

APPENDIX B. WATER LEVEL AND TEMPERATURE DATA

This appendix summarizes monitoring station locations, data collection and analyses for water elevations and temperature across the study area. Monitoring of all stations occurred for only twelve months, so a comparison to hydrologic factors controlling the data over a longer time period is needed. Tables B1 and B2 show a comparison of rainfall and stream flow data for the monitoring period (2007 to 2008) relative to historical data. The nearest rainfall gage was at the Kalama Falls Hatchery which is located 6 miles east of the project site. As discussed in Section 2.1.3, the USGS gage on the East Fork Lewis was used to correlate stream flows. The following observations can be made relative to the data collection period:

- The total precipitation for the monitoring period was 71.6 inches, or 86% of normal. Normal (100%) is the average precipitation for the same time period, based on 41 years of collected data at the station.
- December rainfall was 161% of normal values for that month.
- May, June, July and September precipitation was below normal, with the one exception of August being above normal.
- Stream flows overall for the monitoring period were normal. May and June 2008 flows were nearly 200% of normal. September and October flows were below normal.

These comparisons can be used when looking at the data to make adjustments in results. For example; the groundwater levels in Well Monitoring Station 2 (WMS2) and Test Pit 1 (TP1) remained very high in May and June and dropped rapidly by several feet in September and October. Water levels in WMS2 and TP1 are controlled by the Kalama River and the average monthly flows in the river was way above normal in May and June and below normal in September and October. One could extrapolate the data collected for this time period and conclude the sudden drop is not normal.

	Oct 2007	Nov	Dec	Jan 2008	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Totals
2007 - 2008	6.0	6.0	17.4	10.4	7.3	8.5	4.5	1.7	0.0	0.4	2.6	0.4	3.0	3.5	71.6
41-Yr Ave	5.4	9.9	10.8	9.6	7.6	7.3	5.5	3.8	2.6	1.0	1.6	2.9	5.4	9.9	83.3
% Normal	111%	60%	161%	108%	95%	116%	82%	44%	0%	40%	160%	13%	56%	35%	86%

Table B1. Monthly precipitation for the period of data collection compared to the 41-year average at Coop Station 454084, Kalama Falls Hatchery, Kalama, Washington. Percent normal row numbers indicate the monthly precipitation compared to normal. 100% = normal.

	Oct 2007	Nov	Dec	Jan 2008	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Totals
2007-2008	336	564	1590	1189	1077	1195	898	1029	712	159	93	59	131	336
79 Yr Ave	338	1080	1460	1400	1270	1110	909	584	344	143	83	111	338	338
% Normal	99%	52%	109%	85%	85%	108%	99%	176%	207%	111%	112%	53%	39%	99%

Table B2. Monthly flows for the East Fork Lewis River for the period of data collection compared to the 79 year average. Percent normal row numbers indicate the average monthly flows compared to normal. 100% = normal.

1.0 Monitoring Stations

The following are detailed descriptions of the monitoring stations. They are described in four categories (River, Creek, Pond and groundwater Well). In some instances the water level in ponds (if isolated from surface flow) will be similar to groundwater.

Monitoring stations were associated with a location and bench mark for elevation control. Water elevation was recorded by measuring the vertical distance from the bench mark to the water surface. River flows at monitoring stations were either measured with a flow meter (or correlated to another river with an active stream gage). The Kalama River flows were correlated to the East Fork Lewis River (<http://waterdata.usgs.gov/nwis/uv?14222500>) as is described in the Hydrology and Hydraulics Section (2.1.3). Flows for Spencer Creek were measured on site. Additional information on the data collection at each site can be found in subsequent sections of this appendix: Monitoring Site Locations Map (Section 2.0), Flow and Water Elevation Data (Section 3.0), and Temperature Data (Section 4.0).

1.1 Kalama River

Six River Monitoring Stations (RMS) were established:

- **RMS1.** Located on the right bank of the river (RM 1.4) near the edge of the WDFW parking area for the boat launch. A bench mark was established (elevation 14.5 feet) from a level loop survey from Point # 116 along the highway. This river water level is controlled by Columbia River and tidal elevations.
- **RMS2.** This site is on the left bank of the river just upstream of the Interstate 5 bridge and near the mouth of a potential side channel. A bench mark elevation has not been established.

- **RMS3.** Located on the left bank of the river (RM 1.8) and the mouth of Spencer Creek. A bench mark was never established at this location. This river water level is used as the far downstream control point. There are two or three beaver dams above this point on Spencer Creek so the low flow water control will likely vary over time.
- **RMS4.** Located on the left bank at RM 2.2 near the pipeline alignment. The bench mark is #113, a plastic cap on rebar. This river water level is used as a downstream control point for any projects developed along the left bank floodplain and Spencer Creek. A stage discharge rating curve is important at this location in order to assess the backwater effect on potential projects.
- **RSW5.** A random spot along the left bank, directly adjacent to pond monitoring station LP3 at RM 2.4. Only spot measurements were taken and were used to track river water surface.
- **RMS6.** Located just downstream of the City of Kalama Water Supply Plant on the left bank RM 2.5. The bench mark is a wood stake (elevation 24.3 feet). River water surface elevation and temperature were measured here. This is the furthest upstream monitoring station and is being used as the critical water level control feature for the development of off channel habitat within the left bank floodplain (Ledgett property).

1.2 Spencer Creek

Three Creek Monitoring Stations (CMS) were established:

- **CMS1.** Located adjacent to RMS4 and BM#113, this is the Spencer Creek water level within the reach with beaver dams. Water elevation and temperature were measured here. All the water from Spencer Creek has converged back together at this point before flowing back into the Kalama River.
- **CMS2.** Located adjacent to bench mark Steel Pin 4, this is the water level upstream of a small culvert which receives drainage from LP3 and LP2, which are fed by up-slope surface water connections in the winter. Water level and temperature were recorded.
- **CMS3.** This monitoring station is located along Spencer Creek where springs coming off the hillside have been observed. Water level and temperature were recorded.

1.3 Ponds

Two Pond Monitoring Stations (PMS) were established outside of the Ledgett property, and four were established on the Ledgett property:

- **PMS1 (Kress Lake).** Located near Kress Lake and Port BM # 106 (elevation 20.91 feet) in the parking lot for Kress Lake access. Water levels and temperatures for the lake were recorded. *Note: It is not anticipated that Kress Lake will be connected for habitat restoration, but the water levels will be assessed to determine floodplain response which will help in the development of the other sites.*

- **PMS2 (BPA Pond).** Located near the north shore of the BPA Pond. An orange stake (bench mark) was established, elevation 17.6 feet). Water level and temperature for the pond were recorded. The intent with monitoring this location is to understand the hydraulic connection between the Kalama River, groundwater and surface water drainage, and possibly reconnect a large area for off-channel habitat on the right bank floodplain of the Kalama River.
- **LP1 – LP4 (Ledgett Ponds 1 through 4).** Located on the Ledgett Property, these ponds were excavated at one time for fish culture purposes. Water level and temperature were recorded. During the summer, the water level is controlled by groundwater (likely from the Kalama River), but during the winter the stage of the pond increases from upland surface water flow.

