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PACIFIC POWER
A PacifiCorp Company

November 29, 2005

Ms. Michelle Day National Marine Fisheries Service 1201 NE Lloyd Blvd Suite 1100 Portland, OR 97232	Ms. LouEllyn Jones US Fish and Wildlife Service 510 Desmond Drive SE, Ste. 102 Lacey, WA 98503-1263	Mr. Craig Burley Washington Dept. of Fish and Wildlife 600 Capitol Way North Olympia, WA 98501

Subject: Merwin Trap Upgrades

Dear Ms. Day, Ms, Jones, and Mr. Burley,

On November 30, 2005 the Lewis River Settlement Agreement (SA) was placed into effect with the signing of the document by settlement parties. As defined within the SA, PacifiCorp has the responsibility to complete upgrades to the Merwin fish trap. Specific SA language is as follows:

> 4.2 c. Merwin Trap Upgrades. Within one year after the Effective Date, PacifiCorp shall determine what information is required to improve operating conditions for personnel working in the Merwin Trap by providing a greater margin of safety. PacifiCorp shall gather such information promptly to allow design of operating improvements. By the second anniversary of the Issuance of the New License for the Merwin Project, PacifiCorp shall modify the Merwin Trap as needed to improve the human working environment such that flow restrictions under Section 4.2.2 are no longer necessary, without introducing additional risk to fish (the "Merwin Trap Upgrades"). PacifiCorp shall coordinate with and shall provide 30% and 60% completed preliminary designs for review and comment to the Services and WDFW. PacifiCorp shall provide the 90% preliminary designs for the Merwin Trap Upgrades to the ACC within 18 months after the Effective Date. PacifiCorp shall submit final designs to the Commission upon approval by the Services, subject to Section 15.14, but not later than 90 days after the Issuance of the New License for the Merwin Project or August 31, 2006, whichever is later. Once the Merwin Trap Upgrades are completed or beginning upon the second anniversary of the Issuance of the New License for the Merwin Project, whichever is later, PacifiCorp shall provide for fish to be sorted at the Lewis River Hatchery rather than at the Merwin Trap and shall provide up to two

additional staffers, if necessary, to clear the Merwin Trap once daily for the benefit of the fish in the facility.

PacifiCorp has evaluated the Merwin Trap and has identified what information is needed to improve operating conditions. The attached document entitled "Merwin Trap Operating Condition Improvements" summarizes our assessment and identifies safety measures the company intends to implement in the coming year. Also enclosed is an engineering study entitled "Merwin Hydroelectric Project Fish Trap Upgrades" prepared by Black and Veatch in 2005.

PacifiCorp's recommended improvements include the installation of safety appurtenances that will provide safer work lighting, notify trap workers of an emergency and provide additional assistance in vacating the trap. In addition to these improvements, PacifiCorp will continue restricting flows to maintain the tailrace at a safe operating level. WDFW currently coordinates with PacifiCorp to operate the trap with a turbine discharge of 5,500cfs. These flows may be increased to as much as 9,000cfs after PacifiCorp finishes collection trap inflow data in December 2005. Flow restrictions will be eliminated after improvements identified under SA Section 4.3 are completed, after which time workers will no longer be required in the trap to crowd and lift fish.

Given the outcome of our investigation, PacifiCorp would like to meet and discuss this issue with you following your review. I will be contacting you for available meeting dates. If you have any questions please do not hesitate to call me at (503) 813-6622.

Sincerely,

Frank Shrier
PacifiCorp

Attachment

cc: Lewis River Aquatics Coordination Committee representatives

PACIFICORP

November 29, 2005

Merwin Trap Operating Condition Improvements

Background/Purpose

Under Section 4.3c of the Lewis River Settlement agreement, PacifiCorp is required to identify and implement operational and safety improvements to the Merwin Fish Trap. This purpose of this document is to a) discuss PacifiCorp's assessment of the key operational safety problems in the fish trap, b) summarize the information needed to improve operating conditions, and c) propose modifications to address the key safety problems.

Operational Problem

The key safety problem associated with operating the fish trap is ensuring that workers can safely remain above the water level in the fishway at all times. This is currently accomplished by pumping water out of the trap by operating the fish attraction pump in reverse and by limiting turbine discharge. Currently WDFW coordinates with PacifiCorp to limit the turbine discharge to a maximum of 5,500cfs. If the pump trips off, the water in the fishway rises quickly and without much warning to workers. PacifiCorp has assessed inflows into the fishway and reviewed Washington Department of Fish and Wildlife (WDFW) operating procedures to develop operational and safety improvements.

Needed Information

In July 2005, PacifiCorp completed an engineering study that identified the primary sources of inflows into the trap. These inflows include 1) reverse flow through the fish attraction pump, 2) attraction water piped in from Merwin Hatchery, 3) leakage through the trap from the tailrace, 4) water from the cooling supply line, and 5) water used to hose down the fish when in the fish lift. The complete results of this engineering study are presented in the attached report titled "Merwin Hydroelectric Project Fish Trap Upgrades".

Under normal operating conditions, WDFW lowers the water in the trap to approximately 1.5 ft above the floor grating while performing fish crowding and lifting activities. In situations when the pump trips off, the water level rises as water flows back into the fishway through the pump as well as from other sources. To mitigate this effect, flow through the plant's turbines is restricted during trap operation to keep the tailrace level below approximately 49 ft (3.25 ft above the trap platform grating). The rate of inflow into the trap and the corresponding rate of rise in the water level were estimated by running a series of flow tests with a turbine discharge of 5,000cfs. It was identified that after the pump shuts off, the water level raised to the corresponding tailrace

elevation of 49.8 ft (4.05 ft above the work platform grating) in approximately 30 seconds. A second test was conducted diverting inflow from the Merwin Hatchery (the largest controllable inflow) directly to the tailrace. Under this condition, the time needed for the water level to equalize with the tailrace increased to approximately 60 seconds.

Additional flow tests will be performed in December 2005 to estimate inflow rates with turbine discharge rates above 5,500cfs and corresponding tailrace elevations above 49.8 ft. This data will be collected and reviewed in collaboration with WDFW. The purpose of collecting this additional data is to determine the maximum flow rate at which workers can safely operate the trap after PacifiCorp completes the recommended safety modifications (stated below).

Recommendations to ACC

Providing workers with emergency alarms and assistance in vacating the trap, in tandem with restricting inflows into the fishway, will mitigate the key operational safety problem and improve conditions for workers in the trap. The following safety and operational improvements are proposed;

- Installation of improved lighting in the fishway and near the bottom of the fish lift
- Installation of audible and visible alarms such as sirens and strobe lights to alert workers to vacate the fish trap in the event of a pump failure
- Installation of hand rails above the anticipated high water level to assist workers when vacating the fish trap
- Bypassing Merwin Hatchery water at the bridge bypass valve when workers are in the trap
- Limiting plant discharge flows to maintain tailrace at a level providing minimum headspace in the fish trap after pump failure
    - Current maximum discharge is 5,500 cfs
    - Future max discharge may be 5,500+ to 9,000 cfs pending upcoming flow tests

After these improvements are completed, workers will be signaled when the fish attraction pump trips off. It is anticipated that workers will have 45 to 70+ seconds to maneuver to the exit ladder before the water level rises to the level of the tailrace. The hand rail will assist workers in vacating the trap if they remain after the water level reaches equilibrium with the tailrace. As under current operating procedures, workers will continue to wear life vests while working in the fish trap.

