INSTALLATION OF STREAM-WIDTH PIT TAG INTERROGATION SYSTEMS TO TRACK HABITAT USE AND NON-NATAL REARING PATTERNS OF JUVENILE COHO IN TRIBUTARIES TO THE LOWER KLAMATH RIVER

FINAL REPORT
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Abstract

The Klamath River estuary and its tributaries serve as vital rearing areas for salmonid species migrating from the entire Klamath River Basin. The use of PIT (Passive Integrated Transponder) tags has increased significantly in recent years and fish from the entire basin are being tagged and released. Specifically, the Yurok and Karuk Tribes initiated a project in 2006 to gain knowledge about coho utilization of the mainstem Klamath River and nonnatal corridor habitats.

Data collected will augment information collected by the Yurok Tribal Fisheries Program (YTFP) by increasing the 'recapture' rate of PIT tagged fish and aid in the assessment of survival and length of residency. In addition, data would be collected for non-targeted species that may possess a PIT tag. Through inter-agency communications, this data would be invaluable in determining the fate of fish tagged throughout the Klamath Basin.

Introduction

Coho salmon (*Oncorhynchus kisutch*) in the Klamath River basin, as part of the Southern Oregon/Northern California Coasts evolutionary significant unit (SONCC Coho ESU), were listed as threatened under the Endangered Species Act (ESA) in 1997. The National Marine Fisheries Service (NMFS) cited water management, water quality, loss of habitat, overfishing, and other factors as causing a serious decline of the species within this ESU. The California Department of Fish and Game gave the highest priority to the Klamath Glen HSA in their Recovery Strategy for California Coho Salmon, which is where the proposed project will take place.

Little is known about the fate of juvenile coho rearing in the Klamath River Basin. It is thought that conditions in the mainstem Klamath, especially temperature in summer months and flows during winter months, become too harsh for juvenile coho and that few survive. To address this issue, the Yurok and Karuk Tribes initiated a project in 2006 to gain knowledge about coho utilization in the mainstem Klamath River and nonnatal corridor habitats. Previous studies have shown extensive redistribution of juvenile coho, with some juvenile coho salmon immigrating into off-channel habitats. These habitats provide refuge from high flow velocities. Peterson (1982a) and Peterson and Reid (1984) described extensive movements of juvenile coho out of the mainstem Clearwater River (Washington Coast) into off-channel ponds. Thousands of juvenile coho salmon can move upstream through a tiny egress channel into a single pond within a short period of time—showing this to be a very striking pattern of migration for this species. Once coho juveniles have moved into these sites, few move back out into the main stream during the winter—the large majority stay for the duration and emigrate in the spring as smolts. Their overwinter survival in these sites is typically high (approximately 70%) although it can apparently be less in very shallow ponds (Peterson 1982b; Peterson and Reid 1984).

In 2007, the Yurok and Karuk Tribes began intensive sampling in the middle and lower Klamath River with a focus on PIT (Passive Integrated Transponder) tagging of coho pre-smolts. The

Karuk Tribe deployed over 1,600 tags during the fall of 2007 and the Yurok Tribe implanted over 700 coho with tags in their extensive array of fyke traps in the Lower Klamath River (Figure 1). To date, the Yurok Tribe has had 214 recapture events, with 23 of those recaptures being individuals marked in the Mid-Klamath by the Karuk Tribe. Preliminary data show extensive growth occurring in these non-natal rearing areas (Yurok Tribal Fisheries Program, unpublished data).

Several problems have been encountered by Yurok Tribal Fisheries Program staff in maintaining fyke net traps in off channel areas such as Lower Waukell and Panther Creek. Mammalian predation in fyke traps is common and is difficult to remedy. YTFP staff have deployed live traps and attemped to relocate problem animals, but have had little success. In addition, high winter flows occasionally require staff to remove traps. The role that these two factors play in preventing recaptures, in addition to the fact that traps are never 100% fish tight, is not known. Installation of semi-permanent SPI stations in several sites will undoubtedly increase recapture rates and will likely collect data from other fish that have been PIT tagged throughout the Klamath River Basin.

