Bonneville Power Administration
Fish and Wildlife Program FY98 Watershed Proposal Form

Section 1. General administrative information

Title Upper Toppenish Creek Watershed Analysis

Bonneville project number, if an ongoing project 8065

Business name of agency, institution or organization requesting funding
Yakama Indian Nation

Business acronym (if appropriate) YIN

Proposal contact person or principal investigator:

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Subcontractors.

Organization	Mailing Address	City, ST Zip	Contact Name

NPPC Program Measure Number(s) which this project addresses.
7.6a-d; 7.8a,b,e

NMFS Biological Opinion Number(s) which this project addresses.
N/A

Other planning document references.
Wy Kan Ush Me Wa Kush Wit, Yakima River Subbasin, basinwide recommendations; Yakima River Subbasin Salmon and Steelhead Production Plan, Steelhead Strategies 2-7; Yakima River Basin Water Enhancement Project, (Title XII) **Subbasin.**
Yakima River

Short description.
Inventory extent and condition of areas storing natural peak flow and generating base flow in Toppenish Basin; restore natural storage and release mechanisms through passive and active restoration; monitor to quantify success and adapt/refine strategies

Section 2. Key words

Mark	Programmatic Categories	Mark	Activities	Mark	Project Types
X	Anadromous fish		Construction	X	Watershed
+	Resident fish		O & M		Biodiversity/genetics
+	Wildlife		Production		Population dynamics
	Oceans/estuaries		Research	+	Ecosystems
	Climate	+	Monitoring/eval.	+	Flow/survival
	Other	X	Resource mgmt		Fish disease
			Planning/admin.		Supplementation
			Enforcement	+	Wildlife habitat enhancement/restoration
			Acquisitions		

Other keywords.
base flow, temperature, restoration,

Section 3. Relationships to other Bonneville projects

Project #	Project title/description	Nature of relationship

Section 4. Objectives, tasks and schedules

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Identify opportunities to increase water storage capability in key base flow source areas in the upper Toppenish Creek watershed.	a	Perform field reconnaissance, GIS analysis and aerial photograph interpretation to identify potential base flow source areas.
		b	Assess identified areas for condition, trend, causes of reduced storage capability and potential for

			increased storage/baseflow delivery.
		c	Identify areas responsive to passive restoration.
		d	Prioritize remaining areas, based on cost-effectiveness of treatments required to increase storage capability

Objective schedules and costs

Objective #	Start Date mm/yyyy	End Date mm/yyyy	Cost %
1	3/1998	9/1998	99.99%
			TOTAL 99.99%

Schedule constraints.

Completion date.
1998

Section 5. Budget

FY99 budget by line item

Item	Note	FY98
Personnel	FISCAL YEAR 1998 PROJECT	$42,700
Fringe benefits		$10,803
Supplies, materials, non-expendable property	Office supplies, field supplies, notebook computer	$14,895
Operations & maintenance	Vehicles, insurance, office space	$5,600
Capital acquisitions or improvements (e.g. land, buildings, major equip.)		
PIT tags	# of tags:	
Travel		
Indirect costs		$19,683
Subcontracts		

Other		
TOTAL		$93,681

Outyear costs

Outyear costs	**FY99**	**FY00**	**FY01**	**FY02**
Total budget				
O&M as % of total				

Section 6. Abstract

We propose an analysis and restoration project which focuses effort on those key watershed features in the Toppenish Creek Basin that have a spatially disproportionate influence on runoff processes. The goal is to identify those areas where restoration can achieve the maximum benefits for streamflow, habitat, and water quality at lowest cost. Runoff of snowmelt or rainfall is slowed by natural watershed processes, with the result of decreasing peak flows and increasing base flows. Water enters temporary storage within the watershed during times of high precipitation or runoff and is released from storage as streamflow during times of limited precipitation and runoff. This natural regulation is essential for maintaining channel form and aquatic ecosystems in east-side watersheds. Key areas of the watershed are those with a disproportionately high storage capacity and influence on watershed function, biological productivity and biological diversity. Loss of natural storage increases peak flows, reduces base flows and causes higher stream temperatures, destabilizes channels, and favors exotic plant and animal species. Restoring lost function of important areas drives rapid change toward natural runoff patterns and native ecosystem function The inventory will be completed by the end of fiscal year 1998. Data collection will be designed to measure the effectiveness of particular measures, rather than to produce a broad quantification of watershed processes.

