CUY-90-14.90

PID 77332/85531

APPENDIX DR-05

Southerly Modeling Report Full Document
(Reference Document)

State of Ohio
Department of Transportation
Jolene M. Molitoris, Director

Innerbelt Bridge
Construction Contract Group 1 (CCG1)

Revision Date: August 23, 2006

Northeast Ohio Regional Sewer District

Southerly CSO Phase II
Hydraulic Modeling Report

May 2002

Metcalf & Eddy

CH2MHILL

TABLE OF CONTENTS

CHAPTER FOUR – COLLECTION SYSTEM MODEL DEVELOPMENT

CHAPTER FIVE– COLLECTION SYSTEM MODEL CALIBRATION

CHAPTER SIX – BASELINE CONDITIONS

LIST OF ATTACHMENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS

CCTV	Closed Circuit Televising
CSO	Combined Sewer Overflow
CVI	Cuyahoga Valley Interceptor
DCIA	Directly Connected Impervious Area
DTM	Digital Terrain Model
EMSC	Environmental Maintenance and Service Center
EPA	Environmental Protection Agency
Ft	Feet or foot
In	Inch or Inches
I/I	Infiltration/Inflow
LTCP	Long term control plan
MCI	Mill Creek Interceptor
NEORSD	Northeast Ohio Regional Sewer District
PID	Proportional-Integral-Differential
RDII	Rainfall Derived Inflow and Infiltration
RTC	Real Time Control
SCADA	Supervisory Control and Data Acquisition
SSES	Sewer System Evaluation Survey
SWI	Southwest Interceptor
SWMM	Storm Water Management Model
WWTP	Waste Water Treatment Plant

CHAPTER ONE
INTRODUCTION

In 1994, the Northeast Ohio Regional Sewer District (NEORSD) completed Phase I of the Combined Sewer Overflow (CSO) Facilities Plan Study. This study recommended a more comprehensive and consolidated facilities planning study of CSO Control in the Southerly Service area. Accordingly, the District has undertaken the Southerly District Combined Sewer Overflow Phase II Facilities Plan. This Collection System Model Development and Verification report describes the collection system modeling performed for the Phase II Facilities Plan.

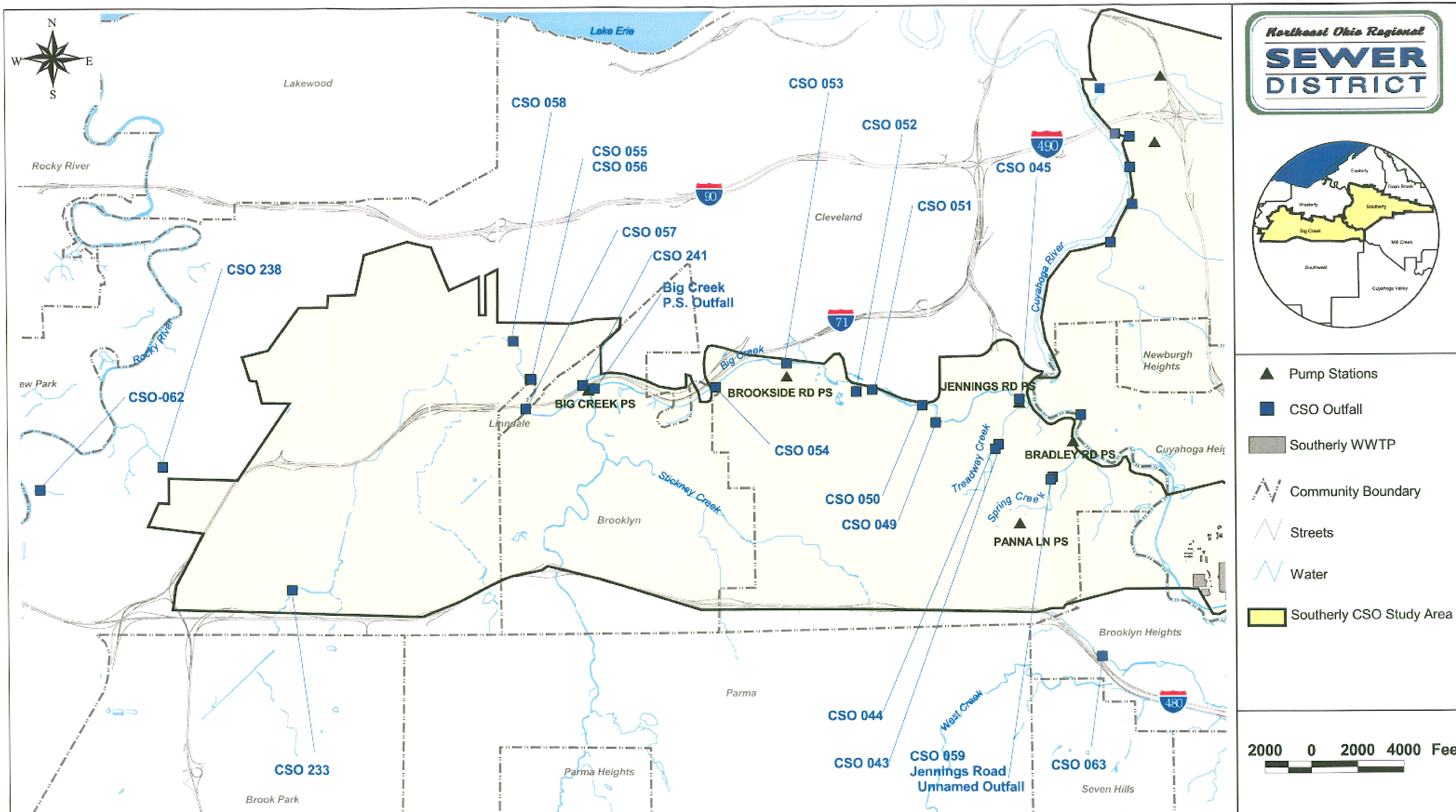
The goal of the Phase II study was to develop a wet weather Long-Term Control Plan (LTCP) for the Southerly District that minimizes the CSO impact on receiving waters, as required by the Environmental Protection Agency's (EPA) CSO Policy. This required that the collection system be modeled in far greater detail than in the Phase I Study.

Scope

This report documents the development and verification of a detailed hydraulic model of the Southerly CSO Study Area collection system, shown in Figure 1-1. The model was developed under Task B-3, as part of the CSO Phase II Facilities Plan. The calibrated model was used in the facilities plan to evaluate existing conditions, conduct a baseline assessment, and evaluate various control alternatives.

This report is divided into five chapters as described below:

<u>Study Area Collection System Description</u>: Chapter Two describes the physical extents of the Southerly Collection System. The service area characteristics are given on an outfall by outfall basis. The interceptors and culverts are also described in this chapter.

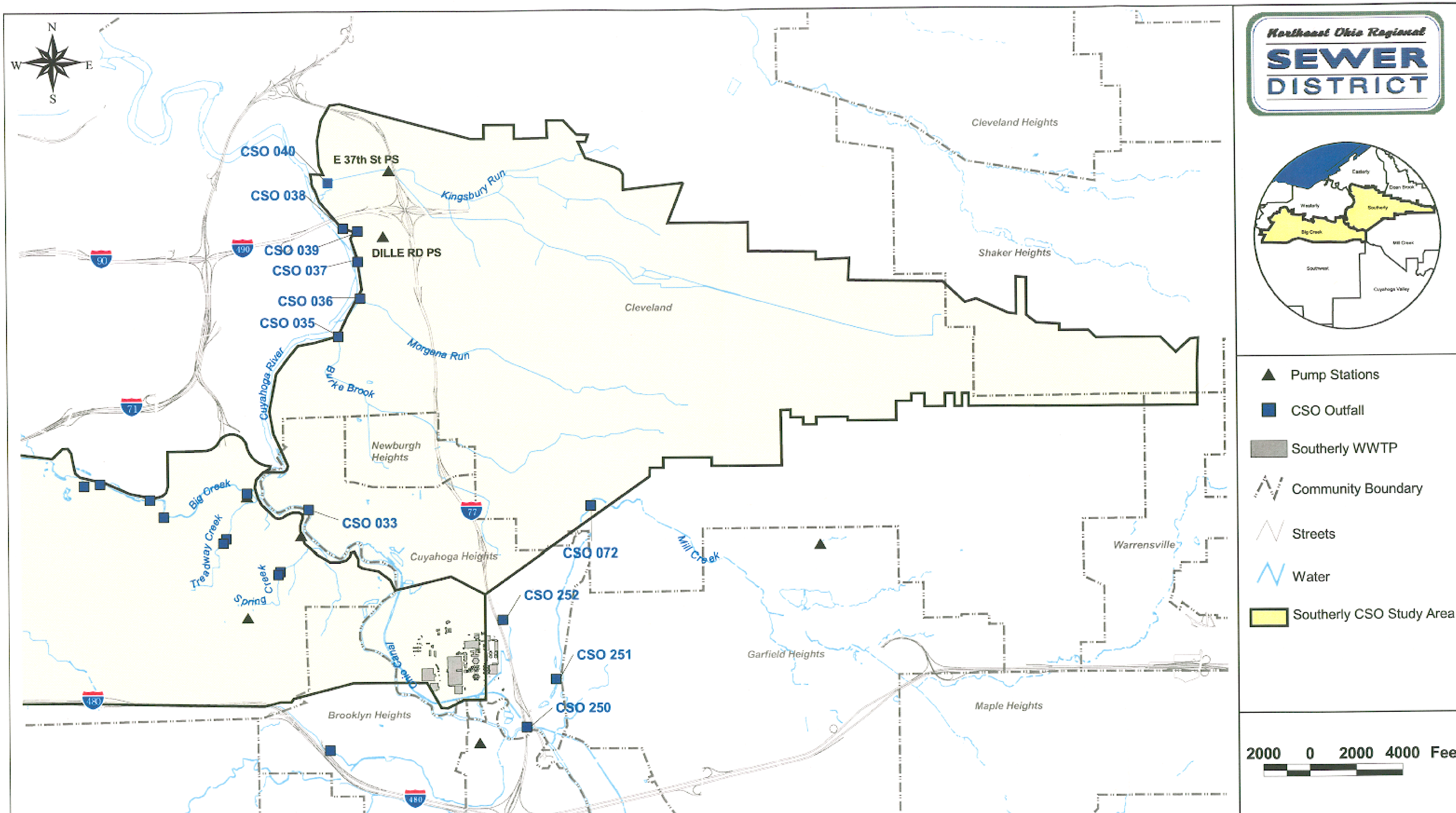


M&E Metcalf & Eddy

Southerly CSO Phase II Facilities Plan

CH2MHILL

Figure 1-1a. Southerly CSO Study Area



Northeast Ohio Regional SEWER DISTRICT

M&E Metcalf & Eddy

Southerly CSO Phase II Facilities Plan

CH2MHILL

Figure 1-1b. Southerly CSO Study Area

Collection System Monitoring Program: Chapter Three details the rainfall monitoring program and presents rainfall statistics. The flow monitoring program and results are also discussed in this chapter.

Collection System Model Development: A description of the software used to create the model is presented in Chapter Four. A description of the model network and the criteria for determining what was modeled is also addressed in this chapter. Modeling parameters for dry and wet weather flows are presented in this chapter.

Collection System Model Calibration: Chapter Five details the calibration process and the issues associated with the model calibration. Calibration results, accuracy and suitability for use are presented in this chapter.

Baseline Conditions: Chapter Six describes the baseline conditions for the Southerly system.

CHAPTER TWO

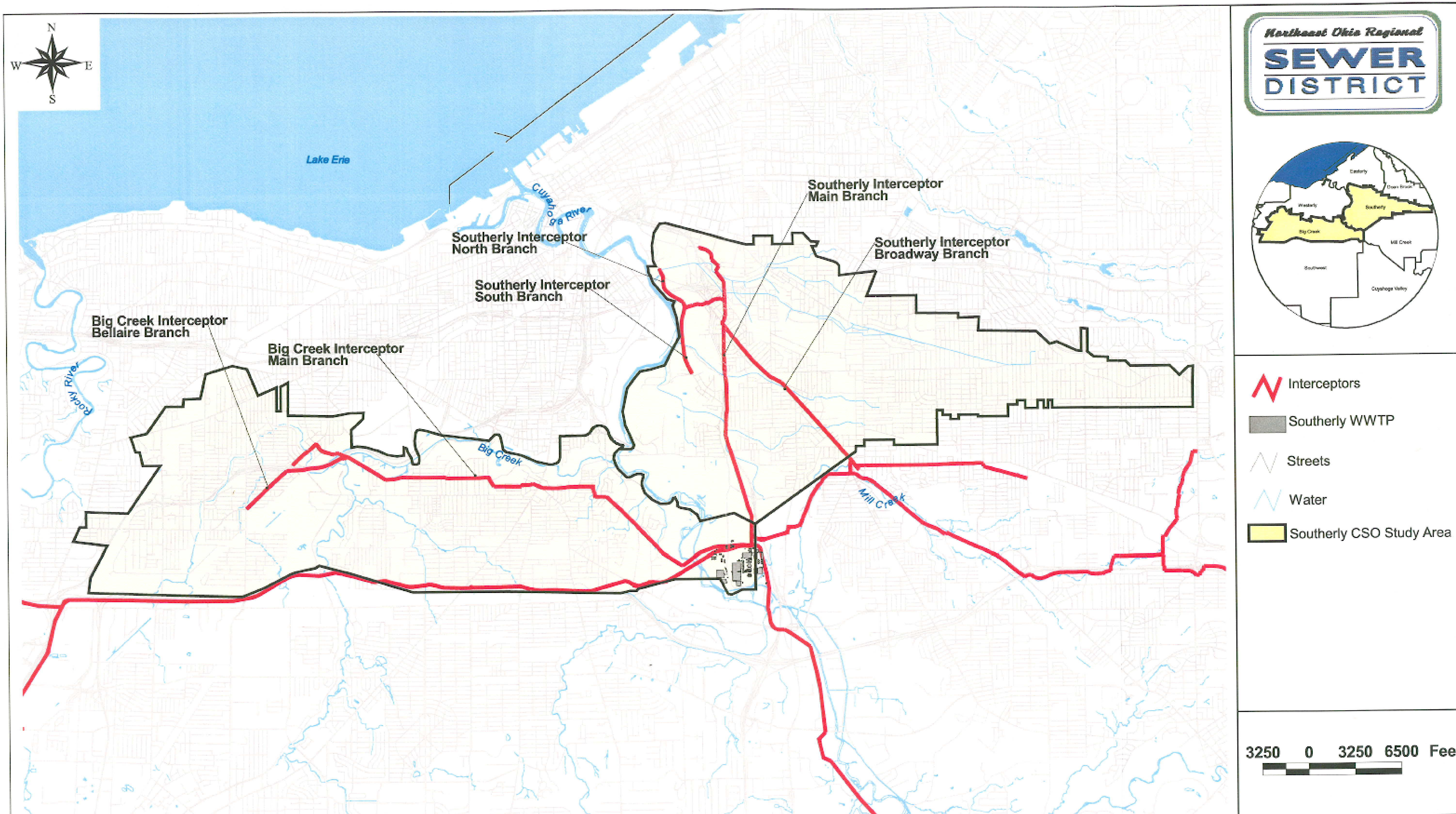
COLLECTION SYSTEM DESCRIPTION

The existing facilities of the Southerly District are presented in detail in this chapter. The facilities are grouped according to function. Combined sewer overflows are further grouped by receiving water. The collection system facilities described include interceptors, combined and separate sewers, regulators, overflows, pump stations and the Southerly WWTP. Southerly District facilities described include the portions of the system owned, operated and maintained by the NEORSD (hereafter referred to as the District); the interceptor system; CSO outfalls and the treatment plant.

The Southerly collection system covers approximately 168,000 acres. The combined sewer area is approximately 16,000 acres, and includes roughly 3,000 acres of isolated pockets of separate sanitary sewer areas that discharge to combined sewers.

The facilities identified in this chapter represent the major combined sewer facilities within the Southerly District and are not intended to describe ownership or maintenance responsibilities. The major collection system components conveying wastewater in the Southerly District can be grouped into five different interceptor systems: Southerly Interceptor, Big Creek Interceptor, Mill Creek Interceptor, Cuyahoga Valley Interceptor, and the Southwest Interceptor, as illustrated in Figure 2-1. The Mill Creek Interceptor, Cuyahoga Valley Interceptor, and Southwest Interceptor were not included in this project's scope. Table 2-1 identifies the interceptors and branch sewers in the Southerly service area.

The receiving waters for the storm and CSO flows from the Southerly service area are the Cuyahoga River, Treadway Creek, Big Creek, Spring Creek, West Creek, Rocky River, Mill Creek and Ohio Canal. The receiving waters are described later in the chapter.



Metcalf & Eddy

Southerly CSO Hydraulic Modeling Report

CH2MHILL

Figure 2-1. Interceptors in Southerly District

Table 2-1. Southerly District Interceptor Sewers*

Area	Main and Tributary Sewers

Southerly Interceptors	• Southerly Main
	  • Broadway Branch
	  • Independence South Branch
	  • Independence North Branch

Big Creek Interceptors	• Big Creek Main • Bellaire Branch
Mill Creek Interceptor	Combined sewer service area, studied separately
Cuyahoga Valley Interceptor	Separate sanitary service area
Southwest Interceptor	Separate sanitary service area

**Owned by the NEORSD.*

DESCRIPTION OF MAJOR COLLECTION AND TREATMENT SYSTEM COMPONENTS

The following sections describe the major components of the collection system consisting of pump stations, automated regulators, interceptors, major combined sewer conduits, CSO outlets and tributary regulators. The figures that accompany this section illustrate the facilities described in the text. Detailed descriptions of regulators tributary to each CSO are provided later in this chapter.

There are 17 automated regulators in the Southerly CSO study area. These automated regulators are listed in Table 2-2. The automated regulators are usually installed at CSO locations and are typically used to maximize in-system storage, limiting the amount of overflows that occur for smaller storm events. They also function to regulate and limit the amount of flow discharging to the Southerly and Big Creek interceptors, preventing the interceptors from becoming overloaded. The automated gates and dams are controlled based on water level set points near each regulator. A detailed description of the modeling, calibration and set points for each regulator are provided in the Southerly CSO Hydraulic Modeling Report (Metcalf & Eddy, Inc. March, 2002).

Table 2-2. Southerly CSO Area Automated Regulators

Regulator	Type of Control	Location	Dry Weather Discharge Interceptor	Overflow Discharge
BC1	KG, SG	Valley/Elston	Big Creek	Big Creek
BC2	PV, SG	Spring/Jennings	Big Creek	Spring Creek
BC3	PV, SG	South Hills/Irving	Big Creek	Treadway Creek
BC4	PV, FB	W15th/Tarlton	Big Creek	Treadway Creek
BC5	PV, SG	Jennings/Big Creek	Big Creek	Big Creek
BC6	FB	W18th/Denison	Big Creek	In-Line Storage
BC7	TG, FB	Bellaire/Kensington	Big Creek	Big Creek
BC8	KG, SG	W145th/Puritas	Big Creek	Big Creek
BC9	TG, FB	W38th/Muriel	Big Creek	Big Creek
SO1	KG, SG	E78th/Harvard	Southerly	Mill Creek
SO2	PV, SG	Burke Brook	Southerly	Burke Brook
SO3	KG, SG	Woodhill/Mt. Auburn	Southerly	Kingsbury Relief
SO4	KG, FB	E93rd/Carton	Southerly	Kingsbury Relief
SO5	KG, SG	E79th/Garden Valley	Southerly	Kingsbury Relief
SO6	KG, SG	E93rd/Kinsman	Southerly	Kingsbury Relief
SO7	KG, FB	E94th/Kinsman	Southerly	Kingsbury Relief
SO8	KG, FB	Kingsbury/Carton	Southerly	Kingsbury Relief

Notes:
Type of Control for dry weather and overflow discharge: KG – Knife Gate, SG – Storm Gate, PV – Plug Valve, FB – Fabridam, TG – Timber Gate

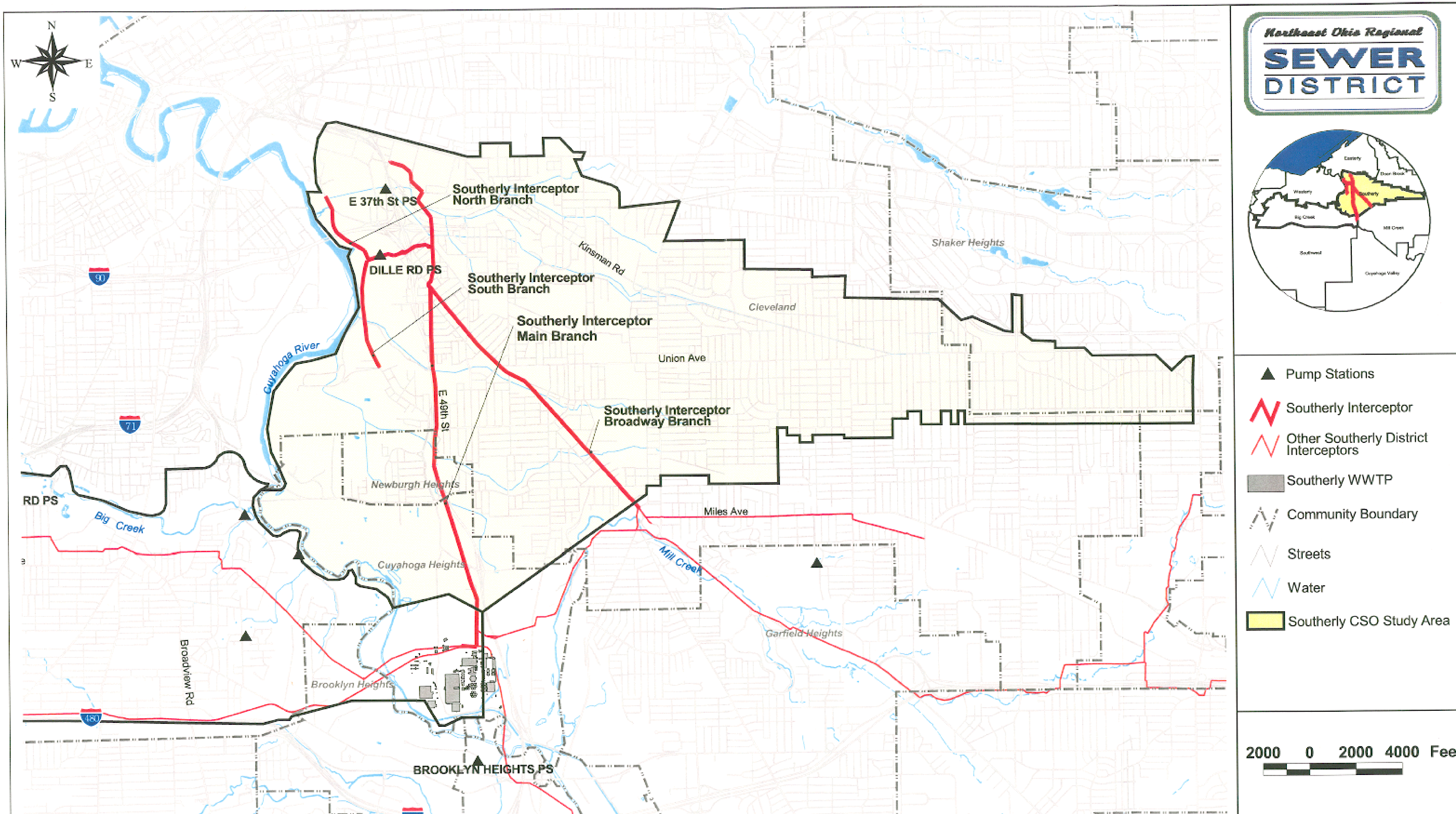
There are seven pump stations that discharge directly to Southerly District facilities, or impact CSO conveyance and/or overflows within the Southerly CSO area. These pump stations are described in Table 2-3. Narrative descriptions of the conveyance routes associated with these pump stations are provided in the interceptor system descriptions.

Table 2-3. Southerly CSO Area Pump Stations

Pump Station	Owner	Pump Type(s)	Capacity (gpm)	Total Dynamic Head (feet)	Force Main Diameter
Big Creek	NEORSD	3 – Fairbanks Morse 75 horsepower	3300	166	16
Bradley Road	Cleveland	2 – Crane Deming 5 horsepower	250	21	6
Brookside Park	Cleveland	2 – Smith and Loveless 20 horsepower	200	102	6
Dille Avenue	NEORSD	2 – Fairbanks Morse 100 horsepower 1 – Fairbanks Morse 50 horsepower	3000 1500	82 76	24
Jennings Road	NEORSD	3 – Fairbanks Morse 75 horsepower	1100	122	16
East 37th Street and Trumbull Avenue	Cleveland	2 - Gorman Rupp 40 horsepower	700	97.6	8
Panna Lane	Cleveland	2 – Smith and Loveless 5 horsepower	350	30	6

Southerly Interceptor

Figure 2-2 shows the Southerly Interceptor alignment. The Southerly Interceptor constitutes one of five interceptor systems providing flow to the Southerly WWTP. The others are the Big Creek, Mill Creek, Southwest and Cuyahoga Valley interceptors. The Southwest and Cuyahoga Valley interceptors are not discussed in this chapter. The Southerly Interceptor system consists of four branches including Main, Broadway, Independence North, and Independence South.



M&E Metcalf & Eddy

Southerly CSO Hydraulic Modeling Report

CH2MHILL

Figure 2-2. Southerly Interceptors

There are two pump stations within the study area that lift flows from low-lying areas to the Southerly Interceptor system. The Dille Road Pump Station lifts flow from the industrial areas along the Cuyahoga River connecting the Independence South and North branches to the Southerly Interceptor. The East 37th Street and Trumbull Avenue Pump Station lifts flow from the Kingsbury Run valley and ultimately to the main branch of the Southerly Interceptor at a point north of I-490.

The Southerly Interceptor is made up of large diameter, egg-shaped brick pipes. The various size configurations for egg-shaped sewers are provided in Table 2-4 for reference.

Table 2-4. Egg-shaped Sewer Sizes

Egg-shaped Sewer Number	Size
No. 4	39 inch by 31 inch
No. 5	45 inch by 36 inch
No. 6	51 inch by 40 inch
No. 7	56 inch by 44 inch
No. 8	61 inch by 48 inch
No. 9	66 inch by 52 inch
No. 10	71 inch by 56 inch
No. 11	76 inch by 60 inch

Routing

Main Branch

The main branch of the Southerly Interceptor begins as a No. 9 brick egg-shaped sewer at the intersection of East 37th Street and Croton Avenue and travels southeast for 1,295 feet to East 40th Street. The interceptor decreases to a No. 7 egg-shaped sewer and continues to the southeast to a manhole north of I-490. Here, the interceptor increases to a 75 inch by 63 inch oval-shaped sewer and travels along East 49th Street. The interceptor increases in size to an 87 inch circular brick pipe just upstream of the dry weather connection from Regulator S-1, and transitions to a 102 inch circular brick pipe just downstream of the dry weather connection from Regulator S-2A at the Morgana Run culvert. The pipe continues south to the Southerly Wastewater Treatment Plant as 102 inch circular brick pipe.

Broadway Branch

The Broadway branch of the Southerly Interceptor begins as a No. 7 brick egg-shaped sewer at the intersection of Broadway Avenue and Miles Avenue and flows to the northwest following Broadway Avenue. At Harvard Avenue, the pipe joins with a 36 inch pipe and flows west to automated Regulator SO1, located just west of East 78th Street on Harvard Avenue.

North of the Harvard/Broadway intersection, the No. 7 brick egg-shaped sewer begins again and travels north for five pipe reaches, changes to a 42 inch circular brick for one reach, and returns to a No. 7 brick egg-shaped sewer for one reach. Along this reach of No. 7 sewer, an unnamed cast-iron overflow structure (flow divider SS-15 in the model) directs overflow to the Burke Brook culvert at Worley Avenue. Downstream of this regulator, the interceptor changes to a 36 inch circular ductile iron pipe for one reach and then becomes a 42 inch circular brick pipe between Wire Avenue and East 71st Street.

Between East 78th and East 71st Street, a relief sewer ranging in size between 27 inch and 42 inch diameter flows parallel to the Broadway Branch sewer. The first two pipe reaches of the relief sewer are 27 inch diameter, and then it transitions to a 30 inch pipe for one reach. At Marble Avenue, the 30 inch pipe meets with another flow split from the 42 inch, and increases in size to a 36 inch that enlarges to a 42 inch at Fullerton Avenue. Another flow split from the Broadway branch to the relief sewer occurs at Osage Avenue. The relief sewer and the Broadway branch reconnect at East 71st Street and the sewer becomes a 48 inch reinforced concrete pipe until reaching Regulator S-60 at Forman Avenue.

At Regulator S-60, the interceptor changes to a 36 inch brick sewer for one reach, becomes a 48 inch brick circular pipe for one reach, and decreases to a diameter of 38 inch at Regulator S-61 at Baxter Avenue. Just south of Aetna Road, the pipe returns to a

No. 6 brick egg-shaped pipe to flow divider 2284 (SS-9 in the model) at Union Avenue. At flow divider 2284, the pipe size transitions to a No. 5 egg-shaped sewer for four reaches and then back to a No. 6 brick egg at Hamlet Avenue. At Barkwill Avenue, the interceptor branch enters flow divider 2283 (SS-3 in the model) directing dry weather flow to the west in a No. 7 brick egg for one pipe length and then a No. 8 brick egg-shaped pipe following Barkwill Avenue. The overflow from 2283 continues northwest along Broadway Avenue as a No. 5 brick egg-shaped sewer for one pipe reach before changing back to a No. 6 egg until it reaches East 49th Street and Broadway Avenue. Here, the interceptor enters an unnamed flow divider (SS-7 in the model) that directs wet weather flow to regulator S-1A at Broadway and Gallup Avenue. The dry weather flow travels south in a No. 7 egg-shaped sewer following East 49th Street. Following East 49th Street south, the interceptor travels two reaches, changes to a No. 8 egg for one reach, and then changes to a No. 9 brick egg for three reaches. It then becomes a No. 10 egg-shaped sewer for two reaches before changing to a 75 inch circular brick pipe at Barkwill Avenue on East 49th Street, and the No. 8 egg-shaped sewer carrying dry weather flow from 2283 joins at a blind connection. The pipe increases in diameter to 78 inch at Hamm Avenue. After one reach, it increases again to 81 inch at Guy Avenue and continues until it is picked up by the main branch of the Southerly Interceptor, approximately 350-feet south of Dalton Avenue at East 49th Street at Regulator S-1.

Independence South

The Independence South branch of the Southerly Interceptor serves the low-lying industrial areas along the Cuyahoga River. Beginning at the intersection of Independence Road and Stillson Avenue as a 12 inch circular vitrified clay pipe, the interceptor flows north for eight pipe reaches where the pipe increases in diameter to 18 inch for one reach and increases again to 24 inch for two reaches. The interceptor then increases in diameter to 36 inch, flows through Regulator S-83 (900 feet south of Dille Road on Independence Road), and flows north to Dille Road where the pipe turns and flows East to the Dille Road Pump Station. The force main outlet from the pump station is a 24 inch circular cast in-place, which flows for approximately 650 feet until the pipe discharges to a 60 inch circular brick pipe that flows to the main branch of the Southerly interceptor near the intersection of Nursery Avenue and Track Avenue.

Independence North

The Independence North branch of the Southerly Interceptor begins at Regulator S-81 north of the intersection of Independence Road and Broadway Avenue as a 12 inch RCP. From here it flows southeast as a 12 inch circular reinforced concrete pipe for three reaches. It continues south along Independence Road as a 60 inch circular reinforced concrete pipe for two reaches. Near I-490 the pipe changes to a 60 inch circular reinforced concrete for two reaches. Here it decreases in size to a 30 inch circular reinforced concrete pipe for one reach, flows through Regulator S-82 located 1200 feet north of Dille Road on Independence Road, and becomes a 30 inch vitrified clay pipe until it joins with the Independence South branch at the intersection of Independence Road and Dille Avenue.

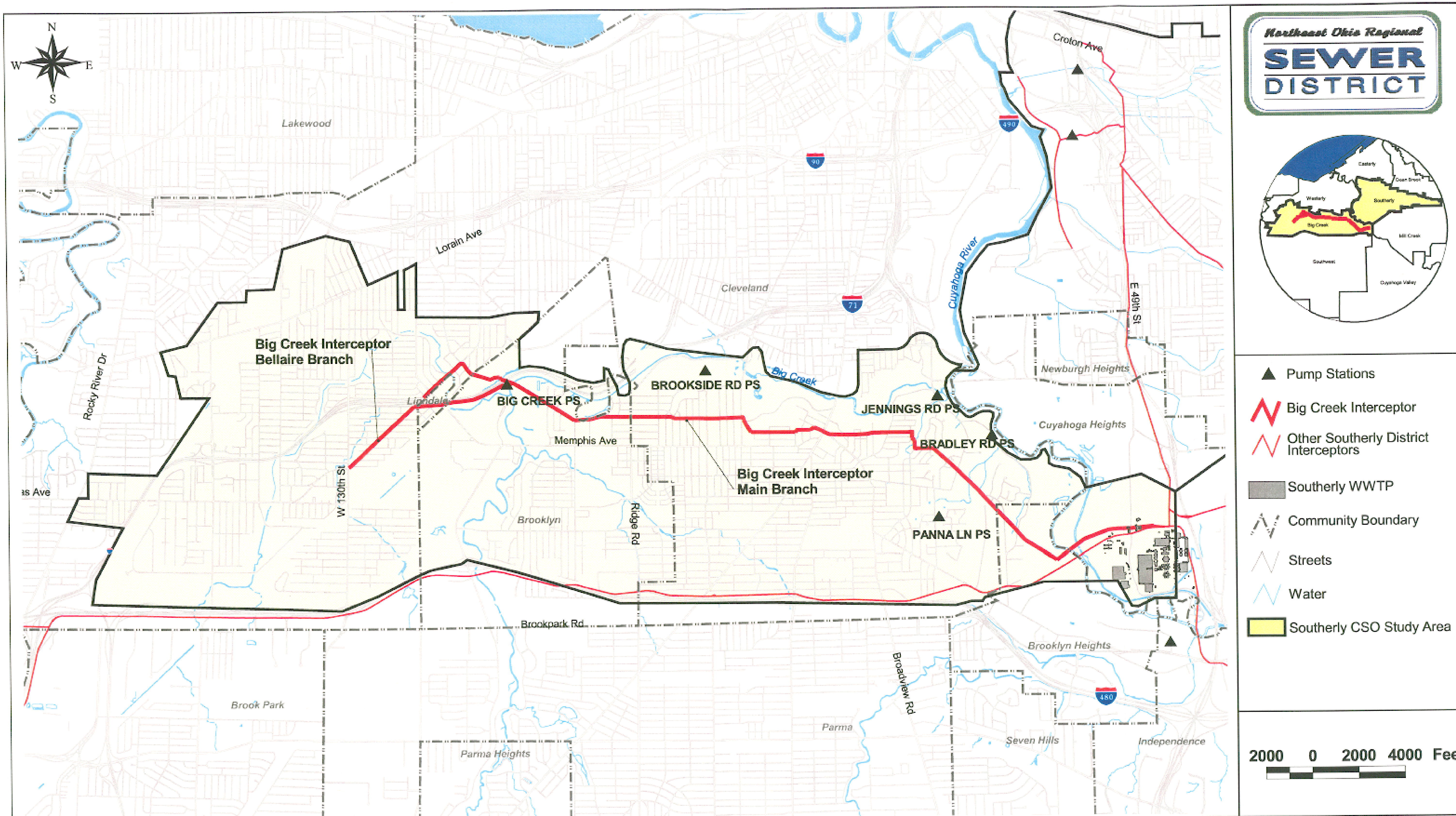
Big Creek Interceptor

Figure 2-3 shows the Big Creek Interceptor components. The Big Creek Interceptor system consists of two branches: the Main branch and the Bellaire branch.

There are five pump stations within the study area that lift flows from low-lying areas to the Big Creek Interceptor system. The Jennings Road Pump Station and the Bradley Road Pump Station lift flow from sewers that serve the industrial areas along the Cuyahoga River. Wastewater from the Brookside Metropark and the Cleveland Metroparks Zoo is lifted out of the Big Creek valley via the Brookside Park Station situated along Big Creek. The Panna Lane Pump Station lifts flow to the Big Creek interceptor from residential areas on the near west side. The Big Creek Pump Station located adjacent to I-71 northeast of Memphis Avenue and Tiedeman Road was constructed during the NEORSD’s Big Creek Interceptor rehabilitation projects in order to bypass flow to the Southwest Interceptor. Although the pump station is now off-line, it is maintained daily by the District.

Main Branch

The main branch of the Big Creek Interceptor begins on Bellaire Road just north of I-71 as a No. 6 brick egg-shaped sewer. The interceptor flows northeast following Bellaire Road to Kensington Avenue where it becomes a 75 inch circular brick pipe and continues



M&E Metcalf & Eddy

Southerly CSO Hydraulic Modeling Report

CH2MHILL

Figure 2-3. Big Creek Interceptors

northeast through automated Regulator BC9. Downstream of the regulator, the pipe decreases to a 48 inch circular concrete pipe for one pipe reach then increases to a 60 inch circular brick pipe. The interceptor continues along Bellaire Road to Bosworth Road where it turns to the southeast and follows Bosworth Road to Briggs Road.

Here, the pipe increases in size to 66 inch and continues southeast to I-71 where the interceptor changes to a 54 inch circular concrete pipe and flows to the Big Creek Pump Station. Downstream of the pump station, which is now off-line, the pipe is a 48 inch circular iron pipe for approximately 120 feet and then increases to a 60 inch circular brick sewer. Continuing to the southeast, the pipe increases in size to 66 inch at Rabbit Run Drive and Westbrook Drive and turns eastward. At Ridge Road and Brookside Drive, the pipe increases in size again to 72 inch and continues east. The pipe changes to a 60 inch circular brick pipe at the intersection of Ridgeview Road and Dellbank Drive and flows eastward following Shadyside Avenue. At Fulton Parkway and Shadyside Avenue, the pipe turns to the southeast, flows to Muriel Avenue, and continues eastward. The pipe increases in diameter to 66 inch at West 38th Street and Muriel Avenue where it receives dry weather flow from automated Regulator BC7. Following Muriel Avenue, the interceptor flows to Pearl Road.

Near Broadview Road and Pearl Road the interceptor flows east along Henninger Road and Fergus Avenue to Ardoyne Avenue as a 66 inch circular brick pipe. Near the east end of Ardoyne Avenue the pipe turns south and flows along West 15th Street where the pipe increases in size to 75 inch circular brick. At Irving Avenue the pipe turns and flows east for 700 feet then flows southeast to Georgette Lane and Jennings Road. Here the pipe changes to 75 inch clay tile for three reaches then back to brick near CSO 059. The interceptor is a 72 inch corrugated metal pipe for one reach then changes back to a 75 inch brick. The pipe continues southeast for approximately 4,500 feet. At a point 850 feet east of Hayes Drive near Van Epps Road the flow travels east as a 75 inch brick and concrete pipe with a PVC liner for 310 feet via aerial crossing. At the terminus of the aerial crossing, the pipe continues for 450 feet as a 75 inch brick and concrete pipe. The pipe then changes direction and flows northeast in a 60 inch steel pipe via aerial crossing over the Cuyahoga River Valley for 1,370 feet. The interceptor then changes back to a 75 inch brick pipe until it ends east of East 49th Street at the Southerly WWTP.

Bellaire Branch

The Bellaire branch of the Big Creek Interceptor begins at Bellaire Road and Firsby Avenue as a 20 inch circular vitrified clay pipe flowing northeast. At Grimsby Avenue, the interceptor branch increases in diameter to a 24 inch pipe. At Sobieski Avenue the pipe changes to a 30 inch circular reinforced concrete pipe for one pipe reach. The pipe diameter increases to 32 inch near Wanda Avenue and increases again to 39 inch between Leeila Avenue and Emery Avenue. The pipe then increases in size to 45 inch for two reaches then the interceptor turns eastward near I-71 and increases in diameter to 48 inch. The pipe becomes a 15 inch vitrified clay pipe at Regulator BC-43 and continues East to the junction with the main branch of the Big Creek Interceptor south of I-71 at West Boulevard.

Mill Creek Interceptor

The Mill Creek Interceptor is not included in this project, but was a part of the Mill Creek Watershed Study. A narrative account of the conveyance routing of the interceptor alignment is included below for system understanding, because it connects to Southerly in a couple spots.

Main Branch

The main branch of the Mill Creek Interceptor begins as a 48 inch pipe near the intersection of East 135th Street and Broadway Avenue. The interceptor flows to the northwest following Broadway Avenue for approximately 3,000 feet where it decreases in diameter to 36 inch for 300 feet before increasing to 42 inch for 670 feet, and then 48 inch after crossing the railroad tracks just north of Henry Street. The pipe then changes to a 48 inch brick pipe and continues northwest along Broadway Avenue. Along Broadway Avenue, south of East 96th Street, the pipe changes to reinforced concrete and passes through Regulator MC-16. The pipe changes back to brick approximately 230 feet south of the intersection of Broadway Avenue and Ella Avenue. From here the interceptor flows northwest along the Broadway Avenue Ramp “A” until it reaches

Beman Avenue. Here it flows west, crosses Mill Creek and continues to Turney Road where it increases in diameter to 64 inch. The pipe follows Beman Avenue to its west side where it increases to 66 inch diameter. The pipe then turns southwest and roughly follows East 77th Street to Force Avenue. The pipe crosses Mill Creek and increases to 87 inch diameter. The interceptor follows Mill Creek to the level of Grand Division Avenue where it decreases to 72 inch. From here the pipe follows a more west-southwest direction. Approximately 880 feet west of East 71st Street and 500 feet south of Chapek Parkway, the pipe becomes 48 inch diameter for 550 feet. Here the interceptor passes through a diversion chamber, splitting into two reaches for 570 feet. The northern reach is a 60 inch corrugated metal pipe and the southern reach a 54 inch brick pipe. The pipe then rejoins as a 51 inch brick pipe and flows northwest for 500 feet until it connects with the Southerly Main branch, a 102 inch reinforced concrete pipe that ends at the Southerly WWTP.

Eastern Branch

The Eastern branch of Mill Creek Interceptor begins at the intersection of East 146th Street and Caine Avenue as a 12 inch vitrified clay pipe. The interceptor follows Caine Avenue to the northwest where it increases in diameter to 15 inch at East 144th Street, decreases to 12 inch at East 141st Street, and increases again at East 139th Street to 18 inch. At East 138th Street the pipe changes to 27 inch reinforced concrete. The pipe size increases to 30 inch at East 137th Street, 36 inch at East 136th Street, and 42 inch at East 134th Street. The interceptor continues northwest on Caine Avenue, until East 131st Street where it turns to the north for approximately 230 feet to the intersection of Miles Avenue and East 131st Street. From there the pipe turns and flows west on Miles Avenue. Just west of the intersection of Miles Avenue and East 131st Street the pipe changes to brick and increases in diameter to 48 inch. At East 122nd Street the pipe material changes to reinforced concrete. The pipe diameter increases to 66 inch at East 119th Street. The interceptor then becomes a 105 inch brick pipe at East 116th Street. The interceptor continues west along Miles Avenue. At East 110th Street the pipe decreases in diameter to 90 inch for roughly 2,700 feet where it changes back to 105 inch brick pipe at East 95th Street. The interceptor passes through Automated Regulator MC3 located at Goodman Avenue and East 77th Street, decreasing in size to 42 inch and changing to reinforced concrete. On the west side of the East 93rd Street and Miles Avenue intersection the pipe changes to No. 4 brick, and continues to the west along Miles Avenue until it reaches Broadway Avenue where it changes direction to flow northwest along Broadway Avenue for 480 feet. At Miles Park Avenue the interceptor passes through Regulator MC-32. Dry weather flow is directed to the south where, after 1,000 feet, the pipe joins with the Main branch of the Mill Creek interceptor at Beman Avenue and Warner Road.

DESCRIPTION OF COMBINED SEWER OVERFLOWS

Eight receiving water bodies within the Southerly combined sewer service area receive CSO during wet weather events: the Cuyahoga River, Treadway Creek, Big Creek, Spring Creek, West Creek, Rocky River, Mill Creek and Ohio Canal. The following sections describe CSO tributary areas based on the collection system model developed for the Southerly CSO project. The areas were defined based on the dry weather flow route upstream of each regulator tributary to a given CSO.

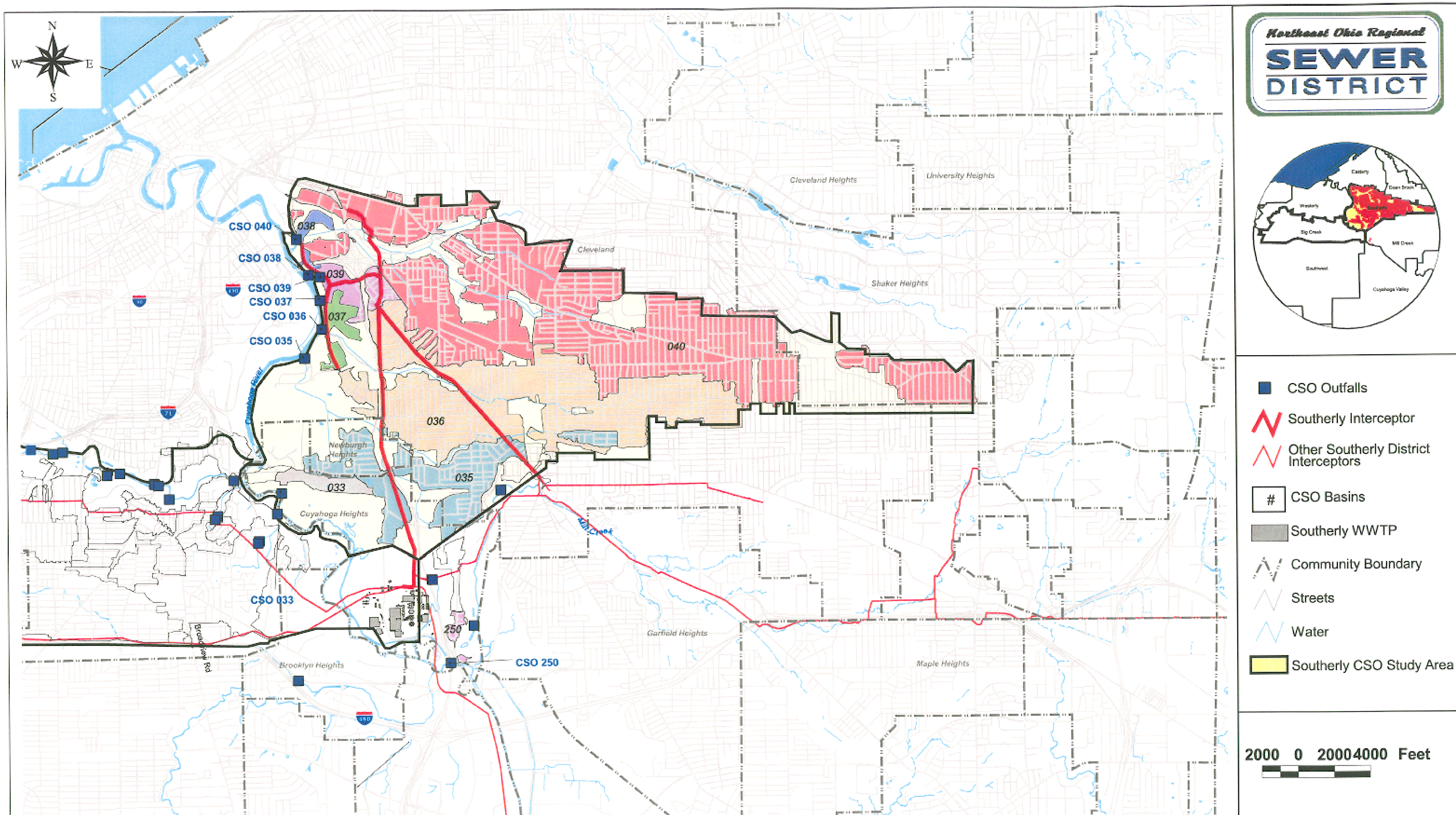
Cuyahoga River

The Cuyahoga River receives CSO flow from eight permitted CSO outfalls within the Southerly combined sewer service area. The Cuyahoga River service area and CSO outfalls are shown in Figure 2-4.

CSO 033. CSO 033 has a combined sewer drainage area of approximately 91 acres of industrial land-use including Alcoa and McGean-Rocho. The modeled population is ten people, and a relatively large baseflow of 1.70 cfs was used to represent the reported industrial discharge. The tributary regulator contributing wet weather flow to this outfall is listed in Table 2-5.

Table 2-5. Regulator Tributary to CSO 033

CSO 033, 91 Acres, Modeled Population of 10			
Regulator Number	**Location**	**Regulator Type**	**Community**
2200	Harvard-Denison Viaduct at Ohio Canal	Sidespill	Cuyahoga Heights



Southerly CSO Hydraulic Modeling Report

Figure 2-4. Cuyahoga River CSO Outfalls

Northeast Ohio Regional Sewer District

Metcalf & Eddy

CH2MHILL

CSO 035. CSO 035 is the Burke Brook culvert and has a combined sewer drainage area of approximately 736 acres and a modeled population of 10,740 people. The portion of Burke Brook to the west of I-77 serves an area of industrial land-use, and the portion East of the highway serves a mixed residential and commercial area. Tributary regulators contributing wet weather flows to this outfall are listed in Table 2-6.

This list includes flow dividers situated upstream of automated Regulator SO2. These are included to characterize their overflow contribution to the stream culvert.

Table 2-6. Regulators Tributary to CSO 035

CSO 035, 736 Acres, Modeled Population of 10,740			
Regulator Number	**Location**	**Regulator Type**	**Community**
SO2	Burke Brook, east of I-77	Gate/Plug Valve w/ Sidespill Weir	Cleveland
S-67†	East 93rd Street and Nelson Avenue	Perpendicular	Cleveland
S-69†	Worley Avenue, 40 ft. east of East 71st Street at Burke Avenue	Sidespill	Cleveland
S-70†	3929 East 71st Street at Worley Avenue	Sidespill	Cleveland
S-72†	Harvard Avenue and East 64th Street	Perpendicular	Cleveland
S-73†	East 55th Street south of Brow Avenue	Perpendicular	Cleveland
S-74†	Brow Avenue at East 55th Street	Sidespill	Newburgh Heights
S-74A	In Valley Between I-77 at 6863 Independence Road	Leaping Weir	Newburgh Heights
S-75	East 42nd Street and Alpha Avenue	Relief Pipe	Newburgh Heights
S-77	I-77, 20 ft. south of Harvard Avenue	Relief Pipe	Newburgh Heights
S-79	Grant Avenue at Burke Brook	Sidespill	Cuyahoga Heights
S-80A	Between Washington Park and Burke Brook	Sidespill	Newburgh Heights
SS-15*†	Broadway Avenue at Worley Avenue	Sidespill	Cleveland

**Not a District regulator. Number denotes wet weather flow regulation to Burke Brook culvert. Flow dividers are re-regulated downstream.*
†Structure is located upstream of SO2.

CSO 036. CSO 036 is the Morgana Run culvert and has a combined sewer drainage area of approximately 1,881 acres and a modeled population of 53,300 people. The portion of Morgana Run to the west of I-77 serves an area of industrial land-use, and the portion East of the highway serves a mixed residential and commercial area. Tributary regulators contributing wet weather flows to this outfall are listed in Table 2-7. This list includes flow dividers situated upstream of Regulator S-2A. These are included to characterize their overflow contribution to the stream culvert. Also, the Morgana Run culvert has a direct combined sewer connection upstream of Regulator S-2A located at Ackley Road, connecting the area south of Morgana Run.

Table 2-7. Regulators Tributary to CSO 036

CSO 036, 1,881 Acres, Modeled Population of 53,300			
Regulator Number	**Location**	**Regulator Type**	**Community**
S-1	East 49th Street and Morgana	Perpendicular	Cleveland
S-2	3539 East 49th Street	Sidespill	Cleveland
S-2A	175 ft. north of 3534 East 49th Street	Perpendicular	Cleveland
S-54†	Union Avenue at Broadway Avenue	Sidespill	Cleveland
S-59†	East 65th Street at Kenyon Avenue	Sidespill	Cleveland
S-60†	Broadway Avenue at Forman Avenue	Sidespill	Cleveland
S-61†	Broadway Avenue at Baxter Avenue	Sidespill	Cleveland
S-62†	6851 Broadway, side of building	Sidespill	Cleveland
S-64†	East 81st Street at Aetna Avenue	Perpendicular	Cleveland
S-65†	East 91st Street in front of Commercial Forgings Co.	Sidespill	Cleveland
S-66†	Sandusky Avenue, 150 ft. east of East 93rd Street	Relief Pipe	Cleveland
2249, (SS-8)*†	Morgana Run culvert, North of Eliza Avenue and East 53rd Street	Sidespill	Cleveland
2284, (SS-9)*†	Broadway Avenue at Union Avenue	Sidespill	Cleveland

Table 2-7. Regulators Tributary to CSO 036 (cont.)

CSO 036, 1,881 Acres, Modeled Population of 53,300			
Regulator Number	**Location**	**Regulator Type**	**Community**
SS-10*†	Morgana Run culvert, north of Kenyon Avenue and East 65th Street	Sidespill	Cleveland
SS-17*†	Morgana Run culvert, north of Eliza Avenue and East 53rd Street	Sidespill	Cleveland
SS-18*†	Morgana Run culvert, 120 ft northwest of Ackley Avenue, 400 ft southwest of Broadway Avenue	Sidespill	Cleveland
SS-19*†	Morgana Run culvert, 360 ft northwest of Ackley Avenue, 410 ft southwest of Broadway Avenue	Sidespill	Cleveland
SS-20*†	Morgana Run culvert, 195 ft north of Kenyon Avenue, 315 ft west of East 65th Street	Sidespill	Cleveland
SS-21*†	Morgana Run culvert, 215 ft north of Kenyon Avenue, 305 ft west of East 65th Street	Sidespill	Cleveland
SS-22*†	Morgana Run culvert, 260 ft southwest of Morgana Avenue, 440 ft east of East 65th Street	Sidespill	Cleveland
SS-24*†	Morgana Run culvert, Forman Avenue, southwest of Winfield Avenue	Sidespill	Cleveland

**Not a District regulator. Number denotes wet weather flow regulation to Morgana Run culvert. Flow dividers are re-regulated downstream.*
† Structure is located upstream of S-2A.

CSO 037. CSO 037 has a combined sewer drainage area of approximately 103 acres and a modeled population of 76 people. This is an industrial area and only a small portion of the wet weather runoff flows to the Independence South branch of the Southerly Interceptor. The tributary regulator contributing wet weather flow to this outfall is listed in Table 2-8.

Table 2-8. Regulator Tributary to CSO 037

CSO 037, 103 Acres, Modeled Population of 76			
Regulator Number	**Location**	**Regulator Type**	**Community**
S-83	Independence Road, 900 ft. south of Dille Avenue	Relief Pipe	Cleveland

CSO 038. CSO 038 has a combined sewer drainage area of approximately 53 acres and a population of approximately 2,000 people. This is an industrial area and only a small portion of the wet weather runoff flows to the Independence North branch of the Southerly Interceptor. The tributary regulator contributing wet weather flow to this outfall is listed in Table 2-9.

Table 2-9. Regulator Tributary to CSO 038

CSO 038, 53 Acres, Modeled Population of 2,000			
Regulator Number	**Location**	**Regulator Type**	**Community**
S-82	Independence Road, past I-490; 1250 ft. north of Dille Avenue	Relief Pipe	Cleveland

CSO 039. CSO 039 has a combined sewer drainage area of approximately 165 acres of primarily industrial land-use and a population of approximately 1,100 people. Tributary regulators contributing wet weather flows to this outfall are listed in Table 2-10.

Table 2-10. Regulators Tributary to CSO 039

CSO 039, 165 Acres, Modeled Population of 1,100			
Regulator Number	**Location**	**Regulator Type**	**Community**
S-1A	Broadway Avenue at Gallup Avenue, northwest corner	Leaping Weir	Cleveland
Unnamed*	Broadway Avenue at Dille Avenue	Leaping Weir	Cleveland

** Unnamed Regulator located at Broadway Avenue and Dille Avenue.*

CSO 040. CSO 040 (Kingsbury Run) has a combined sewer drainage area of approximately 4,504 acres and a population of approximately 88,755 people. The portion of Kingsbury Run to the west of I-77 serves an area of industrial land-use, and the portion east of the highway serves a mixed residential and commercial area. Tributary regulators contributing wet weather flows to this outfall are listed in Table 2-11.

Table 2-11. Regulators Tributary to CSO 040

CSO 040, 4,504 Acres, Modeled Population of 88,755			
Regulator Number	**Location**	**Regulator Type**	**Community**
SO3	Woodhill Avenue and Mount Auburn Avenue	Gate	Cleveland
SO4	Carton Avenue and East 93rd Street	Fabridam/Gate	Cleveland
SO5	East 79th Street and Garden Valley Avenue	Gate	Cleveland
SO6	East 93rd Street and Kinsman Road	Gate	Cleveland
SO7	Kinsman Road and East 94th Street	Fabridam	Cleveland
SO8	Kingsbury Boulevard and Carton Avenue	Fabridam/Gate	Cleveland
2344*	Kinsman Road near East 94th Street	Perpendicular	Cleveland
S-4	East 37th Street, 850 ft. north of East 37th Street P.S.	Leaping Weir	Cleveland
S-5	East 37th Street under North and South R.R. Bridge	Leaping Weir	Cleveland
S-8	East 34th Street, south of Croton Avenue	Leaping Weir	Cleveland
S-9	2725 East 40th Street	Perpendicular	Cleveland
S-10	East 55th Street at Bower Avenue	Leaping Weir	Cleveland
S-11	East 64th Street at Kinsman Road (at Grand Avenue)	Sidespill	Cleveland
S-12	East 64th Street at Kinsman Road	Perpendicular	Cleveland
S-14	Berwick Road at East 66th Street	Sidespill	Cleveland
S-15	7322 Colfax Road, west of East 75th Street	Relief Pipe	Cleveland
S-18	3052 East 80th Street	Perpendicular	Cleveland

Table 2-11. Regulators Tributary to CSO 040 (cont.)

CSO 040, 3,429 Acres, Modeled Population of 88,755			
Regulator Number	**Location**	**Regulator Type**	**Community**
S-20	6814 Grand Avenue, east of NYC R.R.	Leaping Weir	Cleveland
S-21	East 79th Street, south of NYC R.R.	Perpendicular	Cleveland
S-45A	East 149th Street at Spear Avenue	Perpendicular	Cleveland
S-80	Broadway Avenue at 2785 ft. south of Kingsbury Run	Leaping Weir	Cleveland
S-81	Broadway Avenue, north of Kingsbury Run	Perpendicular	Cleveland

** Regulator 2344 identified during CSO Phase I.*

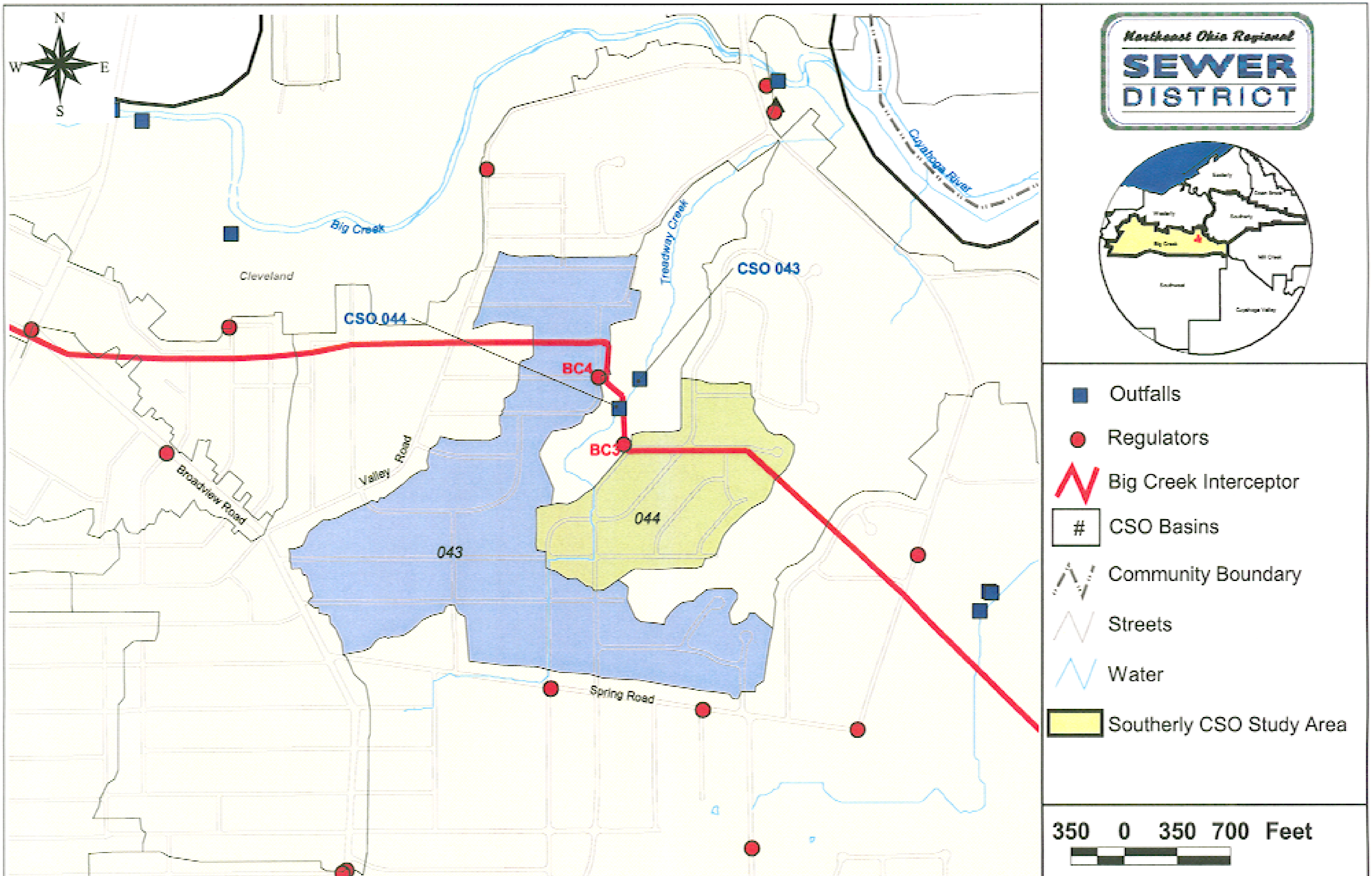
CSO 250. CSO 250 has a combined sewer drainage area of approximately 17 acres of primarily residential land-use with a population of approximately 320 people, and a separate sewer drainage area of approximately seven acres of residential land-use with a population of approximately 160 people. Wet weather overflows go to the Cuyahoga River, and dry weather goes to the CVI just upstream of the pump station. The tributary regulator contributing wet weather flow to this outfall is listed in Table 2-12.

Table 2-12. Regulator Tributary to CSO 250

CSO 250, 24 Acres, Modeled Population of 480			
Regulator Number	**Location**	**Regulator Type**	**Community**
MC-01A	East 71st Street entrance to I-77 northbound	Sidespill	Cuyahoga Heights

Treadway Creek

Treadway Creek is a stream tributary to Big Creek and receives wet weather flows from two CSO outfalls within the Southerly combined sewer area. The Treadway Creek CSO outfalls are shown in Figure 2-5.



Metcalf & Eddy

Southerly CSO
Hydraulic Modeling Report

CH2MHILL

Figure 2-5.
Treadway Creek
CSO Outfalls

CSO 043. CSO 043 has a combined sewer drainage area of approximately 78 acres of residential land-use and a population of approximately 1,265 people. The tributary regulator contributing wet weather flow to this outfall is listed in Table 2-13.

Table 2-13. Regulator Tributary to CSO 043

CSO 043, 78 Acres, Modeled Population of 1,265			
Regulator Number	**Location**	**Regulator Type**	**Community**
BC4	West 15th Street and Tarlton Avenue	Fabridam	Cleveland

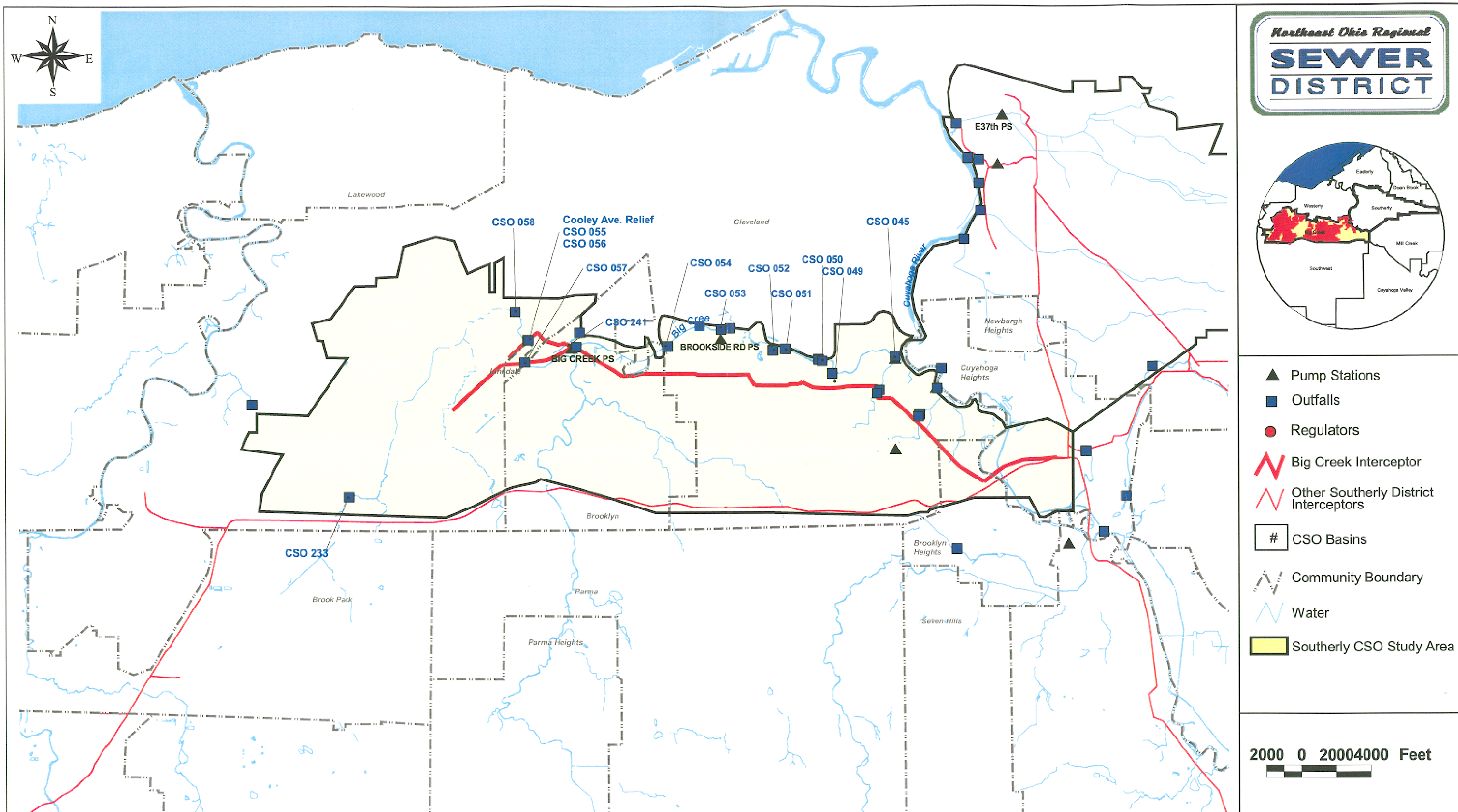
CSO 044. CSO 044 has a combined sewer drainage area of approximately 29 acres of residential land-use and a population of approximately 278 people. The tributary regulator contributing wet weather flow to this outfall is listed in Table 2-14.

Table 2-14. Regulator Tributary to CSO 044

CSO 044, 29 Acres, Modeled Population of 278			
Regulator Number	**Location**	**Regulator Type**	**Community**
BC3	South Hills Drive and Irving Avenue	Gate/Plug Valve	Cleveland

Big Creek

Big Creek receives wet weather flow from 14 CSO outfalls and one pump station overflow within the Southerly combined sewer area. Within the Southerly CSO area, Big Creek is an open stream from I-480 to Puritas Road where the stream enters a culvert for approximately 2.7 miles. At CSO Outfall 058, the stream exits the culvert and remains open channel until reaching the eastern edge of the Brookside Metropark where it again enters a culvert. Near Pearl Road, the stream returns to open channel and travels to its confluence with the Cuyahoga River. The Big Creek CSO outfalls are shown in Figure 2-6, 2-7 and 2-8.

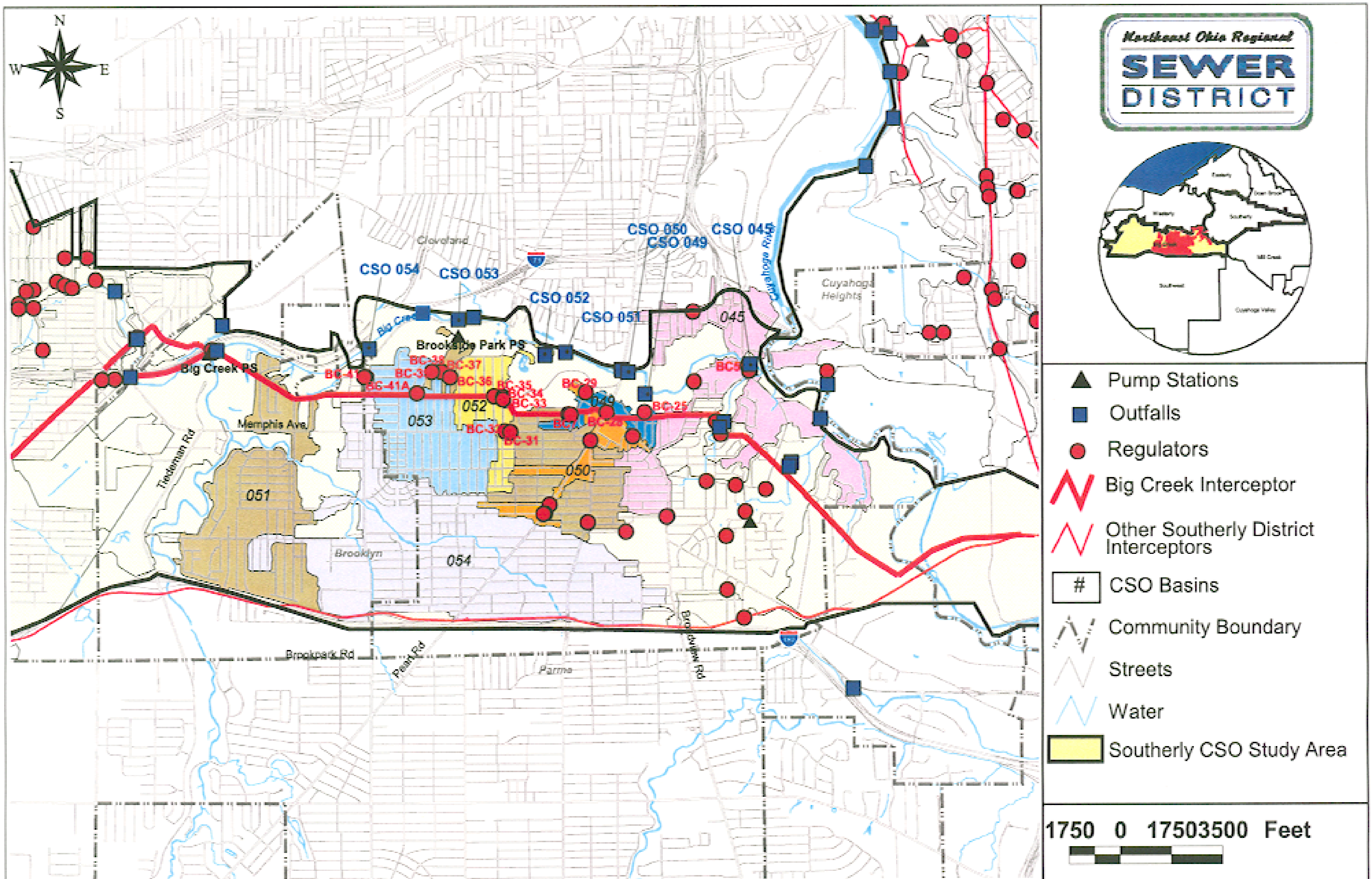


Metcalf & Eddy

Southerly CSO Hydraulic Modeling Report

CH2MHILL

Figure 2-6. Big Creek CSO Outfalls

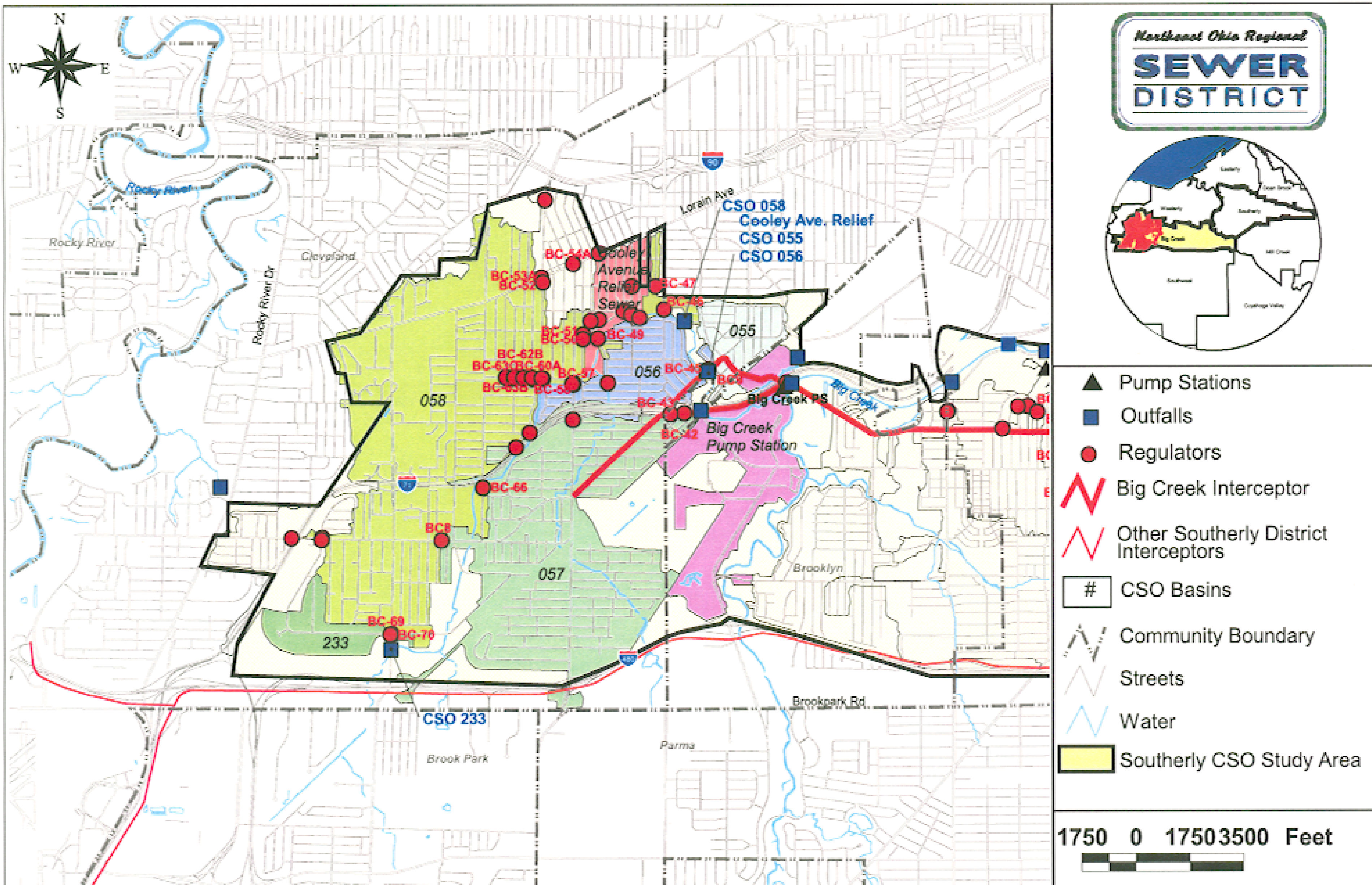


Metcalf & Eddy

Southerly CSO
Hydraulic Modeling Report

CH2MHILL

Figure 2-7.
Big Creek East
CSO Outfalls



Metcalf & Eddy

Southerly CSO
Hydraulic Modeling Report

CH2MHILL

Figure 2-8.
Big Creek West
CSO Outfalls

Regulator BC-55 is located at the intersection of Lorain Avenue at West 127th Street. The overflow from this regulator flows to CSO 071 in the Westerly service area; however, the dry weather flow travels to the Southerly WWTP. The area tributary to BC-55 is not included in this project, although the dry weather flow is accounted for.

Brookside Park Pump Station Overflow. This City of Cleveland pump station lifts flow from the Cleveland Metroparks Zoo and Brookside Park to the Big Creek Interceptor system. The overflow from the pump station wet well travels in an 8 inch clay pipe from the pump station to a 24 inch concrete pipe tributary to Big Creek.

Cooley Avenue Relief Sewer. Overflow from the Cooley Avenue Relief Sewer, constructed by the City of Cleveland, enters Big Creek at an outfall near the intersection of Bellaire Road and Kensington Avenue. The relief sewer has a drainage area of approximately 493 acres of residential land-use and a population of approximately 7,196 people. The tributary regulator contributing wet weather flows to this outfall is listed in Table 2-15.

Table 2-15. Cooley Avenue Relief Sewer Overflow

Cooley Avenue Relief Sewer, 493 Acres, Modeled Population of 7,196			
Regulator Number	**Location**	**Regulator Type**	**Community**
BC-45A	Bellaire Road and Kensington Avenue	Weir	Cleveland

CSO 045. CSO 045 has a combined sewer drainage area of approximately 513 acres of mixed industrial and residential land-use and a population of approximately 6,275 people. The tributary regulator contributing wet weather flows to this outfall is listed in Table 2-16.

Table 2-16. Regulator Tributary to CSO 045

CSO 045, 513 Acres, Modeled Population of 6,275			
Regulator Number	**Location**	**Regulator Type**	**Community**
BC5	Jennings Road and Big Creek	Gate/Plug Valve	Cleveland

CSO 049. CSO 049 has a combined sewer drainage area of approximately 59 acres of residential land-use and a population of approximately 704 people. The tributary regulator contributing wet weather flow to this outfall is listed in Table 2-17.

Table 2-17. Regulator Tributary to CSO 049

CSO 049, 59 Acres, Modeled Population of 704			
Regulator Number	**Location**	**Regulator Type**	**Community**
BC-25	West 23rd Street and Snyder Avenue	Leaping Weir	Cleveland

CSO 050. CSO 050 has a combined sewer drainage area of approximately 120 acres of residential land-use and a population of approximately 1,580 people. Tributary regulators contributing wet weather flows to this outfall are listed in Table 2-18.

Table 2-18. Regulators Tributary to CSO 050

CSO 050, 120 Acres, Modeled Population of 1,580			
Regulator Number	**Location**	**Regulator Type**	**Community**
BC-28	Pearl Road at Broadview Road	Perpendicular	Cleveland
BC-29	4142 West 36th Street near Krather Road	Sidespill	Cleveland

CSO 051. CSO 051 has a combined sewer drainage area of approximately 765 acres of residential land-use and a population of approximately 6,017 people. The tributary regulator contributing wet weather flows to this outfall is listed in Table 2-19.

Table 2-19. Regulators Tributary to CSO 051

CSO 051, 765 Acres, Modeled Population of 6,017			
Regulator Number	**Location**	**Regulator Type**	**Community**
Unnamed*	Downstream of BC7	Sidespill	Cleveland
BC7	Muriel Avenue and West 38th Street	Fabridam/Gate	Cleveland

*Relief structure located on Big Creek Interceptor

CSO 052. CSO 052 has a combined sewer drainage area of approximately 143 acres of residential land-use and a population of approximately 8,315 people. Tributary regulators contributing wet weather flows to this outfall are listed in Table 2-20.

Table 2-20. Regulators Tributary to CSO 052

CSO 052, 143 Acres, Modeled Population of 8,135			
Regulator Number	**Location**	**Regulator Type**	**Community**
BC-31	4513 Memphis Avenue	Sidespill	Cleveland
BC-32	Memphis Avenue and Fulton Parkway	Sidespill	Cleveland
BC-33	4172 Fulton Parkway near Shadyside Avenue	Sidespill	Cleveland
BC-34	4164 Fulton Parkway, 30 ft. south of Shadyside Avenue	Perpendicular	Cleveland
BC-35	West 48th Street and Shadyside Avenue	Sidespill	Cleveland

CSO 053. CSO 053 has a combined sewer drainage area of approximately 318 acres of residential land-use and a population of approximately 3,295 people. Tributary regulators contributing wet weather flows to this outfall are listed in Table 2-21.

Table 2-21. Regulators Tributary to CSO 053

CSO 053, 318 Acres, Modeled Population of 3,295			
Regulator Number	**Location**	**Regulator Type**	**Community**
BC-36	4099 West 56th Street, south of Ridgeview Road	Leaping Weir	Cleveland
BC-37	West 57th Street and Ridgeview Road	Leaping Weir	Cleveland
BC-38	Ridgeview Road and West 57th Street	Leaping Weir	Cleveland
BC-39	Ridgeview Road, 50 ft. west of West 58th Street	Perpendicular	Cleveland

CSO 054. CSO 054 has a sewer drainage area of approximately 1,051 acres of residential land-use and a population of approximately 30,563 people. This area is

predominantly separate. Tributary regulators contributing wet weather flows to this outfall are listed in Table 2-22.

Table 2-22. Regulators Tributary to CSO 054

CSO 054, 1,051 Acres, Modeled Population of 30,563			
Regulator Number	**Location**	**Regulator Type**	**Community**
BC-41	On Ridge Road at Meadowbrook Avenue	Leaping Weir	Cleveland
BC-41A	Ridge Road and Meadowbrook Avenue	Relief Pipe	Cleveland

CSO 055. CSO 055 has a combined sewer drainage area of approximately 138 acres of residential land-use and a population of approximately 1,845 people. The tributary regulator contributing wet weather flows to this outfall is listed in Table 2-23.

Table 2-23. Regulator Tributary to CSO 055

CSO 055, 138 Acres, Modeled Population of 1,845			
Regulator Number	**Location**	**Regulator Type**	**Community**
BC9*	11022 Bellaire Road, east of Kensington Avenue	Fabridam/Gate	Cleveland

** Automated regulator BC9 controls flow for BC-45 (CSO 055) and BC-44 (CSO 056).*

CSO 056. CSO 056 has a combined sewer drainage area of approximately 229 acres of residential land-use and a population of approximately 8,716 people. The tributary regulator contributing wet weather flows to this outfall is listed in Table 2-24.

Table 2-24. Regulator Tributary to CSO 056

CSO 056, 229 Acres, Modeled Population of 8,716			
Regulator Number	**Location**	**Regulator Type**	**Community**
BC9*	Bellaire Road, east of Kensington Avenue (Opposite 11026)	Fabridam/Gate	Cleveland

** Automated regulator BC9 controls flow for BC-45 (CSO 055) and BC-44 (CSO 056).*

CSO 057. CSO 057 has a combined sewer drainage area of approximately 1,065 acres of residential land-use and a population of approximately 24,060 people. Tributary regulators contributing wet weather flows to this outfall are listed in Table 2-25.

Table 2-25. Regulators Tributary to CSO 057

CSO 057, 1,065 Acres, Modeled Population of 24,060			
Regulator Number	**Location**	**Regulator Type**	**Community**
BC-42	4001 West 119th Street (at Avenue of Peace)	Sidespill	Linndale
BC-43	11916 Peelor Avenue	Sidespill	Linndale
BC-56	West 130th Street, south of I-71	Sidespill	Cleveland

CSO 058. CSO 058 has a combined sewer drainage area of approximately 1,500 acres of mixed commercial and residential land-use and a population of approximately 16,436 people. Tributary regulators contributing wet weather flows to this outfall are listed in Table 2-26.

Table 2-26. Regulators Tributary to CSO 058

CSO 058, 1,500 Acres, Modeled Population of 16,436			
Regulator Number	**Location**	**Regulator Type**	**Community**
BC-46	West 117th Street, south of Thrush Avenue	Sidespill	Cleveland
BC-47	Linnett Avenue at West 118th Street	Perpendicular	Cleveland
BC-49	West 128th Street and Brighton Avenue	Sidespill	Cleveland
BC-50	3716 West 129th Street	Sidespill	Cleveland
BC-51	North Road and West 129th Street	Sidespill	Cleveland
BC-52	3591 West 134th Street	Sidespill	Cleveland
BC-53A	Lorain Avenue, west of West 134th Street	Perpendicular	Cleveland
BC-54A	West 130th Street at Lorain Avenue	Perpendicular	Cleveland

Table 2-26. Regulators Tributary to CSO 058

CSO 058, 1,500 Acres, Modeled Population of 16,436			
Regulator Number	**Location**	**Regulator Type**	**Community**
BC-57	West 130th Street, north of Brooklawn Avenue	Sidespill	Cleveland
BC-58	West Avenue at Victory Boulevard	Sidespill	Cleveland
BC-60A*	West 135th Street and West Avenue	Relief Pipe	Cleveland
BC-62B*	West 137th Street and West Avenue	Relief Pipe	Cleveland
BC-63B*	West 138th Street and West Avenue	Relief Pipe	Cleveland
BC-63C*	West 138th Street and West Avenue	Relief Pipe	Cleveland
BC-66	4267 West 140th Street, south of Brookside Boulevard	Leaping Weir	Cleveland

** Not District regulators. Relief structures constructed by City of Cleveland along West Avenue.*

CSO 233. CSO 233 has a combined sewer drainage area of approximately 125 acres of mixed commercial and residential land-use and a population of approximately 3,850 people. Tributary regulators contributing wet weather flows to this outfall are listed in Table 2-27.

Table 2-27. Regulators Tributary to CSO 233

CSO 233, 125 Acres, Modeled Population of 3,850			
Regulator Number	**Location**	**Regulator Type**	**Community**
BC-69	West 150th Street at Industrial Parkway	Relief Pipe	Cleveland
BC-70	Industrial Parkway at West 150th Street	Sidespill	Cleveland

CSO 241. CSO 241 has a combined sewer drainage area of approximately 3,717 acres of mixed commercial and residential land-use and a population of approximately 49,000 people. Tributary regulators contributing wet weather flows to this outfall are listed in Table 2-28.

Table 2-28. Regulator Tributary to CSO 241

CSO 241, 3,717 Acres, Modeled Population of 49,000			
Regulator Number	**Location**	**Regulator Type**	**Community**
Unnamed*	Clinton Road and I-71	Relief Pipe	Cleveland

** Unnamed District regulator is a relief pipe on Big Creek Interceptor.*

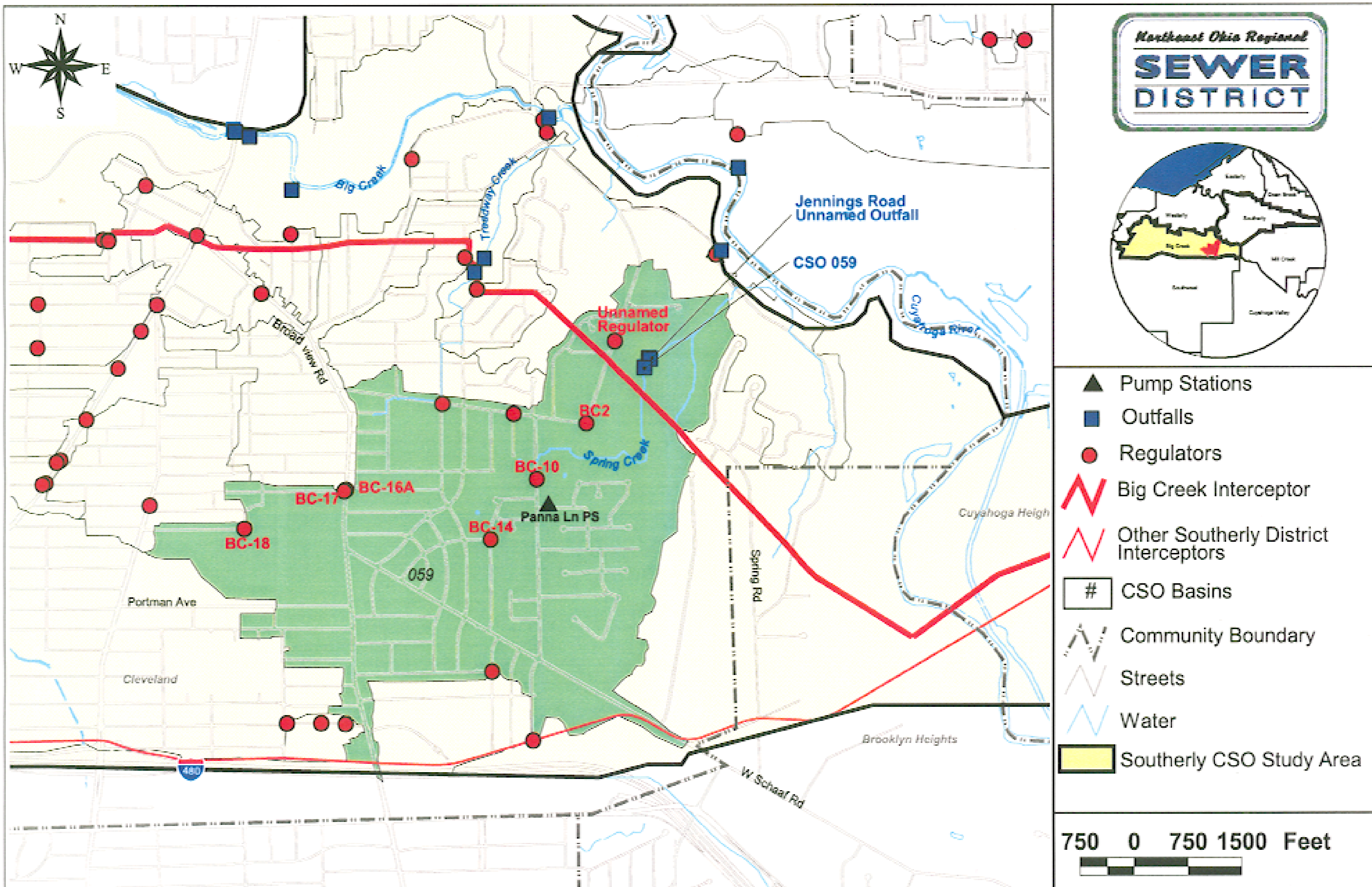
Spring Creek

Spring Creek is a stream tributary to the Cuyahoga River and is culverted from West 29th Street and Hillcrest Avenue to its outfall East of Jennings Road and Georgette Lane near I-176. Downstream of the outfall, the Spring Creek flows as an open channel to its confluence with the Cuyahoga River. The Spring Creek CSO outfalls are shown in Figure 2-9.

CSO 059. CSO 059 has a combined sewer drainage area of approximately 621 acres of residential land-use and a population of approximately 7,711 people. Tributary regulators contributing wet weather flows to this outfall are listed in Table 2-29.

Table 2-29. Regulators Tributary to CSO 059

CSO 059, 621 Acres, Modeled Population of 7,711			
Regulator Number	**Location**	**Regulator Type**	**Community**
BC2	Jennings Road and Spring Road	Gate/Plug Valve	Cleveland
BC-10	4537 West 11th Street	Sidespill	Cleveland
BC-14	Morningside Road at Hilland Drive	Perpendicular	Cleveland
BC-16A	Broadview Road at Saratoga Avenue	Relief Pipe	Cleveland
BC-17	Saratoga Avenue southwest of Broadview Road	Sidespill	Cleveland
BC-18	Hillcrest Avenue at West 29th Street	Sidespill	Cleveland



Metcalf & Eddy

Southerly CSO
Hydraulic Modeling Report

CH2MHILL

Figure 2-9.
Spring Creek
CSO Outfalls

Jennings Road Unnamed CSO. The unnamed CSO has a combined sewer drainage area of approximately 29 acres of residential land-use and a population of approximately 400 people. This overflow was constructed by the ODOT during the Jennings Freeway Project. The tributary regulator contributing wet weather flows to this outfall is listed in Table 2-30.

Table 2-30. Regulator Tributary to Unnamed CSO

Unnamed CSO, 29 Acres, Modeled Population of 400			
Regulator Number	**Location**	**Regulator Type**	**Community**
Unnamed*	Jennings Road near Georgette Lane	Perpendicular	Cleveland

**Regulator constructed by ODOT during the Jennings Freeway Project (I-176).*

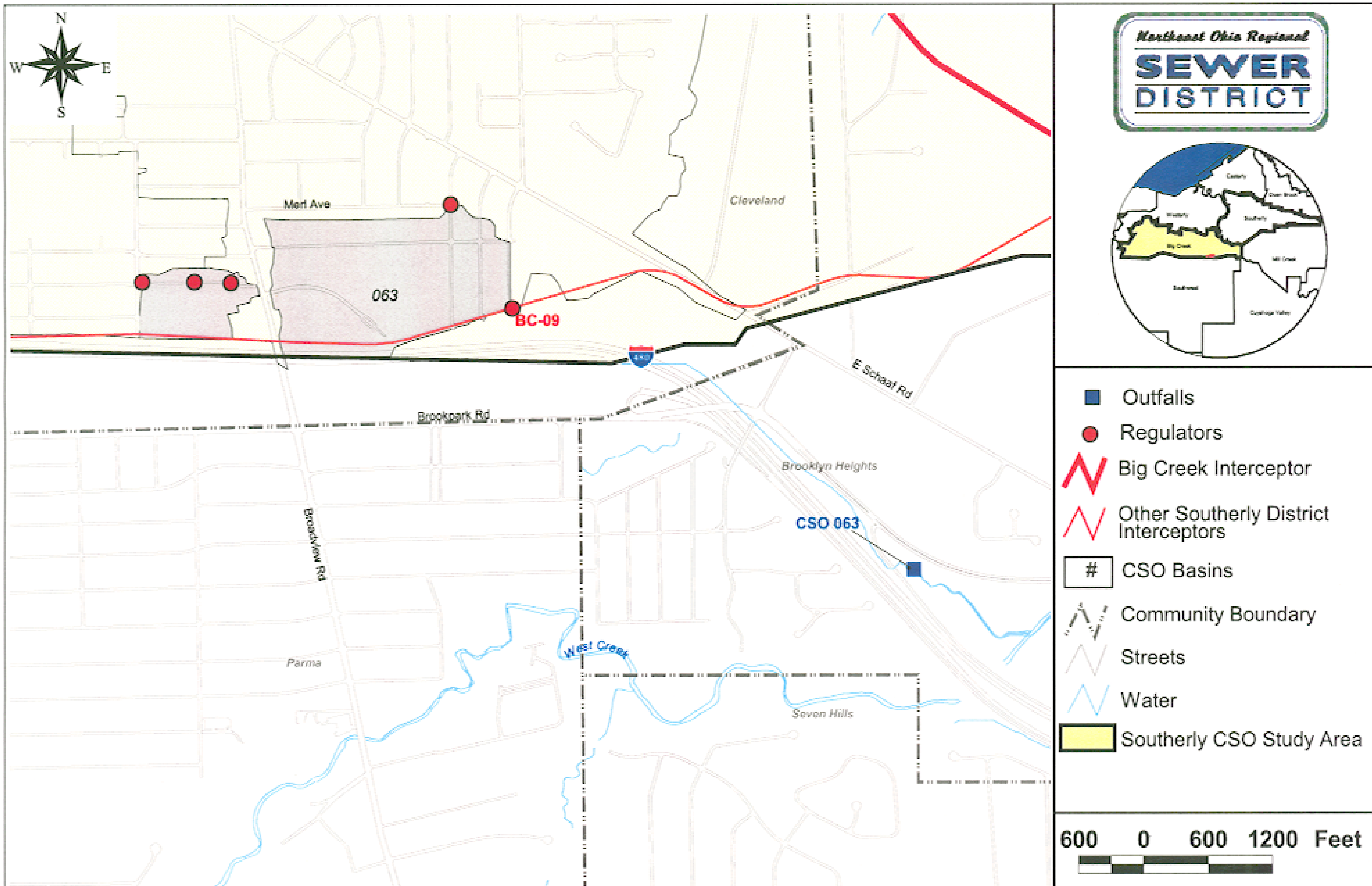
West Creek

West Creek receives wet weather flow from one CSO outfall within the Southerly combined sewer area. The West Creek CSO outfall is shown in Figure 2-10.

CSO 063. CSO 063 has a combined sewer drainage area of approximately 72 acres of residential land-use and a population of approximately 2,350 people. The tributary regulator contributing wet weather flows to this outfall is listed in Table 2-31.

Table 2-31. Regulator Tributary to CSO 063

CSO 063, 72 Acres, Modeled Population of 2,350			
Regulator Number	**Location**	**Regulator Type**	**Community**
BC-09	Cul-De-Sac south of West 12th Street, north of I-480	Perpendicular	Cleveland



Metcalf & Eddy

Southerly CSO Hydraulic Modeling Report

CH2MHILL

Figure 2-10. West Creek CSO Outfalls

Rocky River

Rocky River receives wet weather flows from two CSO outfalls within the Southerly combined sewer area. The Rocky River CSO outfalls are shown in Figure 2-11.

CSO 062. Tributary Regulator BC-74 contributes primarily storm flow to CSO 062. The tributary regulator contributing wet weather flow to this CSO is listed in Table 2-32.

Table 2-32. Regulator Tributary to CSO 062

CSO 062			
Regulator Number	**Location**	**Regulator Type**	**Community**
BC-74	Grayton Road at Puritas Avenue	Perpendicular	Cleveland

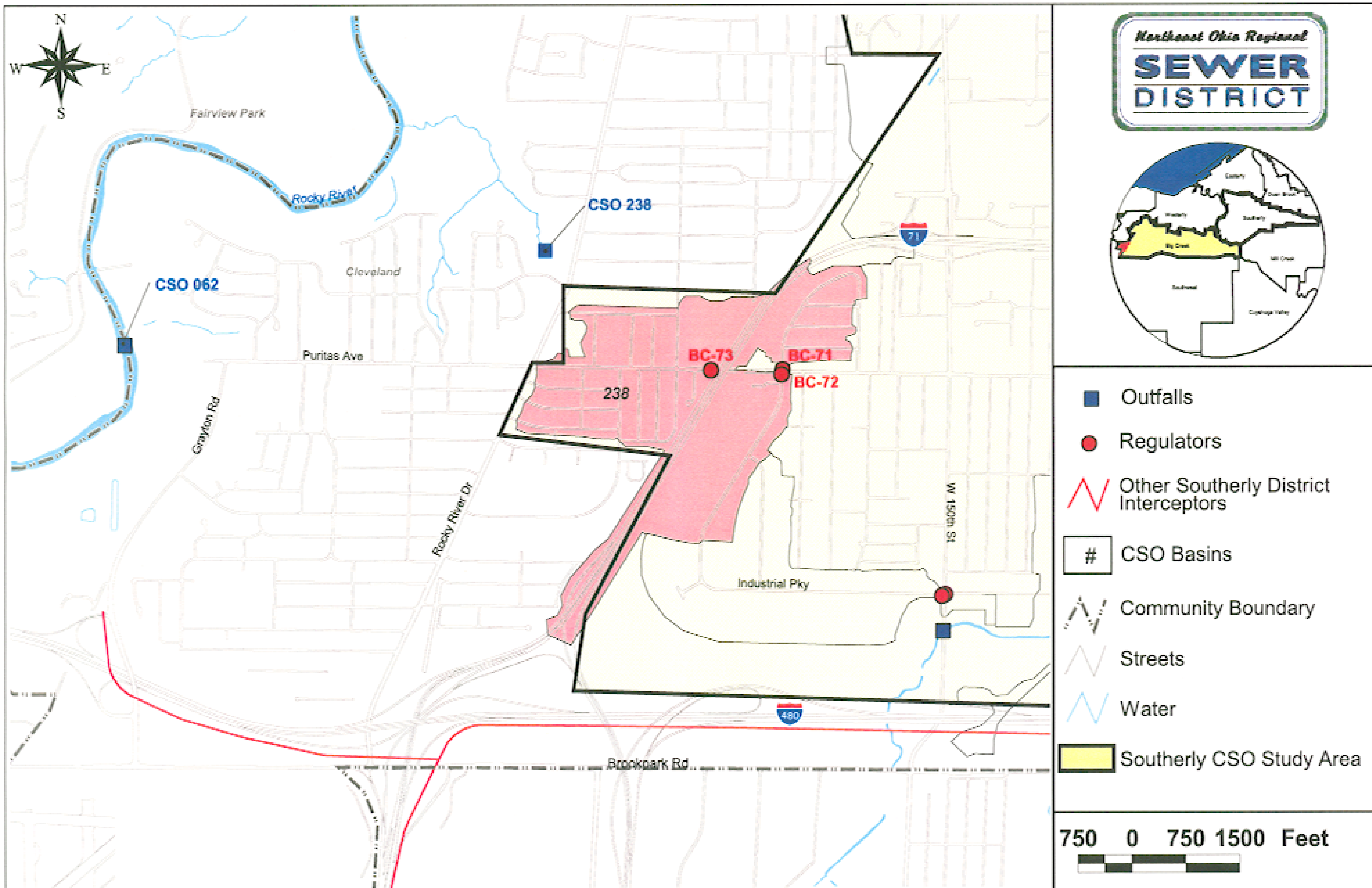
CSO 238. CSO 238 has a combined sewer drainage area of approximately 242 acres of residential land-use and a population of approximately 4,504 people. Tributary regulators contributing wet weather flows to this outfall are listed in Table 2-33.

Table 2-33. Regulators Tributary to CSO 238

CSO 238, 242 Acres, Modeled Population of 4,504			
Regulator Number	**Location**	**Regulator Type**	**Community**
BC-71	Puritas Avenue at Eleanore Avenue	Sidespill	Cleveland
BC-72	West 160th Street at Puritas Avenue	Sidespill	Cleveland
BC-73	Puritas Avenue, east of West 167th Street	Sidespill	Cleveland

Mill Creek

Automated Regulator SO1 directs flow during dry weather to the Southerly interceptor area and overflows to Mill Creek via CSO 072 during wet weather. Because the dry



Southerly CSO
Hydraulic Modeling Report

Metcalf & Eddy

CH2MHILL

Figure 2-11.
Rocky River
CSO Outfalls

weather flow is tributary to the Southerly Interceptor; it was included in this study. CSO 251, tributary to the Cuyahoga Valley Interceptor, is also included in this project. This CSO is eliminated through a baseline project, which is detailed in Chapter Six. The Mill Creek CSO outfalls are shown in Figure 2-12.

CSO 072. CSO 072 has a combined sewer drainage area of approximately 82 acres of mixed commercial and residential land-use and a population of approximately 3,010 people. The tributary regulator contributing wet weather flows to this outfall is listed in Table 2-34.

Table 2-34. Regulator Tributary to CSO 072

CSO 072, 82 Acres, Modeled Population of 3,010			
Regulator Number	**Location**	**Regulator Type**	**Community**
SO1	Harvard Avenue and East 78tth Street	Storm Gate, Knife Gate	Cleveland

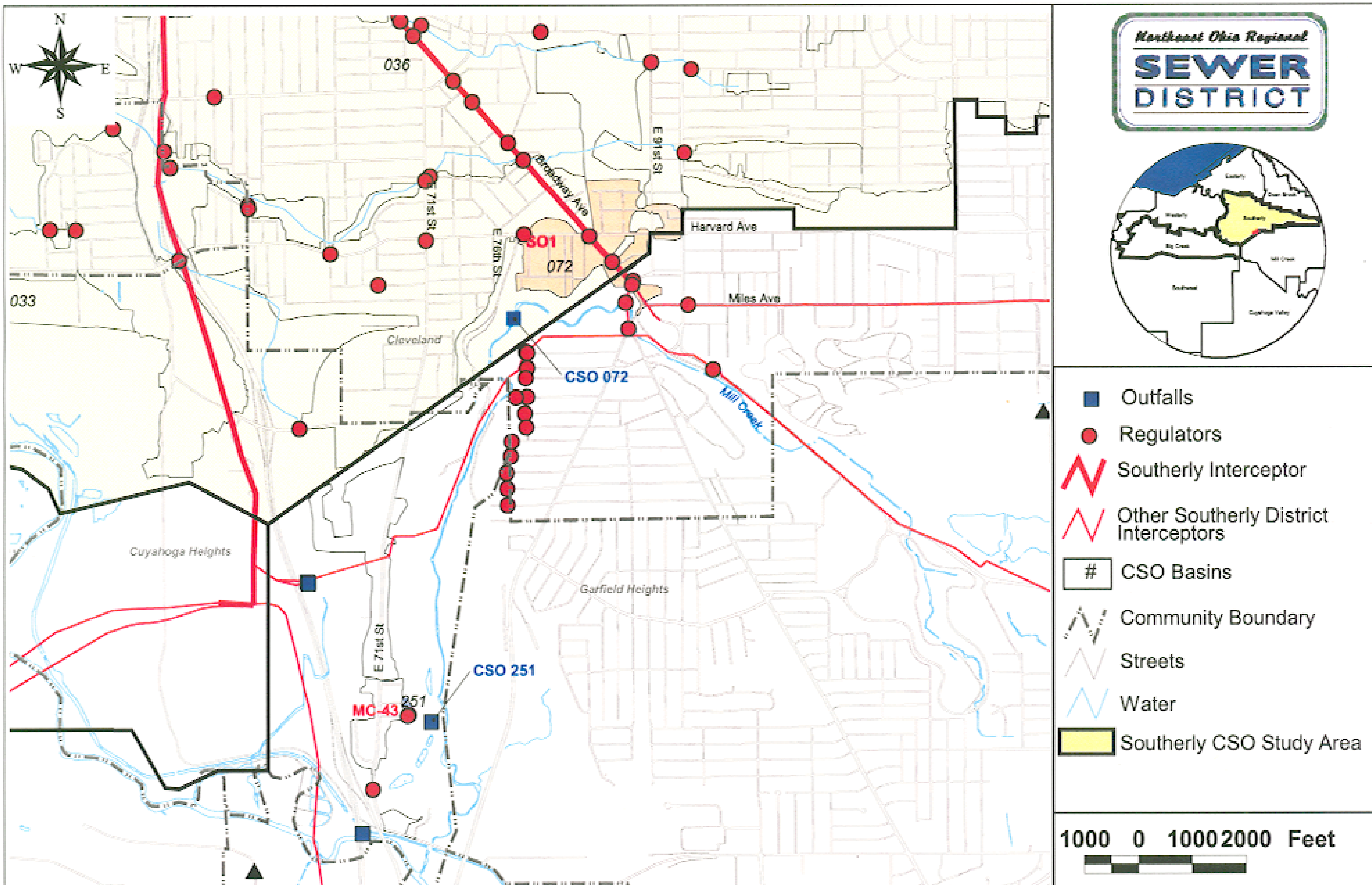
CSO 251. CSO 251 has a combined sewer drainage area of approximately 1.0 acre of residential land-use and a population of approximately 30 people. Wet weather overflows go to Mill Creek, and dry weather goes via Regulator MC-43 to the Cuyahoga Valley Interceptor. The tributary regulator contributing wet weather flows to this outfall is listed in Table 2-35.

Table 2-35. Regulator Tributary to CSO 251

CSO 251, 1 Acre, Modeled Population of 30			
Regulator Number	**Location**	**Regulator Type**	**Community**
MC-43	Bletch Court at East 72nd Street	Sidespill	Cuyahoga Heights

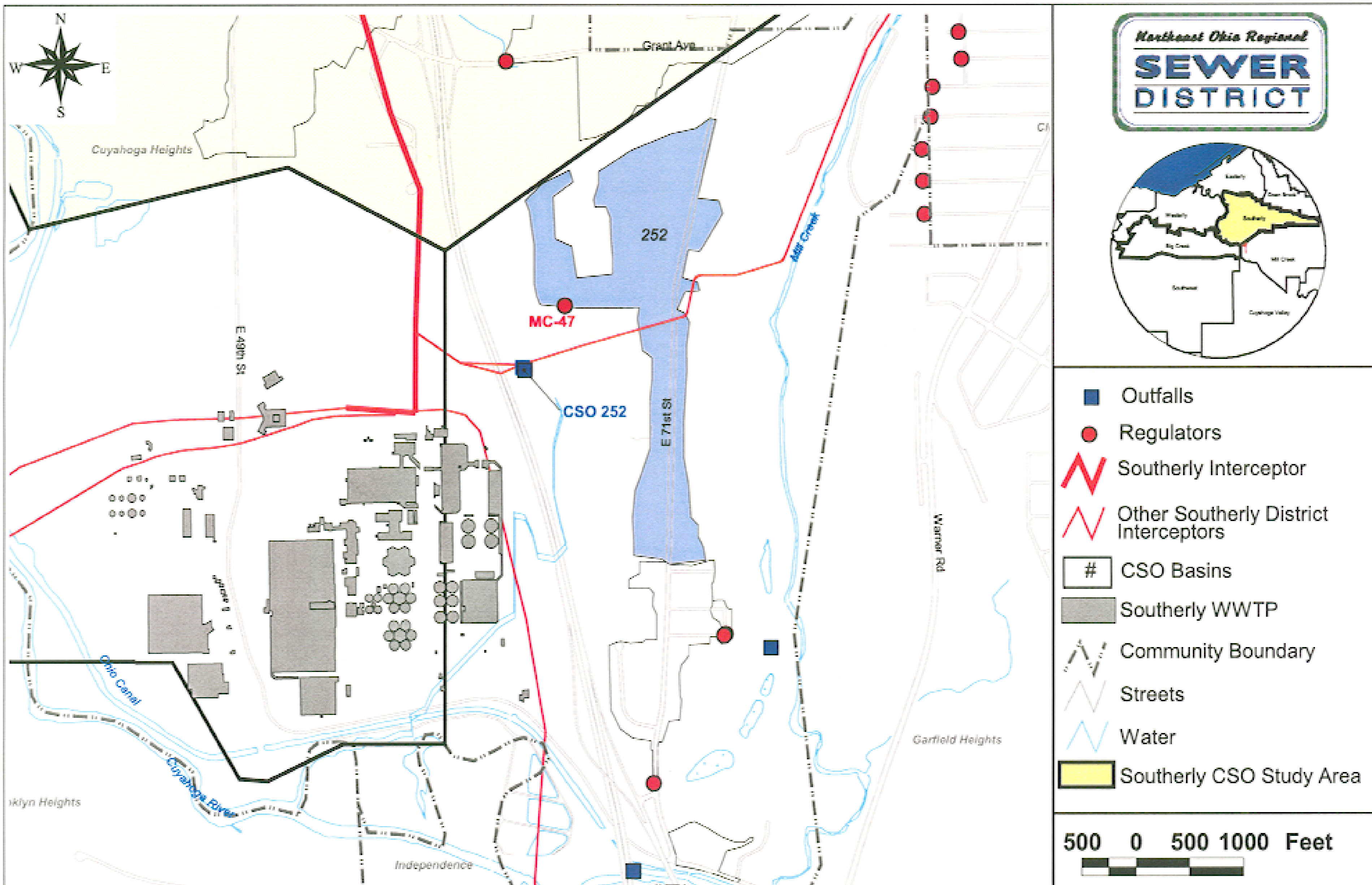
Ohio Canal

The Ohio Canal receives CSO flow from Outfall CSO 252 within the Southerly combined sewer service area. The Ohio Canal service area and CSO outfall is shown in Figure 2-13.



Southerly CSO
Hydraulic Modeling Report

Figure 2-12.
Mill Creek
CSO Outfalls



Southerly CSO
Hydraulic Modeling Report

Figure 2-13.
Ohio Canal
CSO Outfall

CSO 252. CSO 252 has a combined sewer drainage area of approximately 83 acres of mixed industrial and residential land-use and a population of approximately 1,400 people. Wet weather overflows go to the Ohio Canal, and dry weather goes to the Southerly Interceptor. Tributary regulators contributing wet weather flows to this outfall are listed in Table 2-36.

Table 2-36. Regulator Tributary to CSO 252

CSO 252, 83 Acres, Modeled Population of 1400			
Regulator Number	**Location**	**Regulator Type**	**Community**
MC-47	Chapek Parkway, east of East 71st Street	Perpendicular Weir	Cuyahoga Heights

Southerly Wastewater Treatment Plant

Wastewater in the Southerly District is conveyed to the Southerly WWTP. Five interceptor sewers serve the area: Southerly, Big Creek, Mill Creek, Southwest and Cuyahoga Valley. The Southerly WWTP is an advanced treatment plant treating an average daily flow of 175 mgd. Peak wet-weather capacity is 735 mgd, which consists of full (secondary and tertiary) treatment of 400 mgd and 335 mgd of storm flow receiving primary treatment only.

The Southerly plant provides treatment at an advanced level (tertiary) by utilizing a two-stage biological treatment process, effluent filtration and chlorination/ dechlorination. The first stage activated sludge process is similar to the ones used at the District's Easterly and Westerly plants. The second stage activated sludge process uses specialized bacteria to remove ammonia nitrogen. As a final treatment, the flow is passed through multimedia filters and is disinfected by chlorination/dechlorination from May 1st through October 31st.

CHAPTER THREE

COLLECTION SYSTEM MONITORING PROGRAM

This chapter presents the rainfall monitoring program and presents rainfall statistics. The flow monitoring program and results are also discussed in this section. This data was used to calibrate the collection system model.

RAINFALL MONITORING

Rain Gauge Locations

Rain gauges were installed at 13 temporary locations within the Southerly CSO planning area. Figure 3-1 shows the location of the rain gauges and Table 3-1 gives the addresses. The gauges record rainfall at five minute intervals in 0.01 inch increments. Most gauges were functional on April 24, 2000 and operated through August 21, 2000.

Rainfall Events

Precipitation events that were separated by less than six hours of dry weather were considered as one event. If six hours or more elapsed between periods then they were considered multiple events for the purposes of calibrating the flow volumes during storm events.

Rainfall Monitoring Results

The rainfall records were reviewed for completeness, data quality and general agreement between gauges. Two gauges recorded only partial data during the period and one recorded data that upon review, was inconsistent with other gauges. Rain gauge BC_RG4 was installed late and recorded data between 5/26/00 and 9/24/00. Rain gauge BC_RG6 only contains valid data between 5/21/00 and 7/31/00 because the rain gauge was removed from the rooftop by the building owner. The final data submittal contains the rain data through the last collection on 7/31/00. Initially the gauge did not record time correctly, but the problem was identified during data collection and corrected. Documentation identifying the amount of error in the time recorded was not available. As a result, data collected prior to 5/21/00 was not used. Upon review of the data, rain gauge SO_RG2 was found to be inconsistent with other gauges. The recorded data showed lower amounts of rainfall for each 15 minute period, but the rain would start one to two hours prior to any other gauge and end one to two hours after every other gauge. This gauge was not used. There were 25 rainfall events from May 1 thru June 21, 2000.

Figure 3-1. Project and District Rain Gauge Locations

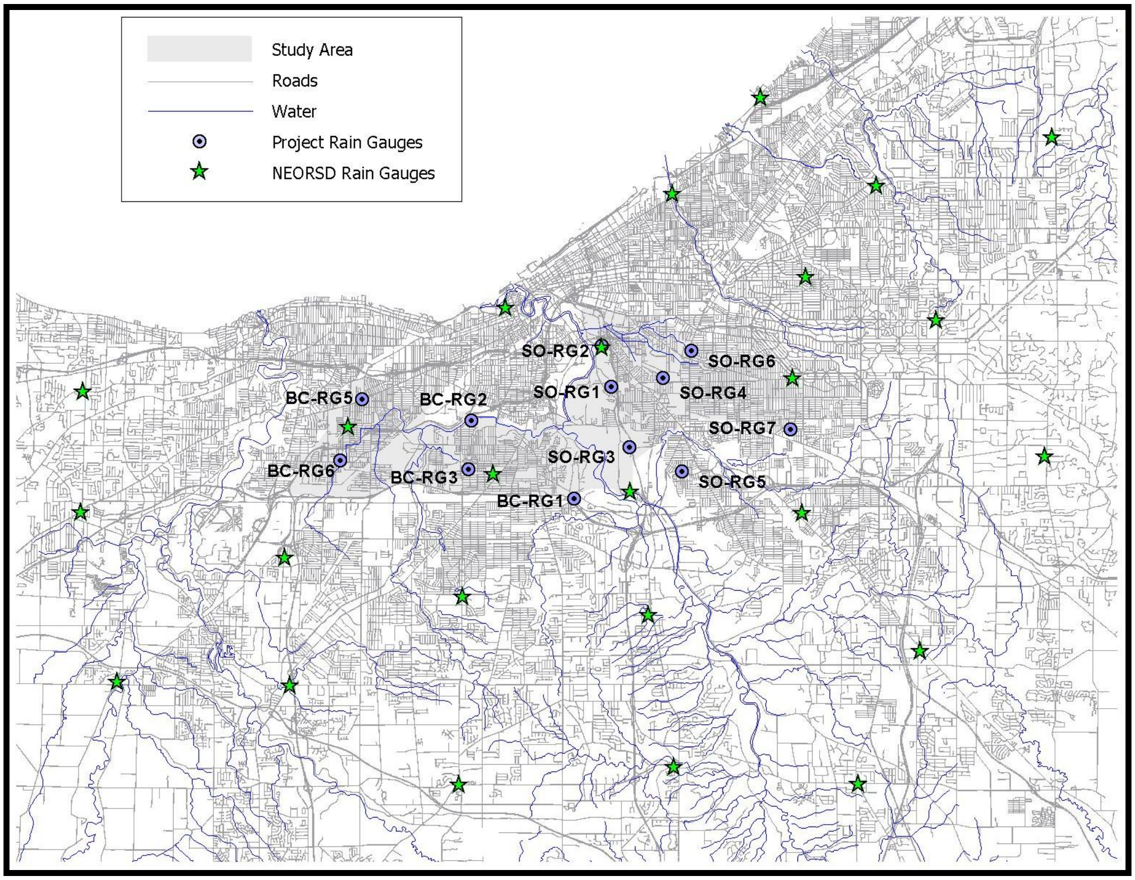


Table 3-1. Temporary Rain Gauge Locations

Designation	Location
BC_RG1	Brooklyn Hts Municipal Building, Tuxedo Avenue
BC_RG2	Municipal Building, John Nagy Boulevard, Brookside Park
BC_RG3	Post Office, Biddulph Road near West 58th Street
BC_RG5	Napa Auto Parts, 13445 Lorain Avenue

Table 3-1. Temporary Rain Gauge Locations (Cont)

Designation	Location
BC_RG6	Old Post Office, 14402 Puritas Avenue
SO_RG1	LTV Safety Office, Badin Avenue and Kimmel Road
SO_RG2	Dille Rd Pump Station, Dille Road
SO_RG3	Cuyahoga Hts Municipal Bldg, Grant Ave at I-77
SO_RG4	AAA Pipe Cleaning, Bessemer Ave btw E 65th and E 79th Street.
SO_RG5	Post Office, East 86th Street and Garfield Boulevard
SO_RG6	Audubon School, MLK Blvd and Dickens Avenue
SO_RG7	Charles Eliot School, East 160th St and Lotus Drive

Table 3-2 gives the distribution of rainfall events during the monitoring period. The events are broken down by peak hourly intensity as an average for all the gauges. A chronological account of the storm events is given in Table 3-3.

Table 3-2. Distribution of Rainfall During May 1 - June 22, 2000

Storm Size (inches)	No. of Storms	Peak Average 15-minute Intensity Range (inches/hour)	Peak Average Hourly Intensity Range (inches/hour)
>1.0	4	0.08-1.36	0.31-1.01
0.75 – 1.0	2	0.44-0.52	0.35-0.41
0.50 – 0.74	0	-	-
0.25 – 0.49	5	0.24-0.44	0.09-0.25
0.10 - 0.24	6	0.08-0.40	0.07-0.18
<0.1	8	0.00-0.08	0.01-0.05
Total	25		

Table 3-3. Summary of Rainfall Events During the Flow Monitoring Period (5/1-6/21, 2000)

Storm Number	Start	End	Average Total Depth (in)	Duration (hrs:min)	Peak 15 Minute Depth Average (in/hr)	Peak Hourly Depth Average (in/hr)
1	05/01/00 14:00	05/01/00 21:30	1.08	7:30	0.52	0.45
2	05/04/00 20:15	05/04/00 22:45	0.06	2:30	0.08	0.05
3	05/08/00 4:15	05/08/00 8:15	0.06	4:00	0.04	0.03
4	05/09/00 23:30	05/10/00 15:45	0.39	16:15	0.44	0.22
5	05/11/00 18:00	05/11/00 19:45	0.05	1:45	0.08	0.04
6	05/12/00 9:30	05/12/00 11:45	0.01	2:15	0.04	0.01
7	05/13/00 6:15	05/13/00 12:15	0.05	6:00	0.08	0.04
8	05/16/00 20:45	05/16/00 23:00	0.04	2:15	0.04	0.02
9	05/18/00 11:15	05/19/00 11:30	1.77	24:15	1.16	0.56
10	05/20/00 5:30	05/20/00 8:00	0.01	2:30	0.00	0.01
11	05/23/00 7:45	05/23/00 20:00	0.34	12:15	0.44	0.25
12	05/27/00 4:15	05/27/00 14:45	0.17	10:30	0.08	0.07
13	05/28/00 6:00	05/28/00 19:45	0.99	13:45	0.44	0.35
14	05/31/00 19:00	05/31/00 22:00	0.19	3:00	0.40	0.18
15	06/05/00 11:30	06/06/00 10:00	1.15	22:30	0.36	0.31
16	06/12/00 4:00	06/12/00 13:30	0.39	9:30	0.12	0.11
17	06/12/00 20:45	06/13/00 2:00	0.11	5:15	0.08	0.07
18	06/13/00 10:00	06/13/00 19:00	0.18	9:00	0.24	0.12
19	06/14/00 14:45	06/15/00 1:30	0.25	10:45	0.24	0.09
20	06/15/00 10:00	06/15/00 11:45	0.02	1:45	0.04	0.02
21	06/16/00 13:15	06/16/00 22:30	1.19	9:15	1.36	1.01
22	06/17/00 1:30	06/17/00 5:45	0.33	4:15	0.36	0.24
23	06/18/00 4:45	06/18/00 11:45	0.94	7:00	0.52	0.41
24	06/20/00 23:30	06/21/00 3:00	0.13	3:30	0.08	0.07
25	06/21/00 10:00	06/21/00 15:15	0.13	5:15	0.16	0.08

FLOW MONITORING

Flow Monitoring Locations

Flow monitors were installed at 128 locations within the Southerly CSO planning area. Each flow monitor (ADS series 1600) included an ultrasonic depth sensor and a velocity sensor that recorded data at five minute intervals. Depth of flow was measured in 0.01-inch increments and velocity was measured to 0.1 ft/s. Most monitors were functional from April 24, 2000 to June 22, 2000. This period was extended until August 21, 2000 for 29 meters in order to provide a longer continuous period of flow metering data at key locations.

Flow metering was conducted throughout the portion of the Southerly District tributary to the Big Creek Interceptor and the Southerly Interceptor. These areas consist mostly of combined sewers and serve the communities of Brooklyn, Brooklyn Heights, Cleveland, Cuyahoga Heights, Garfield Heights, Linndale and Newburgh Heights. Other portions of the Southerly District were studied previously by the NEORSD through projects such as the Southwest Interceptor Operational Evaluation Project and the Mill Creek Watershed Study. Limited flow metering was conducted in these latter areas as part of this study to characterize flows to the Southerly WWTP.

The purpose of the flow metering program was to collect information on the behavior of the collection system during dry and wet weather conditions. This information was used to gain insight into the system operation and to calibrate the hydrologic and hydraulic models. Scattergraphs, which were generated by plotting velocity versus flow depth, produce patterns that can indicate the presence of anomalies such as blockages. The flow meter data revealed dry weather flow diurnal patterns and flows as well as the wet weather characteristics of the system associated with runoff from rain events entering the sewer system. Flow meter locations provide points at which flows calculated by the modeling software were verified by comparison with measured flows.

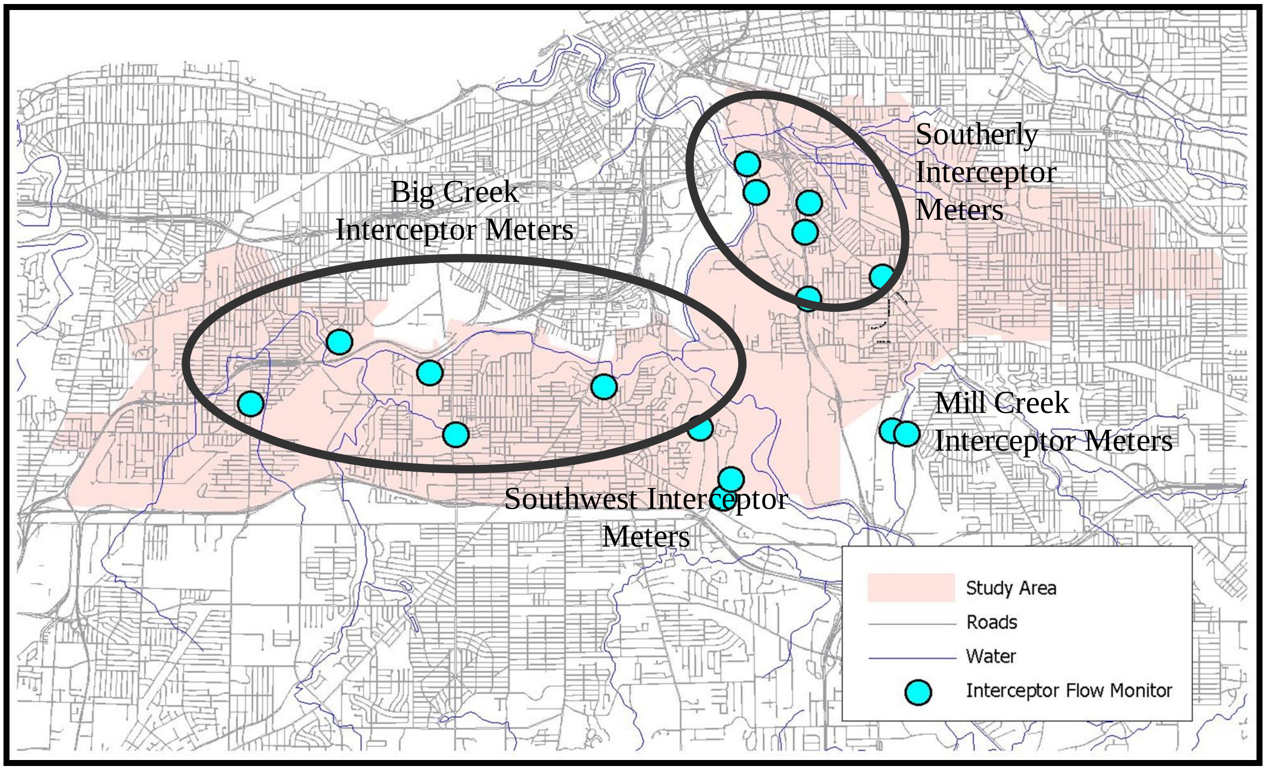
FLOW METERING SITE SELECTION

Flow metering site selection methodology was consistent with that used in the Westerly and Easterly CSO Phase II Facilities Plans. The collection system as a whole was reviewed to determine key features at which flow information was required. Knowing and understanding the ultimate uses of the flow data was an important part of identifying appropriate locations for flow meter siting. As mentioned, the main use of the flow metering data was to calibrate the hydrologic and hydraulic models. The hydraulic model for the Southerly combined sewer system contains thousands of pipes. It was not practical to meter every aspect included in the hydraulic model plus the other points of interest, such as culverts and streams for water quality. After reviewing the system, the following features were targeted for metering:

- Interceptors
- Regulating structures
- Separate sewer areas
- Streams
- Special system locations

The interceptor system is the backbone of the collection system. Flow meters were installed throughout the interceptor to characterize the impacts of the rain events. Twelve flow meters were located along the Big Creek and Southerly Interceptors as shown in Figure 3-2. Four flow meters were located on the Southwest and Mill Creek Interceptors to characterize flows entering the Southerly WWTP from these systems.

Figure 3-2. Location of Interceptor Flow Meters



A total of 68 flow meters were dedicated to flow dividers and regulators. In a combined sewer system, understanding the operation and performance of the regulators is a key factor in quantifying and controlling overflows. At the start of flow metering, available information identified 129 flow splits, static regulators and automated regulators in the Southerly CSO study area. Flow metering was targeted at regulators located in key positions. Two flow meters were typically assigned to the regulators or flow splits that were metered. One meter was placed in the influent line and one was placed in either the dry weather or wet weather outlet pipe. In general, placement of flow meters on wet weather outlet pipes was avoided because it is difficult to calibrate a meter on a pipe without dry weather flow. In eight instances, flow meters were only placed in the wet weather outlets to accommodate complex piping configurations in the dry weather sewers or to record the number of activations by a regulator. The locations of regulator flow meters are shown in Figure 3-3.

The City of Brooklyn and the Old Brooklyn portion of Cleveland are separate sewered and discharge to the Big Creek Interceptor. All other flows to the interceptor are from combined sewers. Ten flow meters were located throughout the separate sewered areas. Sewer System Evaluation Survey (SSES) field investigations were conducted in this area to quantify Inflow and Infiltration (I/I) entering the system and are more fully described in the Flow Monitoring Quality Assurance and Quality Control Report (M&E, December, 2000). To more effectively conduct this type of analysis, the area was sub-divided into smaller basins using flow meters. The sanitary trunk sewer flow meter locations are shown in Figure 3-4.

Twelve flow meters were dedicated to quantifying flows entering the Cuyahoga River from the streams of the study area. The locations of the stream meters are shown in Figure 3-5. The tributary streams metered consisted on Big Creek West Branch, Big Creek, Spring Creek, West Creek, Treadway Creek, Mill Creek, Burke Brook, Morgana Run and Kingsbury Run.

Figure 3-3. Location of Regulator Flow Meters

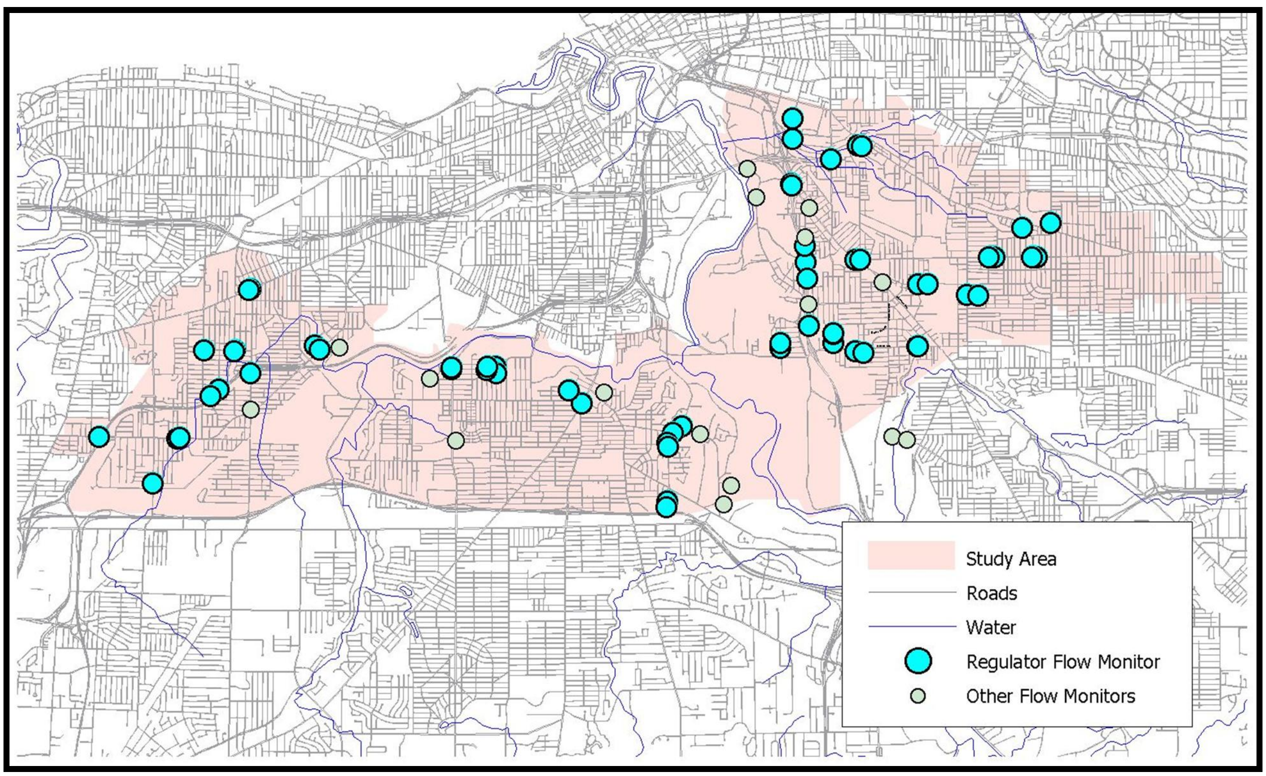


Figure 3-4. Location of Sanitary Trunk Sewer Flow Meters

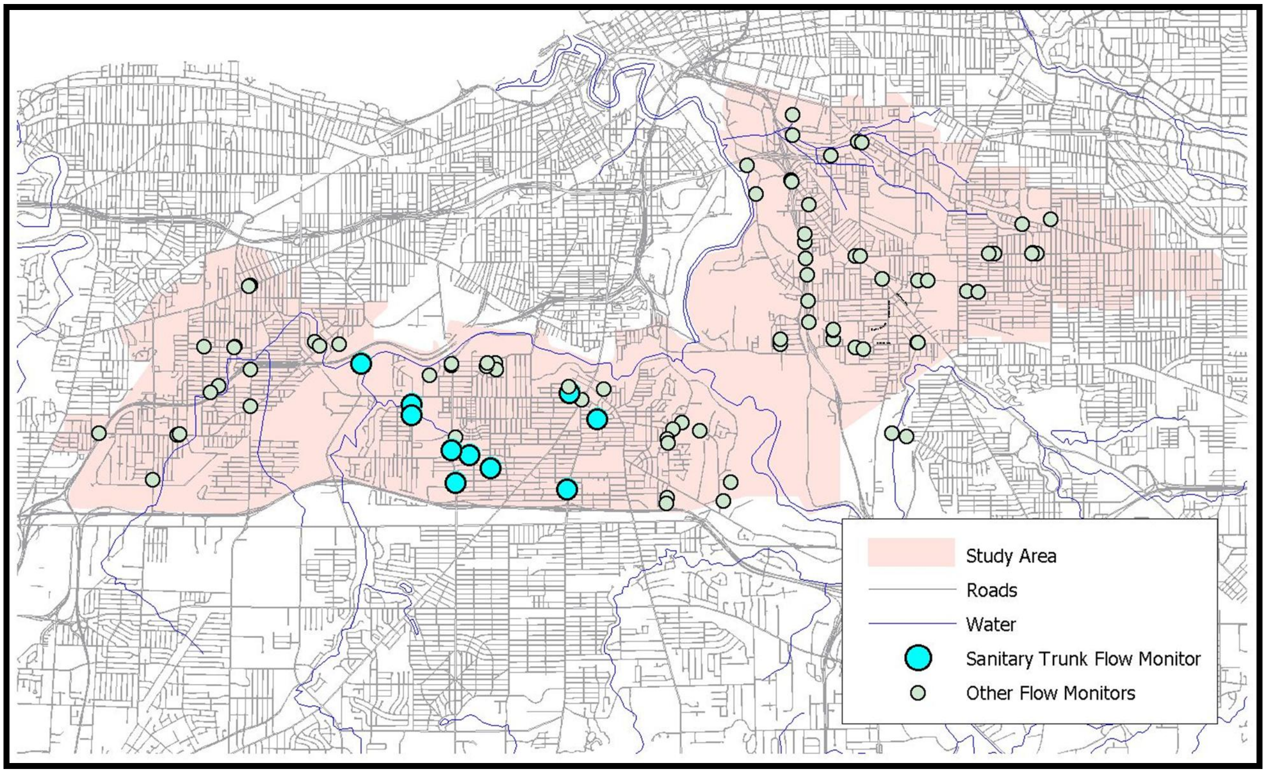
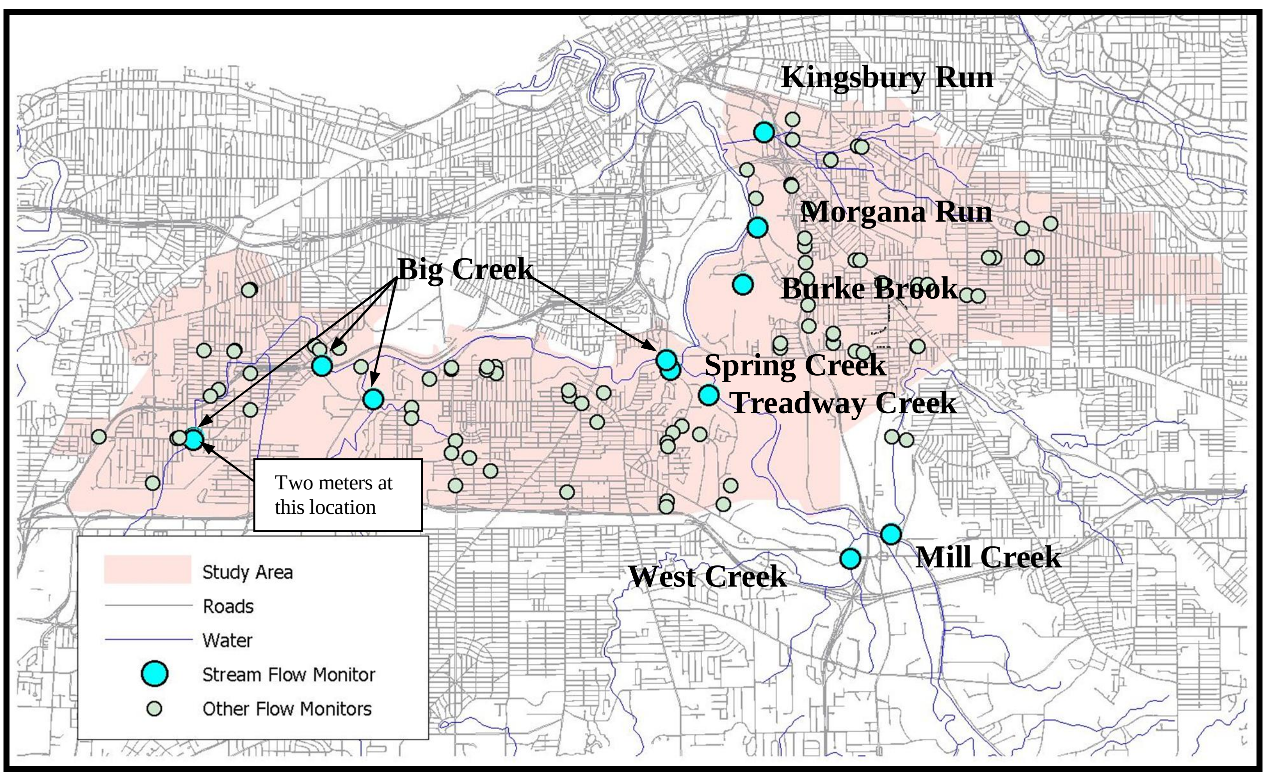


Figure 3-5. Location of Stream Flow Meters



Seven flow meters were used to document flows entering the Dille Road and Jennings Avenue pump stations. One meter at each station recorded the on/off cycling of the pumps. Fifteen additional meters (System Flow Meters) were installed to document specific issues. Eight of these system meters were located along the Kingsbury Run Trunk Sewer, Kingsbury Run Culvert and the Kingsbury Run Storm Relief and seven were installed to record flows from storm sewer / CSO outfalls during water quality sampling events. The locations of these meters are shown in Figure 3-6.

A summary table of meters by purpose is included as Table 3-4. Table 3-5 contains a listing of all 128 flow meter locations and relevant information such as the names of the interceptors and regulators associated with the interceptor and regulator flow meters. Flow meter names were assigned such that meters farthest from Southerly WWTP had higher numbers. The table indicates the size of the pipe in which the flow meter was located, stream sampling locations and local sewer information. Information regarding the rating of the manhole and size of the pipe came directly from the site inspection sheet prepared by ADS Environmental Services during monitor installation.

Figure 3-6. Location of System and Pump Station Flow Meters

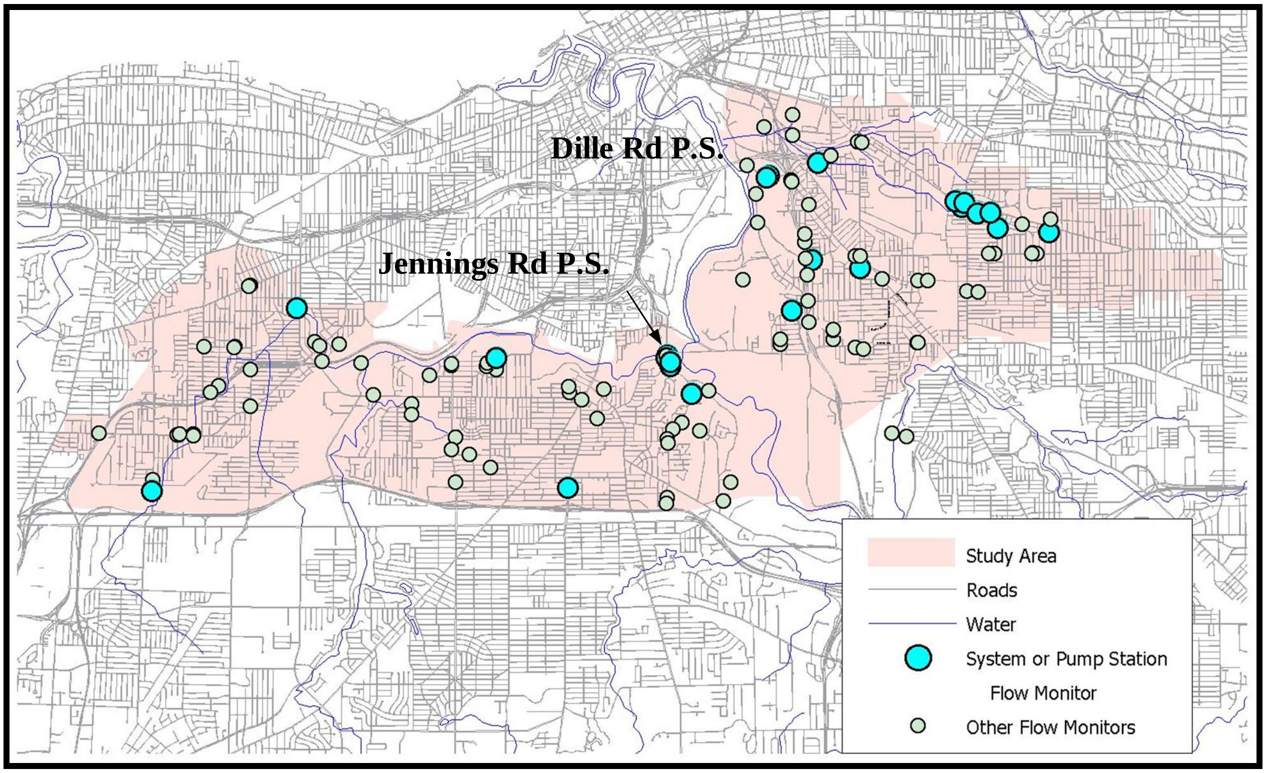


Table 3-4. Southerly District Flow Meter Summary

Meter Purpose	Number of Meters	Number of Metering Sites
Interceptors		
Big Creek	6	6
Southerly	6	6
Southwest	2	2
Mill Creek	2	2
Regulators	58	34
Automated Regulators	10	5
Separate Sanitary Sewers	10	10
Stream Flow	12	12
Storm Sewer / CSO Outfall	7	7
Pump Stations	7	2
Kingsbury Run System	8	8
Total	128	96

Table 3-5. Project Flow Metering Summary

Meter ID	Type	Regulator / Interceptor	Details	Location	Municipality	Pipe Size	Rating
BC-101	Interceptor	Big Creek		North of Hinckley Industrial Parkway	Cleveland	68"	C
BC-115	Interceptor	Big Creek		2410 Henninger	Cleveland	55"x 51"	C
BC-131	Interceptor	Big Creek		Ridge Road at Big Creek	Brooklyn	66"	B
BC-138	Interceptor	Big Creek		10621 Briggs	Cleveland/ Brooklyn	66"	B
BC-153	Interceptor	Big Creek		4256 West 130th	Cleveland	96"	D
BCI1	Interceptor	Big Creek		Brookside Drive behind St. Thomas Moore	Brooklyn	66"	C
SO-101	Interceptor	Mill Creek		Mill Creek Int. @ Canal	Cuyahoga Hts	60"	B
SO-105	Interceptor	Southerly		NEORSD monitoring site on Fleet at I-77	Cleveland	102"	n/r
SO-118	Interceptor	Southerly		4939 Broadway	Cleveland	n/r	n/r
SO-124	Interceptor	Southerly		Independence Road s/o Dille	Cleveland	33"	D
SO-125	Interceptor	Southerly		Independence Road n/o Dille	Cleveland	30"	D
SO-139	Interceptor	Southerly		Broadway between Foreman and Baxter	Cleveland	40"	C
SO-177	Interceptor	Southerly		3359 E 49th Street	Cleveland	71"x64"	C
SW2	Interceptor	Southwest		Improvement 230 off Spring Lane	Brooklyn Hts	30"	C
SWI1I	Interceptor	Southwest		SWI upstream of Improvement 230	Brooklyn Hts	114"	C
BC-114	Interceptor	Mill Creek		7500 Grand Division	Garfield Hts	24"	B
BC-108	Pump Sta.	n/a	Influent	Jennings Avenue PS 78"	Cleveland	78"	B
BC-109	Pump Sta.	n/a	Influent	Jennings Avenue PS	Cleveland	48"	B
BC-110	Pump Sta.	n/a	Influent	Jennings Avenue PS	Cleveland	No 5	B
BC-111	Pump Sta.	n/a	Dry Out	Jennings Avenue PS	Cleveland	24"	B
Dille PS	Pump Sta.	n/a	On/Off	In pump station	Cleveland	n/r	n/r

Table 3-5. Project Flow Metering Summary Table (Continued)

Meter ID	Type	Regulator / Interceptor	Details	Location	Municipality	Pipe Size	Rating
Jennings PS	Pump Sta.	n/a	On/Off	Jennings Ave PS	Cleveland	n/r	n/r
SO-126	Pump Sta.	n/a	Influent	Dille Rd at pump station	Cleveland	36"	C-
BC-102	Autoregulator	BC02	Dry Out	Spring and Jennings	Cleveland	32"x28"	B
BC-103	Autoregulator	BC02	Influent	Spring and Jennings	Cleveland	61"x63"	B
BC-104D	Regulator	BC-10	Dry Out	4534 W 11th Street	Cleveland	No 2	C
BC-104I	Regulator	BC-10	Influent	4537 W 11th Street	Cleveland	54"	D
BC-105	Regulator	BC-09	Dry Out	4902 W 12th Street	Cleveland	12"	B-
BC-106	Regulator	BC-09	Influent	West 12 Cul-de-sac	Cleveland	60"	B
BC-117	Regulator	BC-18A	Dry Out	Pearl and Altoona	Cleveland	60"	C
BC-123	Regulator	BC07	Influent	3707 Muriel	Cleveland	72"	C
BC-124	Regulator	BC07	Wet Out	3707 Muriel	Cleveland	90"	D
BC-126	Regulator	BC-37	Influent	Ridgeview and W 57th Street	Cleveland	60"	B
BC-127	Regulator	BC-37	Dry Out	4125 W 57th Street	Cleveland	48"	B
BC-128	Regulator	BC-39	Influent	4086 Ridgeview	Cleveland	72"	B
BC-129	Regulator	BC-39	Dry Out	4086 Ridgeview	Cleveland	12"	B
BC-140	Regulator	BC-44	Influent	11309 Kensington Avenue	Cleveland	72"	B
BC-141	Regulator	BC-44	Influent	11207 Kensington Avenue	Cleveland	48"	B
BC-142	Regulator	BC-54A	Influent	13018 Lorain Avenue	Cleveland	15"	B
BC-143	Regulator	BC-54A	Dry Out	13018 Lorain Avenue	Cleveland	71"x53"	C
BC-147	Regulator	BC-59	Dry Out	13330 West Avenue	Cleveland	16"	C
BC-148	Regulator	BC-59	Wet Out	13330 West Avenue	Cleveland	90"	B
BC-149	Regulator	BC-58	Dry Out	West Ave at W 134th Street	Cleveland	63"x96"	B
BC-150	Regulator	BC-58	Influent	West 140th and West Avenue	Cleveland	96"	B
BC-151	Regulator	BC-56	Wet Out	West 130th and I-71	Cleveland	60"	C

BC-152	Regulator	BC-56	Influent	West 130th and I-71	Cleveland	96"	C

Table 3-5. Project Flow Metering Summary Table (Continued)

Meter ID	Type	Regulator / Interceptor	Details	Location	Municipality	Pipe Size	Rating
BC-155	Autoregulator	BC08	Influent	Puritas and W 145th Street	Cleveland	n/r	B
BC-155A	Autoregulator	BC08	Influent	Puritas and W 145th Street	Cleveland	85"	B
BC-156	Regulator	BC08	Dry Out	Puritas and W 145th Street	Cleveland	30"	B
BC-157	Regulator	BC-70	Dry Out	W 150 and Industrial Park	Cleveland	24"	C
BC-160	Regulator	BC-65	Dry Out	Victory Blvd at Liberty Avenue	Cleveland	12"	C
BC-161	Regulator	BC-65	Influent	Victory Blvd at Liberty Avenue	Cleveland	90"	C-
BC-162A	Regulator	BC-72	Influent	Puritas and W 177th Street	Cleveland	48"	B
BC-162B	Regulator	BC-73	Influent	Puritas and W 178th Street	Cleveland	60"	B
BC-162C	Regulator	BC-73	Wet Out	Puritas and W 178th Street	Cleveland	78"	B
BC-163	Regulator	BC-41	Influent	Ridge Rd at Meadowbrook Avenue	Cleveland/ Brooklyn	72"	B
BC-164	Regulator	BC-41	Wet Out	Ridge Rd at Meadowbrook Avenue	Cleveland/ Brooklyn	NO 8	B
SO-102	Autoregulator	S02	Dry Out	Burke Brook south of Raus Avenue	Newburgh Hts	24"	C
SO-106	Regulator	S-75	Influent	4020 East 42nd Street	Newburgh Hts	42"x 33"	C
SO-107	Regulator	S-75	Dry Out	3996 East 42nd Street	Newburgh Hts	43"x 35"	C
SO-109	Regulator	S-73	Influent	3998 E 55th Street	Cleveland/ Newburgh Hts	60"	C
SO-111	Autoregulator	S02	Influent	E 55th Street between Brow and Orey	Cleveland/ Newburgh Hts	82"x 68"	B
SO-112	Regulator	S-73, S-74	Dry Out	3949 E 55th Street	Cleveland/ Newburgh Hts	18"	B
SO-113	Autoregulator	S01	Dry Out	Harvard & E 78th Street	Cleveland	27"	C
SO-114	Autoregulator	S01	Influent	Harvard @ Kotecki Monuments	Cleveland	60"	n/r
SO-115	Regulator	S-72	Dry Out	Harvard and E 64th Street	Cleveland	18"	B
SO-116	Regulator	S-72	Influent	Harvard and E 64th Street	Cleveland	60"	C

SO-120	Regulator	S-02A	Influent	Morgana at E 49th Street	Cleveland	145"x167"	n/r

Table 3-5. Project Flow Metering Summary Table (Continued)

Meter ID	Type	Regulator / Interceptor	Details	Location	Municipality	Pipe Size	Rating
SO-121	Regulator	S-02	Influent	E 49th and Chard Avenue	Cleveland	72"x60"	C
SO-123	Regulator	S-01	Influent	E 49th and Guy Avenue	Cleveland	81"x78"	C
SO-128D	Regulator	S-01	Wet Out	Gallup and Broadway Avenue	Cleveland	42"	A
SO-128I	Regulator	S-01	Influent	Gallup and Broadway Avenue	Cleveland	54"	C
SO-130	Regulator	S-09	Dry Out	South of E 40th and Crayton Avenue	Cleveland	57"x44"	B
SO-131	Regulator	S-09	Influent	E 40th at Hillcrest Foods	Cleveland	83"x89"	B
SO-133	Regulator	S-10	Influent	E 55th and Bower Avenue	Cleveland	96"	C
SO-133A	Regulator	S-10	Wet Out	E 55th and Bower Avenue	Cleveland	96"	C
SO-134	Regulator	S-14	Wet Out	South of Berwick Road	Cleveland	62"	B
SO-135	Regulator	S-14	Influent	6616 Berwick Road	Cleveland	60"	n/r
SO-136	Regulator	S-54	Dry Out	6325 Union Avenue	Cleveland	20"	C
SO-137	Regulator	S-54	Influent	6544 Union Avenue	Cleveland	85"	B
SO-141	Regulator	S-64	Dry Out	Aetna & E 80th Street	Cleveland	24"	C
SO-142	Regulator	S-64	Influent	8300 Aetna Road	Cleveland	80"	B
SO-143	Regulator	S-66	Dry Out	3721 East 93rd Street	Cleveland	63"	C
SO-144	Regulator	S-66	Influent	9505 Sandusky Avenue	Cleveland	69"	B
SO-145	Regulator	S-49	Dry Out	9909 Union Avenue	Cleveland	24"	B
SO-146	Regulator	S-49	Influent	10311 Union Avenue	Cleveland	49"x62"	B
SO-147	Regulator	S-48	Influent	MLK and Union Avenue	Cleveland	66"	n/r
SO-149	Regulator	S-48	Influent	11200 Union Avenue	Cleveland	35"x45"	B
SO-154	Regulator	S-48	Dry Out	MLK and Union Avenue	Cleveland	46"x34"	C
SO-155D	Regulator	2360	Wet Out	MLK s/o Kinsman Road	Cleveland	46"x34"	C
SO-159	Regulator	2360	Influent	E 116th and Luke Avenue	Cleveland	72"	B

BC-118	San. Trunk	n/a		2915 Roanoke Avenue	Cleveland	12"	C

Table 3-5. Project Flow Metering Summary Table (Continued)

Meter ID	Type	Regulator / Interceptor	Details	Location	Municipality	Pipe Size	Rating
BC-120	San. Trunk	n/a		State Rd s/o Bader Road	Cleveland	48"	B-
BC-122	San. Trunk	n/a		4231 West 38th Street	Cleveland	15"	n/r
BC-132	San. Trunk	n/a		6303 Biddulph Avenue	Brooklyn	12"	C
BC-132I	San. Trunk	n/a		5726 Ira Avenue	Cleveland	72"	C-
BC-133	San. Trunk	n/a		4624 Ridge Road	Brooklyn	30"	B
BC-134	San. Trunk	n/a		4831 Ridge Road	Brooklyn	24"	B
BC-136	San. Trunk	n/a		4326 Roadoan Road	Brooklyn	66"	B
BC-137	San. Trunk	n/a		4412 Roadoan Road	Brooklyn	10"	B
BC-138D	San. Trunk	n/a		Memphis Park at Tiedeman Road	Brooklyn	21"	n/r
BB48SN	Stream	n/a	BB48SN *	Burke Brook	Cleveland	118"x115"	B
BC-154A	Stream	n/a	BC28SN *	Culvert at Puritas Avenue (2 of 2)	Cleveland	84"x140"	B
BC-154B	Stream	n/a	BC28SN *	Culvert at Puritas Avenue (1 of 2)	Cleveland	84"x140"	B
BC-SS1	Stream	n/a	SP01S *	Spring Creek at Bradley Road	Cleveland	72"	n/r
BC-SS2	Stream	n/a	TR01S *	Treadway Creek	Cleveland	54"	C-
BC-SS3	Stream	n/a	WC36SN *	West Creek at Schaaf Road	Independence	50"x85"	C
BC-SS4	Stream	n/a	BC25SN *	Jennings at Big Creek	Cleveland	112"x68"	C
SS5	Stream	n/a	BC27SN *	Big Creek at Memphis Avenue	Brooklyn	n/r	n/r
BC-SS6	Stream	n/a	BC26SN *	Big Creek at I-71	Cleveland	102"x192"	C
KR46	Stream	n/a	KR46SN *	Kingsbury Run on Broadway Avenue	Cleveland	114"x177"	n/r
SO-122W	Stream	n/a	MR47aSN *	Morgana Run in LTV	Cleveland	196"x16'	B
SO-SS2	Stream	n/a	MC31SN *	Mill Creek	Cuyahoga Hts	86'x29'	C-
BB035	Outfall	S-80A	BB035SS *	Reg S-80A overflow	Newburgh Hts	48"	n/r
BC-121	Stormwater	n/a	Storm water	State Rd n/o Bader Rd - sanitary pipe	Cleveland	18"	n/r

BC-130	Outfall	CSO053	BC053SS *	Outfall pipe to CSO053	Cleveland	72"x144"	C
BC-144	Stormwater	n/a	Storm water	W 117th St and Thrush Avenue	Cleveland	72"	n/r

Table 3-5. Project Flow Metering Summary Table (Continued)

Meter ID	Type	Regulator / Interceptor	Details	Location	Municipality	Pipe Size	Rating
BC-159	Outfall	n/a	BC233SS *	4791 W 150th Street	Cleveland	60"	B
MR036A	Outfall	n/a	MR036aSS*	Morgana Run	Cleveland	n/r	n/r
MR036C	Outfall	n/a	MR036cSS*	Reg overflow at E 65th Street	Cleveland	48"	n/r
SO-129	Kingsbury	n/a		East 51st and Praha Avenue	Cleveland	163"	B
SO-132	Kingsbury	n/a		Kinsman and E 90th Street	Cleveland	80"x90"	B
SO-150	Kingsbury	n/a		3368 East 116th on Regalia Avenue	Cleveland	91"	C
SO-151	Kingsbury	n/a		East 90th south of Kinsman Road	Cleveland	66"	C
SO-152	Kingsbury	n/a		w/o East 93rd and Kinsman Road	Cleveland	68"x66"	n/r
SO-153	Kingsbury	n/a		9515 Carton Avenue	Cleveland	11'	n/r
SO-153I	Kingsbury	n/a		s/o 10245 Kingsbury Road	Cleveland	84"x96"	n/r
SO-156	Kingsbury	n/a		Kinsman at MLK Boulevard	Cleveland	96"	B

** Water quality sampling*
n/r Not Recorded

Site Sheet Ratings

During flow monitor installation, ADS prepared a site report for each location. Site sheets contain location, installation details, hydraulic, and condition information for the metering installation manhole and pipe segments. Also contained on the site report is a hydraulic rating for each location. ADS uses a subjective grading system to predetermine a site's suitability for monitoring. Letter grades of *A*, *B*, *C*, *D*, and *F* are used to represent a continuum from excellent (*A*) to poor (*F*), where *A* would indicate smooth laminar flow with no pipe disturbances (bends, slope changes, etc.) upstream or downstream and *F* would indicate that metering was not possible. Typical for ADS monitoring in sewer systems, most monitoring locations in the Southerly area were rated *C* or higher. Table 3-6 provides a summary of the site sheet ratings.

Table 3-6. Site Sheet Rating Summary

Rating	Number of Sites
A	1
B	56
C	45
D	5
F	0
No Rating	21
Total	**128**

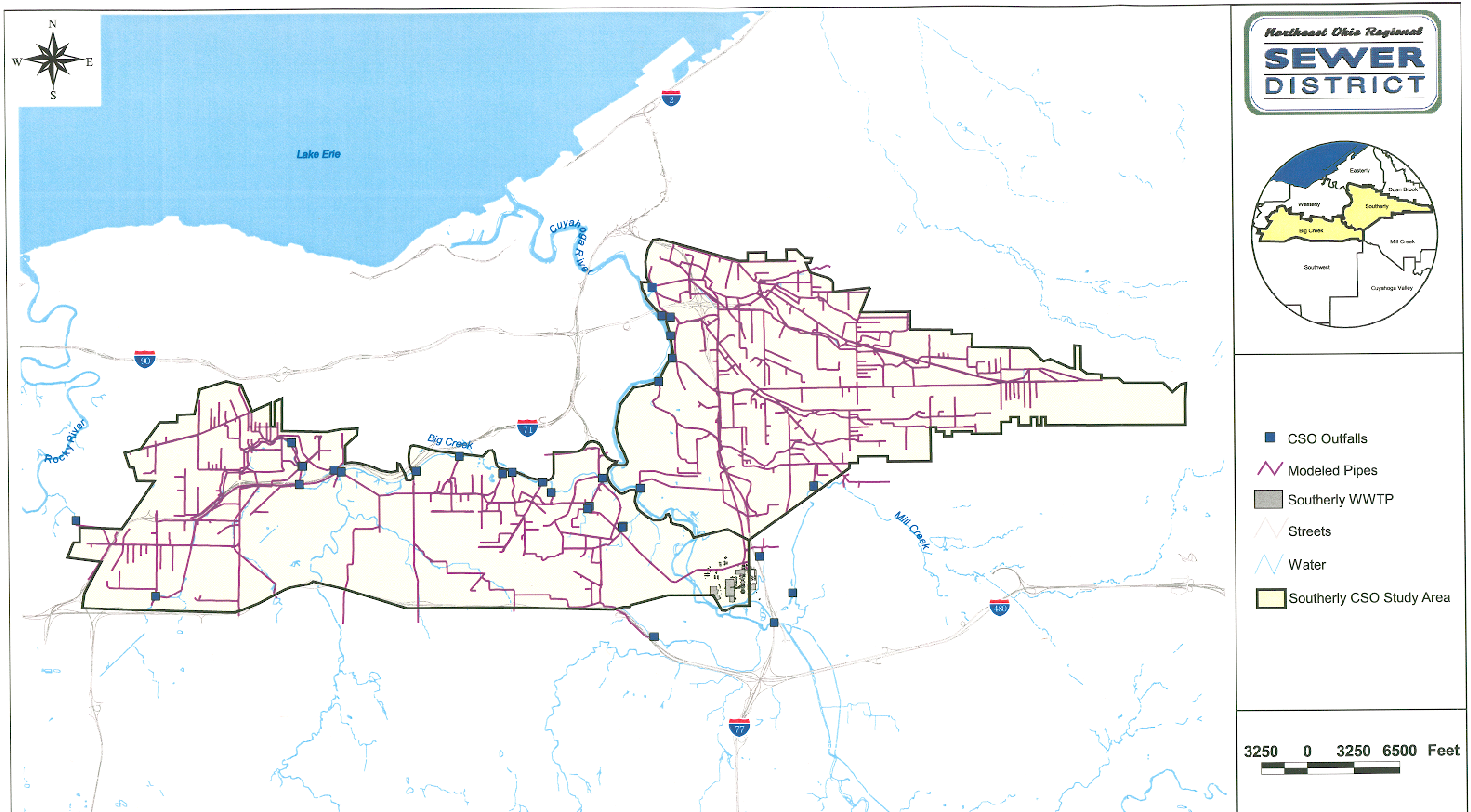
CHAPTER FOUR
COLLECTION SYSTEM MODEL DEVELOPMENT

Detailed collection system information was compiled to develop a hydrologic and hydraulic model in order to assess CSO frequency, volume and control alternatives. This model development consisted of a Storm Water Management Model (SWMM) RUNOFF hydrologic model and the MOUSE hydraulic model of the Southerly CSO study area. These models were used to simulate the hydrologic and hydraulic response of the system to infiltration, sanitary baseflow and rainfall runoff. This chapter presents a discussion of the models used, the model development approach, and the characterization of basins and flows within each sub-system of the collection system model.

MODEL DESCRIPTION

The Southerly Collection System Model consists of the Big Creek and Southerly Interceptors, combined sewers and outfall pipes downstream of regulators, and major trunk sewers (at least 30 inches in diameter or greater, or egg-shaped sewers greater than a No. 2). Smaller diameter sanitary and combined sewers associated with CSO regulators and outfalls or in problem areas were also modeled. The model also includes storm water facilities conveying combined sewer overflows. A large number of the CSO regulators do not discharge directly to the receiving waters, but are connected to culverts that pick up overflows from various locations in the combined sewer areas, as well as storm flows before they outlet to nearby creeks and watercourses. These include Kingsbury Run, Morgana Run, Burke Brook, and portions of Big Creek. The model network is illustrated in Figure 4-1.

- The model was organized into two components:
  - A hydraulic collection system model to simulate the routing of dry weather base flow, sanitary flows, and wet weather flows through the combined sewer system, interceptor system, and Southerly WWTP



Metcalf & Eddy

Southerly CSO Phase II Facilities Plan

CH2MHILL

Figure 4-1.
Model Network

- The runoff hydrology was modeled with SWMM, and the collection system hydraulics was modeled using MOUSE.

MODEL DEVELOPMENT APPROACH

MOUSE Hydraulic Model

MOUSE was used as the hydraulic model for the Southerly collection system. MOUSE is a fully dynamic model that can simulate backwater, looped flow, variable water levels at outlets, pumps and weirs in a collection system network. Community tributary sewers (generally equal to a No. 3 egg or 30" or larger in diameter) and the District's interceptors, regulators, pump stations and all overflow conduits were included in the model. Water levels, flow rates and velocities calculated by the model were stored at each node and conduit at user-specified time intervals, allowing subsequent examination of hydrographs or profiles in the nodes or conduits. MIKEVIEW is a result viewer used for the hydraulic grade line, flow rate, and velocity hydrographs. Model results can also be compared with external time series data such as meter readings. MIKEVIEW also allows the examination of pipe profiles with animations showing the flow rates and hydraulic grade line along the pipe profile as a function of time.

Typical hydraulic elements present in sewer systems can be simulated in MOUSE, including conduit cross-sections, circular manholes, detention basins, weirs, pump stations with a variety of operational modes, flow regulators, and constant or time-variable outlet water levels. These hydraulic elements can be simulated in close correspondence to their actual operational characteristics.

The input data required by MOUSE for nodes and conduits included pipe inverts, pipe diameters, pipe material, manhole inverts and rim elevations, manhole diameters, and their northing and easting coordinates. Pipe lengths are determined by MOUSE based on these coordinates, but could also be user specified through an additional input file. The pipe and node network was first developed in GIS as a starting point for general pipe and node layout and attributes. This network included the majority of the pipes and manholes in the system including the smaller intra-community and inter-community sewers. Using this information the initial model network was delineated based on pipe size as well as pipe function.

Naming Convention

The manholes, blind connections, and regulators for this model network were then assigned labels for the model identification. MOUSE allows up to a seven character alpha- numeric label for the model nodes. The interceptor manholes were assigned names based on the interceptor name. The first three letters were used to represent the branch of sewers and the last four were used for the manhole number. The first letter was “B” for the Big Creek Interceptor and “S” for the Southerly Interceptor. The second letter was used to delineate the branch of the interceptor, so the first two letters are “SA” for Southerly Main, “SB” for Southerly Broadway, “SC” for the Independence South Branch, and “SD” for the Independence North Branch. The third letter was used for a sub-branch; for example, the prefix “SBD” is a branch on Union Avenue that connects to the Broadway Branch of Southerly Interceptor. The first digit was used to represent an additional sub-branch, such as the prefix “SBD1” is a sub-branch of “SBD”. The last three digits are the manhole number and progressively get larger from the downstream end by increments of five. This allowed for the insertion of additional manholes or pipes as the system was examined in more detail and corrections were made.

