APPENDIX D

FIELDWORK MEMORANDA

Memorandum 1: 9/24/02 & 9/25/02 Instream Flow Data Collection

Memorandum 2: 10/24/02, 10/25/02 & 10/31/02 Instream Flow Data Collection

Memorandum 3: 12/16/02 and 12/17/02 Instream Flow Data Collection

Memorandum 4: 1/8/2003 and 1/9/2003 Instream Flow Data Collection

Memorandum 5: 2/6/03 & 2/7/03 Instream Flow Data Collection

Memorandum 6: 3/26/03 and 3/27/03 Instream Flow Data Collection

MEMORANDUM

TO: Instream Flow File **DATE:** May 2003

FR: Donna DeFrancesco (Golder Associates) **OUR REF:** 013-1372.2400

RE: 9/24/02 & 9/25/02 Instream Flow Data Collection

1.0 SEPTEMBER 2002 DATA COLLECTION SUMMARY

Streamflow gaging sites were established at each of the three sites of the Little Spokane River and sites on Deadman, Dragoon and Otter Creeks as selected by the Planning Units. Streamflow data was collected at six sites on September 24th and 25th, 2002. Field collection was completed by Chris Bjornsen (Golder Associates Instream Flow Biologist), Donna DeFrancesco (Golder Associates Ecologist), Bryony Hansen (Golder Asociates Hydrogeoloist) Reanette Boese (Spokane County) and Blake Mee (Spokane Community College on September 24th and 25th

1.1 Sampling Regimen

Data collection included initial site establishment, stream discharge (including depth and velocity) using a Swoffer meter, as well as headpin elevation and water level elevation measured at the cross-section and at 20 feet above and below the cross-section on both sides of the stream, using a laser level. Monitoring sites were established in representative riffle with stable banks within the area of the sites selected by the Planing Unit. An effort was made to place the monitoring sites as close to the existing permenant stream gages as possible.

For Otter Creek, no representative rifle area ocured within the general site locale. A run area representative of most of the stream in this area was selected for site monitoring.

Velocity and hiding cover information was collected for fry, juvenile and adult fish life stages. Percent substrate composition of various substrate size clases was also recorded across the transect at all sites. Vegetation (both aquatic and terrestrial) was also assessed across each transect, as was a description of terrestrial vegetation at the high water mark. A description of transect information from the vegetation line was recorded. Vegetation species, type, condition, and cover was recorded for 10 feet upstream and downstream of each transect.

Initial site establishment included placement of headpins (2.5 ft rebar, ¾" diameter) at ends of the transect. These head pins were counter sunk at each transect end point and marked with pink survey flagging and a woden stake. Distance and compass direction from a benchmark was documented for each pin location. Each pin was documented for location with GPS tools.

Channel cros-sectional morphology was also measured for each transect during this field visit. Two end points were established at each cross-section location. Cross sections were

oriented perpendicular to flow, from the left terrace across the river to the right terrace. Cross sections were surveyed using a laser level and graduated rod with laser detector. A tagline marked in one-foot increments was stretched across the channel between the two pins. The tagline was zeroed on the left downstream bank headpin. Horizontal and vertical coordinates were then obtained across the channel.

Major topographic breaks were surveyed and a minimum of 20 measurements across the channel were made. In addition, the following features were noted for each cross-section: left pin; left terrace; left edge of water; right edge of water; right terrace; and, right pin.

Flows were collected at the following times and with the following corresponding flows at the USGS Dartford gage.

1.2 Issues

Digital photos showing upstream and downstream views were taken at each of the six designated sampling locations.

MEMORANDUM

TO:	Instream Flow File	**DATE:**	February 10, 2003
FR:	Lisa Vaughn (Golder Associates)	**OUR REF:**	013-1372.2400
RE:	10/24/02, 10/25/02 & 10/31/02 Instream Flow Data Collection		

1.0 OCTOBER 2002 DATA COLLECTION SUMMARY

Streamflow data was collected at six sites on the Little Spokane River on October 24th, 25th and 31, 2002. Field collection was completed by Lisa Vaughn (Golder Associates Biologist) and Reanette Boese (Spokane County) on October 24th and 25th. Due to insufficient channel elevation data at Dragoon Creek and Otter Creek, a second field visit was required to obtain this data. Bryony Hansen (Golder Hydrogeologist) and Reanette Boese made the second field visit to these two stations on October 31st, 2002.

