Alberta NAWMP Implementation Plan 2007-2012

Prepared by Alberta NAWMP Partnership Management Committee
February 2008

prairie habitat joint venture

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Executive Summary

The 2007-2012 Alberta NAWMP Implementation Plan provides renewed guidance for provincial partners in conservation planning, program implementation and policy initiatives in support of the goals and objectives of the Prairie Habitat Joint Venture (PHJV). This plan is the second of multiple 5-year plans framed within a long term, 25-year plan. Its goal is to achieve landscape conditions in Alberta's prairie and parkland capable of sustaining average waterfowl populations at the levels of the 1970's. Alberta's Western Boreal Forest is a new component of this plan.

Alberta's prairie and parkland breeding waterfowl population is currently below the average of the 1970's but has shown generally flat or positive trends since the late 1980's. A variety of landscape changes were observed since the 1970's: perennial cover has generally increased coinciding with a small but steady wetland loss (gross wetland loss -4.4% for period 1895-1999). Improvements to landscape upland conditions (including NAWMP programs) appear to have somewhat offset wetland losses over this time period, supporting the stable or slightly reduced population observations. Alberta's Western Boreal Forest populations are generally stable.

A key element of this plan was the introduction of new planning tools - the Waterfowl Productivity Model and Pintail Productivity Model. These models allowed a scientifically strong linkage to be made between population objectives and landscape conditions, permitting both retrospective glances as well as well future predictions of change. Despite conservation successes, measures of PHJV-scale net landscape change over the 1971-2001 period yielded annual productivity declines in prairie and parkland Alberta. Dabbling ducks demonstrated an estimated 15.9% productivity decline (61,153 fewer hatched nests) and northern pintails a 19.6% productivity decline (7,495 fewer hatched nests). The models have revealed and highlighted wetland loss as an important factor influencing duck productivity.

The new 5 year plan sets forth complementary direct, extension and policy habitat program actions for both restoration and retention of wetlands and uplands in prairie and parkland Alberta only. Emphasis is on *wetland restoration* and *wetland retention* in response to model outputs. Five-year habitat *restoration* objectives equal 5,300 wetland acres (7,000 basins), 174,400 acres of winter wheat, 286,600 acres cropland conversion to pasture, 191,100 acres cropland conversion to hayland, and 1,500 acres of planted cover. Five-year habitat *retention* objectives equal 1,378,500 wetland acres (achieved by policy change) and 25,000 upland acres. The estimated 5-year cost of completing all-partner direct and extension activities in this plan is $27,033,400. Additional costs estimated for policy initiatives, research and evaluation, operation and maintenance, communication and coordination raise the total estimated 5-year cost to $58,052,500. Cost estimates exclude the Western Boreal Forest.

The 5-year plan provides a roadmap to achieving approximately 20% of the 25-year habitat objectives in most areas. Two exceptions include wetland restoration, where capacity must be immediately increased, and wetland retention, which is expected to complete the full 25-year objective this term. A future challenges section identifies tasks requiring special attention. Conclusions clearly identify priority issues that will be translated into specified partner actions. The plan will be promoted as a rallying point to expand Alberta's strong partnership potential

Introduction

The North American Waterfowl Management Plan (NAWMP) forged a new era of conservation partnerships in this province. This Plan established unprecedented, cooperative approaches to delivering direct conservation programs, coordinating extension programs, addressing policy challenges, and building partnerships. NAWMP was established in the face of reduced continental waterfowl populations with intent to protect and restore landscape conditions across the continent capable of sustaining waterfowl populations at the average level of the 1970's. The Plan also provided context for activities relative to the Prairie Habitat Joint Venture (PHJV).

The PHJV was initiated in 1988 as a partnership focused on the conservation of wetlands and associated habitats in Prairie Canada to meet the goals of NAWMP. Between 1986 and 2005, PHJV partners secured 3.6 million acres of wetland and associated habitats crucial to the lifecycle needs of waterfowl and other wetland dependant wildlife. An additional 1.8 million acres, secured prior to 1986, are managed by PHJV partners, for a total of 5.4 million acres of NAWMP land in the PHJV. Even with these impressive achievements, dramatic changes in the prairie landscape prompted the need for renewed guidance in the PHJV. Hence, during 2005, the PHJV Strategic Plan renewed the PHJV's vision, mission, and goals for the next 25 years.

PHJV Vision:
Healthy prairie, parkland and boreal landscapes that support sustainable bird populations and provide ecological and economic benefits to society.

PHJV Mission:
Provide leadership to achieve healthy and diverse waterfowl and other bird populations through conservation partnerships. These partnerships strive for sustainable and responsible management of the landscape taking into account social, economic and environmental factors.

PHJV Goals
Bird Population Goals
- Sustain average waterfowl populations of the 1970's
- Set population objectives for priority species of landbirds, shorebirds and waterbirds

Habitat Goals
- Stop further wetland loss
- Stop further loss of native lands, especially native grasslands
- Restore lost wetlands, especially small basins
- Restore function of upland habitats in landscapes conducive for maintenance of bird populations
- Set habitat objectives for priority species of waterfowl, landbirds, shorebirds and waterbirds

The Alberta NAWMP Partnership was established to implement NAWMP in Alberta using the PHJV Strategic Plan as their business plan. This formally links Alberta NAWMP activities to the PHJV. An outcome of the PHJV Strategic Plan was a call for Alberta to update its 1989

Provincial Implementation Plan, resulting in the Alberta Implementation Plan, 2008-2012, referred hereafter as the "plan")..

The plan incorporates many advantages over the original plan: new data and implementation experience to draw from, increased partners and levels of engagement, leading scientific support, greater ability to track net landscape change, and the framework of a long term 25 year plan. New in this plan is inclusion of the Western Boreal Forest and formal integration of all-bird conservation as PHJV priorities.

The Status of Waterfowl in Alberta: 1971-2006

Prairie and Parkland

The prairie and parkland population trend review is limited to the 10 most common duck species (7 dabbling duck species and 3 diving duck species) and May ponds in Alberta's prairie and parkland (Strata 26-29, 75-76; Figure 1). Trends are shown as running 10-year average breeding population size by survey strata and by all strata combined. Running 10-year averages are shown to smooth annual variation and to elucidate trend.

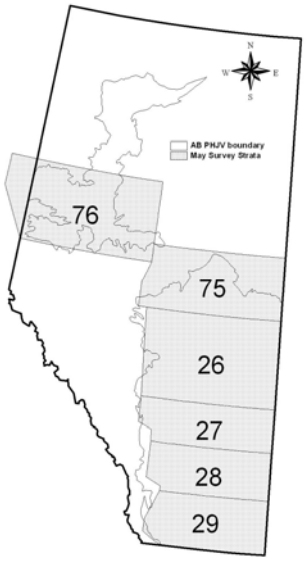

Figure 1. May population survey strata in prairie and parkland Alberta.

Generally, waterfowl populations in these strata are below the average of the 1970's (Appendix Ia). Species-specific population status and trends are variable: some species are above the long term average and 1970's average, while others are below or well below both averages. Relative to average 1970's populations, notable species include canvasback (+24%), northern shoveler (+19%), gadwall (+14%), northern pintail (-80%), wigeon (-55%), lesser scaup (-50%), mallard (-24%), blue-winged teal (-21%), and GW teal (-15%). However, waterfowl populations have shown generally positive or flat trends since the late 1980's in these strata. Detailed status and trend data from 1971-2006 are summarized in Appendix Ia.

A review of status and trends of individual waterfowl species by survey stratum, tempered by pond counts, reveals insights. Generally, increases are evident for most species in strata 75 and 76 (boreal transition zone) while stable or declining in southern strata (26 through 29). Large increases are especially notable for mallards in Stratum 75 and 76 in contrast with significant declines in southern strata, especially parkland strata 26 and 27. Northern pintail, wigeon and lesser scaup populations are consistently lower for most or all strata in comparison to the average 1970's, with trends stable or declining. Northern pintail trends do not appear to have tracked pond counts like most other species have. Stratum status and trend data is summarized in Appendix Ib-d. Status and trends will continue to be monitored: plan and program adaptations will be considered where science supports change.

The proportion of continental waterfowl populations breeding in prairie and parkland Alberta remains stable or has declined slightly in comparison with the average of the 1970's (Strata 26-29, 75-76). Most dabbling duck species have demonstrated slight proportional declines from 1970's levels (e.g. northern pintails -14.2%, mallards -5.0%). The 3 diving duck species assessed (e.g. canvasbacks, redhead and lesser scaup) are relatively unchanged. The causes of these changes are unclear, and have no direct implications to this plan. Concerning trends for individual species or groups of species will be monitored and, where scientifically supported, may lead to future program adaptations.

Western Boreal Forest

Based on the USFWS Breeding Population and Habitat Survey, the Western Boreal Forest (WBF) including Central Alaska supports approximately 13 million ducks, about 30% of the traditional survey area total estimated (all provinces and territories, Figure 2). In addition, it is believed that this region is heavily used by prairie waterfowl displaced by drought or for annual feather molt.

Based on annual breeding waterfowl survey results, over 50% of the continental breeding season population of green-winged teal, American wigeon, scaup, scoters, ring-necked ducks and goldeneye are found in the WBF (all provinces and territories). The western boreal forest south of the 60th parallel supports between 61-72% of the total breeding season population estimate of these six species combined. Although the overall population is stable south of 60; over the last 30 years, 9 species appear to be increasing, 6 decreasing and 3 stable (all provinces and territories, Figure 3).

Figure 2. Extent of Western Boreal Forest

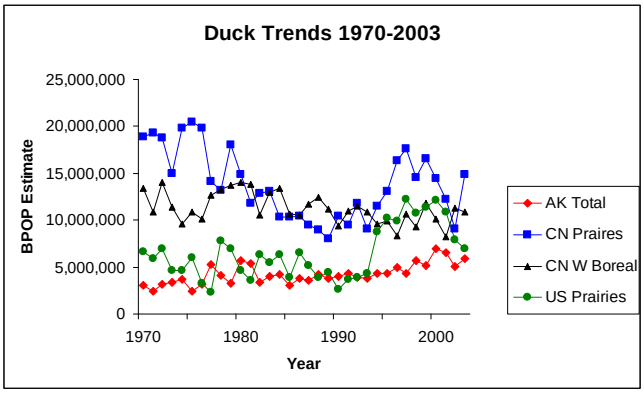

Figure 3. Duck trends from 1970-2003 for the Traditional Survey Area. Data Source: USFWS.

Status of Upland and Wetland Habitat in Alberta 1971-2001

Prairie and Parkland

We used several data sources to examine the current status and trends in upland and wetland habitat within prairie and parkland Alberta. Current landscape composition (circa 1995-2001) and habitat distribution was provided by the Prairie Farm Rehabilitation Administration landcover data (Ashton 2001) and Statistics Canada Census of Agriculture (Statistics Canada 2001; hereafter 'Census'). Trends over time were provided by 1) Census data gathered at 5 year intervals from 1961 to 2001, 2) Watmough et al. (2002 and pers. comm.) for the period 1985-2000, and 3) miscellaneous sources in the literature.

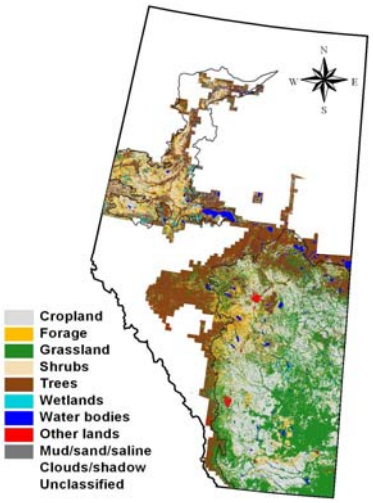

Figure 4. Distribution of landcover classes within the traditional PHJV boundary (source: PFRA landcover).

Upland

General landscape composition within the AB PHJV boundary varies between the Peace Lowlands and the Parkland/Grassland regions (Table 1). Peace Lowlands are dominated by mixed deciduous/coniferous forest interspersed with annual and forage crops whereas the prairie and parkland biomes are dominated by annual crops and pasturelands composed of tame and native grasses and aspen forest (Figure 4).

	Crop	Forage	Grass	Shrub	Trees	Wetl/Water	Other
Peace Lowland	23.3	17.9	2.1	9.2	36.3[a]	10.9	0.3
Grassland/Parkland	37.3	8.0	39.3	1.0	10.9	2.8	0.8

Table 1. General landscape composition (%) within the Peace Lowland and Grassland-Parkland regions of the traditional Alberta PHJV boundary (source: PFRA Landcover)
[a] underestimate due to lack of landcover data in regions (mainly treed) of the PHJV peace Lowland boundary.

Because of consistency in reporting, we primarily relied on Census data at the Census Consolidated Subdivision (CCS) level (i.e., county level; Figure 5) to track general upland change. Because CCS boundaries failed to capture the Peace Lowland region in a readily interpretable way, we concentrated the analysis on the Parkland/Grassland region (Figure 1) which covers most of the high density waterfowl habitat in Alberta. General habitat trends in the Peace Lowlands were captured from other sources.

Figure 5. Location of Census of Agriculture CCS units (grey) in the Grassland/Parkland region used in land use trend analysis.

We extracted the acreage of spring crop, fall crop, summerfallow and hayland for each CCS directly from the Census. The balance of the CCS area was assumed to be "natural"; lands generally in grassland or woodland pasture

and idle habitat remnants. Hence, this analysis tracks cropland, summerfallow, hayland, natural, and tilled (cropland + summerfallow).

Landscape change in Alberta since 1971 is characterized by an increase in tilled land at the expense of natural lands until 1986 after which natural land has increased and tilled land has decreased (Figure 6). Contributing factors to landscape change include NAWMP programs, removal of grain transportation subsidies in 1995 and federal and provincial programs encouraging conversion of marginal cropland. Further, expansion of the cattle industry has increased the demand for pasture and hayland forage.

An important caveat to the above trend in 'natural' land is that while these lands have increased since 1986, the native prairie grassland component has continued to decline. Prairie-wide, native grassland was lost to cultivation at a rate of 0.44%/yr from 1985-2000 (Watmough pers. comm.). Native prairie is a unique and valuable habitat component that, once lost to cultivation, is virtually impossible to restore. Loss rates specific to Alberta native prairie are scarce, however current efforts are underway by Environment Canada to gather this data.

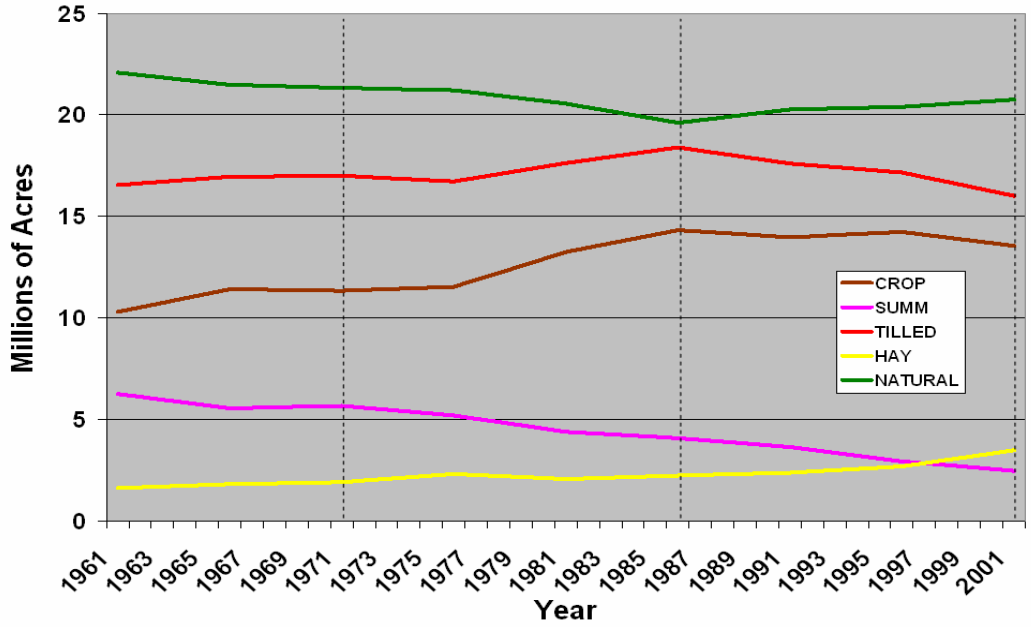

Figure 6. Change in acres of cropland, summerfallow, tilled (cropland + summerfallow), hayland, and natural lands within the Grassland-Parkland region of the traditional PHJV boundary from 1961-2001. Vertical hatched bars indicate the reference years 1971 (habitat composition at NAWMP goal), 1986 (beginning of NAWMP), and 2001 (most recent data).

Trends in land use change have not been uniform across the Grassland/ Parkland region. Comparing land use in 1971 to 2001, tilled land has increased in some parts of southern and eastern Alberta whereas larger decreases have occurred in the western and northern parts of the region (Figure 7a). Hayland has increased in all parts of the region but most dramatically in the western parklands (Figure 7b). Natural land has declined in the grasslands and eastern parklands but has increased somewhat in the western and northern parklands (figure 7c). In summary, upland habitat in the grassland region has generally declined with expansion of tillage whereas uplands have generally improved in the parklands, especially the western parklands. Implications for this plan are to prioritize habitat retention efforts in prairie target landscapes and support

cropland conversion to forage trends in parkland target areas. Capability exists to fine-tune relative land use trend for individual target landscapes by comparison with CCS unit trends.

Winter wheat is of specific interest to waterfowl managers given its use for nesting by most species of dabbling ducks. In Alberta, winter wheat has experienced moderate growth since the early 1990's, from approximately 80,000 acres in 1992 to 220,000 acres in 2006 and the recent trend is strongly upward. Winter wheat provides an opportunity to establish some breeding waterfowl benefits in areas that continue to be dominated by cropland.

