FINAL STUDY REPORT
BIOLOGICAL AND ENGINEERING STUDIES OF THE EAST AND WEST FISH LIFTS
RSP 3.9

CONOWINGO HYDROELECTRIC PROJECT

FERC PROJECT NUMBER 405

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EXECUTIVE SUMMARY

Exelon Generation Company, LLC (Exelon) has initiated with the Federal Energy Regulatory Commission (FERC) the process of relicensing the 573-megawatt Conowingo Hydroelectric Project (Conowingo Project). The current license for the Conowingo Project was issued on August 14, 1980 and expires on September 1, 2014. FERC issued the final study plan determination for the Conowingo Project on February 4, 2010, approving the revised study plan with certain modifications.

The final study plan determination required Exelon to conduct a Biological and Engineering Study of the East and West Fish Lifts at the Conowingo Project. The objectives of this study are to: (1) determine how and to what extent the West Fish Lift and spawning tanks can be expanded to enhance biomonitoring and egg collection to promote American shad restoration; (2) to ensure that excess fish taken in the West Fish Lift can be moved upstream so as to contribute to natural spawning stock upstream; (3) conduct an engineering analysis of the remaining life cycle and maximum fish passage capacity of the existing East Fish Lift and West Fish Lift; (4) determine the costs and logistics of upgrading or replacing the existing fish passage facilities; (5) assess the logistics and cost of utilizing the West Fish Lift as an interim measure to increase fish passage at the project via trap and truck; (6) assess the need for, impact of, and logistics and costs of adding the second hopper to the East Fish Lift; (7) investigate modification or replacement of the existing West Fish Lift and a protocol for upstream transport of American shad and river herring collected in the West Fish Lift, but not needed for biomonitoring and/or egg collection programs; and (8) investigate other upstream fish passage measures or facilities, interim or permanent, which will provide safe, timely and effective upstream passage for target species.

An initial study report (ISR) was filed on May 27, 2011. A meeting was held on August 23 and 24, 2011 with resource agencies and interested members of the public. Formal comments on the ISR including requested study plan modifications were filed with FERC on March 21, 2012 by several resource agencies and interested members of the public. Exelon filed responses to the ISR comments with FERC on April 20, 2012. On May 21, 2012, FERC issued a study plan modification determination order. The order specified what, if any, modifications to the ISR should be made. For this study, FERC's May 21, 2012 order required no modifications to the original study plan. This final study report is being filed with the Final License Application for the Project.

In 1969, the Susquehanna Shad Advisory Committee (now the Susquehanna River Anadromous Fish Restoration Cooperative [SRAFRC]) was formed by the USFWS, PFBC, NYDEC, and MDNR. In 1970 Exelon entered into an agreement with these resource agencies to build a fish-lift facility at Conowingo

Dam; as a result, the West Fish Lift was completed and began operation in 1972. It was operated through 1996 as part of a trap and transport program and in 1997 it began to operate for specific experiments conducted for resource agencies (e.g., induced spawning, transport to specific tributaries). The West Fish Lift cannot pass migrating fish directly to Conowingo Pond.

In 1979, SRAFRC adopted a Strategic Plan for Restoration of Migratory Fishes to the Susquehanna River. The goals of the plan were to reopen the river to natural migrations and to restore annual spawning populations of 2 million American shad and 10 million river herring within 25 years, although the most recent restoration plan has goals of 2 million American shad and 5 million river herring above York Haven Dam (SRAFRC 2010). As part of the most recent FERC License for the Conowingo Project, a 1989 Settlement Agreement with the resource agencies resulted in the construction of the East Fish Lift in 1991.

The East Fish Lift is much larger than the West Fish Lift and is designed to operate at river flows of up to 150,000 cfs. It was designed to have the ability to be used either as a trap and transport facility or for direct passage to Conowingo Pond. It was used as a trap and transport facility from 1991 to 1996, volitional passage began in 1997 and it has been used for this sole purpose since. The facility was designed to utilize two hoppers although only one was installed when constructed. The single hopper system has a design capacity of 750,000 American shad per season.

This report presents an operational history of the lifts, current maintenance and operations methods, potential upgrades, modifications, or replacements to the current passage infrastructure based on the agency requests, and associated conceptual level cost opinions and drawings. Where appropriate, estimates are provided for the increased passage capacity of the various options.

For this study, the following potential changes were assessed for the West Fish Lift:

- decreased cycle time,
- increased lift capacity,
- direct passage to Conowingo Pond,
- trap and transport capability, and
- expansion of biomonitoring and shad egg production.

Items addressed specific to the East Fish Lift include:

- potential installation of a second hopper,
- replacement of the existing lift, and
- trap and transport capability.

The alternatives evaluated ranged from simple upgrades of gates and drive motors to full replacement of the existing lifts, therefore costs and additional passage potential varied significantly. Table ES-1 below presents a summary of the conceptual opinions of probable cost for the alternatives evaluated.

TABLE ES-1: SUMMARY OF ALTERNATIVES AND COST OPINIONS

ALTERNATIVE	BRIEF DESCRIPTION	CAPITAL COSTS (2011 DOLLARS)	ANNUAL OPERATIONS COSTS, IF APPLICABLE (2011 DOLLARS)
West Fish Lift - Decrease Hopper Rail Elevation	Lower the travel rail elevation to decrease cycle time.	$284,000	
West Fish Lift - Increase Sorting Pool Elevation	Raise the elevation of the sorting pool to decrease cycle time, also applicable if trap and transport is implemented.	$161,000	
West Fish Lift - Upgrade Crowder Gate	Replacement of the drive motors and linkage for the crowder gate to decrease cycle time.	$144,000	
West Fish Lift - Enlarged Hopper on Existing Footings	Construct a new lift on the existing footings, with a taller hopper.	$3,058,000	
West Fish Lift - Replacement of Existing Lift	Construct a new lift on new footings with a hopper similar to the dimensions of the East Lift.	$3,665,000	
West Fish Lift - Trap and Transport Capability	Purchase and operation of transport vehicles, includes costs for raising sorting pool.	$503,000	$606,000 per year
Fish Hatchery and Spawning Facility	Construct an 8,400 square foot tank spawning and hatchery facility near the West Fish Lift.	$2,402,000	$288,000 per year
East Fish Lift - Installation of Second Hopper	Install a second hopper within the existing East Fish Lift.	$1,436,000	
East Fish Lift - Replacement of Existing Lift	Construct a new lift in the current location of the East Fish Lift.	$19,462,000	
East Fish Lift - Trap and Transport Capability	Purchase and operation of transport vehicles, includes rehabbing existing sorting pool infrastructure.	$690,000	$769,000 per year

Perhaps the biggest biological concern for fish lift modifications in the context of meeting restoration goals is the dramatic increase of the gizzard shad population since the 1970s. Additional discussion is provided in Section 6.0 on this topic. As a plan for improving fish passage at the project is being formulated and agreed to by the Licensee and the various stakeholders, it is recommended that the approach account for this competing population. A variable combination of trap and transport, spawning and release to tributaries, and volitional passage may be warranted.

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Agencies

PFBC	Pennsylvania Fish and Boat Commission
FERC	Federal Energy Regulatory Commission
MDNR	Maryland Department of Natural Resources
NYDEC	New York Department of Environmental Conservation
SRAFRC	Susquehanna River Anadromous Fish Restoration Cooperative
USFWS	United States Fish and Wildlife Service

Units of Measure

cfs	cubic feet per second
F	Fahrenheit
fps	feet per second
ft	feet
gal	gallon
h	hour
hp	horse power
in	inch
L	liter
min	minute
mm	millimeter
MW	megawatt
rpm	revolutions per minute

Miscellaneous

ILP	Integrated Licensing Process
MIS	modular inclined screen
NOI	Notice of Intent
PAD	Pre-Application Document
PSP	Proposed Study Plan
RSP	Revised Study Plan
PIT	Passive Integrated Transponder

Cost Opinions

LS	Lump Sum (Allowance)
LF	Linear Feet
EA	Each
CF	Cubic Foot
CY	Cubic Yard
SF	Square Feet
MI	Mile
HR	Hour
SY	Square Yard

1.0 INTRODUCTION

Exelon Generation Company, LLC (Exelon) has initiated with the Federal Energy Regulatory Commission (FERC) the process of relicensing the 573-megawatt (MW) Conowingo Hydroelectric Project (Project). Exelon is applying for a new license using the FERC's Integrated Licensing Process (ILP). The current license for the Conowingo Project was issued on August 14, 1980 and expires on September 1, 2014.

As required by the ILP, Exelon filed its Pre-Application Document (PAD) and Notice of Intent (NOI) with FERC on March 12, 2009. On June 11 and 12, 2009, a site visit and two scoping meetings were held at the Project for resource agencies and interested members of the public. Following these meetings, formal study requests were filed with FERC by several resource agencies. Many of these study requests were included in Exelon's Proposed Study Plan (PSP), which was filed on August 24, 2009. On September 22 and 23, 2009, Exelon held a meeting with resource agencies and interested members of the public to discuss the PSP.

Formal comments on the PSP were filed with FERC on November 22, 2009 by Commission staff and several resource agencies. Exelon filed a Revised Study Plan (RSP) for the Project on December 22, 2009. FERC issued the final study plan determination for the Project on February 4, 2010, approving the RSP with certain modifications.

The final study plan determination for Conowingo Project Study 3.9 recommended that Exelon assess or develop the following elements:

(1) How and to what extent the West Fish Lift and spawning tanks can be expanded to enhance biomonitoring and egg collection to promote American shad restoration;

(2) A protocol for upstream transport of American shad and river herring collected in the West Fish Lift not needed for biomonitoring and/or egg collection programs;

(3) Conduct an engineering analysis of the remaining life cycle and maximum fish passage capacity of the existing East and West Fish Lifts;

(4) Determine the costs and logistics of upgrading or replacing the existing fish passage facilities;

(5) Assess the logistics and cost of utilizing the West Fish Lift as an interim measure to increase fish passage at the project via trap and truck;

(6) Assess the logistics and costs of adding the second hopper to the East Fish Lift to achieve its original design capacity of 1.5 million American shad;

(7) Investigate modification or replacement of the existing West Fish Lift with a fully functional fishway (fish lift or fish ladder) capable of passing up to 1.5 million American shad directly into the Conowingo Pond without the need for trucking; and

(8) Investigate other upstream fish passage measures or facilities interim or permanent, which will provide safe, timely and effective upstream passage for target species.

An initial study report (ISR) was filed on May 27, 2011. A meeting was held on August 23 and 24, 2011 with resource agencies and interested members of the public. Formal comments on the ISR including requested study plan modifications were filed with FERC on March 21, 2012 by several resource agencies and interested members of the public. Exelon filed responses to the ISR comments with FERC on April 20, 2012. On May 21, 2012, FERC issued a study plan modification determination order. The order specified what, if any, modifications to the ISR should be made. For this study, FERC's May 21, 2012 order required no modifications to the original study plan. This final study report is being filed with the Final License Application for the Project.

2.0 BACKGOURND

In 1969, the Susquehanna Shad Advisory Committee (now the Susquehanna River Anadromous Fish Restoration Committee [SRAFRC]) was formed by the United States Fish and Wildlife Service (USFWS), the Pennsylvania Fish and Boat Commission (PFBC), the New York Department of Environmental Conservation (NYDEC) and the Maryland Department of Natural Resources (MDNR). In 1970 Exelon entered into an agreement with these resource agencies to build a fish-lift facility at Conowingo Dam. As a result, the West Fish Lift was completed in 1972. See Figure 2.0-1 for the location of the two fish lifts within the context of the dam and powerhouse. See Figure 2.0-2 for more information regarding the configuration of the West Fish Lift.

The West Fish Lift was operated through 1996 as part of a trap and transport program. The lift was to initially operate for only five years, however Exelon has continued to fund its operation as part of the cooperative efforts to restore American shad runs. See Table 2.0-1 for a historical summary of fish passage at the West Fish Lift. Catch peaked at the West Fish Lift in 1995 for American shad when 15,588 fish were reportedly captured. Beginning in 1997, the West Fish Lift began to operate for specific experiments conducted for resource agencies (e.g., induced spawning, transport to specific tributaries). The West Fish Lift can be operated up to river flows of approximately 120,000 cfs.

In 1979, SRAFRC adopted a *Strategic Plan for Restoration of Migratory Fishes to the Susquehanna River*. The goals of the plan were to reopen the river to natural migrations and to restore annual spawning populations of 2 million American shad and 10 million river herring within 25 years, although the most recent restoration plan has goals of 2 million American shad and 5 million river herring above York Haven Dam (SRAFRC 2010). As part of the most recent FERC License for the Conowingo Project, a 1989 Settlement Agreement with the resource agencies resulted in the construction of the East Fish Lift, completed in 1991.

The East Fish Lift is much larger than the West Fish Lift and is designed to operate at river flows of up to 150,000 cfs. The East Fish Lift was designed by Stone & Webster based on the conceptual design supplied by the USFWS, with construction completed by Kewitt Corporation. The location of the East Fish Lift was based on radio telemetry studies and field observations of anglers in the Conowingo tailrace. A schematic of the East Fish Lift is presented as Figure 2.0-3. As-built plan and sectional drawings of the East Fish Lift are presented as Figures 2.0-4 and 2.0-5, see Table 2.0-2 for a historical summary of fish passage at the East Fish Lift.

An agreement was reached in 1984 with the owners of the Holtwood, Safe Harbor, and York Haven Dams to help fund the trap and transport program at the time, as well as expand hatchery and stocking operations. The East Fish Lift was constructed to allow for both trap and transport of fish and direct passage to Conowingo Pond. Although construction was complete by 1991, the trap and transport program continued through 1996. In 1993, owners of the three hydroelectric projects upstream of Conowingo Dam reached a settlement agreement with resource agencies that stipulated: "*…permanent upstream fish passage facilities are developed at the Holtwood and Safe Harbor Dams by 1997 and at York Haven Dam by 2000"*. The construction of the upstream facilities resulted in the cessation of trap and transport operation at Conowingo Dam in 1996.

American shad passage at Conowingo peaked in 2001 when 193,574 fish were reportedly passed by the East Fish Lift into the pond. Correspondingly, the numbers of fish passing Holtwood, Safe Harbor and York Haven peaked in 2001 as well. Since 2001, the numbers of shad passing the dams have generally declined.

In 2009, PPL Holtwood was issued a 401 Water Quality Certification for the Holtwood Hydroelectric Facility, where it proposed to increase generation capacity, upgrade the existing equipment and facilities, and enhance upstream fish passage. The Certification requires the proposed changes to be completed by December 2013.

As fish numbers have declined, attempts are being made to increase passage efficiencies at the four lower Susquehanna River dams. SRAFRC included Task C3 in the Migratory Fish Management and Restoration Plan for the Susquehanna River Basin (2010) that a trap and transport program is a high priority interim option to pass fish from Conowingo Dam to above York Haven Dam for the next several years.

American eels have been known to use fish lifts, but are not discussed in this report. Their passage is discussed in Conowingo RSP 3.3 Biological and Engineering Studies of American Eel.

3.0 WEST FISH LIFT FACILITIES

The following sections define the existing West Fish Lift and the potential alternatives evaluated. Refer to Figures 2.0-1 and 2.0-2 plus photos 1 through 7 in Appendix A for more information regarding the current layout of the West Fish Lift.

3.1 Existing Facilities and Condition

The West Fish Lift is located at the west bank of the tailrace below Conowingo Dam. It is used during the spring to lift fish to a sorting tank on the west bank of the Conowingo tailrace. American shad are then removed from the sorting tank and transferred to holding tanks where they are injected with hormones and spawn. The eggs are transferred to a hatchery in Pennsylvania where they are hatched and then stocked. The West Fish Lift has been in operation since 1972 with no substantial upgrades or changes to its structure or operation. From 1972 to 1996 the lift was used to trap and transport American shad above Safe Harbor dam to upper tributaries of the Susquehanna River. Currently the West Fish Lift is only used to harvest eggs from pre-spawned American shad.

Maintenance is currently performed on the lift only when needed; no substantial preventive maintenance or enhancements have been performed over the last 10 years. The steel structure is in fair shape with overall surface rust. Other than surface rust, no major deterioration of the structure is visible. The crowder gate electric motors, crowder gate linkage, and submersible pumps are removed after the shad run and stored inside for the winter. The weir gates are lowered during the off season and the bypass gates are opened to allow unrestricted flow. The hopper is stored in the full up position with the hopper door open. After spill has stopped in the spring (runoff has subsided), the crowder motors, linkages, and pumps are reinstalled and the lift is inspected prior to lift operations. Additionally, two holding tanks are constructed to hold pre-spawned American shad. These holding tanks are used to chemically induce the American shad into spawning and the eggs are harvested and delivered to the hatchery.

The West Fish Lift is in need of preventive maintenance, which includes replacement of crowder motors, sand blasting, and painting of the steel structure with rust inhibitive paint. The concrete structure appears to be intact with no major spalling or discernable cracks. The weir gate motors are in good condition and are not used as frequently as the crowder gate motors during lifting operations. The hopper has surface rust on the exterior steel and should have the existing rust removed and painted with a rust inhibitive paint. Within the past few years, the foundation of the West Fish Lift was inspected by a diving team. At the time of the inspection, no major structural issues were noted.

According to the PFBC, the West Fish Lift is currently adequate to provide enough fish for spawning American shad at the site. If the operation was expanded to a trap and transport operation, the West Fish Lift would need to be modified. These modifications would concentrate on increasing the number of fish lifted per hour and decreasing the sorting and handling of the collected American shad.

3.2 Projected Useful Life

Life expectancy on the West Fish Lift superstructure could be up to 15 years with the implementation of a more proactive preventive maintenance plan. This estimate is based on non-destructive visual inspections conducted by our structural engineering personnel during the last year; it is an estimate only and actual useful life may differ. This estimate considers prior use and may vary with changes in frequency and duration of use. It does not relieve the owner from inspecting the lift prior to use for damage or corrosion that may have occurred when not in service, or from addressing abnormal signs of wear during operations.

3.3 Design Parameters

The West Fish Lift was designed to use the outflow from the house units as attraction flow for the lift. It does not have the capability to pass fish into Conowingo Pond and was designed as a collection facility to allow for transport of pre-spawned American shad to tributaries above the dam. The numbers of shad caught from 1972 to 1982 were not sufficient for transport to upstream locations, so during this time period, these shad were used to supply fertilized eggs to the upstream tributaries.