A similar methodology was used for the culverted streams. The prefix “K” was used for Kingsbury Run, “R” for Morgana Run, “U” for Burke Brooke and “BZ” for the Big Creek culvert. The second letter was used for branch names of Kingsbury, Morgana, and Burke. Again, the manhole numbers are started at the downstream end and increased moving upstream.

The CSO regulators were typically assigned names based on the District’s structure name, without any dashes or spaces. For example, Regulator S-75 became S75, and automated Regulator SO-2 became SO2. Also, additional regulators or flow dividers were discovered during the modeling process. These were labeled SN01, SN02, etc… for the “Southerly North” region and SS1, SS2, etc… for the “Southerly South” region. For the Big Creek region they were named starting at BC75 and upwards. These names allowed for the differentiation of the new flow dividers from the District maintained structures.

For the wet weather overflow pipes from regulators the manholes were named after the regulator followed by an alpha character (BC7a, BC7b, etc…) until the receiving water or culverted stream was reached.

Pipe and Node Attribute Information

Using this naming convention, the required pipe and manhole attributes were added to the pipe and node coverages in GIS. Record drawings and the inspection database were used to refine pipe connections and manhole locations. Using these two sources of information, the necessary pipe and manhole information was added to the coverage. For pipes, this information included shape, size, upstream and downstream invert elevations and material. For manholes, this information included the invert, diameter, and ground elevation of the manhole. Many tools were developed to assist in the addition of this attribute information. These tools and a more detailed description of their use are provided in the Southerly Sewer System Evaluation Survey (SSES) Report (Metcalf & Eddy, September 2001)

Pipe Information

Pipe shapes are specified in MOUSE either as a standard shape or a unique cross-section. The standard shapes include circular pipes and trapezoidal open channels were defined by the bottom width and the side slope. Unique cross-sections were specified through a cross-section database editor. These unique shapes were specified as a series of points that defined the shape and size. MOUSE then used this cross-section to compute the hydraulic characteristics as a function of depth, such as cross-sectional area and wetted perimeter. The special shapes used for this model consisted of:

- Eggs- standard City of Cleveland sizes; smaller at the base and wider at the top

- Arches-semi-circular top; may have a channelized bottom
- Box Culverts-rectangular pipe; may have channelized bottom
- Circular Equivalent (Inverted Egg)-wider at the base and smaller at the top, may have a channelized bottom
- Ovals-oval pipe
- Open Channel-open channel sections were drawn based on Cuyahoga County ground contours or surveyed cross-sections

With the exception of the open channel sections, all the “Special Shapes” were drawn in AutoCad. A grid was then overlaid, and the x, y coordinates representing the cross-sectional shape was transferred into MOUSE.

Manning’s Roughness

The Manning’s roughness coefficient affects both the velocity and water level in a pipe section. A set of default values consistent with other District projects, shown in Table 4-1, was determined for each of the standard pipe materials. These values could also be set to user specific values for an individual pipe section to match meter data where necessary.

Table 4-1. MOUSE Material Codes

Mousecode	MOUSE Material	Pipe Material	Manning’s n
1	Smooth Concrete	Reinforced Concrete Pipe	0.015
2	Normal Concrete	Corrugated Metal Pipe	0.024
3	Rough Concrete	Segmented Block	0.02
4	Plastic	Poly Vinyl Chloride	0.0125
5	Iron	Cast/Ductile Iron Pipe	0.0143
6	Ceramics	Vitreous Clay Pipe	0.0143
7	Stone	STONE	0.017
8	Other	BRICK	0.017

Control Structures

Control structures in the Southerly Collection System that were modeled in MOUSE consist of pumping stations and regulators, both static and automated.

MOUSE represents pump stations using a functional relation that connects two nodes and uses the pump curves and start/stop elevations. The upstream node is the wet well and the downstream node is the connection of the force main to the gravity sewer. The ground elevation at the upstream end of the force main must be artificially raised to an elevation high enough to accommodate the hydraulic grade line.

The pump station characteristics were entered as a discrete flow versus head relationship. Up to four points were used to characterize the flow as a function of wet well depth. The start and stop levels and pumping rate were obtained from the District, and entered into MOUSE to represent the pump station operation. The pump stations modeled in MOUSE are located at Dille Avenue, E. 37th Street and Jennings Road. The remaining pump stations have relatively small flows, and both the influent and effluent pipes do not meet the minimum size or function criteria necessary to be included in the model.

A regulating structure is any type of structure that splits flow between the dry weather flow and the storm overflow in a combined sewer. A "regulator" overflows directly to a receiving water without being re-regulated, while a "flow divider" is re-regulated before it reaches the receiving water. There were several types of regulating structures modeled: static regulators (which included weir walls, relief pipes, and leaping weirs), automated regulators and orifices. There are a total of ninety-six District maintained overflow regulators. These include: BC1 through BC9 (automated regulators), BC-09 to BC-74 (static regulators), SO1 to SO8 (automated regulators), and S-01 to S-83 (static regulators). Several additional regulators were identified in the study, including 2344, 2200, and an unnamed regulator on Jennings Road on the Jennings Freeway.

Static regulators are structures with a fixed elevation, without the ability to be adjusted based on conditions occurring in real time. The first of these types of structures is a weir wall, which can be classified as perpendicular or sidespill. For a perpendicular weir, the dry weather outlet pipe connects from the influent pipe at an angle. The weir diverts flow to the dry weather outlet pipe. During wet weather events, the flow can overtop the weir wall and continue straight into the storm water outlet. For a sidespill weir, the storm water outlet connects from the influent and dry weather outlet pipe at an angle. A weir parallel to the influent pipe and dry weather pipe keeps the flow in the dry weather pipe until a wet weather event occurs. MOUSE allows for both types of weirs and calculates the overflow based on the weir equation. MOUSE uses the crest elevation, the crest width, and orientation (perpendicular or sidespill) to compute overflow from the weir. For the orientation of the weir, MOUSE uses the kinetic energy of the flow for the calculation of flow over a perpendicular weir (90^o orientation), but not for a sidepill weir (0^o orientation).

Since MOUSE accounts for weirs as a functional relationship between two nodes, an additional node is required at the regulating structures. This node was located immediately downstream of the regulator on the wet weather pipe. It was given the same invert and rim elevation as the original regulator node, and was given the regulator name with an addition of a “W” to the end. For example, Regulator BC23 has a node BC23W on the wet weather outlet pipe, and the weir relationship connects BC23 to BC23W.

Relief pipes (high pipes) are modeled using the elevation difference in the two outlet pipes from a node. However, for relief pipes that overflow to receiving water bodies an artificial weir was added in order to account for the overflow volumes during post-processing. Even if a pipe has no flow, such as a wet weather overflow pipe during dry weather, MOUSE will create a small depth of water in order to avoid an entirely dry pipe. This is done for reasons of numerical stability and results in a small continuous flow. Although this flow is small, it can create a substantial volume when summed over a period of time, such as long dry weather periods. Weirs do not require this artificial flow. Therefore, an artificial weir was added to the wet weather outlet pipe in order to more accurately measure flow. The additional node that is required for a weir is given the same name as the regulator, but is followed "WF" in order to differentiate it from actual weirs. It was verified that a long, low weir would not affect the overflow volume. Therefore a weir, which is ninety-nine feet wide, 0.05 feet above the invert of the overflow pipe and parallel to the influent pipe (90^{o} in MOUSE) was used. The wide width was to create a negligible head loss. The height of 0.05 was necessary in order to prevent the artificial flow in the overflow pipe from backflowing.

A leaping weir is a regulating device in which the dry weather flow in a combined sewer drops into a lower dry weather outlet pipe through an opening in the invert of the combined sewer. During storm events when the velocity and depth of flow increases, the storm water passes over, or leaps, the opening to the dry weather outlet and continues along to the storm water outlet. The hydraulic design of leaping weirs has been based on empirical findings and trial and error testing. Adjustable plates have been used so that the opening may be modified. If the opening was constructed of masonry, it was common practice first to undersize it and then enlarge it as necessary based on actual performance ("Fluid Mechanics", Streeter, Wylie, and Bedford, 4th edition, p. 418, McGraw-Hill Book Company). A rational approach to the design of leaping weirs was developed by McClenahan in 1922 and is based on the trajectory theory ("Handbook of Applied Hydraulics", Davis, 2nd edition. p. 1068, McGraw-Hill Book Company, 1952). Theoretical velocity between points, neglecting losses, is:

$$V=(2gH)^{1/2}$$

V= Velocity (ft/s)
H= Depth of flow (ft)
G= Acceleration due to gravity (ft/s^2)

The velocity of a free stream of water may be determined if the air resistance is negligible. The x-component of the velocity does not change, therefore:

$$Vt=X_0$$

t= time for fluid particle to drop

The time for a particle to drop distance y_0 under the force of gravity when it has no initial velocity in that direction is equal to:

$$y_0=(gt^2)/2$$

Setting the two equations equal, the time can be eliminated giving:

$$V=(X_0)/(2y_0/g)^{1/2}$$

For the leaping weir, y_0 equals the depth of flow in the pipe H, and X_0 is the distance across the opening of the weir. Solving for length:

$$X_0 = V(2H/g)^{1/2}$$

This equation corresponds to the formula developed by McClenahan.

To determine the point at which the flow leaps across the weir opening, a relationship between the pipe velocity and depth of flow was established using Manning's equation for each of the influent sewers for the leaping weirs. The velocity versus depth relationship for the influent sewer is dependent on the pipe slope, roughness, and cross-section. For circular pipes, Manning's equation was used to calculate the velocity-depth relationship. For non-circular pipes the values generated by MOUSE for depth, area, and hydraulic radius were used in the Manning's equation to determine the velocity versus depth relationship. Given these relationships and the length of the weir opening, X_0, the above equation was solved for the minimum amount of flow necessary to leap the weir. The water depth at which this occurs is termed the "activation depth".

Flow metering data has shown that flow typically begins to enter the storm sewer before this activation depth occurs. Therefore, for a starting point, it was assumed that at a depth of one-third the activation depth, 95 percent of the flow enters the dry weather pipe and the remaining 5 percent of the flow enters the storm sewer. At three-quarters of the activation depth, it was assumed that 10 percent of the flow enters the storm sewer. When the depth of flow reached the activation depth, 75 percent of the flow was considered to enter the dry weather pipe. This is the maximum flow that is assumed to enter the dry weather pipe. For flows greater than what occurs at the activation depth, any excess flow would flow to the storm sewer. These depths and flows were coded into MOUSE using a flow versus depth relationship.

For example, assume an activation depth of 1 foot with a corresponding influent flow of $10ft^3/s$ were calculated for a leaping weir. For depths of flow greater than 1 foot it was assumed that 7.5 ft^3/s would go to the dry weather outlet and excess flows would enter the storm sewer. An artificial weir was added to the overflow pipe in order to track the volume of overflow. The same convention that was used for relief pipes was used for leaping weirs.

These assumptions were then checked against meter data at Regulators BC-41, S-1A and S-10. This is further discussed in Chapter Five.

Automated Regulators

Real Time Control Analysis for Southerly Combined Sewer System

There are 17 automated regulators in the Southerly combined sewer system. These automated regulators are listed in Table 4-2. The settings for the regulator are located in a table in Appendix A.

The automated regulators are usually installed at CSO locations and are typically used to maximize in-system storage, limiting the amount of overflows that occur for smaller storm events. They also function to regulate and limit the amount of flow discharging to the Southerly and Big Creek interceptors, preventing the interceptors from becoming overloaded. Sensors were installed to monitor the water depth in the dry weather outlet downstream of the automated regulator (DWO level). When the DWO level sensor rises above the set point, the knife gate, timber gate, or plug valve begins to close in order to restrict the flow to the dry weather outlet. A sensor is also located upstream of the regulator in order to monitor water depths in the influent sewer (TRUNK level). When the trunk level sensor rises above the set point, the weir fabridam deflates or the sluice gate opens to relieve the upstream system and allow overflows.

Table 4-2. List of Real Time Control Sites in the Southerly System

PFP No.	Regulator	Type of Control	Location	Dry Weather Discharge Interceptor	Overflow Discharge
1	SO3	KG, SG	Woodhill/Mt. Auburn	Southerly	Kingsbury Relief
2	SO5	KG, SG	E79th/Garden Valley	Southerly	Kingsbury Relief
4	BC1	KG, SG	Valley/Elston	Big Creek	Jennings/Big Creek
5	BC2	PV, SG	Spring/Jennings	Big Creek	Spring Creek
6	BC3	PV, SG	South Hills/Irving	Big Creek	Treadway Creek
7	SO1	KG, SG	E78th/Harvard	Southerly	Mill Creek
8	SO6	KG, SG	E93rd/Kinsman	Southerly	Kingsbury Relief
9	BC5	PV, SG	Jennings/Big Creek	Big Creek	Big Creek
10	BC4	PV, FB	W15th/Tarlton	Big Creek	Treadway Creek
12	SO4	KG, FB	E93rd/Carton	Southerly	Kingsbury Relief
13	SO8	KG, FB	Kingsbury/Carton	Southerly	Kingsbury Relief
14	BC6	FB	W18th/Denison	Big Creek	In-Line Storage
15	SO7	KG, FB	E94th/Kinsman	Southerly	Kingsbury Relief
16	SO2	PV, SG	Burke Brook	Southerly	Burke Brook
27	BC7	TG, FB	Bellaire/Kensington	Big Creek	Big Creek
28	BC8	KG, SG	W145th/Puritas	Big Creek	Big Creek
29	BC9	TG, FB	W38th/Muriel	Big Creek	Big Creek

Notes:
Type of Control for dry weather and overflow discharge: KG – Knife Gate, SG – Storm Gate, PV – Plug Valve, FB – Fabridam, TG – Timber Gate

Water level measurements are monitored by a Supervisory Control and Data Acquisition (SCADA) system, which records the water levels at sensor points throughout the system. The central data control is located at the Northeast Ohio Regional Sewer District Environmental Maintenance and Service Center (EMSC). The operating logic of the automated regulators is designed based on the operating goals as well as system characteristics to avoid detrimental impacts on the system. Water level “Set Points” are entered into a regulator’s programmable logic controller, and the control gates, valves, and fabridams are adjusted according to these set points. An equation, called the Proportional Integral Differential (PID) equation, is used to control the sensitivity and amount of adjustments to minimize the frequency of adjustments that may result in hydraulic instabilities.

The Real Time Control (RTC) module of the MOUSE model was applied to simulate the automated regulators. This computer program can simulate real time operation of weirs, gates, and pumps based on given logical parameters and PID equation constants. The input data requirements are described as follows:

1. Sensor location(s) – this is a manhole, or a location, where the depth sensor is placed to control the RTC device; it can be located away from the RTC device (e.g. if the water level measured by a sensor located at a manhole downstream exceeds a given elevation, then start to close the RTC gate upstream); there can be more than one sensor location; for example, one sensor downstream to trigger the gate to close and one upstream to trigger the weir fabridam to open to allow overflow.

2. Type of data measured by sensor – elevation or depth of flow, or sometimes flow rate.

3. Dimensions of the gate, invert elevation of the gate and maximum elevation when the gate is opened, speed of opening and closing.

4. Real time pumps – speed of starting and stopping, and minimum time that pumps would stay on or off.

5. Operational Logic – for example, water levels (or flows) at a manhole that will be used to make a decision on opening or closing a dam, gate, or starting a pump; there can be more than one logical operand.

6. Logical statements – these are statements used to test the logical operands (e.g. if the water level at a downstream manhole exceeds a given elevation, and if the water level at the regulator manhole upstream exceeds a given elevation, then keep the sluice gate closed or the weir fabridam opened).

7. Constants used to program the local controller with a Proportional Integral Differential (PID) control algorithm. If the RTC device has a local controller and it is a PID controller - they may include integration time, derivation time, time steps used for testing, factor of proportionality, etc. An example of the RTC and PID files follows:

RTC Example	
0	0 for gate (gate basics)
SO8KG	Gate ID
SO8	From node
SO8KG	To node
1	1 for controllable gate
0.00254	MAX opening speed (m/s)
0.00254	MAX closing speed (m/s)
0.610	Gate width (m)
240.96	Gate sill level (m)
241.57	Top position of gate (m)
0	Degrees (not used for gate)

PID Example	
0	PID type (0 is for gates)
SO8KG	Gate ID
1	Set point type (1 is for water level)
SAB0165	Location where set point is measured
300.0	Integration time, Ti (seconds)
0.0	Derivation time, Td (seconds); set to zero
0.1	Proportionality factor, K
1.0	Weight factor for time level n
0.7	Weight factor for time level n-1
1.0	Weight factor for time level n-2
241.57	Initial value of the bottom lip of the gate (WCL)
0	Control type (0 for non-controllable)

Operational data was provided by the District for the automated regulator modeling. They include:

- A one-page sketch showing configurations of the real time control site, cross-section, inflow and outflow directions, locations of sluice gate (which regulates the flow to the interceptor) and storm gate (which controls the overflow), and current water depths and positions.

- A one-page sketch showing the “Set Points” (i.e. target water level control depths), and current status and positions of the gates.

- A record drawing showing the street location and sewer connections of the site, and the manholes where the real time control site and the depth sensors are located.

- Various tables that list the values used in the programmable logic controller for setting the control water levels and the constants for PID control.

Two input files are prepared to simulate the automated regulations with MOUSE-RTC. The RTC file describes the configuration of the site, sensor locations and the control logic. Gate movements are carried out according to specifications and control logic listed by the user in this file. The PID file allows some degree of flexibility as the “set point” is given as the target water level, and movement of the gate is controlled by the PID algorithm. Whenever the status does not satisfy the set point, the PID algorithm calculates a response that is designed to bring the monitored parameter closer to the set point. When the parameter’s status satisfies the set point, no action will be taken. User selected constants within the PID equation can modify the relative speed and magnitude of the gate responses.

The RTC file contains data such as the name of the site, upstream and downstream nodes, opening and closing speeds, width of the sluice gate or weir fabridam, invert elevation and top opening elevation of the gate, control node where the sensor is located, control specifications, and logical statements. The PID file contains the name of the site, upstream and downstream nodes, constants used in the PID equation (e.g. derivation time, integration time, proportionality factor, etc.), control node where sensor is located, and the water level "set point" at the control node.

An RTC file alone is sufficient for MOUSE-RTC to simulate real time control operation. However, there are situations where PID control will provide a better simulation of the behavior of the site. For these situations, PID control has been used. When input data for a site are entered in both RTC and PID files, specifications in the PID file will take precedence. Depending on the configurations of the controls, a user may elect to use the RTC file alone, or both RTC and PID files. For Southerly, some sites are modeled with the RTC file alone and some sites are modeled with both RTC and PID files.

Some assumptions were made to simplify the coding. Some structures are controlled by two sensors, one at the regulator and one in the interceptor downstream. After testing different modeling options such as RTC file alone, PID file alone, and RTC and PID files together, it was concluded that the RTC file alone would be the best approach to model the site. To prevent surcharge upstream under emergency conditions (the normal level sensor fails), the weir fabridam has been set too fully open to allow overflow when the water level at the site reaches an emergency level. It was concluded that coding this condition was not necessary for these sites because the fabridam will already be fully open even before the flow reached this level, since the level sensor is always assumed to function properly. A complete set of RTC and PID files are in Appendix B.

After the RTC and PID input files were prepared, test runs were carried out to ensure that the sluice gates and weir fabridam were functioning according to the operational logic specified. Water level measurements collected at the real time control sites by NEORSD were then used for calibration, as well as any additional flow meters that were in the area. Logical statements, set points, and opening and closing speeds were adjusted to calibrate the results. Calibrations were not possible for some sites because sufficient water level data were unavailable. The automated regulators did not always behave in the manner that was expected based on the set points provided by the District. However, with calibration they were effectively modeled, see Figure 4-2.

Orifices

Orifices occur in the collection system if there is a short constriction in a pipe, such as a deflection plate that limits the amount of dry weather flow from a regulator, or some other constriction such as an outlet from a storage basin. Orifices were modeled using a passive flow regulation in MOUSE because MOUSE does not model orifices directly. Based on the orifice equation, the stage-discharge relationship was calculated, and then applied through the passive flow regulation based on the head at the node where the orifice was located. The orifice equation is:

$$Q_o = C_o A_o (2 g h)^{1/2}$$

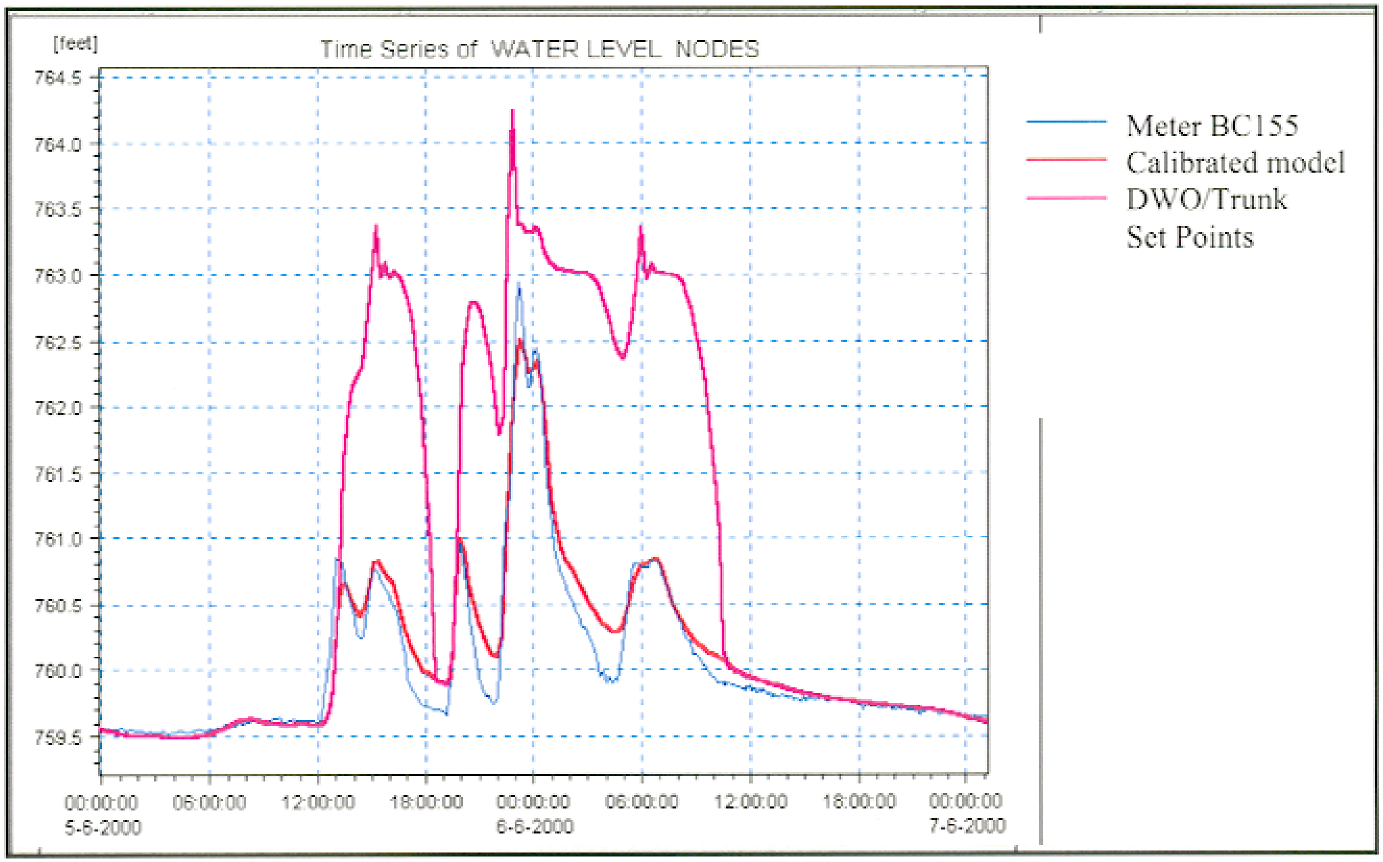
C_o = Orifice discharge coefficient
A_o = Cross-sectional area of the orifice
g = Gravitational acceleration
h = Hydraulic head on the orifice

A typical value for C_o of 0.6 was used, and the flow rate for a range of heads was calculated.

DELINEATION OF SEWER BASINS AND CONTRIBUTING AREAS

Once the network of pipes and nodes was verified and edited, the process of delineating the sewer basins was begun. By overlaying the sewer network on the Cuyahoga County orthophotos and elevation contour coverage in the GIS, the sewer basins were delineated. Each basin was first delineated based on regulating structures. All of the pipes that drained to a particular regulator or flow divider were delineated based on tributary sewers and the slope was determined from the contour coverage. If necessary, these basins were then subdivided so that each basin was approximately 30 to 50 acres in size. This allowed each basin to have more uniform characteristics such as soil type or land use.

Figure 4-2. Calibration of Flow Meter Settings



Also, the basins were subdivided by meter location so that the flows tributary to the meters could be accounted for more accurately. The basins were named after the regulator or flow divider by placing a letter after the regulator name. For example the basins tributary to SO8 would be named SO8a, SO8b, SO8c etc.

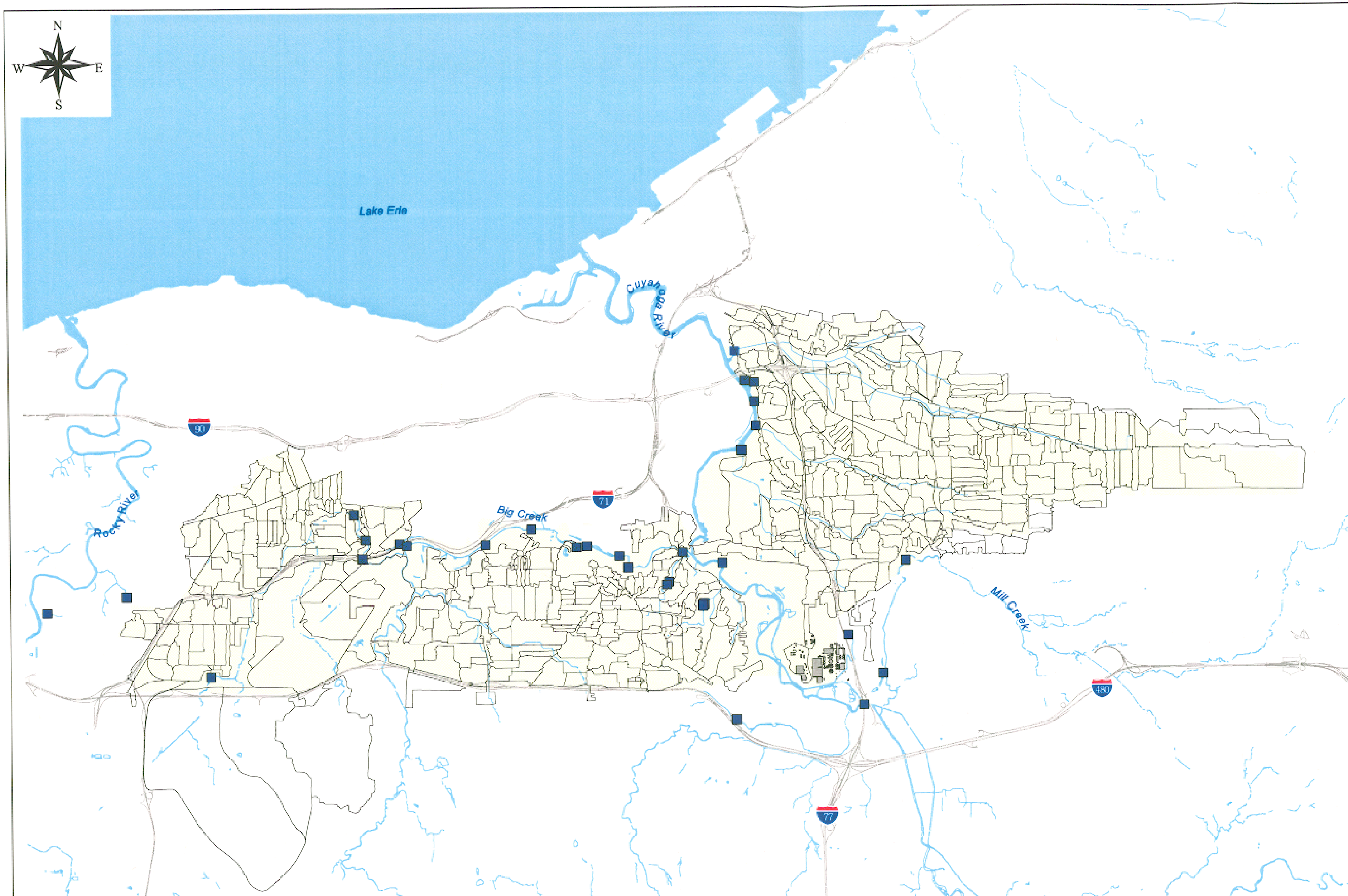
A separate GIS coverage for storm and sanitary basins was created. In most combined sewer areas these two layers are identical. However, in areas where the sewers are separate they may not have the same boundaries. This may also be the case in large industrial areas in which separate storm sewers may be present.

For the Southerly model 402 combined sewer basins, 64 sanitary sewer basins and 65 storm sewer basins were created. The average size of the combined and sanitary basins is 30.87 acres, while the storm basins are generally larger and have an average size of 102.71 acres. The larger average size for the storm basins is due to several large outlying areas that consist only of storm flow and are collected at a common point, such as the large detention basin that flows into the Big Creek culvert. Figure 4-3 shows the storm basins and 4-4 shows the sanitary basins. A schematic was created for each interceptor based on these coverages to give a simplified view of the contributing areas and routing of flows for the model. Figures 4-5 (Big Creek Interceptor) and 4-6 (Southerly Interceptor) can be found in the back pockets of this report.

Because of the large number of basins the Thiessen Polygon method was used to associate each basin with a rain gauge.

Modeled Flows

The primary task of the model was to develop an accurate representation of the Southerly CSO study area collection system. This included understanding how the system was configured and how it responded to inputs including infiltration, sanitary base flow, and wet weather flows. CSO regulators present in the collection system were calibrated to predict overflows into the receiving waters.



Northeast Ohio Regional SEWER DISTRICT

- CSO Outfalls
- Modeled Pipes
- Southerly WWTP
- Streets
- Water
- Southerly CSO Study Area
- Storm Basins

3250 0 3250 6500 Feet

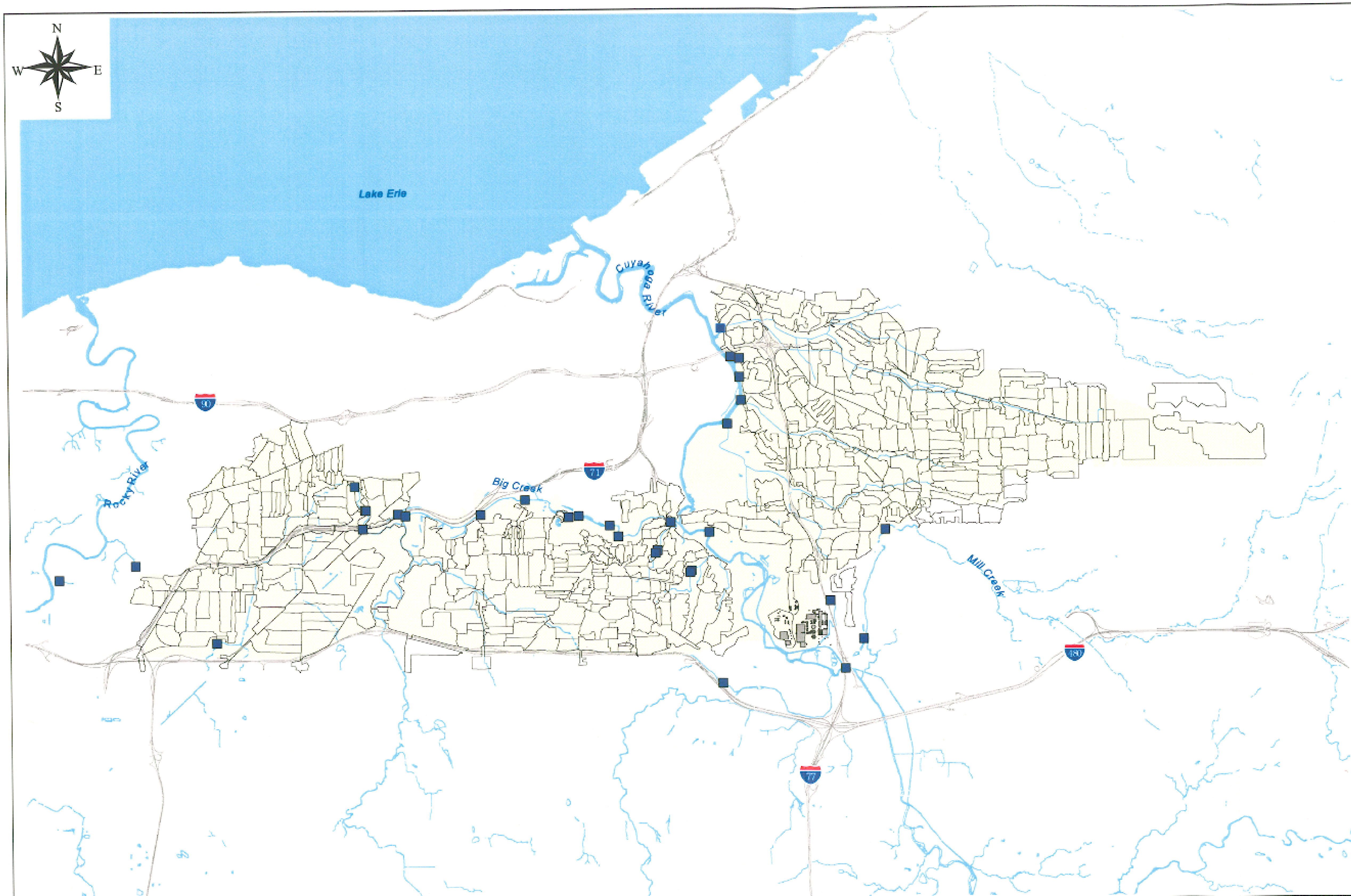
Metcalf & Eddy

Southerly CSO Phase II Facilities Plan

CH2MHILL

Figure 4-3.
Storm Basins

Northeast Ohio Regional SEWER DISTRICT



CSO Outfalls
Modeled Pipes
Southerly WWTP
Streets
Water
Southerly CSO Study Area
Sanitary Basins

3250 0 3250 6500 Feet

M&E Metcalf & Eddy

Southerly CSO Phase II Facilities Plan

CH2MHILL

Figure 4-4.
Sanitary Basins

Dry Weather Flows

The collection system has three potential sources of dry weather flow: wastewater, infiltration, and river inflow. Wastewater is comprised of sanitary flows generated by residential populations and commercial and industrial sources. Infiltration results from groundwater entering the system through cracks in pipes, joints, manholes and other non-specific sources. River inflow may occur if the river level is high enough to backflow through the downstream most regulating structure and enter the collection system. Based on river level data, this was not a concern in the Southerly CSO study area.

Wastewater Flows - The sanitary component of the dry weather flow was determined using population data, per capita wastewater generation rates and billing records for large commercial and industrial sewer customers. Flow monitoring data was then studied to help determine the diurnal pattern of flow.

For dry weather flows, MOUSE calculates sanitary wastewater flows based on population density and a per capita wastewater generation rate for a twenty-four hour diurnal pattern. It is also capable of accepting an inflow data file that specifies the dry weather base flow at any manhole in the collection system.

Diurnal Curve -The parameters input to the MOUSE model at each sub-basin inlet node for specification of dry weather flows were:

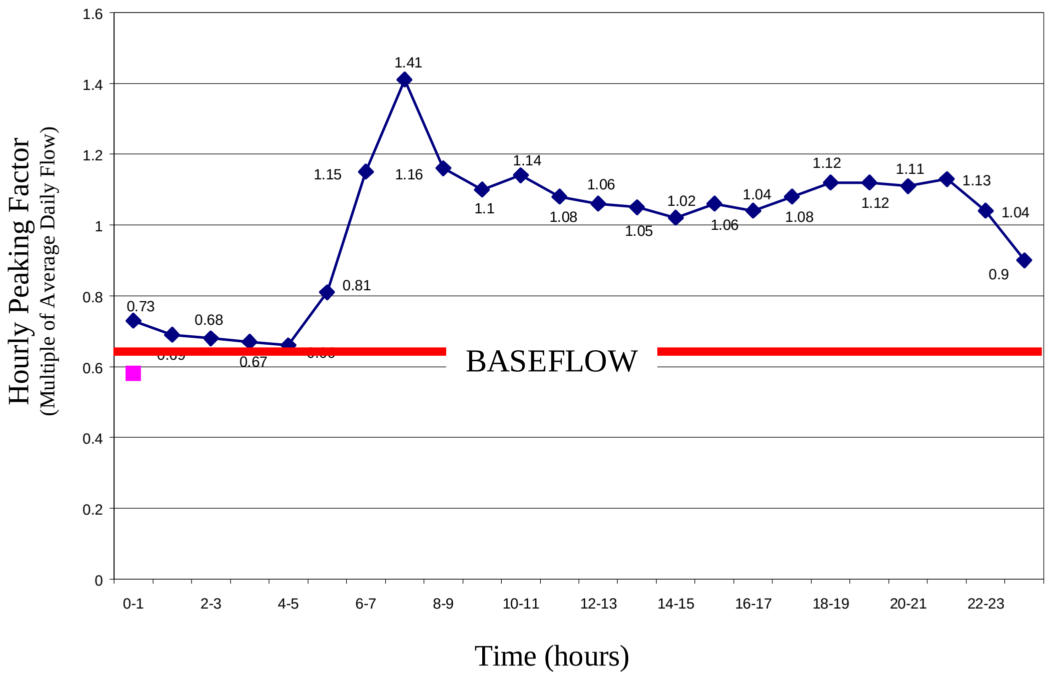
- Contributing area - All catchments were assigned an area of one acre and a population density initially based on TIGER file data.
- Daily per-capita sewerage flow contribution - MOUSE accepts one rate for the entire model. The per capita flow was determined by dividing the flow at the downstream meter by the TIGER population data. The per capita flow entered into MOUSE was assumed to take into account a portion of the infiltration, therefore it was necessary to adjust the population to match the meter data. The EPA has established an historical average of 70 gallons per person per day where

infiltration is not excessive. 120 gallons per person per day can be used, where 70 gal/(capita day) is from domestic flow and 10 gal/(capita day) from light industry and 40 gal/(capita day) for infiltration (Wastewater Engineering, Metcalf & Eddy 1991). A value of 72 gal/(capita day) was used in the Southerly modeling. The diurnal pattern that was used has more of the flow at the morning and late afternoon, when residents are preparing for work or returning from work. This pattern was calibrated against meter data.

- Population - The population of each sub-basin was determined from a GIS analysis of the TIGER files. These population estimates were loaded into a node that was within each of the sub-basins. The populations were adjusted as described above to match the meter data. The initial TIGER population and the final adjusted population can be found in Appendix C. Equivalent population was used for the industrial/commercial flow and verified during dry weather flow calibration using monitoring data.
- Base infiltration - This flow component was estimated as 88 percent of the minimum monitored nighttime flow, except in areas where flow inputs continue during the night. These flows were added as a part of the diurnal pattern except in areas where the baseflow was greater than 88 percent of the minimum nighttime flow. In these areas an additional constant inflow was input into the most upstream nodes in the basin. This was done using a .cif file in MOUSE.

Different patterns do exist for residential areas as compared to the industrial / commercial areas. A discussion of this discrepancy is provided in Chapter Five-Model Calibration. MOUSE has the capability of modeling one dimensionless diurnal curve. Therefore, both weekday and weekend diurnal variations were not represented. It was observed that the diurnal patterns on Saturdays and Sundays did not vary as much as the patterns on weekdays in the industrial/ commercial business areas. Since the majority of the area is residential, this pattern was used throughout the study area. Figure 4-7 shows the diurnal pattern used for the model.

Figure 4-7. Diurnal Pattern



Wet Weather Flows

SWMM RUNOFF Block - The Environmental Protection Agency's Storm Water Management Model (EPA SWMM) is a widely used public domain software package that was most recently updated with version 4.4 in 1997. The RUNOFF block of SWMM simulates the routing of storm water in drainage basins that discharge to the sewer system, and storm water that is flowing directly to the receiving waters. RUNOFF uses rainfall hyetographs to calculate the inflow hydrographs at designated inflow points in the MOUSE model. RUNOFF simulates flow in pervious and impervious areas, calculates infiltration losses in pervious areas, surface detention, and pipe flow in the smaller tributary drains and sewers. The primary parameters characterized by RUNOFF for each basin are surface area, width, slope, percent impervious, depression storage depth, overland flow roughness coefficient (Manning's "n") and infiltration parameters. The interface file from SWMM was processed using SWMM_int, which was provided by

DHI for use with the MOUSE model. This allows the runoff result files from SWMM to be read into MOUSE in order to model the collection system hydraulics.

Wet weather inflow into the collection system was simulated using the RUNOFF block of SWMM as a wet weather hydrograph generator. This same approach was used for the Mill Creek Collection System model, the Southwest Interceptor Operational Evaluation Project, and the Easterly Collection System model. The RUNOFF model uses rainfall as input and produces hydrographs for each model basin at a specified inflow node. A binary file containing the hydrographs was created and read directly by the MOUSE model. A copy of the SWMM input files can be found on the CD bound in the back of the report.

Hydrologic Model Parameters

Wet weather flows were input into the collection system through SWMM RUNOFF. The rain gauge data was processed by SWMM using hydrologic parameters that were adjusted to match the meter data during calibration. The parameters adjusted during calibration include percent imperviousness, basin width, roughness coefficient, and depression storage.

Impervious Area - The percent of Directly Connected Impervious Area (DCIA) is required for each storm water basin for RUNOFF to estimate the volume of runoff. The DCIA is any area that does not allow infiltration, such as paved areas or rooftops, which are directly connected to the sewer system via catch basins or roof drains. A GIS coverage was created to check the land use derived percentage DCIA values. This impervious area coverage was developed by combining all the transportation features (roads and highways) with the building footprints. This area was then divided by the area for each basin and a percentage was determined.

This was checked using the Cuyahoga County parcel base and the Ohio Department of Natural Resources land use data sets. The land use file was developed using both the Cuyahoga County and ODNR land use data sets. The Cuyahoga County land use database defined each parcel using one of hundreds of planning land use names. An intersection of the Southerly CSO service area and the land use data set to identify those found within the study area was performed.

The identified land use values found in this intersection were grouped into similar hydrologic land use classifications (i.e. grouped several types of residential into low, medium and high density). A range of percent impervious values (10 to 90 percent) for these hydrologic land use classifications was then defined. This parameter was adjusted during calibration to match total volume at a meter. An area-weighted average was determined for combined, separate sanitary and direct storm water drainage areas, which are shown in Table 4-3.

Table 4-3. Drainage Areas for the Southerly Collection System Model

Area Type	No. of Areas	Total Area (Acres)	Area-Weighted Percent Impervious
Combined	402	11720	36
Sanitary	64	2352	33
Storm	65	2688	26

Slope - An average overland flow path slope is required for each storm water basin within RUNOFF. This value was automatically determined through an intersection of basin areas with Cuyahoga County Digital Terrain Model (DTM) elevation data.

Width - Width values are required for each storm water basin within RUNOFF. These values were manually determined according to requirements explained in the SWMM RUNOFF manual. The method involves measuring the flow path perpendicular to the channelized flow. During calibration this parameter was adjusted to more accurately represent the sharpness of the inflow peak to the collection system.

Soil Infiltration - Soil infiltration values were required for each storm water basin within RUNOFF. Most of the soils within the Southerly CSO planning area are considered disturbed. Typical soil infiltration values are listed in Table 4-4.

Table 4-4. Typical Soil Infiltration Values

Soil Type	Initial Infiltration Rate (in/hr)	Final Infiltration Rate (in/hr)	Decay Rate
A	10	1	0.00115
B	8	0.5	0.00115
C	5	0.25	0.00115
D	3	0.1	0.00115
U	3	0.1	0.00115

Depression Storage and Evaporation - There is a small amount of depression storage in most watersheds. Therefore, very small storms may not produce any runoff. The depression storage is higher in pervious areas than impervious areas. The SWMM RUNOFF model permits separate depression storage for pervious and impervious areas for each sub-basin. The amount of depression storage for the impervious area can be determined from examining rainfall records and flow meter data. Based on monitoring data, most flow meters did not respond to rainfall less than 0.06 inches, while the typical range was from 0.02 to 0.06 inches. Depression storage in the pervious areas was harder to determine because of infiltration and was set to 0.1 inches. Because depression storage may vary from basin to basin it was also used as a calibration parameter. Final depression storage for each sub-basin can be found in Appendix D.

The depression storage becomes filled after the initial rainfall of 0.02 to 0.06 inches. For continuous model simulation, the depression storage can be removed by evaporation. The default evaporation for the SWMM model is 0.1 inch per day throughout the year. The events used for model calibration were collected in 5/24 – 6/22/2000. The default evaporation rate of 0.1 inches per day for this period produced good calibrations.

Antecedent Conditions

The use of antecedent conditions ensured that the state of soil saturation was accounted for over and above the typical drainage characteristics and is particular for each individual storm. The amount of moisture held within the soil would affect the point at which runoff occurs from pervious surfaces (grasslands, etc.) If this occurs early on in a wet weather event, such as when storms follow close to one another, then greater runoff will occur than if a storm were to occur after an extended dry period. This was a factor during the typical year simulation, by using the default evaporation and pervious infiltration capacity recovery rate for the back to back storm events antecedent conditions were accounted for during the simulation.

CHAPTER FIVE
COLLECTION SYSTEM MODEL CALIBRATION

This chapter presents the steps involved in calibrating the model for dry weather and wet weather, a determination of model accuracy, and meter specific calibration issues.

The Southerly area was divided into four sub-model areas for model development in order to expedite model building and also to allow for faster run times during calibration. These areas were determined based on geographical and system considerations. The first step in dividing the study area was along the two interceptors: Southerly and Big Creek. The Big Creek Interceptor area was then essentially divided in half at meter BCI-1 on Brookside Drive behind St. Thomas Moore Church. This allowed for known values to be used as boundary conditions for the two models. The Southerly Interceptor was divided in terms of the outfall areas. CSO 040 (Kingsbury Run) and CSO 038 were determined to be approximately half of the Southerly area and were therefore separated as one sub-model. The remaining area, including CSO 035 (Burke Brook), CSO 036 (Morgana Run), CSO 033, CSO 037, CSO 072, and CSO 252, comprised the final sub-model. There were three connection points between the two Southerly sub-models; one at Union Avenue and East 102nd Street, one on the Southerly Interceptor at East 49th Street and Barkwill Avenue, and the third on the Independence North branch of the Southerly Interceptor just downstream of Regulator S-82.

Each sub-model was calibrated using the flow monitoring data from April to June of 2000. The two sub-models for Big Creek were then combined to create the Big Creek model, and the Kingsbury Run and Morgana Run/Burke Brook sub-models were combined to create the Southerly model. Each of the interceptor models was then run and calibrated to the 54-day monitoring period, which constituted the calibrated model.

MODEL CALIBRATION PROCESS

The four sub-models described above were used for the calibration. These models were first calibrated for dry weather flow and then for the wet weather monitoring period.

Dry Weather Calibration Process

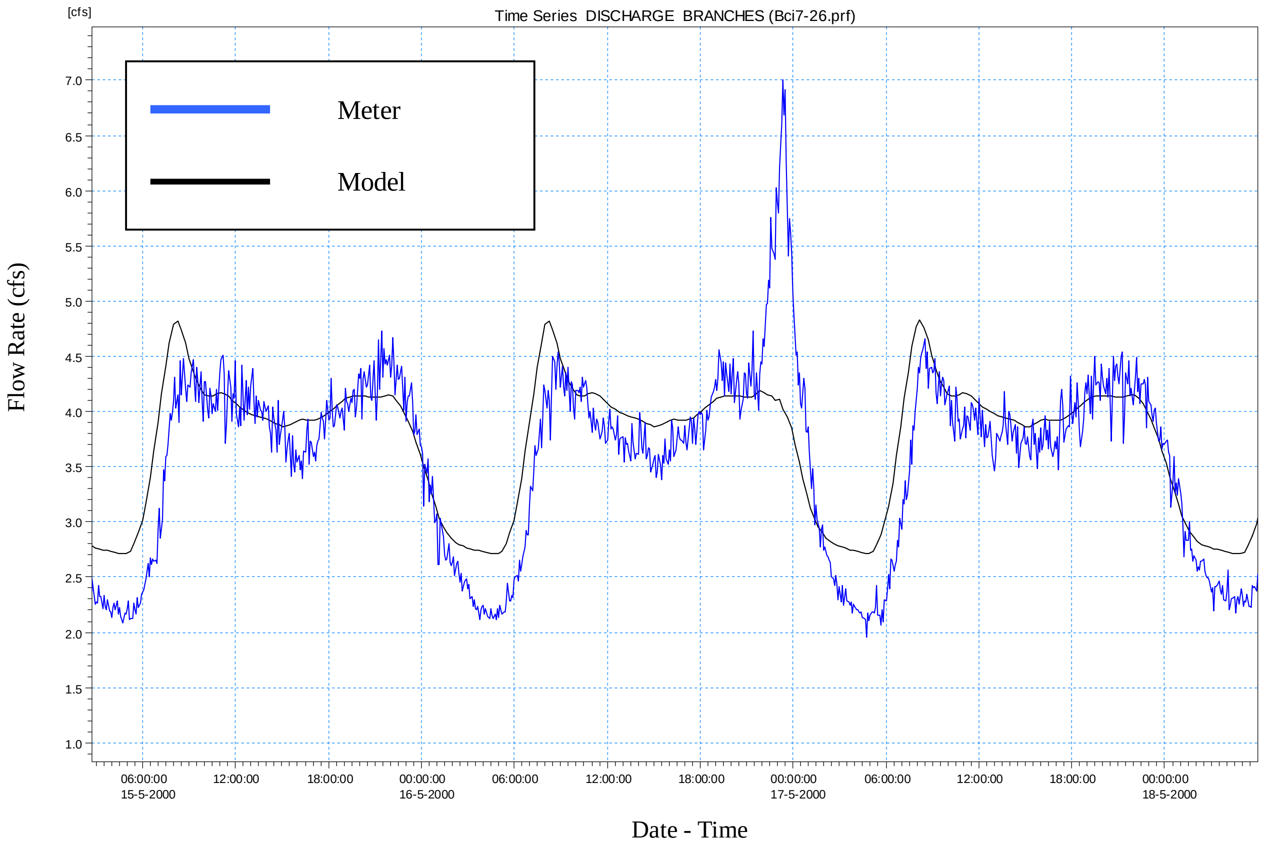
The dry weather calibration process consisted of matching the model dry weather flow to the meter data by adjusting base flow infiltration and population values for the diurnal wastewater flows. When discrepancies between meter data and model output were encountered they were handled in several ways:

- Errors were discovered and corrected in the meter data, such as incorrect pipe sizes and shapes.
- Physical system misrepresentations in the model were discovered and corrected, including pipe connectivity and basin delineations.
- If meter data indicated that flows were escaping or entering the system, Closed Circuit Televising (CCTV) inspection data was reviewed and field inspections were performed to determine the source or cause. Causes included gaps between pipe segments, cracked pipes, pipe blockages, and dry weather overflows from regulators.
- Meters at some locations had unreliable or problematic data that in some cases could not be used.

The monitoring period of April 24 through June 22, 2000 consisted of many wet weather events without many consecutive dry weather days. A three-day period from May 15 to May 18, 2000 was used to calibrate the dry weather flow for most meters. Certain meters were not functioning during this period and others showed results different than the remainder of the calibration period. For these cases, alternative dry weather periods were selected for the calibration.

Based on the meter data, the model was calibrated by adjusting base flow infiltration and population values for the diurnal wastewater flows. The constant inflows are included in Appendix E. Figure 5-1 shows an example of the dry weather calibration.

Figure 5-1. Dry Weather Calibration at Meter BC-163



Wet Weather Flow Calibration

The four sub-models were run for the calibration period from April 24 through June 22, 2000 when flow metering data and rainfall records were collected in order to calibrate and verify the wet weather flows. This rainfall data was entered into SWMM RUNOFF along with the hydrologic and hydraulic parameters described in Chapter Four. The results were loaded into MOUSE for the simulation of the wet weather flows. The output from MOUSE was then compared to the metering data collected for the same time period, and additional refinements were made for the calibration.

The measured flow rates and water levels in the sewer system were used for calibrating the modeled wet weather events. The hydrograph shape, including flow rate, duration and associated volume were compared between the model and meter. Also, the model hydraulic grade line was compared with the measured data.

When discrepancies between meter data and model output were encountered they were handled in several ways:

- Errors were discovered and corrected in the meter data, such as incorrect pipe sizes and shapes.

- Physical system misrepresentations in the model were discovered and corrected, included pipe connectivity and basin delineations.

- Head loss factors were adjusting for some regulators based on the influent and effluent flows. For example, if the influent flows compared well with the meter but the dry weather outlet flows were excessive, the losses in the regulator manhole were increased in order to send more flow to the storm water overflow.

- If meter data indicated that flows were escaping or entering the system, CCTV inspection data was reviewed and field inspections were performed to determine the source or cause. Causes included gaps between pipe segments, cracked pipes, pipe blockages, and previously unknown flow regulations.

- Hydrologic parameters were adjusted to achieve a better match with flow meter data, including:

  - Percent imperviousness (controls overall volume of runoff)

  - Basin width (controls shape of hydrograph)

  - Basin slope

  - Basin infiltration rates

  - Basin depression storage
  - Manning's "n" used for overland surface roughness

- Many flow meters showed a significant delayed inflow volume, and an additional Rainfall Derived Inflow and Infiltration (RDII) basin was used to represent the overall hydrograph shape. This is described in more detail below.

- If hydraulic grade lines showed a large discrepancy, the following were adjusted to calibrate the HGL:

  - Pipe roughness coefficients
  - Pipe configurations
  - Regulator configuration and head losses
  - Silt depositions (as described in more detail below)

- Meters at some locations had unreliable or problematic data that in some cases could not be used.

Rainfall Derived Inflow and Infiltration

It was observed during calibration that for some basins, especially in areas serviced by separate sanitary sewers, the wet weather flows predicted by MOUSE recede much faster that the measured flows at the end of the event. Wet weather inflow from direct connections such as catch basins, roof leaders, and foundation drains usually have a quick response, with a hydrograph that rises and falls rapidly. Wet weather inflow and infiltration that moves through a media, such as the groundwater that moves through soil in the ground, takes a longer time to reach the collection system. This results in delayed inflow and infiltration to the collection system during the recession of a wet weather event. This is termed RDII.

In combined sewer systems, this delayed flow causes the hydrograph to extend beyond the peak of the storm. The volume associated with this flow is typically much smaller than the inflow associated with surface runoff. In sanitary sewers, which are ideally disconnected from direct sources of inflow, this delayed flow typically is the primary source of wet weather flow.

To compensate for this delayed flow, an additional basin was added upstream of the meters that simulated this RDII response. This was added for both combined and sanitary sewers if the meter showed this response. The additional basin is equivalent in size to the area tributary to that meter, but with a greatly reduced width and percent impervious area. In order to determine the reduction in width and impervious area, runoff from basins with varying widths and impervious areas were compared with the meter data from the calibration period. The runoff from the various basins was computed using SWMM, and the results were compared using MIKEVIEW. The RDII basin that best represented the receding limb when combined with the original basin was then chosen. Most of the additional basins had a percent impervious between 5 and 15 percent and a basin width on the order of 0.1 to 1 percent of the original basin width. In some cases, additional refinement of the RDII basin was accomplished by changing basin slope, roughness, and depression storage. However the effect of these parameters was much less than the width and percent impervious. This reduced basin width and percent imperviousness empirically represents the delayed inflow and infiltration that causes the receding limb of the wet weather hydrograph.

Calibration of Hydraulic Grade Lines

Model calculation of pipe flow began with optimum hydraulic conditions, i.e. without pipe deterioration, debris, or stagnant water. Actual sewer conditions were often different from this clean pipe assumption. Adjustments for the pipe hydraulics were necessary to simulate the real flow conditions. At some sites, downstream debris caused standing water in the sewer. In this case, a small silt weir was put in the model to simulate the backup, as described below. At other times, the debris buildup was not severe enough to cause backwater but did cause a higher hydraulic grade line under low flow conditions.

Silt Depositions

Many locations in the collection system were found to have residual silt and debris that impedes the flow. These areas were identified for the sewers that were televised and inspected prior to the model development. Also, the amount of silt at each of the meter locations was noted when the meters were installed and calibrated. Silt weirs were added at certain locations in the model for two purposes:

- To identify and appropriately model locations of system deficiencies which have a significant impact on the hydraulics of the system. An example is the downstream 10,000 feet of the main branch of the Southerly Interceptor, which has known sediment deposits.

- To represent known hydraulic conditions in the vicinity of the flow meters.

Weirs were added in MOUSE to represent this build up of debris on the invert of the pipe. The silt weir was oriented perpendicular to the flow direction, with the height of the silt weir corresponding to the depth of silt observed in the pipe. An additional node was added for the weir functional relationship as described in Chapter Four. Silt Weirs in each of the four sub-models were identified by the following five-digit prefix ranges:

- Kingsbury Area = 10000-19000

- Morgana/Burke Area = 20000 – 29000

- Big Creek East Area = 30000 – 39000

- Big Creek West Area = 40000 – 49000

For example, a silt weir placed in the Morgana/Burke Area would be named 20001 WS.

Silt weirs were added based on silt and debris observed under existing conditions. The majority of the silt weirs were removed for baseline conditions. Chapter Six describes the locations where silt weirs remain for baseline conditions.

Overflow Meters

There were a total of twenty-seven flow meters located in overflow pipes that normally were either dry or had shallow standing water. Since the velocity sensors could not be calibrated and adjusted at these locations, the primary source of model calibration was the hydraulic grade line and number of CSO activations. Although the flow rates were also examined in most locations, the meter results for flow may not be accurate since they could not be calibrated and verified, as discussed in Chapter Three.

MODEL CALIBRATION RESULTS

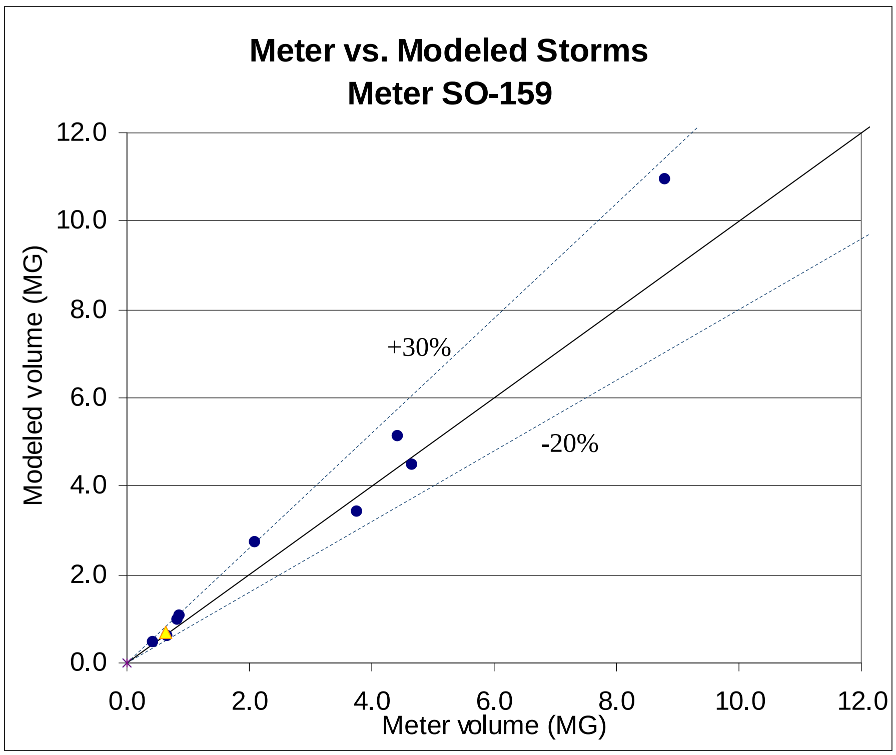
The final model connectivity was shown previously in Figures 4-4 and 4-5 for the Southerly and Big Creek systems, respectively. The calibrated model basin parameters are included on the CD bound in the back of this report.

In addition to matching wet weather hydrograph shapes, the volume of the hydrographs was also compared. This was performed using two evaluation techniques: comparing volume from discrete wet weather periods and also comparing cumulative volume over the entire calibration period. A model volume within plus 30 and minus 20 percent of the metered volume over the calibration period was an objective for calibration.

Discrete Wet Weather Volume

For the discrete wet weather period analysis, nine wet weather periods were selected that consisted of one, two, or three days. For these periods, multiple storm events may have occurred. Meter versus model volume for each period was plotted for each meter as shown in Figure 5–2. Ideally the volume plots would fall along the one to one slope line. The plus 30 and minus 20 lines were also plotted as a general calibration guideline. Plus 30 was used because it would give a more conservative estimate. Most flow meters were not functioning 100 percent of the time, and if they were not it was typically during wet weather events when flow was higher. Therefore, many of the outlying points are associated with meter downtime. Meters that fell outside of these guidelines are discussed later in this chapter. Appendix F includes these plots for the meters in the collection system.

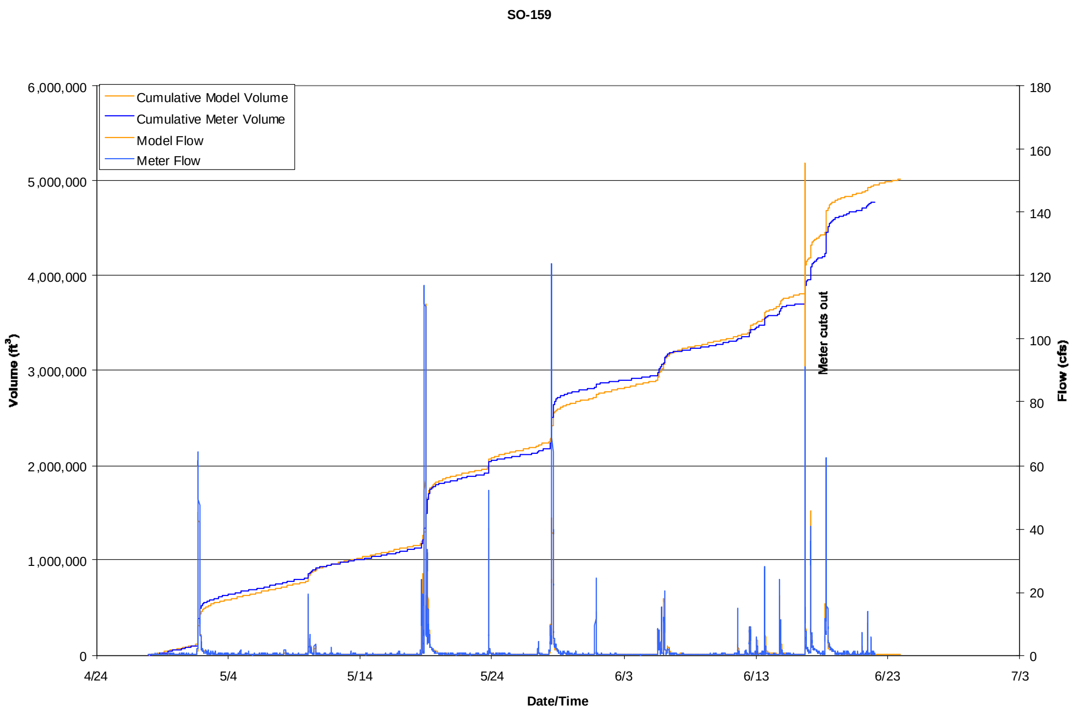
Figure 5-2. Discrete Wet Weather Volume Comparison



Cumulative Volume Comparison

Metered versus measured volume for each meter over the entire calibration period was examined, as shown in Figure 5-3. These plots provide verification as to how the model results compare to the flow meter over the entire calibration period, including both dry and wet weather. Appendix A includes these plots for each meter in the collection system.

Figure 5-3. Cumulative Volume Comparison



In general, most locations met the requirements of peak flow rate and volume within +30% and –20%, and the general shape of the hydrographs are similar. Currently USEPA's *Combined Sewer Overflows: Guidance for Monitoring and Modeling* provides only non-numerical criteria for calibration assessment. Table 5-1 presents the percentage difference for each calibration location for the calibration period and wet weather calibration events.

A qualitative analysis of calibration accuracy was performed, based on a flow weighted average percentage difference between metered and modeled volumes. Some meters could not be calibrated, as detailed in Chapter Three, and were therefore not included in the analysis. Overall, the average percent difference of the modeled versus metered volume was 6.29% over the calibration period and 4.83% for the wet weather calibration events. This indicates a slightly conservative calibration well within the acceptable calibration limits.

Table 5-1. Meter versus Model Volume for 54-Day Calibration Period and Wet Weather Events

Meter #	Total Volume During 54-Day Metering Period (MG)			Volume During Wet Weather Events		
	Meter	Model	%Difference	Meter	Model	%Difference
BB035	6.85	4.02	-41.30	6.81	3.96	-41.81
BB48SN	88.43	82.72	-6.46	57.35	68.69	19.77
BC-101	1206.00	1269.98	5.31	777.50	787.20	1.25
BC-102	77.10	69.62	-9.70	44.90	43.11	-3.99
BC-103	65.70	67.10	2.13	43.10	43.32	0.51
BC-104D	50.00	53.39	6.78	30.50	32.26	5.77
BC-104I	52.30	53.10	1.53	33.36	33.25	-0.35
BC-105	13.90	15.50	11.51	9.08	7.60	-16.33
BC-106	23.80	24.10	1.26	15.45	19.79	28.10
BC-108	13.70	18.00	31.39	13.19	11.66	-11.56
BC-109	8.00	4.20	-47.50	8.89	3.15	-64.57
BC-110	12.64	12.83	1.50	9.85	8.02	-18.58
BC-111	56.60	47.00	-16.96	32.50	27.91	-14.12
BC-115	1087.20	1114.00	2.47	667.16	692.51	3.80
BC-118	5.70	5.40	-5.26	3.42	3.18	-7.16
BC-120	1.31	31.74	2319.21	4.51	20.71	359.20
BC-121	4.40	4.20	-4.55	2.99	3.35	11.92
BC-122	6.80	6.30	-7.35	3.91	3.48	-10.88
BC-123	322.00	61.20	-80.99	205.64	46.76	-77.26
BC-124	59.28	14.97	-74.75	58.81	14.81	-74.82
BC-126	63.10	61.30	-2.85	49.35	49.71	0.74
BC-127	45.90	45.50	-0.87	30.71	32.90	7.13
BC-128	6.60	6.20	-6.06	6.60	5.89	-10.72
BC-129	5.40	5.00	-7.41	3.93	3.59	-8.74
BC-130	20.00	30.40	52.00	19.68	26.81	36.25
BC-131	143.00	151.10	5.66	81.99	94.38	15.11
BC-132	18.40	17.30	-5.98	10.27	9.33	-9.23
BC-132I	71.40	63.90	-10.50	47.14	42.80	-9.20
BC-133	15.60	15.30	-1.92	8.93	8.63	-3.40
BC-134	4.00	4.30	7.50	2.40	2.73	13.67
BC-136	33.70	33.80	0.30	20.59	20.73	0.70
BC-137	7.30	7.20	-1.37	4.99	5.00	0.11
BC-138	520.80	525.50	0.90	341.39	346.30	1.44
BC-138D	15.80	16.40	3.80	8.63	8.59	-0.43
BC-140	310.70	290.60	-6.47	205.50	207.36	0.90
BC-141	306.20	333.60	8.95	198.95	232.06	16.64
BC-142	60.50	63.10	4.30	39.44	43.83	11.13
BC-143	73.40	67.30	-8.31	47.74	48.58	1.77

Table 5-1. Meter versus Model Volume for 54-Day Calibration Period and Wet Weather Events (con'd)

Meter #	Total Volume During 54-Day Metering Period (MG)			Volume During Wet Weather Events		
	Meter	Model	%Difference	Meter	Model	%Difference
BC-144	58.60	58.50	-0.17	43.16	47.86	10.87
BC-147	25.30	24.80	-1.98	15.12	15.21	0.56
BC-148	6.50	9.50	46.15	6.13	9.32	52.13
BC-149	84.60	85.70	1.30	53.83	62.21	15.57
BC-150	78.50	82.30	4.84	62.24	58.37	-6.22
BC-151	34.80	30.80	-11.49	16.97	28.30	66.79
BC-152	389.40	394.20	1.23	259.95	293.38	12.86
BC-153	317.10	301.50	-4.92	228.40	219.48	-3.90
BC-154A	14.37	11.00	-23.45	10.64	7.48	-29.68
BC-154B	320.50	333.50	4.06	294.87	303.66	2.98
BC-155	79.14	81.60	3.11	29.13	35.90	23.25
BC-155A	73.60	71.60	-2.72	52.04	52.76	1.39
BC-156	98.00	99.80	1.84	57.75	63.77	10.44
BC-157	21.90	22.60	3.20	12.15	13.30	9.49
BC-159	10.70	9.90	-7.48	10.39	9.94	-4.26
BC-160	46.80	44.10	-5.77	31.76	29.98	-5.59
BC-161	46.50	50.80	9.25	37.78	41.64	10.23
BC-162A	5.19	5.24	1.00	4.06	4.79	17.92
BC-162B	5.82	6.00	3.09	4.09	5.35	31.03
BC-162C	10.46	10.09	-3.54	9.74	9.75	0.05
BC-163	219.60	196.50	-10.52	127.38	125.18	-1.72
BC-164	97.30	13.16	-86.47	97.15	13.00	-86.62
BCI1	441.50	432.60	-2.02	342.62	326.24	-4.78
BC-SS6	773.70	766.50	-0.93	507.71	533.72	5.12
KR-46	35.77	288.66	707.06	26.58	263.49	891.46
MR036A	147.28	242.22	64.46	110.83	208.88	88.47
MR036C	190.87	9.18	-95.19	19.72	9.17	-53.48
SO-102	48.56	49.24	1.39	23.09	36.96	60.09
SO-105	1022.96	1121.27	9.61	685.34	661.42	-3.49
SO-106	17.75	13.83	-22.06	12.44	10.65	-14.42
SO-107	20.72	9.85	-52.47	14.96	5.84	-60.95
SO-109	26.77	36.25	35.40	14.50	22.41	54.54
SO-111	73.37	70.21	-4.31	42.34	52.88	24.91
SO-112	42.50	42.23	-0.63	21.19	22.61	6.72
SO-113	42.48	43.78	3.05	25.35	26.80	5.75
SO-114	51.81	47.76	-7.80	30.82	30.79	-0.10
SO-115	13.40	14.38	7.37	7.98	9.36	17.31
SO-116	6.61	9.13	38.14	3.86	6.70	73.65
SO-118	13.52	13.28	-1.83	6.38	9.11	42.82
SO-120	164.15	243.41	48.28	22.55	210.06	831.42

Table 5-1. Meter versus Model Volume for 54-Day Calibration Period and Wet Weather Events (con'd)

Meter #	Total Volume During 54-Day Metering Period (MG)			Volume During Wet Weather Events		
	Meter	Model	%Difference	Meter	Model	%Difference
SO-121	68.23	79.02	15.83	34.41	48.99	42.38
SO-122W	126.20	165.07	30.80	45.80	163.14	256.18
SO-123	531.62	397.88	-25.16	285.38	207.91	-27.15
SO-124	24.96	23.72	-4.96	13.14	11.68	-11.09
SO-125	13.28	10.07	-24.19	7.80	5.69	-27.01
SO-126	37.88	41.01	8.24	19.29	21.20	9.87
SO-128D	4.04	4.53	11.98	3.20	4.53	41.56
SO-128I	8.93	12.27	37.37	6.75	9.81	45.20
SO-129	364.21	144.90	-60.21	304.07	139.95	-53.98
SO-130	104.31	75.21	-27.90	84.64	49.74	-41.23
SO-131	59.27	56.83	-4.10	39.12	38.73	-0.99
SO-132	3.21	9.56	198.20	2.32	6.93	198.79
SO-133	111.74	93.85	-16.02	60.47	69.12	14.29
SO-133A	54.88	33.64	-38.70	54.88	33.60	-38.77
SO-134	101.55	3.45	-96.60	101.55	3.32	-96.73
SO-135	302.45	273.94	-9.42	183.72	181.12	-1.41
SO-136	126.93	132.77	4.60	65.86	73.47	11.56
SO-137	164.50	156.74	-4.72	104.73	97.45	-6.95
SO-139	47.61	46.28	-2.80	29.02	29.36	1.16
SO-141	184.15	167.41	-9.09	99.60	96.12	-3.49
SO-142	117.20	210.46	79.56	60.58	139.17	129.71
SO-143	181.75	142.13	-21.80	105.23	92.29	-12.29
SO-144	158.41	158.73	0.20	100.66	109.10	8.38
SO-145	69.22	70.74	2.20	41.68	38.22	-8.29
SO-146	104.12	83.58	-19.72	57.82	51.02	-11.77
SO-147	55.32	55.98	1.20	36.58	37.33	2.07
SO-149	9.81	9.25	-5.69	5.90	5.25	-11.09
SO-150	257.89	200.91	-22.09	120.81	134.32	11.18
SO-151	2.29	3.56	55.38	2.27	3.52	55.03
SO-152	2.35	0.82	-65.13	1.35	0.56	-58.31
SO-153	87.54	90.03	2.84	79.66	88.10	10.59
SO-153I	218.83	293.84	34.28	149.20	211.24	41.58
SO-154	59.98	58.40	-2.62	34.94	33.57	-3.93
SO-155D	75.06	70.88	-5.57	62.95	56.04	-10.97
SO-156	30.76	23.59	-23.32	29.26	22.81	-22.03
SO-159	35.77	37.07	3.63	26.58	29.83	12.24
SO-177	763.55	548.10	-28.22	403.70	342.05	-15.27
Calibrated Meter Flow Weighted Error			6.29%			4.83%
WET WEATHER						

SITE-SPECIFIC CALIBRATION ISSUES

When model parameters were adjusted within the reasonable ranges and the model results and meter records did not agree, inconsistencies in the model, as discussed above, were sought. In addition to investigating the model representation, possible meter errors were also examined.

A total of 128 flow monitors were installed in the Southerly CSO service areas. The meter measurements were calibrated by comparing manual reading of depth and velocity at the site with the values recorded by the meter. Calibrations were performed during both dry and mild wet weather conditions. Thirteen meters were reported as not being calibrated, and twenty – seven meters were located in sites where calibration was not possible. Individual meter calibration error was presented in Table 5 of the Flow Monitoring QA/QC Report (M&E, June 2000). When the model results and meter records did not agree after checking the model for possible errors, additional calibration efforts were not performed if the calibration error for the meter was greater than 50 percent. Calibration plots and descriptions of the site specific calibration issues are located Appendix G.

Conclusion

The purpose of the modeling task was to create an accurate representation of the Southerly collection system network. The model accuracy was sufficient to support the specific system analyses, which included:

- Quantification of CSO frequency and volume for design events and a typical year.
- Collection system capacity analysis.
- CSO reduction alternatives analysis.

The model has certain limitations that were beyond the scope of the Southerly CSO Phase II Facilities Planning project. These limitations include severe event flooding prediction, spatial distribution of rainfall and seasonal variations in groundwater infiltration. In general, the calibration storms were less than a 1-year, 6-hour event, but were representative of a design typical year. Due to the range of intensity in the calibration storms a high degree of confidence is shown in the 5-year, 6-hour design storm flows and volumes. However, larger events should be validated based on rainfall monitoring data and flooding elevations prior to model application for such events. The spatial distribution of rainfall can cause variations in system performance not predicted by the hydraulic model. These variations are not expected to be great during the rainfall patterns in a typical year. Due to the rainfall simulation process discussed previously, many variations would tend to be conservative in the model results. Similarly, the model predicts a static groundwater infiltration rate based on flow monitoring results from April through June 2000. These infiltration rates would be conservative over the entire year, but are insignificant in the prediction of wet weather flows. Overall the model meets all of the requirements for use in the project.

CHAPTER SIX
BASELINE CONDITIONS

The calibrated hydraulic model for the existing condition, presented in Chapter Five, represented the actual performance and capacity of the sewer network measured during the Southerly Phase II CSO Facilities Plan flow monitoring period during April to June of 2000. This chapter describes the modifications to the model to create the baseline condition for the Southerly system. The baseline condition is a near-term future condition that will exist after certain known projects are implemented. It differs from the existing condition, which was based on data collected as part of the facilities planning effort. The baseline condition is the starting point from which the needed level of CSO control is established. The baseline condition represents the consideration of known capital improvement projects to the sewer systems to be completed from June 2000 through the year 2002.

A description of each project that was included in the Southerly baseline condition is presented below. Additionally, discussion of the differences between existing and baseline conditions is presented.

PROJECT DESCRIPTIONS

This section summarizes the projects being implemented in the Southerly facilities planning area that were included in the baseline condition. In order to determine baseline projects, several sources were reviewed, including:

- City of Cleveland Capital Improvements Program
- NEORSD Capital Improvements Program

Additionally, numerous contacts were made and discussions held with the NEORSD, the City of Cleveland, the City of Brooklyn, the Village of Cuyahoga Heights, the Village of Linndale, the Village of Newburgh Heights, and other local communities. Projects were identified that had occurred or will occur in the near future after the existing conditions.

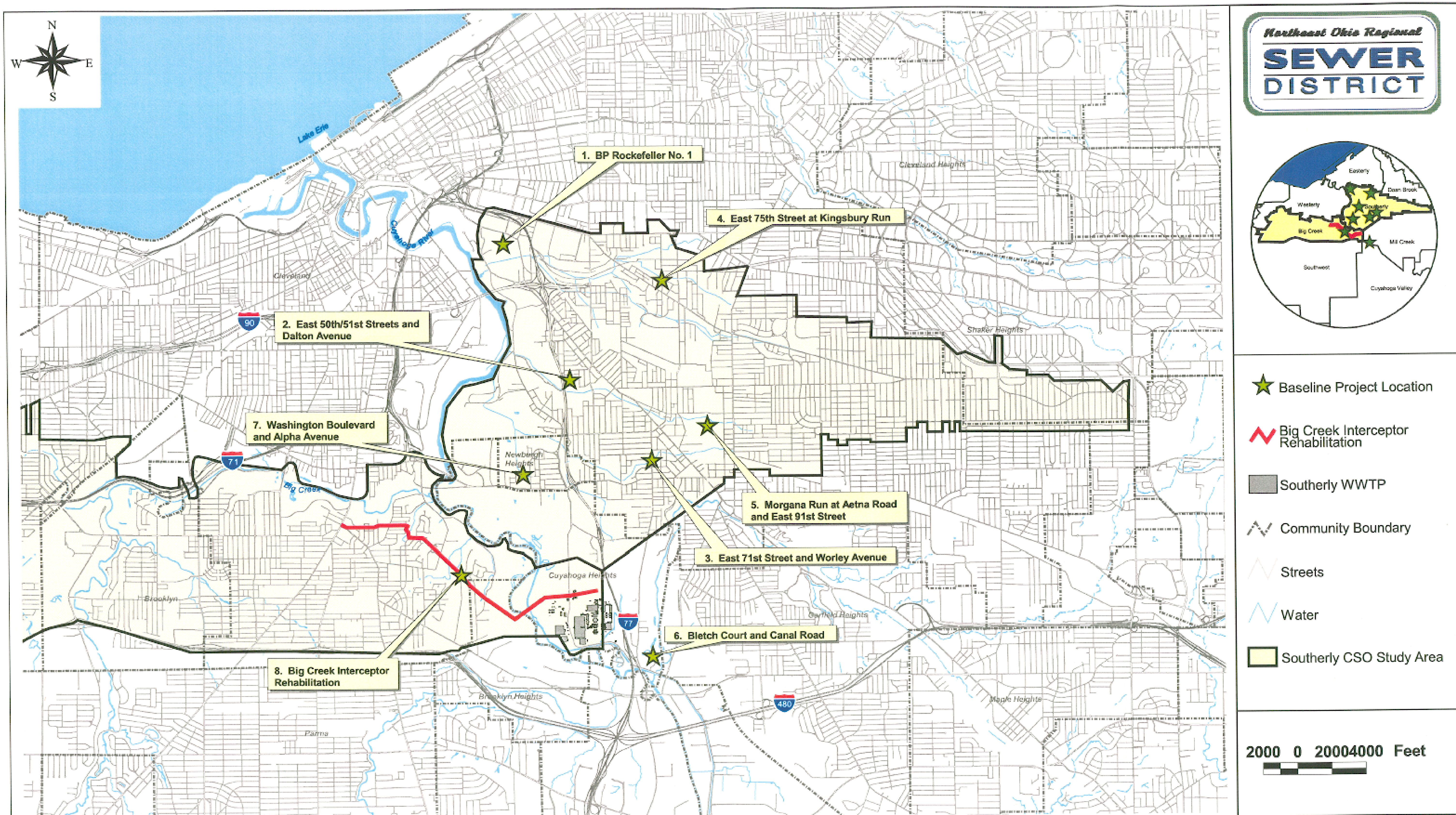
Table 6-1 organizes the projects by the type of project, the owner of the project, and the corresponding number on the general map. Figure 6-1 is a general location map for the baseline projects.

Table 6-1. Baseline Projects

No.	Project	Owner	Type
1	BP Rockefeller No. 1	BP	Sewer Upgrade
2	East 50th/51st Street, south of Dalton Avenue	City of Cleveland	Sewer Construction
3	East 71st Street and Worley Avenue	City of Cleveland	Sewer Replacement
4	East 75th Street at Kingsbury Run	City of Cleveland	Sewer Construction
5	Morgana Run at Aetna Road and East 91st Street, under the railroad track	City of Cleveland	Sewer Replacement
6	Bletch Court and Canal Road	Village of Cuyahoga Heights	Sewer Upgrade
7	Washington Boulevard and Alpha Avenue	Village of Newburgh Heights	Sewer Upgrade
8	Big Creek Interceptor Rehabilitation	NEORSD	Sewer Rehabilitation

BP Rockefeller No. 1

The project consists of constructing a new storm sewer that drains directly into Kingsbury Run. Existing sewers will be used for sanitary sewer services only, resulting in decreased loading to the combined sewers. This project is considered in the baseline conditions.



M&E Metcalf & Eddy

Southerly CSO Hydraulic Modeling Report

CH2MHILL

Figure 6-1. Baseline Project Location

East 50th/51st Street, south of Dalton Avenue

The sewers on these streets were originally connected directly to Morgana Run and were never connected to the Southerly Interceptor after its construction. This project would connect the sewers to the interceptor as originally intended. The baseline model will consider the sewers connected to the Southerly Interceptor.

East 71st Street Sewer Replacement

The sewer at East 71st Street and Worley Avenue has structurally deteriorated and part of the existing pipe has collapsed near this intersection. The baseline model will consider this pipe to be replaced with no change in the original hydraulic design.

East 75th at Kingsbury Run

The combined sewer flowing south from Dell Avenue along East 75th Street currently connects directly to Kingsbury Run. Record plans indicate an overflow structure at Kingsbury Run with dry weather flow continuing south towards Grand Avenue. Due to the minor tributary area, this project will remove the connection from Kingsbury Run completely, and direct all flow toward Grand Avenue. The baseline model will consider this overflow to be eliminated and the pipe to be replaced with no change in the original hydraulic design.

Morgana Run at Aetna Road and East 91st Street, under the railroad tracks

Morgana Run is deteriorated under the Conrail railroad tracks near Aetna Road and East 91st Street. Part of the sewer underneath the railroad tracks has collapsed. The baseline model will consider this pipe to be replaced with no change in the original hydraulic design.

Bletch Court and Canal Road

The regulator at Bletch Court and East 72nd Street controls flow from that area to CSO251. This project will connect that regulating structure to the sanitary sewer on Canal Road. The CSO consolidation sewer will eliminate CSO251. This project is considered in the baseline condition.

Washington Boulevard and Alpha Avenue

There is a direct sanitary discharge to Burke Brook from the residential area near Washington Boulevard and Alpha Avenue in Newburgh Heights. The combined sewer in that area is structurally deteriorated. This project consists of replacing existing sewers in the Washington Boulevard and Alpha Avenue area, installing a new regulating structure to divert sanitary flow to the collection system through a new 30-inch sewer that connects to East 29th Street. This project will be considered in baseline.

Big Creek Interceptor Rehabilitation – Pearl Road to Southerly WWTP

The Big Creek Interceptor has structurally deteriorated. This project has not entered the design phase of planning. Based on recent rehabilitation projects for the interceptors, the baseline condition will consider the remaining section of the interceptor to be slip-lined. This will reduce the diameter, but decrease the friction in the pipe. The effect will be no hydraulic conveyance capacity change in the interceptor.

Operational Changes

The Southerly CSO study area has several automated regulating structures. Initially the model was built using the real-time control settings provided by the District. Subsequent inspection and comparison to flow monitoring data indicated that some of the facilities do not operate exactly as the setting would indicate. Modifications to the RTC settings were made to calibrate the model to the existing condition. In some instances, this reduced the in-system storage capacity and caused increased overflow volumes. For the baseline condition, RTC will be adjusted back to the initial District settings. This will allow subsequent evaluation of operation against a documented baseline.

MAINTENANCE ISSUES

The collection system in the Southerly service area is affected in several areas by the build up of silt and debris. These deposits restrict the ability of the existing system to convey flow. In the existing conditions model, silt “weirs” were added to simulate the blockage of channels and pipes by deposited silt and debris. In most cases, the “weirs” were small and simply elevated the hydraulic grade line (HGL) a small amount. To simulate a clean system for the baseline condition, the silt weirs will be removed in all areas except those noted below.

Three areas in the Southerly basin were identified as having substantial debris accumulation. These locations include:

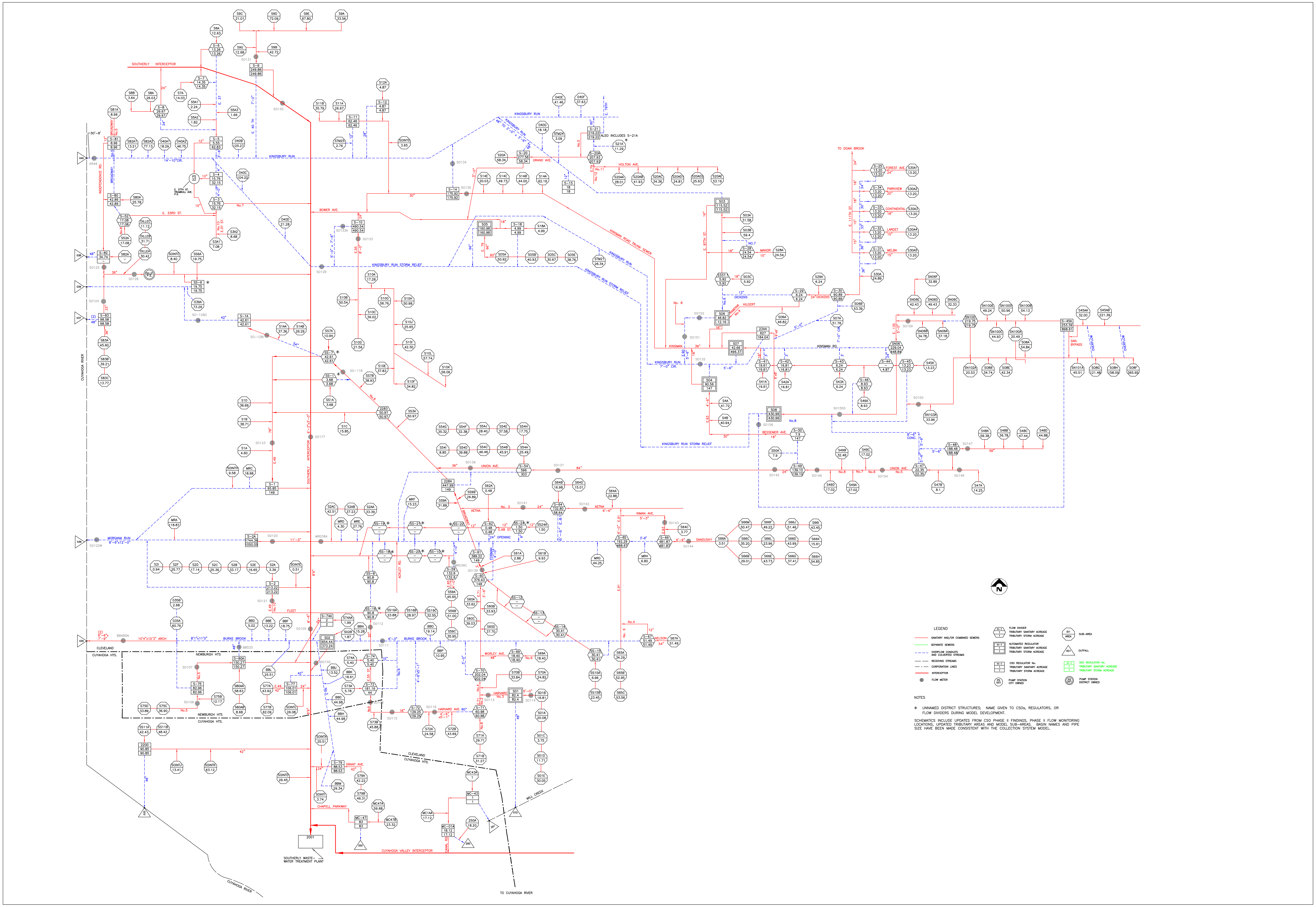
- Southerly Interceptor Main Branch, South of Fleet Road
- RTA property, near Kinsman Road and East 71st Street
- Kingsbury Run Culvert (D-branch), near East 66th Street and Kinsman Road

Due to the slight grade and low dry weather velocities present in the downstream reach of the Southerly Interceptor Main Branch, the existing silt and debris condition will be maintained as a baseline condition. Recommendations from the inspection project include the cleaning and inspection of this section of sewer. However, backwater conditions from the WWTP and design limitations will contribute to rapid accumulation of silt and debris. This assumption is conservative regarding CSO volume, as any additional capacity in the interceptor will reduce overflow volume from CSO 036 significantly.

The combined sewers on the RTA property are owned by the City of Cleveland. These sewers contain a substantial amount of silt and debris. The Southerly CSO model baseline condition will reflect the cleaning of these sewers and assume a clean pipe. This assumption is consistent with the handling of all modeled local sewers. Additionally, a clean system in this area will allow sizing of downstream relief facilities to accommodate flows from this area.

The locations in the D-branch of Kingsbury Run culvert that have substantial debris are immediately upstream and downstream of an open section of stream. The culvert was never constructed in this area, which has allowed silt and debris to almost completely block this reach of storm culvert. Initial estimates for the cleaning and construction of this section developed under the Southerly Interceptor Inspection project are approximately $3-5 million. The only regulator discharging to this reach of culvert is S-21. Due to the substantial cost and limited likelihood of construction, the baseline condition will not be changed from the existing condition.

TO WESTERLY DISTRICT
TO WESTERLY DISTRICT
TO WESTERLY DISTRICT
LORAIN AVE.
COOLEY AVENUE RELIEF
W. 138TH ST.
W. 136TH ST.
W. 134TH ST.
WEST AVENUE RELIEF
W. 117 ST
LEROY AVE.
BROOKLAWN No. 5C
HAROLD AVE.
LIBERTY AVE.
PURITAS AVE.
W. 130TH
W. 160 ST.
INDUSTRIAL PARKWAY
W.150
BIG CREEK
84" X 140" DBL BARREL CULVERT
(HIGHWAY DRAINAGE)
CLEVELAND
LINNDALE
BC-9 CONTROLS BC-44 & BC-45
PEARL RD.
BIG CREEK INTERCEPTOR
FULTON PARKWAY
WICHITA AVE.
BEHRWALD AVE.
W. 56 ST.
SNYDER AVE
W. 29 ST.
W. 23 ST.
HILLCREST AVE.
VALLEY RD.
BROADVIEW RD.
SPRING RD.
SPRING CREEK CULVERT
HILLAND RD.
PANNA LANE P.S.
PANNA LANE
INTERCEPTOR
DENISON No. 10
TREADWAY CREEK
W. 15 ST.
CUYAHOGA RIVER
WEST CREEK
SPRING CREEK
TO SOUTHERLY WASTEWATER TREATMENT PLANT
NOTES
* UNNAMED DISTRICT STRUCTURES; NAME GIVEN TO CSOs, REGULATORS, OR FLOW DIVIDERS DURING MODEL DEVELOPMENT.
SCHEMATICS INCLUDE UPDATES FROM CSO PHASE II FINDINGS, PHASE II FLOW MONITORING LOCATIONS, UPDATED TRIBUTARY AREAS AND MODEL SUB-AREAS. BASIN NAMES AND PIPE SIZE HAVE BEEN MADE CONSISTENT WITH THE COLLECTION SYSTEM MODEL.
LEGEND
SANITARY AND/OR COMBINED SEWERS
SEPARATE SEWERS
OVERFLOW CONDUITS AND CULVERTED STREAMS
RECEIVING STREAMS
CORPORATION LINES
INTERCEPTOR
WATER LEVEL MONITORS
FLOW METER
FLOW DIVIDER
TRIBUTARY SANITARY ACREAGE
TRIBUTARY STORM ACREAGE
AUTOMATED REGULATOR
TRIBUTARY SANITARY ACREAGE
TRIBUTARY STORM ACREAGE
CSO REGULATOR No.
TRIBUTARY SANITARY ACREAGE
TRIBUTARY STORM ACREAGE
PUMP STATION CITY OWNED
SUB-AREA
OUTFALL
SSO REGULATOR No.
TRIBUTARY SANITARY ACREAGE
TRIBUTARY STORM ACREAGE
PUMP STATION DISTRICT OWNED


SOUTHERLY INTERCEPTOR
KINGSBURY RUN
KINGSBURY RUN STORM RELIEF
BURKE BROOK
MORGANA RUN
CUYAHOGA VALLEY INTERCEPTOR
SOUTHERLY WASTE-WATER TREATMENT PLANT
TO CUYAHOGA RIVER
CUYAHOGA RIVER
TO DOAN BROOK
MILL CREEK
CLEVELAND
CUYAHOGA HTS.
NEWBURGH HTS
LEGEND
SANITARY AND/OR COMBINED SEWERS
SEPARATE SEWERS
OVERFLOW CONDUITS AND CULVERTED STREAMS
RECEIVING STREAMS
CORPORATION LINES
INTERCEPTOR
FLOW METER
FLOW DIVIDER
TRIBUTARY SANITARY ACREAGE
TRIBUTARY STORM ACREAGE
AUTOMATED REGULATOR
TRIBUTARY SANITARY ACREAGE
TRIBUTARY STORM ACREAGE
CSO REGULATOR No.
TRIBUTARY SANITARY ACREAGE
TRIBUTARY STORM ACREAGE
PUMP STATION CITY OWNED
SUB-AREA
OUTFALL
SSO REGULATOR No.
TRIBUTARY SANITARY ACREAGE
TRIBUTARY STORM ACREAGE
PUMP STATION DISTRICT OWNED
NOTES
* UNNAMED DISTRICT STRUCTURES; NAME GIVEN TO CSOs, REGULATORS, OR FLOW DIVIDERS DURING MODEL DEVELOPMENT.
SCHEMATICS INCLUDE UPDATES FROM CSO PHASE II FINDINGS, PHASE II FLOW MONITORING LOCATIONS, UPDATED TRIBUTARY AREAS AND MODEL SUB-AREAS. BASIN NAMES AND PIPE SIZE HAVE BEEN MADE CONSISTENT WITH THE COLLECTION SYSTEM MODEL.

Northeast Ohio Regional Sewer District

Southerly CSO Phase II
Hydraulic Modeling Report
APPENDICES

May 2002

Metcalf & Eddy

CH2MHILL

TABLE OF CONTENTS

LIST OF ATTACHMENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS

CCTV	Closed Circuit Televising
CSO	Combined Sewer Overflow
CVI	Cuyahoga Valley Interceptor

DCIA	Directly Connected Impervious Area
DTM	Digital Terrain Model
EMSC	Environmental Maintenance and Service Center
EPA	Environmental Protection Agency
Ft	Feet or foot
In	Inch or Inches
I/I	Infiltration/Inflow
LTCP	Long term control plan
MCI	Mill Creek Interceptor
NEORSD	Northeast Ohio Regional Sewer District
PID	Proportional-Integral-Differential
RDII	Rainfall Derived Inflow and Infiltration
RTC	Real Time Control
SCADA	Supervisory Control and Data Acquisition
SSES	Sewer System Evaluation Survey
SWI	Southwest Interceptor
SWMM	Storm Water Management Model
WWTP	Waste Water Treatment Plant

APPENDIX A

		Calibrated Settings	District-Supplied Settings
	Autoreg	SO1	SO1
	SITE #	7	7
DWO	DWO CONTROL	KNIFE GATE	KNIFE GATE
	DWO ID	SO1_KG	SO1_KG
	FROM NODE	SO1	SO1
	TO NODE	SBG0160	SBG0160
	MAX OPENING SPEED (m/s)	0.122	0.0051
	MAX CLOSING SPEED (m/s)	0.61	0.0051
	WIDTH(m)	0.61	0.61
	SILL (BOTTOM) LEVEL (m)*	229.27	229.27
	TOP POSITION (m)*	229.88	229.88
	DWO SENSOR NODE	SBG0160	SBG0160
	SET POINT (m)	229.87	229.87
	HWL SENSOR LOCATION	N/A	N/A
	HIGH WATER LEVEL (m)	N/A	N/A
SWO	SWO CONTROL	STORM GATE	STORM GATE
	SWO ID	SO1_SG	SO1_SG
	FROM NODE	SO1	SO1
	TO NODE	QA00020	QA00020
	MAX OPENING SPEED (m/s)	0.4433	0.00443
	MAX CLOSING SPEED (m/s)	0.4433	0.04433
	WIDTH(m)	1.83	1.83
	SILL (BOTTOM) LEVEL (m)	229.61	229.61
	TOP POSITION (m)	230.94	230.94
	SWO SENSOR NODE	SO1	SO1
	SET POINT (m)	230.6818	230.6818
	HWL SENSOR LOCATION	SO1	SO1
	HIGH WATER LEVEL (m)	230.7946	230.7946

		Calibrated Settings	District Supplied Settings
	Autoreg	SO2	SO2
	SITE #	16	16
DWO	DWO CONTROL	PLUG VALVE	PLUG VALVE
	DWO ID	SO2_PV	SO2_PV
	FROM NODE	SO2	SO2
	TO NODE	SAR0010	SAR0010
	MAX OPENING SPEED (m/s)	0.02**	0.02**
	MAX CLOSING SPEED (m/s)	0.002**	0.002**
	WIDTH(m)	0.61	0.61
	SILL (BOTTOM) LEVEL (m)*	190.07	190.07
	TOP POSITION (m)*	190.68	190.68
	DWO SENSOR NODE	SAR0010	SAR0010
	SET POINT (m)	190.1	190.1
	HWL SENSOR LOCATION	N/A	N/A
	HIGH WATER LEVEL (m)	N/A	N/A
SWO	SWO CONTROL	SLUICE GATE	SLUICE GATE
	SWO ID	SO2_SG	SO2_SG
	FROM NODE	SO2	SO2
	TO NODE	SO2W	SO2W
	MAX OPENING SPEED (m/s)	0.061	0.061
	MAX CLOSING SPEED (m/s)	0.00254	0.0061
	WIDTH(m)	1.83	1.83
	SILL (BOTTOM) LEVEL (m)	190.1	190.1
	TOP POSITION (m)	191.93	191.93
	SWO SENSOR NODE	SO2	SO2
	SET POINT (m)	198	198
	HWL SENSOR LOCATION	NA	NA
	HIGH WATER LEVEL (m)	NA	NA

		Calibrated Settings	District-Supplied Settings
	Autoreg	SO3	SO3
	SITE #	1	1
DWO	DWO CONTROL	KNIFE GATE	KNIFE GATE
	DWO ID	SO3KG	SO3KG
	FROM NODE	SO3	SO3
	TO NODE	SAB4042	SAB4042
	MAX OPENING SPEED (m/s)	0.0135	0.0135
	MAX CLOSING SPEED (m/s)	0.00135	0.00135
	WIDTH(m)	0.4054	0.4054
	SILL (BOTTOM) LEVEL (m)*	234.504	234.504
	TOP POSITION (m)*	234.9094	234.9094
	DWO SENSOR NODE	SAB4042	SAB4042
	SET POINT (m)	234.59	234.85
	HWL SENSOR LOCATION	NA	NA
	HIGH WATER LEVEL (m)	NA	NA
SWO	SWO CONTROL	STORM GATE	STORM GATE
	SWO ID	SO3SG	SO3SG
	FROM NODE	SO3	SO3
	TO NODE	KD00055	KD00055
	MAX OPENING SPEED (m/s)	0.0038	0.0038
	MAX CLOSING SPEED (m/s)	0.0038	0.0038
	WIDTH(m)	1.83	1.83
	SILL (BOTTOM) LEVEL (m)	234.85	234.81
	TOP POSITION (m)	235.98	236.22
	SWO SENSOR NODE	SO3	SO3
	SET POINT (m)	235.165	235.94
	HWL SENSOR LOCATION	SO3	SO3
	HIGH WATER LEVEL (m)	236.22	236.22

		Calibrated Settings	District Supplied Settings
	Autoreg	SO4	SO4
	SITE #	12	12
DWO	DWO CONTROL	KNIFE GATE	KNIFE GATE
	DWO ID	SO4KG	SO4KG
	FROM NODE	SO4	SO4
	TO NODE	SAD0019	SAD0019
	MAX OPENING SPEED (m/s)	0.015	0.015
	MAX CLOSING SPEED (m/s)	0.002	0.002
	WIDTH(m)	0.410	0.410
	SILL (BOTTOM) LEVEL (m)*	237.650	237.650
	TOP POSITION (m)*	238.060	238.060
	DWO SENSOR NODE	SAB0165	SAB0165
	SET POINT (m)	235.275	235.275
	HWL SENSOR LOCATION	SAD0019	SAD0019
	HIGH WATER LEVEL (m)	237.910	237.910
SWO	SWO CONTROL	FABRIDAM	FABRIDAM
	SWO ID	SO4FD	SO4FD
	FROM NODE	SO4	SO4
	TO NODE	SO4A	SO4A
	MAX OPENING SPEED (m/s)	0.003	0.003
	MAX CLOSING SPEED (m/s)	0.003	0.003
	WIDTH(m)	1.372	1.372
	SILL (BOTTOM) LEVEL (m)	237.957	237.957
	TOP POSITION (m)	238.841	238.841
	SWO SENSOR NODE	SO4	SO4
	SET POINT (m)	238.594	238.899
	HWL SENSOR LOCATION	SO4	SO4
	HIGH WATER LEVEL (m)	239.024	239.024

		Calibrated Settings	District Supplied Settings
	Autoreg	SO5	SO5
	SITE #	2	2
DWO	DWO CONTROL	KNIFE GATE	KNIFE GATE
	DWO ID	SO5KG	SO5KG
	FROM NODE	SO5	SO5
	TO NODE	SAA0107	SAA0107
	MAX OPENING SPEED (m/s)	0.014	0.014
	MAX CLOSING SPEED (m/s)	0.001	0.001
	WIDTH(m)	0.405	0.405
	SILL (BOTTOM) LEVEL (m)*	203.978	203.978
	TOP POSITION (m)*	204.385	204.385
	DWO SENSOR NODE	SAA0107	SAA0107
	SET POINT (m)	204.417	204.417
	HWL SENSOR LOCATION	NA	NA
	HIGH WATER LEVEL (m)	NA	NA
SWO	SWO CONTROL	STORM GATE	STORM GATE
	SWO ID	SO5SG	SO5SG
	FROM NODE	SO5	SO5
	TO NODE	SO5A	SO5A
	MAX OPENING SPEED (m/s)	0.004	0.004
	MAX CLOSING SPEED (m/s)	0.004	0.004
	WIDTH(m)	1.981	1.981
	SILL (BOTTOM) LEVEL (m)	204.283	204.283
	TOP POSITION (m)	205.502	205.502
	SWO SENSOR NODE	SO5	SO5
	SET POINT (m)	205.807	205.807
	HWL SENSOR LOCATION	SO5	SO5
	HIGH WATER LEVEL (m)	205.917	205.917

		Calibrated Settings	District Supplied Settings
	Autoreg	SO6	SO6
	SITE #	8	8
D W O	DWO CONTROL	KNIFE GATE	KNIFE GATE
	DWO ID	SO6KG	SO6KG
	FROM NODE	SO6	SO6
	TO NODE	SAB5005	SAB5005
	MAX OPENING SPEED (m/s)	0.015	0.015
	MAX CLOSING SPEED (m/s)	0.002	0.002
	WIDTH(m)	0.457	0.457
	SILL (BOTTOM) LEVEL (m)*	234.680	234.680
	TOP POSITION (m)*	235.135	235.135
	DWO SENSOR NODE	SAB0165	SAB0165
	SET POINT (m)	235.090	235.090
	HWL SENSOR LOCATION	SAB5005	SAB5005
	HIGH WATER LEVEL (m)	235.030	235.030
S W O	SWO CONTROL	FABRIDAM	FABRIDAM
	SWO ID	SO6FD	SO6FD
	FROM NODE	SO6	SO6
	TO NODE	SO6A	SO6A
	MAX OPENING SPEED (m/s)	0.003	0.003
	MAX CLOSING SPEED (m/s)	0.003	0.003
	WIDTH(m)	1.219	1.219
	SILL (BOTTOM) LEVEL (m)	234.989	234.730
	TOP POSITION (m)	235.827	235.827
	SWO SENSOR NODE	SO6	SO6
	SET POINT (m)	239.301	235.522
	HWL SENSOR LOCATION	SO6	SO6
	HIGH WATER LEVEL (m)	235.976	235.976

		Calibrated Settings	District Supplied Settings
	Autoreg	SO7	SO7
	SITE #	15	15
DWO	DWO CONTROL	KNIFE GATE	KNIFE GATE
	DWO ID	SO7KG	SO7KG
	FROM NODE	SO7	SO7
	TO NODE	SAB0187	SAB0187
	MAX OPENING SPEED (m/s)	0.020	0.020
	MAX CLOSING SPEED (m/s)	0.002	0.002
	WIDTH(m)	0.610	0.610
	SILL (BOTTOM) LEVEL (m)*	234.940	234.940
	TOP POSITION (m)*	235.550	235.550
	DWO SENSOR NODE	SAB0165	SAB0165
	SET POINT (m)	235.090	235.090
	HWL SENSOR LOCATION	SAB0187	SAB0187
	HIGH WATER LEVEL (m)	235.781	235.781
SWO	SWO CONTROL	FABRIDAM	FABRIDAM
	SWO ID	SO7FD	SO7FD
	FROM NODE	SO7	SO7
	TO NODE	KEC0045	KEC0045
	MAX OPENING SPEED (m/s)	0.003	0.003
	MAX CLOSING SPEED (m/s)	0.003	0.003
	WIDTH(m)	1.600	1.600
	SILL (BOTTOM) LEVEL (m)	235.248	235.248
	TOP POSITION (m)	237.690	237.690
	SWO SENSOR NODE	SO7	SO7
	SET POINT (m)	236.410	236.710
	HWL SENSOR LOCATION	NA	NA
	HIGH WATER LEVEL (m)	NA	NA

		Calibrated Settings	District Supplied Settings
	Autoreg	SO8	SO8
	SITE #	13	13
DWO	DWO CONTROL	KNIFE GATE	KNIFE GATE
	DWO ID	SO8KG	SO8KG
	FROM NODE	SO8	SO8
	TO NODE	SAI0060	SAI0060
	MAX OPENING SPEED (m/s)	0.067	0.067
	MAX CLOSING SPEED (m/s)	0.007	0.007
	WIDTH(m)	0.610	0.610
	SILL (BOTTOM) LEVEL (m)*	240.960	240.960
	TOP POSITION (m)*	241.570	241.570
	DWO SENSOR NODE	SAB0165	SAB0165
	SET POINT (m)	235.150	235.150
	HWL SENSOR LOCATION	NA	NA
	HIGH WATER LEVEL (m)	NA	NA
SWO	SWO CONTROL	FABRIDAM	FABRIDAM
	SWO ID	SO8FD	SO8FD
	FROM NODE	SO8	SO8
	TO NODE	SO8A	SO8A
	MAX OPENING SPEED (m/s)	0.003	0.003
	MAX CLOSING SPEED (m/s)	0.005	0.003
	WIDTH(m)	2.440	2.440
	SILL (BOTTOM) LEVEL (m)	241.550	241.550
	TOP POSITION (m)	243.260	243.260
	SWO SENSOR NODE	SO8	SO8
	SET POINT (m)	241.550	242.550
	HWL SENSOR LOCATION	SO8	SO8
	HIGH WATER LEVEL (m)	243.410	243.410

		Calibrated Settings	District Supplied Settings
	Autoreg	BC1	BC1
	SITE #	4	4
DWO	DWO CONTROL	KNIFE GATE	KNIFE GATE
	DWO ID	BC1KG	BC1KG
	FROM NODE	BC1	BC1
	TO NODE	BC1KG	BC1KG
	MAX OPENING SPEED (m/s)	0.00762	0.00762
	MAX CLOSING SPEED (m/s)	0.00762	0.00762
	WIDTH(m)	0.61	0.61
	SILL (BOTTOM) LEVEL (m)*	206.24	206.24
	TOP POSITION (m)*	206.85	206.85
	DWO SENSOR NODE	BD00013	BD00013
	SET POINT (m)	205.27	205.27
	2ND DWO SENSOR NODE	BA00102	BA00102
	SET POINT (m)	198.74	198.74
	HWL SENSOR LOCATION	BD00015	BD00015
	HIGH WATER LEVEL (m)	206.0357	206.0357
SWO	SWO CONTROL	STORM GATE	STORM GATE
	SWO ID	BC1SG	BC1SG
	FROM NODE	BC1	BC1
	TO NODE	BC1SG	BC1SG
	MAX OPENING SPEED (m/s)	0.00254	0.00254
	MAX CLOSING SPEED (m/s)	0.00254	0.00254
	WIDTH(m)	0.9	0.9
	SILL (BOTTOM) LEVEL (m)	206.24	206.24
	TOP POSITION (m)	207.81	207.81
	SWO SENSOR NODE	BC1	BC1
	SET POINT (m)	207.21	207.21
	HWL SENSOR LOCATION	NA	NA
	HIGH WATER LEVEL (m)	NA	NA

		Calibrated Settings	District Supplied Settings
	Autoreg	BC2	BC2
	SITE #	5	5
DWO	DWO CONTROL	PLUG VALVE	PLUG VALVE
	DWO ID	BC2PV	BC2PV
	FROM NODE	BC2	BC2
	TO NODE	BC2PV	BC2PV
	MAX OPENING SPEED (m/s)	0.00127	0.00127
	MAX CLOSING SPEED (m/s)	0.00127	0.00127
	WIDTH(m)	0.61	0.61
	SILL (BOTTOM) LEVEL (m)*	209.15	209.15
	TOP POSITION (m)*	209.76	209.76
	DWO SENSOR NODE	BBA0032	BBA0032
	SET POINT (m)	209.71	209.71
	2ND DWO SENSOR NODE	BA00070	BA00070
	SET POINT (m)	196.9	196.9
	HWL SENSOR LOCATION	BBA0032	BBA0032
	HIGH WATER LEVEL (m)	210.0529	210.0529
SWO	SWO CONTROL	STORM GATE	STORM GATE
	SWO ID	BC2SG	BC2SG
	FROM NODE	BC2	BC2
	TO NODE	BC2SG	BC2SG
	MAX OPENING SPEED (m/s)	0.00254	0.00254
	MAX CLOSING SPEED (m/s)	0.00254	0.00254
	WIDTH(m)	0.91	0.91
	SILL (BOTTOM) LEVEL (m)	209.23	209.23
	TOP POSITION (m)	211.14	211.14
	SWO SENSOR NODE	BC2	BC2
	SET POINT (m)	210.43	210.43
	HWL SENSOR LOCATION	BC2	BC2
	HIGH WATER LEVEL (m)	210.5558	210.5558

		Calibrated Settings	District Supplied Settings
	Autoreg	BC3	BC3
	SITE #	6	6
DWO	DWO CONTROL	PLUG VALVE	PLUG VALVE
	DWO ID	BC3PV	BC3PV
	FROM NODE	BC3	BC3
	TO NODE	BC3PV	BC3PV
	MAX OPENING SPEED (m/s)	0.00254	0.00254
	MAX CLOSING SPEED (m/s)	0.00254	0.00254
	WIDTH(m)	0.61	0.61
	SILL (BOTTOM) LEVEL (m)*	206.72	206.72
	TOP POSITION (m)*	207.32	207.32
	DWO SENSOR NODE	BBZ0005	BBZ0005
	SET POINT (m)	206.73	206.73
	2ND DWO SENSOR NODE	BA00085	BA00085
	SET POINT (m)	197.6	197.6
	HWL SENSOR LOCATION	BBZ0005	BBZ0005
	HIGH WATER LEVEL (m)	207.264	207.264
SWO	SWO CONTROL	STORM GATE	STORM GATE
	SWO ID	BC3SG	BC3SG
	FROM NODE	BC3	BC3
	TO NODE	BC3SG	BC3SG
	MAX OPENING SPEED (m/s)	0.00254	0.00254
	MAX CLOSING SPEED (m/s)	0.00254	0.00254
	WIDTH(m)	0.9	0.9
	SILL (BOTTOM) LEVEL (m)	207.1	207.1
	TOP POSITION (m)	208.63	208.63
	SWO SENSOR NODE	BC3	BC3
	SET POINT (m)	207.77	207.77
	HWL SENSOR LOCATION	BC3	BC3
	HIGH WATER LEVEL (m)	208.06	208.06

		Calibrated Settings	District Supplied Settings
	Autoreg	BC4	BC4
	SITE #	10	10
DWO	DWO CONTROL	PLUG VALVE	PLUG VALVE
	DWO ID	BC4PV	BC4PV
	FROM NODE	BC4	BC4
	TO NODE	BC4PV	BC4PV
	MAX OPENING SPEED (m/s)	0.00254	0.00254
	MAX CLOSING SPEED (m/s)	0.00254	0.00254
	WIDTH(m)	0.61	0.61
	SILL (BOTTOM) LEVEL (m)*	203.51	203.51
	TOP POSITION (m)*	204.12	204.12
	DWO SENSOR NODE	BC4PV1	BC4PV1
	SET POINT (m)	204.18	204.18
	2ND DWO SENSOR NODE	BA00102	BA00102
	SET POINT (m)	198.9	198.9
	HWL SENSOR LOCATION	BA00095	BA00095
	HIGH WATER LEVEL (m)	204.3227	204.3227
SWO	SWO CONTROL	FABRIDAM	FABRIDAM
	SWO ID	BC4FD	BC4FD
	FROM NODE	BC4	BC4
	TO NODE	BC4FD	BC4FD
	MAX OPENING SPEED (m/s)	0.0254	0.0254
	MAX CLOSING SPEED (m/s)	0.00254	0.00254
	WIDTH(m)	1.52	1.52
	SILL (BOTTOM) LEVEL (m)	204.58	204.58
	TOP POSITION (m)	205.5	205.5
	SWO SENSOR NODE	BC4	BC4
	SET POINT (m)	205.27	205.27
	HWL SENSOR LOCATION	NA	NA
	HIGH WATER LEVEL (m)	NA	NA

		Calibrated Settings	District Supplied Settings
	Autoreg	BC5	BC5
	SITE #	9	9
DWO	DWO CONTROL	PLUG VALVE	PLUG VALVE
DWO	DWO ID	BC5PV	BC5PV
DWO	FROM NODE	BC5	BC5
DWO	TO NODE	BC5PV	BC5PV
DWO	MAX OPENING SPEED (m/s)	0.00254	0.00254
DWO	MAX CLOSING SPEED (m/s)	0.00254	0.00254
DWO	WIDTH(m)	0.61	0.61
DWO	SILL (BOTTOM) LEVEL (m)*	174.14	174.14
DWO	TOP POSITION (m)*	174.75	174.75
DWO	DWO SENSOR NODE	JRPS	JRPS
DWO	SET POINT (m)	174.28	174.28
DWO	2ND DWO SENSOR NODE	BA00070	BA00070
DWO	SET POINT (m)	196.9	196.9
DWO	HWL SENSOR LOCATION	NA	NA
DWO	HIGH WATER LEVEL (m)	NA	NA
SWO	SWO CONTROL	STORM GATE	STORM GATE
SWO	SWO ID	BC5SG	BC5SG
SWO	FROM NODE	BC5	BC5
SWO	TO NODE	BC5SG	BC5SG
SWO	MAX OPENING SPEED (m/s)	0.00254	0.00254
SWO	MAX CLOSING SPEED (m/s)	0.00254	0.00254
SWO	WIDTH(m)	1.83	1.83
SWO	SILL (BOTTOM) LEVEL (m)	176.08	176.08
SWO	TOP POSITION (m)	177.3	177.3
SWO	SWO SENSOR NODE	BC5	BC5
SWO	SET POINT (m)	178.08	178.08
SWO	HWL SENSOR LOCATION	NA	NA
SWO	HIGH WATER LEVEL (m)	NA	NA

Section		Calibrated Settings	District Supplied Settings
	Autoreg	BC6	BC6
	SITE #	14	14
DWO	DWO CONTROL	N/A	N/A
	DWO ID	N/A	N/A
	FROM NODE	N/A	N/A
	TO NODE	N/A	N/A
	MAX OPENING SPEED (m/s)	N/A	N/A
	MAX CLOSING SPEED (m/s)	N/A	N/A
	WIDTH(m)	N/A	N/A
	SILL (BOTTOM) LEVEL (m)*	N/A	N/A
	TOP POSITION (m)*	N/A	N/A
	DWO SENSOR NODE	N/A	N/A
	SET POINT (m)	N/A	N/A
	2ND DWO SENSOR NODE	N/A	N/A
	SET POINT (m)	N/A	N/A
	HWL SENSOR LOCATION	N/A	N/A
	HIGH WATER LEVEL (m)	N/A	N/A
SWO	SWO CONTROL	FABRIDAM	FABRIDAM
	SWO ID	BC6FD	BC6FD
	FROM NODE	BC6	BC6
	TO NODE	BC6FD	BC6FD
	MAX OPENING SPEED (m/s)	0.00254	0.00254
	MAX CLOSING SPEED (m/s)	0.00254	0.00254
	WIDTH(m)	1.43	1.43
	SILL (BOTTOM) LEVEL (m)	202.38	202.38
	TOP POSITION (m)	203.93	203.93
	SWO SENSOR NODE	BA00070	BA00070
	SET POINT (m)	197.82	197.82
	HWL SENSOR LOCATION	BC6	BC6
	HIGH WATER LEVEL (m)	203.9508	203.9508

		Calibrated Settings	District Supplied Settings
	Autoreg	BC7	BC7
	SITE #	29	29
DWO	DWO CONTROL	KNIFE GATE	KNIFE GATE
	DWO ID	BC7KG	BC7KG
	FROM NODE	BC7	BC7
	TO NODE	BC7KG	BC7KG
	MAX OPENING SPEED (m/s)	0.00254	0.00254
	MAX CLOSING SPEED (m/s)	0.00254	0.00254
	WIDTH(m)	0.58	0.58
	SILL (BOTTOM) LEVEL (m)*	204.34	204.34
	TOP POSITION (m)*	205.25	205.25
	DWO SENSOR NODE	BA00138	BA00138
	SET POINT (m)	203.47	203.47
	2ND DWO SENSOR NODE	N/A	N/A
	SET POINT (m)	N/A	N/A
	HWL SENSOR LOCATION	N/A	N/A
	HIGH WATER LEVEL (m)	N/A	N/A
SWO	SWO CONTROL	FABRIDAM	FABRIDAM
	SWO ID	BC7FD	BC7FD
	FROM NODE	BC7	BC7
	TO NODE	BC7FD	BC7FD
	MAX OPENING SPEED (m/s)	0.05	0.05
	MAX CLOSING SPEED (m/s)	0.05	0.05
	WIDTH(m)	1.57	1.57
	SILL (BOTTOM) LEVEL (m)	204	204
	TOP POSITION (m)	205.46	205.46
	SWO SENSOR NODE	BC7	BC7
	SET POINT (m)	205.2	205.1
	HWL SENSOR LOCATION	NA	NA
	HIGH WATER LEVEL (m)	NA	NA

		Calibrated Settings	District Supplied Settings
	Autoreg	BC8	BC8
	SITE #	28	28
DWO	DWO CONTROL	KNIFE GATE	KNIFE GATE
	DWO ID	BC8KG	BC8KG
	FROM NODE	BC8	BC8
	TO NODE	BC8DWO	BC8DWO
	MAX OPENING SPEED (m/s)	0.001	0.001
	MAX CLOSING SPEED (m/s)	0.002	0.002
	WIDTH(m)	0.762	0.762
	SILL (BOTTOM) LEVEL (m)*	230.433	230.433
	TOP POSITION (m)*	231.347	231.347
	DWO SENSOR NODE	BUD0092	BUD0092
	SET POINT (m)	230.66	230.66
	2ND DWO SENSOR NODE	NA	NA
	SET POINT (m)	NA	NA
	HWL SENSOR LOCATION	NA	NA
	HIGH WATER LEVEL (m)	NA	NA
SWO	SWO CONTROL	BASCULE GATE	BASCULE GATE
	SWO ID	BC8BG	BC8BG
	FROM NODE	BC8	BC8
	TO NODE	BC8SWO	BC8SWO
	MAX OPENING SPEED (m/s)	0.001	0.001
	MAX CLOSING SPEED (m/s)	0.001	0.001
	WIDTH(m)	1.8287	1.8287
	SILL (BOTTOM) LEVEL (m)	231.56	231.56
	TOP POSITION (m)	233.77	233.77
	SWO SENSOR NODE	BUD093A	BUD093A
	SET POINT (m)	233.35	233.35
	HWL SENSOR LOCATION	NA	NA
	HIGH WATER LEVEL (m)	NA	NA

BC9

		Calibrated Settings Existing Conditions	District Supplied Settings Existing Conditions	Baseline Conditions	Baseline Conditions
	Autoreg	BC45	BC44	BC45	BC44
	SITE #	27	27	27	27
DWO	DWO CONTROL	N/A	N/A	N/A	N/A
	DWO ID	N/A	N/A	N/A	N/A
	FROM NODE	N/A	N/A	N/A	N/A
	TO NODE	N/A	N/A	N/A	N/A
	MAX OPENING SPEED (m/s)	N/A	N/A	N/A	N/A
	MAX CLOSING SPEED (m/s)	N/A	N/A	N/A	N/A
	WIDTH(m)	N/A	N/A	N/A	N/A
	SILL (BOTTOM) LEVEL (m)*	N/A	N/A	N/A	N/A
	TOP POSITION (m)*	N/A	N/A	N/A	N/A
	DWO SENSOR NODE	N/A	N/A	N/A	N/A
	SET POINT (m)	N/A	N/A	N/A	N/A
	2ND DWO SENSOR NODE	N/A	N/A	N/A	N/A
	SET POINT (m)	N/A	N/A	N/A	N/A
	HWL SENSOR LOCATION	N/A	N/A	N/A	N/A
	HIGH WATER LEVEL (m)	N/A	N/A	N/A	N/A
SWO	SWO CONTROL	FABRIDAM	TIMBERGATE	FABRIDAM	TIMBERGATE
	SWO ID	BC45FD	BC44TG	BC45FD	BC44TG
	FROM NODE	BC45	BC44TG	BC45	BC44TG
	TO NODE	BC45SWO	BC44SWO	BC45SWO	BC44SWO
	MAX OPENING SPEED (m/s)	0.005	0.005	0.005	0.005
	MAX CLOSING SPEED (m/s)	0.005	0.005	0.005	0.005
	WIDTH(m)	1.8287	2.743	1.8287	2.743
	SILL (BOTTOM) LEVEL (m)	220.664	222.646	220.664	222.646
	TOP POSITION (m)	221.58	223.103	221.58	223.103
	SWO SENSOR NODE	BC45	BC44	BC45	BC44
	SET POINT (m)	221.58	223.1	221.58	223.1
	HWL SENSOR LOCATION	NA	NA	NA	NA
	HIGH WATER LEVEL (m)	NA	NA	NA	NA

APPENDIX B

```
14                 Number of PID regulations (Baseline PID)

0                  PID type (0 is for gates)
BC1KG              Gate ID
1                  Set point type (1 is for water level)
BD00013            Location where set point is measured
300.0              Integration time, Ti (seconds)
0.0                Derivation time, Td (seconds); set to zero
0.1                Proportionality factor, K
1.0                Weight factor for time level n
0.7                Weight factor for time level n-1
1.0                Weight factor for time level n-2
206.85             Initial value of the bottom lip of the gate (WCL)
1                  Control type (1 for controllable)

2                         # of logical operands
1 1 BD00013 > 205.27      dry weather water level at gate
2 1 BA00102 > 198.74      dry weather water level downstream (m)

3                         # of logical statements
1 0 0 0 A                 Use function A
2 0 0 0 B                 Use function B
0 0 0 0 C                 Use function C

3                         # of functions
A 1 BD00013  4            Function name; water level in a node; node w/
water level; # of values
204.40  205.28            level at the above node; gate level set point
205.20  205.28
205.35  205.28
220.00  205.28

B 1 BA00102  4            Function name; water level in a node; node w/
water level; # of values
197.00  204.7             level at the above node; gate level set point
198.70  204.7
198.80  204.7
220.00  204.7

C 1 BC1 3                 Function name; water level in a node; node w/
water level; # of values
206.10  205.28            100% open; level at the above node; gate level
207.24  205.28
220.00  205.28

1                  PID type (1 is for weir)
BC1SG              Storm gate ID
1                  Set point type (1 is for water level)
```

```
BC1                Location where set point is measured
300.0              Integration time, Ti (seconds)
0.0                Derivation time, Td (seconds); set to zero
1.0                Proportionality factor, K
1.0                Weight factor for time level n
0.7                Weight factor for time level n-1
1.0                Weight factor for time level n-2
207.81             Initial value of weir crest setting (WCL)
0                  Control type (0 for non-controllable)

207.21

0                  PID type (0 is for gates)
BC2PV              Gate ID
1                  Set point type (1 is for water level)
BBA0032            Location where set point is measured
300.0              Integration time, Ti (seconds)
0.0                Derivation time, Td (seconds); set to zero
0.1                Proportionality factor, K
1.0                Weight factor for time level n
0.7                Weight factor for time level n-1
1.0                Weight factor for time level n-2
209.76             Initial value of the bottom lip of the gate (WCL)
1                  Control type (1 for controllable)

2                         # of logical operands
1 1 BBA0032 > 209.71      dry weather water level at gate
2 1 BA00070 > 196.90       dry weather water level downstream (m)

3                         # of logical statements
1 0 0 0 A                 Use function A
2 0 0 0 B                 Use function B
0 0 0 0 C                 Use function C

3                         # of functions
A 1 BBA0032  4            Function name; water level in a node; node w/
water level; # of values
204.40  209.71            100% open; level at the above node; gate level
204.90  209.71            50% open
205.20  209.71            fully closed
220.00  209.71

B 1 BA00070  4            Function name; water level in a node; node w/
water level; # of values
197.00  209.71            100% open; level at the above node; gate level
198.00  209.71            50% open
198.70  209.71            fully closed
220.00  209.71
```

```
C 1 BC2 2                  Function name; water level in a node; node w/
water level; # of values
206.10  209.71             100% open; level at the above node; gate level
220.00  209.71

1                  PID type (1 is for weir)
BC2SG              Storm gate ID
1                  Set point type (1 is for water level)
BC2                Location where set point is measured
300.0              Integration time, Ti (seconds)
0.0                Derivation time, Td (seconds); set to zero
1.0                Proportionality factor, K
1.0                Weight factor for time level n
0.7                Weight factor for time level n-1
1.0                Weight factor for time level n-2
211.14             Initial value of weir crest setting (WCL)
0                  Control type (0 for non-controllable)

210.43

0                  PID type (0 is for gates)
BC3PV              Gate ID
1                  Set point type (1 is for water level)
BA00085            Location where set point is measured
300.0              Integration time, Ti (seconds)
0.0                Derivation time, Td (seconds); set to zero
0.1                Proportionality factor, K
1.0                Weight factor for time level n
0.7                Weight factor for time level n-1
1.0                Weight factor for time level n-2
207.32             Initial value of the bottom lip of the gate (WCL)
0                  Control type (1 for controllable)

197.5

1                  PID type (1 is for weir)
BC3SG              Storm gate ID
1                  Set point type (1 is for water level)
BC3                Location where set point is measured
300.0              Integration time, Ti (seconds)
0.7                Derivation time, Td (seconds); set to zero
1.2                Proportionality factor, K
1.0                Weight factor for time level n
0.7                Weight factor for time level n-1
1.0                Weight factor for time level n-2
208.63             Initial value of weir crest setting (WCL)
0                  Control type (0 for non-controllable)
```

207.77

```
0           PID type (0 is for gates)
BC4PV       Gate ID
1           Set point type (1 is for water level)
BA00102     Location where set point is measured
300.0       Integration time, Ti (seconds)
0.0         Derivation time, Td (seconds); set to zero
0.1         Proportionality factor, K
1.0         Weight factor for time level n
0.7         Weight factor for time level n-1
1.0         Weight factor for time level n-2
204.12      Initial value of the bottom lip of the gate (WCL)
0           Control type (1 for controllable)

199.88

1           PID type (1 is for weir)
BC4FD       Storm gate ID
1           Set point type (1 is for water level)
BC4         Location where set point is measured
300.0       Integration time, Ti (seconds)
0.7         Derivation time, Td (seconds); set to zero
1.2         Proportionality factor, K
1.0         Weight factor for time level n
0.7         Weight factor for time level n-1
1.0         Weight factor for time level n-2
205.50      Initial value of weir crest setting (WCL)
0           Control type (0 for non-controllable)

205.27

1           PID type (1 is for weir)
BC7FD       Storm gate ID
1           Set point type (1 is for water level)
BC30        Location where set point is measured
300.0       Integration time, Ti (seconds)
0.7         Derivation time, Td (seconds); set to zero
1.2         Proportionality factor, K
1.0         Weight factor for time level n
0.7         Weight factor for time level n-1
1.0         Weight factor for time level n-2
205.46      Initial value of weir crest setting (WCL)
0           Control type (0 for non-controllable)

205.10
```

```
0                 PID type (0 is for gates)
BC7KG             Gate ID
1                 Set point type (1 is for water level)
BC7KG             Location where set point is measured
300.0             Integration time, Ti (seconds)
0.0               Derivation time, Td (seconds); set to zero
0.1               Proportionality factor, K
1.0               Weight factor for time level n
0.7               Weight factor for time level n-1
1.0               Weight factor for time level n-2
204.34            Initial value of the bottom lip of the gate (WCL)
0                 Control type (1 for controllable)

203.47

0                 PID type (0 is for gates)
BC8KG             Gate ID
1                 Set point type (1 is for water level)
BUD0092           Location where set point is measured
200.0             Integration time, Ti (seconds) (default 300,decreased
 to 100 not good)
0.8               Derivation time, Td (seconds); b/c of background nois
e in the field, the term with Td is set to zero
1.3               Proportionality factor, K
1.0               Weight factor for time level n
0.7               Weight factor for time level n-1
1.0               Weight factor for time level n-2
231.347           Initial value of the bottom lip of the gate (WCL)
0                 Control type (0 for non-controllable)

231.03            set point  based on meter average changed from 230.85

1                 PID type (1 is for wiers)
BC45FD            Gate ID
1                 Set point type (1 is for water level)
BC45              Location where set point is measured
300.0             Integration time, Ti (seconds)
0.8               Derivation time, Td (seconds); b/c of background nois
e in the field, the term with Td is set to zero
1.2               Proportionality factor, K
1.0               Weight factor for time level n
0.7               Weight factor for time level n-1
1.0               Weight factor for time level n-2
221.58            Initial value of the bottom lip of the weir (WCL)
0                 Control type (0 for non-controllable)

221.58            set point 727'(221.58) TRY 726 FOR CALIBRATION
```

```
1                PID type (1 is for weir)
BC44TG           Gate ID
1                Set point type (1 is for water level)
BC44             Location where set point is measured
300.0            Integration time, Ti (seconds)
0.8              Derivation time, Td (seconds); b/c of background nois
e in the field, the term with Td is set to zero
1.3              Proportionality factor, K
1.0              Weight factor for time level n
0.7              Weight factor for time level n-1
1.0              Weight factor for time level n-2
223.179          Initial value of the bottom lip of the gate (WCL)
0                Control type (0 for non-controllable)

223.1            set point 4' on interceptor (732'-223.1M)TRY 731'

1                PID type (1 is for wiers)
BC8BG            Gate ID
1                Set point type (1 is for water level)
BUD093A          Location where set point is measured
300.0            Integration time, Ti (seconds)
0.8              Derivation time, Td (seconds); b/c of background nois
e in the field, the term with Td is set to zero
1.2              Proportionality factor, K
1.0              Weight factor for time level n
0.7              Weight factor for time level n-1
1.0              Weight factor for time level n-2
233.77           Initial value of the bottom lip of the weir (WCL)
0                Control type (0 for non-controllable)

232.56           set point 763'
```

```
* Header (baseline rtc)
17                       Total # of controllable structures and pumps
17                       # of controllable structures (gate)
0                        # of controllable pumps
0                        # of structures discharging out of the system
0                        # of pumps discharging out of the system

* BC45 Fabridam (model as weir)
1                        1 for weir
BC45FD                   BC45 Fabridam
BC45                     From node
BC45SWO                  To node
1                        1 for controllable gate
0.005                    MAX opening speed (m/s) about 1' per minute
0.005                    MAX closing speed (m/s)
1.8287                   Gate width (m), 6'
220.664                  Weir sill level (m) 724'
221.58                   Top position of the weir (m) 727'
1                        0 degrees (not used for gate)

* Range section
1                        # of logical operands
1 1 BC45    > 221.58     Trunk Level 4' 727'

2                        # of logical statements
1 0 0 0 A                Use function A if trunk greater than 4'
0 0 0 0 B

2                        # of functions
A 1 BC45  4              Function name; water level in a node; node w/
water level; # of values
220.36  221.58           DWF condition gate position 732.25
221.58  221.57           Trunk Level at 4' gate begine to open
221.73  220.664          Trunk Level level 4.5 gate totally open
300.    220.664          high end (line 34)
B 1 BC45  2              Function name; water level in a node; node w/
water level; # of values
220.36  221.579          DWF condition gate inflated
300.    221.579          high end

*  BC 44 Timber Gate, gate basic acted as weir
1                        0 for gate (gate basics)
BC44TG                   Gate ID
BC44                     From node
BC44SWO                  To node
1                        1 for controllable gate
0.005                    MAX opening speed (m/s)
0.005                    MAX closing speed (m/s)
```

```
2.743                       Gate width (m), 9'
222.646                     Gate sill level (m) 730.5
223.103                     Top position of gate (m) 732.0
1                           0 degrees

* Range section
1                           # of logical operands
1 1 BC44    > 223.10        Interceptor Level 4' 732'

2                           # of logical statements
1 0 0 0 A                   Use function A if trunk greater than 4'
0 0 0 0 B

2                           # of functions
A 1 BC44  4                 Function name; water level in a node; node w/
water level; # of values
221.88  223.103             DWF condition gate position 732.25
223.00  223.100             Interceptor Level at 4 begin lower gate
223.255 222.646             Interceptor level 4.5 gate totally open
300.    222.646             high end
B 1 BC44  2                 Function name; water level in a node; node w/
water level; # of values
221.88  223.103             DWF condition gate position 732.25
300.    223.103             high end

*  BC-8 DWO Gate, gate basic
0                           0 for gate (gate basics)
BC8KG                       Gate ID
BC8                         From node
BC8DWO                      To node
1                           1 for controllable gate
0.001                       MAX opening speed (m/s)
0.002                       MAX closing speed (m/s)
0.762                       Gate width (m), 2.5'
230.433                     Gate sill level (m)756.02'
231.347                     Top position of gate (m)759.05'to be verified
1                           0 degrees (not used for gate)

* Range section
1                           # of logical operands
1 1 BUD0092 > 230.66        dry weather water level downstream(m)

2                           # of logical statements
1 0 0 0 A                   Use function A
0 0 0 0 B

2                           # of functions
A 1 BUD0092  6              Function name; water level in a node; node w/
```

```
water level; # of values
230.42  231.347         100% open; level at the above node (where the
sensor is); gate level
230.66  231.347         0.9' deep fully open
230.80  231.20          Based on meter data 757.6' gate start to close
230.90  230.90          Based on meter data 757.6' gate start to close
231.03  230.433         2' deep fully close
235.000 230.433
B 1 BC8DWO  2
230.0   231.347
240.    231.347         Less than 2' gage open

* Bascule Gate (Storm gate open during calibration)
1                       0 for weir
BC8BG                   Bascule Gate model as weir
BC8                     From node
BC8SWO                  To node
1                       1 for controllable gate
0.001                   MAX opening speed (m/s)
0.001                   MAX closing speed (m/s)
1.8287                  Gate width (m), 6'
231.56                  Gate sill level (m) 759.75'
233.77                  Top position of gate (m) 6'x 7'3" 767'
1                       0 degrees (not used for gate)

1                       # of logical operands
1 1 BUD093A > 233.35    Trunk level 7' 765.64

2                       # of logical statements
1 0 0 0 A               Use function A, trunk greater than 7'
0 0 0 0 B               Gate open when water in BC8 raises, but open f
or calibration

2                       # of functions
A 1 BC8  2              Function name; water level in a node; node w/
water level; # of values
230.43   231.56         fully open 7'
240.0    231.56
B 1 BC8  6              Function name; water level in a node; node w/
water level; # of values
230.43   233.77         100% close;
231.56   233.77
232.00   231.56         50% open
232.10   231.56
232.50   231.56         fully open
240.     231.56

0                       0 for gate (gate basics)
```

```
BC1KG                    Gate ID
BC1                      From node
BC1KG                    To node
1                        1 for controllable gate
0.00762                  MAX opening speed (m/s)
0.00762                  MAX closing speed (m/s)
0.610                    Gate width (m)
206.24                   Gate sill level (m)
206.85                   Top position of gate (m)
2                        90 degrees across flow direction (not used for
 gate)

2                        # of logical operands
1 1 BD00013 > 205.27     dry weather water level at gate
2 1 BA00102 > 198.74     dry weather water level downstream (m)

3                        # of logical statements
1 0 0 0 A                Use function A
2 0 0 0 B                Use function B
0 0 0 0 C                Use function C

3                        # of functions
A 1 BD00013  4           Function name; water level in a node; node w/
water level; # of values
204.40  206.85           100% open; level at the above node; gate level
205.20  206.85           50% open
205.35  206.42           fully closed
220.00  206.24

B 1 BA00102  4           Function name; water level in a node; node w/
water level; # of values
197.00  206.85           100% open; level at the above node; gate level
198.70  206.85            50% open
198.80  206.42            fully closed
220.00  206.24

C 1 BC1 3                Function name; water level in a node; node w/
water level; # of values
206.10  206.85           100% open; level at the above node; gate level
207.24  206.85
220.00  206.85

1                        1 for storm gate weir
BC1SG                    storm gate modelled as weir
BC1                      From node
BC1SG                    To node
1                        1 for controllable weir
0.00254                  MAX upward (closing) speed (m/s)
```

```
0.00254                 MAX downward (opening) speed (m/s)
0.9                     width of gate (m)
206.24                  sill level of storm gate (m)
207.81                  Top position of storm gate (m)
2                       90 degrees across flow direction

1                       # of logical operands
1 1 BC1 > 207.21

2                       # of logical statements
1 0 0 0 A               gate will open if water level at BC1 > 207.21
0 0 0 0 B               gate will close if water level at BC1 < 207.21

2                       # of functions
A 1 BC1  5              Function name; water level in a node; node w/
water level; # of values
206.20  207.81          100% closed; level at the above node (where th
e sensor is); gate level
207.10  207.81          100% closed
207.24  206.74          50% down; level at the above node (where the s
ensor is); gate level
208.00  206.24          fully down and open
210.00  206.24

B 1 BC1  4
206.20  207.81          100% closed; level at the above node (where th
e sensor is); gate level
207.10  207.81          100% closed
207.21  207.81          100% closed
207.22  207.30          start to lower and open

0                       0 for gate (gate basics)
BC2PV                   Gate ID
BC2                     From node
BC2PV                   To node
1                       1 for controllable gate
0.00127                 MAX opening speed (m/s)
0.00127                 MAX closing speed (m/s)
0.610                   Gate width (m)
209.15                  Gate sill level (m)
209.76                  Top position of gate (m)
2                       90 degrees across flow direction (not used for
 gate)

2                       # of logical operands
1 1 BBA0032 > 209.71    dry weather water level at gate
2 1 BA00070 > 196.90     dry weather water level downstream (m)
```

```
3                       # of logical statements
1 0 0 0 A               Use function A
2 0 0 0 B               Use function B
0 0 0 0 C               Use function C

3                       # of functions
A 1 BBA0032  4          Function name; water level in a node; node w/
water level; # of values
204.40  206.85          100% open; level at the above node; gate level
204.90  206.42          50% open
205.20  206.24          fully closed
220.00  206.24

B 1 BA00070  4          Function name; water level in a node; node w/
water level; # of values
197.00  206.85          100% open; level at the above node; gate level
198.00  206.42          50% open
198.70  206.24          fully closed
220.00  206.24

C 1 BC2 2               Function name; water level in a node; node w/
water level; # of values
206.10  206.85          100% open; level at the above node; gate level
220.00  206.85

1                       1 for storm gate weir
BC2SG                   storm gate modelled as weir
BC2                     From node
BC2SG                    To node
1                       1 for controllable weir
0.00254                 MAX upward (closing) speed (m/s)
0.00254                 MAX downward (opening) speed (m/s)
0.91                    width of gate (m)
209.23                  sill level of storm gate (m)
211.14                  Top position of storm gate (m)
2                       90 degrees across flow direction

1                       # of logical operands
1 1 BC2 > 210.43

2                       # of logical statements
1 0 0 0 A               gate will open if water level at BC1 > 207.21
0 0 0 0 B               gate will close if water level at BC1 < 207.21

2                       # of functions
A 1 BC2  4              Function name; water level in a node; node w/
water level; # of values
209.05  211.14          100% closed; level at the above node (where th
```

```
e sensor is); gate level
210.35  211.14          100% closed
210.50  210.19          50% down; level at the above node (where the s
ensor is); gate level
225.00  209.23          fully down and open


B 1 BC2  4
209.05  211.14          100% closed; level at the above node (where th
e sensor is); gate level
210.35  211.14          100% closed
210.43  211.14          100% closed
210.45  211.00          start to lower and open

0                       0 for gate (gate basics)
BC3PV                   Gate ID
BC3                     From node
BC3PV                   To node
1                       1 for controllable gate
0.00254                 MAX opening speed (m/s)
0.00254                 MAX closing speed (m/s)
0.610                   Gate width (m)
206.72                  Gate sill level (m)
207.32                  Top position of gate (m)
2                       90 degrees across flow direction (not used for
 gate)

2                       # of logical operands
1 1 BBZ0005 > 206.73    dry weather water level at gate
2 1 BA00085 > 197.60    dry weather water level downstream (m)

3                       # of logical statements
1 0 0 0 A               Use function A
2 0 0 0 B               Use function B
0 0 0 0 C               Use function C

3                       # of functions
A 1 BBZ0005  4          Function name; water level in a node; node w/
water level; # of values
204.40  207.32          100% open; level at the above node; gate level
206.70  207.32
206.75  207.02          50% open
220.00  206.24          fully closed


B 1 BA00085  4          Function name; water level in a node; node w/
water level; # of values
195.75  207.32          100% open; level at the above node; gate level
```

```
197.50  207.32
198.70  207.02          50% open
220.00  206.24          fully closed


C 1 BC3 2               Function name; water level in a node; node w/
water level; # of values
206.70  207.32          100% open; level at the above node; gate level
220.00  207.32

1                       1 for storm gate weir
BC3SG                   storm gate modelled as weir
BC3                     From node
BC3SG                   To node
1                       1 for controllable weir
0.00254                 MAX upward (closing) speed (m/s)
0.00254                 MAX downward (opening) speed (m/s)
0.9                     width of gate (m)
207.10                  sill level of storm gate (m)
208.63                  Top position of storm gate (m)
2                       90 degrees across flow direction

1                       # of logical operands
1 1 BC3 > 207.77

2                       # of logical statements
1 0 0 0 A               gate will open
0 0 0 0 B               gate will close

2                       # of functions
A 1 BC3  4              Function name; water level in a node; node w/
water level; # of values
206.70  208.63          100% closed; level at the above node (where th
e sensor is); gate level
207.70  208.63          100% closed
207.80  207.87          50% down; level at the above node (where the s
ensor is); gate level
215.00  207.10          fully down and open


B 1 BC3  4
206.75  208.63          100% closed; level at the above node (where th
e sensor is); gate level
207.75  208.63          100% closed
207.77  208.63          100% closed
207.78  208.00          start to lower and open
```

```
0                        0 for gate (gate basics)
BC4PV                    Gate ID
BC4                      From node
BC4PV                  To node
1                        1 for controllable gate
0.00254                  MAX opening speed (m/s)
0.00254                  MAX closing speed (m/s)
0.610                    Gate width (m)
203.51                   Gate sill level (m)
204.12                   Top position of gate (m)
2                        90 degrees across flow direction (not used for
 gate)

2                        # of logical operands
1 1 BC4PV1 > 204.18     dry weather water level at gate
2 1 BA00102 > 198.90     dry weather water level downstream (m)

3                        # of logical statements
1 0 0 0 A                Use function A
2 0 0 0 B                Use function B
0 0 0 0 C                Use function C

3                        # of functions
A 1 BC4PV1  4           Function name; water level in a node; node w/ w
ater level; # of values
203.50  204.12           100% open; level at the above node; gate level
204.15  204.12
204.20  203.82           50% open
220.00  203.51           fully closed


B 1 BA00102  4           Function name; water level in a node; node w/
water level; # of values
195.75  204.12           100% open; level at the above node; gate level

197.50  204.12
198.70  203.82           50% open
220.00  203.51           fully closed


C 1 BC4 2                Function name; water level in a node; node w/
water level; # of values
203.60  204.12           100% open; level at the above node; gate level
220.00  204.12

1                        1 for storm gate weir
BC4FD                    storm gate modelled as weir
BC4                      From node
```

```
BC4FD                      To node
1                         1 for controllable weir
0.00254                   MAX upward (closing) speed (m/s)
0.00254                   MAX downward (opening) speed (m/s)
1.52                       width of gate (m)
204.58                    sill level of storm gate (m)
205.50                    Top position of storm gate (m)
2                         90 degrees across flow direction

1                         # of logical operands
1 1 BC4 > 205.27

2                         # of logical statements
1 0 0 0 A                 gate will open
0 0 0 0 B                 gate will close

2                         # of functions
A 1 BC4  4                Function name; water level in a node; node w/
water level; # of values
204.10  205.50            100% closed; level at the above node (where th
e sensor is); gate level
205.20  205.50            100% closed
205.35  205.04            50% down; level at the above node (where the s
ensor is); gate level
215.00  204.58            fully down and open


B 1 BC4  4
204.10  205.50            100% closed; level at the above node (where th
e sensor is); gate level
205.20  205.50            100% closed
205.27  205.50            100% closed
205.28  205.00            start to lower and open

0                         0 for gate (gate basics)
BC5PV                     Gate ID
BC5                       From node
BC5PV                     To node
1                         1 for controllable gate
0.00254                   MAX opening speed (m/s)
0.00254                   MAX closing speed (m/s)
0.610                     Gate width (m)
174.14                    Gate sill level (m)
174.75                    Top position of gate (m)
2                         90 degrees across flow direction (not used for
 gate)

2                         # of logical operands
```

```
1 1 JRPS > 174.28          dry weather water level at gate
2 1 BA00070 > 196.90       dry weather water level downstream (m)

3                          # of logical statements
1 0 0 0 A                  Use function A
2 0 0 0 B                  Use function B
0 0 0 0 C                  Use function C

3                          # of functions
A 1 JRPS  4                Function name; water level in a node; node w/
water level; # of values
172.10  174.75             100% open; level at the above node; gate level
174.25  174.75
174.35  174.75             50% open (modified; initial value 174.45 6/20/
2001)
200.00  174.75             fully closed (modified; initial value 174.14 6
/20)

B 1 BA00070  4             Function name; water level in a node; node w/
water level; # of values
194.90  174.75             100% open; level at the above node; gate level

196.80  174.75
197.10  174.75             50% open (modified; initial value 174.45 6/20/
2001)
220.00  174.75             fully closed (modified; initial value 174.14 6
/20)

C 1 BC5 2                  Function name; water level in a node; node w/
water level; # of values
174.05  174.75             100% open; level at the above node; gate level
220.00  174.75

1                          1 for storm gate weir
BC5SG                      storm gate modelled as weir
BC5                        From node
BC5SG                      To node
1                          1 for controllable weir
0.00254                    MAX upward (closing) speed (m/s)
0.00254                    MAX downward (opening) speed (m/s)
1.83                       width of gate (m)
176.08                     sill level of storm gate (m)
177.30                     Top position of storm gate (m)
2                          90 degrees across flow direction

1                          # of logical operands
1 1 BC5 > 178.08
```

```
2                         # of logical statements
1 0 0 0 A                 gate will open
0 0 0 0 B                 gate will close

2                         # of functions
A 1 BC5  4                Function name; water level in a node; node w/
water level; # of values
174.00  177.30            100% closed; level at the above node (where th
e sensor is); gate level
178.00  177.30            100% closed
178.15  176.69            50% down; level at the above node (where the s
ensor is); gate level
210.00  176.08            fully down and open


B 1 BC5  6
174.00  177.30            100% closed; level at the above node (where th
e sensor is); gate level
175.90  177.30            100% closed
176.05  177.30
178.05  177.30            100% closed
178.10  177.20            start to lower and open
210.00  176.08            fully down and open

1                         1 for weir (gate basics)
BC6FD                     Gate ID
BC6                       From node
BC6FD                     To node
1                         1 for controllable gate
0.00254                   MAX opening speed (m/s)
0.00254                   MAX closing speed (m/s)
1.43                      Gate width (m)
202.38                    Gate sill level (m)
203.93                    Top position of gate (m)
2                         90 degrees across flow direction (not used for
 gate)

1                         # of logical operands
1 1  BA00070 > 197.82     dry weather water level downstream (m)


2                         # of logical statements
1 0 0 0 A                 Use function A
0 0 0 0 B                 Use function B


2                         # of functions
A 1 BA00070  4            Function name; water level in a node; node w/
```

```
water level; # of values
194.90  202.38          100% close; level at the above node; gate leve
l
197.75  202.38
197.90  203.16          50% open
220.00  203.93          fully open


B 1 BC6 2               Function name; water level in a node; node w/
water level; # of values
202.05  202.38          100% open; level at the above node; gate level
220.00  202.38

0                       0 for gate (gate basics)
BC7KG                   Gate ID
BC7                     From node
BC7KG                   To node
1                       1 for controllable gate
0.00254                 MAX opening speed (m/s)
0.00254                 MAX closing speed (m/s)
0.58                    Gate width (m)
204.34                  Gate sill level (m)
205.25                  Top position of gate (m)
2                       90 degrees across flow direction (not used for
 gate)

1                       # of logical operands
1 1 BA00138 > 203.47    dry weather water level downstream (m)


2                       # of logical statements
1 0 0 0 A               Use function A
0 0 0 0 B               Use function B

2                       # of functions
A 1 BA00138  4          Function name; water level in a node; node w/
water level; # of values
202.00  205.25          100% open; level at the above node; gate level
203.40  205.25          intermediate
203.55  204.34          intermediate
220.00  204.34          fully closed

B 1 BA00138 2           Function name; water level in a node; node w/
water level; # of values
202.00  205.25          100% open; level at the above node; gate level
220.00  205.25

1                       1 for storm gate weir
```

```
BC7FD                   storm gate modelled as weir
BC7                     From node
BC7FD                   To node
1                       1 for controllable weir
0.05                    MAX upward (closing) speed (m/s)
0.05                    MAX downward (opening) speed (m/s)
1.57                    width of gate (m)
204.00                  sill level of storm gate (m)
205.46                  Top position of storm gate (m)
2                       90 degrees across flow direction

1                       # of logical operands
1 1 BC7 > 205.10

2                       # of logical statements
1 0 0 0 A               gate will open
0 0 0 0 B               gate will close

2                       # of functions
A 1 BC7  4              Function name; water level in a node; node w/
water level; # of values
203.75  205.46          100% closed; level at the above node (where th
e sensor is); gate level
205.00  205.46          100% closed
205.20  205.20          50% down; level at the above node (where the s
ensor is); gate level
220.00  204.95          fully down and open

B 1 BC7  4
203.75  205.46          100% closed; level at the above node (where th
e sensor is); gate level
205.00  205.46          100% closed
205.20  205.46          100% closed
205.60  205.40          start to lower and open
```

```
13                  Number of PID regulations (existing)

0                   PID type (0 is for gates)
BC1KG               Gate ID
1                   Set point type (1 is for water level)
BD00013             Location where set point is measured
300.0               Integration time, Ti (seconds)
0.0                 Derivation time, Td (seconds); set to zero
0.1                 Proportionality factor, K
1.0                 Weight factor for time level n
0.7                 Weight factor for time level n-1
1.0                 Weight factor for time level n-2
206.85              Initial value of the bottom lip of the gate (WCL)
1                   Control type (1 for controllable)

2                          # of logical operands
1 1 BD00013 > 205.27       dry weather water level at gate
2 1 BA00102 > 198.74       dry weather water level downstream (m)

3                          # of logical statements
1 0 0 0 A                  Use function A
2 0 0 0 B                  Use function B
0 0 0 0 C                  Use function C

3                          # of functions
A 1 BD00013  4             Function name; water level in a node; node w/
water level; # of values
204.40  205.28             level at the above node; gate level set point
205.20  205.28
205.35  205.28
220.00  205.28

B 1 BA00102  4             Function name; water level in a node; node w/
water level; # of values
197.00  204.7              level at the above node; gate level set point
198.70  204.7
198.80  204.7
220.00  204.7

C 1 BC1 3                  Function name; water level in a node; node w/
water level; # of values
206.10  205.28             100% open; level at the above node; gate level
207.24  205.28
220.00  205.28

1                   PID type (1 is for weir)
BC1SG`              Storm gate ID
1                   Set point type (1 is for water level)
```

```
BC1                 Location where set point is measured
300.0               Integration time, Ti (seconds)
0.0                 Derivation time, Td (seconds); set to zero
1.0                 Proportionality factor, K
1.0                 Weight factor for time level n
0.7                 Weight factor for time level n-1
1.0                 Weight factor for time level n-2
207.81              Initial value of weir crest setting (WCL)
0                   Control type (0 for non-controllable)

207.21

0                   PID type (0 is for gates)
BC2PV               Gate ID
1                   Set point type (1 is for water level)
BBA0032            Location where set point is measured
300.0               Integration time, Ti (seconds)
0.0                 Derivation time, Td (seconds); set to zero
0.1                 Proportionality factor, K
1.0                 Weight factor for time level n
0.7                 Weight factor for time level n-1
1.0                 Weight factor for time level n-2
209.76              Initial value of the bottom lip of the gate (WCL)
1                   Control type (1 for controllable)

2                          # of logical operands
1 1 BBA0032 > 209.71       dry weather water level at gate
2 1 BA00070 > 196.90        dry weather water level downstream (m)

3                          # of logical statements
1 0 0 0 A                  Use function A
2 0 0 0 B                  Use function B
0 0 0 0 C                  Use function C

3                          # of functions
A 1 BBA0032  4             Function name; water level in a node; node w/
water level; # of values
204.40  209.71             100% open; level at the above node; gate level
204.90  209.71             50% open
205.20  209.71             fully closed
220.00  209.71

B 1 BA00070  4             Function name; water level in a node; node w/
water level; # of values
197.00  209.71             100% open; level at the above node; gate level
198.00  209.71             50% open
198.70  209.71             fully closed
220.00  209.71
```

```
C 1 BC2 2               Function name; water level in a node; node w/
water level; # of values
206.10  209.71          100% open; level at the above node; gate level
220.00  209.71

1                 PID type (1 is for weir)
BC2SG             Storm gate ID
1                 Set point type (1 is for water level)
BC2               Location where set point is measured
300.0             Integration time, Ti (seconds)
0.0               Derivation time, Td (seconds); set to zero
1.0               Proportionality factor, K
1.0               Weight factor for time level n
0.7               Weight factor for time level n-1
1.0               Weight factor for time level n-2
211.14            Initial value of weir crest setting (WCL)
0                 Control type (0 for non-controllable)

210.43

0                 PID type (0 is for gates)
BC3PV             Gate ID
1                 Set point type (1 is for water level)
BA00085           Location where set point is measured
300.0             Integration time, Ti (seconds)
0.0               Derivation time, Td (seconds); set to zero
0.1               Proportionality factor, K
1.0               Weight factor for time level n
0.7               Weight factor for time level n-1
1.0               Weight factor for time level n-2
207.32            Initial value of the bottom lip of the gate (WCL)
0                 Control type (1 for controllable)

197.5

1                 PID type (1 is for weir)
BC3SG             Storm gate ID
1                 Set point type (1 is for water level)
BC3               Location where set point is measured
300.0             Integration time, Ti (seconds)
0.7               Derivation time, Td (seconds); set to zero
1.2               Proportionality factor, K
1.0               Weight factor for time level n
0.7               Weight factor for time level n-1
1.0               Weight factor for time level n-2
208.63            Initial value of weir crest setting (WCL)
0                 Control type (0 for non-controllable)
```

207.77

0	PID type (0 is for gates)
BC4PV	Gate ID
1	Set point type (1 is for water level)
BA00102	Location where set point is measured
300.0	Integration time, Ti (seconds)
0.0	Derivation time, Td (seconds); set to zero
0.1	Proportionality factor, K
1.0	Weight factor for time level n
0.7	Weight factor for time level n-1
1.0	Weight factor for time level n-2
204.12	Initial value of the bottom lip of the gate (WCL)
0	Control type (1 for controllable)

199.88

1	PID type (1 is for weir)
BC4FD	Storm gate ID
1	Set point type (1 is for water level)
BC4	Location where set point is measured
300.0	Integration time, Ti (seconds)
0.7	Derivation time, Td (seconds); set to zero
1.2	Proportionality factor, K
1.0	Weight factor for time level n
0.7	Weight factor for time level n-1
1.0	Weight factor for time level n-2
205.50	Initial value of weir crest setting (WCL)
0	Control type (0 for non-controllable)

205.27

1	PID type (1 is for weir)
BC7FD	Storm gate ID
1	Set point type (1 is for water level)
BC30	Location where set point is measured
300.0	Integration time, Ti (seconds)
0.7	Derivation time, Td (seconds); set to zero
1.2	Proportionality factor, K
1.0	Weight factor for time level n
0.7	Weight factor for time level n-1
1.0	Weight factor for time level n-2
205.46	Initial value of weir crest setting (WCL)
0	Control type (0 for non-controllable)

