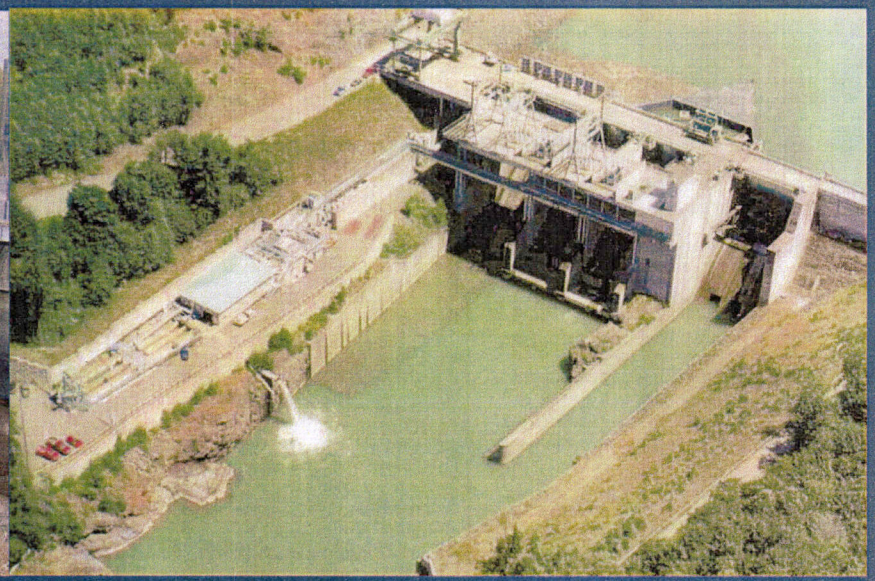
Cowlitz River Project
TACOMA POWER

AECOM



Cowlitz River Project Downstream Fish Passage Update
Presentation by Chick Sweeney, P.E., John Serl, and Marc Wicke

July 15, 2010 Fisheries Technical Committee Meeting

BioAnalysts, Inc.

AECOM Environment

Presentation Outline

- Biological Evaluation of Alternatives
  - Biological Evaluation Approach
  - Selection of Input Values
  - Preliminary Biological Evaluation Status
- Technical Evaluation of Alternatives
  - Biological issues criteria
  - Technical issues criteria
  - Weighting factors
  - Preliminary Technical Evaluation Status
- 2010 BGS Prototype and Supplemental Collection
  - Installation and operation

Biological Evaluation Approach

- Preliminary criteria/matrix approach did not work:
  - Parameters not comparable to License requirements
  - Collection efficiency ranking not scalable to standard
  - Smolt mortality en route to collector site not reflected in ranking
- New Approach
  - Use a fish collection index calculated following Fish Passage Survival (FPS) Settlement Agreement definition
  - Survival of smolts en route to the collection site (Sm)
  - Collection efficiency of the collection device

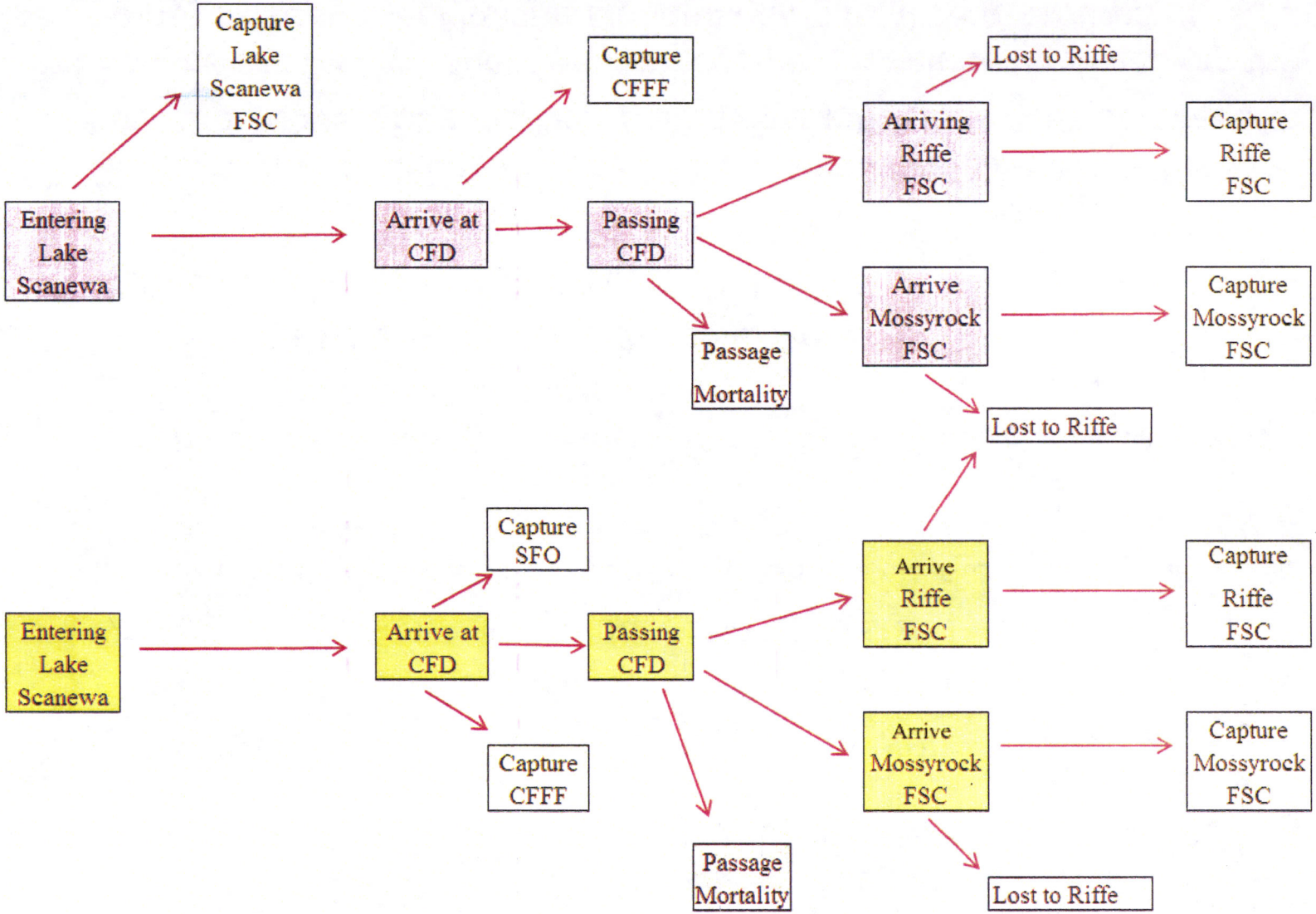
$$FPS = (Sm)\ (CE)$$

  - Spreadsheet model developed by Serl calculates cumulative FPS for collection device at a location or combinations of devices at locations
  - Results are highly dependent on assume CE values for collectors that do not exist and results should be used as relative measures of performance, not expected performance

Cowlitz River Project
TACOMA POWER

Biological Evaluation Process

AECOM



Cowlitz River Project
TACOMA POWER

Spreadsheet Model

AECOM

Species: **Steelhead**
Alternative: Current CFFF collection system

a System Performance	*b* Entering Lake Scanewa	*c* Capture Lake Scanewa	*d* Arrive at CFD	*e* Capture CFFF	*f* Passing CFD	*g* Turbine & Spill Mortality	*h* Arriving CFD Tailrace	*i* Arriving Riffe Collector	*j* Capture in Riffe Lk	*k* Arrive at Mossyrock	*l* Capture at Mossyrock	*m* Total STH Captured	*n* Trans/ Handling Mortality	*o* Total SRP Release	*p* Total FPS (adjusted)
Low	99%	0%		42%		3%		95%	0%	86%	0%		1.0%		
High	99%	0%		68%		3%		95%	0%	86%	0%		1.0%		
Low	19,720	0	19,720	8,282	11,438	343	11,094	10,540	0	9,541	0	8,282	83	8,200	41.4%
High	19,720	0	19,720	13,410	6,310	189	6,121	5,815	0	5,264	0	13,410	134	13,276	67.0%

Selection of Input Values

Survival (Sm)

- Lake Scanewa – estimated from radio telemetry studies (USGS various)
- Cowlitz Falls Dam (CFD) spill and turbine – balloon tag turbine survival (Normandeau and Skalski 2001)
- Riffe Lake - acoustic tag study (USGS 2009)

Selection of Input Values (cont'd)

Table 5. Smolt survival probabilities through reservoirs and passing turbines at CFD, proposed as model input for the alternatives ranking analysis.

Geographic location	steelhead	coho	Chinook
Lake Scanewa	.99	.97	.96
CFD to Riffe transect	.95	.73	.72
CFD to MRD	.86	.38	0
CFD turbines (min)	.97	.97	.97

Selection of Input Values (cont'd)

Collection Efficiency (CE) Potential

- Existing CFD flume – CE from mark recapture (WDFW 2000-2005)
- CFD Weir Box – telemetry from 2009 (Liedtke et. al. 2010)
- Surface Flow Outlet (SFO) or Floating Surface Collector (FSC) with Behavioral Guidance Structure (BGS) Effects
  - CE = Entrance Efficiency (EE) x Discovery Efficiency (DE)
  - Lower bound DE – estimated from CFD data (USGS 1999-2009)
  - Upper Bound DE – estimated from CFD data (USGS 2008-2009)
  - EE – estimated from Baker FSC coho data (Verretto 2009)
- FSC with guide nets – CE from Baker (Verretto 2009)

Selection of Input Values (cont'd)

Table 4. Lower and upper bounds for collection efficiency estimates proposed as model input for the alternatives ranking analysis.

Alternative	steelhead		coho		Chinook		Comment
	lower	upper	lower	upper	lower	upper	
Scanewa FSC or SFO with BGS	.61	.82	.60	.76	.55	.84	
Scanewa FSC or SFO with exclusion net	-	-	-	-	.73	.89	
CFD flume	.42	.68	.33	.45	.12	.24	
CFD weir box	.58	.72	.58	.72	.39	.66	Used coho data for steelhead
Riffe FSC or MRD FSC	.72	.87	.72	.87	.72	.87	

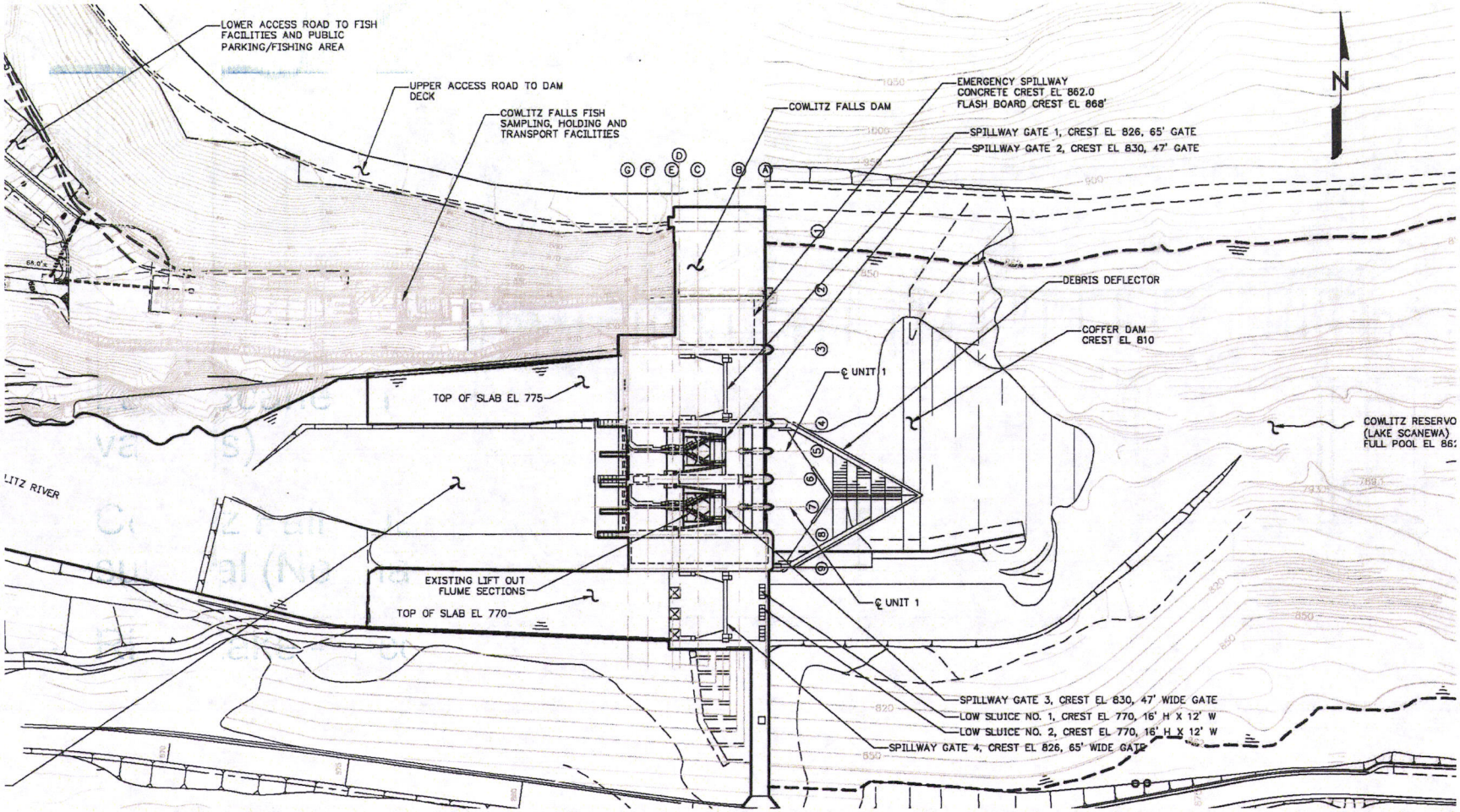
Alternatives Evaluated

Alternative No.	Components				
	Lake Scanewa Collector	Weir Box at CFD	SFO at CFD	Mid-Riffe Lake Collector	Mossyrock Collector
0	Base Case = Existing 4 Flume entrances in radial gates and two baffles in C-horizontal configuration				
1		X			
2	X				
3			X		
4				X	
5					X
6			X	X	
7			X		X
8	X	X			
9		X		X	
10		X			X
11		X	X		
12	X			X	
13	X				X
14	X	X		X	
15	X	X			X
16		X	X	X	
17		X	X		X

