EAST INTERLAKE CONSERVATION DISTRICT: WASHOW BAY CREEK WATERSHED RIPARIAN ASSESSMENT SURVEY – WITH EMPHASIS ON THE WASHOW BAY CREEK AND ASSOCIATED DRAINS - 2007

A Report Prepared
for

by

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2007

EXECUTIVE SUMMARY

The study area for the Washow Bay Creek watershed riparian assessment survey included Washow Bay Creek and the following third order drains: Angle; Ben Johnson; Bump; Hodgson (Sugar Creek); Okno; Petrachek; and Progress.

No historical hydrometric or water quality information was available for: Washow Bay Creek; Angle Drain; Ben Johnson Drain; Bump Drain; Hodgson Drain(Sugar Creek); Okno Drain; Petrachek Drain; or Progress Drain.

A historical review indicated that at least five families of fish, representing nine species, utilize the Washow Bay Creek watershed. None of these species are listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as endangered, threatened, or special concern.

A total of 536 larval fish (primarily suckers) were captured at two locations along Washow Bay Creek, 2006. These results indicate that spawning suckers can migrate up the Washow Bay Creek approximately 23 km.

A total of 119 fish, representing five families and six species, were captured throughout the Washow Bay Creek watershed during the summer of 2006. The majority of these fish were central mudminnow, followed by white suckers and northern pike. The white suckers captured on the Hodgson Drain and Washow Bay Creek represented young-of-the-year and juvenile stages for this species, respectively. Young-of-the-year northern pike were captured on the Washow Bay Creek. Data suggested that northern pike spawned at least 23 km upstream on Washow Bay Creek in 2006.

During spring 2007, a total of 327 fish, representing three species, were captured in one hoop net set in Washow Bay Creek. White suckers accounted for the majority of the catch (n = 200), followed by northern pike (n = 111), and walleye (n = 16).

Approximately 73 km of the Washow Bay Creek watershed were classified according to land use/land cover. Approximately 40 km of this classification was conducted along the mainstem of the Washow Bay Creek. Representative flights, and subsequent land use classifications, were completed along the Angle (2 km), Ben Johnson (3 km), Bump (8 km), Okno (3 km), Petrachek (6 km), and Progress (7 km) drains. The lower 4 km of Sugar Creek were also flown.

Throughout the Washow Bay Creek study area, pasture/grazing (32%) and cropland (20%) composed the greatest land use/land cover. Hayland (15%), non-forested wetland (14%), mixed forest land (11%), other agricultural land (5%), and deciduous forest land (3%) composed the remaining classifications. When combined, approximately 72% of the land use/land cover throughout the study area was classified as anthropogenic in origin, and the remaining 28% was in a natural state or had not necessarily been altered by anthropogenic means.

Approximately 73 km of the Washow Bay Creek study area were rated according to habitat quality. Highly impacted areas (Class C) comprised the largest segment (59%), followed by: severely impacted (Class D, 23%); minimally impacted areas (Class A, 13%); and moderately impacted (Class B, 3%).

Approximately 40 km of Washow Bay Creek were rated according to habitat quality. Highly impacted areas (Class C) composed the largest segment (49%), followed by: severely impacted (Class D, 34%); minimally impacted (Class A, 11%); and moderately impacted areas (Class B, 6%).

With the exception of two beaver dams and two fords, no major barriers to fish migration were observed throughout the Washow Bay Creek watershed.

Based on review of the aerial video, historical information, and groundtruthing, 23 potential rehabilitation sites were identified within the Washow Bay Creek watershed and were prioritized on a scale from one to three.

ACKNOWLEDGMENTS

Manitoba Water Stewardship Fisheries Branch (Winnipeg) is thanked for conducting a search of the Fisheries Inventory and Habitat Classification System.

Manitoba Water Stewardship Fisheries Branch (Gimli) and the East Interlake Conservation District are thanked for providing field assistance and support during the spring, 2007, fish utilization component of this study.

Fieldwork described within this report was conducted under Scientific Collection Permit #'s 18-06 and 02-07 issued to North/South Consultants Inc. by Manitoba Water Stewardship, Fisheries Branch.

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1.0 INTRODUCTION

The use of water in Manitoba for such practices as agriculture, urban expansion and development, and recreation has severely taxed this valuable commodity. Recent policy developments (The Manitoba Water Strategy, 2003; *Water Protection Act*, proclaimed in 2006) focus on a number of water protection strategies, with a focus on watershed planning and a reduction in nutrient loading to Lake Winnipeg.

With funding obtained by the Manitoba Fisheries Enhancement Initiative fund and the federal Stewardship in Action fund, the East Interlake Conservation District (EICD) retained North/South Consultants Inc. to conduct the *Washow Bay Creek Watershed -Riparian Assessment Survey.* The primary objective of this survey was to provide the EICD board with a comprehensive overview of riparian and land use conditions affecting 3rd order drains (and higher) within the Washow Bay Creek watershed (Washow Bay Creek and Angle, Ben Johnson, Bump, Hodgson (Sugar Creek), Okno, Petrachek, and Progress drains). Specific objectives of the assessment included:

- To identify and assess the quality of riparian and aquatic ecosystem habitat;
- To identify barriers to fish passage and migration;
- To identify utilization of recreationally important fish species in the watershed; and
- To provide a list of potential fisheries-based projects for future works within the Washow Bay Creek watershed.

This report provides baseline aquatic habitat and riparian conditions pertaining to the Washow Bay Creek watershed, as well as areas that may be stressors on this watershed. It can act as a resource tool for continued watershed management and water quality improvements.

2.0 METHODS

2.1 REVIEW OF HISTORICAL INFORMATION

2.1.1 Physical and Hydrological Information

The Environment Canada web page (www.msc.ec.gc.ca/wsc) was reviewed for historical hydrological data along the Washow Bay Creek watershed.

Using a USGS digital elevation model (DEM), an elevation profile was generated along Washow Bay Creek. The profile was produced by intersecting points along the Washow Bay Creek polylines with 90 m Shuttle Radar Topography Mission (SRTM) USGS DEM, using Spatial Analyst extension in ESRI ArcGIS® v.9.

2.1.2 Water Quality

The Water Quality Management Section, Manitoba Water Stewardship (WQMS 2006), was queried for water quality records relating to the Washow Bay Creek watershed. Library and internet searches were also conducted for existing documentation.

2.1.3 Fish Species Utilization

Historical fish utilization in the Washow Bay Creek watershed was documented by querying the Manitoba Water Stewardship - Fisheries Branch (MWSFB) office in Winnipeg. The MWSFB Fisheries Inventory Habitat Classification System (FIHCS) was also searched. Where possible, interviews were conducted with local landowners and tenants who live within the watershed.

2.2 FIELD SURVEYS

2.2.1 Aerial Videography

Taiga Air Services (Winnipeg) was chartered to collect aerial video from a helicopter using a digital nose-mounted camera and Red Hen System Media-Mapper software. This application produced real-time geo-referenced video and digital still images that were then

integrated into a Geographic Information System (GIS). In-flight, real-time Geographic Positioning System (GPS) coordinates, altitude, speed and track information were encoded into the digital video and images were captured from the onboard, nose-mounted camera. Specific points of interest (e.g., dams, fords, etc.) along the video flight route were marked as integrated video waypoints.

Aerial surveys of Washow Bay Creek and associated drains (third order and higher) were conducted on September 22, 2006. Depending on width of channel, surveys were conducted at elevations between 500 and 600 m.

2.2.2 Groundtruthing

Classification of physical characteristics via aerial video is often difficult due to a number of factors including, but not limited to, elevation, atmospheric conditions, and ground cover. Therefore, wherever possible, areas of the Washow Bay Creek watershed were groundtruthed to ensure classification accuracy. Groundtruthing also allowed for collection of ground-based photographs and review of potential mitigation sites. Groundtruthing sites were selected during analysis of the aerial video and visited during the fisheries and invertebrate surveys.

2.2.3 Physical and Hydrological Information

To provide a general understanding of stream morphology and substrates in the various branches of the watershed, a number of sampling locations were selected during the field investigations for measurement of cross-sectional profiles and water velocities, and characterization of substrates. Substrate types were assessed based on a modified Wentworth classification, as outlined in Bain and Stevenson (1999). Water velocity was measured with a Model 1210, Price Type "AA" current meter.

2.2.4 Water Quality

In conjunction with groundtruthing and fish utilization surveys, basic water quality parameters were measured *in situ* (i.e., in the field) with a Horiba U-10 water quality meter. The parameters measured included: dissolved oxygen; conductivity (measured as specific conductance); temperature; pH; and turbidity. In some locations, water temperature was measured with a hand-held alcohol filled pocket thermometer.

2.2.5 Fish Species Utilization

2.2.5.1 Spring 2006

One hoop net (1.2 m in diameter, constructed of 6.45 cm^2 nylon mesh, and 10.0 m long wings) was deployed from May 8 to 10 to capture fish moving in an upstream direction. All fish captured were identified to species, measured for fork length (± 1 mm) and weight (± 25 g), classified by sex and state of maturity, and released.

Larval drift traps were deployed from May 8 to 10 to capture drifting eggs and/or recently emerging larval fish. The larval drift traps used for this study had an opening 15 x 15 cm, and a 1 m long cod end constructed of 500 µm Nitex mesh. Fine mesh dip nets (500 µm Nitex mesh) were also used to capture drifting larval fish.

Where possible, visual inspections for fish presence were conducted along stream reaches.

2.2.5.2 Summer 2006

Fish use within the Washow Bay Creek watershed was assessed on July 11. Methods included back-pack electrofishing (Smith-Root Model 15-C) (Photo 1), dip netting, and visual surveys.

Photo 1. Example of back-pack electrofishing unit, Smith-Root Model 15-C.

Sampling was conducted at sites throughout the watershed where access was available, or near the fishing sites sampled in the spring. All fish collected were identified to species and released. Some of the larger-bodied fish were measured for fork length (± 1 mm). A number of the small-bodied fish were preserved in the field (10% formaldehyde solution) for subsequent identification.

2.2.5.3 Spring 2007

One hoop net was used to capture fish moving into Washow Bay Creek from April 11 to 19. Net dimensions and fish sampling techniques are described in Section 2.2.5.1.

2.2.6 Benthic Invertebrate Collection

Because macroinvertebrates respond to a range of stream disturbances (e.g., sedimentation, heat pollution, nutrient loading, chemicals, etc.) they can be used to determine aquatic ecosystem health and integrity (Gibbons et al 1993; Milner and Roberts 1997). However, successful assessments require knowledge of the life cycles of aquatic insects, specific tolerance levels of individual species, and well established sampling protocols (e.g., number of stations, time of sampling, habitat stratification, etc.) (Milner and Roberts 1997; USDA 1998)

Sampling methodology was developed to provide a broad, repeatable characterization (i.e., rapid bio-assessment technique) of the benthic macroinvertebrate fauna of Washow Bay Creek. Sites were selected in the vicinity of existing water quality stations (if possible), and kick net sampling was performed across the entire width of the stream in those locations where the water was shallow enough to permit wading in order to maximize the diversity of habitat types. If sites were not wadeable, sampling locations were selected along the shoreline of the stream. Where the water was too deep and/or fast for a kick net sampler, samples were collected from a bridge or boat using a Tall-Ekman, within a 1 km area of the water quality station. A total of five samples were taken from each sampling site on October 19, 2006.

Photo 2. Kick net used and sampling technique deployed to capture invertebrates.

The kick net was constructed of 500 µm nitex mesh, having an aperture of approximately 0.25 m^2 (Photo 2). The field technician stood in the selected site area with their back facing upstream, kicking up the substrate and then sweeping above the disturbed area to capture dislodged or escaping invertebrates into the kick net. The technician passed over an area of approximately 5m^2 twice in a standard time interval (e.g., 5 minutes), emptying the net contents into a bucket frequently to reduce sample loss and net clogging.

The Tall-Ekman dredge had a 0.023 m^2 opening and attached lead weights to assist in substrate penetration when lowered from a bridge or boat.

Prior to preservation in the field (10% formaldehyde solution), invertebrate samples were rinsed through a 500 µm sieve and placed in individually labelled jars. Invertebrates were then identified to family and enumerated in the lab.

2.3 WATERSHED CLASSIFICATION

Aerial video and groundtruthing data were used to classify predominant land use practices and aquatic habitat quality along reaches of the Washow Bay Creek watershed. In each case, reach boundaries were identified by an obvious change in classification attributes when they extended at least two active channel widths on each side. Potential barriers to fish movement were also identified and classified. The following provides a description of the classification processes and methods.

2.3.1 Land Use/Land Cover

Land use/land cover in the watershed was classified based on visual interpretation of the aerial videography. Land use is defined as usage of land (agriculture, recreation, urban, etc.), whereas land cover is simply what is covering the surface (wetland, deciduous forest, etc.) (Remote Sensing Resources 2006). Interpretations of land use/land cover were based on the identification of patterns, textures, colours, and contrasts visible on the landscape being viewed. Where possible, groundtruthing was used to assist in these interpretations.

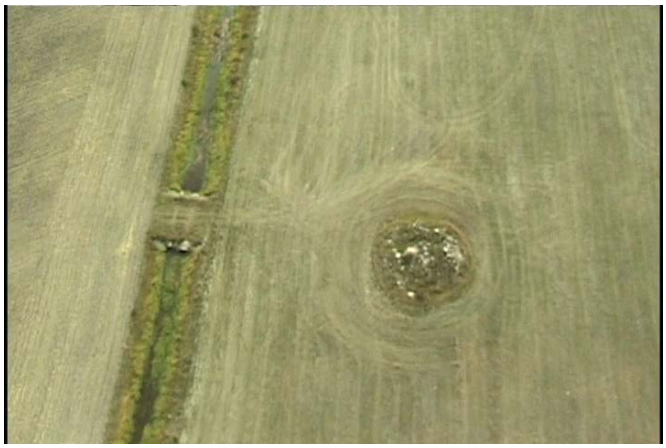
Land use/land cover within the Washow Bay Creek watershed was delineated into ten general categories as outlined below. The categories were developed by North/South Consultants Inc. based on the predominant land use practices found in the east-Interlake and by implementing classifications described by Anderson et al. (1976). The categories focused on reaches of the watercourses and the predominant land use adjacent to them. Although the reaches classified often incorporated more than one land use/land cover type, classification of each reach was based on the most intensive use within the area.

Residential/Commercial: Anderson et al. (1976) define residential as the multiple unit structures of urban cores to houses on lots of more than one acre. Generally, residential strips have uniform size and spacing of structures, linear driveways, and lawn areas. Examples of residential areas are towns or the recently developed ‘suburbs’ of these small towns. The Commercial classification outlines areas used for the sale or production of goods

and services, and may include: warehouses; waste disposal areas; strip developments; junkyards; etc.

Other Agricultural Land: This category is applied when separate land uses cannot be mapped individually and may include residential, commercial, or industrial practices (Anderson et al. 1976). In addition to the Anderson et al. (1976) definition, this classification also includes farmsteads, holding areas for livestock (i.e., corrals), and structures associated with agricultural practices (e.g., barns, storage silos, etc.). For example, practices under this category are typically on a smaller scale than confined feeding operations or mixed urban/built-up land uses.

Other Urban or Built-up Land: Land use within this category is defined as golf courses, parks, cemeteries, and undeveloped land within an urban setting (Anderson et al. 1976).