1.1 Streamflow Variation

Weather patterns preceding and during this sampling period were stable and created little streamflow variability on the Little Spokane River and tributaries during the sampling period. There was no precipitation and air temperatures remained fairly constant throughout the original sampling period from October 24 through October 25. Air temperatures for this sampling period averaged 35°F and 33°F, respectively for October 24 and 25. There was no precipitation during the second sampling period, October 31, 2002, and the average air temperature for this day, 21°F, was quite a bit lower than the averages for the initial sampling period. A very small amount of precipitation (0.01 inches) fell three days prior to this second sampling period, on October 28, 2002. There was likely little to no significant streamflow variation between the two gaging periods.

1.2 Sampling Regimen

Data collection included stream discharge (including depth and velocity) using a Swoffer meter, as well as headpin elevation and water level elevation measured at the cross-section and at 20 feet above and below the cross-section on both sides of the stream, using a laser level. Instream flow sites were sampled in the following order. Please note that two measurements were taken at both Dragoon Creek and Otter Creek due to insufficient channel elevation data. The October 31st data was collected to replace the October 24th data and will be used in the analysis.

1. Little Spokane River @ Chattaroy – October 24th, 13:30
2. Dragoon Creek – October 24th, 15:00 and October 31st, 15:00
3. Little Spokane River @ Elk – October 25th, 10:30
4. Otter Creek – October 24th, 12:00 and October 31st, 13:00
5. Deadman Creek – October 25th, 12:20
6. Little Spokane River @ Pine River Park – October 25th, 13:20

1.3 Observations

Flows at Dartford were quite stable during the initial field visit on October 24 and 25 and ranged from 130-132 cfs on these days. Due to the time elapsed between field visits, there is some inconsistency in flow between the initial field visit and the October 31st field visit. Flows at Dartford on October 31st were a bit more variable and ranged from 123-130 cfs between 13:00 and 16:00.

Date	Temperature Max. (°F)	Temperature Min. (°F)	Temperature Average (°F)	Precipitation Inches
October 22, 2002	55	38	47	0.00
October 23, 2002	54	22	38	0.00
October 24, 2002	53	17	35	0.00
October 25, 2002	52	14	33	0.00
October 29, 2002	35	22	29	0.00
October 30, 2002	34	7	21	0.00
October 31, 2002	38	3	21	0.00

Climate Data Source: NOAA Past Monthly Climate Data website: http://www.wrh.noaa.gov/Spokane/cli.htm

Site	Measured discharge (cfs)	Corresponding discharge on LSR @ Dartford (cfs)	Comments
LSR @ Chattaroy	75.9	132	October 24th @ 13:30
Dragoon Creek	27.8	126-130	October 31st @ 15:00
LSR @ Elk	40.0	130	October 25th @ 10:30
Otter Creek	3.0	123	October 31st @ 13:00
Deadman Creek	8.2	130-132	October 25th @ 12:20
LSR @ Pine River Park	119.5	130	October 25th @ 13:20

1.4 Issues

Due to inadequate channel elevation data, flow data for all six sites were not collected within a concise period of time. Because of this, flows at Dartford are somewhat variable between the sites. The range on October 24 and 25 was 130-132 cfs and the range on October 31 was 123-130 cfs.

Use of a tape measure is likely to introduce some level of inaccuracy due to difficulties in keeping the tape taut throughout the gaging period. Windy conditions present further complications and for this reason, a Kevlar tagline is recommended because it provides improved accuracy.

Digital photos showing upstream and downstream views were taken at each of the six designated sampling locations.

MEMORANDUM

TO:	Instream Flow File	**DATE:**	February 10, 2003
FR:	Lisa Vaughn (Golder Associates)	**OUR REF:**	013-1372.2400
RE:	12/16/02 and 12/17/02 Instream Flow Data Collection		

1.0 DECEMBER 2002 DATA COLLECTION SUMMARY

Streamflow data was collected at six sites on the Little Spokane River on December 16 and 17, 2002. Field collection was completed by Donna DeFrancesco (Golder Associates Ecologist) and Reanette Boese (Spokane County) on December 16th and by Donna DeFrancesco, Reanette Boese and Blake Mee (Spokane County Community College) on December 17th.