Fish that enter the West Fish Lift are deposited through a bottom hatch in the hopper to a sorting tank. The shad are then removed from this tank and deposited in a holding tank at the site. The remaining fish are released back to the tailrace through a 12-inch diameter chute. The West Fish Lift requires a five person team to operate the lift, consisting of one Lift Operator, one Fish Biologist, and three technicians to assist with sorting and removing the American shad from the sorting pool.

The volume of the existing West Fish Lift hopper is approximately 900 gallons. The average number of fish lifted by the hopper is approximately 700 fish (1.3 gallons per fish), which is based on data collected when the lift was used specifically for trap and transport (1991-1996). The lift has historically operated at a nominal cycle time of 35 minutes per lift, based on data from 1991 to 1996 (see Section 6.0). Cycle time refers to the complete cycle of fishing for a given period, crowding the fish to the hopper, then raising, emptying, and lowering the hopper back to the fishing position, including opening the crowder gates. Onsite personnel report that once the crowder gates have been switched to close, it takes

approximately 10 minutes to raise and empty the hopper then return to the fishing position. Fishing time is therefore approximately 25 minutes per lift, based on historical data.

The West Lift motors are reportedly flooded when flows rise above 120,000 cfs.

3.4 Alternatives Considered

To address the items noted in Section 1.0 applicable to the West Fish Lift, the following alternatives were considered.

3.4.1 Modifications to Decrease Cycle Time

This alternative considers modifying the existing lift to decrease the time between lifts. The potential number of fish raised per lift would remain unchanged with increased collection occurring by increasing the number of lifts per day. The majority of the existing infrastructure would be reused.

The West Fish Lift is currently used for collection of American shad for spawning. During fishing operations, the number of American shad collected is a portion of the total fish collected during each lift. Fish not selected for spawning are returned to the tailrace. Decreasing cycle time would allow for more lifts and presumably increased collection of the target species.

Modifications to the West Fish Lift to reduce cycle time include reducing structure height, raising the sorting tank, or decreasing the crowder gate closing time. If the elevation difference between the hopper rail and sorting tanks could be reduced, it would decrease cycle time. Changing the crowder motors and linkage to increase crowder gate speed will allow the crowder to move fish into the hopper more efficiently and return to the fish position faster after the hopper is lowered back into the water.

The hopper on the West Fish Lift must be moved into the full up position before it can travel horizontally on the rail to the location of the sorting tank as it connects with a rigid support that keeps the hopper from swaying as it is moved along the rail. To decrease the hopper rail elevation, the hopper, horizontal travel rail, and all associated motors and electrical supply would need to be temporarily removed from the lift. The columns supporting the horizontal travel rail and hopper would have sections removed from the top and the existing bracing relocated. The hopper, horizontal travel rail, motors, and associated electrical systems would then be reattached at the new elevation. The cost opinion does not consider a new hopper or any other changes in operation of the lift except the lowering of the travel rail to reduce the height the hopper is lifted. A Conceptual Opinion of Probable Construction Cost (Cost Opinion) has been prepared, which is presented as Table 3.4.1-1. The total for this potential alternative is $284,000. A conceptual

layout of this modification is presented as Figure 3.4.1-1. It is estimated that implementing this option would decrease cycle time by approximately two minutes.

The second option explored to reduce cycle time is to raise the elevation of the sorting tank so the hopper does not need to be lowered once it is in position above the sorting tank. Additionally, if the sorting tank is raised to a higher elevation it will allow for more efficient transfer of fish from the hopper to a transport tank if a trap and transport program was restarted. This option involves removal of the existing sorting tank, buildup of a foundation and platform to support the new sorting tanks, and installation of new sorting tanks at a higher elevation. It would not require modifications to the hopper or fish lift structure. Table 3.4.1-2 presents the cost opinion for this potential alternative, the total is $161,000. A conceptual layout of this modification is presented as Figure 3.4.1-2. It is estimated that implementing this option would decrease cycle time by approximately two minutes.

The last option evaluated to reduce cycle time is replacement of the drive motors and linkage for the crowder gate. The motors are removed over the winter and stored, then replaced after the tailrace stage has lowered and spill conditions have ended for the spring. Replacing these motors would not require modification to the lift structure and they could be placed in the location of the existing motors. The electronic controls would need to be reprogrammed to compensate for the faster travel of the crowder gate, with new limit switches required. The total for this potential alternative is $144,000; see Table 3.4.1-3 for the Cost Opinion. This option has the potential to decrease cycle time by approximately one minute.

These options could be combined in two different ways. Upgrading the crowder drive could be implemented for either raising the sorting tank or decreasing the elevation of the hopper travel rail. Raising the sorting tank and implementing the crowder drive upgrade appears to be the most sensible option as it would lend itself to implementing a trap and transport program if desired. The combined time savings of either of these two variations would result in the potential for approximately one to two more lifts each day; this translates to a capacity of approximately 110% of what is possible with the existing lift.

3.4.2 **Modifications to Increase Lift Capacity**

The second major alternative assesses increasing the capacity of the West Fish Lift by installing a larger hopper within the existing footprint of the current lift or constructing a new enlarged system. Modifications to the West Fish Lift to increase lift capacity were evaluated and the existing structure was assessed based on its capability to support a larger hopper.

Two options were evaluated in expanding the capacity of the West Fish Lift, the first is to keep the cross section of the hopper the same but have the new hopper deeper to accommodate more fish. In this scenario the steel structure above the water would be replaced, the concrete footing structure would remain, and the new hopper would be designed to fit in the existing opening at the water surface. This enlarged hopper would have a volume of approximately 1,500 gallons, resulting in a nominal capacity of 1,150 fish per lift or approximately 165% of current capacity. Fish per lift is based on the gallons per fish ratio stated in Section 3.3. The Cost Opinion for this alternative is presented as Table 3.4.2-1 with a total of $3,058,000. If this or the following option were implemented, the new lift should incorporate the faster crowder drive and increased sorting pool elevation discussed above. This would result in approximately 10% (1 to 2) more lifts per day, compared to the current system.

The second option would involve complete removal of the West Fish Lift including footings; the new lift would have a similar volume as the existing hopper on the East Fish Lift. The current superstructure of the West Fish Lift does not have the capacity to support the weight of a hopper the size of that used in the East Fish Lift. If a new, larger hopper is to be installed the entire structure would need to be replaced to support the new hopper. A new hopper would have a side discharge and incorporate similar designs to that of the East Fish Lift to reduce stress on the fish. This proposed hopper would have a volume of approximately 3,300 gallons, or 3.65 times the current hopper's volume. The Cost Opinion for this alternative is presented as Table 3.4.2-2 with a total of $3,665,000.

3.4.3 **Passage to Conowingo Pond**

Item 7 from Section 1.0 related to investigating modification or replacement of the existing West Fish Lift with a fully functional fishway capable of passing up to 1.5 million American shad directly into the Conowingo Pond without the need for trucking. Construction of a completely new lift capable of passing this number of fish per season is considered to be unrealistic based on site constraints, including the location of the intakes for the powerhouse. This is explained in more detail below.

Building a trough to provide fish passage on the west side of the Conowingo powerhouse will be challenging due to the accumulation of debris that is continuously drawn into the powerhouse intake area. Debris is a serious issue at the East Fish Lift and would be worse at the West Fish Lift. The lift design must address preventing debris from entering the facility, as well as removal of debris that does collect. Water leakage from the trough must be prevented since the Administration building is in close proximity to the current fish lift.

The lift must also address the problem of getting fish to Conowingo Pond. The two alternatives are to go over the administration building or to go under Route 1. If the lift is to go over the administration building, the hopper would need to move up to an elevation higher than the building, move horizontally over it and Route 1, then back down to a level to discharge in the pond. Essentially, it would be comprised of two lifts: one for up and over the administration building and one back down to the pond. Logistical problems associated with this alternative include: building a structure over the administration building and over Route 1, addressing leakage problems onto the administration building and Route 1, and discharging fish too close to the turbines. Aside from the engineering and construction constraints of building over Route 1, safety of the public would also be a concern.

The alternative to go under Route 1 also has associated logistical issues as well. The lift structure would need to go around the administration building and discharge to a trough that would be constructed under Route 1. The fish would need to be discharged into the pond upstream far enough so as not to be drawn back through the turbines and to get past the debris that accumulates near the dam.

3.4.4 **Trap and Transport Capability**

Another alternative investigated at the West Fish Lift assesses what modifications and protocol would be necessary to use this lift for upstream transport of American shad and river herring that are collected but not needed for the biomonitoring and egg collection programs. This addresses Items Nos. 2 and 5 listed in Section 1.0.

The West Fish Lift was used primarily as a trap and transport facility from 1983 to 1996. It was used on a limited basis for trap and transport from 1997 to 2000. Restarting this operation would require modification to the sorting pool configuration and purchase of new transport vehicles and associated equipment. Section 3.4.1 above describes an alternative where the elevation of the sorting pool is increased to decrease the cycle time of the lift. Raising the sorting pool elevation would allow direct sluicing of collected fish into a tank mounted on a transport vehicle. This modification is recommended if trap and transport is pursued for the West Fish Lift; costs from that option were included in the Cost Opinion referenced below.

During previous use as a trap and transport facility, several flatbed trucks were fitted with 1,000 gallon tanks, two trash pumps for water circulation, two 2,500 pound oxygen cylinders with a regulator and hosing for aeration, and a temperature/dissolved oxygen monitor. The capacity of the transport tank was approximately 150 to 225 fish per trip. The operation used up to four trucks driven in rotating cycles;

with an average round trip travel time of five hours. Fish were normally transported to waters upstream of York Haven Dam. Six loads were usually transported each day from this lift.

The personnel present during the passage season normally consisted of 1 fish biologist, 1 lift operator, 3 fish technicians, and 4 drivers. During the peak of the passage season an additional technician and driver were occasionally required. The season was an average of 52 days from 1983 to 1996 and work days were generally 12 hours.

For the West Fish Lift to be used as a trap and transport facility, a new fleet of transport vehicles would need to be purchased and equipped with the items described above. It would also require the sorting tank to be modified to allow fish to be sluiced directly into the transport tanks. A Conceptual Opinion of Probable Construction Cost (Cost Opinion) has been prepared, which is presented as Table 3.4.4-1. Costs for a slightly larger tank than used previously (1,500 gallon) have been carried to allow for more capacity.

The Cost Opinions prepared for previous concepts presented primarily capital costs for construction of the alternative. The Cost Opinion for this case also includes values for annual operations of the program, including predicted labor and materials needed each season. The length of season was assumed to be 50 days, although this is expected to vary each year. A project coordinator has been added to the list of personnel to facilitate an organized and monitored approach to the process. If trap and transport were implemented for the East Fish Lift, this same individual would also coordinate those activities to provide a unified approach. Initial capital costs were estimated to be $503,000, with an annual operations budget of $606,000 per year.

3.4.5 **Expansion of Biomonitoring and Shad Egg Production**

To date, current tank spawning operations using hormone injections have produced disappointing results. Although hormone injected fish successfully release their eggs in a timely fashion (24 to 48 hours), egg viability has ranged from 0 to 30%. Some researchers have had successful viable egg production without the use of hormones when fish are placed in a facility with temperature and other climate controls. Without the use of hormones, large volumes of eggs are generally not released over a short period of time, resulting in a limited number of spawning events during the spring spawning season. Facilities with limited space for housing circular tanks (10-ft to 12-ft diameter) and other associated equipment may be unable to meet viable egg production goals and hamper restoration efforts.

At the Conowingo West Fish Lift facility, one 10-ft diameter and one 12-ft diameter tank are currently used for hormone induced spawning trials. If a decision is made to build a climate controlled spawning facility on Exelon property, production will be limited to the number of tanks the building can house

since a spawning trial may take 30 to 40 days to produce viable eggs without hormone injection. Available space at Conowingo Dam may be limited and alternate sites will need to consider power and water supply, transport time of brood stock from Conowingo Dam, and overall ease of access. Collection of biological information at the West Fish Lift is currently conducted within the confines of the fish holding area. In the future, if the agencies require pit tagging of American shad and other species, a processing area with a water source for clean-up purposes, and a fish-friendly sluice for returning marked fish to the river may be required.

A conceptual spawning facility schematic was developed by Mike Hendricks with the PFBC. This schematic, presented as Figure 3.4.5-1, provides details regarding the size and makeup of a potential hatchery and spawning facility at Conowingo Dam. Figure 3.4.5-2 presents a possible location for the facility in the vicinity of the existing West Fish Lift. This facility would have the potential, on an annual basis, to produce approximately 13 million viable eggs and provide incubation facilities for approximately 20 million eggs. A Cost Opinion was prepared based on this schematic and is presented as Table 3.4.5-1, with total costs estimated at $2,402,000. This value includes design and construction of the facility but does not include annual operational and maintenance costs. It is expected that a facility of this magnitude would be staffed five months per year by a hatchery manager and assistant manager. For approximately four months per year, four seasonal hatchery technicians would also be required. Labor costs for these individuals, including an annual allowance for utilities and supplies, results in an approximate annual operations cost of $288,000 per year.

3.5 Operations

Currently, the USFWS administers the spawning program at the West Fish Lift. The funding is provided/split between the PFBC, which provides $75,000 and the MDNR, which provides $25,000 towards the program. Based on funding limitations, the West Fish Lift normally operates from Sunday through Friday (8 hours per day) from about April 24 through about June 6. This duration is shortened to the end of May if sufficient American shad are collected or water temperatures rise and stay above 70^{o}F. The Licensee's accounting group provided a total cost figure of approximately $135,000 to fund the West Fish Lift operations in 2010 ($100,000 of this was paid by PFBC and MDNR).

4.0 EAST FISH LIFT FACILITIES

The following sections define the existing East Fish Lift and the potential alternatives evaluated. Refer to Figures 2.0-1, 2.0-3, 2.0-4, and 2.0-5 plus photos 8 through 14 in Appendix A for more information regarding the overall layout of the East Fish Lift.

4.1 Existing Facilities and Condition

The East Fish Lift is located at the east end of the powerhouse in the first spillway bay of the dam. It is used during the spring to lift fish over the Conowingo Dam directly into Conowingo pond. Attraction water enters the spillway from one of three gates that were used to replace the original regulating gates previously in the spillway bay. Water also enters the trough at the level of the spillway. Water flows through the trough and enters a bypass pipe that returns this water to the spillway creating a flow through the trough for the shad to swim upstream after being lifted and deposited into the trough from the hopper. Fish enter the hopper through 1 of 3 entrance weirs; selection of the weir used is dependent on the turbines in use. The lift has been in operation since 1991 with no substantial upgrades or changes to its structure or operation. Initially, fish were also trapped and transported from the East Fish Lift in addition to the West Fish Lift. Currently there are no trap and transport operations at the East Fish Lift.

Maintenance is currently performed on the lift only when needed; no substantial preventive maintenance or enhancements to the East Fish Lift have been performed over the last 10 years. The steel structure is in fair shape with overall surface rust to the steel. Attachment points for limit switches and seals are in need of repair. Electrical connections and the control panel and associated control building are in good condition. Portions of the lift designed using mild steel need to be replaced with stainless steel parts over the next few years. Other than surface rust no major deterioration of the structure is visible. The crowder gate hydraulic actuators, crowder gate linkage, and submersible pumps are removed after the shad run and stored inside for the winter. The weir gates are lowered during the off season and the bypass gates are opened to allow unrestricted flow. The hopper is stored at the level of the sorting tank. After spill has stopped in the spring (runoff has subsided), the crowder gate hydraulics, linkage, and pumps are reinstalled and the lift is inspected prior to lift operations. During high water in the spring, the fish lift collects large amounts of debris requiring it to be dewatered after spill stops and debris removed before fish lift operations can begin. The East Fish Lift also attracts a substantial number of birds during the fall and winter and the entire structure is completely covered with bird excrement, requiring power washing prior to the start of lift operations.

The East Fish Lift is in need of preventive maintenance to include sand blasting and painting of the steel structure with rust inhibitive paint. The concrete structure appears to be intact with no major spalling or discernable cracks. There is minor spalling at the location of a few of the railing anchors that should be addressed in the near term. The hopper has surface rust on the exterior steel and should have the existing rust removed and painted with a rust inhibitive paint. The main drive motors and associated drive

mechanisms were disassembled and lubricated after each season to extend life of the motors. This maintenance was terminated in 2000.

Other miscellaneous maintenance items have been observed or reported by staff onsite. The head gate that allows water to enter the fish trough and be used as attraction flow is currently only operable from 0-14% open. When headpond levels are low, insufficient water flows through the attraction flow system. The upstream-downstream channel gate, that would allow passage to be set to either the A and B weir gates or the C weir gate, is currently inoperable and set in the full open position. This limits the flexibility of choosing a preferred passage route based on river and generation conditions. Weir gate A is reportedly overtopped when sufficient Kaplan units are generating (Unit Nos. 8, 9, 10, and 11). This may mask the design attraction flow from the crowder area for fish entering through the weir gate C entrance. Weir gate A is normally in the closed position when the Kaplan units are operating and is not used for fish passage.

4.2 Projected Useful Life

Life expectancy on the East Fish Lift could be up to 25 – 30 years with the implementation of a more proactive preventive maintenance plan. This estimate is based on non-destructive visual inspections conducted by our structural engineering personnel during the last year; it is an estimate only and actual useful life may differ. This estimate considers prior use and may vary with changes in frequency and duration of use. It does not relieve the owner from inspecting the lift prior to use for damage or corrosion that may have occurred when not in service, or from addressing abnormal signs of wear during operations.

4.3 Design Parameters

The East Fish Lift at the Conowingo Dam is located on the east end of the powerhouse at the first spillway bay. The regulating gate at this location was removed and the fish lift was constructed in this spillway bay with a new gate to supply attraction flow water to the lift. The East Fish Lift is operated from early April to mid June to lift American shad along with other native fish from the tailrace of the Conowingo Dam to Conowingo Pond. The fish lift is operated on an alternating day basis in early April until 100 American shad have been lifted. Once this minimum number is reached, the lift is then operated daily until the end of the American shad run. Hours of operation are generally 12 hours per day.