Crop Land: This category may be defined as land used for the production of food (e.g., wheat crop, legumes, etc.). These areas are generally characterized by coarser textures, linear crop/cultivation features, and yellow to gold colour tones. Land under cultivation or without vegetative cover (e.g., tilled) also falls under this category.

Hayland: This category is defined as land used for the production of forage crops for livestock (e.g., alfalfa, timothy, etc.). Hayland crops are often characterized by hay bales spotting the landscape adjacent to watercourses.

Pasture/Grazing: Areas of land used for livestock operations were classified as pasture/grazing. This land use is generally characterized by a smooth texture resulting from grazed herbaceous cover. Pasture/grazing is often associated with heavily defined linear tracks and, where applicable, fence lines. Pastures in forested areas were identified by a decreased density of trees within the forest stand.

Deciduous Forest: Areas dominated by forest land (e.g., mixed deciduous) tend to be 'natural' and have few linear or man-made patterns. Forest lands are characterized by a smooth texture and a randomly undulating 'cellular' pattern, resulting from the tree crowns.

Non-Forested Wetland: This category was defined as an area dominated by natural herbaceous vegetation. These areas tend to be 'natural'; having few linear patterns, and are characterized by smooth, undulating textures and random patterns.

Forested Wetland: This classification was defined as a wetland with a water table at/near the land surface, dominated by woody vegetation (Anderson et al 1976).

Mixed Forest: This classification included forested areas where evergreens and deciduous trees are growing, yet neither predominate (Anderson et al. 1976).

Residential/commercial, other agricultural land, other urban or built-up land, cropland, hayland, and pasture/grazing, were considered to be anthropogenic in origin. Deciduous forest land, non-forested wetland, forested wetland, and mixed forest land were assumed to be in a natural state or areas not necessarily altered by anthropogenic means.

Although not identified as specific land use/land cover, drains were identified via aerial videography and groundtruthing efforts. In the context of this report, drains were defined as artificial waterways used for irrigation, drainage, flood prevention, etc. These areas were typically linear and often associated with cement fords and a marginal/non-existent riparian area.

Land use/land cover categories were delineated as accurately as possible; however, there were basic limitations given the temporal scale and resolution of the aerial video. As a result, groundtruthing was utilized (where possible) to confirm the initial classification based on aerial footage.

2.3.2 Aquatic Habitat Conditions

Aerial video and information collected by groundtruthing were used to classify aquatic habitat conditions within the Washow Bay Creek watershed. Stream reaches were classified based on a visual qualitative assessment of conditions in and adjacent to the stream. Stream condition assessments were based on the United States Department of Agriculture Stream Visual Assessment Protocol (USDA 1998).

The classification system was based on identifying potential impacts as a True or False attribute (i.e., 1 or 0 within the geodatabase) within three criteria for each reach. For example; if a reach of stream exhibited a denuded riparian zone on one or both banks, it would receive an attribute value of 1 (true) for the riparian zone criteria. If the stream banks showed excessive erosion or slumping, this reach would receive an additional value of 1 (true), and so on. The three criteria selected were: channel morphology (hydrologic alterations and channelization); bank stability; and riparian zone function. These criteria were chosen based on their relative importance to stream health as described within the USDA Stream Visual Assessment Protocol (1998), and the ability to interpret these criteria using the quality of the videography.

The following sections describe the stream conditions assessed in determining aquatic habitat quality, as well as the classification methods used.

2.3.2.1 Channel Morphology

Bankfull flows and flooding are important in maintaining both the shape of a channel and its function (USDA 1998). High flows can redistribute larger sediments and debris to form pool/riffle habitats and increase the habitat diversity of a watershed. Altered channel morphology can limit the scouring effect of high flows, allowing siltation of important spawning areas and habitat zones (USDA 1998; Bain and Stevenson 1999).

Channel morphology was rated with a true or false value based on the following criteria (USDA 1998):

True condition(s):

- Dykes or other man-made structures that prevented natural flooding of the adjacent floodplain;
- Channel was altered, braided, or with man-made structures restricting floodplain width. Channel may be incised; or
- Evidence of past channel alteration, but with significant recovery of channel and banks.

False condition(s):

- Channel appears to be 'natural' with no structures or dykes. No dams, water withdrawal, dykes or other structures limit stream access to the floodplain.

2.3.2.2 Bank Stability

Stream banks are important transition zones between aquatic and terrestrial systems (Bain and Stevenson 1999). Eroding banks can reduce instream fish cover, reduce water transparency, smother fish eggs and benthic invertebrates with silt, and infill shallow water habitats (Bain and Stevenson 1999). Although some bank erosion is normal in a healthy watershed system, excessive erosion can occur when riparian areas are degraded, hydrology is altered, or when sediment load is increased (USDA 1998).

Assessments of bank stability were based on the potential for detachment of soil from the upper and lower stream banks and the subsequent deposition to the stream channel. Both the left bank (LB) and right bank (RB), when looking upstream, were classified and rated. Due to the scale and resolution of the aerial video, bank stability was at times difficult to assess visually. Ratings were based on the application of groundtruthing data to the aerial video and an overall visual assessment of the stream reach being classified.

Bank stability was rated with a true or false value based on the following criteria (USDA 1998):

True condition(s):

- Bank(s) unstable and typically high. There may be overhanging vegetation at top of a bare bank, trees falling into stream, or a number of slope failures apparent;
- Bank(s) moderately unstable and typically high. Some trees may be falling into the stream and there may be some slope failures apparent; or

- Bank(s) moderately stable and low. A lower amount of eroding surface on outside bends is protected by roots that extend to the base-flow elevation.

False condition(s):

- Bank(s) are stable and low. A large amount of eroding surface area on outside bends is protected by roots that extend to the base-flow elevation.

2.3.2.3 Riparian Zone Function

Riparian zone is defined as an area adjacent to a body of water or as the transition zone between aquatic and upland areas; it can also be referred to as riparian buffer zone, buffer strip, or vegetation retention zone (Kipp and Callaway 2003; Williams et al. 1997; Bain and Stevenson 1999). The health of the riparian zone is fundamental to the well-being of an entire stream ecosystem (USDA 1998). A healthy riparian zone can: buffer the introduction of pollutants and/or organic matter to a stream; regulate instream algal production via shading; decrease erosion by stabilizing stream banks and dissipating energy during flood events; provide a source of cover, food, and microclimate control for fish and invertebrates; and act as a travel corridor for terrestrial animals/birds (Williams et al. 1997; USDA 1998; Bain and Stevenson 1999; Koning 1999; AAFC-PFRA 2004).

From an agricultural standpoint, riparian vegetative cover helps regulate soil climate, stimulate soil activity (via biomass production), and acts as a buffer between water courses and fertilizer and pesticide applications (Donat 1995). It has been found that dew formation, precipitation, and soil moisture increase in the vicinity of a well-established riparian zone (Donat 1995). The quality of the riparian zone increases as both the width and complexity of woody vegetation within it increases (USDA 1998).

Riparian zone function was rated with a true or false value based on the following criteria (USDA 1998):

True condition(s):

- Natural vegetation/regeneration of vegetation is lacking and the 'filtering' function of the riparian zone is severely or moderately compromised.

False condition(s):

- Natural vegetation extends at least two active channel widths on each side and the 'filtering' function of the riparian zone does not appear to be compromised.

2.3.3 Aquatic Habitat Quality Rating

To assist in the identification of sites for rehabilitation, a qualitative rating of aquatic habitat quality was assigned to stream reaches based on an overall assessment using the stream condition descriptions listed above. The rating system incorporated four classes as outlined below:

- Class A: Stream reaches within this category were minimally impacted and tended to have natural channel morphology. The riparian vegetation, which was typically present on both stream banks, provided a high level of buffering capacity, fish habitat, and bank stability.

- Class B: Stream reaches in this category were moderately impacted, and typically had a more natural channel morphology and hydrologic regime than Class C reaches. Bank stability in this class tended to be moderately stable. Commonly, a margin of natural vegetation may have remained increasing bank stability and buffering capacity. Some stream reaches in this category had more 'natural' conditions on one bank and a greater amount of impact on the opposite bank.

- Class C: Stream reaches within this category were highly impacted and generally had altered hydraulic regimes (e.g., channelization, barriers). Bank stability in this class tended to be moderately stable. Reaches with marginal riparian vegetation may have had a moderate filtering capacity.

- Class D: Stream reaches within this category were severely impacted and generally characterized by altered channels and a heavily altered hydrologic regime. There was a lack of vegetation regeneration within the riparian zone, and because of this the filtering function of the riparian zone may have been severely compromised. Bank stability was generally unstable within this class.

2.3.4 Barriers

Barriers to fish movement can be defined as any structure or habitat conditions that create a potential obstacle to fish movements under certain hydrologic conditions (Bain and Stevenson 1999). These barriers can be anthropogenic in origin (e.g., concrete structure, earthen dam, dike, perched culvert) or natural (e.g., beaver dam, debris dam, rapids). Besides limiting/stopping the movement of fishes, barriers can affect the health of a stream via disruption of stream flow, sediment transport, and thermal regimes (Bain and Stevenson 1999).

Barriers, or areas with the potential to impede migration, to fish movement were identified from the aerial video and, where possible, groundtruthed to verify the nature and extent of the blockage. Barriers were classified as follows:

1) Beaver dams;
2) Debris – accumulations of natural or man-made debris; and
3) Anthropogenic – dams, fords, or culverts.

Under the classification of anthropogenic barriers, dams may also be referred to as 'low-head dams'. A low head dam is defined as a constructed barrier in a river, spanning the entire width, with a hydraulic height not exceeding eight meters (ICF 2005). Dam composition may include concrete, rubble, boulder, or a similar aggregate.

Fords are typically defined as low-water stream crossings with bank access allowing either temporary or permanent passage to vehicles and livestock (Fisheries and Oceans - Manitoba Natural Resources 1996; Armantrout 1998). Within this document, ford composition may include naturally occurring materials (e.g., stream bed), transported aggregate (e.g., gravel, boulder, cobble), or a low level composition of cement and culvert. Although allowing some fish passage via culvert placement, the cement culvert ford is considered a potential barrier. Upstream fish passage at these sites may be hindered in the spring during low water events. Downstream (larval, juvenile, or adult) migrations may also be hindered during similar hydrologic conditions. The culverts may also act as velocity barriers or become plugged with debris.

Culverts, within roads, are also listed as potential barriers if: they act as velocity barriers; become plugged with debris; or appear to be perched.

Each barrier was assessed as to the severity of blockage including the potential to limit fish access to important areas for feeding, reproduction, and/or rearing. Potential barriers were also digitized as point features within the geodatabase.

Given the limitations of aerial videography and the logistics involved with groundtruthing, it is expected that some barriers were not identified.

2.3.5 Potential Rehabilitation Sites

Potential rehabilitation sites were determined from a review of the aerial footage and the groundtruthing of specific sites. Once reviewed, sites were prioritized using a scale from 1 to 3. Sites given a priority of 1 were often 'large' in scale, exhibiting multiple environmental issues (e.g., water quality degradation, shoreline erosion, denuded riparian, etc.) that may warrant more immediate attention (i.e., rehabilitation efforts). These sites typically had many direct negative impacts on the health of the watershed and fell within Class D and C reaches. Conversely, sites labelled as priority 3 were often 'smaller' in scale, typically exhibiting only one environmental concern. Sites identified as priority 3 were also areas in which long-term planning could be required or where a site cannot be returned to its 'full' potential within a reasonable time frame (USDA 2004). These sites could be located in Class D reaches, but were typically found in Class C and B reaches.

2.3.6 Instream Flow Requirements

A literature review was conducted regarding the instream flow requirements for regionally significant fish species identified in the watershed.

3.0 RESULTS AND DISCUSSION

3.1 REVIEW OF HISTORICAL INFORMATION

The study area for the Washow Bay Creek watershed, riparian assessment survey included Washow Bay Creek and the following third order drains: Angle; Ben Johnson; Bump; Hodgson (Sugar Creek); Okno; Petrachek; and Progress (Figure 1).

3.1.1 Physical and Hydrological Information

The Washow Bay Creek watershed (1,278 km^2) drains into the southern corner of Washow Bay, located in the south basin of Lake Winnipeg (Figure 1) (Manitoba Land Initiative 2007). Falling within the R.M. of Bifrost, this watershed has low relief and is dominated by soils whose drainage ranges from imperfectly to poorly and very poorly drained soils (Land Resource Unit 1999). The elevation points used and the Washow Bay Creek profile generated are presented in Figures 1 and 2. Along its course, the Washow Bay Creek drops 26 m to its confluence with Lake Winnipeg.

The Washow Bay Creek watershed consists primarily of a system of drains, diversions, and dykes. The Washow Bay Water Management Project was initiated around 1988 to provide improved drainage for farmers north of Riverton (MWSFB, Washow Bay file, circa 1988). The project was initiated due to severe flooding brought on by heavy rainstorms, inadequate drains and outlets, and high water levels on Lake Winnipeg.

No historical hydrological information was available for: Washow Bay Creek; Angle Drain; Ben Johnson Drain; Bump Drain; Hodgson Drain (Sugar Creek); Okno Drain; Petrachek Drain; or Progress Drain (ECWSC, September 2006).

3.1.2 Water Quality

No historical water quality information was available for: Washow Bay Creek; Angle Drain; Ben Johnson Drain; Bump Drain; Hodgson Drain; Okno Drain; Petrachek Drain; Progress Drain; or Sugar Creek (WQMS 2006).

3.1.3 Fish Species Utilization

As a tributary to Lake Winnipeg, Washow Bay Creek (and associated drains) could host up to 60 native freshwater species, eight introduced freshwater species, and one human-made freshwater hybrid species (Stewart and Watkinson 2004). A search of the MWSFB Fisheries Inventory Habitat Classification System (FIHCS: 2006) and fisheries investigations conducted by Milani (2006) indicate that at least five families of fish, representing nine species, utilize the Washow Bay Creek watershed (Table 1). None of the species indicated on Table 1 are listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as endangered, threatened, or special concern.

3.1.4 Benthic Invertebrates

No historical benthic invertebrate information was found for the Washow Bay Creek or associated drains.

3.2 FIELD SURVEYS

Locations of all sites visited throughout the Washow Bay Creek watershed are identified on Table 2 and Figure 3.

3.2.1 Physical and Hydrological Information

Physical and hydrological information collected throughout the Washow Bay Creek watershed is presented in Appendix 1.1.

The majority of Washow Bay Creek has been channelized to accommodate some form of agricultural or domestic use. However, the length of creek from WB1 to WB3 appears to have remained in a natural state (Table 2, Figure 3). Within this lower reach, the channel appeared to maintain some flow and depth during both spring and summer surveys, with flows being altered by wind currents and/or water levels on Lake Winnipeg (Appendix 1.2). From WB3 to WB2, Washow Bay Creek maintained some flow throughout the season (Appendix 1.2). Upstream of WB2 and beyond WB4, the creek either maintained isolated pools of water or was dry with intermittent flow (Appendix 1.2).

On May 9, a stream discharge of 0.171 m^3/s was recorded at WB2, approximately 16.4 km from the mouth of Washow Bay Creek (Table 2, Figure 3). A discharge could not be taken at this site in the summer due to low flows.

Discharge measurements were taken on Hodgson Drain (HD1) on May 9 (0.309 m^3/s) and July 11 (0.006 m^3/s) (Table 2, Figure 3).

