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Public Safety at Low-Head Dams: Fatality Database And Physical Model of Staggered Deflector Retrofit Alternative

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Public Safety at Low-Head Dams: Fatality Database
and Physical Model of Staggered Deflector
Retrofit Alternative

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A thesis submitted to the faculty of
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in partial fulfillment of the requirements for the degree of

Master of Science

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ABSTRACT

Public Safety at Low-Head Dams: Fatality Database
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Retrofit Alternative

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Low-head dams can cause dangerous currents near the downstream face of the structure. Fatalities at low-head dams are poorly documented. This thesis introduces a website with an interactive map and database of fatalities at low-head dams in the United States. The purpose of the web site is to generate interest among the general public to increase support to remediate dangerous structures and to serve as a tool for public education. The user interface allows the general public to browse fatal incidents by geographic location and to read incident circumstances. The site allows submission of public contributions including all metadata needed to characterize the incident. The database is structured to include documentation verifying each entry. The site can be viewed at http://krcproject.groups.et.byu.net.

The danger is due to a uniform channel-wide countercurrent which causes upstream directed surface velocities. Previously, few inexpensive retrofit alternatives have been studied which prevent the uniform countercurrent. This thesis investigates two cost-effective retrofit options: (1) a channel wide horizontal flow deflector and (2) staggered flow deflectors. The channel wide flow deflectors cause uniform downstream directed surface velocities for a narrow range of tailwater elevations. The staggered flow deflectors prevent the uniform countercurrent for a wide range of tailwater elevations.

Keywords: Edward William Kern, low-head dam, hydraulics, river, channel, public safety, database, surface velocity, fatalities

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A special thanks to my parents for their loving support and to Dr. Rollin H. Hotchkiss for his undeviating help and encouragement. I would also like to thank all those who take the time to read this paper. That's right, I'm talking to you.

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1 INTRODUCTION

Low-head dams are small drop structures in rivers, streams, or channels. Low-head dams are constructed to impound water, meter discharge, or maintain stream slope. There is no universally accepted definition of a low-head dam. The US Army Corps of Engineers (USACE) National Inventory of Dams (NID) lists dams that are either equal or exceed 25 feet (7.6 m) in height or equal or exceed 50 acre-ft of storage (61,700 m^3) and exceed 6 ft (1.8 m) in height (USACE, NID, Accessed December 31, 2013, http://geo.usace.army.mil/pgis/f?p=397:1:0::NO). Ostensibly, low-head dams are smaller than either of these two categorical definitions. While several databases and descriptions of dams exist–including NID mentioned above and the World Register of Dams (International Commission on Large Dams, Registry of Dams, Accessed December 31, 2013, www.icold-cigb.org/GB/World_register/world_register.asp)–there is no such compilation for low-head dams. Based on the data set used for the aforementioned databases the listings are biased toward large dams (Lehner, 2011). There are an unknown, but large number of such structures in the United States.

Many low-head dams are dangerous due to a hydraulic condition called the submerged hydraulic jump (Leutheusser, 1999; Govinda Rao, 1963). Members of the general public who are familiar with this phenomenon often refer to it as a "hydraulic" or "drowning machine" (Borland-Coogan, 1980). A submerged hydraulic jump forms when the downstream depth, called the tailwater, rises to a level that partially drowns out the supercritical flow that forms at the base of the structure. A recirculating current develops due to the momentum of the plunging nappe and buoyant force of air entrained water downstream of the structure. The surface velocity of the water immediately downstream from the face of the structure is directed upstream. This upstream directed surface velocity carries objects that have traversed the dam back toward the plunging nappe. The upstream directed surface velocity makes this condition dangerous. The line that separates upstream and downstream surface velocities is called the boil. A diagram and photo of an example submerged hydraulic jump are shown in Figure 1-1. The purpose of this thesis is twofold: (1) to introduce a database and internet information portal documenting fatalities at low-head dams and (2) to investigate a cost effective retrofit alternative through physical modeling.

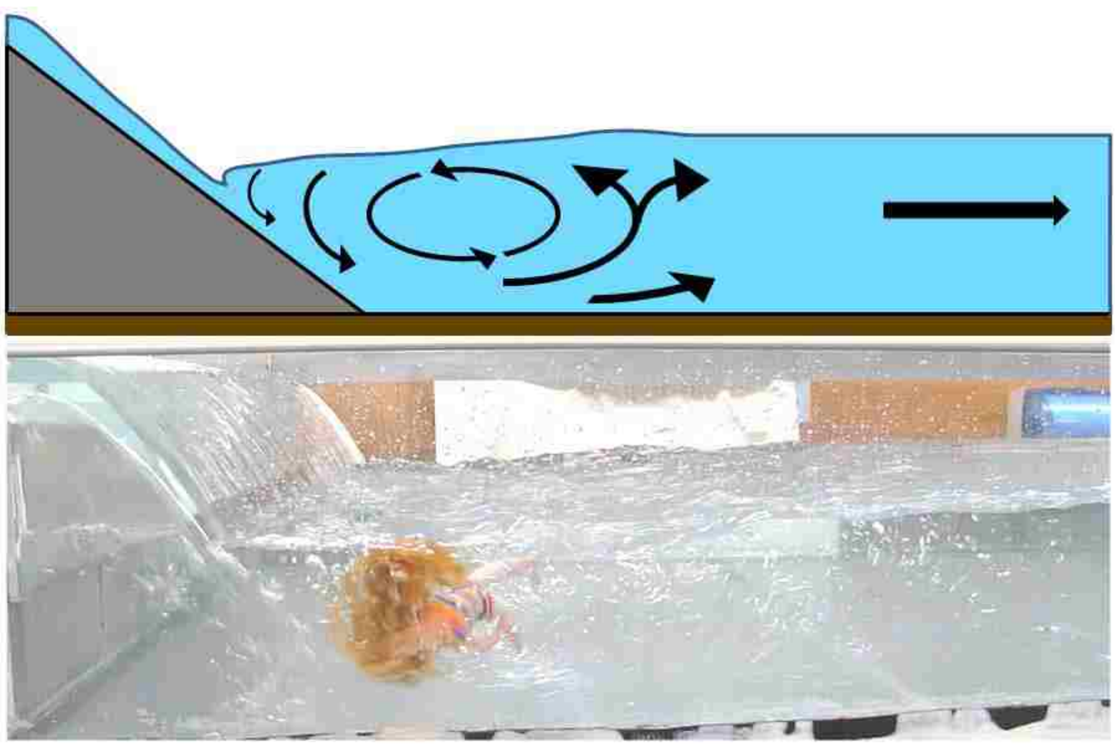

Figure 1-1: Flow paths in a submerged hydraulic jump (top); a toy doll trapped in a submerged hydraulic jump (bottom).

2 INTRODUCING A LOW-HEAD DAM FATALITY DATABASE AND INTERNET INFORMATION PORTAL

Low-head dams can cause dangerous currents near the downstream face of the structure. Fatalities at low-head dams are poorly documented. This chapter presents a website with an interactive map and database of fatalities at low-head dams in the United States. The purpose of the web site is to generate interest among the general public in order to increase support to remediate dangerous structures and to serve as a tool for public education. The user interface allows the general public to browse fatal incidents by geographic location and to read incident circumstances. The site allows submission of public contributions including all metadata needed to characterize the incident. The database is structured to include documentation verifying each entry. The site can be viewed at http://krcproject.groups.et.byu.net.

2.1 Introduction

The calm appearance of submerged hydraulic jumps makes low-head dams deceptively dangerous; rafters and swimmers may not perceive the dam as a significant hazard (Tschantz, 2011). Submerged hydraulic jumps can easily capsize boats, rafts, kayaks, and canoes (Elverum, 2012). If a swimmer gets caught in the current they are likely to be submerged by the force of the plunging nappe, resurface upstream from the boil, and be swept upstream to the plunging nappe to repeat the process (Wright, 1995). The extent of air entrainment makes swimming away from a submerged hydraulic jump very difficult and the swift upstream directed surface velocities are almost certainly faster than even a strong swimmer could swim in ideal conditions (Leutheusser, 2001). Despite the significant hazards associated with low-head dams, the most common rationale for their removal is environmental (Pohl, 2002).

The purpose of this chapter is to introduce a comprehensive database and educational website that documents fatalities at low-head dams with the intent to raise awareness and encourage remediation efforts. While this is the most compressive database made available to date, it is not the first to discuss public safety at low-head dams. Organizations such as the American Canoe Association compile accident reports relating to recreational paddle craft. The Association of State Dam Safety Officials (ASDSO; http://damsafety.org/) provides links to several papers and sites including the American Whitewater Accident Database. State agencies often produce yearly incident reports of boating accidents; however, these reports often do not include recreational paddle craft. Fatal incidents involving swimmers are less likely to be documented than those that involve watercraft. Well-funded media organizations may report on fatal incidents at low-head dams. However, media coverage is less likely in rural areas. A few examples of fatalities at low-head dams reveal their deceptive nature.

Drop Structure 2 in the Walnut Creek Flood Control Channel System (WCFCCS) in Concordia, California has claimed eight lives since its construction (West Yost Associates, 2012). Fencing and signage restricting access to the channel has been present since the structures completion in the early 1970's. Drop Structure 2 occurs just before a rectangular concrete channel transitions to a trapezoidal earthen channel. The structure is located in an urban area. The incidents at WCFCCS Drop Structure 2 are as follows:

- February 2011, a pair of teenage boys tried to raft the channel and drowned.
- April 2010, a car crashed through the fencing into the channel. A couple and their son were in the vehicle at the time. They became captured at the drop structure.

The father and son were drowned. The mother nearly drowned and a firefighter was badly injured during the rescue.

- 1991, a boy drowned while attempting to retrieve a ball.
- February 1973, three adults ages 29-34 attempted to raft the channel. They were ejected from the raft at Drop Structure 2. One person was knocked unconscious and drowned. Fortunately, members of the Flood Control District's maintenance crews were working at the structure when the incident occurred and were able to rescue the other two rafters.
- January 1973, two boys died when attempting to retrieve a ball from the channel.

These descriptions contain information that may be helpful when designing new drop structures or remediating existing structures similar to WCFCCS Drop Structure 2. Three of the eight victims were intentionally rafting or paddling the channel. Assuming that children attempting to retrieve balls were not wearing personal flotation devices (PFDs), at least five victims were not wearing PFD's. Six of the fatalities were adolescents or children. At least five fatalities occurred during winter. At least three people have been saved by bystanders or rescue crews. Despite restricted access, eight people lost their lives at Drop Structure 2.

Many fatalities have occurred at the Dock Street Dam in Harrisburg, Pennsylvania. The dam is present to give the Susquehanna River sufficient depth for recreational use. The crest length is more than one kilometer. A news special aired in 1996 claims that 17 fatalities have occurred at the Dock Street Dam between 1976 and 1996 (WGAL 8 News, 1996).

Boaters, paddlers, rafters, swimmers, and even a snowmobiler have lost their lives at low-head dams. Fatalities are not confined to recreational users. Parents, siblings, and extended relatives have drowned while attempting to save loved ones. Numerous first responders and altruistic bystanders have perished attempting to save strangers trapped in submerged hydraulic jumps. At least five victims have drowned while trying to save dogs. The sites where fatalities occur are as diverse as the circumstances of fatal incidents.

The remainder of this chapter introduces a new database and associated web site and interactive map, which have been developed to manage information related to fatalities at low-head dam sites. The database and web site allow immediate and open access to all information available regarding incidents at these structures.

2.2 Methods

2.2.1 Database Design and Development

A MySQL database was created to store fatality and site information. The database is designed to be as simple as possible while avoiding redundancy. Simplicity allows the database to be maintained by individuals with little MySQL training. Redundancy is avoided to minimize the size of the database and the possibility of duplicate entries. The database consists of four tables: (1) Sites, (2) Incidents, (3) Remediation, and (4) Verification as shown in Figure 2-1. The Sites table contains information that pertains only to an incidents' geographic location. The Incident table contains information that pertains exclusively to a single fatal event. Information for documents used to verify the location of sites and circumstances of incidents is stored in the Verification table. The Verification table is not directly related to the Sites table. A document stored in the Verification table is related to an event in the Incident table, which is related to a location stored in the Sites table. The Remediation table is not in use at this writing; however, it may be used to track remediation measures implemented at a site in the future. Remediation measures include, but are not limited to, posting signage, restricting access, or retrofitting the structure.

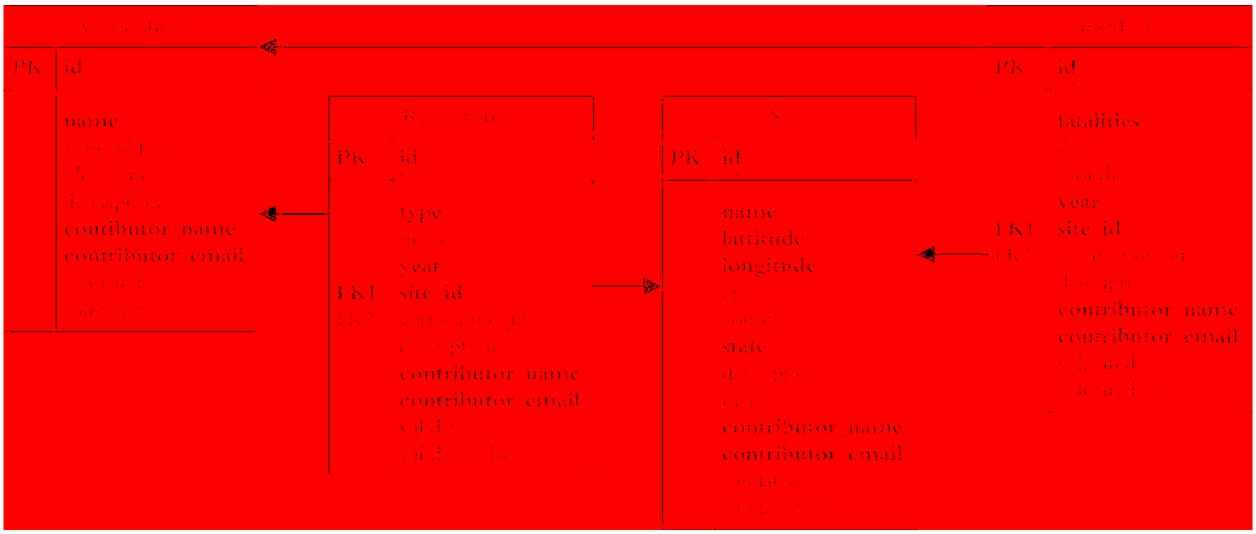

Figure 2-1: Low-head dam fatality relational database structure is shown.

The web site was created using HTML, CSS, JavaScript, PHP, and MySQL. When a user views the database, three PHP arrays are populated with the information contained in the Site, Incident, and Verification tables. These arrays are used to create site markers and ordered lists. Figure 2-2 shows a process flowchart for sorting arrays and displaying the ordered list found on the “Browse Incidents” page. The function shown in the flowchart demonstrates how the tables are related. First, the database is queried, the results of the query are placed into arrays, and each array is sorted. An appropriate title is displayed for each site. If a picture exists, it is placed below the title. The site_id of each incident is checked against the current site; if the site_id matches, the incident details are listed. If an incident is related to a verification document, the document details are displayed. The function loops until all sites have been listed.

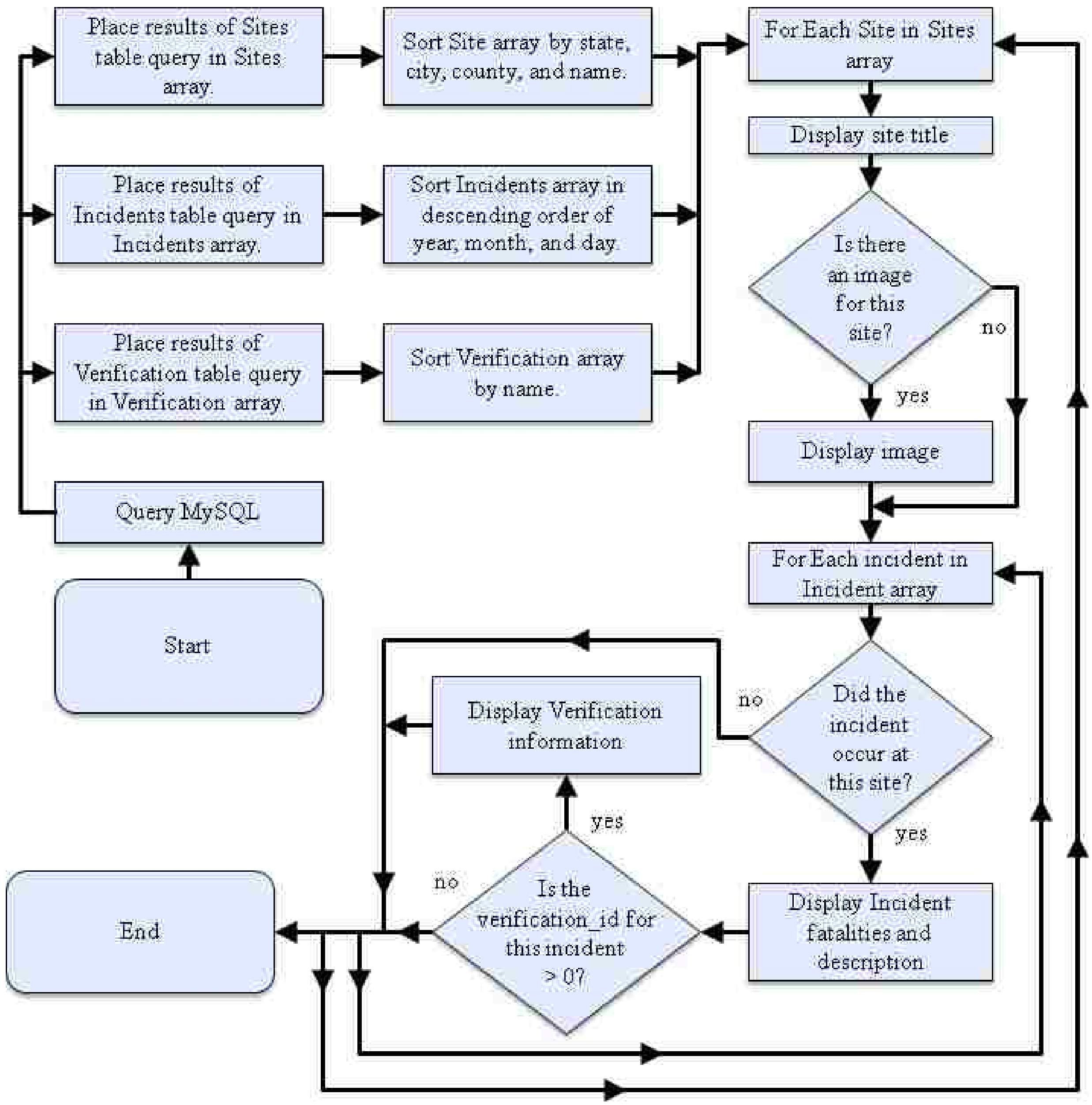

Figure 2-2: Process flowchart for displaying results on the "Browse Incidents" page.

2.2.2 User Interface Design and Development

The low-head dam fatality web site was developed with three primary user-interface pages: (1) “About Submerged Hydraulic Jumps”, (2) “Browse Incidents”, and (3) “Report an Incident”. The “About Submerged Hydraulic Jumps” page is the home page and can be seen in Figure 2-3. It is for purposes of public education. It contains a 24 minute educational video created by the author and a short article summarizing the information presented in the video.

Figure 2-3: krcproject.groups.et.byu.net home page.

The “Browse Incidents” page allows users to view the interactive map and a list of all recorded locations in the United States where fatalities have occurred with their associated incidents. The interactive map can be seen in Figure 2-4. The interactive map was built to allow individuals to browse fatal sites by geographic location. Each site is represented by a marker at its geographic location. When the cursor hovers over a marker, the summary of information at the site is displayed including the site name, total number of fatalities, city, and state. All fatal sites are listed below the map in alphabetical order based on state, city (or county if not within city limits), and site name. If a photo for the site has been submitted it will be displayed below the site title. The incidents at each site are listed below the photo in descending order of date. The date, number of fatalities, and a description of each incident are displayed accompanied by links to documents verifying the information presented. If the user clicks a marker on the map, the browser scrolls to the information corresponding to that site. Ease of use is a high priority. It is essential that each individual who views the site can easily navigate to the information they are seeking.

To ensure as many incidents as possible are reported, the database is designed to allow submission of public contributions. The “Report an Incident” page contains a user form used to submit unreported fatality sites and incidents. If a form is not user friendly, the user may become discouraged or disillusioned and fail to submit beneficial information. The user form is designed to encourage the user to include as much relevant information as possible without being restrictive or overwhelming.

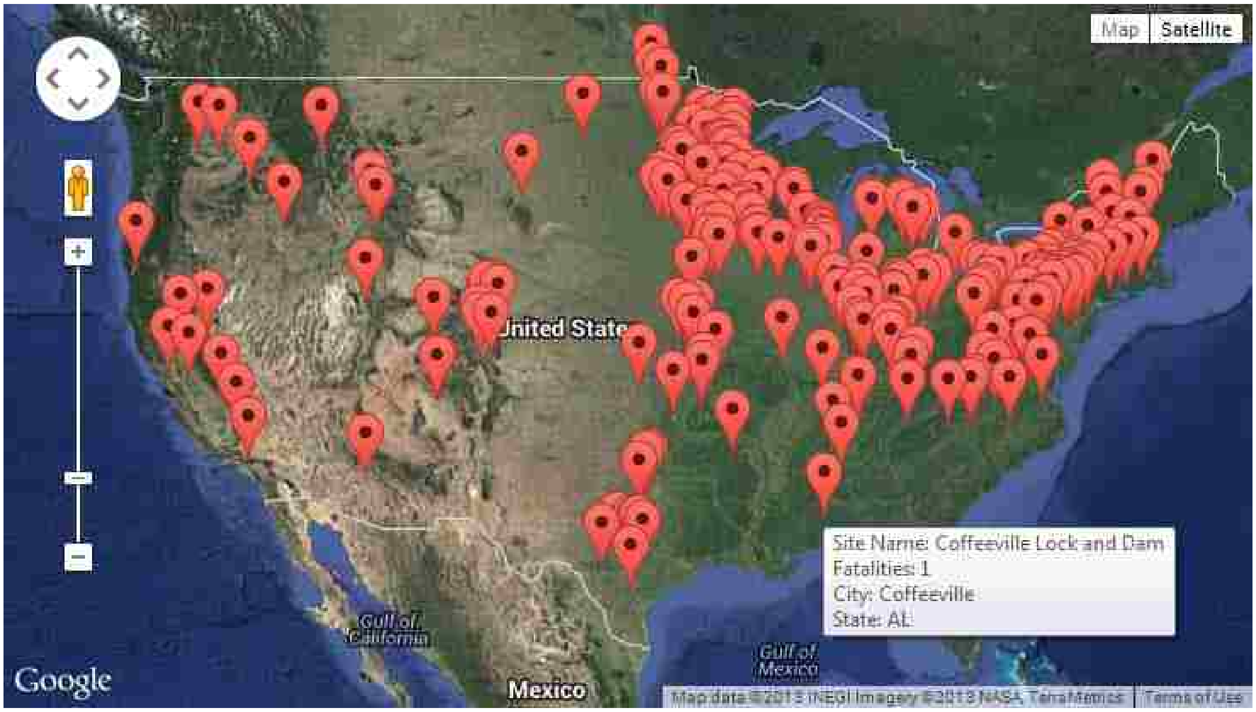

Figure 2-4: Interactive map showing locations of drowning at low-head dams in the United States.

2.2.3 System for Submission of New Incident Information

Information about the circumstances of each incident is vital for future studies. The description of each incident will almost certainly include what the victim was doing prior to becoming trapped at a hydraulic structure. Other information that is useful includes whether or not personal flotation devices (PFD's) were worn, flow was unusually high, the water was unusually cold, or alcohol was a factor. Representative cases will be discussed in a later section. Incident dependent data for each site may include a vast array of information that may be useful in future studies relating to remediation measures at low-head dams. Useful information for such studies may include site information such as whether signs were posted or visible, fencing was present, the site was otherwise restricted, or portage was available.

A user may submit a new site and/or incident on the "Report an Incident" page. When submitting a new incident an existing site must be selected or a new site must be created. When creating a new site the site name, latitude, longitude, city, county, and state may be entered. The user has the option of uploading an image of the site if one is available. Most users will not know the latitude or longitude of the location, and may not know the city or county. A map is provided which allows users to zoom and click on a geographic location. Clicking on the map will automatically populate the latitude, longitude, city, county and state fields as shown in Figure 2-5. If selecting a site that is already in the database the user may select the site from a drop down menu or click the site marker on the map.

Once the site information is complete, the user may enter information for the specific incident that occurred, including the number of fatalities, day, month, year, and description. The description is the field that will contain information regarding the circumstances of the incident. If available, documentation to verify the validity of the entry may be included as a file or web link. The documentation may be accompanied by a brief description which may include who wrote the article and when it was published. A verification document is not required.

The minimum information required to submit a new site is the site name, latitude, longitude, state, and either the city or county. The user must also submit an incident when adding a new site. The minimum requirements to submit an incident are the number of fatalities, year, and a description. An incident may not be added unless it is assigned to either a new or existing site. If an existing site is selected, the fatalities that have been entered at that site are displayed above the incident information user form; the user is prompted to ensure that the incident they intend to submit is not a duplicate entry. A JavaScript function is used to ensure the information the user intends to submit meets the minimum requirements. If the minimum requirements are not met, a prompt advises the user what additional fields are required.

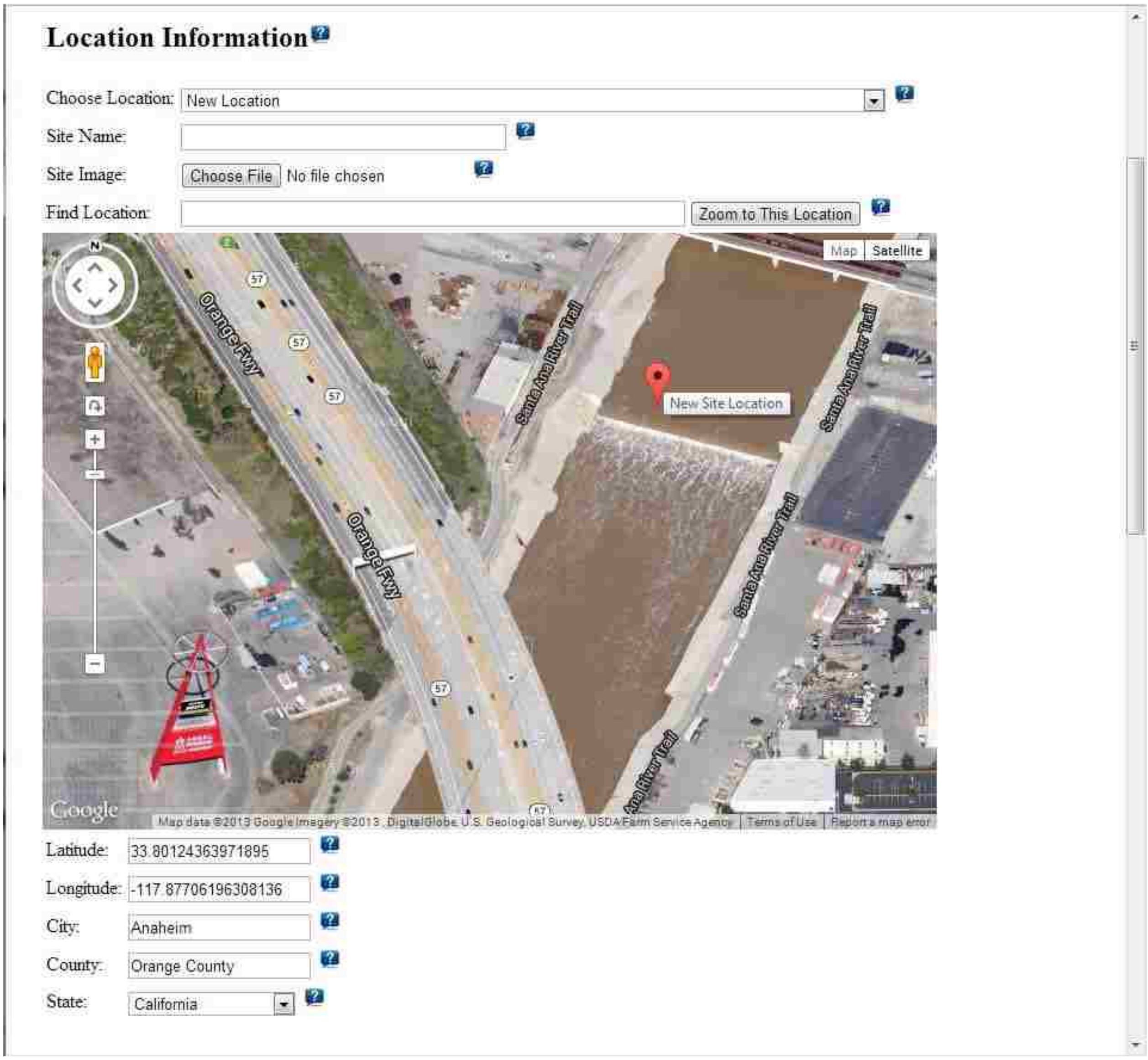

Figure 2-5: Interactive map for specifying location of an incident.

2.2.4 **Data Validation**

All submissions recorded in the MySQL database have met the minimum requirements for required field completion. If a submission is inaccurate, vague, or inappropriate it may be corrected or removed by an administrator. Each table in the database has two fields related to validation. The "validated" field contains a numerical value associated with the extent the entry been validated. A value of 1 indicates the entry has been checked for appropriate content and grammar. A value of 2 indicates the accuracy of the content has been verified. The "validated_by" field contains the name of the administrator who most recently validated the content of the entry. Data can be queried based on the level of validation.

2.2.5 **Populating the Database**

The developed database was initially populated with information and metadata regarding 430 fatalities at 222 low-head dam locations. The data for these incidents was acquired through an extensive search of public records databases throughout the United States. Significant contributions were made by Charlie Walbridge of American Whitewater (http://www.americanwhitewater.org) and Dr. Bruce Tschantz. All data was inputted through the user form on the "Report an Incident" page. The database is not complete. More incidents will be added as new information becomes available.

To prevent malicious software from exploiting the database, a security field must be completed correctly before submission is permitted. For additional security, harmful characters are sanitized before entry into the MySQL database. During the initial population phase of the database, two incidents and sites were submitted by visitors to the site. The database creates a self-contained backup file once every seven days. Each backup file is saved for two years prior to deletion.

2.3 **Results**

The resulting database and user interface can be viewed at the following web URL: http://krcproject.groups.et.byu.net. Each of the user interface web pages ("About Submerged Hydraulic Jumps", "Browse Incidents", and "Report an Incident") are visible to the general public. The site is hosted through the Ira Fulton College of Engineering and Technology at Brigham Young University, Provo. There are no usage restrictions. Links to the database can be found on the ASDSO and American Whitewater websites. It has also been shared extensively through social media.

2.4 **Conclusions**

An extensive database of incidents at low-head dams was created to save lives by garnering public support for the remediation of dangerous structures and making information about the incidents at these structures readily available. As long as dangerous low-head dams exist, there will be more tragic cases and the database is destined to grow. The map and database demonstrate the need for addressing standards to improve public safety at low-head dams. The database is a catalyst to help engineers and lawmakers gather the information necessary to determine what remediation measures are required to make dangerous structures safe.

3 REDUCING HAZARDS AT LOW-HEAD DAMS: PHYSICAL MODEL OF STAGGERED DEFLECTOR SPILLWAY

Low-head dams can cause dangerous currents near the downstream face of the drop structure. The danger is due to a uniform countercurrent which causes upstream directed surface velocities. Few inexpensive retrofit alternatives have been studied that prevent the uniform countercurrent. This chapter investigates two cost-effective retrofit options: (1) a channel-wide horizontal flow deflector and (2) staggered flow deflectors. The channel wide flow deflectors cause uniform downstream directed surface velocities for a narrow range of tailwater elevations. The staggered flow deflectors prevent the uniform countercurrent for a wide range of tailwater elevations.

3.1 Introduction

Low-head dams are small drop structures in rivers, streams, or channels. They are constructed to impound water, set water surface elevations, meter discharge, or maintain stream slope. Many low-head dams are dangerous due to a hydraulic condition known in the engineering community as a submerged hydraulic jump. Members of the general public who are familiar with this phenomenon refer to it as a “hydraulic” or “drowning machine” (Borland-Coogan, 1980). This hydraulic condition forms downstream from the drop structure. More than 400 fatalities have occurred at more than 200 locations across the US (Kern and Hotchkiss, http://krcproject.groups.et.byu.net).

The possible flow conditions at low-head dams have been explained and classified in studies performed by Govinda Rao and Rajaratnam (1963), Leutheusser (1988), Leutheusser and Birk (1991), Ohtsu and Yasuda (1991), Leutheusser and Fan (2001), Mossa et al. (2004), and Tschantz and Wright (2011). These studies outline four possible flow conditions at low-head dams in subcritical channels: (1) swept out hydraulic jump, (2) optimal jump, (3) submerged jump, and (4) drowned-out jump. These four flow conditions are shown in Figure 3-1. A swept out hydraulic jump is characterized by a fully developed hydraulic jump preceded by a region of supercritical flow downstream from the dam. An optimal jump occurs when a fully developed hydraulic jump forms immediately downstream from the drop structure. A submerged hydraulic jump occurs when the tailwater depth is sufficient to cause water to become impounded against the face of the drop structure and is characterized by upstream directed surface velocities. A drowned-out jump is caused by very high tailwater that produces standing waves downstream from the hydraulic structure and swift downstream surface velocities.

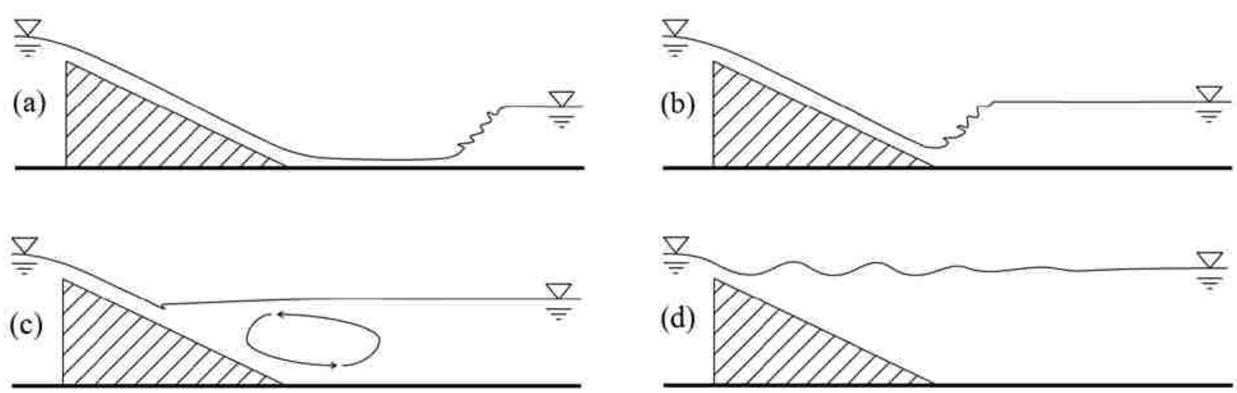

Figure 3-1: Hydraulic Conditions Downstream From Low-Head Dams: (a) Swept-Out Jump, (b) Optimal Jump, (c) Submerged Jump, (d) Drowned-Out Jump.

Unlike swept-out or optimal hydraulic jumps, the submerged hydraulic jump does not develop a region of visibly intense turbulence and rapidly increasing water depth associated with a fully developed hydraulic jump. In the submerged jump the plunging nappe entrains significant amounts of air as it meets the water impounded against the downstream face of the structure. A countercurrent develops due to the momentum of the plunging nappe and buoyant force of the air-entrained water that is carried downstream along the bottom of the channel. The surface velocity of the water just downstream from the face of the structure is directed upstream. This upstream directed surface velocity carries floating debris that has traversed the dam back toward the plunging nappe. It is the upstream directed surface velocity that makes this condition dangerous. The line that separates upstream and downstream surface velocities is called the boil. The submerged jump dissipates energy effectively, yet appears much more tranquil than the swept-out or optimal jumps. Due to the placid appearance, rafters and swimmers may not perceive the dam as a significant hazard (Tschantz and Wright, 2011). The current can easily capsize boats, rafts, kayaks, and canoes. If a swimmer gets caught in the current they are likely to be submerged by the force of the plunging nappe, resurface upstream of the boil, and be carried back to the plunging nappe to repeat the process (Wright et al., 1995). The extent of air entrainment makes swimming very difficult and the high velocities are almost certainly faster than even a strong swimmer could swim in ideal conditions (Leutheusser and Fan, 2001).

When considering remediation options for low-head dams factors such as effects on headwater elevation, debris passage, fish passage, energy dissipation, ice passage, variance of tailwater depths, and cost are important. Some proposed remediation options include dam removal, stepped spillways, sloped boulder spillways, and rock arc dams (Schweiger, 2011). A niche that needs further investigation is the development of a low cost retrofit option that improves public safety under a wide variety of tailwater and flow conditions while providing effective energy dissipation. The purpose of this study is to identify a cost effective and easily constructible retrofit alternative using physical models of various spillway configurations to eliminate the uniform countercurrent responsible for the public safety hazard at low-head dams.

3.2 **Background**

Low-head dams have widely varied spillway geometries including flat-topped and ogee-crested (Olsen et al. 2013). There is no universal definition of a low-head dam, though they are generally accepted to be a drop structure 16 ft or less in height (Tschantz and Wright, 2011). Models of sloping boulder spillways and stepped spillways have been shown to require slopes of 1H:10V and 1H:6V respectively to eliminate the dangerous countercurrent (Freeman and Garcia, 1996). A retrofit alternative utilizing a steep slope is less expensive to construct than a shallow slope, and is therefore more likely to be constructed when remediation options are being considered. United States Bureau of Reclamation (USBR) energy dissipaters are constructed using a 1:2V spillway face (USBR 1987). The primary method of energy dissipation for USBR energy dissipaters is based on the creation of a stable hydraulic jump or head-on impact on an immovable obstruction. Leutheusser and Birk (1991) proposed a USBR Type X spillway or a baffled chute spillway to eliminate the countercurrent, but Hotchkiss and Comstock (1991) countered this proposal noting that baffles are likely to introduce another mechanism of injury which may present even more danger than drowning.

Two spillways tested in this study are based on spillways fitted with horizontal flow deflectors in the Pacific Northwest. The deflectors were installed to decrease the mortality rate of juvenile salmonids traversing the dam by preventing the plunging nappe from impacting baffle blocks at the channel bottom (USACE, 1984). A deflector redirects current downstream without the public safety concerns of the impact associated with baffles.

3.3 Experimental Setup

A 1V:2H sloped spillway was constructed in 4 ft wide flume. The crest height (*P*) for the model was 1 ft. The flume was level for all runs. The headwater elevation was recorded 3*P* upstream from the crest of the dam and tailwater elevation was recorded 6*P* downstream from the crest of the dam. Using a distance of 3*P* upstream from the dam was sufficient to eliminate the effects of drawdown near the crest of the dam, and 6*P* downstream from the crest of the dam was sufficient to eliminate the amplitude of standing waves created by a drowned-out jump. Due to air-entrainment downstream from the dam peizometer readings would not be a reliable method for measuring depth. To obtain headwater and tailwater depths a graduated scale was used. Flow was measured with a venturi meter. The tailwater elevation was adjusted using a tailgate to impound water at the downstream end of the flume. The experimental setup can be seen in Figure 3-2.

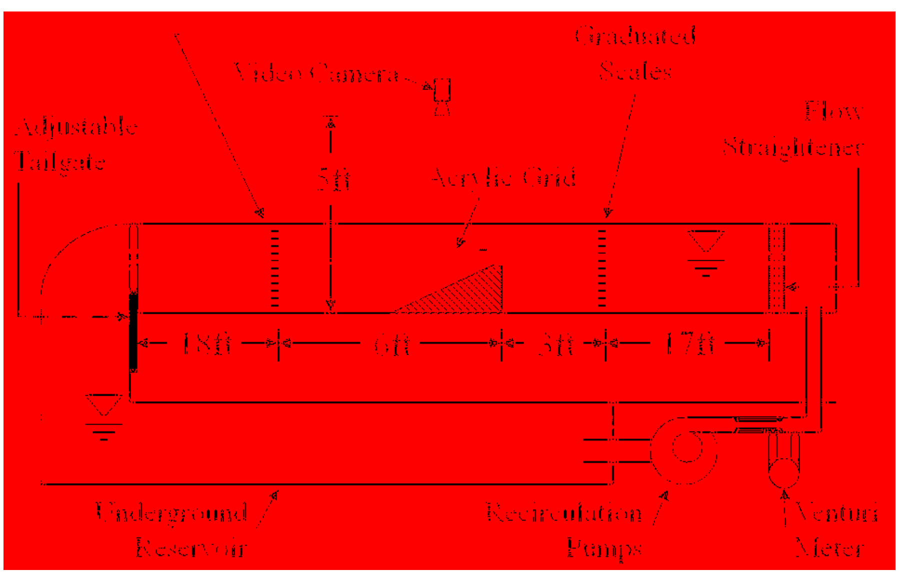

Figure 3-2: Experimental Setup

This study focuses on obtaining surface velocity measurements downstream from a model 1V:2H spillway under varying headwater and tailwater conditions. The submerged hydraulic jump produces a fairly uniform upstream directed velocity across the width of the channel. The unbroken region of upstream velocities provides little opportunity to pass trapped floating debris. In theory, introducing frequent regions of downstream directed surface velocity will provide opportunity for the passage of floating debris. Keeping regions of upstream directed surface velocities as small as possible will decrease the likelihood of entrapment. Surface velocities can also be used to calibrate and verify the results of computational flow dynamics (CFD) models. Studies by Savage and Johnson (2001) and Johnson and Savage (2006) verify that CFD models can be used to accurately model the flow at ogee-crested spillways.

Surface velocities were recorded by tracking 0.025 ft diameter floating beads at the surface of the water downstream from the dam. A horizontal grid was suspended 0.3 ft above the water surface with a grid spacing of 0.1 ft. For purposes of analysis the x-axis is defined to be positive in the downstream direction. The grid was aligned so that the plunging nappe meets the tailwater at an x-position of 0.1 ft. The origin of the y-axis corresponds to the flume wall on river left and the positive y-direction is toward river right. A downward facing video camera was placed 5 ft above the bottom of the channel. The camera recorded uncompressed video footage at a resolution of 720P at 30 frames per second. Downstream directed velocities (V_x) and lateral velocities (V_y) were recorded manually by recording the number of frames a bead took to travel a given distance in the x and y directions. V_y is positive when traveling toward river-right and negative when traveling toward river left. Velocities were recorded manually from the video because in the critical regions, where upstream directed velocities are greatest, beads were often not visible in all frames due to the high levels of air entrainment, thereby making automated tracking infeasible. The acrylic grid as viewed by the camera is shown in Figure 3-3. An example of the beginning and ending position of a bead are shown; the bead positions and frame numbers are recorded and used to calculate average velocity over a short distance.

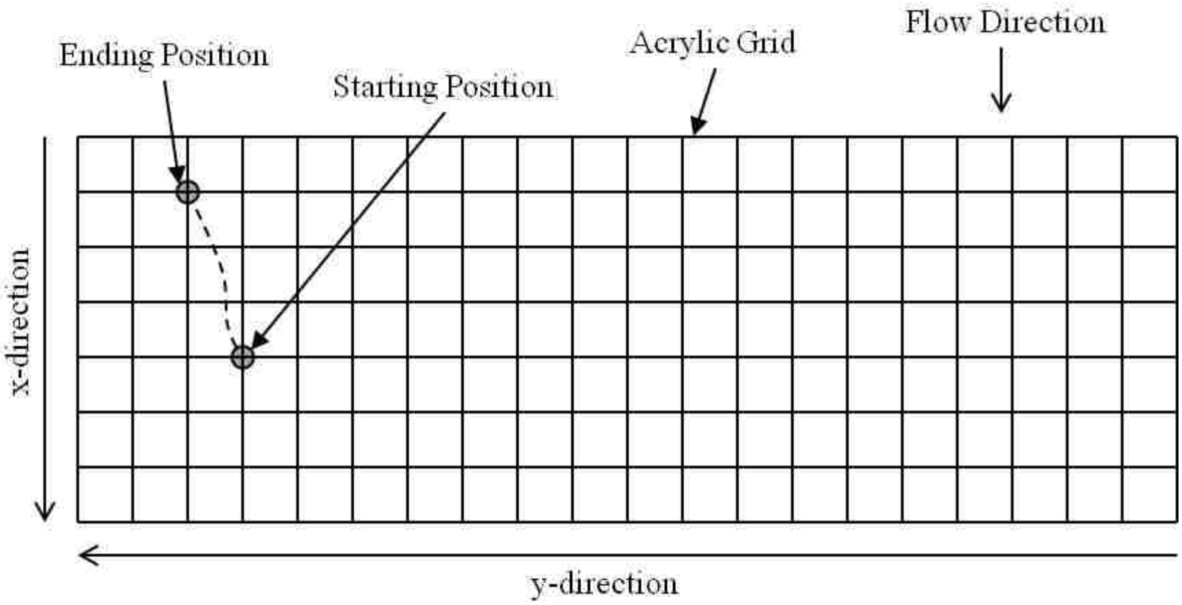

Figure 3-3: The Acrylic Grid as Seen by the Camera

Three spillway configurations were tested under a variety of headwater and tailwater conditions. The first spillway tested was an unmodified 1V:2H sloped spillway. The seconds was a 1V:2H sloped spillway with the addition of a single channel-wide horizontal flow deflector. The third is a 1V:2H sloped spillway with staggered partial-width flow deflectors. Each spillway was tested under a combination of four headwater conditions and four tailwater conditions.

3.4 **Sloped Spillway Methods**

Discharges pertaining to four headwater elevations were tested: 1.1*P*, 1.15*P*, 1.2P and 1.25*P*; these headwater elevations correspond to model discharges of 0.31, 0.64, 0.98, and 1.43 cfs respectively. The maximum headwater elevation that could be tested within the confines of the flume is 1.25*P*. The sloped spillway was tested to find the maximum tailwater elevation that produced an optimal jump for each headwater elevation (h_b) and the minimum tailwater depth that produced a drowned-out jump (h_d). Four tailwater elevations were chosen between h_b and h_d for each headwater elevation. The maximum tailwater elevation tested for each headwater elevation was *P*. Three additional tailwater elevations were selected between *P* and h_b for each discharge. The tailwater elevations tested for each discharge were separated by a constant distance (*k)* as shown in Figure 3-4. The resulting tailwater depths are shown in Table 3-1. Velocities were recorded across the width of the channel at *x*-positions that produced the lowest value of V_x.

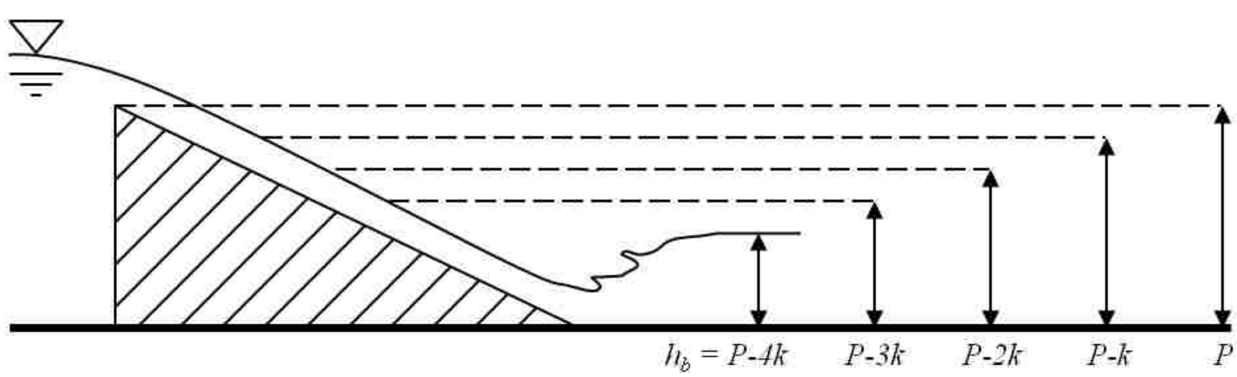

Figure 3-4: Determination of Tailwater Depths Tested

Table 3-1: Headwater/Tailwater Combinations Tested

Headwater [*P*]	Tailwater 1 [*P*]	Tailwater 2 [*P*]	Tailwater 3 [*P*]	Tailwater 4 [*P*]
1.25	1.00	0.85	0.70	0.55
1.2	1.00	0.84	0.67	0.51
1.15	1.00	0.82	0.63	0.45
1.1	1.00	0.79	0.59	0.38

3.5 Sloped Spillway Results

Every headwater/tailwater combination tested produced uniform upstream velocities (negative V_x values) with negligible lateral velocities. To create a dimensionless variable to represent the magnitude of the downstream directed velocity V_x is divided by critical velocity (V_c). Each V_x measurement includes a y-position that corresponds to the beginning and ending position (y_1 and y_2 respectively) of a bead over the course of several frames of video footage. The lateral position used to represent each V_x measurement is the midpoint between y_1 and y_2 (y_A). To create a dimensionless variable to represent the lateral position of each point y_A is divided by P. The results for all headwater/tailwater combinations are shown in Figure 3-5, 3-6, 3-7, and 3-8. Fourth order polynomial trend lines are used to represents the trends of hundreds of data points. The equations are not predictive, but are merely used to illustrate trends. All data collected for the standard spillway can be seen in the Appendix A, as well as a chart containing all the points for each headwater/tailwater combination and its representative trend line.

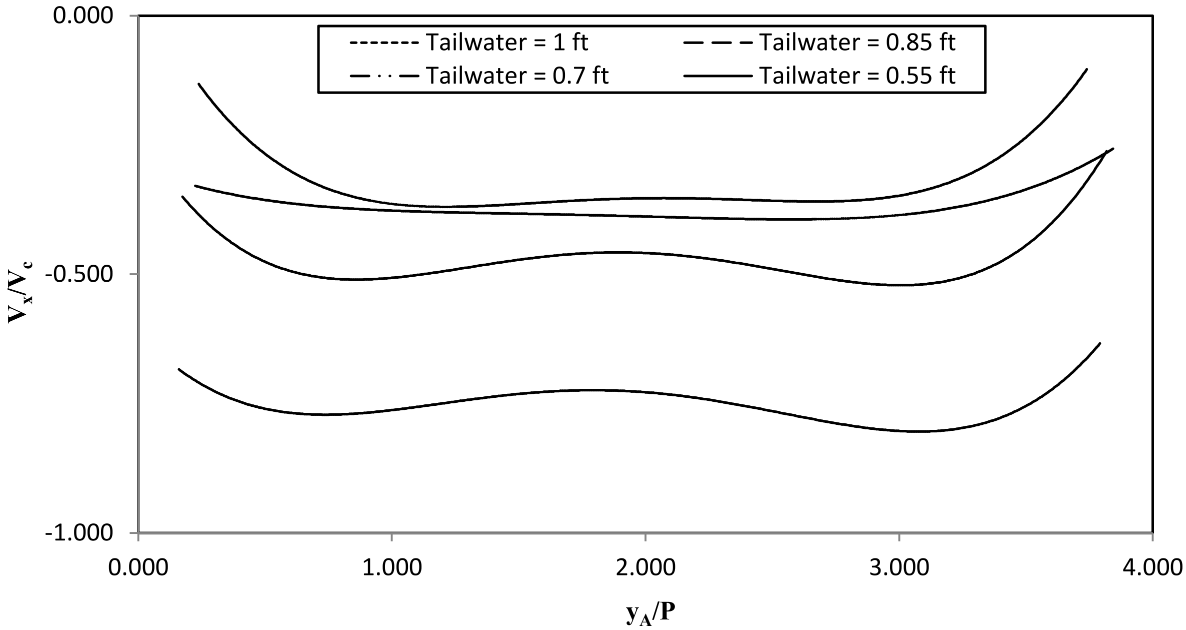

Figure 3-5: Standard Spillway Results; Headwater = 1.25P

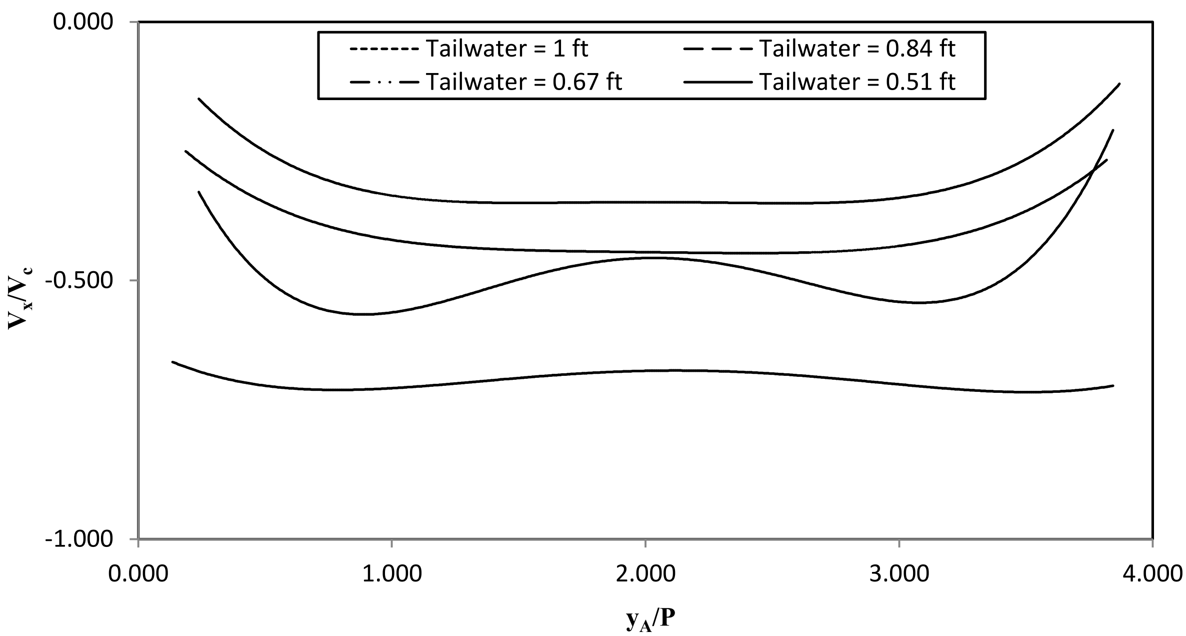

Figure 3-6: Standard Spillway Results; Headwater = 1.20P

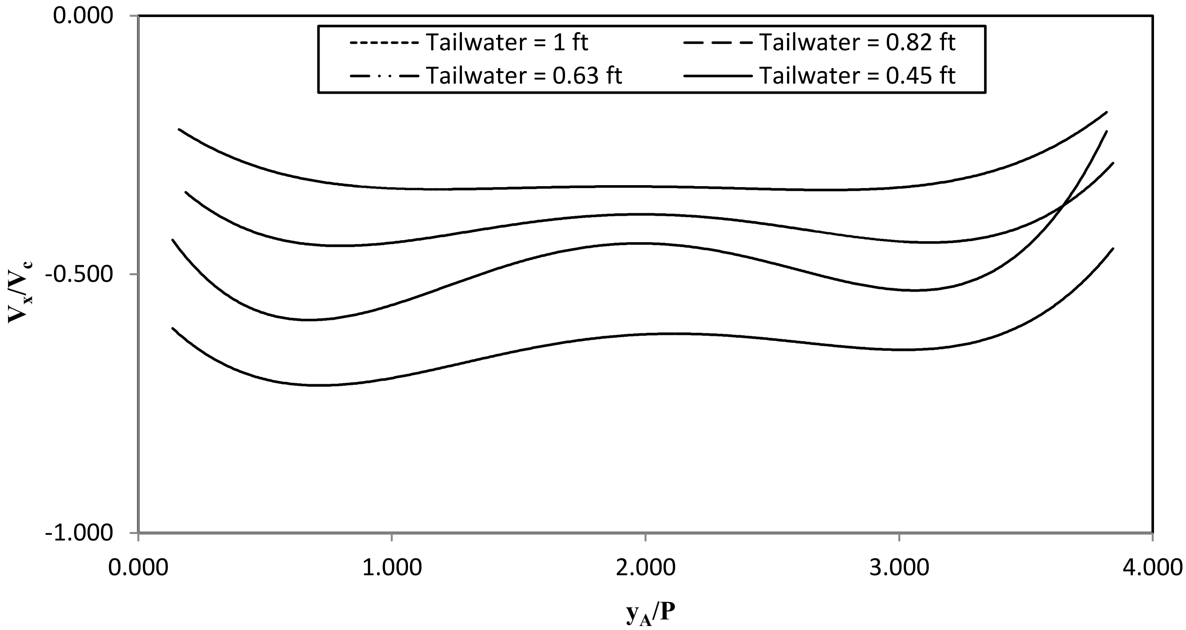

Figure 3-7: Standard Spillway Results; Headwater = 1.15P

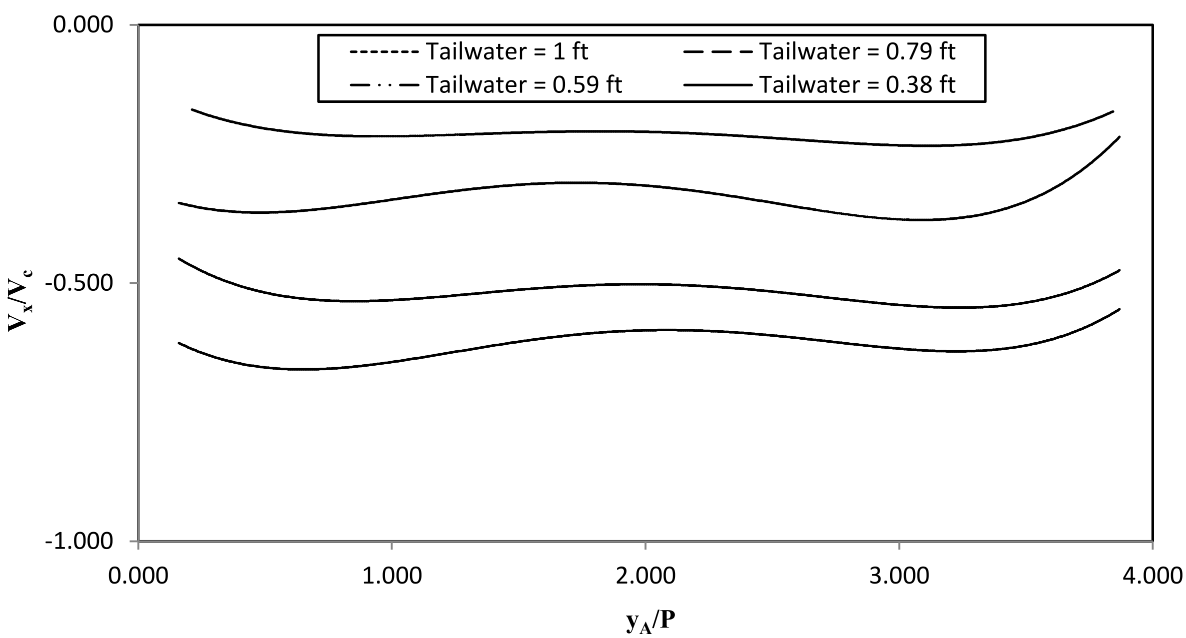

Figure 3-8: Standard Spillway Results; Headwater = 1.10P

3.6 **Spillway with Deflector Methods**

A horizontal flow deflector spanning the channel was added to the 1V:2H spillway. The deflector was installed at a height of 0.7*P*. Two deflector lengths (L_d) were tested, where L_d is the length of the "shelf." The purpose of the flow deflector is to eliminate the downward component of velocity in the plunging nappe. Eliminating the downward component of velocity will prevent air-entrained water from moving downstream along the bottom of the channel and to use the momentum of the redirected nappe to force a downstream directed surface velocity. A deflector with an L_d of 0.15*P* was installed. This deflector spillway was run under the same headwater/tailwater combinations as the standard spillway. When run with the highest headwater elevation, it appeared as if the deflector may not have eliminated the entire downward component of velocity in the nappe. To determine whether or not a greater deflector length was needed a deflector with an L_d of 0.25*P* was tested.

3.7 **Spillway with Deflector Results**

The deflector spillway model was observed under the entire range of tailwater conditions to determine for what range of tailwater elevations the deflector could eliminate upstream directed surface velocities. Figure 3-9 shows the spillway geometry and the resulting flow conditions. Table 3-2 shows the tailwater elevations where transitions occur between flow conditions for deflectors with L_d of 0.15*P* and 0.25*P* at multiple discharges. Tailwater elevations from h_b to a level near 0.7*P* developed a countercurrent; Figure 3-9(c) or condition c. As the tailwater elevation was increased to an elevation above 0.7*P*, a standing wave with the characteristics of a drowned-out jump developed; Figure 3-9(b) or condition b. As the tailwater elevation was increased to an elevation near *P* another countercurrent developed; Figure 3-9(a) or condition a. The transitions from countercurrent to standing wave to countercurrent are abrupt and well defined. As the tailwater elevation was raised from h_b to a level near $0.7P$ the air entrained water forming the countercurrent was suddenly swept downstream and a standing wave formed in its stead (Figure 3-9 c to b). As the tailwater elevation was increased, the amplitude of the standing wave increased until the apex of the first wave began to crown and create a small countercurrent above the deflector (condition b to a). As the tailwater elevation was lowered, the region forming the countercurrent above the deflector decreased until it was swept away beyond the apex of the first standing wave (condition a to b). As the water was lowered the amplitude of the standing wave decreased. When the tailwater elevation was lowered enough for the deflected flow to plunge, a small region would begin to entrain air; that region of air entrainment swiftly spread across the width of the channel (condition b to c). The tailwater elevations that form the lower bound of the standing wave flow conditions are dependent on the current flow conditions. If the tailwater is low enough for a countercurrent to form downstream from the deflector, the transition from countercurrent to standing wave will occur at a higher elevation than the transition from standing wave to countercurrent. It was observed that the less dense air-entrained water forming the countercurrent would cause the horizontal flow leaving the flow deflector to plunge due to its higher density; however, if there was not significant air entrainment downstream from the deflector the flow would not plunge and form a standing wave.

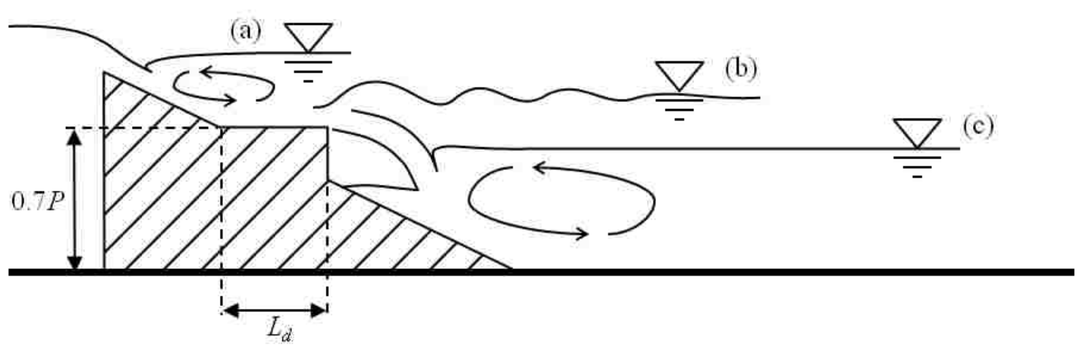

Figure 3-9: Possible Conditions when Tailwater is Near 0.7P

Table 3-2: Tailwater Elevation Boundaries for Safe Flow Conditions

L_d = 0.15*P*				
Headwater [*P*]	a to b	b to a	b to c	c to b
1.10	0.82	0.82	0.70	0.74
1.15	0.86	0.86	0.72	0.77
1.20	0.9	0.91	0.74	0.8
1.25	0.96	0.97	0.78	0.83
L_d = 0.25*P*				
Headwater [*P*]	a to b	b to a	b to c	c to b
1.10	0.81	0.81	0.70	0.73
1.15	0.86	0.86	0.71	0.76
1.20	0.9	0.91	0.73	0.78
1.25	0.96	0.96	0.77	0.82

Based on the data in Table 3-2 it is clear that the differences between the results for both deflectors are negligible. The deflector spillway with an L_d of 0.15*P* was run under the same headwater/tailwater combinations as the standard spillway. The results are shown in Figure 3-10, 3-11, 3-12, and 3-13. The results are represented by fourth order polynomial trend lines. The headwater/tailwater combination of 1.25*P* and 1*P* respectively produced a region of upstream directed velocity smaller than the smallest graduation on the grid used to determine starting and ending position, therefore no results were obtained. For each headwater elevation tested, the countercurrent was only eliminated for one of the four tailwater elevations tested, and there is no apparent decrease in upstream directed velocities for the other tailwater elevations. It is also apparent, based on the resulting surface velocities, that the energy dissipation characteristics of the deflector spillway when the countercurrent is eliminated are poor. All data collected for the deflector spillway can be seen in Appendix B, as well as a chart containing all the points for each headwater/tailwater combination and its representative trend line.

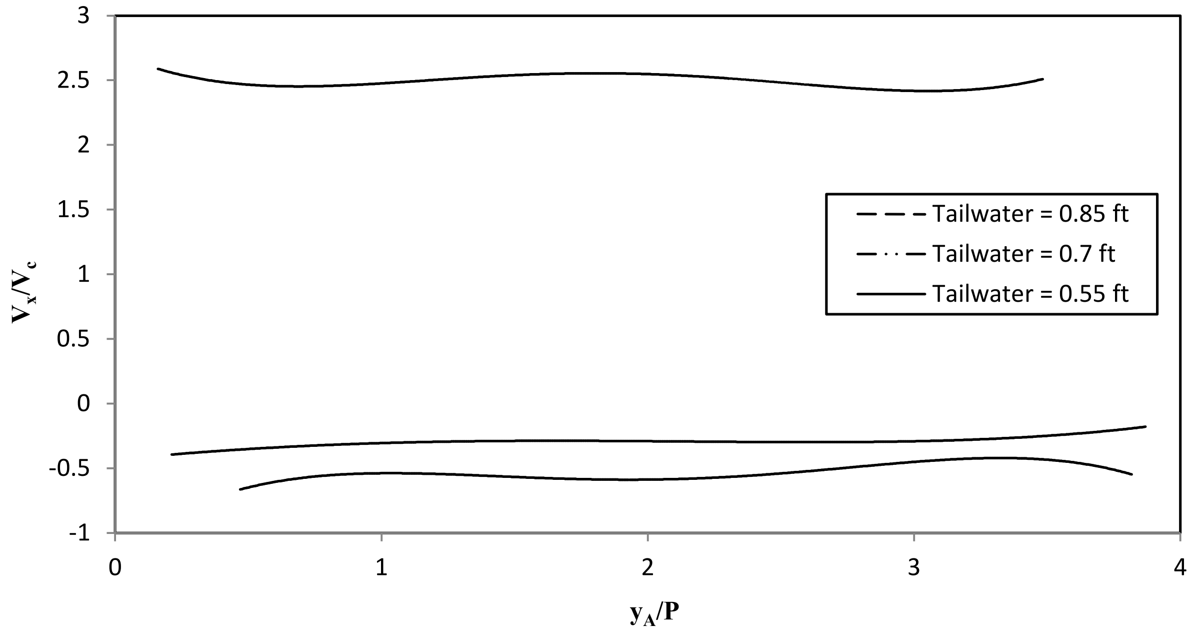

Figure 3-10: Deflector Spillway; Headwater = 1.25P

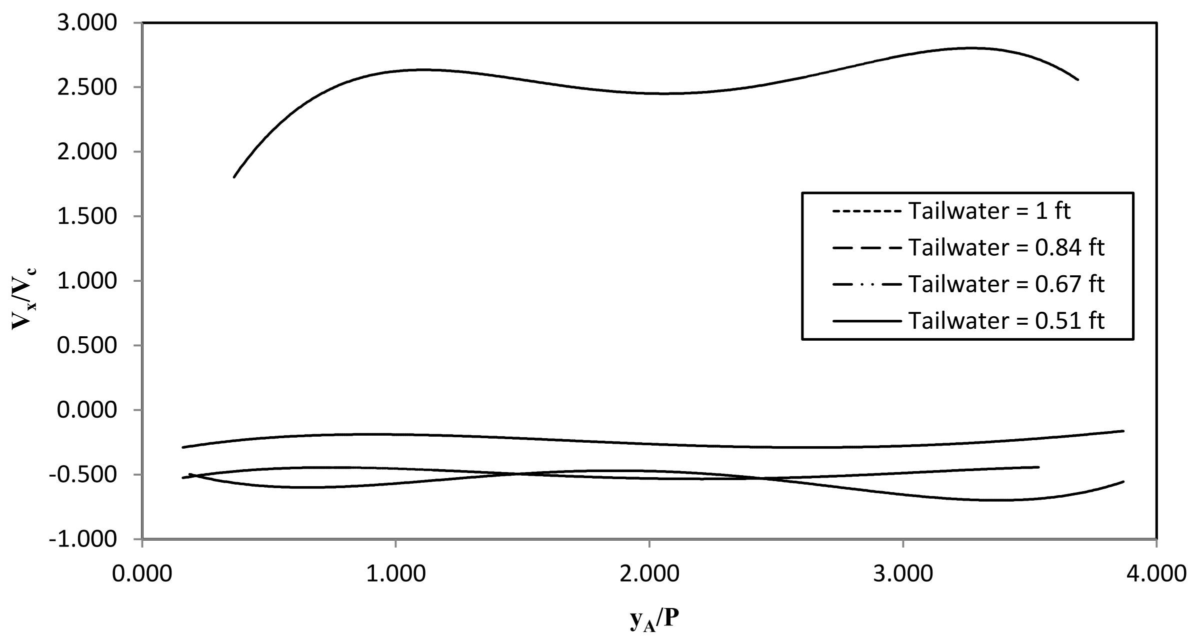

Figure 3-11: Deflector Spillway; Headwater = 1.20P

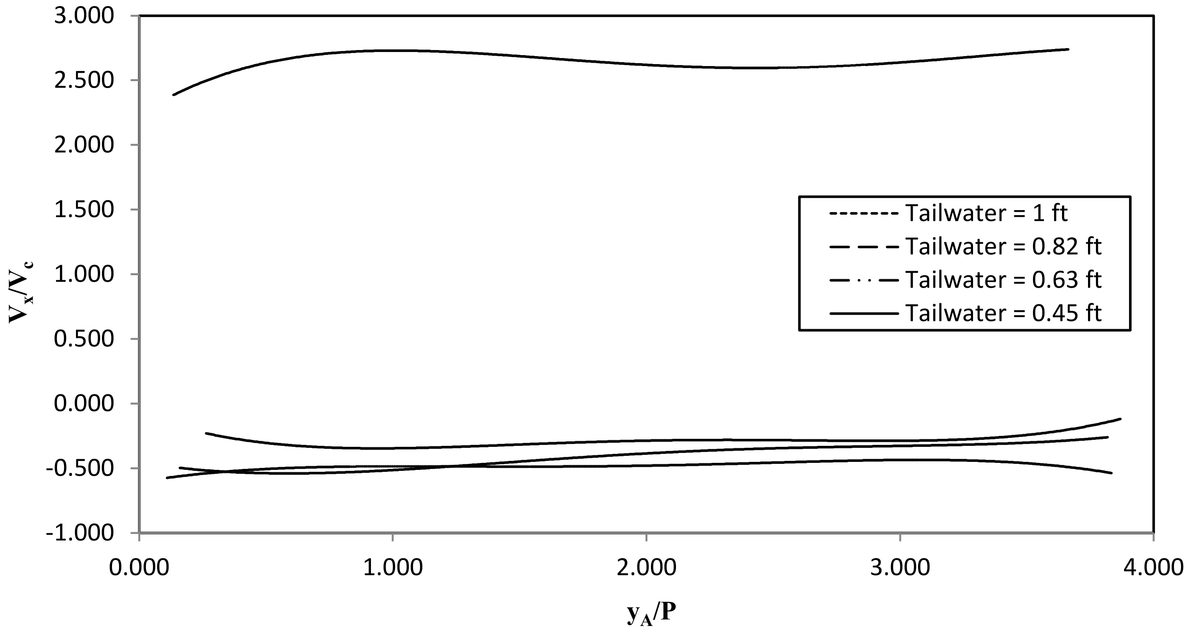

Figure 3-12: Deflector Spillway; Headwater = 1.15P

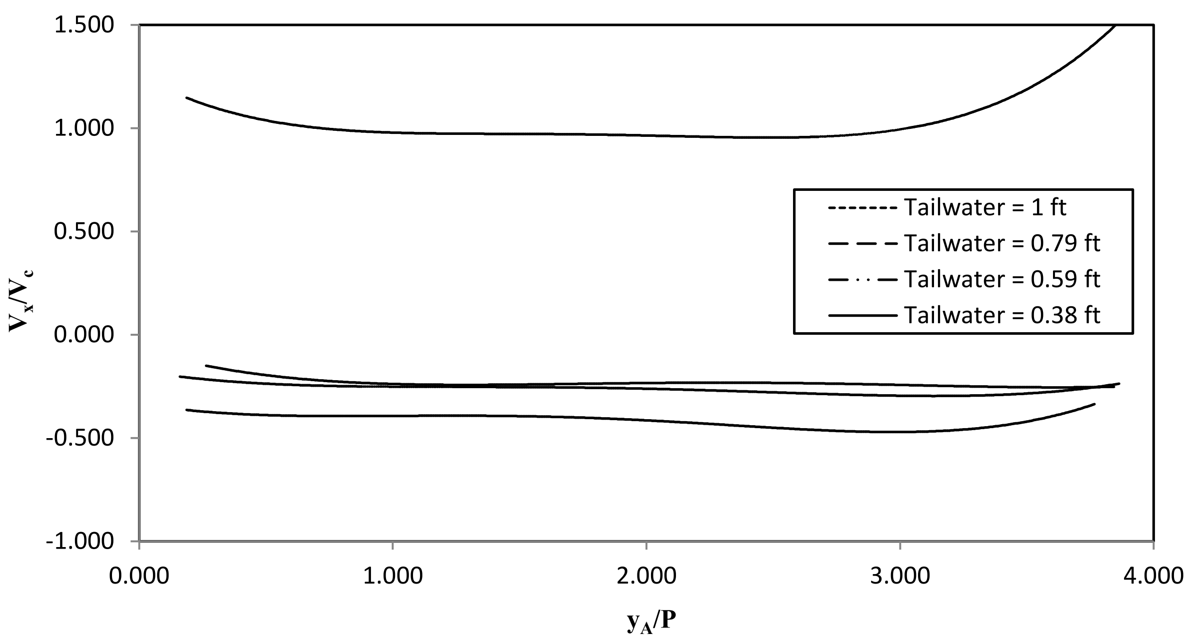

Figure 3-13: Deflector Spillway; Headwater = 1.10P

3.8 Staggered Deflector Spillway Methods

The purpose of the staggered deflector spillway is to place partial-width deflectors at multiple elevations to reduce the spillways sensitivity to tailwater elevation. The staggered deflector spillway is not intended to eliminate all upstream directed velocities, but to minimize the width of regions of upstream velocities and create lateral velocities to allow an object in this region to be ejected. Figure 3-14 shows the geometry of the staggered deflector spillway tested. The results of the full-width deflector spillway suggest that a deflector is needed at vertical intervals of 0.1*P*. However the plunging nappe leaving the deflector at an elevation of 0.7*P* did not make contact with the face of the spillway until it plunged to an elevation of 0.3*P*. Since a deflector cannot deflect flow that it does not touch, the spillway could feasibly have only two levels of deflectors at any given *y*-position across the channel. It is desirable to have two iterations of each step height to ensure that there is at least one instance of each step height near the center of the channel. Due to the width restrictions of the flume, the spillway was separated into six sections with two deflectors each. The resulting elevation difference between deflectors is 0.13*P*. At any given *y*-position the deflector at the higher elevation has an L_d equal to 0.15*P*. It was observed that mild turbulence within deflected flow caused the nappe to spread as it plunged. To ensure that the flow is deflected at the lower deflector an L_d equal to 0.25*P* is used.

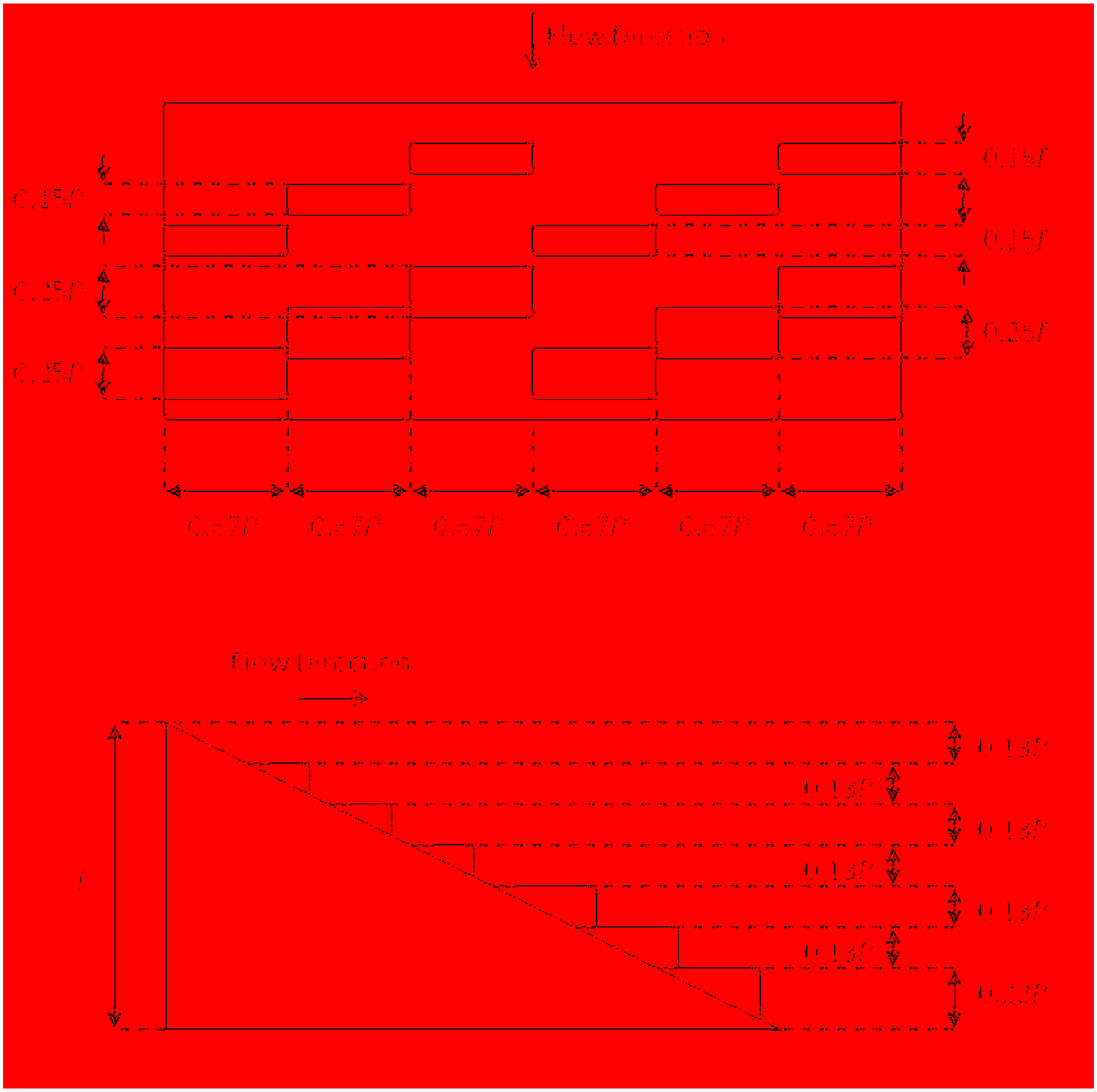

Figure 3-14: Modified Deflector: Plan View (top) and Longitudinal Profile (bottom)

3.9 Staggered Deflector Spillway Results

The results for the staggered deflector spillway can be seen in Figure 3-15, 3-16, 3-17, and 3-18. The data from 0.67*P* to 3.33*P* is represented by sixth order polynomial trend lines. The data within 0.67*P* of the flume walls was excluded because the flow characteristics were greatly altered by the presence of vertical walls. All the headwater/tailwater combinations tested resulted in a zone of downstream directed surface velocity with the exception of the headwater/tailwater combination of 1.1P and 1P respectively. This headwater/tailwater combination produced flow which formed a small countercurrent above the highest deflector. Unlike the deflector spillway, significant amounts of air entrainment were seen for all runs where positive V_x values were observed. The visible turbulence and extent of air entrainment indicates that the modified deflector spillway exhibits much better energy dissipation characteristics than the full-width deflector spillway at tailwater elevations producing positive V_x values. Lateral velocities were much greater than those observed for the other two spillway configurations. At all tailwater elevations below 0.95P at least one deflector was always producing a region of positive V_x values. All data collected for the modified deflector spillway can be seen in Appendix C, as well as a chart containing all the points for each headwater/tailwater combination and its representative trend line.

