Aspect CONSULTING

MEMORANDUM

Project No.: 090180-004-03

August 31, 2012

To: Mark Schuppe – Operations Manager, Office of Columbia River
Washington State Department of Ecology

cc: Dick Ewing, Twin Lakes Aquifer Coalition
Derek Sandison – Director, Office of Columbia River
Washington State Department of Ecology

State of Washington Hydrogeologist 1537 Licensed Geologist
8-31-12
Erick William Miller

From: **Erick W. Miller, LHG**
Senior Associate Hydrogeologist

Timothy J. Flynn, LHG, CGWP
Principal Hydrogeologist

Re: **Twin Lakes Storage Project Overview**

1 Introduction

This memorandum presents an overview of the Twin Lakes Aquifer Coalition (TLAC) water storage project to initiate review by the Washington State Department of Ecology's Office of Columbia River for funding under the Columbia River Water Supply Development Account (RCW 90.90.10). The draft of this memorandum was issued on September 8, 2011.

The objectives of the project include enhancing water storage within the upper portion of the Methow River basin, which is a high priority need identified in the WRIA 48 Detailed Implementation Plan (MWC, 2009). Benefits associated with the TLAC project include increasing winter streamflows in the Methow River, enhancing lake levels within Big and Little Twin Lakes, and improving habitat in the Twin Lakes area. Considerable studies—including preliminary engineering evaluation—have been completed to date demonstrating the feasibility of the TLAC project to meet project objectives and provide for water storage in the basin. The Twin Lakes project area is located near the Town of Winthrop. The project location is shown on Figures 1 and 2. Photos of the project lakes are included in Attachment 1.

In 2003, TLAC filed groundwater right application G4-34915 under the cost reimbursement program requesting a water right appropriation within the Methow River Basin, Water Resources Inventory

Area (WRIA) 48. TLAC is currently pursuing expedited processing under the Office of Columbia River Program (OCR) provisions authorized in the recently amended Hillis Rule Provisions (Washington Administrative Code [WAC] 173-152-050(3)). The amended provisions allow for expedited processing for OCR supported water storage projects.

TLAC's water right application requests a water right appropriation for a maximum withdrawal of 4,500 gallons per minute (gpm) and a quantity of 2,000 acre-feet from wells located near the Methow River. The proposed purpose of use listed on the application is as follows:

- Water storage enhancement for increasing streamflows in mainstem Methow River and Thompson Creek during low flow periods;
- Restore and maintain Twin Lakes Aquifer levels;
- Restore and maintain recreational trout fishing in Big and Little Twin Lakes;
- Restore and maintain riparian habitat and lowland habitat for aquatic species and mammals that use Barnsley and Twin Lakes;
- Restore natural aesthetic appeal of lake areas;
- Increase recreational opportunities; and,
- Maintain or enhance water quality for trout fishery and recreation.

Several engineering/consultant studies have been performed on the Twin Lakes project (refer to Section 8 for a listing of studies). A Hydrogeologic Evaluation Report, which included developing a groundwater model for the project area, evaluates the feasibility of water storage in Twin Lakes (Aspect, 2009a). The hydrogeologic characterization included extensive data collection—groundwater level, streamflow, and lake level measurements—to support development of the groundwater flow model. Subsequent analysis (Aspect, 2012a and Aspect, 2012c) focused on using the groundwater flow model to evaluate the feasibility of water storage in Twin Lakes to address multiple resource needs, including enhancing flows in the Methow River. The groundwater model has been used to predict project lake level and streamflow benefits for various withdrawal scenarios. A habitat assessment of the project was developed that addressed various lake fill scenarios (Herrera, 2010).

2 Project Overview

The project will use water sourced from wells in hydraulic continuity with the Methow River and convey the water via pipeline to Big Twin and Barnsley Lakes and a kettle feature. Review of nearby well logs indicates the aquifer should be capable of meeting project demand (Aspect, 2009a). Discharge to Big Twin Lake would likely occur through a cascading stream with boulders and spawning sites from the property line of Big Twin Campground to the lake. An option considered by TLAC is to supplement direct discharge to Big Twin Lake via an infiltration gallery. Should an infiltration gallery be implemented, in lieu of a portion of direct lake discharge, it is not expected to have a significant effect on the project water balance. Figure 3 shows the proposed well locations, and conceptual piping layout.

Withdrawals under a new water right authorization would be subject to the statutory minimum instream flow (MIF) for the Methow River (WAC 173-548). Figure 4 presents a comparison of the Methow River flows for the 21-year period of record from October 1989 through September 2010 relative to the MIF target flow criteria. Figure 4 indicates flows generally are above the MIF between April and September (approximately 80% of the time), but drop below the MIF with more frequency between October and April (approximately 60% of the time). In addition to consideration of the MIF, the TLAC project withdrawal window has been restricted to an April through September timeframe. This constraint was imposed to eliminate operations during winter months when less water is available, availability occurs for shorter duration, and the lakes are typically frozen. The opportunity for withdrawals during the winter period may be revisited in the future.