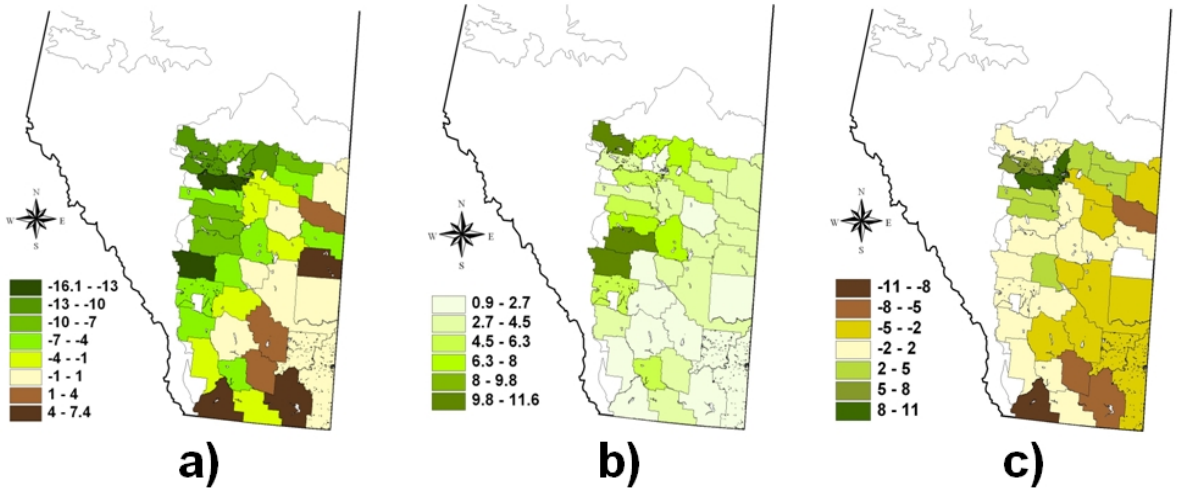

Figure 7. Percent of landscape (CCS) change in a) cultivated acres, b) hayland, and c) natural land from 1971-2001 within the majority of the PHJV planning area of Alberta.

Land use change not captured in the above analysis includes changes in the Peace Lowland and boreal fringe. Land use change in these areas has been substantial since the early 1970's. For example, between 1976 and 1981, approximately 272,000 acres of public forested land were opened to agriculture in the Peace River area (Fox and Macenko, 1985). Expansion of agriculture in the Peace region continued during the 1980's with the Alberta government's policy of accelerated sales of public land (Miller 2000). Agricultural expansion in this region may be reaching its limit as most economically viable land is already in use (MacLock et al. 1996). Typically, expansion of agriculture into the boreal fringe results in large decreases in forest cover and wetlands in these areas (e.g., Hobson et al. 2002, Cumming et al. 2001). Deforestation rates in the boreal fringe have been estimated at approximately 1% per year (Hobson et al. 2002, Cumming et al. 2001). From 1985 to 2000 in the parkland-boreal transition zone, cropland decreased by 9%, tame pasture increased by 4%, and hayland increased by 7%, and other lands (roads, farmsteads, etc.) increased by 1% (Watmough pers. comm.). Total loss in treed habitat over the period was 1%, somewhat less than estimated by Hobson et al. (2002) and Cumming et al. (2001). These negative habitat trends are in contrast with positive waterfowl population trends this trend in this area, providing unclear implications for this plan.

Wetland

The amount of wetland habitat shows marked regional variation within the praire and parkland biomes of Alberta (Figure 8). Generally, wetland habitat is increasingly prevalent from prairie to the parklands and into the boreal transition and Peace Lowland regions. This gradient reflects increased permanency and increased basin size progressing from prairie to boreal.

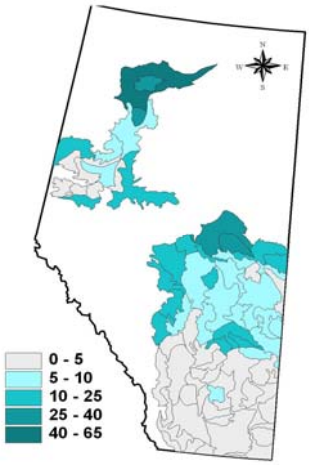

Figure 8. Estimated percent of the soil landscape occupied by wetlands (source: Atlas of Canada – Wetlands; http://atlas.nrcan.gc.ca/site/english/maps/freshwater/distribution/wetlands).

Estimates of wetland loss since settlement in Alberta are uncertain. Prairie-wide, Goodman and Pryor (1972) reported a decrease of 13% in wetland area between 1940 and 1970 within the parkland ecoregion. Watmough et al. (2002 and pers. comm.), examining wetland loss on 44 transects within Alberta's prairie and parkland biomes, indicated an overall gross loss of 5.4% of wetland area from 1985 to 2000 (-0.40% per year). Wetland area lost varied among transects from 0 to 50% and these figures are expected to be conservative given the strict definition of wetland loss applied. Wetland loss tended to be greater in the parklands versus the grasslands. Similar to uplands, capability exists to fine-tune relative wetland trend for individual target landscapes by comparison with CCS unit trends.

Wetland loss appears an important factor influencing duck productivity in Alberta's prairie/parkland (Devries et al. 2004). Current efforts are underway by Environment Canada to refine wetland loss estimates within the PHJV planning area (Watmough pers. comm.). This information will further refine where risk of habitat loss or habitat restoration needs are greatest. Implications for this plan are greater focus on wetland retention and wetland restoration, particularly in the parklands.

Western Boreal Forest

Conventionally thought to be isolated from development and a stable habitat for waterfowl and other waterbirds, the WBF is undergoing far-reaching development by the energy sector (oil and gas, hydroelectricity), forest industry, agriculture, and mining (mineral and peat extraction). In many locations, multiple developments are occurring simultaneously generating concerns about cumulative impacts. Although these developments are taking place across the WBF, by far the greatest direct anthropogenic landscape change is currently occurring south of 60º latitude. The status and trends of wetlands and uplands in this area is at a very preliminary phase: establishing this information in advance of rapid development is the primary concern. No detailed analysis was possible for the WBF as was possible for the prairie and parkland biomes.

Alberta NAWMP Accomplishments to March 31, 2006

Waterfowl habitat conservation activities have been undertaken in prairie, parkland and the parkland-boreal transition of Alberta (including British Columbia's Peace lowland) since the late 1930s, and have increased substantively over the last 50 years. An equally impressive history of conservation partnerships developed over this period, providing a solid foundation for NAWMP to be launched in 1986.

Significant NAWMP organizational and profile accomplishments have also been completed in Alberta. Organizationally, a Board of Directors, Management Committee and three subcommittees (Policy, Science and Communication) were formed upon NAWMP Alberta's inception (except Communications). All committees enjoy a representative from each of the core partners. The work of these committees has greatly advanced NAWMP's identity, credibility and opportunities in Alberta. These positive outcomes nourish the committee representative and partner agency arrangement, leading to continued growth and opportunity development.

Prairie and Parkland

NAWMP Planning in prairie and parkland Alberta began in 1987, initiating a two-year process that employed an earlier version of a duck productivity model (i.e. Mallard Model and Computer Planning Tool). The Buffalo Lake Moraine was chosen to trial program plans, known as Alberta NAWMP's *First Step* Project area. Habitat program delivery was officially piloted in 1989. Following this success, full-scale delivery of NAWMP commenced in 1991, fueled by receipt of the first North American Wetlands Conservation Act (NAWCA) funding.

NAWMP-eligible "Secured" acres quickly accumulated during these initial years of implementation. In addition to these acres, all waterfowl habitat acres secured in NAWMP-eligible areas of Alberta since May, 1986, were also credited as "Secured" by NAWMP. Total NAWMP "Secured" acres to March 31, 2006, equaled 1,293,676 acres. Habitat acres secured prior to 1986 and within NAWMP Key Program Areas were not credited as "Secured" by NAWMP, rather they were accepted as "Managed" NAWMP acres and eligible for project management expenses (492,493 acres were secured prior to 1986 and accepted as "Managed"). NAWMP acres in Alberta are defined as being "Secured" if purchased or an agreement on a specific land parcel was signed between the landowner and a NAWMP partner and the agreement was for a minimum ten-year term. Securement options included acquisition (acquiring land title through fee simple purchase, land donation, Crown title transfer), Crown land designation or termed Licenses; Lease; Cooperative Land Use Agreement, Conservation Agreement or Conservation Easement. Acquisition and Conservation Easement agreements are perpetual while all other agreements have a term of 10 years or more. As of March 31, 2006 Alberta had 117,491 acres under perpetual security and 1,668,688 acres under term agreements (Table 2).

"Stewardship" acres represent voluntary adoption of sustainable land use practices by a land owner or land manager based on information exchange and occasional, minor incentives. No agreements or agreements of terms less than ten years make tracking difficult, therefore stewardship acres are heavily underreported (Table 2.). The Alberta NAWMP partners have

recently implemented systems to track Stewardship acres and report them more accurately through the National NAWMP Tracking System.

SECUREMENT AGREEMENT TYPE	TERM	ACTUAL ACRES AS OF 2006 03 31
Acquisition	Perpetual	101,696
Lease	≥ 10 years	13,660
Cooperative. Land Use Agreement	10 to 30 years	179,472
Conservation Agreement.	10 to 50 years	979,253
Conservation Easement	Perpetual	15,795
No agreement (Stewardship)	Nil	3800
Secured prior to 1986	Variable	492,493
TOTAL		**1,786,169**

Table 2. Acre accomplishments for the Prairie and Parkland Ecoregions of Alberta and the Peace Parklands of Alberta and British Columbia from 1986 to March 31, 2006

Western Boreal Forest

Securement activities occur by different methods and timescales in comparison with Alberta's prairie and parkland regions. Interim protection has recently been announced on several major wetland areas, with formal protection of these and others expected within Alberta during the term of this plan.

The Biological Foundation to Setting Habitat Objectives

Prairie and Parkland Target Landscapes

Target landscapes in this portion of Alberta were defined as areas with long-term average waterfowl pair densities ≥ 30 pairs/mi^2 of the seven primary waterfowl species in Prairie Canada (mallard, gadwall, blue-winged teal, northern shoveler, pintail, redhead, canvasback) *and* areas estimated to have ≥ 6 pairs/mi^2 of northern pintails (Figure 9). These areas were derived from the Waterfowl and Pintail Breeding Pair Distribution maps developed by Ducks Unlimited Canada, with some allowance for boundary modifications based on local knowledge. Target landscapes permit focusing of conservation resources to areas supporting the most waterfowl most years, including special consideration for pintail distribution.

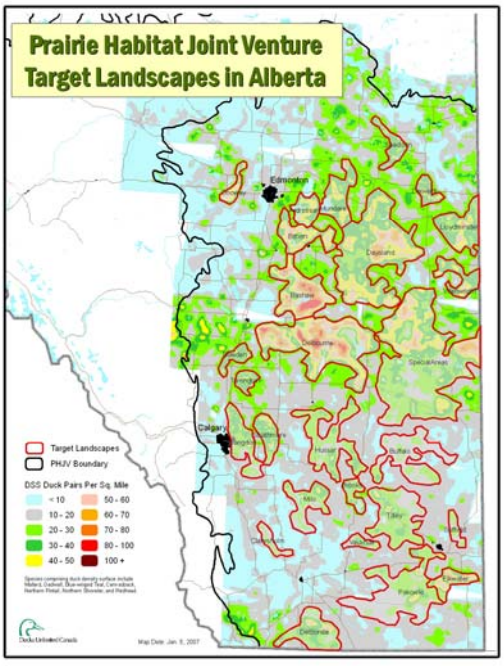

Figure 9. Alberta Prairie and Parkland Target Landscapes

Other areas define all habitat outside target landscapes but within Alberta's prairie and parkland biomes (including the Peace Parklands). No target landscapes are designated within the Peace Parklands primarily due to lower average waterfowl densities.

Western Boreal Forest Target Landscapes

The location and definition of target landscapes in the WBF is at more preliminary stage due to a shorter NAWMP history and its large geographic extent. A total of 21 target areas have been identified primarily within the boreal plains and taiga plains, but also some within the taiga cordiallera and boreal cordillera ecoregions (figure 10).

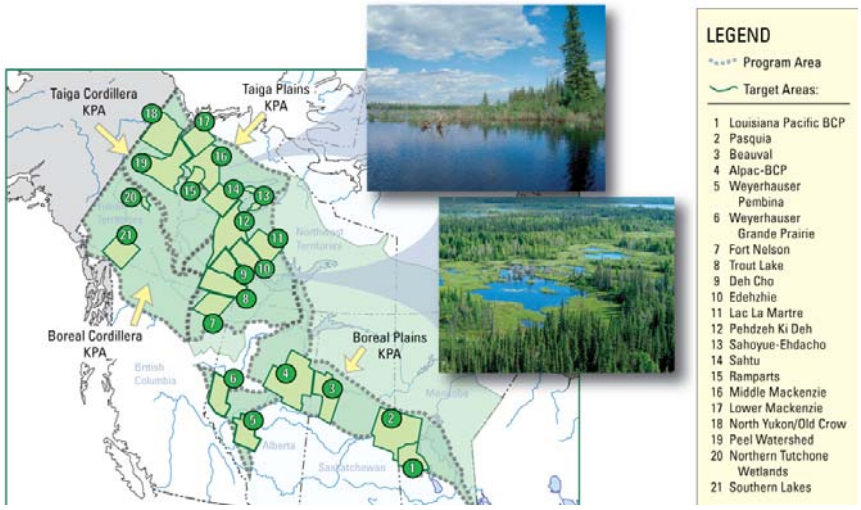

Figure 10. Target Landscapes in the WBF

A current priority is to assess and differentiate basic waterfowl and wetland ecology among target landscapes, and in some, begin understanding the linkages between anthropogenic activities and waterfowl. Boreal and Taiga Plains target landscapes are the priority, where the abundance of waterfowl and wetlands is highest. Current target landscapes of focus include Alpac – BCP, Weyerhauser Pembina, Deh Cho and Ramparts.

Prairie and Parkland Habitat Objectives Updating Process

Previously, Devries et al. (2004) described a process for updating PHJV habitat goals that estimated the influence of wetland and upland changes on waterfowl productivity in prairie Canada from 1971 to 2001 (Figure 10). The year 1971 was chosen because it was an Agricultural Census year near the beginning of the period of NAWMP population objectives and 2001 was chosen as the most recently available Agricultural Census of landscape conditions. Inclusion of habitats delivered under NAWMP since 1986 were incorporated as well (Appendix D of Devries et al. 2004). Changes in waterfowl pair population carrying capacity over this time period were estimated using simulation models that converted wetland loss estimates at the county scale into change in population carrying capacity from 1971 to 2001 (Appendix E of Devries et al. 2004).

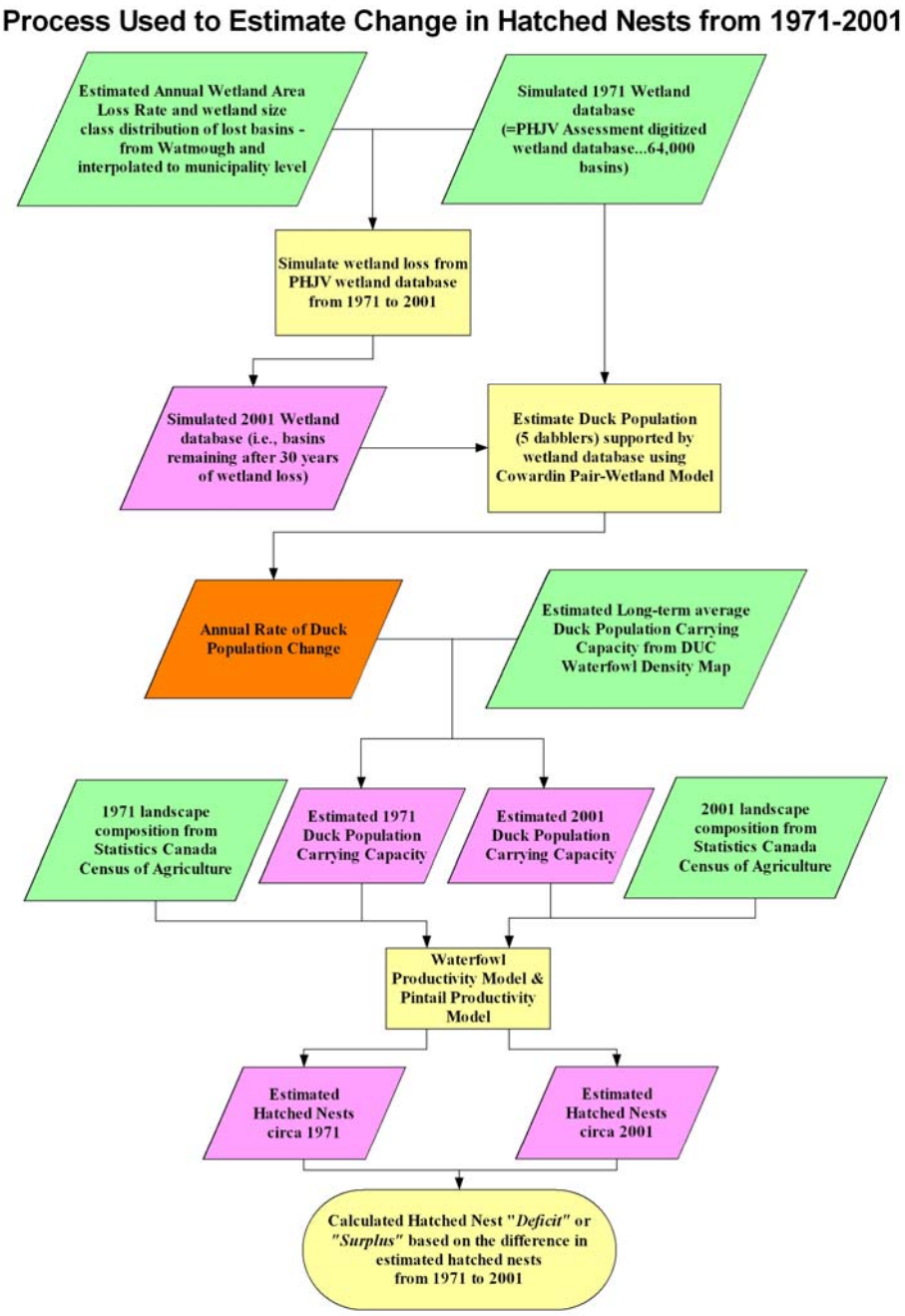

Figure 10. Process used to estimate change in waterfowl productivity potential (estimated hatched nests) at the county scale from 1971 to 2001.

