DUCKS UNLIMITED CANADA

PASQUIA PROJECT

ANNUAL PROGRESS REPORT – JUNE 2002

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EXECUTIVE SUMMARY

The Pasquia Project, which falls under the Western Boreal Program of Ducks Unlimited Canada, was initiated in 2000 with field activities commencing in 2001. Financial and in-kind support for this project has been provided by SaskPower, Saskatchewan Environment and Resource Management, Louisiana Pacific Canada, Manitoba Conservation and Tembec Industries Inc. Activities for the fiscal year 2001/2002 included strengthening the project partnership, commencement of the satellite based landcover classification and mapping, initiation of the first year of a three year waterbird inventory program, meetings and discussions regarding a Traditional Ecological Knowledge pilot project and various communication activities. This report provides an update on the progress of the satellite-based landcover classification and mapping, preliminary results of the waterbird surveys, a review of project expenditures and an overview of other aspects of the project conducted to date. A brief overview of activities scheduled for fiscal year 2002/2003 is also provided.

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I INTRODUCTION AND BACKGROUND

The Western Boreal Forest is second only to the Prairie Pothole Region in terms of continental waterfowl breeding effort (Figure 1). This important area has been ranked number three in priority of the 26 most important waterfowl habitat areas at risk in North America (Ducks Unlimited, 1994). For reasons yet to be determined, populations of common boreal nesting waterfowl species such as lesser scaup and scoters are declining. As a result, these species have been the focus of considerable discussion (Austin et al., 2000) and are currently the emphasis of research projects (Sea Duck Joint Venture, n.d.) including those conducted by Ducks Unlimited Canada (Slattery 2002).

Industrial activity including petroleum exploration and development, forestry, mining and hydro electricity generation as well as agriculture has greatly expanded in the Western Boreal Forest. The influence of these activities, and the potential consequences of climate change on boreal wetland ecosystems remain largely unknown.

In 1997 Ducks Unlimited Canada (DUC) established its Western Boreal Forest Initiative (WBFI) in an effort to help answer questions about the function of boreal wetlands and value to waterbirds. An extensive review of technical and scientific papers pertaining to wetlands, waterbirds and their habitats in the circumpolar boreal zone revealed a significant regional information gap exists (Foote, 1998). One of the greatest information needs is an accurate inventory of wetlands, riparian areas and associated uplands.

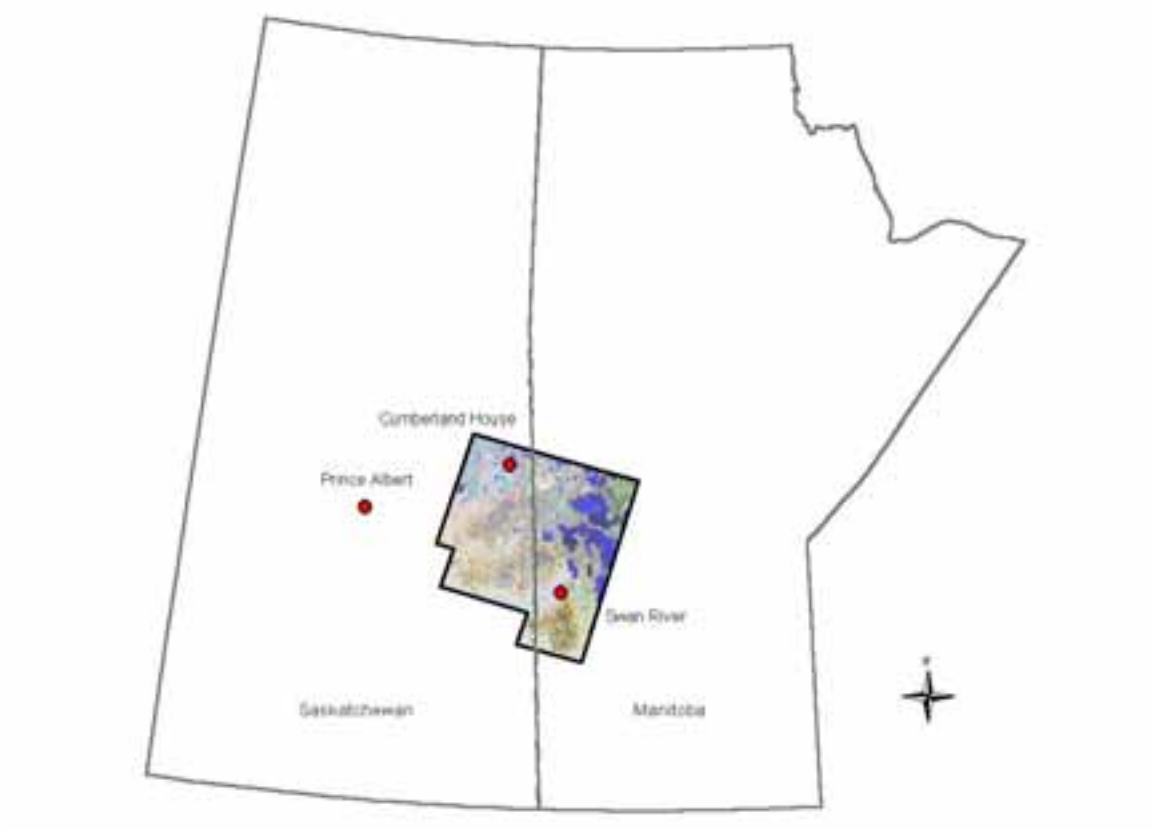
Figure 1. Western Boreal Forest, Ecozone Boundaries and Major Centres.

Since existing landcover inventory and mapping information is often unreliable, non-current or incomplete, a key component of the DUC Boreal Forest program is landcover inventory and mapping. Other important components include an inventory of waterbird communities and water chemistry on associated wetlands and directed research on the ecology, hydrology and disturbance of boreal wetlands.

In 2000 DUC identified the need to establish a project in Manitoba and Saskatchewan to complement the work in Alberta, Northeastern BC, the NWT and the Yukon. Manitoba and Saskatchewan are well recognized as contributing significantly to all flyways in North America, particularly the prairie and parkland regions. However, unlike these southern regions, limited information is available for boreal wetlands that provide more consistent water conditions and contribute significant breeding, moulting and staging habitat for large numbers of waterbirds.

The Pasquia Project area was selected to represent the southeastern portion of the Boreal Plains Ecozone (Ecological Stratification Working Group 1995) and includes portions of six ecoregions including the Mid-Boreal Uplands, Mid-Boreal Lowlands, Boreal Transition, Aspen Parkland, Lake Manitoba Plain, and the Interlake Plain. Notable features include the Saskatchewan River Delta (Mid-Boreal Lowlands), the Porcupine Mountains, the Pasquia Hills, the Duck Mountains (Mid-Boreal Uplands) and portions of Lake Winnipegosis (Interlake Plain).

Figure 2. Location of the Pasquia Project.



Project components include:

- Accurate and enhanced satellite based landcover classification that includes wetlands
- Comprehensive waterbird inventory of representative wetland and wetland complexes within the study area
- Baseline wetland productivity inventory of representative wetlands through the collection of water chemistry parameters
- Development of an understanding of Traditional Ecological Knowledge of wetlands within the project area

A description of the Pasquia Project components is outlined in Stewart et al (2000). This is an annual interim report to provide a synopsis of:

- Activities of the Project for the fiscal year of 2001/2002 and,
- Outline proposed activities for 2002/2003

II OVERVIEW 2001 / 2002

In 2001 principle aspects of the project included establishing a partnership base, initiating the landcover classification, conducting the first year of waterbird surveys, establishing initial contacts to conduct the Traditional Ecological Knowledge and communicating various aspects of the project to the public and the project partners.

Partnerships

Fundamental to the success of the Pasquia Project has been the strong and supportive partner base. Partnerships not only bring financial resources but expertise, local knowledge of issues, field conditions and opportunities as well as ancillary data suitable for use in the project.

Late in 2000 SaskPower became the first financial partner in the project and considerable time was expended in the first quarter of 2001 meeting with other agencies including government, First Nations and the private sector. By summer additional partnerships were established with Saskatchewan Environment and Resource Management (SERM), Louisiana Pacific Canada Ltd, Manitoba Conservation and Tembec Inc.

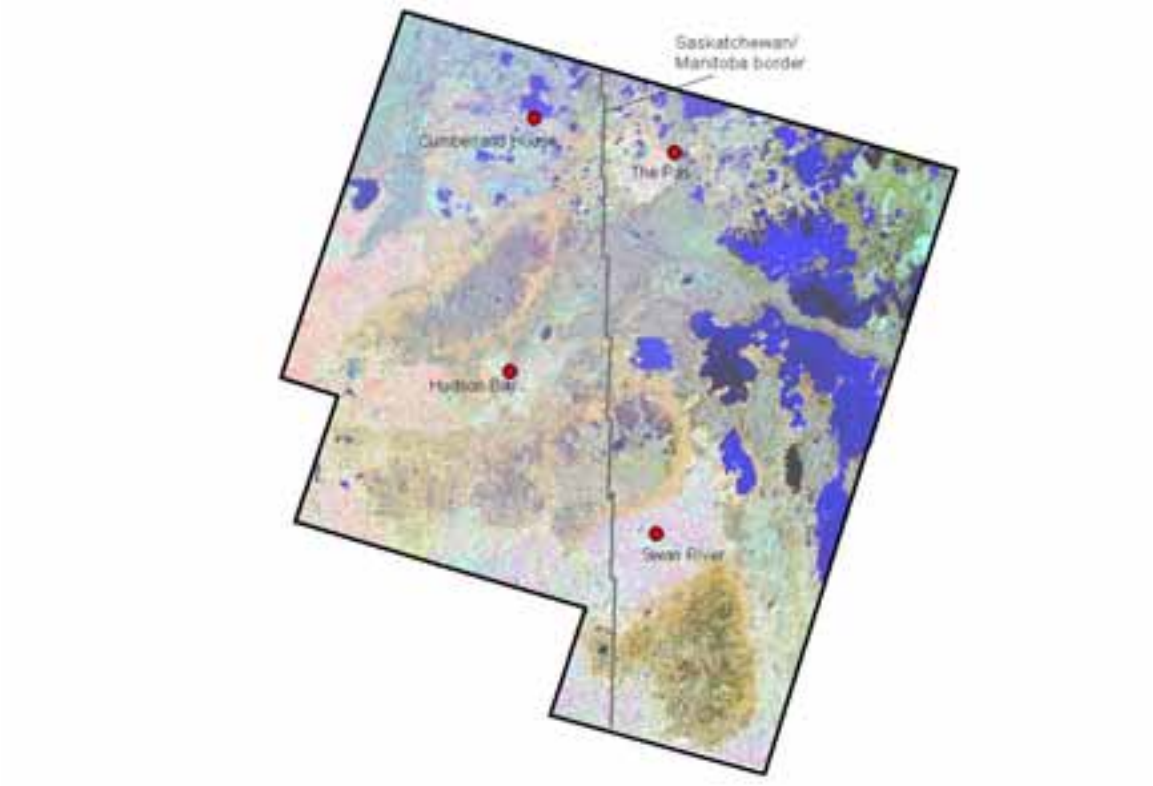
Landcover Classification

The purpose of the landcover classification is to provide baseline information on the various cover types found within the Pasquia Project. This fundamental understanding will provide resource managers, researchers, industry, and other organizations with detailed information on the spatial distribution of cover classes for use in modeling, management decisions, research and many other uses. For Pasquia, the landcover classification is the basis for selecting basins for the waterbird and water chemistry inventories as well as the foundation for evaluating area change information and future modeling exercises.

Landsat Thematic Mapper (TM) satellite imagery has been selected to be the medium of choice by DUC. This choice is based on the experience of Ducks Unlimited Inc (DUI), which has established proven methodologies in Alaska with the U.S. Bureau of Land Management over a period of 15 years. TM imagery provides an accurate digital inventory for numerous cover classes including wetlands and is suitable for the type of information needs identified for the Western Boreal Forest Program. TM imagery is well suited for large-scale mapping projects, since it provides a wide range of spectral information for discrimination of the various earth cover classes. The large area coverage of TM Imagery (160 square kilometers per scene) also allows for cost effective mapping of large-scale project areas.

Early in 2001 DUC and DUI staff searched for the most recent cloud free imagery available for the study area and selected a combination of mid-summer Landsat TM 5 and TM 7 images for 1999. A mosaic of these images was created to match the project area and properly georeferenced followed by quality control measures including the removal of miscellaneous clouds and shadows (Figure 3). An unsupervised classification of the imagery was generated and approximately 2000 field sites were selected based on the spectral uniqueness of the individual cover types. These sites were digitized and the centroid of the polygons calculated for location of field sites that were investigated in the summer.

