HABITAT CONSERVATION TRUST FUND PROJECT REPORT

1. **PROJECT NAME** ECVI Water Storage Feasibility.

2. **HCTF PROJECT FILE #:** 1-430

3. **TYPE OF REPORT** ☒ Progress ☐ Annual ☐ Final

4. **FISCAL YEAR:** 2007/08, YEAR 1 OF 5 YEARS

5. **LOCATION:** Select watersheds on east coast Vancouver Island.

6. **PROJECT OVERVIEW**

a) Project Executive Summary

In prioritized east coast Vancouver Island (ECVI) watersheds, the feasibility of potential stream flow improvement projects was further assessed in partnership with MoE, DFO, FNs, Ducks Unlimited Canada and community stewards. Feasibility work has been prioritized and includes examinations of structural modifications or operational refinements to existing storage sites as well as new sites where potential fish production appears high and impacts to the environmental are likely low. Flow improvements are being considered to increase wild production of trout and salmon in mainstems and sub-basins between Victoria and Port Hardy. This will be achieved by providing elevated seasonal base flows and maintaining and/or increasing summer rearing area in the face of increasing drought frequency related to climate change. Target species are mainly stream rearing salmonids such as steelhead and cutthroat trout as well as coho salmon. Flow improvements may also benefit summer and early fall migrants such as summer run steelhead, pink salmon and chinook salmon.

With the large number of sites being examined at this stage, accomplishments since April 1, 2007 were numerous (see Activities, Section 7, for details) and included:

- Consultation with municipalities, landowners, FNs and community stewards
- Field surveys of virtually all potential sites
- Flow studies to identify potential habitat and fish production gains
- Hydrological studies
- Conceptual engineering designs
- Impact assessments (wildlife and plants).

b) Issue

Climate change in the North Pacific since the early 1990s has strongly influenced steelhead and salmon returns to BC's south coast and particularly to ECVI watersheds. In reference to impacts of climate change on fisheries, Environment Canada states: "*In the Pacific, the abundance of the southern salmon populations are expected to decline…*" (http://www.ec.gc.ca/climate/overview_science-e.html). In response to changing weather patterns, freshwater productivity has declined with an increased frequency of flood and drought events. In an analysis of the decline of steelhead at the Keogh River on northern Vancouver Island, Ward (2000) concluded that due to *factors influencing steelhead in* the ocean and *freshwater*, harvest impacts must be reduced and *appropriate stock rebuilding measures implemented*.

On the ECVI the occurrence of summer droughts over the last decade has been tied to below normal precipitation compounded by low residual mountain snow packs. The net result is that streams unsupported by storage from lakes or reservoirs are increasingly subject to low flows and high water temperatures with significant impacts to native salmon and trout stocks. This is particularly true for species like steelhead and anadromous cutthroat trout and coho salmon that depend on extended stream rearing (up to 3 years) before migrating to the ocean as smolts. Droughts and warm water also affect the survival and reproductive success of early migrating summer run steelhead (Chemainus, Puntledge).

Wightman et al. (1998) documented significant declines of winter steelhead in the 1990s on Vancouver Island, particularly central east coast watersheds. Subsequently, in acknowledgement of further regional declines in steelhead abundance on BC's south coast, the province and the Pacific Salmon Foundation commissioned the Greater Georgia Basin Steelhead Recovery Action Plan in 2002 by A.F. Lill and Associates. Lill states "…wild stocks in most systems will not recover unless their freshwater productivity can be significantly increased to compensate for reductions in marine survival."

Should no action be taken towards insulating BC's trout and salmon stocks (particularly stream rearing species) from chronically low stream flows, many stocks whose watersheds lack storage will experience reduced productivity, be less able to support traditional sportfishing opportunities and may require even more costly protective, regulatory and restorative measures to be implemented.