In making funding decisions, RCW 90.90.010(3) directs Ecology to consider the following: 1) water uses to be served by the facility and the quantity of water required to meet those uses; 2) economic, cultural, and environmental costs and benefits to the state in meeting the water uses; and 3) alternative means to meet the water uses, including costs and the extent to which long-term supply can be met by the alternatives. Project attributes which satisfy the funding considerations are summarized below.

Consideration of Water Supply Needs – Water for out of stream uses, including permitting of new municipal uses in the Methow basin, is limited during the winter months when flows often drop below the MIF. The project would improve water availability for out-of-stream uses during the low flow winter months.

Consideration of Cost/Benefit of the Project and Alternatives – The project is expected to have a positive environmental benefit. Raising lake levels would provide habitat benefits for fish and wildlife in and around the lakes. The project would enhance the trophy trout fishery in Big Twin Lake and provide water to the Methow River during the winter period when the MIF is often not being met. Lake aesthetics and recreational opportunities will improve. Enhancing the lake fisheries, aesthetics, recreation, and providing municipal water is expected to have economic benefits.

RCW 90.90.020 (3) directs Ecology to focus water development in the Columbia River basin to address priority needs. New water supplies resulting from implementation of the TLAC water storage project would contribute to addressing several of the water development priorities listed in the statute, including:

Providing new sources of water supply for pending water right applications – There are approximately 23 pending water applications downstream from the TLAC proposed point of withdrawal, requesting direct surface water withdrawal from the Methow River or groundwater in hydraulic continuity (2 surface water and 21 groundwater applications). While water is potentially available on a seasonal basis for appropriation during times of the year per WAC 173-548, new year-round appropriations are limited by violations of the MIF during the winter low flow periods. The TLAC project would provide additional flow during the winter low flow months and could be used to offset consumptive use impacts of new appropriations during the winter low flow period.

Noninterruptible Supply for Interruptible Water Right Holders – The project is estimated to provide an average annual seasonal return flow quantity of about 370 afy (Aspect, 2012c). This water could be used to provide supply to current, interruptible water right holders.

New domestic industrial and irrigation water needs – As indicated above, the project will provide for new supply by providing an annual average 370 afy return flow.

The project is seeking priority processing of its water right application under the OCR provisions of the Hillis Rule. Under these provisions (WAC 173-152-050(3)), an application for diversionary rights into reservoirs would qualify for expedited processing, if it does not conflict with adopted state instream flow rules, federal flow targets, or federal biological opinions, and is funded or supported pursuant to Chapter 90.90 RCW. This option for expedited processing allows for a new diversionary right into storage reservoirs (Twin Lakes and Barnsley Lake/kettle feature) that do not conflict with the fisheries objectives and are funded or supported by the OCR.

The TLAC water right application meets the criteria for expedited processing:

- ***It does not conflict with instream flows.*** *The TLAC project would withdraw available water during periods when the MIF under WAC 173-548 is met. Thus, withdrawals would be subject to interruption for short periods during the April through September withdrawal window.*
- ***Does not conflict with federal flow targets and federal biological opinions.*** *The instream flow benefits of the TLAC water storage project are consistent with the goals of the OCR.*
- ***Project is funded or supported pursuant to Columbia River Basin Water Management Program (Chapter 90.90 RCW).***

  The OCR was created by Ecology to use legislatively authorized funds to develop new water supplies through storage, conservation, and voluntary regional water management agreements. The intent of this memo is to secure OCR funding for the TLAC project to enhance water storage in the Methow River basin, which is a tributary to the Columbia River.

3 Project Water Balance

The project groundwater model was used to develop a water balance with withdrawals constrained by the April-September MIF withdrawal scenario (Aspect, 2012c). In the modeled scenario, well discharge is directed first to Big Twin Lake, and upon reaching the target lake level is then directed to Barnsley Lake. After Barnsley Lake fills, discharge is directed to the kettle feature. Landowners were consulted by TLAC during staking of the highest acceptable fill level. The staked, maximum fill level was surveyed and the model run to achieve these maximum fill levels.

Project water budget components include evaporative losses from the lake surface, groundwater recharge, aquifer storage, and groundwater discharge to the Methow River. Average annual and monthly Methow River return flow are shown on Figure 5. The majority of the water that recharges to groundwater flows to the north, discharging to the Methow River near the point of diversion and

the remainder flows to the southeast, bypassing an approximate 3-mile reach of the Methow River. Lake evaporation increases under the project as the higher lake fill levels increase the lake surface area (footprint).

