Part ONE (General Information for Project Procedure
I. Introduction

1. **Project Name:**
   Issaquah Creek Fish Passage, 206

2. **Authorization**:
   This project is authorized under section 206 Ecosystem Restoration Authority

3. **Sponsor**:
   Washington Department of Fish and Wildlife

4. **Project Location:**
   The project site is located in King County, Washington, in the city of Issaquah, on Issaquah Creek river mile 3

5. **History**
   (see PRP Report)

6. **Existing Conditions**:
   The intake structure or diversion dam, located ½ mile upstream of the hatchery supplements water intake to the hatchery. The hatchery has three water rights; one for 10 cfs at the lower intake, one for 10 cfs at the gravity intake, and one for 16 cfs, which can be withdrawn at either intake. Therefore, a maximum of 26 cfs can be withdrawn at either intake, as long as the total withdrawal does not exceed 36 cfs. However, without modifications, the current pipeline for the gravity intake can deliver a maximum of 12 cfs.

   The intake structure consists of a wooden dam and spillway with concrete apron. To the east of the dam is a fish ladder, consisting of an 8 step pool and weir type with pool dimensions of 5x5 ft extending the length of the concrete apron, a water bypass, and intake screen of 182 square ft, with 1/8' openings (see figure 2); to the west is a concrete retaining wall. The dam is 50 ft in length, 25 ft wide, and approximately 5 ft high.
   (see PRP report for additional information)

7. **Problem Identification:**
   During both high and low flows the upper intake system (dam, fish ladder, and intake structure-with screens and water bypass) creates a barrier to both upstream and downstream fish passage. Infrastructure is inadequate, requires high maintenance, and is largely dysfunctional. The following problems exist at the existing diversion dam structure:
   - Dam: 1) concrete apron, attracts adult fish during times of low flow 2) right abutment, destabilized by eroding waters 3) spillway, clogged with sediment, high maintenance, unstable

- Fish Ladder: 1) ladder, too steep, impassable during high and low flows 2) attractant flow, inadequate
- Intake Structure: 1) screening, 2) juveniles trapped in intake area, 3) inappropriate sweep velocities, and 4) inadequate fish by-pass return.

8. Planning Process:

Project Goal: Significantly improve juvenile and adult salmonid fish passage survival at the diversion structure in Issaquah Creek.

Planning Objective**:** Project Objective: Provide more efficient and effective fish passage at the Issaquah Creek barrier dam.

- Basis for Planning Objective
  1. Meets project goal: Provide more efficient and effective fish passage at the Issaquah Creek barrier dam. By doing so, we will significantly improve juvenile and adult salmonid survival in Issaquah Creek and the larger Lake Washington Ecosystem.
  2. Consistent with 206 Authority Criteria for restoration projects

Planning Design Constraints

1.Maintain gravity water supply to hatchery at or exceeding present levels, approximately 12 cfs.
2.Avoid increasing flooding of Issaquah Creek.
3. Minimize adverse impacts to established riparian area.

- Basis for Planning Constraints

  1. The first constraint was based upon the following information:
  a. The gravity intake is extremely reliable, cost efficient, provides 50% of the water needed for the fish hatchery, and high savings
  b. High liabilities involved with removing the intake
  c. An alternative supply cannot be found which meets water quality standards and is economical (e.g. Dairy, ground water)
  d. The lower intake has experienced or exhibits several problems which prevent it from reliably providing for the full water demand (exclusive of incubation for the hatchery)
  e. See alternatives 3,4,5 for specific information.