Site Installation and Configurations

Three SPI stations were installed in the Lower Klamath River Sub-basin in Lower Waukell, Salt, and Pather Creeks by BioMark in December of 2008 (Figure 1). The Lower Waukell and Salt Creek antenna arrays consist of two 10-foot swim through channels spaced at least 6 feet apart for detection of directional movement (Figures 2 and 3). The Panther Creek site consists of two 5-foot swim through channels spaced at least 6 feet apart (Figure 4). All three sites are equipped with four 125W solar panels regulated by a solar controller that charge a bank of twelve 12V batteries (Figures 5 and 6). Data from antennas is communicated through a 100’ data cable to a data transceiver and uploaded to an Acumen Datalogger with a 4 GB flash memory card installed (Figure 7).

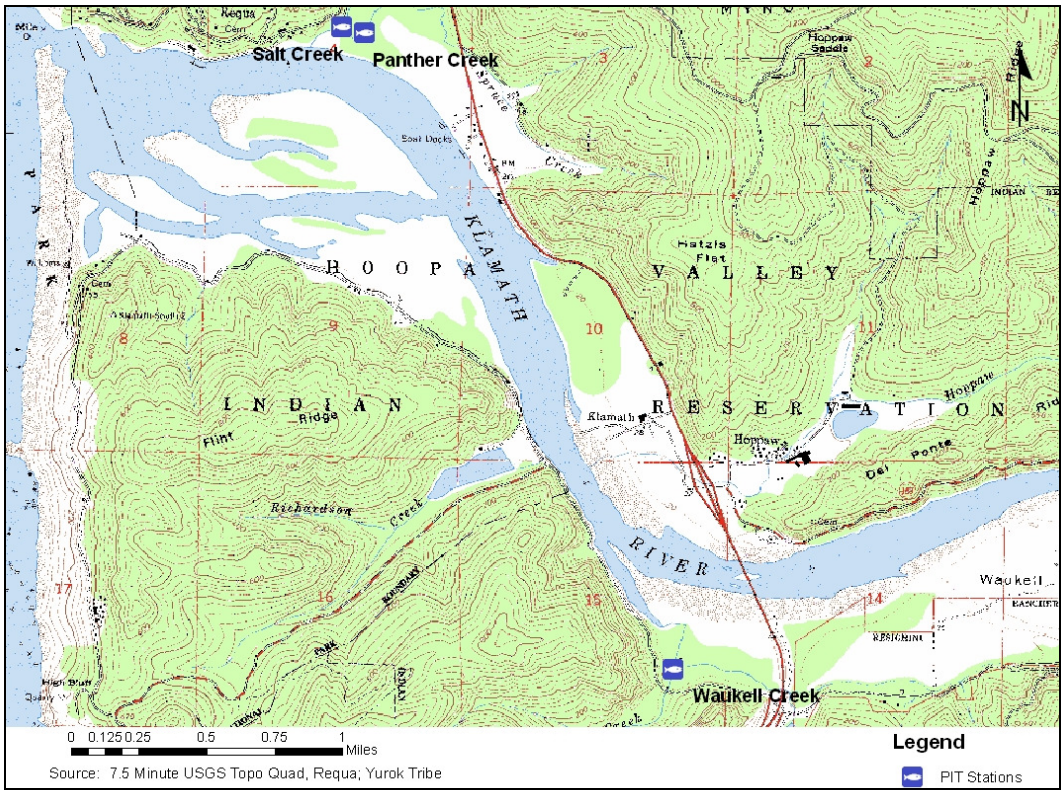

Figure 1. SPI stations in Lower Waukell, Panther, and Salt Creeks (USGS Requa Topographic Map).

Figure 2. Installing antennas at Lower Waukell Remote PIT Tag station, December 2008.

Figure 3. Remote PIT Tag detection system installed in Salt Creek, December 2008.

