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# FIR ISLAND FARM RESTORATION FEASIBILITY STUDY

# SNOW GOOSE BASELINE MEMO

Author: Mike Davison; WDFW

## Introduction:

The Skagit River Chinook Recovery Plan (2005) was the first document to identify management objectives and recovery strategies for diminished Chinook populations in the Skagit River. Endangered Species Act (ESA) listing of the Skagit River Chinook population as "Endangered" in 2005) prompted intensive management focus on this species by federal, state and tribal governments. The Puget Sound Chinook Recovery Plan (2005) currently prioritizes updated management objectives and recovery strategies for the Skagit River Chinook population and balances those strategies with other Chinook recovery programs throughout Puget Sound. A key component of the Puget Sound Chinook Recover Plan is the restoration of altered habitats historically supporting intertidal/estuary ecosystems important to both fish and wildlife.

The Fir Island Farm/Salmon Restoration Steering Committee is tasked with the study, assessment, and evaluation of the feasibility for salmon restoration on WDFW owned lands and adjacent private property currently incorporated into the Fir Island Farm/Hayton Snow Goose Reserve on Fir Island, WA. The committee is ultimately responsible for the development of preliminary salmon restoration options (alternatives) subject to both public and tribal review (comment). Upon completion of public/tribal review and comment the Fir Island Farm Salmon Restoration Steering Committee will make final adjustments to a list of salmon restoration alternatives (with an identified "preferred alternative") to be forwarded to WDFW administration for internal review.

## Snow Goose Biology and Management:

The population of lesser snow geese (*Chen caerulescens caerulescens*) that breeds on Wrangel Island, Russia represents the last major snow goose population breeding in Asia, and the primary Russian goose population that winters in North America. The Wrangel Island snow goose population winters primarily in British Columbia, Washington, and California. Overall management of this population is guided by a comprehensive plan developed through the Pacific Flyway Council and U.S. Fish and Wildlife Service, including participation by Russia, Canada, and U.S. fish and wildlife agencies (Pacific Flyway Council 2006).

The first systematic survey of Wrangel Island snow geese was conducted in 1970, when 150,000 geese were counted in early June on the breeding colony (Bousfield and

Syroechkovsky 1985). The spring population declined to about 50,000 birds by the mid 1970s due to several consecutive years of breeding failures, increased to almost 100,000 birds by the late 1980s and then decreased to about 65,000 birds during the early 1900s. By 2007, the spring population had increased to 140,000 on Wrangel Island due to consecutive years of good weather, low predation, and high adult survival.

The primary wintering areas for Wrangel Island snow geese includes the Fraser/Skagit Delta areas and the Central Valley of California. In the 1990s between 78-90% of the population wintered in California (Hines et al. 1999). By 2000, the ratio shifted to about 60% in the Fraser-Skagit and about 40% in California (Boyd and Cook 200). Wintering counts for the Fraser-Skagit have increased dramatically, from an average of about 23,000 birds in the 1970s to a peak population of 100,000+ birds in 2007-08 winter season.

The Pacific Flyway Management Plan for the Wrangel Island Population of Lesser Snow Geese (PFMP-WISGP) describes guidelines for cooperative management of the population of lesser snow geese that breed on Wrangel Island, Russia and winter in primarily in British Columbia, Washington, and California. For a complete overview of the management goals, objectives, and strategies for the Wrangel Island snow goose population, as well as, the biological history and status of this population, the PFMP-WISGP can be viewed at the following web-site:

www.pacificflyway.gov/abstracts.asp#wilsg

**Current Status of the Fraser-Skagit Snow Goose Population and Recent Habitat Utilization Trends:**

Midwinter snow goose populations in the Skagit-Fraser area have generally declined following the 2007-08 peak of 100,000+ birds. The 2008-09 winter population dropped to 57,145 birds. However, it is possible that some portion of the population was foraging outside the survey area and were not included in the total. Midwinter population levels for the 2009-10 and 2010-11 seasons were 73,964 and 63,641 respectively.

