Attachment 1.

PROPOSED WORK PLAN

PACIFIC NORTHWEST HYDRO ASSESSMENT STUDY

PREPARED BY

THE NORTHWEST POWER PLANNING COUNCIL
700 S. W. Taylor
PORTLAND, OREGON 97205

AUGUST 1984

Note: This proposed work plan describes the general framework of the study. A more detailed work statement (identifying all specific work products and deadlines, for example) will be prepared to aid contracting. The work statement will be consistent with the work plan.

PACIFIC NORTHWEST HYDRO ASSESSMENT STUDY

TABLE OF CONTENTS

Subject

Attachments

Montana Department of Fish, Wildlife and Parks Procedures for Classifying Montana Streams, Spring 1980

Application of Wildlife Values to Montana's Stream Classification System.

I. INTRODUCTION

The Pacific Northwest Hydro Assessment Study will develop data from which the Northwest Power Planning Council will address new hydroelectric development in the region. The Council plans to determine how much cost-effective hydro is realistic within the region for the purpose of preparing its power plan. Additionally, the Council plans to specify whether hydro sites would be consistent with the Council's efforts to protect, mitigate and enhance fish and wildlife in the region. Council preparation of a power plan and a fish and wildlife program are required by the Northwest Electric Power and Conservation Planning Act of 1980.

In its initial consideration of hydro availability, the Council was presented with estimates from 400 Mw to 4000 Mw. This study will help provide a more factual basis for estimating hydro availability but it will not answer all questions. This study does not review hydro sites with the same rigor as will be done in the licensing process. It does attempt to anticipate the results of the licensing process through use of relatively simple surrogate techniques. This work is done in a way that future work can build on it if such a need is identified.

The Hydro Assessment Study would provide the Council with information to aid in:

- -determination of the theoretical potential of hydro and its cost by characterization of both proposed and potential sites (work by the Corps of Engineers, BPA and the Council is currently underway).

- -ranking of hydro sites and designation of areas which should be protected from development based on fish and wildlife concerns (see Section II).

-an interim ranking of hydro sites based on anadromous and migratory fish concerns (see Section III).

-determination of how river values (fish, wildlife, recreation, cultural, natural features and institutions) will affect hydro development (see Section IV).

The Hydro Assessment Study will consider all rivers and streams at least as far upstream to include all hydro sites which have been proposed or that are potential as identified by the Corps of Engineers and tributaries as necessary to characterize their relative significance to river values.

The duration of the study is less than 15 months and will cost less than $1.2 million (see Sections VII and VIII, respectively).

II. SITE RANKING AND PROTECTED AREAS (ANADROMOUS FISH ASSESSMENT)

A. Purpose. The Council is required to develop a program to protect, mitigate and enhance fish and wildlife affected by hydropower facilities in the Columbia River Basin (Section 4(h) of the Regional Power Act). New hydroelectric development has the potential to adversely affect fish and wildlife by impeding migration or loss of habitat and may be beneficial by improving flows or water temperatures. Consequently, new hydro will have a spectrum of impacts -- some will be more or less desirable than others.

In its 1982 Columbia River Basin Fish and Wildlife Program, the Council committed to designate stream reaches and wildlife habitat areas which shall be protected from further hydroelectric development (Section 1204(c)(2)). In its 1983 Northwest Conservation and Electric Power Plan, the Council committed to ranking hydro sites in three categories based on their likely

impacts on fish and wildlife (Action Item 14.2). The purpose of this effort is to provide the data needed to fulfill these commitments.

B. Concept. The best method to rank hydro sites and to designate protected areas would be to design a hydro project for each stream reach, evaluate its impact on fish and wildlife as would be done in the licensing process, then rank and designate site based on the degree of impact. Such an effort would be expensive. Consequently, the Council has selected a less costly surrogate. The Council will make its decisions based on an estimate of the fish and wildlife resource values for each stream reach. The impacts of hydro development are assumed to be uniform from site to site.

For anadromous fish the assessment will estimate the resource value by characterizing the productivity of each stream reach. Productivity is defined to be comprised of three factors: smolt production, migration use and upstream geography which may, through sedimentation, affect downstream anadromous fish areas. This study will quantify the smolt productivity of each stream reach. Migration will be accounted for by including in any estimate of smolt production for an individual stream reach upstream productivity as well, i.e, the productivity will accumulate as one moves down a stream. Stream reaches upstream of anadromous fish areas which have the potential to adversely affect downstream use will be identified quantitatively.

For resident fish and wildlife, the Council will rely on state estimates of the value of stream reaches as identified in the River Assessment Study for non-Anadromous Fish Values (See Section IV).

C. Method. This subsection identifies the method for quantifying productivity of stream reaches which may support anadromous fish. The following data will be provided:

1. Estimate the amount of existing productivity for each stream reach
   a. species
   b. number of smolts
   c. wild or natural fish

2. Estimate the amount of potential productivity for each stream reach
   a. identify how much the existing levels identified in Step 1 could be increased;
   b. identify what actions are needed to achieve these higher levels.

The existing productivity is an observable fact. However, data may not be on hand. During the study process decisions will be made as to what techniques should be used to estimate missing data and to collect such data within the constraints of the budget and schedule.

The potential productivity of each stream reach and each species will be calculated in number of smolts (migrants) that could be produced at full seeding. It will be based on estimated rearing area and average production values (per unit area) determined from existing information sources. This measure of maximum natural smolt production is designed to quantify each system's maximum carrying capacity or smolt production potential if limiting factors, other than those inherent in calculation or average production values, were removed. Subsequently, those other limiting factors will be considered. The productivity will be estimated by the following steps:

Step 1. Review existing literature on salmon/steelhead smolt production per unit area. Identify the habitat characteristics and limiting factors in operation for each applicable study and develop a format for correlating habitat characterization and species with

average production values. Habitat characterization should be generalized and based only on the most critical elements of productivity as determined by the HASC.

Step 2. Compare the above attributes from relevant productivity studies to habitat classification for each basin and species (Step 5), and to the extent possible, determine the productivity value(s) that apply to each basin or subbasin and species.

Step 3. Review the literature and consult the involved fisheries entities and land management agencies to determine the most appropriate unit of measurement for quantification of rearing habitat. It should lend itself readily to the application of production factors previously identified.

Step 4. Survey the involved fisheries entities and determine the appropriate species for consideration in each river basin or appropriate subbasin.

Step 5. Survey all appropriate fisheries entities and land management agencies for existing habitat inventory data. Review the available data and determine the most appropriate method(s) for estimating and displaying the quantity and classification of rearing area quality between and within river basins or subbasins. Implement the methodology determined above and/or use maps, aerial photographs, and flow records in conjunction with local fisheries personnel (where other more specific information is not available) to estimate the size and classify the relative habitat quality of rearing area for each basin and for each appropriate species. The following are the only areas not to be considered in measuring rearing habitat: the areas upstream from Chief Joseph, Hells Canyon, Dworshak, Round Butte, Lookout Point, Detroit, Mossyrock, Merwin, Tieton, Bumping and McKay Dams and the habitat currently inundated by operational hydroelectric dams. Areas above upstream passage blocks should be included and optimum flows should be used

in calculating the rearing capacity of over-appropriated streams. Limiting factors are itemized and will be used elsewhere to rationalize the maximum potential obtained in this section of the study. Other innate constraints to production potential (e.g. summer-winter flows; stream geomorphology, etc.) should be identified and addressed for each basin or appropriate subbasin, and incorporated into the assessment of rearing area.