Consumptive uses (evaporative losses, bypass quantity, and losses to aquifer storage), and return flow quantities are summarized in Table 1 for project steady state conditions. For project operation after initial startup, the model predicts an average of 116 acre-feet per year (afy) (21%) lost to evaporation (ET), 64 (12%) afy going into aquifer storage, and 52 afy (9%) returning to the Methow River via the bypass reach, and 318 afy (58%) returning via northerly return flow (Table 1). Water balance quantities listed in Table 1 are presented relative to the current build-out condition.

Table 1 – Average Annual Water Balance

Inputs				Outputs			
Big Twin Lake Input	Barnsley Lake Input	Kettle Input	Total TLAC Withdrawal	Increase in ET	Lake and Aquifer Storage	Southerly Return Flow (bypass reach)	Northerly Return Flow
271 afy	65 afy	215 afy	551 afy	116 afy	64 afy	52 afy	318 afy
49%	12%	39%	100%	21%	12%	9%	58%

Notes:
1. Water balance based on last 5 years of 21 model prediction period. Predictions are relative to current condition buildout.

4 Project Benefits

The project is expected to provide benefits to Methow River instream flows, and fish and wildlife habitat at the lakes and improve lake aesthetics and recreational opportunities.

4.1 Instream Flow Benefits

The project will provide benefits to instream flows on the Methow River, particularly in the winter low flow months. On average, the model predicts about two-thirds of the lake augmentation water will seep into the subsurface and become return flow. Return flow is water that is not consumed by evapotranspiration that eventually returns to the Methow River or is captured by TLAC pumping wells. The return flow averages about 0.5 cubic feet per second (cfs) (about 370 afy) over the course of the year. About 150 afy of this return flow will augment streamflows during the low flow winter months from October through March. During pumping periods, a portion of the northerly return flow is expected to be captured by the TLAC wells.

4.2 Lake Habitat Benefits

A habitat assessment for the lake fill scenarios was previously completed (Herrera, 2010) to assist in evaluation of the various storage scenarios. The assessment considered effects within the Twin Lakes study area and indicated that any of the scenarios would result in long-term benefits to fish and wildlife habitat in the project area lakes. Rapid filling to achieve target lake levels was most beneficial for providing fish and wildlife habitat and reduction of reed canary grass. Minimization of

lake level fluctuation (i.e., reservoir effect) was beneficial for reducing invasive species and maintaining habitat.

Results of the habitat assessment indicate that the increase in water volume in the lakes will translate to an increase in surface area available for aquatic species utilization at a greater range of depths. Barnsley Lake and the north end of Little Twin Lake will exhibit the greatest change in surface area covered by water with the lake level increases. At Little Twin Lake there is the potential to increase lake area habitat by about 33% of the lake size. As the shoreline moves into area of relic native riparian vegetation, trees in these areas will play a significant role in water quality, nutrient cycles, and aquatic habitat.

Washington State Department of Fish and Wildlife (WDFW) indicated that Big and Little Twin Lakes have historically provided excellent fishing recreation. Big Twin Lake is highly productive and is one of a relatively few waters in North Central Washington capable of producing large trout. An increase in lake levels was considered to be a desirable short-term goal to maintain historic fish and wildlife benefits. WDFW supports the idea of having a cascading stream with boulders and spawning sites from the property line of Big Twin Campground to the lake, allowing for some self-propagation of the Big Twin Lake fish (Bob Jateff, WDFW personal communication to Dick Ewing, TLAC).

4.3 Out-of-Stream Benefits

Water availability in the Methow Basin is very limited during the winter months. Instream flows are not met about 40% of the time between October and March. As shown on Figure 4, no water would have been available for many of the winter periods within the 21-year period of record. Municipalities, such as the Town of Twisp, currently are seeking additional water supplies during the winter months.

For water storage projects funded by the OCR under the Columbia River Water Supply Account, two-thirds of active storage is designated for out-of-stream uses and one-third for instream flows to maximize benefits to salmon and steelhead populations. The estimated annual average water available for out-of-stream benefit would be about 247 afy (153 gpm) (two-thirds of 370 afy average annual return flow). Project withdrawals under the MIF are constrained by hydrologic variability, but as shown on Figure 5, the combined lake/aquifer storage damps the year-to-year variability in return flow. The minimum average annual return flow is 300 afy in model year “2022” (Figure 5, upper graph). The minimum available water for out-of-stream use (two-thirds of the minimum annual average return flow) would be about 200 afy (124 gpm) and may be available as a non-interruptible annual quantity.

4.4 Enhanced Aesthetics and Recreational Opportunities

The increase in lake level will inundate previously submerged shoreline enhancing the visual aesthetic of the lakes. Increasing and maintaining lake levels will also increase recreational opportunities.