  2. Planning Constraints 2,3 were based on potential economic, political and environment impacts.

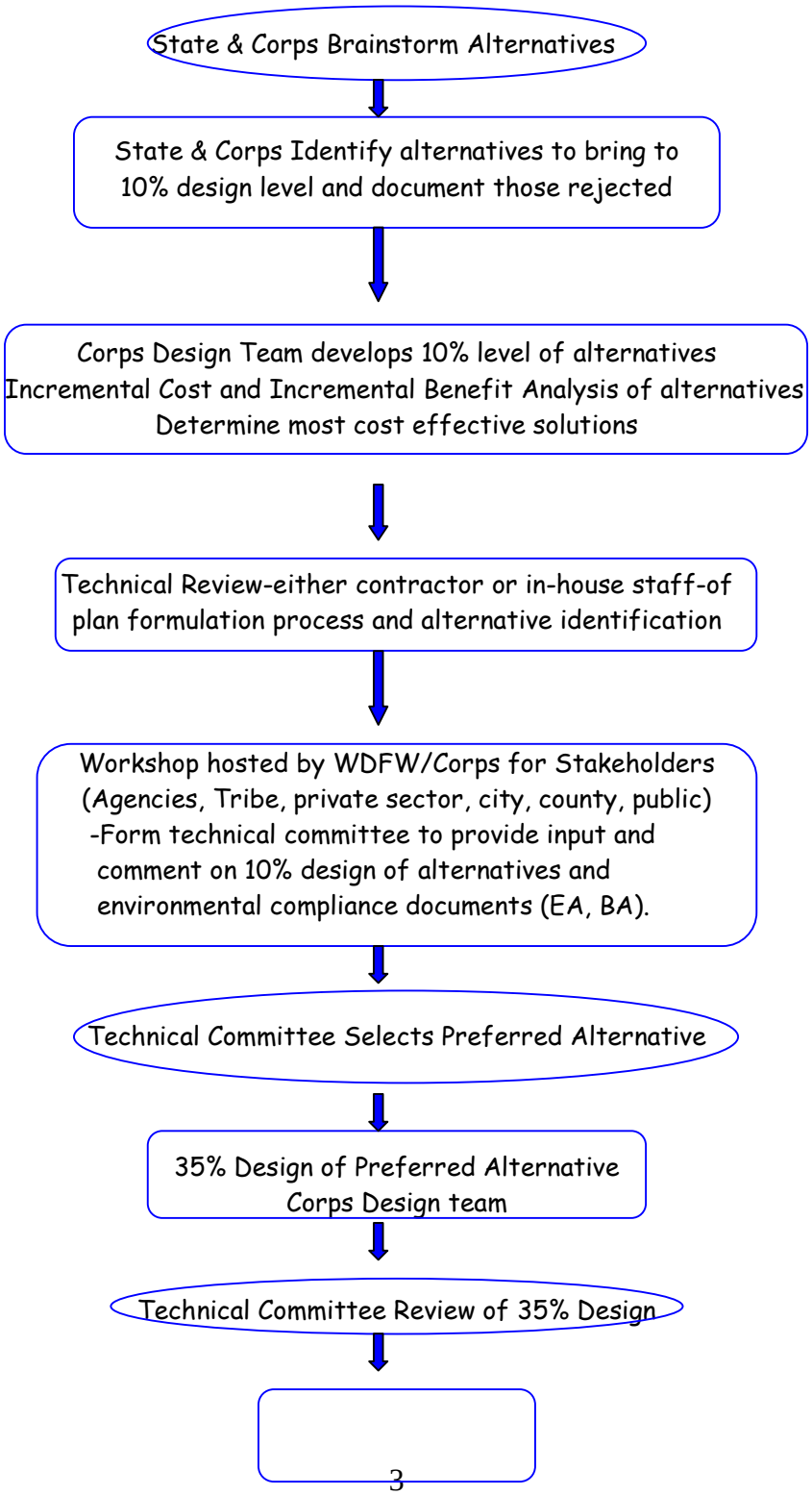
Planning Approach: Alternative plans must incorporate all aspects of the current dam/intake/fish ladder system; modifications to one must include potential impacts to another.

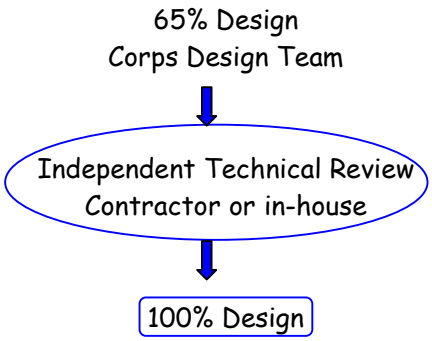
- Basis for Planning Approach
  The intake structure, ladder, and spillway operate as a system; project design will evaluate all three pieces to maximize benefits and efficiency and avoid negative impacts.

