRC involvement for simple activities such as sensor replacement and recalibration. More details on this division of responsibility are provided in SCADA specifications, but the bottom line is that the “devil is in the details” and someone needs to take care of them; otherwise, the district will have software and hardware that will not function properly.

## ATTACHMENT

### *SWCD Phase 2 - Sequence A: SCADA Plan Scope of Work*

The ITRC scope of work for *Phase 2 – Sequence A* includes the following:

- A SCADA plan to Santiam Water Control District (SWCD) that includes:
  - The general system-level operation of the proposed SCADA system
  - Site-by-site information such as:
    - Description of capabilities and general operations specific to the site
    - Simplified (not construction) drawings to illustrate:
      - Infrastructure improvements
      - Numbers and types of SCADA components (sensors and actuators – not including those at the hydro plant)
  - Key dimensions for flow measurement structures (but not construction drawings)
  - SCADA specifications to include details of:
    - Radios and antennas
    - Sensors and their positions
    - Actuators
    - PLC
    - HMI, including screen formats (not the details of each screen)
    - Office details
    - RTUs
    - Security requirements
    - Documentation and training
    - Interface dictionaries for each automated site
- PLC control kernels for each of the automated sites. This is proprietary, customized and protected code. During implementation of automation, the ITRC kernels would be merged with further integrator-provided PLC programming by ITRC (this would be a later, separate contract).
- Hydraulic simulation modeling for the Salem Ditch control scenarios, in order to determine the controllability and pertinent control constants needed in the kernel.
- A 1-day visit to the district to review an early draft, plus take measurements at key locations.

Project details are provided in the body of this memorandum. The expenses to provide the scope of work as defined above are estimated at \$63,700.

### ***SWCD Responsibilities***

- SWCD will work with AMEC to provide ITRC with the hydraulic details for the Salem Ditch. ITRC will conduct its own control simulation once dimensions such as cross sections, slopes, and roughness are provided.
- Cross sections for flow measurement sections – both upstream and downstream, along with details of maximum water depths and flow rates. During the one-day visit, the ITRC engineer can help with this.
- Coordinate radio tests using spread spectrum radios at the approximate locations already

defined by SWCD and details within the Phase 2 SCADA project overview. The radio tests should include but not be limited to the following test information:

- Recommended tower heights at each remote location and the office base station
- Recommended antenna, cabling, connector and radio specifications
- Discuss with ITRC the options for the control of the head of the Salem Ditch. Then make a firm decision of what control options should be incorporated into the SCADA plan.
- Provide the details of the sensors and connections at the power plant that will need to be incorporated into the SCADA system.

#### V.A Technical Proposal: Evaluation Criteria

What is the applicant's average annual acre-feet of water supply?

The Santiam Water Control District water rights are enclosed in the table below including both consumptive and non-consumptive rights. The District has one power generation right for 760 cfs that is currently unexercised and leased instream.

Cert. #'s	Priority Date	CFS	CFS Not to exceed	Acres	Total Acre ft for Right	Reporting Use
30 Certificates	1856-1987	0.325 0	202.554	16016.10	63831.05	Irrigation
4 Stored water permits 2-U.S BOR Contracts	1978-1996	0.025 0	8.500	1376.61	3741.77	Irrigation
3 Certificates	1866-1983	0.000 0	902.000	0.00	652863.09*	Power
1 Permit	1983	0.000 0	185.000	0.00	133902.08*	Power
3 Certificates	1953-1983	0.000 0	32.000	0.00	23161.44*	Cannery Industrial
3 Certificates	1856-1985	0.000 0	102.000	0.00	73827.09*	City of Salem Recreation & Aesthetics
2 Certificates	1970	0.000 0	6.000	0.00	152.30*	Fish Culture
4 Certificates	1907-1911	0.000 0	11.590	0.00	1088.60	City of Stayton Municipal & Irrigation
		0.350 0	1449.644	17392.71	68813.72	Consumptive Use
					952567.42*	Non Consumptive Use

Where is that water currently going (e.g., back to the stream, spilled at the end of the ditch, seeping into the ground, etc.)?

Water is typically spilled to waste ways, borrow ditches and smaller streams.

The connection to local streams provides a pathway for the District's canals to serve as drainage pathways during the winter months providing a secondary benefit to the encompassed lands

Where will the conserved water go?

It will be left in the North Santiam River helping to meet biological opinion and fisheries needs.

### **(3) Irrigation Flow Measurement:**

(a) How have average annual water savings estimates been determined? Please provide all relevant calculations, assumptions, and supporting data

Please see AMEC Foster Wheeler exhibit A

Expected flow savings for hydropower and irrigation diversions combined.

- 2150-5780 cubic feet for Salem Ditch
- 23070-29600 for Stayton Power Canal

with the total minimum savings being 25,220 af and a possible savings of 35,380 af.

There is an additional expected benefit from utilizing stormwater flows to offset diverted flows. The system is currently incapable of doing so and storm flows pass as administrative spills. These flows have been identified in the AMEC study but data is lacking to fully quantify the benefits, current predictions utilize Hec-Ras modeling This project will provide measurement and data capabilities to quantify these savings once implemented.

The current management system using manually operated gates and scattered monitoring sites of various types is labor intensive and provides questionable and inaccurate data. The ability to implement a system wide management plan using remote sensing will result in achievable savings as determined in the Project No. 1-61M-123510 Flow Reduction from Headgate Automation of Salem Ditch and Stayton (Power) Canal report from AMEC earth and environmental engineers. Their analysis looked at water diversion records compared to river fluctuation levels, it was apparent that there was a direct correlation between river stage and diverted flows. Monitoring of the old manual systems relies on field staff presence for visual inspections and manual non-continuous monitoring. Delays in the collection, transmission and analysis of data could result in delayed decision making when responding to changing circumstances. By contrast, automation provides the opportunity to monitor remotely in real time, collect appropriate amounts of data. In addition, automatic alarming allows operators to respond to irregular or emergency operational problems that require immediate attention or intervention. A modern district can establish a central 24 hour a day water operations and monitoring system to ensure proper management, including timely action on problems to minimize service disruption. The wealth of performance data generated is used to monitor and routinely fine tune canal operating parameters to improve system performance. Also as noted in the next section, current measurement of system performance is based upon a "best estimate" scenario as current measurement device accuracy is questionable.

(b) Are flows currently measured at proposed sites and if so what is the accuracy of existing devices? How has the existing measurement accuracy been established?

<i>Type of Measurement Device</i>	<i>Interval Frequency</i>	<i>Accuracy</i>
Recorder	Continuous	±5-10%
Staff Gauge	Single	water depth only
Weir & Stick Measurement	Single	±10%
Weir & Staff Gauge	Single	±10%
Weir, Recorder, & Staff Gauge	Continuous	±10%

The system meters water at the headwaters at two diversion sites: 1- The Stayton/Power canal and 2- The Salem ditch. Each includes a measurement gaging station consisting of a Rated section, Recorder, and Staff Gauge stilling wells. All other measurement sites are mostly estimates, with the best being a weir and stick style measurements. Site gauges provide depth of water measurement only. Where measurement is possible on the headwater side of a gate, the downstream segment may only have a staff gauge or stick measurement therefore losses between measurement points is not possible. Therefore, there is no "real time" ability to monitor flows.

(d) How will actual water savings be verified upon completion of the project?

Given that the District can only accurately measure headwaters into the system, accurate historical data is variable and imprecise. The new measurement system will compile a historic database that, over time, will provide annual use deliveries both in key individual canal segments but also system-wide. The level of accuracy attained by a system wide management program, individual canal segment volumes and flows, and both instantaneous and historical data for same will provide the District with an accurate performance tool. Once the system is operational and water balance is achieved through the automated gate and measurement system and subsequent grower demand controls are in place, the measurement of flows will be compared to historical water release data from the Detroit Dam, and USGS gauge station data upstream and downstream of SWCD diversions.

Each Measurement site will be designed by ITRC and will meet high thresholds for accuracy.

**(4) SCADA and Automation:**

a) How have average annual water savings estimates been determined? Please provide all relevant calculations, assumptions, and supporting data.

See flow measurement answer 3a

(b) Have current operational losses been determined? If water savings are based on a reduction of spills, please provide support for the amount of water currently being lost to spills.

Irrigation deliveries are via open earthen canals, laterals and ditches that by design must deliver at least 5% more water than is needed for specific irrigation system pumping requirements.

Water not pumped to an irrigation system moves on down the ditch to be discharged into local streams. There are numerous out flow locations from the district, none of which are measured. Typically administrative spills vary from 20 to 200 gpm at each outflow. The Santiam WCD has set a goal of improving water control including measurement throughout the district. No records are available for intermittent losses due to administrative spills, which are also difficult to quantify. Spill losses were estimated based on the difference in canal capacity and pumping plant capacity. It was estimated that canals and laterals need to supply 109% of the needed pumping plant capacity. Due to the long length of main canals and laterals with the Santiam WCD, flow varies due to daily temperature changes, riparian vegetation ET, effective rainfall and pump cycling. When using open water conveyance and delivery, administrative spills are required to maintain design deliveries at the lower end of water supply laterals and ditches. In addition, pump suction pipelines require at least 5% administrative spill. Pump capacity varies within an irrigation set, depending on where big gun sprinklers and sprinkler laterals are positioned on the landscape. Ditch riders provide necessary manual operation of main and lateral canal gates to minimize spills while maintaining ditch storage capacities to help offset fluctuations in delivery needs.

It is estimated that approximately 30% of spills are recovered by plants or used for down slope deliveries, improving overall water use efficiency within the district. Net overall administrative spill is estimated to be 9% of diversion.

