

2005 Fish Survey in Recently Dewatered Western Irrigation District Canals

Prepared for:

Western Irrigation District
Strathmore, Alberta
T1P 1C1

Prepared by:

Aquality Environmental Consulting Ltd.
11216 23B Avenue NW
Edmonton, Alberta
T6J 4Z6

Jay S. White, M.Sc., P. Biol.

November 2005



11216 23B Avenue NW ~ Edmonton, Alberta ~ T6J 4Z6 ~ www.aquality.ca

LETTER OF TRANSMITTAL

Date: November 28, 2005

**To: Mr. Jim Webber, General Manager
Western Irrigation District
201 Pine Road
Strathmore, Alberta
T1P 1C1**

Re: 2005 Fish Survey in Recently Dewatered Western Irrigation District Irrigation Canals

Attention: Mr. Webber

Aquality Environmental Consulting Ltd. is pleased to present the following survey of fish in WID Canals A and B downstream of Chestermere Lake following the 2005 fall dewatering. Fewer fish were captured this year, but the mean size of fish was greater than in 2004.

The new flow measuring flume in Canal A has the potential to strand fish during dewatering if not properly timed. This combined with the high visibility of the site may create undesirable public relations consequences. Recommendations to minimize fish entrapment in the WID canal system were developed and presented in this report.

If you have any questions or comments regarding this report, please contact our office at (780) 433-9414.

Regards,

AQUALITY ENVIRONMENTAL CONSULTING LTD.

Per: _____
Jay S. White, M.Sc., P.Biol.
Principal

Table of Contents

1.0 EXECUTIVE SUMMARY	3
2.0 INTRODUCTION	4
3.0 METHODS	4
4.0 RESULTS	7
4.1 RESULTS SUMMARY.....	7
4.2 DETAILED SITE DESCRIPTIONS	7
5.0 CONCLUSIONS AND RECOMMENDATIONS	9
5.1 SUMMARY OF FISH COLLECTIONS	9
5.2 SIGNIFICANCE OF FINDINGS.....	10
5.3 REMEDIATION OPTIONS.....	11
6.0 REFERENCES CITED.....	13

1.0 Executive Summary

Headwater canals within the Western Irrigation District irrigation system were sampled for fish by AQUALITY Environmental Consulting Ltd. on October 4 and 5, 2005 following the annual fall canal dewatering. The purpose of this work was to (i) identify the species of fish occurring in the canals, (ii) quantify fish from pre-selected pools, (iii) comment on the condition of fish, (iv) comment on the significance of the number of fish collected, and (v) suggest potential remediation measures to minimize fish loss. Several sites along canal A and B were inspected downstream of Chestermere Lake, and five holding locations (pools) were sampled.

Five sites were sampled in 2005 including two new sites and three sites sampled in previous years. The new sites included a spot immediately upstream of a new flow measuring flume in canal "A" and on the east side of Hwy. #1 (Figure 1) in canal "B." Fish were collected from all five sites. Lake Whitefish (*Coregonus clupeaformis*), was the most abundant fish species found in the canal system, followed by Yellow Perch (*Perca flavescens*). Other fish found in the survey included White Sucker (*Catostomus commersoni*), Northern Pike (*Esox lucius*), Rainbow Trout (*Oncorhynchus mykiss*) and Brown Trout (*Salmo trutta*). Small numbers of Spoonhead Sculpin (*Cottus ricei*) and Burbot (*Lota lota*) were also collected. There was an abundance of the freshwater shrimp *Gammarus* found, comprising roughly 95% of the invertebrates collected.

The majority of fish collected were in good health, with no apparent lesions or ectoparasites. The number of fish collected increased slightly in 2005 from 2004 but species diversity has declined. Fish sizes (fork length) increased in 2005 in comparison to 2004. Continued sampling and expanding the sampling sites to lower reaches of the canal system will be required to determine if the amounts of fish collected accurately represent the numbers and species of fish trapped in the system. Further study will also be required to determine if fish loss in the canals have a significant impact on local populations. Some suggested solutions to minimize fish entrapment in the WID canal system are to:

- (i) exclude fish from entering into the canal works,
- (ii) coordinate operation of internal WID infrastructure to minimize fish stranding,
- (iii) eliminate deep pool habitat within the canal system that fish find favorable,
- (iv) rescue fish from concentrated, predictable locations for re-release back into the Bow River following fall dewatering,
- (v) provide a flushing process to herd the fish into deeper water bodies, or
- (vi) continue to monitor and report on the status quo.