Habitat utilization trends in the Skagit area have changed significantly over the past 5 years with major expansion in geographic area used for foraging and night feeding being the most notable:

1) Expansion in geographic area used for foraging;

   Historically, winter forage distribution in the Skagit region has typically been restricted to Fir Island and agricultural lands to the south of Stanwood, WA. The 2007-08 season saw major expansion of snow goose foraging activity to agricultural lands in the central Skagit Valley (north of the N.F. Skagit River), east

of the Skagit River in agricultural lands between Mount Vernon and Conway, WA, and east of Stanwood in the Silvana area. As many as 12,000 – 16,000 snow geese were observed routinely foraging in fields near Marysville, WA (a daily flight distance of 40 miles). The 2010-11 season saw further geographic expansion by foraging snow geese with agricultural lands in the northwest portion of Skagit County (north of SR-20 and west of I- 5) and the agricultural lands adjacent to Cook Rd. (Burlington to Sedro Woolley) routinely utilized by foraging birds.

2) Night Feeding;

Night feeding as a foraging behavior has been observed periodically throughout the history of snow geese in the Skagit/Snohomish region, but to a limited degree and in direct response to specific times of stress (extreme cold weather or intensive hunting pressure). Beginning in the late 1990s, night foraging behavior has steadily increased but has been primarily focused upon the agricultural lands on Fir Island, and to a lesser degree, agricultural lands to the south of Stanwood. The 2010-11 winter season included the most intensive night foraging behavior by snow geese ever observed. Night foraging occurred throughout the last half of the hunting season (mid-December thru January) and was focused primarily on agricultural land to the north and east of Fir Island. For a period of 5-6 weeks all foraging by snow geese (day or night) was absent from Fir Island itself. The management significance of this behavioral shift in foraging includes:

- The total acreage of agricultural lands in Skagit County subject to snow goose foraging has increased by a factor of 3 (from 6,000 acres to almost 20,000 acres).

- Increased night feeding behavior in the future would result in diminished hunting opportunity for local hunters. Reduced harvest capability would limit WDFW/U.S. Fish & Wildlife Service options for managing snow goose population levels.

- Expanded foraging range throughout Skagit and Snohomish Counties would most likely result in comparable increases in the number and distribution of snow goose crop damage complaints filed by local landowners.

- Increases in the number of complaints about snow geese foraging on crops will increase public focus upon the need for cover crops on WDFW owned or controlled lands that serve as an alternative food source for wintering geese (resulting in reduced depredation problems on privately owned lands).

- A shift to night foraging and/or to expanded forage range away from Fir Island would have a significant impact on the social, political, and legal problems common to Fir Island itself over the past 7-8 years (reduced hunting pressure, reduced trespass violations, less stress for local residents, reduce shooting from road, fewer liter problems, more dispersed crop impacts (i.e., less impact to Fir Island farms).

**What is a Wildlife Reserve and what does it uniquely provide for the target specie it was established to benefit?**

In its simplest form a wildlife reserve is a secure habitat area (natural or artificial) that affords a particular species with un-restricted access to resources and conditions that enhance biological requirements or support management objectives for that species. Securing unrestricted access to the resources and conditions within the boundary of a reserve is accomplished via statute (RCW – Revised Code of Washington) and secured by the enforcement capability of the agency assigned the statutory authority to enforce the fish and wildlife laws of the state (WDFW). The degree to which unrestricted access to the resources and conditions within a reserve is secured cannot be duplicated outside its boundaries.

The Fir Island Farm/Hayton Snow Goose Reserve provides three basic advantages to wintering snow geese:

1). Unrestricted access to winter wheat crops (pre-hunting season, throughout the 107 day hunting season, and post season up to the time snow geese depart for northern breeding grounds in mid-April.

2). Unrestricted access to fresh water (sheet water areas and drainage ditches).

3). Unrestricted opportunity to conserve biological energy and fat reserves in a designated area secure from hunting pressure, human disturbance associated with trespass, photographers, bird watching, aircraft, and off-site disturbance by domestic pets and farm animals.