Restoring watershed processes, particularly creation of headwater storage to reduce drought impacts, is consistent with the BC government's plan to improve scientific understanding of water management issues related to climate change, develop practical tools and strengthen water management policies ("Weather, Climate and the Future - BC's Plan, December 2004). Through adaptation, the goal is to be able to reduce some of the adverse effects of climate change. New models for water management and allocation are being considered for community level implementation, such as presently envisioned for Sooke, Cowichan Valley, Englishman (Parksville-Qualicum) and Nicola (southern Interior).

Development of new storage and refinement of existing supply structures (or their management) in support of fish conservation is also consistent with strategies identified in the Greater Georgia Basin Steelhead Recovery Action Plan (Lill 2002), the BC Living Rivers – Georgia Basin & Vancouver Island Program, and a commitment by the current government to "lead the world in sustainable environmental management, with the best air and water quality, and the best fisheries management - bar none" (Feb 2005 Speech from the Throne). This proposal is based on a strategic partnership between MoE, DFO's Resource Restoration Division and Ducks Unlimited among others to develop and/or improve the use of storage in large and small salmon-bearing streams between Victoria and Port Hardy.

c) Project Objectives

Initial assessment and ranking of potential storage projects on ECVI headwater lakes and wetlands is complete. Working with project partners, BCCF continues to identify institutional, biological and engineering factors and constraints to be considered/assessed prior to further project development (i.e., dam/weir construction/modification). Consultations with and support from landowner and/or tenure holders and First Nations is crucial to the success of such projects. This project has initiated the hydrologic, engineering and other feasibility assessments required to confirm or reject candidate sites identified since 2006. Specific objectives are as follows:

- Prioritize and further refine candidate sites based on initial feasibility results since 2006 and through ongoing liaison with landowners, tenure holders, federal-provincial fisheries, Ducks Unlimited, FNs, and community stewardship groups.
- Continue field investigations to identify road access, adjacent land tenure/use, suitable storage elevations based on natural high water indicators, impacts to private property and, in particular, downstream flow benefits to anadromous and resident fish by measuring habitat increases under various flow regimes and through habitat suitability assessments.
- Initiate/continue assessment of biological impacts of potential dam/weir construction (i.e., fish and wildlife impact studies)
- Summarize conceptual designs, preliminary construction costs and mitigation and/or compensation issues related to storage development for each site.
- Where project benefits are clearly identified and institutional/community support of conceptual designs is confirmed, prepare blue print designs for implementation in the next fiscal year. A final report will be submitted to HCTF and other funders by the appropriate time lines.

7. ACTIVITIES/TECHNIQUE(S)

Results to date were summarized and presented by BCCF to DFO, MoE and Living Rivers project partners on June 14, 2007. Through examination of factors at each site such as existing base flow (expressed as % of mean annual discharge; MAD), site area, potential base flow increase, stock(s) status, and potential partners (for funding and/or institutional support/licensing), the candidate list was prioritized (Table 1).

Table 1. List of high and moderate priority potential water storage sites on east coast Vancouver Island.

Watershed	Sub-Basin	Site(s)	Target Stream(s)	Priority
Cowichan	Somenos	Crofton Lake	Richards Creek	High
Chemainus	Holyoak	Holyoak Lake	Chemainus River	High
Nanaimo	South Nanaimo	City Reservoirs (existing/future)	South Nanaimo, Nanaimo rivers	Mod
Millstone		Westwood, Witchcraft, Diver, Brannen lakes	Millstone River	High
Englishman	South Englishman	Healy Lake	South Englishman, Englishman rivers	High
French	Hamilton	Hamilton Marsh	French Creek	High
Courtenay	Tsolum	Wolf and Regan lakes	Tsolum River	High
Black	Railway	Railway Marsh	Black Creek	High
Quinsam		Upper Quinsam Lake	Quinsam River	High
Cluxewe	Skidder Chain	Skidder Lakes	Cluxewe River	Mod
Keogh		Keogh and O'Connor lakes	Keogh River	High

Site-specific activities were then initiated with the goal of meeting overall project objectives. The diversity of projects has dictated the need for an individual approach for each site. Several sites have existing infrastructure including Crofton, Holyoak, Nanaimo City reservoirs, Westwood, Wolf, Upper Quinsam, and Keogh lakes. These sites have varying levels of environmental

impacts associated with their facilities or their operation. Remaining sites have relatively few human impacts to date beyond those typically associated with recreational use or adjacent forest harvesting. Project activities undertaken at each site this year were as follows:

Crofton Lake/Reservoir

- Communications and on-site meetings with District of North Cowichan (DNC; landowner and license holder) engineering staff to manipulate storage releases, facilitate flow study, and consider engineering options to improve storage releases to benefit fish.
- Flow and habitat measurements/monitoring in Richards Creek target reach with DFO staff and local community members to quantify potential benefits of increasing summer base flows.