2.0 Introduction

The Western Irrigation District (WID) has been providing water to agricultural operators in southern Alberta since 1907. Water is withdrawn by a diversion structure on the Bow River immediately downstream of the Calgary Zoo. The Bow River water source is world-renowned for its blue-ribbon trout fishery, and boasts over 3000 trout per mile of river (McLennan 1998). The growth of the Bow fishery began with Rainbow Trout stocking efforts in the mid-1920's, which parallels the timelines of irrigation growth. Several species of fish make their way into the WID canal system through the diversion. Diverted waters flow through the Canals east to Chestermere Lake, then flow southeast to Langdon, Strathmore and Gleichen, and north and east toward Standard and Rockyford. It is not currently known how many fish make their way into the WID diversion or how many of these become trapped in the WID irrigation canal system.

To gain some understanding of the magnitude of potential impact to fish from the fall dewatering, the WID hired *Aquality* Environmental Consulting Ltd. (*Aquality*) to identify and quantify fish stranded following the normal fall dewatering (i.e. when diversion activities cease and canals are allowed to run dry) in October of 2004. Canal dewatering typically occurs around the Canadian Thanksgiving weekend in October, and draining of the canals can take up to a week. The majority of fish inhabiting the canals are assumed to move to the safety of deeper waters or reservoirs within the canal system such as Chestermere Lake, Langdon Reservoir and Bruce Lakes during the dewatering process. However, some fish do remain behind in the deeper pools within the canals. The purpose of this work was to (i) identify the species of fish encountered, (ii) quantify fish encountered, (iii) comment on the condition of stranded fish, (iv) comment on the significance of the amounts of fish stranded, and (v) suggest potential remediation measures. *Aquality* has similar data from studies in 2002 – 2004, so the common sites will be compared to the results from those years.

3.0 Methods

Headwater canals within the Western Irrigation District were sampled by *Aquality* Environmental Consulting Ltd. on October 4 and 5, 2005 following the fall canal dewatering. Fish capture was authorized by Fish Research License No. **05-1516-FR**. Sites immediately downstream of Chestermere Lake were selected along canals A and B. Three sites were identified by WID operations staff, based on the sites that had fish in the three previous years of sampling, plus two additional sites which had deep enough water to hold fish (Figure 1). Deep water was typically found immediately downstream of large drop-structure where a plunge pool

was an integral part of energy dissipation. Collected fish were released back into Chestermere Lake, where deeper water will provide a better chance for winter survival (Figure 2).

Pocket seine nets and block nets (50' long by 4' deep, mesh size approximately 1/8") were used to block downstream passage of fish (where necessary), while pools were seined with a smaller (4'x4'x4', mesh size approximately 1/8") two-man pocket seine net (Figure 3). Seine net hauls were made through the sites until fish were no longer collected. Seining was effective at sites that were less than 1m deep, and less effective at increasingly deeper sites. A variable mesh gill net (mesh size approximately 6" to 1/2") was used at the deepest site that was inaccessible by seine net.