3.2.2 Water Quality

Water quality parameters measured by North/South Consultants in the field were taken along Washow Bay Creek and its associated drains in May and July, 2006 (Table 3). Dissolved oxygen concentrations were below the Manitoba Water Quality Objectives for the protection of aquatic life (Williamson 2000; 9.5 mg/L) on at least one occasion at all sites except the Hodgson Drain, which complied with the objective on both sampling dates. All sites were in compliance with the Manitoba Water Quality Guidelines for the protection of aquatic life (6.5-9.0) and recreation (5.0-9.0) for pH during the May sampling period; however during the July sampling period, pH levels at all sites sampled, were greater than allowed by both of these guidelines.

3.2.3 Fish Species Utilization

3.2.3.1 Spring 2006

3.2.3.1.1 Larval

A total of 536 larval fish were captured at two locations (WB2 and WB4) along Washow Bay Creek by either dip net or drift trap (Tables 2 and 4, Figure 3). With the exception of one percid (e.g., walleye, sauger, etc.) captured at WB2, all of these fish were identified as catostomids (e.g., sucker species) (Table 4, Figure 3). These results indicate that spawning suckers can migrate at least up to WB4, a location approximately 23.3 km from the mouth of Washow Bay Creek.

3.2.3.1.2 Adult

One hoop net was set at WB1, in Washow Bay Creek at a location approximately 1.6 km upstream from its mouth (Table 2, Figure 3). As anticipated by the water temperature (14.4 ^oC), the spring spawning migration of northern pike, suckers, and walleye had been missed and only incidental catches were recorded at this site (three white bass and two northern pike). The spawning condition of the fish captured could not be determined.

3.2.3.2 Summer 2006

A total of 119 fish, representing five families and six species, were captured throughout the Washow Bay Creek watershed during summer 2006 (Tables 2 and 5, Figure 3). The majority of these fish were central mudminnow (n = 69), followed by: white sucker (n = 36); northern pike (n = 7); and johnny darter (n = 5) (Table 5). The white suckers captured on the Hodgson Drain (n = 34) and Washow Bay Creek (n= 2) had mean lengths of 36 mm and 131 mm, respectively. These length classes represent both young-of-the-year and juvenile stages for this species, respectively. Data suggested that white suckers had spawned successfully along Hodgson Drain in 2006. Young-of-the-year northern pike were also captured on the Washow Bay Creek (average length 121 mm, n = 7). Data suggested that northern pike had spawned on Washow Bay Creek at least as far as Site WB4, approximately 23.3 km upstream from Lake Winnipeg.

3.2.3.3 Spring 2007

A total of 327 fish, representing three species, were captured in the hoop net set at WB2 (Table 2, Figure 3, and Appendix 2.1). White suckers accounted for the majority of the catch (n = 200), followed by northern pike (n = 111), and walleye (n = 16).

The peak catch of white suckers (n = 53) occurred on April 15, corresponding to a water temperature of 8.0 ^{o}C (Figure 4). White sucker lengths and weights ranged from 365 to 582 mm (average 502 mm) and 350 to 3550 g (average 2164 g), respectively. Of the 40 white suckers examined for sex and state of maturity, 23 were males preparing to spawn in the current year (14 were ripe males), two were females preparing to spawn in the current year, and one was a spent male (Appendix 2.1). The spent male was captured on April 18, while the two females were captured on April 13 and 16, respectively.

This spring spawning species can tolerate a wide range of habitat conditions, utilizing areas of marginal fish habitat which contributes to its wide distribution. Detailed information on the habitat utilization of the white sucker can be found in Scott and Crossman (1973); Nelson and Franzin (2000); and Twomey et al. (1984).

The peak catch of northern pike (n = 25) occurred on April 13, corresponding to a water temperature of 3.0 ^{o}C (Figure 4). Northern pike lengths and weights ranged from 305 to 1200 mm (average 585 mm) and 100 to 10000 g (average 2098 g), respectively. Of the 59 northern pike examined for sex and state of maturity, 50 were males preparing to spawn in the current year, six were females preparing to spawn in the current year, two were ripe

females, and one was a spent male (Appendix 2.1). The two ripe females were captured on April 15 and 17, while the spent male was captured on April 19.

The habitat requirements (all life stages) for northern pike are varied, as this species can tolerate a wide range of conditions. Scott and Crossman (1973), Inskip (1982), Casselman and Lewis (1996), and Stewart and Watkinson (2004) all provide information relating to the habitat preferences of northern pike at various life stages.

Walleye were first captured on April 14, corresponding to a water temperature of 4.5 ^{o}C (Figure 4). Walleye lengths and weights ranged from 415 to 700 mm (average 549 mm) and 1000 to 4200 g (average 2190 g), respectively. Of the walleye examined for sex and state of maturity (n =9), all were males either preparing to spawn or in ripe condition (Appendix 2.1). The ripe males (n = 2) were captured on April 19, corresponding to a water temperature of 9.0 ^{o}C.

The habitat preferences of walleye are well studied and, depending on region, widely varied. Habitat utilization for this species is defined in Scott and Crossman (1973), McMahon et al. (1984), and Nelson and Franzin (2000).

Within this study, white sucker and northern pike were found to be utilizing the Washow Bay Creek watershed for spawning (spring 2007) and rearing (2006 spring and summer fish utilization). Spring fishing efforts (2007) also suggested that walleye utilize the lower reaches of the Washow Bay Creek. However, the extent of upstream migration and utilization of the watershed as nursery habitat for walleye is unknown. Washow Bay Creek could provide suitable habitat for the spawning of northern pike, white sucker, and walleye. However, the extent of spawning throughout the watershed (e.g., along Washow Bay Creek or associated drains) by any of these species is likely limited by low flow conditions (i.e., rapid flushing due to channelization) than by inadequate or lack of instream habitat.

3.2.4 Benthic Invertebrates

The EICD is working towards a three year rapid-bioassessment of benthic invertebrates within its district. Therefore, to ensure complete documentation of invertebrates collected, results of the benthic invertebrate sampling are presented under separate cover to the EICD manager (North/South Consultants 2007).

3.3 WATERSHED CLASSIFICATION

A complete aerial video review and site descriptions are provided in Appendix 3.1.

3.3.1 Land Use/Land Cover

Approximately 73 km of the Washow Bay Creek watershed was classified according to land use/land cover (Table 6, Figure 5). Approximately 40 km of this classification was conducted along the mainstem of the Washow Bay Creek. Representative flights, and subsequent land use classifications, were completed along the Angle (2 km), Ben Johnson (3 km), Bump (8 km), Okno (3 km), Petrachek (6 km), and Progress (7 km) drains. The lower four km of Hodgson Drain (Sugar Creek) were also flown (Table 6).

Throughout the Washow Bay Creek study area, pasture/grazing (32%) and cropland (20%) composed the greatest land use/land cover. Hayland (15%), non-forested wetland (14%), mixed forest land (11%), other agricultural land (5%), and deciduous forest land (3%) composed the remaining classifications. Combined, approximately 72% of the land use/land cover throughout the study area was classified as anthropogenic in origin, and the remaining 28% was in a natural state or had not necessarily been altered by anthropogenic means.

Pasture/grazing (45%) and cropland (23%) composed the greatest land use/land cover along Washow Bay Creek. The remaining classifications comprised: non-forested wetland (13%); other agricultural land (7%); hayland (6%); and deciduous forest land (6%). Combined, approximately 81% of the land use/land cover along Washow Bay Creek was classified as anthropogenic in origin, and the remainder (19%) was in a natural state or had not necessarily been altered by anthropogenic means.

Eighty-eight percent of the 73 km of Washow Bay Creek watershed (Washow Bay Creek and associated drains) that was classified, were ‘drains’ or areas otherwise channelized for land use purposes. Comparable results were found along the 40 km of Washow Bay Creek classified, where 88% of the water body was channelized.

3.3.2 Aquatic Habitat Conditions

Qualitative classifications for channel morphology, bank stability, and riparian zone function (as per Section 2.3.2) are provided for each point on the watercourse within the geodatabase that accompanies this report. Because each of these stream attributes are interrelated in terms of the overall health of the watershed, the classifications were considered collectively

to develop a qualitative aquatic habitat rating for each reach in the Washow Bay Creek watershed. These ratings are presented and discussed in the following section.

3.3.3 Aquatic Habitat Quality Ratings

Approximately 73 km of the Washow Bay Creek watershed were rated according to habitat quality (Table 7, Figure 6). Highly impacted areas (Class C) composed the largest segment (59%), followed by: severely impacted (Class D, 23%); minimally impacted (Class A, 13%); and moderately impacted (Class B, 3%).

Approximately 40 km of Washow Bay Creek was rated according to habitat quality. Highly impacted areas (Class C) composed the largest segment (49%), followed by: severely impacted (Class D, 34%); minimally impacted (Class A, 11%); and moderately impacted (Class B, 6%).

The relatively high percentage of Class C and D reaches for the combined watershed and the Washow Bay Creek itself may be attributable to the degree of channelization found throughout this area. As discussed in Section 3.1.1, drains are often associated with marginal to non-existent riparian areas, erosive banks, and modified flow regimes, all of which are considered when determining aquatic habitat quality.

3.3.4 Barriers

With the exception of two beaver dams (Hodgson Drain/Sugar Creek) and two fords (Ben Johnson and Bump drains), no major barriers to fish migration were observed throughout the Washow Bay Creek watershed.

3.3.5 Potential Rehabilitation Sites

Based on a review of the aerial video, historical information, and groundtruthing, the 23 potential rehabilitation sites identified within the Washow Bay Creek watershed were prioritized from 1 to 3 (Figure 6, Appendix 3.2). The majority of the sites identified fell under priority 3 (70%), followed by priority 1 (n = 5 or 22%) and priority 2 (n = 2 or 9%).

Within this document, the term rehabilitation refers to local or site-specific planning (Williams et al. 1997). The rehabilitation of site-specific areas can be used as a tool towards watershed restoration. Williams et al. (1997) viewed watershed restoration as the process of

reversing the decline of ecosystem health, thus returning a degraded ecosystem toward its historic function. The development of a watershed restoration program is a difficult process to initiate and should begin with an understanding of watershed structure and function, and an understanding of how human activities affect watershed health (Williams et al. 1997).

Typically, strategies for mitigating impacts to a watershed could fall into the following general categories: removing barriers to fish movement, thereby allowing fish access to upstream habitat; ensuring adequate stream flow to maintain aquatic habitat; enhancing instream aquatic habitat; enhancing riparian conditions; and eliminating point and non-point sources of water quality degradation. Most of these strategies overlap to some degree. For example, enhancing riparian conditions not only helps to eliminate non-point sources of habitat degradation but also enhances instream aquatic habitat. Mitigative works should be selected carefully, and the potential effects on stream processes and landowners must be thoroughly considered.

3.3.6 Instream Flow Requirements

Instream flow can be defined as the level of flow required to sustain the existing aquatic habitat and fish community in a particular stream or stream segment (Annear and Conder 1984; Stalnaker et al. 1995; IFNC 1999). Instream flow studies typically are used to determine a minimum flow value which compromises between habitat changes and water needs for development and/or off stream consumption. Biologists have found the application of instream flow modeling useful in the last several decades, using the process for quantifying the impacts of channelization or hydrological modifications of rivers (Lamouroux and Jowett 2005). However, there does not appear to be an agreement on which method is the best to employ or which method is the least biased (Clipperton et al. 2003). Annear and Conder (1984) reviewed four methods (Tennant, wetted perimeter curves, habitat retention models, and physical habitat simulation models) for bias and found the Tennant method to be the least so.

Whatever method is employed, it must be recognised that a single flow determination will neither protect nor guarantee suitable environmental conditions for all organisms (and life stages) found in a riverine system. Bovee (1982: *in* Clipperton et al. 2003) outlined some ecological considerations when determining IFNs, in particular: flows determined to be beneficial for one life stage may be detrimental to another life stage; a flow developed for one species may be detrimental to another; varying amounts of water are required throughout the year to accommodate different species and their life stages; a level of flow designated for

one portion of stream may not provide useable habitat in another; and an increase in water does not equate to an increase in habitat production.

Although fisheries investigations during the course of this study revealed the presence of three regionally significant fish species (i.e., walleye, northern pike, and white sucker) a number of smaller species (e.g., cyprinids) also were located. As suggested, the development of instream flow requirements for the entire watershed, based on three species, would not be ecologically sound. It is suggested that instream flow needs be developed on a 'site specific' basis, using this document as a baseline to identify potential locations within the watershed where instream works or enhancements could be conducted. Instream flow needs projects developed within Manitoba are discussed in MacDonell and Remnant (1999) and IFNC (1999). The Instream Flow Council (2007) has also compiled an extensive reference list on the subject.

4.0 OVERVIEW

A review of the limited historical information and current conditions (i.e., water quality, fish utilization, land use, and riparian conditions) within the Washow Bay Creek watershed indicate an area that is highly impacted by anthropogenic (i.e., human induced) forces. However, severely and minimally impacted areas also figured prominently throughout the study area.

Water flowing through Washow Bay Creek must be protected because it is a tributary to Lake Winnipeg. The lake has been listed as vulnerable, and as such efforts should be made to reduce the levels of nutrients flowing into it from point and non-point sources. Although water quality information on Washow Bay Creek is limited, efforts can be made for future monitoring and point/non-point source protection.

Historical fisheries information (Milani 2006; MWSFB files) and utilization studies conducted by North/South Consultants as part of this study indicate that the Washow Bay Creek watershed provides habitat for commercial and recreationally important species (e.g., walleye, northern pike). This watershed also supplies habitat for course species (e.g., suckers) and forage fish (e.g., minnows), both of which are an important component to any fish community.

The maintenance and improvement of shoreline conditions (e.g., bank stabilization and re-establishment of riparian areas) and a reduction in channelization (e.g., minimize the loss of natural stream processes) throughout the watershed would assist in both water quality improvements/protection and maintenance of habitat for aquatic animals.

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TABLES AND FIGURES

Table 1. Fish species know to use or potentially use the Washow Bay Creek watershed and COSEWIC listing.

FAMILY	COMMON NAME	ABBREVIATION	GENUS	SPECIES	COSEWIC	Washow Bay Creek		Hodgson Road Drain		Angle Drain		Sugar Creek
					LISTING[1]	FIHCS[2]	Milani[3]	FIHCS[2]	Milani[3]	FIHCS[2]	Milani[3]	Milani[3]
Catostomidae	White sucker	WHSC	*Catostomus*	*commersoni*	Not listed	Common						
Cyprinidae	Blacknose shiner	BLSH	*Notropis*	*heterolepis*	Not listed			Unknown	Y			Y
Cyprinidae	Fathead minnow	FTMN	*Pimephales*	*promelas*	Not listed			Unknown	Y			
Cyprinidae	Western blacknose dace	WBDC	*Rhinichthys*	*obtusus*	Not listed							Y
Esocidae	Northern pike	NRPK	*Esox*	*lucius*	Not listed	Common	Y	Unknown	Y			
Gasterosteidae	Brook stickleback	BRST	*Culaea*	*inconstans*	Not listed			Unknown	Y	Unknown	Y	
Percidae	Johnny darter	JHDR	*Etheostoma*	*nigrum*	Not listed			Unknown	Y			
Percidae	Walleye	WALL	*Sander*	*vitreus*	Not listed	Common						
Percidae	Yellow perch	YLPR	*Perca*	*flavescens*	Not listed	Common		Unknown	Y			

[1] COSEWIC listing based on information from Stewart and Watkinson (2004)
[2] Source data: FIHCS listing based on search by MWSFB (2006)
[3] Source data: Milani (2006)

Table 2. Reference list of sites visited and work conducted throughout the Washow Bay Creek watershed, by North/South Consultants, 2006 and spring 2007.