1.4 Wells and Test Pit Standpipes

There were two existing (informal) wells or standpipes on site which were surveyed and tied into the overall project datum as Well Monitoring Stations (WMS):

- **WMS1.** This well is located 75 feet from LP1. The well is a steel tube installed by the LCFEG during some pond excavation and groundwater monitoring in 2005. Water level and temperature were recorded.
- **WMS2.** This well is located 80 feet from the river's water edge near RMS6. The well is a 6 foot diameter culvert on end. It was installed by the landowner, Mr. Ledgett. Water level and temperature were recorded.

In addition to the two existing wells, four test pits (TP) were excavated (see Appendix D). A plastic vertical standpipe with cap was installed before backfilling each excavated pit. The top of the standpipe was tied into the vertical survey datum. See Appendix D for detailed pump test results. Collected data across all monitoring stations are depicted in Figures B1-B8.

1.5 Interpretation of the Data

Figure B1 shows the data collected for the Kalama River water elevations relative to flow. A trend line is shown for RMS6 and RMS1. RMS6 is above the tidal influence and shows a very tight correlation. RMS1 is in the tidal area and the correlation fluctuates on a twice daily basis when the Columbia River is low, but in the late spring and early summer when the Columbia River is high the tidal fluctuations are greatly reduced. These data are useful in developing concepts for off-channel design. In the tidal areas, the backwater provides good opportunities for fish to access off channel habitat. When the Columbia River is high there is good access and when the river is low the tidal action provides access. The tidal action also provides groundwater recharge which could provide good spawning habitat for chum salmon if low swales were excavated and gravel added.

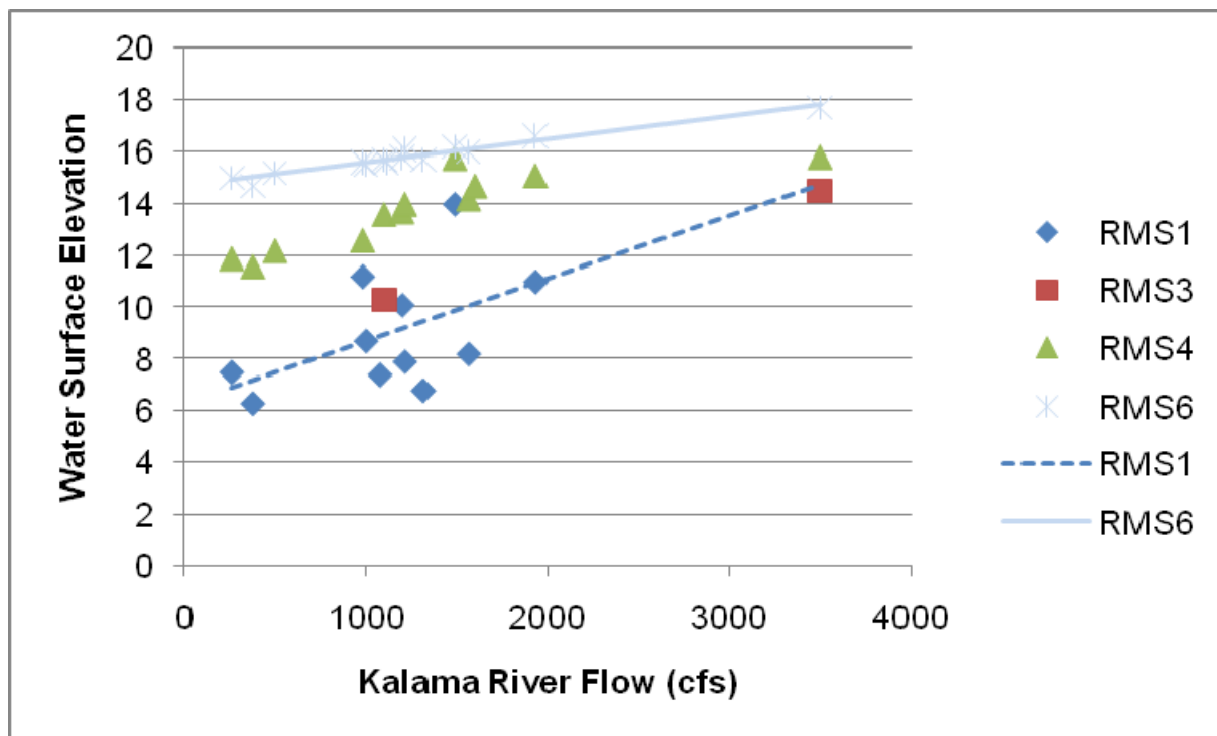


Figure B1. Kalama River water surface elevations versus flow at selected Monitoring Stations. Trendline shown for the most upstream station (RMS6) and the furthest downstream station (RMS1).

Groundwater elevations (Figure B2) in isolated test pits vary 2.5 to 3 feet from the winter to summer. The exception is TP4 (RM 0.7), which varies as much as 6 feet due to backwater from the Columbia River and tidal fluctuations. Groundwater elevations are at the highest in January and at the lowest in August and September. In tidal areas (RM 1.6 to RM 0.0), groundwater elevations are highest in late May and early June. Development of off channel projects should be excavated to a level which corresponds to the late spring or low summer flow levels to ensure year round flow (unless juvenile overwintering is a specific project goal).

The groundwater elevations in WMS1 (left side of the Kalama Floodplain) are 3 to 3.5 feet higher than groundwater elevations from TP3 (right side of the Kalama River floodplain). These two monitoring stations are adjacent to each other at the same River location. TP3 is much closer to the river. Groundwater elevations in WMS1 are also higher than in TP1. TP1 is near the City of Kalama Raney Well. It appears the high groundwater levels in WMS1 provide a good opportunity for creating off channel habitat.