PacifiCorp will continue to collaborate with WDFW to develop and implement these improvements. It is noted that these improvements will likely be removed or replaced by improvements proposed under SA Section 4.3. The intent of Section 4.3 improvements is to eliminate the need for WDFW staff to enter the trap during normal operation and to eliminate the need for turbine flow restrictions.

Enclosure

MERWIN HYDROELECTRIC PROJECT

FISH TRAP UPGRADES

ENGINEERING STUDY NO. RES 3000028924

Prepared by

BLACK & VEATCH
building a world of difference™
ENERGY WATER INFORMATION GOVERNMENT

Kansas City, MO
B&V No. 130683.163

July 2005

BACKGROUND

The arrangement of the Merwin Upstream Fish Trap is shown on Drawing PD-53153 and consists of a 10.5 ft wide fish entrance and 40 ft long fish holding area which is 6 ft wide near the fish elevator. The surface area of the fishway is about 541 sq ft. The fish trap is provided with platform at elevation 45.75 Ft. for fisheries personnel to stand, "crowd", and sort the fish placed into the fish elevator. During the sorting process, the water level in the fishway is maintained between elevations 48.25 to 48.75 ft by operating the fish attraction pump in the reverse direction to pump water out of the fishway to lower the water level below tailwater level. The pump direction, speed and discharge of the fish attraction pump are controlled manually by the pump controls located in the powerhouse and the remote controller located next to the fish elevator. The electrical schematic diagram of the controls is shown on PacifiCorp drawing PD-32281.

The original fish attraction piping shown on PacifiCorp Drawing E-38034 was modified in 1999 and the schematic diagram of the existing piping is shown on Figure 1. The piping to the fish elevator was disconnected from the fish attraction pump and was connected to the powerhouse cooling water supply piping by a 6-inch line as shown on Figure 1. The cooling water supply provides a reliable and continual source of water and oxygen to the fish tank area in the event that the fish attraction pump trips off line.

DESCRIPTION OF THE PROBLEM

When the fish attraction pump is operated in the reverse direction to lower the water level in the fish passage, the water level rises rapidly when the pump trips since the tailwater level is above the water level in the fish passage. Fish Hatchery personnel have reported that when the pump trips, the water level in the fishway rises in about 70 seconds and as a result, hatchery personnel do not operate the trap or work in the fishway when the plant discharge is above 5,000 cfs and corresponding 49.0 ft tailwater elevation. The maximum 49.0 ft tailwater elevation ensures that the water depth in the fishway does not exceed the acceptable limit following a pump trip.

A provision in the Settlement Agreement for the Re-license of the Merwin Hydroelectric Project requires PacifiCorp to determine the information required to improve the operating conditions for personal working in the Merwin Trap by providing a greater margin of safety. The scheduled milestone date for PacifiCorp to comply with this provision is November 30, 2005.

The inflows to the fishway following a pump trip come from the following sources:

1. Reverse flow through the pump
2. Return flow from the fish hatchery
3. Leakage in the fish passage inlet gates and barriers in the fish passage
4. Flow from the cooling water supply line
5. Additional flow during operation of the fish elevator when a temporary fire hose is run to the area of the fish tank elevator to provide additional oxygen to the fish concentrated in the elevator.

PUMP TESTS CONDUCTED MAY 17, 2005

Tests of the fish attraction pump were conducted on May 17, 2005, to determine the following:

1. The rate that the water level in the fishway rises following a pump trip when the fish attraction pump is used to lower the water level in the fishway.
2. The fish attraction pump discharge vs head curve.

Pump Trip Test

The water level in the fishway was lowered below tailwater elevation by operating the fish attraction pump at 920 rpm in the reverse direction. After the water level was lowered, the pump was shut down and the water level in the fishway was recorded every 10 – 15 seconds. Pump trip Tests 1 and 2 were performed with the return flow from the fish hatchery discharged into the fishway, which is the normal method of operation. Test 3 was conducted with the water from the fish hatchery diverted from the fishway which was reported to be 6,000 gpm. During both tests, the fire hose was not used to provide additional flow to the fish elevator.

The data recorded during the pump trip tests is provided in Table 1 and is plotted on Figure 2. During the tests, flow meter measurements of the flow through the fish bypass piping were attempted but the readings are inconsistent and are not reliable; which may be caused by unstable flow conditions. The water level in the fishway was measured by both the staff gage in the fishway and the reading from the powerhouse control system. However, based on the calibration performed prior to the test, the staff gage readings in the fishway are considered the most accurate and have been used in this analysis.

As shown on Figure 2, the time for the water level to rise from elevation 48.75 ft (level when the fish are sorted) to the tailwater elevation of 49.8 Ft. during tests was determined to be:

Tests 1 & 2	20 Seconds
Test 3	35 Seconds

The water level in the fishway near the end of Tests 1 & 2 continued to rise above the tailwater level, but at a slower rate, because of the return flow from the hatchery.

The fish attraction piping is a 32-inch nominal diameter cast iron pipe having a 1.15 inch wall thickness and 36.0 inch inside diameter (ID). The overall length of the fish attraction piping is about 30 ft based on the available Merwin piping drawings. The theoretical flow through a straight length of 36-inch ID piping can be calculated by the following equation: Q(cfs) = (H (ft)/0.000503459)^0.5; in which the inflow is a function of the differential head between the level in the fishway and tailwater level. Therefore, the average theoretical inflow can be approximated by calculating the flow for the average head between the 0.0 – 0.525 ft differential heads and the 0.525 - 1.05 ft differential heads.

Differential Head (ft) Head (ft)	Theoretical Flow (cfs)	(gpm)
0.2625	22.8	10,233
0.7875	39.5	17,728

The area of the fishway is approximately 541 square feet and assuming that all the inflow to the fishway is passed through the fish attraction piping, the average inflow for Test 3 is calculated to be 16.5 cfs (7,406 gpm) or 53% of the theoretical value. The reduced inflow below the theoretical value is likely caused by the flow restriction of the pump impeller. Since the inflow is significantly lower than the theoretical value, the inflows to the fishway from the other sources listed above may be minimal. During Tests 1 & 2, the average inflow is calculated to be about 27.8 cfs (12,500 gpm) which is 5,100 gpm greater than Test 3. Therefore, either the flow from the hatchery is less than the reported 6,000 gpm or the additional inflow from the hatchery reduces the inflow from other sources.