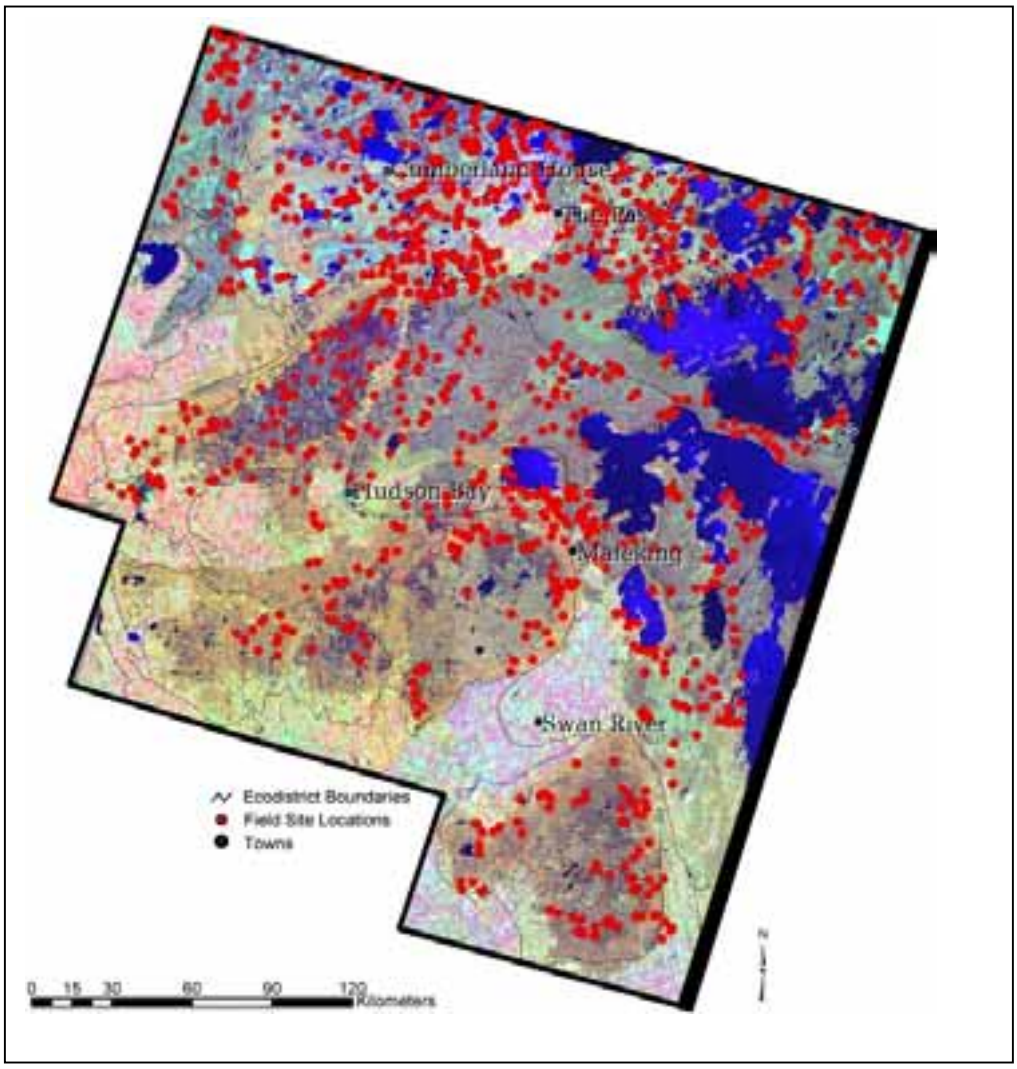
Figure 3. Pasquia Project Landsat Image.



Prior to the fieldwork a draft landcover decision /classification key was prepared and distributed to project partners for review and comment. This was followed by a conference call to customize and finalize the decision tree to capture cover types believed to be important and relevant to the project area and resulted in 59 potential cover types (See Appendix A). A list of common terrestrial and aquatic vegetation was prepared and a customized field form developed in order to record and collate the field data.

Fieldwork was conducted between August 1-26, 2001 out of four base camps including The Pas, Swan River, Hudson Bay and Cumberland House. A total of 1097 sites were visited via helicopter during this period totaling 128.8 hours of flight time (Figure 4). Of the 1097 sites, 945 were from the 2000 predetermined sites and 152 were designated in the field to capture information on sites that would otherwise be under sampled (in particular wetlands and mixedwood sites).

Figure 4. Pasquia Project Landcover Field Sites, 2001.



Data collected at each field site included a complete list of species observed, tree/shrub heights, total percent cover, slope, drainage and the cover class as per the decision/classification tree. In addition, each upland site was assigned a V-type (vegetation type) as per the Manitoba Forest Ecosite Classification for Manitoba (Zoladeski et al. 1995) and peatland sites (bogs / fens) were assigned the appropriate lowland class as per the Field Guide to Ecosites of the Mid-boreal Ecoregions of Saskatchewan (Beckingham et al. 1996). Three digital photos were taken of each site (low, high, and oblique angle shots) and the waypoints recorded for future use and field data was entered into a customized database for future analysis. Following the fieldwork a progress report was prepared to outline a preliminary overview of this component of the project.

Since the field season of 2001 processing of the field data has been completed. Of the 1097 sites visited, data from 812 have been retained to help train and develop the classification. The remaining 286 sites (25%) have been set aside for future accuracy assessment. Analysis of the data is progressing well and so far 23 classes have been confirmed including forest (15), shrub (3), meadow (3) and wetland (2) cover types. The analysis is ongoing and the current projection is that 30 to 35 cover classes will be represented in the final product.

In addition to the field data collected in 2001, project partners have contributed ancillary data in the form of digital forest inventory data, ortho-photo's, fire scar information, forestry cutover records and ground based forestry data for various portions of the project area. This valuable information will augment the field data and strengthen the image classification process. Specific to portions of the upper Saskatchewan River Delta, project partners from Saskatchewan provided year 2000 radar data that will assist in classifying the image in this portion of the project area and will help determine some of the cover classes that are more temporarily influenced near Cumberland House.

Waterbird Inventory

Overview

We conducted a combination of rotary wing and fixed wing surveys throughout the open water period of 2001 to determine waterbird use of wetlands in the project area. Given the unique wetlands within the Pasquia Project a combination of individual basin surveys on the smaller isolated wetlands and line transect strip surveys on selected large basins and the Saskatchewan River Delta (SRD) were conducted. In addition, reconnaissance transect surveys were conducted on a portion of Lake Winnipegosis.

Surveys were scheduled to capture early and late nesting species and to document wetland use over time for the open water season. For individual wetlands, four rotary-wing and 3 fixed-wing surveys were conducted to capture the breeding, brood rearing and post breeding / migration seasons. For the line transect work 7 fixed-wing surveys were conducted to capture the breeding/spring staging, brood rearing/molting and post breeding/ fall staging seasons.

Species of interest, including all waterfowl, colonial waterbirds (e.g., gulls, terns) and other wetland-dependent avian species (e.g., loons) were recorded as encountered. Geo-referencing of waterbird survey data was accomplished using flight following software (ArcView Tracking Analyst®) and incorporated as point data. Data tapes were transcribed onto data sheets and later entered into a database management program (Waterbird Survey Program Ver. 1.0) developed by DUC specifically for these types of waterbird inventories.

Individual Basin Surveys

Basin Selection

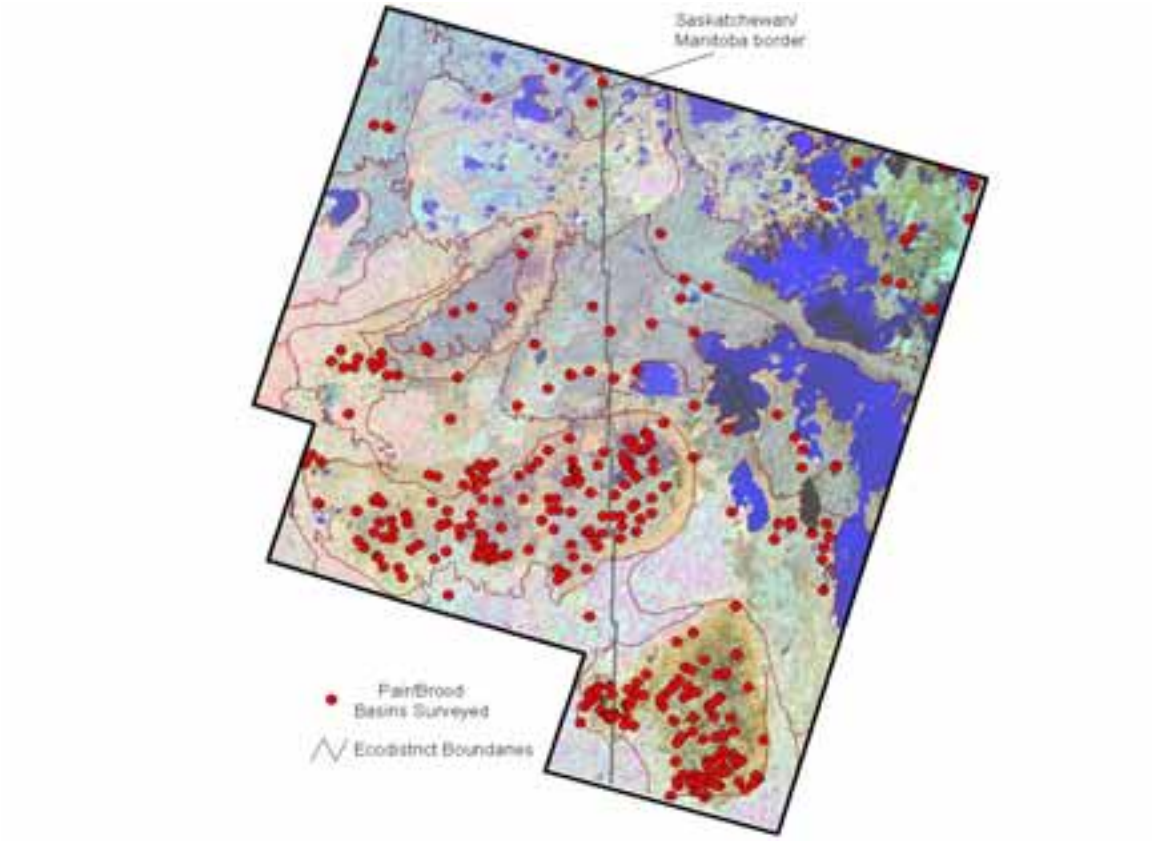
Since waterbird use is expected to vary by wetland/wetland type across the project area a stratification system was established to ensure a representative sample from each "landscape unit". The Ecoregion and Ecodistrict classification framework (Ecological Stratification Working Group 1995) was selected as the landscape unit for stratification purposes. Ecoregions are subdivisions of an ecozone characterized by distinctive large order landforms or assemblages of regional landforms, small order macro- or meso-climates, vegetation, soils, water, and regional human activity patterns/uses. Ecodistricts are subdivisions of ecoregions and are characterized by distinctive assemblages of landform, relief, surficial geologic material, soil, water bodies, vegetation, and land uses.

Within the Pasquia Project study area, there are 22 Ecodistricts contained in 5 Ecoregions including the Mid-Boreal Lowlands, Mid-Boreal Uplands, Boreal Transition, Interlake Plain and the Aspen Parkland. Basin surveys were conducted in 20 of the ecodistricts with the remaining two being the upper and lower SRD (which were surveyed by using the line transect survey method).

An unsupervised classification of the Pasquia Project satellite image was imported into ArcView (ver 3.1; ESRI 1996) and expected classes of wetlands were arbitrarily determined for the selection of the waterbird sampling universe. Sites < 1.0 ha were excluded from the sample universe to reduce risks of misclassification (e.g., terrain shadow, misclassified single and small clusters of pixels, etc.). The total number of wetlands within each Ecodistrict was determined and, using a "proportional allocation protocol (a ratio of wetlands per Ecodistrict to total wetlands on the scene to represent the proportion), individual basins were randomly selected.

For the Indicated Breeding Pair (IBP) and Brood surveys wetlands > 300 ha were excluded from the samples due to survey constraints and the expectation that these wetlands will be more important for fall staging. A subset of 332 wetlands were selected for IBP and brood surveys in 2001 (Figure 5) although some basins were dropped during the survey for a variety of reasons including misclassification from the satellite image.