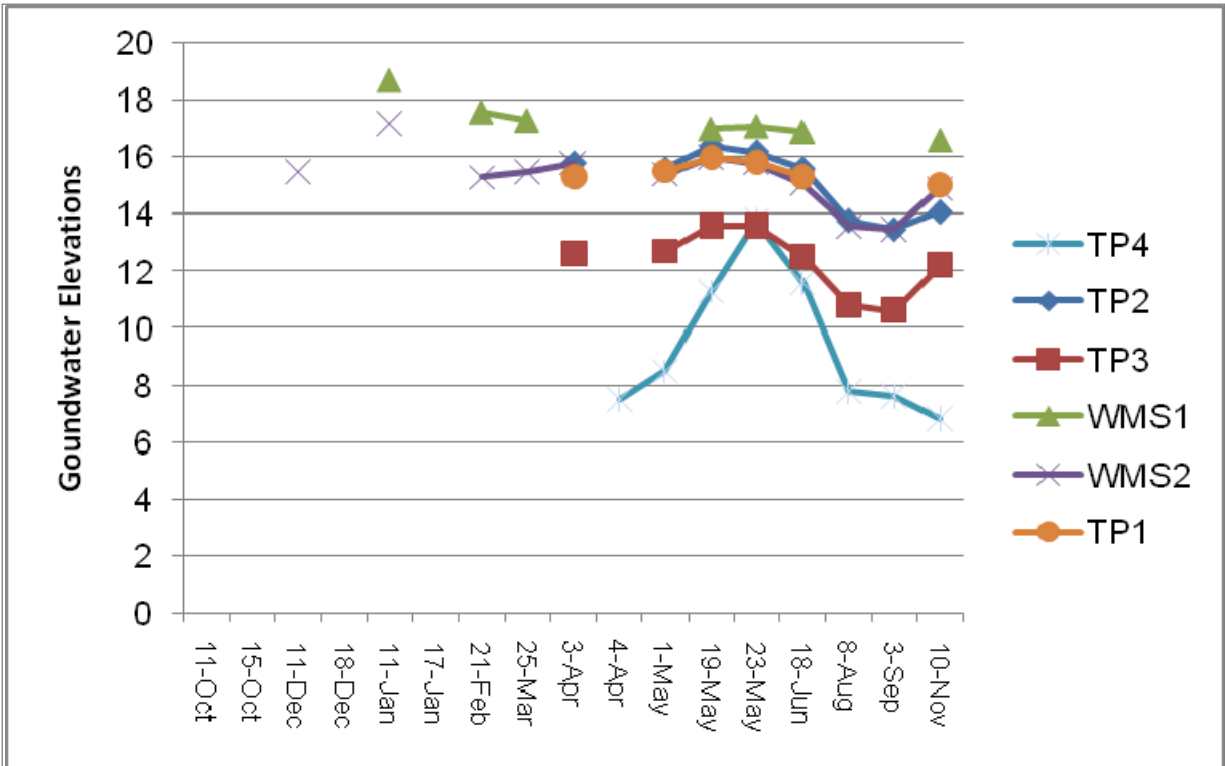


Figure B2. Groundwater elevations at selected well monitoring stations (WMS) and test pits (TP), which are not subjected to rainfall or surface water flow. Dates are October 11, 2007 to November 10, 2008.

Water elevations in ponds (Figure B3) vary drastically when compared to groundwater levels. The BPA Pond (or PMS2) had a water elevation fluctuation of seven feet. There doesn't appear to be any surface connection to this pond, but likely the local groundwater charges the system. Kress Lake (RMS1) levels are similar to the BPA Pond but it is fed by a surface water stream in the winter months. Ledgett Pond 1 (LP1) only varied 3 feet over the monitoring period.

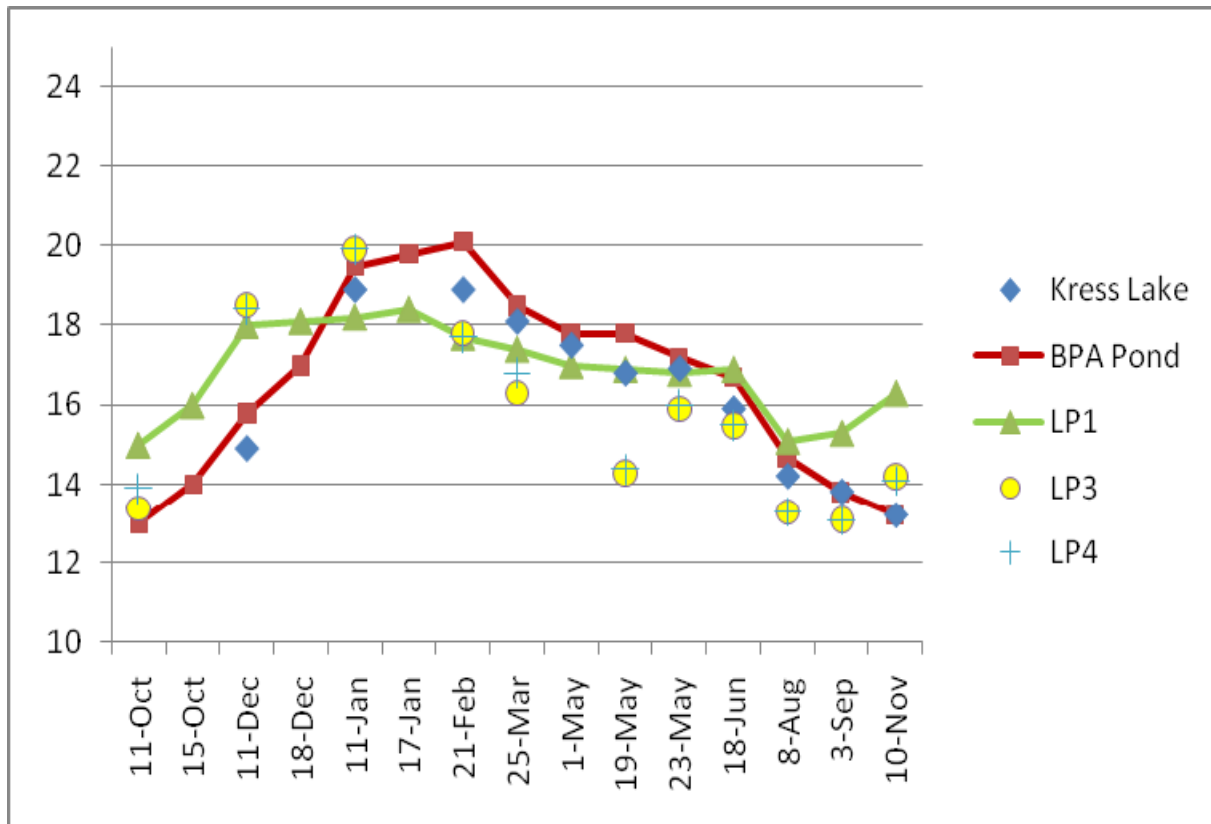


Figure B3. Pond water surface elevations for dates October 11, 2007 to November 10, 2008. Pond water elevation differs from groundwater in that most of the ponds have a surface water connection which creates a high water elevation in the winter. The two solid lines connecting points represent the BPA Pond (PMS2) and the Lower Pond on the Ledgett Property (LP1).