Holyoak Lake/Reservoir

- Communications and/or on-site meetings with TW (landowner), Halalt First Nation, DNC engineering (license holder), MoE, and federal EAO and Fisheries staff as well as consultants examining DNC's Chemainus Well Project.
- Site reconnaissance and field visits with consulting engineers to consider options for increasing storage and re-routing releases to original drainage to increase benefits to Chemainus fish stocks.
- Initiate technical scoping document to outline appropriate steps to achieve storage objectives.

South Nanaimo Reservoirs

- Discussions with City of Nanaimo (CoN) staff to clarify their timelines for South Nanaimo River water storage expansion and communicate MoE/DFO interest in ensuring that designs allow for improved flow conditions for fish (i.e., summer rearing, fall migration) downstream of South Nanaimo River Reservoir #1 (lowermost dam; anadromous barrier).

Westwood Lake

- Site reconnaissance to examine options for flow improvements to existing outlet stream (McGarrigle Creek) versus the lake's original drainage (Darough Creek) and to determine benefits and drawbacks of each approach.
- Water Management Consultants (Richmond, BC) was contracted to undertake a hydrology study of the storage requirements on Westwood Lake to provide target flows downstream in the Millstone River. Study objectives included:
    - Characterize the hydrology of Westwood Lake.
    - Determine required flow releases from the lake to achieve the design flow on the lower Millstone River and in the new Bowen Park Bypass Channel.
    - Simulate operation of Westwood Lake with the inflows and outflows to determine the lake level fluctuations with and without the storage releases.
    - Provide conceptual design drawings of the required outlet facilities at Westwood Lake.
- Review and integrate into project planning recommendations made in *Assessment of Potential Impacts of Proposed Water Level Changes on Amphibians, Fish, Birds, and Plants at Westwood Lake*, by E. Wind Consulting, commissioned by DFO for the project.
- Communications and meetings with DFO and staff from CoN (landowner and license holder) Parks, Recreation & Culture and Engineering departments to develop the storage release concept, address issues and gather support to proceed with modifications planned for 2008 (see separate 2008/09 HCTF proposal "Millstone River Flow Improvement Implementation").

Healy Lake

- Meetings with landowner TimberWest regarding support for project, potential impacts to their forest land base, and likely mitigation/compensation requirements.
- Discussions with Regional District of Nanaimo (RDN) staff regarding the region's current and future domestic water supply needs, and what role they may play in new storage creation.
- Site reconnaissance to document high water indicators and shoreline conditions and to examine outlet configuration and substrates to confirm impoundment suitability.
- Flow and habitat measurements/monitoring on lower South Englishman River target reaches in partnership with local streamkeepers conducting other flow-related assessments in the watershed.
- Presentation of project concept to local community stewards (Mid-Vancouver Island Habitat Enhancement Society).

Hamilton Marsh

- Site reconnaissance with DFO and members of Friends of French Creek/Hamilton Marsh to discuss establishing 30 cm of storage on the marsh, and implications/status of community and TNT efforts to purchase the marsh and surrounding area from Island Timberlands Limited Partnership.
- Co-funded with DFO the sub-contracting of E. Wind Consulting to complete *Assessment of Potential Impacts of Proposed Water Level Changes on Amphibians, Fish, Birds, and Plants at Hamilton Marsh*, and review/consider results and their implications on the Hamilton Marsh project.