Step 6. Develop a numerical estimate of maximum smolt production potential for each river basin and applicable species using the data generated on quantity and quality of rearing area and smolt production per unit of area.

Step 7. Productivity estimations resulting from the above steps will provide a maximum migrant output number for each basin and stock. This number will be generated without considering factors limiting production which were not considered during the studies on unit area productivity. Consideration of factors which could prevent realization of the potential (limiting factors) is essential and will be provided.

Step 7a. For non-quantifiable limiting factors shown below, an empirical method for determining the relative influence of limiting factors will be developed by the HASC. Since there is insufficient information on direct fish loss resulting from non-quantifiable limiting factors, the relative magnitude of the effect of each factor will be defined in general terms from worst to least.

I. Quantifiable Limiting Factors

A. Up and downstream passage problems:

1. dams (smolts and adults)
2. low water flow

3. irrigation water systems
4. natural barriers (adult passage)

B. Spawning escapement (natural and artificial production) problems

C. Spawning area constraints

II. Non-Quantifiable Limiting Factors

A. Biological limiting factors:

1. fish disease
2. fish genetics
3. competition and predation

B. Man-induced limiting factors:

1. riparian habitat loss
2. streambed sedimentation - causes
3. pollution
4. irrigation water systems
5. streambed damage

Step 7b. For quantifiable limiting factors criteria will be established to assure that loss estimates are technically defensible and fully documented.

Step 7c. For each limiting factor the appropriate methods and/or procedures will be used from Steps 7a and 7b above to determine the effect. The limiting factors identified will be ranked from least to most important in terms of adverse production effect.

Step 7d. For each basin-spcific limiting factor, information will be obtained to assess if the limiting factors will change in

the future and why.

Step 8. Factor in existing and potential hatchery productivity to the results of Steps 1 through 7.

III. INTERIM RANKING OF HYDRO PROJECTS

A. Purpose. New hydro projects are currently proposed for the Northwest. Some of these projects, if built, could foreclose the ability of the Council to achieve its goal of protecting, mitigating and enhancing fish and wildlife. It is the purpose of this effort to identify which projectsin the licensing process or proposed for construction by the federal government could go forward without foreclosing Council opportunities.

B. Concept. The Hydro Assessment Steering Committee has identified a list of criteria for Category I sites, i.e, those projects which will have insignificant adverse impacts on anadromous and migratory fish. These groups believe that they can quickly identify projects within the Federal Energy Regulatory Commission (FERC) process and which are proposed by the federal government which will meet these criteria.

The Council will ask fish and wildlife the agencies and tribes to identify Category I projects currently in the FERC process and proposed by the federal government. The Council will consider these recommendations, adopt a list of Category I projects, then advise FERC that these projects could be licensed without interference with the Council's Columbia River Basin Fish and Wildlife Program and Appendix E of the Power Plan and conversely, that other sites have the potential to be inconsistent with the Fish and Wildlife Program and Appendix E and until a regional need for power exists, as identified in the Power Plan, or until completion of the Council's site ranking protected area designations these non-category I projects should not be licensed. further, the council intends to request that FERC allow extensions

to permit and license applications, pending completion of the Council's study. Moreover, the Council intends to do away with the interim ranking one year after adoption.

C. Method. The agencies and tribes will apply the attached criteria to the projects in the FERC process and proposed by the federal government and report to the Council via the HASC.

IV. HYDROPOWER SUPPLY CURVE

A. Purpose. The Council is required by the Regional Power Act to prepare a power plan which includes a forecast of power resources (Section 4(d) and (e)). In its 1983 Northwest Conservation and Electric Power Plan, the Council identified new hydroelectric power plants as the preferred source of new power following conservation. Estimates of the amount of cost-effective power available in the Northwest ranged from 400 to 4000 megawatts. The purpose of this study is to provide a reliable basis for future estimates of hydro availability.

B. Concept. A hydro supply curve (a graph showing the amount of new hydro available as a function of cost) will be developed by recognizing the various constraints which will reduce the theoretical hydro potential of the region. Constraints include Council actions necessary to "protect, mitigate and enhance" fish and wildlife in the region and actions by public, federal, state and local decision-makers.

The theoretical hydro potential of the region and its cost is currently being assessed by the Corps of Engineers and BPA with assistance from the Council through a contract with Ott Engineers. Council actions which will affect hydro will be determined as described in Section II. The degree to which other decision-makers may affect new hydro will be assessed as described in the following subsection. The Council staff will collect these three inputs and recommend to the Council an appropriate hydro supply curve.

The Council will not make value judgments on its own as to the significance of resources identified by state, federal and tribal decision-makers and their likelihood to result in negative decisions on hydro projects. The Council will not arbitrate differences among decision-makers. The Council is only interested in learning where others will resist hydro development so that the Council has an accurate estimate of the amount of available cost-effective hydropower. Decision-makers who may affect hydro development include licensing agencies (federal, state and local), those that may influence licensing agencies (public, tribes, and resource managers) and resource/land managers (federal and state).

The Council could obtain one level of understanding of decision-makers' influence on new hydro by simply compiling existing decisions. The decisions, called institutional constraints, are usually generic determinations which restrict hydro development. Examples could include federal wilderness designations, state and federal wild and scenic river designations or local zoning ordinances. These constraints need to be identified but further efforts are needed because the decision-makers many times do not take a prospective view. Consequently, decision-makers may impose further constraints at the time new hydro is actually proposed for consideration.

It is the Council's intent to anticipate the reaction of the decision-makers to new hydro by asking them to categorize stream reaches in terms of their significance for river values. River values include resident fish, wildlife, recreation, cultural values (e.g., historic and archeologic) and natural features (e.g., endangered and threatened plants). The information will be collected from the decision-makers by the four states except that Indian cultural and archeologic values will be asesessed by the tribes.

C. Method. The objective of this portion of the River

Assessment Study is to identify the significance of stream reaches for several river values. Comparative assessment is the major feature of the process. The result is not rivers ranked in numerical order; rather, it is a clustering of stream reaches into general groups according to their significance. To ensure objectivity all streams are evaluated without regard to special development proposals. The process does not require collection of field data. The emphasis is on the use of existing information, expert evaluation and user and public input.

The method consists of the following steps:

1. Refine criteria to be used to categorize the importance of stream reaches for each river value. The following river values will be evaluated:

Resident Fish
- -cold water
- -warm water

Wildlife
- -migratory birds
- -resident birds
- -big game
- -furbearers
- -small mammals
- -endangered and threatened species (Federal and stae)

Natural Features
- -endangered and threatened plants
- -unique plant communities and other recognized natural areas
- -undeveloped segments
- -free flowing segments
- -scenic corridors
- -sensitive riparian wetlands

-gorges, waterfalls, rapids, miscellaneous geologic features

Social/Cultural Features

-archaeological sites
-river related architectural sites
-miscellaneous heritage sites
-historic trails
-current Indian cultural use sites
-current public use sites

Recreation

-white water boating
-flat water boating
-river camping
-miscellaneous water based recreation

Institutional Constraints

-wild and scenic rivers
-wilderness areas
-research natural areas
-national parks
-unroaded areas

For each river value identified above the states will identify criteria by which data will be evaluated for significance. Both quantitative and qualitative criteria may be employed as appropriate. The terms highest significance, high significance, moderate significance, limited significance and no significance will be used to denote relative value. An effort will be made to standardize criteria among the states. The HASC will recommend the criteria. Each state will consider these recommendations in adapting the study methodology to meet individual state needs. Consistency among the states will be facilitated throughout the process by the HASC and BPA.