9. Plan Formulation: (Building plans that meet the planning objectives and avoid the planning constraints**)**

DFW and Corps agreed on the following plan formulation:

Plan Formulation Map- from Conception through 100% Design:





10% Alternative Development Map: - As a component of the map above, we developed the following map for alternative identification thru 10% design (Developed Jan 30,2002 meeting):

TASK-Steps	**RESPONSIBLE PARTY** **(refer to pmp for members of each team)**
1.Brainstorm Planning Measures	Project Development Team: √
2 .ID Planning Objectives & Constraints	Project Development Team √
3. Combine planning measures to produce alternative plans. (combinability, dependence, exclusive)& Preliminary evaluation of alternatives -Initial screening	Project Development Team: √
4. ID Design Criteria (RE, structural, Fish/boil, H&H) field trip/meeting	Project Development Team√
5.Design Meeting	Design Team:
6.10% Design + Costs + Benefits	DesignTeam/Costs/Biologist
7. Incremental Cost & Cost Effectiveness Analysis	Economist
8. 10% Design Package	

10. List of Acronyms

PMP – Project Management Plan
LER – Land Easements Right of Way
O&M- Operation and Maintenance
PM- Project Manager
ERS- Environmental Resources
RE-Real Estate
NEPA-National Environmental Protection Act
BA-Biological Assessment
EA – Environmental Assessment
PCA-Project Cooperation Agreement
Planning Measures- Individual Components of Alternative Plans

II. Scope:

Preliminary Restoration Plan: Completed September 2001

Planning and Design: Initiated October 2001

Plans and Specs Investigation Tasks

1. Project Planning: (PM)
   - PMP (living document, updated quarterly
   - Schedule, -MS project
   - Detailed Cost Estimate
   - Sponsor Coordination/Team Coordination

2. ERS:
   - Pre-Coordination discussions
   - Initial Agency Meetings
   - Studies Development/ Identification of existing data
   - Biological Criteria for design
   - Quantification of biological benefits (numerical quantification of benefits considering both quantity and quality of each alternative – benefits measured in: habitat units, points, etc.)
   - Contracting and Oversight of Studies
   - Monitoring, field work and data analysis
   - Design Review
   - Impact Assessment and EA/BA preparation
   - Final agency Coordination - FWCA
   - Public Review and Permitting (404 analysis, water quality certification/public notice, coastal zone consistency, cultural resources assessment, collection permit)

3. Civil/ Structures:
   - Site Assessment
   - Preliminary Design
     -Spillway
     -Fish ladder
     -Intake
     -Right Abutment
   - Write Design Analysis

- Assemble Calculations
- Write Specifications
- Provide Cost Engineering Input
- Final Design

NOTE: Due to the short fish window for construction, design may need to promote modular implementation of the project.

4. Geotech
    - Site Assessment/Geotechnical report

5. Economics:
    - Alternatives Analysis
    - Plan Formulation (with PM)
    - Incremental cost and benefit Analysis
    - Recommended plan selection with Study Team
    - Cost Sharing computations
    - Prepare narrative

6. Cost Estimating:
    - Preliminary Costs for PDA estimates
    - Detailed Costs Construction

7. Real Estate:
    - Identification of real estate issues
    - Rights of Entry (ROE)
    - Real Estate Drawings for Real Estate Plan
    - Perform P. L. 91-646 Relocation Survey
    - Prepare Gross/Final Appraisals
    - Prepare a Baseline Cost Estimate for Real Estate in M-CACES Format
    - Prepare a Real Estate Plan (REP) for Planning and Design Report, (design documentation report-DDR)
    - Review, Comment and Coordinate DDR
    - Ascertain Non-Federal Sponsors' Legal Authority
    - Project Cooperation Agreement and Deviation Report
    - Technical Review of Decision Document
    - Revise Comment and Coordinate Response to Technical Review
    - Review and Higher Authority Review Comments
    - Certification of Land
    - LEERRD