Section 7. Project description

a. Technical and/or scientific background.

It is a first principle of watershed hydrology that runoff of snowmelt or rainfall is slowed by natural watershed processes, with the result of decreasing peak flows and increasing base flows (e.g., Dunne and Leopold, 1978). This process occurs as water enters into temporary storage within the watershed during times of high precipitation or runoff and is released from storage as streamflow during times of limited precipitation and runoff. Drainage systems and associated aquatic and terrestrial ecosystems evolved into equilibrium with streamflow patterns where these natural storage and release mechanisms were functioning. In east side watersheds (east of the Cascade Range), such as Toppenish Creek Basin, these mechanisms are essential to sustaining aquatic life. Because these processes naturally moderate the magnitude of floods and increase the delivery of streamflow, to lowland areas during the summer, they are also of great importance to downstream human residents of the watershed.

The natural capacity of a watershed to store water is not evenly distributed across the watershed. Some areas have a high capacity to allow the infiltration of water from the surface and a disproportionately large volume in which to store precipitation and runoff, while other areas are relatively impervious to infiltration and have a relatively low volume of porous material in which to store water. Watersheds that have a high capacity to store water have relatively lower peak flows and higher base flows than watersheds with similar climate, but less natural storage. When the storage mechanisms in a watershed become degraded, peak flows increase and base flows decrease. Side effects of these changes include destabilization of stream beds and banks, hotter summer stream temperatures, loss of native vegetation and animal life, and proliferation of non-native species. Restoring the lost hydrologic function of these important areas and removing the cause of that loss has been shown to drive rapid change back toward natural runoff patterns and native ecosystem function (Stanford et al, 1995).

Typically, climatic conditions in east side watersheds cause the seasonal snowpack to run off relatively early in the season (Mundorff et al, 1977; USGS, 1975). This early runoff is generally not sufficient to provide streamflow through the long, dry summer season. The fact that the streams flow at all in the late summer is a demonstration that the watersheds are releasing water they had previously stored.

Air temperatures east of the Cascades are high during the summer and cold during the winter. The same mechanisms which decrease peak flow and increase base flows act to moderate stream temperatures. Most water enters into storage in spring, when water temperatures are cold. Once in the ground, the water is insulated from atmospheric heating, and release of this water cools the streams and provides thermal refugia for fish. At the other extreme, discharging groundwater locally prevents freezing of streams, providing winter refugia.

Under natural conditions, the areas of natural storage in watersheds typically stayed relatively wet and maintained high water tables well into the summer. This pattern caused them to be populated by characteristic plant and animal life dependent on such conditions. These areas tend to be the focus of biological production and diversity in the watershed making them important out of proportion to their areal extent (Stanford and Ward, 1988). In their degraded condition, many meadow and riparian complexes have become incised, limiting opportunities for water to enter storage and causing rapid draining and desiccation of the soil or alluvium. As a result, native wetland vegetation has been replaced by upland vegetation. Native animal species have suffered in kind, greatly reducing the ecological diversity of the entire watershed.

Channels downstream of areas of natural storage evolved configurations controlled, in part, by the patterns of inflow from above, including reduced peak flows and sustained summer flows. Loss of natural storage upstream causes channels to expand due to higher peak flows. The enlarged channels then receive less summer flow. The results are less usable habitat in the channel during the summer and increased stress to riparian vegetation due to lowering of the water table caused by downcutting and smaller summer water budget. Restoration of lost natural storage function upstream will drive passive restoration of such downstream reaches. This approach has been demonstrated to yield better results than active restoration attempts using instream structures in controlling channel changing processes that are being driven by upstream changes in runoff processes.

Toppenish Creek is approximately 75 miles long, discharging into the Yakima River near Granger at mile 80.4. Its 625-square-mile watershed comprises more than ten percent of the Yakima Basin and lies wholly within the Yakama Indian Reservation. Simcoe Creek, which drains an area of 141 square miles, discharges into Toppenish Creek near its midpoint. Both Toppenish and Simcoe Creek flow through the Wapato Irrigation Project. Both creeks are heavily diverted by private irrigators and by the Wapato Project. Farther downstream, both creeks receive heavy flows of warm and turbid Project tailwater.