Unless the HASC develops recommended alternative criteria by November 1984 the following criteria will be used:

Wildlife - "Application of Wildlife Values to Montana's Stream Classification System." See attached.

Resident Fish - "Montana Department of Fish, Wildlife and Parks Procedure for Classifying Montana Streams", Spring 1980. See attached.

Other Values - "Maine Rivers Study", May 1982.

2. Evaluate the significance of each stream reach for each river value. The final result of the category assessment will be the identification of all river areas which should be recognized for possessing a particular fisheries, wildlife, natural, recreational, or cultural value and an identification of the relative significance of each area. The assessment should include the identification of facilities, such as roads and transmission lines, which would be needed to service any proposed hydro site on the stream reach under study.

3. Document the results of the evaluation. Results will be displayed in tabular form and also recorded on base maps at an appropriate scale for each river value. Where avilable and applicable, a scale of 1:24,000 will be used. The basis for the results will be recorded in narrative form for each river segment or segments. Maps of a scale suitable for public presentation will also be developed. Information regarding sensitive fish and wildlife, plants and archeological sites will be displayed in accordance with state and tribal policy and conservation of these resources.

Information obtained for all river values will be combined. All significant values associated with a given stream will be identified and all tributaries which contribute to these values

will be noted. A matrix format will be used as the mechanism for displaying this information. The matrix will identify the total number of values associated with each stream reach and will indicate the significance ratings.

4. Review Indian cultural and archeological values. Indian values will have an important impact on new hydro development. Tribes will be a full partner in the Anadromous Fish Assessment described in Sections II and III. Tribes will provide information in the River Assessment Study for Non-Anadromous Fish Study through the states (but not modified by the states) that will affect river values identified in steps 1, 2 and 3 above. Finally, the Council will request the tribes to present an independent assessment of how Indian cultural and archeological values would be affected by hydro development.

Historically, Indian values have been closely associated with rivers because they frequently lived adjacent to them. Their cultural and archeologic values will be uniquely affected by hydro development. Information as to how these values may be affected could be sensitive if religiously-based. Therefore, the Council will contract with a person acceptable to Tribal interests to work with the tribes of the Northwest to identify how Indian cultural and archeological values may be affected by new hydro.

The results of this assessment would be held confidential by the tribes for use of only the Council and its staff.

V. STUDY RECOMMENDATIONS AND PUBLIC INVOLVEMENT

Recommendations will be made to the Council by its staff for site ranking, protected areas and hydro supply curves. These recommendations will be made based on data collected from the Anadromous Fish Assessment, Indian Cultural and Archeologic Values assessment, River Assessment Study for Non-Anadromous Fish Values, and hydro supply and cost data from the Corps of Engineers, BPA and

Ott Engineers.

Upon receipt of recommendations from the staff, the Council will propose appropriate amendments to its Power Plan and Fish and Wildlife Program. These proposed amendments will be reviewed through the Council's usual public process including formal public hearings in each of the four states. Hearings in each state will be held jointly with the State Task Force.

The public will also have input in the development of the study data through attendance and participation at meetings of the HASC and State Task Forces. These meetings will be announced through a coordinated state-Council effort.

Once a hydro supply curve, site ranking and protected area designations have been adopted, changes can be proposed, considered and acted upon, based on new information in the context of the Council's routine amendments to its Plan and Program.

VI. ORGANIZATION

The Council's Hydropower Assessment Steering Committee (HASC) will review and make recommendations for the River Assessment Study. The HASC will periodically review participant progress at key milestones. If the HASC cannot reach a consensus on issues the Chairman will make policy decisions important to continuation of the study. BPA will coordinate the four state-level assessments with the HASC and will administer contracts with the participants.

The Indian Cultural and Archeological Values study will be performed by direct contract between the Council staff and a person acceptable to Tribal interests.

The Anadromous Fish Assessment will be managed by either Council staff or an individual anadromous fish coordinator. The role of this individual is to coordinate agreements, if possible,

between the various agencies and tribes on technical matters (methods and techniques) and facilitate collection, either directly or by subcontract, of needed data. Because BPA will be providing some funds for this effort, BPA will retain its statutory responsibilities for contract administration in accordance with existing agreements between BPA and the Council.

The River Assessment for Non-Anadromous Fish Values will be conducted at the state level by a task force under the leadership of a study coordinator. A regional coordinator for this portion of the study will assist the State Task Force. The study is designed to produce consistent results by use of common evaluation criteria (see subsection C1 above). The state task force will consist of state, federal and tribal authorities and will be comprised of technical experts with river resource expertise. The state task force should include cognizant state agencies, local jurisdictions to the extent it is possible and consistent with a local government jurisdiction over hydro within the state, National Marine Fisheries Service, U.S. Fish and Wildlife Service, BLM and USFS.

Figure 1 shows the regionwide organization and Figure 2 shows the state organization. The roles and responsibilities of each group are defined below.

