QUARTERLY PROGRESS REPORT

April 1, 2011 to Jun 30, 2011

No additional funding was received for the project in this reporting period. The total funding received for the TPF-5(164) study so far is $270,000.

The following tasks were performed in accordance with the proposed statement of work/time schedule:

Task #1 Preparing Pipe

In order to conduct the tests in the fish passage culvert flume a predefined section on the CMP pipe had to be extruded. The original pipe was cut using a torch. In addition a grinder was used to smoothen the edges of the pipe not to scratch the Plexiglass flume walls. The pipe surface was coated with a two component special coal tar to eliminate the laser light reflections during Particle Image Velocimetry (PIV) recordings. The technical specification of coating was *C9578402 high performance coal tar epoxy*. This base component needs C9502 504 activator both of which meet C-200 specifications. Fig. 2 depicts the pipe that is placed and sealed inside the fish passage culvert flume.

Figure 1 longitudinal view (YZ axis)

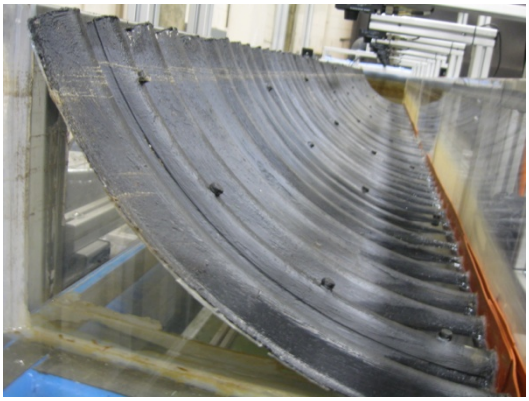

Figure 2 Lateral View (XY axis)

Task #2 Acoustic Doppler Velocimetry (ADV) results

General Information

ADV is a powerful technique to measure velocity distributions in open channel flow. However, intrusive nature, near bed noise and not being able to function accurately close to obstacles are restrictions which should be taken into consideration. In our case, a SonTek 16 MHz Micro-ADV was used for the velocity measurements. The measuring sampling volume is at distance of 50mm from the probe. Due to physical restrictions (pipe shape), it was impossible to measure flow inside the groves of the corrugated pipe. Therefore, diagrams showing velocity flow fields exclude data close to the boundaries. All the tests have been conducted under uniform flow conditions. The velocity components u, v and w correspond to the velocity components in x, y and z directions.

1st Case Scenario:

Table 1 1st case scenario hydraulic properties for ADV test

Bed El. [in]	Water Level [in]	Average Velocity [ft/s]	Wetted Area [in^2]	Discharge [in^3/s]
0	6	0.71	56.18	478.69