1.1 Streamflow Variation

Weather patterns preceding and during this sampling period created a highly variable flow pattern on the Little Spokane River. Air temperature for the days of sampling averaged 39°F and 33°F, respectively for December 16th and 17th. The two days prior to this were much warmer with average temperatures of 50°F and 46°F, for December 14th and 15th respectively. Precipitation occurred on all four days, but a larger amount occurred on December 14th (0.65 in) and December 16th (0.59 in). On December 16th, most of this precipitation occurred in the morning prior to sampling with slight precipitation occurring through early afternoon. Climate data is summarized below.

The two days of precipitation resulted in a rapid increase in streamflow. On December 16th, the first day of sampling, flow at USGS gage on Little Spokane River at Dartford was 300 cfs throughout the day. During the overnight period stream flow increased by 100 cfs. By the morning of December 17th (second day of sampling) the streamflow at Dartford was 400 cfs.

This increase in streamflow reflects the increase in precipitation for the period of December 14th and December 16th. For each approximately 0.5 cfs of precipitation there was an approximate 100 cfs increase in streamflow occurring over the 12 –24 hour period following the precipitation event.

1.2 Sampling Regimen

Data collection included stream discharge (including depth and velocity) using a Swoffer meter, as well as headpin elevation and water level elevation measured at the cross-section and at 20 feet above and below the cross-section on both sides of the stream, using a laser level. Instream flow sites were sampled in the following order.

1. Little Spokane River @ Chattaroy –December 16th 11:30

2. Dragoon Creek--December 16th 13:15

3. Little Spokane River @ Elk – December 16th 14:45

4. Otter Creek – December 16th 16:15

5. Little Spokane River @ Pine River Park – December 17th 9:30

6. Deadman Creek – December 17th 11:15

1.3 Observations

An increase in flow occurred between December 16th and 17th. LSR @ Chatteroy and Dragoon Creek, the first sites sampled, were sampled when the Little Spokane River @Dartford was at 300 cfs. LSR @ Pine River Park and Deadman Creek, the last sites sampled, were sampled when the Little Spokane River @ Dartford was at 400 cfs. The middle sites sampled, Otter Creek and LSR @ Elk were sampled late on December 16th, and I believe that these areas, which are far upstream of Dartford, were reflecting an increase in cfs that would appear later in the evening at Dartford and is not portrayed in the 318 cfs that was recorded at Dartford.

In addition, water level was near bankfull at several of the sites during this period of measurement. LSR @Pine River Park and Deadman Creek were within 1.5 ft of overflowing the banks when the Little Spokane River at Dartford was measuring 400 cfs; LSR@ Chattaroy and Otter Creek were within 1.0 to 1.5 feet of overflowing the banks when the Little Spokane River at Dartford measured 300-320 cfs.

Date	Temperature Max. (°F)	Temperature Min. (°F)	Temperature Average (°F)	Precipitation Inches
December 14, 2002	55	44	50	0.65
December 15, 2002	52	39	46	0.15
December 16, 2002	46	32	39	0.59
December 17, 2002	37	29	33	0.02

Climate Data Source: NOAA Past Monthly Climate Data website: http://www.wrh.noaa.gov/Spokane/cli.htm

Site	Measured discharge (cfs)	Corresponding discharge on LSR @ Dartford (cfs)	Comments
LSR @ Elk	48.9	318	At 12/16/2002 @ 14:45
LSR @ Chattaroy	152.4	305	At 12/16/2002 @ 11:30
LSR @ Pine River Park	340.5	400	At 12/17/2002 @ 9:30
Otter Creek	7	318	At 12/16/2002 @ 16:15
Dragoon Creek	73.5	305	At 12/16/2002 @ 13:15
Deadman Creek	34.5	400	At 12/17/2002 @ 11:15

1.4 Issues

The changing variability in stream flow resulting from storm events should be avoided during future sampling events. This can be addressed by avoiding sampling during periods where large weather events appear imminent.