This approach recognizes that duck productivity from the region is impacted by both the amount of wetland habitat present (i.e. its carrying capacity for duck pairs) and the type and amount of upland habitat available for use by nesting female ducks.

The Waterfowl Productivity Model (WPM) and the Pintail Productivity Model (PPM) are a new generation of scientific tools that allow linkage of population objectives to habitat objectives together with ambient environmental trends. **Hatched nests** are the unit of measurement for

these models, and all wetland and upland changes can be attributed impacts either individually or in tandem with others. Given measures of wetland and upland change over the 1971-2001 time period, changes in estimated hatched nests at the county scale were calculated using the Waterfowl Productivity Model (WPM; Appendix C of Devries et al. 2004; for mallard, gadwall, blue-winged teal, and northern shoveler) and the Pintail Productivity Model (PPM). Changes in hatched nests at the county scale were recorded as either a '**deficit**' (or possibly, 'surplus)'. Deficits (or surpluses) at the county scale were then attributed to Target Landscapes and Other Areas relative to the proportion of the local waterfowl population falling within them. Actions which reduce this deficit are defined as a '**gain**', which in consideration with other factors, results in a '**net change**' in productivity.

*Note1: Deficits reported here are **greater** than those reported previously in Devries et al. (2004) because here we have used estimated wetland loss rates for each county rather than province-ecoregion level averages. This results in greater overlap of high wetland loss rates with high wetland density areas hence increasing the effect of wetland loss on waterfowl carrying capacity.*
*Note2: Because our biological models are based on average breeding parameters gathered over a number of years, we assume that a specific Ag Census year represents **average** landscape conditions for a broad time period around the specific Ag Census year and not the specific year itself. Therefore, we are assuming average waterfowl populations for the time period with average reproductive effort interacting with average landscape conditions at local scales.*

Western Boreal Forest Habitat Objectives Updating Process

Habitat objectives were not described for WBF target landscapes at this time. Scenrario testing and establishment of habitat objectives aided by the Waterfowl Prodcutivity Model apply solely to the prairie and parkland areas of Alberta.

Testing Prairie and Parkland Habitat Restoration and Retention Scenarios

Wetland and upland habitat restoration goals were established based on a series of simulation runs of the WPM and PPM with a minimum objective of removing productivity deficits over the 25 year planning horizon. Landscape change scenarios involved both prescriptive and non-prescriptive (i.e. environmental) influences within target landscapes and other areas.

The Alberta NAWMP Management Committee reviewed and selected habitat change scenarios with the goal of eliminating provincial deficits in hatched nests (1971-2001) for the 4 dabbling ducks plus pintails separately. The process combined locally knowledgeable provincial planners and implementation staff with regional data and productivity modeling expertise by DUC staff. For all target landscapes and other areas, program scenarios were estimated (e.g. types and amounts), models were run, results reviewed, and programs changed and remodeled in a trial-and-error, iterative process until the sum provincial deficit was erased over 25 years. Program scenarios were applied appropriate to landscape characteristics, including any or all of the following: 1) wetland restoration with the assumption that basins restored would match the size class distribution of wetlands most frequently drained (Watmough, 2002), 2) conversion of cropland to hayland or tame pasture, 3) adoption of winter wheat into cropping rotations, 4) conversion of cropland to planted nesting cover. This process recognized that habitat restoration

activities are the exclusive means to reducing productivity deficits, or conversely, achieving productivity gains.

To assist with selection of program types and weighting for each target landscape, a simple matrix was developed and applied (Figure 11). The matrix helps to differentiate target landscapes needs based on changes to landscape condition. It assesses whether the landscape should be predominantly restoration based or retention based, and if restoration, whether wetlands or uplands are the primary focus. Restoration was the dominant theme (both wetlands and uplands), with wetland versus upland emphasis determined by a combination of need tempered with opportunity). Expanded program scenario descriptions follow.

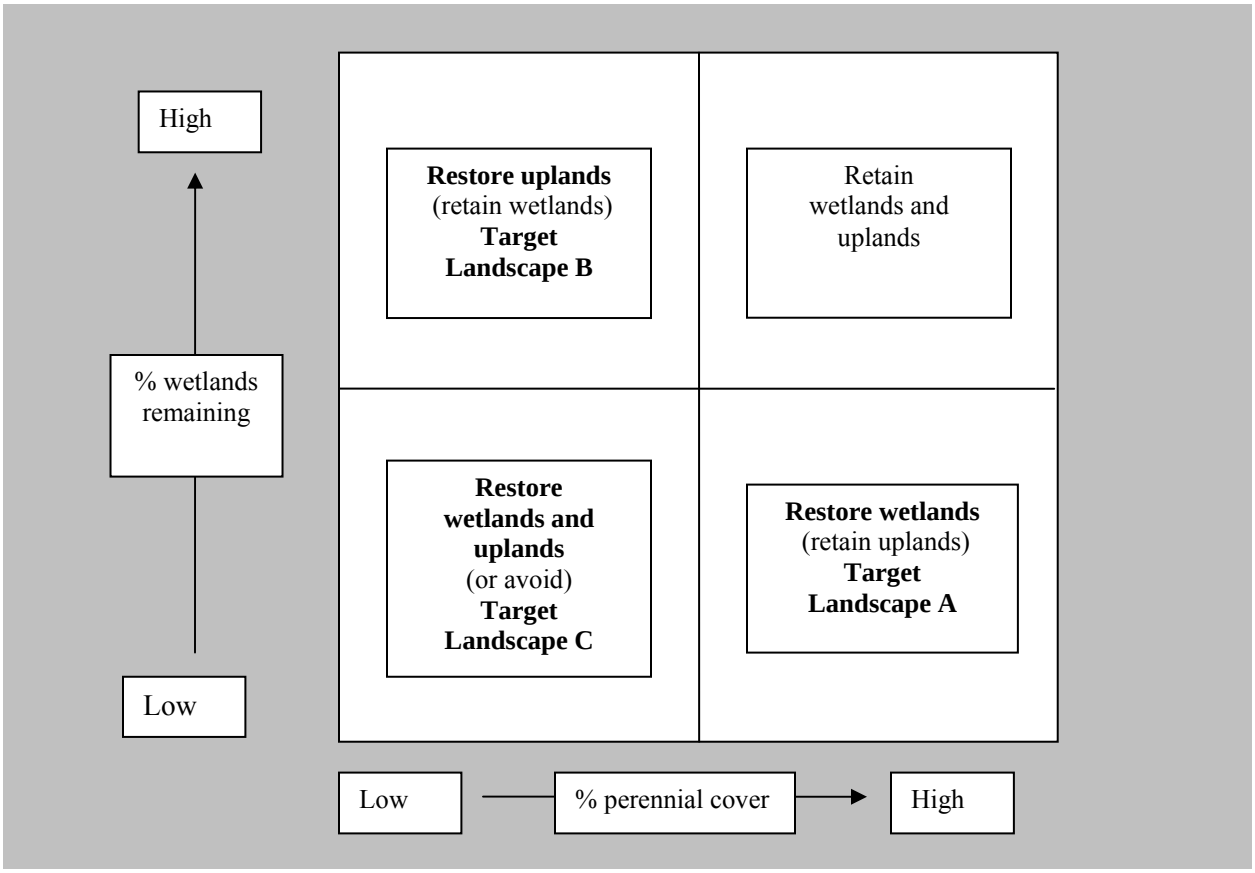

Figure 11. Matrix relating Target Landscape Habitat Condition to Program Selection

Wetland Restoration. Estimated losses (and therefore restoration requirements) were estimated using county-specific wetland loss rates, data on the size of lost basins (Watmough pers comm.), and Cowardin (1988) wetland-duck pair models. Restoration objectives are a function of target landscape size and historic wetland loss rate. The intent of wetland restoration in this plan is to restore all lost pair carrying capacity caused by wetland loss in target landscapes in Alberta since the early 1970's, with emphasis on target landscape type A, and in tandem with upland restoration, type C (Figure 11). Brooks and Tilley target landscapes were exceptions: wetland loss in these areas was deemed overestimated and none will be initiated. In other areas of

Alberta, we have assumed 50% success rate in restoring lost wetlands and hence waterfowl pair carrying capacity. Wetland losses experienced in parkland Alberta were among some of the highest in Canada's prairie and parkland, requiring wetland restoration to be a dominant feature in its plan.

The proportion of those basins that are set as restoration objectives for target landscapes is based on the percentage of cropland present in the target landscape. If cropland is ≥ 90%, no restoration effort is applied; if no cropland is present 100% of potential wetland restoration is applied. In most landscapes where both upland and wetland restoration opportunities exist, both are added in consistent proportions. In the non-target portion of Alberta, it is assumed wetland restoration would be minimal.

Upland Restoration: Adding Hay and Pasture. Estimated trend of perennial cover increase/decrease by target landscape was determined based on an area-weighted balance of change among the portions of counties falling within a given target landscape. Calculations of cropland conversion to hay and pasture were based on 1996-2001 Census of Agriculture data for each County (fixed ratio of 60% pasture/ 40% hay). The observed rate of change was assumed to continue until 2016, after which cultivated acres were assumed to remain unchanged for the balance of the planning horizon (assumption will be monitored and changed as new information supports this). Most target landscapes and other areas applied the full projected change (defined as the G5 scenario, focus on target landscape type B, and in tandem with wetland restoration, type C, Figure 11). More extreme type B target landscapes include Daysland, Delbourne, Special Areas and Wainwright, where opportunities for cropland conversion were greater than normal and applied 140% of the projected change (140% designated as G7 scenario).Exceptions included the Elkwater and Pakowki Target Landscapes, who have limited/no opportunity for further cropland conversion.

Upland Restoration: Adding Winter Wheat. Estimate of potential winter wheat acres was based on a projection of the current growth trend (1992-2006) in acres across the prairies to 2021 (25 years). Based on this projection, an estimated 15% of all wheat acres would be winter wheat varieties at that point in time. However, the opinion of the Management Committee was that achieving 20% of all wheat acres as winter wheat in target landscapes and other areas was possible in that time period (emphasis on type B and C target landscapes, Figure 11). We assumed that overall wheat acres would remain relatively constant. Industry experts estimate a 30% ceiling for winter wheat as a percentage of all wheat acres.

Upland Restoration: Planted Nesting Cover. Due to the extreme costs associated with planted nesting cover in Alberta, this technique would be used sparingly. On this basis, the Management Committee selected type B target landscapes Bashaw and Delbourne for delivery of planted nesting cover (Figure 11, upper limit of set at 0.36% and 0.38% of total landscape respectively). No planted nesting cover is planned outside target landscapes.

Wetland and Upland Retention. Wetland and upland retention activities do not reduce a productivity deficit, rather they prevent further productivity decline. Project-based retention activities, although important, do not translate into landscape scale effect and therefore are not included in modeling scenarios. **By contrast, where policy or regulatory changes result in broad-scale protection for wetlands or grasslands (e.g. province), such influence is included**

in modeling scenarios. The current Alberta Wetland Policy development is an example of such a broad-scale protective action. As no broad-scale retention actions were in effect during this planning period (2008-2012), the effect of wetland loss continuing at current rates for until 2011 was applied. However, **scenario planning beginning in 2012 (i.e. start of the next 5-year term of the remaining 25-year period) assumed wetland loss will end by policy efforts.** Credit for this accomplishment was assumed within this 5-year plan (i.e. coinciding with its end point). This assumption is plausible in Alberta given the current status and apparent public support of wetland policy initiatives.

Selecting Prairie and Parkland Habitat Restoration and Retention Objectives

Selection of restoration and retention objectives recognized a need for an emphasis on restoration activities to dominate in order to reduce the productivity deficit. Most target landscapes ultimately applied major restoration and minor retention components for both wetlands and uplands.

Restoration. Habitat restoration objectives were established over a 25-year term based on most appropriate, realistic, cost-considerate scenarios among numerous possible scenarios (Appendix II). Restoration objectives in tandem with assumed landscape change will achieve productivity gains for Dabblers (4 species) and Pintails sufficient to eliminate the Alberta provincial deficit for both groups. Results are presented for Target Landscapes and other Areas.

Alberta NAWMP (and PHJV) Implementation Plans will be reviewed and adjusted on a regular (approximate 5-year) interval as new information on landscape change becomes available. Improvements in waterfowl science that refines current productivity models include:

1) Measurable changes to habitat and agricultural land use patterns affecting waterfowl productivity across landscapes of interest
2) Progress made towards habitat objectives and waterfowl productivity deficit recovery in the current five-year plan

Five year habitat restoration objectives were selected for each program based on an ideal of achieving 20%, or one-fifth, of the estimated 25-year deficit (Table 3).

For all upland restoration programs, NAWMP partner-driven direct and extension programs coupled with projected industry trends enabled achieving the 20% target. **Upland trend assumptions were made prior to recent and dramatic changes in commodity prices, and must be monitored closely under these circumstances.** Wetland restoration programs cannot achieve the 20% target due to a combination of an exceptionally high long-term wetland restoration objective with organizational capacity limitations. An ambitious yet realistic target was established for the current 5-year term that will address approximately 2% of the 25-year objective. Achieving the 5-year and 25-year targets will require a major increase in attention by all partners and "ramping-up" of wetland restoration capacity by those partners directly implementing this program (primarily DUC and some NCC). Shifts in current program emphasis will likely also be required.

Upland restoration objectives for the 5-year period 2008-2012 is equal to 174,400 additional acres of winter wheat (20%), 286,600 additional acres of cropland conversion to pasture (20%), 191,100 additional acres of cropland conversion to hayland (20%), and 1,500 new acres of planted nesting cover (20%). Wetland restoration objectives for the 5-Year period 2008-2012 equal 5,300 acres (or 7,000 basins). A total of 658,900 wetland and upland restoration acres are presented in this 5-year plan, representing 19% of the 25-year habitat objective (table 3). Restoration of large wetland complexes will occur under this plan but are not included in acre totals.

Wetland restorations will be achieved through direct programs by Ducks Unlimited Canada (DUC) with support from Agriculture and Agri-Food Canada (AAFC, facilitation and financial) and Nature Conservancy of Canada (NCC, facilitation). Restorations will only occur on lands secured by acquisition or agreement. Winter wheat will be delivered exclusively by DUC through extension programs. Cropland conversion programs (hay and pasture) will be delivered by DUC and AAFC through a combination of direct (secured lands) and extension (no agreement). Planted cover will occur on DUC-secured lands. Detailed program descriptions follow in this document.

Retention. Retention of existing "at-risk", high quality wetland and upland habitats are necessary to prevent further increases in the productivity deficit and undermining productivity gains. At risk wetlands are a subset of total wetlands, characterized by small size (<1.0 acre, average 0.75 acres) and frequently associated with cropland. At risk uplands are typically native, naturalized or occasionally tame grass directly associated with at risk wetlands. Habitat retention objectives were estimated for a 25-year period based on (and equal to) the estimated loss to occur over this same period (at risk wetlands only, uplands by extrapolation). Wetland loss estimates were calculated based on rates utilized by the WPM in target landscapes. Upland retention objectives were then estimated based on a simple 3 (upland):1 (retained wetland) acre ratio**.** Wetland retention objectives presented in this 5-year plan pertain to direct program and extension activities necessary while the Alberta Wetland Policy comes into effect. When the policy takes effect, no further direct or extension wetland retention effort and expenditures should be necessary and this objective should be revised accordingly.

Similar to restoration objectives, 5-year wetland and upland habitat retention objectives were selected based on an ideal of achieving 20%, or one-fifth, of the estimated 25-year deficit. The pending Alberta Wetland Policy will enable greatly exceeding this objective during the term 2007-2012, capturing 100% of the 25-year objective (1.378,500 acres). An upland habitat retention objective for the same term equals 25,000 acres of native, naturalized and some tame grass (27% of at risk objective). A total of 1,403,500 wetland and upland retention acres are presented in this 5-year plan, representing 95% of the 25-year habitat objective. Opportunities for large-scale habitat retention with historic partners within all Target Landscapes will be reassessed (e.g. Special Areas Board, Irrigation Districts).

Wetland retention will be achieved by a combination of policy efforts (Alberta Wetland Policy – all Alberta NAWMP partners,), direct securement programs by DUC and NCC, plus extension by DUC, Alberta Environment (AE) and Alberta Agriculture (AA). Retention of native, naturalized and some tame wetland-associated grass will be achieved through direct securement

Table 3 Alberta 5-year habitat objectives and expenditure forecast (2007-2012) relative to 25-year habitat objectives

Activities	25-Year Habitat Objective (Acres)		5-Year Habitat Objectives (Acres)					% 25-Year Habitat Objective	5-Year Expenditure Forecast
			Direct NAWMP	Extension NAWMP	Policy NAWMP	Industry Trend *	Total		
Habitat Restoration									
Winter Wheat	872,100		25,000	149,400	0	0	**174,400**	20%	**$ 775,000**
Tame Pasture	1,433,100		49,000	4,000	0	233,600	**286,600**	20%	**$ 3,108,000**
Tame Hay	955,600		49,000	4,000	0	138,100	**191,100**	20%	**$ 3,108,000**
Planted Cover	7,700		1,500	0	0	0	**1,500**	20%	**$ 4,200,000**
Wetlands **	227,900		5,300	0	0	0	**5,300**	2%	**$ 7,734,900**
Restoration Sub-total	**3,496,400**		**129,800**	**157,400**	**0**	**371,700**	**658,900**	**19%**	**$ 18,925,900**

	25-Year Habitat Objective (Acres)		5-Year Habitat Objectives (Acres)					% 25-Year Habitat Objective	5-Year Expenditure Forecast
			Direct NAWMP	Extension NAWMP	Policy NAWMP	Industry Trend *	Total		
Habitat Retention									
Wetland	1,378,500		6,200	300	1,372,000	0	**1,378,500**	100%	**$ 2,464,500**
Upland ***	91,800		20,000	5,000	0	0	**25,000**	27%	**$ 5,643,000**
Retention Sub-total	**1,470,300**		**26,200**	**5,300**	**1,372,000**	**0**	**1,403,500**	**95%**	**$ 8,107,500**
Direct and Extension	**4,966,700**		**156,000**	**162,700**	**1,372,000**	**371,700**	**2,062,400**	**42%**	**$ 27,033,400**
Policy									**$ 1,262,100**
Operation & Maintenance									**$ 12,353,200**
Research & Evaluation									**$ 7,448,400**
Communication									**$ 2,766,800**
Coordination									**$ 7,188,600**
Grand Total									**$ 58,052,500**

* An estimate of change of specific land use types based on current, broad-scale data (Ag Census).
** Assumes small basins are primary restoration target (range 0.5-1.0 acre, average 0.75 acre)
*** May include tame or native grass acres

by DUC, NCC and AAFC and through extension by DUC and AA. Detailed program descriptions follow in this document.

