Columbia River Project Water Use Plan

Kinbasket and Arrow Recreation Management Plan

Boat Ramp Use Study

Implementation Year 3

Reference: CLBMON-14

Boat Ramp Use Study Progress Report

Study Period: 2012

Lees + Associates Research & Planning
604-899-3806
www.elac.bc.ca

July 19, 2013

LEES + Associates
RESEARCH & PLANNING
604 899 3806 | www.elac.bc.ca

CLBMON 14 Boat Ramp Use Study

Year 3 Progress Report
Study Period: 2012

July 19, 2013

Submitted to:

BC Hydro
Burnaby, BC

Prepared By:

LEES + Associates
Vancouver, BC

#509 318 Homer Street Vancouver, BC V6B 2V2 | fax: 604 899 3805 | email: elees@elac.bc.ca

Contact Information

LEES + Associates

509-318 Homer St.

Vancouver, BC

V6B 2V2

T: 604-899-3806

F: 604-899-3805

elees@elac.bc.ca

Citation

Lees+Associates. (2012). *CLBMON-14 Boat Ramp Use Study (CLBMON 14): 2012 (Year 3) Progress Report*. Vancouver, BC. BC Hydro, Water License Requirements.

Table 1. CLBMON 14 STATUS of OBJECTIVES, MANAGEMENT QUESTIONS and HYPOTHESES after Year 3

Objectives	Management Questions	Management Hypotheses	Year 3 (2012) Status
The objective of this study is to monitor trends in public use of boat ramp facilities where access improvements have been made as part of the Columbia River WUP, and assess the effectiveness of these projects in providing benefits to recreational interests in the area.	1) Does public use of boat ramps increase on Kinbasket and Arrow Lakes reservoirs after installation and upgrading of the WUP boat ramp facilities?	H1: The volume of public use of existing boat ramps where improvements have been undertaken increases over time following implementation of the Water Use Plan.	Results to date suggest a decrease in volume of public use; this may be due to the high water period and boating hazards experienced in summer 2012. Expecting more data in 2013.
	2) If there is an increasing use of new or improved facilities, is it due to existing users visiting more often or new users being attracted to the area?	H2: The volume of public use of new boat ramps increases with the availability of new access opportunities. H2A: The volume of public use of new boat ramps does not reduce the usage of nearby existing boat ramps negatively. H2B: The volume of public use increases due to new users being attracted.	Results to date show no evidence of increasing use of new or improved facilities, except at MacDonald Creek. Expecting more data in 2013.
	3) Does user satisfaction increase with improvements made to the existing boat ramps and construction of the new boat ramps?	H3: User satisfaction of the new and upgraded boat ramps is greater than that experienced by users of the older facilities.	Results to date suggest an increase in user satisfaction following improvements to existing boat ramps. Expecting more data in 2013.
	4) Is there a need for installation of additional facilities to satisfy the needs of boat users on Kinbasket Reservoir and Arrow Lakes Reservoir?	H4: There are no changes in the socio-demographic or trip behavior characteristics of users of boat ramps on Kinbasket and Arrow Lakes reservoirs.	Results to date show the need for installation of additional facilities appears to be site-dependent; there were no common patterns across the three improved boat launches examined. Expecting more data in 2013.

Table of Contents

List of Figures

List of Tables

1. Executive Summary

During the Columbia River Water Use Planning (WUP) process, the Consultative Committee recognized an opportunity to improve access for water-based recreation on the Arrow Lakes and Kinbasket Reservoirs through physical improvements to existing boat ramps and the construction of new ramps (BC Hydro 2007). Since that time, BC Hydro has planned or completed boat ramp facility improvements at eight locations – six locations on the Arrow Lakes and two locations on Kinbasket Lake. The CLBMON 14 Boat Ramp Use Study was ordered by the Comptroller of Water Rights to monitor use levels and user satisfaction at the boat launch improvement sites to inform future operational decisions.

Information gained through this monitoring program will assist future decision making during the next WUP review about the effectiveness of the boat launch works and their maintenance, the value of implementing additional physical works to improve access to the reservoirs, and any potential unintended impacts associated with improved boat access.

To address CLBMON 14's management questions and supporting hypotheses (Table 1), specific parameters were measured through a combination of monitoring (traffic count and observational data collection) and interviews (on-site and online surveys). The study has a 10 year horizon (2010-2019), with sampling occurring in Years 1 – 4 inclusive, and in Year 10.

Based on results to date there is no evidence that there has been increasing use of new or improved facilities, except at MacDonald Creek. However, it may be too early to draw any firm conclusions about the actual impact of the installation and upgrading of the WUP boat ramp facilities as the volume of visitor use was relatively lower than usual. This is likely due to higher than expected reservoir levels in summer 2012 – resulting driftwood, floating debris and boating safety hazards may have reduced the potential amount of boat use during the high water period.

Visitor satisfaction with boat ramp facilities and parking lot conditions has increased following improvements made to the existing boat ramps. This suggests that the improvements made were effective in addressing visitor expectations.

The need for the installation of additional facilities appears to be site-dependent, as there were no common patterns across the three improved boat launches that were examined.

More robust conclusions may be made after more visitors have been able to use the improved sites; it is also likely that the examination of additional improved boat launches may provide a means of identifying improvement trends and visitor use and satisfaction.

2. Introduction

2.1 Background

During the Columbia River Water Use planning process, the Consultative Committee (CC) recognized an opportunity to improve access for water-based recreation on the Arrow Lakes and Kinbasket Reservoirs through physical improvements to existing boat ramps and the construction of new ramps (BC Hydro 2007). Since that time, BC Hydro has initiated or planned boat ramp facility improvements[1] at eight locations – six locations on the Arrow Lakes and two locations on Kinbasket Lake, and some projects have been completed (see Table 2).

While the CC recognized the value of these projects, they also highlighted a need for a public use measurement study to monitor use levels and user satisfaction at the boat launch improvement sites to inform future operational decisions. CLBMON 14 Boat Ramp Use Study was ordered by the Comptroller of Water Rights as one of a series of monitoring programs that fulfills BC Hydro's obligations under the Columbia River Water Use Plan[2].

CLBMON 14 is a 10-year study that will establish a link between levels of use and boat access improvements. Information gained through this monitoring program will assist future decision making during the next WUP review about the effectiveness of the boat launch works and their maintenance, the value of implementing additional physical works to improve access to the reservoirs, and any potential unintended impacts associated with improved boat access. This report summarizes and synthesizes results from the 2012 (Year 3) season. Study results are presented by geographic area, *i.e.*, Arrow Lakes and Kinbasket Lake.

[1] Recreational boat access improvements may include ramp extensions, breakwaters, debris booms, docking floats, parking and other site changes.
[2] Concurrent to CLBMON 14, BC Hydro is conducting the Arrow Lakes Recreation Demand Study (CLBMON 41), a 5-year study focusing on the relationship between reservoir levels and intensity of recreational use on the Arrow Lakes. Due to significant similarities and overlaps between the two studies they have been combined into one delivery model.

2.2 Management Questions and Objectives

The key management questions addressed by this study are:

1. Does public use of boat ramps increase on Kinbasket and Arrow Lakes reservoirs after installation and upgrading of the WUP boat ramp facilities?
2. If there is an increasing use of new or improved facilities, is it due to existing users visiting more often or new users being attracted to the area?
3. Does user satisfaction increase with improvements made to the existing boat ramps and construction of the new boat ramps?
4. Is there a need for installation of additional facilities to satisfy the needs of boat users on Kinbasket Reservoir and Arrow Lakes Reservoir?

The main objective of the study is to monitor trends in public use of boat ramp facilities where access improvements have been made as part of the Columbia River WUP, and assess the effectiveness of these projects in providing benefits to recreational interests in the area.

2.3 Management Hypotheses

Four primary management hypotheses frame this monitoring program:

"The first hypothesis is associated with evaluating whether increasing the usability of the existing ramps over a wider range of reservoir water elevations results in increased public use relative to pre-WUP conditions, at times when water levels are low. Testing of this hypothesis is informed directly by observed trends in usage obtained through ongoing monitoring of these sites.

H1: The volume of public use of existing boat ramps where improvements have been undertaken increases over time following implementation of the Water Use Plan.

The second hypothesis is associated with determining whether construction of new ramp facilities results in increased access to the reservoir, or a shift in use away from existing boat ramps because of accessibility to the area (i.e., proximity to the boat ramp) or safer launch conditions. Testing of this hypothesis is informed both directly

through use data collected during the monitoring, as well as through survey questionnaires related to user characteristics and level of user satisfaction.

H2: The volume of public use of new boat ramps increases with the availability of new access opportunities.

H2A: The volume of public use of new boat ramps does not reduce the usage of nearby existing boat ramps negatively.

H2B: The volume of public use increases due to new users being attracted.

A third hypothesis addresses possible changes to the recreation experience offered to the users of the boat ramps. The simplest indicator of a quality recreation experience is user satisfaction, which is investigated as part of the survey questionnaires. Satisfaction analysis s also considers related information that is collected during the monitoring study. Other changes to the users, such as socio-demographic characteristics or reservoir recreation behaviour related variables, are also used as indicators.

H3: User satisfaction of the new and upgraded boat ramps is greater than that experienced by users of the older facilities.

Finally, satisfaction alone does not provide any insights about changes to user groups characteristics. Therefore, it is important to monitor if user characteristics change over time.

H4: There are no changes in the socio-demographic or trip behavior characteristics of users of boat ramps on Kinbasket and Arrow Lakes reservoirs."

(Terms of Reference, BC Hydro, 2009 p.6)

One of the key issues with the CLBMON 14 management questions and management hypotheses is the timing of improvements at each of the boat launch ramps. Ramp locations that are improved early in the study period will not have much, if any, pre-improvement data against which the post-improvement data can be compared. Conversely, ramps that are improved later in the study period (after year 4) will not have as much post-improvement data, except that gathered in year 10. This will mean that H_{2B}, H_3 *and* H_4 hypotheses may not be uniformly tested over every boat launch ramp location.

3. Methods

To address the management questions and supporting hypotheses, specific parameters are being measured through a combination of monitoring (traffic counters, spots counts and observational data collection) and interviews (on-site intercept and online surveys). The study period is over a 10 year horizon, with sampling occurring in spring, summer, and fall seasons in Years 1 – 4, inclusive, and in Year 10. Sampling intensity is higher during the summer due to the proportional increase in volume, the diversity of recreational activities during this period, and the longer season (as spring and fall on-water recreation seasons are limited by snow, cold weather and daylight hours). At the end of each sampling year, the data is summarized in an interim report format. A mid-term analysis report will be prepared in 2014, as well as comprehensive report at the conclusion of the study. These reports will include a detailed summary of the findings as they relate to the management questions and hypotheses.

This section is presented under the following headings:

- Sampling Sites;
- Traffic Data Collection;
- Observational Data Collection;
- Sampling Design;
- Survey Delivery;
- Survey Design, and
- Sampling Analyses.

3.1 Sampling Sites

The ten sampling sites included in this study (see Table 2; Figure 1, Figure 2) include those eight sites that have been approved by the Comptroller of Water Rights for access improvement work, such as the construction of new boat ramps and improvements to existing ramps, as well as two control sites.

Table 2. Locations and actions of boat ramp improvement projects[3].

Location	Upgrade Action	Construction Period	Status
Kinbasket Lake			
Valemount Marina	Ramp Extension, dock and breakwater	2011-04-01 to 2011-06-27	Major extension done but not fully completed
Bush Harbour	Complete new ramp, dock, breakwater and parking lot	2010-04-12 to 2010-08-09	Ramp completed. No dock or breakwater yet installed
Esplanade Bay	No upgrades planned	-	Control site
Arrow Lakes			
Nakusp	Replace ramp and dock	-	Construction in 2013
MacDonald Creek	Ramp extension, dock and breakwater	2010-05-16 to 2010-07-01	Completed
Burton	No upgrades planned	-	Control site
Burton South	Complete new ramp, dock, breakwater and parking lot	-	Substantially complete prior to study
Fauquier	Ramp extension, dock and breakwater	2010-05-31 to 2010-09-21	Completed
Edgewood	Ramp extension, dock and breakwater	-	Construction in 2013
Anderson Point	Complete new ramp, dock and breakwater. Minor improvements to parking lot.	2012-05-14 to 2012-06-12	Under construction

Figure 1. Sampling locations map – Arrow Lakes.

[3] Traffic counters were installed at Esplanade Bay and Burton South boat ramps on August 24, 2011 as additional control sites. No environmental monitoring or interviews were conducted.

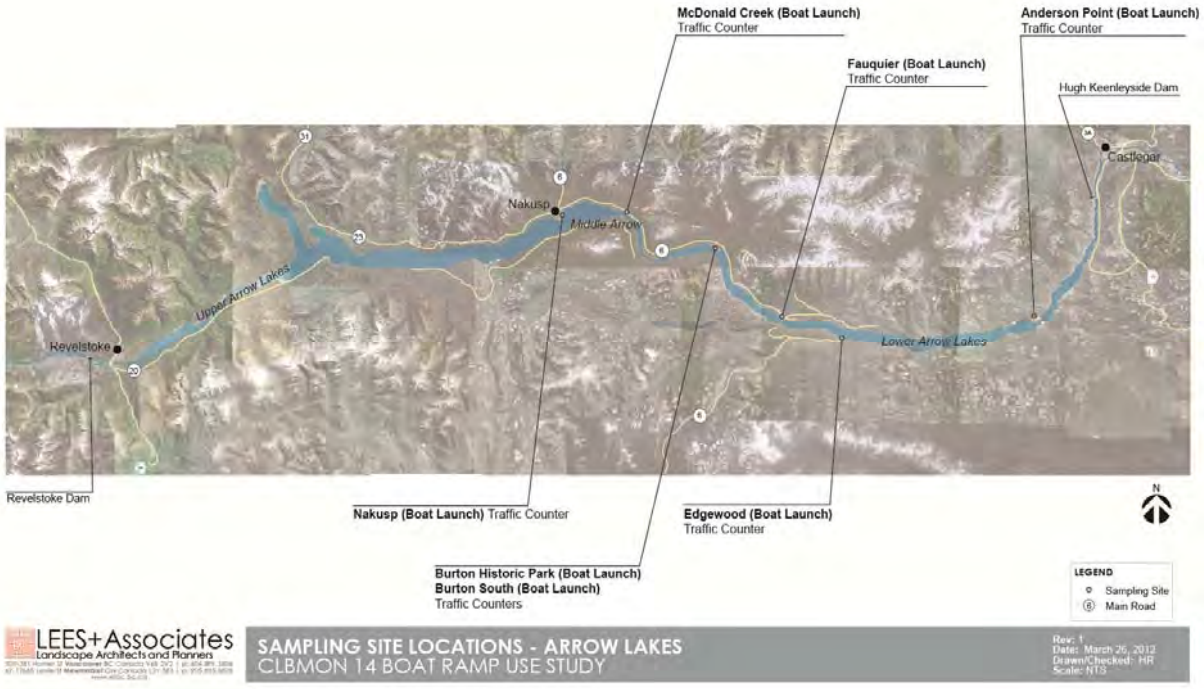
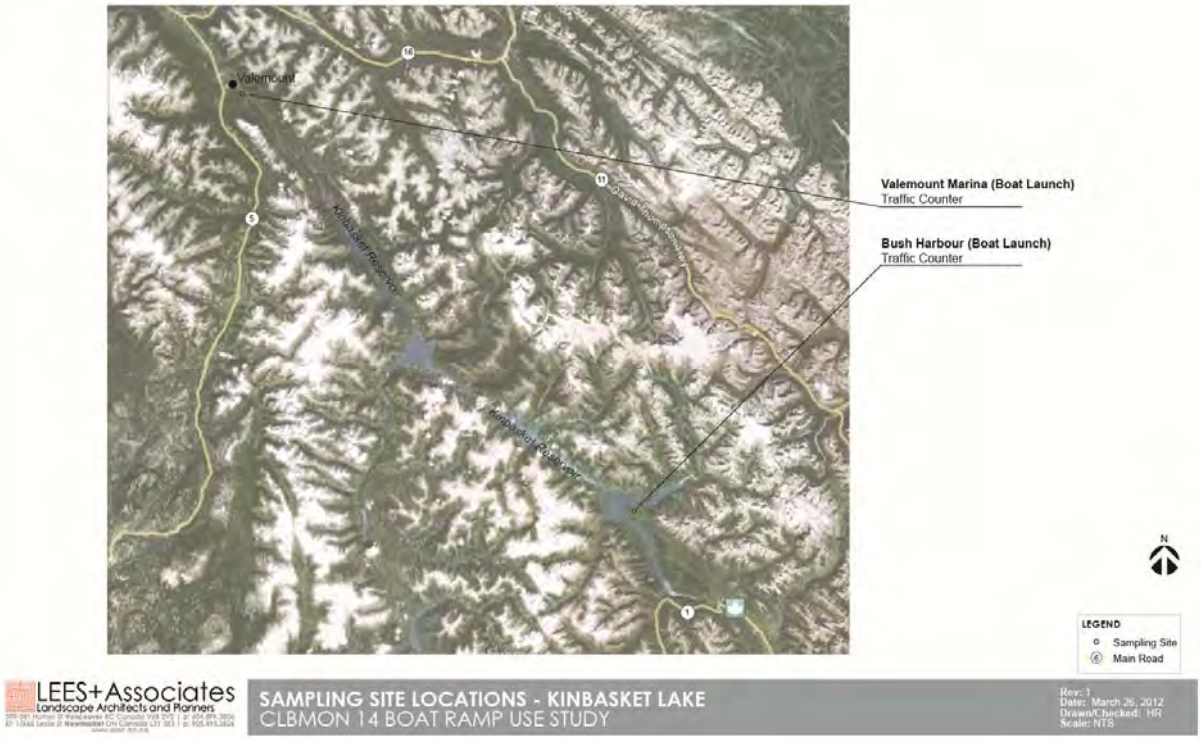


Figure 2. Sampling locations map – Kinbasket Lake.