Figure 5. Basins selected for Pair and Brood Surveys Pasquia Project, 2001.



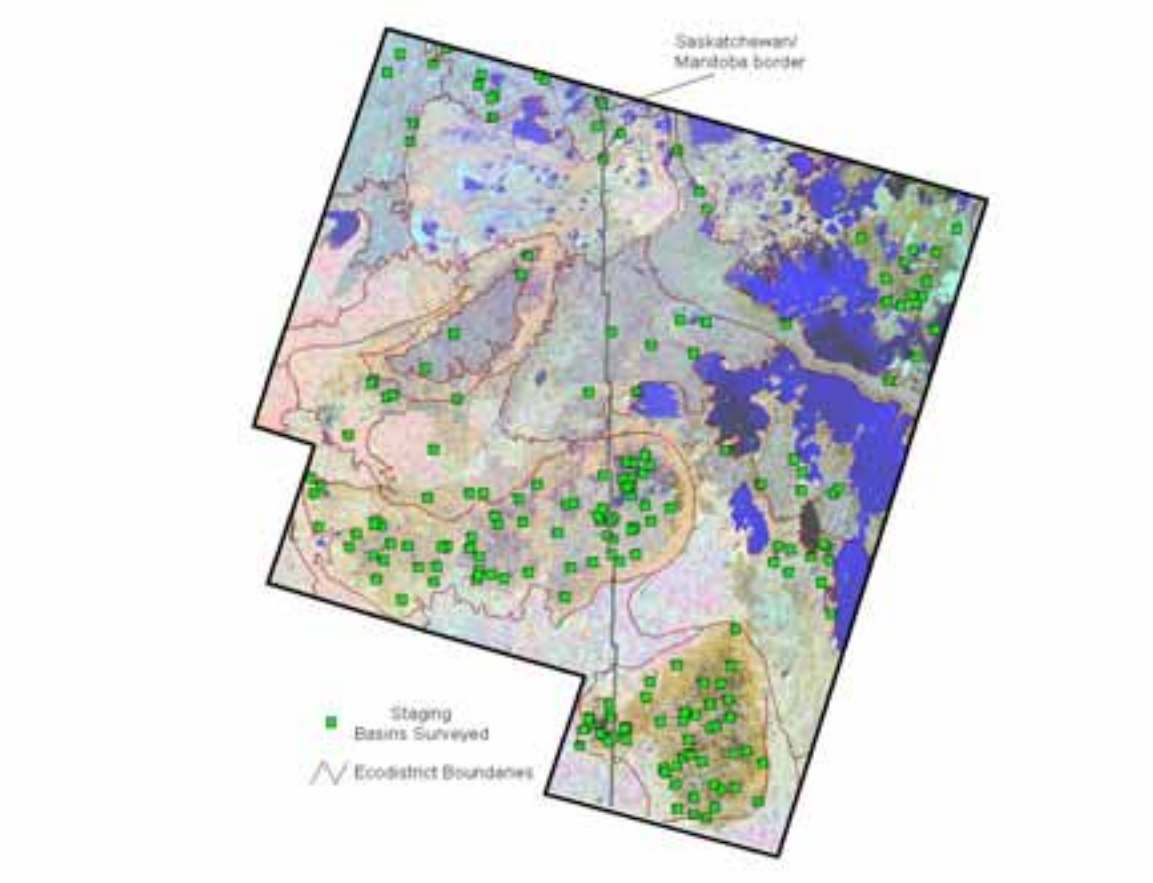
For post breeding / staging surveys wetlands >300ha and less than 1000ha were included in the sample universe. A subset of 230 basins was selected for surveys and represented 66% of the total number of basins selected (Figure 6). Time and budget constraints precluded the full set of individual wetlands being sampled for staging in 2001.

Basin Survey Protocols

Survey techniques were modified from protocols developed by the Canadian Wildlife Service (CWS) for application in eastern North America (Black Duck Joint Venture, 1996). Individual wetlands functioned as the unit of measure for recording all observations. Both ArcView 3.2a software integrated with a Tracking Analyst moving map extension and a global positioning system (GPS) ensured that all basins visited corresponded with pre-defined coordinates (Environmental Systems Research Institute Inc. 1996).

The survey crew consisted of a pilot, an observer / navigator seated in the front beside the pilot and an observer seated in the rear behind the pilot. Both observers were responsible for observations on opposite sides of the aircraft and employed individual micro-cassette tape recorders to record all waterbirds observed. Bell 206B and 206L helicopters on skids equipped with bubble windows were utilized for the IBP and brood surveys.

Figure 6. **Basins selected for Post Breeding/Staging Surveys Pasquia Project, 2001.**



Surveys were flown at a nominal altitude of 35 m, however the survey elevation was occasionally reduced to between 15 and 35 m above ground level (AGL) as required given shoreline complexity, vegetative cover conditions, or unconfirmed species or sex. Ground speeds did not exceed 100 km/h during the active survey effort however, over areas with reduced visibility, significantly slower speeds (e.g. 30 km/h) were employed. Depending on the size and shape of the basins, different flight paths were required to attain 100% coverage based on maximum estimated visibility (i.e. one central transect, circle from shoreline, multiple transects, etc).

Two breeding pair surveys (May 6 - 9 and May 28-31) and 2 brood surveys (June 24-27 and July 23-26) were conducted to document waterbird productivity for early and late nesting species. Due to the large number of individual wetlands two helicopter survey crews were utilized for the breeding and brood production surveys with one crew focusing on basins on the Saskatchewan portion of the project area while the second crew surveyed the Manitoba side. IBP surveys required the recording of species, sex, and social status for all waterbirds encountered. During the brood surveys, brood species, age, clutch size, and presence of a female were recorded. Age of duck broods were estimated based on Gollop and Marshall (1954) and Wishart (1983). The same basins were surveyed for all breeding pair and brood surveys.

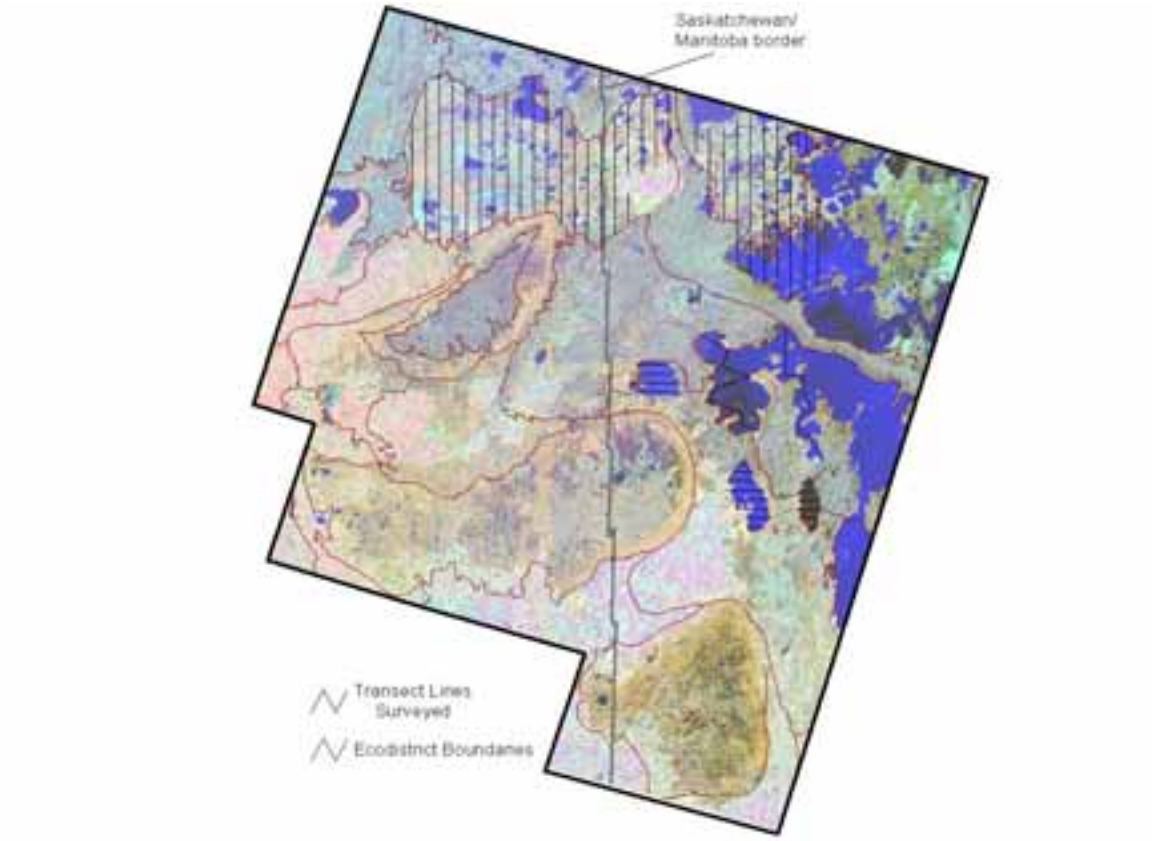
Three post-breeding/fall staging surveys were conducted (Aug 27- Sept 5, Sept 17-20, and Oct 01-10) using a high-wing Cessna 206 on wheels. The aircraft was flown approximately 100m AGL at a speed of 150 km/hr. The number of birds, by species, was recorded for each wetland surveyed.

Line Transect Surveys

Transect Establishment

Line transect surveys were established for the Saskatchewan River Delta (SRD), Opuskow Bay, Plummer's Marsh, Reddeer Lake, Swan Lake and Pelican Lake. Given the large size of the SRD (approx. 950,000 ha) it was determined that survey coverage should target approximately 5% of the two ecodistricts that make up the delta. For the remaining basins the survey area covered approximately 10% of the basin water area. This resulted in 31 transects being established for the SRD and 4, 2, 4, 8, 6 transects established for Opuskow Bay, Plummer's Marsh, Reddeer Lake, Swan Lake and Pelican Lake respectively (Figure 7). Transects were oriented north to south in the SRD, Opuskow Bay and Plummer's Marsh and east to west for the remaining basins to maximize the number of replicates for future statistical analysis.

Figure 7. Line Transects for Selected Large Basins and the Saskatchewan River Delta, Pasquia Project, 2001.



Transect Survey Protocols

Survey protocols were similar to those employed by the USFWS (U.S. Fish and Wildlife Service / Canadian Wildlife Service 1987) although slight modifications were employed. Surveys were conducted at a nominal elevation of 30 m AGL at approximately 150 km/hr using a Cessna 185 on floats with an observer/navigator located in the front right position of the aircraft and a second observer seated on the opposite side of the aircraft in the rear. For the SRD, Opuskow Bay and Plummer's Marsh observations were recorded within a 300m strip of the aircraft flight path (150m on each side) for the breeding pair and brood/molting surveys and 400m (200m on each side) for the post breeding/migration surveys to account for visibility factors during the growing season. For the remainder of the basins a 400 m strip width was employed for all surveys.

ArcView 3.2a software integrated with a Tracking Analyst moving map extension and a global positioning system (GPS) ensured that each transect flown corresponded with pre-defined start and end coordinates (Environmental Systems Research Institute Inc. 1996). Specific waterbird observation locations were geo-referenced by linking observation interval (recorded to the nearest second) with latitude/longitude position generated by simultaneous GPS position identification as recorded using a PC based moving map display (ArcView Tracking Analyst software).

Two breeding pair surveys (May 10-13 and June 01-06) and 2 brood /molting surveys (June 28-July 5 and July 27-Aug 01) were conducted to document waterbird abundance for early and late nesting species. Breeding pair surveys required the recording of species, sex, and social status for all waterbirds encountered. During the brood/molting surveys brood observations were incidental due to visibility bias and surveys concentrated on securing waterbird abundance information. Three post breeding/fall staging surveys were also conducted (Aug 28-Sept 05, Sept 17-20, and Oct 01-05) where the numbers of birds, by species, were recorded.

Lake Winnipegosis Reconnaissance

Due to the size of Lake Winnipegosis, systematic line transect surveys were not conducted due to budget and time limitations. In order to secure an indication of waterbird use in this lake a series of short reconnaissance transects were established in Dawson and Pelican Bay that correlated to different water depths as per lake contour maps produced by the Canadian Hydrographic Service (See Figure 7). The assumption was that there would be a relationship between waterbird use and water depth.