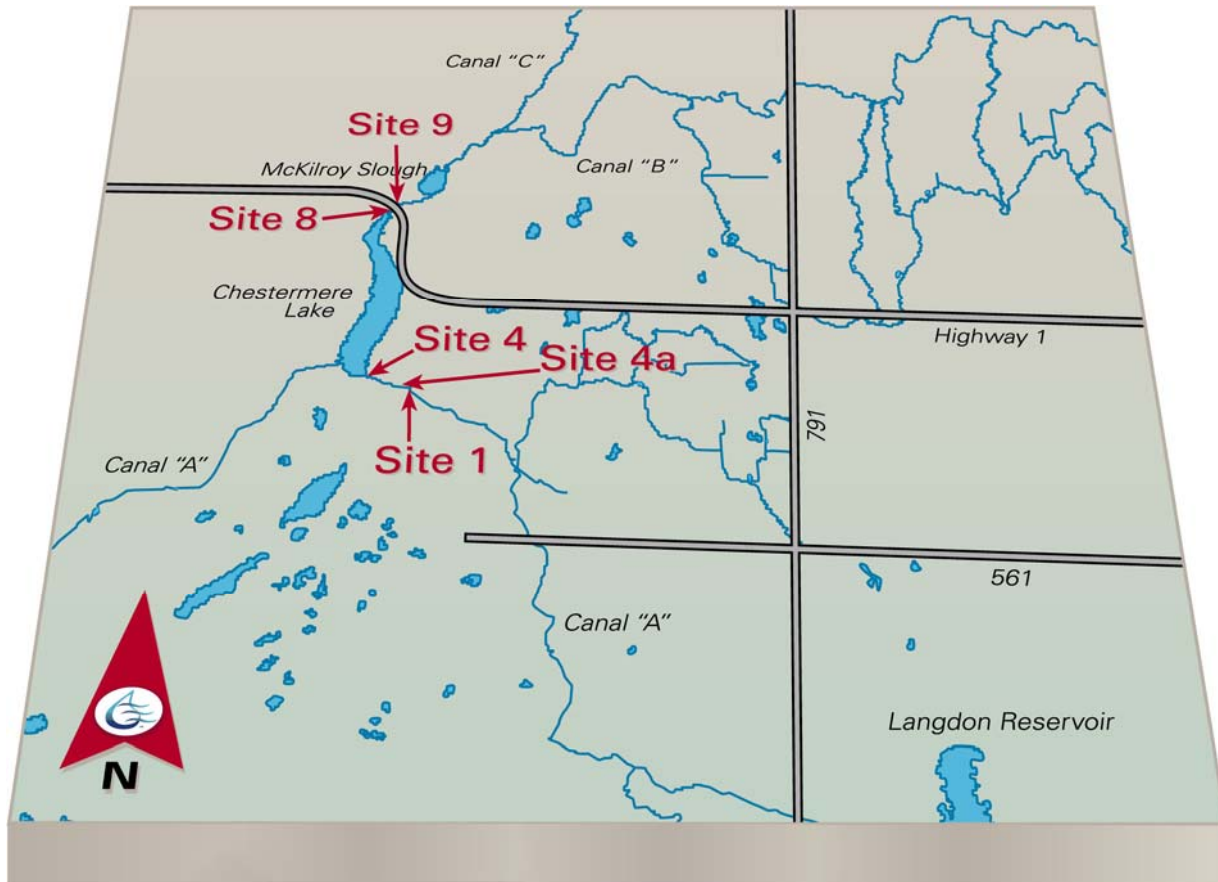


Figure 1: Sites sampled by *AQUALITY* on October 4 and 5, 2005 along dewatered WID canal headwater sites.



Figure 2: Western irrigation staff live-releasing rainbow trout into Chestermere Lake after capture and measurement.



Figure 3: Seining in a easterly direction along Canal A immediately upstream of the new measuring flume. Wes Sproule (centre) and Dwight Gittel (right) use a seine net in the shallow waters of Canal A while Jay White observes.

4.0 Results

4.1 Results Summary

The five sampling locations visited on October 4 and 5, 2005 appear in Figure 1. Sites were visited by Jay White, Gary Kindrat, Wes Sproule and Dwight Gittel. A results summary of fish numbers collected appears in Table 1. Fish were collected from all five sites visited. Four sites immediately downstream of Chestermere Lake (Sites 1, 4, 4a and 8) contained the majority of fish found on canals A and B. Three locations were previously sampled in 2004, of which two are long term sites. Sampling at pre-existing sites involved the same methodology. When comparing two sites with fish in both years (Sites 1 and 8), there was a 54% percent decline in fish collected this year (Figure 6). Two species, Spoonhead Sculpin and Burbot were collected this year that were absent in previous years. No Spottail Shiners were collected in 2005. Large numbers of the aquatic invertebrate *Gammarus* were present in the water and captured within the nets, which accounted for an estimated 95% of invertebrates seen.

Table 1: Numbers of fish seined by *AQUALITY* on October 5 and 7, 2005 along eight dewatered WID canal headwater sites.