Fish enter the tailrace and are attracted to the lift by 300 to 900 cfs of attraction flow supplied from Conowingo Pond. The average number of fish lifted by the hopper is approximately 1,300 fish (2.5 gallons per fish), which is based on data from 1997 to 2010. Daily operations of the fish lift requires a

team of 1 lift operator, 1 technician, and 1 to 2 personnel at the observation window to count and document the fish that are lifted to the pond.

The current lift has three downstream entrances for fish to enter the lift; each of which are 14-ft high by 10-ft wide. The entrances that are open at any specific time vary with the generation output of the powerhouse. Weir gates at the entrance to the lift are adjusted to keep the velocity of the attraction flow between 3.5 to 5 fps. The hopper installed in the lift has a capacity of approximately 3,300 gallons and the hoist has a lifting capacity of 22 tons. Design cycle time for the hopper is stated as 15 minutes to raise, unload, and lower back to the tailrace level; onsite staff report that it normally takes 40 to 50 minutes for the hopper to fill with water and the crowder gate to move fish into the hopper. The hopper, due to its design, is buoyant when set in the water and takes some time to submerge. This results in a nominal cycle time of 1 hour. Historical data from 1997 to 2010 also support an average cycle time of approximately 1 hour, see Section 6.0. Fish exit the hopper at Conowingo pond elevation and swim through a 190-ft long exit flume (Fish Trough) that includes an observation window.

4.4 Alternative Considered

To address the items noted in Section 1.0 applicable to the East Fish Lift, the following alternatives were considered.

4.4.1 Installation of Second Hopper

This alternative includes the installation of the second hopper within the current lift. The second hopper was a component of the original design that was not installed during initial construction. This addresses Item No. 6 in the list from Section 1.0.

Improvement in the East Fish Lift could be accomplished by adding a second hopper to the existing structure. The second hopper would be placed directly upstream of the existing hopper, closer to the spillway. In addition to the controls, motors, and lifting cables to operate a new hopper, the existing crowder gate will need to be reconfigured to allow movement past the existing hopper and full movement through the trough. Figures 4.4.1-1, 4.4.1-2, and 4.4.1-3 present additional detail for the relationship of the second hopper with the fish trough, the layout of the existing hopper, and the crowder area, respectively. A Cost Opinion was developed for this option and is included as Table 4.4.1-1, the estimated total is $1,436,000.

The addition of a new hopper will volumetrically double the capacity of the East Fish Lift, although it is not expected to simply double its passage potential. It is expected that fish migrating upstream would

favor the second hopper as they would be seeking the most upstream point in the system. There would likely be a disparity in the relative amount of fish collected in each hopper. It is estimated that the upstream hopper would be favored approximately 3 to 1 (i.e., 75% of catch in upstream hopper, 25% in downstream hopper). It is estimated that adding the second hopper could result in a total passage capacity of approximately 150% of the existing rate for the East Fish Lift. These proportions and estimates were based on the experience of personnel familiar with the lift's operation and habits of migrating fish at the project. More discussion regarding historical and potential future performance of the lifts is presented in Section 6.0.

4.4.2 Replacement of Existing Lift

A cost opinion has been prepared for the replacement of the existing East Fish Lift in its current location. The facility would resemble the existing lift, although current passage and control technologies would be incorporated into the system. It would also include a second hopper. Total costs for this option were predicted to be $19,462,000, as shown in Table 4.4.2-1.

4.5 Operations

Currently, East Fish Lift operations start on or about April 1 if water temperature is at or above 50°F and Conowingo Dam is not spilling water through the crest gates. Conowingo goes into spill mode when river flows exceed approximately 86,000 cfs. When East Fish Lift operations start, the lift is operated for eight hours on alternate days (every other day) until 100 shad are passed in a single day. This triggers daily operation and the length operated per day is extended to 11 or 12 hours (approximately 7 am to 7 pm). The operators base how long they operate each day on the hourly passage count. If the count declines sharply, they may shut down prior to 7 p.m.

Near the end of the shad season when water temperatures are sustained above 70°F and they are passing less than 100 shad per day, a proposed shutdown scenario is presented to the agencies stating tentative stop dates for Conowingo, Holtwood, and Safe Harbor passage operations. The lifts continue to operate until the agencies grant approval to cease operations for the season.

The Licensee's accounting group provided a total cost figure of approximately $267,500 to fund the East Fish Lift operations in 2010.

5.0 TRAP AND TRANSPORT AT BOTH THE EAST AND WEST FISH LIFTS

The East and West Fish Lifts were both used for trap and transport from 1991 to 1996. The details of using the West Fish Lift for trap and transport were discussed in Section 3.4.4. This section provides a

brief history of the period when both lifts were used concurrently and presents a conceptual approach and costs for trap and transport from the East Fish Lift.

5.1 Design Parameters

When both lifts were used for trap and transport (from 1991 to 1996) the average total of American shad transported during this period was approximately 33,000 per season. The maximum number of American shad transported occurred in 1995 when approximately 63,000 American shad were trapped via the East and West Lifts, with approximately 56,000 of them transported and released upstream of the project. Those not transported were returned to the tailrace. Of this total, approximately 38,000 were trapped at the East Fish Lift, approximately 12,000 were trapped at the West Fish Lift, and the remaining 6,000 were categorized as "mixed origin". The "mixed origin" component were trips where the transport tank held fish from both lifts (i.e. to create a full tank fish were gathered from both lifts).

It appears that transporting approximately 50,000 American shad during a given season is possible, assuming the current capacity of both lifts is not changed. It will, however, be limited by the fish available in the tailrace and their desire to enter the lifts. Additional investment in personnel and infrastructure to have the capacity to transport more fish may not result in increased passage if the fish are not available or willing to enter the facilities.

5.2 Capital Investment

During the East Fish Lift's previous use as a trap and transport facility, several flatbed trailers were fitted with 750 gallon tanks, two trash pumps for water circulation, two 2,500 pound oxygen cylinders with a regulator and hosing for aeration, and a temperature/dissolved oxygen monitor. The capacity of the transport tank was approximately 100 to 125 fish per trip. A hy-rail truck and forklift were used to position and move the trailers to and from the sorting tank at the East Fish Lift and the West shore. The operation used up to five trucks and trailers driven in rotating cycles; with an average round trip travel time of five hours and a maximum of 10 trips per day. Fish were normally transported to waters upstream of York Haven Dam.

For the East Fish Lift to be used as a trap and transport facility, a new fleet of transport vehicles would need to be purchased and equipped with the items described above. A hy-rail truck and forklift would also be required if they are not available at the project. It is recommended that the existing sorting tank and support grating be replaced due to its age and reportedly poor condition. The gate allowing fish to be sent to the sorting tank or passed to Conowingo pond would also need to be repaired to function as it did historically. When trap and transport was ceased at the East Fish Lift this gate was welded to the

volitional setting. Costs for a slightly larger tank than used previously (1,000 gallon) have been carried to allow for more capacity. Figures 5.2-1 and 5.2-2 present a full scale plan and section of the collection area, showing the existing hopper, sorting tank, and location of the gantry rails.

5.3 Operations

The personnel present during the passage season normally consisted of 1 fish biologist, 1 lift operator, 4 fish technicians, and 4 drivers. During the peak of the passage season an additional technician and driver were occasionally required. The season was an average of 54 days from 1991 to 1996 and work days were generally 12 hours.

The Cost Opinion for this case also includes values for annual operations of the program, including predicted labor and materials needed each season. The length of season was assumed to be 50 days, although this is expected to vary each year. A project coordinator has been added to the list of personnel to facilitate an organized and monitored approach to the process. If trap and transport were implemented for the West Fish Lift, this same individual would also coordinate those activities to provide a unified approach. A Conceptual Opinion of Probable Construction Cost (Cost Opinion) has been prepared, which is presented as Table 5.3-1. Initial capital costs as described in the previous section were estimated to be $690,000, with an annual operations budget of $769,000 per year.

6.0 BIOLOGICAL CONSIDERATIONS

Perhaps the biggest biological concern for fish lift modifications in the context of meeting restoration goals is the dramatic increase of the gizzard shad population since the 1970s. There is ideal spawning habitat for gizzard shad above the lower Susquehanna River dams, which has contributed to the rapid expansion of the population. The construction of the dams creating suitable spawning habitat, along with increased fish passage, has caused gizzard shad to become the dominant fish in the lower river. The increase in gizzard shad has not translated into more fish harvested commercially as there is a constant but small demand for the species that is not driven by supply. Operational changes increasing flows at the fish lift entrances in an attempt to block gizzard shad and allow passage of American shad may have only created another unanticipated problem as anecdotal evidence suggests that gizzard shad congregate at the fish lift entrances and "crowd out" the American shad attempting to pass upstream.

Table 6.0-1 summarizes the historical fish passage rates at Conowingo Dam, for the East and West Fish Lifts, during selected operational periods. From 1991 to 1996, both lifts were used for trap and transport of American shad to upstream locations. From 1997 to 2010, the East Fish Lift was used to pass migrating fish to the Conowingo Pond. Referring back to the discussion regarding a potential second hopper at the East Fish Lift and using the average passage rates from 1997 to 2010, the East Fish Lift would need to pass approximately 19 times the average amount of American shad to meet the original design capacity of 1.5 million American shad (i.e., 18 additional hoppers at a similar effectiveness).

As this simple correlation likely overestimates the carrying capacity of gizzard shad in the Conowingo Pond, it illustrates an important point. To meet restoration goals using non-selective volitional passage techniques, many more gizzard shad will be passed above Conowingo Dam in an effort to pass more American shad. As they are already a nuisance species, this will only exacerbate the current problem. Passing this many gizzard shad can have detrimental effects on the food web as large numbers of a species such as gizzard shad can greatly deplete a food resource and therefore, affect the food availability for other species. A concern was raised in the draft management and restoration plan (SRAFRC 2010) that large numbers of gizzard shad can eutrophy the Chesapeake Bay and adversely affect water quality. Increasing their population by giving more individuals access to spawning areas may greatly exacerbate this problem as well. Predatory fish such as largemouth bass may show an increase in numbers as they will feed on juvenile gizzard shad, however, the sheer numbers of gizzard shad introduced into the system may make this increase negligible. It may be necessary to develop a method, if at all possible, to exclude gizzard shad when the new fish lift configurations are completed. This will be a difficult task and may not be determined to be feasible if it causes any undue stress to American shad.

As a plan for improving fish passage at the project is being formulated and agreed to by the Licensee and the various stakeholders, it is recommended that the approach account for this competing population. A variable combination of trap and transport, spawning and release to tributaries, and volitional passage may be warranted.

Task C3 of the SRAFRC (2010) management plan states the following:

> *"Consider trap and transport of adult American shad from Conowingo Dam fish lift(s) to above York Haven Dam while upstream fish passage is being improved at the Conowingo, Holtwood and/or York Haven hydroelectric facilities."*

The plan rates this as a high priority and notes that trap and transport is a viable interim measure as passage improvements are evaluated at the three hydroelectric facilities addressed in the task.

Additionally, Task C4 identifies the utilization of the West Fish Lift as a further measure to attempt to meet restoration goals.

> *"Develop a reliable source of Susquehanna River American shad eggs to replace out-of-basin sources and to enhance genetic integrity of the program."*

This could be accomplished by increasing the number of hormone trials on fish collected at the West Fish Lift, using existing spawning infrastructure. Another alternative would be to construct the spawning and hatchery facility described earlier.

7.0 REFERENCES

Susquehanna River Anadromous Fish Restoration Cooperative (SRAFRC). 2010. Migratory Fish Management and Restoration Plan for the Susquehanna River Basin. Final Draft Approved by Policy Committee.

TABLE 2.0-1. HISTORICAL SUMMARY OF FISH CATCH RATES AT THE WEST FISH LIFT.

Year	Days Operated	Number of Lifts	American shad	Gizzard shad	Total Catch
1972	54	817	182	24,849	241,419
1973	62	1,527	65	45,668	1,300,345
1974	58	819	121	119,672	1,617,887
1975	55	514	87	139,222	917,043
1976	63	684	82	382,275	1,175,616
1977	61	707	165	742,056	1,169,061
1978	35	358	54	55,104	276,045
1979	29	301	50	75,553	197,769
1980	30	403	1,369	275,736	372,379
1981	37	490	328	1,156,662	1,353,310
1982	44	725	2,039	1,226,374	1,403,176
1983	29	648	413	950,252	1,028,092
1984	34	519	167	912,666	957,821
1985	55	1,118	1,546	2,182,888	2,317,797
1986	59	831	5,195	1,714,441	1,830,569
1987	60	1,414	7,667	2,488,618	2,593,445
1988	63	1,330	5,146	1,402,565	1,592,938
1989	51	1,117	8,218	926,213	1,035,121
1990	64	1,363	15,719	1,084,073	1,162,841
1991	63	1,257	13,330	433,108	533,052
1992	64	1,559	10,335	1,450,299	1,559,814
1993	45	1,032	5,343	6,660,140	713,155
1994	47	964	5,615	511,139	563,773
1995	68	1,245	15,588	799,694	995,447
1996	28	464	11,473	196,019	232,615
1997	44	611	12,974	126,570	345,983
1998	41	476	6,577	497,375	575,220
1999	43	709	9,658	652,770	722,945
2000	34	424	9,785	366,099	458,349
2001	41	425	10,940	218,124	309,804
2002	31	417	9,347	339,292	419,103
2003	31	367	9,802	118,852	147,388
2004	14	151	3,426	22,899	37,589
2005	30	295	3,896	82,412	94,767
2006	37	349	3,970	149,250	163,131
2007	29	288	4,272	146,821	159,389
2008	34	481	2,627	724,737	733,553
2009	28	282	6,534	210,633	225,794
2010	27	238	5,605	145,946	157,662

TABLE 2.0-2. HISTORICAL SUMMARY OF FISH CATCH RATES AT THE EAST FISH LIFT.

Year	Days Operated	Number of Lifts	American shad	Gizzard shad	Total Catch
1991	60	1,168	13,897	575,505	650,940
1992	49	599	15,386	2,315,351	2,394,583
1993	42	848	8,203	504,116	529,594
1994	55	955	26,715	1,025,418	1,062,634
1995	68	986	46,062	1,737,685	1,796,460
1996	49	599	26,040	455,317	492,384
1997	64	652	90,971	344,332	719,297
1998	50	652	39,904	654,575	712,993
1999	53	610	69,712	950,500	1,184,101
2000	45	570	153,546	317,753	493,953
2001	43	559	193,574	429,461	921,916
2002	51	560	108,001	513,794	656,894
2003	44	645	125,135	459,634	589,177
2004	44	590	109,360	602,677	715,664
2005	52	541	68,926	305,378	377,762
2006	61	619	56,899	655,990	714,918
2007	39	479	25,464	508,627	539,203
2008	51	483	19,914	919,975	943,838
2009	57	618	29,272	876,412	915,417
2010	59	685	37,757	813,429	857,263

Table 3.4.1-1. Cost Opinion, West Fish Lift, Modifications to Decrease Cycle Time - Decrease Hopper Rail Elevation

Item No.	Item	Quantity	Unit	Unit Price	Cost
331	**Structures and Improvements**				
	10 Ton Crane	2	Months	$45,000	$90,000
	Remove and Store Existing Hopper	1	LS	$5,000	$5,000
	Remove Horizontal Travel Rails	1	LS	$4,000	$4,000
	Remove Existing Electrical, Limit Switches, and Cables	1	LS	$5,000	$5,000
	Remove Upper Portion of Columns	1	LS	$9,000	$9,000
	Attach Bracing	1	LS	$9,000	$9,000
	Reattach Horizontal Rails and Hopper	1	LS	$20,000	$20,000
	331 Subtotal*				**$142,000**
334	**Accessory Electric Equipment**				
	Electrical (5%)	1	LS	$7,100	$7,100
	Mechanical (3%)	1	LS	$4,260	$4,260
	334 Subtotal*				**$11,000**

Mobilization/Demobilization (10%)*	**$15,000**
Subtotal Direct Cost	**$168,000**
Contingencies (25%)*	$42,000
Total Direct Cost	**$210,000**
Design (20%)*	$42,000
Construction Administration (15%)*	$32,000
Total	**$284,000**

**Note: Rounded to nearest $1,000*

Table 3.4.1-2. Cost Opinion, West Fish Lift, Modifications to Decrease Cycle Time - Increase Sorting Pool Elevation

Item No.	Item	Quantity	Unit	Unit Price	Cost
331	**Structures and Improvements**				
	Removal of Existing Sorting Tank	1	LS	$5,000	$5,000
	Foundation Improvements	1	LS	$8,000	$8,000
	Support Frame for New Sorting Tanks	1	LS	$12,000	$12,000
	Stairs	18	EA	$500	$9,000
	Railing	120	LF	$150	$18,000
	New Sorting Tanks	2	EA	$10,000	$20,000
	Pumps, Filters, and Piping	1	LS	$6,000	$6,000
	331 Subtotal*				**$78,000**
334	**Accessory Electric Equipment**				
	Electrical (2%)	1	LS	$1,560	$1,560
	Mechanical (2%)	1	LS	$1,560	$1,560
	334 Subtotal*				**$3,000**

Mobilization/Demobilization (10%)*	**$8,000**
Subtotal Direct Cost	**$89,000**
Contingencies (25%)*	$22,000
Total Direct Cost	**$111,000**
Design (25%)*	$28,000
Construction Administration (20%)*	$22,000
Total	**$161,000**

**Note: Rounded to nearest $1,000*

Table 3.4.1-3. Cost Opinion, West Fish Lift, Modifications to Decrease Cycle Time - Upgrade Crowder Gate

Item No.	Item	Quantity	Unit	Unit Price	Cost
331	**Structures and Improvements**				
	New Motors	2	EA	$15,000	$30,000
	Replace Linkage and Limit Switches	1	LS	$10,000	$10,000
	Reprogram Control Panel to Accept Crowder Speed	1	LS	$5,000	$5,000
	Updated Crowder (Smooth Operation)	1	LS	$10,000	$10,000
	331 Subtotal*				**$55,000**
334	**Accessory Electric Equipment**				
	Electrical (15%)	1	LS	$8,250	$8,250
	Mechanical (15%)	1	LS	$8,250	$8,250
	334 Subtotal*				**$17,000**

Mobilization/Demobilization (10%)*	**$7,000**
Subtotal Direct Cost	**$79,000**
Contingencies (25%)*	$20,000
Total Direct Cost	**$99,000**
Design (25%)*	$25,000
Construction Administration (20%)*	$20,000
Total	**$144,000**