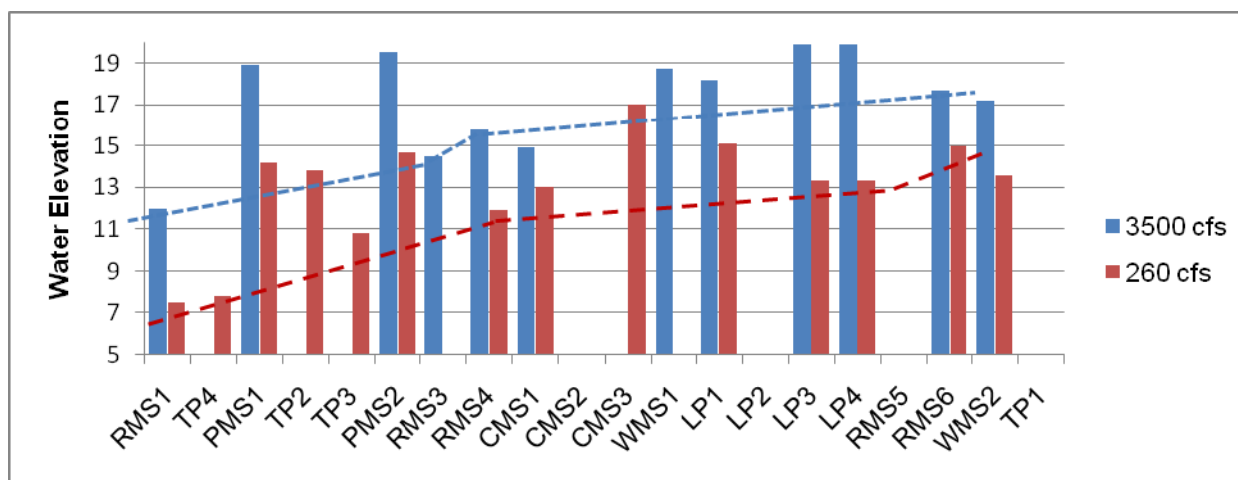


Figure B4. Water elevations for selected dates and river flows. The 3500 cfs flow occurred on January 11, 2008, and the 260 cfs flow occurred on August 8, 2008. The dashed lines are approximate and represent the Kalama River water surface profiles adjacent to the monitoring site. Note the nearly 6-foot differential in water level at LP3 and LP4. The proposed project design elevation for these two ponds is 14.0 feet.

The water temperature data is plotted graphically in Figures B5 through B8). Figure B5 is a plot of all the data within the project area (15 monitoring sites); Figure B6 is a plot for just the surface fed streams (Columbia River, Kalama River and Spencer Creek). Figure B7 is a plot of temperature data for the six pond monitoring sites and Figure B8 is a plot of the six groundwater sites. The following are trends and observations from analysis of the data:

- For the Lower Kalama, the data collected shows water temperature in the winter is all within the 40° to 45° F range for most of the monitoring sites. In May there is a large shift in temperature in the Columbia River and large open ponds warm to 70 to 75°F, however the Kalama River and groundwater sources remain low within the 45 to 50° F range. Groundwater sources tend to be 3 to 5° warmer than the Kalama River. Towards the end of the summer this trend reverses and the Kalama River is 3 to 4° warmer than the groundwater.
- Water temperatures in the Kalama River for the monitoring period never got over 58°F, which is ideal for juvenile coho growth and rearing.
- For the open ponds, the temperatures ranged from 40 to 45° in the winter to over 70° in the summer. The exception is LP1 which remained cooler in May and June. The intent of collecting these data was to explore the options of connecting existing open ponds to the Kalama River so fish have access. For a successful project, the connection needs to intercept groundwater and be constructed in a manner so riparian vegetation can shade the open water. The project objective would be to lower the pond level, initiate groundwater flow and therefore reduce the water temperatures.

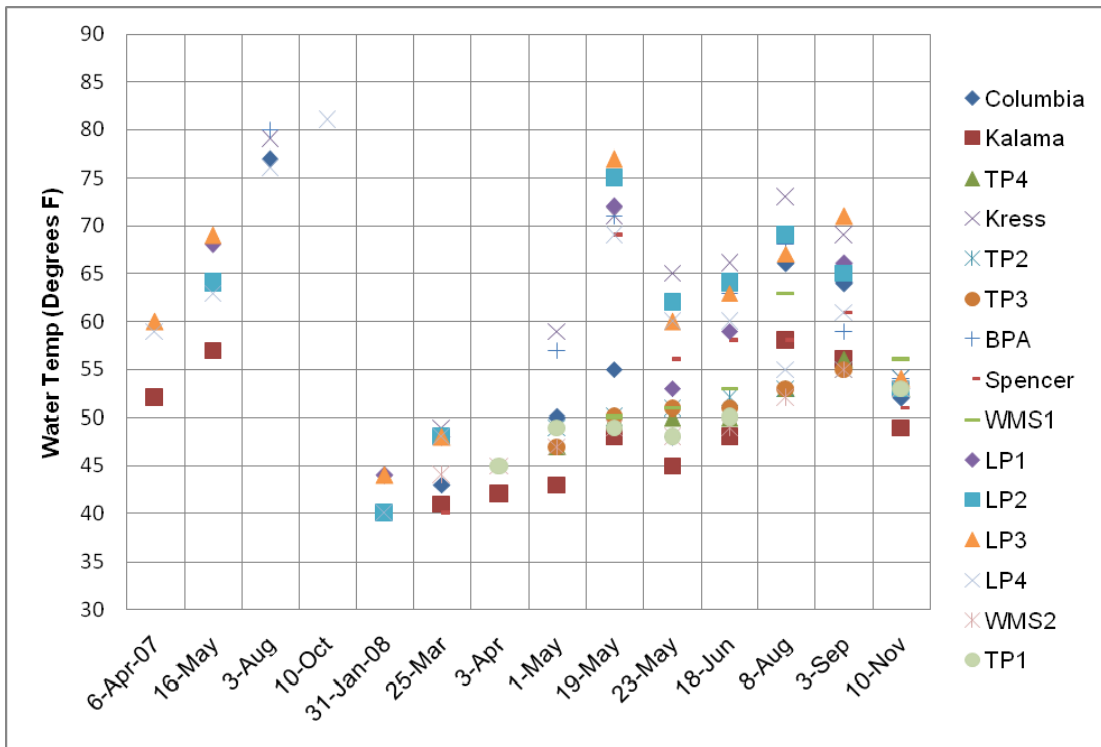


Figure B5. Water temperature data for selected monitoring stations from April 2007 to November 2008. Monitoring sites denoted in legend (top to bottom) generally represents the downstream to upstream direction (i.e. TP1 is the most upstream test pit monitoring station).