3.2 Traffic Data Collection

Vehicle counters were installed year round at all sampling locations (Table 2). Vehicle counters are a reliable tool for monitoring public recreation use and have been found to be very useful in identifying use trends and patterns to better manage public access. TRAFx G3 magnetic field controlled vehicle counters were selected for use in this study, as they are the preferred and recommended traffic counter of BC Parks, Parks Canada and the US National Parks Service.

Vehicle counters were configured and installed at each boat access monitoring site as per the manufacturer's specifications to monitor the number of vehicles using the ramp facilities. Traffic counters remain in place year-round and will continue to collect vehicle counts in years 1-4, inclusive, and in year 10 of the study. Counters remained in-situ during construction periods for applicable boat ramps; however these periods have been excluded from the data (Table 3). Counters were removed during the high water period experienced in July and August 2012 (Table 4). Annual Traffic Counts are collected and automatically compiled by the TRAFx DataNet system for each full calendar year. This is done to standardize the calculation and application of average daily use to missing data. The system then enables the selection of any time period across years for calculating and reporting daily, weekly and monthly counts, averages and comparisons. Further discussion of annual traffic count calculations and how the counters work can be found in Appendix A: TRAFx Vehicle Counters.

Table 3. Construction periods (Years 1-3).

Location	Construction Period		
Bush Harbour	2010-04-12	to	2010-08-09
McDonald Creek	2010-05-16	to	2010-07-01
Fauquier	2010-05-31	to	2010-09-21
Valemount	2011-04-01	to	2011-06-27
Anderson Point	2012-05-14	to	2012-06-12
Anderson Point	2012-10-31	to	present

Note: the above dates are excluded in the data.

Table 4. High water periods (Years 1-3).

Location	High Water Period		
Edgewood Boat Launch	2012-07-06	to	2012-08-15
Fauquier Boat Launch	2012-07-06	to	2012-08-15
McDonald Creek	2012-07-06	to	2012-08-15
Burton Boat Launch	2012-07-06	to	2012-08-15
Burton South	2012-07-06	to	2012-08-15
Esplanade Bay	2012-07-21	to	2012-09-10
Bush Harbour	2012-07-21	to	2012-09-10
Valemount	2012-07-24	to	2012-09-11

Note: Year 4 (2012) produced an excessively high water year with a sustained water level of 1446 feet elevation (or about 2 feet above normal pond level of 1444') for six weeks of the summer beginning July 6, 2012. Counters at the above ramps were removed to prevent water damage thus no readings were taken during these periods.

3.2.1 Arrow Lakes Traffic Counters

Traffic counters are in place at boat access sites at Nakusp, MacDonald Creek, Burton, Fauquier, and Edgewood and Anderson Point. An additional traffic counter was installed at the new Burton south boat launch on August 24, 2011 once it was substantially complete, in order to capture post-construction data. In general, the traffic counters will remain in place at old boat ramps until the construction of new boat ramp locations is completed. Fauquier and MacDonald Creek boat ramp and breakwater upgrades were completed in 2010 (Figure 3, Figure 4). Anderson Point work was initiated in October, 2012. Work at Nakusp and Edgewood will begin in 2013.

Figure 3. McDonald Creek, Sept 10, 2012.

Figure 4. Fauquier July 5, 2012.

Counter sensitivity and delay settings were configured to most accurately record traffic at each site, in order to achieve a level of accuracy that will permit conclusive answers to the hypotheses. Timestamps were configured to least sensitivity to pick up a vehicle passing through but not picking up smaller or more distant metal objects; 15 second delay between counts on single lane ramps and 12 second delay on double lane ramps to reduce multiple counts of same vehicle.

The current settings at the Arrow Lakes sites are as follows:

Table 5. Traffic counter settings at Arrow Lakes.

Location	Mode	Period	Delay	Threshold	Rate
Nakusp	VEH_4d	000	96	16	S
MacDonald Creek	VEH_2s	000	120	16	S
Burton	VEH_2s	000	120	16	S
Burton South	VEH_2s	000	120	16	S
Fauquier	VEH_2s	000	120	16	S
Edgewood	VEH_2s	000	120	16	S
Anderson Point	VEH_2s	000	120	16	S

Notes:
Mode: Veh_2s = single lane traffic; Veh_4d = double lane traffic
Period = 000: means timestamps
Delay: 8 = 1 sec; 96 = 12 sec; 120 = 15 sec
Threshold: Range is 3-16; 16 is least sensitive[4]
Rate: S is slow (<50 km/h)

3.2.2 Kinbasket Lake Traffic Counters

Traffic counters at the Bush Harbour and Valemount Marina boat ramps have been in place since the beginning of the study in April 2010 (Figures 5-8). In August 2011, a new traffic counter was installed at Esplanade Bay, a Forest Service campground with private cottages nearby. Esplanade will act as a control site to compare data at improved launches with a nearby existing boat launch, and to assist in addressing

[4] Counter thresholds were adjusted to the least sensitive setting that would still trip the counter when a vehicle passes through. This also prevented the count of bicycles, and smaller metal objects.

Management Hypothesis H_2 (Table 1). The Esplanade Bay counter was installed on August 24, 2011 so counts are shown only from that date.

Traffic counter sensitivity and delay settings were configured to most accurately record traffic at each site.

The current settings at Kinbasket Lake sites are as follows:

Table 6. Traffic counter settings at Kinbasket Lake.

Location	Mode	Period	Delay	Threshold	Rate
Bush Harbour	VEH_2s	000	120	16	S
Esplanade Bay	VEH_2s	000	120	16	S
Valemount	VEH_2s	000	120	16	S

Notes:
Mode: Veh_2s = single lane traffic; Veh_4d = double lane traffic
Period = 000: means timestamps
Delay: 8 = 1 sec; 96 = 12 sec; 120 = 15 sec
Threshold: Range is 3-16; 16 is least sensitive
Rate: S is slow (<50 km/h)

Figure 5. Bush Harbour, spring low water

Figure 6. Valemount boat launch in spring

Figure 7 and Figure 8. Bush Harbour, preparation for dock installation.

3.3 Observational Data Collection

Field surveyors collected observational data about the visitors that they encountered, photographs of site conditions and natural conditions (Table 7). These observations consider information on visitors including number of people seen, gender and age range, recreational activities, and number and origin of cars in the parking lot. They also consider information on natural conditions that can affect the level and nature of boat ramp usage, such as weather and reservoir conditions such as precipitation, wind, waves, percent cloud cover, and air temperature. Observational data were assessed using standardized forms and definitions developed for this purpose (see Appendix D).

Table 7. Observational data collection: variables collected each field day.

Observation	Description
Number of people seen	• Provides an overall sense of the level of activity that day; recording the number of people approached provides basis for calculating response rate for the on-site survey. • Party size was recorded where possible to compare with established BC Parks statistics[5].
Gender and age range	• Total male or female • Age range (1-10, 11-15, 16-20, 21-30, 31-40, 41-50, 51-60, 61-70, 71+)
Activities	• Type of recreational activity observed
Number of cars in parking lot (and origin)	• The number and origin of license plates was recorded through continuous observation to provide information about the number of parties using the facilities, visitors' place of residence and rough travel distance. A systematic tally system was used in conjunction with the surveys to minimize double counting.
Site photography	• Photographic records of sample sites to capture site conditions. • Taken from same vantage point to facilitate comparison between years.
Weather*	• General descriptions to supplement individual measurements.
Presence of waves*	• Wave height and formation.
Wind*	• Wind direction and an estimate of speed (Beaufort Scale).
Percent cloud cover*	• An assessment of the amount of sky/sun obscured by clouds.
Air temperature*	• Recorded in Celsius.
Water temperature*	• Recorded in Celsius.

* Note: environmental data collected each field day at 13h00.

3.4 Sampling Design

This section outlines the sampling design including details about the methods of data collection: observational data collection, traffic counter installation, on-site survey, and online survey.

Sampling periods were designed to maximize the response to the user survey and to capture a broad selection of outdoor recreation participants.

[5] BC Parks party size data are determined by number of people in group divided by the number of groups. Averages have been developed over years of surveys.

3.4.1 Arrow Lakes Sampling Strategy

Sampling of the CLBMON 14 boat ramp sites on the Arrow Lakes was synchronized with the sampling days already scheduled for CLBMON 41 Arrow Reservoir Recreational Demand Study. Survey days at sample sites were randomly selected (Gregoire & Buhyoff, 1999). The random sample was stratified by four factors: (1) section of the Arrow Lakes; (2) season (the number of sample days in each season is proportional to the number of days in that season); (3) type of day (*i.e.*, weekends, week days, holidays); and (4) the time of day that sampling occurs (*i.e.*, morning or afternoon). Over the course of the sampling horizon, this approach provides a representative sample of visitors to boat ramp sites on the Arrow Lakes.

Data collection for the 2012 season commenced Monday June 18, 2012 and finished Monday, October 29, 2012 (See Appendix E – Sampling Schedule). As a further step to ensure the representation of a wide range of outdoor recreation activities and respondents, surveyors were on-site during randomly selected six-hour periods (8:00 am to 2:00 pm or 2:00pm to 7:00pm in summer; and 8:30 am to 2:30 pm or 10:30 am to 4:30 pm[6] in spring and fall.

3.4.2 Kinbasket Sampling Strategy

The sampling strategy adopted for Kinbasket Lake provides that survey days at sample sites were randomly selected (Gregoire & Buhyoff, 1999). The random sample was stratified by three factors: (1) season (the number of sample days in each season is proportional to the number of calendar days in that season); (2) type of day (*i.e.*, weekends, week days, holidays), and (3) the time of day that sampling occurs (*i.e.*, morning or afternoon).

During 2012, each sample site on Kinbasket Lake was sampled eight times. Data collection for the 2012 season commenced Monday June 18, 2012 and finished Wednesday, October 24, 2012 (Appendix E – Sampling Schedule). As a further step to ensure the representation of a wide range of outdoor recreation activities and

[6] The six hour sampling period is based on successful application in previous recreational studies undertaken by the study team. An overlap of morning and afternoon periods ensures surveyors capture the higher use time over lunch hour. In 2012, summer sampling hours were shifted to capture more 'evening' recreationists.

respondents, surveyors were on-site during randomly selected six-hour periods (8:00 am to 2:00 pm or 2:00pm to 7:00pm in summer; and 8:30 am to 2:30 pm or 10:30 am to 4:30 pm[7] in spring and fall.

3.5 Survey Delivery

The visitor survey is designed to be delivered in two formats over the course of this project: (1) an on-site survey, administered to visitors at sample sites; and (2) an online survey, administered to regional residents to capture a broader range of attitudes and opinions about boat ramp use (or non-use) on the Arrow and Kinbasket Lakes.

3.5.1 On-site Survey

Wherever possible, all parties at a sample site were approached for inclusion in this study. People were approached *after* using a boat ramp facility so that their responses would be based on their use of the facilities that day. Except where single-family parties are identified, all party members were asked to participate in the survey; when families were identified, only one representative was asked to participate in the survey; however, if other members of the party wished to participate they were welcomed to do so. Respondents completed the questionnaires on-site. The number of people approached for inclusion in the study was recorded to permit the calculation of response rate. Number of parties and total number of people on site was also recorded. People who refused to participate were thanked for their time and were not engaged further. A standard introduction statement was made to all prospective participants that summarized the cover letter that accompanied the questionnaire. If asked what the surveys would be used for, people were told that the information would be used to inform the development of strategies to guide the management of water flows and recreational access points on the Arrow and Kinbasket Lakes. Contact information for the project team was provided in the event that anyone had questions or concerns about the project.

[7] The six hour sampling period is based on successful application in previous recreational studies undertaken by the study team. An overlap of morning and afternoon periods ensures surveyors capture the higher use time over lunch hour. In 2012, summer sampling hours were shifted to capture more 'evening' recreationists.

3.5.2 Online Survey

In addition to the on-site survey, information about the use (or non-use) of the Kinbasket and Arrow Lakes, and reasons for non-use, was solicited through on online survey. This self-selected sample was invited to participate in the online survey in order to capture a broader range of attitudes and opinions about boat ramp use, or non-use, on the Kinbasket and Arrow Lakes.

The online version of the survey was also available for on-site visitors that preferred to provide their information online. The online survey is identical to the on-site survey and is available at www.arrow-kinbasket-recreation-survey.ca. In 2012, one individual completed the survey online.

3.6 Survey Design

Questions that specifically address the usage of boat ramp facilities were added to the visitor questionnaire already in use for the Arrow Reservoir Recreational Demand Study (CLBMON 41). By combining questions onto one questionnaire the need for multiple interviews and the potential for survey fatigue was minimized.

The Visitor Survey questionnaire was developed using the principles of the *Tailored Design Method*. This method identifies procedures to maximize survey return rates and minimize survey error (Salant & Dillman, 1994; Dillman, 2000), including questionnaire layout considerations. The questionnaire was designed to ensure a logical flow of the questions, and that the wording of the questions and instructions to the respondents be clear and as brief as possible. A key requirement of the questionnaire was that it be suitable for repeated delivery at multiple locations in order that a better understanding of recreation and boat ramp use on the Kinbasket and Arrow Lakes be identified.

Prior to the beginning of the Boat Ramp Use Study, drafts of the additional survey questions specific to boat ramp use were circulated in order to promote discussion around question ordering, question wording, answer options, and/or question instructions. Reviewers included the ELAC team, the BC Hydro team, and members of the *Collaborative for Advanced Landscape Planning* at the *University of British*

Columbia. The resulting final questionnaire includes four questions pertaining specifically to boat ramp usage, in Section 6. The other sections remain the same. The questionnaire has retained the same format – a four-page booklet (two 8.5" by 11" sheets printed on both sides, stapled in the top left corner) that comprehensively measures people's use of, and attitudes about, recreation on the Kinbasket and Arrow Lakes. A distinct version of the questionnaire was used for Kinbasket sampling and Arrow Lakes sampling to avoid confusion about which lake users were being asked about (Appendix B – Visitor Survey).

The questions permitted the isolation of variables to characterize boat ramp use on the Kinbasket and Arrow Lakes. Recreationists are not a homogeneous group (Bryan, 1977; Manning, 1999; Salz *et al*., 2001; Rollins & Robinson, 2002), as participants differ in their values, the activities that they pursue, preferred settings, desired experiences, and motivations for participating (Choi *et al*., 1994); however, the variation among preferences, attitudes, and behaviours can be explained by the recreation specialization framework (Bryan, 1977; McFarlane *et al*., 1998). Understanding the desires and needs of recreationists is important for the management of recreational access points (McFarlane, 1994). As the recreation specialization framework can provide a basis for the differentiation of recreationists holding various goals, preferences, and behaviors (McFarlane, 2001), it was used to frame the collection of recreation data, as it provides a coherent and comprehensive approach, which can violate statistical assumptions about independent samples (Jackson, 1986). These measurement protocols follow standard practices and are appropriate for a project of this type.

The questionnaire was composed of seven sections:

Section 1: Arrow/Kinbasket Lakes Outdoor Recreation Activities.

Section 2: Important Outdoor Recreation Activities.

Section 3: Arrow/Kinbasket Lakes Outdoor Recreation Experiences.

Section 4: Use and Familiarity of Arrow/Kinbasket Lakes.

Section 5: Arrow/Kinbasket Lakes Outdoor Recreation Management.

Section 6: Arrow/Kinbasket Lakes Outdoor Recreation Experiences.

Section 7: Demographics.

Given that visitor satisfaction is multidimensional, data collection in this study takes advantage of the different elements of this study (*i.e.*, traffic counter and observational data and questionnaire-elicited data). Table 8 illustrates the links between the specific monitoring parameters and the management hypotheses.

Table 8. Relationship of monitoring components to management hypotheses.