Based on the test results, the inflow to the fishway through the fish attraction piping and other sources is about 7,400 gpm following the pump trip. Since the return flow from the hatchery reported to be 6,000 gpm is nearly equal to the inflow from all other sources, any significant increase in the time for the water level to rise would also require the diversion or curtailment of hatchery flows.

Assuming that 75% of the inflow following a pump trip goes through the fish attraction piping and 25% of the inflow is from other sources, the leakage from other sources would be 1,850 gpm. Therefore, the time for the water level to rise from elevation 48.75 ft (level when the fish are sorted) to the tailwater elevation of 49.8 ft could be increased from 35 seconds to 140 seconds, provided the inflows from the hatchery and reverse flow in the fish attraction piping could be eliminated. Since the water level currently rises in 20 seconds, increasing the time for the water level to rise to 140 seconds would significantly improve the operating conditions in the fishway.

Fish Attraction Pump Test

The fish attraction pump test was conducted by operating the pump at 590 rpm to provide the required 33 cfs (14,800 gpm) fish attraction flow for the corresponding plant discharge of 5,000 cfs. The pump performance data was obtained by measuring the pump discharge and discharge pressure over the operating range of the pump. The pump discharge was measured by a Panametric Transport Model PT868 single pass ultrasonic flow meter mounted on the discharge piping and the discharge pressure was measured by a piezometer connected to pump housing. The first test point was measured with the valve on the pump discharge fully open and subsequent operating head conditions were obtained by closing the valve to increase the discharge pressure on the pump. The data from the pump tests is provided in Table 2 and the pump discharge vs. head curve is shown on Figure 3.

The fish attraction pump is reported to be rated at 30,000 gpm at 920 rpm; however, the manufacturer of the pump is unable to provide any engineering data or design information on the pump. Since the pump discharge of centrifugal pumps varies directly with the speed and the discharge pressure varies with the square of the speed, the existing pump is capable of 23,400 gpm at 920 rpm and 4 ft head. Therefore, it appears that the performance of the pump may have deteriorated since it was installed, as would be expected.

The purpose of the pump discharge test was to determine if the existing fish pump would be capable of pumping the required fish attraction flow above the maximum tailwater elevation of 53.0 ft. Installing a check valve on the inlet to the pump which would close in the direction of the fish attraction flow and re-routing the fish attraction pump piping above the elevation of 53.0 ft as shown on Figure 4 would preclude reverse flow into the fishway after a pump trip.

Assuming a minimum operating tailwater elevation of 46 ft. pump head would be about 9 feet (53 – 46 + the 2 ft head loss measured during the test). Based on the pump curve in Figure 3, the existing fish attraction pump is capable of delivering the required 33 cfs (14,800 gpm) at 24 ft head at 920 rpm. Therefore, the results of the pump test confirm that the fish attraction pump is capable of pumping the required fish attraction flow to elevation 53.0 ft.

CONCLUSIONS AND RECOMENDATIONS

1. Diverting the inflows to the fishway from the hatchery during fish sorting operations would significantly increase the time for the water level to rise. Therefore, modifying the operating procedures to divert the return flow from the hatchery from the fishway when personnel are in the fishway area should be implemented if the diversion does not risk fish survival. Diverting hatchery inflows would increase the time for the water level to rise by 15 seconds if nothing else is done.
2. While the impact of the 6-inch cooling water supply to the fishway was not evaluated during the tests; shutting off the flows from the cooling water system during fish sorting operations could also be included in the operating requirements and would eliminate this inflow to the fishway and further contribute to the time for the water level to rise. Since flow to the fishway is provided by the fire hose during sorting operations, shutting off the cooling water supply should also be considered if it does not risk fish survival.
3. Modifying the piping to re-rout the fish attraction pump piping above the elevation of 53.0 ft as shown on Figure 4 when combined with diverting the hatchery return flow in Item 1 above could increase the time for the water level to rise to 140 seconds.
4. Repairing or installing lights in the ceiling of the fishway, could be implemented to improve the working conditions in the fishway. Additionally, installing a level sensor and audible alarm to warn the workers when the water level rises above a preset level would further improve the working conditions.
5. Installing a handrail on the wall of the fishway could be implemented to improve the working conditions in the fishway. Additionally, a step could be installed on the platform next to one of the walls, to allow personnel to step up in the event of rising water.
6. During fish sorting operations, the discharge from the Merwin powerhouse is limited to 5,000 cfs and output to 44% of plant capacity. The hydraulic capacity of the plant is 11,167 cfs and the corresponding tailwater elevation is 53 ft. The 5,000 cfs discharge restriction ensures that the depth of water in the fishway will not exceed the maximum allowable depth above the platform when the pump trips. Installing a one foot high step as described in Item 5 above, may allow the maximum tailwater limitation to be increased. A one foot step could potentially increase the plant discharge to about 7,000 cfs or 63% of plant capacity.

It would also be possible to install a second platform above the existing platform to obtain approval to increase the maximum tailwater restriction during sorting operations while maintaining the existing maximum water depth above the platform. The second higher platform may, however, not be feasible since the platform forms the floor for the fish entering the fishway and a higher platform would require that a minimum plant discharge be maintained to maintain sufficient water depth while the fish are being held in the fishway.

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TABLE 1 - FISH ATTRACTION PUMP TRIP TEST

5/17/2005

TW El (ft) 48.9 Powerhouse Gage (49.95 Fishway Staff Gage)
Plant discharge 5,400 cfs
Fishery Return Flow 6,000 gpm (13.36 cfs)

	Control Room Data				Fish Elevator Staff Gage 0 at Grating Elevation 45.75			
TEST	Time	Elapsed Time Sec	Fishway Elevation Ft.	Fishway Elevation Ft.	Time	Elapsed Time Sec	Fishway Elevation Ft.	Fishway Elevation Ft.
TEST - 1	2:00 PM				2:00 PM			
	21.30		0.96	46.71	24.00		0.80	46.55
	21.45	15.00	1.38	47.13	24.10	10.00	2.20	47.95
	22.00	30.00	2.04	47.79	24.15	15.00	2.90	48.65
	22.15	45.00	2.78	48.53	24.25	25.00	3.50	49.25
	22.30	60.00	3.62	49.37	24.40	40.00	4.00	49.75
	22.45	75.00	4.49	50.24	24.45	45.00	4.40	50.15
	23.00	90.00	5.33	51.08	25.00	60.00	4.60	50.35
	23.15	105.00	5.74	51.49				
	23.30	120.00	5.80	51.55				
TEST - 2	32.45		0.90	46.65	31.15		0.70	46.45
	33.00	15.00	1.85	47.60	31.30	15.00	2.80	48.55
	33.15	30.00	2.59	48.34	31.45	30.00	3.70	49.45
	33.30	45.00	3.20	48.95	32.00	45.00	4.50	50.25
	33.45	60.00	3.96	49.71	32.15	60.00	4.60	50.35
	34.00	75.00	4.79	50.54	32.30	75.00	4.70	50.45
	34.15	90.00	5.63	51.38	33.00	105.00	4.80	50.55
	34.30	105.00	5.73	51.48	33.15	120.00	4.90	50.65
	Hatchery Return Shut Diverted							
TEST - 3	47.25		0.90	46.65	45.45		0.70	46.45
	47.40	15.00	1.50	47.25	46.00	15.00	1.60	47.35
	47.55	30.00	2.32	48.07	46.15	30.00	2.60	48.35
	48.10	45.00	3.20	48.95	46.30	45.00	3.20	48.95
	48.25	60.00	3.81	49.56	46.45	60.00	3.80	49.55
	48.40	75.00	4.73	50.48	47.00	75.00	4.10	49.85
	48.55	90.00	5.21	50.96	47.15	90.00	4.10	49.85
	49.10	105.00	5.24	50.99	47.30	105.00	4.30	50.05