As in previous field visits, use of a tape measure is likely to introduce some level of inaccuracy due to difficulties in keeping the tape taut throughout the gaging period. Windy conditions present further complications and for this reason, a Kevlar tagline is recommended because it provides improved accuracy.

Photographs were taken during site visits and should continue to be taken throughout the sampling periods at various flows from the same locale.

Unfortunately, photos existed on the digital camera at the time of the survey and prior to leaving the hotel during the survey period. However, after coming off the plane and downloading photos in Redmond, the camera was empty and showed no recorded pictures, including a great blue heron one taken by Reanette. In this instance the digital camera was included in checked baggage and perhaps was erased as a result of airport baggage scanning. In the future it would be best to download the camera prior to boarding the aircraft if possible or take the camera as carry on luggage.

MEMORANDUM

TO:	Instream Flow File	**DATE:**	February 10, 2003
FR:	Lisa Vaughn (Golder Associates)	**OUR REF:**	013-1372.2400
RE:	1/8/2003 and 1/9/2003 Instream Flow Data Collection		

1.0 JANUARY 2003 DATA COLLECTION SUMMARY

Streamflow data was collected at six sites on the Little Spokane River on January 8 and 9, 2003. Field collection was completed by Lisa Vaughn (Golder Associates Biologist) and Reanette Boese (Spokane County) on both of these days.

1.1 Streamflow Variation

Weather patterns preceding and during this sampling period were stable and created little streamflow variability on the Little Spokane River and tributaries during the sampling period. There was no precipitation and air temperatures remained fairly constant throughout the sampling period, averaging 26°F and 31°F on January 8th and 9th, respectively. The most recent precipitation event occurred on January 4, 2003, when 0.28 inches of rain fell.

1.2 Sampling Regimen

Data collection included stream discharge (including depth and velocity) using a Swoffer meter, as well as headpin elevation and water level elevation measured at the cross-section and at 20 feet above and below the cross-section on both sides of the stream, using a laser level. Instream flow sites were sampled in the following order.

1. Dragoon Creek – January 8th, 13:25
2. Little Spokane River @ Elk – January 8th, 15:10
3. Otter Creek – January 8th, 16:20
4. Little Spokane River @ Chattaroy – January 9th, 10:00
5. Little Spokane River @ Pine River Park – January 9th, 11:30
6. Deadman Creek – October 25th, 12:45

1.3 Observations

Flows at Dartford on January 8, 2003 ranged from 322-329 cfs and declined slightly throughout the day. Flows on January 9, 2003 remained constant at 308 cfs throughout the field data collection.

Date	Temperature Max. (°F)	Temperature Min. (°F)	Temperature Average (°F)	Precipitation Inches
January 6, 2003	40	26	33	0.00
January 7, 2003	37	23	30	0.00
January 8, 2003	28	24	26	0.00
January 9, 2003	38	23	31	0.00

Climate Data Source: NOAA Past Monthly Climate Data website: http://www.wrh.noaa.gov/Spokane/cli.htm

Site	Measured discharge (cfs)	Corresponding discharge on LSR @ Dartford (cfs)	Comments
LSR @ Chattaroy	188.9	308	January 9 @ 10:00
Dragoon Creek	54.6	329	January 8 @ 13:25
LSR @ Elk	51.5	325-322	January 8 @ 15:10
Otter Creek	3.7	322-325	January 8 @ 16:20
Deadman Creek	24.4	308	January 9 @ 12:45
LSR @ Pine River Park	300.9	308	January 9 @ 11:30

1.4 Issues

There were no issues during this sampling round. Upstream and downstream photographs were taken at all six sites.

As in previous visits, use of a tape measure is likely to introduce some level of inaccuracy due to difficulties in keeping the tape taut throughout the gaging period. Windy conditions present further complications and for this reason, a Kevlar tagline is recommended because it provides improved accuracy.

MEMORANDUM

TO:	Chris Pitre (Golder Associates)	**DATE:**	February 10, 2003
FR:	Lisa Vaughn (Golder Associates)	**OUR REF:**	013-1372.2400
RE:	2/6/03 & 2/7/03 Instream Flow Data Collection		

1.0 FEBRUARY 2003 DATA COLLECTION SUMMARY

Streamflow data was collected at six sites on the Little Spokane River on February 6and 7, 2003. Field collection was completed by LisaVaughn (Golder Associates Biologist), Dave Hrutfiord (Golder Associates Geophysicist) and Reanette Boese (Spokane County) on both of these days. High flow sampling was required for two of the six sites and is discussed below in greater detail.