STUDY POINT	SITE CODE	DESCRIPTION	km	UTM (14U)		WORK CONDUCTED								
				easting	northing	in situ	hoops	pictures	discharge	electro	dip net	drift trap	inverts	physical
1	AD1	Angle Drain		637112	5671534	Y		Y						
2	AD2	Angle Drain		637076	5672373			Y						
3	HD1	Hodgson Road Drain	6.9	637023	5677763	Y		Y	Y	E1				Y
4	HD2	Hodgson Road Drain		636956	5677645			Y						
5	HDS1	Hodgson Road Drain and Sugar Creek		638551	5678827			Y						
6	WB1	Washow Bay Creek mouth	1.6	638909	5671588	Y	H1	Y						
7	WB2	Washow Bay Creek (2006 and 2007)	16.4	634960	5659100	Y	Y	Y	Y	E2, E3	DN1	DT1		Y
8	PD1	Progress Drain		640797	5657619	Y		Y						
9	BJ1	Ben Johnson Drain		642962	5659322	Y		Y						
10	BD1	Bump Drain		637266	5665713	Y		Y						
11	WB3	Washow Bay Creek	8.3	638861	5665763	Y		Y						Y
12	PET1	Petrachek Drain		630797	5662297			Y						
13	OK1	Okno Drain		630934	5657367			Y						
14	WB4	Washow Bay Creek	23.3	630979	5655701	Y		Y		E4	DN2			Y
15	BJ1b	Ben Johnson Drain		642369	5659325			Y						
16	PET2	Petrachek Drain		634084	5662364			Y						Y
17	BJ1b	Ben Johnson Drain		642369	5659325			Y						
18	INL	Washow Bay Creek inverts; lower		638603	5671240	Y		Y					Y	Y
19	INM	Washow Bay Creek inverts; middle		638911	5665678	Y		Y					Y	Y
20	IMU	Washow Bay Creek inverts; upper		634981	5659047	Y		Y					Y	Y

Description of Work Conducted:
km = distance (km) from mouth or confluence
in situ = water quality parameters measured in the field
hoops = hoop nets set for adult migrating fish
pictures = digital 'still' photos
discharge = hydrologic measurement
electro = backpack electrofishing unit used to capture small bodied fish
dip net = fine mesh dip net used for larval fish
drift trap = stationary (fine mesh) trap collecting drifting fish eggs and larval fish
inverts = invertebrate collection site
physical = physical parameters recorded (e.g., substrate compaction, composition)

Table 3. Water quality data collected *in situ* (i.e., in the field) from the Washow Bay Creek watershed study area, 2006.

DATE	LOCATION	SITE	DO (mg/L)	Temperature (^{o}C)	pH	Turbidity (NTU)	Specific Conductance (mS/cm)
8-May-06	Angle Drain	AD1	9.99	18.8	7.74	52	0.502
11-Jul-06	Angle Drain	AD1	8.94	25.2	9.29	144	0.571
9-May-06	Bump Drain	BD1	4.35	12.2	8.24	3	0.430
9-May-06	Ben Johnson Drain	BJ1	2.60	14.3	8.23	7	0.731
8-May-06	Hodgson Road Drain	HD1	10.40	19.1	7.79	7	0.302
11-Jul-06	Hodgson Road Drain	HD1	9.54	24.2	9.47	27	0.430
9-May-06	Progress Drain	PD1	3.90	14.3	8.61	9	0.940
11-Jul-06	Progress Drain	PD1	8.10	23.4	10.15	6	0.791
8-May-06	Washow Bay Creek	WB1	8.36	14.4	8.90	67	0.450
10-May-06	Washow Bay Creek	WB2	4.24	11.1	8.71	6	0.634
11-Jul-06	Washow Bay Creek	WB2	8.31	24.6	9.60	45	0.617
9-May-06	Washow Bay Creek	WB3	7.47	14.4	8.87	33	0.616
11-Jul-06	Washow Bay Creek	WB3	9.60	22.1	9.51	13	0.506
9-May-06	Washow Bay Creek	WB4	8.12	16.9	8.93	3	0.595
19-Oct-06	Washow Bay Creek	INL	-	2.0	-	-	-
19-Oct-06	Washow Bay Creek	INM	-	2.0	-	-	-
19-Oct-06	Washow Bay Creek	INU	-	2.0	-	-	-

Table 4. Results of larval drift sampling conducted in the Washow Bay Creek watershed study, 2006.

LOCATION	SITE CODE	METHOD	DATE	SPECIES		TOTALS
				PERCID	Catostomids	
Washow Bay Creek	WB2	DT1	9-May-06	1	113	114
Washow Bay Creek	WB2	DT1	10-May-06	-	13	13
Washow Bay Creek	WB2	DN1	9-May-06	-	359	359
Washow Bay Creek	WB4	DN2	9-May-06	-	50	50
TOTALS				1	535	536

DT = Drift trap

DN = Fine mesh dip net

Table 5. Summer fish utilization results, by location, from the Washow Bay Creek watershed study, 2006.

FAMILY	COMMON NAME	ABBREVIATION	GENUS	SPECIES	Hodgson Drain	Washow Bay Creek			TOTALS
					E1	E2	E3	E4	
Catostomidae	White sucker	WHSC[1]	*Catostomus*	*commersoni*	34	2	-	-	36
Esocidae	Northern pike	NRPK[2]	*Esox*	*lucius*	-	-	-	7	7
Ictaluridae	Tadpole madtom	TDMD	*Noturus*	*gyrinus*	-	-	1	-	1
Percidae	Johnny darter	JHDR	*Etheostoma*	*nigrum*	5	-	-	-	5
Percidae	Yellow perch	YLPR	*Perca*	*flavescens*	-	-	1	-	1
Umbridae	Central mudminnow	CNMD	*Umbra*	*limi*	27	18	19	5	69
TOTALS					66	20	21	12	119

[1] Average length of white sucker (n = 34) from Hodgson Drain = 36 mm; Average length of white sucker (n = 2) from Washow Bay Creek = 131 mm
[2] Average length of northern pike (n = 7) from Washow Bay Creek = 121 mm.

Table 6. Total number of reaches (by land use/land cover), length of watercourse classified, percentage of reach by land use/land cover, drain length and percent of drain in the Washow Bay Creek watershed study, 2006.

LAND USE/LAND COVER	# OF REACHES	TOTAL LENGTH OF REACHES (KM)	% OF REACHES (km)	CANAL LENGTH (km)	%CANAL
Angle Drain					
Cropland	2	1	63		
Nonforested Wetland	1	1	37		
Total Along Angle Drain	3	2	100	2	100
Ben Johnson Drain					
Hayland	1	2	62		
Nonforested Wetland	1	1	38		
Total Along Ben Johnson	2	3	100	3	100
Bump Drain					
Cropland	1	1	7		
Mixed Forest Land	1	5	70		
Other Agricultural Land	1	1	10		
Pasture/Grazing	1	1	14		
Total Along Bump Drain	4	8	100	8	100
Okno Drain					
Cropland	1	2	50		
Pasture/Grazing	1	2	50		
Total Along Okno Drain	2	3	100	3	100
Petrachek Drain					
Cropland	2	2	35		
Hayland	1	1	22		
Pasture/Grazing	2	3	43		
Total Along Petrachek Drain	5	6	100	6	100
Progress Drain					
Hayland	1	6	82		
Nonforested Wetland	1	1	18		
Total Along Progress Drain	2	7	100	7	100
Sugar Creek					
Mixed Forest Land	1	2	54		
Nonforested Wetland	1	2	46		
Total Along Sugar Creek	2	4	100	0	0

Table 6. Continued.

LAND USE/LAND COVER	# OF REACHES	TOTAL LENGTH OF REACHES (KM)	% OF REACHES (km)	CANAL LENGTH (km)	%CANAL
Washow Bay Creek					
Cropland	6	9	23		
Deciduous Forest Land	2	2	6		
Hayland	1	2	6		
Nonforested Wetland	3	5	13		
Other Agricultural Land	3	3	7		
Pasture/Grazing	10	18	45		
Total Along Washow Bay Creek	25	40	100	35	88
Combined					
Cropland	12	14	20		
Deciduous Forest Land	2	2	3		
Hayland	4	11	15		
Mixed Forest land	2	8	11		
Nonforested Wetland	7	10	14		
Other Agricultural Land	4	4	5		
Pasture/Grazing	14	23	32		
Total Combined	45	73	100	64	88

Table 7. Total number of reaches (by habitat quality rating), length of watercourse classified, and percentage of reach by rating in the Washow Bay Creek watershed study, 2006.

HABITAT QUALITY RATING	# OF REACHES PER RATING	TOTAL LENGTH OF REACHES (km)	% OF REACH BY RATING km
Angle Drain			
Class 'A'	1	1	37
Class 'B'	1	(~0.4)	22
Class 'D'	1	1	42
Total Along Angle Drain	4	2	100
Ben Johnson Drain			
Class 'C'	2	3	100
Total Along Ben Johnson Drain	2	3	100
Bump Drain			
Class 'C'	1	5	70
Class 'D'	3	2	30
Total Along Bump Drain	5	8	100
Okno Drain			
Class 'D'	1	2	50
Class 'C'	1	2	50
Total Along Okno Drain	2	3	100
Petrachek Drain			
Class 'C'	5	6	100
Total Along Petrachek Drain	5	6	100
Progress Drain			
Class 'C'	2	7	100
Total Along Progress Drain	2	7	100

Table 7. Continued.

HABITAT QUALITY RATING	# OF REACHES PER RATING	TOTAL LENGTH OF REACHES (km)	% OF REACH BY RATING km
Sugar Creek			
Class 'A'	2	4	100
Total Along Sugar Creek	2	4	100
Washow Bay Creek			
Class 'A'	2	4	11
Class 'B'	2	2	6
Class 'C'	14	20	49
Class 'D'	7	14	34
Total Along Washow Bay Creek	25	40	100
Combined			
Class 'A'	5	9	13
Class 'B'	3	2	3
Class 'C'	25	42	59
Class 'D'	11	17	23
Total Combined	44	72	100

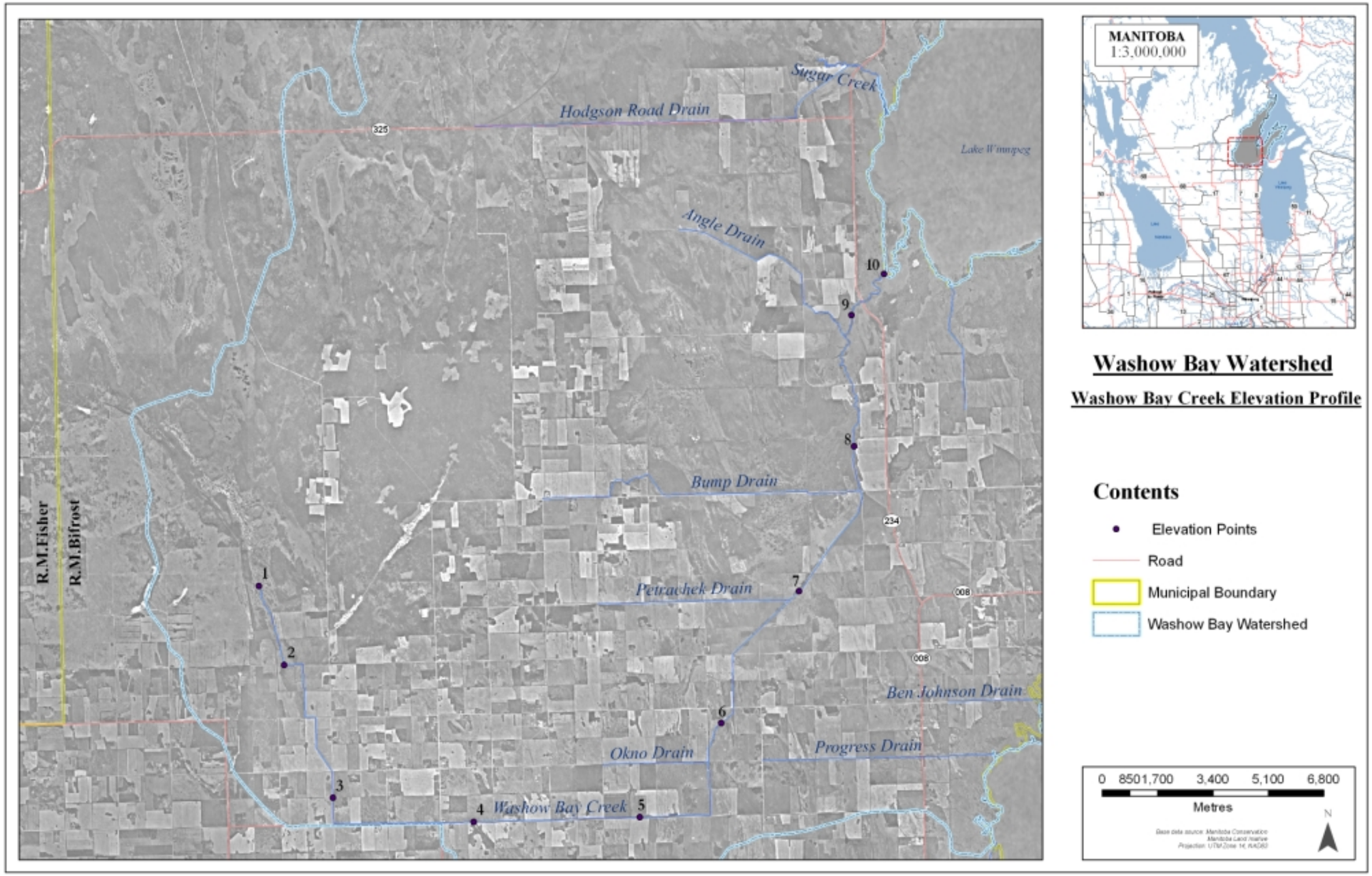

Figure 1. The Washow Bay Creek watershed study area and elevation points used to generate the Washow Bay Creek elevation profile, 2006.