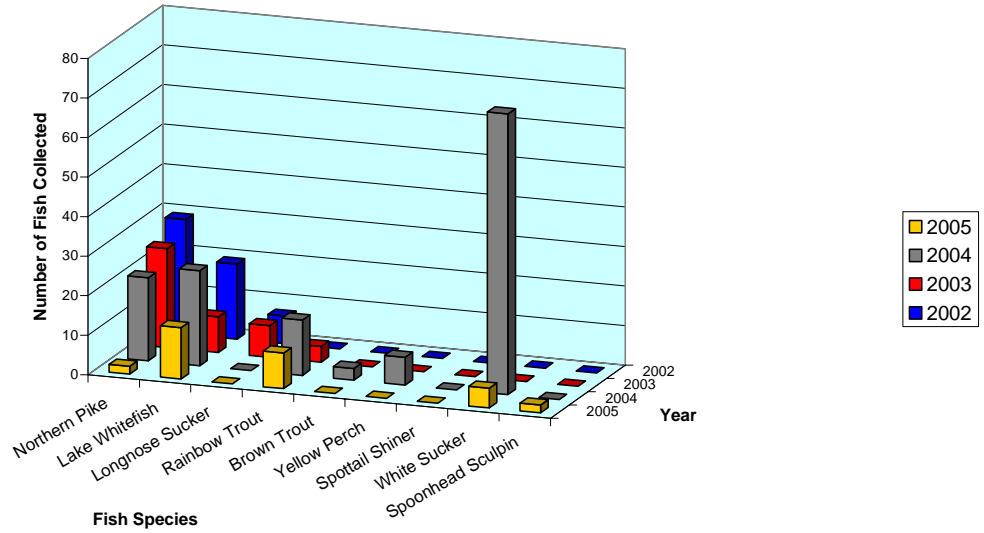
Site	Northern Pike	Lake Whitefish	White Sucker	Rainbow Trout	Brown Trout	Yellow Perch	Spoonhead Sculpin	Burbot
1*	2	13	5	9	0	0	2	0
4*	5	8	7	0	32	0	2	1
4a	12	51	21	0	0	44	0	0
8*	12	0	0	0	4	0	0	0
9	3	0	0	2	0	0	0	0

4.2 Detailed Site Descriptions

Site 1: Seine samplings were limited to upstream of the deepest waters, where nets were effective and could touch bottom. The large, deep pool under the railway tracks was inaccessible to seine netting. Gill nets were used under the railway crossing bridge, and fish were removed from the nets immediately to minimize fish mortality.

Site 4: Canal A Headgates were replaced in January 2005 with automated gates. A small shallow, isolated pool located downstream from the headgates was seined repeatedly. When comparing only the amount of area searched between sites, site 4 produced the highest number of fish.

Site 1 Comparison of Species Collected 2002-2005



Site 8 Comparison of Species Collected 2002-2005

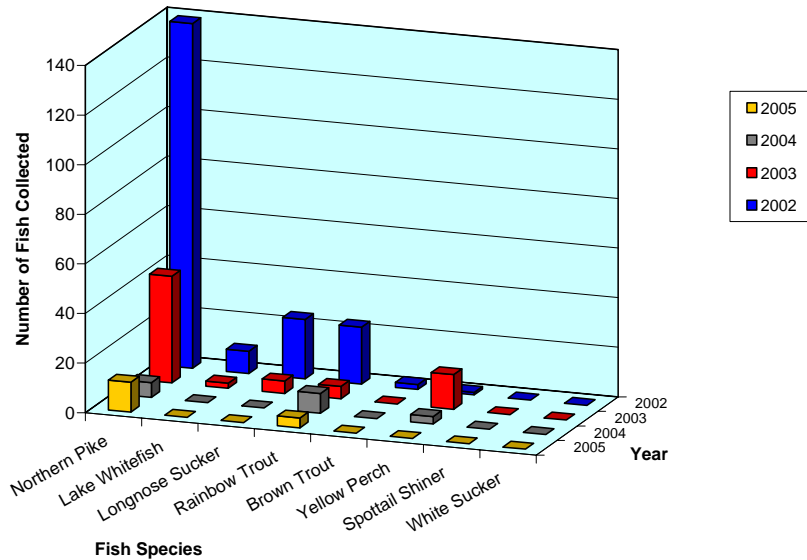


Figure 6: Comparison of numbers and fish species collected in 2002 - 2005 inclusive for Sites 1 (top) and 8 (bottom).

Site 4a: A new site in 2005. A measuring flume in canal A located between Site 1 and Site 4 was constructed in the winter of 2004-2005. The upstream side of the flume (approximately 50m) was seined October 4 and October 5 to take advantage of the lower water level from the day before. Heavy weed growth made it difficult for the seine to reach the bottom of the canal. A gate located on the new flume allows upstream water pass through the flume during dewatering of the canal. Operation of this gate needs to be timed so fish are not trapped between the two structures (headgate & measuring flume) during dewatering. However, water levels on the downstream side of the flume need to be sufficient to prevent fish from being stranded. A few large white fish and numerous northern pike were stranded overnight (Oct 4-5) as fish passed through the flume gate to lower water levels on the downstream side of the flume.