The Districts water conservation plan addressed only irrigation rights and losses are included below;

**Table 2 Summary of Estimated District Water Losses**

	Average (1999)	High (2003)	Low (1998)
	Acre Feet	Acre Feet	Acre Feet
Diversion <sup>1/</sup>	42,224	53,639	35,560
Administrative Spills <sup>2/</sup>	5,067	6,437	4,267
Conveyance Losses <sup>3/</sup>	12,667	16,092	10,668
On-Farm Delivery	24,490	31,111	20,625
On-Farm Delivery Needs <sup>4/</sup>	27,561	26,681	23,713
Net On-Farm Irrigation Requirements <sup>5/</sup>	19,355	19,986	17,763
On-Farm Losses <sup>6/</sup>	8,206	6,695	5,950
	Acres	Acres	Acres

Acres Irrigated	15,797	16,315	14,500
Fallow, Idle, CRP, etc.	1,032	517	2,332
Total Irrigated Cropland	16,832	16,832	16,832

1. Measured Salem Ditch and Main (Stayton) Canal Diversions.
2. Santiam WCD administrative spills are estimated at 9%.
3. Conveyance losses i.e. seepage and riparian ET in the Santiam WCD are estimated to be 22%.
4. Net on-farm crop Irrigation Requirement (IR) plus field application losses.
5. Annual on-farm crop Irrigation Requirement (IR) minus estimated carry over soil moisture of 3 inches. See Section III, F. Farm Deliveries for more information.
6. Estimated on-farm losses are primarily deep percolation plus soil and plant leaf surface evaporation, some of which is unavoidable.

(c) Will annual farm delivery volumes be reduced by more efficient and timely deliveries? If so, how has this reduction been estimated?

Yes! The ability to deliver water to each user in a day vs. multiple days or in some cases days down to hours, will allow the District to better manage each grower's needs (without excess water flow as currently exists that result in spills or oversupply) while maintaining a water balance within each canal segment. This will offset the current system of increasing flows from the headworks to achieve downstream deliveries to multiple growers by visually measuring and constantly monitoring each canal segment and making delayed (due to travel time by the ditch tender) manual gate adjustments to maintain flow rates through the entire system. On an automated and remote metered system, less water is required to flow through the system and the grower gets exactly what he needs, when he needs it.

Currently river stage fluctuations can cause excesses or shortages in deliveries. Excesses lead to administrative spills, and shortages lead to farmer pump shutoffs and application inefficiencies.

(d) Will canal seepage be reduced through improved system management? If so, what is the estimated amount and how was it calculated?

Seepage is not anticipated to be greatly reduced. Automation of gates will allow a lesser need to surcharge canals to prevent shortages from fluctuation. The ability to more accurately measure flows will allow the District to monitor volumes, which will provide a level of accuracy to more precisely determine losses.

(e) How will actual water savings be verified upon completion of the project?

The Automation and measurement system will compile a historic database that, over time, will provide annual use and efficiency system-wide. The level of accuracy attained by a system wide management program, individual canal segment volumes and flows, and both instantaneous and historical data for same, will provide the District with an accurate performance tool that currently is at best guesswork based solely on 2 gaging stations at the diversions and estimates from ditch riders and their logs. Once the system is operational and water balance is achieved through the automated gate and measurement system, the measurement of flows will be compared to historical water release data from the Detroit Dam, and USGS gauge station data upstream and downstream of SWCD diversions.



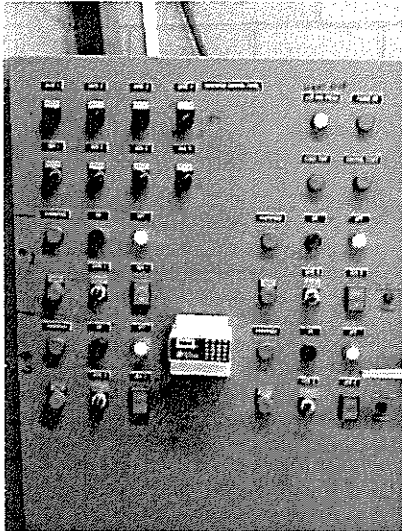
**Subcriterion No. A.2: Percentage of Total Supply**

10,330 af (AMEC report tables 1 and 2) volume reduction from river stage fluctuation low range value for months of March thru September only. Used to correspond to irrigation certificate time period. Other months will derive hydro efficiency benefit only.

68813.72 af annual water supply from irrigation certificate allowed duty total 15% of total irrigation water supply saved.

**V.A.2 Evaluation Criterion B: Energy-Water Nexus (16 points)**

The project will provide for the automation and control of the district's 185 kw small hydropower generation plant. The plant was constructed in 1985 and it relies on electro-mechanical controls for operation.



The plant has water rights and operates year around. The plant is subject to an abundance of electrical fluctuations and sensor glitches that automatically shut the plant down, staff estimate about 40 per year but good records are not available as to the number of shutdowns The SCADA system will include a Programmable Logic Controller (PLC) that would enable the Hydro facility to identify its own shutdown and generate a restart of the facility immediately if the shutdown were the result of a power fluctuation. The District used the actual highest kwh per year production rate as the basis of the most reliable situation. We then compared the base case to other generation years. Generation production could increase as much as 352,761.61 kwh per year from its lowest production year, or increase 169,023.56 kwh per year from its average performance.

Will the project result in reduced vehicle miles driven, in turn reducing carbon emissions? Please provide supporting details and calculations. **Describe** any renewable energy components

that will result in minimal energy savings/production (e.g., installing small-scale solar as part of a SCADA system).

The installation of a SCADA automation system will allow the District to maintain constant water levels in each channel segment using a monitoring system. The combination of automated gates, flow monitoring and centralized reporting system (SCADA) devices will allow the District to implement a network management system that provides management of flow control, demand management (faster response to meet grower demands in multiple channel segments), customer order management (from multiple days to a day and in some instances, down to hours), distribution efficiency and system wide operational controls that are lacking at this time due to the required individual manual gate operations that impact accuracy of water deliveries.

Currently Santiam Water Control District initiates a twice per day check of the hydro facility, fish screen and head gates for verification facilities are up and running (6 miles per run, twice per day, 365 days a year = 4380 miles). This check would be cut to once per day with the installation of a SCADA automation system (6 miles per run, once per day, 365 days a year = 2190). We are also called from the field twice per week during the irrigation season to initiate a water level adjustment, due to shortages or exceedance of water consumption (11 miles per run twice per week, 30 weeks). These calls would all but be eliminated with a SCADA automation system. Santiam Water Control District mileage driven for these checks and adjustments would be reduced from 5040 miles to 2850 miles with the installation of a SCADA automation system, which would reduce our carbon footprint by 1.62 metric tons per year. Employee hours for these checks would be reduced from 1368 hours to 684 with the installation of a SCADA system.

### **V.A.3 Evaluation Criterion C: Benefits to Endangered Species (12 points)**

(1) How is the species adversely affected by a Reclamation project?

Historically, the North Santiam River contained significant runs of Upper Willamette spring Chinook salmon and winter steelhead, and remains a key target basin for the recovery of these ESA-threatened species. However, current habitat conditions are significantly lacking. With the majority of the high quality spawning and rearing habitat located above major fish passage barriers (namely USACE Detroit and Big Cliff Dams), restoration priorities for the North Santiam are side channels and tributaries below these fish passage barriers. While native fish and wildlife species have been observed in the floodplain habitats of the Lower North Santiam River, quality habitat is limited due to channel simplification, installation and maintenance of flood and channel migration and flow control structures and conversion of floodplain forests to agricultural fields. Any restoration efforts that will improve flow, temperature and floodplain connectivity in the lower North Santiam reaches will greatly benefit these ESA listed species.

(2) Is the species subject to a recovery plan or conservation plan under the ESA?

The North Santiam is designated as essential salmonid habitat and one of the core recovery basins for ESA listed Upper Willamette spring Chinook salmon and winter steelhead. The following are a list of assessments and recovery plans that document restoration efforts in the North Santiam Watershed as high priority:

- North Santiam Watershed Council Watershed Restoration Action Plan Adopted October 2014 – pp17-20, 25-28 & 40.
- North Santiam Watershed Assessment: Middle and Lower Reach Subwatersheds (June 2002) – pp 3-2, 3-6, 3-26, 7-8, 7-17, 7-29. 8-26 to 8-28.
- ODFW, NOAA & State of Oregon Upper Willamette River Conservation & Recovery Plan for Chinook Salmon & Steelhead. (August 2011) – pp 17-18
- ODFW & NMFS Upper Willamette River Conservation and Recovery Plan for Chinook Salmon & Steelhead. (August 5, 2011) –pp 5-48 to 5-53
- OWEB Willamette Basin Restoration Priorities Watershed Summaries (Dec. 21, 2005) – pp 80-84
- USACE Willamette Project Supplemental Biological Assessment (May 2007) – Ch. 5 pp. 5-6

“Anadromous fish are considered indicator species; therefore, their decline is a barometer to understanding overall watershed health. Implementing restoration actions that address salmonid population declines could build watershed resiliency that results in sustainability of the water and land resources human communities rely on to support economies and communities.” (NSWC Action Plan 2014)

(3) What is the extent to which the proposed project would reduce the likelihood of listing or would otherwise improve the status of the species?

The main stem North Santiam is predominately influenced by USACE dams affecting flow and temperature, which influences habitat forming processes and timing of biological cycles (e.g. anadromous fish migration and emergence from eggs). With the uncertainty that climate change brings to natural resource managers proactive conservation measures such as this proposal will be critical in mitigating future water quantity unknowns.

The Oregon Plan ([www.oregon-plan.org](http://www.oregon-plan.org)) identifies ten ways that irrigation delivery entities such as Santiam WCD can help restore clean water and salmon. The plan has identified addressing low flows as a high priority. However, to-date little if any projects have been completed that would support that priority. This project would be the first (or among the first few) projects that would address the low flow priority for this key watershed.

The Santiam WCD is involved in each area that irrigation delivery entities can help restore clean water and salmon, but this proposed project particularly implements two as follows:

1. Water measurement capabilities: This project enhances water measurement capabilities at the point of diversion from the North Santiam, at the head of each canal or lateral, and at farm delivery points. Water use measurement allows resource managers to develop greater understanding of how water is being used and to integrate that into management. Using only as much water as is needed leaves more water instream, where fish and other aquatic species depend on regular water flows to survive.

2. Conservation techniques: Automation of head gates employs conservation techniques to stabilize and enhance the water supply, resulting in reduction of water diversion that is lost to

administrative spills. These innovative conservation practices can help conserve water and benefit aquatic life with little impact to water users.