8. H &H
    - Determine / define functional criteria - Includes design discharges, design velocities through ladder, losses at screens, intakes and dam.
    - Design / configure dam alteration –(if applicable) Includes assessment of the best alternative for downstream dam face, dam crest elevation and apron configuration.
    - Design / configure fish screen at intakes (if applicable), including any bypass chute for juvenile fish

- Design fish ladder extension (if applicable). Includes design / assessment of intake and outlet hydraulics, configuration for optimal velocities and attraction flows and addressing of sediment issues
- Define channel hydraulics for upstream and downstream reaches – Includes determination of hydraulic and sediment conditions for the post-construction channel configuration at both high and low flow conditions, (depths, velocities)
- Determine high flow impacts - Includes channel/system stability at high flow and consequent design of any required bank stabilization.

9. DFW:
    - Assist in plan formulation and identification and selection of alternatives
    - Public outreach/ workshop coordination (with PM)
    - Technical review of design
    - PCA development
    - HPA (concurrent to permit acquisition by the corps, Seattle will work on HPA Acquisition)
    - Provide Cost share responsibilities

PDA Task Deliverables

1. Scopes of work from each team member
2. PCA -draft
2. Final PCA
3. Costs and Benefits/Economic Analysis of Alternatives
4. Public Notice
5. Technical Review of plan formulation and alternative selection
6. 10%, 35%, 65%, 100% design drawings
7. Technical Review of design drawings with documented backcheck
8. Stakeholder Workshop
9. Sponsor Financial Plan and Statement of Financial Capability
10. Permits (404 (b)(1) analysis, 401 water quality certification, Coastal Zone consistency determination, Cultural Resource Assessment, Fish and Wildlife Coordination Act concurrence
11. BA/EA/FONSI (ESA consultation, section 7 consultation)
12. Detailed Project Report (DPR) with NEPA compliance – Decision making document

Construction

1. Bid/ Award Contract

NOTE: How will operation of the hatchery and intake be effected during construction?

Scope changes

For any changes in scope or schedule, the responsible person will notify the PM for concurrence. Because several events are sequential, the scope change may require a team meeting. All significant changes that effect the team and schedule will be discussed as a team to determine the best course of action. All final decisions rest with the PM.