Figure 4. Remote PIT Tag Detection system installed in Panther Creek, December 2008.

Figure 5. Solar panel configuration and battery storage container on elevated platform at Panther Creek, April 2009.

Figure 6. Solar controller and enclosure installed at Lower Waukell, Panther, and Salt Creeks.

Figure 7. Data transceiver (left), Acumen data storage device (top right), and electronic regulators installed at Lower Waukell, Panther, and Salt Creeks.

PIT Tag Detections (11-Dec-08 through 15-Jan-09)

A total of 179 individual tags were detected during the first month of operation in Lower Waukell Creek at the remote PIT tag station. Of those 179 tags, 20 individuals were marked in the Mid-Klamath by the Karuk Tribe and 159 were marked in tributaries to the Lower Klamath. Tag origin of fish marked in the Mid-Klamath by the Karuk Tribe included one fish marked at Stanshaw Creek (rm 76.05); one fish marked at Titus Creek (rm 95.57); eight fish marked at Aikens Creek (rm 49.57); and ten fish marked at Independence Creek (rm 93.88). Fish that were tagged in the Lower Klamath that were recaptured at the Lower Waukell PIT tag station originated from Ah-Pah Creek (rm 17.27), Blue Creek (rm 15.96), McGarvey Creek (rm 6.38), Terwer Creek (5.63), and within Waukell Creek and Saugep Creek (a tributary to Lower Waukell Creek)(Appendix 1).

A total of five individual juvenile coho were recaptured at the Salt Creek remote PIT tag monitoring station. Four of the fish detected were tagged in tributaries to the Lower Klamath River. Two juvenile coho originated from the McGarvey Creek drainage, one from Terwer Creek, and one was tagged moving upstream into Salt Creek. The fish originating from the Middle Klamath River was tagged in Aikens Creek on 9-Sept-08 (Appendix 1).

Data is not presented for the Panther Creek remote PIT tag monitoring station for several reasons. No tags were detected at the station between 11-Dec and 24-Dec-08. During a storm on 24-Dec-08, severe flooding inundated the electronics at the site. The site was repaired on 10-Feb-09 and has been functioning properly since that date.

Appendix 1

PIT tags detected at Remote PIT Tag Monitoring Stations in Lower Waukell, Salt, and Panther Creeks 11-Dec-08 through 15-Jan-09