Substantial water appropriations and withdrawals from the North Santiam River occur at and below the community of Stayton. During low flow months (July through October), domestic water use, combined with irrigation withdrawals in the lower elevations of the watershed, may significantly reduce stream lows. This project would reduce irrigation withdrawals in this critical area by using the improved operational facility to limit North Santiam River withdrawals that result in administrative spills.

**V.A.4 Evaluation Criterion D: Water Marketing (12 points)**

**Briefly describe any water marketing elements included in the proposed project.**

Estimated amount of water to be marketed  
50% of the conserved water

A detailed description of the mechanism through which water will be marketed (e.g., individual sale, contribution to an existing market, the creation of a new water market, or construction of a recharge facility)

The district will attempt to market the water to Confederated tribes of the Grand Ronde, an ecological group or the state of Oregon for conversion to an instream water right using the Allocation of Conserved water process ORS 537.470

**V.A.5 Evaluation Criterion E: Other Contributions to Water Supply Sustainability (14 points)**

Describe how the adaptation strategy and proposed WaterSMART Grant project will address the imbalance between water supply and demand identified by the Basin Study.

The Oregon Water Resources Department is working with the U.S. Bureau of Reclamation to complete a Plan of Study. The focus of this effort is to fill possible data gaps related to water demands in the basin (instream and out-of-stream), with the primary goal of supporting the Willamette Basin Reservoir Study efforts. It has been determined that since the U.S. ACOE is operator of the system and BOR just holds the water rights that a basin plan would overlap too much with ACOE efforts already underway. There is a Major data gap in the basin as it relates to agricultural water use and our project will help provide scientific data to apply to the larger basin.

Identify the applicant's level of involvement in the Basin Study (e.g., costshare partner, participating stakeholder, etc.).

Santiam Water Control District is a key stakeholder in the Willamette basin study efforts and is one of if not the largest agricultural user in the basin.

Describe whether the project will result in further collaboration among Basin Study partners.

Yes the project will provide usage data with a high level of accuracy. individual canal segment volumes and flows, and both instantaneous and historical data can then be used as an informative basis to apply basin wide.

***Subcriterion E.2: Expediting Future On-Farm Irrigation Improvements***

Describe the extent to which this project complements an existing NRCS-funded project or a project that either has been submitted or will be submitted to NRCS for funding.

In 2014 The District received a small state NRCS Conservation Innovation grant to implement phase 1 of the automation project. By design, Phase 1 is expected to function as:

- an introductory system. Providing a “soft” transition and a familiarization period for district personnel, the board of directors and other stakeholders that have proven successful in the past.
- The foundation of a future, expanded SCADA system. The system will be designed to accept several additional, future SCADA sites (Phase 2).

“Real Time Flow Monitoring and Automation Project #69-0436-13-62 \$158,203.00”

The Oregon NRCS has been implementing a Strategic Approach to Conservation since 2010. A Local Work Group decided that water quantity was the number one resource concern in the county. Today the water quantity resource concern remains our priority concern. This identified resource concern lead to a Conservation Implementation Strategy written to improve water quantity that would last from 2010-2015 and be focused on the Stayton-Sublimity Restricted Groundwater Priority Area. This CIS allows producers to apply for cost share to improve existing irrigation systems with newer more efficient systems through NRCS’s Environmental Quality Incentive Program (EQIP). The key to the success of the Strategic Approach is the NRCS’s partnership with Local Work Groups that are comprised of stakeholders such as the Marion County Soil and Water Conservation District, local Water Control Districts, Watershed Councils, and the USFWS.

Prior to 2010, NRCS cost shared on eighteen new low-pressure energy efficient irrigation systems within the priority area covering approximately 3167 acres and saving approximately 2993 acre-feet of both surface and ground water during the irrigation season which lasts March 1 thru October 31.

Currently, this new strategic approach to conservation has led to Twenty-Six new low-pressure energy efficient irrigation systems in the priority area since 2010; covering 2496 acres and saving 3167.3 acre-feet of both surface and ground water (Please, see table 1 below). The total future water savings can be quantified by multiplying the annual water savings by the number of years implemented (ex. 1000 ac/ft saved annually X 10 years = 10,000 ac/ft saved). With this new strategic approach to conservation the Marion County NRCS hopes to improve ground water levels in the Stayton-Sublimity Restricted Groundwater Priority Area for agriculture production and future generations.

Table 1: Stayton-Sublimity Priority Area

	< 2010	2010 >	Totals
<b>Acres</b>	<b>3166.6</b>	<b>2496</b>	<b>5662.6</b>
<b>Ac/Ft saved</b>	<b>2992.7</b>	<b>3167.3</b>	<b>6160</b>
<b>Ac/Ft saved per acre</b>	<b>0.96</b>	<b>1.27</b>	<b>1.09</b>

***Subcriterion E.3: Building Drought Resilency***

***Subcriterion E.4: Other Water Supply Sustainability Benefits***

Will the project directly address a heightened competition for finite water supplies and over-allocation (e.g., population growth)?

Yes. The project will provide more instream flow. It will also allow the district to scientifically quantify its diversions and better communicate its water usage information.

Describe how the water source that is the focus of this project (river, aquifer, or other source of supply) is impacted by climate variation.

The District is a cooperator in the WW 2100 effort and our water usage data has been used for some input assumptions. It will be very helpful to have more complete and accurate data for future model calibration. While we don't have specific answers at this point, the North Santiam River does rely on mid-level snowpack that appears to be heavily impacted in early model runs.

**Synopsis of WW2100 Project**

In 2010, Oregon State University (OSU), Portland State University, and University of Oregon researchers were awarded a competitive National Science Foundation (NSF) grant under the Water Sustainability and Climate funding category. The "Anticipating Water Scarcity and Informing Integrative Solutions" or "Willamette Water 2100" (WW2100) project was funded at \$4.3 M (total over 5-6 yr. period) to develop a unique Willamette Basin model using the *Envision*™ computer platform integrated with climate, hydrology and economic models. The computing framework developed at OSU is being utilized to evaluate how climate change, population growth, and economic growth alter the availability and the use of water in the Willamette Basin. The research allows analysis of the potential impacts of changes in the availability and use of water on water scarcity, land use, water temperature, fisheries, and society's ability to meet diverse demands.

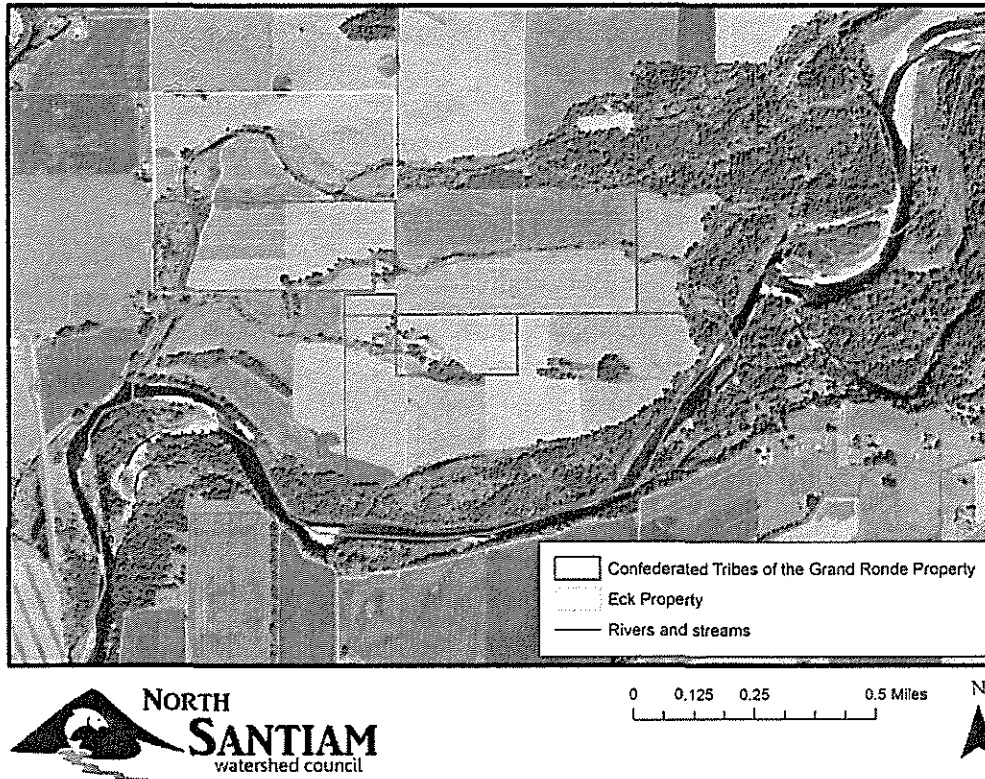
Will the project help to address an issue that could potentially result in an interruption to the water supply if unresolved?

Low river flow could lead to increased regulation and changes in the Willamette river basin system. New biological opinions related low flows could impact water delivery contracts with the BOR. This project will help to increase river flows.

Will the project make additional water available for Indian tribes?

Yes water left instream will flow 1.5 miles downstream where the Confederated Tribes of Grand Ronde recently purchased 338 acres to restore floodplain habitat.

### Lower North Santiam Restoration Alternatives Analysis OWEB Technical Assistance Grant Proposal



More recently the River Design Group, Inc. and WEST Consultants have initiated a floodplain restoration analysis which will result in a list of proposed floodplain restoration actions and preferred alternatives for the (338 acre) Chahalpam Wildlife Area property and for the (70 acre) Eck property both located in the lower North Santiam River floodplain. The analysis will assist the NSWC with identifying feasible and practical opportunities for reconnecting side channels and historic floodplain habitats along Dieckman Creek, several unnamed tributaries and along the lower North Santiam River between approximate river miles 12.5 to 14.6. Consultants, NSWC and technical team will identify and prioritize up to 5 floodplain restoration alternatives to incorporate into hydraulic model to determine risk and feasibility. Partners include the Confederated Tribes of Grand Ronde (landowner), Steve Eck (landowner), and technical advisors from the BLM, ODFW, TNC, Santiam WCD, USGS, etc.