Surveys were conducted as per the transect survey protocols (200 m strip width on both side of the aircraft) and occurred on June 1, July 4, July 31, Aug 30, Sept 19 and October 5 to capture most of the open water period. Results of these surveys will assist in determining waterbird use of this lake and future survey requirements.

Preliminary Results

Following are initial results of data collected in 2001 comprised primarily of descriptive statistics to provide an initial broad overview. Further analysis will be conducted as additional data is collected and the classified satellite image for the project area is completed.

Individual Basin Surveys

Data from both breeding pair surveys were utilized to estimate the indicated breeding pairs (IBP) of ducks on basins surveyed by backdating nest initiation dates. IBP survey 1 was used to determine IBP estimates for mallard, bufflehead, common goldeneye and canvasback while IBP survey 2 was used for blue-winged and green-winged teal, American wigeon and lesser scaup. An average of survey 1 and 2 were used to calculate the IBP estimates for the other waterfowl species. Note that the Alpha-code for observed waterbird species is included in Appendix B.

A total of 314 and 318 basins were surveyed during the first and second survey respectively and a total estimate of 2209 IBP representing 18 duck species were observed. This represents approximately 6.98 pairs per basins with almost an even split between diving and dabbler duck species (although there were slightly more diving ducks observed). Mallard, ring-necked duck, bufflehead, blue-winged teal and common goldeneye were the most abundant species observed representing approximately 78% of all duck species documented (Table 1).

Table 1. IBP estimates for duck species from two spring waterbird surveys on selected basins in the Pasquia study area, 2001. [a]

Species[b]	IBP 1 May 6-9[c]	IBP 2 May 28-31[c]	IBP ([d])	IBP/Basin
MALL	650	433	650 (1)	**2.057**
BWTE	272	206	206 (2)	**0.648**
AGWT	119	103	103 (2)	**0.324**
AMWI	59	60	60 (2)	**0.189**
NOPI	35	3	19 (avg)	**0.060**
NSHO	28	16	22 (avg)	**0.070**
GADW	0	6	13 (avg)	**0.041**
BUFF	330	204	330 (1)	**1.051**
RNDU	302	418	418 (2)	**1.314**
LESC	283	93	93 (2)	**0.292**
COGO	112	38	112 (1)	**0.357**
CANV	28	11	28 (1)	**0.089**
REDH	25	14	20 (avg)	**0.063**
HOME	15	9	12 (avg)	**0.038**
COME	14	10	75 (avg)	**0.237**
RUDU	12	15	14 (avg)	**0.044**
OTHER[d]	43	25	34 (avg)	**0.108**
Total	**2327**	**1664**	**2209**	**6.982**

[a] IBP equals the total of lone males, pairs and small groups of males (≤4).
[b] Alpha code species list included in Appendix B
[c] Number of basins surveyed = 314 and 318 for first and second survey respectively.
[d] Denotes survey used to determine IBP (ie. 1st, 2nd, or average of both)
[e] Other includes observations of WODU, SCOT, RNDU/SCAU and unidentified ducks.

Two brood surveys were conducted in late June and July on 314 and 309 basins respectively. Total estimated broods were determined by backdating brood observations and unique brood observations include only positively identified broods. A total of 768 broods were observed with 605 unique broods (79%) being identified (Table 2). Mallard, ring-necked duck, bufflehead, lesser scaup and common goldeneye were the most abundant broods observed representing approximately 80% of the unique broods.

Table 2. Observed duck broods from surveys conducted on selected basins in the Pasquia study area, 2001.

Species [a]	Brood 1 Jun 24-27 [b]	Brood 2 Jul 23-26 [b]	Total Broods	Unique Broods [c]
MALL	61	110	171	**166**
BWTE	9	35	44	**44**
AGWT	5	16	21	**21**
AMWI	2	17	19	**19**
NOPI	0	1	1	**1**
NSHO	1	0	1	**1**
GADW	2	2	4	**4**
BUFF	50	48	98	**98**
RNDU	13	92	105	**105**
LESC	2	66	68	**68**
COGO	33	13	46	**46**
CANV	8	12	20	**20**
REDH	1	2	3	**3**
COME	4	2	6	**6**
RUDU	0	3	3	**3**
RN/SC	2	56	58	**n/a**
BU/GO	1	10	11	**n/a**
OTHER[d]	8	81	89	**n/a**
Total	**202**	**566**	**768**	**605[e]**

[a] Alpha code species list included in Appendix B
[b] Number of basins surveyed = 314 and 309 for brood 1 and brood 2 respectively
[c] Estimated by backdating brood observations
[d] Other contains broods which were aged but not identified to species
[e] Unique broods contains only those positively identified to species

Three post breeding/ staging surveys were conducted between late August and early October and estimated waterfowl numbers are presented in Table 3. Large concentrations of post breeding waterfowl were not observed on most basins surveyed and the largest numbers recorded were on the first survey in late August. Identification to species at this time of the year is difficult due to the post breeding plumage, however, for species that were identified ring-necked, redhead and mallard were the most abundant. Divers were more abundant than dabbler species.

Table 3. Estimated numbers of ducks for three fall staging surveys conducted on basins in the Pasquia study, 2001. [a]

Species[b]	Staging 1 Aug 28-Sep 5	Staging 2 Sep 17-20	Staging 3 Oct 1-10	TOTAL
AGWT	0	10	0	**10**
BUFF	8	4	63	**75**
BWTE	40	5	63	**108**
MALL	456	134	362	**952**
NOPI	5	2	0	**7**
GADW	0	20	0	**20**
CANV	363	53	81	**497**
REDH	740	388	0	**1128**
RNDU	1057	677	16	**1750**
SCAU	90	193	221	**504**
RUDU	30	0	120	**150**
HOME	1	0	10	**11**
UNDA	1078	237	627	**1942**
UNDI	3774	2393	2779	**8946**
UNDU	1803	1444	2955	**6202**
OTHER[c]	830	665	780	**2275**
TOTAL	**10,275**	**6225**	**8077**	**24577**

[a] Number of basins surveyed = 195, 197 and 197 for staging survey 1, 2 and 3 respectively
[b] Alpha code species list included in Appendix B
[c] Includes unidentified ducks but does not include water birds included in Table 4.

Waterbirds other than duck species were also documented during surveys and species identified are outlined in Table 4. American coot, Canada goose, common loon, red-necked grebe and double crested cormorant were the most abundant non-duck species documented. Specific to breeding birds Canada goose, common loon and red-necked grebe were the most abundant. Both American coot and double crested cormorant were present in large numbers only in the fall. Of particular interest is the documented presence of trumpeter swans, which, with the exception of two single birds were recorded in the Porcupine and Pasquia Hills in Saskatchewan. Note that several broods with cygnets were documented during the field season, which is significant considering this species has just recently been recorded as breeding in this portion of the province.

Table 4. Non-duck waterbirds recorded on selected basin in the Pasquia study area, 2001.

Species[a]	IBP 1 May 6-9	IBP 2 May 28-31	Brood 1 Jun 24-27	Brood 2 Jul 23-26	Staging 1 Aug 28-Sep 5	Staging 2 Sep 17-20	Staging 3 Oct 1-10	Total
AMCO	265	29	40	69	1839	424	1	**2667**
RNGR	155	129	265	225	9			**783**
COLO	194	185	294	269	92	27	4	**1065**
CAGO	519	344	48	71	480	35	392	**1889**
TRUS	8	4	2	0	3	1		**18**
AWPE	35	9	14	35	105	7		**205**
GBHE	18	21	7	8	4			**58**
SACR	10	7	10	5	2			**34**
BOGU	61	17	30	13				**121**
WEGR					4		57	**61**
DCCO	1		4	2	405	25	3	**440**
Total	**1266**	**745**	**714**	**697**	**2943**	**519**	**457**	**7341**

[a] Alpha code species list included in Appendix B

Transect Surveys – Saskatchewan River Delta

Surveys in the SRD were conducted on 31 line transects from May through to early October to capture waterbird use during the entire open water period. Two surveys were conducted in May to document early and late nesting species and a total of 1689 and 1239 IPB were documented on the transects surveyed during the first and second survey respectively representing 16 duck species (Table 5). Mallard was the most abundant species documented followed by lesser scaup, ring-necked duck, blue winged teal and northern shoveler. These five species represent approximately 64 % of the total IBP with diving ducks being slightly more abundant overall (53% of total IBP).

The results of the post breeding molting and staging surveys for duck species within the SRD are provided in Table 6. Divers were more abundant than dabbling ducks although mallard was the most abundant species overall followed by lesser scaup, redhead, canvasback and ring-necked duck. These species represent approximately 13% of the duck species identified during the surveys. Total duck numbers for the SRD during this post breeding period increased with each survey peaking during the first week of October demonstrating the significant value of this region as a molting and fall staging area.

Waterbirds other than duck species were also documented during the SRD surveys and species identified are outlined in Table 7. Canada geese, American coot, tundra swan, gull species and American white pelican were the most abundant non-duck species documented. The SRD was significant for American coot, gulls and Canada geese throughout the open water period, while seasonally important to tundra swan and American white pelican.

Total number of ducks and other waterbirds documented during the surveys in the SRD are summarized in Figure 8. Based on this data, with the exception of early spring when the region was utilized for spring staging, waterbird use increased over the course of the summer months and peaking in the late fall just prior to freeze-up.

Table 5. IBP estimates for duck species from two spring waterbird surveys in the Saskatchewan River Delta, Pasquia study area, 2001. [a]

SPECIES[b]	IBP 1 May 6-9	IBP 2 May 28-31
MALL	380	248
BWTE	92	134
AGWT	21	8
AMWI	86	45
NOPI	40	9
NSHO	82	102
GADW	65	46
BUFF	122	55
RNDU	163	198
LESC	336	153
RN/SC	3	2
COGO	100	63
CANV	98	79
REDH	67	41
HOME	1	2
COME	15	15
RUDU	14	36
OTHER[c]	4	3
Total[d]	**1689**	**1239**

[a] IBP equals the total of lone males, pairs and small groups of males ($\leq$4).
[b] Alpha code species list included in Appendix B
[c] Includes observations of WODU, RNDU/SCAU and WWSC
[d] Does not include observations that could not be recorded to species

Table 6. Total number of ducks by species recorded during molting and staging surveys conducted in the Saskatchewan River Delta, 2001.

Species[a]	Brood 1 Jun 24-27	Brood 2 Jul 23-26	Staging 1 Aug 28-Sep 5	Staging 2 Sep 17-20	Staging 3 Oct 1-10	Total
AGWT	5	0	25	247	55	**332**
AMWI	117	80	36	322	192	**747**
MALL	377	228	942	2000	1748	**5295**
GADW	45	0	152	520	72	**789**
BWTE	20	9	103	34	0	**166**
UNDA	636	1461	2600	3862	9186	**17745**
BUFF	13	0	44	37	41	**135**
CANV	368	132	320	318	457	**1595**
REDH	9	350	386	1388	56	**2189**
RNDU	138	193	321	585	11	**1248**
LESC	108	295	827	534	627	**2391**
RN/SC	12	251	611	75	300	**1249**
COGO	69	31	78	163	374	**415**
RUDU	14	0	1	3	102	**120**
COME	1	0	1	1	14	**17**
UNDI	823	2668	2631	3677	11798	**21597**
UNDU	1329	4506	6917	12196	15688	**40636**
Total	**4084**	**10204**	**15995**	**25962**	**40721**	**96666**

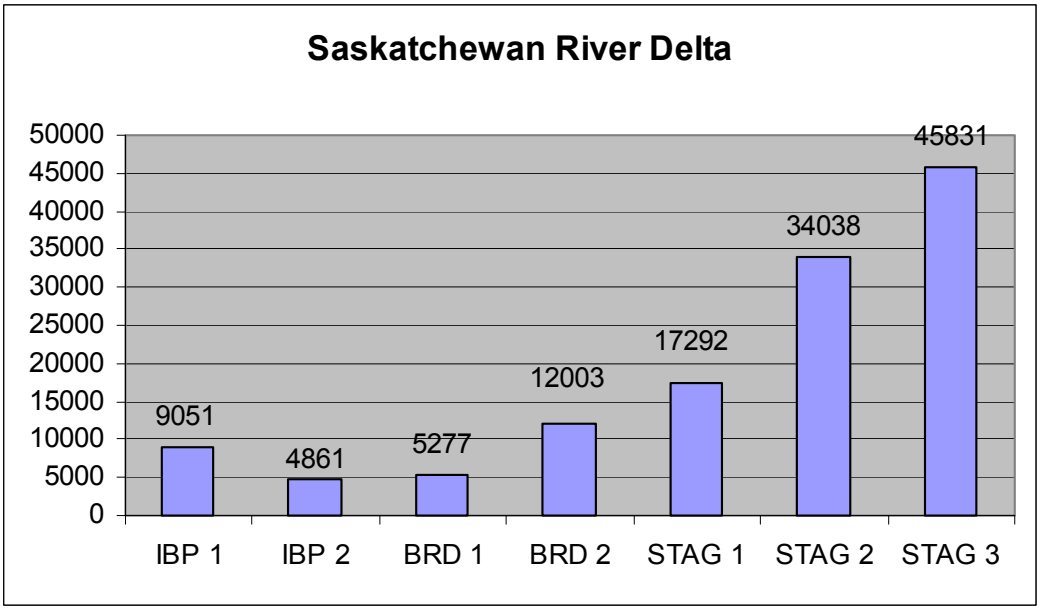
[a] Alpha code species list included in Appendix B

Table 7. Total numbers of other waterbirds recorded on transect surveys conducted in the Saskatchewan River Delta, 2001.