Management Hypothesis	Related Data or Questionnaire Subsection
H_1: The volume of public use of existing boat ramps where improvements have been undertaken increases over time following implementation of the Water Use Plan.	Traffic Counters and Observational Data
H_2: The volume of public use of new boat ramps increases with the availability of new access opportunities. H_{2A}: The volume of public use of new boat ramps does not reduce the usage of nearby existing boat ramps negatively. H_{2B}: The volume of public use increases due to new users being attracted.	Traffic Counters and Observational Data Section 1: Outdoor Recreation Activities Section 2: Important Outdoor Recreation Activities
H_3: User satisfaction of the new and upgraded boat ramps is greater than that experienced by users of the older facilities.	Section 3: Outdoor Recreation Experiences Section 4: Use and Familiarity Section 5: Arrow Lakes Outdoor Recreation Management Section 6: Outdoor Recreation Experiences
H_4: There are no changes in the socio-demographic or trip behavior characteristics of users of boat ramps on Kinbasket and Arrow Lakes.	Section 7: Demographics

The following sections demonstrate how the data captured by the questionnaire will further inform the management questions being examined in CLBMON 14, and how the questions address the theoretical framework of the study. Figure illustrations are taken from the Arrow Lakes version of the questionnaire.

3.6.1 Section 1: Outdoor Recreation Activities

The questions in this section (Figure 9) ask about the recreation activities done on the water or onshore of the reservoir. The questions provide an assessment of the

different activities that each respondent engages in. This can help to inform the likelihood of visitors substituting activities *vs*. opportunities (*i.e.*, location) if satisfaction is not achieved. These questions address H_2 by measuring the frequency of use by season.

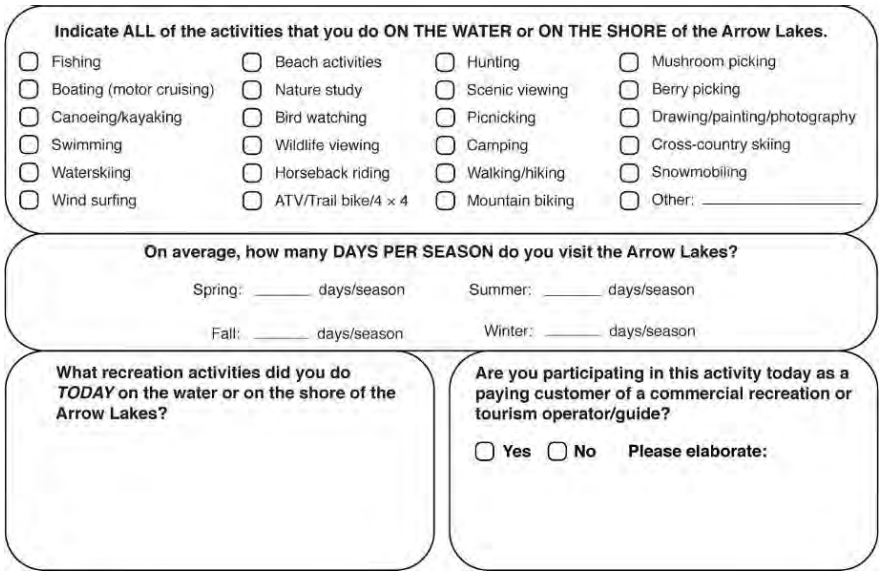
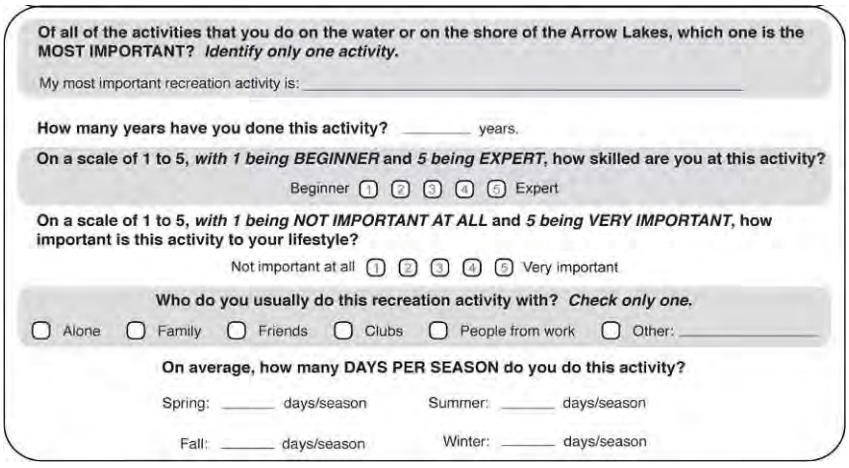


Figure 9. Section 1 questions.

3.6.2 Section 2: Important Outdoor Recreation Activities

Section 2 asks about respondents' most important outdoor recreation activities (Figure 10). These questions inform H_2 by providing information about the type of user, their degree of specialization and how long they have been engaged in an activity.



Of all of the activities that you do on the water or on the shore of the Arrow Lakes, which one is the MOST IMPORTANT? ***Identify only one activity.***

My most important recreation activity is: _____

How many years have you done this activity? _____ years.

On a scale of 1 to 5, ***with 1 being BEGINNER*** **and** ***5 being EXPERT*****, how skilled are you at this activity?**

Beginner (1) (2) (3) (4) (5) Expert

On a scale of 1 to 5, ***with 1 being NOT IMPORTANT AT ALL*** **and** ***5 being VERY IMPORTANT*****, how important is this activity to your lifestyle?**

Not important at all (1) (2) (3) (4) (5) Very important

Who do you usually do this recreation activity with? ***Check only one.***

☐ Alone ☐ Family ☐ Friends ☐ Clubs ☐ People from work ☐ Other: _____

On average, how many DAYS PER SEASON do you do this activity?

Spring: _____ days/season Summer: _____ days/season

Fall: _____ days/season Winter: _____ days/season

Figure 10. Section 2 questions.

3.6.3 Section 3: Outdoor Recreation Experiences.

This section has two parts. The first part (Figure 11) asks about some of the experiences that respondents may have had while visiting the reservoir for recreation activities. These two questions provide information about social settings by eliciting individual's encounter norms to provide an assessment of crowding (Manning, 1999; Vaske & Donnelly, 2002).

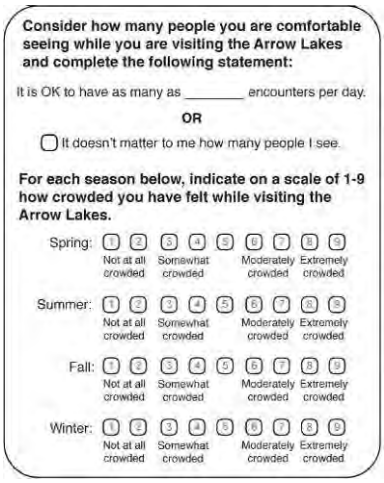


Figure 11. Section 3 questions, part 1.

The second part addresses recreation conflicts (Figure 12). Recreation conflict occurs when the presence, behaviour, or values of an individual or group interferes with another individual or group (Vaske, *et al.*, 2007). This question provides information about the social setting by asking whether individuals have encountered any conflicts with other recreation visitors.

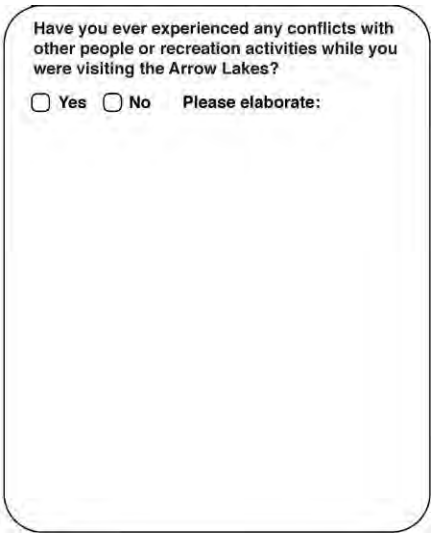


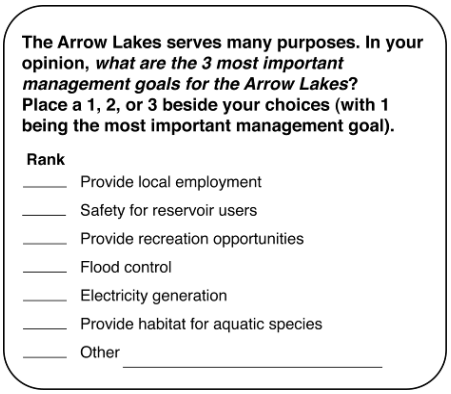
Figure 12. Section 3 questions, part 2.

3.6.4 Section 4: Use and Familiarity of Arrow Lakes/Kinbasket Lake.

This section includes two questions. The first question (Figure 13) asks about respondents' use of, and familiarity with, the reservoir. People can have multiple motivations for engaging in recreation activities, which may include enjoyment from the activity itself, socialization, as well as other benefits (Driver *et al.*, 1991). An understanding of people's motivations for pursuing recreation activities on the Arrow and Kinbasket Lakes helps to inform the attitudes and preferences element of the *subjective evaluation* component of statisfaction in addressing H_3.

Figure 13. Section 4 questions, part 1.

The second question (Figure 14) addresses respondents' knowledge about the management goals of the Arrow and Kinbasket Lakes. People engage in outdoor recreation activities with the expectation that this engagement will fulfill particular needs, motivations, or other desires (Fishbein & Ajzen, 1975; Manning, 1999). Understanding individual's expectations informs their recreation satisfaction. If people are not aware of the management goals for the Arrow and Kinbasket Lakes, their expectations may not be realistic, and their satisfaction affected.



The Arrow Lakes serves many purposes. In your opinion, *what are the 3 most important management goals for the Arrow Lakes*? Place a 1, 2, or 3 beside your choices (with 1 being the most important management goal).

Rank

_____ Provide local employment
_____ Safety for reservoir users
_____ Provide recreation opportunities
_____ Flood control
_____ Electricity generation
_____ Provide habitat for aquatic species
_____ Other _____

Figure 14. Section 4 questions, part 2.

3.6.5 Section 5: Outdoor Recreation Management.

This section has two parts. The first part of this section (Figure 15) asks about how respondents feel about the management of recreation on the reservoir. Although there are not any standardized measures of visitor satisfaction, a common approach is to gauge overall satisfaction through the use of multiple-item measures of satisfaction that are context specific (Manning, 1999). This question provides an overall assessment of visitor satisfaction, which will be used to test H_3.

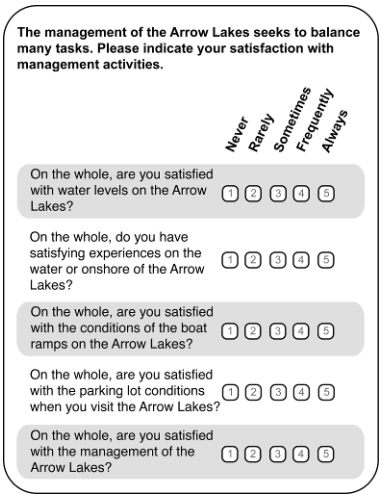


Figure 15. Section 5 questions, part 1.

The second part of this section (Figure 16) addresses H_3 as it explicitly asks whether respondents will return based on the water levels that they have experienced. This question informs the conceptual model of satisfaction by examining the link between Resource Setting and likelihood of returning (*i.e.*, achieved satisfaction).

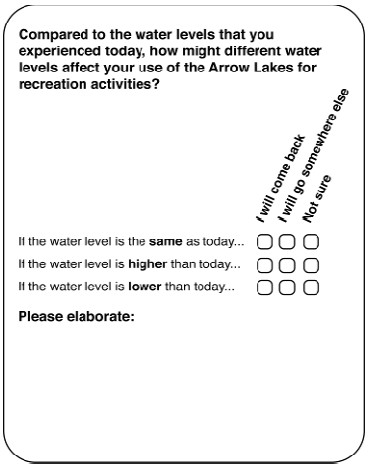


Figure 16. Section 5 questions, part 2.

3.6.6 Section 6: Arrow Lakes Outdoor Recreation Experiences.

This section has three parts (Figure 17) which ask about respondents' recreation experiences on the reservoir. The first part of this section establishes respondents' familiarity with the reservoir by asking about the length of time that they have used the area for outdoor recreation. The degree of familiarity influences visitors' expectations, which has an effect on their degree of satisfaction.

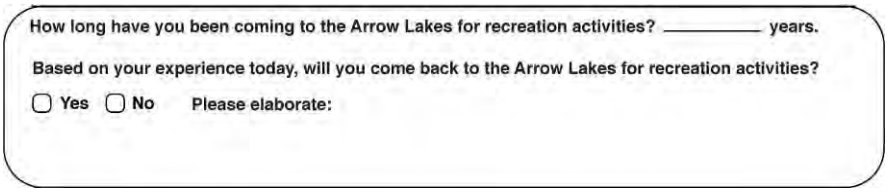


Figure 17. Section 6 questions, part 1.

The second part includes 4 questions related to respondents' experience while using boat ramp facilities (Figure 18). These questions address H_3 by asking about people's motivations, and their degree of satisfaction.

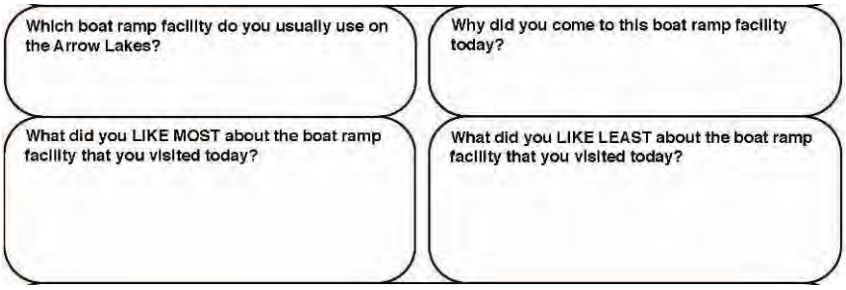


Figure 18. Section 6, part 2, questions pertaining to boat ramp use.

Respondents are also asked where they first heard about recreation opportunities near and on the reservoir (Figure 19).

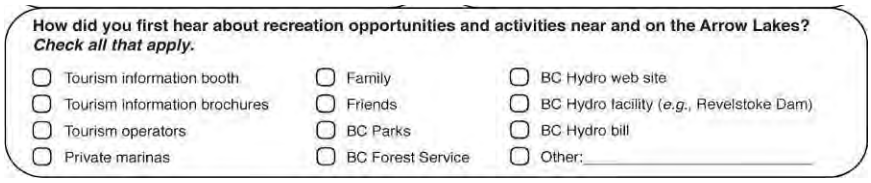


Figure 19. Section 6 questions, part 3.

Section 7: Demograhics.

Section 7 (Figure 20) collects basic information about respondents' demographic characteristics. These questions provide explicit information about individuals' place of residence, which informs the user classification as either resident or tourist (*i.e.,* travelled more than 80km (Murphy, 1991)). They also provide information about user socioeconomic characteristics, which addresses H_4. This question provides data about socioeconomic characteristics, which addresses the *subjective evaluation* component of the conceptual model of satisfaction.

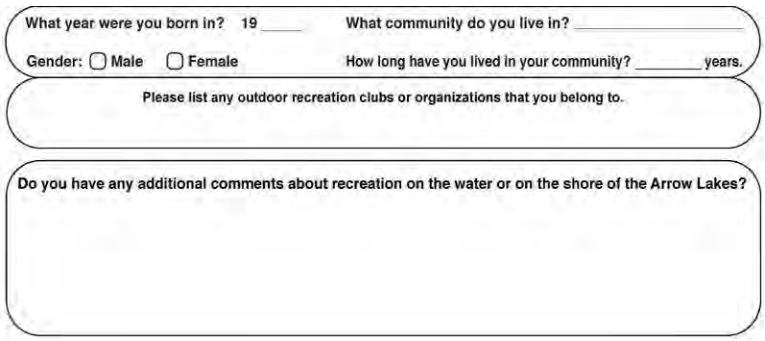


Figure 20. Section 7 questions.

3.7 Survey Analyses

Although there were four boat ramps that received upgrades, boat ramp counter data for pre-ramp construction was not available for Bush Harbour. Thus the current analysis only considers the Fauquier, MacDonald Creek, and Valemount Boat Launches.

Independent sample t-tests were used to examine Management Question 1; boat ramp counter data was compared for average daily visits for the pre-construction phase and the post-construction phase. Independent t-tests were also employed to examine Management Question 3; visitor satisfaction with boat ramp facilities and parking lot conditions were compared pre- and post-construction. Chi-square tests were used to examine Management Question 4; aspects of their experience that visitors disliked about the boat ramp that they visited on the day they completed a questionnaire were compared between pre- and post-construction sample days. Management Question #2 was not assessed at this time.

3.7.1 Data Entry QA/QC

The data from all completed questionnaires were entered (twice) into two SPSS databases to facilitate the verification of data for keying errors, and accuracy and consistency in data coding (Salant & Dillman, 1994). Each completed questionnaire was compared among the two datasets such that each cell (each answer to a question) was verified using the Identify Duplicate Cases function is SPSS (if two cases are identified as being duplicates, then it is assumed that they have been entered correctly). When discrepancies were identified, the appropriate questionnaire was consulted and the necessary correction was made. The resultant dataset can be considered to be free of errors from data entry. The data were checked for “protest votes” (*i.e.,* outliers or obvious patterns such as multiple responses from the same IP address); when these were identified they were checked against the corresponding questionnaire. No obvious “protest votes” were identified.