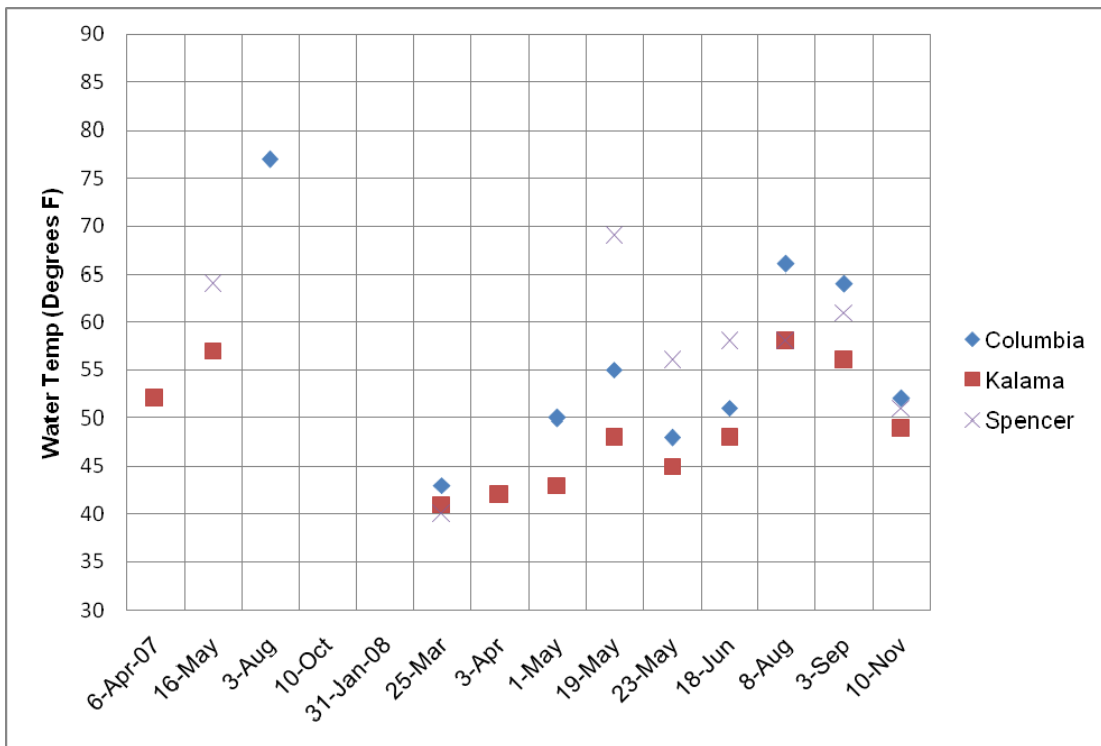


Figure B6. Water temperature data for the Columbia and Kalama Rivers and Spencer Creek. The Spencer Creek measurement is CMS3.

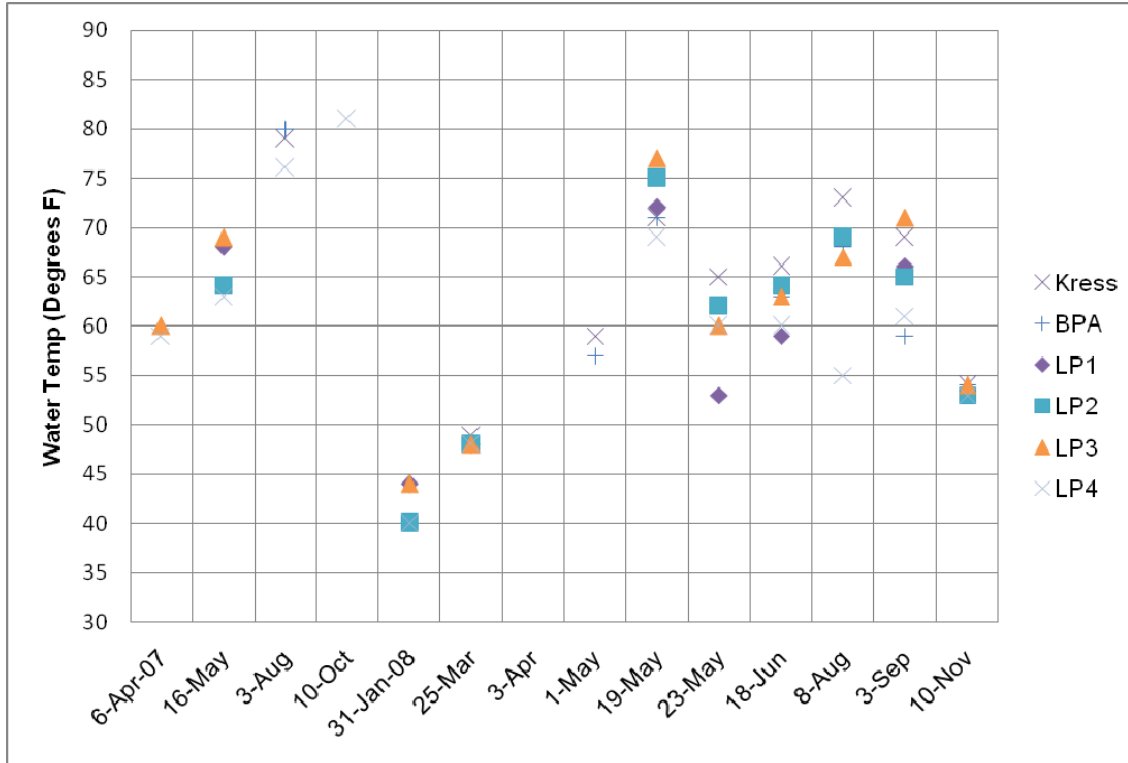


Figure B7. Water temperature data for the Pond Monitoring Stations.

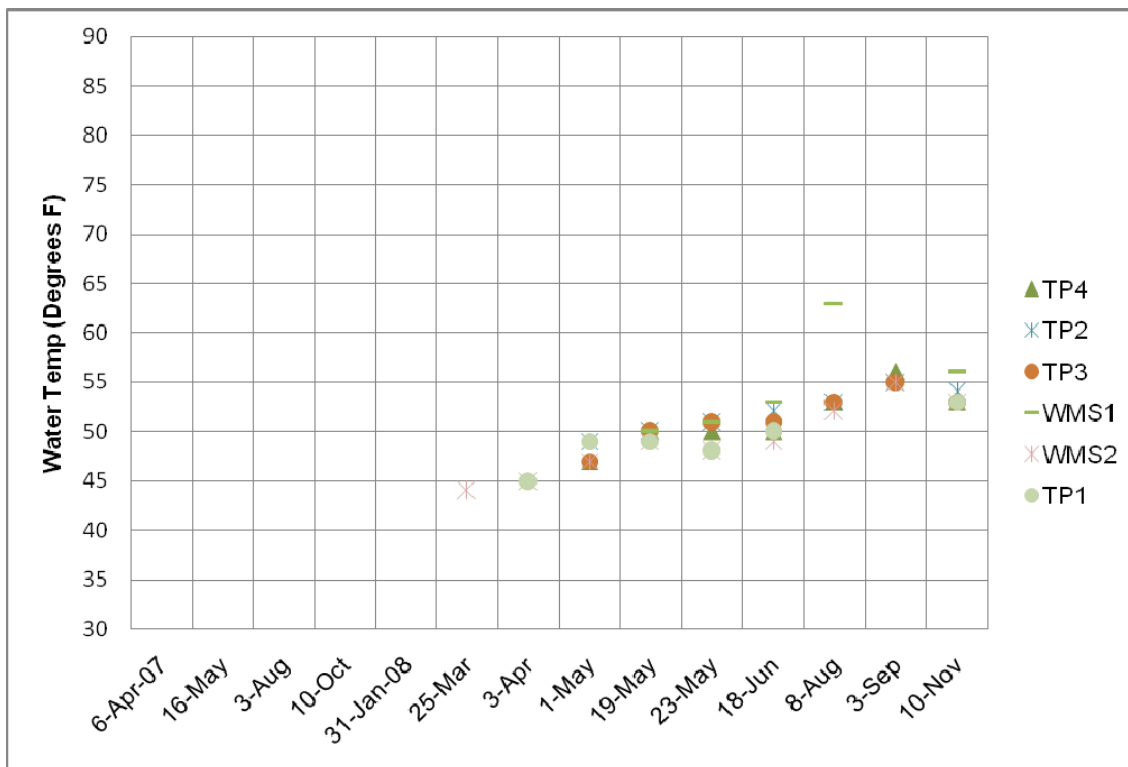


Figure B8. Water temperature data for the groundwater well monitoring stations and test pits.