Species[a]	IBP 1 May 6-9	IBP 2 May 28-31	Brood 1 Jun 24-27	Brood 2 Jul 23-26	Staging 1 Aug 28-Sep 5	Staging 2 Sep 17-20	Staging 3 Oct 1-10	Total
AMCO	204	98	251	527	228	852	147	**2307**
RNGR	92	39	33	31	2	1	0	**198**
COLO	17	10	17	15	2	4	4	**69**
CAGO	245	277	40	208	384	2076	803	**4033**
TUSW[b]	1562	1	0	0	4	729	1411	**3707**
AWPE	31	75	136	139	57	3	3	**444**
GBHE	8	6	7	7	5	7	4	**44**
SACR	15	7	2	21	5	0	0	**50**
GULL[c]	226	364	374	552	286	834	298	**2934**
WEGR	0	5	64	2	9	0	7	**87**
DCCO	79	15	15	18	2	38	245	**412**
Total	**2479**	**897**	**939**	**1520**	**984**	**4544**	**2922**	**14285**

[a] Alpha code species list included in Appendix B
[b] Includes observations of unidentified white swans
[c] Includes observations of BOGU, RNGU and unidentified gull species.

Figure 8. Total numbers of waterbirds observed during transect surveys from May through to October in the Saskatchewan River Delta, 2001.



Transect Surveys – Other Lakes

Line transect surveys were also conducted on Opuskow Bay, Plummer's Marsh, Reddeer Lake, Swan Lake and Pelican Lake. As with the Saskatchewan River Delta, data was collected for the entire open water season from May through to October.

Table 8 provides an overview of total waterbird abundance on transects surveyed on Reddeer Lake highlighting the five most abundant duck and other waterbird species. Most ducks were divers with canvasback dominating the observations followed by scaup. Western grebe was the most abundant non-waterfowl species and was one of two basins surveyed in 2001 with significant numbers documented. The greatest waterbird use of Reddeer Lake was during the post breeding period with peak numbers documented during the later half of September.

Table 8. Total number of waterfowl and other waterbirds observed during transect surveys from May through to October on Red Deer Lake, 2001.

Species [a] [b]	IBP 1 May 6-9	IBP 2 May 28-31	Brood 1 Jun 24-27	Brood 2 Jul 23-26	Staging 1 Aug 28-Sep 5	Staging 2 Sep 17-20	Staging 3 Oct 1-10	Total
CANV	27	243	198	305	811	206	22	**1812**
SCAU	10	5	2	126	5	86	236	**470**
MALL	8	3	27	1	8	169	13	**229**
GADW	0	0	0	0	0	105	0	**105**
COGO	25	20	12	2	0	32	2	**93**
UNDA	9	10	85	111	5	1950	147	**2317**
UNDI	13	13	59	454	127	139	66	**871**
UNDU	16	19	10	43	397	46	117	**648**
WEGR	88	73	134	85	84	14	0	**478**
Gulls	38	46	68	61	146	14	71	**444**
AWPE	0	27	12	105	7	0	0	**151**
Terns	0	8	19	81	0	0	0	**108**
Shorebirds	0	1	0	53	32	2	1	**89**
Other	23	23	27	63	5	22	112	**275**
Total	**257**	**491**	**653**	**1490**	**1627**	**2785**	**787**	**8090**

[a] Alpha code species list included in Appendix B
[b] UIDA includes other assorted dabbler ducks; UIDI includes other assorted diving ducks; Gulls include ring-billed, Franklin gulls and herring gulls; terns include common tern, forster's and black terns; shorebirds include unidentified shorebirds and yellowlegs; other includes American coot, Canada goose, common loon, double crested cormorant, great-blue heron, unidentified grebe, red-necked grebe and unidentified birds

Total waterbird abundance documented on transects surveyed on Swan Lake are outlined in Table 9. Similar to Reddeer Lake, divers were more abundant than dabbler duck species with canvasbacks being the most abundant duck followed by scaup. Western grebe was the most abundant non-waterfowl waterbird species indicating the regional importance of Swan Lake to this species. Of interest was the significant use in the fall by lesser snow geese. Peak waterbird use on Swan Lake occurred during mid summer during the post breeding/molting period although fall staging numbers were also significant.

Table 9. Total number of waterfowl and other waterbirds observed during transect surveys from May through to October on Swan Lake, 2001.

Species [ab]	IBP 1 May 6-9	IBP 2 May 28-31	Brood 1 Jun 24-27	Brood 2 Jul 23-26	Staging 1 Aug 28-Sep 5	Staging 2 Sep 17-20	Staging 3 Oct 1-10	Total
CANV	15	89	809	312	445	72	44	**1786**
SCAU	8	3	57	56	21	98	21	**264**
REDH	6	5	100	0	17	46	0	**174**
MALL	6	9	38	26	0	7	1	**87**
COGO	24	7	0	13	0	0	4	**48**
UNDA	21	17	15	226	16	21	76	**392**
UNDI	27	12	366	690	134	61	91	**1381**
UNDU	36	23	10	390	58	305	645	**1467**
WEGR	148	149	311	317	122	22	19	**1088**
LSGO	0	0	0	0	0	1000	0	**1000**
Gulls	77	7	89	89	148	8	6	**424**
AWPE	13	142	101	24	30	26	0	**336**
DCCO	33	27	0	1	0	150	0	**211**
Other	33	32	8	16	48	84	109	**330**
Total	**447**	**522**	**1904**	**2160**	**1039**	**1900**	**1016**	**8988**

[a] Alpha code species list included in Appendix B
[b] UIDA includes other assorted dabbler ducks; UIDI includes other assorted diving ducks; Gulls include ring-billed, Franklin gulls and herring gulls; terns include common tern, forster's and black terns; shorebirds include unidentified shorebirds and yellowlegs; other includes American coot, Canada goose, common loon, great-blue heron, unidentified grebe, red-necked grebe and unidentified birds

Table 10 provides an overview of total waterbird use documented on transects surveyed on Pelican Lake. Overall there was limited use of this lake during the spring and early summer, however, by mid summer waterfowl use increased significantly, particularly by diving ducks. Pelican Lake appears to be of significance to redheads in the fall with peak numbers occurring in mid to late September. Other waterbird use was not significant with double crested cormorant and gull species being most abundant.

Preliminary analysis of the data for Opuskow Bay and Plummer's marsh have not been compiled for this report, however, figures outlining total waterbird abundance is included in Appendix C for reader reference.

Table 10. Total number of waterfowl and other waterbirds observed during transect surveys from May through to October on Pelican Lake, 2001.

Species	IBP 1 May 6-9	IBP 2 May 28-31	Brood 1 Jun 24-27	Brood 2 Jul 23-26	Staging 1 Aug 28-Sep 5	Staging 2 Sep 17-20	Staging 3 Oct 1-10	Total
REDH	2	0	0	27	111	3917	74	**4131**
CANV	2	0	95	36	235	42	0	**410**
COGO	34	37	56	29	0	6	41	**203**
SCAU	8	0	0	58	4	75	31	**176**
RNDU	0	4	0	28	0	0	0	**32**
UNDA	0	2	0	4	0	12	2	**20**
UNDI	1	2	0	1161	45	2083	1297	**4589**
UNDU	2	1	6	105	85	137	5	**341**
DCCO	39	134	3	106	0	0	0	**282**
Gulls	5	139	32	38	34	4	1	**253**
AWPE	45	25	5	3	0	1	0	**79**
WEGR	0	0	1	27	39	3	0	**70**
RNGR	0	0	1	14	0	0	0	**15**
Other	0	14	5	22	3	0	0	**44**
Total	**138**	**358**	**204**	**1658**	**556**	**6280**	**1451**	**10645**

[a] Alpha code species list included in Appendix B
[b] UIDA includes other assorted dabbler ducks; UIDI includes other assorted diving ducks;
Gulls include ring-billed, Franklin gulls and herring gulls; terns include common tern, forster's and black terns; shorebirds include unidentified shorebirds and yellowlegs; other includes American coot, Canada goose, common loon, great-blue heron, unidentified grebe, red-necked grebe and unidentified birds

Lake Winnipegosis Reconnaissance

Data collected during the six reconnaissance surveys on Lake Winnipegosis were utilized to generate total duck and other non-waterfowl waterbird numbers for Dawson and Pelican Bay. Diving ducks dominated waterfowl use in this portion of Lake Winnipegosis during 2001 with redhead and goldeneye being most abundant (Table 11). Pelican Bay appeared to be more attractive than Dawson Bay. The greatest waterfowl use occurred during mid summer (presumably for molting) and in early October for fall staging (Table 12). From these data, density estimates were generated for each transect to assist in determining which portions of the survey area were most attractive for ducks which, based on this analysis, appears that the more shallow, protected bay areas (see Appendix D).

Table 11. Total numbers of ducks by species observed on six Lake Winnipegosis reconnaissance transect surveys June - October, 2001.[a]

Species[b]	Dawson Bay	Pelican Bay	Total
REDH	42	4688	**4730**
COGO	205	508	**713**
CANV	405	211	**616**
SCAU	76	5	**81**
COME	34	31	**65**
MALL	13	8	**21**
UNDU[c]	821	3075	**3896**
Total	**1596**	**8526**	**10122**

[a] Survey dates were June 1, July 4, July 31, Aug 30, Oct 5
[b] Alpha code species list included in Appendix B
[c] Mostly divers

Table 12. Total numbers of ducks observed on six Lake Winnipegosis reconnaissance transect surveys June – October 2001.

Survey Date	Dawson Bay	Pelican Bay	Total
June 04 2001	160	53	**213**
July 04 2001	407	295	**702**
July 31 2001	68	2339	**2407**
August 30 2001	167	489	**656**
Sept 19 2001	514	720	**1234**
October 05 2001	280	4630	**4910**
Total	**1596**	**8526**	**10122**

Table 13 provides an overview of non-waterfowl waterbirds observed. Double crested cormorant, white headed gulls (primarily ring-billed gulls) and American white pelican were the most abundant species documented and for the most part Pelican Bay held more birds than Dawson Bay (except for double crested cormorant). Of note was the relative abundance of western grebes in portions of Dawson Bay. The greatest non-waterfowl use occurred in mid-summer and by mid September use dropped off significantly with the onset of fall (Table 14). Density estimates for these species are included in Appendix D.

Table 13. Total number of non-waterfowl waterbirds by species observed on six Lake Winnipegosis reconnaissance transect surveys June - October, 2001.[a]

Species[b]	Dawson Bay	Pelican Bay	Total
DCCO	10868	2856	**13724**
Gulls[c]	958	1595	**2553**
AWPE	258	1669	**1927**
WEGR	258	48	**306**
Terns[d]	22	19	**41**
BLTE	16	6	**22**
Other[e]	0	55	**55**
Total	**12380**	**6248**	**18628**

[a] Survey dates were June 1, July 4, July 31, Aug 30, Oct 5
[b] Alpha code species list included in Appendix B
[c]Includes ring-billed, herring and likely california gull.
[d]Includes common tern, forster's tern and caspian tern.
[e]Includes unidentified shorebirds.

Table 14. Total numbers of non-waterfowl waterbirds for each of six reconnaissance transect surveys conducted on Lake Winnipegosis, 2001.

