Intent to Develop Alberta Offset System Quantification Protocol: *Conversion of Annual Cropland to Perennials*

Please contact Climate Change Central with any questions or clarification of requirements at contact@climatechangecentral.com.

This Intent to Develop an Alberta Offset System Quantification Protocol document is intended to provide Alberta Environment with an overview of the proposed protocol idea to demonstrate how this protocol will meet the requirements of the Alberta Offset System. The protocol developer is required to present this information to Alberta Environment and **must** receive approval in concept for the protocol before the protocol idea will be considered for development in the Alberta Offset System.

Familiarity with and general knowledge of the Alberta Offset System is required prior to initiating a protocol. Information on the Alberta Offset System is available on the Carbon Offset Solution website (http://carbonoffsetsolutions.climatechangecentral.com) and on the Alberta Environment website (http://environment.alberta.ca/02275.html).

Alberta Environment will review the submitted information in order to assess and provide feedback on the following elements:

- How the proposed protocol meets the eligibility criteria in section 7 of the *Specified Gas Emitters Regulation;*
- Applicability of the proposed protocol against purpose and intent of the Alberta Offset System;
- Baseline adoption levels and credit potential for Alberta;
- Baseline, project condition, and key assumptions for the proposed protocol;
- Key stakeholders and technical experts in the field; and
- Relevant science and technical information

General Description of the Proposed Protocol[1] [Provide a written overview on the intent, purpose and relevant background information on the protocol.]

Intent [Describe the protocol activity and reduction opportunity.]

The intent of this protocol is to enhance biological carbon capture and storage by building soil carbon reserves with crops that enhance the removal of greenhouse gas (GHG) emissions. One of the best ways of building soil carbon levels is through a land use conversion from row crops (grown and harvested an annual basis) to perennial crops (grown continuously). Perennial cropping is one of the best means of enhancing GHG removals from the atmosphere and increasing soil carbon storage. This is due to: the year-long growing season; deeper and more fibrous rooting systems that increase each year; reduced soil disturbance that protects soil

[1] **Some important notes to consider:**

- *Protocols should be based on best available science.*
- *Follow the ISO 14064:2 standard processes – specifically addressing principles of conservativeness, completeness, relevant, consistent with others, accuracy and be completely transparent in development and descriptive processes.*
- *Be very clear with respect to the Measurement, Monitoring and Verification requirements to allow little interpretation.*

aggregates; and higher plant biomass inputs per area of soil.

In addition to quantifying GHG removals resulting from increasing the soil sink capacity, the proposed protocol quantifies emission reductions in fuel use due to converting from annual row crops to perennial-based systems, as well as emission reductions from decreased fertilizer use. Indirect reductions of energy and fertilizer for upstream activities impacted by the Project Condition are also quantified.

This protocol will exclude lands that are used for cattle grazing due to the increased GHG accounting complexity of methane emissions from the rumen, and nitrous oxide (N20) emissions from dung and urine patches in extensively grazed systems. Thus, eligible practices are those that convert land use from annual cropland to perennial crops for the purposes of producing forage, hay or forage seed crops for sale or other uses.

Baseline [Explain the project baseline condition, adoption levels for the province, business as usual activity, general baseline assumptions, credit potential in Alberta, other relevant information.]

The Baseline Condition for this protocol will be established on a project-by-project basis. The average number of acres in perennial crops over a 3 year period, for the entire farm enterprise (i.e. lands owned and managed or leased) will represent the Baseline Condition for the Project. Standardized quantification emission factors (see below) will be applied to estimate the emissions from the Baseline Condition. This will require collecting farm-specific data as evidence of the acreage in perennial crops. Farm records and supporting information (satellite imagery, vegetation cover maps, air photos, county tax records, crop insurance records etc) will need to be gathered to prove the Baseline Condition.
The use of a project-specific baseline suggests that this protocol will likely result in a go-forward implementation timeline as it isn't common for farmers and ranchers to track specific data on perennial based systems; however, this type of information is increasingly being collected by farmers who are interested in developing other offset projects, such as Reduced Tillage. These requirements help to ensure that the reductions achieved though implementation of a Conversion to Perennials project are additional or incremental to what would have occurred under business as usual for that farm, or series of farms.