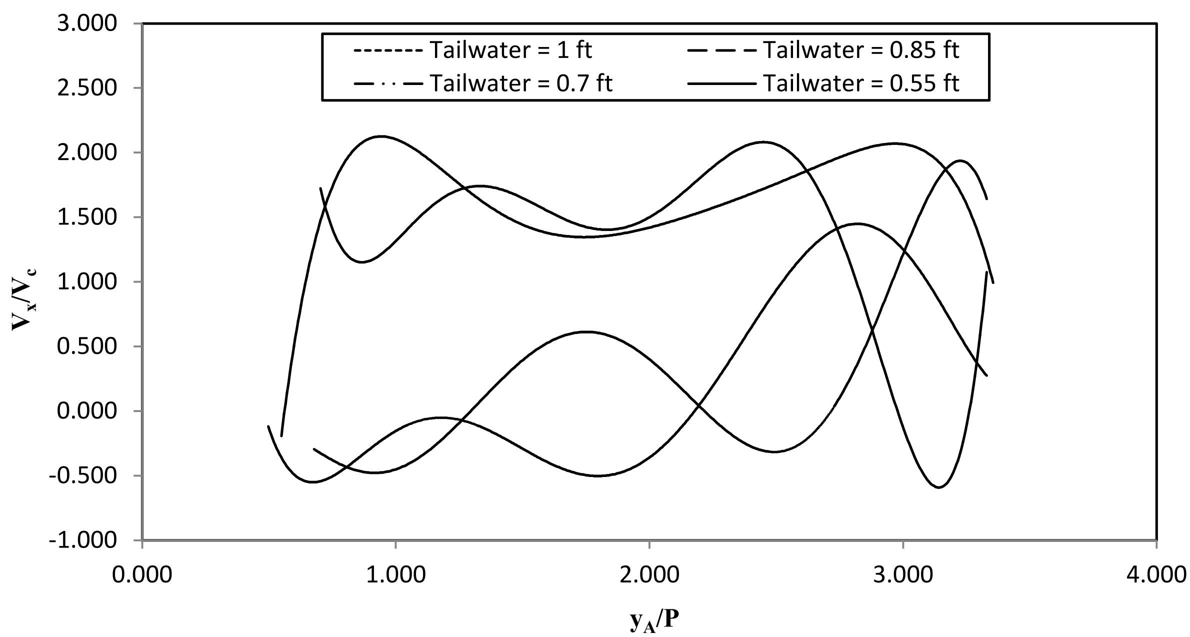

Figure 3-15: Modified Deflector Spillway; Headwater = 1.25P

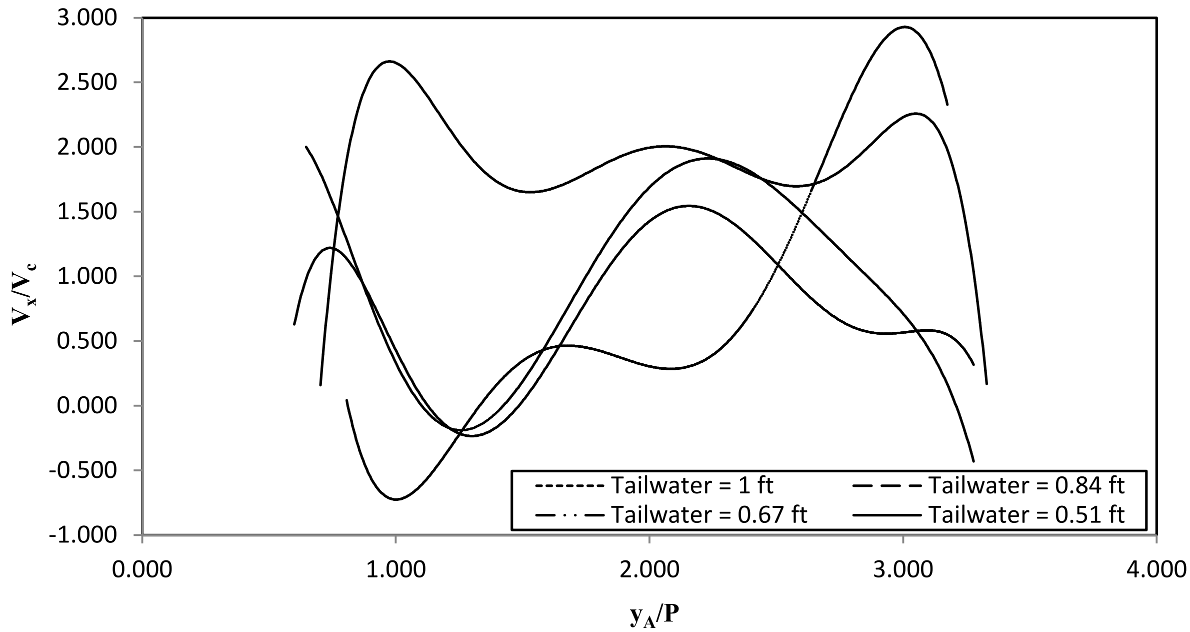

Figure 3-16: Modified Deflector Spillway; Headwater = 1.20P

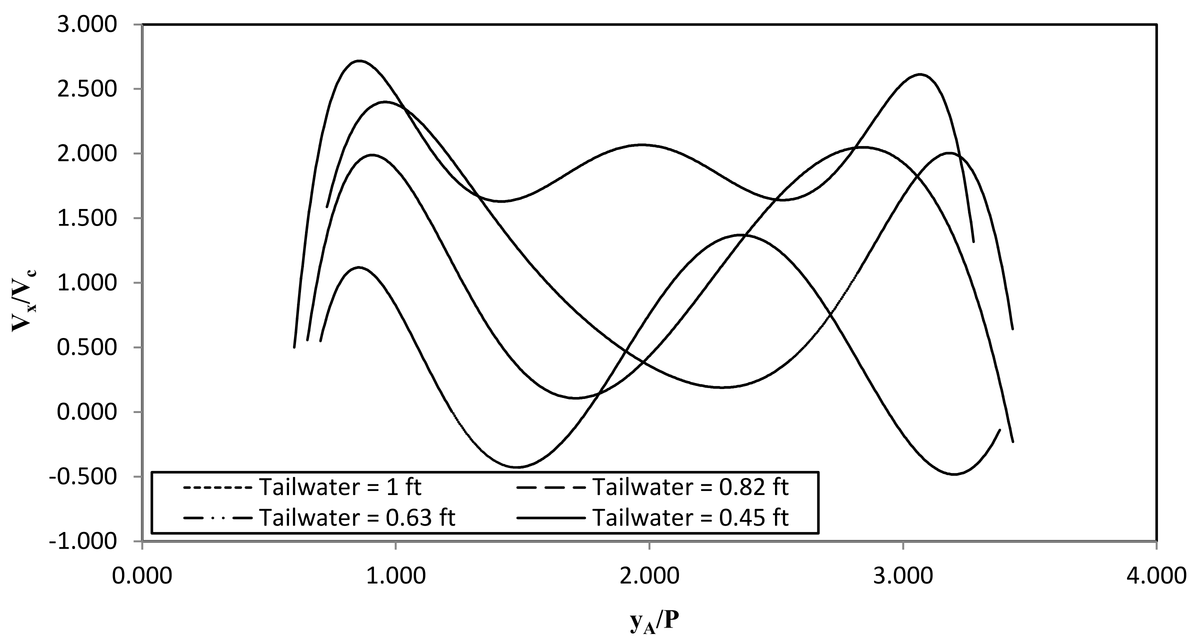

Figure 3-17: Modified Deflector Spillway; Headwater = 1.15P

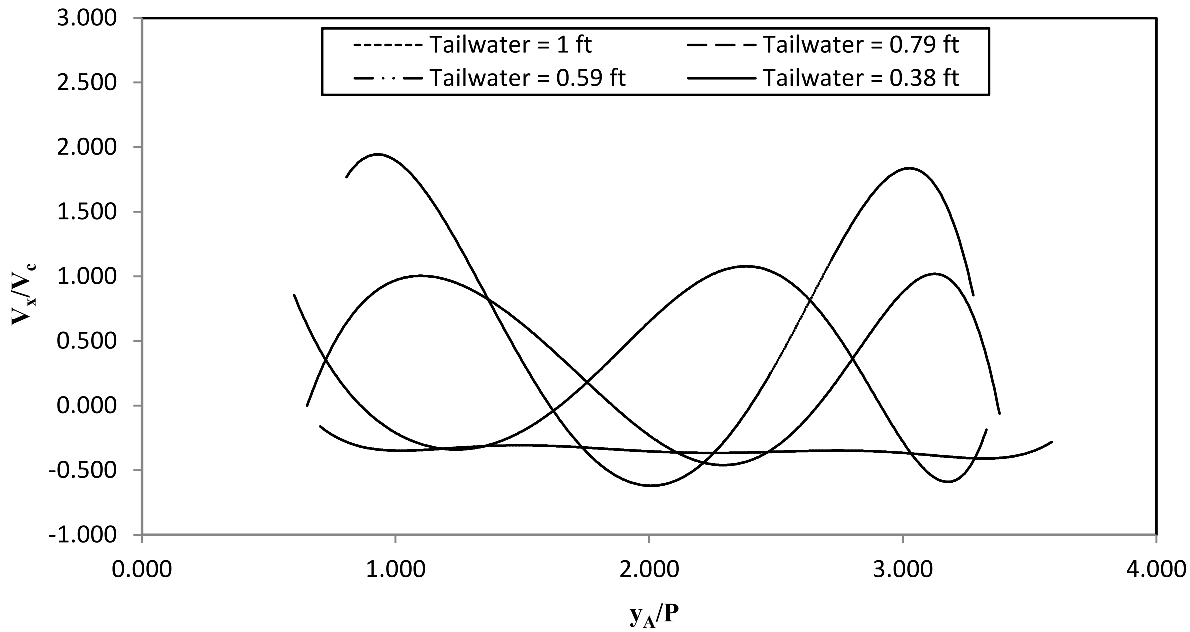

Figure 3-18: Modified Deflector Spillway; Headwater = 1.10P

3.10 **Conclusions**

The standard spillway produces a channel-wide region of upstream directed surface velocities for a broad range of tailwater elevations. When testing under the same headwater and tailwater conditions, the deflector spillway was able to produce a zone of uniform downstream directed velocities for a narrow range of tailwater elevations near the deflector. The modified partial-width deflector spillway was able to break up the countercurrent and produce zones of downstream directed velocity for a broad range of tailwater elevations. The results presented in this paper can serve to calibrate CFD models which can be used to further investigate the effects of deflector size and position. The results presented ultimately demonstrate the merit of the staggered deflector spillway as a method to improve public safety at low head dams.

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APPENDIX A. STANDARD SPILLWAY DATA AND CALCULATIONS

This section presents the raw data collected and variables calculated from the raw data. The data presented includes the starting *x*-position (x_1), starting *y*-position (y_1), ending *x*-position (x_2), ending *y*-position (y_2), starting frame ($Frame_1$), and ending frame ($Frame_2$). The calculated dimensionless variables include the downstream directed velocity (V_x) divided by critical velocity (V_c), the lateral velocity in the direction of river-right (V_y) divided by V_c, the average *x*-position (x_{Ave}) divided by the crest heght of the dam (P), and the average y-position (y_{Ave}) divided by P.

Table A-1: Headwater = 1.25P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.7	0.2	0.2	0.55	955	1012	-0.12	0.084	0.419	0.368
2	0.7	0.2	0.2	0.35	1322	1361	-0.175	0.052	0.419	0.265
3	0.7	0.2	0.2	0.35	1433	1473	-0.17	0.051	0.419	0.265
4	0.7	0.2	0.4	0.35	1363	1418	-0.124	-0.012	0.419	0.368
5	0.7	0.2	0.4	0.4	2058	2089	-0.22	0	0.419	0.394
6	0.7	0.2	0.4	0.4	4497	4531	-0.2	0	0.419	0.394
7	0.7	0.2	0.6	0.4	1439	1461	-0.31	-0.124	0.419	0.497
8	0.7	0.2	0.6	0.65	4300	4332	-0.213	0.021	0.419	0.626
9	0.7	0.2	0.6	0.5	4725	4745	-0.341	-0.068	0.419	0.549
10	0.7	0.2	0.8	0.7	4634	4651	-0.401	-0.08	0.419	0.754
11	0.7	0.2	0.8	0.75	4782	4804	-0.31	-0.031	0.419	0.78
12	0.7	0.2	0.8	0.9	4869	4894	-0.273	0.055	0.419	0.857
13	0.7	0.2	1	0.9	5013	5029	-0.426	-0.085	0.419	0.96
14	0.7	0.2	1	0.9	5025	5042	-0.401	-0.08	0.419	0.96
15	0.7	0.2	1	0.75	5201	5219	-0.379	-0.189	0.419	0.883
16	0.7	0.2	1.2	0.9	5341	5364	-0.296	-0.178	0.419	1.063
17	0.7	0.2	1.2	1.2	5386	5406	-0.341	0	0.419	1.218

Table A-1 Continued: Headwater = 1.25P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
18	0.7	0.2	1.2	1	5579	5603	-0.284	-0.114	0.419	1.115
19	0.7	0.2	1.4	1.35	5800	5815	-0.454	-0.045	0.419	1.398
20	0.7	0.2	1.4	1.35	6104	6124	-0.341	-0.034	0.419	1.398
21	0.7	0.2	1.4	1.25	6257	6272	-0.454	-0.136	0.419	1.347
22	0.7	0.2	1.6	1.6	6563	6582	-0.359	0	0.419	1.63
23	0.7	0.2	1.6	1.7	6780	6802	-0.31	0.062	0.419	1.681
24	0.7	0.2	1.8	1.8	7517	7532	-0.454	0	0.419	1.836
25	0.7	0.2	1.8	1.9	7742	7759	-0.401	0.08	0.419	1.887
26	0.7	0.2	1.8	1.85	7998	8020	-0.31	0.031	0.419	1.862
27	0.7	0.2	2	2.05	8149	8165	-0.426	0.043	0.419	2.068
28	0.7	0.2	2	2	8485	8505	-0.341	0	0.419	2.042
29	0.7	0.2	2	1.95	9217	9244	-0.252	-0.025	0.419	2.016
30	0.7	0.2	2.2	2.2	2339	2368	-0.235	0	0.419	2.248
31	0.7	0.2	2.2	2.35	2447	2468	-0.324	0.097	0.419	2.325
32	0.7	0.2	2.2	2.25	2504	2518	-0.487	0.049	0.419	2.274
33	0.7	0.2	2.4	2.5	3206	3223	-0.401	0.08	0.419	2.505
34	0.7	0.2	2.4	2.3	3530	3549	-0.359	-0.072	0.419	2.402
35	0.7	0.2	2.4	2.35	3992	4015	-0.296	-0.03	0.419	2.428
36	0.7	0.2	2.6	2.7	4022	4036	-0.487	0.097	0.419	2.711
37	0.7	0.2	2.6	2.6	4158	4180	-0.31	0	0.419	2.66
38	0.7	0.2	2.6	2.55	4387	4412	-0.273	-0.027	0.419	2.634
39	0.7	0.2	2.8	2.9	4554	4576	-0.31	0.062	0.419	2.917
40	0.7	0.2	2.8	2.85	4624	4641	-0.401	0.04	0.419	2.892
41	0.7	0.2	2.8	2.8	4708	4734	-0.262	0	0.419	2.866
42	0.7	0.2	3	3	4772	4788	-0.426	0	0.419	3.072
43	0.7	0.2	3	2.9	4808	4836	-0.243	-0.049	0.419	3.02
44	0.7	0.2	3	3	4866	4881	-0.454	0	0.419	3.072
45	0.7	0.2	3.2	3.3	4962	4983	-0.324	0.065	0.419	3.329
46	0.7	0.2	3.2	3.25	4981	4999	-0.379	0.038	0.419	3.304
47	0.7	0.2	3.2	3.2	5058	5080	-0.31	0	0.419	3.278
48	0.7	0.2	3.4	3.55	5180	5239	-0.115	0.035	0.419	3.561
49	0.7	0.2	3.4	3.55	5250	5277	-0.252	0.076	0.419	3.561
50	0.7	0.2	3.4	3.55	5334	5370	-0.189	0.057	0.419	3.561
51	0.7	0.2	3.6	3.55	634	683	-0.139	-0.014	0.419	3.664
52	0.7	0.2	3.6	3.45	1019	1079	-0.114	-0.034	0.419	3.613
53	0.7	0.2	3.6	3.4	1418	1442	-0.284	-0.114	0.419	3.587
54	0.7	0.2	3.8	3.45	5916	5967	-0.134	-0.094	0.419	3.716
55	0.7	0.2	3.8	3.55	2233	2271	-0.179	-0.09	0.419	3.767
56	0.7	0.2	3.8	3.4	6582	6634	-0.131	-0.105	0.419	3.69

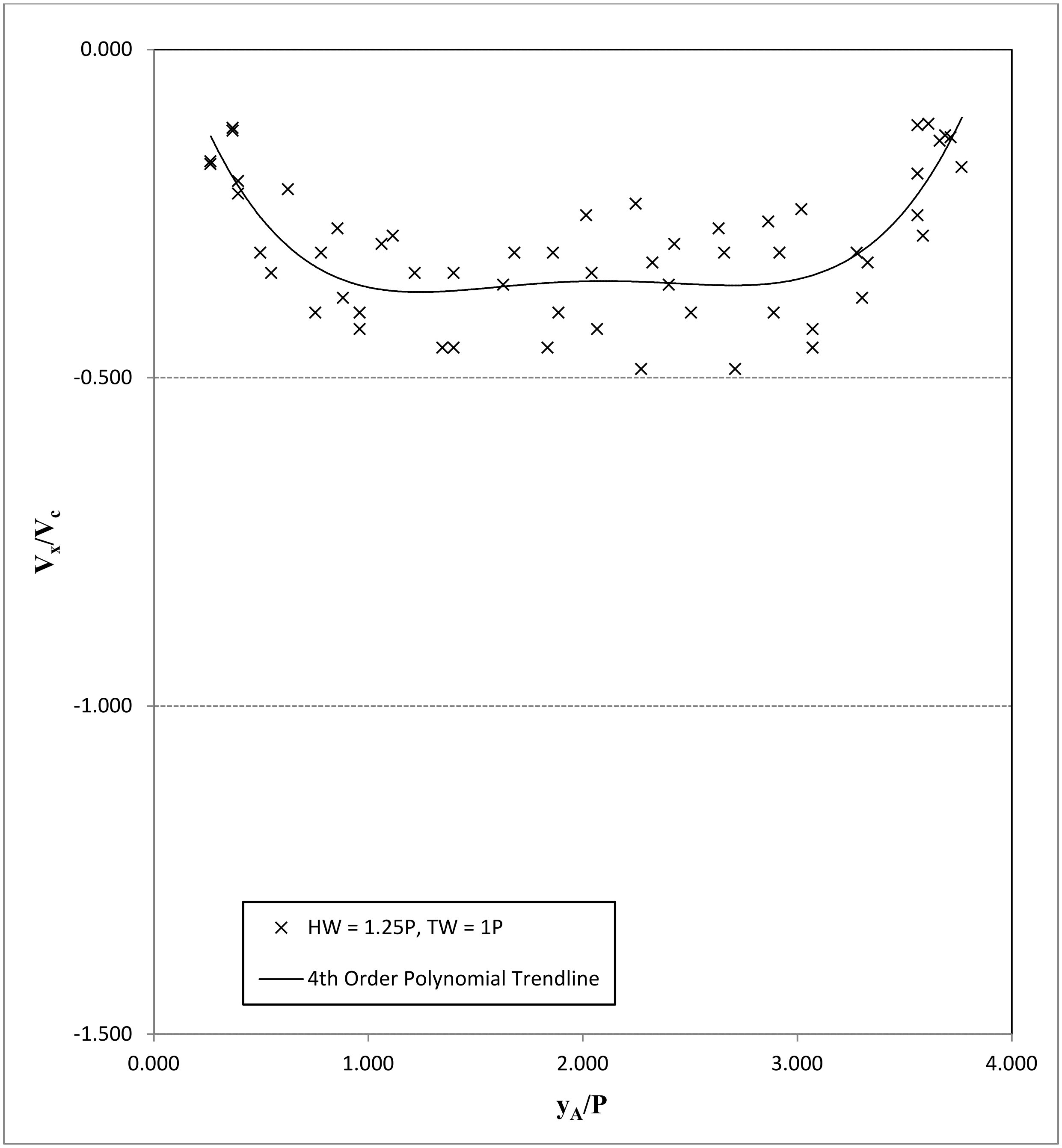

Figure A-1: Headwater = 1.25P, Tailwater = 1P

Table A-2: Headwater = 1.25P, Tailwater = 0.85P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.7	0.2	0.2	0.525	1811	1850	-0.175	0.114	0.419	0.355
2	0.7	0.2	0.2	0.6	2295	2328	-0.206	0.165	0.419	0.394
3	0.7	0.2	0.2	0.325	3081	3095	-0.487	0.122	0.419	0.252
4	0.7	0.2	0.4	0.4	1169	1197	-0.243	0	0.419	0.394
5	0.7	0.2	0.4	0.45	1421	1439	-0.379	0.038	0.419	0.42
6	0.7	0.2	0.4	0.35	1473	1488	-0.454	-0.045	0.419	0.368
7	0.7	0.2	0.6	0.4	768	789	-0.324	-0.13	0.419	0.497
8	0.7	0.2	0.6	0.625	935	955	-0.341	0.017	0.419	0.613
9	0.7	0.2	0.6	0.55	1542	1558	-0.426	-0.043	0.419	0.574
10	0.7	0.2	0.8	0.7	653	670	-0.401	-0.08	0.419	0.754
11	0.7	0.2	0.8	0.95	705	720	-0.454	0.136	0.419	0.883
12	0.7	0.2	0.8	0.75	1039	1058	-0.359	-0.036	0.419	0.78
13	0.7	0.2	1	0.875	564	577	-0.524	-0.131	0.419	0.948
14	0.7	0.2	1	0.95	664	684	-0.341	-0.034	0.419	0.986
15	0.7	0.2	1	1.25	1365	1385	-0.341	0.17	0.419	1.141
16	0.7	0.2	1.2	1	937	952	-0.454	-0.182	0.419	1.115
17	0.7	0.2	1.2	1	1089	1113	-0.284	-0.114	0.419	1.115
18	0.7	0.2	1.2	0.9	1278	1293	-0.454	-0.273	0.419	1.063
19	0.7	0.2	1.4	1.2	747	775	-0.243	-0.097	0.419	1.321
20	0.7	0.2	1.4	1.2	786	809	-0.296	-0.119	0.419	1.321
21	0.7	0.2	1.4	1.3	1009	1024	-0.454	-0.091	0.419	1.372
22	0.7	0.2	1.6	1.6	363	378	-0.454	0	0.419	1.63
23	0.7	0.2	1.6	1.55	1303	1327	-0.284	-0.028	0.419	1.604
24	0.7	0.2	1.6	1.85	1587	1609	-0.31	0.155	0.419	1.759
25	0.7	0.2	1.8	1.8	244	259	-0.454	0	0.419	1.836
26	0.7	0.2	1.8	1.7	540	559	-0.359	-0.072	0.419	1.784
27	0.7	0.2	1.8	1.7	795	815	-0.341	-0.068	0.419	1.784
28	0.7	0.2	2	2.1	244	260	-0.426	0.085	0.419	2.093
29	0.7	0.2	2	1.95	577	591	-0.487	-0.049	0.419	2.016
30	0.7	0.2	2	2.05	730	746	-0.426	0.043	0.419	2.068
31	0.7	0.2	2.2	2.4	451	473	-0.31	0.124	0.419	2.351
32	0.7	0.2	2.2	2.15	934	953	-0.359	-0.036	0.419	2.222
33	0.7	0.2	2.2	2.3	1094	1110	-0.426	0.085	0.419	2.299
34	0.7	0.2	2.4	2.4	486	502	-0.426	0	0.419	2.454
35	0.7	0.2	2.4	2.15	669	688	-0.359	-0.179	0.419	2.325
36	0.7	0.2	2.4	2.5	728	749	-0.324	0.065	0.419	2.505
37	0.7	0.2	2.6	2.5	489	502	-0.524	-0.105	0.419	2.608
38	0.7	0.2	2.6	2.6	826	844	-0.379	0	0.419	2.66
39	0.7	0.2	2.6	2.55	998	1012	-0.487	-0.049	0.419	2.634

Table A-2 Continued: Headwater = 1.25P, Tailwater = 0.85P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.7	0.2	2.8	2.7	396	418	-0.31	-0.062	0.419	2.814
41	0.7	0.2	2.8	2.8	886	906	-0.341	0	0.419	2.866
42	0.7	0.2	2.8	2.85	1065	1078	-0.524	0.052	0.419	2.892
43	0.7	0.2	3	3.3	593	612	-0.359	0.215	0.419	3.226
44	0.7	0.2	3	3	691	711	-0.341	0	0.419	3.072
45	0.7	0.2	3	3.15	752	771	-0.359	0.108	0.419	3.149
46	0.7	0.2	3.2	3.25	839	865	-0.262	0.026	0.419	3.304
47	0.7	0.2	3.2	3.35	964	986	-0.31	0.093	0.419	3.355
48	0.7	0.2	3.2	3.2	1117	1142	-0.273	0	0.419	3.278
49	0.7	0.2	3.4	3.325	1197	1213	-0.426	-0.064	0.419	3.445
50	0.7	0.2	3.4	3.4	1260	1280	-0.341	0	0.419	3.484
51	0.7	0.2	3.4	3.55	1635	1653	-0.379	0.114	0.419	3.561
52	0.7	0.2	3.6	3.45	995	1009	-0.487	-0.146	0.419	3.613
53	0.7	0.2	3.6	3.6	1045	1063	-0.379	0	0.419	3.69
54	0.7	0.2	3.6	3.4	1077	1100	-0.296	-0.119	0.419	3.587
55	0.7	0.2	3.8	3.7	1611	1634	-0.296	-0.059	0.419	3.844
56	0.7	0.2	3.8	3.525	5771	5801	-0.227	-0.125	0.419	3.754
57	0.7	0.2	3.8	3.75	6439	6480	-0.166	-0.017	0.419	3.87

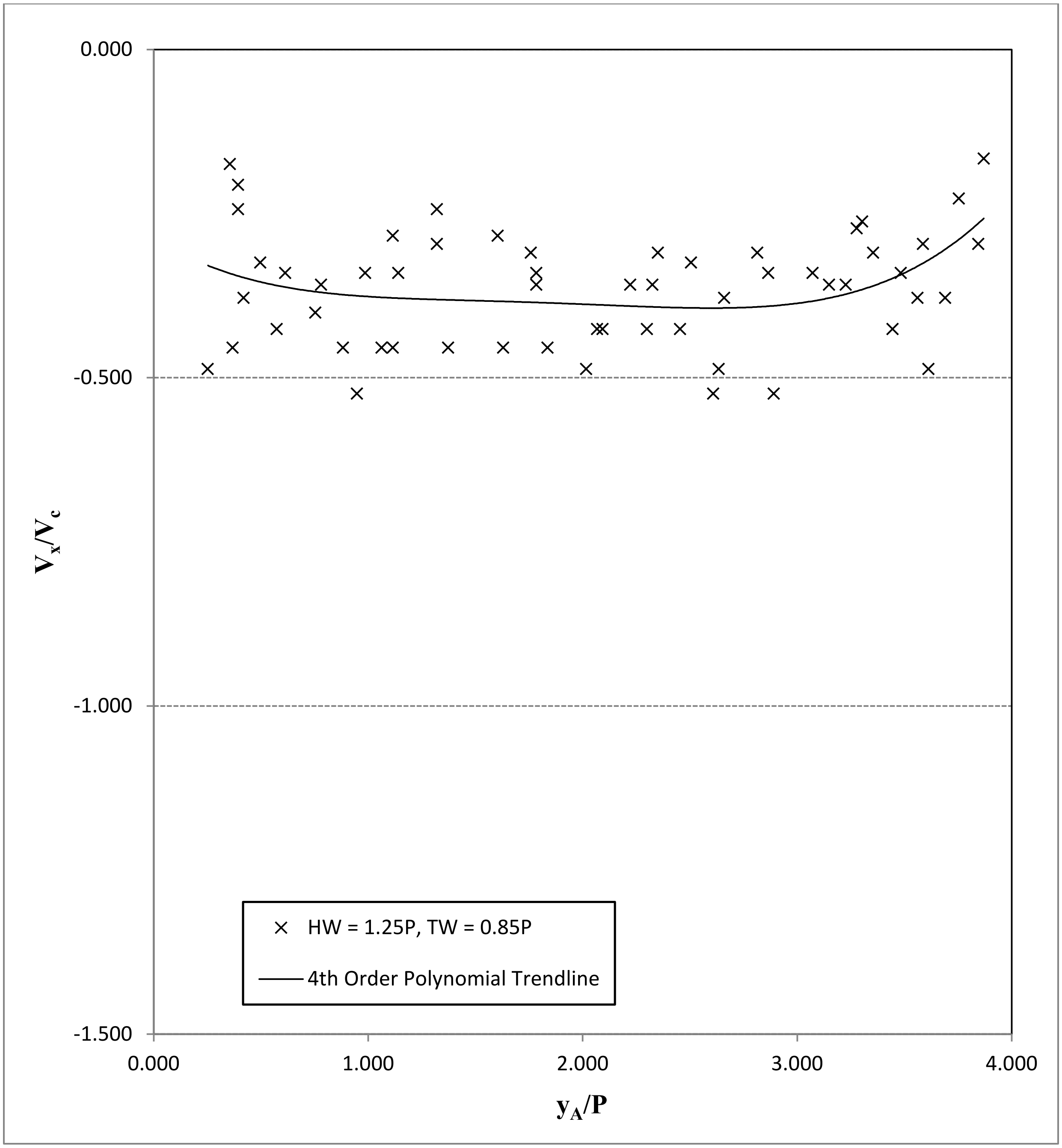

Figure A-2: Headwater = 1.25P, Tailwater = 0.85P

Table A-3: Headwater = 1.25P, Tailwater = 0.7P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.7	0.2	0.2	0.35	1114	1130	-0.426	0.128	0.419	0.265
2	0.7	0.2	0.2	0.325	1360	1379	-0.359	0.09	0.419	0.252
3	0.7	0.2	0.2	0.225	1731	1750	-0.359	0.018	0.419	0.201
4	0.7	0.2	0.4	0.55	2016	2033	-0.401	0.12	0.419	0.471
5	0.7	0.2	0.4	0.225	2591	2612	-0.324	-0.114	0.419	0.304
6	0.7	0.2	0.4	0.55	2666	2686	-0.341	0.102	0.419	0.471
7	0.7	0.2	0.6	0.4	816	828	-0.568	-0.227	0.419	0.497
8	0.7	0.2	0.6	0.5	1401	1420	-0.359	-0.072	0.419	0.549
9	0.7	0.2	0.6	0.7	1627	1636	-0.757	0.151	0.419	0.651
10	0.7	0.2	0.8	0.7	463	475	-0.568	-0.114	0.419	0.754
11	0.7	0.2	0.8	0.8	959	971	-0.568	0	0.419	0.806
12	0.7	0.2	0.8	0.75	995	1006	-0.619	-0.062	0.419	0.78
13	0.7	0.2	1	0.9	471	488	-0.401	-0.08	0.419	0.96
14	0.7	0.2	1	0.9	709	726	-0.401	-0.08	0.419	0.96
15	0.7	0.2	1	1.05	892	903	-0.619	0.062	0.419	1.038
16	0.7	0.2	1.2	1.2	934	949	-0.454	0	0.419	1.218
17	0.7	0.2	1.2	1.3	997	1013	-0.426	0.085	0.419	1.269
18	0.7	0.2	1.2	1.2	1138	1150	-0.568	0	0.419	1.218
19	0.7	0.2	1.4	1.4	484	497	-0.524	0	0.419	1.424
20	0.7	0.2	1.4	1.35	708	722	-0.487	-0.049	0.419	1.398
21	0.7	0.2	1.4	1.45	1000	1014	-0.487	0.049	0.419	1.45
22	0.7	0.2	1.6	1.65	779	793	-0.487	0.049	0.419	1.656
23	0.7	0.2	1.6	1.45	902	922	-0.341	-0.102	0.419	1.553
24	0.7	0.2	1.6	1.6	1744	1758	-0.487	0	0.419	1.63
25	0.7	0.2	1.8	1.75	677	692	-0.454	-0.045	0.419	1.81
26	0.7	0.2	1.8	1.85	1012	1030	-0.379	0.038	0.419	1.862
27	0.7	0.2	1.8	1.65	1114	1153	-0.175	-0.052	0.419	1.759
28	0.7	0.2	2	1.95	606	624	-0.379	-0.038	0.419	2.016
29	0.7	0.2	2	1.9	828	844	-0.426	-0.085	0.419	1.99
30	0.7	0.2	2	2.05	2183	2196	-0.524	0.052	0.419	2.068
31	0.7	0.2	2.2	2.3	2252	2261	-0.757	0.151	0.419	2.299
32	0.7	0.2	2.2	2.25	3353	3367	-0.487	0.049	0.419	2.274
33	0.7	0.2	2.2	2.3	3734	3745	-0.619	0.124	0.419	2.299
34	0.7	0.2	2.4	2.3	3755	3773	-0.379	-0.076	0.419	2.402
35	0.7	0.2	2.4	2.4	3771	3785	-0.487	0	0.419	2.454
36	0.7	0.2	2.4	2.3	4259	4270	-0.619	-0.124	0.419	2.402
37	0.7	0.2	2.6	2.7	4280	4292	-0.568	0.114	0.419	2.711
38	0.7	0.2	2.6	2.5	4451	4467	-0.426	-0.085	0.419	2.608
39	0.7	0.2	2.6	2.7	4573	4584	-0.619	0.124	0.419	2.711

Table A-3 Continued: Headwater = 1.25P, Tailwater = 0.7P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.7	0.2	2.8	2.7	4741	4766	-0.273	-0.055	0.419	2.814
41	0.7	0.2	2.8	2.45	5058	5072	-0.487	-0.341	0.419	2.686
42	0.7	0.2	2.8	2.8	5313	5324	-0.619	0	0.419	2.866
43	0.7	0.2	3	2.95	878	890	-0.568	-0.057	0.419	3.046
44	0.7	0.2	3	3.05	1313	1328	-0.454	0.045	0.419	3.098
45	0.7	0.2	3	2.9	3435	3448	-0.524	-0.105	0.419	3.02
46	0.7	0.2	3.2	3.2	995	1010	-0.454	0	0.419	3.278
47	0.7	0.2	3.2	3.2	1684	1699	-0.454	0	0.419	3.278
48	0.7	0.2	3.4	3.55	2196	2209	-0.524	0.157	0.419	3.561
49	0.7	0.2	3.4	3.6	3560	3579	-0.359	0.143	0.419	3.587
50	0.7	0.2	3.4	3.65	3827	3852	-0.273	0.136	0.419	3.613
51	0.7	0.2	3.6	3.5	964	987	-0.296	-0.059	0.419	3.638
52	0.7	0.2	3.6	3.5	1570	1585	-0.454	-0.091	0.419	3.638
53	0.7	0.2	3.6	3.45	2450	2464	-0.487	-0.146	0.419	3.613
54	0.7	0.2	3.8	3.7	1052	1070	-0.379	-0.076	0.419	3.844
55	0.7	0.2	3.8	3.65	1416	1438	-0.31	-0.093	0.419	3.819
56	0.7	0.2	3.8	3.65	4557	4587	-0.227	-0.068	0.419	3.819

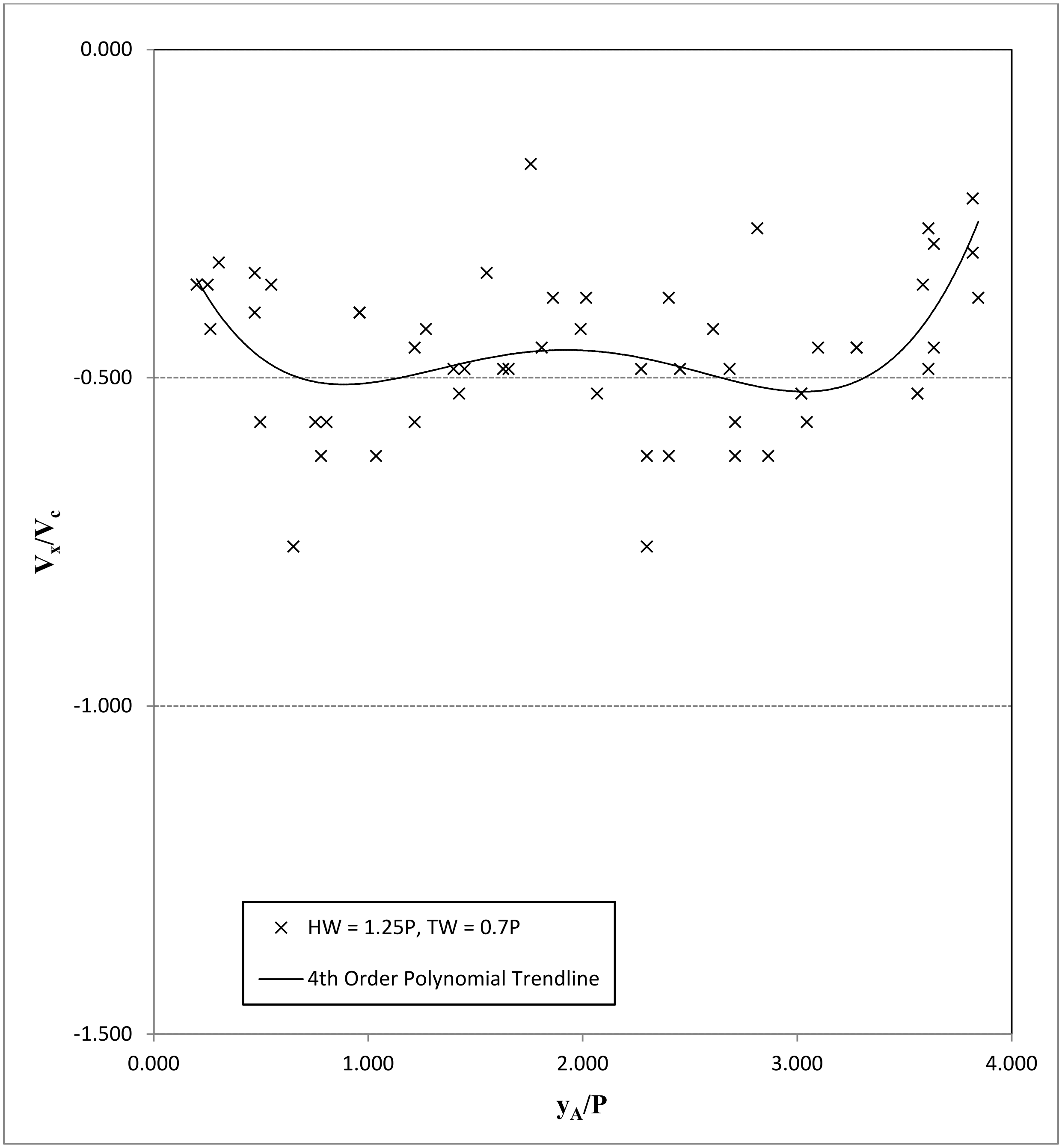

Figure A-3: Headwater = 1.25P, Tailwater = 0.7P

Table A-4: Headwater = 1.25P, Tailwater = 0.55P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.7	0.2	0.2	0.2	1321	1329	-0.966	0	0.419	0.188
2	0.7	0.2	0.2	0.45	1527	1538	-0.703	0.351	0.419	0.317
3	0.7	0.2	0.2	0.2	2495	2510	-0.515	0	0.419	0.188
4	0.7	0.2	0.4	0.45	2488	2499	-0.703	0.07	0.419	0.42
5	0.7	0.2	0.4	0.4	5782	5792	-0.773	0	0.419	0.394
6	0.7	0.2	0.4	0.5	8036	8053	-0.455	0.091	0.419	0.446
7	0.7	0.2	0.6	0.7	6706	6712	-1.288	0.258	0.419	0.651
8	0.7	0.2	0.6	0.7	7125	7137	-0.644	0.129	0.419	0.651
9	0.7	0.2	0.6	0.5	1046	1057	-0.703	-0.141	0.419	0.549
10	0.7	0.2	0.8	0.7	1228	1236	-0.966	-0.193	0.419	0.754
11	0.7	0.2	0.8	0.8	1515	1524	-0.859	0	0.419	0.806
12	0.7	0.2	0.8	0.9	1897	1914	-0.455	0.091	0.419	0.857
13	0.7	0.2	1	1.05	2052	2073	-0.368	0.037	0.419	1.038
14	0.7	0.2	1	0.9	2232	2240	-0.966	-0.193	0.419	0.96
15	0.7	0.2	1	1.1	2351	2362	-0.703	0.141	0.419	1.063
16	0.7	0.2	1.2	1.3	2555	2563	-0.966	0.193	0.419	1.269
17	0.7	0.2	1.2	1.4	2616	2627	-0.703	0.281	0.419	1.321
18	0.7	0.2	1.2	0.9	2933	2951	-0.429	-0.258	0.419	1.063
19	0.7	0.2	1.4	1.5	3245	3253	-0.966	0.193	0.419	1.475
20	0.7	0.2	1.4	1.3	3269	3278	-0.859	-0.172	0.419	1.372
21	0.7	0.2	1.4	1.3	3280	3290	-0.773	-0.155	0.419	1.372
22	0.7	0.2	1.6	1.7	3641	3650	-0.859	0.172	0.419	1.681
23	0.7	0.2	1.6	1.6	3724	3733	-0.859	0	0.419	1.63
24	0.7	0.2	1.6	1.75	4815	4825	-0.773	0.232	0.419	1.707
25	0.7	0.2	1.8	1.85	4914	4926	-0.644	0.064	0.419	1.862
26	0.7	0.2	1.8	1.75	5374	5384	-0.773	-0.077	0.419	1.81
27	0.7	0.2	2	2.1	5414	5423	-0.859	0.172	0.419	2.093
28	0.7	0.2	2	2.1	5800	5814	-0.552	0.11	0.419	2.093
29	0.7	0.2	2	2	6075	6089	-0.552	0	0.419	2.042
30	0.7	0.2	2.2	2.25	6533	6548	-0.515	0.052	0.419	2.274
31	0.7	0.2	2.2	2.2	919	929	-0.773	0	0.419	2.248
32	0.7	0.2	2.2	2.2	8197	8213	-0.483	0	0.419	2.248
33	0.7	0.2	2.4	2.4	823	836	-0.595	0	0.419	2.454
34	0.7	0.2	2.4	2.49	1536	1546	-0.773	0.139	0.419	2.5
35	0.7	0.2	2.4	2.4	2168	2175	-1.104	0	0.419	2.454
36	0.7	0.2	2.6	2.55	1291	1301	-0.773	-0.077	0.419	2.634
37	0.7	0.2	2.6	2.55	6603	6615	-0.644	-0.064	0.419	2.634
38	0.7	0.2	2.6	2.7	6623	6631	-0.966	0.193	0.419	2.711
39	0.7	0.2	2.8	2.8	1627	1634	-1.104	0	0.419	2.866

Table A-4 Continued: Headwater = 1.25P, Tailwater = 0.55P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.7	0.2	2.8	2.7	1828	1837	-0.859	-0.172	0.419	2.814
41	0.7	0.2	3	3	6718	6727	-0.859	0	0.419	3.072
42	0.7	0.2	3	2.85	6813	6823	-0.773	-0.232	0.419	2.995
43	0.7	0.2	3	2.8	6874	6890	-0.483	-0.193	0.419	2.969
44	0.7	0.2	3.2	3.3	6486	6499	-0.595	0.119	0.419	3.329
45	0.7	0.2	3.2	3.2	6741	6749	-0.966	0	0.419	3.278
46	0.7	0.2	3.2	3.4	6872	6888	-0.483	0.193	0.419	3.381
47	0.7	0.2	3.4	3.3	2056	2064	-0.966	-0.193	0.419	3.432
48	0.7	0.2	3.4	3.4	2171	2180	-0.859	0	0.419	3.484
49	0.7	0.2	3.4	3.35	4072	4081	-0.859	-0.086	0.419	3.458
50	0.7	0.2	3.6	3.6	2007	2018	-0.703	0	0.419	3.69
51	0.7	0.2	3.6	3.5	1607	1615	-0.966	-0.193	0.419	3.638
52	0.7	0.2	3.6	3.4	6939	6952	-0.595	-0.238	0.419	3.587
53	0.7	0.2	3.8	3.65	1094	1103	-0.859	-0.258	0.419	3.819
54	0.7	0.2	3.8	3.6	1634	1646	-0.644	-0.258	0.419	3.793
55	0.7	0.2	3.8	3.6	4132	4160	-0.276	-0.11	0.419	3.793

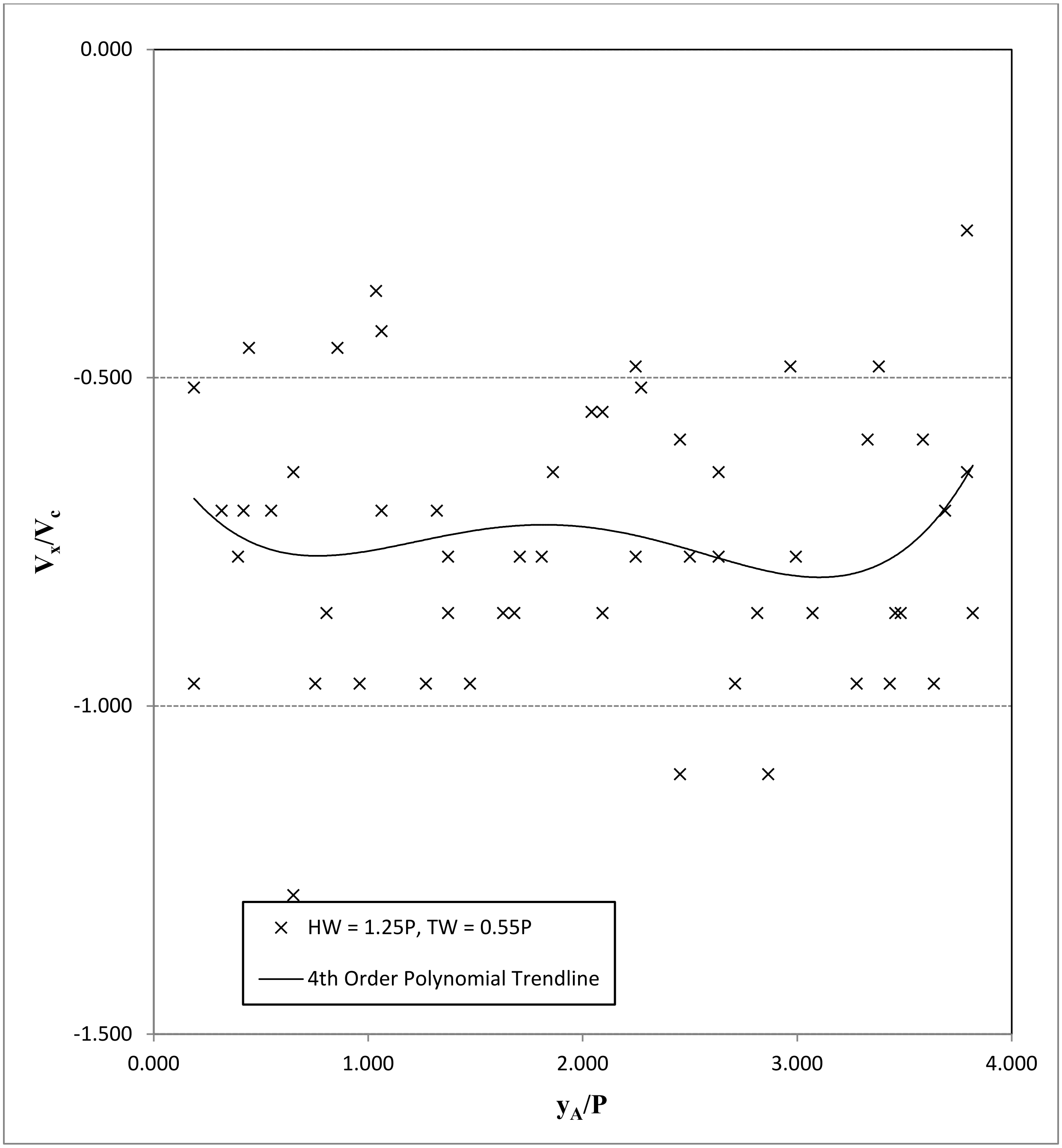

Figure A-4: Headwater = 1.25P, Tailwater = 0.55P

Table A-5: Headwater = 1.20P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.7	0.2	0.2	0.35	875	922	-0.164	0.049	0.419	0.265
2	0.7	0.2	0.2	3.5	1495	1530	-0.221	1.457	0.419	1.887
3	0.7	0.2	0.2	0.4	1882	1956	-0.104	0.042	0.419	0.291
4	0.7	0.2	0.4	0.2	2041	2072	-0.249	-0.1	0.419	0.291
5	0.7	0.2	0.4	0.25	2081	2155	-0.104	-0.031	0.419	0.317
6	0.7	0.2	0.4	0.35	2185	2215	-0.258	-0.026	0.419	0.368
7	0.7	0.2	0.6	0.45	2235	2259	-0.322	-0.097	0.419	0.523
8	0.7	0.2	0.6	0.49	2313	2352	-0.198	-0.044	0.419	0.543
9	0.7	0.2	0.6	0.45	2355	2388	-0.234	-0.07	0.419	0.523
10	0.7	0.2	0.8	0.7	2394	2420	-0.297	-0.059	0.419	0.754
11	0.7	0.2	0.8	0.4	3037	3069	-0.242	-0.193	0.419	0.6
12	0.7	0.2	0.8	0.6	3081	3105	-0.322	-0.129	0.419	0.703
13	0.7	0.2	1	0.7	3366	3393	-0.286	-0.172	0.419	0.857
14	0.7	0.2	1	0.6	3431	3463	-0.242	-0.193	0.419	0.806
15	0.7	0.2	1	0.7	3467	3495	-0.276	-0.166	0.419	0.857
16	0.7	0.2	1.2	1	3555	3584	-0.267	-0.107	0.419	1.115
17	0.7	0.2	1.2	1.3	3630	3648	-0.429	0.086	0.419	1.269
18	0.7	0.2	1.2	1.15	4121	4142	-0.368	-0.037	0.419	1.192
19	0.7	0.2	1.4	1.3	4243	4257	-0.552	-0.11	0.419	1.372
20	0.7	0.2	1.4	1.2	4304	4324	-0.386	-0.155	0.419	1.321
21	0.7	0.2	1.4	1.35	4406	4430	-0.322	-0.032	0.419	1.398
22	0.7	0.2	1.6	1.8	5131	5160	-0.267	0.107	0.419	1.733
23	0.7	0.2	1.6	1.6	5348	5371	-0.336	0	0.419	1.63
24	0.7	0.2	1.6	1.65	6533	6554	-0.368	0.037	0.419	1.656
25	0.7	0.2	1.8	1.7	6659	6678	-0.407	-0.081	0.419	1.784
26	0.7	0.2	1.8	1.7	6694	6720	-0.297	-0.059	0.419	1.784
27	0.7	0.2	1.8	1.6	6777	6793	-0.483	-0.193	0.419	1.733
28	0.7	0.2	2	1.9	6796	6818	-0.351	-0.07	0.419	1.99
29	0.7	0.2	2	2	7087	7109	-0.351	0	0.419	2.042
30	0.7	0.2	2	1.9	7128	7153	-0.309	-0.062	0.419	1.99
31	0.7	0.2	2.2	2.1	7248	7280	-0.242	-0.048	0.419	2.196
32	0.7	0.2	2.2	1.95	7748	7777	-0.267	-0.133	0.419	2.119
33	0.7	0.2	2.2	2.25	7816	7837	-0.368	0.037	0.419	2.274
34	0.7	0.2	2.4	2.4	7882	7902	-0.386	0	0.419	2.454
35	0.7	0.2	2.4	2.45	7914	7935	-0.368	0.037	0.419	2.48
36	0.7	0.2	2.4	2.5	8230	8249	-0.407	0.081	0.419	2.505
37	0.7	0.2	2.6	2.8	8293	8313	-0.386	0.155	0.419	2.763
38	0.7	0.2	2.6	2.8	8394	8413	-0.407	0.163	0.419	2.763
39	0.7	0.2	2.6	2.6	8975	9001	-0.297	0	0.419	2.66

Table A-5 Continued: Headwater = 1.20P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.7	0.2	2.8	2.95	9177	9196	-0.407	0.122	0.419	2.943
41	0.7	0.2	2.8	3	1065	1087	-0.351	0.141	0.419	2.969
42	0.7	0.2	2.8	2.95	1761	1785	-0.322	0.097	0.419	2.943
43	0.7	0.2	3	3.3	2056	2090	-0.227	0.136	0.419	3.226
44	0.7	0.2	3	3.1	2219	2250	-0.249	0.05	0.419	3.123
45	0.7	0.2	3	3.15	1452	1472	-0.386	0.116	0.419	3.149
46	0.7	0.2	3.2	3.6	671	703	-0.242	0.193	0.419	3.484
47	0.7	0.2	3.2	3.2	1347	1369	-0.351	0	0.419	3.278
48	0.7	0.2	3.2	3.4	1490	1511	-0.368	0.147	0.419	3.381
49	0.7	0.2	3.4	3.6	941	984	-0.18	0.072	0.419	3.587
50	0.7	0.2	3.4	3.55	1510	1533	-0.336	0.101	0.419	3.561
51	0.7	0.2	3.4	3.55	1602	1623	-0.368	0.11	0.419	3.561
52	0.7	0.2	3.6	3.7	1384	1483	-0.078	0.016	0.419	3.741
53	0.7	0.2	3.6	3.6	1826	1891	-0.119	0	0.419	3.69
54	0.7	0.2	3.6	3.69	1933	2004	-0.109	0.02	0.419	3.736
55	0.7	0.2	3.8	3.59	1321	1347	-0.297	-0.125	0.419	3.788
56	0.7	0.2	3.8	3.8	2598	2640	-0.184	0	0.419	3.896
57	0.7	0.2	3.8	3.55	3729	3776	-0.164	-0.082	0.419	3.767

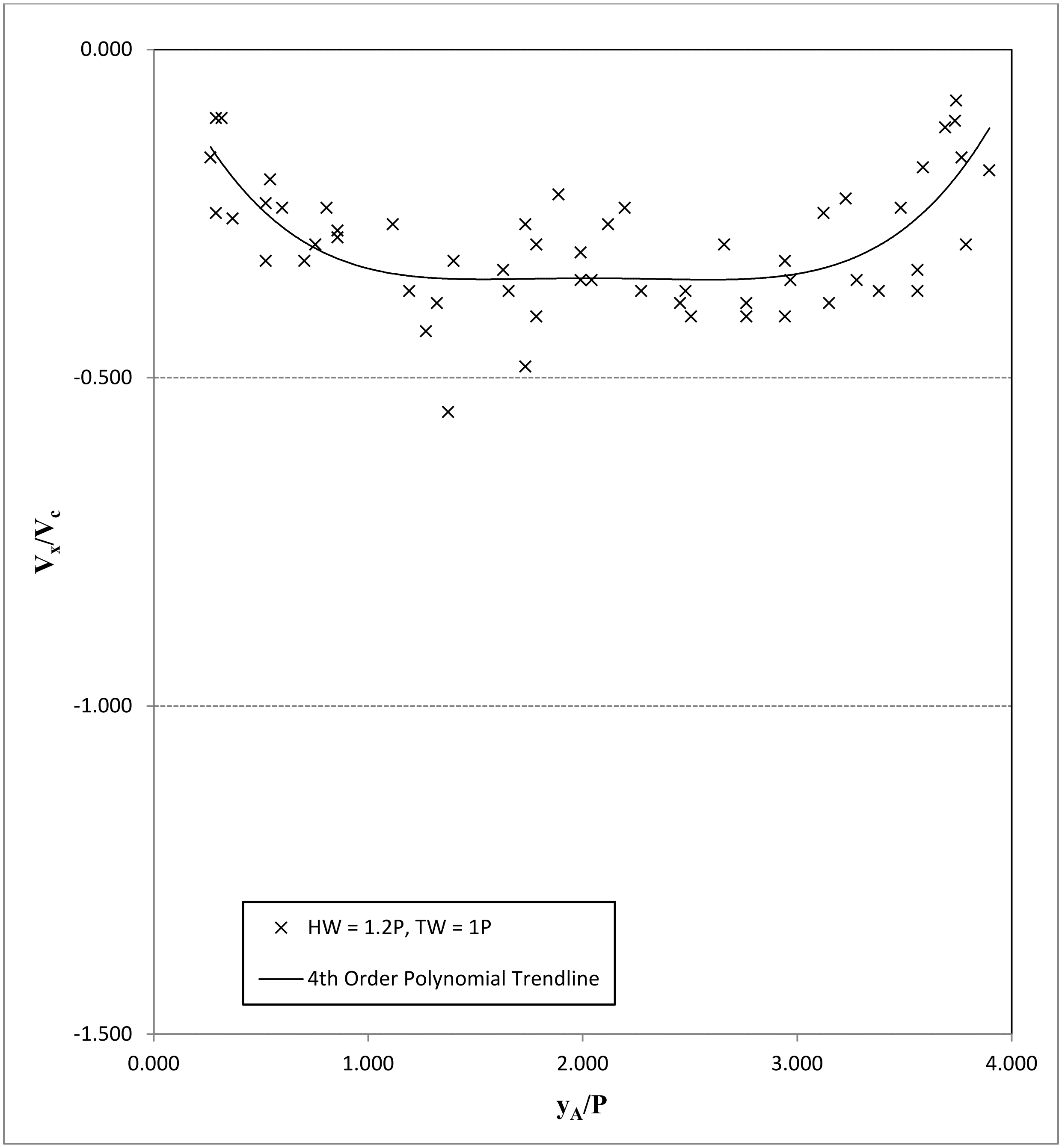

Figure A-5: Headwater = 1.20P, Tailwater = 1P

Table A-6: Headwater = 1.20P, Tailwater = 0.84P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.7	0.2	0.2	0.25	947	987	-0.193	0.019	0.419	0.214
2	0.7	0.2	0.2	0.45	1306	1332	-0.297	0.149	0.419	0.317
3	0.7	0.2	0.2	0.3	1466	1493	-0.286	0.057	0.419	0.24
4	0.7	0.2	0.4	0.5	1234	1256	-0.351	0.07	0.419	0.446
5	0.7	0.2	0.4	0.49	1646	1685	-0.198	0.036	0.419	0.44
6	0.7	0.2	0.4	0.59	1740	1756	-0.483	0.184	0.419	0.492
7	0.7	0.2	0.6	0.5	1316	1346	-0.258	-0.052	0.419	0.549
8	0.7	0.2	0.6	0.6	1398	1416	-0.429	0	0.419	0.6
9	0.7	0.2	0.8	0.7	1426	1440	-0.552	-0.11	0.419	0.754
10	0.7	0.2	0.8	0.7	1521	1543	-0.351	-0.07	0.419	0.754
11	0.7	0.2	0.8	0.75	1609	1630	-0.368	-0.037	0.419	0.78
12	0.7	0.2	1	0.8	1684	1699	-0.515	-0.206	0.419	0.909
13	0.7	0.2	1	1.2	1966	1984	-0.429	0.172	0.419	1.115
14	0.7	0.2	1	1.1	2178	2199	-0.368	0.074	0.419	1.063
15	0.7	0.2	1.2	1	2215	2234	-0.407	-0.163	0.419	1.115
16	0.7	0.2	1.2	1	2412	2428	-0.483	-0.193	0.419	1.115
17	0.7	0.2	1.2	1.3	2441	2461	-0.386	0.077	0.419	1.269
18	0.7	0.2	1.4	1.3	2969	3000	-0.249	-0.05	0.419	1.372
19	0.7	0.2	1.4	1.4	3094	3113	-0.407	0	0.419	1.424
20	0.7	0.2	1.4	1.5	3146	3173	-0.286	0.057	0.419	1.475
21	0.7	0.2	1.6	1.55	3739	3757	-0.429	-0.043	0.419	1.604
22	0.7	0.2	1.6	1.6	4176	4194	-0.429	0	0.419	1.63
23	0.7	0.2	1.6	1.55	4271	4286	-0.515	-0.052	0.419	1.604
24	0.7	0.2	1.8	1.8	4874	4889	-0.515	0	0.419	1.836
25	0.7	0.2	1.8	1.8	5331	5349	-0.429	0	0.419	1.836
26	0.7	0.2	1.8	1.75	5526	5539	-0.595	-0.059	0.419	1.81
27	0.7	0.2	2	2	5872	5892	-0.386	0	0.419	2.042
28	0.7	0.2	2	2	6121	6136	-0.515	0	0.419	2.042
29	0.7	0.2	2	2.1	6340	6359	-0.407	0.081	0.419	2.093
30	0.7	0.2	2.2	2.3	6648	6663	-0.515	0.103	0.419	2.299
31	0.7	0.2	2.2	2.1	7033	7047	-0.552	-0.11	0.419	2.196
32	0.7	0.2	2.2	2.2	7746	7764	-0.429	0	0.419	2.248
33	0.7	0.2	2.4	2.45	8003	8024	-0.368	0.037	0.419	2.48
34	0.7	0.2	2.4	2.35	8026	8041	-0.515	-0.052	0.419	2.428
35	0.7	0.2	2.4	2.45	8408	8426	-0.429	0.043	0.419	2.48
36	0.7	0.2	2.6	2.5	8501	8517	-0.483	-0.097	0.419	2.608
37	0.7	0.2	2.6	2.7	8522	8546	-0.322	0.064	0.419	2.711
38	0.7	0.2	2.6	2.55	8551	8566	-0.515	-0.052	0.419	2.634
39	0.7	0.2	2.8	2.8	8712	8733	-0.368	0	0.419	2.866

Table A-6 Continued: Headwater = 1.20P, Tailwater = 0.84P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.7	0.2	2.8	2.8	8711	8732	-0.368	0	0.419	2.866
41	0.7	0.2	2.8	2.9	8788	8808	-0.386	0.077	0.419	2.917
42	0.7	0.2	3	3.1	9109	9124	-0.515	0.103	0.419	3.123
43	0.7	0.2	3	2.95	9216	9235	-0.407	-0.041	0.419	3.046
44	0.7	0.2	3	3.05	9287	9301	-0.552	0.055	0.419	3.098
45	0.7	0.2	3.2	3.4	9371	9393	-0.351	0.141	0.419	3.381
46	0.7	0.2	3.2	3.3	1788	1821	-0.234	0.047	0.419	3.329
47	0.7	0.2	3.2	3.3	2666	2683	-0.455	0.091	0.419	3.329
48	0.7	0.2	3.4	3.5	800	822	-0.351	0.07	0.419	3.535
49	0.7	0.2	3.4	3.5	3001	3018	-0.455	0.091	0.419	3.535
50	0.7	0.2	3.4	3.5	3050	3069	-0.407	0.081	0.419	3.535
51	0.7	0.2	3.6	3.65	3067	3089	-0.351	0.035	0.419	3.716
52	0.7	0.2	3.6	3.5	3277	3296	-0.407	-0.081	0.419	3.638
53	0.7	0.2	3.6	3.5	4311	4338	-0.286	-0.057	0.419	3.638
54	0.7	0.2	3.8	3.5	4806	4841	-0.221	-0.132	0.419	3.741
55	0.7	0.2	3.8	3.7	5305	5335	-0.258	-0.052	0.419	3.844
56	0.7	0.2	3.8	3.45	5589	5612	-0.336	-0.235	0.419	3.716

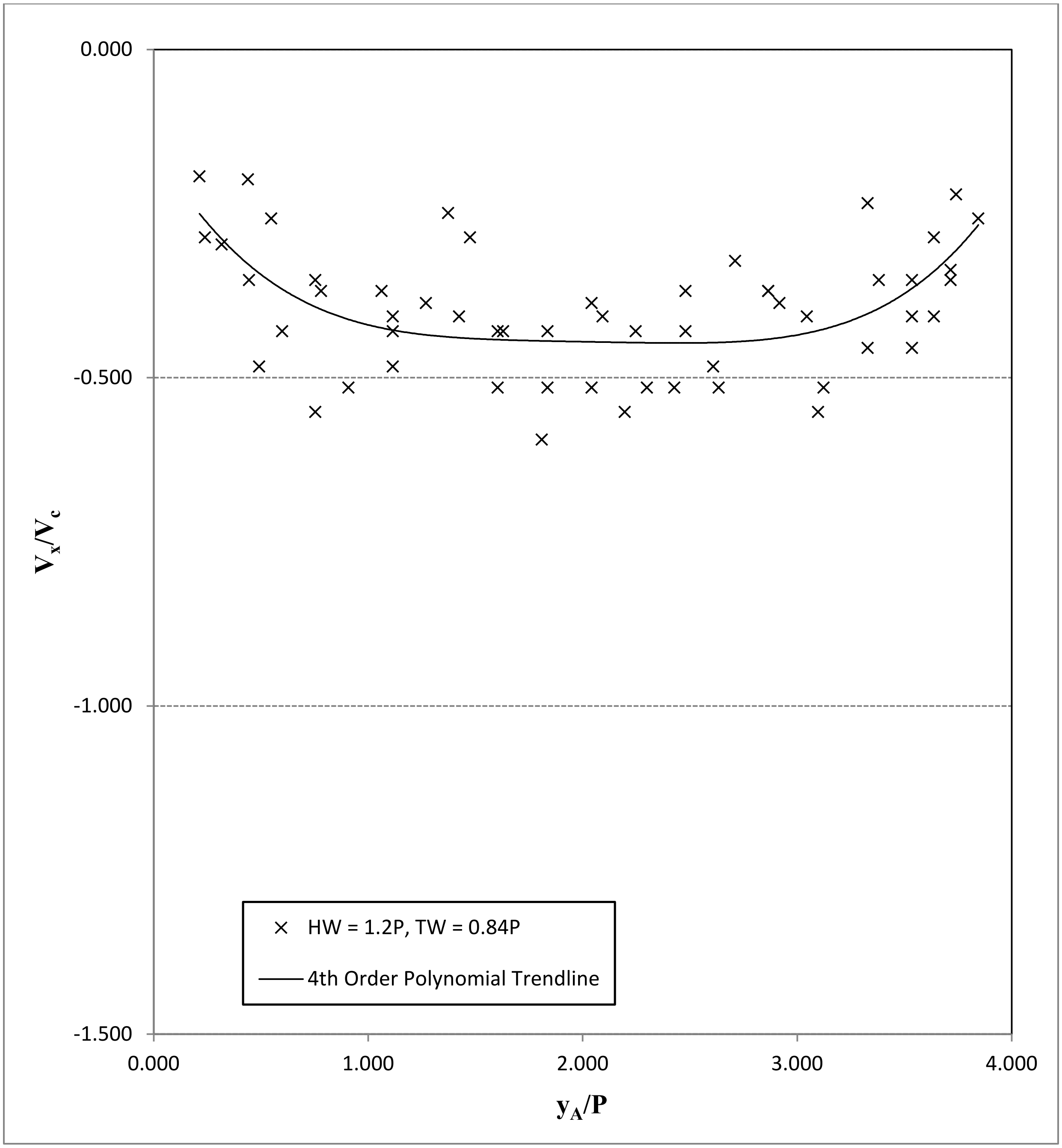

Figure A-6: Headwater = 1.20P, Tailwater = 0.84P

Table A-7: Headwater = 1.20P, Tailwater = 0.67P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.7	0.2	0.2	0.45	1332	1358	-0.297	0.149	0.419	0.317
2	0.7	0.2	0.2	0.35	1470	1491	-0.368	0.11	0.419	0.265
3	0.7	0.2	0.2	0.4	1623	1649	-0.297	0.119	0.419	0.291
4	0.7	0.2	0.4	0.35	890	905	-0.515	-0.052	0.419	0.368
5	0.7	0.2	0.4	0.4	1038	1063	-0.309	0	0.419	0.394
6	0.7	0.2	0.4	0.4	1100	1115	-0.515	0	0.419	0.394
7	0.7	0.2	0.6	0.75	875	888	-0.595	0.178	0.419	0.677
8	0.7	0.2	0.6	0.65	942	959	-0.455	0.045	0.419	0.626
9	0.7	0.2	0.6	0.6	1057	1069	-0.644	0	0.419	0.6
10	0.7	0.2	0.8	0.85	602	612	-0.773	0.077	0.419	0.832
11	0.7	0.2	0.8	0.6	733	752	-0.407	-0.163	0.419	0.703
12	0.7	0.2	0.8	0.7	975	991	-0.483	-0.097	0.419	0.754
13	0.7	0.2	1	1.1	708	726	-0.429	0.086	0.419	1.063
14	0.7	0.2	1	1	1146	1160	-0.552	0	0.419	1.012
15	0.7	0.2	1	0.95	1274	1287	-0.595	-0.059	0.419	0.986
16	0.7	0.2	1.2	1.1	656	671	-0.515	-0.103	0.419	1.166
17	0.7	0.2	1.2	1.1	1055	1071	-0.483	-0.097	0.419	1.166
18	0.7	0.2	1.2	1.05	1159	1171	-0.644	-0.193	0.419	1.141
19	0.7	0.2	1.4	1.2	553	570	-0.455	-0.182	0.419	1.321
20	0.7	0.2	1.4	1.35	657	669	-0.644	-0.064	0.419	1.398
21	0.7	0.2	1.4	1.4	692	705	-0.595	0	0.419	1.424
22	0.7	0.2	1.6	1.4	589	606	-0.455	-0.182	0.419	1.527
23	0.7	0.2	1.6	1.7	772	790	-0.429	0.086	0.419	1.681
24	0.7	0.2	1.6	1.45	943	959	-0.483	-0.145	0.419	1.553
25	0.7	0.2	1.8	1.85	971	987	-0.483	0.048	0.419	1.862
26	0.7	0.2	1.8	1.75	1132	1145	-0.595	-0.059	0.419	1.81
27	0.7	0.2	1.8	1.95	1195	1214	-0.407	0.122	0.419	1.913
28	0.7	0.2	2	2	1666	1694	-0.276	0	0.419	2.042
29	0.7	0.2	2	1.9	2071	2086	-0.515	-0.103	0.419	1.99
30	0.7	0.2	2	1.7	2308	2327	-0.407	-0.244	0.419	1.887
31	0.7	0.2	2.2	2.2	2418	2439	-0.368	0	0.419	2.248
32	0.7	0.2	2.2	2.25	2447	2463	-0.483	0.048	0.419	2.274
33	0.7	0.2	2.2	2.25	2504	2522	-0.429	0.043	0.419	2.274
34	0.7	0.2	2.4	2.25	2596	2610	-0.552	-0.166	0.419	2.377
35	0.7	0.2	2.4	2.4	2813	2833	-0.386	0	0.419	2.454
36	0.7	0.2	2.4	2.3	3286	3298	-0.644	-0.129	0.419	2.402
37	0.7	0.2	2.6	2.7	3297	3310	-0.595	0.119	0.419	2.711
38	0.7	0.2	2.6	2.75	3445	3460	-0.515	0.155	0.419	2.737
39	0.7	0.2	2.6	2.5	3586	3602	-0.483	-0.097	0.419	2.608

Table A-7 Continued: Headwater = 1.20P, Tailwater = 0.67P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.7	0.2	2.8	2.7	3731	3744	-0.595	-0.119	0.419	2.814
41	0.7	0.2	2.8	2.85	3828	3851	-0.336	0.034	0.419	2.892
42	0.7	0.2	2.8	2.85	4120	4134	-0.552	0.055	0.419	2.892
43	0.7	0.2	3	3	4223	4236	-0.595	0	0.419	3.072
44	0.7	0.2	3	2.95	4289	4302	-0.595	-0.059	0.419	3.046
45	0.7	0.2	3	3.15	4451	4462	-0.703	0.211	0.419	3.149
46	0.7	0.2	3.2	3.2	4589	4601	-0.644	0	0.419	3.278
47	0.7	0.2	3.2	3.4	4721	4737	-0.483	0.193	0.419	3.381
48	0.7	0.2	3.2	3.3	4752	4773	-0.368	0.074	0.419	3.329
49	0.7	0.2	3.4	3.15	5065	5084	-0.407	-0.203	0.419	3.355
50	0.7	0.2	3.4	3.5	5290	5302	-0.644	0.129	0.419	3.535
51	0.7	0.2	3.4	3.45	5542	5572	-0.258	0.026	0.419	3.51
52	0.7	0.2	3.6	3.45	6500	6520	-0.386	-0.116	0.419	3.613
53	0.7	0.2	3.6	3.45	1838	1859	-0.368	-0.11	0.419	3.613
54	0.7	0.2	3.6	3.55	2771	2788	-0.455	-0.045	0.419	3.664
55	0.7	0.2	3.8	3.6	3617	3639	-0.351	-0.141	0.419	3.793
56	0.7	0.2	3.8	3.75	1757	1792	-0.221	-0.022	0.419	3.87
57	0.7	0.2	3.8	3.5	4496	4521	-0.309	-0.185	0.419	3.741

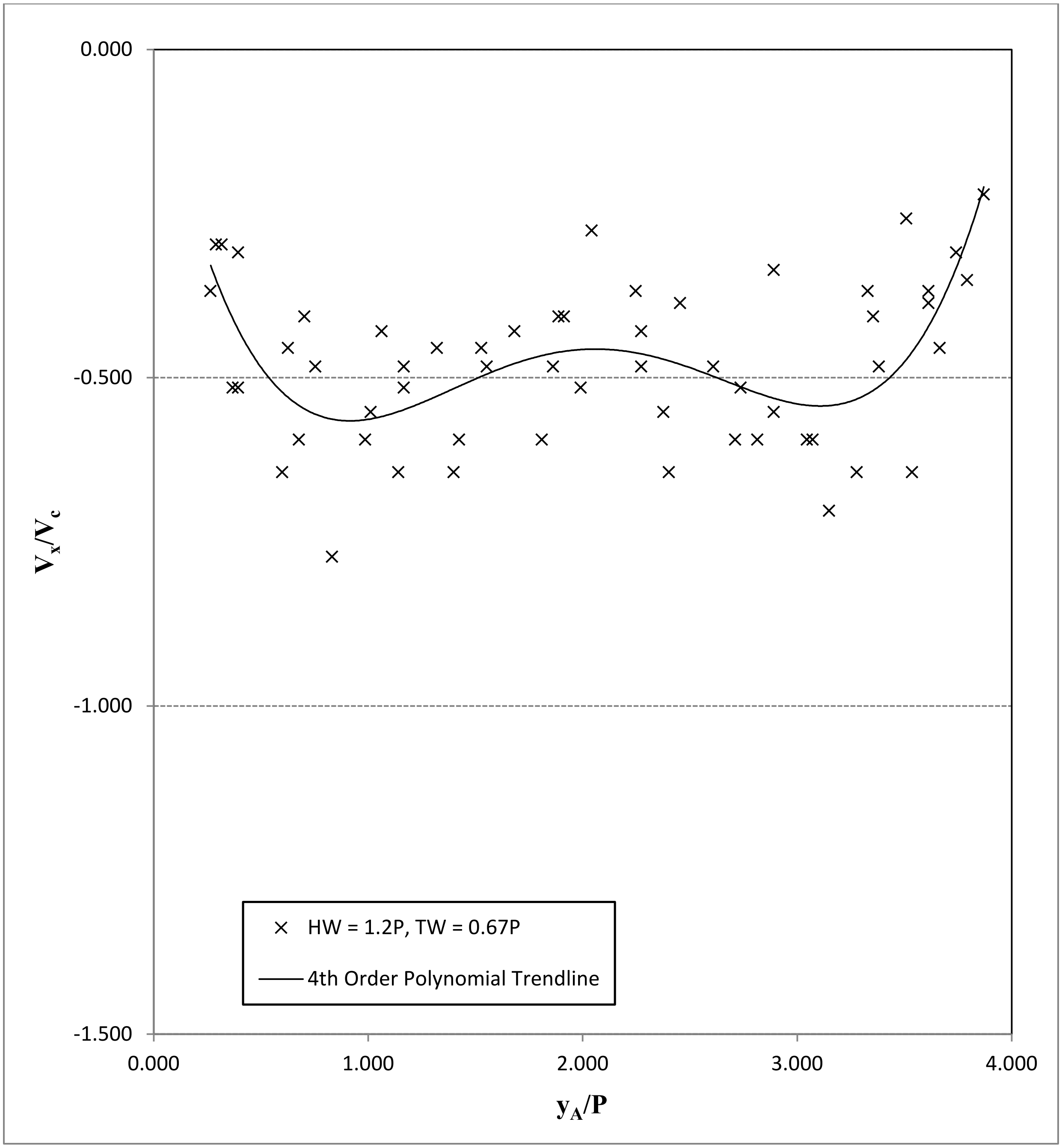

Figure A-7: Headwater = 1.20P, Tailwater = 0.67P

Table A-8: Headwater = 1.20P, Tailwater = 0.51P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.7	0.2	0.2	0.15	1036	1047	-0.81	-0.081	0.419	0.162
2	0.7	0.2	0.2	0.35	2059	2072	-0.685	0.206	0.419	0.265
3	0.7	0.2	0.2	0.45	2362	2378	-0.557	0.278	0.419	0.317
4	0.7	0.2	0.4	0.3	2889	2900	-0.81	-0.162	0.419	0.343
5	0.7	0.2	0.4	0.5	3049	3068	-0.469	0.094	0.419	0.446
6	0.7	0.2	0.4	0.5	3433	3445	-0.742	0.148	0.419	0.446
7	0.7	0.2	0.6	0.55	3458	3474	-0.557	-0.056	0.419	0.574
8	0.7	0.2	0.6	0.65	3666	3675	-0.99	0.099	0.419	0.626
9	0.7	0.2	0.6	0.45	3876	3892	-0.557	-0.167	0.419	0.523
10	0.7	0.2	0.8	0.9	4120	4135	-0.594	0.119	0.419	0.857
11	0.7	0.2	0.8	0.8	4312	4324	-0.742	0	0.419	0.806
12	0.7	0.2	1	1.1	4683	4693	-0.891	0.178	0.419	1.063
13	0.7	0.2	1	0.95	4823	4835	-0.742	-0.074	0.419	0.986
14	0.7	0.2	1	1.05	6034	6046	-0.742	0.074	0.419	1.038
15	0.7	0.2	1.2	1.3	6062	6074	-0.742	0.148	0.419	1.269
16	0.7	0.2	1.2	1.4	6123	6142	-0.469	0.188	0.419	1.321
17	0.7	0.2	1.2	1.25	6142	6155	-0.685	0.069	0.419	1.244
18	0.7	0.2	1.4	1.45	6287	6300	-0.685	0.069	0.419	1.45
19	0.7	0.2	1.4	1.2	6396	6416	-0.445	-0.178	0.419	1.321
20	0.7	0.2	1.4	1.55	6421	6432	-0.81	0.243	0.419	1.501
21	0.7	0.2	1.6	1.7	6628	6642	-0.636	0.127	0.419	1.681
22	0.7	0.2	1.6	1.55	6643	6655	-0.742	-0.074	0.419	1.604
23	0.7	0.2	1.6	1.5	6935	6951	-0.557	-0.111	0.419	1.578
24	0.7	0.2	1.8	1.85	7213	7225	-0.742	0.074	0.419	1.862
25	0.7	0.2	1.8	1.9	7368	7376	-1.114	0.223	0.419	1.887
26	0.7	0.2	1.8	1.85	8074	8084	-0.891	0.089	0.419	1.862
27	0.7	0.2	2	1.95	1358	1367	-0.99	-0.099	0.419	2.016
28	0.7	0.2	2	3.05	1443	1454	-0.81	1.701	0.419	2.583
29	0.7	0.2	2	1.85	1474	1493	-0.469	-0.141	0.419	1.965
30	0.7	0.2	2.2	2.2	1593	1603	-0.891	0	0.419	2.248
31	0.7	0.2	2.2	2.15	1899	1915	-0.557	-0.056	0.419	2.222
32	0.7	0.2	2.2	1.95	2386	2397	-0.81	-0.405	0.419	2.119
33	0.7	0.2	2.4	2.45	2481	2516	-0.255	0.025	0.419	2.48
34	0.7	0.2	2.4	2.55	2610	2624	-0.636	0.191	0.419	2.531
35	0.7	0.2	2.4	2.35	2659	2687	-0.318	-0.032	0.419	2.428
36	0.7	0.2	2.6	2.5	2994	3004	-0.891	-0.178	0.419	2.608
37	0.7	0.2	2.6	2.65	3057	3069	-0.742	0.074	0.419	2.686
38	0.7	0.2	2.6	2.5	3052	3105	-0.168	-0.034	0.419	2.608
39	0.7	0.2	2.8	2.8	3113	3128	-0.594	0	0.419	2.866

Table A-8 Continued: Headwater = 1.20P, Tailwater = 0.51P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.7	0.2	2.8	2.7	3286	3302	-0.557	-0.111	0.419	2.814
41	0.7	0.2	2.8	2.9	4103	4116	-0.685	0.137	0.419	2.917
42	0.7	0.2	3	2.95	5708	5718	-0.891	-0.089	0.419	3.046
43	0.7	0.2	3	2.9	6032	6044	-0.742	-0.148	0.419	3.02
44	0.7	0.2	3	3.25	6048	6058	-0.891	0.445	0.419	3.201
45	0.7	0.2	3.2	3.45	2750	2764	-0.636	0.318	0.419	3.407
46	0.7	0.2	3.2	3.2	2905	2917	-0.742	0	0.419	3.278
47	0.7	0.2	3.2	3.1	4002	4016	-0.636	-0.127	0.419	3.226
48	0.7	0.2	3.4	3.45	1873	1883	-0.891	0.089	0.419	3.51
49	0.7	0.2	3.4	3.35	2825	2835	-0.891	-0.089	0.419	3.458
50	0.7	0.2	3.4	3.6	3653	3665	-0.742	0.297	0.419	3.587
51	0.7	0.2	3.6	3.6	3150	3162	-0.742	0	0.419	3.69
52	0.7	0.2	3.6	3.5	3188	3202	-0.636	-0.127	0.419	3.638
53	0.7	0.2	3.6	3.6	3150	3162	-0.742	0	0.419	3.69
54	0.7	0.2	3.8	3.75	2972	2989	-0.524	-0.052	0.419	3.87

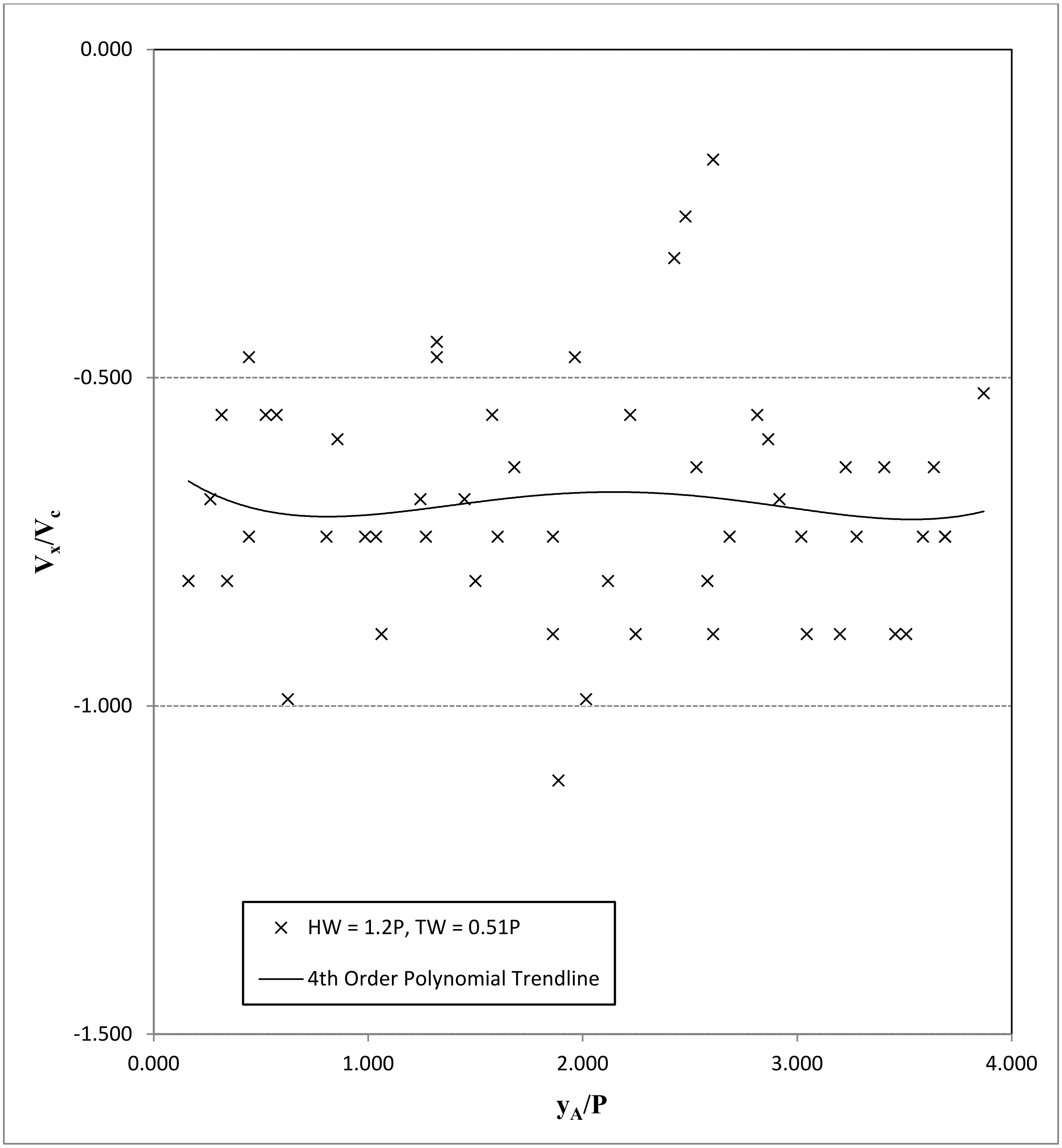

Figure A-8: Headwater = 1.20P, Tailwater = 0.51P

Table A-9: Headwater = 1.15P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.7	0.2	0.2	0.35	1442	1504	-0.144	0.043	0.419	0.265
2	0.7	0.2	0.2	0.2	1656	1690	-0.262	0	0.419	0.188
3	0.7	0.2	0.2	0.3	2245	2281	-0.247	0.049	0.419	0.24
4	0.7	0.2	0.4	0.25	1076	1121	-0.198	-0.059	0.419	0.317
5	0.7	0.2	0.4	0.3	1185	1223	-0.234	-0.047	0.419	0.343
6	0.7	0.2	0.4	0.2	1310	1343	-0.27	-0.108	0.419	0.291
7	0.7	0.2	0.6	0.25	1724	1756	-0.278	-0.195	0.419	0.42
8	0.7	0.2	0.6	0.45	1860	1876	-0.557	-0.167	0.419	0.523
9	0.7	0.2	0.6	0.4	2047	2077	-0.297	-0.119	0.419	0.497
10	0.7	0.2	0.8	0.8	2230	2263	-0.27	0	0.419	0.806
11	0.7	0.2	0.8	0.7	3287	3315	-0.318	-0.064	0.419	0.754
12	0.7	0.2	0.8	0.45	3506	3536	-0.297	-0.208	0.419	0.626
13	0.7	0.2	1	0.9	3024	3055	-0.287	-0.057	0.419	0.96
14	0.7	0.2	1	1	4177	4205	-0.318	0	0.419	1.012
15	0.7	0.2	1	0.85	2272	2300	-0.318	-0.095	0.419	0.935
16	0.7	0.2	1.2	0.9	1492	1522	-0.297	-0.178	0.419	1.063
17	0.7	0.2	1.2	0.85	2149	2185	-0.247	-0.173	0.419	1.038
18	0.7	0.2	1.2	1	2219	2252	-0.27	-0.108	0.419	1.115
19	0.7	0.2	1.4	1.35	762	785	-0.387	-0.039	0.419	1.398
20	0.7	0.2	1.4	1.3	841	869	-0.318	-0.064	0.419	1.372
21	0.7	0.2	1.4	1.3	1664	1687	-0.387	-0.077	0.419	1.372
22	0.7	0.2	1.6	1.55	1896	1919	-0.387	-0.039	0.419	1.604
23	0.7	0.2	1.6	1.58	2061	2081	-0.445	-0.018	0.419	1.62
24	0.7	0.2	1.6	1.55	2725	2753	-0.318	-0.032	0.419	1.604
25	0.7	0.2	1.8	1.9	635	660	-0.356	0.071	0.419	1.887
26	0.7	0.2	1.8	1.8	1176	1202	-0.343	0	0.419	1.836
27	0.7	0.2	1.8	1.7	1355	1383	-0.318	-0.064	0.419	1.784
28	0.7	0.2	2	2.1	625	650	-0.356	0.071	0.419	2.093
29	0.7	0.2	2	2.05	1991	2018	-0.33	0.033	0.419	2.068
30	0.7	0.2	2	2.15	2201	2229	-0.318	0.095	0.419	2.119
31	0.7	0.2	2.2	2.4	989	1019	-0.297	0.119	0.419	2.351
32	0.7	0.2	2.2	2.2	2241	2267	-0.343	0	0.419	2.248
33	0.7	0.2	2.2	2.35	2885	2919	-0.262	0.079	0.419	2.325
34	0.7	0.2	2.4	2.6	2898	2928	-0.297	0.119	0.419	2.557
35	0.7	0.2	2.4	2.5	1390	1412	-0.405	0.081	0.419	2.505
36	0.7	0.2	2.4	2.5	4868	4917	-0.182	0.036	0.419	2.505
37	0.7	0.2	2.6	2.7	1570	1598	-0.318	0.064	0.419	2.711
38	0.7	0.2	2.6	1.55	1618	1641	-0.387	-0.813	0.419	2.119
39	0.7	0.2	2.6	2.7	2616	2643	-0.33	0.066	0.419	2.711