**Establishment of the Fir Island Farm/Hayton Snow Goose Reserve:**

**A. Acquisition of Land**

WDFW purchased 224.7 acres of land originally recognized as the Von Moose Farm. Of the total 224.7 acres, 215 acres was farmable agricultural land. The primary purpose for purchasing the property was to establish a reserve for snow geese and to plant winter wheat as a food source for the geese. The property was purchased on 4/19/95 for $803,000 (Deed, Deed of Right, and Lease Agreement on file). 100% of the purchase price was IAC (Inter Agency

Committee) funded. All of the $803,000 where later used as 100% match for three additional NAWCA (North American Waterfowl Conservation Act) land acquisitions in north Region 4:

1. Glick Property (Leque Island) – 91 Acres
   Purchased: 3/22/96
   Purchase Price: $324,500

2. Johnson Property (DeBays Slough) – 75 Acres
   Purchased: 2/26/97
   Purchase Price: $144,000

3. Trucker Property (DeBays Slough) – 131 Acres
   Purchased: 9/18/95
   Purchase Price: $246, 000

The surplus dollars were incorporated into Acquisition costs (Capitol Staff Time, Closing Costs, Appraisal Costs, Environmental Audit, Surveys as needed).

**B. Designation as Reserve**

The Fir Island Farm Game Reserve incorporates WDFW owned lands into a separate codification from lands in reserve status that are owned by the Hayton Farm (Hayton Game Reserve). Both reserves were established by the Washington State Wildlife Commission in 1997. The WAC (Washington Administrative Code) designations and legal descriptions are as follows:

WAC 232-16-780 (Fir Island Game Farm). In Skagit County, beginning at the intersection of Fir Island Road and the west bank of Brown's Slough (inside base of dike); then east along Fir Island Road (96 feet) to the Brown's Slough dike; then southerly and easterly along the Brown's Slough dike to the Fir Island Farm access road; then north along the Fir Island Farm access road to Fir Island Road; then east along Fir Island Road to the northeast corner of Section 22 (T33N, R3E); then south along the east line of Section 22 (T33N, R3E) to Dry Slough; then westerly and south along the west bank of Dry Slough to the intersection with Dike District #22 dike; then westerly along the south side (Skagit Bay side) of the Dike District #22 dike to the intersection of Dike District #22 dike and the south line of Government Lot #5 (Section 22, T33N, R3E), then west approximately 1900 feet to the west bank of Brown's Slough (inside base of dike), then north along the west bank of Brown's Slough to the intersection with the Fir Island Road and the point of beginning.

WAC 232-16-790 (Hayton Game Reserve). In Skagit County, beginning at the intersection of the west bank of Dry Slough and the Dike District #22 Skagit Bay dike; then east approximately 1333 feet along the south side of the Dike District #22 dike to the intersection of District #22 dike and the west bank of McDonald's Slough, then north along the west bank to the point where the adjacent farmland field boundary extends West, then west along the boundary of the farmed field boundary to the point where the farmed field boundary intersects Dry Slough, then across Dry Slough to the west bank of Dry Slough, then south along the west bank of Dry Slough to the point of beginning.

### C. Hayton's Crop Farm ("HCF") Farm Lease and Crop Planting Agreement

The Fir Island Farm/Hayton Reserve incorporates 215 acres of farmable agricultural land and 15 acres of marsh, managed primarily for the population of lesser snow geese (*Chen caerulescens caerulescens*) that breed on Wrangel Island, Russia. Agricultural lands within the Fir Island Farm portion of the reserve (215 acres – WDFW) are leased to Robert Hayton (Haytons Crop farm – HCF) who plants spring crops for harvest, and has a requirement to plant the entire acreage to winter wheat forage for snow geese once the cash crops have been harvested in the fall. As part of his original bid for the lease option on WDFW lands (Fir Island Farm), Robert Hayton agreed to place his adjacent farm (290 acres) in Game Reserve status, and plant his farm and an additional 110 acres on adjacent lands leased by HCF to winter wheat. Total winter wheat forage on both WDFW and Hayton ownerships is 615 acres. For every acre that WDFW leases to HCF, an additional 1.86 acres of winter wheat acreage is provided via the lease agreement.

## Management objectives associated with the establishment of the Fir Island Farm/Hayton Snow Goose Reserve:

**Objective 1**. Partial mitigation for the anticipated loss of snow goose forage capacity in both Skagit and Port Susan Bays resulting from the invasion of non-native cordgrass (*Spartina anglica*).