4. Results

A total of 241 boat launch visitors were encountered at sample sites on Kinbasket Lake between June 18 and October 24, 2012. Field staff asked 156 visitors to participate in the survey (2 of whom had already completed a questionnaire in the current sampling year); 112 completed questionnaires were returned, which represents an overall response rate of 72.7% (Table 9). The frequency of completed questionnaires by date is illustrated in Figure 21; the frequency of completed returns by sample site is illustrated in Figure 22. Visitors completed one web-based survey.

Table 9. Kinbasket Lake visitor encounters and survey response rates.

# Visitors Encountered	# Visitors Asked to Participate	# Previously Completed[†]	# Completed Questionnaires[‡]	Response Rate
241	156	2	112	72.7%

[†] People who have previously completed the survey in this sampling year.

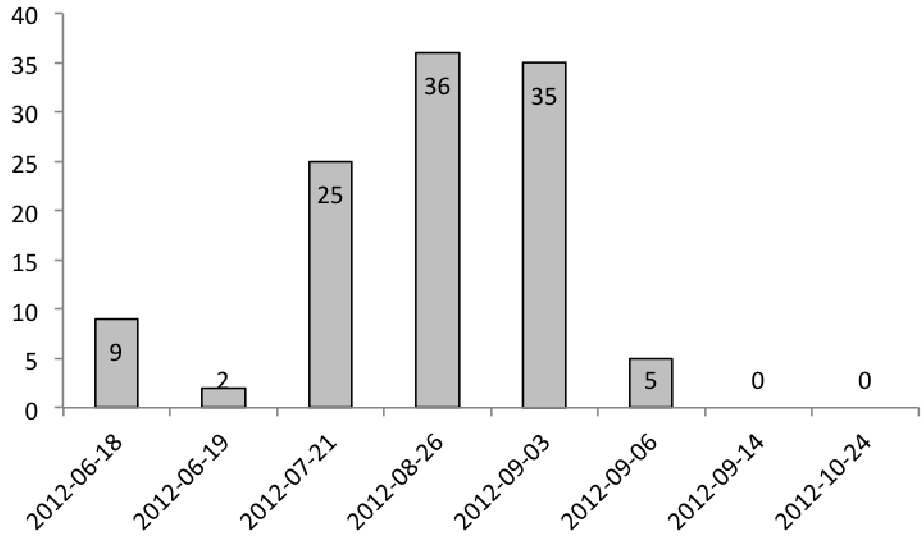


Figure 21. Completed questionnaires by sample date (n = 112).

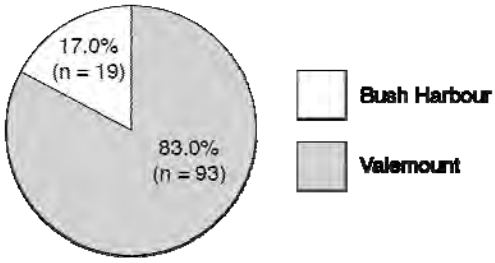


Figure 22. Completed questionnaires by sample site (n = 112).

4.1 Management Question 1:

MQ1. Does public use of boat ramps increase on Kinbasket and Arrow Lakes reservoirs after installation and upgrading of the WUP boat ramp facilities?

There were significant differences between pre- and post-ramp construction for two of the three sites on the Arrow and Kinbasket Lakes. Both Fauquier and Valemount boat ramps saw declines in average daily visits post-construction (Table 10).

Table 10. Average daily number of visits to boat ramp locations that have had new ramps constructed.

Boat Ramp	Construction Phase	n	Mean	95% CI	SD	t	df	p
Fauquier	Pre	257	0.47	± 0.11	0.910	7.200	272.856	0.000
	Post	595	0.06	± 0.02	0.250			
MacDonald Creek	Pre	245	0.77	± 0.15	1.183	-6.843	968.021	0.000
	Post	793	1.64	± 0.20	2.915			
Valemount	Pre	348	0.42	± 0.11	1.061	1.864	671.075	0.063
	Post	339	0.28	± 0.10	0.894			

Surveyors observed a much greater than normal amount of driftwood and floating debris on the lake during the high water period which created a boating safety hazard as well as making access to the water at the boat launches more difficult.

4.2 Management Question 2:

MQ2. If there is an increasing use of new or improved facilities, is it due to existing users visiting more often or new users being attracted to the area?

There is no evidence that there has been increasing use of new or improved facilities, except at MacDonald Creek. Future reports will address this question.

4.3 Management Question 3:

MQ3. Does user satisfaction increase with improvements made to the existing boat ramps and construction of the new boat ramps?

There were significant differences of visitor satisfaction with boat ramp facilities between responses collected pre- and post-construction (Tables 11 and 12) for all three boat launches; the Fauquier Boat Launch saw the largest increase in visitor satisfaction.

Table 11. Satisfaction with boat ramp facilities at boat ramp locations that have had new ramps constructed.

Location	Construction Phase	n	Never	Rarely	Sometimes	Frequently	Always
Fauquier	Pre	32	38.8%	12.5%	3.1%	12.5%	3.1%
	Post	27	3.7%	3.7%	3.7%	22.2%	66.7%
MacDonald Creek	Pre	7	—	14.3%	42.9%	14.3%	28.6%
	Post	73	4.1%	1.4%	2.7%	30.1%	61.6%
Valemount	Pre	58	6.9%	13.8%	36.2%	22.4%	20.7%
	Post	116	2.6%	6.0%	17.2%	29.3%	44.8%

Table 12. Average satisfaction with boat ramp facilities at locations that have had new ramps constructed.

Boat Ramp	Construction Phase	n	Mean	95% CI	SD	t	df	p
Faquier	Pre	32	1.69	± 0.42	1.203	-9.417	57	0.000
	Post	27	4.44	± 0.38	1.013			
MacDonald Creek	Pre	7	3.57	± 0.84	1.134	-2.285	78	0.025
	Post	73	4.44	± 0.42	2.369			
Valemount	Pre	58	3.36	± 0.30	1.165	-4.088	172	0.000
	Post	116	4.08	± 0.19	1.048			

There were significant differences of visitor satisfaction with parking lot conditions between responses collected pre- and post-construction (Tables 13 and 14) for the Fauquier and Valemount Boat Launches. Although not statistically significant, visitor satisfaction also increased for the MacDonald Creek Boat Launch. Parking lots were not upgraded at the above locations (Table 2).

Table 13. Satisfaction with parking lot conditions at boat ramp locations that have had new ramps constructed.

Location	Construction Phase	n	Never	Rarely	Sometimes	Frequently	Always
Fauquier	Pre	32	3.1%	12.5%	18.8%	43.8%	21.9%
	Post	28	7.1%	—	3.6%	39.3%	50.0%
MacDonald Creek	Pre	11	—	9.1%	9.1%	36.4%	45.5%
	Post	119	0.8%	0.8%	5.9%	32.8%	59.7%
Valemount	Pre	62	6.5%	11.3%	32.3%	19.4%	30.6%
	Post	127	3.1%	5.5%	15.7%	32.3%	43.3%

Table 14. Average satisfaction with parking lot conditions at boat ramp locations that have had new ramps constructed.

Boat Ramp	Construction Phase	n	Mean	95% CI	SD	t	df	p
Faquier	Pre	32	3.69	± 0.37	1.061	-2.036	58	0.046
	Post	28	4.25	± 0.40	1.076			
MacDonald Creek	Pre	11	4.18	± 0.58	0.982	-1.334	128	0.185
	Post	119	4.50	± 0.13	0.723			
Valemount	Pre	62	3.56	± 0.30	1.223	-2.950	187	0.004
	Post	127	4.07	± 0.18	1.048			

4.4 Management Question 4:

MQ4. Is there a need for installation of additional facilities to satisfy the needs of boat users on Kinbasket Reservoir and Arrow Lakes Reservoir?

There was a significant difference between pre- and post-construction visitor dislikes about the Fauquier Boat Launch (χ^2 = 40.485, df = 13, $p < 0.001$; Cramer's V = 0.959). Table 15 suggests that post-construction, more people indicated problems with the breakwater, the ramp being too narrow/not wide enough, and the ramp angle being too steep; over half of post-construction visitors provided a positive comment, or indicated that they did not experience any problems with the Fauquier Boat Launch.

Table 15. Fauquier: What do you like least about the boat ramp facility that you visited today?

Response Categories	Pre-construction (n = 27)		Post-construction (n = 17)	
	n	%	n	%
Problems with dock/dock ramp	11	40.7%	0	0.0%
Problems with breakwater	0	0.0%	2	11.8%
Too narrow/not wide enough	0	0.0%	1	5.9%
Ramp angle to steep	0	0.0%	2	11.8%
Problems with parking lot	1	3.7%	0	0.0%
Too crowded	1	3.7%	0	0.0%
Improvements needed for all components	4	14.8%	0	0.0%
Ramp not long enough	2	7.4%	0	0.0%
Water levels	5	18.5%	1	5.9%
Debris	1	3.7%	0	0.0%
Not well maintained/not clean	1	3.7%	0	0.0%
Too sandy/muddy	1	3.7%	0	0.0%
No problems/positive comment	0	0.0%	9	52.9%
Other	0	0.0%	2	11.8%

There was not a significant difference between pre- and post-construction visitor dislikes about the MacDonald Creek Boat Launch (χ^2 = 2.829, df = 6, $p > 0.05$). The patterns of response are listed in Table 16.

Table 16. MacDonald Creek: What do you like least about the boat ramp facility that you visited today?

Response Categories	Pre-construction (n = 3)		Post-construction (n = 15)	
	n	%	n	%
Problems with dock/dock ramp	1	33.3%	1	6.7%
Too narrow/not wide enough	0	0.0%	2	13.3%
Problems with parking lot	0	0.0%	1	6.7%
Too crowded	0	0.0%	1	6.7%
No problems/positive comment	1	33.3%	3	20.0%
Other	1	33.3%	6	40.0%
Multiple	0	0.0%	1	6.7%

There was a significant difference between pre- and post-construction visitor dislikes about the Valemount Boat Launch ($\chi^2 = 50.901$, df = 20, $p < 0.001$; Cramer's V = 0.703). Table 17 suggests that post-construction, more people indicated problems with dock/dock ramp and debris; however, fewer people indicated that the ramps were too narrow/not wide enough, too crowded, that more parking is needed, and that barrier-free access was needed at the post-construction ramps at the Valemount Boat Launch.

Table 17. Valemount: What do you like least about the boat ramp facility that you visited today?

Response Categories	Pre-construction (n = 39)		Post-construction (n = 64)	
	n	%	n	%
Problems with dock/dock ramp	2	5.1%	6	9.4%
Problems with breakwater	1	2.6%	0	0.0%
Rough road	0	0.0%	1	1.6%
Washrooms needed	1	2.6%	0	0.0%
Too narrow/not wide enough	5	12.8%	2	3.1%
Problems with parking lot	1	2.6%	0	0.0%
Too crowded	5	12.8%	1	1.6%
Ramp not long enough	3	7.7%	0	0.0%
Water levels	2	5.1%	2	3.1%
More parking needed	1	2.6%	0	0.0%
Not enough room to turn around/load/unload	2	5.1%	0	0.0%
Debris	2	5.1%	31	48.4%
Docks too far from shore	1	2.6%	0	0.0%
Not well maintained/not clean	2	5.1%	1	1.6%
Hard to use	0	0.0%	1	1.6%
Needs barrier-free access	2	5.1%	0	0.0%
Too sandy/muddy	1	2.6%	0	0.0%
No problems/positive comment	6	15.4%	10	15.6%
Did not use today	0	0.0%	4	6.3%
Other	2	5.1%	3	4.7%
Multiple	0	0.0%	2	3.1%

5. Discussion

5.1 Management Question 1:

MQ 1. Does public use of boat ramps increase on Kinbasket and Arrow Lakes reservoirs after installation and upgrading of the WUP boat ramp facilities?

Although the Fauquier and Valemount Boat Launches saw declines in average daily visits post-construction, it may be too early to draw any firm conclusions about the actual impact that the installation and upgrading of the WUP boat ramp facilities as the volume of visitor use was relatively lower than usual. This is likely due to higher than expected reservoir levels in summer 2012 – resulting driftwood, floating debris and boating safety hazards may have reduced the potential amount of boat use during the high water period.

5.2 Management Question 2

MQ2. If there is an increasing use of new or improved facilities, is it due to existing users visiting more often or new users being attracted to the area?

There is no evidence that there has been increasing use of new or improved facilities, except at MacDonald Creek. Future reports will address this question. An examination of the total traffic counts across sample sites (Appendix C) suggests that the total number of visitors in the Kinbasket has risen since 2010 (562 visitors) to reach 665 visitors in 2011 and 664 (adjusted) in 2012; in the Arrow, the number of visitors rose between 2009 (3,361 visitors) and 2010 (6,167 visitors), and then decreased in 2011 (5,337 visitors) and in 2012 (4,311 visitors adjusted).

5.3 Management Question 3

MQ3. Does user satisfaction increase with improvements made to the existing boat ramps and construction of the new boat ramps?

Visitor satisfaction with boat ramp facilities and with parking lot conditions has increased following improvements made to the existing boat ramps. This suggests that the improvements made were effective in addressing visitor expectations.

5.4 Management Question 4

MQ4. Is there a need for installation of additional facilities to satisfy the needs of boat users on Kinbasket Reservoir and Arrow Lakes Reservoir?

The need for the installation of additional facilities appears to be site-dependent, as there were no common patterns across the three boat launches that were examined. At the Fauquier Boat Launch, some issues remained with the breakwater, the ramp being too narrow/not wide enough, and the ramp angle being too steep. At the MacDonald Creek Boat Launch, there were no issues identified. At the Valemount Boat Launch, there were issues with dock/dock ramp and debris (though debris is not related to construction); there were also declines in reports of issues that the ramps were too narrow/not wide enough, too crowded, that more parking is needed, and calls for barrier-free access.

6. Limitations of Study

A variety of uncontrollable variables arise each year that affect use, particularly with construction and high water curtailment of traffic counts. Gathering traffic counter data over a longer period (i.e., leaving counters in situ through 2019) would provide much more valuable pre- and post-improvement data to inform comparisons.

7. Conclusions

It may be too early to draw definitive conclusions about the impact of the installation and upgrading of the WUP boat ramp facilities as the volume of visitor use was relatively lower than usual, perhaps due to higher than expected reservoir levels in 2012. However, visitor satisfaction increased for both boat ramp facilities and parking lot conditions, which suggests that the improvements are being well received. More robust conclusions may be made after more visitors have been able to use the improved sites; it is also likely that the examination of additional improved boat launches may provide a means of identifying improvement trends and visitor use and satisfaction.

8. References

BC Hydro (2007). Columbia River Project Water Use Plan. BC Hydro dated January 11, 2007.

BC Hydro (2009). Columbia River Project Water Use Plan Monitoring Program Terms of Reference – CLBMON 14 Boat Ramp Use Study.

Bryan, H. (1977). Leisure value systems and recreational specialization: The case of trout fishermen. *Journal of Leisure Research*, 9(3), 174-187.

Choi, S., D.K. Loomis, and R.B. Ditton. (1994). Effect of social group, activity, and specialization on recreation substitution decisions. *Leisure Sciences*, 16, 143-159.

Dillman, D.A. (2000). *Mail and Internet Surveys: The Tailored Design Method* (2nd ed.). Toronto: John Wiley & Sons, Inc.

Driver, B., P. Brown, and G. Peterson (Eds.). (1991). *Benefits of Leisure*. State College, PA: Venture Publishing.

Fishbein, M. and I. Ajzen. (1975). *Belief, Attitude, Interaction and Behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley Publishing Company.

Gregoire, T.G. and G.J. Buhyoff. (1999). *Sampling and estimating recreational use*. (General technical report No. PNW-GTR-456). Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest research Station.

Jackson, E. (1986). Outdoor recreation participation and attitudes to the environment. *Leisure Studies*, 5, 1-23.

Lees+Associates. (2012). *CLBMON 41 Arrow Reservoir Recreational Demand Study. Year 3 Progress Report – 2011.* Vancouver, BC. BC Hydro, Water License Requirements.

Manning, R.E. (1999). *Studies in Outdoor Recreation: Search and research for satisfaction* (2 ed.). Corvallis OR: Oregon State University Press.

McFarlane, B.L. (2001). Comments on recreational specialization: A critical look at the construct. *Journal of Leisure Research*, 33(3), 348-350.

McFarlane, B.L. (1994). Specialization and motivations of birdwatchers. *Wildlife Society Bulletin,* 22(3), 361–370.

McFarlane, B.L., P.C. Boxall, & D.O. Watson. (1998). Past experience and behavioral choice among wilderness users. *Journal of Leisure Research,* 30(2), 195-213.

Murphy, Peter E. (1991). Data gathering for community-oriented tourism planning: case study of Vancouver Island, British Columbia. *Leisure Studies*, 11(1), 65-79.