Included in retention activities (but not acre totals) are large wetland complexes and associated uplands. Most large wetlands remain intact and are Crown-owned but at risk of degradation, or in extreme cases, or loss. These areas provide critical molting and staging habitat for waterfowl, waterbirds, shorebirds and migratory landbirds. These sites are located throughout the PHJV program area, many of which have permanent protection through past partner actions. Large wetland retention activitites will occur under this Plan lead by DUC's provincial Crown Lands initiative. A list of key staging and moulting wetlands is attached as Appendix III

Partner Programs and Roles in Support of Habitat Objectives

Prairie and Parkland

The Alberta NAWMP Implementation Plan will advance restoration and retention habitat objectives through a broad mix of conservation actions. Methods include direct interventions, extension, and policy change.

The Alberta NAWMP partnership boasts a long term, highly integrated working arrangement. Roles and responsibilities of Alberta NAWMP partners are defined in an organizational document and governed by the Alberta NAWMP Board of Directors and Management Committee. They are tasked with coordinating the partnership and advancing its goals and objectives, as well as assigning tasks to respective Policy, Science and Communications subcommittees. In some cases individual NAWMP partners will employ members of the general public in their consultations and outreach to government. All partners have a role in planning and monitoring implementation of NAWMP in Alberta. DUC was assigned NAWMP coordination by the province, and may or may not chair committees. NAWMP partners' roles are summarized in Table 4. A summary of programs and initiatives to achieve stated habitat objectives follows.

Direct Programs

Direct habitat programs aim to retain important, at risk, wetland and upland habitats and/or facilitate wetland and upland restoration. They employ long-term (>= 10 years) securement tools including purchase, conservation easements, conservation agreements, management agreements, and forage agreements are delivered by Alberta NAWMP partners DUC, NCC and AAFC. Direct habitat programs are focused sparingly within target landscapes with the exception of forage agreements which occur throughout Alberta's prairie/parkland. Opportunities are continually sought to identify and create direct program opportunities among Alberta NAWMP partners (e.g. through Integrated Watershed Management, Biodiversity planning/Wildlife and biodiversity enhancement BMPs).

Wetland restoration, achieved only through direct programs, seeks to return historic hydrological and ecological function of basins previously drained. The primary target is small, temporary or seasonal wetlands, the same type that have endured greatest losses through agricultural

development (range 0.5 to 1.0 acre, average 0.75 acres). Restoration usually involves minor earth-fill construction applying "ditch plugs" on outlets of drained basins. DUC is currently the only partner who implements wetland restoration, with NCC actively facilitating wetland restoration opportunities through its securement efforts. Alberta NAWMP partner Alberta Environment, with assistance from DUC, is creating major wetland restoration funding opportunities through expansion of its wetland mitigation process.

Upland restoration direct program activities include cropland-to-perennial cover conversion and planted nesting cover. Most cropland conversion is to pasture or hayland with regular agricultural use. Direct programs are delivered by DUC and AAFC requiring minimum 10-year agreements (which also include securement of existing wetlands). Management of forage stands is the responsibility of landowners. Planted nesting cover is set-aside for waterfowl nesting on small amount of the highest quality, permanently secured lands. Only periodic management occurs to maintain cover quality. DUC is the only Alberta NAWMP partner offering this program.

A total of 156,000 acres of Direct NAWMP programs are presented in this 5-year plan: 129,800 acres are restoration-based and 26,200 retention-based. Direct programs will be the only means to address wetland restoration objective acres and will work in tandem with extension and industry trends to address upland restoration objectives. Direct programs will provide the primary means to address upland retention objective acres in this plan.

Extension

Extension programs are designed to change land-use decisions (or maintain desirable ones) through the provision of information, and ultimately, lead to direct program opportunities. Alberta NAWMP partners will coordinate extension efforts towards the agricultural and water resource management communities to adoption wildlife and wetland -friendly land and water management practices. Because extension provides information to a broad audience, it has the potential to affect large acreages relative to the more intensive activities associated direct implementation described above. Alberta NAWMP partners place a high priority on achieving results through extension activities.

Extension programs primarily serve to restore uplands and to retain wetland and upland habitats. Occasionally, they facilitate wetland restoration in conjunction with upland restoration. They generally do not employ agreements, or if so, are less than 10 years in duration. Extension programs include forage conversion, winter cereals (both upland restoration) and species at risk (wetland and upland retention). DUC, AAFC and AA are the Alberta NAWMP partners providing forage extension programs, DUC is the only partner providing winter cereals extension, and EC and ASRD (through ACA) both implement species at risk-based extension activities. Extension programs are delivered throughout Alberta's prairie/parkland. Similar to direct programs, partners continually seek to identify and align collaborative opportunities for extension programs (e.g. Integrated Watershed Management, Biodiversity planning/Wildlife and biodiversity enhancement BMPs, and environmental goods and services. Note: latter currently being examined by Alberta NAWMP Board of Directors).

To support the ambitious winter wheat projections included in this plan, an accelerated effort is being applied: removal of barriers to adoption through technology-transfer and directed promotion of the economic benefits to target audiences. Important actions include 1) DUC's Core Grower Program, which provide assistance to leading agricultural producers to demonstrate and support further adoption of winter wheat in their communities and, 2) DUC's winter wheat incentive program. DUC is also supporting winter wheat variety research designed to improve disease resistance and over-winter survival.

A total of 162,700 acres of Extension NAWMP programs are presented in this 5-year plan: 157,400 acres are restoration-based (primarily winter cereals) and 5,300 retention-based. A detailed account is provided in table 3.

Policy

Policy in the context of this Plan refers to activities with outcomes that change government and industry policies and programs to positively impact wetland and waterfowl habitat. Policy efforts will address federal, provincial and municipal levels of governments, with emphasis on provincial jurisdiction over wetlands. Alberta NAWMP has advanced the provincial wetland policy agenda the furthest within the PHJV. The Alberta Wetland Policy, a component of the provincial *Water for Life* Strategy, will have significant bearing on the status and future of all wetlands in Alberta. Stewarding the Wetland Policy is the Alberta Water Council, a government-formed stakeholder group. A Wetland Policy Project Team is currently submitting final recommendations to the Alberta Wetland Council, and ultimately the Minister of Alberta Environment. Various partner agency staff are directly involved with both the Alberta Water Council and the Wetland Policy Project Team. A related opportunity under the *Water for Life* strategy is integrated watershed management, a process that enables community-based planning toward both wetland retention and restoration opportunities. The Alberta NAWMP Policy Sub-Committee monitors and guides all policy activities within the broader partnership. Due to the nature of policy work, some partners (e.g. government agencies) will not be able to participate in some policy activities.

Specific components of the Policy Sub-Committee workplan include:

- An Alberta Wetland Policy for conservation, protection and restoration of wetlands is in place by 2011. Alberta NAWMP members, as both participants of the Alberta Water Council and Wetland Policy Project Team, will actively be involved in the development and implementation of the policy.

- Explicit wetland conservation, protection and restoration objectives are set for all watersheds in Alberta under appropriate planning mechanisms (e.g. Integrated Watershed Management plans under Water for Life strategy, the Alberta Land Use Framework, Alberta Environment's cumulative effects management system). Alberta NAWMP will participate in the development of objectives at all levels and types of planning mechanisms.

- Explicit perennial upland (wetland-associated) conservation and protection objectives are set for all target landscapes in Alberta under appropriate planning mechanisms (e.g. the Alberta

Land Use Framework). Alberta NAWMP will participate in the development of objectives at all levels and types of planning mechanisms.

- Enhanced incentives for the conservation, protection and restoration of wetlands and associated native habitats are incorporated into appropriate government programs. Alberta NAWMP will complete an Environmental Goods & Services (EG&S) discussion paper and implement the recommendations through policy channels. The Alberta NAWMP Policy Sub-Committee will coordinate with the Alberta NAWMP Science subcommittee to provide information in support of this concept.

- Permanent cover programs are provided by government through incentives to convert cropland to ecologically appropriate perennial cover. This will be achieved by directly engaging federal government in *Growing Forward* and promoting new provincial government programs (including monitoring uplands and wetlands under existing Greencover and Permanent Cover programs (PCP).

- Waterfowl crop damage prevention and compensation programs are maintained at appropriate levels. Alberta NAWMP will continue to support funding and implementation agencies to ensure program is maintained and adequately funded. The Policy Sub-Committee will evaluate current programs with support from the Science subcommittee.

- Habitat-related Beneficial Management Practices (BMP) are included in the second generation of *Growing Forward* and other government initiatives. Alberta NAWMP will promote and develop habitat-related BMPs in *Growing Forward* plus other government initiatives. The Alberta NAWMP Policy Sub-Committee will coordinate with the Alberta NAWMP Science Sub-Committee to provide information in support of this concept.

A total of 1,372,000 wetland acres are expected to achieve retained status under the Alberta Wetland Policy during this 5-year term (area is total estimated wetland area in prairie and parkland Alberta). This new policy is the result of a major, long term investment in policy development and consultation from both individual agency and NAWMP-based efforts.

Operation and Maintenance

Alberta NAWMP partners DUC, and to a much lesser extent, NCC, manage approximately 1.8 million habitat acres in Alberta. This includes wetlands of a wide range in size, management intensity (within years) and frequency (between years). Licensed wetland projects legally require frequent inspections and must maintain certain safety standards. Occasional repairs are additive to project management costs. Uplands generally have lower management costs as these tend to remain the responsibility of the landowner. The exception is lands with no-agricultural use, where more intensive management is sometimes required. Somewhat offsetting these costs are agricultural revenues which result from use for management purposes. The need to minimize management costs while meeting acceptable standards are continually balanced with the need to advance habitat restoration and retention objectives.

Research and Evaluation

Evaluation and monitoring provide important information to change or refine NAWMP planning and implementation priorities and help identify barriers to achieving those priorities. EC, DUC and ASRD assume a lead role in scientific evaluation of NAWMP programs. EC and ASRD lead annual waterfowl population monitoring with support from DUC. EC and ASRD also lead population monitoring of other bird groups and species at risk. EC, periodically supported by DUC, conducts wetland habitat monitoring to assess trends and inform NAWMP planners of changes in landscape conditions separate from NAWMP accomplishments (e.g. Watmough, 2002. AAFC supports research through its Technical Assistance grants. AE, ASRD and AA conduct social research relating to conservation support and motivations. Various wetland-based directed studies are undertaken by EC, ASRD, and DUC, frequently with funding support from the Alberta NAWMP Science Fund. The Science fund, directed by the partners and broader scientific committee, fund a variety of wetland related studies which span agricultural, water management and ecological studies.

Activity	**Agency** (L=Lead, S=Support)						
	Ducks Unlimited Canada	Nature Conservancy of Canada	Alberta Sustainable Resource Development	Alberta Environment	Alberta Agriculture & Food	Environment Canada/ CWS	Agriculture & Agri-Food Canada
Planning & Coordination	L	L	L	L	L	L	L
Direct Program & Management	L	L	S	S	S	S	S
Extension	L	S	L	L	L	L	L
Policy	L	L	L	L	L	L	L
Evaluation	L	S	L	L	L	L	L
Communication	L	L	L	L	L	L	L

Table 4. Summary of Alberta NAWMP partner roles relative to primary activity areas.

Communications

Alberta NAWMP is fully engaged in communications activities with emphasis on increasing internal awareness and knowledge within the provincial partnership network (some external communications are required). Individual agency communications are also frequently coordinated with key messages of the partnership. A communications sub-committee is specifically assigned to this task. All partners are represented and engage on this committee.

Coordination

Coordination is time and effort dedicated to organizing and managing partner-based meetings, conferences, field trips and other activities. Primary categories include administrative, financial and communications. Coordination ensures momentum and continuity among partnership agencies and their representatives and maximizes opportunities to integrate resources.

Western Boreal Forest

Activities in the WBF are focused on ecological inventories of wetlands, waterfowl and other wetland-associated features that lead to protection through special designation (e.g. national wildlife area) or protection under landuse planning mechanisms. The provincial Water for Life Strategy also highlights the need for a comprehensive inventory of boreal wetlands. NAWMP partners include Environment Canada, Ducks Unlimited Canada and Alberta Environment.

Waterbird, Shorebird and Migratory Landbird Initiatives

In 2002, the North American Wetlands Conservation Act (NAWCA) was amended to permit NAWMP Joint Ventures to formally "embrace a broader conservation mandate". The provision: sustain an abundance of waterfowl *and* other wetland-associated migratory birds consistent with the NAWMP and other national/international bird conservation plans. NAWCA funds would continue to be used for wetland conservation projects that benefit waterfowl and, more intentionally, other wetland-associated migratory birds. It is important to note that NAWCA cannot fund "all-bird habitat" conservation projects.

The PHJV responded to this amendment during its 2005 Strategic Plan update. The new PHJV Mission, *Provide leadership to achieve healthy and diverse waterfowl and other bird populations through conservation partnerships,* positioned the PHJV to realistically assess and deliver conservation results for wetland-associated migratory birds for Bird Conservation Region (BCR) #11. Significant partnership work has formed the basis of an all-bird plan: formation of species groups, identification of priority species and establishment of population objectives (as possible).

Alberta NAWMP has provided leadership within the PHJV on all-bird conservation, and has extended this beyond birds to other wetland-dependent species. Through establishment of a Science Fund, the partners have supported considerable research aiding the planning, delivery and benefits assessment of NAWMP in Alberta.

Populations

Shorebirds. Forty (40) species of shorebirds breed regularly in Canada, of which at least 12 breed in the PHJV including eight species whose breeding range in Canada is primarily or entirely in this region. The area also provides important staging sites for another 22 species of both spring and fall migrating shorebirds. The seven most significant breeding species, in terms of the proportion of their Canadian and world populations breeding in the PHJV, are the focus of conservation efforts for shorebirds within the PHJV (Table 5).
Waterbirds. Ninety three (93) species of waterbirds occur in Canada, of which 29 waterbird species occur regularly in the PHJV. Two of the 29 PHJV species are listed under the Species at Risk Act and six are ranked as High Conservation Importance. A total of 8 priority species are the focus of conservation efforts for waterbirds within the PHJV (Table 5).

Migratory Landbirds. Of the 259 landbird species that occur in the PHJV, the majority (145) are regular breeding species with the remainder marginal breeders, migrants, or winter residents. Twenty-two (22) landbird species have been identified as PHJV priority breeding species and are the focus of future conservation efforts for landbirds within the PHJV. Nine of these are listed under the Species at Risk Act, with the balance priority species designated by the Landbird Conservation Plan for Bird Conservation Region 11 (Table 5).

Habitat Associations, Targeting and Objectives

Shorebirds. Conservation efforts for prairie breeding shorebirds should focus on conservation of native prairie – wetland complexes, including shallow wetland habitat. Many of the important staging areas for migrant shorebirds have been identified as Western Hemisphere Shorebird Reserve Network (WHSRN) sites (Morrison et al. 1995). Except for Piping Plovers, identification of specific target areas for breeding shorebirds is more problematic, as most of the priority species have widespread breeding ranges and variable affinity to wetlands for various life cycle needs. Distribution maps available for some species should be related to NAWMP priority areas. Waterbirds. Conservation efforts for colonial waterbirds including Franklin's Gulls and Western Grebe should focus on important, historic breeding, non-breeding and staging lakes. "Hotspots" for combined occurrence of Horned Grebe, American Bittern and Black Tern were obtained by overlaying BBS species distribution layers in a GIS format. Fine-scale site selection methods are required that apply known habitat associations for elusive species such as Yellow Rail and American Bittern.
Landbirds. A targeting tool using stop by stop BBS species data for 138 routes from the period 1992 – 1998 combined with spatially explicit data on soils, precipitation, cover type, and location yielded a map of target areas. Areas where the greatest number of priority species is likely to occur are considered the best candidates for effective conservation. Information on general habitat requirements is known for most priority species and indicates that conservation efforts for landbirds in the PHJV should focus on native habitats, particularly grassland. Knowledge is also increasing for some species on habitat suitability at a local scale.

Specific habitat objectives are precluded at this time for shorebirds, waterbirds and landbirds because of information needs for most priority species in the PHJV. Information needs vary widely across bird groups as well as among species within groups. Recurring needs include, but are not limited to: a detailed wetland inventory (including very small ephemeral and semi permanent wetlands), an accurate and fine-scale grasslands mapping layer, a GIS-based predictive distribution model for each bird group/subgroups, models relating population objectives to habitat objectives, improved understanding of multiple-species interactions, and expanded, scientifically valid surveying and monitoring systems.

Future Work

Conservation efforts that focus on conserving, maintaining and restoring existing landscapes with healthy native upland cover and wetlands will generally benefit all bird groups. Efforts will continue to overlap geographic priorities for major bird and other animal groups to allow benefit assessment from past actions and to maximize future, mutually beneficial opportunities.