*S. anglica*, commonly known as cordgrass, is an aggressive noxious weed that has severely disrupted the ecosystems of native salt water estuaries in Washington State. Left unchecked, *S. anglica* out competes native vegetation and converts mudflats and estuaries into monotypic *S. anglica* meadows. As a result, important migratory shorebird and waterfowl habitats, as well as critical rearing areas for juvenile salmonids, are lost (WSDA Spartina Eradication Program – Project Report, 2010). *S. anglica* was introduced into Puget Sound in 1961 on the eastern shore of Port Susan Bay, three miles south of Stanwood by the Research and Extention Unit of Washington State

University (Ranwell 1967; Frankel 1987). The original purpose of the introduction was to stabilize a dike system and provide forage for cattle. Aberle (1993) reports that the plants thrived and produced seed in 1963 but, it was not until the mid 1970s when 2.7 hectares of *S. anglica* coverage was documented by Washington State Department of Wildlife, that any serious attention was focused upon the invasion.

The Washington State Department of Agriculture (WSDA) has served as the lead state agency for the eradication of invasive *S. anglica* since 1995. WSDA facilitates and coordinates the combined eradication efforts of local, state, federal, and tribal governments; universities; interest groups; and private landowners throughout western Washington shoreline areas. Overall, the success of the eradication effort in the Puget Sound region has been significant with an estimated 99% reduction in *S. anglica* from the peak infestation of more than 1000 solid acres in 1997 (*Spartina* Eradication Program Progress Report – 2010). Between 2003 and 2009 over 500 acres of dense *S. anglica* meadow were treated using integrated pest management strategies (disking, crushing, digging, spraying). According to David Heimer (WDFW; Skagit Bay *Spartina* Management Synopsis – 2010), this effort not only eliminated *S. anglica* meadows, but prevented expansion and seed production which could have threatened thousands of additional acres of high quality habitat in both Skagit and Port Susan Bays. However, it is important to note that post treatment monitoring following the 2007 and 2008 seasons indicate that, although *S. anglica* coverage and densities have significantly decreased across south Skagit Bay, seedlings are still widespread, and distribution remains relatively unchanged from 2003.

From a snow goose management perspective, the elimination of large and dense colonies of *S. anglica* represents a significant improvement in that 1) the mature *S. anglica* plants in these colonies (that are capable of producing viable seed) no longer pose a threat to the remaining native marsh in both Skagit and Port Susan Bays and 2) Thompson (1991) describes the process whereby *S. anglica* plants slow water flow causing sediment deposition and eventual elevation of intertidal habitat up to more than 1 meter thick. Post meadow removal and monitoring in Skagit Bay indicates that the rate of elevation change returns to background levels within two years (Rybezyk 2010). Morgan (2008) reports that re-colonization by *S. anglica* and native plants occurs rapidly in these accreted areas once meadow formations have been eliminated. Three-square bulrush (*Scirpus americanus*), the primary native food source for wintering snow geese now has at least a chance to re-establish in historically occupied areas of the marsh. The Fir Island Farm/Hayton Snow Goose Reserve was established to partially mitigate for the anticipated loss of snow goose winter forage (three-square bulrush) resulting from the invasion of non-native cordgrass (Objective 1). However, in spite of the habitat improvements associated with recent *S. anglica* control efforts, substantial problems

and questions regarding the full recovery of the native marshes in Skagit and Port Susan Bays persist.

1. In spite of the recent *S. anglica* control and eradication effort that have established over 500 acres of estuary habitat where *S. anglica* meadows no longer exist, the 500 acres of native habitat that historically supported snow geese in Skagit Bay has not returned requiring wintering birds today to continue seeking alternative (replacement) food sources such as agricultural crops.

2. Although it has been documented by Morgan (2008) that re-colonization by either *S. anglica* or native plant species can occur in accreted areas following removal of *S. anglica* meadows, it remains unclear whether or not *S. americanus* will prevail in impacted areas or how long it will take to achieve native plant densities equivalent to historical levels.

3. *S. anglica* seedlings are still widespread, and the distribution remains relatively unchanged from 2003 (pre-eradication), which demonstrates that consistent, yearly treatment is still needed to guard against meadow restoration (Hiemer 2010). Under difficult economic conditions as currently exists, it is unclear if continued *S. anglica* control efforts will occur in the future as required.