Site 8: Samplings were taken immediately downstream of canal B headgates before the canal is piped under Highway 1. The deepest pool was found below a large culvert draining into the canal on the south side. The pool was not isolated, and the water depth was 1-2 m throughout. Large rocks on the canal bottom may have prevented us from thoroughly sampling this site.

Site 9: This site is one of two new sites in 2005 and is located on the east side of TransCanada Highway as water exits the culverts which separates site 8 and 9. The water depth was 1-2 m with large angular rock lining the bottom of the canal. The sampling site was not an isolated pond but rather a continuous water body that connected to McElroy Slough. A variable mesh size gill net was use to sample the pool created by water exiting the culverts. Staff entered the canal downstream of the sampling site and walked towards the net in an attempt to herd fish into the gill net.

5.0 Conclusions and Recommendations

5.1 Summary of fish collections

Five sites along the upper headwaters of the Western Irrigation District canal system downstream of Chestermere Lake were inhabited by fish. Fish species collected (in order of abundance) were: Lake Whitefish (*Coregonus clupeaformis*); Yellow Perch (*Perca flavescens*); Northern Pike (*Esox lucius*); White Sucker (*Catostomus commersoni*); Brown Trout (*Salmo trutta*); Burbot (*Lota lota*) Rainbow Trout (*Oncorhynchus mykiss*); Spoonhead Sculpin (*Cottus ricei*) and Burbot (*Lota lota*). Spottail Shiners (*Notropis hudsonius*) were absent in the 2005 collections. There were 9% more fish collected in 2005 when compared to 2004, and the average fish size was larger. Most fish collected were in good condition, and had no obvious lesions or ectoparasites.

5.2 Significance of findings

Assuming that all of the fish collected in this survey would die throughout the winter months if left in the canal, it is likely that the species and proportions of fish collected in this survey represent the species and proportions of fish removed from the system yearly (i.e. mostly White Sucker, Northern Pike, Lake Whitefish and to a much lesser extent Rainbow Trout, Brown Trout Yellow Perch, Spoonhead Sculpin and Burbot). Four years of data collection is beginning to reveal that distribution of the fish is highly variable site to site and from year to year while species collected remains reasonably consistent. Expanding the program to include additional sampling sites further downstream in the canal system would test the assumption that fish distribution and species composition is similar throughout the system. Overall numbers of fish collected in 2005 were greater than from 2004 for all species at Site 1, except for the absence of Longnose Sucker and Spottail Shiners. Spoonhead sculpins were added to the species found at Site 1 which had an overall decrease in numbers of all fish species captured.

Our repeated seine samplings of isolated pools < 1m deep were quite effective in removing fish, however deeper sites were less effectively sampled. Further, it is quite possible that the majority of fish that are stranded in the WID canals are in the deeper pools that were the most difficult to sample. If this is true, then the number of fish trapped in deeper pools may be underestimated. Some of the deep pools may provide for winter survival for some species, and so we cannot confirm that all fish trapped in these pools are lost. Salvage licences from Sustainable Resource Development allow fish harvesting on some canal waters, which provides the local community with fish for a food source. Although the irrigation system lands are on private property, the sites are remote and the public are not bound to inform the WID of their fish salvaging activities.

To properly determine how many fish may be trapped in WID canals, future studies should identify how many deep pools exist in canals A, B, and C, and should quantify how many fish there are on average within each pool (by performing mark-recapture studies within these pools). With this information, the number of fish stranded in deep pools of the WID system could be more accurately quantified. Backpack electroshocking and boat electroshocking could be considered for future sampling undertakings. The estimated total number of fish trapped along the entire canal network could then be compared to the source populations. To assess whether or not the loss of fish would have a significant impact on the population, each species will have to be addressed individually.

The Northern Pike collected in this study are likely to have originated from Chestermere Lake, which has an established pike fishery (Council 2001). This may explain why we see large

numbers of small pike downstream of the lake. As well, due to the multiple age-classes of pike in Chestermere Lake (Council 2001), we can assume that pike safely over winter there. Because pike find shallow water to be suitable habitat, they will tend to remain in the canals as they are dewatered. Therefore, this species will likely be the most abundant following canal dewatering, and potentially be the species most adversely affected. By not including a measure of the abundance of these fish throughout the canal system, we are likely to underestimate pike stranding. In this case, the underestimate is potentially very high because there are very long stretches of shallow water. Although pike were not caught at every site in this study, there existed suitable habitat for pike at every site visited.

