Credit Class

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GHG & Co-Benefits in Watershed Carbon

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Ecosystem focus: Watersheds

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1. Introduction

This Credit Class can be used by Project Proponents to generate carbon credits by reducing nonpoint source contamination of watersheds, thereby avoiding the increased greenhouse gas emissions from the status-quo infrastructure construction and electricity use associated with industrial drinking water and wastewater management and treatment.

While green water infrastructure is often more affordable than gray water infrastructure, it is not presently the preferred solution by most water treatment facilities because key decision-makers are structurally biased towards preferring technology, given that distributed, nature-based solutions have more variable benefits based on changing environmental conditions, and implementing green infrastructure generally involves the complexity of working with many private landowners.

Under this Credit Class, the anticipated carbon revenues therefore provide the additional required incentive to motivate greater installation of nature-based solutions, reducing both performance and regulatory risk, and being credited upon demonstration of implementation success and subsequent avoidance of gray infrastructure construction requirements.

2. Credit Class Overview

2.1. Credit Type

Carbon Emissions Avoided: Avoided future CO_2e emissions calculated by quantifying the multi-year energy and material use from:

1. reducing the use of existing infrastructure,
2. eliminating the need for new infrastructure, and/or
3. eliminating the need for upgrades or retrofits.

For energy this would be the corresponding energy savings multiplied by the average grams or tons CO_2e that exists and is projected to exist in the regional electricity grid for the life of the projected upgrade. For materials this would be the material-specific life cycle inventory data for CO_2e emissions.

2.2. Co-Benefits

By recognizing and promoting the co-benefits of the green infrastructure program, Project Proponents can increase the program's impact and promote a more holistic approach to sustainable development. The co-benefits can be monitored and reported alongside the avoided emissions of not upgrading water treatment infrastructure to provide a comprehensive picture of the program's impact.

2.2.1. Water Quality Health

This Credit Class is designed to use green infrastructure to improve water quality in watersheds. Project Proponents may model or directly measure these water quality benefits and quantify them separately where appropriate.

3. Project Eligibility

This Credit Class is applicable to green infrastructure projects implemented in any watershed, provided that the project meets the eligibility criteria outlined below. This Credit Class is applicable to new or existing programs, provided additionality is demonstrated, and can be used by Project Proponents seeking to develop carbon offset projects or to claim emission reduction benefits for their green infrastructure projects. This Credit Class and its approved Methodologies are designed to align with international standards for carbon accounting and verification.

3.1. Project Activity

The project activity approved by this Credit Class is green infrastructure providing water quality benefits. There are many practices that fall under this definition, with examples provided below.

Green infrastructure project activities creditable under this Credit Class will be highly variable in context, design, implementation, and monitoring. The design and implementation process will be iterative, contextual and require qualified expertise.

As such, it is outside of scope of a third party validator to be responsible for approving or monitoring the design of the green infrastructure programs. Instead, the third party validator will verify that the program is additional, is implemented as planned, and that water quality is monitored, consistent with the Credit Verification and Release Schedule detailed in Section 6 of this document.

However, Project Proponents must clearly detail their relevant methodologies, design approaches, standards and approvals in their Project Plan, to provide transparency to all stakeholders.

Project types in the following list are deemed within the scope of applicability for this Credit Class. Project Developers may propose other green infrastructure alternatives for consideration by Regen Registry as substantially compliant with the methodology intent. No project types may be used that simply move water quality degradation from one watershed to another.

Watershed Program Project Types

For temperature reduction:

- riparian forest buffer restoration
- flow augmentation
- island augmentation/creation

- water reuse

Nutrient and sediment runoff reductions, agricultural or non-forested lands:

- Structural:
    - riparian forest buffer restoration
    - tree planting
    - livestock exclusion fencing
    - off-stream livestock watering
    - streambank stabilization
    - dredging and aquatic habitat restoration
    - animal waste management system
    - barnyard runoff control
    - sediment basins
    - underground outlet
    - sprinkler irrigation upgrade
    - micro irrigation upgrade
    - surg irrigation
    - tailwater recovery
    - diversions
    - retirement of highly erodible land
    - wetland restoration and natural water courses restoration
    - water reuse
- Practice-based:
    - conservation easements
    - cover cropping
    - crop rotations
    - conservation tillage
    - filter strips
    - rotational grazing
    - straw in furrows
    - nutrient management
    - grass waterways
    - riparian grass buffer/restoration

Runoff reductions and water quality improvements, forested lands:

- riparian forest buffer restoration
- forest road management or decommissioning
- forest harvesting practice improvements
- prescribed fire following native practices
- forest thinning
- reforestation
- Erosion control

Upland non-forestry practices:

- wet meadow restoration

- beaver dam analog development
- beaver introduction
- increasing stream complexity
- opening historic side-channels

A range of example 'best practice' quantification methodologies, protocols, policies and project quality standards are presented below - but many others exist that would also be usable for this Credit Class.