**Note: Rounded to nearest $1,000*

Table 3.4.2-1. Cost Opinion, West Fish Lift, Modifications to Increase Lift Capacity - Enlarged Hopper on Existing Footings

Item No.	Item	Quantity	Unit	Unit Price	Cost
331	**Structures and Improvements**				
	Demolition (Tower and Travel Rail)	9,000	CF	$1.00	$9,000
	Concrete Wall	40	CY	$800	$32,000
	Concrete Floor	15	CY	$800	$12,000
	Structural Steel	12	TON	$12,000	$144,000
	Handrail	170	LF	$150	$25,500
	Ladders	26	LF	$150	$3,900
	Grating	450	SF	$50	$22,500
	Stairs	10	EA	$500	$5,000
	331 Subtotal*				**$254,000**
332	**Reservoirs, Dams, and Waterways**				
	Sorting Tank (16-ft diam.)	2	EA	$30,000	$60,000
	Sluicing Pipe (1-ft diam.)	9	LF	$70	$595
	Hopper (Includes Hoist Motors and Cables)	1	EA	$500,000	$500,000
	Screens	1	EA	$250,000	$250,000
	Crowder Gate, Motors, Drives	1	LS	$350,000	$350,000
	Associated Pumps and Hoses for Water Circulation	1	LS	$75,000	$75,000
	Sheet Piling	2,800	SF	$30	$84,000
	Silt Curtain	2,800	SF	$5	$14,000
	Diversion and Care of Water	60	DAY	$1,000	$60,000
	332 Subtotal*				**$1,394,000**
334	**Accessory Electric Equipment**				
	Electrical (7.5% of 331 and 332)	1	LS	$123,600	$123,600
	Mechanical (5% of 331 and 332)	1	LS	$82,400	$82,400
	334 Subtotal*				**$206,000**

Mobilization/Demobilization (10%)*	**$185,000**
Subtotal Direct Cost	**$2,039,000**
Contingencies (25%)*	$510,000
Total Direct Cost	**$2,549,000**
Design (10%)*	$255,000
Permitting (5%)*	$127,000
Construction Administration (5%)*	$127,000
Total	**$3,058,000**

**Note: Rounded to nearest $1,000*

Table 3.4.2-2. Cost Opinion, West Fish Lift, Modifications to Increase Lift Capacity - Replacement of Existing Lift

Item No.	Item	Quantity	Unit	Unit Price	Cost
331	**Structures and Improvements**				
	Demolition	42,750	CF	$1.00	$42,750
	Concrete Wall and Footings	160	CY	$800	$128,000
	Concrete Floor	30	CY	$800	$24,000
	Structural Steel	22	TON	$12,000	$264,000
	Handrail	170	LF	$150	$25,500
	Ladders	26	LF	$150	$3,900
	Grating	450	SF	$50	$22,500
	Stairs	10	EA	$500	$5,000
	331 Subtotal*				**$516,000**
332	**Reservoirs, Dams, and Waterways**				
	Sorting Tank (16-ft diam.)	2	EA	$30,000	$60,000
	Sluicing Pipe (1-ft diam.)	9	LF	$70	$595
	Hopper (Includes Hoist Motors and Cables)	1	EA	$550,000	$550,000
	Screens	1	EA	$250,000	$250,000
	Crowder Gate, Motors, Drives	1	EA	$350,000	$350,000
	Associated Pumps and Hoses for Water Circulation	1	EA	$75,000	$75,000
	Sheet Piling	4,400	SF	$30	$132,000
	Silt Curtain	4,400	SF	$5	$22,000
	Diversion and Care of Water	60	DAY	$1,000	$60,000
	332 Subtotal*				**$1,500,000**
334	**Accessory Electric Equipment**				
	Electrical (7.5% of 331 and 332)	1	LS	$151,200	$151,200
	Mechanical (5% of 331 and 332)	1	LS	$100,800	$100,800
	334 Subtotal*				**$252,000**

Mobilization/Demobilization (10%)*	**$227,000**
Subtotal Direct Cost	**$2,495,000**
Contingencies (25%)*	$624,000
Total Direct Cost	**$3,119,000**
Design (10%)*	$312,000
Permitting (2.5%)*	$78,000
Construction Administration (5%)*	$156,000
Total	**$3,665,000**

**Note: Rounded to nearest $1,000*

Table 3.4.4-1. Cost Opinion, West Fish Lift - Trap and Transport Capability

Item No.	Item	Quantity	Unit	Unit Price	Cost
331	**Structures and Improvements**				
	This Option Assumes "Increase Sorting Pool Elevation" Alternative is Pursued (Cost is Included Below)				
332	**Reservoirs, Dams, and Waterways**				
	Transport Tank (1,500 gal)	4	EA	$2,000	$8,000
	Trash Pump	8	EA	$1,500	$12,000
	Dissolved Oxygen Injection System	4	LS	$1,000	$4,000
	Temperature Monitor	4	EA	$500	$2,000
	332 Subtotal*				**$26,000**
335	**Miscellaneous Power Plant Equipment**				
	Haul Truck	4	EA	$50,000	$200,000
	335 Subtotal*				**$200,000**

Mobilization/Demobilization (10%)*	**$23,000**
Subtotal Direct Cost	**$249,000**
Contingencies (25%)*	$62,000
Total Direct Cost	**$311,000**
Design (10%)*	$31,000
"Increase Sorting Pool Elevation" (See Table 4)	*$161,000*
Total	**$503,000**

**Note: Rounded to nearest $1,000*

Item No.	Item	Quantity	Unit	Unit Price	Cost
901	**Annual Operations - Non-Labor**				
	Mileage	36,000	MI	$0.50	$18,000
	Fuel	12,000	GAL	$5	$60,000
	Salt (Stress Reduction)	10	TON	$500	$5,000
	Tank Refills (Oxygen)	1	LS	$1,000	$1,000
	901 Subtotal*				**$84,000**
902	**Annual Operations - Labor *(Assumes 50 Days)***				
	Project Coordinator *(4 hrs/day)*	200	HR	$100	$20,000
	Lift Operator *(12 hrs/day)*	600	HR	$100	$60,000
	Fish Biologist *(12 hrs/day)*	600	HR	$90	$54,000
	Fish Technicians *(3 @ 12 hrs/day)*	1,800	HR	$75	$135,000
	Drivers *(4 @ 12 hrs/day)*	2,400	HR	$55	$132,000
	902 Subtotal*				**$401,000**

Subtotal Annual Operations Cost	**$485,000**
Contingencies (25%)*	$121,000
Annual Operations Total	**$606,000 / YEAR**

**Note: Rounded to nearest $1,000*

Table 3.4.5-1. Cost Opinion, Spawning and Hatchery Facility

Item No.	Item	Quantity	Unit	Unit Price	Cost
331	**Structures and Improvements**				
	Demolition (Pavement)	1,000	SY	$8.50	$8,500
	Mass Excavation & Grading	1,300	CY	$10	$13,000
	Footing Excavation	60	CY	$15	$900
	Trucking for Export	1,700	CY	$6	$10,200
	Compacted Base	700	CY	$40	$28,000
	Gravel	350	CY	$40	$14,000
	Trucking for Import	1,365	CY	$6	$8,190
	Concrete Wall	160	CY	$800	$128,000
	Concrete Floor	155	CY	$800	$124,000
	Footings	30	CY	$800	$24,000
	Forms	6,400	SF	$8	$51,200
	Insulation, Roof Bat	9,700	SF	$3.50	$33,950
	Brick Exterior	4,800	SF	$12.50	$60,000
	Roof Trusses, Decking, Sheeting	9,700	SF	$15.00	$145,500
	Window (4' x 6')	20	EA	$1,250	$25,000
	Door (3' x 7')	6	EA	$1,500	$9,000
	Overhead Door (12' x 12')	2	EA	$2,500	$5,000
	Skylights	30	EA	$1,000	$30,000
	331 Subtotal*				**$718,000**
332	**Reservoirs, Dams, and Waterways**				
	River Water Supply (100 GPM)	1	LS	$5,000	$5,000
	Potable Water Supply (25 GPM Pump & Piping)	1	LS	$4,000	$4,000
	Potable Water Supply (Well)	150	LF	$100	$15,000
	Water Recirculation (Facility)	1	LS	$4,000	$4,000
	Water Heating	1	LS	$10,000	$10,000
	Degassing	1	LS	$5,000	$5,000
	UV Sterilization	1	LS	$3,000	$3,000
	Biofilter	2	EA	$3,000	$6,000
	Microscreen Filter	1	EA	$5,000	$5,000
	Supplemental Oxygen	6	EA	$1,000	$6,000
	Water Recirculation (Tanks)	3	EA	$5,000	$15,000
	Supply Trough	300	LF	$25	$7,500
	16-ft Tanks	6	EA	$10,000	$60,000
	Egg Sock	12	EA	$200	$2,400
	5-ft Tanks	35	EA	$500	$17,500
	150-L Cone Bottom Tanks	5	EA	$500	$2,500
	Plumbing (7.5% of 331 and 332, exclusive of this item)	1	LS	$66,443	$66,443
	332 Subtotal*				**$234,000**
334	**Accessory Electric Equipment**				
	Freezer	3	EA	$800	$2,400
	Disecting Microscope	3	EA	$2,000	$6,000
	Fluorescent Microscope	1	EA	$2,500	$2,500
	Electrical (20% of 331 and 332)	1	LS	$190,400	$190,400
	Mechanical (20% of 331 and 332)	1	LS	$190,400	$190,400
	334 Subtotal*				**$392,000**

Mobilization/Demobilization (10%)*	**$134,000**
Subtotal Direct Cost	**$1,478,000**
Contingencies (25%)*	$370,000
Total Direct Cost	**$1,848,000**
Design (15%)*	$277,000
Permitting (5%)*	$92,000
Construction Administration (10%)*	$185,000
Total	**$2,402,000**

**Note: Rounded to nearest $1,000*

Cost per Square Foot = $286

Item No.	Item	Quantity	Unit	Unit Price	Cost
901	**Annual Operations - Non-Labor**				
	Consumables	1	LS	$18,000	$18,000
	Utilities	1	LS	$5,000	$5,000
	901 Subtotal*				**$23,000**
902	**Annual Operations - Labor**				
	Hatchery Manager *(1 @ 5 months/year)*	867	HR	$85	$73,667
	Assistant Manager *(1 @ 5 months/year)*	867	HR	$50	$43,333
	Hatchery Technician *(4 @ 4 months/year)*	2,560	HR	$35	$89,600
	902 Subtotal*				**$207,000**

Subtotal Annual Operations Cost	**$230,000**
Contingencies (25%)*	$58,000
Annual Operations Total	**$288,000 / YEAR**

**Note: Rounded to nearest $1,000*

Table 4.4.1-1. Cost Opinion, East Fish Lift - Installation of Second Hopper

Item No.	Item	Quantity	Unit	Unit Price	Cost
331	**Structures and Improvements**				
	Structural Steel	2	TON	$8,000	$12,000
	331 Subtotal*				**$12,000**
332	**Reservoirs, Dams, and Waterways**				
	Hopper (Includes Hoist Cables and Drive Motors)	1	EA	$220,000	$220,000
	Picket Screen	2	EA	$200,000	$400,000
	Reconfigure Crowder Gate Guides, Limits, and Motors	1	LS	$125,000	$125,000
	332 Subtotal*				**$745,000**
334	**Accessory Electric Equipment**				
	Electrical (10% of 331 and 332)	1	LS	$75,700	$75,700
	Mechanical (10% of 331 and 332)	1	LS	$75,700	$75,700
	334 Subtotal*				**$151,000**

Mobilization/Demobilization (10%)*	**$91,000**
Subtotal Direct Cost	**$999,000**
Contingencies (25%)*	$250,000
Total Direct Cost	**$1,249,000**
Design (10%)*	$125,000
Construction Administration (5%)*	$62,000
Total	**$1,436,000**

**Note: Rounded to nearest $1,000*

Table 4.4.2-1. Cost Opinion, East Fish Lift - Replacement of Existing Lift

Item No.	Item	Quantity	Unit	Unit Price	Cost
331	**Structures and Improvements**				
	Demolition	1,000,000	CF	$0.40	$400,000
	Concrete Walls	4,000	CY	$550	$2,200,000
	Concrete Floor	1,700	CY	$600	$1,020,000
	Structural Steel	152	TON	$8,000	$1,216,000
	Pre-Engineered Building (10'-4" x 8')	2	LS	$5,000	$10,000
	Handrail	2,800	LF	$150	$420,000
	Ladders	55	LF	$150	$8,250
	Grating	7,400	SF	$50	$370,000
	Stairs	176	EA	$500	$88,000
	331 Subtotal*				**$5,732,000**
332	**Reservoirs, Dams, and Waterways**				
	Sorting Tank (8'-6" x 18')	1	EA	$10,000	$10,000
	Attraction Feed Pipe (3-ft diam.)	160	LF	$400	$64,000
	Feed Pipe Valve	1	EA	$1,500	$1,500
	Fish Trough (Steel Plate)	7,500	SF	$8	$60,000
	Weir Gate and Operator	3	EA	$500,000	$1,500,000
	Trough Head Gate and Operator	3	EA	$400,000	$1,200,000
	Spillway Trash Rack Upstream of Head Gates	1	EA	$275,000	$275,000
	Hopper (Includes Hoist Cables and Drive Motors)	2	EA	$220,000	$440,000
	Crowder Gate and Associated Hardware	1	EA	$350,000	$350,000
	Picket Screen	3	EA	$200,000	$600,000
	Sheet Piling	8,000	SF	$30	$240,000
	Silt Curtain	8,000	SF	$5	$40,000
	Prefabricated Cofferdam for Channel Construction	1	LS	$100,000	$100,000
	Diversion and Care of Water	120	DAY	$1,000	$120,000
	332 Subtotal*				**$5,001,000**
334	**Accessory Electric Equipment**				
	Electrical (15% of 331 and 332)	1	LS	$1,609,950	$1,609,950
	Mechanical (10% of 331 and 332)	1	LS	$1,073,300	$1,073,300
	334 Subtotal*				**$2,683,000**

Mobilization/Demobilization (10%)*	**$1,342,000**
Subtotal Direct Cost	**$14,758,000**
Contingencies (25%)*	$3,690,000
Total Direct Cost	**$18,448,000**
Design (2.5%)*	$461,000
Permitting (1%)*	$184,000
Construction Administration (2%)*	$369,000
Total	**$19,462,000**

**Note: Rounded to nearest $1,000*

Table 5.3-1. Cost Opinion, East Fish Lift - Trap and Transport Capability

Item No.	Item	Quantity	Unit	Unit Price	Cost
331	**Structures and Improvements**				
	Reconfigure Hopper & Gates	1	LS	$10,000	$10,000
	Grating, Replace Existing	300	SF	$50	$15,000
	Relocate Draft Tube Bulkhead Gates	1	LS	$5,000	$5,000
	331 Subtotal*				**$30,000**
332	**Reservoirs, Dams, and Waterways**				
	Transport Tank (1,000 gal)	5	EA	$1,500	$7,500
	Trash Pump	10	EA	$1,500	$15,000
	Dissolved Oxygen Injection System	5	LS	$1,000	$5,000
	Temperature Monitor	5	EA	$500	$2,500
	Sorting Tank (8'-6" x 18'), Replace Existing	1	EA	$10,000	$10,000
	332 Subtotal*				**$40,000**
335	**Miscellaneous Power Plant Equipment**				
	Trailer	5	EA	$6,500	$32,500
	Haul Truck	5	EA	$50,000	$250,000
	Hy-Rail Truck	1	EA	$35,000	$35,000
	Fork Lift	1	EA	$30,000	$30,000
	335 Subtotal*				**$348,000**

Mobilization/Demobilization (10%)*	**$42,000**
Subtotal Direct Cost	**$460,000**
Contingencies (25%)*	$115,000
Total Direct Cost	**$575,000**
Design (15%)*	$86,000
Construction Administration (5%)*	$29,000
Total	**$690,000**

**Note: Rounded to nearest $1,000*

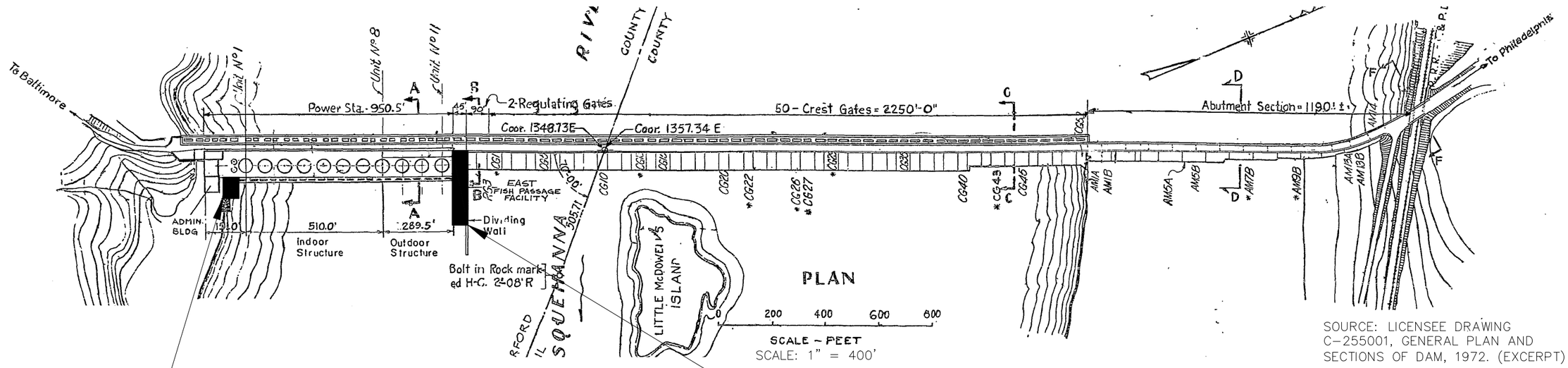
Item No.	Item	Quantity	Unit	Unit Price	Cost
901	**Annual Operations - Non-Labor**				
	Mileage	60,000	MI	$0.50	$30,000
	Fuel	20,000	GAL	$5	$100,000
	Salt (Stress Reduction)	10	TON	$500	$5,000
	Tank Refills (Oxygen)	1	LS	$1,000	$1,000
	901 Subtotal*				**$136,000**
902	**Annual Operations - Labor *(Assumes 50 Days)***				
	Project Coordinator *(4 hrs/day)*	200	HR	$100	$20,000
	Lift Operator *(12 hrs/day)*	600	HR	$100	$60,000
	Fish Biologist *(12 hrs/day)*	600	HR	$90	$54,000
	Fish Technicians *(4 @ 12 hrs/day)*	2,400	HR	$75	$180,000
	Drivers *(5 @ 12 hrs/day)*	3,000	HR	$55	$165,000
	902 Subtotal*				**$479,000**