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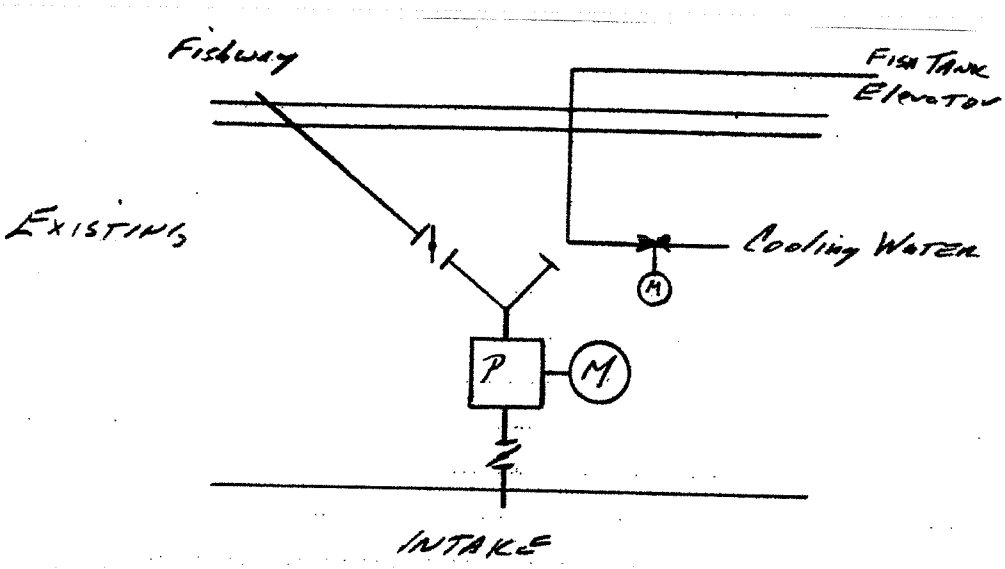
TABLE 2 - FISH ATTRACTION PUMP TEST PERFORMANCE TEST DATA
5/17/2005

Pump Speed 590 rpm
TW El 48.9 Powerhouse Gage
Red Data not used

Run	1		2		3		4		5		6		7		8
Pump Discharge (gpm)	GPM		GPM		GPM		GPM		GPM		GPM		GPM		GPM
1	15272		14350		11824		6971		8217		6984		8200		6890
2	14728		11313		11577		7127		8116		6795		7803		6728
3	14898		9613		11513		7102		7663		7050		7386		7654
4	14810		13263		11717		7412		8173		6495		7107		7935
5	14891		13229		11696		7261		7876		6416		7216		7605
6	15038		13100		12048		7533		7909		6412		7335		
7	15097		13138		11634		8485		8227		6839		7190		
8	15072		13181		11502		9133		8377		6722		6835		
9	15122		13199		11582		5554		8306		6882		3927		
10	15168		13067		11637		6237		8071		6550		4074		
11	15167		13176		11313		5823		9130		7011		5190		
12	15220		13197		10480		6159		5601				5601		
13	15202		12973		8870		22756		7707				6288		
14			12791		8515		7133						8026		
15			12827		8469		7771						3646		
16			13006		8593		8059						9058		
17			13209		9067		8098						7785		
18			13225		9245		9270						7579		
19					13258		9315						7764		
20					12010		8992						7195		
21					11987		9378						6664		
22					11706		9120						6772		
23					11709		8912								
24							8679								
25							8989								
Ave Pump Disch (gpm)	15053		12881		10954		8881		7952		6741		6756		7362
Discharge El - Ft.	51		52.2		53.04		54.16		55.48		56.375		57.4		58.12
TW - EL - Ft.	48.9		48.9		48.9		48.9		48.9		48.9		48.9		48.9
Pump Head Ft.	2.1		3.3		4.14		5.26		6.58		7.475		8.5		9.22