Rollins, R. and D.W. Robinson. (2002). Social science, conservation, and protected areas. In P. Dearden & R. Rollins (*Eds*.), *Parks and Protected Areas in Canada: Planning and Management* (2 ed., pp. 117-147). Toronto: Oxford University Press.

Salant, P. and D.A. Dillman. (1994). *How to Conduct Your Own Survey*. New York: John Wiley & Sons Inc.

Salz, R.J., D.K. Loomis, and K.L. Finn. (2001). Development and validation of a specialization index and testing of specialization theory. *Human Dimensions of Wildlife*, 6(4), 239-258

Vaske, J.J., M.D. Needham, and R.C. Cline Jr. (2007). Clarifying interpersonal and social values conflict among recreationists. *Journal of Leisure Research*, 39(1), 182-195.

Vaske, J.J. and M.P. Donnelly. (2002). Generalizing the encounter-norm-crowding relationship. *Leisure Sciences*, 24(3-4), 255-269.

APPENDIX A – TRAFx Vehicle Counters

How were traffic counters used in this study?

Traffic counters were configured and installed at 8 boat launch facilities that were slated for construction upgrades and improvements. This includes two on Kinbasket Lake (Valemount Marina and Bush Harbour) and six on the Arrow Lakes (Nakusp, MacDonald Creek, Burton, Edgewood, Fauquier, and Anderson Point). In 2011, two additional traffic counters were installed at control sites at Esplanade Bay and Burton South. The TRAFx G3 magnetic field controlled vehicle counters were selected for use in this study as they are the preferred and recommended traffic counter of BC Parks, Parks Canada and the US National Parks Service.

How does the traffic counter work?

Ferrous metal (*i.e*., metals with iron content) objects distort the earth's magnetic field as they move through it. Pure aluminum (non-alloy aluminum) will not be detected. Moving the counter (*i.e*., pointing it in different compass directions, tilting it, jiggling or jolting it) will also cause counts to occur. This is because the earth's magnetic field has different strengths for different directions and tilts, and the counter senses this.

As vehicles move, they disturb the earth's magnetic field. The TRAFx Vehicle Counter digitizes and analyzes these disturbances using highly sophisticated hardware and software. Thus, as a vehicle passes within the detection zone it changes the earth's magnetic field in that area which triggers a count. Different modes are used to meet the particular needs and traffic pattern of a given site. That is why the modes and sensitivity settings were selected at each site to best reflect the local conditions.

Can the vehicle counter be buried? Does it perform differently when buried?

Yes it can be buried. Because it responds to changes in the earth's magnetic field, the TRAFx Vehicle Counter functions the same whether the counter is buried or installed above ground.

Will the counter still function if a vehicle parks over or near the counter?

Yes. Unlike most other types of vehicle counters, the TRAFx Vehicle Counter will

automatically adjust to the presence of a vehicle parked over top or nearby, and continue to function properly. Likewise, if the counter is placed near a metal pole (*e.g*., signpost) or similar static metal object (*e.g.*, guard rail, cattleguard, bridge beam *etc*.) it will automatically adjust to its presence.

How are annual traffic counts calculated?

TRAFx DataNet traffic count estimates follow the most widely accepted vehicle traffic calculation methods used in North America. This system is used by the US Army Corps of Engineers, US Bureau of Land Management, US Fish and Wildlife, US Forest Service, US National Parks Service, Parks Canada, most Canadian provicincial and territorial governments, and numerous countries in Europe and the South Pacific.

Annual Traffic Counts are collected and automatically compiled by the TRAFx DataNet system for each full calendar year. This is done to standardize the calculation and application of average daily use to missing data. The system then enables the selection of any time period across years for calculating and reporting daily, weekly and monthly counts, averages and comparisons.

The Annual Traffic Summary shows estimated total yearly counts by recording the total daily counts and calculating the average daily count for that month, then applying that average daily count to missing data periods (such as partial months due to mid-month start date or interruptions due to data downloads, dead batteries or missing data). Thus, if a given counter has at least one day of counts in a month but is also missing at least one day of counts that month, the TRAFx Datanet will apply the monthly average daily count to only those days where data has been interrupted or is missing. If the counter had been operating without interruption during a day or month and there was absolutely no traffic recorded, the TRAFx DataNet calculates a '0' traffic count for that day or month. For years with complete months of missing data (not zero counts, but actually missing data) an annual average daily traffic count (AADT) is applied to all days within a missing month. The total estimate for the year is generated by adding the recorded and calculated counts.

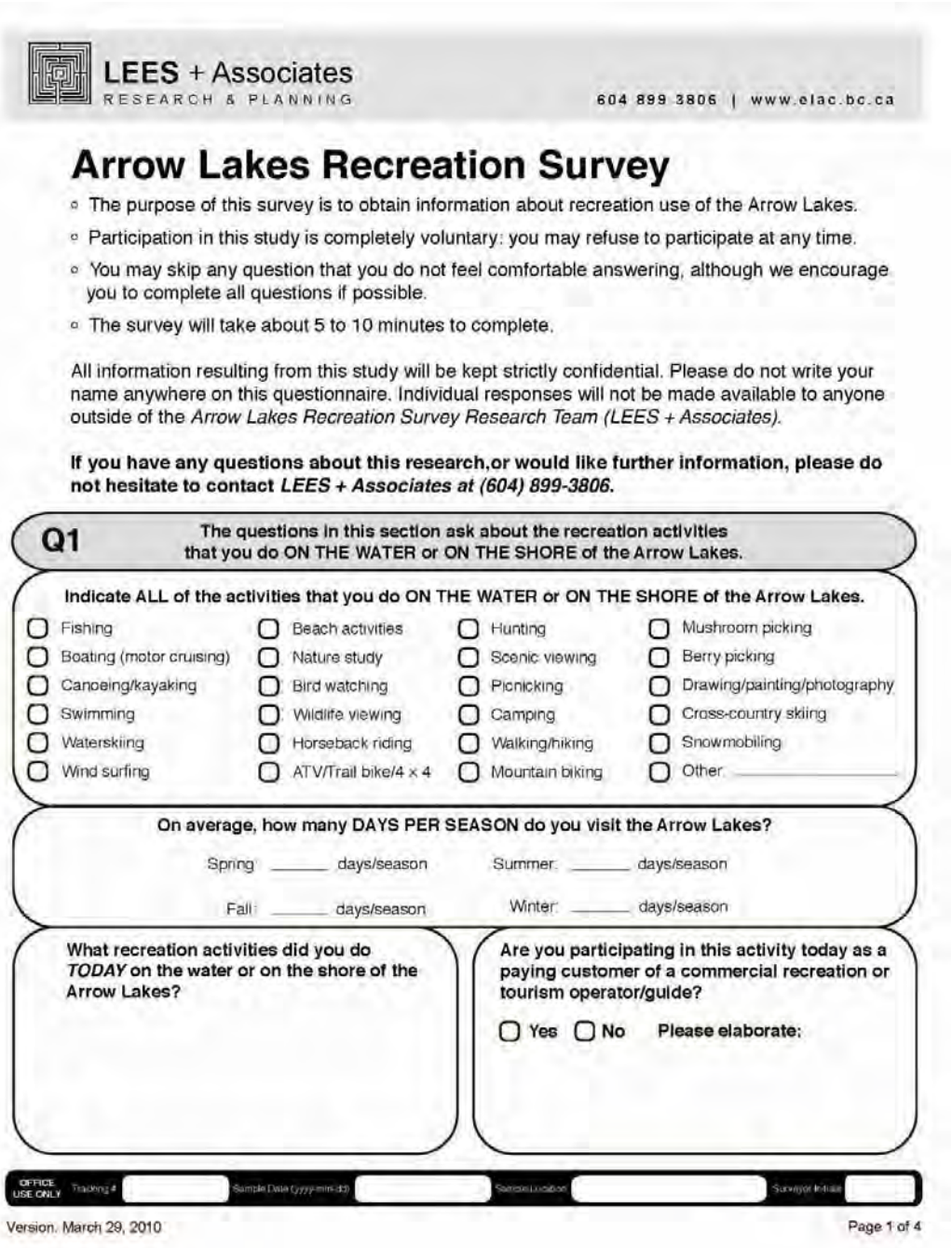
How are boat launch counts calculated?

To get an accurate count at a boat launch it is necessary to apply additional factors, including:

- Filter – a 12-17 second delay is applied (12 seconds on double lane ramps and 17 seconds on single lane ramps) to remove any multiple counts within those intervals to reduce the possibility of multiple counts for a single launch.
- Divide by two – as a vehicle must pass the counter twice to launch a boat (going into the water loaded and coming out empty) the count is divided by two.
- Adjustment Factor of '0.5' – as a vehicle must make two trips per boating experience (one to launch the boat and another to load the boat) the count is again multiplied by 0.5 (or in other words again divided by two).

APPENDIX B – Visitor Survey

(Arrow Lakes Version)



LEES + Associates
RESEARCH & PLANNING
604 899 3806 | www.elac.bc.ca

Arrow Lakes Recreation Survey

- The purpose of this survey is to obtain information about recreation use of the Arrow Lakes.
- Participation in this study is completely voluntary: you may refuse to participate at any time.
- You may skip any question that you do not feel comfortable answering, although we encourage you to complete all questions if possible.
- The survey will take about 5 to 10 minutes to complete.

All information resulting from this study will be kept strictly confidential. Please do not write your name anywhere on this questionnaire. Individual responses will not be made available to anyone outside of the *Arrow Lakes Recreation Survey Research Team (LEES + Associates).*

If you have any questions about this research,or would like further information, please do not hesitate to contact *LEES + Associates at (604) 899-3806.*

Q1 **The questions in this section ask about the recreation activities that you do ON THE WATER or ON THE SHORE of the Arrow Lakes.**

Indicate ALL of the activities that you do ON THE WATER or ON THE SHORE of the Arrow Lakes.

☐ Fishing	☐ Beach activities	☐ Hunting	☐ Mushroom picking
☐ Boating (motor cruising)	☐ Nature study	☐ Scenic viewing	☐ Berry picking
☐ Canoeing/kayaking	☐ Bird watching	☐ Picnicking	☐ Drawing/painting/photography
☐ Swimming	☐ Wildlife viewing	☐ Camping	☐ Cross-country skiing
☐ Waterskiing	☐ Horseback riding	☐ Walking/hiking	☐ Snowmobiling
☐ Wind surfing	☐ ATV/Trail bike/4 x 4	☐ Mountain biking	☐ Other: _____

On average, how many DAYS PER SEASON do you visit the Arrow Lakes?

Spring: _____ days/season Summer: _____ days/season

Fall: _____ days/season Winter: _____ days/season

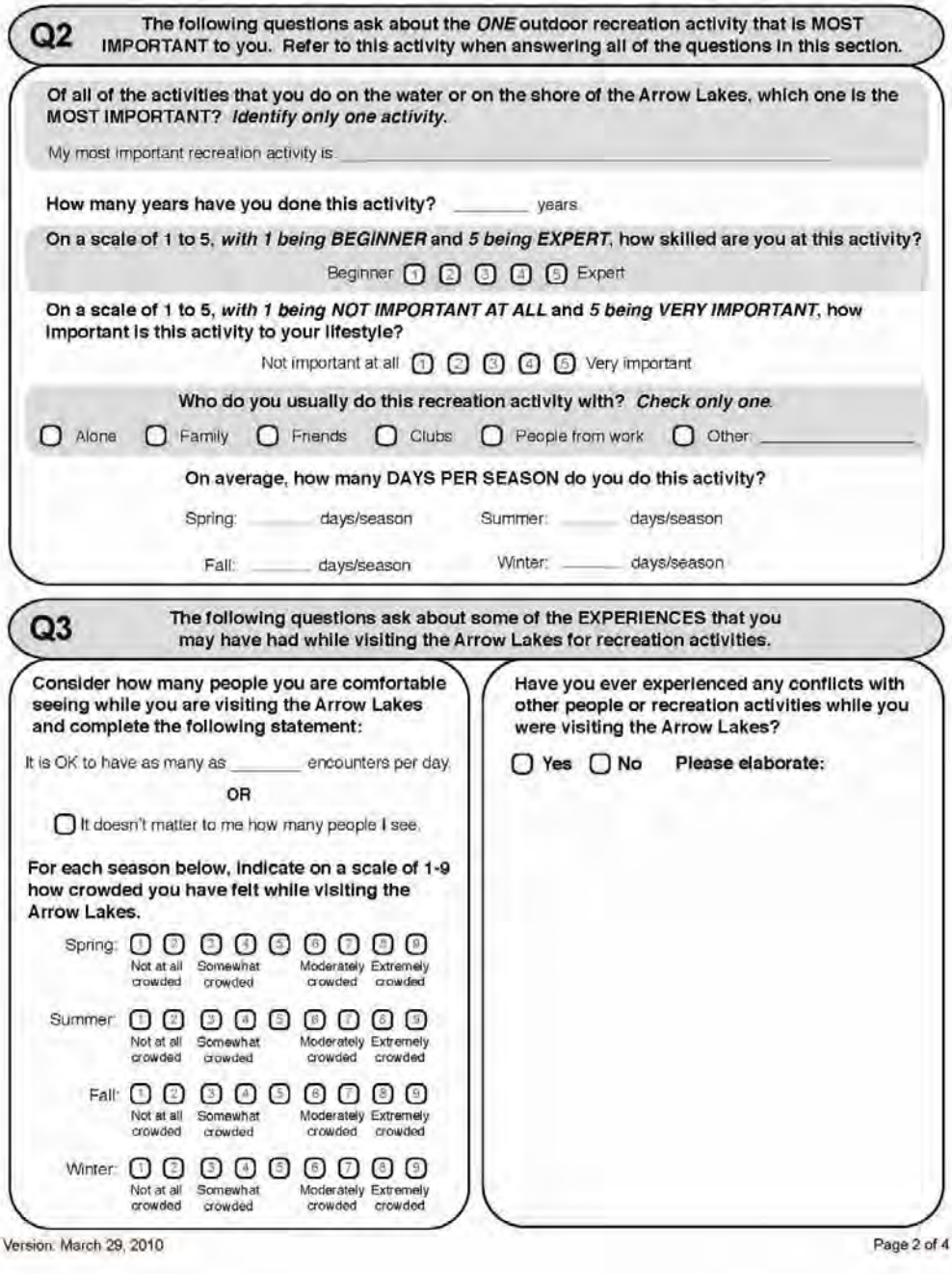
What recreation activities did you do *TODAY* on the water or on the shore of the Arrow Lakes?

Are you participating in this activity today as a paying customer of a commercial recreation or tourism operator/guide?

☐ Yes ☐ No **Please elaborate:**

OFFICE USE ONLY Tracking # | Sample Date (yyyy-mm-dd) | Survey Location | Surveyor Initials

Version: March 29, 2010 Page 1 of 4



Q2 The following questions ask about the *ONE* outdoor recreation activity that is MOST IMPORTANT to you. Refer to this activity when answering all of the questions in this section.

Of all of the activities that you do on the water or on the shore of the Arrow Lakes, which one is the MOST IMPORTANT? ***Identify only one activity.***

My most important recreation activity is: _____

How many years have you done this activity? _____ years

On a scale of 1 to 5, *with 1 being BEGINNER* and *5 being EXPERT*, how skilled are you at this activity?

Beginner ① ② ③ ④ ⑤ Expert

On a scale of 1 to 5, *with 1 being NOT IMPORTANT AT ALL* and *5 being VERY IMPORTANT*, how important is this activity to your lifestyle?

Not important at all ① ② ③ ④ ⑤ Very important

Who do you usually do this recreation activity with? ***Check only one.***

☐ Alone ☐ Family ☐ Friends ☐ Clubs ☐ People from work ☐ Other: _____

On average, how many DAYS PER SEASON do you do this activity?

Spring: _____ days/season Summer: _____ days/season

Fall: _____ days/season Winter: _____ days/season

Q3 The following questions ask about some of the EXPERIENCES that you may have had while visiting the Arrow Lakes for recreation activities.

Consider how many people you are comfortable seeing while you are visiting the Arrow Lakes and complete the following statement:

It is OK to have as many as _____ encounters per day.

OR

☐ It doesn't matter to me how many people I see.

For each season below, indicate on a scale of 1-9 how crowded you have felt while visiting the Arrow Lakes.