It's important to point out that this protocol represents a land use change from the Baseline Condition – this is not adoption of a practice or installation of a new technology. For the most part, amounts of land used to grow perennial crops have not changed between recent Census reports (Table 1). Further, in recent years there has been increasing pressure to grow annual crops due to high crop prices – a financial barrier to converting land use to perennial-based systems.

Table 1. Percentage of Hay/Fodder relative to cropland in Alberta by region.

Region	**2001**	**2006**	**% Change**
South	15	16	+6
Central	27	27	0

Northeast	21	21	0
Northwest	45	40	-10
Peace	30	31	-3
Alberta Total:	**26**	**25**	**-4**

Source: Statistics Canada, Census of Agriculture, 2001-2006

Estimated adoption rates for this protocol are not large since only a few farmers and ranchers would be willing to commit to converting land to perennial crop uses where grazing is not permitted. Areas of potential application in oil and gas reclamation and by acreage owners are also not large. The Technical Working Group estimated that this protocol would be applicable to only 0.1 to 0.2 M ha (0.25 to 0.50 M ac) of annual cropland per year in Alberta.

Project Condition [Explain the project condition, activity creating the emission reduction or removal, other relevant information.]

The proposed Conversion to Perennials protocol will focus on converting annual cropland to perennial cover for forage or seed production for a period of 18 years. Perennial crops include legumes and grasses used for hay or seed production. While grazing is closely associated with perennial cover, grazing management will be addressed in a separate protocol that is currently under development. Perennials in rotations for shorter periods of time (less than 6 years) are not considered in this protocol. As species mix change, perennial crops typically require rejuvenation with seed and / or fertilizer after about 6 years, which will be addressed by specifications within the protocol.

The protocol considers four typical scenarios for conversion of land use in Alberta (Figure 1 below). The main drivers of GHG emissions are (1) species composition (i.e. percent of legumes), (2) end product (seed or hay) (3) application of fertilizer, and (4) number of field operations. These scenarios were used to identify crop sequences that were used as the basis for calculating the standardized, regional carbon emission factors for the National Inventory Report (NIR), as described in McConkey et al. (2007) and verified against measured data in VandenBygaart et al (2008). The NIR approach represents the best available science combined with best practice guidance (IPCC Tier 2 approach) to represent conservative GHG emission changes associated with this land use practice change. The aggregate emission factors developed for the NIR variations take regional land use management into account and were adopted for use in this protocol.

Table 2 outlines the management associated with the land use conversion to perennial-based systems. These are used in developing the scenarios used to quantify the emission factors.