205.10

```
0                PID type (0 is for gates)
BC7KG            Gate ID
1                Set point type (1 is for water level)
BC7KG            Location where set point is measured
300.0            Integration time, Ti (seconds)
0.0              Derivation time, Td (seconds); set to zero
0.1              Proportionality factor, K
1.0              Weight factor for time level n
0.7              Weight factor for time level n-1
1.0              Weight factor for time level n-2
204.34           Initial value of the bottom lip of the gate (WCL)
0                Control type (1 for controllable)

203.47

0                PID type (0 is for gates)
BC8KG            Gate ID
1                Set point type (1 is for water level)
BUD0092          Location where set point is measured
200.0            Integration time, Ti (seconds) (default 300,decreased
 to 100 not good)
0.8              Derivation time, Td (seconds); b/c of background nois
e in the field, the term with Td is set to zero
1.3              Proportionality factor, K
1.0              Weight factor for time level n
0.7              Weight factor for time level n-1
1.0              Weight factor for time level n-2
231.347          Initial value of the bottom lip of the gate (WCL)
0                Control type (0 for non-controllable)

230.90           set point  based on meter average changed from 230.85

1                PID type (1 is for wiers)
BC45FD           Gate ID
1                Set point type (1 is for water level)
BC45             Location where set point is measured
300.0            Integration time, Ti (seconds)
0.8              Derivation time, Td (seconds); b/c of background nois
e in the field, the term with Td is set to zero
1.2              Proportionality factor, K
1.0              Weight factor for time level n
0.7              Weight factor for time level n-1
1.0              Weight factor for time level n-2
221.58           Initial value of the bottom lip of the weir (WCL)
0                Control type (0 for non-controllable)

221.27           set point 727'(221.58) TRY 726 FOR CALIBRATION
```

```
1                PID type (1 is for weir)
BC44TG           Gate ID
1                Set point type (1 is for water level)
BC44             Location where set point is measured
300.0            Integration time, Ti (seconds)
0.8              Derivation time, Td (seconds); b/c of background nois
e in the field, the term with Td is set to zero
1.3              Proportionality factor, K
1.0              Weight factor for time level n
0.7              Weight factor for time level n-1
1.0              Weight factor for time level n-2
223.179          Initial value of the bottom lip of the gate (WCL)
0                Control type (0 for non-controllable)

222.798          set point 4' on interceptor (732'-223.1M)TRY 731'

1                PID type (1 is for wiers)
BC8BG            Gate ID
1                Set point type (1 is for water level)
BUD093A          Location where set point is measured
300.0            Integration time, Ti (seconds)
0.8              Derivation time, Td (seconds); b/c of background nois
e in the field, the term with Td is set to zero
1.2              Proportionality factor, K
1.0              Weight factor for time level n
0.7              Weight factor for time level n-1
1.0              Weight factor for time level n-2
233.77           Initial value of the bottom lip of the weir (WCL)
0                Control type (0 for non-controllable)

232.56           set point 763'
```

```
BC7FD                   storm gate modelled as weir
BC7                     From node
BC7FD                   To node
1                       1 for controllable weir
0.05                    MAX upward (closing) speed (m/s)
0.05                    MAX downward (opening) speed (m/s)
1.57                    width of gate (m)
204.00                  sill level of storm gate (m)
205.46                  Top position of storm gate (m)
2                       90 degrees across flow direction

1                       # of logical operands
1 1 BC7 > 205.10

2                       # of logical statements
1 0 0 0 A               gate will open
0 0 0 0 B               gate will close

2                       # of functions
A 1 BC7  4              Function name; water level in a node; node w/
water level; # of values
203.75  205.46          100% closed; level at the above node (where th
e sensor is); gate level
205.00  205.46          100% closed
205.20  205.20          50% down; level at the above node (where the s
ensor is); gate level
220.00  204.95          fully down and open

B 1 BC7  4
203.75  205.46          100% closed; level at the above node (where th
e sensor is); gate level
205.00  205.46          100% closed
205.20  205.46          100% closed
205.60  205.40          start to lower and open
```

```
* Header (existing)
17                          Total # of controllable structures and pumps
17                          # of controllable structures (gate)
0                           # of controllable pumps
0                           # of structures discharging out of the system
0                           # of pumps discharging out of the system

* BC45 Fabridam (model as weir)
1                           1 for weir
BC45FD                      BC45 Fabridam
BC45                        From node
BC45SWO                     To node
1                           1 for controllable gate
0.005                       MAX opening speed (m/s) about 1' per minute
0.005                       MAX closing speed (m/s)
1.8287                      Gate width (m), 6'
220.664                     Weir sill level (m) 724'
221.58                      Top position of the weir (m) 727'
1                           0 degrees (not used for gate)

* Range section
1                           # of logical operands
1 1 BC45    > 221.58        Trunk Level 4' 727'

2                           # of logical statements
1 0 0 0 A                   Use function A if trunk greater than 4'
0 0 0 0 B

2                           # of functions
A 1 BC45  4                 Function name; water level in a node; node w/
water level; # of values
220.36  221.58              DWF condition gate position 732.25
221.58  221.57              Trunk Level at 4' gate begine to open
221.73  220.664             Trunk Level level 4.5 gate totally open
300.    220.664             high end (line 34)
B 1 BC45  2                 Function name; water level in a node; node w/
water level; # of values
220.36  221.579             DWF condition gate inflated
300.    221.579             high end

*  BC 44 Timber Gate, gate basic acted as weir
1                           0 for gate (gate basics)
BC44TG                      Gate ID
BC44                        From node
BC44SWO                     To node
1                           1 for controllable gate
0.005                       MAX opening speed (m/s)
0.005                       MAX closing speed (m/s)
```

```
2.743                   Gate width (m), 9'
222.646                 Gate sill level (m) 730.5
223.103                 Top position of gate (m) 732.0
1                       0 degrees

* Range section
1                       # of logical operands
1 1 BC44    > 223.10    Interceptor Level 4' 732'

2                       # of logical statements
1 0 0 0 A               Use function A if trunk greater than 4'
0 0 0 0 B

2                       # of functions
A 1 BC44  4             Function name; water level in a node; node w/
water level; # of values
221.88  223.103         DWF condition gate position 732.25
223.00  223.100         Interceptor Level at 4 begin lower gate
223.255 222.646         Interceptor level 4.5 gate totally open
300.    222.646         high end
B 1 BC44  2             Function name; water level in a node; node w/
water level; # of values
221.88  223.103         DWF condition gate position 732.25
300.    223.103         high end

*  BC-8 DWO Gate, gate basic
0                       0 for gate (gate basics)
BC8KG                   Gate ID
BC8                     From node
BC8DWO                  To node
1                       1 for controllable gate
0.001                   MAX opening speed (m/s)
0.002                   MAX closing speed (m/s)
0.762                   Gate width (m), 2.5'
230.433                 Gate sill level (m)756.02'
231.347                 Top position of gate (m)759.05'to be verified
1                       0 degrees (not used for gate)

* Range section
1                       # of logical operands
1 1 BUD0092 > 230.66    dry weather water level downstream(m)

2                       # of logical statements
1 0 0 0 A               Use function A
0 0 0 0 B

2                       # of functions
A 1 BUD0092  6          Function name; water level in a node; node w/
```

```
water level; # of values
230.42  231.347         100% open; level at the above node (where the
sensor is); gate level
230.66  231.347         0.9' deep fully open
230.80  231.20          Based on meter data 757.6' gate start to close
230.90  230.90          Based on meter data 757.6' gate start to close
231.03  230.433         2' deep fully close
235.000 230.433
B 1 BC8DWO  2
230.0   231.347
240.    231.347         Less than 2' gage open

* Bascule Gate (Storm gate open during calibration)
1                       0 for weir
BC8BG                   Bascule Gate model as weir
BC8                     From node
BC8SWO                  To node
1                       1 for controllable gate
0.001                   MAX opening speed (m/s)
0.001                   MAX closing speed (m/s)
1.8287                  Gate width (m), 6'
231.56                  Gate sill level (m) 759.75'
233.77                  Top position of gate (m) 6'x 7'3" 767'
1                       0 degrees (not used for gate)

1                       # of logical operands
1 1 BUD093A > 233.35    Trunk level 7' 765.64

2                       # of logical statements
1 0 0 0 A               Use function A, trunk greater than 7'
0 0 0 0 A               Gate open when water in BC8 raises, but open f
or calibration

2                       # of functions
A 1 BC8  2              Function name; water level in a node; node w/
water level; # of values
230.43   231.56         fully open 7'
240.0    231.56
B 1 BC8  6              Function name; water level in a node; node w/
water level; # of values
230.43   233.77         100% close;
231.56   233.77
232.00   231.56         50% open
232.10   231.56
232.50   231.56         fully open
240.     231.56

0                       0 for gate (gate basics)
```

```
BC1KG                       Gate ID
BC1                         From node
BC1KG                       To node
1                           1 for controllable gate
0.00762                     MAX opening speed (m/s)
0.00762                     MAX closing speed (m/s)
0.610                       Gate width (m)
206.24                      Gate sill level (m)
206.85                      Top position of gate (m)
2                           90 degrees across flow direction (not used for
 gate)

2                           # of logical operands
1 1 BD00013 > 205.27        dry weather water level at gate
2 1 BA00102 > 198.74        dry weather water level downstream (m)

3                           # of logical statements
1 0 0 0 A                   Use function A
2 0 0 0 B                   Use function B
0 0 0 0 C                   Use function C

3                           # of functions
A 1 BD00013  4              Function name; water level in a node; node w/
water level; # of values
204.40  206.85              100% open; level at the above node; gate level
205.20  206.85              50% open
205.35  206.42              fully closed
220.00  206.24

B 1 BA00102  4              Function name; water level in a node; node w/
water level; # of values
197.00  206.85              100% open; level at the above node; gate level
198.70  206.85               50% open
198.80  206.42               fully closed
220.00  206.24

C 1 BC1 3                   Function name; water level in a node; node w/
water level; # of values
206.10  206.85              100% open; level at the above node; gate level
207.24  206.85
220.00  206.85

1                           1 for storm gate weir
BC1SG                       storm gate modelled as weir
BC1                         From node
BC1SG                       To node
1                           1 for controllable weir
0.00254                     MAX upward (closing) speed (m/s)
```

```
0.00254                 MAX downward (opening) speed (m/s)
0.9                     width of gate (m)
206.24                  sill level of storm gate (m)
207.81                  Top position of storm gate (m)
2                       90 degrees across flow direction

1                       # of logical operands
1 1 BC1 > 207.21

2                       # of logical statements
1 0 0 0 A               gate will open if water level at BC1 > 207.21
0 0 0 0 B               gate will close if water level at BC1 < 207.21

2                       # of functions
A 1 BC1  5              Function name; water level in a node; node w/
water level; # of values
206.20  207.81          100% closed; level at the above node (where th
e sensor is); gate level
207.10  207.81          100% closed
207.24  206.74          50% down; level at the above node (where the s
ensor is); gate level
208.00  206.24          fully down and open
210.00  206.24

B 1 BC1  4
206.20  207.81          100% closed; level at the above node (where th
e sensor is); gate level
207.10  207.81          100% closed
207.21  207.81          100% closed
207.22  207.30          start to lower and open

0                       0 for gate (gate basics)
BC2PV                   Gate ID
BC2                     From node
BC2PV                   To node
1                       1 for controllable gate
0.00127                 MAX opening speed (m/s)
0.00127                 MAX closing speed (m/s)
0.610                   Gate width (m)
209.15                  Gate sill level (m)
209.76                  Top position of gate (m)
2                       90 degrees across flow direction (not used for
 gate)

2                       # of logical operands
1 1 BBA0032 > 209.71    dry weather water level at gate
2 1 BA00070 > 196.90     dry weather water level downstream (m)
```

```
3                         # of logical statements
1 0 0 0 A                 Use function A
2 0 0 0 B                 Use function B
0 0 0 0 C                 Use function C

3                         # of functions
A 1 BBA0032  4            Function name; water level in a node; node w/
water level; # of values
204.40  206.85            100% open; level at the above node; gate level
204.90  206.42            50% open
205.20  206.24            fully closed
220.00  206.24

B 1 BA00070  4            Function name; water level in a node; node w/
water level; # of values
197.00  206.85            100% open; level at the above node; gate level
198.00  206.42            50% open
198.70  206.24            fully closed
220.00  206.24

C 1 BC2 2                 Function name; water level in a node; node w/
water level; # of values
206.10  206.85            100% open; level at the above node; gate level
220.00  206.85

1                         1 for storm gate weir
BC2SG                     storm gate modelled as weir
BC2                       From node
BC2SG                      To node
1                         1 for controllable weir
0.00254                   MAX upward (closing) speed (m/s)
0.00254                   MAX downward (opening) speed (m/s)
0.91                      width of gate (m)
209.23                    sill level of storm gate (m)
211.14                    Top position of storm gate (m)
2                         90 degrees across flow direction

1                         # of logical operands
1 1 BC2 > 210.43

2                         # of logical statements
1 0 0 0 A                 gate will open if water level at BC1 > 207.21
0 0 0 0 B                 gate will close if water level at BC1 < 207.21

2                         # of functions
A 1 BC2  4                Function name; water level in a node; node w/
water level; # of values
209.05  211.14            100% closed; level at the above node (where th
```

```
e sensor is); gate level
210.35  211.14          100% closed
210.50  210.19          50% down; level at the above node (where the s
ensor is); gate level
225.00  209.23          fully down and open


B 1 BC2  4
209.05  211.14          100% closed; level at the above node (where th
e sensor is); gate level
210.35  211.14          100% closed
210.43  211.14          100% closed
210.45  211.00          start to lower and open

0                       0 for gate (gate basics)
BC3PV                   Gate ID
BC3                     From node
BC3PV                   To node
1                       1 for controllable gate
0.00254                 MAX opening speed (m/s)
0.00254                 MAX closing speed (m/s)
0.610                   Gate width (m)
206.72                  Gate sill level (m)
207.32                  Top position of gate (m)
2                       90 degrees across flow direction (not used for
 gate)

2                       # of logical operands
1 1 BBZ0005 > 206.73    dry weather water level at gate
2 1 BA00085 > 197.60    dry weather water level downstream (m)

3                       # of logical statements
1 0 0 0 A               Use function A
2 0 0 0 B               Use function B
0 0 0 0 C               Use function C

3                       # of functions
A 1 BBZ0005  4          Function name; water level in a node; node w/
water level; # of values
204.40  207.32          100% open; level at the above node; gate level
206.70  207.32
206.75  207.02          50% open
220.00  206.24          fully closed


B 1 BA00085  4          Function name; water level in a node; node w/
water level; # of values
195.75  207.32          100% open; level at the above node; gate level
```

```
197.50  207.32
198.70  207.02           50% open
220.00  206.24           fully closed


C 1 BC3 2                Function name; water level in a node; node w/
water level; # of values
206.70  207.32           100% open; level at the above node; gate level
220.00  207.32

1                        1 for storm gate weir
BC3SG                    storm gate modelled as weir
BC3                      From node
BC3SG                    To node
1                        1 for controllable weir
0.00254                  MAX upward (closing) speed (m/s)
0.00254                  MAX downward (opening) speed (m/s)
0.9                      width of gate (m)
207.10                   sill level of storm gate (m)
208.63                   Top position of storm gate (m)
2                        90 degrees across flow direction

1                        # of logical operands
1 1 BC3 > 207.77

2                        # of logical statements
1 0 0 0 A                gate will open
0 0 0 0 B                gate will close

2                        # of functions
A 1 BC3  4               Function name; water level in a node; node w/
water level; # of values
206.70  208.63           100% closed; level at the above node (where th
e sensor is); gate level
207.70  208.63           100% closed
207.80  207.87           50% down; level at the above node (where the s
ensor is); gate level
215.00  207.10           fully down and open


B 1 BC3  4
206.75  208.63           100% closed; level at the above node (where th
e sensor is); gate level
207.75  208.63           100% closed
207.77  208.63           100% closed
207.78  208.00           start to lower and open
```

```
0                        0 for gate (gate basics)
BC4PV                    Gate ID
BC4                      From node
BC4PV                  To node
1                        1 for controllable gate
0.00254                  MAX opening speed (m/s)
0.00254                  MAX closing speed (m/s)
0.610                    Gate width (m)
203.51                   Gate sill level (m)
204.12                   Top position of gate (m)
2                        90 degrees across flow direction (not used for
 gate)

2                        # of logical operands
1 1 BC4PV1 > 204.18     dry weather water level at gate
2 1 BA00102 > 198.90     dry weather water level downstream (m)

3                        # of logical statements
1 0 0 0 A                Use function A
2 0 0 0 B                Use function B
0 0 0 0 C                Use function C

3                        # of functions
A 1 BC4PV1  4           Function name; water level in a node; node w/ w
ater level; # of values
203.50  204.12           100% open; level at the above node; gate level
204.15  204.12
204.20  203.82           50% open
220.00  203.51           fully closed


B 1 BA00102  4           Function name; water level in a node; node w/
water level; # of values
195.75  204.12           100% open; level at the above node; gate level

197.50  204.12
198.70  203.82           50% open
220.00  203.51           fully closed


C 1 BC4 2                Function name; water level in a node; node w/
water level; # of values
203.60  204.12           100% open; level at the above node; gate level
220.00  204.12

1                        1 for storm gate weir
BC4FD                    storm gate modelled as weir
BC4                      From node
```

```
BC4FD                    To node
1                        1 for controllable weir
0.00254                  MAX upward (closing) speed (m/s)
0.00254                  MAX downward (opening) speed (m/s)
1.52                     width of gate (m)
204.58                   sill level of storm gate (m)
205.50                   Top position of storm gate (m)
2                        90 degrees across flow direction

1                        # of logical operands
1 1 BC4 > 205.27

2                        # of logical statements
1 0 0 0 A                gate will open
0 0 0 0 B                gate will close

2                        # of functions
A 1 BC4  4               Function name; water level in a node; node w/
water level; # of values
204.10  205.50           100% closed; level at the above node (where th
e sensor is); gate level
205.20  205.50           100% closed
205.35  205.04           50% down; level at the above node (where the s
ensor is); gate level
215.00  204.58           fully down and open


B 1 BC4  4
204.10  205.50           100% closed; level at the above node (where th
e sensor is); gate level
205.20  205.50           100% closed
205.27  205.50           100% closed
205.28  205.00           start to lower and open

0                        0 for gate (gate basics)
BC5PV                    Gate ID
BC5                      From node
BC5PV                    To node
1                        1 for controllable gate
0.00254                  MAX opening speed (m/s)
0.00254                  MAX closing speed (m/s)
0.610                    Gate width (m)
174.14                   Gate sill level (m)
174.75                   Top position of gate (m)
2                        90 degrees across flow direction (not used for
 gate)

2                        # of logical operands
```

```
1 1 JRPS > 174.28           dry weather water level at gate
2 1 BA00070 > 196.90        dry weather water level downstream (m)

3                           # of logical statements
1 0 0 0 A                   Use function A
2 0 0 0 B                   Use function B
0 0 0 0 C                   Use function C

3                           # of functions
A 1 JRPS  4                 Function name; water level in a node; node w/
water level; # of values
172.10  174.75              100% open; level at the above node; gate level
174.25  174.75
174.35  174.75              50% open (modified; initial value 174.45 6/20/
2001)
200.00  174.75              fully closed (modified; initial value 174.14 6
/20)

B 1 BA00070  4              Function name; water level in a node; node w/
water level; # of values
194.90  174.75              100% open; level at the above node; gate level

196.80  174.75
197.10  174.75              50% open (modified; initial value 174.45 6/20/
2001)
220.00  174.75              fully closed (modified; initial value 174.14 6
/20)

C 1 BC5 2                   Function name; water level in a node; node w/
water level; # of values
174.05  174.75              100% open; level at the above node; gate level
220.00  174.75

1                           1 for storm gate weir
BC5SG                       storm gate modelled as weir
BC5                         From node
BC5SG                       To node
1                           1 for controllable weir
0.00254                     MAX upward (closing) speed (m/s)
0.00254                     MAX downward (opening) speed (m/s)
1.83                        width of gate (m)
176.08                      sill level of storm gate (m)
177.30                      Top position of storm gate (m)
2                           90 degrees across flow direction

1                           # of logical operands
1 1 BC5 > 178.08
```

```
2                         # of logical statements
1 0 0 0 A                 gate will open
0 0 0 0 B                 gate will close

2                         # of functions
A 1 BC5  4                Function name; water level in a node; node w/
water level; # of values
174.00  177.30            100% closed; level at the above node (where th
e sensor is); gate level
178.00  177.30            100% closed
178.15  176.69            50% down; level at the above node (where the s
ensor is); gate level
210.00  176.08            fully down and open


B 1 BC5  6
174.00  177.30            100% closed; level at the above node (where th
e sensor is); gate level
175.90  177.30            100% closed
176.05  177.30
178.05  177.30            100% closed
178.10  177.20            start to lower and open
210.00  176.08            fully down and open

1                         1 for weir (gate basics)
BC6FD                     Gate ID
BC6                       From node
BC6FD                     To node
1                         1 for controllable gate
0.00254                   MAX opening speed (m/s)
0.00254                   MAX closing speed (m/s)
1.43                      Gate width (m)
202.38                    Gate sill level (m)
203.93                    Top position of gate (m)
2                         90 degrees across flow direction (not used for
 gate)

1                         # of logical operands
1 1  BA00070 > 197.82     dry weather water level downstream (m)


2                         # of logical statements
1 0 0 0 A                 Use function A
0 0 0 0 B                 Use function B


2                         # of functions
A 1 BA00070  4            Function name; water level in a node; node w/
```

```
water level; # of values
194.90  202.38          100% close; level at the above node; gate leve
l
197.75  202.38
197.90  203.16          50% open
220.00  203.93          fully open


B 1 BC6 2               Function name; water level in a node; node w/
water level; # of values
202.05  202.38          100% open; level at the above node; gate level
220.00  202.38

0                       0 for gate (gate basics)
BC7KG                   Gate ID
BC7                     From node
BC7KG                   To node
1                       1 for controllable gate
0.00254                 MAX opening speed (m/s)
0.00254                 MAX closing speed (m/s)
0.58                    Gate width (m)
204.34                  Gate sill level (m)
205.25                  Top position of gate (m)
2                       90 degrees across flow direction (not used for
 gate)

1                       # of logical operands
1 1 BA00138 > 203.47    dry weather water level downstream (m)


2                       # of logical statements
1 0 0 0 A               Use function A
0 0 0 0 B               Use function B

2                       # of functions
A 1 BA00138  4          Function name; water level in a node; node w/
water level; # of values
202.00  205.25          100% open; level at the above node; gate level
203.40  205.25          intermediate
203.55  204.34          intermediate
220.00  204.34          fully closed

B 1 BA00138 2           Function name; water level in a node; node w/
water level; # of values
202.00  205.25          100% open; level at the above node; gate level
220.00  205.25

1                       1 for storm gate weir
```

```
16              Number of PID regulations (baseline)

0               PID type (0 is for gates)
SO8KG           Gate ID
1               Set point type (1 is for water level)
SAB0165         Location where set point is measured
300.0           Integration time, Ti (seconds)
0.0             Derivation time, Td (seconds); set to zero
0.1             Proportionality factor, K
1.0             Weight factor for time level n
0.7             Weight factor for time level n-1
1.0             Weight factor for time level n-2
241.57          Initial value of the bottom lip of the gate (WCL)
0               Control type (0 for non-controllable)

235.15

1               PID type (1 is for weir)
SO8FD           Fabridam ID
1               Set point type (1 is for water level)
SO8             Location where set point is measured
300.0           Integration time, Ti (seconds)
0.0             Derivation time, Td (seconds); set to zero
1.0             Proportionality factor, K
1.0             Weight factor for time level n
0.7             Weight factor for time level n-1
1.0             Weight factor for time level n-2
243.26          Initial value of weir crest setting (WCL)
0               Control type (0 for non-controllable)

242.55

0               PID type (0 is for gates)
SO3KG           Gate ID
1               Set point type (1 is for water level)
SAB4042         Location where set point is measured
300.0           Integration time, Ti (seconds)
0.0             Derivation time, Td (seconds); set to zero
0.1             Proportionality factor, K
1.0             Weight factor for time level n
0.7             Weight factor for time level n-1
1.0             Weight factor for time level n-2
234.9094        Initial value of the bottom lip of the gate (WCL)
0               Control type (0 for non-controllable)

234.85

1               PID type (1 is for weir)
```

```
SO3FD               Fabridam ID
1                   Set point type (1 is for water level)
SO3                 Location where set point is measured
300.0               Integration time, Ti (seconds)
0.0                 Derivation time, Td (seconds); set to zero
1.0                 Proportionality factor, K
1.0                 Weight factor for time level n
0.7                 Weight factor for time level n-1
1.0                 Weight factor for time level n-2
235.165              Initial value of weir crest setting (WCL)
0                   Control type (0 for non-controllable)

235.94

0                   PID type (0 is for gates)
SO6KG               Gate ID
1                   Set point type (1 is for water level)
SAB0165             Location where set point is measured
300.0               Integration time, Ti (seconds)
0.0                 Derivation time, Td (seconds); set to zero
0.1                 Proportionality factor, K
1.0                 Weight factor for time level n
0.7                 Weight factor for time level n-1
1.0                 Weight factor for time level n-2
235.135             Initial value of the bottom lip of the gate (WCL)
0                   Control type (0 for non-controllable)

235.09

1                   PID type (1 is for weir)
SO6FD               Fabridam ID
1                   Set point type (1 is for water level)
SO6                 Location where set point is measured
300.0               Integration time, Ti (seconds)
0.0                 Derivation time, Td (seconds); set to zero
1.0                 Proportionality factor, K
1.0                 Weight factor for time level n
0.7                 Weight factor for time level n-1
1.0                 Weight factor for time level n-2
235.8268            Initial value of weir crest setting (WCL)
0                   Control type (0 for non-controllable)

235.522

0                   PID type (0 is for gates)
SO4KG               Gate ID
1                   Set point type (1 is for water level)
SAB0165             Location where set point is measured
```

```
300.0               Integration time, Ti (seconds)
0.0                 Derivation time, Td (seconds); set to zero
0.1                 Proportionality factor, K
1.0                 Weight factor for time level n
0.7                 Weight factor for time level n-1
1.0                 Weight factor for time level n-2
238.06              Initial value of the bottom lip of the gate (WCL)
0                   Control type (0 for non-controllable)

235.2751

1                   PID type (1 is for weir)
SO4FD               Fabridam ID
1                   Set point type (1 is for water level)
SO4                 Location where set point is measured
300.0               Integration time, Ti (seconds)
0.0                 Derivation time, Td (seconds); set to zero
1.0                 Proportionality factor, K
1.0                 Weight factor for time level n
0.7                 Weight factor for time level n-1
1.0                 Weight factor for time level n-2
238.59              Initial value of weir crest setting (WCL)
0                   Control type (0 for non-controllable)

238.899
0                   PID type (0 is for gates)
SO7KG               Gate ID
1                   Set point type (1 is for water level)
SAB0165             Location where set point is measured
300.0               Integration time, Ti (seconds)
0.0                 Derivation time, Td (seconds); set to zero
0.1                 Proportionality factor, K
1.0                 Weight factor for time level n
0.7                 Weight factor for time level n-1
1.0                 Weight factor for time level n-2
235.55              Initial value of the bottom lip of the gate (WCL)
0                   Control type (0 for non-controllable)

235.09

1                   PID type (1 is for weir)
SO7FD               Fabridam ID
1                   Set point type (1 is for water level)
SO7                 Location where set point is measured
300.0               Integration time, Ti (seconds)
0.0                 Derivation time, Td (seconds); set to zero
1.0                 Proportionality factor, K
1.0                 Weight factor for time level n
```

```
0.7                Weight factor for time level n-1
1.0                Weight factor for time level n-2
236.1621           Initial value of weir crest setting (WCL)
0                  Control type (0 for non-controllable)

236.71

0                  PID type (0 is for gates)
SO5_KG             Gate ID
1                  Set point type (1 is for water level)
SAA0107            Location where set point is measured
300.0              Integration time, Ti (seconds)
0.0                Derivation time, Td (seconds); set to zero
0.1                Proportionality factor, K
1.0                Weight factor for time level n
0.7                Weight factor for time level n-1
1.0                Weight factor for time level n-2
204.3847           Initial value of the bottom lip of the gate (WCL)
0                  Control type (0 for non-controllable)

204.4172

1                  PID type (1 is for weir)
SO5_SG             Storm Gate ID
1                  Set point type (1 is for water level)
SO5                Location where set point is measured
300.0              Integration time, Ti (seconds)
0.0                Derivation time, Td (seconds); set to zero
1.0                Proportionality factor, K
1.0                Weight factor for time level n
0.7                Weight factor for time level n-1
1.0                Weight factor for time level n-2
205.807            Initial value of weir crest setting (WCL)
0                  Control type (0 for non-controllable)

205.807

0                  PID type (0 is for gates)
SO1_KG             Gate ID
1                  Set point type (1 is for water level)
SBG0160            Location where set point is measured
300.0              Integration time, Ti (seconds)
0.0                Derivation time, Td (seconds); set to zero
0.1                Proportionality factor, K
1.0                Weight factor for time level n
0.7                Weight factor for time level n-1
1.0                Weight factor for time level n-2
229.88             Initial value of the bottom lip of the gate (WCL)
```

```
0               Control type (1 for controllable)

229.87          Set point

0               PID type (0 is for gates)
SO1_SG          Gate ID
1               Set point type (1 is for water level)
SO1             Location where set point is measured
300.0           Integration time, Ti (seconds)
0.0             Derivation time, Td (seconds); set to zero
0.1             Proportionality factor, K
1.0             Weight factor for time level n
0.7             Weight factor for time level n-1
1.0             Weight factor for time level n-2
230.94          Initial value of the bottom lip of the gate (WCL)
0               Control type (1 for controllable)

230.68          Set point

0               PID type (0 is for gates)
SO2_PV          Gate ID
1               Set point type (1 is for water level)
SAR0010         Location where set point is measured
300.0           Integration time, Ti (seconds)
0.0             Derivation time, Td (seconds); set to zero
0.1             Proportionality factor, K
1.0             Weight factor for time level n
0.7             Weight factor for time level n-1
1.0             Weight factor for time level n-2
190.68          Initial value of the bottom lip of the gate (WCL)
0               Control type (1 for controllable)

190.10          Set point

0               PID type (0 is for gates)
SO2_SG          Gate ID
1               Set point type (1 is for water level)
SO2             Location where set point is measured
300.0           Integration time, Ti (seconds)
0.0             Derivation time, Td (seconds); set to zero
-0.1            Proportionality factor, K
1.0             Weight factor for time level n
0.7             Weight factor for time level n-1
1.0             Weight factor for time level n-2
190.10          Initial value of the bottom lip of the gate (WCL)
0               Control type (1 for controllable)

198.00          Set point
```

```
16                         Total # of controllable structures and pumps (baseline)
16                         # of controllable structures (gate)
0                          # of controllable pumps
0                          # of structures discharging out of the system
0                          # of pumps discharging out of the system

0                          0 for gate (gate basics)
SO8KG                      Gate ID
SO8                        From node
SO8KG                      To node
1                          1 for controllable gate
0.00254                    MAX opening speed (m/s)
0.00254                    MAX closing speed (m/s)
0.610                      Gate width (m)
240.96                     Gate sill level (m)
241.57                     Top position of gate (m)
1                          0 degrees (not used for gate)

1                          # of logical operands
1 1 SAB0165 > 235.15       dry weather water level downstream(m)

1                          # of logical statements
0 0 0 0 A                  Use function A

1                          # of functions
A 1 SAB0165  3             Function name; water level in a node; node w/ water level; # of values
234.18  241.57             100% open; level at the above node (where the sensor is); gate level
235.15  241.33             50% open
238.00  240.96             fully closed

1                          1 for weir
SO8FD                      Fabridam modelled as weir
SO8                        From node
SO8FD                      To node
1                          1 for controllable weir
0.00254                    MAX upward (closing) speed (m/s)
0.00254                    MAX downward (opening) speed (m/s)
1.7                        width of fabric dam (m)
241.55                     sill level of fabridam (m)
243.26                     Top position of fabridam (m)
2                          90 degrees across flow direction

1                          # of logical operands
1 1 SO8 > 242.55

1                          # of logical statements
0 0 0 0 A                  fully inflate if water level at SO8 < 242.55

1                          # of functions
A 1 SO8  5                 Function name; water level in a node; node w/ water level; # of values
241.00  243.26             100% inflated; level at the above node (where the sensor is); gate level
242.55  243.26             100% inflated
243.00  242.35             50% inflated; level at the above node (where the sensor is); gate level
243.40  241.55             fully deflated
300.00  241.55

0                          0 for gate (gate basics) SO3 INVERT 769.37ft (234.5m)
SO3KG                      Gate ID                  SO3KG INVERT 769.36 (234.5m)
SO3                        From node
SO3KG                      To node
1                          1 for controllable gate
0.00254                    MAX opening speed (m/s)
0.00254                    MAX closing speed (m/s)
0.4054                     Gate width (m)
234.504                    Gate sill level (m)
234.9094                   Top position of gate (m)
1                          0 degrees (not used for gate)

1                          # of logical operands
1 1 SAB4042 > 234.85       dry weather water level downstream(m)

1                          # of logical statements
0 0 0 0 A                  Use function A

1                          # of functions
A 1 SAB4042  3             Function name; water level in a node; node w/ water level; # of values
234.5    234.9094          100% open; level at the above node (where the sensor is); gate level
234.7    234.3013          50% open
239.585  234.504           fully closed

1                          1 for weir
SO3FD                      Fabridam modelled as weir
SO3                        From node
SO3FD                      To node
1                          1 for controllable weir
```

```
0.00254                  MAX upward (closing) speed (m/s)
0.00254                  MAX downward (opening) speed (m/s)
1.83                     width of fabric dam (m)
234.85                   sill level of fabridam (m)
236.22                   Top position of fabridam (m)
2                        90 degrees across flow direction

1                        # of logical operands
1 1 SO3 > 235.94

1                        # of logical statements
0 0 0 0 A                fully inflate if water level at SO3 < 234.5
1                        # of functions
A 1 SO3  5               Function name; water level in a node; node w/ water level; # of values
234.5   236.22           100% inflated; level at the above node (where the sensor is); gate level
235.15  236.22           100% inflated
236.00  235.05           50% inflated; level at the above node (where the sensor is); gate level
236.22  234.85           fully deflated
240.00  234.85

0                        0 for gate (gate basics)
SO6KG                    Gate ID
SO6                      From node
SO6KG                    To node
1                        1 for controllable gate
0.015                    MAX opening speed (m/s)
0.0015                   MAX closing speed (m/s)
0.4572                   Gate width (m)
234.68                   Gate sill level (m)
235.135                  Top position of gate (m)
1                        0 degrees (not used for gate)

1                        # of logical operands
1 1 SAB0165 > 235.09     dry weather water level downstream(m)

1                        # of logical statements
0 0 0 0 A                Use function A

1                        # of functions
A 1 SAB0165  3           Function name; water level in a node; node w/ water level; # of values
234.18  235.135          100% open; level at the above node (where the sensor is); gate level
235.15  234.90           50% open
238.00  234.68           fully closed

1                        1 for weir
SO6FD                    Fabridam modelled as weir
SO6                      From node
SO6FD                    To node
1                        1 for controllable weir
0.0025                   MAX upward (closing) speed (m/s)
0.0025                   MAX downward (opening) speed (m/s)
1.2192                   width of fabric dam (m)
234.730                  sill level of fabridam (m)
235.8268                 Top position of fabridam (m)
2                        90 degrees across flow direction

1                        # of logical operands
1 1 SO6 > 235.522
1                        # of logical statements
0 0 0 0 A                fully inflat if water level at SO6 < 235.86

1                        # of functions
A 1 SO6  5               Function name; water level in a node; node w/ water level; # of values
234.68   235.827         100% inflated; level at the above node (where the sensor is); gate level
235.00   235.827         100% inflated
235.95   235.20          50% inflated; level at the above node (where the sensor is); gate level
235.9762 234.73          fully deflated
300.00   234.73

0                        0 for gate (gate basics)
SO4KG                    Gate ID
SO4                      From node
SO4KG                    To node
1                        1 for controllable gate
0.015                    MAX opening speed (m/s)
0.0015                   MAX closing speed (m/s)
0.410                    Gate width (m)
237.65                   Gate sill level (m)
238.06                   Top position of gate (m)
1                        0 degrees (not used for gate)

1                        # of logical operands
1 1 SAB0165 > 235.2751   dry weather water level downstream(m)

1                        # of logical statements
```

```
0 0 0 0 A                  Use function A

1                          # of functions
A 1 SAB0165  3             Function name; water level in a node; node w/ water level; # of values
234.18  238.06             100% open; level at the above node (where the sensor is); gate level
235.15  237.80             50% open
238.00  237.65             fully closed

1                          1 for weir
SO4FD                      Fabridam modelled as weir
SO4                        From node
SO4FD                      To node
1                          1 for controllable weir
0.00254                    MAX upward (closing) speed (m/s)
0.00254                    MAX downward (opening) speed (m/s)
1.7                        width of fabric dam (m)
237.9574                   sill level of fabridam (m)
238.80                     Top position of fabridam (m)
2                          90 degrees across flow direction

1                          # of logical operands
1 1 SO4 > 238.899

1                          # of logical statements
0 0 0 0 A                  fully inflate if water level at SO4 < 238.8992

1                          # of functions
A 1 SO4  5                 Function name; water level in a node; node w/ water level; # of values
237.65  238.80             100% inflated; level at the above node (where the sensor is); gate level
238.57  238.80             100% inflated
238.92  238.20             50% inflated; level at the above node (where the sensor is); gate level
239.0242 237.9574          fully deflated
300.00  237.9574

0                          0 for gate (gate basics)
SO7KG                      Gate ID
SO7                        From node
SO7KG                      To node
1                          1 for controllable gate
0.02                       MAX opening speed (m/s)
0.002                      MAX closing speed (m/s)
0.610                      Gate width (m)
234.94                     Gate sill level (m)
235.55                     Top position of gate (m)
1                          0 degrees (not used for gate)

1                          # of logical operands
1 1 SAB0165 > 235.09       dry weather water level downstream(m)

1                          # of logical statements
0 0 0 0 A                  Use function A

1                          # of functions
A 1 SAB0165  3             Function name; water level in a node; node w/ water level; # of values
234.18  235.55             100% open; level at the above node (where the sensor is); gate level
235.15  235.27             50% open
238.00  234.94             fully closed

1                          1 for weir
SO7FD                      Fabridam modelled as weir
SO7                        From node
SO7FD                      To node
1                          1 for controllable weir
0.0025                     MAX upward (closing) speed (m/s)
0.0025                     MAX downward (opening) speed (m/s)
1.6002                     width of fabric dam (m)
235.2477                   sill level of fabridam (m)
237.69                     Top position of fabridam (m)
2                          90 degrees across flow direction

1                          # of logical operands
1 1 SO7 > 236.71

1                          # of logical statements
0 0 0 0 A                  fully inflate if water level at SO7 < 236.7

1                          # of functions
A 1 SO7  5                 Function name; water level in a node; node w/ water level; # of values
234.94  237.69             100% inflated; level at the above node (where the sensor is); gate level
236.40  237.69             100% inflated
236.45  236.70             50% inflated; level at the above node (where the sensor is); gate level
236.53  235.2477           fully deflated
300.00  235.2477

0                          0 for gate (gate basics)
```

```
SO5_KG                    Gate ID
SO5                       From node
SO5_KG                    To node
1                         1 for controllable gate
0.0135                    MAX opening speed (m/s)
0.00135                   MAX closing speed (m/s)
0.4054                    Gate width (m)
203.978                   Gate sill level (m)
204.3847                  Top position of gate (m)
1                         0 degrees (not used for gate)

1                         # of logical operands
1 1 SAA0107 > 204.4172    dry weather water level downstream(m)

1                         # of logical statements
0 0 0 0 A                 Use function A

1                         # of functions
A 1 SAA0107  3            Function name; water level in a node; node w/ water level; # of values
203.899 204.3847          100% open; level at the above node (where the sensor is); gate level
204.00  204.10            50% open
207.00  203.9783          fully closed

1                         1 for weir
SO5_SG                    Storm Gate modelled as weir
SO5                       From node
SO5_SG                    To node
1                         1 for controllable weir
0.004                     MAX upward (closing) speed (m/s)
0.004                     MAX downward (opening) speed (m/s)
1.9812                    width of fabric dam (m)
204.2831                  sill level of storm gate (m)
205.807                   Top position of storm gate (m)
2                         90 degrees across flow direction

1                         # of logical operands
1 1 SO5 > 205.807

1                         # of logical statements
0 0 0 0 A                 fully inflate if water level at SO5 < 205.0

1                         # of functions
A 1 SO5  5                Function name; water level in a node; node w/ water level; # of values
203.9783 205.807          100% inflated; level at the above node (where the sensor is); gate level
205.00   205.807          100% inflated
205.50   204.50           50% inflated; level at the above node (where the sensor is); gate level
205.5023 204.2831         fully deflated
300.00   204.2831

0                         0 for gate (gate basics)
SO1_KG                    Gate ID
SO1                       From node
SO1_KG                    To node
1                         1 for controllable gate
0.0051                    MAX opening speed (m/s) based on 2 minutes
0.0051                    MAX closing speed (m/s) based on 2 minutes
0.610                     Gate width (m)
229.27                    Gate sill level (m)
229.88                    Top position of gate (m)
2                         90 degrees across flow direction (not used for gate)

1                         # of logical operands
1 1 SBG0160 > 229.87      water level at DWO sensor

2                         # of logical statements
1 0 0 0 A                 Use function A
0 0 0 0 B                 Use function B

2                         # of functions
A 1 SBG0160  4            Function name; water level in a node; node w/ water level; # of values
229.20  229.88            100% open: slightly below invert of DWO sensor node; gate level at 100% open
229.85  229.88            100% open--right before it starts to close: slightly below set point; gate level at 100% open
229.95  229.58            valve is starting to close, about 50% level:slightly above set point;gate level about 50% open
240.00  229.27            water level above manhole rim; valve is fully closed

B 1 SBG0160 3             Function name; water level in a node; node w/ water level; # of values
229.20  229.88            100% open; slightly below invert of DWO sensor node; gate level at 100% open
230.00  229.88
240.00  229.88

1                         1 for storm gate weir
SO1_SG                    storm gate modeled as weir
SO1                       From node
SO1_SG                    To node
1                         1 for controllable weir
```

```
0.00443                    MAX upward (closing) speed (m/s) based on 5 min
0.04433                    MAX downward (opening) speed (m/s) based on 30 sec
1.83                       width of gate (m)
229.61                     sill level of storm gate (m)
230.94                     Top position of storm gate (m)
2                          90 degrees across flow direction

1                          # of logical operands
1 1 SO1 > 230.68           water level at SWO sensor, used for logical statements/functions

2                          # of logical statements
1 0 0 0 A                  gate will open if water level at SO1 > 230.68
0 0 0 0 B                  gate will close if water level at SO1 < 230.68

2                          # of functions
A 1 SO1  5                 Function name; water level in a node; node w/ water level; # of values
229.20  230.94             100% closed: slightly below invert of SWO sensor node; gate level at 100% closed
230.65  230.94             100% closed--right before it starts to open:slightly below set point; gate level at 100% closed
230.72  230.28             gate is starting to open, about 50% level: slightly above set point; gate level about 50% open
230.83  229.61             fully down and open
240.00  229.61             water level above manhole rim; gate is fully open

B 1 SO1  2
229.20  230.94             100% closed; slightly below invert of SWO sensor node; gate level at 100% closed
230.69  230.94             100% closed

0                          0 for gate (gate basics)
SO2_PV                     Gate ID
SO2                        From node
SO2_PV                     To node
1                          1 for controllable gate
0.020                      MAX opening speed (m/s) based on 30 sec
0.002                      MAX closing speed (m/s) based on 5 min
0.610                      Gate width (m)
190.07                     Gate sill level (m)
190.68                     Top position of gate (m)
2                          90 degrees across flow direction (not used for gate)

1                          # of logical operands
1 1 SAR0010 > 190.10       water level at DWO sensor

2                          # of logical statements
1 0 0 0 A                  Use function A
0 0 0 0 B                  Use function B

2                          # of functions
A 1 SAR0010  4             Function name; water level in a node; node w/ water level; # of values
188.50  190.68             100% open: slightly below invert of DWO sensor node; gate level at 100% open
190.08  190.68             100% open--right before it starts to close: slightly below set point;  gate level at 100% open
190.15  190.38             valve is starting to close, about 50% level: slightly above set point; gate level about 50% open
210.00  190.07             water level above manhole rim; valve is fully closed

B 1 SAR0010 3              Function name; water level in a node; node w/ water level; # of values
188.50  190.68             100% open; slightly below invert of DWO sensor node; gate level at 100% open
190.00  190.68
200.00  190.68

0                          0 for sluice gate (gate basics)
SO2_SG                     Gate ID
SO2                        From node
SO2_SG                     To node
1                          1 for controllable gate
0.061                      MAX opening speed (m/s) based on 0.5 minutes
0.0061                     MAX closing speed (m/s) based on 5 minutes
1.83                       width of gate (m)
190.10                     Sill level of sluice gate (m)
191.93                     Top position of sluice gate (m)
2                          90 degrees across flow direction

1                          # of logical operands
1 1 SO2 < 198.00           water level at SWO sensor, used for logical statements/functions

2                          # of logical statements
1 0 0 0 A                  gate will close if water level at SO2 < 198.00
0 0 0 0 B                  gate will open if water level at SO2 > 198.00

2                          # of functions
A 1 SO2  2
190.05  190.10             100% closed; slightly below invert of SWO sensor node; gate level at 100% closed
198.01  190.10             100% closed

B 1 SO2  5                 Function name; water level in a node; node w/ water level; # of values
190.11  190.10             100% closed: slightly below invert of SWO sensor node; gate level at 100% closed
197.95  190.10             100% closed--right before it starts to open: slightly below set point; gate level at 100% closed
198.05  191.02             gate is starting to open, about 50% level: slightly above set point; gate level about 50% open
```

198.20	191.93	gate is fully open
210.00	191.93	water level above manhole rim; gate is fully open

```
16              Number of PID regulations (existing)

0               PID type (0 is for gates)
SO8KG           Gate ID
1               Set point type (1 is for water level)
SAB0165         Location where set point is measured
300.0           Integration time, Ti (seconds)
0.0             Derivation time, Td (seconds); set to zero
0.1             Proportionality factor, K
1.0             Weight factor for time level n
0.7             Weight factor for time level n-1
1.0             Weight factor for time level n-2
241.63          Initial value of the bottom lip of the gate (WCL)
0               Control type (0 for non-controllable)

235.15

1               PID type (1 is for weir)
SO8FD           Fabridam ID
1               Set point type (1 is for water level)
SO8             Location where set point is measured
300.0           Integration time, Ti (seconds)
0.0             Derivation time, Td (seconds); set to zero
1.0             Proportionality factor, K
1.0             Weight factor for time level n
0.7             Weight factor for time level n-1
1.0             Weight factor for time level n-2
243.26          Initial value of weir crest setting (WCL)
0               Control type (0 for non-controllable)

241.55          Fabridam lowered to sill level 04/19/01

0               PID type (0 is for gates)
SO3KG           Gate ID
1               Set point type (1 is for water level)
SAB4042         Location where set point is measured
300.0           Integration time, Ti (seconds)
0.0             Derivation time, Td (seconds); set to zero
0.1             Proportionality factor, K
1.0             Weight factor for time level n
0.7             Weight factor for time level n-1
1.0             Weight factor for time level n-2
234.9094        Initial value of the bottom lip of the gate (WCL)
0               Control type (0 for non-controllable)

234.59

1               PID type (1 is for weir)
```

```
SO3FD             Fabridam ID
1                 Set point type (1 is for water level)
SO3               Location where set point is measured
300.0             Integration time, Ti (seconds)
0.0               Derivation time, Td (seconds); set to zero
1.0               Proportionality factor, K
1.0               Weight factor for time level n
0.7               Weight factor for time level n-1
1.0               Weight factor for time level n-2
235.165            Initial value of weir crest setting (WCL)
0                 Control type (0 for non-controllable)

235.165           CHANGED TO MATCH SENSOR DATA

0                 PID type (0 is for gates)
SO6KG             Gate ID
1                 Set point type (1 is for water level)
SAB0165           Location where set point is measured
300.0             Integration time, Ti (seconds)
0.0               Derivation time, Td (seconds); set to zero
0.1               Proportionality factor, K
1.0               Weight factor for time level n
0.7               Weight factor for time level n-1
1.0               Weight factor for time level n-2
235.135           Initial value of the bottom lip of the gate (WCL)
0                 Control type (0 for non-controllable)

235.09

1                 PID type (1 is for weir)
SO6FD             Fabridam ID
1                 Set point type (1 is for water level)
SO6               Location where set point is measured
300.0             Integration time, Ti (seconds)
0.0               Derivation time, Td (seconds); set to zero
1.0               Proportionality factor, K
1.0               Weight factor for time level n
0.7               Weight factor for time level n-1
1.0               Weight factor for time level n-2
235.8268          Initial value of weir crest setting (WCL)
0                 Control type (0 for non-controllable)

239.301           Set to ground level, doesn't appear to overflow 04/17
/01

0                 PID type (0 is for gates)
SO4KG             Gate ID
1                 Set point type (1 is for water level)
```

SAB0165	Location where set point is measured
300.0	Integration time, Ti (seconds)
0.0	Derivation time, Td (seconds); set to zero
0.1	Proportionality factor, K
1.0	Weight factor for time level n
0.7	Weight factor for time level n-1
1.0	Weight factor for time level n-2
238.06	Initial value of the bottom lip of the gate (WCL)
0	Control type (0 for non-controllable)

235.2751

1	PID type (1 is for weir)
SO4FD	Fabridam ID
1	Set point type (1 is for water level)
SO4	Location where set point is measured
300.0	Integration time, Ti (seconds)
0.0	Derivation time, Td (seconds); set to zero
1.0	Proportionality factor, K
1.0	Weight factor for time level n
0.7	Weight factor for time level n-1
1.0	Weight factor for time level n-2
238.59	Initial value of weir crest setting (WCL)
0	Control type (0 for non-controllable)

238.59

0	PID type (0 is for gates)
SO7KG	Gate ID
1	Set point type (1 is for water level)
SAB0165	Location where set point is measured
300.0	Integration time, Ti (seconds)
0.0	Derivation time, Td (seconds); set to zero
0.1	Proportionality factor, K
1.0	Weight factor for time level n
0.7	Weight factor for time level n-1
1.0	Weight factor for time level n-2
235.55	Initial value of the bottom lip of the gate (WCL)
0	Control type (0 for non-controllable)

235.09

1	PID type (1 is for weir)
SO7FD	Fabridam ID
1	Set point type (1 is for water level)
SO7	Location where set point is measured
300.0	Integration time, Ti (seconds)
0.0	Derivation time, Td (seconds); set to zero

```
1.0          Proportionality factor, K
1.0          Weight factor for time level n
0.7          Weight factor for time level n-1
1.0          Weight factor for time level n-2
236.1621     Initial value of weir crest setting (WCL)
0            Control type (0 for non-controllable)

236.41

0            PID type (0 is for gates)
SO5_KG       Gate ID
1            Set point type (1 is for water level)
SAA0107      Location where set point is measured
300.0        Integration time, Ti (seconds)
0.0          Derivation time, Td (seconds); set to zero
0.1          Proportionality factor, K
1.0          Weight factor for time level n
0.7          Weight factor for time level n-1
1.0          Weight factor for time level n-2
204.3847     Initial value of the bottom lip of the gate (WCL)
0            Control type (0 for non-controllable)

204.4172

1            PID type (1 is for weir)
SO5_SG       Storm Gate ID
1            Set point type (1 is for water level)
SO5          Location where set point is measured
300.0        Integration time, Ti (seconds)
0.0          Derivation time, Td (seconds); set to zero
1.0          Proportionality factor, K
1.0          Weight factor for time level n
0.7          Weight factor for time level n-1
1.0          Weight factor for time level n-2
205.807      Initial value of weir crest setting (WCL)
0            Control type (0 for non-controllable)

205.807

0            PID type (0 is for gates)
SO1_KG       Gate ID
1            Set point type (1 is for water level)
SBG0160      Location where set point is measured
300.0        Integration time, Ti (seconds)
0.0          Derivation time, Td (seconds); set to zero
0.1          Proportionality factor, K
1.0          Weight factor for time level n
0.7          Weight factor for time level n-1
```

```
1.0             Weight factor for time level n-2
229.88          Initial value of the bottom lip of the gate (WCL)
0               Control type (1 for controllable)

229.87          Set point

0               PID type (0 is for gates)
SO1_SG          Gate ID
1               Set point type (1 is for water level)
SO1             Location where set point is measured
300.0           Integration time, Ti (seconds)
0.0             Derivation time, Td (seconds); set to zero
0.1             Proportionality factor, K
1.0             Weight factor for time level n
0.7             Weight factor for time level n-1
1.0             Weight factor for time level n-2
230.94          Initial value of the bottom lip of the gate (WCL)
0               Control type (1 for controllable)

230.68          Set point

0               PID type (0 is for gates)
SO2_PV          Gate ID
1               Set point type (1 is for water level)
SAR0010         Location where set point is measured
300.0           Integration time, Ti (seconds)
0.0             Derivation time, Td (seconds); set to zero
0.1             Proportionality factor, K
1.0             Weight factor for time level n
0.7             Weight factor for time level n-1
1.0             Weight factor for time level n-2
190.68          Initial value of the bottom lip of the gate (WCL)
0               Control type (1 for controllable)

190.10          Set point

0               PID type (0 is for gates)
SO2_SG          Gate ID
1               Set point type (1 is for water level)
SO2             Location where set point is measured
300.0           Integration time, Ti (seconds)
0.0             Derivation time, Td (seconds); set to zero
-0.1            Proportionality factor, K
1.0             Weight factor for time level n
0.7             Weight factor for time level n-1
1.0             Weight factor for time level n-2
190.10          Initial value of the bottom lip of the gate (WCL)
0               Control type (1 for controllable)
```

198.00 Set point

```
16                      Total # of controllable structures and pumps (existing)
16                      # of controllable structures (gate)
0                       # of controllable pumps
0                       # of structures discharging out of the system
0                       # of pumps discharging out of the system

0                       0 for gate (gate basics)
SO8KG                   Gate ID
SO8                     From node
SO8KG                   To node
1                       1 for controllable gate
0.00254                 MAX opening speed (m/s)
0.00254                 MAX closing speed (m/s)
0.610                   Gate width (m)
240.96                  Gate sill level (m)
241.57                  Top position of gate (m)
1                       0 degrees (not used for gate)

1                       # of logical operands
1 1 SAB0165 > 235.15    dry weather water level downstream(m)

1                       # of logical statements
0 0 0 0 A               Use function A

1                       # of functions
A 1 SAB0165  3          Function name; water level in a node; node w/ water level; # of values
234.18  241.57          100% open; level at the above node (where the sensor is); gate level
235.15  241.33          50% open
238.00  240.96          fully closed

1                       1 for weir
SO8FD                   Fabridam modelled as weir
SO8                     From node
SO8FD                   To node
1                       1 for controllable weir
0.00254                 MAX upward (closing) speed (m/s)
0.00508                 MAX downward (opening) speed (m/s) (doubled speed 04/18/01)
1.7                     width of fabric dam (m)
241.55                  sill level of fabridam (m)
243.26                  Top position of fabridam (m)
2                       90 degrees across flow direction

1                       # of logical operands
1 1 SO8 > 241.55

1                       # of logical statements
0 0 0 0 A               fully inflate if water level at SO8 < 241.55  (Fabridam lowered to sill level 04/19/01)

1                       # of functions
A 1 SO8  5              Function name; water level in a node; node w/ water level; # of values
241.00  241.55          100% inflated; level at the above node (where the sensor is); gate level
242.55  241.55          100% inflated
243.00  241.55          50% inflated; level at the above node (where the sensor is); gate level
243.40  241.55          fully deflated
300.00  241.55

0                       0 for gate (gate basics) SO3 INVERT 769.37ft (234.5m)
SO3KG                   Gate ID                  SO3KG INVERT 769.36 (234.5m)
SO3                     From node
SO3KG                   To node
1                       1 for controllable gate
0.00254                 MAX opening speed (m/s)
0.00254                 MAX closing speed (m/s)
0.4054                  Gate width (m)
234.504                 Gate sill level (m)
234.9094                Top position of gate (m)
1                       0 degrees (not used for gate)

1                       # of logical operands
1 1 SAB4042 > 234.59    dry weather water level downstream(m) (changed to match sensor data 04/11/00)

1                       # of logical statements
0 0 0 0 A               Use function A

1                       # of functions
A 1 SAB4042  3          Function name; water level in a node; node w/ water level; # of values
234.5    234.9094       100% open; level at the above node (where the sensor is); gate level
234.7    234.3013       50% open
239.585  234.504        fully closed

1                       1 for weir
SO3FD                   Fabridam modelled as weir
SO3                     From node
SO3FD                   To node
1                       1 for controllable weir
```

```
0.00254                 MAX upward (closing) speed (m/s)
0.00127                 MAX downward (opening) speed (m/s) changed downward speed by one half 4/16/01
1.83                    width of fabric dam (m)
234.85                  sill level of fabridam (m)
236.22                  Top position of fabridam (m)
2                       90 degrees across flow direction

1                       # of logical operands
1 1 SO3 > 235.165       changed to match sensor data 4/10/00

1                       # of logical statements
0 0 0 0 A               fully inflate if water level at SO3 < 234.5
1                       # of functions
A 1 SO3  5              Function name; water level in a node; node w/ water level; # of values
234.5   236.22          100% inflated; level at the above node (where the sensor is); gate level
235.15  236.22          100% inflated
236.00  235.05          50% inflated; level at the above node (where the sensor is); gate level
236.22  234.85          fully deflated
240.00  234.85

0                       0 for gate (gate basics)
SO6KG                   Gate ID
SO6                     From node
SO6KG                   To node
1                       1 for controllable gate
0.015                   MAX opening speed (m/s)
0.0015                  MAX closing speed (m/s)
0.4572                  Gate width (m)
234.68                  Gate sill level (m)
235.135                 Top position of gate (m)
1                       0 degrees (not used for gate)

1                       # of logical operands
1 1 SAB0165 > 235.09    dry weather water level downstream(m)

1                       # of logical statements
0 0 0 0 A               Use function A

1                       # of functions
A 1 SAB0165  3          Function name; water level in a node; node w/ water level; # of values
234.18  235.135         100% open; level at the above node (where the sensor is); gate level
235.15  234.90          50% open
238.00  234.68          fully closed

1                       1 for weir
SO6FD                   Fabridam modelled as weir
SO6                     From node
SO6FD                   To node
1                       1 for controllable weir
0.0025                  MAX upward (closing) speed (m/s)
0.0025                  MAX downward (opening) speed (m/s)
1.2192                  width of fabric dam (m)
234.730                 sill level of fabridam (m)
235.8268                Top position of fabridam (m)
2                       90 degrees across flow direction

1                       # of logical operands
1 1 SO6 > 235.86

1                       # of logical statements
0 0 0 0 A               fully inflat if water level at SO6 < 235.86

1                       # of functions (set to ground level 04/18/01)
A 1 SO6  5              Function name; water level in a node; node w/ water level; # of values
234.68    239.301       100% inflated; level at the above node (where the sensor is); gate level
235.00    239.301       100% inflated
235.95    239.301       50% inflated; level at the above node (where the sensor is); gate level
235.9762 239.301        fully deflated
300.00    239.301

0                       0 for gate (gate basics)
SO4KG                   Gate ID
SO4                     From node
SO4KG                   To node
1                       1 for controllable gate
0.015                   MAX opening speed (m/s)
0.0015                  MAX closing speed (m/s)
0.410                   Gate width (m)
237.65                  Gate sill level (m)
238.06                  Top position of gate (m)
1                       0 degrees (not used for gate)

1                       # of logical operands
1 1 SAB0165 > 235.2751  dry weather water level downstream(m)
```

```
1                           # of logical statements
0 0 0 0 A                   Use function A

1                           # of functions
A 1 SAB0165  3              Function name; water level in a node; node w/ water level; # of values
234.18  238.06              100% open; level at the above node (where the sensor is); gate level
235.15  237.80              50% open
238.00  237.65              fully closed

1                           1 for weir
SO4FD                       Fabridam modelled as weir
SO4                         From node
SO4FD                       To node
1                           1 for controllable weir
0.00254                     MAX upward (closing) speed (m/s)
0.00254                     MAX downward (opening) speed (m/s)
1.7                         width of fabric dam (m)
237.9574                    sill level of fabridam (m)
238.80                      Top position of fabridam (m)
2                           90 degrees across flow direction

1                           # of logical operands
1 1 SO4 > 238.594           changed to match sensor data 4/10/01

1                           # of logical statements
0 0 0 0 A                   fully inflate if water level at SO4 < 238.8992

1                           # of functions
A 1 SO4  5                  Function name; water level in a node; node w/ water level; # of values
237.65  238.594             100% inflated; level at the above node (where the sensor is); gate level
238.57  238.594             100% inflated
238.92  238.20              50% inflated; level at the above node (where the sensor is); gate level
239.0242 237.9574           fully deflated
300.00  237.9574

0                           0 for gate (gate basics)
SO7KG                       Gate ID
SO7                         From node
SO7KG                       To node
1                           1 for controllable gate
0.02                        MAX opening speed (m/s)
0.002                       MAX closing speed (m/s)
0.610                       Gate width (m)
234.94                      Gate sill level (m)
235.55                      Top position of gate (m)
1                           0 degrees (not used for gate)

1                           # of logical operands
1 1 SAB0165 > 235.09        dry weather water level downstream(m)

1                           # of logical statements
0 0 0 0 A                   Use function A

1                           # of functions
A 1 SAB0165  3              Function name; water level in a node; node w/ water level; # of values
234.18  235.55              100% open; level at the above node (where the sensor is); gate level
235.15  235.27              50% open
238.00  234.94              fully closed

1                           1 for weir
SO7FD                       Fabridam modelled as weir
SO7                         From node
SO7FD                       To node
1                           1 for controllable weir
0.0025                      MAX upward (closing) speed (m/s)
0.0025                      MAX downward (opening) speed (m/s)
1.6002                      width of fabric dam (m)
235.2477                    sill level of fabridam (m)
237.69                      Top position of fabridam (m)
2                           90 degrees across flow direction

1                           # of logical operands
1 1 SO7 > 236.41

1                           # of logical statements
0 0 0 0 A                   fully inflate if water level at SO7 < 236.4

1                           # of functions
A 1 SO7  5                  Function name; water level in a node; node w/ water level; # of values
234.94  237.69              100% inflated; level at the above node (where the sensor is); gate level
236.40  237.69              100% inflated
236.45  236.40              50% inflated; level at the above node (where the sensor is); gate level
236.53  235.2477            fully deflated
300.00  235.2477
```

```
0                      0 for gate (gate basics)
SO5_KG                 Gate ID
SO5                    From node
SO5_KG                 To node
1                      1 for controllable gate
0.0135                 MAX opening speed (m/s)
0.00135                MAX closing speed (m/s)
0.4054                 Gate width (m)
203.978                Gate sill level (m)
204.3847               Top position of gate (m)
1                      0 degrees (not used for gate)

1                      # of logical operands
1 1 SAA0107 > 204.4172 dry weather water level downstream(m)

1                      # of logical statements
0 0 0 0 A              Use function A

1                      # of functions
A 1 SAA0107  3         Function name; water level in a node; node w/ water level; # of values
203.899 204.3847       100% open; level at the above node (where the sensor is); gate level
204.00  204.10         50% open
207.00  203.9783       fully closed

1                      1 for weir
SO5_SG                 Storm Gate modelled as weir
SO5                    From node
SO5_SG                 To node
1                      1 for controllable weir
0.004                  MAX upward (closing) speed (m/s)
0.004                  MAX downward (opening) speed (m/s)
1.9812                 width of fabric dam (m)
204.2831               sill level of storm gate (m)
205.807                Top position of storm gate (m)
2                      90 degrees across flow direction

1                      # of logical operands
1 1 SO5 > 205.807

1                      # of logical statements
0 0 0 0 A              fully inflate if water level at SO5 < 205.0

1                      # of functions
A 1 SO5  5             Function name; water level in a node; node w/ water level; # of values
203.9783 205.807       100% inflated; level at the above node (where the sensor is); gate level
205.00   205.807       100% inflated
205.50   204.50        50% inflated; level at the above node (where the sensor is); gate level
205.5023 204.2831      fully deflated
300.00   204.2831

0                      0 for gate (gate basics)
SO1_KG                 Gate ID
SO1                    From node
SO1_KG                 To node
1                      1 for controllable gate
0.122                  MAX opening speed (m/s) based on 5 sec
0.610                  MAX closing speed (m/s) based on 1 sec
0.610                  Gate width (m)
229.27                 Gate sill level (m)
229.88                 Top position of gate (m)
2                      90 degrees across flow direction (not used for gate)

1                      # of logical operands
1 1 SBG0160 > 229.87   water level at DWO sensor

2                      # of logical statements
1 0 0 0 A              Use function A
0 0 0 0 B              Use function B

2                      # of functions
A 1 SBG0160  4         Function name; water level in a node; node w/ water level; # of values
229.20  229.88         100% open: slightly below invert of DWO sensor node; gate level at 100% open
229.85  229.88         100% open--right before it starts to close: slightly below set point;  gate level at 100% open
229.95  229.58         valve is starting to close, about 50% level: slightly above set point; gate level about 50% open
240.00  229.27         water level above manhole rim; valve is fully closed

B 1 SBG0160 3          Function name; water level in a node; node w/ water level; # of values
229.20  229.88         100% open; slightly below invert of DWO sensor node; gate level at 100% open
230.00  229.88
240.00  229.88

1                      1 for storm gate weir
SO1_SG                 storm gate modeled as weir
SO1                    From node
SO1_SG                 To node
```

```
1                         1 for controllable weir
0.44330                   MAX upward (closing) speed (m/s) based on 3 sec
0.44330                   MAX downward (opening) speed (m/s) based on 3 sec
1.83                      width of gate (m)
229.61                    sill level of storm gate (m)
230.94                    Top position of storm gate (m)
2                         90 degrees across flow direction

1                         # of logical operands
1 1 SO1 > 230.68          water level at SWO sensor, used for logical statements/functions

2                         # of logical statements
1 0 0 0 A                 gate will open if water level at SO1 > 230.68
0 0 0 0 B                 gate will close if water level at SO1 < 230.68

2                         # of functions
A 1 SO1  5                Function name; water level in a node; node w/ water level; # of values
229.20  230.94            100% closed: slightly below invert of SWO sensor node; gate level at 100% closed
230.65  230.94            100% closed--right before it starts to open: slightly below set point; gate level at 100% closed
230.72  230.28            gate is starting to open, about 50% level: slightly above set point; gate level about 50% open
230.83  229.61            fully down and open
240.00  229.61            water level above manhole rim; gate is fully open

B 1 SO1  2
229.20  230.94            100% closed; slightly below invert of SWO sensor node; gate level at 100% closed
230.69  230.94            100% closed

0                         0 for gate (gate basics)
SO2_PV                    Gate ID
SO2                       From node
SO2_PV                    To node
1                         1 for controllable gate
0.020                     MAX opening speed (m/s)
0.002                     MAX closing speed (m/s)
0.610                     Gate width (m)
190.07                    Gate sill level (m)
190.68                    Top position of gate (m)
2                         90 degrees across flow direction (not used for gate)

1                         # of logical operands
1 1 SAR0010 > 190.10      water level at DWO sensor

2                         # of logical statements
1 0 0 0 A                 Use function A
0 0 0 0 B                 Use function B

2                         # of functions
A 1 SAR0010  4            Function name; water level in a node; node w/ water level; # of values
188.50  190.68            100% open: slightly below invert of DWO sensor node; gate level at 100% open
190.08  190.68            100% open--right before it starts to close: slightly below set point;  gate level at 100% open
190.15  190.38            valve is starting to close, about 50% level: slightly above set point; gate level about 50% open
210.00  190.07            water level above manhole rim; valve is fully closed

B 1 SAR0010 3             Function name; water level in a node; node w/ water level; # of values
188.50  190.68            100% open; slightly below invert of DWO sensor node; gate level at 100% open
190.00  190.68
200.00  190.68

0                         0 for sluice gate (gate basics)
SO2_SG                    Gate ID
SO2                       From node
SO2_SG                    To node
1                         1 for controllable gate
0.061                     MAX opening speed (m/s) based on 0.5 minutes
0.00254                   MAX closing speed (m/s) based on 0.5 ft/min (rtc sheets say it closes in 5 minutes)
1.83                      width of gate (m)
190.10                    Sill level of sluice gate (m)
191.93                    Top position of sluice gate (m)
2                         90 degrees across flow direction

1                         # of logical operands
1 1 SO2 < 198.00          water level at SWO sensor, used for logical statements/functions

2                         # of logical statements
1 0 0 0 A                 gate will close if water level at SO2 < 198.00
0 0 0 0 B                 gate will open if water level at SO2 > 198.00

2                         # of functions
A 1 SO2  2
190.05  190.10            100% closed; slightly below invert of SWO sensor node; gate level at 100% closed
198.01  190.10            100% closed

B 1 SO2  5                Function name; water level in a node; node w/ water level; # of values
190.11  190.10            100% closed: slightly below invert of SWO sensor node; gate level at 100% closed
197.95  190.10            100% closed--right before it starts to open: slightly below set point; gate level at 100% closed
```

198.05	191.02	gate is starting to open, about 50% level: slightly above set point; gate level about 50% open
198.20	191.93	gate is fully open
210.00	191.93	water level above manhole rim; gate is fully open

APPENDIX C

Kingsbury Area			
NAME	TIGER POPULATION	MODELED POPULATION	MODEL NODE
dr1		3835	SH00020
dr1	4265	3835	SAI1290
S10a	338	770	SAA1030
S10b	133	300	SAA1175
S10c	278	630	SAA1180
S10d	245	560	SAA1235
S10e	656	1490	SAA1325
S10f	600	1370	SAA1400
S10g	179	410	SAA1435
S10h	1227	2800	SAA1087
S10i	419	950	SAA1650
S10j	186	420	SAA1120
S10k	587	1340	SAA1683
S10l	78	180	SAA1610
S11a	202	590	SAB9025
S11b	82	240	SAB9050
S12a	7	20	S12
S14a	471	420	SAB0140
S14b	855	760	SAB0100
S14c	1491	1330	SAB0035
S14d	544	480	SAB0110
S14e	186	170	SAL1005
S18a	6	20	SAA0130
S20a	386	1080	SAL0045
S20a		50	SAL0045
S20Aa	93	270	SAL0102
S20Ab	300	880	SAL7005
S20Ac	57	170	SAL8010
S20Ad	88	260	SAL0132
S20Ae	357	1040	SAL0150
S21a	0	0	S20AB
S28a	739	660	SAB4213
S29a	144	130	SAB4260
S30a	338	2880	SAB4340
S38a	43	40	SAD0015
S3a	2	10	SAP1045
S41a	201	180	SAB7005
S42a	348	310	SAB0225
S43a	98	90	SAB0250
S44a	99	90	S440001
S45a	177	160	S450001
S46a	274	240	S460001
S47a	332	1000	SBD8025
S47b	195	1050	SBD8010
S48a	1296	2090	SBD0305
S48b	786	1270	SBD0330

S48c	729	1180	SBD0350
S48d	823	1330	SBD0380
S49a	696	680	SBD0235
S49b	703	690	SBD0230
S49c	868	850	SBD0265
S49d	438	400	SBD0225
S4a	768	680	SAD0030
S4b	913	810	SAD3015
S50a	222	220	S49C
S52a	183	530	SAP2017
S5a	0	0	SAP1075
S6a	0	0	SAP1105
S7a	252	1240	KAC1010
S80a	72	144	S52D
S81a	11	22	KD01020
S82a	150	300	SD00030
S8a	11	2000	SAK2030
S8b	42	210	SAK2010
S9a	371	840	SAN0120
S9b	0	0	SA00145
S9c	299	682	SAM0015
S9d	542	1225	SA00170
S9e	2538	5775	SAN0055
S9f	0	0	SAN2030
S9g	0	0	SA00157
SN06a	700	920	SAF0055
SN06b	693	910	SAF0020
SN06c	716	940	SAF1015
SN06d	1188	1070	SAH0015
SN06e	839	760	SAG0010
SN06f	791	720	SAG0030
SN100a	1931	3480	SAI1225
SN100b	1118	2010	SAF4040
SN100c	1108	1990	SAF3010
SN100d	1578	2840	SAF4070
SN100e	1063	1910	SAF0090
SN101a	515	930	SAF5025
SN102a	262	470	SAE0050
SN103a	823	730	SAE0015
SO3a	761	680	SAB4180
SO3b	1324	1180	SAB4110
SO3c	158	140	S29D
SO5a	108	310	SAA0145
SO5b	39	110	SAA0170
SO5c	1	0	SAA0210
SO5d	207	600	SAA0115
SO5e	548	1600	SAA0230
SO6a	1070	950	SAB5025
SO8a	1216	2190	KG06010

SO8b	439	790	KG01015
SO8e	997	1790	KG05010
SO8g	600	1080	SAI1230
SOintf	552	1610	SAA0075
SOintg	5	5	SAB9110
	51369	89393	
Burke Brook/ Morgana Run Area			
NAME	TIGER POPULATION	MODELED POPULATION	MODEL NODE
SO1a	237	1050	SBG0175
SO1b	141	630	SBG6015
SO1c	1	10	SB00240
SO1d	43	190	SB00252
SO1e	253	1130	SBG0210
S61b	127	200	SBF0005
S60a	429	670	SBG0015
S60b	171	270	SS12
S60c	153	240	SB00180
S60d	618	970	SBG0050
S69a	333	520	SBG3015
SS15a	28	40	SB00192
SS15b	61	100	SB00200
S70a	505	500	SBG0090
S70b	508	500	SBG0130
S71a	536	530	SAT0240
S71b	574	570	SAT0287
SO2b	27	30	UA00062
S66b	639	1300	SBE0165
S66c	674	1300	SBE0205
S66d	870	1700	SBE0255
S66e	780	1600	SBE4060
S66f	1006	2000	SBE4105
S66g	967	1900	SBE4320
S66h	1041	2100	SBE8005
S66i	824	1600	SBE6140
S66j	949	1900	SBE6025
S66k	306	600	SBE0315
S66l	620	1200	SBE4210
S66m	897	1800	SBE5020
S64c	15	30	SBE0140
S66a	42	70	SBE0150
S64a	9	20	SBE0105
S64b	271	540	SBE2020
S64d	271	540	SBE0130
S65a	351	690	SBE3015
S65b	1036	2050	SBE3405
S65c	269	530	SBE3035
S65d	0	0	SBE3035

S67a	728	1440	SBE3350
S54a	70	140	SBD0015
S54b	800	1590	SBD0045
S54c	367	730	SBD0090
S54d	2	0	SBD0115
S54e	296	590	SBD0145
S54f	870	1730	SBD6010
S54g	631	1260	SBD6035
S54h	202	400	SBD2010
S54i	51	100	SBD2015
S54j	323	640	SBD0180
SS7b	395	1500	SB00025
S1b	888	3230	SAU0020
S1c	235	850	SBB0030
S1d	798	2900	SAU0045
S61a	28	100	SB00120
SS1a	50	180	SBB0020
SS3a	660	2400	SB00068
SS7a	148	540	SBA0017
SS9a	177	640	SB00095
SS9b	319	1160	SBE0050
S83a	22	22	SC00095
S83b	23	23	SC00105
S83c	31	31	SC00135
DILLEa	9	9	SC00072
DILLEb	71	71	SD00010
DILLEc	29	29	SC00080
S1Aa	794	780	SAY1010
S1Ab	328	320	SAY0050
SOintc	1	0	SC00060
SS6a	56	110	SCA0060
S2Aa	410	820	SAX1025
S2Ab	802	1600	SAX1115
S2Ac	759	1520	RAA0030
S59a	930	1860	SAX2015
S59b	1171	2340	SAX2075
S59c	609	1220	SAX2105
S62a	3	10	S62
SS24a	11	20	SS24
S72b	767	1000	SAT0205
S72a	280	1200	SAT0192
S73b	404	1500	SAT0160
S2i	7	20	S74
S73a	65	170	SAT0145
S74a	83	210	SAT5020
S2b	368	470	SAT1030
S2c	256	330	SAT1055
S2d	208	270	SAT2015
S2e	249	320	SAT0020

S2f	490	630	SAT0065
SS16a	454	580	SAT0105
SS16b	620	800	SAT3015
SS16c	473	610	SAT3045
S1a	102	200	SAU0006
S2a	5	10	SAT0010
SOinte	0	0	SAZ0015
SOinth	195	390	S1C
S75c	287	570	SAS0110
S75d	142	290	SAS0135
S75b	205	400	SAS0095
035a	109	230	S75D
035b	36	70	S75B
SS11b	3	10	SAP0050
S74Aa	14	30	SAS3005
S77a	11	20	SAQ0040
S77b	49	100	SAQ0080
S79a	83	160	SAV0070
S79b	272	540	SAV0105
S80Aa	691	1370	SAS0065
S80Ab	140	280	SAS0085
SOinta	0	0	SAV0045
SOintb	0	0	SAV0040
SOintd	23	50	SA00007
SOinti	34	70	SAW0010
SOintj	2	0	SAP0020
SOintk	1	0	SAP0010
SOintl	154	300	SAQ1115
SS11a	2	0	SAP0030
MC47b	31	560	MC47_65
MC47a	47	840	MC47_50
MC1Aa	110	220	CV00170
MC1Ab	127	250	CV00170
MC1Ac	3	10	CV00147
	38278	79605	
Big Creek East			
Name	TIGER Population	Final Population	Model_ID
BC121a	62	52	BB00010
BC121b	260	217	BBA0010
BC16Ab	716	597	BC16A
BC17a	151	126	BC17
BC1a	460	1053	BD00020
BC1b	643	474	BD00090
BC25a	305	791	BE00010
BC25b	190	383	BE00050
BC25d	120	536	BE00070
BC29a	45	214	BC29
BC3a	333	254	BBZ0020

BC4a	569	158	BCA0010
BC4c	949	133	BCA0055
BC99a	1263	188	BC99
BcIntb	257	333	BE00005
BcIntc	188	45	BA00110
BC25c	159	159	BE00110
BC21a	171	655	BBA0025
BC2b	489	1066	BC99P
BC15ABa	556	242	BBAB035
BC16a	214	23	BBAB015
BC2a	41	111	BBA0035
BC2d	41	692	BBA0055
BC2e	204	117	BBA0060
BC2f	418	304	BBA0085
BC2c	71	616	BBAA030
BC10b	435	3199	BBAA045
BC10c	415	985	BBAA145
BC10d	286	649	BBAA090
BC10f	1417	574	BBAA040
BC13a	253	940	BBAA130
BC14a	77	177	BC14
BC09a	10	3	BC89M
BC10a	2	293	BBAAA40
BC09b	1260	2057	BC89L
Jenningsb	355	1333	BBB165B
Jenningsc	952	60	BBB052B
Jenningsd	739	1035	BBB145B
Jenningsf	43	497	BBB080A
Jenningsa	166	504	BC1E
BC120c	143	602	JEN1020
Jenningsi	203	799	JEN1030
Jenningsj	317	360	JEN0035
Jenningsk	143	360	JEN1005
Jenningsl	239	512	JEN0030
Jenningse	1	50	BBB040A
Jenningsh	18	90	BC1H
BC100a	160	57	BC100
BC20Aa	54	150	BC20A
BC28a	257	480	BFE0025
BC30a	20	324	BA00207
BC30m	151	545	BJ00010
BC30n	19	1254	BA00180
BC30p	35	318	BL00015
BC31a	26	2280	BG00070
BC32a	672	192	BHB0030
BC33a	137	1542	BHB0010
BC34a	121	2714	BC34
BC35a	763	78	BI00015
BC35b	593	600	BIB0005

BC36a	209	3024	BC36
BC40a	565	2289	BMA0020
BC40b	554	1779	BM00015
BC93a	106	453	BC93
BcInta	603	105	BG00010
BCIntk	190	2593	BF00010
BCIntm	192	2543	BFA0010
BC18Aa	142	390	BFA010A
BC19a	117	150	BC19
BC20a	185	93	BC98A
BC92a	45	93	BC92
BC96a	28	617	BC92C
BC98a	28	1780	BC98
BcIntg	106	353	BF00090
BcIntl	534	413	BF00060
BC7e	436	1092	BC95B5
BC41g	680	20	BN00295
BC41o	403	55	BN00330
BC41x	287	1636	BND0005
BC89a	13	969	BC89
BC90a	34	97	BC90
BC91a	40	692	BN00355
BC41e	573	858	BN00285
BC7aa	143	1388	BE00115
BC18a	124	322	BC18
BC7a	496	1928	W370015
BC7b	294	294	BC20H1
BC7c	645	150	BC94C
BC7d	232	361	BC95B1
BC7f	174	645	BC95C1
BC7g	219	482	BC95A2
BC7h	803	219	BC20F4
BC7i	361	232	BC94B
BC7j	212	174	BC94E
BC94a	150	842	BC94A
BC37a	551	257	BKA0005
BC37b	6	11	BK00015
BC37c	638	277	BKA0017
BC37d	482	963	BK00060
BC37e	960	1919	BK00070
BC37f	139	1102	BK00020
BC38a	129	1276	BC38
BC30o	51	250	BK00010
BC39b	176	100	BC40C
BC39a	6	134	BC39
BC41f	550	1563	BN00070
BC41j	134	377	BN00080
BC41p	1274	3598	BN00115
BC41q	483	1364	BN00130

BC41r	594	1678	BN00145
BC41k	544	3509	BN00097
BC41s	397	350	BNC0030
BC41t	248	797	BN00155
BC41u	701	212	BNC0010
BC41v	1028	2475	BNB0003
BC41w	495	1127	BN00200
BC41z	88	639	BN00275
BC41b	1865	1492	BNA0025
BC41d	146	841	BNA0060
BC41l	279	1684	BNA0065
BC41m	300	388	BNA0075
BC41n	250	250	BNA0075
BC41a	390	46	BN00015
BC41aa	23	881	BC41
BC41h	519	1037	BN00035
BC41i	312	312	BNA0005
	43042	95192	

APPENDIX D

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
*	BCW	submodel												
*	delay	basins												
*	for	meters	BC142,	BC143										
H1	6	'BC54x'	'BYC0110'	100	311	30	0.005	0.025	0.045	0.1	1	0.1	0.1	0.00115
*	for	meter	BC147											
H1	5	'BC60ax'	'BTD0025'	10	49.44	36	0.01	0.013	0.045	0.1	0.1	1	0.1	0.00115
*	for	meter	BC149											
*	take	out	delay	basin	for	BC149								
*H1	5	'BC58ax'	'BZAA015'	50	61.35	10	0.009	0.013	0.045	1.06	0.1	2	0.2	0.00115
*H1	5	'BC62ax'	'BC62U'	50	11.67	10	0.01	0.013	0.045	1.06	0.1	2	0.2	0.00115
*H1	5	'BC63ax'	'BT00170'	50	23.46	10	0.01	0.013	0.045	1.06	0.1	2	0.2	0.00115
*H1	6	'BC64ax'	'BC64U'	50	14.33	10	0.008	0.013	0.045	1.06	0.1	2	0.2	0.00115
*H1	5	'BC149x'	'BZAA015'	20	110.8	25	0.009	0.013	0.045	0.1	0.1	1	0.1	0.00115
*	for	meters	BC150											
H1	5	'BC150x'	'BC87B'	5	351.4	30	0.005	0.025	0.045	0.1	1	0.5	0.5	0.00115
H1	5	'BC53Aex'	'BYC0205'	21	21.44	34	0.01	0.013	0.045	5.6	0.5	0.1	0.1	0.00115
H1	5	'BC53Afx'	'BYC0160'	19	36.45	38	0.02	0.013	0.045	5.6	0.5	0.1	0.1	0.00115
*	BC	152	meter	basin	slow	respond	basin	(BC56	a,b,c,d)					
H1	6	'BC152X'	'BU00050'	200	161.8	50	0.005	0.025	0.045	0.1	1	0.1	0.1	0.00115
H1	6	'BC66X'	'BUB0105'	200	91.2	20	0.04	0.013	0.045	0.1	1	0.1	0.1	0.00115
*	BC	153	meter	basin	slow	respond	basin							
H1	6	'BC56onp'	'BUO0195'	200	218.6	50	0.005	0.025	0.045	0.1	1	0.1	0.1	0.00115
H1	6	'BC56mlu'	'BUO0175'	200	142.1	50	0.005	0.025	0.045	0.1	1	0.1	0.1	0.00115
H1	6	'BC56hijk'	'BUD0017'	200	105.4	50	0.005	0.025	0.045	0.1	1	0.1	0.1	0.00115
H1	6	'BC56efgt'	'BU00150'	200	195.4	50	0.005	0.025	0.045	0.1	1	0.1	0.1	0.00115
*	BC	155	meter	basin	slow	respond	basin							
H1	6	'BC155x'	'BUD165B'	100	145.2	40	0.01	0.013	0.045	0.06	0.8	0.1	0.1	0.00115
H1	6	'BC73x'	'BUD0215'	100	88.8	40	0.01	0.013	0.045	0.06	0.8	0.1	0.1	0.00115
*	BC	155A	meter	basin	slow	respond	basin							
H1	6	'BC155AX'	'BUD170A'	10	244.1	30	0.01	0.013	0.045	0.06	0.1	5	0.1	0.00115
*	BC	157	meter	basin	slow	respond	basin							
H1	6	'BC157'	'BUDF085'	100	120	10	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
*	Meters	160,	161											
*	08-May	in	submodel											
*H1	5	'BC65'	'BZBA020'	200	228	50	0.005	0.025	0.045	0.1	0.1	99	99	0.00115
H1	5	'BC65X'	'BZBA020'	200	228	50	0.005	0.025	0.045	0.1	1	0.1	0.1	0.00115
*	BC-162A													
H1	6	'STM10x'	'BCST71F'	6	38.81	15	0.01	0.013	0.045	0.1	0.6	5	0.4	0.00115
*	Meter	BC-162B	(CSO)	Delay	inflow									
H1	6	'BC71ax'	'BUDK015'	3	32.25	29	0.01	0.013	0.045	0.06	0.1	0.1	0.1	0.00115
H1	6	'BC72ax'	'BUDL015'	3	31.63	38	0.01	0.013	0.045	0.06	0.1	0.1	0.1	0.00115
H1	6	'BC72bx'	'BUDL040'	4	23.95	39	0.02	0.013	0.045	0.06	0.1	0.1	0.1	0.00115
H1	6	'BC72cx'	'BUDL035'	3	44.42	25	0.07	0.013	0.045	0.06	0.1	0.1	0.1	0.00115
H1	6	'I71ax'	'GUNST20'	3	26.3	40	0.08	0.013	0.045	0.06	0.3	0.5	0.1	0.00115
*	End	of	Delay	basins										

*==

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
*	Sanitary	areas												
*	combine	BC30	g,	q,	k,	e	i							
H1	3	'BC30g'	'BP00065'	15	333.19	6.8	0.03	0.013	0.045	0.04	0.1	1	0.5	0.00115
*	Meter	BC137	(included	in	BC136)									
H1	3	'BC30h'	'BPN0010'	30	58.73	10	0.01	0.013	0.045	1.5	1.5	1	0.05	0.00115
H1	3	'BC30h'	'BPN0010'	1	58.73	54	0.01	0.013	0.045	0.5	0.5	1	0.05	0.00115
*	Meter	BC138D												
H1	3	'BC30f'	'BQQ0015'	10	332.93	1.5	0.01	0.013	0.045	0.04	0.1	99	99	0.00115
*==														
*	Combined	areas												
*	Meter	BCI1												
*	combine	BC30b,c,	r											
*H1	2	'BC30c'	'BA00230'	6140	79.05	36	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	2	'BC30bcr'	'BA00230'	30	93.2	3	0.02	0.013	0.045	0.04	0.1	0.1	0.01	0.00115
*	downstream	of	BC138D											
H1	5	'BC30l'	'BQ00010'	50	27.26	1	0.19	0.013	0.045	0.06	0.1	99	99	0.00115
H1	2	'BC30d'	'BA00250'	1200	38.83	10	0.07	0.013	0.045	0.06	0.1	99	99	0.00115
*														
H1	5	'BC42a'	'BC42U'	1180	17.82	30	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	5	'BC43a'	'BQ00070'	1600	24.45	30	0.01	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	5	'BC43b'	'BQ00065'	1000	32.79	10	0.01	0.013	0.045	0.06	1	5	0.25	0.00115
H1	6	'BC43c'	'BQ00100'	2365	54.37	30	0.01	0.013	0.045	0.06	0.1	5	0.25	0.00115
*	Meter	BC140	(upstream	meter	BC147,	149)								
*	Peak	too	high	reduce	%	of	Imp	by	10%	added	to	delayed	basins	
H1	5	'BC49a'	'BC49U'	200	7	33	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	5	'BC44a'	'BC122'	772	31.65	26	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC44b'	'BT00085'	500	25.33	32	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC44c'	'BT00050'	900	52.1	26	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC44d'	'BTA0010'	1100	29.97	32	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC44e'	'BTA0035'	1100	32.91	31	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC44f'	'BT00025'	410	27.32	20	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC46a'	'BC46U'	225	13.66	28	0.03	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC57a'	'BT00130'	450	44.24	23	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
*	Meter	BC140	pervious	runoff	add	10%	imp,	reduce	width	by	half			
H1	5	'BC49ax'	'BC49U'	5	7	53	0.03	0.013	0.045	1.06	0.2	1	0.1	0.00115
H1	5	'BC44ax'	'BC122'	15	31.65	46	0.02	0.013	0.045	1.06	0.2	1	0.1	0.00115
H1	5	'BC44cx'	'BT00050'	20	52.1	46	0.02	0.013	0.045	1.06	0.2	1	0.1	0.00115
H1	5	'BC44dx'	'BTA0010'	22	29.97	52	0.01	0.013	0.045	1.06	0.2	1	0.1	0.00115
H1	5	'BC44ex'	'BTA0035'	15	32.91	51	0.02	0.013	0.045	1.06	0.2	1	0.1	0.00115
H1	5	'BC44fx'	'BT00025'	10	27.32	40	0.02	0.013	0.045	1.06	0.2	1	0.1	0.00115
H1	5	'BC46ax'	'BC46U'	20	13.66	48	0.03	0.013	0.045	1.06	0.2	1	0.1	0.00115
H1	5	'BC57ax'	'BT00145'	5	44.24	43	0.01	0.013	0.045	1.06	0.2	1	0.1	0.00115
*	end	of	Meter	BC140										
*	Meter	BC141	after	BC152										
H1	5	'BC44g'	'BA00285'	1120	8.54	39	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	5	'BC44h'	'BA00300'	6390	18.66	48	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
*	Meter	BC138	after	BC140,	BC141	and	BC144							
*	reduce	%	of	imp	by	10%								
H1	5	'BC45a'	'BXA0030'	1200	51.39	28	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC45b'	'BXC0015'	1260	42.25	26	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC45c'	'BXB0015'	1600	44.18	26	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
*	Meter	BC138	pervious	runoff										
H1	5	'BC45a'	'BXA0030'	20	51.39	17	0.02	0.013	0.045	3.06	0.1	1	0.1	0.00115
H1	5	'BC45b'	'BXC0015'	26	42.25	18	0.01	0.013	0.045	3.06	0.1	1	0.1	0.00115
H1	5	'BC45c'	'BXB0015'	60	44.18	18	0.02	0.013	0.045	3.06	0.1	1	0.1	0.00115
*	end	of	BC138	local	areas									
*	BC54	submodel	Meter	BC142	143									
*	03/30/2000	increase	%	of	imp	by	5%							
H1	5	'BC52a'	'BC52U'	550	11.36	30	0.01	0.013	0.045	0.02	0.04	8	0.5	0.00115
H1	5	'BC53Aa'	'BYC0110'	2400	33.59	43	0.02	0.013	0.045	0.02	0.04	3	0.1	0.00115
H1	5	'BC53Ab'	'BYC0115'	2800	36.53	37	0.02	0.013	0.045	0.02	0.04	8	0.5	0.00115
H1	5	'BC53Ac'	'BYCJ015'	2200	51.57	44	0.01	0.013	0.045	0.02	0.04	3	0.1	0.00115
H1	5	'BC53Ad'	'BYCJ055'	1825	24.82	40	0.04	0.013	0.045	0.02	0.04	8	0.5	0.00115
*	move	to	Meter	basin	BC150									
*H1	5	'BC53Ae'	'BYC0205'	2600	21.44	34	0.01	0.013	0.045	0.02	0.06	8	0.5	0.00115
*H1	5	'BC53Af'	'BYC0160'	2400	36.45	38	0.02	0.013	0.045	0.02	0.06	3	0.1	0.00115
H1	5	'BC54Aa'	'BYCD010'	2860	33.71	27	0.009	0.013	0.045	0.02	0.04	8	0.5	0.00115
H1	5	'BC54Ab'	'BYCE015'	1615	30.41	34	0.01	0.013	0.045	0.02	0.04	8	0.5	0.00115
H1	5	'BC54Ac'	'BYCC020'	1200	18.77	39	0.02	0.013	0.045	0.02	0.04	8	0.5	0.00115
H1	5	'BC55a'	'BYCA015'	1070	57.97	41	0.01	0.013	0.045	0.02	0.04	8	0.5	0.00115
H1	5	'BC55b'	'BYCB005'	800	23.83	41	0.01	0.013	0.045	0.02	0.04	8	0.5	0.00115
*	end	of	BC54	submodel										
*	Meter	BC-144												
H1	5	'BC47a'	'BC47U'	480	10.98	35	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC50a'	'BC50U'	300	6.41	34	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC51a'	'BC51U'	600	12.13	37	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC53a'	'BC53U'	250	1.42	41	0.01	0.013	0.045	0.02	0.06	8	0.5	0.00115
H1	5	'BC54a'	'BC54U'	1200	1.44	40	0.02	0.013	0.045	0.02	0.06	8	0.5	0.00115
H1	5	'BC83a'	'BYA0015'	1100	19.22	42	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC84a'	'BC84'	1100	19.42	38	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC101a'	'BYC0010'	1200	18.43	34	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC102a'	'BYB0010'	700	5.91	45	0.03	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC103a'	'BYA0010'	400	5.57	39	0.03	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC104a'	'BY00060'	660	41.36	10	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC114a'	'BC114U'	400	4.25	20	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC115a'	'BC115U'	400	6.41	20	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC116a'	'BC116U'	400	6.78	20	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
*	Meter	BC-144	pervious	areas,	reduce	%	of	imp	by	04-Jan				
H1	5	'BC50a'	'BC50U'	30	6.41	9	0.01	0.013	0.045	3.06	0.3	1.5	0.3	0.00115
H1	5	'BC51a'	'BC52L'	60	12.13	9	0.01	0.013	0.045	3.06	0.3	1.5	0.3	0.00115
H1	5	'BC53a'	'BC53U'	25	1.42	10	0.01	0.013	0.045	3.02	0.3	1.5	0.3	0.00115
H1	5	'BC54a'	'BC54U'	120	1.44	10	0.02	0.013	0.045	3.02	0.3	1.5	0.3	0.00115

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate	
H1	5	'BC83a'	'BYA0015'	110	19.22	10	0.01	0.013	0.045	3.06	0.3	1.5	0.3	0.00115	
H1	5	'BC84a'	'BC84'	110	19.42	9	0.01	0.013	0.045	3.06	0.3	1.5	0.3	0.00115	
H1	5	'BC101a'	'BYC0010'	120	18.43	9	0.02	0.013	0.045	3.06	0.3	1.5	0.3	0.00115	
H1	5	'BC102a'	'BYB0010'	70	5.91	11	0.03	0.013	0.045	3.06	0.3	1.5	0.3	0.00115	
H1	5	'BC103a'	'BYA0010'	40	5.57	10	0.03	0.013	0.045	3.06	0.3	1.5	0.3	0.00115	
H1	5	'BC104a'	'BY00060'	66	41.36	3	0.02	0.013	0.045	3.06	0.3	1.5	0.3	0.00115	
H1	5	'BC114a'	'BC114U'	40	4.25	5	0.02	0.013	0.045	3.06	0.3	1.5	0.3	0.00115	
H1	5	'BC115a'	'BC115U'	40	6.41	5	0.02	0.013	0.045	3.06	0.3	1.5	0.3	0.00115	
H1	5	'BC116a'	'BC116U'	40	6.78	5	0.02	0.013	0.045	3.06	0.3	1.5	0.3	0.00115	
***	BC152	submodel	(BC152	submodel	includes	BC8	and	BC162	submodels)						
*	Meter	BC152	(COMB),	BC151(SWO)											
*	Meter	BC152	includes	all	DWO	from	BC156	and	BC160						
H1	6	'BC56a'	'BUA0025'	600	16.8	23	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115	
H1	6	'BC56b'	'BU00055'	2400	45.56	28	0.01	0.013	0.045	0.06	0.1	99	99	0.00115	
H1	6	'BC56c'	'BUA0015'	2600	53.66	25	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115	
H1	6	'BC56d'	'BUB0055'	4000	45.76	25	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115	
H1	6	'BC56e'	'BUC0035'	4800	58.88	23	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115	
H1	6	'BC56f'	'BU00150'	1200	57.57	23	0.01	0.013	0.045	0.06	0.1	99	99	0.00115	
H1	6	'BC56g'	'BU00140'	800	57.74	23	0.01	0.013	0.045	0.06	0.1	99	99	0.00115	
H1	6	'BC56h'	'BUD0010'	1600	82.19	26	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115	
*	COMBINE	BC56i,	k												
*H1	6	'BC56i'	'BUD0085'	430	15.16	25	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115	
*H1	6	'BC56k'	'BUD0090'	100	0.31	44	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115	
*	BC56i	has	storm	sewer											
H1	6	'BC56ik'	'BUD0085'	1200	15.47	10	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115	*
H1	6	'BC56j'	'BUD0075'	810	7.74	26	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115	
H1	6	'BC56l'	'BUO0175'	1200	57.97	18	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115	
H1	6	'BC56m'	'BU00165'	1200	43.66	18	0.01	0.013	0.045	0.06	0.1	99	99	0.00115	
H1	6	'BC56n'	'BUO0195'	1200	54.39	18	0.01	0.013	0.045	0.06	0.1	99	99	0.00115	
H1	6	'BC56o'	'BUO0200'	1250	87.72	43	0.01	0.013	0.045	0.06	0.1	99	99	0.00115	
H1	6	'BC56p'	'BUO1025'	2850	76.5	55	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115	
H1	6	'BC56q'	'BUDA010'	1000	43.6	3	0.02	0.013	0.045	0.06	0.1	99	99	0.00115	
H1	6	'BC56r'	'BC65U2'	550	9	28	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115	
*	COMBINE	BC56s	TO	BC8g											
H1	6	'BC56t'	'BU00150'	600	21.17	15	0.02	0.013	0.045	0.06	0.1	99	99	0.00115	
H1	6	'BC56u'	'BUO0185'	600	40.5	15	0.004	0.013	0.045	0.06	0.1	99	99	0.00115	
*	Regulator	BC66	and	BC66A											
H1	6	'BC66a'	'BC66U'	200	12.97	38	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115	
*	$break	BC66Aa	to	BC66Aa	and	BC66Ab									
H1	6	'BC66Aa'	'BUBB015'	1260	46.65	15	0.04	0.013	0.045	0.06	0.1	8	0.5	0.00115	
H1	6	'BC66Ab'	'BUB0105'	1400	44.53	10	0.04	0.013	0.045	0.06	0.1	8	0.5	0.00115	
*******end	of	BC152	submodel												
*	BC150	submodel													
H1	5	'BC53Ae'	'BYC0205'	2100	21.44	34	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115	
H1	5	'BC53Af'	'BYC0160'	1900	36.45	38	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115	
*															

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
H1	5	'BC58b'	'BC86B'	2275	53.99	33	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	5	'BC58c'	'BC87I'	3685	60.78	25	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC58d'	'BTCBA10'	2460	29.51	40	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC58e'	'BTC0040'	1300	36.98	28	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC58f'	'BTCE020'	400	13.33	25	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC58g'	'BTCC035'	2400	67.37	38	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC58h'	'BTCC085'	1610	28.86	30	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
*	End	of	BC150	submodel										
*	Meter	BC147												
H1	5	'BC59a'	'BC59U'	400	9.33	32	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC60a'	'BTD0025'	1000	29.49	36	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC61a'	'BC61U'	300	10.62	38	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
*	Meter	BC149	(BC148	WET)										
*	combine	BC105-6,7	a	to	BC58a									
*	30-Mar	reduce	%	of	imp	by	10%,	increase	width	by	1000	feet		
H1	5	'BC58a'	'BZAA015'	2800	61.35	15	0.009	0.013	0.045	0.08	0.1	8	0.5	0.00115
H1	5	'BC62a'	'BC62U'	2045	11.67	30	0.01	0.013	0.045	0.08	0.1	8	0.5	0.00115
H1	5	'BC63a'	'BT00170'	2400	23.46	24	0.01	0.013	0.045	0.08	0.1	8	0.5	0.00115
H1	6	'BC64a'	'BC64U'	2250	14.33	23	0.008	0.013	0.045	0.08	0.1	8	0.5	0.00115
*	combined	with	BC58a											
*H1	5	'BC105a'	'BC63A'	860	3.63	26	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	5	'BC106a'	'BC62A'	260	1.48	30	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	5	'BC107a'	'BC60A'	390	0.9	35	0.008	0.013	0.045	0.06	0.1	8	0.5	0.00115
*	Meter	BC161(COMB),	BC162(DWO)											
*	BC65	submodel												
*	reduce	%	of	imp	by	10	%,							
H1	5	'BC65ag'	'BZBA020'	1600	54.17	25	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC65b'	'BZBB020'	2000	27.91	26	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC65c'	'BZB0090'	640	32.83	27	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC65d'	'BZBBA15'	1200	52.26	23	0.009	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC65e'	'BZBB070'	1480	34.81	28	0.006	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC65f'	'BZBBB20'	840	29.57	15	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
*	combine	BC65g	to	BC65a										
*H1	6	'BC65g'	'BZB0030'	1440	0.95	100	0.13	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	5	'BC56r'	'BC65U2'	400	9	25	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
*	end	of	BC65	submodel										
********	BC-8	submodel												
*	BC-8	submodel												
*	I-71	drainage	to	BC-162A										
H1	6	'STM10'	'BCST71F'	300	38.81	30	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Meter	BC-162B	(CSO)	for	REG	BC71,	BC72	Meter	BC162C	(CSO)	including	REG	BC-73	overflow
H1	6	'BC71a'	'BUDK015'	1000	32.25	29	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	6	'BC72a'	'BUDL015'	1200	31.63	38	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	6	'BC72b'	'BUDL040'	800	23.95	39	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	6	'BC72c'	'BUDL035'	250	44.42	25	0.07	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	6	'I71a'	'GUNST20'	324	26.3	10	0.08	0.013	0.045	0.06	0.2	8	0.5	0.00115

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
*	OF	to	BC	162C										
H1	6	'BC73a'	'BUD0196'	200	2.32	51	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	6	'BC73b'	'BUD0215'	600	26.92	31	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	6	'BC73c'	'BUD0205'	690	19.45	37	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	6	'BC73d'	'BUDN010'	685	40.15	38	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
*	reduce	%	of	Imp	from	38%								
H1	6	'BC73c'	'BUD0205'	690	19.45	30	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	6	'BC73d'	'BUDN010'	685	40.15	30	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
*	CSO	233												
*	Meter	BC-157	(DWO),	BC159	(CSO)	to	BC155A							
H1	6	'BC69a'	'BC69U'	400	4.71	10	0.04	0.015	0.045	0.04	0.1	3	0.3	0.00115
H1	6	'BC70a'	'BUDF075'	2200	51.26	32	0.01	0.015	0.045	0.04	0.1	3	0.3	0.00115
H1	6	'BC70b'	'BUDFA20'	1400	25.41	47	0.01	0.015	0.045	0.04	0.1	3	0.3	0.00115
H1	6	'BC70c'	'BUDF115'	1400	43.22	32	0.02	0.015	0.045	0.04	0.1	3	0.3	0.00115
*	add	BC8l	to	BC8d										
*H1	6	'BC8l'	'BUDF060'	525	1.81	30	0.004	0.013	0.045	0.04	0.1	3	0.1	0.00115
*	CSO	to	Big	Creek	culvert									
*	Meter	BC-155A(INFLOW),	BC-156	(DWO)										
*	move	pervious	storm	to	detention	by	increase	infiltraton						
H1	6	'BC8a'	'BUD095A'	350	9.83	25	0.01	0.013	0.045	0.04	0.1	10	5	0.00115
H1	6	'BC8b'	'BUDB015'	1400	26.14	25	0.01	0.013	0.045	0.04	0.1	10	5	0.00115
H1	6	'BC8c'	'BUD115A'	1818	52.16	25	0.01	0.013	0.045	0.04	0.1	10	5	0.00115
H1	6	'BC8dl'	'BUDF025'	1750	70.8	25	0.009	0.013	0.045	0.04	0.1	10	5	0.00115
H1	6	'BC8e'	'BUD165A'	1000	50.99	20	0.007	0.013	0.045	0.04	0.1	3	0.1	0.00115
H1	6	'BC8f'	'BUD145A'	600	33.88	15	0.009	0.013	0.045	0.04	0.1	8	0.5	0.00115
*	Meter	BC-155	to	BC-156	(DWO)									
*	ADD	0.28	ACRES	FROM	BC56s	TO	BC8g							
*	05/10/2001	re-divide	BC8h	&	k,	reduce	%imp	and	width	from	BC8i			
H1	6	'BC8g'	'BUDC020'	944	31.38	34	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	6	'BC8h'	'BUDE020'	800	20.98	30	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	6	'BC8i'	'BUDE075'	1000	49.86	15	0.01	0.013	0.045	0.06	0.1	8	0.1	0.00115
H1	6	'BC8j'	'BUDC035'	745	6.94	51	0.01	0.013	0.045	0.06	0.1	8	0.1	0.00115
H1	6	'BC8k'	'BUD0150'	530	36.03	30	0.09	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	COMBINE	BC56i,	j	AND	k	and	move	to	BCW	submodel				
*H1	6	'BC56i'	'BUD0085'	430	15.47	25	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	6	'BC56k'	'BUD0090'	100	0.31	44	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
*	COMBINE	BC56s	TO	BC8g										
*H1	6	'BC56s'												
****	end	of	BC8	submodel										
*	Regulator	BC88												
H1	2	'BC88a'	'BR00035'	600	34.66	20	0.03	0.013	0.045	0.06	0.1	8	0.5	0.00115
*	Big	Creek	Storm	basins										
*	JK	NAMEW	NGTO	Width	area	%Imp	Slope	IMPN	PERVN	IDS	PDS	Fmax	Fmin	Decay
*	BIG	CREEK	WEST	BRANCH	INTO	PURITAS	DETENTION							
H1	6	'BIGea'	'BZ00245'	8260	1646	35	0.003	0.02	0.045	0.1	0.2	5	0.5	0.00115
H1	6	'BIGeb'	'BZ00245'	10000	744.5	45	0.003	0.02	0.045	0.1	0.2	5	0.5	0.00115

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
H1	6	'BIGec'	'BZ00225'	500	177	60	0.001	0.02	0.045	0.1	0.2	5	0.5	0.00115
H1	6	'BIGeax'	'BZ00245'	200	846	35	0.003	0.02	0.045	1.5	1	3	0.3	0.00115
H1	6	'BIGebx'	'BZ00245'	100	344	45	0.003	0.02	0.045	1.5	1	3	0.3	0.00115
H1	6	'BIGecx'	'BZ00225'	50	100	60	0.001	0.02	0.045	1.5	1	3	0.3	0.00115
*	BIG	CREEK	EAST	BRANCH	-	CHEV	BRANCH	INTO	I-480	BASIN				
H1	6	'BIGwa'	'BZC0070'	8000	829.55	40.6	0.001	0.02	0.045	0.1	0.2	8	0.5	0.00115
H1	6	'BIGwb'	'BZC0015'	600	606	25	0.001	0.02	0.045	2.1	0.2	0.5	0.1	0.00115
H1	6	'BIGwbx'	'BZC0015'	60	606	25	0.001	0.02	0.045	2.1	0.5	0.5	0.1	0.00115
*	other	storm	water	basins										
*	05/10/2001	reduce	Fmax	Fmin										
*	combine	STM23	and	STM18										
H1	6	'STM23+18'	'BC42A'	3800	39.12	45	0.001	0.02	0.045	0.4	0.1	3	0.1	0.00115
H1	6	'STM02'	'I710040'	4800	59.83	45	0.001	0.02	0.045	0.4	0.1	3	0.1	0.00115
*	The	following	areas	flow	into	Big	Creek	D/S	of	BCW	model			
*H1	6	'STM13'	'CSO057'	6200	229.85	5	0.001	0.02	0.045	0.4	0.1	3	0.1	0.00115
*H1	6	'STM13x'	'CSO057'	62	229.85	5	0.001	0.02	0.045	1	0.5	0.1	0.1	0.00115
*H1	3	'BC30f'	'BQQ0015'	10	332.93	1.5	0.01	0.013	0.045	0.04	0.1	99	99	0.00115
*	combine	STM01	STM15											
H1	6	'STM01+15'	'BZ00004'	2800	32.07	5	0.001	0.02	0.045	0.4	0.1	3	0.1	0.00115
**==														
*	BCE	submodel												
*H1	JK	NAMEW	NGTO	WW1	WAREA	WW3	WSLOPE	WW5	WW6	WW7	WW8	WLMAX	WLMIN	DECAY
*														
*****basins	tributary	to	flow	monitor	BC-101									
H1	1	'-1'	'adjust'	1	1	0.5	1	1	1	1	1	1	1	1
H1	1	'BC121a'	'BB00010'	1780	13	38	0.0096	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	'BC121b'	'BBA0010'	1300	16.13	36	0.0081	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	'BC3a'	'BBZ0020'	1760	29.13	40	0.011	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	'BC4a'	'BCA0010'	2830	36	37	0.0241	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	'BC4c'	'BCA0055'	580	42.39	35	0.0226	0.013	0.045	0.06	0.1	8	0.5	0.00115
**	06/08/2001	added	by	WRCE	for	calibration	of	BCSS02						
H1	1	'BC4d'	'TDW0035'	8000	25.8	5	0.0626	0.013	0.045	0.06	0.1	3	0.3	0.00115
H1	1	'BC4f'	'TDW0035'	1200	14	85	0.0326	0.013	0.045	0.06	0.1	3	0.3	0.00115
H1	1	'BC1a'	'BD00020'	4220	28.95	40	0.0231	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	'BC1b'	'BD00100'	3710	29.33	39	0.0294	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	'BC99a'	'BC99'	1730	51.25	40	0.0287	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'BC17a'	'BC17'	3380	7.99	48	0.0201	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'STM22'	'BC18I'	1610	50.04	1	0.0361	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'BC16Ab'	'BC16A'	4980	46.53	41	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
****RDII	for	BC-101												
H1	1	'-1'	'adjust'	0.01	1	0.1	1	1	1	1	1	1	1	1
H1	1	'BCIntc'	'BA00110'	2850	14.22	31	0.0293	0.013	0.045	0.06	0.1	8	0.5	0.00115
*****basins	tributary	to	flow	monitor	BC-102									
H1	1	'-1'	'adjust'	1	1	1.5	1	1	1	1	1	1	1	1
H1	1	'BC21a'	'BBA0025'	1080	6.76	27	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	'BC2b'	'BC99P'	3090	13.97	37	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
*****basins	tributary	to	flow	monitor	BC-103									
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	1	'BC2f'	'BBA0085'	1380	30.76	31	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	'BC15ABa'	'BBAB035'	3330	42.97	39	0.04	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	'BC2d'	'BBA0055'	1020	4.68	35	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	'BC2a'	'BBA0035'	1060	5.77	40	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	'BC16a'	'BBAB015'	910	12.98	36	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	'BC2e'	'BBA0060'	700	14.49	37	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
*****basins	tributary	to	flow	monitor	BC-104d									
H1	1	'-1'	'adjust'	1	1	0.5	1	1	1	1	1	1	1	1
H1	1	'BC2c'	'BC10'	1000	7.72	41	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
****RDII	for	BC-104d												
H1	1	'-1'	'adjust'	0.01	1	0.1	1	1	1	1	1	1	1	1
H1	1	'BC2c'	'BBAA030'	1000	7.72	41	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
*****basins	tributary	to	flow	monitor	BC-104i									
H1	1	'-1'	'adjust'	0.1	1	0.6	1	1.2	1	1	1	1	1	1
H1	1	'BC10b'	'BBAA045'	2030	27.74	35	0.03	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	'BC10c'	'BBAA145'	2340	34.18	36	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'BC14a'	'BC14'	1940	8.19	28	0.03	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	'BC10d'	'BBAA090'	2535	47.72	48	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*****slow	response	basin	tributary	to	flow	monitor	BC-104i							
H1	1	'-1'	'adjust'	1	1	0.6	1	1.2	1	1	1	1	1	1
H1	1	'104ls'	'BBAA045'	1	181.52	48	0.03	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	'BC10f'	'BBAA040'	1	62.64	3	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
*****basins	tributary	to	flow	monitor	BC-105									
H1	1	'-1'	'adjust'	1	1	0.5	1	1	1	1	1	1	1	1
H1	1	'BC10a'	'BC09'	370	1.05	58	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
*****RDII	basins	tributary	to	flow	monitor	BC-105								
H1	1	'-1'	'adjust'	0.01	1	0.1	1	1	1	1	1	1	1	1
H1	1	'BC10a'	'BBAAA40'	370	1.05	58	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
*****basins	tributary	to	flow	monitor	BC-106									
H1	1	'-1'	'adjust'	0.6	1	0.8	1	1.5	1	1	1	0.2	1	1
H1	1	'BC09a'	'BC89M'	650	1.57	57	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'STM19'	'BC89C'	440	3	18	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'STM20'	'BC91A'	760	46.12	27	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'BC13a'	'BBAA130'	3170	13.35	36	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'BC90a'	'BC89A'	630	1.81	41	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'BC91a'	'BC91B'	950	2.14	42	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'BC09b'	'BC89L'	2690	56.84	29	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'BC89a'	'BC89B'	350	0.63	40	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
*****Flow	Monitor	BC-108******												
H1	1	'-1'	'adjust'	1	1	0.5	1	1	1	1.5	1.5	1	1	1
H1	2	'Jenningsb'	'BBB165B'	1780	16.24	36	0.0201	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	2	'Jenningsc'	'BBB145B'	3250	35.74	41	0.0137	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	7	'Jenningsd'	'BBB052B'	4930	51.91	38	0.0793	0.013	0.045	0.06	0.1	8	0.5	0.00115
*****Flow	Monitor	BC-109*****												

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	1	'Jenningsa'	'BC1E'	2535	18.5	19	0.142	0.013	0.045	0.06	0.1	3	0.1	0.00115
*****Flow	Monitor	BC-109*****												
*	RDII	Basin												
H1	1	'Jenningsx'	'BC1F'	50	18.5	1	0.142	0.013	0.045	0.06	0.1	3	0.1	0.00115
*****Flow	Monitor	BC-110*****												
H1	1	'-1'	'adjust'	1	1	1.5	1	1	1	1	1	1	1	1
H1	1	'Jenningsi'	'JEN1030'	2250	22.33	25	0.0198	0.013	0.045	0.06	0.1	3	0.5	0.00115
*****Flow	Monitor	BC-110*****												
*	RDII	Basin												
H1	1	'-1'	'adjust'	1	1	0.2	1	1	1	1	1	1	1	1
H1	1	'Jenningsix'	'JEN0015'	10	22.33	1	0.137	0.013	0.045	0.06	0.1	8	0.5	0.00115
*****Flow	Monitor	BC-111*****												
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	7	'Jenningsf'	'BBB085A'	1890	30	41	0.0426	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'Jenningse'	'BBB052B'	1600	9.25	39	0.0136	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'Jenningsh'	'BC1H'	690	3.34	29	0.1345	0.013	0.045	0.06	0.1	3	0.1	0.00115
*****basins	tributary	to	flow	monitor	BC-115									
H1	1	'-1'	'adjust'	1	1	0.5	1	1	1	1	1	1	1	1
H1	2	'BC20Aa'	'BC20A'	1060	2.79	35	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	2	'BC28a'	'BFE0025'	1340	12.21	43	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	2	'BC29a'	'BC29'	940	5.05	21	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	2	'BC30m'	'BJ00010'	1400	6	35	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	2	'BC30n'	'BA00180'	780	1.42	41	0.03	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	2	'BC31a'	'BG00070'	350	1.55	40	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	3	'BC32a'	'BHB0030'	3900	32.2	39	0.04	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	2	'BC33a'	'BHB0010'	2300	10.85	38	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	2	'BC34a'	'BC34'	2475	21.12	27	0.04	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	2	'BC35a'	'BI00015'	2925	44.8	33	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	2	'BC35b'	'BIB0005'	1590	32.24	35	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	2	'BC36a'	'BC36'	3600	9.53	31	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	2	'BCintk'	'BC20AF'	2200	16.49	49	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	2	'BCintm'	'BC20AE2'	4040	12.6	56	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
*														
*RDII														
H1	1	'-1'	'adjust'	0.01	1	0.1	1	1	1	1	1	1	1	1
H1	2	'BC25b'	'BE00050'	1920	17.25	43	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	2	'BC25d'	'BE00070'	1845	8.24	41	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
*****basins	tributary	to	flow	monitor	BC-117									
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	3	'BC18Aa'	'BFA010A'	1485	4.7	42	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*****slow	response	basin	tributary	to	flow	monitor	BC-117	(infiltration)						
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	3	'BC18-s'	'BFA010A'	5	4.7	42	0.02	0.013	0.045	0.06	0.1	1	0.1	0.00115
*****slow	response	basin	tributary	to	flow	monitor	BC-118							
H1	1	'-1'	'adjust'	0.1	0.5	1	1	1	1	1	1	1	1	1

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
H1	3	'BC7e-s'	'BC95B5'	1260	20.36	41	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
*****basins	tributary	to	flow	monitor	BC-120	(inflow	to	sanitary	basin)					
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	3	'BC41x'	'BND0005'	111	26.47	27	0.02	0.013	0.045	0.06	0.1	6	0.1	0.00115
H1	3	'BC41g'	'BN00295'	301	40.67	27	0.02	0.013	0.045	0.06	0.1	6	0.1	0.00115
*****slow	response	basin	tributary	to	flow	monitor	BC-120	(infiltration	to	sanitary	basin)			
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	3	'120slw'	'BND0005'	5	71.72	27	0.02	0.013	0.045	0	0	1	0.1	0.00115
*****basins	tributary	to	flow	monitor	BC-121	(inflow	to	sanitary	basin)					
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	3	'BC41e2'	'BN00285'	182	60.89	8	0.02	0.013	0.045	0.06	0.1	6	0.1	0.00115
*****slow	response	basin	tributary	to	flow	monitor	BC-121	(infiltration	to	sanitary	basin)			
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	3	'121slw'	'BN00285'	5	60.89	8	0.02	0.013	0.045	0	0	1	0.1	0.00115
*****basins	tributary	to	flow	monitor	BC-122	(inflow	and	infiltration	to	sanitary	basin)			
H1	1	'-1'	'adjust'	0.005	1	1	1	1	1	1	1	1	1	1
H1	2	'BC7aa'	'BE00115'	680	9.74	41	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	2	'BC25c'	'BC18AD'	1640	7.63	36	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
*****basins	tributary	to	flow	monitor	BC-123									
H1	1	'-1'	'adjust'	1	1	0.8	1	1	1	1	1	1	1	1
H1	3	'BC7b'	'BC20H1'	2280	9.92	36	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	3	'BC7c'	'BC94C'	3730	27.65	40	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	3	'BC7d'	'BC95B1'	2520	7.21	41	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	3	'BC7f'	'BC95C1'	2100	8.63	28	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	3	'BC7g'	'BC95A2'	3000	16.44	33	0.04	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	3	'BC7i'	'BC94B'	2465	15.78	37	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	3	'BCintl'	'BC20G'	5100	38.17	46	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	3	'BC125a'	'BC20F4'	6640	41.04	36	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	3	'BC95a'	'BC95A'	2000	10.27	45	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	3	'BC94a'	'BC94A'	1900	8.49	48	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	3	'BCintg'	'BF00095'	1940	6.38	49	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	3	'BC19a'	'BC19'	3160	7.19	51	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	3	'BC20a'	'BC98A'	2250	8.57	31	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	3	'BC92a'	'BC92'	1360	2.72	55	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	3	'BC96a'	'BC92C'	680	1.55	57	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	3	'BC98a'	'BC975'	700	1.43	60	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	3	'BC100a'	'BC100'	1540	6.72	38	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	3	'BC93a'	'BC93'	1860	6.45	35	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	2	'BCInta'	'BC93E'	1775	22	40	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	2	'BC7a'	'BC18AC'	680	22	41	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	3	'BC7e'	'BC95B4'	1260	20.36	41	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
*****basins	tributary	to	flow	monitor	BC-126									
H1	1	'-1'	'adjust'	1.3	1	1.2	1	1	1	1	1	1	1	1
H1	3	'BC37a'	'BKA0005'	4560	40.37	37	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	2	'BC37b'	'BK00015'	50	0.66	29	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	3	'BC37c'	'BKA0017'	4280	47.55	36	0.04	0.013	0.045	0.06	0.1	3	0.1	0.00115

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
H1	3	'BC37d'	'BK00060'	4860	38.46	39	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	3	'BC37e'	'BK00070'	5360	54.12	35	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	2	'BC37f'	'BK00020'	4100	10.12	35	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
*****slow	response	basin	tributary	to	flow	monitor	BC-126	(infiltration)						
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	3	'BC37x'	'BK00020'	40	191.28	37	0.03	0.013	0.045	0.06	0.1	0.1	0.1	0.00115
*****basins	tributary	to	flow	monitor	BC-127									
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	2	'BC30o'	'BK00010'	1850	16.71	4	0.15	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	2	'BC38a'	'BC38'	3700	11.6	35	0.01	0.013	0.045	0.06	0.1	5	0.25	0.00115
*****slow	response	basin	tributary	to	flow	monitor	BC-127	(infiltration)						
H1	1	'-1'	'adjust'	0.5	0.5	1	1	1	1	1	1	1	1	1
H1	2	'BC127x'	'BK00010'	5550	28.31	4	0.15	0.013	0.045	0.06	0.1	5	0.25	0.00115
*****basins	tributary	to	flow	monitor	BC-128									
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	2	'BC39a'	'BC40E'	335	2.32	23	0.08	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	2	'BC39b'	'BC40C'	845	19.18	32	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	2	'BC40a'	'BMA0020'	2015	39.63	37	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	2	'BC40b'	'BM00015'	1500	40.7	40	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
*****basins	tributary	to	flow	monitor	BC-129									
H1	1	'-1'	'adjust'	1	1	0.3	1	1	1	1	1	1	1	1
H1	2	'BC30p'	'BL00015'	990	3.88	24	0.09	0.013	0.045	0.06	0.1	5	0.25	0.00115
*****slow	response	basin	tributary	to	flow	monitor	BC-129	(infiltration)						
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	2	'BC39x'	'BL00023'	1	105.71	5	0.15	0.013	0.045	0.06	0.1	5	0.25	0.00115
*****basins	tributary	to	flow	monitor	BC-131	(inflow	and	infiltration	to	sanitary	basin)			
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	3	'BC41f'	'BN00070'	1410	46.08	1	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	3	'BC41j'	'BN00080'	2520	27.79	1	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	3	'BC41p'	'BN00115'	2820	120.34	1	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	3	'BC41q'	'BN00130'	5350	37.98	1	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	3	'BC41r'	'BN00145'	3230	45.63	1	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
*****basins	tributary	to	flow	monitor	BC-132	(inflow	and	infiltration	to	sanitary	basin)			
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	3	'BC41k'	'BN00097'	10	41.74	22	0.01	0.013	0.045	0.06	0.1	6	0.1	0.00115
*****basins	tributary	to	flow	monitor	BC-132i	(inflow	to	sanitary	basin)					
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	3	'BC41s'	'BNC0030'	150	28.08	27	0.02	0.013	0.045	0.06	0.1	6	0.1	0.00115
H1	3	'BC41t'	'BN00155'	3825	19.1	27	0.01	0.013	0.045	0.06	0.1	6	0.1	0.00115
H1	3	'BC41u'	'BNC0010'	275	61.44	27	0.02	0.013	0.045	0.06	0.1	6	0.1	0.00115
H1	3	'BC41v'	'BNB0003'	187	67.4	27	0.02	0.013	0.045	0.06	0.1	6	0.1	0.00115
H1	3	'BC41w'	'BN00200'	485	45.32	27	0.02	0.013	0.045	0.06	0.1	6	0.1	0.00115
H1	3	'BC41z'	'BN00275'	2300	8.3	27	0.01	0.013	0.045	0.06	0.1	6	0.1	0.00115
*****slow	response	basin	tributary	to	flow	monitor	BC-132i	(infiltration	to	sanitary	basin)			
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	3	'132islw'	'BNC0030'	5	229.64	27	0.02	0.013	0.045	0	0	1	0.1	0.00115

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
*****basins	tributary	to	flow	monitor	BC-133	(inflow	and	infiltration	to	sanitary	basin)			
H1	1	'-1'	'adjust'	1	1	2	1	1	1	1	1	1	1	1
H1	3	'BC41l'	'BNA0065'	4	21.15	8	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	3	'BC41b'	'BNA0025'	4	90.29	8	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	3	'BC41d'	'BNA0060'	6	12.45	8	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*****basins	tributary	to	flow	monitor	BC-134	(inflow	and	infiltration	to	sanitary	basin)			
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	3	'BC41m'	'BNA0075'	3	28.31	8	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	3	'BC41n'	'BNA0075'	1	52	8	0.04	0.013	0.045	0.06	0.1	3	0.1	0.00115
*****basins	tributary	to	flow	monitor	BC-164	(storm	basins	un-regulated	to	outfall	54)			
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	2	'BC164st'	'BC41B'	6000	53	50	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
*****basins	tributary	to	flow	monitor	BC-163	(inflow	and	infiltration	to	sanitary	basin)			
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	3	'BC41h'	'BN00035'	5	58.4	55	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	3	'BC41i'	'BNA0010'	6	41.9	55	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	2	'BC41a'	'BN00015'	4	32.04	55	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	2	'BC41aa'	'BC41'	5	1.51	55	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
*****basins	tributary	to	outfall	50										
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	2	'BC25b'	'BC28A'	1920	17.25	43	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	2	'BC25d'	'BC28'	1845	8.24	41	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
*****basins	tributary	to	outfall	51										
H1	1	'-1'	'adjust'	1	1	1.4	1	1	1	1	1	1	1	1
H1	2	'BCInta1'	'BC30B'	1775	18	40	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
*****basins	tributary	to	outfall	53										
*H1	2	'STM16'	'BC37b'	990	3.56	8	0.083	0.013	0.045	0.06	0.1	8	0.5	0.00115
*****basins	tributary	to	outfall	49										
H1	2	'BC25a'	'BE00010'	2000	11.69	37	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	2	'BCIntb'	'BC25A'	2230	14.17	36	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
*****basins	tributary	to	outfall	59										
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	3	'BC18a'	'BC18'	1900	10.22	28	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*EXTRAS	AS	OF	06/16/2001											
*Direct														
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	2	'BC41a'	'BC41B'	3670	32.04	42	0.0204	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	2	'BC41aa'	'BC41A'	590	1.51	38	0.0225	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	2	'BC30a'	'BC41B'	600	1.08	60	0.0145	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	9	'BCintj'	'BA00019'	5760	30.21	23	0.0464	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'BC16Ab'	'BC18I'	4980	51.6	41	0.0268	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	2	'BC25c'	'BC30B'	1640	7.63	36	0.029	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	3	'BC41h'	'BC41B'	4640	58.4	37	0.0282	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'Jenningsl'	'JEN0035'	1110	75.77	18	0.137	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	'BC16Aba'	'BC16A'	4980	6.65	41	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'BC41o'	'BC91A'	760	25.34	27	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
H1	3	'BC41ta'	'BN00155'	3825	7.73	27	0.01	0.013	0.045	0.06	0.1	6	0.1	0.00115
H1	7	'Jenningsfc'	'BBB045B'	1890	13.39	41	0.0426	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'Jenningsfb'	'BBB080A'	1890	8.8	41	0.0426	0.013	0.045	0.06	0.1	3	0.1	0.00115
*RDII														
H1	1	'-1'	'adjust'	0.01	1	0.1	1	1	1	1	1	1	1	1
H1	2	'BCintk'	'BF00010'	2200	16.49	49	0.0165	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	2	'BCintm'	'BFA0010'	4040	12.6	56	0.0181	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	2	'BCinta'	'BA00140'	3550	39.85	40	0.0262	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	3	'BCintg'	'BC20A1'	1940	6.38	49	0.0274	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	2	'BC30a'	'BA00207'	600	1.08	60	0.0145	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	'BC16Ab'	'BC16A'	4980	51.6	41	0.0268	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	2	'BC25c'	'BE00110'	1640	7.63	36	0.029	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	2	'BCIntb'	'BE00005'	2230	14.17	36	0.0334	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	1	'BCinte'	'BA00040'	1850	105.61	34	0.0415	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	1	'BCinth'	'BA00029'	6200	44.24	51	0.156	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	'BCinti'	'BA00036'	6860	77.08	40	0.0475	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'Jenningsk'	'JEN0010'	1210	14.07	34	0.1086	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	2	'STM16'	'BC39A'	990	3.56	8	0.0826	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	'BC16Aba'	'BC16A'	4980	6.65	41	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'BC16Abb'	'BC16A'	4980	12.04	41	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'BC41o'	'BN00350'	760	25.34	27	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'BCIntd'	'BA00040'	1220	27.03	32	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
H1	1	-1	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	13	'SO8a'	'KG06010'	1000	54.84	43	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	13	'SO8b'	'KG01015'	5400	20.47	41	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	13	'SO8e'	'KG05010'	8960	42.34	33	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	13	'SO8f'	'SAI1270'	10580	365.65	14	0.04	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	13	'SO8g'	'SAI1225'	1750	121.48	33	0.1	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	13	'SO8h'	'SAI1260'	6000	158.09	33	0.05	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	13	'S45Aa'	'SH00015'	1500	32	33	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	13	'S45Ab'	'SH00020'	18000	221.39	40	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	13	'S45Ac'	'SH00020'	5030	169.73	13	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	13	'SN100b'	'SAF4040'	1960	54.13	36	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	13	'SN100c'	'SAF3010'	3520	44.93	38	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	13	'SN100d'	'SAF4070'	3570	50.96	37	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	12	'SN100e'	'SAF0090'	1350	49.24	37	0.17	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	13	'SN101a'	'SAF5025'	3830	20.18	38	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	13	'SN100a'	'KG03015'	1800	20.49	33	0.05	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'SN102a'	'SAE0050'	2720	20.53	35	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	12	'SN06a'	'SAF0055'	3200	37.18	38	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	12	'SN06b'	'SAF0020'	2610	34.78	35	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	12	'SN06c'	'SAF1015'	2830	32.33	40	0.08	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	12	'S45a'	'S450001'	1370	13.23	35	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	12	'S46a'	'S460001'	1020	8.93	42	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	12	'SN06d'	'SAH0015'	2610	49.43	35	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	12	'SN06e'	'SAG0010'	2090	42.43	41	0.07	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	12	'SN06f'	'SAG0030'	4560	32.89	38	0.04	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	12	'SN103a'	'SAE0015'	3120	33.96	40	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	12	'S44a'	'SAI0115'	1210	4.87	41	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
*	METER	SO-150												
*H1	1	-1	'adjust'	1	0.75	1.43								
H1	1	-1	'adjust'	1	1	1.07	1	1	1	1	1	1	1	1
H1	13	'SO8a'	'KG06010'	1000	54.84	43	0.006	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	13	'SO8b'	'KG01015'	5400	20.47	41	0.002	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	13	'SO8e'	'KG05010'	4960	42.34	33	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	13	'SN101a'	'SAF5025'	3830	45.51	38	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'SN102a'	'SAE0050'	2720	20.53	35	0.01	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	1	-1	'adjust'	1	0.25	1.43	1	1	1	1	1	1	1	1
*H1	13	'DS0150a'	'SAI1290'	179.1	158.31	37	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	-1	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	13	'DS0150a'	'SAI1290'	5	158.31	15	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
*														
*														
*UPSTREAM	OF	S45A												
*	AREA	SPLIT	IN	HALF	TO	REDUCE	SURFACE	FLOODING						
H1	1	-1	'adjust'	1	0.75	1	1	1	0.8	0.8	1	1	1	1
H1	13	'SO8f1'	'SAI1270'	2790	182.825	35	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	13	'SO8f2'	'SAI1280'	2790	182.825	35	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
*														
H1	13	'SO8g'	'SAI1225'	1750	121.48	33	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	13	'SO8h'	'SAI1260'	6000	158.09	33	0.025	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	13	'S45Aa'	'SH00015'	1500	32	40	0.01	0.013	0.045	0.05	0.1	3	0.1	0.00115
H1	13	'S45Ab'	'SH00020'	2250	221.39	34	0.01	0.013	0.045	0.05	0.1	3	0.1	0.00115
*H1	1	-1	'adjust'	1	0.25	1	1	1	1	1	1	1	1	1
*H1	13	'DS0150b'	'SAI1290'	170.8	898.61	37	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	-1	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	13	'DS0150b'	'SAI1290'	20	645.22	15	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	13	'DS0150c'	'SH00020'	10	253.39	15	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
*														
*	METER	SO-159	CALIBRATED											
H1	1	-1	'adjust'	1	1	1.1	1	1	1	1	1	1	1	1
H1	13	'SN100b'	'SAF4040'	1960	54.13	36	0.015	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	13	'SN100c'	'SAF3010'	3520	44.93	38	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	13	'SN100d'	'SAF4070'	3570	50.96	37	0.018	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'SN100e'	'SAF0090'	1350	49.24	37	0.015	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	13	'SN100a'	'KG03015'	1800	20.49	33	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'SN06a'	'SAF0055'	3200	37.18	38	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'SN06b'	'SAF0020'	2610	34.78	35	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'SN06c'	'SAF1015'	2830	32.33	40	0.015	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	1	-1	'adjust'	1	0.25	1.35	1	1	1	1	1	1	1	1
*H1	12	'DSO159'	'SAF1015'	180	324.04	36	0.08	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	1	-1	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	12	'DSO159'	'SAF1015'	10	324.04	10	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
*														
*														
*	METER	SO-155D												
H1	1	-1	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	12	'S45a'	'S450001'	1370	13.23	35	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S46a'	'S460001'	1020	8.93	42	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'SN06d'	'SAH0015'	2610	49.43	35	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'SN06e'	'SAG0010'	2090	42.43	41	0.01	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'SN06f'	'SAG0030'	4560	32.89	38	0.01	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'SN103a'	'SAE0015'	3120	33.96	40	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S44a'	'S440001'	1210	4.87	41	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	1	-1	'adjust'	1	0.25	1.25	1	1	1	1	1	1	1	1
*H1	12	'DSO155D'	'SAH0015'	123.8	158.7	37	0.02	0.013	0.045	0.12	0.1	5	0.25	0.00115
H1	1	-1	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	12	'DSO155D'	'SAH0015'	10	158.7	15	0.02	0.013	0.045	0.12	0.1	5	0.25	0.00115
H1	12	'S44a'	'S440001'	12.1	4.87	41	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S45a'	'S450001'	13.7	13.23	35	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S46a'	'S460001'	10.2	8.93	42	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
*														
*	METER	SO-149												
*H1	1	-1	'adjust'	1	0.75	1.31	1	1	0.75	1	1	1	1	1

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
*H1	12	'S47a'	'SBD8025'	680	14.25	33	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	-1	'adjust'	1	1	1.05	1	1	0.75	1	1	1	1	1
H1	12	'S47a'	'SBD8025'	680	14.25	33	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	1	-1	'adjust'	1	0.25	1.31	1	1	0.75	1	1	1	1	1
*H1	12	'DSO149'	'SBD8025'	6.8	14.25	33	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	-1	'adjust'	1	1	1	1	1	0.75	1	1	1	1	1
H1	12	'S47x'	'SBD8025'	2	14.25	10	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*														
*	METER	SO-147												
*H1	1	-1	'adjust'	1	0.75	1.36	1	1	1	1	1	1	1	1
*H1	12	'S48a'	'SBD0305'	3000	59.38	34	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	12	'S48b'	'SBD0330'	2550	36.78	37	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	13	'S48c'	'SBD0350'	2970	47.44	37	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	13	'S48d'	'SBD0380'	3510	44.88	35	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	-1	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	12	'S48a'	'SBD0305'	3250	59.38	34	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S48b'	'SBD0330'	2900	36.78	37	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	13	'S48c'	'SBD0350'	3300	47.44	37	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	13	'S48d'	'SBD0380'	3900	44.88	35	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	1	-1	'adjust'	1	0.25	1.36	1	1	1	1	1	1	1	1
*H1	12	'DSO147'	'SBD0315'	133.5	188.48	36	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	1	-1	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	12	'DSO147'	'SBD0315'	10	188.48	15	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
*														
*	METER	SO-154												
H1	1	-1	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	12	'S47b'	'SBD8010'	500	8.1	39	0.04	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	1	-1	'adjust'	1	0.25	1	1	1	1	1	1	1	1	1
*H1	12	'DSO154'	'SBD8010'	5	8.1	39	0.04	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	-1	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	12	'DSO154'	'SBD8010'	2	8.1	10	0.04	0.013	0.045	0.06	0.1	3	0.1	0.00115
*														
*	METER	SO-146,	SO-145											
*H1	1	-1	'adjust'	1	0.75	1	1	1	1	1	1	1.67	2.5	1
*H1	12	'S49a'	'SBD0235'	1870	27.02	39	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'S49b'	'SBD0230'	1400	32.48	36	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'S49c'	'SBD0265'	1700	40.23	39	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'S49d'	'SBD0225'	5760	17.02	39	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	-1	'adjust'	1	1	0.75	1	1	1	1	1	1.67	2.5	1
H1	12	'S49a'	'SBD0235'	1870	27.02	39	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'S49b'	'SBD0230'	1400	32.48	36	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'S49c'	'SBD0265'	1700	40.23	39	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'S49d'	'SBD0225'	5760	17.02	39	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	1	-1	'adjust'	1	1	0.095	1	1	1	1	1	1	1	1
*H1	12	'DSO145'	'SBD0225'	107.3	116.75	38	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	-1	'adjust'	1	1	1	1	1	1	1	1	1	1	1

*	JK	NAMEW		NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
H1	12	'DSO145'		'SBD0230'	20	116.75	15	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
*															
*	METER	SO-153I													
H1	1		-1	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	12	'STM11'		'SAI0085'	2730	16.57	22	0.08	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	12	'S50a'		'S49C'	2410	7.9	39	0.04	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'STM11'		'SAI0085'	2730	16.57	22	0.08	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S50a'		'S49C'	2410	7.9	39	0.025	0.013	0.045	0.06	0.1	5	0.25	0.00115
*															
*	slow	response		basins	not	needed	for	this	area						
*H1	12	'SO6b'		'SAB5055'	700	53.39	38	0.013	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'SO7a'		'S30A'	2200	51.76	38	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'DS28'		'SAB4213'	81.3	24.54	33	0.06	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	12	'DSO3'		'SAB4110'	400	100	33	0.06	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	12	'DS4'		'SAD3015'	41	80.94	30	0.07	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	12	'DSO6'		'SAB5055'	100	100	30	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'DS25'		'SAB4440'	10	13.2	30	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'DS34'		'SAB4435'	10	13.2	30	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'DS33'		'SAB4430'	10	13.2	30	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'DS32'		'SAB4425'	10	13.2	30	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'DS31'		'SAB4420'	10	13.2	30	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'DS151'		'SAB4005'	38	64	33	0.06	0.013	0.045	0.06	0.1	5	0.25	0.00115
*															
*	METER	SO-152,		SO-151											
H1	1		-1	'adjust'	1	1	0.8	1	1	1	1	1	1	1	1
H1	12	'S30a'		'SAB4340'	2400	12.89	21	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S29a'		'SAB4260'	2300	6.24	33	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S41a'		'SAB7005'	2350	19.61	24	0.07	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S42a1'		'SAB0225'	595	8.4	33	0.035	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S42a2'		'SAB0230'	595	8.41	33	0.035	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S43a'		'SAB0250'	1640	6.24	33	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'SO6b'		'S30A'	700	53.39	22	0.013	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'SO7a'		'S30A'	1100	51.76	22	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'S30a1'		'SAB4440'	1000	13.2	33	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'S30a2'		'SAB4435'	1000	13.2	33	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'S30a3'		'SAB4430'	1000	13.2	33	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'S30a4'		'SAB4425'	1000	13.2	33	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'S30a5'		'SAB4420'	1000	13.2	33	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'SO6a1'		'SAB5040'	1385	23.41	32	0.0309	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'SO6a2'		'SAB5060'	1385	23.41	32	0.0309	0.013	0.045	0.06	0.1	5	0.25	0.00115
*															
*	DRY	WEATHER		METER	SO-135,	WET	WEATHER	TO	METER	KR-46					
*H1	1		-1	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	12	'SO3a'		'SAB4180'	6950	31.58	33	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'SO3b'		'SAB4110'	5040	59.4	33	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'SO3c'		'S29D'	3170	5.92	40	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
H1	12	'S28a'	'SAB4213'	5730	24.54	33	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
*														
*	METER	SO-132												
H1	1	-1	'adjust'	1	1	1	1	1	1.15	1.15	1.15	1.15	1.15	1
H1	12	'S4a'	'SAD0030'	1410	41.72	33	0.014	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S4b'	'SAD3015'	2110	40.94	33	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
*														
*	METERED	OUTSIDE	AREA											
H1	1	-1	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	12	'S38a'	'SAD0015'	830	1.65	33	0.05	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S14a1'	'SAB0140'	1700	25.16	33	0.06	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S14a2'	'KEC0026'	1700	37	33	0.06	0.013	0.045	0.06	0.1	5	0.25	0.00115
*														
*	FROM	SO177	ADDED	IN	TO	EXISTING	FILE							
*H1	10	'S10a'	'SAA1030'	1750	17.28	40	0.04	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'S10b'	'SAA1185'	2700	50.54	34	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'S10c'	'SAA1180'	2700	39.02	42	0.05	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	7	'S10d'	'SAA1235'	3060	21.56	33	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'S10e'	'SAA1325'	2340	37.83	33	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'S10f'	'SAA1400'	3380	34.82	37	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'S10g'	'SAA1435'	3550	56.76	37	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'S10h'	'SAA1087'	3370	50.98	41	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'S10i'	'SAA1650'	4300	42.3	32	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'S10j'	'SAA1120'	880	25.65	48	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'S10k'	'SAA1683'	3460	56.06	26	0.05	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	10	'S10l'	'SAA1610'	5020	57.74	43	0.05	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'S9a'	'SAN0120'	3880	33.56	32	0.04	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	12	'S9b'	'SA00157'	2880	42.72	43	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'S9c'	'SAM0015'	2760	21.01	56	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'S9d'	'SA00170'	5760	72.09	31	0.09	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'S9e'	'SAN0055'	5030	67.8	34	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	12	'S9f'	'SAN2030'	1410	3.69	15	0.04	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'S6a'	'SAP1105'	2090	13.26	52	0.06	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'S7a'	'KAC1010'	990	14.35	34	0.05	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'S8a'	'SAK2030'	920	26.03	58	0.04	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'S8b'	'SAK2010'	820	3.64	35	0.11	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'S9g'	'SA00157'	1210	12.68	63	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	8	'S81a'	'KD01020	2390	8.96	35	0.08	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	8	'S82a'	'SD00030	2720	92.73	10	0.14	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	8	'S52a'	'SAP2017	1890	17.08	54	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	8	'S80a'	'S52D'	2190	25.78	16	0.07	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	12	'S18a'	'SAA0130'	850	4.99	26	0.06	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	10	'SO5a'	'SAA0145'	2300	50.62	34	0.04	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'SO5b'	'SAA0170'	4400	40.93	36	0.05	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'SO5c'	'SAA0210'	1530	30.67	24	0.07	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'SO5e'	'SAA0230'	1580	38.76	38	0.06	0.013	0.045	0.06	0.1	5	0.25	0.00115

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
*H1	12	'STM21'	'KE00110'	4360	26.34	8	0.07	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'DSO130''SA00157'	1210	12.68	63	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115	
*H1	7	'S82a'	'SD00030'	2720	92.73	2.5	0.14	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'DSO133''SAA1610'	3650	320	20	0.05	0.013	0.045	0.06	0.1	3	0.1	0.00115	
*														
*	METER	SO133,	SO133A											
H1	1	-1	'ADJUST'	1	1	1	1	1	1	1	1	1.2	1.2	1
H1	10	'S10a'	'SAA1030'	1750	17.28	40	0.026	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'S10b'	'SAA1185'	2700	50.54	37	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'S10c'	'SAA1180'	2700	39.02	42	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'S10d'	'SAA1235'	3060	21.56	34	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'S10e'	'SAA1325'	2340	37.83	34	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'S10f'	'SAA1400'	3380	34.82	37	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'S10g'	'SAA1435'	3550	56.76	37	0.003	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'S10h'	'SAA1087'	3370	50.98	41	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'S10i'	'SAA1650'	4300	42.3	35	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'S10j'	'SAA1120'	880	25.65	48	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'S10k'	'SAA1683'	3460	56.06	28	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'S10l1'	'SAA1610'	2560	28.87	43	0.013	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	10	'S10l2'	'SAA1630'	2560	28.87	43	0.013	0.013	0.045	0.06	0.1	3	0.1	0.00115
*														
*	METER	SO131												
H1	1	-1	'ADJUST'	1	1	1	1	1	1	1	1	1	1	1
H1	12	'S9f'	'SAN2030'	2410	3.69	25	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'S9c'	'SAM0015'	4760	21.01	56	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'S9d'	'SA00170'	8760	72.09	43	0.013	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'S9e'	'SAN0055'	8030	67.8	43	0.01	0.013	0.045	0.04	0.1	5	0.25	0.00115
H1	12	S9a'	'SAN0120'	6880	33.56	43	0.04	0.013	0.045	0.04	0.1	5	0.25	0.00115
*														
*	METER	SO130												
H1	1	-1	'ADJUST'	1	1	1	1	1	1	1	1	1	1	1
H1	12	'S6a'	'SAP1105'	2090	13.26	52	0.015	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'S7a'	'KAC1010'	990	14.35	34	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'S8a'	'SAK2030'	920	26.03	58	0.011	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'S8b'	'SAK2010'	820	3.64	35	0.08	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'S9g'	'SA00157'	1210	12.68	63	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'S9b'	'SA00157'	2880	42.72	43	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*														
*	METER	SO125												
H1	1	-1	'ADJUST'	1	1	1	1	1	1	1	1	1	1	1
H1	7	'S81a'	'KD01020'	2390	8.96	30	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'S52a'	'SAP2017'	1890	17.08	30	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	-1	'ADJUST'	0.1	1	1	1	1	1	1	1	1	1	1
H1	7	'S80a'	'S52D'	2190	25.78	12	0.07	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	-1	'ADJUST'	1	1	1	1	1	1	1	1	1	1	1
H1	12	'S18a'	'SAA0130'	850	4.99	26	0.06	0.013	0.045	0.06	0.1	5	0.25	0.00115

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
H1	10	'SO5a'	'SAA0145'	2300	50.62	34	0.037	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'SO5b'	'SAA0170'	4400	40.93	36	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'SO5c'	'SAA0210'	1530	30.67	24	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'SO5e'	'SAA0230'	1580	38.76	38	0.04	0.013	0.045	0.06	0.1	5	0.25	0.00115
*														
*	METER	KR46												
H1	1	-1	'ADJUST'	1	1	1	1	1	1	1	1	1	1	1
H1	12	'STM21a'	'KE00105'	560	6.59	8	0.07	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'STM21b'	'KE00090'	560	19.75	8	0.07	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'STM24'	'S15A'	350	3.09	37	0.09	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'STM25'	'S11A'	700	2.76	51	0.1	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	10	'040a1'	'KA00017'	850	18.08	38	0.13	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'040a2'	'KA00030'	5000	46.75	38	0.13	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'040b'	'KA00080'	9000	125.46	38	0.13	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'040c'	'KE00050'	4000	104.2	38	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'040d'	'KE00050'	2600	21.28	38	0.08	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'040e'	'KA01033'	4200	41.64	38	0.13	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'040f'	'KA01055'	4600	37.63	38	0.11	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'040g'	KD00015'	3000	18.18	38	0.18	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	split	S82a	to	more	accurately	model	storm	flow	to	sewers				
H1	7	'S82a1'	'SD00045'	100	13.21	4	0.04	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'S82a2'	'KA00010'	2720	77.13	15	0.04	0.013	0.045	0.06	0.1	3	0.1	0.00115
*														
*	METER	SO177												
H1	1	-1	'ADJUST'	1	1	1	1	1	1	1	1	1	1	1
H1	10	'S12a'	'S120001'	1300	4.87	19	0.09	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	12	'S14b'	'SAB0100'	6400	44	42	0.04	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S14c'	'SAB0035'	4100	49.73	36	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S14e1'	'SAL1015'	2080	10.01	27	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S14e2'	'SAL1025'	2080	10.02	27	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
*	Basin	S14e	split	into	two	parts	in	order	to	better	represent	flows	to	regulator
H1	12	'S21a'	'S20AB'	670	11.29	55	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	10	'S11a'	'SAB9025'	2800	26.67	35	0.03	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	10	'S11b'	'SAB9050'	4840	35.79	58	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
**	SPLIT	UP	BASIN	S20a	BECAUSE	OF	BLOCKED	OVERFLOW	AT	E.75TH	AND	DELL		
H1	12	'S20a1'	'SAL3025'	750	5	29	0.04	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S20a2'	'SAL0045'	5450	53.34	29	0.04	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S20Aa'	'SAL0102'	2025	28.01	26	0.012	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S20Ab'	'SAL7005'	5400	41.93	32	0.015	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S20Ac'	'SAL8010'	2850	34.36	22	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S20Ad1'	'SAL0132'	650	24.81	8	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S20Ad2'	'KD00045'	1320	25.63	8	0.02	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S20Ae'	'SAL0150'	1880	53.19	24	0.11	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	10	'SOintg'	'SAB9110'	910	3.65	36	0.04	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'S5a'	'SAP1075'	1540	5.55	63	0.21	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'S3a'	'SAP2028'	2340	15.07	44	0.07	0.013	0.045	0.06	0.1	8	0.5	0.00115

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
H1	10	'S04a'	'S03D'	882	4.71	80	0.05	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	10	'S5b'	'SAP1080'	900	3.89	80	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
*														
*														
*Initial	slow	response	basin	to	meter	SO-177,	based	on	areas	tributary	to	meters	SO-131,	SO-130,
*need	to	split	into	areas	to	each	of	these	meters					
*H1	10	'SOintx'	'SA00085'	20	1011.54	5	0.07	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	10	'SOintx'	'SA00086'	50	1011.54	5	0.07	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	10	'SOintx'	'SA00087'	100	1011.54	5	0.07	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	10	'SOintx'	'SA00088'	500	1011.54	5	0.07	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	10	'SOintx'	'SA00089'	2000	1011.54	5	0.07	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	10	'SOintx'	'SA00090'	20	1011.54	10	0.07	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	10	'SOintx'	'SA00091'	50	1011.54	10	0.07	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	10	'SOintx'	'SA00092'	100	1011.54	10	0.07	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	10	'SOintx'	'SA00093'	500	1011.54	10	0.07	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	10	'SOintx'	'SA00094'	2000	1011.54	10	0.07	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	10	'SOintx'	'SA00095'	5000	1011.54	5	0.07	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	10	'SOintx'	'SA00096'	5000	1011.54	10	0.07	0.013	0.045	0.06	0.1	5	0.25	0.00115
*														
*														
*														
**														
***	Morgana	Run	and	Burke	Brook	Area	***							
**														
*														
*														
*														
*														
*														
**************************														
***	Dille_ps	Submodel	***											
**************************														
*														
**	Meter	SO124(COMB)												
*H1	8	'S83a'	'SC00095'	1060	45.6	45	0.0573	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	8	'S83b'	'SC00105'	1500	39.21	23	0.1221	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	7	'S83c'	'SC00135'	2510	13.77	29	0.1641	0.013	0.045	0.06	0.1	3	0.1	0.00115
**	Meter	SO125(COMB)												
*H1	8	'S80a'	'S52D'	2190	25.78	16	0.0691	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	8	'S81a'	'KD01020'	2390	8.96	35	0.0789	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	8	'S82a'	'SD00030'	2720	92.73	10	0.1356	0.013	0.045	0.06	0.1	3	0.1	0.00115
**	Meter	SO126(COMB)												
*H1	8	'DILLEa'	'SC00072'	2430	30.42	55	0.0979	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	8	'DILLEb'	'SD00010'	1320	31.71	25	0.105	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	8	'DILLEc'	'SC00080'	2040	11.12	62	0.0568	0.013	0.045	0.06	0.1	3	0.1	0.00115
**														

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
*	Meter	SO124(COMB)												
H1	1	'-1'	'adjust'	0.1	1	0.1	1	1	1	1	1	2	1	1
H1	7	'S83a'	'SC00095'	1060	45.6	45	0.05	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'S83b'	'SC00105'	1500	39.21	23	0.04	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'S83c'	'SC00135'	2510	13.77	29	0.09	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Basin	for	delayed	RDII										
H1	7	'S83X'	'SC00095'	50	98.58	3	0.005	0.025	0.045	0.1	1	0.1	0.1	0.00115
*														
*	Meter	SO125(COMB)												
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	8	'S80a'	'S52D'	2190	25.78	16	0.0691	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	8	'S81a'	'KD01020'	2390	8.96	35	0.0789	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	8	'S82a'	'SD00030'	2720	92.73	10	0.1356	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Meter	SO126(COMB)												
H1	1	'-1'	'adjust'	0.1	1	0.1	1	1	1	1	1	2	1	1
H1	7	'DILLEa'	'SC00072'	2430	30.42	55	0.06	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'DILLEb'	'SD00010'	1320	31.71	25	0.07	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'DILLEc'	'SC00080'	2040	11.12	62	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
*														
*	NOTE:	Rainfall	for	basins	S83a,	S83b,	DILLEa,	DILLEb,	DILLEc	changed	from	meter	#8	to
*	NOTE:	Basins	S83a,	S83b,	S83c,	DILLEa,	DILLEb,	DILLEc	are	heavy	industry	near	the	Cuyahoga
*	they	behave	more	like	a	separate	sewered	area.	It	looks	like	there	must	be
*														
*														
*														
*														
************************														
***	BB_east	Submodel	***											
************************														
**	Meter	SO141	(COMB-DWO)	/	SO142	(COMB-INFLUENT)								
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	10	'S64a'	'SBE0105'	2820	22.88	42	0.0441	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'S64b'	'SBE2020'	2200	16.99	38	0.0435	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	10	'S64d'	'SBE0130'	2200	15	38	0.0435	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	10	'S65a'	'SBE3015'	6920	34.29	37	0.0454	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'S65b'	'SBE3405'	4480	52.95	30	0.0408	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'S65c'	'SBE3035'	8800	53.8	49	0.0365	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'S67a'	'SBE3350'	4320	51.49	33	0.041	0.013	0.045	0.06	0.1	3	0.1	0.00115
**														
**	Meter	SO143	(COMB)	(meter	SO144	is	upstream)							
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	10	'S66a'	'SBE0150'	780	3.51	32	0.0756	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'S64c'	'SBE0140'	330	3.77	33	0.0487	0.013	0.045	0.06	0.1	3	0.1	0.00115
**														
**	Meter	SO139	(COMB)											

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	10	'S60a'	'SBG0015'	3460	43.55	43	0.1049	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	10	'S60b'	'SS12'	1900	33.93	52	0.0401	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'S60c'	'SB00185'	800	39.03	34	0.0402	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'S60d'	'SBG0050'	2060	37.7	38	0.1065	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'SS15a'	'SB00192'	920	6.96	34	0.0402	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	10	'SS15b'	'SB00200'	2660	23.45	29	0.0447	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'S69a'	'SBG3015'	1500	18.4	31	0.1874	0.013	0.045	0.06	0.1	5	0.25	0.00115
**														
**	Meter	SO139	or	SO111	(depending	on	configuration	of	reg	S-70)				
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	10	'S70a'	'SBG0090'	2660	24.82	39	0.0845	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	9	'S70b'	'SBG0130'	3110	33.84	38	0.0488	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	9	'S71a'	'SAT0240'	1980	32.34	38	0.0445	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	9	'S71b'	'SAT0287'	2190	31.27	38	0.0283	0.013	0.045	0.06	0.1	5	0.25	0.00115
**														
**	Meter	SO116	(COMB)											
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	9	'S72b'	'SAT0205'	2700	43.69	42	0.0197	0.013	0.045	0.06	0.1	5	0.25	0.00115
**														
**	Meter	SO115	(COMB)											
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	9	'S72a'	'SAT0192'	1000	24.58	49	0.0328	0.013	0.045	0.06	0.1	3	0.1	0.00115
**														
**	Meter	SO109	(COMB)											
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	9	'S73b'	'SAT0160'	2280	45.89	50	0.0314	0.013	0.045	0.06	0.1	3	0.1	0.00115
**														
**	Meter	SO112	(COMB)											
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	9	'S2i'	'S74'	470	0.94	43	0.0192	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	9	'S73a'	'SAT0145'	1730	5.78	41	0.0246	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	9	'S74a'	'SAT5020'	1560	5.4	32	0.014	0.013	0.045	0.06	0.1	8	0.5	0.00115
**														
**	Meter	SO121	(COMB)											
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	7	'S2b'	'SAT1030'	4740	33.17	34	0.0191	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	7	'S2c'	'SAT1055'	1050	25.36	38	0.0165	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	7	'S2d'	'SAT2015'	3100	17.15	47	0.0179	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	7	'S2e'	'SAT0020'	1500	16.65	41	0.0197	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	7	'S2f'	'SAT0065'	1100	25.76	43	0.0128	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	7	'SS16a'	'SAT0105'	4000	23.88	43	0.0128	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	7	'SS16b'	'SAT3015'	1520	28.97	44	0.0106	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	7	'SS16c'	'SAT3045'	870	32.55	26	0.0132	0.013	0.045	0.06	0.1	8	0.5	0.00115
**														
**	Additional	Basins	for	Regulator	S-2									

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	7	'S2a'	'SAT0010'	720	3.39	65	0.1207	0.013	0.045	0.06	0.1	3	0.1	0.00115
**														
**	Additional	Basins	for	Regulator	SO-2	(meter	SO-102	for	dry	weather	flow)			
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	7	'BBn'	'UA00065'	2920	15.28	5	0.2132	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	7	'SO2b'	'UA00062'	400	1.87	34	0.0681	0.013	0.045	0.06	0.1	3	0.1	0.00115
**														
**	Meter	SO111	(Burke	Brook	u/s	of	auto	reg	SO-2)					
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	9	'BBo'	'UA00090'	3160	19.14	2	0.0601	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	9	'BBp'	'UA00110'	4000	10.95	3	0.0488	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	10	'BBq'	'UA00210'	2500	20.44	21	0.0378	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'BBr'	'UA00230'	8000	61.07	11	0.0714	0.013	0.045	0.06	0.1	3	0.1	0.00115
**														
**	Area	to	Morgana	Run										
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	10	'SS9a'	'SB00095'	5550	31.88	37	0.0225	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'SS9b'	'SBE0050'	2290	26.89	38	0.0367	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	10	'SS12a'	'SBG0015'	500	1.5	33	0.0515	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'S61a'	'SB00120'	630	2.86	65	0.0323	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	10	'S62a'	'S62'	320	0.48	32	0.0678	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	10	'MRg'	'RA00150'	4000	44.25	7	0.1003	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'MRh'	'RA00245'	2200	6.8	13	0.0816	0.013	0.045	0.06	0.1	5	0.25	0.00115
*														
*														
*														
*														
*														
*														
*	Meter	SO141	(COMB-DWO)	/	SO142	(COMB-INFLUENT)								
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	10	'S64a'	'SBE0105'	2820	22.88	42	0.027	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'S64b'	'SBE2020'	2200	16.99	38	0.023	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	10	'S64d'	'SBE0130'	2200	15	38	0.023	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	10	'S65a'	'SBE3015'	6920	34.29	37	0.023	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'S65b1'	'SBE3405'	2240	31.78	30	0.017	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'S65b2'	'SBE3215'	2240	21.18	30	0.017	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Basin	65b	was	split	into	two	basins	to	avoid	overloading	manhole	SBE3405		
H1	10	'S65c1'	'SBE3035'	4400	36.05	49	0.016	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'S65c2'	'SBE3025'	4400	17.75	49	0.016	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Basin	65c	was	split	into	two	basins	to	avoid	overloading	manhole	SBE3035		
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	10	'S67a'	'SBE3350'	4320	51.49	33	0.021	0.013	0.045	0.06	0.1	3	0.1	0.00115
*														

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
*	Meter	SO143	(COMB)	(meter	SO144	is	upstream)							
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	10	'S66a'	'SBE0150'	780	3.51	32	0.049	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'S64c'	'SBE0140'	330	3.77	33	0.049	0.013	0.045	0.06	0.1	3	0.1	0.00115
*														
*	Additional	Basin	for	Delayed	RDII	to	Reg.	S-64---may	not	be	needed			
*H1	10	'S64X'	'SBE0095'	100	254.68	35	0.04	0.025	0.045	1	0.1	4	0.1	0.00115
*	Meter	SO139	(COMB)											
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	10	'S61b'	'SBF0005'	1000	9.93	43	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	10	'S60a'	'SBG0015'	3460	33.62	43	0.018	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	10	'S60b'	'SS12'	1900	33.93	52	0.023	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'S60c'	'SB00180'	800	39.03	34	0.026	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'S60d'	'SBG0050'	2060	37.7	38	0.015	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	10	'SS15a'	'SB00192'	920	6.96	34	0.027	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'SS15b'	'SB00200'	2660	23.45	29	0.013	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Stormwater	from	reg.	S69	could	also	go	to	meter	SO-111				
H1	10	'S69a'	'SBG3015'	1500	18.4	31	0.036	0.013	0.045	0.06	0.1	5	0.25	0.00115
*	Delayed	inflow	to	Meter	SO139									
H1	10	'S60x'	'SBG0015'	20	174.69	10	0.04	0.013	0.045	0.06	0.1	5	0.25	0.00115
*														
*	Meter	SO139	or	SO111	(depending	on	configuration	of	reg	S-70)				
*	Stormwater	from	reg.	S71	could	also	go	to	meter	SO-116;	S70	could	go	to
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	10	'S70a'	'SBG0090'	2660	24.82	39	0.026	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	9	'S70b'	'SBG0130'	3110	33.84	38	0.024	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	9	'S71a'	'SAT0240'	1980	29.62	38	0.024	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	9	'S71b'	'SAT0287'	2190	31.27	38	0.016	0.013	0.045	0.06	0.1	5	0.25	0.00115
*														
*	Meter	SO116	(COMB)											
H1	1	'-1'	'adjust'	1.4	1	0.85	1	1	1	1.2	1.2	1	1	1
H1	9	'S72b'	'SAT0205'	2700	43.69	42	0.01	0.013	0.045	0.06	0.1	5	0.25	0.00115
*														
*	Meter	SO115	(COMB)											
******the	following	basin	looked	good	for	volume,	but	the	peak	was	somewhat	high,	and	there
******meter,	and	so	this	basin	was	broken	down	for	the	slow	response.			
******H1	1	'-1'	'adjust'	1	1	0.8	1	1	1	1	1	1	1	1
******H1	9	'S72a'	'SAT0192'	1000	24.58	49	0.0328	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'-1'	'adjust'	1	1	0.7	1	1	1	1	1	1	1	1
H1	9	'S72a'	'SAT0192'	1000	24.58	49	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Basin	for	delayed	RDII										
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	9	'S72x'	'SAT0192'	5	24.58	7.4	0.0328	0.013	0.045	0.06	0.1	3	0.1	0.00115
*														
*	Meter	SO109	(COMB)											
H1	1	'-1'	'adjust'	1	1	0.8	1	1	1	1	1	1	1	1

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
H1	9	'S73b'	'SAT0160'	2280	45.89	50	0.015	0.013	0.045	0.06	0.1	3	0.1	0.00115
*														
*	Meter	SO112	(COMB)											
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	9	'S2i'	'S74'	470	0.94	43	0.015	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	9	'S73a'	'SAT0145'	1730	5.78	41	0.015	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	9	'S74a'	'SAT5020'	1560	5.4	32	0.014	0.013	0.045	0.06	0.1	8	0.5	0.00115
*														
*	Meter	SO121	(COMB)											
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	7	'S2b'	'SAT1030'	4740	33.17	34	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	7	'S2c'	'SAT1055'	1050	25.36	38	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
*														
H1	1	'-1'	'adjust'	1	1	0.8	1	1	1	1	1	1	1	1
H1	7	'S2d'	'SAT2015'	3100	17.15	47	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	7	'S2e'	'SAT0020'	1500	16.65	41	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'S2f'	'SAT0065'	1100	25.76	43	0.013	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	7	'SS16a'	'SAT0105'	4000	23.88	43	0.013	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	7	'SS16b'	'SAT3015'	1520	28.97	44	0.011	0.013	0.045	0.06	0.1	8	0.5	0.00115
*														
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	7	'SS16c'	'SAT3045'	870	32.55	26	0.013	0.013	0.045	0.06	0.1	8	0.5	0.00115
*														
*	Additional	Basins	for	Regulator	S-2									
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	7	'S2a'	'SAT0010'	720	3.39	65	0.07	0.013	0.045	0.06	0.1	3	0.1	0.00115
*														
*	Additional	Basins	for	Regulator	SO-2	(meter	SO-102	for	dry	weather	flow)			
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	7	'BBn'	'UA00065'	2920	15.28	5	0.213	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	7	'SO2b'	'UA00062'	400	1.87	34	0.068	0.013	0.045	0.06	0.1	3	0.1	0.00115
*														
*	Meter	SO111	(Burke	Brook	u/s	of	auto	reg	SO-2)					
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	9	'BBo'	'UA00090'	3160	19.14	2	0.036	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	9	'BBp'	'UA00110'	4000	10.95	3	0.049	0.013	0.045	0.06	0.1	5	0.25	0.00115
****Due	to	some	problems	with	the	SO-102	flow	meter,	it	is	difficult	to	determine	if
H1	10	'BBq'	'UA00210'	2500	20.44	21	0.022	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'BBr'	'UA00230'	8000	61.07	11	0.021	0.013	0.045	0.06	0.1	3	0.1	0.00115
*														
*														
*														
*														
*														
*														

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
*														
**********************														
***	BB_MR	Submodel	***											
**********************														
*														
*	Meter	SO137	(COMB)	/	SO136	(SWO)								
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	10	'S54a'	'SBD0015'	2950	25.49	43	0.0268	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'S54b'	'SBD0045'	3675	45.91	36	0.0382	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	10	'S54c'	'SBD0090'	1530	46.46	70	0.0425	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	10	'S54d'	'SBD0120'	1050	39.88	23	0.1044	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'S54e'	'SBD0130'	2840	37.58	70	0.0425	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	10	'S54f'	'SBD6010'	690	32.38	33	0.073	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	10	'S54g'	'SBD6035'	800	35.32	33	0.0395	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	10	'S54h'	'SBD2010'	1200	17.75	55	0.0756	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'S54i'	'SBD2015'	1700	8.85	29	0.0524	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	12	'S54j'	'SBD0180'	3030	28.4	55	0.0756	0.013	0.045	0.06	0.1	3	0.1	0.00115
**														
**	Meter	SO123	(dry	weather	flow)	/	Meter	SO118	(possible	storm	overflow)			
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	10	'SS9a'	'SB00095'	5550	31.88	37	0.0225	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'SS9b'	'SBE0050'	2290	26.89	38	0.0367	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	10	'S61a'	'SB00120'	630	2.86	65	0.0323	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	7	'SS3a'	'SB00068'	3690	50.97	49	0.0117	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	7	'SS1a'	'SBB0020'	1330	3.68	42	0.0134	0.013	0.045	0.06	0.1	3	0.1	0.00115
**	Meter	SO123	only											
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	7	'S1c'	'SBB0030'	2160	15.85	43	0.0109	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	7	'S1b'	'SAU0020'	990	38.71	44	0.0158	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	8	'S1d'	'SAU0045'	3360	36.69	42	0.0142	0.013	0.045	0.06	0.1	3	0.1	0.00115
**	Meter	SO118	/	Meter	SO123	(dry	weather	flow)						
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	8	'SS7b'	'SB00025'	2250	38.93	42	0.0067	0.013	0.045	0.06	0.1	3	0.1	0.00115
**	Meter	SO123	(dry	weather	flow)	/	Meter	SO128I	(possible	storm	overflow)			
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	8	'SS7a'	'SBA0017'	3560	10.94	43	0.0142	0.013	0.045	0.06	0.1	3	0.1	0.00115
**	Meter	SO128I	(dry	weather	flow)	/	Meter	SO128D	(storm	water	overflow)			
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	8	'S1Aa'	'SAY1010'	2000	37.36	44	0.0243	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	8	'S1Ab'	'SAY0050'	2100	26.29	42	0.0119	0.013	0.045	0.06	0.1	3	0.1	0.00115*
**	Meter	MR036A												
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	10	'SS12a'	'SBG0015'	500	1.5	33	0.0515	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'S62a'	'S62'	320	0.48	32	0.0678	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	7	'MRe'	'RA00045'	4600	27.76	20	0.2062	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'MRf'	'RA00065'	3800	15.23	22	0.0275	0.013	0.045	0.06	0.1	8	0.5	0.00115

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
*H1	10	'MRg'	'RA00150'	4000	44.25	7	0.1003	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'MRh'	'RA00245'	2200	6.8	13	0.0816	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	7	'S2Aa'	'SAX1025'	4370	33.39	25	0.0398	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	7	'S2Ab'	'SAX1115'	1300	37.23	37	0.0098	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	7	'S2Ac'	'RAA0030'	3970	42.51	38	0.0267	0.013	0.045	0.06	0.1	8	0.5	0.00115
**	Storm	flows	from	S59a,	S59b,	and	S59c	are	metered	by	MR036c	but	the	meter
*H1	10	'S59a'	'SAX2015'	2780	45.65	43	0.0167	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	10	'S59b'	'SAX2065'	1670	51	44	0.027	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	9	'S59c'	'SAX2105'	1900	35.95	42	0.0225	0.013	0.045	0.06	0.1	5	0.25	0.00115
**	Meter	SO122W												
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	7	'MRa'	'RA00010'	7100	118.87	15	0.1065	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	7	'MRb'	'S2B'	2300	5.4	98	0.0661	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	7	'MRc'	'S1B'	8000	18.68	96	0.0871	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	7	'MRd'	'RA00026'	360	4.3	44	0.146	0.013	0.045	0.06	0.1	3	0.1	0.00115
**	Outfall	39	(unmetered)											
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	8	'SS6a'	'SCA0060'	4290	19.75	48	0.0551	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	8	'039a'	'TA00045'	3000	73.35	94	0.1293	0.013	0.045	0.06	0.1	3	0.1	0.00115
**	Additional	basins	to	Meter	SO177									
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	8	'SOintc'	'SC00060'	2125	8.4	19	0.1519	0.013	0.045	0.06	0.1	3	0.1	0.00115
**	Additional	basins	to	Meter	SO105									
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	7	'S1a'	'SAU0006'	750	4.6	48	0.0217	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	7	'SOinth'	'RA00026'	260	9.58	38	0.0731	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	7	'SOinte'	'SAZ0010'	360	0.51	84	0.0576	0.013	0.045	0.06	0.1	3	0.1	0.00115
**	Meter	SO106												
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	9	'S75b'	'SAS0100'	2070	12.02	34	0.0165	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	9	'S75c'	'SAS0110'	1420	35.91	35	0.0103	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	7	'S75d'	'SAS0135'	2900	33.89	23	0.0067	0.013	0.045	0.06	0.1	3	0.1	0.00115
**	Meter	SO107												
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	7	'S75a'	'SAS0095'	380	1.15	31	0.0231	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	7	'S80Ab'	'SAS0085'	2000	8.68	40	0.0164	0.013	0.045	0.06	0.1	8	0.5	0.00115
**	Storm	flow	to	Meter	BB035									
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	7	'S80Aa'	'SAS0065'	3840	58.62	42	0.0136	0.013	0.045	0.06	0.1	8	0.5	0.00115
**	Unmetered	to	outfall	35										
**	It	is	difficult	to	determine	if	these	flows	actually	go	to	the	outfall	
**	No	impervious	percentage	was	applied	from	the	query						
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	7	'BBa'	'UA00004'	1700	32.69	0.0453	0.013	0.045	0.06	0.1	3	0.1	0.00115	
*H1	7	'BBb'	'UA00005'	3800	259.57	0.1085	0.013	0.045	0.06	0.1	3	0.1	0.00115	
**	Meter	BB48SN												

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	7	'035a'	'S75J'	4450	60.79	15	0.0885	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	7	'SS4a'	'SS4'	590	7.25	49	0.0272	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	7	'BBc'	'UA00040'	4600	64.27	3	0.0203	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	7	'BBd'	'UA00056'	800	5.02	32	0.1727	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	7	'BBe'	'UAC0030'	4200	13.22	59	0.1196	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	7	'BBf'	'UAB0040'	6800	18.75	40	0.1022	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	9	'BBg'	'UAB0090'	6800	44.98	65	0.0374	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	9	'BBh'	'UAB0120'	5300	24.47	81	0.1212	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	7	'BBi'	'UA00059'	3400	16.58	31	0.1233	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	7	'BBj'	'UB00005'	2800	13.52	17	0.2187	0.013	0.045	0.06	0.1	8	0.5	0.00115
*H1	9	'BBk'	'UB00037'	2600	18.61	42	0.026	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	9	'BBl'	'UB00060'	1760	25.51	43	0.0361	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	9	'BBm'	'UB00095'	2100	29.34	17	0.0415	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	7	'S74Aa'	'S74A'	380	1.99	43	0.069	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	9	'SOinti'	'UAB0110'	470	3.74	38	0.0197	0.013	0.045	0.06	0.1	3	0.1	0.00115
**	Unmetered	to	the	WWTP										
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	9	'S77a'	'SAQ0055'	3530	43.92	31	0.0174	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	9	'S77b'	'SAQ0080'	2890	62.09	38	0.0217	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	9	'SOintl'	'SAQ1115'	1780	26.07	50	0.0188	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	9	'S79a'	'SAV0070'	1750	36.47	33	0.037	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	9	'S79b'	'SAV0105'	2900	46.31	33	0.0349	0.013	0.045	0.06	0.1	3	0.1	0.00115
**	Unmetered	to	Regulator	SS-11	/	Outfall	33							
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	7	'SS11a'	'SAP0030'	3570	42.43	45	0.086	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	9	'SS11b'	'SAP0050'	4780	48.42	58	0.019	0.013	0.045	0.06	0.1	3	0.1	0.00115
*														
*														
*														
*														
*														
*														
*	Meter	SO137	(COMB)	/	SO136	(SWO)								
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	10	'S54a'	'SBD0015'	2950	25.49	43	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'S54b'	'SBD0045'	3675	45.91	36	0.024	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	'-1'	'adjust'	1	1	0.6	1	1	1	1	1	1	1	1
H1	10	'S54c'	'SBD0090'	1530	46.46	70	0.024	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	10	'S54d'	'SBD0115'	1050	39.88	23	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'-1'	'adjust'	1	1	0.55	1	1	1	1	1	1	1	1
H1	10	'S54e'	'SBD0145'	2840	37.58	70	0.028	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	10	'S54f'	'SBD6010'	690	32.38	33	0.024	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	10	'S54g'	'SBD6035'	800	35.32	33	0.022	0.013	0.045	0.06	0.1	5	0.25	0.00115

