

City of New Haven Long Term CSO Control Plan

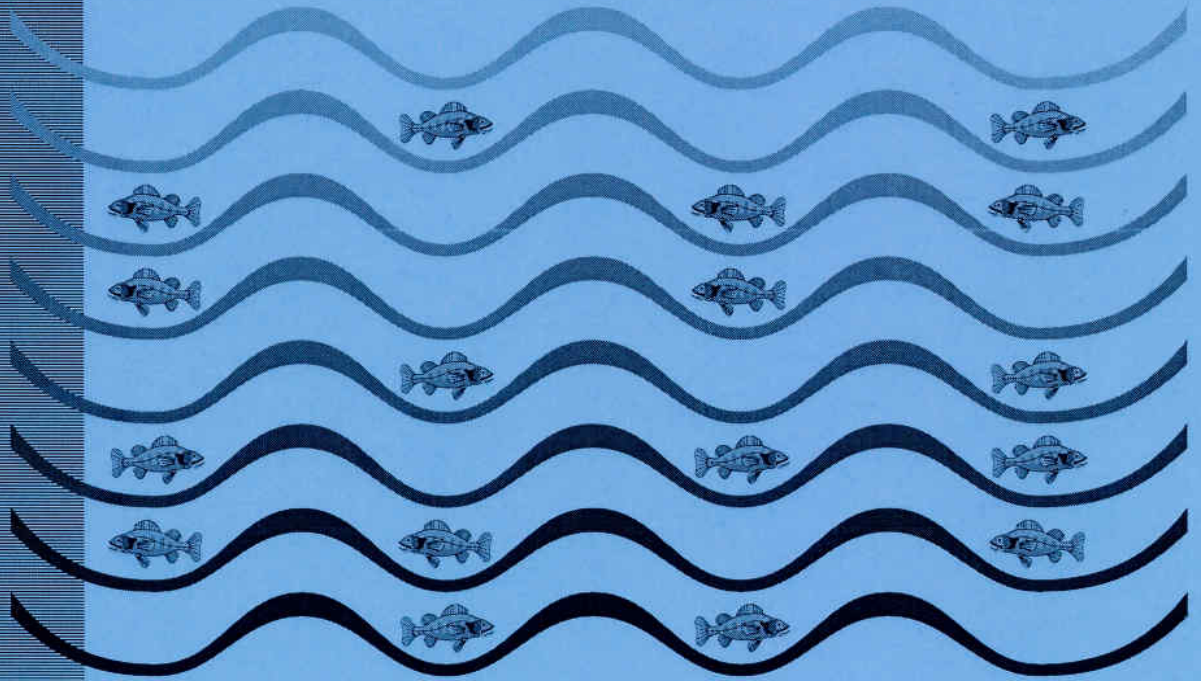


The City of New Haven



New Haven Water Pollution Control Authority

Technical Memorandum #4



October, 1997

October 9, 1997

135807.BA.03

Mr. Lawrence Smith
City of New Haven
City Engineer's Office
200 Orange Street, 5th Floor
New Haven, CT 06510

Mr. Raymond Smedberg, P.E.
City of New Haven
Water Pollution Control Authority
East Shore Water Pollution Abatement Facility
345 East Shore Parkway
New Haven, CT 06512

Dear Sirs:

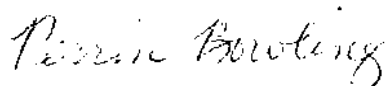
Subject: New Haven LTCP Project
Task 3 - Monitoring Program

Attached for your review and comment is a draft of Technical Memorandum #4. This memorandum documents the approach being used with data management and the flow/rain monitoring program. It includes draft plots from the interim report which show the first two weeks of data. It will be followed in a few months with Technical Memorandum #5, which will provide the final results of the 90-day monitoring program.

We would appreciate receiving your comments or suggestions by October 24, 1997.

Sincerely,

CH2M HILL



Perrin Bowling/BOS
Task Manager

cc: Cliff Bowers/CH2M HILL
Peter von Zweck/CH2M HILL

Introduction

The model being developed under Task 2 of the Long-Term CSO Control Project is a representation of the sewer system in New Haven. In order for the model to provide a realistic simulation, it must be calibrated with flow and rain data taken from the study area. The purpose of Task 3 of the project is to support calibration of the model and evaluation of receiving water impacts through the collection and management of data.

The scope of Task 3 is threefold: identifying required data, gathering and reviewing available data, and then conducting a monitoring program to provide data that are still lacking. This technical memorandum documents the data management plan developed to maintain the collected data as well as the monitoring program.

Data Management Plan

The purpose of the data management plan is to maintain collected data in a format that will be readily available for model calibration. This section identifies data sources and addresses proposed software packages and formats to be used in establishing an electronic database for the project.

Data Sources

Electronic data that have been collected from existing sources are identified below.