Fish Attraction Piping
Existing Piping Arrangement
Figure 1

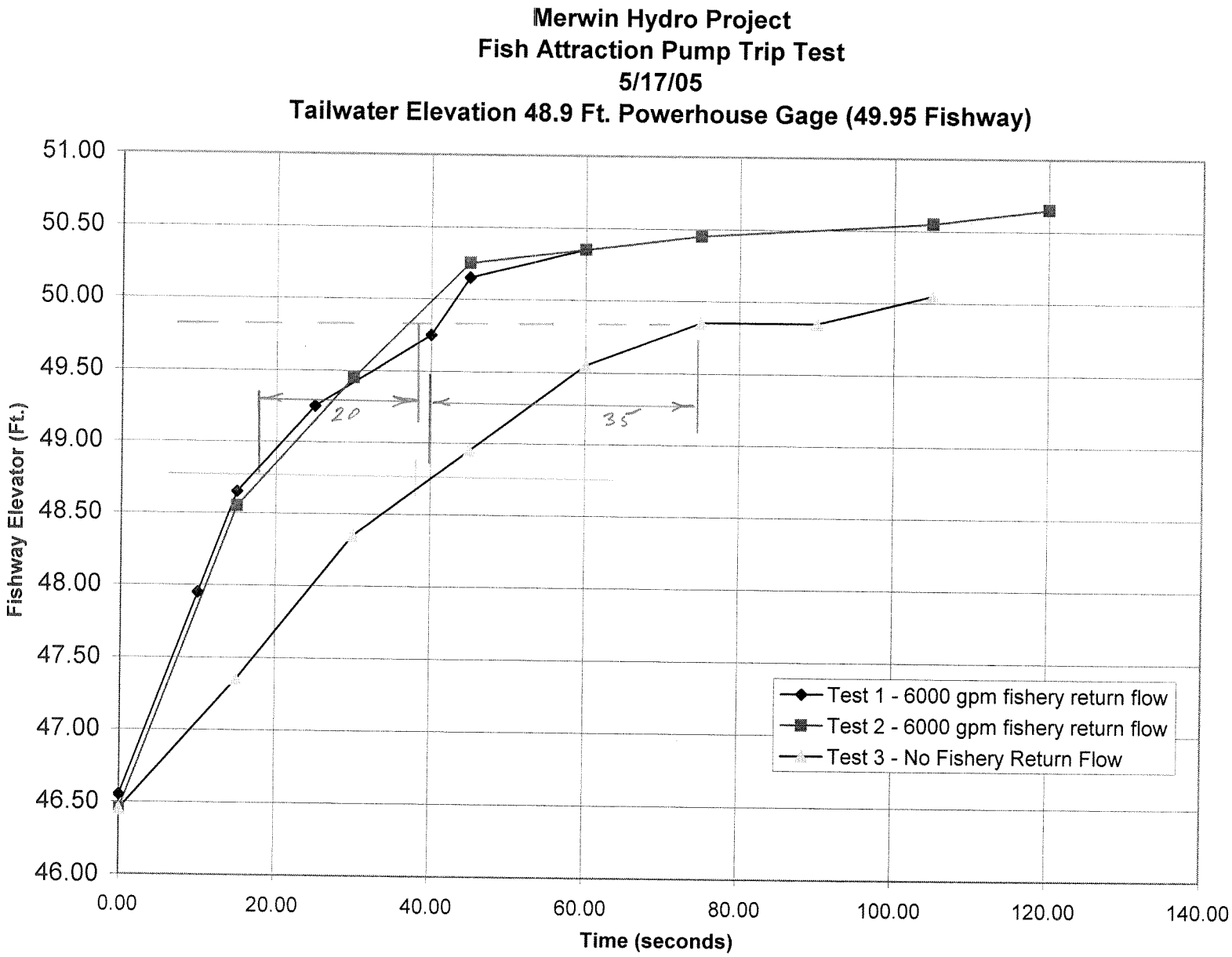

Merwin Hydro Project
Fish Attraction Pump Trip Test
5/17/05
Tailwater Elevation 48.9 Ft. Powerhouse Gage (49.95 Fishway)
Fishway Elevator (Ft.)
51.00
50.50
50.00
49.50
49.00
48.50
48.00
47.50
47.00
46.50
46.00
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
Time (seconds)
20
35
Test 1 - 6000 gpm fishery return flow
Test 2 - 6000 gpm fishery return flow
Test 3 - No Fishery Return Flow