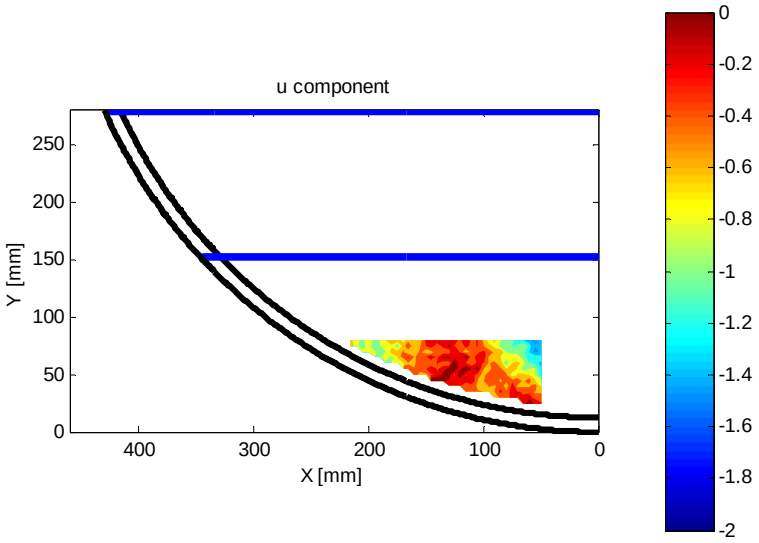

Figure 3 ADV u component for 1st case

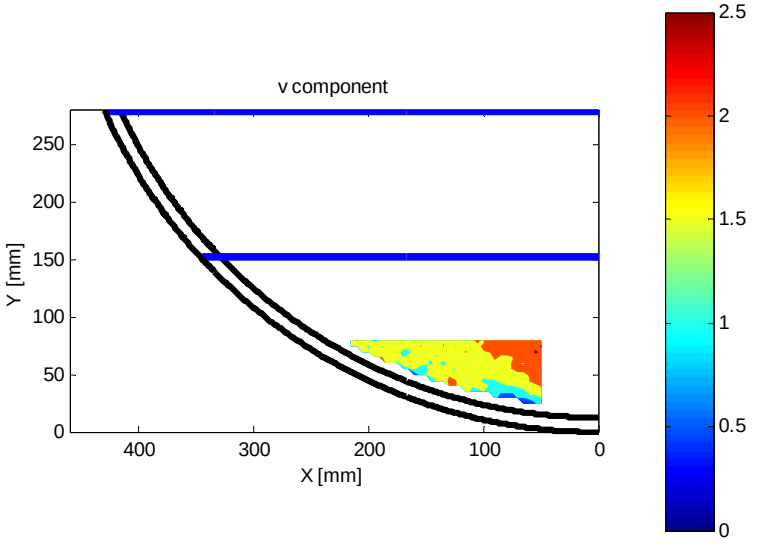

Figure 4 ADV v component for 1st case

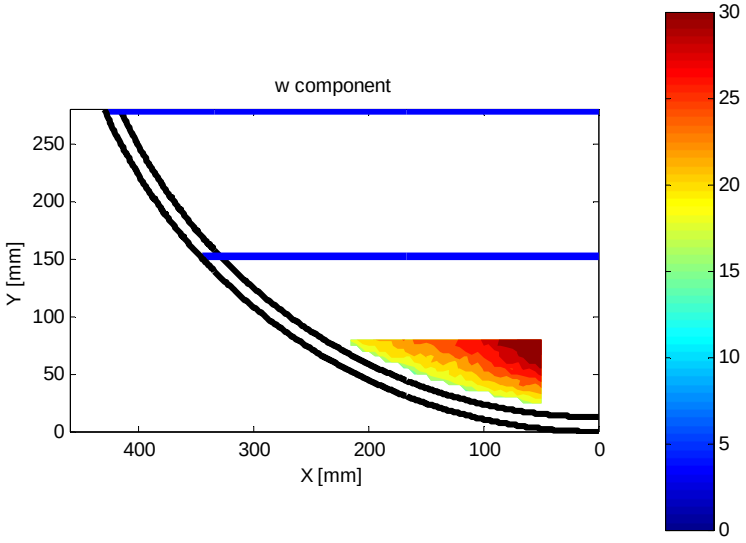

Figure 5 ADV w component for 1st case

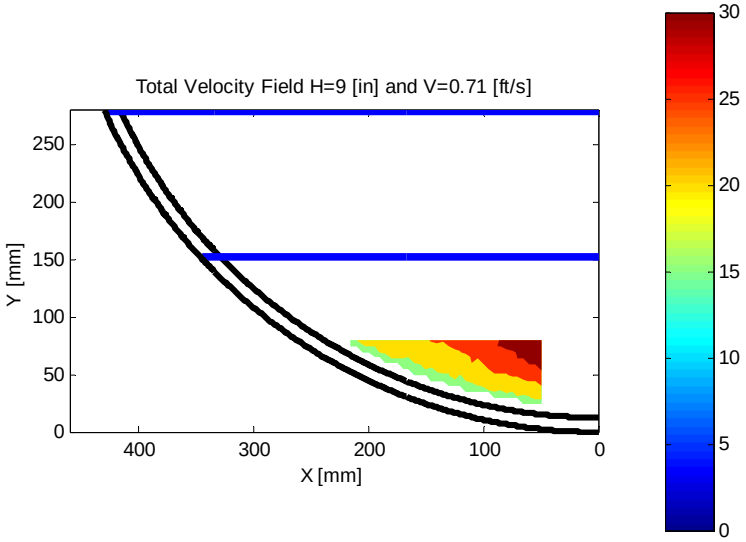

Figure 6 ADV total velocity magnitude for 1st case

2nd Case Scenario:

Table 2 2nd case scenario hydraulic properties for ADV test

Bed El. [in]	Water Level [in]	Average Velocity [ft/s]	Wetted Area [in^2]	Discharge [in^3/s]
0	9	0.71	100.31	854.64

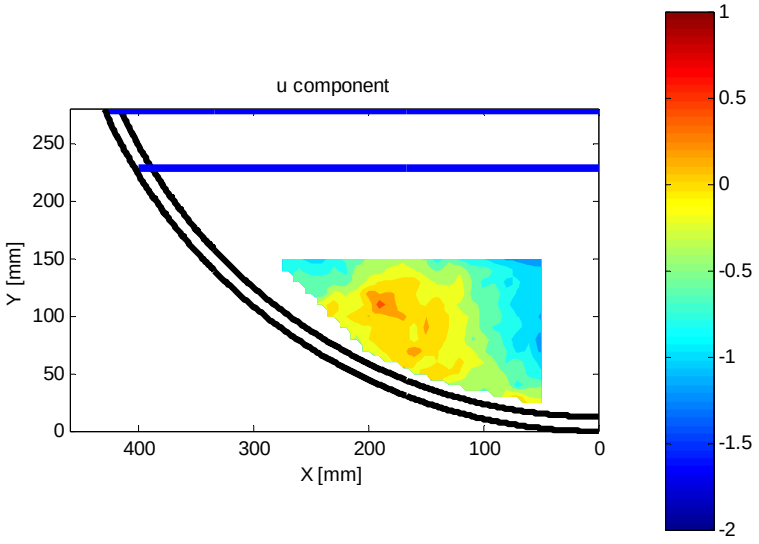

Figure 7 ADV u component for 2nd case

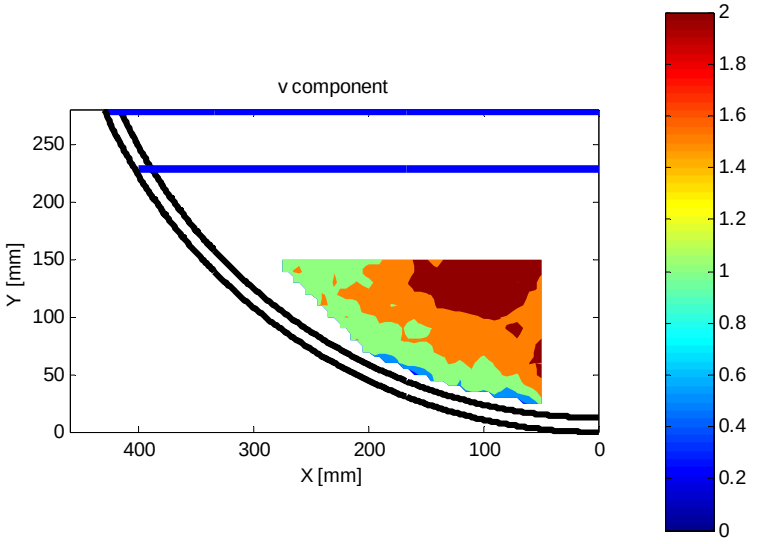

Figure 8 ADV v component for 2nd case

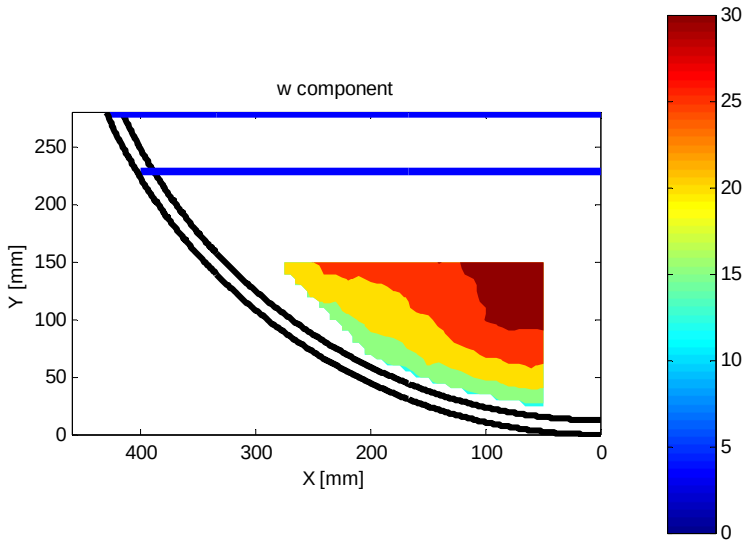

Figure 9 ADV w component for 2nd case

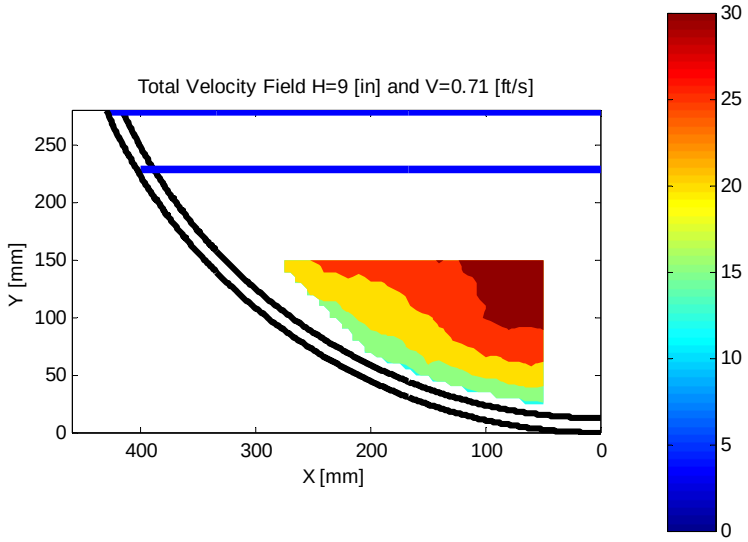

Figure 10 ADV total velocity magnitude for 2nd case

Task #3 Particle Image Velocimetry (PIV) results