Cowlitz River Project
TACOMA POWER

Base Case Plan View

AECOM



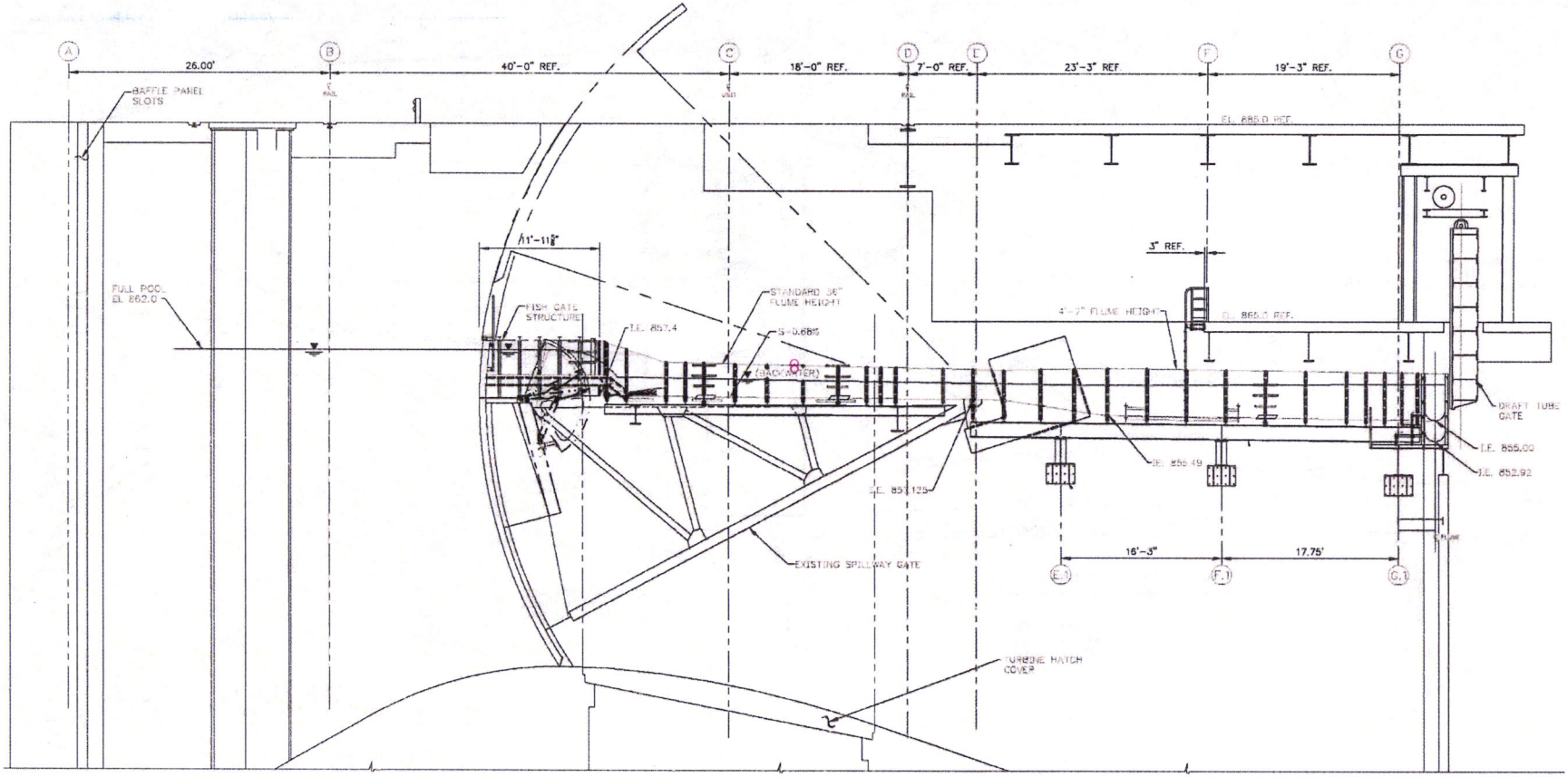
BioAnalysts, Inc.

AECOM Environment

Cowlitz River Project
TACOMA POWER

Base Case Profile View

AECOM



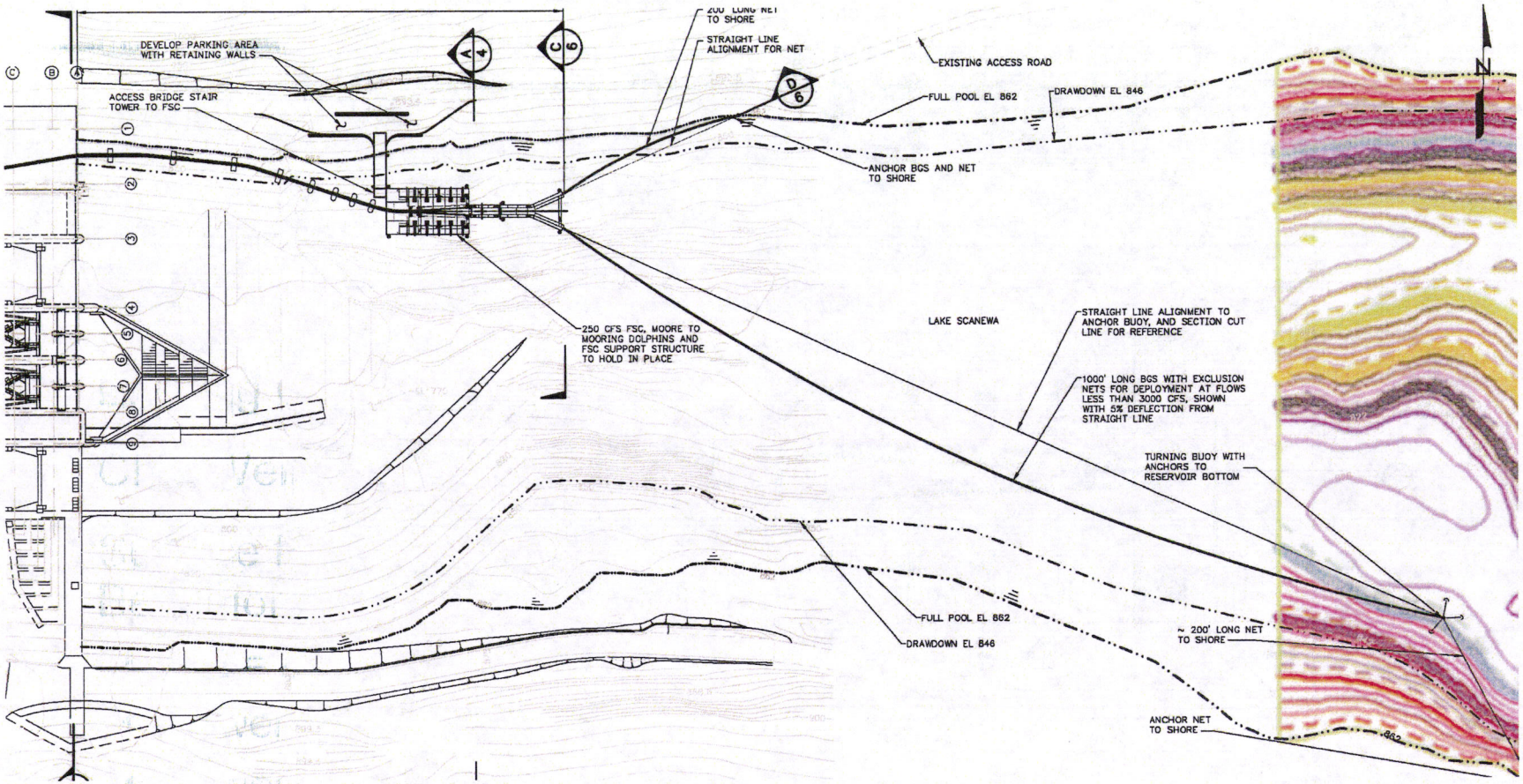
BioAnalysts, Inc.

AECOM Environment

Cowlitz River Project
TACOMA POWER

Lake Scanewa FSC Plan View

AECOM



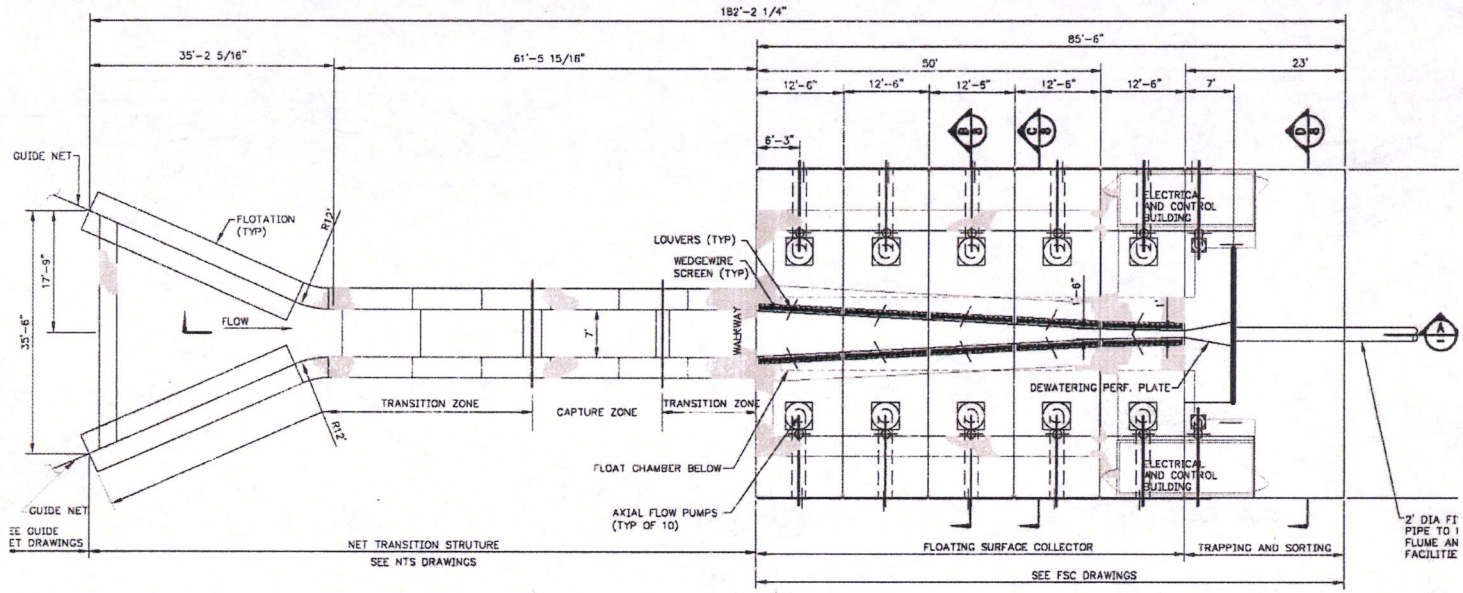
BioAnalysts, Inc.