The Toppenish Creek basin supports a small summer steelhead run which has generally declined over the last decade. The population nevertheless appears to be genetically distinct from other populations in the Yakima Basin. Juvenile steelhead are spawned and reared primarily upstream from irrigation diversions in Toppenish Creek and its North Fork.

Using a combination of redd counts and radiotagging data, an adult steelhead run size of 100 fish seems to have been typical for the years 1989 through 1992. Since then, adult escapements to Toppenish Creek are likely to have followed the trends further downward seen elsewhere in the Yakima River subbasin.

The Toppenish Creek basin can be broadly subdivided into an upland region and a lowland region (USGS, 1975). The lowland region consists of a broad valley floor made up of gravels and other sediments delivered to the valley by Toppenish Creek, its tributaries, and the Yakima River. The lower 40 miles of Toppenish Creek flow across this alluvial valley. Through this valley reach, the creek is subjected to a host of alterations by agricultural activities, flood control, and road building.

In the Toppenish Creek Basin uplands, the most important natural mechanisms for moderating runoff occur in the meadow complexes high in the watershed and flood plain reaches in the complex of canyon streams draining the upland.

The drainage divide separating the Toppenish Creek drainage from the Klickitat River drainage to the west is not a sharp divide, but rather a broad plateau underlain by nearly horizontal volcanic rocks. This plateau features several large meadow complexes. These meadows capture a portion of the snowmelt-generated seasonal runoff and return this water to the stream system along flow path varying in length from a few feet to tens of miles. Much of the late summer flow in the watershed originates as infiltration into the soils on the plateau. Previous studies have indicated that recharge from this plateau area is also the source of water for groundwater flow in the deep aquifer system discharging to the Yakima River, tens of miles east of the source (Hendry et al, 1992).

Lower in the watershed, streamflow is largely in narrow canyons without much ability to store and release water. At places within the drainage, however, gravel flood plains act to retard runoff, diffuse stream energy to some degree and cool the streams by storing and releasing cold spring runoff. Such alluvial flood plain reaches serve as centers of productivity of the aquatic food web of which the fish are a part.

No inventory of these areas of disproportionate importance in moderating streamflow and temperature or assessment of their functioning condition has been undertaken across the Toppenish Creek Basin. The purpose of this proposal is, initially, to inventory and evaluate the condition of these areas, and second, to develop a program of restoring them and monitoring improvement in system function.

b. **Proposal objectives**.

We propose an analysis project which focuses on those key watershed features in the Toppenish Creek Basin that have a spatially disproportionate influence on runoff processes. In the Toppenish Creek watershed these features are meadow complexes, riparian areas, flood plains, and roads. The analysis will generate a prioritzed plan for restoration and monitoring of these natural storage areas. Passive restoration will be our first priority. Sites proposed for active restoration will be those where existing data and professional judgment suggest that the maximum restoration of natural watershed function can be gained at minimum expense of cost, time, and labor. Proposed monitoring will be designed to measure the effectiveness of particular measures, rather than to produce a broad description of the watershed. The plan generated by this analysis will be intended to maximize benefits to the watershed, produce focused, significant records of the effectiveness of restoration treatments to help guide the restoration efforts of other professionals in the field, and minimize unnecessary cost.

c. **Rationale and significance to Regional Programs**.

This proposal would complement the Toppenish/Simcoe Instream Flow Restoration project (funded by BPA) and the Toppenish Creek Corridor Enhancement Project, a planning effort currently involving the Yakama Indian Nation under Public Law 103-434 (Yakima River Basin Water Enhancement Project or YRBWEP). Both of these projects focus on activities downstream from the project proposed here, but will provide valuable information as part of a watershed approach and will help to establish watershed and stream connectivity. In addition, the Satus Creek Watershed Restoration Project has acquired equipment and expertise in water and fisheries monitoring that will be useful to this project. An overriding goal of each of these projects is to decrease watershed fragmentation and provide for connected systems which more closely mimic natural watershed hydrologic function, species assemblages, vegetation, and cultural values.

d. **Project history**

Type here (provide answers in paragraph form)

e. **Methods**.