1.1 Streamflow Variation

Weather patterns preceeding and during this sampling period were stable and created little streamflow variability on the Little Spokane River and tributaries during the sampling period. There was no precipitation and air temperatures remained fairly constant throughout the sampling period. Air temperature for the days of sampling averaged 32°F and 30°F, February 6th and 7th for respectively. The two days prior had similar average temperatures of 34°F and 31°F, for February 4th and 5th respectively. The most recent rainfall event occurred on February 3, 2003, when approximately 0.12 inches of rain and 0.3 inches of snow fell.

1.2 Sampling Regimen

Data collection included stream discharge (including depth and velocity) using a Swoffer meter, as well as headpin elevation and water level elevation measured at the cross-section and at 20 feet above and below the cross-section on both sides of the stream, using a laser level. Streamflows at two sites, the Little Spokane River at Chattaroy and the Little Spokane River at Pine River Park were measured using a high flow sampling technique. This technique required the use of a zodiac boat, an outboard motor and a tagline to obtain depth and velocity measurements across the study transects. This methodology is described Section 1.3 of this memo. Instream flow sites were sampled in the following order.

1. Little Spokane River @ Chattaroy – February 6th, 10:00
2. Dragoon Creek – February 6th, 12:00
3. Little Spokane River @ Pine River Park – February 6th, 14:00

4. Little Spokane River @ Elk – February 7th, 9:45

5. Otter Creek – February 7th, 10:50

6. Deadman Creek – February 7th, 16:30

1.3 High Flow Sampling

The following sections provides a description of equipment and the procedure used to measure flows in high flow stream environments. This technique was required to measure flows on the Little Spokane River at Chattaroy and the Little Spokane River at Pine River Park.

1.3.1 Equipment

- Life Vests/Safety Ropes
- Inflatable boat (3 meter long Zodiac)
- Outboard Motor (use size appropriate for river)
- Poly Rope (3/4")
- Anchor posts (1/2" diameter x 4' long rebar)
- Slide Hammer and/or Sledge Hammer
- Caribiners (4")
- Swoffer flow meter and wading rod

1.3.2 High Flow Sampling Procedure

1. All staff review and sign Health and Safety Plan
2. Pound anchor posts into banks on transect, one upslope of each of the transect headpins.
3. Tie ¾-inch rope to anchor post on the 'zero' bank with the zero mark over the top of the headpin.
4. Wade or use motorboat to stretch rope to opposite bank. Secure rope to opposite anchor pin.

5. Tighten rope using simple rope knot techniques.

6. Stretch the marked tagline or tape measure between headpins and secure.

7. Attach the boat to the rope using a carabiner to allow the boat to slide along the rope. Move the boat across the transect along the rope to take measurements at each of the stations.

8. One person remains on shore at all times with safety rope; this person retains health and safety plan and cell phone at all times.

9. Measure water depth and velocity using the flow meter and the wading rod according to the standard flow measurement technique.

In small watercourses the measurements will be made over the side of the boat using the wading rod if the maximum depth is less than 4.25 feet. Based on previous measurements, depths greater than 4.25 feet are not anticipated.

10. Gather all equipment after measurement and ensure its proper storage

11. Review field books between sites to ensure no missing or incorrect data before leaving site.

Date	Temperature Max. (°F)	Temperature Min. (°F)	Temperature Average (°F)	Precipitation Inches
February 4, 2003	42	25	34	0.00
February 5, 2003	40	21	31	0.00
February 6, 2003	42	21	32	0.00
February 7, 2003	37	22	30	0.00

Climate Data Source: NOAA Past Monthly Climate Data website: http://www.wrh.noaa.gov/Spokane/cli.htm

Site	Measured discharge (cfs)	Corresponding discharge on LSR @ Dartford (cfs)	Comments
LSR @ Chattaroy	312.0	525	February 6 @ 10:00
Dragoon Creek	123.2	525	February 6 @ 12:00
LSR @ Elk	58.0	496	February 7 @ 9:45
Otter Creek	5.3	496	February 7 @ 10:50
Deadman Creek	49.8	520	February 6 @ 16:30
LSR @ Pine River Park	549.4	525-520	February 6 @ 14:00

1.4 Observations

Flows at Dartford on February 6, 2003 ranged from 520-525 cfs and declined slightly throughout the day. Flows on February 7, 2003 remained constant at 496 cfs throughout the field data collection.