Will the project make water available for rural or economically disadvantaged communities?  
Yes if some of the conserved water is used to irrigate new lands

Does the project promote and encourage collaboration among parties?  
Yes

Is there widespread support for the project?

Yes. The District has support from a wide variety of constituents! supported interests include Ecological, municipal, soil conservation, farming and stormwater. Letters of support are supplied by the county, 2 cities, and 2 watershed groups

Will the project help to prevent a water-related crisis or conflict?

Yes. In 2012 The tributary mill creek sustained a near 500 year flood event. In response local jurisdictions implemented the Mill Creek Watershed Flood Warning System.

The Warning System will incorporate existing City of Salem infrastructure with infrastructure funded through the Hazard Mitigation Grant Program, to form an area-wide network of stream and rainfall gauge data collection stations. The information gathered from these stations during wet weather events will be used to provide timely notification of the location and severity of potential flooding in the Mill Creek Watershed. Successful implementation of the project will assist in mitigating property damage and public safety issues in future wet weather events. The grant application was for a Federal Emergency Management Agency (FEMA) Hazard Mitigation Grant Program, specifically under the provisions of the 5 percent initiative criteria. The total grant project costs are \$159,952. The Implementation of this project will provide further data and sites will be incorporated into the Mill Creek Flood Warning System.

Is there frequently tension or litigation over water in the basin?

Section V. Application Review Information 51

The District had filed suit against our local city related to unauthorized stormwater discharges. We settled and entered into an MOU and partnership. The automation is a key component to the success of that partnership and will provide a fix that helps both parties. The district hopes to utilize the stormwater to offset (trade) diversion amounts. This can only be done with a fully automated system.

Will the project increase awareness of water and/or energy conservation and efficiency efforts?

Yes. This project will demonstrate the viability of installing automation and replacement of antiquated manual gate systems with retrofit equipment that minimizes water losses.

Will the project serve as an example of water and/or energy conservation and efficiency within a community?

Yes! The pacific northwest lags behind other areas in water system automation, in fact finding professionals with automating irrigation system experience was impossible. The district finally contracted with ITRC Cal-Poly to design the system. Once implemented successfully it should provide a local example of the benefits. One must travel to the east half of the state or California for examples now.

Does the project integrate water and energy components?

Yes. The project incorporates physical improvements to the water delivery system and incorporates small scale solar installations to power these devices and the SCADA control systems that manage them.



#### **V.A.6 Evaluation Criterion F: Implementation and Results (10 points)**

(1) Identify any district-wide, or system-wide, planning that provides support for the proposed project. This could include a Water Conservation Plan, SOR, Basin Study, drought contingency plan, or other planning efforts done to determine the priority of this project in relation to other potential projects.

The District has an approved Water Management and Conservation Plan approved by Oregon Water Resources Dept. on May 25, 2007 that meets the requirements of OAR Chapter 690, Division 086.

(2) Describe how the project conforms to and meets the goals of any applicable planning efforts, and identify any aspect of the project that implements a feature of an existing water plan(s).

The District's Water Management and Conservation Plan identified Goals, Concerns and Opportunities related to;

- SCADA implementation
- upgrading flow measurement capabilities to improve accuracy and accountability
- providing remote monitoring and data collection capabilities
- headgate automation

SWCD has contracted with ITRC Cal-Poly for design and project management. Phase One is progressing and all components are in place to easily transition into the Phase 2 component. Pre planning design has been completed with the whole project in mind.

This proposed project involves: i) removing existing gates and retrofitting new gate systems into existing concrete weirs and abutments, and ii) installation of flow measuring devices and monitoring equipment conduits, stilling wells and panel mounts all by District staff no permits are required for this work. The sites that will utilize 120 volts will need standard electrical permits. The SCADA and solar power installation is also modular and either mounts to the gate frames and adjacent concrete abutments or pole mounted adjacent to the installation along access roads. The project may entail minor earthwork immediately adjacent to the gate installations and minor formwork on some gate locations to fit the new frames. Work can proceed as soon as the irrigation "off-season" arrives.

The following schedule shows the sequence and timing of the proposed work.

Task ID	Task Description	Weeks Prior to Contract Finalization				Weeks After Contract Finalization													
		4	3	2	1	1	2	3	4	5	6	7	8	9	10	11	12	13	
1	Pre-bid walk-through and radio testing	█	█																
2	Contract bidding		█	█	█														
3	Kick-off meeting/conference call		█																
4	Infrastructure submittal					█	█												
5	Construction					█	█	█	█	█	█	█	█	█	█	█			
6	RTU CAD drawing submittal							█											
7	HMI and OIT screen review									█	█								
8	Integrator field visit and out shell completion										█	█							
9	Remote verification												█						
10	ITRC field visit													█					
11	O&M Manual submittal													█	█				
12	O&M acceptance														█	█			
13	System acceptance																	█	

**Table 3. General tasks and responsibilities for SCADA integration team**

	Major Tasks	Integrator	Contractor or District	ITRC
General	Provide a tentative schedule of work for SCADA coordination	X		
	Create an online tag list database for each PLC	X		
Wireless Communications	Provide SWCD with radio performance and hardware specifications to be met during radio testing	X		
	Schedule and conduct radio testing		X	
	Furnish and install radio masts		X	
	Pull and terminate radio cabling	X		
Power Supply	Provide new power drop, electric meter service from local utility		X	
	Arrange for pole/power and transformer at site Land high voltage (>48V) wires in RTU		X X	
Sensors and Conduits	Provide SWCD with a conduit schedule, schematic/drawing	X		
	Provide and install walkways, grating and safety handrails		X	
	Provide and install staff gauges at correct 0.00 ft reference		X	
	Provide and install conduit between sensors and RTU		X	
	Provide and install stilling wells and water level sensor mounts		X	
	Furnish and install water level and position sensors		X	
	Furnish and install sensor vandalism enclosures		X	
RTU Panels	Provide and pull sensor cabling		X	
	Terminate sensor cabling	X		
	Provide SWCD with RTU enclosure drawings	X		
	Provide complete and tested RTU NEMA enclosure	X		
	Install RTU panel		X	
	Provide and install RTU vandalism enclosures		X	
	Provide and install RTU vandalism enclosure intrusion switches	X		
Actuators	Provide and install motorized actuators		X	
	Pull and terminate power and signal conductors	X		
ISaGRAF Program	Program PLC with the site-office communications	X		
	Program ISaGRAF out shell based on ITRC specifications	X		
	Provide the ISaGRAF code for <u>remote manual</u> controls for gates	X		
HMI	Provide ISaGRAF code for the <u>automatic</u> control algorithm			X
	Provide ITRC and SWCD with HMI screens for review	X		
	Complete HMI programming, and auto dialer configuration	X		
	Final quality review of HMI content and functionality	X	X	X
OIT	Provide ITRC and SWCD with OIT screens for review	X		
	Program OIT touch screen	X		
Documentation	Final quality control recommendations for OIT screens		X	X
	Prepare the wiring diagram, datasheets and/or manual of the parts used	X		
	Provide SCADA Standard Operations Manual	X		
Quality Control	Provide automation and control manual			X
	Field testing of general functions and remote manual functions	X		X
	Remote testing of general functions, remote manual functions, HMI functions, etc.	X	X	
	Verify analog signal calibrations	X		X
Training	Verify digital signal I/O	X		X
	Field testing of automatic control logic with Integrator support			X
	Provide 8 hours of training for district personnel	X		X

***Subcriterion No. F.3: Performance Measures***

The performance measures for the project will include the following:

a) Improved operational control throughout the district - provide graphs of the before and after conditions. The District will more accurately be able to quantify losses through seepage between the new gates and metering devices, compare historic flows into and out of the system against a system wide management program. The latter issue will help quantify actual water conservation efforts and utilization of storm flows.

The post project SCADA system will allow the District to measure performance in a real time environment and allow decision makers to make adjusts with immediate impact to flow management.

b) Reduced staffing and trip costs along with energy generation savings from small scale solar installations - analysis of time cards and trip logs. How much time was spent on water operations vs. maintenance that would have been deferred?

The completion of the SCADA installation for system wide management will involve training of staff to use the software systems to manage water flows, thereby shifting staff from a in the field operational/management role to supervisory. A contract with the system provider will require a training component for District employees to facilitate this change in operations.

There is also a secondary benefit to real time monitoring of the system by the District staff. Spills and dike breaches will register as flow loss in the system and allow staff to become more alert via an alarm and therefore able to react quicker and more responsive to solving the problem before it results in significant losses. Remote operation of gates would allow isolation of a canal segment to confine the loss.

c) Water savings from reduced spills - actual vs. previously estimated and reaction time by staff to resolve the issues based on an automated alarm system as opposed to visual inspection or farmer notification. This measure also allows the District to quantify spills that will continue to occur until a water balance within canal segments is achieved at completion of the improvements and to measure spills in a before and after state.

d) Increased service levels to farmers - responding to on demand delivery and maintaining channel levels for same. Graphing of flow measurements through each segment which cannot be done currently. The implementation of accurate flow management will allow the District to measure distribution of irrigation waters throughout its 114 miles of canals through remote sensing as opposed to manual adjustments and field observations.

e) Accurate measurement of water sold - allocations for market water can be measured. Retention within a water balanced system will show exactly what is available for transfer as opposed to the current pass through, especially for storm water flow excess.

f) Accurate accounting of environmental flows to North Santiam River

g) Increased annual output of hydropower system indicating increased reliability

**Subcriterion No. F.4: Reasonableness of Costs**

The following calculation assumes an average rainfall year and does not account for the storm water flows which will be better managed by the District using a water balance within the canal system monitored and controlled by the SCADA management system.

$$\begin{aligned} & \$941,700 \\ & 25,220 \times 40 = .93 \end{aligned}$$

**V.A.7 Evaluation Criterion G: Additional Non-Federal Funding (4 points)**

Non-Federal Funding - \$641,700.00

Total Project Cost - \$941,700.00

Non Federal Funding – 68.1%

**V.A.8 Evaluation Criterion H: Connection to Reclamation Project Activities (4 points)**

(1) How is the proposed project connected to Reclamation project activities?