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
H1	1	'-1'	'adjust'	1	1	0.6	1	1	1	1	1	1	1	1
H1	10	'S54h'	'SBD2010'	1200	17.75	55	0.048	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	10	'S54i'	'SBD2015'	1700	8.85	29	0.025	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'-1'	'adjust'	1	1	0.65	1	1	1	1	1	1	1	1
H1	12	'S54j1'	'SBD0180'	1500	14.2	55	0.033	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'S54j2'	'SBD5007'	1500	14.2	55	0.033	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Basin	S54j	was	split	into	two	basins	to	avoid	an	unrealistic	overloading	of	manhole
*														
*	Delayed	inflow	basin	for	Meters	SO137/SO136								
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	10	'S54x'	'SBD0020'	50	318.02	10	0.0756	0.013	0.045	0.06	0.1	3	0.1	0.00115
*														
*	Meter	SO123	(dry	weather	flow)	/	Meter	SO118	(possible	storm	overflow)			
H1	1	'-1'	'adjust'	1	1	1.4	1	1	1	1	1	1	1	1
H1	10	'SS9a'	'SB00095'	5550	31.88	37	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'-1'	'adjust'	1	1	1.2	1	1	1	1	1	1	1	1
H1	10	'SS9b'	'SBE0050'	2290	26.89	38	0.023	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	10	'S61a'	'SB00120'	630	2.86	65	0.032	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	7	'SS3a'	'SB00068'	3690	50.97	49	0.012	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'SS1a'	'SBB0020'	1330	3.68	42	0.013	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Meter	SO123	only											
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	7	'S1b'	'SAU0020'	990	38.71	44	0.016	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'S1c'	'SBB0030'	2160	15.85	43	0.011	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'S1d'	'SAU0045'	3360	36.69	42	0.014	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Meter	SO118	/	Meter	SO123	(dry	weather	flow)						
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	7	'SS7b'	'SB00025'	2250	38.93	42	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Meter	SO123	(dry	weather	flow)	/	Meter	SO128I	(possible	storm	overflow)			
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	7	'SS7a'	'SBA0017'	3560	10.94	43	0.014	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Meter	SO128I	(dry	weather	flow)	/	Meter	SO128D	(storm	water	overflow)			
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	7	'S1Aa'	'SAY1010'	2000	37.36	44	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'S1Ab'	'SAY0050'	2100	26.29	42	0.012	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Meter	MR036A												
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	10	'SS24a'	'SS24'	500	1.5	33	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'-1'	'adjust'	1	1	1.7	1	1	1	1	1	1	1	1
H1	10	'S62a'	'S62'	320	0.48	32	0.068	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	7	'MRe'	'RA00045'	4600	27.76	20	0.206	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'MRf'	'RA00065'	3800	15.23	22	0.02	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	10	'MRg'	'RA00150'	4000	44.25	7	0.011	0.013	0.045	0.06	0.1	3	0.1	0.00115

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
H1	10	'MRh'	'RA00245'	2200	6.8	13	0.063	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	7	'S2Aa'	'SAX1025'	4370	33.39	25	0.012	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	7	'S2Ab'	'SAX1115'	1300	37.23	37	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	7	'S2Ac'	'RAA0030'	3970	42.51	38	0.027	0.013	0.045	0.06	0.1	8	0.5	0.00115
*	Storm	flows	from	S59a,	S59b,	and	S59c	are	metered	by	MR036c,	but	the	meter
H1	10	'S59a'	'SAX2015'	2780	45.65	43	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	10	'S59b'	'SAX2075'	1670	51	44	0.019	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	9	'S59c'	'SAX2105'	1900	35.95	42	0.023	0.013	0.045	0.06	0.1	5	0.25	0.00115
*	Meter	SO120												
H1	1	'-1'	'adjust'	1	1	0.4	1	1	1	1	1	1	1	1
H1	7	'MRd'	'RA00026'	360	4.3	44	0.08	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Meter	SO122W												
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	7	'MRa'	'RA00010'	7100	118.87	15	0.05	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'MRb'	'S2B'	2300	5.4	98	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'MRc'	'S1B'	8000	18.68	96	0.087	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Outfall	39	(unmetered)											
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	7	'SS6a'	'SCA0060'	4290	19.75	48	0.01	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	1	'-1'	'adjust'	1	1	0.5	1	1	1	1	1	1	1	1
H1	7	'039a'	'TA00045'	3000	73.35	94	0.129	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Additional	basins	to	Meter	SO177									
H1	1	'-1'	'adjust'	1	1	2	1	1	1	1	1	1	1	1
H1	7	'SOintc'	'SC00060'	2125	8.4	19	0.1	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	NOTE:	Basin	'SOintc'	may	actually	drain	to	outfall	39					
*	Additional	basins	to	Meter	SO105									
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	7	'S1a'	'SAU0006'	750	4.6	48	0.012	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'SOinth'	'RA00026'	260	9.58	38	0.073	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	7	'SOinte'	'SAZ0015'	360	0.51	84	0.03	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Meters	SO-106	and	SO-107	show	a	very	large	delayed	inflow,	but	it	is	not
*	It	looks	like	the	volume	during	the	delayed	inflow	portion	of	the	hydrograph	is
*	Meter	SO106												
*	Impervious	%	for	basins	S75c	and	S75d	might	be	larger--looks	like	mostly	paved	area
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	9	'S75c'	'SAS0110'	1420	36.9	35	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'-1'	'adjust'	1	1	2	1	1	1	1	1	1	1	1
H1	7	'S75d'	'SAS0135'	2900	33.89	23	0.007	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Meter	SO107												
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	9	'S75b'	'SAS0095'	2070	12.18	34	0.017	0.013	0.045	0.06	0.1	8	0.5	0.00115
*	Storm	flow	to	Meter	BB035,	unmetered	dry	weather	to	WWTP				
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	7	'S80Aa'	'SAS0065'	3840	58.62	42	0.014	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	7	'S80Ab'	'SAS0085'	2000	8.68	40	0.016	0.013	0.045	0.06	0.1	8	0.5	0.00115
*	Unmetered	to	outfall	35										

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
*	It	is	difficult	to	determine	if	these	flows	actually	go	to	the	outfall	
*	No	impervious	percentage	was	applied	from	the	query						
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	7	'BBa'	'UA00004'	1700	32.69	35	0.045	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'BBb'	'UA00005'	3800	259.57	10	0.109	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Meter	BB48SN												
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	7	'035a'	'S75J'	4450	60.79	15	0.089	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'035b'	'S75B'	380	2.68	21	0.024	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	7	'SS4a'	'SS4'	590	7.25	49	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Note:	Flow	from	basin	SS4a	goes	to	node	'S75D'	for	existing	conditions	and	'SS4'
H1	7	'BBc'	'UA00040'	4600	64.27	3	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'BBd'	'UA00056'	800	5.02	32	0.173	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	7	'BBe1'	'UAC0040'	2100	6.61	59	0.12	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'BBe2'	'UAC0025'	2100	6.61	59	0.12	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Basin	BBe	was	split	into	two	basins	to	avoid	overloading	manhole	UAC0030		
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*	H1	7	'BBf'	'UAB0040'	6800	18.75	40	0.102	0.013	0.045	0.06	0.1	3	0.1
H1	7	'BBf1'	'UB00036'	1300	3.75	40	0.102	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'BBf2'	'UA00059'	680	1.875	40	0.102	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'BBf3'	'UAB0040'	4800	13.125	40	0.102	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Basin	BBf	was	split	into	three	basins	in	order	to	more	accurately	account	for
*	BBf1	accounts	for	20%	of	the	total,	BBf2	is	10%,	and	BBf3	is	70%
*	See	record	drawing	CUY-77-1050-52	and	CUY-77-1050-58	for	details	on	the	inflow	to	the	storm
H1	1	'-1'	'adjust'	1	1	0.5	1	1	1	1	1	1	1	1
*	H1	9	'BBg'	'UAB0090'	6800	44.98	65	0.037	0.013	0.045	0.06	0.1	3	0.1
H1	9	'BBg1'	'UAB1025'	6120	40.482	65	0.037	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	9	'BBg2'	'UAB0090'	680	4.498	65	0.037	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Basin	BBg	was	split	into	two	basins	in	order	to	more	accurately	account	for
*	See	record	drawing	CUY-77-1050-52	for	details	on	the	inflow	to	the	storm	drainage	
H1	1	'-1'	'adjust'	1	1	0.6	1	1	1	1	1	1	1	1
H1	9	'BBh'	'UAB0120'	5300	24.47	81	0.121	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	7	'BBi'	'UA00059'	3400	16.58	31	0.123	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'BBj'	'UB00005'	2800	13.52	17	0.219	0.013	0.045	0.06	0.1	8	0.5	0.00115
H1	9	'BBk'	'UB00037'	2600	18.61	42	0.015	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	9	'BBl'	'UB00060'	1760	25.51	43	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	9	'BBm'	'UB00095'	2100	29.34	17	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	7	'S74Aa'	'SAS3005'	380	1.99	43	0.069	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	9	'SOinti'	'UAB0110'	470	3.74	38	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Unmetered	to	the	WWTP										
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	9	'S77a'	'SAQ0040'	3530	43.92	31	0.017	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	9	'S77b'	'SAQ0080'	2890	62.09	38	0.022	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	9	'SOintl'	'SAQ1115'	1780	26.07	50	0.019	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	9	'S79a'	'SAV0070'	1750	42.22	33	0.018	0.013	0.045	0.06	0.1	3	0.1	0.00115

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
H1	9	'S79b'	'SAV0105'	2900	46.31	33	0.013	0.013	0.045	0.06	0.1	3	0.1	0.00115
*	Unmetered	to	Regulator	SS-11	/	Outfall	33							
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	7	'SS11a'	'SAP0030'	3570	42.43	45	0.015	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	9	'SS11b'	'SAP0050'	4780	48.42	58	0.019	0.013	0.045	0.06	0.1	3	0.1	0.00115
*														
*														
*														
*														
*														
***********************														
***	SO-113	Submodel	***											
***********************														
*														
*	Meter	SO113(COMB)/SO114(COMB)												
*H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
*H1	10	'SO1a'	'SBG0175'	1580	20.08	36	0.0269	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	11	'SO1b'	'SBG6015'	3230	16.81	100	0.098	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'SO1c'	'SB00240'	1330	3.75	36	0.4019	0.013	0.045	0.06	0.1	5	0.25	0.00115
*H1	11	'SO1d'	'SB00252'	1530	11.71	39	0.2109	0.013	0.045	0.06	0.1	3	0.1	0.00115
*H1	10	'SO1e'	'SBG0210'	1940	30.05	100	0.098	0.013	0.045	0.06	0.1	3	0.1	0.00115
*														
*Basins	to	represent	overflows	from	Mill	Creek	regulators	MC-32	and	MC-33				
*	Tributary	area	from	MC-32	=	287	acres	from	MC	modeling	report			
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	11	'MC32'	'MC00820'	5000	287	42	0.01	0.013	0.045	0.04	0.1	7	0.1	0.00115
*	Basin	for	delayed	RDII										
H1	11	'MC32X'	'MC00820'	500	287	15	0.005	0.025	0.045	0.04	0.1	0.1	0.1	0.00115
*														
*	Tributary	area	from	MC-33	=	540	acres	from	MC	modeling	report			
H1	1	'-1'	'adjust'	1	1	1.2	1	1	1	1	1	1	1	1
H1	11	'MC33'	'MC00305'	6000	540	42	0.01	0.013	0.045	0.04	0.1	4	0.1	0.00115
*	Basin	for	delayed	RDII										
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	11	'MC33X'	'MC00305'	400	540	20	0.005	0.025	0.045	0.04	0.1	0.1	0.1	0.00115
*	Basins	MC32X	and	MC33X	seemed	to	match	the	meter	data	better	with	an	impervious
*	so	the	smaller	20%	is	used								
*														
H1	1	'-1'	'adjust'	1	1	0.8	1	1	1	1	1	1	1	1
H1	10	'SO1a'	'SBG0175'	1580	20.08	36	0.018	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	11	'SO1b'	'SBG6015'	3230	16.81	40	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'SO1c'	'SB00240'	1330	3.75	36	0.09	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	11	'SO1d'	'SB00252'	1530	11.71	39	0.025	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'SO1e'	'SBG0210'	1940	30.05	40	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
*														

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
*														
*														
*														
***********************														
***	SO144	Submodel	***											
***********************														
*														
*														
*	Meter	SO144												
*H1	10	'S66b'	'SBE0165'	3940	29.01	33	0.0354	0.013	0.045	0.06	0.1	1	0.1	0.00115
*H1	12	'S66c'	'SBE0205'	6700	35.2	37	0.0457	0.013	0.045	0.06	0.1	1	0.1	0.00115
*H1	13	'S66d'	'SBE0255'	6050	43.99	42	0.0233	0.013	0.045	0.06	0.1	1	0.1	0.00115
*H1	12	'S66e'	'SBE4060'	2140	43.73	48	0.0525	0.013	0.045	0.06	0.1	1	0.1	0.00115
*H1	12	'S66f'	'SBE4105'	3560	49.22	39	0.0333	0.013	0.045	0.06	0.1	1	0.1	0.00115
*H1	12	'S66g'	'SBE4320'	2650	37.41	39	0.0297	0.013	0.045	0.06	0.1	2	0.25	0.00115
*H1	13	'S66h'	'SBE8005'	1340	54.85	40	0.0922	0.013	0.045	0.06	0.1	2	0.25	0.00115
*H1	13	'S66i'	'SBE6140'	2600	43.45	36	0.0805	0.013	0.045	0.06	0.1	1	0.1	0.00115
*H1	13	'S66j'	'SBE6025'	1430	51.46	36	0.0253	0.013	0.045	0.06	0.1	1	0.1	0.00115
*H1	13	'S66k'	'SBE0315'	3100	15.61	39	0.1043	0.013	0.045	0.06	0.1	1	0.1	0.00115
*H1	12	'S66l'	'SBE4210'	1080	23.96	36	0.0477	0.013	0.045	0.06	0.1	1	0.1	0.00115
*H1	10	'S66m'	'SBE5020'	1340	50.47	36	0.0273	0.013	0.045	0.06	0.1	1	0.1	0.00115
*														
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	10	'S66b'	'SBE0165'	3940	29.01	33	0.035	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'S66c'	'SBE0205'	6700	35.2	37	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	13	'S66d'	'SBE0255'	6050	43.99	42	0.023	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'S66e'	'SBE4060'	2140	43.73	48	0.024	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'S66f'	'SBE4105'	3560	49.22	39	0.033	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	12	'S66g'	'SBE4320'	2650	37.41	39	0.03	0.013	0.045	0.06	0.1	5	0.25	0.00115
H1	13	'S66h'	'SBE8005'	1340	54.85	40	0.01	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	13	'S66i'	'SBE6140'	2600	43.45	36	0.015	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	13	'S66j'	'SBE6025'	1430	51.46	36	0.025	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	13	'S66k'	'SBE0315'	3100	15.61	39	0.02	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	12	'S66l'	'SBE4210'	1080	23.96	36	0.026	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'S66m'	'SBE5020'	1340	50.47	36	0.027	0.013	0.045	0.06	0.1	3	0.1	0.00115
*														
*	Basin	for	delayed	RDII										
H1	12	'S66X'	'SBE0160'	500	478.36	20	0.005	0.025	0.045	0.1	1	0.1	0.1	0.00115
*														
*														
*														
*														
*														
*														
*														

*	JK	NAMEW	NGTO	Width	area	Percent Impervious	Slope	Impervious Manning's n	Pervious Manning's n	Impervious Depression Storage	Pervious Depression Storage	Maximum Infiltration Rate	Minimum Infiltration Rate	Decay Rate
**********************************														
***	MC-47	(CSO-252)	Submodel	***										
**********************************														
*														
*														
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	10	'MC47a'	'MC47_50'	800	59.68	42	0.007	0.04	0.3	0.04	0.19	1	0.1	0.00115
H1	10	'MC47b'	'MC47_65'	800	30.32	42	0.007	0.04	0.3	0.04	0.19	1	0.1	0.00115
*NOTE:	values	are	based	on	the	1995	Mill	Creek	Study,	see	Chapter	5	of	the
*														
*														
**********************************														
***	MC-1A	(CSO-250)	Submodel	***										
**********************************														
*														
*														
H1	1	'-1'	'adjust'	1	1	1	1	1	1	1	1	1	1	1
H1	10	'MC1Aa'	'CV00170'	200	17.12	40	0.05	0.013	0.045	0.06	0.1	3	0.1	0.00115
H1	10	'250a'	'MC1AG'	1400	18.2	25	0.05	0.013	0.045	0.06	0.1	5	0.25	0.00115
*NOTE:	the	RDII	from	basins	MC1Ab	and	MC1Ac	is	assumed	to	be	small	compared	to
*	(direct	storm	runoff	from	basins	MC1Ab	and	MC1Ac	does	not	drain	to	regulator	MC-1A)

APPENDIX E

```
;Kingsbury Run Area
; flow in cms
; BEGIN BASIN SO151 SUBMODEL FOR WET WEATHER
; INCLUDED IN SO159
SAF1030   0.0002   downstream of unregulated flowsplit
SAF1520   0.0002
SAF0065   0.0002
SAF0055   0.0002
SAF1010   0.0002
SAF0030   0.0002
SAF0070   0.0002   downstream of unregulated flowsplit
SAF4100   0.0002   upstream of unregulated flowsplit
SAF4017   0.0002
SAF2020   0.0002
SAF3025   0.0002
SAF0160   0.0002
KG03020   0.0002   upstream of unregulated flowsplit
; INCLUDED IN BASIN SO159
; EXCLUSIVE TO BASIN SO155D
SAH0035   0.0001
SAH0040   0.0001
SAH0045   0.0001
SAE0045   0.0001
SAG0030   0.0001
; END BASIN SO155D SUBMODEL FOR DRY WEATHER
; EXCLUSIVE TO BASIN so150
SAE0060   0.0002
KG01025   0.0002
KG02030   0.0002
SAF5030   0.0002
SAF6030   0.0002
KG05030   0.0002
KG06020   0.0002
SAI1290   0.0002
SH00020   0.0002
; END BASIN SO150
; wet weather pipe to so156
KG00040   0.0009
; BASIN SO153I
SAI0085   0.0006
SAI1010   0.0006
; END BASIN SO153I
; END BASIN SO150
S450001   0.0001
S460001   0.0001
; FROM BASIN 135 (PARTIAL)
SAB4075   0.0002
SAB4195   0.0002
SAB4415   0.0002
SAB4213   0.0002
KEC0026   0.0014
; FROM SO147
SBD8130    0.0018
SBD8245    0.0018
SBD8335    0.0018
SBD9005    0.0018
SBD0415    0.0018
```

```
; FROM SO149
SBD8035    0.0029
; END BASIN SO149
; BEGIN basin so146
SBD7020    0.0046
SBD0415    0.0001
; END BASIN SO146
; BEGIN BASIN SO145
SBD0215    0.0001
;END BASIN SO145
; BEGIN BASIN SO177
SAL8050    0.0025
SAL0175    0.0025
SAL9030    0.0025
SAL7045    0.0025
SAL6010    0.0025
SAL5015    0.0025
SAL2020    0.0025
SAL3010    0.0025
SAB9105    0.0025
SAA0240    0.0025
SAA0130    0.0025
SAP2015    0.0025
; BASIN SO125
S52F       0.0037   Clean Harbors of Cle. Inc., 2100 Broadway Ave., 0.18 cfs
SD00025    0.0017   Zaclon Inc., 2981 Independence Ave., 0.06 cfs
; END BASIN SO177
;
;
;Morgana Run and Burke Brook Area
;
; flow in cms
;
;  Start of SO-137 Submodel
SBD0205   0.0000   Flow Mtr SO-145--changed from 0.0122 when Dan's Mouse output
was used as a boundary condition
;
SBD1020   0.0027   Flow Mtr SO-137/SO-136
SBD2015   0.0027   Flow Mtr SO-137/SO-136
SBD3015   0.0027   Flow Mtr SO-137/SO-136
SBD4010   0.0027   Flow Mtr SO-137/SO-136
SBD5010   0.0027   Flow Mtr SO-137/SO-136
SBD6040   0.0033   Flow Mtr SO-137/SO-136 Inflow from Aramark Uniform Services
(0.0032 cms)
;  End of SO-137 Submodel
;
;  Start of SO-144 Submodel
SBE0315   0.0013   Flow Mtr SO-144
SBE4135   0.0013   Flow Mtr SO-144
SBE4215   0.0013   Flow Mtr SO-144
SBE4335   0.0013   Flow Mtr SO-144
SBE4420   0.0013   Flow Mtr SO-144
SBE4520   0.0013   Flow Mtr SO-144
SBE5030   0.0013   Flow Mtr SO-144
SBE6035   0.0013   Flow Mtr SO-144
SBE6175   0.0013   Flow Mtr SO-144
SBE7015   0.0013   Flow Mtr SO-144
```

```
SBE8010   0.0013   Flow Mtr SO-144
; End of SO-144 Submodel
;
SBE2030   0.0020   Flow Mtr SO-141/SO-142
SBE3120   0.0020   Flow Mtr SO-141/SO-142
SBE3215   0.0020   Flow Mtr SO-141/SO-142
SBE3405   0.0020   Flow Mtr SO-141/SO-142
SBE3365   0.0020   Flow Mtr SO-141/SO-142
SBE3510   0.0020   Flow Mtr SO-141/SO-142
SBE3045   0.0020   Flow Mtr SO-141/SO-142
;
; Start of DILLE_PS Submodel
;Unknown industrial pump discharge of 0.0119 cms from LTV (LTV East PS-13 A-1)
SC00072   0.0048   Flow Mtr SO-126; primarily LTV East Dille Rd DWF Discharge
(0.0048 cms) at SC00072
SC00160   0.0045   Flow Mtr SO-124
SC00135   0.0045   Flow Mtr SO-124
SC00105   0.0028   Flow Mtr SO-124; primarily Reilly Industries DWF Discharge
(0.0028 cms) at SC00120
SC00095   0.0062   Flow Mtr SO-124; primarily LTV East Labor Bld SMIO DWF
Discharge (0.0100 cms)
; End of DILLE_PS Submodel
;
; Start of SO_113 Submodel
SBG0230   0.0040   Flow Mtr SO-113/SO-114
SBG6045   0.0040   Flow Mtr SO-113/SO-114
SBG7020   0.0040   Flow Mtr SO-113/SO-114
SB00252   0.0040   Flow Mtr SO-113/SO-114
;
MC00305   0.0500   Mill Creek
MC00820   0.0080   Mill Creek
; End of SO_113 Submodel
;
SBF0015   0.0002   Flow Mtr SO-139
SBG0016   0.0002   Flow Mtr SO-139
SBG2020   0.0002   Flow Mtr SO-139
SBG3030   0.0002   Flow Mtr SO-139
SBI0015   0.0002   Flow Mtr SO-139
SBH1015   0.0002   Flow Mtr SO-139
SBJ0020   0.0026   Flow Mtr SO-139; BF Goodrich (Marble Ave.) DWF Discharge
(0.0031 cms)
SB00239   0.0002   Flow Mtr SO-139
;
SAT7010   0.0003   Flow Mtr SO-116
;
SAT0192   0.0001   Flow Mtr SO-115
;
SAT0160   0.0085   Flow Mtr SO-109; Ferro Corp DWF Discharge (0.0106 cms)
;
SAT5020   0.0025   Flow Mtr SO-112
SAT6020   0.0025   Flow Mtr SO-112
SAT6105   0.0025   Flow Mtr SO-112
;
SBG4035   0.0005   Flow Mtr SO-111 (Burke Brook)/SO-139
SAT0315   0.0005   Flow Mtr SO-111 (Burke Brook)/SO-139
;
SAT1055   0.0005   Flow Mtr SO-121
```

```
SAT1105    0.0005   Flow Mtr SO-121
SAT1220    0.0005   Flow Mtr SO-121
SAT2020    0.0005   Flow Mtr SO-121
SAT3045    0.0005   Flow Mtr SO-121
SAT4005    0.0005   Flow Mtr SO-121
;
SAX1120    0.0005   Flow Mtr SO-120/MR036A
RAA1010    0.0005   Flow Mtr SO-120/MR036A
RAA0075    0.0005   Flow Mtr SO-120/MR036A
RAA2010    0.0005   Flow Mtr SO-120/MR036A
SAX2220    0.0005   Flow Mtr SO-120/MR036A
SAX2115    0.0005   Flow Mtr SO-120/MR036A
SAX2310    0.0005   Flow Mtr SO-120/MR036A
SAX2410    0.0005   Flow Mtr SO-120/MR036A
RA00150    0.0020   Flow Mtr SO-120/MR036A; baseflow to Morgana Run (storm basin
MRg)
RA00065    0.0020   Flow Mtr SO-120/MR036A; baseflow to Morgana Run (storm basin
MRf)
RA00045    0.0020   Flow Mtr SO-120/MR036A; baseflow to Morgana Run (storm basin
MRe)
;
SB00025    0.0002   Flow Mtr SO-118
;
SBE1010    0.0035   Flow Mtr SO-123
SBC0015    0.0035   Flow Mtr SO-123
SAU2115    0.0035   Flow Mtr SO-123
SAU1020    0.0035   Flow Mtr SO-123
SBB0030    0.0035   Flow Mtr SO-123
SBA0030    0.0035   Flow Mtr SO-123
SAU4015    0.0035   Flow Mtr SO-123
SAU3010    0.0035   Flow Mtr SO-123
;
SAY1110    0.0001   Flow Mtr SO-128I
SS7W       0.0001   Flow Mtr SO-128I
;
SAS0155    0.0010   Flow Mtr SO-106
SAS0210    0.0010   Flow Mtr SO-106
;
S1C        0.0001   Flow Mtr SO-122W; Added to represent DW outfall location
MR0190C (0.0025cfs)
;
UB00095    0.0001   Flow Mtr BB48SN
UBA0010    0.0001   Flow Mtr BB48SN
UAB0155    0.0001   Flow Mtr BB48SN
UAC0060    0.0001   Flow Mtr BB48SN
;
SAP0030    0.0460   PLANT (unmetered); Reg SS-11; ALCOA DWF Discharge (0.0460
cms)
SAP0045    0.0020   PLANT (unmetered); Reg SS-11; McGean-Rocho DWF Discharge
(0.0020 cms)
SAP0060    0.0001   PLANT (unmetered); Reg SS-11
SAW0015    0.0001   PLANT (unmetered); Unregulated (sanitary flow)
SAQ0100    0.0001   PLANT (unmetered); Reg  S-77
SAQ0055    0.0032   PLANT (unmetered); Reg  S-77; Birmingham Steel DWF Discharge
(0.0032 cms)
SAQ0045    0.0028   PLANT (unmetered); Reg  S-77; Research Organics DWF Discharge
(0.0028 cms)
```

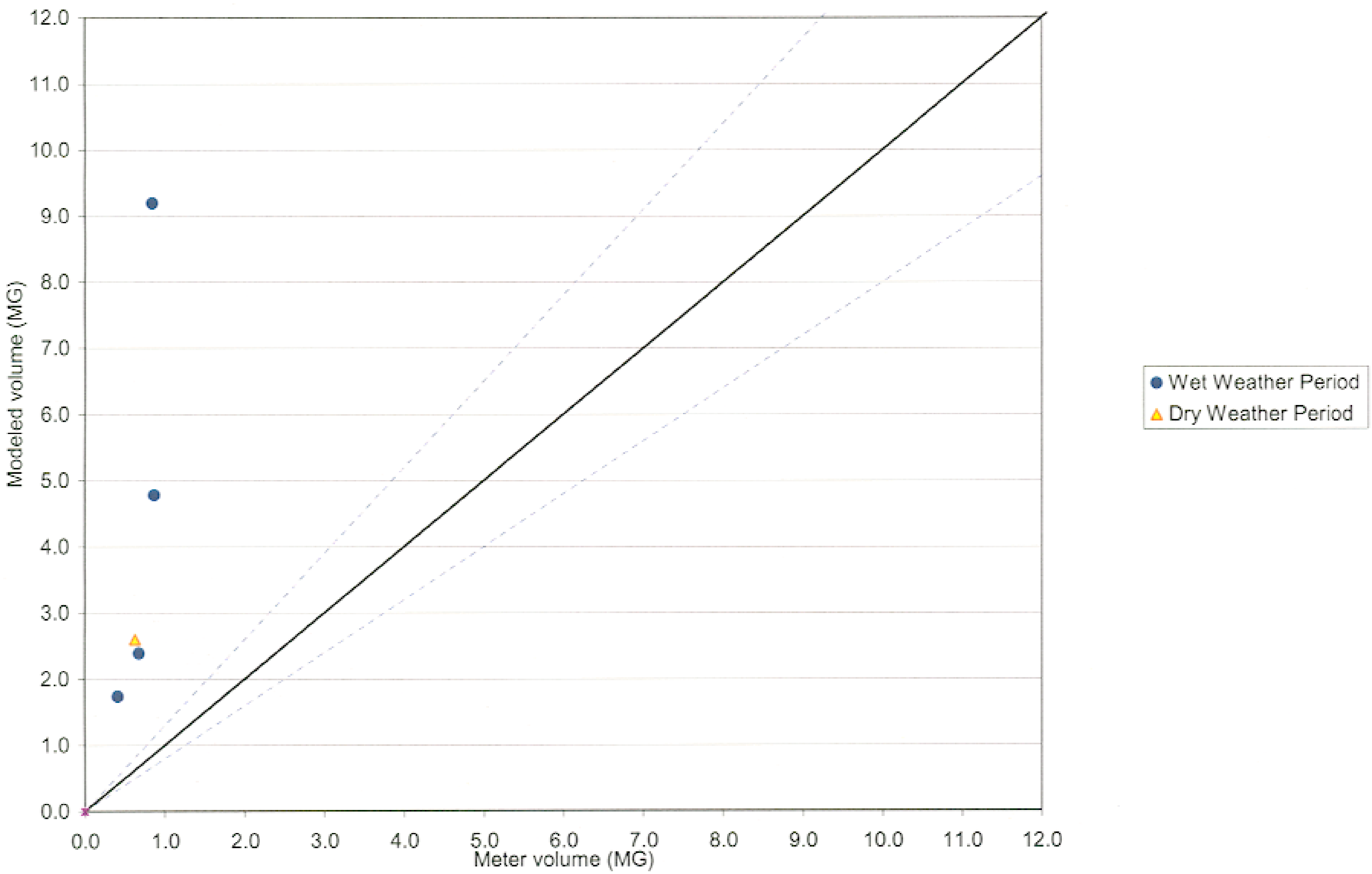
```
SAQ1120   0.0001   PLANT (unmetered); Unregulated
SAV0115   0.0001   PLANT (unmetered); Reg  S-79
SAS3005   0.0001   PLANT (unmetered); Reg  S-74A
SAS1005   0.0001   PLANT (unmetered); Unregulated (short pipe length)
;
CIFEND
```

```
; flow in cms        Description                              Model Basin
;BP00030    -0.0015  Flow Mtr BC-136  U/S of meter     BC30j
;BPN0010    -0.0020  Flow Mtr BC-137  U/S of meter     BC30h   (seperate san
sewer)
BXA0030   0.00028   Flow Mtr BC-138              BC45a        Industrial discharge
;BXAA015   0.0040   Flow Mtr BC-138              BC45a
;BX00060   0.0040   Flow Mtr BC-138              BC45b
;BXC0025   0.0040   Flow Mtr BC-138              BC45b
;BXB0020   0.0040   Flow Mtr BC-138              BC45c
;BQQ0015   -0.0015  Flow Mtr BC-138D U/S of meter     BC30f (seperate san sewer)
BTB0010   0.01175  Flow Mtr BC-140               BC44a
BC49U     0.00075  Flow Mtr BC-140               BC49a
BTA0057   0.01100  Flow Mtr BC-140               BC49a
BT00085   0.00283  Flow Mtr BC-140               BC44b
BT00095   0.00283  Flow Mtr BC-140               BC44c
BT00015   0.00283  Flow Mtr BC-140               BC44d
BTAA003   0.00283  Flow Mtr BC-140               BC44e
BT00030   0.00283  Flow Mtr BC-140               BC44f
; deleted to drop flow at BC-141
;BA00315   0.0050   Flow Mtr BC-141              BC44h
BYC0030   0.0050   Flow Mtr BC-142               BC54Ac
BC52U     0.0003   Flow Mtr BC-143               BC52a
BYCG035   0.0003   Flow Mtr BC-143               BC53Ab
;BYCH015   0.0003   Flow Mtr BC-143              BC53Ab
BYCI035   0.00057  Flow Mtr BC-143               BC53Ab       Industrial discharge
BYCJ065   0.0003   Flow Mtr BC-143               BC53Ad
BYCD010   0.0003   Flow Mtr BC-143               BC54Aa
BYCE020   0.0003   Flow Mtr BC-143               BC54Ab
; added for submodel may need to take out later
BYC0158   0.00283   Flow meter BC-143
;  End  of BC54 Submodel
;BY00025    -0.006   Flow Mtr BC-144
BC114U    0.00133  Flow Mtr BC-144               BC114a
BC115U    0.00133  Flow Mtr BC-144               BC115a
BC116U    0.00133  Flow Mtr BC-144               BC116a
BC47U     0.00133  Flow Mtr BC-144               BC47a
BC50U     0.00133  Flow Mtr BC-144               BC50a
BC53U     0.00100  Flow Mtr BC-144               BC53a
BC54U     0.00133  Flow Mtr BC-144               BC54a
BYCA050   0.00133  Flow Mtr BC-144               BC55a
BYCA050   0.00028  Flow Mtr BC-144               BC55a        Industrial discharge
BC59U     0.0029   Flow Mtr BC-147               BC59a
BTD0030   0.0029   Flow Mtr BC-147               BC60a
BC61U     0.00263  Flow Mtr BC-147               BC61a
BTCC085   0.00065  Flow Mtr BC-150               BC58g        Industrial Discharge
BC86D     0.0036   Flow Mtr BC-150               BC58b        Industrial Discharge
BC56W     0.014     Flow Meter BC-151
;BUA0055   0.0007   Flow Mtr BC-152              BC56c
;BUB0055   0.0007   Flow Mtr BC-152              BC56d
;BC65U2    0.0007   Flow Mtr BC-152              BC56r
;BC66U     0.0007   Flow Mtr BC-152              BC66a
;BUBA005   0.0007   Flow Mtr BC-152              BC66Aa
;BUBB015   0.0007   Flow Mtr BC-152              BC66Aa
;BUB0130   0.0007   Flow Mtr BC-152              BC66Ab
BUO0185   0.0016   Flow Mtr BC-153               BC56u        Industrial discharge
BUO0235   0.0008   Flow Mtr BC-153               BC56o        Industrial discharge
BUO1065   0.0008   Flow Mtr BC-153               BC56p        Industrial discharge
```

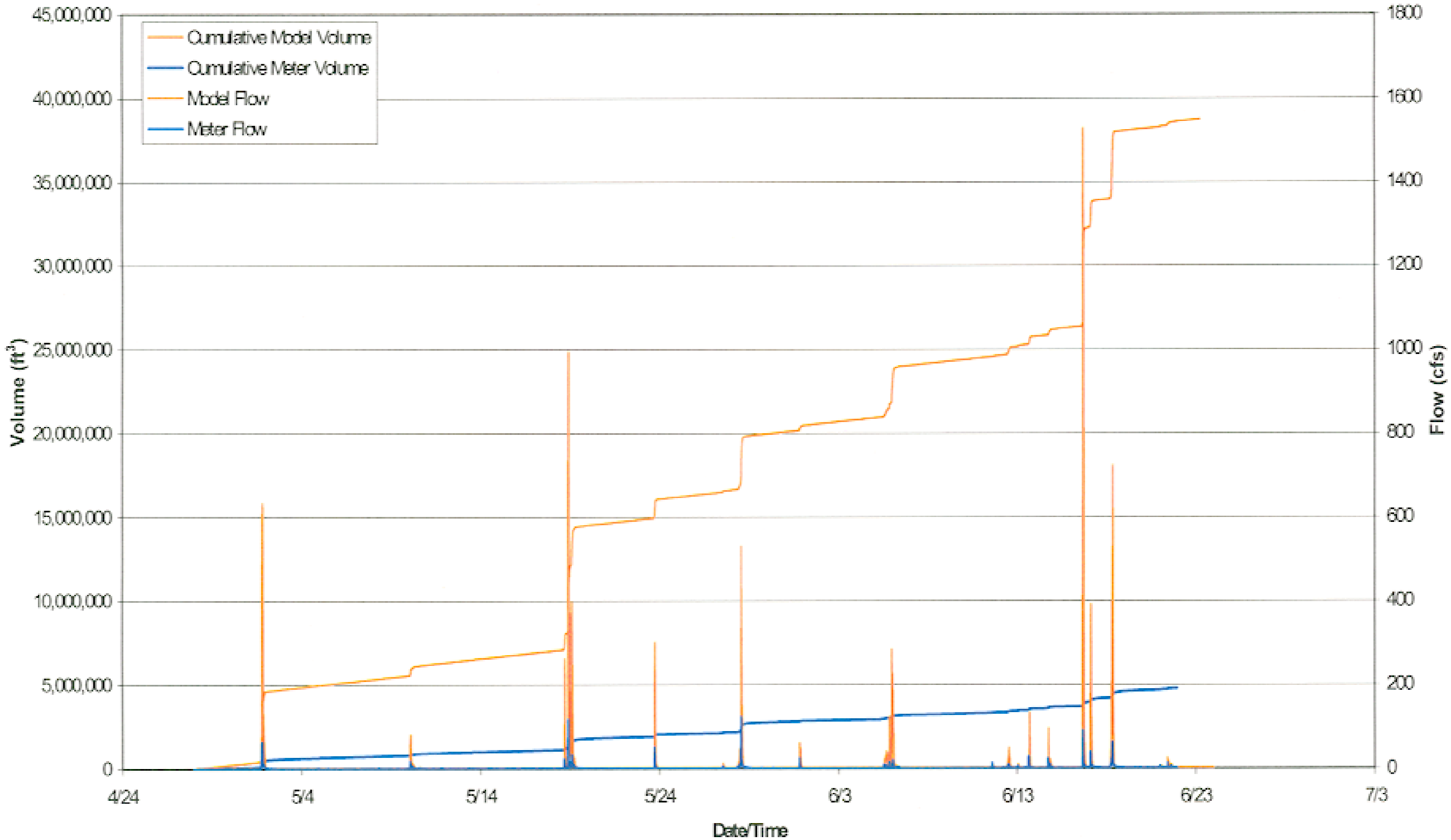
```
BUO1075    0.0008   Flow Mtr BC-153                BC56p        Industrial discharge
BU00115        0.0000  Flow Mtr BC-153  U/S of meter
BZBA045    0.0000   Flow Mtr BC-161                BC65a
BZB0090    0.0000   Flow Mtr BC-161                BC65c
BZBC005    0.0000   Flow Mtr BC-161                BC65c
BZBBA15    0.0000   Flow Mtr BC-161                BC65d
BZBB070    0.0000   Flow Mtr BC-161                BC65e
BZBBB20    0.0000   Flow Mtr BC-161                BC65f
;BZB0040    -0.004  Flow Mtr BC-161  U/S of meter
;BZB0030     0.004  Flow Mtr BC-160  U/S of meter
BQ00045     0.001   Flow Mtr BCI1                  BC301
BC42U       0.001   Flow Mtr BCI1                  BC42a
BQ00145     0.001   Flow Mtr BCI1                  BC43c
BQ00150     0.001   Flow Mtr BCI1                  BC43c
BR00060     0.001   Flow Mtr BCI1                  BC88a
BR00060     0.00142 Flow Mtr BCI1                  BC88a        Industrial discharge
; BC8 submodel
BCST71H    0.0007   BC162A
GUNST30    0.0009   BC162B
BC73A     -0.00127  BC162C, needed for remove MOUSE generated flows
BUD0235    0.0057   BC156
BUDF145    0.00288  BC 157
; Big Creek baseflows
; 5-8-01 need to remove 6 cfs baseflow
BZ00245    0.0226   BC154B 0.8 cfs
BZ0215A    0.0055   BC154A 0.2 cfs
BZ0150B    0.0729   West Branch 3 cfs
BC56E      0.0283   I-71 S. 1 cfs
;BZC0070    0.145    Chev Branch  5.13 cfs
BZC0070    0.0320   Chev Branch  1.13 cfs
BZC0065    0.0716   Chev Branch  to 3.66 cfs (2.5)
BZC0025    0.0138   Chev Branch  up 4.18 cfs (0.5)
;  End  of BCW Submodel
BC89           0.004           BI from BC-132i (minus BC-121) divided by 3
BC82           0.004           BI from BC-132i (minus BC-121) divided by 4
BN00285        0.00142         Adjusted BI for BC-121
BNC0045        0.004           BI from BC-132i (minus BC-121) divided by 4
BN00097        0.00142         BI from BC-132
BN00105        0.00142         BI from BC-131 (minus all upstream BI)
BNA0085        0.000142        BI from BC-134.  Change node name to reflect most
current upstream node in model network
BNA0025        0.000142        BI from BC-133 (minus that of BC-134)
BN00015        0.000028        BI from BC-163 (actually came out to 0 when
subtracting upstream areas.  .001 is a placeholder)
BBB185B        0.0006
BBB085B        0.00001
BD00130        0.00001
BBAB040        0.00001
JEN1030        0.00001
BBBA015        0.00001
BBAA165        0.00001
BCA0065        0.00001
BBAA130        0.00001
BBB0005        0.0085
BL00025        0.00126
CIFEND
```

APPENDIX F

Meter KR-46
Meter vs. Modeled Storms

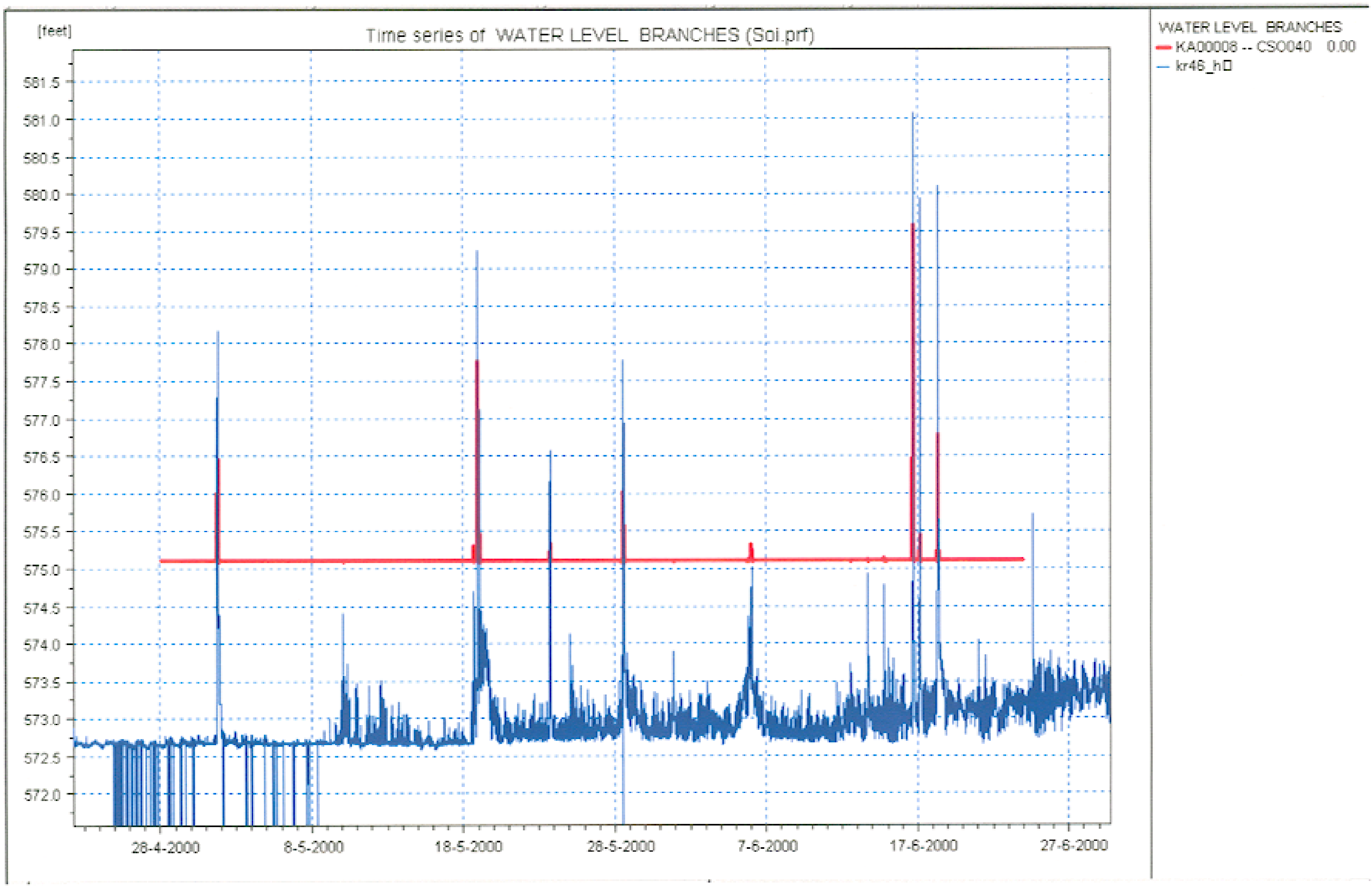


KR-46

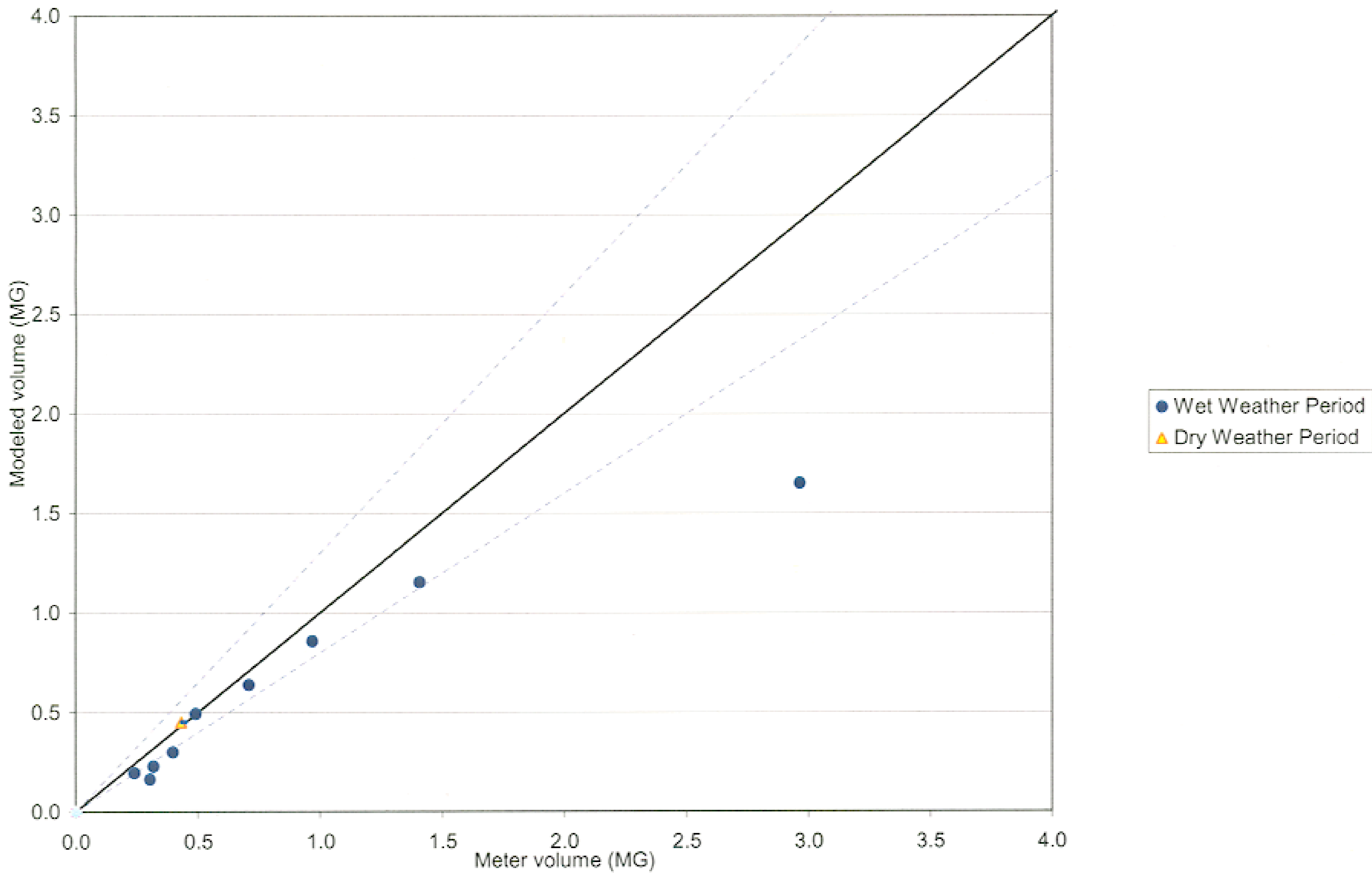


Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Volume (ft³)
Flow (cfs)
Date/Time
45,000,000
40,000,000
35,000,000
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
1800
1600
1400
1200
1000
800
600
400
200
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3

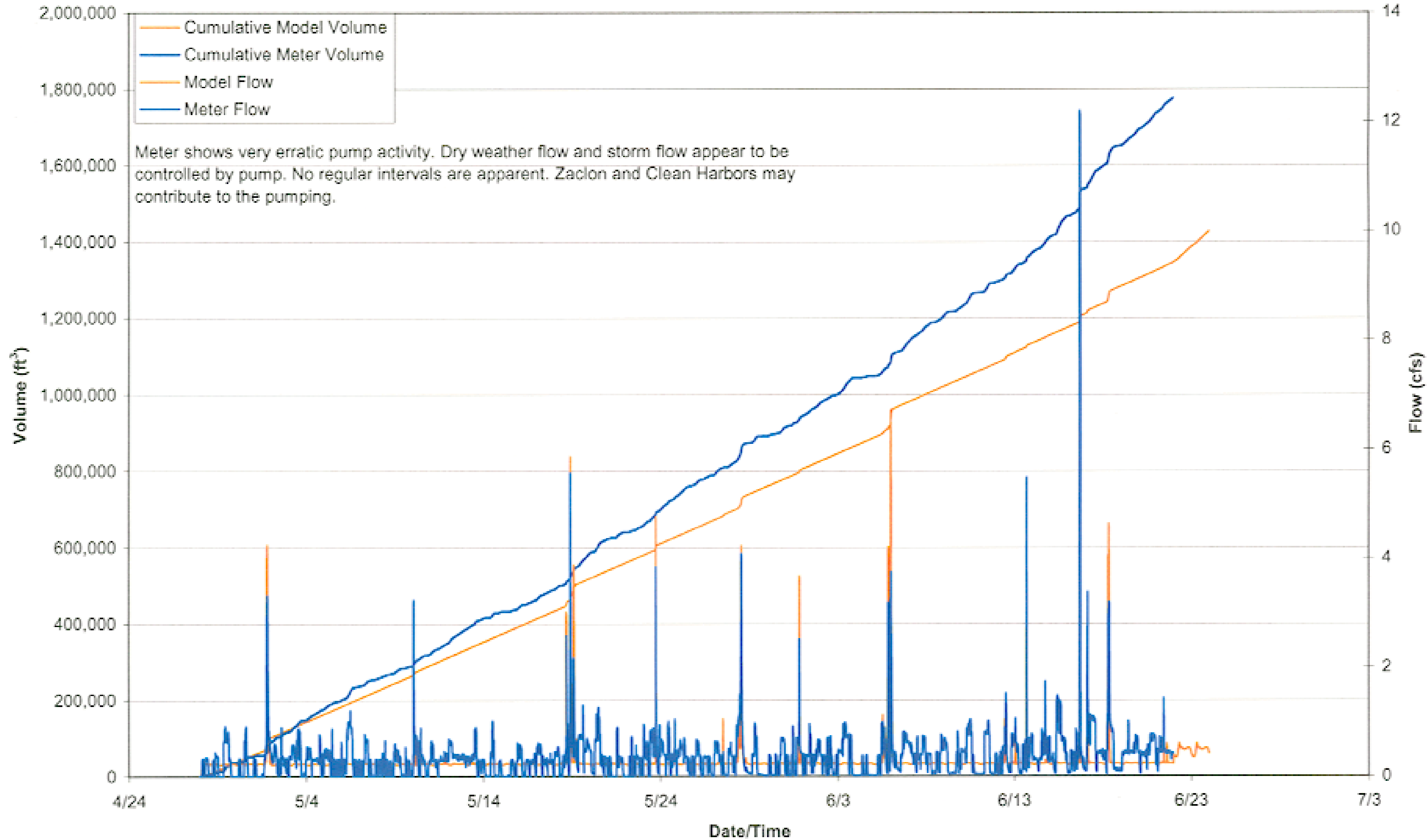
Meter KR-46
Hydraulic Gradeline



Meter SO-125
Meter vs. Modeled Storms

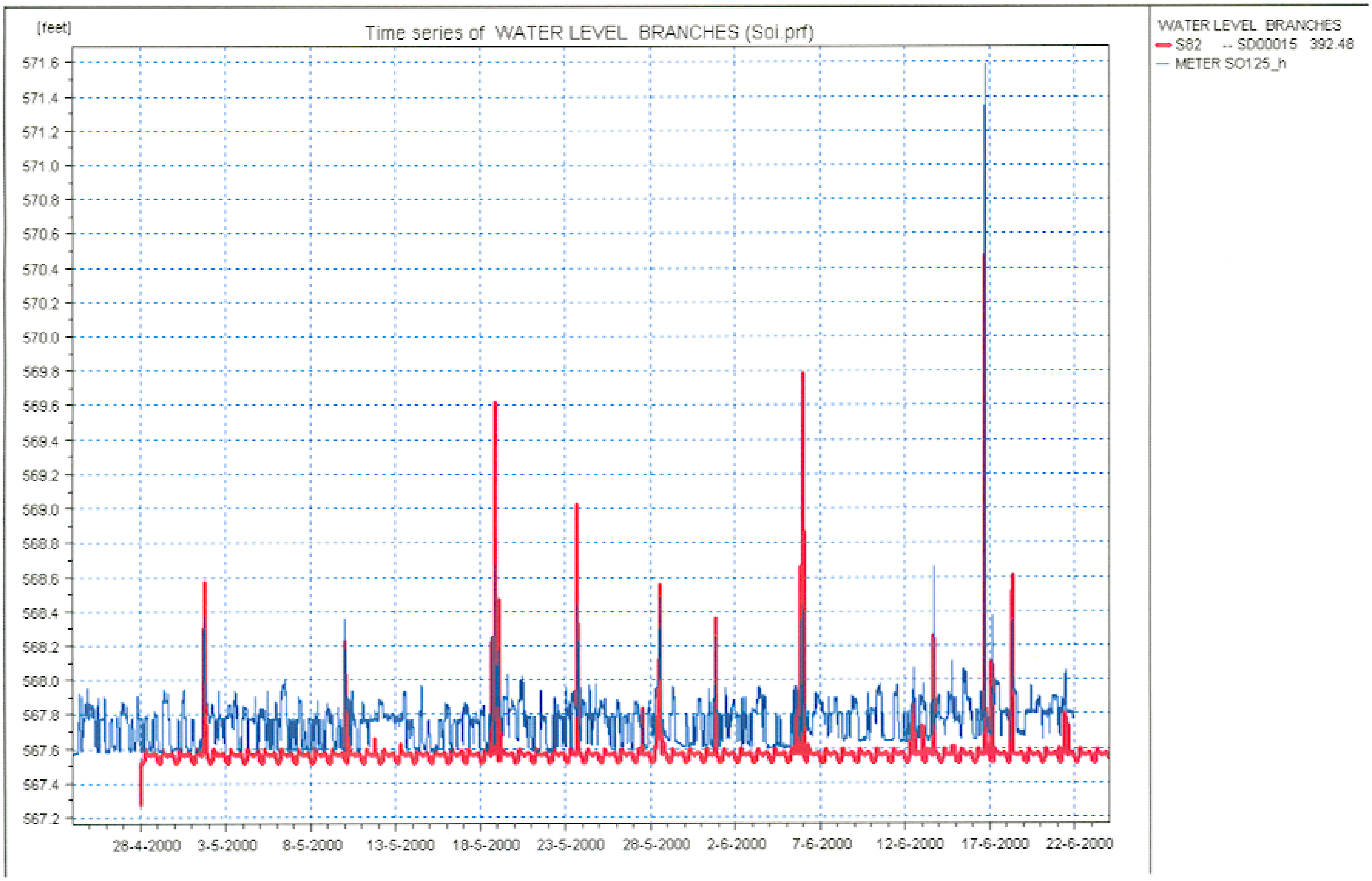


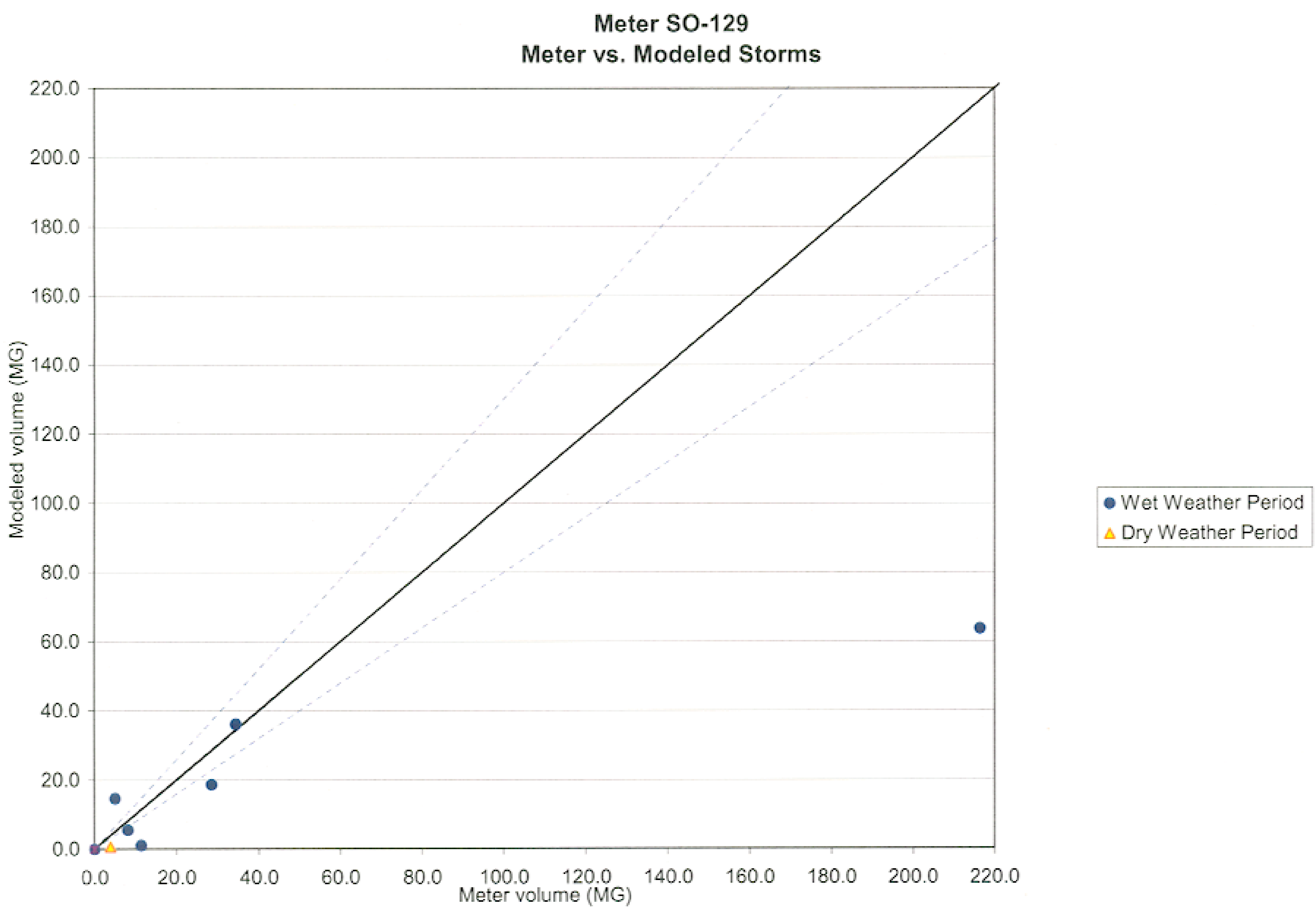
SO-125



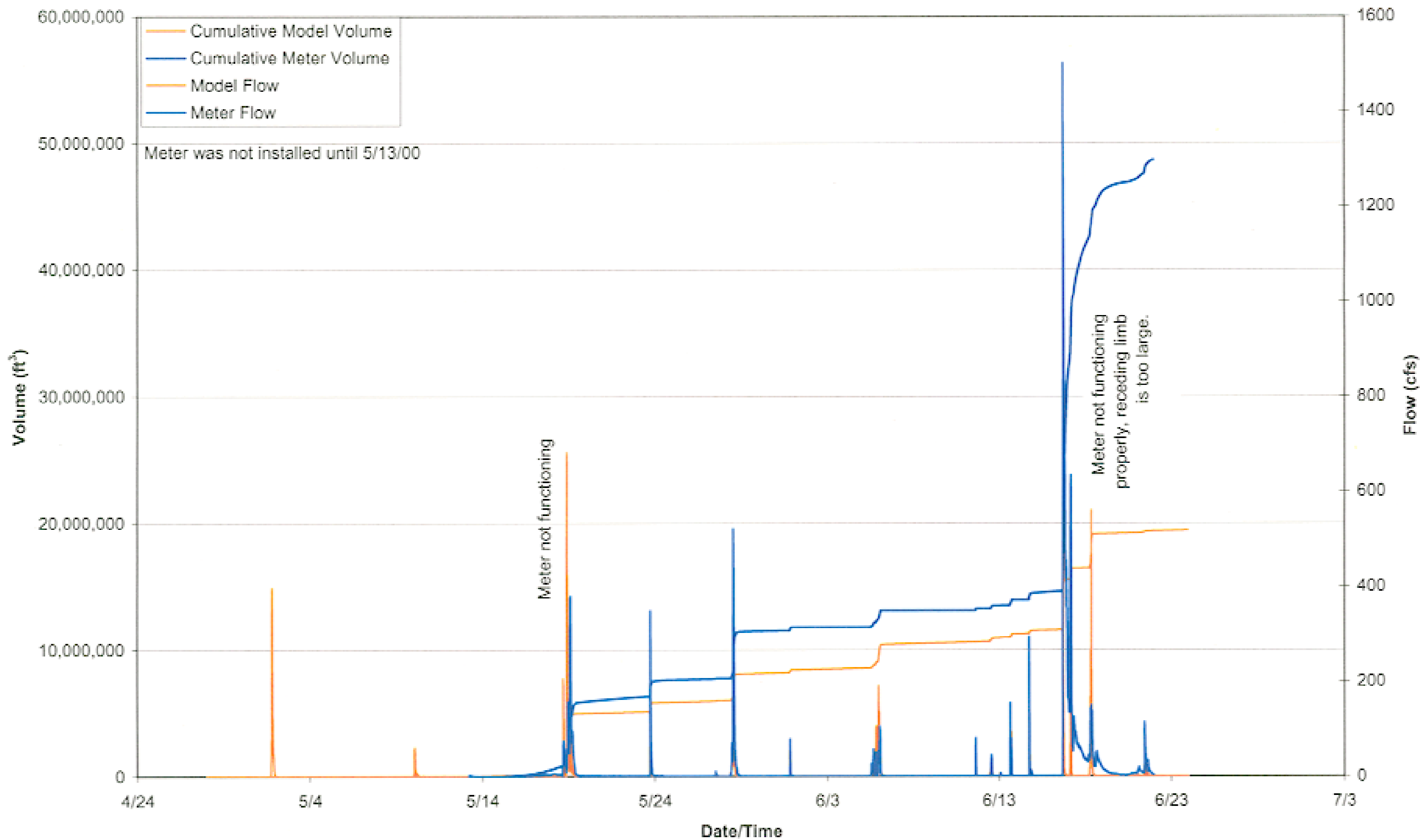
Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Meter shows very erratic pump activity. Dry weather flow and storm flow appear to be controlled by pump. No regular intervals are apparent. Zaclon and Clean Harbors may contribute to the pumping.
Volume (ft³)
2,000,000
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Flow (cfs)
14
12
10
8
6
4
2
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

Meter SO-125
Hydraulic Gradeline

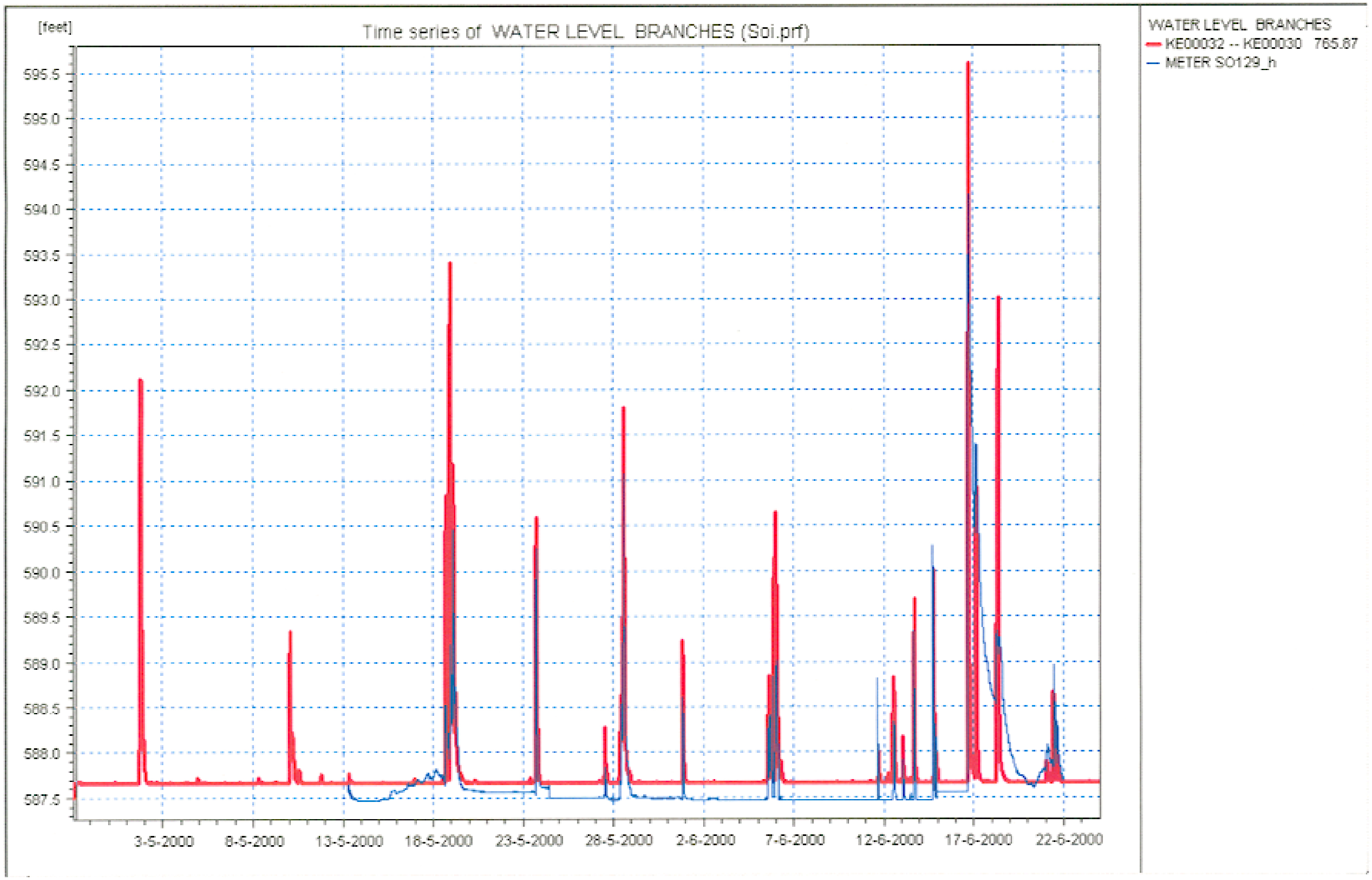


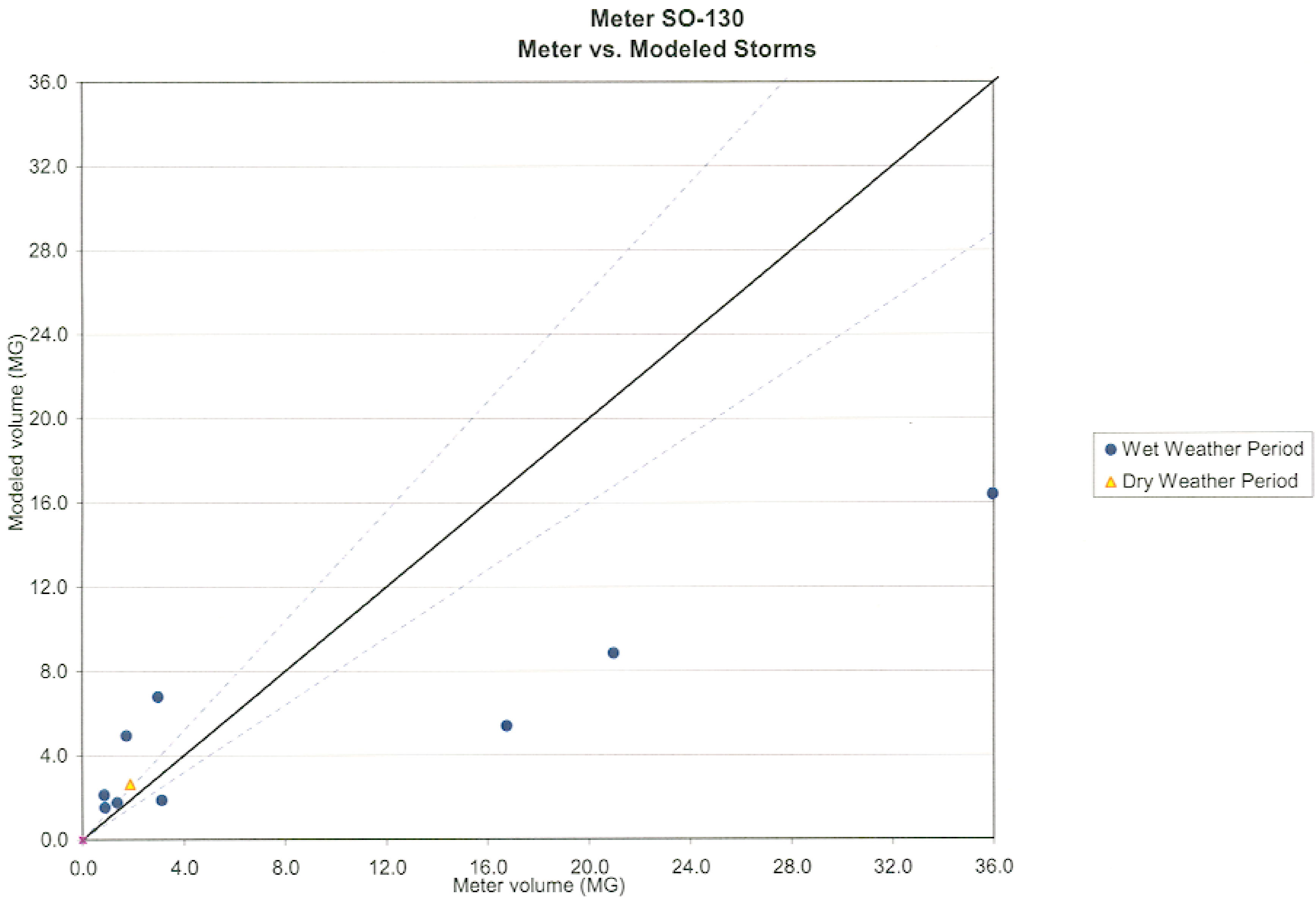

Meter SO-129
Meter vs. Modeled Storms
Modeled volume (MG)
220.0
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
200.0
220.0
Meter volume (MG)
Wet Weather Period
Dry Weather Period

SO-129


Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Meter was not installed until 5/13/00
Meter not functioning
Meter not functioning properly, receding limb is too large.
Volume (ft^3)
60,000,000
50,000,000
40,000,000
30,000,000
20,000,000
10,000,000
0
Flow (cfs)
1600
1400
1200
1000
800
600
400
200
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

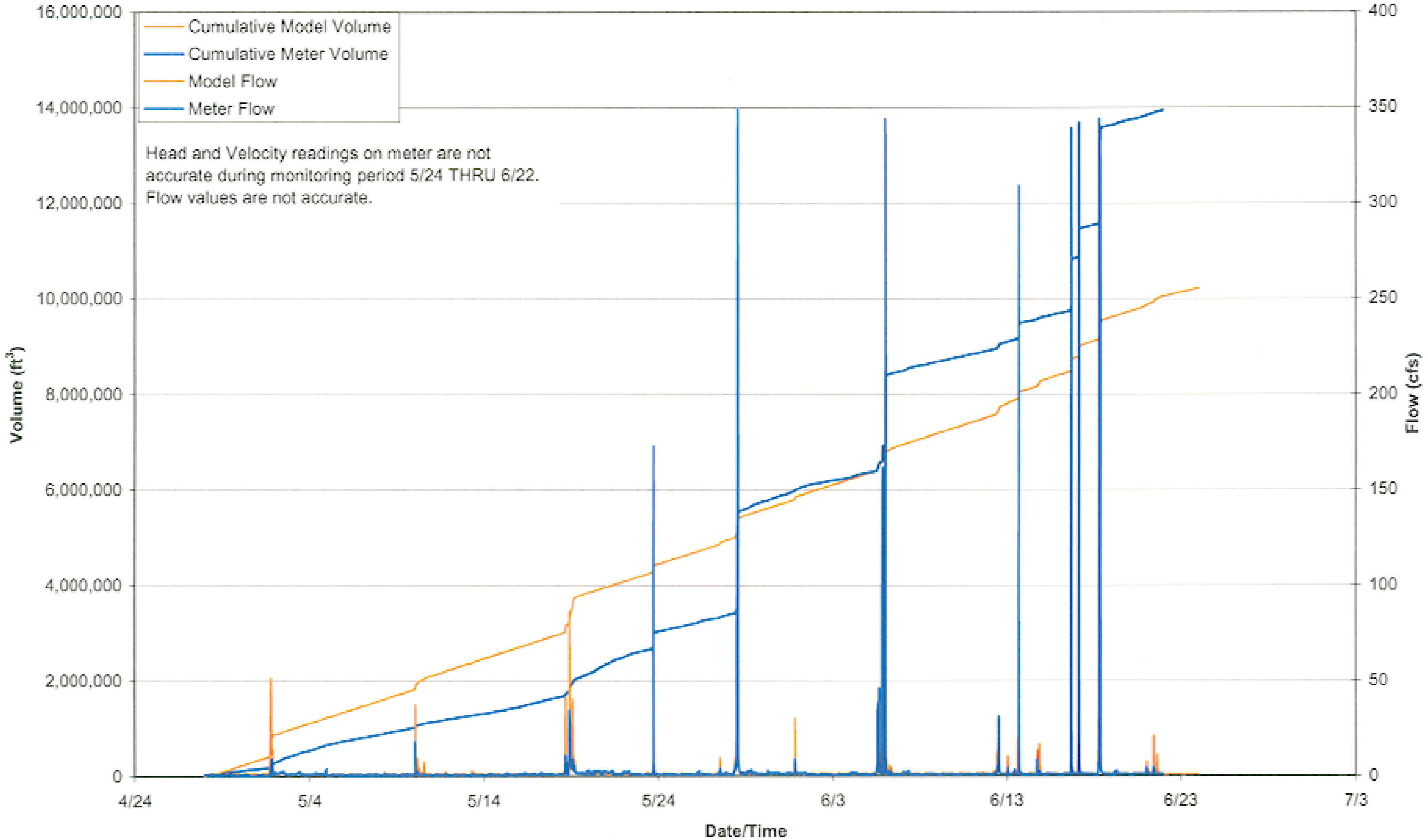
Meter SO-129
Hydraulic Gradeline





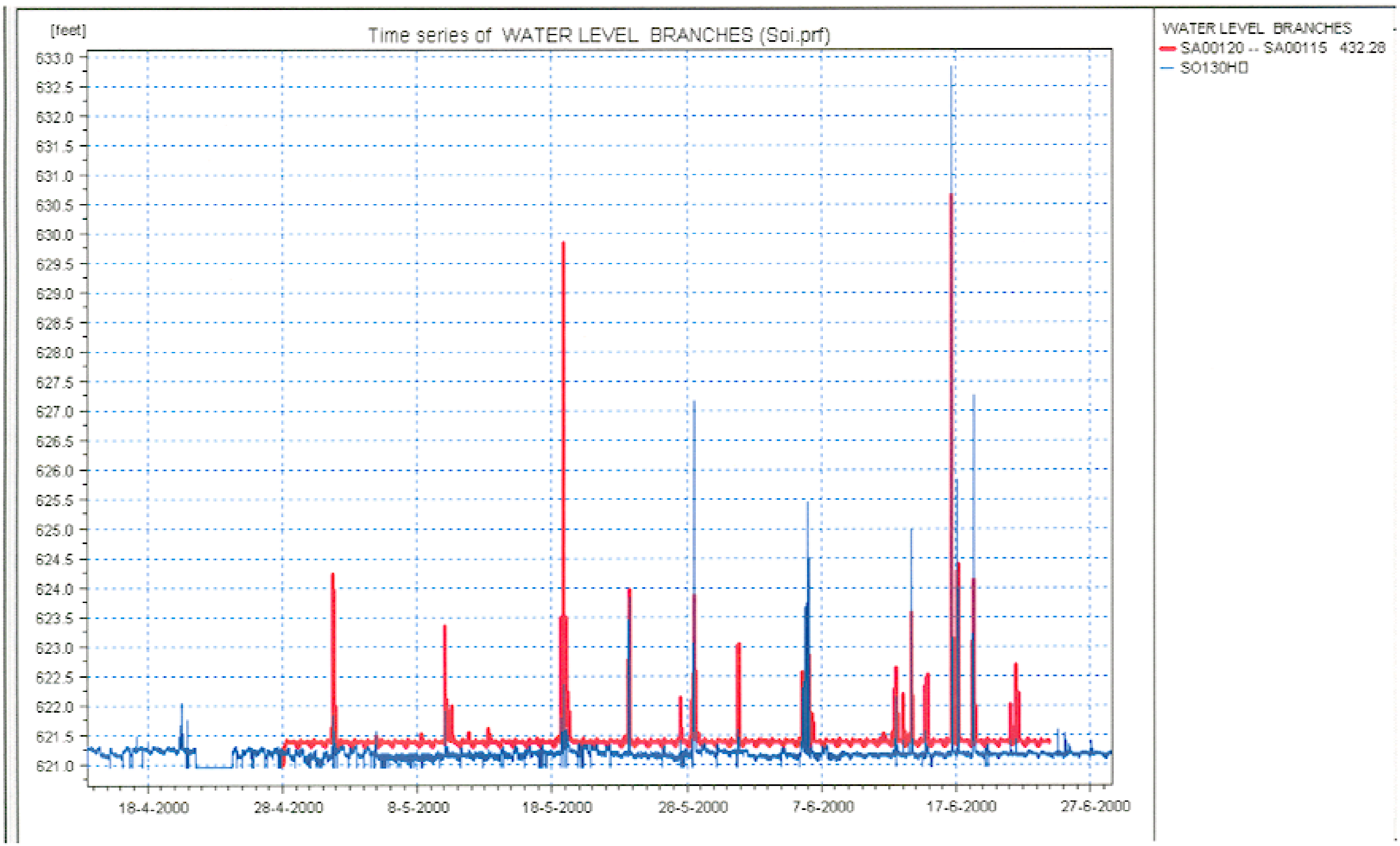
Meter SO-130
Meter vs. Modeled Storms
Modeled volume (MG)
36.0
32.0
28.0
24.0
20.0
16.0
12.0
8.0
4.0
0.0
0.0
4.0
8.0
12.0
16.0
20.0
24.0
28.0
32.0
36.0
Meter volume (MG)
Wet Weather Period
Dry Weather Period

SO-130

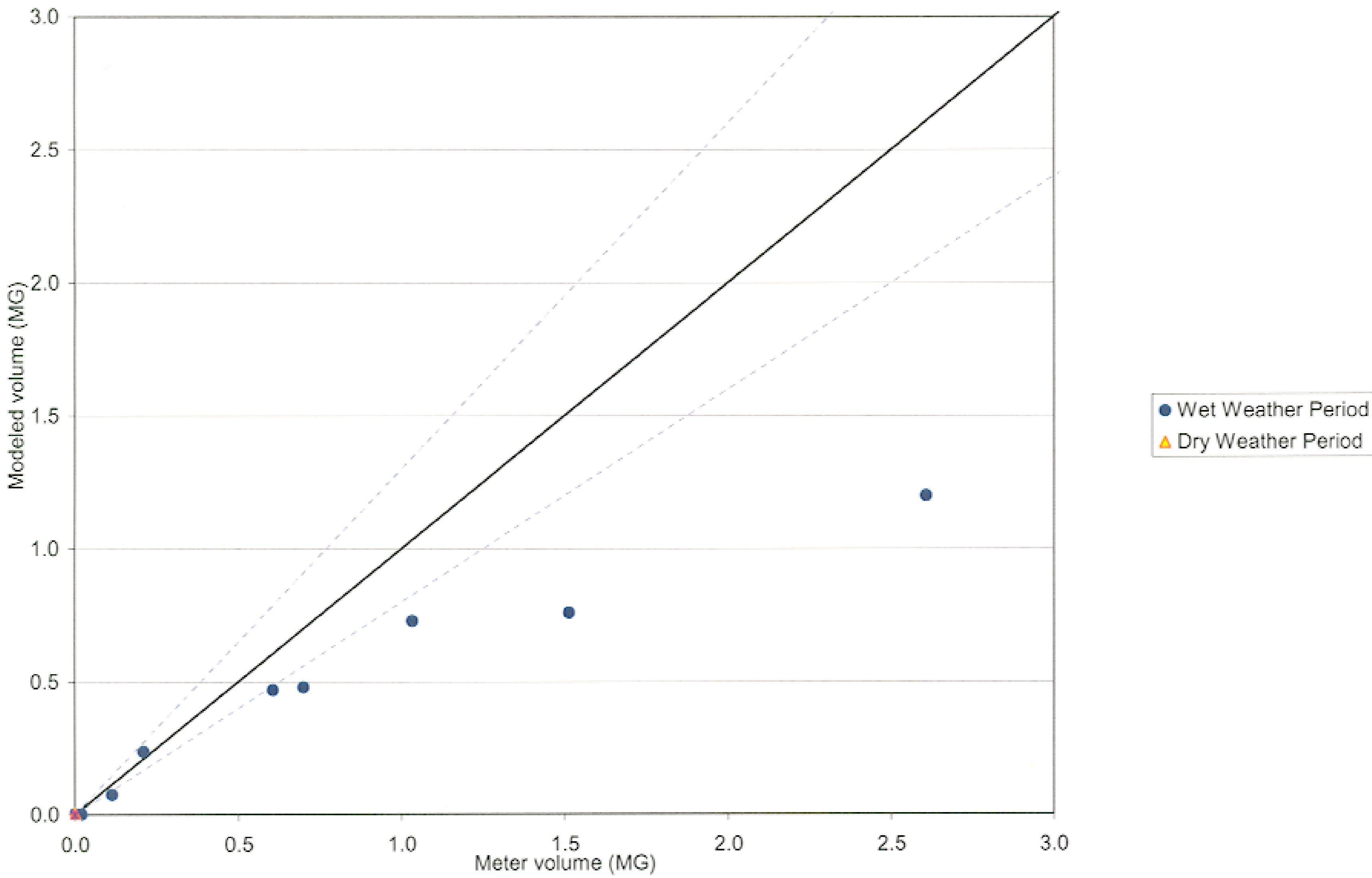


Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Head and Velocity readings on meter are not accurate during monitoring period 5/24 THRU 6/22. Flow values are not accurate.
Volume (ft³)
16,000,000
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
Flow (cfs)
400
350
300
250
200
150
100
50
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

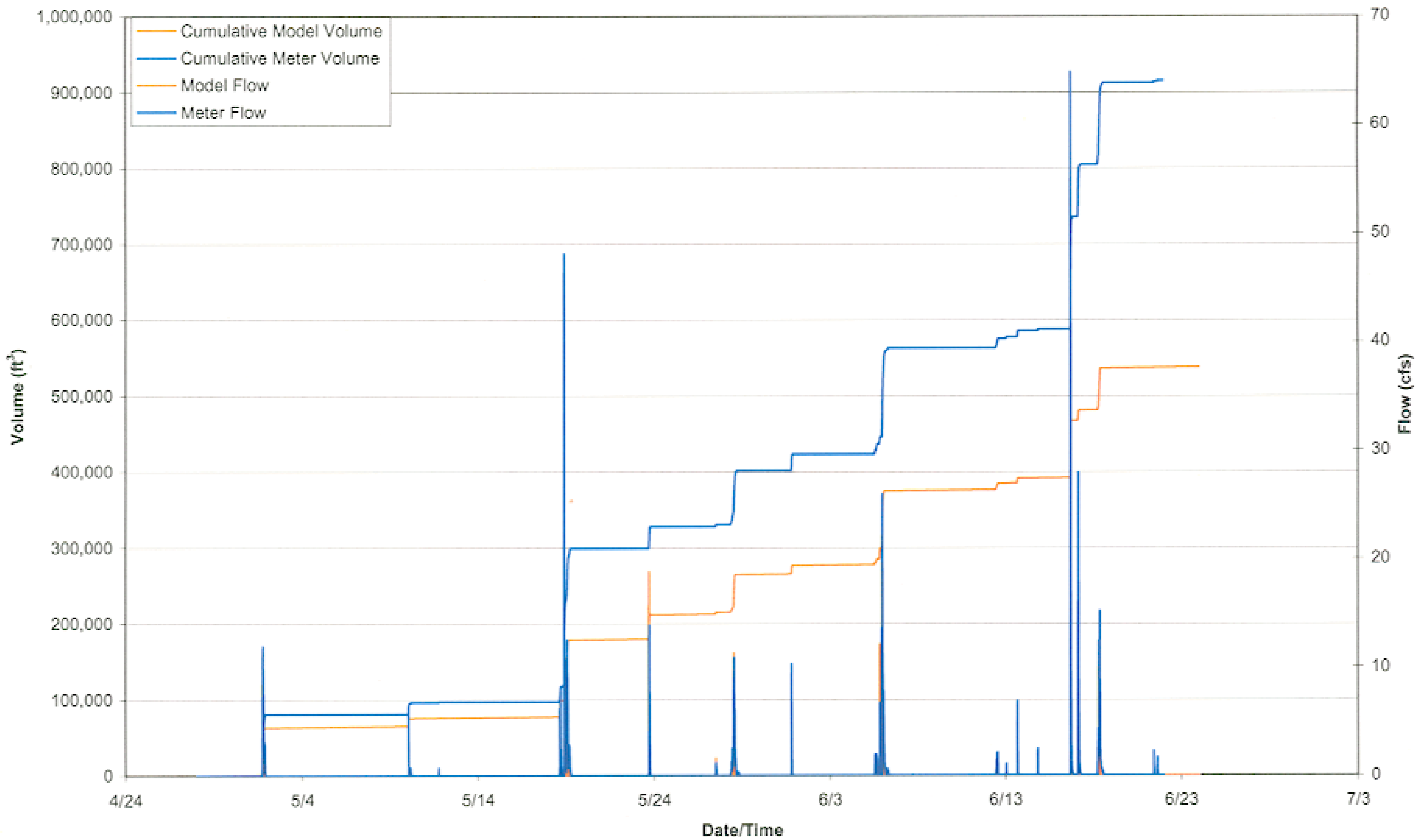
Meter SO-130
Hydraulic Gradeline



Meter BB035
Meter vs. Modeled Storms

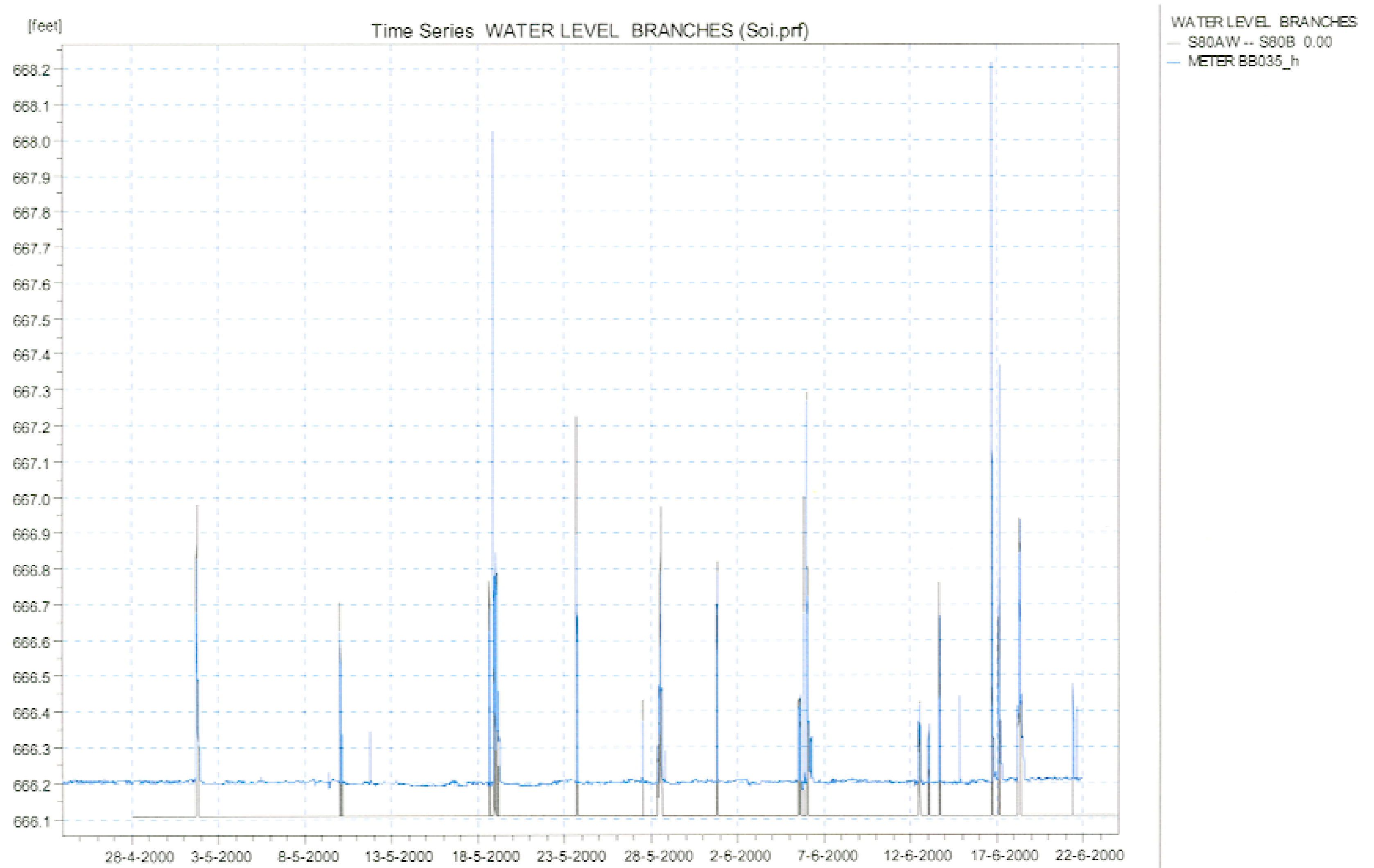


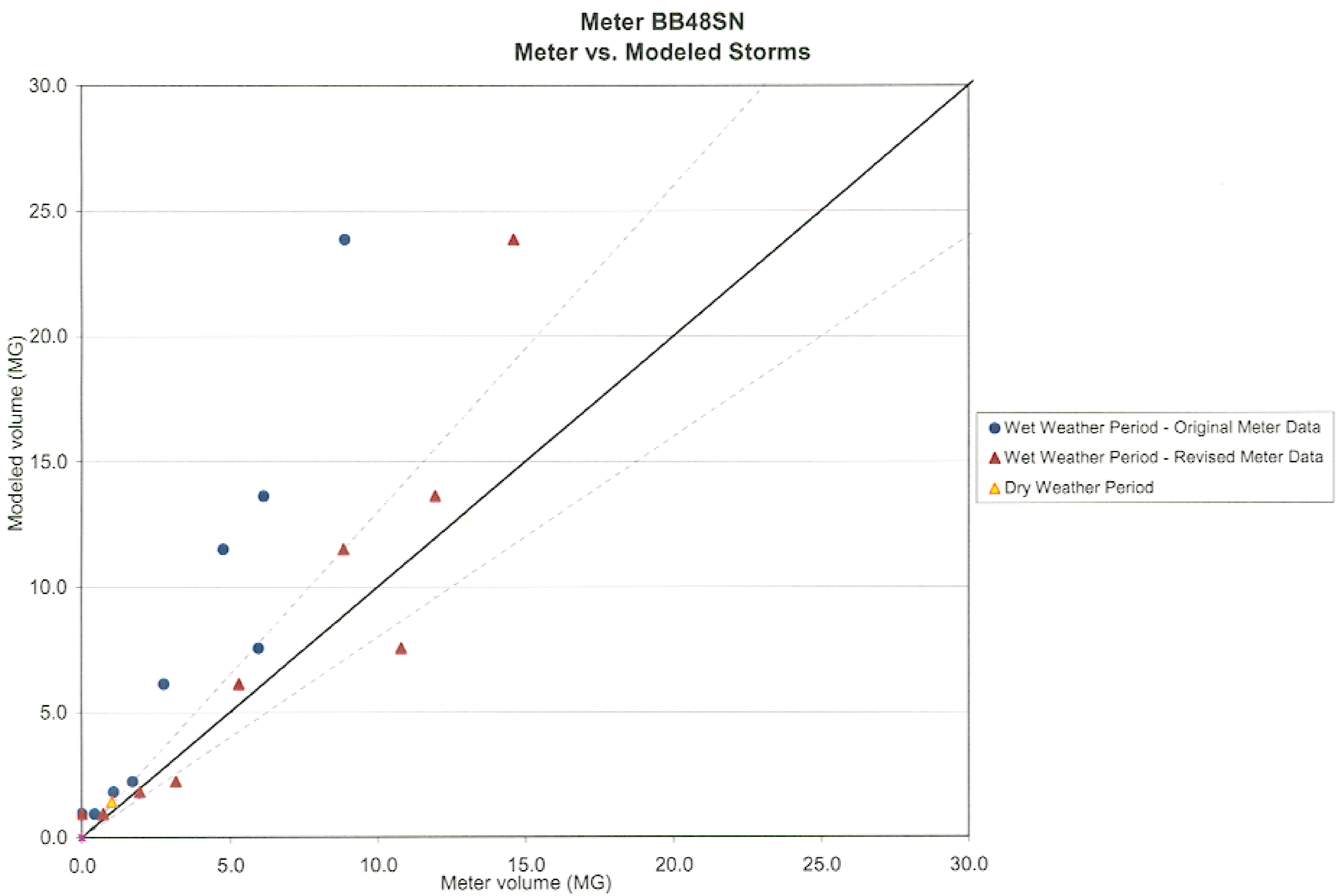
BB035



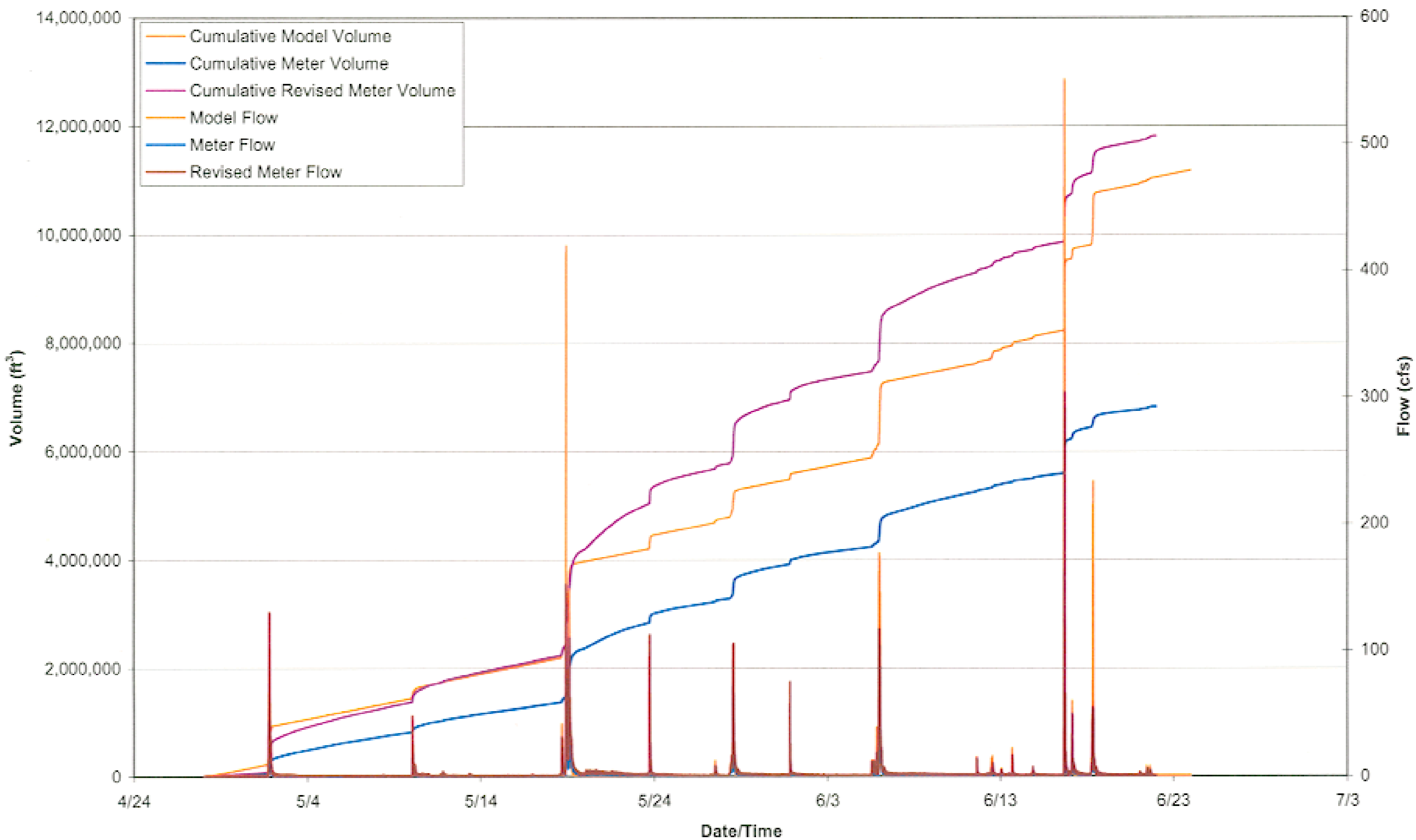
Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Volume (ft^3)
1,000,000
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
Flow (cfs)
70
60
50
40
30
20
10
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

Meter BB035
Hydraulic Gradeline



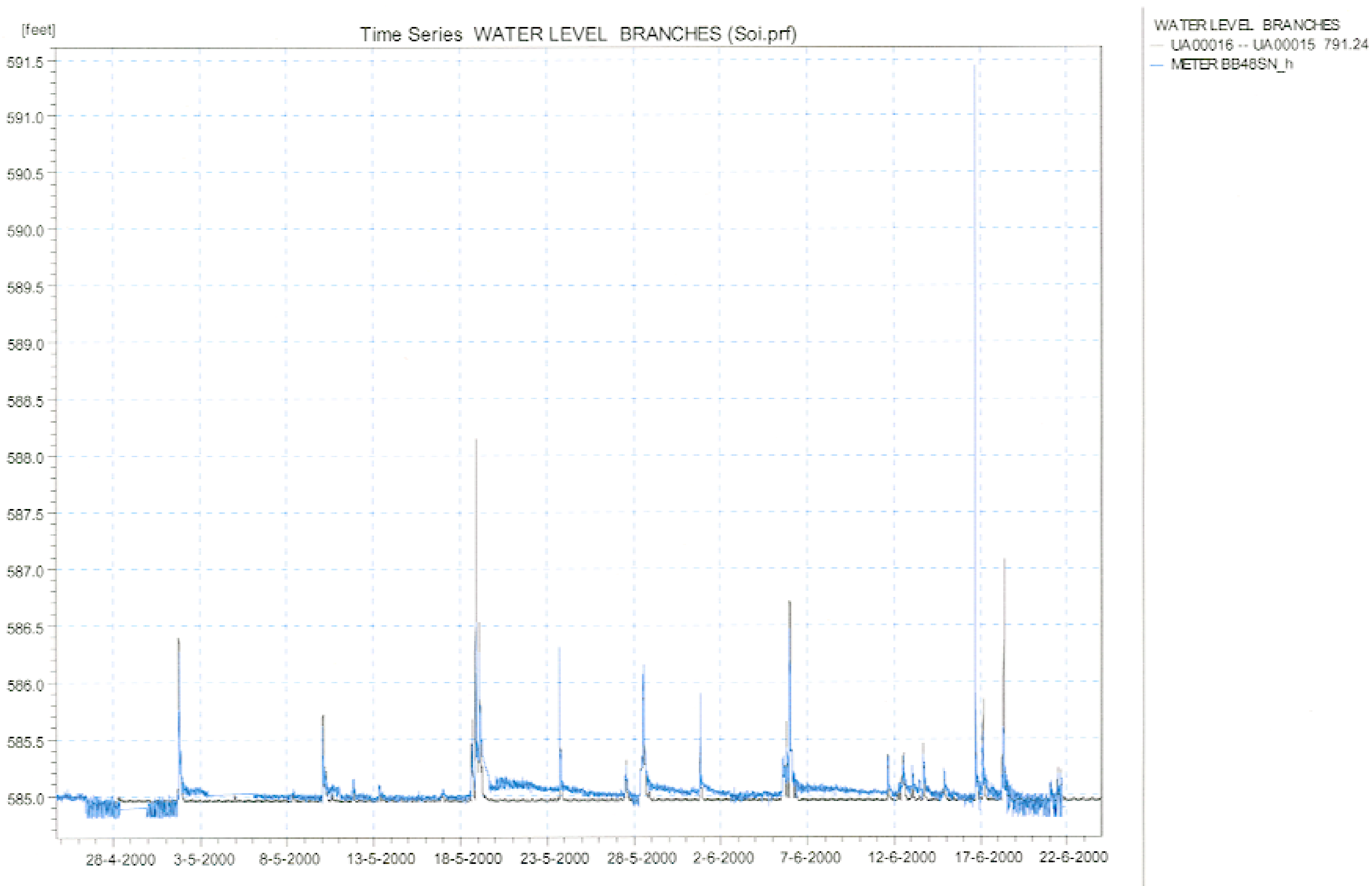

Meter BB48SN
Meter vs. Modeled Storms
Modeled volume (MG)
Meter volume (MG)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
Wet Weather Period - Original Meter Data
Wet Weather Period - Revised Meter Data
Dry Weather Period

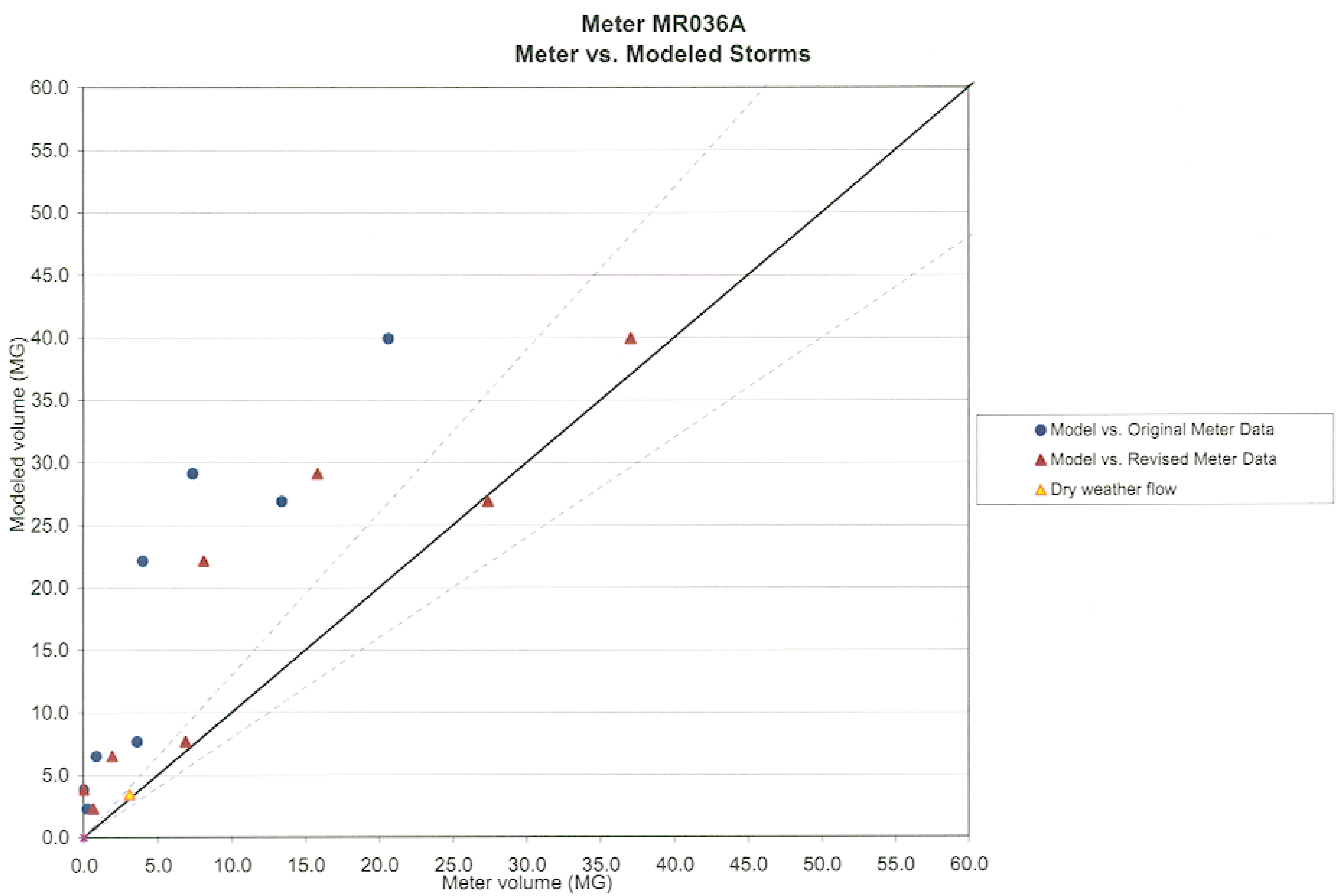
BB48SN



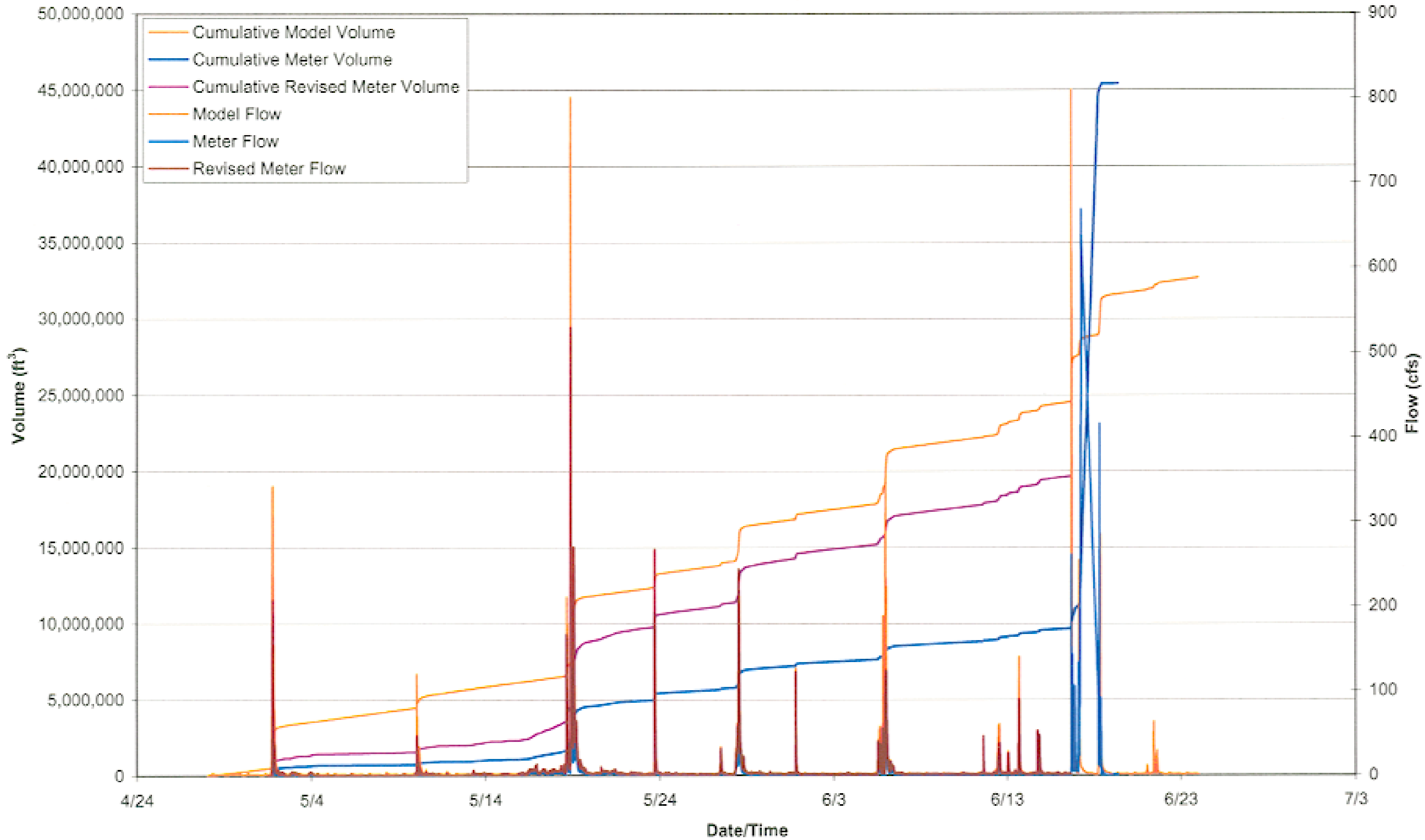
Cumulative Model Volume
Cumulative Meter Volume
Cumulative Revised Meter Volume
Model Flow
Meter Flow
Revised Meter Flow
Volume (ft³)
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
Flow (cfs)
600
500
400
300
200
100
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

Meter BB48SN
Hydraulic Gradeline



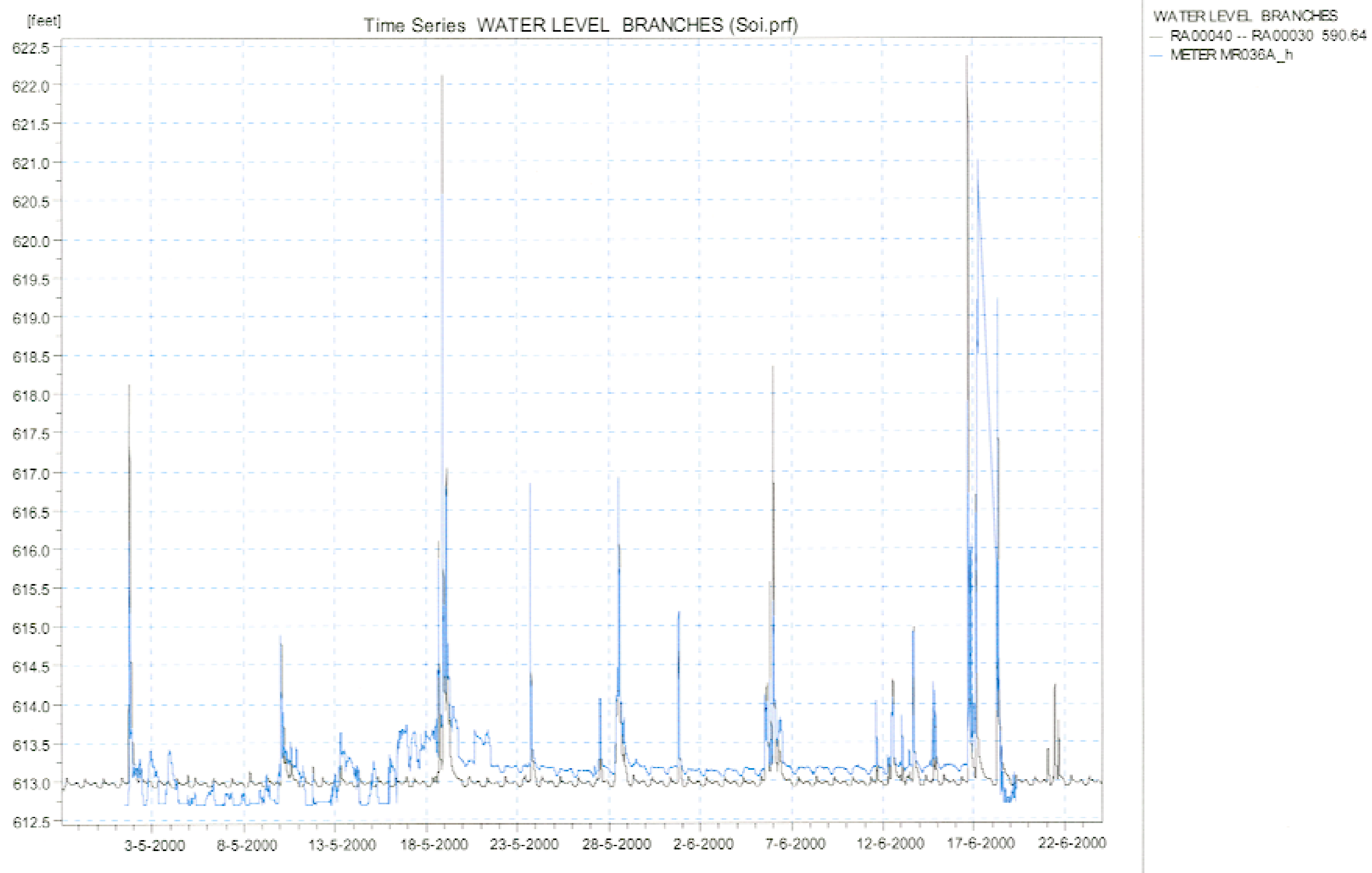

Meter MR036A
Meter vs. Modeled Storms
Modeled volume (MG)
Meter volume (MG)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
Model vs. Original Meter Data
Model vs. Revised Meter Data
Dry weather flow

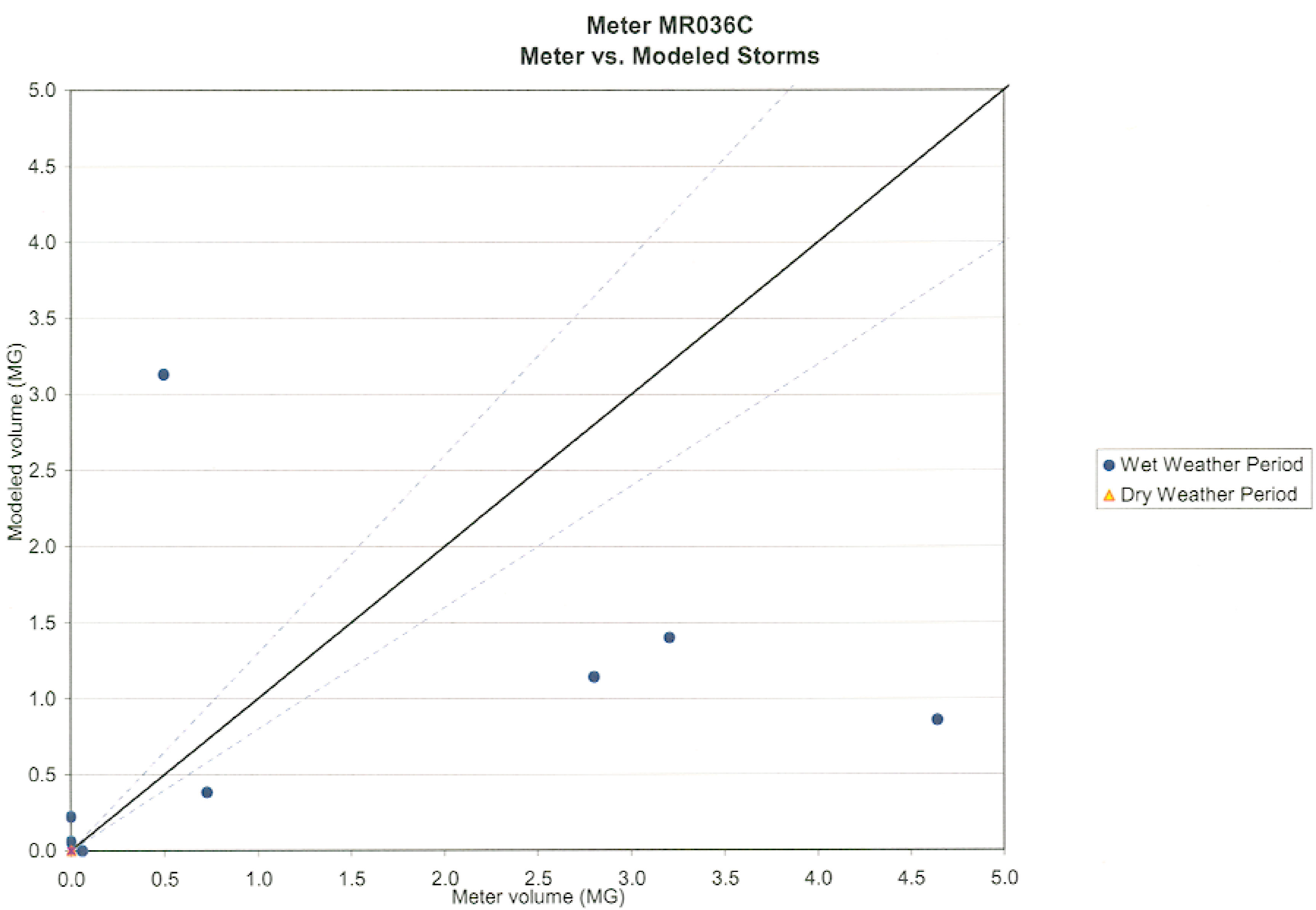
MR036A



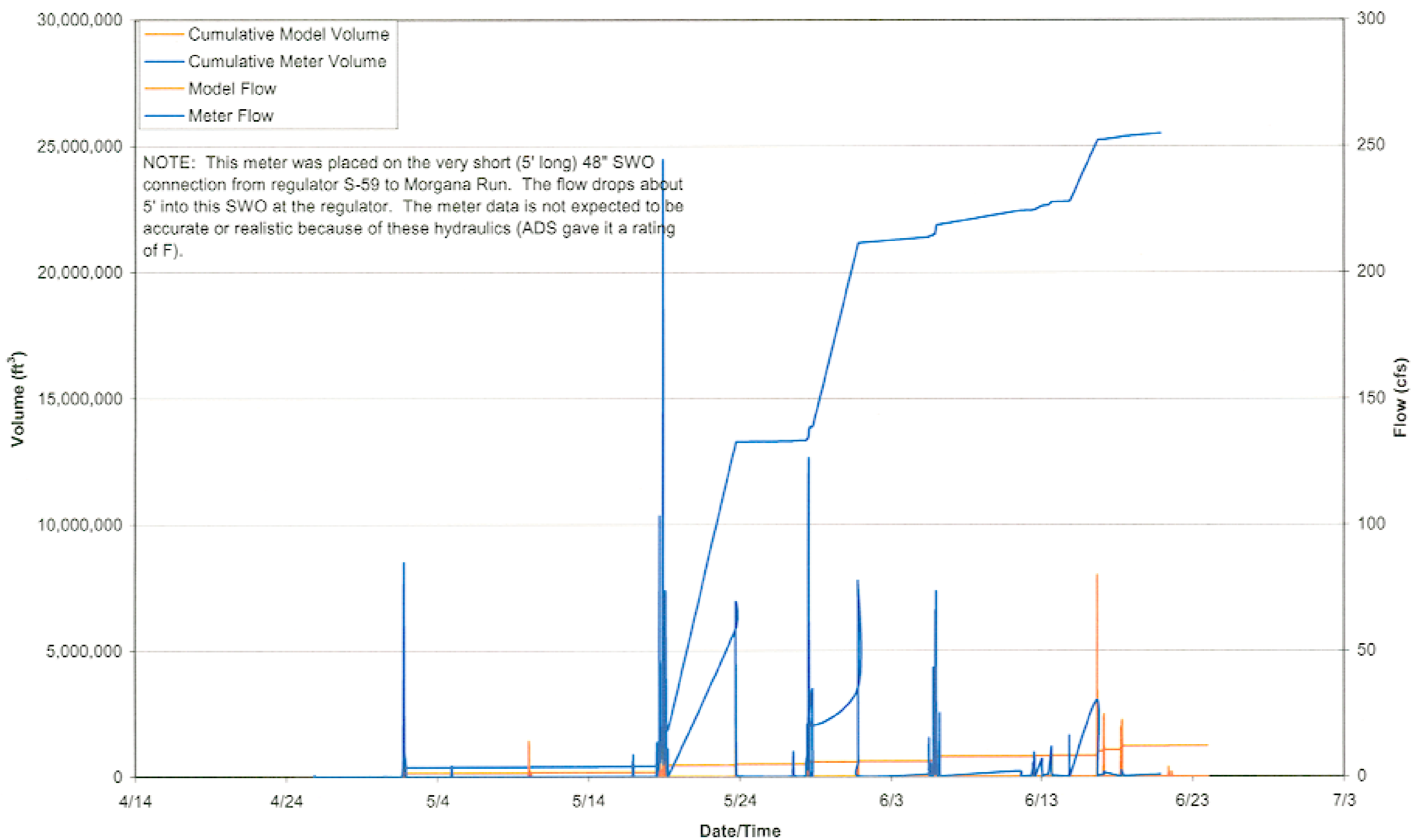
Cumulative Model Volume
Cumulative Meter Volume
Cumulative Revised Meter Volume
Model Flow
Meter Flow
Revised Meter Flow
Volume (ft³)
50,000,000
45,000,000
40,000,000
35,000,000
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
Flow (cfs)
900
800
700
600
500
400
300
200
100
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

Meter MR036A
Hydraulic Gradeline



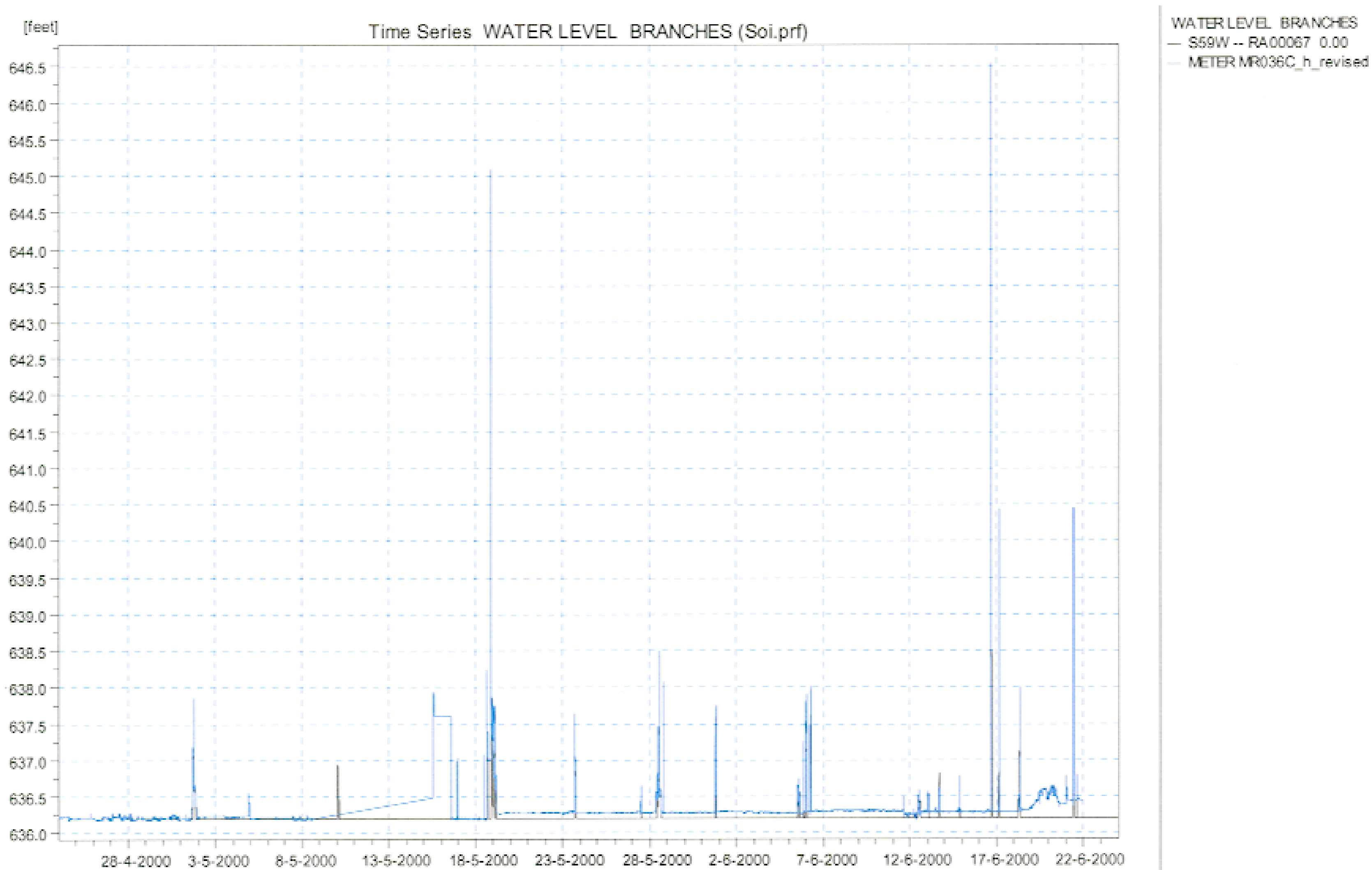

Meter MR036C
Meter vs. Modeled Storms
Modeled volume (MG)
Meter volume (MG)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Wet Weather Period
Dry Weather Period

MR036C

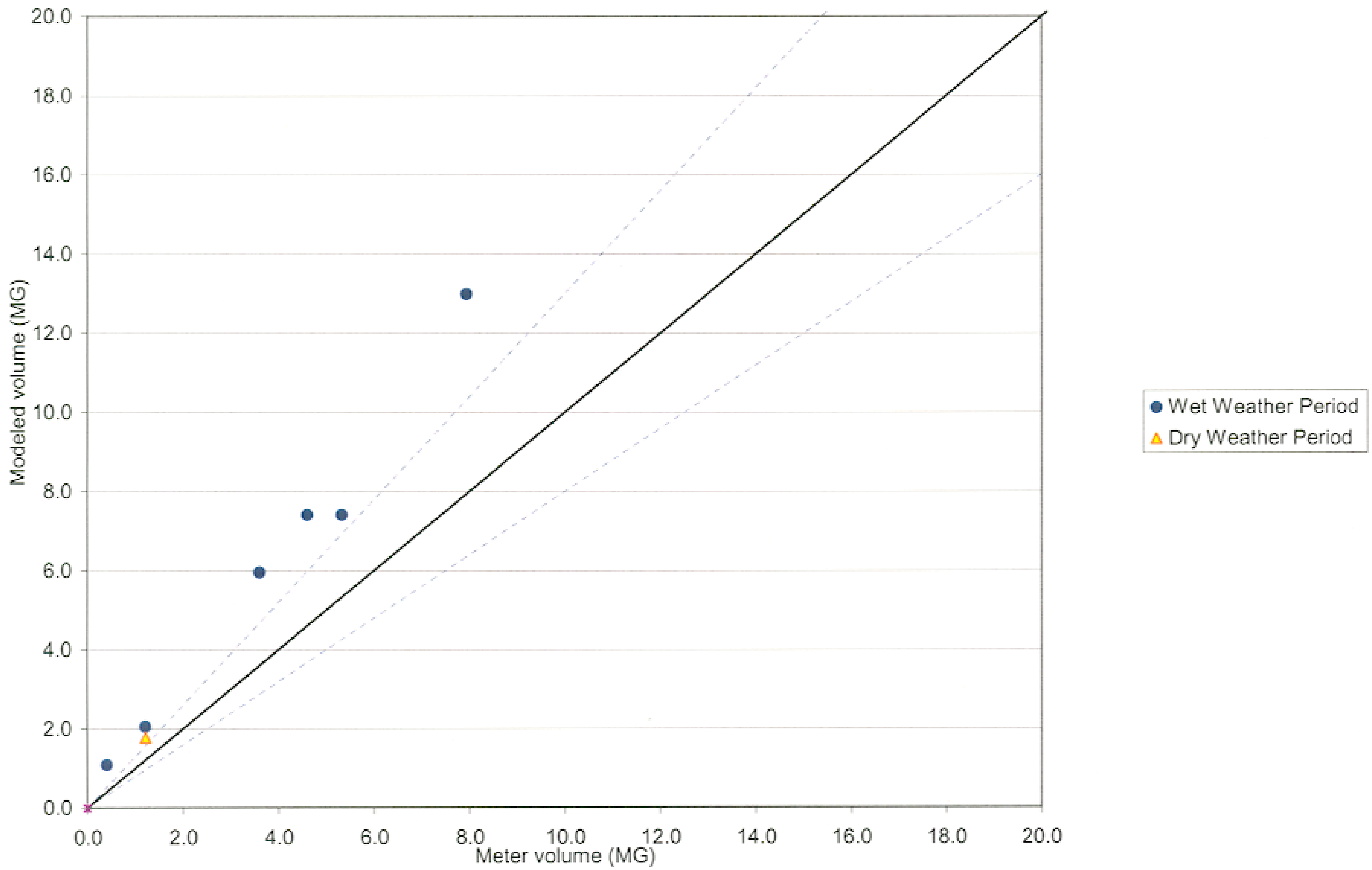


Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
NOTE: This meter was placed on the very short (5' long) 48" SWO connection from regulator S-59 to Morgana Run. The flow drops about 5' into this SWO at the regulator. The meter data is not expected to be accurate or realistic because of these hydraulics (ADS gave it a rating of F).
Volume (ft³)
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
Flow (cfs)
300
250
200
150
100
50
0
4/14
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

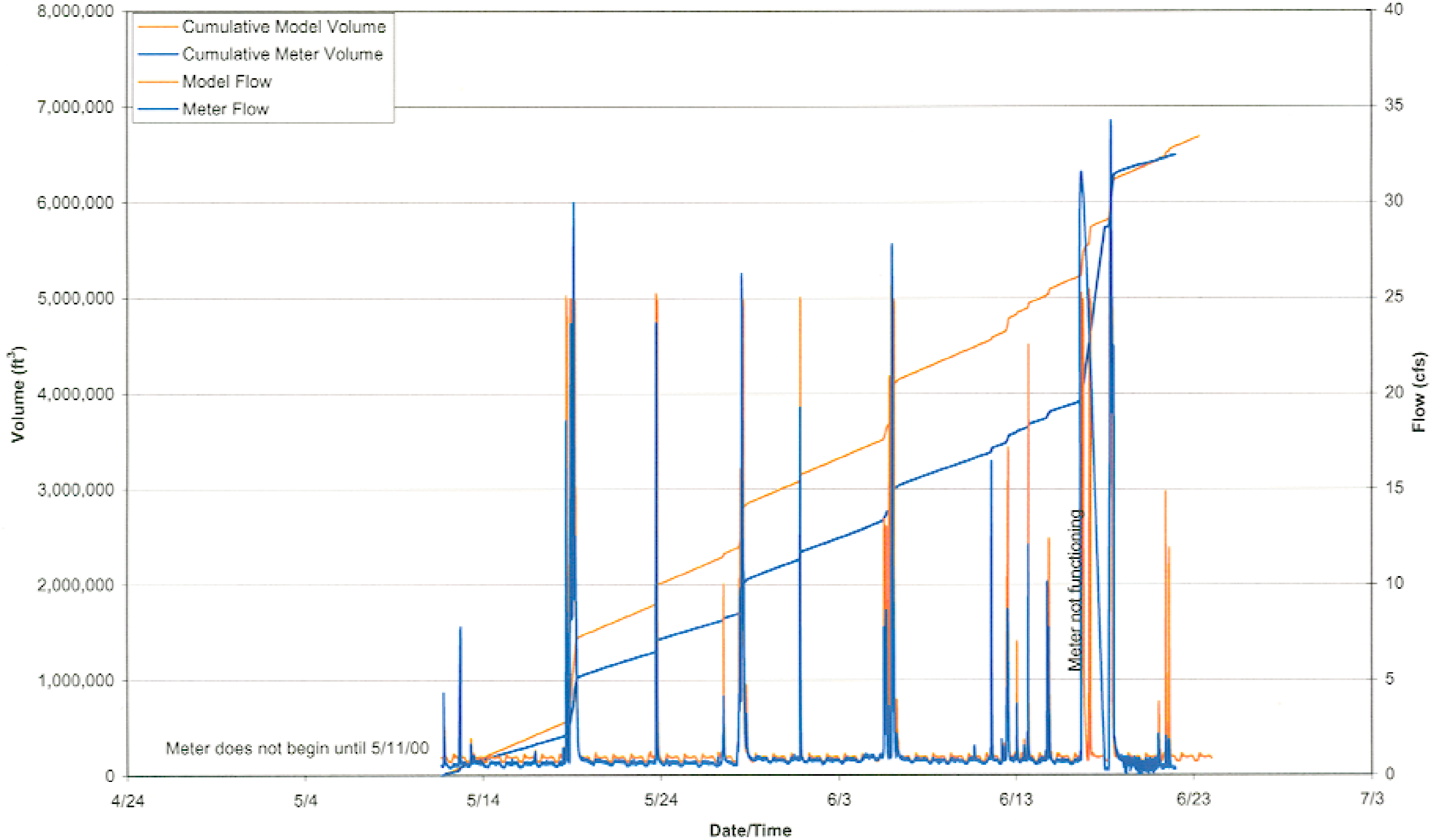
Meter MR036C
Hydraulic Gradeline



Meter SO-102
Meter vs. Modeled Storms

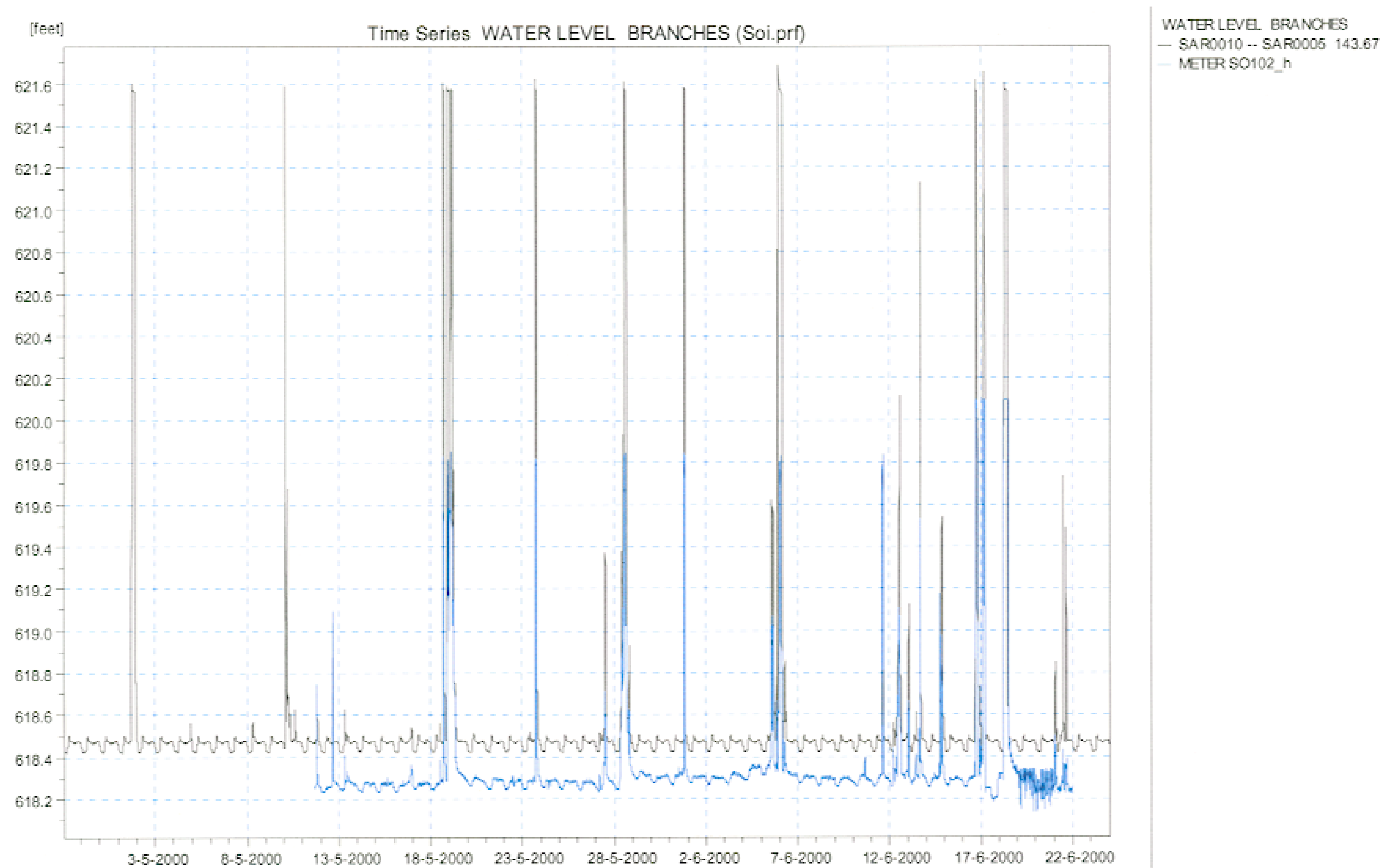


SO-102

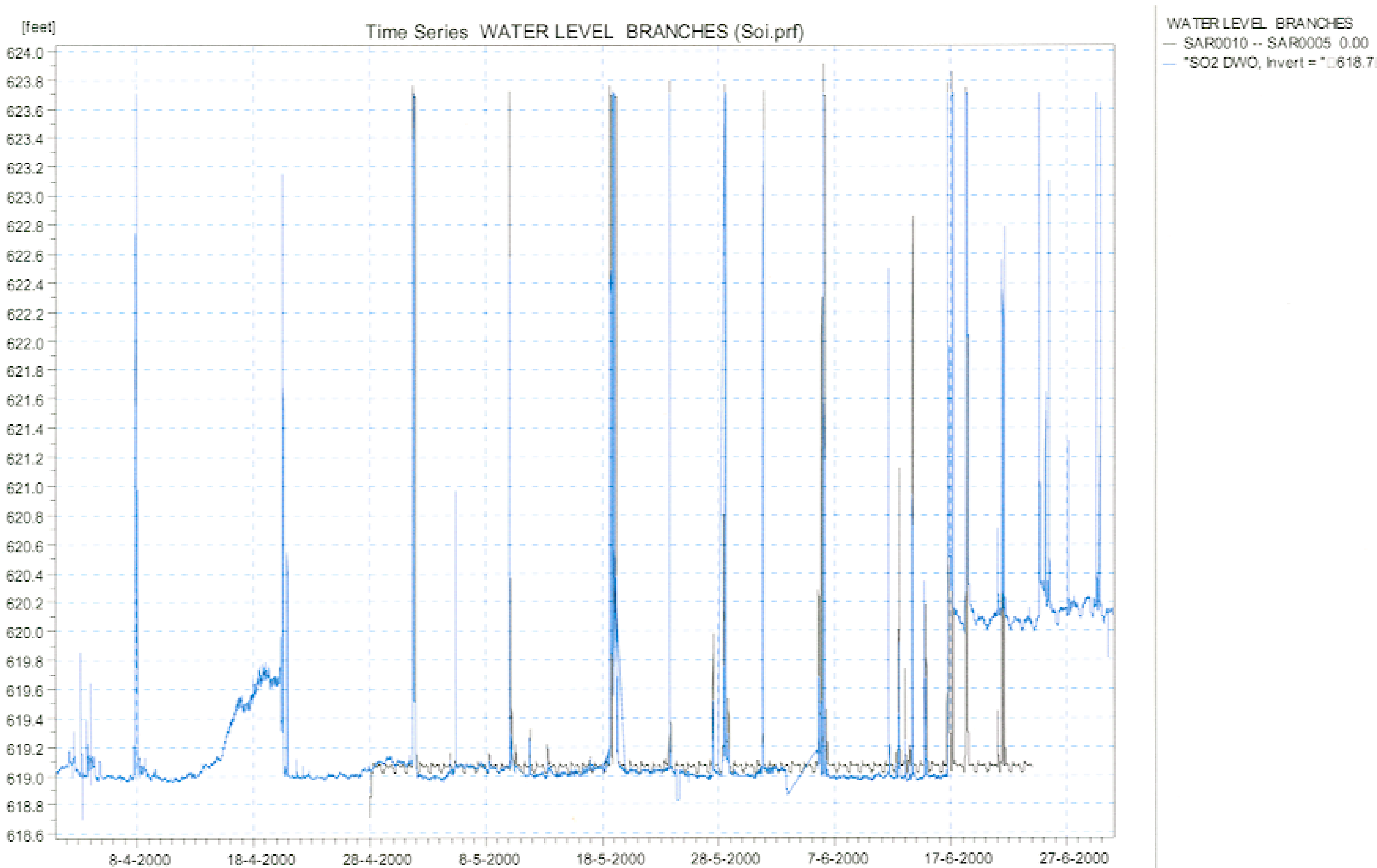


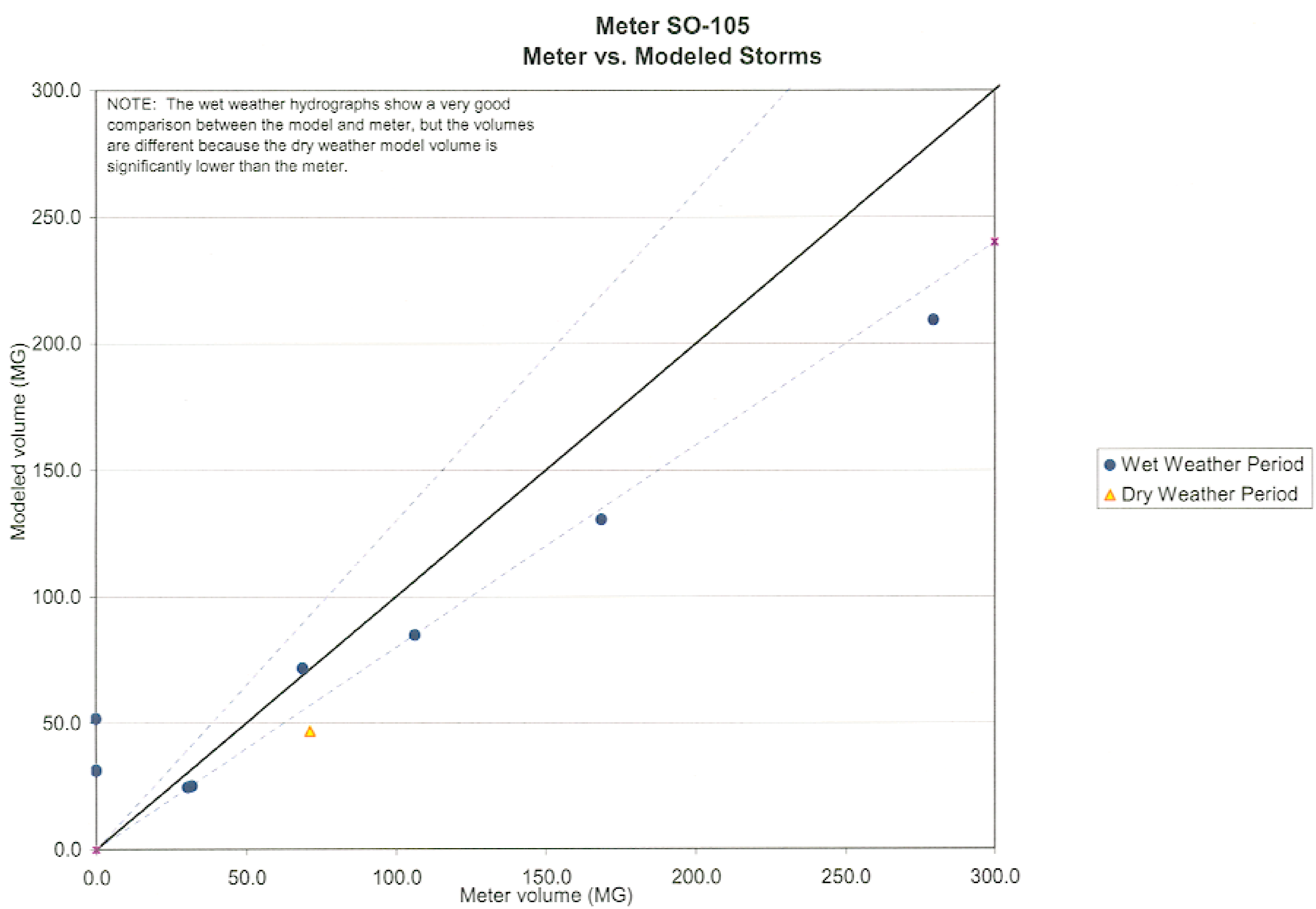
Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Volume (ft³)
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
Flow (cfs)
40
35
30
25
20
15
10
5
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time
Meter does not begin until 5/11/00
Meter not functioning

Meter SO-102
Hydraulic Gradeline



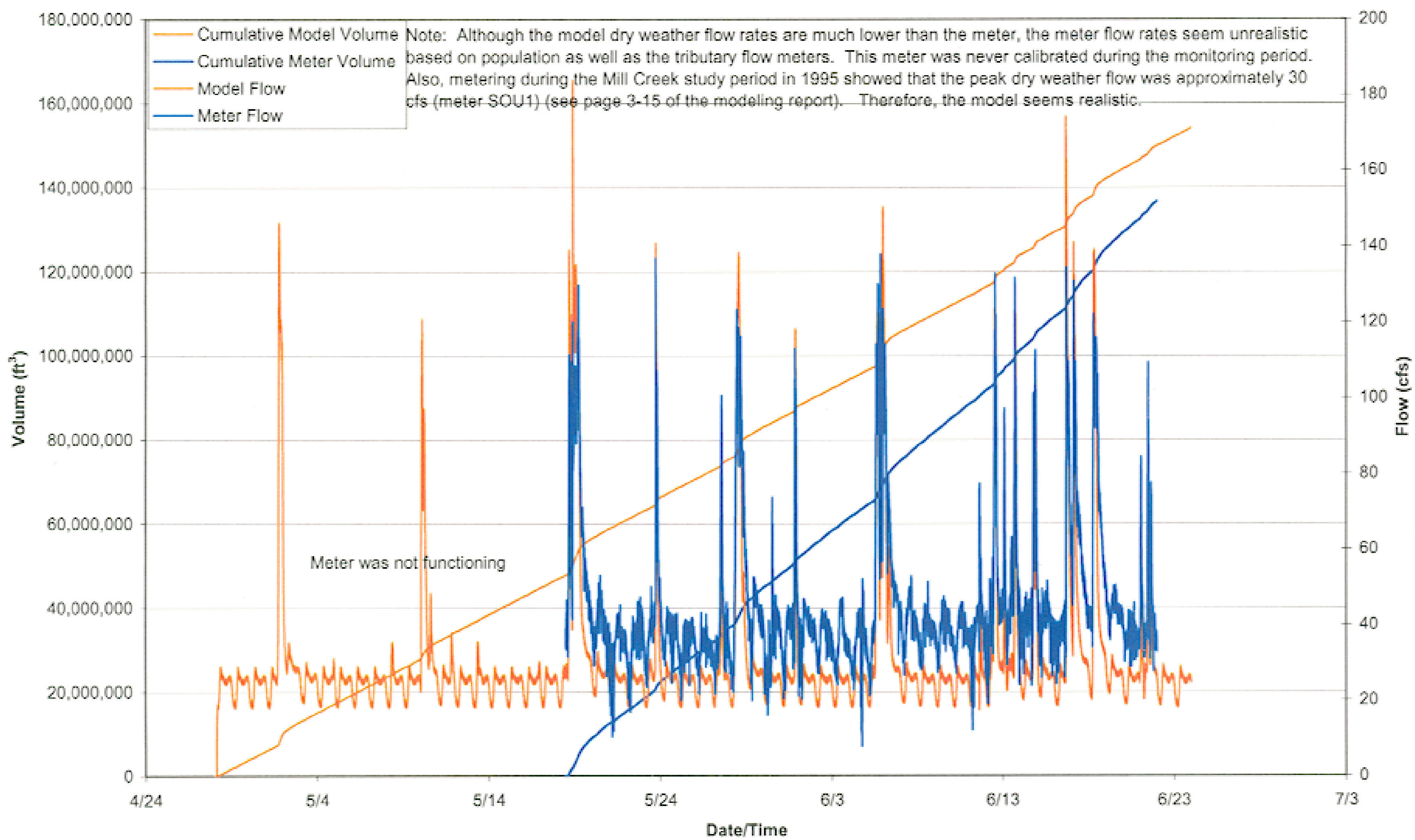
NEORSD Level Sensor for the DWO from Automated Regulator SO-2 Hydraulic Gradeline (Meter SO-102 was located just downstream of this level sensor)





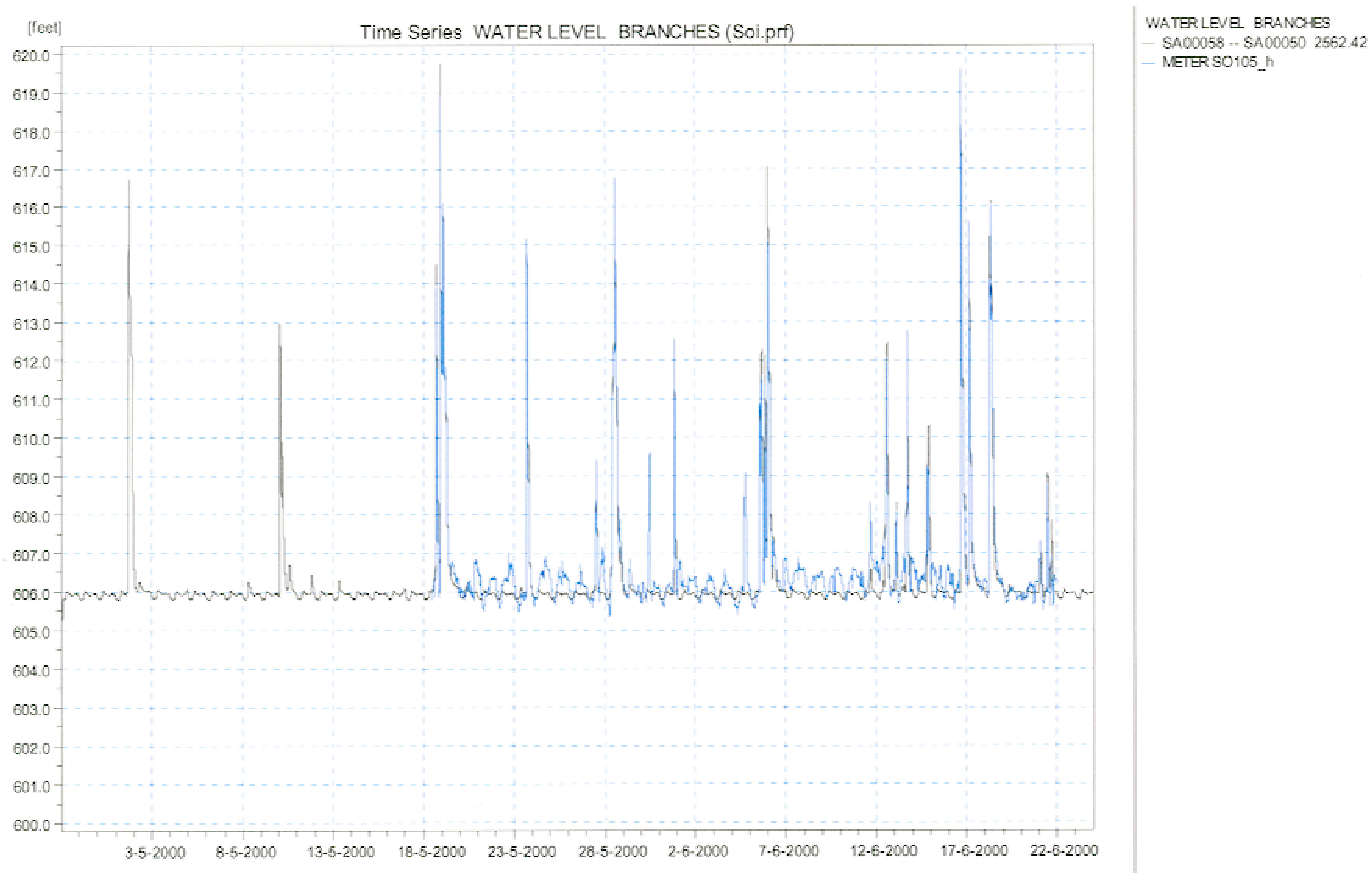
Meter SO-105
Meter vs. Modeled Storms
NOTE: The wet weather hydrographs show a very good comparison between the model and meter, but the volumes are different because the dry weather model volume is significantly lower than the meter.
Modeled volume (MG)
Meter volume (MG)
0.0
50.0
100.0
150.0
200.0
250.0
300.0
Wet Weather Period
Dry Weather Period

SO-105

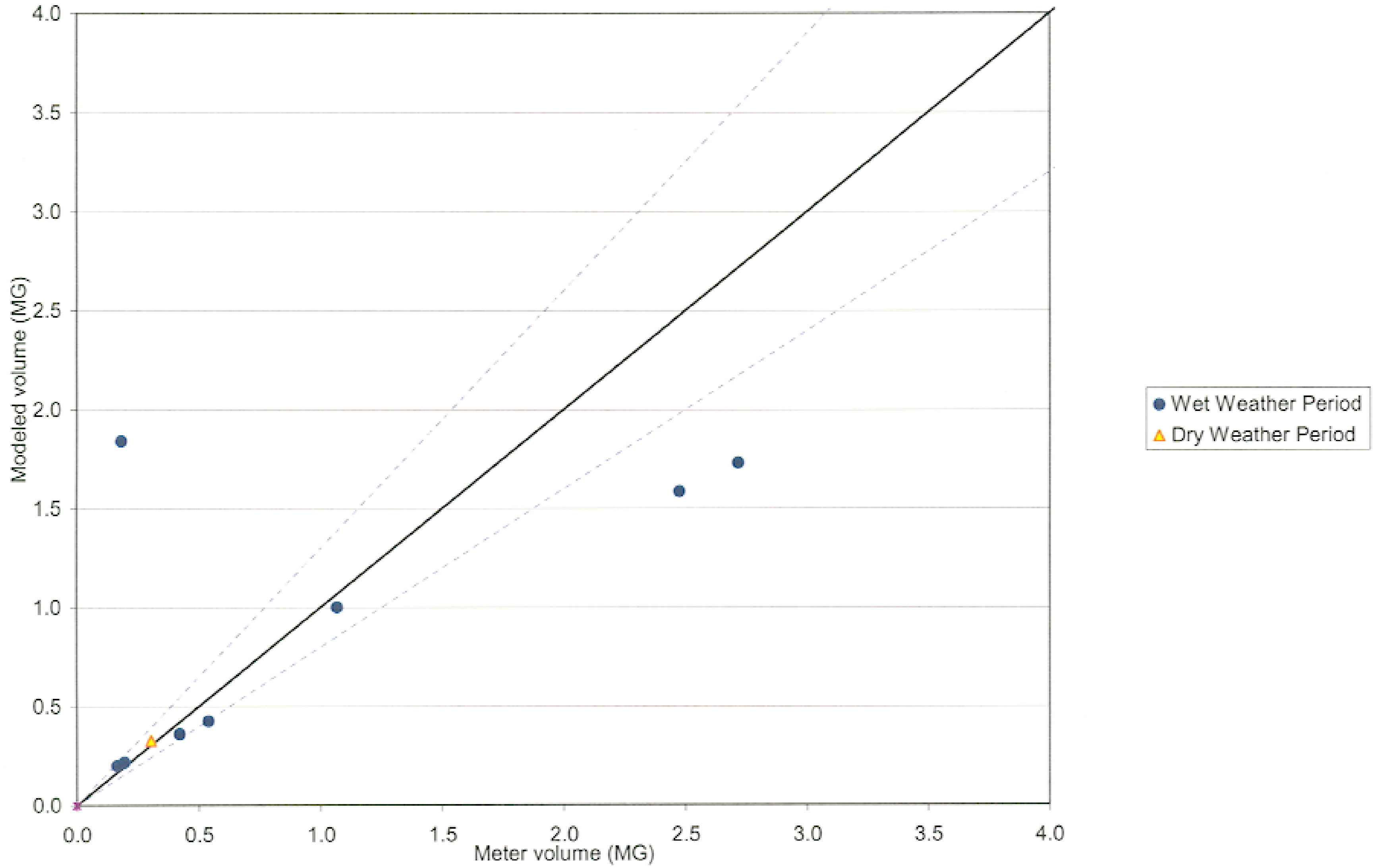


Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Note: Although the model dry weather flow rates are much lower than the meter, the meter flow rates seem unrealistic based on population as well as the tributary flow meters. This meter was never calibrated during the monitoring period. Also, metering during the Mill Creek study period in 1995 showed that the peak dry weather flow was approximately 30 cfs (meter SOU1) (see page 3-15 of the modeling report). Therefore, the model seems realistic.
Meter was not functioning
180,000,000
160,000,000
140,000,000
120,000,000
100,000,000
80,000,000
60,000,000
40,000,000
20,000,000
0
Volume (ft3)
200
180
160
140
120
100
80
60
40
20
0
Flow (cfs)
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

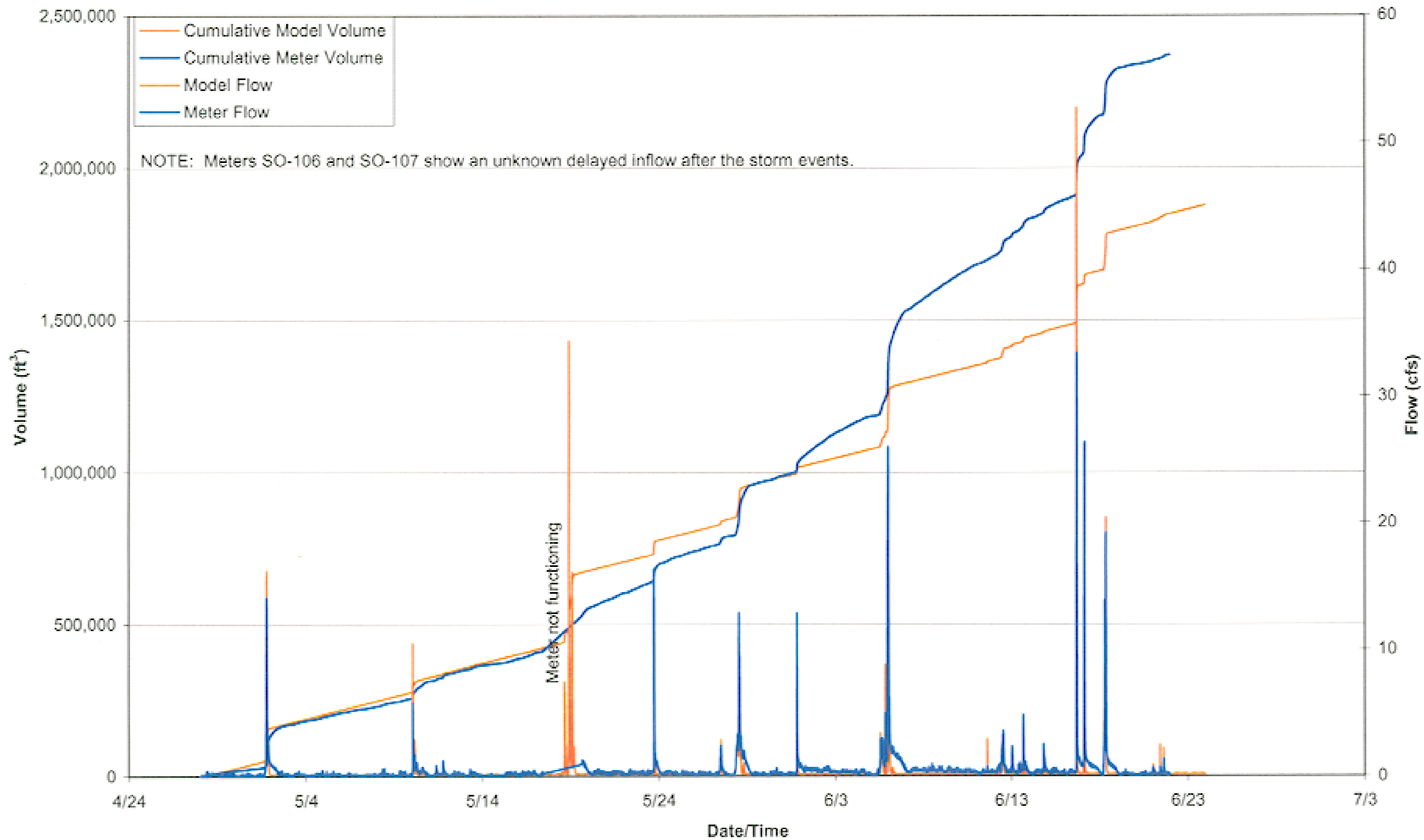
Meter SO-105
Hydraulic Gradeline



Meter SO-106
Meter vs. Modeled Storms



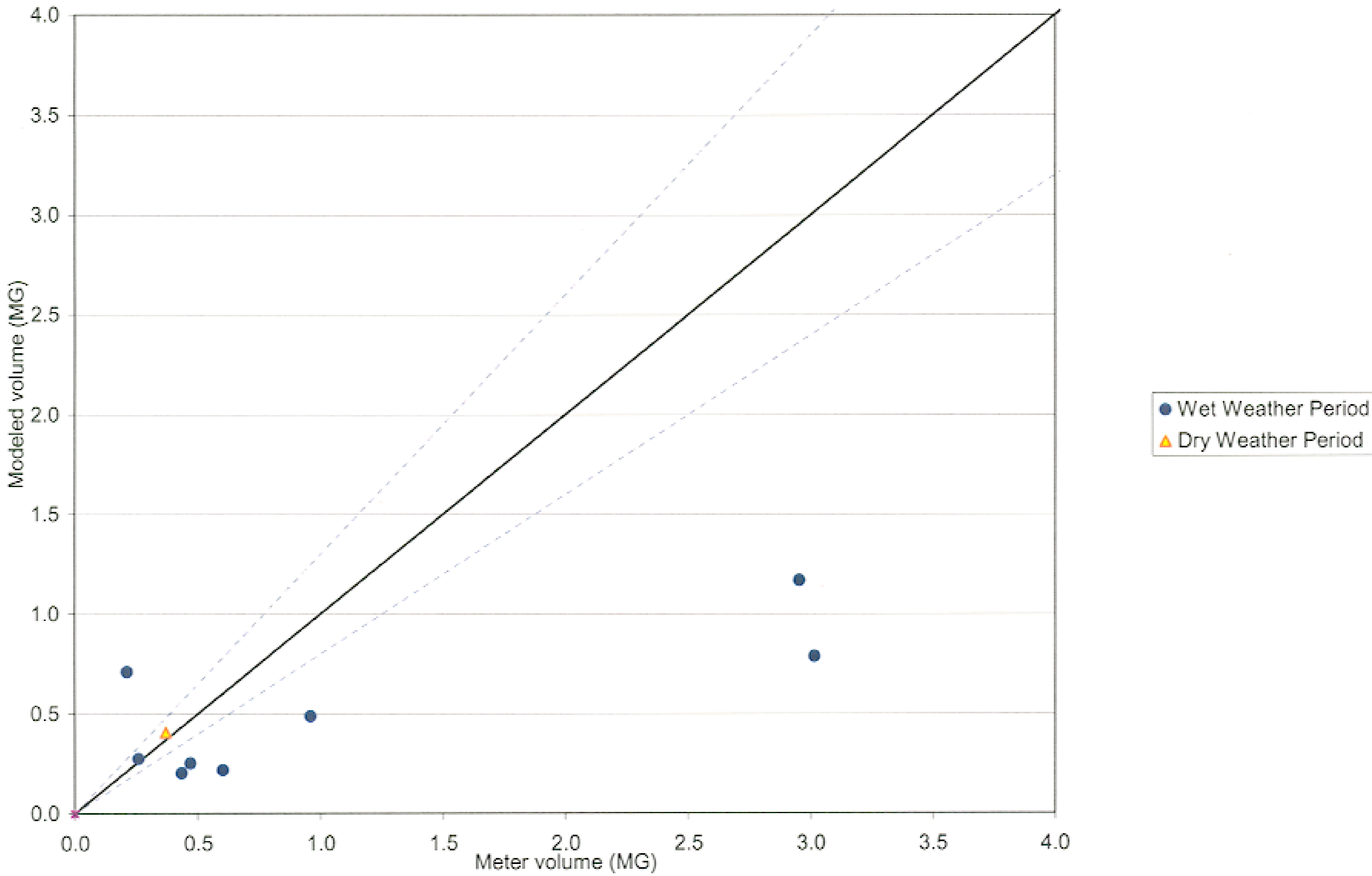
SO-106



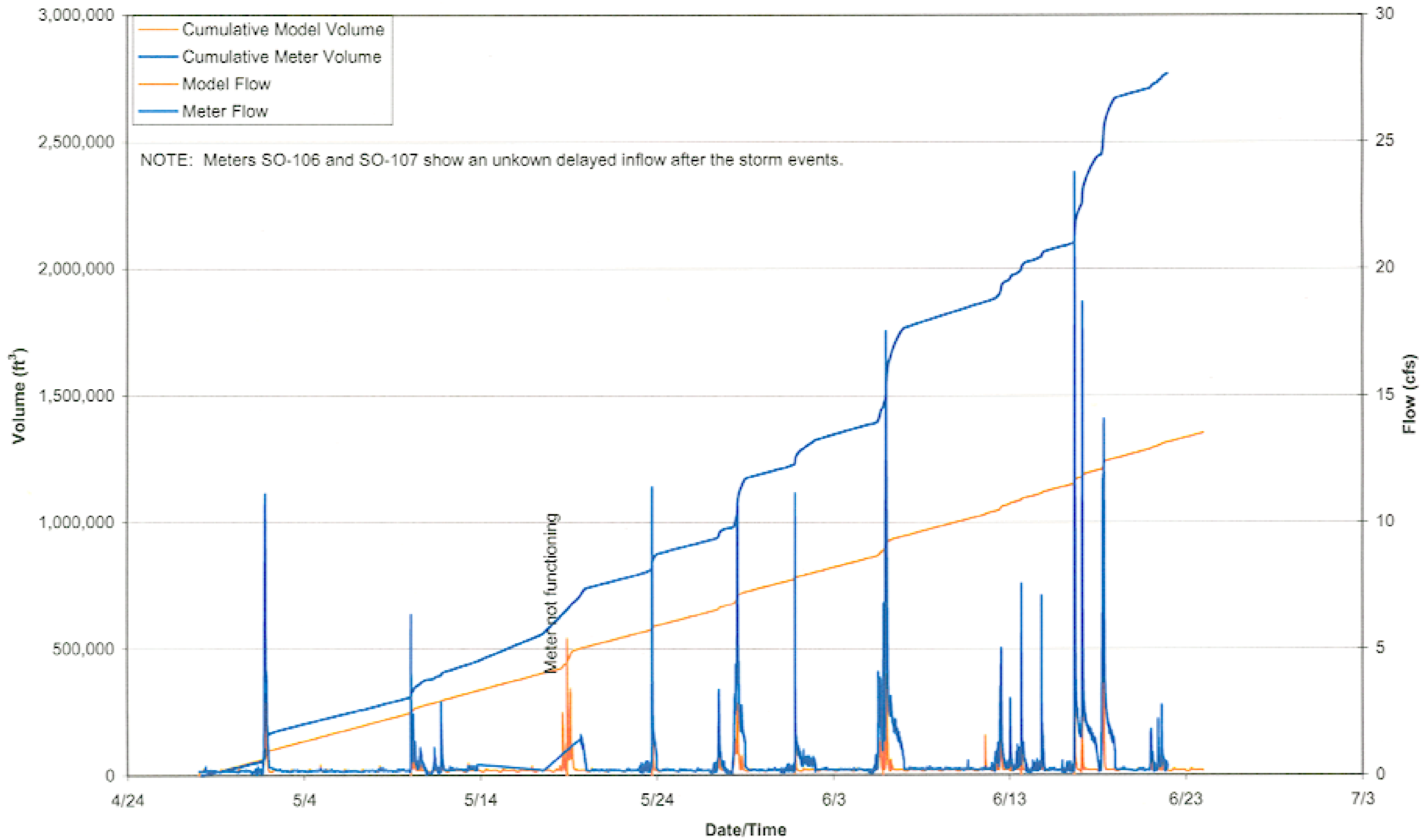
Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
NOTE: Meters SO-106 and SO-107 show an unknown delayed inflow after the storm events.
Meter not functioning
Volume (ft³)
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Flow (cfs)
60
50
40
30
20
10
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