Species	Alberta population estimate (% of PHJV population)	PHJV/Alberta Population trend	Alberta population objective
Shorebirds			
Piping Plover	200 (15)	decreasing	300
Long-billed Curlew	38,000 (88)	stable	38,000
Marbled Godwit	60,000 (57)	decreasing	90,000
Wilson's Phalarope	90,000 (45)	stable	99,000
Willet	42,000 (42)	decreasing	63,000
American Avocet	15,000 (31)	stable	16,000
Upland Sandpiper	8,000 (19)	stable	9,000
Waterbirds			
American Bittern	20,022 (5)	possible decrease	40,044
Black Tern	184,681 (25)	uncertain	369,362
Franklin's Gull	Unknown (--)	uncertain	Unknown
Horned Grebe	71,665 (18)	large decrease	143,330
Western Grebe	13,000 (--)	uncertain	14,300
Yellow Rail	Unknown (--)	uncertain	Unknown
Whooping Crane	Not applicable	--	Not applicable
Landbirds			
Baird's Sparrow	194,000 (28)	uncertain	388,000
Black-billed Cuckoo	360 (1)	large decrease	720
Bobolink	1,500 (1)	possible decrease	3,000
Burrowing Owl	2904 (37)	decline	See Recovery Tm
Chestnut-collared Longspur	1,150,000 (68)	large decrease	3,000,000
Ferruginous Hawk	1,000 (35)	possible decrease	1,100
Grasshopper Sparrow	101,000 (62)	possible decrease	111,100
Greater Sage-Grouse	350 (60)	decline	See Recovery Tm
Lark Bunting	60,000 (31)	uncertain	66,000
LeConte's Sparrow	480,000 (26)	uncertain	960,000
Loggerhead Shrike	58,000 (29)	uncertain	See Recovery Tm
McCown's Longspur	159,000 (51)	possible decrease	318,000
Nelson's Sharp-tailed Sparrow	49,000 (24)	stable/poss increase	53,900
Northern Harrier	4,000 (27)	large decrease	8,000
Peregrine Falcon	Not available	uncertain	See Recovery Tm
Prairie Falcon	640 (85)	uncertain	704
Red-headed Woodpecker	Not available	possible decrease	See Recovery Tm
Sage Thrasher	Not available	uncertain	See Recovery Tm
Sharp-tailed Grouse	29,000 (23)	possible decrease	58,000
Short-eared Owl	790 (26)	uncertain	869
Sprague's Pipit	438,000 (60)	large decrease	See Recovery Tm
Swainson's Hawk	7,500 (48)	large decrease	15,000

Table 5. Priority Species, Population Trends and Objectives for Alberta

Expenditure Forecast

Prairie and Parkland

The total Alberta NAWMP Implementation Plan 5 year (2008-2012) expenditure forecast, based on direct and indirect (applied direct) expenses, is **$58,052,500** (table 3). Sub-totals include direct programs and extension-based programs ($27,033,400), policy initiatives (1,262,100), operation and maintenance ($12,353,200), research & evaluation ($7,448,400), communication ($2,766,800) and coordination (7,188,600).

Direct and extension-based activities ($27,033,400) comprise 48% of the total 5-year expenditure forecast. These activities can be further divided between restoration ($18,925,900) and retention ($8,107,500), demonstrating an emphasis on restoration (71%) over retention efforts (29%). Operation and maintenance ($12,353,200) comprises 21%, evaluation ($7,448,400) 13%, communication ($2,766,800) 5%, and coordination (7,188,600) 13% of the total 5-year expenditure forecast respectively.

Expenditure forecasts provided in this plan need to be verified against the sum of projected NAWMP-dedicated partner budgets identified in this plan. Expenditure forecasts were based on estimates of agency-specific direct and extension program costs plus applied direct (or indirect) cost based on a representative agency (DUC, only agency with readily available data). Inflationary costs were included as appropriate (e.g. operation and maintenance). Some data was sourced from NAWMP's National Tracking System.

Western Boreal Forest

No expenditure forecast is provided for the Western Boreal Forest in this plan.

Future Challenges

A number of important challenges were identified in both the 5-year and 25-year Alberta NAWMP Implementation planning process.

The single most significant short and long-term challenge that emerged in Alberta was the scope of past wetland loss and **need for large-scale wetland restoration actions**. The 25-year wetland restoration objective of 303,910 basins (or 227,900 small wetland acres) is an exceptionally high target: to achieve it will require diligence by existing means combined with new innovations. In the immediate 5-year term, the priority is to "ramp-up" agency capacities on conventional methods through increased technical, volume and relative financial investment. For example, DUC in Alberta is projecting an approximate ten fold increase from several hundred to about 2000 small wetlands per year by 2011. These ambitious targets, even if increased further, will still fall short of the 5-year objective and be insufficient to achieve the 25-year habitat objective. Extension, and particularly policy initiatives, must be immediately explored that can facilitate large scale wetland restoration. The integrated watershed planning process and the emerging environmental goods & services concept are two potential avenues. Innovative approaches must

also be considered to increasing individual landowner reception to wetland restoration proposals. This is a current limitation to implementation in many instances, and requires a fresh look.

The introduction of the Alberta Wetland Policy is a major accomplishment for Alberta NAWMP: it provides a dual benefit of reducing or removing wetland retention resources and increases resources for other priorities, such as wetland restoration. This policy will encounter its own challenges, the most obvious being **enforcement of the Wetland Policy** by Alberta Environment. Alberta NAWMP partners should anticipate the need for support as this policy transitions into place.

An important assumption in this plan is the **continuation of permanent cover programs** as currently provided by Greencover Canada and its precursor Permanent Cover Program (AAFC). This program has provided significant upland restoration benefit to NAWMP through large-scale conversion of cropland to perennial cover. The status of this program will soon be evident as the new Agricultural Policy Framework is announced. Failure to include such programs will require NAWMP planners to address this important factor in reducing the productivity deficit. Environmental factors, such as increasing commodity prices, will also have a bearing on rates of uptake.

Related to permanent cover conversion programs and trend is retention of existing grassland. The same economic forces potentially reducing cropland conversion to permanent cover are the same ones converting lands currently in grass to cropland. Continued investment by all NAWMP partners in **promoting grassland retention through the provincial Land Use Framework** planning process offers the greatest prospect for large-scale grassland retention, particularly native grassland. Direct partnerships should also be pursued or expanded with agencies controlling large grassland holdings (e.g. Irrigation districts, Special Areas Board, some Municipalities).

Integration of the WBF with prairie and parkland ecoregions on common topics of planning and implementation will continue to be sought.

An analysis of **future funding needs relative to projected revenue**s has not been completed in this plan. This analysis should be undertaken to ensure approximate alignment of needs and availability over the term of this plan. Insufficient funding would be a major limitation, if realized.

Rapid changes in industry trends have underlined the need for **annual progress reviews that permit short-term adaptations** within 5-year plans.

Assumptions and Adaptive Management Needs

Planning Assumptions

The planning process used in the development of Provincial Implementation Plans is dependent on several models that incorporate the best information currently available regarding landscape conditions and waterfowl productive capacity. Assumptions are necessary, and clearly stating

them provides a basis for future testing and refinement of the models and updating management plans under an adaptive management framework.

Key assumptions behind current Implementation Plans include:

1) That landuse reflected in the 1971 and 2001 Agricultural Census years were reasonably accurate.
2) That the amounts of wetland and upland habitats that existed in the early 1970's were sufficient to support continental waterfowl populations at NAWMP goals with the average water conditions of the 1970's and that returning hatched nest levels to 1970's levels will achieve NAWMP population goals.
3) That wetland loss rates measured by Watmough between 1985 and 1999 have remained constant within municipalities over the period 1971-2001.
4) That landscape influences on reproductive success have remained constant over the 1970-current time span.
5) That temporal dynamics (annual variation) is an integral part of the prairie system and influence reproductive effort and success. We assume that our models have adequately captured the 'average' values for habitat selection and reproductive parameters through the wet-dry cycle.
6) That diving ducks (primarily redheads and canvasbacks) will benefit from wetland retention and restoration efforts.
7) Wetland loss will continue until 2011 after which PHJV will have succeeded in arresting the decline.
8) The current upward trend in grassland will continue through 2011 and then be maintained.

Operational Assumptions

Evaluating and adaptively improving habitat programs in response to new information have been hallmarks of the PHJV. The latest round of planning reflects continued adaptation with program shifts towards increased focus on wetland restoration and an increase focus on policy initiatives to conserve habitat. In accordance with these modifications come new needs for evaluation and tests of assumptions. The following list, while not complete, contains some uncertainties that should receive consideration for development in an adaptive management framework.

1) Planning tools.
2) Effects of wetland loss/restoration.
3) Relationship between reproductive success and perennial cover
4) Land-use change
5) Fall cereals
6) Environmental Good & Services
7) Species of Concern
8) Biofuels
9) Climate Change

A complete description of assumptions and uncertainties is presented in Appendix IV.

Conclusions

The 2007-2012 Alberta NAWMP Implementation Plan has provided a new perspective on our current standing and on the types and magnitude of future challenges facing NAWMP partners in Alberta and the PHJV.

A key factor in reaching this perspective was the introduction of a productivity model capable of linking waterfowl population objectives to habitat objectives over large spatial and temporal scales. This tool, in concert with new, large scale habitat change databases, permitted valuable retrospective glances as well as future projections. Model outputs initially challenged many conventional views, and in the end, provided compelling evidence of the need to reassess and adjust priorities and methods.

Several important conclusions resulted from this plan:

- **Waterfowl status is neutral or positive.** Although below levels of the 1970's, populations have generally shown flat or positive trends since the late 1980's coinciding with NAWMP habitat program delivery.
- **Wetland loss is a serious problem.** The slow, continual loss of small wetlands has resulted in very significant accumulations over time. New wetland loss data applied to the productivity model confirmed the large negative implications of this type of habitat change for breeding waterfowl. Wetland loss is a problem throughout Canada's prairie and parkland biomes, but is more apparent in Alberta due to reduced influence of uplands. Concurrent, positive upland change likely offset the measured negative effects of wetland loss during the same period
- **Wetland loss will soon cease due to government policy.** This is a milestone achievement in Alberta and should be celebrated in the NAWMP community. The need for direct and extension activities to prevent wetland loss should be reduced or unnecessary.
- **Wetland restoration is the primary means to address productivity deficits in Alberta.** The large relative percentage of Alberta as perennial cover, while a positive attribute for current productivity levels, translates into smaller potential to recoup productivity deficits through upland conversion to perennial cover or use of winter cereals.
- **Wetland restoration objectives will not be achieved by direct and extension methods alone.** The exceptionally high objectives are daunting and will require innovative means and risk-taking for large scale wetland restoration to occur. Integrated watershed planning process and the emerging environmental goods & services concept are two potential avenues for large scale wetland restoration.

The new 5 year plan sets forth complementary direct, extension and policy habitat program actions supporting both restoration and retention of wetlands and uplands. Emphasis is on *wetland restoration*, through primarily direct programs, and *wetland retention*, through primarily policy initiatives. Upland restoration is also important in tandem with favourable industry trends projected during this period.

Twenty percent (20%) of the 25-year habitat objectives described in this plan will be achieved with the significant exception of wetland restoration and wetland retention. An estimated 5,300 acres of wetlands will be restored (2% of 25-year objective), while 1,378,500 acres of wetlands (100% of 25-year objective) will be retained.

The new Alberta Implementation Plan represents a "rallying point" for NAWMP partners in Alberta and the PHJV. The process has helped highlight the significant accomplishments made since the previous plan, and has helped clarify future needs and opportunities required to achieve the current plan. It intends to build on past partnership successes of NAWMP in Alberta and ensure its continued, vital contribution to future successes of the PHJV.

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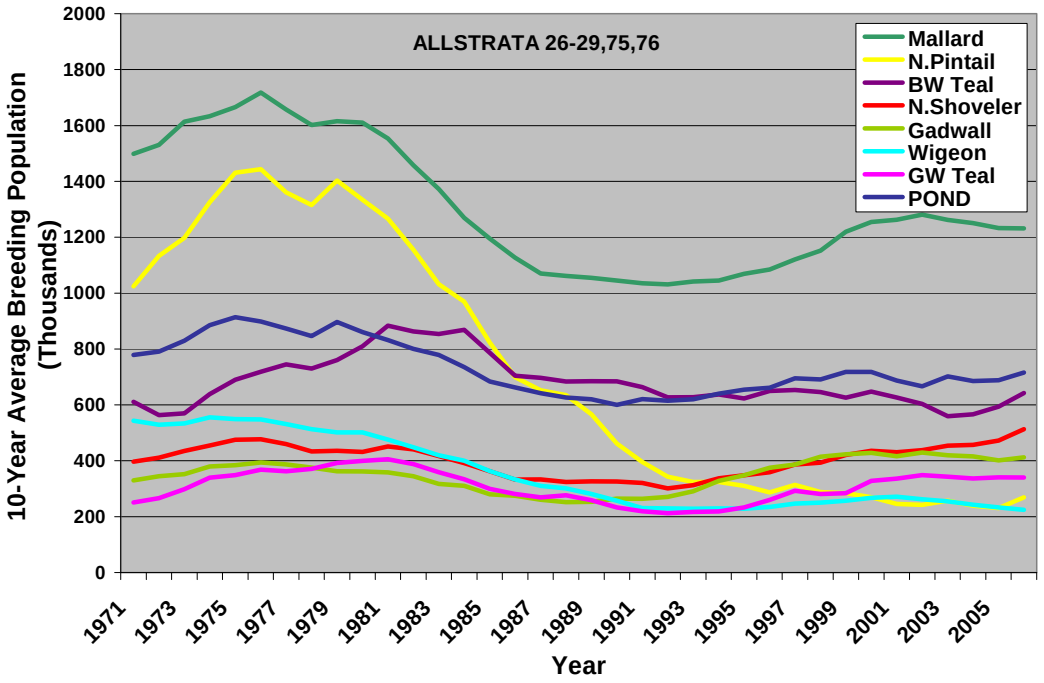
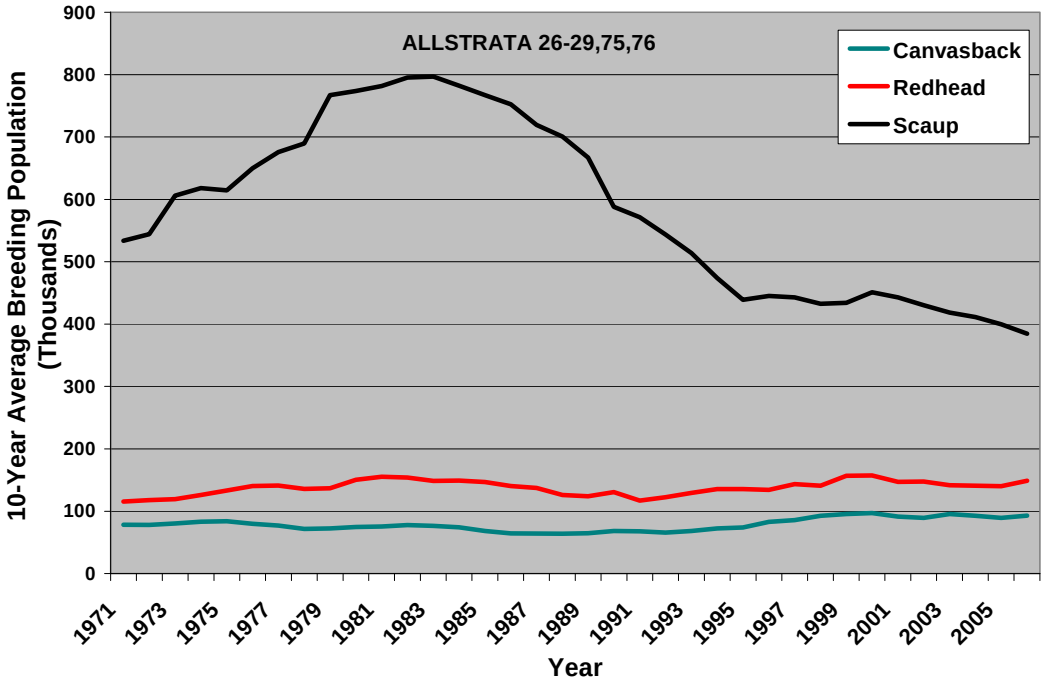
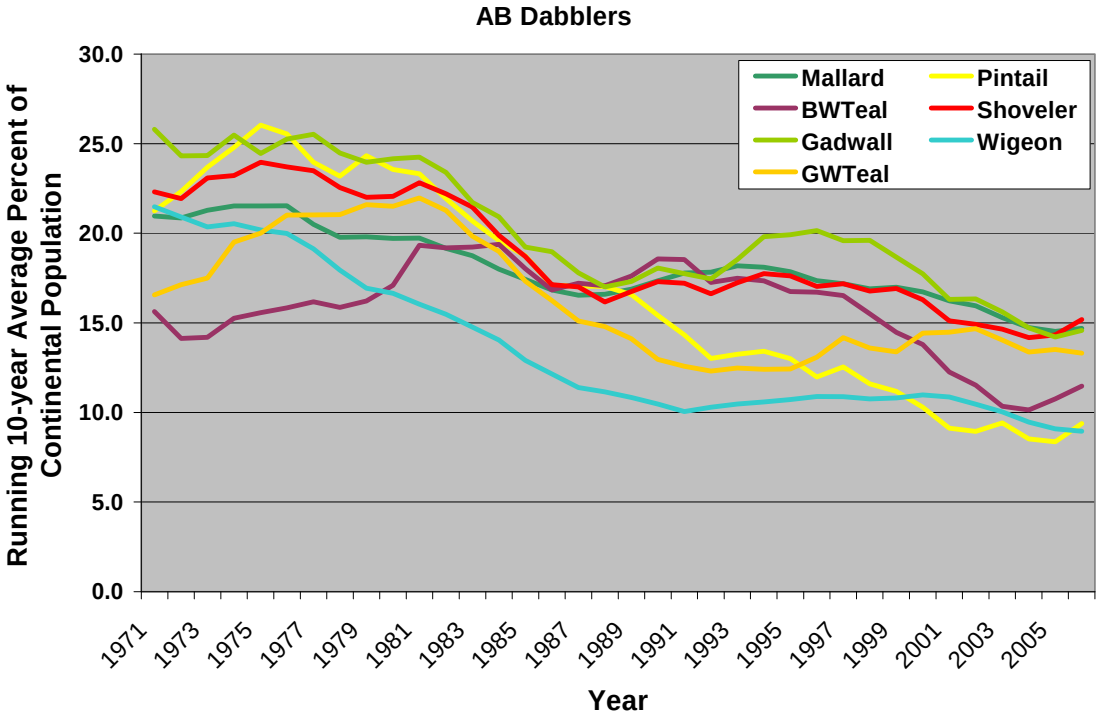
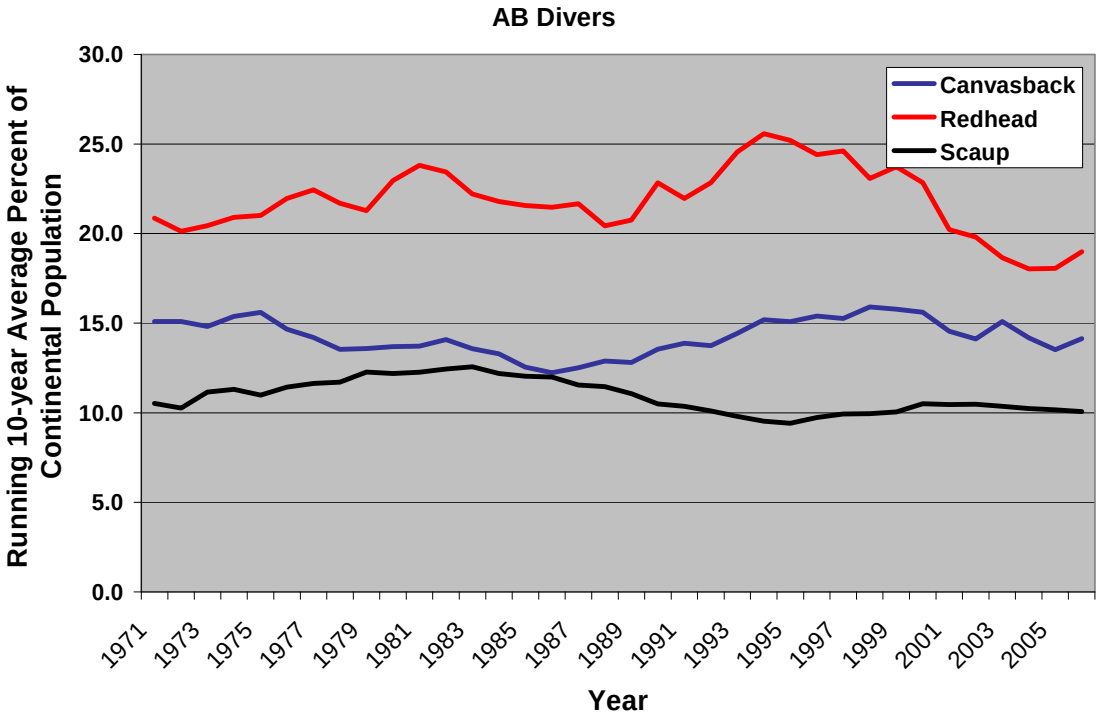
Appendix Ia. Trends in the ten-year running average pond and breeding population estimates (1971-2006) summarized provincially across CWS survey strata 26-29, 75 and 76 covering the PHJV delivery area of Alberta. The top chart provides population trends for ponds and the seven most common dabbling duck species and the bottom chart provides population trends for the three most common diving duck species. Annual data points represent the average population estimate over the previous 10 years.