FIGURE 1: Organization Chart: Regional Level

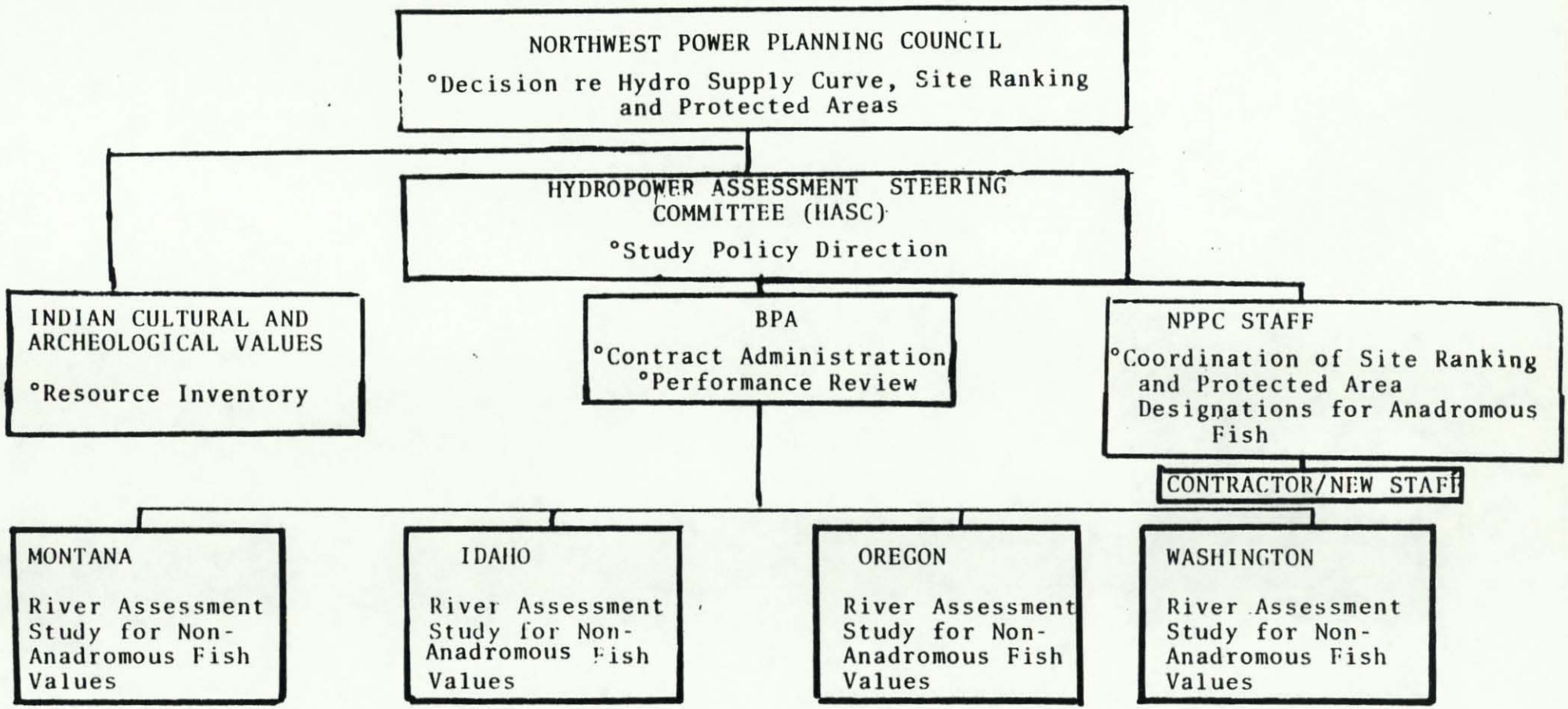
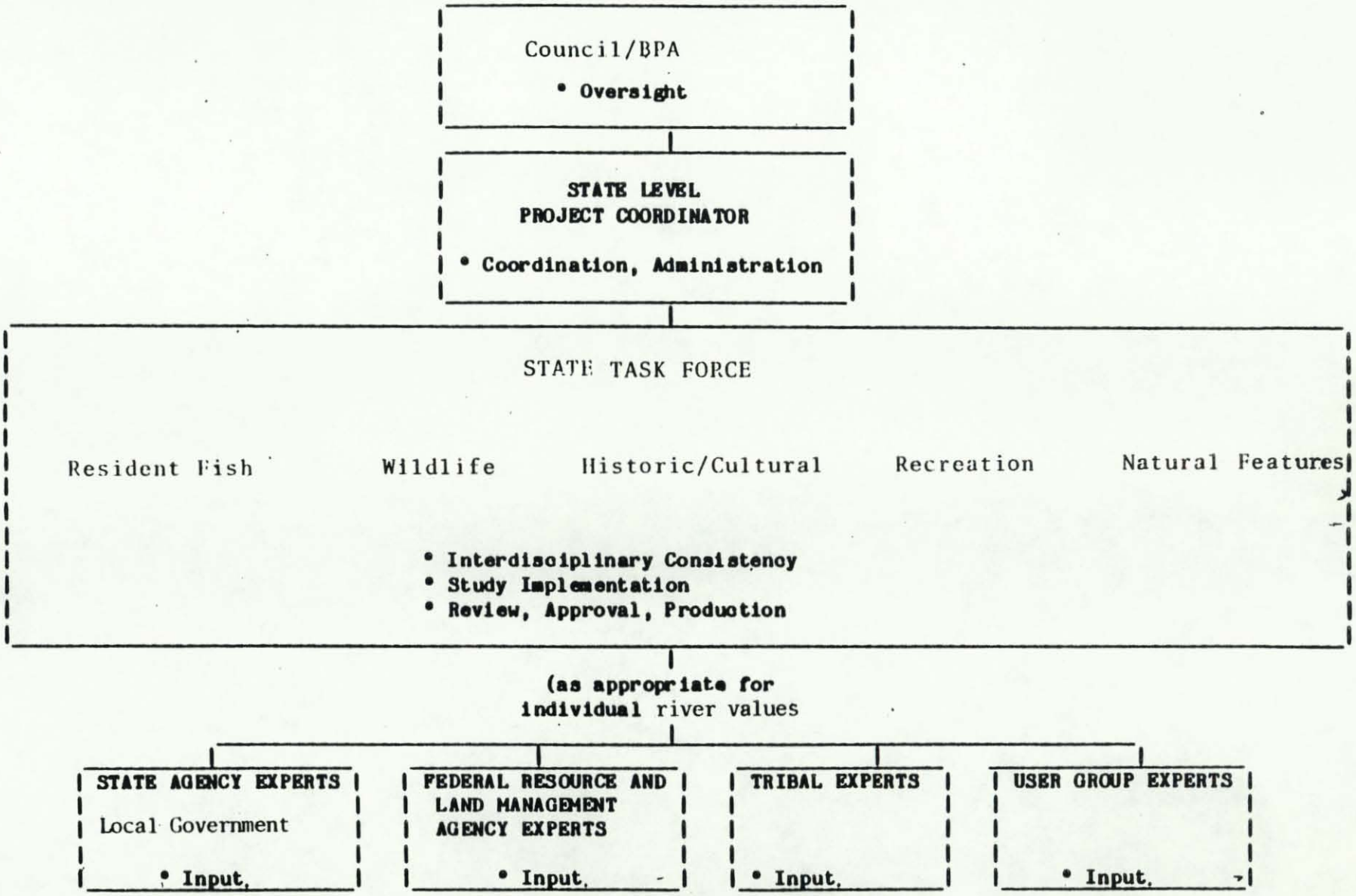


FIGURE 2 - ORGANIZATION CHART: STATE LEVEL



State level study organizations will be designed to meet individual circumstances.

1. Northwest Power Planning Council

   Determine final uses of study results.

2. NPPC staff

   a. Coordination of Hydropower Assessment Steering Committee activities.
   b. Manage site ranking and protected area regional studies (Anadromous Fish Assessment).
   c. Manage contract for Indian cultural and archeological values.
   d. Propose and implement overall public information/involvement strategy.
   e. Recommend hydro supply curve, protected area and site ranking decisions to NPPC.

3. Hydropower Assessment Steering Committee (HASC)

   a. Recommend study direction including recommendation on study method and criteria.
   b. Review participant progress and products.

4. Bonneville Power Administration

   a. Administer contracts with State River Assessment Studies for Non-Anadromous Fish Values.
   b. Coordinate for HASC review consistent regionwide criteria for non-anadromous fish values.
   c. Develop data management system for all study products
   d. Print all study documents and maps.
   e. Participate on HASC.

5. States (Oregon, Washington, Idaho and Montana)

a. Perform River Assessment Study for Non-Anadromous Fish Values.
b. Coordination of the study with HASC and BPA and federal resource/land management agencies, Indian tribes and local governments.
c. Participate on HASC.
d. Participate in site ranking and protected area designations (Anadromous Fish Assessment).
e. Recommend interim site ranking to NPPC (fish and wildlife agencies).