2.0 Monitoring Site Locations Maps

The monitoring site locations are depicted for the study area overall (Figure B9) and an enlargement of the Ledgett property (Figure B10).

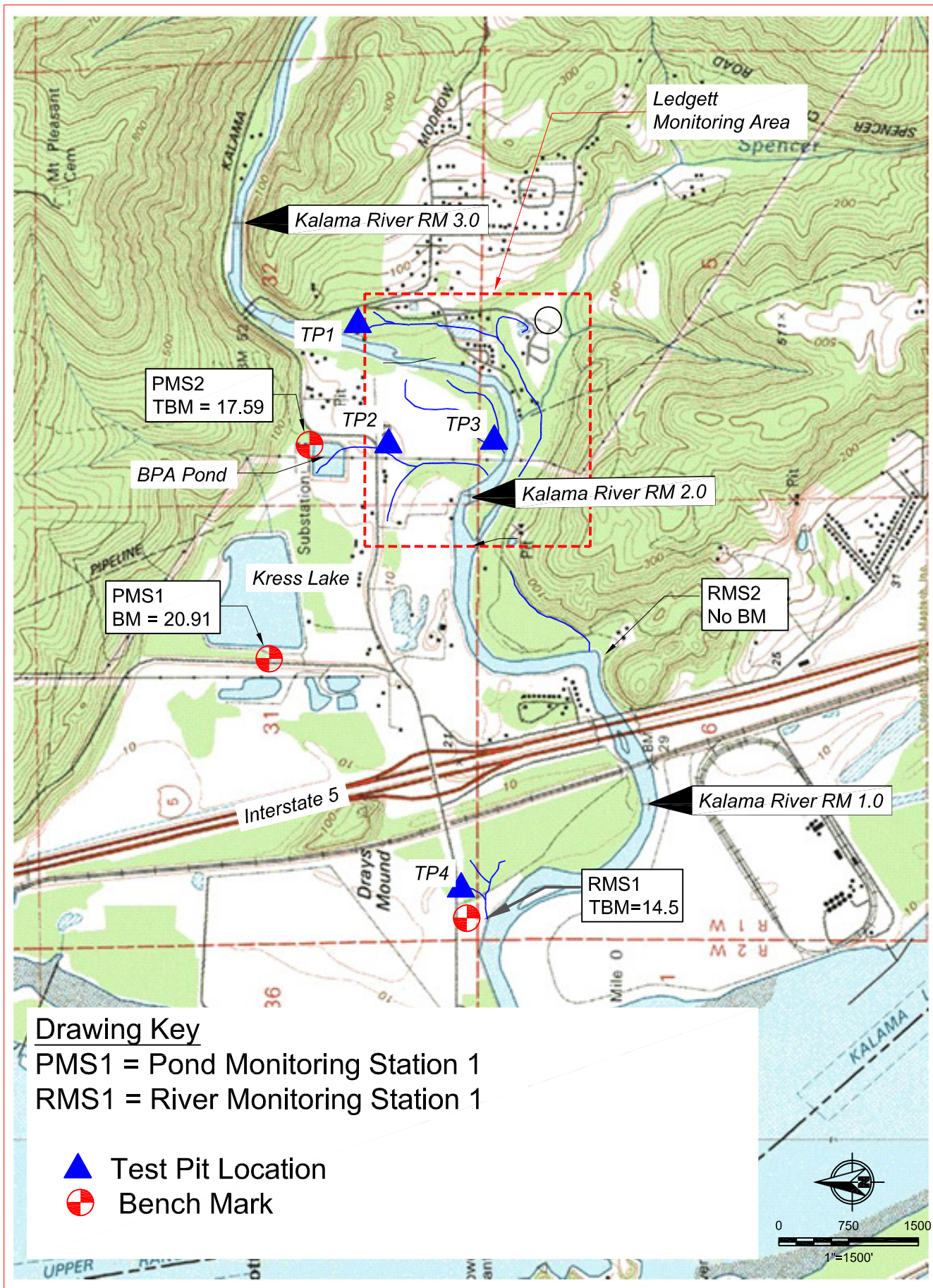
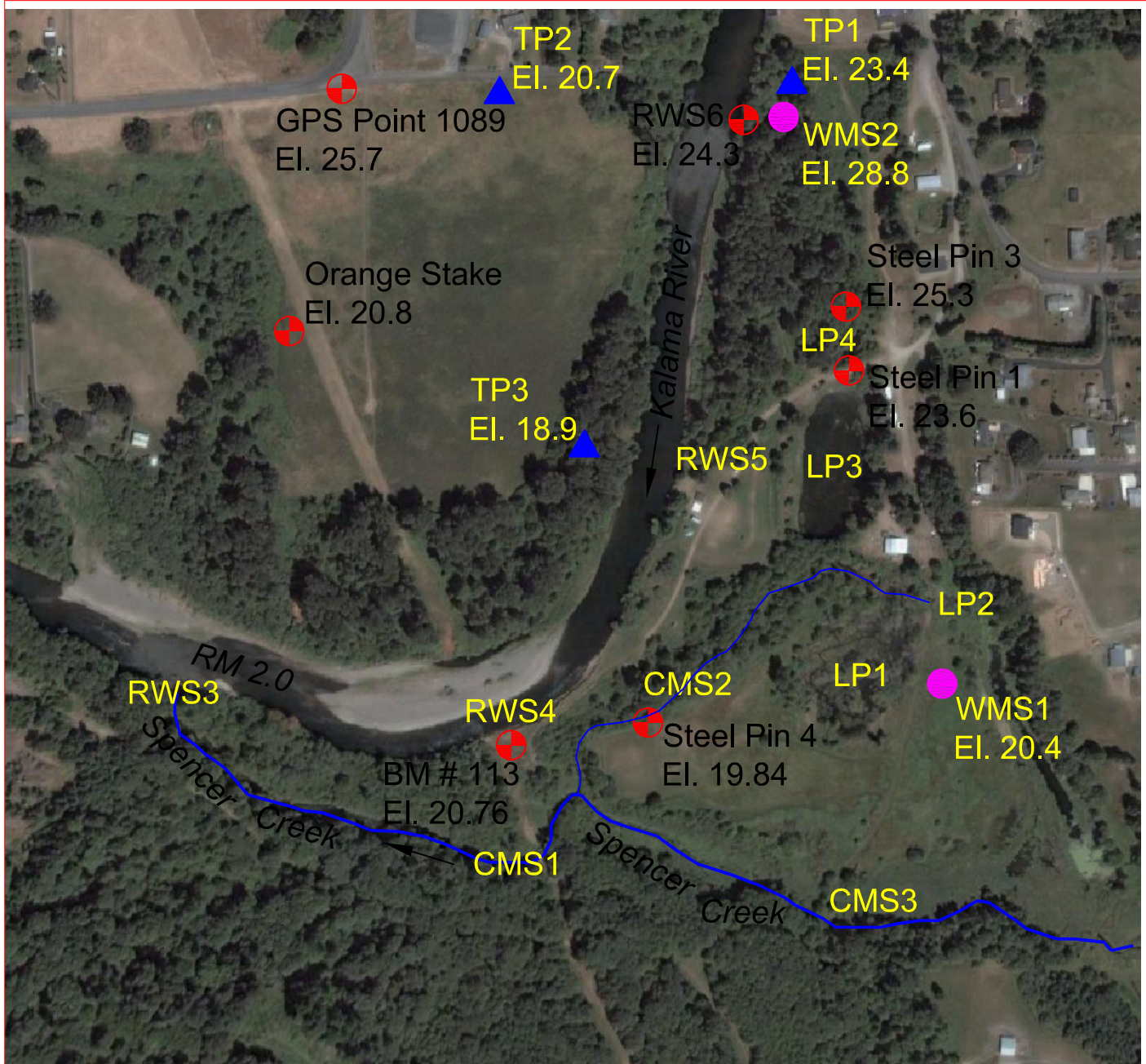