Global

Models:

- Global NEWS: The Global NEWS (Global Nutrient Export from WaterSheds) model simulates the river export of nutrients from land to coastal seas. The model quantifies the annual river export of nitrogen, phosphorus, carbon, and silica in dissolved inorganic, organic, and particulate forms. Furthermore, Global NEWS calculates the source attribution of these elements as well as the Indicator for Coastal Eutrophication Potential (ICEP). The model distinguishes between point and diffuse sources of nutrients in rivers. Point sources include sewage effluents from wastewater treatment plants, and diffuse sources include typically leaching/runoff of nutrients to rivers from fertilized and unfertilised soils. Global NEWS takes into account the retention and losses of nutrients in the river network, including losses due to denitrification, water consumption, and damming.
- The MARINA models: The Model to Assess River Inputs of Nutrients to seAs 1.0 is a downscaled version of the Global NEWS model for China, but with improved methods of accounting for animal manure and human waste, as well as with updated information for reservoirs. The model quantifies past and future trends in annual river export of nitrogen and phosphorus in dissolved inorganic and organic forms. MARINA 1.0 is constructed to assess: (1) sources of nutrient pollution in rivers, (2) impacts of upstream human activities on downstream water quality, (3) effects of nutrient pollution on coastal waters (eutrophication potential), and (4) solutions to reduce nutrient pollution in rivers and coastal waters. The model performs these assessments based on human activities on land, while taking into account sub-basin characteristics and losses of nutrients during their transport towards the river mouth. MARINA 2.0 includes human waste from rural population that is connected to sewerage systems, has additional basin delineations and has an updated approach to quantify human waste. MARINA-Global-L has a focus on livestock manure, and is calibrated for China and Africa.
- Geospatial Regression Equation for European Nutrient Losses: GREEN is a statistical model used to assess the impact of agricultural fertilizers and other sources of nutrients on the environment. The GREEN model estimates the mass discharge of total nitrogen (N) and total phosphorus (P) through the stream network down to marine coastal areas, the concentration of N and P, and the

relative contribution of diffuse and point sources to the total mass discharge/concentration.

- StreamLight: The StreamLight model is a dynamic, biophysically based model that incorporates canopy structure and phenology to predict light reaching the stream surface, intended to enhance the ability to predict light regimes in the smaller stream reaches that represent most global stream lengths.
- Soil and Water Assessment Tool (SWAT): The Soil & Water Assessment Tool is a small watershed to river basin-scale model used to simulate the quality and quantity of surface and ground water and predict the environmental impact of land use, land management practices, and climate change. SWAT is widely used in assessing soil erosion prevention and control, non-point source pollution control (including temperature) and regional management in watersheds.
- OverseerFM: Calibrated for New Zealand and used in the Lake Taupo Nitrogen Market, OverseerFM provides a way to estimate how nutrients are cycled within a farm system. This allows the user to better understand annual average nutrient requirements and the likely effects of changing management practices on the farm's overall nutrient inputs and losses.

Protocols, Quality Standards, Examples:

- Roundtable on Sustainable Palm Oil Manual on Best Management Practices for the Management and Rehabilitation of Riparian Reserves
- Integrated Sediment Management Guidelines and Good Practices for the European Union
- REFORM River Restoration Wiki for the European Union
- Global guidelines for peatland rewetting and restoration
- Guidelines for Riparian Restoration in British Columbia
- Case Study Research on Offsets for Water Quality Management, focused on examples from Canada, New Zealand and the US.
- River restoration: a strategic approach to planning and management, a UNESCO report
- Standards for Ecologically Successful River Restoration, by the British Ecological Society.

United States

Models:

- APEX: APEX has components for routing water, sediment, nutrients, and pesticides across complex landscapes and channel systems to the watershed outlet as well as groundwater and reservoir components. A watershed can be subdivided as much as necessary to assure that each subarea is relatively homogeneous in terms of soil, land use, management, and weather. APEX was constructed to evaluate various land management strategies considering sustainability, erosion (wind, sheet, and channel), economics, water supply and quality, soil quality, plant competition, weather, and pests. The routing of water,

sediment, nutrient, and pesticide capabilities are some of the most comprehensive available in current landscape-scale models and can be simulated between subareas and channel systems within the model.