Pittag	Salt Creek	Waukell	Tag Origin	Date Tagged
985121013766091		11-Dec-08	Lower Waukell Site #1 (upstream)	12/11/2008
985121014821122		11-Dec-08	Lower Waukell Site #1 (upstream)	12/11/2008
985121015338678		11-Dec-08	Lower Waukell Site #1 (upstream)	12/11/2008
985121015337729		11-Dec-08	Lower Waukell Site #1 (upstream)	12/11/2008
985121013873888		12-Dec-08	Lower Waukell Site #1 (upstream)	12/5/2008
985121014801371		12-Dec-08	Lower Waukell Site #1 (upstream)	12/12/2008
985121013738546		14-Dec-08	Lower Waukell Site #1 (upstream)	12/5/2008
985121013762695		15-Dec-08	Lower Waukell Site #1 (upstream)	11/18/2008
985121014779040		15-Dec-08	Saugep (upstream)	12/2/2008
985121003617913		15-Dec-08	Lower Waukell Site #1 (Downstream)	7/28/2008
985121013793893		15-Dec-08	Lower Waukell Site #1 (upstream)	12/15/2008
985121015344648		15-Dec-08	Lower Waukell Site #1 (upstream)	12/15/2008
985121014776648		15-Dec-08	Lower Waukell Site #1 (upstream)	1/15/2008
985121013762205		15-Dec-08	Lower Waukell Site #1 (upstream)	11/17/2008
985121013764320		15-Dec-08	Lower Waukell Site #1 (upstream)	12/15/2008
985121014715897		15-Dec-08	Lower Waukell Site #1 (upstream)	11/13/2008
985121013761624		15-Dec-08	Lower Waukell Site #1 (upstream)	12/15/2008
985121015340912		15-Dec-08	Saugep (upstream)	12/5/2008
985121013735815		16-Dec-08	Lower Waukell Site #1 (upstream)	11/15/2008
985121015355723		16-Dec-08	Lower Waukell Site #1 (upstream)	12/15/2008
985121013839974		16-Dec-08	Lower Waukell Site #1 (upstream)	11/17/2008
985121014832504		16-Dec-08	Lower Waukell Site #1 (upstream)	12/16/2008
985121015346340		16-Dec-08	Lower Waukell Site #1 (upstream)	12/16/2008
985121014782522		16-Dec-08	Lower Waukell Site #1 (upstream)	12/16/2008
985121014803412		16-Dec-08	Lower Waukell Site #1 (upstream)	12/16/2008
985121014793210		16-Dec-08	Lower Waukell Site #1 (upstream)	12/16/2008
985121013739059		16-Dec-08	Lower Waukell Site #1 (upstream)	12/16/2008
985121015337864		16-Dec-08	Lower Waukell Site #1 (upstream)	11/14/2008
985121014712415		16-Dec-08	Lower Waukell Site #1 (upstream)	12/15/2008
985121014850920		16-Dec-08	Lower Waukell Site #1 (upstream)	12/15/2008
985121015337857		16-Dec-08	Lower Waukell Site #1 (upstream)	12/16/2008
985121014708505		16-Dec-08	Lower Waukell Site #1 (upstream)	12/16/2008
985121013878872		16-Dec-08	Lower Waukell Site #1 (upstream)	12/16/2008
985121014045800		16-Dec-08	McGarvey Downstream Trap	11/10/2008
985121013877440		17-Dec-08	Lower Waukell Site #1 (upstream)	12/17/2008
985121015347777		17-Dec-08	Lower Waukell Site #1 (upstream)	12/6/2008
985121015348271		17-Dec-08	Lower Waukell Site #1 (upstream)	12/17/2008
985121014792646		17-Dec-08	Lower Waukell Site #1 (upstream)	12/17/2008
985121013734434		17-Dec-08	McGarvey Downstream Trap	12/14/2008
985121014778423		17-Dec-08	Lower Waukell Site #1 (upstream)	12/17/2008
985121015373756		17-Dec-08	Lower Waukell Site #1 (upstream)	11/13/2008
985121013736200		17-Dec-08	Lower Waukell Site #1 (upstream)	12/17/2008
985121013790844		17-Dec-08	Lower Waukell Site #1 (upstream)	12/17/2008
985121014795822		17-Dec-08	McGarvey Downstream Trap	11/14/2008
985121013875831		17-Dec-08	Lower Waukell Site #1 (upstream)	12/17/2008
985121013762552		17-Dec-08	Lower Waukell Site #1 (upstream)	12/17/2008
985121014782234		17-Dec-08	Lower Waukell Site #1 (upstream)	12/17/2008
985121015352613		17-Dec-08	Lower Waukell Site #1 (upstream)	12/17/2008
985121013739022		18-Dec-08	McGarvey Downstream Trap	12/15/2008