Table A-9 Continued: Headwater = 1.15P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.7	0.2	2.8	2.9	1842	1867	-0.356	0.071	0.419	2.917
41	0.7	0.2	2.8	2.9	2229	2256	-0.33	0.066	0.419	2.917
42	0.7	0.2	2.8	3.05	2409	2439	-0.297	0.148	0.419	2.995
43	0.7	0.2	3	3.35	1115	1138	-0.387	0.271	0.419	3.252
44	0.7	0.2	3	3.2	1441	1465	-0.371	0.148	0.419	3.175
45	0.7	0.2	3	3.15	1725	1749	-0.371	0.111	0.419	3.149
46	0.7	0.2	3.2	3.35	1347	1385	-0.234	0.07	0.419	3.355
47	0.7	0.2	3.2	3.5	1784	1812	-0.318	0.191	0.419	3.432
48	0.7	0.2	3.2	3.2	2174	2199	-0.356	0	0.419	3.278
49	0.7	0.2	3.4	3.6	1022	1055	-0.27	0.108	0.419	3.587
50	0.7	0.2	3.4	3.6	1493	1530	-0.241	0.096	0.419	3.587
51	0.7	0.2	3.4	3.55	1613	1650	-0.241	0.072	0.419	3.561
52	0.7	0.2	3.6	3.7	1313	1353	-0.223	0.045	0.419	3.741
53	0.7	0.2	3.6	3.65	1464	1495	-0.287	0.029	0.419	3.716
54	0.7	0.2	3.6	3.7	2282	2329	-0.19	0.038	0.419	3.741
55	0.7	0.2	3.8	3.7	2822	2912	-0.099	-0.02	0.419	3.844
56	0.7	0.2	3.8	3.7	3268	3317	-0.182	-0.036	0.419	3.844
57	0.7	0.2	3.8	3.7	3963	3997	-0.262	-0.052	0.419	3.844

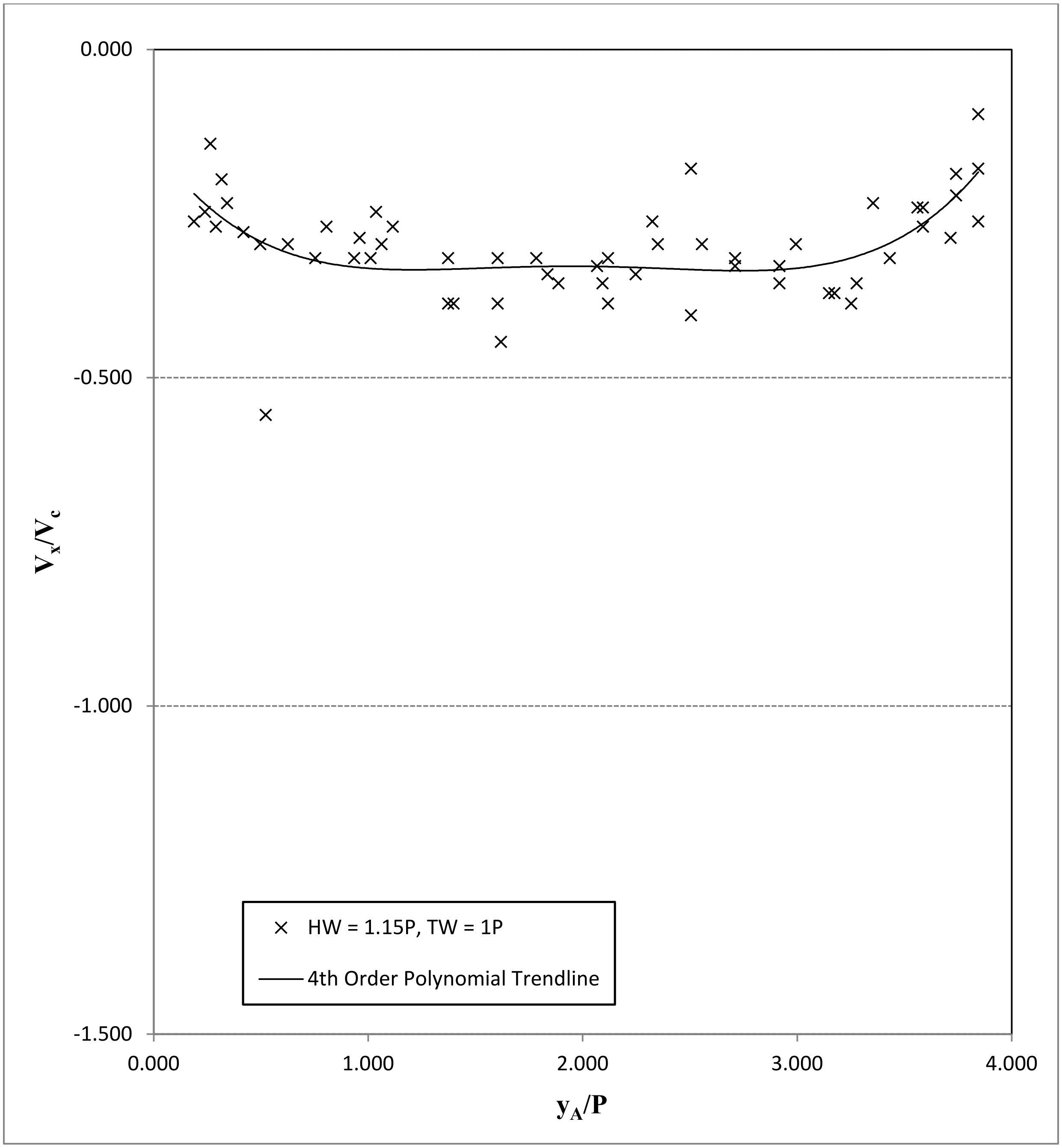

Figure A-9: Headwater = 1.15P, Tailwater = 1P

Table A-10: Headwater = 1.15P, Tailwater = 0.82P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.7	0.2	0.2	0.25	1688	1704	-0.557	0.056	0.419	0.214
2	0.7	0.2	0.2	0.25	1839	1859	-0.445	0.045	0.419	0.214
3	0.7	0.2	0.2	0.25	2428	2469	-0.217	0.022	0.419	0.214
4	0.7	0.2	0.4	0.3	1472	1521	-0.182	-0.036	0.419	0.343
5	0.7	0.2	0.4	0.35	1514	1544	-0.297	-0.03	0.419	0.368
6	0.7	0.2	0.4	0.35	1641	1659	-0.495	-0.049	0.419	0.368
7	0.7	0.2	0.6	0.35	1348	1377	-0.307	-0.154	0.419	0.471
8	0.7	0.2	0.6	0.3	1407	1428	-0.424	-0.255	0.419	0.446
9	0.7	0.2	0.6	0.3	1902	1919	-0.524	-0.314	0.419	0.446
10	0.7	0.2	0.8	0.7	1124	1150	-0.343	-0.069	0.419	0.754
11	0.7	0.2	0.8	0.7	1200	1223	-0.387	-0.077	0.419	0.754
12	0.7	0.2	0.8	0.35	1274	1296	-0.405	-0.364	0.419	0.574
13	0.7	0.2	1	0.85	1368	1389	-0.424	-0.127	0.419	0.935
14	0.7	0.2	1	0.9	1944	1964	-0.445	-0.089	0.419	0.96
15	0.7	0.2	1	0.85	2154	2173	-0.469	-0.141	0.419	0.935
16	0.7	0.2	1.2	1.05	1418	1434	-0.557	-0.167	0.419	1.141
17	0.7	0.2	1.2	1.3	1465	1487	-0.405	0.081	0.419	1.269
18	0.7	0.2	1.2	1.2	1971	1993	-0.405	0	0.419	1.218
19	0.7	0.2	1.4	1.3	1297	1315	-0.495	-0.099	0.419	1.372
20	0.7	0.2	1.4	1.4	2077	2101	-0.371	0	0.419	1.424
21	0.7	0.2	1.4	1.45	2297	2320	-0.387	0.039	0.419	1.45
22	0.7	0.2	1.6	1.55	2000	2020	-0.445	-0.045	0.419	1.604
23	0.7	0.2	1.6	1.6	2020	2047	-0.33	0	0.419	1.63
24	0.7	0.2	1.6	1.5	2198	2216	-0.495	-0.099	0.419	1.578
25	0.7	0.2	1.8	1.6	1144	1164	-0.445	-0.178	0.419	1.733
26	0.7	0.2	1.8	1.6	1167	1185	-0.495	-0.198	0.419	1.733
27	0.7	0.2	1.8	1.9	1289	1309	-0.445	0.089	0.419	1.887
28	0.7	0.2	2	2	1322	1345	-0.387	0	0.419	2.042
29	0.7	0.2	2	2.3	1575	1610	-0.255	0.153	0.419	2.196
30	0.7	0.2	2	2	2285	2309	-0.371	0	0.419	2.042
31	0.7	0.2	2.2	2.3	1232	1250	-0.495	0.099	0.419	2.299
32	0.7	0.2	2.2	2.25	1629	1659	-0.297	0.03	0.419	2.274
33	0.7	0.2	2.2	2.25	1737	1761	-0.371	0.037	0.419	2.274
34	0.7	0.2	2.4	2.7	1269	1304	-0.255	0.153	0.419	2.608
35	0.7	0.2	2.4	2.45	1358	1387	-0.307	0.031	0.419	2.48
36	0.7	0.2	2.4	2.4	1705	1731	-0.343	0	0.419	2.454
37	0.7	0.2	2.6	2.8	1200	1223	-0.387	0.155	0.419	2.763
38	0.7	0.2	2.6	2.5	1619	1641	-0.405	-0.081	0.419	2.608
39	0.7	0.2	2.6	2.6	2134	2154	-0.445	0	0.419	2.66

Table A-10 Continued: Headwater = 1.15P, Tailwater = 0.82P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.7	0.2	2.8	2.8	2130	2146	-0.557	0	0.419	2.866
41	0.7	0.2	2.8	2.9	2250	2277	-0.33	0.066	0.419	2.917
42	0.7	0.2	2.8	2.9	2277	2294	-0.524	0.105	0.419	2.917
43	0.7	0.2	3	3.2	1821	1843	-0.405	0.162	0.419	3.175
44	0.7	0.2	3	3.05	1843	1863	-0.445	0.045	0.419	3.098
45	0.7	0.2	3	2.9	2048	2065	-0.524	-0.105	0.419	3.02
46	0.7	0.2	3.2	3.2	1667	1691	-0.371	0	0.419	3.278
47	0.7	0.2	3.2	3.35	1724	1746	-0.405	0.121	0.419	3.355
48	0.7	0.2	3.2	3.3	1845	1861	-0.557	0.111	0.419	3.329
49	0.7	0.2	3.4	3.4	1673	1697	-0.371	0	0.419	3.484
50	0.7	0.2	3.4	3.6	1895	1919	-0.371	0.148	0.419	3.587
51	0.7	0.2	3.4	3.5	2134	2152	-0.495	0.099	0.419	3.535
52	0.7	0.2	3.6	3.6	1641	1666	-0.356	0	0.419	3.69
53	0.7	0.2	3.6	3.6	2138	2158	-0.445	0	0.419	3.69
54	0.7	0.2	3.6	3.65	2263	2286	-0.387	0.039	0.419	3.716
55	0.7	0.2	3.8	3.65	3247	3286	-0.228	-0.069	0.419	3.819
56	0.7	0.2	3.8	3.75	3945	3983	-0.234	-0.023	0.419	3.87

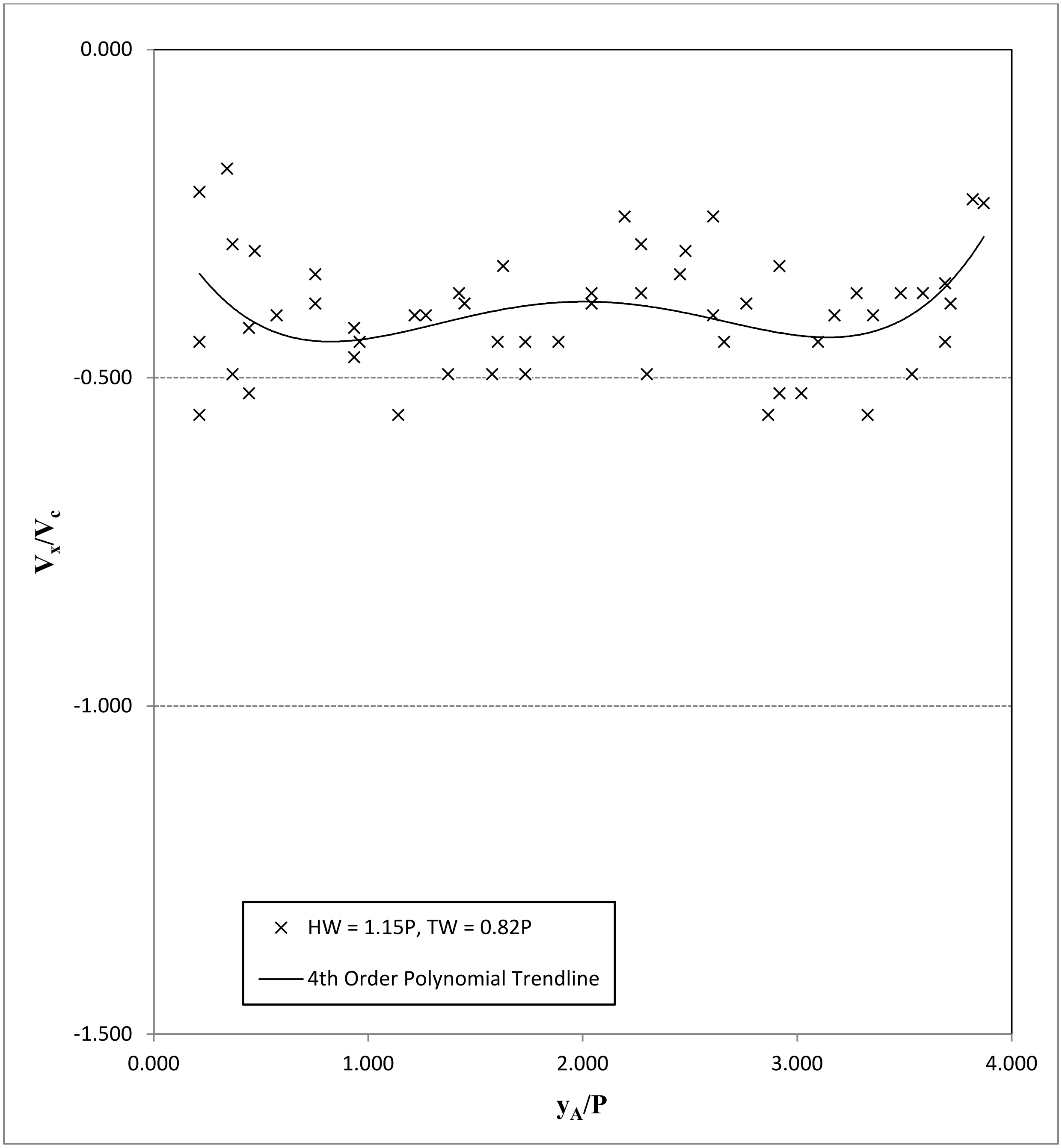

Figure A-10: Headwater = 1.15P, Tailwater = 0.82P

Table A-11: Headwater = 1.15P, Tailwater = 0.63P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.7	0.2	0.2	0.2	1352	1374	-0.405	0	0.419	0.188
2	0.7	0.2	0.2	0.15	1467	1487	-0.445	-0.045	0.419	0.162
3	0.7	0.2	0.2	0.25	1563	1579	-0.557	0.056	0.419	0.214
4	0.7	0.2	0.4	0.3	1364	1377	-0.685	-0.137	0.419	0.343
5	0.7	0.2	0.4	0.3	1635	1652	-0.524	-0.105	0.419	0.343
6	0.7	0.2	0.4	0.2	1707	1735	-0.318	-0.127	0.419	0.291
7	0.7	0.2	0.6	0.5	1893	1907	-0.636	-0.127	0.419	0.549
8	0.7	0.2	0.6	0.4	2091	2109	-0.495	-0.198	0.419	0.497
9	0.7	0.2	0.6	0.55	2390	2403	-0.685	-0.069	0.419	0.574
10	0.7	0.2	0.8	1	2031	2045	-0.636	0.255	0.419	0.909
11	0.7	0.2	0.8	0.6	2414	2431	-0.524	-0.21	0.419	0.703
12	0.7	0.2	0.8	0.75	2480	2500	-0.445	-0.045	0.419	0.78
13	0.7	0.2	1	1	2220	2235	-0.594	0	0.419	1.012
14	0.7	0.2	1	0.8	2504	2518	-0.636	-0.255	0.419	0.909
15	0.7	0.2	1	0.9	2780	2803	-0.387	-0.077	0.419	0.96
16	0.7	0.2	1.2	1.35	2252	2268	-0.557	0.167	0.419	1.295
17	0.7	0.2	1.2	1.1	2824	2840	-0.557	-0.111	0.419	1.166
18	0.7	0.2	1.2	1.1	2845	2859	-0.636	-0.127	0.419	1.166
19	0.7	0.2	1.4	1.25	2353	2373	-0.445	-0.134	0.419	1.347
20	0.7	0.2	1.4	1.3	2910	2926	-0.557	-0.111	0.419	1.372
21	0.7	0.2	1.4	1.3	2994	3009	-0.594	-0.119	0.419	1.372
22	0.7	0.2	1.6	1.55	2595	2619	-0.371	-0.037	0.419	1.604
23	0.7	0.2	1.6	1.3	3017	3035	-0.495	-0.297	0.419	1.475
24	0.7	0.2	1.6	1.55	3071	3089	-0.495	-0.049	0.419	1.604
25	0.7	0.2	1.8	1.55	3270	3290	-0.445	-0.223	0.419	1.707
26	0.7	0.2	1.8	1.9	3380	3398	-0.495	0.099	0.419	1.887
27	0.7	0.2	1.8	1.7	3447	3481	-0.262	-0.052	0.419	1.784
28	0.7	0.2	2	2.1	3506	3522	-0.557	0.111	0.419	2.093
29	0.7	0.2	2	2.1	3546	3565	-0.469	0.094	0.419	2.093
30	0.7	0.2	2	1.9	3581	3597	-0.557	-0.111	0.419	1.99
31	0.7	0.2	2.2	2.3	3633	3662	-0.307	0.061	0.419	2.299
32	0.7	0.2	2.2	2	3668	3694	-0.343	-0.137	0.419	2.145
33	0.7	0.2	2.2	2.1	3989	4007	-0.495	-0.099	0.419	2.196
34	0.7	0.2	2.4	2.6	3793	3814	-0.424	0.17	0.419	2.557
35	0.7	0.2	2.4	2.4	3945	3962	-0.524	0	0.419	2.454
36	0.7	0.2	2.4	2.4	4056	4083	-0.33	0	0.419	2.454
37	0.7	0.2	2.6	2.6	4103	4120	-0.524	0	0.419	2.66
38	0.7	0.2	2.6	2.65	4173	4191	-0.495	0.049	0.419	2.686
39	0.7	0.2	2.6	2.6	4197	4216	-0.469	0	0.419	2.66

Table A-11 Continued: Headwater = 1.15P, Tailwater = 0.63P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.7	0.2	2.8	3	4227	4246	-0.469	0.188	0.419	2.969
41	0.7	0.2	2.8	3	4306	4318	-0.742	0.297	0.419	2.969
42	0.7	0.2	2.8	2.7	4374	4391	-0.524	-0.105	0.419	2.814
43	0.7	0.2	3	2.95	4666	4680	-0.636	-0.064	0.419	3.046
44	0.7	0.2	3	3.35	4766	4782	-0.557	0.39	0.419	3.252
45	0.7	0.2	3	3.35	4789	4807	-0.495	0.346	0.419	3.252
46	0.7	0.2	3.2	3.4	4800	4826	-0.343	0.137	0.419	3.381
47	0.7	0.2	3.2	3.2	6376	6390	-0.636	0	0.419	3.278
48	0.7	0.2	3.2	3.4	6586	6605	-0.469	0.188	0.419	3.381
49	0.7	0.2	3.4	3.4	4887	4907	-0.445	0	0.419	3.484
50	0.7	0.2	3.4	3.75	6419	6446	-0.33	0.231	0.419	3.664
51	0.7	0.2	3.4	3.6	6601	6628	-0.33	0.132	0.419	3.587
52	0.7	0.2	3.6	3.5	5024	5043	-0.469	-0.094	0.419	3.638
53	0.7	0.2	3.6	3.55	6446	6473	-0.33	-0.033	0.419	3.664
54	0.7	0.2	3.6	3.5	6643	6663	-0.445	-0.089	0.419	3.638
55	0.7	0.2	3.8	3.5	6302	6359	-0.156	-0.094	0.419	3.741
56	0.7	0.2	3.8	3.65	6511	6544	-0.27	-0.081	0.419	3.819
57	0.7	0.2	3.8	3.7	6839	6863	-0.371	-0.074	0.419	3.844

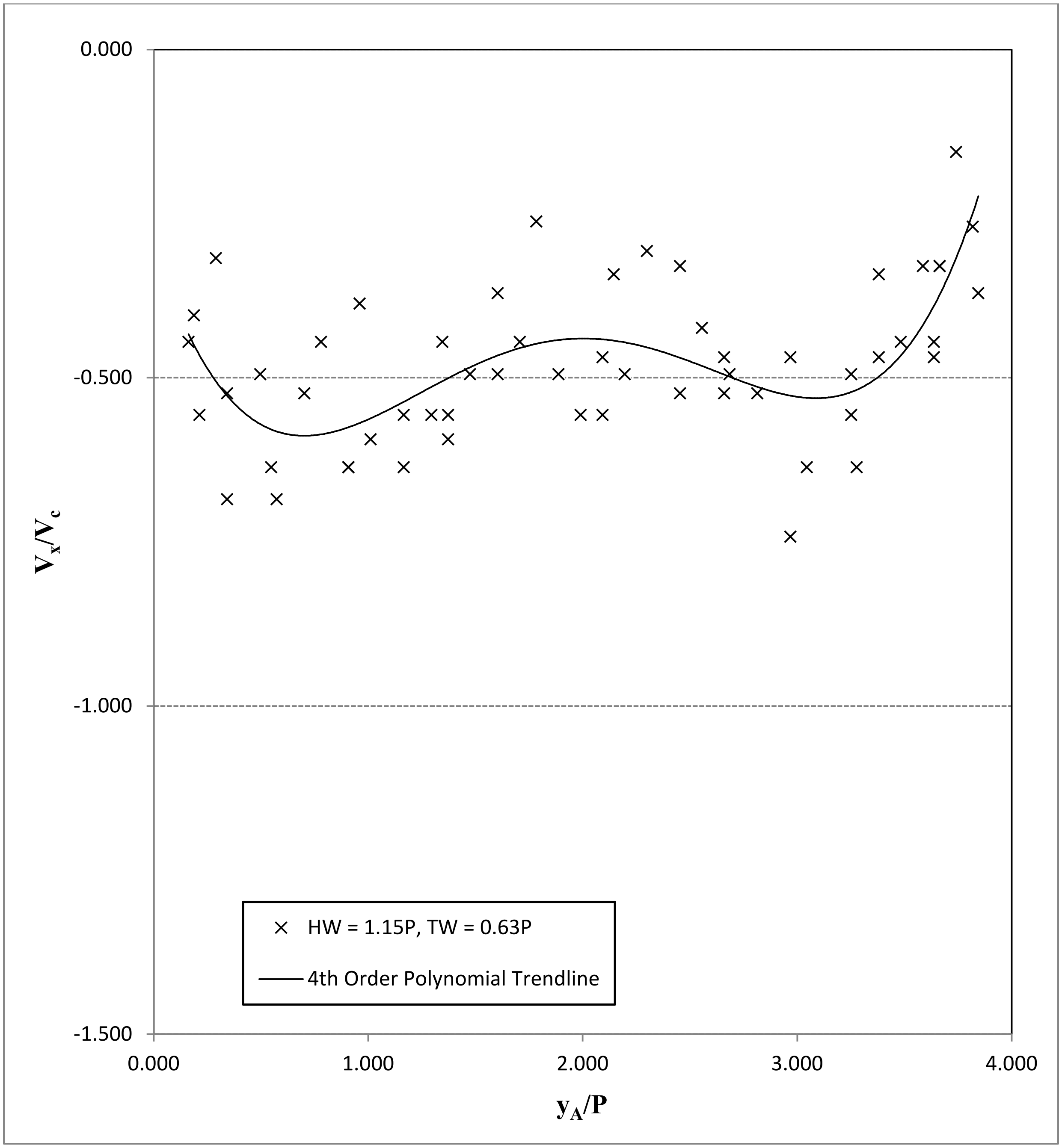

Figure A-11: Headwater = 1.15P, Tailwater = 0.63P

Table A-12: Headwater = 1.15P, Tailwater = 0.45P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.7	0.2	0.2	0.3	6958	6974	-0.709	0.142	0.419	0.24
2	0.7	0.2	0.2	0.15	5614	5640	-0.436	-0.044	0.419	0.162
3	0.7	0.2	0.2	0.2	5674	5688	-0.81	0	0.419	0.188
4	0.7	0.2	0.4	0.4	6973	6989	-0.709	0	0.419	0.394
5	0.7	0.2	0.4	0.35	5737	5756	-0.597	-0.06	0.419	0.368
6	0.7	0.2	0.4	0.35	5757	5778	-0.54	-0.054	0.419	0.368
7	0.7	0.2	0.6	0.6	6996	7017	-0.54	0	0.419	0.6
8	0.7	0.2	0.6	0.35	5786	5799	-0.873	-0.436	0.419	0.471
9	0.7	0.2	0.6	0.4	5830	5844	-0.81	-0.324	0.419	0.497
10	0.7	0.2	0.8	0.8	7116	7131	-0.756	0	0.419	0.806
11	0.7	0.2	0.8	0.7	5848	5868	-0.567	-0.113	0.419	0.754
12	0.7	0.2	0.8	0.7	5998	6013	-0.756	-0.151	0.419	0.754
13	0.7	0.2	1	0.95	7156	7174	-0.63	-0.063	0.419	0.986
14	0.7	0.2	1	1	6054	6072	-0.63	0	0.419	1.012
15	0.7	0.2	1	0.9	6251	6267	-0.709	-0.142	0.419	0.96
16	0.7	0.2	1.2	1.3	7439	7455	-0.709	0.142	0.419	1.269
17	0.7	0.2	1.2	1.3	6967	6982	-0.756	0.151	0.419	1.269
18	0.7	0.2	1.2	1.25	7112	7129	-0.667	0.067	0.419	1.244
19	0.7	0.2	1.4	1.5	8019	8037	-0.63	0.126	0.419	1.475
20	0.7	0.2	1.4	1.5	8019	8037	-0.63	0.126	0.419	1.475
21	0.7	0.2	1.4	1.5	8108	8127	-0.597	0.119	0.419	1.475
22	0.7	0.2	1.6	1.55	8212	8229	-0.667	-0.067	0.419	1.604
23	0.7	0.2	1.6	1.55	8213	8230	-0.667	-0.067	0.419	1.604
24	0.7	0.2	1.6	1.65	8347	8360	-0.873	0.087	0.419	1.656
25	0.7	0.2	1.8	1.7	8847	8865	-0.63	-0.126	0.419	1.784
26	0.7	0.2	1.8	1.7	8849	8866	-0.667	-0.133	0.419	1.784
27	0.7	0.2	1.8	1.7	8920	8936	-0.709	-0.142	0.419	1.784
28	0.7	0.2	2	2.1	9017	9031	-0.81	0.162	0.419	2.093
29	0.7	0.2	2	2.1	9053	9075	-0.516	0.103	0.419	2.093
30	0.7	0.2	2	2.1	9126	9152	-0.436	0.087	0.419	2.093
31	0.7	0.2	2.2	2.1	9062	9079	-0.667	-0.133	0.419	2.196
32	0.7	0.2	2.2	2.2	9245	9266	-0.54	0	0.419	2.248
33	0.7	0.2	2.2	2.25	9287	9308	-0.54	0.054	0.419	2.274
34	0.7	0.2	2.4	2.55	9273	9296	-0.493	0.148	0.419	2.531
35	0.7	0.2	2.4	2.4	1278	1297	-0.597	0	0.419	2.454
36	0.7	0.2	2.4	2.3	1443	1467	-0.473	-0.095	0.419	2.402
37	0.7	0.2	2.6	2.6	9348	9369	-0.54	0	0.419	2.66
38	0.7	0.2	2.6	2.65	2867	2882	-0.756	0.076	0.419	2.686
39	0.7	0.2	2.6	2.7	3106	3121	-0.756	0.151	0.419	2.711

Table A-12 Continued: Headwater = 1.15P, Tailwater = 0.45P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.7	0.2	2.8	2.8	1411	1423	-0.945	0	0.419	2.866
41	0.7	0.2	2.8	2.9	1643	1661	-0.63	0.126	0.419	2.917
42	0.7	0.2	2.8	2.8	1906	1924	-0.63	0	0.419	2.866
43	0.7	0.2	3	3.05	2226	2252	-0.436	0.044	0.419	3.098
44	0.7	0.2	3	2.9	2383	2402	-0.597	-0.119	0.419	3.02
45	0.7	0.2	3	2.95	2524	2540	-0.709	-0.071	0.419	3.046
46	0.7	0.2	3.2	3.35	2660	2678	-0.63	0.189	0.419	3.355
47	0.7	0.2	3.2	3.2	2805	2826	-0.54	0	0.419	3.278
48	0.7	0.2	3.2	3.5	2886	2909	-0.493	0.296	0.419	3.432
49	0.7	0.2	3.4	3.45	2911	2929	-0.63	0.063	0.419	3.51
50	0.7	0.2	3.4	3.55	3006	3028	-0.516	0.155	0.419	3.561
51	0.7	0.2	3.4	3.55	3510	3533	-0.493	0.148	0.419	3.561
52	0.7	0.2	3.6	3.55	3728	3745	-0.667	-0.067	0.419	3.664
53	0.7	0.2	3.6	3.65	3874	3889	-0.756	0.076	0.419	3.716
54	0.7	0.2	3.6	3.5	3911	3924	-0.873	-0.175	0.419	3.638
55	0.7	0.2	3.8	3.75	4140	4218	-0.145	-0.015	0.419	3.87
56	0.7	0.2	3.8	3.5	5012	5035	-0.493	-0.296	0.419	3.741
57	0.7	0.2	3.8	3.65	5587	5609	-0.516	-0.155	0.419	3.819

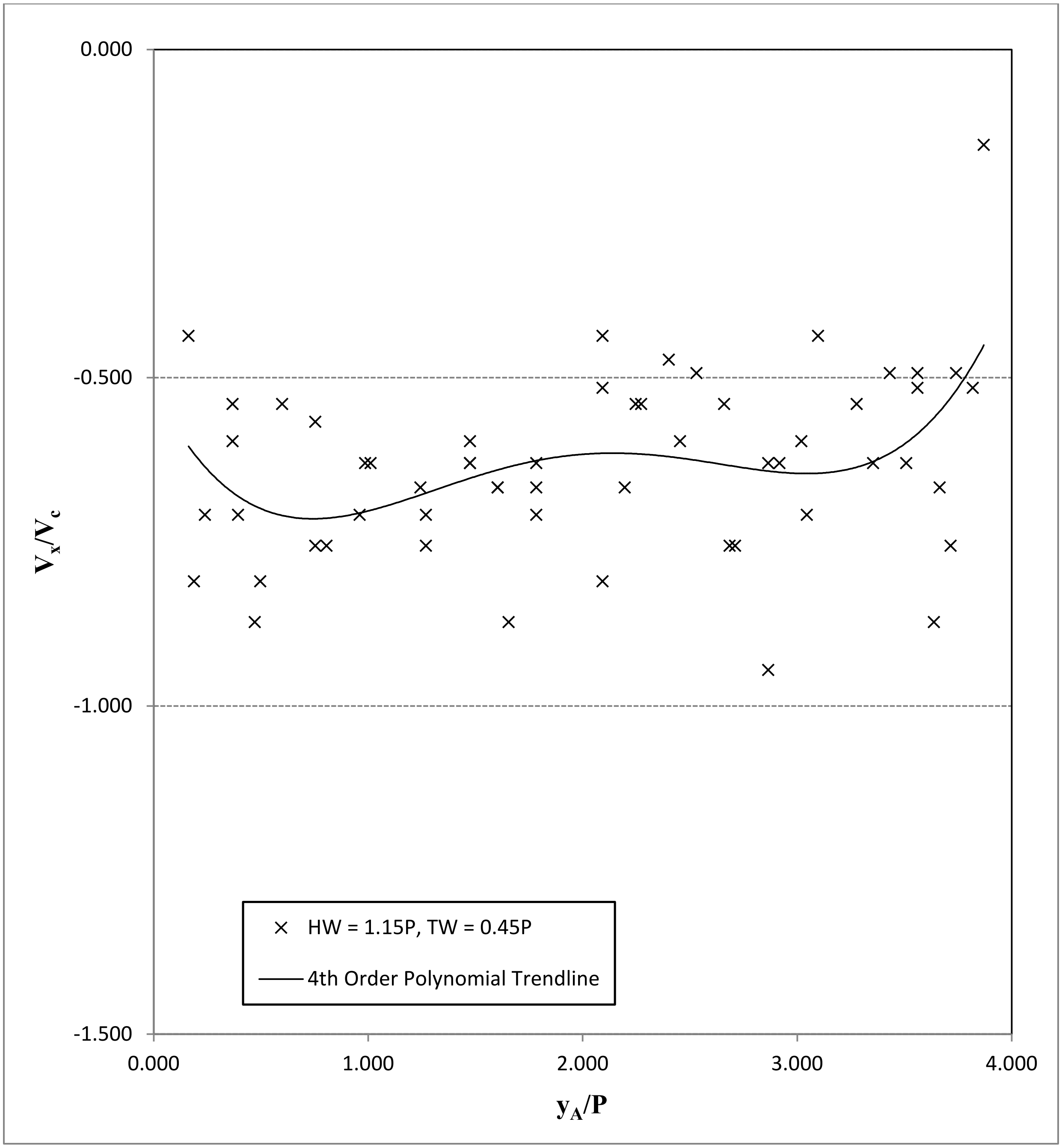

Figure A-12: Headwater = 1.15P, Tailwater = 0.45P

Table A-13: Headwater = 1.10P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.7	0.2	0.2	0.3	1437	1492	-0.206	0.041	0.419	0.24
2	0.7	0.2	0.4	0.4	1590	1654	-0.177	0	0.419	0.394
3	0.7	0.2	0.4	0.45	2530	2593	-0.18	0.018	0.419	0.42
4	0.7	0.2	0.4	0.25	2836	2919	-0.137	-0.041	0.419	0.317
5	0.7	0.2	0.6	0.4	3204	3258	-0.21	-0.084	0.419	0.497
6	0.7	0.2	0.6	0.5	3624	3670	-0.247	-0.049	0.419	0.549
7	0.7	0.2	0.6	0.5	4513	4580	-0.169	-0.034	0.419	0.549
8	0.7	0.2	0.8	0.8	5340	5391	-0.222	0	0.419	0.806
9	0.7	0.2	0.8	0.7	6008	6058	-0.227	-0.045	0.419	0.754
10	0.7	0.2	0.8	0.9	6318	6375	-0.199	0.04	0.419	0.857
11	0.7	0.2	1	0.95	7970	8016	-0.247	-0.025	0.419	0.986
12	0.7	0.2	1	0.4	8638	8705	-0.169	-0.203	0.419	0.703
13	0.7	0.2	1	1	2105	2153	-0.236	0	0.419	1.012
14	0.7	0.2	1.2	1.05	5311	5364	-0.214	-0.064	0.419	1.141
15	0.7	0.2	1.2	1.15	5369	5441	-0.158	-0.016	0.419	1.192
16	0.7	0.2	1.2	1.1	6028	6068	-0.284	-0.057	0.419	1.166
17	0.7	0.2	1.4	1.3	7826	7885	-0.192	-0.038	0.419	1.372
18	0.7	0.2	1.4	1.3	8379	8444	-0.175	-0.035	0.419	1.372
19	0.7	0.2	1.4	1.8	8896	8944	-0.236	0.189	0.419	1.63
20	0.7	0.2	1.6	1.5	554	600	-0.247	-0.049	0.419	1.578
21	0.7	0.2	1.6	1.7	1615	1692	-0.147	0.029	0.419	1.681
22	0.7	0.2	1.6	1.55	2710	2764	-0.21	-0.021	0.419	1.604
23	0.7	0.2	1.8	2	3203	3268	-0.175	0.07	0.419	1.939
24	0.7	0.2	1.8	1.7	3301	3352	-0.222	-0.044	0.419	1.784
25	0.7	0.2	1.8	1.95	8891	8948	-0.199	0.06	0.419	1.913
26	0.7	0.2	2	1.9	3063	3115	-0.218	-0.044	0.419	1.99
27	0.7	0.2	2	2	3113	3166	-0.214	0	0.419	2.042
28	0.7	0.2	2	2.1	3576	3624	-0.236	0.047	0.419	2.093
29	0.7	0.2	2.2	2.25	6340	6394	-0.21	0.021	0.419	2.274
30	0.7	0.2	2.2	2.3	7350	7406	-0.203	0.041	0.419	2.299
31	0.7	0.2	2.2	2.2	8108	8151	-0.264	0	0.419	2.248
32	0.7	0.2	2.4	2.55	7648	7703	-0.206	0.062	0.419	2.531
33	0.7	0.2	2.4	2.65	3560	3607	-0.241	0.121	0.419	2.583
34	0.7	0.2	2.4	2.45	3690	3746	-0.203	0.02	0.419	2.48
35	0.7	0.2	2.6	2.55	7781	7830	-0.231	-0.023	0.419	2.634
36	0.7	0.2	2.6	2.7	998	1048	-0.227	0.045	0.419	2.711
37	0.7	0.2	2.6	2.65	1308	1408	-0.113	0.011	0.419	2.686
38	0.7	0.2	2.8	2.8	7078	7140	-0.183	0	0.419	2.866
39	0.7	0.2	2.8	2.8	8015	8057	-0.27	0	0.419	2.866

Table A-13 Continued: Headwater = 1.10P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.7	0.2	2.8	2.85	8132	8177	-0.252	0.025	0.419	2.892
41	0.7	0.2	3	3.2	8057	8108	-0.222	0.089	0.419	3.175
42	0.7	0.2	3	3.2	5493	5532	-0.291	0.116	0.419	3.175
43	0.7	0.2	3	3.15	7317	7364	-0.241	0.072	0.419	3.149
44	0.7	0.2	3.2	3.25	5586	5630	-0.258	0.026	0.419	3.304
45	0.7	0.2	3.2	3.3	7635	7680	-0.252	0.05	0.419	3.329
46	0.7	0.2	3.2	3.1	8375	8425	-0.227	-0.045	0.419	3.226
47	0.7	0.2	3.4	3.6	8610	8687	-0.147	0.059	0.419	3.587
48	0.7	0.2	3.4	3.5	8886	8935	-0.231	0.046	0.419	3.535
49	0.7	0.2	3.4	3.45	8942	8989	-0.241	0.024	0.419	3.51
50	0.7	0.2	3.6	3.6	9022	9089	-0.169	0	0.419	3.69
51	0.7	0.2	3.6	3.8	1392	1458	-0.172	0.069	0.419	3.793
52	0.7	0.2	3.6	3.75	2671	2731	-0.189	0.057	0.419	3.767
53	0.7	0.2	3.8	3.75	944	999	-0.206	-0.021	0.419	3.87
54	0.7	0.2	3.8	3.7	1397	1451	-0.21	-0.042	0.419	3.844
55	0.7	0.2	3.8	3.65	2314	2399	-0.133	-0.04	0.419	3.819

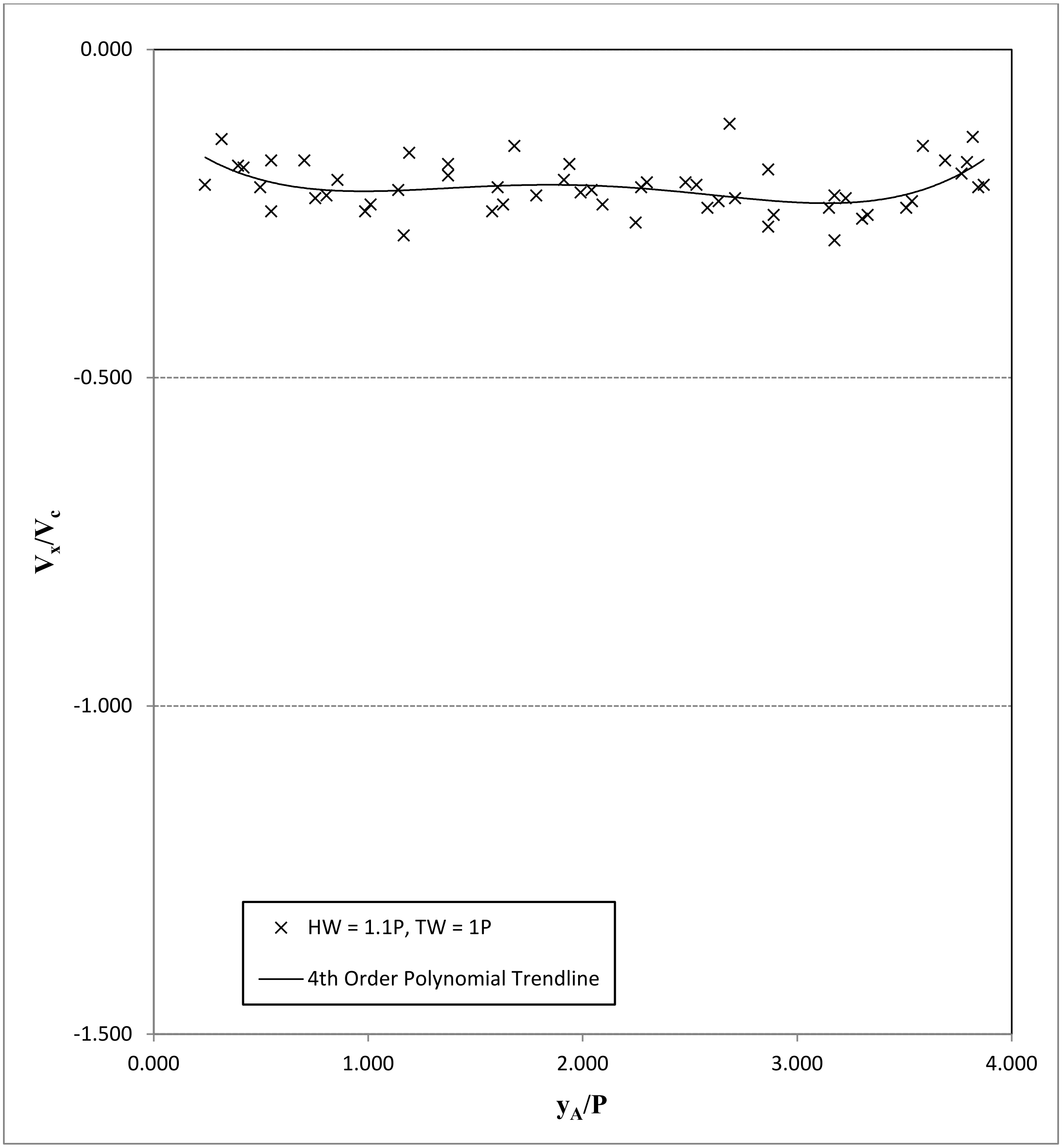

Figure A-13: Headwater = 1.10P, Tailwater = 1P

Table A-14: Headwater = 1.10P, Tailwater = 0.79P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.7	0.2	0.2	0.3	1608	1638	-0.378	0.076	0.419	0.24
2	0.7	0.2	0.2	1.28	1798	1836	-0.298	0.645	0.419	0.744
3	0.7	0.2	0.2	0.2	2232	2267	-0.324	0	0.419	0.188
4	0.7	0.2	0.4	0.6	2636	2666	-0.378	0.151	0.419	0.497
5	0.7	0.2	0.4	0.45	3167	3192	-0.454	0.045	0.419	0.42
6	0.7	0.2	0.4	0.35	3687	3719	-0.354	-0.035	0.419	0.368
7	0.7	0.2	0.6	0.65	4020	4052	-0.354	0.035	0.419	0.626
8	0.7	0.2	0.6	0.6	5629	5667	-0.298	0	0.419	0.6
9	0.7	0.2	0.6	0.55	5803	5840	-0.307	-0.031	0.419	0.574
10	0.7	0.2	0.8	0.5	5966	6002	-0.315	-0.189	0.419	0.651
11	0.7	0.2	0.8	0.7	6254	6291	-0.307	-0.061	0.419	0.754
12	0.7	0.2	0.8	0.7	7652	7676	-0.473	-0.095	0.419	0.754
13	0.7	0.2	1	0.85	9400	9430	-0.378	-0.113	0.419	0.935
14	0.7	0.2	1	1.05	1589	1625	-0.315	0.032	0.419	1.038
15	0.7	0.2	1	0.95	1945	1982	-0.307	-0.031	0.419	0.986
16	0.7	0.2	1.2	1.15	3093	3123	-0.378	-0.038	0.419	1.192
17	0.7	0.2	1.2	1.1	7750	7778	-0.405	-0.081	0.419	1.166
18	0.7	0.2	1.2	1.1	8541	8573	-0.354	-0.071	0.419	1.166
19	0.7	0.2	1.4	1.5	1288	1318	-0.378	0.076	0.419	1.475
20	0.7	0.2	1.4	1.4	1585	1618	-0.344	0	0.419	1.424
21	0.7	0.2	1.4	1.45	2018	2087	-0.164	0.016	0.419	1.45
22	0.7	0.2	1.6	1.45	2316	2350	-0.334	-0.1	0.419	1.553
23	0.7	0.2	1.6	1.5	2622	2665	-0.264	-0.053	0.419	1.578
24	0.7	0.2	1.6	1.65	3054	3108	-0.21	0.021	0.419	1.656
25	0.7	0.2	1.8	1.55	3993	4045	-0.218	-0.109	0.419	1.707
26	0.7	0.2	1.8	1.75	4681	4705	-0.473	-0.047	0.419	1.81
27	0.7	0.2	1.8	1.85	6015	6042	-0.42	0.042	0.419	1.862
28	0.7	0.2	2	1.8	7105	7141	-0.315	-0.126	0.419	1.939
29	0.7	0.2	2	1.85	7330	7365	-0.324	-0.097	0.419	1.965
30	0.7	0.2	2	1.9	8787	8824	-0.307	-0.061	0.419	1.99
31	0.7	0.2	2.2	2.05	3789	3845	-0.203	-0.061	0.419	2.171
32	0.7	0.2	2.2	2.3	6584	6619	-0.324	0.065	0.419	2.299
33	0.7	0.2	2.2	2.05	8672	8715	-0.264	-0.079	0.419	2.171
34	0.7	0.2	2.4	2.35	922	953	-0.366	-0.037	0.419	2.428
35	0.7	0.2	2.4	2.4	1930	1970	-0.284	0	0.419	2.454
36	0.7	0.2	2.4	2.3	3344	3373	-0.391	-0.078	0.419	2.402
37	0.7	0.2	2.6	2.85	3620	3647	-0.42	0.21	0.419	2.789
38	0.7	0.2	2.6	2.5	8491	8520	-0.391	-0.078	0.419	2.608
39	0.7	0.2	2.6	2.5	8701	8725	-0.473	-0.095	0.419	2.608

Table A-14 Continued: Headwater = 1.10P, Tailwater = 0.79P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.7	0.2	2.8	2.95	8908	8943	-0.324	0.097	0.419	2.943
41	0.7	0.2	2.8	2.8	8635	8676	-0.277	0	0.419	2.866
42	0.7	0.2	2.8	2.85	5898	5936	-0.298	0.03	0.419	2.892
43	0.7	0.2	3	2.95	1340	1374	-0.334	-0.033	0.419	3.046
44	0.7	0.2	3	2.8	1634	1666	-0.354	-0.142	0.419	2.969
45	0.7	0.2	3	3.15	5895	5931	-0.315	0.095	0.419	3.149
46	0.7	0.2	3.2	3.2	6078	6109	-0.366	0	0.419	3.278
47	0.7	0.2	3.2	3.2	6375	6400	-0.454	0	0.419	3.278
48	0.7	0.2	3.2	3.5	6641	6672	-0.366	0.22	0.419	3.432
49	0.7	0.2	3.4	3.4	6774	6807	-0.344	0	0.419	3.484
50	0.7	0.2	3.4	3.5	6819	6849	-0.378	0.076	0.419	3.535
51	0.7	0.2	3.4	3.45	6960	6985	-0.454	0.045	0.419	3.51
52	0.7	0.2	3.6	3.7	6980	7021	-0.277	0.055	0.419	3.741
53	0.7	0.2	3.6	3.7	7079	7164	-0.133	0.027	0.419	3.741
54	0.7	0.2	3.6	3.6	7177	7207	-0.378	0	0.419	3.69
55	0.7	0.2	3.8	3.65	7245	7275	-0.378	-0.113	0.419	3.819
56	0.7	0.2	3.8	3.8	7382	7442	-0.189	0	0.419	3.896
57	0.7	0.2	3.8	3.7	7524	7595	-0.16	-0.032	0.419	3.844

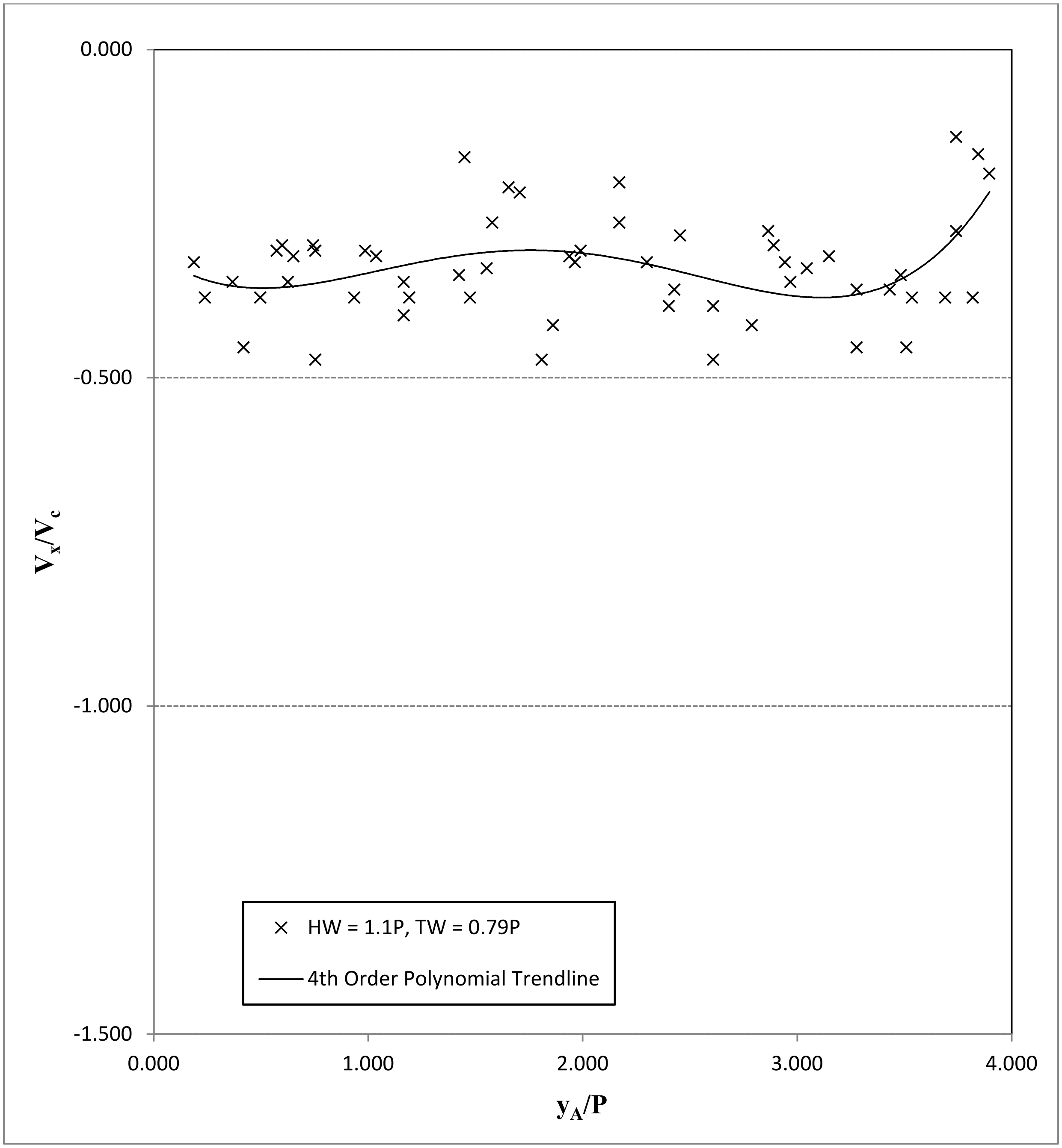

Figure A-14: Headwater = 1.10P, Tailwater = 0.79P

Table A-15: Headwater = 1.10P, Tailwater = 0.59P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.7	0.2	0.2	0.2	1324	1348	-0.473	0	0.419	0.188
2	0.7	0.2	0.2	0.2	1532	1563	-0.366	0	0.419	0.188
3	0.7	0.2	0.2	0.2	2256	2279	-0.493	0	0.419	0.188
4	0.7	0.2	0.4	0.4	2350	2369	-0.597	0	0.419	0.394
5	0.7	0.2	0.4	0.4	2429	2445	-0.709	0	0.419	0.394
6	0.7	0.2	0.4	0.3	2549	2589	-0.284	-0.057	0.419	0.343
7	0.7	0.2	0.6	0.6	3517	3536	-0.597	0	0.419	0.6
8	0.7	0.2	0.6	0.45	3565	3587	-0.516	-0.155	0.419	0.523
9	0.7	0.2	0.6	0.35	3614	3637	-0.493	-0.247	0.419	0.471
10	0.7	0.2	0.8	0.85	4266	4284	-0.63	0.063	0.419	0.832
11	0.7	0.2	0.8	0.65	4576	4598	-0.516	-0.155	0.419	0.729
12	0.7	0.2	0.8	0.8	4778	4808	-0.378	0	0.419	0.806
13	0.7	0.2	1	1	6074	6098	-0.473	0	0.419	1.012
14	0.7	0.2	1	1.5	6716	6738	-0.516	0.516	0.419	1.269
15	0.7	0.2	1	1	7596	7621	-0.454	0	0.419	1.012
16	0.7	0.2	1.2	1.25	7631	7652	-0.54	0.054	0.419	1.244
17	0.7	0.2	1.2	1.3	7657	7678	-0.54	0.108	0.419	1.269
18	0.7	0.2	1.2	1.35	7856	7880	-0.473	0.142	0.419	1.295
19	0.7	0.2	1.4	1.35	7906	7925	-0.597	-0.06	0.419	1.398
20	0.7	0.2	1.4	1.4	7998	8020	-0.516	0	0.419	1.424
21	0.7	0.2	1.4	1.45	8241	8261	-0.567	0.057	0.419	1.45
22	0.7	0.2	1.6	1.6	8290	8316	-0.436	0	0.419	1.63
23	0.7	0.2	1.6	1.65	9258	9279	-0.54	0.054	0.419	1.656
24	0.7	0.2	1.6	1.6	2919	2941	-0.516	0	0.419	1.63
25	0.7	0.2	1.8	1.9	3004	3026	-0.516	0.103	0.419	1.887
26	0.7	0.2	1.8	1.85	5171	5189	-0.63	0.063	0.419	1.862
27	0.7	0.2	1.8	1.7	5813	5837	-0.473	-0.095	0.419	1.784
28	0.7	0.2	2	2	7042	7061	-0.597	0	0.419	2.042
29	0.7	0.2	2	1.95	7155	7178	-0.493	-0.049	0.419	2.016
30	0.7	0.2	2	2.1	7208	7236	-0.405	0.081	0.419	2.093
31	0.7	0.2	2.2	2.2	7844	7865	-0.54	0	0.419	2.248
32	0.7	0.2	2.2	2.1	8336	8357	-0.54	-0.108	0.419	2.196
33	0.7	0.2	2.2	2.35	8493	8515	-0.516	0.155	0.419	2.325
34	0.7	0.2	2.4	2.25	8985	9004	-0.597	-0.179	0.419	2.377
35	0.7	0.2	2.4	2.2	1386	1418	-0.354	-0.142	0.419	2.351
36	0.7	0.2	2.4	2.55	1710	1738	-0.405	0.122	0.419	2.531
37	0.7	0.2	2.6	2.7	2079	2102	-0.493	0.099	0.419	2.711
38	0.7	0.2	2.6	2.6	2170	2191	-0.54	0	0.419	2.66
39	0.7	0.2	2.6	2.8	3584	3604	-0.567	0.227	0.419	2.763

Table A-15 Continued: Headwater = 1.10P, Tailwater = 0.59P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.7	0.2	2.8	2.9	4348	4369	-0.54	0.108	0.419	2.917
41	0.7	0.2	2.8	2.9	4911	4931	-0.567	0.113	0.419	2.917
42	0.7	0.2	2.8	2.95	5049	5082	-0.344	0.103	0.419	2.943
43	0.7	0.2	3	3	5138	5161	-0.493	0	0.419	3.072
44	0.7	0.2	3	3.2	5511	5533	-0.516	0.206	0.419	3.175
45	0.7	0.2	3	3	6132	6149	-0.667	0	0.419	3.072
46	0.7	0.2	3.2	3.2	6402	6419	-0.667	0	0.419	3.278
47	0.7	0.2	3.2	3.2	6428	6448	-0.567	0	0.419	3.278
48	0.7	0.2	3.2	3.15	6478	6496	-0.63	-0.063	0.419	3.252
49	0.7	0.2	3.4	3.55	6623	6642	-0.597	0.179	0.419	3.561
50	0.7	0.2	3.4	3.7	6670	6691	-0.54	0.324	0.419	3.638
51	0.7	0.2	3.4	3.4	6826	6846	-0.567	0	0.419	3.484
52	0.7	0.2	3.6	3.55	1462	1485	-0.493	-0.049	0.419	3.664
53	0.7	0.2	3.6	3.6	1497	1529	-0.354	0	0.419	3.69
54	0.7	0.2	3.6	3.7	1541	1566	-0.454	0.091	0.419	3.741
55	0.7	0.2	3.8	3.6	2392	2420	-0.405	-0.162	0.419	3.793
56	0.7	0.2	3.8	3.75	2805	2822	-0.667	-0.067	0.419	3.87
57	0.7	0.2	3.8	3.8	2830	2855	-0.454	0	0.419	3.896

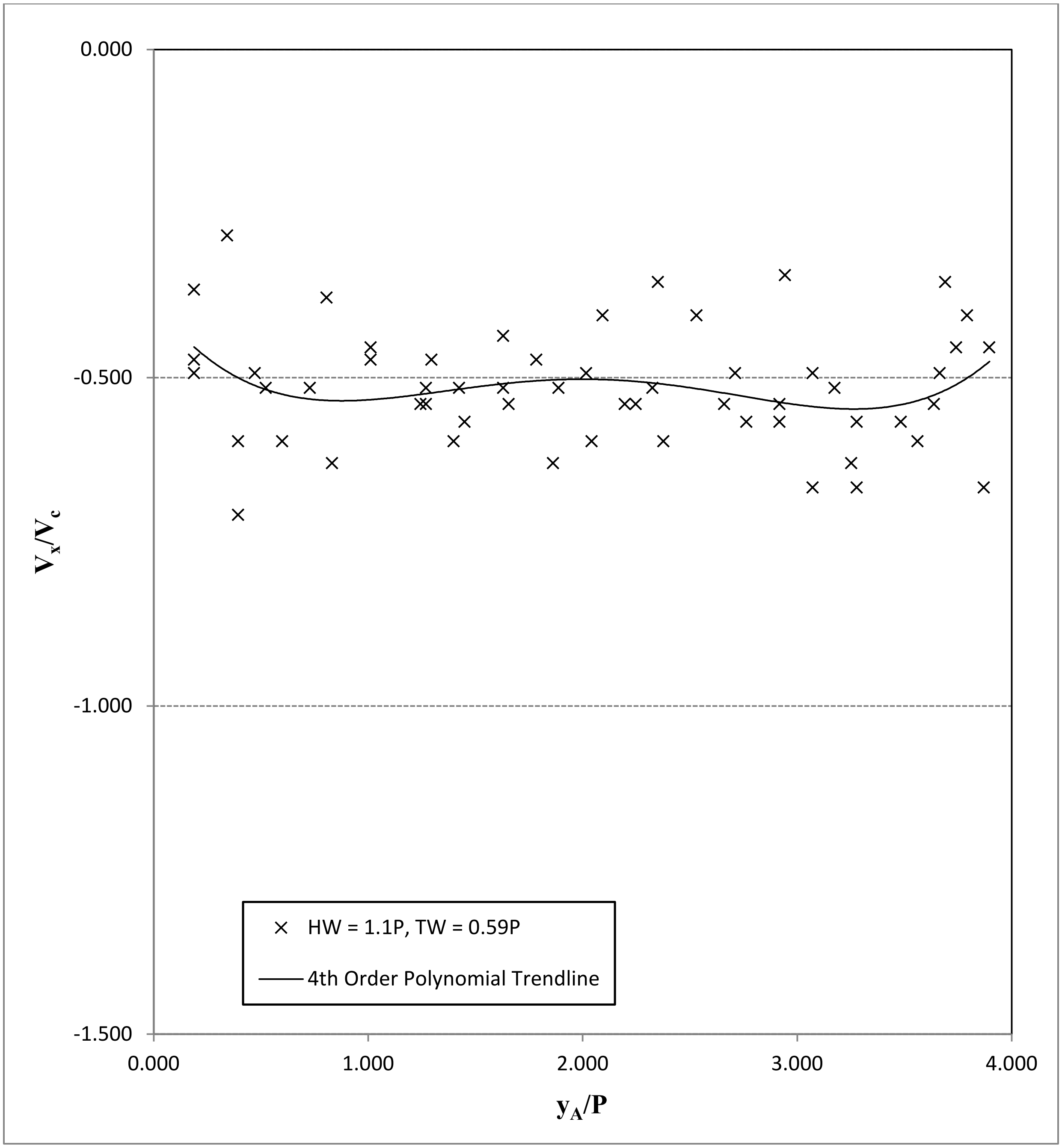

Figure A-15: Headwater = 1.10P, Tailwater = 0.59P

Table A-16: Headwater = 1.10P, Tailwater = 0.38P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.7	0.2	0.2	0.25	1158	1176	-0.63	0.063	0.419	0.214
2	0.7	0.2	0.2	0.2	1255	1276	-0.54	0	0.419	0.188
3	0.7	0.2	0.2	0.4	1670	1687	-0.667	0.267	0.419	0.291
4	0.7	0.2	0.4	0.4	2146	2162	-0.709	0	0.419	0.394
5	0.7	0.2	0.4	0.3	2371	2390	-0.597	-0.119	0.419	0.343
6	0.7	0.2	0.4	0.35	2458	2477	-0.597	-0.06	0.419	0.368
7	0.7	0.2	0.6	0.7	2853	2869	-0.709	0.142	0.419	0.651
8	0.7	0.2	0.6	0.7	3712	3728	-0.709	0.142	0.419	0.651
9	0.7	0.2	0.6	0.4	3906	3921	-0.756	-0.302	0.419	0.497
10	0.7	0.2	0.8	0.85	4828	4844	-0.709	0.071	0.419	0.832
11	0.7	0.2	0.8	0.85	4957	4972	-0.756	0.076	0.419	0.832
12	0.7	0.2	0.8	0.85	5249	5273	-0.473	0.047	0.419	0.832
13	0.7	0.2	1	0.8	5360	5381	-0.54	-0.216	0.419	0.909
14	0.7	0.2	1	1	5695	5710	-0.756	0	0.419	1.012
15	0.7	0.2	1	0.9	5957	5972	-0.756	-0.151	0.419	0.96
16	0.7	0.2	1.2	1.3	5970	5989	-0.597	0.119	0.419	1.269
17	0.7	0.2	1.2	1.15	5994	6009	-0.756	-0.076	0.419	1.192
18	0.7	0.2	1.2	1.15	6175	6194	-0.597	-0.06	0.419	1.192
19	0.7	0.2	1.4	1.45	5737	5760	-0.493	0.049	0.419	1.45
20	0.7	0.2	1.4	1.55	5898	5915	-0.667	0.2	0.419	1.501
21	0.7	0.2	1.4	1.5	6042	6063	-0.54	0.108	0.419	1.475
22	0.7	0.2	1.6	1.55	6129	6150	-0.54	-0.054	0.419	1.604
23	0.7	0.2	1.6	1.65	6402	6421	-0.597	0.06	0.419	1.656
24	0.7	0.2	1.6	1.65	6493	6520	-0.42	0.042	0.419	1.656
25	0.7	0.2	1.8	1.8	7030	7049	-0.597	0	0.419	1.836
26	0.7	0.2	1.8	1.7	7484	7504	-0.567	-0.113	0.419	1.784
27	0.7	0.2	1.8	1.85	7511	7526	-0.756	0.076	0.419	1.862
28	0.7	0.2	2	2	1369	1388	-0.597	0	0.419	2.042
29	0.7	0.2	2	2.1	1661	1685	-0.473	0.095	0.419	2.093
30	0.7	0.2	2	2.05	1719	1736	-0.667	0.067	0.419	2.068
31	0.7	0.2	2.2	2.25	2277	2293	-0.709	0.071	0.419	2.274
32	0.7	0.2	2.2	2.25	2376	2393	-0.667	0.067	0.419	2.274
33	0.7	0.2	2.2	2.15	2716	2734	-0.63	-0.063	0.419	2.222
34	0.7	0.2	2.4	2.4	3079	3095	-0.709	0	0.419	2.454
35	0.7	0.2	2.4	2.35	3683	3703	-0.567	-0.057	0.419	2.428
36	0.7	0.2	2.4	2.4	2355	2376	-0.54	0	0.419	2.454
37	0.7	0.2	2.6	2.6	3421	3441	-0.567	0	0.419	2.66
38	0.7	0.2	2.6	2.45	3617	3637	-0.567	-0.17	0.419	2.583
39	0.7	0.2	2.6	2.45	3976	3993	-0.667	-0.2	0.419	2.583

Table A-16 Continued: Headwater = 1.10P, Tailwater = 0.38P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.7	0.2	2.8	2.95	4827	4853	-0.436	0.131	0.419	2.943
41	0.7	0.2	2.8	2.8	5276	5305	-0.391	0	0.419	2.866
42	0.7	0.2	2.8	2.65	6045	6059	-0.81	-0.243	0.419	2.789
43	0.7	0.2	3	3.15	1249	1266	-0.667	0.2	0.419	3.149
44	0.7	0.2	3	3.2	1538	1553	-0.756	0.302	0.419	3.175
45	0.7	0.2	3	2.85	3407	3423	-0.709	-0.213	0.419	2.995
46	0.7	0.2	3.2	3.1	4174	4197	-0.493	-0.099	0.419	3.226
47	0.7	0.2	3.2	3.3	4805	4824	-0.597	0.119	0.419	3.329
48	0.7	0.2	3.2	3.2	4915	4931	-0.709	0	0.419	3.278
49	0.7	0.2	3.4	3.3	5204	5221	-0.667	-0.133	0.419	3.432
50	0.7	0.2	3.4	3.45	5709	5728	-0.597	0.06	0.419	3.51
51	0.7	0.2	3.4	3.4	6652	6667	-0.756	0	0.419	3.484
52	0.7	0.2	3.6	3.65	7371	7391	-0.567	0.057	0.419	3.716
53	0.7	0.2	3.6	3.65	7566	7590	-0.473	0.047	0.419	3.716
54	0.7	0.2	3.6	3.45	7651	7674	-0.493	-0.148	0.419	3.613
55	0.7	0.2	3.8	3.8	1980	1996	-0.709	0	0.419	3.896
56	0.7	0.2	3.8	3.7	2141	2162	-0.54	-0.108	0.419	3.844
57	0.7	0.2	3.8	3.8	2599	2620	-0.54	0	0.419	3.896

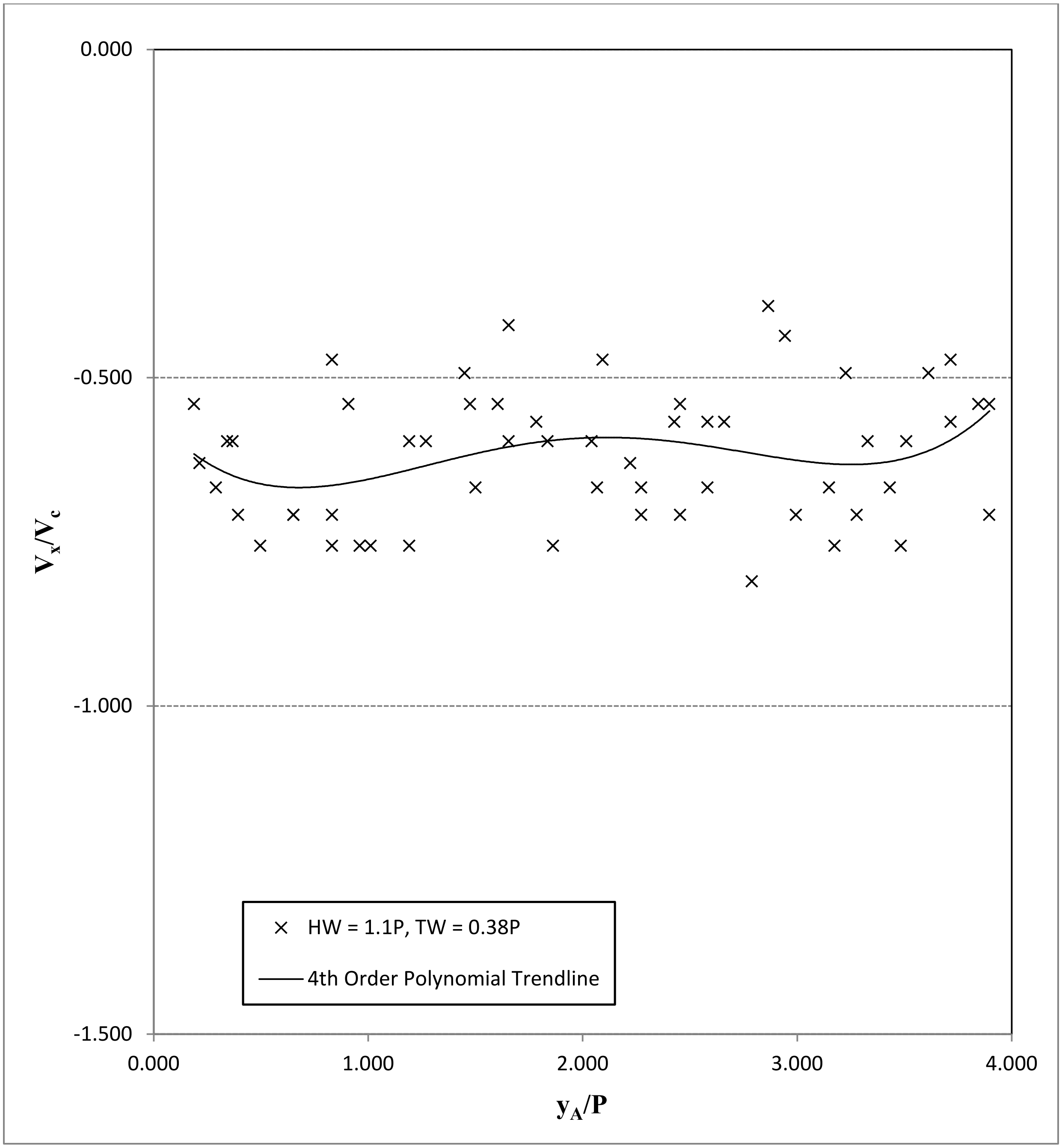

Figure A-16: Headwater = 1.10P, Tailwater = 0.38P

APPENDIX B. DEFLECTOR SPILLWAY DATA AND CALCULATIONS

This section presents the raw data collected and variables calculated from the raw data. The data presented includes the starting *x*-position (x_1), starting *y*-position (y_1), ending *x*-position (x_2), ending *y*-position (y_2), starting frame ($Frame_1$), and ending frame ($Frame_2$). The calculated dimensionless variables include the downstream directed velocity (V_x) divided by critical velocity (V_c), the lateral velocity in the direction of river-right (V_y) divided by V_c, the average *x*-position (x_{Ave}) divided by the crest heght of the dam (P), and the average y-position (y_{Ave}) divided by P.