- Nutrient Tracking Tool: The Nutrient Tracking Tool (NTT) is a free, online, user-friendly decision-making tool that quantitatively estimates the nitrogen, phosphorus and sediment losses from crop, pasture, forest lands. NTT has been developed by the modeling team at Texas Institute for Applied Environmental Research (TIAER) at Tarleton State University in cooperation with USDA's Office of Environmental Markets, NRCS, and ARS for the last nine years.
- Shade-A-Lator: The Shade-a-lator model contained in HeatSource Version 8.0.8 (Shade-a-lator) is an approved metric for calculating Water Quality Temperature Credits in the Willamette Partnership's Ecosystem Credit Accounting System. Shade-a-lator was developed by Oregon's Department of Environmental Quality (DEQ) to calculate thermal load reductions (or shade potential), in kcal/day, from riparian shade restoration projects. The assessment's spatial unit is a stream reach whose upstream-downstream boundaries are defined by the user, and whose lateral boundaries extend outward and perpendicular to the stream to a distance also defined by the user, but typically not more than 150 feet (the usual size of recommended buffers).
- COMET-Farm: COMET-Farm is a whole farm and ranch carbon and greenhouse gas accounting system. The tool guides users through farm and ranch management practice descriptions, including alternative future management scenarios. Once complete, a report is generated comparing the carbon changes and greenhouse gas emissions between current management practices and future scenarios.
- Water Temperature Transactions Tool: The Water Temperature Transaction Tool (W3T) is an easy-to-use, interactive model for quickly evaluating stream temperatures under a variety of scenarios. The tool allows users to define a simple river reach and change basic characteristics, such as surrounding shade, cross-section form, channel slope, and tributaries and diversions, to evaluate potential benefits of flow transactions as they relate to river temperature.

Protocols, Quality Standards, Examples:

- Willamette Partnership's 'General Crediting Protocol', including Addendum 1 'Minimum Quality Standards for Riparian Planting'
- Willamette Partnership's Protocol for Quantifying the Thermal Benefits of Riparian Shade
- Watercourse Engineering's Water Temperature Transaction Tool (W3T) monitoring protocol
- USDA's Nutrient Tracking Tool users manual
- US Government policies in support of water quality credit trading
- Great Lakes Commission's Framework for Water Quality Trading in the Western Lake Erie Basin
- Electric Power Research Institute's Pilot Trading Plan 1.0 for the Ohio River Basin Interstate Water Quality Trading Project

- Pennsylvania Department of Environmental Protection's Phase 3 Watershed Improvement Plan Nutrient Trading Supplement
- Maryland Department of Agriculture's Maryland Policy For Nutrient Cap Management and Trading in Maryland's Chesapeake Bay Watershed
- Virginia Department of Environmental Quality's Trading Nutrient Reductions from Nonpoint Source Best Management Practices in the Chesapeake Bay Watershed: Guidance for Agricultural Landowners and Your Potential Trading Partners
- Wisconsin Department of Natural Resources' Guidance for Implementing Water Quality Trading in WPDES Permits:
- American Society of Agricultural and Biological Engineers' Guidelines for Calibrating, Validating, and Evaluating Hydraulic and Water Quality Models

3.2. Project Boundaries

By setting a clear, logical and science-based project boundary, Project Proponents can establish a foundation to support accurately monitoring, attributing and verifying a program's impact.

3.2.1. Geographic Applicability

The project boundary should be defined based on the geographic scope of the green infrastructure program. This may include the entire watershed or specific sub-watersheds, depending on the program's objectives and resources. The project boundary will also include the water entity which may or may not be within a continuous boundary of the green infrastructure program. This Credit Class is applicable anywhere in the world where green infrastructure could be incentivized and demonstrated to replace gray infrastructure for water quality goals.

3.2.2. Land Use

The project boundary should also consider the land use within the defined area. The program should prioritize green infrastructure projects in areas where they will have the most impact, such as areas with high erosion rates, degraded riparian areas, or areas with high nutrient loads.

3.2.3. Land Ownership or Tenure

The program should also consider land ownership within the project boundary. Green infrastructure projects may be implemented on private or public land, and the program must establish clear guidelines for engaging with landowners and securing their participation in the program.

This Credit Class accepts projects which can properly demonstrate land ownership or landowner approval with adequate documentation.