Meter SO-106
Hydraulic Gradeline

Meter SO-107
Meter vs. Modeled Storms

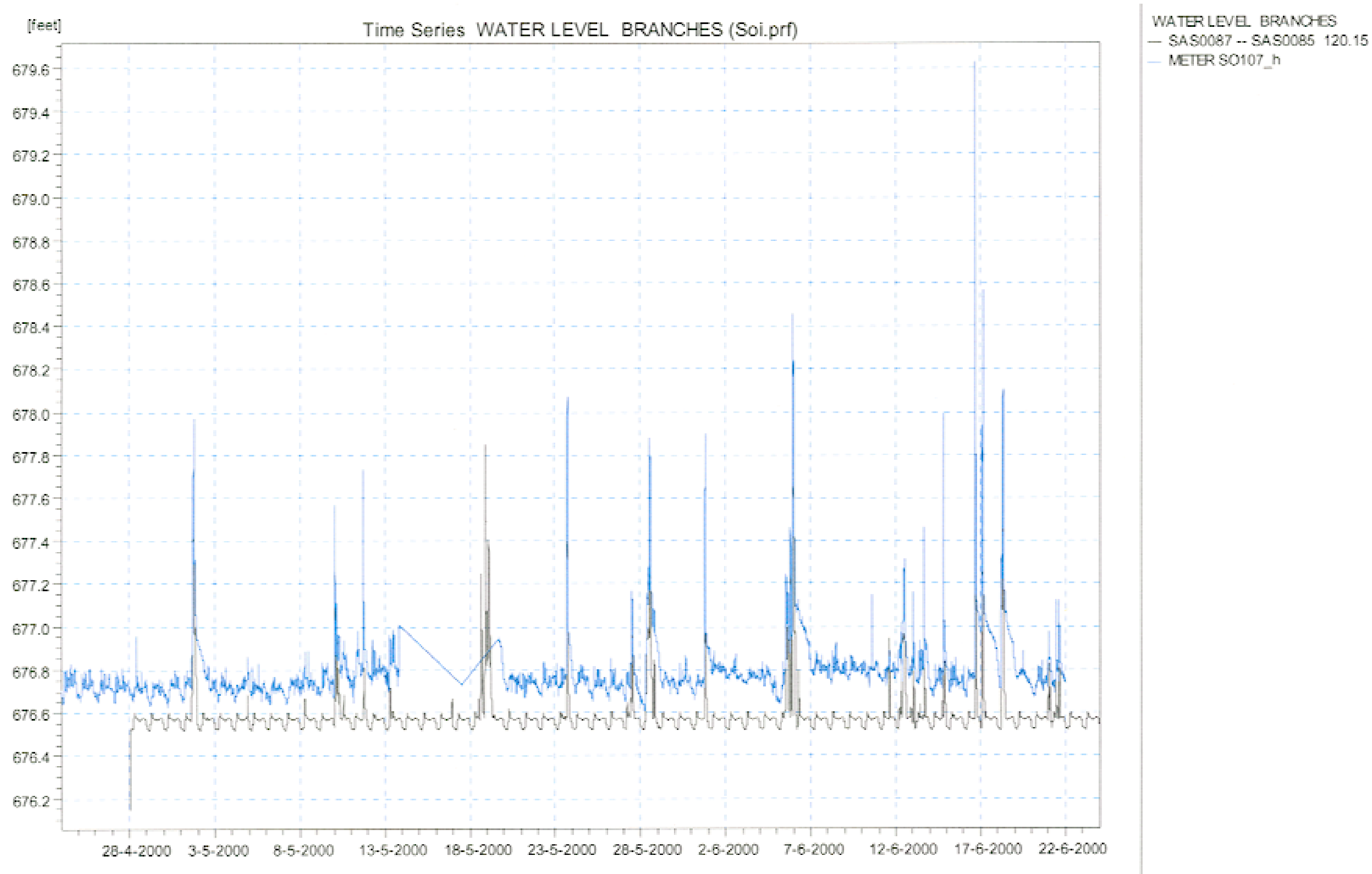


SO-107

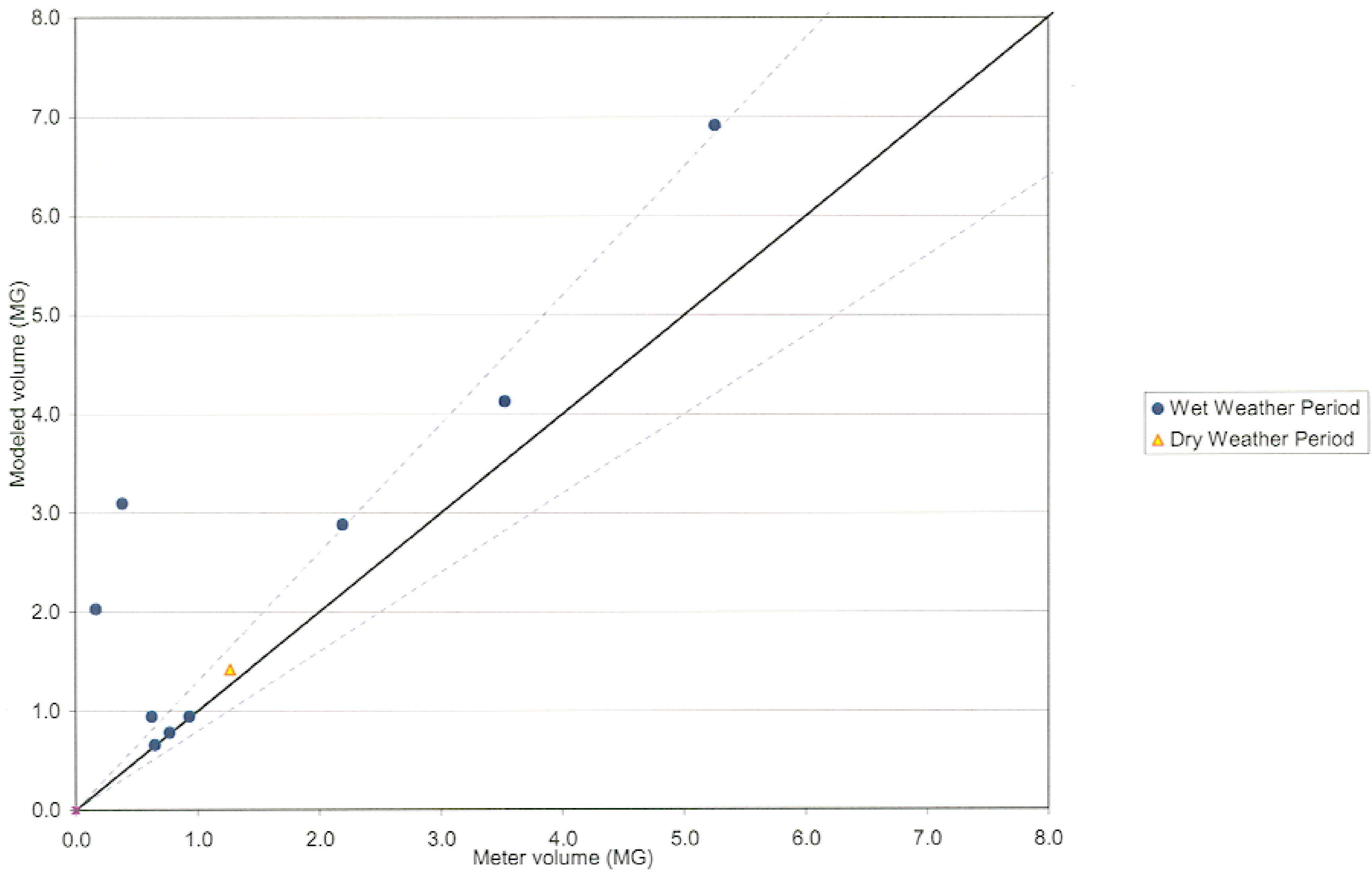


Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
NOTE: Meters SO-106 and SO-107 show an unkown delayed inflow after the storm events.
Meter not functioning
Volume (ft³)
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Flow (cfs)
30
25
20
15
10
5
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

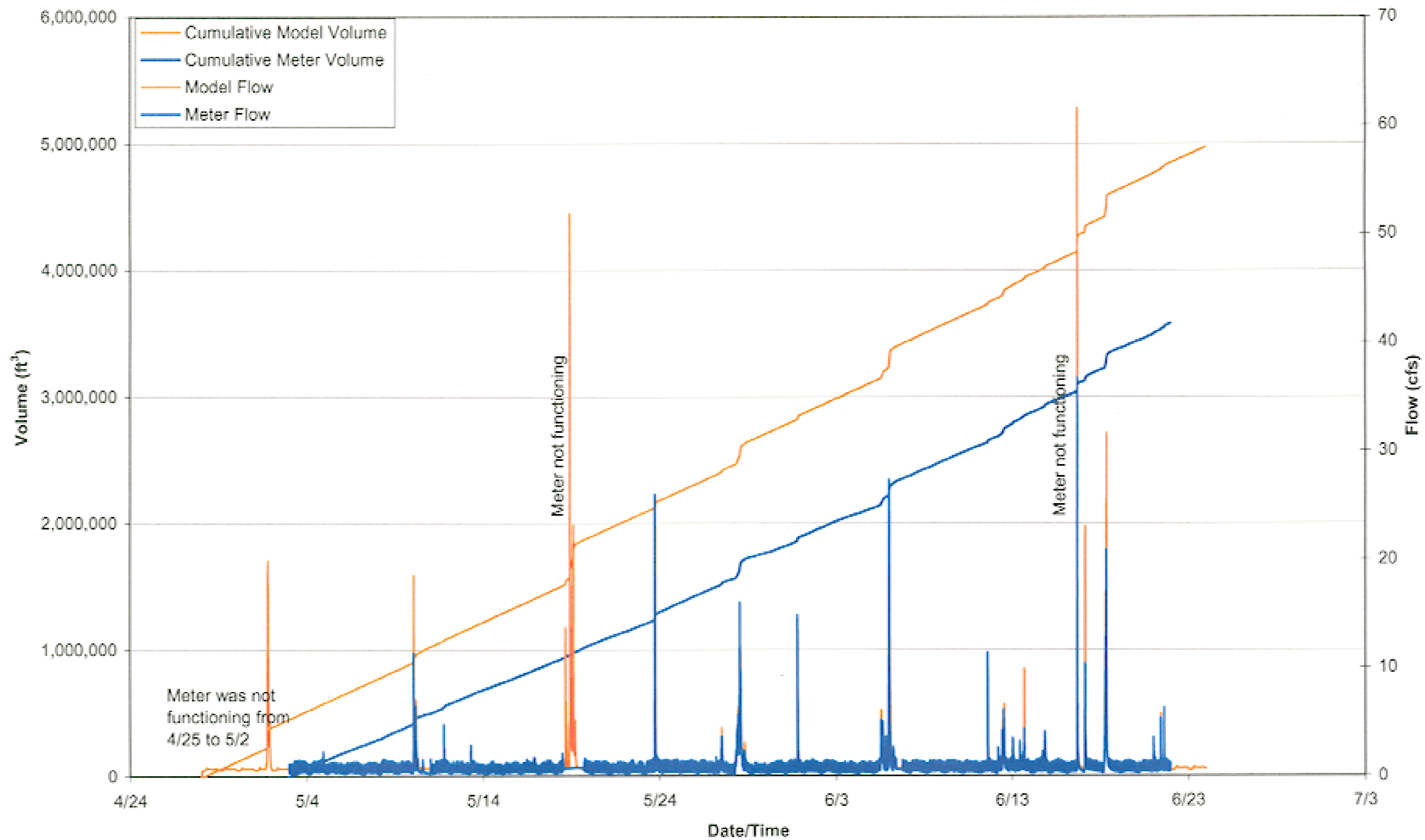
Meter SO-107
Hydraulic Gradeline



Meter SO-109
Meter vs. Modeled Storms

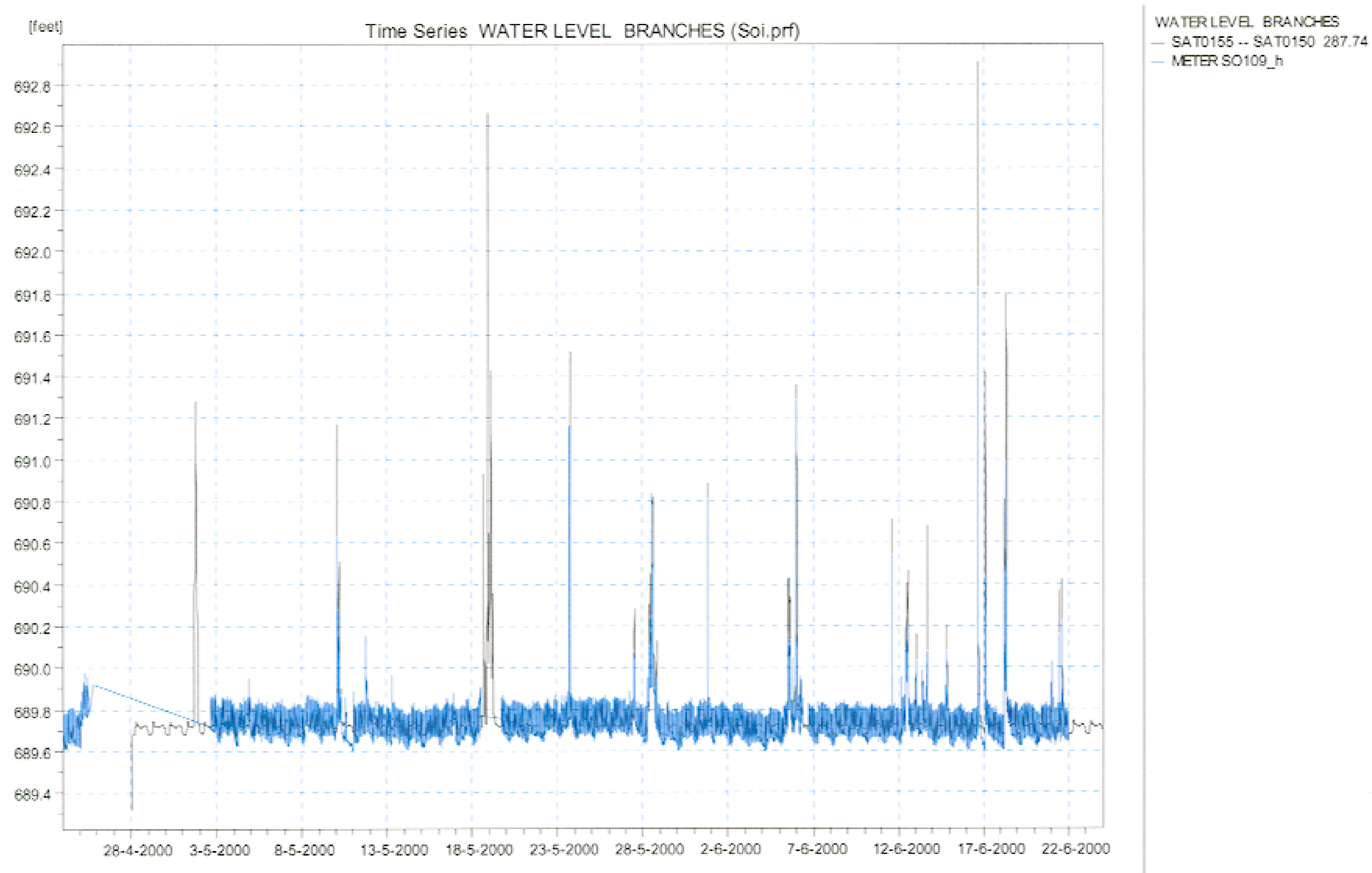


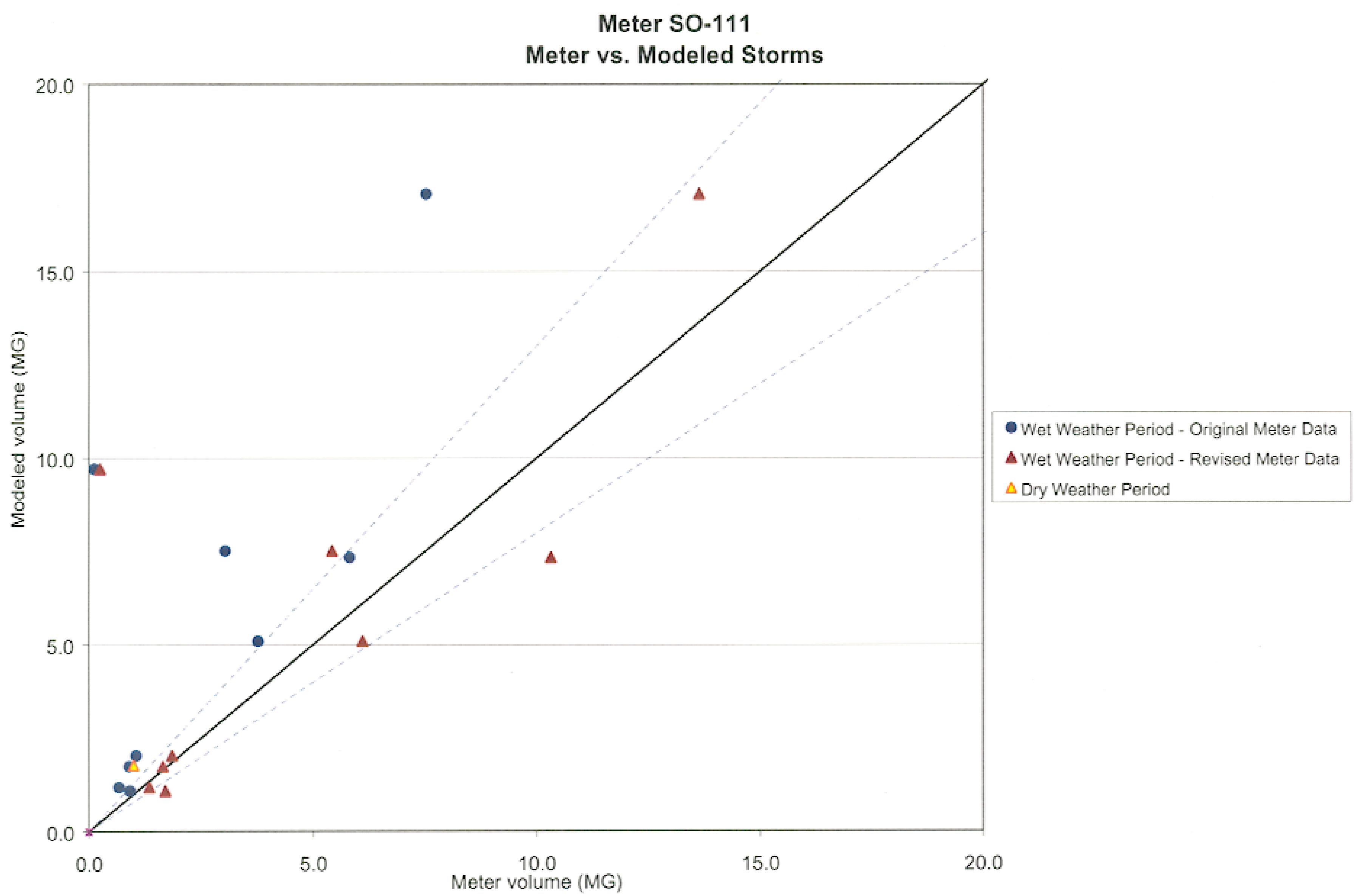
SO-109



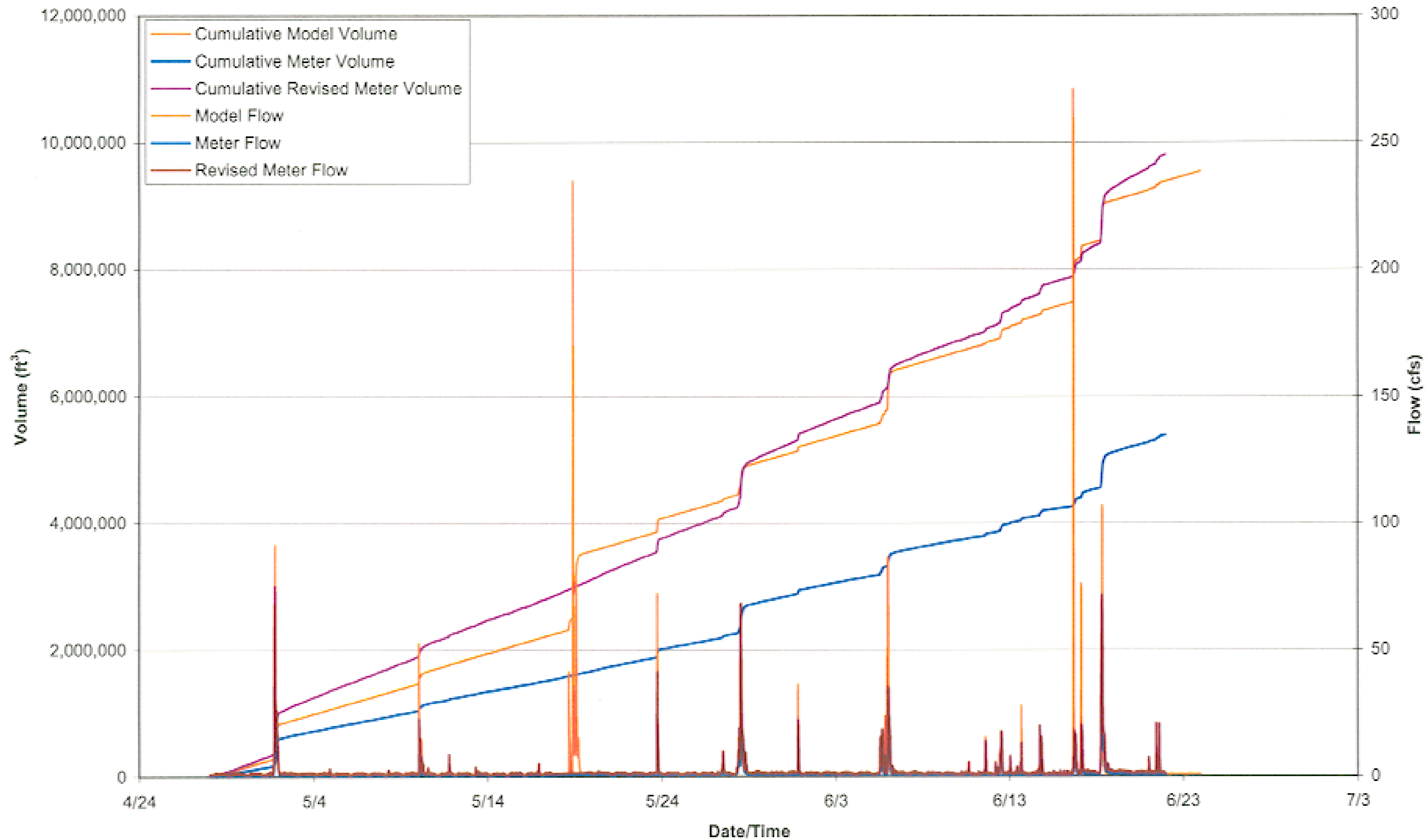
Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Volume (ft³)
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
Flow (cfs)
70
60
50
40
30
20
10
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time
Meter was not functioning from 4/25 to 5/2
Meter not functioning
Meter not functioning

Meter SO-109
Hydraulic Gradeline



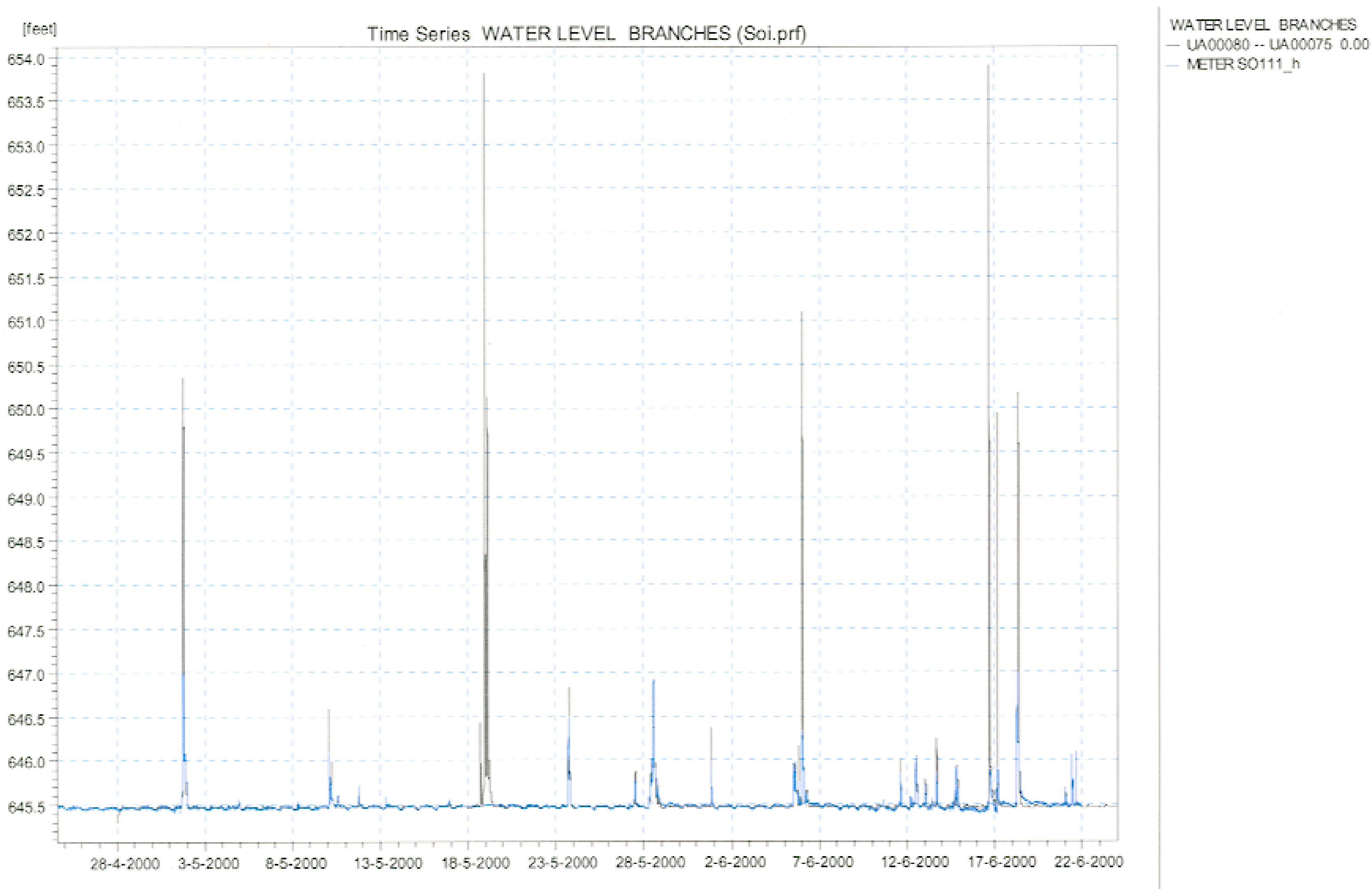

Meter SO-111
Meter vs. Modeled Storms
Modeled volume (MG)
Meter volume (MG)
0.0
5.0
10.0
15.0
20.0
Wet Weather Period - Original Meter Data
Wet Weather Period - Revised Meter Data
Dry Weather Period

SO-111

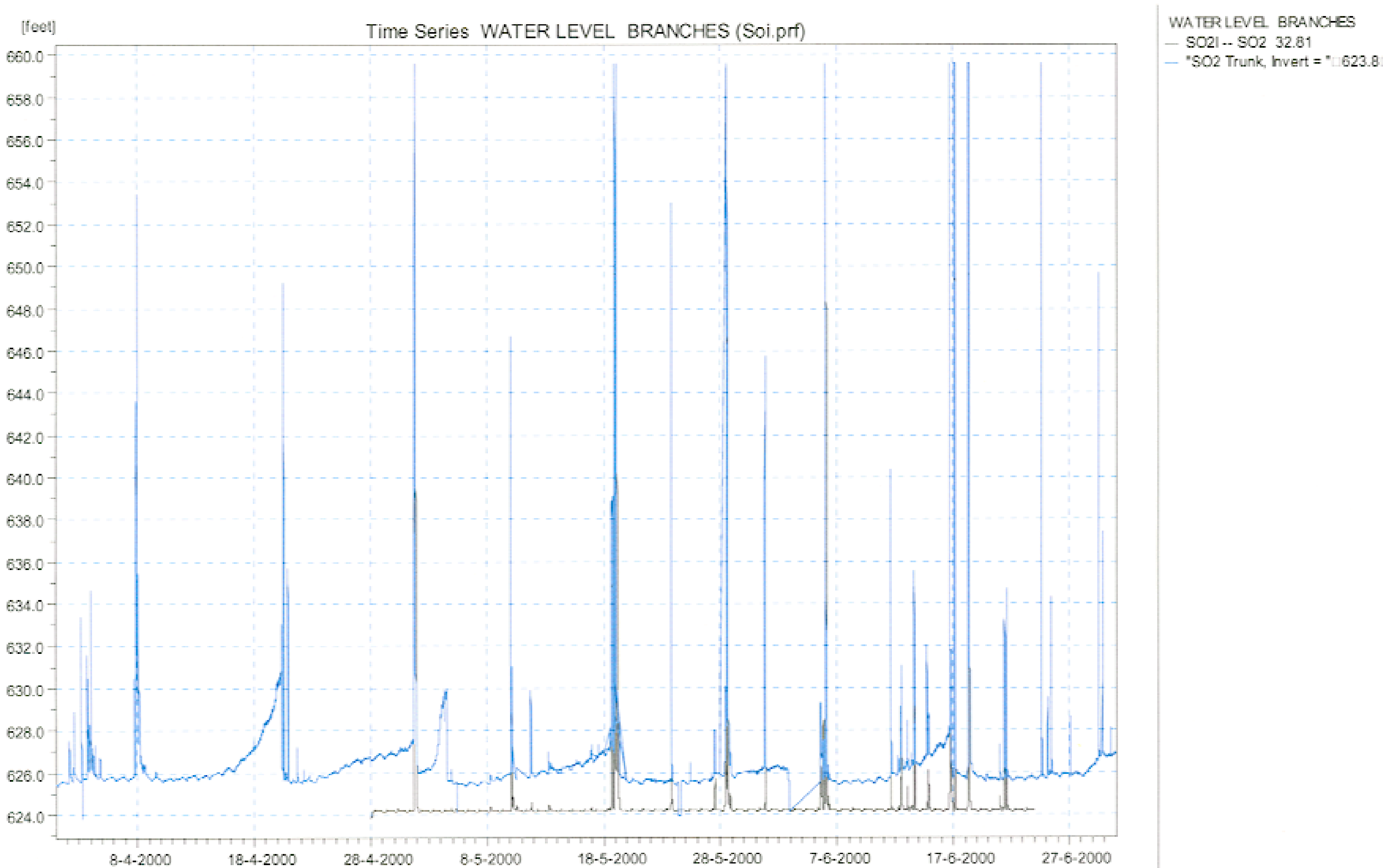


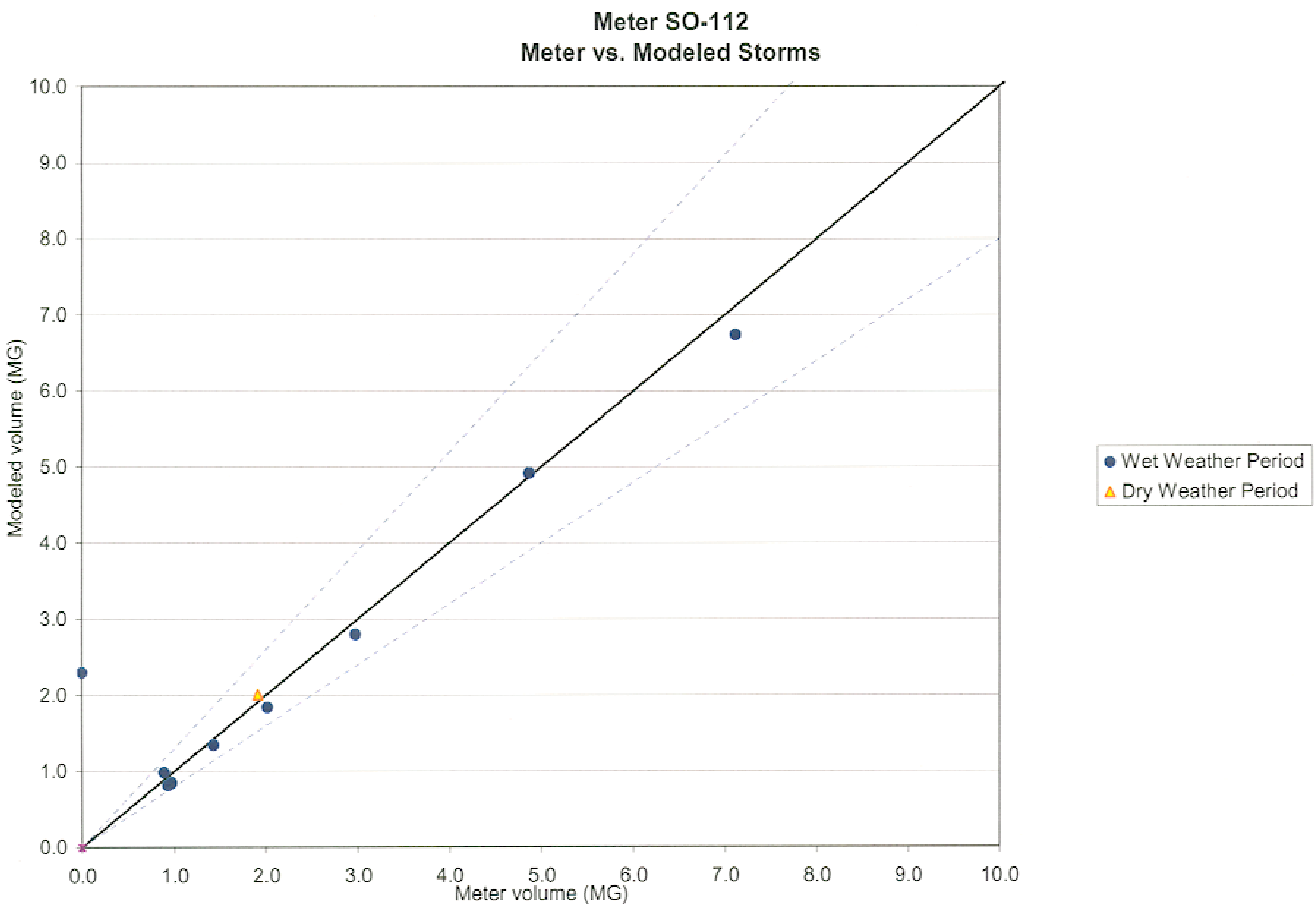
Cumulative Model Volume
Cumulative Meter Volume
Cumulative Revised Meter Volume
Model Flow
Meter Flow
Revised Meter Flow
Volume (ft³)
Flow (cfs)
Date/Time
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
300
250
200
150
100
50
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3

Meter SO-111
Hydraulic Gradeline



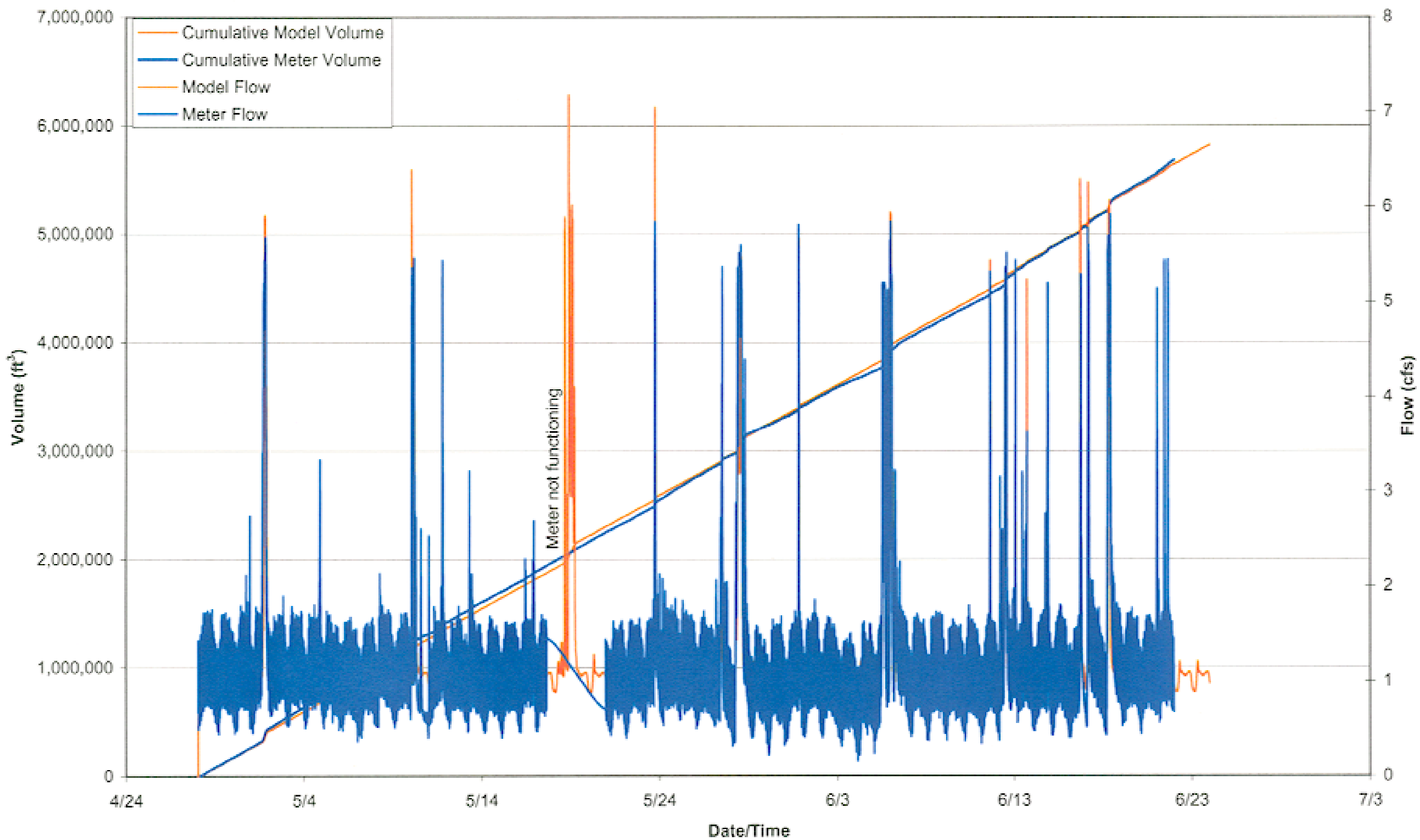
NEORSD Level Sensor for the Influent Sewer to Automated Regulator SO-2
Hydraulic Gradeline
(Meter SO-111 was located upstream of this level sensor)





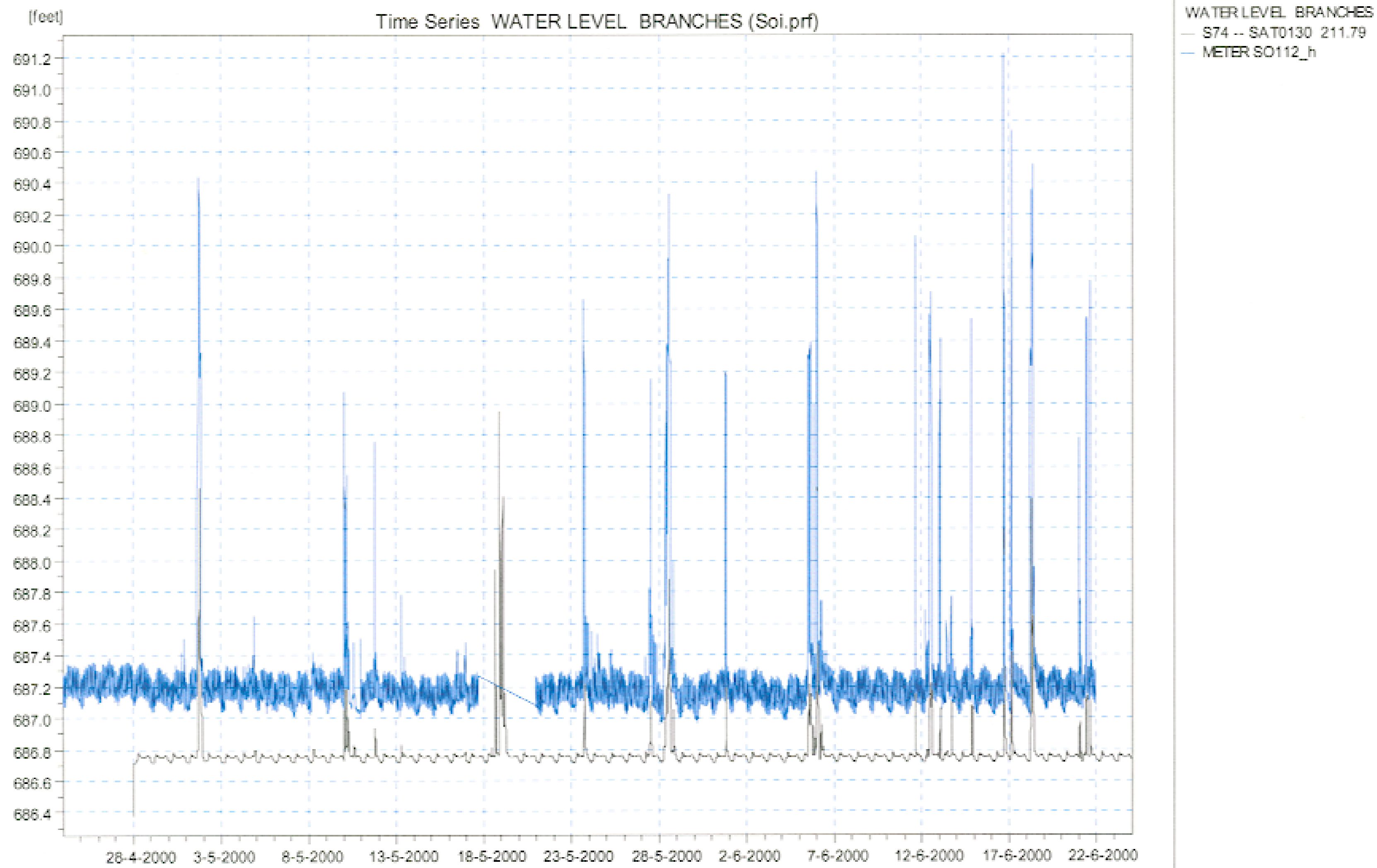
Meter SO-112
Meter vs. Modeled Storms
Modeled volume (MG)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
Meter volume (MG)
Wet Weather Period
Dry Weather Period

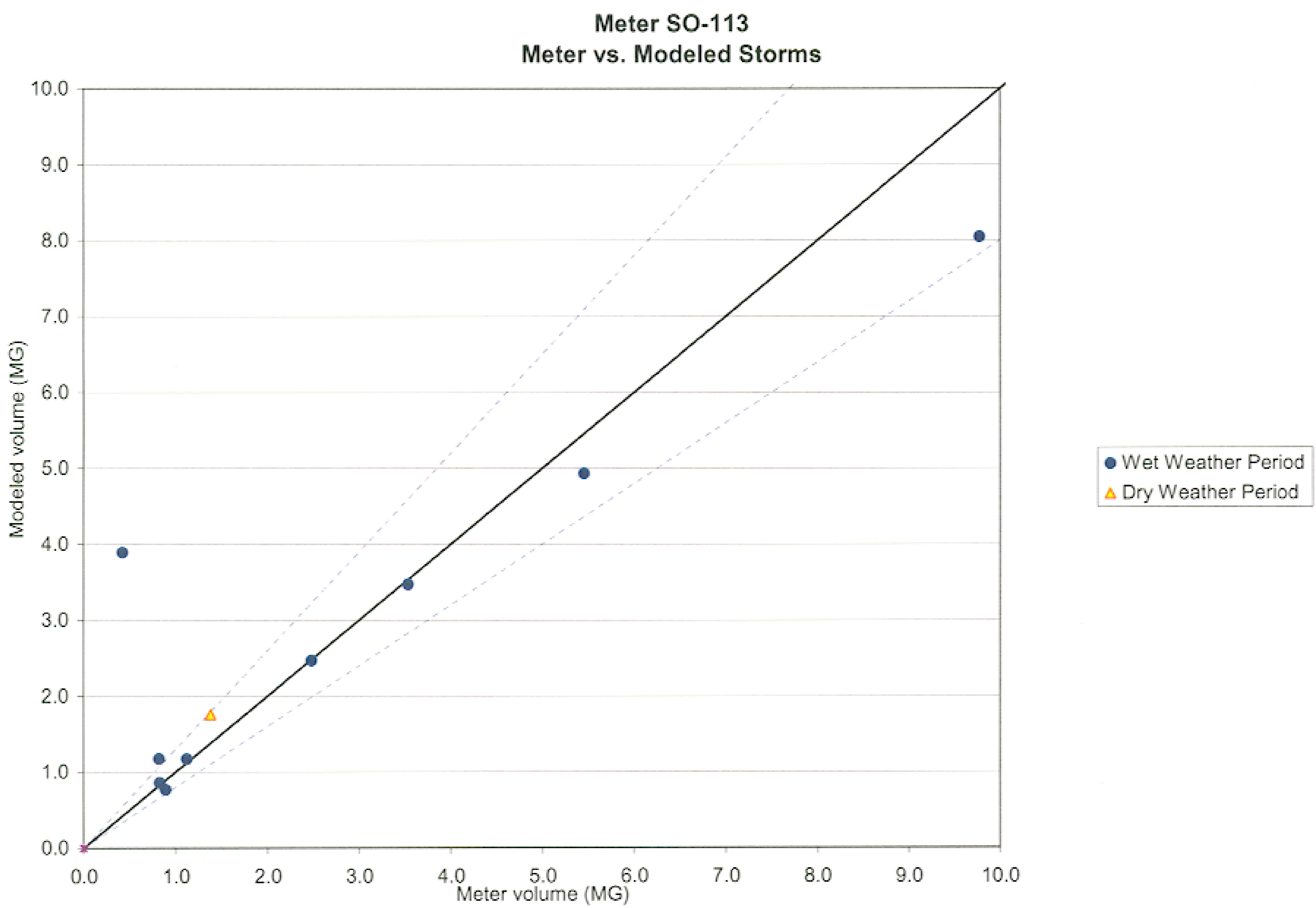
SO-112



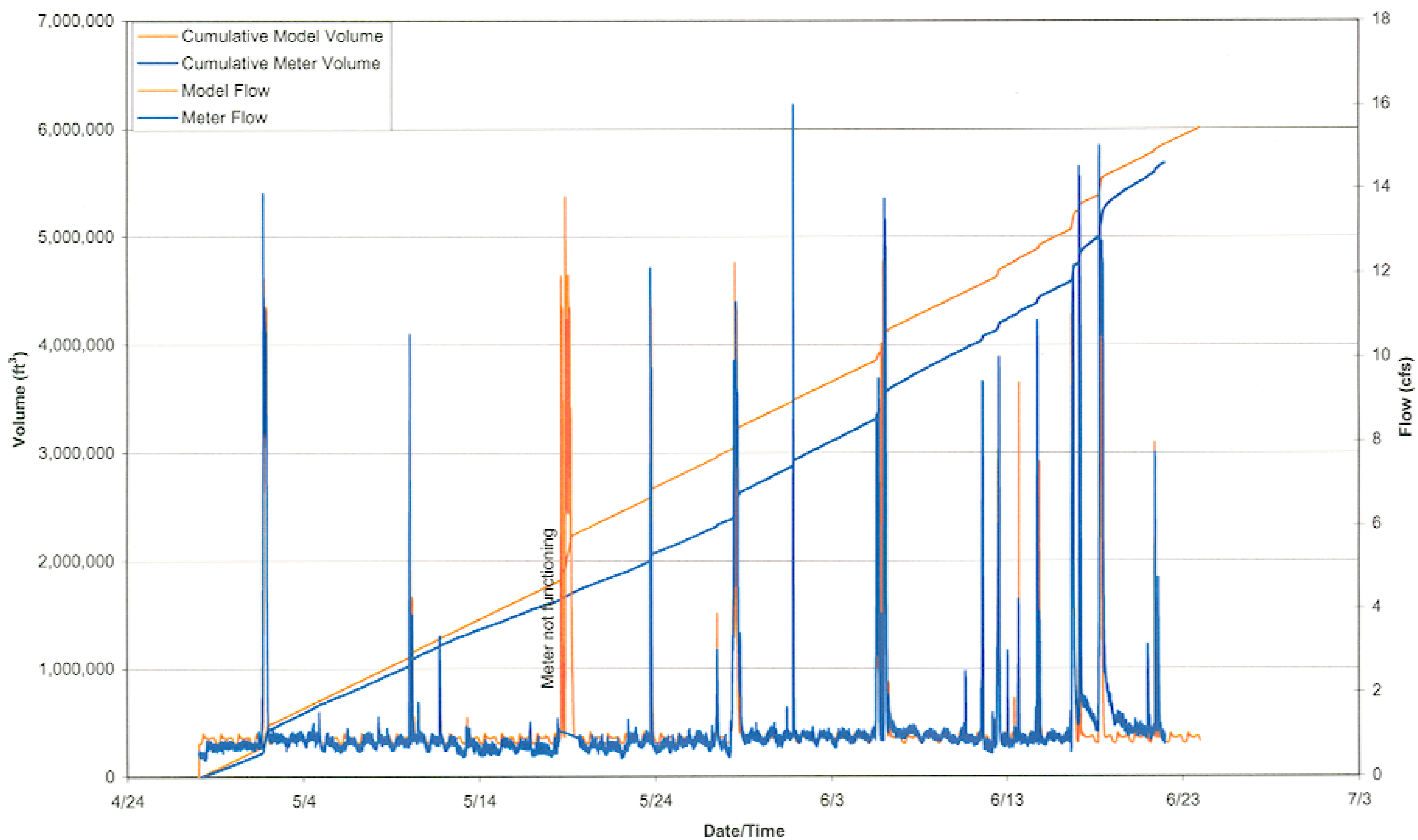
Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Meter not functioning
Volume (ft³)
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
Flow (cfs)
8
7
6
5
4
3
2
1
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

Meter SO-112
Hydraulic Gradeline



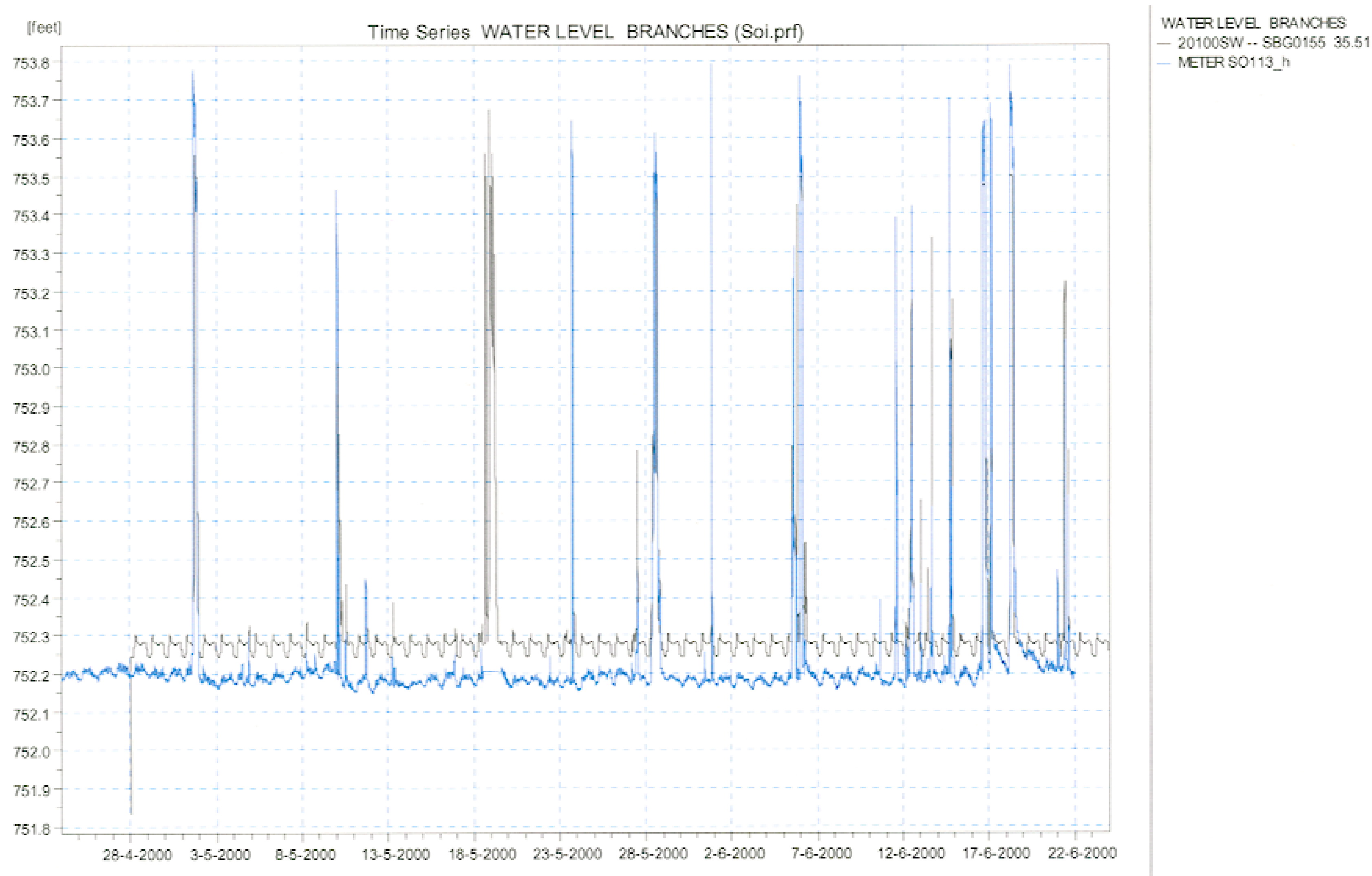

Meter SO-113
Meter vs. Modeled Storms
Modeled volume (MG)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
Meter volume (MG)
Wet Weather Period
Dry Weather Period

SO-113

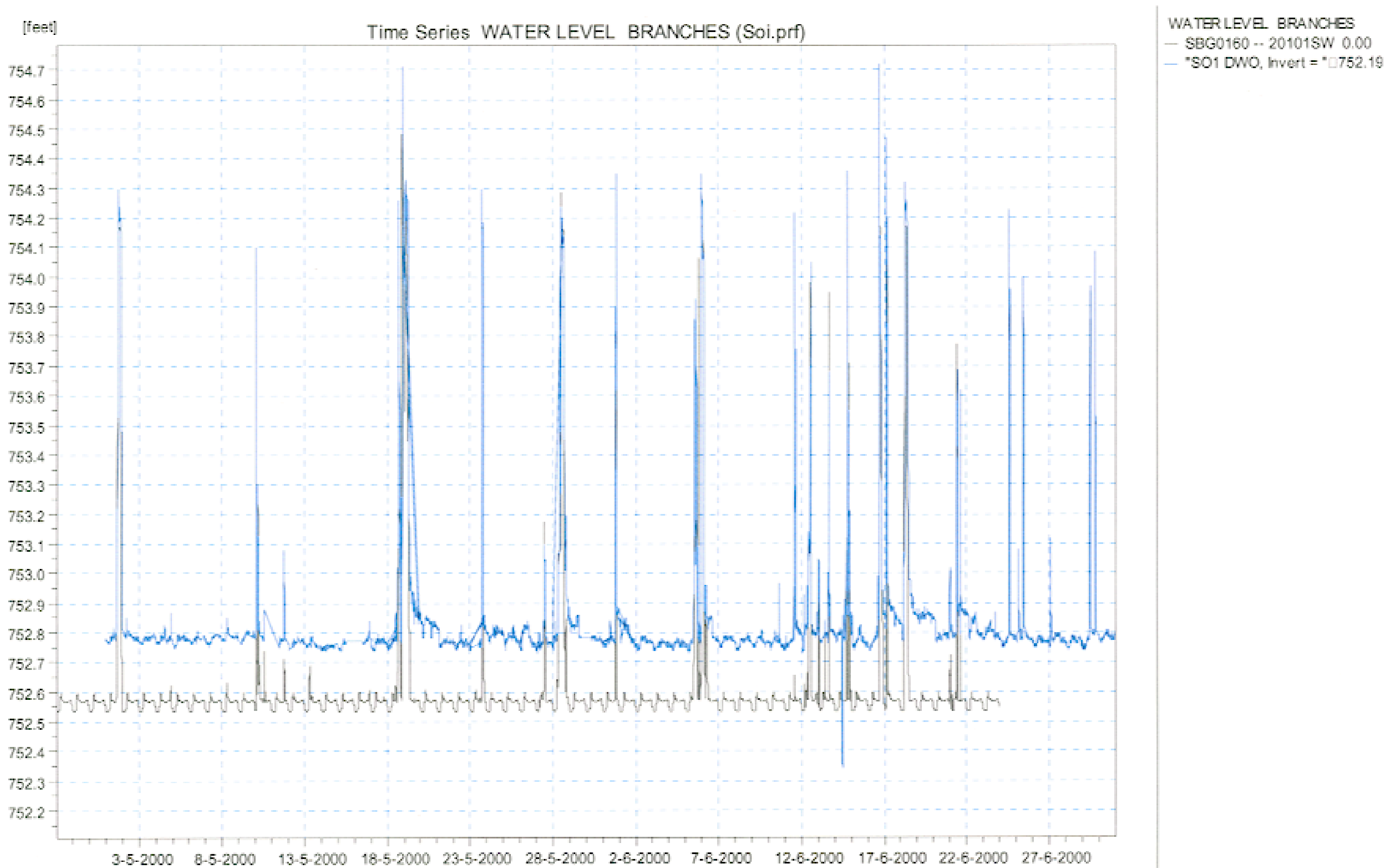


Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Volume (ft³)
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
Flow (cfs)
18
16
14
12
10
8
6
4
2
0
Meter not functioning
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

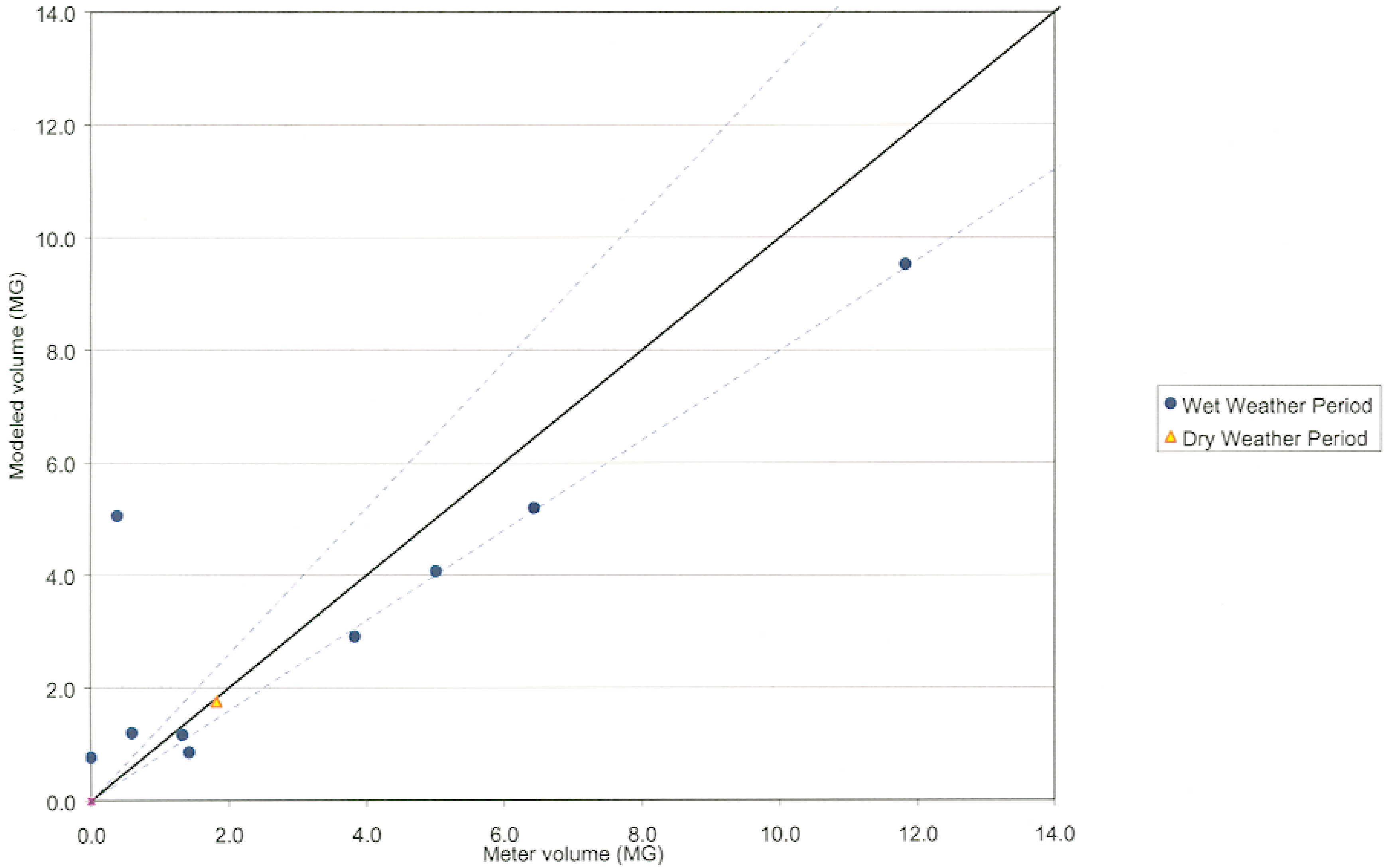
Meter SO-113
Hydraulic Gradeline



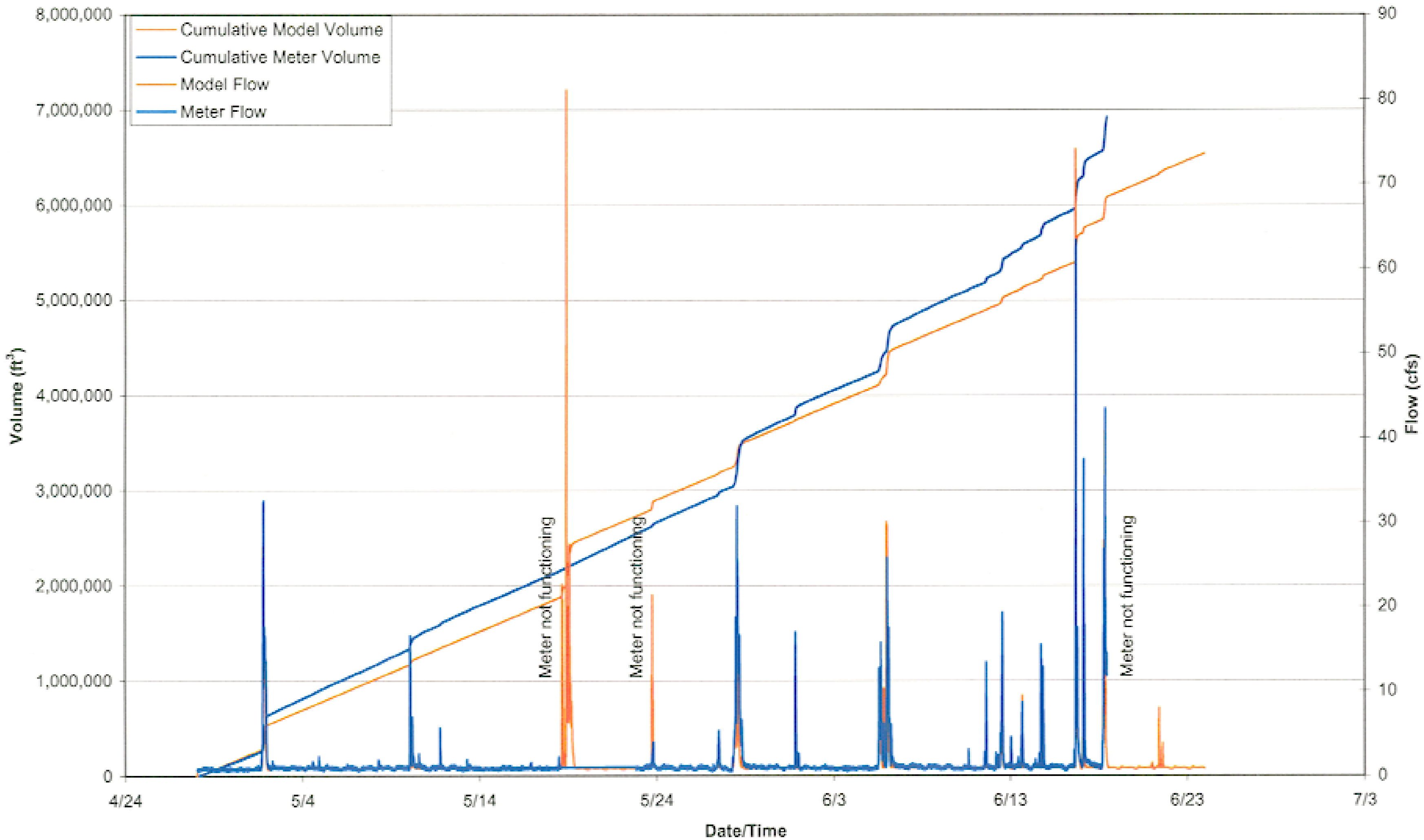
NEORSD Level Sensor for the DWO from Automated Regulator SO-1 Hydraulic Gradeline (Meter SO-113 was located downstream of this level sensor)



Meter SO-114
Meter vs. Modeled Storms

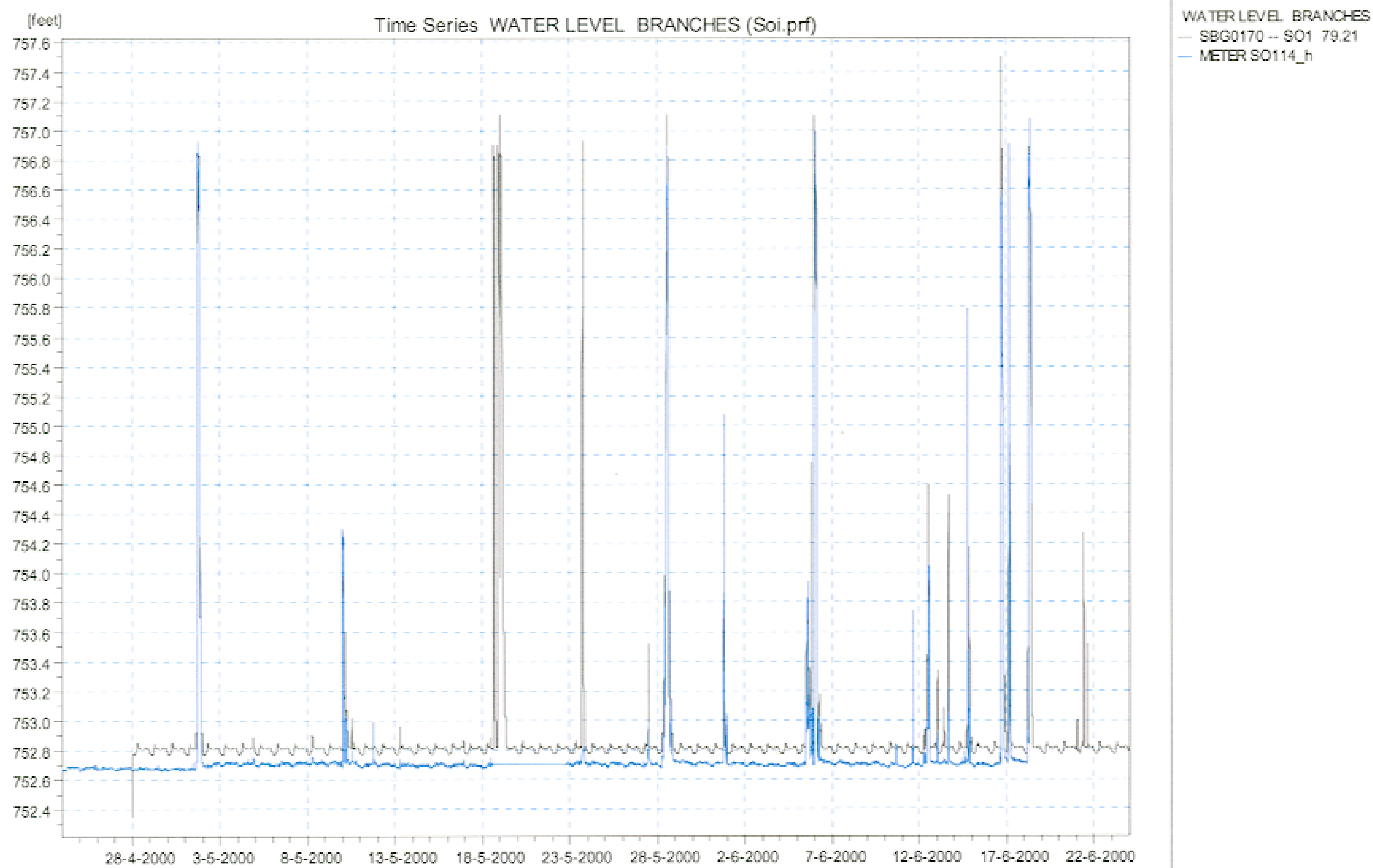


SO-114



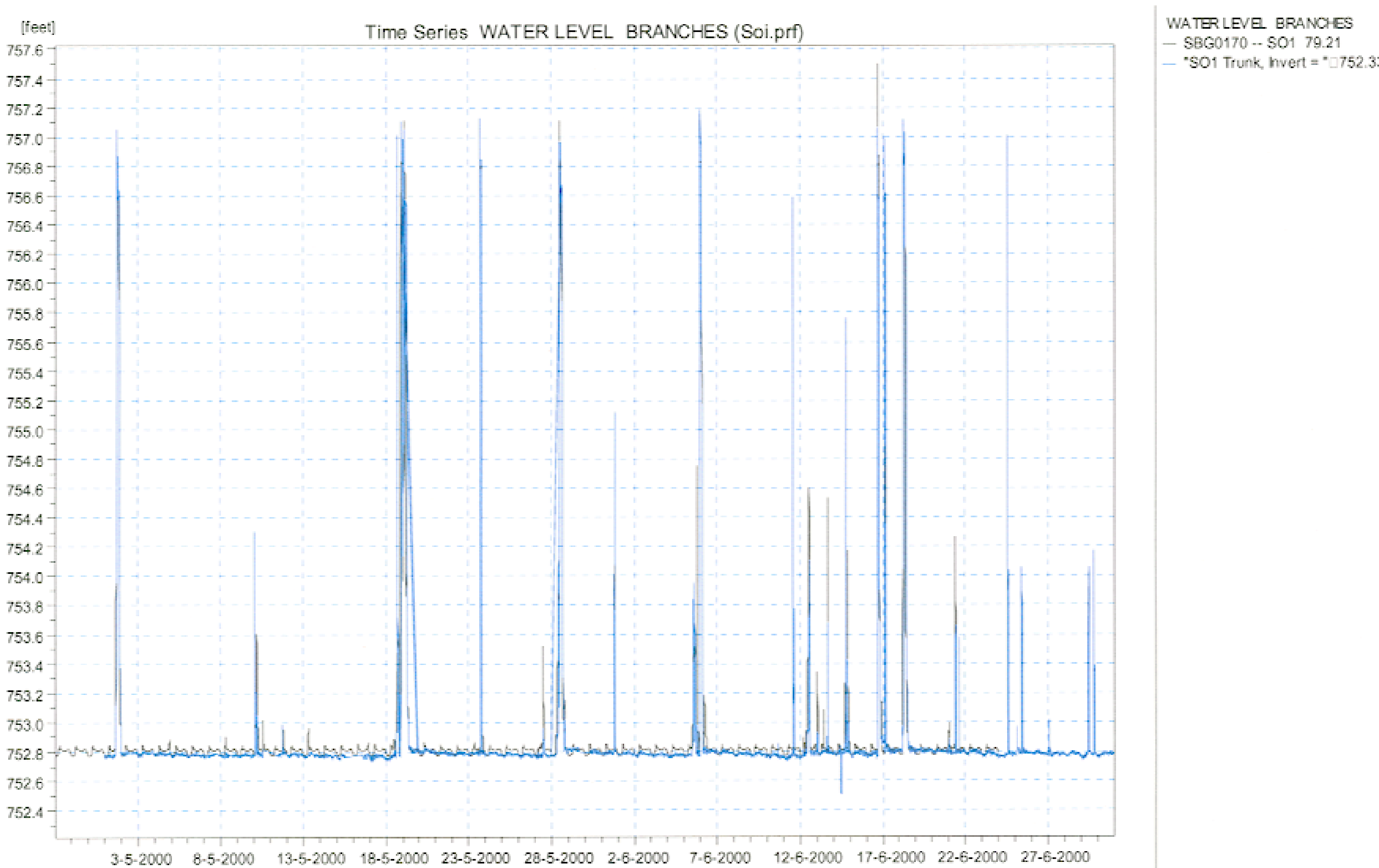
Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Volume (ft^3)
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
Flow (cfs)
90
80
70
60
50
40
30
20
10
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time
Meter not functioning
Meter not functioning
Meter not functioning

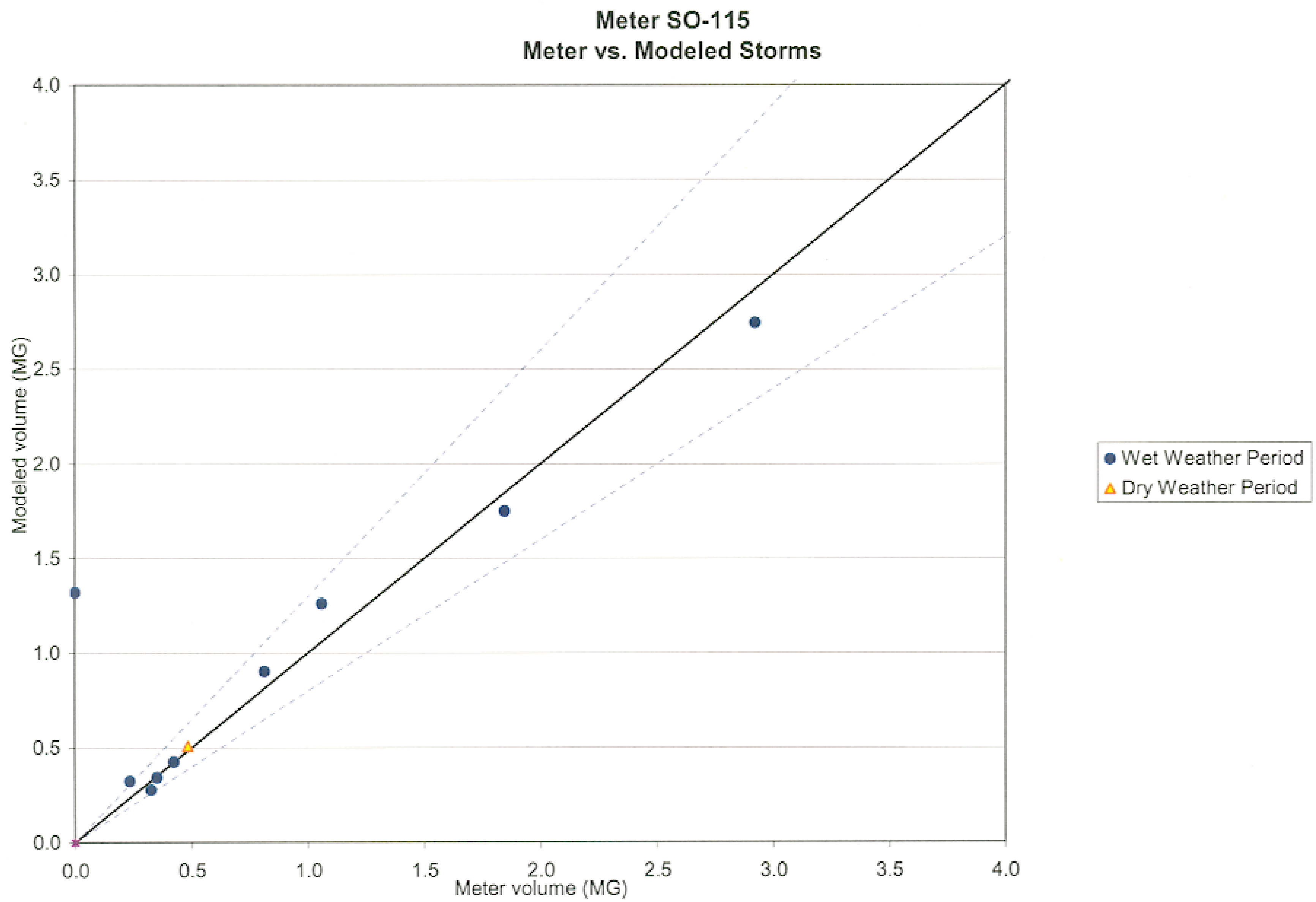
Meter SO-114
Hydraulic Gradeline



NEORSD Level Sensor for the Influent Sewer to Automated Regulator SO-1 Hydraulic Gradeline

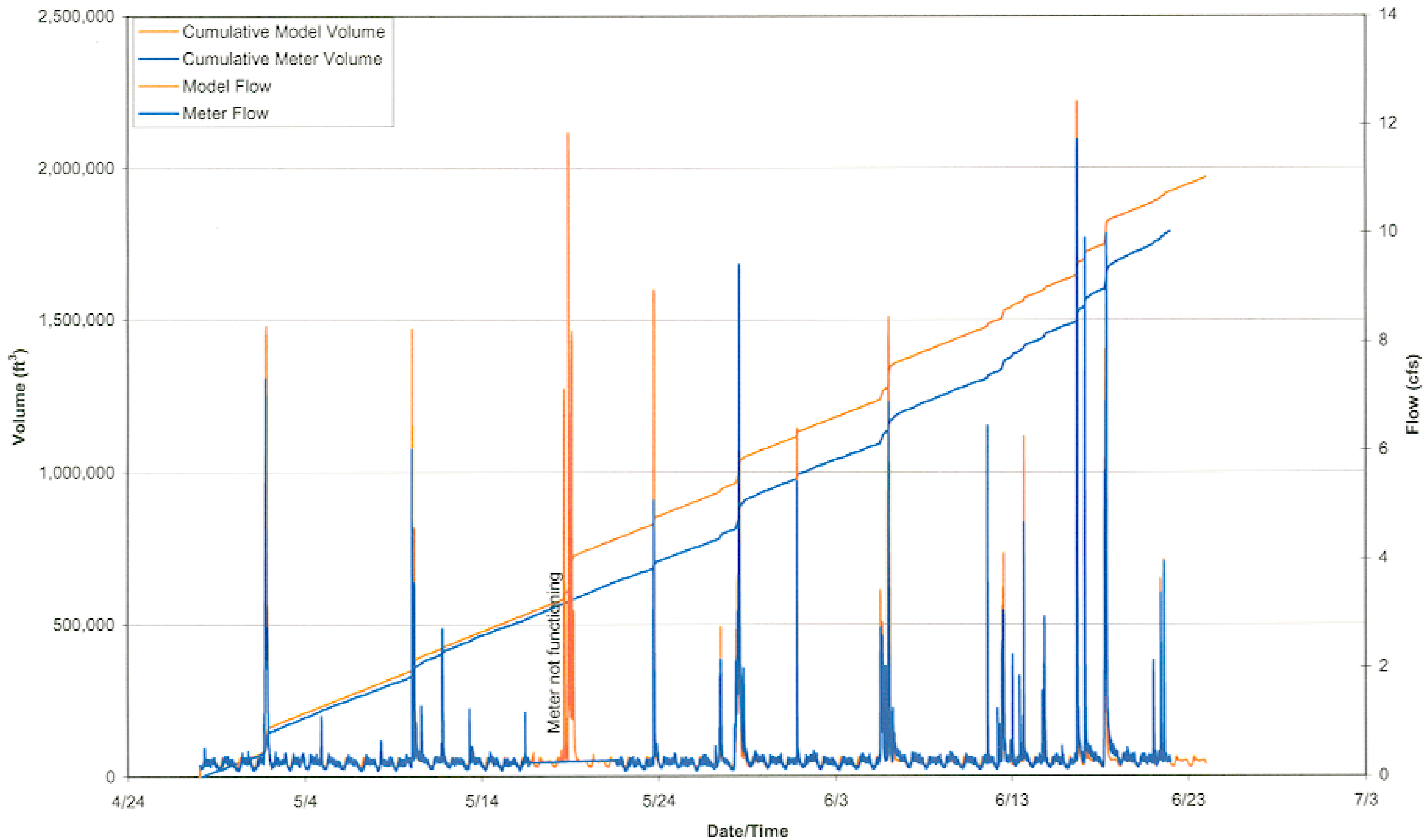
(Meter SO-114 was located in the same manhole as this level sensor)





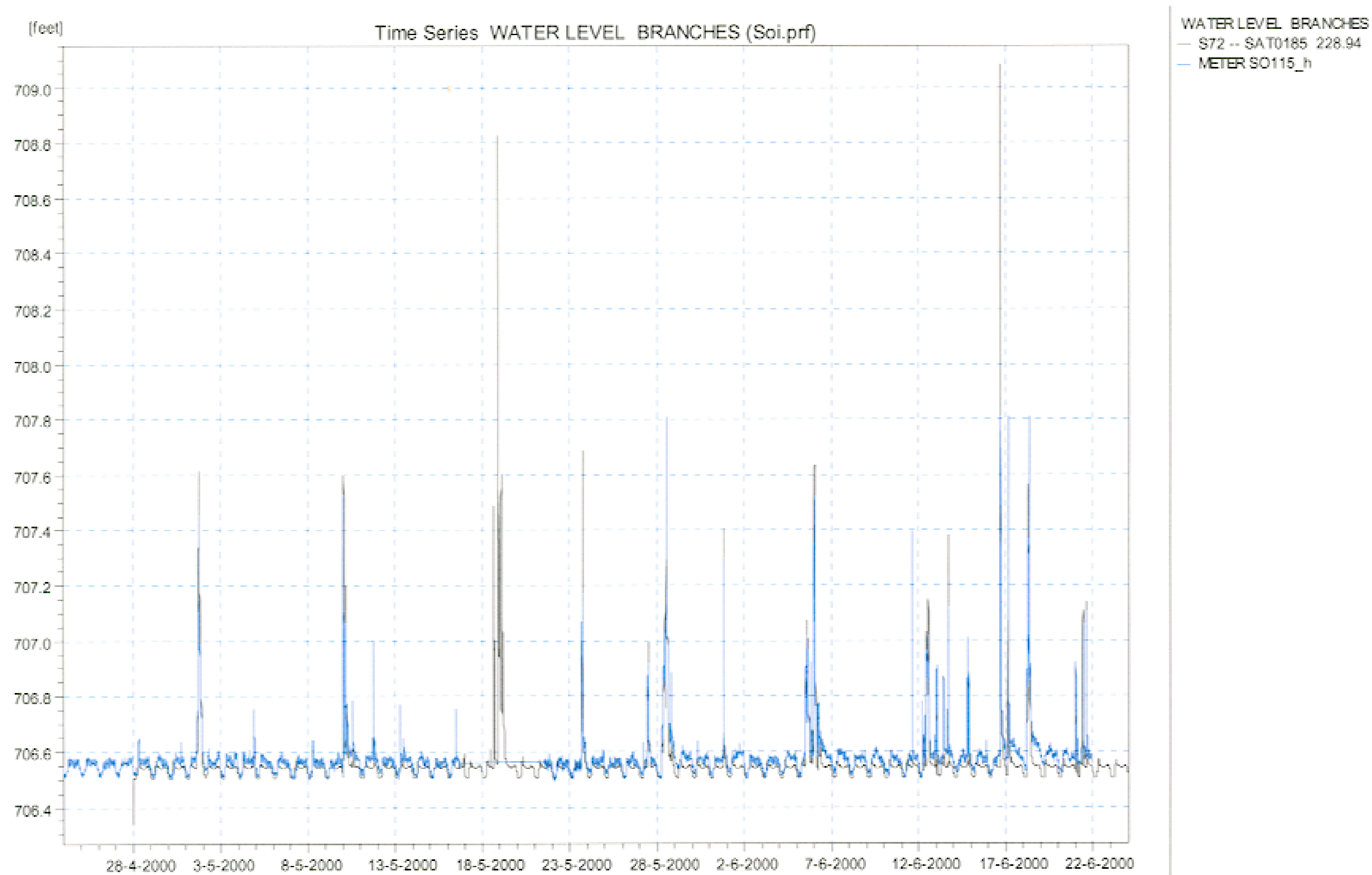
Meter SO-115
Meter vs. Modeled Storms
Modeled volume (MG)
Meter volume (MG)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Wet Weather Period
Dry Weather Period

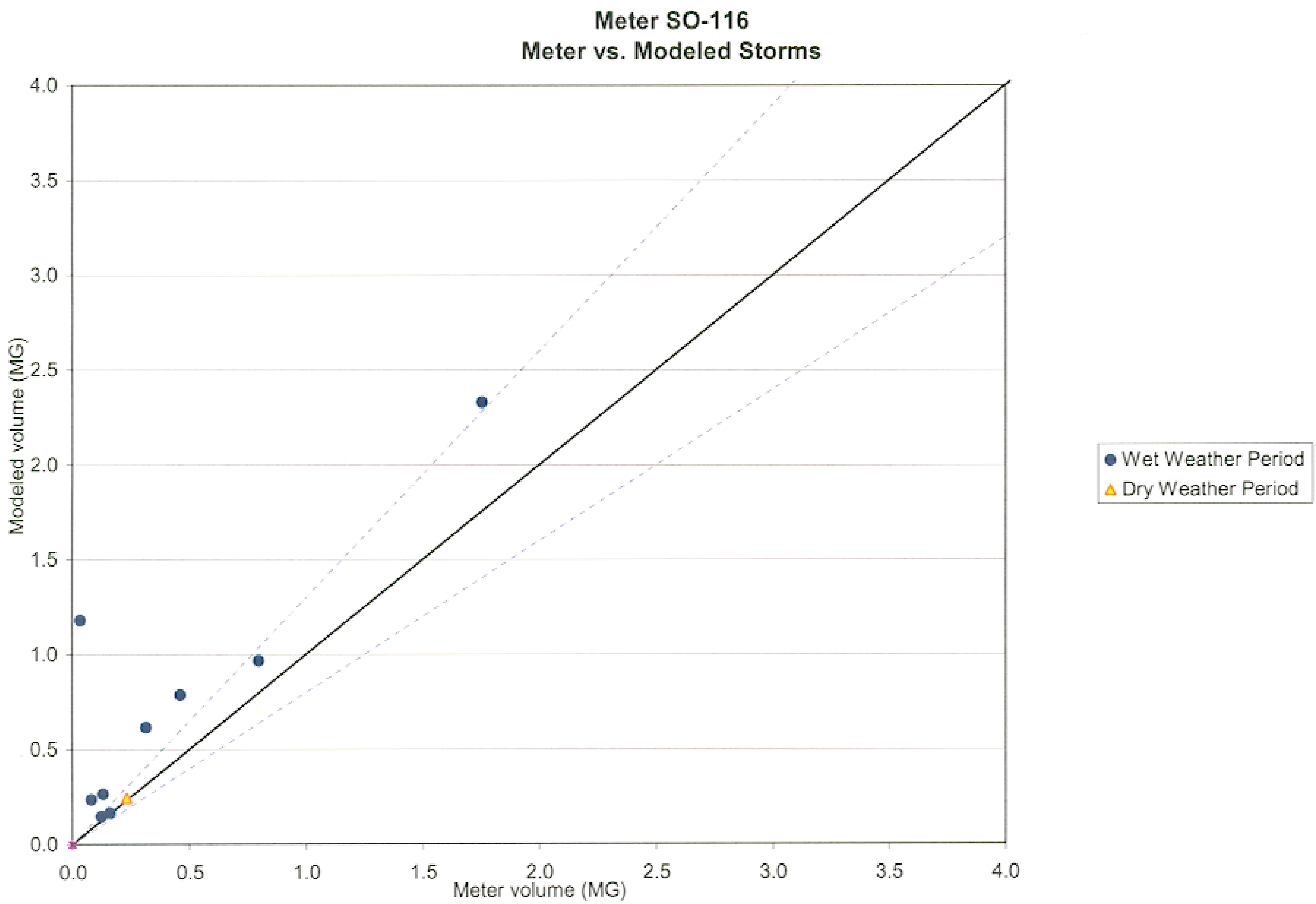
SO-115



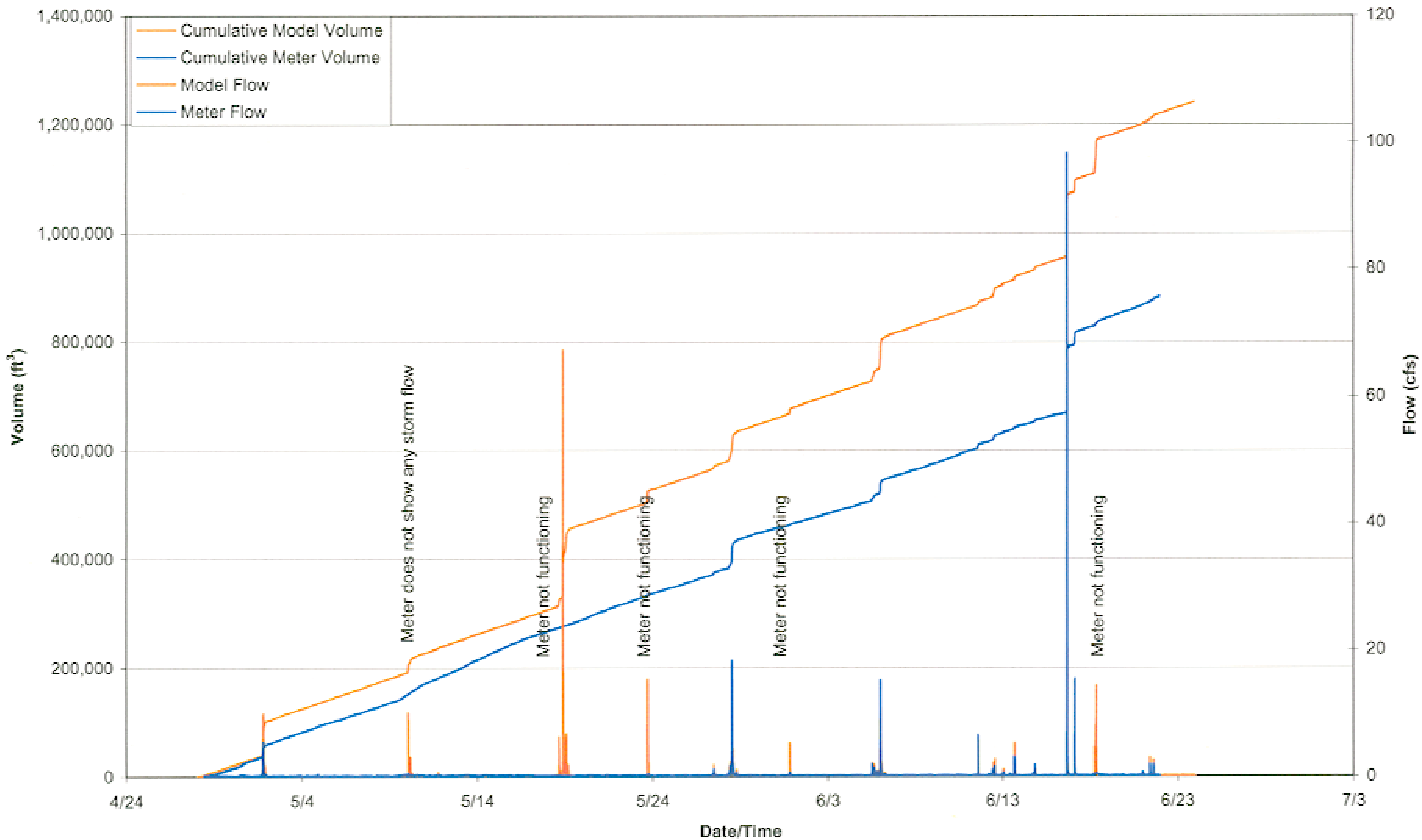
Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Meter not functioning
Volume (ft³)
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Flow (cfs)
14
12
10
8
6
4
2
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

Meter SO-115
Hydraulic Gradeline



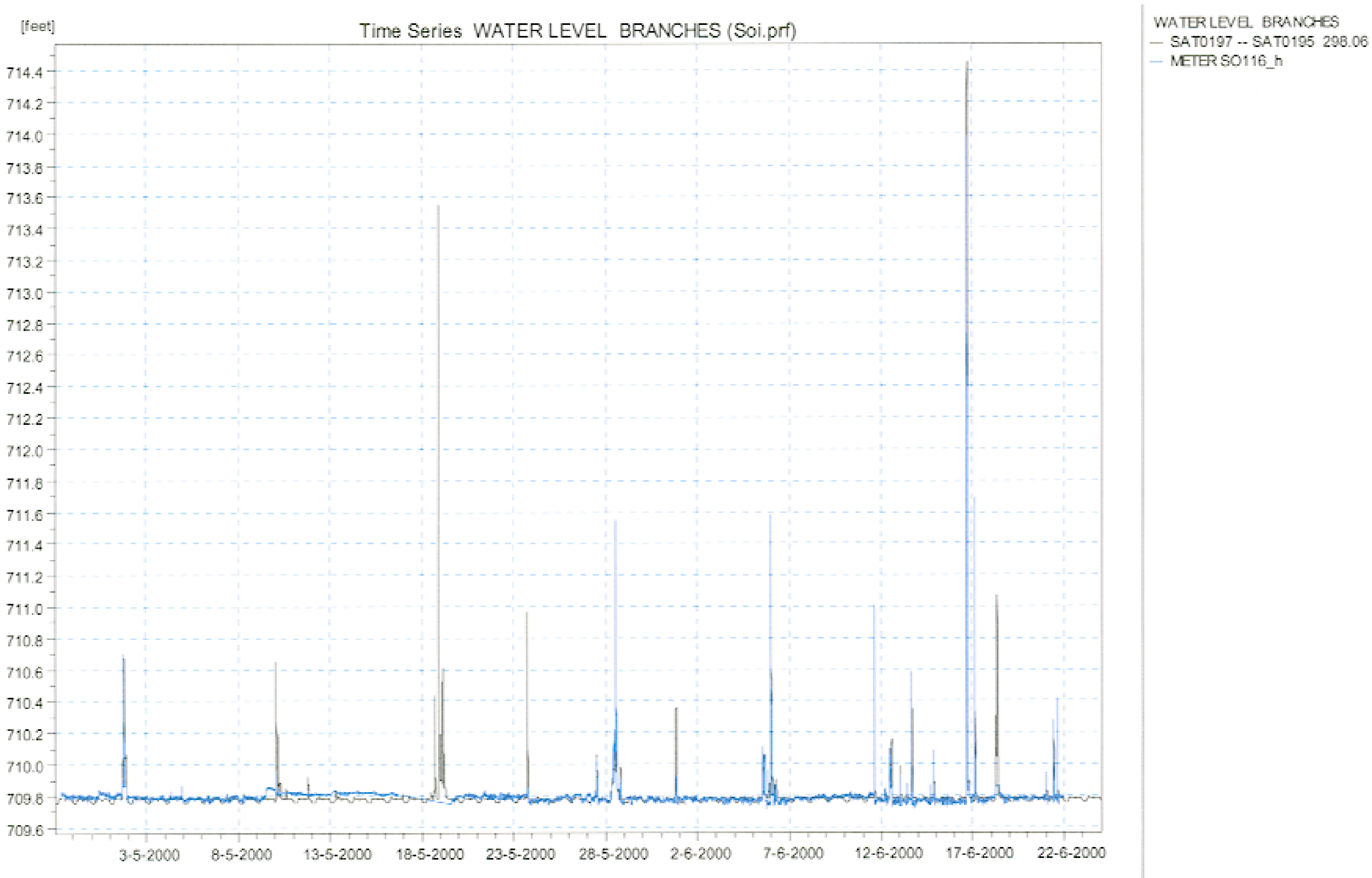

Meter SO-116
Meter vs. Modeled Storms
Modeled volume (MG)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Meter volume (MG)
Wet Weather Period
Dry Weather Period

SO-116

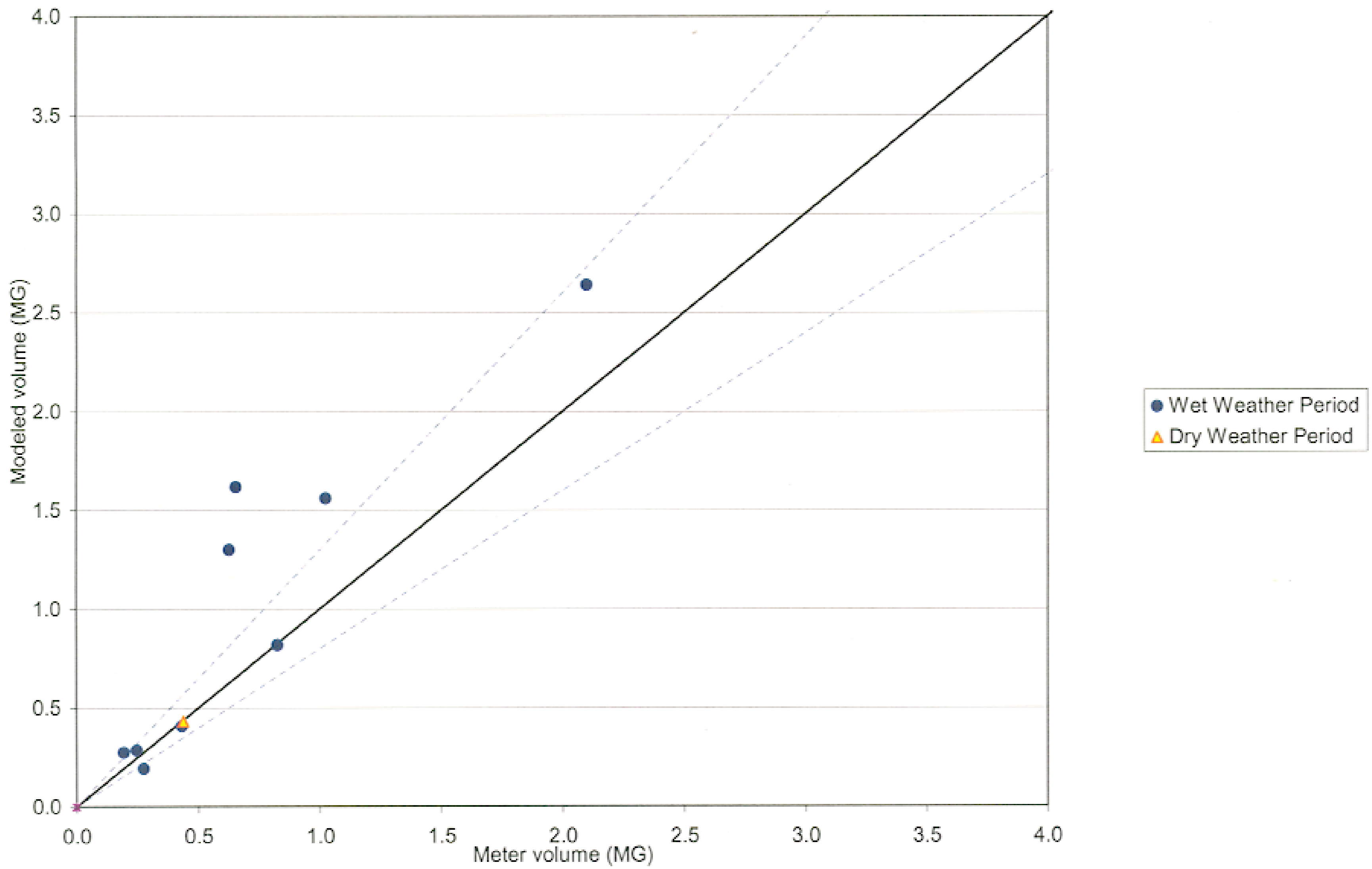


Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Volume (ft³)
Flow (cfs)
Date/Time
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
120
100
80
60
40
20
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Meter does not show any storm flow
Meter not functioning
Meter not functioning
Meter not functioning
Meter not functioning

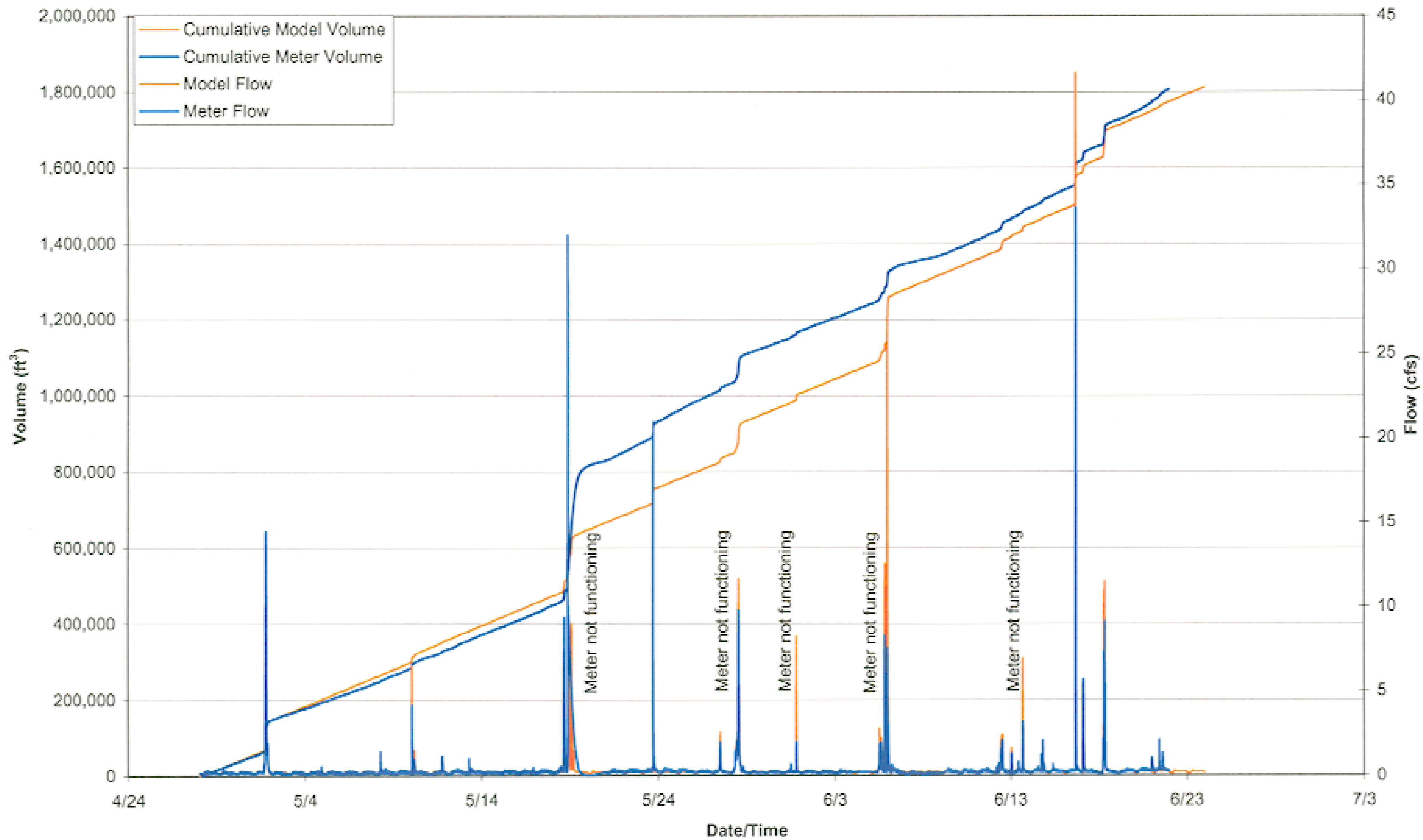
Meter SO-116
Hydraulic Gradeline



Meter SO-118
Meter vs. Modeled Storms

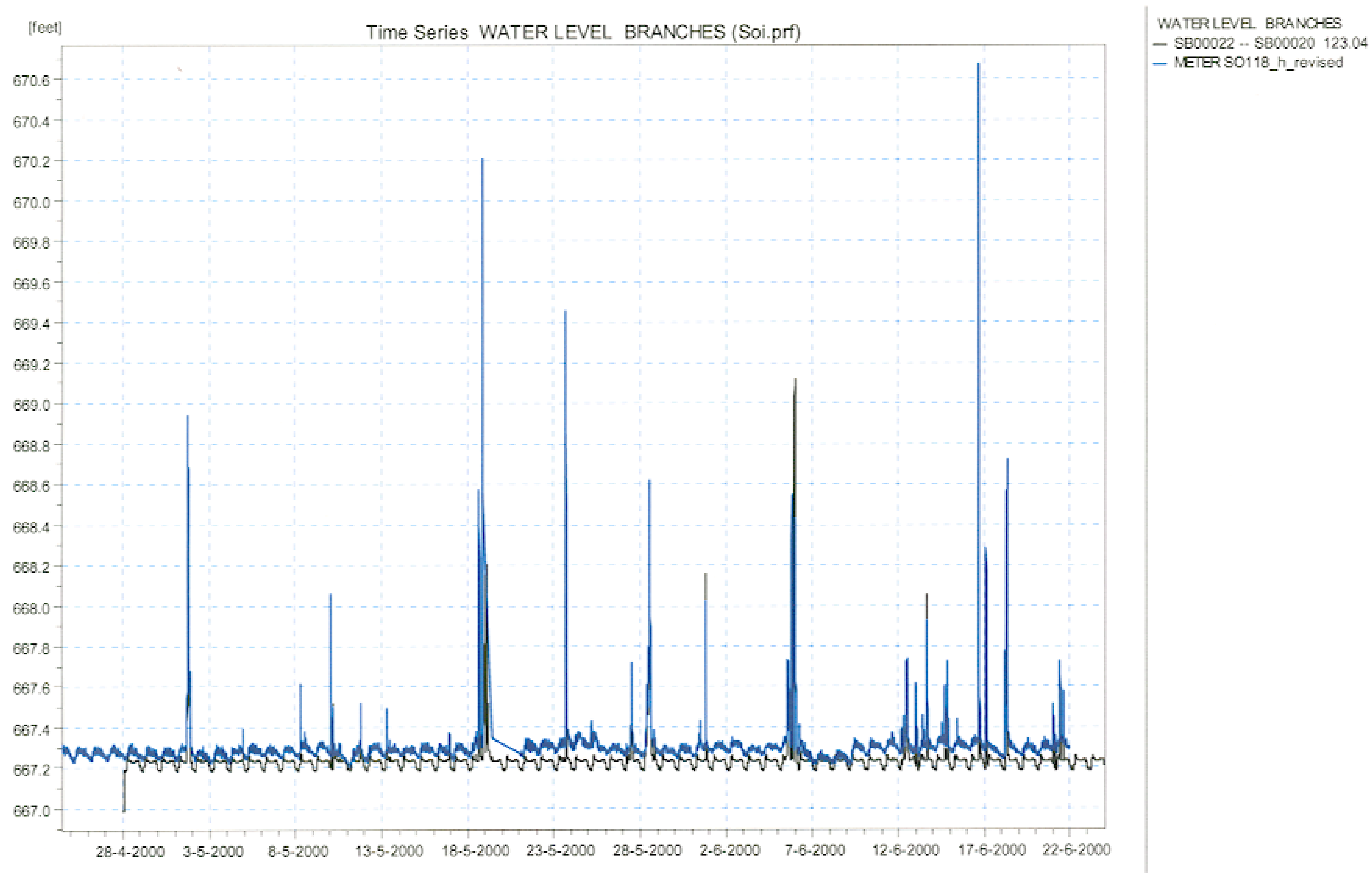


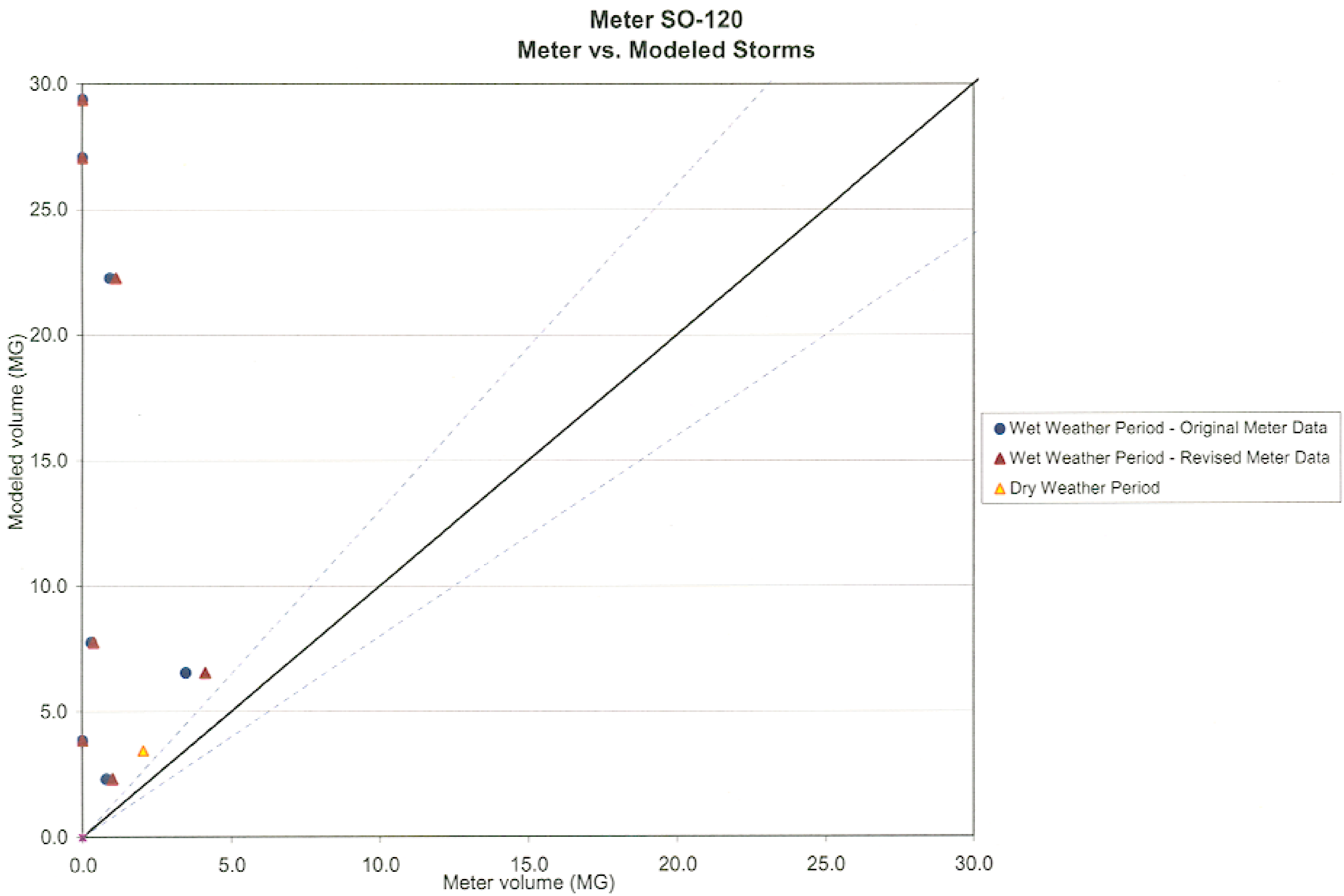
SO-118



Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Volume (ft³)
Flow (cfs)
Date/Time
2,000,000
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
45
40
35
30
25
20
15
10
5
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Meter not functioning
Meter not functioning
Meter not functioning
Meter not functioning
Meter not functioning

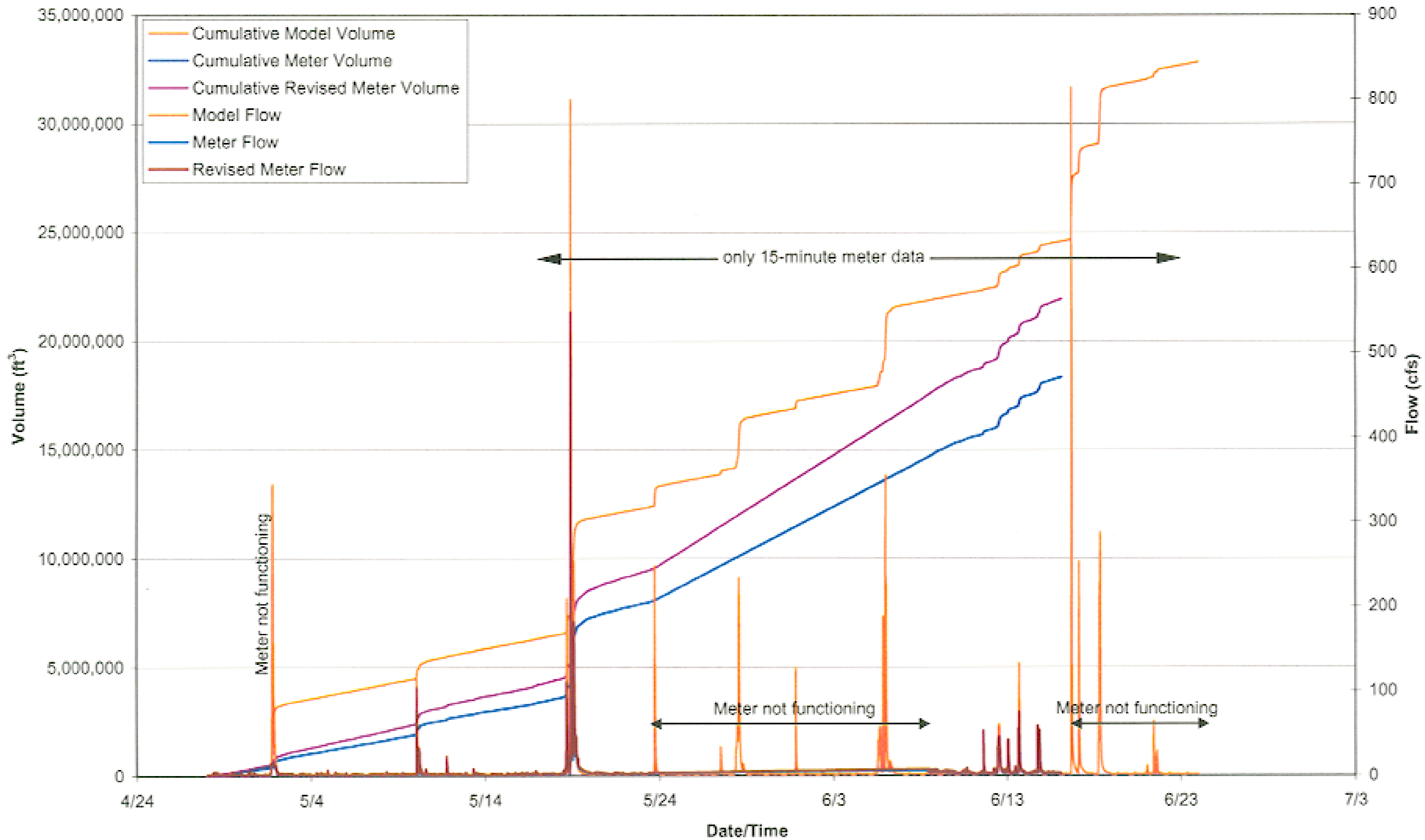
Meter SO-118
Hydraulic Gradeline





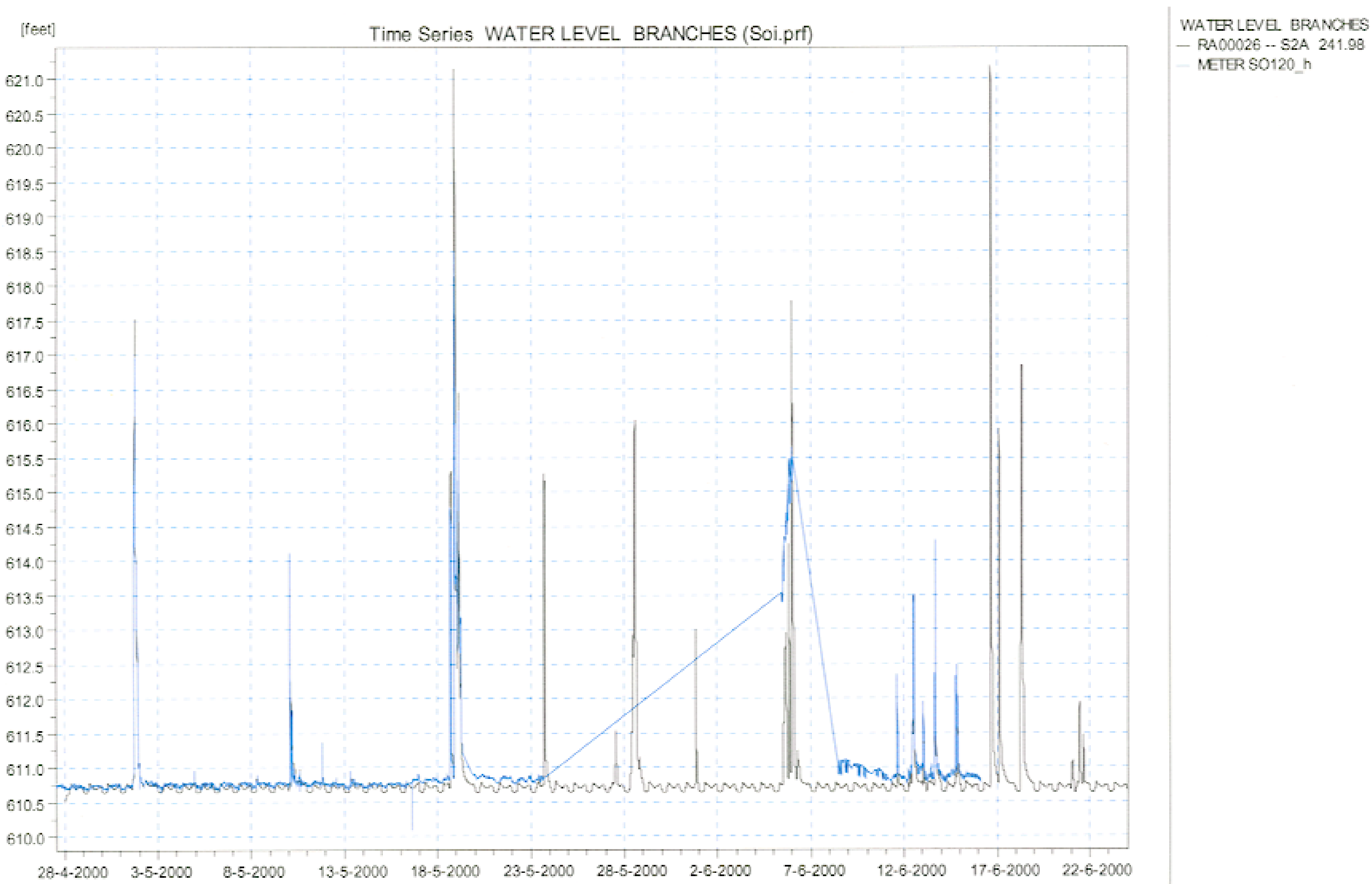
Meter SO-120
Meter vs. Modeled Storms
Modeled volume (MG)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0
5.0
10.0
15.0
20.0
25.0
30.0
Meter volume (MG)
Wet Weather Period - Original Meter Data
Wet Weather Period - Revised Meter Data
Dry Weather Period

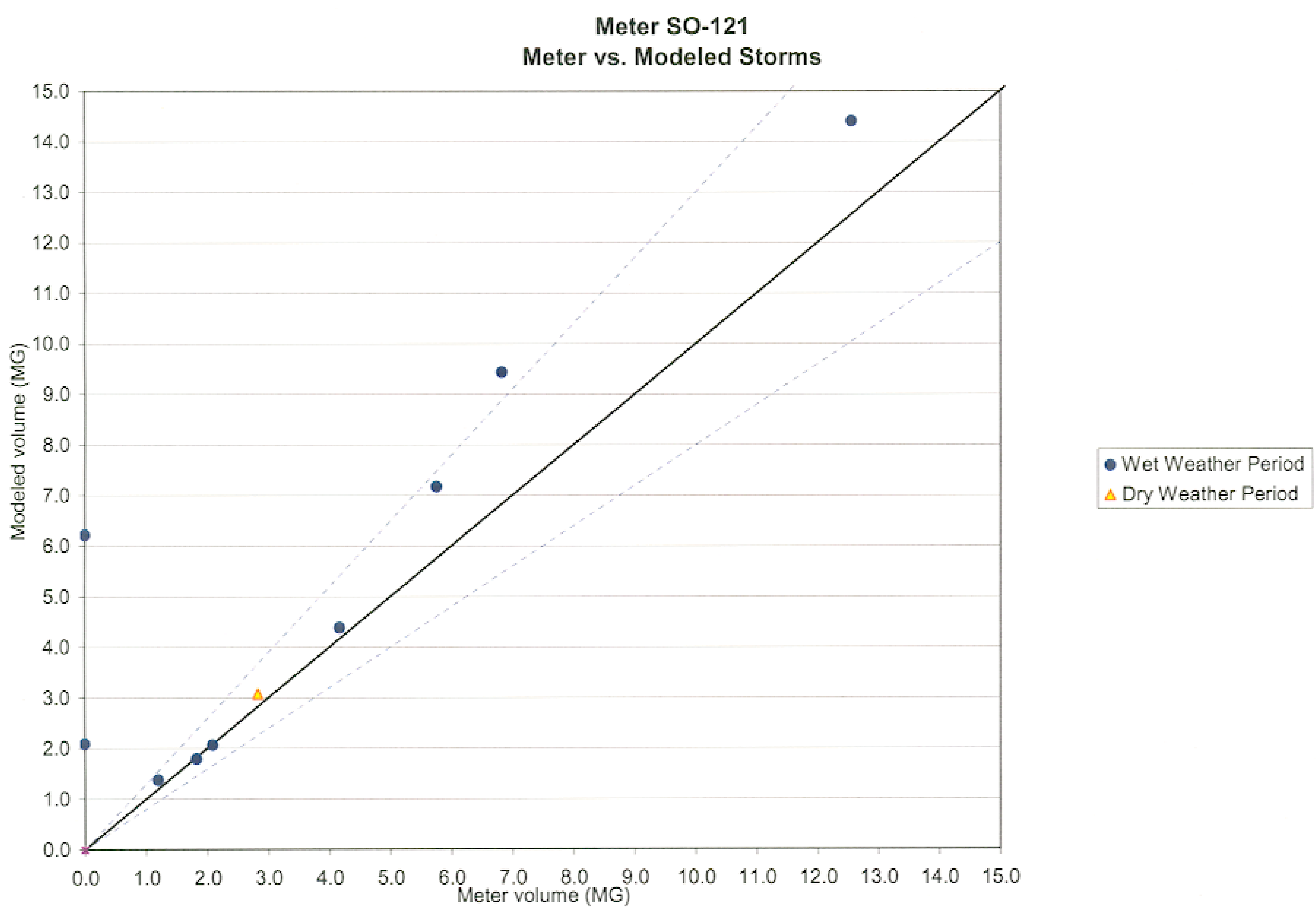
SO-120



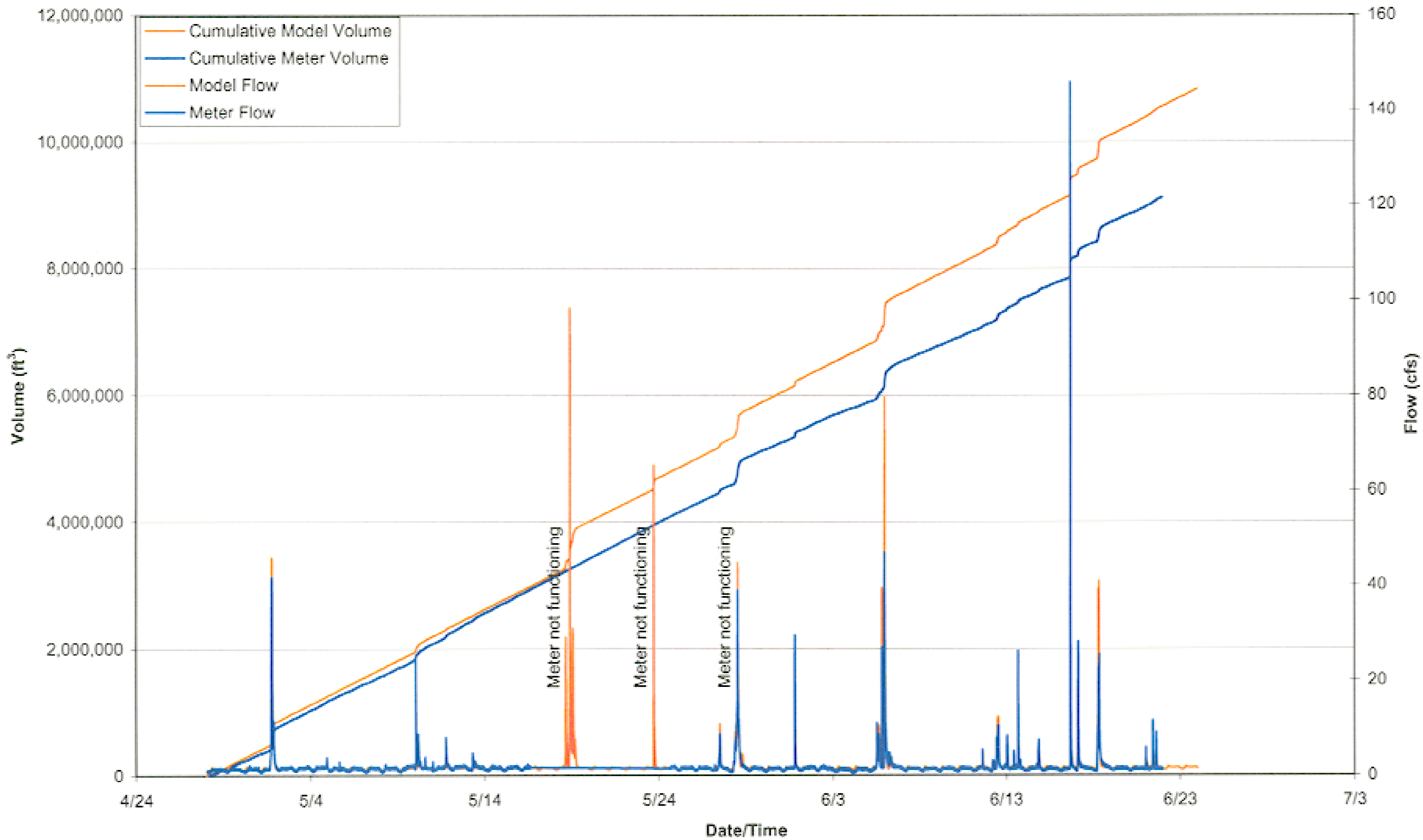
Cumulative Model Volume
Cumulative Meter Volume
Cumulative Revised Meter Volume
Model Flow
Meter Flow
Revised Meter Flow
only 15-minute meter data
Meter not functioning
Meter not functioning
Meter not functioning
Volume (ft³)
Flow (cfs)
Date/Time
35,000,000
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
900
800
700
600
500
400
300
200
100
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3

Meter SO-120
Hydraulic Gradeline



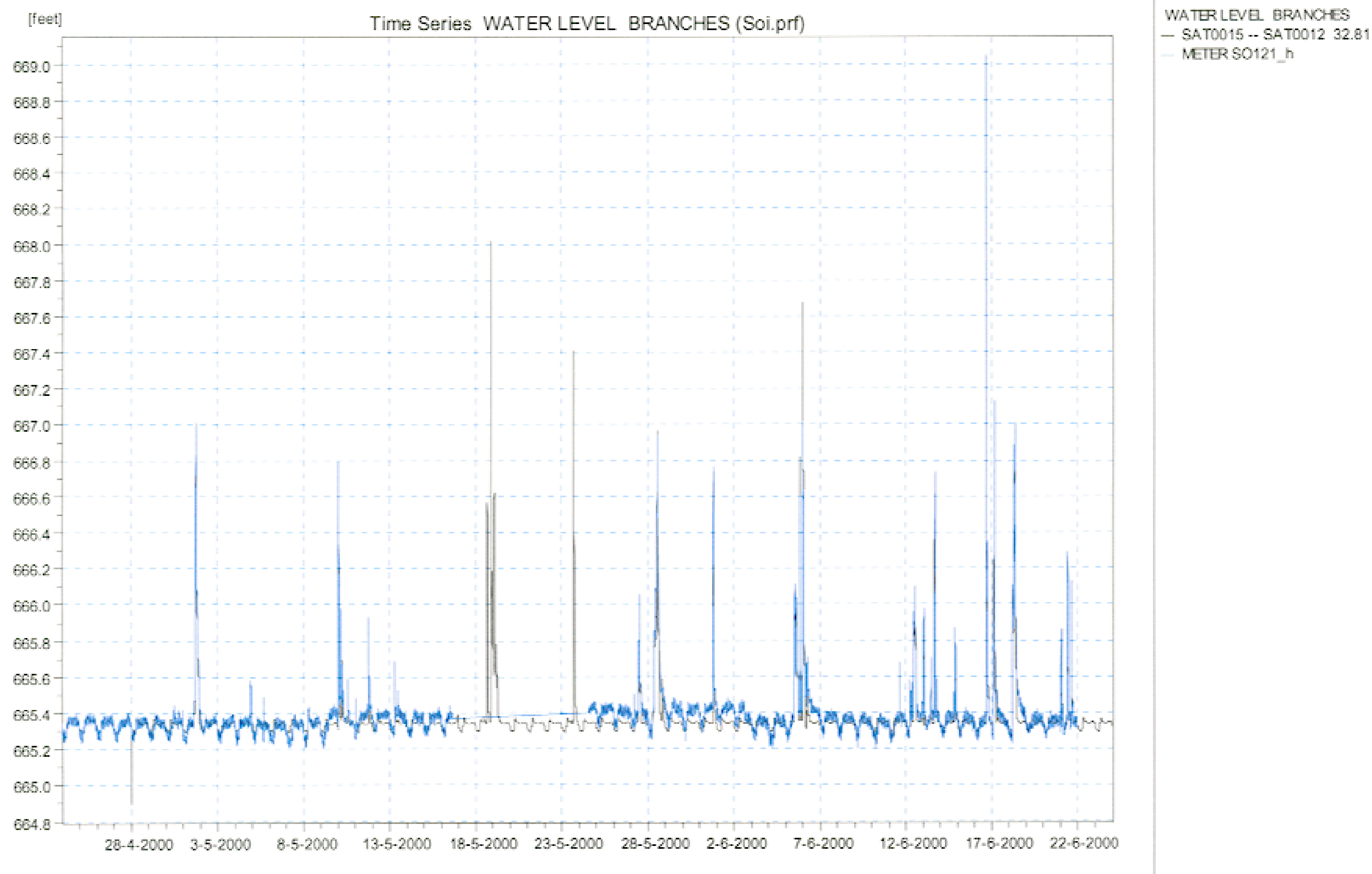

Meter SO-121
Meter vs. Modeled Storms
Modeled volume (MG)
15.0
14.0
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
15.0
Meter volume (MG)
Wet Weather Period
Dry Weather Period

SO-121

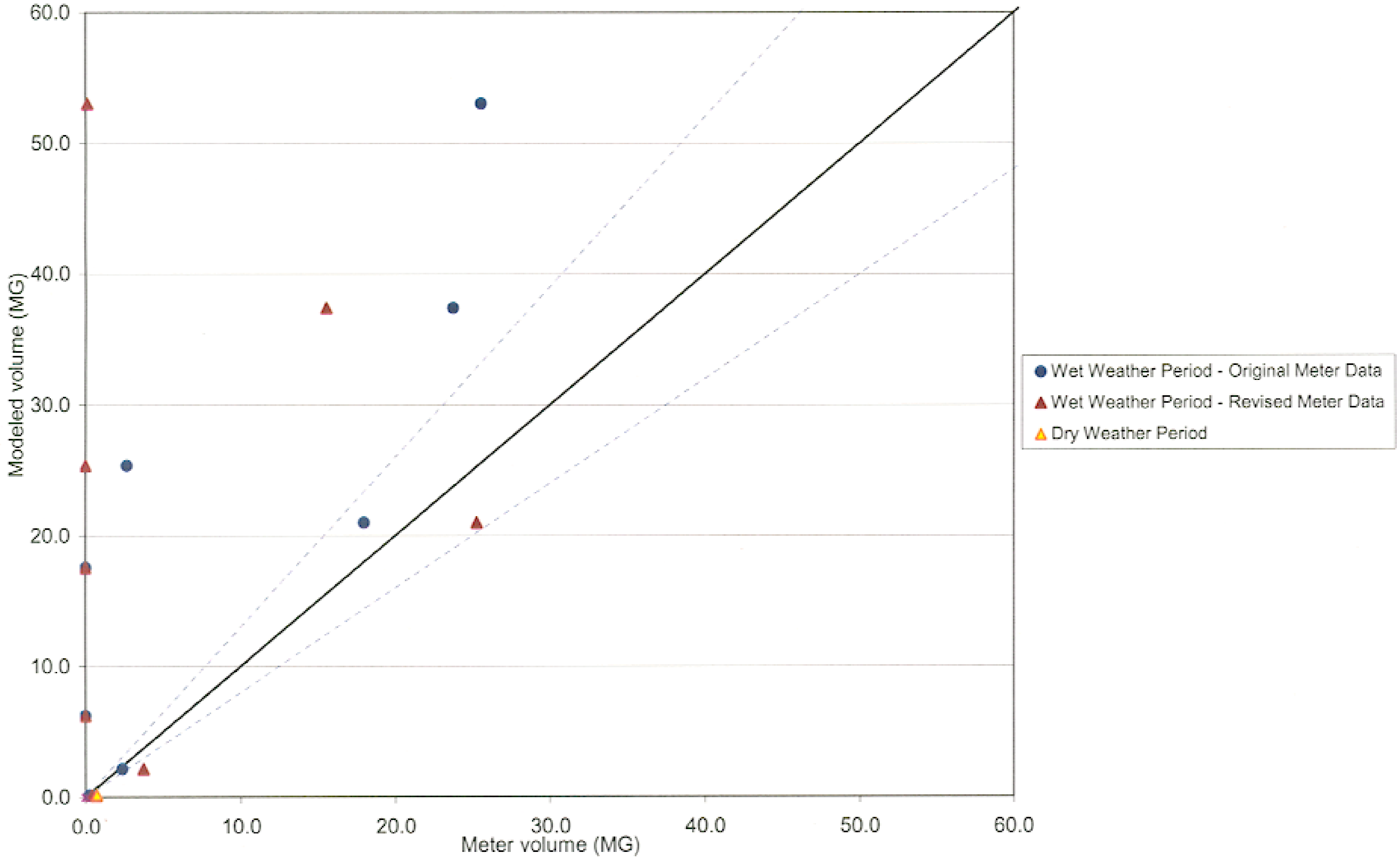


Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Volume (ft³)
Flow (cfs)
Date/Time
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
160
140
120
100
80
60
40
20
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Meter not functioning
Meter not functioning
Meter not functioning

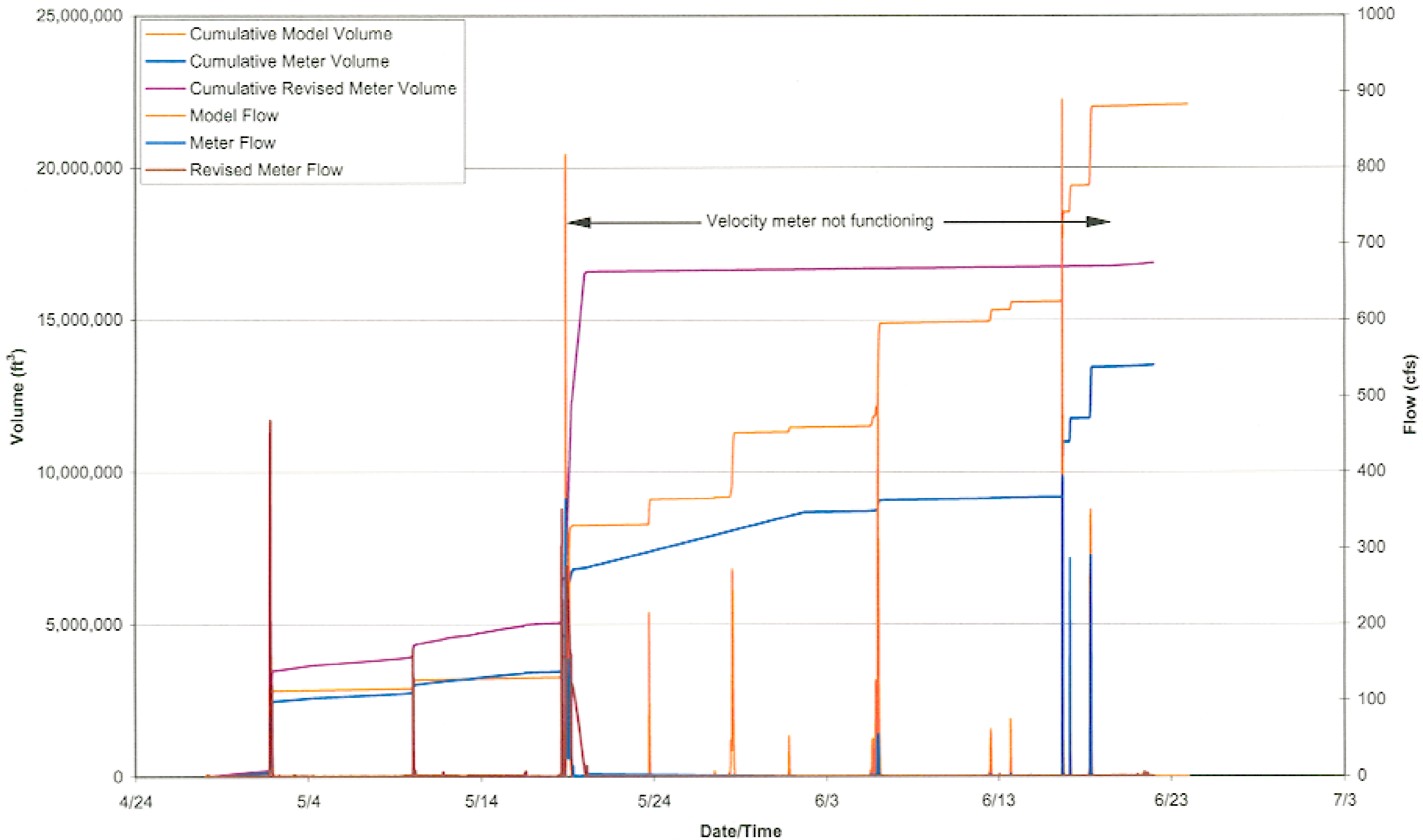
Meter SO-121
Hydraulic Gradeline



Meter SO-122W
Meter vs. Modeled Storms

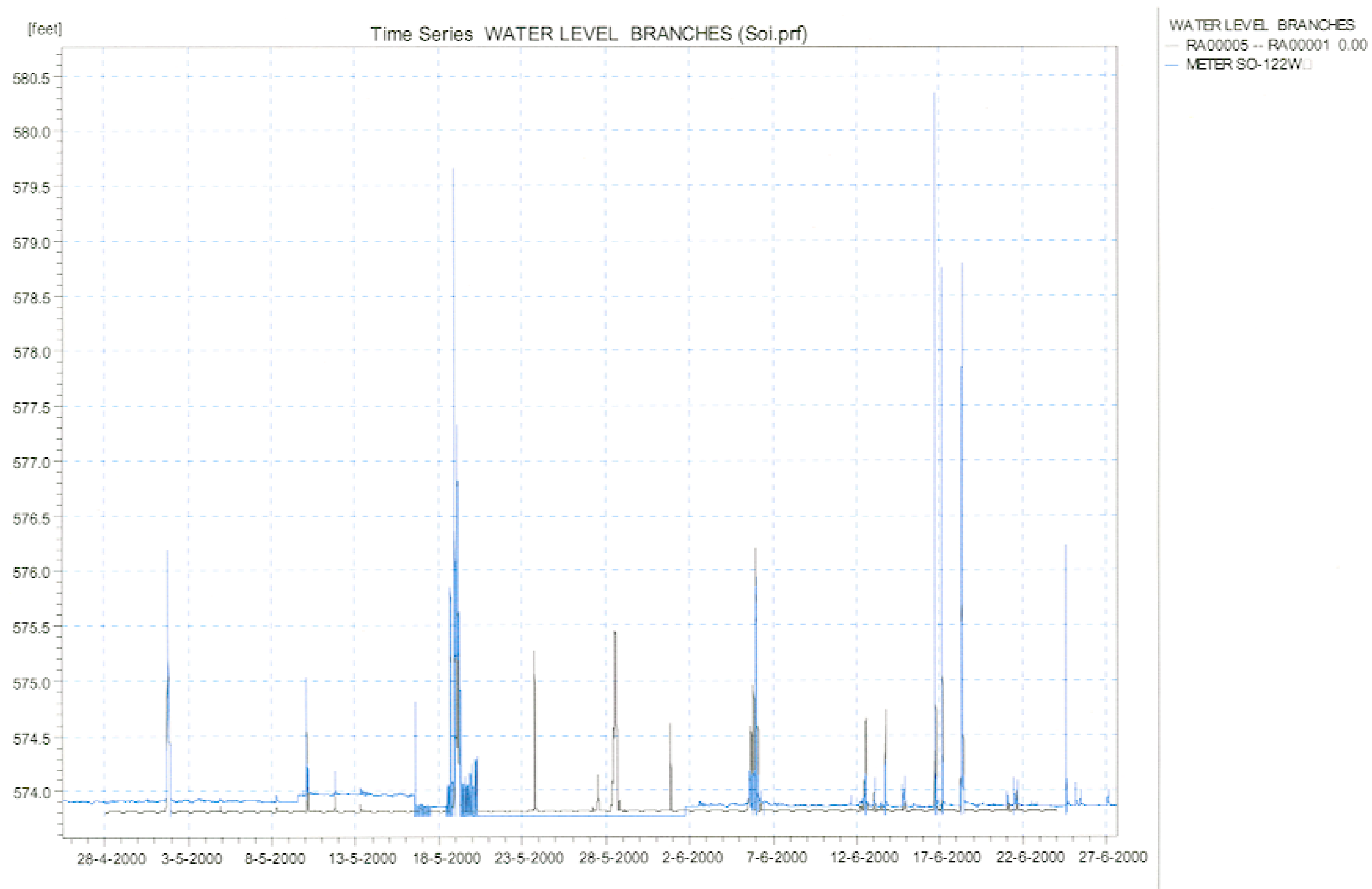


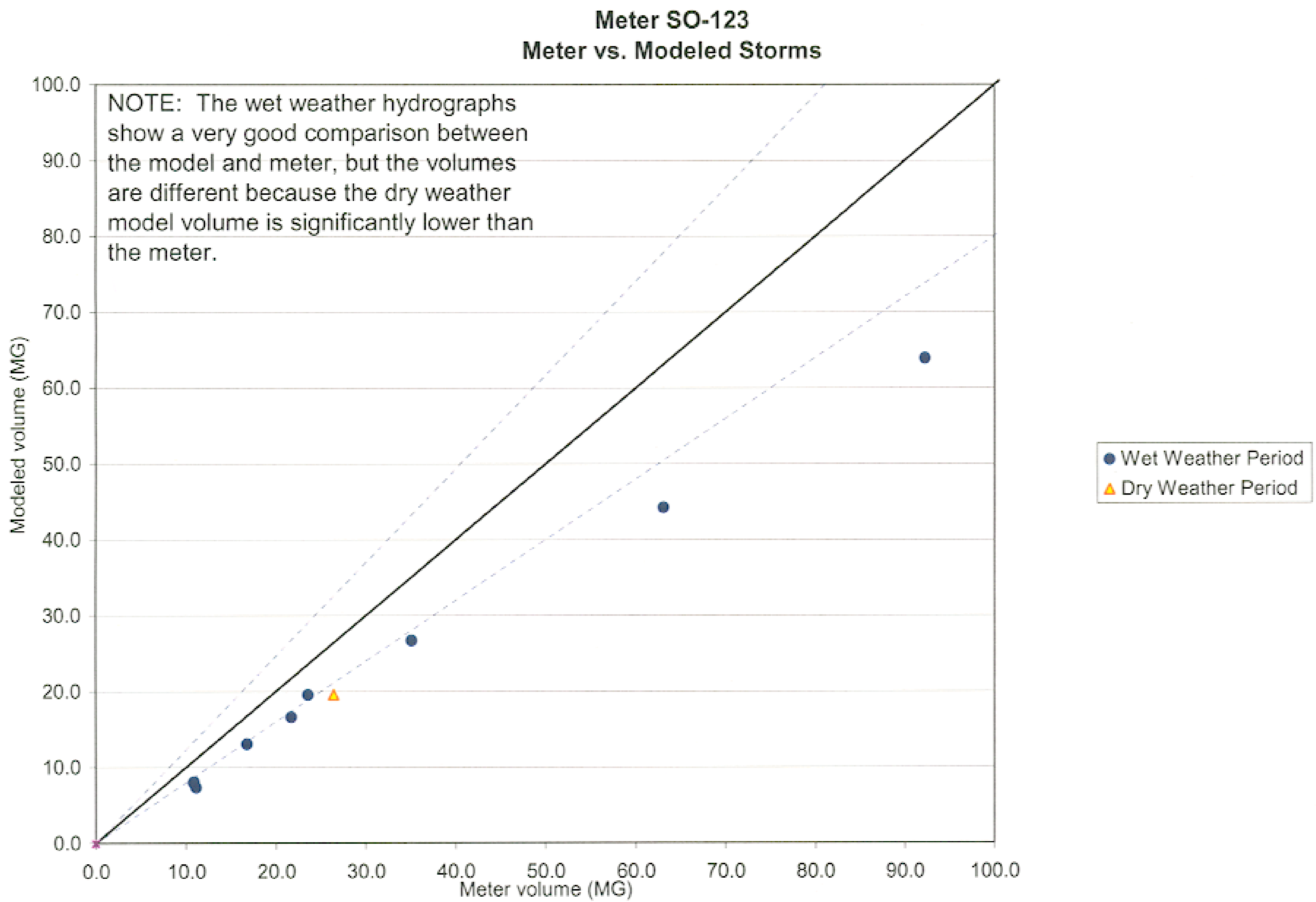
SO-122W



25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
Volume (ft³)
1000
900
800
700
600
500
400
300
200
100
0
Flow (cfs)
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time
Cumulative Model Volume
Cumulative Meter Volume
Cumulative Revised Meter Volume
Model Flow
Meter Flow
Revised Meter Flow
Velocity meter not functioning

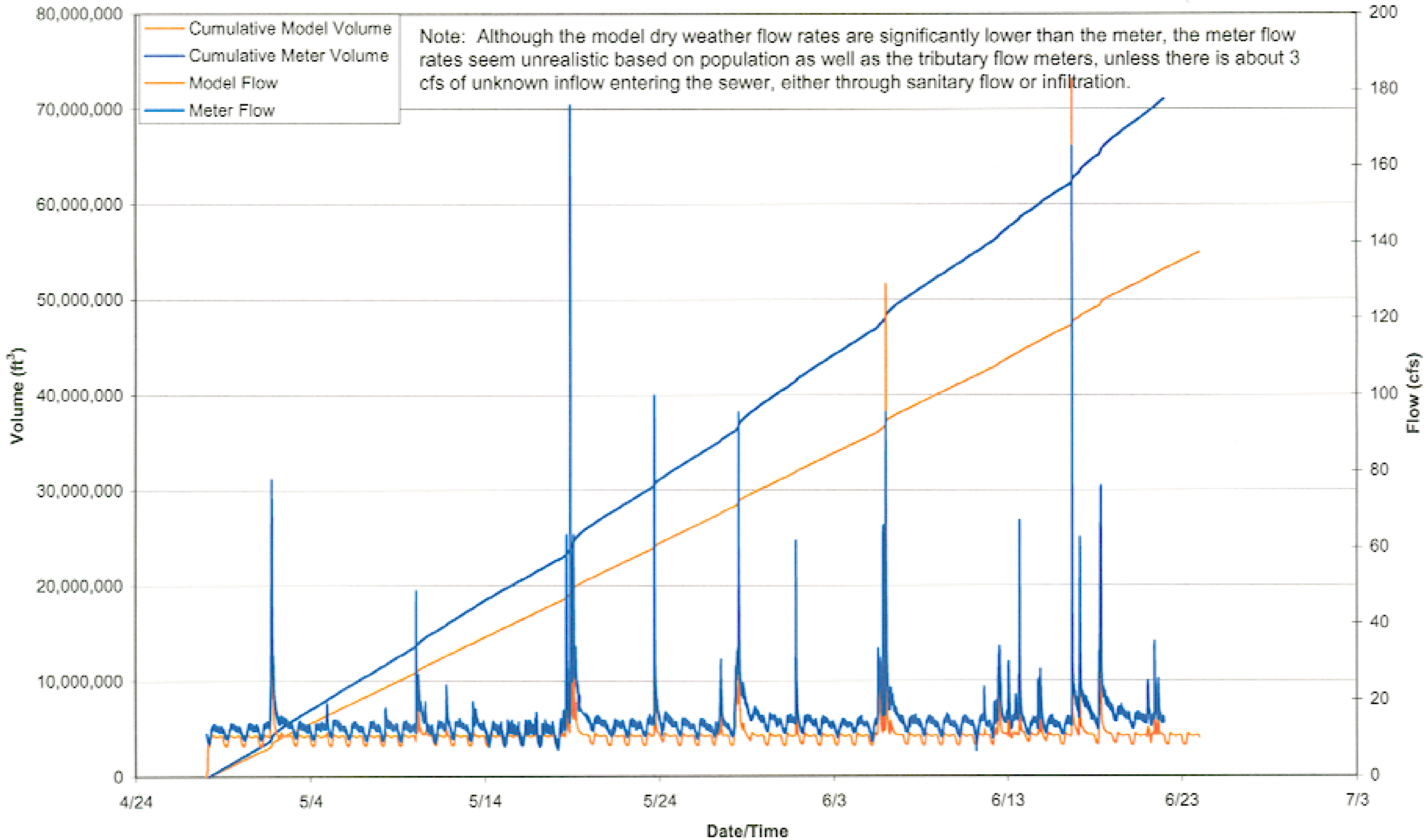
Meter SO-122W
Hydraulic Gradeline





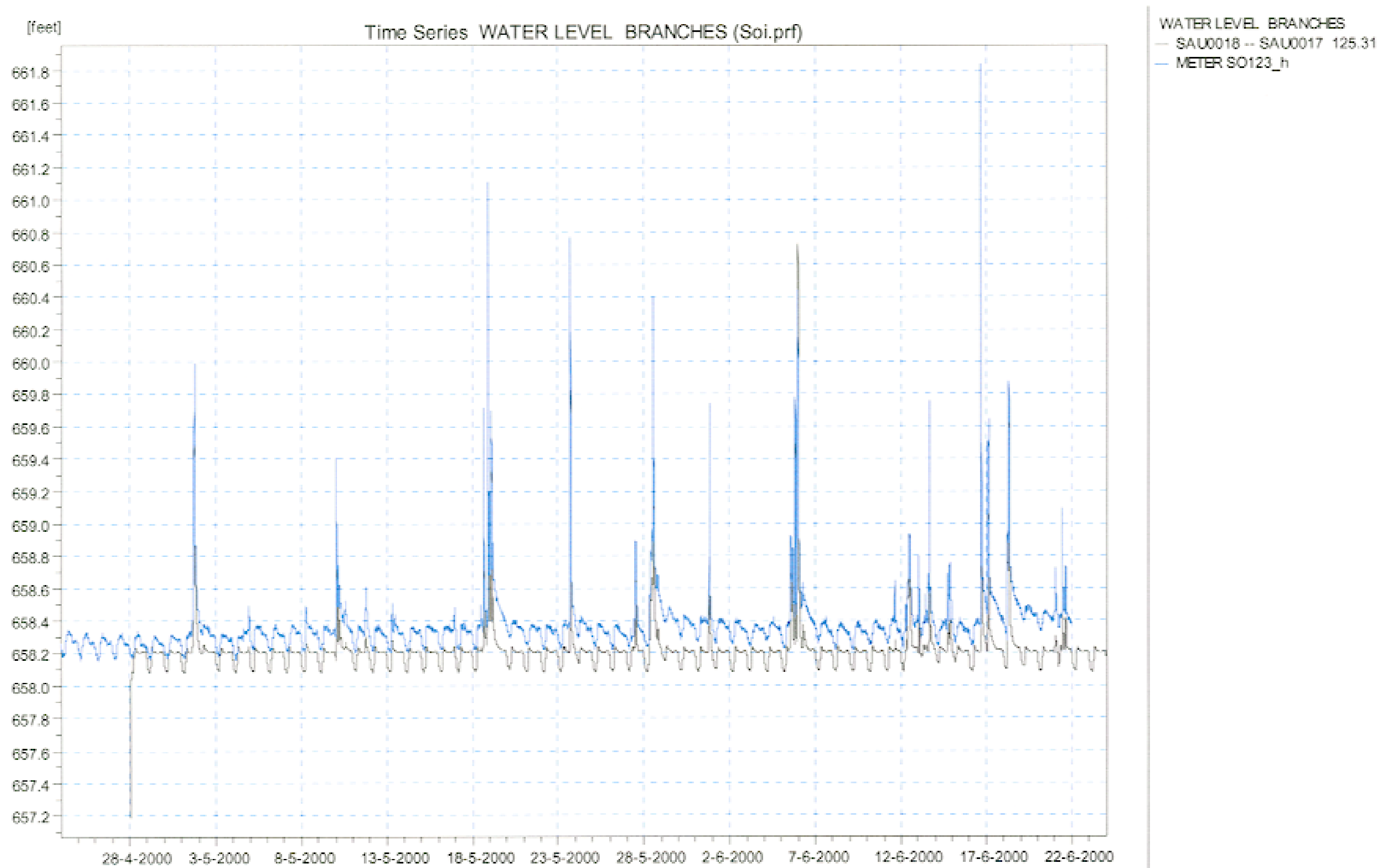
Meter SO-123
Meter vs. Modeled Storms
NOTE: The wet weather hydrographs show a very good comparison between the model and meter, but the volumes are different because the dry weather model volume is significantly lower than the meter.
Modeled volume (MG)
Meter volume (MG)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
Wet Weather Period
Dry Weather Period

SO-123

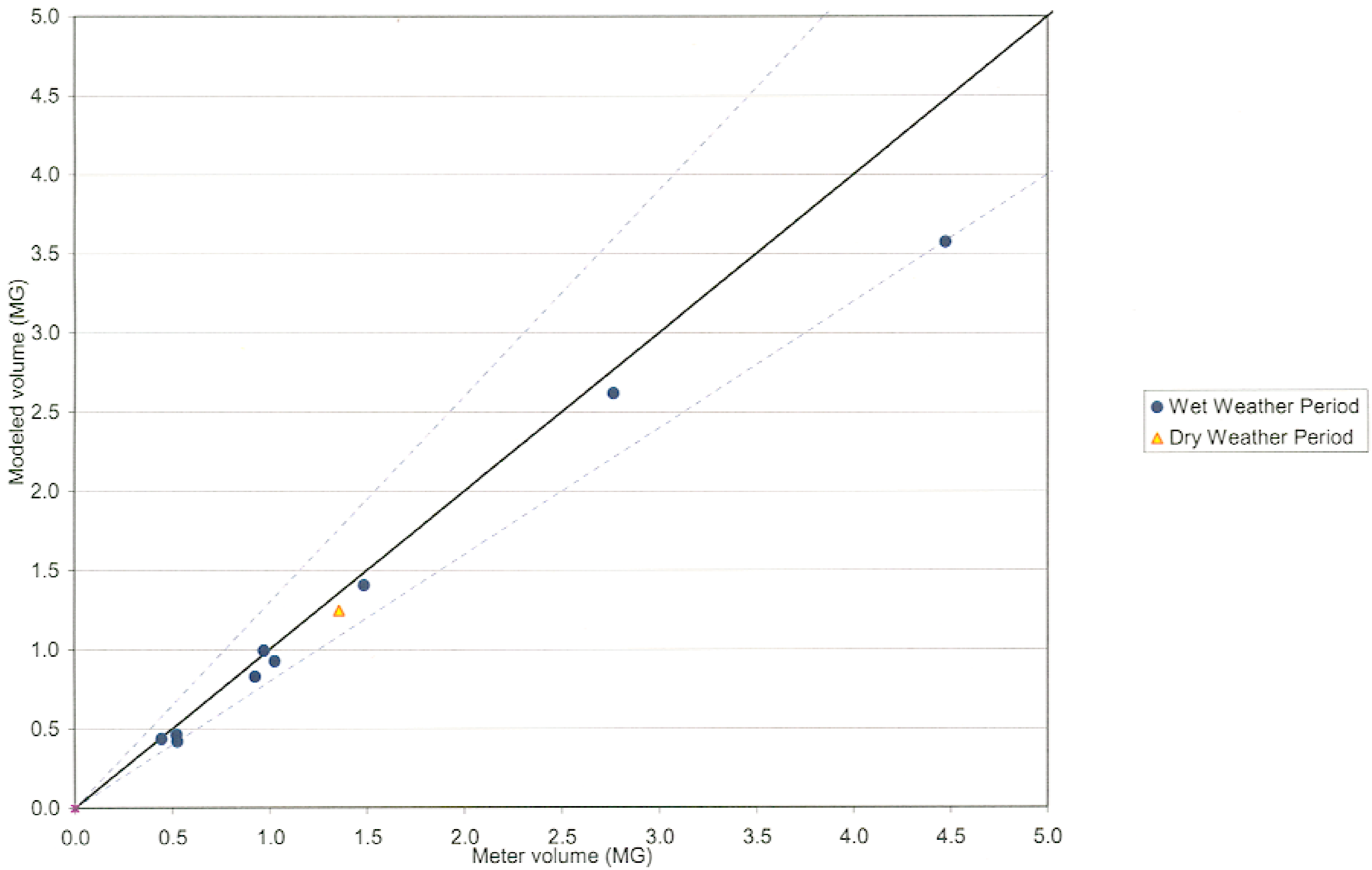


Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Note: Although the model dry weather flow rates are significantly lower than the meter, the meter flow rates seem unrealistic based on population as well as the tributary flow meters, unless there is about 3 cfs of unknown inflow entering the sewer, either through sanitary flow or infiltration.
Volume (ft³)
80,000,000
70,000,000
60,000,000
50,000,000
40,000,000
30,000,000
20,000,000
10,000,000
0
Flow (cfs)
200
180
160
140
120
100
80
60
40
20
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