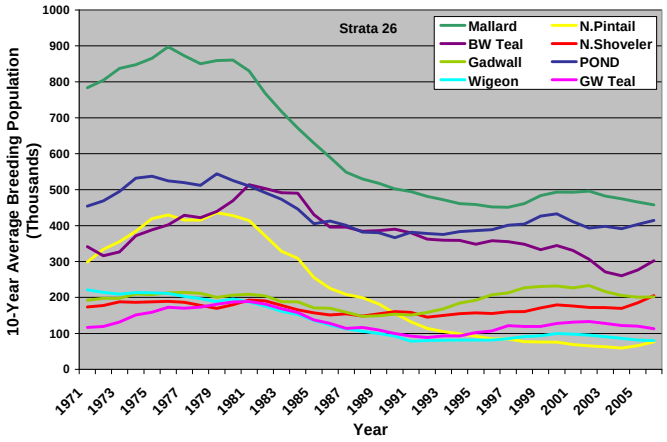


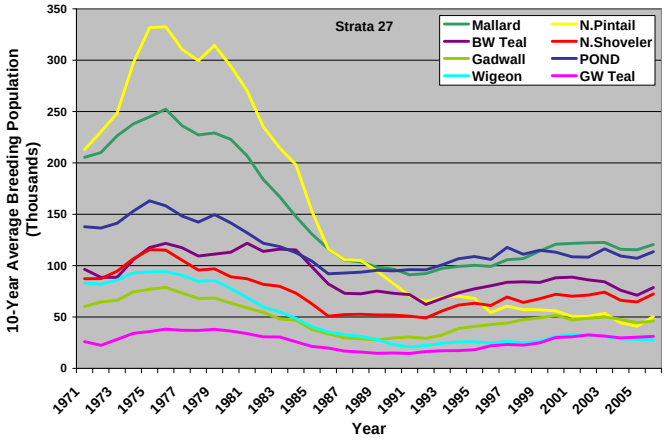
Appendix Ib. Trends in the ten-year running average percent of the continental population (1971-2006) of the seven most common dabbling duck species and three most common diving duck species found in CWS survey strata 26-29, 75 and 76 of Alberta. Annual data points represent the average percent of the continental population over the previous 10 years.

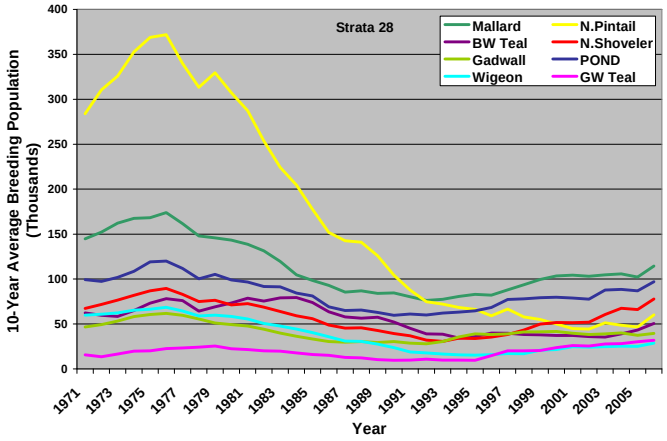


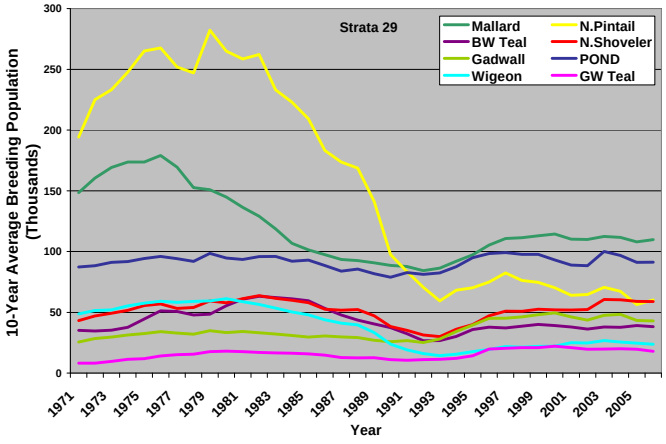


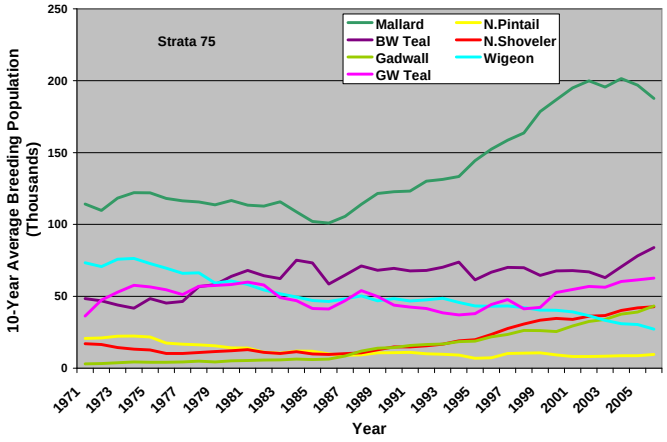
Appendix Ic. Trends in the ten-year running average pond and breeding population estimates (1971-2006) by CWS survey strata for the seven most common dabbling duck species found in the PHJV delivery area of Alberta. Annual data points represent the average population estimate over the previous 10 years.

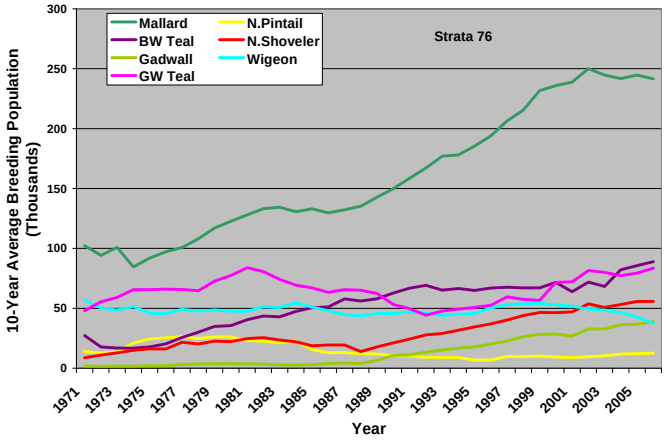




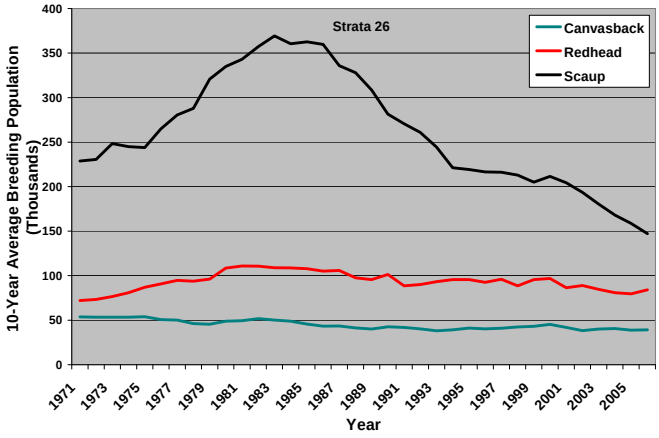


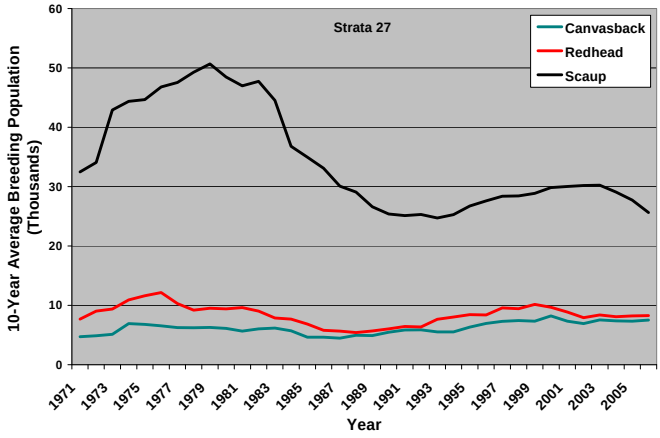


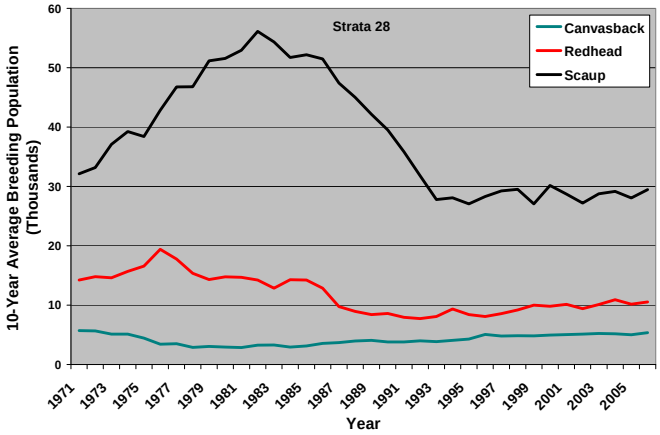


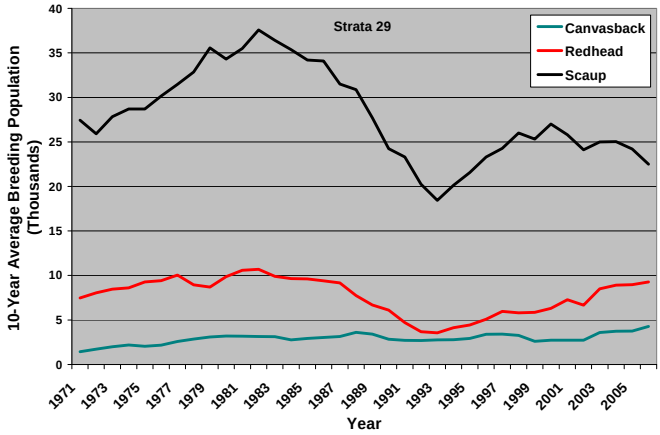


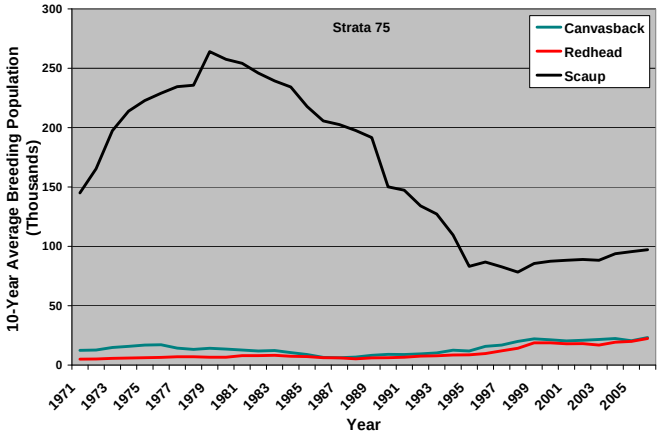
Appendix Id. Trends in the ten-year running average breeding population estimates (1971-2006) by CWS survey strata for the three most common diving duck species found in the PHJV delivery area of Alberta. Annual data points represent the average population estimate over the previous 10 years.

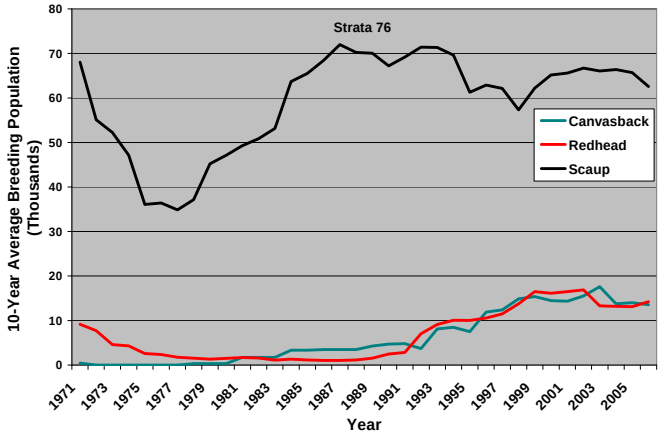












Appendix II. Estimated habitat restoration needs over 25 years for each Target Landscape and Other Areas within the PHJV program area of Alberta.

ALBERTA - 25 YEARS	Habitat Restorations (in Acres)						Hatched Nest Gain/Deficit			
TARGET LANDSCAPE (% geographic area)	**Wetland Restoration (Basins)**	**Wetland Restoration (Acres)**	**Additional Winter Wheat Ac**	**Conversion to Tame Pasture Ac**	**Conversion to Hayland Ac**	**Planted Cover Ac**	**25 Year 4 Dabbler Gain**	**25 Year 4 Dabbler Deficit**	**25 Year Pintail Gain**	**25 Year Pintail Deficit**
Ardrossan (Cookg Lk)	4014	2408	1345	6006	4004	0	646	-471	118	-71
Bashaw (Buffalo Lk)	23576	14146	9505	12684	8456	2190	3384	-3378	410	-519
Bittern (Cooking Lk)	15832	9499	6846	13706	9137	0	2328	-2065	359	-273
Bowden	5452	3271	2033	9137	6091	0	864	-843	127	-110
Brooks	0	0	902	928	619	0	-97	-347	-36	-143
Buffalo	1834	1100	3187	17077	11385	0	537	-299	288	-190
Claresholm	957	574	3580	8068	5379	0	274	-158	148	-91
Daysland (Viking)	38214	22928	61602	120549	80366	0	6632	-4594	1150	-1111
DelBonita (Milk River Ridge)	613	368	6563	14823	9882	0	380	-281	297	-324
Delbourne (Pine+Sull)	51976	31186	22845	67379	44967	5471	8424	-7502	1685	-1355
Derwent	2356	1414	3960	8853	5902	0	405	-303	52	-47
Elkwater (Cypr Hills)	1921	1153	2886	0	0	0	436	-438	130	-231
Hussar	7584	4550	24804	26599	17732	0	1960	-1261	783	-599
Langdon (Calgy W)	5607	3364	12529	6948	4632	0	1190	-946	409	-348
Lloydminister	8960	5376	13526	37563	25042	0	1584	-1295	236	-223
Milo	6490	3894	9397	2259	1506	0	1302	-1051	522	-500
Mundare (Beaverhill)	8882	5329	12946	23130	15420	0	1458	-987	212	-134
Onoway	1377	826	719	2920	1946	0	212	-178	30	-1
Pakowki (Cypr Hills)	7939	4763	55990	0	0	0	1652	-1593	818	-965
Special Areas	14129	8477	44382	93409	62445	0	5221	-3433	1629	-1252
Strathmore (Calgy E)	3064	1838	6303	9379	6253	0	799	-476	259	-229
Suffield	350	210	1793	3	2	0	81	-84	24	-38
Tilley	0	0	2274	2475	1650	0	35	0	18	0
Torrington	3912	2347	2591	13807	9205	0	1176	-636	244	-111
Vauxhall	1269	761	1727	2711	1807	0	286	-245	132	-117
Wainwright	3797	2278	6556	3658	2438	0	509	-623	82	-139
Target Areas Total (35%)	***220,105***	***132,063***	***320,790***	***504,070***	***336,267***	***7,661***	***41,677***	***-33,488***	***10,126***	***-9,122***
Non-target Areas Total (65%)	***83,805***	***50,283***	***551,307***	***928,997***	***619,332***	***0***	***19,476***	***-27665***	***7,369***	***-8,373***
PROVINCIAL TOTAL	***303,910***	***182,346***	***872,097***	***1,433,068***	***955,599***	***7,661***	***61,153***	***-61,153***	***17,495***	***-17,495***