Tasks:
A) GIS analysis and aerial photograph interpretation will identify landscape features, such as floodplains and headwater meadows, which normally store water during runoff periods and release it as base flow. Also identified will be road sections which drain directly toward a channel (including the ephemeral and intermittent channel system). The extent and location of these features will be ground-truthed by technicians.

B) The areas identified in Task A will be assessed by an interdisciplinary team composed of professional staff (i.e., hydrologist, watershed biologist, and hydrogeologist/geomorphologist) to evaluate condition, trend, causes of reduced storage capability, and potential for increased storage/baseflow delivery.
C) The interdisciplinary team will identify which of those areas are capable of recovery if given passive restoration treatments, and the specific nature of the passive restoration that is needed for recovery.
D) The remaining areas will be prioritized for proposed restoration, based on the cost-effectiveness of the combination of active and passive restoration needed to recover lost storage capability.

This analysis will yield a plan for restoring lost baseflow storage in the upper Toppenish/Simcoe watershed. The plan will be prioritized for cost-effectiveness, and will prioritize passive treatments over active ones.
Our assessment and findings (i.e., proposed plan for restoration of watershed storage capabilities) will be based on the following assumptions:
1. The stream/riparian ecosystem is an expression (integration) of the functioning of the entire watershed, i.e., the landscape-scale interactions between soil, water, and vegetation.
2. Long-term sustainability of aquatic and terrestrial ecosystems rely on developing land uses which allow the soil-water-vegetation interactions to remain within a natural range of variability.
3. Vegetation is the key to stabilizing soils and moderating the routing of water and sediment through the watershed; manipulation of the vegetation is our primary tool for restoring watershed functioning and normative channel conditions.
4. Passive restoration opportunities should be our restoration priority.
5. Our restoration proposal, if implemented, will gradually alter the routing of soil and water through the watershed, returning them to within the range capable of supporting healthy aquatic ecosystems.

The critical uncertainty associated with this analysis is the extent to which the natural storage areas of the upper Toppenish/Simcoe watershed have been degraded, i.e. the amount of base flow that can be generated by active and passive restoration in the upper watershed storage areas.

f. Facilities and equipment.

The ongoing Satus Creek Basin Watershed Analysis project has already assembled much of the human and equipment resources needed for the project. We are requesting two vehicles and a notebook computer (see budget).

g. References.

Hendry, J., Armstrong, S., and Ring, T., 1992, Application of Environmental Isotopes to the study of groundwaters in the Toppenish Creek Basin, Washington: in Jones, M.E., and Laenen, A., Interdisciplinary Approaches in Hydrology and Hydrogeology, American Institute of Hydrology, P. 107-118.

Mundorff, M.J., MacNish, R.D., and Cline, D.R., 1977, Water Resources of the Satus Creek Basin, Yakima Indian Reservation, Washington: U.S. Geological Survey Open-File Report 76-685, 102p.

Stanford, J. A. and others, 1995, A general Protocol for the Restoration of Regulated Rivers: Regulated Rivers:Research and Management (in press).

Stanford, J.A., and Ward, J.V., 1988, The hyporheic habitat of river ecosystems: Nature, V. 335, No. 6185, pp.64-66.

U.S. Geological Survey, 1975, Water Resources of the Toppenish Creek Basin, Yakima Indian Reservation, Washington: U.S Geological Survey Water-Resources Investigations 42-74.

Section 8. Relationships to other projects

This project principally relates to the other projects in progress in Toppenish Creek Basin (as discussed in section 3). This project is needed to help provide base flow to the extensive alluvial fan system in the lowlands where restoration efforts are being planned, but summer flows are critically low. The federal Yakima River Water Enhancement Project is a major effort to restore streamflow, habitat and fish runs in the Yakima River Basin.

Section 9. Key personnel

Gina has this on a spreadsheet.

Section 10. Information/technology transfer

The approach to monitoring described above should be of use to others working in the Columbia Basin. The results of this project will be presented at meetings and, if appropriate, published in the literature.