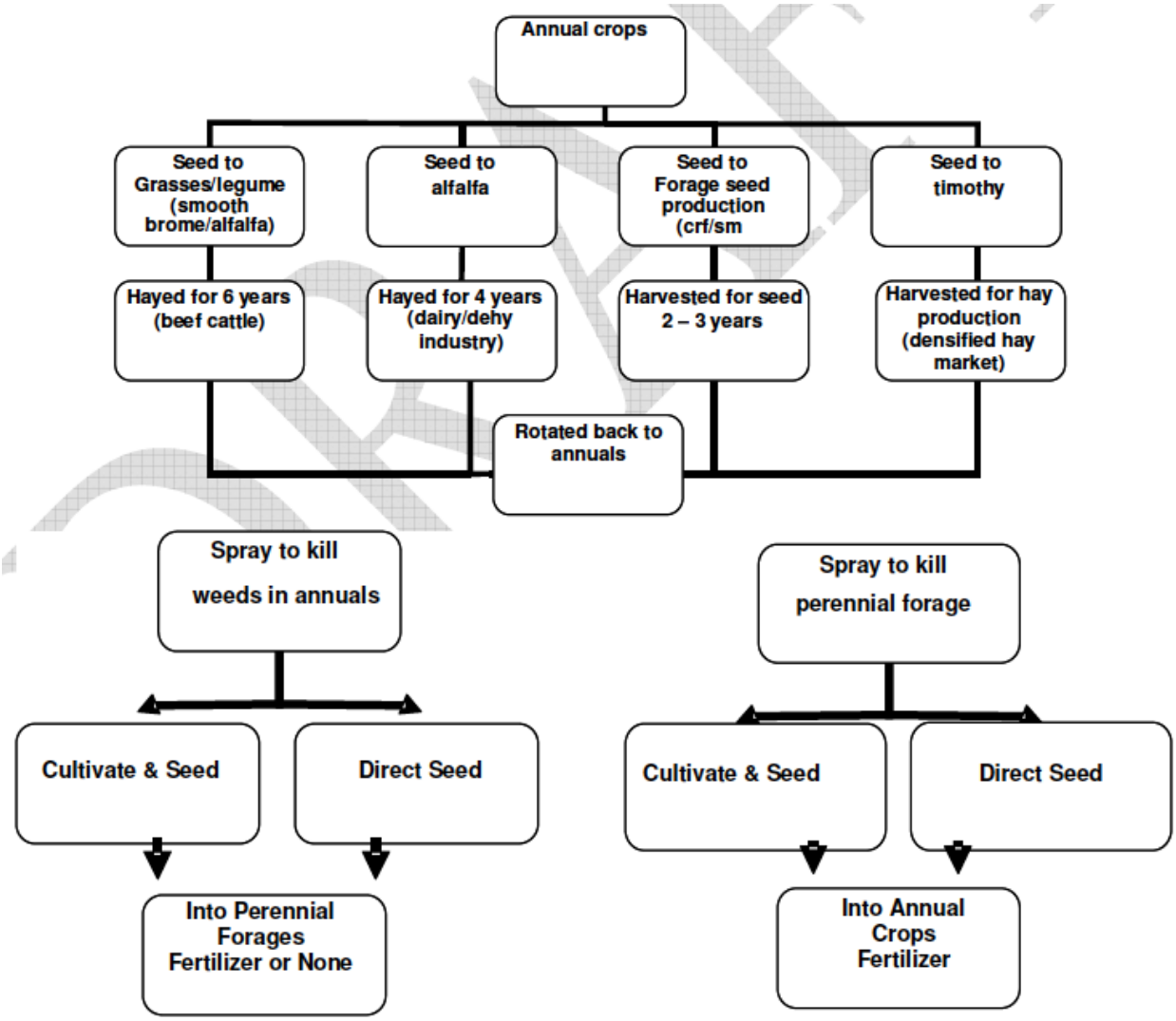

Figure 1. Typical scenarios for the perennial cropping systems.

Table 2. Land management of the perennial conversions used to quantify scenarios.

Protocol Region	Scenario	Species and Mixes	Nitrogen Fertilizer (kg N ha^{-1}) [x]	Harvest[y]
Dry Prairie	A	> 30% legume	None	Fall
Dry Prairie	B	Non-legume and < 30% legume	33	Fall
Parkland	C	> 30% legume	None	Summer, Fall
Parkland	D	Non-legume and <30% legume	49	Summer, Fall

x– Averaged between soil zones based on Huffman et al. 2008

y– Impact of multiple harvest operations and other agronomic variations were aggregated in the regional emission factors developed by McConkey et al. 2007.

The protocol quantifies the following reductions/removals as a result of land use change to perennial-based systems:

- Increased soil carbon sequestration rates
- Decreased on-farm N20 emissions as a result of less fertilizer use
- Decreased on-farm carbon dioxide (CO2) emissions as a result of less farm operations

The results of examining a number of different scenarios in Phase 1 showed that emission factors were similar between scenarios, ranging from 1.97 t CO_2e /ha for Dry Prairie with > 30% legume to 2.16 t CO_2e /ha for Parkland with < 30% legume.

The estimated potential for reductions through this protocol is calculated as:

Annual Potential for Converting Annual to Perennial Land Use

= 2.0 t CO_2e / ha / year x 0.15 M ha = 0.3 Mt CO2e / year

For an estimated total of 7.2 Mt of emission removals during the 18-year credit duration period that is proposed.

Applicability [Who is the intended user(s) for this protocol?]

Intended users of this protocol are primarily farmers and ranchers since they have the capacity (equipment and knowledge) to apply this land use change. This protocol would appeal to farmers and ranchers on marginal lands that would benefit from building soil quality as a result of the proposed land use change from annual cropping. The restriction to land not used for cattle grazing will restrict the applicability of this protocol. Evaluations of past programs that have incentivized conversion to perennial crops for 10 or 21 year contract period indicate that only about 20% of the enrolled acres converted to hay production only. The rest were grazed or some combination of grazed/hayed lands.