Appendix III Important Staging and Moulting Wetlands – Alberta

PROV	WETLAND_NA	LAT	LONG	BIRD_GROUP	STATUS
AB	Airport Lake	55.19338	-118.88143	WF	
AB	Algar Lake	56.31190	-112.29191	WF	
AB	Anderson Lake	55.33932	-119.24603	WF	DUC Project
AB	Antelope Lake	51.67137	-111.24870	WF	DUC Project
AB	Antelope Lakes	51.29000	-112.25353	WF	
AB	Antelope Lakes	51.28660	-112.23653	WF	
AB	Antelope Lakes	51.28491	-112.22979	WF	
AB	Antelope Lakes	51.28397	-112.22441	WF	
AB	Antoine Lake	54.77000	-112.08000	WF	
AB	Audet Lake	57.64488	-110.91416	WF	
AB	Badger Lake	50.38157	-112.46386	WF	
AB	Bantry 1 & 2	50.36170	-111.59320	WF	DUC Project
AB	Barbara Lake	54.52818	-110.86120	WF	DUC Project
AB	Bartman Reservoir	51.11394	-111.45533	WF	DUC Project
AB	Baxter Lake	52.92000	-110.73000	WF	
AB	Bear Lake	55.25150	-118.99578	WF	DUC Project
AB	Bear Lake	54.22463	-114.87242	WF	DUC Project
AB	Bear Lake	54.01699	-110.22256	WF	DUC Project
AB	Bearhills Lake	52.93927	-113.61038	WF	DUC Project; IBA
AB	Beaver Ranch	58.43482	-115.67125	WF	
AB	Beaverhill "A" Lake	53.37780	-112.50100	WF	
AB	Beaverhill Lake	53.45887	-112.53605	WF, WB, SB	Wetlands For Tomorrow; DUC Project; IBA; Ramsar; Regional
AB	Bellshill Lake	52.60358	-111.56238	WF	IBA
AB	Bens Lake	53.66784	-111.86341	WF	Wetlands For Tomorrow; DUC Project
AB	Berry Lakes	51.08862	-111.50425	WF	DUC Project
AB	Bethel Lake	55.60789	-119.96047	WF	
AB	Big Hay Lake	53.16661	-113.17583	WF	Wetlands For Tomorrow; DUC Project
AB	Big Lake	53.60101	-113.67919	WF	Wetlands For Tomorrow; DUC Project; IBA
AB	Bisbing Lake	55.25840	-119.64111	WF	DUC Project
AB	Bittern Lake	53.05255	-113.07078	WF	Wetlands For Tomorrow; DUC Project
AB	Bittern Lake North	53.07230	-113.04280	WF	Wetlands For Tomorrow; DUC Project
AB	Black Duck Lake	56.18342	-118.45555	WF	
AB	Black Lake			WF	

AB	Blood Indian Creek Reser	51.25592	-111.20706	WF	DUC Project
AB	Bowman Lake	55.09091	-119.33532	WF	
AB	Brosten Reservoir	51.36434	-111.07149	WF	DUC Project
AB	Bruce Lake	51.20155	-113.54790	WF	DUC Project
AB	Buffalo Bay/Horse Lakes	55.55800	-116.18300	WF	Wetlands For Tomorrow
AB	Buffalo Lake	55.37978	118.97573-	WF	DUC Project
AB	Buffalo Lake	52.47335	-112.92872	WF, WB	Wetlands For Tomorrow
AB	Bunder Lake	54.28884	-111.70024	WF	DUC Project
AB	Cadotte Lake	56.44976	-116.39267	WF	DUC Project
AB	Calumet Lake	57.41712	-111.76678	WF	
AB	Cardinal Lake	56.23587	-117.72369	WF, WB	DUC Project; IBA
AB	Carroll Lakes	54.11836	-111.66034	WF	DUC Project
AB	Cemetery Lake	55.32348	-118.83349	WF	
AB	Center Slough	52.01413	-113.86038	WF	DUC Project
AB	Cessford Reservoir	51.02821	-111.45772	WF	
AB	Chain Lakes	51.86452	-112.21986	WF, SB	IBA
AB	Chain Lakes	51.85080	-112.20275	WF, SB	IBA
AB	Chain Lakes	51.83682	-112.18298	WF, SB	IBA
AB	Chain Lakes	51.81995	-112.17429	WF, SB	IBA
AB	Chain Lakes	51.83145	-112.16671	WF, SB	IBA
AB	Chain Lakes	51.80604	-112.15710	WF, SB	IBA
AB	Chain Lakes	51.79094	-112.12284	WF, SB	IBA
AB	Chain Lakes	51.76861	-112.11405	WF, SB	IBA
AB	Chain Lakes	51.77741	-112.11329	WF, SB	IBA
AB	Chain Lakes	51.75816	-112.09286	WF, SB	IBA
AB	Chain Lakes	51.76164	-112.08309	WF, SB	IBA
AB	Chappice Lake	50.16537	-110.36880	WF, SB	IBA
AB	Charlotte Lake	54.25512	-110.63313	WF	DUC Project
AB	Chin Lakes	49.74293	-112.46461	WF	
AB	Chin Lakes	49.69555	-112.39216	WF	
AB	Chin Lakes	49.63437	-112.25027	WF	
AB	Chip Lake	53.65883	-115.37434	WF, WB	Wetlands For Tomorrow; DUC Project
AB	Cipher Lake	52.68000	-110.08000	SB	
AB	Clairmont Lake	55.25593	-118.76205	WF	DUC Project
AB	Clear Lake	50.14720	-113.41732	WF	
AB	Coal Lake	53.07073	-113.26144	WF	

AB	Coaldale Lake	49.83300	-112.60000	WF	
AB	Coleman Lake	51.44093	-111.87092	WF	DUC Project
AB	Conrad Flats	49.36540	-111.83730	WF	DUC Project
AB	Contracosta Lake	51.68300	-111.58300	WF	DUC Project
AB	Cooking Lake	53.42000	-113.04000	WB	
AB	Cowoki Lake	50.58534	-111.69043	WF	
AB	Craig Lake	51.93780	-111.57800	WF	
AB	Crawling Valley Res.	50.92214	-112.36317	WF	
AB	Crestomere Lake	52.67469	-113.91951	WF	DUC Project
AB	Cutbank Lake	55.71888	-119.76119	WF	
AB	Cutbank Lake	55.25885	-119.12468	WF	
AB	Cutbank Lake	52.05800	-112.31700	WF	
AB	Cygnet Lake	52.28162	-114.01516	WF	Wetlands For Tomorrow; DUC Project
AB	Cygnet Lake	52.27718	-113.97851	WF	Wetlands For Tomorrow; DUC Project
AB	Dalemead Lake	50.92000	-113.62000	WB	
AB	Dapp Lake	54.34129	-113.60725	WF	DUC Project
AB	Deadhorse Lake	51.06494	-112.66584	WF	
AB	Deadwood Lake	56.71465	-117.58876	WF	DUC Project
AB	Deep Lake	55.24845	-119.08009	WF	
AB	Deep Lake	56.70281	-119.02229	WF	
AB	Demay Lake	53.12348	-112.69763	WF	
AB	Devil Lake	58.37338	-116.78576	WF	
AB	Dishpan Lake	50.59172	-110.54547	WF	
AB	Dolcy Lake	52.64912	-110.46995	WF	
AB	Dowling Lake	51.73406	-112.02722	WF, SB	IBA
AB	Driedmeat Lake	52.83947	-112.74009	WF	DUC Project
AB	Dusty Lake	53.13022	-112.48176	WF	
AB	Eagle Lake	51.00081	-113.32511	WF, WB	IBA
AB	East Mustus Lake	58.17357	-116.47350	WF	
AB	Edberg Slough	52.77378	-112.86137	WF	DUC Project
AB	Egg Lake	56.07001	-111.40557	WF	DUC Project
AB	Elhardt Lake			WF	
AB	Elvestad Lake	55.43973	-119.34625	WF	
AB	Erskine Lake	52.30823	-112.88269	WF	DUC Project; IBA
AB	Farrell Lake	51.87191	-112.33203	WF	
AB	Ferguson Lake	55.26837	-118.81764	WF	DUC Project

AB	Field and Stream Project	50.86100	-112.06560	WF	DUC Project
AB	Fincastle Reservoir	49.83300	-111.98300	WF	
AB	Fitzgerald Lake	51.80114	-111.06586	WF	IBA
AB	Flat Lake	54.65354	-112.90542	WF	DUC Project
AB	Fleischman Lake	50.88200	-112.13150	WF	DUC Project
AB	Flood Lake	56.49826	-117.81477	WF	DUC Project
AB	Flyingshot Lake	55.13937	-118.86605	WF	
AB	Forster Reservoir	50.99281	-111.77062	WF	
AB	Forty Mile Coulee	49.59230	-114.48840	WF	DUC Project
AB	Frank Lake	50.54748	-113.70957	WF, WB, SB	DUC Project; IBA
AB	Fresno-Honens	51.27830	-113.48750	WF	DUC Project
AB	George Lake	56.22650	-118.56911	WF	DUC Project
AB	George Lake	54.53478	-113.48094	WF	DUC Project
AB	Gillespie Lake	52.33000	-110.18000	SB	
AB	Goodfare Lake	55.27291	-119.68993	WF	DUC Project
AB	Gooseberry Lake	52.11700	-110.71700	WF, SB	IBA
AB	Gopher Lake	51.71995	-111.35000	WF	DUC Project
AB	Gordon Lake	56.51507	-110.45089	WF	
AB	Gough Lake	51.99325	-112.47012	WF	
AB	Grantham Lake	50.91700	-111.93300	WF	
AB	Grassy Island Lake	54.24312	-111.37368	WF	DUC Project
AB	Grassy Island Lake	51.82655	-110.31329	WF	DUC Project
AB	Gull Lake	58.43397	-116.13229	WF	DUC Project
AB	Gummer Lake	55.36725	-118.99628	WF	
AB	Hackmatack Lake	55.18603	-119.66636	WF	
AB	Handhills Lake	51.49252	-112.13157	WF, SB	IBA
AB	Hastings Lake	53.42000	-112.92000	WB	
AB	Hay Lake	58.83658	-118.82505	WF	Wetlands For Tomorrow; DUC Project; IBA; Ramsar
AB	Hay Lakes	49.20000	-111.63300	WF	
AB	Hays Reservoir	50.05877	-111.82976	WF	IBA
AB	Helen Lake	56.54319	-117.82782	WF	DUC Project
AB	Henderson Lake	55.34404	-119.09988	WF	
AB	Hermit Lake	55.20586	-118.96442	WF	DUC Project
AB	Horse Lake	55.33642	-119.71530	WF	DUC Project
AB	Horse Lake	56.83856	-113.60733	WF	DUC Project
AB	Horse Lake	54.87462	-112.35264	WF	DUC Project

AB	Horse Lake	56.14218	-111.94715	WF	DUC Project
AB	Horse Lake	56.30430	-110.93416	WF	DUC Project
AB	Horsefly Lakereservoir	49.73354	-112.10116	WF	
AB	Horseshoe Lake	54.61509	-114.25113	WF	
AB	Horseshoe Lake	54.49013	-113.78802	WF	
AB	Horseshoe Lake	56.65676	-110.99269	WF	
AB	Houcher Lake	52.40766	-110.82934	WF	DUC Project
AB	Hughes Lake	55.19843	-118.91416	WF	
AB	Hume Creek	55.28100	-119.93325	WF	
AB	Huppie Lake	54.55349	-111.81685	WF	DUC Project
AB	Intermittent Lake	55.34287	-118.93538	WF	
AB	Jamieson Lake	50.60947	-111.88271	WF	DUC Project
AB	Jenson Reservoir	49.31492	-112.89790	WF	
AB	Jessie Lake	54.25246	-110.73381	WF, WB	DUC Project
AB	John Lake	53.73391	-110.03640	WF	DUC Project
AB	Johnson Reservoir	50.37127	-111.84558	WF	
AB	Jones Lake	55.39110	-119.00497	WF	
AB	Kakut Lake	55.62882	-118.52849	WF	
AB	Kamisak 6	55.13460	-119.80793	WF	DUC Project
AB	Kamisak E Lake	55.16364	-119.73089	WF	
AB	Kamisak Lake	55.16301	-119.75615	WF	
AB	Kamisak SW Lake	55.14912	-119.75615	WF	DUC Project
AB	Kearl Lake	57.29025	-111.23634	WF	
AB	Keeping Lake	55.46131	-119.93601	WF	
AB	Keho Lake	49.94792	-113.00471	WF	
AB	Kenilworth Lake	53.32820	-110.51827	WF	
AB	Killarney lake	52.61000	-110.15000	SB	IBA
AB	Kimiwan Lake	55.75324	-116.91361	WF, WB, SB	IBA
AB	Kings Lake	49.35760	-111.65820	WF	DUC Project
AB	Kininvie Flat	50.37200	-111.50200	WF	DUC Project
AB	Kirkpatrick Lake	51.87941	-111.31546	WF	IBA
AB	Kitsim Reservoir	50.45000	-112.05000	WF, WB	DUC Project; IBA
AB	Kleskun Lake	55.35243	-118.57703	WF	Wetlands For Tomorrow; DUC Project
AB	La Glace East Lake	55.38418	-119.24247	WF	DUC Project
AB	La Glace West Lake	55.38102	-119.32048	WF	
AB	Lac Des Jones	54.24734	-113.73845	WF	DUC Project

AB	Lac Emilien	53.54437	-111.11732	WF	DUC Project
AB	Lac La Biche	54.84000	-111.97000	WF	IBA
AB	Lac Magloire	55.86675	-117.17799	WF	DUC Project
AB	Lac Ste. Anne	53.70000	-114.40000	WB	
AB	Lacrete Lake	58.19534	-116.44598	WF	
AB	Lake Newell (reservoir)	50.44063	-111.94594	WF, WB	IBA
AB	Lanes Lake	52.20800	-111.98300	WF	
AB	Langdon Reservoir	50.91429	-113.47895	WF	DUC Project
AB	Lathom Lake	50.71211	-112.29634	WF	
AB	Leane Lake	52.57000	-110.07000	SB	IBA
AB	Lesser Slave Lake	55.46000	-115.35000	SB	IBA
AB	Linton Lake	58.17103	-116.48559	WF	
AB	Little Beave Lake	54.59402	-112.35400	WF	
AB	Little Beaver Lake	52.77127	-112.97597	WF	DUC Project
AB	Little Bow Lake (Res.)	50.19310	-112.67558	WF	
AB	Little Fish Lake	51.37710	-112.23263	WF, SB	DUC Project; IBA
AB	Little Lake	55.19992	-119.08371	WF	
AB	Little McClelland Lake	57.45296	-111.29017	WF	
AB	Little Red Deer Marsh	52.75475	-113.14149	WF	Wetlands For Tomorrow; DUC Project
AB	Little Utikuma Lake	55.90769	-114.74854	WF	
AB	Lost Lake	56.24008	-118.01351	WF	
AB	Lost Lake	50.14299	-112.30483	WF	DUC Project
AB	Lost Lemon Lake	50.35400	-112.28800	WF	DUC Project (part of Circle E Project)
AB	Louisiana Lakes	50.55672	-111.64204	WF	DUC Project
AB	Louisiana Lakes	50.53626	-111.63984	WF	DUC Project
AB	Louisiana Lakes	50.53855	-111.63217	WF	DUC Project
AB	Louisiana Lakes	50.54383	-111.60797	WF	DUC Project
AB	Louisiana Lakes	50.51988	-111.59223	WF	DUC Project
AB	Louisiana Lakes	50.50040	-111.58398	WF	DUC Project
AB	Louisiana Lakes	50.52305	-111.56081	WF	DUC Project
AB	Louisiana Lakes	50.46399	-111.52046	WF	DUC Project
AB	Louisiana Lakes	50.48857	-111.51617	WF	DUC Project
AB	Lowden Lakes	52.14626	-112.68557	WF	
AB	Lowe Lake	55.32670	-119.17927	WF	
AB	Majors Lake	51.13008	-111.17108	WF	DUC Project
AB	Manatokan Lake	54.46425	-110.94469	WF	DUC Project

AB	Manawan Lake	53.89569	-113.69212	WF	Wetlands For Tomorrow; DUC Project
AB	Many Island Lake	50.12346	-110.04474	WF	Wetlands For Tomorrow; DUC Project
AB	Marion Lake	52.18300	-112.43300	WF	Wetlands for Tomorrow
AB	Martin Lake	55.44286	-119.56411	WF	DUC Project
AB	Mattoyekiu Lake	51.12818	-112.44536	WF	
AB	McGregor Lake	50.49000	-112.87000	WB	IBA
AB	McNaught Lake	55.14652	-119.44920	WF	DUC Project
AB	McNeil Lake	59.54406	-112.40575	WF	
AB	Meadowville One	55.32315	-119.21784	WF	DUC Project
AB	Metheral	49.40330	-111.49610	WF	Wetlands for Tomorrow
AB	Metiskow Lake	52.44000	-110.65000	SB	
AB	Milk River Ridge Reservoir	49.37112	-112.56848	WF, WB	
AB	Ministik Lake	53.43598	-113.01033	WF	IBA
AB	Miquelon Lake	53.25000	-112.93000	WB	IBA
AB	Moose Lake	54.25000	-110.91000	WB	
AB	Mud Lake	49.75374	-113.53997	WF	
AB	Mulligan Lake	55.37099	-119.12488	WF	
AB	Muriel Lake	54.15000	-110.69000	WB	IBA
AB	Murray Lake	49.80352	-110.95563	WF	
AB	Mustus Lake	58.14835	-116.39450	WF	
AB	Namaka Lake	50.93360	-113.21841	WF, WB	DUC Project; IBA
AB	North Cache Lake	54.40920	-112.99370	WF	DUC Project
AB	Oakland Lake	51.39088	-111.83802	WF	
AB	Oldman Lake	53.87585	-114.54017	WF	DUC Project
AB	Oldman Lake	51.70709	-111.37828	WF	DUC Project
AB	Onetree Reservoir	50.60747	-111.82608	WF	
AB	Pakowki Lake	49.30368	-110.90081	WF, SB	IBA; DUC Project
AB	Peace Athabasca Delta	58.73267	-111.10787	WF	Wetlands For Tomorrow; IBA; Ramsar
AB	Peace River (Ft. Vermillion Bridge-Beaver Ranch I.R.)	58.45000	-115.88300	WF	
AB	Peace River (Moose Island-Prairie Point)	58.21700	-116.58300	WF	
AB	Peace River (Prairie Point-Ft. Vermillion Bridge)	58.33000	-116.31700	WF	
AB	Pemukan Lake	51.95800	-110.45800	WF	
AB	Picture Butte Reservoir	49.88560	-112.77884	WF	
AB	Plover Lake	51.49307	-111.38208	WF	DUC Project