Spring: ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
Not at all crowded — Somewhat crowded — Moderately crowded — Extremely crowded

Summer: ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
Not at all crowded — Somewhat crowded — Moderately crowded — Extremely crowded

Fall: ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
Not at all crowded — Somewhat crowded — Moderately crowded — Extremely crowded

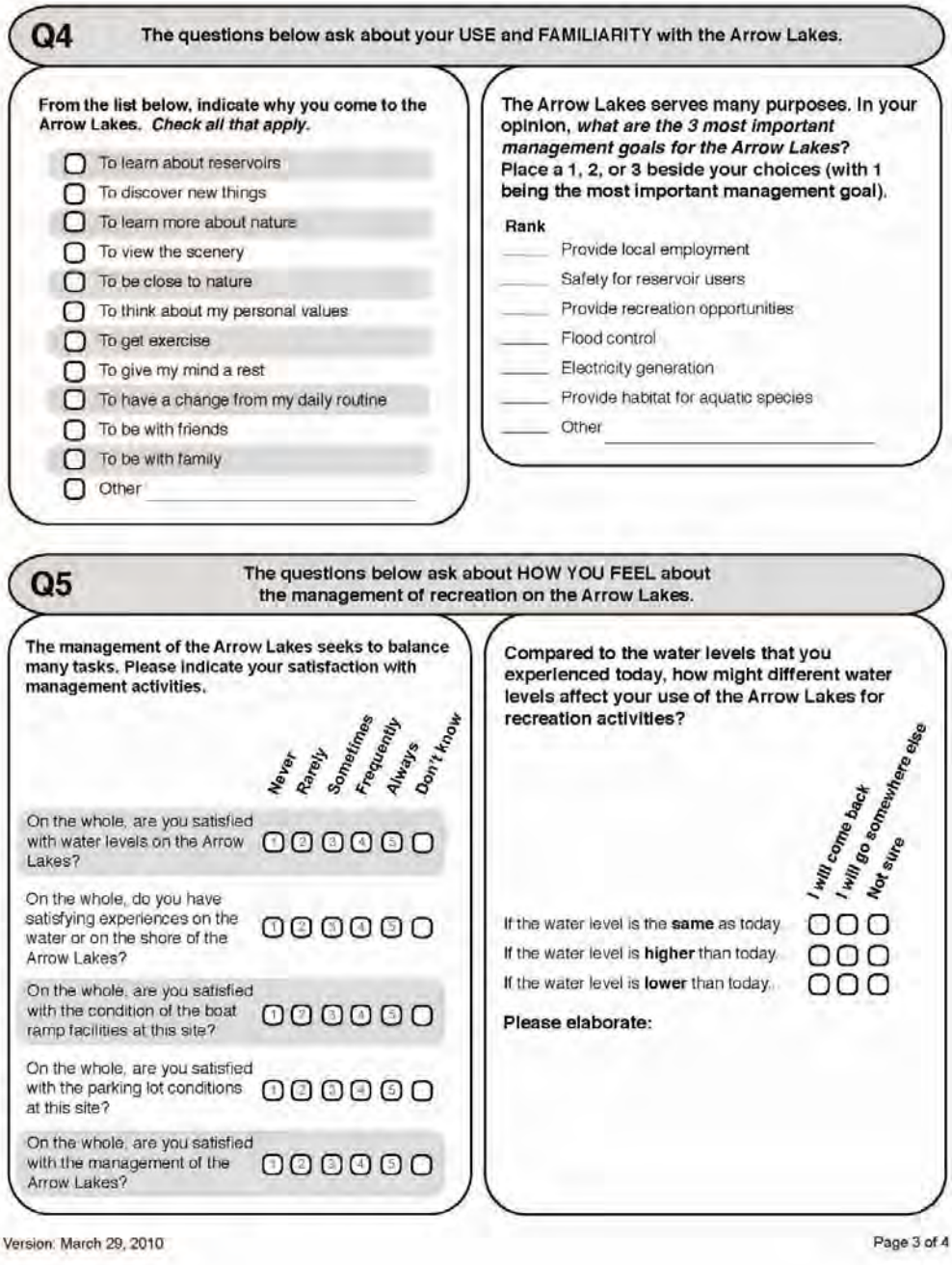
Winter: ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
Not at all crowded — Somewhat crowded — Moderately crowded — Extremely crowded

Have you ever experienced any conflicts with other people or recreation activities while you were visiting the Arrow Lakes?

☐ **Yes** ☐ **No** **Please elaborate:**

Version: March 29, 2010

Page 2 of 4



Q4 The questions below ask about your USE and FAMILIARITY with the Arrow Lakes.

From the list below, indicate why you come to the Arrow Lakes. *Check all that apply.*

- ☐ To learn about reservoirs
- ☐ To discover new things
- ☐ To learn more about nature
- ☐ To view the scenery
- ☐ To be close to nature
- ☐ To think about my personal values
- ☐ To get exercise
- ☐ To give my mind a rest
- ☐ To have a change from my daily routine
- ☐ To be with friends
- ☐ To be with family
- ☐ Other _____

The Arrow Lakes serves many purposes. In your opinion, *what are the 3 most important management goals for the Arrow Lakes*? Place a 1, 2, or 3 beside your choices (with 1 being the most important management goal).

Rank

- ____ Provide local employment
- ____ Safety for reservoir users
- ____ Provide recreation opportunities
- ____ Flood control
- ____ Electricity generation
- ____ Provide habitat for aquatic species
- ____ Other _____

Q5 The questions below ask about HOW YOU FEEL about the management of recreation on the Arrow Lakes.

The management of the Arrow Lakes seeks to balance many tasks. Please indicate your satisfaction with management activities.

	Never	Rarely	Sometimes	Frequently	Always	Don't know
On the whole, are you satisfied with water levels on the Arrow Lakes?	1	2	3	4	5	☐
On the whole, do you have satisfying experiences on the water or on the shore of the Arrow Lakes?	1	2	3	4	5	☐
On the whole, are you satisfied with the condition of the boat ramp facilities at this site?	1	2	3	4	5	☐
On the whole, are you satisfied with the parking lot conditions at this site?	1	2	3	4	5	☐
On the whole, are you satisfied with the management of the Arrow Lakes?	1	2	3	4	5	☐

Compared to the water levels that you experienced today, how might different water levels affect your use of the Arrow Lakes for recreation activities?

	I will come back	I will go somewhere else	Not sure
If the water level is the **same** as today	☐	☐	☐
If the water level is **higher** than today	☐	☐	☐
If the water level is **lower** than today	☐	☐	☐

Please elaborate:

Version: March 29, 2010

Page 3 of 4

Q6 The following questions ask about YOUR RECREATION EXPERIENCES on the Arrow Lakes.

How long have you been coming to the Arrow Lakes for recreation activities? _____ years.

Based on your experience today, will you come back to the Arrow Lakes for recreation activities?

☐ Yes ☐ No Please elaborate:

Which boat ramp facility do you usually use on the Arrow Lakes?

Why did you come to this boat ramp facility today?

What did you LIKE MOST about the boat ramp facility that you visited today?

What did you LIKE LEAST about the boat ramp facility that you visited today?

How did you first hear about recreation opportunities and activities near and on the Arrow Lakes? *Check all that apply.*

☐ Tourism information booth	☐ Family	☐ BC Hydro web site
☐ Tourism information brochures	☐ Friends	☐ BC Hydro facility (*e.g.*, Revelstoke Dam)
☐ Tourism operators	☐ BC Parks	☐ BC Hydro bill
☐ Private marinas	☐ BC Forest Service	☐ Other: _____

Q7 These questions below ask about you. We use this information only to assist us in compiling the survey results.

What year were you born in? 19____ What community do you live in? _____

Gender: ☐ Male ☐ Female How long have you lived in your community? _____ years.

Please list any outdoor recreation clubs or organizations that you belong to.

Do you have any additional comments about recreation on the water or on the shore of the Arrow Lakes?

Version: March 29, 2010 Page 4 of 4

APPENDIX C – Traffic Counter Results

2012 Operational Considerations

Year 3 (2012) produced an eccessively high water year with a sustained water level approximately two feet above normal pond level in both the the Arrow and Kinbasket Lakes for much of the summer. This created a number of operational challenges to data collection during the busiest boating periods on the lake.

To protect the sensitive electronic traffic counters from being submerged and water damaged it was necessary to remove all the counters in the Arrow Lakes from July 6, 2012 to August 15, 2012, inclusive except the one at the Anderson Point boat launch. In Kinbasket Lake the counters had to be removed for over 7 weeks at Bush Harbour and Esplanade Bay from July 21 to September 10, 2012 and at Valemount from July 24 to September 11, 2012. Alternatives such as relocating counters will be considered if high water occurs in future years - provided the physical design of the ramps permits relocation and the counters will not be exposed to tampering.

This disruption of traffic counts posed a few challenges but we feel confident in providing the best estimates available for boat launch use in 2012. The traffic estimates recorded for the summer months are conservative as the AADT is lower than the actual use during the summer months, as that is the peak use period, but it would be higher than actual use in November and December when the ramps are not accessible or used very little. Thus, to best reflect actual use for all locations, the use estimates for missed days in partial months of counts have been based on the Average Annual Daily Traffic (AADT). However, monthly average traffic from past years was used for complete months of missing data. The AADT calculations were adjusted where average monthly data was added in to provide the correct number of days with data, thus avoiding over counting. This has also facilitated comparison between years as previous years have more complete data sets and are calculated on a calendar year basis.

The high water resulted in a much greater than normal amount of driftwood and floating debris on the lake which created a boating safety hazard as well as making access to the water at the boat launches more difficult. This may have further reduced the potential amount of boat use during the high water period.

In addition, upon removal of the Bush Harbour counter it was found to have a faulty battery pack case which was immediately replaced with a spare unit until it could be replaced. The problem was relayed to the equipment producer. Upon review of the purchase dates they aknowledged their receipt of sub-standard battery cases for those counters and agreed to replace the three battery pack cases that had been purchased at the same time. No data was lost from this counter. Upon inspection of the Valemount counter during the fall winterization, it was discovered the valve cover protecting it was demolished by an excavator that was cleaning up woody debris on the boat ramp; the same problem was encountered and the battery pack was immediately replaced.

Kinbasket Lake – Traffic Results

As mentioned previously, Kinbasket Lake experienced excessively high water for much of the summer of 2012 which required the removal of the traffic counters for 7 weeks of the summer. Below is a summary of un-adjusted traffic counts for the last three years as calculated on the TRAFx system. Below that is another table of just 2012 data adjusted to best reflect actual use as described above.

Kinbasket Lake - Traffic Summary[8]

Year	Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AADT†	Days with data	Totals
2010	Bush Harbour[ADF]								86*	37	38*	6	0	0.986	142	360**
	Valemount[ADF]				12*	6	13*	61	28	23	3*	0	0	0.554	258	202**
2011	Bush Harbour[ADF]	0	0*		0*	39	43	102*	82	60	33*	4	0	1.181	298	431**
	Esplanade[ADF]								67*	26	6*	0	0	0.358	123	131**
	Valemount[ADF]	0	0	2			40*	30*	12	10	0*			0.282	195	103**
2012	Bush Harbour[ADF]	0	0	0	0	40*	61	98*		2*	1*			0.661	245	242**
	Esplanade[ADF]	0	0	0	0	7*	7	31*		9*	1*			0.167	239	61**
	Valemount[ADF]	1*	0	0	0*	1*	25	10*		10*	2*			0.174	235	64**

† AADT = Annual Average Daily Traffic, the total whole day counts for the given year, divided by the number of whole days with data in that year.

* Some monthly totals are estimated when there is only partial data for the month. The values shown are calculated based on the daily average for the available data, multiplied by the number of days in that month.

** Totals in years where data is incomplete are calculated by multiplying the AADT by the number of days in that year.

[A] = adjustment applied, [D] = divide by 2 applied, [F] = filtering applied

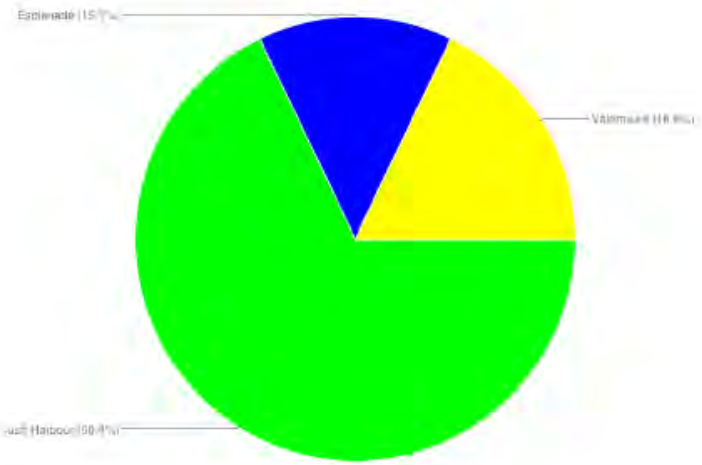
[8] See Appendix A for a discussion of how the traffic counters work and how annual traffic counts are calculated.

Kinbasket Lake – Traffic Summary 2012 (adjusted)

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AADT	Days with data	Total
Bush Harbour	0	0	0	0	*40*	61	*98*	84	*49*	*1*	5	0	1.003	337	***367***
Esplanade	0	0	0	0	*7*	7	*31*	67	*26*	*1*	0	0	0.420	331	***154***
Valemount	*1*	0	0	*0*	*1*	25	*10*	20	*10*	*2*	0	0	0.336	327	***123***

At all locations in this study, recorded summer use has being higher and winter use has been lower than the annual daily average. Thus, to more accurately present the total boat ramp use for the current year we have calculated the average November and December counts for each location from the past two years and applied them to the 2012 November and December data. As August was a prime activity month we likewise applied the average August values from past years for August 2012. We adjusted the AADT calculations to match each change.

Kinbasket Lake - Traffic by Site

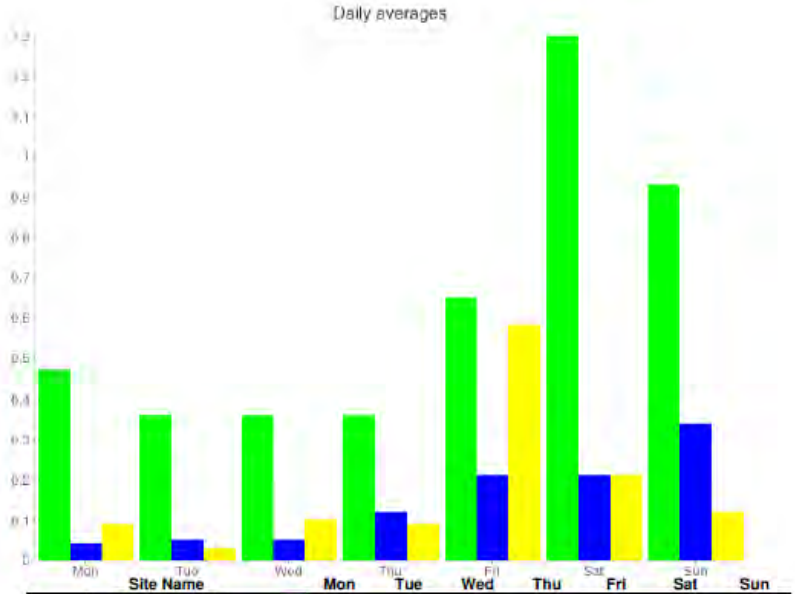


Site Name	Daily Average
Bush Harbour (ADF)	0.6 (66.4%)
Esplanade (ADF)	0.1 (15.1%)
Valemount (ADF)	0.2 (18.5%)

A = adjustment applied, D = divide by 2 applied, F = filtering applied

In 2012, Bush Harbour generated 57% of the recorded (adjusted) use, Esplanade Bay 24% and Valemount 19%.