5 Project Monitoring

A project baseline monitoring network has been established and is currently on-going. Staff gauges have been installed and lake levels are recorded monthly in Barnsley, Big Twin, Little Twin, and Dibble Lakes. A continuous record of lake levels have been recorded by a transducer and datalogger installed in Big Twin Lake since June 2010. In addition, a continuous water level record is being obtained in two domestic wells equipped with transducers and dataloggers. Streamflow is monitored at two locations on Thompson Creek. The monitoring network was established by Aspect and is now operated and maintained by TLAC.

6 Planning Level Project Costs

The estimated capital cost of the project, based on an opinion of probable planning level capital project costs (Aspect, 2009b and Aspect, 2012b), is $1.8 million, including tax and contingency for a 12-inch pipeline. Long-term project O&M costs are estimated at $66,000 annually for a 550 afy withdrawal, including a 20% contingency (Table 2). These costs may vary, depending on final project design, operation, and administration.

Table 2 – Planning Level Long-term Operation and Maintenance Costs

Annual Volume Pumped (afy)	Annual Pumping Cost (at 1000 gpm)	Annual Maintenance/Operating Labor	Contingency (20%)	Total Annual O and M Cost (w/contingency) (1,000 gpm)
550	**$12,000**	**$43,000**	**$11,000**	**$66,000**

Assumptions:

1. Pumping costs based on 550 afy at 1,000 gpm flow rate.
2. Energy cost is 0.052 $/kwh plus $100/month basic and demand charges.
3. Static lift is 205 feet (120 feet plus 85 feet water surface to ground surface).
4. Pipeline is 12,500 feet of 12" HDPE.
5. Pumping system efficiency is 70%.
6. Annual operational period is 6 months.
7. Burdened labor rate is estimated at $70 per hour for one-quarter position.
8. 20% contingency is added to Total Annual O&M Cost.

6.1 Operations Funding Options

Project O&M costs could potentially be funded through the sale or lease of seasonal water made available by implementation of the TLAC water storage project. As discussed above, for a 550 afy withdrawal scenario under the OCR about 247 afy per year is estimated to be available for out-of-stream uses in an average year.

7 Project Next Steps

Implementation of the TLAC water storage project, assuming it is funded by OCR, is anticipated to proceed in the following sequence of steps

1. **State Environmental Policy Act (SEPA) Compliance –** Prepare a SEPA checklist and initiate scoping to evaluate environmental impacts of the proposed project.
2. **Identify Project Owner/Managing Entity –** A managing entity for the project that will be legally obligated to own, operate, and maintain the system will be identified.
3. **Expedited Processing under revised Hillis Rule –** Expedited processing of TLAC water right application under the revised Hillis Rule option will be requested.
4. **Confirm source of long-term O&M funding –** This step would be on a parallel track with development of the project under the OCR. Sale of a portion of the return flow to the Methow River to a downstream user would be investigated to offset project O&M costs.
5. **Pilot Testing –** Investigate water sources under Step 2 for a pilot test. Pilot test should run for a 1- to 2-year period.
6. **Project Design**
   a. Install wells
   b. Develop plans, specifications, and bid documents
   c. Bid/Select Contractor
7. **Construction**
8. **Project Startup**
9. **Monitoring and Adaptive Management**

8 Bibliography of TLAC Consulting Reports and References Cited

Aspect Consulting, LLC (Aspect), 2005, Report of Phase 1 Analysis, Twin Lakes Aquifer Coalition Water Right Application G4-34915 Cost Reimbursement Project. Bainbridge Island, Washington. Unpublished Work. March 28, 2005.

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Aspect Consulting, LLC (Aspect), 2012a, Memorandum RE Preliminary Feasibility Assessment of Multipurpose Storage, Twin Lakes Area, Okanogan County, Washington. Bainbridge Island, Washington. Unpublished Work. August 31, 2012.

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Aspect Consulting, LLC (Aspect), 2012c, Assessment of Maximizing Twin Lakes Project Storage, Draft Memorandum. Bainbridge Island, Washington. Unpublished Work. August 31, 2012.

Herrera Environmental Consultants (Herrera), 2010, Twin Lakes Area Habitat Assessment, Technical Memorandum, prepared for Aspect Consulting. May 2010.

IRZ Consulting, LLC, 2003a, Twin Lakes Aquifer Recharge Project, Final Interim Report, January 6, 2003.

IRZ Consulting, LLC, 2003b, Twin Lake Aquifer Recharge Project, Final Conceptual Design Report, June 30, 2003.

Methow Watershed Council (MWC), 2009, Final Detailed Implementation Plan, Methow River Basin, WRIA 48, prepared with assistance from Aspect Consulting, LLC, October 29, 2009.

Limitations

Work for this project was performed and this memorandum prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This memorandum does not represent a legal opinion. No other warranty, expressed or implied, is made.