Figure 2

Merwin Hyrdo Project
Fish Attraction Pump Test
5/17/05
Pump Speed 590 rpm

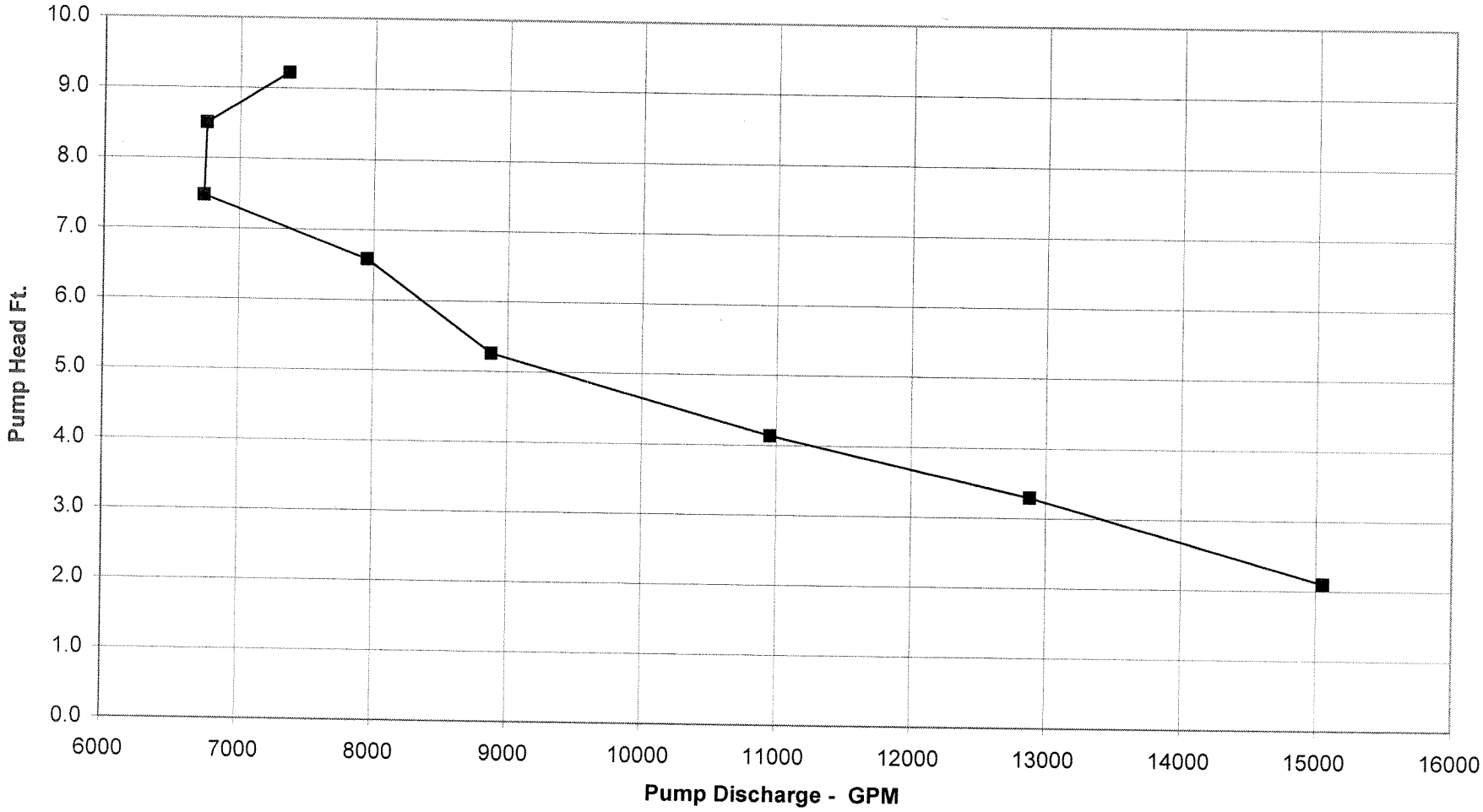


Figure 3

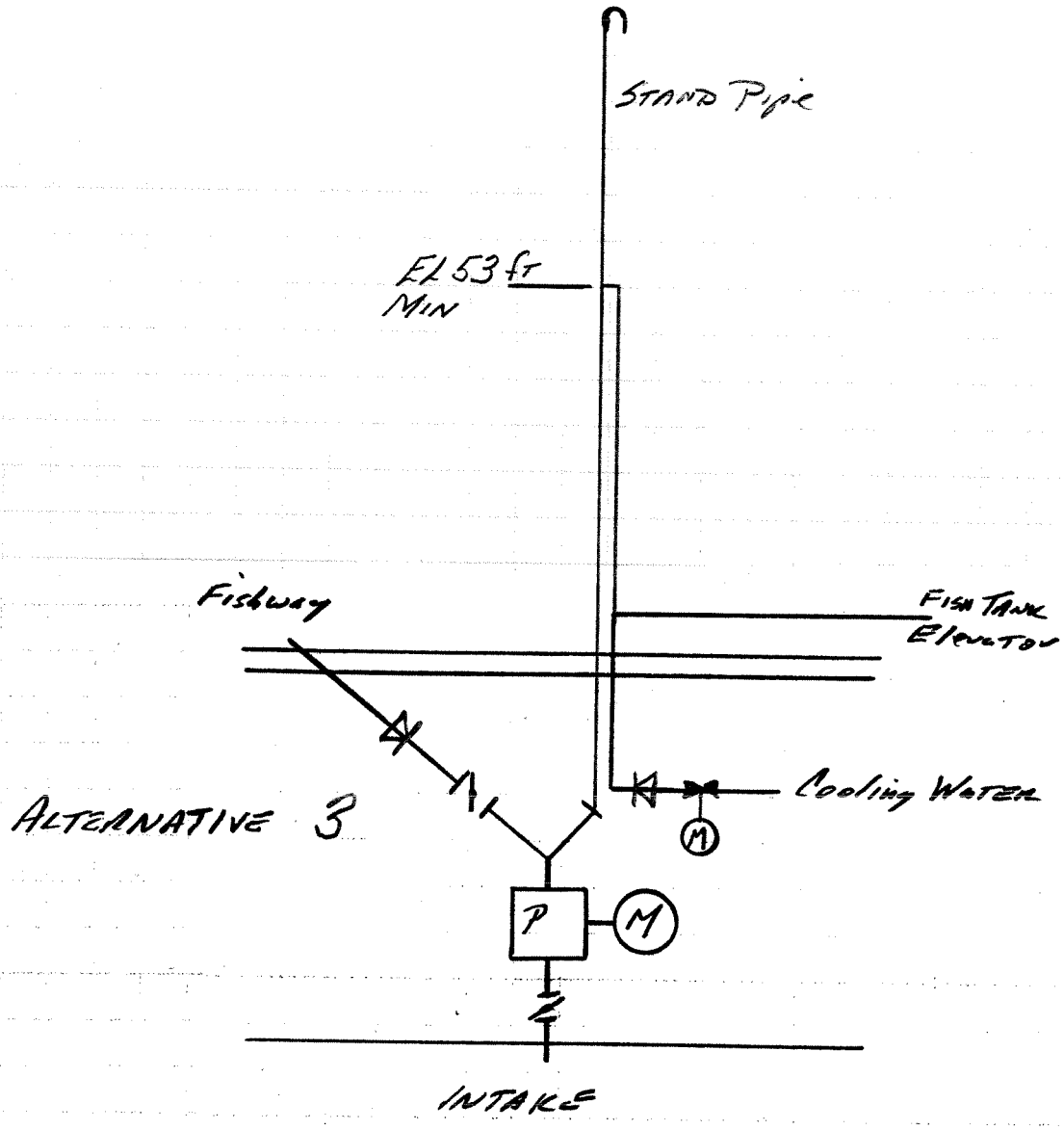
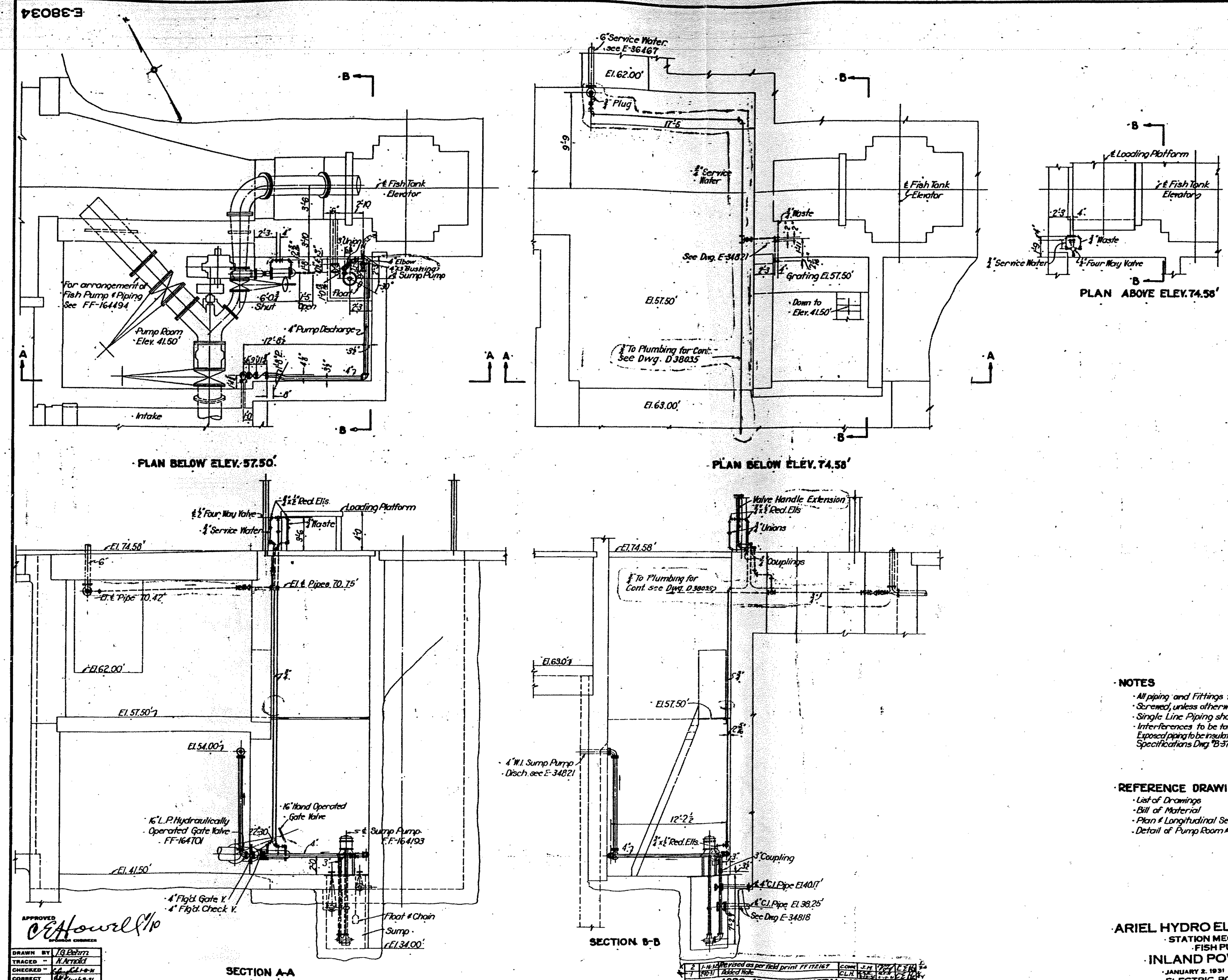


Figure 4



NOTES

- All piping and Fittings to be 125# A.S.A. Standard
- Screwed, unless otherwise noted.
- Single Line Piping shown diagrammatically.
- Interferences to be taken care of in field. Exposed piping to be insulated in accordance with Specifications Dwg. #B-37096.