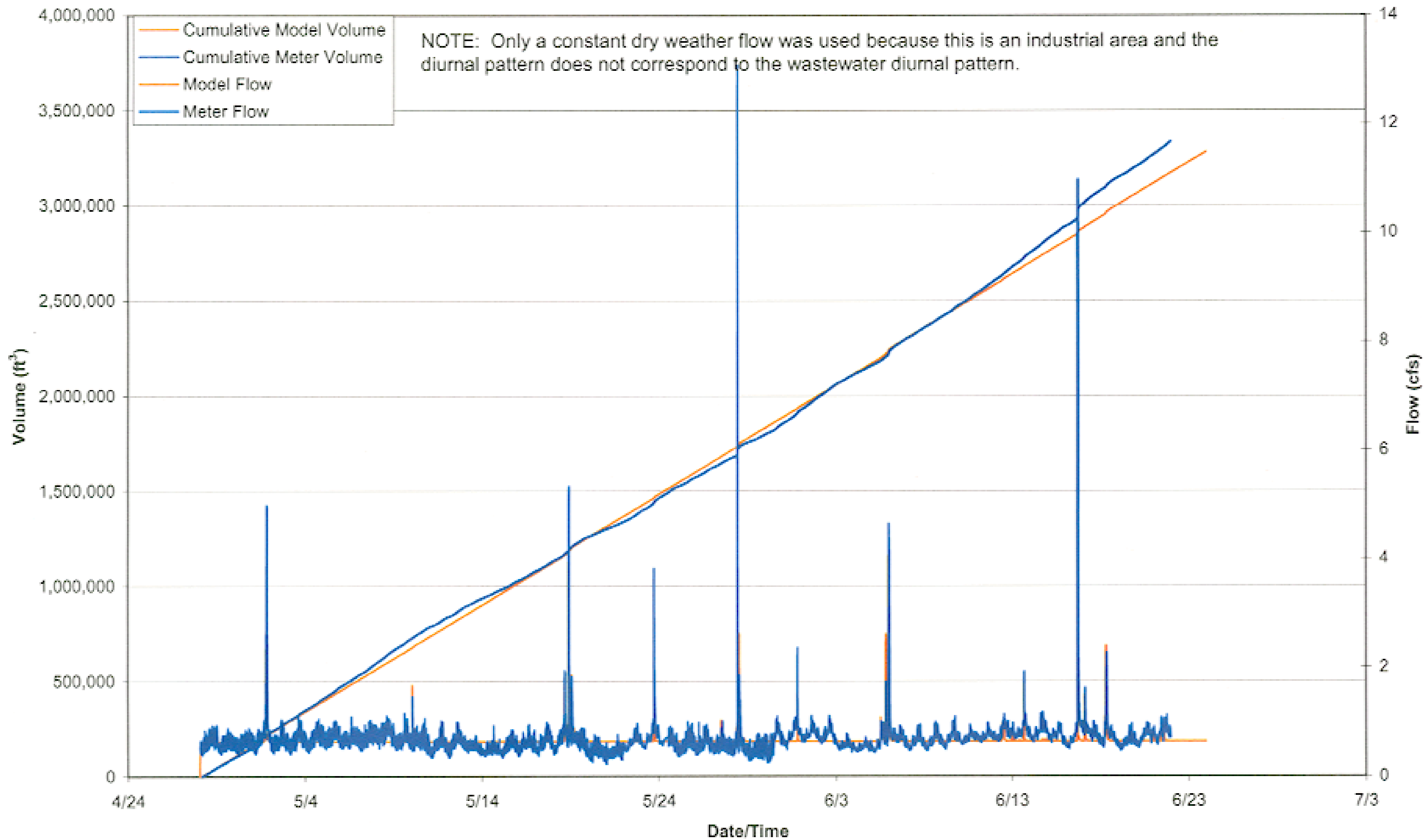
Meter SO-123
Hydraulic Gradeline



Meter SO-124
Meter vs. Modeled Storms

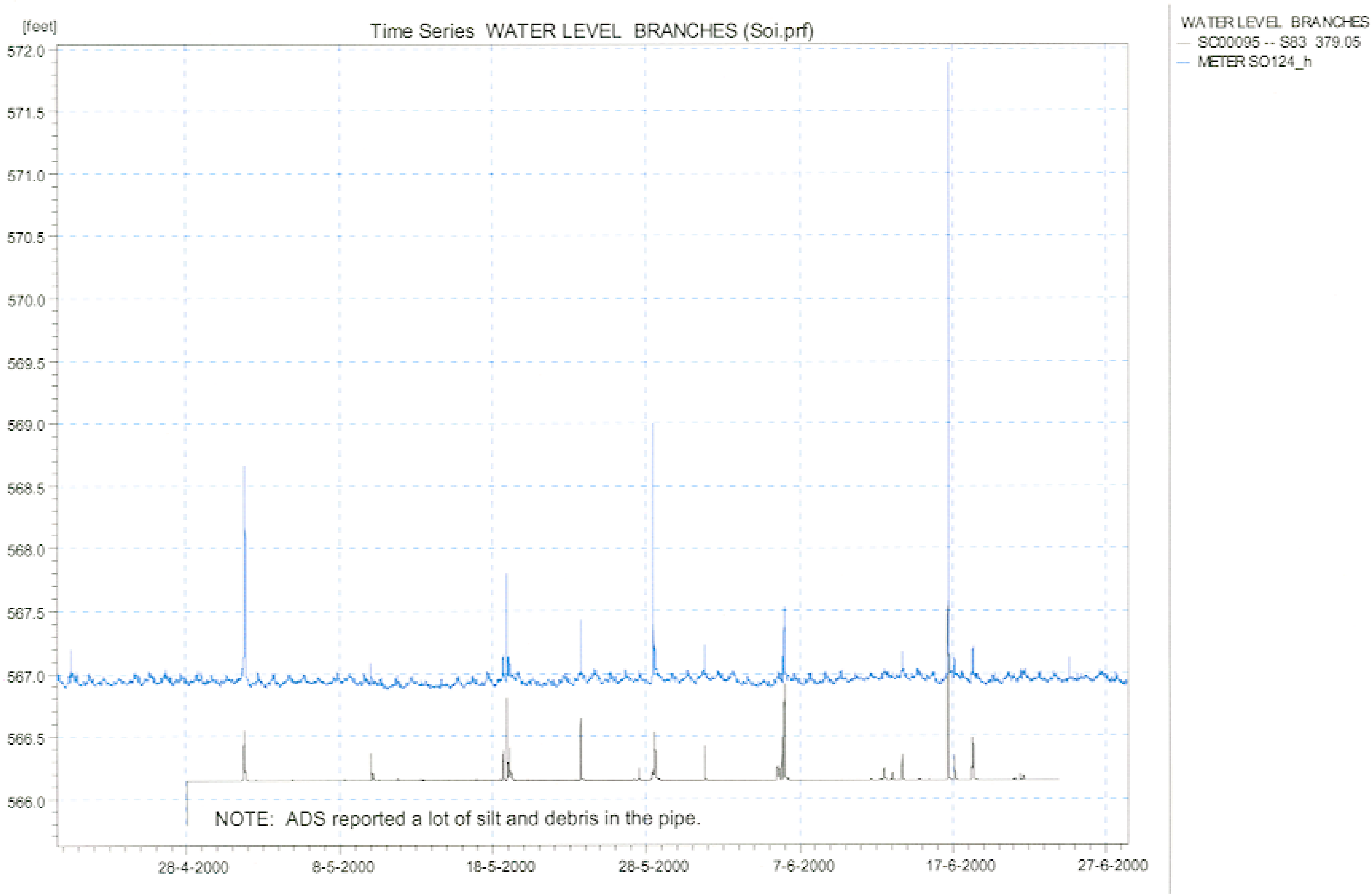


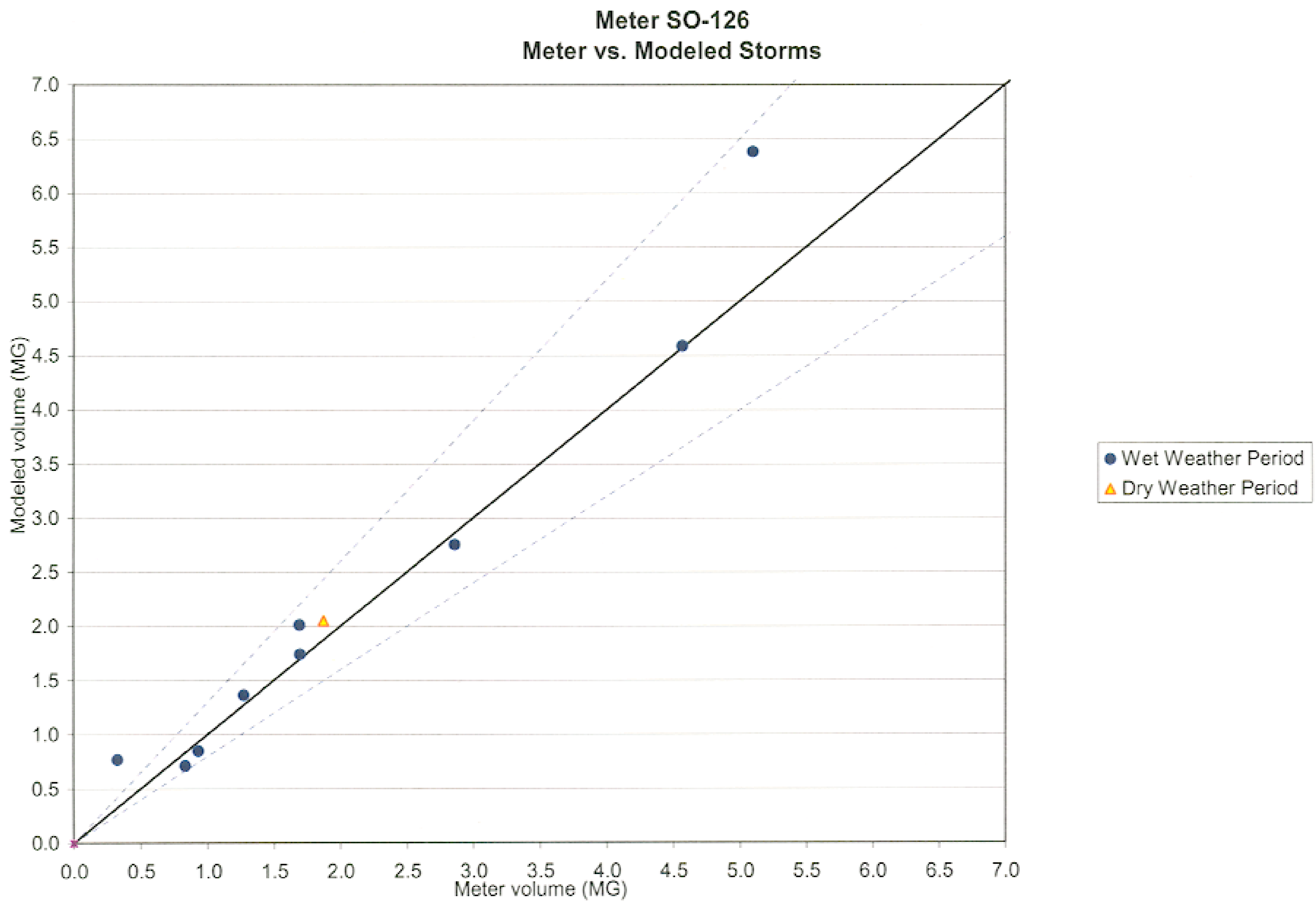
SO-124



Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
NOTE: Only a constant dry weather flow was used because this is an industrial area and the diurnal pattern does not correspond to the wastewater diurnal pattern.
Volume (ft³)
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Flow (cfs)
14
12
10
8
6
4
2
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

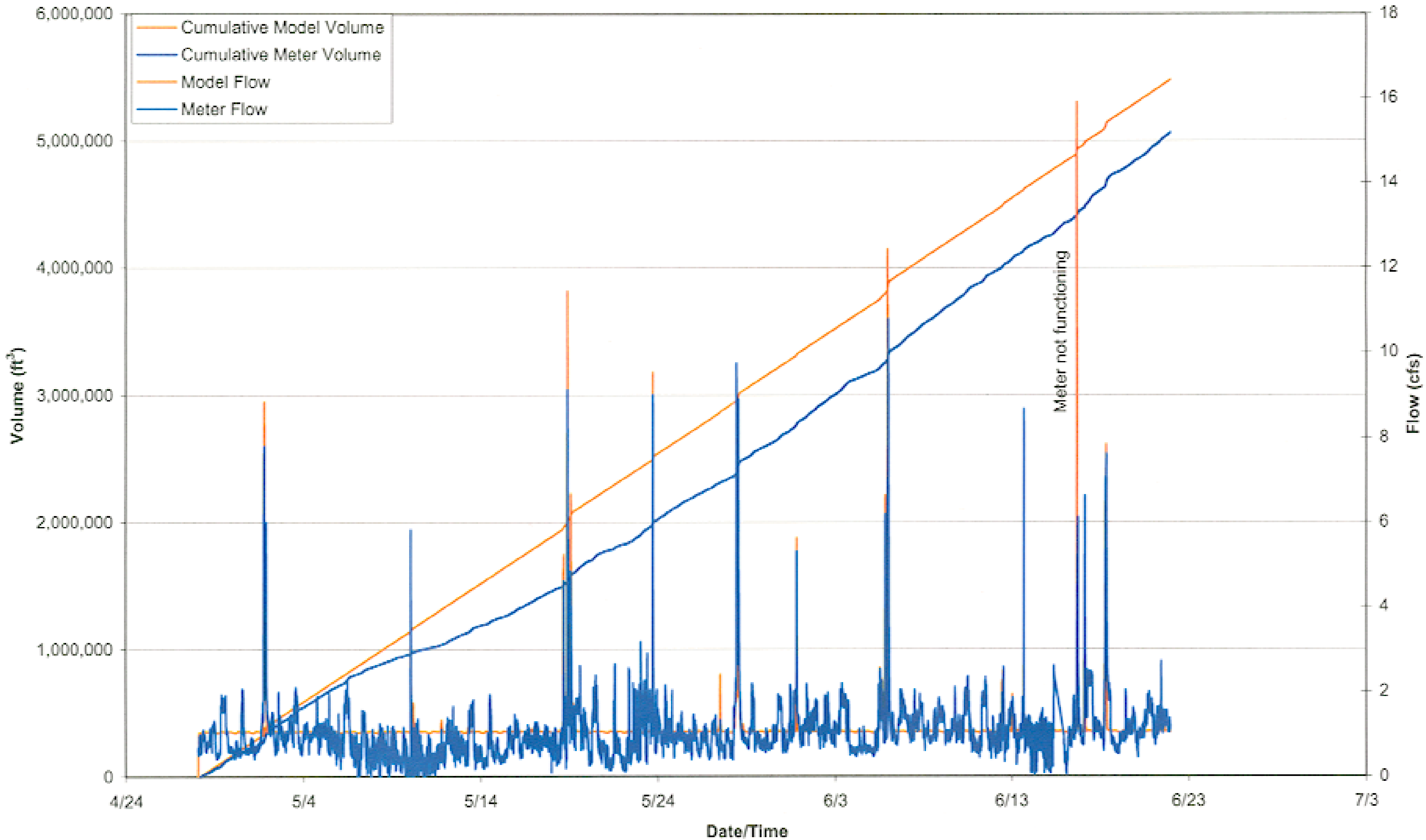
Meter SO-124
Hydraulic Gradeline





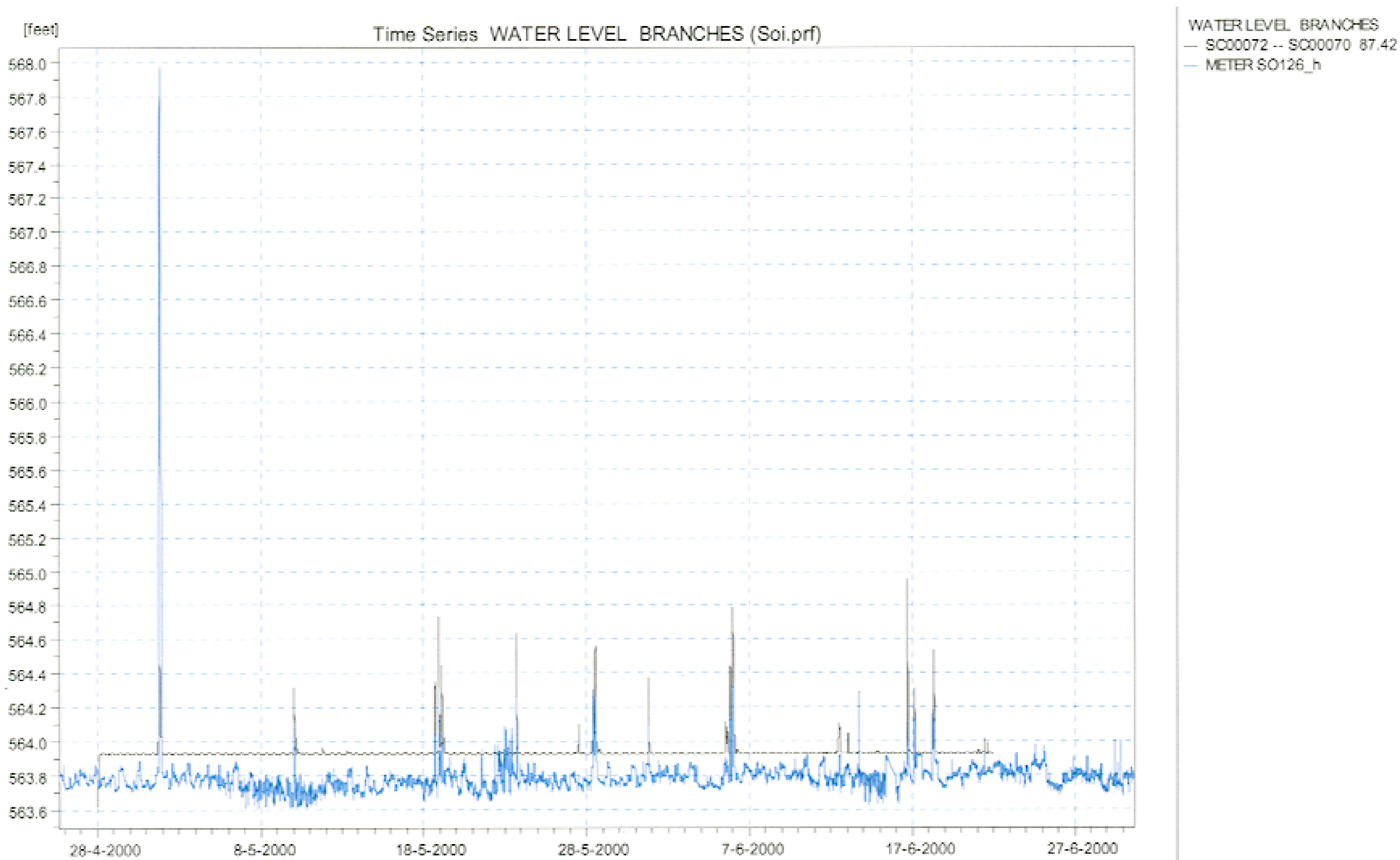
Meter SO-126
Meter vs. Modeled Storms
Modeled volume (MG)
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
Meter volume (MG)
Wet Weather Period
Dry Weather Period

SO-126

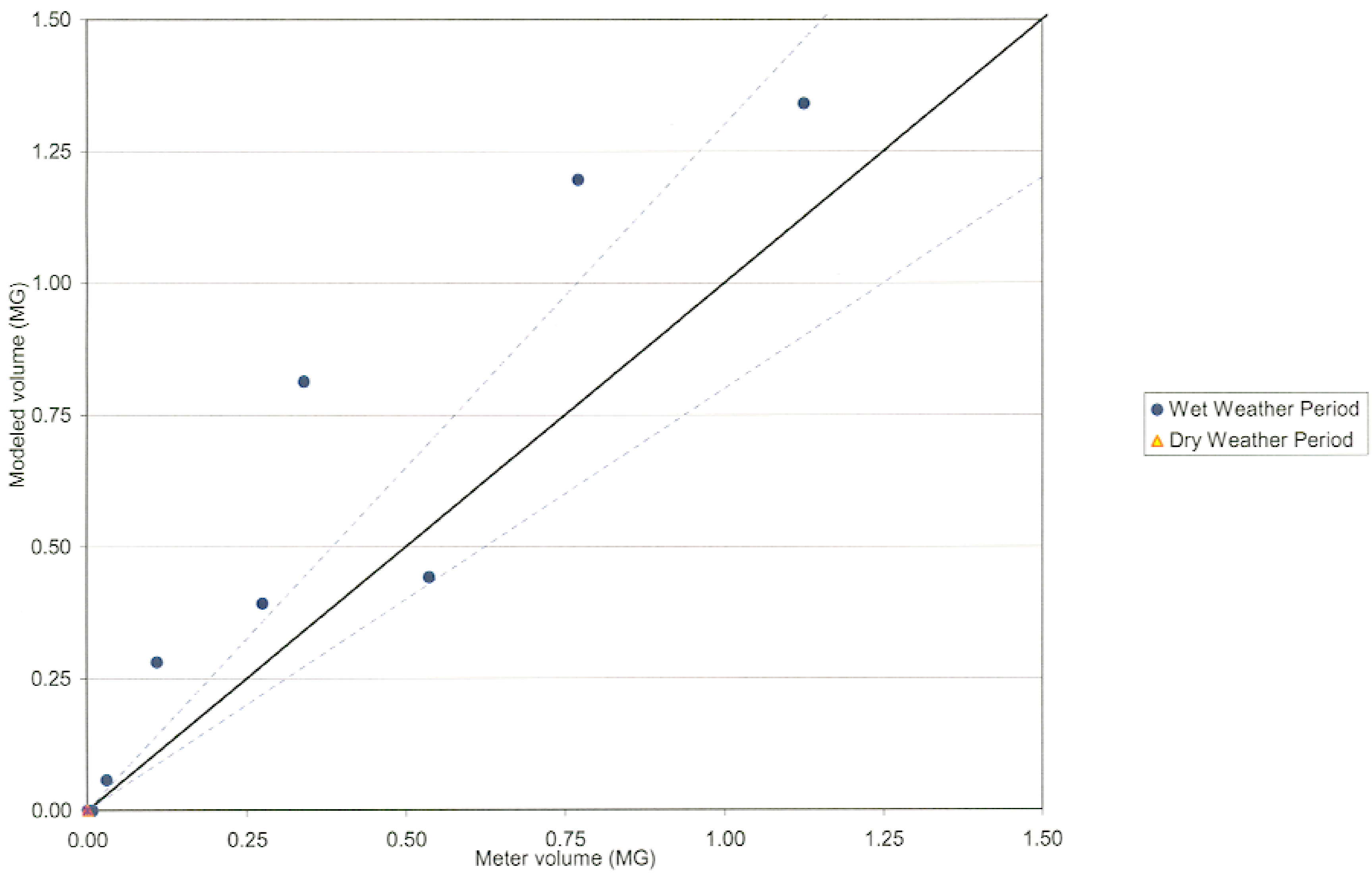


Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Volume (ft³)
Flow (cfs)
Date/Time
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
18
16
14
12
10
8
6
4
2
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Meter not functioning

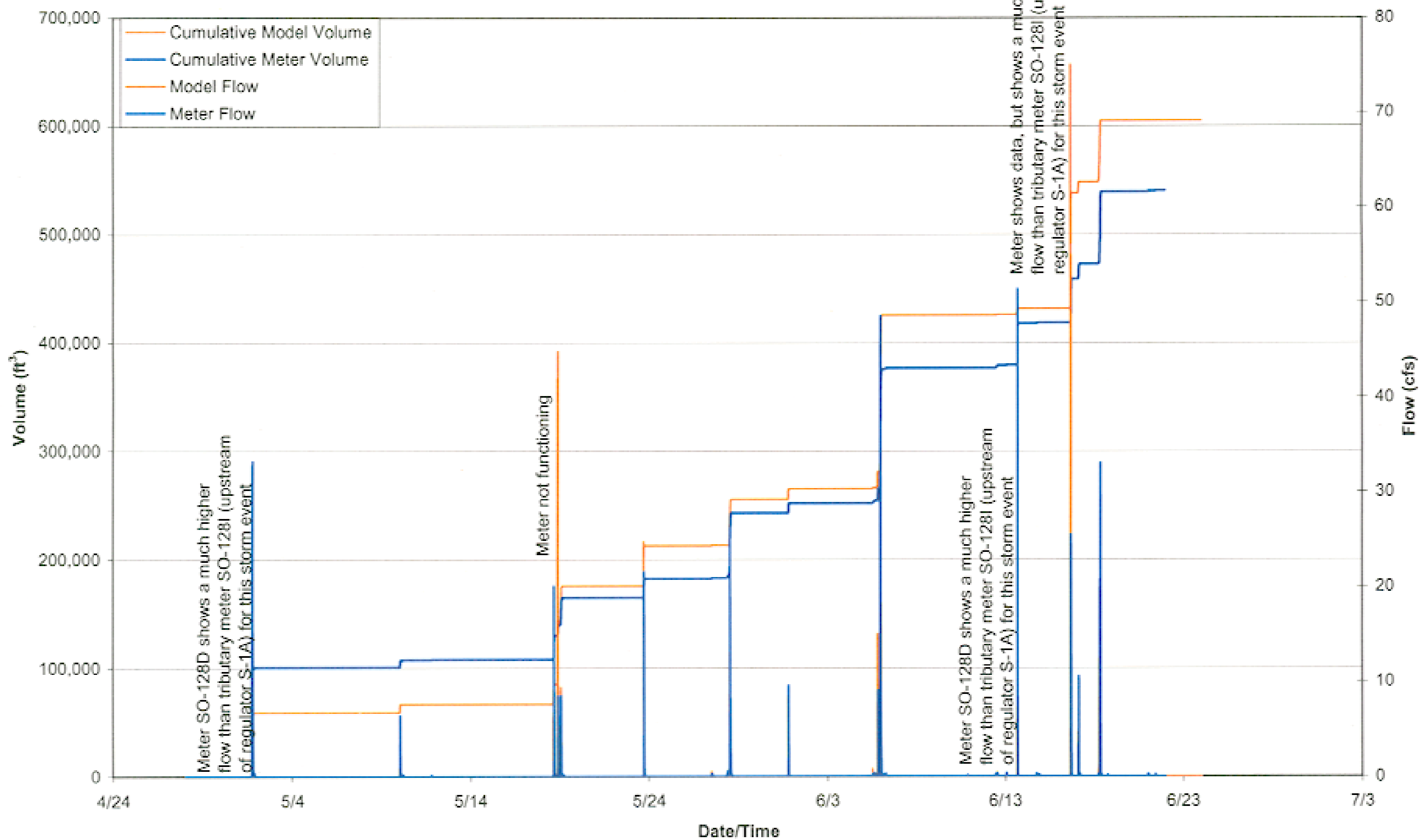
Meter SO-126
Hydraulic Gradeline



Meter SO-128D
Meter vs. Modeled Storms

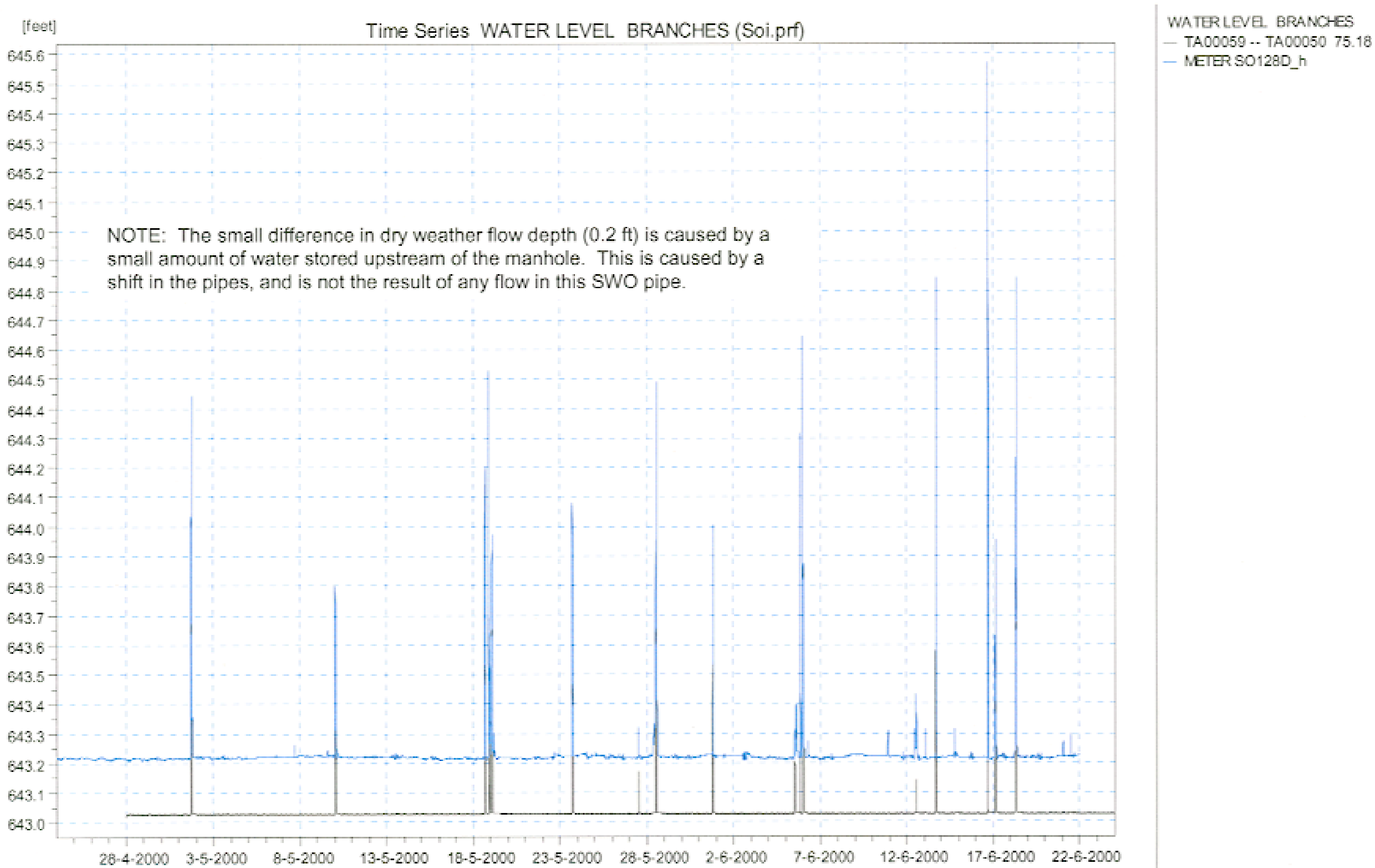


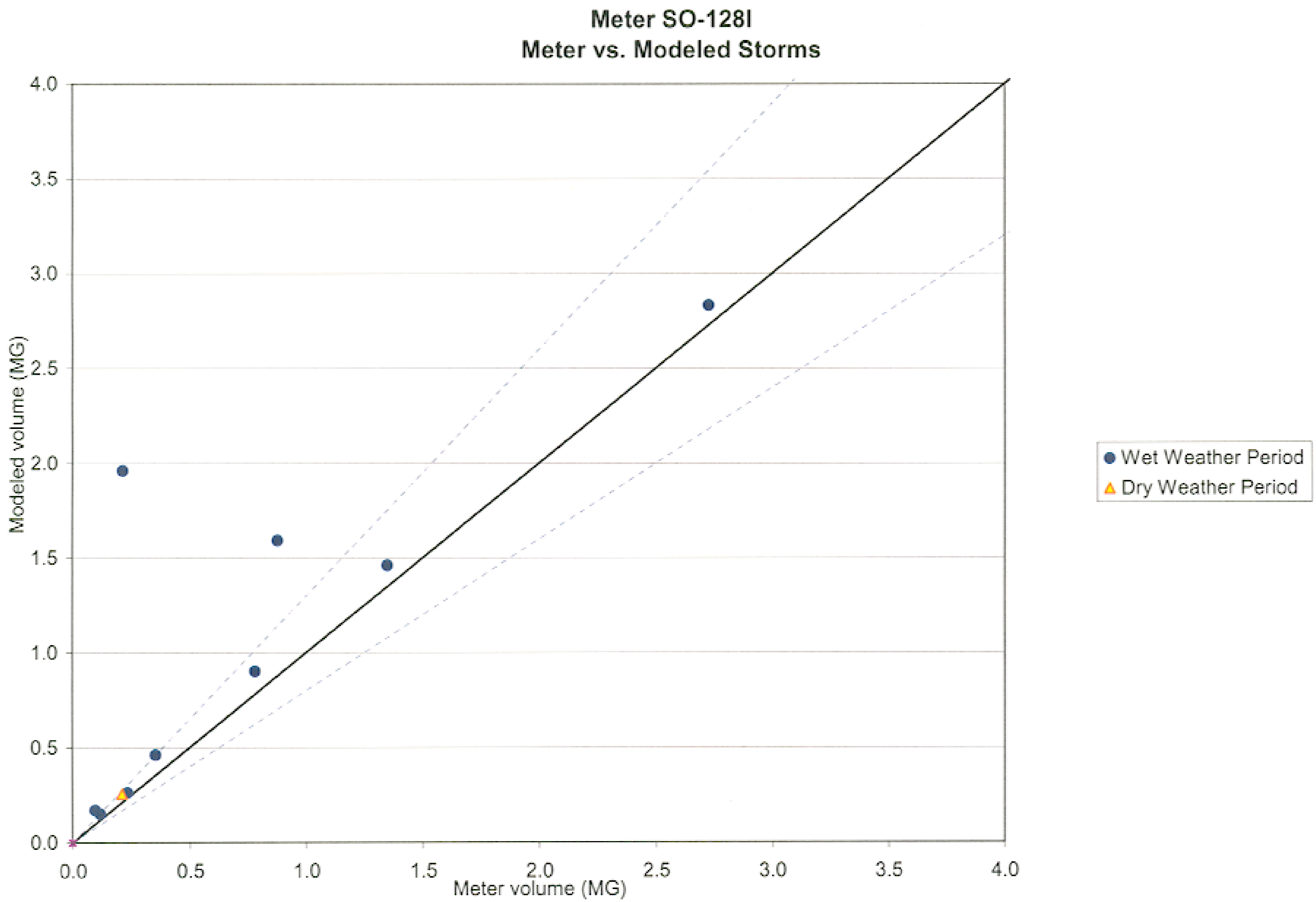
SO-128D



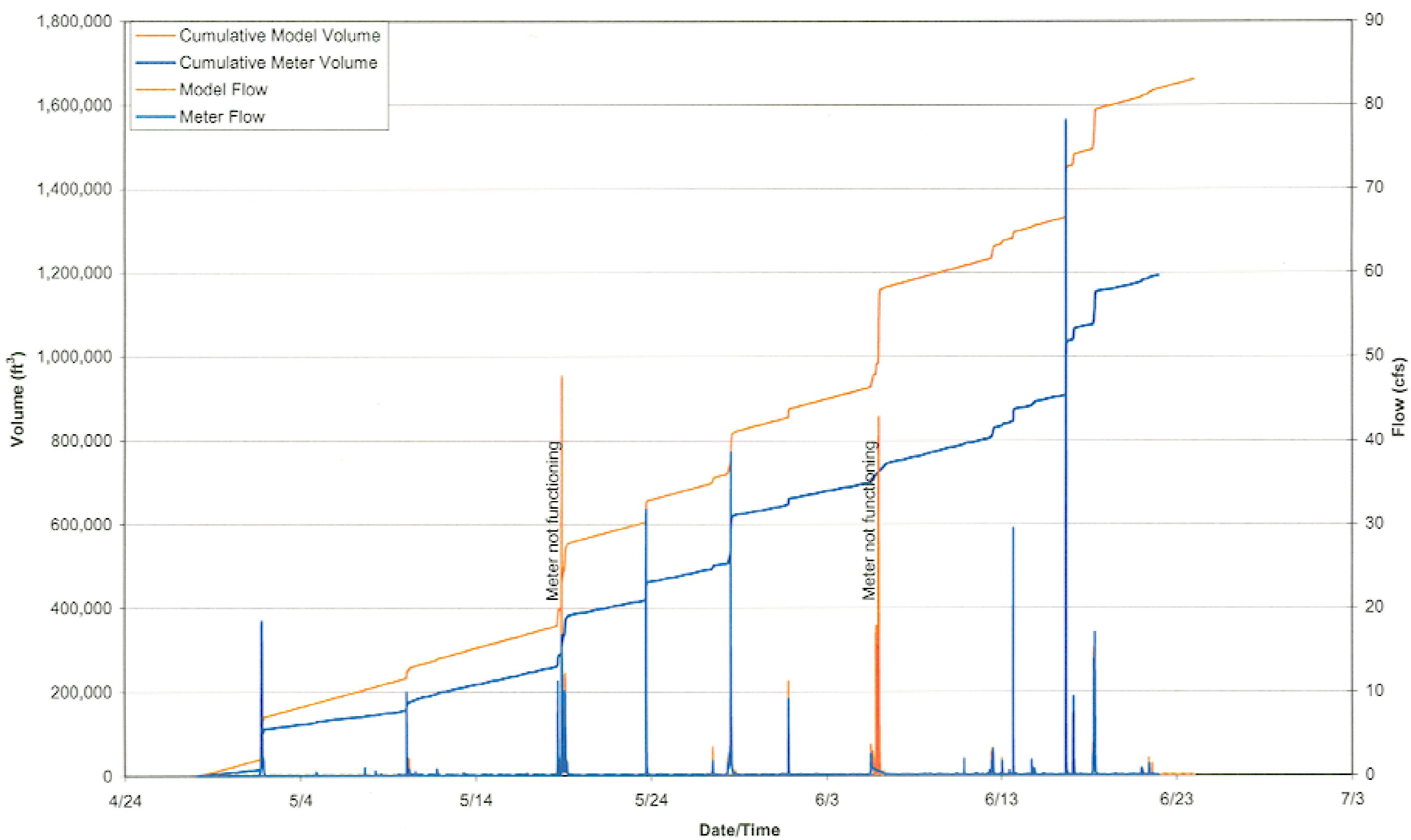
Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Volume (ft³)
Flow (cfs)
Date/Time
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
80
70
60
50
40
30
20
10
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Meter SO-128D shows a much higher flow than tributary meter SO-128I (upstream of regulator S-1A) for this storm event
Meter not functioning
Meter SO-128D shows a much higher flow than tributary meter SO-128I (upstream of regulator S-1A) for this storm event
Meter shows data, but shows a much smaller flow than tributary meter SO-128I (upstream of regulator S-1A) for this storm event

Meter SO-128D
Hydraulic Gradeline



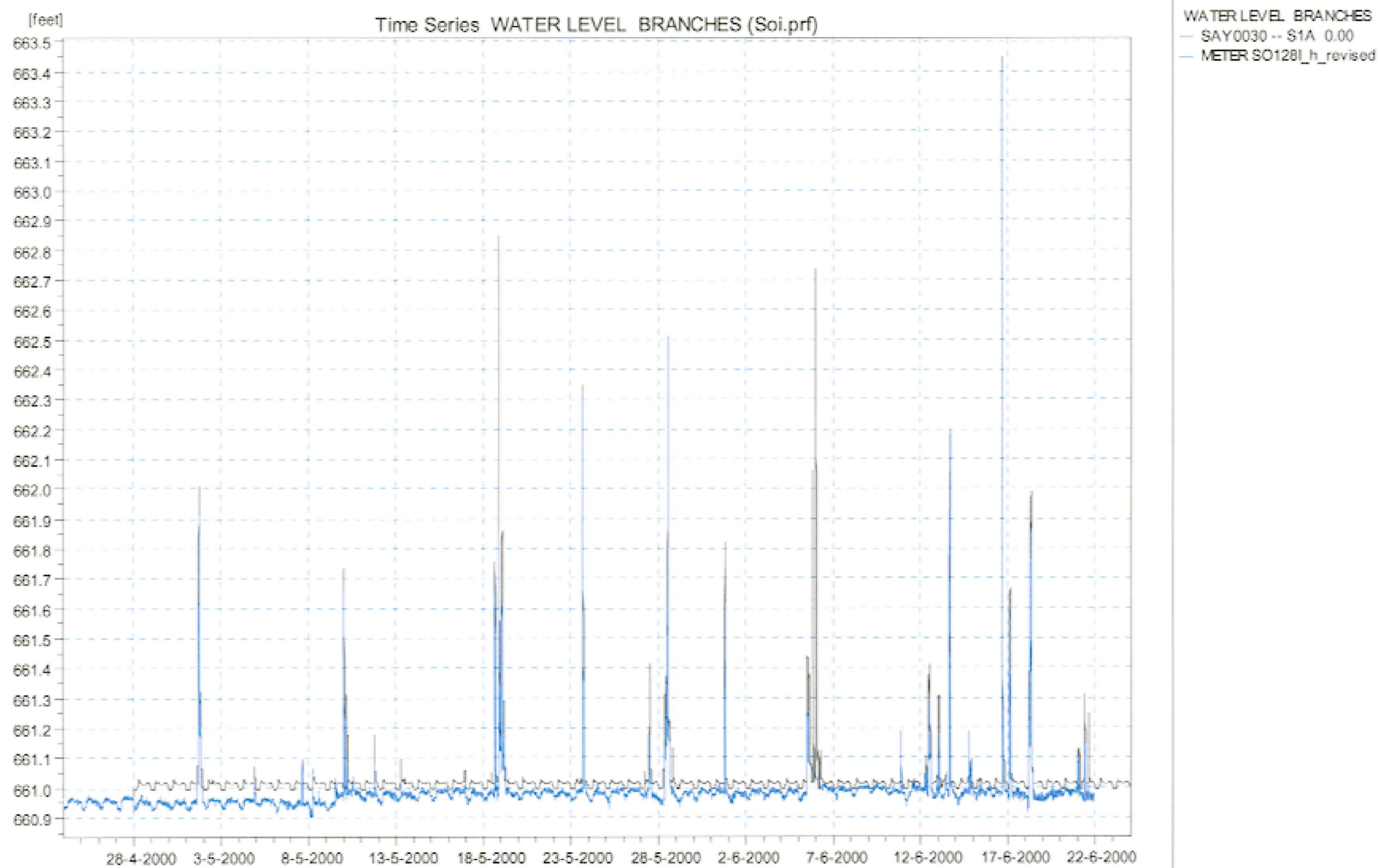

Meter SO-128I
Meter vs. Modeled Storms
Modeled volume (MG)
Meter volume (MG)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Wet Weather Period
Dry Weather Period

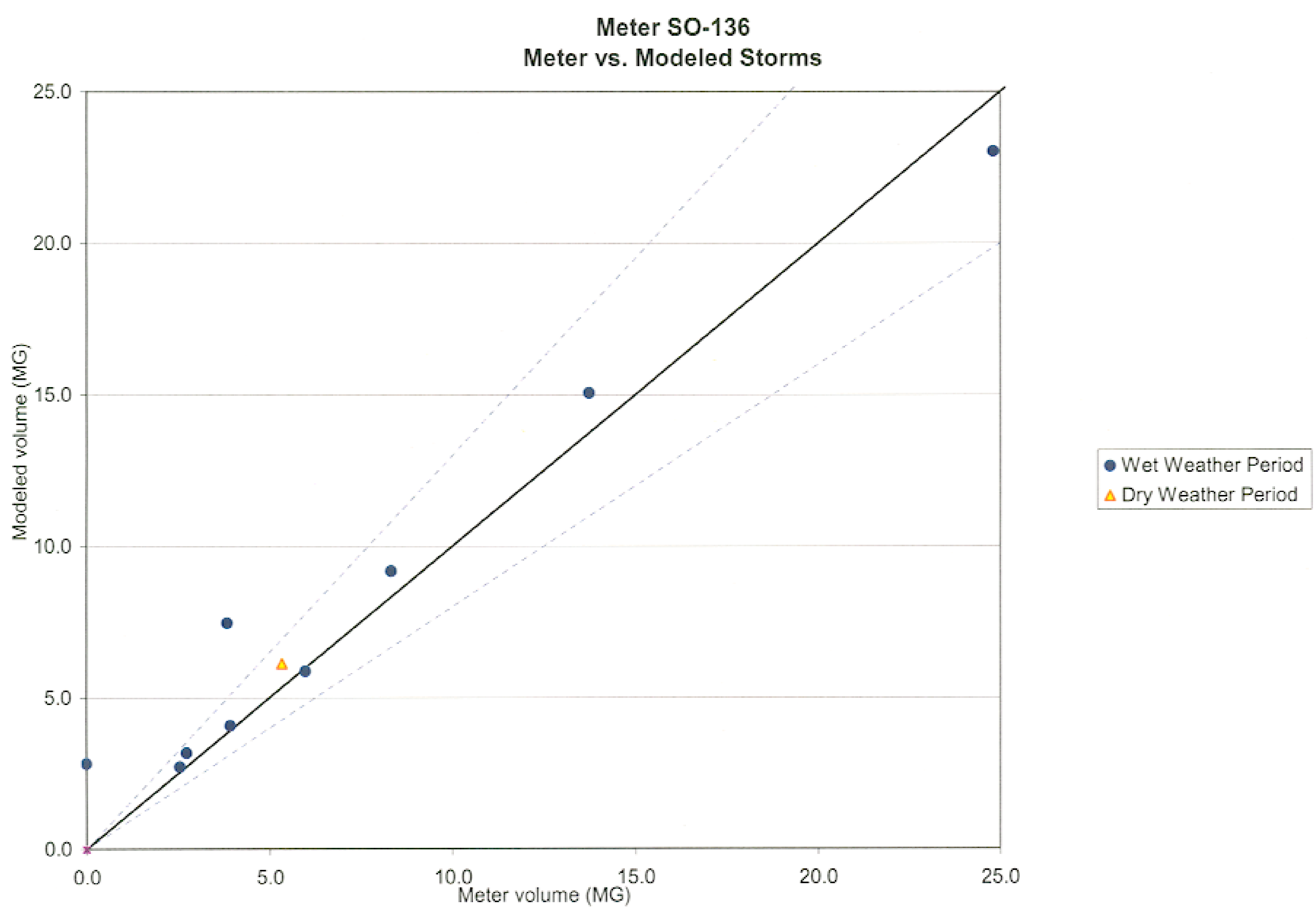
SO-128I



Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Meter not functioning
Meter not functioning
Volume (ft^3)
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Flow (cfs)
90
80
70
60
50
40
30
20
10
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

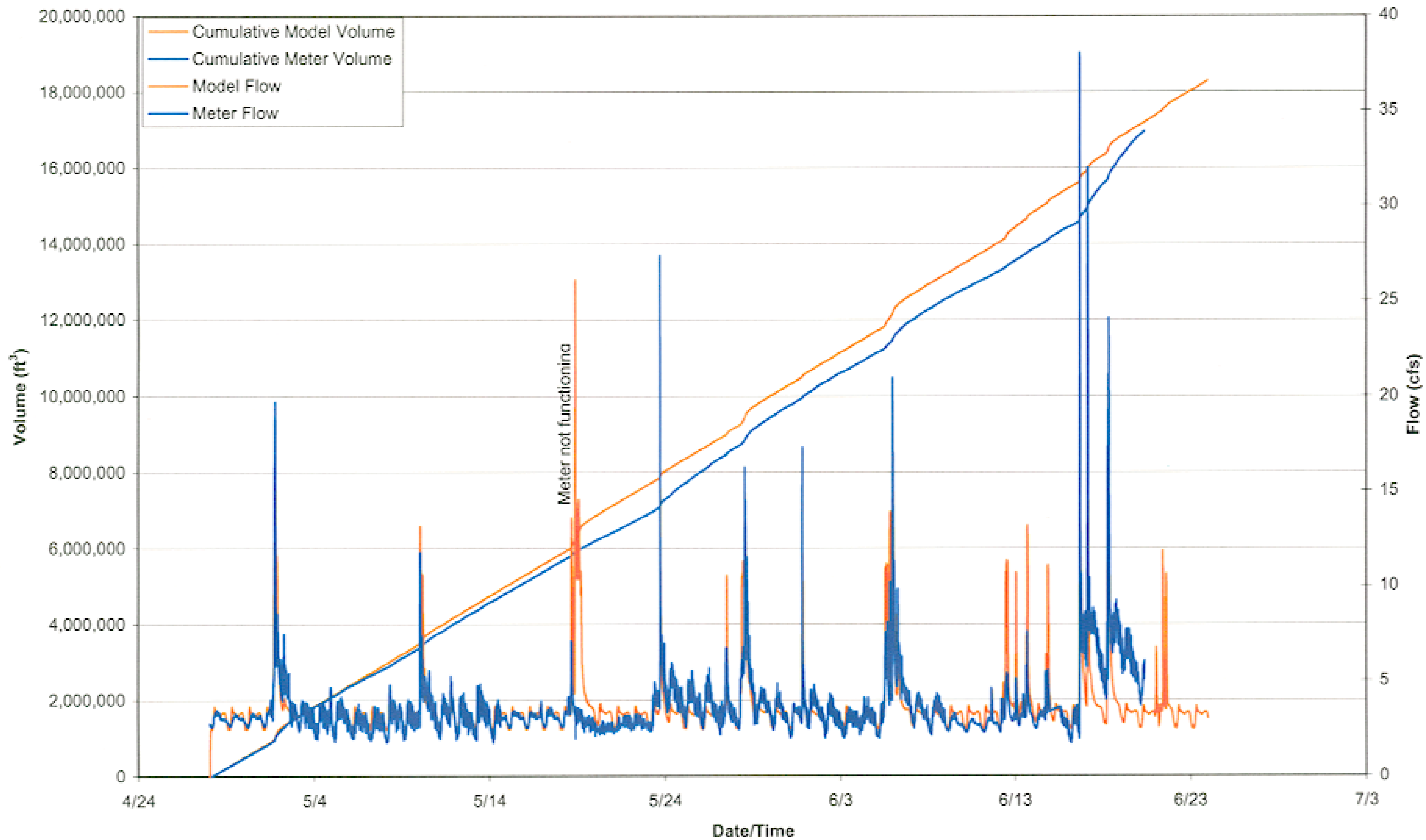
Meter SO-128I
Hydraulic Gradeline





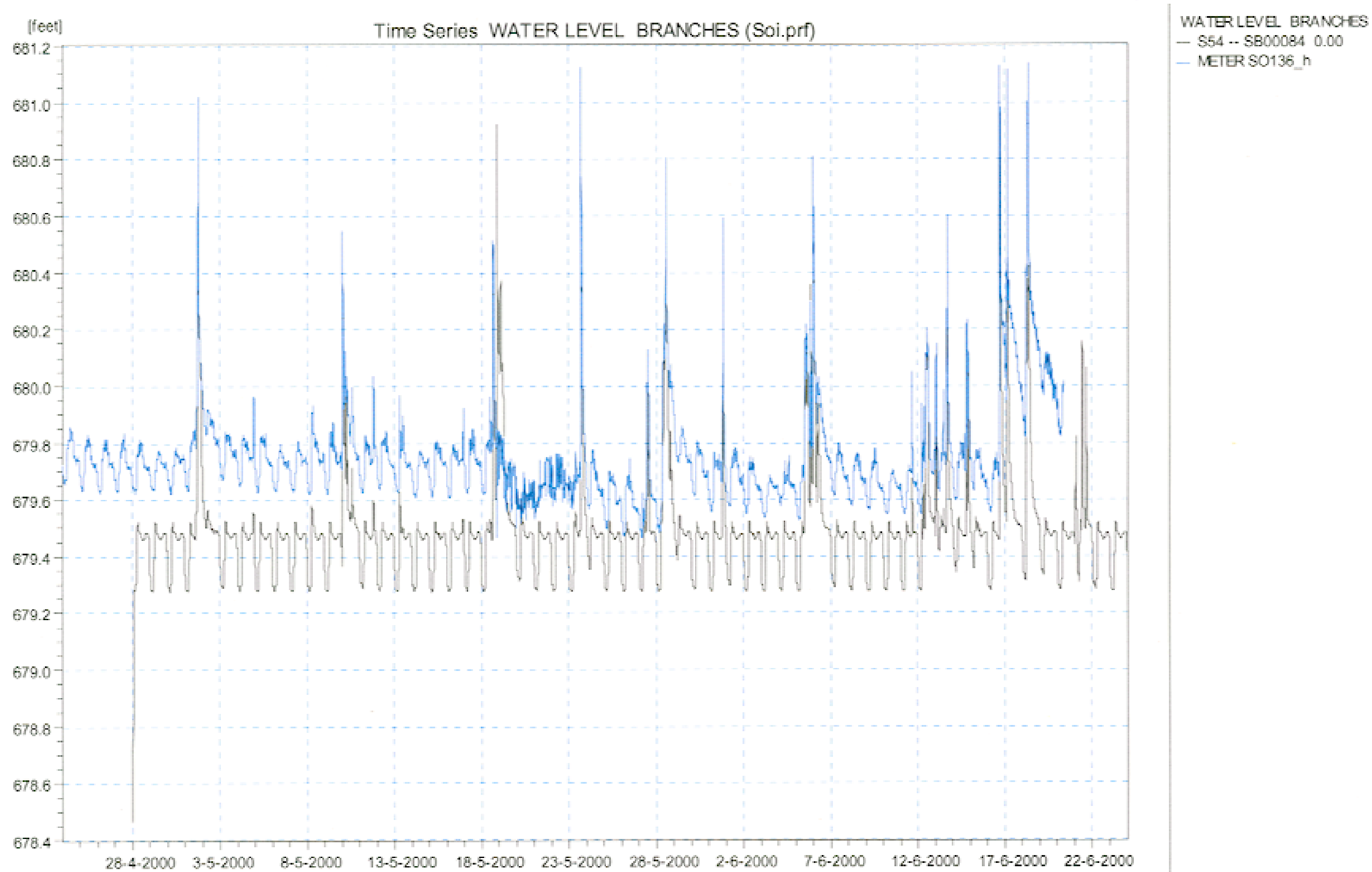
Meter SO-136
Meter vs. Modeled Storms
Modeled volume (MG)
Meter volume (MG)
0.0
5.0
10.0
15.0
20.0
25.0
Wet Weather Period
Dry Weather Period

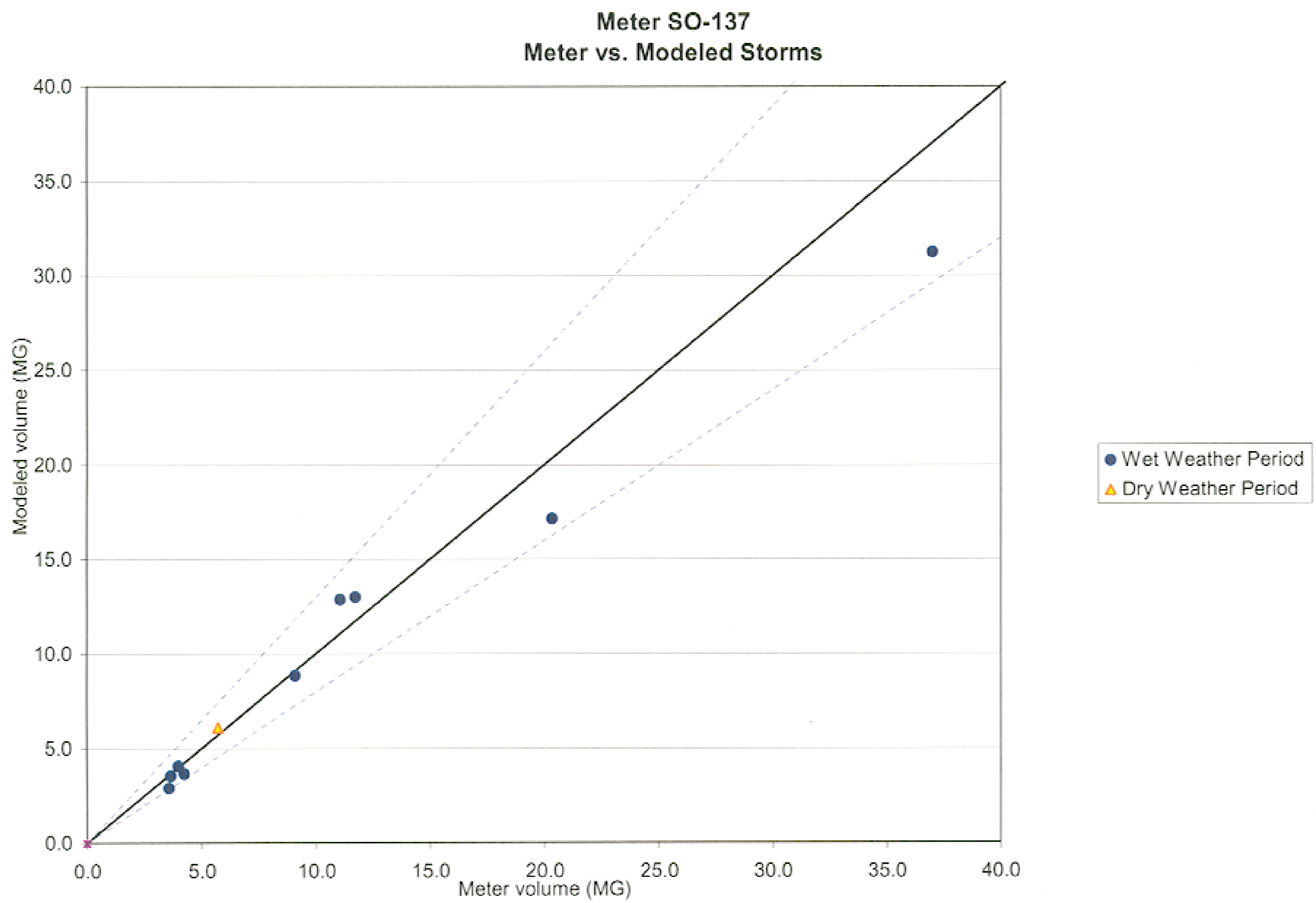
SO-136



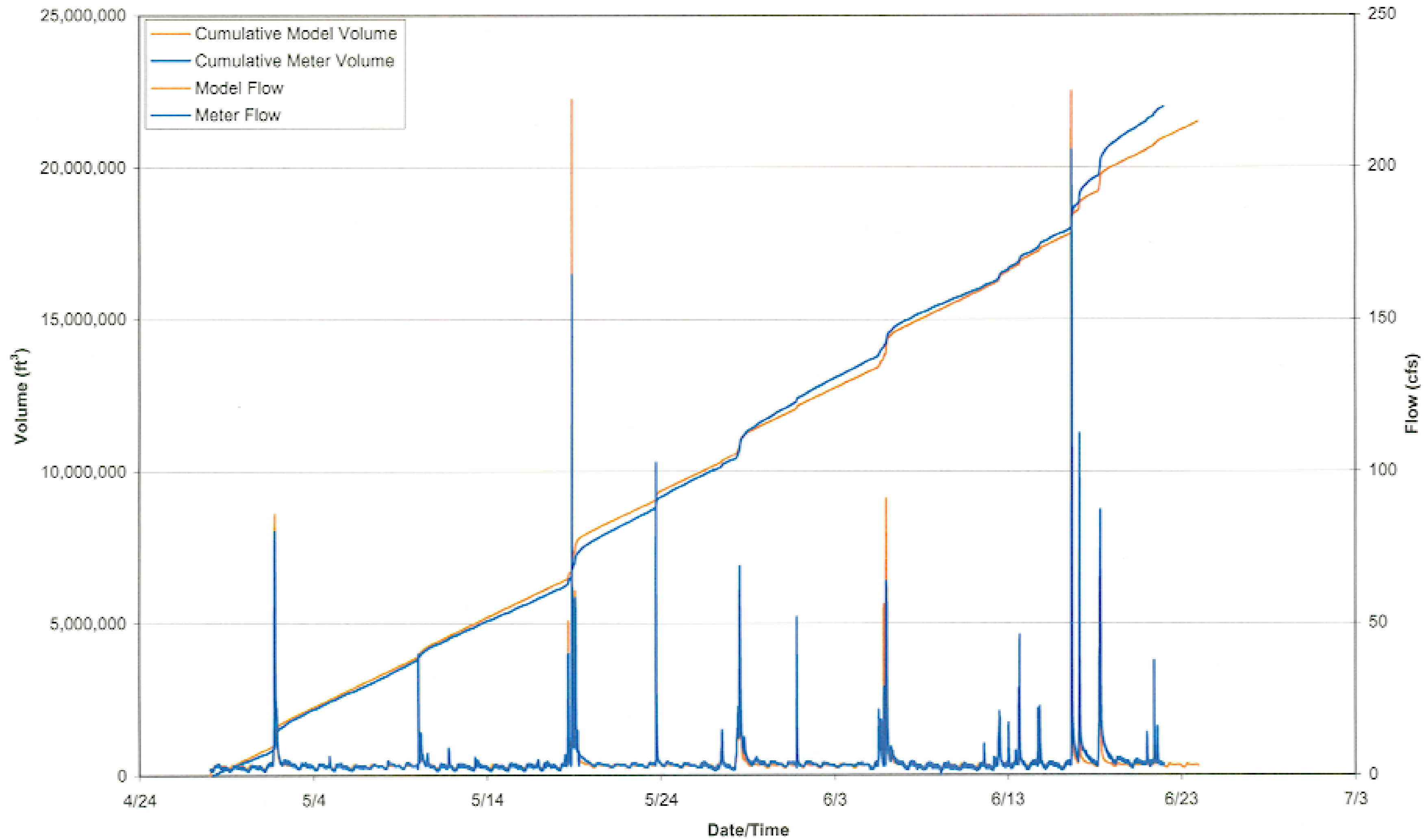
Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Meter not functioning
Volume (ft³)
Flow (cfs)
Date/Time
20,000,000
18,000,000
16,000,000
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
40
35
30
25
20
15
10
5
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3

Meter SO-136
Hydraulic Gradeline



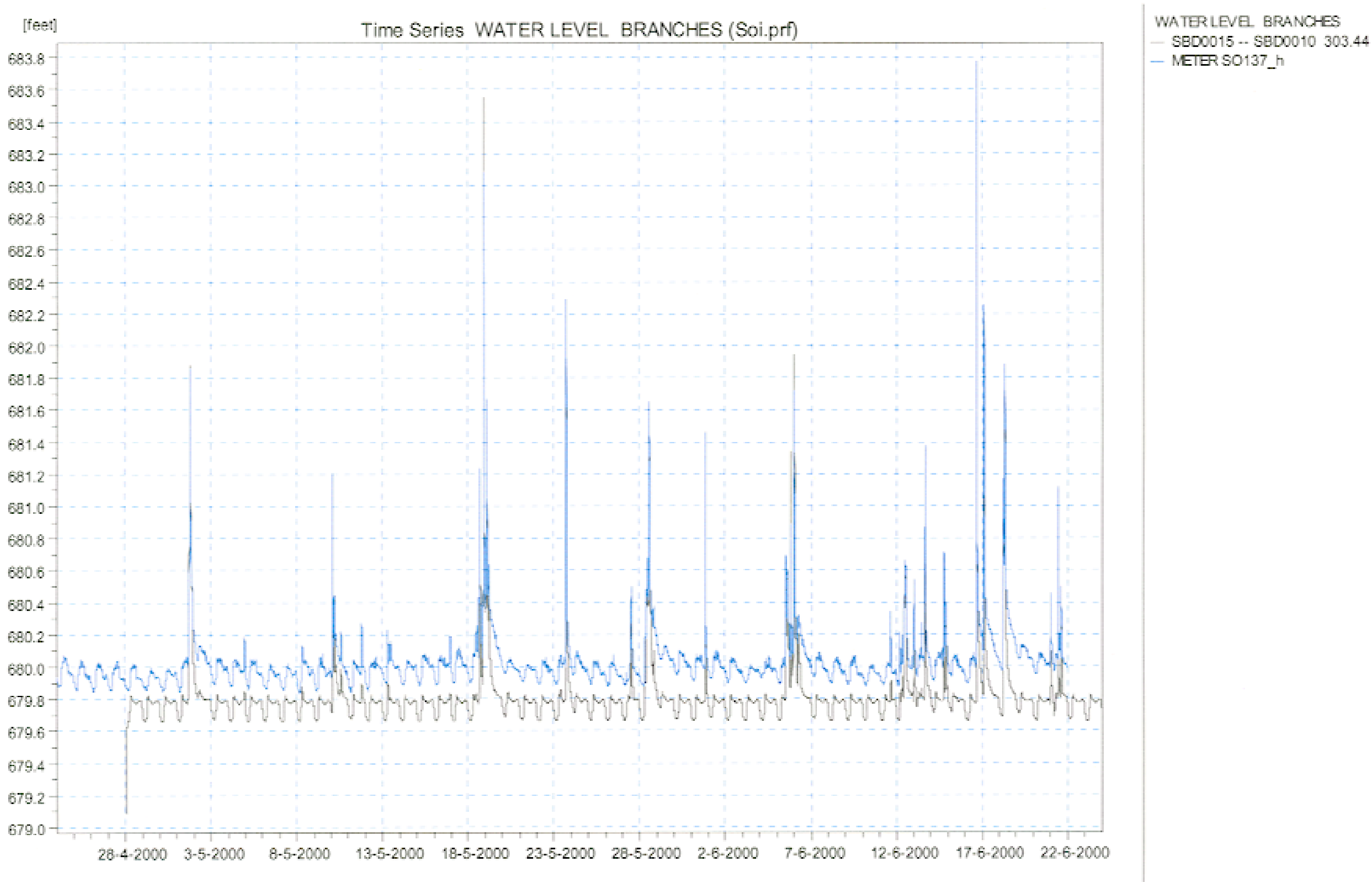

Meter SO-137
Meter vs. Modeled Storms
Modeled volume (MG)
Meter volume (MG)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
Wet Weather Period
Dry Weather Period

SO-137

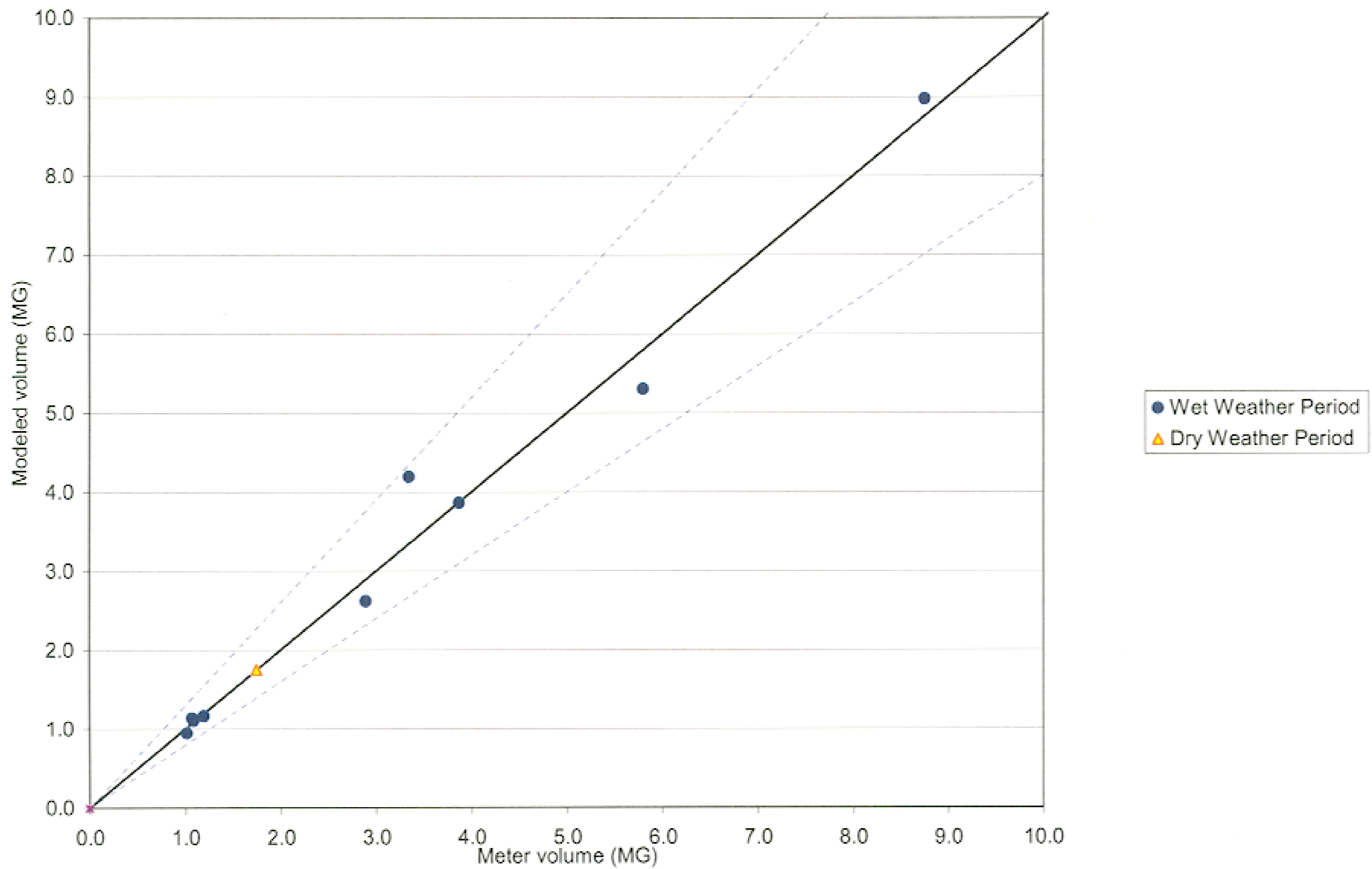


Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
Volume (ft³)
250
200
150
100
50
0
Flow (cfs)
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

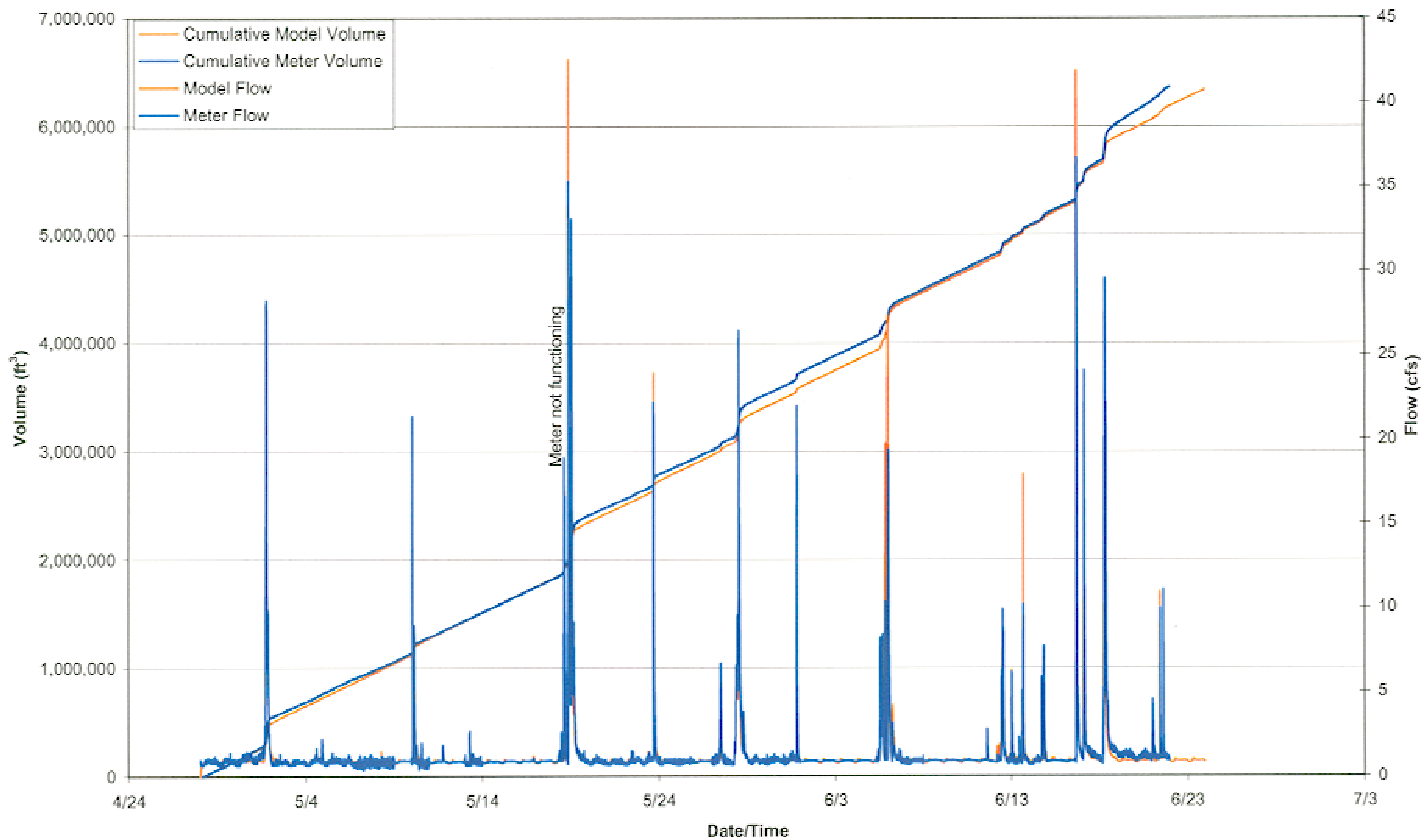
Meter SO-137
Hydraulic Gradeline



Meter SO-139
Meter vs. Modeled Storms

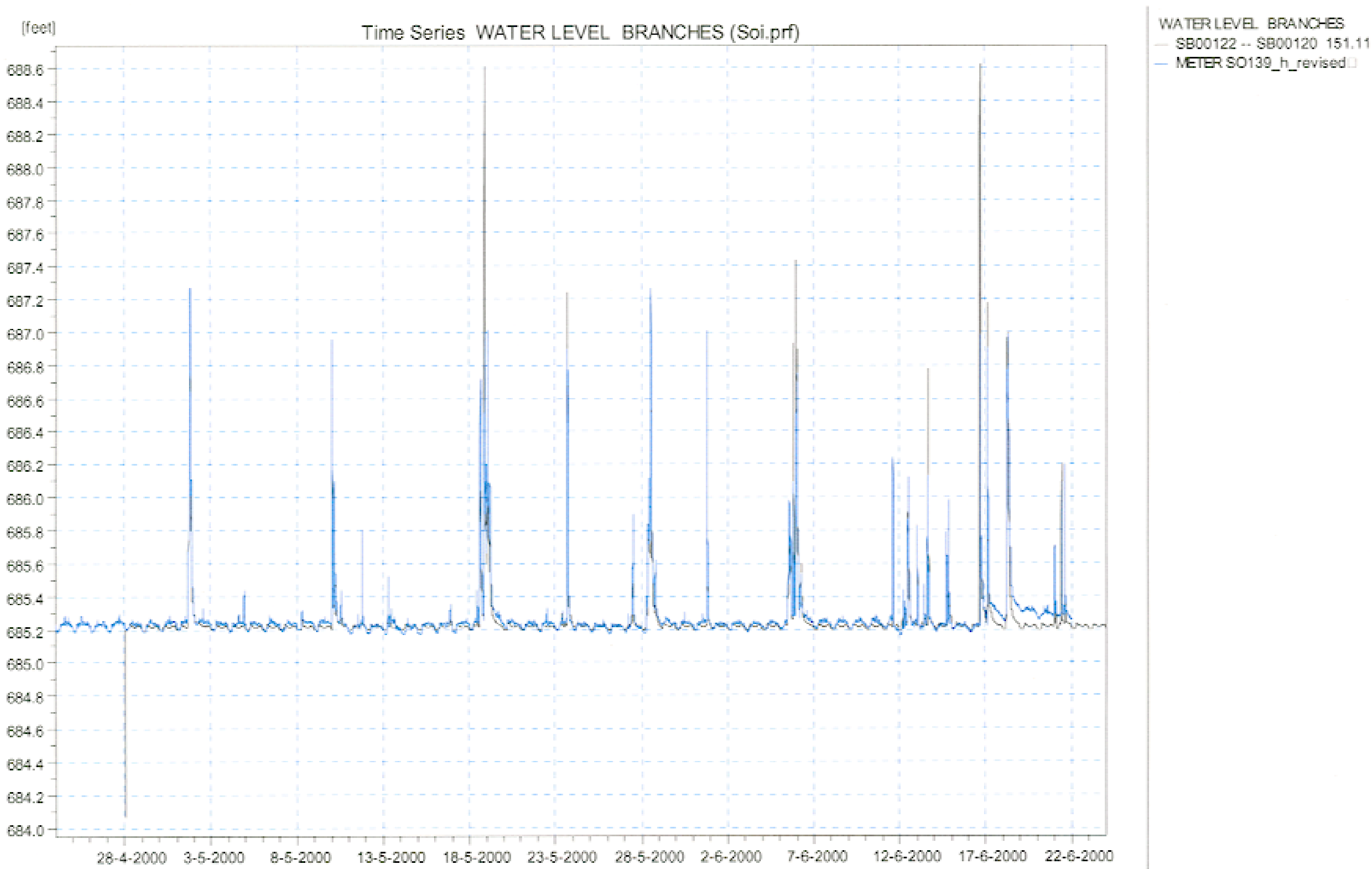


SO-139

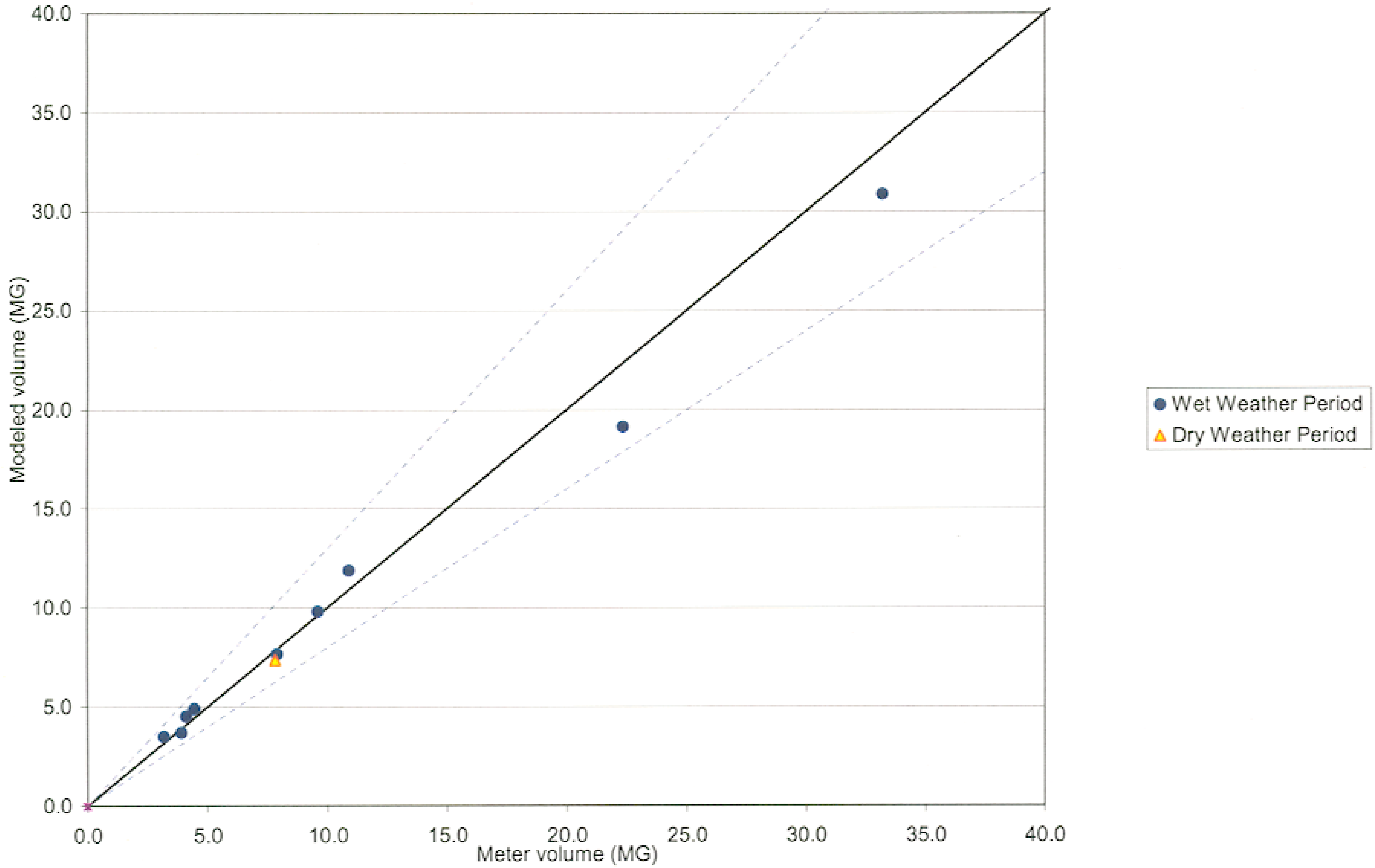


Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Meter not functioning
Volume (ft³)
Flow (cfs)
Date/Time
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
45
40
35
30
25
20
15
10
5
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3

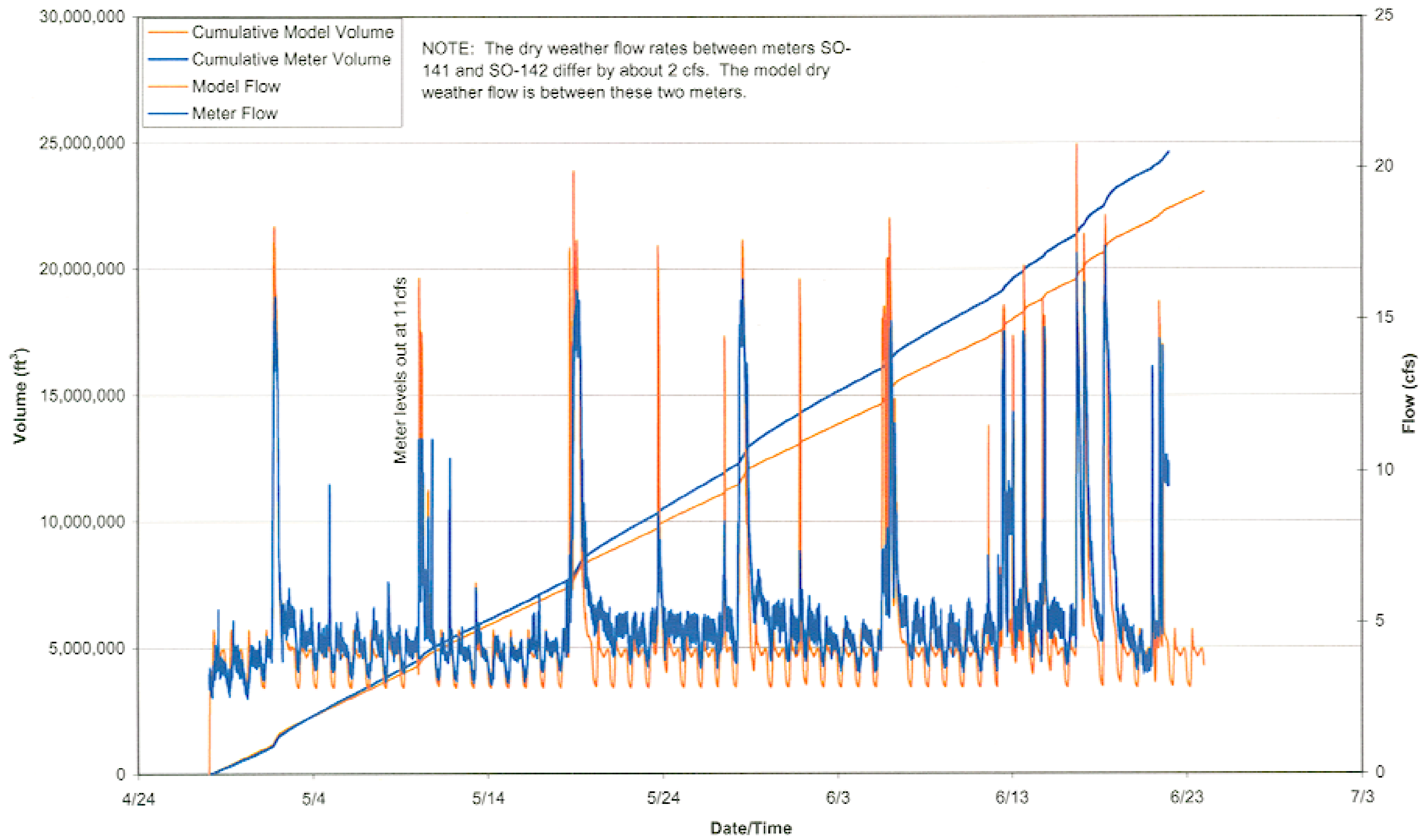
Meter SO-139
Hydraulic Gradeline



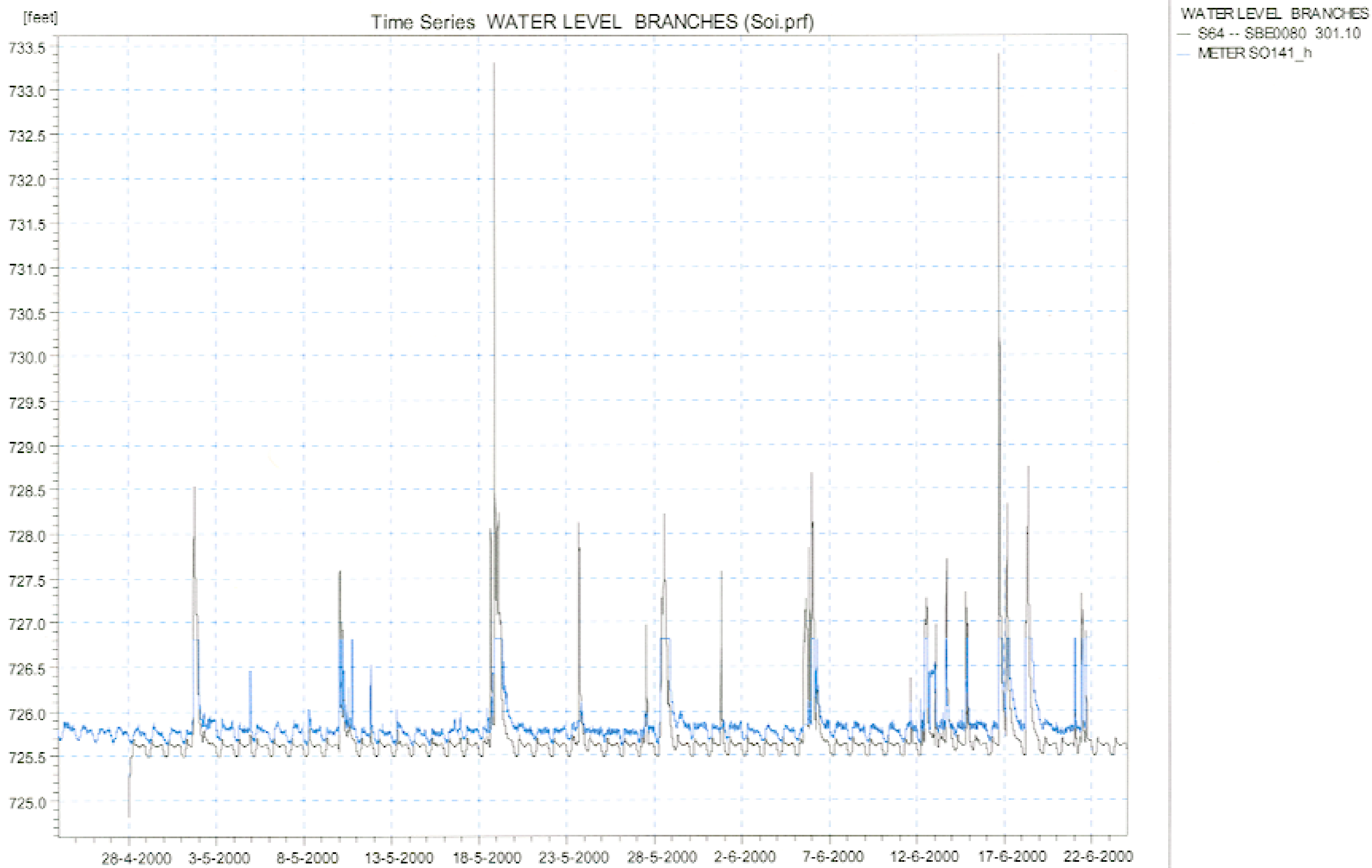
Meter SO-141
Meter vs. Modeled Storms

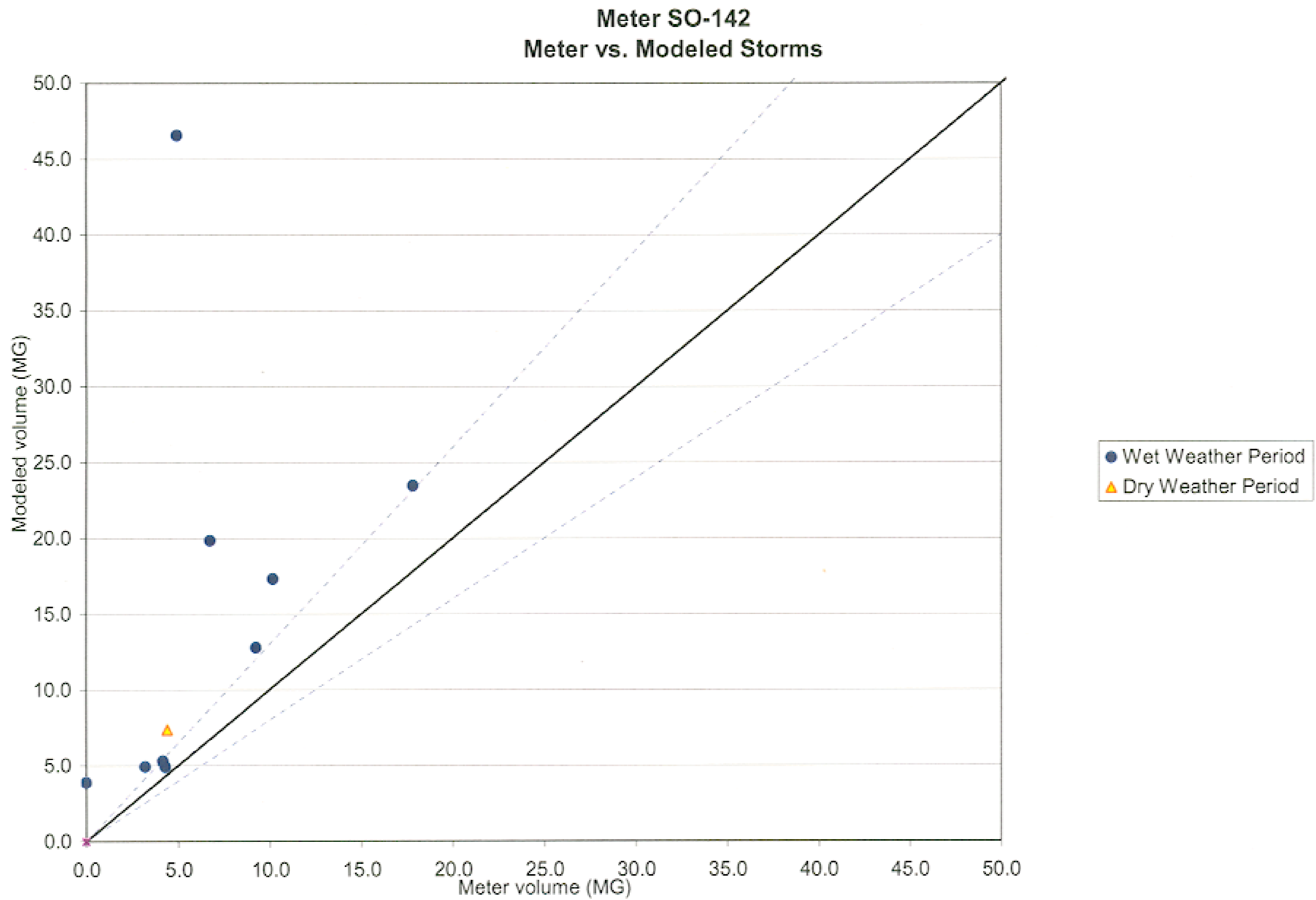


SO-141


Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
NOTE: The dry weather flow rates between meters SO-141 and SO-142 differ by about 2 cfs. The model dry weather flow is between these two meters.
Meter levels out at 11cfs
Volume (ft³)
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
Flow (cfs)
25
20
15
10
5
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

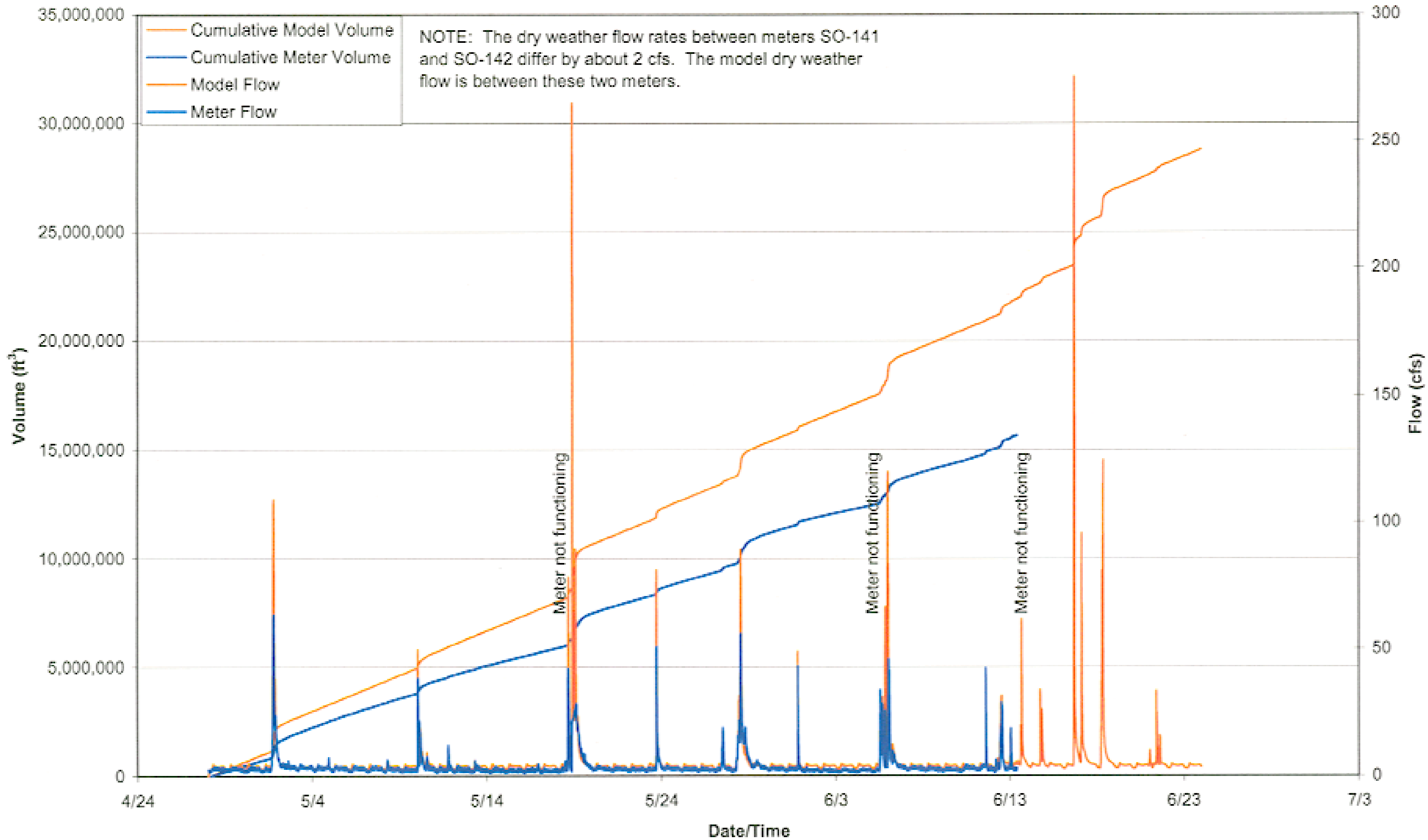
Meter SO-141
Hydraulic Gradeline



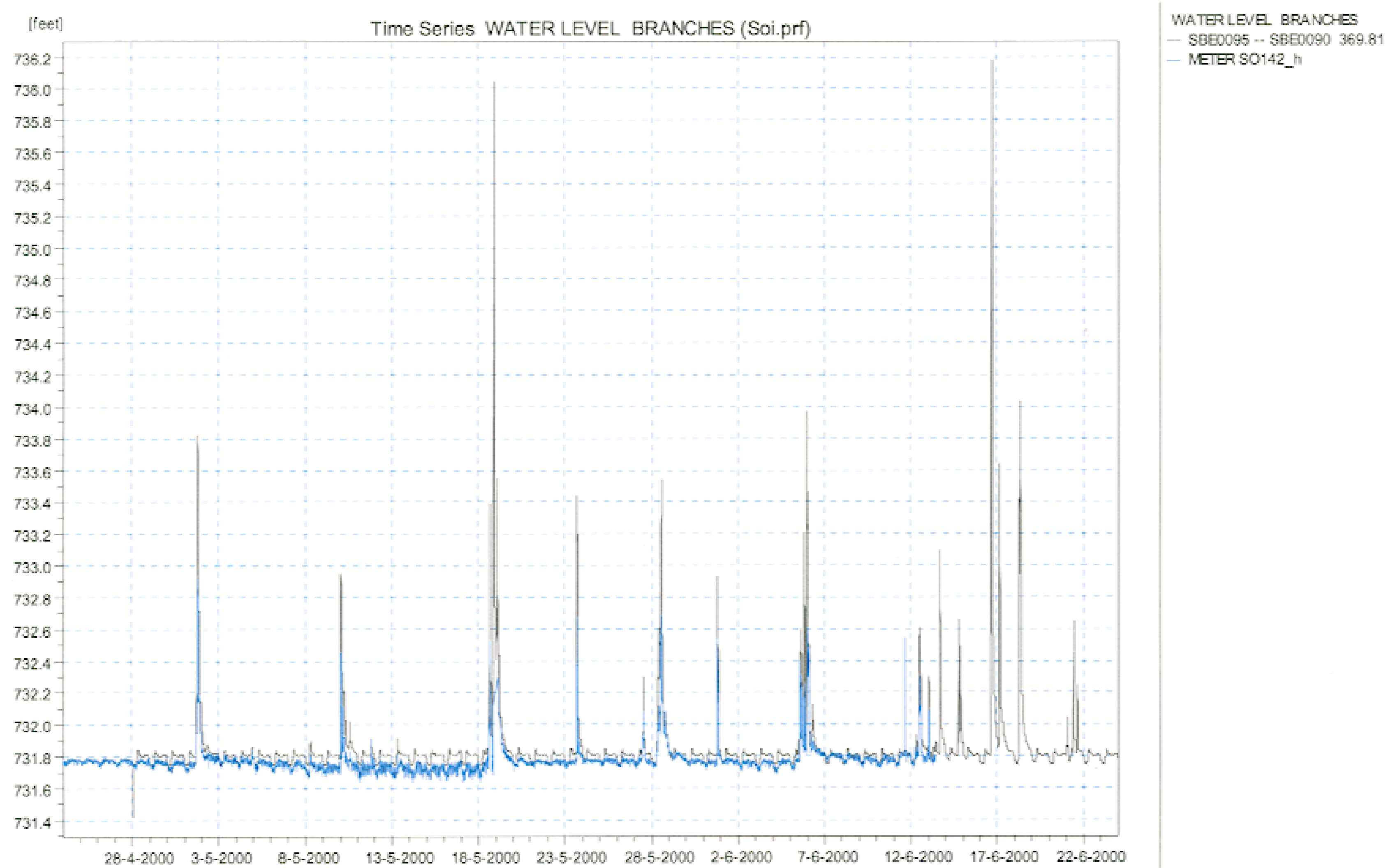


Meter SO-142
Meter vs. Modeled Storms
Modeled volume (MG)
Meter volume (MG)
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Wet Weather Period
Dry Weather Period

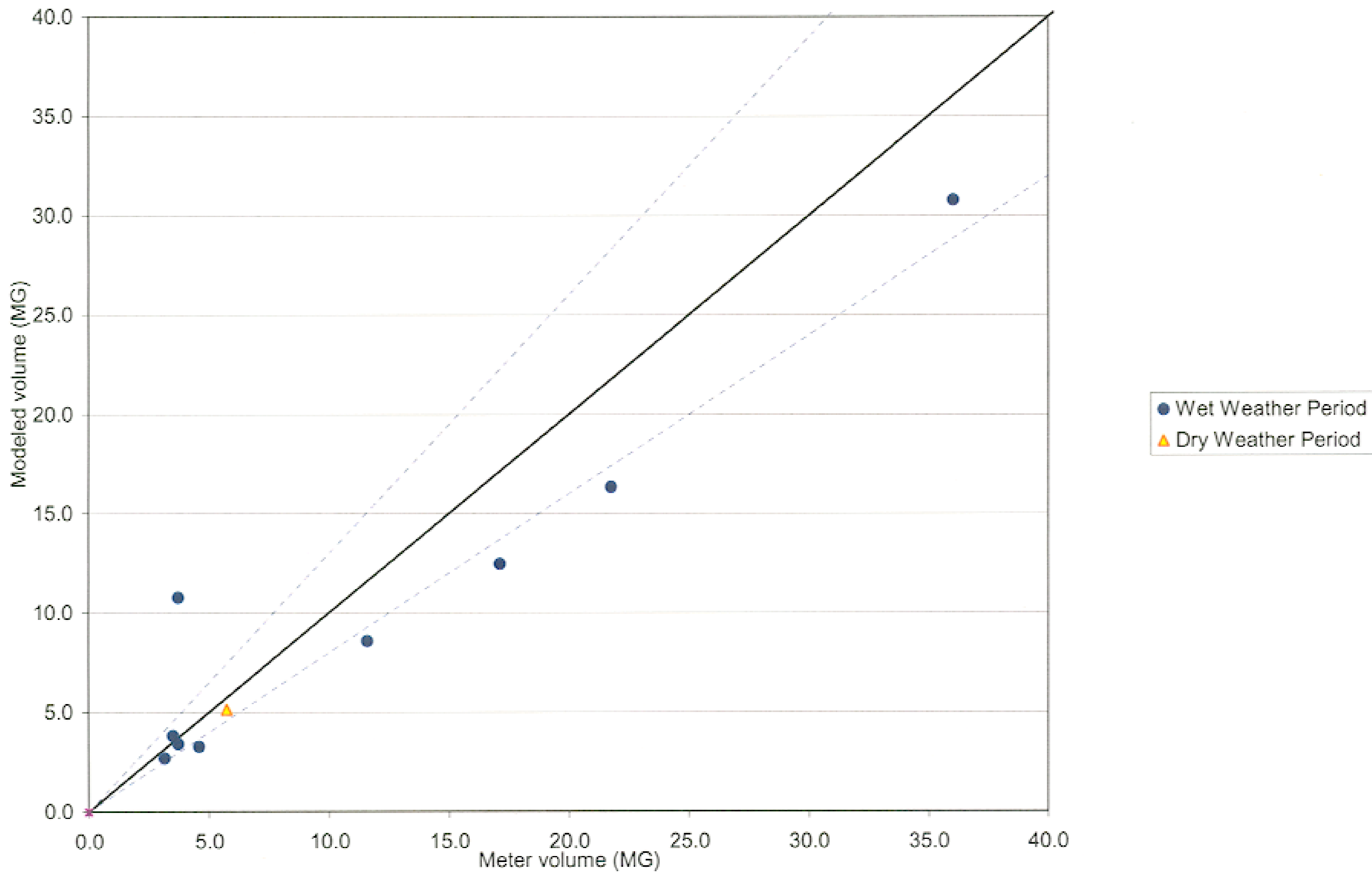
SO-142


Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
NOTE: The dry weather flow rates between meters SO-141 and SO-142 differ by about 2 cfs. The model dry weather flow is between these two meters.
Meter not functioning
Meter not functioning
Meter not functioning
Volume (ft³)
35,000,000
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
Flow (cfs)
300
250
200
150
100
50
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

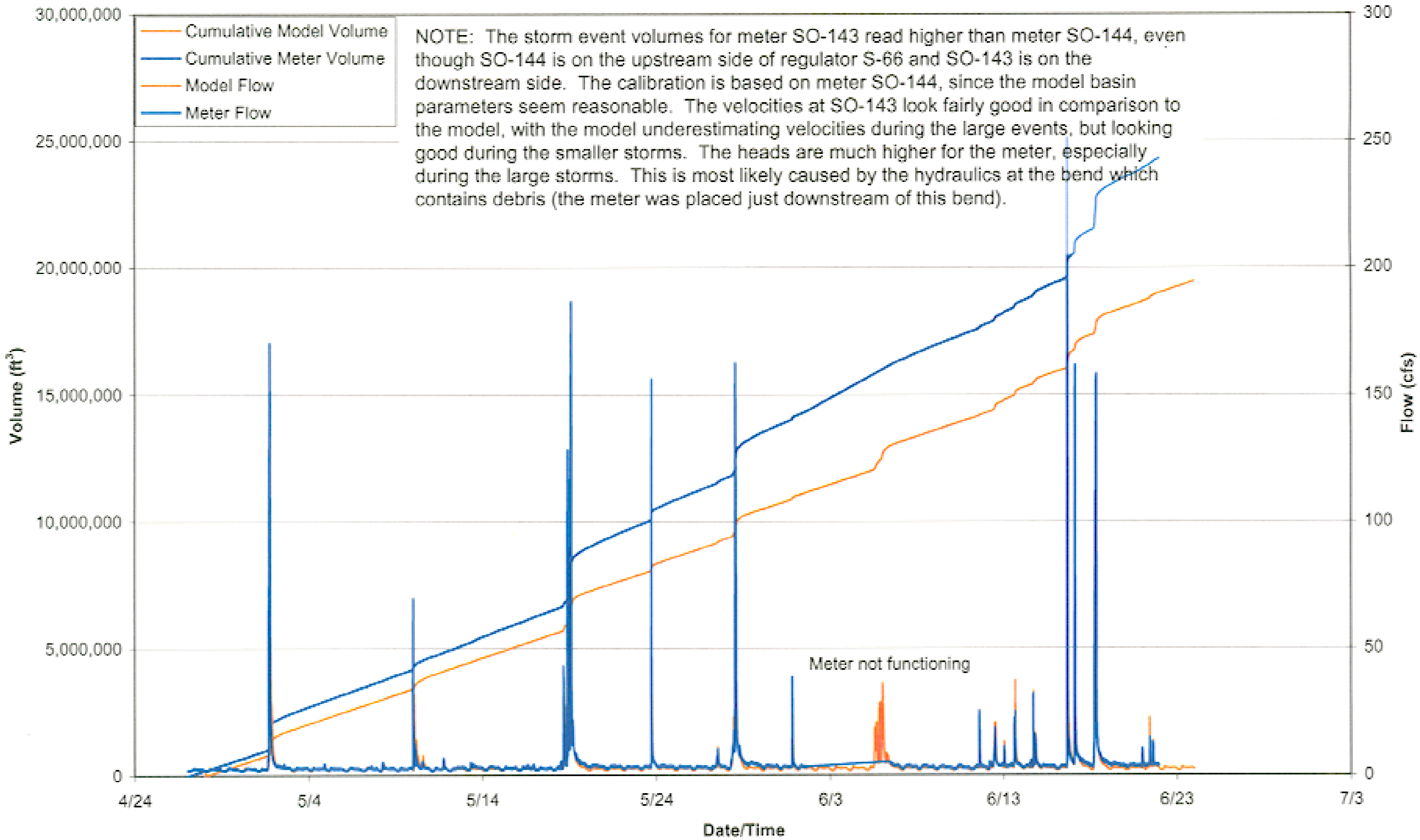
Meter SO-142
Hydraulic Gradeline



Meter SO-143
Meter vs. Modeled Storms

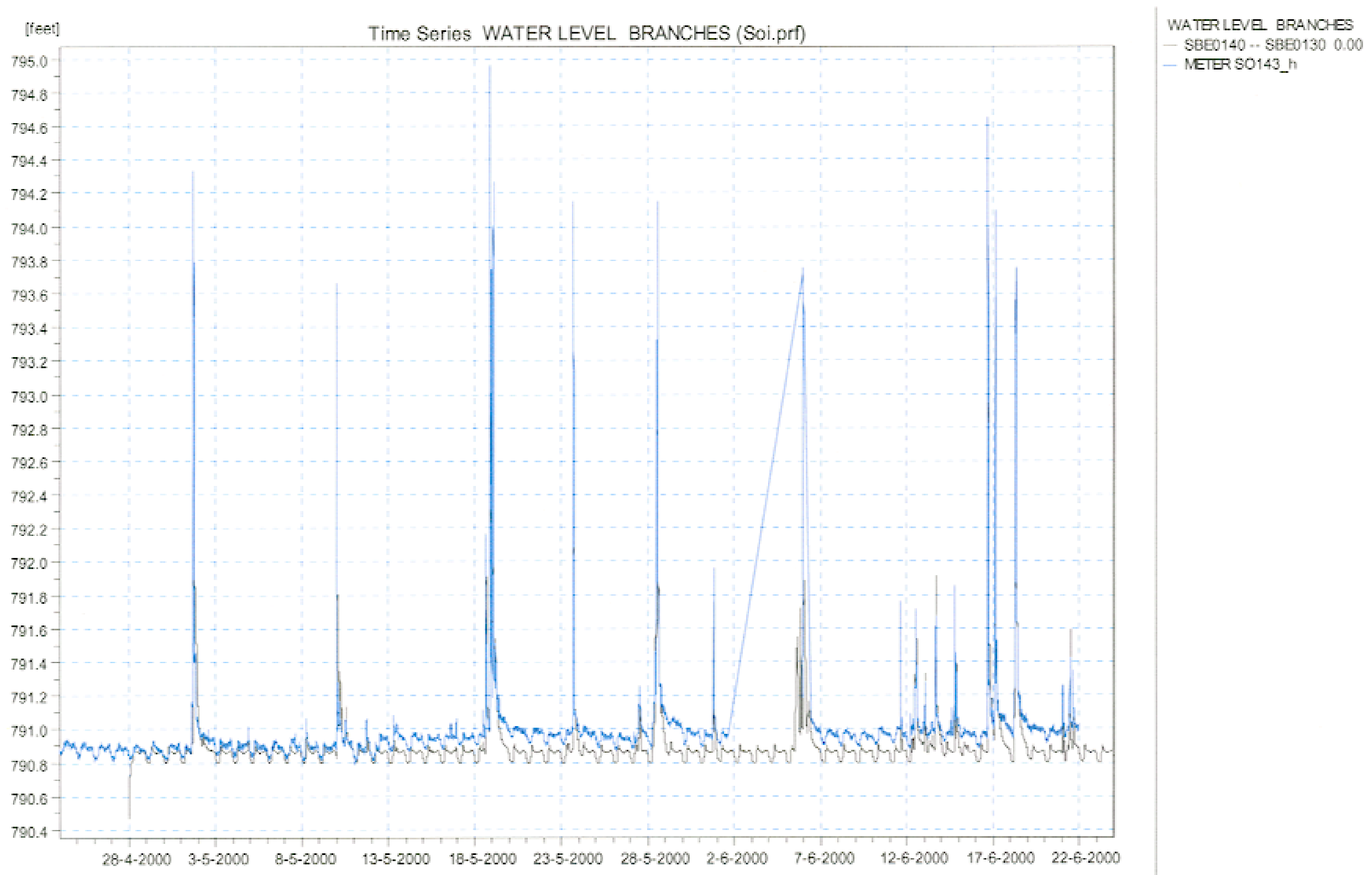


SO-143

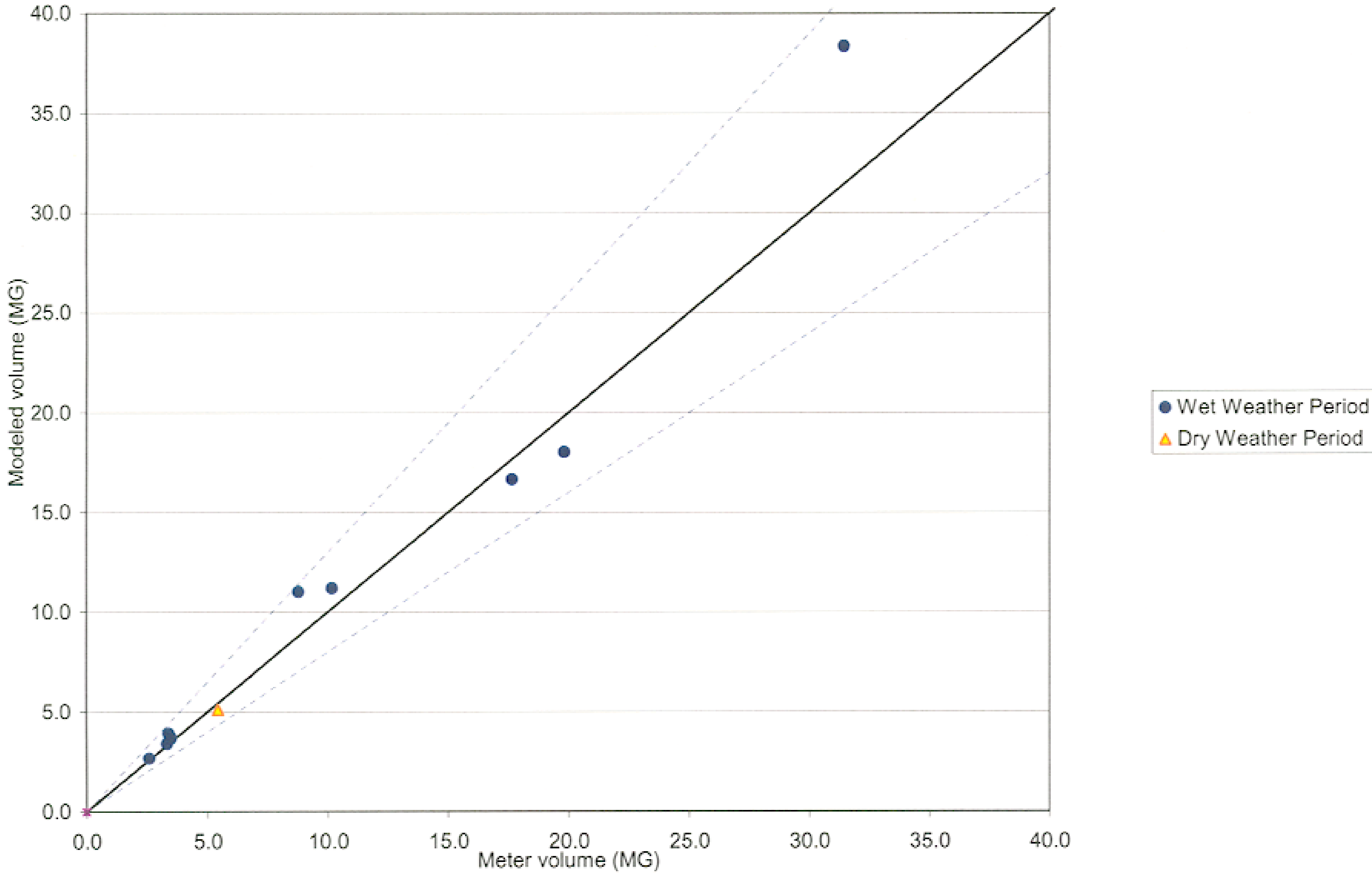


30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
Volume (ft³)
300
250
200
150
100
50
0
Flow (cfs)
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time
Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
NOTE: The storm event volumes for meter SO-143 read higher than meter SO-144, even though SO-144 is on the upstream side of regulator S-66 and SO-143 is on the downstream side. The calibration is based on meter SO-144, since the model basin parameters seem reasonable. The velocities at SO-143 look fairly good in comparison to the model, with the model underestimating velocities during the large events, but looking good during the smaller storms. The heads are much higher for the meter, especially during the large storms. This is most likely caused by the hydraulics at the bend which contains debris (the meter was placed just downstream of this bend).
Meter not functioning

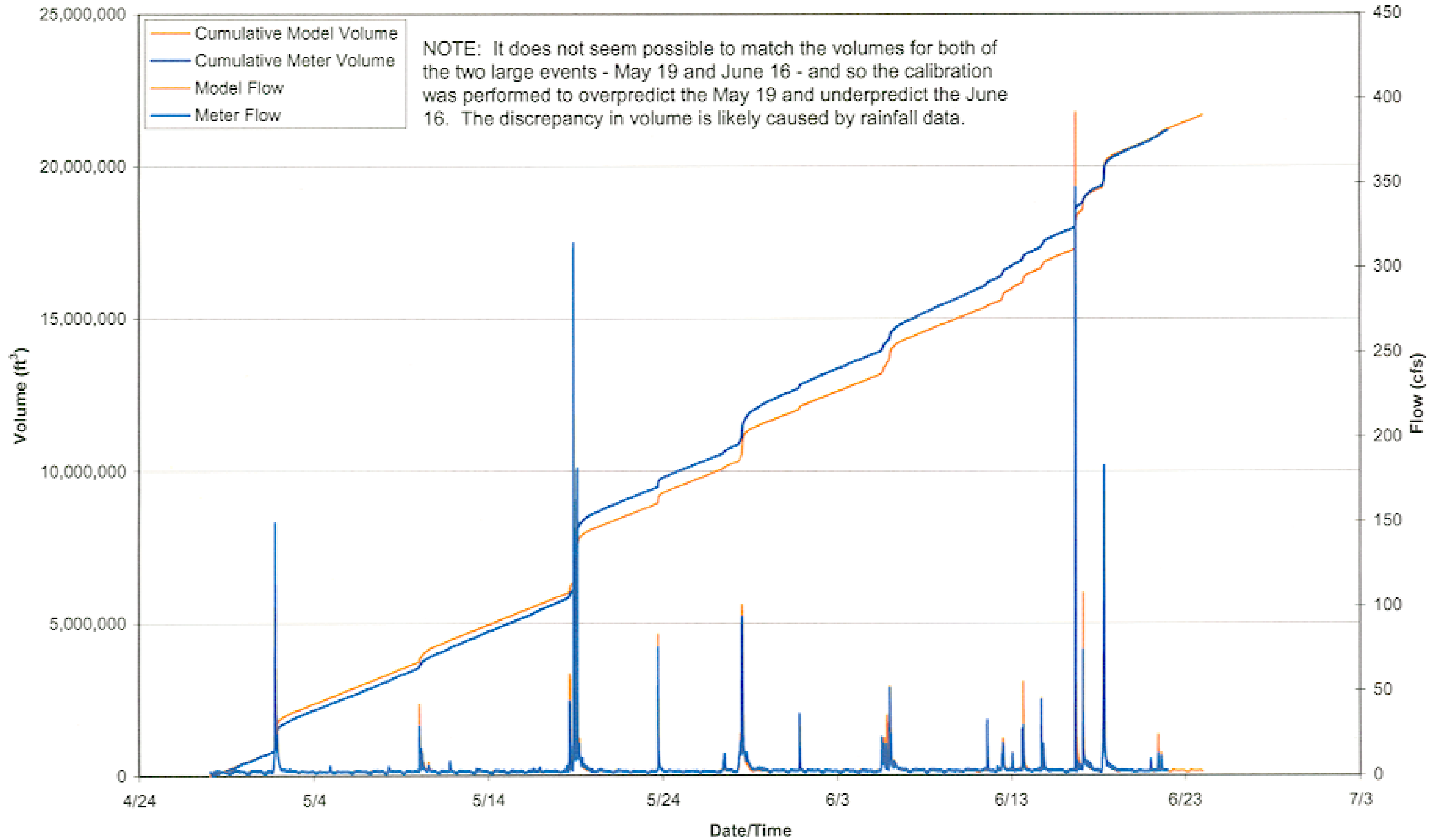
Meter SO-143
Hydraulic Gradeline



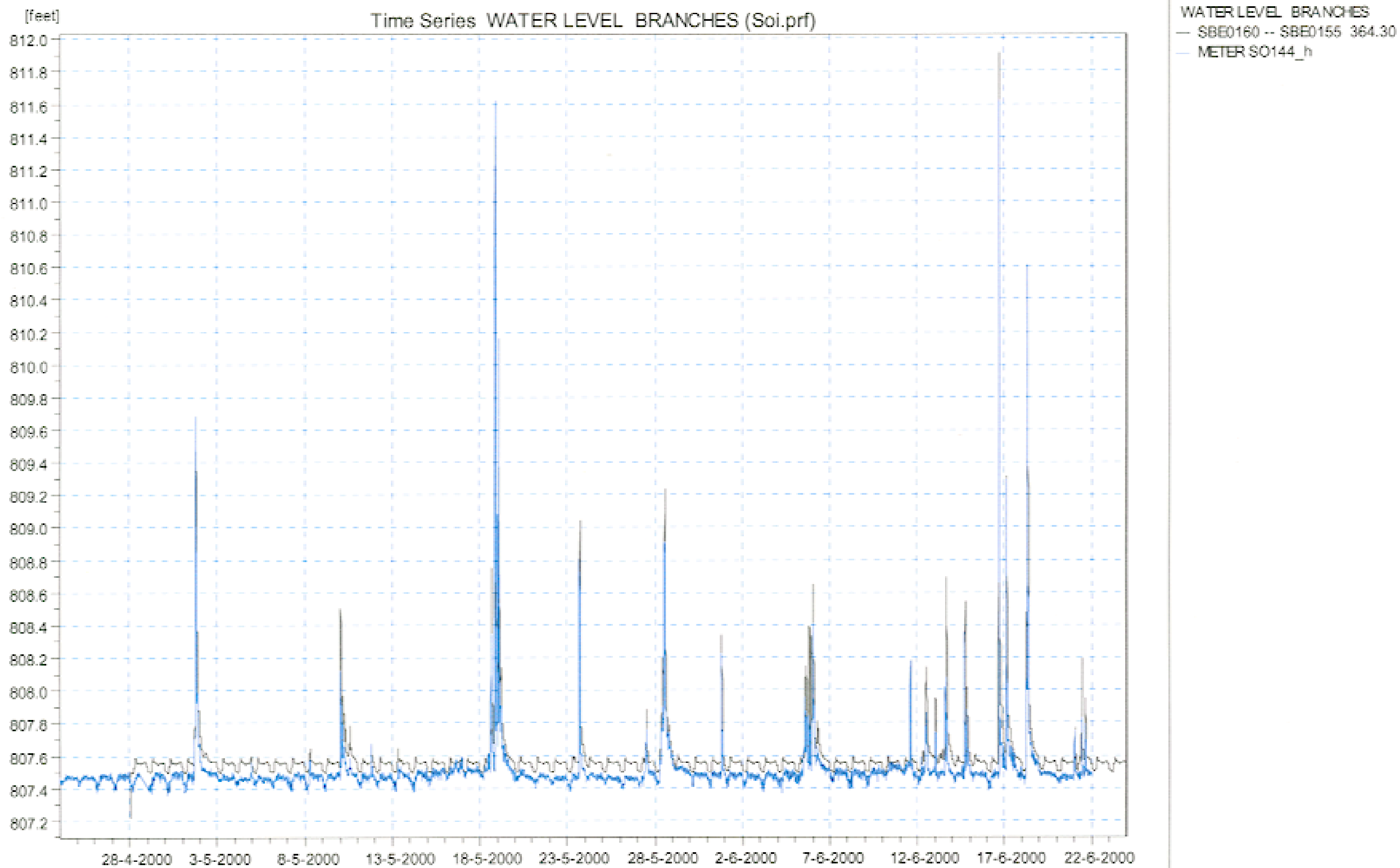
Meter SO-144
Meter vs. Modeled Storms

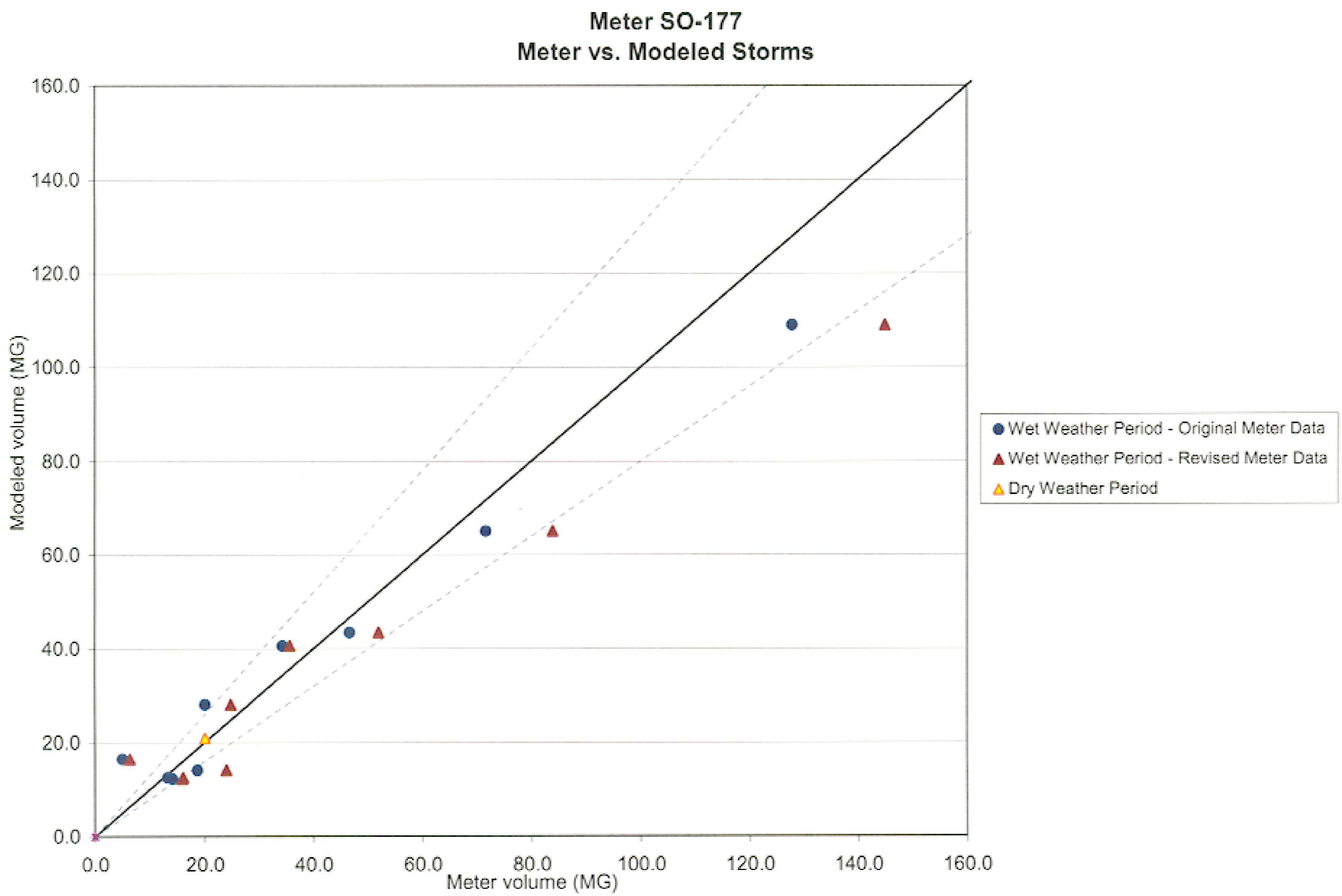


SO-144


25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
Volume (ft³)
450
400
350
300
250
200
150
100
50
0
Flow (cfs)
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time
Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
NOTE: It does not seem possible to match the volumes for both of the two large events - May 19 and June 16 - and so the calibration was performed to overpredict the May 19 and underpredict the June 16. The discrepancy in volume is likely caused by rainfall data.

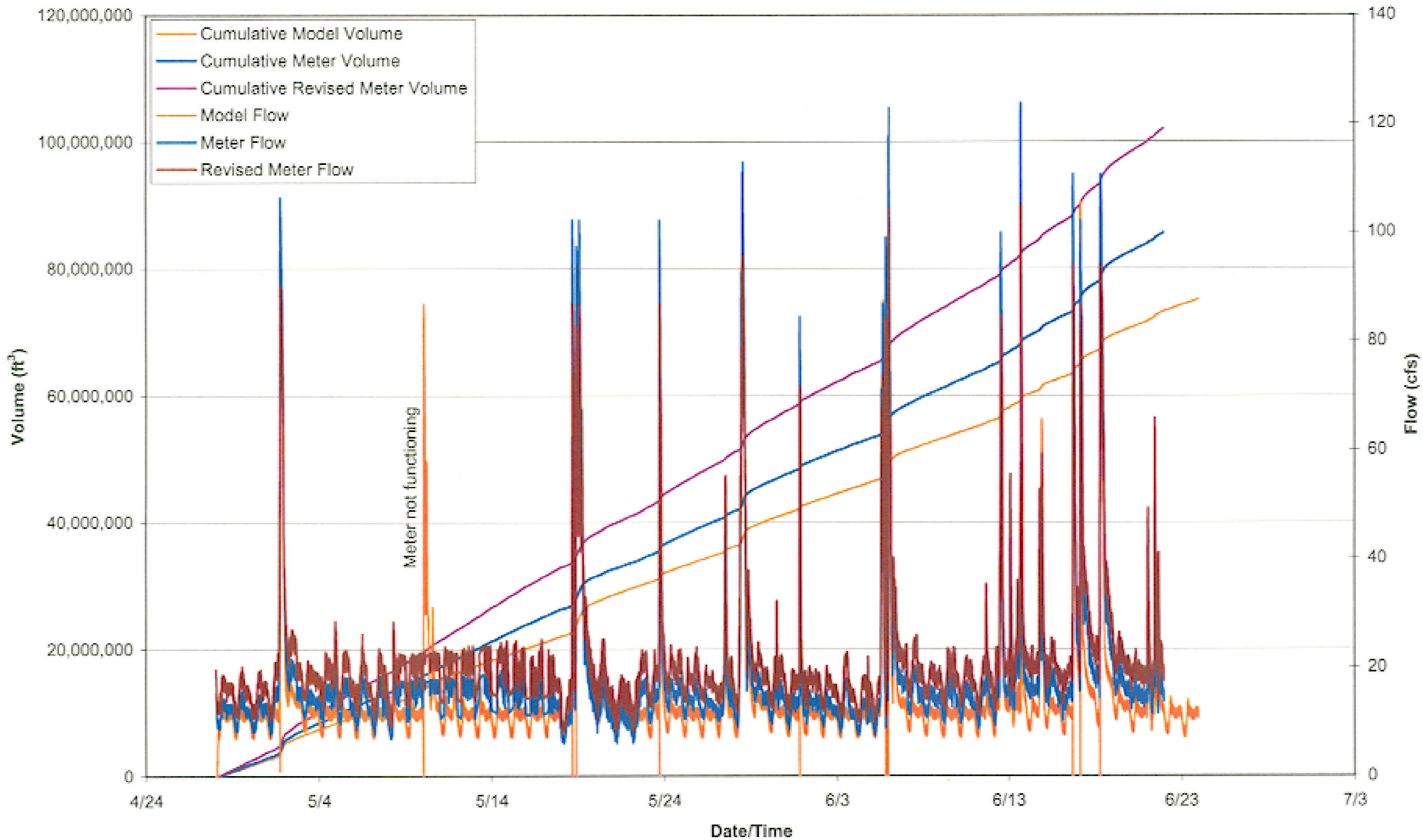
Meter SO-144
Hydraulic Gradeline





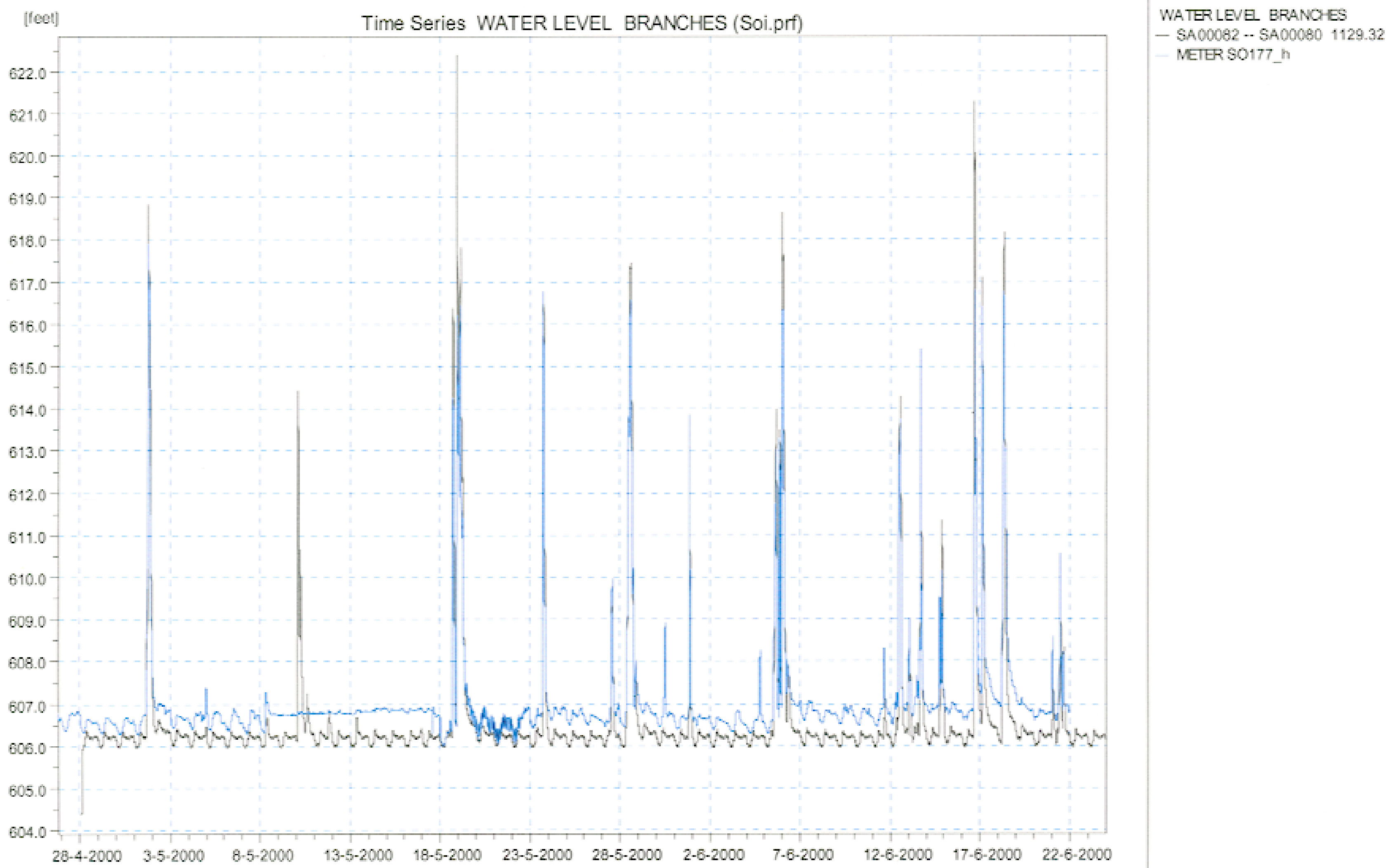
Meter SO-177
Meter vs. Modeled Storms
Modeled volume (MG)
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
Meter volume (MG)
Wet Weather Period - Original Meter Data
Wet Weather Period - Revised Meter Data
Dry Weather Period

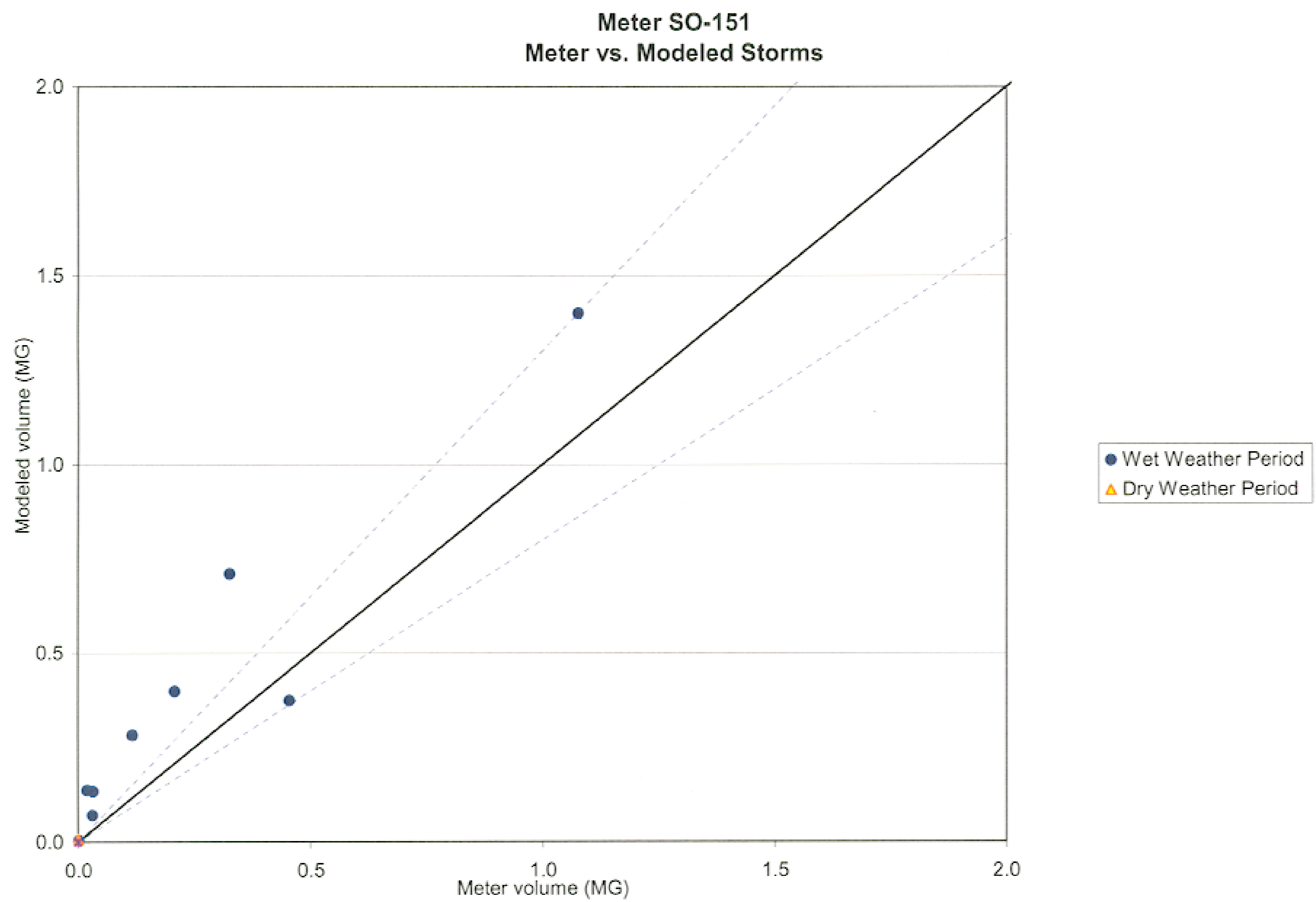
SO-177



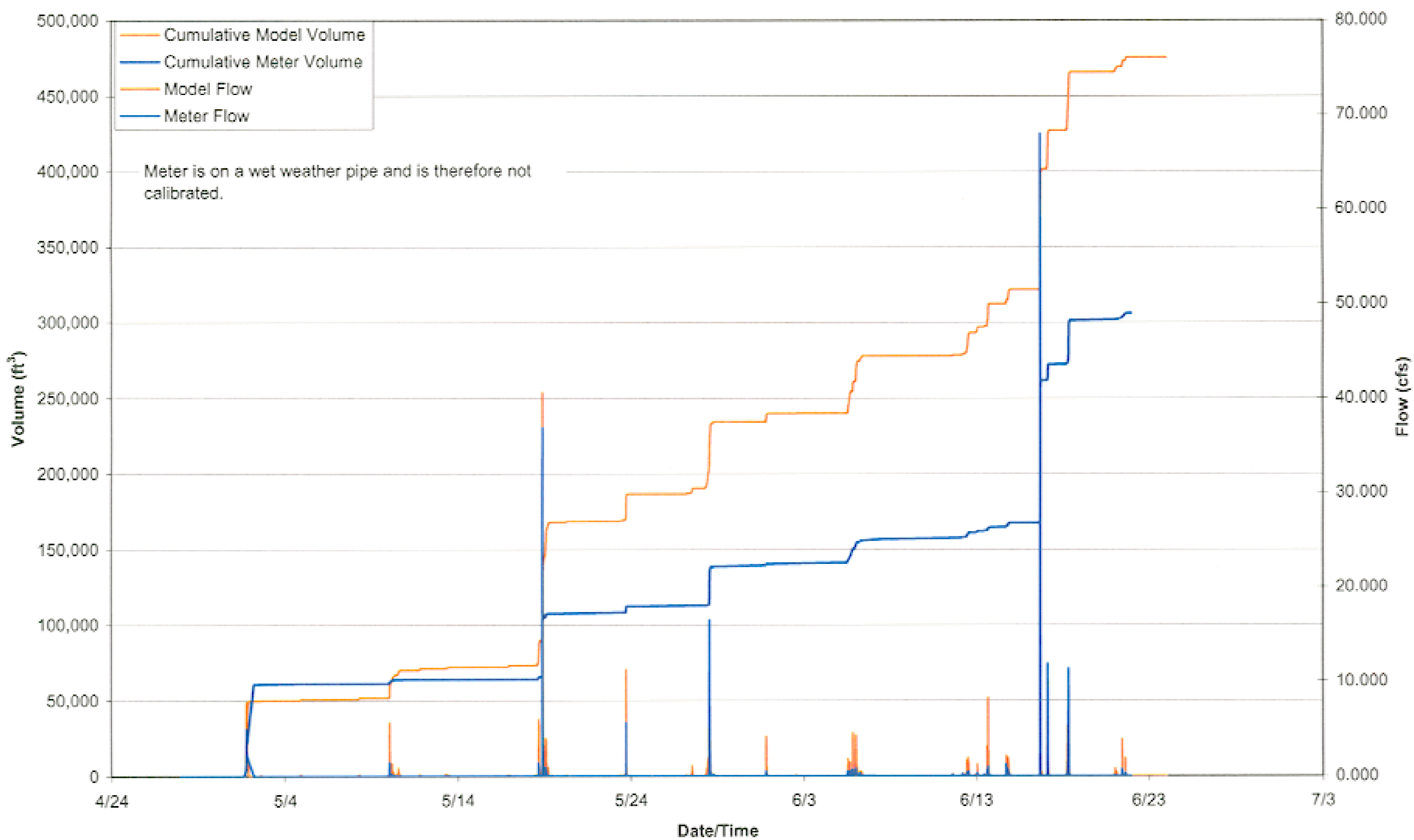
Cumulative Model Volume
Cumulative Meter Volume
Cumulative Revised Meter Volume
Model Flow
Meter Flow
Revised Meter Flow
Meter not functioning
Volume (ft³)
Flow (cfs)
Date/Time
0
20,000,000
40,000,000
60,000,000
80,000,000
100,000,000
120,000,000
0
20
40
60
80
100
120
140
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3

Meter SO-177
Hydraulic Gradeline



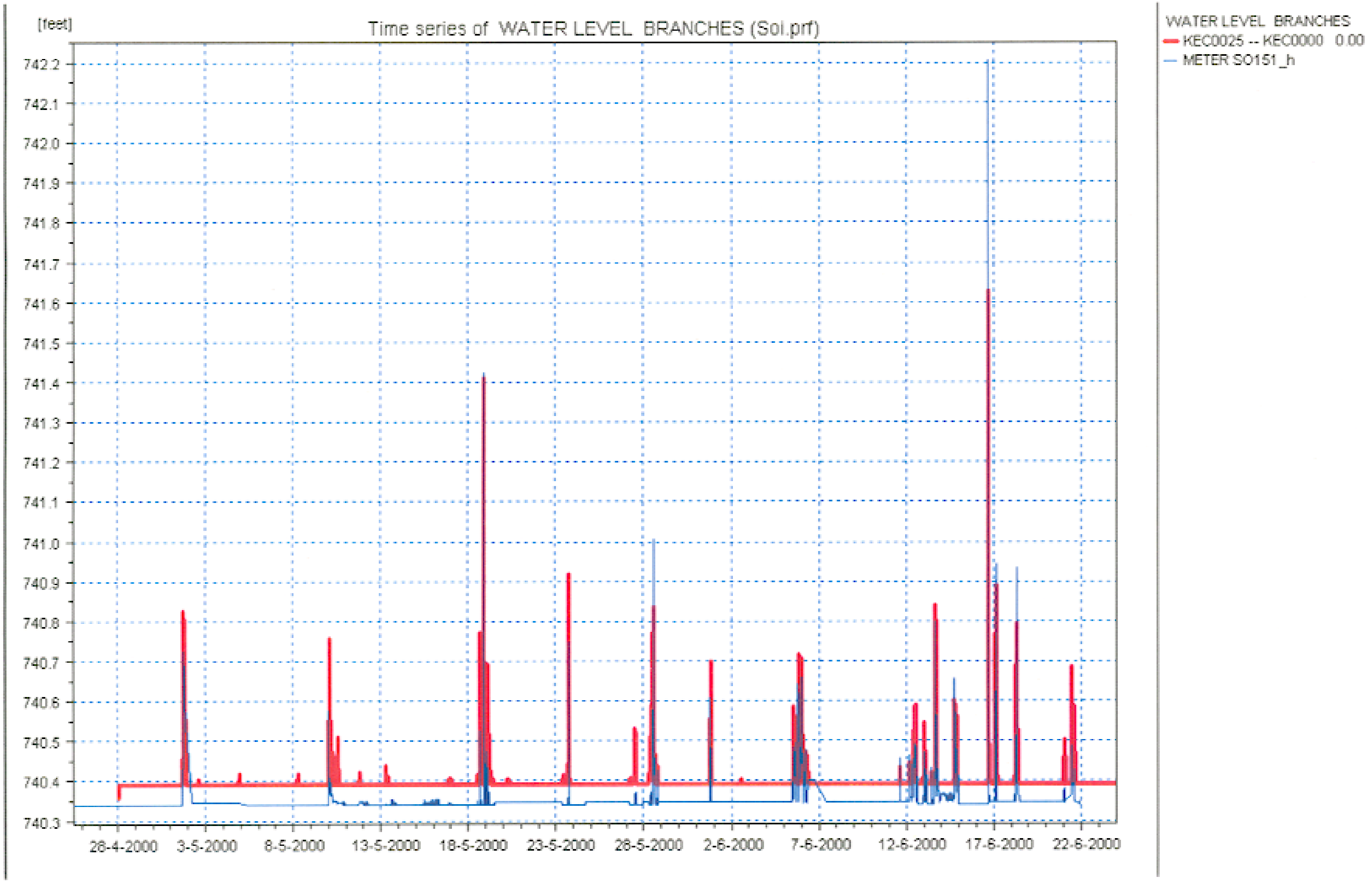

Meter SO-151
Meter vs. Modeled Storms
Modeled volume (MG)
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
Meter volume (MG)
Wet Weather Period
Dry Weather Period

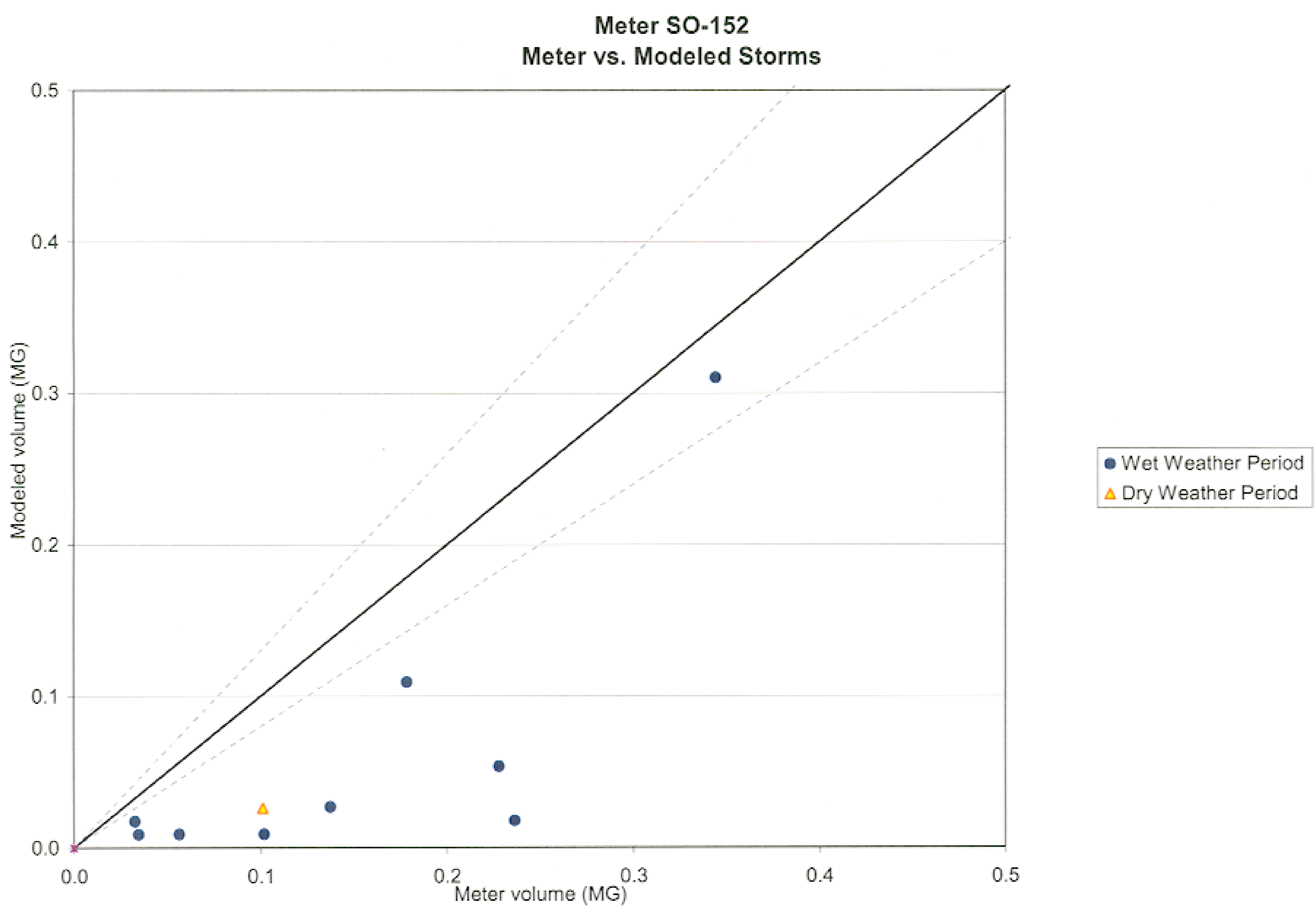
SO-151



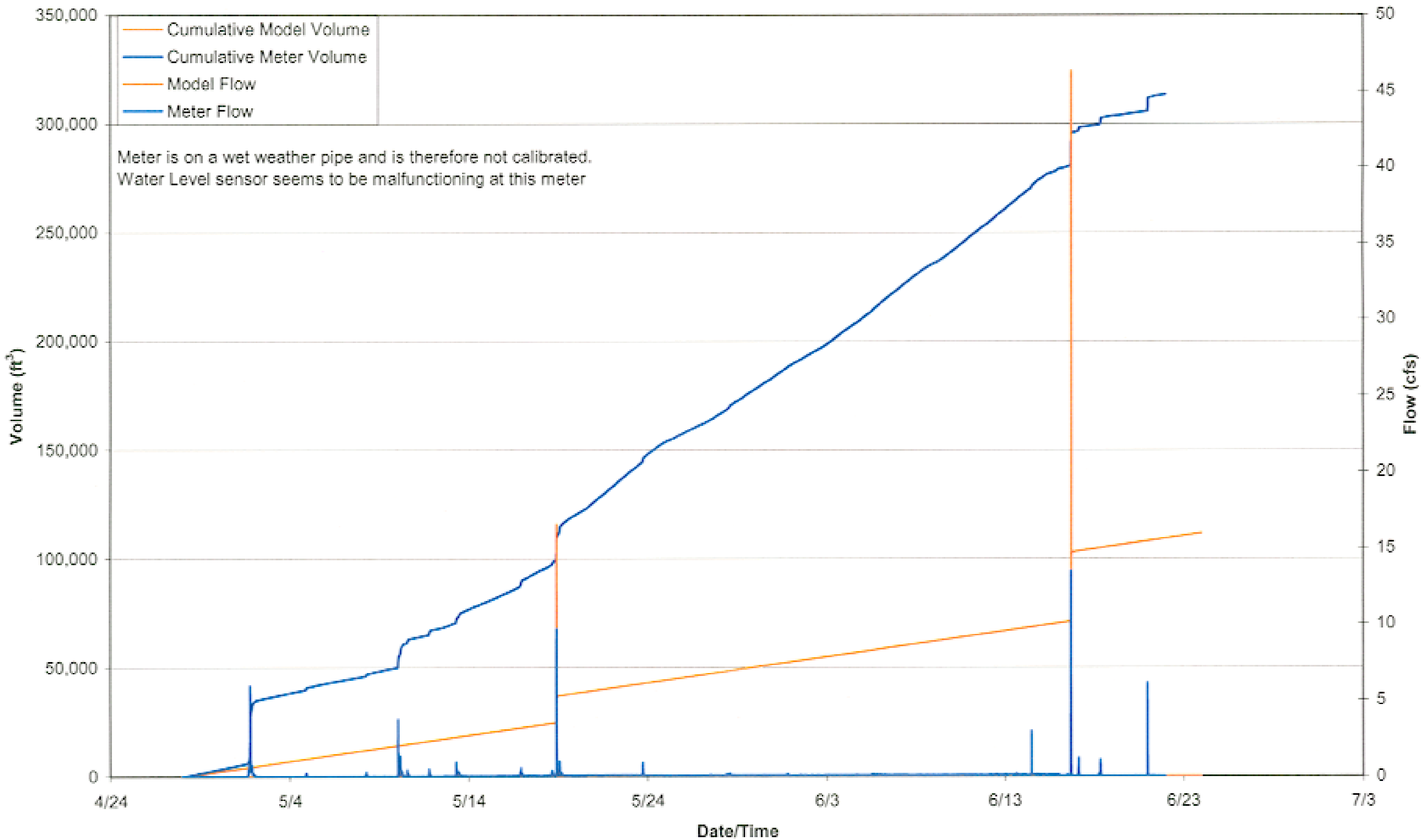
Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Meter is on a wet weather pipe and is therefore not calibrated.
Volume (ft^3)
500,000
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
Flow (cfs)
80.000
70.000
60.000
50.000
40.000
30.000
20.000
10.000
0.000
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

Meter SO-151
Hydraulic Gradeline

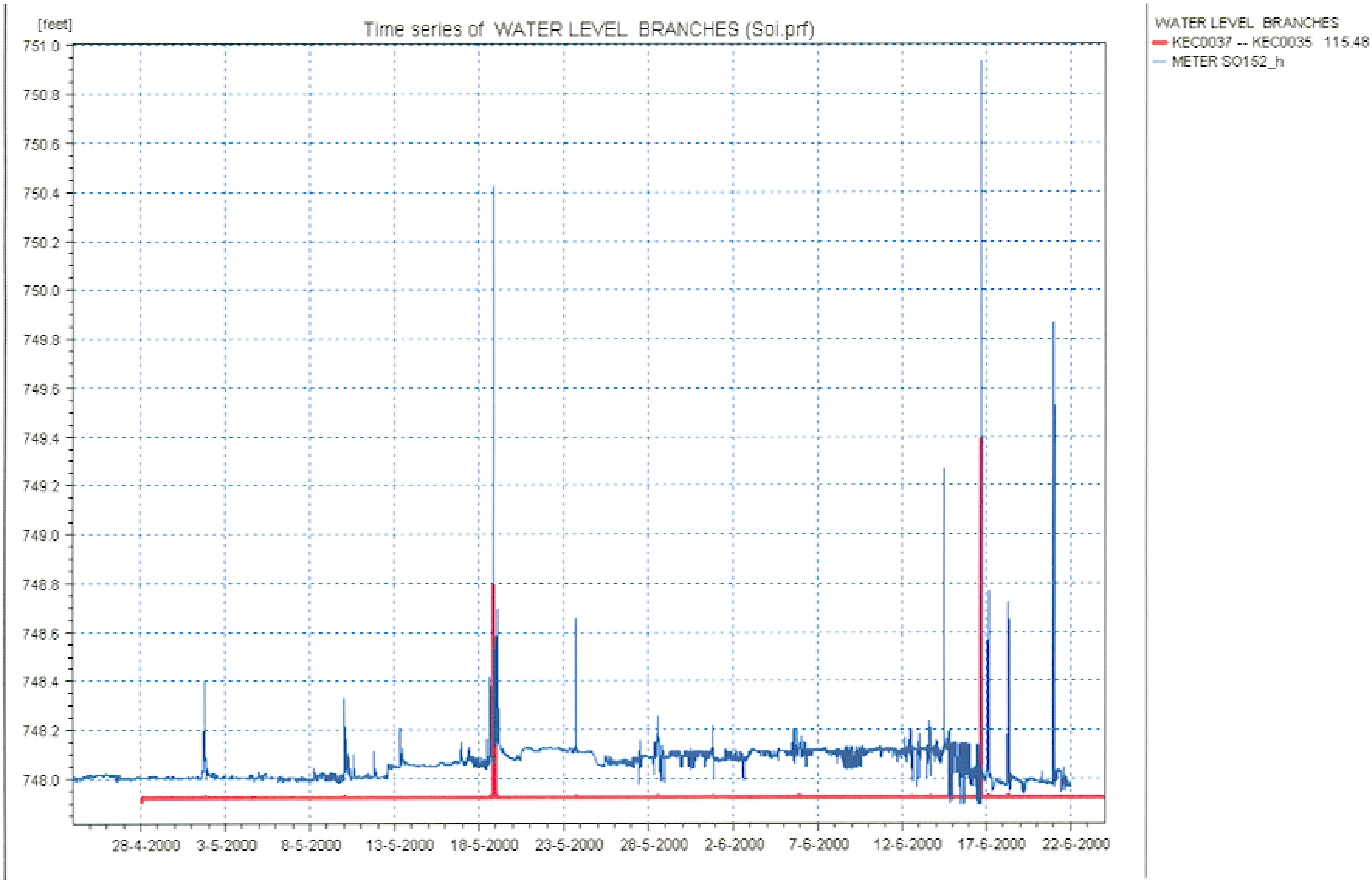


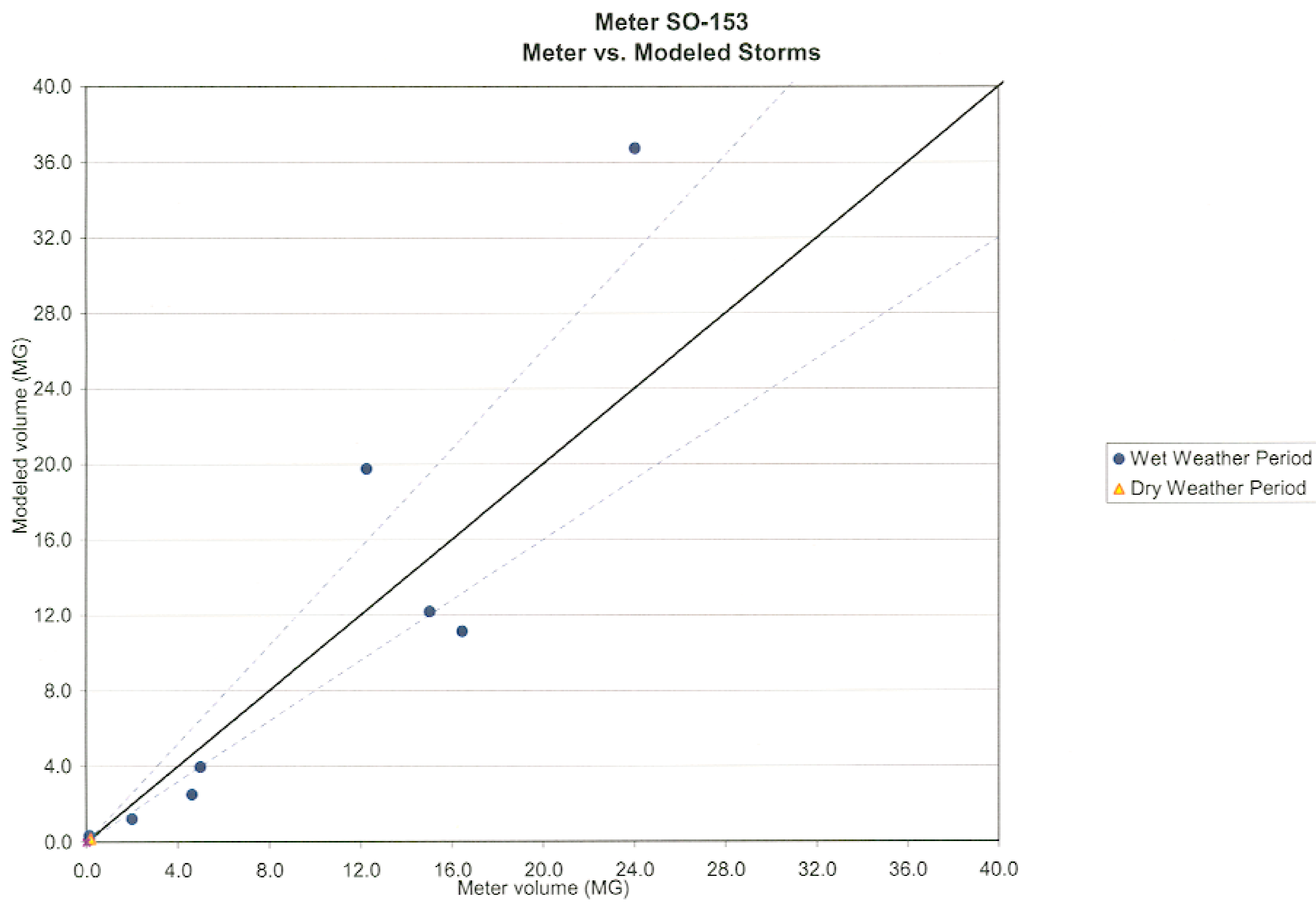

Meter SO-152
Meter vs. Modeled Storms
0.5
0.4
0.3
0.2
0.1
0.0
Modeled volume (MG)
0.0
0.1
0.2
0.3
0.4
0.5
Meter volume (MG)
Wet Weather Period
Dry Weather Period

SO-152

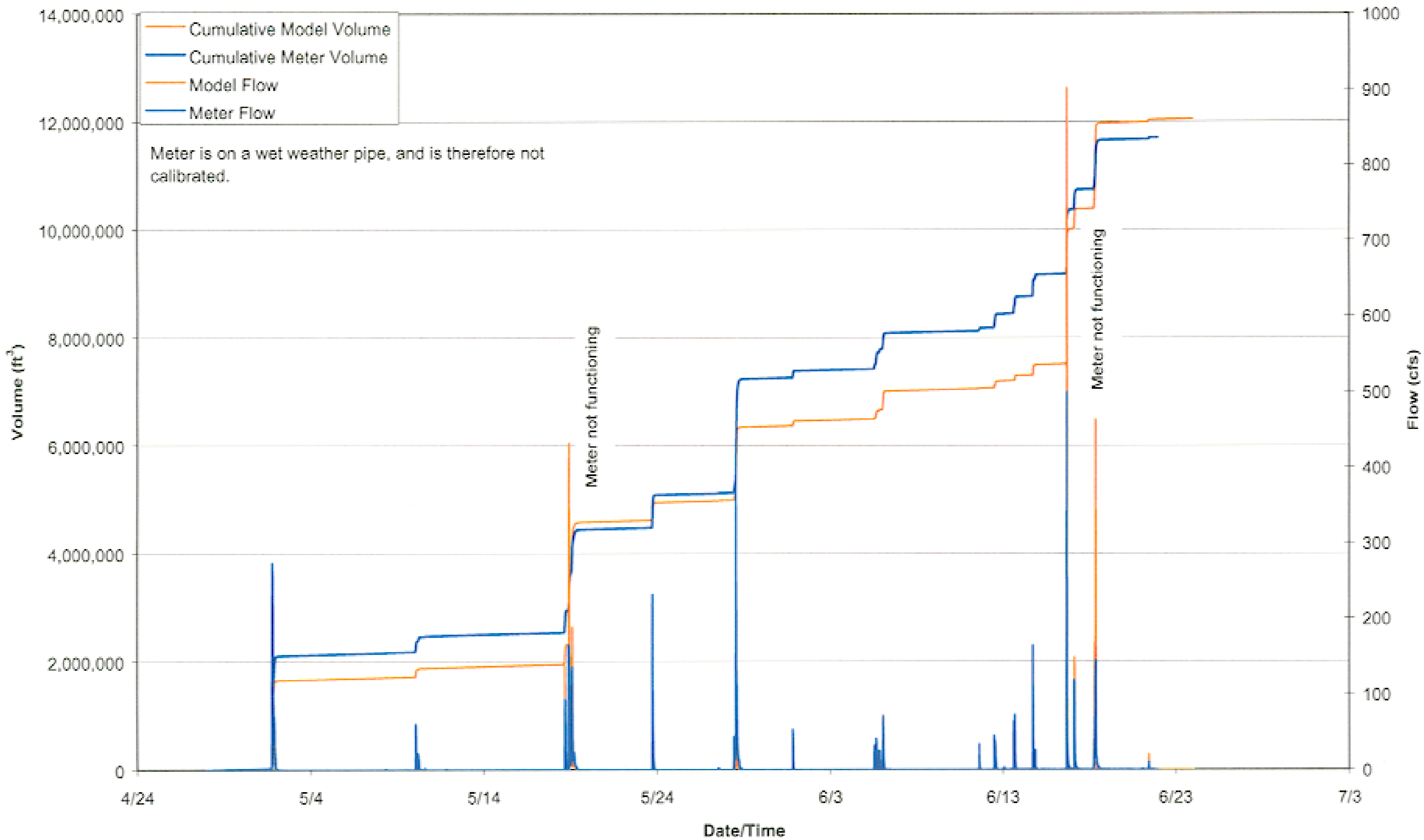

Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Meter is on a wet weather pipe and is therefore not calibrated.
Water Level sensor seems to be malfunctioning at this meter
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
Volume (ft^3)
50
45
40
35
30
25
20
15
10
5
0
Flow (cfs)
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

Meter SO-152
Hydraulic Gradeline



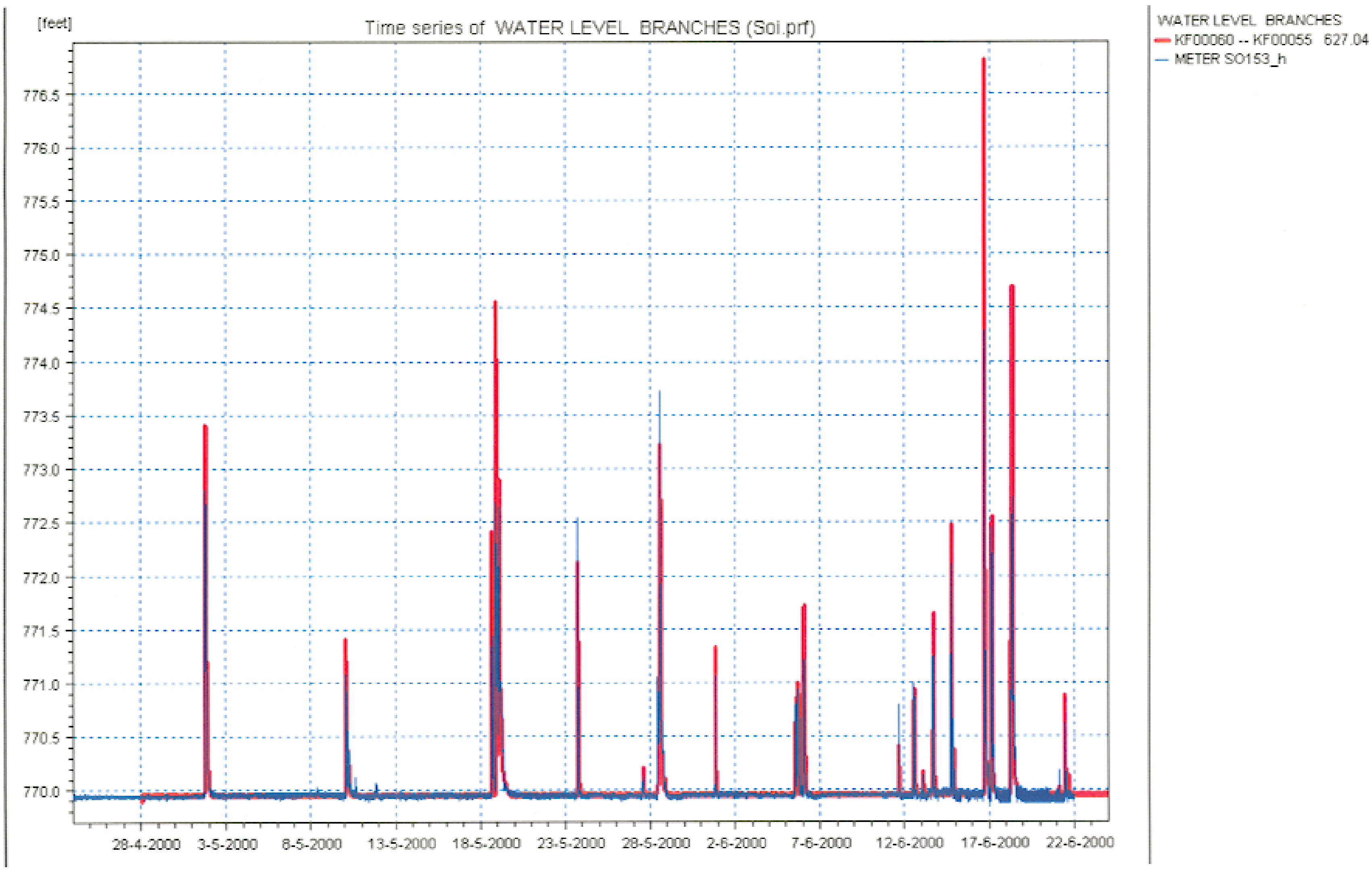

Meter SO-153
Meter vs. Modeled Storms
Modeled volume (MG)
40.0
36.0
32.0
28.0
24.0
20.0
16.0
12.0
8.0
4.0
0.0
0.0
4.0
8.0
12.0
16.0
20.0
24.0
28.0
32.0
36.0
40.0
Meter volume (MG)
Wet Weather Period
Dry Weather Period

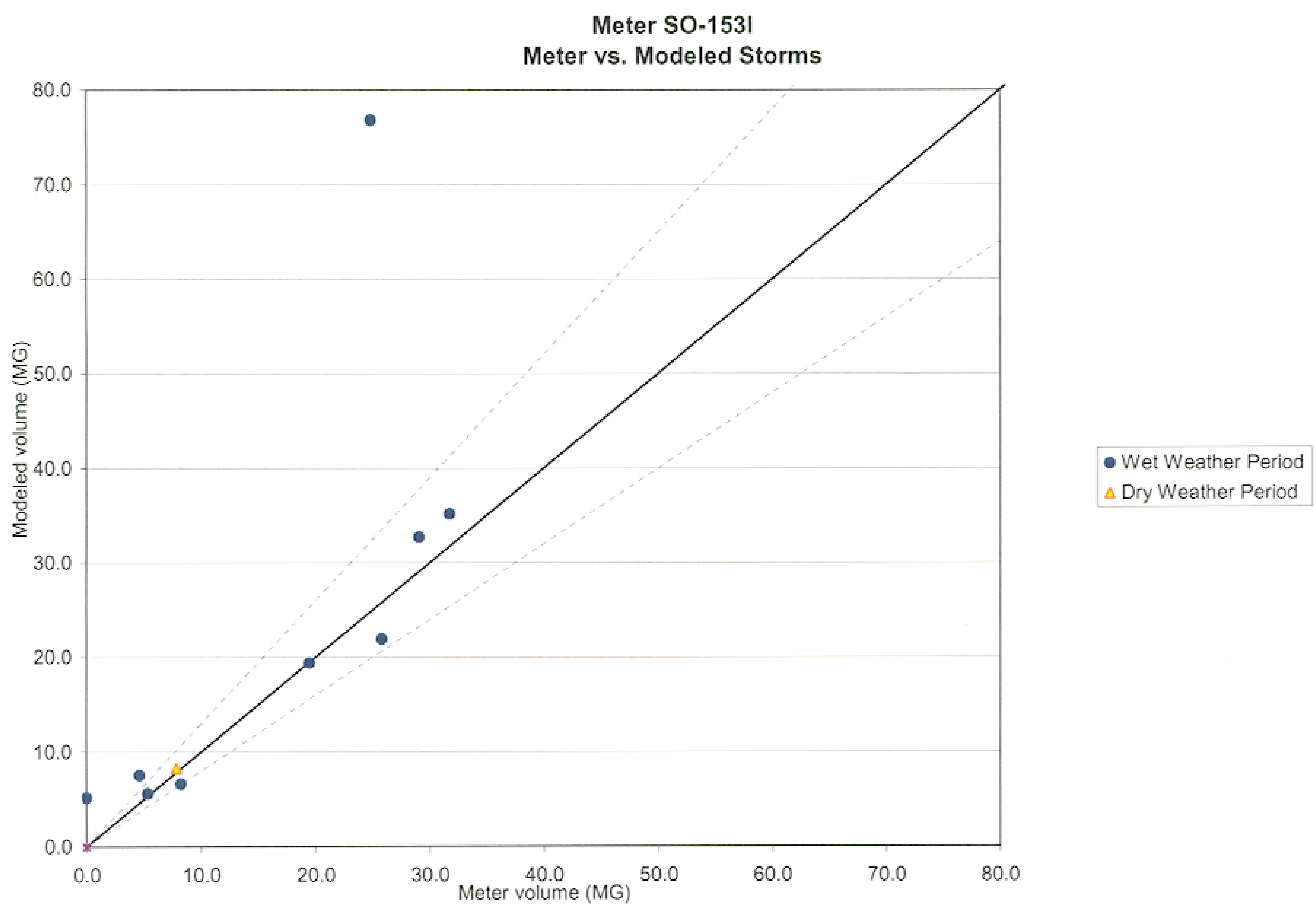
SO-153



Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Meter is on a wet weather pipe, and is therefore not calibrated.
Meter not functioning
Meter not functioning
Volume (ft^3)
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
Flow (cfs)
1000
900
800
700
600
500
400
300
200
100
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