6. Indian Tribes

a. Perform assessment of Indian cultural and archeological values.
b. Participate in site ranking and protected area designations (Anadromous Fish Assessment).
c. Participate in state River Assessment Studies for Non-Anadromous Fish Values.
d. Participate on HASC.
e. Recommend interim site ranking to NPPC.

7. Federal Resource and Land Management Agencies (U.S. Fish and Wildlife, U,S. Forest Service, U.S. Bureau of Land Management, National Marine Fisheries Service, Corps of Engineers)
a. Participate in site ranking and protected areas designations (Anadromous Fish Assessment).
b. Participate in state River Assessment Study for Non-Anadromous Fish Values.
c. Participate on HASC.

8. Pacific Northwest Utilities Conference Committee/Resource Developers

Participate on HASC

VII. SCHEDULE

The schedule for the River Assessment Study follows.

FIGURE 3

PACIFIC NORTHWEST RIVERS STUDY
SCHEDULE OF PRODUCTS

	TASK	RESPONSIBLE PARTIES	COMPLETION DATES
1.	Approve Work Plan	Council	August 29-30, 1984
2.	Identify Rivers to be studied	NPPC Staff	Sept. 10, 1984
3.	Designate State Coordinators	Council Members/ State Governors	Sept. 15, 1984
4.	Completed Contracts	Council/BPA	Sept. 30, 1984
5.	Select Anadromous Fish Assessment Coordinator	NPPC Staff	Sept 1984
6.	Convene State Task Force	State Coordinator	Oct 1984
7.	Adopt criteria for river values	BPA/State Task Force	Nov 1984
8.	Prepare evaluation format and base maps for state use	BPA	Dec 1984
9.	Interim ranking report	HASC/Agencies/Tribes	Jan 1985
10.	Council Action on Interim ranking	Tribes	March 1985
11.	Indian Cultural and Archeologic Assessment	Tribes	Oct-Mar 1985
12.	Anadromous Fish Assessment	HASC/Coordinator/ Agencies/Tribes	Oct-June 1985
13.	Perform River Resource Assessments	State Task Force	Jan-June 1985
14.	Publish Results	BPA	July 1985
15.	Computerize River Assessment	BPA	July 1985
16.	Overlay Hydropower Sites	NPPC Staff	July 1985
17.	Recommend Supply Curves	NPPC Staff	Aug 1985
18.	Recommend Protected Area Designations	NPPC Staff	Aug 1985
19.	Recommend Site Ranking	NPPC Staff	Aug 1985

VIII. BUDGET

A budget for the Hydropower Assessment Study follows. This is a maximum budget which will not be exceeded. It is anticipated that actual costs will be less.

BUDGET

CONTRACT	CONTRACTOR	SOURCE OF FUNDS	AMOUNT
Interim Site Ranking	Agencies/Tribes	--	No cost
Indian Cultural and Archeological Values	Individual	NWPPC	$40,000[1]
Anadromous Fish Assessment	NWPPC Staff or Individual Contract (Subcontracts with agencies and tribes as necessary to collect data)	NWPPC, supplemented by BPA as needed	500,000
River Assessment Study for Non-anadromous Fish Values	States[2] (Oregon, Washington, Idaho, and Montana)	BPA	400,000
	Tribes		130,000
	Federal Agencies		130,000
			$1,200,000

[1] This figure is based on the estimated time of one individual to coordinate this effort among more than 40 tribes and prepare reports. It is recommended by the Chairman of the HASC.

[2] Including local governments.

MONTANA DEPARTMENT OF FISH, WILDLIFE & PARKS

PROCEDURE FOR CLASSIFYING MONTANA STREAMS

SPRING 1980

G E N E R A L

Six value classes were established:

Value Class	Class Definition
1	Highest-value fishery resource
2	High priority fishery resource
3	Substantial fishery resource
4	Moderate fishery resource
5	Limited fishery resource
6	Not yet classified

Each stream reach was placed in a value class for each of the two criteria below. The final classification, the fishery resource value, was the higher class given for criterion 1 or 2. In accomplishing this, data for each stream reach were entered in a computer file and a computer program used to check the attributes and assign the class for each reach.

Criterion 1 - Habitat and Species Value of Stream Reach

The class of each reach was determined by a point system in which most points were awarded for important habitats of fishes of special concern (native fishes found in limited numbers and/or limited waters). Fewer points were awarded to less important habitats of fishes of special concern and for the occurrence of widespread species found in substantial numbers. Least points were awarded for occurrence of non-indigenous species considered of minimal value. Additional consideration was given streams that are important sources of trout recruitment. Points were also given for spring streams; esthetics (natural beauty); and for local community value where a stream, being one of few or the only one in the immediate area, is important to a community for scientific study, nature study, and/or recreation.

Criterion 2 - Sport Fishery Potential of Stream Reach

The class of each reach was based on a point system in which points were awarded for (1) fish abundance as indicated by biomass or numbers and sizes of game or sport fish, (2) ingress (legal rights of the public to fish the reach or willingness of landowner to permit fishing), (3) esthetics and (4) use by fishermen (fishing pressure).

A listing naming each stream reach, describing its upper and lower boundaries, and giving its classification is available, as is a detailed account of how each reach met the requirements of its class.

DETAILED PROCEDURE FOR ASSIGNING VALUE CLASSES

A. Procedure for Criterion 1 Habitat and Species Value of Stream Reach

I. Standards and Associated Points

Points [1]	Standard	
15	I	Highest-valued habitat [2] for a class A fish of special concern [3].
10	II	High priority habitat for a class A fish of special concern OR Highest-valued habitat for a class B fish of special concern.
5	III	Substantial habitat for a class A fish of special concern. OR High priority habitat for a class B fish of special concern. OR Highest-valued habitat for a class C fish of special concern.
3	IVA	Substantial habitat for a class B fish of special concern. OR High priority habitat for a class C fish of special concern.
1.5	IVB	Substantial habitat for a class C fish of special concern.
.4	V	Limited habitat for any fish of special concern. OR Abundant [4] population of: (1) native not fish of special concern [5] or (2) non-native game or sport species [5].
.3	VIA	Common abundance of: (1) native not fish of special concern OR (2) non-native game or sport species.
.2	VIB	Same as VIA only abundance rating is uncommon or unknown.
.1	VII	Same as VIA only abundance is rated as rare, M (species absent might be present if habitat problem corrected) or E (species expected but not verified). OR Presence of any non-native non-sport species.
3	VIII	Esthetics rating is C or higher on a scale of A highest to E lowest [6].
3	IX	Stream is one of few streams or only one in the immediate area and is important to community for scientific study, nature study and/or recreation.
3	X	Stream is a spring stream or spring creek.

1/ Points are awarded for each species meeting a standard.
2/ Habitat designations: highest-valued, high priority, substantial and limited are based on judgment decisions of fisheries biologists.
3/ See list of fishes of special concern in Appendix.
4/ See "Fish Abundance Ratings" in Appendix.
5/ See list of Montana fish species in Appendix.
6/ See explanations of esthetics ratings in Appendix.

II. Assignment of class

Points	Habitat and Species Value Class
15 or more	1
10 to less than 15	2
5 to less than 10	3
.3 to less than 5	4
Greater than zero to less than .3	5
0	6

Important streams for trout recruitment, including passage, are advanced one class but not higher than class 3.

NOTE: Unless fish are known to be present the stream reach is automatically in class 6.