Table B-1: Headwater = 1.25P, Tailwater = 0.85P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.2	0.8	0.2	0.2	2046	2049	2.726	0	0.47	0.188
2	0.3	1	0.4	0.4	5639	5643	2.385	0	0.625	0.394
3	0.3	0.7	0.6	0.6	1890	1892	2.726	0	0.47	0.6
4	0.2	0.7	0.6	0.6	1497	1500	2.271	0	0.419	0.6
5	0.2	0.7	0.6	0.6	1021	1024	2.271	0	0.419	0.6
6	0.2	0.7	0.8	0.8	552	555	2.271	0	0.419	0.806
7	0.2	0.7	0.8	0.8	554	557	2.271	0	0.419	0.806
8	0.3	0.7	0.8	0.8	1237	1239	2.726	0	0.47	0.806
9	0.1	1.2	1	1	762	768	2.498	0	0.625	1.012
10	0.3	0.8	1	0.95	1715	1718	2.271	-0.227	0.522	0.986
11	0.2	0.8	1	1	4987	4990	2.726	0	0.47	1.012
12	0.3	0.8	1.2	1.2	1708	1711	2.271	0	0.522	1.218
13	0.3	0.7	1.2	1.2	2819	2821	2.726	0	0.47	1.218
14	0.1	0.8	1.2	1.15	6495	6499	2.385	-0.17	0.419	1.192
15	0.1	1.2	1.4	1.4	789	795	2.498	0	0.625	1.424
16	0.2	1	1.4	1.3	795	799	2.726	-0.341	0.573	1.372
17	0.3	0.7	1.4	1.4	1392	1394	2.726	0	0.47	1.424

Table B-1: Headwater = 1.25P, Tailwater = 0.85P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
18	0.2	1.1	1.6	1.6	977	982	2.453	0	0.625	1.63
19	0.1	1.2	1.6	1.6	990	996	2.498	0	0.625	1.63
20	0.3	0.7	1.6	1.8	1379	1381	2.726	1.363	0.47	1.733
21	0.2	1	1.8	1.8	643	647	2.726	0	0.573	1.836
22	0.2	1.2	1.8	1.8	696	702	2.271	0	0.676	1.836
23	0.3	0.7	1.8	1.6	1354	1356	2.726	-1.363	0.47	1.733
24	0.2	1	2	2	966	970	2.726	0	0.573	2.042
25	0.2	0.7	2	2	1618	1621	2.271	0	0.419	2.042
26	0.3	0.7	2.2	2.2	1751	1753	2.726	0	0.47	2.248
27	0.3	1	2.2	2.2	1807	1811	2.385	0	0.625	2.248
28	0.2	0.7	2.2	2.2	1840	1843	2.271	0	0.419	2.248
29	0.2	0.7	2.4	2.45	1570	1573	2.271	0.227	0.419	2.48
30	0.3	0.7	2.4	2.4	2114	2116	2.726	0	0.47	2.454
31	0.2	0.7	2.6	2.55	611	614	2.271	-0.227	0.419	2.634
32	0.2	0.7	2.6	2.6	1103	1106	2.271	0	0.419	2.66
33	0.3	0.7	2.6	2.6	3080	3082	2.726	0	0.47	2.66
34	0.1	1.2	2.8	2.7	912	918	2.498	-0.227	0.625	2.814
35	0.1	0.8	2.8	2.8	3920	3924	2.385	0	0.419	2.866
36	0.2	0.7	2.8	2.8	1210	1213	2.271	0	0.419	2.866
37	0.3	1	3	3	4260	4264	2.385	0	0.625	3.072
38	0.4	1	3	3	4513	4516	2.726	0	0.676	3.072
39	0.1	0.8	3	3	6295	6299	2.385	0	0.419	3.072
40	0.3	0.7	3.2	3.2	2377	2379	2.726	0	0.47	3.278
41	0.1	0.8	3.4	3.4	5101	5105	2.385	0	0.419	3.484
42	0.1	0.8	3.4	3.45	8724	8728	2.385	0.17	0.419	3.51

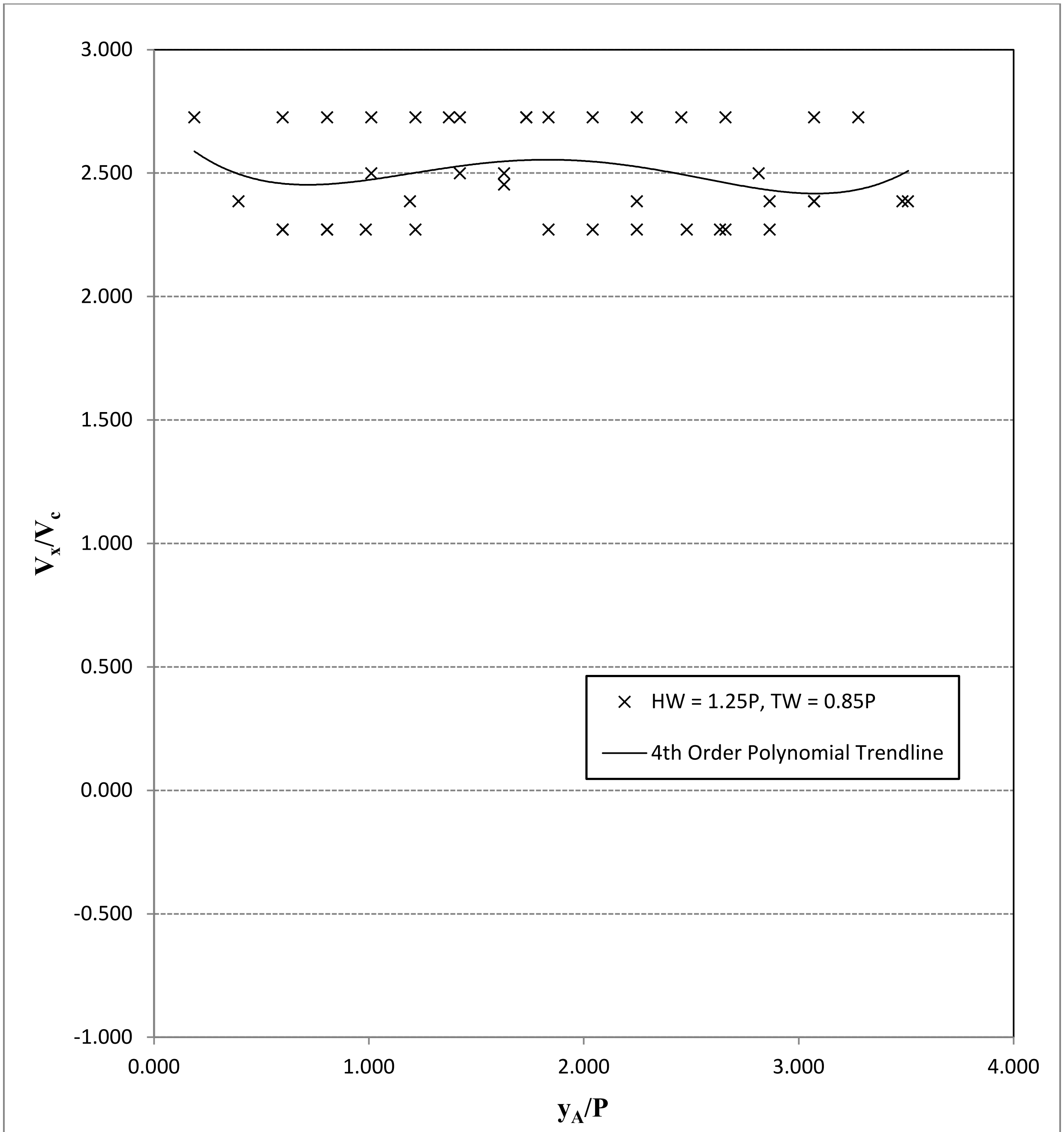

Figure B-1: Headwater = 1.25P, Tailwater = 0.85P

Table B-2: Headwater = 1.25P, Tailwater = 0.7P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	1	0.4	0.2	1.15	2216	2244	-0.292	0.462	0.676	0.677
2	1.2	0.6	0.2	0.3	8188	8211	-0.356	0.059	0.882	0.24
3	1	0.5	0.2	0.4	8466	8484	-0.379	0.151	0.728	0.291
4	1	0.6	0.4	0.5	5869	5883	-0.389	0.097	0.779	0.446
5	0.9	0.6	0.4	0.35	8535	8546	-0.372	-0.062	0.728	0.368
6	0.9	0.6	0.4	0.6	9264	9278	-0.292	0.195	0.728	0.497
7	1.2	0.7	0.6	0.4	3150	3165	-0.454	-0.182	0.934	0.497
8	1.2	0.7	0.6	0.5	8052	8073	-0.324	-0.065	0.934	0.549
9	1.1	0.6	0.6	0.7	8695	8718	-0.296	0.059	0.831	0.651
10	0.9	0.5	0.8	0.8	2247	2264	-0.321	0	0.676	0.806
11	0.7	0.5	0.8	0.8	2352	2363	-0.248	0	0.573	0.806
12	1.2	0.7	0.8	0.7	7560	7580	-0.341	-0.068	0.934	0.754
13	0.7	0.5	1	1	2371	2378	-0.389	0	0.573	1.012
14	1.2	0.8	1	1.1	2680	2692	-0.454	0.114	0.985	1.063
15	0.9	0.5	1	0.8	2790	2800	-0.545	-0.273	0.676	0.909
16	1.1	0.8	1.2	1.2	2750	2770	-0.204	0	0.934	1.218
17	1	0.6	1.2	1	3403	3426	-0.237	-0.119	0.779	1.115
18	1.1	0.9	1.2	2.4	1576	1592	-0.17	1.022	0.985	1.836
19	0.9	0.5	1.4	1.6	5725	5757	-0.17	0.085	0.676	1.527
20	0.9	0.6	1.4	1.4	7410	7429	-0.215	0	0.728	1.424
21	0.7	0.5	1.4	1.25	1567	1583	-0.17	-0.128	0.573	1.347
22	1	0.7	1.6	1.7	2913	2927	-0.292	0.097	0.831	1.681
23	0.8	0.5	1.6	1.5	3203	3212	-0.454	-0.151	0.625	1.578
24	1.2	0.6	1.6	1.7	3823	3860	-0.221	0.037	0.882	1.681
25	1	0.8	1.8	1.8	3086	3097	-0.248	0	0.882	1.836
26	0.8	0.3	1.8	2.2	3275	3303	-0.243	0.195	0.522	2.042
27	1.2	0.8	1.8	1.85	3345	3357	-0.454	0.057	0.985	1.862
28	0.9	0.4	2	1.9	2547	2576	-0.235	-0.047	0.625	1.99
29	0.9	0.3	2	2	2985	3009	-0.341	0	0.573	2.042
30	1	0.5	2	2.05	3909	3929	-0.341	0.034	0.728	2.068
31	1.1	0.7	2.2	2.1	5147	5170	-0.237	-0.059	0.882	2.196
32	0.9	0.5	2.2	2.2	5308	5331	-0.237	0	0.676	2.248
33	0.6	0.3	2.2	2.1	5391	5405	-0.292	-0.097	0.419	2.196
34	1	0.7	2.4	2.2	3480	3494	-0.292	-0.195	0.831	2.351
35	1	0.5	2.4	2.6	7489	7508	-0.359	0.143	0.728	2.557
36	1.2	0.8	2.4	2.45	1644	1662	-0.303	0.038	0.985	2.48
37	0.8	0.4	2.6	2.9	2704	2725	-0.26	0.195	0.573	2.814
38	0.9	0.5	2.6	2.8	2820	2835	-0.363	0.182	0.676	2.763
39	0.7	0.5	2.6	2.5	3134	3144	-0.273	-0.136	0.573	2.608

Table B-2 Continued: Headwater = 1.25P, Tailwater = 0.7P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.9	0.6	2.8	2.8	3004	3012	-0.511	0	0.728	2.866
41	0.9	0.8	2.8	2.9	3878	3899	-0.065	0.065	0.831	2.917
42	1.2	0.8	2.8	3	3957	3971	-0.389	0.195	0.985	2.969
43	0.9	0.4	3	1.8	3023	3042	-0.359	-0.861	0.625	2.454
44	1	0.5	3	2.9	3305	3326	-0.324	-0.065	0.728	3.02
45	0.9	0.5	3	3	3674	3688	-0.389	0	0.676	3.072
46	0.8	0.4	3.2	3.4	1053	1091	-0.143	0.072	0.573	3.381
47	0.9	0.5	3.2	3.2	1656	1673	-0.321	0	0.676	3.278
48	0.7	0.4	3.4	3.2	7071	7089	-0.227	-0.151	0.522	3.381
49	0.8	0.4	3.4	3.1	7094	7112	-0.303	-0.227	0.573	3.329
50	0.7	0.6	3.4	3.4	1762	1776	-0.097	0	0.625	3.484
51	0.7	0.5	3.6	3.7	7775	7792	-0.16	0.08	0.573	3.741
52	1.1	0.5	3.6	3.5	9356	9401	-0.182	-0.03	0.779	3.638
53	1.1	0.7	3.8	3.7	3171	3189	-0.303	-0.076	0.882	3.844
54	1.1	0.8	3.8	3.8	4154	4172	-0.227	0	0.934	3.896

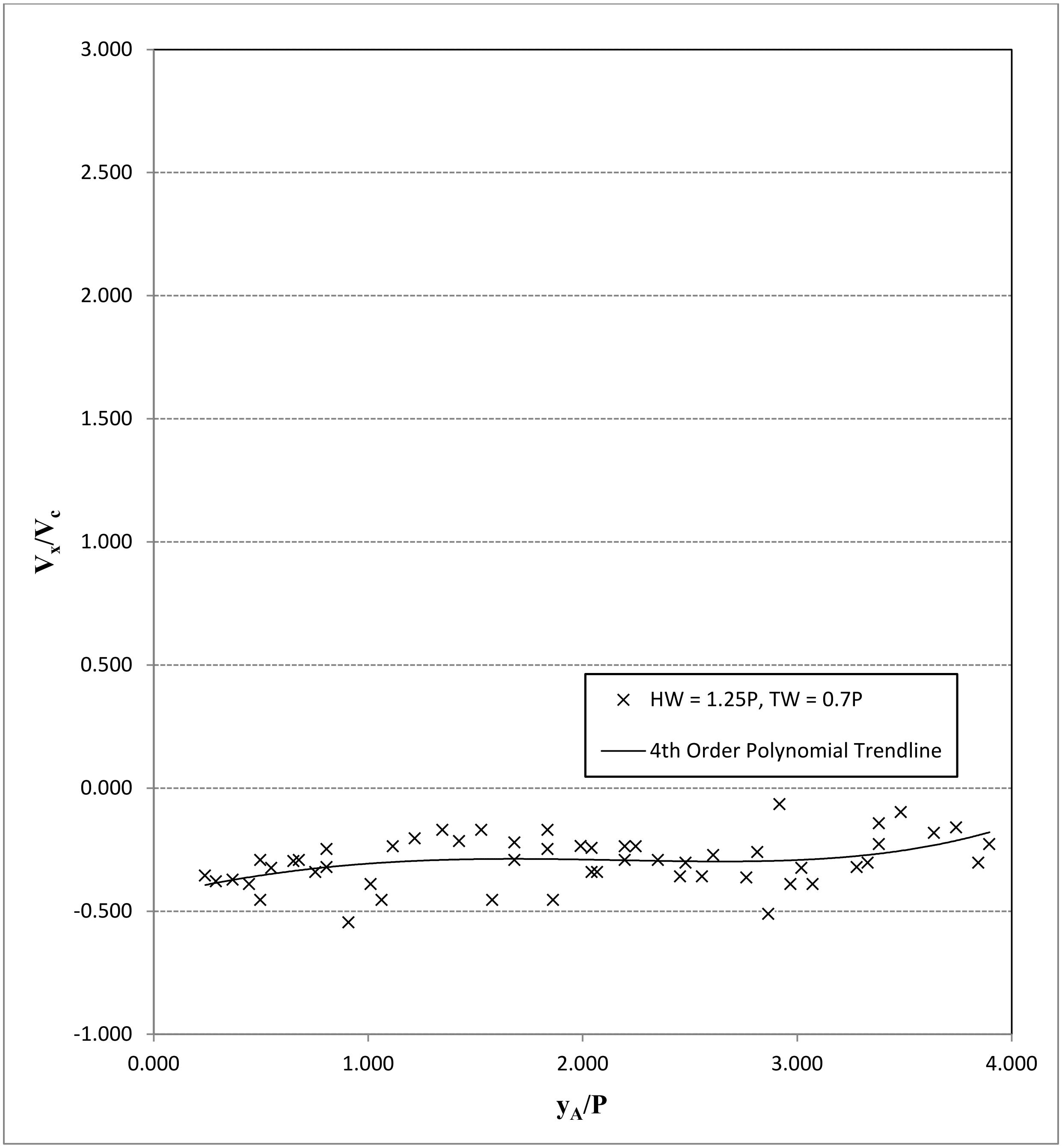

Figure B-2: Headwater = 1.25P, Tailwater = 0.7P

Table B-3: Headwater = 1.25P, Tailwater = 0.55P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.7	0.3	0.4	0.8	675	686	-0.562	0.562	0.47	0.6
2	0.7	0.2	0.4	0.6	968	984	-0.483	0.193	0.419	0.497
3	0.8	0.5	0.4	0.6	1138	1145	-0.662	0.442	0.625	0.497
4	0.8	0.2	0.6	0.7	876	885	-1.03	0.172	0.47	0.651
5	0.7	0.2	0.6	0.6	2052	2061	-0.859	0	0.419	0.6
6	0.7	0.2	0.6	0.5	2382	2398	-0.483	-0.097	0.419	0.549
7	0.7	0.2	0.8	0.6	1972	1997	-0.309	-0.124	0.419	0.703
8	0.7	0.2	0.8	0.75	2644	2657	-0.595	-0.059	0.419	0.78
9	0.7	0.2	0.8	0.85	3579	3595	-0.483	0.048	0.419	0.832
10	0.7	0.3	1	0.95	2131	2145	-0.442	-0.055	0.47	0.986
11	0.7	0.2	1	1.05	2589	2598	-0.859	0.086	0.419	1.038
12	0.7	0.2	1	1	2898	2909	-0.703	0	0.419	1.012
13	0.8	0.2	1.2	0.9	3030	3055	-0.371	-0.185	0.47	1.063
14	0.7	0.2	1.2	1.3	5693	5705	-0.644	0.129	0.419	1.269
15	0.8	0.2	1.4	1.6	1739	1783	-0.211	0.07	0.47	1.527
16	0.9	0.5	1.4	1.4	783	791	-0.773	0	0.676	1.424
17	0.7	0.2	1.4	1.3	2877	2894	-0.455	-0.091	0.419	1.372
18	0.9	0.2	1.6	1.5	938	956	-0.601	-0.086	0.522	1.578
19	0.7	0.2	1.6	1.3	2694	2721	-0.286	-0.172	0.419	1.475
20	0.7	0.2	1.8	1.8	4327	4355	-0.276	0	0.419	1.836
21	0.7	0.2	1.8	1.85	4524	4537	-0.595	0.059	0.419	1.862
22	0.7	0.2	1.8	1.75	6251	6266	-0.515	-0.052	0.419	1.81
23	0.7	0.2	2	2.15	2068	2088	-0.386	0.116	0.419	2.119
24	0.7	0.2	2	2	3276	3285	-0.859	0	0.419	2.042
25	0.7	0.3	2	2	4135	4142	-0.883	0	0.47	2.042
26	1	0.3	2.2	2.2	962	977	-0.721	0	0.625	2.248
27	0.9	0.5	2.2	2.05	1014	1022	-0.773	-0.29	0.676	2.171
28	0.9	0.5	2.2	2.1	1234	1243	-0.687	-0.172	0.676	2.196
29	1	0.2	2.4	2.15	976	995	-0.651	-0.203	0.573	2.325
30	0.7	0.2	2.4	2.3	1990	2003	-0.595	-0.119	0.419	2.402
31	0.7	0.2	2.4	2.35	3154	3182	-0.276	-0.028	0.419	2.428
32	1	0.3	2.6	2.7	917	935	-0.601	0.086	0.625	2.711
33	1.2	0.2	2.6	2.8	1475	1509	-0.455	0.091	0.676	2.763
34	0.7	0.2	2.6	2.6	1944	1957	-0.595	0	0.419	2.66
35	0.7	0.2	2.8	2.9	2357	2389	-0.242	0.048	0.419	2.917
36	0.7	0.2	2.8	3.1	2835	2853	-0.429	0.258	0.419	3.02
37	0.7	0.2	2.8	2.9	4079	4098	-0.407	0.081	0.419	2.917
38	0.7	0.3	3	3.2	1469	1481	-0.515	0.258	0.47	3.175
39	0.7	0.2	3	2.9	1958	1973	-0.515	-0.103	0.419	3.02

Table B-3 Continued: Headwater = 1.25P, Tailwater = 0.55P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.7	0.2	3	3.1	8152	8185	-0.234	0.047	0.419	3.123
41	0.7	0.2	3.2	3	2242	2259	-0.455	-0.182	0.419	3.175
42	0.7	0.2	3.2	3.3	2431	2455	-0.322	0.064	0.419	3.329
43	0.7	0.2	3.2	3.1	3521	3553	-0.242	-0.048	0.419	3.226
44	0.7	0.2	3.4	3.55	8396	8408	-0.644	0.193	0.419	3.561
45	0.8	0.2	3.4	3.2	8553	8571	-0.515	-0.172	0.47	3.381
46	0.7	0.2	3.4	2.5	8686	8699	-0.595	-1.07	0.419	3.02
47	0.7	0.5	3.6	3.65	1168	1172	-0.773	0.193	0.573	3.716
48	0.7	0.2	3.6	3.65	2218	2242	-0.322	0.032	0.419	3.716
49	0.8	0.2	3.6	3.4	1157	1179	-0.422	-0.141	0.47	3.587
50	0.7	0.3	3.8	3.7	1938	1949	-0.562	-0.141	0.47	3.844
51	0.7	0.2	3.8	3.7	984	1002	-0.429	-0.086	0.419	3.844
52	0.7	0.2	3.8	3.7	1021	1036	-0.515	-0.103	0.419	3.844

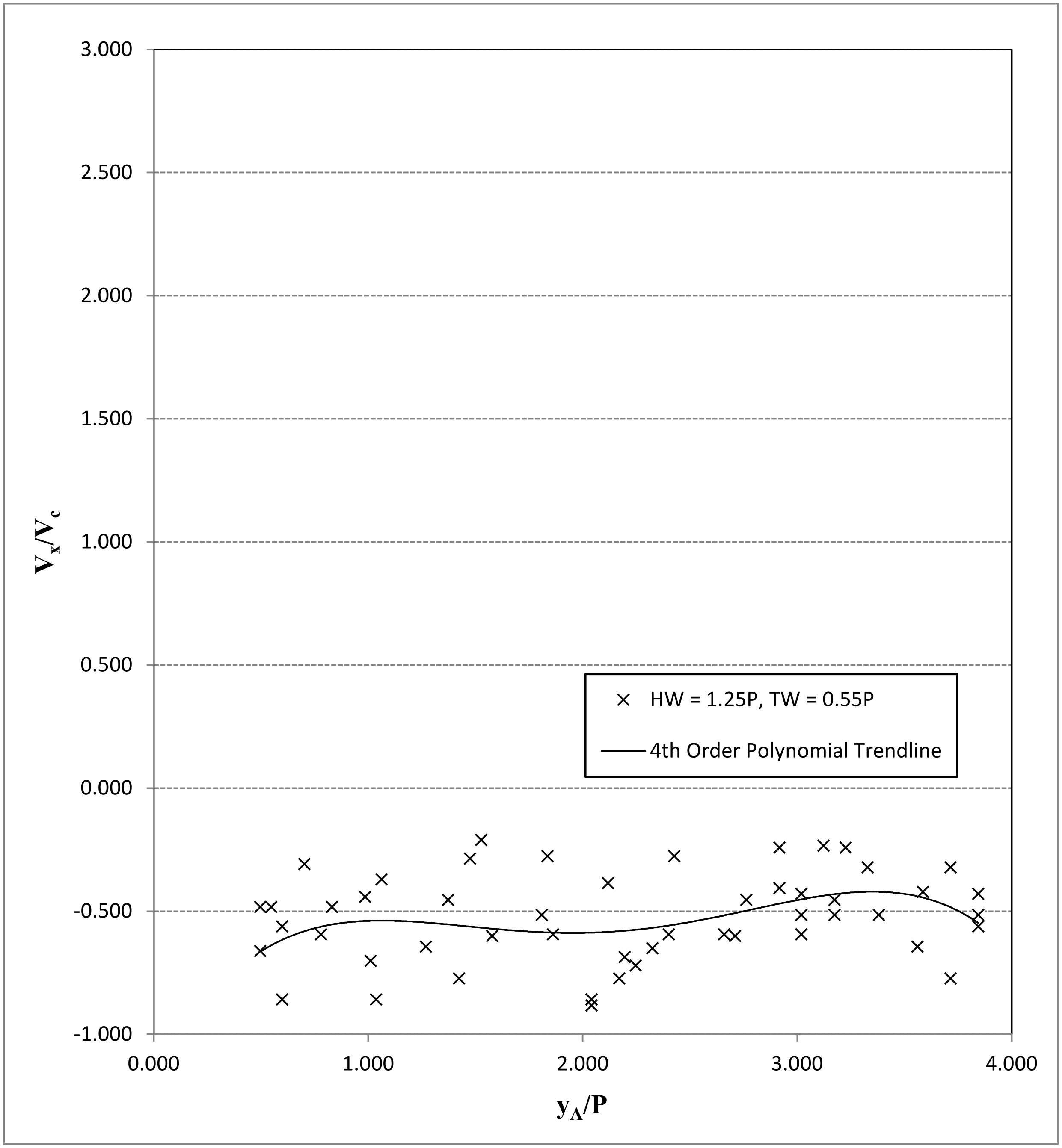

Figure B-3: Headwater = 1.25P, Tailwater = 0.55P

Table B-4: Headwater = 1.20P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.7	0.2	0.2	0.4	1220	1237	-0.455	0.182	0.419	0.291
2	0.7	0.2	0.2	0.2	1333	1348	-0.515	0	0.419	0.188
3	0.5	0.2	0.4	0.4	696	704	-0.58	0	0.316	0.394
4	0.6	0.15	0.4	0.4	1379	1397	-0.386	0	0.341	0.394
5	0.6	0.2	0.4	0.55	1528	1539	-0.562	0.211	0.367	0.471
6	0.6	0.2	0.6	0.6	1269	1286	-0.364	0	0.367	0.6
7	0.5	0.2	0.6	0.6	1648	1657	-0.515	0	0.316	0.6
8	0.7	0.2	0.6	0.6	1719	1736	-0.455	0	0.419	0.6
9	0.6	0.2	0.8	0.8	628	649	-0.294	0	0.367	0.806
10	0.7	0.4	0.8	0.7	1876	1887	-0.422	-0.141	0.522	0.754
11	0.7	0.2	0.8	0.75	5465	5480	-0.515	-0.052	0.419	0.78
12	0.6	0.3	1	0.9	780	792	-0.386	-0.129	0.419	0.96
13	0.6	0.2	1	1	4636	4646	-0.618	0	0.367	1.012
14	0.5	0.2	1	0.95	4674	4683	-0.515	-0.086	0.316	0.986
15	0.5	0.2	1.2	1.3	2243	2253	-0.464	0.155	0.316	1.269
16	0.7	0.3	1.2	1.1	8376	8399	-0.269	-0.067	0.47	1.166
17	0.7	0.3	1.2	1.05	8682	8694	-0.515	-0.193	0.47	1.141
18	0.5	0.2	1.4	1.3	899	910	-0.422	-0.141	0.316	1.372
19	0.7	0.3	1.4	1.3	7154	7166	-0.515	-0.129	0.47	1.372
20	0.7	0.4	1.4	1.4	7360	7369	-0.515	0	0.522	1.424
21	0.5	0.2	1.6	1.5	849	861	-0.386	-0.129	0.316	1.578
22	0.7	0.2	1.6	1.4	1433	1449	-0.483	-0.193	0.419	1.527
23	0.6	0.2	1.6	1.6	1782	1793	-0.562	0	0.367	1.63
24	0.6	0.2	1.8	1.9	2260	2270	-0.618	0.155	0.367	1.887
25	0.5	0.2	1.8	1.9	3028	3037	-0.515	0.172	0.316	1.887
26	0.5	0.2	1.8	1.8	5450	5458	-0.58	0	0.316	1.836
27	0.65	0.25	2	1.9	2486	2497	-0.562	-0.141	0.419	1.99
28	0.6	0.3	2	2	7308	7315	-0.662	0	0.419	2.042
29	0.7	0.3	2	2.1	7968	7979	-0.562	0.141	0.47	2.093
30	0.6	0.3	2.2	2.1	654	665	-0.422	-0.141	0.419	2.196
31	0.6	0.2	2.2	2.2	7948	7959	-0.562	0	0.367	2.248
32	0.7	0.2	2.2	2.25	8822	8840	-0.429	0.043	0.419	2.274
33	0.6	0.3	2.4	2.4	2852	2861	-0.515	0	0.419	2.454
34	0.5	0.2	2.4	2.45	4289	4296	-0.662	0.11	0.316	2.48
35	0.6	0.2	2.4	2.4	6670	6689	-0.325	0	0.367	2.454
36	0.65	0.4	2.6	2.7	1958	1967	-0.429	0.172	0.496	2.711
37	0.6	0.2	2.6	2.7	2566	2578	-0.515	0.129	0.367	2.711
38	0.5	0.2	2.6	2.5	9380	9388	-0.58	-0.193	0.316	2.608
39	0.6	0.2	2.8	2.7	845	857	-0.515	-0.129	0.367	2.814

Table B-4 Continued: Headwater = 1.20P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.65	0.3	2.8	2.7	2575	2586	-0.492	-0.141	0.444	2.814
41	0.7	0.2	2.8	2.8	2699	2713	-0.552	0	0.419	2.866
42	0.6	0.3	3	2.9	841	849	-0.58	-0.193	0.419	3.02
43	0.6	0.2	3	3.1	863	872	-0.687	0.172	0.367	3.123
44	0.5	0.2	3	2.9	3431	3447	-0.29	-0.097	0.316	3.02
45	0.6	0.2	3.2	3.2	5939	5952	-0.476	0	0.367	3.278
46	0.7	0.2	3.2	3.1	6393	6412	-0.407	-0.081	0.419	3.226
47	0.5	0.2	3.2	3.25	7585	7595	-0.464	0.077	0.316	3.304
48	0.5	0.2	3.4	3.5	2942	2953	-0.422	0.141	0.316	3.535
49	0.7	0.3	3.4	3.55	2983	2997	-0.442	0.166	0.47	3.561

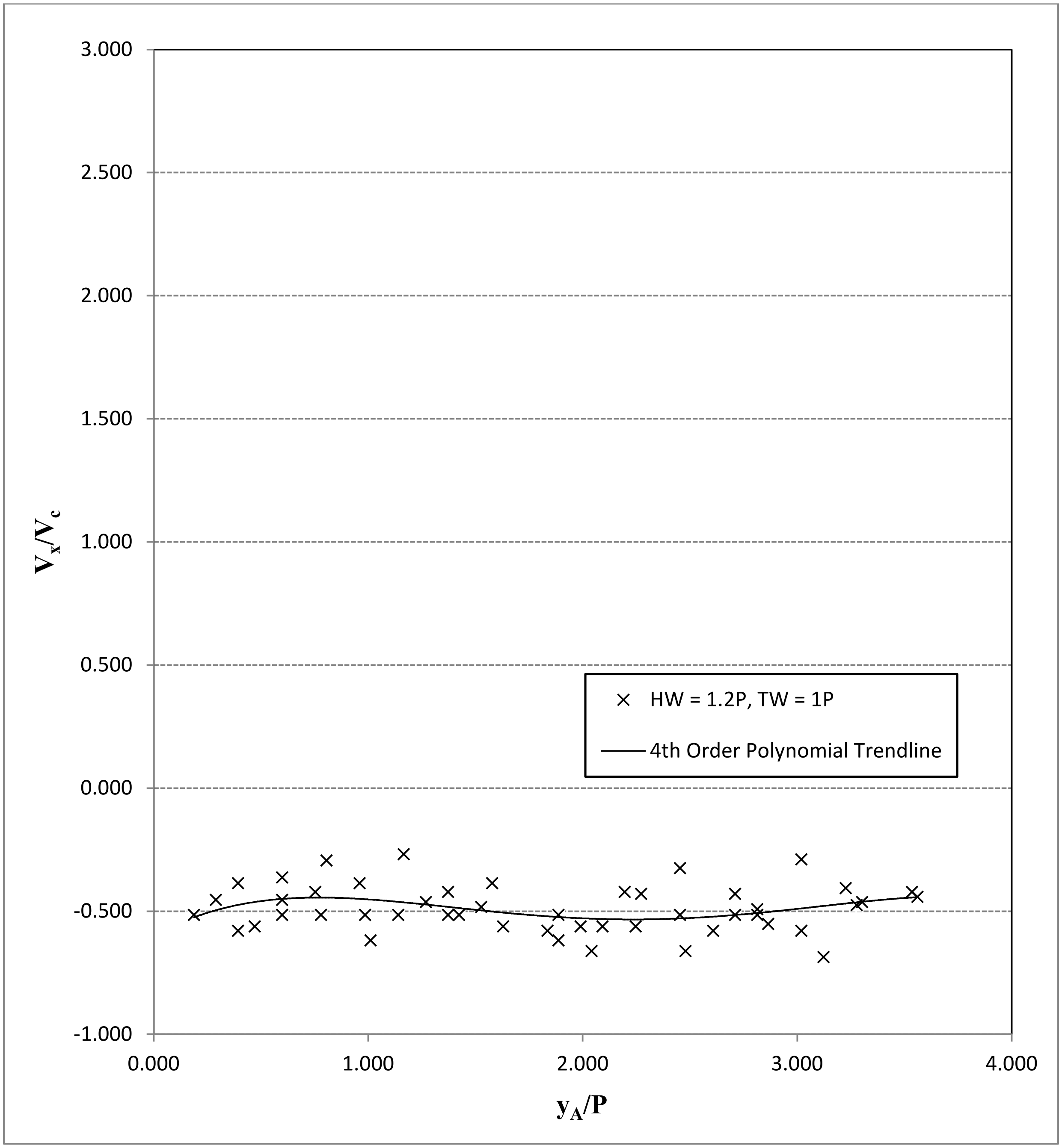

Figure B-4: Headwater = 1.20P, Tailwater = 1P

Table B-5: Headwater = 1.20P, Tailwater = 0.84P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.2	0.7	0.4	3.6	760	763	2.576	16.488	0.419	2.042
2	0.4	0.7	0.4	0.39	4309	4312	1.546	-0.052	0.522	0.389
3	0.2	0.7	0.8	0.75	5877	5880	2.576	-0.258	0.419	0.78
4	0.1	0.8	0.8	0.79	7343	7347	2.705	-0.039	0.419	0.801
5	0.25	0.98	0.8	0.78	771	775	2.821	-0.077	0.588	0.796
6	0.2	0.7	1	0.79	771	774	2.576	-1.082	0.419	0.904
7	0.1	0.8	1	0.96	3897	3901	2.705	-0.155	0.419	0.991
8	0.1	0.8	1	0.95	411	415	2.705	-0.193	0.419	0.986
9	0.2	0.7	1.2	1.2	800	803	2.576	0	0.419	1.218
10	0.2	0.7	1.2	1.15	1477	1480	2.576	-0.258	0.419	1.192
11	0.13	1	1.2	1.15	415	420	2.69	-0.155	0.537	1.192
12	0.2	0.7	1.4	1.38	1691	1694	2.576	-0.103	0.419	1.414
13	0.1	0.7	1.4	1.4	4375	4379	2.319	0	0.367	1.424
14	0.2	0.7	1.4	1.39	7367	7370	2.576	-0.052	0.419	1.419
15	0.2	0.7	1.6	1.58	451	454	2.576	-0.103	0.419	1.62
16	0.25	0.7	1.6	1.58	435	439	1.739	-0.077	0.444	1.62
17	0.2	0.7	2	2	459	462	2.576	0	0.419	2.042
18	0.2	0.7	2	1.95	1222	1225	2.576	-0.258	0.419	2.016
19	0.1	0.7	2	2.01	9211	9215	2.319	0.039	0.367	2.047
20	0.25	0.9	2.2	2.23	6047	6051	2.512	0.116	0.547	2.263
21	0.1	1	2.2	2.19	9215	9220	2.782	-0.031	0.522	2.243
22	0.2	0.7	2.4	2.41	1667	1670	2.576	0.052	0.419	2.459
23	0.35	1	2.4	2.43	938	942	2.512	0.116	0.65	2.469
24	0.1	0.8	2.6	2.59	936	940	2.705	-0.039	0.419	2.655
25	0.2	0.7	2.6	2.6	1216	1219	2.576	0	0.419	2.66
26	0.4	0.9	2.6	2.61	1741	1744	2.576	0.052	0.625	2.665
27	0.2	0.7	2.8	2.8	612	615	2.576	0	0.419	2.866
28	0.15	0.7	2.8	2.8	1311	1314	2.834	0	0.393	2.866
29	0.1	1	2.8	2.78	1687	1692	2.782	-0.062	0.522	2.856
30	0.15	0.69	3	3	981	984	2.782	0	0.388	3.072
31	0.1	0.8	3	3.05	1368	1372	2.705	0.193	0.419	3.098
32	0.1	0.8	3	3.04	1712	1716	2.705	0.155	0.419	3.093
33	0.1	0.8	3.2	3.22	999	1003	2.705	0.077	0.419	3.288
34	0.2	0.9	3.2	3.25	4138	4142	2.705	0.193	0.522	3.304
35	0.2	0.7	3.4	3.43	615	618	2.576	0.155	0.419	3.499
36	0.2	0.7	3.4	3.42	961	964	2.576	0.103	0.419	3.494
37	0.2	0.7	3.6	3.59	639	642	2.576	-0.052	0.419	3.685
38	0.1	0.85	3.6	3.65	4222	4226	2.898	0.193	0.444	3.716

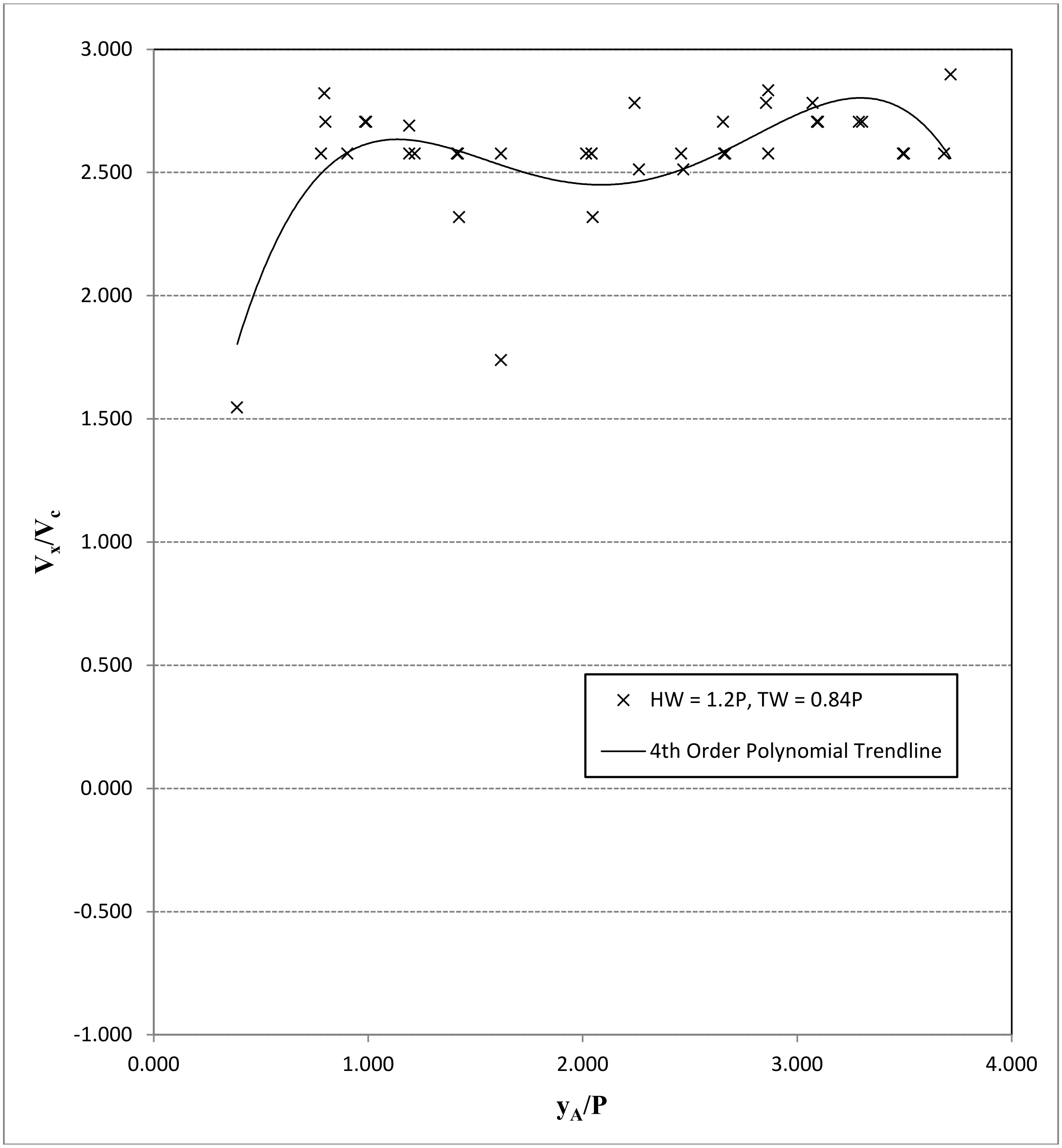

Figure B-5: Headwater = 1.20P, Tailwater = 0.84P

Table B-6: Headwater = 1.20P, Tailwater = 0.67P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.7	0.2	0.2	0.3	769	792	-0.336	0.067	0.419	0.24
2	0.7	0.2	0.2	0.4	1212	1262	-0.155	0.062	0.419	0.291
3	0.7	0.2	0.2	0.2	1330	1359	-0.267	0	0.419	0.188
4	0.7	0.2	0.4	0.45	847	876	-0.267	0.027	0.419	0.42
5	0.7	0.2	0.4	0.3	1184	1221	-0.209	-0.042	0.419	0.343
6	0.7	0.2	0.4	0.55	1205	1236	-0.249	0.075	0.419	0.471
7	0.7	0.2	0.6	0.45	1320	1378	-0.133	-0.04	0.419	0.523
8	0.7	0.2	0.6	0.7	1382	1409	-0.286	0.057	0.419	0.651
9	0.7	0.2	0.6	0.7	1382	1410	-0.276	0.055	0.419	0.651
10	0.7	0.2	0.8	1.5	549	592	-0.18	0.252	0.419	1.166
11	0.7	0.2	0.8	1	572	606	-0.227	0.091	0.419	0.909
12	0.7	0.2	0.8	0.8	649	683	-0.227	0	0.419	0.806
13	0.7	0.2	1	1.1	545	585	-0.193	0.039	0.419	1.063
14	0.7	0.2	1	1.2	583	627	-0.176	0.07	0.419	1.115
15	0.7	0.2	1	1	669	707	-0.203	0	0.419	1.012
16	0.7	0.2	1.2	1	630	661	-0.249	-0.1	0.419	1.115
17	0.7	0.2	1.2	1.2	722	755	-0.234	0	0.419	1.218
18	0.7	0.2	1.2	1.1	1705	1752	-0.164	-0.033	0.419	1.166
19	0.7	0.2	1.4	1.3	1247	1282	-0.221	-0.044	0.419	1.372
20	0.7	0.2	1.4	1.3	1627	1668	-0.189	-0.038	0.419	1.372
21	0.7	0.2	1.6	1.25	1471	1518	-0.164	-0.115	0.419	1.45
22	0.7	0.2	1.6	1.6	1526	1570	-0.176	0	0.419	1.63
23	0.7	0.2	1.6	1.35	1806	1866	-0.129	-0.064	0.419	1.501
24	0.7	0.2	1.8	1.55	1785	1840	-0.141	-0.07	0.419	1.707
25	0.7	0.2	1.8	1.5	1908	1942	-0.227	-0.136	0.419	1.681
26	0.7	0.2	1.8	1.7	1984	2009	-0.309	-0.062	0.419	1.784
27	0.7	0.2	2	1.9	1904	1938	-0.227	-0.045	0.419	1.99
28	0.7	0.2	2	1.75	2130	2180	-0.155	-0.077	0.419	1.913
29	0.7	0.2	2	1.8	2205	2236	-0.249	-0.1	0.419	1.939
30	0.7	0.2	2.2	2.05	2134	2161	-0.286	-0.086	0.419	2.171
31	0.7	0.2	2.2	2.15	3106	3125	-0.407	-0.041	0.419	2.222
32	0.7	0.2	2.2	2	3173	3200	-0.286	-0.114	0.419	2.145
33	0.7	0.2	2.4	2.2	3456	3475	-0.407	-0.163	0.419	2.351
34	0.7	0.2	2.4	2.35	3545	3564	-0.407	-0.041	0.419	2.428
35	0.7	0.2	2.4	2	3580	3647	-0.115	-0.092	0.419	2.248
36	0.7	0.2	2.6	2.2	3930	3978	-0.161	-0.129	0.419	2.454
37	0.7	0.2	2.6	2.6	4609	4635	-0.297	0	0.419	2.66
38	0.7	0.2	2.6	2.3	4806	4825	-0.407	-0.244	0.419	2.505
39	0.7	0.2	2.8	2.75	3989	4010	-0.368	-0.037	0.419	2.84

Table B-6 Continued: Headwater = 1.20P, Tailwater = 0.67P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.7	0.2	2.8	3.3	4263	4297	-0.227	0.227	0.419	3.123
41	0.7	0.2	2.8	2.45	4574	4599	-0.309	-0.216	0.419	2.686
42	0.7	0.2	3	2.95	5371	5401	-0.258	-0.026	0.419	3.046
43	0.7	0.2	3	3.25	5501	5519	-0.429	0.215	0.419	3.201
44	0.7	0.2	3.2	3.35	5621	5650	-0.267	0.08	0.419	3.355
45	0.7	0.2	3.2	3.5	5683	5735	-0.149	0.089	0.419	3.432
46	0.7	0.2	3.2	3.1	5768	5798	-0.258	-0.052	0.419	3.226
47	0.7	0.2	3.4	3.45	7523	7582	-0.131	0.013	0.419	3.51
48	0.7	0.2	3.4	3.15	3081	3139	-0.133	-0.067	0.419	3.355
49	0.7	0.2	3.6	3.5	8697	8734	-0.209	-0.042	0.419	3.638
50	0.7	0.2	3.6	3.4	9057	9115	-0.133	-0.053	0.419	3.587
51	0.7	0.2	3.6	3.65	2863	2895	-0.242	0.024	0.419	3.716
52	0.7	0.2	3.8	3.8	6045	6097	-0.149	0	0.419	3.896
53	0.7	0.2	3.8	3.8	7083	7125	-0.184	0	0.419	3.896
54	0.7	0.2	3.8	3.8	9181	9212	-0.249	0	0.419	3.896

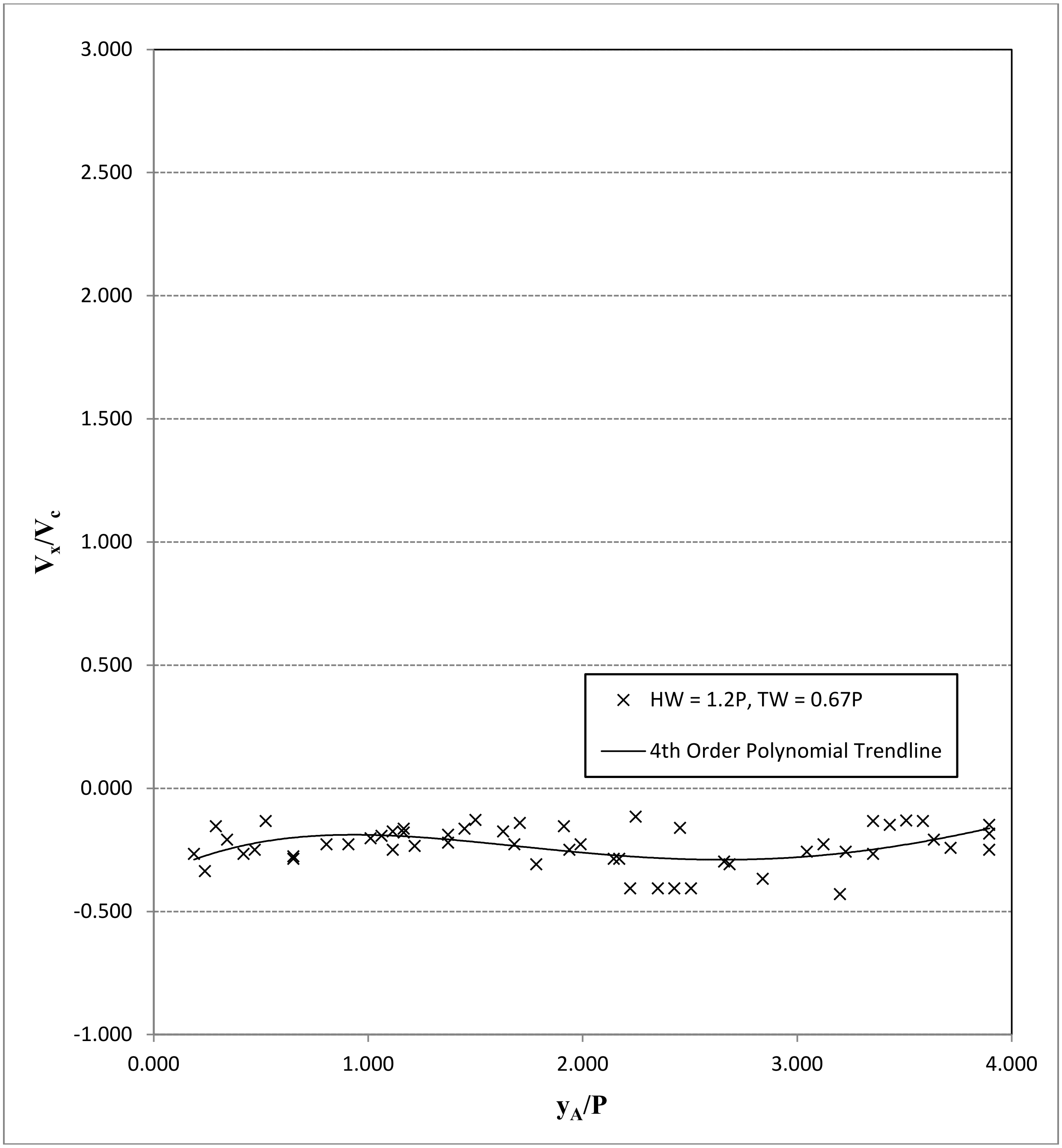

Figure B-6: Headwater = 1.20P, Tailwater = 0.67P

Table B-7: Headwater = 1.20P, Tailwater = 0.51P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.7	0.2	0.2	0.4	677	697	-0.445	0.178	0.419	0.291
2	0.7	0.2	0.2	0.25	1012	1043	-0.287	0.029	0.419	0.214
3	0.7	0.2	0.2	0.3	1340	1353	-0.685	0.137	0.419	0.24
4	0.7	0.2	0.4	0.5	591	605	-0.636	0.127	0.419	0.446
5	0.7	0.2	0.4	0.5	612	627	-0.594	0.119	0.419	0.446
6	0.7	0.2	0.4	0.6	632	644	-0.742	0.297	0.419	0.497
7	0.7	0.2	0.6	0.75	1381	1399	-0.495	0.148	0.419	0.677
8	0.7	0.2	0.6	0.75	1645	1668	-0.387	0.116	0.419	0.677
9	0.7	0.2	0.6	0.7	1745	1757	-0.742	0.148	0.419	0.651
10	0.7	0.2	0.8	0.7	2051	2064	-0.685	-0.137	0.419	0.754
11	0.7	0.2	0.8	0.7	2365	2376	-0.81	-0.162	0.419	0.754
12	0.7	0.2	0.8	0.7	2485	2507	-0.405	-0.081	0.419	0.754
13	0.7	0.2	1	0.95	2920	2931	-0.81	-0.081	0.419	0.986
14	0.7	0.2	1	1.05	3868	3888	-0.445	0.045	0.419	1.038
15	0.7	0.2	1	0.85	3907	3920	-0.685	-0.206	0.419	0.935
16	0.7	0.2	1.2	1.4	4032	4062	-0.297	0.119	0.419	1.321
17	0.7	0.2	1.2	1.4	4409	4449	-0.223	0.089	0.419	1.321
18	0.7	0.2	1.2	1.3	4716	4728	-0.742	0.148	0.419	1.269
19	0.7	0.2	1.4	1.5	5695	5714	-0.469	0.094	0.419	1.475
20	0.7	0.2	1.4	1.6	6775	6805	-0.297	0.119	0.419	1.527
21	0.7	0.2	1.4	1.25	1388	1413	-0.356	-0.107	0.419	1.347
22	0.7	0.2	1.6	1.4	793	818	-0.356	-0.143	0.419	1.527
23	0.7	0.2	1.6	1.55	1024	1041	-0.524	-0.052	0.419	1.604
24	0.7	0.2	1.6	1.5	1552	1565	-0.685	-0.137	0.419	1.578
25	0.7	0.2	1.8	1.5	1281	1304	-0.387	-0.232	0.419	1.681
26	0.7	0.2	1.8	2	1884	1897	-0.685	0.274	0.419	1.939
27	0.7	0.2	1.8	1.65	2187	2206	-0.469	-0.141	0.419	1.759
28	0.7	0.2	2	2	924	944	-0.445	0	0.419	2.042
29	0.7	0.2	2	2	940	950	-0.891	0	0.419	2.042
30	0.7	0.2	2	2.1	2441	2462	-0.424	0.085	0.419	2.093
31	0.7	0.2	2.2	2.4	2254	2267	-0.685	0.274	0.419	2.351
32	0.7	0.2	2.2	2.23	3938	3950	-0.742	0.045	0.419	2.263
33	0.7	0.2	2.2	1.9	4053	4075	-0.405	-0.243	0.419	2.093
34	0.7	0.2	2.4	2.5	5558	5575	-0.524	0.105	0.419	2.505
35	0.7	0.2	2.4	2.2	5565	5584	-0.469	-0.188	0.419	2.351
36	0.7	0.2	2.4	2	5878	5900	-0.405	-0.324	0.419	2.248
37	0.7	0.2	2.6	2.6	4404	4417	-0.685	0	0.419	2.66
38	0.7	0.2	2.6	2.6	4876	4891	-0.594	0	0.419	2.66
39	0.7	0.2	2.6	2.8	5831	5847	-0.557	0.223	0.419	2.763

Table B-7 Continued: Headwater = 1.20P, Tailwater = 0.51P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.7	0.2	2.8	2.8	8279	8294	-0.594	0	0.419	2.866
41	0.7	0.2	2.8	3.05	8668	8691	-0.387	0.194	0.419	2.995
42	0.7	0.2	2.8	2.9	8805	8825	-0.445	0.089	0.419	2.917
43	0.7	0.2	3	2.9	7295	7316	-0.424	-0.085	0.419	3.02
44	0.7	0.2	3	2.95	8231	8252	-0.424	-0.042	0.419	3.046
45	0.7	0.2	3	3	8725	8737	-0.742	0	0.419	3.072
46	0.7	0.2	3.2	3.3	9037	9053	-0.557	0.111	0.419	3.329
47	0.7	0.2	3.2	3.25	1050	1063	-0.685	0.069	0.419	3.304
48	0.7	0.2	3.2	3.1	1197	1207	-0.891	-0.178	0.419	3.226
49	0.7	0.3	3.4	3.5	1800	1809	-0.792	0.198	0.47	3.535
50	0.7	0.2	3.4	3.3	1912	1930	-0.495	-0.099	0.419	3.432
51	0.7	0.2	3.4	3.6	2226	2231	-1.782	0.713	0.419	3.587
52	0.7	0.2	3.6	3.5	1535	1562	-0.33	-0.066	0.419	3.638
53	0.7	0.3	3.6	3.6	1848	1856	-0.891	0	0.47	3.69
54	0.7	0.2	3.6	3.4	2220	2239	-0.469	-0.188	0.419	3.587
55	0.7	0.2	3.8	3.8	2569	2590	-0.424	0	0.419	3.896
56	0.7	0.2	3.8	3.8	2625	2640	-0.594	0	0.419	3.896
57	0.6	0.2	3.8	3.8	3107	3128	-0.339	0	0.367	3.896

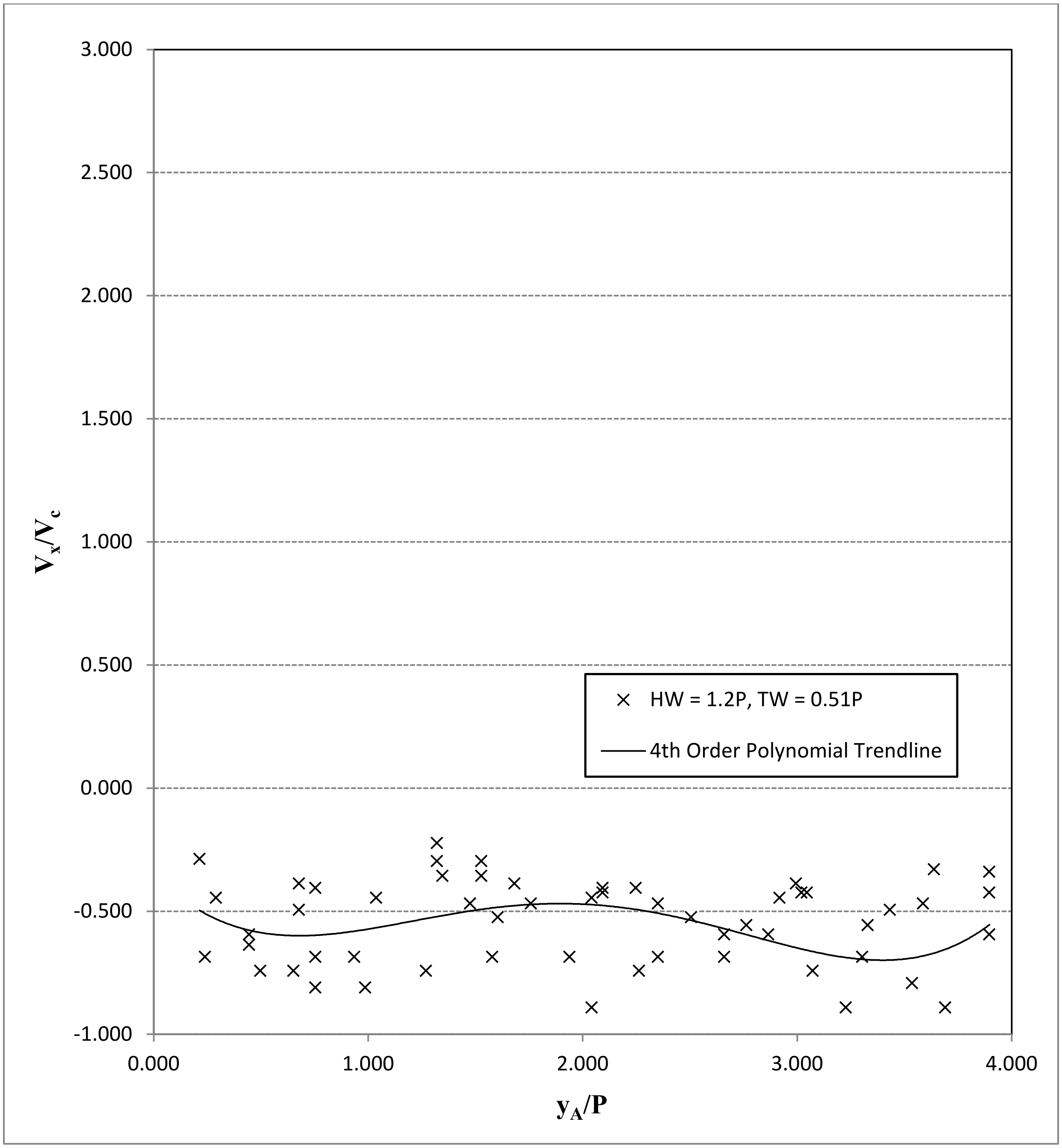

Figure B-7: Headwater = 1.20P, Tailwater = 0.51P

Table B-8: Headwater = 1.15P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.7	0.2	0.2	0.1	1505	1523	-0.495	-0.099	0.419	0.137
2	0.7	0.2	0.2	0.25	1802	1816	-0.636	0.064	0.419	0.214
3	0.7	0.2	0.2	0.2	1933	1950	-0.524	0	0.419	0.188
4	0.7	0.2	0.4	0.35	2679	2695	-0.557	-0.056	0.419	0.368
5	0.7	0.2	0.4	0.5	2900	2915	-0.594	0.119	0.419	0.446
6	0.7	0.2	0.6	0.65	3671	3692	-0.424	0.042	0.419	0.626
7	0.7	0.2	0.6	0.45	3700	3719	-0.469	-0.141	0.419	0.523
8	0.7	0.2	0.6	0.7	3856	3879	-0.387	0.077	0.419	0.651
9	0.7	0.2	0.8	0.8	3021	3039	-0.495	0	0.419	0.806
10	0.7	0.2	0.8	0.85	3402	3416	-0.636	0.064	0.419	0.832
11	0.7	0.2	0.8	0.65	3486	3500	-0.636	-0.191	0.419	0.729
12	0.7	0.2	1	0.95	4015	4034	-0.469	-0.047	0.419	0.986
13	0.7	0.2	1	0.9	4746	4764	-0.495	-0.099	0.419	0.96
14	0.7	0.2	1	1.15	5500	5518	-0.495	0.148	0.419	1.089
15	0.7	0.2	1.2	1.1	6956	6976	-0.445	-0.089	0.419	1.166
16	0.6	0.2	1.2	1.05	1739	1754	-0.475	-0.178	0.367	1.141
17	0.5	0.2	1.2	1.05	2112	2125	-0.411	-0.206	0.316	1.141
18	0.5	0.1	1.4	1.5	1789	1802	-0.548	0.137	0.264	1.475
19	0.5	0.2	1.4	1.35	1965	1980	-0.356	-0.059	0.316	1.398
20	0.55	0.1	1.4	1.47	2180	2199	-0.422	0.066	0.29	1.46
21	0.5	0.2	1.6	1.55	2539	2552	-0.411	-0.069	0.316	1.604
22	0.5	0.2	1.6	1.58	2580	2592	-0.445	-0.03	0.316	1.62
23	0.7	0.2	1.6	1.45	2855	2878	-0.387	-0.116	0.419	1.553
24	0.7	0.2	1.8	1.72	2642	2658	-0.557	-0.089	0.419	1.795
25	0.5	0.1	1.8	1.65	2819	2827	-0.891	-0.334	0.264	1.759
26	0.6	0.1	1.8	1.88	3035	3061	-0.343	0.055	0.316	1.877
27	0.55	0.1	2	1.82	4879	4893	-0.573	-0.229	0.29	1.949
28	0.52	0.1	2	1.75	5994	6021	-0.277	-0.165	0.274	1.913
29	0.6	0.2	2	2	6569	6585	-0.445	0	0.367	2.042
30	0.6	0.2	2.2	2.2	6354	6364	-0.713	0	0.367	2.248
31	0.7	0.2	2.2	2.32	6525	6539	-0.636	0.153	0.419	2.31
32	0.6	0.1	2.2	2.1	8171	8190	-0.469	-0.094	0.316	2.196
33	0.6	0.2	2.4	2.4	1669	1690	-0.339	0	0.367	2.454
34	0.5	0.2	2.4	2.52	1910	1924	-0.382	0.153	0.316	2.516
35	0.6	0.2	2.4	2.46	2189	2207	-0.396	0.059	0.367	2.485
36	0.6	0.1	2.6	2.63	2425	2445	-0.445	0.027	0.316	2.675
37	0.4	0.2	2.6	2.58	2465	2474	-0.396	-0.04	0.264	2.65
38	0.53	0.1	2.6	2.57	2538	2553	-0.511	-0.036	0.279	2.645
39	0.6	0.2	2.8	2.88	3232	3246	-0.509	0.102	0.367	2.907

Table B-8 Continued: Headwater = 1.15P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.4	0.1	2.8	2.85	3299	3310	-0.486	0.081	0.213	2.892
41	0.5	0.2	2.8	2.85	3369	3387	-0.297	0.049	0.316	2.892
42	0.4	0.1	3	3.05	3502	3516	-0.382	0.064	0.213	3.098
43	0.5	0.2	3	3.1	3769	3782	-0.411	0.137	0.316	3.123
44	0.6	0.2	3	3.1	3790	3802	-0.594	0.148	0.367	3.123
45	0.5	0.2	3.2	3.35	3886	3911	-0.214	0.107	0.316	3.355
46	0.5	0.2	3.2	3.28	3995	4010	-0.356	0.095	0.316	3.319
47	0.7	0.2	3.2	3.22	4422	4438	-0.557	0.022	0.419	3.288
48	0.4	0.2	3.4	3.45	4625	4634	-0.396	0.099	0.264	3.51
49	0.5	0.2	3.4	3.45	4771	4781	-0.534	0.089	0.316	3.51
50	0.4	0.2	3.4	3.41	4824	4835	-0.324	0.016	0.264	3.489
51	0.7	0.2	3.6	3.53	5117	5128	-0.81	-0.113	0.419	3.654
52	0.7	0.2	3.6	3.65	5155	5172	-0.524	0.052	0.419	3.716
53	0.4	0.2	3.6	3.58	5290	5297	-0.509	-0.051	0.264	3.68
54	0.7	0.2	3.8	3.7	5400	5420	-0.445	-0.089	0.419	3.844
55	0.5	0.2	3.8	3.73	5479	5490	-0.486	-0.113	0.316	3.86

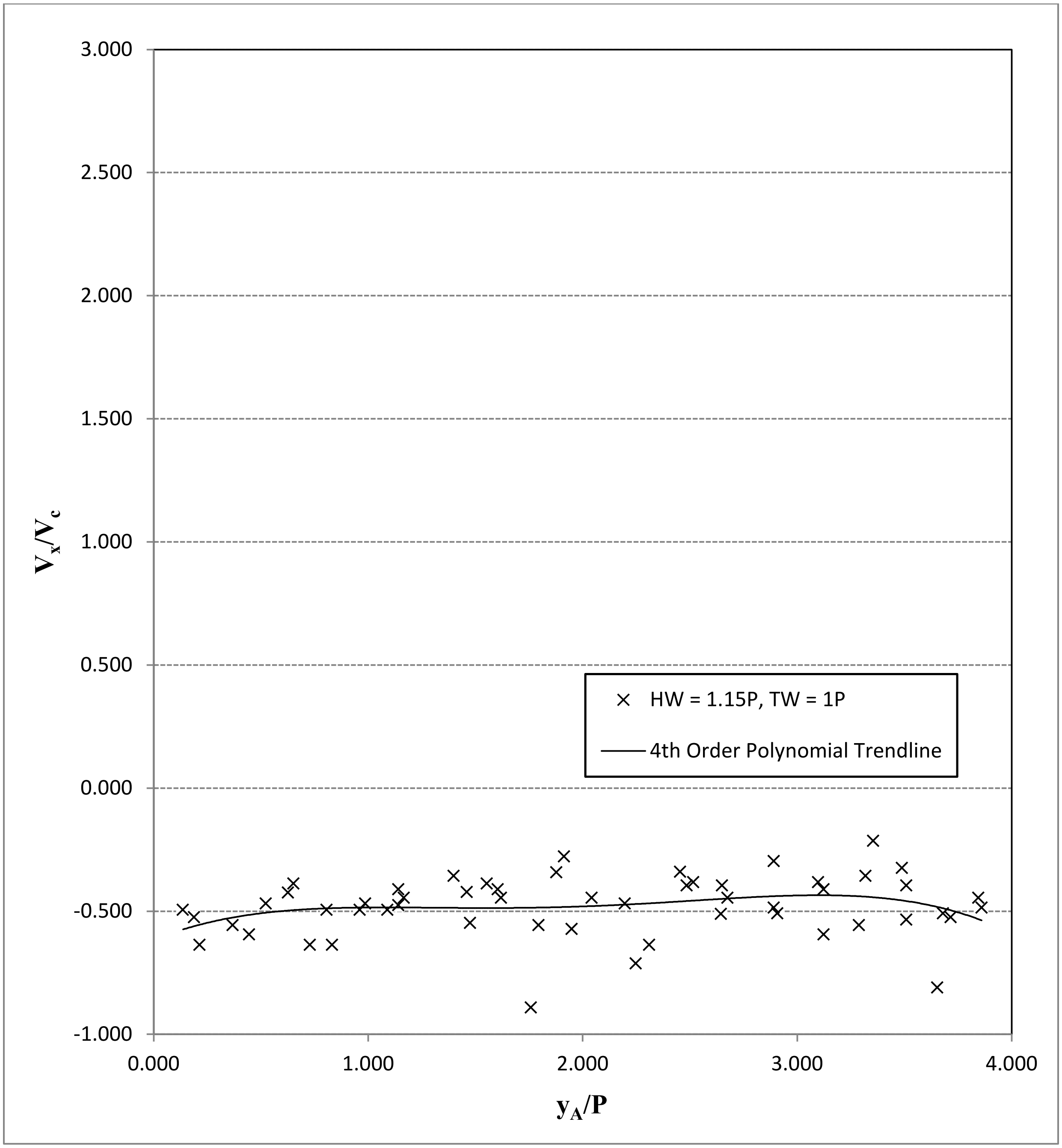

Figure B-8: Headwater = 1.15P, Tailwater = 1P

Table B-9: Headwater = 1.15P, Tailwater = 0.82P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.2	0.7	0.2	0.15	406	410	2.227	-0.223	0.419	0.162
2	0.1	0.7	0.2	0.15	409	413	2.672	-0.223	0.367	0.162
3	0.2	0.7	0.2	0.2	1103	1107	2.227	0	0.419	0.188
4	0.2	0.8	0.4	0.35	1817	1821	2.672	-0.223	0.47	0.368
5	0.2	0.7	0.4	0.35	1828	1832	2.227	-0.223	0.419	0.368
6	0.1	0.7	0.4	0.4	1988	1992	2.672	0	0.367	0.394
7	0.1	0.7	0.6	0.6	414	418	2.672	0	0.367	0.6
8	0.1	0.7	0.6	0.6	445	449	2.672	0	0.367	0.6
9	0.1	0.9	0.6	0.55	1130	1135	2.851	-0.178	0.47	0.574
10	0.2	0.8	0.8	0.8	465	469	2.672	0	0.47	0.806
11	0.2	0.7	0.8	0.7	1136	1139	2.969	-0.594	0.419	0.754
12	0.1	0.7	0.8	0.8	1150	1154	2.672	0	0.367	0.806
13	0.2	0.8	1	0.9	555	559	2.672	-0.445	0.47	0.96
14	0.1	0.7	1	0.95	6707	6711	2.672	-0.223	0.367	0.986
15	0.1	0.7	1.2	1.2	499	503	2.672	0	0.367	1.218
16	0.2	0.8	1.2	1.15	1148	1152	2.672	-0.223	0.47	1.192
17	0.1	0.7	1.2	1.15	2179	2183	2.672	-0.223	0.367	1.192
18	0.2	0.8	1.4	1.4	586	590	2.672	0	0.47	1.424
19	0.2	0.8	1.4	1.4	5246	5250	2.672	0	0.47	1.424
20	0.2	0.8	1.4	1.4	5254	5258	2.672	0	0.47	1.424
21	0.1	0.7	1.6	1.6	584	588	2.672	0	0.367	1.63
22	0.2	0.9	1.6	1.6	604	609	2.494	0	0.522	1.63
23	0.2	0.8	1.6	1.6	722	726	2.672	0	0.47	1.63
24	0.2	0.8	1.8	1.8	651	655	2.672	0	0.47	1.836
25	0.2	0.8	1.8	1.75	1299	1303	2.672	-0.223	0.47	1.81
26	0.2	0.8	1.8	1.75	2190	2194	2.672	-0.223	0.47	1.81
27	0.1	0.7	2	2	1320	1324	2.672	0	0.367	2.042
28	0.2	0.8	2	2	1336	1340	2.672	0	0.47	2.042
29	0.2	0.8	2	1.95	5279	5283	2.672	-0.223	0.47	2.016
30	0.1	0.7	2.2	2.2	625	629	2.672	0	0.367	2.248
31	0.1	0.7	2.2	2.2	913	917	2.672	0	0.367	2.248
32	0.2	0.8	2.2	2.2	1560	1564	2.672	0	0.47	2.248
33	0.2	0.8	2.4	2.4	5411	5415	2.672	0	0.47	2.454
34	0.2	0.8	2.6	2.6	794	798	2.672	0	0.47	2.66
35	0.1	0.7	2.6	2.6	942	946	2.672	0	0.367	2.66
36	0.2	0.8	2.6	2.6	1344	1349	2.138	0	0.47	2.66
37	0.1	0.7	2.8	2.9	873	877	2.672	0.445	0.367	2.917
38	0.2	0.8	2.8	2.8	1028	1032	2.672	0	0.47	2.866
39	0.1	0.7	2.8	3.8	1514	1518	2.672	4.454	0.367	3.381

Table B-9 Continued: Headwater = 1.15P, Tailwater = 0.82P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.1	0.8	3	3	863	868	2.494	0	0.419	3.072
41	0.2	0.8	3	3	946	950	2.672	0	0.47	3.072
42	0.2	0.8	3	3	1417	1421	2.672	0	0.47	3.072
43	0.2	0.8	3.2	3.2	970	974	2.672	0	0.47	3.278
44	0.2	0.8	3.2	3.25	993	997	2.672	0.223	0.47	3.304
45	0.2	0.8	3.2	3.2	1553	1557	2.672	0	0.47	3.278
46	0.1	1	3.4	3.4	1580	1586	2.672	0	0.522	3.484
47	0.2	1	3.4	3.4	7209	7214	2.851	0	0.573	3.484
48	0.2	0.8	3.6	3.6	1679	1683	2.672	0	0.47	3.69
49	0.1	0.9	3.6	3.6	5660	5665	2.851	0	0.47	3.69
50	0.2	0.8	3.6	3.6	7189	7193	2.672	0	0.47	3.69

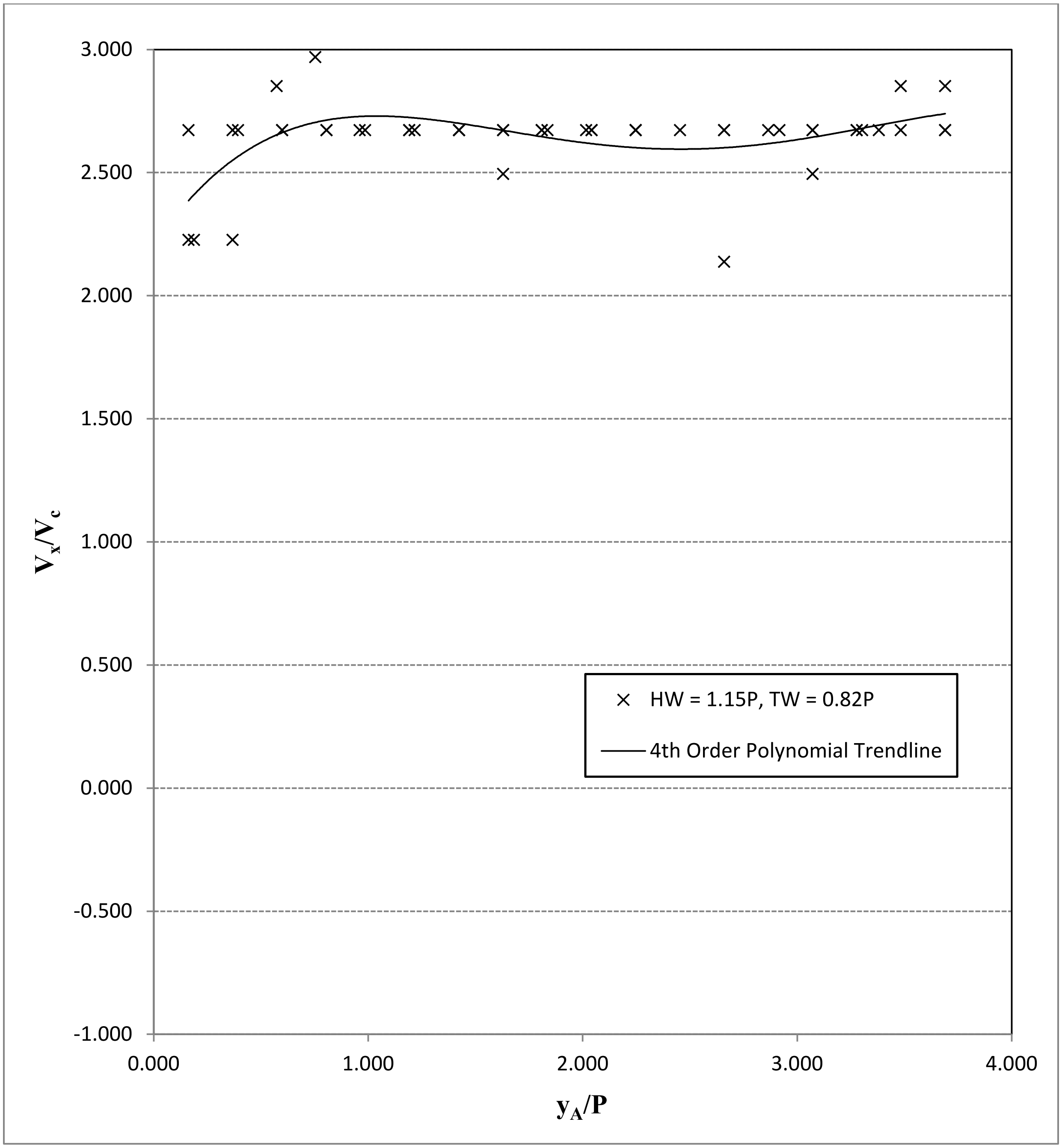

Figure B-9: Headwater = 1.15P, Tailwater = 0.82P

Table B-10: Headwater = 1.15P, Tailwater = 0.63P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.6	0.3	0.2	0.4	1696	1716	-0.267	0.178	0.419	0.291
2	0.5	0.2	0.4	0.4	565	590	-0.214	0	0.316	0.394
3	0.5	0.2	0.4	0.3	627	648	-0.255	-0.085	0.316	0.343
4	0.5	0.2	0.4	0.4	2957	2982	-0.214	0	0.316	0.394
5	0.7	0.3	0.6	0.6	3015	3040	-0.285	0	0.47	0.6
6	0.7	0.3	0.6	0.55	3125	3152	-0.264	-0.033	0.47	0.574
7	0.6	0.2	0.6	0.6	3302	3322	-0.356	0	0.367	0.6
8	0.6	0.3	0.8	0.8	3018	3038	-0.267	0	0.419	0.806
9	0.7	0.2	0.8	0.7	3332	3353	-0.424	-0.085	0.419	0.754
10	0.7	0.3	0.8	0.7	3389	3406	-0.419	-0.105	0.47	0.754
11	0.6	0.2	1	1.05	3421	3440	-0.375	0.047	0.367	1.038
12	0.6	0.2	1	0.9	3747	3771	-0.297	-0.074	0.367	0.96
13	0.7	0.4	1	0.9	3881	3890	-0.594	-0.198	0.522	0.96
14	0.7	0.3	1.2	1.3	3930	3953	-0.31	0.077	0.47	1.269
15	0.7	0.2	1.2	1	3954	3982	-0.318	-0.127	0.419	1.115
16	0.7	0.4	1.2	1.1	4038	4055	-0.314	-0.105	0.522	1.166
17	0.6	0.3	1.4	1.3	4378	4405	-0.198	-0.066	0.419	1.372
18	0.6	0.3	1.4	1.4	4428	4446	-0.297	0	0.419	1.424
19	0.6	0.3	1.4	1.5	4451	4468	-0.314	0.105	0.419	1.475
20	0.6	0.3	1.6	1.6	4565	4582	-0.314	0	0.419	1.63
21	0.6	0.2	1.6	1.65	4600	4626	-0.274	0.034	0.367	1.656
22	0.6	0.3	1.6	1.6	4724	4744	-0.267	0	0.419	1.63
23	0.6	0.3	1.8	1.95	5162	5188	-0.206	0.103	0.419	1.913
24	0.7	0.3	1.8	1.8	6163	6180	-0.419	0	0.47	1.836
25	0.7	0.3	1.8	1.6	6382	6417	-0.204	-0.102	0.47	1.733
26	0.7	0.3	2	1.9	5059	5075	-0.445	-0.111	0.47	1.99
27	0.7	0.3	2	1.9	6995	7023	-0.255	-0.064	0.47	1.99
28	0.7	0.3	2	2	7115	7135	-0.356	0	0.47	2.042
29	0.6	0.3	2.2	2.2	8002	8018	-0.334	0	0.419	2.248
30	0.7	0.3	2.2	2.1	848	869	-0.339	-0.085	0.47	2.196
31	0.7	0.4	2.2	2.1	1340	1371	-0.172	-0.057	0.522	2.196
32	0.7	0.3	2.4	2.4	1365	1397	-0.223	0	0.47	2.454
33	0.7	0.3	2.4	2.4	1701	1731	-0.238	0	0.47	2.454
34	0.7	0.4	2.4	2.5	2398	2417	-0.281	0.094	0.522	2.505
35	0.6	0.2	2.6	2.55	2853	2882	-0.246	-0.031	0.367	2.634
36	0.7	0.2	2.6	2.5	4306	4335	-0.307	-0.061	0.419	2.608
37	0.6	0.2	2.6	2.65	4388	4417	-0.246	0.031	0.367	2.686
38	0.6	0.2	2.8	2.7	4892	4931	-0.183	-0.046	0.367	2.814
39	0.7	0.3	2.8	2.9	5014	5027	-0.548	0.137	0.47	2.917

Table B-10 Continued: Headwater = 1.15P, Tailwater = 0.63P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.7	0.3	2.8	2.9	5140	5161	-0.339	0.085	0.47	2.917
41	0.6	0.2	3	3.1	5271	5290	-0.375	0.094	0.367	3.123
42	0.6	0.2	3	3.1	5624	5650	-0.274	0.069	0.367	3.123
43	0.7	0.3	3	2.9	6266	6289	-0.31	-0.077	0.47	3.02
44	0.7	0.3	3.2	3.3	6650	6676	-0.274	0.069	0.47	3.329
45	0.6	0.3	3.2	3.25	6804	6834	-0.178	0.03	0.419	3.304
46	0.7	0.3	3.2	3.2	1217	1241	-0.297	0	0.47	3.278
47	0.5	0.2	3.4	3.4	2095	2127	-0.167	0	0.316	3.484
48	0.5	0.2	3.4	3.5	2531	2554	-0.232	0.077	0.316	3.535
49	0.5	0.2	3.4	3.5	2761	2790	-0.184	0.061	0.316	3.535
50	0.4	0.3	3.6	3.6	3971	3983	-0.148	0	0.316	3.69
51	0.5	0.3	3.6	3.6	4277	4294	-0.21	0	0.367	3.69
52	0.6	0.4	3.6	3.5	4359	4378	-0.188	-0.094	0.47	3.638
53	0.4	0.2	3.8	3.8	4803	4819	-0.223	0	0.264	3.896

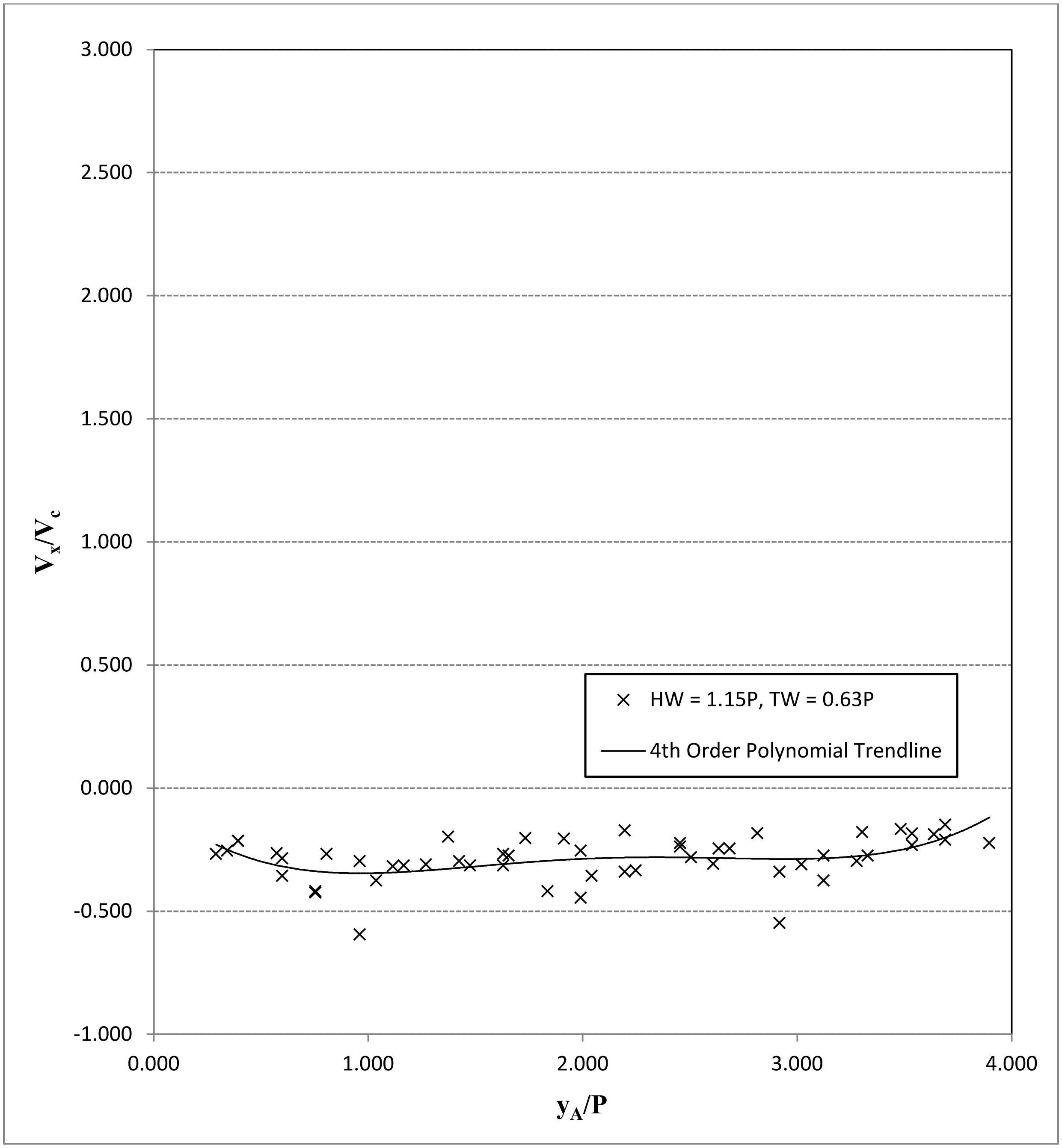

Figure B-10: Headwater = 1.15P, Tailwater = 0.63P

Table B-11: Headwater = 1.15P, Tailwater = 0.45P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.5	0.2	0.2	0.2	1336	1349	-0.524	0	0.316	0.188
2	0.6	0.4	0.2	0.3	1826	1836	-0.454	0.227	0.47	0.24
3	0.6	0.3	0.2	0.3	2287	2298	-0.619	0.206	0.419	0.24
4	0.7	0.5	0.4	0.3	2373	2381	-0.567	-0.284	0.573	0.343
5	0.6	0.4	0.4	0.4	2416	2426	-0.454	0	0.47	0.394
6	0.5	0.3	0.4	0.5	2450	2462	-0.378	0.189	0.367	0.446
7	0.6	0.3	0.6	0.6	421	434	-0.524	0	0.419	0.6
8	0.6	0.2	0.6	0.5	2479	2494	-0.605	-0.151	0.367	0.549
9	0.6	0.2	0.6	0.7	2640	2660	-0.454	0.113	0.367	0.651
10	0.7	0.3	0.8	0.8	2697	2708	-0.825	0	0.47	0.806
11	0.6	0.3	0.8	0.8	2790	2803	-0.524	0	0.419	0.806
12	0.6	0.3	0.8	0.8	2977	2991	-0.486	0	0.419	0.806
13	0.7	0.4	1	1	3408	3420	-0.567	0	0.522	1.012
14	0.7	0.2	1	0.8	3498	3518	-0.567	-0.227	0.419	0.909
15	0.6	0.2	1	1.1	3611	3647	-0.252	0.063	0.367	1.063
16	0.6	0.3	1.2	1.2	4065	4087	-0.309	0	0.419	1.218
17	0.7	0.4	1.2	1.2	4292	4305	-0.524	0	0.522	1.218
18	0.7	0.2	1.2	1.1	4398	4418	-0.567	-0.113	0.419	1.166
19	0.7	0.2	1.4	1.4	4452	4481	-0.391	0	0.419	1.424
20	0.7	0.3	1.4	1.3	4497	4511	-0.648	-0.162	0.47	1.372
21	0.7	0.4	1.4	1.5	4649	4665	-0.425	0.142	0.522	1.475
22	0.7	0.3	1.6	1.5	4684	4707	-0.395	-0.099	0.47	1.578
23	0.7	0.4	1.6	1.6	4745	4758	-0.524	0	0.522	1.63
24	0.7	0.3	1.6	1.5	4774	4792	-0.504	-0.126	0.47	1.578
25	0.7	0.3	1.8	1.8	4824	4844	-0.454	0	0.47	1.836
26	0.6	0.2	1.8	1.9	4883	4909	-0.349	0.087	0.367	1.887
27	0.7	0.2	1.8	1.8	4928	4964	-0.315	0	0.419	1.836
28	0.7	0.2	2	2.1	5544	5570	-0.436	0.087	0.419	2.093
29	0.7	0.2	2	2	6975	7011	-0.315	0	0.419	2.042
30	0.7	0.2	2	1.9	7085	7103	-0.63	-0.126	0.419	1.99
31	0.7	0.3	2.2	2.15	1994	2009	-0.605	-0.076	0.47	2.222
32	0.7	0.2	2.2	2.4	2195	2246	-0.222	0.089	0.419	2.351
33	0.7	0.3	2.2	1.9	2396	2434	-0.239	-0.179	0.47	2.093
34	0.5	0.3	2.4	2.45	2850	2862	-0.378	0.095	0.367	2.48
35	0.7	0.2	2.4	2.5	3078	3116	-0.298	0.06	0.419	2.505
36	0.7	0.2	2.4	2.38	3187	3249	-0.183	-0.007	0.419	2.444
37	0.7	0.2	2.6	2.6	3445	3483	-0.298	0	0.419	2.66
38	0.65	0.2	2.6	2.75	5315	5347	-0.319	0.106	0.393	2.737
39	0.7	0.2	2.6	2.35	6297	6326	-0.391	-0.196	0.419	2.531

Table B-11 Continued: Headwater = 1.15P, Tailwater = 0.45P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.7	0.4	2.8	2.95	7096	7112	-0.425	0.213	0.522	2.943
41	0.6	0.2	2.8	2.7	7506	7540	-0.267	-0.067	0.367	2.814
42	0.5	0.2	2.8	2.65	2236	2277	-0.166	-0.083	0.316	2.789
43	0.7	0.2	3	2.7	2903	2947	-0.258	-0.155	0.419	2.917
44	0.7	0.2	3	2.85	3977	4010	-0.344	-0.103	0.419	2.995
45	0.6	0.2	3	2.08	6368	6389	-0.432	-0.994	0.367	2.598
46	0.6	0.2	3.2	3.1	6543	6567	-0.378	-0.095	0.367	3.226
47	0.6	0.2	3.2	2.98	6692	6712	-0.454	-0.25	0.367	3.165
48	0.7	0.2	3.2	3.25	6751	6774	-0.493	0.049	0.419	3.304
49	0.7	0.2	3.4	3.6	6857	6889	-0.354	0.142	0.419	3.587
50	0.7	0.3	3.4	3.4	6974	7000	-0.349	0	0.47	3.484
51	0.6	0.2	3.4	3.22	7282	7346	-0.142	-0.064	0.367	3.391
52	0.7	0.4	3.6	3.4	1798	1818	-0.34	-0.227	0.522	3.587
53	0.7	0.6	3.6	3.49	3432	3456	-0.095	-0.104	0.625	3.633
54	0.8	0.3	3.8	3.7	3819	3867	-0.236	-0.047	0.522	3.844
55	0.7	0.4	3.8	3.6	3994	4015	-0.324	-0.216	0.522	3.793

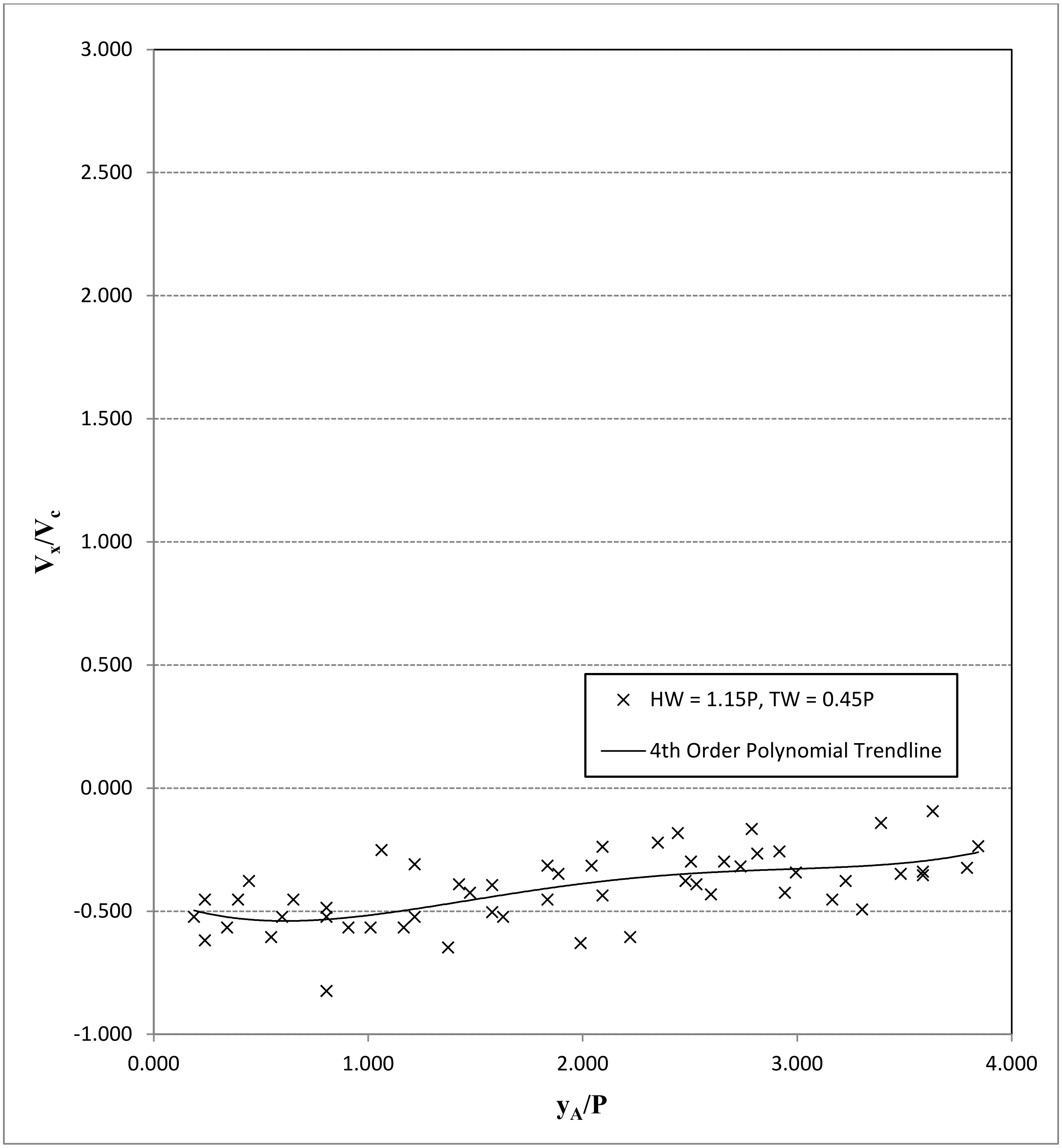

Figure B-11: Headwater = 1.15P, Tailwater = 0.45P

Table B-12: Headwater = 1.10P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.5	0.2	0.2	0.22	585	621	-0.189	0.013	0.316	0.198
2	0.5	0.2	0.2	0.2	796	830	-0.2	0	0.316	0.188
3	0.4	0.2	0.2	0.25	878	893	-0.302	0.076	0.264	0.214
4	0.6	0.2	0.4	0.5	1058	1104	-0.197	0.049	0.367	0.446
5	0.5	0.2	0.4	0.6	1113	1174	-0.112	0.074	0.316	0.497
6	0.6	0.2	0.4	0.55	1214	1273	-0.154	0.058	0.367	0.471
7	0.5	0.2	0.6	0.56	1301	1327	-0.262	-0.035	0.316	0.579
8	0.6	0.2	0.6	0.68	1362	1392	-0.302	0.06	0.367	0.641
9	0.4	0.2	0.6	0.65	1811	1830	-0.239	0.06	0.264	0.626
10	0.5	0.2	0.8	0.78	2070	2096	-0.262	-0.017	0.316	0.796
11	0.4	0.2	0.8	0.85	2269	2284	-0.302	0.076	0.264	0.832
12	0.5	0.2	0.8	0.7	2958	2983	-0.272	-0.091	0.316	0.754
13	0.4	0.2	1	1.02	3304	3320	-0.284	0.028	0.264	1.022
14	0.4	0.2	1	0.9	3549	3569	-0.227	-0.113	0.264	0.96
15	0.5	0.2	1	0.9	4046	4069	-0.296	-0.099	0.316	0.96
16	0.55	0.2	1.2	0.9	6326	6363	-0.215	-0.184	0.341	1.063
17	0.5	0.2	1.2	1.18	6406	6428	-0.309	-0.021	0.316	1.208
18	0.4	0.2	1.4	1.44	7472	7513	-0.111	0.022	0.264	1.445
19	0.5	0.2	1.4	1.4	7662	7688	-0.262	0	0.316	1.424
20	0.5	0.2	1.4	1.38	7791	7813	-0.309	-0.021	0.316	1.414
21	0.5	0.2	1.6	1.65	8325	8342	-0.4	0.067	0.316	1.656
22	0.6	0.2	1.6	1.45	8554	8593	-0.233	-0.087	0.367	1.553
23	0.4	0.2	1.6	1.5	8931	8957	-0.175	-0.087	0.264	1.578
24	0.4	0.2	1.8	1.65	1426	1449	-0.197	-0.148	0.264	1.759
25	0.5	0.2	1.8	1.95	1767	1825	-0.117	0.059	0.316	1.913
26	0.5	0.2	1.8	1.69	1918	1939	-0.324	-0.119	0.316	1.779
27	0.5	0.2	2	2	3428	3453	-0.272	0	0.316	2.042
28	0.5	0.2	2	2	3805	3832	-0.252	0	0.316	2.042
29	0.4	0.2	2	1.98	3878	3909	-0.146	-0.015	0.264	2.032
30	0.6	0.2	2.2	2.3	3983	4018	-0.259	0.065	0.367	2.299
31	0.55	0.2	2.2	2	5485	5508	-0.345	-0.197	0.341	2.145
32	0.6	0.2	2.2	2.18	5700	5716	-0.567	-0.028	0.367	2.238
33	0.4	0.2	2.4	2.4	6288	6309	-0.216	0	0.264	2.454
34	0.4	0.2	2.4	2.45	6643	6657	-0.324	0.081	0.264	2.48
35	0.4	0.2	2.4	2.52	3811	3845	-0.133	0.08	0.264	2.516
36	0.3	0.2	2.6	2.58	4339	4349	-0.227	-0.045	0.213	2.65
37	0.5	0.2	2.6	2.75	4658	4686	-0.243	0.122	0.316	2.737
38	0.55	0.2	2.6	2.62	5921	5944	-0.345	0.02	0.341	2.67
39	0.5	0.2	2.8	2.9	6039	6081	-0.162	0.054	0.316	2.917