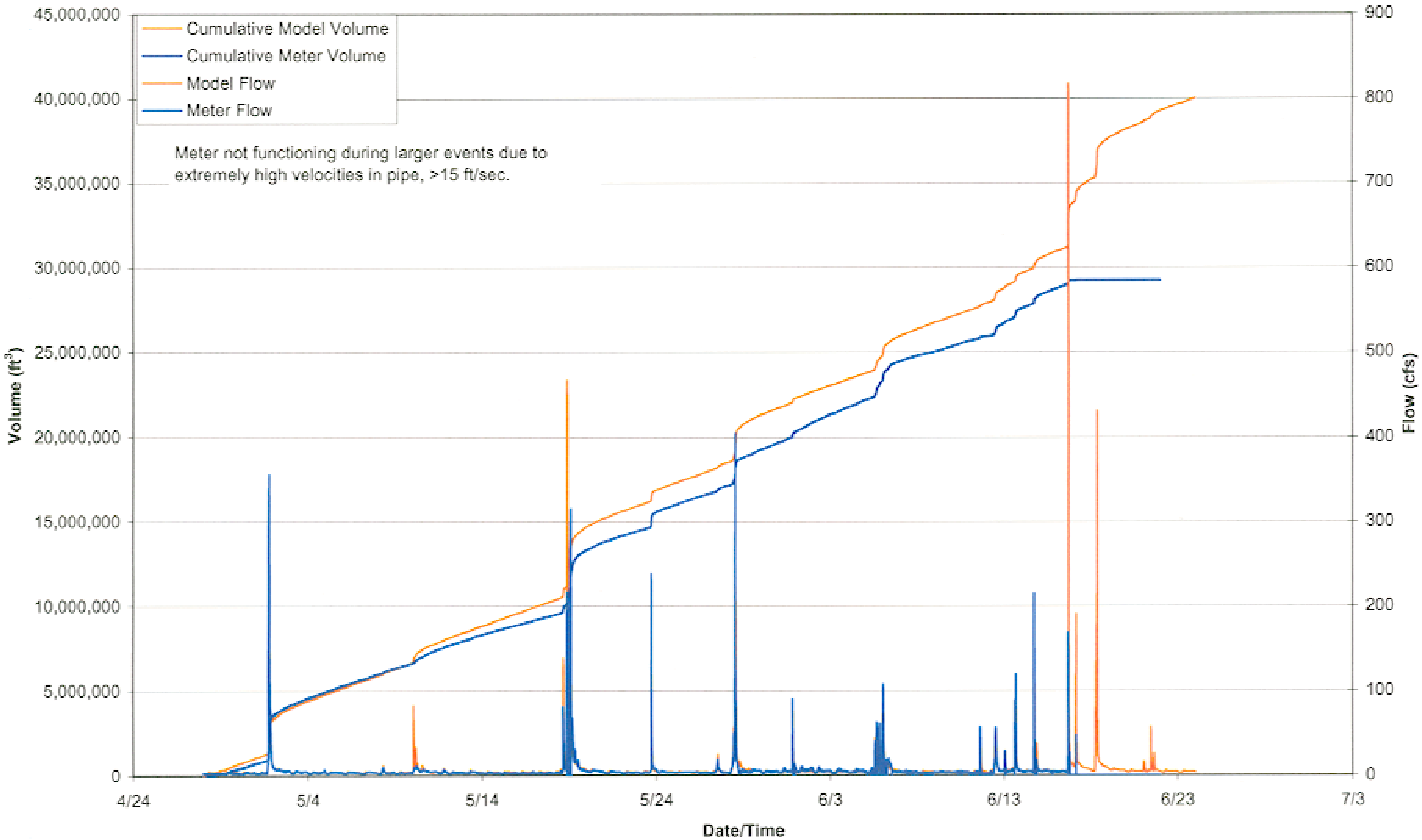
Meter SO-153
Hydraulic Gradeline





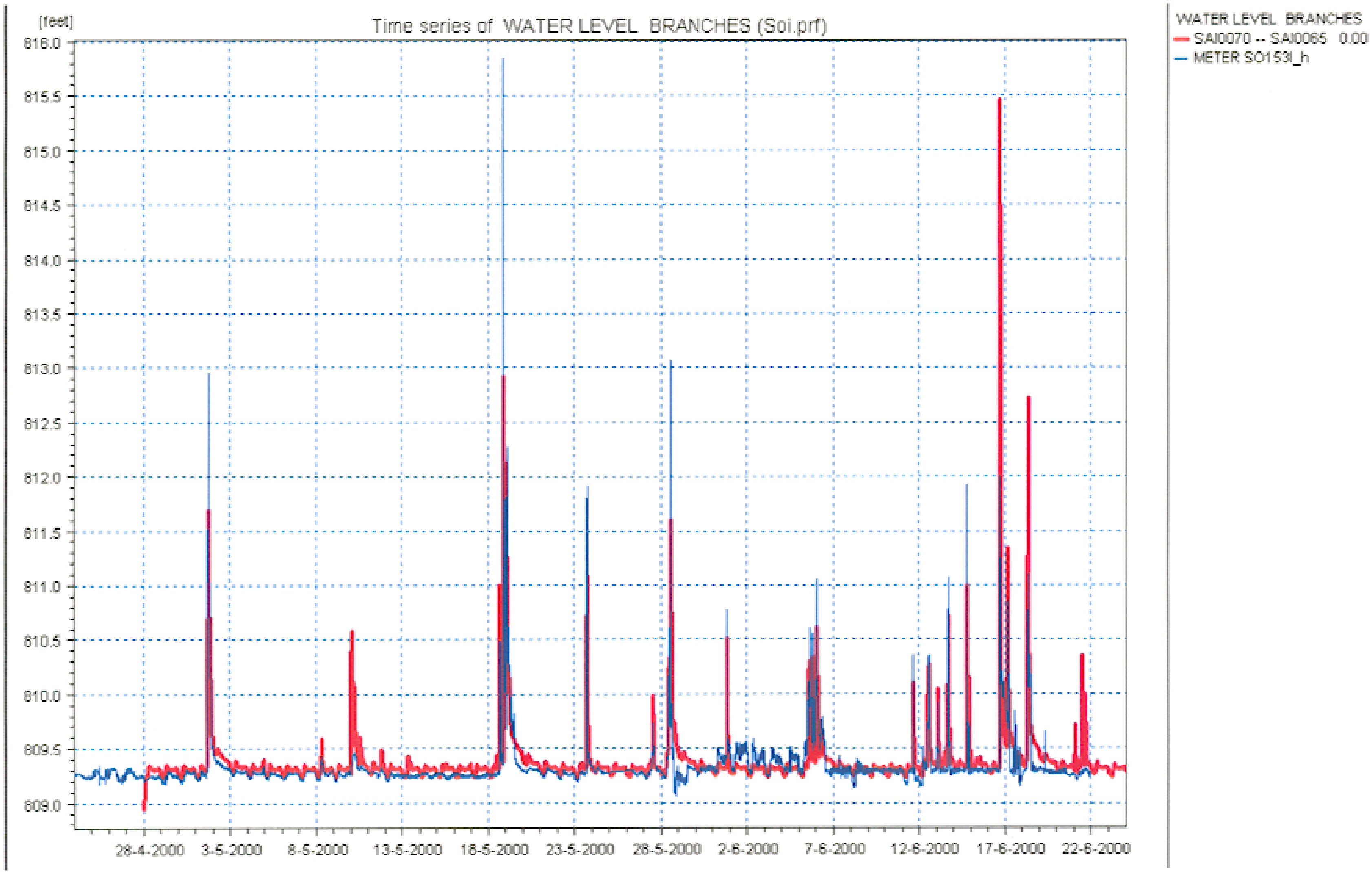
Meter SO-153I
Meter vs. Modeled Storms
Modeled volume (MG)
Meter volume (MG)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
Wet Weather Period
Dry Weather Period

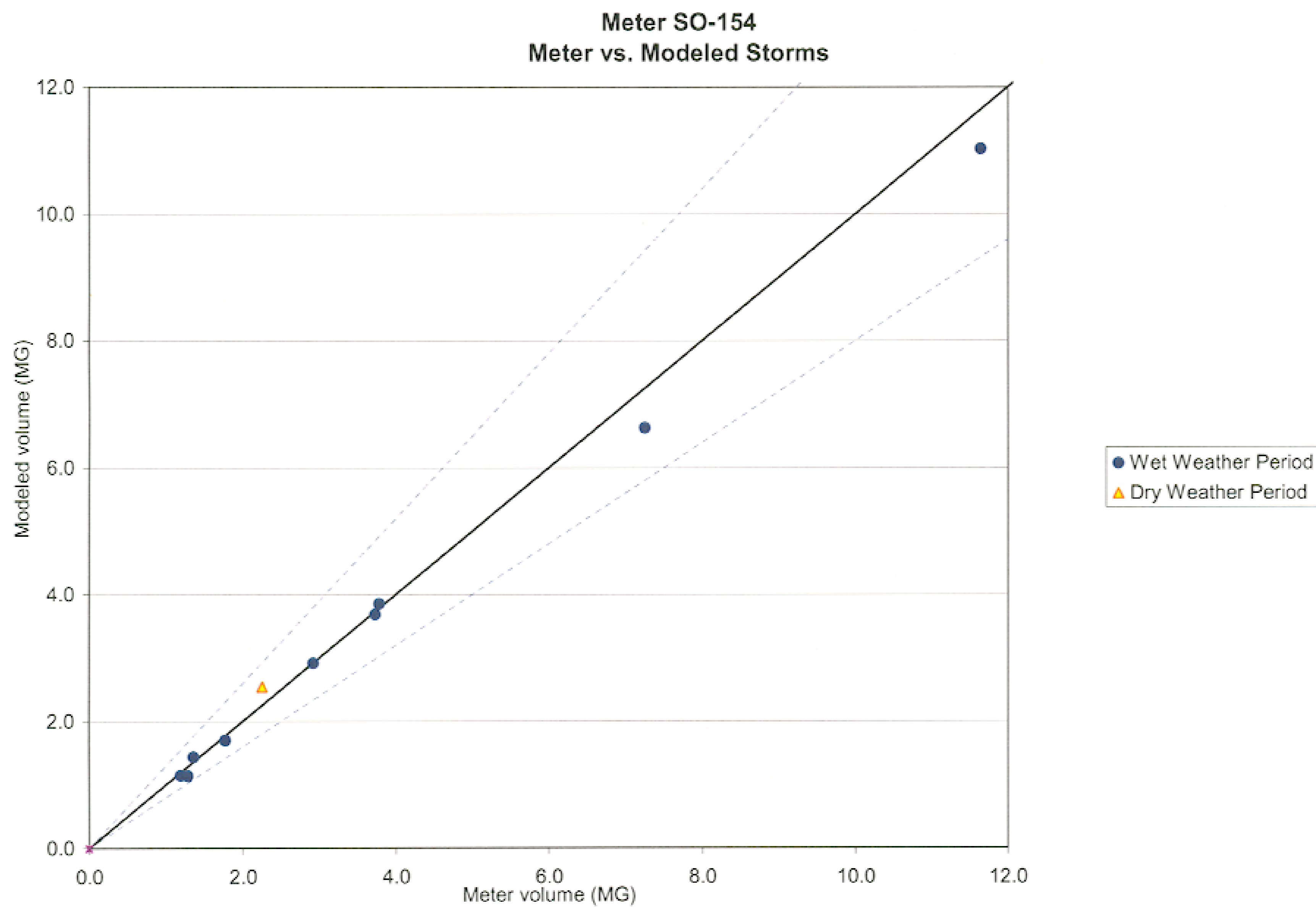
SO-153I



Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Meter not functioning during larger events due to extremely high velocities in pipe, >15 ft/sec.
Volume (ft³)
45,000,000
40,000,000
35,000,000
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
Flow (cfs)
900
800
700
600
500
400
300
200
100
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

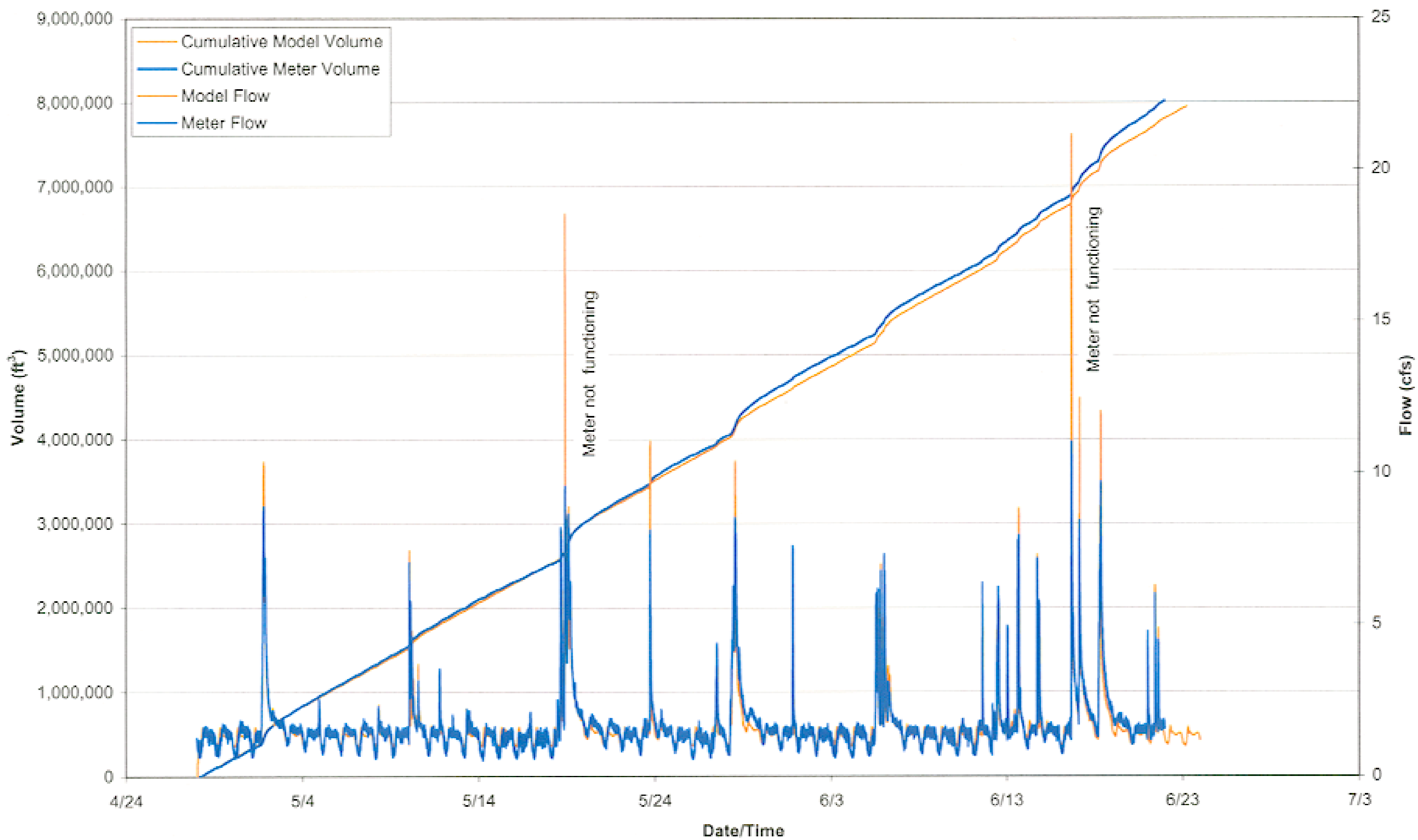
Meter SO-153I
Hydraulic Gradeline





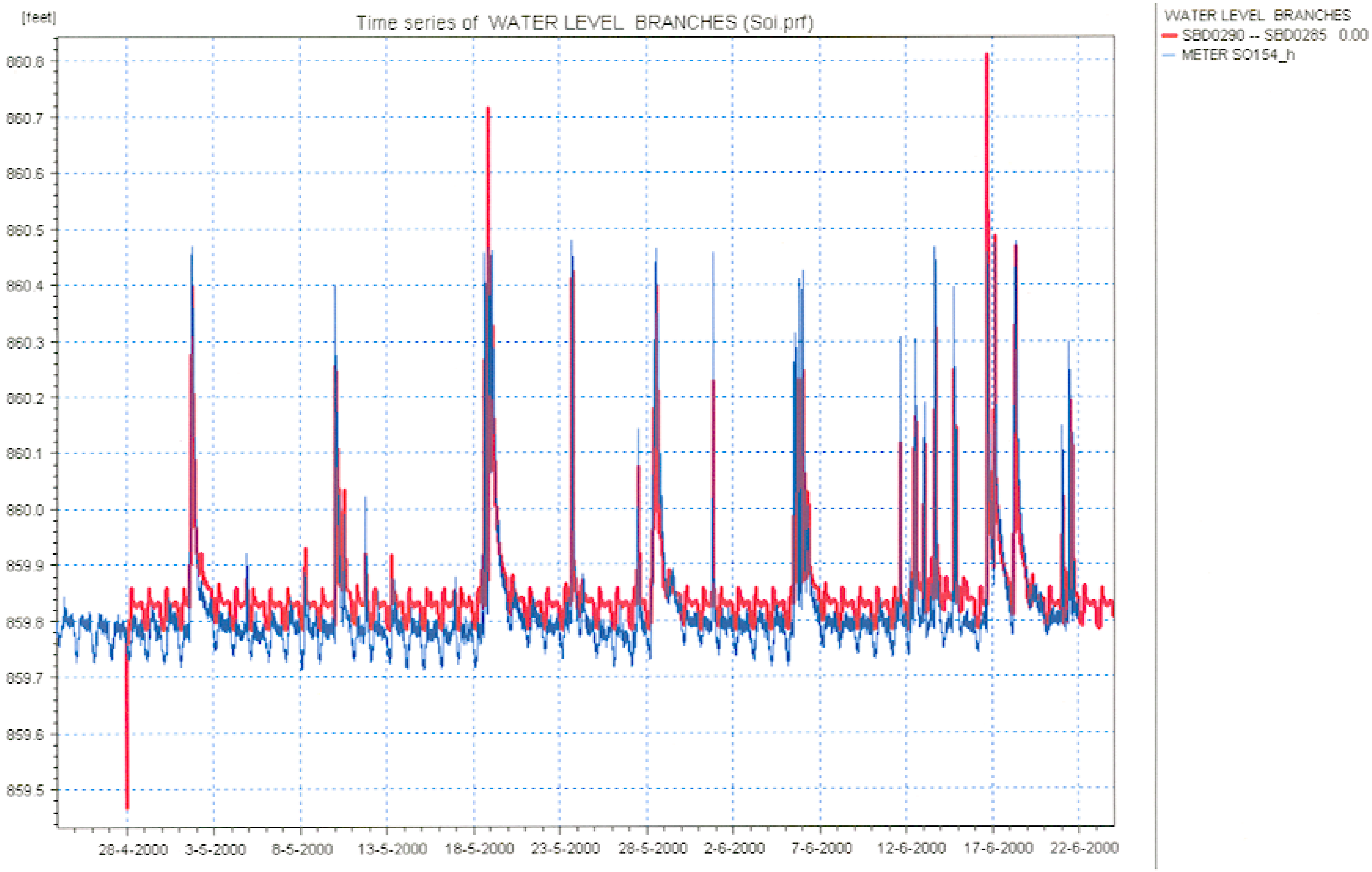
Meter SO-154
Meter vs. Modeled Storms
Modeled volume (MG)
Meter volume (MG)
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Wet Weather Period
Dry Weather Period

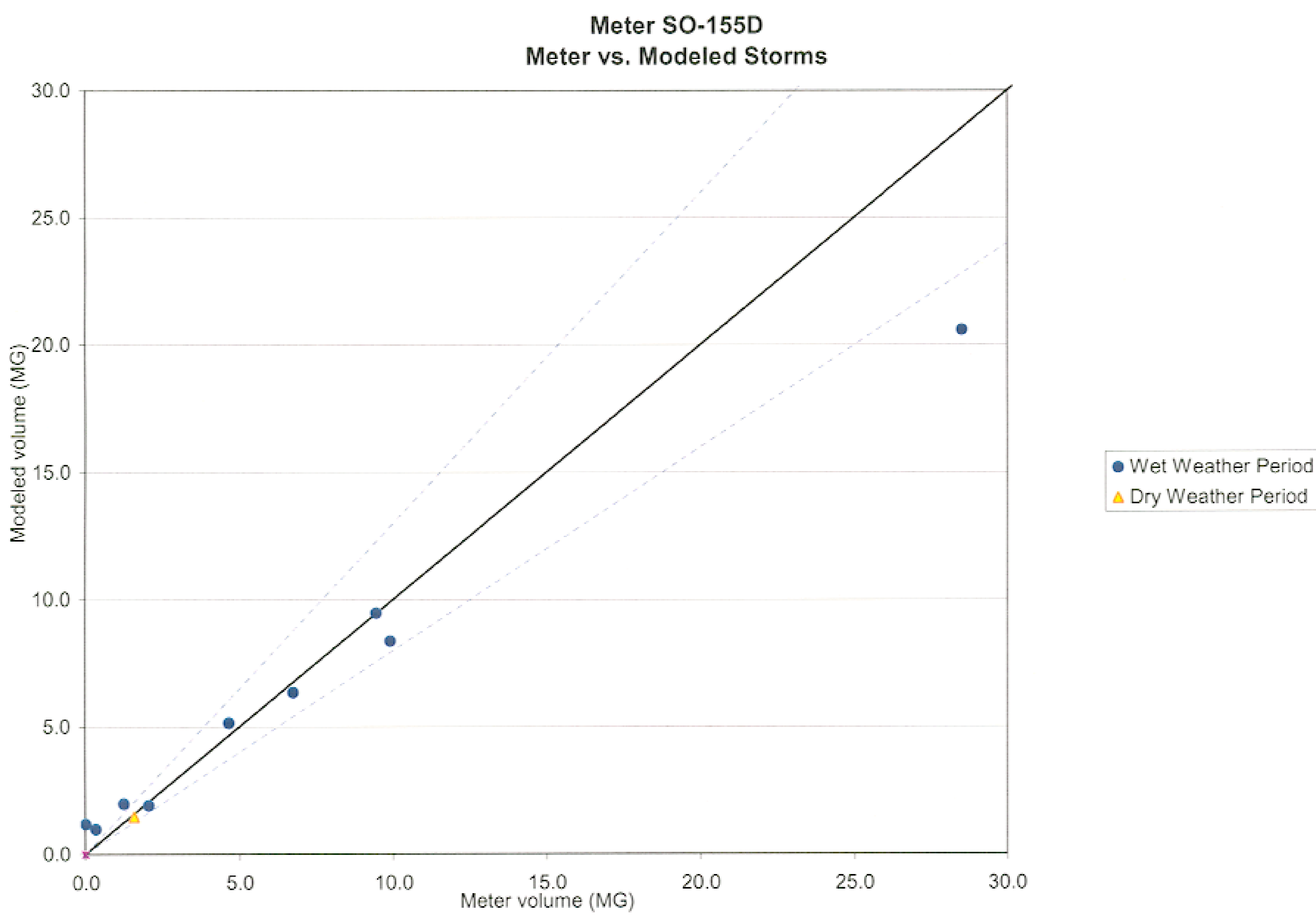
SO-154



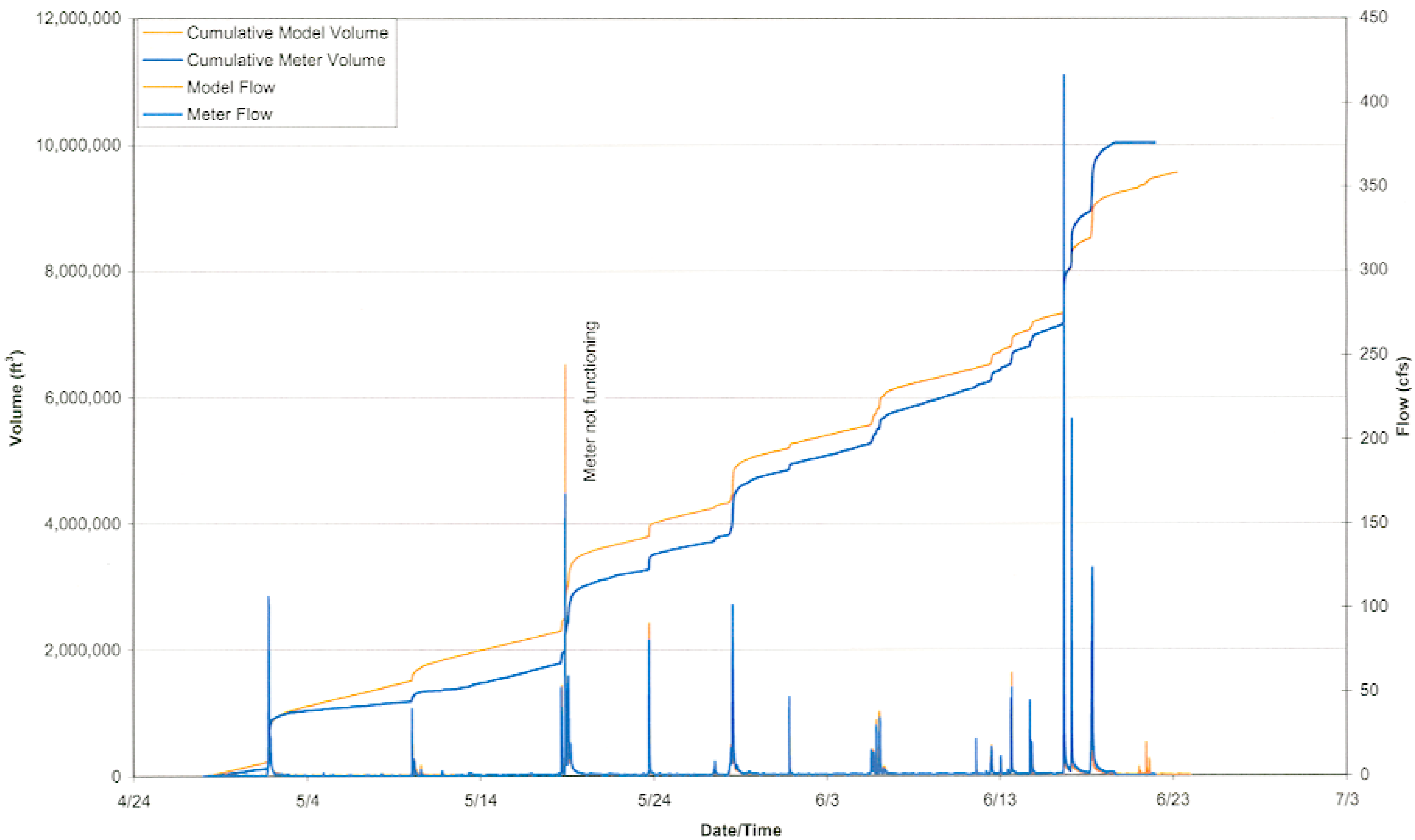
Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Volume (ft³)
9,000,000
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
Flow (cfs)
25
20
15
10
5
0
Meter not functioning
Meter not functioning
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

Meter SO-154
Hydraulic Gradeline



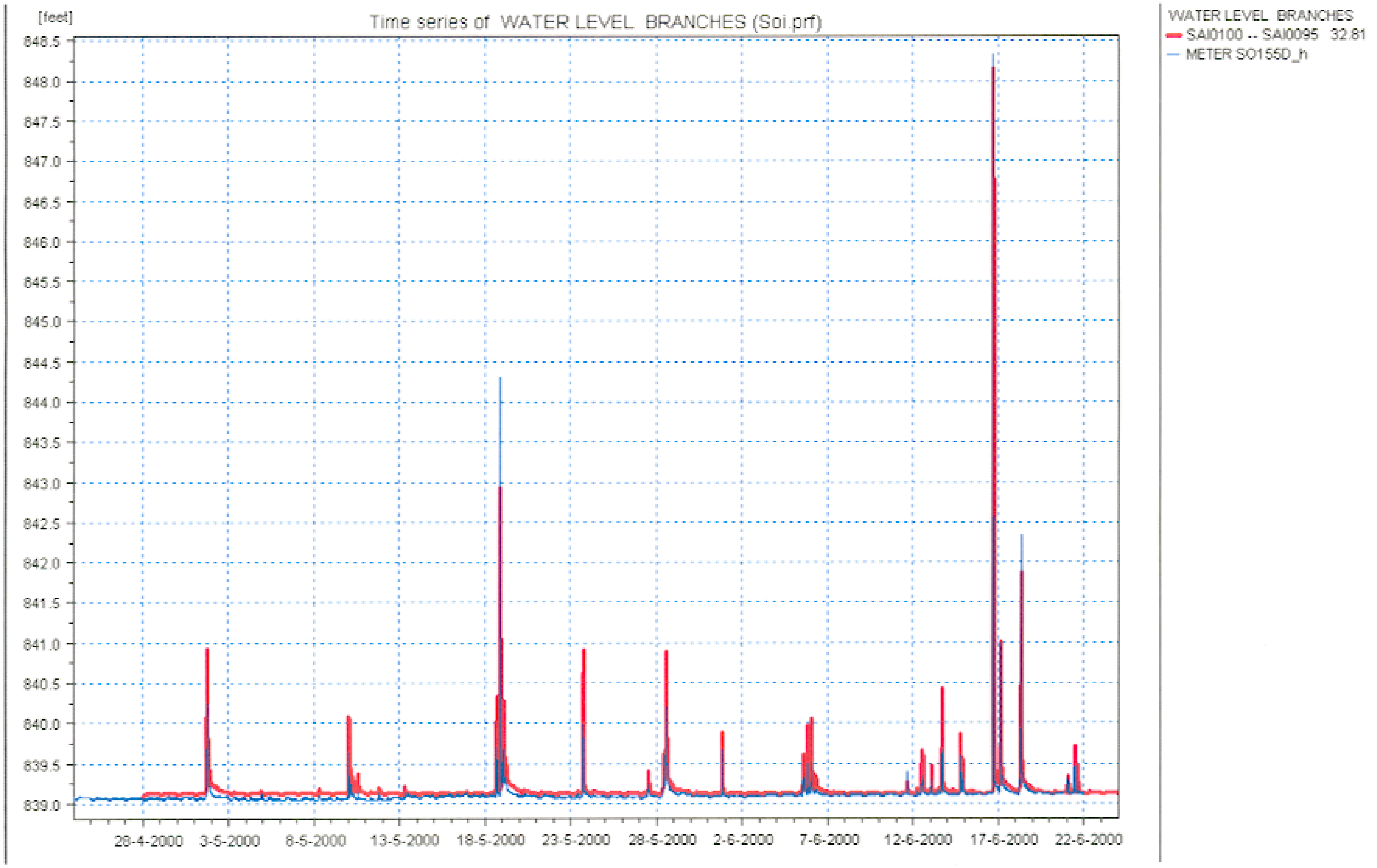

Meter SO-155D
Meter vs. Modeled Storms
Modeled volume (MG)
Meter volume (MG)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
Wet Weather Period
Dry Weather Period

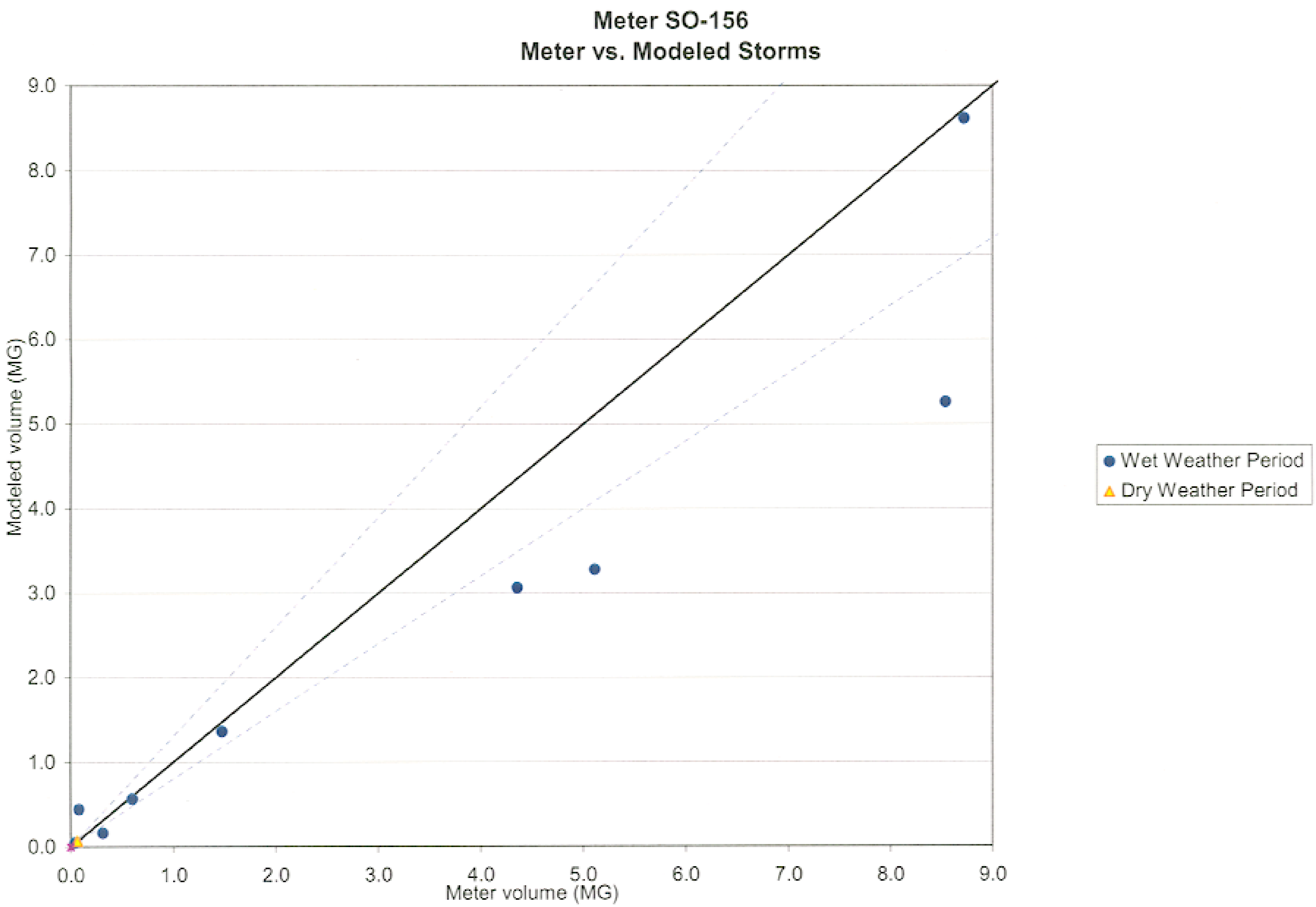
SO-155D



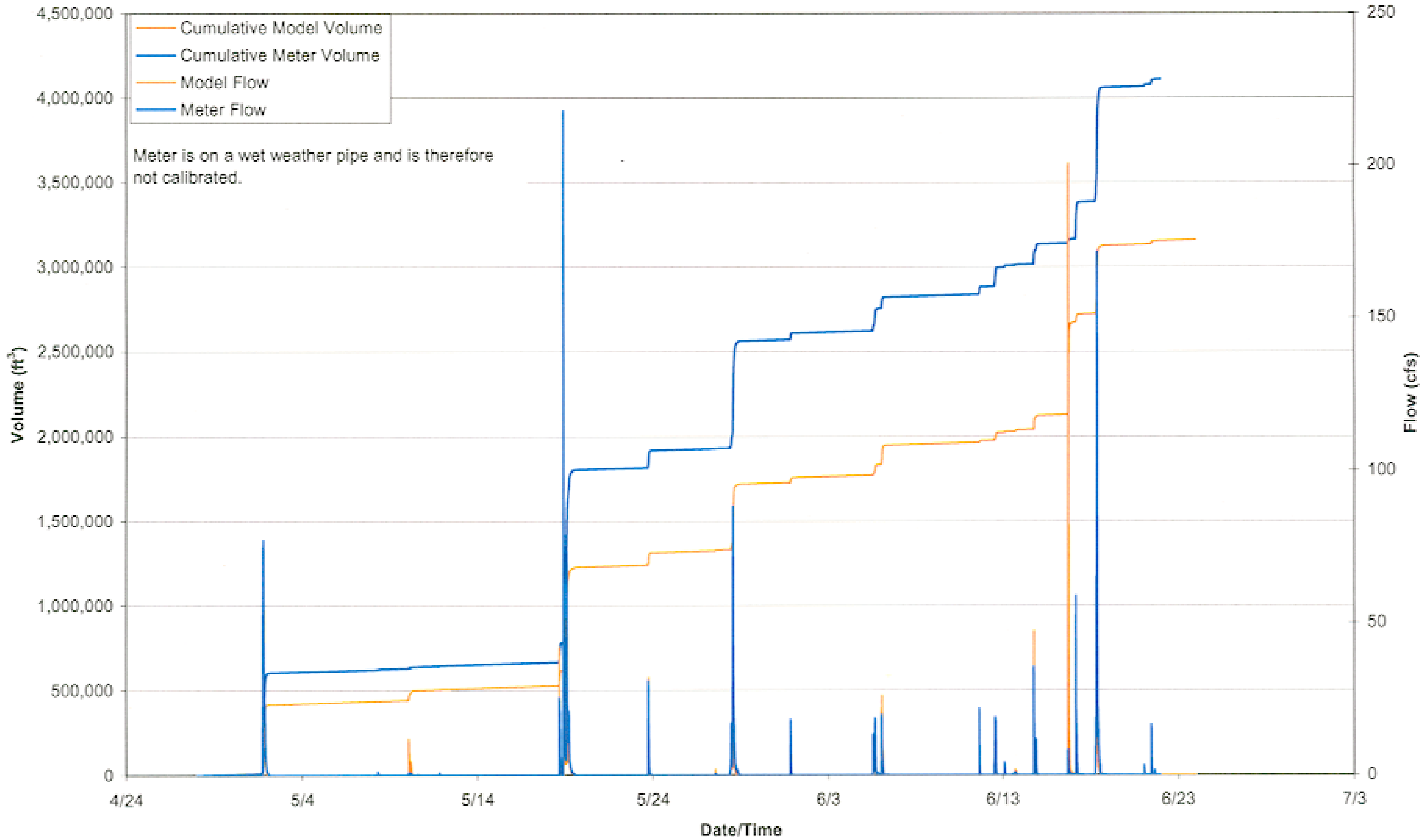
Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Meter not functioning
Volume (ft^3)
Flow (cfs)
Date/Time
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
450
400
350
300
250
200
150
100
50
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3

Meter SO-155D
Hydraulic Gradeline



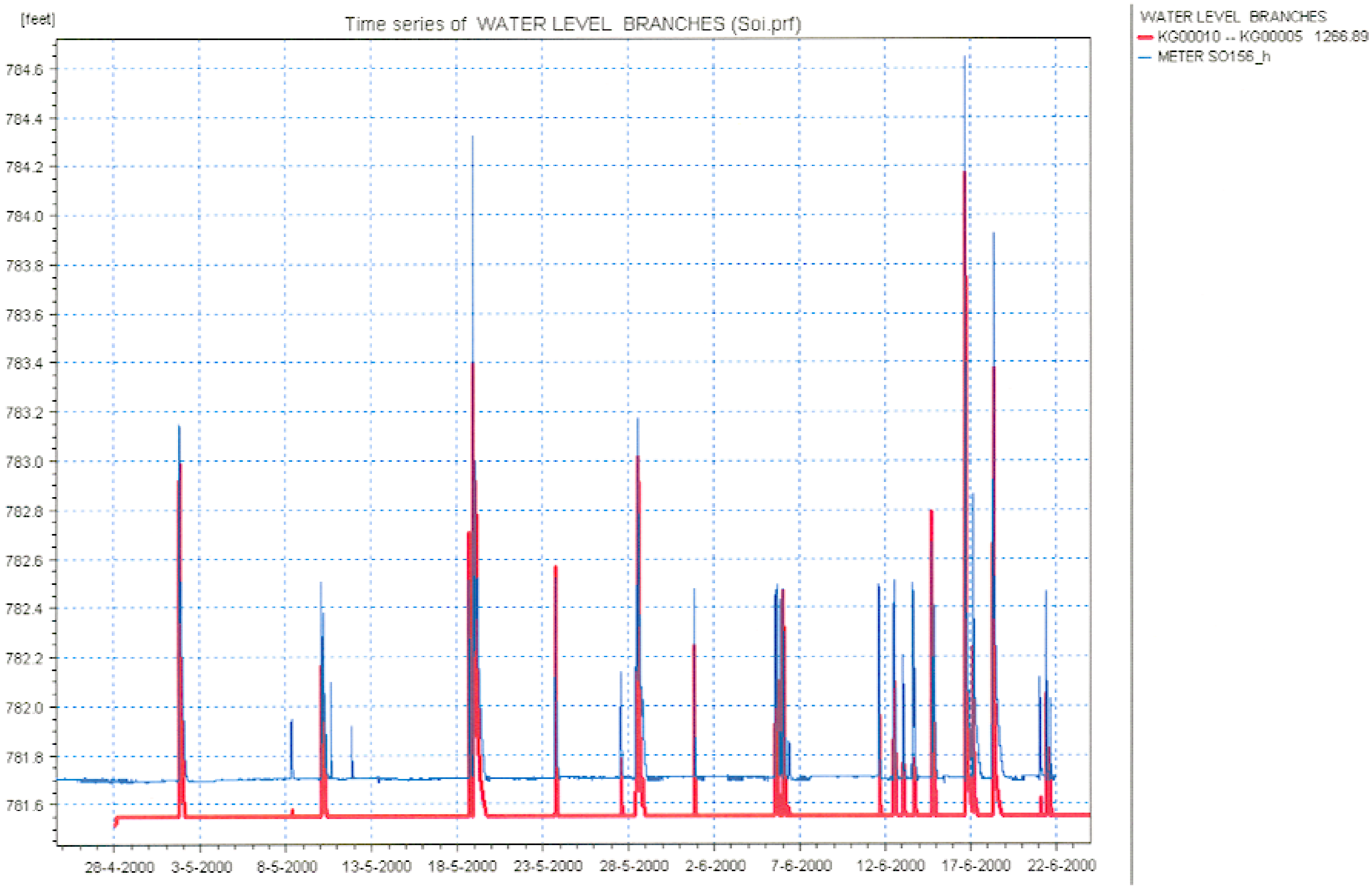

Meter SO-156
Meter vs. Modeled Storms
Modeled volume (MG)
Meter volume (MG)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
Wet Weather Period
Dry Weather Period

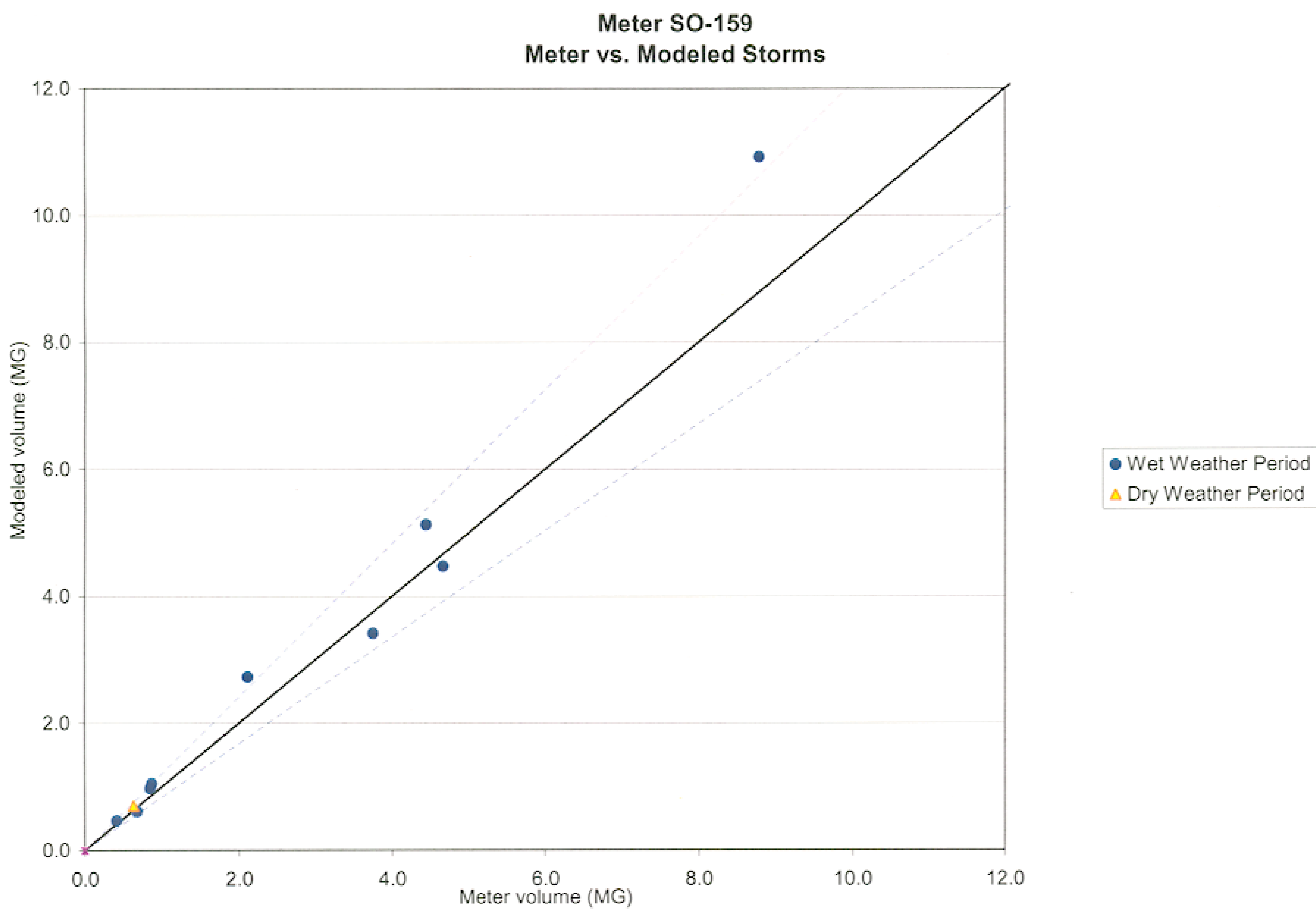
SO-156



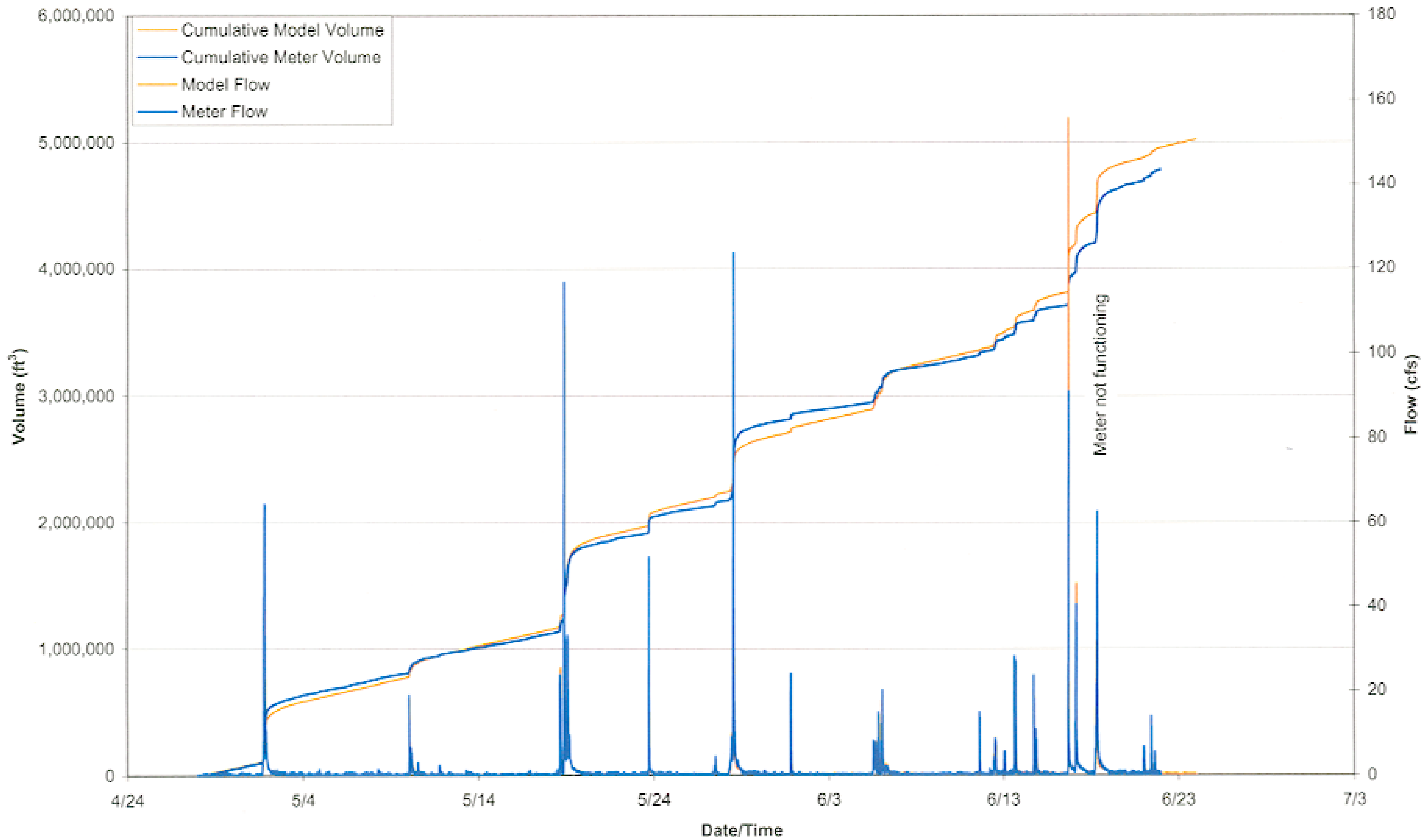
Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Meter is on a wet weather pipe and is therefore not calibrated.
Volume (ft^3)
4,500,000
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Flow (cfs)
250
200
150
100
50
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

Meter SO-156
Hydraulic Gradeline



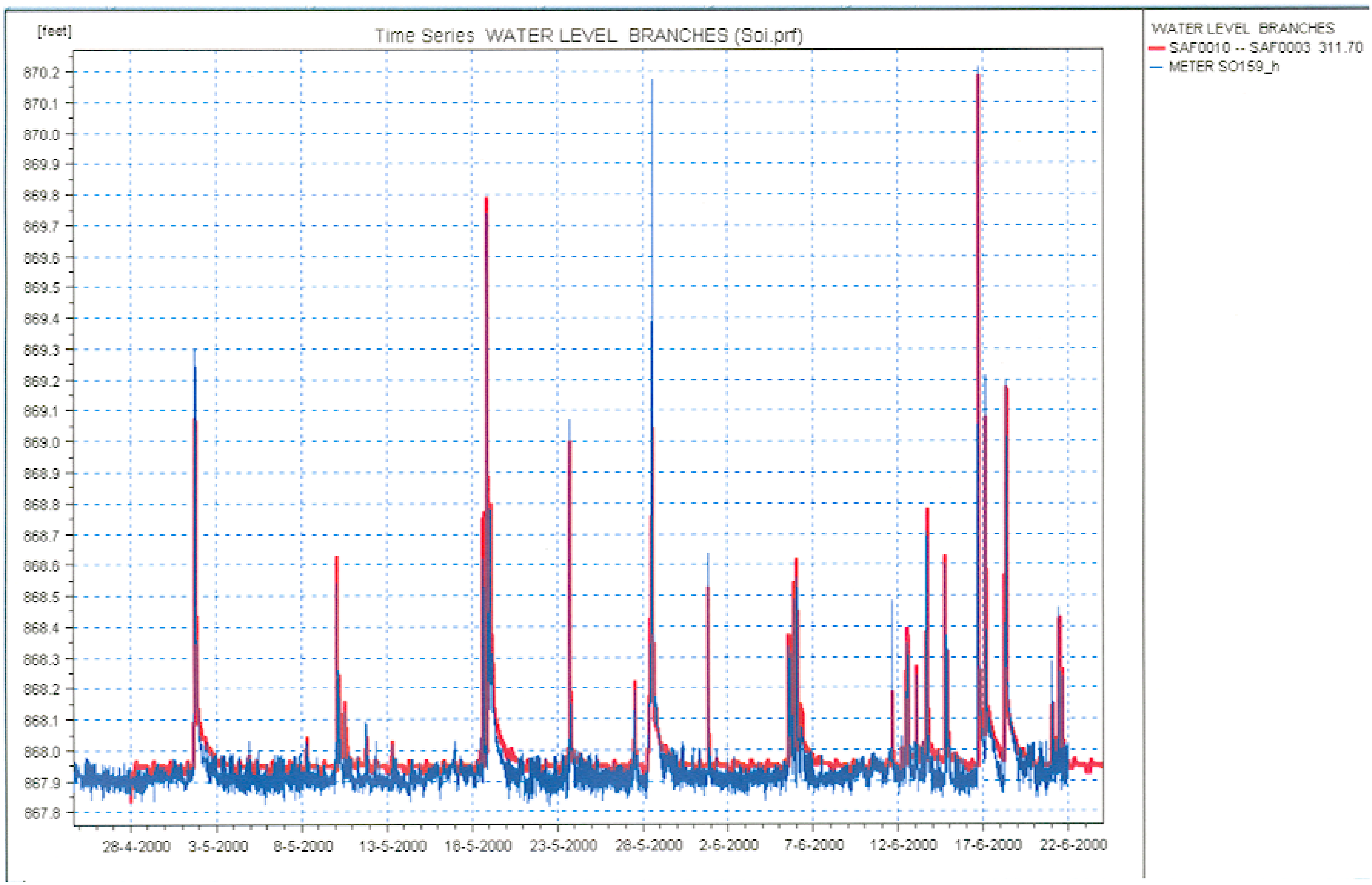

Meter SO-159
Meter vs. Modeled Storms
Modeled volume (MG)
Meter volume (MG)
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Wet Weather Period
Dry Weather Period

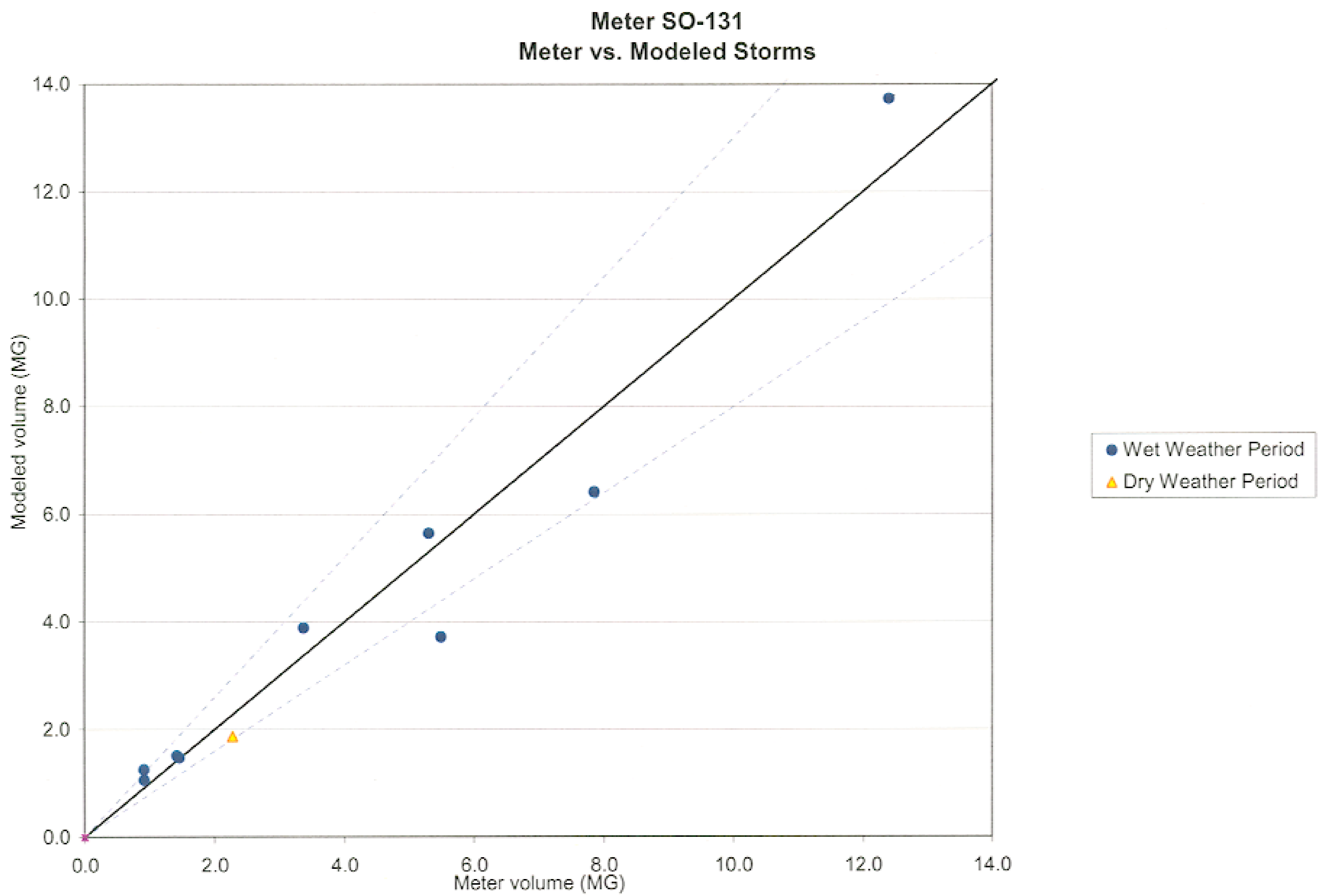
SO-159



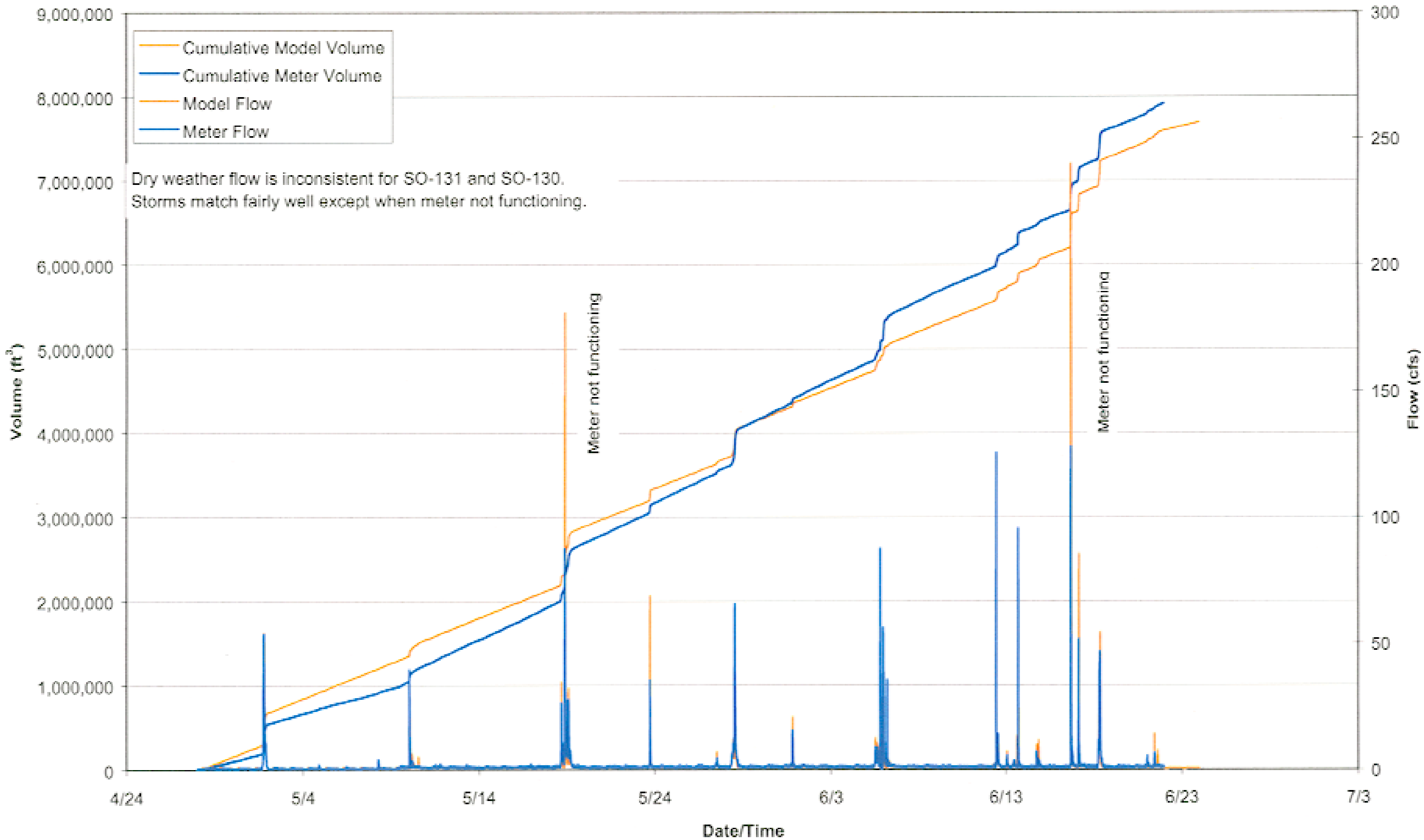
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
Volume (ft3)
180
160
140
120
100
80
60
40
20
0
Flow (cfs)
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time
Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Meter not functioning

Meter SO-159
Hydraulic Gradeline



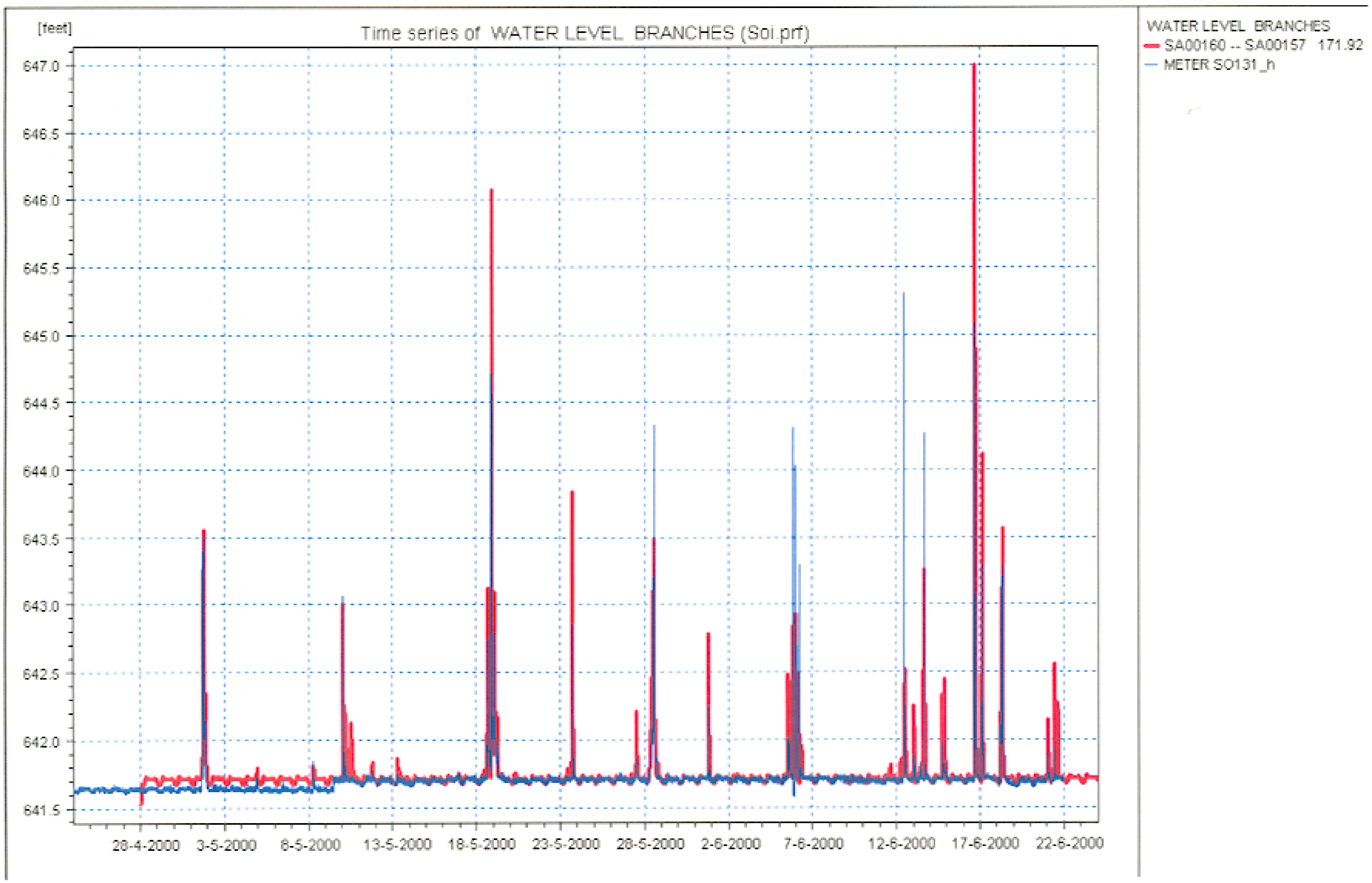

Meter SO-131
Meter vs. Modeled Storms
Modeled volume (MG)
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
Meter volume (MG)
Wet Weather Period
Dry Weather Period

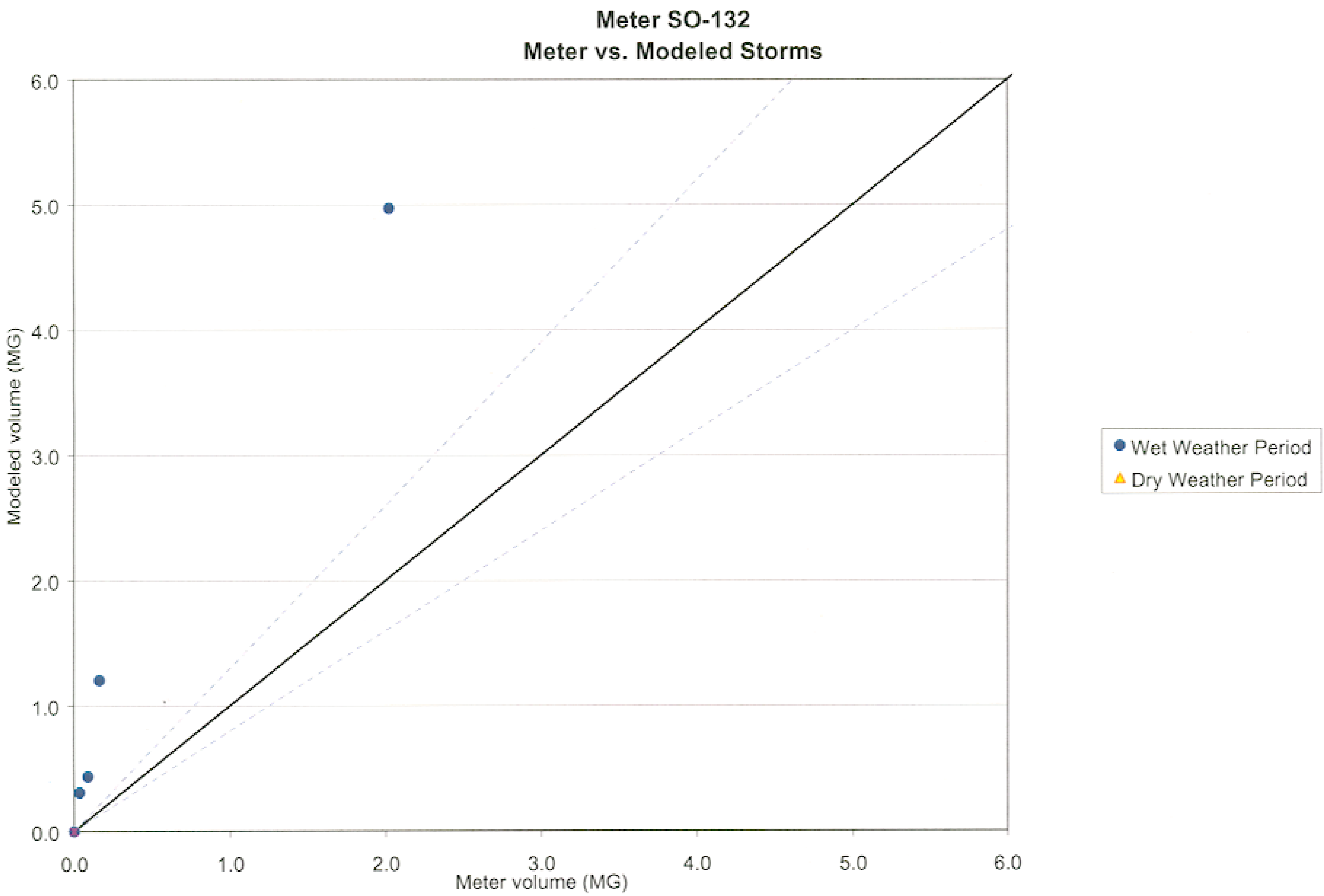
SO-131



9,000,000
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
Volume (ft³)
300
250
200
150
100
50
0
Flow (cfs)
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time
Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Dry weather flow is inconsistent for SO-131 and SO-130.
Storms match fairly well except when meter not functioning.
Meter not functioning
Meter not functioning

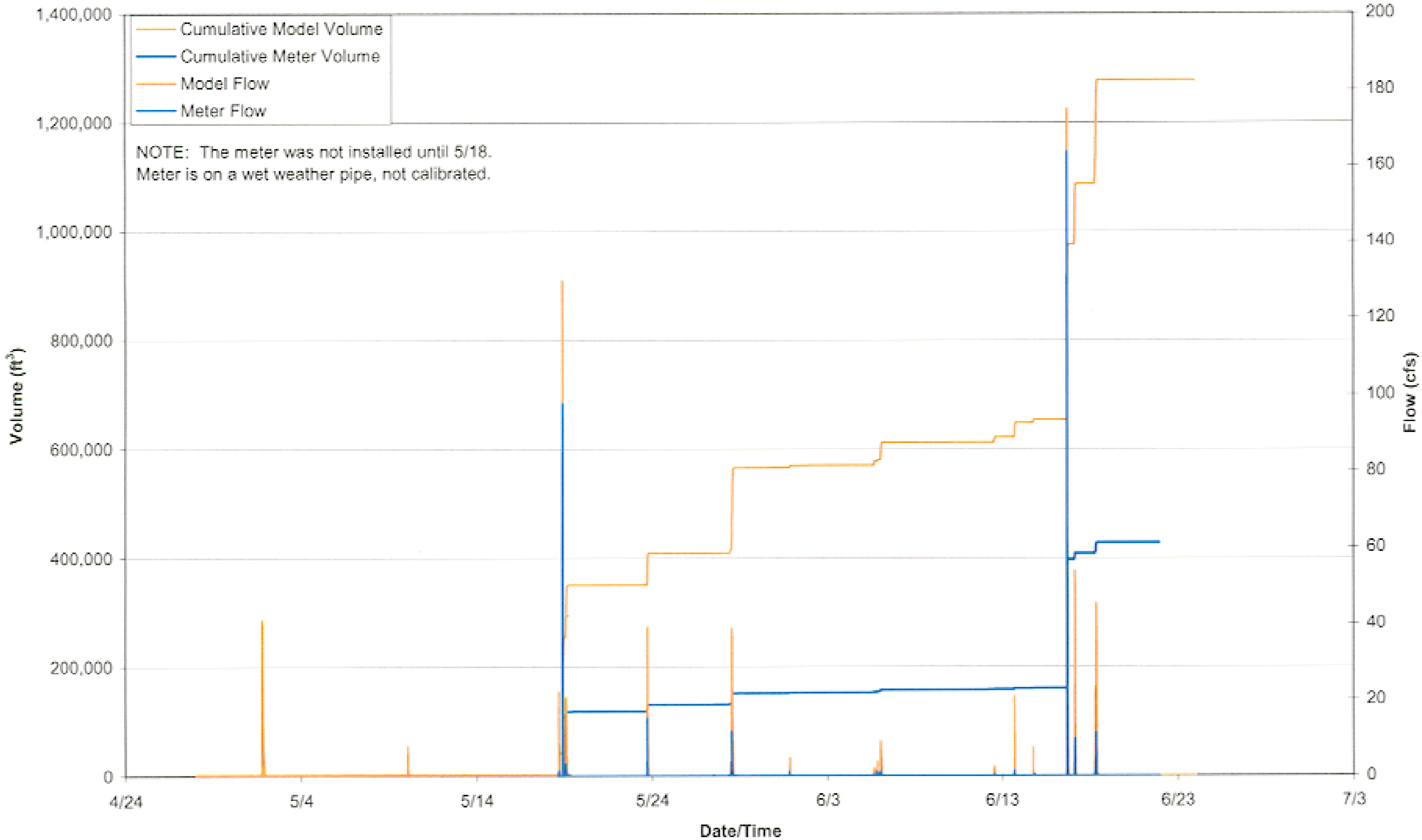
Meter SO-131
Hydraulic Gradeline





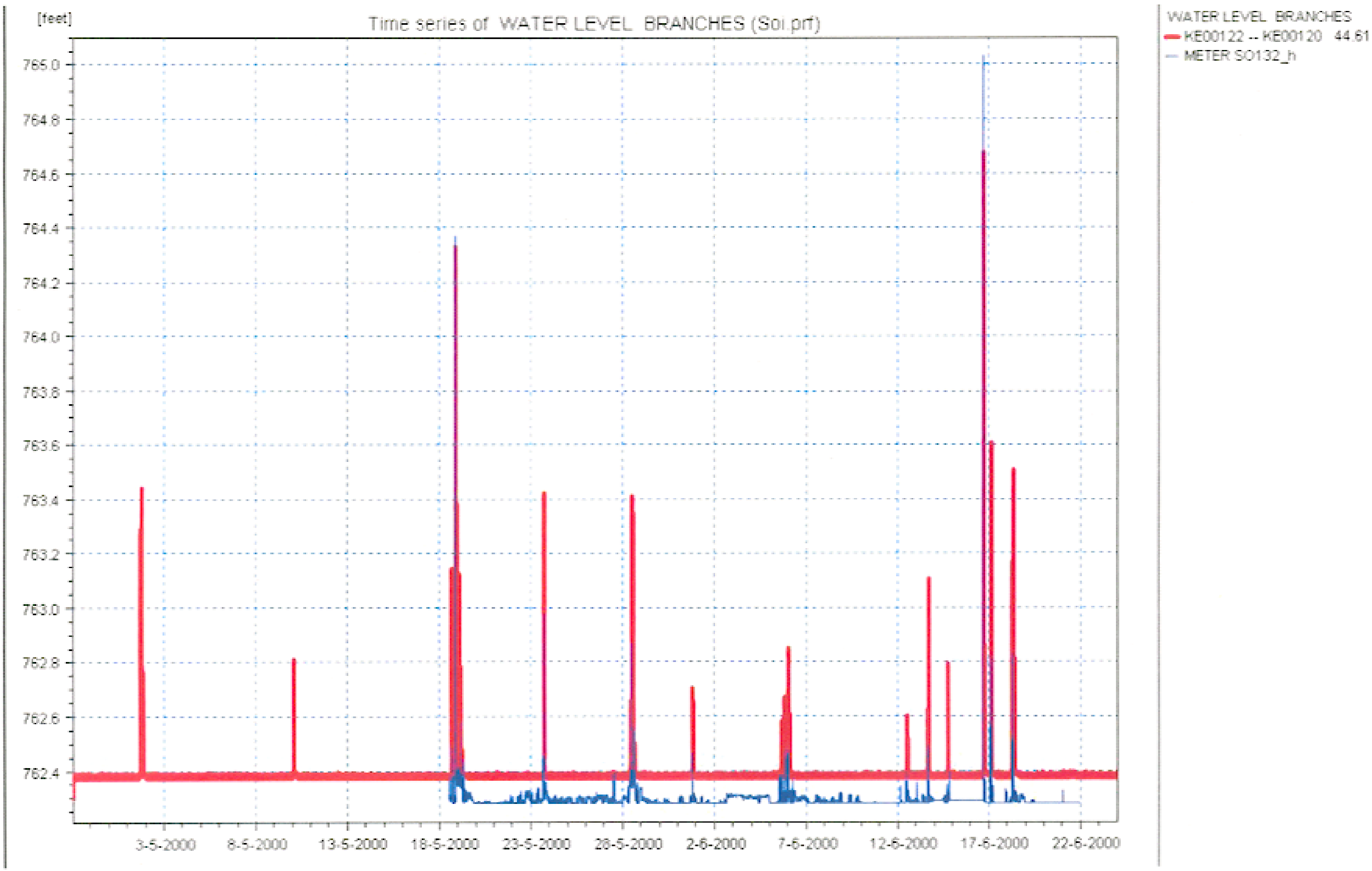
Note: Meter not installed until 5/18. No dry weather flow, wet weather pipe.

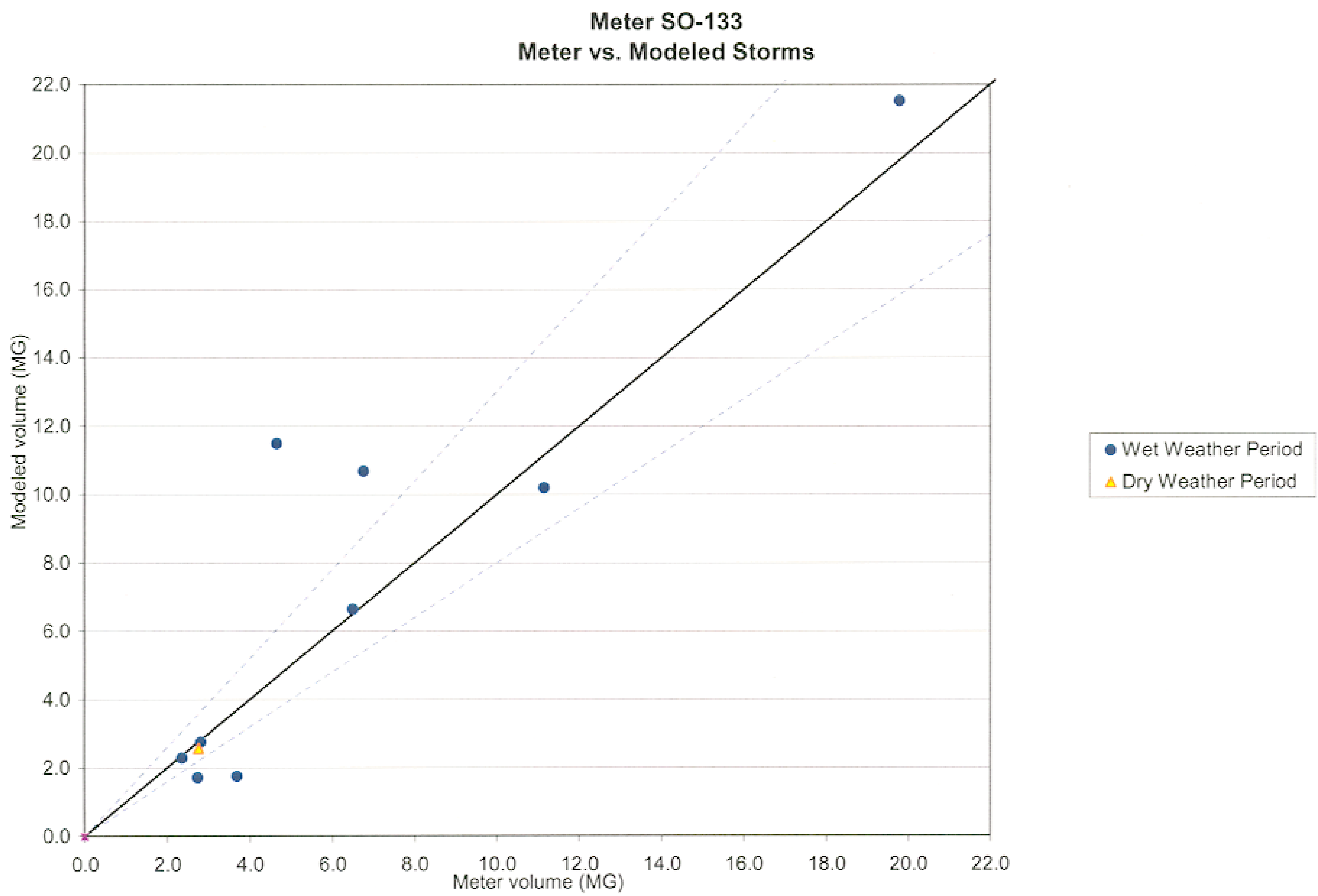
SO-132



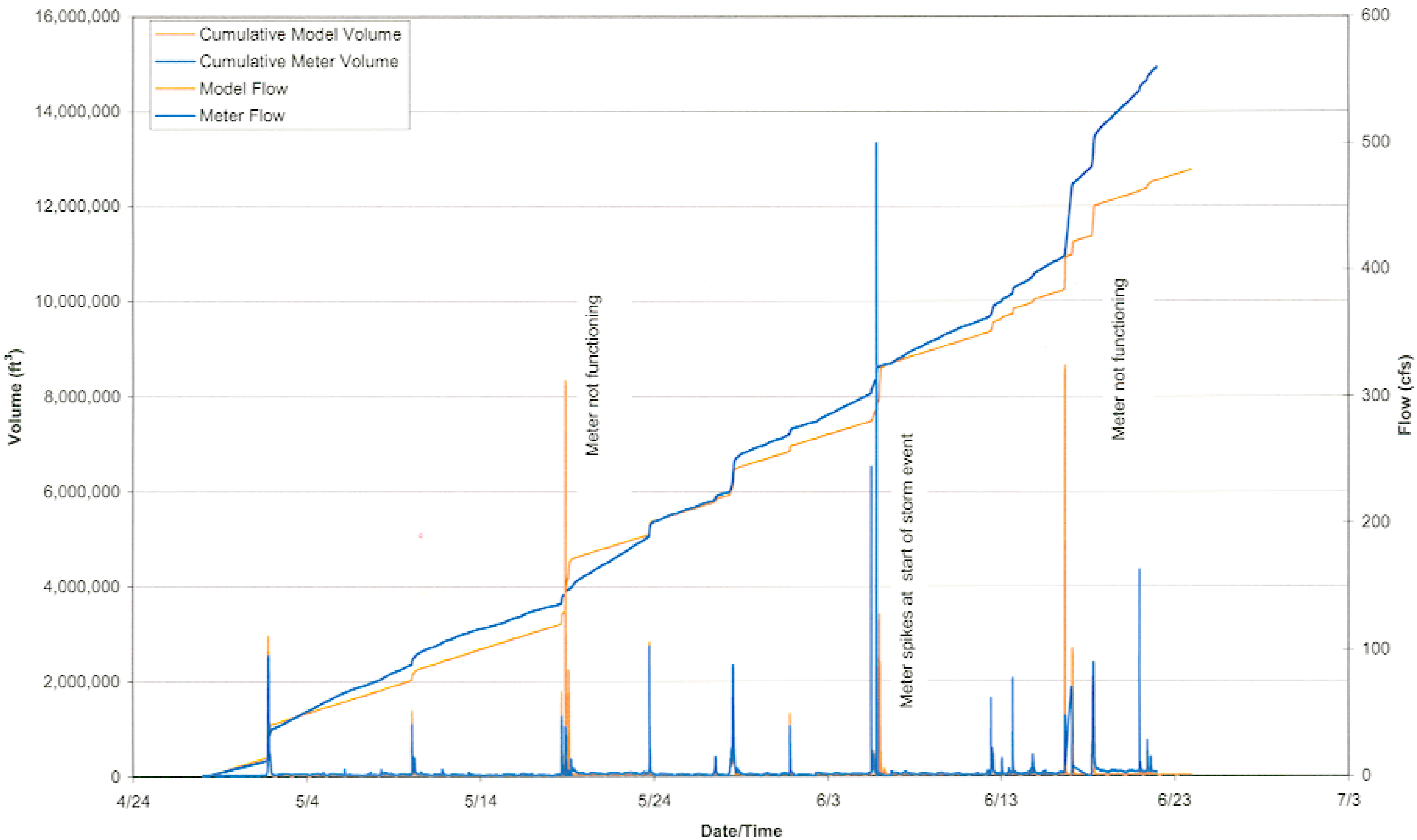
Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
NOTE: The meter was not installed until 5/18.
Meter is on a wet weather pipe, not calibrated.
Volume (ft³)
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Flow (cfs)
200
180
160
140
120
100
80
60
40
20
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

Meter SO-132
Hydraulic Gradeline



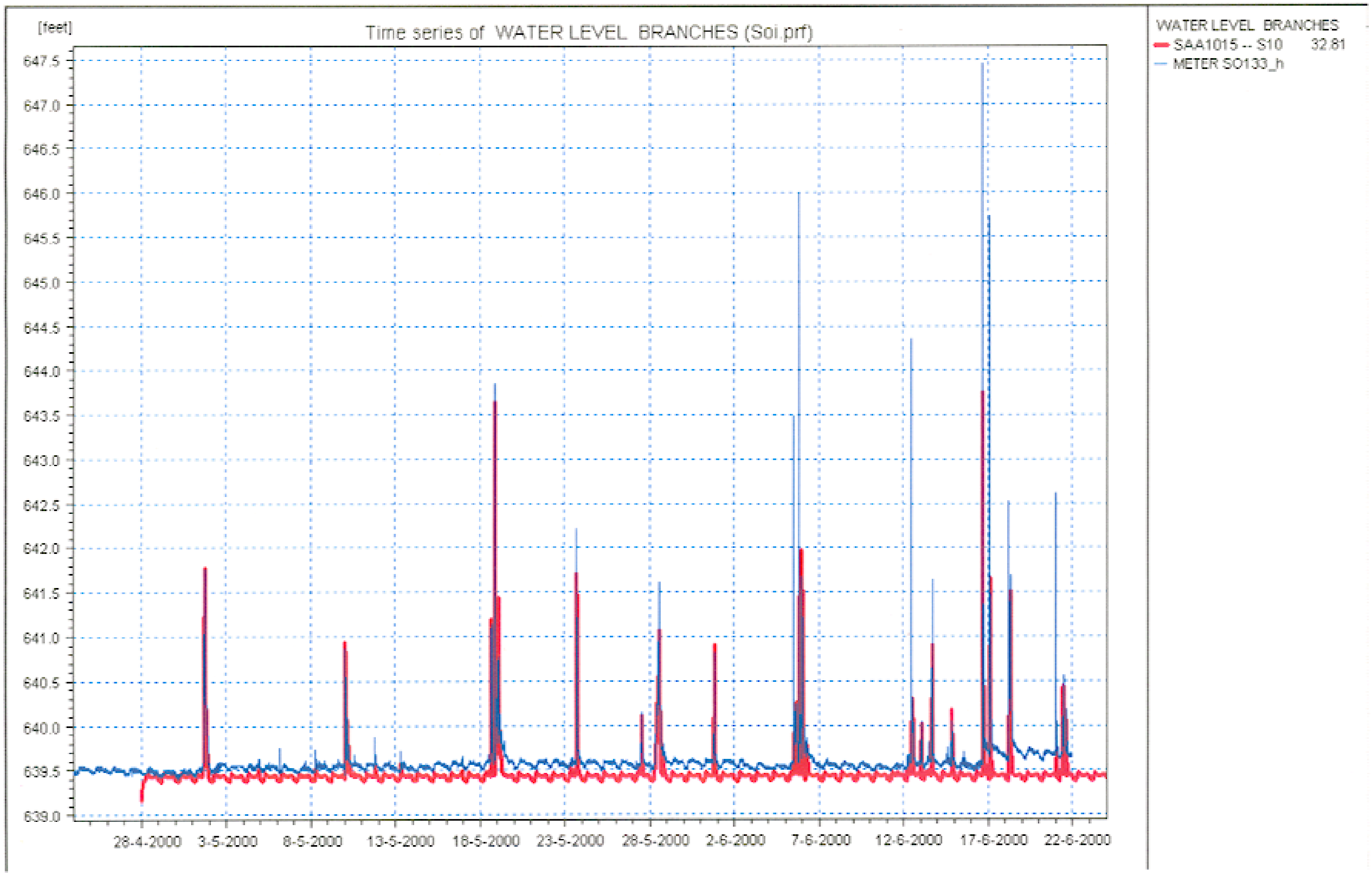

Meter SO-133
Meter vs. Modeled Storms
Modeled volume (MG)
Meter volume (MG)
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
22.0
Wet Weather Period
Dry Weather Period

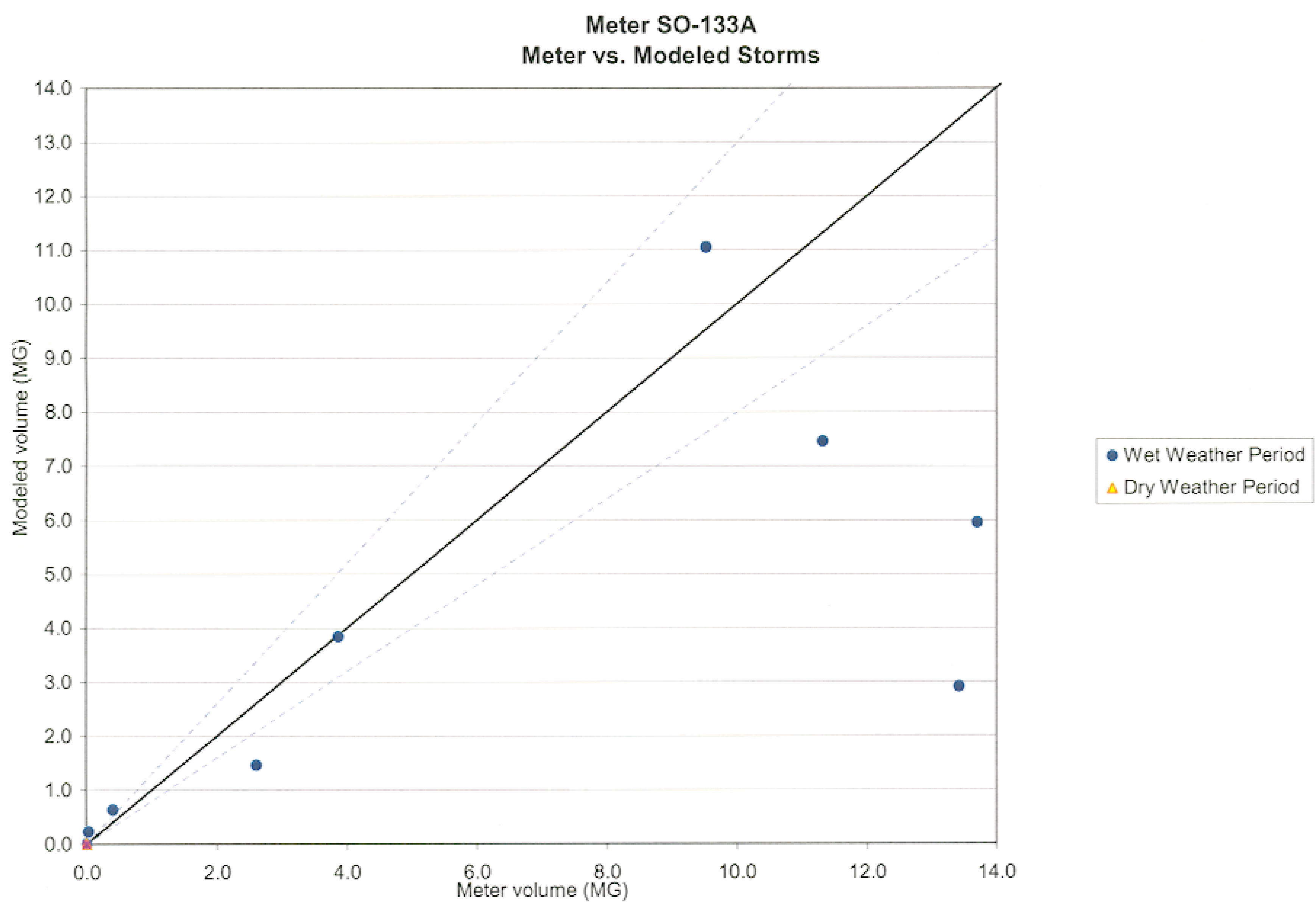
SO-133



Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Volume (ft³)
Flow (cfs)
Date/Time
16,000,000
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
600
500
400
300
200
100
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Meter not functioning
Meter spikes at start of storm event
Meter not functioning

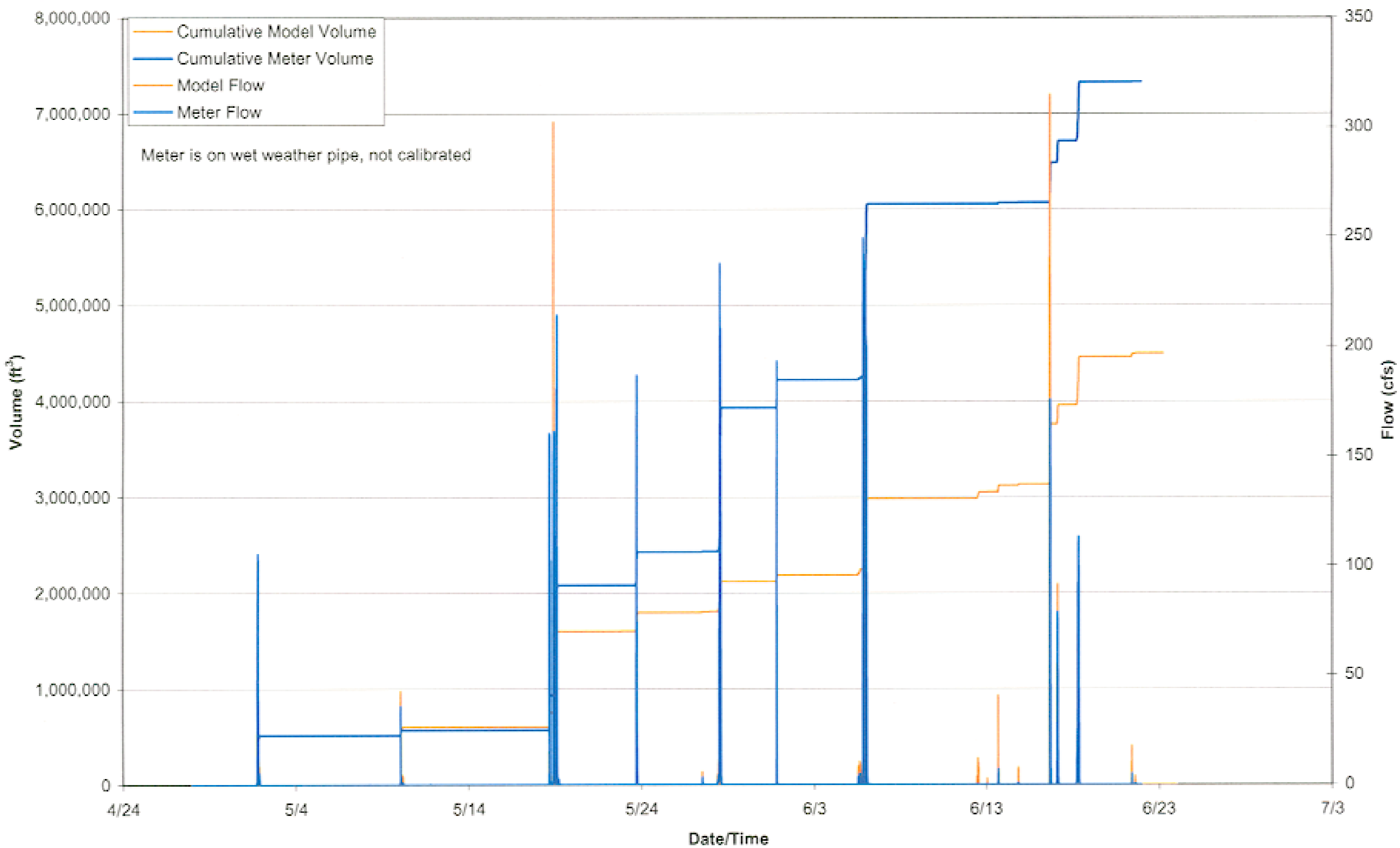
Meter SO-133
Hydraulic Gradeline





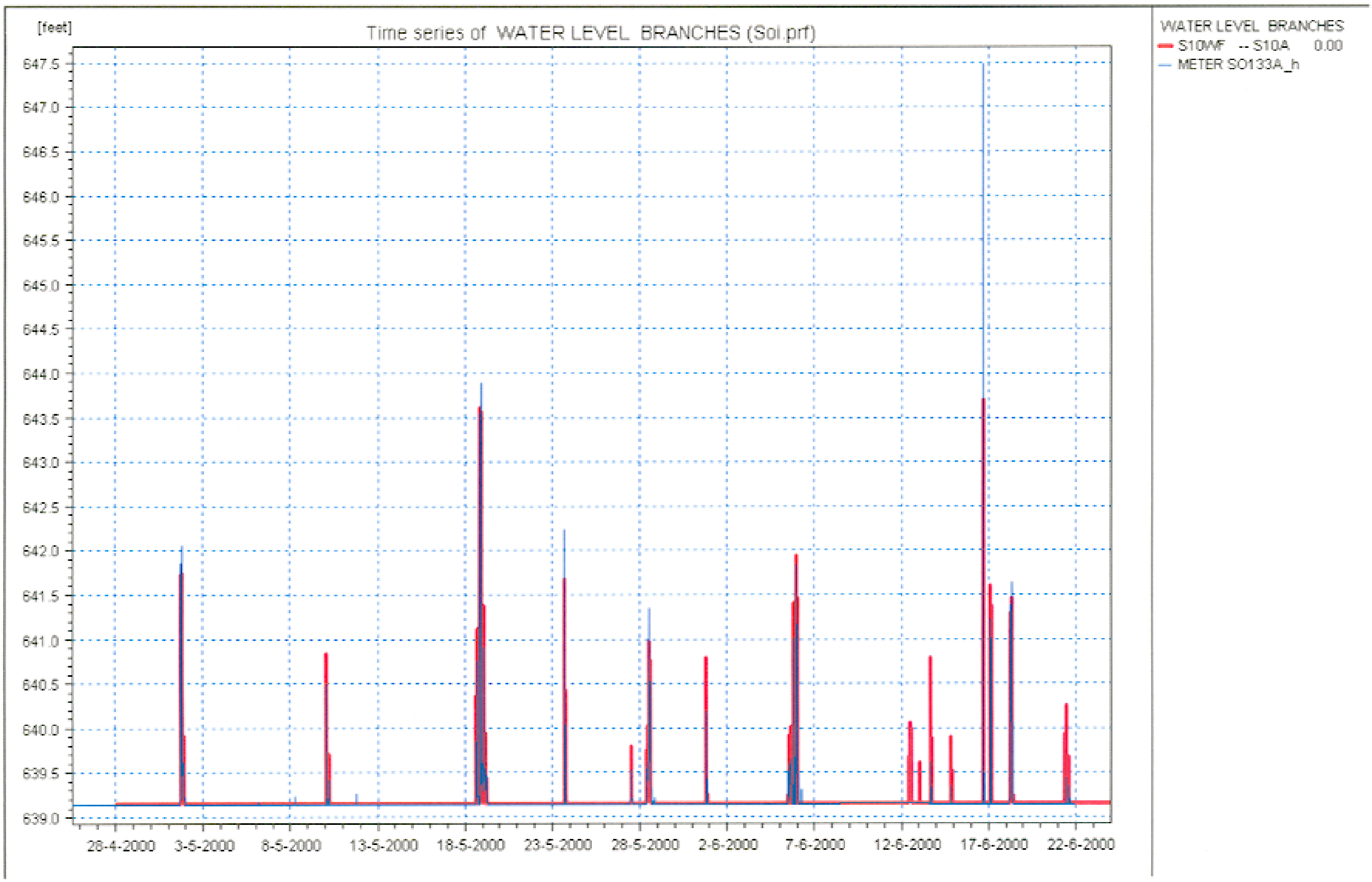
Meter SO-133A
Meter vs. Modeled Storms
Modeled volume (MG)
Meter volume (MG)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
Wet Weather Period
Dry Weather Period

SO-133A

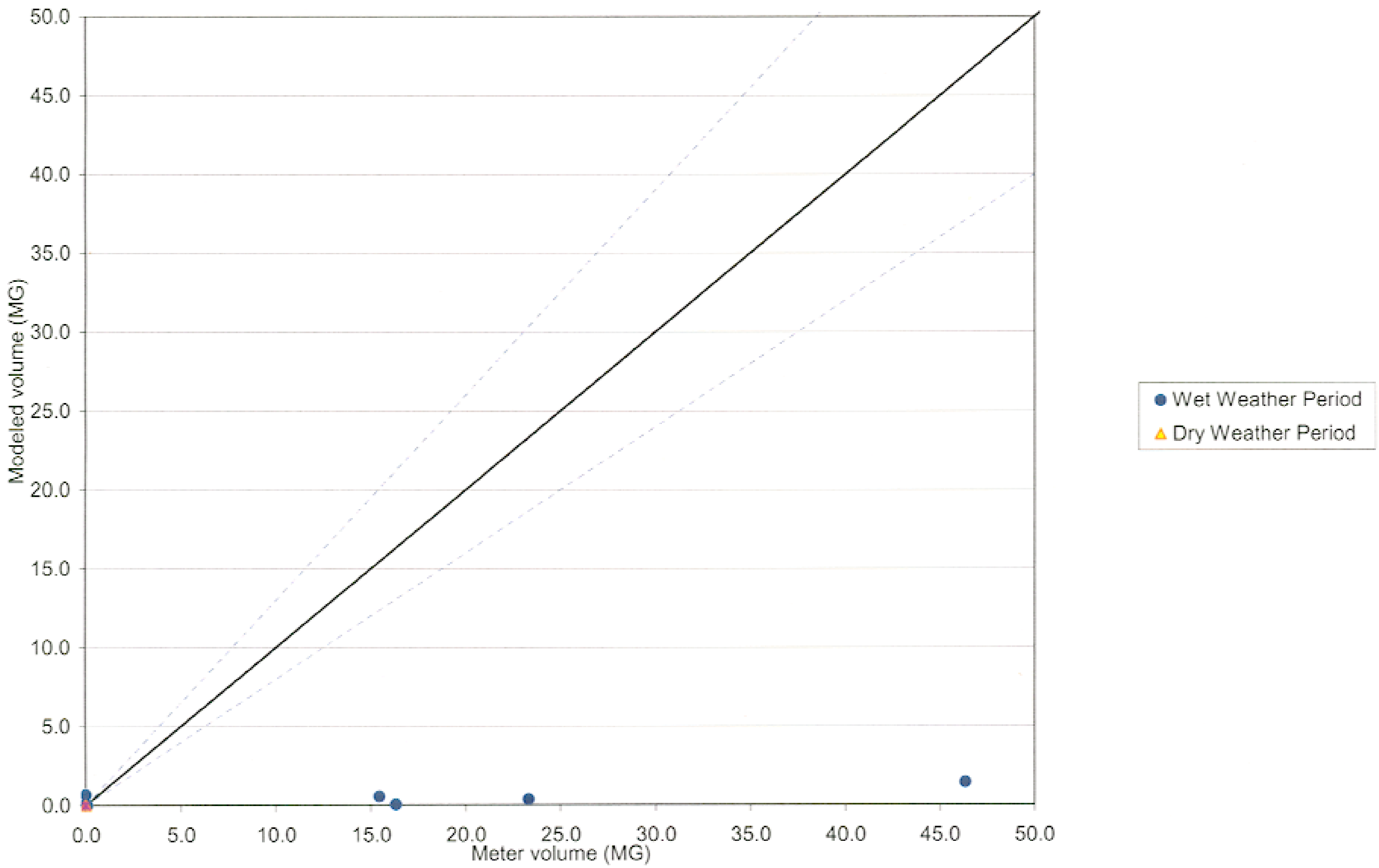


Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Meter is on wet weather pipe, not calibrated
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
Volume (ft^3)
350
300
250
200
150
100
50
0
Flow (cfs)
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

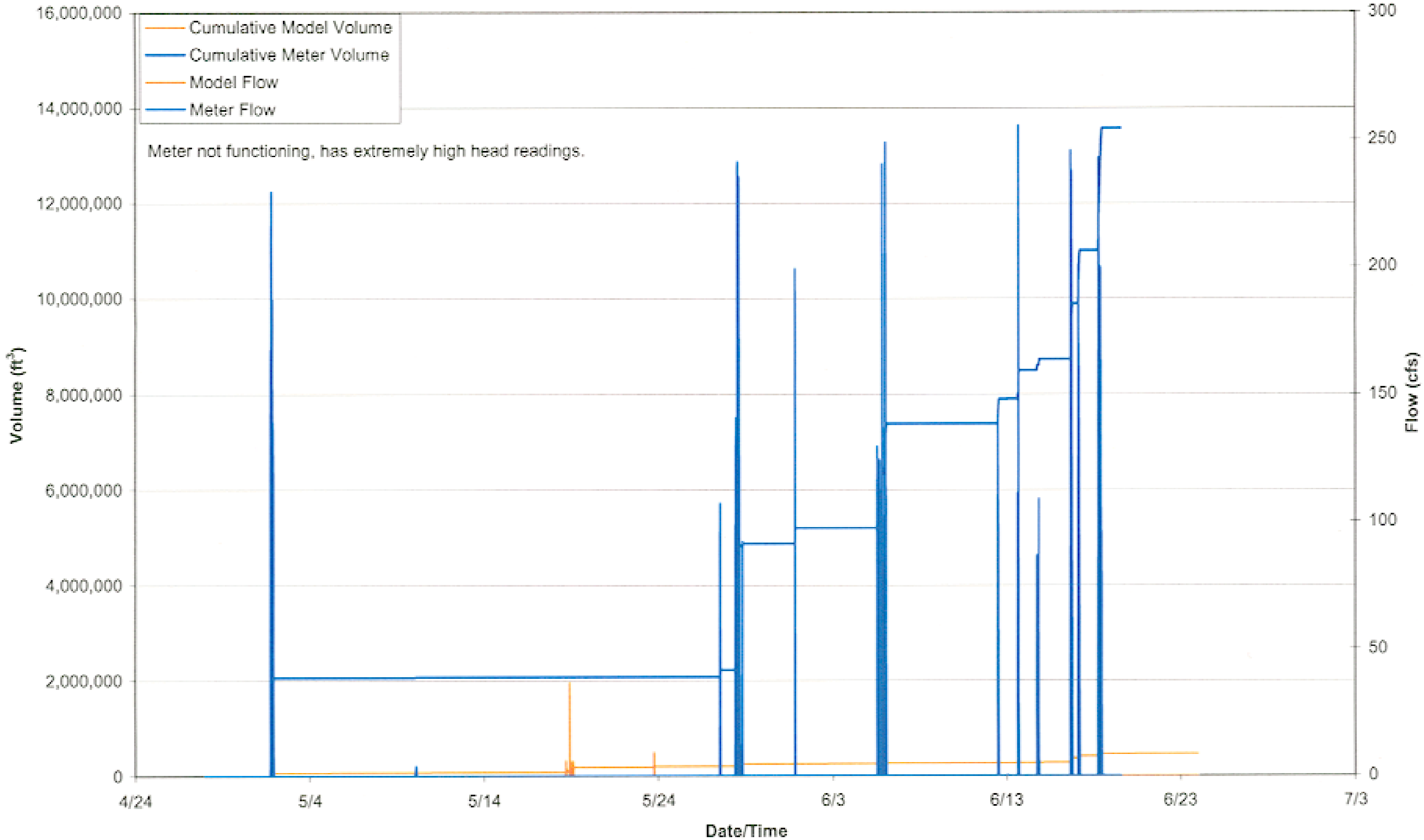
Meter SO-133A
Hydraulic Gradeline



Meter SO-134
Meter vs. Modeled Storms

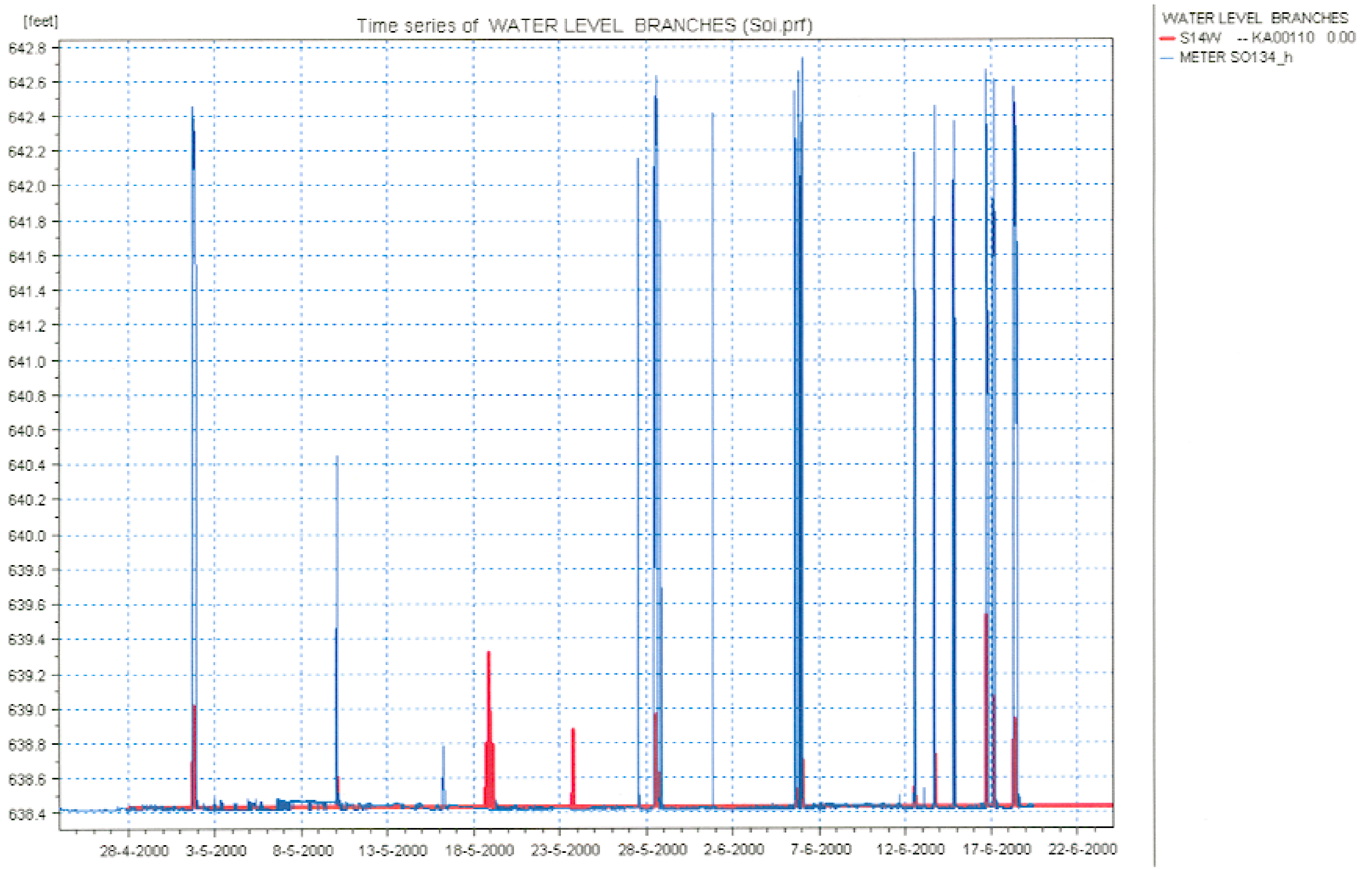


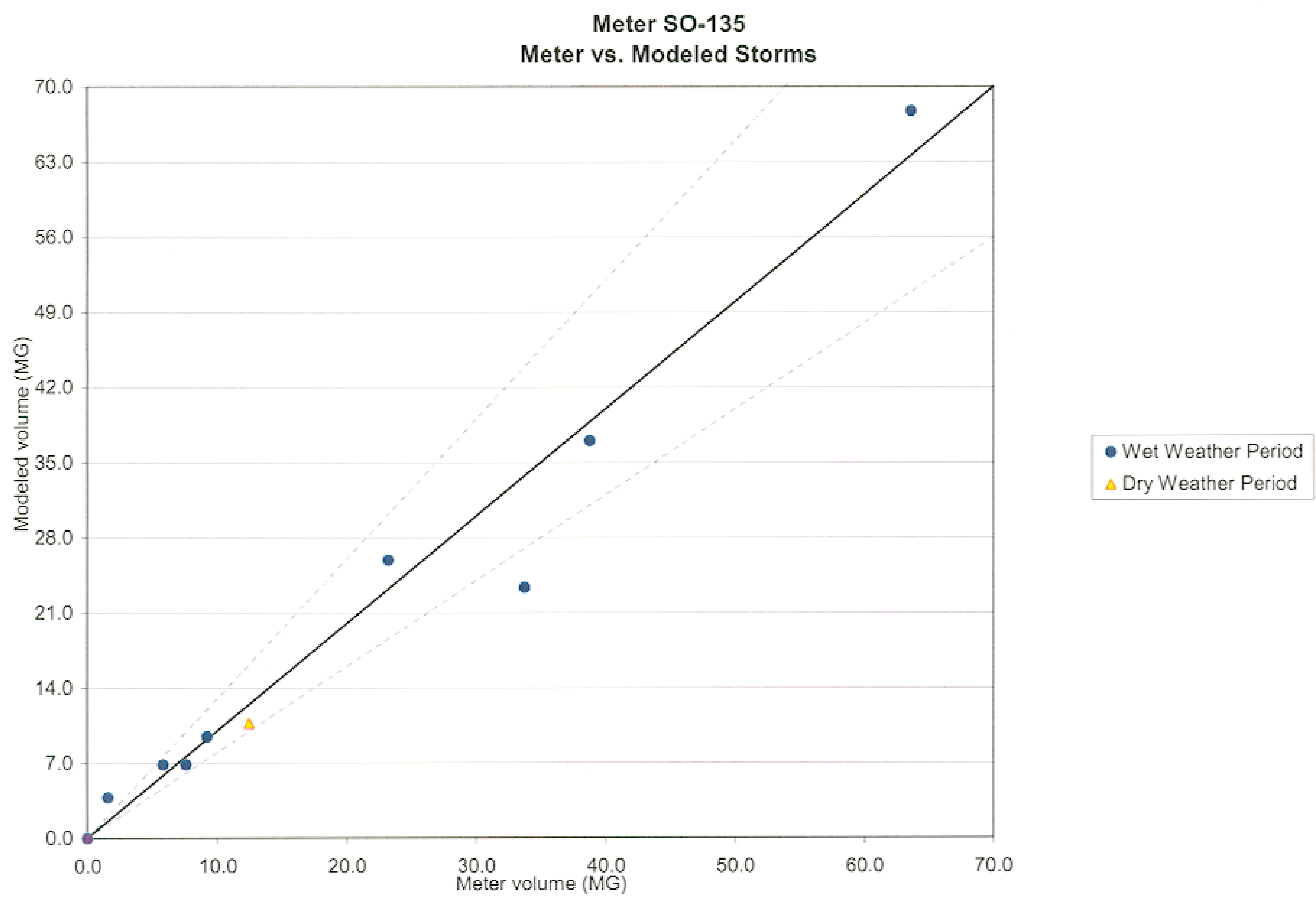
SO-134



16,000,000
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
Volume (ft³)
300
250
200
150
100
50
0
Flow (cfs)
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time
Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Meter not functioning, has extremely high head readings.

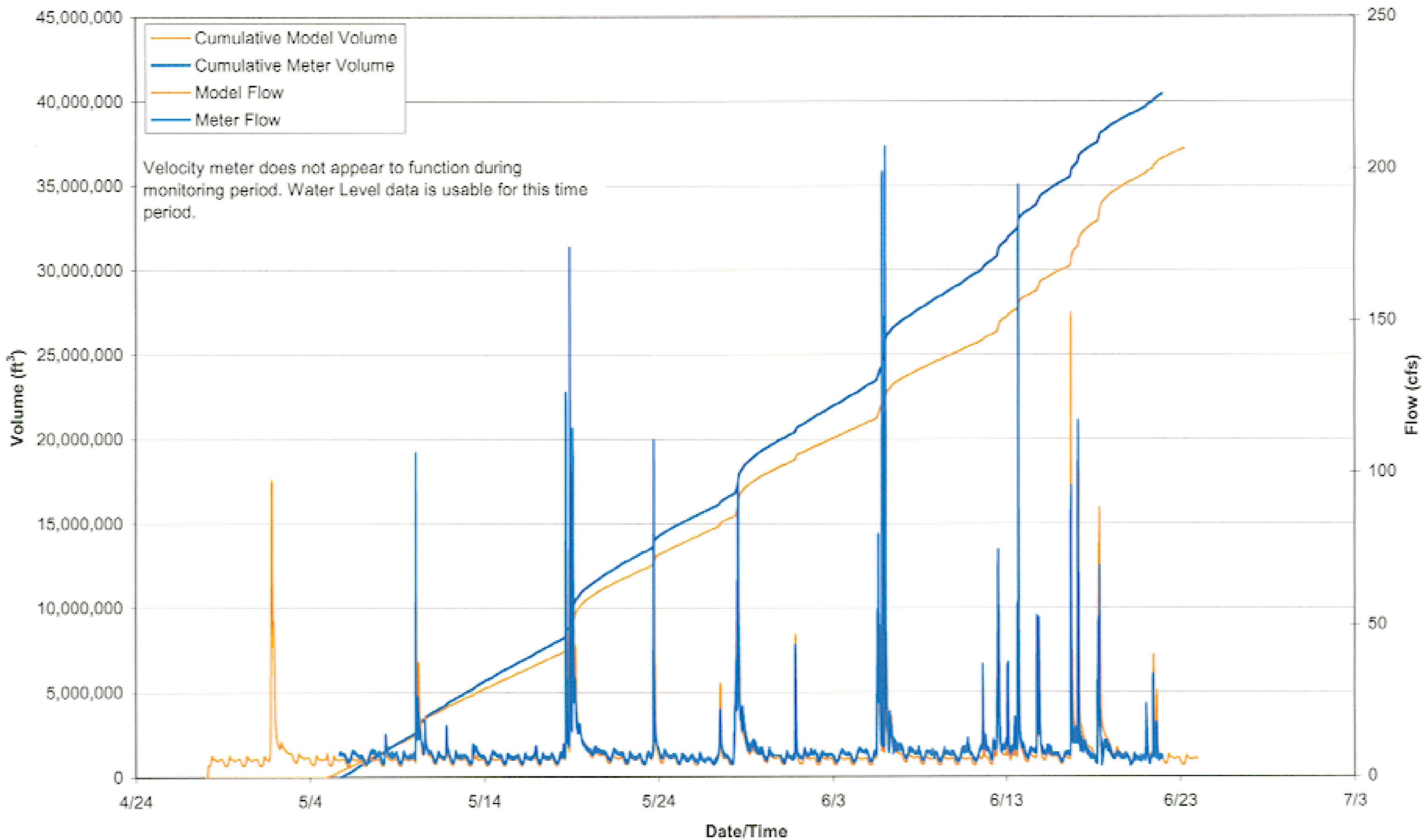
Meter SO-134
Hydraulic Gradeline





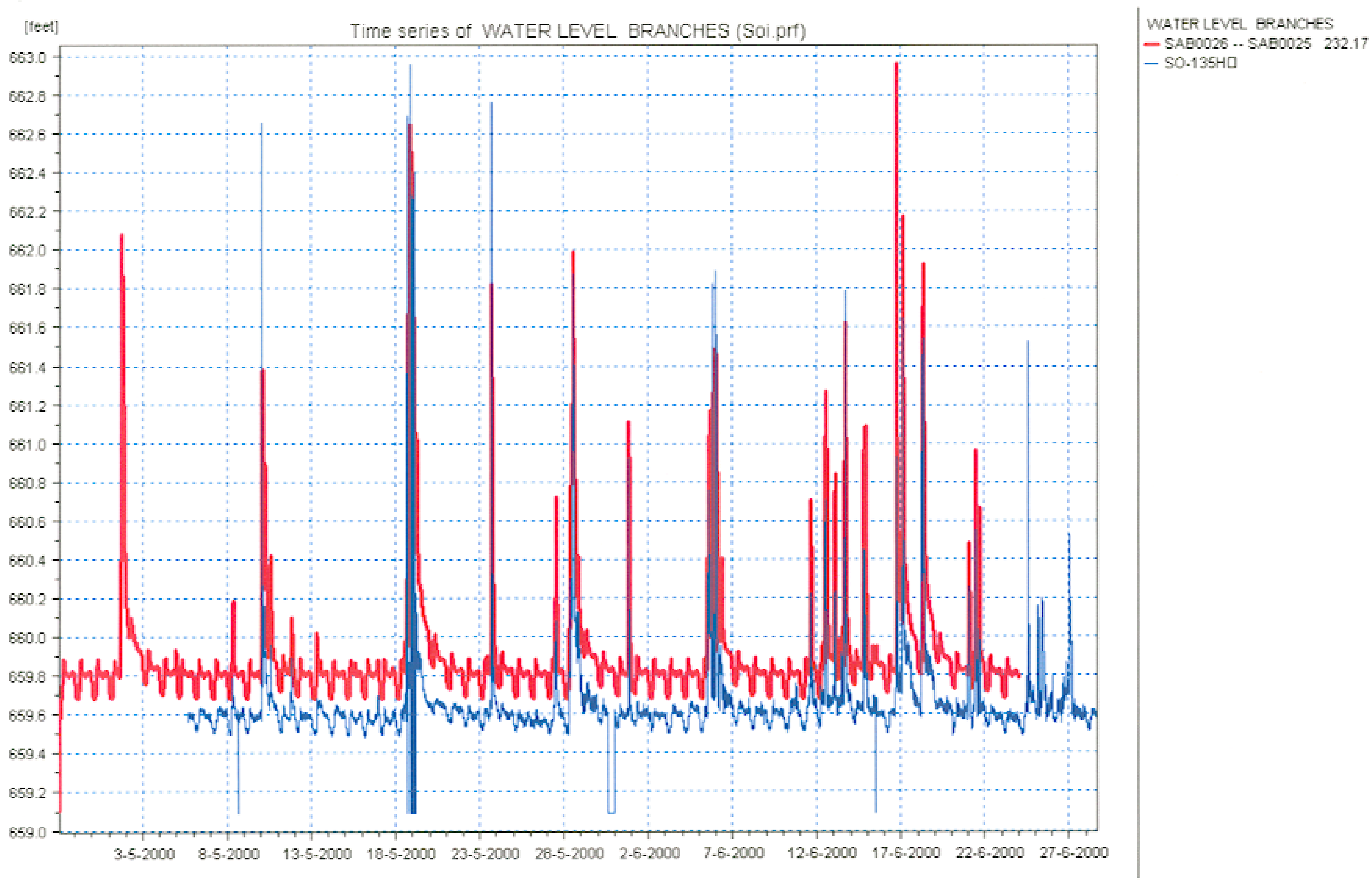
Meter SO-135
Meter vs. Modeled Storms
Modeled volume (MG)
70.0
63.0
56.0
49.0
42.0
35.0
28.0
21.0
14.0
7.0
0.0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
Meter volume (MG)
Wet Weather Period
Dry Weather Period

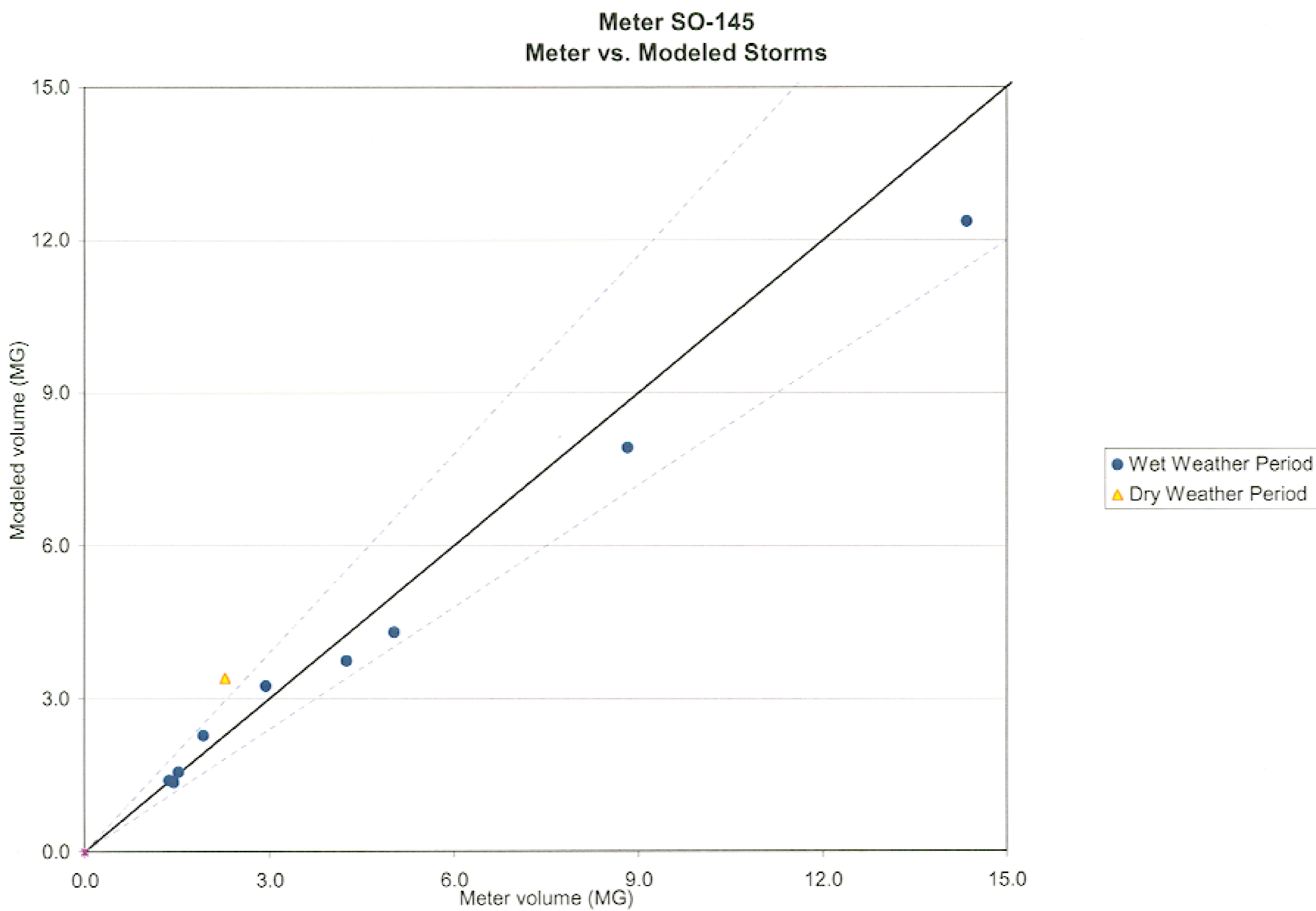
SO-135



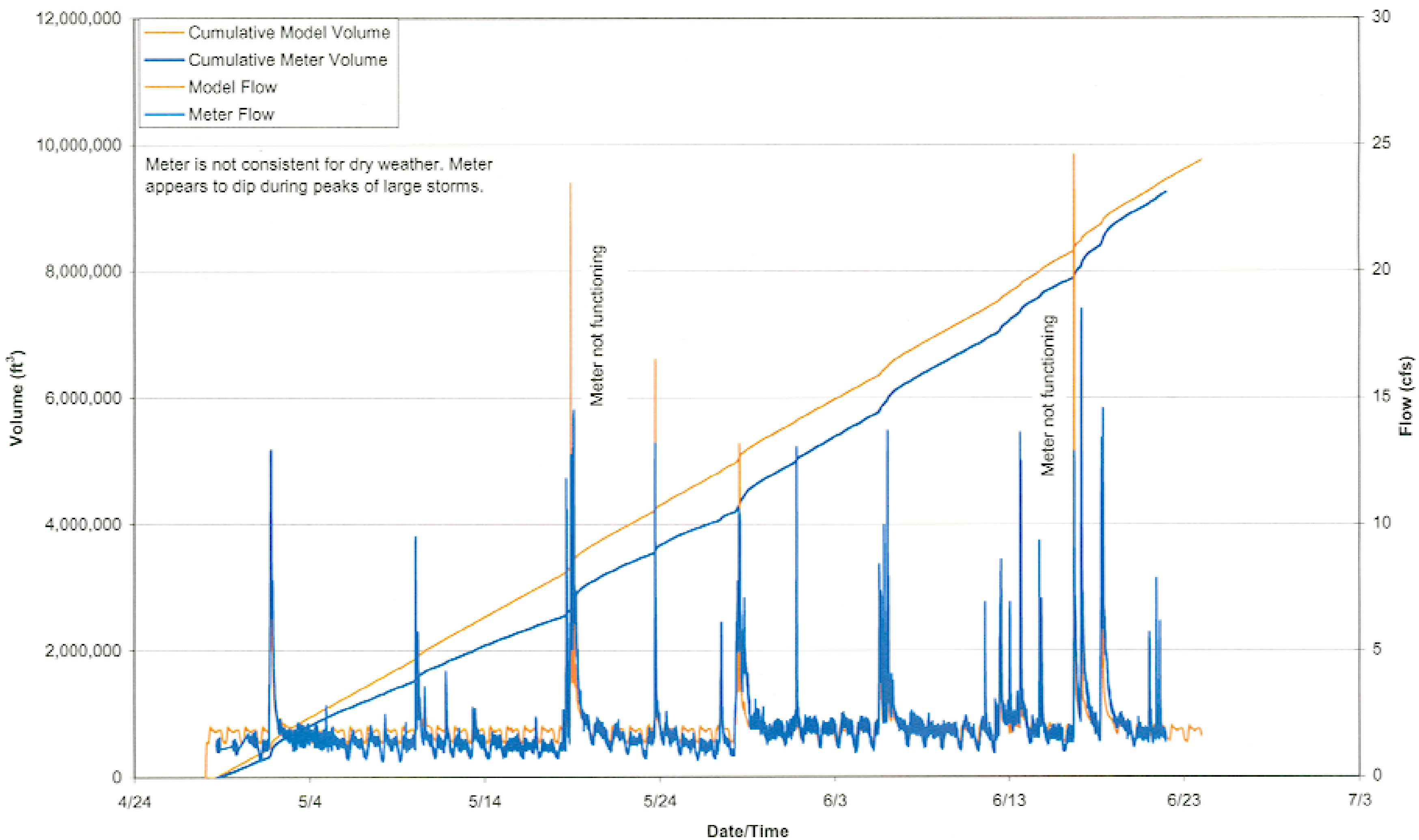
Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Velocity meter does not appear to function during monitoring period. Water Level data is usable for this time period.
Volume (ft³)
45,000,000
40,000,000
35,000,000
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
Flow (cfs)
250
200
150
100
50
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

Meter SO-135
Hydraulic Gradeline



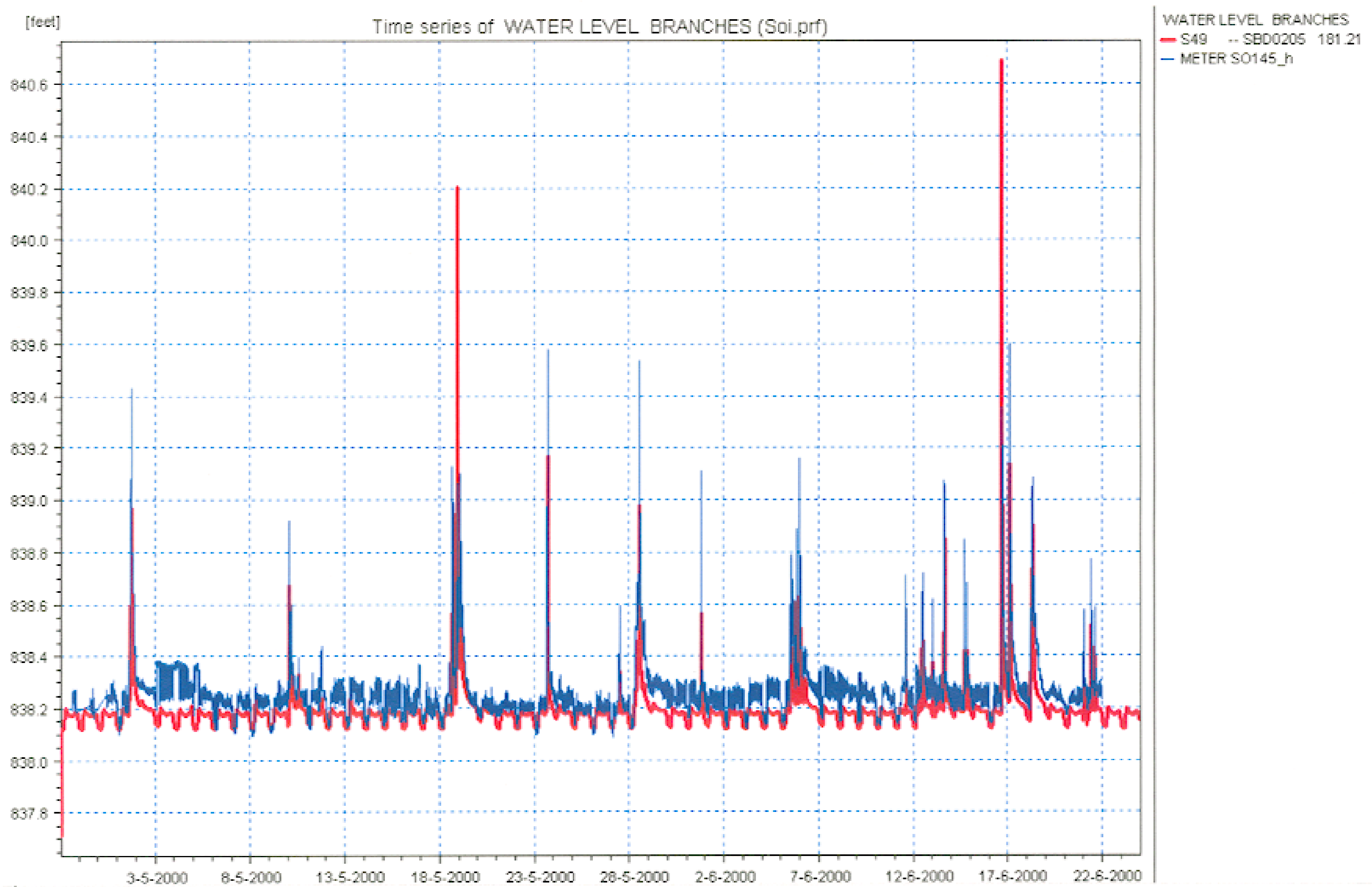

Meter SO-145
Meter vs. Modeled Storms
15.0
12.0
9.0
6.0
3.0
0.0
Modeled volume (MG)
0.0
3.0
6.0
9.0
12.0
15.0
Meter volume (MG)
Wet Weather Period
Dry Weather Period

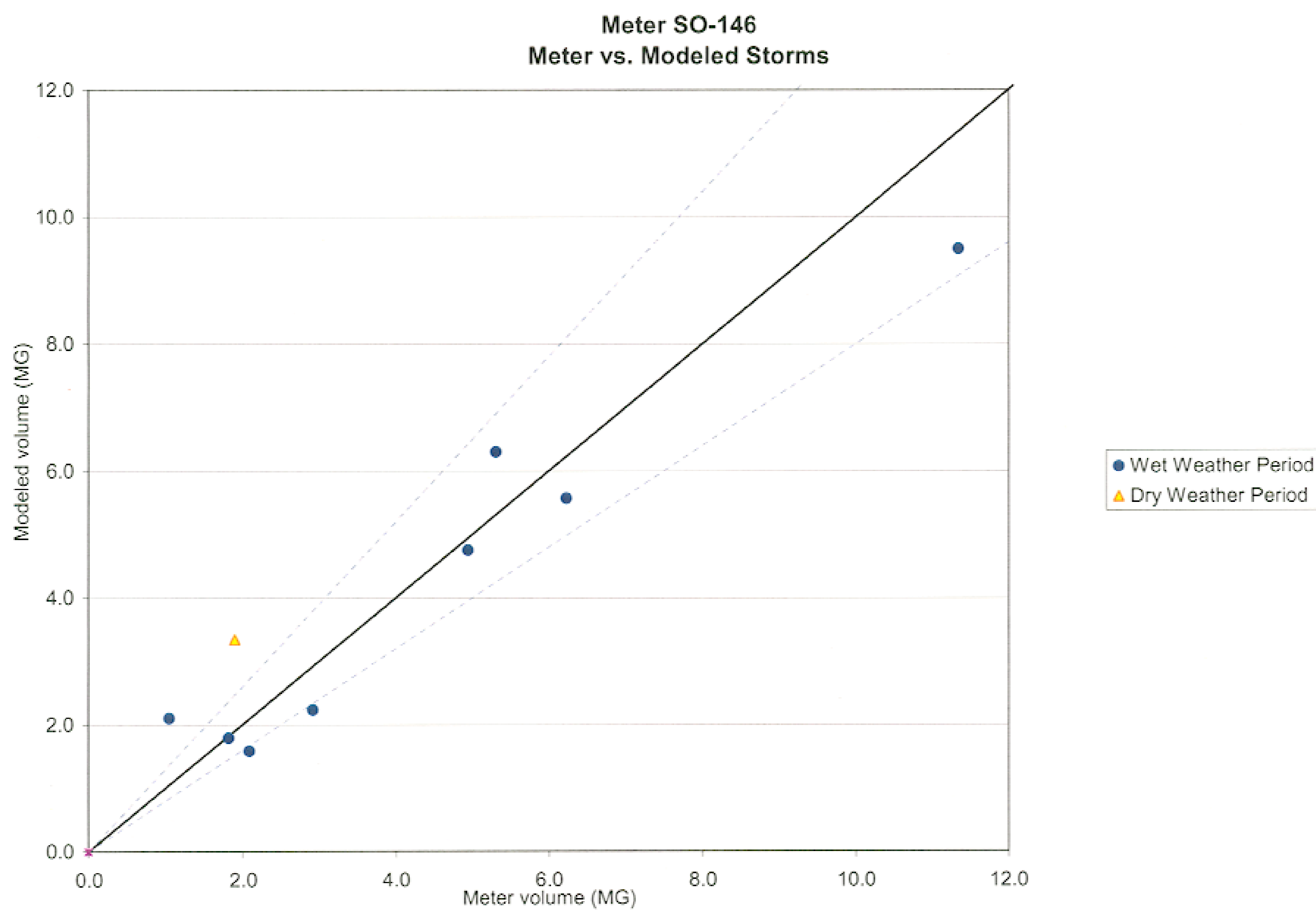
SO-145



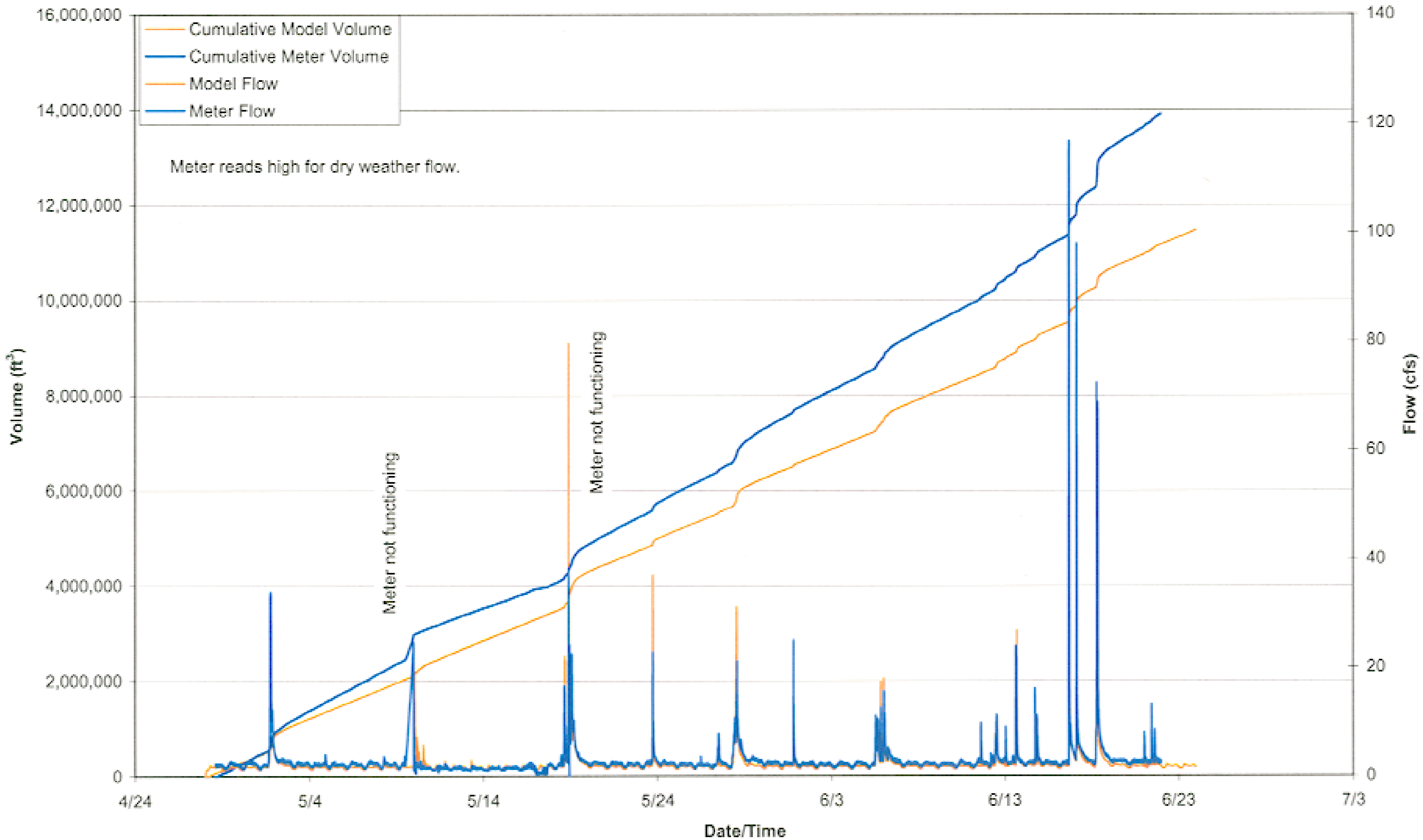
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
Volume (ft3)
30
25
20
15
10
5
0
Flow (cfs)
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time
Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Meter is not consistent for dry weather. Meter appears to dip during peaks of large storms.
Meter not functioning
Meter not functioning

Meter SO-145
Hydraulic Gradeline



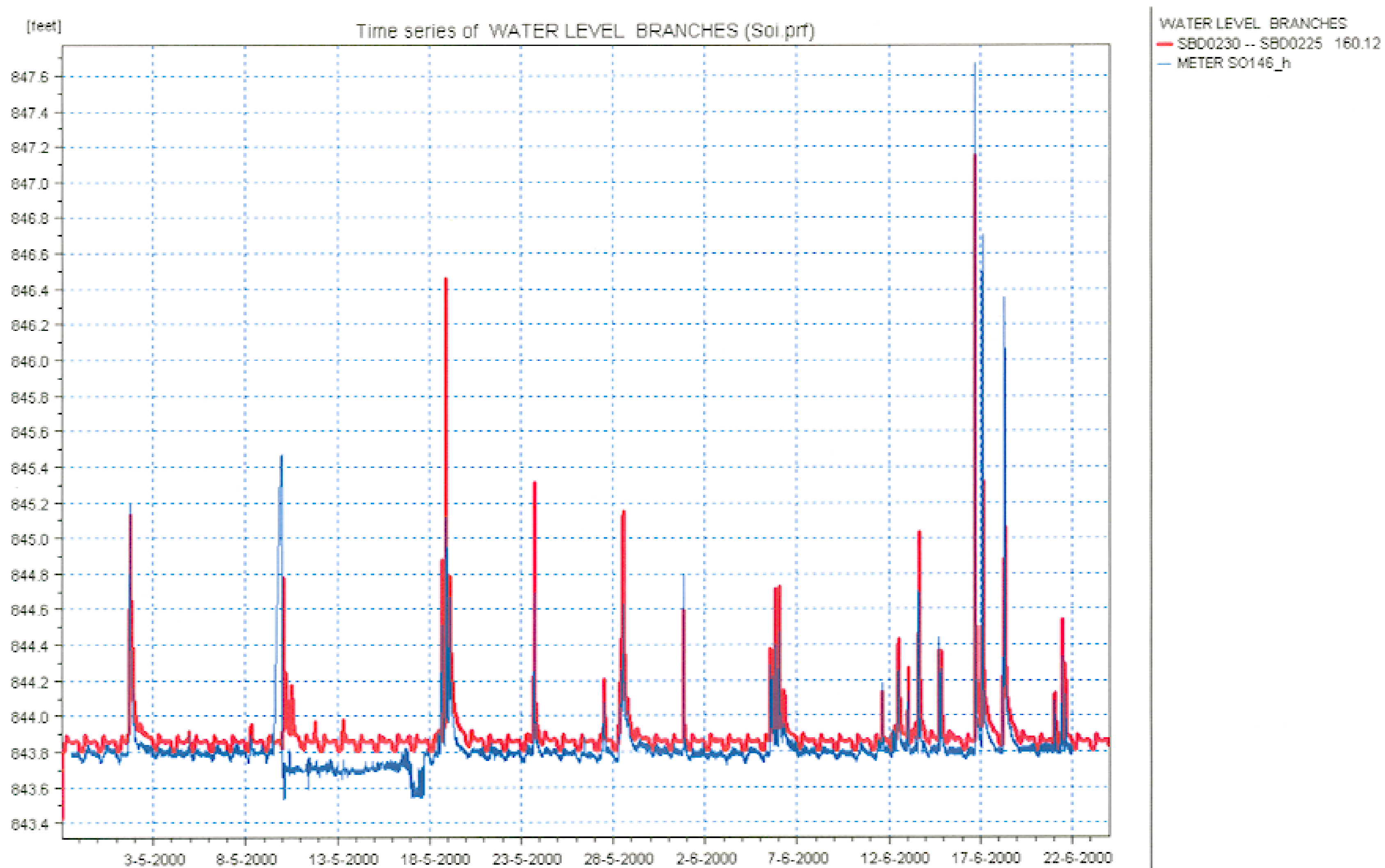

Meter SO-146
Meter vs. Modeled Storms
Modeled volume (MG)
Meter volume (MG)
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Wet Weather Period
Dry Weather Period

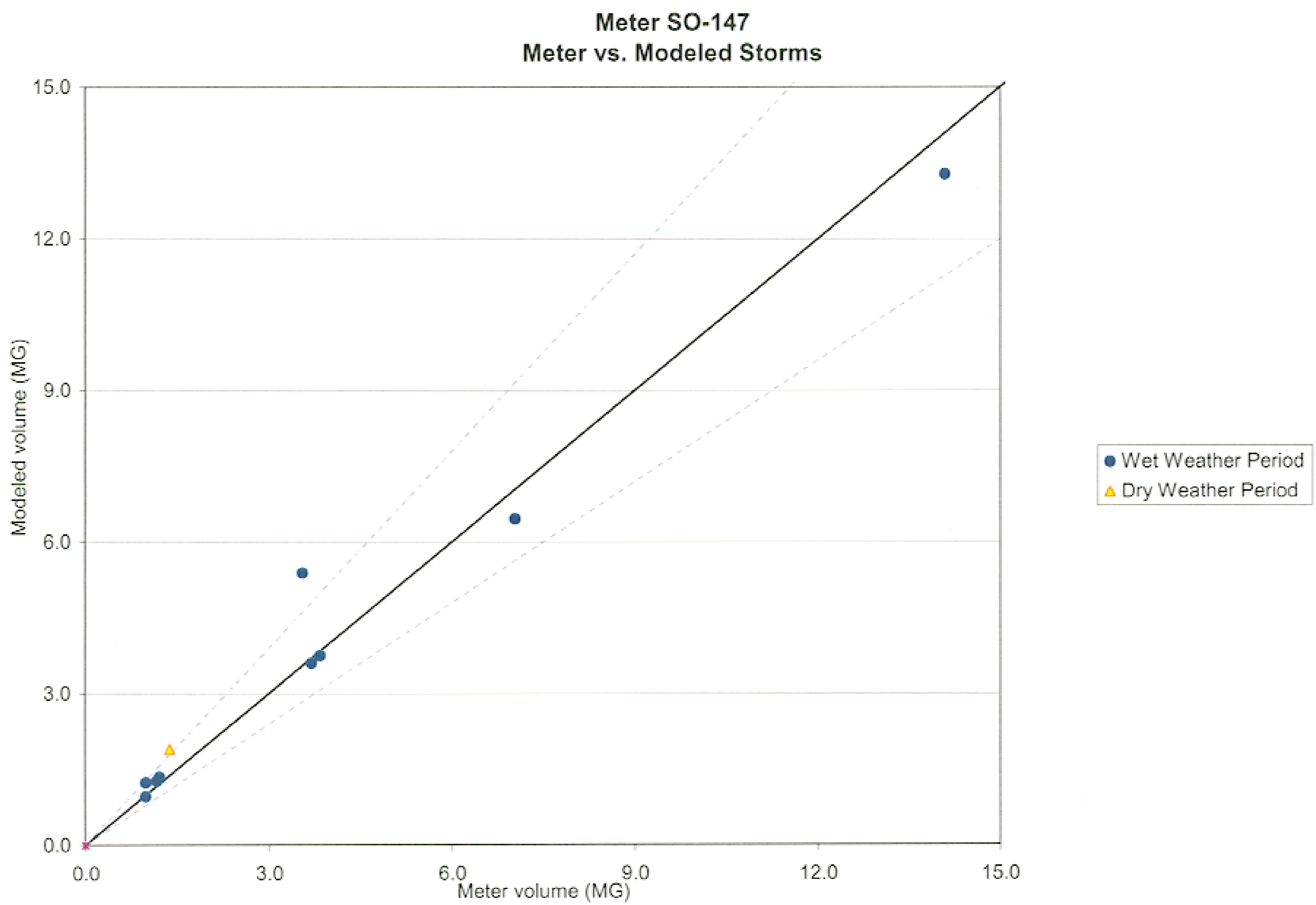
SO-146



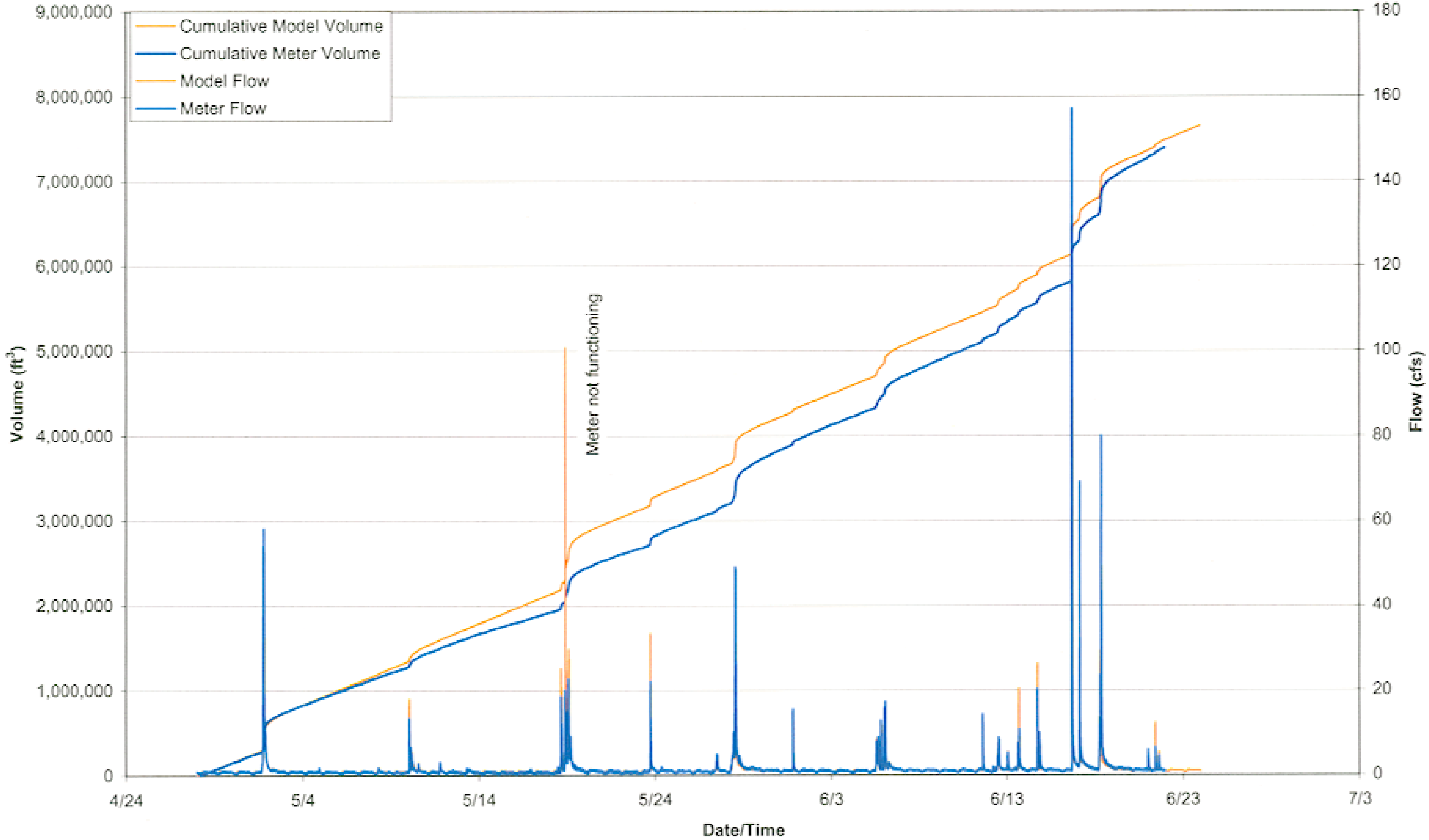
Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Meter reads high for dry weather flow.
Meter not functioning
Meter not functioning
Volume (ft³)
16,000,000
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
Flow (cfs)
140
120
100
80
60
40
20
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

Meter SO-146
Hydraulic Gradeline



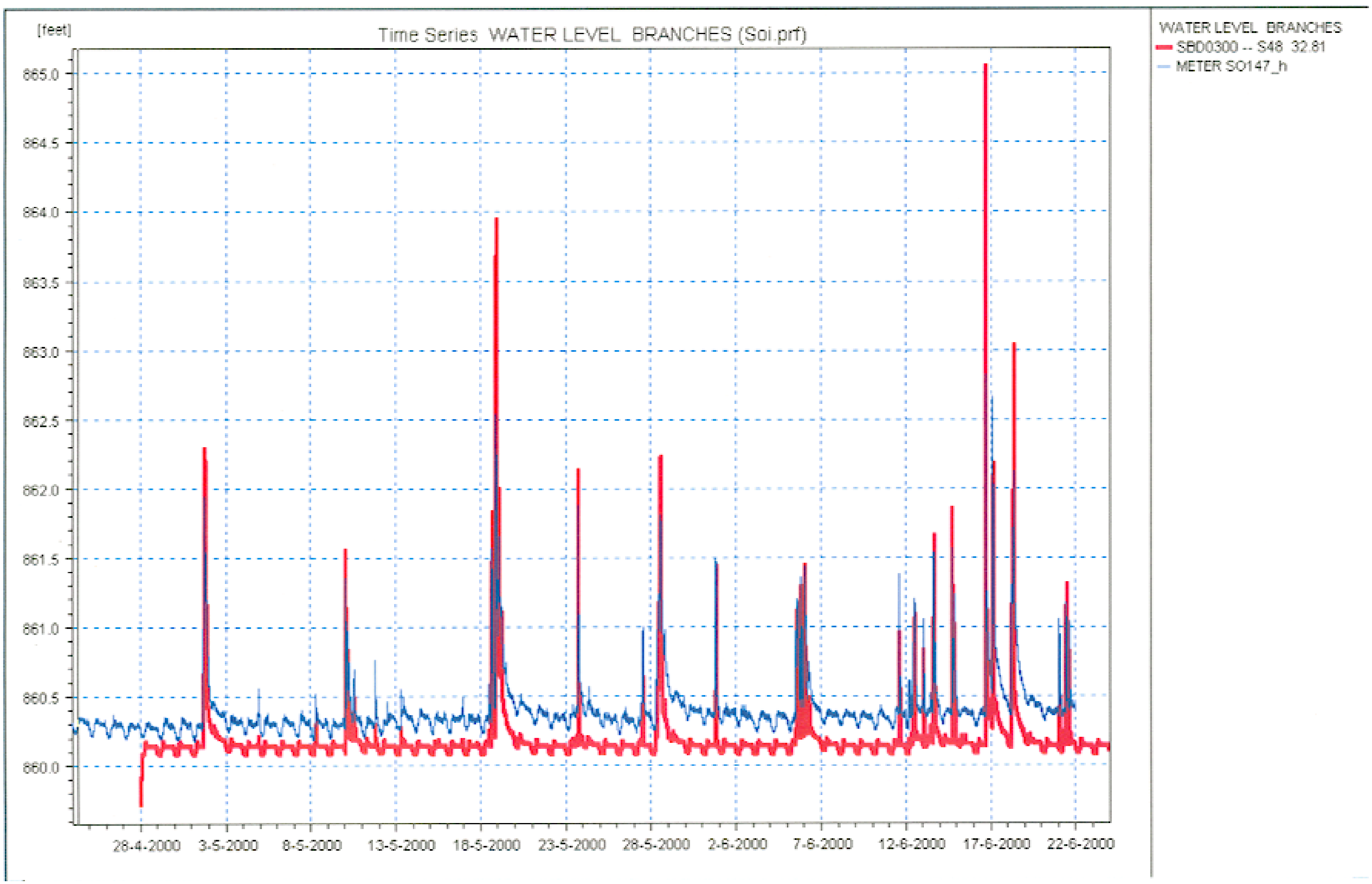

Meter SO-147
Meter vs. Modeled Storms
Modeled volume (MG)
Meter volume (MG)
0.0
3.0
6.0
9.0
12.0
15.0
Wet Weather Period
Dry Weather Period

SO-147

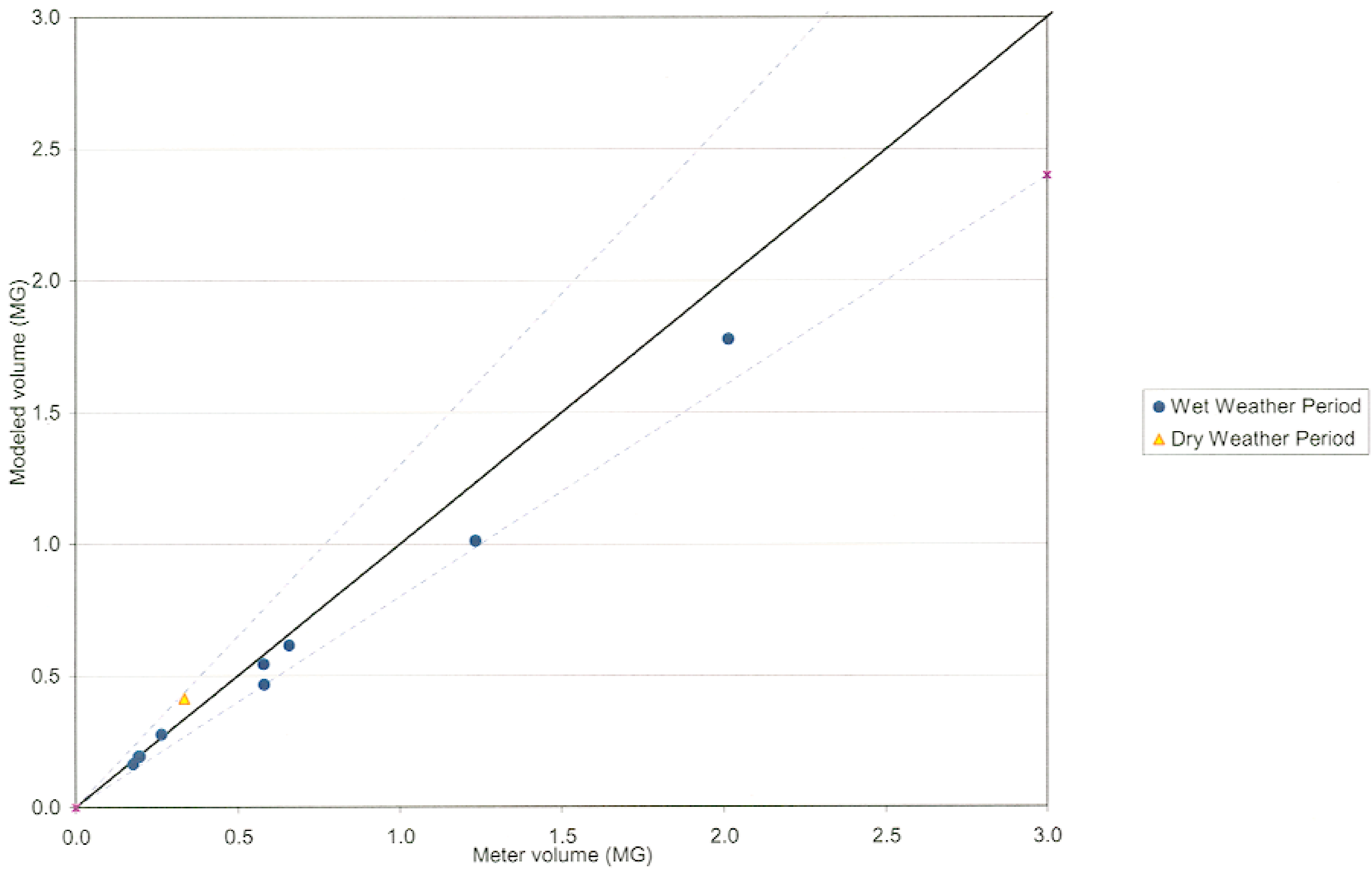


Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Meter not functioning
Volume (ft³)
9,000,000
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
Flow (cfs)
180
160
140
120
100
80
60
40
20
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3
Date/Time

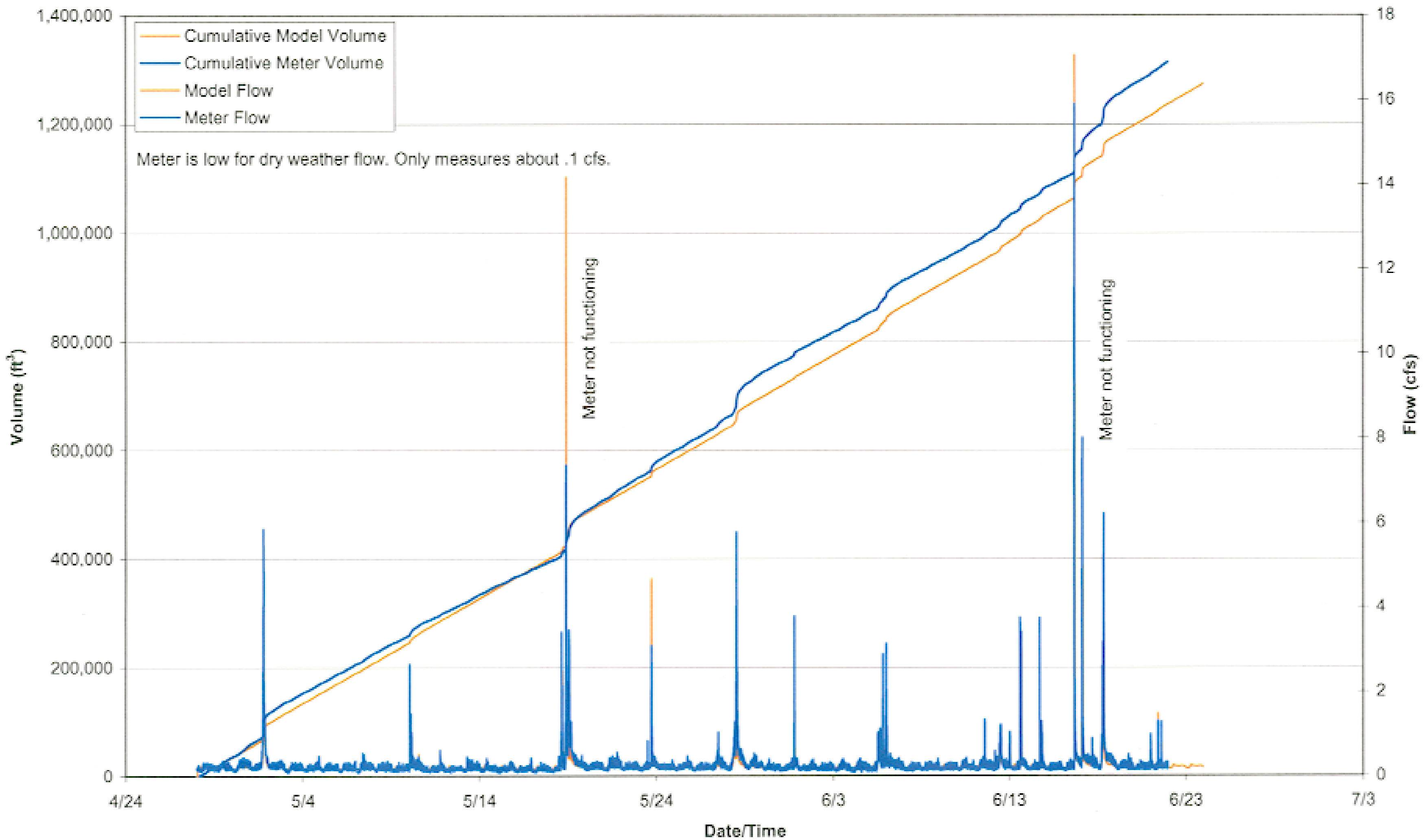
Meter SO-147
Hydraulic Gradeline



Meter SO-149
Meter vs. Modeled Storms

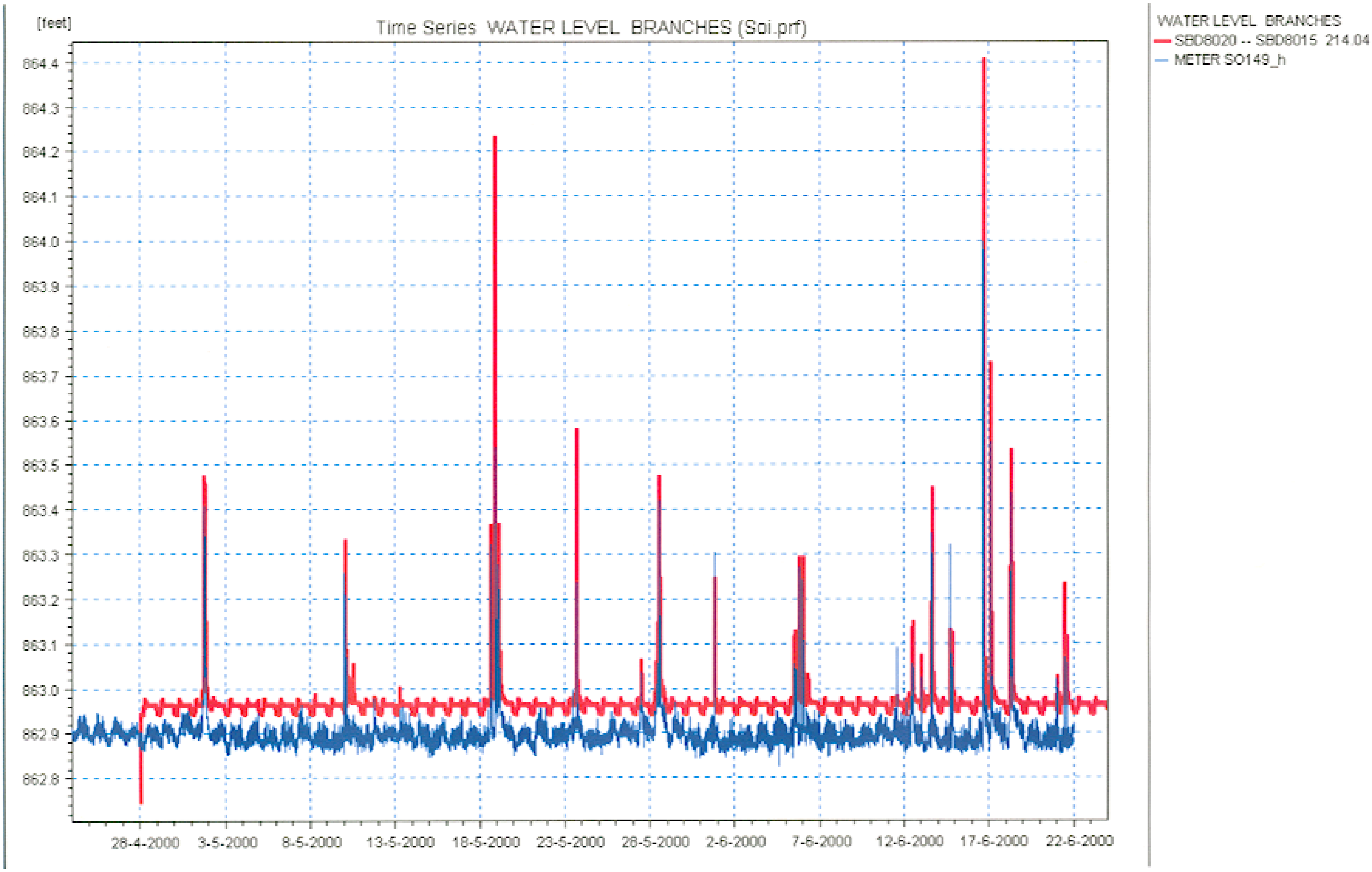


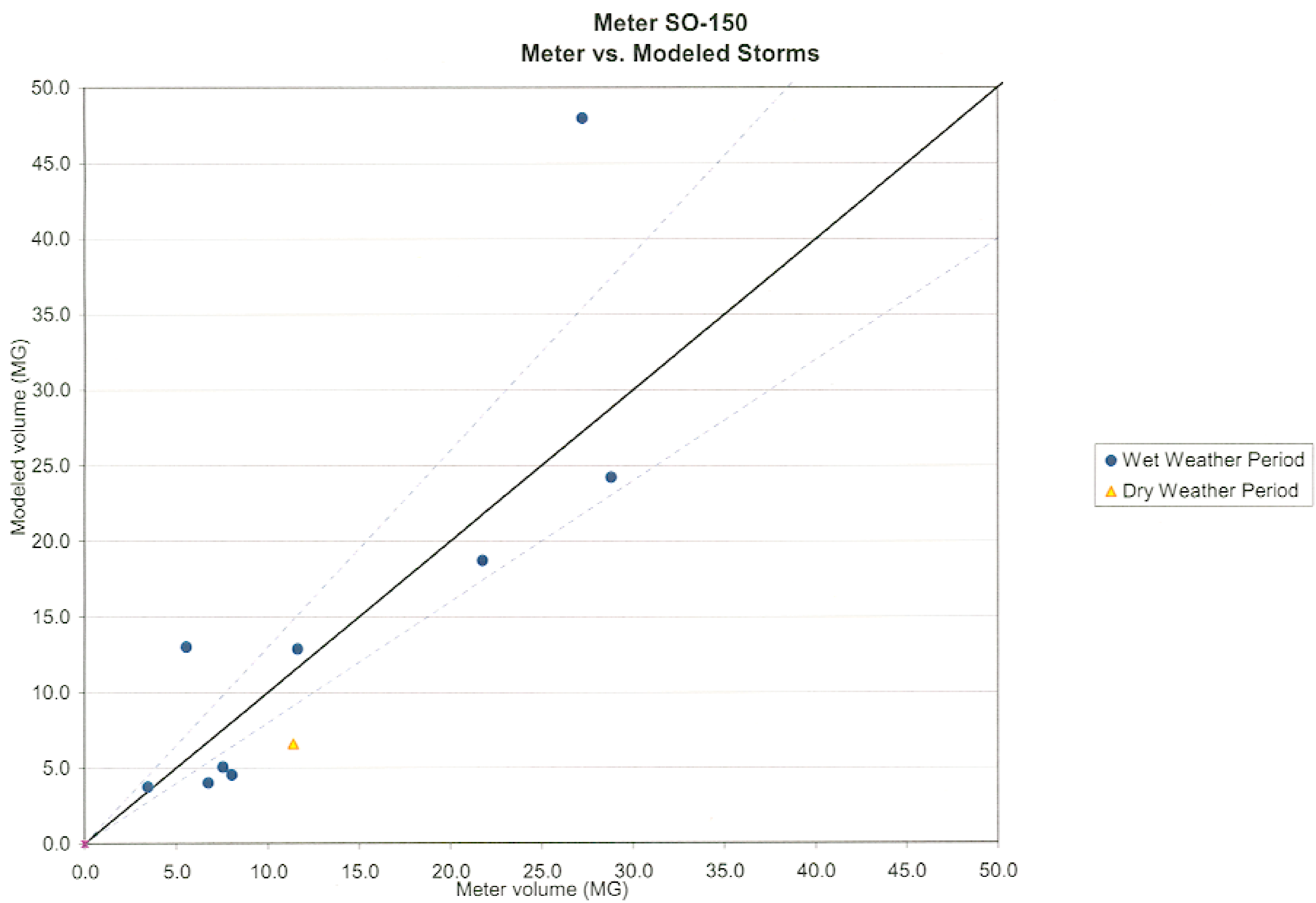
SO-149



Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Meter is low for dry weather flow. Only measures about .1 cfs.
Meter not functioning
Meter not functioning
Volume (ft^3)
0
200,000
400,000
600,000
800,000
1,000,000
1,200,000
1,400,000
Flow (cfs)
0
2
4
6
8
10
12
14
16
18
Date/Time
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3

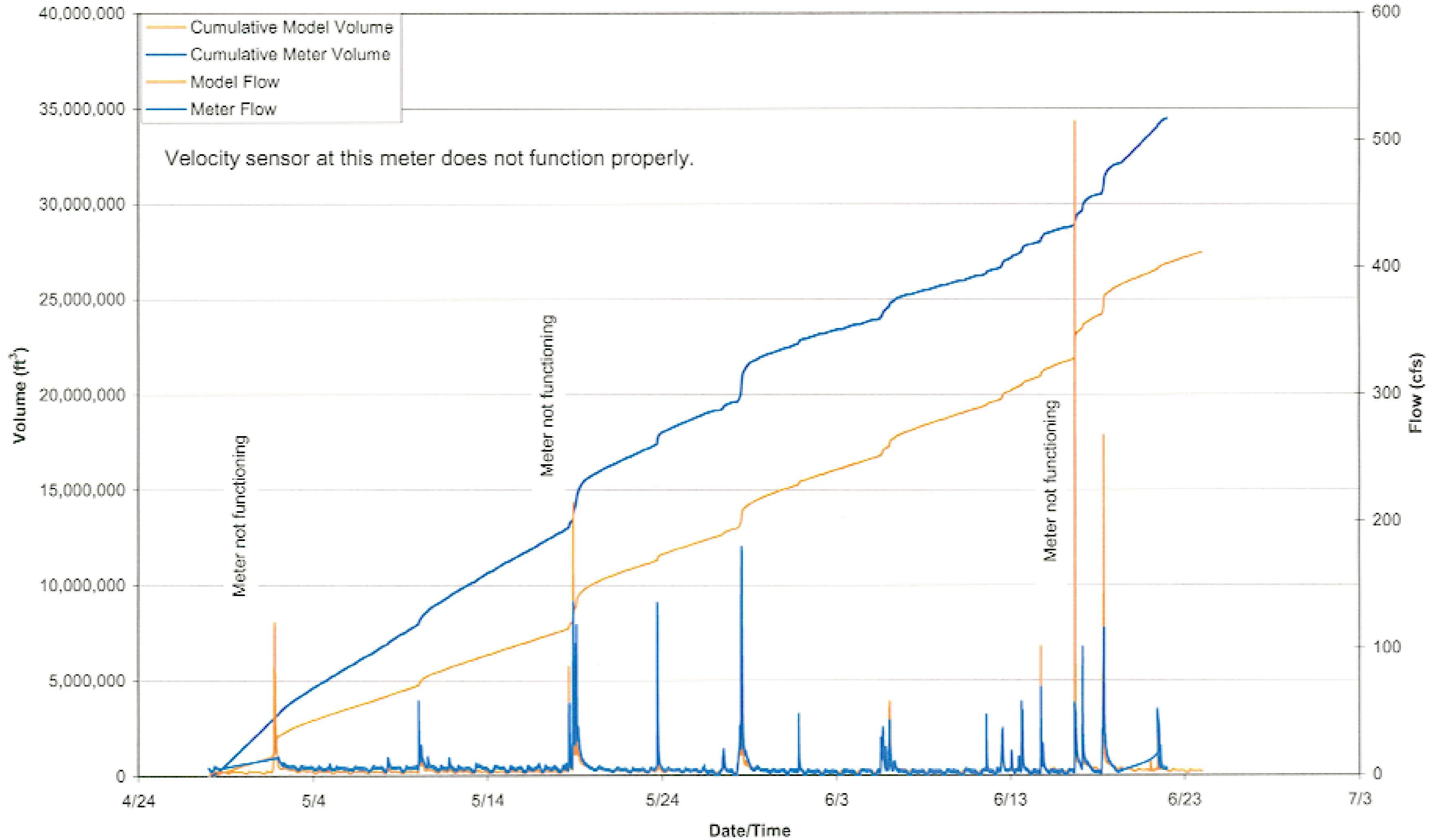
Meter SO-149
Hydraulic Gradeline





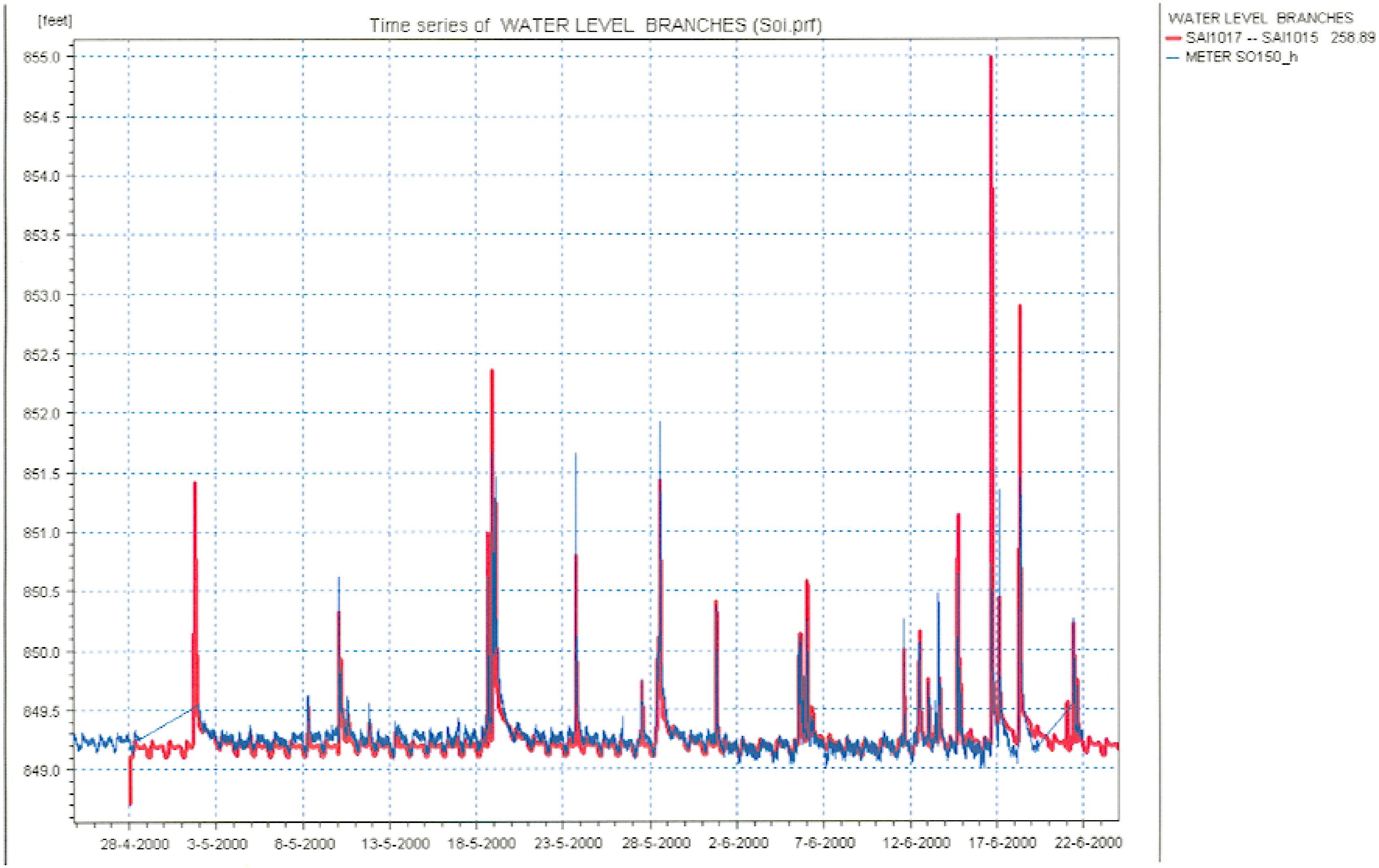
Meter SO-150
Meter vs. Modeled Storms
Modeled volume (MG)
Meter volume (MG)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
Wet Weather Period
Dry Weather Period

SO-150



Cumulative Model Volume
Cumulative Meter Volume
Model Flow
Meter Flow
Velocity sensor at this meter does not function properly.
Meter not functioning
Meter not functioning
Meter not functioning
Volume (ft³)
Flow (cfs)
Date/Time
40,000,000
35,000,000
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
600
500
400
300
200
100
0
4/24
5/4
5/14
5/24
6/3
6/13
6/23
7/3

Meter SO-150
Hydraulic Gradeline



APPENDIX G

SITE-SPECIFIC CALIBRATION ISSUES

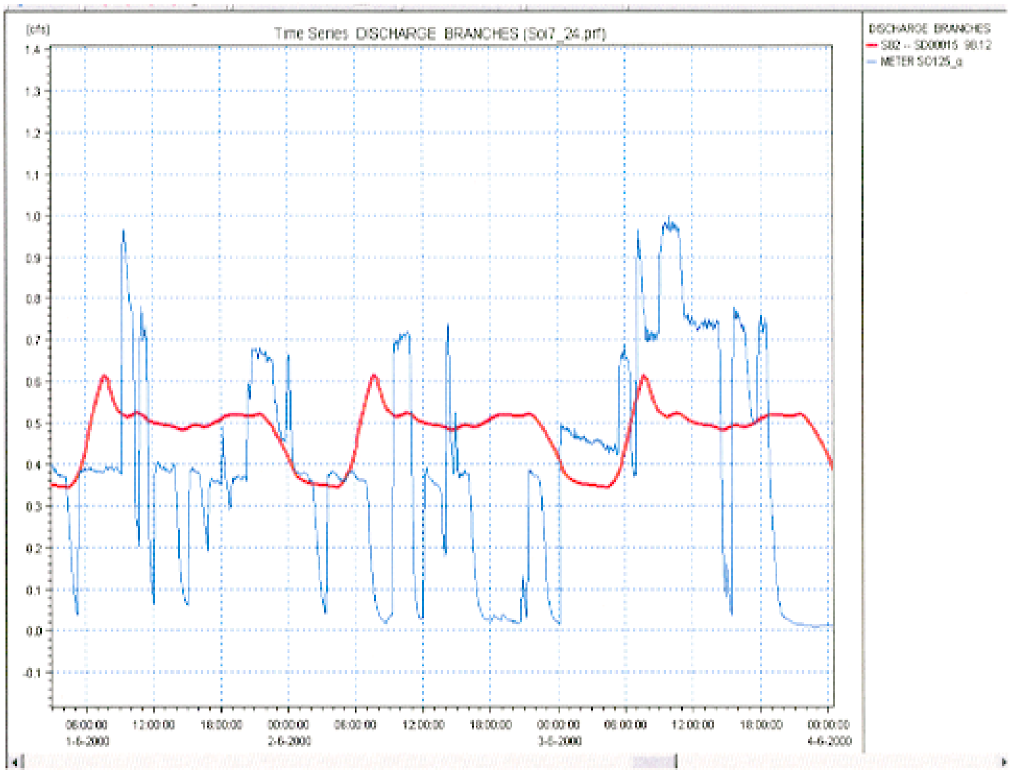
In the process of calibrating the model, the meter data was reviewed when the model and meter did not match during storm events or dry weather flow rates. Some meters clipped the peaks on wet weather events. This is usually due to higher velocities achieved during the wet weather events that exceeded the range of the meter. The meters are only able to give accurate data up to approximately 15 ft per second of flow. This problem seemed to be most common in the Kingsbury Run section of the model. This is potentially due to the fact that the pipes are at a fairly steep slope throughout this area, and thus higher velocities are more easily achieved. This was the case at meters SO-150, SO-159, and SO-153I. This also occurred to a lesser extent at meters SO –149, SO-147, and SO-146. Meters SO-129, SO-135, SO-134, SO-152, and SO-130 all had problems related to velocity but not necessarily confined to storm events. In most of these cases it was still possible to use the water level values recorded by the meter during calibration.