In view of persistent problems and questions surrounding the *S. anglica* eradication issue, the management priority focusing upon partial mitigation for the loss of snow goose winter forage capacity in Skagit and Port Susan Bays (Objective 1) remains valid.

**Objective 2.** Provide alternative forage capability for wintering snow geese in response to documented deterioration of intertidal marsh.

Snow geese were rare on the Skagit Delta during the late 1800s and early 1900s (Jeffry & Kaiser 1979). Brown (in Jewett et al 1953) reported observation of approximately 5000 birds in late November 1922. Hall (1936) recorded snow goose sightings on the Skagit Delta (5000 birds and 12,000 birds) in January 1936. Snow goose foraging in the early 1900s on both the Skagit and Fraser Delta's was entirely focused upon the intertidal marsh and their primary food source *S. americanus*. Historically, snow geese using the Fraser Delta foraged primarily in intertidal estuaries until the late 1970s, when they first began using agricultural fields (Campbell et al 1990). Hatfield (1991) reported a similar shift to inland feeding on the Alaskan National Wildlife Reserve British Columbia during the 1970s.

Snow goose foraging, commonly referred to as "grubbing" involves the excavation of *Scirpus spp.* in an effort to feed on underground rhizomes (Burton 1977). Significant damage to salt marsh on the Louisiana coast by snow goose foraging has been documented by Lynch et al (1997). Similarly, snow goose foraging on eastern salt

marsh has resulted in severely reduced biomass and primary production (Smith & Odem 1951, Smith 1973).

The Fraser and Skagit Delta's are roughly the same size and they support the same dominant vegetative types (Ewing 1982, per observation). However, Boyd (2010) reports that mean rhizome masses (*Scirpus spp.*) on the Fraser and Skagit Delta's are only at a small fraction of their potential and, that maximum level and mass on the Skagit Delta was almost half that on the Fraser Delta. Boyd (2010) also suggests that the documented shift of snow goose foraging from intertidal habitat to inland crops may be the result of two factors:

1. *Scirpus spp.* rhizomes were grubbed down to a level where the geese were unable to meet their requirements for energy or some essential nutrient.
2. A food-profitability gradient exists where grazing on farms results in greater foraging returns compared to grubbing *Scirpus spp.* (Stephens and Krebs 1986, Krebs and Davies 1983).

Cover crops have significantly higher concentrations of nitrogen and carbohydrates and lower levels of fiber (Boyd, unpublished data).

Compensating for the loss of foraging capacity of the Skagit Delta is a primary emphasis of the Fir Island Farm/Hayton Snow Goose Reserve (Objective 2). Unrestricted access to cover crops, especially during hunting season, is critical to the maintenance of body reserves for wintering snow geese. However, it is well documented that the contribution of nutrients from agricultural foods is also important to reproductive success. Ankney & MacInnes, 1978; and Davies & Cook, 1983 report that "the proportion of female lesser snow geese that nest and their potential clutch sizes vary with the magnitude of fat reserves carried to the breeding grounds".

Boyd (2010) has observed that "In association with the impact of geese, other mechanisms are causing the upper and lower 100-200m of the *Scirpus spp.* zone to revert back to mudflat. Altogether, the entire *Scirpus spp.* zone on the Fraser Delta is moving toward a state of "functional extinction" in as little as 15-20 years. This has serious negative implications for other components of the estuarine food web as well as for snow geese themselves. *S. americanus* is still an important component of their diet and, during extreme cold weather events when farms are frozen over or snowed under, they are entirely dependent on the marsh for food".

This same type of vegetation zone degradation in Skagit Bay, presumably due to the combined influences of grubbing by snow geese, shifts in hydrological influences, and reduced sedimentation, have been documented by Shannon and Wilson (2011). They report "Measurements of the retreat of vegetation lines indicate that the vegetated

marsh areas along the exterior margins of the Fir Island Farm dike have retreated distances between 400 and 1000 feet as observed on 1937 and 2010 aerial photographs. This corresponds to a loss of 75 acres of tidal marsh area along the Fir Island Farm bay front over the past 73 years".

Considering that the Skagit Delta, as reported by Boyd (2008), is currently supporting maximum rhizome levels and mass approximately half that on the Fraser Delta, the *Scirpus spp.* zone on the Skagit Delta may already be approaching a state of "functional extinction". Therefore, the need for supplemental cover crops in reserve status remains a critical component of management for snow geese both now and in the future.