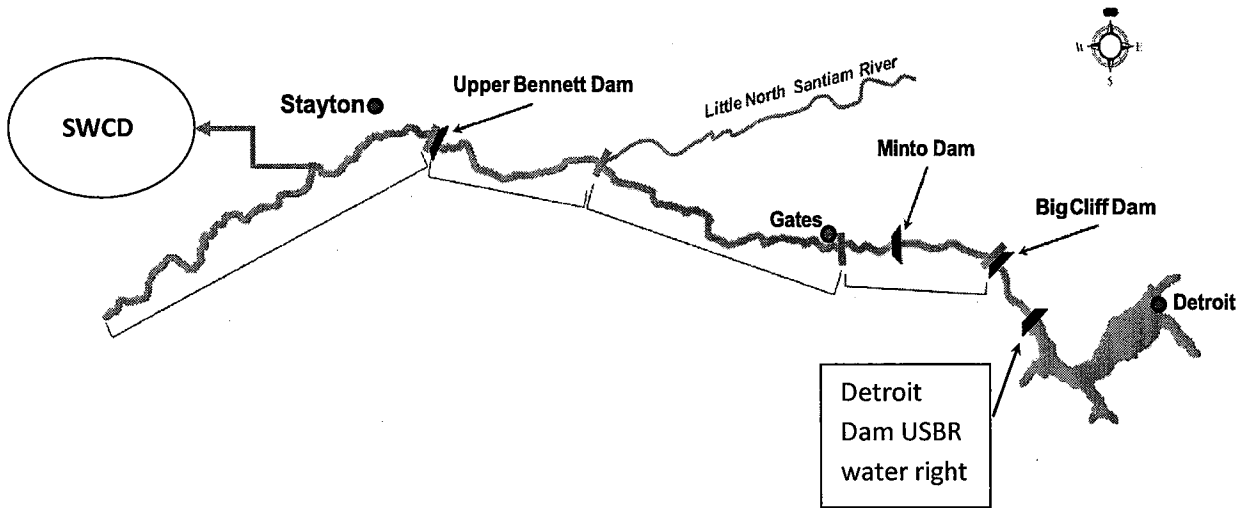


Figure V.A.8 Detroit Dam US A.C.O.E., water rights held by US B.O.R.

(2) Does the applicant receive Reclamation project water?

Yes: Willamette Basin Project: Contract #140510W0675 and 140510W1118 source from Detroit lake

(3) Is the project on Reclamation project lands or involving Reclamation facilities?

No

(4) Is the project in the same basin as a Reclamation project or activity?

Yes

(5) Will the proposed work contribute water to a basin where a Reclamation project is located?

No

(6) Will the project help Reclamation meet trust responsibilities to Tribes?

Yes

## Environmental and Cultural Resources Compliance

1) Will the project impact the surrounding environment (e.g., soil [dust], air, water [quality and quantity], animal habitat)? Please briefly describe all earth-disturbing work and any work that will affect the air, water, or animal habitat in the project area. Please also explain the impacts of such work on the surrounding environment and any steps that could be taken to minimize the impacts.

Soil – Slight impact to canal banks, nothing more extensive than normal maintenance activities. Work will be completed when ditches are turned off for the season.

Air - None

Water – Controlled water release results in minimizing operational spillage and improved water delivery to the user.

Plants – None.

Animals – None

Energy, Human – High technology will control water release results in minimizing operational spillage and improved water delivery to the user.

2) Are you aware of any species listed or proposed to be listed as a Federal threatened or endangered species, or designated critical habitat in the project area? If so, would they be affected by any activities associated with the proposed project?

Salmonids are listed as threatened in the basin but the project will occur on district easements and facilities while water is shut off. Activities will be similar to normal maintenance activities and occur on existing structures and canals. All planned activities and will not introduce a new element of activity.

3) Are there wetlands or other surface waters inside the project boundaries that potentially fall under CWA jurisdiction as “waters of the United States?” If so, please describe and estimate any impacts the project may have. None present

4) When was the water delivery system constructed? The construction of ditches dates back to the late 1800s but all have been cleaned excavated or re-dug since.

5) Will the project result in any modification of or effects to, individual features of an irrigation system (e.g., headgates, canals, or flumes)? If so, state when those features were constructed and describe the nature and timing of any extensive alterations or modifications to those features completed previously.

Santiam Water Control District Fish Screen and Barrier Project – Constructed July 2002  
– September 2003

6) Are any buildings, structures, or features in the irrigation district listed or eligible for listing on the National Register of Historic Places? A cultural resources specialist at your local Reclamation office or the State Historic Preservation Office can assist in answering this question.

Yes. Stayton Hydroelectric Project, Santiam Water Control District, Stayton, Marion County, Oregon (FERC Project No. 12574-00-OR)

7) Are there any known archeological sites in the proposed project area?

No Known sites, No archeological sites have been encountered in the immediate area in the past due to project installations on Santiam WCD right-of-ways, or farming activities on the adjacent fields.

8) Will the project have a disproportionately high and adverse effect on low income or minority populations?

No, this project will not have an effect on low income or minority populations.

9) Will the project limit access to and ceremonial use of Indian sacred sites or result in other impacts on tribal lands?

No, this project will not impact any tribal lands. No cultural resource activities have been encountered in the immediate area in the past due to project installations on Santiam WCD right-of-ways, or farming activities on the adjacent fields.

(10) Will the project contribute to the introduction, continued existence, or spread of noxious weeds or non-native invasive species known to occur in the area?

No, it will not.

### Required Permits or Approvals

<b>Project Activity Requiring a Permit/License</b>	<b>Permit or License Name</b>	<b>Entity Issuing Permit or License</b>
Installation of electrical panels	Electrical permit & inspection	City of Stayton (inside City)
Installation of electrical panels	Electrical permit & inspection	Marion County (outside City)
Use of radio equipment TBD (if a licensed frequency is used)	FCC Universal license	Federal Communications commission





**Marion County**  
OREGON

Board of Commissioners

(503) 588-5212  
(503) 588-5237 - FAX

BOARD OF  
COMMISSIONERS

**Samuel Brentano**  
**Patti Milne**  
**Janet Carlson**

April 15, 2014

Brent Stevenson  
General Manager  
Santiam Water Control District  
284 E Water Street  
Stayton, OR 97383

Keith Campbell  
City Administrator  
City of Stayton  
362 N. 3<sup>rd</sup> Avenue  
Stayton, Oregon 97383

CHIEF  
ADMINISTRATIVE  
OFFICER

**John Lattimer**

RE: Automation of Santiam Water Control District Headgates

Dear Mr. Stevenson and Mr. Campbell:

The Marion County Board of Commissioners supports the City of Stayton and Santiam Water Control District proposal to automate headgates on the District's waterways in Stayton. In January 2014, the Board approved a \$19,500 Marion County grant to help pay for design engineering for this project in anticipation of the City's and District's plan to seek construction grant funding for this project.

The proposed project is consistent with the County's mission to support our local communities and special districts. We agree the efficient management and control of water flows is needed, particularly during peak storm events. The project will also protect water quality, reduce flood impacts and support our agricultural economy. We encourage OWEB to approve a construction grant for this important project.

Sincerely,

Sam Brentano  
Chair



April 21, 2014

Oregon Watershed Enhancement Board  
775 Summer St NE, STE 360  
Salem, OR 97301-1290

RE: Irrigation Automation in the Santiam Water Control District Grant Proposal

Dear OWEB Board Members:

The North Santiam Watershed Council is writing this letter in support for the Santiam Water Control District and City of Stayton's OWEB Restoration grant proposal which will allow for the automation of the irrigation waterway delivery system throughout the Santiam Water Control District.

We understand irrigation water for the Santiam Water Control District is diverted from the North Santiam River at two diversion points both located in Stayton (Salem Ditch and Stayton Ditch). The diverted water flows through Stayton before entering into the irrigation channels that provide water to 17,000 acres of agricultural fields located southwest and west of Stayton. In addition, the City of Stayton uses this waterway system to discharge the majority of its storm water runoff. At present, the Water Control District staff controls the flow of water in these canals by manually operating 14 Key head gates throughout the irrigation district.

With the rapid rate in which water flow conditions can change in the North Santiam River, either due to varying flow releases from Big Cliff and Detroit Dams or from weather related events, having a manual operating system is highly inefficient. The North Santiam Watershed Council recognizes that there is a need for a more efficient water control management system in the Lower North Santiam, particularly during peak storm events.

Many of the North Santiam restoration plans identify low flow and connectivity as issues of concern. The OWEB Willamette Basin Restoration Priorities Watershed Summaries (Dec. 21, 2005) – pp 80-84 specifically identifies withdrawals in the lower reach as a high priority. The proposed project aligns with the North Santiam Watershed Council's mission to protect, enhance and improve the natural resources in the North Santiam Watershed. Managing our water resources efficiently, particularly water flow is an essential component to improving the water quality and the fish and wildlife habitats in the North Santiam.

Please contact me if you have any questions regarding this letter of support.

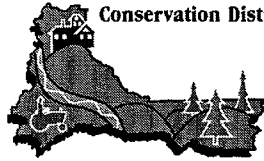
Thank you for your time.

Sincerely,

A handwritten signature in black ink that reads "Brad A. Nanke".

Brad A. Nanke  
Council Chair

**Marion Soil & Water  
Conservation District**



650 Hawthorne Ave. SE # 130 – Salem, OR 97301

Phone 503-391-9927 – FAX 503-399-5799

[www.marionswcd.net](http://www.marionswcd.net)

April 17, 2014

Oregon Watershed Enhancement Board  
775 Summer St.NE, Ste. 360  
Salem, OR 97301-1290

RE: Irrigation Automation in the Santiam Water Control District Grant Proposal

Dear OWEB Board Members:

The Marion Soil and Water Conservation District is writing this letter in support for the Santiam Water Control District and City of Stayton's OWEB Restoration grant proposal which will allow for the automation of the irrigation waterway delivery system throughout the Santiam Water Control District.

On April 2, 2014, the Marion SWCD Board of Directors approved a **\$20,000 cash match** and also will **donate \$28,000 of used flow measuring equipment** for the project since many of the North Santiam restoration plans identify low flow and connectivity as issues of concern.