Acreage owners are also intended users as they would be interested in committing to contracting requirements. As well, lands being reclaimed from oil and gas activities would gain additional benefits from soil improvements that are above and beyond requirements to restore productivity to original levels.

Regulatory Requirements [Describe all relevant regulations that apply to this activity and explain how the activity is going beyond regulatory requirements.]

At present there are no regulations requiring that land be committed to the production of perennial crops[2]. It is possible that the new Alberta Land Stewardship Act may support this type

[2] Note – on crown lands such as Special Areas, there are agreements in place with the Special Areas Board for how the land is to be used/grazed – but it's unlikely that these lands would be involved in this protocol. The protocol could state words to this effect.

of land use change in the future. Alberta's *Environmental Protection and Enhancement Act,* Part 6 - Conservation and Reclamation requires conservation and reclamation of land to equivalent capability. In many cases, conversion from annual cropping to a perennial based land use will result in improvements beyond this requirement.

Additionality [Explain how this activity result in real, quantifiable, and verifiable reductions beyond business as usual activity and government regulations. How does this protocol result in new, incremental greenhouse gas emission reductions and/or removals that would not otherwise have occurred?]

The two main features of this protocol that will result in **real** GHG emission reductions that are new, incremental and would not have otherwise occurred are requirements for: i) increased amounts of land converted to perennial crops rather than annual crops relative to previous years, and ii) contractual commitment to this land use change for a period of 18 years (three, six year increments). Both the increased area of perennial cropping and the contractual commitment are beyond the scope of what farmers and ranchers would typically engage in, since annual crop prices have increased dramatically in recent years and farmers wish to have options to address changes in market conditions.

Of the two common ways of identifying additionality for a project - project specific tests or performance standard tests – the former is recommended since project-specific tests evaluate individual projects on the basis of whether they would have occurred in absence of the offset program (e.g. CDM). It's acknowledged that Alberta Environment prefers sector-level additionality testing, but in this case, where the project condition represents a land use conversion – adoption rates don't make sense since this is not a practice change. Comparable situations would involve determining whether afforestation is an additional activity. One does not examine adoption rates at a sector level for afforestation – the determination is based on the historical use of that particular piece of land to determine the eligibility of the project.

In this case, the recommendation is to use a project-specific test for additionality to place the burden of proof on the project developer to provide evidence that the land base in perennial crops of the Project Condition, at the farm enterprise level, is higher than in the Baseline Condition. This will be backed up through a proposed contracting process in the protocol to secure the land use change and establish that new and incremental GHG emission removals will occur. This requires commitment to the land use change of growing perennial crops rather than annual crops. The contract will also serve to assure permanence (see Appendix for similar contracting methods in agriculture programs). The contracts can be established with a Land Trust agency in the project's region. These details will be worked out with input from agencies who have administered programs of these kinds in the past.

The science basis for **quantifying** this emission reduction is the internationally recognized work of Canadian scientists in developing the Tier 2 approach to quantifying soil carbon changes in Canada's National Inventory Report, as outlined in the Project Condition section above. The **verification** of Baseline and Project conditions will be based on a variety of on and off-farm sources, including air photos, satellite imagery, county tax and/or crop insurance records, field

inspections as well as bills for equipment, seed and fertilizer, as described in more detail below.

Barriers [Identify barriers that would, in absence of the Offset protocol, disincent or prevent this activity or project from taking place.]

The rationale for the Additionality of the increased conversion of cropped acres to permanent cover acres is based on several criteria:

1. Surplus to regulation: Agriculture remains for the most part an unregulated sector in Canada. And, although converting more acres to permanent cover, in rotations or in perennial systems, is deemed the best land use for removing GHGs from the atmosphere and building soil building, no regulations exist to mandate requirement of these activities.
2. Surplus to Incentives received: In Alberta, no provincial programs currently exist that provide incentive for this activity. Some federal/national programs (Permanent Cover Program and Greencover Program) did exist that provided incentives on marginal lands to increase perennial cover (under the Federal-Provincial Agriculture Policy Framework 2003-2008) and these contracts are still active (last ones to expire in 2018). Typically these programs/contracts have specific language regarding carbon offsets. This language states that the applicant must be prepared to waive rights to the credits, and is given flexibility for buying out the amount paid to date, if they choose to exit the incentive agreement and enter the carbon marketplace (see Appendix).
3. Investment barriers: For a producer of annual crops to increase acres in perennial crops, significant economic issues arise. Grains and oilseed prices (annual crops) for the last 3 to 4 years have had significantly higher value trends than forage for several reasons – world grain and oilseed stockpiles have diminished, investor confidence in purchasing commodities over paper-backed assets has been the trend; hoarding of grains and oilseeds by specific countries, increased global demand for meats and oils (leading to higher demands for grains/oilseeds to feed livestock and humans in Asian countries) and biofuel policies. These trends are expected to continue for some time. Growing hay and forage seed to feed to animals is currently a lower revenue returning option than growing grains and oilseeds to sell directly. And the higher returns are causing growers to push more acres traditionally in hay and forage into annually produced crops. This is also occurring on marginal lands that are better suited to perennial systems. The potential income from GHG offset credits may give sufficient incentive to address these increased costs and risks, and reverse the trend to marginal land conversion to annual cropping and increase GHG removals/reductions.
4. Technological barriers: The technology required to switch from annual cropping to perennial cropping is readily available.
5. Institutional barriers: Market forces and land resource quality can basically drive the barriers or lack of barriers to this activity.

6. Not common practice: This criterion doesn't apply well to land use changes like those referred to in this protocol. This is not a practice change – it is a land use conversion. Having said that, the trend in recent years is to convert perennial systems to annually cropped systems due to market forces. The pork and beef herd in Alberta is shrinking due to the higher costs of available feeds (corn, barley, wheat), and demand on oils for biofuels and human consumption is encouraging this trend.

Permanence [Are emission reductions and/or removals reversible. If so, how does the protocol developer propose to address permanence of Offset Credits associated with this activity?]

The most important feature to address permanence is the use of a contract to commit the landowner to growing the perennial crop for a time period 6 years, with options to renew 3 times over the 18 year credit duration period. Contracts have been successfully used in other land conservation programs (see Appendix). However, it is recognized that contracts can be broken, and so a number of options to support adoption of the land use change beyond the incentive of the offset sale are recommended.

The proposed protocol will use a combination of a mandated reporting period with a risk-based assurance factor that is lowered in return for good performance. The protocol (and contract) will stipulate a mandated reporting/verification period of 3-years. This allows for 2 credit claims during a reporting period and considers the establishment cycle of the perennial stand. After each reporting period, the longer the conversion to perennial crops is maintained and the stand fits the protocol requirements, the lower the assurance factor as performance is demonstrated. This will require the building of a reserve account, as for the Tillage Management Protocol.

This effect of demonstrated assurance will be rewarded to the project, based on the previous reporting periods' demonstrated performance. This provides an incentive for continuing the land use change for the contract, and can apply to covering off any reversal of stored carbon in the future. In addition, the effect of including perennials in rotations with annual has a net positive effect on increasing amounts of soil carbon after a return to annual cropping, so the benefit of the land use change continues beyond the occurrence of possible reversals. This will be quantified in the next phase of analysis.

Based on evaluations of land conversion programs run by the federal government, approximately 15% of the contracts were liquidated and converted back to annual crops (Appendix). Based on this historical trend, it's proposed the assurance factor would be set at 20% initially. Thus 20% of the verified offsets would be held in the buffer account after the initial 3 year reporting period. Although initially high, the amount of offsets generated is higher in this protocol due to the effectiveness of this practice change in increasing soil carbon. If all requirements are met for the second reporting period (i.e. the 6 year mark), then the overall percentage deduction goes down to 18% for the next 6 year period, then 16% for the final 6 years. If requirements weren't met for one of the 3 year reporting periods (e.g. the recommended species mix) then the risk rating of the project will not decline. This process continues until the 18 year time period has expired. Note – there is no return of reserved offsets returned to the project developer over time, just a

smaller discount or assurance factor based on project performance.

Note – The determination of the initial buffer reserve and subsequent reduction of the assurance factor will be addressed in the next analysis phase.