Subtotal Annual Operations Cost	**$615,000**
Contingencies (25%)*	$154,000
Annual Operations Total	**$769,000 / YEAR**

**Note: Rounded to nearest $1,000*

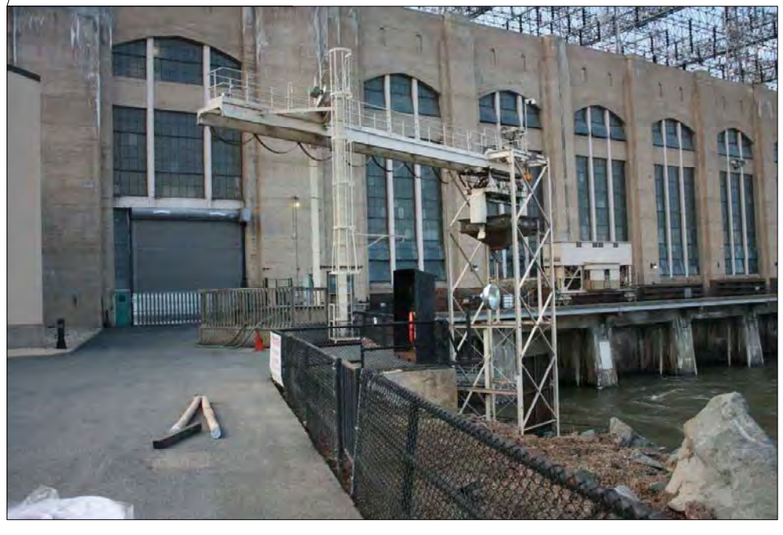
Table 6.0-1 - Summary of Project Fish Passage Statistics, 1991-2010

Lift: *Period:*	**West Fish Lift** **1991-1996**	**East Fish Lift** **1991-1996**	**East Fish Lift** **1997-2010**
Average Annual Values:			
Total Fish Passed, rounded:	765,000	1,150,000	740,000
American Shad Passed, rounded:	10,300	22,700	80,600
American shad as a % of Total Fish Passed:	1.3%	2.0%	10.9%
Lifts per Season:	1,087	859	590
Days in Operation:	52	54	51
Lifts per Day:	21	16	12
Cycle Time (minutes), Based on 12-hour Day:	34	45	60
Total Fish per Lift:	704	1,339	1,254
American Shad per Lift:	9	26	137



SOURCE: LICENSEE DRAWING C-255001, GENERAL PLAN AND SECTIONS OF DAM, 1972. (EXCERPT)

WEST FISH LIFT,
AS VIEWED FROM WEST BANK.



EAST FISH LIFT,
AS VIEWED FROM WEST BANK.

NO.	DATE	ISSUED FOR	BY

DESIGNED
DRAWN
CHECKED
SECT.CHIEF
PROJ.ENGR.

200' 0 200' 400'
SCALE: 1" = 400'

GOMEZ AND SULLIVAN Engineers, P.C.
288 Genesee Street, Utica, NY 13502, (315) 724-4860
41 Liberty Rd, Bldg 1, Henniker, NH 03242, (603) 428-4960
5820 Main Street, Williamsville, NY 14221, (716) 250 4960

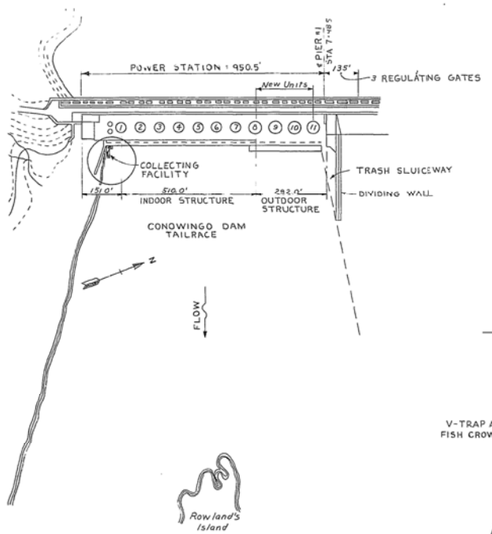
Exelon.

CONOWINGO RELICENSING

FISH LIFT OVERVIEW PLAN

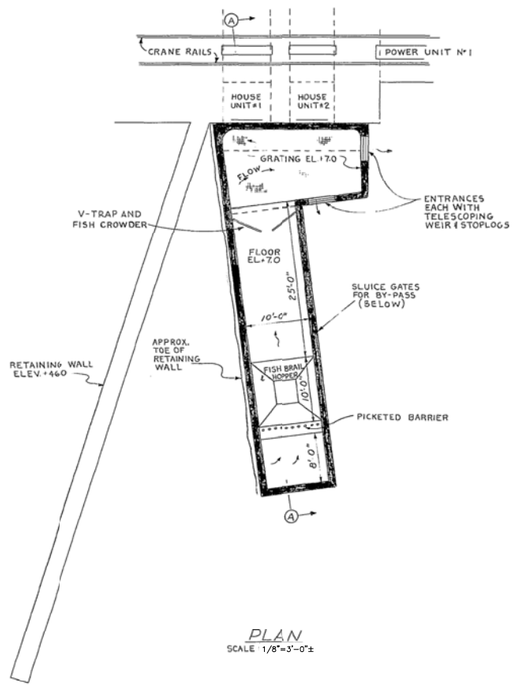
DATE AUGUST 2012

FIGURE NO: 2.0-1



LOCATION MAP
SCALE : 1"=600'±

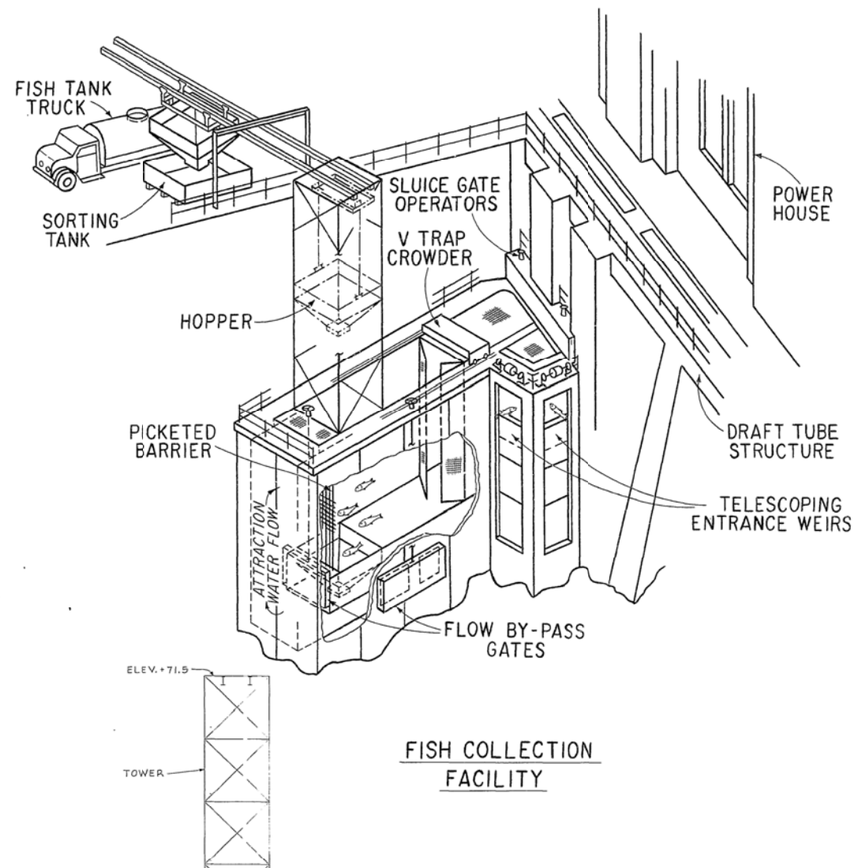
TAILRACE ELEV.	FLOW CONDITION
10.0	NO UNIT FLOW
13.8	1 UNIT (#1-#7) FLOW = 5000 C.F.S.
16.1	4 UNITS (#1-#7) FLOW = 20,000 C.F.S.
17.1	4 UNITS (#1-#7) & 1 UNIT (#8-#11) FLOW = 30,000 C.F.S.
20.8	ALL UNITS FLOW = 73,000 C.F.S.



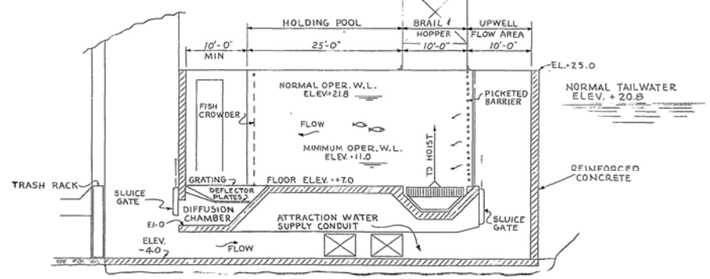
PLAN
SCALE: 1/8"=1'-0"±

PARAMETERS FOR FISH COLLECTION FACILITIES

1. GATED FISHWAY ENTRANCE
   - A. NUMBER - TWO
   - B. SIZE - 4' WIDE X VARIABLE HEIGHT
   - C. ENTRANCE GATE TYPE - TELESCOPIC (CLOSING FROM BOTTOM UP)
   - D. ENTRANCE JET VELOCITY RANGE - 3 TO 8 FEET PER SECOND
2. ATTRACTION FLOW 350 C.F.S. MINIMUM. WATER SOURCE - GRAVITY FROM FOREBAY.
3. FLOW DIFFUSION
   - A. DIFFUSION CHAMBER EXIT FLOW VELOCITY - 1 FPS. MAX.
   - B. DIFFUSION CHAMBER GRATING - 1 INCH CLEAR OPENING
4. OPERATING RANGE
   - A. MINIMUM TAILWATER ELEVATION +10.0 FT.
   - B. MAXIMUM TAILWATER ELEVATION +23.0 FT.
5. MISCELLANEOUS EQUIPMENT
   - A. HOISTS AND GATE OPERATORS
   - B. STOP LOGS
   - C. SAFETY RAILINGS
   - D. ACCESS LADDERS
   - E. WORKING PLATFORMS AND TANKS
   - F. TRASH RACKS
   - G. BRAIL AND HOPPER



FISH COLLECTION FACILITY



SECTION A-A
SCALE: 1/8"=1'-0"±

SOURCE: LICENSEE DRAWING AB-519662, EXHIBITS: FISH COLLECTION FACILITY, 1972.

NO.	DATE	ISSUED FOR	BY

DESIGNED
DRAWN
CHECKED
SECT.CHIEF
PROJ.ENGR.

SCALE: AS SHOWN

GOMEZ AND SULLIVAN Engineers, P.C.
288 Genesee Street, Utica, NY 13502, (315) 724-4860
41 Liberty Rd, Bldg 1, Henniker, NH 03242, (603) 428-4960
5820 Main Street, Williamsville, NY 14221, (716) 250 4960

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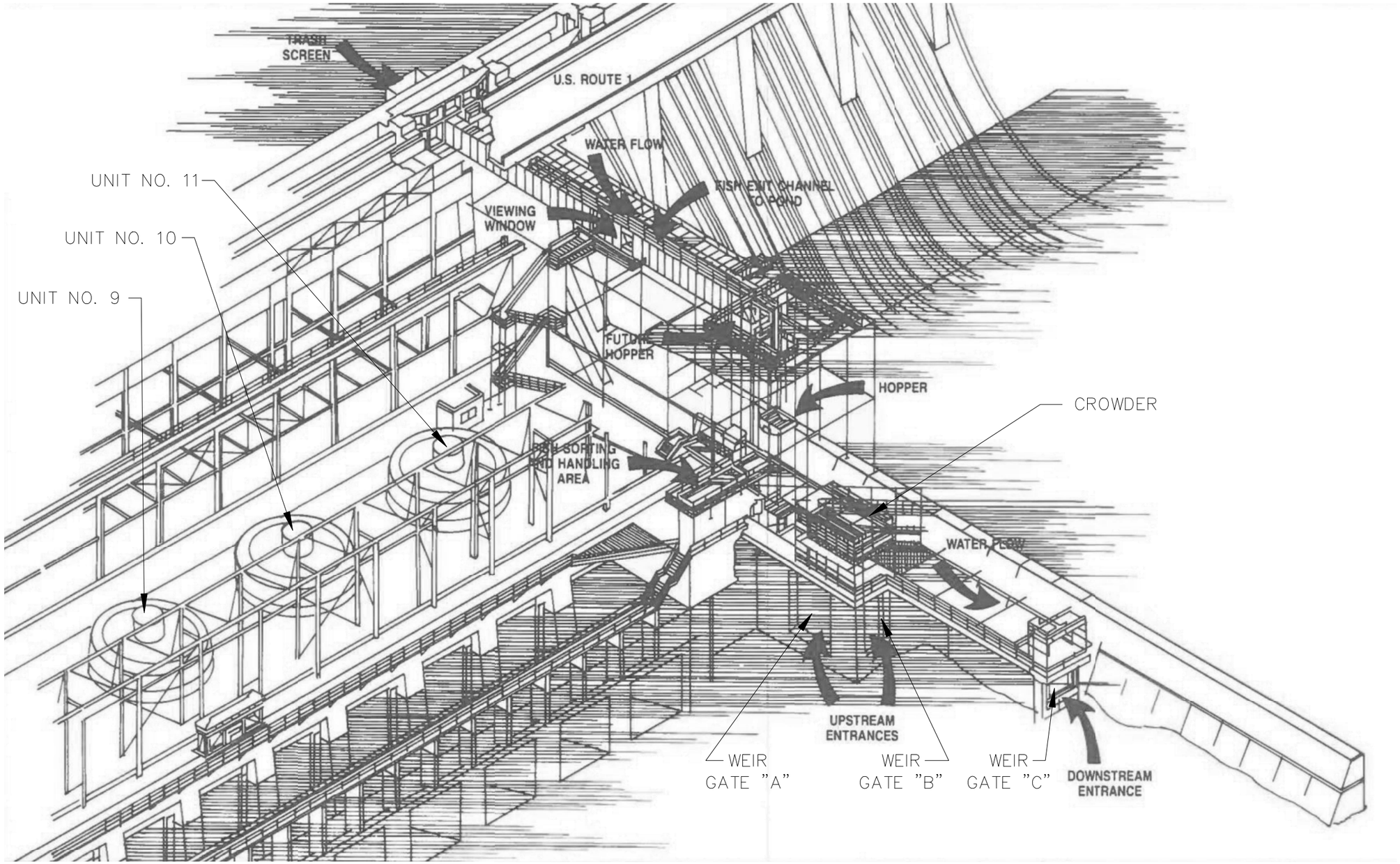
CONOWINGO RELICENSING

WEST FISH LIFT
EXISTING CONDITIONS

DATE AUGUST 2012

FIGURE NO: 2.0-2



SOURCE: "AMERICAN SHAD: PHILADELPHIA ELECTRIC COMPANY'S EFFORTS TO RESTORE THEM TO THE SUSQUEHANNA RIVER", 1991.

NO.	DATE	ISSUED FOR	BY

DESIGNED
DRAWN
CHECKED
SECT.CHIEF
PROJ.ENGR.

SCALE: N.T.S.

GOMEZ AND SULLIVAN Engineers, P.C.
288 Genesee Street, Utica, NY 13502, (315) 724-4860
41 Liberty Rd, Bldg 1, Henniker, NH 03242, (603) 428-4960
5820 Main Street, Williamsville, NY 14221, (716) 250 4960

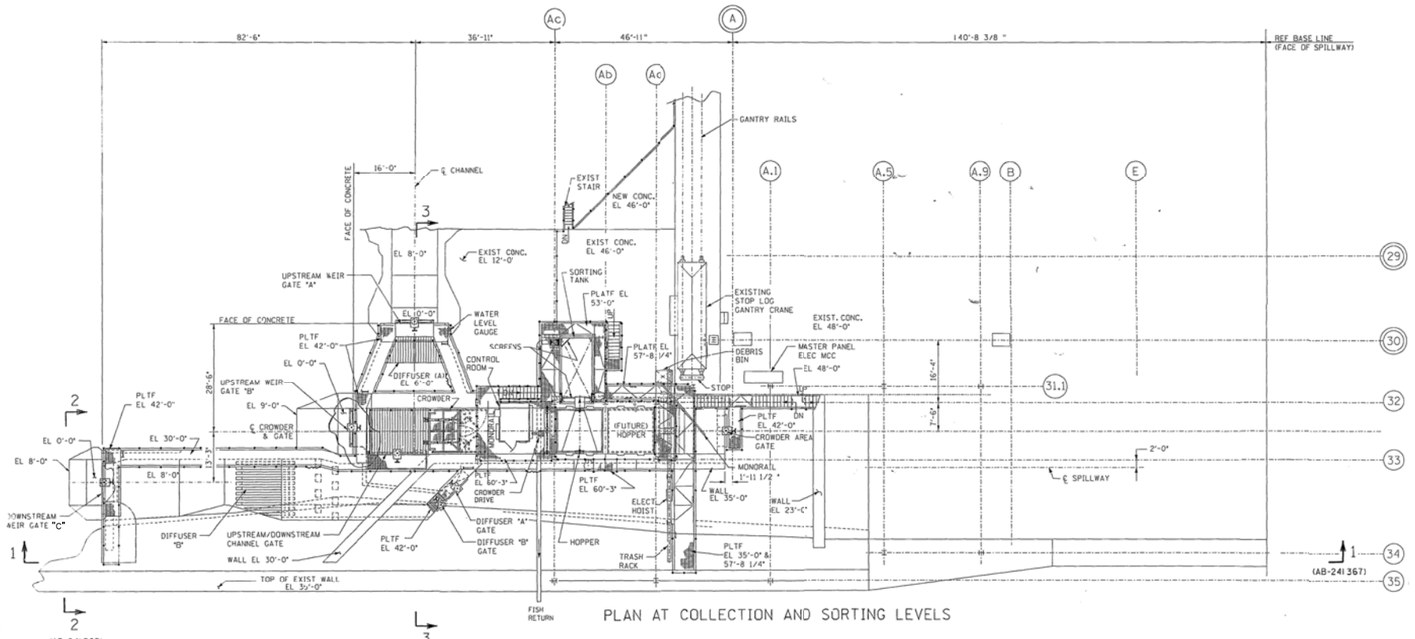
Exelon.