Project Proponent shall provide documentation and/or attestation of land tenure. In the case of leased/rented land, the landowner shall agree to all contractual obligations taken by the Project Proponent, and the Project Proponent shall provide documentation and/or attestation of title agreement to credits.

3.2.4. Exclusions

The program may also establish exclusions within the project boundary where green infrastructure projects will not be implemented, such as areas that are unsuitable for certain practices, areas with critical infrastructure or areas where other land use practices are prioritized.

3.3. Adoption Date

Green infrastructure programs implemented by water treatment facilities often require 10-year or longer planning, approval, implementation and monitoring periods. The start of implementation (including pilot or smaller scale demonstrations) may occur before stakeholders, including the facilities or regulators, have committed to avoiding the construction of gray infrastructure upgrades.

Therefore, recognizing the lengthy timelines for project development, approval and/or implementation, and consistent and predicated on the definition and demonstration of Additionality in this Credit Class, projects registered under this Credit Class will accept an Adoption Date (the start of the alternative, green infrastructure deployment) up to 10 years prior to Project Registration Date provided the Project deployment is on-going and not fully implemented by the Project Registration Date. In order to claim an Adoption Date before the Project Registration Date, the Project Proponent must have maintained clear historical records demonstrating the implementation design and timeline, as specified in the Approved Methodology.

3.4. Crediting Term

The Crediting Term starts on the Adoption Date and extends to the expected life of the avoided water treatment system.

3.5. Regulatory Compliance

The Project Proponent will certify that Project Activities were conducted in compliance with applicable laws, regulations, permits, and other legally binding requirements, including mandatory provisions of the Approved Methodology.

4. Project Rules & Regulations

4.1. Approved Methodology

The approved methodologies for this Credit Class are:

1. Watershed Nature-Based and Green Infrastructure Activities Avoiding Emissions from Water Management Gray Infrastructure Construction and Operations Methodology v1.0

4.2. Project Plan

Any project run using this Credit Class must have an aligned project plan.

The Project Plan will define and evidence Project Area(s) Project Activity, Project Eligibility and Project Rules and Regulations. The Project Proponent shall fill out the Project Plan Template and submit for review by the Regen Registry.

4.3. Aggregate Projects

Aggregate Projects are permitted in this Credit Class. Aggregate projects can be defined as separate facility upgrades and/or entities discharging into the same watershed and stream/river.

In the United States, this is defined as facility projects and/or separate entities within the same EPA HUC 12 watershed.

An aggregate project may combine several avoided facility upgrades at one or more facilities within a watershed, and may further combine alternative green infrastructure programs to meet water quality goals, provided that the aggregate green infrastructure programs meet, in combination, the summation of all aggregate gray infrastructure baseline alternatives.

The Project Proponent must separately provide LCA analysis for each avoided gray infrastructure alternative, and must monitor the green infrastructure for performance consistent with aggregate water quality goals.

4.4. Project Renewal

Any Project Proponent and/or client water facility may renew the program at the end of the crediting term, provided the water quality goals remain in place, and the green infrastructure program meeting the water quality goals remain viable or renewable in lieu of new gray infrastructure construction.

However, any Project Proponent and/or client water facility may not renew and/or submit a new project for registration covering the same water quality goal or obligation during the initial, first registered crediting term. This prevents a scenario wherein a green infrastructure program has failed, resulting in a new or renewed gray infrastructure potential construction that could be double-counted for crediting.

5. GHG Removal & Emission Reduction Requirements

5.1. Additionality

Green infrastructure programs designed to meet water quality obligations or goals, and thereby offsetting emissions associated with gray infrastructure, have variable and evolving effectiveness, costs, risks, and uncertainties. Further, the carbon credit revenue anticipated under this Credit Class is in most cases anticipated to be only a fractional contribution toward the project cost.

While green infrastructure is often projected to be more affordable than gray infrastructure, it is presently the preferred solution by most global water treatment facilities because decision-makers work within a system that is heavily biased towards the certainty provided by technological upgrades and processes. For example, in the United States where green infrastructure has the longest track record globally of being used in lieu of facility upgrades, the water treatment sector spends approximately $30B/year – with far less than $1B/year of that going to green infrastructure.