1.5 Issues

As in previous field visits, use of a tape measure is likely to introduce some level of inaccuracy due to difficulties in keeping the tape taut throughout the gaging period. Windy conditions present further complications and for this reason, a Kevlar tagline is recommended because it provides improved accuracy.

The high flow sampling technique described above was used to measure flows on both the Little Spokane River at Chattaroy and at Pine River Park. The aluminum Swoffer rod used for gaging on the Little Spokane River and tributaries was not heavy duty enough for the flow velocities in some locations on the Little Spokane River at Pine River Park and vibrated during some measurements. Swoffer makes steel rods that would be more stable in high flows. At high flows, a larger prop may be appropriate. Swoffer should be consulted on this.

The aluminum Swoffer rod is not marked for 8/10's measurements for depths over about 3'. A ruled piece of paper was used to set the prop to the correct depth for 8/10's measurements. This worked well, but does introduce some error. The steel Swoffer rod is graduated to allow for 8/10's measurements in deep water.

No digital photos were taken during this round of stream gaging. Once flows at Dartford reach 500 cfs again, photos will be taken to provide views of channel conditions at each of the six sites for comparison with other flow levels. Digital photos should be taken during each field visit from the same location to provide a visual comparison of channel conditions at various flow levels.

4. Little Spokane River @ Elk – February 7th, 9:45

5. Otter Creek – February 7th, 10:50

6. Deadman Creek – February 7th, 16:30

1.3 High Flow Sampling

The following sections provides a description of equipment and the procedure used to measure flows in high flow stream environments. This technique was required to measure flows on the Little Spokane River at Chattaroy and the Little Spokane River at Pine River Park.

1.3.1 Equipment

- Life Vests/Safety Ropes
- Inflatable boat (3 meter long Zodiac)
- Outboard Motor (use size appropriate for river)
- Poly Rope (3/4")
- Anchor posts (1/2" diameter x 4' long rebar)
- Slide Hammer and/or Sledge Hammer
- Caribiners (4")
- Swoffer flow meter and wading rod

1.3.2 High Flow Sampling Procedure

1. All staff review and sign Health and Safety Plan
2. Pound anchor posts into banks on transect, one upslope of each of the transect headpins.
3. Tie ¾-inch rope to anchor post on the 'zero' bank with the zero mark over the top of the headpin.
4. Wade or use motorboat to stretch rope to opposite bank. Secure rope to opposite anchor pin.

5. Tighten rope using simple rope knot techniques.

6. Stretch the marked tagline or tape measure between headpins and secure.

7. Attach the boat to the rope using a carabiner to allow the boat to slide along the rope. Move the boat across the transect along the rope to take measurements at each of the stations.

8. One person remains on shore at all times with safety rope; this person retains health and safety plan and cell phone at all times.

9. Measure water depth and velocity using the flow meter and the wading rod according to the standard flow measurement technique.

In small watercourses the measurements will be made over the side of the boat using the wading rod if the maximum depth is less than 4.25 feet. Based on previous measurements, depths greater than 4.25 feet are not anticipated.

10. Gather all equipment after measurement and ensure its proper storage

11. Review field books between sites to ensure no missing or incorrect data before leaving site.

Date	Temperature Max. (°F)	Temperature Min. (°F)	Temperature Average (°F)	Precipitation Inches
February 4, 2003	42	25	34	0.00
February 5, 2003	40	21	31	0.00
February 6, 2003	42	21	32	0.00
February 7, 2003	37	22	30	0.00

Climate Data Source: NOAA Past Monthly Climate Data website: http://www.wrh.noaa.gov/Spokane/cli.htm

Site	Measured discharge (cfs)	Corresponding discharge on LSR @ Dartford (cfs)	Comments
LSR @ Chattaroy	312.0	525	February 6 @ 10:00
Dragoon Creek	123.2	525	February 6 @ 12:00
LSR @ Elk	58.0	496	February 7 @ 9:45
Otter Creek	5.3	496	February 7 @ 10:50
Deadman Creek	49.8	520	February 6 @ 16:30
LSR @ Pine River Park	549.4	525-520	February 6 @ 14:00

1.4 Observations

Flows at Dartford on February 6, 2003 ranged from 520-525 cfs and declined slightly throughout the day. Flows on February 7, 2003 remained constant at 496 cfs throughout the field data collection.