CONOWINGO RELICENSING

EAST FISH LIFT
EXISTING CONDITIONS SCHEMATIC

DATE AUGUST 2012

FIGURE NO: 2.0-3



SOURCE: LICENSEE DRAWING AB-241366-2, GENERAL ARRANGEMENT EAST FISH PASSAGE FACILITY PLAN, 1991.

NO.	DATE	ISSUED FOR	BY

DESIGNED
DRAWN
CHECKED
SECT.CHIEF
PROJ.ENGR.

20' 0 20' 40'
SCALE: 1" = 40'

GOMEZ AND SULLIVAN Engineers, P.C.
288 Genesee Street, Utica, NY 13502, (315) 724-4860
41 Liberty Rd, Bldg 1, Henniker, NH 03242, (603) 428-4960
5820 Main Street, Williamsville, NY 14221, (716) 250 4960

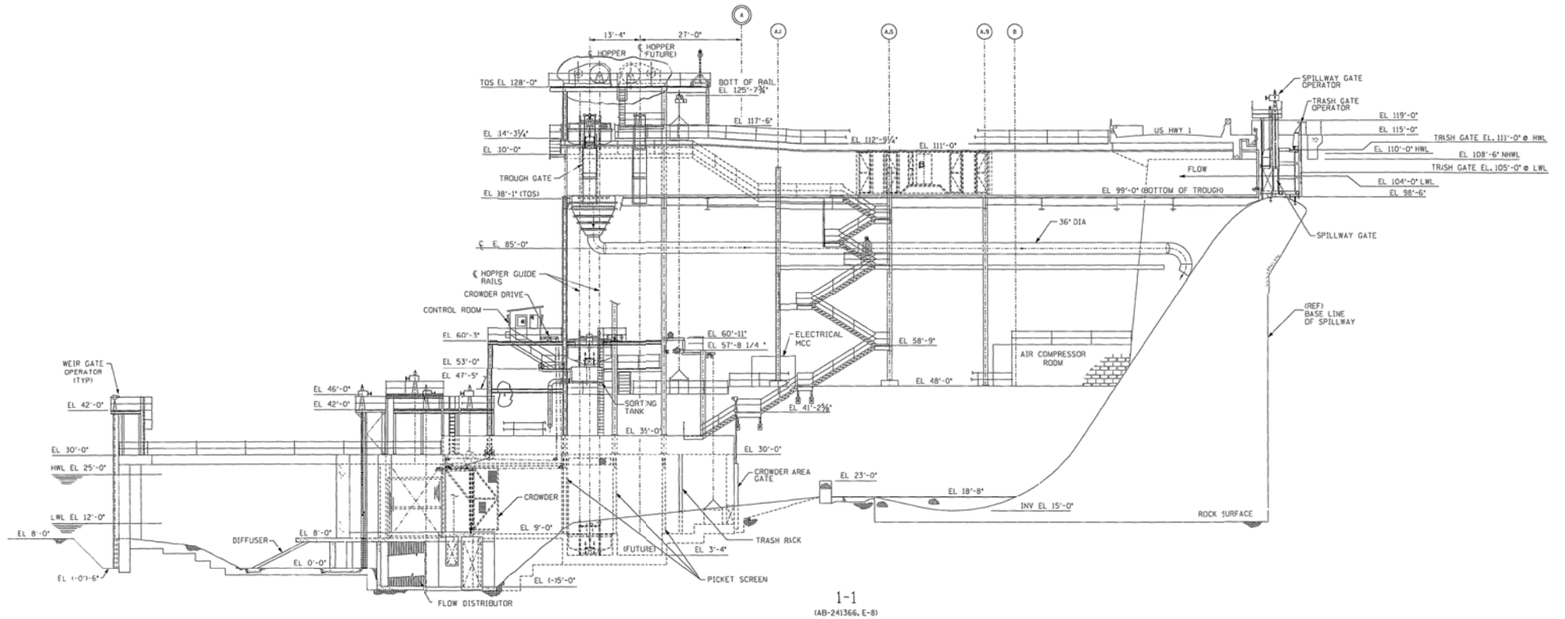
Exelon.

CONOWINGO RELICENSING

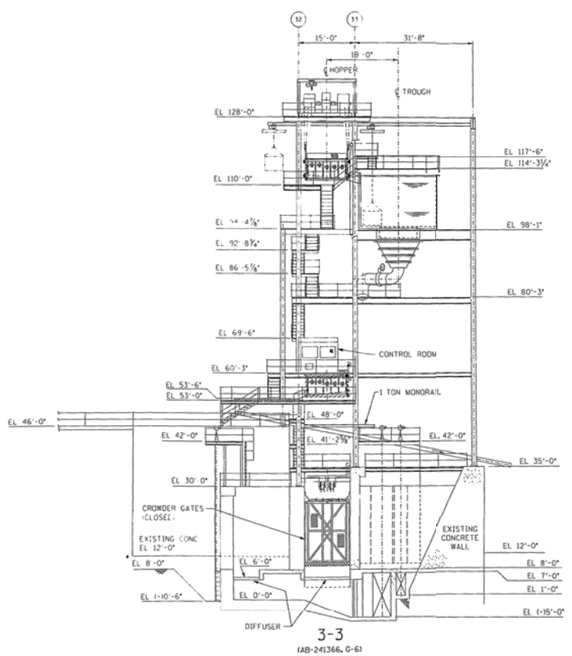
EAST FISH LIFT
EXISTING CONDITIONS PLAN

DATE AUGUST 2012

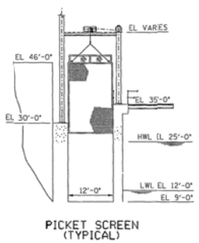
FIGURE NO: 2.0-4



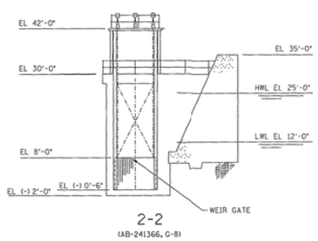
1-1
(AB-241366, E-8)



3-3
(AB-241366, G-6)



PICKET SCREEN (TYPICAL)



2-2
(AB-241366, G-8)

SOURCE: LICENSEE DRAWING AB-241367-2, GENERAL ARRANGEMENT EAST FISH PASSAGE FACILITY SECTIONS, 1991.

NO.	DATE	ISSUED FOR	BY

DESIGNED
DRAWN
CHECKED
SECT.CHIEF
PROJ.ENGR.

20' 0 20' 40'
SCALE: 1" = 40'

GOMEZ AND SULLIVAN Engineers, P.C.
288 Genesee Street, Utica, NY 13502, (315) 724-4860
41 Liberty Rd, Bldg 1, Henniker, NH 03242, (603) 428-4960
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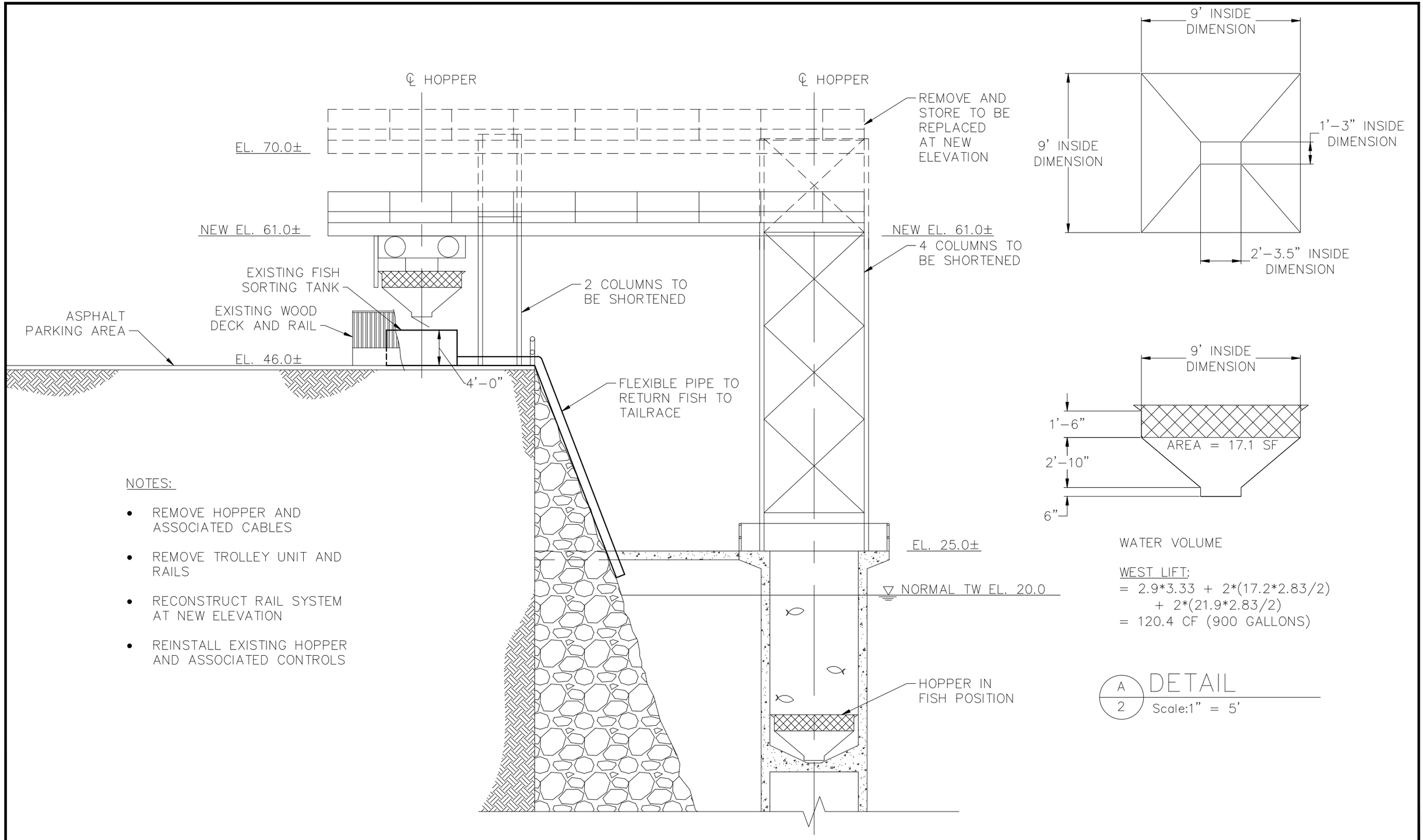
CONOWINGO RELICENSING

EAST FISH LIFT
EXISTING CONDITIONS SECTIONS

DATE AUGUST 2012

FIGURE NO: 2.0-5



NOTES:

- REMOVE HOPPER AND ASSOCIATED CABLES
- REMOVE TROLLEY UNIT AND RAILS
- RECONSTRUCT RAIL SYSTEM AT NEW ELEVATION
- REINSTALL EXISTING HOPPER AND ASSOCIATED CONTROLS

WATER VOLUME

WEST LIFT:
= 2.9*3.33 + 2*(17.2*2.83/2)
+ 2*(21.9*2.83/2)
= 120.4 CF (900 GALLONS)

A/2 DETAIL
Scale:1" = 5'

NO.	DATE	ISSUED FOR	BY

DESIGNED
DRAWN
CHECKED
SECT.CHIEF
PROJ.ENGR.

5' 0 5' 10'
SCALE: 1" = 10'

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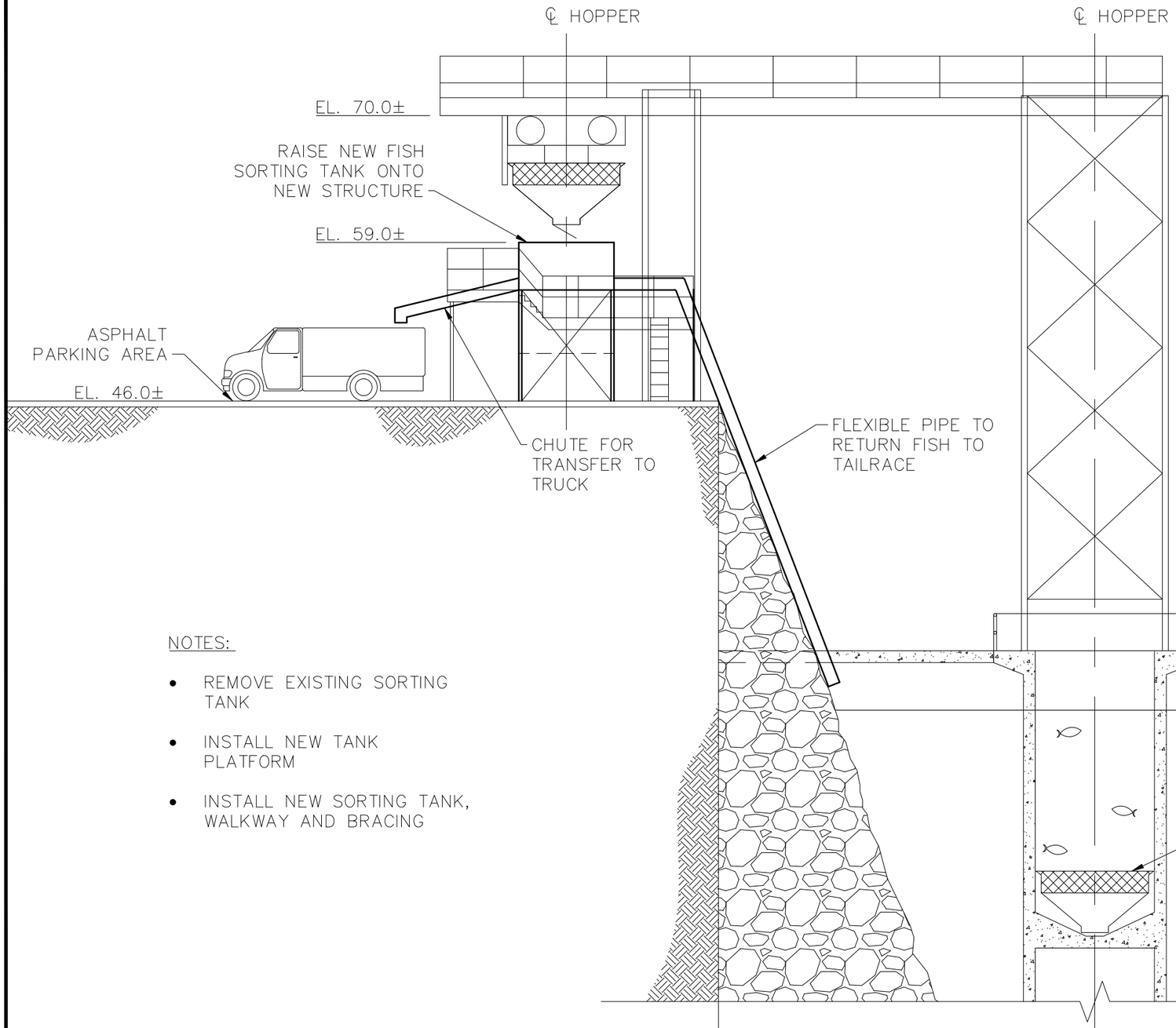
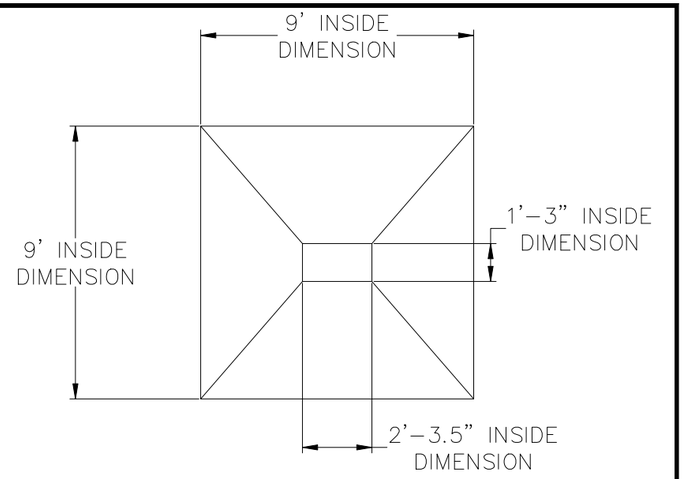
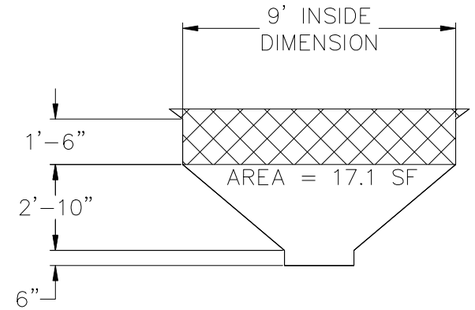
CONOWINGO RELICENSING
WEST FISH LIFT
DECREASE HOPPER RAIL ELEVATION

DATE AUGUST 2012

FIGURE NO: 3.4.1–1







NOTES:

- REMOVE EXISTING SORTING TANK
- INSTALL NEW TANK PLATFORM
- INSTALL NEW SORTING TANK, WALKWAY AND BRACING

WATER VOLUME

WEST LIFT:
= 2.9*3.33 + 2*(17.2*2.83/2)
+ 2*(21.9*2.83/2)
= 120.4 CF (900 GALLONS)

A/2 DETAIL
Scale:1" = 5'

NO.	DATE	ISSUED FOR	BY

DESIGNED
DRAWN
CHECKED
SECT.CHIEF
PROJ.ENGR.