General Information

All the tests have been conducted under uniform flow conditions. For the sake of simplicity, velocity components u, v and w are ignored and the only total velocity values are demonstrated.

1st Case Scenario:

Table 3 1st case scenario hydraulic properties for PIV test

Bed El. [in]	Water Level [in]	Average Velocity [ft/s]	Wetted Area [in^2]	Discharge [in^3/s]	Flap Gate Angle [Deg]	Tilting Slope [Deg]
0	6	0.71	56.18	478.69	22	0.23

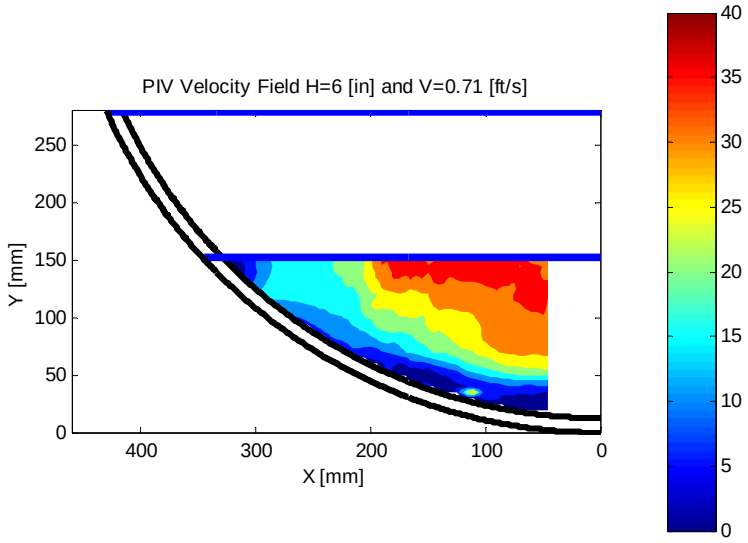

Figure 11 PIV total Velocity Magnitude for 1st case

2nd Case Scenario:

Table 4 2nd case scenario hydraulic properties for PIV test

Bed El. [in]	Water Level [in]	Average Velocity [ft/s]	Wetted Area [in^2]	Discharge [in^3/s]	Flap Gate Angle [Deg]	Tilting Slope [Deg]
0	9	0.71	100.31	854.64	43	0.07

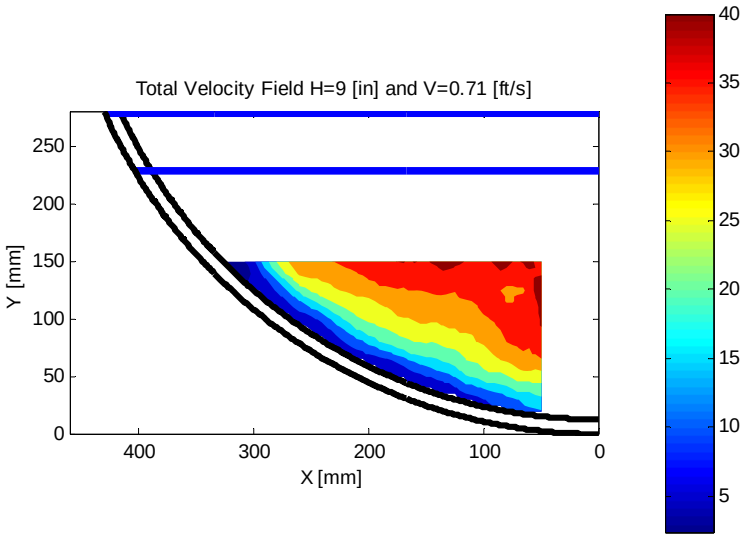

Figure 12 PIV total velocity magnitude for 2nd case

Task #4 Comparison and Discussion

General Information

In order to have a point by point comparison the PIV results were matched with ADV results. The PIV colorbar was scaled down to 30. Both distributions and the values are in a good agreement.

1st Case Scenario:

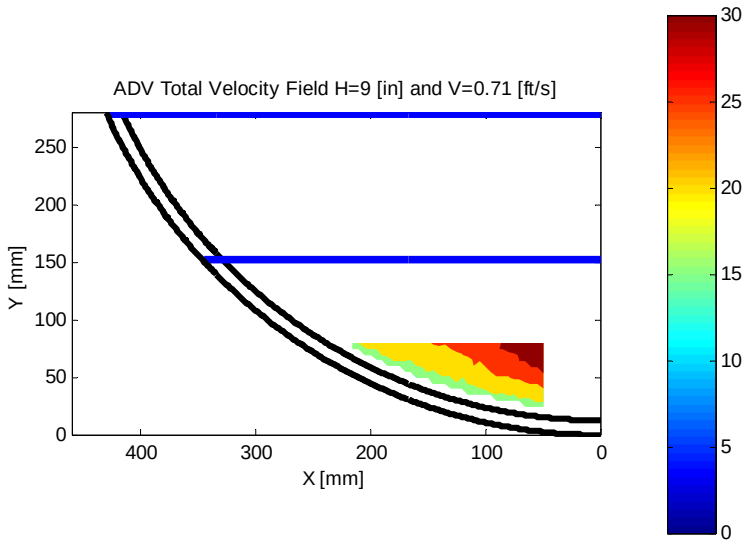

Figure 13 ADV total velocity magnitude scaled down to 0-30 for 1st case

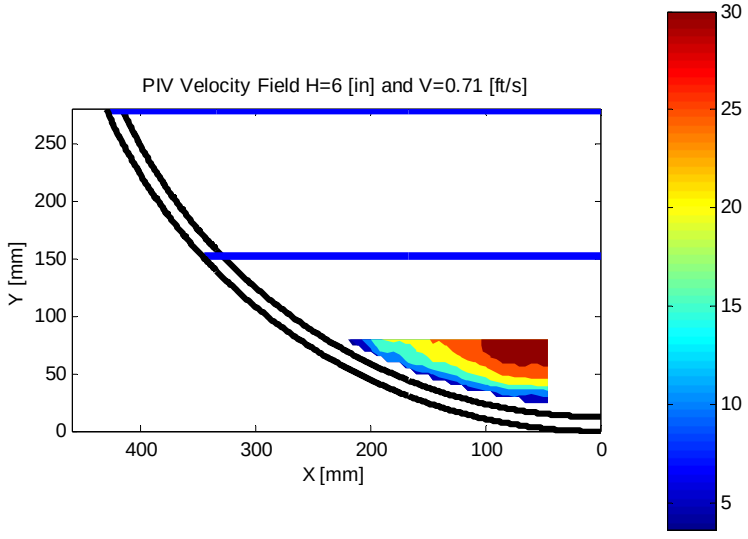

Figure 14 PIV total velocity magnitude scaled down to 0-30 for 1st case

2nd Case Scenario:

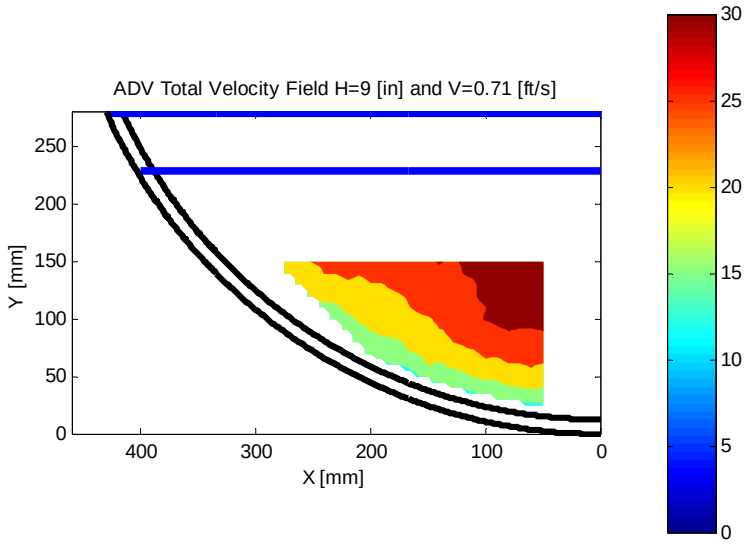

Figure 15 ADV total velocity magnitude scaled down to 0-30 for 2nd case

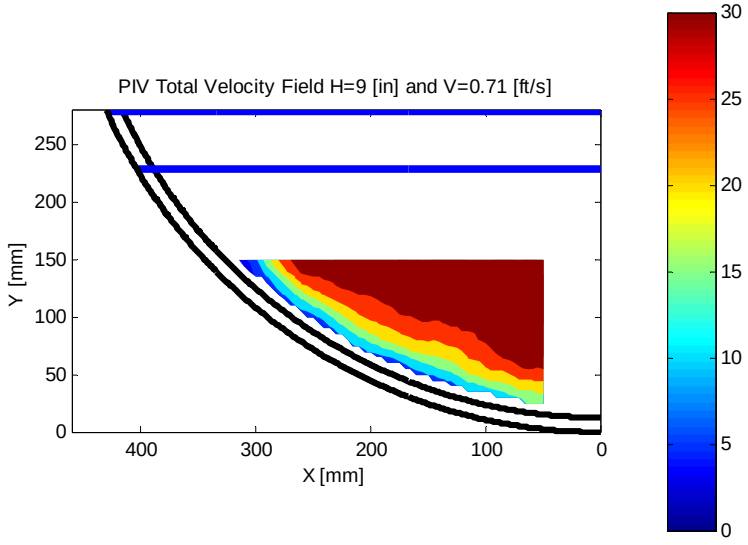

Figure 16 PIV total velocity magnitude scaled down to 0-30 for 2nd case

The Transportation Research Analysis and Computing Center (TRACC) at the Argonne National Laboratory continued performing computer modeling for the study. The current status of the high performance Computational

Fluid Dynamics (CFD) modeling for the fish passage study is presented in the TRACC-CFD quarterly progress report.

In the period from 04-01-2011 to 06-30-2011 $38,489.79 TPF funds were spent.