Pittag	Salt Creek	Waukell	Tag Origin	Date Tagged
985121014798632		18-Dec-08	Lower Waukell Site #1 (upstream)	12/17/2008
985121014969017		19-Dec-08	Lower Waukell Site #1 (upstream)	12/19/2008
985121013761631		19-Dec-08	Saugep (upstream)	12/17/2008
985121015345220		19-Dec-08	Lower Waukell Site #1 (upstream)	12/19/2008
985121014778913		19-Dec-08	Lower Waukell Site #1 (upstream)	12/19/2008
985121014793208		19-Dec-08	Saugep (upstream)	12/18/2008
985121014801852		19-Dec-08	Lower Waukell Site #1 (upstream)	12/19/2008
985121015342274		19-Dec-08	Lower Waukell Site #1 (upstream)	12/19/2008
985121014795367		19-Dec-08	Lower Waukell Site #1 (upstream)	12/19/2008
985121014791613		19-Dec-08	Lower Waukell Site #1 (upstream)	12/19/2008
985121014807799		19-Dec-08	Saugep (upstream)	12/4/2008
985121013393703		20-Dec-08	Lower McGarvey Creek (fish rescue)	9/4/2008
985121013734067		21-Dec-08	McGarvey Downstream Trap	11/15/2008
985121015337038		21-Dec-08	Saugep (upstream)	11/20/2008
985121015372029		21-Dec-08	McGarvey Downstream Trap	12/2/2008
985121013382624		21-Dec-08	West Fork McGarvey Single Stream	9/9/2008
985121014781429		21-Dec-08	McGarvey Downstream Trap	12/16/2008
985121015302444		21-Dec-08	Lower Waukell Site #1 (upstream)	11/15/2008
985121014810063		21-Dec-08	McGarvey Downstream Trap	12/16/2008
985121014842676		21-Dec-08	McGarvey Downstream Trap	12/17/2008
985121013875951		21-Dec-08	Lower Waukell Site #1 (upstream)	12/21/2008
985121014838357		21-Dec-08	McGarvey Downstream Trap	12/17/2008
985121014807737		21-Dec-08	Lower Waukell Site #1 (upstream)	12/21/2008
985121003610545		21-Dec-08	Lower Waukell Site #1 (upstream)	7/24/2008
985121014719571		21-Dec-08	Terwer Creek (fish rescue)	12/8/2008
985121013762752		21-Dec-08	Lower Waukell Site #1 (upstream)	12/21/2008
985121015302691		21-Dec-08	McGarvey Downstream Trap	12/16/2008
985121013384330		21-Dec-08	Blue Creek Rotary Screw Trap	9/26/2008
985121013394177		22-Dec-08	Terwer Creek (fish rescue)	10/22/2008
985121014794074		22-Dec-08	Lower Waukell Site #1 (upstream)	12/16/2008
985121015344201		22-Dec-08	McGarvey (Upstream)	11/24/2008
985121013734452		22-Dec-08	Lower Waukell Site #1 (upstream)	12/15/2008
985121015377321		22-Dec-08	McGarvey Downstream Trap	12/20/008
985121013765472		22-Dec-08	McGarvey Downstream Trap	12/16/2008
985121013384038		22-Dec-08	McGarvey Downstream Trap	11/13/2008
985121014777841		22-Dec-08	Lower Waukell Site #1 (upstream)	12/22/2008
985121014819588		22-Dec-08	McGarvey Downstream Trap	11/17/2008
985121013766546		22-Dec-08	Lower Waukell Site #1 (upstream)	12/22/2008
985121013764925		22-Dec-08	Lower Waukell Site #1 (upstream)	12/22/2008
985121013761632		22-Dec-08	Lower Waukell Site #1 (upstream)	12/22/2008
985121013738728		22-Dec-08	Lower Waukell Site #1 (upstream)	12/22/2008
985121014782191		22-Dec-08	Terwer Creek (fish rescue)	12/8/2008
985121014707592		22-Dec-08	Lower Waukell Site #1 (upstream)	12/22/2008
985121014063842		23-Dec-08	McGarvey Downstream Trap	11/13/2008
985121013763552		23-Dec-08	Lower Waukell Site #1 (upstream)	12/22/2008
985121013765476		23-Dec-08	Lower Waukell Site #1 (upstream)	12/22/2008
985121015338190		23-Dec-08	Lower Waukell Site #1 (upstream)	12/22/2008
985121003606078		23-Dec-08	Aikens Creek	9/9/2008
985121013764839		23-Dec-08	Lower Waukell Site #1 (upstream)	12/23/2008