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Attachments

Table 1 – Average Annual Water Balance (In Text)
Table 2 – Planning Level Long-term Operation and Maintenance Costs (In Text)
Figure 1 – Project Location
Figure 2 – Twin Lakes Project Area
Figure 3 – Twin Lakes Project Infrastructure Layout
Figure 4 – Comparison of Methow River Flows with WAC 173-548 MIF
Figure 5 – Annual and Monthly Return Flow
Attachment 1 – Site Photographs

Project Location

TLAC Water Right Application
Washington

Aspect CONSULTING	AUG-2011	BY: PPW	FIGURE NO.
	PROJECT NO. 090180-004-02	REV BY: - - -	1

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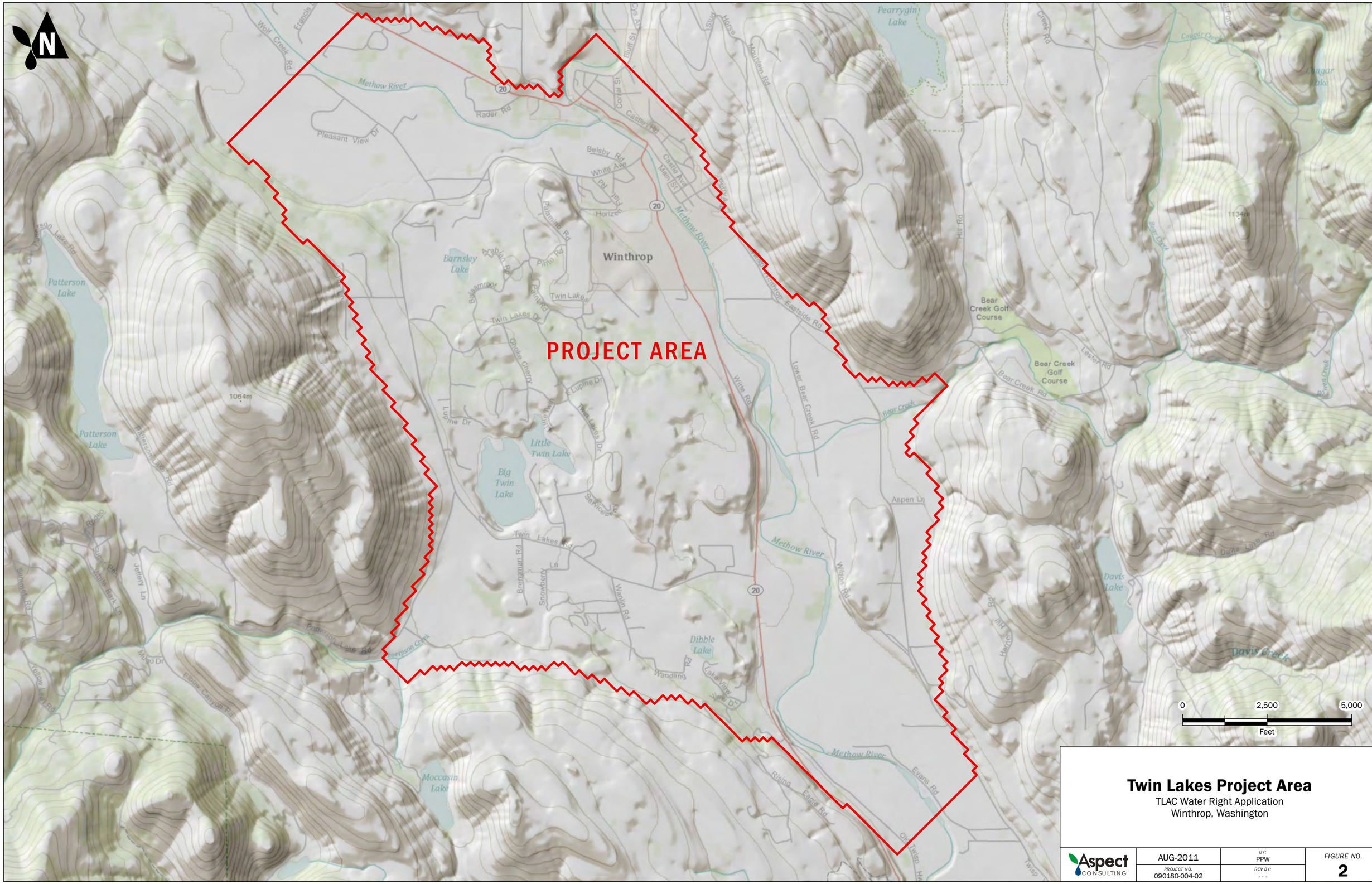

Twin Lakes Project Area

TLAC Water Right Application
Winthrop, Washington

Aspect CONSULTING	AUG-2011	BY: PPW	FIGURE NO.
	PROJECT NO. 090180-004-02	REV BY: - - -	2

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Twin Lakes Project Infrastructure Layout