1.5 Issues

As in previous field visits, use of a tape measure is likely to introduce some level of inaccuracy due to difficulties in keeping the tape taut throughout the gaging period. Windy conditions present further complications and for this reason, a Kevlar tagline is recommended because it provides improved accuracy.

The high flow sampling technique described above was used to measure flows on both the Little Spokane River at Chattaroy and at Pine River Park. The aluminum Swoffer rod used for gaging on the Little Spokane River and tributaries was not heavy duty enough for the flow velocities in some locations on the Little Spokane River at Pine River Park and vibrated during some measurements. Swoffer makes steel rods that would be more stable in high flows. At high flows, a larger prop may be appropriate. Swoffer should be consulted on this.

The aluminum Swoffer rod is not marked for 8/10's measurements for depths over about 3'. A ruled piece of paper was used to set the prop to the correct depth for 8/10's measurements. This worked well, but does introduce some error. The steel Swoffer rod is graduated to allow for 8/10's measurements in deep water.

No digital photos were taken during this round of stream gaging. Once flows at Dartford reach 500 cfs again, photos will be taken to provide views of channel conditions at each of the six sites for comparison with other flow levels. Digital photos should be taken during each field visit from the same location to provide a visual comparison of channel conditions at various flow levels.

MEMORANDUM

TO: Instream Flow File **DATE:** April 1, 2003

FR: Lisa Vaughn (Golder Associates) **OUR REF:** 013-1372.2400

RE: 3/26/03 and 3/27/03 Instream Flow Data Collection

1.0 MARCH 2003 DATA COLLECTION SUMMARY

Streamflow data was collected at six sites on the Little Spokane River on March 26 and 27, 2003. Field collection was completed by Nina Talayco (Golder Associates Biologist), Dave Hrutfiord (Golder Associates Geophysicist) and Reanette Boese (Spokane County) on both of these days. An additional County employee was present for half of the day on March 26th. Blake Mee, a student volunteer from Spokane Community College, assisted with gaging and channel elevation measurements on March 27th. High flow sampling was required for two of the six sites and is discussed below in greater detail.

1.1 Streamflow Variation

Weather patterns preceding and during this sampling period created some streamflow variability on the Little Spokane River and tributaries during the sampling period. Air temperatures for March 26th and 27th averaged 40°F for both of these days. Approximately 0.41 inches of precipitation fell on the 26th, which likely created an increase in streamflow on the Little Spokane and tributaries between the two sampling days. The two days prior to sampling had no precipitation and similar average temperatures of 36 and 43°F, for March 24th and 25th respectively.

1.2 Sampling Regimen

Data collection included stream discharge (including depth and velocity) using a Swoffer meter, as well as headpin elevation and water level elevation measured at the cross-section and at 20 feet above and below the cross-section on both sides of the stream, using a laser level. Streamflows at two sites, the Little Spokane River at Chattaroy and the Little Spokane River at Pine River Park were measured using a high flow sampling technique. This technique required the use of a zodiac boat, an outboard motor and a tagline to obtain depth and velocity measurements across the study transects. This methodology is described Section 1.3 of this memo. Instream flow sites were sampled in the following order.

1. Little Spokane River @ Chattaroy – March 26th, 10:00
2. Little Spokane River @ Pine River Park – March 26th, 13:00
3. Deadman Creek – March 26th, 15:00
4. Dragoon Creek – March 26th, 16:30

5. Little Spokane River @ Elk – March 27th, 10:15

6. Otter Creek – March 27th, 11:40

1.3 High Flow Sampling

High flow sampling techniques were required to attain streamflow measurements at both LSR at Chattaroy and LSR at Pine River Park. These techniques are described in detail below.