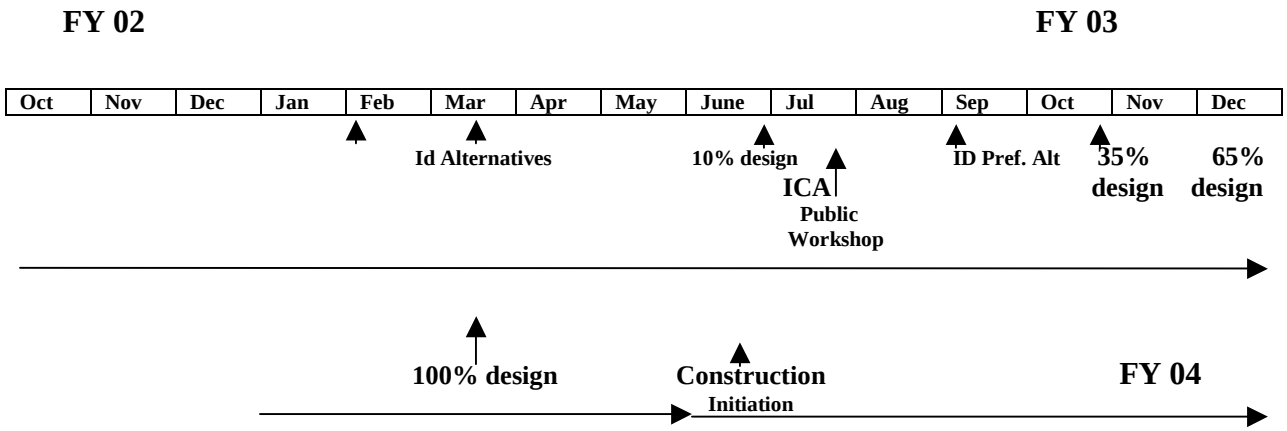
III. Human Resources

Team Members:	Title:		e-mail
Alicia Austin	Project Manager	(206)764-5522	alicia.m.austin@usace.army.mil
Matt Caesar	Civil Designer	(206)764-6574	mathew.j.caesar@usace.army.mil
Chuck Ebel	Biologist	(206)764 –3626	charles.j.ebel@usace.army.mil
Monte Kaiser	Geotech Engineer	(206)764-6194	monte.e.Kaiser@usace.army.mil
Kevin Kane	Real Estate	(206)764 - 6652	kevin.l.kane@usace.army.mil
Jeff Mendenhall	Economist	(206)764 -3644	jeffery.o.mendenhall@usace.army.mil
Sonny Neumiller	Cost Estimating	(206)764-3672	alray.neumiller@usace.army.mil
Catherine Petroff	H &H	(206)764-6684	Cpetroff@u.washington.edu
Mario Russo	Structural Engineering	(206)764-3814	Mario.c.russo@usace.army.mil
Bob Zillmer	Rev. Appraiser	(206)764-3560	robert.zillmer@usace.army.mil
WDFW Contacts:			
Doug Hatfield	Complex Manager	(206)719-3293	Hatfidgh@dfw.wa.gov
Chuck Johnson	Division Area Manager	(360)902-2653	Johnscwj@dfw.wa.gov
Darrell Mills	Hatchery Cood./boil	(360)902-2657	millsdwn@dfw.wa.gov
Doug Nelson	Engineer	(360)902-8378	Nelsodgn@dfw.wa.gov
Pat Powers	Design Engineer	(360)902-2546	powerpdp@dfw.wa.gov

V. Risk

- Currently Federal Costs are estimated below 1 million. If scope changes during project formulation cause federal costs to exceed 1 million, the project must complete a feasibility stage in addition to PDA. This will increase study time and cost.
- Cost Sharing: It is likely the intake if modified or removed for fish passage improvement as well as modifications to the dam may be included as part of the total project cost and cost shared. However, if proven unrelated to fish passage and specific maintenance issues, these costs will be the responsibility of the Sponsor.

VI. Schedule



Submit PRP	August 2001
Initiate PDA	October 2001
Complete PDA	May 2003
Initiate Construction	June 2003
Complete Construction	December 2003

Please refer to MS project for detailed schedule

VII. Cost . All costs are in 2001 dollars, estimated by project team members for the PRP. More detailed costs will be generated when the preferred alternative is selected. These costs may be assumed at a 10% design level.

	Total	Non-Federal	Federal	FY01	FY02	FY03	Balance
PDA	$364,000	$0	$364,000	$3,000	$285,000	$76,000	
Construction	$641,000	$352,000	$289,000			$200,000	$89,000
Total	$1,005,000	$352,000	$653,000	$3,000	$285,000	$276,000	$89,000

b.Non-Federal Requirements:

LER	$11,500
Cash	$340,000
Work –in-kind	$0.00
Annual OMRR&R	$1,000

c. Fully funded cost estimate: $1,005,000

VIII Quality

To ensure a quality product, all action will be documented in the PMP, including decisions, rejection or acceptance of alternatives, etc. A review of the designers assumptions, analyses and calculations within each discipline will be accomplished by an independent technical reviewer. The review team will provide the designer and PM with written or electronic comments for annotation as appropriate. A scheduled "face to face" review meeting will take place between the customer, the design team and other interested parties as appropriate. The comments will be discussed and the PM and design team will provide an anticipated action for each comment. As the design process continues, designers will provide feedback to the reviewer as to the action taken on a specific comment. Prior to advertising, the PM will coordinate a "backcheck" wherein it will be verified via spot-checking that comments made on the previous submittal have been adequately addressed.

All final design drawings and documents will be reviewed by the design team, independent technical reviewer, and the Non-federal Sponsor as appropriate.

Members of the technical review team will include:
Linda Smith, PM-PL

Fred Goetz
…

IX. Customer Expectations/Responsibilities

The Washington Department of Fish and Wildlife is the primary customer involved in this project. This customer expects to contribute to the development of the project and have their input significantly effect the project. They expect the corps to produce quality projects on time and on budget. They expect quarterly progress updates and open communication throughout the planning and design phases.