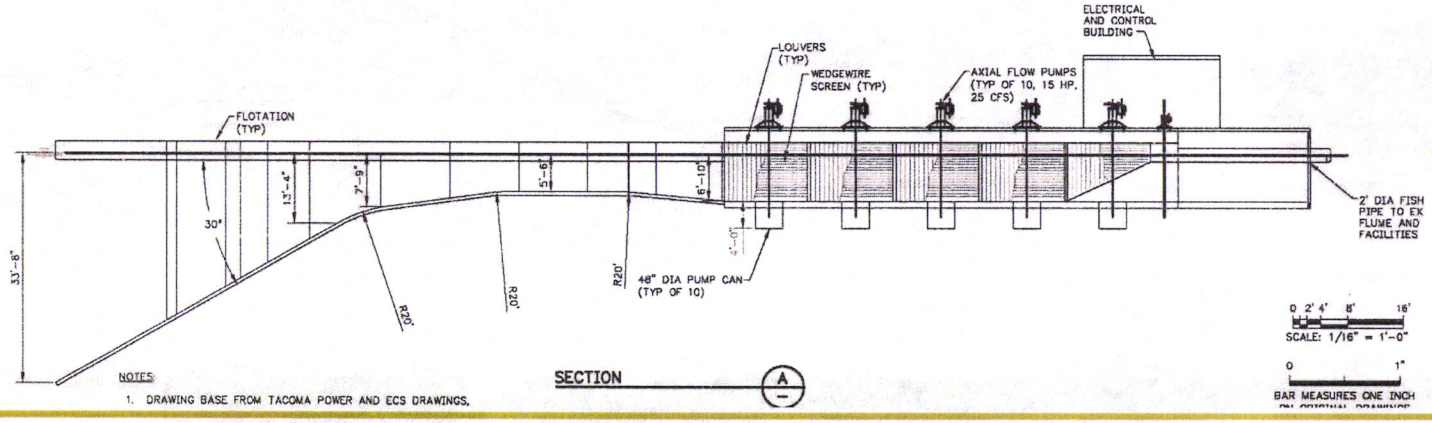
AECOM Environment

Cowlitz River Project
TACOMA POWER

Lake Scanewa FSC Details

AECOM





NOTES:
1. DRAWING BASE FROM TACOMA POWER AND ECS DRAWINGS.

SECTION A

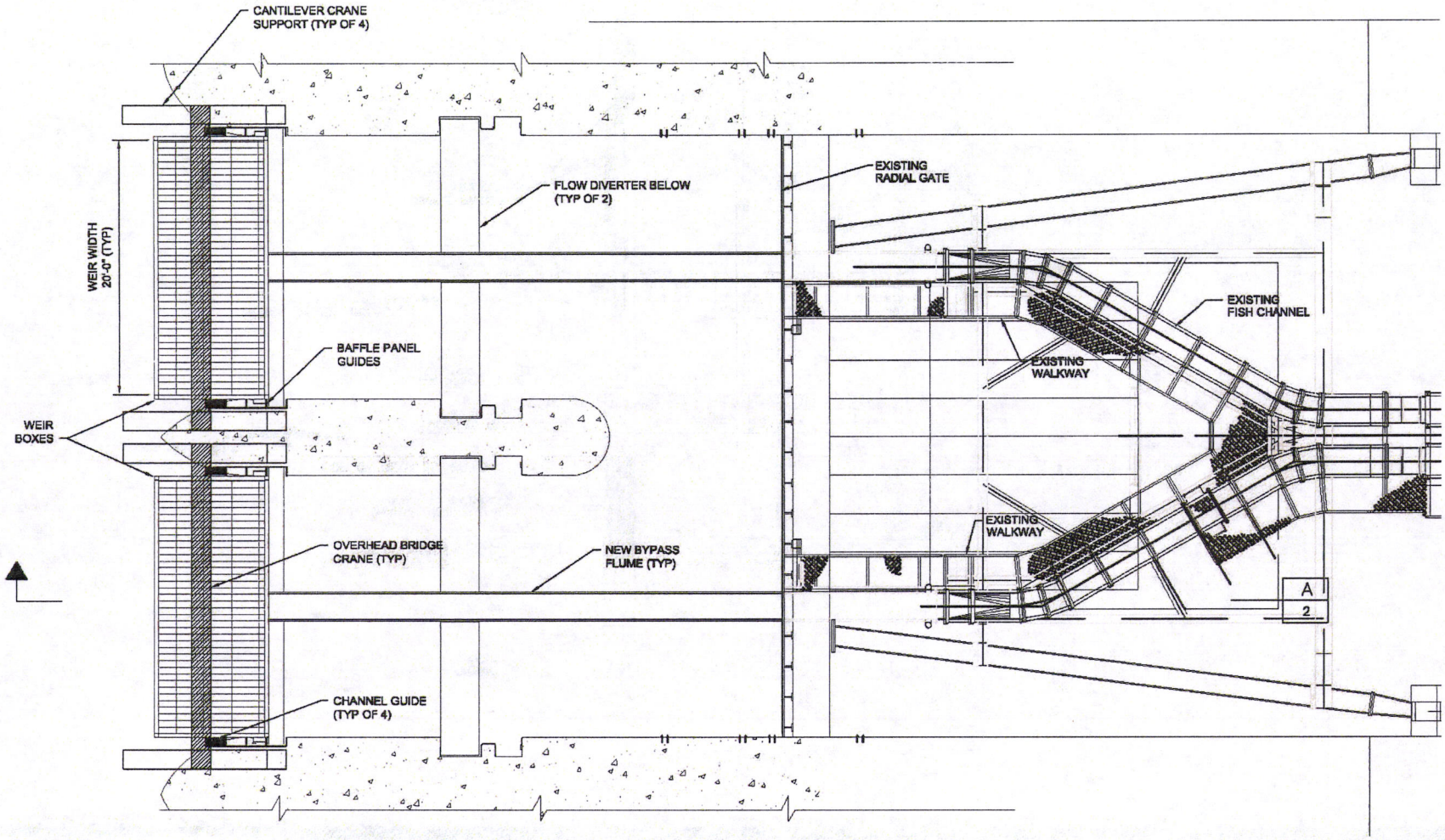
BioAnalysts, Inc.

AECOM Environment

Cowlitz River Project
TACOMA POWER

Weir Box Plan View

AECOM



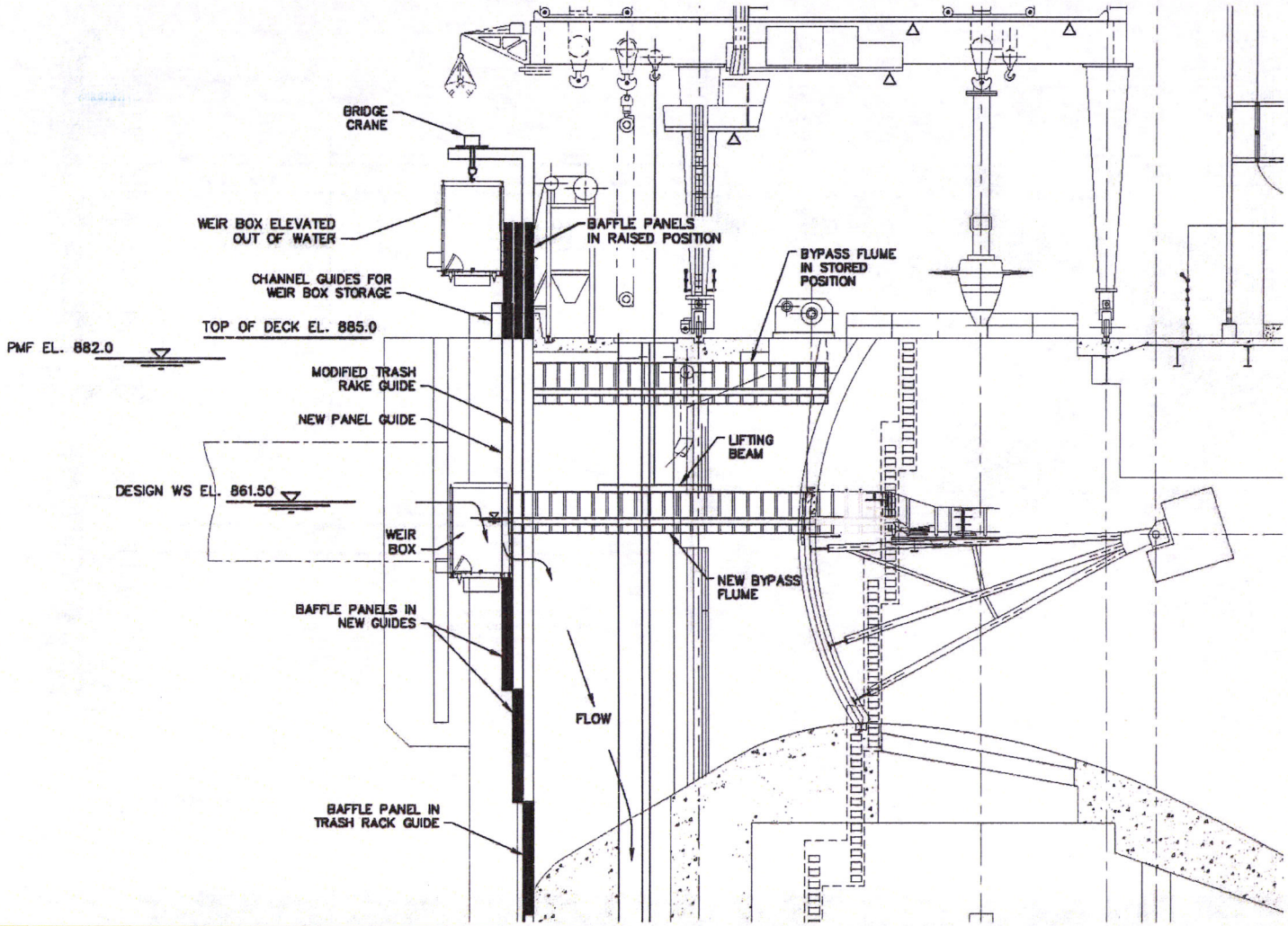
BioAnalysts, Inc.

AECOM Environment

Cowlitz River Project
TACOMA POWER

Weir Box Profile View

AECOM



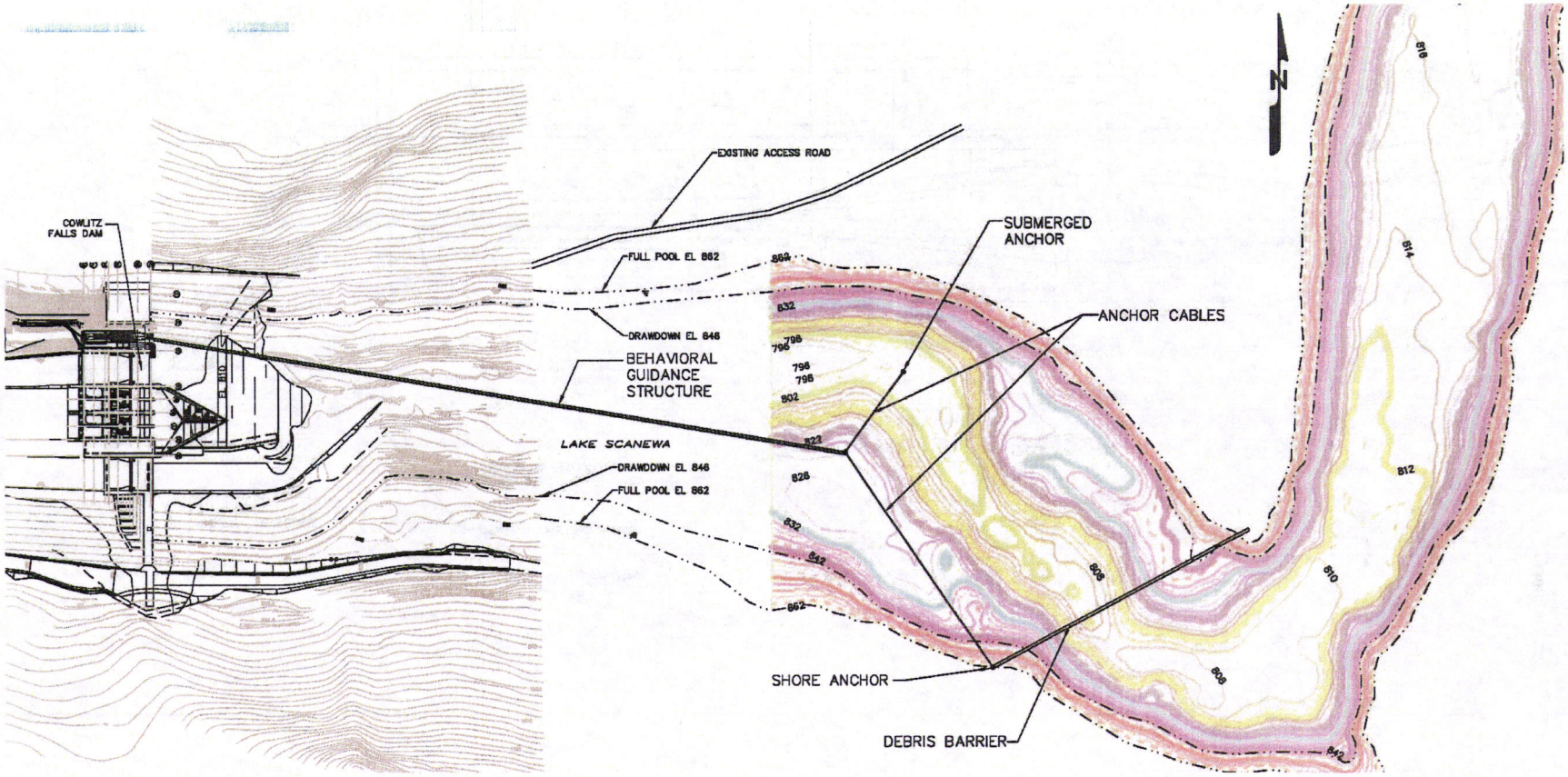
BioAnalysts, Inc.