	Survey Date					
Species[a]	**June 04 / 01**	**July 04 / 01**	**July 31 / 01**	**Aug 30 / 01**	**Sept 19 / 01**	**Oct 05 / 01**
DCCO	13	720	12603	193	192	
Gulls[b]	825	93	1167	221	198	49
AWPE	130	240	1154	400	3	
WEGR	36	15	175	22	58	52
Terns[c]	34	1	4	1	1	
BLTE	16	4	2			3
Other[d]	6	3	16	30	0	
Total	**1060**	**1076**	**15121**	**867**	**452**	**104**

[a] Alpha code species list included in Appendix B
[b]Includes ring-billed, herring and likely california gull.
[c]Includes common tern, forester tern and caspian tern.
[d]Includes unidentified shorebirds.

Ancillary Data Collection

During the field season we collected information on additional species of interest including bald eagle and osprey (individual observations and nest sites), colonial nesting sites (great-blue heron, gull, double crested cormorant, American white pelican), moose, black bear, woodland caribou and elk. Information on other features including mineral licks, potential piping plover beaches (Lake Winnipegosis) and hunting/trapper cabins were collected. Each observation point was logged in a GPS and the associated information recorded in a hand held tape recorder and later transcribed. This information is currently being compiled into a spatial database for future reference and distribution to project partners.

Traditional Ecological Knowledge

Traditional Ecological Knowledge (or Traditional Environmental Knowledge or TEK) is the knowledge that Aboriginal people have accumulated over generations of intimate contact with all aspects of local ecosystems, including plants, animals and natural phenomena. It includes knowledge of animal behavior, seasons and cycles, and the interrelationships that exist among life-forms (Natural Resources Canada, 1997). This information will compliment the western science data that is being collected with the landcover inventory, waterbird surveys and water chemistry inventory.

TEK can be all encompassing to include information such as medicinal plants, moose calving, fish spawning areas and spiritual sites. For the purpose of this project TEK will endeavor to also include non-aboriginal local knowledge and will attempt to focus on information related to wetlands, waterbirds and other wetland dependant wildlife. This will include documenting important seasonal waterbird areas, important areas for specific waterbird species (e.g. scoter, scaup or colonial nesting species) and key areas for other wetland dependant wildlife (e.g. moose, beaver, muskrat).

Fundamental to the success of TEK will be the interest and full cooperation of local First Nations communities. Given the large size of the Pasquia Project and the large number of individual first nations and several tribal councils, it has been determined that a pilot project concentrating on a region with a few first nations would be the best approach. Based on the historical presence of DU in the SRD and the combined interest of a number of project partners it was decided that an effort to conduct a TEK pilot in this region would be suitable.

Over the course of 2001 meetings were held with the Swampy Cree Tribal Council in The Pas as well as the resource councils of the Opaskwayak and Mosakahiken Cree Nations. These meetings discussed the potential partnership in the Pasquia Project and included discussions about the opportunities for TEK within the Tribal Council area.

Most recently discussions have focused on seeking the assistance of an established private consultant experienced in conducting TEK studies. The preparation of a request for proposals to conduct this work will be developed in 2002 under the guidance of a steering committee comprised of DUC and interested partner representatives.

Communications

Communication is critical to the continued success of the western boreal program and the accomplishment of DUC's conservation vision for the Western Boreal Forest. Throughout the past year, public awareness was raised through a number of articles including those published in the Canadian Forest Industries Magazine (June/July 2001), DUC's Conservator Magazine (Vol. 22/2, 2001), and Birdscapes (Winter, 2002). In addition, a general fact sheet was developed to support the communication of DUC's conservation efforts in the Western Boreal Forest.

Specific to the Pasquia Project, the Project was introduced to DUC members in the Flyway insert of the Conservator magazine in the July 2001 issue. A major feature article highlighting the cutting-edge GIS technology being used at Pasquia also appeared in the business section of the Winnipeg Free Press (August 21,2001). In addition, a handful of articles were published by local newspapers within the project area as well as in the Manitoba Partners in Flight newsletter (Winter 2001).

Ongoing communications between DUC staff and the Pasquia Project partners were maintained throughout the year by way of periodic phone calls and written progress reports on the waterbird survey program and the landcover fieldwork. In early 2002 meetings were held with the Saskatchewan and Manitoba partners to review the progress of the Pasquia Project to date and to outline the forthcoming years activities.

Expenditures and In-kind Contributions

Pasquia Project expenditures for fiscal year 2001/2002 (i.e. April to April) compared to the budget as outlined the 2001 project proposal is outlined in Table 15. Not included in this overview are the significant in-kind contributions provided by the Pasquia Project partners. These contributions are summarized in Appendix E and include fuel, flight watch, staff time and additional resources.

Table 15. Projected Budget and Estimated Expenditure for Pasquia Project, fiscal year 2001/2002.

Project Activity	Budget [a]	Estimated Expenditure
Landcover Inventory	$577,096[b]	$278,043[c]
Waterbird Surveys	$401,654	$397,251[d]
Other Project Costs[e]		$40,916
TOTAL		**$716,210**

[a] Budget as prepared in Stewart et al, 2001
[b] Budget projected over 2 years
[c] Includes in-kind fuel ($4363) and GIS support ($20,977) in in-kind fuel contributions
[d] Includes in-kind fuel contributions ($4525) and GIS support ($13,984.55)
[e] Includes project administration, communications, general meetings etc.

III 2002/2003 PROJECT ACTITIVIES

Landcover Classification

Classification of the Pasquia satellite image is scheduled for delivery in January 2003. Activities leading up to the final product include the completion of the image classification, accuracy assessment, change detection and sub-pixel analysis. As the image classification reaches completion a committee comprised of representatives from the project partners will be established to review and provide input into the final product. Once the product is complete a final report will be prepared followed by a meeting and debriefing session with the project partners.

Waterbird Inventory

The second of the three year waterbird survey program will be conducted including individual basin and line transect surveys within the Saskatchewan River Delta, Reddeer Lake, Swan Lake, Pelican Lake and Plummer's Marsh.

Transect surveys will not be conducted on Rocky Lake and Opuskow Bay in 2002 due to the low waterbird use documented in 2001. Specific to Lake Winnipegosis, more focused and intensive line-transect surveys will be conducted in Overflow Bay and Pelican Bay. These areas have been selected based on the analysis of the reconnaissance surveys conducted in 2001.

Traditional Ecological Knowledge

As previously noted, recent discussions with project partners have focused on seeking the assistance of someone experienced in conducting TEK studies. A working committee comprised of DUC and interested partner representatives will be established to discuss this approach further. It is anticipated that this group will provide input into a request for proposals to conduct a TEK pilot project within the Pasquia Project study area, commencing in the 2002/2003 fiscal year.

Communications

Communications will include the launching of the Western Boreal Forest web page within the DUC web site, which in fact took place in May 2002. Plans are to expand the web page to include additional information of interest and of value to the project partners and the general public. We will also pursue opportunities through various newspapers within the project area to highlight the Pasquia Project. Additional activities include an updated Western Boreal Forest Fact Sheet, regular progress reports of project activities and an annual report on 2002/2003 activities.

IV ACKNOWLEDGEMENTS

Louisiana Pacific Canada, Manitoba Conservation, SaskPower, Saskatchewan Environment and Resource Management and Tembec Industries Inc. provided financial and in-kind support for this project. In addition to the authors a number of individuals assisted with the fieldwork and components of this report. Kevin Smith and Brandon Sullivan of Ducks Unlimited Inc. conducted the landcover fieldwork with the assistance of Alain Richard (DUC), Eric Butterworth (DUC), Graham Thibault (DUC), Donna Grassia (LP) and Carman Dodge (SERM). Waterbird surveys were conducted with the assistance of a number of DUC observers including Gary Stewart, Calvin Cuthbert, Dave Clayton, Martin Van Osch, Dave Atamanchuk, Dave Pochailo, Pat Tkachuk, John Trevor and Andrew Hak. Garth Ball and Kent Whaley of MC also assisted with the fall staging surveys. DUC staff Joanne Kellington and Wally Price assisted with data transcription and data entry and Sara McClacherty assisted with summarizing the data. Alain Richard and Sean Smyth (DUC) provided GIS technical support for all aspects of the project. Appreciation is extended to pilots George Beuler, Robert Woodhead, and Jodie M^{c}Crae of Hudson Bay Helicopters and Kelly Skorlatowski of Star Helicopters Ltd. who continued to provide efficient and safe service.

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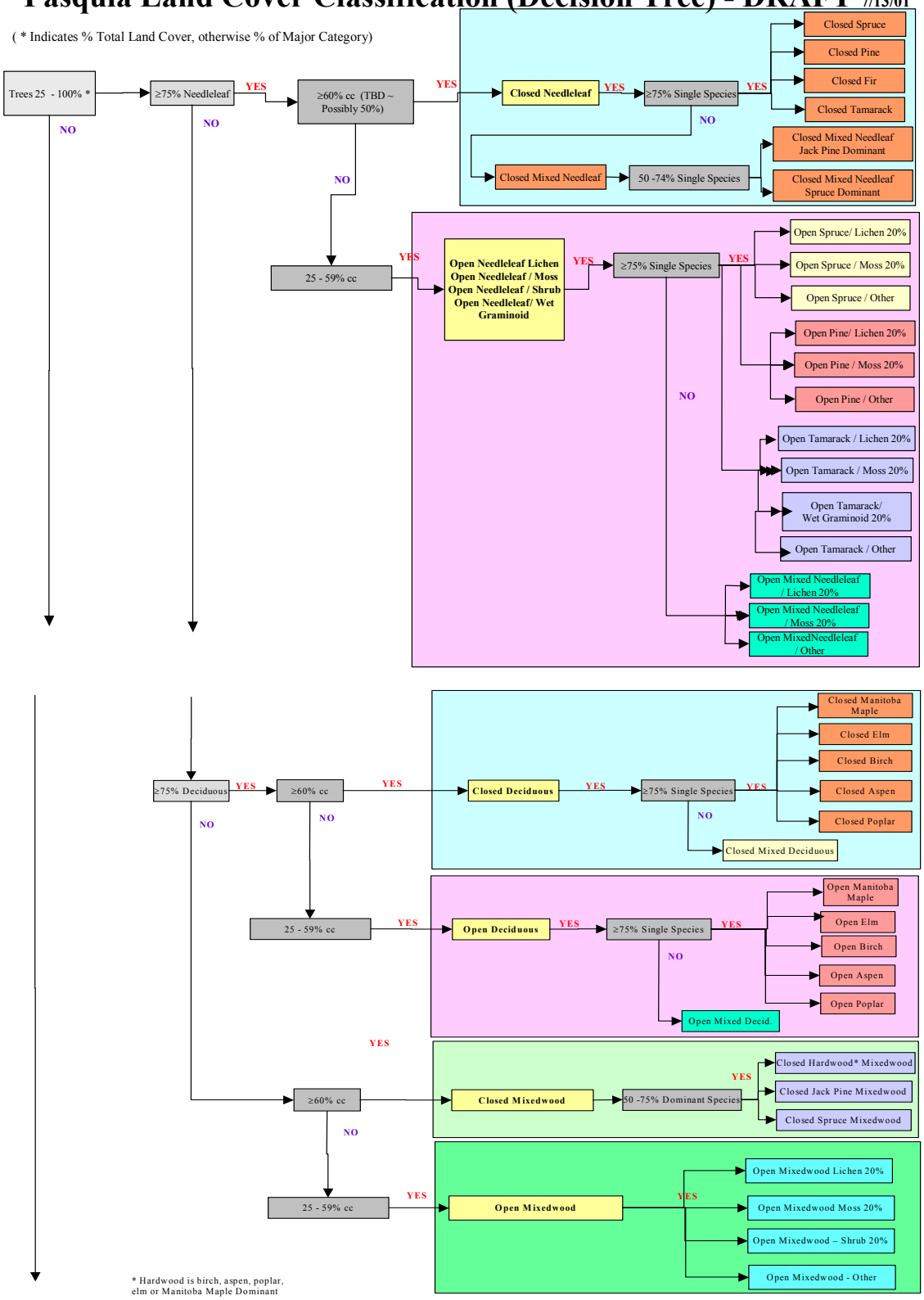
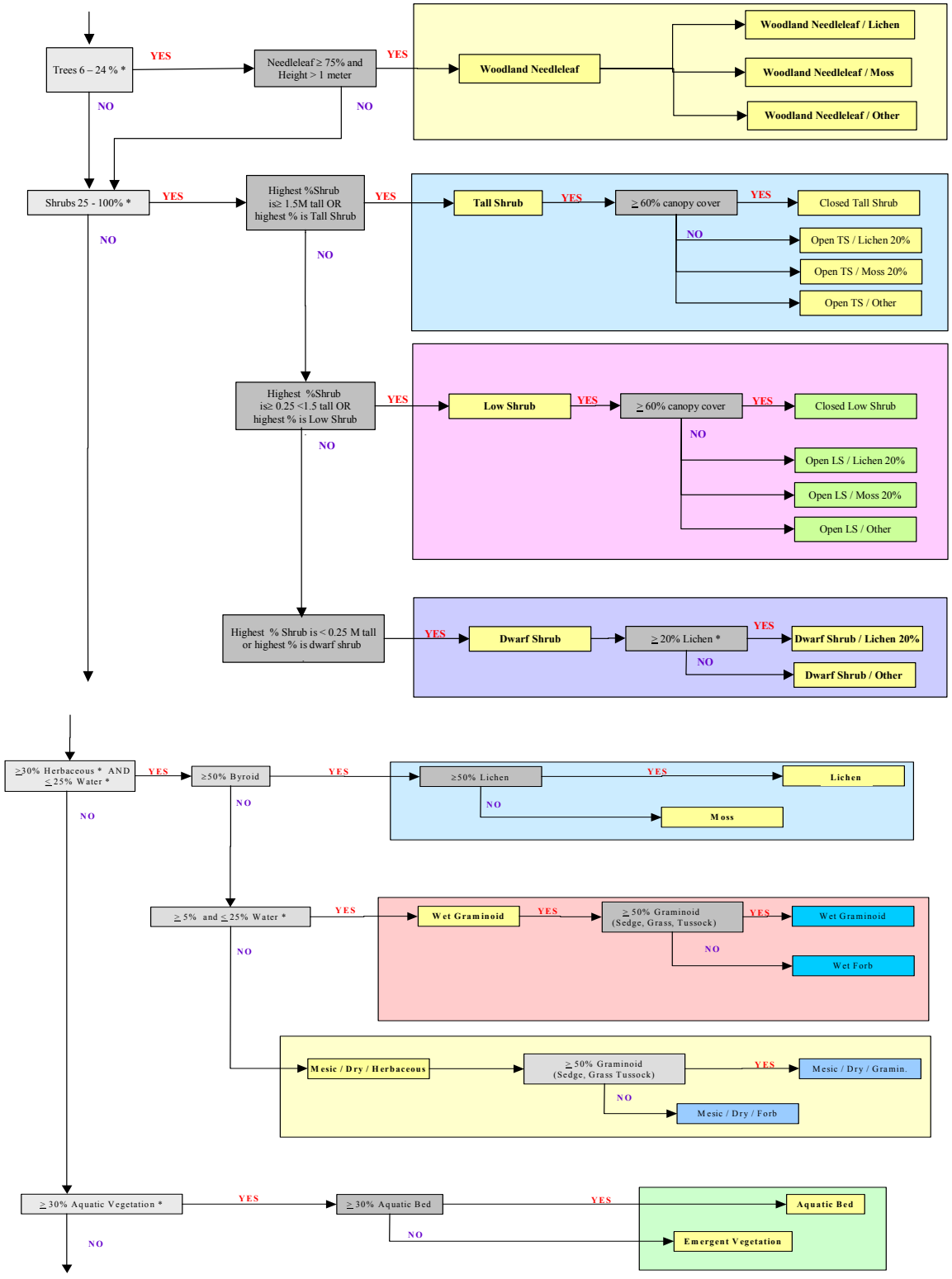
APPENDIX A