DFW will make available all of the lands required for project implementation. DFW has received a copy of the PRP and is in agreement with it and aware of the estimated project cost. DFW intends to sign the PCA at the appropriate time, cost share the project, and willing and able to assume responsibility for project O&M.

X Documents

All Documents are found in the PM's folder: My documents/Issaquah Creek. All recent photos will be kept in: Y:\planning\pictures\Issaquah Creek

Part 2: Progress Documentation/Plan Formulation – Alternatives, Decisions, Rationale-

Progress/Action (Summary to date)

Kick off meeting – In house	Nov 9, 2001√
Initial Site Visit with Sponsor	Nov 19, 2001√
Initial Plan Formulation Meeting – sponsor/corps	Dec 11, 2001√
Alternative Discussion/Plan formulation Meeting – Spons/Corp	January 30, 2002√
Follow-up Alternative Meeting – Sponsor/Corps	March 8, 2002√
Design Criteria Meeting-sponsor/corps (tech committee)	March 29, 2002√
Design Meeting – In –house designers (design team)	April 16, 2002√
Design Meeting – In house designers (design team)	April 30, 2002√
10% Design Package	June 30, 2002

NOTE: Refer to Plan formulation Map I. 9 for overall process/goals

Specific Progress: Listed chronologically

Step 1: Brainstorm Planning Measures (alternatives)
Step 2: Identify planning objectives & Constraints
Step 3: Combine Planning Measures to produce alternative plans and Preliminary evaluation of Alternatives
Step 4: Identify Design Criteria (RE, structural, fish/boil, H&H)
Step 6. Design Meeting
Step 7: 10% Design +Costs +Benefits
Step 8: Incremental Cost and Cost Effectiveness Analysis
Step 9: 10% Design Package

Step 1: Planning Measures/Alternative Brainstorming –Complete Packages and individual Planning Measures

Alternative Brainstorming : Listed below are two sets of alternatives: 1) complete packages -as we discussed in Dec 11, 2001 meeting, and 2) individual components-separated into categories -as compiled by Mendenhall – following brainstorming.

Complete package ideas (as discussed Dec 11, 2001):

Alternative	Constraints Identified
1. Remove Dam and Weir, modify pipe ends	Flooding issues/ grade changes/head cutting, +$'s
2. Modify existing structures-the preferred alternative in the PRP	-Must see the system as a whole
3. Multiple flow option, pool/ slot	Char? Keeping ladder functional in low flow
4. Ladder bends around intake structure, pool/chute design as previously developed by WD FW (traditional, pool/chute, ½ pool chute) (see Callis Barrier dam modification example)	Few DNR issues, State owns access road and project foot print
5. Intake Structure placed in stream bed	Sediment clogging potential, especially following flood event; high maintenance
6. Pool Attraction	Sediment Load is high, difficult to maintain
7. Demolition/Dam Removal	Require intake extension upstream for head -erosion potential, headcutting, flood concerns
8.Scaling project (hatchery production) to water quantity at lower intake; Restore stream passage without regard to intake water requirements	-Muckleshoot and State – joint owners of hatchery, issues -Production level is maintained in an agreement with PSE/tribes
9. Alternative water source (pumping from river, Dairy, other sources); Restore stream passage without regard to upper intake water requirements	-Water quality from potential sites was deemed unfit for in-stream use -$'s, the current intake functions very economically, any change in this operation will increase maintenance costs

Individual Components (Planning Measures):

Plan formulation Note: Initial plan formulation functions consists of identifying the problem, defining the goal of the project, listing and evaluation of the alternatives which help meet the goal. Evaluation of the alternatives and combination of alternatives will result in a preferred alternative. Alternatives identified so far are listed below and have been separated into categories.

DAM

A. Remove dam only (includes removing sediment, regrading creek, bank protection)
B. Remove dam and construct series of downstream weirs.
C. Remove dam and construct new dam, diversion structure and fish ladder.
D. Modify existing dam/ stabilize right abutment, in conjunction with improved water intake and fish ladder.

FISH LADDER

E. Replace existing ladder with multiple water flow fish ladder(s) located at existing ladder area.

F. Remove existing ladder and replace with multiple flow ladders in spillway area of project. Spillway is in effect turned into the fish ladder.
G. Replace existing ladder with a new ladder around dam.