Wolf Reservoir/Regan Lake

- Meetings with landowner TimberWest regarding support for project, potential impacts to their forest land base and hauling road system (Wolf), and likely mitigation/compensation requirements.
- Meetings with DFO (license holder) at Puntledge Hatchery and on site (at Wolf Lake reservoir) to discuss potential for modifications to outlet structure for additional storage. DFO supports the concept.

Railway Marsh

- Review *Black Creek Wetland Recon*, a DU Canada report on potential storage candidate sites in Black Creek watershed.
- Communications with TimberWest (part landowner) regarding potential access, mitigation, and/or compensation for storage creation.
- Discussions with DFO staff who originally identified "Railway" site.
- Reconnaissance of southern perimeter of "Railway" site to quantify potential inundation zone.

Upper Quinsam Lake/Reservoir

- Preliminary meetings with BC Hydro (facility owner, license holder). BCH supports the project, understanding that it will improve their ability to meet new minimum flows recommended in the Campbell River WUP Consultative Committee Report (soon to be implemented).
- Consultations with local First Nations (Campbell River Indian Band, A-Tlegay Fisheries Society), DFO habitat staff and the MoE Lakes Biologist.
- Site reconnaissance of Upper Quinsam tributaries, access roads, connection channel to Wokas Lake, and Wokas Lake dam infrastructure.

Skidder Lakes

- Communications and/or on-site meetings with Kwakiutl FN (KFN), DFO, North Vancouver Island Salmon Enhancement Association and Western Forest Products (tenure holder) regarding storage site options and involvement in habitat/forest land base impact assessments.
- Field reconnaissance of upper and lower Skidder Lake to document high water indicators and shoreline conditions and examine outlet configuration and substrates for weir placement.
- Pacificus Consulting Ltd. was sub-contracted to work with/mentor KFN fisheries staff in flow and habitat measurements/monitoring on Cluxewe River target reaches to quantify habitat improvements stemming from augmented streamflows.

Keogh and O'Connor Lakes

- Communications with MoE/UBC Fisheries staff, DFO, North Vancouver Island Salmon Enhancement Association and Western Forest Products (tenure holder) regarding options for new storage (O'Connor) and to better use existing storage (Keogh Lake). Synoptic surveys of the outlets of Keogh and O'Connor lakes.

8. FOR PROGRESS REPORTS ONLY - REMAINING ACTIVITIES IN THE YEAR

Communications and consultation will continue with FNs, community stakeholders and potential project partners, as required. Water license applications will be prepared and submitted where appropriate. Site specific activities for the balance of the year include:

Crofton Lake/Reservoir

- BCCF and their engineer consultant will work with DNC engineering and DFO staff to design suitable release mechanisms for installation in 2008.
- Flow and habitat measurements/monitoring in Richards Creek will be completed, and data processed to confirm expected habitat improvements from augmented base flows.

Holyoak Lake/Reservoir

- Technical scoping document to outline appropriate steps to achieve storage objectives will be drafted/refined in consultation with DNC.

Westwood Lake

- Water Management Consultants (Richmond, BC) will complete hydrology study and work with BCCF, CoN and DFO on conceptual design drawings of the required outlet facilities at Westwood Lake.
- When release structure design is complete, initiate construction planning, tendering, contracting.

Healy Lake

- Complete/analysis of flow and habitat measurements and monitoring results from lower South Englishman River target reaches. Model habitat gains and potential fish production resulting from flow augmentation.
- Plan and sub-contract required impact assessments.

Hamilton Marsh

- Depending on status of community and TNT efforts to purchase Hamilton Marsh, preliminary design and construction plans to create 30cm of storage may be initiated.

Wolf Reservoir/Regan Lake

- Sub-contract conceptual design to raise outlet of Wolf Lake at least 30 cm. This design will form the basis of discussions with TimberWest, allowing impacts to their land base to be identified. A concept to divert water out of the lake's north end to a higher tributary of the Tsolum River will also be explored.
- Field reconnaissance to Regan Lake, the largest lake in the Tsolum sub-basin after Wolf, with project partner Tsolum River Restoration Society and their contracted hydrologist will occur following leaf fall when surveys are most easily completed and timed with high water to better document the natural inundation zone. This work may be combined with a helicopter over-flight.