Kinbasket Lake – Traffic by Days of the Week

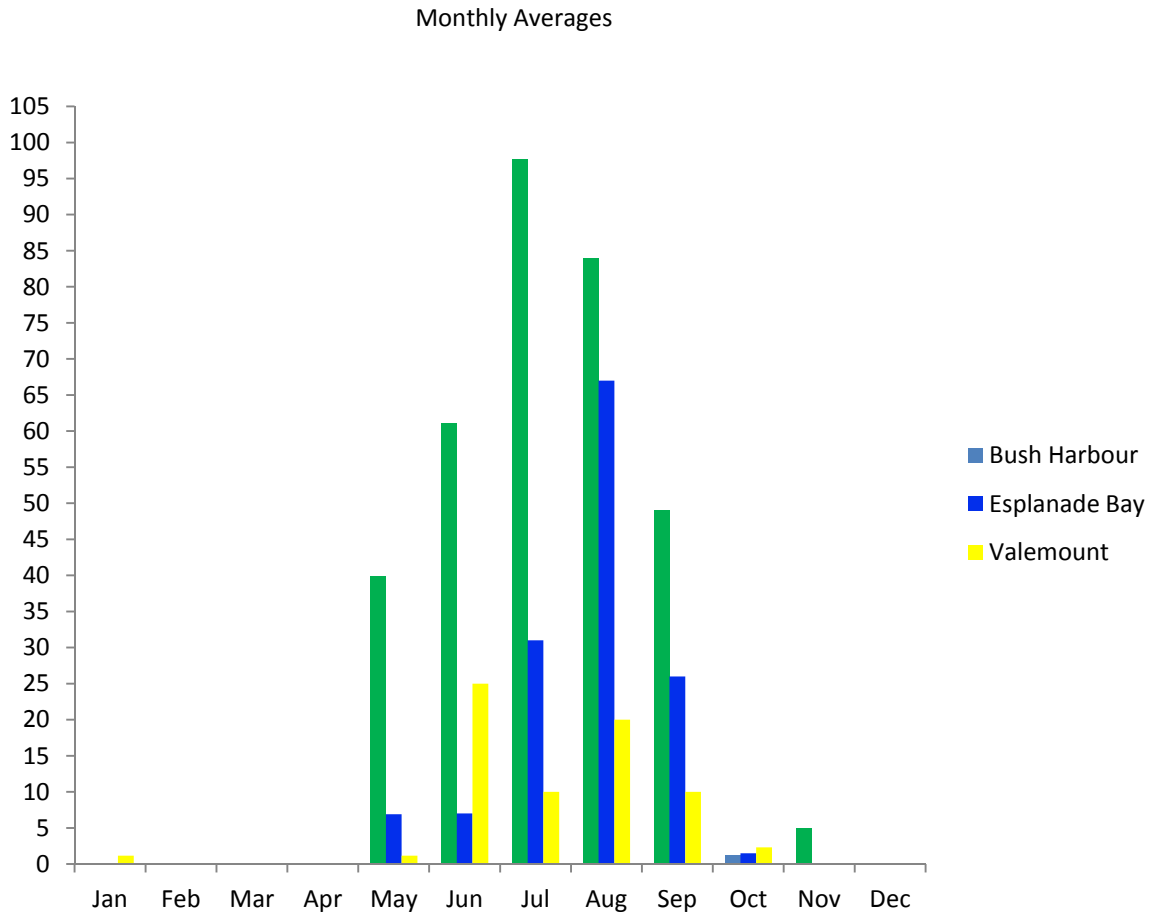


Site Name	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Bush Harbour (ADF)	0.5	0.4	0.4	0.4	0.7	1.3	0.9
Esplanade (ADF)	0.0	0.0	0.0	0.1	0.2	0.2	0.3
Valemount (ADF)	0.1	0.0	0.1	0.1	0.6	0.2	0.1
Daily Averages	0	0	0	0	0	1	0

A = adjustment applied, D = divide by 2 applied, F = filtering applied

As expected, most recorded use occurs on the weekends with over 50% of it attributed to those days. Saturdays and Sundays get two to three times as much use as other days of the week. Fridays get about 1.5 – 2.0 times as much use as other week days. Saturdays get the heaviest use in Bush Harbour and Esplanade Bay while Fridays are heaviest in Valemount. Boats are kept at the Valemount marina and there are several Forest Service campgrounds close by so there may be more boating activity than the recorded traffic indicates.

Kinbasket Lake – Traffic by Months of the Year



According to adjusted figures, the heaviest boat launch use by site occurred in July in Bush Harbour, in August in Esplanade Bay and in June in Valemount.

Arrow Lakes – Traffic Results

As mentioned previously, Arrow Lakes experienced excessively high water for much of the summer of 2012 which required the removal of the traffic counters for 6 weeks of the summer. Below is a summary of un-adjusted traffic counts for the last three years as calculated on the TRAFx system. Below that is another table of just 2012 data adjusted to best reflect actual use as described above.

Some preparatory roadwork has been carried out at Anderson Point but no work has yet been initiated at the Nakusp or Edgewood locations. Burton South still requires an extension of the cement ramp.

Arrow Lakes - Traffic Summary 2012

Year	Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AADT†	Days with data	Totals
2009	Burton ADF									62*	19*	8	0	0.604	106	220**
	Edgewood ADF									84*	51	48	37	1.726	113	630**
	Fauquier ADF									33*	7*	6	3	0.351	111	128**
	McDonald Cr ADF									71*	26	15	7	0.867	113	317**
	Nakusp ADF									245*	178	144	149	5.661	112	2,066**
2010	Anderson Point ADF				32	49	99	97	96	55	43	20	14	1.836	275	670**
	Burton ADF	0	3	2*	8*	32*	83	106	123	15	19	9	2	1.134	351	414**
	Edgewood ADF	96	100	136*	64	61	88	174	103	26	34*	21	15	2.524	361	921**
	Fauquier ADF	3	17	18*	12	35*				3*	0*	0	0	0.340	244	124**
	McDonald Cr ADF	4	19	16*	32*	124*		300*	215	87	37*	12	2	2.530	328	924**
	Nakusp ADF	152	162	170*	192	247	330	748	529*	161	185	90	150	8.530	362	3,114**
2011	Anderson Point ADF	12	12	12	21*	42	61	104	86	60	56*	30*	4	1.372	358	501**
	Burton ADF	0	9	2	11*	32	72	121	144*	56	6*	2	2	1.257	358	459**
	Burton South ADF								35*	22	5*	0	1	0.283	127	103**
	Edgewood ADF	12	10	42	51*	66	68	140	123	53	29*	7	11	1.683	360	614**
	Fauquier ADF	2	0	0	4*	2	3	3*	2	3	0*	0*	0	0.058	313	21**
	McDonald Cr ADF	0	0	0	36*	33	55	101	148	52	3*	0	7	1.217	355	444**
	Nakusp ADF	183	114	125	198*	202	318	643	724	266	165*	90	161	8.752	363	3,195**
2012	Anderson Point ADF	12	13	32	49	64*	63*	71	92	90*				1.613	222	590**
	Burton ADF	1	0	0	1	13*	44	101*	128*	30	6*			0.677	251	248**
	Burton South ADF	0	0	2	8	4*	13	8*	37*	24	5*			0.297	249	109**
	Edgewood ADF	14	12	33	52	50*	52	68*	126*	76	35*			1.510	259	553**
	Fauquier ADF	0	0	2	2	4*	7	0*		0*				0.076	184	28**
	McDonald Cr ADF	2	0	0	11	37*	47	70*	110*	57	13*			0.892	259	326**
	Nakusp ADF	171	112	209	213	231*	225	524	697	320	224*			9.619	302	3,521**

† AADT = Annual Average Daily Traffic, the total whole day counts for the given year, divided by the number of whole days with data in that year.

* Some monthly totals are estimated when there is only partial data for the month. The values shown are calculated based on the daily average for the available data, multiplied by the number of days in that month.

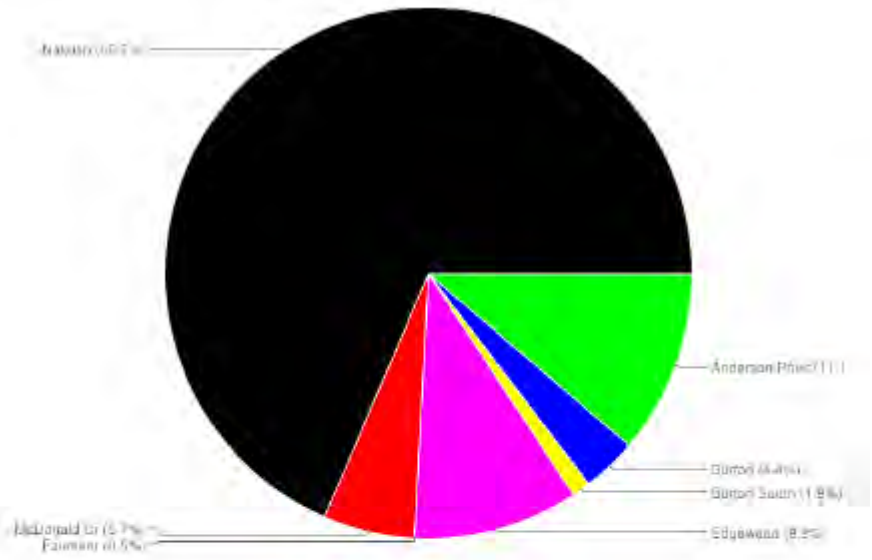
** Totals in years where data is incomplete are calculated by multiplying the AADT by the number of days in that year.

A = adjustment applied, D = divide by 2 applied, F = filtering applied

Arrow Lakes - Traffic Summary 2012 (adjusted)

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AADT	Days with data	Total
Anderson Point	12	13	32	49	*64*	*63*	71	92	*90*	50	25	9	1.038	314	*380*
Burton	1	0	0	1	*13*	44	*101*	*128*	30	*5*	6	1	0.677	251	*248*
Burton South	0	0	2	8	*4*	13	*8*	*37*	24	*35*	0	1	0.239	310	*87*
Edgewood	14	12	33	52	*50*	52	*68*	*126*	76	*35*	25	21	1.222	320	*447*
Fauquier	0	0	2	2	*4*	7	*0*	2	*0*	2	2	1	0.046	307	*17*
McDonald Cr	2	0	0	11	*37*	47	*70*	*110*	57	*13*	9	5	0.746	310	*273*
Nakusp	171	112	209	213	*231*	225	524	697	320	*224*	108	153	8.003	363	*2929*

Arrow Lakes - Traffic by Site



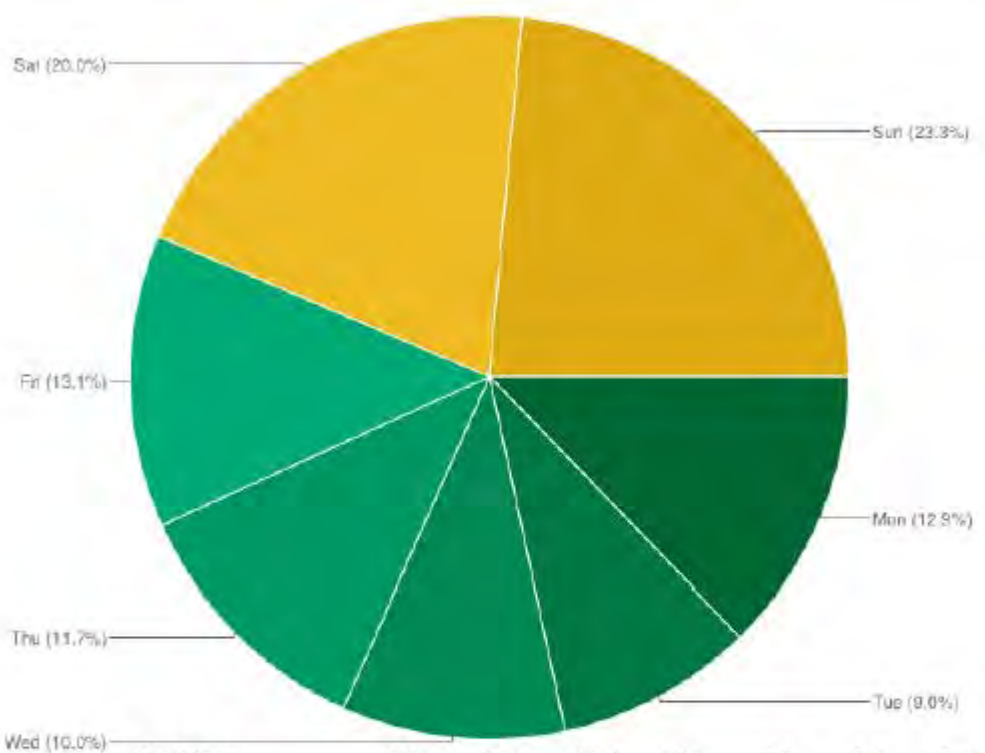
Site Name	Daily Average
Anderson Point (ADF)	1.4 (11.1%)
Burton (ADF)	0.6 (4.4%)
Burton South (ADF)	0.2 (1.9%)
Edgewood (ADF)	1.3 (9.8%)
Fauquier (ADF)	0.1 (0.5%)
McDonald Cr (ADF)	0.7 (5.7%)
Nakusp (ADF)	8.5 (66.7%)

A = adjustment applied, D = divide by 2 applied, F = filtering applied

The Nakusp boat launch accounted for 67% of the recorded traffic at the selected boat launch locations on the Arrow Lakes in this study.[9] The Fauquier counter was re-checked and tested again to try to determine if a faulty counter was the cause for such low use rates but it functioned appropriately during testing. This site will continue to be monitored closely to determine the cause.

[9] This percentage is for the locations used in this study only and does not represent the overall percentage of boat launch use on the Arrow Lakes. The Arrow Lake Recreation Study indicates that Nakusp accounts for about 27% of the overall recorded boat launch counts on the Arrow Lakes.

Arrow Lakes – Traffic by Days of the Week

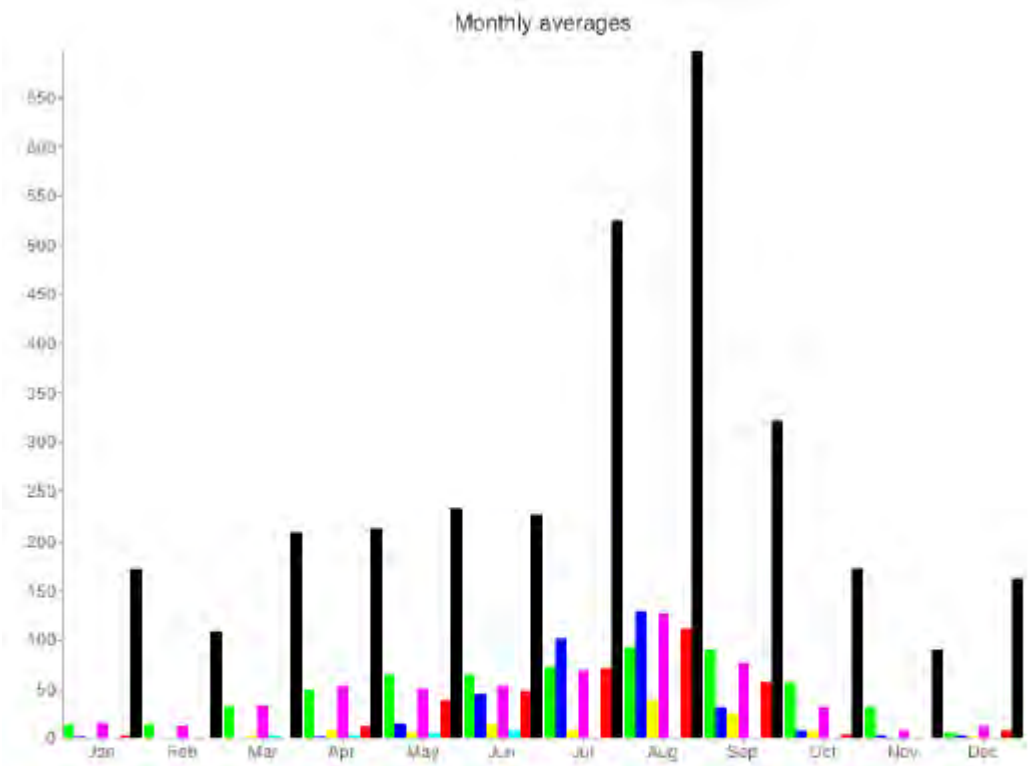


Site Name	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Anderson Point (ADF)	1.4	1.3	1.3	1.2	1.8	1.3	1.6
Burton (ADF)	0.4	0.3	0.5	0.7	0.6	0.8	0.6
Burton South (ADF)	0.3	0.2	0.1	0.2	0.2	0.2	0.5
Edgewood (ADF)	1.1	0.7	0.8	1.2	1.4	1.8	1.8
Fauquier (ADF)	0.1	0.0	0.1	0.1	0.1	0.1	0.0
McDonald Cr (ADF)	0.5	0.6	0.5	0.6	0.7	1.0	1.2
Nakusp (ADF)	8.2	5.1	5.9	7.7	8.2	11.9	12.6
Revelstoke (ADF)	1.2	1.0	1.2	1.3	0.8	1.0	1.3
Shelter Bay (ADF)	1.9	1.6	1.6	1.5	2.2	4.7	4.9
Syringa Cr. (ADF)	7.9	5.2	6.1	6.2	7.2	12.9	16.8
Daily Averages	2	2	2	2	2	4	4

A = adjustment applied, D = divide by 2 applied, F = filtering applied

Shelter Bay, Syringa Creek, Nakusp, McDonald Creek, Burton, Burton South, and Edgewood boat launches had an expected relationship of greater weekend than weekday use, ie. Saturdays and Sundays received about 1.5 – 2.0 times as much traffic as weekdays. Anderson Point, had a higher percentage of weekday use (especially Fridays) than other locations. This may be attributed to a higher component of commuter rather than recreational traffic.