Pittag	Salt Creek	Waukell	Tag Origin	Date Tagged
985121014716216		23-Dec-08	Lower Waukell Site #1 (upstream)	12/23/2008
985121013737440		23-Dec-08	Lower Waukell Site #1 (upstream)	12/23/2008
985121015304093		23-Dec-08	Lower Waukell Site #1 (upstream)	12/23/2008
985121014837069		23-Dec-08	Lower Waukell Site #1 (upstream)	12/23/2008
985121014780553		23-Dec-08	Lower Waukell Site #1 (upstream)	12/23/2008
985121015368799		23-Dec-08	McGarvey Downstream Trap	12/20/008
985121013761674		23-Dec-08	Terwer Creek (fish rescue)	12/8/2008
985121014826837		24-Dec-08	Lower Waukell Site #1 (upstream)	12/23/2008
985121013394394		24-Dec-08	McGarvey Downstream Trap	11/13/2008
985121014834044		24-Dec-08	McGarvey Downstream Trap	11/25/2008
985121014795363		24-Dec-08	Lower Waukell Site #1 (upstream)	12/24/2008
985121013876716		24-Dec-08	Lower Waukell Site #1 (upstream)	12/22/2008
985121014719215		24-Dec-08	McGarvey Downstream Trap	11/15/2008
985121003620727		05-Jan-09	Aikens Creek	10/14/2008
985121003599181		05-Jan-09	Independence Creek	9/29/2008
985121003628623		06-Jan-09	Aikens Creek	9/9/2008
985121013761926		06-Jan-09	McGarvey Downstream Trap	11/14/2008
985121003600924		07-Jan-09	Independence Creek	9/22/2008
985121003613604		07-Jan-09	Independence Creek	9/22/2008
985121014798825		08-Jan-09	Terwer Creek (fish rescue)	12/10/2008
985121003615186		08-Jan-09	Aikens Creek	9/9/2008
985121013762770		08-Jan-09	Lower Waukell Site #1 (upstream)	1/8/2009
985121014707027		08-Jan-09	Lower Waukell Site #1 (upstream)	11/12/2008
985121003624589		09-Jan-09	Independence Creek	9/22/2008
985121003596022		09-Jan-09	Independence Creek	9/22/2008
985121004373595		09-Jan-09	Aikens Creek	9/9/2008
985121014799085		09-Jan-09	Lower Waukell Site #1 (upstream)	1/9/2009
985121014773550		09-Jan-09	Lower Waukell Site #1 (upstream)	1/9/2009
985121013738941		09-Jan-09	Lower Waukell Site #1 (upstream)	1/9/2009
985121014779704		09-Jan-09	Lower Waukell Site #1 (upstream)	1/9/2009
985121003618920		09-Jan-09	Stanshaw Creek	10/7/2008
985121003612610		10-Jan-09	Independence Creek	9/22/2008
985121014782332		10-Jan-09	McGarvey Downstream Trap	11/15/2008
985121003606306		10-Jan-09	Aikens Creek	7/1/2008
985121014800945		10-Jan-09	Lower Waukell Site #1 (upstream)	11/8/2008
985121003606491		10-Jan-09	Independence Creek	12/5/2008
985121004374084		10-Jan-09	Independence Creek	9/29/2008
985121014714754		11-Jan-09	McGarvey Downstream Trap	12/27/2008
985121003635733		11-Jan-09	Titus Creek	8/11/2008
985121003603827		11-Jan-09	Aikens Creek	9/9/2008
985121003612245		12-Jan-09	Independence Creek	6/9/2008
985121014797855		12-Jan-09	Lower Waukell Site #1 (upstream)	1/12/2009
985121014799772		12-Jan-09	Lower Waukell Site #1 (upstream)	1/12/2009
985121013874496		12-Jan-09	Lower Waukell Site #1 (upstream)	1/12/2009
985121015351560		12-Jan-09	Lower Waukell Site #1 (upstream)	1/12/2009
985121013738057		12-Jan-09	Lower Waukell Site #1 (upstream)	1/12/2009
985121014794418		12-Jan-09	Lower Waukell Site #1 (upstream)	1/12/2009
985121015340945		12-Jan-09	Lower Waukell Site #1 (upstream)	1/12/2009
985121015307654		12-Jan-09	Lower Waukell Site #1 (upstream)	1/12/2009