We understand how vital irrigation water is especially to those that farm within the Santiam Water Control District's boundaries and how that water is now diverted from the North Santiam River at two diversion points both located in Stayton (Salem Ditch and Stayton Ditch). The diverted water flows through Stayton before entering into the irrigation channels that provide water to 17,000 acres of agricultural fields located southwest and west of Stayton. In addition, the City of Stayton uses this waterway system to discharge the majority of its storm water runoff. At present, the Water Control District staff controls the flow of water in these canals by manually operating 14 Key head gates throughout the irrigation district.

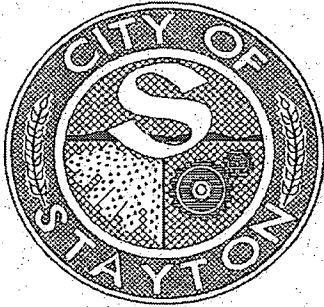
With the rapid rate in which water flow conditions can change in the North Santiam River, either due to varying flow releases from Big Cliff and Detroit Dams or from weather related events, having a manual operating system is highly inefficient. The Marion SWCD recognizes that there is a need for a more efficient water control management system in the Lower North Santiam, particularly during peak storm events and is willing to support these efforts with a cash match and the donation of used flow measuring equipment.

Therefore, the Marion SWCD strongly encourages the OWEB Board Members to fund the grant application from the Santiam Water Control District and the City of Stayton.

Sincerely,

*Tim Bielenberg*

Tim Bielenberg, Board Chair



# City of Stayton

*Administration • Finance*

362 N. Third Avenue • Stayton, OR 97383  
Phone: (503) 769-3425 • Fax: (503) 769-1456

April 16, 2014

Oregon Watershed Enhancement Board  
775 Summer St NE, STE 360  
Salem, OR 97301-1290

RE: Irrigation Automation in the Santiam Water Control District Grant Proposal

Dear OWEB Board Members:

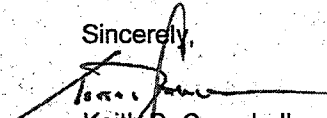
The City of Stayton is pleased the Santiam Water Control District is submitting a grant application to the Oregon Watershed Enhancement Board to automate headgates on the District's waterways in Stayton. Earlier this year SWCD and the City of Stayton signed a memorandum of agreement to resolve a lawsuit regarding the discharge of the city's storm drainage into the District's waterways.

Under our agreement, the automation of the headgates is the highest priority project for completion in 2014. The City obtained a small grant of \$19,500 from Marion County to assist with design analysis and preliminary engineering for this project and the City of Stayton has committed up to \$230,000 for the construction of the automated headgates.

The City and SWCD are working cooperatively to plan for and complete priority projects to improve the City's storm drainage system in a manner that will benefit all city residents and the patrons of the District. We are committed to working with the District during the final design and construction of these improvements. The completion of this project will be a major step forward for both agencies.

The City of Stayton strongly supports this project and recommends that OWEB approve construction grant funding. The grant will enable both agencies to move forward and improve the management of our water resources.

Sincerely,



Keith D. Campbell  
City Administrator

**Police**

386 N. Third Avenue  
Stayton, OR 97383  
Phone: (503) 769-3423  
Fax: (503) 769-7497

**Planning**

362 N. Third Avenue  
Stayton, OR 97383  
Phone: (503) 769-2998  
Fax: (503) 767-2134

**Public Works**

362 N. Third Avenue  
Stayton, OR 97383  
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**Wastewater Facilities**

950 Jetters Way  
Stayton, OR 97383  
Phone: (503) 769-2810  
Fax: (503) 769-7413

**Public Library**

515 N. First Avenue  
Stayton, OR 97383  
Phone: (503) 769-3313  
Fax: (503) 769-3218



# Oregon

John A. Kitzhaber MD., Governor

Department of Fish and Wildlife  
South Willamette Watershed District Office  
7118 NE Vandenberg Avenue  
Corvallis, OR 97330  
(541) 757-4186  
FAX (541) 757-4252

April 17, 2014

Oregon Watershed Enhancement Board  
775 Summer St NE, STE 360  
Salem, OR 97301



RE: Automated irrigation project in the Santiam Water Control District

Dear OWEB Board Members:

The Mid-Willamette District office of the Oregon Department of Fish and Wildlife (ODFW) is supportive of the Santiam Water Control District's (SWCD) proposal to automate their head gates.

Providing continual, reliable flow to the SWCD channels means consistent habitat and water temperatures for fish within these channels. While much of the canal system is screened, juvenile trout and migratory fish exist in the canal system and ensuring a steady water supply to them is important for fish habitat and to reduce bird predation. The present system with 14 manual head gates means that reducing or increasing flows when necessary is a laborious process. The new automated gates will provide flexibility to SWCD's response in varied situations including emergency situations that could impact native fish.

More efficient management of our water resources means more water for all, including fish and other wildlife.

Thank you for your consideration of this proposal.

Sincerely,

Elise Kelley, Ph.D.  
District Fish Biologist

**Official Resolution**

To be submitted within 30 of the application deadline.

Santiam Water Control District Board next meets February 9<sup>th</sup>, 2015

**Project Budget**

The following provides an explanation of costs for the proposed project budget:

- a) *Salaries and Wages* – The District intends to complete the removal of the existing gates and to install the new automated gates, SCADA system and solar power components and possibly measurement device concrete. Using its own employees under force account labor. The estimated cost is based on the budget per task as provided by ITRC. It is also assumed that the work will be done in the "off irrigation season" which will require two calendar years to complete. The following table illustrates who will be involved in the project, monthly salary or hourly rates, fringe benefits per month or hourly and percent of their monthly time involved in the project. It is understood that this project will require full time attention during the off season for 2 years, temporary staff may be hired to assist with work load

Designated Personnel:

Name/Title	Base Salaries/Wages Hours	Fringe	
Brent Stevenson, Manager	\$35.91 / hr.	\$16.32 / hr.	345
John Asman	\$25.50 / hr.	\$14.33 / hr.	760
Ben Devine	\$18.50 / hr.	\$10.33 / hr.	648
Tresa Peters	\$22.00 / hr.	\$10.89 / hr.	85

- b) *Fringe Benefits* - Fringe Benefit Rates per employee account for medical, dental and life insurance, retirement, State workers compensation insurance and unemployment, Medicare and Social Security taxes and vehicle reimbursement expense.
- c) *Travel* – No travel and related expense costs outside of the District are anticipated for the purposes of implementing this project.
- d) *Equipment* – The District proposes to use its own construction equipment and no rental or purchase is anticipated at this time. Unanticipated expense not foreseen at this time would be purchased out of contingencies.
- e) *Materials and Supplies* - The District proposes to purchase concrete for minor modification of the gate structures to hold the frames for the new automated gates systems. The estimated cost of \$130 per cubic yard for delivery of short loads which usually have a higher cost and include a fuel surcharge by the vendor.
- f) Contractual - The following list includes contracted work and tasks;
  - ITRC Cal-Poly

- SCADA System Design, measuring device concepts, programming, training and final system testing.
  - Sierra Controls
    - Integrator, SCADA device wiring ,panels
  - AMEC foster wheeler
    - Measuring device design, district facility engineering, Reporting
- g) *Environmental and Regulatory Compliance Costs* – Non expected
- h) *Reporting* – In addition to the required 1% set-aside for environmental and regulatory permits as set forth in the application instructions, the District will contract with a consultant to prepare the required reports, reimbursements and other grantor required information as it does not have sufficient administrative staff. It is anticipated that 2.5% of project cost will be sufficient to cover this expense over a two year project timeline.
- i) *Indirect Costs* - The District does not have an approved OMB overhead cost allocation plan.

**Table 1.—Summary of non-Federal and Federal funding sources**

Funding sources	Funding
Phase One cost for information only (pre-July 2014)	
Federal	\$15,000
In-kind	\$10,774
Phase One Pre project cost for information only (post-July	
Federal	\$60,000
In-Kind	\$72,429
Existing Phase One NRCS grant	\$158,203
Non-Federal entities	
Santiam Water Control District (capital improvement funds)	\$ 372,200
Marion Co Community Projects Grant Program	\$ 19,500
City of Stayton	\$ 230,000
Marion Soil & Water Conservation District	\$ 20,000
<i>Non-Federal subtotal:</i>	\$ 641,700
Other Federal entities	
<i>Other Federal subtotal:</i>	



<i>Requested Reclamation funding:</i>	\$ 300,000
<i>Total project funding:</i>	\$ 941,700

**Table 3.—Funding sources**

<b>Funding sources</b>	<b>Percent of total project cost</b>	<b>Total cost by source</b>
SWCD funding	40%	\$ - 372,200
City of Stayton	24.5%	\$ - 230,000
Marion SWCD	2%	\$ - 20,000
Marion County	2%	\$ - 19,500
Reclamation funding	32%	\$ - 300,000
Other Federal funding	0%	\$ -
<b>Totals</b>	<b>100%</b>	<b>\$ -</b>

Related funding consists of Phase one funding;

**NRCS Conservation Innovation Grant:**

The SWCD has received a grant “Real Time Flow Monitoring and Automation Project #69-0436-13-62 \$158,203.00” for the automation of one single gate and a base station (lite version) currently funded under the NRCS Conservation Innovation Grant program. This project being proposed in this application (phase 2) will build on the current efforts. The overall project design and preliminary budget was developed on the project as a whole but as instructions have indicated all the answers address this application only. For the purposes of the application narrative it is being treated as a secured funding component but for all detail of benefits and costs it has been considered as an independent project. The District did apply for a state funded grant through the Oregon Watershed Enhancement Board but was unsuccessful. Support letters are written for the OWEB application but all entities have agreed their support letters are applicable regardless of funding entity.