Leakage [Will this protocol result in or threaten leakage of greenhouse gas emissions, and if so, how will these risks be mitigated? Include a discussion on possible scenarios that may occur.]

Leakage of downstream emissions was not deemed to be of concern since it is anticipated that uptake of this protocol will not be large. In addition, many of the end uses of the perennial crop for seed or export will not be included in livestock diets.

Conservativeness [How does the proposed protocol idea address conservativeness in emission reduction quantifications?]

Conservativeness in the use of coefficients is addressed through the use of selected data to validate Century modeled results, such as, study durations of more than 10 years, inclusion of control treatments, organic matter calculations on an equivalent mass basis. This is a sound approach to reducing the high variability of measured results and is based on strong science foundation. Since the modeled results are within the variation of measured results in Western Canada (VandenBygaart et al. 2008), conservative interpretation of the coefficients is assured.

The approach to assuring permanence is conservative since the application of a discount factor results in an increasing pool of offsets that accumulate over time, reducing impact of risks of practice reversals. Discussions have been initiated with the Alberta Offset Registry about formalizing the pool that has been developing for the Tillage Management Protocol. This approach would also be applicable to this protocol.

Aggregation [Is this protocol likely to result in aggregated projects? If so, are there risks associated with aggregated projects, and how does the protocol propose to handle these risks?]

Individual sites are not likely to generate enough offsets to form a project that is large enough to be of interest to buyers. If multiple sites are aggregated, there may be risks associated with different types of records and with changing contracts over a number of years. Some of the proof of the practice change will reside with the landowner (e.g. crop records, equipment, bills of sale) and some proof may reside with the project developer (e.g. air photo analysis) and it is expected that these arrangements will be documented in contracts. An approved Land Trust agency can manage the details of these transactions to minimize associated risks.

The use of protocols to generate agricultural offsets is requiring increasing sophistication on the part of the producer and the aggregator. As sophistication with multiple sources of record keeping over multiple years is increasing, risks associated with potential multiple projects are decreasing.

Verification [What types of records are available to support implementation and verification of the proposed activity or project?]

Air photos or satellite imagery could be used to establish proportions of annual and perennial crops in the Baseline Condition and Project Conditions since its very straightforward to differentiate perennial from annual cropped land uses. County tax records (taken at 5 year intervals) and /or crop insurance records identify whether the land use is annual or perennial. Sales and receipts of forage seed, forage tonnage sold to third parties, and export records will also support verification claims. Species mix can be differentiated according to whether the perennial crop is controlled by livestock or by mechanical / agronomic means. Use of the land for grazing would be evident from random, periodic inspections for evidence that cattle had been present in the field. Field patterns will also provide evidence as haying will remove the crop uniformly, but cows do not graze uniformly. Hoof damage and water points show use. Supplemental bills of sale for seed and fertilizer (if needed, depending on seed mix) could be also used. Proof of land ownership will be required.

Ownership [Identify issues around ownership that pertain to this activity or project.]

Will belong to the owner of the land location where the land use change occurred. As with other protocols, contracts with renters will need to specify how carbon offsets will be addressed.

Related Protocols and/or Methodologies [Do other jurisdictions, programs or offset systems have similar or related protocols available, and if so, discuss similarities and differences between the proposed protocol idea for Alberta relative to other jurisdictions.]

There are other programs that have or are developing similar protocols. The Chicago Climate Exchange (CCX) has a rangeland protocol that allows restoration of degraded rangelands but it is not exactly applicable since it is not a land use conversion protocol. Under the CCX's soil offset program however, there is a conversion to grasslands, where grass cover plantings are taken on or after January 1, 1999. The protocol/program does not address permanence after the 4 year contract period, and only takes into account carbon dioxide has a gas (sequestration rates are set at 0.75 t CO_2e/ac/yr).

Under the Voluntary Carbon Standard, an 'Adoption of Sustainable Grassland Management Through Adjustment of Fire and Grazing Protocol' has been submitted to the AFOLU program, but validation of the protocol has not yet occurred. Under this protocol the land is required to have already been in use as grassland so there is no conversion or land use change accommodated. This protocol is not directly applicable to this approach.