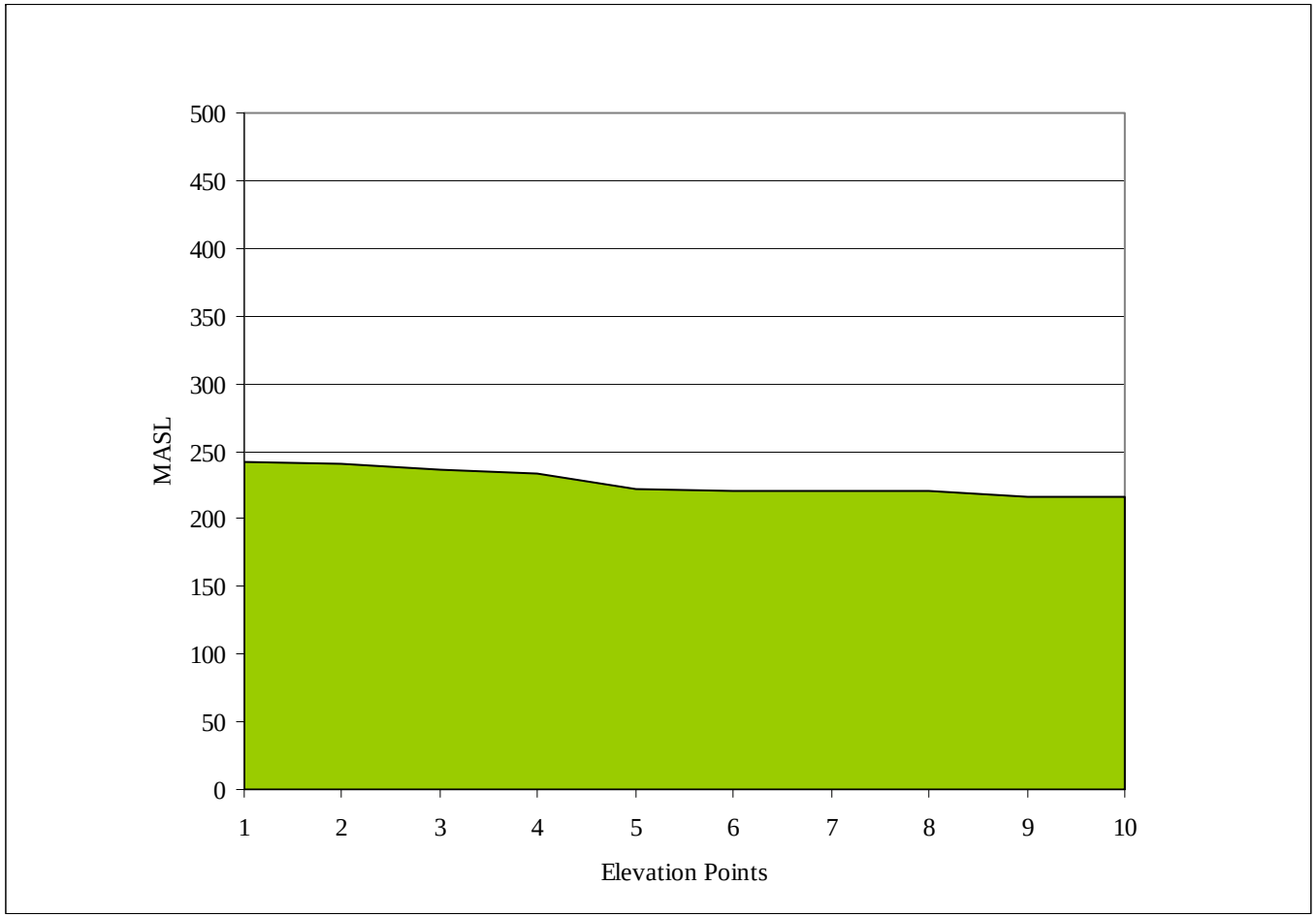

Figure 2. Elevation profile of the Washow Bay Creek (elevation in MASL).

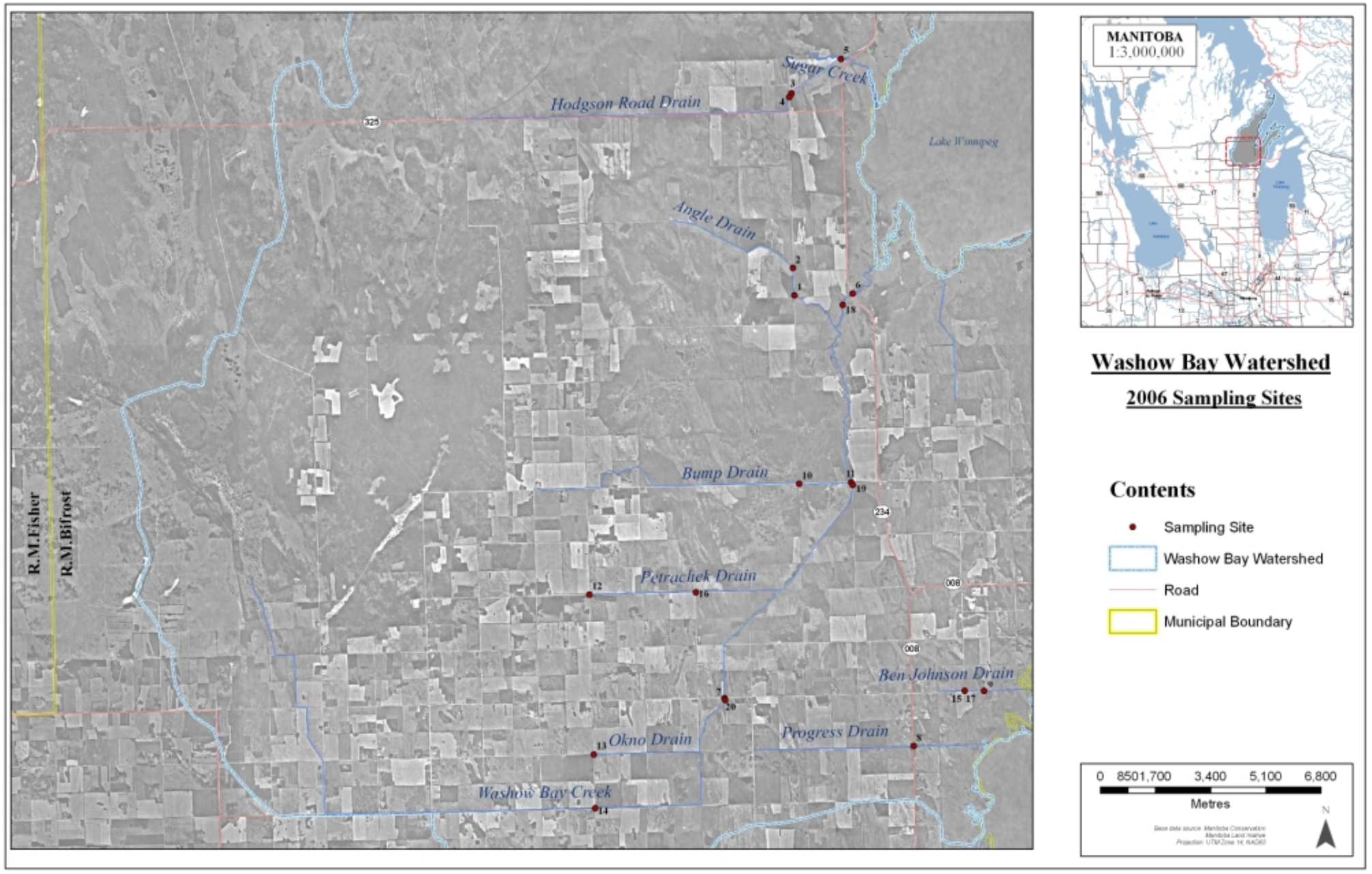

Figure 3. Sampling sites visited throughout the Washow Bay Creek watershed study area, 2006 and 2007. Sampling techniques used at each site are described on Table 2.

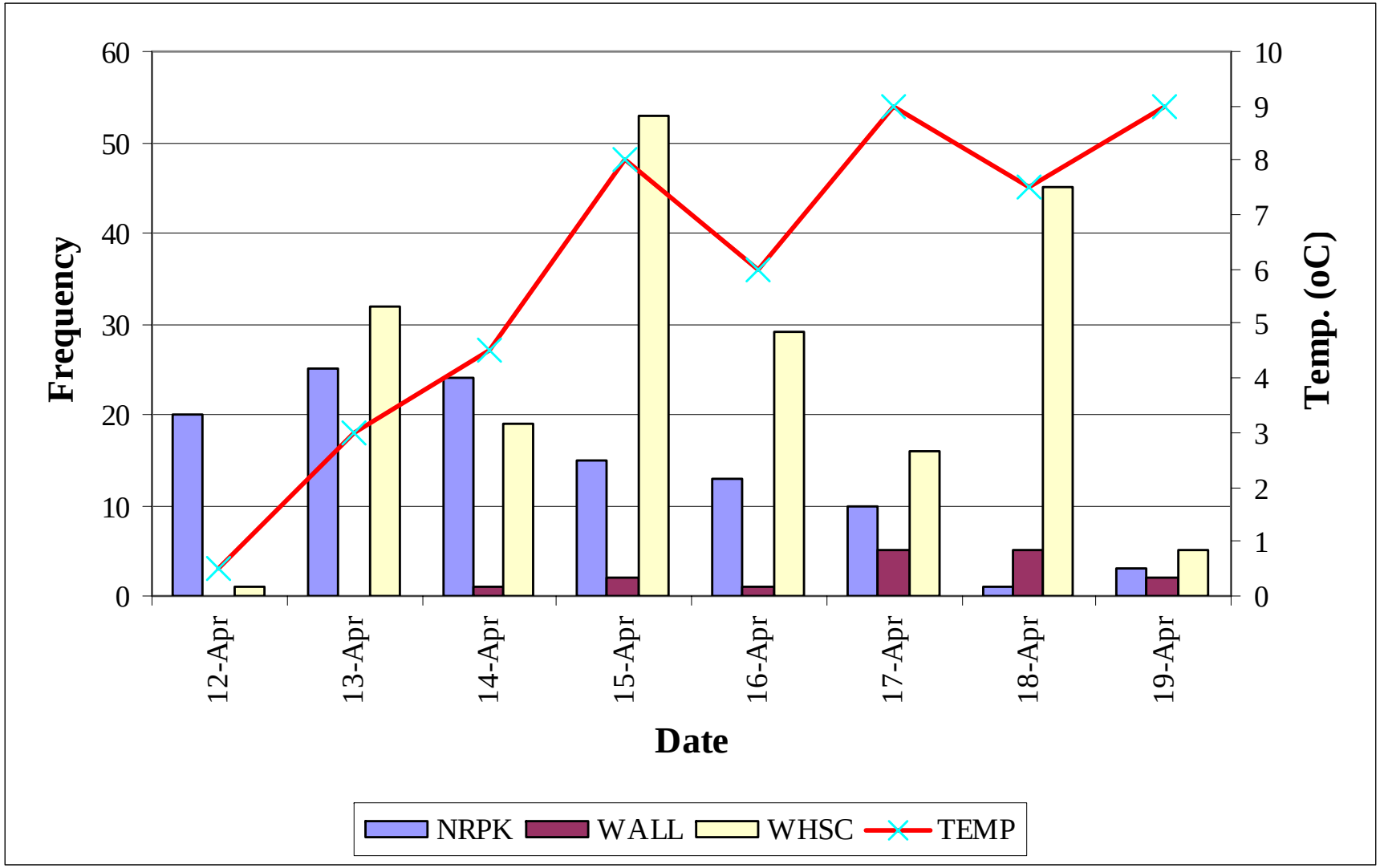

Figure 4. Catch of fish species, by date and water temperature, in Washow Bay Creek, spring, 2007

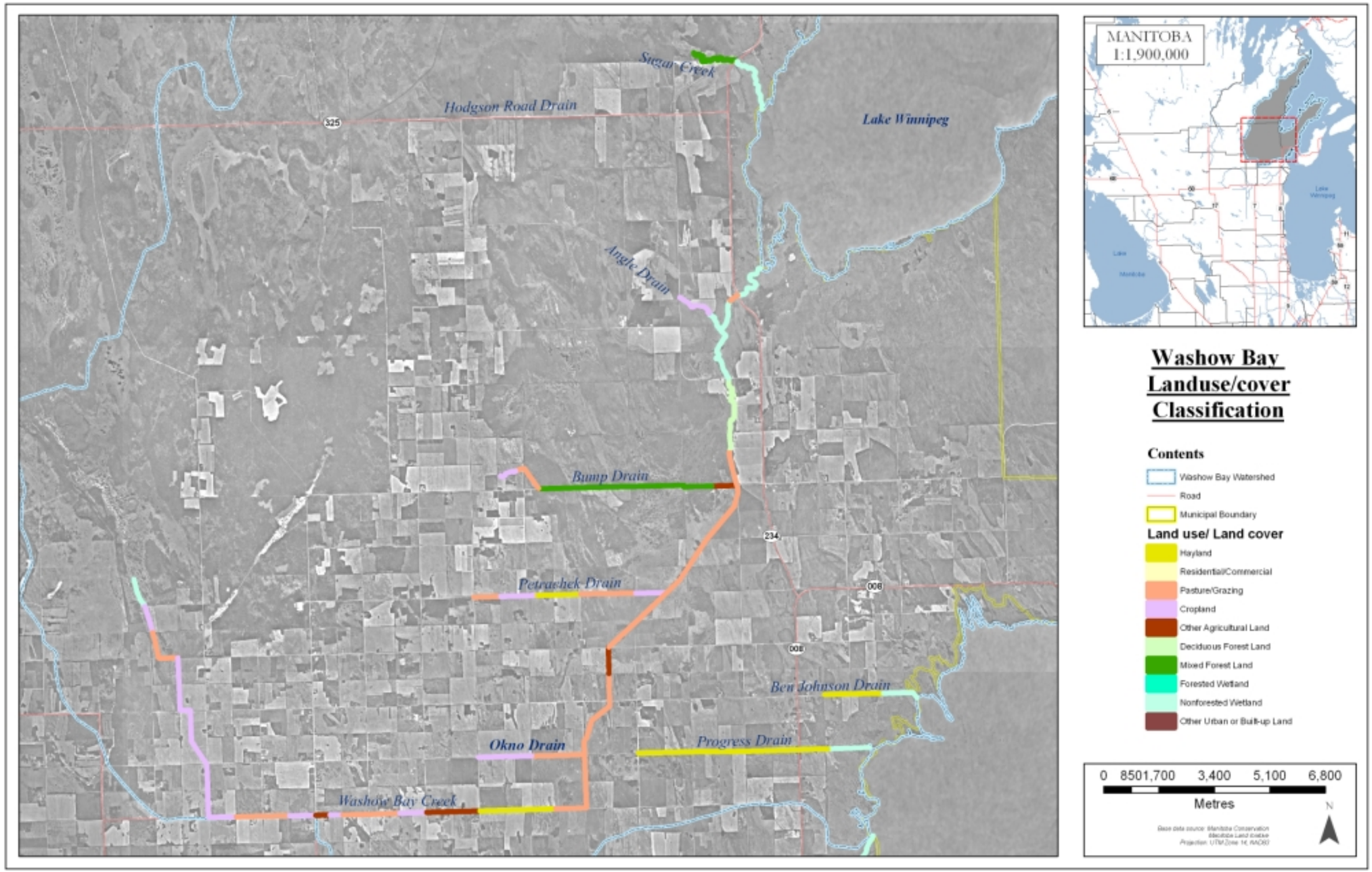

Figure 5. General land use/land cover classifications, based on aerial footage, throughout the Washow Bay Creek watershed study area, 2006.