ITRC Phase 2 SCADA plan								\$63,700	
Site	Sierra Controls Integration - RTU, sensors, wiring, radio, install and implementation	Number of actuators	Actuator cost	Gate replacement?	Gate Cost (est. \$4000 per gate)	Item to be constructed	Construction	Other	
1A - Head of Salem Ditch (not including measurement of water level at rated section)	\$35,000	1	\$12,000						
8 - Rated Section	\$30,000					Weir under bridge	\$20,000		
NorPak Weir	\$35,000	1	\$8,000			New LCW	\$40,000		
5 - Butler Head	\$35,000	1	\$8,000	Y	\$4,000	Replogle Flume	\$15,000		
6 - Mix Head	\$35,000	1	\$8,000	Y	\$4,000	New gate section	\$15,000		
3 - Flow monitoring	\$20,000					Modified section	\$15,000		
1 - Power Canal Diversion	\$10,000	3	\$48,000		\$12,000				
H - Hydro Plant on Power Canal	\$25,000								
2 - Entrance to Main Canal; spill from Power Canal to river	\$35,000	3	\$48,000	Y	\$12,000				
7 - upstream of private hydro; bifurcation u/s of hydro (Facility "A")	\$18,000	1		Y	\$4,000	Long crested weir u/s of hydro, gate installation	\$30,000		
7 - downstream of hydro. Spill to river and re-start of Main Canal (Facility "B")	\$35,000	1	\$8,000	Y	\$4,000	Long crested weir, gate installation	\$30,000		
Flow measurement various (3 total)	\$60,000						\$40,000		
Base Station	\$50,000					Antenna tower	\$10,000		
ITRC Implementation and testing								\$60,000	
Subtotals	\$423,000		\$140,000		\$40,000		\$215,000	\$60,000	\$878,000
<b>Total</b>								<b>\$941,700</b>	



October 17, 2014  
Project No. 1-61M-123510

Santiam Water Control District (SWCD)  
284 E Water Street  
Stayton, Oregon 97383

Attention: Brent Stevenson

Subject: Flow Reduction from Headgate Automation of Salem Ditch and Stayton (Power) Canal  
Stayton, Oregon

Dear Brent:

AMEC has analyzed the reduction in diversion flows to Salem Ditch and Stayton (Power) Canal that might be expected if operation of their respective headgates were to be automated. Figures 1 and 2 plot the average monthly flows in Salem Ditch and Power Canal, respectively, including the range of flows attributed to excess diverted flow (see below for discussion). Tables 1 and 2 summarize the mean monthly flows and range of reduction in diverted flows to Salem Ditch and Power Canal (respectively) that are predicted. The tables also summarize the range of reductions in volume of diverted flow that are predicted for the two canals.

### **RIVER STAGE FLUCTUATIONS LEAD TO DIVERSION FLOW FLUCTUATIONS**

The flow diverted to Salem Ditch and Stayton (Power) fluctuates from day to day, and much of that fluctuation represents excess water that was diverted as a result of fluctuations in upstream river stage. A visual comparison of flows diverted into Salem Ditch and Stayton (Power) Canal shows that the pattern of variation (high and low points) is often similar between the two flows, even though the flows are controlled by two separate headgates and are measured separately. Much of the variation is therefore from the upstream water surface in the North Santiam River, because its variation will affect both diversions similarly. Figure 3 illustrates this comparison by showing time series of mean daily flows in Salem Ditch and Power Canal (flow data from SWCD, 2014). The figure's legend also shows the order of the lines on the figure (top-to-bottom). Both flows often have coincident patterns of variability.

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**Table 1: Flow reductions for Salem Ditch**

Month	Salem Ditch				
	Mean daily flow (cfs)	Flow reduction (cfs) from:		Volume reduction (acre-ft) from:	
		Downstream precipitation	River stage fluctuation	Downstream precipitation	River stage fluctuation
January	55.9	2.8	4.7 - 10.6	170	290 - 650
February	48.6	0.9	2 - 7.2	50	110 - 400
March	34.4	0.8	3.6 - 3.8	49	220 - 230
April	34.8	0.9	2.6 - 4.7	54	150 - 280
May	47.3	0.5	2.9 - 4.8	31	180 - 300
June	61.4	0.3	1.8 - 7.4	18	110 - 440
July	61	0.1	1.6 - 9	6	100 - 550
August	68	0.2	1.6 - 9.1	12	100 - 560
September	75.3	0.6	1.6 - 9.2	36	100 - 550
October	58.2	1.9	3.5 - 12	120	220 - 740
November	55.6	1.3	4 - 8	77	240 - 480
December	59.7	2.9	5.3 - 9.8	180	330 - 600

**Table 2: Flow reductions for Stayton (Power) Canal**

Month	Stayton (Power) Canal		
	Mean monthly flow (cfs)	Flow reduction from river stage fluctuation (cfs)	Volume reduction from river stage fluctuation (acre-ft)
January	307	39 - 42	2400 - 2600
February	306	52 - 25	2900 - 1400
March	368	54 - 24	3300 - 1500
April	333	8 - 58	480 - 3500
May	323	4 - 34	250 - 2100
June	361	9 - 63	540 - 3700
July	364	27 - 30	1700 - 1800
August	346	30 - 35	1800 - 2200
September	363	21 - 36	1300 - 2100
October	350	69 - 53	4200 - 3300
November	297	42 - 44	2500 - 2600
December	321	28 - 46	1700 - 2800



Headgate structures at the inlets to Salem Ditch and Power Canal are used to control how much flow is diverted from the North Santiam River into the two canals by varying the opening of one or more sluice gates. However, the flow diversion is also governed by the upstream stage in the North Santiam River. These gates (one for Salem Ditch and four for Power Canal) are at present operated manually and are thus unable to be operated to actively respond to changes in the water surface and inflows from downstream runoff that affect the amount of water in the canals flowing to downstream users.

Automation of headgate operation uses electrical links from downstream flow meters to control electrical motors that operate the gates. This allows a desired flow to be maintained in each canal. Automation thus offsets two sources of variation in diverted flows: downstream precipitation increasing flow in the canal above the diverted flow, and higher river stages forcing extra flow through the diversion structure than intended. Both effects result in diverting extra water than downstream users required, and both effects can be offset by headgate automation.

## **DIVERTED FLOW SAVINGS BY AUTOMATION**

The data summarized in Figures 1 and 2 and Table 1 was based on analysis of mean daily flow data. A two-step process was utilized to estimate the amount of excess diverted flow to Salem Ditch that headgate automation would save. First, daily precipitation was downloaded from the Salem airport gage (NOAA, 2014). Mean daily flows from that precipitation were estimated by multiplying the daily precipitation depth (inches) by the ratio 11.1. This ratio relates the 2-year precipitation depth (2.5 inches per day) (Stayton, 2008) to the 2-year runoff volume (as mean cubic feet per second, cfs) for areas draining to Salem Ditch. Runoff was summarized from tables of modeled outflows developed for the Stayton plan (Keller, 2013).

Second, a range of diversion flow variation from river stage fluctuation was visually estimated using the time series of flows in Salem Ditch. Figure 4 compares the time series of mean daily flows in Salem Ditch to the reduced flow from subtracting downstream runoff from precipitation and a range of estimated variation due to river stage fluctuation. The figure's legend also shows the order of the lines on the figure (top-to-bottom).

Similarly for Power Canal a range of diversion flow variation from river stage fluctuation was visually estimated using the time series of flows. However, downstream runoff from precipitation was not estimated because relative to Salem Ditch the diverted flows are much higher and the drainage area (and resulting runoff from precipitation) is much lower, so the effect of precipitation would be a small fraction of 1 percent. Figure 5 compares the time series of mean daily flows in Power Canal to the reduced flow from subtracting a range of estimated variation due to river stage fluctuation. The figure's legend also shows the order of the lines on the figure (top-to-bottom).



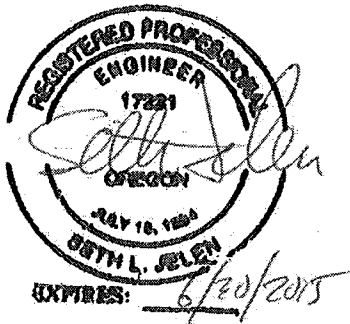
## LIMITATIONS

This report was prepared exclusively for SWCD by AMEC Environment & Infrastructure, Inc. (AMEC). The quality of information, conclusions, and estimates contained herein is consistent with the level of effort involved in AMEC services and based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions, and qualifications set forth in this report. This report is intended to be used by SWCD for this project only, subject to the terms and conditions of its contract with AMEC. Any other use of, or reliance on, this report by any third party is at that party's sole risk.

Sincerely,

AMEC Environment & Infrastructure, Inc.

REVIEWED BY:



Seth Jelen, PE, CFM, CWRE  
Principal Engineer – Water Resources

Habib Matin, PE, PhD  
Principal Engineer – Water Resources

SJ/\_\_\_



## REFERENCES

SWCD (2014). *Mean daily flow and stage data for Salem Ditch and Stayton (Power) Canal for 2007-2008 and 2013-2014*. Email communication to AMEC from Santiam Water Control District. October 2014.

Stayton (2008). *Storm Water Master Plan for City of Stayton*. Stayton, Oregon. May 2008.

Keller (2013). *Hydrographs from XP-SWMM Model Files from City of Stayton Storm Water Master Planning*. Stayton, Oregon. Email communication to AMEC from Keller Associates. 2013.

NOAA (2014). *Global Summary of the Day for Salem McNary Field Airport, Station ID 726940, WBAN ID 24232, for 1973 through 2014*. Downloaded from <http://www.ncdc.noaa.gov> October 6, 2014.