Table B-12 Continued: Headwater = 1.10P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.6	0.2	2.8	2.95	7101	7129	-0.324	0.122	0.367	2.943
41	0.5	0.2	2.8	2.78	7809	7829	-0.34	-0.023	0.316	2.856
42	0.5	0.2	3	3.1	7277	7305	-0.243	0.081	0.316	3.123
43	0.7	0.2	3	3	7913	7948	-0.324	0	0.419	3.072
44	0.6	0.2	3	3.13	8628	8655	-0.336	0.109	0.367	3.139
45	0.7	0.2	3.2	3.15	1179	1207	-0.405	-0.041	0.419	3.252
46	0.68	0.2	3.2	3.37	1479	1513	-0.32	0.113	0.408	3.366
47	0.55	0.2	3.2	3.3	2854	2881	-0.294	0.084	0.341	3.329
48	0.7	0.2	3.4	3.48	8692	8741	-0.231	0.037	0.419	3.525
49	0.7	0.2	3.4	3.45	2975	3012	-0.307	0.031	0.419	3.51
50	0.7	0.2	3.4	3.55	4330	4371	-0.277	0.083	0.419	3.561
51	0.7	0.2	3.6	3.58	4686	4724	-0.298	-0.012	0.419	3.68
52	0.7	0.2	3.6	3.65	5076	5133	-0.199	0.02	0.419	3.716
53	0.7	0.2	3.6	3.55	5139	5181	-0.27	-0.027	0.419	3.664
54	0.7	0.2	3.8	3.65	5246	5300	-0.21	-0.063	0.419	3.819
55	0.7	0.2	3.8	3.75	5501	5539	-0.298	-0.03	0.419	3.87
56	0.7	0.2	3.8	3.79	6388	6436	-0.236	-0.005	0.419	3.891

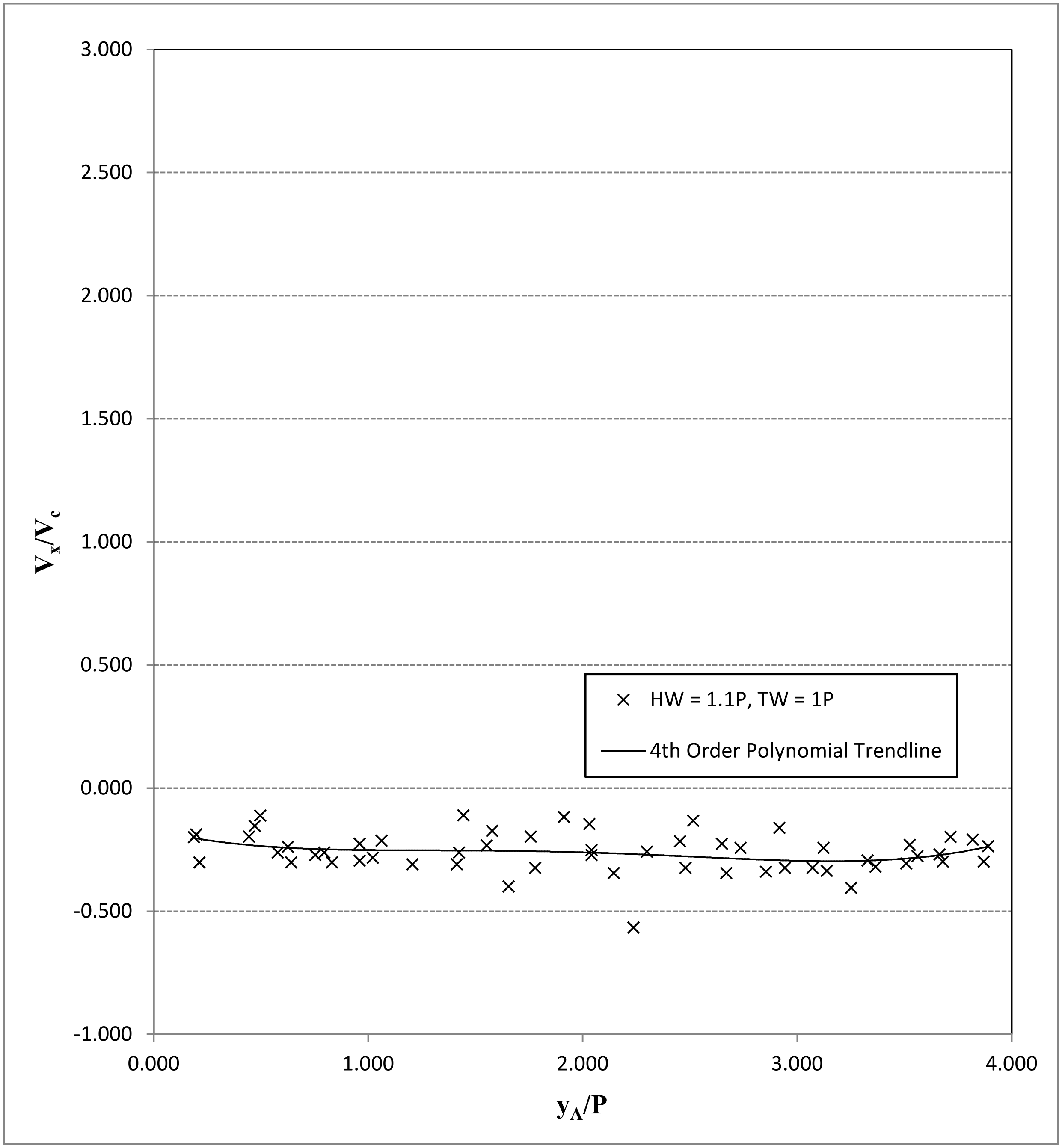

Figure B-12: Headwater = 1.10P, Tailwater = 1P

Table B-13: Headwater = 1.10P, Tailwater = 0.79P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.2	0.7	0.2	0.35	493	499	1.89	0.567	0.419	0.265
2	0.2	0.7	0.2	0.25	1486	1498	0.945	0.095	0.419	0.214
3	0.2	0.7	0.2	0.4	2567	2579	0.945	0.378	0.419	0.291
4	0.2	0.7	0.4	0.34	1524	1541	0.667	-0.08	0.419	0.363
5	0.2	0.7	0.4	0.3	1592	1604	0.945	-0.189	0.419	0.343
6	0.2	0.7	0.6	0.6	553	564	1.031	0	0.419	0.6
7	0.2	0.7	0.6	0.62	690	700	1.134	0.045	0.419	0.61
8	0.2	0.7	0.6	0.55	1549	1559	1.134	-0.113	0.419	0.574
9	0.2	0.7	0.8	0.8	678	694	0.709	0	0.419	0.806
10	0.2	0.7	0.8	0.75	9089	9099	1.134	-0.113	0.419	0.78
11	0.2	0.7	0.8	0.75	9106	9116	1.134	-0.113	0.419	0.78
12	0.2	0.7	1	0.95	743	759	0.709	-0.071	0.419	0.986
13	0.2	0.7	1	0.96	1638	1651	0.873	-0.07	0.419	0.991
14	0.2	0.7	1	0.91	1847	1855	1.418	-0.255	0.419	0.966
15	0.2	0.7	1.2	1.28	1721	1737	0.709	0.113	0.419	1.259
16	0.2	0.7	1.2	1.2	2538	2555	0.667	0	0.419	1.218
17	0.2	0.7	1.2	1.25	8890	8903	0.873	0.087	0.419	1.244
18	0.2	0.7	1.4	1.43	2940	2953	0.873	0.052	0.419	1.439
19	0.2	0.7	1.4	1.35	9115	9127	0.945	-0.095	0.419	1.398
20	0.2	0.7	1.4	1.28	820	831	1.031	-0.247	0.419	1.362
21	0.2	0.7	1.6	1.65	1705	1716	1.031	0.103	0.419	1.656
22	0.2	0.7	1.6	1.6	2925	2931	1.89	0	0.419	1.63
23	0.2	0.7	1.6	1.42	9150	9162	0.945	-0.34	0.419	1.537
24	0.2	0.7	1.8	1.8	1750	1761	1.031	0	0.419	1.836
25	0.2	0.7	1.8	1.8	1922	1932	1.134	0	0.419	1.836
26	0.2	0.7	1.8	1.79	2974	2988	0.81	-0.016	0.419	1.831
27	0.2	0.7	2	2	936	946	1.134	0	0.419	2.042
28	0.2	0.7	2	1.78	2085	2097	0.945	-0.416	0.419	1.929
29	0.2	0.7	2	1.98	969	984	0.756	-0.03	0.419	2.032
30	0.2	0.7	2.2	2.25	8967	8976	1.26	0.126	0.419	2.274
31	0.2	0.7	2.2	2.32	9343	9358	0.756	0.181	0.419	2.31
32	0.2	0.7	2.2	2.24	1021	1037	0.709	0.057	0.419	2.269
33	0.2	0.7	2.4	2.5	1125	1137	0.945	0.189	0.419	2.505
34	0.2	0.7	2.4	2.43	2144	2161	0.667	0.04	0.419	2.469
35	0.2	0.7	2.4	2.42	2977	2987	1.134	0.045	0.419	2.464
36	0.2	0.7	2.6	2.6	1171	1185	0.81	0	0.419	2.66
37	0.2	0.7	2.6	2.56	1068	1084	0.709	-0.057	0.419	2.639
38	0.2	0.7	2.6	2.8	2160	2173	0.873	0.349	0.419	2.763
39	0.2	0.7	2.8	2.9	1082	1094	0.945	0.189	0.419	2.917

Table B-13 Continued: Headwater = 1.10P, Tailwater = 0.79P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.2	0.7	2.8	2.9	8955	8972	0.667	0.133	0.419	2.917
41	0.2	0.7	2.8	2.81	9147	9156	1.26	0.025	0.419	2.871
42	0.2	0.7	3	3.05	2221	2233	0.945	0.095	0.419	3.098
43	0.2	0.7	3	3.05	2336	2351	0.756	0.076	0.419	3.098
44	0.2	0.7	3	3	8945	8954	1.26	0	0.419	3.072
45	0.2	0.7	3.2	3.2	2440	2448	1.418	0	0.419	3.278
46	0.2	0.7	3.2	3.2	3035	3042	1.62	0	0.419	3.278
47	0.2	0.7	3.2	3.19	1123	1131	1.418	-0.028	0.419	3.273
48	0.2	0.7	3.4	3.22	9026	9043	0.667	-0.24	0.419	3.391
49	0.2	0.7	3.4	3.5	9222	9232	1.134	0.227	0.419	3.535
50	0.2	0.7	3.4	3.5	1440	1453	0.873	0.175	0.419	3.535
51	0.2	0.7	3.6	3.68	1292	1302	1.134	0.181	0.419	3.731
52	0.2	0.7	3.6	3.6	1352	1359	1.62	0	0.419	3.69
53	0.2	0.7	3.6	3.65	1430	1439	1.26	0.126	0.419	3.716
54	0.2	0.7	3.8	3.8	1519	1525	1.89	0	0.419	3.896
55	0.2	0.7	3.8	3.75	2353	2361	1.418	-0.142	0.419	3.87
56	0.2	0.7	3.8	3.8	2409	2418	1.26	0	0.419	3.896

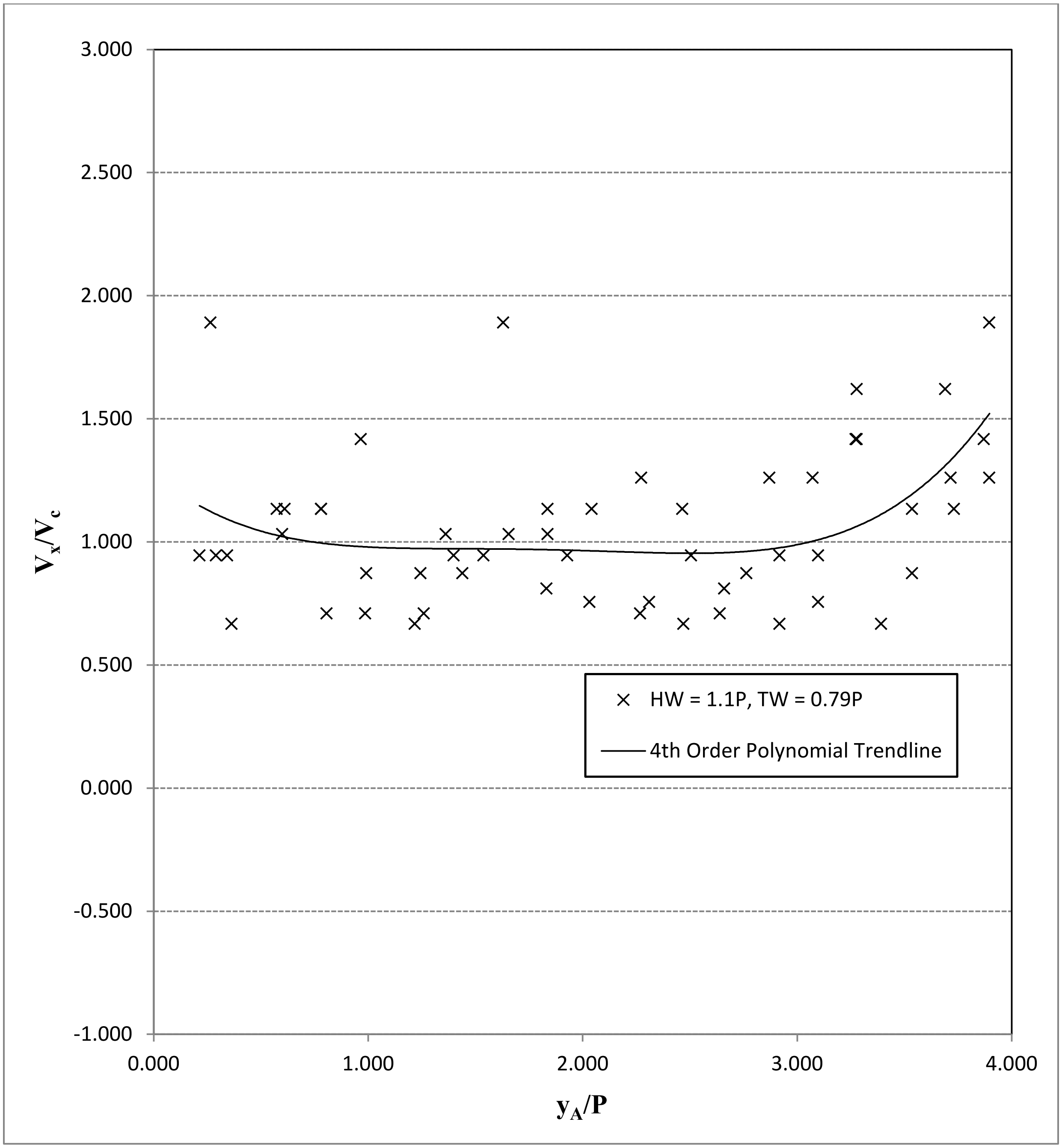

Figure B-13: Headwater = 1.10P, Tailwater = 0.79P

Table B-14: Headwater = 1.10P, Tailwater = 0.59P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.7	0.2	0.2	0.4	670	711	-0.277	0.111	0.419	0.291
2	0.7	0.2	0.2	0.5	1604	1672	-0.167	0.1	0.419	0.343
3	0.7	0.25	0.4	0.4	1961	2045	-0.122	0	0.444	0.394
4	0.7	0.5	0.4	0.3	2034	2067	-0.137	-0.069	0.573	0.343
5	0.7	0.3	0.4	0.5	2134	2189	-0.165	0.041	0.47	0.446
6	0.7	0.2	0.6	0.4	2748	2809	-0.186	-0.074	0.419	0.497
7	0.7	0.2	0.6	0.45	3134	3200	-0.172	-0.052	0.419	0.523
8	0.7	0.2	0.6	0.5	3255	3349	-0.121	-0.024	0.419	0.549
9	0.7	0.2	0.8	0.7	3876	3930	-0.21	-0.042	0.419	0.754
10	0.7	0.2	0.8	0.8	4072	4112	-0.284	0	0.419	0.806
11	0.7	0.2	0.8	0.95	4078	4121	-0.264	0.079	0.419	0.883
12	0.7	0.2	1	0.9	4112	4152	-0.284	-0.057	0.419	0.96
13	0.7	0.3	1	1.05	4874	4912	-0.239	0.03	0.47	1.038
14	0.7	0.2	1	0.8	5071	5142	-0.16	-0.064	0.419	0.909
15	0.7	0.2	1.2	1	5166	5214	-0.236	-0.095	0.419	1.115
16	0.6	0.3	1.2	1	5279	5305	-0.262	-0.175	0.419	1.115
17	0.5	0.2	1.2	1.35	5842	5888	-0.148	0.074	0.316	1.295
18	0.5	0.3	1.4	1.3	3585	3600	-0.302	-0.151	0.367	1.372
19	0.7	0.4	1.4	1.3	4565	4602	-0.184	-0.061	0.522	1.372
20	0.7	0.4	1.4	1.4	5109	5130	-0.324	0	0.522	1.424
21	0.7	0.4	1.6	1.4	1931	1959	-0.243	-0.162	0.522	1.527
22	0.7	0.2	1.6	1.6	2619	2657	-0.298	0	0.419	1.63
23	0.7	0.2	1.6	1.8	3407	3452	-0.252	0.101	0.419	1.733
24	0.7	0.3	1.8	1.6	2731	2758	-0.336	-0.168	0.47	1.733
25	0.7	0.4	1.8	1.6	5594	5625	-0.22	-0.146	0.522	1.733
26	0.7	0.3	1.8	1.6	7485	7529	-0.206	-0.103	0.47	1.733
27	0.7	0.3	2	2	2379	2411	-0.284	0	0.47	2.042
28	0.7	0.3	2	1.9	2460	2530	-0.13	-0.032	0.47	1.99
29	0.7	0.2	2.2	2	7594	7642	-0.236	-0.095	0.419	2.145
30	0.7	0.2	2.2	2.2	8050	8103	-0.214	0	0.419	2.248
31	0.6	0.3	2.2	2.2	8213	8243	-0.227	0	0.419	2.248
32	0.7	0.3	2.4	2.2	1674	1714	-0.227	-0.113	0.47	2.351
33	0.2	0.1	2.4	2.4	2289	2306	-0.133	0	0.11	2.454
34	0.4	0.2	2.4	2.4	2722	2740	-0.252	0	0.264	2.454
35	0.7	0.2	2.6	2.4	3545	3588	-0.264	-0.106	0.419	2.557
36	0.7	0.2	2.6	2.5	3792	3830	-0.298	-0.06	0.419	2.608
37	0.7	0.3	2.6	2.5	4820	4857	-0.245	-0.061	0.47	2.608
38	0.7	0.3	2.8	2.8	5506	5544	-0.239	0	0.47	2.866
39	0.7	0.3	2.8	2.6	6017	6073	-0.162	-0.081	0.47	2.763

Table B-14 Continued: Headwater = 1.10P, Tailwater = 0.59P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.7	0.3	2.8	2.85	8265	8322	-0.159	0.02	0.47	2.892
41	0.7	0.2	3	3.1	8417	8456	-0.291	0.058	0.419	3.123
42	0.5	0.2	3	3.05	4389	4416	-0.252	0.042	0.316	3.098
43	0.5	0.2	3	3	5302	5323	-0.324	0	0.316	3.072
44	0.7	0.2	3.2	3.1	3021	3066	-0.252	-0.05	0.419	3.226
45	0.7	0.2	3.2	3.4	4516	4547	-0.366	0.146	0.419	3.381
46	0.5	0.2	3.2	3.1	6261	6317	-0.122	-0.041	0.316	3.226
47	0.7	0.4	3.4	3.4	4083	4118	-0.194	0	0.522	3.484
48	0.7	0.2	3.4	3.5	4149	4187	-0.298	0.06	0.419	3.535
49	0.7	0.2	3.4	3.35	5775	5812	-0.307	-0.031	0.419	3.458
50	0.7	0.2	3.6	3.5	6721	6774	-0.214	-0.043	0.419	3.638
51	0.7	0.3	3.6	3.4	8284	8312	-0.324	-0.162	0.47	3.587
52	0.7	0.3	3.6	3.5	8494	8542	-0.189	-0.047	0.47	3.638
53	0.3	0.2	3.8	3.75	8947	8959	-0.189	-0.095	0.213	3.87
54	0.7	0.5	3.8	3.7	9342	9357	-0.302	-0.151	0.573	3.844

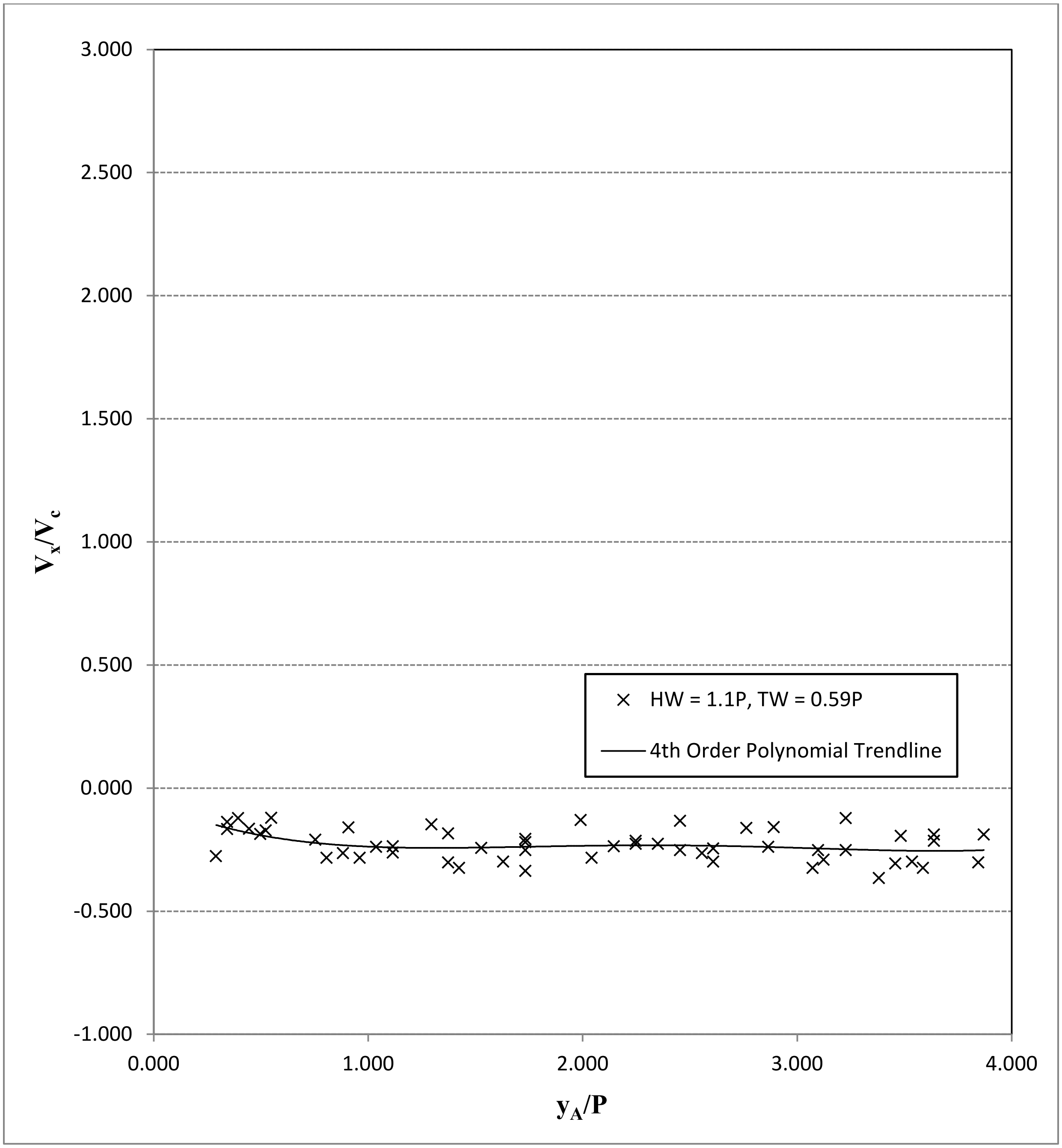

Figure B-14: Headwater = 1.10P, Tailwater = 0.59P

Table B-15: Headwater = 1.10P, Tailwater = 0.38P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.7	0.2	0.2	0.25	1062	1105	-0.264	0.026	0.419	0.214
2	0.7	0.2	0.2	0.4	1158	1199	-0.277	0.111	0.419	0.291
3	0.7	0.2	0.2	0.35	1248	1275	-0.42	0.126	0.419	0.265
4	0.7	0.2	0.4	0.25	1272	1308	-0.315	-0.095	0.419	0.317
5	0.7	0.2	0.4	0.35	1413	1437	-0.473	-0.047	0.419	0.368
6	0.7	0.2	0.4	0.3	1449	1476	-0.42	-0.084	0.419	0.343
7	0.7	0.2	0.6	0.75	1580	1605	-0.454	0.136	0.419	0.677
8	0.7	0.2	0.6	0.55	1777	1800	-0.493	-0.049	0.419	0.574
9	0.7	0.2	0.6	0.7	2050	2081	-0.366	0.073	0.419	0.651
10	0.7	0.2	0.8	0.9	2190	2210	-0.567	0.113	0.419	0.857
11	0.7	0.2	0.8	0.75	2268	2295	-0.42	-0.042	0.419	0.78
12	0.7	0.2	0.8	0.8	2756	2782	-0.436	0	0.419	0.806
13	0.7	0.2	1	0.9	3053	3081	-0.405	-0.081	0.419	0.96
14	0.7	0.2	1	0.85	3149	3192	-0.264	-0.079	0.419	0.935
15	0.7	0.2	1	0.85	3270	3299	-0.391	-0.117	0.419	0.935
16	0.7	0.2	1.2	1.15	3299	3345	-0.247	-0.025	0.419	1.192
17	0.7	0.2	1.2	1.1	3377	3409	-0.354	-0.071	0.419	1.166
18	0.7	0.2	1.2	1.2	3604	3631	-0.42	0	0.419	1.218
19	0.7	0.2	1.4	1.4	3702	3730	-0.405	0	0.419	1.424
20	0.7	0.2	1.4	1.4	3986	4007	-0.54	0	0.419	1.424
21	0.7	0.2	1.4	1.45	4062	4110	-0.236	0.024	0.419	1.45
22	0.7	0.2	1.6	1.75	4148	4190	-0.27	0.081	0.419	1.707
23	0.7	0.2	1.6	1.6	5459	5507	-0.236	0	0.419	1.63
24	0.7	0.2	1.6	1.3	6846	6874	-0.405	-0.243	0.419	1.475
25	0.7	0.2	1.8	1.6	8580	8611	-0.366	-0.146	0.419	1.733
26	0.7	0.2	1.8	1.6	8781	8809	-0.405	-0.162	0.419	1.733
27	0.7	0.2	1.8	1.8	9085	9121	-0.315	0	0.419	1.836
28	0.7	0.2	2	2	9266	9289	-0.493	0	0.419	2.042
29	0.7	0.2	2	2.1	850	873	-0.493	0.099	0.419	2.093
30	0.7	0.2	2	1.95	1437	1457	-0.567	-0.057	0.419	2.016
31	0.7	0.2	2.2	1.9	2945	2972	-0.42	-0.252	0.419	2.093
32	0.7	0.2	2.2	2.1	3269	3290	-0.54	-0.108	0.419	2.196
33	0.7	0.2	2.2	2.1	3748	3775	-0.42	-0.084	0.419	2.196
34	0.7	0.2	2.4	2.5	3859	3887	-0.405	0.081	0.419	2.505
35	0.7	0.2	2.4	2.3	7102	7123	-0.54	-0.108	0.419	2.402
36	0.7	0.2	2.4	2.15	7996	8020	-0.473	-0.236	0.419	2.325
37	0.7	0.2	2.6	2.7	8927	8954	-0.42	0.084	0.419	2.711
38	0.7	0.2	2.6	2.6	8845	8867	-0.516	0	0.419	2.66
39	0.7	0.2	2.6	2.65	9376	9399	-0.493	0.049	0.419	2.686

Table B-15 Continued: Headwater = 1.10P, Tailwater = 0.38P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.7	0.2	2.8	2.85	626	647	-0.54	0.054	0.419	2.892
41	0.7	0.2	2.8	2.4	918	954	-0.315	-0.252	0.419	2.66
42	0.7	0.2	2.8	2.7	3729	3763	-0.334	-0.067	0.419	2.814
43	0.7	0.2	3	2.95	3761	3780	-0.597	-0.06	0.419	3.046
44	0.7	0.2	3	3	4085	4104	-0.597	0	0.419	3.072
45	0.7	0.2	3	2.75	8212	8240	-0.405	-0.203	0.419	2.943
46	0.7	0.2	3.2	3.1	8002	8026	-0.473	-0.095	0.419	3.226
47	0.7	0.2	3.2	3.25	8522	8547	-0.454	0.045	0.419	3.304
48	0.7	0.2	3.2	3.25	1036	1067	-0.366	0.037	0.419	3.304
49	0.7	0.2	3.4	3.5	9009	9038	-0.391	0.078	0.419	3.535
50	0.7	0.2	3.4	3.3	854	880	-0.436	-0.087	0.419	3.432
51	0.7	0.2	3.4	3.25	1196	1224	-0.405	-0.122	0.419	3.407
52	0.7	0.2	3.6	3.35	1585	1615	-0.378	-0.189	0.419	3.561
53	0.7	0.2	3.6	3.65	1722	1750	-0.405	0.041	0.419	3.716
54	0.7	0.2	3.6	3.4	1116	1157	-0.277	-0.111	0.419	3.587
55	0.7	0.2	3.8	3.55	2356	2386	-0.378	-0.189	0.419	3.767
56	0.7	0.2	3.8	3.6	1886	1911	-0.454	-0.181	0.419	3.793
57	0.7	0.2	3.8	3.5	2462	2497	-0.324	-0.194	0.419	3.741

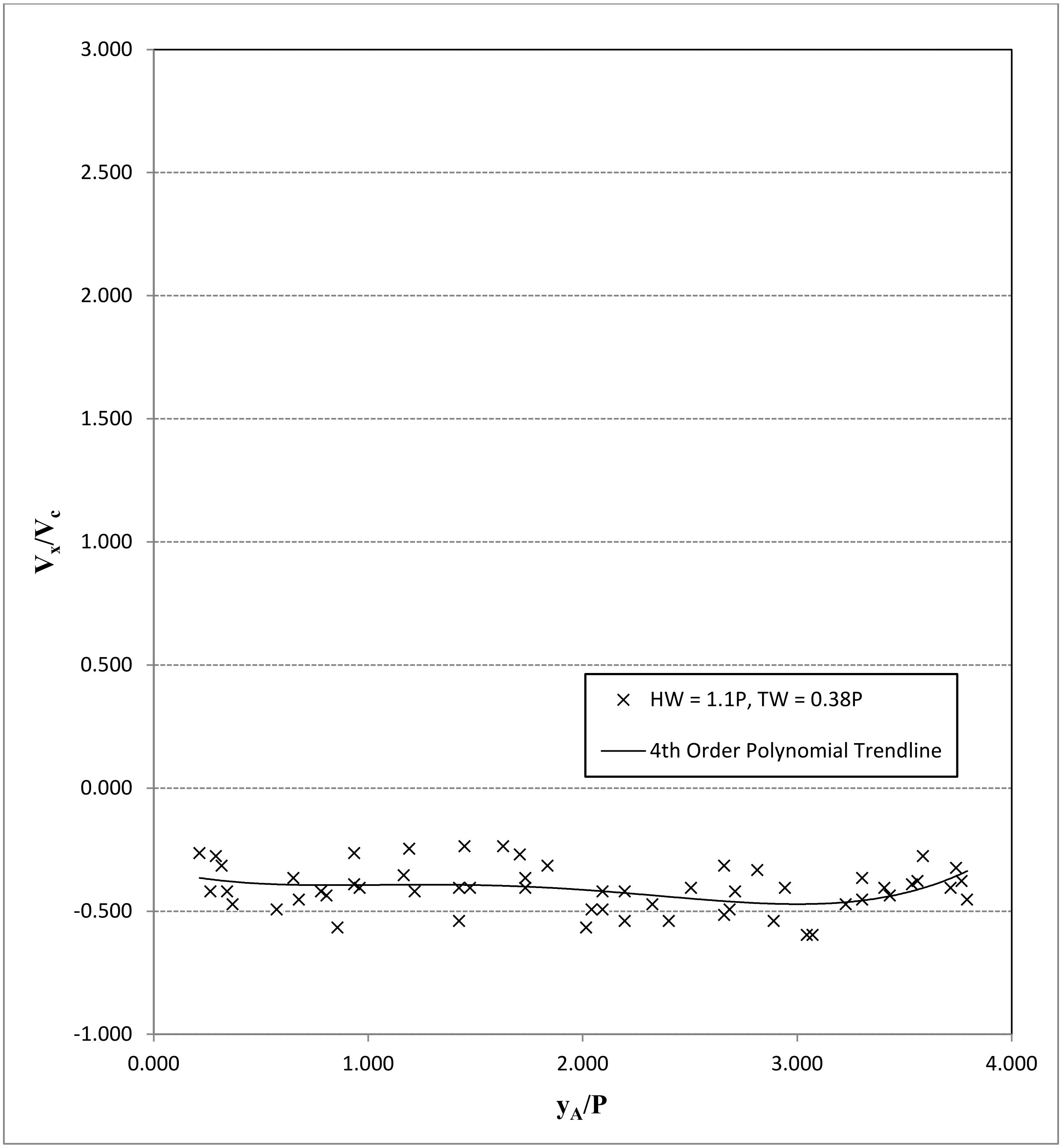

Figure B-15: Headwater = 1.10P, Tailwater = 0.38P

APPENDIX C. STAGGERED DEFLECTOR SPILLWAY DATA AND CALCULATIONS

This section presents the raw data collected and variables calculated from the raw data. The data presented includes the starting *x*-position (x_1), starting *y*-position (y_1), ending *x*-position (x_2), ending *y*-position (y_2), starting frame ($Frame_1$), and ending frame ($Frame_2$). The calculated dimensionless variables include the downstream directed velocity (V_x) divided by critical velocity (V_c), the lateral velocity in the direction of river-right (V_y) divided by V_c, the average *x*-position (x_{Ave}) divided by the crest heght of the dam (P), and the average y-position (y_{Ave}) divided by P.

Table C-1: Headwater = 1.25P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.4	0.2	0.2	0.2	771	783	-0.227	0	0.264	0.188
2	0.4	0.2	0.2	0.2	1762	1767	-0.545	0	0.264	0.188
3	0.7	0.5	0.2	0.1	6404	6416	-0.227	-0.114	0.573	0.137
4	0.5	0.4	0.3	0.25	6415	6422	-0.195	-0.097	0.419	0.265
5	0.5	0.3	0.3	0.3	800	806	-0.454	0	0.367	0.291
6	0.8	0.4	0.3	0.5	1104	1124	-0.273	0.136	0.573	0.394
7	0.9	0.2	0.4	0.45	1211	1240	-0.329	0.023	0.522	0.42
8	0.7	0.6	0.4	0.4	1733	1743	-0.136	0	0.625	0.394
9	0.6	0.4	0.4	0.3	1790	1798	-0.341	-0.17	0.47	0.343
10	0.7	0.25	0.5	0.4	1843	1859	-0.383	-0.085	0.444	0.446
11	0.55	0.2	0.5	0.5	1872	1887	-0.318	0	0.341	0.497
12	0.7	0.2	0.5	0.45	1892	1908	-0.426	-0.043	0.419	0.471
13	0.5	0.3	0.6	0.5	1925	1930	-0.545	-0.273	0.367	0.549
14	0.6	0.2	0.6	0.6	6542	6555	-0.419	0	0.367	0.6
15	0.5	0.25	0.6	0.4	12225	12235	-0.341	-0.273	0.341	0.497

Table C-1 Continued: Headwater = 1.25P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
16	0.6	0.2	0.7	0.7	12271	12297	-0.21	0	0.367	0.703
17	0.6	0.2	0.7	0.7	786	803	-0.321	0	0.367	0.703
18	0.8	0.35	0.7	0.8	2087	2107	-0.307	0.068	0.547	0.754
19	0.6	0.2	0.8	0.6	17879	17892	-0.419	-0.21	0.367	0.703
20	0.7	0.1	0.8	0.85	18195	18214	-0.43	0.036	0.367	0.832
21	0.7	0.45	0.8	0.9	859	864	-0.681	0.273	0.547	0.857
22	0.8	0.25	0.9	0.9	796	815	-0.394	0	0.496	0.909
23	0.6	0.4	0.9	0.95	808	818	-0.273	0.068	0.47	0.935
24	0.85	0.15	0.9	1.1	868	898	-0.318	0.091	0.47	1.012
25	0.5	0.35	1	1.2	1736	1742	-0.341	0.454	0.393	1.115
26	0.7	0.3	1	1	4645	4667	-0.248	0	0.47	1.012
27	0.6	0.3	1	1.1	8278	8290	-0.341	0.114	0.419	1.063
28	0.7	0.6	1.1	1.3	12249	12257	-0.17	0.341	0.625	1.218
29	0.65	0.4	1.1	1.1	1712	1726	-0.243	0	0.496	1.115
30	0.9	0.75	1.1	1.1	15782	15792	-0.204	0	0.805	1.115
31	0.5	0.8	1.2	1.3	4184	4191	0.584	0.195	0.625	1.269
32	0.5	0.9	1.2	1.3	12341	12352	0.496	0.124	0.676	1.269
33	0.5	0.8	1.2	1.2	6364	6369	0.818	0	0.625	1.218
34	0.6	0.25	1.3	1.2	6721	6733	-0.397	-0.114	0.393	1.269
35	0.5	0.2	1.3	1.3	18264	18275	-0.372	0	0.316	1.321
36	0.2	0.1	1.3	1.3	1778	1786	-0.17	0	0.11	1.321
37	0.6	0.4	1.4	1.4	8316	8331	-0.182	0	0.47	1.424
38	0.7	0.5	1.4	1.5	6552	6572	-0.136	0.068	0.573	1.475
39	0.7	0.3	1.4	1.4	6756	6770	-0.389	0	0.47	1.424
40	0.6	0.2	1.5	1.4	13920	13932	-0.454	-0.114	0.367	1.475
41	0.65	0.2	1.5	1.4	13953	13966	-0.472	-0.105	0.393	1.475
42	0.4	0.2	1.5	1.5	1788	1797	-0.303	0	0.264	1.527
43	0.7	0.2	1.6	1.5	12492	12506	-0.487	-0.097	0.419	1.578
44	0.7	0.3	1.6	1.5	14167	14178	-0.496	-0.124	0.47	1.578
45	0.7	0.3	1.6	1.5	15613	15622	-0.606	-0.151	0.47	1.578
46	0.6	0.1	1.7	1.6	836	853	-0.401	-0.08	0.316	1.681
47	0.7	0.2	1.7	1.5	944	960	-0.426	-0.17	0.419	1.63
48	0.6	0.2	1.7	1.7	1737	1748	-0.496	0	0.367	1.733
49	0.9	0.2	1.8	1.7	1272	1303	-0.308	-0.044	0.522	1.784
50	0.5	0.2	1.8	1.7	1508	1516	-0.511	-0.17	0.316	1.784
51	0.7	0.3	1.8	1.8	1512	1530	-0.303	0	0.47	1.836
52	0.8	0.2	1.9	1.7	4166	4190	-0.341	-0.114	0.47	1.836
53	0.5	0.2	1.9	1.8	4224	4232	-0.511	-0.17	0.316	1.887
54	0.6	0.4	1.9	1.8	4500	4510	-0.273	-0.136	0.47	1.887
55	0.4	0.2	2	2	8032	8040	-0.341	0	0.264	2.042

Table C-1 Continued: Headwater = 1.25P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
56	0.4	0.2	2	1.7	1396	1406	-0.273	-0.409	0.264	1.887
57	0.7	0.4	2	1.8	4505	4520	-0.273	-0.182	0.522	1.939
58	0.4	0.2	2.1	2	9745	9751	-0.454	-0.227	0.264	2.093
59	0.4	0.2	2.1	1.9	15725	15733	-0.341	-0.341	0.264	2.042
60	0.6	0.2	2.1	1.65	15879	15899	-0.273	-0.307	0.367	1.913
61	0.6	0.3	2.2	1.8	9927	9942	-0.273	-0.363	0.419	2.042
62	0.4	0.6	2.2	2.3	1816	1825	0.303	0.151	0.47	2.299
63	0.5	0.3	2.3	2.3	14156	14163	-0.389	0	0.367	2.351
64	0.5	0.6	2.3	1.8	1821	1836	0.091	-0.454	0.522	2.093
65	0.5	0.3	2.3	1.9	6714	6723	-0.303	-0.606	0.367	2.145
66	0.4	0.3	2.4	2.1	1202	1211	-0.151	-0.454	0.316	2.299
67	0.4	0.4	2.4	2	1842	1851	0	-0.606	0.367	2.248
68	0.1	0.5	2.4	2.4	6699	6702	1.817	0	0.264	2.454
69	0.2	0.6	2.5	2.3	1467	1479	0.454	-0.227	0.367	2.454
70	0.4	0.6	2.5	2.2	9917	9927	0.273	-0.409	0.47	2.402
71	0.1	0.4	2.5	2.5	1094	1096	2.044	0	0.213	2.557
72	0.1	0.8	2.6	2.5	1452	1460	1.192	-0.17	0.419	2.608
73	0.2	0.7	2.6	2.6	1520	1525	1.363	0	0.419	2.66
74	0.2	1	2.6	2.5	1835	1845	1.09	-0.136	0.573	2.608
75	0.5	1	2.7	2.6	1450	1455	1.363	-0.273	0.728	2.711
76	0.3	0.9	2.7	2.9	1837	1841	2.044	0.681	0.573	2.866
77	0.2	0.9	2.7	2.7	1197	1204	1.363	0	0.522	2.763
78	0.5	1.1	2.8	2.7	1326	1333	1.168	-0.195	0.779	2.814
79	0.4	1	2.8	2.65	1558	1564	1.363	-0.341	0.676	2.789
80	0.4	0.9	2.8	2.8	1091	1095	1.703	0	0.625	2.866
81	0.4	1	2.9	2.8	1373	1379	1.363	-0.227	0.676	2.917
82	0.5	0.9	2.9	2.7	6723	6727	1.363	-0.681	0.676	2.866
83	0.1	1.1	2.9	2.8	1194	1203	1.514	-0.151	0.573	2.917
84	0.3	0.8	3	3	1332	1339	0.973	0	0.522	3.072
85	0.3	0.9	3	2.9	1537	1547	0.818	-0.136	0.573	3.02
86	0.4	1	3	2.9	1121	1128	1.168	-0.195	0.676	3.02
87	0.2	0.8	3.1	3.1	1378	1391	0.629	0	0.47	3.175
88	0.3	0.9	3.1	3.25	1556	1567	0.743	0.186	0.573	3.252
89	0.2	1.2	3.1	3.1	1085	1099	0.973	0	0.676	3.175
90	0.3	0.8	3.2	3.3	1328	1338	0.681	0.136	0.522	3.329
91	0.4	0.2	3.2	3.15	1870	1880	-0.273	-0.068	0.264	3.252
92	0.3	0.6	3.2	3.2	4356	4367	0.372	0	0.419	3.278
93	0.5	0.4	3.3	3.65	1317	1325	-0.17	0.596	0.419	3.561
94	0.2	0.8	3.3	3.3	1581	1590	0.909	0	0.47	3.381
95	0.7	1.1	3.3	3.3	1231	1238	0.779	0	0.882	3.381

Table C-1 Continued: Headwater = 1.25P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
96	0.4	0.1	3.4	3.4	1334	1341	-0.584	0	0.213	3.484
97	0.6	0.2	3.4	3.6	9743	9757	-0.389	0.195	0.367	3.587
98	0.6	0.5	3.4	3.7	4362	4371	-0.151	0.454	0.522	3.638
99	0.4	0.2	3.5	3.45	1358	1364	-0.454	-0.114	0.264	3.561
100	0.6	0.6	3.5	3.7	4302	4308	0	0.454	0.573	3.69
101	0.4	0.2	3.5	3.6	1915	1921	-0.454	0.227	0.264	3.638
102	0.5	0.2	3.6	3.6	1351	1365	-0.292	0	0.316	3.69
103	0.4	0.1	3.6	3.6	4333	4341	-0.511	0	0.213	3.69
104	0.3	0.1	3.6	3.5	4449	4455	-0.454	-0.227	0.161	3.638
105	0.6	0.2	3.7	3.75	1340	1353	-0.419	0.052	0.367	3.819
106	0.6	0.4	3.7	3.7	9793	9801	-0.341	0	0.47	3.793
107	0.4	0.2	3.7	3.7	1266	1271	-0.545	0	0.264	3.793
108	0.6	0.2	3.8	3.75	4323	4334	-0.496	-0.062	0.367	3.87

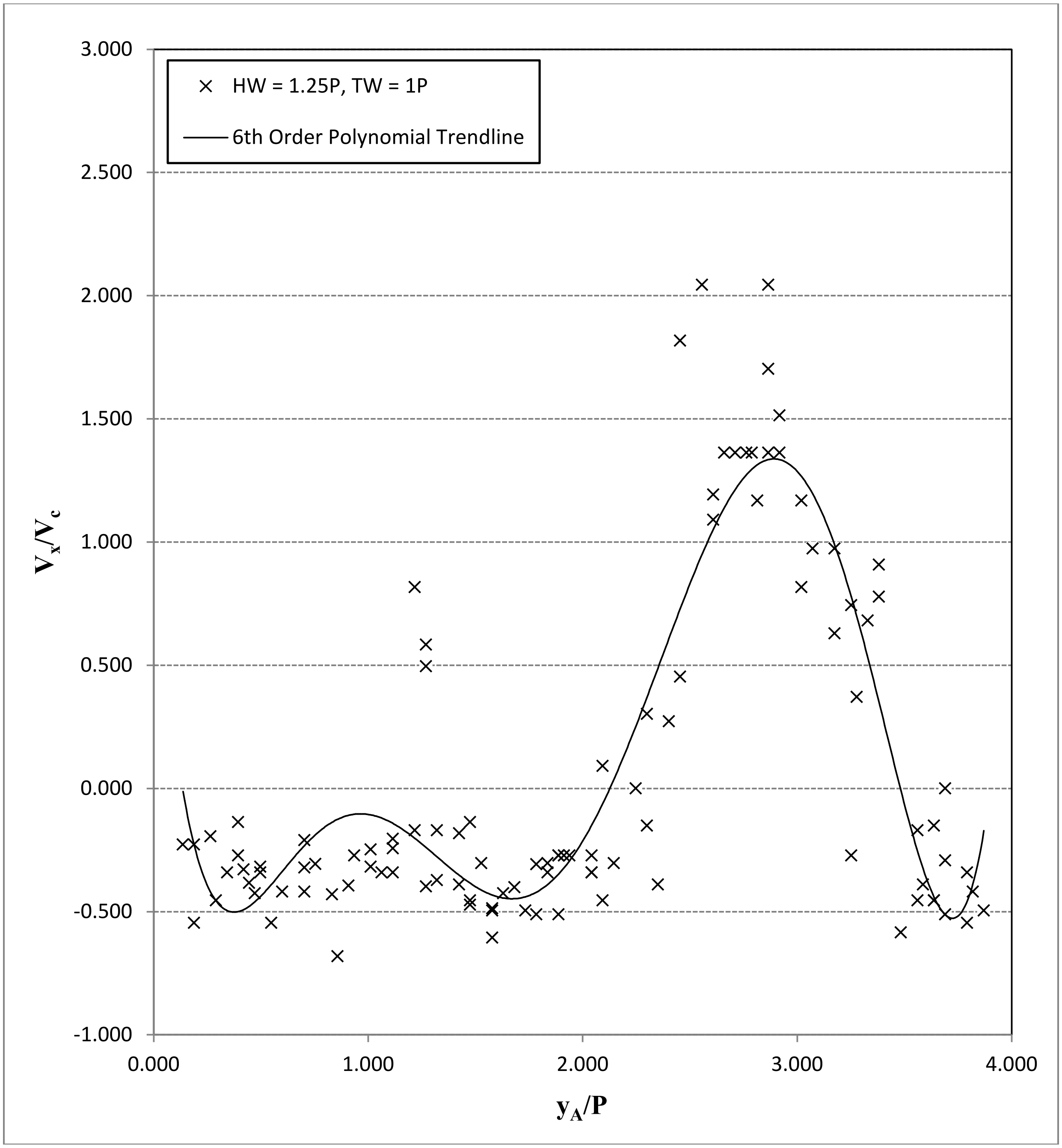

Figure C-1: Headwater = 1.25P, Tailwater = 1P

Table C-2: Headwater = 1.25P, Tailwater = 0.85P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.9	0.2	0.2	0.2	1012	1032	-0.477	0	0.522	0.188
2	0.15	1.2	0.2	0.2	3384	3413	0.493	0	0.65	0.188
3	0.9	0.4	0.3	0.4	5709	5725	-0.426	0.085	0.625	0.343
4	0.7	0.3	0.3	0.4	11274	11285	-0.496	0.124	0.47	0.343
5	0.9	0.6	0.3	0.4	12683	12689	-0.681	0.227	0.728	0.343
6	0.9	0.3	0.4	0.7	1024	1045	-0.389	0.195	0.573	0.549
7	0.8	0.35	0.4	0.45	6840	6853	-0.472	0.052	0.547	0.42
8	0.9	0.5	0.4	0.3	5753	5767	-0.389	-0.097	0.676	0.343
9	0.9	0.4	0.5	0.6	5709	5726	-0.401	0.08	0.625	0.549
10	0.75	0.22	0.5	0.7	1626	1644	-0.401	0.151	0.455	0.6
11	0.7	0.4	0.5	0.5	12641	12648	-0.584	0	0.522	0.497
12	0.9	0.4	0.6	0.5	5753	5774	-0.324	-0.065	0.625	0.549
13	0.9	0.2	0.6	0.7	6764	6782	-0.53	0.076	0.522	0.651
14	0.7	0.1	0.7	0.65	670	688	-0.454	-0.038	0.367	0.677
15	0.9	0.55	0.7	0.85	11289	11301	-0.397	0.17	0.702	0.78
16	0.9	0.3	0.7	0.7	12573	12592	-0.43	0	0.573	0.703
17	0.8	0.55	0.8	0.95	6827	6833	-0.568	0.341	0.65	0.883
18	0.8	0.55	0.8	0.9	6827	6832	-0.681	0.273	0.65	0.857
19	0.7	1.05	0.9	1.4	12626	12641	0.318	0.454	0.856	1.166
20	0.4	0.3	0.9	1.1	16659	16664	-0.273	0.545	0.316	1.012
21	0.3	0.9	0.9	1	18025	18033	1.022	0.17	0.573	0.96
22	0.8	0.4	1	1.25	6876	6889	-0.419	0.262	0.573	1.141
23	0.9	0.5	1	1.5	1041	1066	-0.218	0.273	0.676	1.269
24	0.7	0.2	1	1.45	6902	6925	-0.296	0.267	0.419	1.244
25	1	0.6	1.1	1.5	6830	6845	-0.363	0.363	0.779	1.321
26	0.7	0.2	1.1	1.4	6909	6924	-0.454	0.273	0.419	1.269
27	0.8	0.5	1.1	1.3	11365	11374	-0.454	0.303	0.625	1.218
28	1	0.65	1.2	1.5	620	637	-0.281	0.24	0.805	1.372
29	0.8	0.45	1.2	1.4	1593	1606	-0.367	0.21	0.599	1.321
30	0.9	0.6	1.2	1.6	6892	6903	-0.372	0.496	0.728	1.424
31	0.9	0.3	1.3	1.65	632	650	-0.454	0.265	0.573	1.501
32	0.9	0.6	1.3	1.4	1072	1083	-0.372	0.124	0.728	1.372
33	0.9	0.5	1.3	1.5	1083	1103	-0.273	0.136	0.676	1.424
34	0.3	0.8	1.4	1.6	7051	7060	0.757	0.303	0.522	1.527
35	0.7	0.5	1.4	1.5	1055	1068	-0.21	0.105	0.573	1.475
36	0.1	0.7	1.5	1.6	5439	5445	1.363	0.227	0.367	1.578
37	0.1	0.7	1.5	1.6	11351	11356	1.635	0.273	0.367	1.578
38	0.9	0.6	1.5	1.5	12654	12666	-0.341	0	0.728	1.527
39	0.2	0.75	1.6	1.6	5206	5220	0.535	0	0.444	1.63

Table C-2 Continued: Headwater = 1.25P, Tailwater = 0.85P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.1	0.93	1.6	1.7	5480	5489	1.257	0.151	0.485	1.681
41	0.2	0.9	1.6	1.5	5266	5271	1.908	-0.273	0.522	1.578
42	0.2	0.4	1.7	1.7	5270	5271	2.726	0	0.264	1.733
43	0.8	1.1	1.7	1.8	1106	1114	0.511	0.17	0.934	1.784
44	0.7	1	1.7	1.75	1148	1155	0.584	0.097	0.831	1.759
45	0.2	0.9	1.8	1.7	5173	5184	0.867	-0.124	0.522	1.784
46	0.2	0.6	1.8	1.7	5439	5443	1.363	-0.341	0.367	1.784
47	0.3	0.9	1.8	1.75	7166	7179	0.629	-0.052	0.573	1.81
48	0.2	0.7	1.9	1.8	11491	11495	1.703	-0.341	0.419	1.887
49	0.3	0.5	1.9	1.7	11543	11549	0.454	-0.454	0.367	1.836
50	0.5	0.9	1.9	1.6	1429	1441	0.454	-0.341	0.676	1.784
51	0.8	0.7	2	1.9	1521	1532	-0.124	-0.124	0.728	1.99
52	0.9	0.25	2	1.8	5153	5173	-0.443	-0.136	0.547	1.939
53	0.1	0.7	2	2	11406	11413	1.168	0	0.367	2.042
54	0.8	0.55	2.1	1.85	3475	3488	-0.262	-0.262	0.65	2.016
55	0.9	0.5	2.1	1.95	3645	3662	-0.321	-0.12	0.676	2.068
56	0.7	0.3	2.1	1.9	5159	5171	-0.454	-0.227	0.47	2.042
57	0.7	0.19	2.2	2	16650	16667	-0.409	-0.16	0.413	2.145
58	0.9	0.45	2.2	1.9	8885	8900	-0.409	-0.273	0.65	2.093
59	0.65	0.25	2.2	1.9	8888	8904	-0.341	-0.256	0.419	2.093
60	0.2	0.6	2.3	2.1	11447	11458	0.496	-0.248	0.367	2.248
61	0.2	0.7	2.3	2.35	669	673	1.703	0.17	0.419	2.377
62	0.7	0.5	2.3	2.1	1216	1225	-0.303	-0.303	0.573	2.248
63	0.75	0.3	2.4	1.9	3515	3541	-0.236	-0.262	0.496	2.196
64	0.85	0.55	2.4	1.85	3790	3807	-0.24	-0.441	0.676	2.171
65	0.8	0.29	2.4	2.15	11494	11507	-0.535	-0.262	0.516	2.325
66	0.9	0.5	2.5	2.3	8807	8818	-0.496	-0.248	0.676	2.454
67	0.9	0.2	2.5	1.9	8841	8873	-0.298	-0.256	0.522	2.248
68	0.85	0.3	2.5	1.9	8860	8880	-0.375	-0.409	0.547	2.248
69	0.5	0.25	2.6	2.3	8743	8753	-0.341	-0.409	0.341	2.505
70	0.9	0.4	2.6	2	8857	8877	-0.341	-0.409	0.625	2.351
71	0.75	0.4	2.6	2.3	712	722	-0.477	-0.409	0.547	2.505
72	0.5	0.4	2.7	2.4	8740	8750	-0.136	-0.409	0.419	2.608
73	0.2	0.6	2.7	2.65	17970	17980	0.545	-0.068	0.367	2.737
74	0.6	0.3	2.7	2.4	3833	3843	-0.409	-0.409	0.419	2.608
75	0.6	0.2	2.8	2.45	3829	3846	-0.321	-0.281	0.367	2.686
76	0.5	1	2.8	2.45	12778	12789	0.619	-0.434	0.728	2.686
77	0.3	0.8	2.8	2.4	16679	16689	0.681	-0.545	0.522	2.66
78	0.1	0.9	2.9	2.8	8903	8914	0.991	-0.124	0.47	2.917
79	0.6	0.6	2.9	2.7	8943	8946	0	-0.909	0.573	2.866

Table C-2 Continued: Headwater = 1.25P, Tailwater = 0.85P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
80	0.1	0.7	2.9	2.9	18004	18009	1.635	0	0.367	2.969
81	0.5	0.4	3	2.4	8875	8888	-0.105	-0.629	0.419	2.763
82	0.1	0.7	3	2.9	1381	1386	1.635	-0.273	0.367	3.02
83	0.4	0.5	3	2.7	3821	3833	0.114	-0.341	0.419	2.917
84	0.3	1	3.1	2.7	1429	1444	0.636	-0.363	0.625	2.969
85	0.1	0.6	3.1	3	3612	3616	1.703	-0.341	0.316	3.123
86	0.1	0.8	3.2	3.1	786	791	1.908	-0.273	0.419	3.226
87	0.1	0.7	3.2	3.3	839	843	2.044	0.341	0.367	3.329
88	0.2	0.9	3.2	3.1	8784	8791	1.363	-0.195	0.522	3.226
89	0.2	0.7	3.3	3.4	1416	1419	2.271	0.454	0.419	3.432
90	0.23	0.73	3.3	3.4	8785	8788	2.271	0.454	0.449	3.432
91	0.2	1	3.3	3.5	8824	8829	2.18	0.545	0.573	3.484
92	0.4	0.9	3.4	3.45	12743	12746	2.271	0.227	0.625	3.51
93	0.6	1.2	3.4	3.4	4951	4955	2.044	0	0.882	3.484
94	0.4	1	3.5	3.6	17987	17991	2.044	0.341	0.676	3.638
95	0.5	1.1	3.5	3.6	17999	18003	2.044	0.341	0.779	3.638
96	0.2	0.9	3.5	3.6	816	821	1.908	0.273	0.522	3.638
97	0.6	1.2	3.6	3.55	14545	14549	2.044	-0.17	0.882	3.664
98	0.4	1	3.6	3.7	14587	14591	2.044	0.341	0.676	3.741
99	0.6	1.2	3.6	3.5	819	824	1.635	-0.273	0.882	3.638
100	0.2	0.9	3.7	3.8	3835	3840	1.908	0.273	0.522	3.844
101	0.15	1.15	3.7	3.7	3835	3842	1.947	0	0.625	3.793

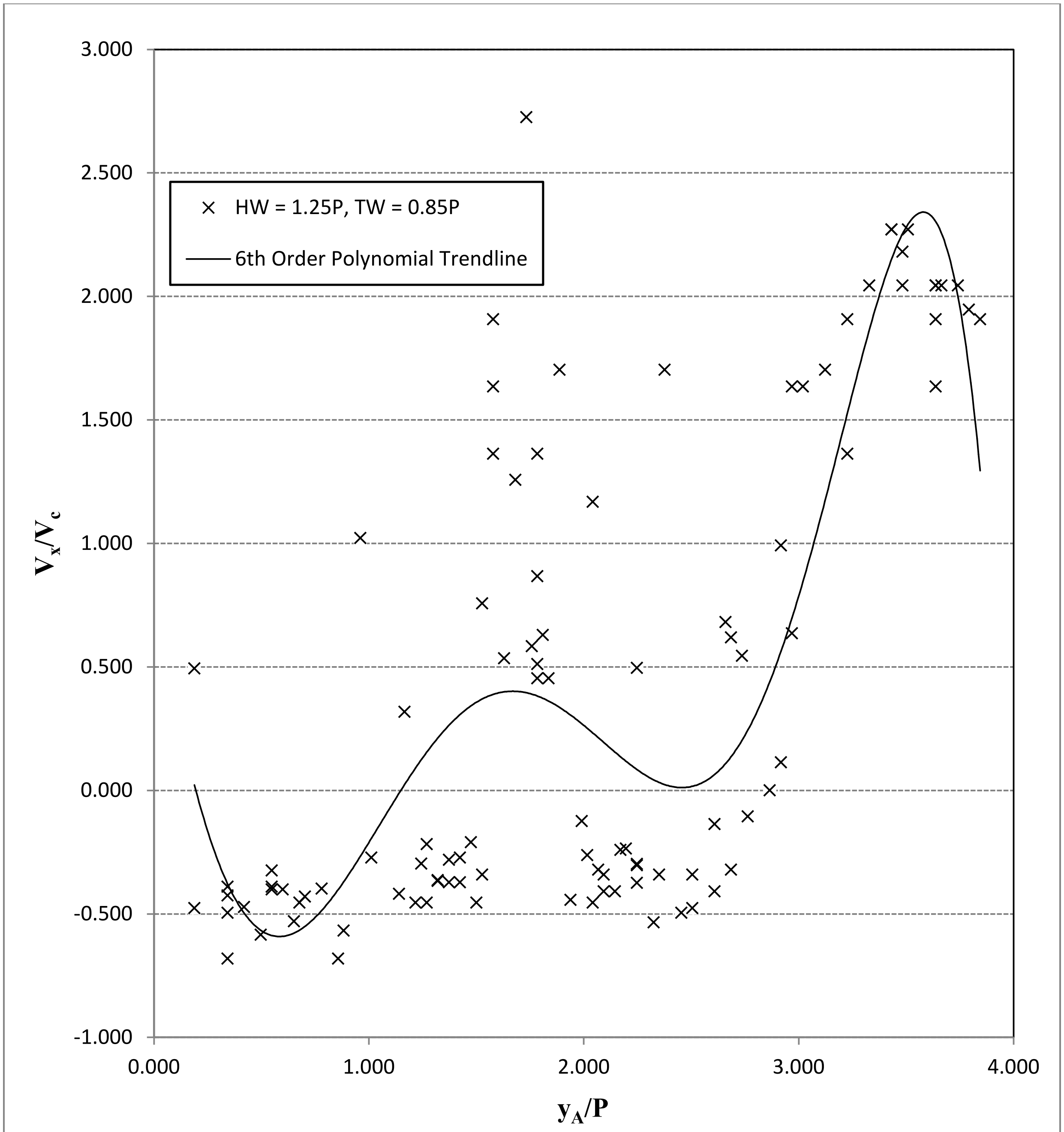

Figure C-2: Headwater = 1.25P, Tailwater = 0.85P

Table C-3: Headwater = 1.25P, Tailwater = 0.70P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.2	0.8	0.3	0.25	1066	1070	2.044	-0.17	0.47	0.265
2	0.1	0.8	0.3	0.25	19242	19246	2.385	-0.17	0.419	0.265
3	0.2	0.8	0.3	0.25	19956	19960	2.044	-0.17	0.47	0.265
4	0.2	1	0.4	0.4	808	813	2.18	0	0.573	0.394
5	0.1	0.7	0.4	0.3	1073	1077	2.044	-0.341	0.367	0.343
6	0.1	1	0.4	0.3	19247	19253	2.044	-0.227	0.522	0.343
7	0.1	0.7	0.5	0.5	11990	11994	2.044	0	0.367	0.497
8	0.5	1	0.5	0.4	16664	16668	1.703	-0.341	0.728	0.446
9	0.6	1.2	0.5	0.5	16694	16699	1.635	0	0.882	0.497
10	0.2	0.9	0.6	0.55	1063	1067	2.385	-0.17	0.522	0.574
11	0.4	1	0.6	0.6	19699	19703	2.044	0	0.676	0.6
12	0.1	0.8	0.7	0.8	16672	16677	1.908	0.273	0.419	0.754
13	0.3	0.9	0.7	0.7	364	370	1.363	0	0.573	0.703
14	0.1	0.9	0.8	1	820	828	1.363	0.341	0.47	0.909
15	0.7	1	0.9	1.2	2917	2921	1.022	1.022	0.831	1.063
16	0.2	0.7	0.9	1.1	380	385	1.363	0.545	0.419	1.012
17	0.8	1.1	0.9	1	400	406	0.681	0.227	0.934	0.96
18	0.1	0.9	1	1.1	5740	5749	1.211	0.151	0.47	1.063
19	0.3	0.8	1	0.9	396	400	1.703	-0.341	0.522	0.96
20	0.1	0.5	1.5	1.5	432	434	2.726	0	0.264	1.527
21	0.2	0.5	1.5	1.5	421	423	2.044	0	0.316	1.527
22	0.1	0.3	1.5	1.5	429	430	2.726	0	0.161	1.527
23	0.1	0.55	1.6	1.6	411	413	3.066	0	0.29	1.63
24	0.8	1.2	1.6	2.1	1103	1115	0.454	0.568	0.985	1.887
25	0.8	0.8	1.7	1.4	2802	2807	0	-0.818	0.779	1.578
26	0.1	1.1	1.7	1.7	473	481	1.703	0	0.573	1.733
27	0.8	1	1.8	1.5	470	476	0.454	-0.681	0.882	1.681
28	0.15	0.9	1.8	1.75	2803	2807	2.555	-0.17	0.496	1.81
29	0.8	0.8	1.8	1.5	2820	2825	0	-0.818	0.779	1.681
30	0.2	0.7	1.9	1.9	433	438	1.363	0	0.419	1.939
31	0.8	1.2	1.9	1.7	438	445	0.779	-0.389	0.985	1.836
32	0.1	0.8	2	1.9	2815	2819	2.385	-0.341	0.419	1.99
33	0.1	0.7	2	1.7	12069	12077	1.022	-0.511	0.367	1.887
34	0.15	1.1	2	1.5	463	478	0.863	-0.454	0.599	1.784
35	0.1	1	2.1	2.2	863	868	2.453	0.273	0.522	2.196
36	0.1	0.9	2.1	2.2	2831	2836	2.18	0.273	0.47	2.196
37	0.2	0.9	2.1	2.09	12049	12054	1.908	-0.027	0.522	2.14
38	0.4	1	2.2	2.2	811	815	2.044	0	0.676	2.248
39	0.3	1	2.2	2	2872	2878	1.59	-0.454	0.625	2.145

Table C-3 Continued: Headwater = 1.25P, Tailwater = 0.70P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.3	0.9	2.2	2.35	16754	16759	1.635	0.409	0.573	2.325
41	0.2	1	2.3	2.35	647	652	2.18	0.136	0.573	2.377
42	0.2	0.8	2.3	2.3	2828	2833	1.635	0	0.47	2.351
43	0.15	0.9	2.3	2.35	5796	5800	2.555	0.17	0.496	2.377
44	0.2	0.9	2.4	2.6	834	839	1.908	0.545	0.522	2.557
45	0.1	0.8	2.4	2.4	1172	1176	2.385	0	0.419	2.454
46	0.1	0.7	2.5	2.4	724	730	1.363	-0.227	0.367	2.505
47	0.2	0.7	2.5	2.55	16758	16761	2.271	0.227	0.419	2.583
48	0.1	0.8	2.5	2.45	19614	19621	1.363	-0.097	0.419	2.531
49	0.6	1.2	2.6	2.9	651	666	0.545	0.273	0.882	2.814
50	0.2	0.75	2.6	2.8	2855	2860	1.499	0.545	0.444	2.763
51	0.6	0.7	2.7	3	1194	1202	0.17	0.511	0.625	2.917
52	0.2	0.9	2.7	2.65	2836	2848	0.795	-0.057	0.522	2.737
53	0.1	0.4	2.7	2.7	602	604	2.044	0	0.213	2.763
54	0.6	0.9	2.8	2.95	898	907	0.454	0.227	0.728	2.943
55	0.7	0.8	2.8	3.05	1193	1204	0.124	0.31	0.728	2.995
56	0.7	0.5	3	3.4	869	884	-0.182	0.363	0.573	3.278
57	0.1	0.7	3	2.1	14029	14033	2.044	-3.066	0.367	2.608
58	0.8	0.3	3.2	3	1205	1221	-0.426	-0.17	0.522	3.175
59	0.1	0.3	3.2	3.3	606	607	2.726	1.363	0.161	3.329
60	0.8	0.5	3.3	3.2	634	645	-0.372	-0.124	0.625	3.329
61	0.9	0.5	3.3	3.65	908	929	-0.26	0.227	0.676	3.561
62	0.9	0.7	3.4	3.55	614	630	-0.17	0.128	0.779	3.561
63	0.9	0.4	3.4	3.45	1262	1277	-0.454	0.045	0.625	3.51
64	0.8	0.4	3.5	3.5	864	875	-0.496	0	0.573	3.587
65	0.9	0.5	3.5	3.7	1408	1437	-0.188	0.094	0.676	3.69
66	1	0.4	3.6	3.75	3211	3230	-0.43	0.108	0.676	3.767
67	1.2	0.4	3.7	3.7	902	936	-0.321	0	0.779	3.793
68	1	0.4	3.7	3.7	999	1024	-0.327	0	0.676	3.793
69	0.8	0.4	3.7	3.8	1012	1032	-0.273	0.068	0.573	3.844
70	0.9	0.5	3.8	3.8	1002	1021	-0.287	0	0.676	3.896
71	1	0.4	3.8	3.7	1019	1038	-0.43	-0.072	0.676	3.844
72	0.9	0.3	3.8	3.75	1046	1072	-0.314	-0.026	0.573	3.87

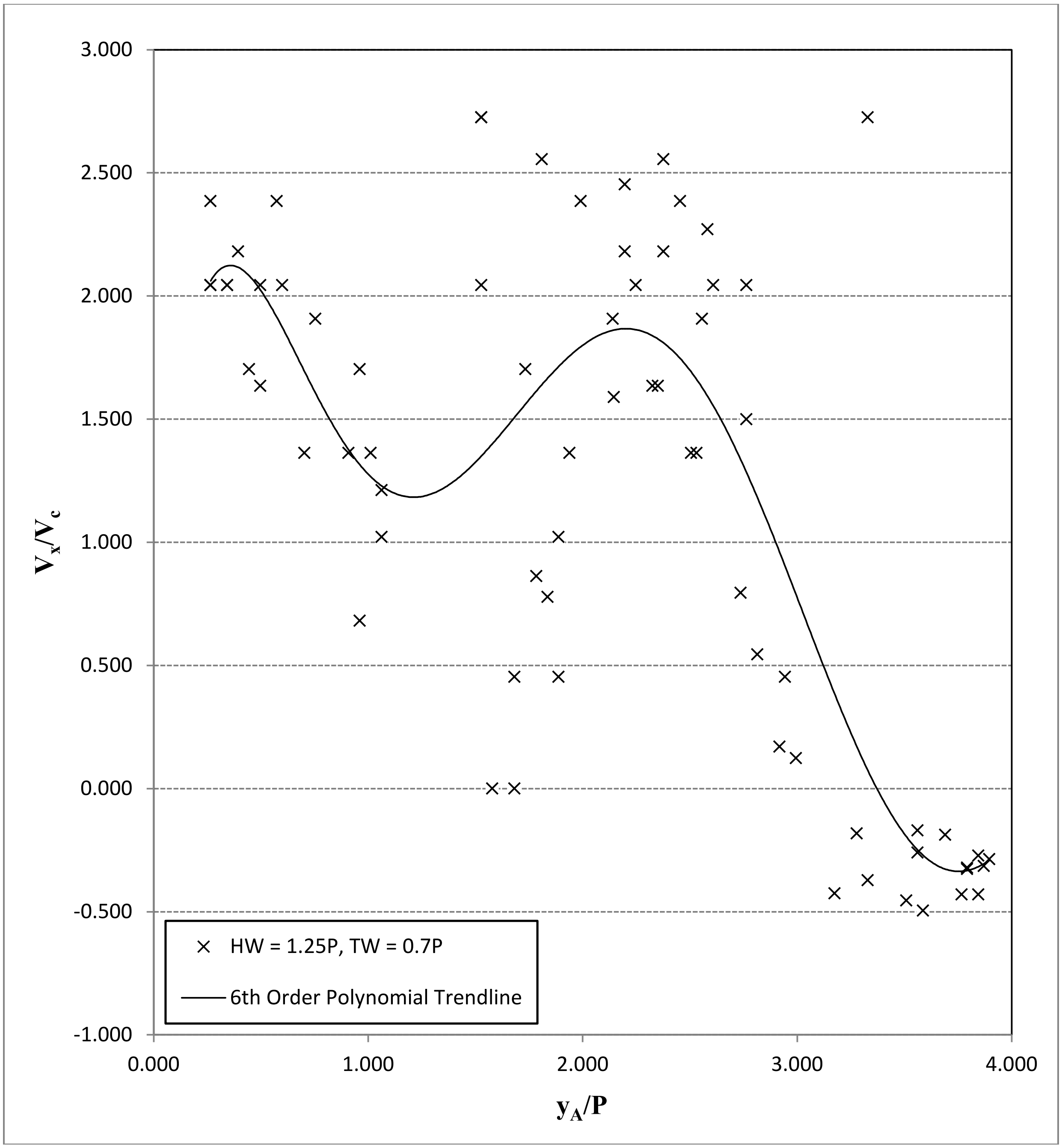

Figure C-3: Headwater = 1.25P, Tailwater = 0.7P

Table C-4: Headwater = 1.25P, Tailwater = 0.55P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	1.2	0.55	0.1	0.4	1331	1373	-0.239	0.11	0.856	0.24
2	1.1	0.2	0.1	0.2	3531	3577	-0.302	0.034	0.625	0.137
3	1.2	0.5	0.1	0.1	5826	5862	-0.301	0	0.831	0.085
4	0.75	0.25	0.2	0.3	8344	8363	-0.407	0.081	0.47	0.24
5	1.2	0.2	0.2	0.2	11109	11165	-0.276	0	0.676	0.188
6	0.95	0.45	0.3	0.2	3441	3471	-0.258	-0.052	0.676	0.24
7	1.2	0.2	0.3	0.1	8755	8819	-0.242	-0.048	0.676	0.188
8	0.7	0.2	0.3	0.3	769	792	-0.336	0	0.419	0.291
9	1.15	0.45	0.4	0.9	503	531	-0.386	0.276	0.779	0.651
10	1.2	0.45	0.4	0.1	533	586	-0.219	-0.087	0.805	0.24
11	1.2	0.2	0.4	0.2	3648	3690	-0.368	-0.074	0.676	0.291
12	1.2	0.65	0.5	0.4	711	749	-0.224	-0.041	0.908	0.446
13	1.2	0.2	0.5	0.2	5781	5832	-0.303	-0.091	0.676	0.343
14	0.8	0.2	0.5	0.15	5886	5934	-0.193	-0.113	0.47	0.317
15	1.2	0.2	0.6	0.25	603	679	-0.203	-0.071	0.676	0.42
16	1.2	0.65	0.6	0.35	3635	3689	-0.157	-0.072	0.908	0.471
17	1.05	0.25	0.6	0.1	5992	6046	-0.229	-0.143	0.625	0.343
18	0.1	1.2	0.7	0.7	11043	11069	0.654	0	0.625	0.703
19	0.8	0.6	0.7	0.4	12543	12568	-0.124	-0.185	0.676	0.549
20	0.6	1.2	0.7	0.8	12797	12807	0.927	0.155	0.882	0.754
21	0.2	0.42	0.8	0.76	3988	3989	3.401	-0.618	0.274	0.785
22	0.2	1.2	0.8	0.9	12701	12712	1.405	0.141	0.676	0.857
23	0.3	1.2	0.8	0.85	12707	12714	1.987	0.11	0.728	0.832
24	0.45	0.85	0.9	0.9	1223	1226	2.061	0	0.625	0.909
25	0.2	1.2	0.9	0.9	10436	10444	1.932	0	0.676	0.909
26	0.1	1.2	0.9	0.85	10445	10455	1.7	-0.077	0.625	0.883
27	0.2	0.6	1	1.05	10630	10632	3.091	0.386	0.367	1.038
28	0.1	0.8	1	1.1	10641	10650	1.202	0.172	0.419	1.063
29	0.2	1.2	1	1	10878	10890	1.288	0	0.676	1.012
30	0.2	0.9	1.1	1.2	1198	1202	2.705	0.386	0.522	1.166
31	0.1	0.9	1.1	1.1	10206	10210	3.091	0	0.47	1.115
32	0.2	1.2	1.1	1.05	10499	10507	1.932	-0.097	0.676	1.089
33	0.2	0.8	1.2	1.2	1332	1335	3.091	0	0.47	1.218
34	0.2	0.8	1.2	1.25	1497	1500	3.091	0.258	0.47	1.244
35	0.8	0.73	1.2	1.35	4073	4079	-0.18	0.386	0.743	1.295
36	0.5	0.8	1.3	1.5	3630	3634	1.159	0.773	0.625	1.424
37	0.4	1	1.3	1.05	10314	10322	1.159	-0.483	0.676	1.192
38	0.5	1.2	1.3	1.5	12841	12847	1.803	0.515	0.831	1.424
39	0.15	0.75	1.4	1.15	3371	3378	1.325	-0.552	0.419	1.295

Table C-4 Continued: Headwater = 1.25P, Tailwater = 0.55P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.2	1.2	1.4	1.9	10457	10476	0.814	0.407	0.676	1.681
41	0.4	1.2	1.4	1.8	13068	13086	0.687	0.343	0.779	1.63
42	0.7	0.8	1.5	1.7	3385	3390	0.309	0.618	0.728	1.63
43	0.8	1.2	1.5	1.7	10247	10258	0.562	0.281	0.985	1.63
44	0.1	0.8	1.5	1.55	11178	11186	1.353	0.097	0.419	1.553
45	0.1	1.2	1.6	1.7	10532	10548	1.063	0.097	0.625	1.681
46	0.15	1.2	1.6	1.8	10920	10928	2.029	0.386	0.65	1.733
47	0.1	1.05	1.6	1.6	12883	12889	2.447	0	0.547	1.63
48	0.2	1.2	1.7	1.9	10578	10586	1.932	0.386	0.676	1.836
49	0.2	1.15	1.7	1.7	15262	15269	2.098	0	0.65	1.733
50	0.2	1.2	1.7	1.85	17502	17526	0.644	0.097	0.676	1.81
51	0.5	0.9	1.8	1.75	3547	3552	1.237	-0.155	0.676	1.81
52	0.1	1.2	1.8	1.7	10701	10718	1	-0.091	0.625	1.784
53	0.1	1.2	1.8	1.5	1179	1189	1.7	-0.464	0.625	1.681
54	0.35	0.65	1.9	1.8	4038	4041	1.546	-0.515	0.47	1.887
55	0.1	1.2	1.9	1.8	10473	10482	1.889	-0.172	0.625	1.887
56	0.15	1.2	1.9	1.9	13293	13304	1.475	0	0.65	1.939
57	0.1	0.5	2	2	10548	10550	3.091	0	0.264	2.042
58	0.1	1.2	2	2	10790	10805	1.134	0	0.625	2.042
59	0.3	1.2	2	2	13079	13094	0.927	0	0.728	2.042
60	0.2	0.5	2.1	2.1	10561	10563	2.319	0	0.316	2.145
61	0.3	1.2	2.2	2.1	13093	13105	1.159	-0.129	0.728	2.196
62	0.1	1.2	2.2	2.15	13481	13490	1.889	-0.086	0.625	2.222
63	0.2	1.2	2.2	2.35	13502	13510	1.932	0.29	0.676	2.325
64	0.55	0.75	2.3	2.1	3784	3787	1.03	-1.03	0.625	2.248
65	0.4	1.2	2.3	2.2	10381	10394	0.951	-0.119	0.779	2.299
66	0.3	1	2.3	2.3	3498	3503	2.164	0	0.625	2.351
67	0.2	1.2	2.4	2.3	15844	15857	1.189	-0.119	0.676	2.402
68	0.1	0.7	2.4	2.4	1551	1557	1.546	0	0.367	2.454
69	0.5	0.9	2.4	2.05	3783	3791	0.773	-0.676	0.676	2.274
70	0.1	1.1	2.5	2.6	10672	10679	2.208	0.221	0.573	2.608
71	0.1	1.2	2.5	2.3	12949	12964	1.134	-0.206	0.625	2.454
72	0.1	0.7	2.5	2.45	1479	1482	3.091	-0.258	0.367	2.531
73	0.1	0.9	2.6	2.55	10825	10831	2.061	-0.129	0.47	2.634
74	0.1	1.2	2.6	2.6	13338	13347	1.889	0	0.625	2.66
75	0.2	1.2	2.6	2.3	18126	18148	0.703	-0.211	0.676	2.505
76	0.2	1.2	2.7	2.55	10600	10608	1.932	-0.29	0.676	2.686
77	0.15	1.05	2.7	2.7	11201	11206	2.782	0	0.573	2.763
78	0.2	1.2	2.7	2.75	11205	11211	2.576	0.129	0.676	2.789
79	0.1	0.9	2.8	2.8	10634	10645	1.124	0	0.47	2.866