Figure B9 - Lower Kalama Monitoring Sites - Overall



Drawing Key

RMS1 = River Monitoring Station 1
 CMS2 = Creek Monitoring Station 2
 LP1 = Ledgegett Pond 1

- WMSX = Well Monitoring Station
- ▲ Test Pit Location
- ⊕ Bench Mark

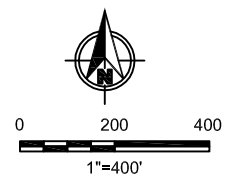


Figure B10 - Lower Kalama Monitoring Locations - Ledgett Area

3.0 Flow and Water Elevation Data

The columns of each table for the data collected generally start in the downstream reaches and move upstream (left to right in the table). The first three columns denote who collected the data, date and time. As you move from left to right, the next five columns are river and stream flow and or stage data (values are in cfs or ft). The next 20 columns contain the data pertaining to each monitoring site. The rows of the table are in order from top to bottom for the date collected. There are some gaps in the data. For example; data collection started in October of 2007, but the Test Pits were not excavated until April 2008.

Kalama River Off Channel Habitat Design - Water Flow and Elevation Data

Water Surface Elevations - For Monitoring Site Locations, see Appendix B, Section 2.0

By	Date	Time	E.Fk. Lewis Flow	Kalama Flow	Columbia River Longview	Gage St. Helens	Spencer Cr Flow	RMS1 WDFW	PMS1 Kress	PMS2 BPA	RMS3 Spencer	RMS4 BM #113	CMS1 TBM1	CMS2 Steel Pin 4	CMS3 Steel Rail	WMS1 Well Case	LP1 Well Case	LP2	LP3 Steel Pin 1	LP4 Steel Pin 1	RMS5 HWM	RMS6 Water Plant	WMS2 Ledgett	TP1 Ledgett			
BM Elev			15	13	14	1	2	17	18	3	4	5	6	7	8	9	10	11	12	16							
		Notes	15	cfs	13	14	cfs	1	2	17	18	3	4	5	6	7	8	9	10	11	12	16					
	10/11/2007			500			1					12.2							13.4	13.9	12.2	15.2					
	10/15/2007										9.4																
	12/11/2007			1100			5		14.9		10.3	13.6	13.1				18	19.5	18.5	18.4		15.7	15.5				
	12/18/2007			1000	6.5			8.7														15.5					
	1/11/2008			3500			18		18.9		14.5	15.8	14.9			18.7	18.2		19.9	19.9		17.7	17.2				
	1/17/2008			1600								14.7	13.9				18.4										
	2/21/2008	2:24 PM		1200	6			10.1	18.9			13.7	13.6			17.6	17.7		17.8	17.7		15.8	15.3				
		4:18 PM			9																						
N	3/25/2008	9:30 AM	1060	1564	4.2	3.5		8.2	18.1			14.2		15.8	17	17.3	17.4		16.3	16.8		16	15.5				
N,P	4/3/2008	9:00 AM	680	1112						15.8	12.6	18.6										15.6	15.8	15.3			
		3:00 PM																				15.5	15.3	15.6			
N,P	4/4/2008	10:50 AM			2.8	3.1		6.4	7.5																		
		12:40 PM	650	1077	5.6	3.5		7.4																			
P	5/1/2008	11:00 AM	850	1315	5.3	5.3		6.8	8.5	17.5	15.6	12.7	17.8									15.7	15.4	15.5			
N	5/19/2008	12:00 PM	1370	1933	10.0	10.7		11.0	11.3	16.8	16.4	13.6	17.8			15.1			16.8	17.0	16.9	14.3	14.4	16.6	16.0	16.0	
N	5/23/2008	12:00 PM	996	1488	11.4	13.0		14.0	13.8	16.9	16.2	13.6	17.2			15.8			16.1	17.0	17.1	16.8	15.9	16.0	16.2	15.8	15.8
Nello	6/18/2008	8:35 AM	570	981	8.7	9		11.2	11.6	15.9	15.6	12.5	16.7			12.6			15.3	17.2	16.9	16.9	15.5	15.5	15.6	15.1	15.3
N,P	8/8/2008	9:00 AM	70	260	4.2	3.65		7.5	7.8	14.2	13.8	10.8	14.7			11.9	13		17	dry	15.1		13.3	13.3	15	13.6	14 dry
N	9/3/2008	10:00 AM	62	377	2.74	1.82		6.3	7.6	13.8	13.5	10.6	13.8			11.6			17.1	dry	15.3		13.1	13.1	14.7	13.5	13.7 dry
N	11/10/2008	10:15 AM	766	1215	5.47	4.59		7.9	6.8	13.2	14.1	12.2	13.2			14			17.3	16.6	16.3		14.2	14.1	16.1	14.9	15

Notes:

- 1 TBM is Orange Stake on RB River at Upstream End of Parking Area next to Concrete Block
- 2 BM is PK Nail in Parking Lot Near Outhouse and North Entrane Road
- 3 TBM is Orange Stake along the North East Bank Near Building
- 4 BM is Plastic Cap on Rebar along Pipeline 30 feet back from Kalama River LB
- 5 Located in Spencer Creek Along Pipeline Alignment, WS controlled by Beaver Dams
- 6 BM is Steel Pin along LB of Creek where spur road crosses into field
- 7 BM yet to be set, but WSEL is near culvert/road
- 8 BM is top of square tube with cap removed adjacent to LP1
- 9 Steel Pin on North Edge of Road between LP3 and LP4
- 10 Area where high water marks have been measured from debris on fence posts
- 11 TBM is wood stake on RB River just DS Kalama PUD Treatment Plant
- 12 TBM is top of Lid on Ledgett Well (Vertical CMP)
- 13 Longview <http://ahps2.wrh.noaa.gov/ahps2/hydrograph.php?wfo=pqr&gage=lopw1&view=1,1,1,1,1&toggles=10,7,8,2,9,15,6&type=0>
- 14 St. Helens <http://ahps2.wrh.noaa.gov/ahps2/hydrograph.php?wfo=pqr&gage=shno3&view=1,1,1,1,1&toggles=10,7,8,2,9,15,6&type=0>
- 15 E. Fk. Lewis <http://waterdata.usgs.gov/nwis/uv?14222500>
- 16 BM is rim of 4" white PVC pipe on Ledgett Property
- 17 BM is rim of 4" white PVC pipe
- 18 BM is rim of 4" white PVC pipe