AECOM Environment

Cowlitz River Project
TACOMA POWER

SFO Plan View

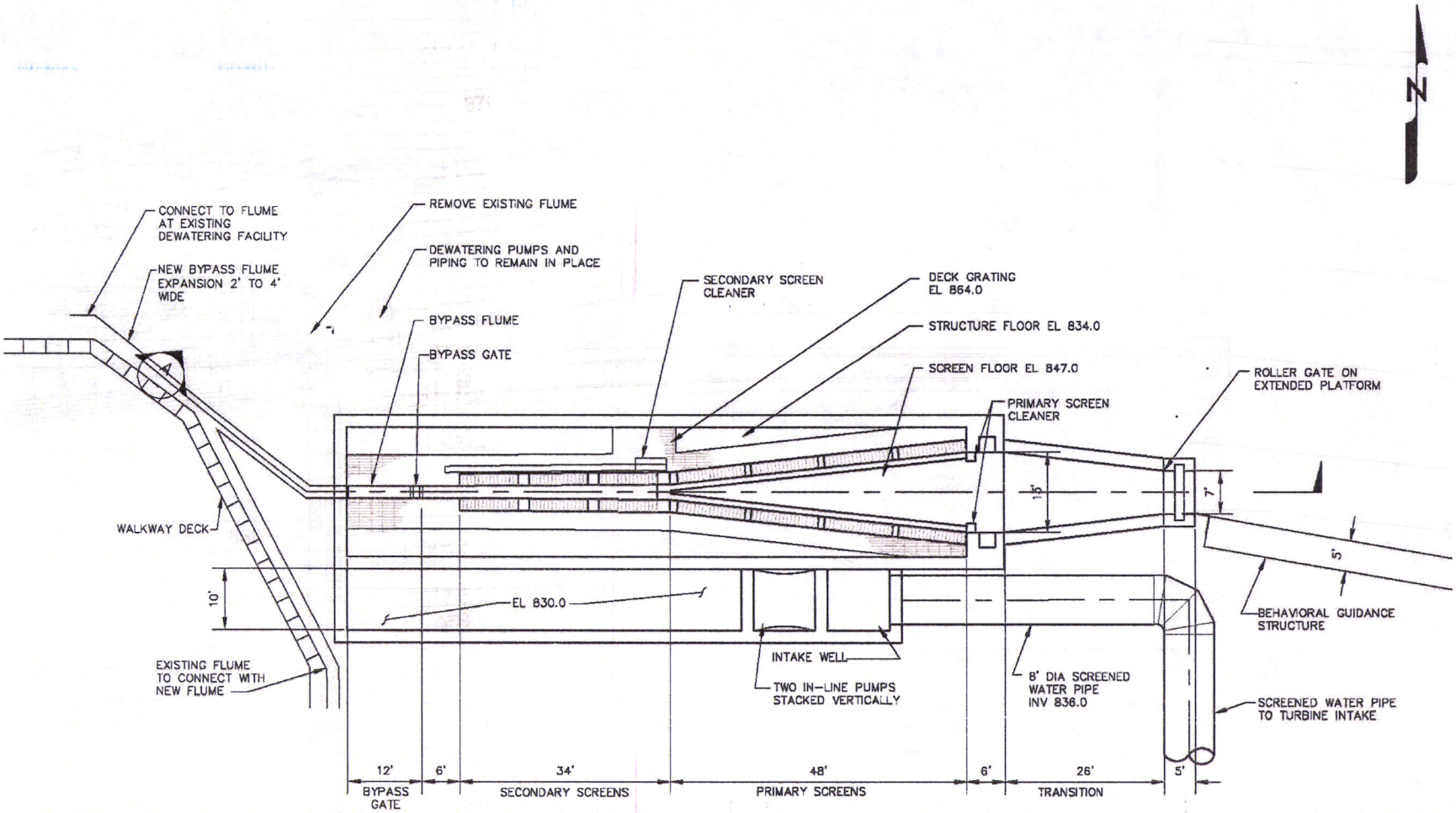
AECOM



Cowlitz River Project
TACOMA POWER

SFO Details

AECOM



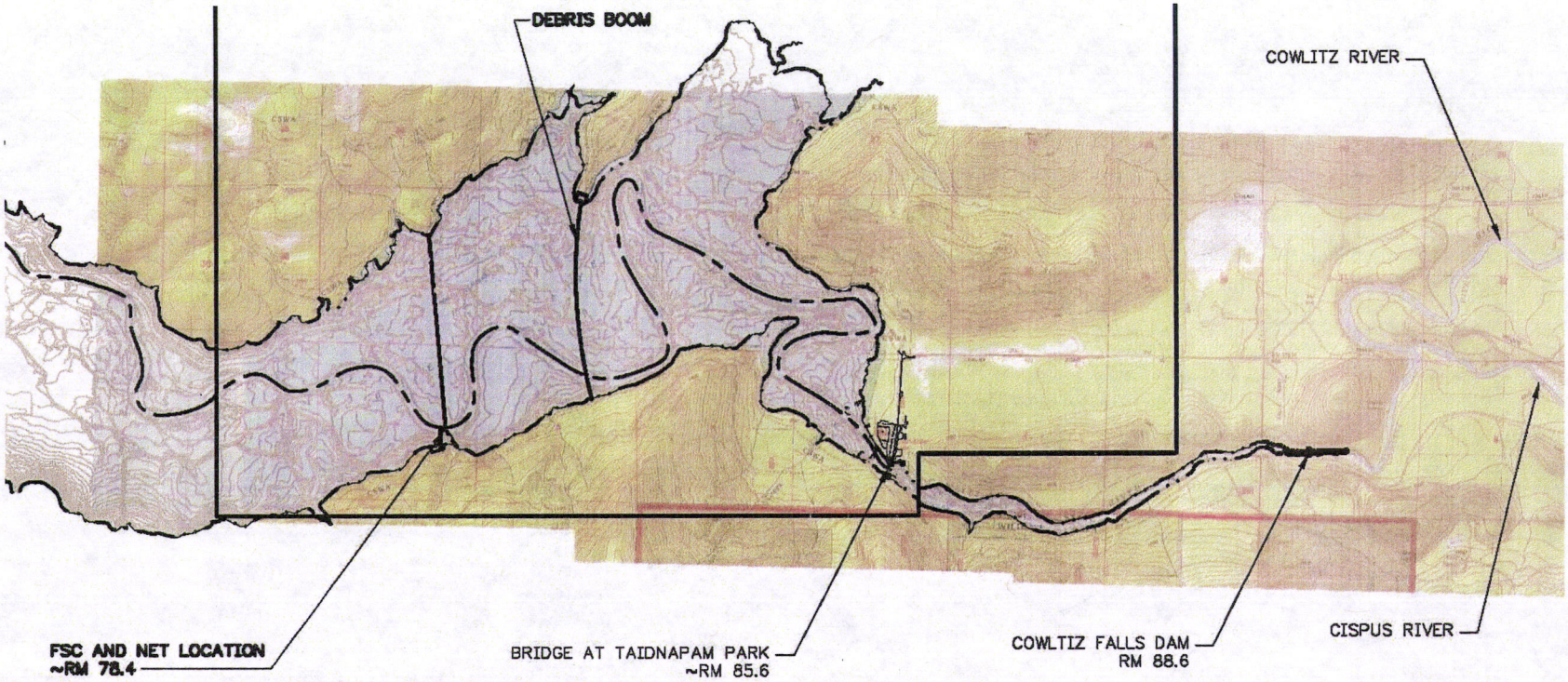
BioAnalysts, Inc.

AECOM Environment

Cowlitz River Project
TACOMA POWER

Riffe Lake Collector

AECOM



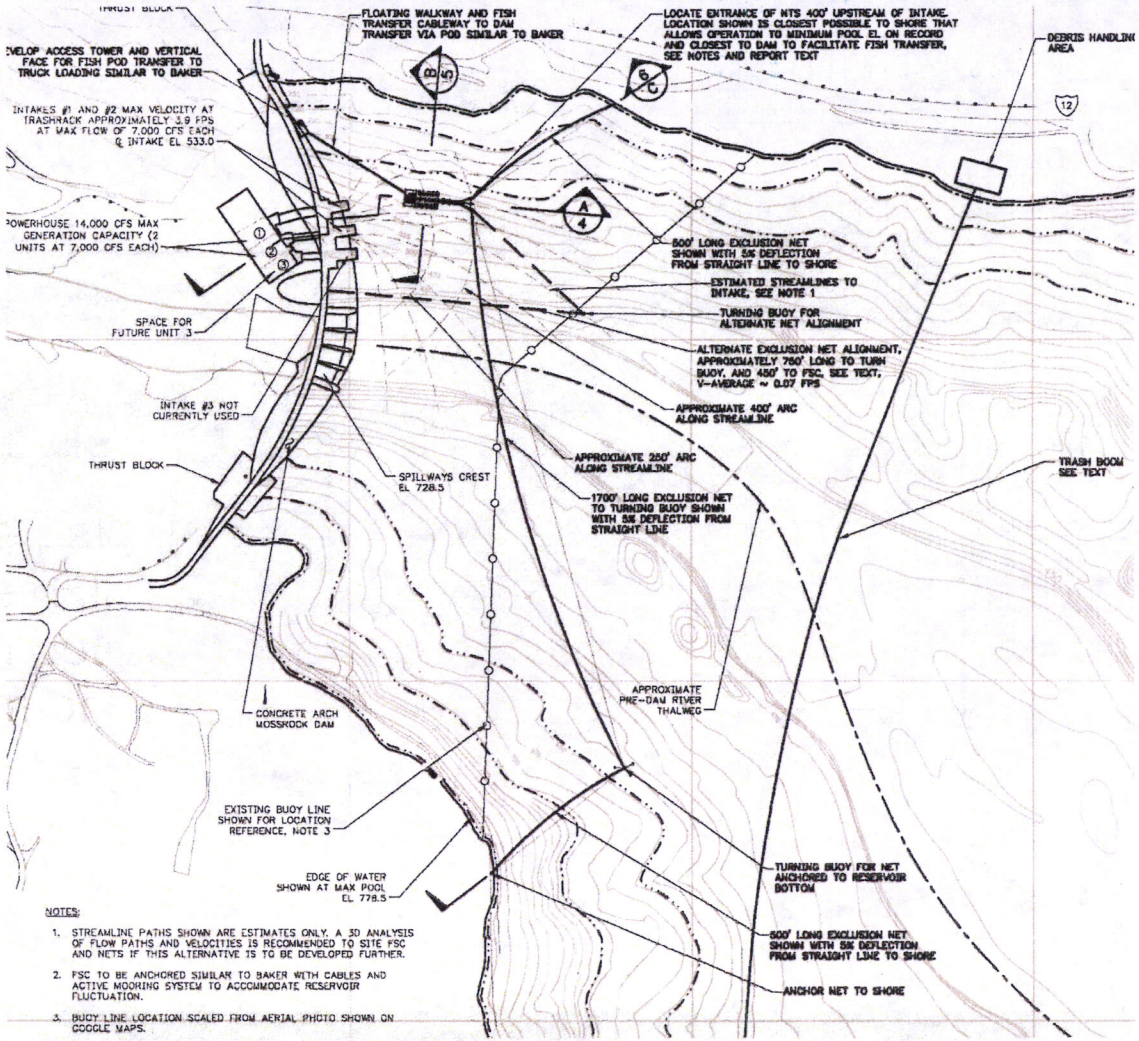
BioAnalysts, Inc.