Table C-4 Continued: Headwater = 1.25P, Tailwater = 0.55P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
80	0.4	1.2	2.8	2.9	10782	10793	1.124	0.141	0.779	2.917
81	0.2	1.1	2.8	2.7	13025	13032	1.987	-0.221	0.625	2.814
82	0.3	0.9	2.9	2.7	10818	10822	2.319	-0.773	0.573	2.866
83	0.1	1.15	2.9	3.15	13535	13542	2.319	0.552	0.599	3.098
84	0.2	1.2	2.9	3	15934	15942	1.932	0.193	0.676	3.02
85	0.25	1.2	3	2.9	10406	10414	1.836	-0.193	0.702	3.02
86	0.1	1.1	3	3	12453	12461	1.932	0	0.573	3.072
87	0.5	1	3	3	15404	15407	2.576	0	0.728	3.072
88	0.2	0.6	3.1	3.2	8865	8869	1.546	0.386	0.367	3.226
89	0.3	0.9	3.1	3.2	8897	8900	3.091	0.515	0.573	3.226
90	0.4	0.8	3.1	3.2	8950	8995	0.137	0.034	0.573	3.226
91	0.1	0.4	3.2	3.35	1570	1577	0.662	0.331	0.213	3.355
92	0.3	0.6	3.2	3.35	3855	3859	1.159	0.58	0.419	3.355
93	0.4	1	3.2	3.2	11102	11107	1.855	0	0.676	3.278
94	0.2	0.6	3.3	3.5	8631	8638	0.883	0.442	0.367	3.484
95	0.2	0.5	3.3	3.35	8942	8946	1.159	0.193	0.316	3.407
96	0.7	1.1	3.3	3.8	15845	15876	0.199	0.249	0.882	3.638
97	0.15	1.2	3.4	3.65	11073	11092	0.854	0.203	0.65	3.613
98	0.1	1.2	3.4	3.75	15713	15726	1.308	0.416	0.625	3.664
99	0.1	0.4	3.4	3.45	6469	6473	1.159	0.193	0.213	3.51
100	0.4	1	3.5	3.7	11067	11088	0.442	0.147	0.676	3.69
101	0.1	0.7	3.5	3.55	12448	12452	2.319	0.193	0.367	3.613
102	0.2	0.8	3.5	3.5	12479	12485	1.546	0	0.47	3.587
103	0.6	1	3.6	3.7	8569	8578	0.687	0.172	0.779	3.741
104	0.3	1.2	3.6	3.75	15717	15726	1.546	0.258	0.728	3.767
105	0.5	1	3.7	3.7	18126	18134	0.966	0	0.728	3.793
106	0.6	1	3.7	3.7	18200	18208	0.773	0	0.779	3.793

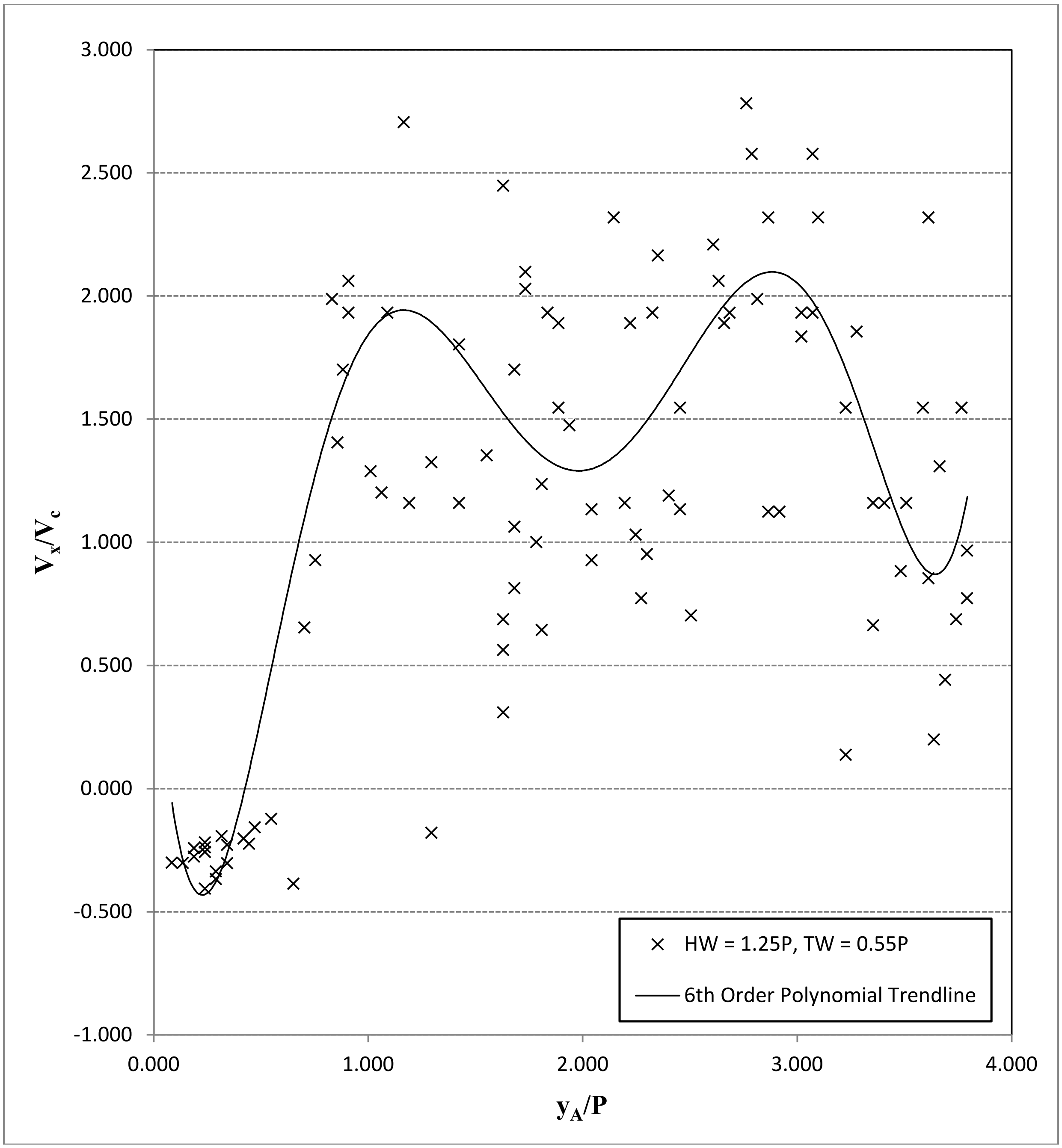

Figure C-4: Headwater = 1.25P, Tailwater = 0.55P

Table C-5: Headwater = 1.20P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.15	0.7	0.1	0.1	3496	3500	2.125	0	0.393	0.085
2	0.3	1.1	0.1	0.15	6708	6714	2.061	0.129	0.676	0.111
3	0.15	0.8	0.1	0.1	14247	14252	2.009	0	0.444	0.085
4	0.1	0.75	0.2	0.23	4005	4010	2.009	0.093	0.393	0.203
5	0.1	0.75	0.2	0.2	13933	13938	2.009	0	0.393	0.188
6	0.4	1	0.3	0.4	545	550	1.855	0.309	0.676	0.343
7	0.2	1.2	0.3	0.4	560	568	1.932	0.193	0.676	0.343
8	0.15	0.73	0.3	0.33	10413	10418	1.793	0.093	0.408	0.306
9	0.1	0.75	0.4	0.4	571	576	2.009	0	0.393	0.394
10	0.1	0.75	0.4	0.72	1170	1175	2.009	0.989	0.393	0.559
11	0.2	0.7	0.4	0.45	1201	1205	1.932	0.193	0.419	0.42
12	0.1	0.8	0.5	0.5	9839	9844	2.164	0	0.419	0.497
13	0.3	0.8	0.5	0.8	1177	1186	0.859	0.515	0.522	0.651
14	0.2	0.7	0.5	0.59	3495	3499	1.932	0.348	0.419	0.543
15	0.1	1.1	0.6	0.9	588	597	1.717	0.515	0.573	0.754
16	0.3	1	0.6	0.7	3769	3775	1.803	0.258	0.625	0.651
17	0.2	0.7	0.6	0.69	14136	14140	1.932	0.348	0.419	0.646
18	0.1	1	0.7	1	597	607	1.391	0.464	0.522	0.857
19	0.2	0.67	0.7	0.75	9786	9790	1.816	0.193	0.403	0.729
20	0.3	0.8	0.7	0.9	3754	3760	1.288	0.515	0.522	0.806
21	0.35	0.6	0.8	0.9	15954	15975	0.184	0.074	0.444	0.857
22	0.2	0.7	0.8	0.92	1162	1171	0.859	0.206	0.419	0.868
23	0.2	0.75	0.8	0.9	12876	12884	1.063	0.193	0.444	0.857
24	0.1	0.9	0.9	1.1	621	629	1.546	0.386	0.47	1.012
25	0.5	0.65	0.9	1	17460	17463	0.773	0.515	0.547	0.96
26	0.1	0.8	0.9	0.98	3735	3743	1.353	0.155	0.419	0.95
27	0.4	0.2	1	0.9	10095	10104	-0.343	-0.172	0.264	0.96
28	0.7	0.95	1	1	9849	9853	0.966	0	0.805	1.012
29	0.2	0.7	1	1	10043	10052	0.859	0	0.419	1.012
30	0.5	0.25	1.1	1	1197	1206	-0.429	-0.172	0.341	1.063
31	0.5	0.3	1.1	1	6620	6625	-0.618	-0.309	0.367	1.063
32	0.5	0.4	1.1	1	10284	10290	-0.258	-0.258	0.419	1.063
33	0.65	0.3	1.2	1.1	3695	3717	-0.246	-0.07	0.444	1.166
34	0.5	0.25	1.2	3.3	3822	3838	-0.242	2.029	0.341	2.299
35	0.55	0.25	1.2	1.1	4121	4132	-0.422	-0.141	0.367	1.166
36	0.35	0.2	1.3	1.2	6742	6747	-0.464	-0.309	0.238	1.269
37	0.5	0.25	1.3	1.1	9763	9772	-0.429	-0.343	0.341	1.218
38	0.75	0.65	1.3	1.1	12474	12485	-0.141	-0.281	0.676	1.218
39	0.6	0.25	1.4	1.1	1214	1228	-0.386	-0.331	0.393	1.269

Table C-5 Continued: Headwater = 1.20P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.7	0.3	1.4	1	3679	3704	-0.247	-0.247	0.47	1.218
41	0.55	0.25	1.4	1.2	3854	3869	-0.309	-0.206	0.367	1.321
42	0.45	0.2	1.5	1.05	3592	3605	-0.297	-0.535	0.29	1.295
43	0.55	0.2	1.5	1.2	4119	4134	-0.361	-0.309	0.341	1.372
44	0.35	0.15	1.5	1.2	6665	6675	-0.309	-0.464	0.213	1.372
45	0.5	0.2	1.6	1.3	13867	13878	-0.422	-0.422	0.316	1.475
46	0.15	0.7	1.6	1.33	8977	8987	0.85	-0.417	0.393	1.491
47	0.15	0.6	1.6	1.5	1430	1436	1.159	-0.258	0.341	1.578
48	0.15	0.6	1.7	1.6	3562	3566	1.739	-0.386	0.341	1.681
49	0.35	0.55	1.7	1.5	4114	4119	0.618	-0.618	0.419	1.63
50	0.2	0.4	1.8	1.4	3588	3594	0.515	-1.03	0.264	1.63
51	0.2	0.7	1.8	1.3	6750	6762	0.644	-0.644	0.419	1.578
52	0.1	0.4	1.8	1.6	9782	9786	1.159	-0.773	0.213	1.733
53	0.25	0.45	1.9	1.65	15901	15905	0.773	-0.966	0.316	1.81
54	0.35	0.55	1.9	1.8	17644	17646	1.546	-0.773	0.419	1.887
55	0.1	0.45	1.9	1.5	1204	1211	0.773	-0.883	0.238	1.733
56	0.2	0.45	2	2	9922	9924	1.932	0	0.29	2.042
57	0.6	0.75	2	2	10421	10422	2.319	0	0.65	2.042
58	0.45	0.65	2	1.95	17293	17295	1.546	-0.386	0.522	2.016
59	0.55	0.65	2.1	2.1	9934	9935	1.546	0	0.573	2.145
60	0.1	1.1	2.1	2	1202	1210	1.932	-0.193	0.573	2.093
61	0.1	0.7	2.1	2.09	1207	1212	1.855	-0.031	0.367	2.14
62	0.25	0.6	2.2	2.25	12773	12776	1.803	0.258	0.393	2.274
63	0.2	0.45	2.2	2.2	14022	14024	1.932	0	0.29	2.248
64	0.4	0.65	2.2	2.2	16007	16009	1.932	0	0.496	2.248
65	0.25	0.45	2.3	2.3	17302	17304	1.546	0	0.316	2.351
66	0.3	0.65	2.3	2.3	17712	17715	1.803	0	0.444	2.351
67	0.1	0.75	2.3	2.33	1343	1348	2.009	0.093	0.393	2.366
68	0.2	0.45	2.4	2.4	10474	10476	1.932	0	0.29	2.454
69	0.25	0.5	2.4	2.4	12503	12505	1.932	0	0.341	2.454
70	0.3	0.55	2.4	2.4	12881	12883	1.932	0	0.393	2.454
71	0.25	0.4	2.5	2.5	12607	12608	2.319	0	0.29	2.557
72	0.25	0.5	2.5	2.55	14043	14045	1.932	0.386	0.341	2.583
73	0.5	0.95	2.5	1.9	7832	7836	1.739	-2.319	0.702	2.248
74	0.25	0.5	2.6	2.65	17359	17361	1.932	0.386	0.341	2.686
75	0.35	0.65	2.6	2.65	6574	6577	1.546	0.258	0.47	2.686
76	0.1	0.5	2.6	3	3881	3887	1.03	1.03	0.264	2.866
77	0.3	0.45	2.7	2.9	3811	3814	0.773	1.03	0.341	2.866
78	0.6	0.7	2.7	2.8	3820	3822	0.773	0.773	0.625	2.814
79	0.15	0.7	2.7	3.2	1020	1031	0.773	0.703	0.393	3.02

Table C-5 Continued: Headwater = 1.20P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
80	0.45	0.5	2.8	3	1342	1345	0.258	1.03	0.444	2.969
81	0.23	0.73	2.8	3	8980	8987	1.104	0.442	0.449	2.969
82	0.1	0.8	2.8	2.9	15864	15875	0.984	0.141	0.419	2.917
83	0.5	0.5	2.9	3.05	1062	1065	0	0.773	0.47	3.046
84	0.5	0.65	2.9	3.1	3965	3968	0.773	1.03	0.547	3.072
85	0.5	0.5	2.9	3.1	15967	15976	0	0.343	0.47	3.072
86	0.6	0.75	3	3.2	1005	1010	0.464	0.618	0.65	3.175
87	0.5	0.5	3	3.1	3727	3729	0	0.773	0.47	3.123
88	0.3	0.7	3	3	4172	4178	1.03	0	0.47	3.072
89	0.4	0.2	3.1	3.3	979	989	-0.309	0.309	0.264	3.278
90	0.6	0.3	3.1	3.7	999	1014	-0.309	0.618	0.419	3.484
91	0.5	0.2	3.1	3.7	1391	1413	-0.211	0.422	0.316	3.484
92	0.55	0.2	3.2	3.5	1035	1048	-0.416	0.357	0.341	3.432
93	0.5	0.15	3.2	3.5	3891	3922	-0.175	0.15	0.29	3.432
94	0.6	0.25	3.2	3.6	3925	3942	-0.318	0.364	0.393	3.484
95	0.4	0.15	3.3	3.65	1425	1444	-0.203	0.285	0.238	3.561
96	0.5	0.25	3.3	3.1	1441	1455	-0.276	-0.221	0.341	3.278
97	0.4	0.2	3.3	3.5	6795	6805	-0.309	0.309	0.264	3.484
98	0.5	0.25	3.4	3.8	1357	1379	-0.176	0.281	0.341	3.69
99	0.5	0.2	3.4	3.5	3735	3745	-0.464	0.155	0.316	3.535
100	0.65	0.15	3.4	3.4	4194	4217	-0.336	0	0.367	3.484
101	0.6	0.2	3.5	3.5	3856	3882	-0.238	0	0.367	3.587
102	0.6	0.15	3.5	3.5	6612	6630	-0.386	0	0.341	3.587
103	0.8	0.2	3.5	3.55	17317	17352	-0.265	0.022	0.47	3.613
104	0.7	0.6	3.6	3.75	6664	6670	-0.258	0.386	0.625	3.767
105	0.3	0.2	3.6	3.6	9028	9032	-0.386	0	0.213	3.69
106	0.5	0.2	3.6	3.65	10036	10051	-0.309	0.052	0.316	3.716
107	0.6	0.3	3.7	3.75	1140	1160	-0.232	0.039	0.419	3.819
108	0.65	0.15	3.7	3.75	1393	1413	-0.386	0.039	0.367	3.819
109	0.15	0.4	3.7	3.6	8987	8993	0.644	-0.258	0.238	3.741
110	0.7	0.15	3.8	3.75	1050	1074	-0.354	-0.032	0.393	3.87
111	0.8	0.4	3.8	3.8	1064	1083	-0.325	0	0.573	3.896
112	0.6	0.15	3.8	3.8	3946	3960	-0.497	0	0.341	3.896

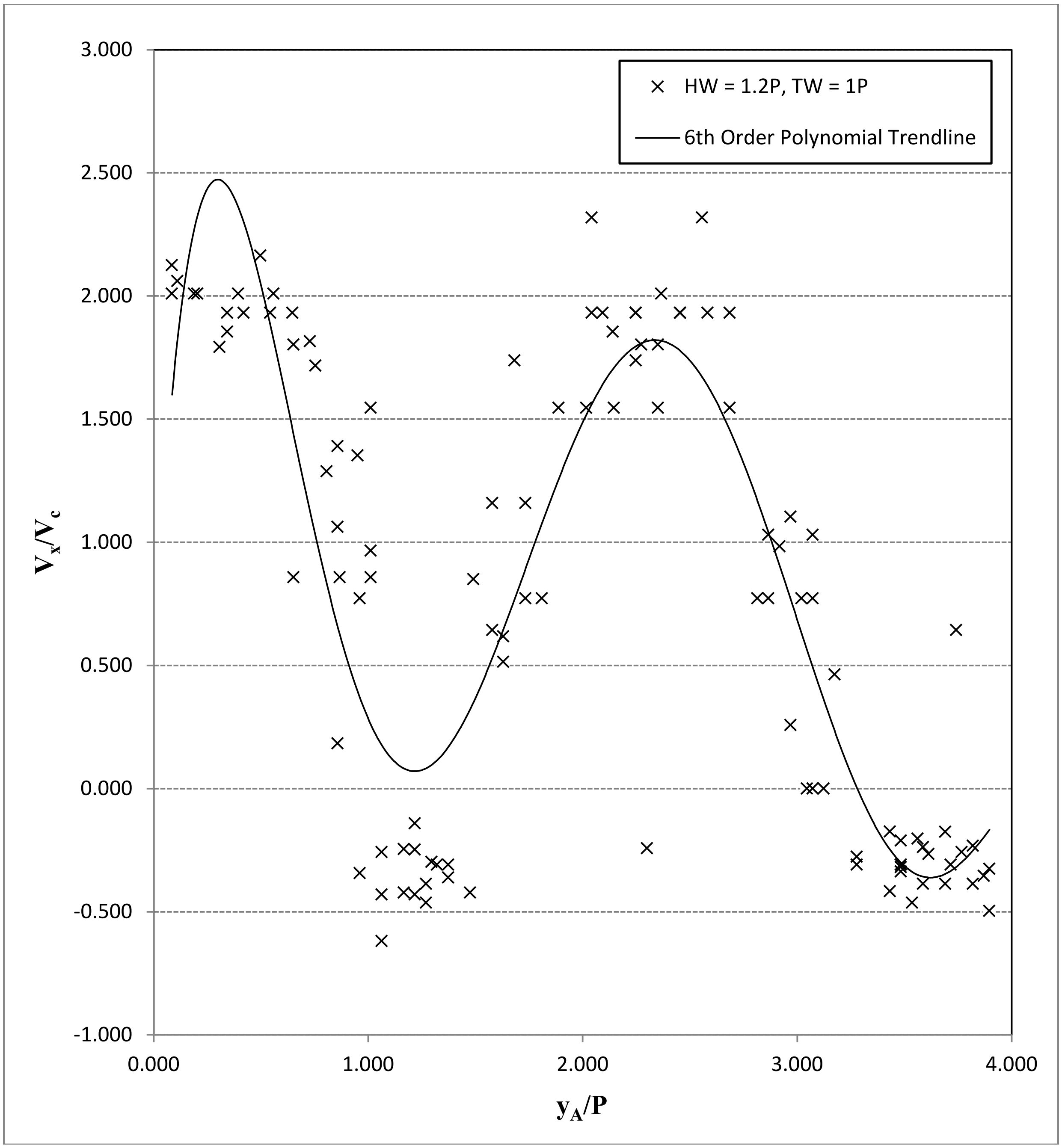

Figure C-5: Headwater = 1.20P, Tailwater = 1P

Table C-6: Headwater = 1.20P, Tailwater = 0.84P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	1	0.6	0.1	0.1	9752	9780	-0.221	0	0.779	0.085
2	0.9	0.5	0.1	0.2	9766	9781	-0.412	0.103	0.676	0.137
3	0.45	0.2	0.2	0.1	858	879	-0.184	-0.074	0.29	0.137
4	0.7	0.2	0.2	0.35	890	907	-0.455	0.136	0.419	0.265
5	0.6	0.3	0.2	0.15	743	756	-0.357	-0.059	0.419	0.162
6	0.6	0.3	0.3	0.3	714	728	-0.331	0	0.419	0.291
7	0.6	0.2	0.3	0.3	786	807	-0.294	0	0.367	0.291
8	0.5	0.2	0.3	0.35	896	907	-0.422	0.07	0.316	0.317
9	0.9	0.3	0.4	0.5	4866	4883	-0.546	0.091	0.573	0.446
10	0.7	0.5	0.4	0.5	7492	7500	-0.386	0.193	0.573	0.446
11	0.7	0.2	0.4	0.5	9691	9708	-0.455	0.091	0.419	0.446
12	0.9	0.4	0.5	0.4	835	847	-0.644	-0.129	0.625	0.446
13	0.7	0.5	0.5	0.5	9651	9656	-0.618	0	0.573	0.497
14	0.8	0.5	0.5	0.5	943	949	-0.773	0	0.625	0.497
15	0.75	0.35	0.6	0.6	880	893	-0.476	0	0.522	0.6
16	0.7	0.4	0.6	0.7	5069	5076	-0.662	0.221	0.522	0.651
17	0.6	0.2	0.6	0.6	7474	7488	-0.442	0	0.367	0.6
18	0.6	0.2	0.7	0.65	431	439	-0.773	-0.097	0.367	0.677
19	0.8	0.4	0.7	0.6	445	459	-0.442	-0.11	0.573	0.651
20	0.85	0.4	0.7	0.9	977	994	-0.409	0.182	0.599	0.806
21	0.85	0.5	0.8	1.1	478	491	-0.416	0.357	0.65	0.96
22	0.9	0.4	0.8	1.1	4327	4346	-0.407	0.244	0.625	0.96
23	0.8	0.4	0.8	0.85	1093	1110	-0.364	0.045	0.573	0.832
24	0.85	0.5	0.9	1.1	405	420	-0.361	0.206	0.65	1.012
25	0.3	0.2	0.9	0.9	4761	4768	-0.221	0	0.213	0.909
26	0.7	1	0.9	1.7	5130	5135	0.927	2.473	0.831	1.321
27	1.02	0.9	1	1.5	490	507	-0.109	0.455	0.944	1.269
28	0.8	0.3	1	1.5	909	929	-0.386	0.386	0.522	1.269
29	0.45	0.3	1	1.1	4717	4722	-0.464	0.309	0.341	1.063
30	0.9	0.4	1.1	1.5	4361	4383	-0.351	0.281	0.625	1.321
31	0.85	0.5	1.1	1.35	4415	4434	-0.285	0.203	0.65	1.244
32	0.9	0.4	1.1	1.6	4764	4789	-0.309	0.309	0.625	1.372
33	0.95	0.3	1.2	1.53	913	940	-0.372	0.189	0.599	1.388
34	1	0.35	1.2	1.3	1417	1447	-0.335	0.052	0.65	1.269
35	1.02	0.4	1.2	1.6	1460	1478	-0.532	0.343	0.686	1.424
36	1.05	0.7	1.3	1.5	1112	1125	-0.416	0.238	0.856	1.424
37	0.8	0.5	1.3	1.4	4607	4615	-0.58	0.193	0.625	1.372
38	0.85	0.3	1.4	1.6	1675	1705	-0.283	0.103	0.547	1.527
39	0.9	0.7	1.4	1.5	4536	4549	-0.238	0.119	0.779	1.475

Table C-6 Continued: Headwater = 1.20P, Tailwater = 0.84P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.8	0.5	1.4	1.5	4884	4907	-0.202	0.067	0.625	1.475
41	0.2	0.6	1.5	1.5	4585	4589	1.546	0	0.367	1.527
42	0.2	0.7	1.5	1.5	4622	4628	1.288	0	0.419	1.527
43	0.7	0.5	1.5	1.5	4986	4993	-0.442	0	0.573	1.527
44	0.3	0.9	1.6	1.5	4506	4515	1.03	-0.172	0.573	1.578
45	0.3	0.8	1.6	1.6	5194	5204	0.773	0	0.522	1.63
46	0.4	0.9	1.6	1.8	7379	7401	0.351	0.141	0.625	1.733
47	0.2	0.55	1.7	1.5	4508	4516	0.676	-0.386	0.341	1.63
48	0.3	0.7	1.7	1.7	4614	4624	0.618	0	0.47	1.733
49	0.3	0.9	1.7	1.7	5017	5029	0.773	0	0.573	1.733
50	0.2	0.7	1.8	1.8	4345	4349	1.932	0	0.419	1.836
51	0.5	1.1	1.8	1.8	4460	4467	1.325	0	0.779	1.836
52	0.1	0.7	1.8	1.7	4574	4583	1.03	-0.172	0.367	1.784
53	0.1	0.7	1.9	1.7	4576	4583	1.325	-0.442	0.367	1.836
54	0.2	0.8	1.9	1.9	4751	4759	1.159	0	0.47	1.939
55	0.1	0.9	1.9	1.8	4861	4868	1.767	-0.221	0.47	1.887
56	0.4	0.25	2	1.9	5037	5041	-0.58	-0.386	0.29	1.99
57	0.5	0.3	2	1.9	5037	5045	-0.386	-0.193	0.367	1.99
58	0.4	0.2	2	1.8	7412	7418	-0.515	-0.515	0.264	1.939
59	0.62	0.3	2.1	1.9	1615	1633	-0.275	-0.172	0.429	2.042
60	0.6	0.3	2.1	1.8	4489	4502	-0.357	-0.357	0.419	1.99
61	0.7	0.3	2.1	1.9	5166	5184	-0.343	-0.172	0.47	2.042
62	0.6	0.3	2.2	1.7	1330	1352	-0.211	-0.351	0.419	1.99
63	0.45	0.2	2.2	1.9	1431	1443	-0.322	-0.386	0.29	2.093
64	0.8	0.3	2.2	2	4728	4748	-0.386	-0.155	0.522	2.145
65	0.5	0.25	2.3	2.12	695	710	-0.258	-0.185	0.341	2.258
66	0.3	0.3	2.3	2.2	4506	4511	0	-0.309	0.264	2.299
67	0.2	0.5	2.4	2.4	7480	7482	2.319	0	0.316	2.454
68	0.35	0.7	2.4	2.2	7668	7680	0.451	-0.258	0.496	2.351
69	0.4	1	2.4	2.2	8151	8162	0.843	-0.281	0.676	2.351
70	0.1	0.5	2.5	2.4	9887	9892	1.237	-0.309	0.264	2.505
71	0.1	0.4	2.5	2.5	11539	11541	2.319	0	0.213	2.557
72	0.3	0.7	2.5	2.4	12484	12491	0.883	-0.221	0.47	2.505
73	0.1	0.7	2.6	2.6	4354	4358	2.319	0	0.367	2.66
74	0.2	0.5	2.6	2.2	8053	8061	0.58	-0.773	0.316	2.454
75	0.7	1.1	2.6	2.55	10010	10015	1.237	-0.155	0.882	2.634
76	0.1	0.9	2.7	2.7	4723	4728	2.473	0	0.47	2.763
77	0.8	1.2	2.7	2.6	8174	8177	2.061	-0.515	0.985	2.711
78	0.1	0.6	2.7	2.7	9712	9715	2.576	0	0.316	2.763
79	0.1	0.8	2.8	2.8	4675	4679	2.705	0	0.419	2.866

Table C-6 Continued: Headwater = 1.20P, Tailwater = 0.84P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
80	0.4	0.7	2.8	2.8	4868	4870	2.319	0	0.522	2.866
81	0.2	0.7	2.8	2.8	7416	7419	2.576	0	0.419	2.866
82	0.3	1	2.9	2.9	5050	5054	2.705	0	0.625	2.969
83	0.2	0.7	2.9	2.9	7410	7413	2.576	0	0.419	2.969
84	0.3	0.8	2.9	2.8	9831	9834	2.576	-0.515	0.522	2.917
85	0.1	0.8	3	3	4455	4459	2.705	0	0.419	3.072
86	0.2	0.9	3	2.9	4460	4465	2.164	-0.309	0.522	3.02
87	0.1	0.8	3	3	5136	5139	3.607	0	0.419	3.072
88	0.2	0.8	3.1	3.1	4673	4677	2.319	0	0.47	3.175
89	0.1	0.7	3.1	3.1	9732	9736	2.319	0	0.367	3.175
90	0.2	0.7	3.1	3.1	9740	9743	2.576	0	0.419	3.175
91	0.1	0.8	3.2	3.6	4655	4663	1.353	0.773	0.419	3.484
92	0.1	0.7	3.2	3.6	7419	7427	1.159	0.773	0.367	3.484
93	0.1	0.5	3.2	3.3	9767	9770	2.061	0.515	0.264	3.329
94	0.1	0.7	3.3	3.6	4662	4671	1.03	0.515	0.367	3.535
95	0.2	0.6	3.3	3.6	7634	7639	1.237	0.927	0.367	3.535
96	0.3	0.8	3.3	3.1	7666	7669	2.576	-1.03	0.522	3.278
97	0.2	0.8	3.4	3.6	4648	4655	1.325	0.442	0.47	3.587
98	0.1	0.6	3.4	3.5	4695	4699	1.932	0.386	0.316	3.535
99	0.2	0.7	3.4	3.55	9703	9707	1.932	0.58	0.419	3.561
100	0.1	0.9	3.5	0.9	5078	5087	1.374	-4.465	0.47	2.248
101	0.1	0.7	3.5	3.5	9712	9717	1.855	0	0.367	3.587
102	0.2	0.4	3.5	3.5	9722	9724	1.546	0	0.264	3.587
103	0.4	1	3.6	3.8	5320	5334	0.662	0.221	0.676	3.793
104	0.7	1.2	3.6	3.6	15039	15046	1.104	0	0.934	3.69
105	0.6	1.2	3.6	3.7	15431	15442	0.843	0.141	0.882	3.741
106	0.7	1.1	3.7	3.7	5428	5434	1.03	0	0.882	3.793
107	0.5	0.3	3.7	3.7	12804	12809	-0.618	0	0.367	3.793
108	0.5	0.2	3.7	3.6	17520	17532	-0.386	-0.129	0.316	3.741
109	0.6	0.95	3.8	3.8	9826	9835	0.601	0	0.753	3.896
110	0.9	1.2	3.8	3.75	14974	14978	1.159	-0.193	1.037	3.87
111	0.8	1.2	3.8	3.8	17554	17564	0.618	0	0.985	3.896

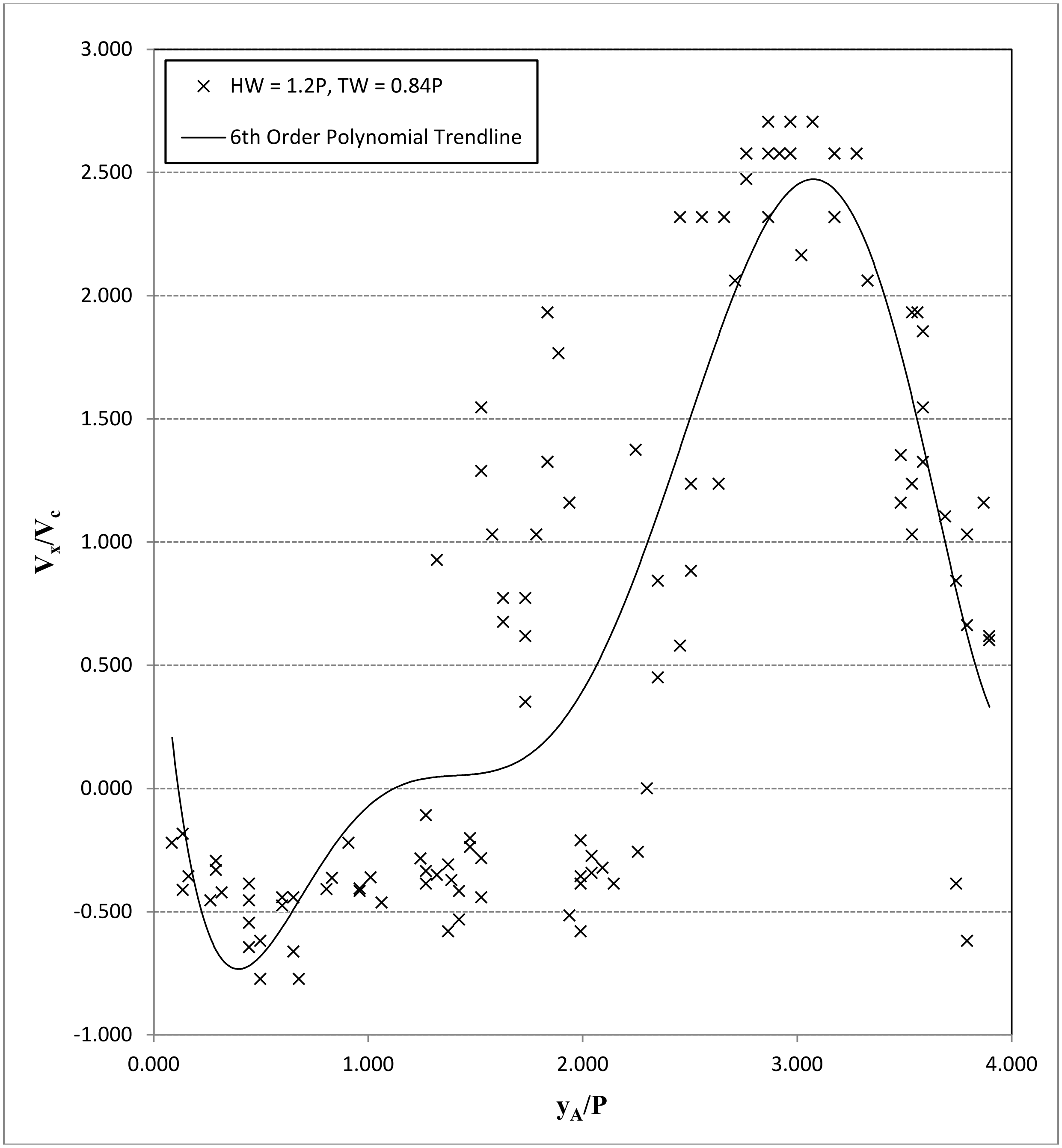

Figure C-6: Headwater = 1.20P, Tailwater = 0.84P

Table C-7: Headwater = 1.20P, Tailwater = 0.67P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.6	1.2	0.2	0.2	6467	6471	2.319	0	0.882	0.188
2	0.7	1.2	0.2	0.3	6481	6485	1.932	0.386	0.934	0.24
3	0.6	1.2	0.2	0.25	6493	6497	2.319	0.193	0.882	0.214
4	0.5	1.1	0.3	0.45	6272	6278	1.546	0.386	0.779	0.368
5	0.6	1.2	0.3	0.4	6329	6336	1.325	0.221	0.882	0.343
6	0.7	1.15	0.3	0.45	8820	8825	1.391	0.464	0.908	0.368
7	0.55	1.2	0.4	0.5	9058	9067	1.116	0.172	0.856	0.446
8	0.5	0.9	0.4	0.4	9689	9692	2.061	0	0.676	0.394
9	0.5	1.2	0.4	0.25	9809	9819	1.082	-0.232	0.831	0.317
10	0.5	1	0.5	0.6	3339	3342	2.576	0.515	0.728	0.549
11	0.6	1.2	0.5	0.5	6336	6341	1.855	0	0.882	0.497
12	0.6	1.2	0.5	0.6	8873	8879	1.546	0.258	0.882	0.549
13	0.6	1.2	0.6	0.8	5827	5838	0.843	0.281	0.882	0.703
14	0.7	1.2	0.6	0.8	6037	6044	1.104	0.442	0.934	0.703
15	0.5	1.2	0.6	0.6	8509	8517	1.353	0	0.831	0.6
16	0.8	1.2	0.7	0.7	8800	8805	1.237	0	0.985	0.703
17	0.6	0.9	0.7	0.8	8949	8959	0.464	0.155	0.728	0.754
18	0.5	1.2	0.7	0.8	8983	8996	0.832	0.119	0.831	0.754
19	0.8	1.2	0.8	1	941	954	0.476	0.238	0.985	0.909
20	0.7	1.2	0.8	0.85	978	991	0.595	0.059	0.934	0.832
21	0.5	1.2	0.8	1.35	6476	6492	0.676	0.531	0.831	1.089
22	0.65	1.2	0.9	0.75	6007	6014	1.214	-0.331	0.908	0.832
23	0.35	0.45	0.9	1.1	6348	6352	0.386	0.773	0.367	1.012
24	0.7	1.15	0.9	0.9	8721	8729	0.869	0	0.908	0.909
25	1	1.2	1	1	5953	5956	1.03	0	1.088	1.012
26	0.5	0.3	1	1.4	1190	1210	-0.155	0.309	0.367	1.218
27	0.4	1.15	1	0.95	6388	6396	1.449	-0.097	0.753	0.986
28	0.4	0.2	1.1	1.4	18338	18347	-0.343	0.515	0.264	1.269
29	0.4	0.2	1.1	1.3	18407	18412	-0.618	0.618	0.264	1.218
30	0.6	1.1	1.1	1.2	5992	6009	0.455	0.091	0.831	1.166
31	0.5	0.3	1.2	1.4	1199	1210	-0.281	0.281	0.367	1.321
32	0.5	0.3	1.2	1.4	3728	3736	-0.386	0.386	0.367	1.321
33	0.4	0.2	1.2	1.4	12820	12828	-0.386	0.386	0.264	1.321
34	0.5	0.3	1.3	1.6	9526	9537	-0.281	0.422	0.367	1.475
35	0.4	0.3	1.3	1.4	12106	12110	-0.386	0.386	0.316	1.372
36	0.4	0.2	1.3	1.5	14865	14873	-0.386	0.386	0.264	1.424
37	0.55	0.3	1.4	1.45	896	907	-0.351	0.07	0.393	1.45
38	0.5	0.3	1.4	1.6	18627	18633	-0.515	0.515	0.367	1.527
39	0.5	0.3	1.4	1.45	776	785	-0.343	0.086	0.367	1.45

Table C-7 Continued: Headwater = 1.20P, Tailwater = 0.67P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.5	0.3	1.5	1.4	1001	1010	-0.343	-0.172	0.367	1.475
41	0.4	1.1	1.5	1.5	404	412	1.353	0	0.728	1.527
42	0.4	0.3	1.5	1.6	9532	9537	-0.309	0.309	0.316	1.578
43	0.8	1.1	1.6	1.6	6139	6143	1.159	0	0.934	1.63
44	0.8	1.2	1.6	1.55	9750	9757	0.883	-0.11	0.985	1.604
45	0.7	1.2	1.6	1.4	9764	9775	0.703	-0.281	0.934	1.527
46	0.5	0.4	1.7	1.6	3380	3383	-0.515	-0.515	0.419	1.681
47	0.5	0.4	1.7	1.6	17960	17971	-0.141	-0.141	0.419	1.681
48	0.6	1	1.7	1.4	8575	8582	0.883	-0.662	0.779	1.578
49	0.9	1.2	1.8	1.8	6299	6303	1.159	0	1.037	1.836
50	0.7	1.2	1.8	1.8	12184	12202	0.429	0	0.934	1.836
51	0.8	1.2	1.8	1.8	12962	12969	0.883	0	0.985	1.836
52	0.65	1.2	1.9	1.7	1477	1484	1.214	-0.442	0.908	1.836
53	0.5	1.1	1.9	1.7	3413	3422	1.03	-0.343	0.779	1.836
54	0.5	1.2	1.9	1.55	9942	9960	0.601	-0.301	0.831	1.759
55	0.3	0.7	2	2	15001	15005	1.546	0	0.47	2.042
56	0.5	1	2	1.95	1249	1253	1.932	-0.193	0.728	2.016
57	0.6	1.2	2.1	2.1	5974	5979	1.855	0	0.882	2.145
58	0.7	1.15	2.1	2	918	922	1.739	-0.386	0.908	2.093
59	0.5	1.2	2.1	2.1	3367	3372	2.164	0	0.831	2.145
60	0.7	0.9	2.2	2.2	9331	9333	1.546	0	0.779	2.248
61	0.5	0.4	2.2	2.4	15828	15836	-0.193	0.386	0.419	2.351
62	0.6	1.2	2.2	2.15	3569	3574	1.855	-0.155	0.882	2.222
63	0.5	0.8	2.3	2.3	9331	9333	2.319	0	0.625	2.351
64	0.8	1.2	2.3	2.2	3344	3351	0.883	-0.221	0.985	2.299
65	0.4	1.1	2.3	2.3	6013	6019	1.803	0	0.728	2.351
66	0.5	1.2	2.4	2.5	3376	3387	0.984	0.141	0.831	2.505
67	0.6	1.2	2.4	2.3	3567	3572	1.855	-0.309	0.882	2.402
68	0.7	1.2	2.4	2.3	6102	6108	1.288	-0.258	0.934	2.402
69	0.5	0.8	2.5	2.55	1237	1240	1.546	0.258	0.625	2.583
70	0.6	1.2	2.5	2.55	3849	3861	0.773	0.064	0.882	2.583
71	0.6	1.2	2.5	2.5	4098	4107	1.03	0	0.882	2.557
72	0.6	0.9	2.6	2.5	5995	6006	0.422	-0.141	0.728	2.608
73	0.5	0.4	2.6	2.8	6016	6021	-0.309	0.618	0.419	2.763
74	0.75	1.2	2.6	2.4	1311	1320	0.773	-0.343	0.959	2.557
75	0.5	0.4	2.7	2.8	7010	7014	-0.386	0.386	0.419	2.814
76	0.9	1.2	2.7	2.75	5924	5931	0.662	0.11	1.037	2.789
77	1	1.2	2.7	2.65	5932	5936	0.773	-0.193	1.088	2.737
78	0.9	1.2	2.8	2.95	506	511	0.927	0.464	1.037	2.943
79	0.8	1.2	2.8	3	1014	1020	1.03	0.515	0.985	2.969

Table C-7 Continued: Headwater = 1.20P, Tailwater = 0.67P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
80	1	1.2	2.8	2.85	1057	1061	0.773	0.193	1.088	2.892
81	0.7	1.2	2.9	3	543	559	0.483	0.097	0.934	3.02
82	1	1.2	2.9	3	1217	1221	0.773	0.386	1.088	3.02
83	0.7	1.2	2.9	3.4	3315	3338	0.336	0.336	0.934	3.226
84	0.6	0.4	3	3.2	1264	1276	-0.258	0.258	0.47	3.175
85	0.9	1.2	3	3	3327	3330	1.546	0	1.037	3.072
86	0.8	1.2	3	3	3376	3384	0.773	0	0.985	3.072
87	0.9	1.2	3.1	3.2	526	530	1.159	0.386	1.037	3.226
88	0.7	1.2	3.1	3.3	961	975	0.552	0.221	0.934	3.278
89	0.5	0.1	3.1	3.2	1271	1285	-0.442	0.11	0.264	3.226
90	0.6	0.3	3.2	3.5	833	845	-0.386	0.386	0.419	3.432
91	0.7	1.2	3.2	3.6	1303	1326	0.336	0.269	0.934	3.484
92	0.8	1.2	3.2	3.6	3462	3479	0.364	0.364	0.985	3.484
93	0.9	0.5	3.3	3.8	1072	1097	-0.247	0.309	0.676	3.638
94	1	1.2	3.3	3.4	3594	3598	0.773	0.386	1.088	3.432
95	0.6	0.5	3.3	3.35	3639	3643	-0.386	0.193	0.522	3.407
96	0.6	0.4	3.4	3.55	837	849	-0.258	0.193	0.47	3.561
97	0.9	1.2	3.4	3.6	3470	3479	0.515	0.343	1.037	3.587
98	0.7	1	3.4	3.35	3487	3490	1.546	-0.258	0.831	3.458
99	0.8	0.4	3.5	3.8	1080	1097	-0.364	0.273	0.573	3.741
100	0.7	0.5	3.5	3.6	3741	3748	-0.442	0.221	0.573	3.638
101	0.9	1.1	3.5	3.7	3729	3743	0.221	0.221	0.985	3.69
102	0.7	0.6	3.6	3.8	8663	8680	-0.091	0.182	0.625	3.793
103	0.8	0.3	3.6	3.8	1115	1134	-0.407	0.163	0.522	3.793
104	0.6	1.2	3.6	3.8	3571	3592	0.442	0.147	0.882	3.793
105	0.7	0.3	3.7	3.8	1119	1134	-0.412	0.103	0.47	3.844
106	0.8	0.4	3.7	3.6	1181	1192	-0.562	-0.141	0.573	3.741
107	0.9	0.7	3.7	3.7	1176	1184	-0.386	0	0.779	3.793

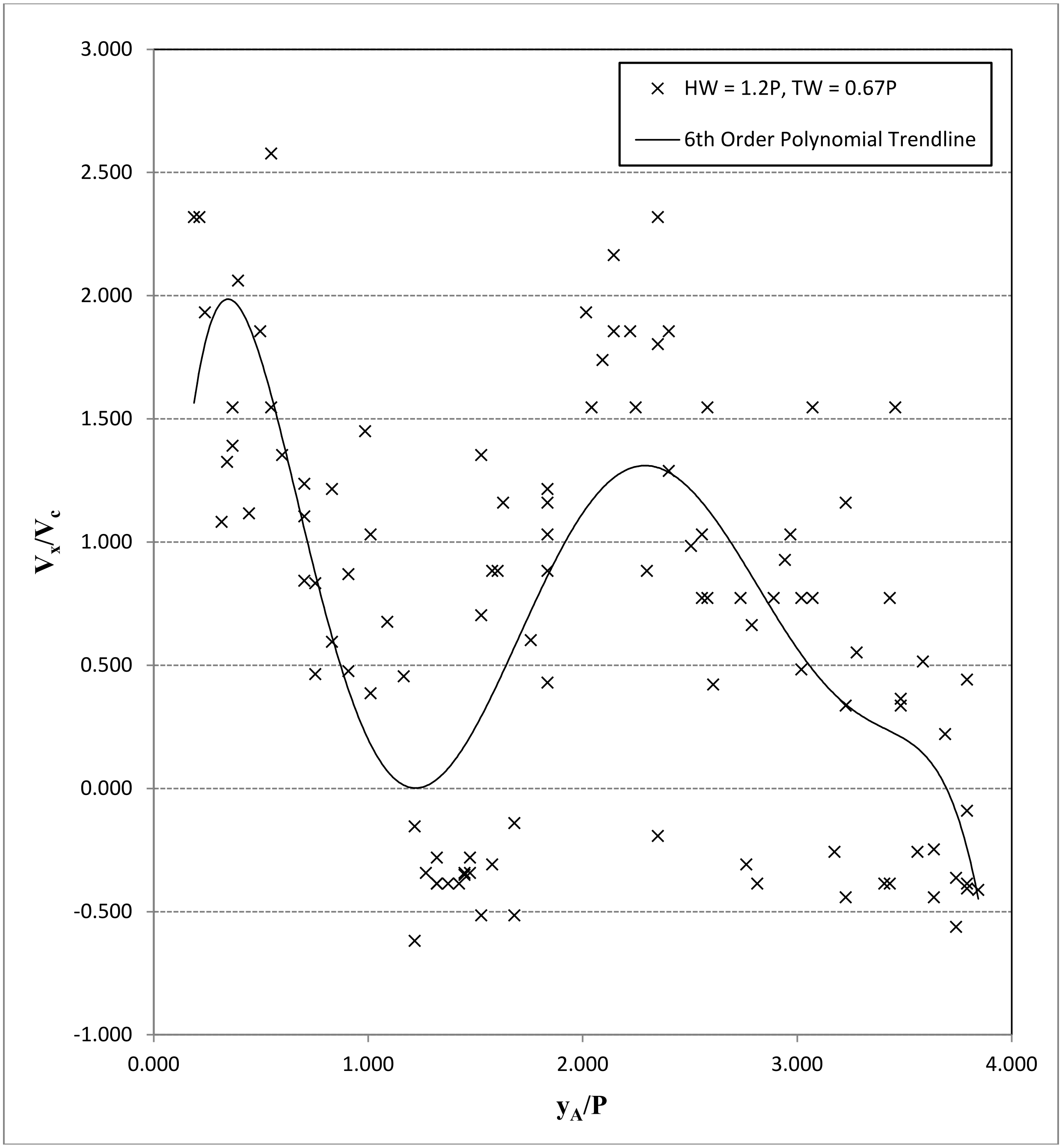

Figure C-7: Headwater = 1.20P, Tailwater = 0.67P

Table C-8: Headwater = 1.20P, Tailwater = 0.51P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.1	0.7	0.1	0.1	13423	13432	1.188	0	0.367	0.085
2	0.1	0.5	0.2	0.2	1158	1160	3.563	0	0.264	0.188
3	0.6	0.8	0.2	0.2	9398	9402	0.891	0	0.676	0.188
4	0.8	1	0.2	0.2	12519	12525	0.594	0	0.882	0.188
5	0.9	1.2	0.3	0.4	1224	1229	1.069	0.356	1.037	0.343
6	0.1	0.9	0.3	0.2	9745	9751	2.375	-0.297	0.47	0.24
7	0.1	0.5	0.3	0.3	15869	15872	2.375	0	0.264	0.291
8	0.25	0.6	0.4	0.25	15900	15904	1.559	-0.668	0.393	0.317
9	0.75	0.9	0.4	0.45	9486	9487	2.672	0.891	0.805	0.42
10	0.5	1.2	0.5	0.8	1205	1230	0.499	0.214	0.831	0.651
11	0.8	0.7	0.5	0.4	18178	18185	-0.255	-0.255	0.728	0.446
12	0.2	0.75	0.5	0.4	9482	9486	2.45	-0.445	0.444	0.446
13	0.7	1.2	0.6	0.7	1307	1330	0.387	0.077	0.934	0.651
14	0.5	1.2	0.6	0.4	1336	1353	0.734	-0.21	0.831	0.497
15	0.4	0.7	0.6	0.5	1305	1309	1.336	-0.445	0.522	0.549
16	0.7	1.2	0.7	0.8	1333	1351	0.495	0.099	0.934	0.754
17	0.3	0.8	0.7	0.7	1480	1486	1.485	0	0.522	0.703
18	0.75	0.6	0.7	0.7	6736	6739	-0.891	0	0.65	0.703
19	0.4	0.8	0.8	0.8	4201	4204	2.375	0	0.573	0.806
20	0.2	0.5	0.8	0.6	6787	6793	0.891	-0.594	0.316	0.703
21	0.2	0.7	0.8	0.9	9640	9644	2.227	0.445	0.419	0.857
22	0.9	1.2	0.9	0.9	1331	1335	1.336	0	1.037	0.909
23	0.5	0.9	0.9	0.75	1362	1367	1.425	-0.534	0.676	0.832
24	0.15	0.47	0.9	1	7733	7736	1.9	0.594	0.274	0.96
25	0.1	0.6	1	0.95	4113	4116	2.969	-0.297	0.316	0.986
26	0.1	0.7	1	0.9	4164	4169	2.138	-0.356	0.367	0.96
27	0.3	0.5	1	1	4360	4361	3.563	0	0.367	1.012
28	0.3	1.2	1.1	1.3	1357	1367	1.603	0.356	0.728	1.218
29	0.2	0.7	1.1	1.1	6759	6762	2.969	0	0.419	1.115
30	0.3	0.7	1.1	1.1	6760	6762	3.563	0	0.47	1.115
31	0.3	0.6	1.2	1.3	1315	1318	1.782	0.594	0.419	1.269
32	0.1	0.6	1.2	1.2	1649	1652	2.969	0	0.316	1.218
33	0.2	0.4	1.2	1.2	6728	6729	3.563	0	0.264	1.218
34	0.2	0.3	1.3	1.35	1734	1735	1.782	0.891	0.213	1.347
35	0.3	0.6	1.3	1.3	1834	1837	1.782	0	0.419	1.321
36	0.35	0.7	1.3	1.3	7040	7045	1.247	0	0.496	1.321
37	0.2	0.4	1.4	1.45	4172	4175	1.188	0.297	0.264	1.45
38	0.2	0.4	1.4	1.45	7621	7623	1.782	0.445	0.264	1.45
39	0.1	0.4	1.4	1.5	12954	12958	1.336	0.445	0.213	1.475

Table C-8 Continued: Headwater = 1.20P, Tailwater = 0.51P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.2	0.3	1.5	1.5	5160	5163	0.594	0	0.213	1.527
41	0.2	0.3	1.5	1.5	7249	7250	1.782	0	0.213	1.527
42	0.2	0.65	1.5	1.7	15444	15450	1.336	0.594	0.393	1.63
43	0.2	0.4	1.6	1.7	7289	7291	1.782	0.891	0.264	1.681
44	0.25	0.7	1.6	1.65	15833	15837	2.004	0.223	0.444	1.656
45	0.25	0.7	1.6	1.65	15834	15838	2.004	0.223	0.444	1.656
46	0.4	1	1.7	1.8	7291	7297	1.782	0.297	0.676	1.784
47	0.3	0.6	1.7	1.8	18820	18824	1.336	0.445	0.419	1.784
48	0.4	0.9	1.7	1.55	9816	9820	2.227	-0.668	0.625	1.656
49	0.35	0.8	1.8	1.55	9903	9909	1.336	-0.742	0.547	1.707
50	0.3	0.9	1.8	1.7	10445	10451	1.782	-0.297	0.573	1.784
51	0.5	0.8	1.8	1.8	12898	12902	1.336	0	0.625	1.836
52	0.5	0.9	1.9	1.8	15706	15716	0.713	-0.178	0.676	1.887
53	0.5	0.8	1.9	2.4	2004	2011	0.764	1.273	0.625	2.196
54	0.4	1	1.9	2.05	7623	7633	1.069	0.267	0.676	2.016
55	0.3	0.8	2	2.1	4932	4939	1.273	0.255	0.522	2.093
56	0.2	0.4	2	2.1	7166	7167	3.563	1.782	0.264	2.093
57	0.3	0.5	2	2	7315	7316	3.563	0	0.367	2.042
58	0.2	0.4	2.1	2.1	6925	6926	3.563	0	0.264	2.145
59	0.1	0.3	2.1	2.1	7327	7328	3.563	0	0.161	2.145
60	0.4	0.55	2.2	2.2	6876	6877	2.672	0	0.444	2.248
61	0.1	0.5	2.2	2.2	12406	12408	3.563	0	0.264	2.248
62	0.7	1	2.3	2.2	1666	1673	0.764	-0.255	0.831	2.299
63	0.3	0.9	2.3	2.3	6810	6815	2.138	0	0.573	2.351
64	0.2	0.5	2.3	2.3	7094	7096	2.672	0	0.316	2.351
65	0.1	0.7	2.4	2.8	4588	4591	3.563	2.375	0.367	2.66
66	0.2	0.5	2.4	2.2	5401	5406	1.069	-0.713	0.316	2.351
67	0.25	0.5	2.4	2.4	7401	7410	0.495	0	0.341	2.454
68	0.2	0.5	2.5	2.5	1995	1998	1.782	0	0.316	2.557
69	0.4	0.75	2.5	2.6	2415	2424	0.693	0.198	0.547	2.608
70	0.2	0.7	2.5	2.4	4748	4756	1.114	-0.223	0.419	2.505
71	1	0.9	2.6	2.4	5197	5203	-0.297	-0.594	0.934	2.557
72	0.5	0.7	2.6	2.5	2048	2051	1.188	-0.594	0.573	2.608
73	0.3	0.5	2.6	2.6	2391	2393	1.782	0	0.367	2.66
74	0.3	0.7	2.7	2.8	15880	15884	1.782	0.445	0.47	2.814
75	0.2	0.6	2.7	2.7	1900	1903	2.375	0	0.367	2.763
76	0.6	0.8	2.7	2.7	6800	6807	0.509	0	0.676	2.763
77	0.3	0.9	2.8	2.85	16423	16427	2.672	0.223	0.573	2.892
78	0.25	0.65	2.8	2.8	7519	7521	3.563	0	0.419	2.866
79	0.2	0.7	2.8	2.7	10225	10229	2.227	-0.445	0.419	2.814

Table C-8 Continued: Headwater = 1.20P, Tailwater = 0.51P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
80	0.3	0.7	2.9	2.8	4311	4314	2.375	-0.594	0.47	2.917
81	0.2	0.5	2.9	2.8	4616	4619	1.782	-0.594	0.316	2.917
82	0.4	0.7	2.9	2.9	4867	4869	2.672	0	0.522	2.969
83	0.3	1	3	3.1	1961	1968	1.782	0.255	0.625	3.123
84	0.2	0.5	3	3	6882	6885	1.782	0	0.316	3.072
85	0.1	0.65	3	1.75	13121	13128	1.4	-3.181	0.341	2.428
86	0.1	0.75	3.1	3.15	12640	12645	2.316	0.178	0.393	3.201
87	0.1	0.4	3.1	3.2	12640	12642	2.672	0.891	0.213	3.226
88	0.7	1	3.1	3.1	12703	12705	2.672	0	0.831	3.175
89	0.9	0.8	3.2	3.1	1847	1851	-0.445	-0.445	0.831	3.226
90	1	0.8	3.2	3.2	7933	7940	-0.509	0	0.882	3.278
91	0.3	0.7	3.2	3.3	18527	18532	1.425	0.356	0.47	3.329
92	1	0.5	3.3	3.5	1364	1389	-0.356	0.143	0.728	3.484
93	0.9	0.8	3.3	3.4	10246	10252	-0.297	0.297	0.831	3.432
94	1.2	0.7	3.4	3.3	1523	1539	-0.557	-0.111	0.934	3.432
95	1.1	1	3.4	3.2	5145	5157	-0.148	-0.297	1.037	3.381
96	0.8	0.6	3.4	3.3	6842	6849	-0.509	-0.255	0.676	3.432
97	0.2	0.75	3.5	3.7	10015	10023	1.225	0.445	0.444	3.69
98	0.9	0.8	3.6	3.4	2475	2484	-0.198	-0.396	0.831	3.587
99	0.2	0.6	3.6	3.6	4219	4224	1.425	0	0.367	3.69
100	0.7	0.6	3.6	3.5	9923	9926	-0.594	-0.594	0.625	3.638
101	0.4	0.6	3.7	3.7	10100	10103	1.188	0	0.47	3.793
102	0.4	0.7	3.7	3.8	13154	13161	0.764	0.255	0.522	3.844
103	0.7	1.2	3.8	3.7	1540	1548	1.114	-0.223	0.934	3.844

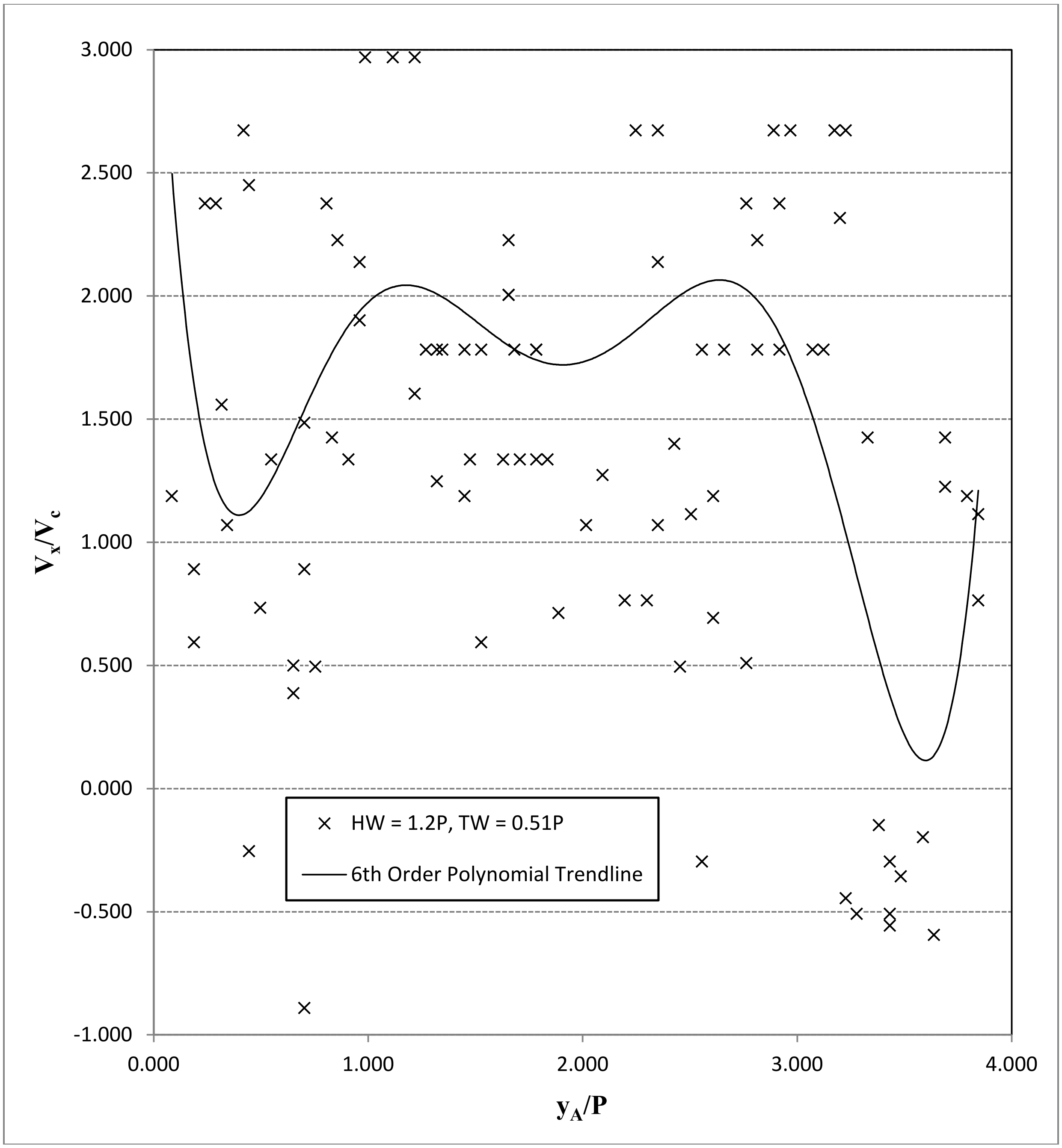

Figure C-8: Headwater = 1.20P, Tailwater = 0.51P

Table C-9: Headwater = 1.15P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.5	1.15	0.2	0.25	2818	2827	1.287	0.099	0.805	0.214
2	0.25	1.15	0.2	0.2	6987	6997	1.603	0	0.676	0.188
3	0.45	1.2	0.2	0.25	7272	7280	1.67	0.111	0.805	0.214
4	0.2	1	0.3	0.3	586	594	1.782	0	0.573	0.291
5	0.45	1.15	0.3	0.35	1850	1858	1.559	0.111	0.779	0.317
6	0.45	1.2	0.3	0.3	1859	1868	1.485	0	0.805	0.291
7	0.2	0.75	0.4	0.39	577	583	1.633	-0.03	0.444	0.389
8	0.2	1.1	0.4	0.35	624	634	1.603	-0.089	0.625	0.368
9	0.1	1.2	0.5	0.4	4279	4291	1.633	-0.148	0.625	0.446
10	0.4	1.2	0.5	0.65	4335	4346	1.296	0.243	0.779	0.574
11	0.45	1	0.5	0.5	4382	4391	1.089	0	0.702	0.497
12	0.35	1.2	0.6	0.6	1010	1019	1.683	0	0.753	0.6
13	0.2	1.2	0.6	0.6	1230	1242	1.485	0	0.676	0.6
14	0.2	1.2	0.6	0.6	4112	4123	1.62	0	0.676	0.6
15	0.85	1.2	0.7	0.7	4287	4294	0.891	0	1.011	0.703
16	0.1	0.4	0.7	1	7343	7350	0.764	0.764	0.213	0.857
17	0.1	0.35	0.7	1	7501	7507	0.742	0.891	0.187	0.857
18	0.2	1.2	0.8	1	1104	1137	0.54	0.108	0.676	0.909
19	0.2	0.5	0.8	0.9	1378	1383	1.069	0.356	0.316	0.857
20	0.1	0.5	0.8	1	3312	3317	1.425	0.713	0.264	0.909
21	0.15	0.6	0.9	1.1	4184	4192	1.002	0.445	0.341	1.012
22	0.2	0.4	0.9	1	4470	4474	0.891	0.445	0.264	0.96
23	0.2	0.5	0.9	1.1	6626	6633	0.764	0.509	0.316	1.012
24	0.45	0.2	1	1.25	1661	1671	-0.445	0.445	0.29	1.141
25	0.25	1.2	1	1.15	1484	1505	0.806	0.127	0.702	1.089
26	0.2	0.45	1	1	3601	3606	0.891	0	0.29	1.012
27	0.5	1.2	1.1	1.25	622	639	0.734	0.157	0.831	1.192
28	0.45	0.6	1.1	1	1675	1680	0.534	-0.356	0.496	1.063
29	0.25	1.2	1.1	1.05	1700	1719	0.891	-0.047	0.702	1.089
30	0.55	0.2	1.2	1.56	1091	1114	-0.271	0.279	0.341	1.403
31	0.5	0.2	1.2	1.5	1493	1509	-0.334	0.334	0.316	1.372
32	0.79	0.2	1.2	1.6	1695	1719	-0.438	0.297	0.465	1.424
33	0.7	0.3	1.3	1.45	3256	3273	-0.419	0.157	0.47	1.398
34	0.4	0.2	1.3	1.52	5269	5281	-0.297	0.327	0.264	1.434
35	0.5	0.2	1.3	1.81	1291	1314	-0.232	0.395	0.316	1.584
36	0.7	0.3	1.4	1.65	1230	1251	-0.339	0.212	0.47	1.553
37	0.6	0.2	1.4	1.8	4049	4072	-0.31	0.31	0.367	1.63
38	0.7	0.2	1.4	1.9	7526	7551	-0.356	0.356	0.419	1.681
39	0.65	0.23	1.5	1.73	3414	3429	-0.499	0.273	0.408	1.645

Table C-9 Continued: Headwater = 1.15P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.49	0.2	1.5	1.68	4157	4169	-0.431	0.267	0.31	1.62
41	0.3	0.2	1.5	1.65	7731	7743	-0.148	0.223	0.213	1.604
42	0.35	0.2	1.6	1.8	605	613	-0.334	0.445	0.238	1.733
43	0.5	0.2	1.6	1.75	660	672	-0.445	0.223	0.316	1.707
44	0.7	0.2	1.6	1.65	3286	3319	-0.27	0.027	0.419	1.656
45	0.3	0.2	1.7	1.8	576	584	-0.223	0.223	0.213	1.784
46	0.5	0.2	1.7	1.95	7613	7627	-0.382	0.318	0.316	1.862
47	0.2	1.2	1.7	1.75	11937	11959	0.81	0.04	0.676	1.759
48	0.25	0.8	1.8	1.9	7521	7543	0.445	0.081	0.496	1.887
49	0.35	1.2	1.8	1.8	10438	10462	0.631	0	0.753	1.836
50	0.25	0.8	1.8	2	10917	10933	0.612	0.223	0.496	1.939
51	0.15	0.6	1.9	1.9	4695	4718	0.349	0	0.341	1.939
52	0.2	1.2	1.9	1.9	580	637	0.313	0	0.676	1.939
53	0.55	0.25	1.9	1.95	7578	7601	-0.232	0.039	0.367	1.965
54	0.1	0.7	2	2.01	2126	2132	1.782	0.03	0.367	2.047
55	0.1	0.7	2	2	517	525	1.336	0	0.367	2.042
56	0.3	1.2	2	2.1	10219	10244	0.641	0.071	0.728	2.093
57	0.2	1.2	2.1	2.3	7896	7909	1.37	0.274	0.676	2.248
58	0.2	1.2	2.1	2.3	9937	9949	1.485	0.297	0.676	2.248
59	0.2	1.2	2.1	2.2	10244	10256	1.485	0.148	0.676	2.196
60	0.2	0.69	2.2	2.18	1735	1740	1.746	-0.071	0.413	2.238
61	0.5	1.2	2.2	2.3	7767	7776	1.386	0.198	0.831	2.299
62	0.15	1.1	2.2	2.3	7843	7852	1.881	0.198	0.599	2.299
63	0.15	0.7	2.3	2.3	3931	3936	1.96	0	0.393	2.351
64	0.7	1.1	2.3	2.3	11018	11024	1.188	0	0.882	2.351
65	0.8	1.2	2.3	2.35	11891	11899	0.891	0.111	0.985	2.377
66	0.15	0.73	2.4	2.42	545	551	1.722	0.059	0.408	2.464
67	0.95	1.2	2.4	2.4	9592	9597	0.891	0	1.062	2.454
68	0.3	1.2	2.4	2.35	9664	9676	1.336	-0.074	0.728	2.428
69	0.1	0.7	2.5	2.6	3877	3886	1.188	0.198	0.367	2.608
70	0.45	1.1	2.5	2.35	9532	9545	0.891	-0.206	0.753	2.48
71	0.1	1.2	2.5	2.3	10931	10944	1.508	-0.274	0.625	2.454
72	0.1	0.35	2.6	2.7	9852	9856	1.114	0.445	0.187	2.711
73	0.1	0.4	2.6	2.75	10322	10329	0.764	0.382	0.213	2.737
74	0.25	1.2	2.6	2.35	10381	10409	0.604	-0.159	0.702	2.531
75	0.1	1.2	2.7	2.6	10169	10203	0.576	-0.052	0.625	2.711
76	0.7	1.2	2.7	2.45	11021	11044	0.387	-0.194	0.934	2.634
77	0.4	1.2	2.7	2.7	12174	12193	0.75	0	0.779	2.763
78	0.5	0.2	2.8	3.05	1892	1909	-0.314	0.262	0.316	2.995
79	0.3	0.2	2.8	2.9	3363	3368	-0.356	0.356	0.213	2.917

Table C-9 Continued: Headwater = 1.15P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
80	0.3	1.2	2.8	2.7	10528	10546	0.891	-0.099	0.728	2.814
81	0.4	0.2	2.9	3	1757	1764	-0.509	0.255	0.264	3.02
82	0.6	0.4	2.9	3.2	2001	2014	-0.274	0.411	0.47	3.123
83	0.7	0.2	2.9	3.2	547	570	-0.387	0.232	0.419	3.123
84	0.7	0.2	3	3.2	549	570	-0.424	0.17	0.419	3.175
85	0.5	0.2	3	3.2	1960	1975	-0.356	0.238	0.316	3.175
86	0.7	0.3	3	3.3	3457	3471	-0.509	0.382	0.47	3.226
87	0.7	0.4	3.1	3.3	3406	3425	-0.281	0.188	0.522	3.278
88	0.65	0.2	3.1	3.35	12186	12205	-0.422	0.234	0.393	3.304
89	0.35	0.2	3.1	3.2	14104	14118	-0.191	0.127	0.238	3.226
90	0.6	0.2	3.2	3.4	626	649	-0.31	0.155	0.367	3.381
91	0.6	0.4	3.2	3.3	1837	1846	-0.396	0.198	0.47	3.329
92	0.75	0.2	3.2	3.5	12221	12250	-0.338	0.184	0.444	3.432
93	0.6	0.2	3.3	3.65	12219	12251	-0.223	0.195	0.367	3.561
94	0.7	0.1	3.3	3.5	12248	12285	-0.289	0.096	0.367	3.484
95	0.65	0.15	3.3	3.3	12502	12524	-0.405	0	0.367	3.381
96	0.8	0.2	3.4	3.65	600	635	-0.305	0.127	0.47	3.613
97	0.7	0.5	3.4	3.8	2513	2538	-0.143	0.285	0.573	3.69
98	0.65	0.4	3.4	3.5	1787	1804	-0.262	0.105	0.496	3.535
99	0.85	0.2	3.5	3.65	561	596	-0.331	0.076	0.496	3.664
100	0.7	0.2	3.5	3.65	665	692	-0.33	0.099	0.419	3.664
101	0.6	0.2	3.5	3.65	2674	2702	-0.255	0.095	0.367	3.664
102	0.72	0.2	3.6	3.73	2186	2225	-0.238	0.059	0.429	3.757
103	0.5	0.2	3.6	3.52	2304	2323	-0.281	-0.075	0.316	3.649
104	0.6	0.2	3.6	3.69	2334	2354	-0.356	0.08	0.367	3.736
105	0.5	0.2	3.7	3.65	2423	2441	-0.297	-0.049	0.316	3.767
106	0.7	0.4	3.7	3.7	1649	1666	-0.314	0	0.522	3.793
107	0.6	0.3	3.7	3.7	1681	1698	-0.314	0	0.419	3.793
108	0.7	0.2	3.8	3.75	2920	2940	-0.445	-0.045	0.419	3.87
109	0.4	0.2	3.8	3.8	1677	1685	-0.445	0	0.264	3.896

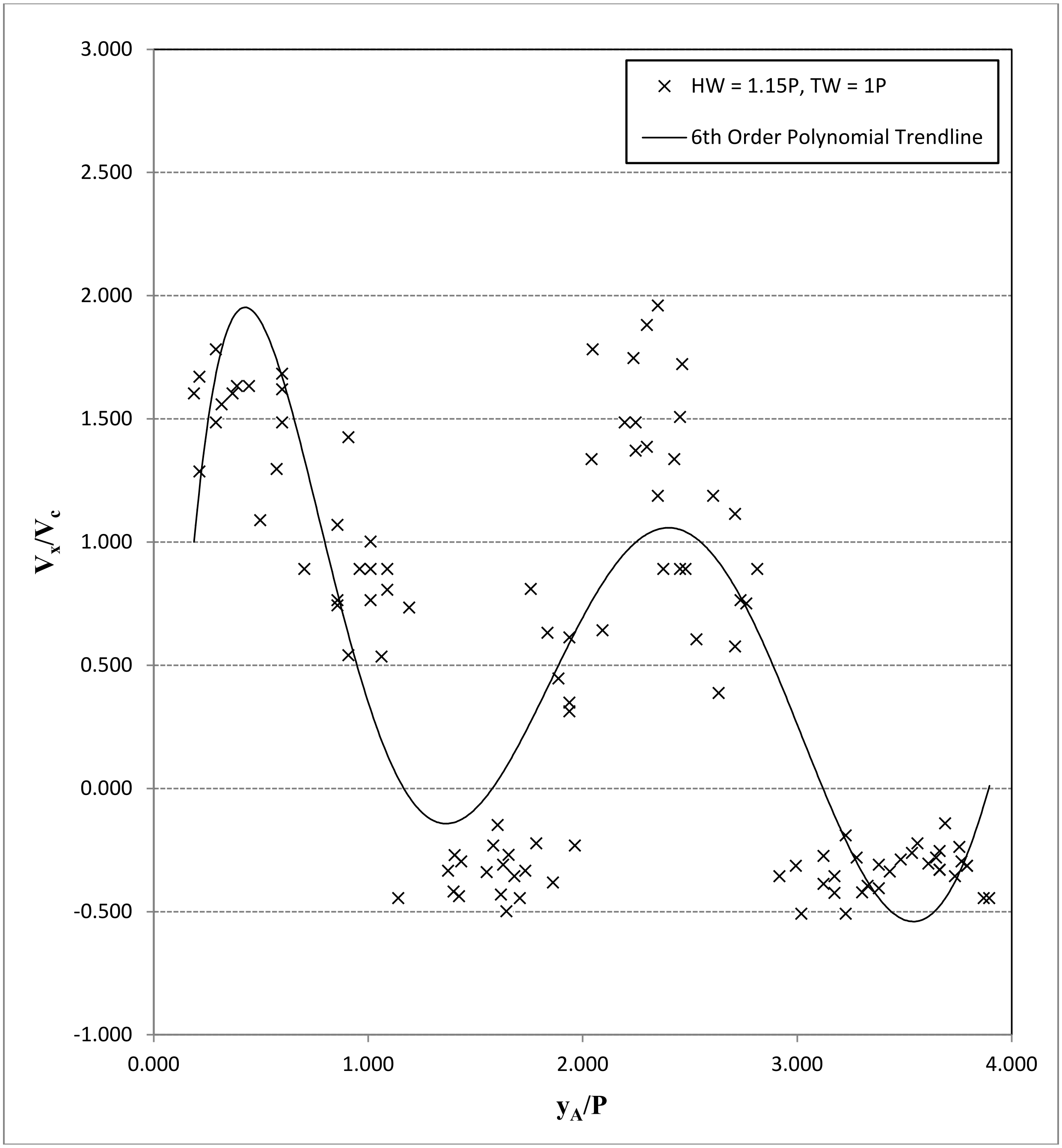

Figure C-9: Headwater = 1.15P, Tailwater = 1P

Table C-10: Headwater = 1.15P, Tailwater = 0.82P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.95	0.1	0.1	0.1	584	644	-0.252	0	0.496	0.085
2	0.4	0.2	0.1	0.1	1092	1105	-0.274	0	0.264	0.085
3	0.7	0.25	0.2	0.1	509	550	-0.196	-0.043	0.444	0.137
4	0.6	0.2	0.2	0.15	684	713	-0.246	-0.031	0.367	0.162
5	0.8	0.1	0.3	0.1	460	516	-0.223	-0.064	0.419	0.188
6	0.6	0.2	0.3	0.1	687	726	-0.183	-0.091	0.367	0.188
7	0.8	0.3	0.3	0.1	940	993	-0.168	-0.067	0.522	0.188
8	0.7	0.3	0.4	0.1	984	1038	-0.132	-0.099	0.47	0.24
9	0.6	0.3	0.4	0.1	1198	1244	-0.116	-0.116	0.419	0.24
10	0.9	0.2	0.4	0.1	3310	3393	-0.15	-0.064	0.522	0.24
11	0.2	0.8	0.5	0.5	3348	3355	1.527	0	0.47	0.497
12	0.2	0.6	0.5	0.5	6091	6104	0.548	0	0.367	0.497
13	0.4	0.4	0.5	0.1	8579	8600	0	-0.339	0.367	0.291
14	0.2	0.8	0.6	0.4	3712	3722	1.069	-0.356	0.47	0.497
15	0.2	0.6	0.6	0.3	6332	6364	0.223	-0.167	0.367	0.446
16	0.1	0.5	0.6	0.4	8229	8237	0.891	-0.445	0.264	0.497
17	0.1	0.7	0.7	0.5	6268	6280	0.891	-0.297	0.367	0.6
18	0.3	0.6	0.7	0.5	6276	6293	0.314	-0.21	0.419	0.6
19	0.1	0.8	0.7	0.6	8277	8286	1.386	-0.198	0.419	0.651
20	0.4	1.2	0.8	0.65	667	677	1.425	-0.267	0.779	0.729
21	0.1	1.2	0.8	0.8	805	815	1.96	0	0.625	0.806
22	0.1	1.2	0.8	0.8	853	862	2.178	0	0.625	0.806
23	0.6	1.2	0.9	0.95	613	620	1.527	0.127	0.882	0.935
24	0.1	0.7	0.9	0.9	3555	3559	2.672	0	0.367	0.909
25	0.2	0.8	0.9	0.9	5880	5884	2.672	0	0.47	0.909
26	0.1	0.9	1	1	3323	3328	2.851	0	0.47	1.012
27	0.2	0.8	1	1.05	3404	3408	2.672	0.223	0.47	1.038
28	0.2	0.8	1	1	5671	5675	2.672	0	0.47	1.012
29	0.2	1.2	1.1	1.1	726	743	1.048	0	0.676	1.115
30	0.2	0.8	1.1	1.1	1249	1253	2.672	0	0.47	1.115
31	0.2	1	1.1	1	3336	3341	2.851	-0.356	0.573	1.063
32	0.1	1.2	1.2	1.2	967	977	1.96	0	0.625	1.218
33	0.2	0.8	1.2	1.2	4086	4091	2.138	0	0.47	1.218
34	0.2	0.7	1.2	1.2	5841	5848	1.273	0	0.419	1.218
35	0.2	1.2	1.3	1.3	715	732	1.048	0	0.676	1.321
36	0.1	0.7	1.3	1.35	3574	3579	2.138	0.178	0.367	1.347
37	0.1	0.7	1.4	1.7	1239	1253	0.764	0.382	0.367	1.578
38	0.1	0.9	1.4	1.6	4185	4196	1.296	0.324	0.47	1.527
39	0.2	0.1	1.4	1.75	6209	6221	-0.148	0.52	0.11	1.604

Table C-10 Continued: Headwater = 1.15P, Tailwater = 0.82P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.2	0.8	1.5	1.6	1374	1382	1.336	0.223	0.47	1.578
41	0.2	0.8	1.5	1.8	3453	3462	1.188	0.594	0.47	1.681
42	0.2	0.7	1.5	1.8	3453	3460	1.273	0.764	0.419	1.681
43	0.2	0.8	1.6	2	1679	1715	0.297	0.198	0.47	1.836
44	0.5	0.9	1.6	1.9	3402	3417	0.475	0.356	0.676	1.784
45	0.4	0.7	1.6	2.2	5855	5875	0.267	0.534	0.522	1.939
46	0.2	1.2	1.7	2.6	911	945	0.524	0.472	0.676	2.196
47	0.5	1	1.7	1.8	3972	3983	0.81	0.162	0.728	1.784
48	0.5	0.3	1.7	2	4017	4028	-0.324	0.486	0.367	1.887
49	0.2	0.6	1.8	2.6	897	932	0.204	0.407	0.367	2.248
50	0.2	0.4	1.8	1.8	1231	1236	0.713	0	0.264	1.836
51	0.4	0.4	1.8	2.3	3215	3230	0	0.594	0.367	2.093
52	0.2	0.7	1.9	2	1355	1365	0.891	0.178	0.419	1.99
53	0.1	0.8	1.9	2	3574	3587	0.959	0.137	0.419	1.99
54	0.3	0.8	1.9	2.1	4127	4137	0.891	0.356	0.522	2.042
55	0.3	0.8	2	2	1245	1252	1.273	0	0.522	2.042
56	0.6	0.7	2	2.4	3208	3226	0.099	0.396	0.625	2.248
57	0.5	0.6	2	2.5	5757	5782	0.071	0.356	0.522	2.299
58	0.55	0.2	2.1	2.5	1051	1070	-0.328	0.375	0.341	2.351
59	0.1	0.7	2.1	2.15	1236	1246	1.069	0.089	0.367	2.171
60	0.5	0.2	2.2	2.5	957	972	-0.356	0.356	0.316	2.402
61	0.5	0.3	2.2	2.6	1038	1055	-0.21	0.419	0.367	2.454
62	0.1	0.55	2.2	2.4	1358	1378	0.401	0.178	0.29	2.351
63	0.7	1	2.3	2.7	1192	1224	0.167	0.223	0.831	2.557
64	0.8	0.6	2.3	2.6	1408	1427	-0.188	0.281	0.676	2.505
65	0.8	0.5	2.3	2.6	1739	1749	-0.534	0.534	0.625	2.505
66	0.5	0.4	2.4	2.65	1550	1566	-0.111	0.278	0.419	2.583
67	0.8	0.6	2.4	2.6	1624	1651	-0.132	0.132	0.676	2.557
68	0.6	0.2	2.4	2.3	3928	3947	-0.375	-0.094	0.367	2.402
69	0.3	0.6	2.5	2.5	1388	1406	0.297	0	0.419	2.557
70	0.3	0.9	2.5	2.4	1493	1513	0.534	-0.089	0.573	2.505
71	0.85	0.6	2.6	2.6	678	692	-0.318	0	0.702	2.66
72	0.7	1.2	2.6	2.6	1056	1064	1.114	0	0.934	2.66
73	0.4	1.2	2.6	2.8	1068	1080	1.188	0.297	0.779	2.763
74	0.8	1.2	2.7	2.7	948	957	0.792	0	0.985	2.763
75	0.1	0.9	2.7	2.7	1571	1577	2.375	0	0.47	2.763
76	0.2	0.9	2.7	2.6	3726	3732	2.079	-0.297	0.522	2.711
77	0.2	1.2	2.8	2.8	894	908	1.273	0	0.676	2.866
78	0.1	0.8	2.8	2.7	1258	1263	2.494	-0.356	0.419	2.814
79	0.3	0.8	2.8	2.7	3726	3766	0.223	-0.045	0.522	2.814