AB	Pluvius Lake	56.57334	-117.60683	WF	DUC Project
AB	Ponita Lake	55.50858	-119.84175	WF	
AB	Portage Lake	54.96000	-112.05000	WB	
AB	Powell Lake	55.37931	-119.81054	WF	DUC Project
AB	Preston Lake	55.36738	-119.91806	WF	DUC Project
AB	Prouty Lake	50.25090	-112.43770	WF	DUC Project
AB	Rail Lake	56.51563	-117.63099	WF	
AB	Railroad Lake	51.27718	-113.48606	WF	
AB	Rat Lake	54.44059	-118.78190	WF	DUC Project
AB	Rat Lake	59.87388	-117.00274	WF	DUC Project
AB	Ray Lake	55.43233	-119.88203	WF	
AB	Ray Lake	56.66085	-119.12629	WF	
AB	Red Deer Lake	52.71271	-113.04448	WF	
AB	Red Deer Lake	50.28497	-110.38229	WF	
AB	Reed Lake	49.17156	-112.80998	WF	
AB	Reflex Lake (Salt Lake)	52.67000	-110.00000	SB	
AB	Ribstone Creek Irrigation System	52.76512	-110.64980	WF	DUC Project (multiple wetland projects)
AB	Ribstone Lake	52.76512	-110.64980	WF	DUC Project
AB	Robb Lake	51.97029	-111.35583	WF	DUC Project
AB	Rock Lake	50.69024	-112.01751	WF	
AB	Rolling Hills Lake	50.35887	-111.89885	WF	
AB	Ronald Lake	57.97148	-111.67036	WF	
AB	Roreigh	56.18171	-118.46197	WF	DUC Project
AB	Rush Lake	53.81919	-112.20333	WF	Wetlands For Tomorrow; IBA
AB	Rushmere Lake	51.83097	-111.13185	WF	
AB	Saline Lake	57.07849	-111.52222	WF	
AB	Sampson Lake	52.74778	-113.23771	WF	
AB	San Francisco Lake	50.59401	-112.11867	WF	DUC Project
AB	San Joaquin	50.91427	-113.33096	WF	DUC Project
AB	Sandy Lake	53.78833	-114.04062	WF	DUC Project
AB	Saskatoon Lake	55.21925	-119.09369	WF	
AB	Scope Reservoir	50.06700	-111.81700	WF, WB	
AB	Shanks Lake	49.06897	-112.72576	WF	
AB	Sherborne Lake	49.76387	-111.81486	WF	
AB	Shoal Lake	54.25020	-114.43210	WF	DUC Project
AB	Shooting Lake	52.18300	-112.35000	WF	

AB	Sieu Lake	51.14864	-112.40247	WF	
AB	Sinclair Lake	54.72594	-110.65838	WF	DUC Project
AB	Smoky Lake	54.15039	-112.63874	WF	DUC Project
AB	Snake Lake	51.94726	-112.76022	WF	DUC Project
AB	Snipe Lake	55.12704	-116.78641	WF	
AB	Snow Lake	52.71641	-113.79522	WF	DUC Project
AB	Sounding Creek	51.58300	-110.36700	WF	
AB	Sounding Creek Reservoir	51.57647	-110.70192	WF	
AB	Sounding lake	52.16000	-110.47000	SB	IBA
AB	South Mustus Lake	58.15889	-116.36270	WF	
AB	Spotted Lake	52.49096	-113.13258	WF	DUC Project
AB	Square Lake	59.05968	-112.47197	WF	
AB	Square Lake	54.91020	-111.83712	WF	
AB	St. Mary Reservoir	49.30972	-113.22672	WF, WB	IBA
AB	Stirling Lake	49.52799	-112.55502	WF	
AB	Stobart Lake	50.90598	-113.18708	WF, WB	DUC Project; IBA
AB	Sturgeon Lake	55.10446	-117.56894	WF	DUC Project; Provincial Park
AB	Sucker Lake	56.41968	-110.86348	WF	
AB	Sullivan Lake	51.94036	-111.96551	WF, SB	DUC Project (W Arm); IBA
AB	Sunrise	56.15241	-118.50953	WF	DUC Project
AB	Surette Lake	58.34491	-116.68617	WF	
AB	Taber Lake	49.80296	-112.09291	WF	
AB	Texas Irricana Lake	51.27735	-113.64061	WF, WB	DUC Project
AB	Texas Salt Lake	51.30160	-113.55440	WF	
AB	Therien Lakes	53.96000	-111.33000	WB	
AB	Tilley A Reservoir	50.49470	-111.61320	WF	DUC Project
AB	Tilley B Reservoir	50.55030	-111.63650	WF	DUC Project
AB	Tilley Slough	50.45128	-111.61720	WF	
AB	Timko Lake (bantry Reser	50.47650	-111.73284	WF	
AB	Travers Reservoir	50.22086	-112.84315	WF	IBA
AB	Twelve Mile Coulee	50.18300	-111.60000	WF	
AB	Twin Lakes	55.01282	-119.60127	WF	DUC Project
AB	Twin Lakes	55.00172	-119.58948	WF	DUC Project
AB	Tyrrell Lake	49.38639	-112.27172	WF	DUC Project
AB	Updike Lake	55.44119	-119.80392	WF	
AB	Utikuma Lake	55.86409	-115.39199	WF	Wetlands For Tomorrow; DU Project; IBA

AB	Valhalla Lake	55.37623	-119.45271	WF	DUC Project
AB	Verdigris Lake	49.25193	-112.05535	WF	DUC Project
AB	Verdigris Slough	49.15670	-111.83790	WF	DUC Project
AB	Vermillion Lakes	53.69194	-111.65582	WF	DUC Project
AB	Vermillion Lakes	53.68817	-111.60542	WF	DUC Project
AB	Vermillion Lakes	53.67201	-111.54730	WF	DUC Project
AB	Vermillion Lakes	53.65376	-111.49545	WF	DUC Project
AB	Vernon Project	49.42640	-111.35160	WF	DUC Project
AB	Wakomao Lake	54.16142	-113.55612	WF	DUC Project
AB	Waterton Reservoir	49.29838	-113.68448	WF	
AB	Watt Lake	53.71051	-111.93174	WF	Wetlands For Tomorrow; DUC Project
AB	Wavy Lake	52.87776	-112.06957	WF	IBA
AB	Wembley Lake	55.14894	-119.14034	WF	DUC Project
AB	West Arm Reservoir	49.36079	-111.02734	WF	DUC Project
AB	West Buffalo Lake	55.38144	-119.01298	WF	
AB	West Muskeg Lake	56.90083	-112.49799	WF	
AB	Weston Lake	49.33426	-112.18086	WF	
AB	Whitehorse Lake	50.66471	-110.48858	WF	
AB	Whitford Lake	53.85791	-112.26368	WF, SB	Wetlands For Tomorrow; IBA
AB	Wilkin Lake	55.27922	-119.34625	WF	
AB	Wilson Prairie Lake	58.18756	-116.05924	WF	
AB	Winagami Lake	55.62863	-116.75644	WF, WB	DUC Project
AB	Wolf Lake	58.09958	-116.47341	WF	
AB	Wolfe Lake	55.43106	-119.19190	WF	DUC Project
AB	Wood Lake	55.15382	-118.72582	WF	
AB	Yellow Lake	49.73538	-111.50040	WF	DUC Project
AB	Yoke Lake	55.22038	-119.67923	WF	DUC Project
AB	Zama Lake	58.77425	-118.99262	WF	Wetlands For Tomorrow; DUC Project; IBA; Ramsar

Appendix IV

Assumptions in the PHJV Adaptive Management Cycle

Planning Assumptions

The planning process used in the development of Provincial Implementation Plans is dependent on several models that incorporate the best information currently available regarding landscape and wetland influences on waterfowl productive capacity at landscape scales. Implicit in the use of any model and modeling process are key assumptions about the biological/ecological system and the interaction of component parts. These assumptions are necessary and clearly stating them provides a basis for future testing and refinement of the models and updating management plans under an adaptive management framework.

Key assumptions behind current Implementation Plans include:

9) That landuse reflected in the 1971 and 2001 Agricultural Census years were reasonably accurate.
10) That the amounts of wetland and upland habitats that existed in the early 1970's were sufficient to support continental waterfowl populations at NAWMP goals with the average water conditions of the 1970's and that returning hatched nest levels to 1970's levels will achieve NAWMP population goals.
11) That wetland loss rates measured by Watmough between 1985 and 1999 have remained constant within municipalities over the period 1971-2001.
12) That landscape influences on reproductive success have remained constant over the 1970-current time span.
13) That temporal dynamics (annual variation) is an integral part of the prairie system and influence reproductive effort and success. We assume that our models have adequately captured the 'average' values for habitat selection and reproductive parameters through the wet-dry cycle.
14) That diving ducks (primarily redheads and canvasbacks) will benefit from wetland retention and restoration efforts.
15) Wetland loss will continue until 2011 after which PHJV will have succeeded in arresting the decline.
16) The current upward trend in grassland will continue through 2011 and then be maintained.

Operational Assumptions

Evaluating and adaptively improving habitat programs in response to new information have been hallmarks of the PHJV. The latest round of planning reflects continued adaptation with program shifts towards increased focus on wetland restoration and an increase focus on policy initiatives to conserve and restore natural capital. In accordance with these modifications come new needs for evaluation and tests of assumptions. The

following list, while not complete, contains some uncertainties that should receive consideration for development in an adaptive management framework.

1. **Planning tools.**

   Scope: Implementation plans rely on spatially explicit models that relate landscape conditions to waterfowl reproduction. The current implementation plans were constructed using a second-generation of planning tools. Parameter estimates and modeled relationships need to be evaluated and refined with additional data.

   Assumptions:

   - The Cowardin et al. (1995) wetland-duck models from North Dakota apply to the prairies and parklands of Canada.
   - Surrounding landscape composition has minimal influence on the use of various wetland types by ducks
   - Parameter estimates for nest success and nest-site selection currently in the WPM and PPM accurately capture the interaction between landscape attributes and duck nesting.

2. **Cost efficiencies of delivery options (direct, extension, policy)**

   Scope: Evaluations have revealed that meeting our objectives through direct programs will be both difficult and expensive. Therefore, new implementation plans rely increasingly on extension and policy initiatives.

   Assumptions:

   - PHJV influence through extension and policy-makers can accomplish desired landscape change more cost-effectively than direct programs.

3. **Effects of wetland loss/restoration**

   Scope: Continued wetland loss has been identified as the single greatest factor affecting waterfowl productivity since the inception of NAWMP. Accordingly, increased focus has been placed on conserving and restoring wetlands. New information about the temporal dynamics of pair settling would improve management decisions. Density dependence is likely most intense during periods of drought. Conversely, density dependence may be least intense when the prairies are coming out of drought and ponds are plentiful while populations of birds are low.

   Assumptions:

   - Density dependence as mediated through behavioral spacing mechanisms limits the breeding population (carrying capacity) within the PHJV area (i.e., all the ponds are essentially ‘full’).

- Restoring wetlands results in 'new' breeding pairs and not simply a redistribution of birds.
- Increasing the carrying capacity in prairie Canada increases the productive capacity of the population (i.e., reduces overflight into less productive habitat).

4. Relationship between reproductive success and perennial cover

Scope: Naturally occurring perennial vegetation has been largely replaced by cereal grain agriculture in much of the PHJV focus area. Many PHJV programs are designed to retain or restore perennial vegetation to improve nest survival. Evidence from the PHJV Assessment study confirmed that population dynamics of mallards are responsive to nesting success—especially where nesting success rates are typically low. However, where nesting success rates typically appear higher (e.g. prairie biome), populations may be equally sensitive to variation in other vital rates. Evidence for a positive relationship between nesting success and amounts of perennial covers is growing, though lots of 'scatter' remains. Ongoing efforts through the SpATs study to account for both temporal variability and variation in cover height and density should help clarify the relationship. Finally, models embedded within current planning tools use a linear relationship between perennial cover and nesting success. Non-linearities would have substantial implications for targeting; therefore, the assumption of linearity should continue to be evaluated with the addition of new data.

Assumptions:

- Population dynamics of prairie-nesting ducks are most responsive to changes in nesting success
- Nesting success is related to the cumulative amounts of perennial grassland types in the landscape
- Current models suggest this effect is approximately 3 times stronger in the prairies than in the parklands.

5. Land-use change

Scope: Recent analyses reveal that since 1986, perennial cover has increased throughout much of the PHJV area. The WPM predicts that nesting success has increased with the increase in perennial cover. Current planning efforts project this increase to continue through 2011. Much of the increase, though, has been in tame forages (Pasture and Hay) while native prairie has continued to be lost. Continued loss of habitats (primarily wetlands and native prairie/parkland habitats) is a significant threat to PHJV goals. However, given limited resources, an efficient retention strategy requires the ability to predict where loses are likely to occur. Efficient monitoring and a mechanistic understanding of the drivers of habitat loss will ultimately allow the best predictions for targeting retention efforts.

Assumptions:

- Increased hayland does not increase female mortality.
- Waterfowl production at a landscape scale is more influenced by the proportion of 'Grazed" versus 'Idle' grassland than the degree or timing of use (currently being investigated by the DUC SpATS study.
- For waterfowl, native prairie (grazed or idle) is no more productive than seeded (restored) grassland (grazed or idle).
- Tools being developed by PHJV partners will improve the ability to identify habitat parcels (wetland and native prairie) at risk of loss.

6. Fall cereals

Scope: Fall cereals have shown excellent promise for providing safe, attractive nesting habitat in agriculturally dominated landscapes. Much of the evaluations of fall cereals have occurred in the prairie biome, however. Implementation plans call for increases in winter wheat in both prairie and parkland ecoregions.

Assumptions:

- Fall cereals (especially winter wheat) will be similarly attractive to nesting ducks in the parklands as they are in the prairies, and will have similar nesting success rates.

7. EGS on PHJV projects

Scope: Interest in ecological goods and services has grown in recent years, both for PHJV projects and for natural habitats generally. PHJV should endeavor to better quantify the provision of EGS from habitats upon which waterfowl rely including other types of plant and animal diversity, habitat for pollinators, both consumptive and non consumptive recreational opportunities, water storage, groundwater recharge, improved water quality, carbon sequestration. Additionally, more work is needed to quantify societal demand, and therefore true market value, for these goods and services.

Assumptions:

- PHJV habitat programs provide EGS for which 'markets' already exist or for which they could be developed.

8. Species of concern

Scope: Within the PHJV area several species are below target population levels. The current Pintail Study is providing much new information about pintail nesting, but more information is required about environmental correlates of other vital rates. American wigeon provide a perplexing problem. Populations on the prairies are well below long-term averages (74% below LTA in Manitoba in 2006), yet are well above

their LTA's in Alaska (+61% in 2006). This dramatic redistribution is cause for concern for the PHJV. Little research has been conducted on factors affecting population dynamics of wigeon, though initial indication may suggest that reproductive success on the prairies and Canadian boreal forest may be responsible. A retrospective analysis of landscape correlates of population change should be a first step, likely to be followed by a study of factors affecting their reproductive ecology.

Assumptions:

- For pintails, nest survival is limited due to their selection of cropland stubble for nesting and subsequent nest destruction by agricultural machinery and nest predation.
- Habitat programs will improve nest survival for a significant portion of the nesting population to restore populations to the NAWMP goal.

9. Biofuels

Scope: Biofuels have the potential to rapidly alter the economics of agriculture throughout the prairies. A rapid transformation is already underway in the U.S. prairies with some spill-over effects evident in Canada. If the growth of biofuels is driven mostly through grain-based ethanol or biodiesel, with the exception of winter wheat, impact on duck populations could be substantial and negative. If cellulosic ethanol production gains the competitive advantage, the effects on waterfowl and other wildlife could be quite positive. This dynamic warrants close attention by the PHJV

Assumptions:

- Biofuels will be a significant driver of land use decisions in prairie Canada in the near future

10. Climate change

Scope: Evidence of warming climates is growing daily. The most recent Global Circulation Models predict continued warming over the PPR while predictions for precipitation range form slight decreases to slight increases. Continued warming likely will result in greater rates of evapotranspiration and reduced soil moisture. Among other effects, this likely will reduce the numbers of wetlands holding water in an average year. Substantial uncertainty remains about interannual variability of wetland conditions. Drought may be more frequent and more prolonged. Conversely, climate change may encourage conversion of annual cropping to forage production. Concurrent changes to the hydrology and ecology of the boreal forest are likely, with the thawing of permafrost likely resulting in wetland drying in some regions, and floral and faunal distributional changes most likely. Increased monitoring and application of global circulation models should inform the regional prioritization of PHJV target areas as data become more available.

Assumptions:

- Climate change impacts will most likely affect wetland availability and hence waterfowl carrying capacity in prairie Canada in, as yet, unpredictable ways.