B. Procedure for Criterion 2 - Sport Fishery Potential of Stream Reach

Component I. Fish Abundance - Award of Points and Assignment of Grade

a. Points for abundance of all trout species combined [1/]

Biomass (Kg) per 300 m	Points
70 and over	9
12 to less than 70	6.5
5 to less than 12	4
3.5 to less than 5	2
Greater than 0 to less than 3.5	1

If trout present but biomass unknown:
Each species with abundance A,B,C or D [2/] is assigned 1 point
Each species with abundance U,V or Z is assigned .5 points

b. Points for abundance, class A non-trout game and sport fish for streams. [1/]

Abundance Rating [2/]	Points
A	2
B	3
C	1
D	2
U, V and Z	.5

NOTE: Maximum for mountain whitefish is 2 points.

c. Assignment of abundance grade

Points (sum of points from a and b above)	Grade
9 and over	4
6 to less than 9	3
3 to less than 6	2
Greater than 1 to less than 3	1
1 or less	0

Component II. Assignment of ingress grade

Ingress rating [2/]	Grade
1	4
2	3
3	3
4	2
5	1
6 and 7	0

1/ For species designations see list of Montana fishes in Appendix.
2/ See explanation or ratings in Appendix.

Component III. Assignment of Esthetics Grade

Esthetics rating [1]	Grade
A	4
B	3
C	2
D	1
E	0

Component IV. Assignment of Use (Fishing Pressure) Grade

Fisherman-days/10 km	Grade
1250 and over	4
310 to less than 1250	3
65 to less than 310	2
Greater than 0 to less than 65	1
0 (none or unknown)	0

Computation of Sport Fishery Potential Score and Assignment of Class.

A. Score = Sum of (grade for each component x multiplier [2]).

B. Assignment of Class

	Score	Conditions	Sport Fishery potential class
1.	17 and over	Fish production based on natural reproduction. Trout with abundance B or D (large-sized) [3] or paddlefish must be present. and ingress rating of 1, 2 or 3 and esthetics rating of A, B or C and overall use of 5000 or more [4]	1
2.	17 and over	Ingress rating of 1, 2 or 3 and at least one condition in 1 above not met.	2
3.	17 and 18	Ingress rating of 4 to 7	3
4.	15 to less than 17	Ingress rating of 1,2 or 3	2
5.	15 to less than 17	Ingress rating of 4 to 7	3
6.	Greater than 11 to less than 15		3
7.	Greater than 4 to 11		4
8.	Greater than 0 to 4		5
9.	0		6

Note: If no fish are present stream reach is automatically in class 6.

1/ See explanation of ratings in Appendix.
2/ Multiplier for fish abundance is 2; for other components (ingress, esthetic and use) the multiplier is 1.
3/ See explanation of abundance ratings in Appendix.
4/ For the purpose of meeting the 5000 fisherman days (FMD) requirement, the stream segment may be a composite of adjoining reaches that meet all other conditions for class 1, provided each reach with less than 5000 FMD's is less than 6 km. long.

C. Assignment of Fishery Resource Value Class

The fishery resource value class is simply the higher class given for criterion 1 or 2 above.

APPENDIX

INGRESS RATING. As used here, ingress means the legal right to enter. .

Code

1 - Stream section bordered almost entirely by public lands which insure ingress by anglers (exclude state school sections).

2 - A stream section bordered by a mix of private and public land where the public land is distributed in such a way that no significant portion of the stream is unavailable by vehicle and/or walking. Floating may also be a major means of access.

3 - A stream section bordered by mostly private land where ingress in uncontrolled or readily available by permission. This portion may be available by floating or through navigability laws. Also includes corporate lands - these are currently open but could go to individual ownership in the future or company policy regarding ingress could change.

4 - A stream section bordered mostly by private land where ingress is limited but some fishing is allowed. May include minor portions where public land or road crossing may provide limited ingress. The portion through private land may be available by floating or through navigability laws.

5 - A stream section bordered entirely by private land where public fishing is available for a fee or where a small group has leased exclusive rights. Legality may be in question on some streams but this category identifies the current "fee" or "lease" fishing areas.

6 - A stream section bordered mostly by private land where little or no ingress by permission is allowed. Floating precluded by stream size or other physical limitation (no road or public land to reach stream).

7 - A stream or stream segment bordered by public land that is unavailable because of posting on private land or locked gates on private roads.

FISH ABUNDANCE RATINGS. Abundance of fish refers only to adult fish, or in case game and sport fish to keeper size (7" minimum for trout; exception 6" minimum for trout populations which spawn when shorter than 7"). By nature abundance ratings are subjective. Since trout command the most interest of Montana fishes, the abundance ratings for all fishes were geared to trout. The abundance graph (Figure 1) is a guide to numbers associated with abundant, common, uncommon and rare. The ratings reflect the peak abundance during the year, e.g., when migratory spawners are present.

A = Abundant
B = Abundant with proportional number of large-sized fish (see appendix)
C = Common
D = Common with proportional number of large-sized fish (see appendix)
U = Uncommon
V = Uncommon with proportional number of large-sized fish (see appendix)
R = Rare
E = Presence not verified but expected
H = Species absent but could be present if habitat problems corrected
N = Not present
P = Species absent, but might be present if introduced
(e.g. potential habitat in a barren stream)
Z = Abundance unknown

Special codes entered in abundance column to indicate habitat value of reach for species of special concern.

G = Highest-valued

H = High priority

S = Substantial value

L = Limited value

CODES FOR FISHES' USE OF REACH

Codes indicating single use or dominant use:

L = Resident throughout life cycle

A = Spawning elsewhere (includes hatchery fish) -- spends part or most of life in reach

H = Spawning and hatching -- young promptly move downstream

J = Spawning and nursery to subadult

C = Passing through -- species uses reach as a corridor to migrate upstream and return downstream

F = Feeding run

N = No use (in connection with abundance codes M, N and p)

Z = Use undetermined

Codes that are combinations of the above codes to indicate more than one population of a species.

R = L plus A, H or J

P = C plus L, A, H or J

S = H and J combined

Any other combination: Code entered for dominant use.

ESTHETICS RATINGS. Esthetics were rated A (high) through E (low). Features that detract from esthetics include: pollution, dewatering, channelization, riprap (particularly car bodies and discarded building materials), mine tailings, a busy highway along stream and severe land abuse. As a guide:

A - A water of outstanding natural beauty in a pristine setting.

B - A water comparable to A except that it may lack pristine characteristics. Presence of human development such as roads, farms, etc., usually comprise the difference between B and A.

C - A water with natural beauty but of a more common type than listed under A and B. A clean stream in an attractive setting.

D - A stream and area with fair esthetics.

E - A stream with low esthetics.