**Objective 3**. Provide "Focus Crop" on WDFW owned or controlled lands designed to reduce snow goose crop depredation on private farmlands.

As the wintering population of snow geese in the Fir Island/Stanwood area has increased, so have the number and severity of crop damaged complaints received from local farmers. Damage has primarily occurred to fields with green chop, winter wheat, grass seed crops, rye grass, potatoes, and grass turf. Soil compaction and poor field drainage caused by snow goose trampling have also been identified as problems. The most severe damage occurs in the spring months (February and March) when soil moisture content is high. Snow geese ordinarily clip the tops of plants when foraging on green plants. However, when root systems are weakened by excess soil moisture, the birds tend to pull the entire plant from the ground. Clipped plants will sprout and continue to grow in the spring after snow geese have departed the area. When plants are uprooted the crop is totally destroyed.

Generally speaking, private landowners and local community leaders view WDFW land ownerships as "the first line of defense" for mitigating snow goose crop damage. Leque Island and the Fir Island Farm/Hayton Snow Goose Reserve are the only two state owned properties that exist within the core snow goose forage area. The Fir Island Farm/Hayton Snow Goose Reserve is currently managed as a "Focus Crop" with primary emphasis upon fall and winter snow goose use. Focus crops are essentially cover crops that are designated for snow goose foraging. The basic premise is that these sites will provide alternative feeding opportunity for geese other than critical crops on private land. The more time geese spend on focus crops, the less time they spend damaging private crops. Focus crops can be managed to provide crop protection during fall or winter months or during the critical spring time period when a significant amount of post hunting season damage occurs. The best crop type for focus crops is winter wheat (the preferred forage crop of snow geese). Rye grass is a more cost effective alternative to winter wheat and it has improved growth capabilities during periods of unusually cold weather. The 615 acres incorporated in the Fir Island Farm/Hayton Snow Goose Reserve provides only a portion of the energy requirements (expressed as

kilocalorie, kcal) required to over winter the current population of approximately 76,000 birds (See Summary of snow goose forage supplement programs managed by WDFW, pp 17).

**Objective 4.** Enhanced Public Safety.

Fir Island is intensively farmed. Snow goose viewers frequently block roads when pulling over to get a better look, creating a public safety hazard, as well as an impediment to normal movement of agricultural equipment. The overwhelming demand for snow goose viewing poses serious problems for local residents, farmers, and local officials. Although there have been numerous "near misses" and a few minor collisions along the poorly-shouldered Fir Island Road, no serious personal injuries have occurred to date (Maynard Axelson – local resident; pers. com.). The Fir Island Farm/Hayton Snow Goose Reserve was intended as a remedy to the public safety issue associated with intensive snow goose watching activities on Fir Island. However, to date the reserve has not accomplished the Enhanced Public Safety objective. Recommendations from the Fir Island Snow Goose Working Group designed to resolve public safety concerns include:

- Establish a permanent vegetative screen along the Fir Island Road right of way that blocks the view of geese by passing motorists;
- Avoid planting focus crop (winter wheat and rye grass intended to attract snow geese) within 200 feet of the road;
- Improve the visibility of the entrance sign for the reserve;
- Enlarge the reserve and add additional off-road parking.

**Objective 5.** Establish a developed snow goose viewing site.

Unofficial estimates of the number of bird watching public that visit Skagit County over the course of a year ranges between 500,000 and 750,000 annually. The majority of that activity occurs in the fall, winter and early spring months. Although many organized and more focused bird watching groups like Audubon benefit from designated viewing sites, this segment of the viewing public tends to be self sufficient and more aware of viewing ethics. The majority of problems associated with the general public viewing wildlife stems from that portion of metropolitan travelers who pass through Skagit County and are attracted by the spectacle of snow geese along the roadside. Many newspaper and television coverage's on eagles, swans, and snow geese in the area result in mass visitations from all over the Puget Sound region ultimately causing problems for local residents and landowners alike. The purpose of a developed viewing site is to provide an opportunity for large numbers of people to gain quality access to

unique wildlife resources and to provide a viewing alternative to dangerous roadside stopping, parking in residential driveways, trespassing on private property, obstructing farm equipment, and even harassment of the wildlife itself. Developed wildlife viewing sites support eco-tourism in the Skagit Valley and create strong economic benefits to local communities.