APPENDIX A
PASQUIA PROJECT LANDCOVER DECISION TREE

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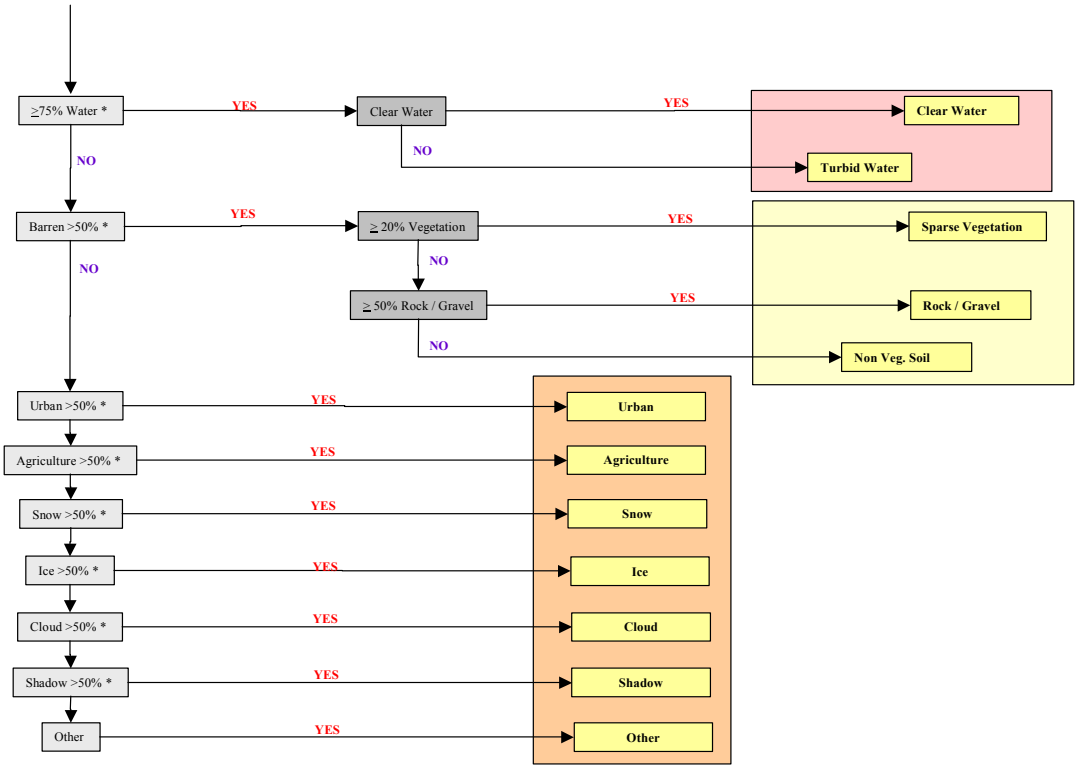
NO
Needleleaf ≥ 75% and Height > 1 meter
YES
NO
Woodland Needleleaf
Woodland Needleleaf / Lichen
Woodland Needleleaf / Moss
Woodland Needleleaf / Other
Shrubs 25 - 100% *
YES
NO
Highest %Shrub is≥ 1.5M tall OR highest % is Tall Shrub
YES
NO
Tall Shrub
YES
≥ 60% canopy cover
YES
NO
Closed Tall Shrub
Open TS / Lichen 20%
Open TS / Moss 20%
Open TS / Other
Highest %Shrub is≥ 0.25 <1.5 tall OR highest % is Low Shrub
YES
NO
Low Shrub
YES
≥ 60% canopy cover
YES
NO
Closed Low Shrub
Open LS / Lichen 20%
Open LS / Moss 20%
Open LS / Other
Highest % Shrub is < 0.25 M tall or highest % is dwarf shrub
YES
Dwarf Shrub
≥ 20% Lichen *
YES
NO
Dwarf Shrub / Lichen 20%
Dwarf Shrub / Other
≥30% Herbaceous * AND ≤25% Water *
YES
NO
≥50% Byroid
YES
NO
≥50% Lichen
YES
NO
Lichen
Moss
≥ 5% and ≤ 25% Water *
YES
NO
Wet Graminoid
YES
≥ 50% Graminoid (Sedge, Grass, Tussock)
YES
NO
Wet Graminoid
Wet Forb
Mesic / Dry / Herbaceous
≥ 50% Graminoid (Sedge, Grass Tussock)
YES
NO
Mesic / Dry / Gramin.
Mesic / Dry / Forb
≥ 30% Aquatic Vegetation *
YES
NO
≥ 30% Aquatic Bed
YES
NO
Aquatic Bed
Emergent Vegetation


≥75% Water *
YES
Clear Water
YES
Clear Water
NO
Turbid Water
NO
Barren >50% *
YES
≥ 20% Vegetation
YES
Sparse Vegetation
NO
NO
≥ 50% Rock / Gravel
YES
Rock / Gravel
NO
Non Veg. Soil
Urban >50% *
YES
Urban
Agriculture >50% *
YES
Agriculture
Snow >50% *
YES
Snow
Ice >50% *
YES
Ice
Cloud >50% *
YES
Cloud
Shadow >50% *
YES
Shadow
Other
YES
Other

APPENDIX B

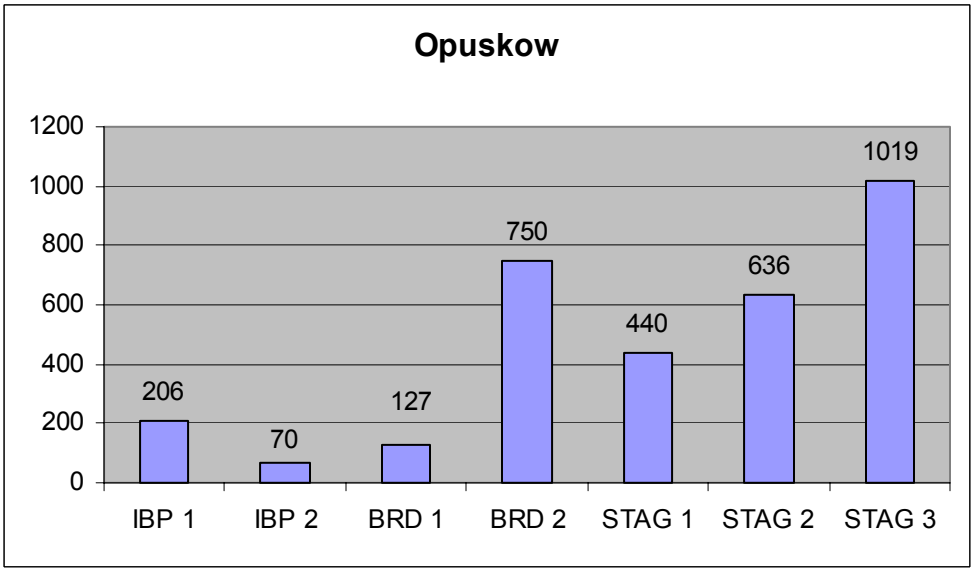
Appendix B
Alpha Code for Waterbird species
Pasquia Project

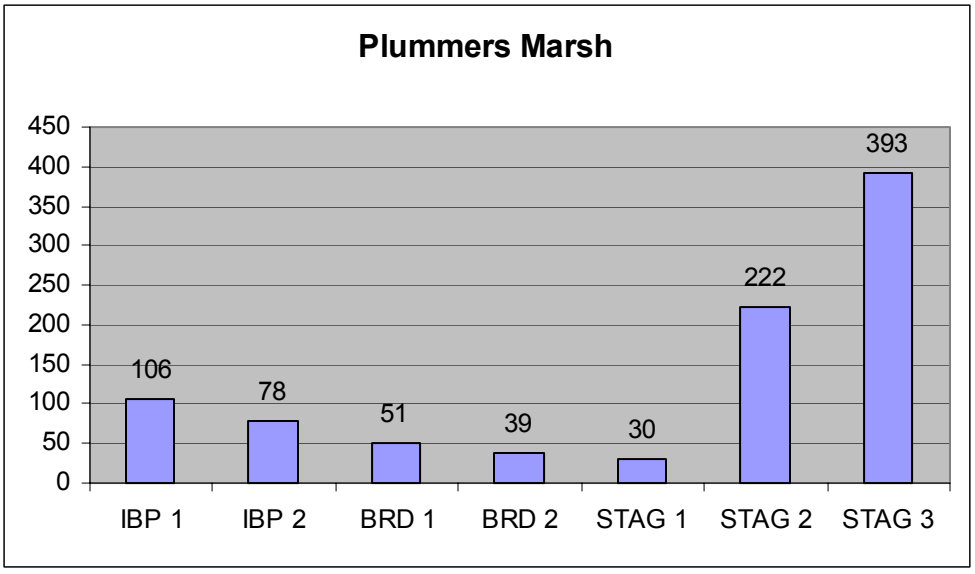
AOU Code	Common Name
AGWT	American Green-winged Teal
AMCO	American Coot
AMWI	American Wigeon
AWPE	American White Pelican
BLTE	Black Tern
BOGU	Bonaparte's Gull
BUFF	Bufflehead
BU/GO	Bufflehead / Goldeneye
BWTE	Blue-winged Teal
CAGO	Canada Goose
CANV	Canvasback
COGO	Common Goldeneye
COLO	Common Loon
COME	Common Merganser
DCCO	Double Crested Cormorant
FRGU	Franklin's Gull
GADW	Gadwall
GBHE	Great Blue Heron
GULL	Gull spp.
HERG	Herring Gull
HOME	Hooded Merganser
LESC	Lesser Scaup
LSGO	Lesser Snow Goose
MALL	Mallard
NOPI	Northern Pintail
NSHO	Northern Shoveler