5' 0 5' 10'
SCALE: 1" = 10'

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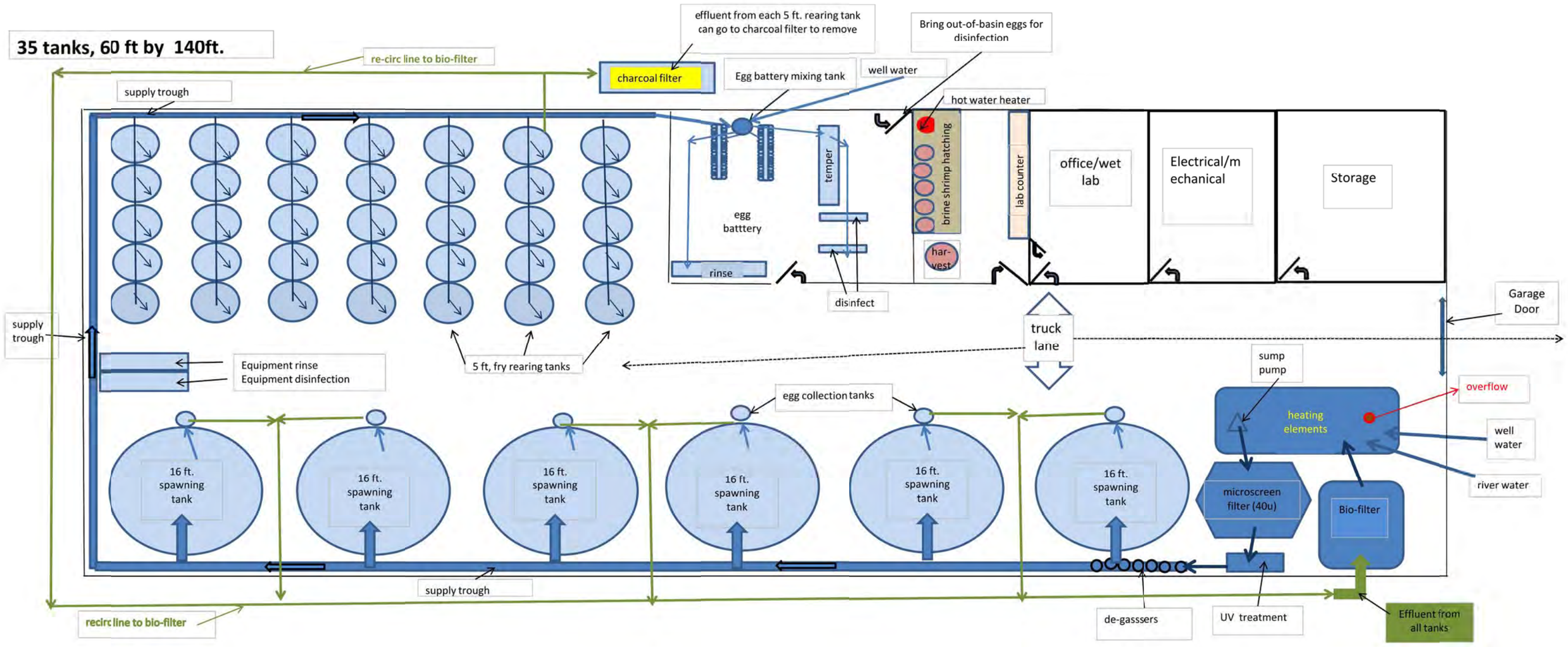
CONOWINGO RELICENSING
WEST FISH LIFT
INCREASE SORTING TANK ELEVATION

DATE AUGUST 2012

FIGURE NO: 3.4.1-2



SOURCE: MIKE HENDRICKS, PFBC

NO.	DATE	ISSUED FOR	BY

DESIGNED
DRAWN
CHECKED
SECT.CHIEF
PROJ.ENGR.

5' 0 5' 10'
SCALE: 1" = 10'±

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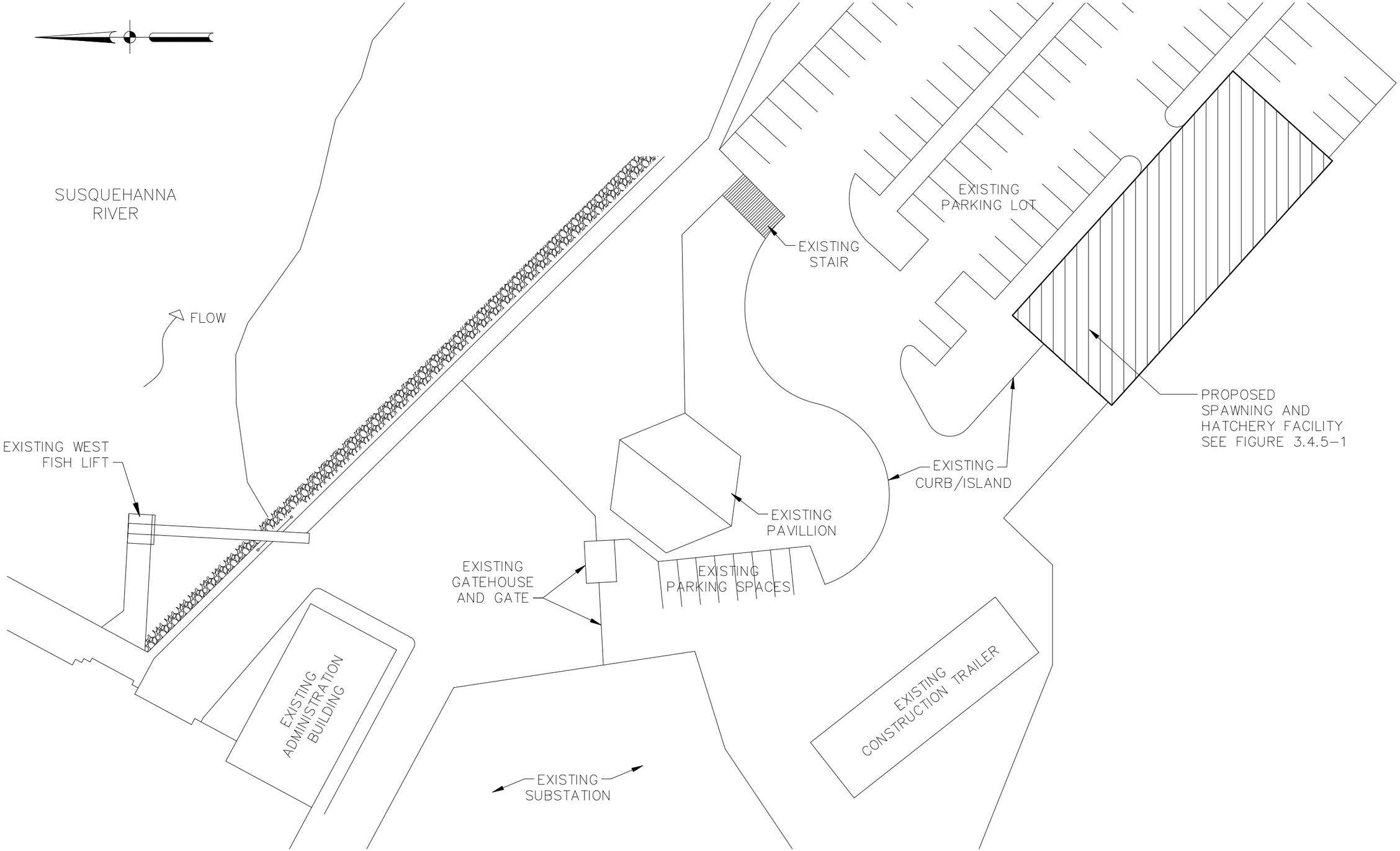
CONOWINGO RELICENSING
CONCEPTUAL DESIGN,
AMERICAN SHAD TANK SPAWNING AND HATCHERY FACILITY

DATE AUGUST 2012
FIGURE NO: 3.4.5–1



NO.	DATE	ISSUED FOR	BY

DESIGNED
DRAWN
CHECKED
SECT.CHIEF
PROJ.ENGR.

20' 0 20' 40'
SCALE: 1" = 40'

GOMEZ AND SULLIVAN Engineers, P.C.
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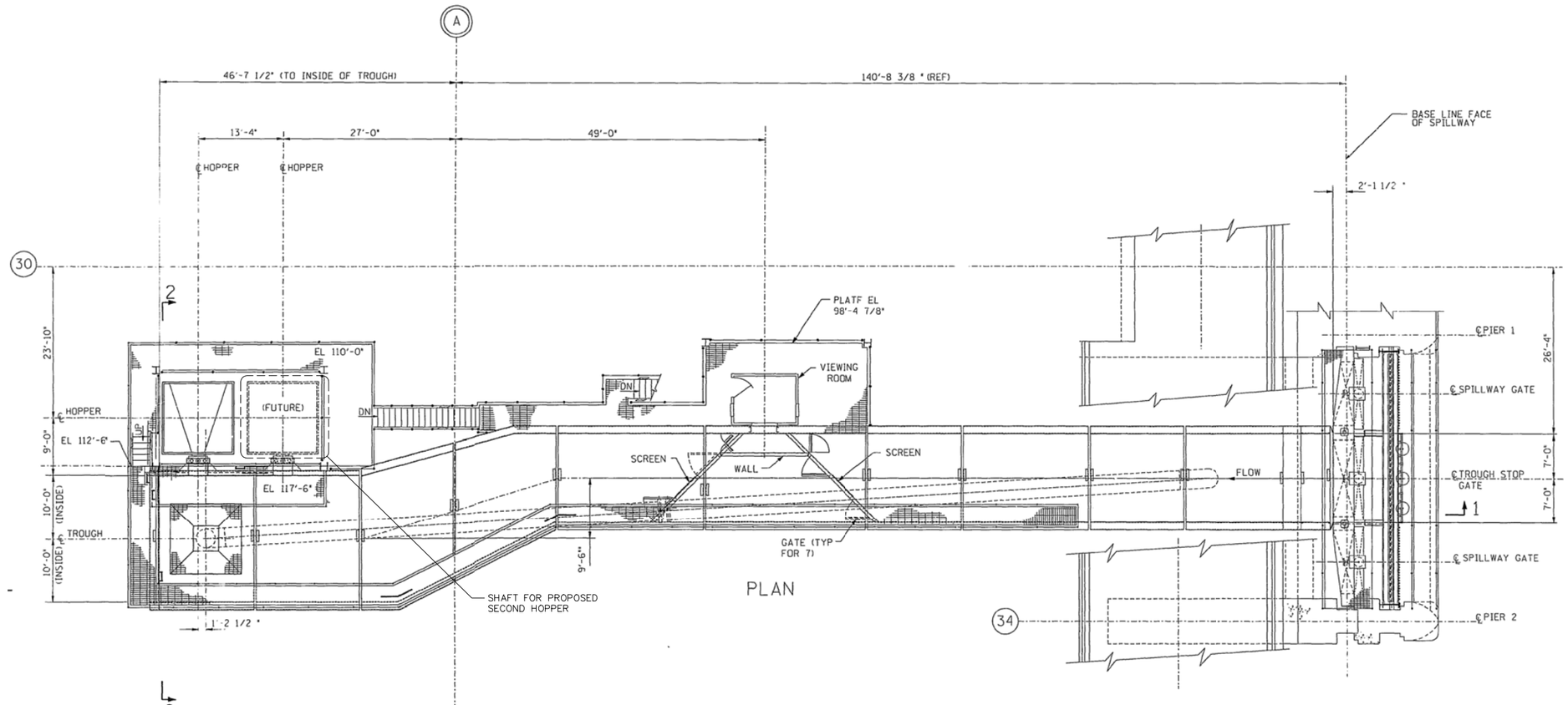
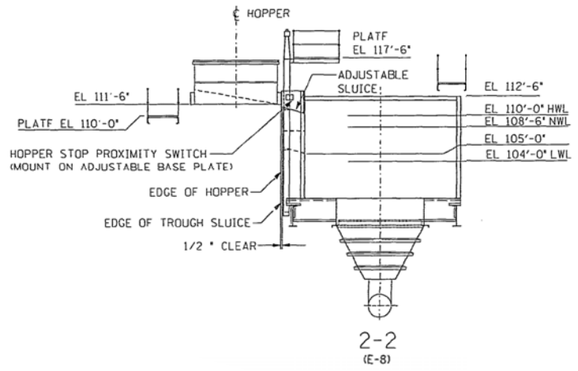
CONOWINGO RELICENSING

POTENTIAL LOCATION OF SPAWNING AND HATCHERY FACILITY

DATE AUGUST 2012

FIGURE NO: 3.4.5–2





SOURCE: LICENSEE DRAWING AB-241370-2, GENERAL ARRANGEMENT FISH TROUGH, 1991. (EXCERPT)

NO.	DATE	ISSUED FOR	BY

DESIGNED
DRAWN
CHECKED
SECT.CHIEF
PROJ.ENGR.

10' 0 10' 20'
SCALE: 1" = 20'

GOMEZ AND SULLIVAN Engineers, P.C.
288 Genesee Street, Utica, NY 13502, (315) 724-4860
41 Liberty Rd, Bldg 1, Henniker, NH 03242, (603) 428-4960
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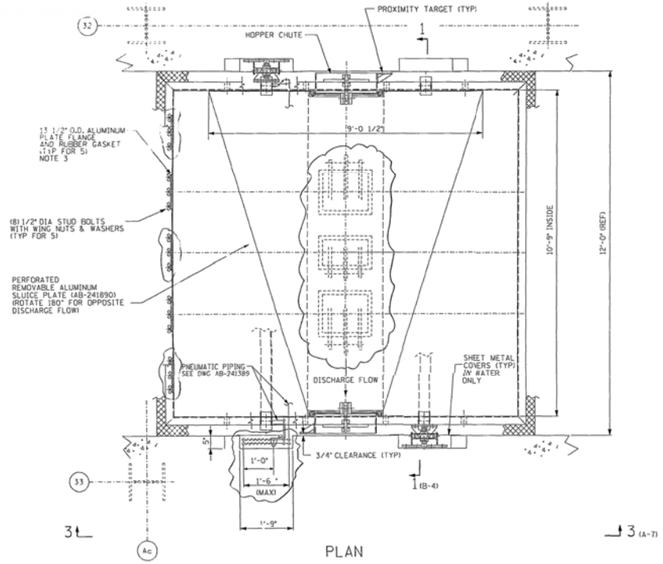
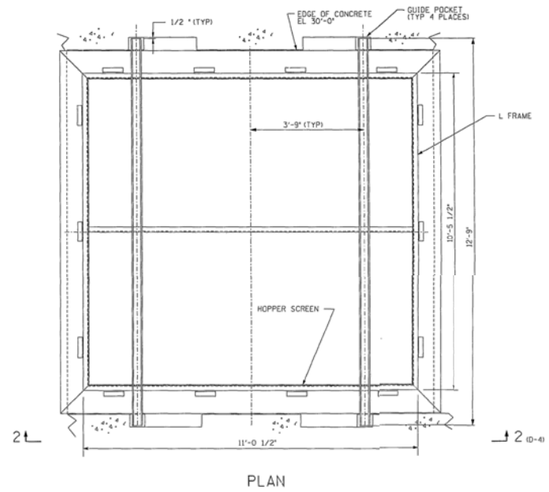
CONOWINGO RELICENSING

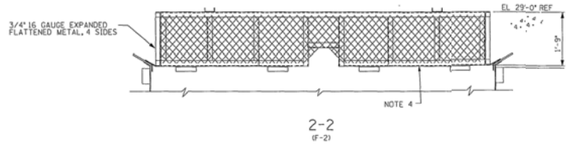
EAST FISH LIFT
FISH TROUGH PLAN

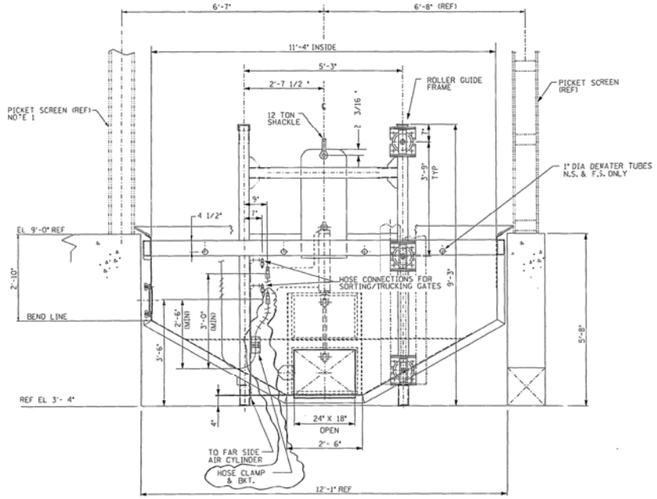
DATE AUGUST 2012

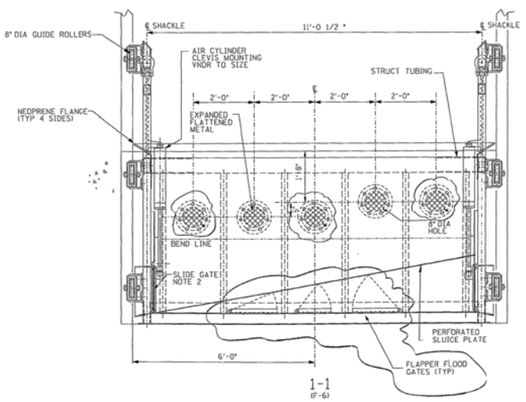
FIGURE NO: 4.4.1-1











NOTES:

1. PICKET SCREEN IS TO REMAIN IN LOWERED POSITION UNTIL HOPPER IS RETURNED TO BOTTOM OF HOPPER WELL.
2. SLIDE GATE DOOR IS TO REMAIN OPEN ON RETURN TO ALLOW HOPPER TO FLOOD.
3. HOPPER CAN BE DEWATERED BY THE ADJUSTMENT OR REMOVAL OF THE ALUMI FLANGES FOR STOCKED WATER DISCHARGE INTO FISH SORTING TANK.
4. HOPPER SCREEN RESTS AT EL. 29'-0" AND IS NOT PHYSICALLY ATTACHED TO HOPPER

SOURCE: LICENSEE DRAWING AB-241372-2, GENERAL ARRANGEMENT: HOPPER AND SCREEN, 1991.

NO.	DATE	ISSUED FOR	BY

DESIGNED
DRAWN
CHECKED
SECT.CHIEF
PROJ.ENGR.