REFERENCE DRAWINGS

List of Drawings	A-34676
Bill of Material	A-34675
Plan & Longitudinal Section of Fish Trap	E-34818
Detail of Pump Room & Elevator Shaft	E-34821

NO.	DATE	REVISION	BY	CH	CORR	APP.
2	1-16-32	Revised as per field print FF 172167	C.COOK	J.M.		
1	2-10-31	Added Note	C.L.H.			

1930–40,000 KW. INSTALLATION

APPROVED C.E. Howell

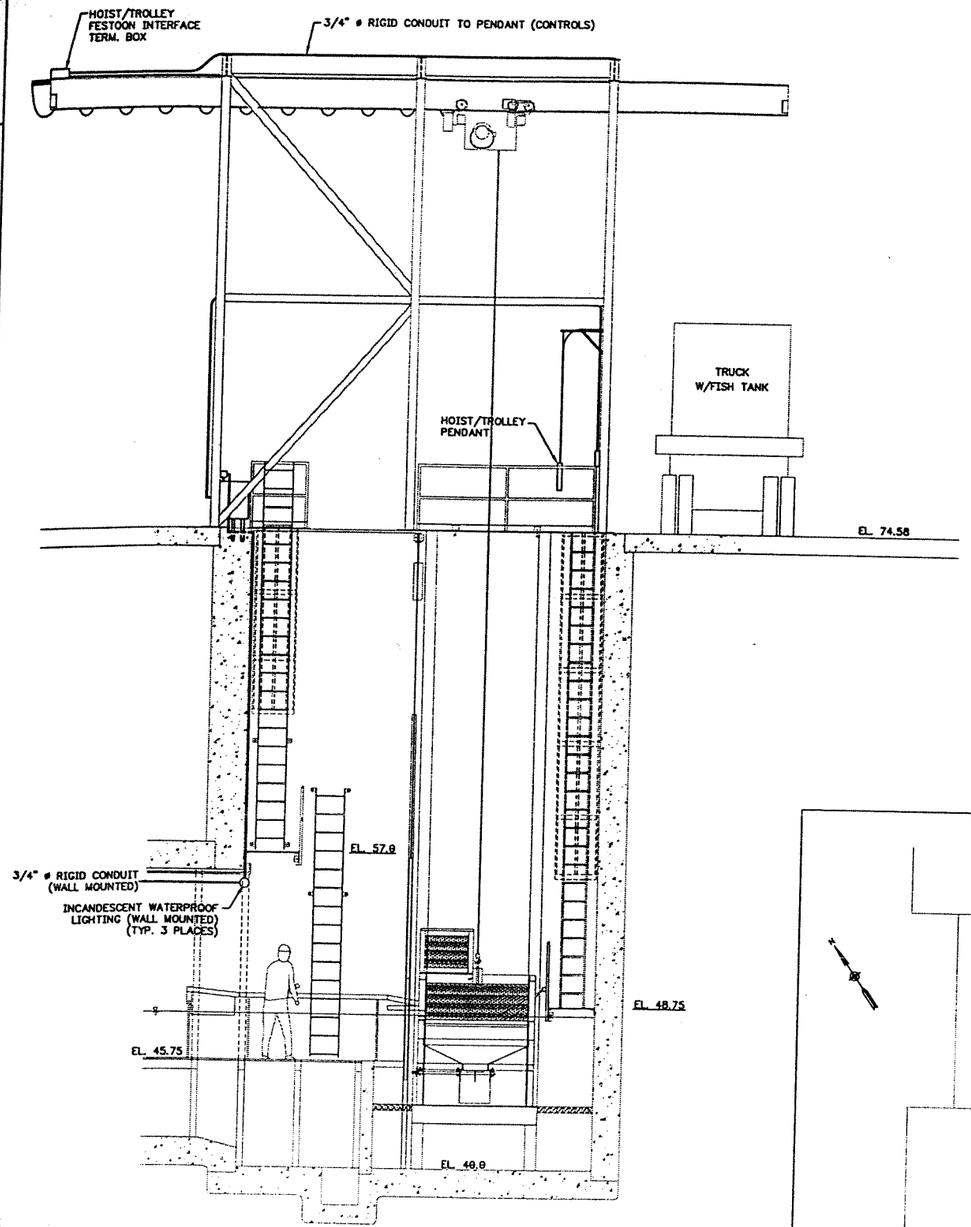
DRAWN BY T.G. Behm
TRACED N. Arnold

ARIEL HYDRO ELECTRIC DEVELOPMENT
STATION MECHANICAL EQUIPMENT
FISH PUMP ROOM PIPING
INLAND POWER AND LIGHT CO.
JANUARY 2. 1931 — SCALE 1/4" : 1' 0"
ELECTRIC BOND & SHARE COMPANY
NEW YORK
E-38034