The above fish ladders alternatives could be designed to include one or more of the following:

a. Extend ladders downstream.
b. Steps only.
c. Pool and Chute (steps on one side of ladder).
d. Pool and Weir (steps on alternate sides of ladder).

APRON

H. Remove apron.
I. Reconfigure apron so water flows toward fish ladder.
J. Replace apron with Ogee face spillway

The above alternatives would be designed based on the need to continue to provide gravity fed water to the fish hatchery. There are alternatives that could be evaluated that are associated with different water diversion ideas. Water diversion alternatives may not have a federal interest but may play in the design of the above alternatives. Water diversion alternatives include:

WATER DIVERSION

K. Replace existing water diversion structure and keep at same location.
L. Replace existing intake structure and place new intake in stream bed.
M. Drill new water well and pump water (Rejected, 12-11-01, see below)
N. Pump water from Issaquah Creek (Rejected, 12-11-01, see below)
O. Buy water from Dairy (Rejected, 12-11-01, see below)
P. Modify existing screen structure to comply with current screening criteria.

***Step 2: Identify General Planning Objectives & Constraints**:*

Planning Objectives

The following Planning Objectives were identified and approved by the study team as the basis for selection / rejection of alternatives:

1. Maintain gravity water supply to hatchery at or exceeding 12 cfs.
2. Modify and/or replace current barrier dam components

Basis for Planning Objectives

1. The first objective was based upon the following information:
   a. The gravity intake is extremely reliable, cost efficient, and high savings
   b. High liabilities involved with removing the intake
   c. An alternative supply cannot be found which meets water quality standards and is economical (e.g. Dairy, ground water, surface pumping)
   d. The lower intake has experienced or exhibits several problems which prevent it from reliably providing for the full water demand (exclusive of incubation for the hatchery)
   e. See alternatives 3,4,5 for specific information.
   f. The upper intake supplies 50% of the water for the hatchery

2. The second objective was based upon the following:

a. Meets project goal: Significantly improve juvenile and adult salmonid fish passage survival at the diversion structure in Issaquah Creek.
b. Consistent with 206 Authority Criteria for restoration projects

Planning Constraints

1. Future Operations and Maintenance costs of completed project should not exceed current costs.
2. Project can not increase the likelihood of overbank flooding of Issaquah Creek
3. Must minimize land acquisition

Step3: Preliminary evaluation of Planning Measures (initial rejection or accepted for further study) and Combining Planning Measures to produce Alternative Plans

The following alternatives were compiled and evaluated, separated into those rejected and those selected for further analysis:

Planning Measures Rejected:

1. No Action: Does not address criteria number 2 nor project goals
2. Scaling hatchery production to water quantity supplied by lower intake; Restore stream passage without regard to intake water requirements:
    - Does not fit criteria selection
    - The upper intake is necessary to supply 50% of the water to the hatchery; diminishing hatchery production is not an option (production level of the hatchery is mandated by an agreement with the Tribe/State/PSE.
3. Find alternative water source for hatchery; restore stream passage without regard to upper intake water requirements
    - Groundwater: Groundwater exploration was completed by Mr. Richard Rogney, a geologist in 1972-73 to perform testing and research to determine groundwater availability for the Issaquah Hatchery. He projected potential yields of 100-200 gpm, which are will below production water requirements (13,000 gpm).
    - Dairy Gold water is being used presently to supplement some needs, but volumes are inadequate to supply the entire hatchery (500 gpm max, 13,000gpm needed).
    - Water pumped directly from stream: (Insert here study, costs of pumping station, O&M costs, costs of dam removal and stabilization, view of the sponsor)
4. Increase water uptake at lower intake to eliminate use of upper intake:
    - Does not meet planning objectives
    - WDFW is not converting over to exclusive use of the lower intake for full supply of it's water per the Issaquah Hatchery Master Plan: The lower intake has experienced or exhibits several problems which prevent it from reliably providing for the full water demand (exclusive of incubation for the hatchery). The problems are as follows:

        a. High creek flows create a hydraulic condition in which water acceptance stops. WDFW had a consultant model this phenomenon, and propose a "fix". When funding is secured, this fix will be incorporated.

b. Large quantities of bed load sediment are accepted by the intake, which reduces the quality of the rearing, and creates an excessive cleaning burden for the facility.

c. The screens experience very significant blinding (clogging) that cannot be cleaned during normal creek flows. This can severely reduce the intakes water acceptance capacity. We have seen blinding greater than 50%, which we think loosely, correlates with an equivalent reduction in acceptance capability. The reason this particular problem has not manifested itself to a significant degree as of yet is that the hatchery has only half of the pumps installed at this time. Therefore, the intake has only needed to supply water at half of its intended capacity.