2.5' 0 2.5' 5'
SCALE: 1" = 5'

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5820 Main Street Williamsville, NY 14221 (716) 250 4960

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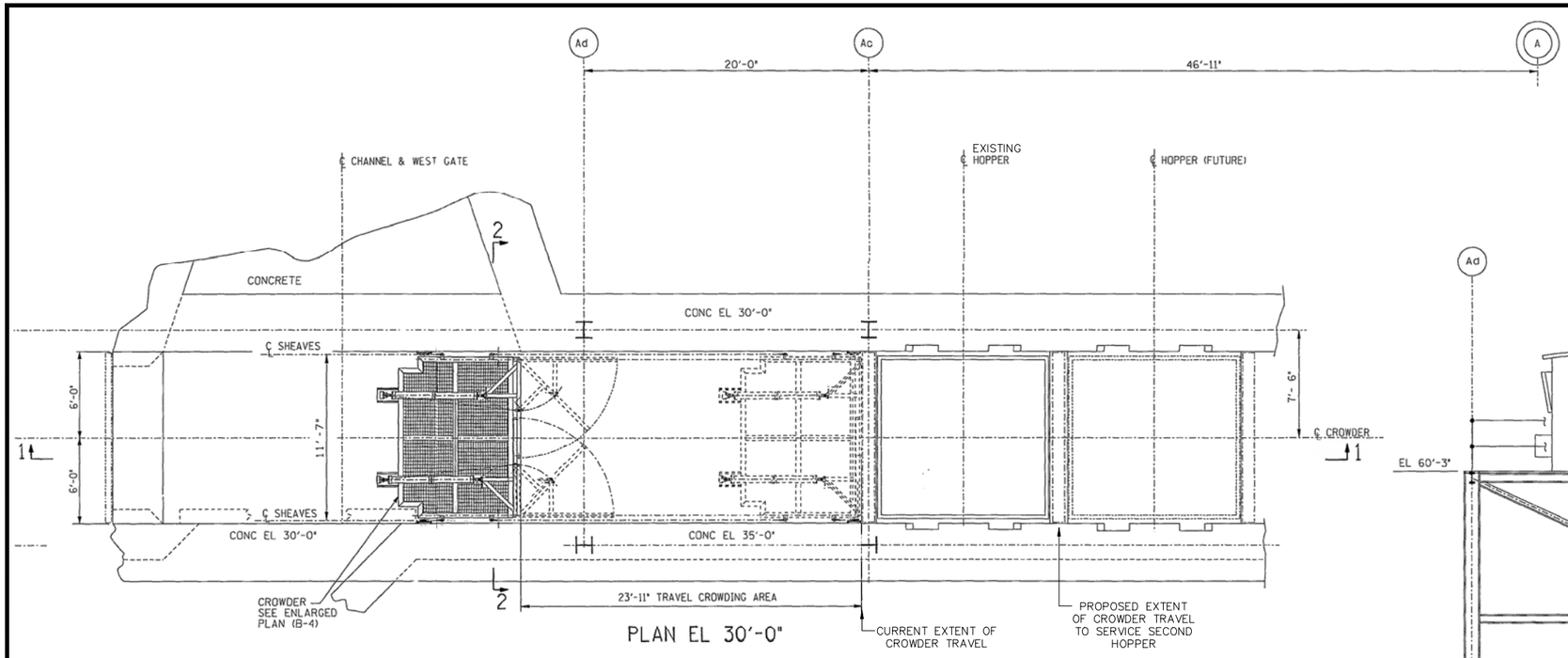
CONOWINGO RELICENSING

EAST FISH LIFT
HOPPER PLAN AND SECTIONS

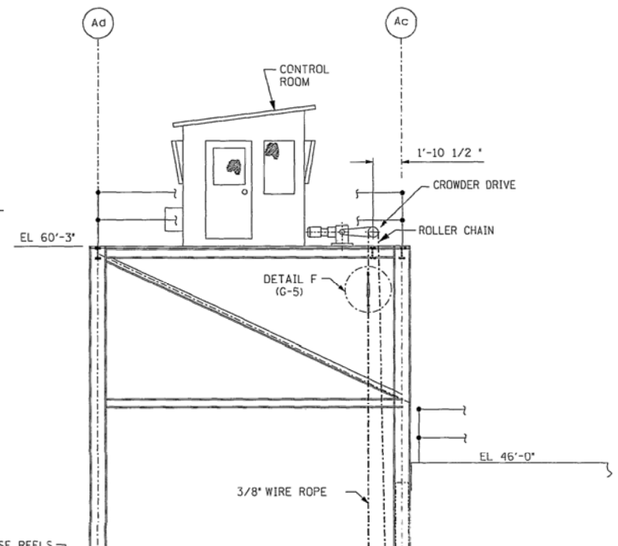
DATE AUGUST 2012

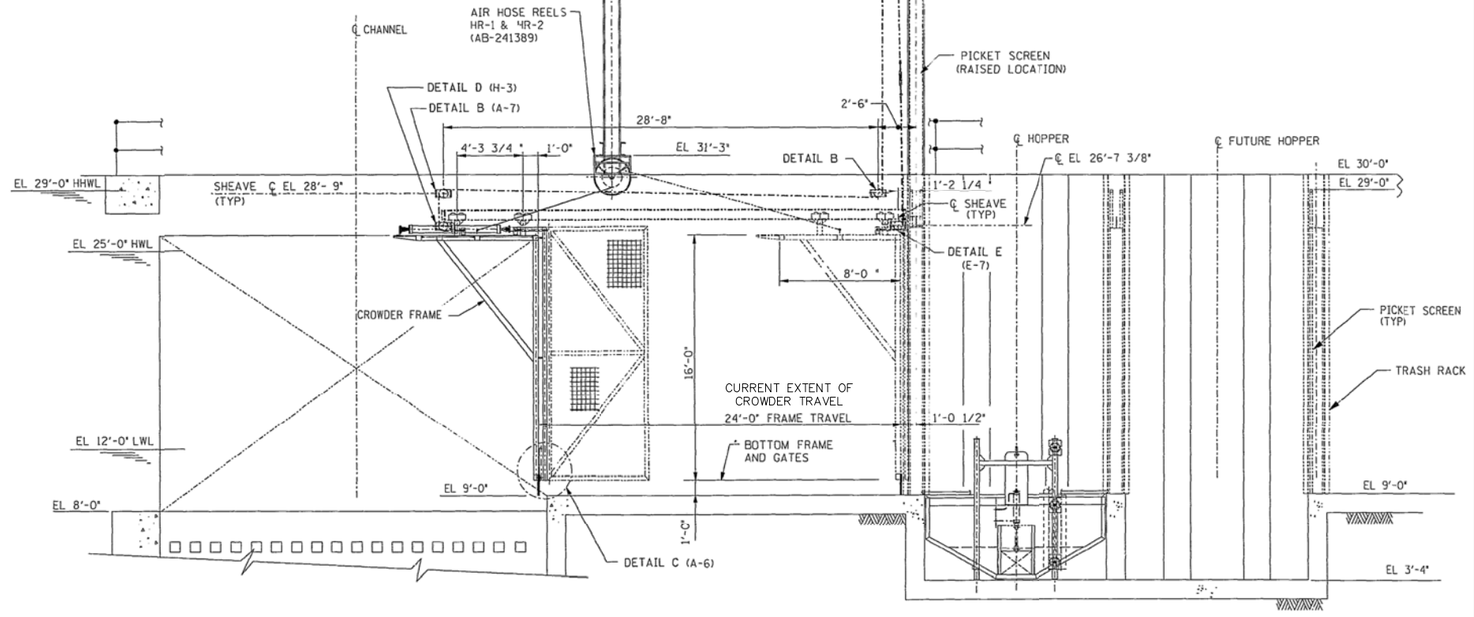
FIGURE NO: 4.4.1-2

SOURCE: LICENSEE DRAWINGS AB-241381-2 AND AB-241382-2, ARRANGEMENT: CROWDER AND DRIVE AND CROWDER AND DRIVE SECTION AND DETAILS, 1991. (EXCERPTS)



2-2





1-1

NO.	DATE	ISSUED FOR	BY

DESIGNED
DRAWN
CHECKED
SECT.CHIEF
PROJ.ENGR.

5' 0 5' 10'
SCALE: 1" = 10'

GOMEZ AND SULLIVAN Engineers, P.C.
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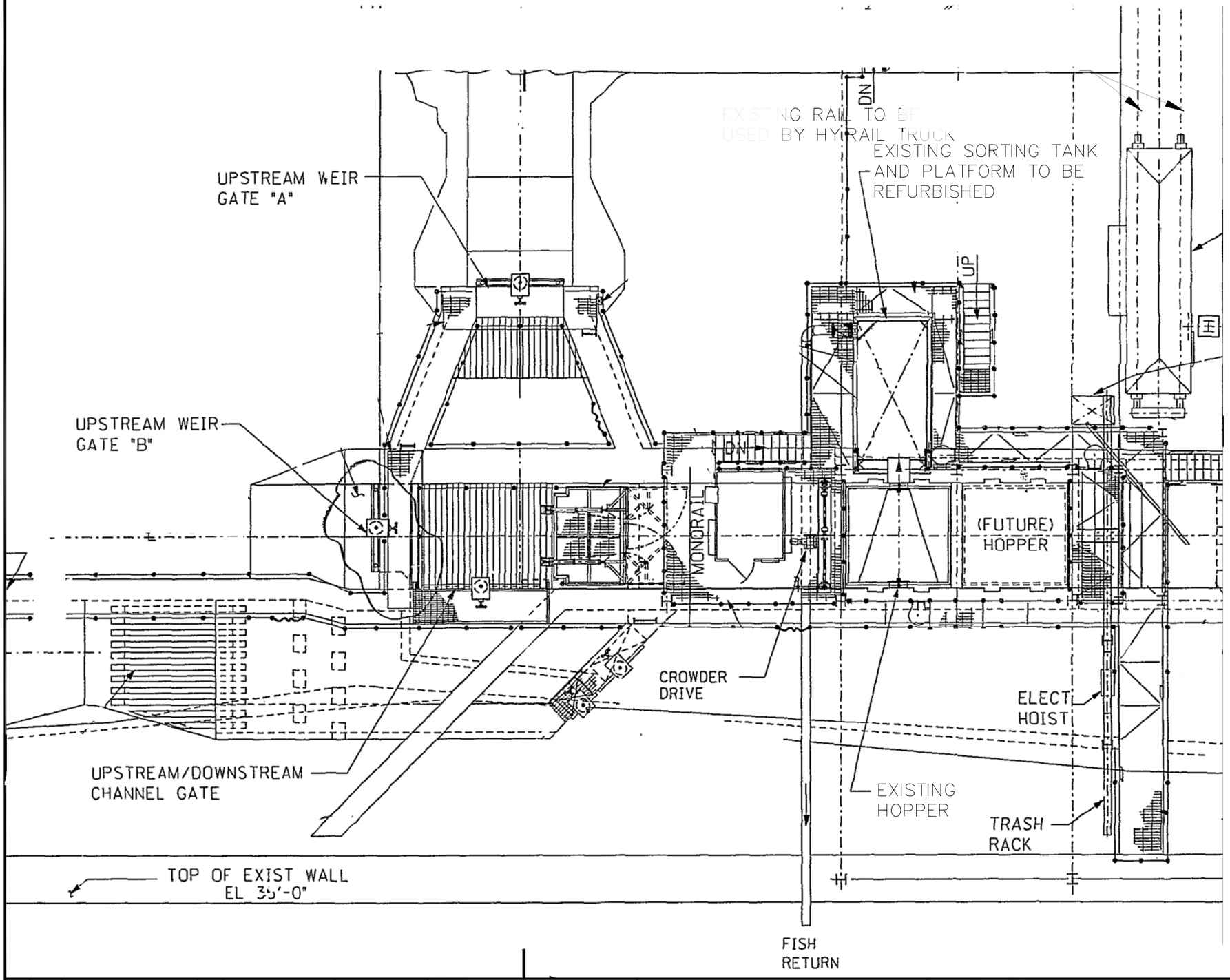
CONOWINGO RELICENSING

EAST FISH LIFT
CROWDER PLAN AND SECTIONS

DATE AUGUST 2012

FIGURE NO: 4.4.1-3



SOURCE: LICENSEE DRAWING AB-241366-2, GENERAL ARRANGEMENT EAST FISH PASSAGE FACILITY PLAN, 1991. (EXCERPT)

NO.	DATE	ISSUED FOR	BY

DESIGNED
DRAWN
CHECKED
SECT.CHIEF
PROJ.ENGR.

6' 0 6' 12'
SCALE: 3/32" = 1'-0"

GOMEZ AND SULLIVAN Engineers, P.C.
288 Genesee Street, Utica, NY 13502, (315) 724-4860
41 Liberty Rd, Bldg 1, Henniker, NH 03242, (603) 428-4960
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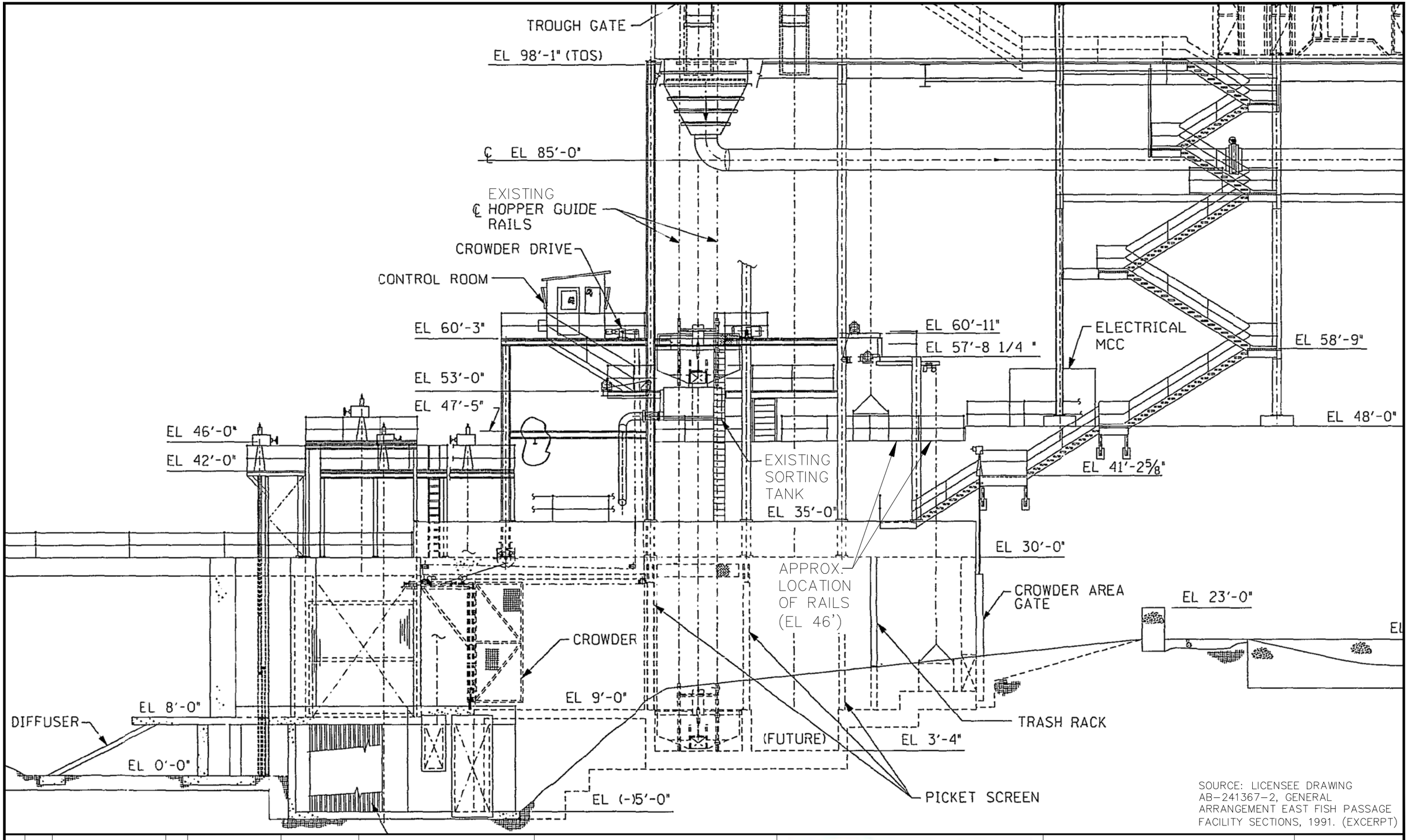
CONOWINGO RELICENSING
EAST FISH LIFT
FULL SCALE PLAN
AT COLLECTION EL.

DATE AUGUST 2012

FIGURE NO: 5.2-1



SOURCE: LICENSEE DRAWING AB-241367-2, GENERAL ARRANGEMENT EAST FISH PASSAGE FACILITY SECTIONS, 1991. (EXCERPT)

NO.	DATE	ISSUED FOR	BY

DESIGNED
DRAWN
CHECKED
SECT.CHIEF
PROJ.ENGR.

6' 0 6' 12'
SCALE: 3/32" = 1'-0"

GOMEZ AND SULLIVAN Engineers, P.C.
288 Genesee Street, Utica, NY 13502, (315) 724-4860
41 Liberty Rd, Bldg 1, Henniker, NH 03242, (603) 428-4960
5820 Main Street, Williamsville, NY 14221, (716) 250 4960

Exelon.

CONOWINGO RELICENSING
EAST FISH LIFT
FULL SCALE SECTION
AT COLLECTION EL.

DATE AUGUST 2012

FIGURE NO: 5.2-2

APPENDIX A- REPRESENTATIVE PHOTOGRAPHS OF WEST AND EAST FISH LIFTS

Photo 1. West Fish Lift, as viewed looking west from downstream side of powerhouse.

Photo 2. West Lift superstructure and hopper, as viewed from upstream side.

Photo 3. West Lift hopper starting a lift, looking downstream.

Photo 4. West Lift hopper in full up position, starting to travel along rail.

Photo 5. West Lift hopper and transport rail.

Photo 6. West Lift collection and sorting tanks.

Photo 7. West Lift spawning tanks and related equipment.

Photo 8. East Lift, looking east from downstream side of Powerhouse.

Photo 9. East Fish Lift, Weir Gate "A".

Photo 10. East Lift, plan view of Weir Gate "A" (right) and Weir Gate "B" (top).

Photo 11. East Lift, Training Wall (left), Weir Gate "C" (center), and Weir Gate "B" (lower right).

Photo 12. East Lift, looking upstream at spillway bay, attraction flow pipe at top.

Photo 13. East Lift superstructure as viewed from west bank.

Photo 14. East Lift fish trough, attraction flow pipe, and hopper.