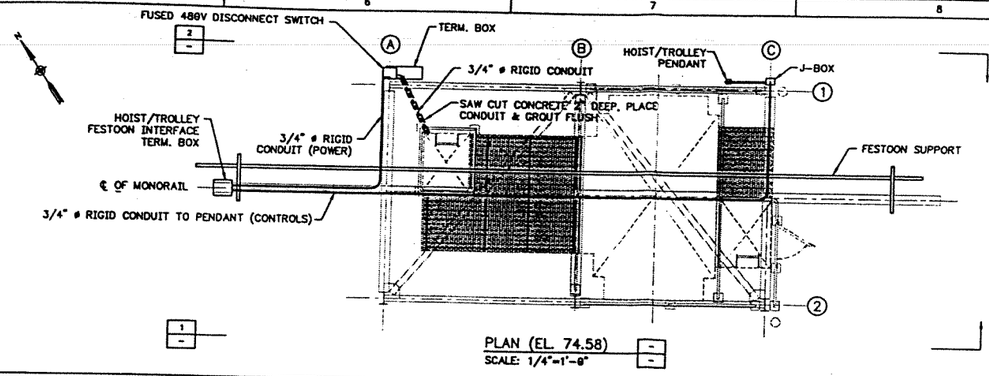
MERWIN
E-38034-01

ct Flume Tunnel

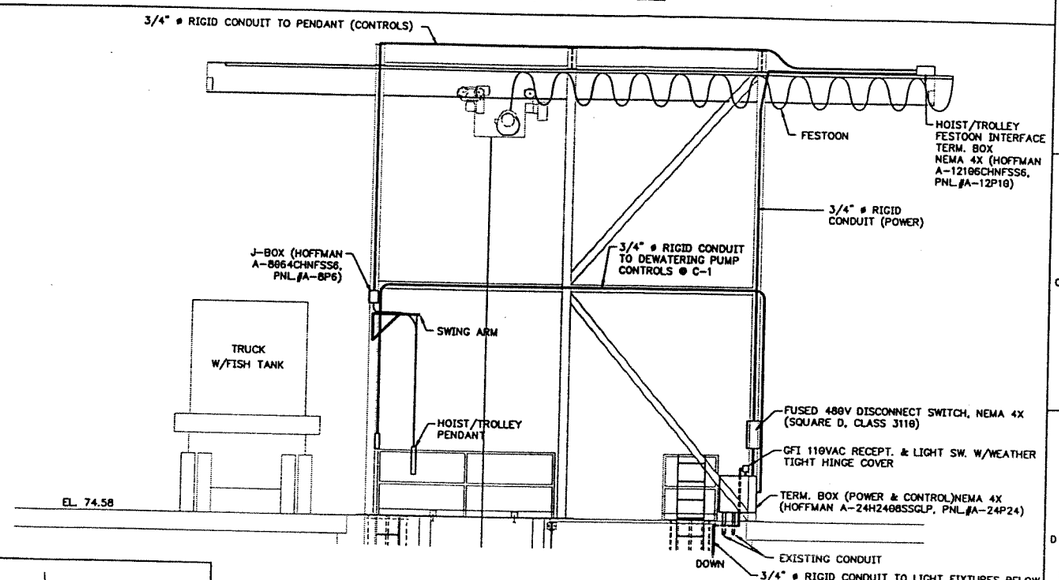
AA 87070D



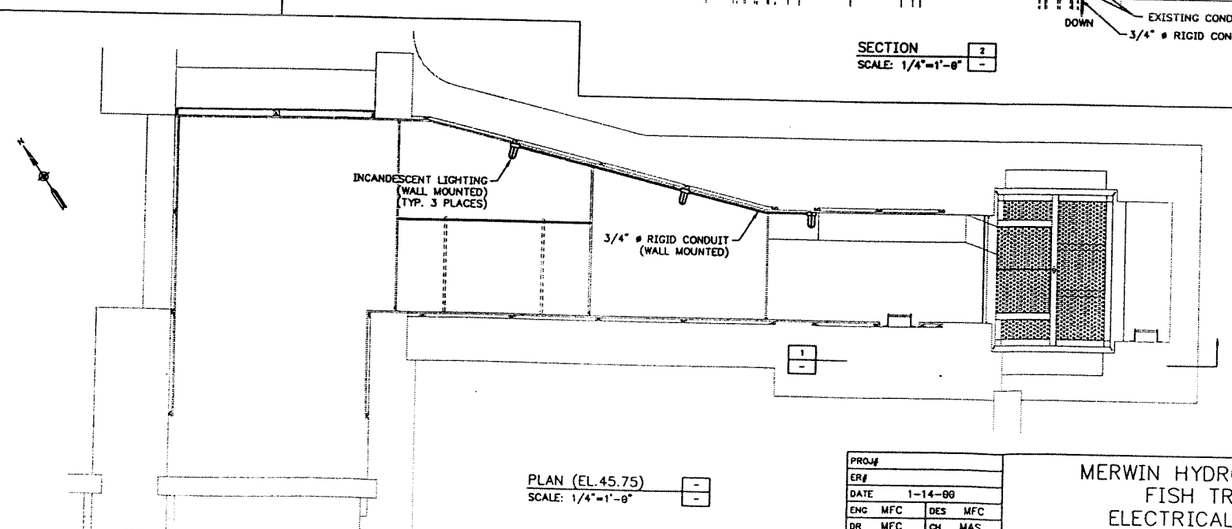
SECTION 1
SCALE: 1/4"=1'-0"



PLAN (EL. 74.58) 2
SCALE: 1/4"=1'-0"



SECTION 2
SCALE: 1/4"=1'-0"



PLAN (EL.45.75) 1
SCALE: 1/4"=1'-0"

PROJ#
ER#
DATE 1-14-00
ENG MFC | DES MFC
DR MFC | CH MAS
APPROVAL
MARK STURTEVANT

MERWIN HYDRO PLANT
FISH TRAP
ELECTRICAL PLAN

PACIFICORP HYDRO

SCALE: AS NOTED | SHEET 11 | PD-53153 | REV. 0

CAD No: 5315JH11.DWG
PLOT SCALE: 1 = 48

No.	DATE	REVISION	BY	CHK	APP
0	1-14-00	AS-BUILT	MFC	MFC	MAS

REVISION	DRAWING No.	REFERENCE DRAWINGS	DRAWING No.	CHK	APP
A					
B					
C					
D					

480V MCC NO. 1

480V AC 3Ø

L1
L2
L3

150 AMP

52 SECT 4F

L1 L2 L3

3-1/C #1/0 AWG

ASD (#601-0100-5-C00B1200800)

M

SPICE TO EXISTING CABLES BENEATH PLATFORM (TYPICAL)

1SP

1-3/C #14 AWG

584 ALARM TO PLC

X27 3 2 1
X26 3 2 1
X25 3 2 1
X23 2 1
X24
V26
V25
X29 3 2 1
X28 3 2 1
X22 9 8 7 6 5 4 3 2 1
X21 12 11 10 9 8 7 6 5 4 3 2 1

W2 V2 U2

1-3/C #2 AWG 1-3/C #2 AWG 586 TO MOTOP

5SP

1-12/C #14 AWG 585 TO FISH TRAP REMOTE CONTROL

W1 V1 U1

3-1/C #1/0 AWG FROM BREAKER

REMOTE CONTROL

BR BR X22-7 (+24)
REVERSE D(4) D X22-3
STOP BL(8) Y X22-2
START R(2) R-B X22-1

REMOTE CONTROL

X21-1 R R(7)
X21-2 B B
X21-3 BL BL(3)
X21-4

480V MCC NO.2 SECT.11C

3-1/C #4 AWG 566

SAFETY SWITCH

MAGNETIC SWITCH WITH THERMAL RELAY

M

FLOAT SWITCH

1 2 4 3
START
HAND
AUTOMATIC
STOP

CR-2490
BS-32-BN
PUSH-BUTTON STATION

DIAGRAM OF FISH RUNWAY UNWATERING PUMP CONNECTIONS

PROJ#	
ER#	
DATE	8/12/98
ENG	DES
DR FC	CH SCE
APPROVAL	
P.F. GUNTHER	

MERWIN HYDRO PLANT
WIRING
FISH PUMP #1

PACIFICORP HYDRO

SCALE NONE | SHEET 1 | PD-32281 | REV 3

NO.	DATE	REVISION	BY	CHK	APP
1	2.25.99	REDRAWN ON CAD, ADDED FUSED DISCONNECT SAFETY SWITCH AND ASD, RELOCATED INFO FROM D-37983	FC	SCE	RWG
2	9/16/02	REVISED PER NEW MCC LINE-UP REVISED CABLE TYPE, ASD & FUSE LOCATIONS, AS-BUILT	VVK	DMJ	PNF

PLOT SCALE 1 = 1

CAE NO. 32281H01.DWG

vs Folder: J:\Eng\Shared Data\Work In Progress\Hydro\LEWIS\MERWIN\Automation\New Gen 3\Final\PD32281H01.DWG Plot178 DATE: APR 25, 2002 TIME: 8:56 AM