TLAC Water Right Application
Winthrop, Washington

Aspect CONSULTING	AUG-2011	BY: PPW	FIGURE NO.
	PROJECT NO. 090180-004-02	REV BY: - - -	3

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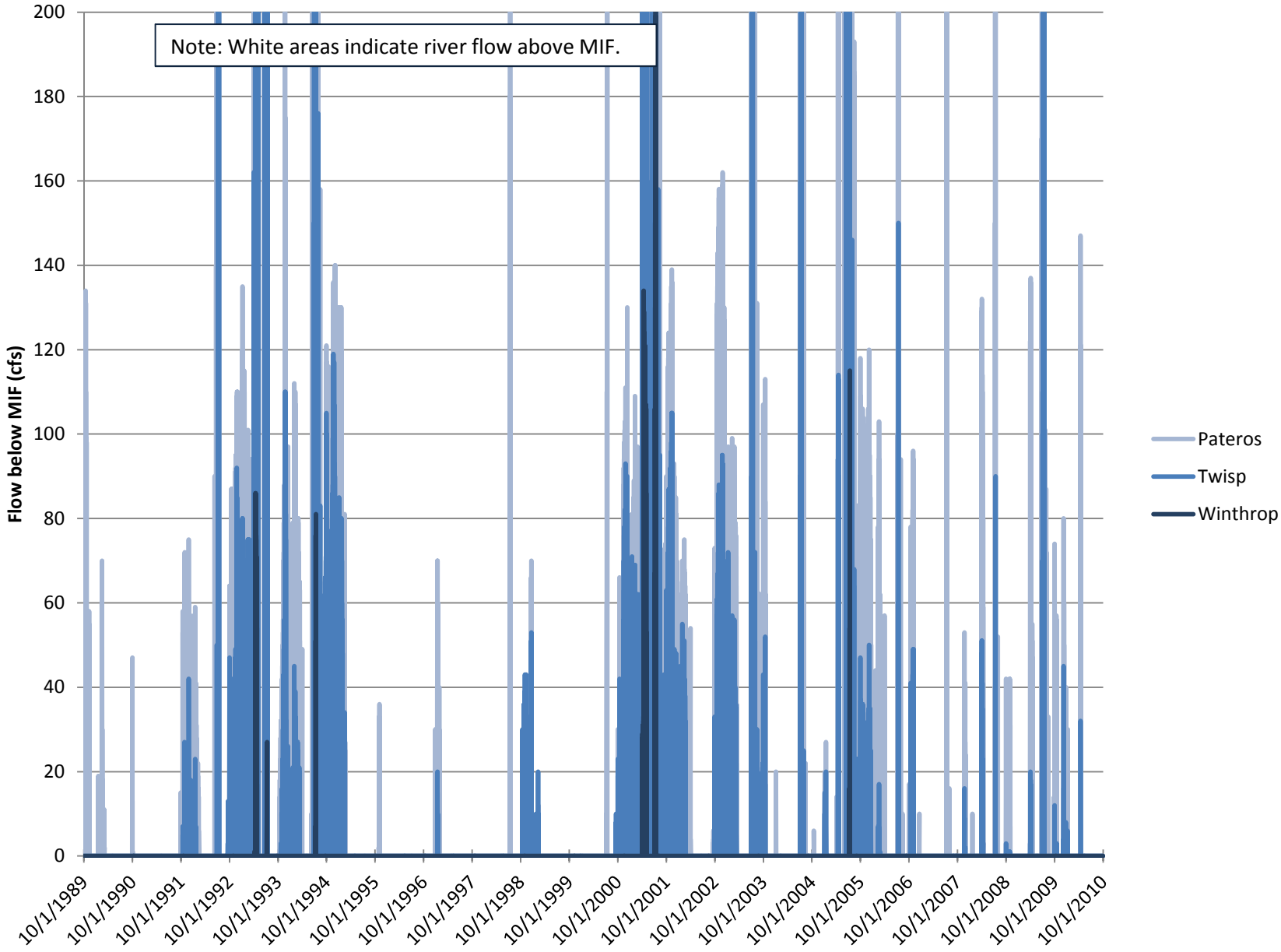
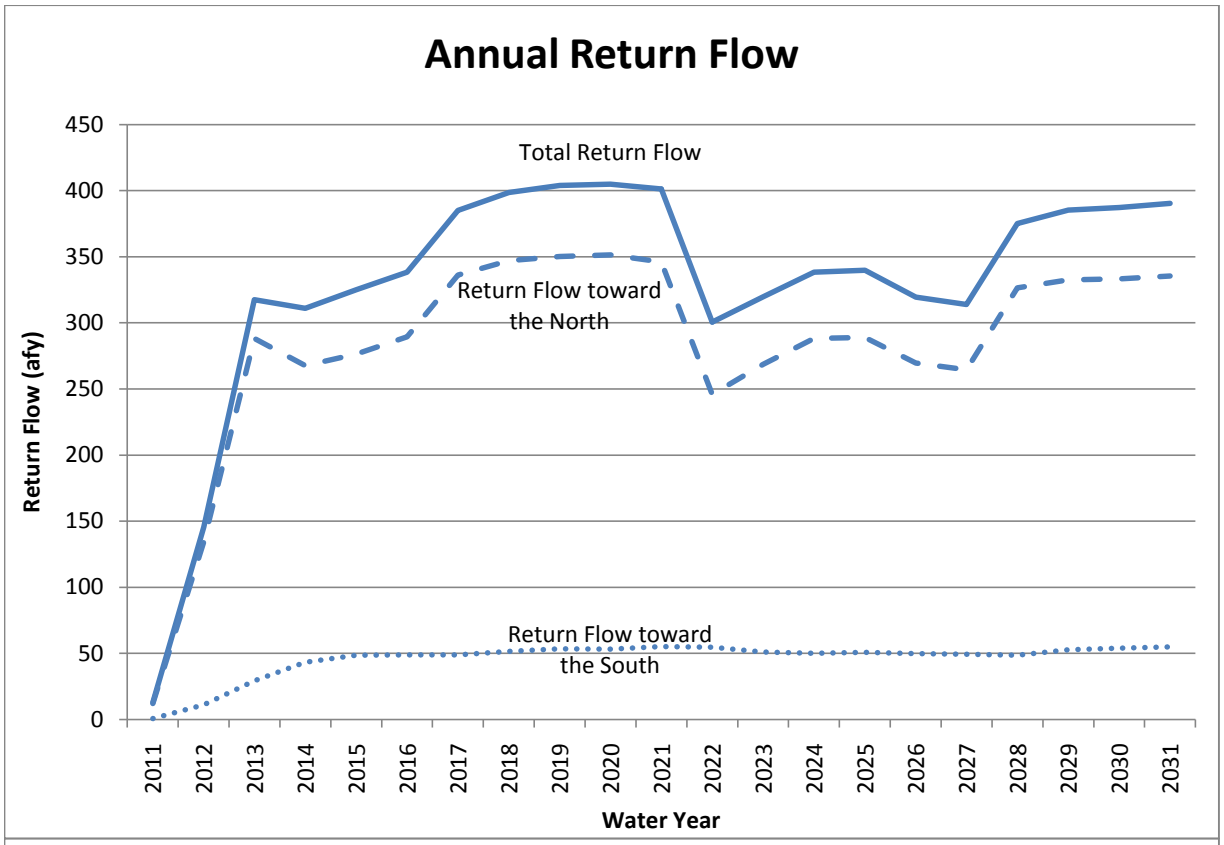