MONTANA FISHES IN FAMILY SEQUENCE (Also see fishes of special concern list)

MT FW&P Code	
+ 27	Sturgeon*
+ 90	White sturgeon
+ 91	Pallid sturgeon
+ 92	Shovelnose sturgeon
+ 28	Paddlefish
38	Shortnose gar
34	Goldeye
* 01 #	Rainbow trout* (See 122)
* 02	Cutthroat trout*
* 03 #	Brook trout
* 04 #	Brown trout
* 05	Dolly Varden
* 06	Lake trout
* 07 #	Golden trout
+ 08 #	Kokanee
09 #	Coho salmon
+ 10	Arctic grayling
* 11 #	Rainbow x cutthroat trout hybrid
* 12	Westslope cutthroat trout (pure)
* 13	Yellowstone cutthroat trout (pure)
14	Whitefish*
15 #	Lake whitefish (May be native in St. Mary's Lake)
+ 85	Mountain whitefish
86	Pygmy whitefish
87 #	Chinook salmon
88 #	Splake
+ 89 #	Salmon*
*118	Trout*
119	Trout/Salmon*
*120 #	Rainbow trout x golden trout hybrid
*121	Upper Missouri cutthroat trout (pure)
*122	Native rainbow trout
99 #	Rainbow smelt
23 #	Northern pike (native only in (Saskatchewan River Drainage)
29	Peamouth
30 .	Goldfish
32 .	Carp
33	Northern squawfish
35 .	Utah chub
37	Minnow*
39	Longnose dace
41	Northern redbelly/Finescale dace*
42	Brassy minnow
43	Silvery/Plains minnow*
44	Flathead chub
45	Lake chub
46	Sturgeon chub
47	Emerald shiner
48	Sand shiner
49	Redside shiner
50	Creek chub
51	Pearl dace
52	Fathead minnow
53 .	Golden shiner (May be native in eastern Montana)
54	Sicklefin chub

MT FW&P Code	
140	Silvery minnow
141	Plains minnow
142	Finescale dace
143	Northern redbelly dace
31	Sucker*
40	Buffalo
55	River carpsucker
56	Longnose sucker
57	White sucker
58	Largescale sucker
59	Blue sucker
60	Bigmouth buffalo
61	Smallmouth buffalo
62	Shorthead redhorse
63	Mountain sucker
+24	Channel catfish
25 #	Bullhead*
64	Stonecat
65 #	Black bullhead
66 #	Yellow bullhead
100	Trout-perch
+26	Burbot
103	Plains killifish (Probably native)
106 .	Mosquitofish
109 .	Shortfin molly
112 .	Variable platyfish
115 .	Green swordtail
71	Brook stickleback
72 #	White bass
17 #	Largemouth bass
18 #	Bass*
19 #	Sunfish*
21 #	Crappie*
+73 #	Smallmouth bass
74 #	Bluegill
75 #	Pumpkinseed
76 #	Green sunfish
77 #	Black crappie
78 #	White crappie
79 #	Rock bass
20 #	Yellow perch
+22	Sauger/Walleye*
+81	Sauger
+82 #	Walleye
83	Iowa darter
36	Freshwater drum
16	Sculpin*
130	Mottled sculpin
131	Slimy sculpin
132	Torrent sculpin
133	Shorthead sculpin
134	Spoonhead sculpin

Codes:

- * Trout species
- # Non-native game or sport fish
- + Class A non-trout game or sport fish for streams
- - Native fish, i.e. indigenous
- . Non-native non-sport fish
- * Undesignated as to species or strain

MONTANA FISHES OF SPECIAL CONCERN *

Class A--limited numbers and/or limited habitats both in Montana and elsewhere in North America; elimination from Montana would be a significant loss to the gene pool of the species or subspecies.

White sturgeon (Acipenser transmontanus)
Pallid sturgeon (Scaphirhynchus albus)
Paddlefish (Polyodon spathula)
Yellowstone cutthroat trout (Salmo clarki bouvieri)
Arctic grayling (Thymallus arcticus)

Class B--intermediate between classes A and C. Limited numbers and/or limited habitats in Montana; fairly widespread and fair numbers in North America as a whole. Elimination from Montana would be at least a moderate loss to the gene pool of the species or subspecies.

Westslope cutthroat trout (Salmo clarki lewisi)
--includes upper Missouri cutthroat trout
Native rainbow trout (Salmo gairdneri)
Sturgeon chub (Hybopsis gelida)
Sicklefin chub (Hybopsis meeki)
Shorthead sculpin (Cottus confusus)

Class C--limited numbers and/or limited habitats in Montana; widespread and numerous in North America as a whole. Elimination from Montana would be only a minor loss to the gene pool of the species or subspecies.

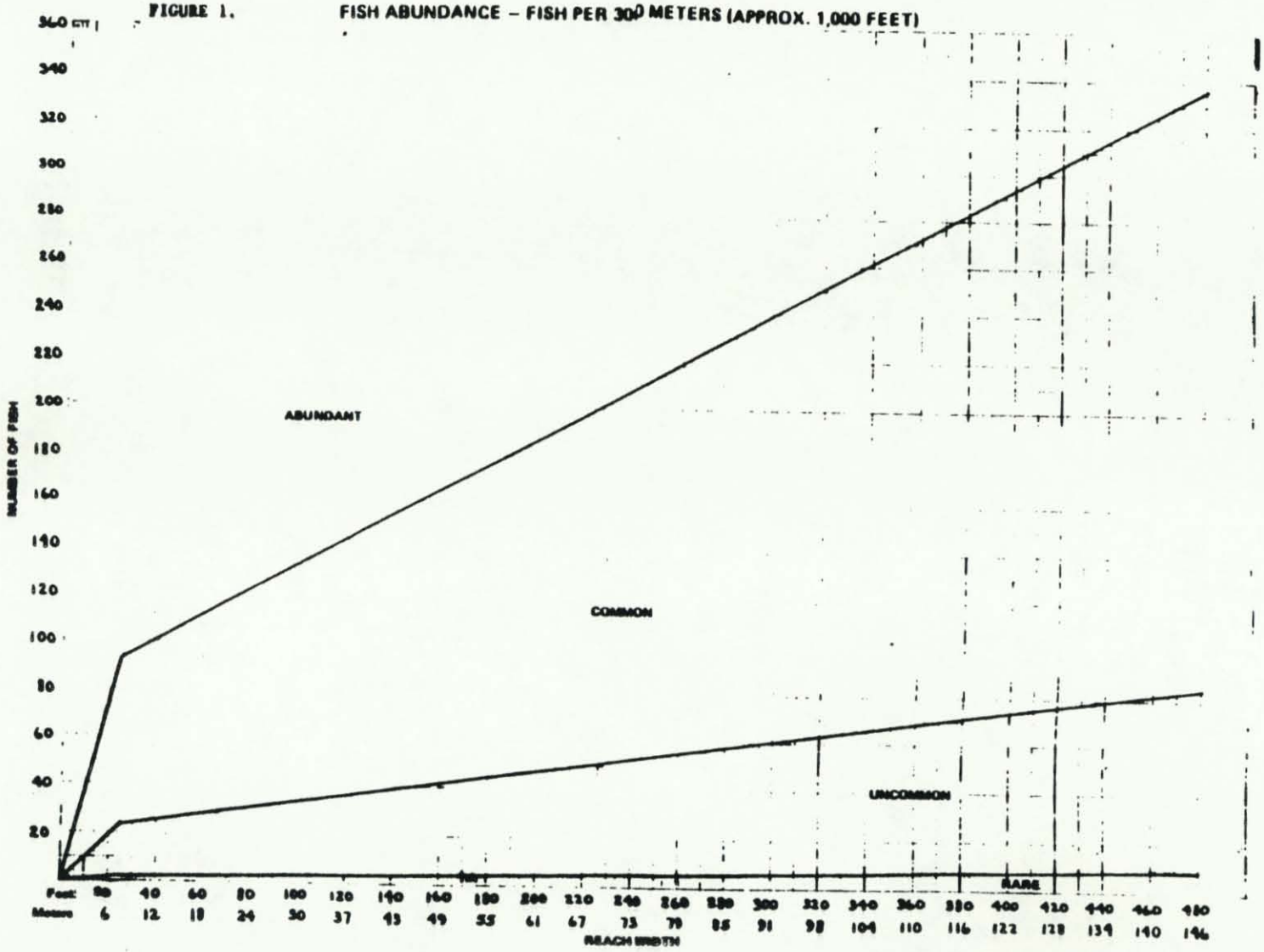
Shortnose gar (Lepisosteus platostomus)
Finescale dace (Phoxinus neogaeus)
Trout-perch (Percopsis omiscomaycus)
Spoonhead sculpin (Cottus ricei)