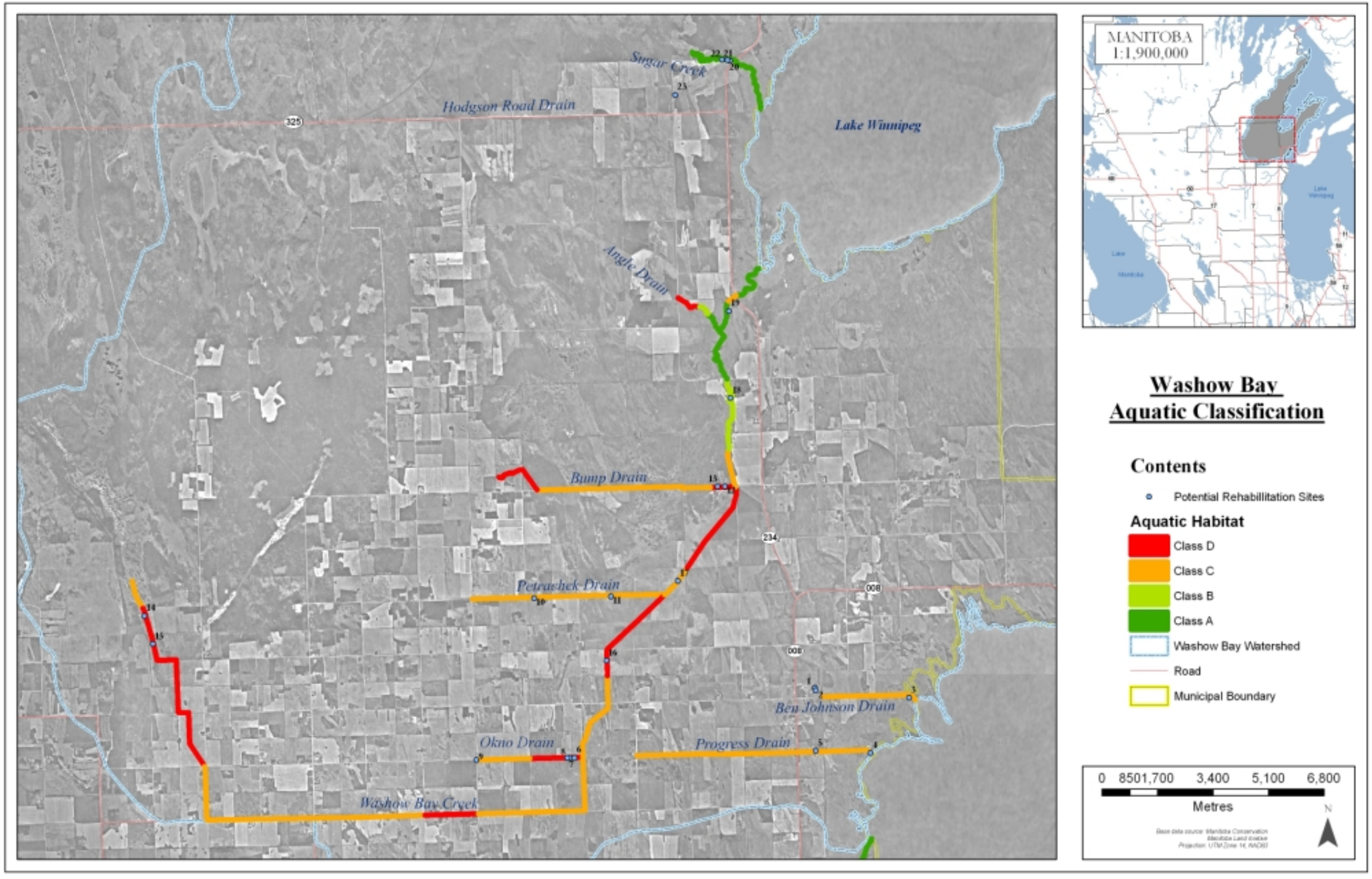

Figure 6. Aquatic habitat quality ratings and potential rehabilitation sites identified throughout the Washow Bay Creek watershed study area, 2006.

APPENDICES

Appendix 1.1. Water depths and substrate composition/compactions recorded throughout the Washow Bay Creek watershed, in 2006.

DATE	LOCATION	SITE	SIDE	DISTANCE FR. SHORE (m)	DEPTH (m)	SUBSTRATE Composition	SUBSTRATE Compaction	SUBSTRATE Shape	OTHER
8-May-06	Angle Drain	AD1							Minimal flow, brown water
9-May-06	Hodgson Drain	HD1	RB	0.50	0.32	gravel/cobble	Medium	Uniform	
9-May-06	Hodgson Drain	HD1		1.00	0.44	gravel/cobble	Medium	Uniform	
9-May-06	Hodgson Drain	HD1		1.50	0.44	gravel/cobble	Medium	Uniform	
9-May-06	Hodgson Drain	HD1		2.00	0.40	gravel/cobble	Medium	Uniform	
9-May-06	Hodgson Drain	HD1		2.40	-	gravel/cobble	Medium	Uniform	
9-May-06	Hodgson Drain	HD1	LB	2.44	-	gravel/cobble	Medium	Uniform	
9-May-06	Bump Drain	BD1							Draining 'peaty' area of grass/willow/tamarack/poplar
9-May-06	Washow Bay Creek	WB3	LB	1	0.40	Mud	Soft	Uniform	
9-May-06	Washow Bay Creek	WB3		2	0.70	Gravel	Medium	Uniform	
9-May-06	Washow Bay Creek	WB3		3	1.20	Gravel	Hard	Uniform	
9-May-06	Washow Bay Creek	WB3		4	1.30	Gravel	Hard	Uniform	
9-May-06	Washow Bay Creek	WB3		5	1.40	Gravel	Hard	Uniform	
9-May-06	Washow Bay Creek	WB3		6	1.40	Gravel	Medium	Uniform	
9-May-06	Washow Bay Creek	WB3		7	1.40	Gravel	Medium	Uniform	Minimal flow and there appeared to be a 'backing effect from either Lake Wpg. or the wind. Aquatic marcophytes were 'pointing' u/s.
9-May-06	Washow Bay Creek	WB3		8.0	1.30	Gravel	Medium	Uniform	
9-May-06	Washow Bay Creek	WB3		9.0	1.30	Gravel	Medium	Uniform	
9-May-06	Washow Bay Creek	WB3		10.0	1.30	Gravel	Hard	Uniform	
9-May-06	Washow Bay Creek	WB3		11.0	1.20	Gravel	Hard	Uniform	
9-May-06	Washow Bay Creek	WB3		12.0	1.00	Gravel	Hard	Uniform	
9-May-06	Washow Bay Creek	WB3		13.0	0.70	Mud	Soft	Uniform	
9-May-06	Washow Bay Creek	WB3		14.0	0.40	Mud	Soft	Uniform	
9-May-06	Washow Bay Creek	WB3	RB	15.0	Shore				
9-May-06	Washow Bay Creek	WB2	RB	0.5	0.20	Mud	Soft	Uniform	
9-May-06	Washow Bay Creek	WB2		1.0	0.30	Mud	Soft	Uniform	Aquatic vegetation and grasses on both banks.
9-May-06	Washow Bay Creek	WB2		1.5	0.30	Mud	Soft	Uniform	
9-May-06	Washow Bay Creek	WB2		2.0	0.38	Mud	Soft	Uniform	

Appendix 1.1.Continued.

DATE	LOCATION	SITE	SIDE	DISTANCE FR. SHORE (m)	DEPTH (m)	SUBSTRATE Composition	SUBSTRATE Compaction	SUBSTRATE Shape	OTHER
9-May-06	Washow Bay Creek	WB2		2.5	0.40	Mud	Soft	Uniform	
9-May-06	Washow Bay Creek	WB2		3.0	0.42	Mud	Soft	Uniform	
9-May-06	Washow Bay Creek	WB2		3.5	0.42	Mud	Soft	Uniform	
9-May-06	Washow Bay Creek	WB2		4.0	0.40	Mud	Soft	Uniform	
9-May-06	Washow Bay Creek	WB2		4.5	0.30	Mud	Soft	Uniform	
9-May-06	Washow Bay Creek	WB2		5.0	0.30	Mud	Soft	Uniform	
9-May-06	Washow Bay Creek	WB2	LB	5.5	Shore				
9-May-06	Okno Drain	OK1							Very little water at this time
11-Jul-06	Hodgson Drain	HD1	RB	0.3	0.24	Silt/Gravel	Medium		
11-Jul-06	Hodgson Drain	HD1		0.5	0.26	Silt/Gravel	Medium		
11-Jul-06	Hodgson Drain	HD1		0.8	0.2	Silt/Gravel	Medium		
11-Jul-06	Hodgson Drain	HD1		1.0	0.14	Silt/Gravel	Medium		
11-Jul-06	Hodgson Drain	HD1		1.3	0.1	Silt/Gravel	Medium		
11-Jul-06	Hodgson Drain	HD1		1.5	0.08	Silt/Gravel	Medium		
11-Jul-06	Hodgson Drain	HD1	LB	1.6	Shore				
11-Jul-06	Angle Drain	AD1				Silt/Mud	Very soft		Extremely soft (smell of rotting veg./sulfur)
11-Jul-06	Washow Bay Creek	WB3			~1.0	Silt/Mud	Soft		Aquatic plants in area, water clear to bottom
11-Jul-06	Petrachek Drain	PET1							Dry with grasses/reeds/hay
11-Jul-06	Petrachek Drain	PET2							Dry with cattails
11-Jul-06	Washow Bay Creek	WB2				Silt/Mud	Soft		Aquatic plants with boulder, minimal flow
11-Jul-06	Washow Bay Creek	WB4			~0.1 - 0.2	Silt/Gravel	Medium		
11-Jul-06	Ben Johnson Drain	BJ1							Aquatic vegetation

Appendix 1.1. Continued.

DATE	LOCATION	SITE	SIDE	DISTANCE FR. SHORE (m)	DEPTH (m)	SUBSTRATE Composition	SUBSTRATE Compaction	SUBSTRATE Shape	OTHER
11-Jul-06	Ben Johnson Drain	BJ1b							Duck weed and algae present
11-Jul-06	Bump Drain			Mouth					Mouth of drain near dry, >80% aquatic veg.
11-Jul-06	Okno Drain	OK1							Dry
11-Jul-06	Hodgson Drain	HD2							Dry and grass covered
19-Oct-06	Washow Bay Creek	INL		wide channel	1.5	Silt/Clay	Hard		Perennial stream; scrubland
19-Oct-06	Washow Bay Creek	INM		15.3 m wetted	0.75-0.9	Silt/Clay	Soft		0.08 m/sec surface velocity; ditch
19-Oct-06	Washow Bay Creek	INU		7.2 m wetted	0.41-.59	Clay	Soft		Grass and weeds covering bottom

Appendix 1.2. Hydraulic information collected by North/South Consultants from the Washow Bay Creek watershed, in 2006.

DATE	LOCATION	SIDE	DISTANCE	WIDTH	DEPTH	AREA	REV.	SEC.	VELOCITY	DISCHARGE (m^3/sec)
9-May-06	HD1	RB	0.00	0.25	-	-	-	-	-	-
9-May-06	HD1		0.50	0.5	0.32	0.16	26	43.0	0.412	0.066
9-May-06	HD1		1.00	0.5	0.44	0.22	30	43.0	0.475	0.105
9-May-06	HD1		1.50	0.5	0.44	0.22	25	42.0	0.406	0.089
9-May-06	HD1		2.00	0.45	0.4	0.18	17	42.0	0.276	0.050
9-May-06	HD1		2.40	0.22	-	-	-	-	-	-
9-May-06	HD1	LB	2.44	0.02	-	-	-	-	-	**0.309**
9-May-06	WB2	RB	0.0	0.25	-	-	-	-	-	-
9-May-06	WB2		0.5	0.5	0.2	0.1	1	51.4	0.014	0.001
9-May-06	WB2		1.0	0.5	0.3	0.15	3	44.0	0.047	0.007
9-May-06	WB2		1.5	0.5	0.3	0.15	5	43.3	0.079	0.012
9-May-06	WB2		2.0	0.5	0.38	0.19	7	44.6	0.108	0.020
9-May-06	WB2		2.5	0.5	0.4	0.2	3	42.0	0.049	0.010
9-May-06	WB2		3.0	0.5	0.42	0.21	6	46.4	0.089	0.019
9-May-06	WB2		3.5	0.5	0.42	0.21	13	44.4	0.200	0.042
9-May-06	WB2		4.0	0.5	0.4	0.2	12	45.0	0.182	0.036
9-May-06	WB2		4.5	0.5	0.3	0.15	5	41.2	0.083	0.013
9-May-06	WB2		5.0	0.5	0.3	0.15	5	46.2	0.074	0.011
9-May-06	WB2		5.5	0.3	-	-	-	-	-	-
9-May-06	WB2	LB	5.6	0.05	-	-	-	-	-	**0.171**
11-Jul-06	HD1	RB	0.00	0.13	-	-	-	-	-	-
11-Jul-06	HD1		0.25	0.25	0.24	0.06	3	41.8	0.050	0.003
11-Jul-06	HD1		0.50	0.25	0.26	0.065	2	48.3	0.029	0.002
11-Jul-06	HD1		0.75	0.25	0.2	0.05	2	66.9	0.021	0.001
11-Jul-06	HD1		1.00	0.25	0.14	0.035	-	-	-	-
11-Jul-06	HD1		1.25	0.25	0.1	0.025	-	-	-	-
11-Jul-06	HD1		1.50	0.18	0.08	0.0144	-	-	-	-
11-Jul-06	HD1	LB	1.61	0.06	-	-	-	-	-	**0.006**
19-Oct-06	INM			15.3 wetted	0.75-0.9				0.08 SV	
19-Oct-06	INU			7.2 wetted	0.41-0.59				0.14 SV	

Appendix 2.1. Biological information for fish captured from Washow Bay Creek, spring 2007.

Field Site No.	Total	Fish Species	Check Date (y/m/d)	Check Time (h:m)	Fork Length (mm)	Weight (g)	Sex ID[1]	Maturity ID[1]
WB-2	1	NRPK	2007-04-12	10:15	414	600	M	7
WB-2	1	NRPK	2007-04-12	10:15	950	7800		
WB-2	1	NRPK	2007-04-12	10:15	635	1850	M	7
WB-2	1	NRPK	2007-04-12	10:15	936	6700		
WB-2	1	NRPK	2007-04-12	10:15	745	3450	M	7
WB-2	1	NRPK	2007-04-12	10:15	876	5350		
WB-2	1	NRPK	2007-04-12	10:15	713	2850		
WB-2	1	NRPK	2007-04-12	10:15	571	1500	M	7
WB-2	1	NRPK	2007-04-12	10:15	895	6650		
WB-2	1	NRPK	2007-04-12	10:15	517	1100	M	7
WB-2	1	NRPK	2007-04-12	10:15	611	1650	M	7
WB-2	1	NRPK	2007-04-12	10:15	1020	9150		
WB-2	1	NRPK	2007-04-12	10:15	587	1650	M	7
WB-2	1	NRPK	2007-04-12	10:15	907	5350		
WB-2	1	NRPK	2007-04-12	10:15	900	5400		
WB-2	1	NRPK	2007-04-12	10:15	914	6300		
WB-2	1	NRPK	2007-04-12	10:15	495	1000	M	7
WB-2	1	NRPK	2007-04-12	10:15	677	2500	M	7
WB-2	1	NRPK	2007-04-12	10:15	621	2000	M	7
WB-2	1	NRPK	2007-04-12	10:15	589	1700	M	7
WB-2	1	WHSC	2007-04-12	10:15	555	3100		
WB-2	1	NRPK	2007-04-13	11:40	460	700		
WB-2	1	NRPK	2007-04-13	11:40	470	750		
WB-2	1	NRPK	2007-04-13	11:40	540	1300		
WB-2	1	NRPK	2007-04-13	11:40	510	1100		
WB-2	1	NRPK	2007-04-13	11:40	420	500	M	7
WB-2	1	NRPK	2007-04-13	11:40	460	700	F	2
WB-2	1	NRPK	2007-04-13	11:40	430	600	M	7
WB-2	1	NRPK	2007-04-13	11:40	580	1600		
WB-2	1	NRPK	2007-04-13	11:40	560	1400	F	2
WB-2	1	NRPK	2007-04-13	11:40	510	1000	M	7
WB-2	1	NRPK	2007-04-13	11:40	385	500		
WB-2	1	NRPK	2007-04-13	11:40	405	500	F	2
WB-2	1	NRPK	2007-04-13	11:40	395	600	M	7
WB-2	1	NRPK	2007-04-13	11:40	680	2400	F	2
WB-2	1	NRPK	2007-04-13	11:40	480	900	M	7
WB-2	1	NRPK	2007-04-13	11:40	890	5500		
WB-2	1	NRPK	2007-04-13	11:40	550	1400		
WB-2	1	NRPK	2007-04-13	11:40	480	900	M	7
WB-2	1	NRPK	2007-04-13	11:40	440	700	M	7
WB-2	1	NRPK	2007-04-13	11:40	400	500	F	2
WB-2	1	NRPK	2007-04-13	11:40	515	1000	M	7
WB-2	1	NRPK	2007-04-13	11:40	475	900	M	7
WB-2	1	NRPK	2007-04-13	11:40	305	300	M	7
WB-2	1	NRPK	2007-04-13	11:40	620	2100	M	7

Appendix 2.1. Continued.