The approved Tillage System Management Protocol is also based on IPCC Tier 2 coefficients derived from the National Inventory Report that are applied on a regional basis. However, unlike the proposed Conversion to Perennials protocol, no proof of Baseline Condition is required for the Tillage Management Protocol.

A number of other approved protocols in the Alberta Offset System identify Baseline Conditions on a project-specific basis, e.g. Beef Lifecycle, Beef-Feeding. Other land management protocols that are currently under review also identify project-specific Baseline Conditions, e.g. the Nitrous Oxide Emission Reduction protocol.

Other Benefits [List all associated benefits that will result from this activity. These other benefits can include environmental benefits, economic benefits, etc.]

There are many important co-benefits to this land use change since it substantially increases soil organic matter which increases its capacity to adapt to climate change as a result of improved nutrient cycling and water holding capacity. This is particularly the case for marginal lands where this practice change is most likely to occur. Land degradation by water and wind erosion as a result of increased root and plant biomass will also be reduced. Biodiversity will also be enhanced in perennial land use systems that are more similar to native grassland conditions.

Adverse Effects [List any adverse effects that may result from implementing this activity or project.]

Landowners may not be supportive of the lengthy contracting requirements.

References [Provide a list of relevant references.]

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Proposed Timing for Submission into the Offset System Review Process

[Please identify the anticipated submission date for this protocol to be considered for Stakeholder review (formerly 2nd Round Stakeholder Review). Note: the Stakeholder review is held once per year in fall.]

October 2011

Appendix A – Performance Assessments from PFRA Permanent Cover Programs 1989-1992

The following summarizes two Evaluation Reports of the Permanent Cover Programs (PCP) prepared by Clint Hilliard et al (2009):

Study Goals:

- 15 years post-incentive payments - what land is still in forage, as required by the contracts?

PCP Programs:

- CLI 5 or 6 - $20/acre seeding payment contract for 10 or 21 years - one time; caveat against title to guarantee contract - fully prescribed in one month initially
- For 21 year contracts, amounts were greater per acre
- No trends are given, but the reports implied that there was maximum participation for the eligible acres
- Note - the 21 year agreements will reach maturity between 2010 and 2015 for the original PCP contracts of 1989 (PCP-1) and 1992 (PCP-2) (GreenCover came later)
- Total cost -$65M
- Results in Saskatchewan - 95% of lands remain under forage today. 19% hay production. The

remaineder was either grazed or hayed and grazed.
- Extrapolating to the Prairies - of total area converted under the PCP programs, 85% remains under cover. 15% reverted to annual cropland. All liquidated contracts were assumed to be returned to annual production.

Summary: Only about 20% of eligible acres are likely to convert to hay production only, and a likely discount factor w 15% reversion rate.

Additional Information on GreenCover Program

Land Conversion (approximately 48% of expenditures)
The Land Conversion component offers farmers and ranchers financial assistance to offset a portion of the costs of converting environmentally sensitive annual crop land to perennial cover and provides a one-time incentive to enter into a Contribution and Land-Use Agreement to establish and maintain perennial cover on approved lands for a 10-year period. This component is delivered by PFRA, part of the Environment Team.

- Land Conversion: change in the level of conversion, measured by number of seeded acres, by agricultural producers of environmentally sensitive cropland to perennial cover, and number of hectares protected.

Contribution agreements with recipients address performance reporting requirements for PFRA-delivered Program components. The Client Service Centre collects performance reports from the recipients. Contribution agreements with provincial and third-party delivery agents include clauses specifying performance reporting requirements. Performance reporting requirements are based on a recipient's annual Work Plan, quarterly progress reports/updates and an annual Performance Management Report.

An annual Work Plan from the recipient is required to identify the activities to be undertaken in the upcoming year and objectives, outcomes and results to be achieved.

Eligible Activities
- Converting environmentally sensitive land to perennial cover.

Eligible Costs
- $20 per acre for seeding or planting tame forage or trees and signing a Contribution and Land-Use Agreement, or $75 per acre for seeding native species and signing a Contribution and Land-Use Agreement; and
- $25 per acre after you establish the perennial cover, and after Greencover Canada advisors/planners inspect it and issue a Certificate of Stand Establishment (Greencover Canada will adjust this payment to account for any seeding overpayment).