Increasing water supply at the lower intake will require structural modifications at both the lower intake and upper intakes (fish passage problems associated with the upper intake will still need to be addressed, regardless of lower intake efficiency). This solution incurs higher costs than an alternative focusing only on the upper intake.

- Notes from DNR….. add here (Doug Nelson)

5. Dam Removal Only
    - Does not meet planning objective – will eliminate gravity intake
    - Hydraulic stability issues- head cutting, bank erosion, possible threats to upstream bank structures

6. Intake Structure placed in streambed to eliminate need for dam:
    - Bed load material constricts functioning of lower intake, which draws water from the bed. Presumably, sediment would clog up upper intake and decrease water intake efficiency as well.
    - High maintenance would be necessary to keep screens clean of sediment. This would be of greater impact during times of flooding and where access to screens would be difficult.

7. Pool Attraction – improve attraction to fish ladder:
    - Does not meet project goals
        - Would increase some minor efficiency of fish ladder (less attraction to concrete apron) but not solve fish passage problems.
        - Would not significantly improve juvenile and adult salmonid survival in Issaquah Creek

8. Maintain existing dam with minor modifications to fish ladder
    - Does not meet project goals
        - During times of high and low flows, fish migration will continue to be impeded

- Would not significantly improve juvenile and adult salmonid survival in Issaquah Creek

Planning Measures Combined to form Preliminary Alternatives: The following alternatives will be specifically defined following design criteria identification and follow-up design meeting (please see 10% alternative development map).
Note: each alternative requires removal of the fish ladder.

1. Step/Weir – (Remove dam/spillway)
    - May or may not maintain intake structure; weirs may extend from bank to bank, or bank to structure
    - Weirs/steps extend upstream and/or downstream of dam
2. Step/Weir – (Keep Dam/spillway)
    - Present top of dam is top of upstream weir
    - Weirs/steps extend downstream from dam
    - Maintain Intake Structure with modification to screens
3. Construct new dam/spillway/apron/fish ladder with current fish passage compliance.
4. Modify existing dam with structural upgrades; includes replacement of current fish ladder (preferred alternative documented in PRP)

Alternatives were Further Modified following March 8 Design Meeting: These specific alternatives will be developed to the 10% design level

1: Pool and Chute Fishway within Dam
2: Pool and Weir Fishway on left bank
3: Pool and Chute on LB with turning Pool
4: Pool and Weir wrap around back to dam crest
5: Weirs-remove dam
    a. Pumping water from stream to provide hatchery water
    b. Extend pipe upstream from intake
    c. Maintain level of existing dam, stabilize reach below dam

Note: Pool and weir fishway; consider auxiliary flow

Step 4: Identify design Criteria (RE, structural, Fish/biology, H&H)

Design Guidelines/Criteria (Based on Fish Timing and Hydrological Data-please see corresponding reports for more information:

- Creek (structural) design flow: 20 to 390 cfs
- Fishway (biological) design flow: 5-40 cfs (pool and weir)
  5-200 cfs (pool and chute)
- Hydraulic drop 1.0 adult (.8 juvenile)

We have decided to design the 10% level using .8 drop for all ladder design options. Confirmed in March meeting, and reconfirmed in phone conversation: May 21, with Doug Hatfield. When we evaluate costs associated with extra weirs we can change if appropriate.

Design Issues:

Dam Stability: There is some concern that if we move the dam crest forward then headcutting could destabilize the entire structure. Other concerns involve the right abutment where the channel could cut around the abutment and destabilize the slope. The concerns will be addressed in a Geotechnical investigation.