Field Site No.	Total	Fish Species	Check Date (y/m/d)	Check Time (h:m)	Fork Length (mm)	Weight (g)	Sex ID[1]	Maturity ID[1]
WB-2	1	NRPK	2007-04-13	11:40	750	3200	M	7
WB-2	1	WHSC	2007-04-13	11:40	540	2700		
WB-2	1	WHSC	2007-04-13	11:40	530	2500	M	7
WB-2	1	WHSC	2007-04-13	11:40	530	2600		
WB-2	1	WHSC	2007-04-13	11:40	540	2700		
WB-2	1	WHSC	2007-04-13	11:40	365	350	M	7
WB-2	1	WHSC	2007-04-13	11:40	570	3500		
WB-2	1	WHSC	2007-04-13	11:40	530	2900		
WB-2	1	WHSC	2007-04-13	11:40	485	1700	F	2
WB-2	1	WHSC	2007-04-13	11:40	515	2050	M	7
WB-2	1	WHSC	2007-04-13	11:40	480	1900	M	7
WB-2	1	WHSC	2007-04-13	11:40	470	1900		
WB-2	1	WHSC	2007-04-13	11:40	435	1500		
WB-2	1	WHSC	2007-04-13	11:40	551	2700		
WB-2	1	WHSC	2007-04-13	11:40	486	2100		
WB-2	1	WHSC	2007-04-13	11:40	448	1500	M	7
WB-2	1	WHSC	2007-04-13	11:40	431	1350	M	7
WB-2	1	WHSC	2007-04-13	11:40	450	1550	M	7
WB-2	1	WHSC	2007-04-13	11:40	482	1950	M	7
WB-2	1	WHSC	2007-04-13	11:40	466	1750	M	7
WB-2	1	WHSC	2007-04-13	11:40	463	1550	M	7
WB-2	1	WHSC	2007-04-13	11:40	520	2425		
WB-2	1	WHSC	2007-04-13	11:40	505	2250	M	8
WB-2	1	WHSC	2007-04-13	11:40	478	1700	M	7
WB-2	1	WHSC	2007-04-13	11:40	471	1675	M	7
WB-2	1	WHSC	2007-04-13	11:40	500	2200		
WB-2	1	WHSC	2007-04-13	11:40	550	2600		
WB-2	1	WHSC	2007-04-13	11:40	570	2900		
WB-2	1	WHSC	2007-04-13	11:40	460	1750		
WB-2	1	WHSC	2007-04-13	11:40	480	1800		
WB-2	1	WHSC	2007-04-13	11:40	460	1650		
WB-2	1	WHSC	2007-04-13	11:40	450	1500	M	7
WB-2	1	WHSC	2007-04-13	11:40	440	1500		
WB-2	1	NRPK	2007-04-14	12:00	683	2425	M	7
WB-2	1	NRPK	2007-04-14	12:00	436	650	M	7
WB-2	1	NRPK	2007-04-14	12:00	496	1400	M	7
WB-2	1	NRPK	2007-04-14	12:00	659	2350	M	7
WB-2	1	NRPK	2007-04-14	12:00	398	475		
WB-2	1	NRPK	2007-04-14	12:00	526	1200	M	7
WB-2	1	NRPK	2007-04-14	12:00	579	1575	M	7
WB-2	1	NRPK	2007-04-14	12:00	470	850	M	7
WB-2	1	NRPK	2007-04-14	12:00	444	600	M	7
WB-2	1	NRPK	2007-04-14	12:00	539	1325	M	7
WB-2	1	NRPK	2007-04-14	12:00	533	1375		
WB-2	1	NRPK	2007-04-14	12:00	539	1225	M	7

Appendix 2.1. Continued.

Field Site No.	Total	Fish Species	Check Date (y/m/d)	Check Time (h:m)	Fork Length (mm)	Weight (g)	Sex ID[1]	Maturity ID[1]
WB-2	1	NRPK	2007-04-14	12:00	607	1750	M	7
WB-2	1	NRPK	2007-04-14	12:00	525	1250	M	7
WB-2	1	NRPK	2007-04-14	12:00	524	1175		
WB-2	1	NRPK	2007-04-14	12:00	432	600	M	7
WB-2	1	NRPK	2007-04-14	12:00	-	-		
WB-2	1	NRPK	2007-04-14	12:00	-	-		
WB-2	1	NRPK	2007-04-14	12:00	-	-		
WB-2	1	NRPK	2007-04-14	12:00	-	-		
WB-2	1	NRPK	2007-04-14	12:00	-	-		
WB-2	1	NRPK	2007-04-14	12:00	-	-		
WB-2	1	NRPK	2007-04-14	12:00	-	-		
WB-2	1	NRPK	2007-04-14	12:00	-	-		
WB-2	1	WHSC	2007-04-14	12:00	565	3025		
WB-2	1	WHSC	2007-04-14	12:00	582	2825		
WB-2	1	WHSC	2007-04-14	12:00	498	1900	M	7
WB-2	1	WHSC	2007-04-14	12:00	509	2400		
WB-2	1	WHSC	2007-04-14	12:00	471	1750		
WB-2	1	WHSC	2007-04-14	12:00	555	2625		
WB-2	1	WHSC	2007-04-14	12:00	532	2700		
WB-2	1	WHSC	2007-04-14	12:00	540	2800		
WB-2	1	WHSC	2007-04-14	12:00	488	1750		
WB-2	1	WHSC	2007-04-14	12:00	461	1525		
WB-2	1	WHSC	2007-04-14	12:00	372	2250		
WB-2	1	WHSC	2007-04-14	12:00	533	2850		
WB-2	1	WHSC	2007-04-14	12:00	578	3525		
WB-2	1	WHSC	2007-04-14	12:00	540	2800	M	7
WB-2	1	WHSC	2007-04-14	12:00	480	1925	M	7
WB-2	1	WHSC	2007-04-14	12:00	-	-		
WB-2	1	WHSC	2007-04-14	12:00	-	-		
WB-2	1	WHSC	2007-04-14	12:00	-	-		
WB-2	1	WHSC	2007-04-14	12:00	-	-		
WB-2	1	WALL	2007-04-14	12:00	569	2100	M	
WB-2	1	NRPK	2007-04-15	15:20	1200	10000	F	2
WB-2	1	NRPK	2007-04-15	15:20	1150	9800		
WB-2	1	NRPK	2007-04-15	15:20	960	8000		
WB-2	1	NRPK	2007-04-15	15:20	835	4750		
WB-2	1	NRPK	2007-04-15	15:20	490	1000		
WB-2	1	NRPK	2007-04-15	15:20	580	1600	M	7
WB-2	1	NRPK	2007-04-15	15:20	520	1000	M	7
WB-2	1	NRPK	2007-04-15	15:20	545	1250		
WB-2	1	NRPK	2007-04-15	15:20	428	700		
WB-2	1	NRPK	2007-04-15	15:20	500	1000		
WB-2	1	NRPK	2007-04-15	15:20	530	1500		
WB-2	1	NRPK	2007-04-15	15:20	520	1250		
WB-2	1	NRPK	2007-04-15	15:20	530	1300		

Appendix 2.1. Continued.

Field Site No.	Total	Fish Species	Check Date (y/m/d)	Check Time (h:m)	Fork Length (mm)	Weight (g)	Sex ID[1]	Maturity ID[1]
WB-2	1	NRPK	2007-04-15	15:20	380	500	M	7
WB-2	1	NRPK	2007-04-15	15:20	870	5000	F	3
WB-2	1	WALL	2007-04-15	15:20	415	1000	M	7
WB-2	1	WALL	2007-04-15	15:20	530	1900	M	7
WB-2	1	WHSC	2007-04-15	15:20	530	2600		
WB-2	1	WHSC	2007-04-15	15:20	552	2800		
WB-2	1	WHSC	2007-04-15	15:20	525	2700		
WB-2	1	WHSC	2007-04-15	15:20	470	1750		
WB-2	1	WHSC	2007-04-15	15:20	540	2500		
WB-2	1	WHSC	2007-04-15	15:20	475	2000		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		

Appendix 2.1. Continued.

Field Site No.	Total	Fish Species	Check Date (y/m/d)	Check Time (h:m)	Fork Length (mm)	Weight (g)	Sex ID[1]	Maturity ID[1]
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	WHSC	2007-04-15	15:20	-	-		
WB-2	1	NRPK	2007-04-16	9:40	990	9000		
WB-2	1	NRPK	2007-04-16	9:40	550	1450		
WB-2	1	NRPK	2007-04-16	9:40	510	1000	M	7
WB-2	1	NRPK	2007-04-16	9:40	825	4500		
WB-2	1	WALL	2007-04-16	9:40	560	2050		
WB-2	1	WHSC	2007-04-16	9:40	460	1600		
WB-2	1	WHSC	2007-04-16	9:40	510	2350		
WB-2	1	WHSC	2007-04-16	9:40	535	2900		
WB-2	1	WHSC	2007-04-16	9:40	562	2600	F	2
WB-2	1	WHSC	2007-04-16	9:40	540	2850		
WB-2	1	WHSC	2007-04-16	9:40	435	1300	M	7
WB-2	1	WHSC	2007-04-16	9:40	510	2150		
WB-2	1	WHSC	2007-04-16	9:40	500	1950	M	8
WB-2	1	NRPK	2007-04-16	9:40	500	1000	M	7
WB-2	1	NRPK	2007-04-16	9:40	560	1500		
WB-2	1	NRPK	2007-04-16	9:40	575	1550		
WB-2	1	NRPK	2007-04-16	9:40	495	1100		
WB-2	1	NRPK	2007-04-16	9:40	520	1200	M	7
WB-2	1	NRPK	2007-04-16	9:40	440	700	M	7
WB-2	1	NRPK	2007-04-16	9:40	530	1000		
WB-2	1	NRPK	2007-04-16	9:40	390	500	M	7
WB-2	1	NRPK	2007-04-16	9:40	670	2500	M	7
WB-2	1	WHSC	2007-04-16	9:40	490	1950		
WB-2	1	WHSC	2007-04-16	9:40	480	1850	M	7
WB-2	1	WHSC	2007-04-16	9:40	510	2050	M	8
WB-2	1	WHSC	2007-04-16	9:40	550	2500		
WB-2	1	WHSC	2007-04-16	9:40	500	2000	M	8
WB-2	1	WHSC	2007-04-16	9:40	500	2100	M	8
WB-2	1	WHSC	2007-04-16	9:40	500	2100	M	8
WB-2	1	WHSC	2007-04-16	9:40	458	1800		
WB-2	1	WHSC	2007-04-16	9:40	-	-		
WB-2	1	WHSC	2007-04-16	9:40	-	-		
WB-2	1	WHSC	2007-04-16	9:40	-	-		
WB-2	1	WHSC	2007-04-16	9:40	-	-		

Appendix 2.1. Continued.

Field Site No.	Total	Fish Species	Check Date (y/m/d)	Check Time (h:m)	Fork Length (mm)	Weight (g)	Sex ID[1]	Maturity ID[1]
WB-2	1	WHSC	2007-04-16	9:40	-	-		
WB-2	1	WHSC	2007-04-16	9:40	-	-		
WB-2	1	WHSC	2007-04-16	9:40	-	-		
WB-2	1	WHSC	2007-04-16	9:40	-	-		
WB-2	1	WHSC	2007-04-16	9:40	-	-		
WB-2	1	WHSC	2007-04-16	9:40	-	-		
WB-2	1	WHSC	2007-04-16	9:40	-	-		
WB-2	1	WHSC	2007-04-16	9:40	-	-		
WB-2	1	WHSC	2007-04-16	9:40	-	-		
WB-2	1	NRPK	2007-04-17	13:20	325	100	M	7
WB-2	1	WALL	2007-04-17	13:20	453	1000	M	7
WB-2	1	NRPK	2007-04-17	13:20	755	3550		
WB-2	1	WHSC	2007-04-17	13:20	525	2300		
WB-2	1	WALL	2007-04-17	13:20	627	2800	M	7
WB-2	1	WHSC	2007-04-17	13:20	550	2600	M	7
WB-2	1	WHSC	2007-04-17	13:20	457	1500		
WB-2	1	NRPK	2007-04-17	13:20	575	1500		
WB-2	1	WHSC	2007-04-17	13:20	467	1500	M	7
WB-2	1	NRPK	2007-04-17	13:20	453	700	M	7
WB-2	1	NRPK	2007-04-17	13:20	530	1000	M	7
WB-2	1	NRPK	2007-04-17	13:20	573	1500		
WB-2	1	NRPK	2007-04-17	13:20	520	1100	M	7
WB-2	1	WALL	2007-04-17	13:20	700	3900	M	7
WB-2	1	NRPK	2007-04-17	13:20	564	1200		
WB-2	1	WALL	2007-04-17	13:20	555	1700	M	7
WB-2	1	NRPK	2007-04-17	13:20	590	1400	F	3
WB-2	1	WHSC	2007-04-17	13:20	545	2300		
WB-2	1	WHSC	2007-04-17	13:20	520	2300		
WB-2	1	WHSC	2007-04-17	13:20	550	2700		
WB-2	1	WHSC	2007-04-17	13:20	475	1700	M	8
WB-2	1	WHSC	2007-04-17	13:20	505	1850		
WB-2	1	NRPK	2007-04-17	13:20	430	550	M	7
WB-2	1	WHSC	2007-04-17	13:20	467	1400	M	7
WB-2	1	WHSC	2007-04-17	13:20	508	2100	M	7
WB-2	1	WHSC	2007-04-17	13:20	447	1300		
WB-2	1	WHSC	2007-04-17	13:20	421	1100		
WB-2	1	WHSC	2007-04-17	13:20	545	2000		
WB-2	1	WHSC	2007-04-17	13:20	489	2050		
WB-2	1	WHSC	2007-04-17	13:20	569	3550		
WB-2	1	WALL	2007-04-17	13:20	605	2550		
WB-2	1	WHSC	2007-04-18	11:00	563	3000		
WB-2	1	WHSC	2007-04-18	11:00	507	2000	M	7
WB-2	1	WHSC	2007-04-18	11:00	457	1700	M	8
WB-2	1	WHSC	2007-04-18	11:00	470	1600	M	8
WB-2	1	WHSC	2007-04-18	11:00	495	1700		

Appendix 2.1. Continued.