The trout species collected in this study are likely to have originated from the Bow River, entering the canal at the WID headworks diversion. The Bow River contains a managed trout fishery, with different regulations for eight different sections of the River (Alberta Sustainable Resource Development 2005). There are specific regulations for catch limits specified for all trout species. The loss of the small number of fish identified in this survey are likely negligible when compared to the larger Bow River fishery. As well, the impacted fish populations were limited to a few localized deep pockets downstream of Chestermere Lake. The age of the trout observed (most were mature fish, 2 to 3 years of age) also raises the question of long-term trout survival within the system. We cannot assume that all fish collected in our study were not in the canal system last year. The apparent lack of smaller, younger trout may be attributed to the abundance of pike preying on these fish throughout the canal system. The presence of young Yellow Perch suggests the conditions in Chestermere Lake are favorable for Perch recruitment.

5.3 Remediation options

There are several options for remediating the loss of fish in dewatered canals, if it is shown that the loss of these fish causes an adverse effect on fish populations. Remediation measures for Northern Pike will be much more difficult than for any other species, because they were found spread throughout the canal system. Coldwater trout species however, were found concentrated in more predictable locations (i.e. the deepest pools). Further, the source of the fish in the canal system is most likely from both outside the canal system (trout from the Bow River) and from within the system (Northern Pike and White Suckers from the reservoirs along the Canal).

The suggested solutions to minimize fish entrapment in the WID canal system would be to:

- (i) exclude fish from entering into the canal works, though a major Provincial investment may not be warranted based upon the apparent fish loss,
- (ii) coordinate operation of internal WID infrastructure to minimize fish stranding,

- (iii) eliminate deep pool habitat within the canal system that fish find favourable if the structural requirements allow,
- (iv) rescue fish from concentrated, predictable locations for re-release back into the Bow River following fall dewatering if the fish can stand the stress of handling,
- (v) provide a flushing process to herd the fish into deeper water bodies, or
- (vi) continue to monitor and report on the status quo.

The three types of fish exclusion structures would utilize physical and behavioral methods, as well as a combination of the two. While the most logical place for a fish exclusion structure is at the WID diversion structure at the Bow River, having exclusion screens at the outflows from Chestermere Lake may also be effective at keeping coldwater (trout) species out of the rest of the system. However, these screens may not be effective for young cool water (pike, perch and sucker) species.

If deep pool habitats are eliminated below drop structures, it may encourage fish to move to safe deep waters during fall dewatering (i.e. within Chestermere Lake or Langdon Reservoir). Deeper pools could be filled in with rocks to decrease their depths and make them less favourable to fish. However, this cannot be considered at sites where the pool depth is an integral part of energy dissipation. Further, this may need to be reconsidered if it is shown that fish are overwintering in some of the deepest pools. If the majority of fish trapped in dewatered canals can be identified as originating from a few, predictable pools, then a local fish rescue operation may mitigate some fish losses. How such an arrangement would work on WID private lands, for an operation that is outside of its irrigation mandate, would require further discussion with interested partners.

Chemical astringents used for fish “herding” may be released into the canal head works at the start of the dewatering phase to move the fish downstream to deeper water bodies. This would work well for Site 8, as the McElroy slough is immediately downstream. This may also be an effective method to move fish from deeper pools to shallower locations downstream where they would be more easily captured.

Continuing to monitor and report on the status quo is also an option. The number of fish captured in this study and assumed to be lost would not indicate a major problem. Accepting some amount of operational loss has been the practice for the last 90 years. However, the WID intends to continue monitoring fish populations within the canals and to observe year to year variance. The findings from this report and the previous three reports will provide a basis to measure future change and make management decisions.

6.0 References Cited

Alberta Sustainable Resource Development. 2005. Alberta Guide to Sportfishing Regulations. Alberta Sustainable Resource Development, Edmonton. 54 p.

Council, T.C. 2001. Investigations into Northern Pike (*Esox lucius*) status in prairie region reservoirs, Alberta. Alberta Conservation Association, Lethbridge, Alberta. 142 p.

McLennan, J. 1998. Blue Ribbon Bow. Johnson Gorman Publishers, Red Deer Alberta. 184 p.