AECOM Environment

Cowlitz River Project
TACOMA POWER

Mossyrock Collector

AECOM



NOTES:

1. STREAMLINE PATHS SHOWN ARE ESTIMATES ONLY. A 3D ANALYSIS OF FLOW PATHS AND VELOCITIES IS RECOMMENDED TO SITE FSC AND NETS IF THIS ALTERNATIVE IS TO BE DEVELOPED FURTHER.
2. FSC TO BE ANCHORED SIMILAR TO BAKER WITH CABLES AND ACTIVE MOORING SYSTEM TO ACCOMMODATE RESERVOIR FLUCTUATION.
3. BUOY LINE LOCATION SCALED FROM AERIAL PHOTO SHOWN ON GOOGLE MAPS.

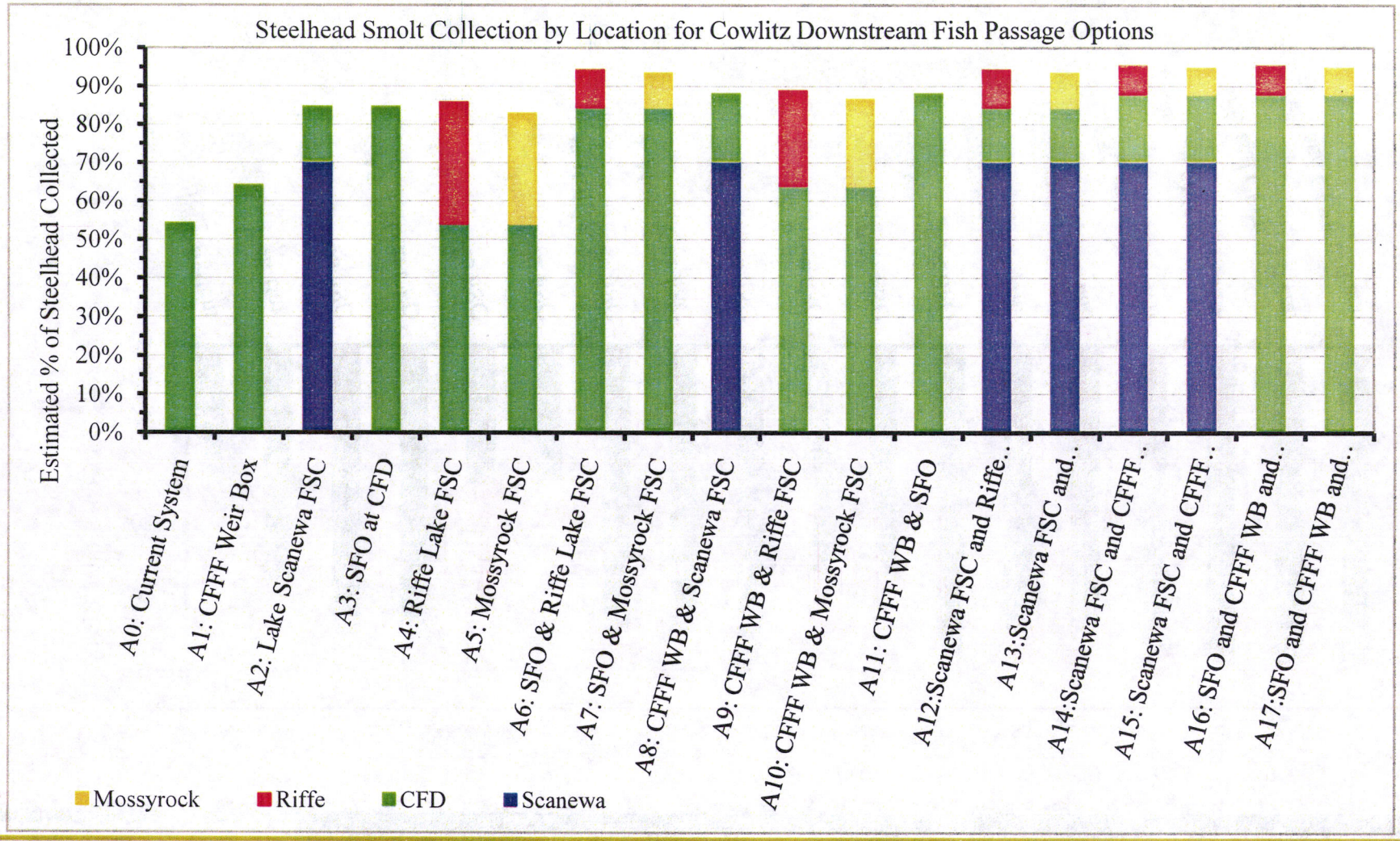
BioAnalysts, Inc.

AECOM Environment

Cowlitz River Project
TACOMA POWER

Preliminary Biological Evaluation Status - Steelhead

AECOM



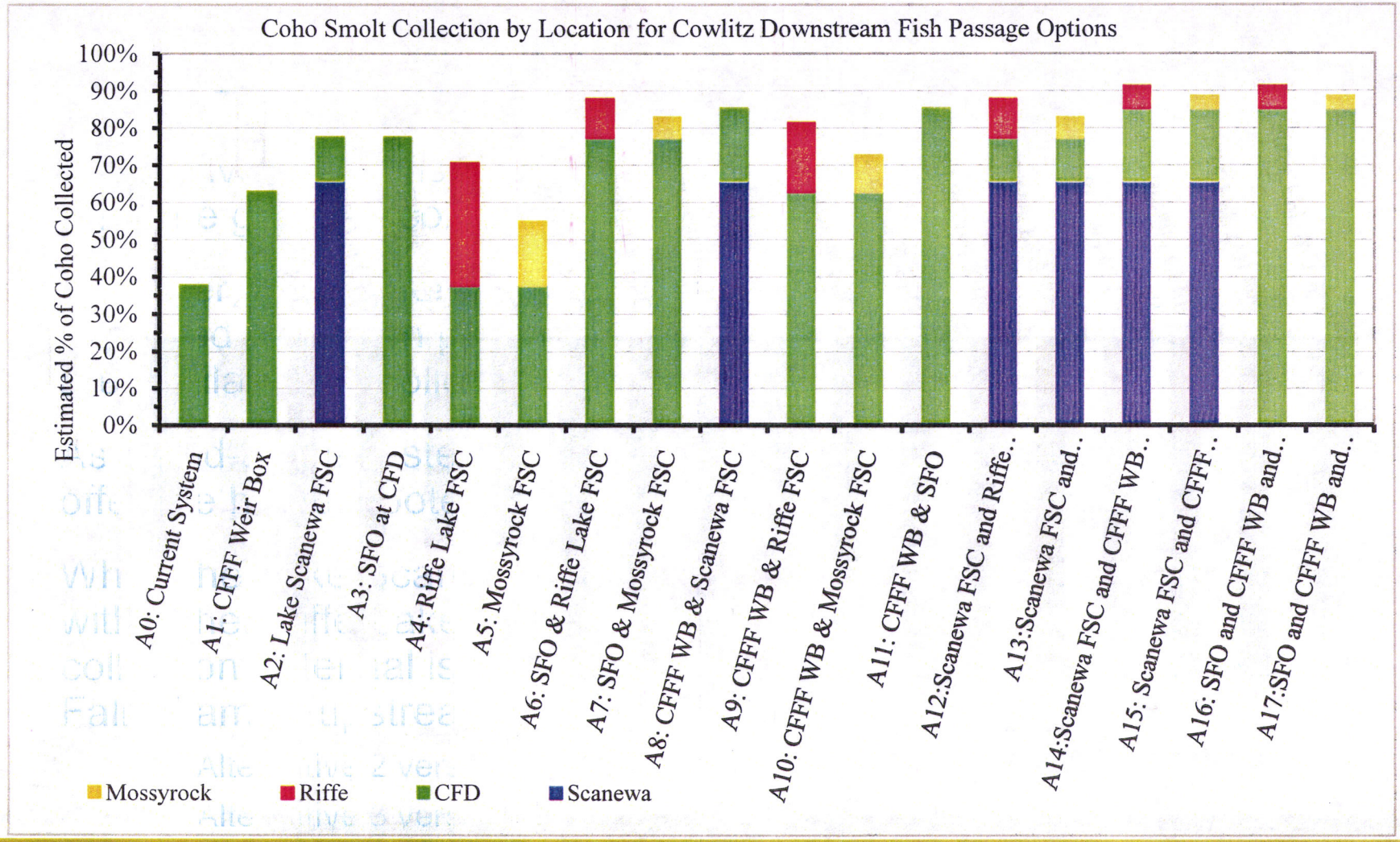
BioAnalysts, Inc.

AECOM Environment

Cowlitz River Project
TACOMA POWER

Preliminary Biological Evaluation Status - Coho

AECOM



BioAnalysts, Inc.

AECOM Environment

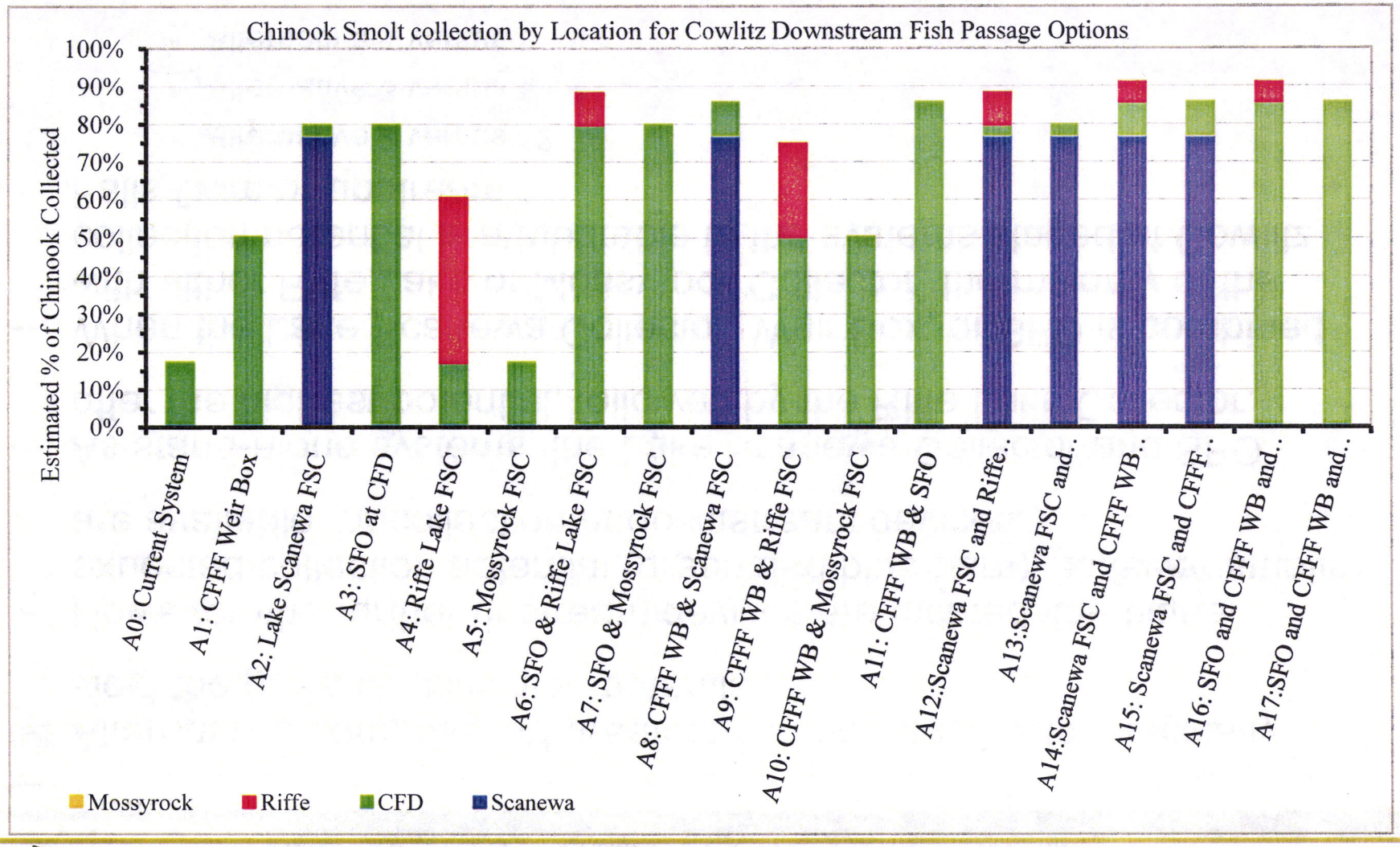
Preliminary Biological Evaluation – Steelhead/Coho

- Alternatives comprised of greatest number of collectors logically yield the greatest collection potential.
- However, the further upstream devices are located, the higher expected collection potential (green and blue bars), as fewer smolts are available for collection at downstream devices.
- As stand-alone systems, the Lake Scanewa Collector and SFO offer the highest potential, followed by the Riffe Lake Collector.
- When the Lake Scanewa Collector, Weir Box, or SFO is combined with either Riffe Lake or Mossyrock Collector, the majority of the collection potential is attributable to the systems staged at Cowlitz Falls Dam or upstream:
  - Alternative 2 versus 12
  - Alternative 3 versus 6
  - Alternative 1 versus 9

Cowlitz River Project
TACOMA POWER

Preliminary Biological Evaluation Status - Chinook

AECOM



BioAnalysts, Inc.