AOU Code	Common Name
RBGU	Ring-billed Gull
REDH	Redhead
RNDU	Ring-necked Duck
RNGR	Red-necked Grebe
RN/SC	Ring-necked Duck / Scaup
RUDU	Ruddy Duck
SACR	Sandhill Crane
SCAU	Scaup
SCOT	Scoter
TRUS	Trumpeter Swan
TUSW	Tundra Swan
UNDA	Unidentified Dabbler
UNDI	Unidentified Diver
UNDU	Unidentified Duck
UNSW	Unidentified Swan
WEGR	Western Grebe
WODU	Wood Duck
WWSC	White-winged Scoter

APPENDIX C

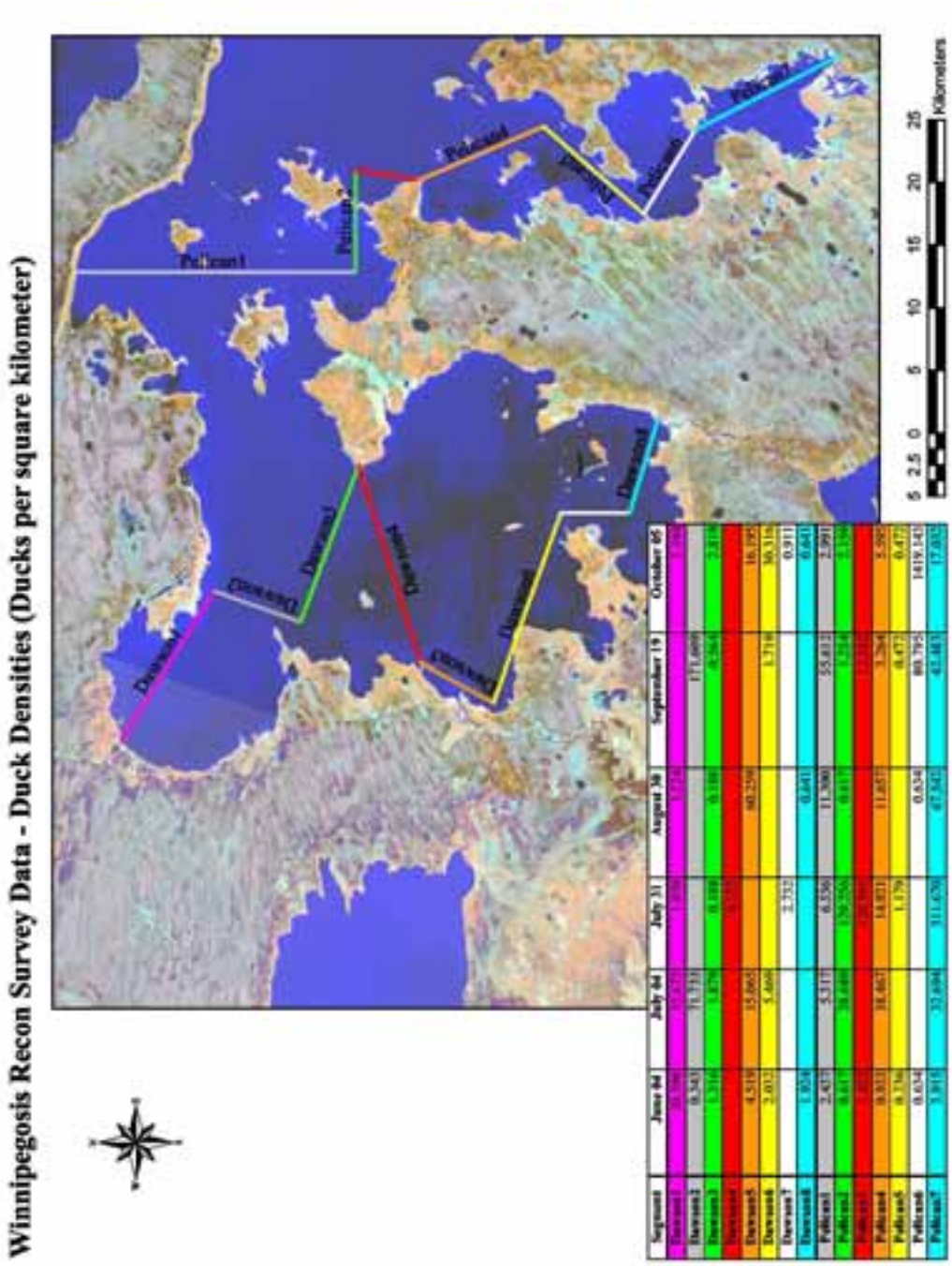
APPENDIX C
FIGURES DEPICTING TOTAL WATERBIRDS
OPUSKOW BAY AND PLUMMER'S MARSH





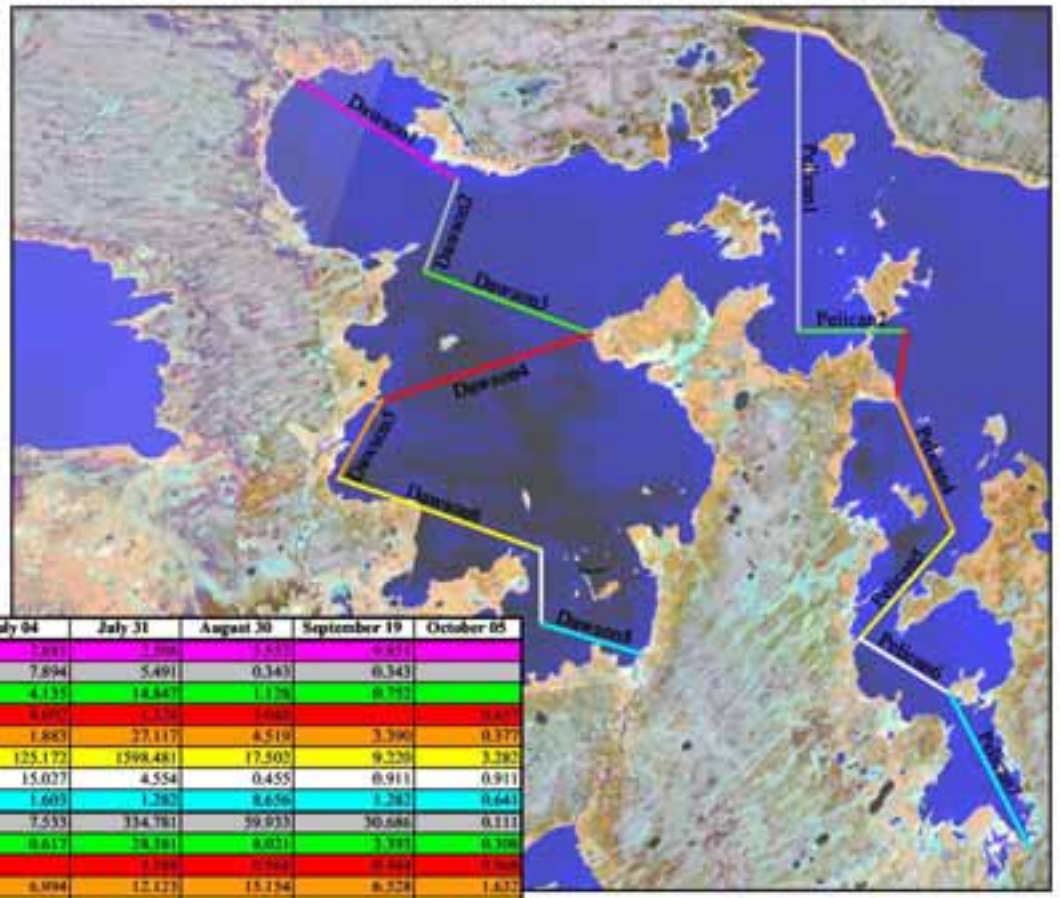
APPENDIX D

APPENDIX D
Waterfowl and other Waterbird Density Estimates for
Dawson and Pelican Bay Winnipegosis, 2001



Segment	June 04	July 04	July 31	August 30	September 19	October 05
Dawson1	[illegible]	[illegible]	[illegible]	[illegible]	171.699	[illegible]
Dawson2	6.343	71.771	[illegible]	[illegible]	[illegible]	[illegible]
Dawson3	1.316	1.876	0.188	0.188	0.564	2.818
Dawson4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Dawson5	4.519	35.865	[illegible]	60.259	[illegible]	16.795
Dawson6	2.612	5.466	[illegible]	[illegible]	1.716	10.316
Dawson7	[illegible]	[illegible]	2.352	[illegible]	[illegible]	0.911
Dawson8	1.954	[illegible]	[illegible]	0.641	[illegible]	0.641
Pelican1	2.475	5.577	6.550	11.300	55.612	2.991
Pelican2	0.611	39.488	150.755	0.611	1.554	2.139
Pelican3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pelican4	0.933	38.867	14.021	11.857	3.264	5.598
Pelican5	0.176	[illegible]	1.179	[illegible]	0.471	0.471
Pelican6	0.634	[illegible]	[illegible]	0.634	80.795	1419.143
Pelican7	3.915	32.694	111.470	47.843	45.483	17.015

Winnipegosis Recon Survey Data - Other Bird Densities (Other Birds per square kilometer)



Segment	June 01	July 04	July 31	August 30	September 19	October 05
Dawson1	20.219	2.891	2.891	2.573	0.472	
Dawson2	44.275	7.894	5.491	0.343	0.343	
Dawson3	13.343	4.135	14.847	1.178	0.752	
Dawson4	6.554	8.997	1.376	5.040		0.657
Dawson5	8.286	1.883	27.117	4.519	3.390	0.377
Dawson6	56.726	125.172	1598.481	17.502	9.220	3.282
Dawson7	8.652	15.027	4.554	0.455	0.911	0.911
Dawson8	12.183	1.603	1.282	8.656	1.282	0.641
Pelican1	1.440	7.553	334.781	59.933	30.686	0.111
Pelican2	6.170	0.617	28.381	8.021	2.393	0.308
Pelican3	13.907		5.104	0.564	0.564	0.564
Pelican4	16.319	6.994	12.123	15.154	6.528	1.632
Pelican5	0.943	0.236	4.952	4.244	0.472	0.472
Pelican6	0.634					
Pelican7	5.871		0.783	0.979		1.958

APPENDIX E

APPENDIX E

Pasquia Project Partner In-Kind Contributions 2001/2002

Agency	Bulk Fuel (litres)	Fuel Drums	Staff (days)	Other	Comments
SaskPower				Radar Data	Unknown Cost
SERM	1968				Waterbird surveys
	873				Landcover Classification
		6			Surveys during summer
	2841				Total bulk fuel for SERM
			8.0		C. Dodge Landcover Veg Caller (incl vehicle)*
				Flight support	Periodically throughout the season
LP			2.0		D. Grassia - landcover recorder*
			1.0		Fuel delivery to Cache Lake (2 people X 1/2 day)*
Mb Cons	6604				Waterbird Surveys and Landcover Classification
		1			Grand Rapids (May 10)
		4			Davidson Lake (Aug 2 and 3)
		2			The Pas (May 10 and 27th)
		5			Swan River (June 24, 25 and 26)
		6			Easterville (May 31, June 27, July 27, Aug 5th)
			1.0		K Whaley - staging survey*
			5.0		G Ball - staging surveys - MC paid all expenses*
			1.0		Fuel delivery to Cache Lake (2 people X 1/2 day)
			1.0		Fuel delivery to Easterville (2 X 1/2 day)*
				Flight Support	Periodically throughout the season

* In-kind support costs not known.

SERM: **Carman Dodge** (staff time and vehicle)
LP: Provided 2 men and vehicle to transport fuel to Cache Lake
D. Grassia (staff time)
MC: Provided 2 men and vehicle to transport fuel to Cache Lake
Kent Whaley (staff time)
Garth Ball (staff time, vehicle and all additional expenses)
Easterville fuel (2 men and vehicle on two occasions)