## Lease Revenue Projections for the Fir Island Farm/Hayton Snow Goose Reserve

Hayton Crop Farm (HCF) pays $225 per acre as a lease amount for farming rights on the land owned by WDFW. The total lease amount is adjusted upward by the addition of a Lease Holder Excise Tax (L&E) of .1284 %. The leasee (HCF) receives a credit for the cost of planting cover crop that is a reimbursement for the cost of tilling the ground, cost of the seed, and planting costs. For purposes of simplification, the "Planting Credit" has been standardized @ $50 per acre for a total of 200 acres ($10,000 per growing season).

For every acre that WDFW leases to HCF an additional 1.86 acres of winter forage acres is provided via the lease agreement (See Hayton Crop Farm (HCF) Farm Lease and Crop Planting Agreement, pp 9).

## Cover Crop Energy Calculations and Projected Snow Goose Population Equivalents

The primary function of the Fir Island Farm/Hayton Snow Goose Reserve is driven by the winter wheat cover crops that provide forage and ultimately the metabolized energy required by wintering geese. Snow geese begin arriving in mid-September and steadily build in number until they reach peak population level on the Skagit/Port Susan Deltas by late-December. In a typical season, snow geese begin foraging immediately upon arrival and focus specifically on the Reserve. Beginning in late-December, snow geese routinely leave the Reserve and begin targeting private farmlands as a source of food. By this time cover crops in the Reserve have been heavily grazed by geese with as much as 60% of the biomass removed. The cover crop (and a variety of local forbs eaten by snow geese) continue to grow throughout the winter to varying degree with growth rates influenced by weather. Cover crop growth rates accelerate in the spring months (February–April) during which time the birds divide their foraging efforts between the reserve and private farmlands. Calculation of per acre biomass and equivalent energy produced is based upon maximum cover crop yields in order to account for total season grazing in the Reserve by snow geese. Cover crop yield in the reserve is estimated at 1600 lbs per acre (seasonally). Based upon crop energy parameters in Petrie (2009), a single acre of winter wheat cover crop yields 1,741,795 kcal with 614 kcal required per bird/per day for normal winter maintenance. Calculation

of the total energy requirement for the total winter population of snow geese per season is as follows:

> 614 kcal/per bird/per day x 197 (# days snow geese are here in a season) x 75,410 (mid winter S.G. population) = Total kcal required by winter population per season). The total kcal required to over winter the 2010-11 population of 75,410 birds is 9,121,442,780.

The Fir Island Farm/Hayton Snow Goose Reserve (615 acres) produces 1,071,203,806 kcal in winter wheat available to snow geese. This represents 11.7% of the total 9,121,442,780 total kcal required to over winter the current 2010-11 snow goose population of 75,410 birds. 11.7% of the total kcal required to over winter the entire 2010-11 population of snow geese is sufficient to over winter a total of 8,856 snow geese for an entire season (197 days). A second snow goose reserve in south of Stanwood (181 acres) represents 3.5% of the total kcal required to over winter the current (2010-11 season) winter population of 75,410 birds which is sufficient to over winter a total of 2,606 snow geese for an entire season (197 days). The fall and winter of 2010 marked the 5th season the Snow Goose Quality Hunt Program contracted with local farmers for the placement of cover crops available to snow geese. This past season (2010-11) there was a total of 934 acres enrolled in the program. This program provided 17.8% of the total kcal required to over winter the total winter population of 75,410 birds for an entire season (197 days). The combined total acreage for all programs is 1,730 which provides 33.0% of the total annual kcal requirements for 75, 410 birds (Table 4):

Table 4. Summary of Snow Goose forage supplement programs managed by WDFW

| Program | Acres | kcal Provided | % provided | S.G. Supported |
|---|---|---|---|---|
| Fir Island Reserve | 615 | 1071203806 | 11.7 | 8,856 |
| Stanwood Reserve | 181 | 315264862 | 3.5 | 2,606 |
| S.G. Quality Hunt | 934 | 1626244148 | 17.8 | 13,445 |
| Total: | 1730 | 3012712815 | 33.0 | 24,907 |