AECOM Environment

Preliminary Biological Evaluation – Chinook

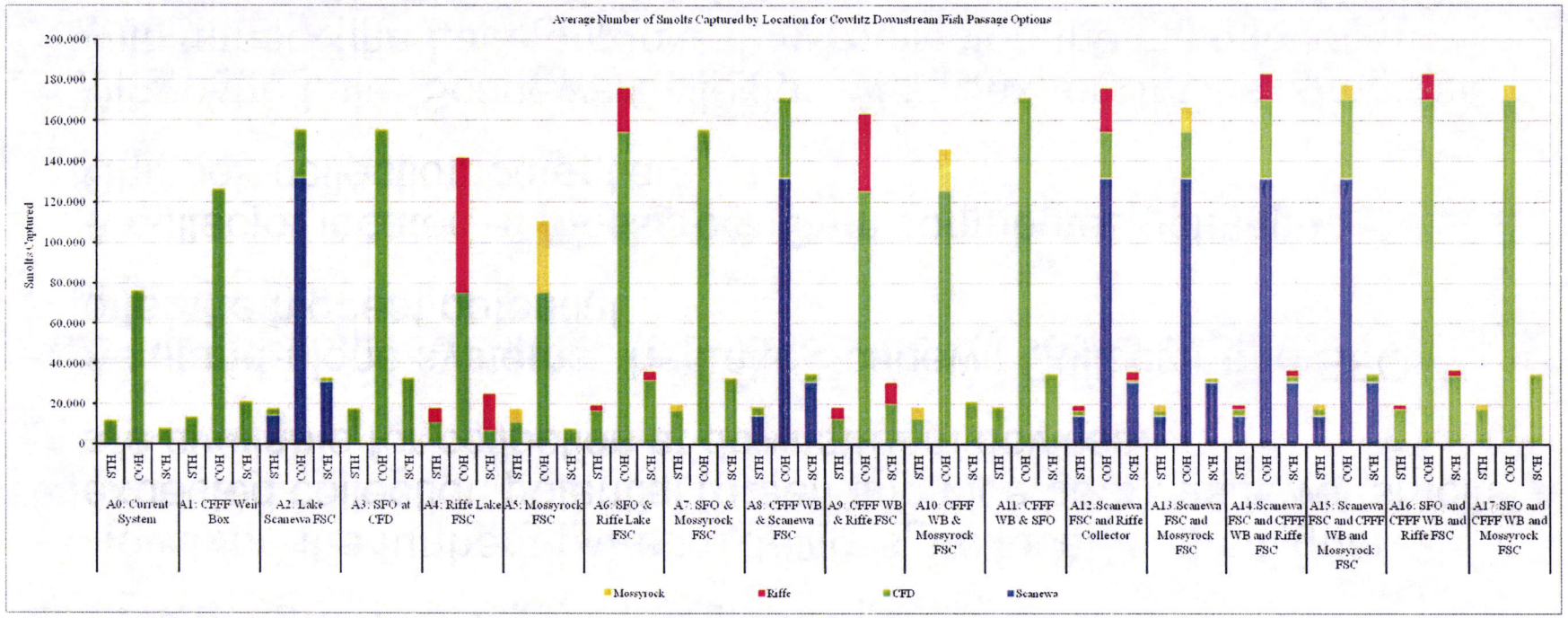
- Alternatives comprised of greatest number of collectors logically yield the greatest collection potential.
- However, the further upstream devices are located, the higher expected collection potential (green and blue bars), as fewer smolts are available for collection at downstream devices.
- As stand-alone systems, the Lake Scanewa Collector and SFO offer the highest potential.
- A collector located at Mossyrock Dam contributes nothing to Chinook collection potential.
- When the Lake Scanewa Collector, Weir Box, or SFO is combined with either Riffe Lake or Mossyrock Collector, the majority of the collection potential is attributable to the systems staged at Cowlitz Falls Dam or upstream:
  - Alternative 2 versus 12
  - Alternative 3 versus 6

Cowlitz River Project
TACOMA POWER

Preliminary Biological Evaluation Status – All Species

AECOM

- The Y-axis in the following graph represents the approximate smolt yield of upper basin tributaries by species



BioAnalysts, Inc.

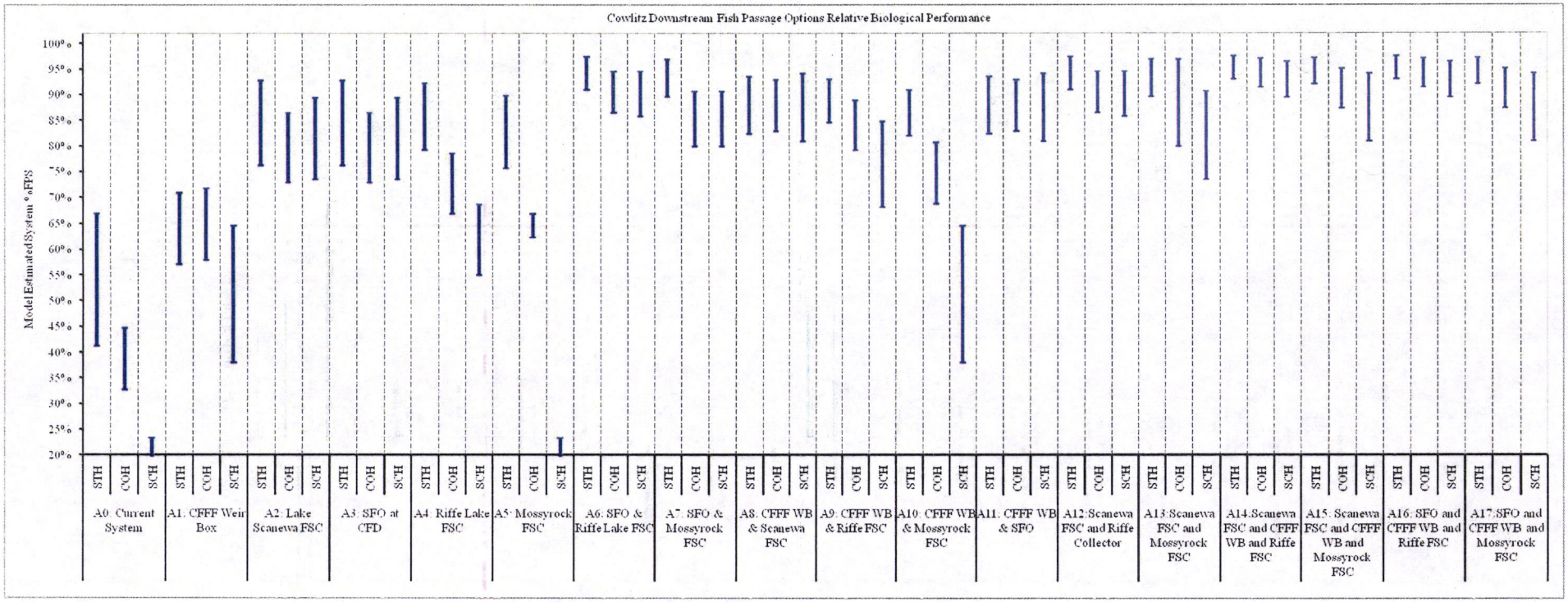
AECOM Environment

Preliminary Biological Evaluation Status – All Species

Cowlitz River Project
TACOMA POWER

AECOM

– The bars represent low and high collection estimates produced by the model.



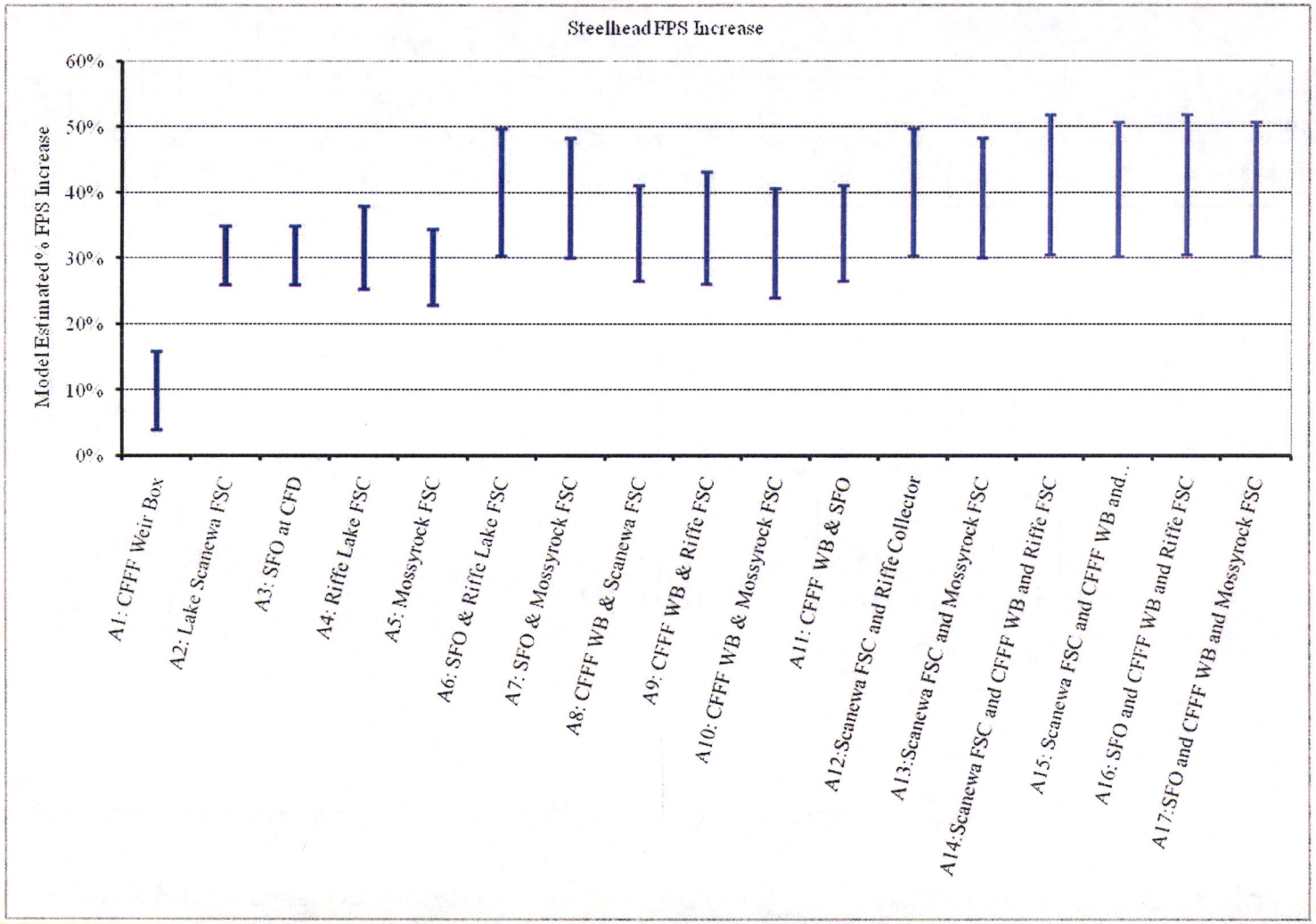
BioAnalysts, Inc.