The following describes the meter specific calibration issues for the four sub-models.

Kingsbury Run Sub-Model

SO-125 - Meter SO-125 is located on Independence Road just south of regulator S-82 in a 30 inch brick pipe. This meter showed signs of an upstream industrial discharger, possibly from Clean Harbors or Zaclon. The pumping intervals were somewhat erratic making it difficult to match a particular flow pattern. An average flow rate was matched for this meter. See Figure G-1.

Figure G-1. Meter SO-125, Flow Rate Calibration



SO-130 - Meter SO-130 is located in a No.7 brick pipe just upstream of a manhole south of Crayton Road among the railroad tracks. The velocity sensor at this meter did not function during the monitoring period as shown in Figure G-2. The water level was used to calibrate at this location where possible (see Figure G-3).

Figure G-2. Meter SO-130, Velocity Calibration

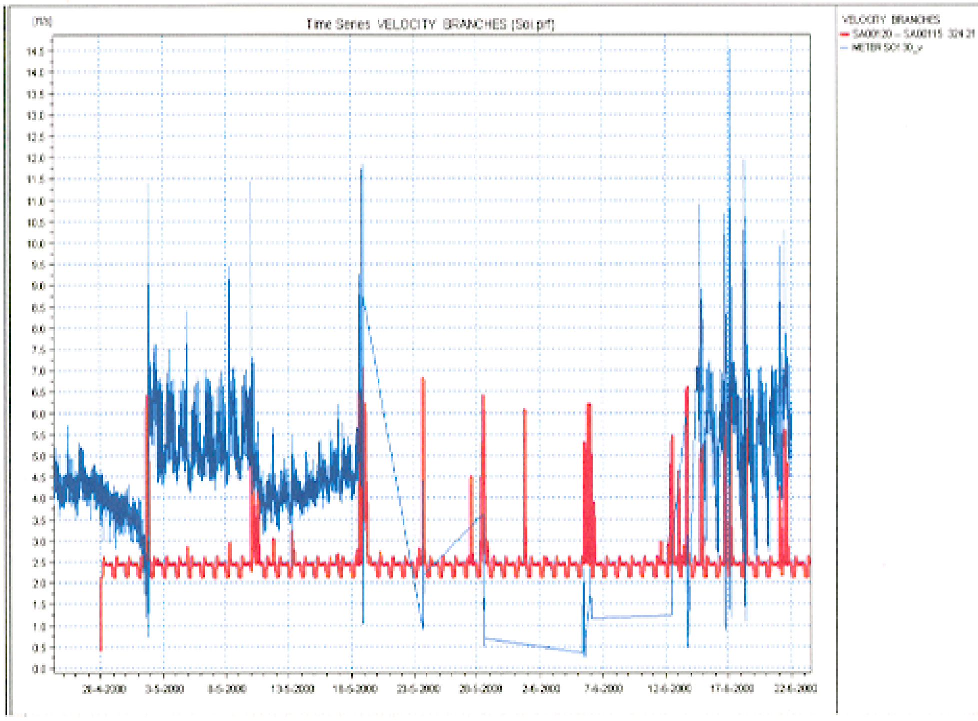
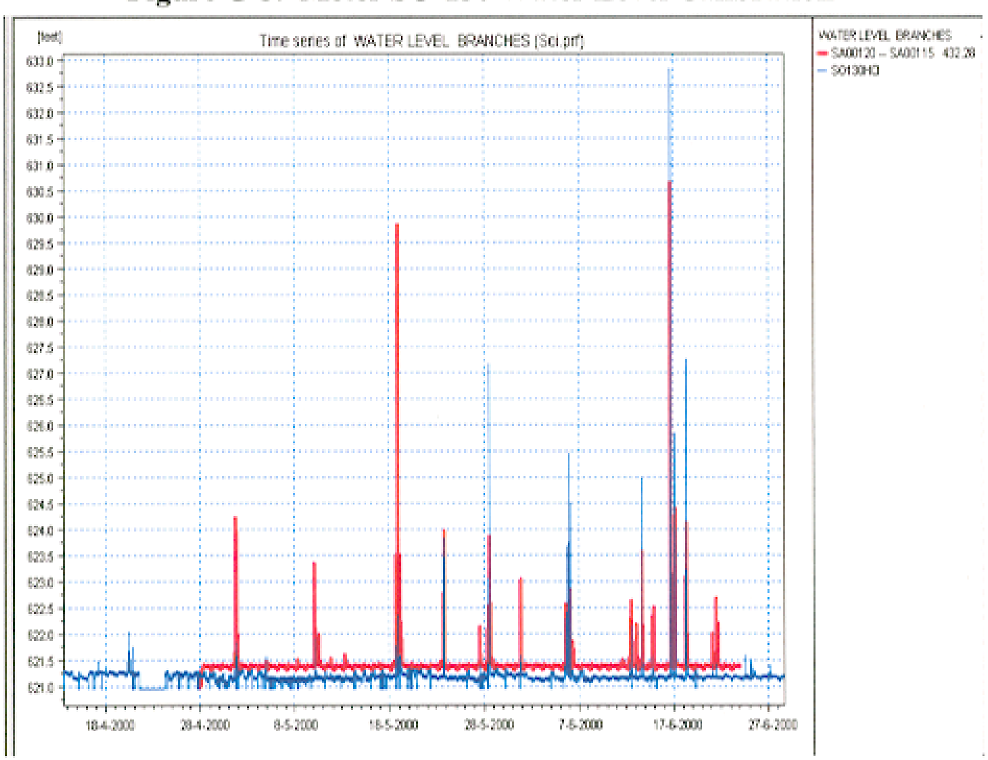


Figure G-3. Meter SO-130 Water Level Calibration



SO-131 - Meter SO-131 is just upstream of regulator S-9 in a 7.25 foot circular brick pipe. This velocity at this meter was higher than was expected during dry weather flow and possibly an industrial discharger based on the flow pattern. No large industrial dischargers were known for this area (see Figure G-4).

Figure G-4. Meter SO-131, Velocity Calibration

SO-134 - Meter SO-134 is on the 36 inch circular concrete wet weather pipe just downstream of regulator S-14. The velocity sensor and water level sensor both failed between 5/17 and 5/28 during the metering period (see Figures G-5 and G-6). The water level values seem high during the rest of the metering period. There is very little difference in recorded water level values for the differing storm events. Flow at this meter was calibrated to the number of overflow events.

Figure G-5. Meter SO-134, Velocity Calibration

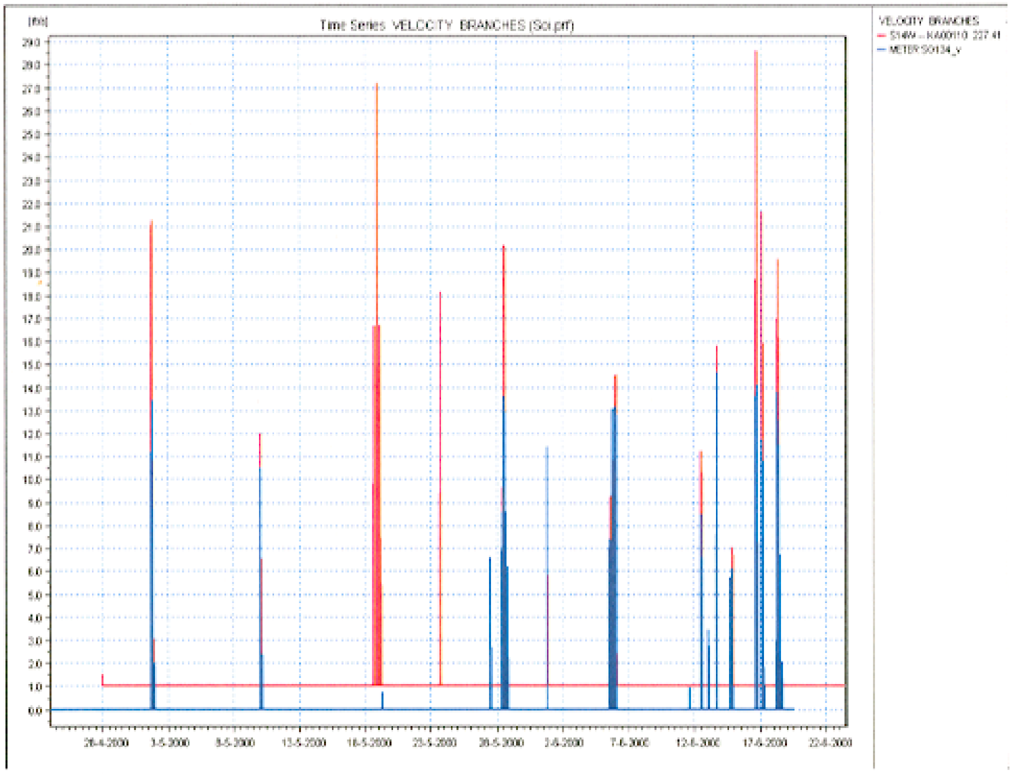
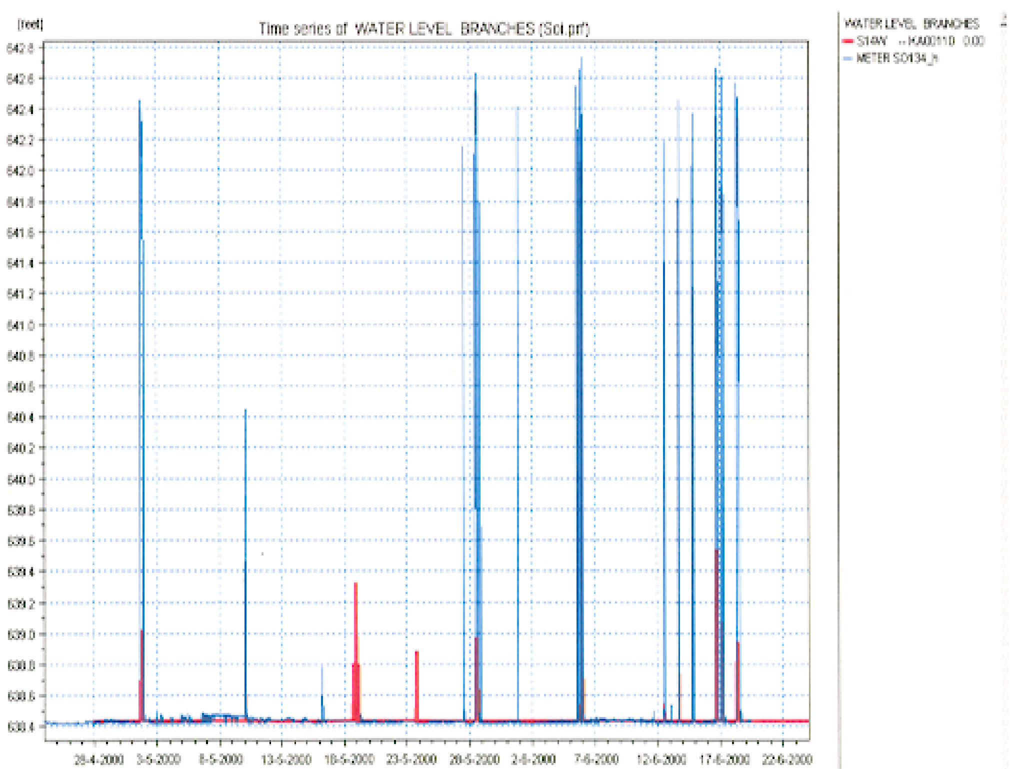


Figure G-6. Meter SO-134, Water Level Calibration



SO-135 - Meter SO-135 is located just upstream of regulator S-14 on 5.25 ft circular brick pipe. The velocity sensor at this meter does not appear to be working between 6/1 and 6/18. The velocity also seems high during the rest of the metering period. See Figure G-7. However, when the meter was placed in this location the measured velocity was 12.98 feet per second during dry weather flow. See Figure G-8. It was not possible to recreate this in the model without differing significantly from any known invert elevations for these pipes.

Figure G-7. Meter SO-135, Velocity Calibration

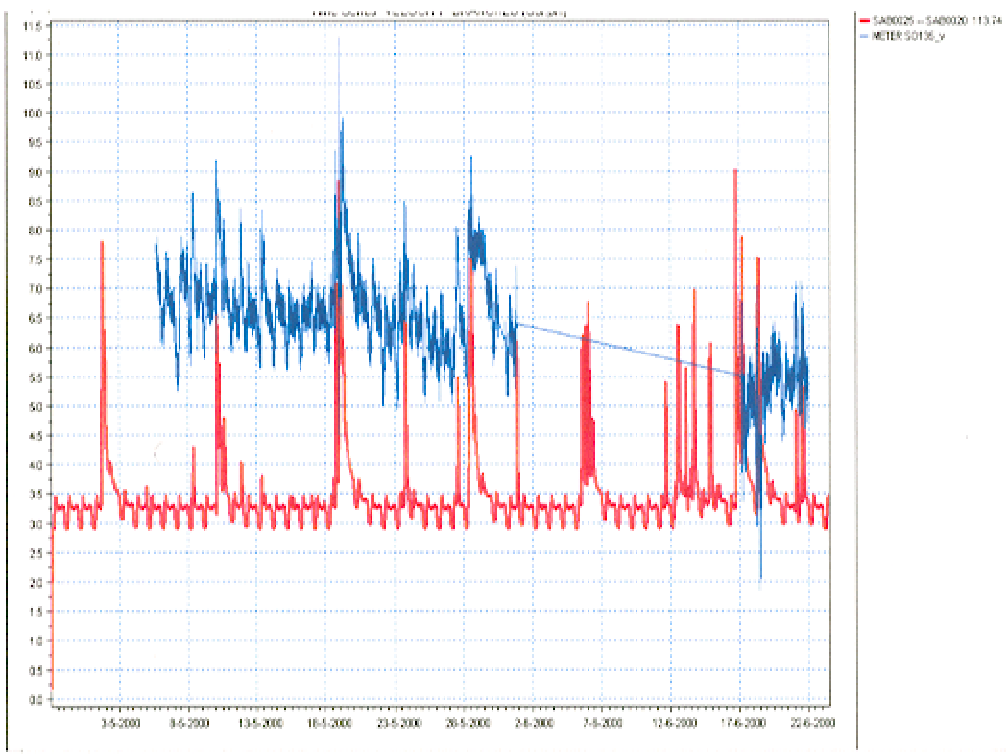
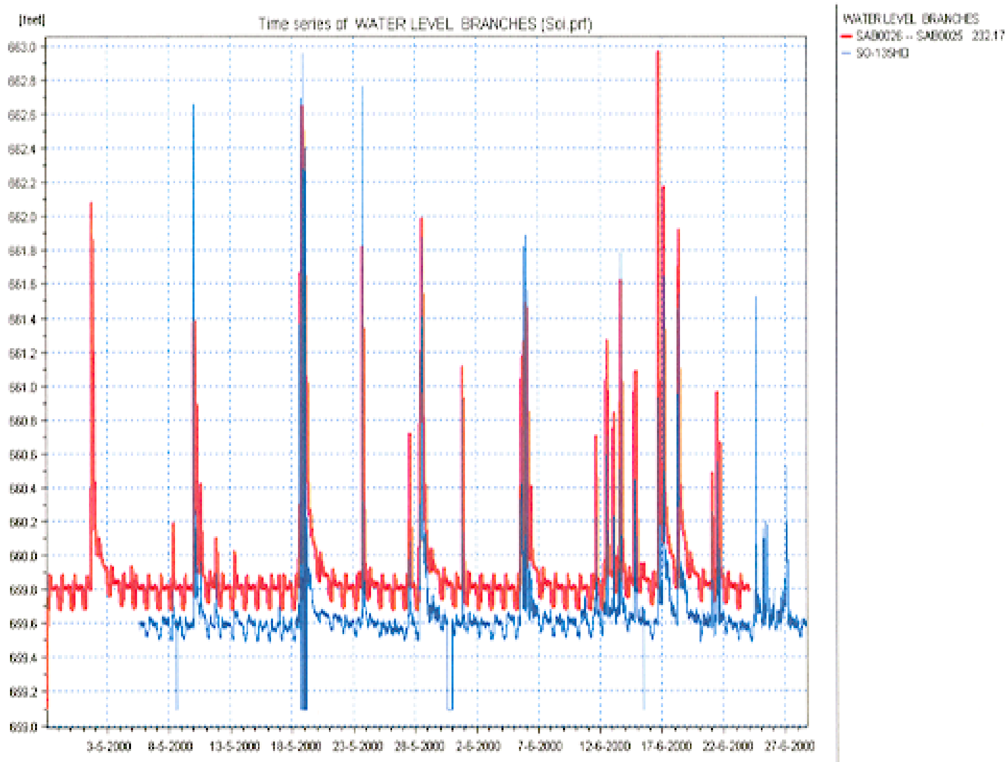


Figure G-8. Meter SO-135, Water Level Calibration



The water level values seem to be reasonable except for a few instances where it shows no data and during the large event at the end of the monitoring period. This meter was calibrated to the number of overflow events.

SO-146 - Meter SO-146 is located on Union Avenue just upstream of Regulator S-49 on a No.8 brick pipe. The dry weather flow at this meter was higher than at the next downstream meter and was therefore not used for calibration. The velocity sensor caused the high flow values at this site. See Figure G-9. The water level reading is out from 5/6 until 5/18. See Figure G-10.

Figure G-9. Meter SO-146, Velocity Calibration

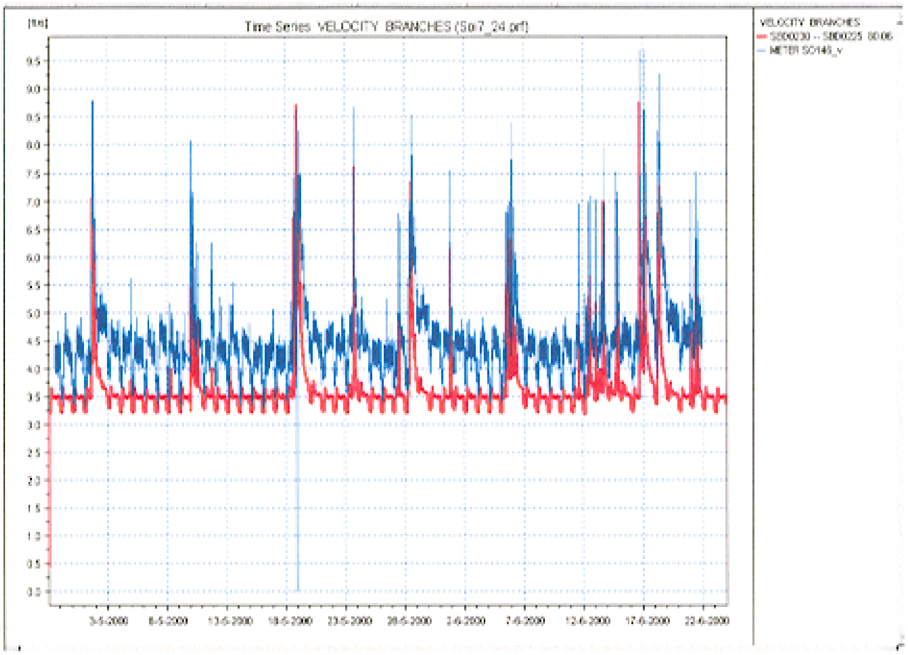
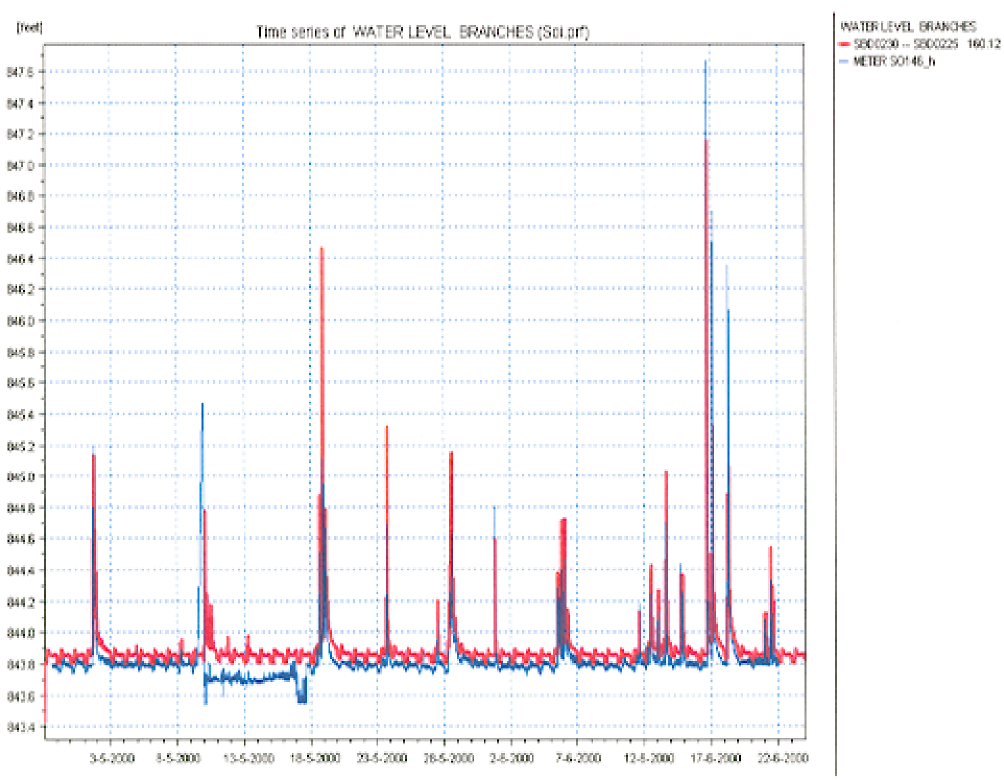


Figure G-10. Meter SO-146, Water Level Calibration



SO-150

Meter SO-150 is located on East 116th Street just south of Kinsman Avenue in a 9 ft circular brick pipe. The velocity sensor at this meter is not working. See Figure G-11. The water level was used to calibrate this meter where possible. See Figure G-12.

Figure G-11. Meter SO-150, Velocity

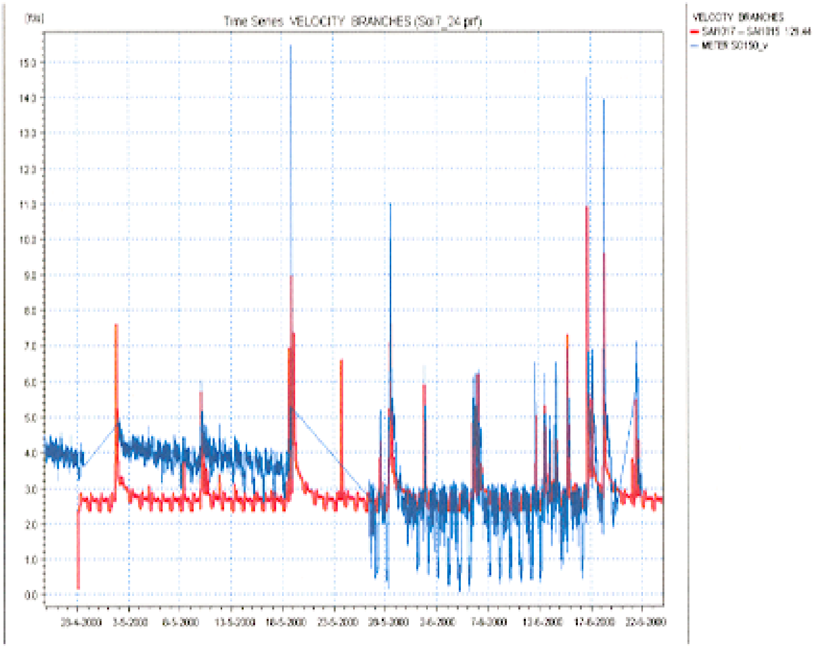
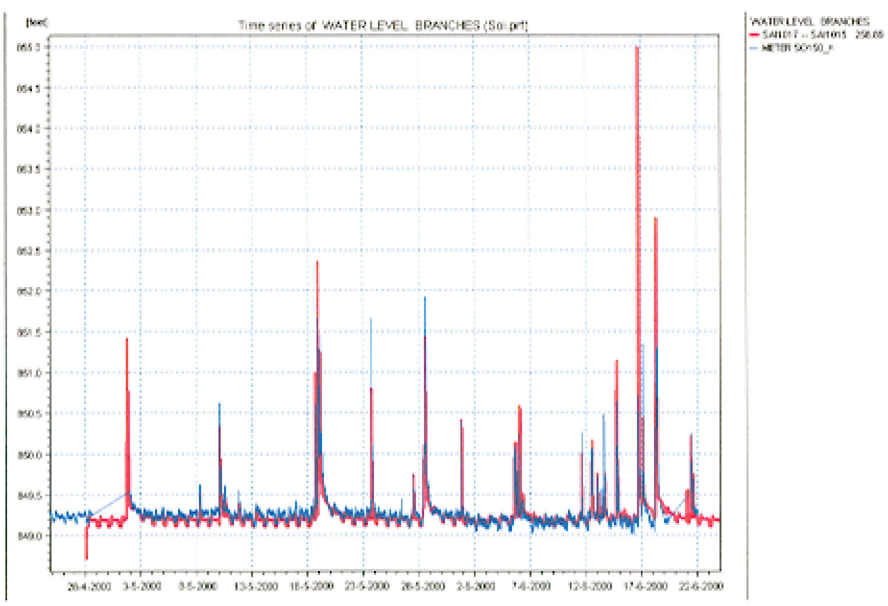


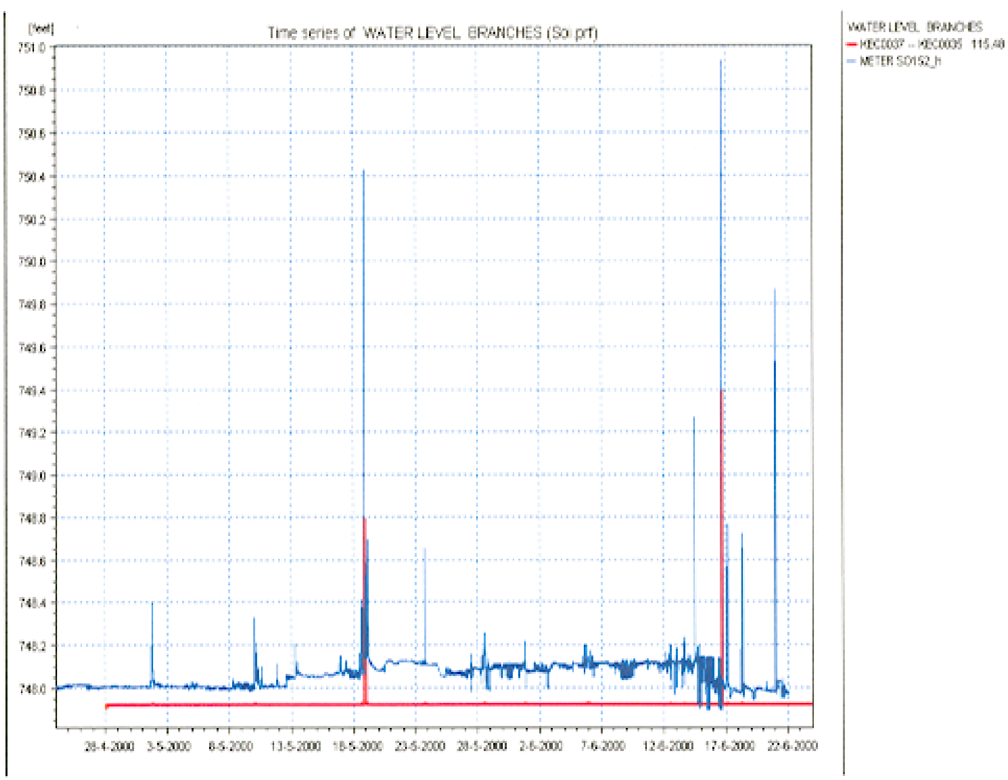
Figure G-12. Meter SO-150, Water Level



SO-152

Meter SO-152 is located on a 5.5 ft circular brick wet weather pipe located on Kinsman Avenue downstream of SO6. The water level at this meter did not function. Flow was recorded during dry weather on a wet weather pipe. Because this a wet weather pipe no calibration was possible. This meter was calibrated to the number of overflow events though it was difficult to determine for the smaller events. See Figure G-13.

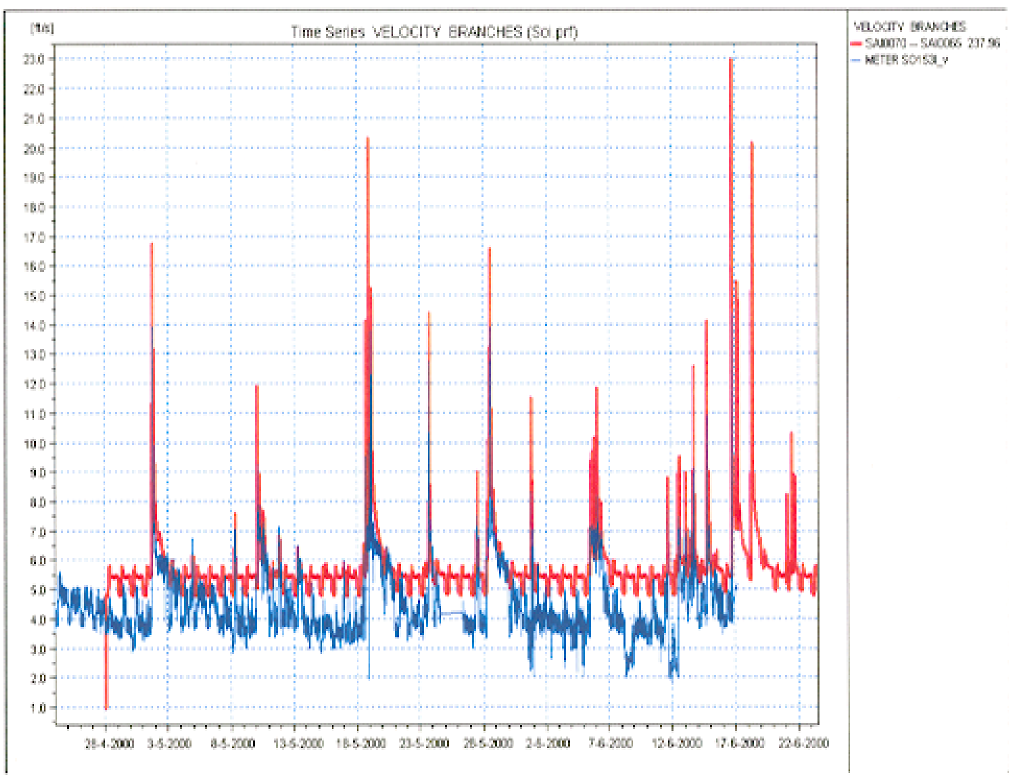
Figure G-13. Meter SO-152, Water Level



SO-153I

Meter SO-153I this meter is located on a 7 ft x 8 ft box culvert at Kingsbury Boulevard upstream of Regulator SO8. This stretch of pipe is known to have high velocities, outside of the range of the metering device, and this may have contributed to the meter problems. See Figure G-14. The model was calibrated to overflow events and water level where possible.

Figure G-14. Meter SO-153I, Velocity



BURKE BROOK /MORGANA RUN SUB-MODEL

The model of the Burke Brook and Morgana Run areas showed some discrepancies with the flow meters. These discrepancies are explained below for meters SO-113, SO-114, SO-123, SO-177, SO-105, SO-106, SO-107, SO-128I, SO-128D, SO-144, SO-143, SO-142, and SO-141.

Also, incorrect pipe dimensions were used during flow monitoring for some of the meters to calculate flow rate. These were primarily located in the culverted streams where the pipe cross-sections are not standard. The meters with the largest differences in the cross-section dimensions were BB48SN, SO-111, SO-122W, SO-120, MR036A, and SO-177. For these meters, the flows were recalculated based on the velocity and water level data, along with the approximate water level vs. area relationship for the pipe in order to calculate a revised flow.

Meter BB48SN is located near the downstream end of Burke Brook where the cross-section is an arch with dimensions of 123"H x 120"W. The flow data provided was based on a round pipe with dimensions of 119"H x 116.5"W.

Meter SO-111 is located on Burke Brook near East 55th Street. The pipe is a 6'3" circular equivalent at this location, with dimensions of 81"H x 71.6"W. Since it is a circular equivalent cross-section, the wide part of the egg shape is at the bottom of the pipe, and the tapered point is at the top. These dimensions, as shown in record drawings 322-1 and G-C-42, were also verified by field inspection. The flow data provided was based on an egg-shaped pipe with dimensions of 83"H x 83"W. Since the specified pipe was an egg-shape, it is not clear if the tapered point is at the top (like the circular equivalent pipe), or the bottom (consistent with Cleveland egg shapes). The original site sheet has the dimensions as a 82.5"H x 68"W pipe, and the revised site sheet has the pipe as 83"H x 76"W.

Meter SO-122W is located near the downstream end of Morgana Run where the cross-section is a box with dimensions of 75"H x 192"W. The flow data provided was based on a circular pipe with a diameter of 84.25". The original site sheet has the dimensions as a 73.5"H x 192"W pipe, and the revised site sheet has the pipe as 84.25"H x 193"W.

Meter SO-120 is located on Morgana Run just upstream of regulator S-2A. The pipe is an 11'0" circular equivalent at this location, with dimensions of 144"H x 127"W. These dimensions, as shown in record drawing WL-3, were also verified by field inspection. The flow data provided was based on a circular pipe with a diameter of 98". The original site sheet has the dimensions as a 156.0"H x 123.25"W pipe, and the revised site sheet has the pipe as 98"H x 125"W.

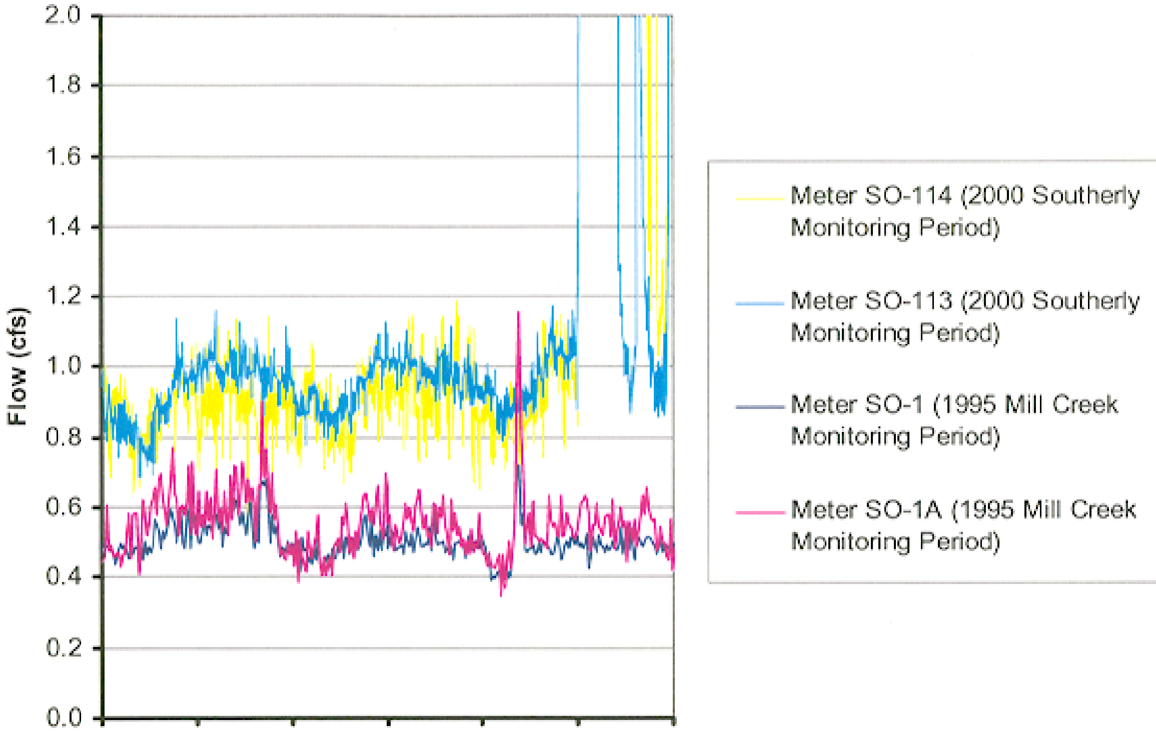
Meter MR036A is located on Morgana Run approximately 850 feet upstream of meter SO-120 and regulator S-2A. The pipe is also an 11'0" circular equivalent at this location, with dimensions of 144"H x 127"W. Since it is a circular equivalent cross-section, the wide part of the egg shape is at the bottom of the pipe, and the tapered point is at the top. These dimensions, as shown in record drawing WL-3, were also verified by field inspection. The flow data provided was based on an egg-shaped pipe with dimensions of 168"H x 127.25"W. Since the specified pipe was an egg-shape, it is not clear if the tapered point is at the top (like the circular equivalent pipe), or the bottom (consistent with Cleveland egg shapes). The original site sheet has no dimensions, and the revised site sheet has the pipe as 168"H x 127.5"W.

Meter SO-177 is located on the Southerly Interceptor at Barkwill Avenue. The pipe is a 75"H x 63"W approximately oval section at this location. These dimensions were verified in the field by inspection, and the CCTV of this section shows that the pipe is approximately oval. The flow data provided was based on an egg-shaped pipe with dimensions of 91.25"H x 63.75"W. The original site sheet has the dimensions as a 71.25"H x 64.0"W pipe, and the revised site sheet has the pipe as 91.25"H x 63.75"W.

SO-113/SO-114

Meters SO-113 and SO-114 are located at Auto-regulator SO-1, with SO-113 on the 30-inch diameter concrete DWO sewer, and SO-114 on the G-foot diameter brick influent sewer. Although the dry weather flow rates are consistent between these two meters, the flow seems slightly high based on GIS estimates of population as well as the flow metering done for the Mill Creek study in 1995. The flow rates during for the Mill Creek study were about 0.4 cfs lower, as shown in Figure G-15. Meters SO-113 and SO-114 were both calibrated multiple times during the monitoring period. Since both SO-113 and SO-114 show similar flow rates, the model was adjusted to match these flows, as shown in Figure G-15.

Figure G-15. Comparison Of Dry Weather Flows At Auto Regulator SO-1



Meter SO-123 is located on the 78-inch circular brick "B" branch of the Southerly Interceptor, at East 49th Street and Guy Avenue. This pipe was measured as an 81-inch diameter at the location of the meter. It is just upstream of Regulator S-1, which connects to the main branch of the Southerly Interceptor. The dry weather flow rates for the meter were high based on GIS population estimates as well as the tributary flow meters. The meter is about 3 cfs higher than the model, as shown in Figure G-16. Figures G-17 through G-21 show the dry weather calibrations for the tributary meters SO-139, SO-136, SO-137, SO-141, and SO-118 respectively. These meters show a good dry weather flow match, and the additional 3 cfs of flow for meter SO-123 does not seem to make sense. There are no reported large industrial dischargers in this area. There is a University Health Systems Hospital at Broadway and McBride, but these flows should be tributary to meter SO-118. Also, new construction was occurring during for the Fifth Third Bank Headquarters between Broadway and Aetna to East 71st Street, but this does not seem large enough to cause the additional flow, and the metered flow is consistent between the weekdays and the weekends. Therefore, the model was not calibrated to match the meter during dry weather.

Figure G-16. Calibration of Dry Weather Flows at Meter SO-123

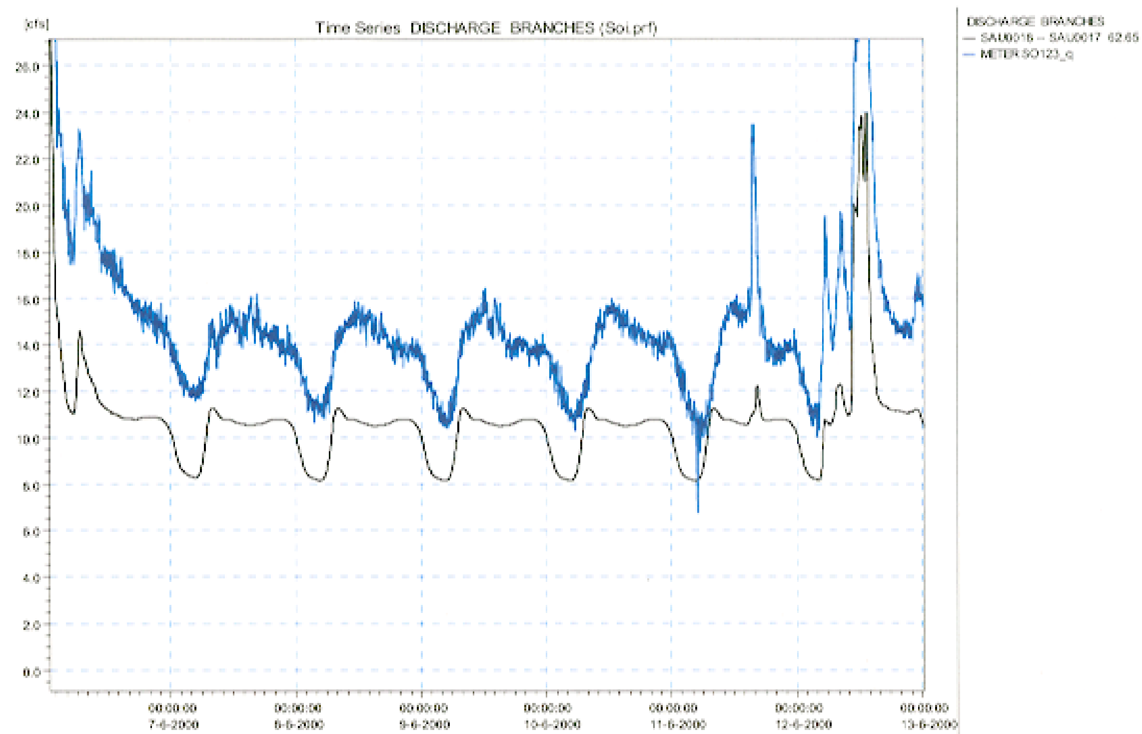


Figure G-17. Calibration of Dry Weather Flows at Meter SO-139

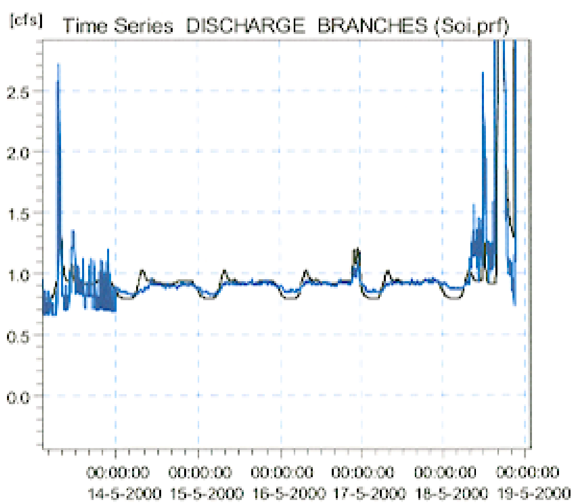


Figure G-18. Calibration of Dry Weather Flows at Meter SO-136

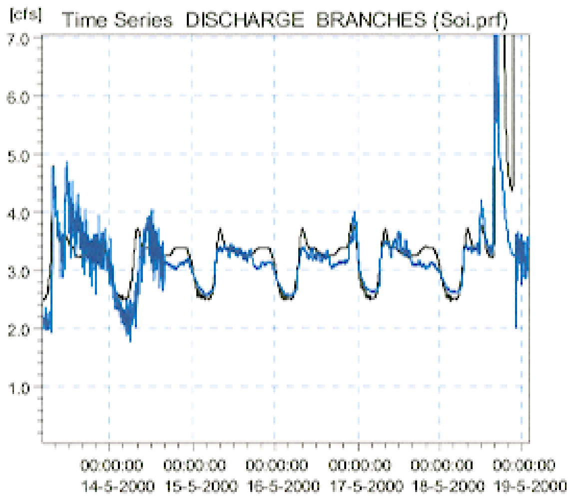


Figure G-19. Calibration of Dry Weather Flows at Meter SO-137

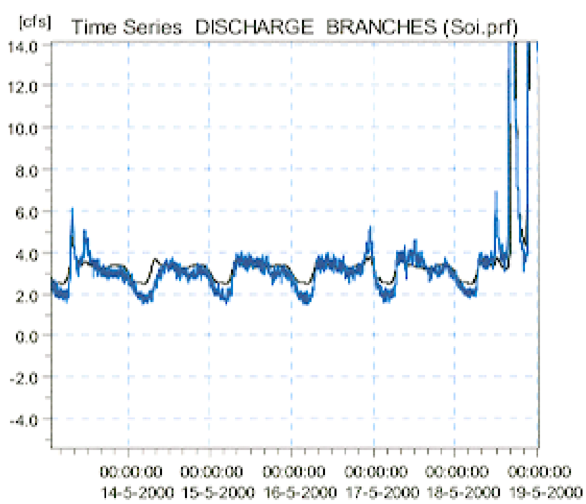


Figure G-20. Calibration of Dry Weather Flows at Meter SO-141

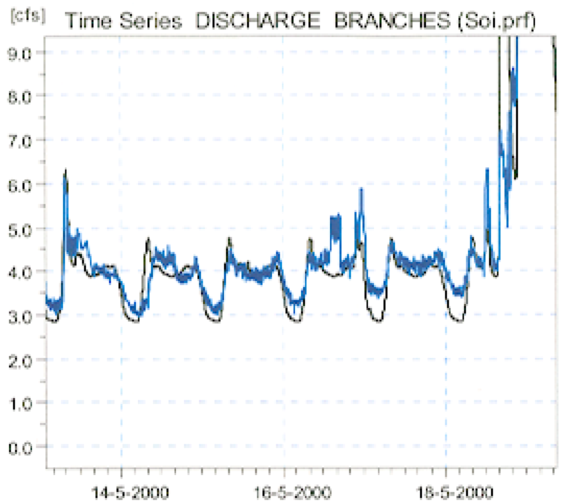
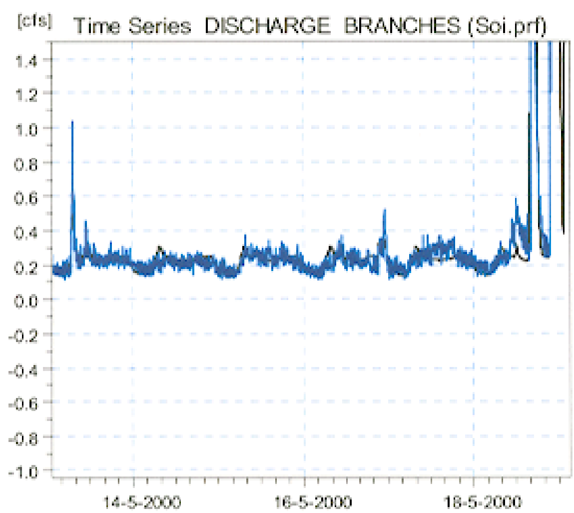


Figure G-21. Calibration of Dry Weather Flows at Meter SO-118



SO-177

Meter SO-177 is located on the Southerly Interceptor at Barkwill Avenue. The pipe is a 75"H x 63"W approximately oval section at this location. The dry weather flows for meter SO-177 are high based on GIS population estimates and upstream flow meters. As discussed previously, the meter flow rates were based on an incorrect cross-section. Therefore, the model results were compared with the original meter flow rates as well as recalculated flows. Figure G-22 shows the dry weather flow for Meter 177. The meter was calibrated with three measurements, one of which was on 5/17/00 at 13:24. The model is much closer to the meter at this time, as shown in Figure G-22. About 5 inches of silt was reported during these calibrations, which could be causing inaccuracies. The model shows a very good calibration during wet weather, as shown in Figures G-23 and G-24. The negative flow shown in Figure G-26 is caused by the rapid filling of the Southerly Interceptor at Morgana Run (Regulator S-2A). The model shows this occurring for the larger storm events.

Figure G-22. Calibration of Dry Weather Flows at Meter SO-177

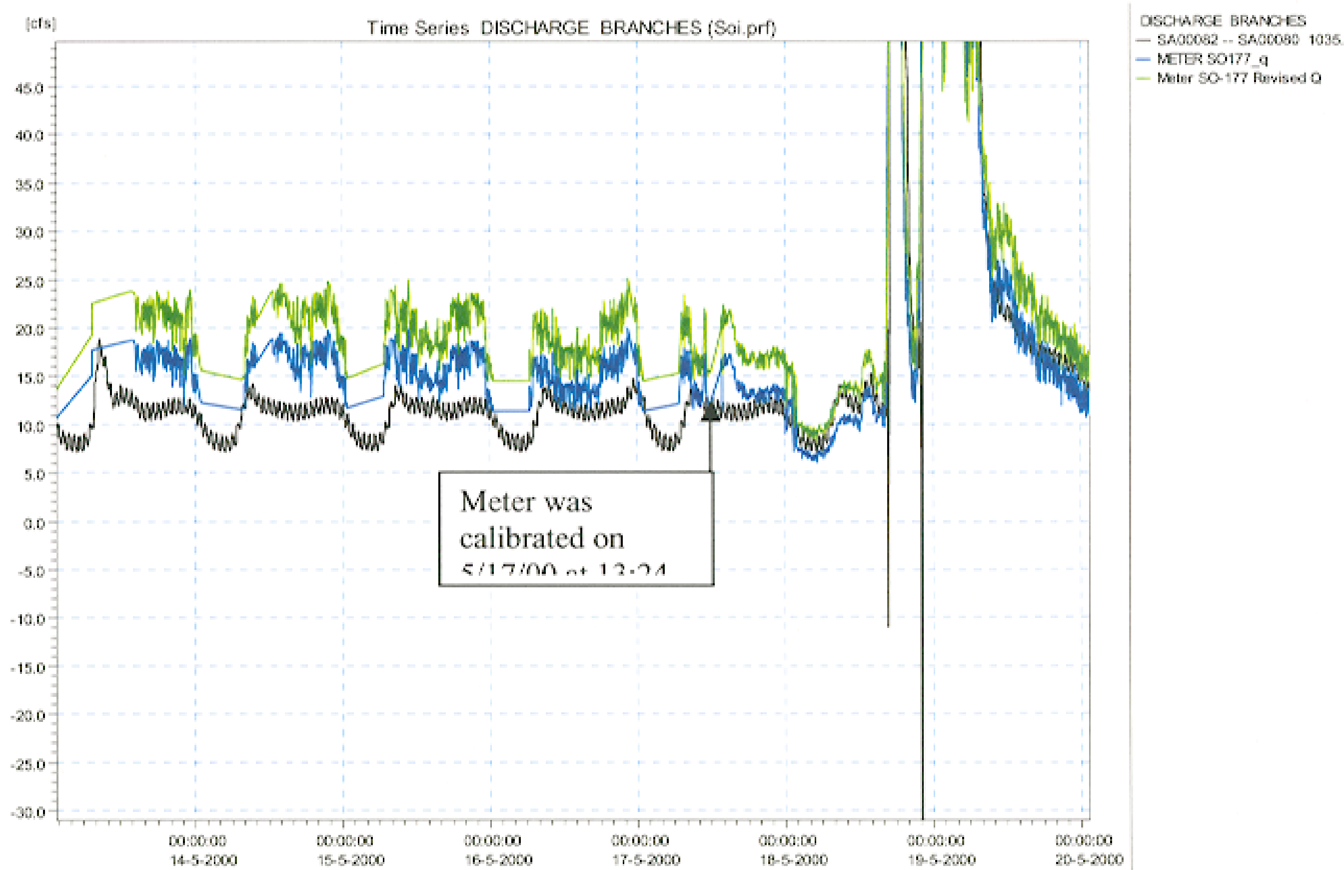


Figure G-23. Calibration of Wet Weather Flows at Meter SO-177

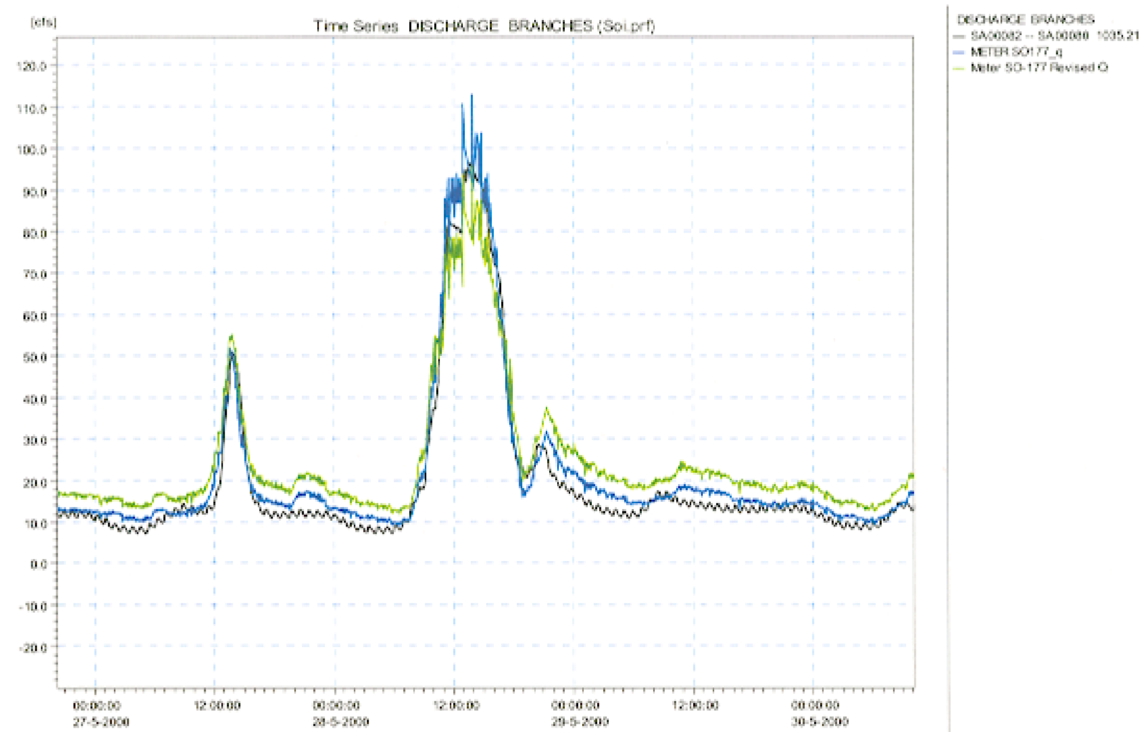
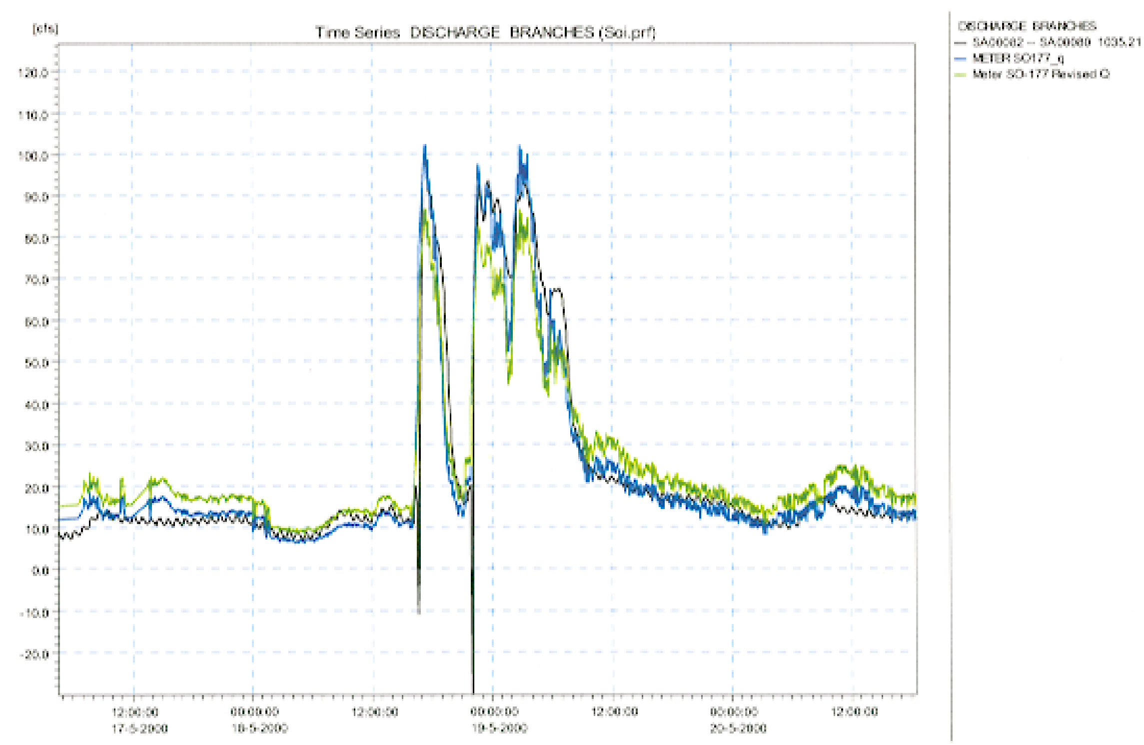


Figure G-24. Calibration of Wet Weather Flows at Meter SO-177



SO-105

Meter SO-105 is located on the Southerly Interceptor at Fleet Avenue. The pipe is a 102 inch circular brick pipe at this location. The manhole is about 80 feet deep with a large amount of debris in the pipe. Because of the difficulty in accessing this flow meter, it was not calibrated during the metering period. The dry weather flows for meter SO-105 were high based on GIS population estimates and upstream flow meters. Although meters SO-123 and SO-177 show higher dry weather flow than the model, the meters upstream of these calibrated well. Without using unreasonable population estimates, a dry weather model calibration could not be made, as shown in Figure G-25.

The slope of the Southerly Interceptor from this flow meter down to the treatment plant is only about 0.03 percent. Because of this very small slope, the water level at the headworks of the treatment plant controls the water level at meter SO-105. The water level at the headworks is dependent on the total flow coming into the treatment plant from the five interceptors as well as the control of the treatment plant. The water level at the headworks influences the amount of wet weather flow that enters the interceptor from Regulator S-2A at Morgana Run. As the water level rises at the treatment plant as a result of the wet weather flow from the five interceptors, the amount of flow entering the Southerly Interceptor from Morgana Run is controlled. The plant is to be modeled in Mouse to determine the wet weather characteristics. However, at the time of the Southerly Interceptor calibration, a fixed water surface level was used to represent the treatment plant. An elevation slightly above normal dry weather flow was used to represent the impacts during a smaller storm. Therefore, the wet weather flow rates during the smaller storms calibrate well with the flow meter, as shown in Figure G-26. However, during the larger storm events, the model over-predicts the peak flow rate in the interceptor, as shown in Figure G-27. Although the hydraulic grade line calibrates well over the range of storms as shown in Figure G-28, in reality the higher water level at the treatment plant for larger storms controls the amount of flow from Morgana Run.

Figure G-25. Calibration of Dry Weather Flows at Meter SO-105

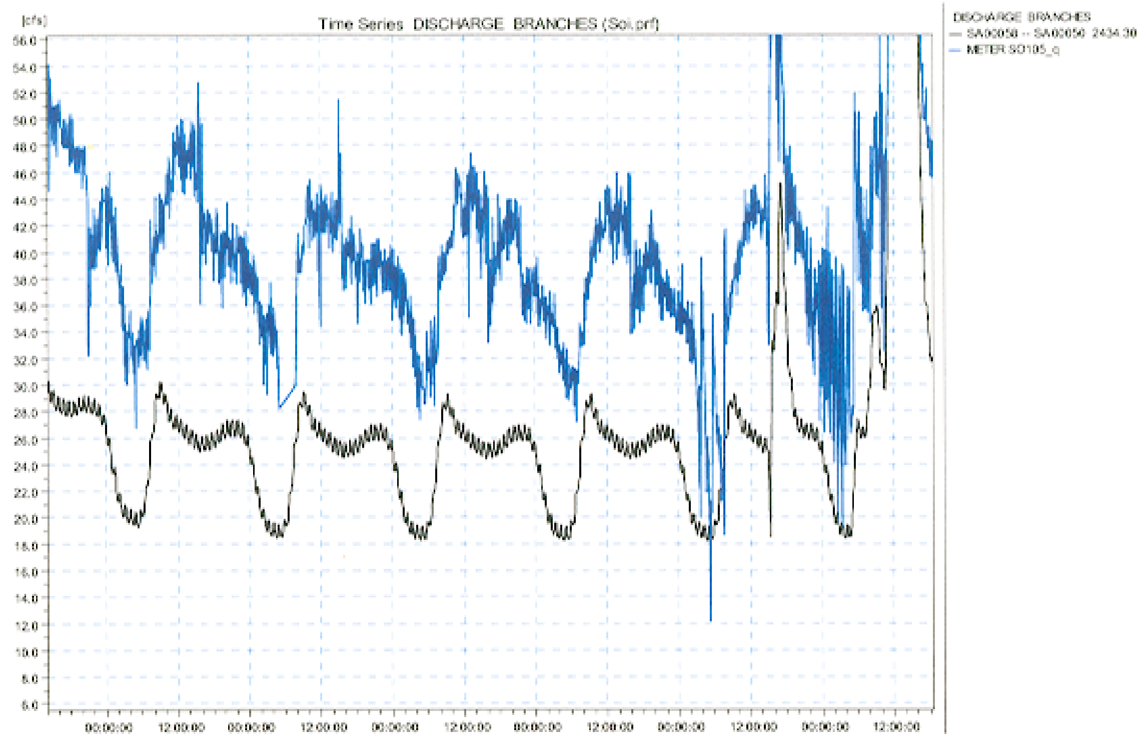


Figure G-26. Calibration of Small Storm Wet Weather Flows at Meter SO-105

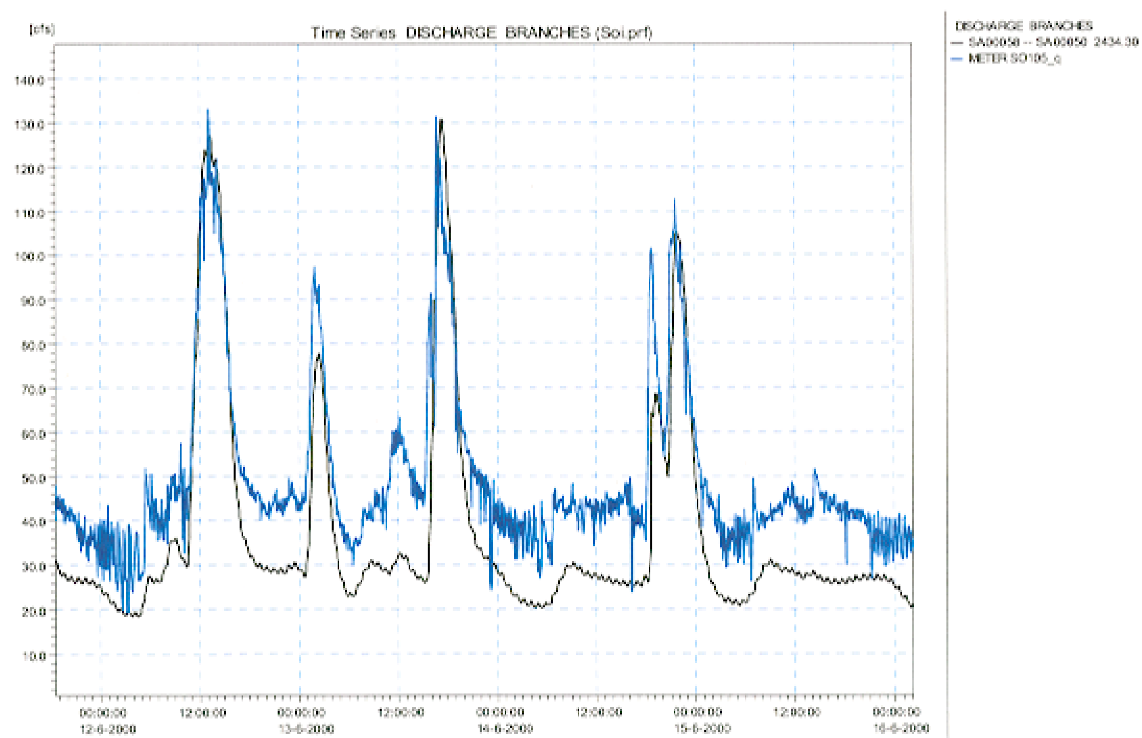


Figure G-27. Calibration of Large Storm Wet Weather Flows at Meter SO-105

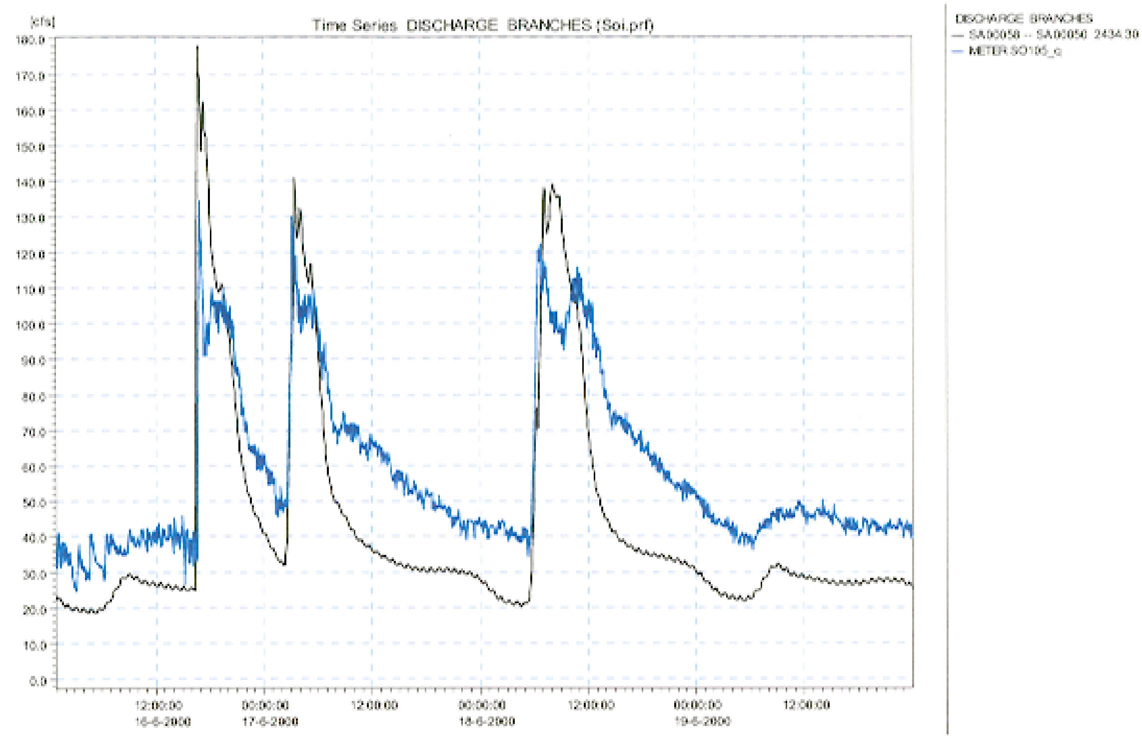
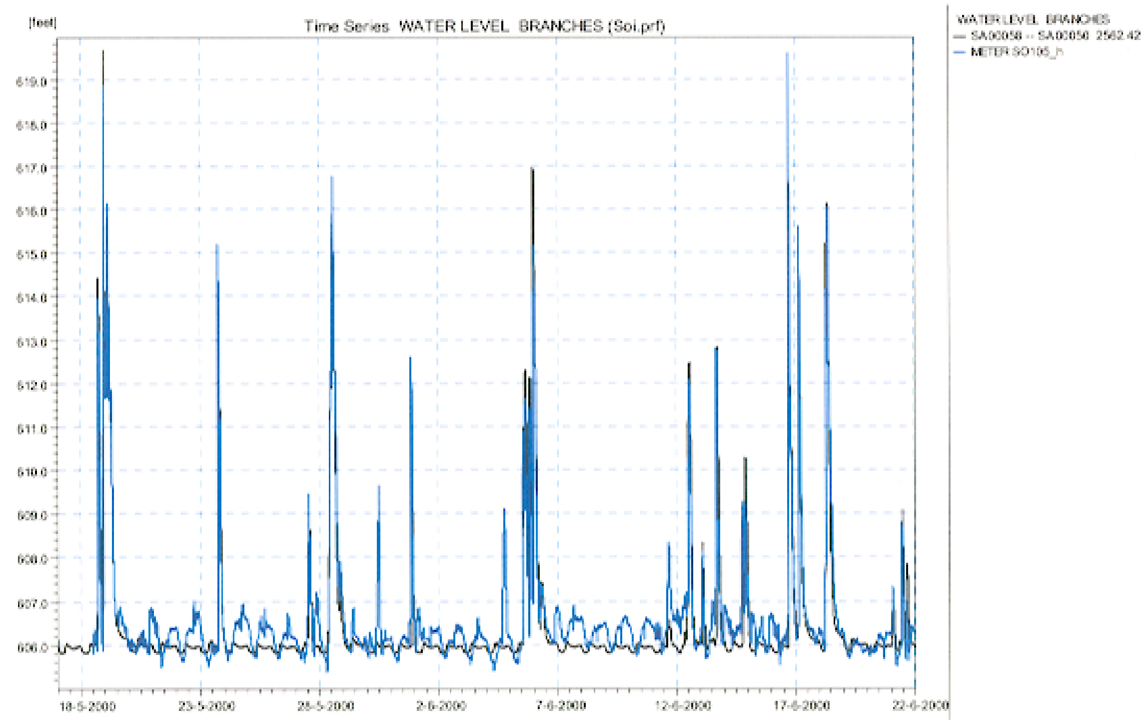


Figure G-28. Calibration of Hydraulic Grade Line at Meter SO-105



SO-106/SO-107

Meters SO-106 and SO-107 are located upstream and downstream of Regulator S-75 on East 42nd Street in Newburgh Heights. Meter SO-106 is on the #5 egg influent sewer, and SO-107 is on the #5 egg DWO sewer. Both of these meters show a very large delayed inflow after wet weather events, as shown in Figure G-29 for meter SO-106 and Figure G-30 for meter SO-107. The source of this delayed inflow could not be determined. Therefore, the model was not calibrated for this delayed inflow. Also, the flow rates for meter SO-107 seem unreasonably high. For some storm events, the meter shows flows that are higher than meter SO-106, even though the flows are regulated at S-75. Meter SO-107 is located at the next manhole downstream of Regulator S-75, and is on the pipe coming into this manhole. There are no blind connections between the regulator and the flow meter. Therefore, only the regulated flow should be at this flow meter. Also, Regulator S-75 consists of a 5 foot long, 12 inch diameter pipe constriction on the dry weather out, which should limit the peak flows at meter SO-107. The meter shows flows for some storm events at around 20 cfs, which would translate to a velocity of 25 ft/sec through the constriction. It was noted on the site sheets that there may be a backup from the 12-inch lateral that connects just downstream of meter SO-107.

Figure G-29. Calibration of Wet Weather Flows at Meter SO-106

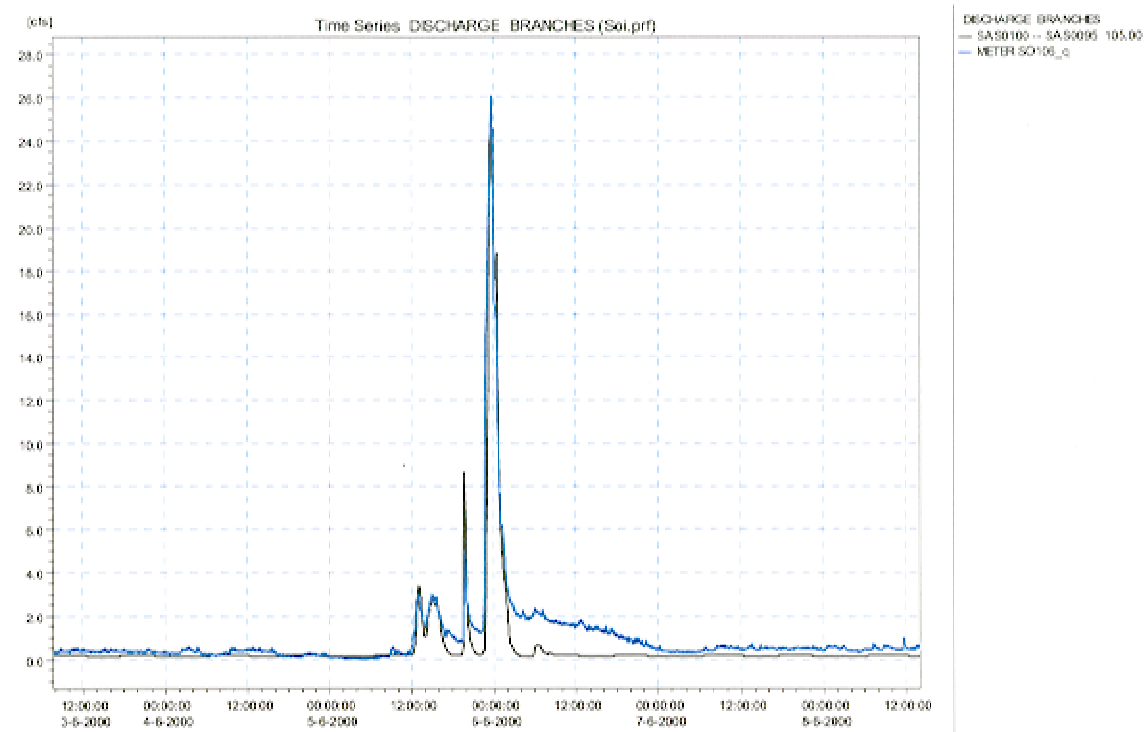
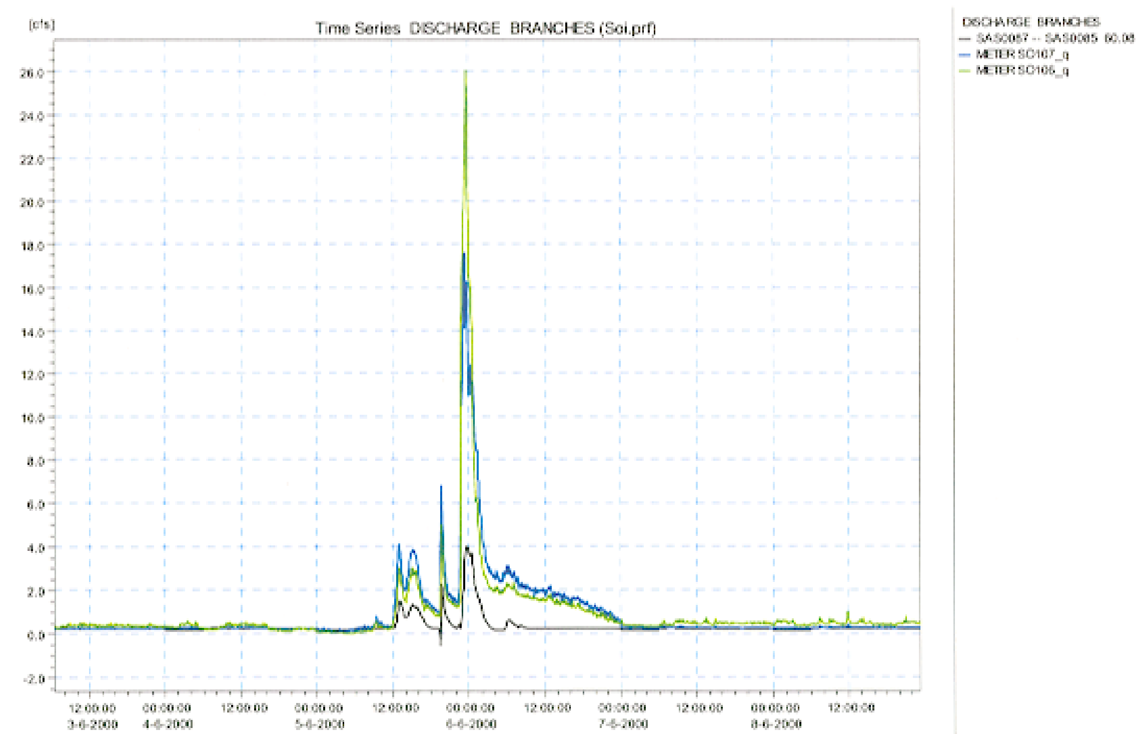


Figure G-30. Calibration of Wet Weather Flows at Meter SO-107



SO-128I/SO-128D

Meters SO-128I and SO-128D are located upstream and downstream of Regulator S-1A at Gallup Avenue and Broadway Avenue. This is a leaping weir, and meter SO-128I is on the 54 inch concrete influent sewer, and SO-128D is on the 42 inch concrete SWO pipe. The model showed a very good match to meter SO128I, as shown in Figure G-31. However, the calibration of meter SO-128D was less consistent. For some storm events, the meter shows higher flow rates than the model, and for other storm events, the model over-predicts the wet weather volumes, as shown in Figure G-32. For some of the storms, meter SO-128D shows higher flows than meter SO-128I, even though a portion of the flow is expected to be routed through the dry weather pipe at regulator S-1A. This is shown by comparing the storm event on June 18, 2000 in Figures G-31 and G-32.

Figure G-33 shows the hydraulic grade line for meter SO-128D. The 0.2 foot difference in elevation during dry weather is caused by a small amount of water stored upstream of the manhole due to a shift in the pipe joints.

Figure G-31. Calibration of Wet Weather Flows at Meter SO-128I

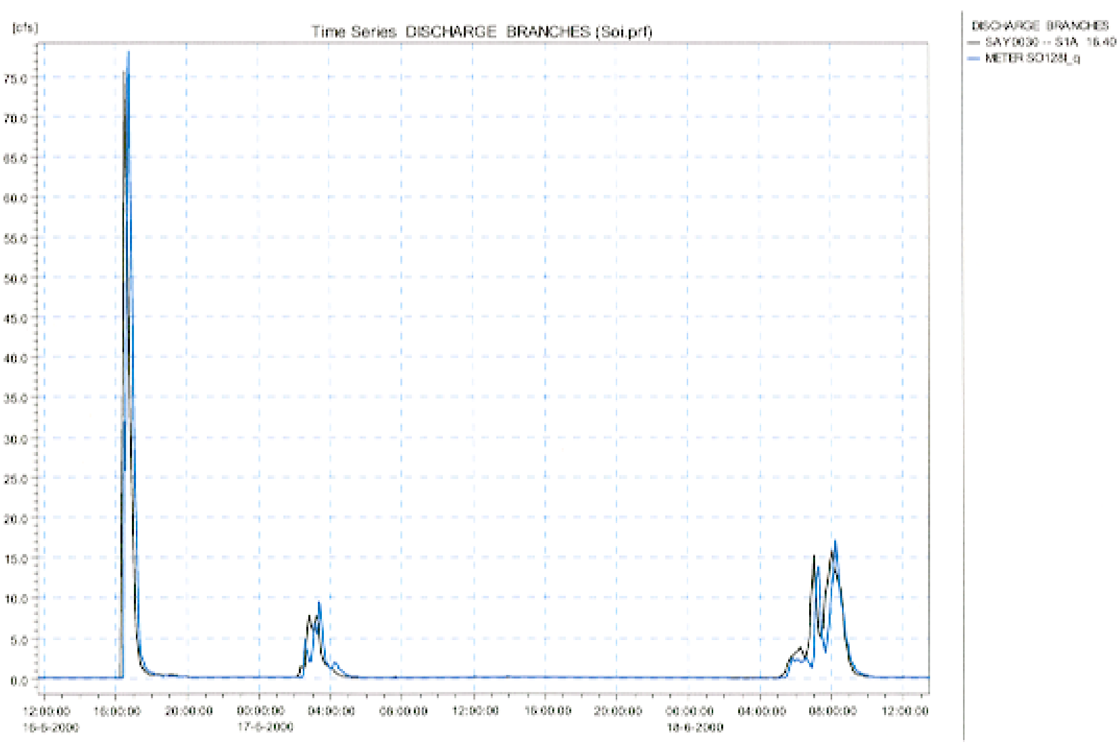


Figure G-32. Calibration of Wet Weather Flows at Meter SO-128D

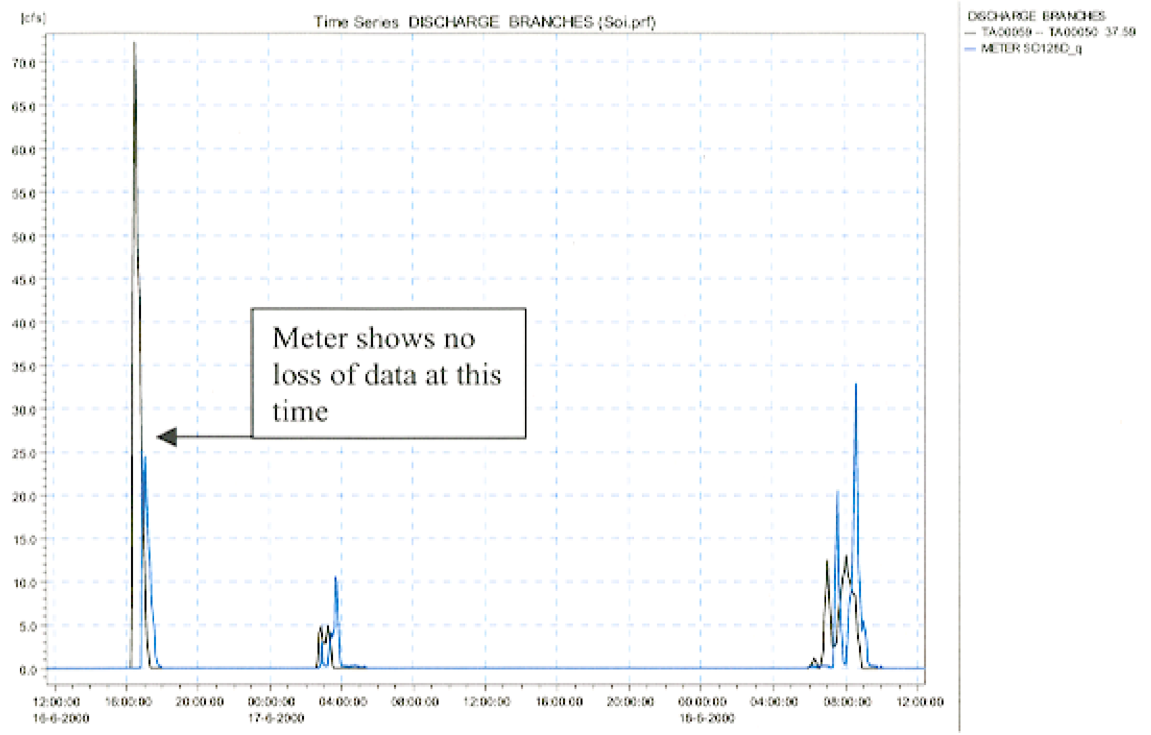
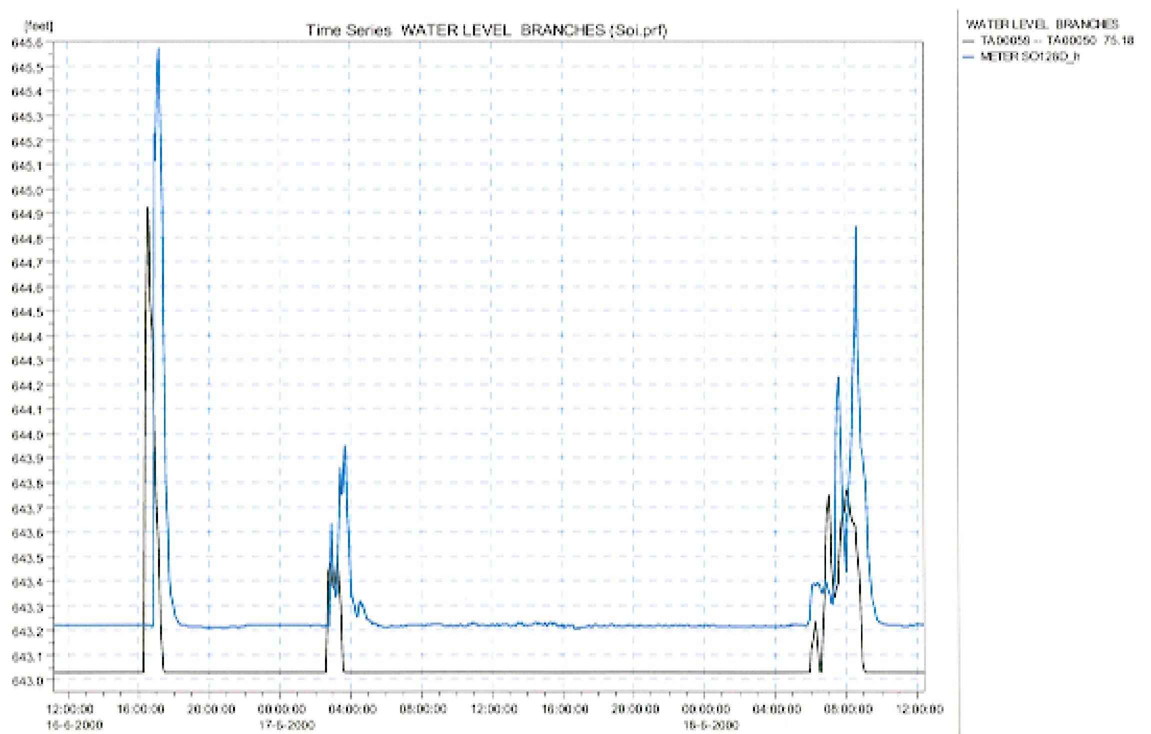


Figure G-33. Calibration of Hydraulic Gradeline at Meter SO-128D



SO-144/SO-143/SO-142/SO-141

Meters SO-144, SO-143, SO-142, and SO-141 are located in the collection system at the upstream region of Morgana Run. Meter SO-144 is located upstream of Regulator S-66 on Sandusky between East 95th and East 96th Streets. It is on a 69 inch circular brick sewer. The model calibrated well to this meter, as shown in Figures G-34 and G-35.

Meter SO-143 is located downstream of Regulator S-66 at East 93rd and Sandusky. It is on a 63 inch circular brick sewer just downstream of a short, sharp bend in the pipe. A collapse of bricks was reported in the incoming pipe. The model shows smaller wet weather flows than the meter at this location, as shown in Figures G-36 and G-37. Meter SO-143 also shows higher flows than SO-144 for some storm events, even though meter SO-144 is upstream of the regulator. This is shown by comparing Figures G-35 and G-37. This means that either flow is coming from Morgana Run into the sewer, or there is a problem with the meter. The velocities at Meter SO-143 look fairly good in the model, with the model underestimating velocities during the large events, but matching well for the smaller storms, as shown in Figures G-38 and G-39. The water levels are much higher for the meter, especially during the large storms, as shown in Figures G-40 and G-41. This is most likely caused by the hydraulics at the bend that contains debris.

Meter SO-142 is located downstream of Regulators S-65 and S-66, and upstream of Regulator S-64, at East 82nd and Aetna. It is on a 78 inch circular brick sewer. The model matches the meter well for the smaller storms, but over-predicts the flow rates for larger storms, as shown in Figure G-42.

Meter SO-141 is located on the dry weather pipe from Regulator S-64, at East 80th and Aetna. It is on a 24 inch vitrified clay pipe. The model and the meter show a good comparison for this flow meter, as shown in Figure G-43. Meters SO-141 and SO-142 show about a 2 cfs difference in dry weather flow rates, as shown in Figure G-44. The model was calibrated between these two flow rates.

Figure G-34. Calibration of Wet Weather Flows at Meter SO-144

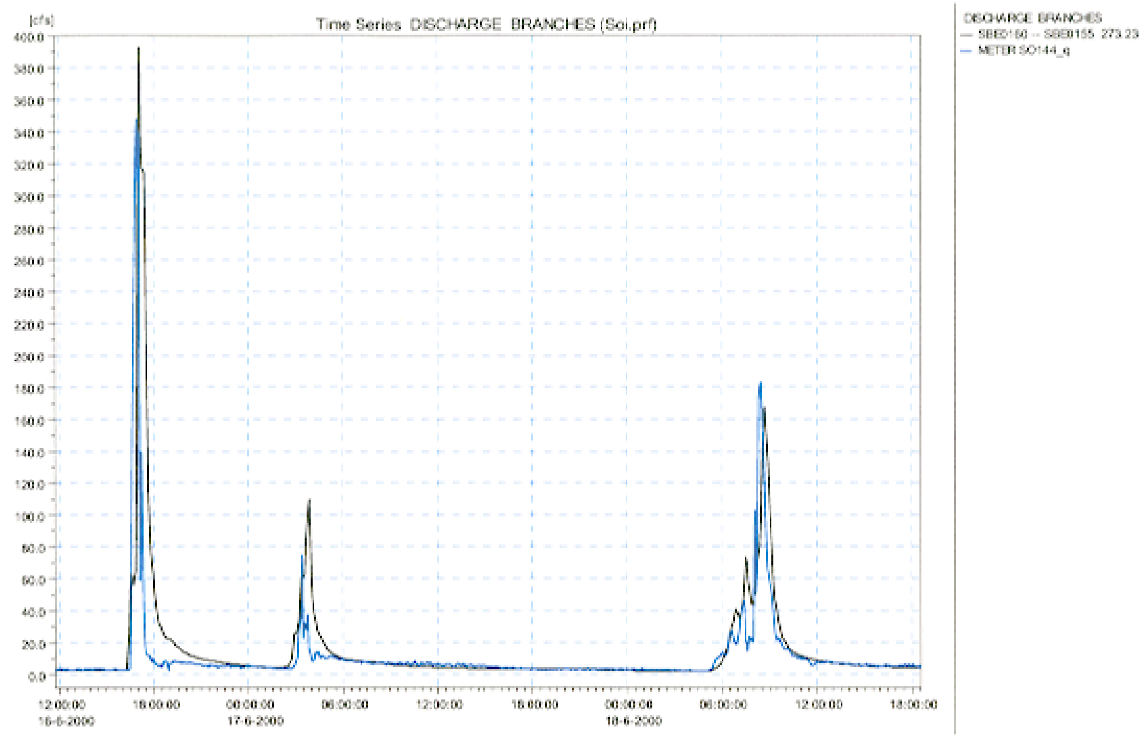


Figure G-35. Calibration of Wet Weather Flows at Meter SO-144

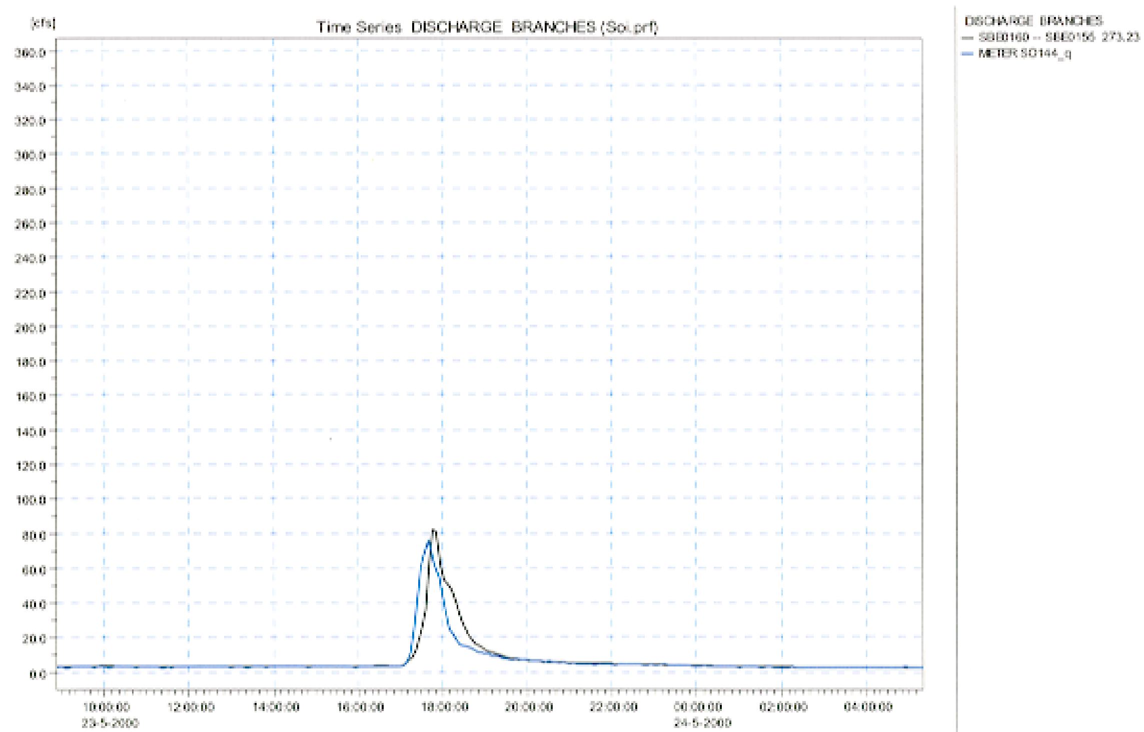


Figure G-36. Calibration of Wet Weather Flows at Meter SO-143

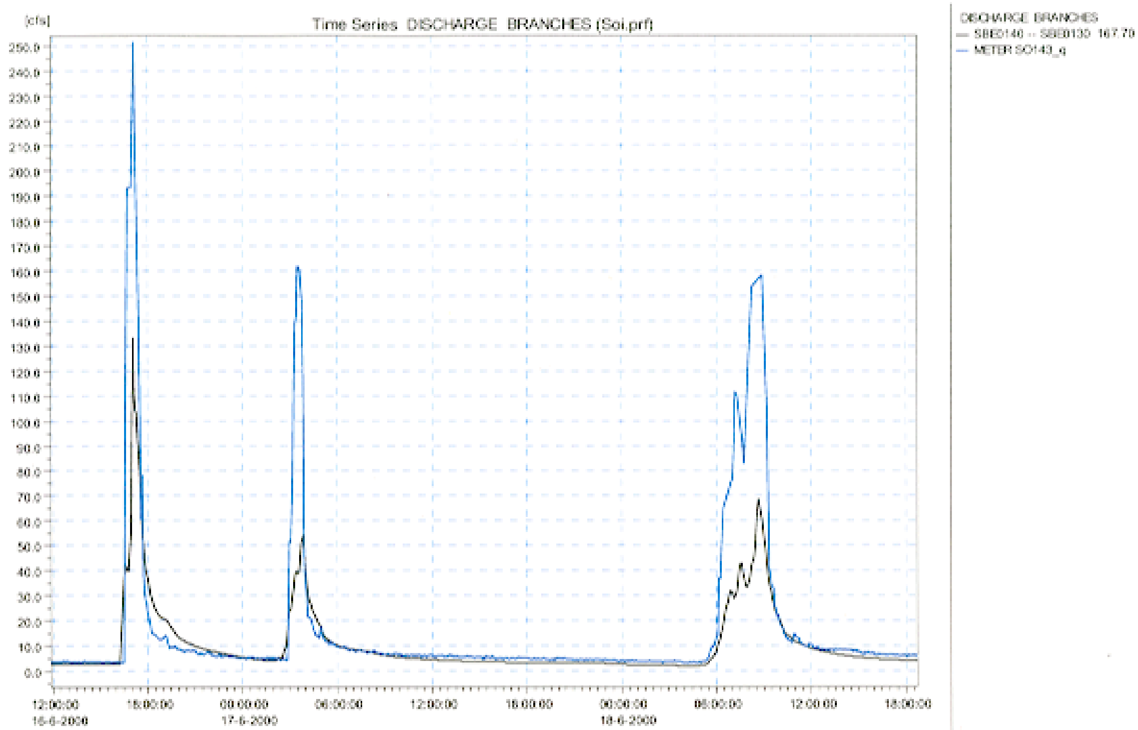


Figure G-37. Calibration of Wet Weather Flows at Meter SO-143

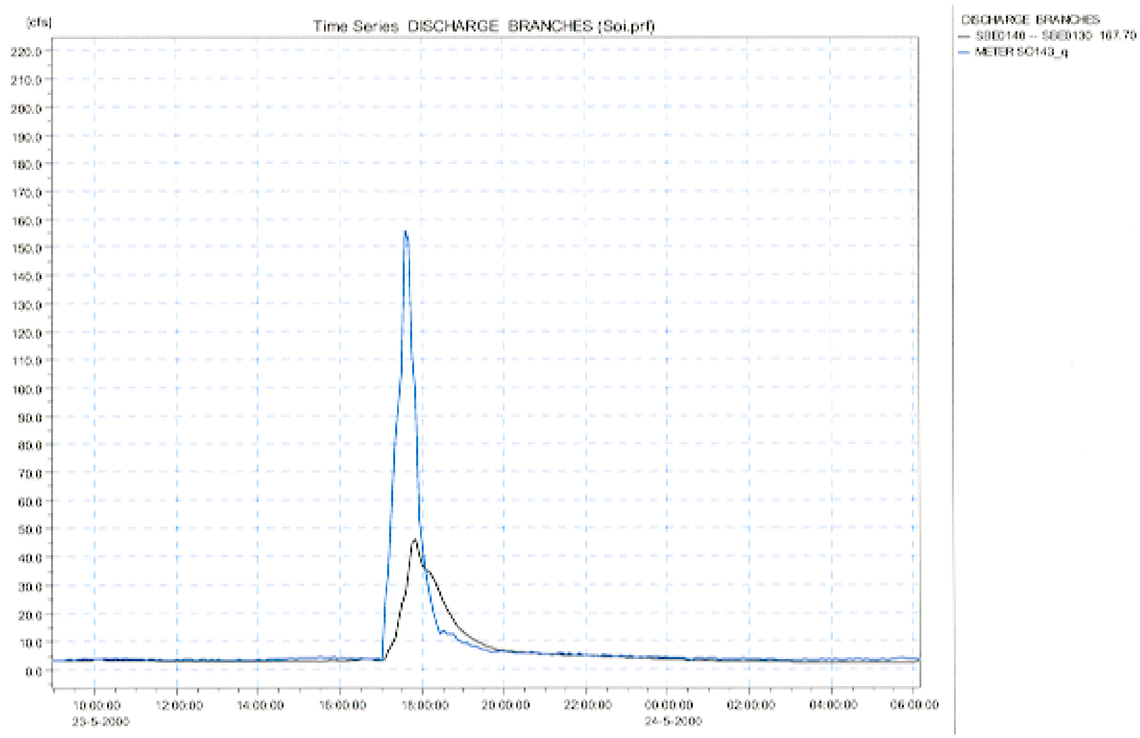


Figure G-38. Calibration of Wet Weather Velocities at Meter SO-143

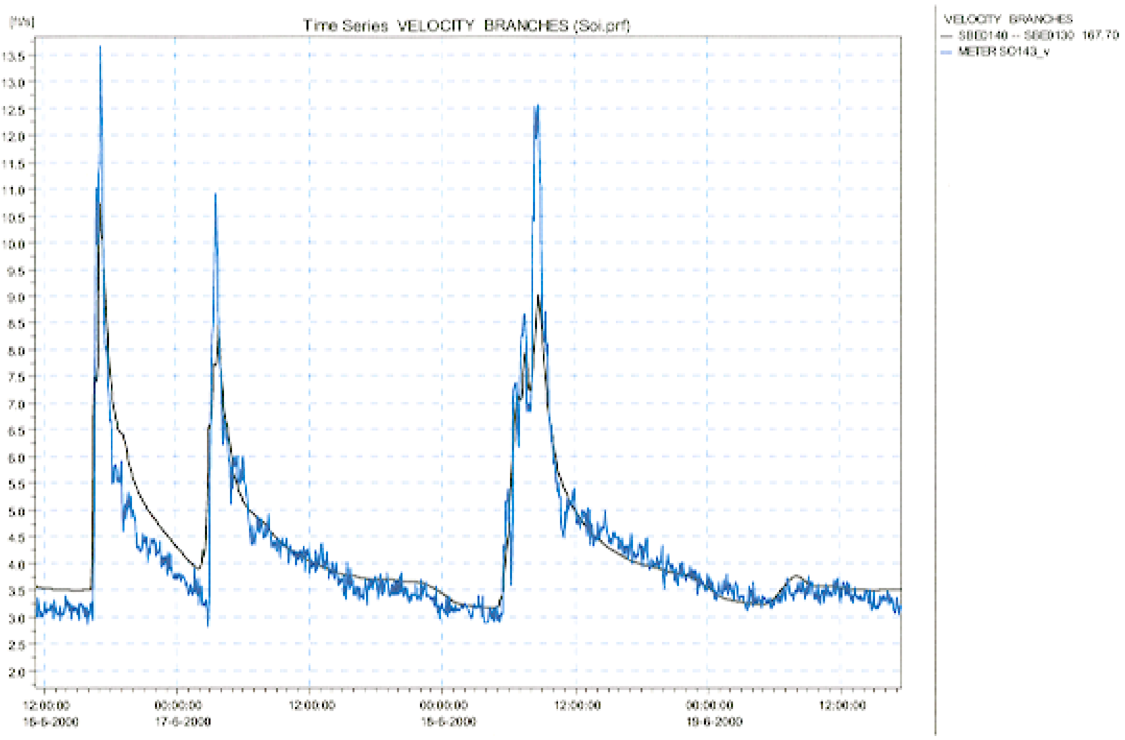


Figure G-39. Calibration of Wet Weather Velocities at Meter SO-143

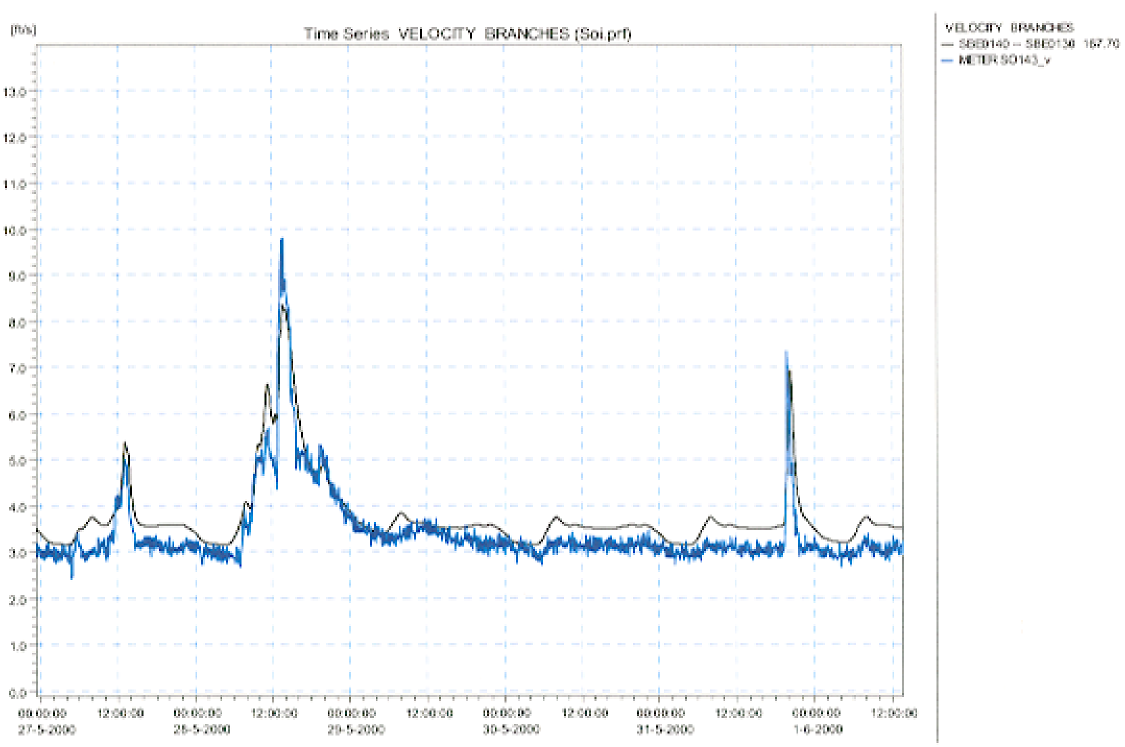


Figure G-40. Calibration of Wet Weather Hydraulic Grade Line at Meter SO-143

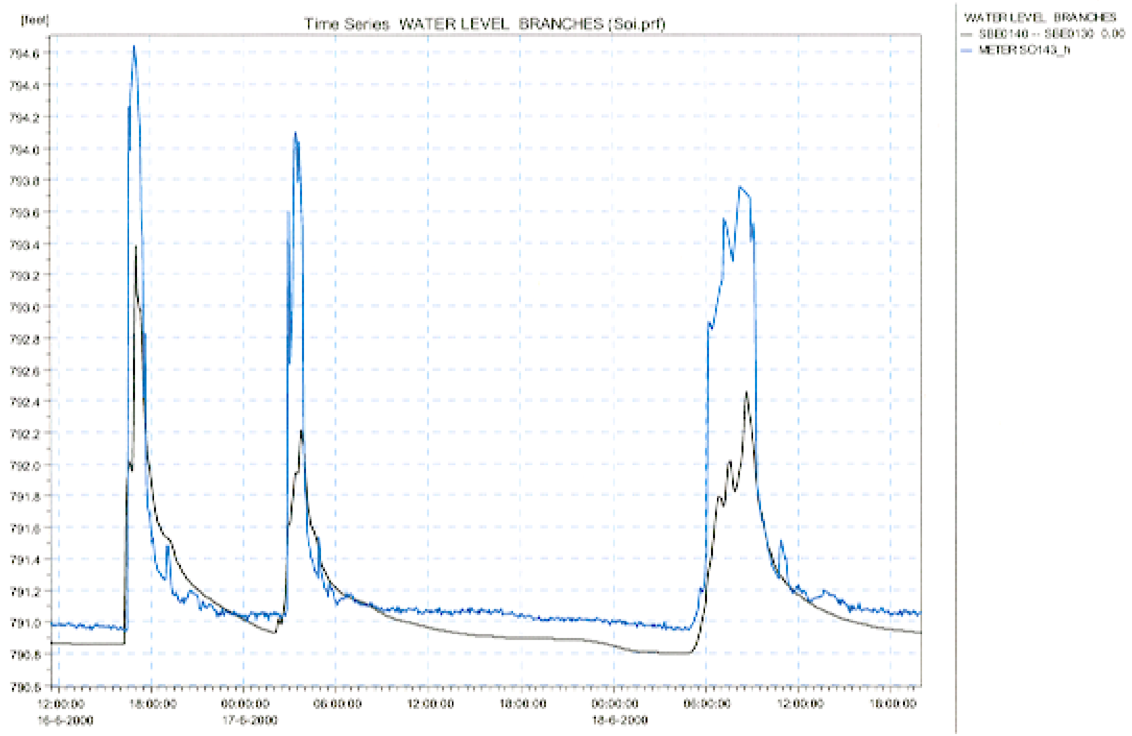


Figure G-41. Calibration of Wet Weather Hydraulic Grade Line at Meter SO-143

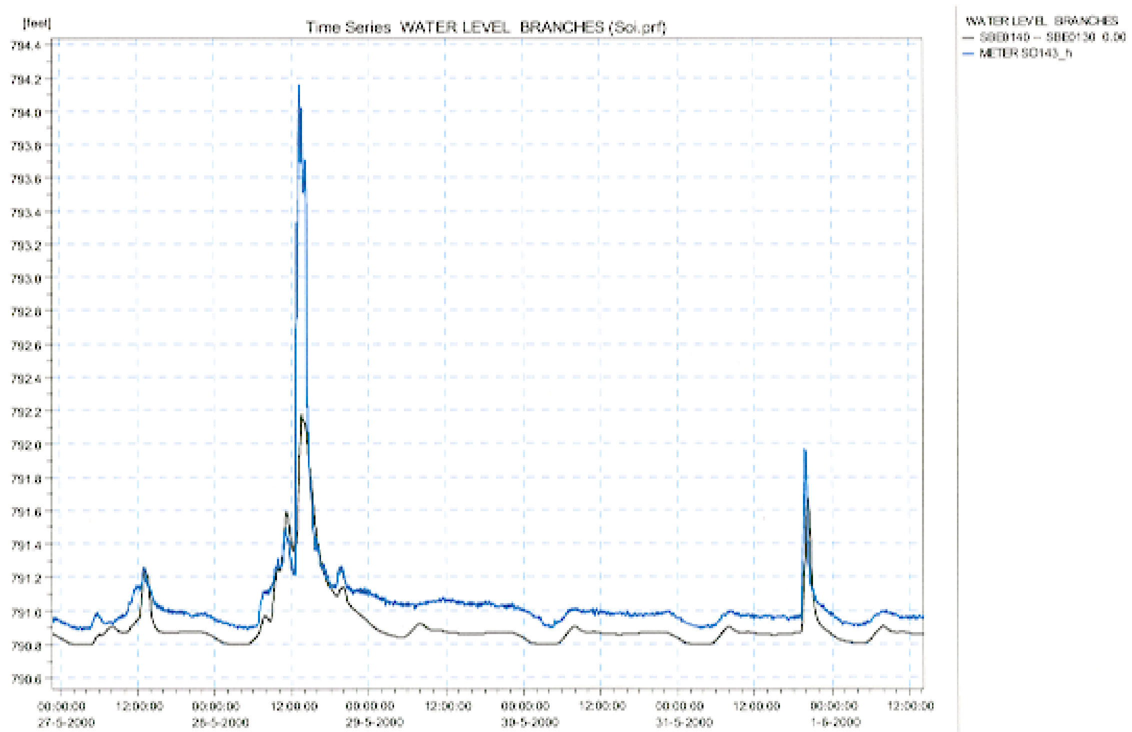


Figure G-42. Calibration of Wet Weather Flows at Meter SO-142

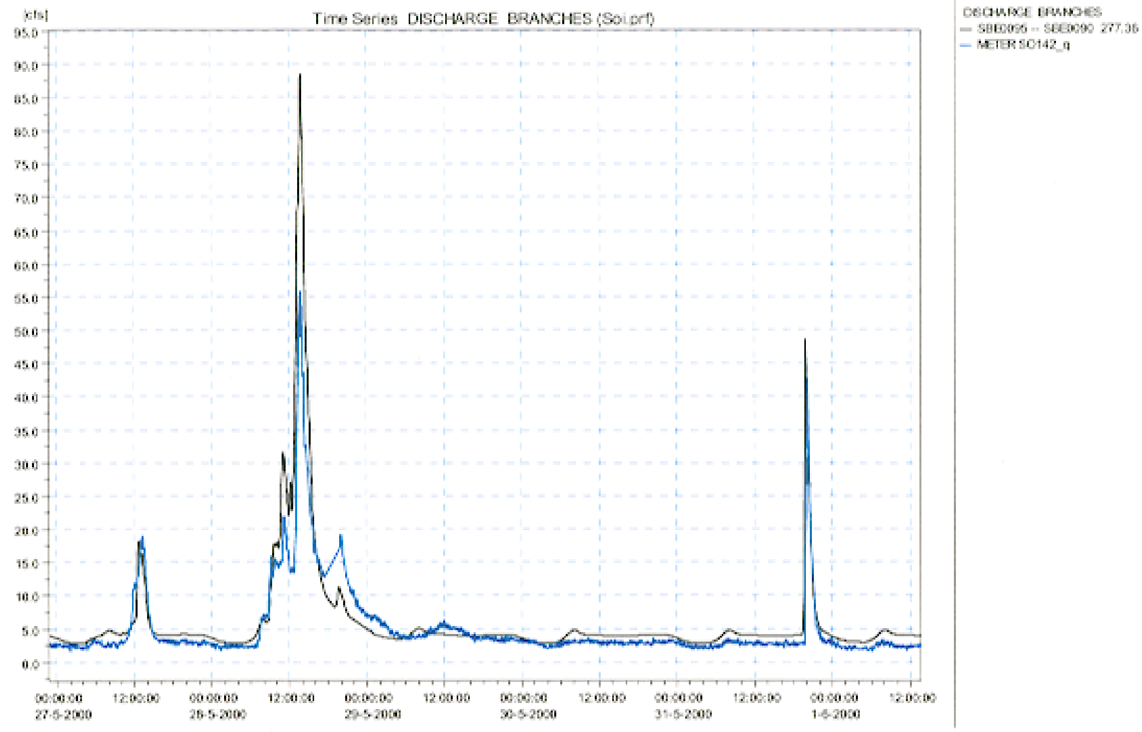


Figure G-43. Calibration of Flows at Meter SO-141

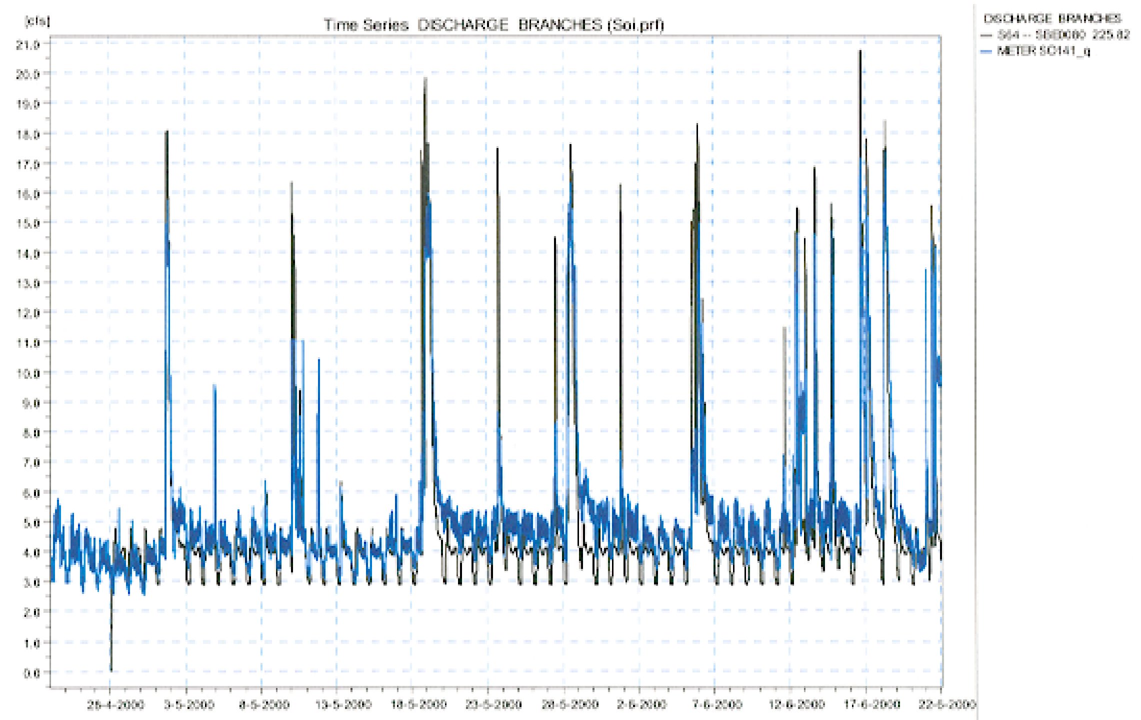
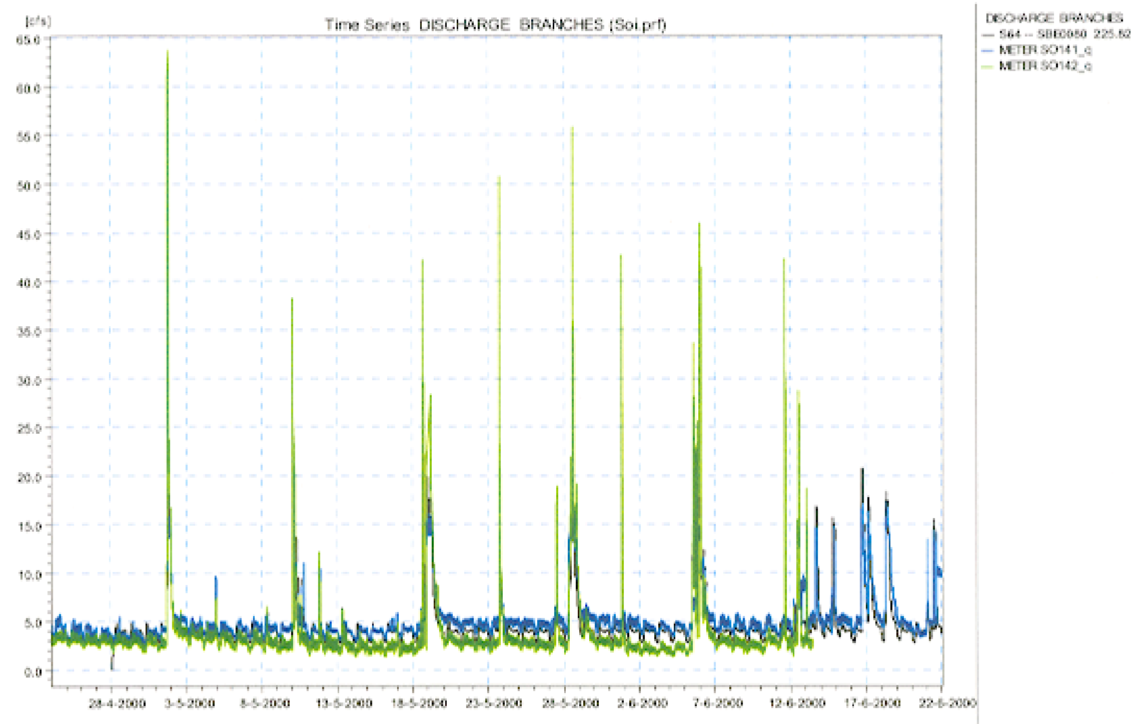


Figure G-44. Comparison of Dry Weather Flows at Meters SO-141 and SO-142



BIG CREEK EAST SUB-MODEL

METER PROBLEMS

During modeling of the Big Creek sub-model it was found that several flow meters were exhibited discrepancies . These flow meters include BC-108, BC-109, BC-110, BC-117, BC-120, BC-123, BC-124 and BC-164.

BC-108

BC-108 is located on a 78-inch combined line and monitors flows from a primarily residential area (89-acres) upstream of Jennings Road Pump Station. The flow rate plot at this meter often goes down to zero and flow rate values are not functioning simultaneously with the recorded water level and velocity values. Therefore, the model was calibrated with respect to the water level and velocity readings recorded by this meter. The water level and velocity comparisons at this station generated values that were within a desirable range. See Figures G-45 through G-47.

Figure G-45. Meter BC-108 Water Level

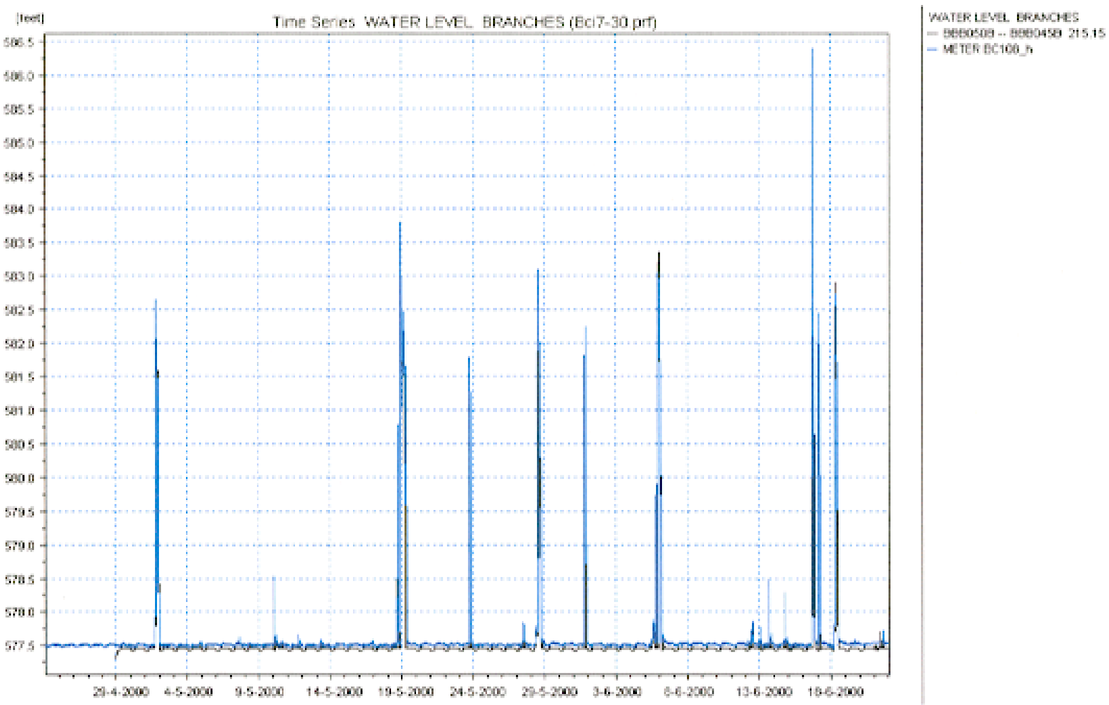


Figure G-46. Meter BC-108 Water Level

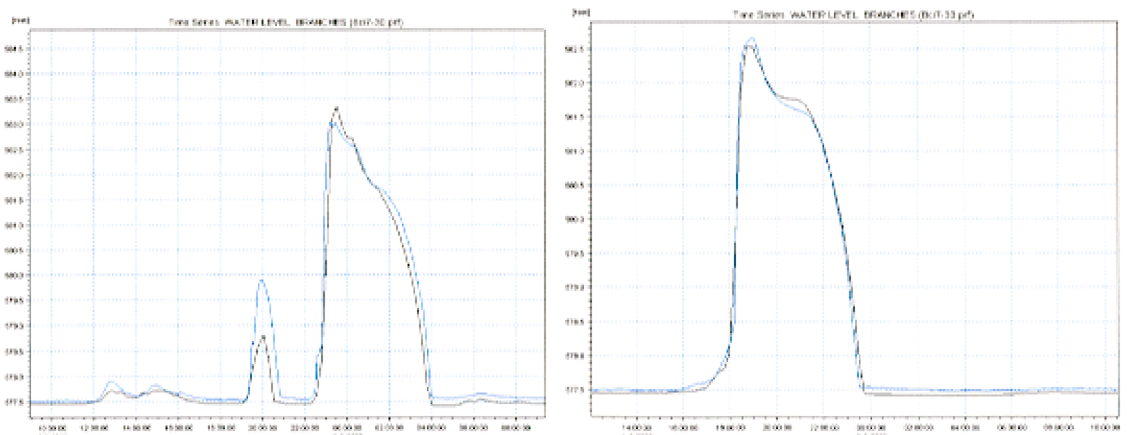


Figure G-47. Meter BC-108 Velocity

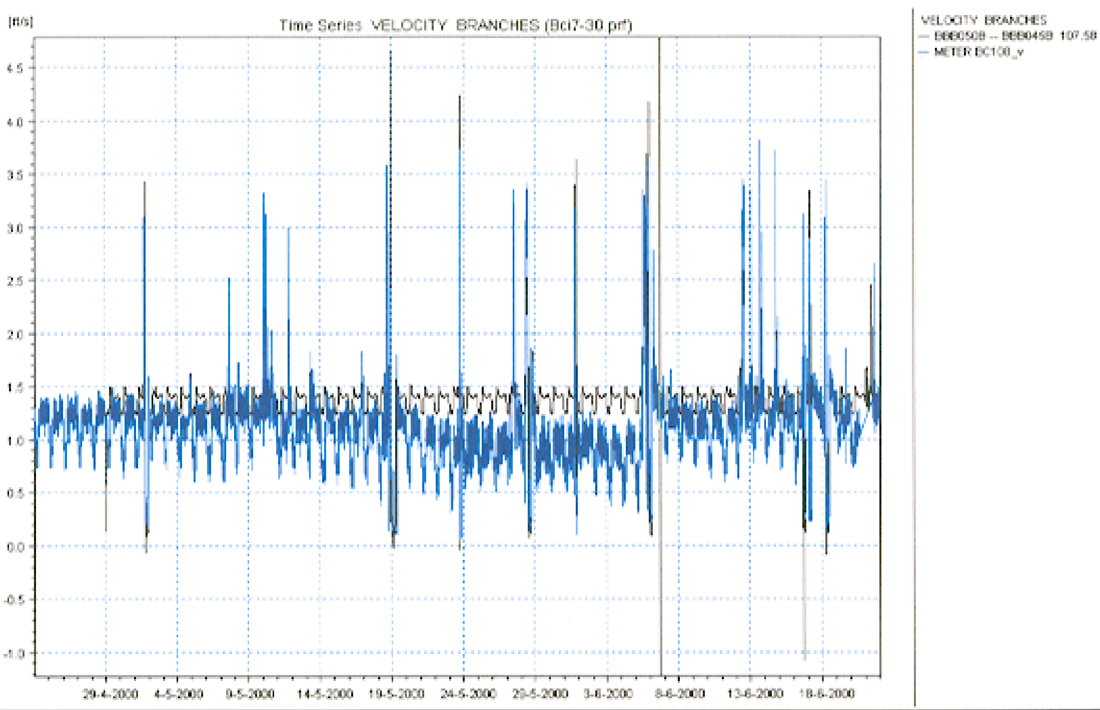
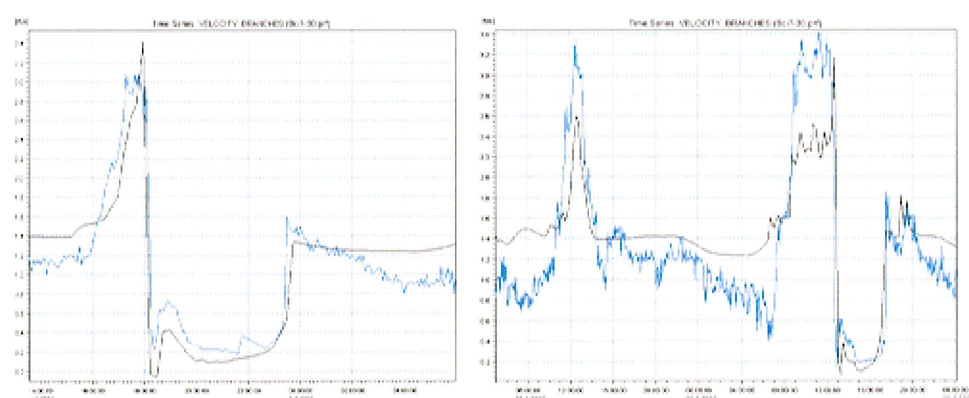


Figure G-48. BC-108 Velocity



BC-109

Flow monitor BC-109 is on the downstream of the stormwater outlet of automated regulator BC-1. It is receiving wet and dry weather flows from industrial area along Valley Road off Jennings

Road. This flow meter recorded incorrect flow values due to back-up in this line during storm events. This site was calibrated to water level and velocity. The results appear to be consistent. See Figures G-49 through G-52.

Figure G-49. Meter BC-109 Water Level

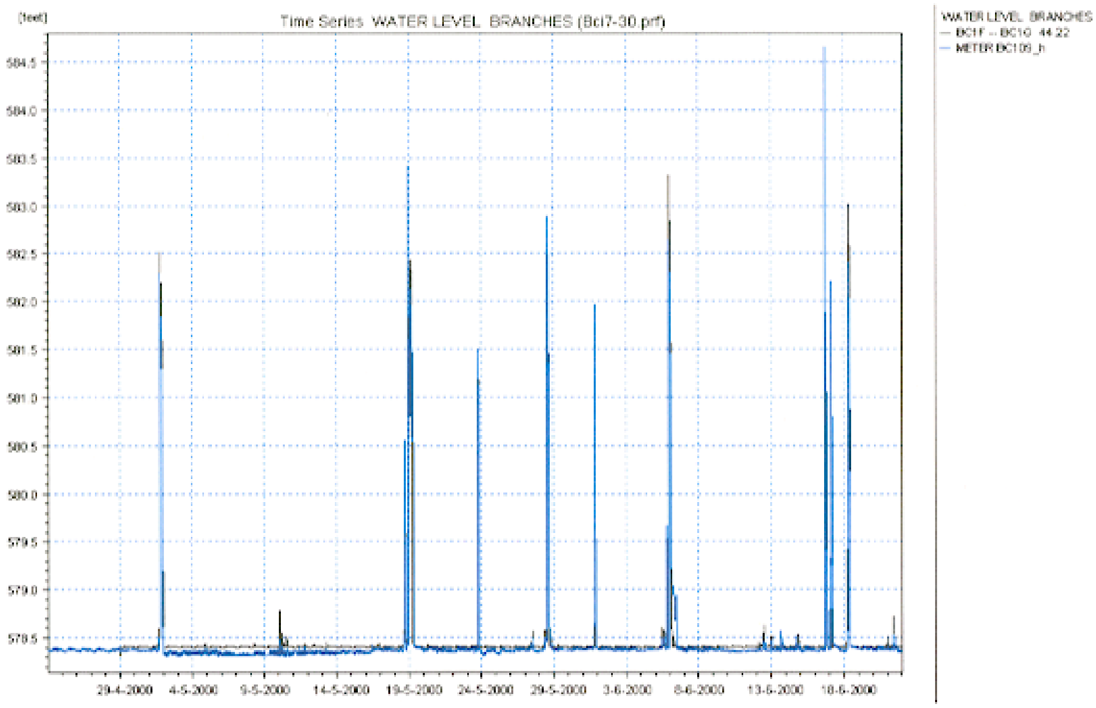


Figure G-50. Meter BC-109 Water Level

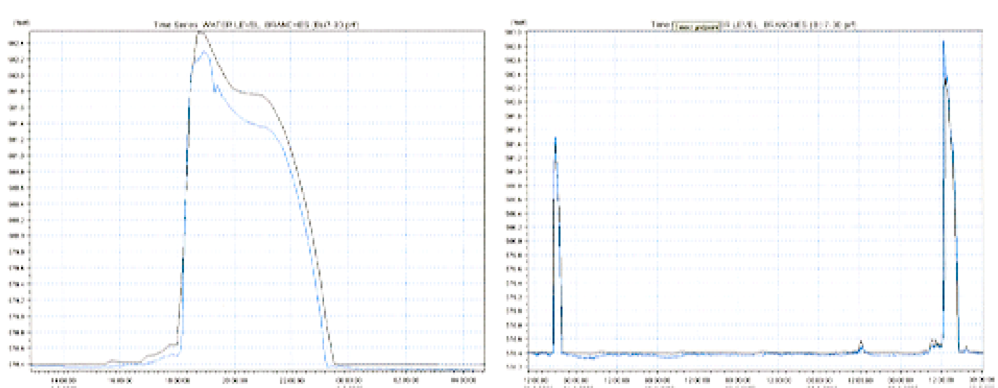


Figure G-51. Meter BC-109 Velocity

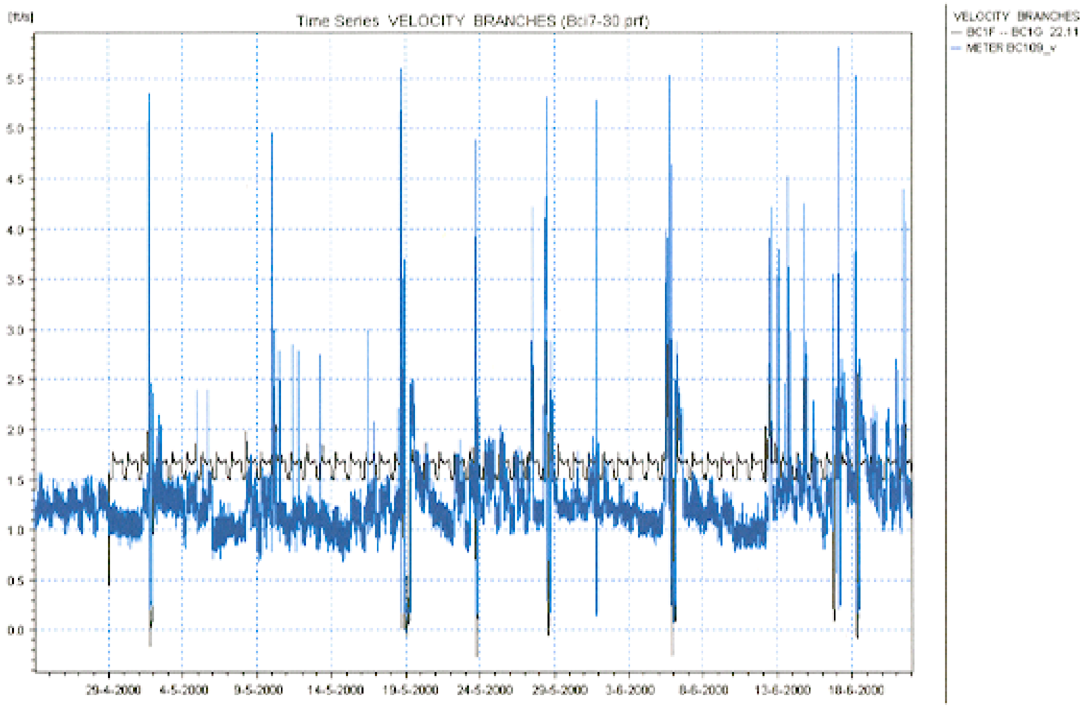
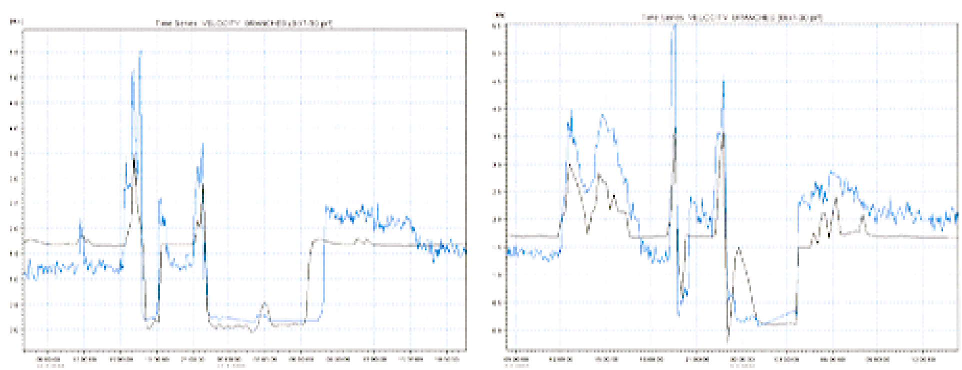


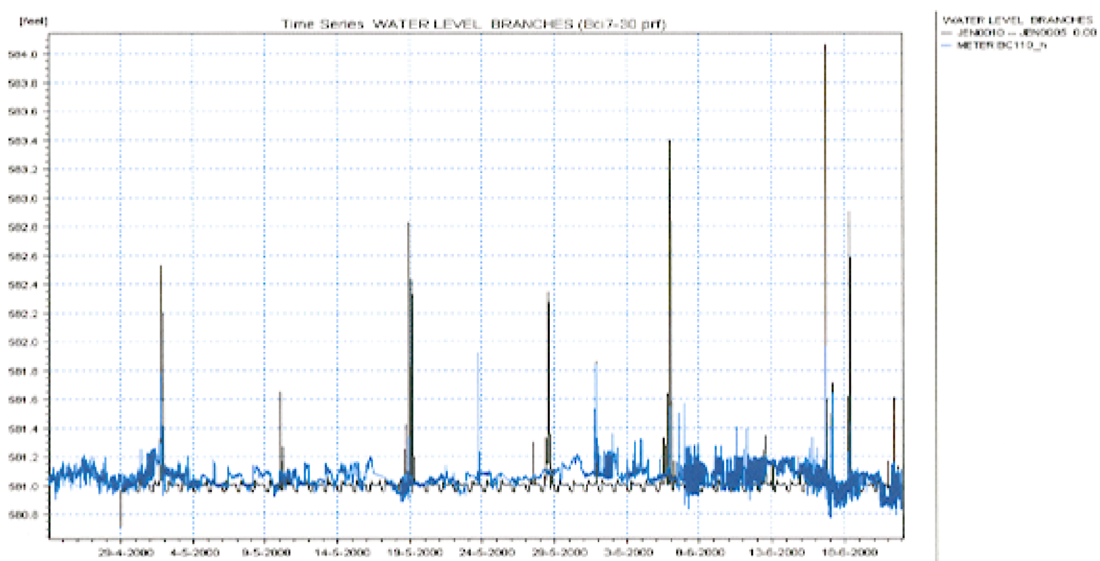
Figure G-52. Meter BC-109 Velocity



BC-110

Meter BC-110 did not operate correctly. Dry weather readings were not consistent throughout the calibration period. During storm events, flow values generated by the MOUSE model were either too high or too low compared to the meter readings. The water level values were also inconsistent at this meter, see Figure G-53. This meter was not used for calibration.

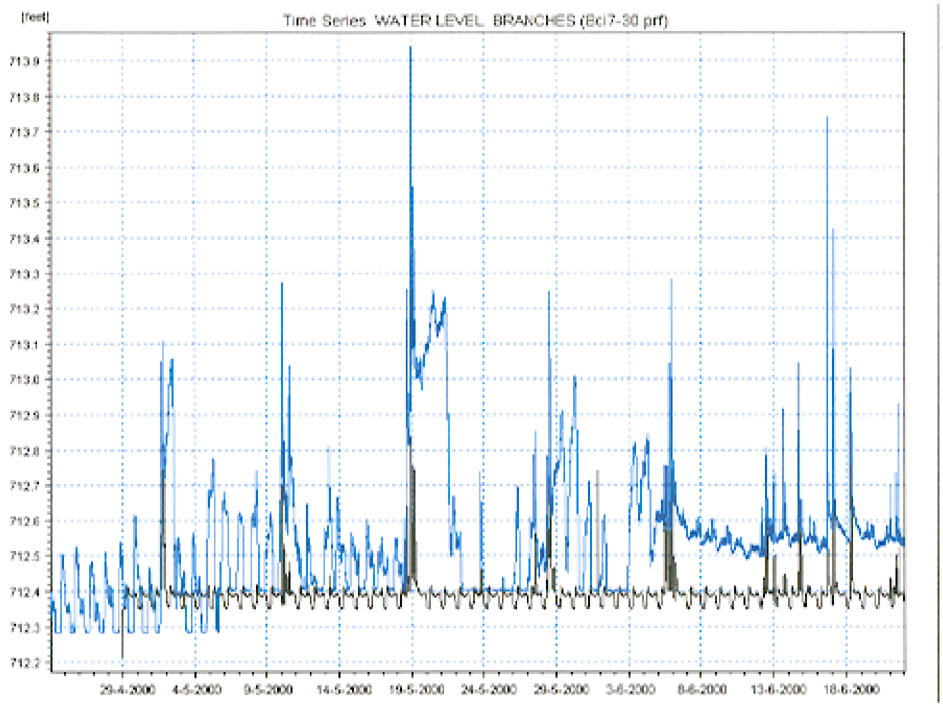
Figure G-53. Meter BC-110 Water Level



BC-117

Meter BC-117 did not operate correctly. During calibration period, the meter often recorded zero water level value on the combined sewer line running north on Pearl Road. Additionally, the water level and flow rate sensors did not function simultaneously. See Figure G-54.

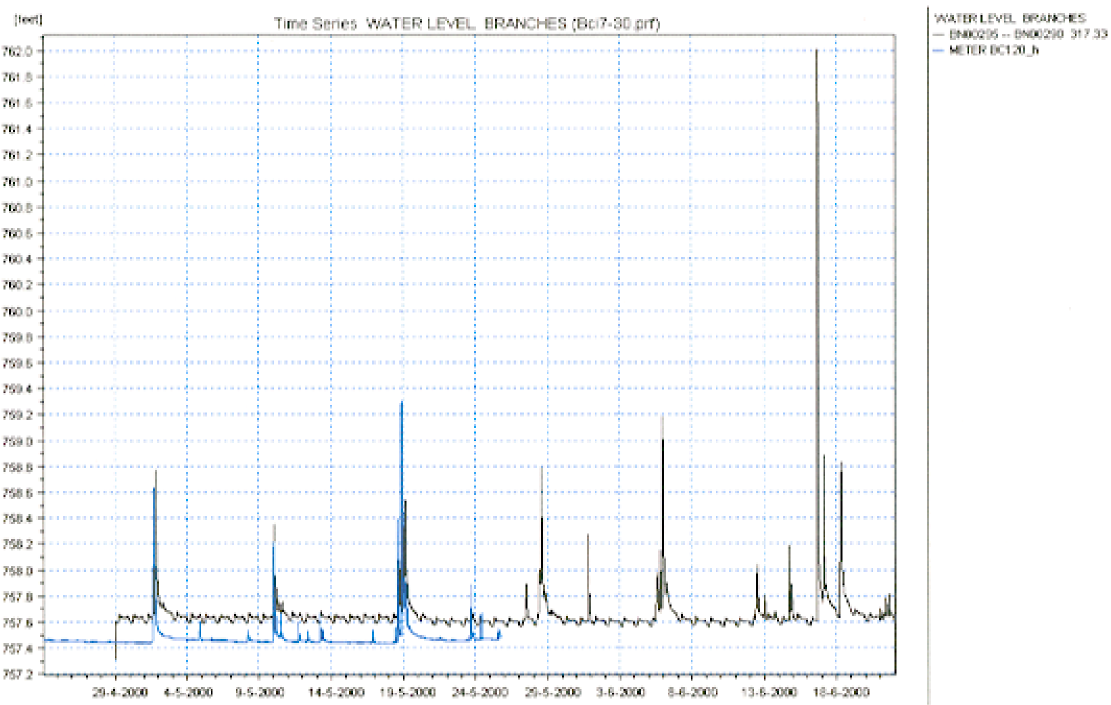
Figure G-54. Meter BC-117 Water Level



BC-120

Flow meter BC-120 did not function during the whole calibration period. This meter recorded zero flow rate values during dry weather conditions on a No. 5 sanitary sewer. See Figure G-55.

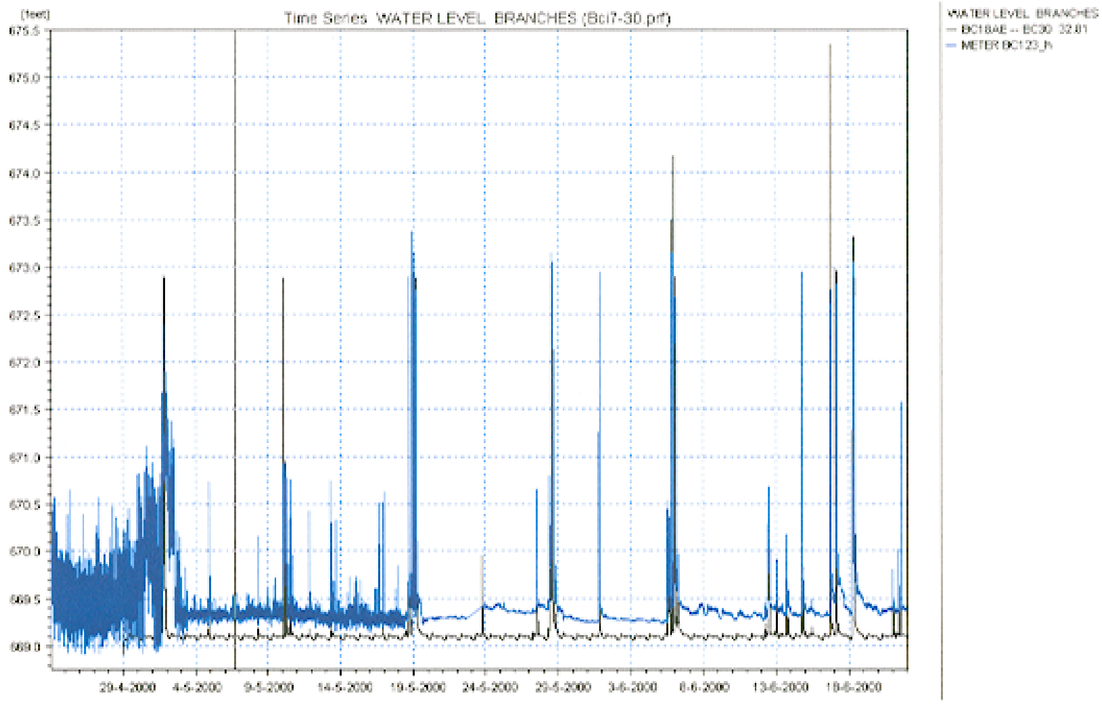
Figure G-55. Meter BC-120 Water Level



BC-123

Meter BC-123 was not calibrated for flow rate. Dry weather flow conditions were 5 times the expected values based on population estimates in the sanitary basins tributary to this flow meter. The model was calibrated to water level values recorded by this meter during storm events as shown in Figure G-56.

Figure G-56. Meter BC-123 Water Level



BC-124

BC-124 is downstream of automated regulator BC-7 and flow meter BC-123 on the wet weather overflow pipe. The flows seemed unreasonable, based on upstream flows, therefore the model was calibrated to the number of overflow events.

BC-164

The volume of flow reported at BC-164 was significantly higher than the total volume of upstream meters. This meter is located on the overflow pipe from Regulator BC-41 and was not able to be calibrated for velocity or volume. Therefore, the model was calibrated to the number of overflow events.

BIG CREEK WEST SUB-MODEL

Flow Meter BC-156

The calibration of this meter was hindered by the operation of automated regulator BC-8. Flow Meter BC-156 was located just downstream of automated regulator BC-8 on the 30" dry weather outlet pipe. Auto-regulator BC-8 consists of a sluice gate on the dry weather pipe and a storm gate on the 6' x 6' wet weather outlet pipe. The sluice gate was programmed to maintain 2' of head in the downstream dry weather outlet pipe. The storm gate is programmed to open when high flow occurs. The model cannot be calibrated with the meter using these conditions. It appears as if neither of the programmed operations occurs properly. A reasonable match between the meter and the model was obtained if the storm gate was left open at all times and a head of 1.4' was maintained in the downstream dry weather outlet pipe.

FLOW METER BC-138

This meter was located on the Big Creek Interceptor in a 66 inch pipe. The dry weather flow for this meter is less than the sum of all the upstream meters. The calibration plots appear reasonable after subtracting 3 cfs from the meter to account for the inaccuracy of the meter in recording the dry weather flow.

FLOW METER BC-148

This meter is located in a 90 inch storm sewer and appears to have inherent problems with the data. A 2.15' silt weir was added to adjust the model head to the recorded meter level. The meter overestimates the flow rate during the May 18 to May 19, 2001 storm event. The meter malfunctioned during the June 5 to June 7, 2001 storm event as well as during the June 12 to June 19, 2001 storm event. The resulting small values for the head and flow rate make this meter difficult to calibrate.

FLOW METER BC-149

This meter is located in a 5' x 8' box combined sewer pipe. There was a problem with balancing the dry weather flow at this meter. The meter calibration was good after 0.7 cfs was taken out of the meter flow.

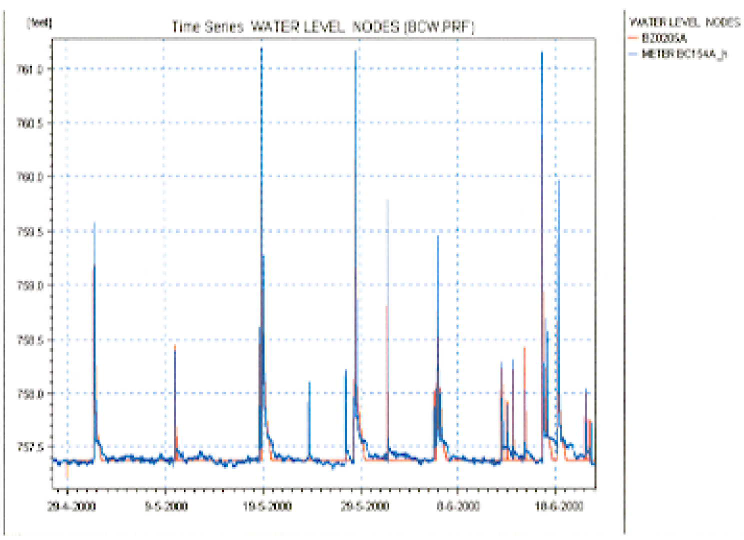
FLOW METER BC-152

This meter is located in a 96 inch combined sewer pipe. There was a problem with balancing the dry weather flow at this meter. The meter calibration was good after 5 cfs was subtracted from the meter flow.

FLOW METER BC-154A

This meter is located in the western barrel of the double barrel Big Creek Culvert in a 150" x 74" arch and appears to have inherent problems with the data. The meter records flow during dry weather periods and it appears to overestimate the head and flow rate for several storms, most noticeably between June 16 and June 18, 2001. See Figure G-57.

Figure G-57. Meter BC-154A Water Level



METER BC-155

This meter is located in a 6' x 6' box combined sewer pipe. There was a problem with balancing the dry weather flow at this meter. The meter calibration was good after 1 cfs was added to the meter flow.