Table C-10 Continued: Headwater = 1.15P, Tailwater = 0.82P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
80	0.2	1.2	2.9	3	845	862	1.048	0.105	0.676	3.02
81	0.3	0.9	2.9	2.8	1379	1385	1.782	-0.297	0.573	2.917
82	0.2	0.9	2.9	2.85	1464	1470	2.079	-0.148	0.522	2.943
83	0.1	0.8	3	3	3392	3397	2.494	0	0.419	3.072
84	0.3	0.8	3	3.1	3414	3420	1.485	0.297	0.522	3.123
85	0.3	0.8	3	3.1	3414	3420	1.485	0.297	0.522	3.123
86	0.2	1.2	3.1	2.9	933	945	1.485	-0.297	0.676	3.072
87	0.1	1.2	3.1	3.2	1161	1174	1.508	0.137	0.625	3.226
88	0.2	0.9	3.1	3.1	1325	1331	2.079	0	0.522	3.175
89	0.1	1.2	3.2	3.4	1004	1021	1.153	0.21	0.625	3.381
90	0.1	0.8	3.2	3.5	5702	5714	1.039	0.445	0.419	3.432
91	0.1	0.8	3.2	3.4	8428	8439	1.134	0.324	0.419	3.381
92	0.2	0.8	3.3	3.8	3276	3294	0.594	0.495	0.47	3.638
93	0.1	0.7	3.3	3.5	5796	5803	1.527	0.509	0.367	3.484
94	0.2	0.7	3.3	3.5	5829	5837	1.114	0.445	0.419	3.484
95	0.3	0.8	3.4	3.5	3259	3268	0.99	0.198	0.522	3.535
96	0.3	0.4	3.4	3.7	3947	3954	0.255	0.764	0.316	3.638
97	0.2	0.1	3.4	3.7	5734	5748	-0.127	0.382	0.11	3.638
98	0.3	0.8	3.5	3.7	3756	3771	0.594	0.238	0.522	3.69
99	0.5	1.1	3.5	3.65	5943	5954	0.972	0.243	0.779	3.664
100	0.2	0.1	3.5	3.7	6051	6066	-0.119	0.238	0.11	3.69
101	0.3	1.2	3.6	3.7	877	894	0.943	0.105	0.728	3.741
102	0.2	1.2	3.6	3.6	887	900	1.37	0	0.676	3.69
103	0.4	0.9	3.6	3.6	5878	5887	0.99	0	0.625	3.69
104	0.4	1	3.7	3.8	3989	4007	0.594	0.099	0.676	3.844
105	0.2	1	3.7	3.8	5951	5967	0.891	0.111	0.573	3.844
106	0.2	0.8	3.7	3.8	6067	6080	0.822	0.137	0.47	3.844
107	0.4	0.8	3.8	3.7	3964	3979	0.475	-0.119	0.573	3.844
108	0.5	0.1	3.8	3.8	6409	6424	-0.475	0	0.264	3.896
109	0.6	1.1	3.8	3.8	6513	6525	0.742	0	0.831	3.896

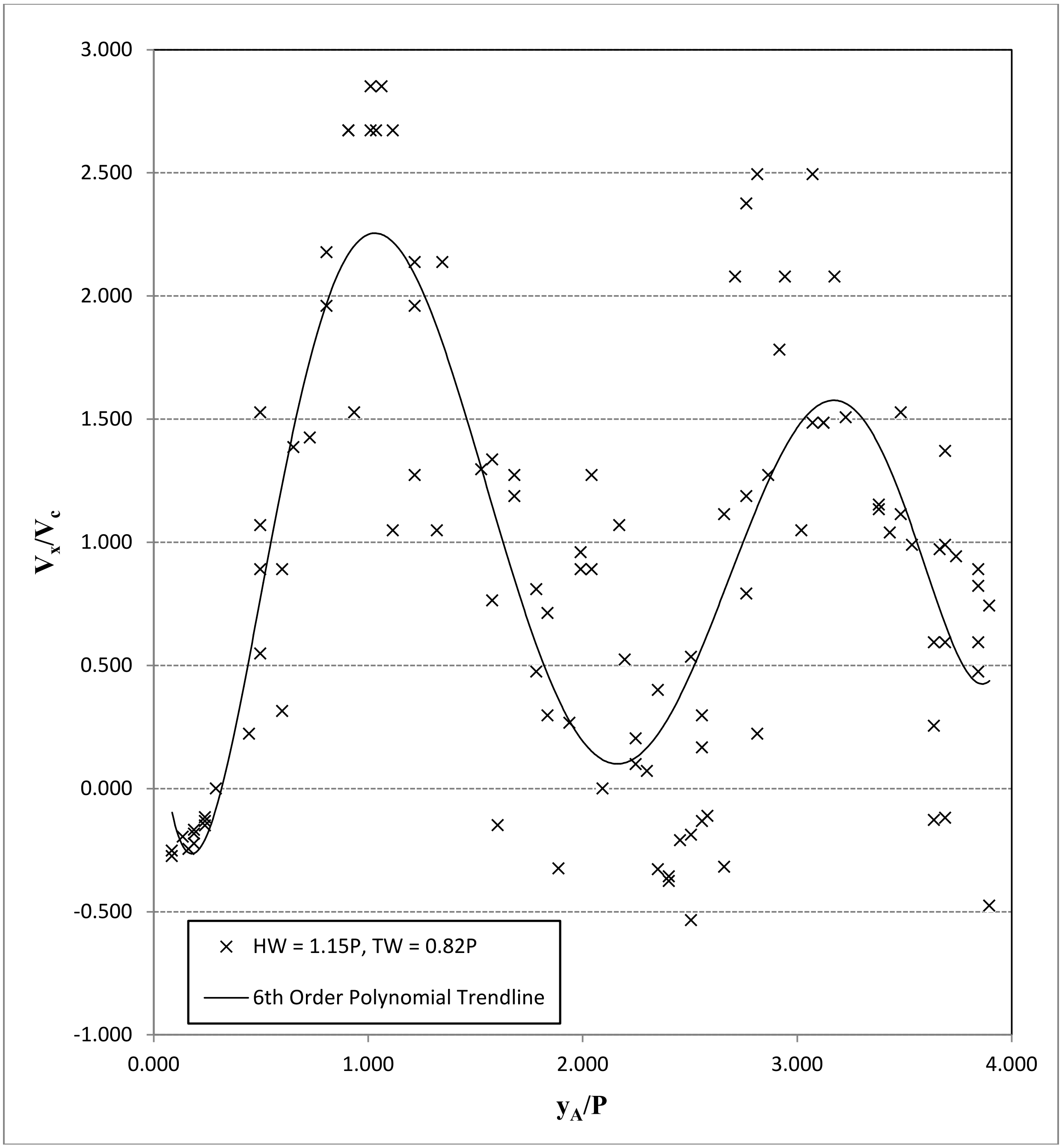

Figure C-10: Headwater = 1.15P, Tailwater = 0.82P

Table C-11: Headwater = 1.15P, Tailwater = 0.63P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.4	0.75	0.1	0.1	1122	1125	2.079	0	0.547	0.085
2	0.2	0.2	0.2	0.8	8963	8968	0	2.138	0.161	0.497
3	0.6	0.8	0.2	0.3	13080	13083	1.188	0.594	0.676	0.24
4	0.5	1	0.2	0.2	16395	16409	0.636	0	0.728	0.188
5	0.2	0.7	0.3	0.15	621	625	2.227	-0.668	0.419	0.214
6	0.2	0.8	0.3	0.15	621	625	2.672	-0.668	0.47	0.214
7	0.2	0.7	0.3	0.2	643	648	1.782	-0.356	0.419	0.24
8	0.5	0.9	0.4	0.4	1290	1295	1.425	0	0.676	0.394
9	0.1	0.7	0.4	0.4	840	845	2.138	0	0.367	0.394
10	0.1	0.7	0.4	0.3	640	645	2.138	-0.356	0.367	0.343
11	0.4	0.8	0.5	0.4	9482	9487	1.425	-0.356	0.573	0.446
12	0.6	1	0.5	0.5	9502	9507	1.425	0	0.779	0.497
13	0.4	0.8	0.5	0.5	10097	10103	1.188	0	0.573	0.497
14	0.3	0.9	0.6	0.6	615	625	1.069	0	0.573	0.6
15	0.1	0.7	0.6	0.6	614	621	1.527	0	0.367	0.6
16	0.1	0.8	0.6	0.5	909	916	1.782	-0.255	0.419	0.549
17	0.3	0.7	0.7	1.1	868	881	0.548	0.548	0.47	0.909
18	0.2	0.9	0.7	0.6	3463	3477	0.891	-0.127	0.522	0.651
19	0.6	0.9	0.7	0.6	3977	3984	0.764	-0.255	0.728	0.651
20	0.1	0.6	0.8	1.1	633	651	0.495	0.297	0.316	0.96
21	0.1	0.6	0.8	1.1	633	651	0.495	0.297	0.316	0.96
22	0.1	0.6	0.8	0.9	784	791	1.273	0.255	0.316	0.857
23	0.1	0.8	0.9	0.9	769	776	1.782	0	0.419	0.909
24	0.3	0.2	0.9	1.1	7473	7478	-0.356	0.713	0.213	1.012
25	0.3	0.2	0.9	1	3497	3500	-0.594	0.594	0.213	0.96
26	0.5	0.2	1	1.3	1212	1225	-0.411	0.411	0.316	1.166
27	0.7	1.1	1	0.9	3635	3641	1.188	-0.297	0.882	0.96
28	0.6	0.5	1	1.25	3870	3877	-0.255	0.636	0.522	1.141
29	0.6	0.4	1.1	1.4	651	660	-0.396	0.594	0.47	1.269
30	0.6	0.4	1.1	1.4	651	660	-0.396	0.594	0.47	1.269
31	0.7	0.4	1.1	1.4	1367	1390	-0.232	0.232	0.522	1.269
32	0.65	0.4	1.2	1.4	4025	4036	-0.405	0.324	0.496	1.321
33	0.3	0.2	1.2	1.3	3658	3666	-0.223	0.223	0.213	1.269
34	0.5	0.4	1.2	1.4	888	900	-0.148	0.297	0.419	1.321
35	0.6	0.5	1.3	1.4	3678	3683	-0.356	0.356	0.522	1.372
36	0.7	0.6	1.3	1.3	3967	3972	-0.356	0	0.625	1.321
37	0.5	0.4	1.3	1.5	6674	6689	-0.119	0.238	0.419	1.424
38	0.4	0.9	1.4	1.7	900	912	0.742	0.445	0.625	1.578
39	0.5	1	1.4	1.5	1393	1406	0.685	0.137	0.728	1.475

Table C-11 Continued: Headwater = 1.15P, Tailwater = 0.63P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.6	0.5	1.4	1.5	7395	7404	-0.198	0.198	0.522	1.475
41	0.4	0.9	1.5	1.7	1014	1021	1.273	0.509	0.625	1.63
42	0.2	0.3	1.5	1.4	4647	4651	0.445	-0.445	0.213	1.475
43	0.2	0.7	1.5	1.5	6921	6925	2.227	0	0.419	1.527
44	0.2	0.7	1.6	1.5	4018	4025	1.273	-0.255	0.419	1.578
45	0.4	0.7	1.6	1.6	7285	7289	1.336	0	0.522	1.63
46	0.5	0.9	1.6	1.55	7483	7493	0.713	-0.089	0.676	1.604
47	0.2	0.6	1.7	1.7	5029	5032	2.375	0	0.367	1.733
48	0.2	0.6	1.7	1.7	6820	6823	2.375	0	0.367	1.733
49	0.3	0.8	1.8	1.7	3726	3732	1.485	-0.297	0.522	1.784
50	0.3	0.6	1.8	1.8	6593	6596	1.782	0	0.419	1.836
51	0.6	1	1.8	1.7	9731	9737	1.188	-0.297	0.779	1.784
52	0.6	0.9	1.9	1.8	6972	6978	0.891	-0.297	0.728	1.887
53	0.4	0.6	1.9	1.8	7091	7094	1.188	-0.594	0.47	1.887
54	0.2	0.6	1.9	1.8	7268	7272	1.782	-0.445	0.367	1.887
55	0.5	1	2	1.8	1075	1087	0.742	-0.297	0.728	1.939
56	0.1	0.8	2	2.1	1326	1337	1.134	0.162	0.419	2.093
57	0.1	0.7	2	1.9	9619	9632	0.822	-0.137	0.367	1.99
58	0.3	0.8	2.1	2	877	887	0.891	-0.178	0.522	2.093
59	0.2	0.8	2.1	2.2	3727	3732	2.138	0.356	0.47	2.196
60	0.3	0.8	2.1	2.1	4177	4181	2.227	0	0.522	2.145
61	0.2	0.9	2.2	2.3	695	700	2.494	0.356	0.522	2.299
62	0.2	0.7	2.2	2.2	872	876	2.227	0	0.419	2.248
63	0.3	0.8	2.2	2.3	3903	3907	2.227	0.445	0.522	2.299
64	0.3	0.7	2.3	2.4	1191	1194	2.375	0.594	0.47	2.402
65	0.2	0.7	2.3	2.3	4337	4340	2.969	0	0.419	2.351
66	0.4	0.8	2.3	2.3	9202	9205	2.375	0	0.573	2.351
67	0.3	0.6	2.4	2.4	3995	3997	2.672	0	0.419	2.454
68	0.3	0.7	2.4	2.4	4169	4173	1.782	0	0.47	2.454
69	0.6	0.9	2.4	2.35	9229	9238	0.594	-0.099	0.728	2.428
70	0.1	0.7	2.5	2.6	525	535	1.069	0.178	0.367	2.608
71	0.1	0.6	2.5	2.5	1042	1047	1.782	0	0.316	2.557
72	0.3	0.8	2.5	2.5	1450	1458	1.114	0	0.522	2.557
73	0.2	0.3	2.6	2.8	838	843	0.356	0.713	0.213	2.763
74	0.6	0.4	2.6	2.9	7324	7339	-0.238	0.356	0.47	2.814
75	0.2	0.3	2.6	2.7	4659	4666	0.255	0.255	0.213	2.711
76	0.4	0.3	2.7	3	1370	1379	-0.198	0.594	0.316	2.917
77	0.4	0.3	2.7	2.8	3431	3438	-0.255	0.255	0.316	2.814
78	0.6	0.5	2.7	3.1	3510	3524	-0.127	0.509	0.522	2.969
79	0.7	0.5	2.8	3.1	1270	1284	-0.255	0.382	0.573	3.02

Table C-11 Continued: Headwater = 1.15P, Tailwater = 0.63P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
80	0.5	0.9	2.8	3.1	5134	5144	0.713	0.534	0.676	3.02
81	0.2	0.6	2.8	2.6	7050	7054	1.782	-0.891	0.367	2.763
82	0.6	0.4	2.9	3.2	5055	5063	-0.445	0.668	0.47	3.123
83	0.6	0.4	2.9	3.2	7112	7120	-0.445	0.668	0.47	3.123
84	0.5	0.4	2.9	3	3530	3534	-0.445	0.445	0.419	3.02
85	0.1	0.7	3	3	459	465	1.782	0	0.367	3.072
86	0.1	0.4	3	3.3	461	483	0.243	0.243	0.213	3.226
87	0.7	0.5	3	3.2	3581	3593	-0.297	0.297	0.573	3.175
88	0.4	0.15	3.1	3.5	546	564	-0.247	0.396	0.238	3.381
89	0.5	0.4	3.1	3.5	696	707	-0.162	0.648	0.419	3.381
90	0.6	0.4	3.1	3.4	3567	3576	-0.396	0.594	0.47	3.329
91	0.6	0.5	3.2	3.45	707	718	-0.162	0.405	0.522	3.407
92	0.5	0.4	3.2	3.5	4679	4688	-0.198	0.594	0.419	3.432
93	0.4	0.3	3.2	3.3	9179	9183	-0.445	0.445	0.316	3.329
94	0.6	0.4	3.3	3.4	1165	1175	-0.356	0.178	0.47	3.432
95	0.6	0.4	3.3	3.3	3840	3846	-0.594	0	0.47	3.381
96	0.7	0.5	3.3	3.5	6759	6769	-0.356	0.356	0.573	3.484
97	0.2	0.7	3.4	3.4	471	474	2.969	0	0.419	3.484
98	0.1	0.5	3.4	3.5	476	482	1.188	0.297	0.264	3.535
99	0.2	0.75	3.4	3.35	542	546	2.45	-0.223	0.444	3.458
100	0.2	0.7	3.5	3.4	961	964	2.969	-0.594	0.419	3.535
101	0.65	0.5	3.5	3.6	4133	4142	-0.297	0.198	0.547	3.638
102	0.7	0.6	3.5	3.6	4948	4955	-0.255	0.255	0.625	3.638
103	0.3	0.7	3.6	3.5	6899	6902	2.375	-0.594	0.47	3.638
104	0.8	1.1	3.6	3.8	9273	9283	0.534	0.356	0.934	3.793
105	0.6	0.5	3.6	3.7	9383	9387	-0.445	0.445	0.522	3.741
106	0.8	1.1	3.7	3.75	7166	7174	0.668	0.111	0.934	3.819
107	0.1	0.25	3.7	3.65	9167	9168	2.672	-0.891	0.135	3.767
108	0.1	0.3	3.7	3.7	9564	9565	3.563	0	0.161	3.793
109	0.7	1.1	3.8	3.8	3764	3777	0.548	0	0.882	3.896
110	0.6	0.7	3.8	3.8	12620	12622	0.891	0	0.625	3.896

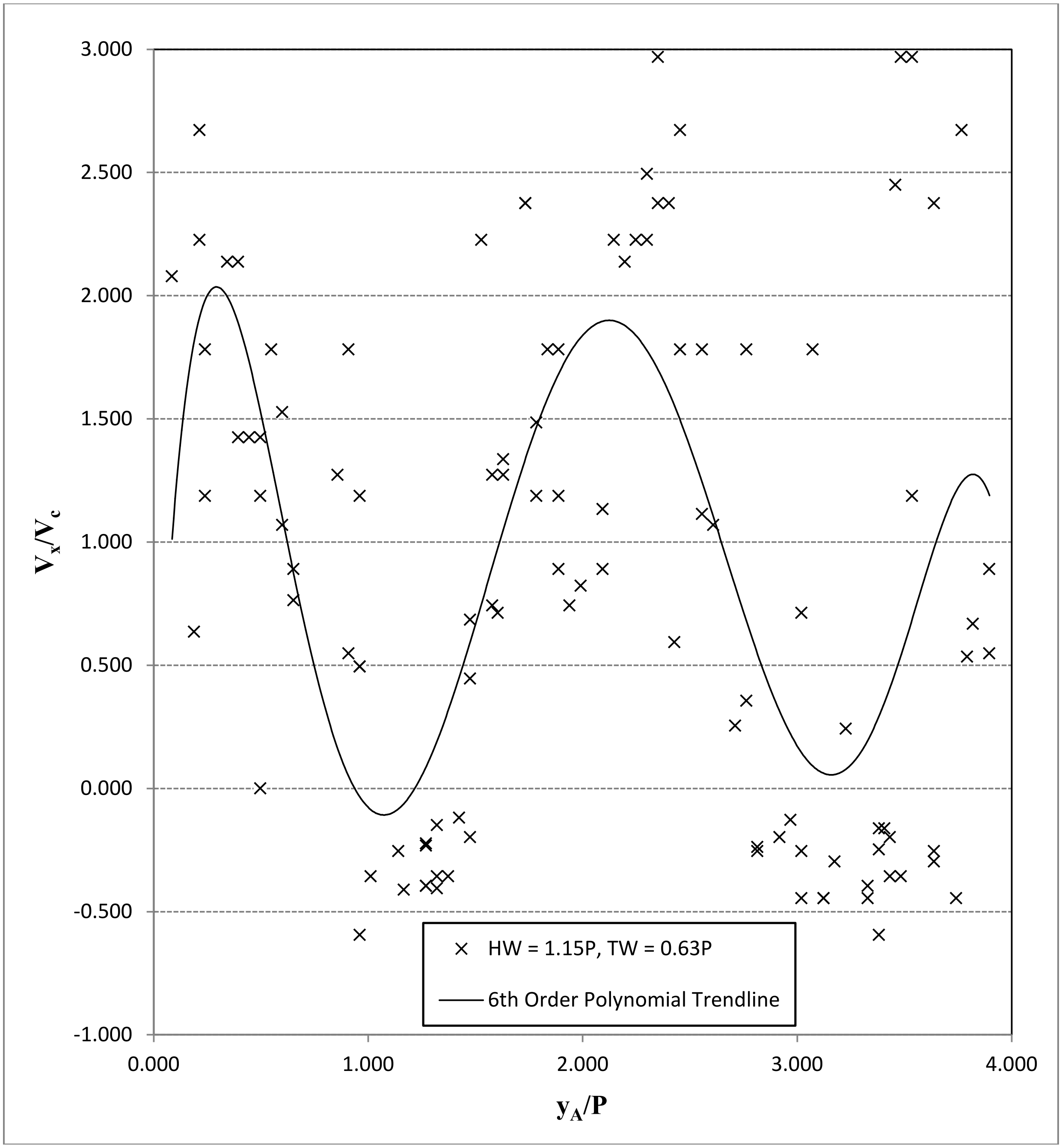

Figure C-11: Headwater = 1.15P, Tailwater = 0.63P

Table C-12: Headwater = 1.15P, Tailwater = 0.45P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.2	0.4	0.2	0.3	655	656	4.537	2.269	0.264	0.24
2	0.4	0.7	0.2	0.2	15793	15796	2.269	0	0.522	0.188
3	0.5	0.8	0.2	0.2	15793	15796	2.269	0	0.625	0.188
4	0.1	0.5	0.3	0.3	15674	15676	4.537	0	0.264	0.291
5	0.2	0.5	0.3	0.3	15816	15818	3.403	0	0.316	0.291
6	0.3	0.7	0.3	0.2	16302	16305	3.025	-0.756	0.47	0.24
7	0.1	0.6	0.4	0.6	2041	2051	1.134	0.454	0.316	0.497
8	0.1	0.7	0.4	0.3	13915	13920	2.722	-0.454	0.367	0.343
9	0.2	0.7	0.4	0.3	15469	15475	1.89	-0.378	0.419	0.343
10	0.1	0.5	0.5	0.5	661	663	4.537	0	0.264	0.497
11	0.3	0.8	0.5	0.5	798	803	2.269	0	0.522	0.497
12	0.2	0.7	0.6	0.6	554	562	1.418	0	0.419	0.6
13	0.5	0.7	0.6	0.6	750	754	1.134	0	0.573	0.6
14	0.2	0.6	0.6	0.5	6995	7004	1.008	-0.252	0.367	0.549
15	0.4	0.8	0.7	0.7	695	701	1.512	0	0.573	0.703
16	0.15	0.7	0.7	0.75	3764	3770	2.08	0.189	0.393	0.729
17	0.2	0.6	0.7	0.55	15937	15941	2.269	-0.851	0.367	0.626
18	0.2	0.6	0.8	0.4	661	669	1.134	-1.134	0.367	0.6
19	0.6	0.4	0.8	0.7	686	694	-0.567	-0.284	0.47	0.754
20	0.4	0.9	0.8	0.9	1135	1148	0.873	0.175	0.625	0.857
21	0.3	0.7	0.9	0.8	1462	1465	3.025	-0.756	0.47	0.857
22	0.1	0.7	0.9	0.88	4414	4417	4.537	-0.151	0.367	0.899
23	0.2	0.7	0.9	1	7949	7954	2.269	0.454	0.419	0.96
24	0.6	1	1	1	1027	1036	1.008	0	0.779	1.012
25	0.25	0.75	1	1	10108	10111	3.781	0	0.47	1.012
26	0.1	0.7	1	1.05	10871	10874	4.537	0.378	0.367	1.038
27	0.1	0.55	1.1	1.15	7825	7828	3.403	0.378	0.29	1.141
28	0.1	0.4	1.1	1.1	15941	15943	3.403	0	0.213	1.115
29	0.3	0.55	1.1	1.2	15931	15934	1.89	0.756	0.393	1.166
30	0.1	0.8	1.2	1.3	13510	13519	1.764	0.252	0.419	1.269
31	0.3	0.5	1.2	1.4	629	637	0.567	0.567	0.367	1.321
32	0.5	0.9	1.2	1.3	980	986	1.512	0.378	0.676	1.269
33	0.2	0.6	1.3	1.3	934	939	1.815	0	0.367	1.321
34	0.3	0.5	1.3	1.3	1176	1181	0.907	0	0.367	1.321
35	0.15	0.8	1.3	1.4	10592	10600	1.843	0.284	0.444	1.372
36	0.15	0.7	1.4	1.5	10678	10686	1.56	0.284	0.393	1.475
37	0.2	0.3	1.4	1.5	1077	1079	1.134	1.134	0.213	1.475
38	0.2	0.5	1.5	1.55	17897	17903	1.134	0.189	0.316	1.553
39	0.6	0.9	1.5	1.4	640	649	0.756	-0.252	0.728	1.475

Table C-12 Continued: Headwater = 1.15P, Tailwater = 0.45P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.8	1.1	1.6	1.4	4101	4107	1.134	-0.756	0.934	1.527
41	0.4	0.8	1.6	1.5	4302	4308	1.512	-0.378	0.573	1.578
42	0.1	0.3	1.7	1.7	935	936	4.537	0	0.161	1.733
43	0.5	0.8	1.7	1.7	1711	1714	2.269	0	0.625	1.733
44	0.8	1.2	1.7	1.7	1767	1772	1.815	0	0.985	1.733
45	0.15	0.7	1.8	1.7	4240	4247	1.782	-0.324	0.393	1.784
46	0.4	0.6	1.8	1.7	1287	1290	1.512	-0.756	0.47	1.784
47	0.2	0.6	1.8	1.9	1459	1463	2.269	0.567	0.367	1.887
48	0.3	0.7	1.9	1.9	1036	1045	1.008	0	0.47	1.939
49	0.2	0.8	1.9	1.7	1297	1310	1.047	-0.349	0.47	1.836
50	0.1	0.7	1.9	1.7	13250	13258	1.701	-0.567	0.367	1.836
51	0.2	0.7	2	2	6965	6972	1.62	0	0.419	2.042
52	0.1	0.7	2	2	11681	11688	1.944	0	0.367	2.042
53	0.1	0.73	2	2.02	12937	12942	2.858	0.091	0.382	2.052
54	0.1	0.7	2.1	2.1	1705	1710	2.722	0	0.367	2.145
55	0.2	0.7	2.1	2	5331	5336	2.269	-0.454	0.419	2.093
56	0.6	1	2.2	2.2	883	887	2.269	0	0.779	2.248
57	0.2	0.9	2.2	2	1334	1341	2.269	-0.648	0.522	2.145
58	0.5	1	2.3	2.2	1183	1190	1.62	-0.324	0.728	2.299
59	0.2	0.7	2.3	2.3	7643	7647	2.836	0	0.419	2.351
60	0.2	0.5	2.4	2.4	16450	16452	3.403	0	0.316	2.454
61	0.2	0.5	2.4	2.4	16584	16591	0.972	0	0.316	2.454
62	0.1	0.6	2.4	2.4	18067	18072	2.269	0	0.316	2.454
63	0.5	0.9	2.5	2.4	809	814	1.815	-0.454	0.676	2.505
64	0.15	0.7	2.5	2.4	4735	4742	1.782	-0.324	0.393	2.505
65	0.2	0.7	2.5	2.45	4905	4910	2.269	-0.227	0.419	2.531
66	0.7	1.1	2.6	2.7	858	867	1.008	0.252	0.882	2.711
67	0.6	0.4	2.6	2.6	16730	16737	-0.648	0	0.47	2.66
68	0.2	0.9	2.6	2.6	2119	2130	1.444	0	0.522	2.66
69	0.2	0.7	2.7	2.7	1769	1782	0.873	0	0.419	2.763
70	0.2	0.7	2.7	2.5	3823	3830	1.62	-0.648	0.419	2.66
71	0.2	0.7	2.7	2.45	4874	4884	1.134	-0.567	0.419	2.634
72	0.3	0.8	2.8	2.9	720	731	1.031	0.206	0.522	2.917
73	0.3	0.7	2.8	2.8	885	890	1.815	0	0.47	2.866
74	0.2	0.8	2.8	2.9	3892	3896	3.403	0.567	0.47	2.917
75	0.1	0.7	2.9	2.9	1717	1721	3.403	0	0.367	2.969
76	0.1	0.7	2.9	3	3823	3827	3.403	0.567	0.367	3.02
77	0.15	0.7	2.9	2.9	7848	7851	4.159	0	0.393	2.969
78	0.3	0.65	3	3	1154	1157	2.647	0	0.444	3.072
79	0.2	0.7	3	1.65	1948	1960	0.945	-2.552	0.419	2.377

Table C-12 Continued: Headwater = 1.15P, Tailwater = 0.45P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
80	0.1	0.7	3	3	4785	4789	3.403	0	0.367	3.072
81	0.1	0.5	3.1	3.2	1729	1733	2.269	0.567	0.264	3.226
82	0.15	0.7	3.1	3.15	6765	6770	2.495	0.227	0.393	3.201
83	0.2	0.7	3.1	3.2	10816	10822	1.89	0.378	0.419	3.226
84	0.2	0.6	3.2	3.2	18126	18132	1.512	0	0.367	3.278
85	0.6	0.9	3.2	3	18197	18215	0.378	-0.252	0.728	3.175
86	0.2	0.7	3.2	3.2	18245	18256	1.031	0	0.419	3.278
87	0.4	0.6	3.3	3.5	15751	15758	0.648	0.648	0.47	3.484
88	0.5	0.8	3.3	3.3	15785	15790	1.361	0	0.625	3.381
89	0.2	0.3	3.3	3.4	1743	1746	0.756	0.756	0.213	3.432
90	0.5	0.8	3.4	3.5	16027	16036	0.756	0.252	0.625	3.535
91	0.1	0.3	3.4	3.4	18050	18051	4.537	0	0.161	3.484
92	0.1	0.7	3.4	3.5	1182	1191	1.512	0.252	0.367	3.535
93	0.1	0.3	3.5	3.5	920	921	4.537	0	0.161	3.587
94	0.2	0.7	3.5	3.5	16040	16044	2.836	0	0.419	3.587
95	0.4	0.7	3.5	3.5	16060	16063	2.269	0	0.522	3.587
96	0.4	0.6	3.6	3.7	18226	18232	0.756	0.378	0.47	3.741
97	0.8	1	3.7	3.8	16138	16141	1.512	0.756	0.882	3.844
98	0.6	1.1	3.7	3.6	16169	16180	1.031	-0.206	0.831	3.741

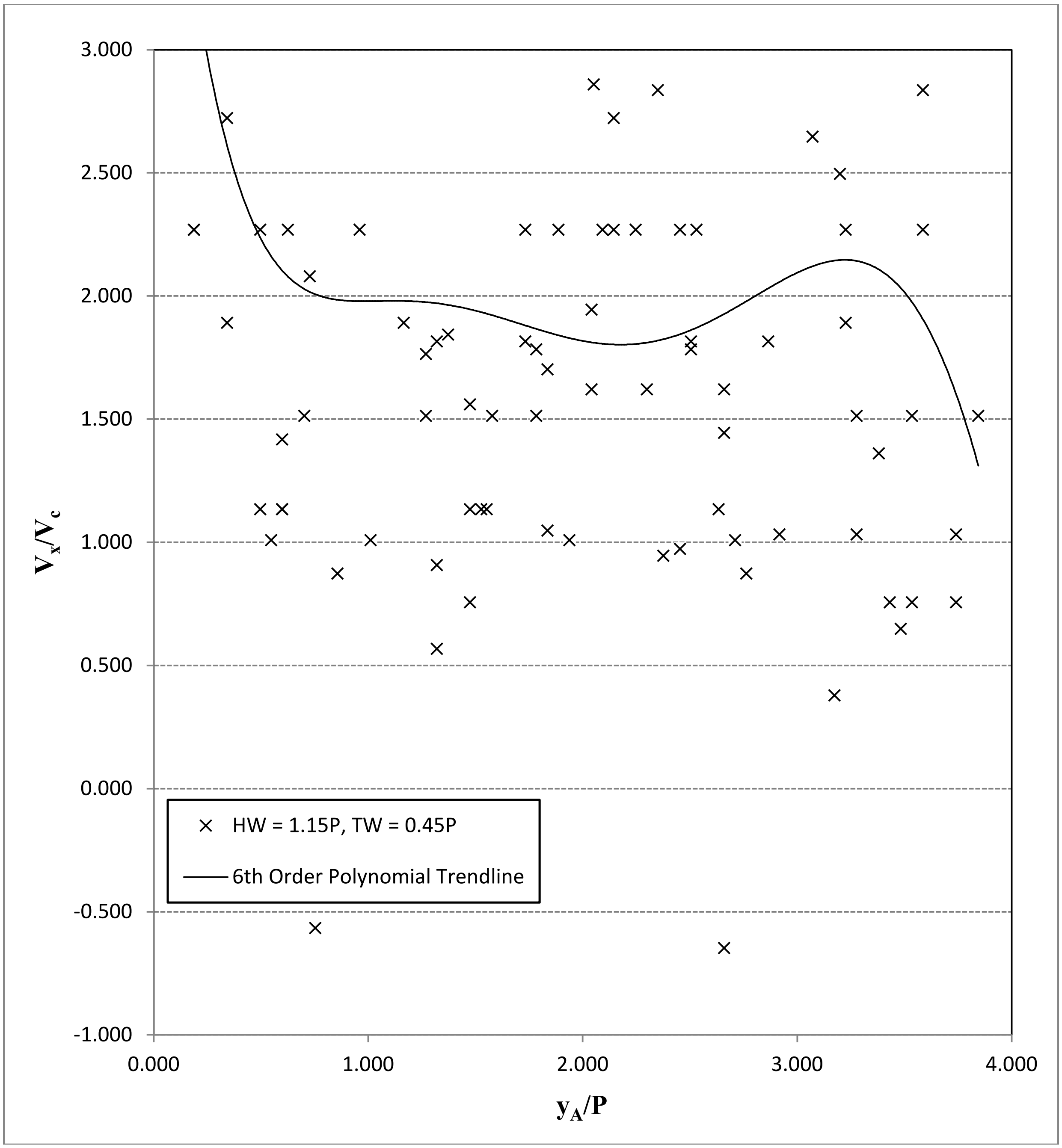

Figure C-12: Headwater = 1.15P, Tailwater = 0.45P

Table C-13: Headwater = 1.10P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.3	0.2	0.2	0.25	396	403	-0.324	0.162	0.213	0.214
2	0.4	0.2	0.4	0.45	491	504	-0.349	0.087	0.264	0.42
3	0.3	0.2	0.4	0.45	8782	8789	-0.324	0.162	0.213	0.42
4	0.4	0.2	0.5	0.55	8464	8472	-0.567	0.142	0.264	0.523
5	0.4	0.25	0.5	0.5	8877	8886	-0.378	0	0.29	0.497
6	0.3	0.2	0.6	0.6	587	600	-0.175	0	0.213	0.6
7	0.4	0.2	0.6	0.6	655	673	-0.252	0	0.264	0.6
8	0.35	0.2	0.6	0.7	8217	8233	-0.213	0.142	0.238	0.651
9	0.2	0.2	0.7	0.7	473	483	0	0	0.161	0.703
10	0.3	0.2	0.7	0.8	8846	8853	-0.324	0.324	0.213	0.754
11	0.4	0.2	0.8	0.8	592	605	-0.349	0	0.264	0.806
12	0.4	0.2	0.8	0.9	613	623	-0.454	0.227	0.264	0.857
13	0.45	0.3	0.8	1	8863	8874	-0.309	0.412	0.341	0.909
14	0.4	0.25	0.9	0.95	9006	9018	-0.284	0.095	0.29	0.935
15	0.35	0.2	0.9	0.95	398	407	-0.378	0.126	0.238	0.935
16	0.4	0.25	0.9	1	2962	2972	-0.34	0.227	0.29	0.96
17	0.5	0.1	1	1.2	511	548	-0.245	0.123	0.264	1.115
18	0.7	0.1	1	1.4	504	547	-0.317	0.211	0.367	1.218
19	0.3	0.2	1	0.95	471	476	-0.454	-0.227	0.213	0.986
20	0.4	0.1	1.1	1.2	653	684	-0.22	0.073	0.213	1.166
21	0.35	0.25	1.1	1.15	524	534	-0.227	0.113	0.264	1.141
22	0.4	0.3	1.1	1.2	4380	4392	-0.189	0.189	0.316	1.166
23	0.35	0.25	1.2	1.25	3165	3171	-0.378	0.189	0.264	1.244
24	0.35	0.2	1.2	1.25	4311	4322	-0.309	0.103	0.238	1.244
25	0.3	0.2	1.2	1.2	6045	6051	-0.378	0	0.213	1.218
26	0.4	0.25	1.3	1.4	791	802	-0.309	0.206	0.29	1.372
27	0.45	0.25	1.3	1.45	3149	3171	-0.206	0.155	0.316	1.398
28	0.3	0.15	1.3	1.35	6188	6194	-0.567	0.189	0.187	1.347
29	0.4	0.2	1.4	1.5	986	997	-0.412	0.206	0.264	1.475
30	0.3	0.2	1.4	1.4	579	587	-0.284	0	0.213	1.424
31	0.4	0.2	1.4	1.45	942	956	-0.324	0.081	0.264	1.45
32	0.7	0.5	1.5	1.5	446	467	-0.216	0	0.573	1.527
33	0.4	0.1	1.5	1.6	555	575	-0.34	0.113	0.213	1.578
34	0.4	0.2	1.5	1.5	738	750	-0.378	0	0.264	1.527
35	0.5	0.1	1.6	1.6	575	600	-0.363	0	0.264	1.63
36	0.8	0.2	1.6	1.4	907	956	-0.278	-0.093	0.47	1.527
37	0.8	0.65	1.6	1.55	2611	2626	-0.227	-0.076	0.702	1.604
38	0.3	0.2	1.7	1.8	610	618	-0.284	0.284	0.213	1.784
39	0.4	0.25	1.7	1.75	2883	2891	-0.425	0.142	0.29	1.759

Table C-13 Continued: Headwater = 1.10P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.45	0.3	1.7	1.8	3188	3201	-0.262	0.175	0.341	1.784
41	0.4	0.2	1.8	1.8	724	736	-0.378	0	0.264	1.836
42	0.3	0.2	1.8	1.9	1021	1030	-0.252	0.252	0.213	1.887
43	0.3	0.2	1.8	1.85	2595	2600	-0.454	0.227	0.213	1.862
44	0.3	0.2	1.9	1.95	665	672	-0.324	0.162	0.213	1.965
45	0.3	0.2	1.9	1.9	885	890	-0.454	0	0.213	1.939
46	0.4	0.25	1.9	1.95	6560	6571	-0.309	0.103	0.29	1.965
47	0.4	0.2	2.1	2.2	552	570	-0.252	0.126	0.264	2.196
48	0.3	0.2	2.1	2.15	2738	2746	-0.284	0.142	0.213	2.171
49	0.3	0.2	2.1	2.15	5005	5011	-0.378	0.189	0.213	2.171
50	0.35	0.2	2.2	2.3	2616	2624	-0.425	0.284	0.238	2.299
51	0.3	0.15	2.2	2.25	3427	3433	-0.567	0.189	0.187	2.274
52	0.35	0.25	2.2	2.3	6070	6079	-0.252	0.252	0.264	2.299
53	0.3	0.2	2.3	2.3	634	647	-0.175	0	0.213	2.351
54	0.35	0.2	2.3	2.4	664	675	-0.309	0.206	0.238	2.402
55	0.3	0.2	2.3	2.35	727	735	-0.284	0.142	0.213	2.377
56	0.3	0.2	2.4	2.4	910	914	-0.567	0	0.213	2.454
57	0.3	0.2	2.4	2.45	2747	2754	-0.324	0.162	0.213	2.48
58	0.35	0.25	2.4	2.45	6778	6782	-0.567	0.284	0.264	2.48
59	0.3	0.2	2.5	2.5	6755	6762	-0.324	0	0.213	2.557
60	0.3	0.2	2.5	2.55	6825	6834	-0.252	0.126	0.213	2.583
61	0.3	0.2	2.5	2.5	7116	7123	-0.324	0	0.213	2.557
62	0.35	0.2	2.6	2.65	3109	3118	-0.378	0.126	0.238	2.686
63	0.3	0.2	2.6	2.6	5096	5102	-0.378	0	0.213	2.66
64	0.4	0.2	2.6	2.6	6686	6695	-0.504	0	0.264	2.66
65	0.4	0.2	2.7	2.8	624	642	-0.252	0.126	0.264	2.814
66	0.3	0.2	2.7	2.7	700	710	-0.227	0	0.213	2.763
67	0.3	0.2	2.7	2.7	3312	3321	-0.252	0	0.213	2.763
68	0.3	0.2	2.8	2.8	3098	3104	-0.378	0	0.213	2.866
69	0.45	0.35	2.8	2.9	5634	5640	-0.378	0.378	0.367	2.917
70	0.3	0.2	2.8	2.85	5777	5785	-0.284	0.142	0.213	2.892
71	0.4	0.2	2.9	2.9	795	806	-0.412	0	0.264	2.969
72	0.4	0.25	2.9	2.95	2966	2974	-0.425	0.142	0.29	2.995
73	0.3	0.2	2.9	2.9	3128	3133	-0.454	0	0.213	2.969
74	0.4	0.2	3.4	3.45	769	789	-0.227	0.057	0.264	3.51
75	0.6	0.2	3.5	3.5	949	975	-0.349	0	0.367	3.587
76	0.4	0.2	3.5	3.5	1033	1048	-0.302	0	0.264	3.587
77	0.5	0.2	3.6	3.6	995	1022	-0.252	0	0.316	3.69
78	0.5	0.2	3.7	3.8	674	693	-0.358	0.119	0.316	3.844
79	0.4	0.2	3.7	3.7	977	989	-0.378	0	0.264	3.793

Table C-13 Continued: Headwater = 1.10P, Tailwater = 1P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
80	0.5	0.2	3.8	3.6	709	730	-0.324	-0.216	0.316	3.793
81	0.5	0.2	3.8	3.8	724	741	-0.4	0	0.316	3.896
82	0.6	0.2	3.8	3.8	860	896	-0.252	0	0.367	3.896

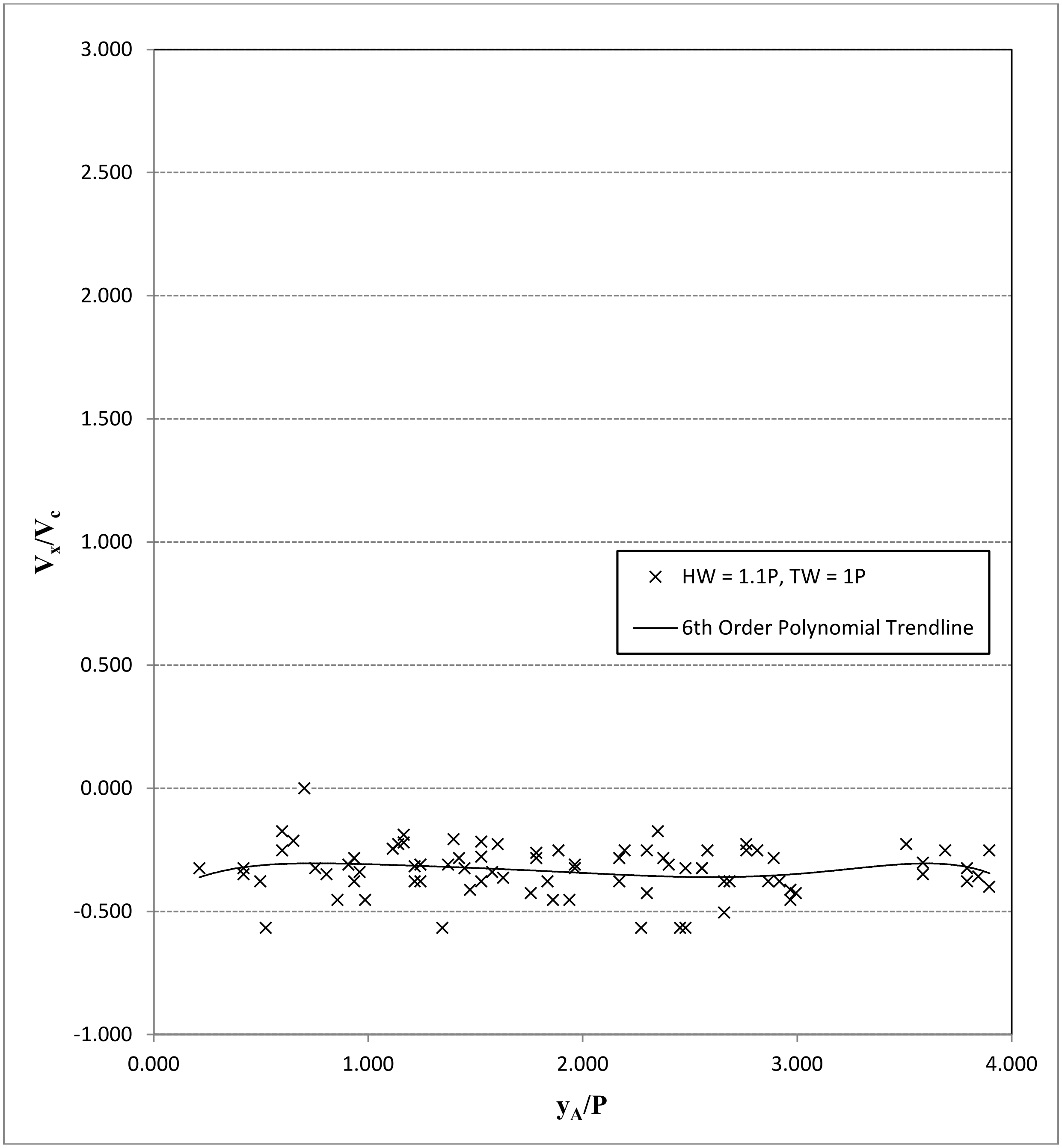

Figure C-13: Headwater = 1.10P, Tailwater = 1P

Table C-14: Headwater = 1.10P, Tailwater = 0.79P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.6	0.2	0.1	0.1	618	644	-0.349	0	0.367	0.085
2	0.6	0.2	0.1	0.1	712	741	-0.313	0	0.367	0.085
3	0.5	0.25	0.1	0.2	899	918	-0.298	0.119	0.341	0.137
4	0.5	0.2	0.2	0.2	687	728	-0.166	0	0.316	0.188
5	0.5	0.2	0.2	0.1	781	804	-0.296	-0.099	0.316	0.137
6	0.7	0.25	0.2	0.2	886	921	-0.292	0	0.444	0.188
7	0.5	0.2	0.3	0.1	655	687	-0.213	-0.142	0.316	0.188
8	0.7	0.4	0.3	0.2	852	881	-0.235	-0.078	0.522	0.24
9	0.7	0.2	0.3	0.1	992	1034	-0.27	-0.108	0.419	0.188
10	0.6	0.2	0.4	0.2	1261	1294	-0.275	-0.137	0.367	0.291
11	0.3	0.15	0.4	0.35	1314	1325	-0.309	-0.103	0.187	0.368
12	0.5	0.2	0.4	0.2	1397	1429	-0.213	-0.142	0.316	0.291
13	0.6	0.2	0.5	0.1	4901	4959	-0.156	-0.156	0.367	0.291
14	0.3	0.15	0.5	0.3	5659	5679	-0.17	-0.227	0.187	0.394
15	0.5	0.4	0.6	0.6	649	658	-0.252	0	0.419	0.6
16	0.3	0.7	0.6	0.4	1237	1254	0.534	-0.267	0.47	0.497
17	0.1	0.5	0.7	0.6	662	673	0.825	-0.206	0.264	0.651
18	0.4	0.7	0.7	0.4	679	694	0.454	-0.454	0.522	0.549
19	0.6	1.1	0.7	0.5	7895	7921	0.436	-0.175	0.831	0.6
20	0.1	1.1	0.8	0.9	1172	1188	1.418	0.142	0.573	0.857
21	0.1	1.1	0.8	0.8	1177	1188	2.062	0	0.573	0.806
22	0.1	0.8	0.8	0.9	1415	1421	2.647	0.378	0.419	0.857
23	0.5	1.2	0.9	0.85	892	901	1.764	-0.126	0.831	0.883
24	0.3	1.2	0.9	0.8	1103	1115	1.701	-0.189	0.728	0.857
25	0.2	0.9	0.9	0.9	1401	1412	1.444	0	0.522	0.909
26	0.1	1.1	1	1	1229	1241	1.89	0	0.573	1.012
27	0.6	1.1	1	1.05	1578	1586	1.418	0.142	0.831	1.038
28	0.2	1.1	1	1	5241	5252	1.856	0	0.625	1.012
29	0.3	1.2	1.1	1.2	1179	1192	1.571	0.175	0.728	1.166
30	0.1	0.9	1.1	1	1626	1635	2.017	-0.252	0.47	1.063
31	0.1	1.2	1.1	1.1	1742	1755	1.92	0	0.625	1.115
32	0.3	1.1	1.2	1.2	611	626	1.21	0	0.676	1.218
33	0.1	1	1.2	1.2	2546	2557	1.856	0	0.522	1.218
34	0.5	1.2	1.2	1.2	2939	2950	1.444	0	0.831	1.218
35	0.5	1.2	1.3	1.25	5417	5429	1.323	-0.095	0.831	1.295
36	0.5	1.2	1.3	1.2	5808	5824	0.992	-0.142	0.831	1.269
37	0.1	1.1	1.3	1.3	6784	6804	1.134	0	0.573	1.321
38	0.2	0.2	1.4	1.6	5078	5086	0	0.567	0.161	1.527
39	0.3	0.1	1.5	1.7	5179	5195	-0.284	0.284	0.161	1.63

Table C-14 Continued: Headwater = 1.10P, Tailwater = 0.79P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.3	0.1	1.5	1.65	5282	5294	-0.378	0.284	0.161	1.604
41	0.25	0.1	1.6	1.75	1315	1323	-0.425	0.425	0.135	1.707
42	0.3	0.1	1.6	1.85	1445	1463	-0.252	0.315	0.161	1.759
43	0.4	0.1	1.6	1.75	1971	1983	-0.567	0.284	0.213	1.707
44	0.3	0.1	1.7	1.8	2126	2133	-0.648	0.324	0.161	1.784
45	0.4	0.1	1.7	1.85	5161	5178	-0.4	0.2	0.213	1.81
46	0.4	0.1	1.7	1.9	5581	5596	-0.454	0.302	0.213	1.836
47	0.3	0.1	1.8	1.95	1540	1552	-0.378	0.284	0.161	1.913
48	0.25	0.1	1.8	2	1978	1991	-0.262	0.349	0.135	1.939
49	0.2	0.1	1.8	1.85	5942	5946	-0.567	0.284	0.11	1.862
50	0.4	0.2	1.9	2.1	2050	2061	-0.412	0.412	0.264	2.042
51	0.4	0.1	1.9	1.95	6074	6110	-0.189	0.032	0.213	1.965
52	0.4	0.15	1.9	2	10086	10099	-0.436	0.175	0.238	1.99
53	0.5	0.2	2.2	2.3	9005	9026	-0.324	0.108	0.316	2.299
54	0.5	0.2	2.2	2.2	9463	9478	-0.454	0	0.316	2.248
55	0.4	0.2	2.3	2.35	5100	5123	-0.197	0.049	0.264	2.377
56	0.45	0.2	2.3	2.2	9320	9366	-0.123	-0.049	0.29	2.299
57	0.4	0.2	2.4	2.3	3136	3154	-0.252	-0.126	0.264	2.402
58	0.7	0.4	2.4	2.4	1600	1667	-0.102	0	0.522	2.454
59	0.5	0.2	2.4	2.4	1622	1661	-0.175	0	0.316	2.454
60	0.6	1	2.5	2.5	1575	1590	0.605	0	0.779	2.557
61	0.6	0.8	2.5	2.5	1579	1588	0.504	0	0.676	2.557
62	0.7	1.2	2.5	2.5	1660	1686	0.436	0	0.934	2.557
63	0.7	1.2	2.6	2.6	1173	1192	0.597	0	0.934	2.66
64	0.9	1.2	2.6	2.6	1521	1528	0.972	0	1.037	2.66
65	0.5	0.9	2.6	2.6	1701	1709	1.134	0	0.676	2.66
66	0.4	1.1	2.7	2.8	1309	1320	1.444	0.206	0.728	2.814
67	0.1	0.9	2.7	2.7	5475	5484	2.017	0	0.47	2.763
68	0.2	1.1	2.7	2.7	5787	5802	1.361	0	0.625	2.763
69	0.2	1.1	2.8	2.8	626	638	1.701	0	0.625	2.866
70	0.75	1.1	2.8	2.7	1113	1120	1.134	-0.324	0.908	2.814
71	0.15	0.9	2.8	2.7	5434	5444	1.701	-0.227	0.496	2.814
72	0.45	1.1	2.9	2.7	904	912	1.843	-0.567	0.753	2.866
73	0.35	0.9	2.9	2.9	5166	5173	1.782	0	0.599	2.969
74	0.15	0.9	2.9	2.9	6287	6299	1.418	0	0.496	2.969
75	0.2	0.9	3	3	1257	1267	1.588	0	0.522	3.072
76	0.15	1.2	3	3.2	11548	11564	1.489	0.284	0.65	3.175
77	0.2	0.8	3.1	3.1	688	698	1.361	0	0.47	3.175
78	0.2	0.7	3.1	3.1	1235	1240	2.269	0	0.419	3.175
79	0.2	1	3.1	3	5115	5128	1.396	-0.175	0.573	3.123

Table C-14 Continued: Headwater = 1.10P, Tailwater = 0.79P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
80	0.5	1	3.2	3.2	705	718	0.873	0	0.728	3.278
81	0.45	1.2	3.2	3.15	1384	1400	1.063	-0.071	0.805	3.252
82	0.6	1.2	3.2	3.15	1496	1510	0.972	-0.081	0.882	3.252
83	0.4	0.1	3.8	3.8	562	583	-0.324	0	0.213	3.896

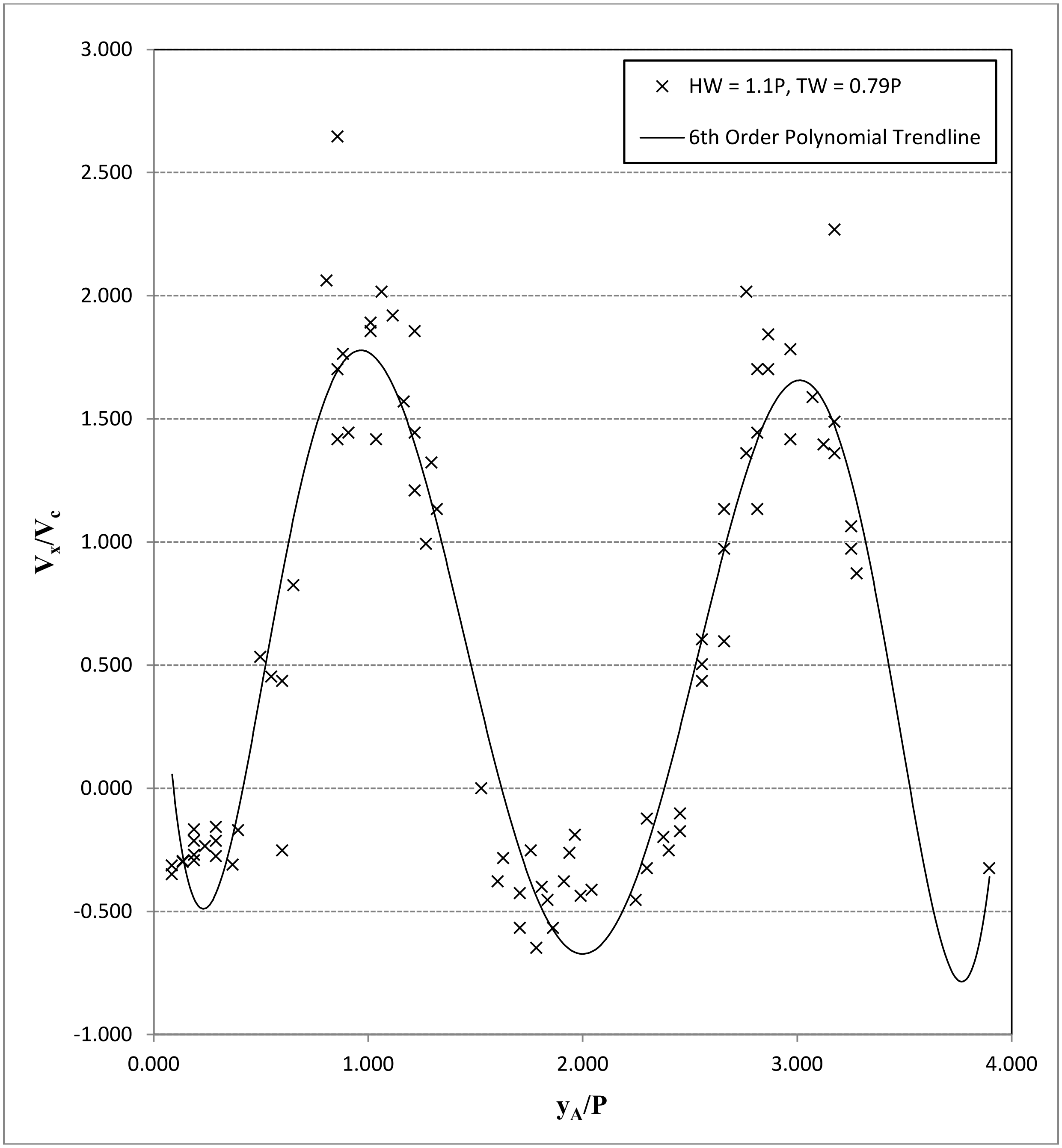

Figure C-14: Headwater = 1.10P, Tailwater = 0.79P

Table C-15: Headwater = 1.10P, Tailwater = 0.59P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.2	1.2	0.1	0.1	1445	1466	1.08	0	0.676	0.085
2	0.4	0.8	0.1	0.1	10465	10472	1.296	0	0.573	0.085
3	0.2	0.8	0.1	0.1	1445	1459	0.972	0	0.47	0.085
4	0.5	1.2	0.2	0.2	773	788	1.059	0	0.831	0.188
5	0.4	1.2	0.2	0.15	943	958	1.21	-0.076	0.779	0.162
6	0.2	1.2	0.2	0.3	3808	3819	2.062	0.206	0.676	0.24
7	0.1	1.2	0.3	0.4	8018	8042	1.04	0.095	0.625	0.343
8	0.2	1.2	0.3	0.3	8171	8208	0.613	0	0.676	0.291
9	0.4	1.2	0.3	0.2	8218	8234	1.134	-0.142	0.779	0.24
10	0.5	1.2	0.4	0.4	723	738	1.059	0	0.831	0.394
11	0.6	1.2	0.4	0.3	809	817	1.701	-0.284	0.882	0.343
12	0.4	1.2	0.4	0.2	4520	4537	1.068	-0.267	0.779	0.291
13	0.3	1.2	0.5	0.25	796	810	1.458	-0.405	0.728	0.368
14	0.2	1.2	0.5	0.4	3878	3891	1.745	-0.175	0.676	0.446
15	0.3	1.2	0.5	0.5	3837	3852	1.361	0	0.728	0.497
16	0.2	1.2	0.6	0.4	815	833	1.26	-0.252	0.676	0.497
17	0.2	0.7	0.6	0.3	10408	10415	1.62	-0.972	0.419	0.446
18	0.2	0.3	0.6	0.5	10542	10547	0.454	-0.454	0.213	0.549
19	0.1	0.3	0.7	0.7	6681	6690	0.504	0	0.161	0.703
20	0.1	0.4	0.7	0.5	924	932	0.851	-0.567	0.213	0.6
21	0.5	0.3	0.7	1.2	2188	2214	-0.175	0.436	0.367	0.96
22	0.3	0.3	0.8	0.9	1016	1019	0	0.756	0.264	0.857
23	0.3	0.35	0.8	0.9	1031	1036	0.227	0.454	0.29	0.857
24	0.4	0.3	0.8	1	1130	1142	-0.189	0.378	0.316	0.909
25	0.4	0.2	0.9	1	769	783	-0.324	0.162	0.264	0.96
26	0.6	0.2	0.9	1.1	831	853	-0.412	0.206	0.367	1.012
27	0.4	0.1	0.9	1.25	6700	6725	-0.272	0.318	0.213	1.089
28	0.5	0.2	1	1.2	760	778	-0.378	0.252	0.316	1.115
29	0.65	0.2	1	1.2	1129	1152	-0.444	0.197	0.393	1.115
30	0.45	0.2	1	1.1	1465	1479	-0.405	0.162	0.29	1.063
31	0.45	0.2	1.1	1.2	1094	1115	-0.27	0.108	0.29	1.166
32	0.2	1.2	1.1	1.5	1201	1241	0.567	0.227	0.676	1.321
33	0.3	0.1	1.1	1.2	10805	10814	-0.504	0.252	0.161	1.166
34	0.5	0.3	1.2	1.2	1779	1795	-0.284	0	0.367	1.218
35	0.7	0.15	1.2	1.35	3885	3930	-0.277	0.076	0.393	1.295
36	0.5	0.2	1.2	1.4	7060	7076	-0.425	0.284	0.316	1.321
37	0.5	0.2	1.3	1.3	1137	1156	-0.358	0	0.316	1.321
38	0.5	0.2	1.3	1.1	1171	1192	-0.324	-0.216	0.316	1.218
39	0.4	0.2	1.3	1.1	1494	1511	-0.267	-0.267	0.264	1.218

Table C-15 Continued: Headwater = 1.10P, Tailwater = 0.59P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.5	0.2	1.4	1.3	1013	1026	-0.524	-0.175	0.316	1.372
41	0.2	1.2	1.4	1.55	1394	1425	0.732	0.11	0.676	1.501
42	0.45	0.15	1.4	1.4	6757	6770	-0.524	0	0.264	1.424
43	0.3	1.2	1.5	2	904	949	0.454	0.252	0.728	1.784
44	0.3	1.2	1.5	1.8	905	941	0.567	0.189	0.728	1.681
45	0.5	0.3	1.5	1.5	1346	1358	-0.378	0	0.367	1.527
46	0.62	0.22	1.6	1.68	4552	4611	-0.154	0.031	0.388	1.671
47	0.7	0.2	1.6	1.7	4635	4694	-0.192	0.038	0.419	1.681
48	0.1	0.3	1.6	1.6	6878	6881	1.512	0	0.161	1.63
49	0.6	0.3	1.7	1.6	1598	1650	-0.131	-0.044	0.419	1.681
50	0.6	0.25	1.7	1.6	4502	4546	-0.18	-0.052	0.393	1.681
51	0.5	0.3	1.7	1.6	7456	7477	-0.216	-0.108	0.367	1.681
52	0.6	0.2	1.8	1.6	1440	1478	-0.239	-0.119	0.367	1.733
53	0.9	0.2	1.8	1.65	2123	2186	-0.252	-0.054	0.522	1.759
54	0.8	0.55	1.8	1.75	5246	5266	-0.284	-0.057	0.65	1.81
55	0.8	1.2	1.9	2.15	977	1003	0.349	0.218	0.985	2.068
56	0.7	0.3	1.9	1.6	1269	1310	-0.221	-0.166	0.47	1.784
57	0.8	0.8	1.9	1.8	4030	4045	0	-0.151	0.779	1.887
58	0.35	0.2	2	1.8	15556	15570	-0.243	-0.324	0.238	1.939
59	0.1	1.1	2	2.4	1152	1166	1.62	0.648	0.573	2.248
60	0.1	1.2	2	2.3	1831	1852	1.188	0.324	0.625	2.196
61	0.2	1.2	2.1	2.25	1133	1149	1.418	0.213	0.676	2.222
62	0.15	1.2	2.1	2.4	1463	1477	1.701	0.486	0.65	2.299
63	0.2	1.2	2.1	2.25	1643	1658	1.512	0.227	0.676	2.222
64	0.25	1.2	2.2	2.4	3843	3858	1.437	0.302	0.702	2.351
65	0.3	1.2	2.2	2.45	3898	3916	1.134	0.315	0.728	2.377
66	0.4	1.2	2.2	2.35	4154	4164	1.815	0.34	0.779	2.325
67	0.25	1.2	2.3	2.5	1042	1067	0.862	0.181	0.702	2.454
68	0.45	1.15	2.3	2.3	1658	1671	1.222	0	0.779	2.351
69	0.45	1.2	2.3	2.5	4285	4320	0.486	0.13	0.805	2.454
70	0.25	1.2	2.4	2.6	4534	4586	0.414	0.087	0.702	2.557
71	0.3	1.15	2.4	2.3	4849	4864	1.286	-0.151	0.702	2.402
72	0.1	0.7	2.4	2.5	7789	7804	0.907	0.151	0.367	2.505
73	0.1	0.3	2.5	2.3	11532	11538	0.756	-0.756	0.161	2.454
74	0.1	0.6	2.5	2.3	14669	14684	0.756	-0.302	0.316	2.454
75	0.3	0.7	2.5	2.6	4539	4555	0.567	0.142	0.47	2.608
76	0.55	0.15	2.6	3.1	7581	7612	-0.293	0.366	0.316	2.917
77	0.2	0.6	2.6	2.7	4893	4907	0.648	0.162	0.367	2.711
78	0.2	0.5	2.6	2.7	7272	7282	0.681	0.227	0.316	2.711
79	0.6	0.1	2.7	3.1	7516	7555	-0.291	0.233	0.316	2.969

Table C-15 Continued: Headwater = 1.10P, Tailwater = 0.59P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
80	0.35	0.15	2.7	3.05	10479	10499	-0.227	0.397	0.213	2.943
81	0.5	0.2	2.7	3.2	10653	10689	-0.189	0.315	0.316	3.02
82	0.45	0.1	2.8	3.1	3763	3786	-0.345	0.296	0.238	3.02
83	0.62	0.1	2.8	3.1	4835	4880	-0.262	0.151	0.326	3.02
84	0.5	0.1	2.8	3.02	7287	7311	-0.378	0.208	0.264	2.979
85	0.55	0.15	2.9	3.2	3865	3892	-0.336	0.252	0.316	3.123
86	0.3	0.1	2.9	3.05	10522	10535	-0.349	0.262	0.161	3.046
87	0.45	0.15	2.9	3.1	10647	10663	-0.425	0.284	0.264	3.072
88	0.6	0.1	3	3.15	4352	4382	-0.378	0.113	0.316	3.149
89	0.62	0.1	3	3.15	6591	6614	-0.513	0.148	0.326	3.149
90	0.55	0.1	3	3.05	10543	10568	-0.408	0.045	0.29	3.098
91	0.4	0.15	3.1	3.2	6855	6873	-0.315	0.126	0.238	3.226
92	0.55	0.2	3.1	3.2	8457	8477	-0.397	0.113	0.341	3.226
93	0.65	0.1	3.1	3.15	10592	10611	-0.657	0.06	0.341	3.201
94	0.5	0.35	3.2	3.3	15592	15603	-0.309	0.206	0.393	3.329
95	0.2	0.1	3.2	3.2	6518	6525	-0.324	0	0.11	3.278
96	0.3	0.1	3.2	3.2	6862	6867	-0.907	0	0.161	3.278
97	0.8	0.35	3.3	3.4	11163	11193	-0.34	0.076	0.547	3.432
98	0.7	0.6	3.3	3.5	13918	13929	-0.206	0.412	0.625	3.484
99	0.4	0.8	3.3	3.7	6507	6516	1.008	1.008	0.573	3.587
100	0.65	0.4	3.4	3.4	6815	6834	-0.298	0	0.496	3.484
101	0.9	0.75	3.4	3.5	10737	10748	-0.309	0.206	0.805	3.535
102	0.55	0.35	3.4	3.4	14017	14025	-0.567	0	0.419	3.484
103	0.8	1.2	3.5	3.6	824	837	0.698	0.175	0.985	3.638
104	0.1	0.5	3.5	3.5	6518	6524	1.512	0	0.264	3.587
105	0.1	0.8	3.5	3.6	6814	6829	1.059	0.151	0.419	3.638
106	0.2	1.2	3.6	3.7	818	835	1.334	0.133	0.676	3.741
107	0.2	0.3	3.6	3.6	7149	7150	2.269	0	0.213	3.69
108	0.3	0.8	3.6	3.6	7671	7678	1.62	0	0.522	3.69
109	0.15	1.2	3.7	3.7	791	807	1.489	0	0.65	3.793
110	0.4	0.2	3.7	3.25	6511	6528	-0.267	-0.601	0.264	3.561
111	0.6	0.9	3.7	3.7	8510	8514	1.701	0	0.728	3.793
112	0.4	0.7	3.8	3.8	10430	10435	1.361	0	0.522	3.896
113	0.4	0.7	3.8	3.8	10497	10505	0.851	0	0.522	3.896
114	0.2	0.7	3.8	3.8	10720	10727	1.62	0	0.419	3.896

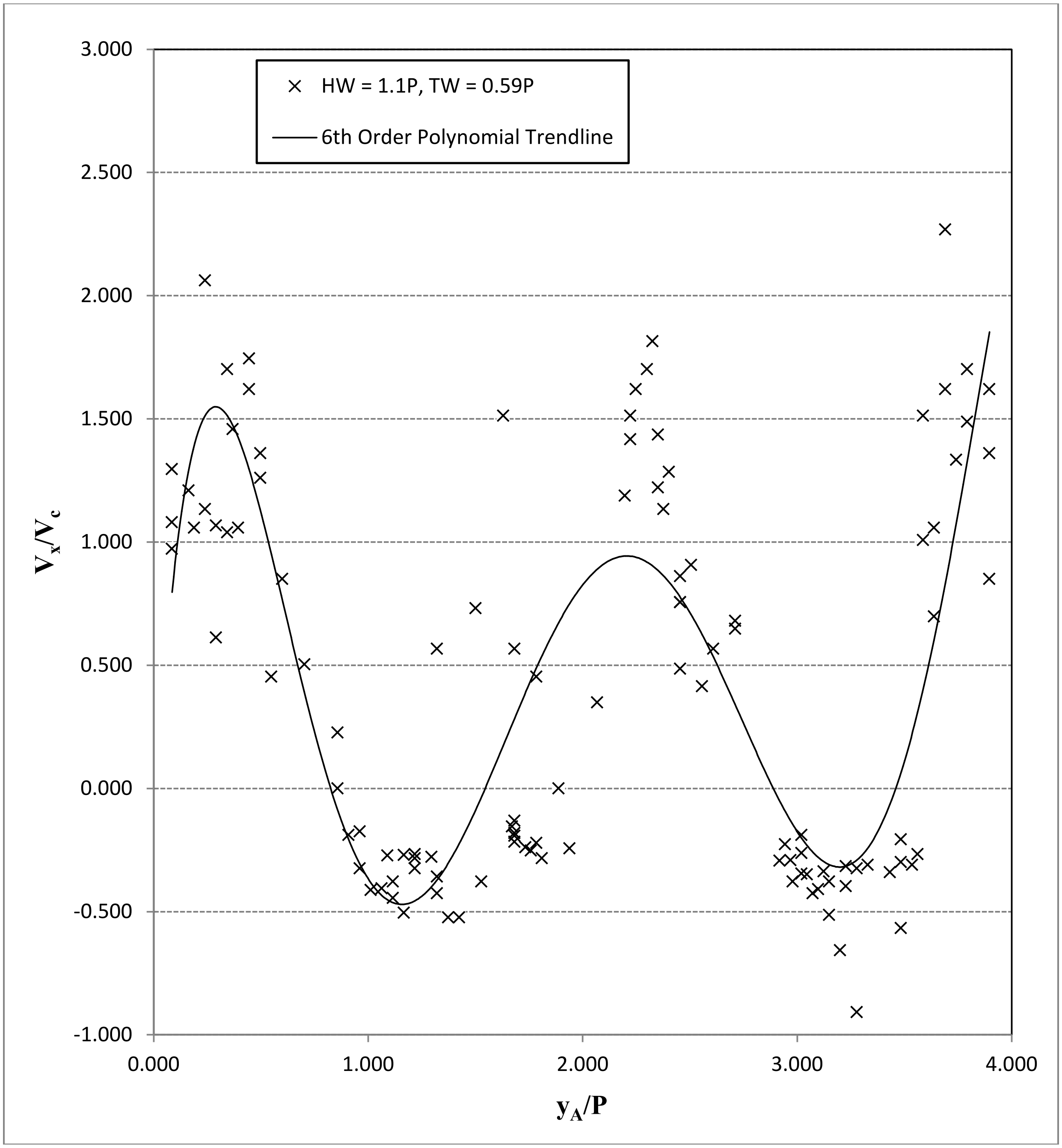

Figure C-15: Headwater = 1.10P, Tailwater = 0.59P

Table C-16: Headwater = 1.10P, Tailwater = 0.38P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
1	0.2	0.7	0.1	0.1	11893	11904	1.031	0	0.419	0.085
2	0.2	0.7	0.1	0.1	18236	18246	1.134	0	0.419	0.085
3	0.6	0.8	0.2	0.15	14692	14700	0.567	-0.142	0.676	0.162
4	0.2	0.7	0.2	0.1	14739	14751	0.945	-0.189	0.419	0.137
5	0.1	0.4	0.2	0.2	15064	15067	2.269	0	0.213	0.188
6	0.5	0.7	0.3	0.3	4262	4272	0.454	0	0.573	0.291
7	0.2	0.7	0.3	0.3	17804	17810	1.89	0	0.419	0.291
8	0.6	1	0.3	0.2	18062	18071	1.008	-0.252	0.779	0.24
9	0.25	1.2	0.4	0.1	4363	4400	0.582	-0.184	0.702	0.24
10	0.2	1.2	0.4	0.5	4581	4598	1.334	0.133	0.676	0.446
11	0.5	0.7	0.4	0.4	4303	4310	0.648	0	0.573	0.394
12	0.9	0.8	0.5	0.6	4352	4369	-0.133	0.133	0.831	0.549
13	0.2	1.2	0.5	0.4	547	581	0.667	-0.067	0.676	0.446
14	0.2	1.2	0.6	0.45	663	686	0.986	-0.148	0.676	0.523
15	1	0.85	0.6	0.6	8573	8586	-0.262	0	0.908	0.6
16	0.9	1.2	0.6	0.6	17506	17519	0.524	0	1.037	0.6
17	1.1	0.65	0.7	0.8	1258	1292	-0.3	0.067	0.856	0.754
18	1.1	0.95	0.7	0.6	14590	14603	-0.262	-0.175	1.011	0.651
19	0.9	0.7	0.8	0.9	14461	14473	-0.378	0.189	0.779	0.857
20	0.4	0.9	0.8	0.5	14537	14554	0.667	-0.4	0.625	0.651
21	0.25	1.2	0.9	0.5	2089	2126	0.582	-0.245	0.702	0.703
22	0.15	1.2	0.9	0.95	2262	2289	0.882	0.042	0.65	0.935
23	0.25	1.2	0.9	0.55	2266	2310	0.49	-0.18	0.702	0.729
24	0.2	1.2	1	1.15	1088	1100	1.89	0.284	0.676	1.089
25	0.15	1.2	1	1.15	1092	1110	1.323	0.189	0.65	1.089
26	0.2	1.2	1	1	1218	1240	1.031	0	0.676	1.012
27	0.15	1.05	1.1	1.25	2036	2059	0.888	0.148	0.573	1.192
28	0.25	1.2	1.1	1.1	2175	2187	1.796	0	0.702	1.115
29	0.25	1.2	1.1	1.3	2217	2233	1.347	0.284	0.702	1.218
30	1	0.45	1.2	1.25	8535	8568	-0.378	0.034	0.702	1.244
31	0.25	1.15	1.2	1.2	4347	4365	1.134	0	0.676	1.218
32	0.3	0.9	1.2	1.1	11998	12005	1.944	-0.324	0.573	1.166
33	0.3	1.2	1.3	1.15	2045	2085	0.51	-0.085	0.728	1.244
34	0.2	0.55	1.3	1.35	11412	11417	1.588	0.227	0.341	1.347
35	0.3	0.8	1.3	1.3	12131	12141	1.134	0	0.522	1.321
36	1	0.9	1.4	1.15	8315	8332	-0.133	-0.334	0.934	1.295
37	1	0.6	1.4	1.45	11639	11654	-0.605	0.076	0.779	1.45
38	0.1	0.2	1.4	1.4	15306	15309	0.756	0	0.11	1.424
39	1.2	1.1	1.5	1.35	14794	14806	-0.189	-0.284	1.14	1.45

Table C-16: Headwater = 1.10P, Tailwater = 0.38P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
40	0.1	0.6	1.5	1.4	14462	14471	1.26	-0.252	0.316	1.475
41	0.3	0.7	1.5	1.4	15578	15590	0.756	-0.189	0.47	1.475
42	0.1	0.9	1.6	1.6	11447	11456	2.017	0	0.47	1.63
43	0.3	0.8	1.6	1.6	12019	12029	1.134	0	0.522	1.63
44	0.5	0.7	1.6	1.5	12047	12060	0.349	-0.175	0.573	1.578
45	1.15	0.85	1.7	1.7	4688	4739	-0.133	0	0.985	1.733
46	1.2	0.9	1.7	1.6	4868	4908	-0.17	-0.057	1.037	1.681
47	0.3	1.2	1.7	1.4	936	959	0.888	-0.296	0.728	1.578
48	1.2	0.3	1.8	1.7	5148	5206	-0.352	-0.039	0.728	1.784
49	0.85	0.65	1.8	1.9	11494	11508	-0.324	0.162	0.728	1.887
50	1.05	0.7	1.8	2	15428	15457	-0.274	0.156	0.856	1.939
51	1.1	0.8	1.9	1.75	4595	4660	-0.105	-0.052	0.934	1.862
52	1	0.7	1.9	1.8	5032	5050	-0.378	-0.126	0.831	1.887
53	1.1	0.6	1.9	1.8	5270	5306	-0.315	-0.063	0.831	1.887
54	1.1	1	2	1.9	4561	4575	-0.162	-0.162	1.037	1.99
55	1.2	0.45	2	1.8	5190	5229	-0.436	-0.116	0.805	1.939
56	1.2	0.85	2	2.2	8279	8320	-0.194	0.111	1.011	2.145
57	1.2	0.3	2.1	2.3	4955	5036	-0.252	0.056	0.728	2.248
58	1.1	0.85	2.1	1.8	5449	5482	-0.172	-0.206	0.959	1.99
59	0.6	0.35	2.1	2.1	11516	11539	-0.247	0	0.444	2.145
60	0.85	0.2	2.2	2.3	4835	4880	-0.328	0.05	0.496	2.299
61	1.2	0.3	2.2	2.4	5091	5156	-0.314	0.07	0.728	2.351
62	1.1	0.45	2.2	1.8	5217	5257	-0.369	-0.227	0.753	2.042
63	1.2	0.2	2.3	2.55	4449	4497	-0.473	0.118	0.676	2.48
64	1.1	0.3	2.3	2.1	4536	4616	-0.227	-0.057	0.676	2.248
65	1.2	0.4	2.3	2.2	4564	4628	-0.284	-0.035	0.779	2.299
66	1.2	0.3	2.4	2.1	4520	4588	-0.3	-0.1	0.728	2.299
67	1.2	0.3	2.4	2.1	5148	5220	-0.284	-0.095	0.728	2.299
68	1.2	0.35	2.4	1.75	5151	5225	-0.261	-0.199	0.753	2.119
69	0.75	0.5	2.5	2.6	11471	11498	-0.21	0.084	0.599	2.608
70	0.75	0.5	2.5	2.75	14674	14690	-0.354	0.354	0.599	2.686
71	0.6	0.25	2.5	2.6	18708	18733	-0.318	0.091	0.393	2.608
72	0.1	1.2	2.6	2.5	932	963	0.805	-0.073	0.625	2.608
73	0.2	1.2	2.6	2.75	1356	1397	0.553	0.083	0.676	2.737
74	0.8	0.65	2.6	2.75	8442	8452	-0.34	0.34	0.702	2.737
75	0.8	0.45	2.7	2.75	708	729	-0.378	0.054	0.599	2.789
76	1.15	0.9	2.7	2.55	1552	1577	-0.227	-0.136	1.011	2.686
77	1.1	1	2.7	2.6	14757	14781	-0.095	-0.095	1.037	2.711
78	0.2	1.2	2.8	2.9	1318	1343	0.907	0.091	0.676	2.917
79	0.45	1.2	2.8	3	1592	1623	0.549	0.146	0.805	2.969

Table C-16: Headwater = 1.10P, Tailwater = 0.38P

#	x_1 [ft]	x_2 [ft]	y_1 [ft]	y_2 [ft]	$Frame_1$	$Frame_2$	V_x/V_c	V_y/V_c	x_{Ave}/P	y_{Ave}/P
80	0.2	1.2	2.8	2.85	1732	1752	1.134	0.057	0.676	2.892
81	0.6	0.35	2.9	2.9	8064	8075	-0.516	0	0.444	2.969
82	0.15	1.2	2.9	2.95	1322	1350	0.851	0.041	0.65	2.995
83	0.1	0.7	2.9	3	12541	12552	1.237	0.206	0.367	3.02
84	0.15	1.2	3	3.1	731	765	0.701	0.067	0.65	3.123
85	0.1	0.7	3	2.95	4458	4479	0.648	-0.054	0.367	3.046
86	0.2	0.68	3	2.88	9154	9159	2.178	-0.544	0.408	3.01
87	0.15	1.2	3.1	3.2	793	814	1.134	0.108	0.65	3.226
88	0.15	1.2	3.1	3	1048	1073	0.953	-0.091	0.65	3.123
89	0.1	0.7	3.1	3.1	4798	4807	1.512	0	0.367	3.175
90	1.2	0.95	3.2	3.3	12595	12621	-0.218	0.087	1.062	3.329
91	0.2	0.7	3.2	3.2	14755	14764	1.26	0	0.419	3.278
92	0.1	0.6	3.2	3.2	14786	14806	0.567	0	0.316	3.278
93	1.2	0.95	3.3	3.3	14504	14556	-0.109	0	1.062	3.381
94	0.1	0.7	3.3	3.5	4430	4449	0.716	0.239	0.367	3.484
95	0.1	0.7	3.3	3.5	8053	8063	1.361	0.454	0.367	3.484
96	0.15	1.2	3.4	3.5	1017	1031	1.701	0.162	0.65	3.535
97	0.2	1.2	3.4	3.7	4591	4610	1.194	0.358	0.676	3.638
98	0.2	0.7	3.4	3.5	12266	12279	0.873	0.175	0.419	3.535
99	0.15	1.2	3.5	3.7	905	921	1.489	0.284	0.65	3.69
100	0.5	0.8	3.5	3.5	12183	12186	2.269	0	0.625	3.587
101	0.1	0.5	3.5	3.6	14961	14967	1.512	0.378	0.264	3.638
102	0.3	1.2	3.6	3.6	520	531	1.856	0	0.728	3.69
103	0.2	0.7	3.6	3.7	11864	11870	1.89	0.378	0.419	3.741
104	0.2	1.2	3.7	3.8	4711	4725	1.62	0.162	0.676	3.844
105	0.1	0.9	3.7	3.8	8353	8364	1.65	0.206	0.47	3.844
106	0.5	0.6	3.7	3.7	12225	12227	1.134	0	0.522	3.793
107	0.3	1.15	3.8	3.8	1017	1036	1.015	0	0.702	3.896
108	0.3	0.75	3.8	3.8	8517	8525	1.276	0	0.496	3.896
109	0.6	0.9	3.8	3.8	14830	14835	1.361	0	0.728	3.896

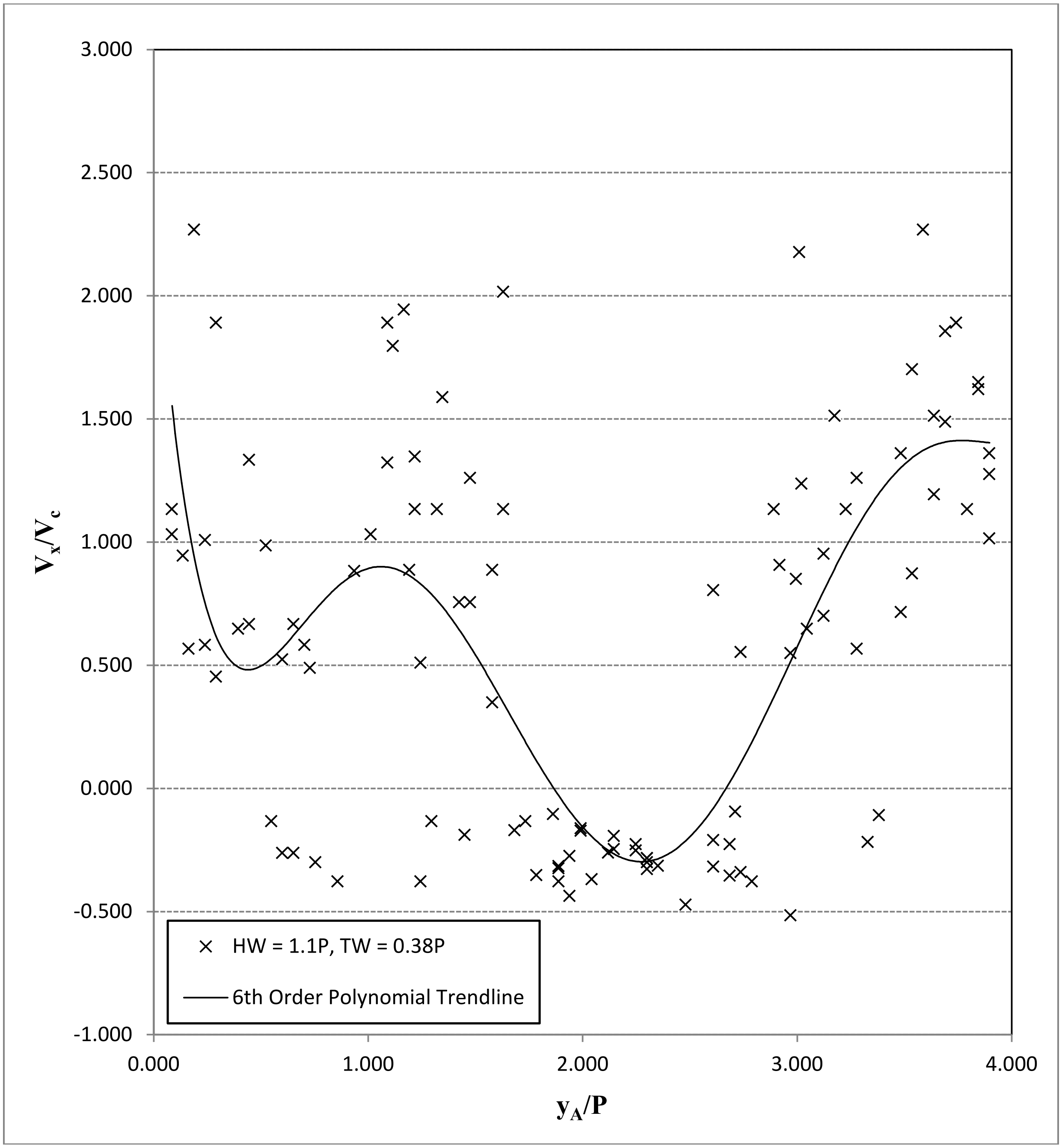

Figure C-16: Headwater = 1.10P, Tailwater = 0.38P

APPENDIX D. CODE FOR KRCPROJECT.GROUPS.ET.BYU.NET

The following sections show the source code for each page used to allow krcproject.groups.et.byu.net to function. The site is hosted on servers maintained by the Computer Aided Engineering Design and Manufacturing service provided by the College of Engineering and Technology at Brigham Young University. The following files are located in the krcproject groups folder within the /www directory. For access to the folder please contact Dr. Rollin H. Hotchkiss.