Pittag	Salt Creek	Waukell	Tag Origin	Date Tagged
985121014712244		12-Jan-09	Lower Waukell Site #1 (upstream)	1/12/2009
985121013737461		12-Jan-09	Lower Waukell Site #1 (upstream)	1/12/2009
985121013767248		12-Jan-09	Lower Waukell Site #1 (upstream)	1/12/2009
985121015347209		12-Jan-09	Lower Waukell Site #1 (upstream)	1/12/2009
985121014716323		12-Jan-09	Lower Waukell Site #1 (upstream)	1/12/2009
985121014782111		12-Jan-09	Lower Waukell Site #1 (upstream)	1/12/2009
985121014781418		13-Jan-09	Lower Waukell Site #1 (upstream)	1/13/2009
985121014798734		13-Jan-09	Lower Waukell Site #1 (upstream)	1/13/2009
985121014808232		13-Jan-09	Lower Waukell Site #1 (upstream)	1/13/2009
985121014797570		13-Jan-09	Lower Waukell Site #1 (upstream)	1/13/2009
985121014799821		13-Jan-09	Lower Waukell Site #1 (upstream)	1/13/2009
985121014792528		13-Jan-09	Lower Waukell Site #1 (upstream)	1/13/2009
985121015306130		13-Jan-09	Lower Waukell Site #1 (upstream)	1/13/2009
985121014801352		13-Jan-09	Lower Waukell Site #1 (upstream)	1/13/2009
985121013737046		13-Jan-09	Lower Waukell Site #1 (upstream)	1/13/2009
985121013762246		13-Jan-09	Lower Waukell Site #1 (upstream)	1/13/2009
985121014717401		13-Jan-09	Lower Waukell Site #1 (upstream)	1/13/2009
985121003634278		14-Jan-09	Independence Creek	6/9/2008
985121013765015		14-Jan-09	Lower Waukell Site #1 (upstream)	1/14/2009
985121014793625		14-Jan-09	Lower Waukell Site #1 (upstream)	1/14/2009
985121015346344		14-Jan-09	Lower Waukell Site #1 (upstream)	1/14/2009
985121015305909		15-Jan-09	McGarvey Downstream Trap	12/1/2008
985121013382204		15-Jan-09	Ah Pah (eshock)	7/30/2008
985121014808615		15-Jan-09	Lower Waukell Site #1 (upstream)	1/15/2009
985121015348315		15-Jan-09	Lower Waukell Site #1 (upstream)	1/15/2009
985121015359608		15-Jan-09	Lower Waukell Site #1 (upstream)	1/15/2009
985121013765867		15-Jan-09	Lower Waukell Site #1 (upstream)	1/15/2009
985121014783785		15-Jan-09	Lower Waukell Site #1 (upstream)	1/15/2009
985121014794564		15-Jan-09	Lower Waukell Site #1 (upstream)	1/15/2009
985121003610196		15-Jan-09	Lower Waukell Site #1 (upstream)	7/7/2008
985121013811418		15-Jan-09	Terwer Creek (fish rescue)	10/22/2008
985121014717887	18-Dec-08		McGarvey Downstream Trap	12/4/2008
985121013763720	21-Dec-08		Salt Creek (upstream)	11/19/2008
985121014816186	22-Dec-08		Terwer Creek (fish rescue)	12/8/2008
985121003627952	24-Dec-08		Aikens Creek	9/9/2008
985121013384297	24-Dec-08		Upper McGarvey Creek Single Stream	8/25/2008

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Figure 2. Proposed installation locations for SPI stations in Lower Waukell, Panther, and Salt Creeks (USGS Requa Topographic Map).