Railway Marsh

- Through ground surveys and a helicopter over-flight, complete reconnaissance of "Railway" site during high water to quantify inundation zone and potential impacts to nearby private properties.

Upper Quinsam Lake/Reservoir

- Prepare for first multi-stakeholder meeting in Campbell River at BC Hydro offices on November 30, 2007.
- Work with MoE Lakes Biologist to clarify current impacts from BCH drawdown procedures, identify concerns over accessing new negative storage, fill data gaps needed to assess status quo and determine potential mitigation options.

Skidder Lakes

- Process flow and habitat measurements/monitoring on Cluxewe River target reaches.
- Model habitat gains and potential fish production resulting from flow augmentation.

Keogh and O'Connor Lakes

- To provide rationale for storage improvements, collect and examine existing river height and Keogh Lake weir data from UBC Fisheries Research staff (discharge data has never been regularly collected at Keogh River) and examine methods to convert information to discharge data.
- Consider installation of permanent hydrometric station on lower river, to be maintained by staff conducting annual counting fence operations.
- Survey (rod and level) Keogh Lake outlet
- Sub-contract conceptual design for 0.5-1.0m of storage on O'Connor Lake, allowing impacts to WFP forest tenure to be quantified for discussion.

9. MEASURES OF RESULTS

To date, projects in 11 watersheds have been identified and ranked as moderate and high priority. Progress on each project is varied, but field surveys have occurred on each and the majority of stakeholders have been contacted. On several sites, habitat improvements have been documented under augmented flow conditions, and will be included in annual project reporting. Environmental impact and hydrology assessments have been completed or are underway of a number of sites. Implementation phases are being considered and/or scheduled for 2008 on at least three project sites (Crofton, Westwood, Wolf).

Working relationships with regional/municipal governments, FNs, and local Streamkeepers continue to be fostered through ongoing consultations and planning exercises.

An integrated summary report of all projects including concepts, assessments, cost/benefits, consultations and any engineering designs, will be compiled and submitted by March 31, 2008 to HCTF and other funders, and made available to fisheries and water stewardship agencies, First Nations, community resource stakeholders and the private sector, where applicable.

10. BENEFITS/RISKS

For each storage candidate, salmon and trout production benefits have been estimated using current biostandards and predictive models. As this project is geared toward feasibility work, actual benefits will only be realized when projects are implemented in the future.

Lessons learned from current storage development projects on Cameron, Cowichan and Quatse lakes will help guide projects relative to the legal requirements of MoE's Water Stewardship Division, construction, design, cost, landowner and environmental considerations.

Typically affecting fish, wildlife and communities at large, water storage and flow augmentation projects are multi-faceted in nature, requiring extensive consultation with landowners, tenure holders, government agencies and community stakeholders. The degree of human development around and downstream of the site often dictates project complexity and may influence timelines and ultimately budgets. This initiative seeks to develop a balance of projects to ensure that some sites are fully prescribed and near implementation stage at its completion.

With support from the provincial Living Rivers Trust Fund through 2009, projects that require more than one year to develop to the implementation stage are assured of a base level of funding to complete tasks required. As this year's project is limited to feasibility, no construction-related liability exists.

11. EXTENSION/PUBLIC INFORMATION/PARTICIPATION/PARTNERS

Media coverage pertaining to this initiative is attached. There has been no negative reaction to projects to date, though public consultations have yet to occur for several sites.

A website being designed for the provincial Living Rivers Trust Fund will promote this project and acknowledge all co-funders including HCTF.

Partners are crucial to this initiative, particularly with respect to implementation phases and ongoing legal requirements (i.e., landownership, land claims, licensing, maintenance, etc.). Accordingly, including them from the start of the process is seen as critical to future project success.

12. CONTRACTOR PERFORMANCE

Contractor and sub-contractor performance has been satisfactory to date. Feasibility activities have been completed safely, at a satisfactory pace, and on budget. The contractor communicates well with project funders, partners and MoE/DFO managers, and provides regular project updates.