D.1 **arrays_to_javascript.php**

```
<?php

$json_incident_array = json_encode($incident_array);
$json_site_array = json_encode($site_array);
$json_verification_array = json_encode($verification_array);

echo <<<_END
<script type="text/javascript">;

//Populate incident_array in JavaScript with the PHP array
var incident_array = $json_incident_array;

//Populate site_array in JavaScript with the PHP array
var site_array = $json_site_array;

//Populate verification_array in JavaScript with the PHP array
var verification_array = $json_verification_array;

</script>
_END;

?>
```

D.2 **browse.php**

```
<html>
  <head>
    <title>Fatal Submerged Hydraulic Jumps</title>

    <!-- link
          href='http://fonts.googleapis.com/css?family=Alegreya+
          SC' rel='stylesheet' type='text/css' -->
    <link href="css/site.css" rel="stylesheet" type="text/css"
          />

    <meta http-equiv="Content-Type" content="text/html;
          charset=UTF-8">

<script type="text/javascript"

          src="https://maps.googleapis.com/maps/api/js?key=AIzaS
          yBXXGNS887tQiPKmvodZlVwvBcqYBsxLVw&sensor=false">
</script>
<?php

//Get the login info for MySQL
include_once 'db_login.php';

//Query the database. Create and sort site_array,
          incident_array, and verification_array
require_once 'query_sort.php';

//Trim the PHP arrays so they no longer include the contributors
          email address
require_once 'trim_emails.php';

//Transfer the PHP arrays to javascript
require_once 'arrays_to_javascript.php';

?>
<script type="text/javascript">
//Define globals
var total_fatalities = 0;
var max_fatalities = 0;
var max_fatalities_site = [];

//Add total fatalities to the site_array
if (Object.prototype.toString.call(site_array) === '[object
          Array]' )
{
  for (i = 0, j = site_array[0].length ; i < site_array.length ;
          ++i)
  {
    site_array[i][j] = 0;
    for (k = 0 ; k < incident_array.length ; ++k)
    {
```

```
      //The first time this loop is run add up all the
          fatalities
      if (i == 0)
      {
        total_fatalities += parseInt(incident_array[k][1]);
      }
      if (incident_array[k][5] == site_array[i][0])
      {
        site_array[i][j] += parseInt(incident_array[k][1]);
      }
    }
  }
}

//Find the max fatalities at a single site
for (i = 0 ; i < site_array.length ; ++i)
{
  if (site_array[i][site_array[0].length - 1] > max_fatalities)
  {
    max_fatalities = site_array[i][site_array[0].length - 1];
    max_fatalities_site = [];
    max_fatalities_site[0] = i;

  }
  else if (site_array[i][site_array[0].length - 1] >
          max_fatalities)
  {
    max_fatalities_site.push(i);
  }
}

//Define globals
var marker = [];
var map = null;
var mapOptions = null;

//This is called in a script that occurs just below the map
          <div>. This is for map stuff since the <div id="map">
          needs to be present before the map can load into it
function onload()
{
  resize_headers();

  //Set initial settings for the map
  mapOptions =
  {
    //Set center of map as center for the contiguous US
    center: new google.maps.LatLng(38.828, -96.5795),
    zoom: 4,
    mapTypeId: google.maps.MapTypeId.HYBRID
  };

  //Load the map
```

```
  map = new
          google.maps.Map(document.getElementById('map_canvas'),
          mapOptions);

  //Create markers for sites
  for (i = 0; i < site_array.length; ++i)
  {
    //Title for the markers will show the site name, number of
          fatalities, city/county, and state.
    if (site_array[i][4] == "")
    {
      var site_title = "Site Name: " + site_array[i][1] +
          "\nFatalities: " + site_array[i][12] + "\nCounty: " +
          site_array[i][5] + "\nState: " + site_array[i][6];
    }
    else
    {
      var site_title = "Site Name: " + site_array[i][1] +
          "\nFatalities: " + site_array[i][12] + "\nCity: " +
          site_array[i][4] + "\nState: " + site_array[i][6];
    }

    //Make the marker
    marker[site_array[i][0]] = new google.maps.Marker(
      {
        position: new google.maps.LatLng (site_array[i][2],
          site_array[i][3]),
        map: map,
        title: site_title
      });
  }

   //Restrict how far out the user can zoom
   google.maps.event.addListener(map, 'zoom_changed', function()
          {
     if (map.getZoom() < 3) map.setZoom(3);
   });

<?php
  //Add listeners to all the markers
  for ($i = 0 ; $i < count($site_array) ; ++$i)
  {
    echo "  google.maps.event.addListener(marker[" .
          $site_array[$i][0] . "] , 'click', function(event)\n";
    echo "  {\n";
    echo "    location.href = \"#\";";
    echo "    location.href = \"#" . $site_array[$i][0] .
          "_header\";";
    echo "  });\n";
  }
?>

//  SetMapWidth();
```

```
//  SetMapHeight();
}//End of onload()


//function SetMapWidth()
//{
//  var x = 0;
//  if (self.innerHeight)
//  {
//    x = self.innerWidth;
//  }
//  else if (document.documentElement &&
          document.documentElement.clientHeight)
//  {
//    x = document.documentElement.clientWidth;
//  }
//  else if (document.body)
//  {
//    x = document.body.clientWidth;
//  }
//  x = x - 80;
//  document.getElementById('map_canvas').style.width = x +
          "px";
//  //document.getElementById('map_canvas').style.width =
          "700px";
//}
//
//function SetMapHeight()
//{
//  var y = 0;
//  if (self.innerHeight)
//  {
//    y = self.innerHeight;
//  }
//  else if (document.documentElement &&
          document.documentElement.clientHeight)
//  {
//    y = document.documentElement.clientHeight;
//  }
//  else if (document.body)
//  {
//    y = document.body.clientHeight;
//  }
//  y = y - 100
//  document.getElementById('map_canvas').style.height = y +
          "px";
//  //document.getElementById('map_canvas').style.height =
          "500px";
//}

function ResizeImage(element_id, percent)
{
  var w = 0;
```

```
  x0 = document.getElementById(element_id).width;
  y0 = document.getElementById(element_id).height;

  if (self.innerHeight)
  {
    w = self.innerWidth;
  }
  else if (document.documentElement &&
          document.documentElement.clientHeight)
  {
    w = document.documentElement.clientWidth;
  }
  else if (document.body)
  {
    w = document.body.clientWidth;
  }

  //If the image is wider than the image width specified by the
          percent, then resize the image
  if (x0 > w*percent/100)
  {
    x1 = Math.round(w*percent/100);
    y1 = Math.round(y0*x1/x0);

    if (x1 > 400)
    {
      document.getElementById(element_id).style.width = x1 +
          "px";
      document.getElementById(element_id).style.height = y1 +
          "px";
    }
    else if (x1 <= 400)
    {
      x1 = 400;
      y1 = Math.round(y0*x1/x0);
      document.getElementById(element_id).style.width = x1 +
          "px";
      document.getElementById(element_id).style.height = y1 +
          "px";
    }
  }
}

function resize_headers()
{
  var h = document.getElementById('current').offsetHeight;
  document.getElementById('header_tabs').style.height = h +
          "px";
}

</script>
  </head>
  <body>
```

```
<img id="logo" src="images/byuhomelogo.png" />

<div id="full_header">
  <div id="top_credits">
    <p>Ira A. Fulton College of Engineering and
      Technology</p>
    <p>Civil & Environmental Engineering</p>
    <p><a href="mailto:rhh@byu.edu" title="Email Dr.
      Hotchkiss">Dr. Rollin H. Hotchkiss</a></p>
    <p><a href="mailto:eddiekern@gmail.com" title="Email Ed
      Kern">Edward Kern</a></p>
  </div>

  <div id="header_tabs">
    <ul id="top_menu">
      <li><a href="index.php">About Submerged Hydraulic
      Jumps</a></li>
      <li id="current"><a href="browse.php">Browse
      Incidents</a></li>
      <li><a href="input_form.php">Report an
      Incident</a></li>
    </ul>
  </div>
</div>

<div id="content">

<h1>Locations of Fatalities at Submerged Hydraulic
      Jumps</h1>

<p>The interactive database was designed and built by Ed Kern, a
          masters student at BYU. John Guymon, a former BYU
          graduate student, created a <a
          href="http://www.arcgis.com/home/webmap/viewer.html?we
          bmap=06d21099a8514ceb89b95db06a62893a">GIS
          database</a> with 65 locations, and more than 200
          fatalities recorded. There are many more locations
          that need to be recorded, which is why we are striving
          to obtain public contributions. If there are any false
          or inappropriate entries please report them to <a
          href="mailto:eddiekern@gmail.com" title="Email Ed
          Kern">Ed Kern</a>. We have received significant
          contributions from several sources including Dr. Bruce
          Tschantz who has supplied the data he has been
          collecting on the incidents and dangers at low head
          dams, and Charlie Walbridge from the American
          Whitewater Association who has given us the data that
          they have been collecting at <a
          href="http://www.americanwhitewater.org">americanwhite
          water.org</a>.</p><br /><br />

<div id="map_canvas"></div>
```

```
<br /><br />

<h1>Database at a Glance</h1><br />

<table cellpadding="4">
  <tr>
    <td>Total fatalities recorded:</td>
    <td><script
          type="text/javascript">document.write(total_fatalities
          );</script></td>
  </tr>
  <tr>
    <td>Number of fatal sites:</td>
    <td><script
          type="text/javascript">document.write(site_array.lengt
          h);</script></td>
  </tr>
  <tr>
    <td>Max. fatalities at a single location:</td>
    <td><script
          type="text/javascript">document.write(max_fatalities);
          </script></td>
  </tr>
  <tr>
    <td>Site<script type="text/javascript">if
          (max_fatalities_site.length > 1)
          document.write("s");</script> with the most
          fatalities:</td>
    <td>
      <script type="text/javascript">

        onload();

        //If there are more than one site that have the maximum
          number of fatalities at a single location display all
          of them
        document.write(site_array[max_fatalities_site[0]][6] + "
          - " + site_array[max_fatalities_site[0]][4] + " - " +
          site_array[max_fatalities_site[0]][1]);
        if (max_fatalities_site.length > 1)
        {
          for (i = 1 ; i < max_fatalities_site.length ; ++i)
          {
            document.write("<br />\n" +
          site_array[max_fatalities_site[i]][6] + " - " +
          site_array[max_fatalities_site[i]][4] + " - " +
          site_array[max_fatalities_site[i]][1])
          }
        }
      </script>
    </td>
  </tr>
```

```
  <tr>
    <td>Average fatalities per site:</td>
    <td><script
          type="text/javascript">document.write(Math.round(100*t
          otal_fatalities/(site_array.length))/100);</script></t
          d>
  </tr>
</table><br /><br />

<h1>Sites and Incidents</h1>

<table class="browse_table">

<script type="text/javascript">
for (i = 0 ; i < site_array.length ; ++i)
{
  if (site_array[i][4] == "")
  {
    //document.write("<h2 id=\"" + site_array[i][0] +
          "_header\">" + site_array[i][6] + " - " +
          site_array[i][5] + " County - " + site_array[i][1] +
          "</h2>\n");
    document.write("<tr><td colspan=\"2\"><br /><br /><h2 id=\""
          + site_array[i][0] + "_header\">" + site_array[i][6] +
          " - " + site_array[i][5] + " County - " +
          site_array[i][1] + "</h2></td></tr>\n");
  }
  else
  {
    //document.write("<h2 id=\"" + site_array[i][0] +
          "_header\">" + site_array[i][6] + " - " +
          site_array[i][4] + " - " + site_array[i][1] +
          "</h2>\n");
    document.write("<tr><td colspan=\"2\"><h2 id=\"" +
          site_array[i][0] + "_header\">" + site_array[i][6] + "
          - " + site_array[i][4] + " - " + site_array[i][1] +
          "</h2></td></tr>\n");
  }

  if (site_array[i][8] != null)
  {
    document.write("<tr><td colspan=\"2\">\n");
    document.write("  <a href=\"site_images/" +
          site_array[i][8] + "\" target=\"_blank\">\n");
    document.write("    <img id=\"site_image_" +
          site_array[i][0] + "\" src=\"site_images/" +
          site_array[i][8] + "\"
          onload=\"ResizeImage('site_image_" + site_array[i][0]
          + "', 35)\"><br />\n");
    document.write("  </a>\n");
    document.write("</td></tr>\n");
  }
```

```
document.write("<tr><td
        colspan=\"2\"><h3>Incidents</h3></td></tr>\n");

for (j = 0 ; j < incident_array.length ; ++j)
{
  if(site_array[i][0] == incident_array[j][5])
  {
    //document.write("<table>\n");
    document.write("  <tr>\n");
    document.write("    <td>\n");
    document.write("      Date:\n");
    document.write("    </td>\n");
    document.write("    <td>\n");
    if (incident_array[j][3] > 0 && incident_array[j][2] > 0)
    {
      if (incident_array[j][3] == 1) document.write("      " +
        incident_array[j][2] + " - Jan - " +
        incident_array[j][4] + "\n");
      if (incident_array[j][3] == 1) document.write("      " +
        incident_array[j][2] + " - Jan - " +
        incident_array[j][4] + "\n");
      if (incident_array[j][3] == 2) document.write("      " +
        incident_array[j][2] + " - Feb - " +
        incident_array[j][4] + "\n");
      if (incident_array[j][3] == 3) document.write("      " +
        incident_array[j][2] + " - Mar - " +
        incident_array[j][4] + "\n");
      if (incident_array[j][3] == 4) document.write("      " +
        incident_array[j][2] + " - Apr - " +
        incident_array[j][4] + "\n");
      if (incident_array[j][3] == 5) document.write("      " +
        incident_array[j][2] + " - May - " +
        incident_array[j][4] + "\n");
      if (incident_array[j][3] == 6) document.write("      " +
        incident_array[j][2] + " - Jun - " +
        incident_array[j][4] + "\n");
      if (incident_array[j][3] == 7) document.write("      " +
        incident_array[j][2] + " - Jul - " +
        incident_array[j][4] + "\n");
      if (incident_array[j][3] == 8) document.write("      " +
        incident_array[j][2] + " - Aug - " +
        incident_array[j][4] + "\n");
      if (incident_array[j][3] == 9) document.write("      " +
        incident_array[j][2] + " - Sep - " +
        incident_array[j][4] + "\n");
      if (incident_array[j][3] == 10) document.write("      "
        + incident_array[j][2] + " - Oct - " +
        incident_array[j][4] + "\n");
      if (incident_array[j][3] == 11) document.write("      "
        + incident_array[j][2] + " - Nov - " +
        incident_array[j][4] + "\n");
```

```
  if (incident_array[j][3] == 12) document.write("       "
    + incident_array[j][2] + " - Dec - " +
    incident_array[j][4] + "\n");
}
else if (incident_array[j][3] > 0)
{
  if (incident_array[j][3] == 1) document.write("      Jan
    - " + incident_array[j][4] + "\n");
  if (incident_array[j][3] == 2) document.write("      Feb
    - " + incident_array[j][4] + "\n");
  if (incident_array[j][3] == 3) document.write("      Mar
    - " + incident_array[j][4] + "\n");
  if (incident_array[j][3] == 4) document.write("      Apr
    - " + incident_array[j][4] + "\n");
  if (incident_array[j][3] == 5) document.write("      May
    - " + incident_array[j][4] + "\n");
  if (incident_array[j][3] == 6) document.write("      Jun
    - " + incident_array[j][4] + "\n");
  if (incident_array[j][3] == 7) document.write("      Jul
    - " + incident_array[j][4] + "\n");
  if (incident_array[j][3] == 8) document.write("      Aug
    - " + incident_array[j][4] + "\n");
  if (incident_array[j][3] == 9) document.write("      Sep
    - " + incident_array[j][4] + "\n");
  if (incident_array[j][3] == 10) document.write("
    Oct - " + incident_array[j][4] + "\n");
  if (incident_array[j][3] == 11) document.write("
    Nov - " + incident_array[j][4] + "\n");
  if (incident_array[j][3] == 12) document.write("
    Dec - " + incident_array[j][4] + "\n");
}
else
{
  document.write("      " + incident_array[j][4] + "\n");
}
document.write("    </td>\n");
document.write("  </tr>\n");
document.write("  <tr>\n");
document.write("    <td>\n");
document.write("      Fatalities:\n");
document.write("    </td>\n");
document.write("    <td>\n");
document.write("      " + incident_array[j][1] + "\n");
document.write("    </td>\n");
document.write("  </tr>\n");

if (incident_array[j][7] != null && incident_array[j][7]
    != "")
{
  document.write("  <tr>\n");
  document.write("    <td valign=\"top\">\n");
  document.write("      Description:\n");
  document.write("    </td>\n");
```

```
        document.write("    <td>\n");
        document.write("      " + incident_array[j][7] + "\n");
        document.write("    </td>\n");
        document.write("  </tr>\n");
      }

      if (incident_array[j][6] > 0)
      {
        for (v_num = 0 ; v_num < verification_array.length ;
          ++v_num)
        {
          if(verification_array[v_num][0] ==
          incident_array[j][6])
          {
            if (verification_array[v_num][2] != null &&
          verification_array[v_num][2] != "")
            {
              document.write("  <tr>\n");
              document.write("    <td>\n");
              document.write("      Web Documentation:\n");
              document.write("    </td>\n");
              document.write("    <td>\n");
              document.write("      <a href=\"" +
          verification_array[v_num][2] + "\" target=\"_blank\">"
          + verification_array[v_num][2] + "</a>\n");
              document.write("    </td>\n");
              document.write("  </tr>\n");
            }
            if (verification_array[v_num][3] != null &&
          verification_array[v_num][3] != "")
            {
              document.write("  <tr>\n");
              document.write("    <td>\n");
              document.write("      File Documentation:\n");
              document.write("    </td>\n");
              document.write("    <td>\n");
              document.write("      <a
          href=\"verification_uploads/" +
          verification_array[v_num][3] + "\" target=\"_blank\">"
          + verification_array[v_num][3] + "</a>\n");
              document.write("    </td>\n");
              document.write("  </tr>\n");
            }
          }
        }
      }
      //document.write("</table><br /><br />\n");
      document.write("    <tr><td><br/><br /></td></tr>\n");
    }
  }
}
</script>
```

```
</table>

  <br /><br />

</div>
  </body>
</html>
```

D.3 **db_login.php**

```
<?php

$db_hostname   = 'caedmdb.et.byu.edu';
$db_database   = 'CENSORED';
$db_username   = 'CENSORED';
$db_password   = 'CENSORED';

//Connect to the MySQL server
$db_server = mysql_connect($db_hostname, $db_username,
          $db_password);
  if(!$db_server) die("<html><body><h1>Sorry, this page is
          temporarily down for maintenance. We are currently
          upgrading the submittal process to prevent bots from
          submitting false or obscene entries. Thank you for you
          patience.</h1></body></html>");
  //if(!$db_server) die("Unable to connect to MySQL: " .
          mysql_error());

//Choose the krcproject database
$db_selected = mysql_select_db('krcproject');
  if(!$db_selected) die("Unable to select database: " .
          $mysql_error());

//Check to see if the database has been backed up in the last 7
          days.
$i = 0;
$backed_up = false;
while ($i < 7)
{
          $file_check = 'sql_backups/KRC_Database_Backup_' .
          date('Y-m-d', strtotime(' -' . $i . ' day')) . '.sql';
          if (file_exists($file_check))
          {
               $backed_up = true;
          }
          $i++;
}

//If the file hasn't been backed up in the last 7 days, then
          back it up.
if ($backed_up == false)
```

```
{
          $db_export = 'sql_backups/KRC_Database_Backup_' .
          date('Y-m-d') . '.sql';
          $command='mysqldump --opt -h' . $db_hostname .' -u' .
          $db_username .' -p' . $db_password . ' ' .
          $db_database . ' > ' . $db_export;
          exec($command,$output=array(),$worked);
          // This part is for troubleshooting
          // switch($worked)
          // {
               // case 0:
               // echo 'Database <b>' . $db_database .'</b>
          successfully exported to <b>~/' . $db_export .'</b>';
               // break;
               // case 1:
               // echo 'There was a warning during the export of
          <b>' . $db_database .'</b> to <b>~/' . $db_export
          .'</b>';
               // break;
               // case 2:
               // echo 'There was an error during export. Please
          check your values:<br/><br/><table><tr><td>MySQL
          Database Name:</td><td><b>' . $db_database
          .'</b></td></tr><tr><td>MySQL User Name:</td><td><b>'
          . $db_username .'</b></td></tr><tr><td>MySQL
          Password:</td><td><b>NOTSHOWN</b></td></tr><tr><td>MyS
          QL Host Name:</td><td><b>' . $db_hostname
          .'</b></td></tr><tr><td>MySQL File Path:</td><td><b>'
          . $db_export .'</b></td></tr></table>';
               // break;
          // }
}
?>
```

D.4 **handle_incident_input.php**

```
<?php

function sanitize_input($var)
{
  $var = mysql_real_escape_string($var);
  if(get_magic_quotes_gpc()) $var = stripcslashes ($var);
  $var = htmlentities($var);
  $var = strip_tags($var);
  return $var;
}

//If the user submits something using the user form, then add it
          to the database
if (isset($_POST['fatalities']))
{
```

```
//This is to verify that a human is entering the data. If they
        answer the human test question correctly, then we
        process their submission
if ($_POST['human_test'] == "sword")
{
  //Sanitize user inputs and assign them to new variables
  $fatalities = sanitize_input($_POST['fatalities']);
  $incident_description =
        sanitize_input($_POST['incident_description']);
  $day = sanitize_input($_POST['day']);
  $month = sanitize_input($_POST['month']);
  $year = sanitize_input($_POST['year']);
  $site_id = sanitize_input($_POST['site_id']);
  $site_name = sanitize_input($_POST['site_name']);
  $latitude = sanitize_input($_POST['latitude']);
  $longitude = sanitize_input($_POST['longitude']);
  $city = sanitize_input($_POST['city']);
  $county = sanitize_input($_POST['county']);
  $state = sanitize_input($_POST['state']);
  $site_image = $site_name;
  $verify_id = sanitize_input($_POST['verify_id']);
  $doc_name = sanitize_input($_POST['doc_name']);
  $doc_description =
        sanitize_input($_POST['doc_description']);
  $doc_address = sanitize_input($_POST['doc_address']);
  $doc_file = sanitize_input($_FILES['doc_file']['name']);
  $name_alias = sanitize_input($_POST['name_alias']);
  $contributor_email =
        sanitize_input($_POST['contributor_email']);

  //If there is a verification document being uploaded, move
        it to it's proper folder
  if ($_FILES['doc_file']['tmp_name'] != '')
  {
    $file_destination = "verification_uploads/" . $doc_file;
    move_uploaded_file($_FILES['doc_file']['tmp_name'],
        $file_destination);
  }

  //If the user is adding a new document for verification,
        then add the data to the verification table
  if ($verify_id == "new")
  {
    //Create a variable contining the MySQL code to add data
        to the validation table
    $query = "INSERT INTO verification VALUES (NULL,
        '$doc_name', '$doc_address', '$doc_file',
        '$doc_description', '$name_alias',
        '$contributor_email', NULL, NULL)";
    $result = mysql_query($query);
    If (!$result) die ("Database access failed: " .
        mysql_error());
    $verify_id = mysql_insert_id();
```

```
}

//If the user is adding a new site, then add the data to the
      site table
if ($site_id == "new")
{
  //Create a variable contining the MySQL code to add data
      to the site table
  $query = "INSERT INTO site VALUES (NULL, '$site_name',
      '$latitude', '$longitude', '$city', '$county',
      '$state', NULL, NULL, '$name_alias',
      '$contributor_email', NULL, NULL)";
  $result = mysql_query($query);
  If (!$result) die ("Database access failed: " .
      mysql_error());
  $site_id = mysql_insert_id();
}

//If there is a site_image being uploaded, move it to it's
      proper folder
if ($_FILES['site_image']['name'] != '')
{
  $temp = '';
  switch ($_FILES['site_image']['type'])
  {
    case 'image/jpeg': $temp = 'jpg'; break;
    case 'image/gif': $temp = 'gif'; break;
    case 'image/png': $temp = 'png'; break;
    case 'image/tiff': $temp = 'tif'; break;
    default: $temp = ''; break;
  }
  if ($temp)
  {
    $site_image = $site_image . " - (site " . $site_id .
      ")." . $temp;
    $file_destination = "site_images/" . $site_image;
    move_uploaded_file($_FILES['site_image']['tmp_name'],
      $file_destination);

    //Insert the file name into the database for the site
    $query = "UPDATE site SET image ='" . $site_image . "'
      WHERE id ='" . $site_id . "'";
    $result = mysql_query($query);
    If (!$result) die ("Database access failed: " .
      mysql_error());
  }
  else
  {
    alert ("The image was not recognized as an image
      filetype. The site was entered without the image");
  }
}
```

```
    //Create a variable containing the MySQL code to add data to
          the incident table
    $query = ”INSERT INTO incident VALUES (NULL, ’$fatalities’,
          ’$day’, ’$month’, ’$year’, ’$site_id’, ’$verify_id’,
          ’$incident_description’, ’$name_alias’,
          ’$contributor_email’, NULL, NULL)”;
    $result = mysql_query($query);
    If (!$result) die (”Database access failed: ” .
          mysql_error());
  }
  else
  {
    die(”You failed the human test.”);
  }
}

?>
```

D.5 **index.php**

```
<html>
  <head>
    <title>Fatal Submerged Hydraulic Jumps</title>

    <!-- link
          href=’http://fonts.googleapis.com/css?family=Alegreya+
          SC’ rel=’stylesheet’ type=’text/css’ -->
    <link href=”css/site.css” rel=”stylesheet” type=”text/css”
          />

    <meta http-equiv=”Content-Type” content=”text/html;
          charset=UTF-8”>

<script type=”text/javascript”>

function resize_headers()
{
  var h = document.getElementById(’current’).offsetHeight;
  document.getElementById(’header_tabs’).style.height = h +
          ”px”;
}

</script>
  </head>
  <body>

    <img id=”logo” src=”images/byuhomelogo.png” />

    <div id=”full_header”>
      <div id=”top_credits”>
        <p>Ira A. Fulton College of Engineering and
          Technology</p>
```

```
    <p>Civil & Environmental Engineering</p>
    <p><a href="mailto:rhh@byu.edu" title="Email Dr.
      Hotchkiss">Dr. Rollin H. Hotchkiss</a></p>
    <p><a href="mailto:eddiekern@gmail.com" title="Email Ed
      Kern">Edward Kern</a></p>
  </div>

  <div id="header_tabs">
    <ul id="top_menu">
      <li id="current"><a href="index.php">About Submerged
      Hydraulic Jumps</a></li>
      <li><a href="browse.php">Browse Incidents</a></li>
      <li><a href="input_form.php">Report an
      Incident</a></li>
    </ul>
  </div>
</div>

<script>
  resize_headers();
</script>

<div id="about">

  <h1>Video Presentation: Submerged Hydraulic Jumps</h1>

    <iframe width="800" height="450"
      src="http://www.youtube.com/embed/XsYgODmmiAM"
      frameborder="0" allowfullscreen style="display:block;
      margin-left: auto; margin-right: auto"></iframe><br
      /><br /><br /><br />

  <h1>Dangerous Currents at Low-head Dams</h1>

    <p>On 1-Aug-10 a couple were kayaking down the Jordan
      River south of Salt Lake City. Just after passing
      beneath the bridge at Winchester St. their kayak
      capsized. The couple tried to swim to safety, but by
      the time the fire department arrived, the couple had
      drowned. Their bodies were recovered less than 20ft
      from the point where their kayak had capsized. The
      couple had become trapped. They were not trapped by
      solid objects, but by a dangerous current present in
      the river. This dangerous current developed just
      downstream of a small drop less than 3ft high as seen
      in Figure 1. The water on the surface of the river
      just below the drop was not moving downstream, but was
      moving upstream, back toward the drop. Figure 2 shows
      a longitudinal view of this type of current; due to
      the recirculating nature of the current it is often
      called a "roller" or "hydraulic".</p>
```

```
<div class=”figure”><img src=”images/WinStSign.JPG”
  /><p>Figure 1 - A couple drown at this site in August
  2010.</p></div><br /><br />
<div class=”figure”><img
  src=”images/Hydraulic%20Jump%20-%20Case%20C%20-
  %20Wright%20Water.bmp” /><p>Figure 2 - Profile view of
  a ”roller”. Courtesy of Wright Water Engineers, Inc.
  and ASDSO.</p></div>

<p>An important phenomenon responsible for dissipating
  energy in a channel is the hydraulic jump. A hydraulic
  jump occurs in a channel when shallow, high velocity
  (supercritical) water meets slower moving
  (subcritical) water. The short and turbulent
  transition between the two water depths is called a
  hydraulic jump. An image of a hydraulic jump can be
  seen in Figure 3. When there is a large amount of
  excess energy in a channel it can be dissipated by a
  hydraulic jump. At many overflow structures,
  especially large ones, a stilling basin may be
  installed to control and confine the resulting
  hydraulic jump. At many smaller low-head structures
  stilling basins are not installed, as a result the
  hydraulic jumps near these structures may not be well
  controlled. If the high energy water flowing over a
  drop structure (headwater) can force the water away
  from the downstream face of the structure, then a
  ”fully developed” hydraulic jump can occur, much like
  the one in Figure 4.  A fully developed hydraulic jump
  is relatively safe for human passage.</p>

<div class=”figure”><img src=”images/JumpInFlume.png”
  /><p>Figure 3 - A hydraulic jump in the lab. Flow
  moves toward the right.</p></div><br /><br />
<div class=”figure”><img
  src=”images/Hydraulic%20Jump%20-%20Case%20A%20-
  %20Wright%20Water.bmp” /><p>Figure 4 - Profile of a
  ”swept out” hydraulic jump.</p></div>

<p>The current can become dangerous when the water
  downstream of the structure (tailwater) is too deep
  for a fully developed hydraulic jump to form. Figure 5
  shows the situation where the current may pose a
  significant public safety hazard. This current occurs
  when the falling water, or nappe, meets a body of slow
  moving water and travels to the bottom of the channel.
  The water entrains a significant amount of air as it
  plunges to the bottom of the channel. Momentum causes
  the air entrained water to travel downstream along the
  bottom of the channel. Once the buoyant force of the
  entrained air can overcome the inertial forces of the
  water, it will begin to rise. The force of the rising
  air creates a strong current. By the time this current
```

has reached the surface it may be a significant distance downstream of the drop structure. Some of this water that has been forced to the surface will double back toward the drop structure creating an upstream current on the surface of the water. This type of current is a ”submerged” hydraulic jump. Energy is being dissipated, but the headwater does not have enough energy to push the tailwater away from the face of the structure.</p>

<div class=”figure”><p>Figure 5 - Anything that floats may get trapped in a submerged hydraulic jump.</p></div>

<p>There are a myriad of ways to prevent a submerged hydraulic jump from forming, however most solutions have serious drawbacks. Some points to consider when designing a retrofit include: cost, safety, energy dissipation, scour, sediment deposition, variable flow, fish passage, effects on headwater depth, and ice passage. For example, the current at Winchester St. develops just downstream of a box culvert, so any changes to headwater depths would be unacceptable.</p>
<p>To recommend mitigation measures for the dangerous current at Winchester St. on the Jordan River, a 1:23 scale model was built and tested by John Guymon in the BYU fluid mechanics laboratory. John’s model revealed that an apparent scour hole and deposition zone immediately downstream of the structure contributed to the formation and strength of the submerged hydraulic jump as seen in Figure 6. When the deposition was removed in the model, it was found that a weakened submerged jump occurred. If the deposition was left in place and the scour hole filled, a fully developed hydraulic jump occurred right at the face of the structure in the model. Although a fully developed jump at the face of the structure would pass a human, it is sensitive to tailwater depth, and would be susceptible to developing a submerged jump with even minor changes in the channel. With the model scour hole filled and the deposition removed, a swept out jump occurred a safe distance from the face of the structure. If the scour hole were to be filled, the material would have to be grouted into place to prevent scour or foot entrapment. A picture of the model can be seen in Figure 7.</p>

<div class=”figure”><p>Figure 6 - Depiction of Scour and Deposition Zones.</p></div>


```
        <div class="figure"><img src="images/JohnModel.jpg"
          /><p>Figure 7 - 1:23 scale model of the drop at
          Winchester St. Flow Starts at the top right and flows
          toward the bottom left.</p></div>

        <p>A promising solution that may be applied to any
          structure developing a submerged hydraulic jump is
          currently being developed and tested here at BYU. It
          is a design based on a crest modification used in the
          Northwest to safely pass juvenile salmon downstream; a
          lip is added to the spillway to redirect the velocity
          of the plunging nappe. A rough image of the concept
          can be seen in Figure 7. By nearly eliminating the
          downward velocity component in the plunging nappe, it
          may prevent air entrained water from traveling
          downstream along the bottom of the channel and prevent
          a boil area (Figure 5) from forming. It may also cause
          a swift downstream velocity along the channel surface,
          ensuring the safe passage of people. </p>

        <div class="figure"><img
          src="images/Modified%20Flip%20Lip%203D.bmp"
          /><p>Figure 7 - A modified flip-lip designed to
          prevent upstream surface velocities.</p></div><br
          /><br />

    </div>

  </body>
</html>
```

D.6 **input_form.php**

```
<html>
  <head>
    <title>Fatal Submerged Hydraulic Jumps</title>

    <!-- link
          href='http://fonts.googleapis.com/css?family=Alegreya+
          SC' rel='stylesheet' type='text/css' -->
    <link href="css/site.css" rel="stylesheet" type="text/css"
          />

    <meta http-equiv="Content-Type" content="text/html;
          charset=UTF-8">

<script type="text/javascript"
          src="https://maps.googleapis.com/maps/api/js?key=AIzaS
          yBXXGNS887tQiPKmvodZlVwvBcqYBsxLVw&sensor=false">
</script>
<?php
```

```
//Log into MySQL
include_once 'db_login.php';

//Input any new entries into the database
require_once 'handle_incident_input.php';

//Query the database. Create and sort site_array,
          incident_array, and verification_array
require_once 'query_sort.php';

//Trim the PHP arrays so they no longer include the contributors
          email address (for privacy)
require_once 'trim_emails.php';

//Transfer the PHP arrays to javascript
require_once 'arrays_to_javascript.php';

?>
<script type="text/javascript">
//Define globals
var marker = [];
var saved_site_name = null;
var saved_latitude = null;
var saved_longitude = null;
var saved_city = null;
var saved_county = null;
var saved_state = 0;
var map = null;
var mapOptions = null;

//Define globals
var total_fatalities = 0;
var max_fatalities = 0;
var max_fatalities_site = [];


//Add total fatalities to the site_array
if (Object.prototype.toString.call(site_array) === '[object
          Array]')
{
  for (i = 0, j = site_array[0].length ; i < site_array.length ;
          ++i)
  {
    site_array[i][j] = 0;
    for (k = 0 ; k < incident_array.length ; ++k)
    {
      //The first time this loop is run add up all the
          fatalities
      if (i == 0)
      {
        total_fatalities += parseInt(incident_array[k][1]);
      }
```

```
      if (incident_array[k][5] == site_array[i][0])
      {
        site_array[i][j] += parseInt(incident_array[k][1]);
      }
    }
  }
}

//Find the max fatalities at a single site
for (i = 0 ; i < site_array.length ; ++i)
{
  if (site_array[i][site_array[0].length - 1] > max_fatalities)
  {
    max_fatalities = site_array[i][site_array[0].length - 1];
    max_fatalities_site = [];
    max_fatalities_site[0] = i;
  }
  else if (site_array[i][site_array[0].length - 1] >
          max_fatalities)
  {
    max_fatalities_site.push(i);
  }
}

function onload()
{
  resize_headers();
  //Set initial settings for the map
  mapOptions =
  {
    //Set center of map as center for the contiguous US
    center: new google.maps.LatLng(39.828, -98.5795),
    zoom: 4,
    mapTypeId: google.maps.MapTypeId.HYBRID
  };

  //Load the map
  map = new
          google.maps.Map(document.getElementById('map_canvas_sm
          all'), mapOptions);

  geocoder = new google.maps.Geocoder();

  //Create a marker for when the user selects a new site. This
          marker is not visible yet. Also create an array to
          store all the markers.
  var latlng = new google.maps.LatLng(39.828, -98.5795);
  marker[0] = new google.maps.Marker(
    {
      position: latlng,
      title: "New Site Location"
    });
```

```
//This function runs when the user clicks on the map
google.maps.event.addListener(map, 'click', function(event)
{
  //Initialize geocoder
  var geocoder = new google.maps.Geocoder()

  //Clear relevant userform fields
  main_form.latitude.value = null;
  main_form.longitude.value = null;
  main_form.city.value = null;
  main_form.county.value = null;
  main_form.state.value = "0";

  //Show inputs, and hide incident info for other sites
  show_location_inputs();
  document.getElementById('incident_info').innerHTML = null;

  //Load coordinates into the user form
  main_form.latitude.value = event.latLng.lat();
  main_form.longitude.value = event.latLng.lng();

  //Prepare latitude and longitude
  latlng = new google.maps.LatLng(event.latLng.lat(),
        event.latLng.lng());

  //Get address info such as city and state from lat and long
  geocoder.geocode({'latLng': latlng}, function(results,
        status)
  {
    if (status == google.maps.GeocoderStatus.OK)
    {
      //Break down the three dimensional array into simpler
        arrays
      var super_var1 = results[0].address_components;
      for (i = 0 ; i < super_var1.length ; ++i)
      {
        var super_var2 = super_var1[i].types;
        for (j = 0 ; j < super_var2.length ; ++j)
        {
          //Find city
          if (super_var2[j] == "locality")
          {
            //Put the city name in the form
            main_form.city.value = super_var1[i].long_name;
          }
          //Find county
          if (super_var2[j] == "administrative_area_level_2")
          {
            //Put the county name in the form
            main_form.county.value = super_var1[i].long_name;
          }
          //Find State
```

```
          if (super_var2[j] == "administrative_area_level_1")
          {
            //Put the state abbreviation in the form
            main_form.state.value =
        super_var1[i].short_name.toUpperCase();
          }
        }
      }
    }
  });
  //Make reposition the marker for "New Site" and make it
        visible by assigning it to the map
  marker[0].setPosition(latlng);
  marker[0].setMap(map);

  //Set the location field to "New Location"
  main_form.site_id.value = "new";
});

//Create markers for all existing sites
var site_fatality_total = 0;
for (var i = 0; i < site_array.length; ++i)
{
  site_fatality_total = 0;
  for (j = 0 ; j < incident_array.length ; ++j)
  {
    if (incident_array[j][5] == site_array[i][0])
    {
      site_fatality_total += parseInt(incident_array[j][1]);
    }
  }
  //Title for the markers will show the site name,, number of
        fatalities, city, and state.
  if (site_array[i][4] == "")
  {
    var site_title = "Site Name: " + site_array[i][1] +
        "\nFatalities: " + site_array[i][12] + "\nCounty: " +
        site_array[i][5] + "\nState: " + site_array[i][6];
  }
  else
  {
    var site_title = "Site Name: " + site_array[i][1] +
        "\nFatalities: " + site_array[i][12] + "\nCity: " +
        site_array[i][4] + "\nState: " + site_array[i][6];
  }

  //Make the marker
  marker[site_array[i][0]] = new google.maps.Marker(
    {
      position: new google.maps.LatLng (site_array[i][2],
        site_array[i][3]),
      map: map,
      title: site_title
```

```
    });
  }


<?php
  //Add listeners to all the markers
  for ($i = 0 ; $i < count($site_array) ; ++$i)
  {
    echo "  google.maps.event.addListener(marker[" .
          $site_array[$i][0] . "] , 'click', function(event)\n";
    echo "  {\n";
    echo "    //This saves values in the user form to repopulate
          the form later if needed";
    echo "    saved_site_name = main_form.site_name.value;\n";
    echo "    saved_latitude = main_form.latitude.value;\n";
    echo "    saved_longitude = main_form.longitude.value;\n";
    echo "    saved_city = main_form.city.value;\n";
    echo "    saved_county = main_form.county.value;\n";
    echo "    saved_state = main_form.state.value;\n";
    echo "    //Select the site_id of the marker and clear the
          contents of the form relating to the location\n";
    echo "    main_form.site_id.value = " . $site_array[$i][0] .
          ";\n";
    echo "    main_form.site_name.value =  null;\n";
    echo "    main_form.latitude.value =  null;\n";
    echo "    main_form.longitude.value = null;\n";
    echo "    main_form.city.value = null;\n";
    echo "    main_form.county.value = null;\n";
    echo "    main_form.state.value = null;\n";
    echo "    marker[0].setMap(null);\n";
    echo "    show_incidents(" . $site_array[$i][0] . ");\n";
    echo "    ZoomToLocation(new google.maps.LatLng(" .
          $site_array[$i][2] . ", " . $site_array[$i][3] . "),
          16);\n";
    echo "  });\n\n";
  }
?>

//  SetMapWidth();
//  SetMapHeight();

}//end initialize()


//Validate the data in the user form before proceeding
function check_data()
{
  var check_data_errors = "";

  if (main_form.name_alias.value.length <= "3")
    check_data_errors += "-Please enter a name or alias that we
          may disply that is at least 3 characters long.\n\n";
  if (main_form.fatalities.value == "0")
```

```
  check_data_errors += "-Please select the number of
        fatalities.\n\n";
if (main_form.day.value == "-1")
  check_data_errors += "-For the date of the incident, please
        select a day or select \"Unknown\".\n\n";
if (main_form.month.value == "-1")
  check_data_errors += "-For the date of the incident, please
        select a month or select \"Unknown\".\n\n";

if (main_form.site_id.value == "-1")
{
  check_data_errors += "-For the location of the incident,
        please select an existing site, or select \"New
        Location\" to enter a new site.\n\n";
}
else if (main_form.site_id.value == "new")
{
  if (main_form.latitude.value == "")
    check_data_errors += "-Latitude is a required field.\n\n";
  if (main_form.longitude.value == "")
    check_data_errors += "-Longitude is a required
        field.\n\n";
  if (main_form.city.value == "" && main_form.county.value ==
        "")
    check_data_errors += "-Either the city or the county must
        be entered.\n\n";
  if (main_form.state.value == "0")
    check_data_errors += "-The state is a required
        field.\n\n";
}

if (main_form.verify_id.value == "-1")
{
  check_data_errors += "-For the verification document, please
        select an existing document, \"No Documentation\", or
        \"New Location\".\n\n";
}
else if (main_form.verify_id.value == "new")
{
  if (main_form.doc_name.value.length <= "7")
    check_data_errors += "-Your verification document name is
        less than 8 characters long ... you can do better than
        that.\n\n";
  if (main_form.doc_address.value == "" &&
        main_form.doc_file.value == "")
    check_data_errors += "-Either the a web address must be
        entered or a file selected.\n\n";
}

if (main_form.human_test.value != "sword")
{
```

```
    check_data_errors += "-Please verify that you are human in
          lowercase letters by filling in the blank with the
          word \"sword\".\n\n";
  }

  //If there aren't any errors then proceed. If there are errors
          then tell the user what to fix
  if (check_data_errors == "")
  {
    return true;
  }
  else
  {
    alert (check_data_errors);
    return false;
  }
}// end data_check

//This is for remembering the values the user input when they
          switch to an existing site
function site_change ()
{
  if (main_form.site_id.value == "new")
  {
    main_form.site_name.value = saved_site_name;
    main_form.latitude.value = saved_latitude;
    main_form.longitude.value = saved_longitude;
    main_form.city.value = saved_city;
    main_form.county.value = saved_county;
    main_form.state.value = saved_state;
    marker[0].setMap(map);
    show_location_inputs();
    document.getElementById('incident_info').innerHTML = null;
  }
  else if (main_form.site_id.value == "-1")
  {
    saved_site_name = main_form.site_name.value;
    saved_latitude = main_form.latitude.value;
    saved_longitude = main_form.longitude.value;
    saved_city = main_form.city.value;
    saved_county = main_form.county.value;
    saved_state = main_form.state.value;
    main_form.site_name.value = "";
    main_form.latitude.value = "";
    main_form.longitude.value = "";
    main_form.city.value = "";
    main_form.county.value = "";
    main_form.state.value = "0";
    marker[0].setMap(null);
    document.getElementById('incident_info').innerHTML = null;
    ZoomToLocation(new google.maps.LatLng(39.828, -98.5795), 4);
  }
  else
```

```
  {
    saved_site_name = main_form.site_name.value;
    saved_latitude = main_form.latitude.value;
    saved_longitude = main_form.longitude.value;
    saved_city = main_form.city.value;
    saved_county = main_form.county.value;
    saved_state = main_form.state.value;
    main_form.site_name.value = "";
    main_form.latitude.value = "";
    main_form.longitude.value = "";
    main_form.city.value = "";
    main_form.county.value = "";
    main_form.state.value = "0";
    marker[0].setMap(null);
    show_incidents(main_form.site_id.value);
  }
}


function show_incidents(show_id) //Display the incidents for the
          site in the "incident_info" span
{
  //Sort through the sites until you find the site_id of the
          site
  for (i = 0 ; i < site_array.length ; ++i)
  {
    //When we get to the site we are looking for, add it to the
          stuff_to_write
    if (site_array[i][0] == show_id)
    {
      stuff_to_write = "<h2>Incidents Recorded at \"" +
          site_array[i][1] + "\"</h2>\n"; // + " in " +
          site_array[i][4] + ", " + site_array[i][6];
      stuff_to_write += "<dl>\n";

      //Show location info in lieu of input fields
      show_location_info(i);

      //Stop the loop
      i = site_array.length;
    }
  }

  //Go through the incidents, when we find one that occured at
          our site_id, add the incedent to the stuff to write
  for (j = 0 ; j < incident_array.length ; ++j)
  {

    if(show_id == incident_array[j][5])
    {
      stuff_to_write += "<dt>";
```

```
if (incident_array[j][3] > 0 && incident_array[j][2] > 0)
    //If it had a known month and day
{
  if (incident_array[j][3] == 1) stuff_to_write +=
    incident_array[j][2] + "-Jan-" + incident_array[j][4];
  if (incident_array[j][3] == 1) stuff_to_write +=
    incident_array[j][2] + "-Jan-" + incident_array[j][4];
  if (incident_array[j][3] == 2) stuff_to_write +=
    incident_array[j][2] + "-Feb-" + incident_array[j][4];
  if (incident_array[j][3] == 3) stuff_to_write +=
    incident_array[j][2] + "-Mar-" + incident_array[j][4];
  if (incident_array[j][3] == 4) stuff_to_write +=
    incident_array[j][2] + "-Apr-" + incident_array[j][4];
  if (incident_array[j][3] == 5) stuff_to_write +=
    incident_array[j][2] + "-May-" + incident_array[j][4];
  if (incident_array[j][3] == 6) stuff_to_write +=
    incident_array[j][2] + "-Jun-" + incident_array[j][4];
  if (incident_array[j][3] == 7) stuff_to_write +=
    incident_array[j][2] + "-Jul-" + incident_array[j][4];
  if (incident_array[j][3] == 8) stuff_to_write +=
    incident_array[j][2] + "-Aug-" + incident_array[j][4];
  if (incident_array[j][3] == 9) stuff_to_write +=
    incident_array[j][2] + "-Sep-" + incident_array[j][4];
  if (incident_array[j][3] == 10) stuff_to_write +=
    incident_array[j][2] + "-Oct-" + incident_array[j][4];
  if (incident_array[j][3] == 11) stuff_to_write +=
    incident_array[j][2] + "-Nov-" + incident_array[j][4];
  if (incident_array[j][3] == 12) stuff_to_write +=
    incident_array[j][2] + "-Dec-" + incident_array[j][4];
}
else if (incident_array[j][3] > 0) //If it had a known
    month
{
  if (incident_array[j][3] == 1) stuff_to_write += "Jan-"
    + incident_array[j][4];
  if (incident_array[j][3] == 2) stuff_to_write += "Feb-"
    + incident_array[j][4];
  if (incident_array[j][3] == 3) stuff_to_write += "Mar-"
    + incident_array[j][4];
  if (incident_array[j][3] == 4) stuff_to_write += "Apr-"
    + incident_array[j][4];
  if (incident_array[j][3] == 5) stuff_to_write += "May-"
    + incident_array[j][4];
  if (incident_array[j][3] == 6) stuff_to_write += "Jun-"
    + incident_array[j][4];
  if (incident_array[j][3] == 7) stuff_to_write += "Jul-"
    + incident_array[j][4];
  if (incident_array[j][3] == 8) stuff_to_write += "Aug-"
    + incident_array[j][4];
  if (incident_array[j][3] == 9) stuff_to_write += "Sep-"
    + incident_array[j][4];
  if (incident_array[j][3] == 10) stuff_to_write += "Oct-"
    + incident_array[j][4];
```

```
        if (incident_array[j][3] == 11) stuff_to_write += ”Nov-”
          + incident_array[j][4];
        if (incident_array[j][3] == 12) stuff_to_write += ”Dec-”
          + incident_array[j][4];
      }
      else //If it only has a known year
      {
        stuff_to_write += incident_array[j][4];
      }

      //Add the number of fatalities
      if (incident_array[j][1] > 1)
      {
        stuff_to_write += ”, ” + incident_array[j][1] + ”
          Fatalities</dt>\n”;
      }
      else
      {
        stuff_to_write += ”, ” + incident_array[j][1] + ”
          Fatality</dt>\n”;
      }

      //Add description and end the list item
      stuff_to_write += ”<dd>” + incident_array[j][7] +
          ”</dd><br />\n”;
    }
  }

  //End the list
  stuff_to_write += ”</d1><br /><br />\n”;

  //Write all the incident info we have compiled
  document.getElementById(’incident_info’).innerHTML =
          stuff_to_write;
}


function show_location_info(show_id)
{
  document.getElementById(’site_name_input’).style.display =
          ”none”;
  document.getElementById(’site_image_input’).style.display =
          ”none”;
  document.getElementById(’latitude_input’).style.display =
          ”none”;
  document.getElementById(’longitude_input’).style.display =
          ”none”;
  document.getElementById(’city_input’).style.display = ”none”;
  document.getElementById(’county_input’).style.display =
          ”none”;
  document.getElementById(’state_input’).style.display = ”none”;
```

```
          document.getElementById('site_name_input_question').st
          yle.display = "none";

          document.getElementById('site_image_input_question').s
          tyle.display = "none";
  document.getElementById('lat_question').style.display =
          "none";
  document.getElementById('long_question').style.display =
          "none";
  document.getElementById('city_input_question').style.display =
          "none";
  document.getElementById('county_input_question').style.display
          = "none";
  document.getElementById('state_input_question').style.display
          = "none";

  document.getElementById('site_name_span').innerHTML =
          site_array[show_id][1];
  document.getElementById('site_image_span').innerHTML =
          site_array[show_id][9];
  document.getElementById('latitude_span').innerHTML =
          site_array[show_id][2];
  document.getElementById('longitude_span').innerHTML =
          site_array[show_id][3];
  document.getElementById('city_span').innerHTML =
          site_array[show_id][4];
  document.getElementById('county_span').innerHTML =
          site_array[show_id][5];
  document.getElementById('state_span').innerHTML =
          site_array[show_id][6];

  ZoomToLocation(new google.maps.LatLng(site_array[show_id][2],
          site_array[show_id][3]), 16);
}


function show_location_inputs()
{
  document.getElementById('site_name_input').style.display =
          "inline";
  document.getElementById('site_image_input').style.display =
          "inline";
  document.getElementById('latitude_input').style.display =
          "inline";
  document.getElementById('longitude_input').style.display =
          "inline";
  document.getElementById('city_input').style.display =
          "inline";
  document.getElementById('county_input').style.display =
          "inline";
  document.getElementById('state_input').style.display =
          "inline";
```

```
          document.getElementById('site_name_input_question').st
          yle.display = "inline";

          document.getElementById('site_image_input_question').s
          tyle.display = "inline";
  document.getElementById('lat_question').style.display =
          "inline";
  document.getElementById('long_question').style.display =
          "inline";
  document.getElementById('city_input_question').style.display =
          "inline";
  document.getElementById('county_input_question').style.display
          = "inline";
  document.getElementById('state_input_question').style.display
          = "inline";

  document.getElementById('site_name_span').innerHTML = null;
  document.getElementById('site_image_span').innerHTML = null;
  document.getElementById('latitude_span').innerHTML = null;
  document.getElementById('longitude_span').innerHTML = null;
  document.getElementById('city_span').innerHTML = null;
  document.getElementById('county_span').innerHTML = null;
  document.getElementById('state_span').innerHTML = null;
}


//function SetMapWidth()
//{
//  var x = 0;
//  if (self.innerHeight)
//  {
//    x = self.innerWidth;
//  }
//  else if (document.documentElement &&
          document.documentElement.clientHeight)
//  {
//    x = document.documentElement.clientWidth;
//  }
//  else if (document.body)
//  {
//    x = document.body.clientWidth;
//  }
//  x = x - 75;
//  document.getElementById('map_canvas').style.width = x +
          "px";
//  //document.getElementById('map_canvas').style.width =
          "750px";
//}
//
//function SetMapHeight()
//{
```

```
//  var y = 0;
//  if (self.innerHeight)
//  {
//    y = self.innerHeight;
//  }
//  else if (document.documentElement &&
          document.documentElement.clientHeight)
//  {
//    y = document.documentElement.clientHeight;
//  }
//  else if (document.body)
//  {
//    y = document.body.clientHeight;
//  }
//  y = y - 100
//  document.getElementById('map_canvas').style.height = y +
          "px";
//  //document.getElementById('map_canvas').style.height =
          "500px";
//}

function FindLocation()
{
  if(main_form.find_location.value != "")
  {
    var geocoderRequest = {address:
          main_form.find_location.value};
    geocoder.geocode(geocoderRequest, function(results, status){

      if(status == google.maps.GeocoderStatus.OK)
      {
        ZoomToLocation(results[0].geometry.location, 14);
      }
      else if (status ==
          google.maps.GeocoderStatus.ZERO_RESULTS)
      {
        alert("Google maps failed to find this location. It has
          returned \"ZERO_RESULTS\".");
      }
      else if (status ==
          google.maps.GeocoderStatus.OVER_QUERY_LIMIT)
      {
        alert("Google maps failed to find this location. It has
          returned \"OVER_QUERY_LIMIT\".");
      }
      else if (status ==
          google.maps.GeocoderStatus.REQUEST_DENIED)
      {
        alert("Google maps failed to find this location. It has
          returned \"REQUEST_DENIED\".");
      }
      else if (status ==
          google.maps.GeocoderStatus.INVALID_REQUEST)
```

```
      {
        alert("Google maps failed to find this location. It has
          returned \"INVALID_REQUEST\".");
      }
      else
      {

      }
    });
  }
}


function ZoomToLocation(newLatLng, newZoom)
{
  map.panTo(newLatLng);
  map.setZoom(newZoom);
}


function OpenHelp(item)
{
  if (item == "location_information")
    {
      alert("You may click on the map to select an existing
          location or to create a new location. The map will
          fill in the latitude, longitude, city, county, and
          state. The map may not be 100% accurate so please
          verify that this information is correct once it
          populates. If you do not know the exact location of a
          specific site please select the location to the best
          of your knowledge, but do not place it directly on the
          water.")
    }
  else if (item == "select_location")
    {
      alert("You may select an existing site or create a new one
          here. You may also click the map to select a site.")
    }
  else if (item == "site_name")
    {
      alert("The site name is a required field. The site name
          should include the river/canal name and a nearby
          landmark such as a cross street or park. The name
          should be short and descriptive. (e.g. \"Jordan River
          near 7800 South\" or \"Soldier Creek near the Thistle
          Shooting Range\".)")
    }
  else if (item == "site_image")
    {
      alert("If you have a picture of the site, you may upload
          it here. This is optional. Only one image may be
          uploaded per site")
```

```
  }
else if (item == ”lat_long”)
  {
    alert(”The latitude and longitude coordinates are required
        fields. If you do not know the latitude or longitude
        coordinates of the site, please find the site within
        the map and click it. The location informaion will be
        filled in for you.”)
  }
else if (item == ”city_input”)
  {
    alert(”Since some sites may not be within a municipality,
        the city field is not required. However either the
        city OR the county field is required for submission.
        You may click on the site within the map to populate
        these fields.”)
  }
else if (item == ”county_input”)
  {
    alert(”Either the city OR the county field is required for
        submission. You may click on the site within the map
        to populate these fields.”)
  }
else if (item == ”state_input”)
  {
    alert(”The state is a required field. You may click on the
        site within the map to populate this field.”)
  }
else if (item == ”incident_information”)
  {
    alert(”This is information partaining to a particular
        fatal incident. The number of fatalities and the year
        are required fields.”)
  }
else if (item == ”fatalities”)
  {
    alert(”Fatalities is a required field.”)
  }
else if (item == ”incident_description”)
  {
    alert(”Please describe all the relevant details of the
        incident. If known, please include whether signs were
        posted to warn of impending danger, swift-water rescue
        teams were deployed, fences were present to restrict
        access, PFD’s were worn, etc.”)
  }
else if (item == ”date”)
  {
    alert(”The year is a required field. If the day or month
        are not known you may select \”unknown\”.”)
  }
else if (item == ”verification_information”)
  {
```

```
    alert(”Verification information is not required. Since
        this form accepts public input, third party
        information is collected to provide a means of
        demonstrating the validity of entries. If no document
        is being referenced then please select the \”No
        Documents Available\” option for the \”Verification
        Document\” field.”)
  }
else if (item == ”verify_doc”)
  {
    alert(”You may indicate that you would like to add a new
        link or document to verify the incident that is being
        reported, to do this select \”New Document\”. If you
        have already referenced a site or a document you may
        reference it again by selecting it here. If you do not
        have a document to link to the incident you may select
        \”No Documents Available\”.”)
  }
else if (item == ”doc_name”)
  {
    alert(”If you are adding a document please choose a short
        name that describes where it is from and what type of
        document being referenced.”)
  }
else if (item == ”doc_description”)
  {
    alert(”A description is not required, but any information
        about the document is appreciated.”)
  }
else if (item == ”doc_address”)
  {
    alert(”If the document is available online, you may put
        the web address in this field. You may include a link
        and upload a file. Only one link can be submitted for
        each incident.”)
  }
else if (item == ”doc_file”)
  {
    alert(”Use this button to select a file stored on your
        computer. You may submit a file and a web address in
        this form. Only one file can be submitted for each
        incident.”)
  }
else if (item == ”Contributor Information”)
  {
    alert(”This is to give you kudos for your valuable
        contribution. The \”Name or Alias\” field is required.
        You do not need to use your real name (you may put
        \”anonymous\”). Your email address is not required.”)
  }
else if (item == ”name_alias”)
  {
```

```
      alert(”This is a required field that will be displayed
          publicly. If you do not wish to give your name or an
          alias you may put \”anonymous\”.”)
    }
  else if (item == ”contributor_email”)
    {
      alert(”Your email address is not required. Your email
          address will NEVER be displayed publicly. It will only
          be used if there are questions about any of the
          information submitted.”)
    }
  else if (item == ”human_test”)
    {
      alert(”Just type \”sword\” into the blank.”)
    }
}

function resize_headers()
{
  var h = document.getElementById(’current’).offsetHeight;
  document.getElementById(’header_tabs’).style.height = h +
          ”px”;
}

</script>
  </head>
  <body onload=”onload()”>

    <img id=”logo” src=”images/byuhomelogo.png” />

    <div id=”full_header”>
      <div id=”top_credits”>
        <p>Ira A. Fulton College of Engineering and
          Technology</p>
        <p>Civil & Environmental Engineering</p>
        <p><a href=”mailto:rhh@byu.edu” title=”Email Dr.
          Hotchkiss”>Dr. Rollin H. Hotchkiss</a></p>
        <p><a href=”mailto:eddiekern@gmail.com” title=”Email Ed
          Kern”>Edward Kern</a></p>
      </div>

      <div id=”header_tabs”>
        <ul id=”top_menu”>
          <li><a href=”index.php”>About Submerged Hydraulic
          Jumps</a></li>
          <li><a href=”browse.php”>Browse Incidents</a></li>
          <li id=”current”><a href=”input_form.php”>Report an
          Incident</a></li>
        </ul>
      </div>
    </div>

<div id=”content”>
```

```
<h1>Locations of Fatalities at Submerged Hydraulic Jumps
          [Beta]</h1>

<p style="text-align:center">Not all the fields are required.
          Click on the map to populate the location fields. If
          you are missing a required field you will be notified
          upon hitting the "Submit" button.</p><br /><br />

<form name="main_form" method="post" action="input_form.php"
          enctype="multipart/form-data" onSubmit="return
          check_data()">

  <table>
    <tr>
      <td colspan="2">
        <h2>Location Information<img src="/images/question.png"
          width="20" height="20"
          onclick="OpenHelp('location_information')" /></h2>
      </td>
    </tr>
    <tr>
      <td>
        Choose Location:
      </td>
      <td>
        <select name="site_id" onchange="site_change()">
          <option value="-1">Select Location</option>
          <option value="new">New Location</option>
<?php

  //Sort site_array by city and state
  foreach ($site_array as $key => $row)
  {
    $city[$key] = $row[4];
    $county[$key] = $row[5];
    $state[$key] = $row[6];
  }
  array_multisort($state, SORT_ASC, SORT_STRING, $city,
          SORT_ASC, SORT_STRING, $county, SORT_ASC, SORT_STRING,
          $site_array);

  //Fill in site options from the database
  for($i = 0 ; count($site_array) > $i ; ++$i)
  {
    if($site_array[$i][4] == "")
    {
      $city_county = $site_array[$i][5] + " County";
    }
    else
    {
      $city_county = $site_array[$i][4];
    }
```

```
    echo "          <option value=\"" . $site_array[$i][0] .
          "\">" . $site_array[$i][6] . " - " . $city_county . "
          - " . $site_array[$i][1] . "</option>\n";
  }
?>
        </select> <img src="/images/question.png" width="20"
          height="20" onclick="OpenHelp('select_location')" />
      </td>
    </tr>
    <tr>
      <td>
        Site Name:
      </td>
      <td>
        <input type="text" size="40" name="site_name"
          id="site_name_input" />
        <span id="site_name_span"></span><img
          id="site_name_input_question"
          src="/images/question.png" width="20" height="20"
          onclick="OpenHelp('site_name')" />
      </td>
    </tr>
    <tr>
      <td>
        Site Image:
      </td>
      <td>
        <input type="file" name="site_image"
          id="site_image_input" />
        <span id="site_image_span"></span><img
          id="site_image_input_question"
          src="/images/question.png" width="20" height="20"
          onclick="OpenHelp('site_image')" />
      </td>
    </tr>
    <tr>
      <td>
        Find Location:
      </td>
      <td>
        <input type="text" size="65" name="find_location"
          id="find_location_input" /><input type="button"
          name="find_location_button" value="Zoom to This
          Location" onclick="FindLocation()" />
        <img id="site_image_input_question"
          src="/images/question.png" width="20" height="20"
          onclick="OpenHelp('find_location')" />
      </td>
    </tr>
  </table>

  <div id="map_canvas_small"></div>
```

```
<table>
  <tr>
    <td>
      Latitude:
    </td>
    <td>
      <input type="text" name="latitude" id="latitude_input"
        />
      <span id="latitude_span"></span><img id="lat_question"
        src="/images/question.png" width="20" height="20"
        onclick="OpenHelp('lat_long')" />
    </td>
  </tr>
  <tr>
    <td>
      Longitude:
    </td>
    <td>
      <input type="text" name="longitude" id="longitude_input"
        />
      <span id="longitude_span"></span><img id="long_question"
        src="/images/question.png" width="20" height="20"
        onclick="OpenHelp('lat_long')" />
    </td>
  </tr>
  <tr>
    <td>
      City:
    </td>
    <td>
      <input type="text" name="city" id="city_input" />
      <span id="city_span"></span> <img
        id="city_input_question" src="/images/question.png"
        width="20" height="20"
        onclick="OpenHelp('city_input')" />
    </td>
  </tr>
  <tr>
    <td>
      County:
    </td>
    <td>
      <input type="text" name="county" id="county_input" />
      <span id="county_span"></span> <img
        id="county_input_question" src="/images/question.png"
        width="20" height="20"
        onclick="OpenHelp('county_input')" />
    </td>
  </tr>
  <tr>
    <td>
      State:
    </td>
```

```
<td>
  <select name="state" id="state_input">
    <option value="0">---</option>
    <option value="AL">Alabama</option>
    <option value="AK">Alaska</option>
    <option value="AZ">Arizona</option>
    <option value="AR">Arkansas</option>
    <option value="CA">California</option>
    <option value="CO">Colorado</option>
    <option value="CT">Connecticut</option>
    <option value="DE">Delaware</option>
    <option value="DC">District of Columbia</option>
    <option value="FL">Florida</option>
    <option value="GA">Georgia</option>
    <option value="HI">Hawaii</option>
    <option value="IA">Iowa</option>
    <option value="ID">Idaho</option>
    <option value="IL">Illinois</option>
    <option value="IN">Indiana</option>
    <option value="KS">Kansas</option>
    <option value="KY">Kentucky</option>
    <option value="LA">Louisiana</option>
    <option value="ME">Maine</option>
    <option value="MD">Maryland</option>
    <option value="MA">Massachusetts</option>
    <option value="MI">Michigan</option>
    <option value="MN">Minnesota</option>
    <option value="MS">Mississippi</option>
    <option value="MO">Missouri</option>
    <option value="MT">Montana</option>
    <option value="NE">Nebraska</option>
    <option value="NV">Nevada</option>
    <option value="NH">New Hampshire</option>
    <option value="NJ">New Jersey</option>
    <option value="NM">New Mexico</option>
    <option value="NY">New York</option>
    <option value="NC">North Carolina</option>
    <option value="ND">North Dakota</option>
    <option value="OH">Ohio</option>
    <option value="OK">Oklahoma</option>
    <option value="OR">Oregon</option>
    <option value="PA">Pennsylvania</option>
    <option value="RI">Rhode Island</option>
    <option value="SC">South Carolina</option>
    <option value="SD">South Dakota</option>
    <option value="TN">Tennessee</option>
    <option value="TX">Texas</option>
    <option value="UT">Utah</option>
    <option value="VT">Vermont</option>
    <option value="VA">Virginia</option>
    <option value="WA">Washington</option>
    <option value="WV">West Virginia</option>
    <option value="WI">Wisconsin</option>
```

```
        <option value="WY">Wyoming</option>
      </select>
      <span id="state_span"></span><img
        id="state_input_question" src="/images/question.png"
        width="20" height="20"
        onclick="OpenHelp('state_input')" />
    </td>
  </tr>
</table><br /><br /><br />

<span id="incident_info"></span>

<table>
  <tr>
    <td colspan="2">
      <h2>New Incident Information<img
        src="/images/question.png" width="20" height="20"
        onclick="OpenHelp('incident_information')" /></h2>
    </td>
  </tr>
  <tr>
    <td>
      Number of Fatalities:
    </td>
    <td>
      <select name="fatalities">
        <option value="0">---</option>
        <option value="1">1</option>
        <option value="2">2</option>
        <option value="3">3</option>
        <option value="4">4</option>
        <option value="5">5</option>
        <option value="6">6</option>
        <option value="7">7</option>
        <option value="8">8</option>
        <option value="9">9</option>
      </select><img src="/images/question.png" width="20"
        height="20" onclick="OpenHelp('fatalities')" />
    </td>
  </tr>
  <tr>
    <td valign="top">
      Incident Description:
    </td>
    <td valign="top">
      <textarea name="incident_description" cols="50"
        rows="10" maxlength="1027"></textarea><img
        valign="top" src="/images/question.png" width="20"
        height="20" onclick="OpenHelp('incident_description')"
        />
    </td>
  </tr>
  <tr>
```

```
<td>
  Date:
</td>
<td>
  <select name="day">
    <option value="-1">Day</option>
    <option value="0">Unknown</option>
    <option value="1">1</option>
    <option value="2">2</option>
    <option value="3">3</option>
    <option value="4">4</option>
    <option value="5">5</option>
    <option value="6">6</option>
    <option value="7">7</option>
    <option value="8">8</option>
    <option value="9">9</option>
    <option value="10">10</option>
    <option value="11">11</option>
    <option value="12">12</option>
    <option value="13">13</option>
    <option value="14">14</option>
    <option value="15">15</option>
    <option value="16">16</option>
    <option value="17">17</option>
    <option value="18">18</option>
    <option value="19">19</option>
    <option value="20">20</option>
    <option value="21">21</option>
    <option value="22">22</option>
    <option value="23">23</option>
    <option value="24">24</option>
    <option value="25">25</option>
    <option value="26">26</option>
    <option value="27">27</option>
    <option value="28">28</option>
    <option value="29">29</option>
    <option value="30">30</option>
    <option value="31">31</option>
  </select>
  <select name="month">
    <option value="-1">Month</option>
    <option value="0">Unknown</option>
    <option value="1">Jan</option>
    <option value="2">Feb</option>
    <option value="3">Mar</option>
    <option value="4">Apr</option>
    <option value="5">May</option>
    <option value="6">Jun</option>
    <option value="7">Jul</option>
    <option value="8">Aug</option>
    <option value="9">Sep</option>
    <option value="10">Oct</option>
    <option value="11">Nov</option>
```

```
    <option value="12">Dec</option>
  </select>
  <select name="year">
    <option value="1960">1960</option>
    <option value="1961">1961</option>
    <option value="1962">1962</option>
    <option value="1963">1963</option>
    <option value="1964">1964</option>
    <option value="1965">1965</option>
    <option value="1966">1966</option>
    <option value="1967">1967</option>
    <option value="1968">1968</option>
    <option value="1969">1969</option>
    <option value="1970">1970</option>
    <option value="1971">1971</option>
    <option value="1972">1972</option>
    <option value="1973">1973</option>
    <option value="1974">1974</option>
    <option value="1975">1975</option>
    <option value="1976">1976</option>
    <option value="1977">1977</option>
    <option value="1978">1978</option>
    <option value="1979">1979</option>
    <option value="1980">1980</option>
    <option value="1981">1981</option>
    <option value="1982">1982</option>
    <option value="1983">1983</option>
    <option value="1984">1984</option>
    <option value="1985">1985</option>
    <option value="1986">1986</option>
    <option value="1987">1987</option>
    <option value="1988">1988</option>
    <option value="1989">1989</option>
    <option value="1990">1990</option>
    <option value="1991">1991</option>
    <option value="1992">1992</option>
    <option value="1993">1993</option>
    <option value="1994">1994</option>
    <option value="1995" selected="selected">1995</option>
    <option value="1996">1996</option>
    <option value="1997">1997</option>
    <option value="1998">1998</option>
    <option value="1999">1999</option>
    <option value="2000">2000</option>
    <option value="2001">2001</option>
    <option value="2002">2002</option>
    <option value="2003">2003</option>
    <option value="2004">2004</option>
    <option value="2005">2005</option>
    <option value="2006">2006</option>
    <option value="2007">2007</option>
    <option value="2008">2008</option>
    <option value="2009">2009</option>
```

```
          <option value="2010">2010</option>
          <option value="2011">2011</option>
          <option value="2012">2012</option>
          <option value="2013">2013</option>
          <option value="2014">2014</option>
          <option value="2015">2015</option>
          <option value="2016">2016</option>
          <option value="2017">2017</option>
          <option value="2018">2018</option>
          <option value="2019">2019</option>
        </select><img src="/images/question.png" width="20"
          height="20" onclick="OpenHelp('date')" />
      </td>
    </tr>
  </table><br /><br /><br />


  <table>
    <tr>
        <td colspan="2">
          <h2>Verification Information<img
          src="/images/question.png" width="20" height="20"
          onclick="OpenHelp('verification_information')" /></h2>
        </td>
    </tr>
    <tr>
      <td>
        Verification Document:
      </td>
      <td>
        <select name="verify_id">
          <option value="-1">Please Choose an Option</option>
          <option value="new">New Document</option>
          <option value="0">No Documents Available</option>
<?php

  //Fill in verification options from the database
  for($i = 0 ; count($verification_array) > $i ; ++$i)
  {
    echo "          <option value=\"" .
          $verification_array[$i][0] . "\">" .
          $verification_array[$i][1] . "</option>\n";
  }
?>
        </select><img src="/images/question.png" width="20"
          height="20" onclick="OpenHelp('verify_doc')" />
      </td>
    </tr>
    <tr>
      <td>
        Document Name:
      </td>
      <td>
```

```
      <input type="text" name="doc_name" /><img
        src="/images/question.png" width="20" height="20"
        onclick="OpenHelp('doc_name')" />
    </td>
  </tr>
  <tr>
    <td valign="top">
      Document Description:
    </td>
    <td valign="top">
      <textarea name="doc_description" cols="50" rows="6"
        maxlength="1027"></textarea><img valign="top"
        src="/images/question.png" width="20" height="20"
        onclick="OpenHelp('doc_description')" />
    </td>
  </tr>
  <tr>
    <td>
      Document Web Address:
    </td>
    <td>
      <input type="text" name="doc_address" size="60" /><img
        src="/images/question.png" width="20" height="20"
        onclick="OpenHelp('doc_address')" />
    </td>
  </tr>
  <tr>
    <td>
      Upload Document:
    </td>
    <td>
      <input type="file" name="doc_file" /><img
        src="/images/question.png" width="20" height="20"
        onclick="OpenHelp('doc_file')" />
    </td>
  </tr>
</table><br /><br /><br />

<table>
  <tr>
      <td colspan="2"><h2>Contributor Information<img
        src="/images/question.png" width="20" height="20"
        onclick="OpenHelp('contributor_information')"
        /></h2></td>
  </tr>
  <tr>
    <td>
      Name or Alias:
    </td>
    <td>
      <input type="text" name="name_alias" /><img
        src="/images/question.png" width="20" height="20"
        onclick="OpenHelp('name_alias')" />
```

```
      </td>
    </tr>
    <tr>
      <td>
        Email Address:
      </td>
      <td>
        <input type="text" name="contributor_email" /><img
          src="/images/question.png" width="20" height="20"
          onclick="OpenHelp('contributor_email')" /> (Will never
          be displayed to the public)
      </td>
    </tr>
    <tr>
      <td colspan="2">
        <br /><br />
        Please verify that you are a person by filling in the
          blank. Use lowercase letters.<br>
        The pen is mightier than the <input type="text"
          name="human_test" /><img src="/images/question.png"
          width="20" height="20"
          onclick="OpenHelp('human_test')" />
      </td>
    </tr>
  </table><br /><br /><br />

  <input type="submit" value="Submit New Information"/>
</form>

  <br /><br />

</div>

  </body>
</html>
```

D.7 **query_sort.php**

```
<?php

//Query tables and return all their contents
$query_incident = "SELECT * FROM incident";
$query_site = "SELECT * FROM site";
$query_retrofit = "SELECT * FROM retrofit";
$query_verification = "SELECT * FROM verification";

//Populate $incident_array with the results of the MySQL query
$incident_array = array();
$result = mysql_query($query_incident);
If (!$result) die ("Database access failed: " . mysql_error());
$rows = mysql_num_rows($result);
```

```
for ($i = 0 ; $i < $rows ; ++$i)
{
  $row = mysql_fetch_row($result);
  $incident_array[$i] = array();
  for ($j = 0 ; $j < count($row) ; ++$j)
  {
    $incident_array[$i][$j] = $row[$j];
  }
}

//Populate $site_array with the results of the MySQL query
$site_array = array();
$result = mysql_query($query_site);
If (!$result) die ("Database access failed: " . mysql_error());
$rows = mysql_num_rows($result);
for ($i = 0 ; $i < $rows ; ++$i)
{
  $row = mysql_fetch_row($result);
  $site_array[$i] = array();
  for ($j = 0 ; $j < count($row) ; ++$j)
  {
    $site_array[$i][$j] = $row[$j];
  }
}

//Populate $verification_array with the results of the MySQL
          query
$verification_array = array();
$result = mysql_query($query_verification);
If (!$result) die ("Database access failed: " . mysql_error());
$rows = mysql_num_rows($result);
for ($i = 0 ; $i < $rows ; ++$i)
{
  $row = mysql_fetch_row($result);
  $verification_array[$i] = array();
  for ($j = 0 ; $j < count($row) ; ++$j)
  {
    $verification_array[$i][$j] = $row[$j];
  }
}

//Sort site_array by city and state
foreach ($site_array as $key => $row)
{
  $city[$key] = $row[4];
  $county[$key] = $row[5];
  $state[$key] = $row[6];
}
array_multisort($state, SORT_ASC, SORT_STRING, $city, SORT_ASC,
          SORT_STRING, $county, SORT_ASC, SORT_STRING,
          $site_array);

//Sort incident_array by year, month, day
```

```
foreach ($incident_array as $key => $row)
{
  $day[$key] = $row[2];
  $month[$key] = $row[3];
  $year[$key] = $row[4];
}
array_multisort($year, SORT_DESC, SORT_STRING, $month,
          SORT_DESC, SORT_STRING, $day, SORT_DESC, SORT_STRING,
          $incident_array);

//Sort verification_array by name
foreach ($verification_array as $key => $row)
{
  $name[$key] = $row[1];
}
array_multisort($name, SORT_ASC, SORT_STRING,
          $verification_array);
?>
```

D.8 **trim_emails.php**

```
<?php

//Eliminate the email addresses before returning the array
foreach ($incident_array as &$element)
{
    array_splice($element, 9, 1);
}
foreach ($site_array as &$element)
{
    array_splice($element, 10, 1);
}
foreach ($verification_array as &$element)
{
    array_splice($element, 6, 1);
}

?>
```

D.9 css/site.css

```
html, body
{
  height: 100%;
  width: 100%;
  padding: 0;
  margin: 0;
  border: none;
}
```

```
div#map_canvas
{
  width: 70%;
  height: 80%;
  padding: 0;
  margin-left: auto;
  margin-right:auto;
}

div#map_canvas_small
{
  width: 750px;
  height: 500px;
  padding: 0;
  margin: 0;
}

div#full_header
{
  margin: 0;
  padding: 0;
  box-shadow: 0 0 2px 2px #777;
}

div#header_tabs
{
  margin: 0;
  padding: 0;
  /*Background gradients compatible with all modern browsers*/
  background: #0e3e6f; /* Old browsers */
  background: -moz-linear-gradient(left, #0e3e6f 0%, #002255
          34%, #002255 66%, #0f3f7a 100%); /* FF3.6+ */
  background: -webkit-gradient(linear, left top, right top,
          color-stop(0%,#0e3e6f), color-stop(34%,#002255),
          color-stop(66%,#002255), color-stop(100%,#0f3f7a)); /*
          Chrome,Safari4+ */
  background: -webkit-linear-gradient(left, #0e3e6f 0%,#002255
          34%,#002255 66%,#0f3f7a 100%); /* Chrome10+,Safari5.1+
          */
  background: -o-linear-gradient(left, #0e3e6f 0%,#002255
          34%,#002255 66%,#0f3f7a 100%); /* Opera 11.10+ */
  background: -ms-linear-gradient(left, #0e3e6f 0%,#002255
          34%,#002255 66%,#0f3f7a 100%); /* IE10+ */
  background: linear-gradient(to right, #0e3e6f 0%,#002255
          34%,#002255 66%,#0f3f7a 100%); /* W3C */
  filter: progid:DXImageTransform.Microsoft.gradient(
          startColorstr='#0e3e6f',
          endColorstr='#0f3f7a',GradientType=1 ); /* IE6-9 */
}

div#top_credits
{
```

```
  box-sizing: border-box;
  width: 100%;
  font-family: Arial, Helvetica, sans-serif;
  text-align: right;
  margin: 0;
  padding: 10px;
  /*Background gradients compatible with all modern browsers*/
  background: #0e3e6f; /* Old browsers */
  background: -moz-linear-gradient(left, #0e3e6f 0%, #002255
          34%, #002255 66%, #0f3f7a 100%); /* FF3.6+ */
  background: -webkit-gradient(linear, left top, right top,
          color-stop(0%,#0e3e6f), color-stop(34%,#002255),
          color-stop(66%,#002255), color-stop(100%,#0f3f7a)); /*
          Chrome,Safari4+ */
  background: -webkit-linear-gradient(left, #0e3e6f 0%,#002255
          34%,#002255 66%,#0f3f7a 100%); /* Chrome10+,Safari5.1+
          */
  background: -o-linear-gradient(left, #0e3e6f 0%,#002255
          34%,#002255 66%,#0f3f7a 100%); /* Opera 11.10+ */
  background: -ms-linear-gradient(left, #0e3e6f 0%,#002255
          34%,#002255 66%,#0f3f7a 100%); /* IE10+ */
  background: linear-gradient(to right, #0e3e6f 0%,#002255
          34%,#002255 66%,#0f3f7a 100%); /* W3C */
  filter: progid:DXImageTransform.Microsoft.gradient(
          startColorstr='#0e3e6f',
          endColorstr='#0f3f7a',GradientType=1 ); /* IE6-9 */
}

div#top_credits p, div#top_credits p a, div#top_credits p
          a:visited
{
  color: #FFF;
  text-shadow: 3px 3px 2px #000;
  padding: 0;
  margin-top: 2px;
  margin-right: 0;
  margin-bottom: 2px;
  margin-left: 0;
  border:none;
  text-decoration: none;
}

div#top_credits p a:hover
{
  color: #0FF;
  text-shadow: 3px 3px 2px #000;
  padding: 0;
  margin-top: 2px;
  margin-right: 0;
  margin-bottom: 2px;
  margin-left: 0;
  border:none;
  text-decoration: none;
```

```
}

img#logo
{
  position: absolute;
  top: 15px;
  left: 15px;
}

div#about
{
  width: 850px;
  margin-left:auto;
  margin-right:auto;
  margin-top: 25px;
  margin-bottom:35px;
  padding: 0;
}

div#about h1.subH1
{
  margin-bottom: 0px;
  padding-bottom: 0px;
}

div#about p.subH1
{
  text-align: center;
  font-style: italic;
  font-size: medium;
  text-indent: 0;
}

div#content
{
  margin-left: 30px;
  margin-right: 30px;
  margin-top: 25px;
  margin-bottom:35px;
  padding: 0;
}

div.figure
{
  margin-left:auto;
  margin-right:auto;
}

div.figure img
{
  display: block;
  margin-left: auto;
```

```
  margin-right: auto;
  border: solid black;
}

div.figure p
{
  text-align: center;
  font-style: italic;
  font-size: smaller;
  text-indent: 0;
}

div.content
{
  width: 850px;
  margin-left: auto;
  margin-right: auto;
}

#top_menu
{
  list-style:none;
  height:2em;
  padding:0;
  margin:0;
  border: none;
}

#top_menu li
{
  float:left;
  margin-right:0.13em;
  margin-top: 0;
  margin-bottom: 0;
}

#top_menu li a
{
  display:block;
  height: 2em;
  padding:0 1em;
  text-decoration:none;
  border:0.06em solid #000;
  border-bottom:0;
  font:bold 0.88em/2em arial,geneva,helvetica,sans-serif;
  color:#000;
  background-color:#ccc;
  margin-top: 0;
  margin-bottom: 0;

  /* CSS 3 elements */
  -webkit-border-top-right-radius:0.50em;
  -webkit-border-top-left-radius:0.50em;
```

```
  -moz-border-radius-topright:0.50em;
  -moz-border-radius-topleft:0.50em;
  border-top-right-radius:0.50em;
  border-top-left-radius:0.50em;
}

#top_menu li a:hover
{
  background:#39C;
  color:#fff;
  text-decoration:none;
}

#top_menu li#current a
{
  background-color: #777;
  color: #fff;
}

#top_menu li#current a:hover
{
  background: #777;
  color: #000;
}

table.border_table
{
  border: 1px;
  border-color: black;
}

.border_table td
{
  border: 1px;
  border-color: black;
  vertical-align: top;
}

h1
{
  text-align: center;
}
```