Aspect Consulting, LLC
8/31/2012
W:\090180 Water Resources Consultant Pool\Twin Lakes ASP004\Deliverables\Storage Project Overview Memo\RiverFlows_2011.xlsx

Figure 4: Comparison of Methow River Flows with WAC 173-548 MIF
TLAC Water Right Application
Winthrop, Washington



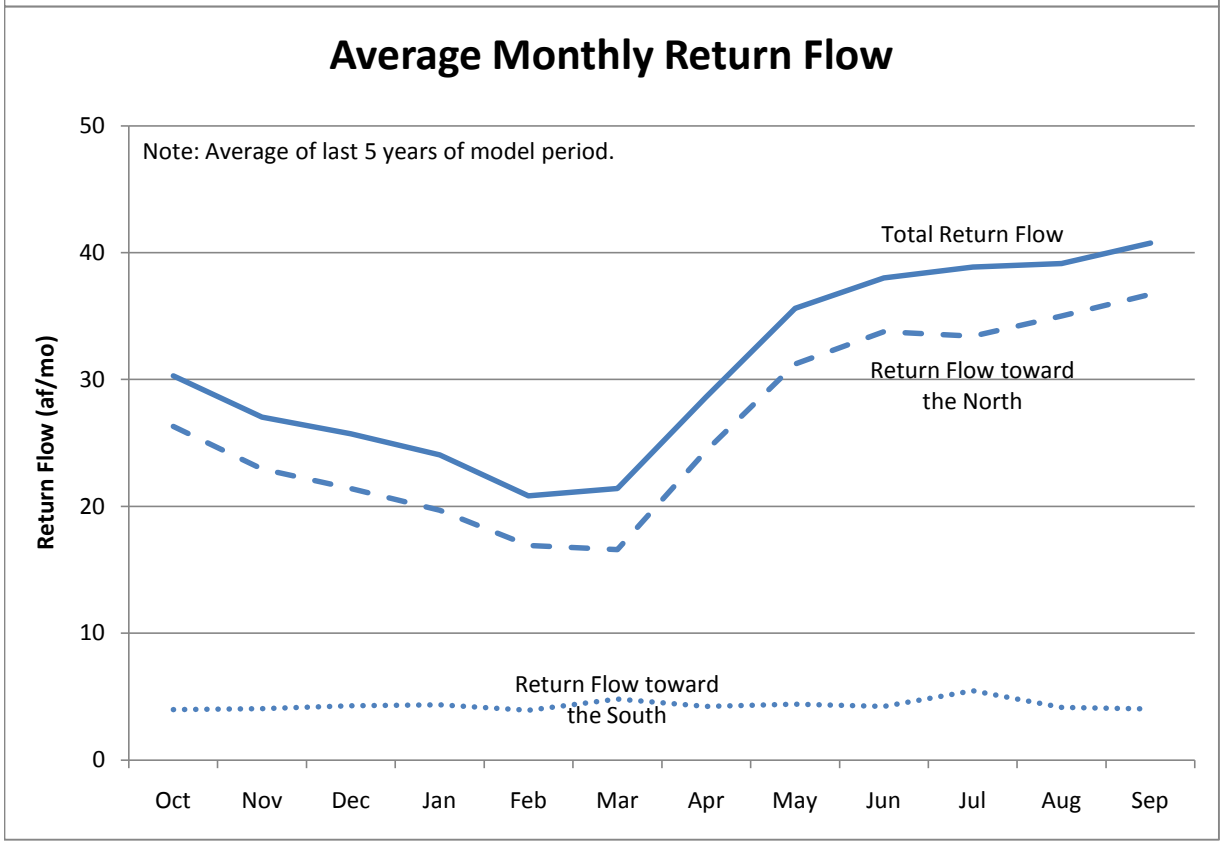


Figure 5
Annual and Monthly Return Flow
TLAC Water Right Application
Winthrop, Washington

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8/31/2012
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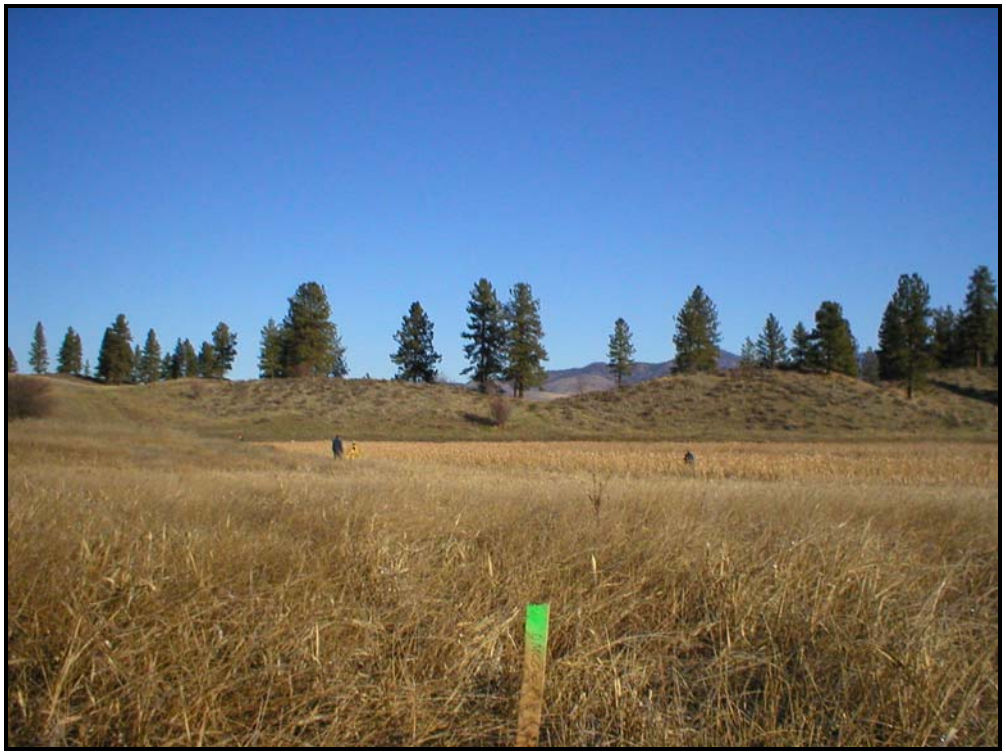
ATTACHMENT 1

Site Photographs

Attachment 1 – Site Photographs



Photograph #1: Barnsley Lake, November, 2009.

Photograph #2: Kettle Feature, November, 2009.

Photograph #3: Little Twin Lake, November, 2009

Photograph #4: Big Twin Lake, November, 2009 view east.

Photograph #5: Big Twin Lake, November, 2009, view south along west shoreline.

Photograph #6: Big Twin Lake, Spring 2002.

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