AECOM Environment

Cowlitz River Project
TACOMA POWER

Preliminary Biological Evaluation Status - Steelhead

AECOM



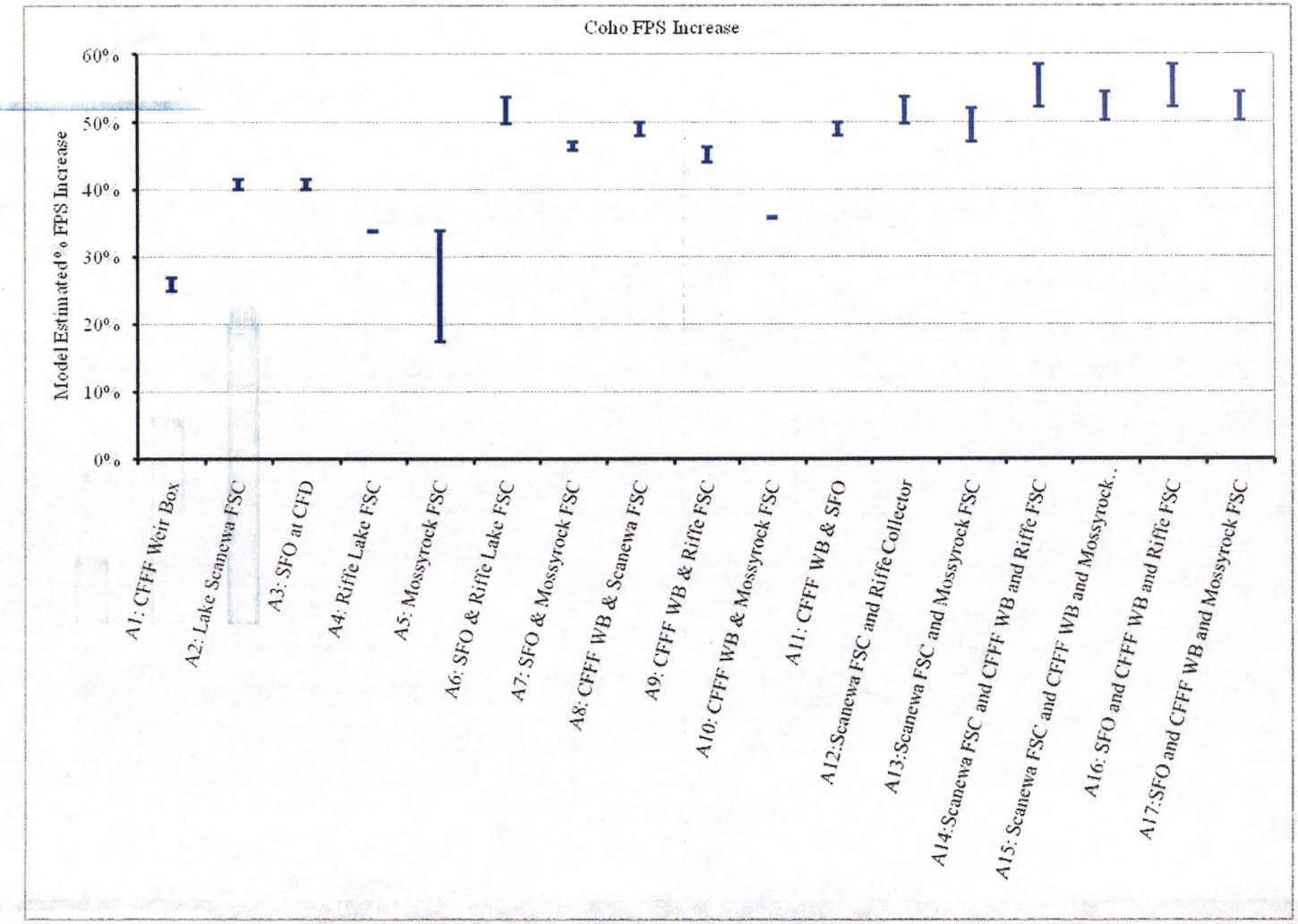
BioAnalysts, Inc.

AECOM Environment

Cowlitz River Project
TACOMA POWER

Preliminary Biological Evaluation Status - Coho

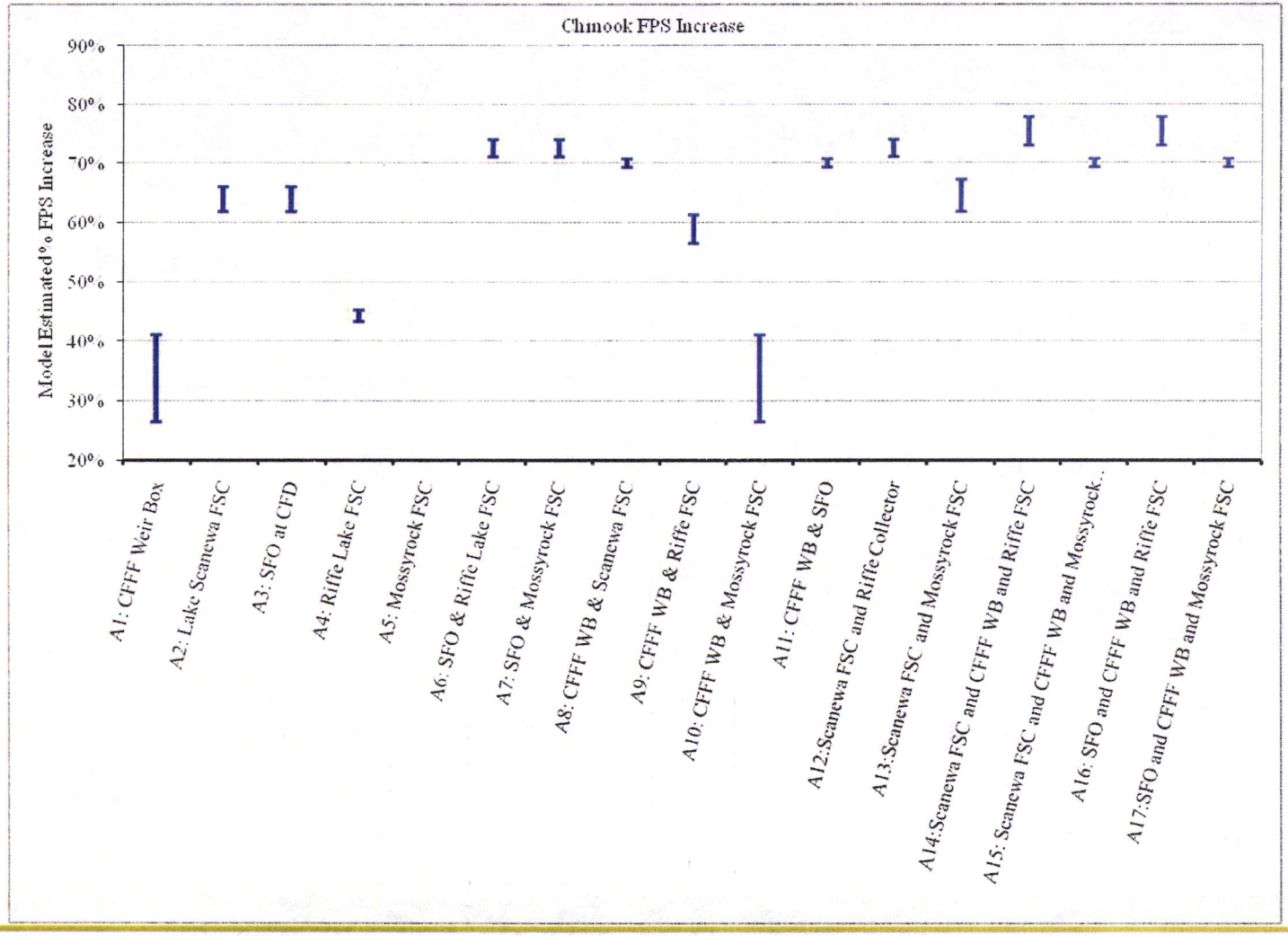
AECOM



BioAnalysts, Inc.

AECOM Environment

Preliminary Biological Evaluation Status - Chinook



Preliminary Technical Evaluation Status

– DRAFT UNDER REVIEW BY DOWNSTREAM FISH PASSAGE TEAM

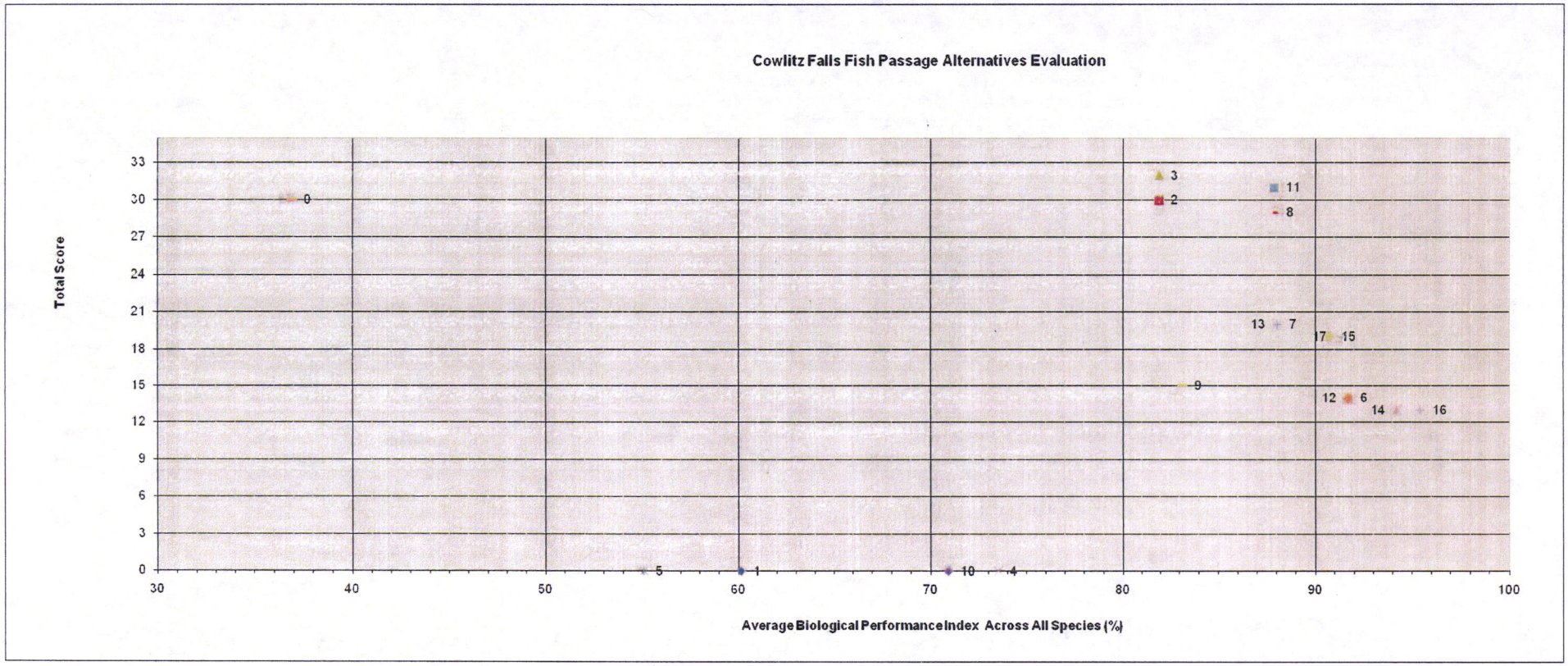
Alternative No.	Components					Average Biological Performance Index Across All Species *	Adult and Resident		Risk of Fish Loss Due to Operational Conditions	Thermal Stratification	Successful Precedents	Construction Complexity	Construction Cost	Operational Complexity	Tacoma Power Control of Facility	Can it be prototyped, phased or adjusted?	Total Score
							Fallback	Isolation									
Weighting Factor ***	Lake Scanewa Collector	Weir Box at CFD	SFO at CFD	Mid-Riffe Lake Collector	Mossyrock Collector		1.00	1.00	3.00	2.00	1.00	1.00	2.00	2.00	1.00	3.00	
0						37		3.00	3.00	3.00	2.00	3.00	3.00	3.00	1.00		30.00
1		X				60											0.00
2	X					82		2.00	2.00	3.00	2.00	2.00	2.00	3.00	2.00	2.00	30.00
3			X			82		2.00	2.00	3.00	2.00	2.00	3.00	3.00	2.00	2.00	32.00
4				X		74											0.00
5					X	55											0.00
6			X	X		92		0.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	1.00	14.00
7			X		X	88		2.00	1.00	1.00	2.00	2.00	2.00	1.00	2.00	1.00	20.00
8	X	X				88		2.00	2.00	1.00	2.00	2.00	2.00	3.00	1.00	2.00	29.00
9		X		X		83		0.00	1.00	1.00	1.00	1.00	2.00	1.00	1.00	1.00	15.00
10		X			X	71											0.00
11		X	X			88		2.00	2.00	3.00	2.00	2.00	3.00	3.00	1.00	2.00	31.00
12	X			X		92		0.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	1.00	14.00
13	X				X	88		2.00	1.00	1.00	2.00	2.00	2.00	1.00	2.00	1.00	20.00
14	X	X		X		94		0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	13.00
15	X	X			X	91		2.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	19.00
16		X	X	X		95		0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	13.00
17		X	X		X	91		2.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	19.00

* - Derived from Biological Assessment Model
** - Scored: 0 = show stopper; 1 = poor; 2 = average; 3 = good
*** - Weighted in order of relative importance: 1 = low; 2 = moderate; 3 = high