13. PHOTOGRAPHIC RECORD

Monitoring stream flow on the Cluxewe River near Port McNeill……..and Richards Creek near Duncan.

Westwood Lake storage dam, Nanaimo.

Beaver dam, Healy Lake outlet, upper S. Englishman River.

BC Hydro storage dam including spillway (E), sluiceway (F) and trash rack (A) at outlet of Wokas Lake, upper Quinsam River.

14. Financial Details

As of November 14, 2007, approximately 44% of the budget has been spent. In addition to BCCF technician wages, major expenses include a hydrology study by Water Management Consultants Inc. (Richmond, BC) on Westwood Lake (Millstone watershed) to aid design work, and an amphibian, fish, bird, and plant impact assessment by E. Wind Consulting (Nanaimo, BC) on Hamilton Marsh (French Creek watershed). .

Project Financial Report

Proponent / Project Leader: Craig Wightman **HCTF Proj. #:** 1-430

HCTF Approved Budget Amount: $25,000

Project Name: ECVI Water Storage Feasibility, Yr 2 of 5.

Reporting Period: 04/01/07 (mm/dd/yy) to 11/14/07 (mm/dd/yy)

Reporting Purpose: ☒ Progress Report ☐ Annual Report ☐ Final Report

PART 1. FINANCIAL REPORTING (HCTF MONIES ONLY)

A. Labour Costs

i. Human Resources – Wages & Salaries

Position	# of Crew	# of Work Days	Rate/day	HCTF Amount
Project Coord	1	5.7	280	1596.00
Fish Tech	1	3.7	250	925.00
Research	1	2.02	200	404.14
Person Days (# of crew x work days)			**Subtotal i**	$2925.14

ii. Subcontractors & Consultants (provide details in text)

Contractor	# of Crew	# of Work Days	Rate/day	HCTF Amount
Bio consultant (E.Wind Assoc)				1270.00
Eng consultant (Water Mgmt Con)				2491.79
			Subtotal ii	$3,761.79
			A. Total Labour Costs	$6,686.93

B. Site / Project Costs

	Details	HCTF Amount
Travel		53.15
Small Tools & Equipment		
Site Supplies & Materials	Field equipment	228.41
Equipment Rental	Flow meter, 7.5 days	525.00
Vehicle Rental (incl. Helicopters)	21.5 days, truck lease incl ins	2,150.00
Work & Safety Supplies		
Repairs & Maintenance		
Permits		
Technical Monitoring		
Other Site / Project Costs	GST	115.01
	B. Total Site / Project Costs	$3,071.57

C. Overhead

	Details	HCTF Amount
Office space, utilities, etc.		
Insurance		
Office supplies		
Telephone & long distance		
Photocopies & printing		
Administration fees		
Other overhead costs	BCCF 12.5% on chgs to date	1,219.81
	C. Total Overhead Costs	$1,219.81

PART 2. SUMMARY OF EXPENDITURES FROM ALL FUNDING SOURCES (Please list all partnership funding for the project and identify the partner)

	HCTF Funding Amount	Other Funding			Total
		Source	In-kind	Cash	
A. Labour Costs	6,686.93	PSC, GBVILR, MoE, DFO	3,000.00	17,966.55	27,653.48
B. Project / Site Costs	3,071.57	PSC, GBVILR,		14,646.50	17,718.07
C. Overhead Costs	1,219.81	PSC, GBVILR,		4,121.14	5,340.95
Total Costs	$10,978.31		3,000.00	36,734.19	$50,712.50

PART 3. EQUIPMENT PURCHASE SUMMARY

Equipment (list items >$1000 purchased and quantity)	Serial Number	Dollar Value	Location Stored	Contact

Certified that the project has been satisfactorily completed and all purchases and equipment over $1000 per item have been returned in satisfactory condition.

Project Proponent Signature | Date | Print Name

HCTF USE ONLY – Financial Report Accepted by:

Comptroller, Habitat Conservation Trust Fund | Date