Arrow Lakes – Traffic by Months of the Year



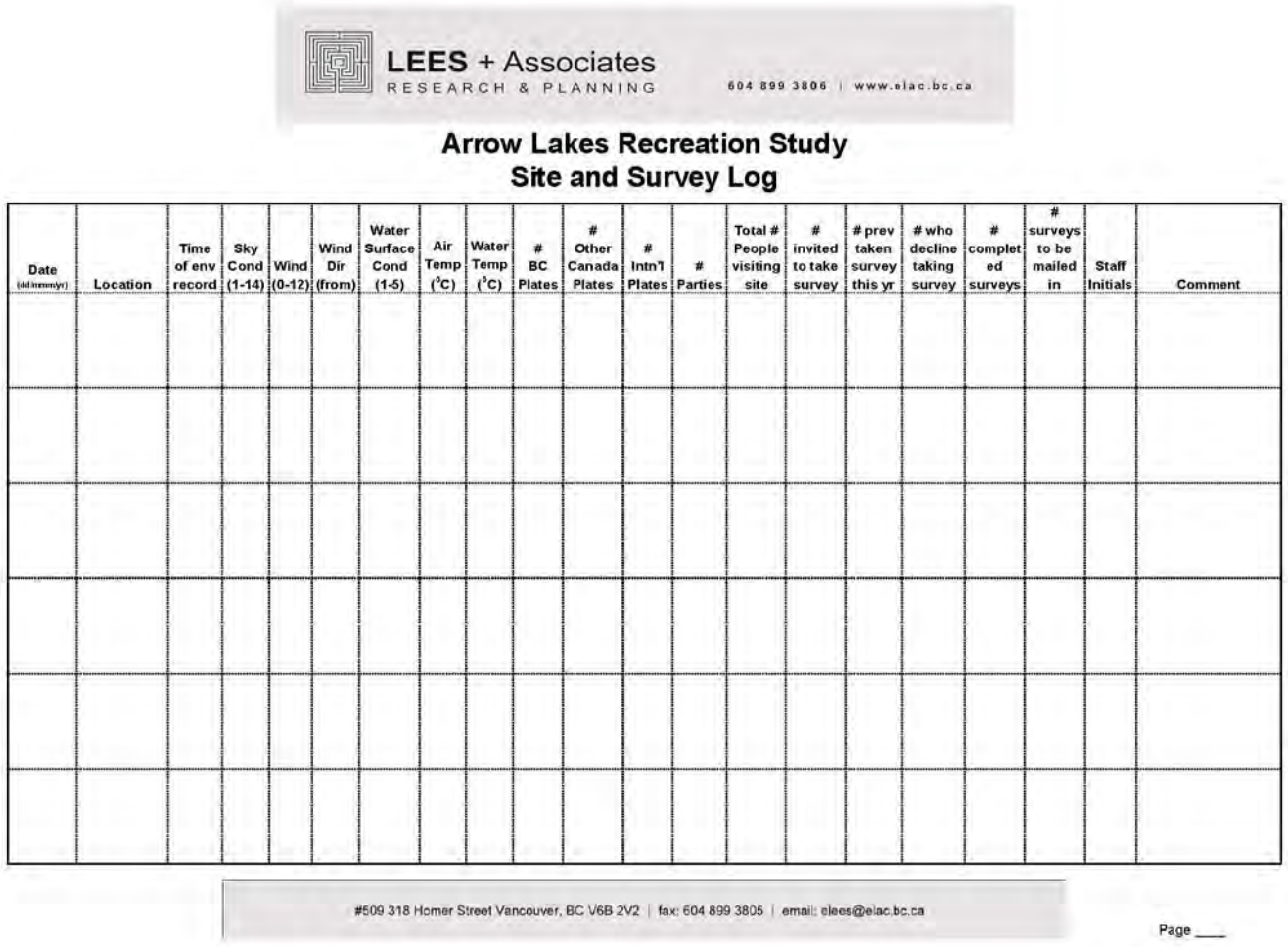
Site Name	Average	Median	STDV	Min	Max
Anderson Point (ADF)	48.0	52.6	28.7	4.0	92.0
Burton (ADF)	27.4	4.3	41.4	1.0	127.9
Burton South (ADF)	8.6	5.3	10.8	1.0	36.8
Edgewood (ADF)	44.3	41.6	33.2	7.0	126.1
Fauquier (ADF)	1.3	0.0	2.1	2.0	7.0
McDonald Cr (ADF)	28.7	9.0	34.4	2.0	110.4
Nakusp (ADF)	260.1	211.0	170.4	90.0	697.0

A = adjustment applied, D = divide by 2 applied, F = filtering applied

Use patterns are as expected with increasing activity in the summer months with most locations peaking in July or August, and then tapering off in the fall. Nakusp generates significant use throughout the winter months and exceeds Syringa Creek for seven months of the year. Nakusp, Edgewood and Anderson Point receive more relative use over the winter months (November – March) than other locations. Nakusp showed an increase in December and January over adjacent months but the reason for this is not

readily evident from the data. It may be that boats normally kept in the marina are not left there over winter thus need to be launched each time a person wants to use them or these are the best months for catching fish.

APPENDIX D – Observational Data Forms and Definitions



LEES + Associates
RESEARCH & PLANNING
604 899 3806 | www.elac.bc.ca

Arrow Lakes Recreation Study
Site and Survey Log

Date (dd/mm/yr)	Location	Time of env record	Sky Cond (1-14)	Wind (0-12)	Wind Dir (from)	Water Surface Cond (1-5)	Air Temp (°C)	Water Temp (°C)	# BC Plates	# Other Canada Plates	# Intn'l Plates	# Parties	Total # People visiting site	# invited to take survey	# prev taken survey this yr	# who decline taking survey	# completed surveys	# surveys to be mailed in	Staff Initials	Comment

#509 318 Homer Street Vancouver, BC V6B 2V2 | fax: 604 899 3805 | email: slees@elac.bc.ca

Page ___

LEES + Associates
RESEARCH & PLANNING
604 899 3806 | www.elac.bc.ca

Arrow Lakes Recreation Study – Detailed Daily Sample Summary

Date: Sample Site: Surveyor: Page ____ of ____

Total # in Group	Gender Total M/F	Age Range 1 – 10	11 – 15	16 – 20	21 – 30	31 – 40	41 – 50	51 – 60	61 – 70	71 +	Activities	Comments

Version: September 7, 2009

#509 318 Homer Street Vancouver, BC V6B 2V2 | fax: 604 899 3805 | email: elees@elac.bc.ca

Observational Data Definitions

1 - Wind Condition Definitions

2 - Water Surface Condition Definitions

3 - Forecasting Terminology

4 - Sky Conditions Definitions

5 - Air and Water Temperature Data Collection Procedures

Boat Ramp Use Study
Wind Condition
Definitions

International Description	Specifications	Beaufort Number	MPH	Knots
Calm	• Calm, smoke rises vertically	0	< 1	< 1
Light air	• Direction of wind shown by smoke drift but not by wind vanes	1	1 - 3	1 - 3
Light Breeze	• Wind felt on face • Leaves rustle • Vanes moved by wind	2	4 - 7	4 - 6
Gentle Breeze	• Leaves and small twigs in constant motion • Wind extends light flag	3	8 - 12	7 - 10
Moderate	• Raises dust, loose paper • Small branches moved	4	13 - 18	11 - 16
Fresh	• Small trees in leaf begin to sway • Crested wavelets form on inland waters	5	19 - 24	17 - 21
Strong	• Large branches in motion • Whistling heard in telegraph wires • Umbrellas used with difficulty	6	25 - 31	22 - 27
Near Gale	• Whole trees in motion • Inconvenience felt walking against wind	7	32 - 38	28 - 33
Gale	• Breaks twigs off trees • Impedes progress	8	39 - 46	34 - 40
Strong Gale	• Slight structural damage occurs	9	47 - 54	41 - 47
Storm	• Trees uprooted • Considerable damage occurs	10	55 - 63	48 - 55
Violent Storm	• Wide Spread Damage	11	64 - 72	56 - 63
Hurricane	• Wide Spread Damage	12	73 - 82	64 - 71

Source: Oregon Emergency Management Net – Net Protocol

Boat Ramp Use Study
Water Surface Condition Definitions

Water Condition	Description
1. Calm	Flat surface – some ripples, no noticeable breeze
2. Gentle	Noticeable breeze; low gentle waves
3. Small waves	Light winds – larger waves but no white caps
4. Moderate waves	Moderate winds; choppy water; white caps
5. Stormy	Strong winds; steep waves

Boat Ramp Use Study
Forecasting Terminology

Condition	Description
Duration of Precipitation	• Brief - short, sudden showers or periods of rain • Intermittent - on and off intervals, not continuous • Occasional - irregular, infrequent intervals of precipitation • Frequent - persistent short intervals, happening regularly and often • Periods of precipitation - rain or snow falling most of the time with breaks
Distribution of Precipitation, as in showers	• Isolated - showers separated during a given period of time • Few - indicated in time, not over an area • Local - restricted to a smaller area • Patchy - irregularly occurring in an area • Scattered - not widespread but of greater occurrence than isolated showers
Precipitation Intensity	• Light - each drop or small flake of precipitation can be easily seen, puddles form slowly, some water flow in gutters • Moderate - water puddles quickly, roads and other surfaces collect water, rain streams down windows • Heavy - numerous flakes or sheets of rain, large puddles form, flooding can occur, visibility reduced
Cloud Cover	• Clear or sunny - free of clouds or less than one tenth cloudy • Partly cloudy or partly sunny - three tenths to six tenths of the sky is clouded • Mostly cloudy - the sky is predominantly clouded or seven tenths to eight tenths of the sky has clouds • Cloudy or overcast - the sky is covered with clouds from nine tenths to a hundred percent cloud covered
Showers vs. Rain: A Difference of Duration and Intensity	• Rain - forms from stratus clouds, more widespread over larger area, uniformly steady, less intense • Showers - forms from cumulus clouds, more isolated, short-lived, affects a smaller area, sometimes more intense
Partly Cloudy vs. Partly Sunny	According to the National Oceanic and Atmospheric Administration there is no official difference between the two terms. One or the other may be emphasized, to help clarify the meaning of the term used.

Read more: http://weatherforecasting.suite101.com/article.cfm/meteorologist_forecasting_terms#ixzz0QBMaiiTT

Boat Ramp Use Study
Sky Condition
Definitions

Sky Condition	Description
1. Clear (Sunny)	< 10% cloud cover
2. Partly Cloudy (mostly sunny)	30 - 60% cloud cover
3. Mostly Cloudy (partly sunny)	70-80 % cloud cover
4. Overcast	≥ 90% cloud cover
5. Fog	Report visibility in tenths of a kilometer (*e.g.*, 100m, 200m, etc.)
6. Trace of Rain or Snow	Not enough to measure
7. Light Rain	from stratus (layers/blanket) clouds, more widespread, steady, less intense; each drop of precipitation can be easily seen, puddles form slowly, some water flow in gutters
8. Moderate Rain	water puddles quickly, roads and other surfaces collect water, rain streams down windows
9. Heavy Rain	numerous sheets of rain, large puddles form, flooding can occur, visibility reduced
10. Showers	forms from cumulus clouds, more isolated, short-lived, affects a smaller area, sometimes more intense
11. Drizzle	Fine consistent light rain, <1mm droplet size (no wind)
12. Light Snow	Visibility is > 1 km; often very little accumulation results
13. Moderate Snow	Visibility between 400m - 1km; < 10 cm in 12 hours
14. Heavy Snow	Numerous flakes, visibility <400m; 10 cm in 12 hrs or 15 cm in 24 hrs

Source: http://weatherforecasting.suite101.com/article.cfm/meteorologist_forecasting_terms

Boat Ramp Use Study
Air and Water Temperature
Data Collection Procedures

Field staff should take air and water temperature readings any time between 11:00 am and 2:00 pm on each survey day. First collect air temperatures then water temperatures.

Summary of procedure for air temperature readings

1. Expose the thermometer to the air yet suspended away from any other material that may affect an accurate air temperature reading. The thermometer should be sheltered from direct solar radiation and other weather related influences.
2. Allow the thermometer to equilibrate before reading.
3. Read temperature.
4. Record temperature in the field form, along with ancillary information such as site, date, and time.

Summary of procedure for near surface water temperature readings

1. Select a representative area of the water body 2m from shore and hold the thermometer directly in the water 10 cm below the surface (*e.g.,* attach thermometer to a fishing line and pole and hang so as to have thermometer bulb about 10cm below surface).
2. Allow the immersed thermometer to equilibrate before reading (hold in water about 2 minutes).
3. Read temperature. If the thermometer is unreadable while it is immersed in the water, pull the thermometer out and check the reading quickly. Do this multiple times until an accurate reading is achieved (the lowest reading for a reading from cold water when the air is hot and still, or the highest reading if the water is warm and a wind is cooling the wet thermometer).
4. Record temperature in the field form, along with ancillary information such as site, date, and time.
5. If temperature readings are unstable (which can occur in lakes or poorly mixed streams), take multiple readings.

Suggested tips for taking the water-temperature measurements

Be careful not to break your thermometer and keep it in the shade at all times. While reading temperature, avoid warming the thermometer bulb or water sample with your hands or by the sun. Read the temperature measurements to the nearest ½ degree C.

Source: Adapted from SFU Water Studies (http://www.educ.sfu.ca/nbcr/tempprot.html), and Washington State Department of Ecology Environmental Assessment Program Standard Operating Procedures for Instantaneous Measurements of Temperature in Water http://www.ecy.wa.gov/programs/eap/qa/docs/ECY_EAP-SOP_011InstantMeasureofTempinWater.pdf
Note: Thermometers used in study: waterproof pocket thermometer (-30/+50c), not calibrated.

APPENDIX E – Sampling Schedule

Arrow Lakes Summer 2012 Sampling Schedule

Day	Date	Lower Arrow Lake		Middle Arrow Lake		Upper Arrow Lake	
Monday	June 18	Syringa Creek Park Day Use	PM	Edgewood Community Park	PM	Eagle Bay	AM
Thursday	June 21	Syringa Creek Park Boat Launch	PM	Fauquier Community Park Boat Launch	AM	Shelter Bay	AM
Saturday	June 23	Syringa Creek Park Day Use	AM	Burton Historic Park	AM	Shelter Bay	AM
Wednesday	June 27	Syringa Creek Park Day Use	AM	Nakusp Beach	PM	Revelstoke Boat Launch	PM
Monday	July 2	Syringa Creek Park Boat Launch	AM	Edgewood Community Park	AM	Shelter Bay	AM
Thursday	July 5	Anderson Point	PM	Fauquier Community Park Boat Launch	AM	Revelstoke Boat Launch	AM
Sunday	July 15	Anderson Point	AM	Nakusp Boat Launch	PM	Shelter Bay	AM
Saturday	July 21	Syringa Creek Park Boat Launch	AM	MacDonald Creek Provincial Park	PM	Revelstoke Boat Launch	PM
Sunday	July 29	Anderson Point	PM	Burton Historic Park	PM	Revelstoke Boat Launch	AM
Sunday	August 5	Syringa Creek Park Day Use	AM	Nakusp Beach	PM	Eagle Bay	PM
Monday	August 6	Syringa Creek Park Boat Launch	PM	Burton Historic Park	AM	Eagle Bay	PM
Saturday	September 1	Syringa Creek Park Day Use	AM	MacDonald Creek Provincial Park	PM	Eagle Bay	AM
Sunday	September 2	Syringa Creek Park Boat Launch	PM	Nakusp Boat Launch	AM	Revelstoke Boat Launch	PM
Saturday	September 8	Syringa Creek Park Boat Launch	PM	Nakusp Beach	AM	Eagle Bay	PM
Monday	September 10	Anderson Point	AM	MacDonald Creek Provincial Park	PM	Shelter Bay	PM
Friday	September 21	Syringa Creek Park Day Use	PM	Edgewood Community Park	PM	Revelstoke Boat Launch	PM
Thursday	September 27	Anderson Point	AM	Nakusp Boat Launch	AM	Shelter Bay	PM
Friday	September 28	Anderson Point	PM	Fauquier Community Park Boat Launch	AM	Eagle Bay	AM

Summer sampling hours
AM: 8:00 am to 2:00 pm
PM: 1:00 pm to 7:00 pm

Arrow Lakes Fall 2012 Sampling Schedule

Day	Date	Lower Arrow Lake		Middle Arrow Lake		Upper Arrow Lake	
Wednesday	October 3	Syringa Creek Park Boat Launch	PM	Nakusp Beach	PM	Revelstoke Boat Launch	AM
Monday	October 8	Anderson Point	PM	Edgewood Community Park	PM	Shelter Bay	PM
Saturday	October 13	Syringa Creek Park Boat Launch	AM	Nakusp Boat Launch	AM	Eagle Bay	PM
Sunday	October 21	Anderson Point	PM	Fauquier Community Park Boat Launch	PM	Revelstoke Boat Launch	AM
Monday	October 29	Syringa Creek Park Day Use	AM	MacDonald Creek Provincial Park	AM	Shelter Bay	PM

Fall sampling hours
AM: 8:30 am to 2:30 pm
PM: 10:30 am to 4:30 pm

Kinbasket Summer 2012 Sampling Schedule

Day	Date	Sample Site			
Monday	June 18	Valemont	PM	Bush Harbour	PM
Tuesday	June 19	Valemont	AM	Bush Harbour	PM
Saturday	July 21	Valemont	PM	Bush Harbour	PM
Sunday	August 26	Valemont	PM	Bush Harbour	AM
Monday	September 3	Valemont	AM	Bush Harbour	PM
Thursday	September 6	Valemont	PM	Bush Harbour	AM
Friday	September 14	Valemont	AM	Bush Harbour	AM

Summer sampling hours
AM: 8:00 am to 2:00 pm
PM: 1:00 pm to 7:00 pm

Kinbasket Fall 2012 Sampling Schedule

Day	Date	Sample Site			
Wednesday	October 24	Valemont	AM	Bush Harbour	AM

Fall sampling hours
AM: 8:30 am to 2:30 pm
PM: 10:30 am to 4:30 pm