1.3.1 Equipment

- Life Vests/Safety Ropes
- Inflatable boat (3 meter long Zodiac)
- Outboard Motor (use size appropriate for river)
- Poly Rope (3/4")
- Anchor posts (1/2" diameter x 4' long rebar)
- Slide Hammer and/or Sledge Hammer
- Carabineers (4")
- Swoffer flow meter and wading rod

1.3.2 High Flow Sampling Procedure

1. All staff review and sign Health and Safety Plan
2. Pound anchor posts into banks on transect, one upslope of each of the transect headpins.
3. Tie ¾-inch rope to anchor post on the 'zero' bank with the zero mark over the top of the headpin.
4. Wade or use motorboat to stretch rope to opposite bank. Secure rope to opposite anchor pin.
5. Tighten rope using simple rope knot techniques.
6. Stretch the marked tagline or tape measure between headpins and secure.

7. Attach the boat to the rope using a carabiner to allow the boat to slide along the rope. Move the boat across the transect along the rope to take measurements at each of the stations.

8. One person remains on shore at all times with safety rope; this person retains health and safety plan and cell phone at all times.

9. Measure water depth and velocity using the flow meter and the wading rod according to the standard flow measurement technique.

In small watercourses the measurements will be made over the side of the boat using the wading rod if the maximum depth is less than 4.25 feet. Based on previous measurements, depths greater than 4.25 feet are not anticipated.

10. Gather all equipment after measurement and ensure its proper storage

11. Review field books between sites to ensure no missing or incorrect data before leaving site.

Date	Temperature Max. (°F)	Temperature Min. (°F)	Temperature Average (°F)	Precipitation Inches
March 24, 2003	47	24	36	0.00
March 25, 2003	50	35	43	No Data
March 26, 2003	51	28	40	0.41
March 2, 2003	51	28	40	0.00

Climate Data Source: NOAA Past Monthly Climate Data website: http://www.wrh.noaa.gov/Spokane/cli.htm

Site	Measured discharge (cfs)	Corresponding discharge on LSR @ Dartford (cfs)	Comments
LSR @ Chattaroy	509.2	823-828	March 26th @ 10:00
Dragoon Creek	172.2	828-832	March 26th @ 16:30
LSR @ Elk	69.2	894	March 27th @ 10:15
Otter Creek	10.1	894	March 27th @ 11:40
Deadman Creek	152.0	828	March 26th @ 15:00
LSR @ Pine River Park	868.1	828	March 26th @ 13:00

1.4 Observations

Flows at Dartford on March 26, 2003 ranged from 823-832 cfs and increased throughout the day due to precipitation. Flows on March 27, 2003 remained constant at 894 cfs throughout the field data collection and no precipitation fell on this day.

1.5 Issues

In windy conditions and wide channels, a kevlar tagline provides more accuracy than a tape measure. The tagline remains taut in the wind. A tagline, provided by Nina Talayco, was used on the 26th and 27th. Use of a kevlar tagline is preferable and it is recommended for future gaging endeavors.

High flow sampling protocol was used to measure flows on two sites, the Little Spokane River at Chattaroy and the Little Spokane River at Pine River Park. The aluminum Swoffer rod used for gaging on the Little Spokane River and tributaries was not heavy duty enough for the flow velocities in the streams during this visit. It vibrated intensely while measuring the 3 largest streams. At the Little Spokane River at Chattaroy, the propeller was lost when the vibrations loosened the lock nut at the tip of the prop. It may not have been screwed on tightly enough, but Nina Talayco did check it before measuring, to be sure it was at least moderately secure. No more tips were lost after that event. Swoffer has steel rods that would be more stable in high flows. At high flows, a larger prop may be appropriate. Swoffer should be consulted on this.

The aluminum Swoffer rod is not marked for 8/10's measurements for depths over about 3'. A ruled piece of paper was used to set the prop to the correct depth for 8/10's measurements. This worked well, but does introduce some error. The steel Swoffer rod is graduated to allow for 8/10's measurements in deep water.

At the sites where we used a boat and the water was ripping by, it was difficult to hold the rod perfectly vertical. However this is not likely to be a major concern, but use of a steel Swoffer rod is recommended for future measurements.