STANDARDS FOR LARGE-SIZED FISH

Species	Kg	Lbs.	Species	Kg	Lbs.
Shovelnose sturgeon	2.7	6	Northern Pike	6.8	15
Paddlefish	34.0	75	Bullhead--		
Mountain whitefish	.9	2	black & yellow	.3	.7
Kokanee	.9	2	Channel catfish	3.6	8
Cutthroat trout	.7	1.5	Burbot	2.7	6
Rainbow trout	1.4	3	Smallmouth bass	.9	2
Brown trout	1.4	3	Largemouth bass	1.8	4
Brook trout	.5	1	Crappie--		
Dolly Varden	3.6	8	black & white	.5	1
Lake trout	6.8	15	Yellow perch	.5	1
Arctic Grayling	.9	2	Sauger	.9	2
Golden trout	.5	1	Walleye	1.8	4
Kokanee		2.5			

* See January/February 1980 Montana Outdoors for article on fishes of special concern.

FIGURE 1. FISH ABUNDANCE – FISH PER 300 METERS (APPROX. 1,000 FEET)



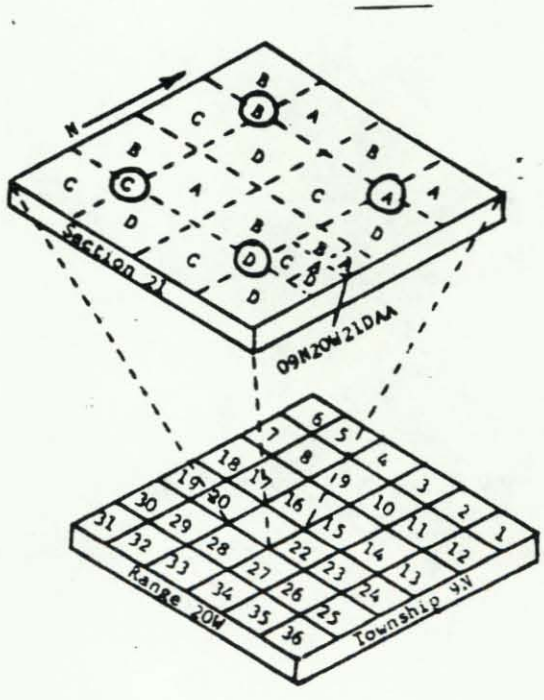
Land Description: Township - Range - Section - Subsection

Explanation of letters (A, B, C and D) designating subsections

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Townships are located by a numbered grid system consisting of Range and Township lines. The Township lines run east and west of a principal meridian. The Range lines run north and south of an established base line. Thus, a Township is described as a number N or S of the base line, and a number E or W of the principal meridian.

A desirable modification of the usual method of describing a location on a map is the one used by several agencies, including the USGS. A location is specified by using 12 characters - the first three give the Township; the next three the Range; the next two the Section number within the Township; and the next four the location within the quarter section (160 A), the quarter-quarter section (40 A), the quarter-quarter-quarter section (10A) and the quarter-quarter-quarter-quarter section (2½ A). The subdivisions of the 640 A section are designated as A, B, C and D in a counterclockwise direction, beginning in the northeast quadrant. For example, if a lake is located in Township 9N, Range 20W, Section 21 the description would be 09N20W21DAA. The letters DAA indicate the lake is in the NE¼ of the NE¼ of the SE¼. As indicated above, a still further breakdown to a 2½ acre area is possible using a fourth letter (A, B, C, or D).



APPLICATION OF WILDLIFE VALUES TO MONTANA'S STREAM CLASSIFICATION SYSTEM

I. Value Class System

The value class system used for fisheries values must also be used for wildlife to make the combined system compatible. This presents no problem and can easily be adopted. It would be as follows:

Class	Description
1	Highest value wildlife resource
2	High priority wildlife resource
3	Substantial wildlife resource
4	Moderate wildlife resource
5	Limited wildlife resource
6	Not yet classified

II. Criteria

The following criteria will be used to determine value classes:

Criterion 1 - Habitat Component

Vertical structure of vegetation
Horizontal diversity of vegetation types
Type and quality of adjacent habitat
Land use *and condition* of riparian habitat
Age structure and dominant vegetation
Width of riparian zone
Number and types of islands present
Presence of special features or habitat components

Criterion 2 - Species Component

Species of special concern (presence and abundance)
Endangered species (presence and abundance)
Large mammals (diversity and abundance)
Upland gamebirds (diversity and abundance)
Waterfowl (diversity and abundance)
Furbearers (diversity and abundance)
Raptors (diversity and abundance)
Small mammals and other birds (diversity and abundance)
Grizzly bear within designated ecosystem (abundance)

Criterion 3 - Recreation Component

Access (relative degree)
Hunting potential
Floating potential/wildlife viewing
Local community importance
Aesthetics

III. Assignment of Class

The following steps need to be completed before stream and associated riparian habitat can be assigned to the designated classes:

1. Define criteria components
2. Establish quantitative means where possible for assigning point values to criteria components
3. Establish qualitative criteria where quantitative not possible (i.e., aesthetics)
4. Determine the scale of points to be allocated to all three criteria
5. Determine cutoff point values for assigning classes

Discussion

It is generally felt that Criterion 1 (habitat) should have proportionately higher point values assigned to each component than the other two Criteria. It should also be noted that there will be an inherent bonus allowed for certain components such as good lands use, special features, endangered and other special species, and grizzly bear. This is intentional and will assure protection of key habitats and species. *This could also be handled by adjusting assigned point values.*

Resource Values

For wildlife there has been *four* key components identified that will automatically trigger Class 1 assignment. *These are* grizzly bear spring use within designated Ecosystems, *bald eagle roost sites, winter feeding areas, nest sites, wolf denning or foraging areas and peregrine falcon nesting or foraging areas.*

IV. Application

For each stream rated, point scores will be calculated for each of the three *criteria* and added before assignment. Highest point totals would be included in Class 1 according to point cutoff levels previously determined. This will result in identifying Class 1 streams (and other classes) for wildlife values. These streams will then be compared to those identified under the fisheries value system. If the rankings are different, the highest ranking will be selected for a combined classification and ranking. For example a stream rated Class 1 for wildlife and Class 2 for fisheries would receive a Class 1 ranking for combined wildlife/fisheries values.