Therefore, under this Credit Class, additionality is established as follows:

1. The water treatment facility (which may or may not also be the Project Owner and/or Project Developer) attests in writing that the anticipated carbon revenue enables, in part or full, green infrastructure water quality solutions that avoid the construction and operation of an energy consuming facility upgrade. Attestation shall also include confirmation that the facility will not shift its water treatment obligations to a neighboring facility during the crediting period.
2. The Project Proponent demonstrates that adoption of the proposed project activities is not common practice. The Project Proponent must determine whether the proposed project activity (or suite of activities) are common practice in the specified region (at the state/provincial level). The United Nations Framework Convention on Climate Change Tool for the Demonstration and Assessment of Additionality defines “common practice” as greater than 20 percent adoption. To demonstrate that a project activity is not common practice, the Project Proponent must show that expenditures for the proposed project activity types within the project state or province (or equivalent) is below 20 percent of water treatment infrastructure expenditures in the past decade. Evidence may be provided in the form of publicly available information contained in: 1) Government (e.g., survey) data; 2) Peer-reviewed scientific literature; 3) Independent research data; or d) Reports or assessments compiled by industry associations.

5.2. Leakage

Leakage is not required to be accounted for in this Credit Class, as improving water quality with green infrastructure would not plausibly cause a water treatment facility to increase additional emissions elsewhere, as regulated water and wastewater entities are permitted on a per-intake/discharge basis and not allowed to distribute water quality obligations per-pipe across multiple facilities.

5.3. Permanence Period

The credits issued under this Credit Class are permanent during and beyond the credit period upon conversion from *ex-ante* to *ex-post.*

5.4. Permanence Approach

Credits are permanent upon conversion from *ex-ante* to *ex-post.*

5.5. Buffer Pool

A buffer pool is not required for this Credit Class as all credits are issued *ex-post,* upon demonstration that the anticipated avoided emissions have in fact been avoided through the non-construction of infrastructure.

5.6. Verification

5.6.1. Verifier Requirements

Qualifications of the verifier include:

Education: A bachelor's or master's degree in environmental science, sustainability, industrial ecology, engineering, or a related field is typically required.

Knowledge of LCA methodologies: Strong understanding of Life Cycle Assessment principles, methodologies, and standards such as ISO 14040 and ISO 14044. Proficiency in using LCA software tools for data collection, inventory analysis, and impact assessment.

Environmental expertise: Comprehensive knowledge of environmental science, including principles of ecology, pollution prevention, climate change, resource management, and waste management.

Technical skills: Familiarity with relevant software tools for LCA, such as OpenLCA, or similar platforms. Competence in using spreadsheets, databases, and other data management tools.

Experience: Experience performing LCA in the areas of biobased systems and traditional infrastructure. This includes experience in all aspects of a life cycle assessment including development of engineering process models, model validation, life cycle inventory data gathering, impact assessment and interpretation of results.

The LCA practitioner must be an expert in the area of life cycle assessment with relevant recent experience.

5.6.2. Verifier Responsibilities

A third party Verifier will verify:

1. Additionality is demonstrated.
2. The methods and results applied to calculate the avoided GHG calculations are as described in the approved Methodology.
3. The start of implementation of the as-designed green infrastructure project as described in the Project Plan.
4. Water quality monitoring has been deployed as described in the Project Plan.
5. The Verifier may also conduct site visits to the water treatment facility and the site of the green infrastructure installations to verify that the alternative anticipated upgrade has not taken place and that the green infrastructure project is in place and maintained.

6. Credit Verification & Release Schedule

The primary credit-generating activity under this Credit Class is the selection and implementation of green infrastructure by a water treatment facility which then avoids decades of GHG emissions related to the facility upgrade which has been rendered unnecessary. In order to mitigate the risk that the counterfactual, the construction and operation of a facility upgrade, occurs, credits issued under this Credit Class are issued *ex-post* on annual increments over the anticipated lifetime of the avoided instructure upgrade.

Upon each annual anniversary of the start of the Crediting Term, the Project Proponent will calculate, based on the established life cycle analysis method in their Project Plan, the actual avoided emissions associated with the avoided infrastructure and the retrospective energy intensity on the grid, using the most recent publicly available data.

The Project Proponent is required, every 5 years, to re-certify the following conditions. If either are violated the Project may not continue to issue *ex-post* credits:

1. The counterfactual infrastructure used as the basis of the credit calculations and replaced with the green infrastructure alternative remains un-built (i.e., the attestation by the facility owners provided as part of the Additionality evidence remains valid).
2. The green infrastructure project implementation is continuing or complete and is demonstrated with monitoring and/or modeling to be on track (though full compliance may not be yet achieved) to meeting water quality performance standards as described in the Project Plan.