Notes: (See Figure 3.2)

- RMS6 River Monitoring Station 6 Just DS of Kalama Plant
- RMS5 River 1/2 way between 6 and 4 where the river floods overbank
- RMS4 River under Pipeline
- RMS3 River Monitoring Station 3 at the Mouth Spencer Creek
- RMS2 Just U/S I5 on LB No data Collected
- RMS1 WDFW Parking Area
- WMS2 Ledgetts Ranney Well
- WMS1 LCFEG Well Steel Tube
- LP4 Ledgett Most Upstream Pond
- LP3 Ledgett Pond Next to House
- LP2 Ledgett Pond US Road Crossing
- LP1 Ledgett Pond Out in Field
- CMS3 S. Br. Spencer at Crossing with 4 foot culvert
- CMS2 N. Br. Spencer at Crossing with small culvert
- CMS1 Lower Section of Spencer Creek
- PMS1 Kress Lake
- PMS2 BPA Pond

4.0 Temperature Data

The columns of each table for the data collected generally start in the downstream reaches and move upstream (left to right in the table). The first three columns denote who collected the data, date and time. As you move from left to right, the next five columns are river and stream flow and or stage data (values are in cfs or ft). The next 20 columns contain the data pertaining to each monitoring site. The rows of the table are in order from top to bottom for the date collected. There are some gaps in the data. For example; data collection started in October of 2007, but the Test Pits were not excavated until April 2008.

Kalama River Off Channel Habitat Design - Temperature Data

Water Temperature -- For Monitoring Site Locations, see Appendix B, Section 2.0

Date	Time	E. Fk. Lewis Flow	Kalama Flow	Columbia River Longview	Spencer Cr St. Helens Flow	Columbia River	RMS1 WDFW	TP4	PMS1 Kress	TP2	TP3	PMS2 BPA	RMS3 Spencer	RMS4 BM #113	CMS1	CMS2 Steel Pin 4	CMS3 Steel Rail	WMS1 Well Case	LP1	LP2	LP3 Steel Pin 1	LP4	RMS5 HWM	RMS6 Water Plant	WMS2 Ledgett	TP1	Air
BM Elev		15	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Notes		15	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
4/6/2007																					60	59		52			
5/16/2007															59	59	64		68	64	69	63		57			
8/3/2007	1:30 PM	200				77	69		79			80															
10/10/2007															58												
10/11/2007		500			1																						
10/15/2007																											
12/11/2007		1100			5																						
12/18/2007		1000	6.5				46																	43			
1/11/2008		3500			18																						
1/17/2008		1600												38													
1/31/2008																			44	40	44	40				45	
2/21/2008	2:24 PM	1200	6																								
	4:18 PM		9																								
3/25/2008	9:30 AM	1060	1564	4.2	3.5	43	41		49			48		43	43	40		48	48	48	48		41	44			
4/3/2008	9:00 AM	680	1112																				42	45	45		
	3:00 PM								48	46													43		48		
4/4/2008	10:50 AM			2.8	3.1		45																				
	12:40 PM	650	1077	5.6	3.5																						
5/1/2008	11:00 AM	850	1315	5.3	5.3	50	44	47	59	49	47	57											43	47	49	47	
5/19/2008	12:00 PM	1370	1933	10.0	10.7	55	48	50	71	50	50	71		68	58	69	50	72	75	77	69		48	49	49		
5/23/2008	12:00 PM	996	1488	11.4	13.0	48	48	50	65	51	51	62		56	51	56	51	53	62	60	60		45	48	48	60	
6/18/2008	8:35 AM	570	981	8.7	9	51	48	50	66	52	51	63		58	47	58	53	59	64	63	60		48	49	50	58	
8/8/2008	9:00 AM	70	260	4.2	3.65	66	59	53	73	53	53	68		63		58	63		69	67	55		58	52	dry	60	
9/3/2008	10:00 AM	62	377	2.74	1.82	64	54	56	69	55	55	59		58		61	dry	66	65	71	61		56	55	dry	62	
11/10/2008	10:15 AM	766	1215	5.47	4.59	52	48	53	54	54	53	54		51		51	56	53	53	54	53		49	53	53	50	

Notes:

- 1 TBM is Orange Stake on RB River at Upstream End of Parking Area next to Concrete Block
- 2 BM is PK Nail in Parking Lot Near Outhouse and North Entrane Road
- 3 TBM is Orange Stake along the North East Bank Near Building
- 4 BM is Plastic Cap on Rebar along Pipeline 30 feet back from Kalama River LB
- 5 Located in Spencer Creek Along Pipeline Alignment, WS controlled by Beaver Dams
- 6 BM is Steel Pin along LB of Creek where spur road crosses into field
- 7 BM yet to be set, but WSEL is near culvert/road
- 8 BM is top of square tube with cap removed adjacent to LP1
- 9 Steel Pin on North Edge of Road between LP3 and LP4
- 10 Area where high water marks have been measured from debris on fence posts
- 11 TBM is wood stake on RB River just DS Kalama PUD Treatment Plant
- 12 TBM is top of Lid on Ledgett Well (Vertical CMP)
- 13 Longview <http://ahps2.wrh.noaa.gov/ahps2/hydrograph.php?wfo=pqr&gage=lopw1&view=1,1,1,1,1&toggles=10,7,8,2,9,15,6&type=0>
- 14 St. Helens <http://ahps2.wrh.noaa.gov/ahps2/hydrograph.php?wfo=pqr&gage=shno3&view=1,1,1,1,1&toggles=10,7,8,2,9,15,6&type=0>
- 15 E. Fk. Lewis <http://waterdata.usgs.gov/nwis/uv?14222500>

Notes: (See Figure 3.2)

- RMS6 River Monitoring Station 6 Just DS of Kalama Plant
- RMS5 River 1/2 way between 6 and 4 where the river floods overbank
- RMS4 River under Pipeline
- RMS3 River Monitoring Station 3 at the Mouth Spencer Creek
- RMS2 Just U/S I5 on LB No data Collected
- RMS1 WDFW Parking Area
- WMS2 Ledgetts Ranney Well
- WMS1 LCFEG Well Steel Tube
- LP4 Ledgett Most Upstream Pond
- LP3 Ledgett Pond Next to House
- LP2 Ledgett Pond US Road Crossing
- LP1 Ledgett Pond Out in Field
- CMS3 Spencer Creek - Upstream of culvert near alluvial fan
- CMS2 N. Br. Spencer at Crossing with small culvert
- CMS1 Lower Section of Spencer Creek
- PMS1 Kress Lake
- PMS2 BPA Pond