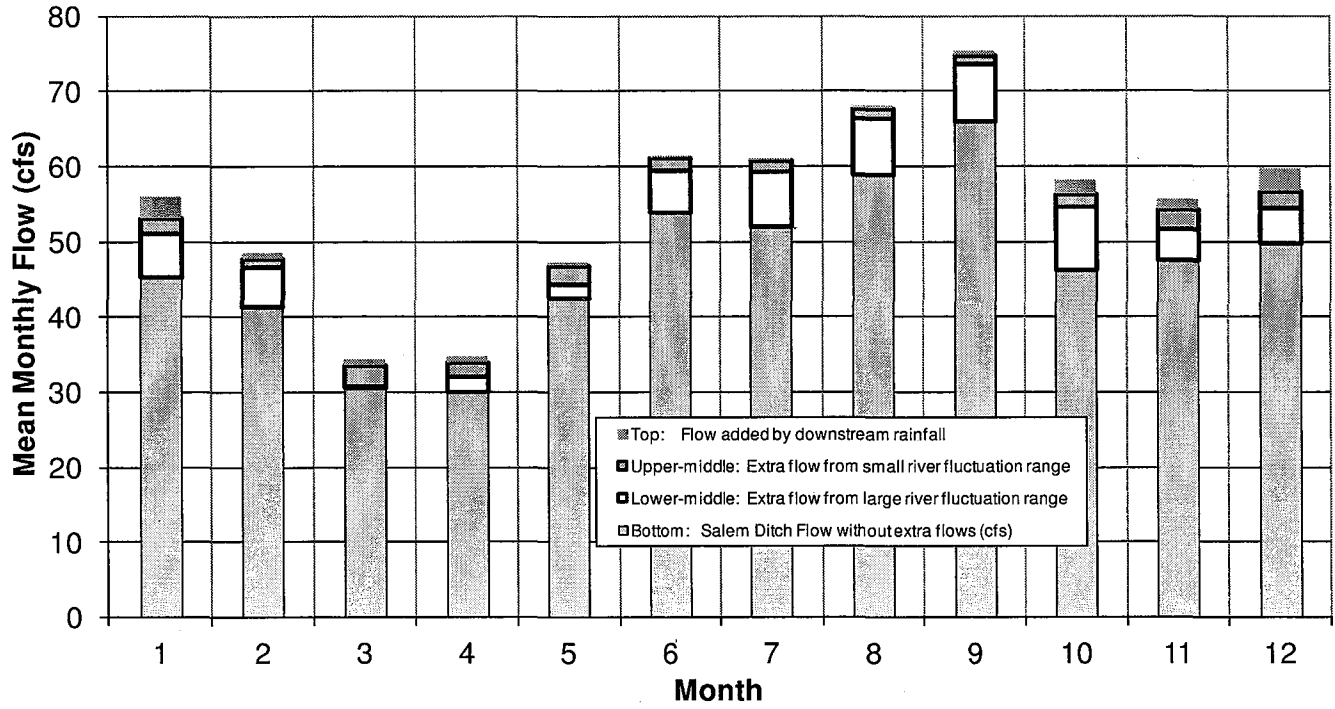
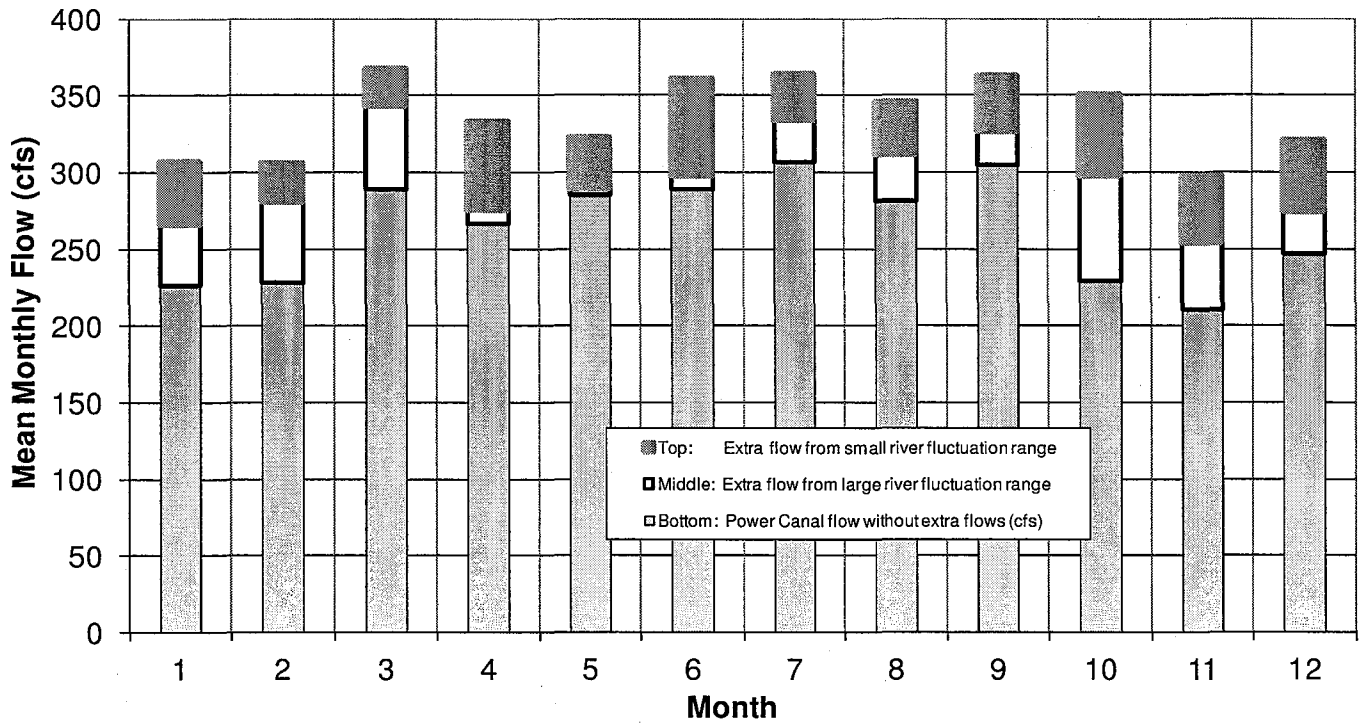


Figure 1: Salem Ditch Flows by Month



**Figure 2: Stayton (Power) Canal Flows by Month**

Figure 3: Salem Ditch and Power (Salem) Canal Flow Variations

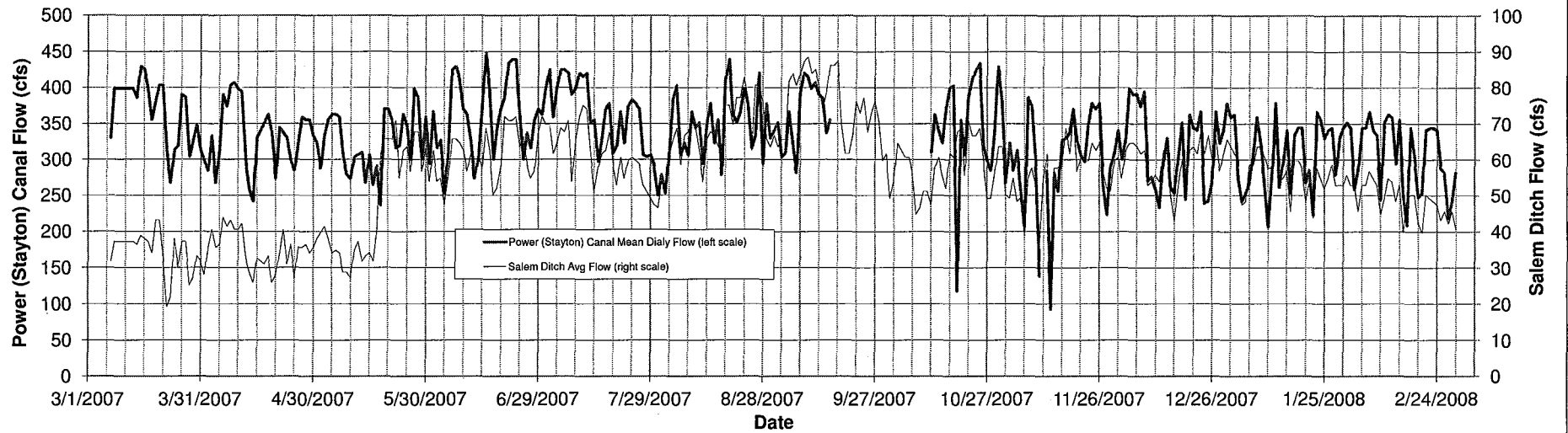
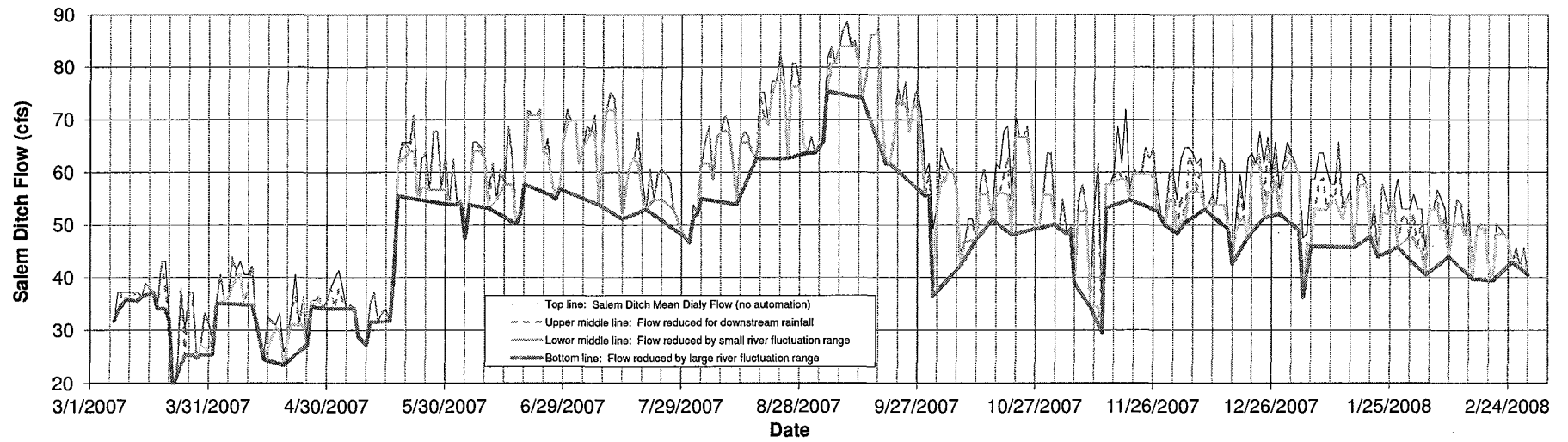


Figure 4: Salem Ditch Flow Analysis



**Figure 5: Power (Salem) Canal Flow Analysis**