Field Site No.	Total	Fish Species	Check Date (y/m/d)	Check Time (h:m)	Fork Length (mm)	Weight (g)	Sex ID[1]	Maturity ID[1]
WB-2	1	WHSC	2007-04-18	11:00	515	2300		
WB-2	1	WHSC	2007-04-18	11:00	436	1500	M	8
WB-2	1	WHSC	2007-04-18	11:00	465	1650	M	8
WB-2	1	WHSC	2007-04-18	11:00	485	1600	M	9
WB-2	1	WHSC	2007-04-18	11:00	563	2600		
WB-2	1	WHSC	2007-04-18	11:00	449	1500	M	8
WB-2	1	WHSC	2007-04-18	11:00	534	2650	M	8
WB-2	1	WHSC	2007-04-18	11:00	539	2700		
WB-2	1	WHSC	2007-04-18	11:00	560	3400		
WB-2	1	WHSC	2007-04-18	11:00	500	2100	M	8
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WHSC	2007-04-18	11:00	-	-		
WB-2	1	WALL	2007-04-18	11:00	685	4200		
WB-2	1	WALL	2007-04-18	11:00	435	2200		
WB-2	1	WALL	2007-04-18	11:00	527	2000		
WB-2	1	WALL	2007-04-18	11:00	474	1500		
WB-2	1	WALL	2007-04-18	11:00	599	2450		

Appendix 2.1. Continued.

Field Site No.	Total	Fish Species	Check Date (y/m/d)	Check Time (h:m)	Fork Length (mm)	Weight (g)	Sex ID[1]	Maturity ID[1]
WB-2	1	NRPK	2007-04-18	11:00	440	650		
WB-2	1	WHSC	2007-04-19	11:25	573	3100		
WB-2	1	WHSC	2007-04-19	11:25	550	3150		
WB-2	1	WHSC	2007-04-19	11:25	505	2000		
WB-2	1	WHSC	2007-04-19	11:25	455	1600		
WB-2	1	WHSC	2007-04-19	11:25	524	2500		
WB-2	1	NRPK	2007-04-19	11:25	396	400		
WB-2	1	NRPK	2007-04-19	11:25	424	600	M	9
WB-2	1	NRPK	2007-04-19	11:25	375	400		
WB-2	1	WALL	2007-04-19	11:25	540	2000	M	8
WB-2	1	WALL	2007-04-19	11:25	510	1700	M	8

[1] Sex and Maturity Codes Used:
F = Female
F2 = Female preparing to spawn in the current year
F3 = A female, ripe and ready to spawn in the current year
M = Male
M7 = Male preparing to spawn in the current year
M8 = A male, ripe and ready to spawn in the current year
M9 = A male that has spawned in the current year

Appendix 3.1 Video review of Washow Bay Creek and associated drains, 2006.

Area	Type	Composition	Comment	Priority	Video Time	Tape Name
Ben Johnson Drain	Operation	See ground photos	Appears to be livestock operation along drain; fenced?	1	00:01:10	ICELANDIC3
Ben Johnson Drain	Ford	Drain bed	Appears to be machinery ford and or cattle access point	2	00:01:12	ICELANDIC3
Ben Johnson Drain	Duck weed		Mats of duck weed present		00:01:14	ICELANDIC3
Ben Johnson Drain	Road Crossing	2 culverts	Main road; mats of duck weed evident		00:01:39	ICELANDIC3
Ben Johnson Drain	Road Crossing	3 culverts	Private property		00:01:56	ICELANDIC3
Ben Johnson Drain	Confluence		Ben Johnson and Lake Wpg; slight plume and delta formation	3	00:02:40	ICELANDIC3
Progress Drain	Confluence		Progress and Lake Wpg; Note delta formation	3	00:03:52	ICELANDIC3
Progress Drain	Tributary		A natural tributary to Progress Drain?		00:05:22	ICELANDIC3
Progress Drain	Road Crossing	Bridge	To private property		00:06:03	ICELANDIC3
Progress Drain	Road Crossing	2 culverts	Onto field; erosion of drain apparent on downstream side (RB)	3	00:06:14	ICELANDIC3
Progress Drain	Road Crossing	2 culverts	Hwy. 8		00:06:24	ICELANDIC3
Progress Drain	Dugout		Large dugout on far RB; not attached to drain		00:06:26	ICELANDIC3
Progress Drain	Road Crossing	2 culverts	Main crossing		00:07:06	ICELANDIC3
Progress Drain	Road Crossing	2 culverts	Gravel/mud top; machinery to fields		00:07:25	ICELANDIC3
Progress Drain	Road Crossing	2 culverts	Main crossing		00:07:43	ICELANDIC3
Progress Drain	Road Crossing	?	Onto private property		00:07:55	ICELANDIC3
Progress Drain	Road Crossing	?	Main crossing		00:08:19	ICELANDIC3
Okno Drain	Confluence		Okno Drain and Washow Bay Creek		00:09:33	ICELANDIC3
Okno Drain	Grazing		Cattle grazing extensively along LB; fenced?; duck weed?	1	00:09:43	ICELANDIC3
Okno Drain	Grazing		Possible cattle access and watering in small dugout	1	00:09:47	ICELANDIC3
Okno Drain	Road Crossing	2 culverts?	Mud and gravel; machine access and cattle?; duckweed	1	00:09:49	ICELANDIC3
Okno Drain	Road Crossing	1 culvert	Main crossing		00:10:13	ICELANDIC3
Okno Drain	Road Crossing	1 culvert	Mud and gravel; machine access onto field		00:10:31	ICELANDIC3
Okno Drain	Road Crossing	1 culvert	Main crossing		00:10:50	ICELANDIC3
Okno Drain	Cropland		Extensive tilled field (bare?) on LB; possible runoff	3	00:10:54	ICELANDIC3
Petrachek Drain	Road Crossing	2 culvert	Gravel top for machine access to field		00:14:06	ICELANDIC3
Petrachek Drain	Road Crossing	2 culvert	Main crossing		00:14:29	ICELANDIC3
Petrachek Drain	Road Crossing	2 culvert	Gravel top for machine access to field; possible erosion site	3	00:14:44	ICELANDIC3
Petrachek Drain	Road Crossing	2 culvert	Onto private property		00:14:59	ICELANDIC3
Petrachek Drain	Road Crossing	3 culvert	Main crossing		00:15:27	ICELANDIC3

Appendix 3.1 Continued.

Area	Type	Composition	Comment	Priority	Video Time	Tape Name
Petrachek Drain	Grazing		Possible grazing on LB; appears to be fenced	3	00:16:03	ICELANDIC3
Petrachek Drain	Road Crossing	1 culvert	Machinery crossing		00:16:17	ICELANDIC3
Petrachek Drain	Confluence		Petrachek and Washow Bay Creek		00:16:47	ICELANDIC3
Bump Drain	Confluence		Bump Drain and Washow Bay Creek		00:18:46	ICELANDIC3
Bump Drain	Road Crossing		Main/well used crossing; private property		00:18:58	ICELANDIC3
Bump Drain	Grazing		Grazing area on LB; fenced	3	00:19:01	ICELANDIC3
Bump Drain	Grazing		Pasture on LB; likely fenced	3	00:19:08	ICELANDIC3
Bump Drain	Road Crossing		Cart track with culverts		00:19:33	ICELANDIC3
Bump Drain	Ford	Drain bed	Machinery crossing; cropland on both sides	no	00:22:08	ICELANDIC3
Washow Bay Creek	Cropland		Field adjacent to Washow Bay Creek? RB	3	00:27:16	ICELANDIC3
Washow Bay Creek	Grazing		Possible grazing on LB and RB	2	00:27:38	ICELANDIC3
Washow Bay Creek	Road Crossing	1 culvert?	Main/well used crossing		00:28:56	ICELANDIC3
Washow Bay Creek	Road Crossing	2 culverts	Mud/gravel covered machinery crossing		00:30:30	ICELANDIC3
Washow Bay Creek	Road Crossing	2 culverts	Main road		00:30:56	ICELANDIC3
Washow Bay Creek	Road Crossing	2 culverts	Main road; sharp bend possible site of erosion		00:31:32	ICELANDIC3
Washow Bay Creek	Road Crossing	2 culverts	Main road		00:32:32	ICELANDIC3
Washow Bay Creek	Road Crossing	2 culverts	Main road		00:33:21	ICELANDIC3
Washow Bay Creek	Industrial		Vidir Machine (again at 00:34:56)	no	00:33:26	ICELANDIC3
Washow Bay Creek	Road Crossing	2 culverts	Main road		00:35:41	ICELANDIC3
Washow Bay Creek	Road Crossing	2 culverts	Mud/gravel covered machinery crossing		00:36:06	ICELANDIC3
Washow Bay Creek	Road Crossing	2 culverts	Main/well used crossing; private property		00:36:40	ICELANDIC3
Washow Bay Creek	Grazing		Possible grazing on RB; fenced?	no	00:36:44	ICELANDIC3
Washow Bay Creek	Pasture		Pasture/grazing on far LB (across road)	no	00:37:02	ICELANDIC3
Washow Bay Creek	Road Crossing	3 culverts	Main road		00:37:06	ICELANDIC3
Washow Bay Creek	Road Crossing	3 culvert ?	Main/well used crossing		00:37:47	ICELANDIC3
Washow Bay Creek	Road Crossing	2 culverts	Main road; sharp bend possible site of erosion		00:38:27	ICELANDIC3
Washow Bay Creek	Grazing		Possible grazing on RB; fenced (cattle at 00:39:15)	no	00:38:55	ICELANDIC3
Washow Bay Creek	Road Crossing	2 culverts	Main road		00:40:25	ICELANDIC3
Washow Bay Creek	Operation		Larger agricultural structures on LB; with possible grazing	3	00:41:17	ICELANDIC3
Washow Bay Creek	Road Crossing	2 culverts	Main road		00:41:20	ICELANDIC3
Washow Bay Creek	Grazing		Possible grazing on RB; possibly fenced; access?	no	00:41:25	ICELANDIC3

Appendix 3.1 Continued.

Area	Type	Composition	Comment	Priority	Video Time	Tape Name
Washow Bay Creek	Road Crossing	1 culvert	Road along drain with 1 culvert from field; possible sediment load		00:42:32	ICELANDIC3
Washow Bay Creek	Feeding		Possible livestock feeding area on LB; access to drain?	3	00:43:01	ICELANDIC3
Washow Bay Creek	Dugout		On far LB; not attached to drain; pipe fed?		00:43:25	ICELANDIC3
Washow Bay Creek	Grazing		On RB; appears to be fenced	no	00:44:26	ICELANDIC3
Washow Bay Creek	Road Crossing	Bridge	Main crossing		00:44:29	ICELANDIC3
Washow Bay Creek	Tributary		Small, 'natural' tributary (RB)		00:45:19	ICELANDIC3
Washow Bay Creek	Meander		Original stream meander prior to channelization? (RB)		00:45:33	ICELANDIC3
Washow Bay Creek	Tributary		Small, 'natural' tributary (RB)		00:45:37	ICELANDIC3
Washow Bay Creek	Homestead		Small homestead on LB	3	00:45:52	ICELANDIC3
Washow Bay Creek	Road Crossing	Bridge	Main road		00:46:02	ICELANDIC3
Washow Bay Creek	Grazing	Pasture	Grazing area on far LB; dugout with drain?;good buffer	3	00:47:20	ICELANDIC3
Washow Bay Creek	Boat launch		Boat launch	no	00:47:30	ICELANDIC3
Washow Bay Creek	Road Crossing	Bridge	Main road and boat launch on RB		00:47:29	ICELANDIC3
Hodgson Drain (Sugar Creek)	Confluence		Mouth of Hodgson Drain at Lake Winnipeg		00:50:58	ICELANDIC3
Hodgson Drain (Sugar Creek)	Road Crossing	Bridge	Main road		00:51:45	ICELANDIC3
Hodgson Drain (Sugar Creek)	Barrier	Beaver dam	Possible beaver dam with slight impoundment	3	00:51:56	ICELANDIC3
Hodgson Drain (Sugar Creek)	Barrier	Beaver dam(s)	Possible beaver dam(s) with impoundment	3	00:51:59	ICELANDIC3
Hodgson Drain (Sugar Creek)	Cropland		Bare field in close proximity to drain/creek	3	00:52:02	ICELANDIC3
Hodgson Drain (Sugar Creek)	Cropland	Erosion	Cropland and bank failure?; not on video but on ground at HD1	1	not applicable	
Angle Drain	Road Crossing	3 culverts	Main road		00:54:26	ICELANDIC3

Appendix 3.2 Potential rehabilitation sites identified throughout the Washow Bay Creek watershed, 2006.

RPT ID	DISC	VTR TIME	TYPE	COMMENT	PRIORITY	UTM		WATERCOURSE
						Easting	Northing	
1	3	00:01:10	Operation	Appears to be livestock operation along drain; fenced?	1	641315	5659582	Ben Johnson Drain
2	3	00:01:12	Ford	Appears to be machinery ford and or cattle access point	2	641338	5659502	Ben Johnson Drain
3	3	00:02:40	Confluence	Ben Johnson and Lake Wpg; slight plume and delta formation	3	644204	5659279	Ben Johnson Drain
4	3	00:03:52	Confluence	Progress and Lake Wpg; Note delta formation	3	643027	5657585	Progress Drain
5	3	00:06:14	Road Crossing	Onto field; erosion of drain apparent on downstream side (RB)	3	641345	5657653	Progress Drain
6	3	00:09:43	Grazing	Cattle grazing extensively along LB; fenced? duck weed?	1	633935	5657441	Okno Drain
7	3	00:09:47	Grazing	Possible cattle access and watering in small dugout	1	633786	5657439	Okno Drain
8	3	00:09:49	Road Crossing	Mud and gravel; machine access and cattle?; duckweed	1	633707	5657438	Okno Drain
9	3	00:10:54	Cropland	Extensive tilled field (bare?) on LB; possible runoff	3	630917	5657375	Okno Drain
10	3	00:14:44	Road Crossing	Gravel top for machine access to field; possible erosion site	3	632689	5662330	Petrachek Drain
11	3	00:16:03	Grazing	Possible grazing on LB; appears to be fenced	3	635050	5662387	Petrachek Drain
12	3	00:19:01	Grazing	Grazing area on LB; fenced	3	638552	5665761	Bump Drain
13	3	00:19:08	Grazing	Pasture on LB; likely fenced	3	638327	5665755	Bump Drain
14	3	00:27:16	Cropland	Field adjacent to Washow Bay Creek? RB	3	620725	5661787	Washow Bay Creek
15	3	00:27:38	Grazing	Possible grazing on LB and RB	2	620985	5660923	Washow Bay Creek
16	3	00:41:17	Operation	Larger agricultural structures on LB; with possible grazing	3	634911	5660414	Washow Bay Creek
17	3	00:43:01	Feeding	Possible livestock feeding area on LB; access to drain?	3	637111	5662858	Washow Bay Creek
18	3	00:45:52	Homestead	Small homestead on LB	3	638717	5668468	Washow Bay Creek
19	3	00:47:20	Grazing	Grazing area on far LB; dugout with drain?;good buffer	3	638673	5671136	Washow Bay Creek
20	3	00:51:56	Barrier	Possible beaver dam with slight impoundment	3	638708	5678809	Hodgson Drain (Sugar Creek)
21	3	00:51:59	Barrier	Possible beaver dam(s) with impoundment	3	638630	5678827	Hodgson Drain (Sugar Creek)
22	3	00:52:02	Cropland	Bare field in close proximity to drain/creek	3	638465	5678844	Hodgson Drain (Sugar Creek)
23	-	-	Erosion	Cropland causing bank failure?; ground truthed at HD1	1	637023	5677763	Hodgson Drain (Sugar Creek)

Note: The second ford (located on the Bump Drain) was not identified as a priority and therefore not indicated on this list (see Appendix 3.1).