0-51 M = 3
51-102 M = 2
102-154 M = 1

Preliminary Technical Evaluation Status

– DRAFT UNDER REVIEW BY DOWNSTREAM FISH PASSAGE TEAM



Cowlitz River Project
TACOMA POWER

2010 BGS Prototype and Supplementary Collection

AECOM

← At Cowlitz Falls, testing started at ~~Cowli~~ April 2010

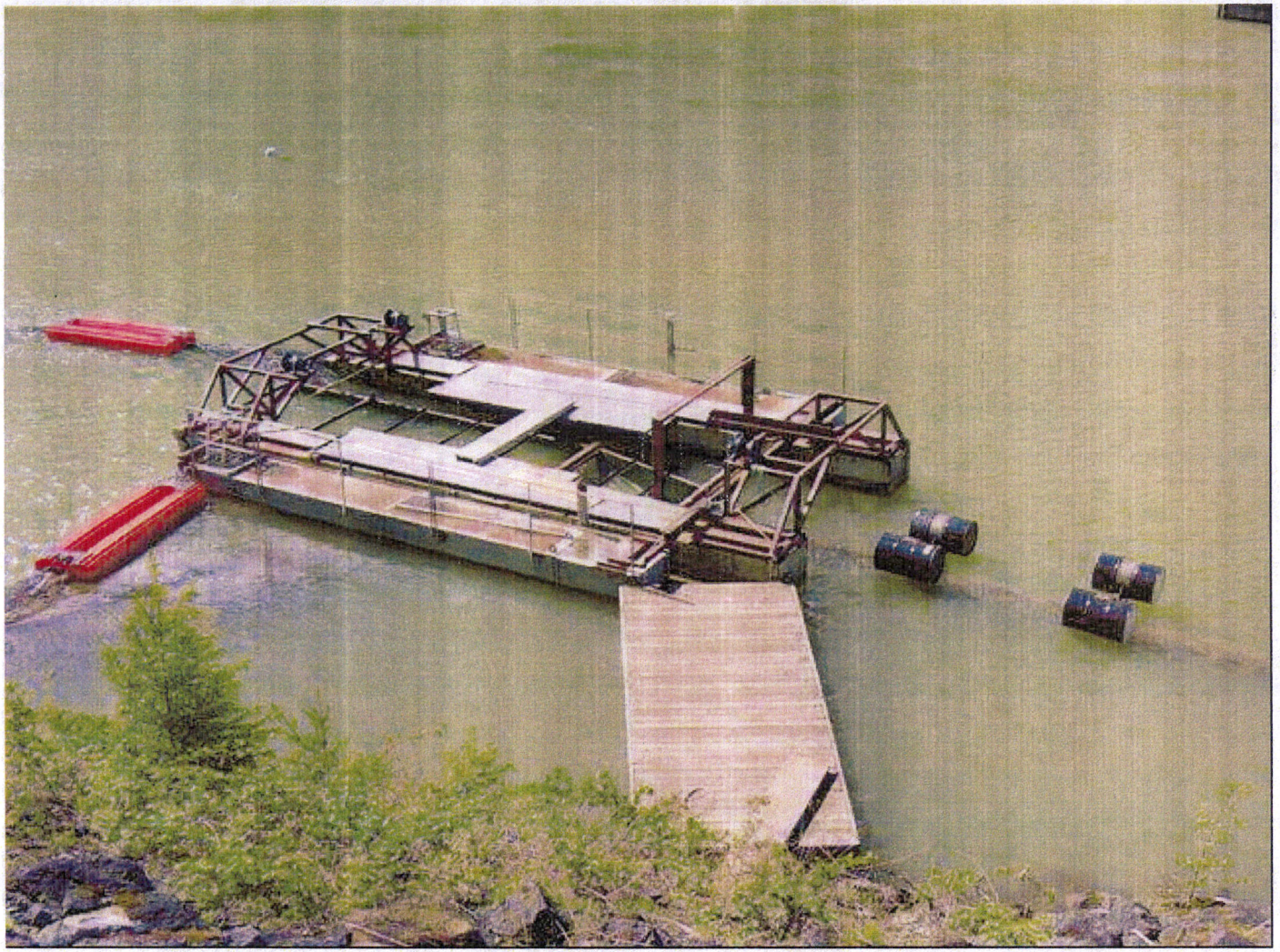
BioAnalysts, Inc.

AECOM Environment

Cowlitz River Project
TACOMA POWER

2010 BGS Prototype and Supplementary Collection

AECOM



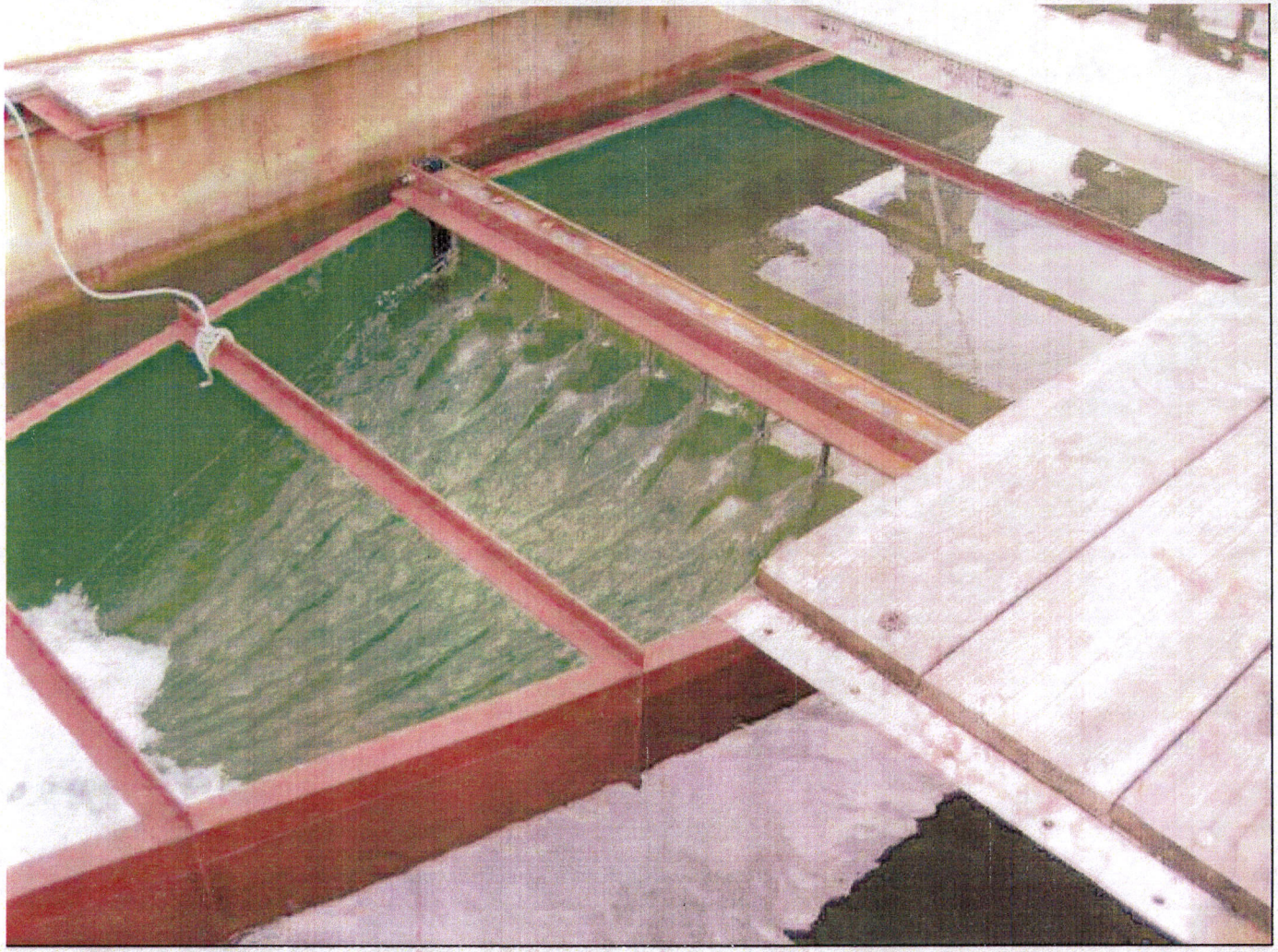
BioAnalysts, Inc.

AECOM Environment

Cowlitz River Project
TACOMA POWER

2010 BGS Prototype and Supplementary Collection

AECOM



BioAnalysts, Inc.

AECOM Environment

Cowlitz River Project
TACOMA POWER

2010 BGS Prototype and Supplementary Collection

AECOM

BioAnalysts, Inc.

AECOM Environment

Cowlitz River Project
TACOMA POWER

2010 BGS Prototype and Supplementary Collection

AECOM

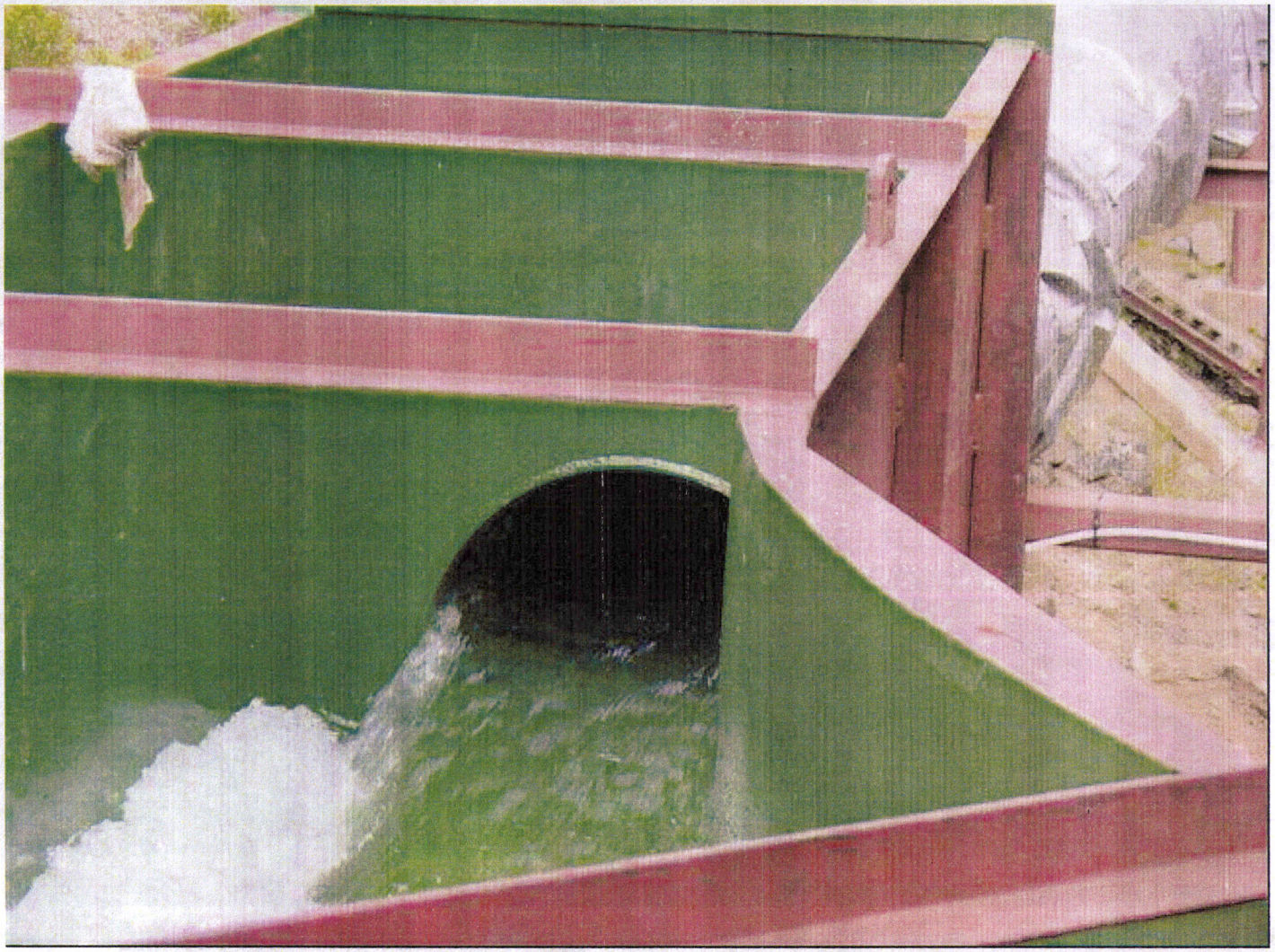
BioAnalysts, Inc.

AECOM Environment

Cowlitz River Project
TACOMA POWER

2010 BGS Prototype and Supplementary Collection

AECOM



BioAnalysts, Inc.

AECOM Environment

Cowlitz River Project
TACOMA POWER

Questions?

AECOM

BioAnalysts, Inc.

AECOM Environment