- Depth, velocity, and flow measurements at 15-minute timesteps were obtained for 12 locations on the boundaries of the City of New Haven (where inflow from neighboring communities enters the city). At 10 of the sites, data are available from January 1996 through April 1997. The other two sites have fewer data, one from September 1996 to April 1997 and the other for January through April 1997. (*Source: ADS Environmental Services, Inc.*)
- Short-term (21-day) records of depth, velocity, and flow at 15-minute timesteps were acquired for 7 locations in eastern New Haven (near and in Fair Haven). These data were taken during March and April of 1997 to examine flooding problems associated with the James Street Siphon. (*Source: ADS Environmental Services, Inc.*)
- Daily effluent flows from the East Shore WWTP are available from January 1993 through May 1997. (*Source: Water Pollution Control Authority*)
- Rainfall depth from a gauge at the East Shore WWTP was obtained in half-hour increments from July 1994 through May 1997. (*Source: Water Pollution Control Authority*)

- Rainfall records for six gauges near the city were obtained in 15-minute intervals. At three of the gauges, data were available from January 1996 through June 1997. The remaining three gauges collected data from January through June 1997. One of the gauges is quite near the city boundary, and most are within 2 miles. The furthest rain gauge is within 10 miles of the city. (Source: *South Central Connecticut Regional Water Authority*)
- Long-term rainfall records for two stations near the study area (Tweed Airport and Lake Saltonstall) were acquired as daily rainfall depths for May 1948 through May 1969 and April 1978 through December 1995 for Tweed and Saltonstall, respectively. The Lake Saltonstall data set has a large amount of data missing. Hourly records also were obtained for January 1991 through December 1995 for the Lake Saltonstall station. (Source: *EarthInfo, Inc.*)
- Bi-monthly pumping station throughput is available for July 1996 to June 1997 at the Welton Street, Park Street, Arch Street, and Brookside Pumping Stations. (Source: *Water Pollution Control Authority*)

Additionally, the following data are available, though not in electronic format at the current time:

- Flows through the Boulevard, East St., and East Shore pumping stations and the WWTP effluent flow are available in hourly increments for 1996 and January through May of 1997 with the exception of a few missing days. These data are handwritten on paper and require electronic data entry into the database. (Source: *Water Pollution Control Authority*)

Proposed Software

An important requirement of calibration data is that they be easily imported into the model. In addition, facility of use leads towards a PC-based database software package. Given these factors, and the use of Microsoft products within the consulting team, the proposed software for the data management plan is Microsoft Access. One great advantage to using MS Access is that an individual table can archive a larger number of records than a spreadsheet can, so that all the data pertaining to a specific site can be kept in one table.

Proposed Format

It is suggested that a new database be created for data from each different source. Thus, flow data for the WWTP and flow data from the City boundaries constitute two separate databases. Within a database, different tables will be used to distinguish between different monitoring locations or gauges. The preferred data format is shown in Table 1, where there can be multiple parameters (e.g. flow, velocity, and depth). The time column functions as a dummy variable when daily values are presented in a table.

In the MS Access tables, field names should be descriptive (for example, the headings used in Table 1, with "Velocity (fps)" and "Flow (MGD)" as the parameters). Data types are also indicated in Table 1. Tables should also have a unique identifier as a primary key (e.g., a counter).

Table 1. *Format of data in database under Data Management Plan.*

Field Name	ID	DATE	TIME	parameter 1	parameter 2	...
Data Type	counter	date/time	date/time	number	number	...
	1	1/1/96	00:00	1.23456...	7.89123456...	...
	2	1/1/96	00:15	0.999...	2.2323...	...

	96	1/1/96	23:45	0.8787...	5.3125...	...
	97	1/2/96	00:00	1.000...	6.2437729...	...

Data Collection Program

Introduction

To supplement the data already obtained, and to meet the needs of the model development and calibration tasks, a data collection/monitoring program is included in the project. Specific goals of the program include determining volume, frequency, and duration of CSOs throughout New Haven, and obtaining flow measurements from small service areas with characteristics representative of those found throughout the study area, including:

- combined sewer areas,
- separated sewer areas without roof leader connections (originally built separated), and
- separated sewer areas with roof leader connections (originally built combined).

The sites selected for monitoring should include drainage basins of a range of sizes (10 to 100 acres) and should be representative of land uses found throughout the study area to allow extension of the measurements to other, similar areas during model calibration.

Generally, the more data available for use in calibrating a model, the better. However, data needs always have to be balanced with limited resources available for acquisition. With these ends of the spectrum in mind, an extensive amount of consideration went into deciding where to locate the flow meters. A pre-bid meeting was held on July 16 to discuss complexities of the New Haven sewer system, to provide information to potential bidders for the monitoring program subcontract, and to obtain consensus and support from the steering committee. The meeting included representatives of ADS Environmental Services and Utility Pipeline Services as bidders as well as the City of New Haven, the Water Pollution Control Authority, DEP, and the consulting team. Issues that were addressed

included data needs, seasonal impacts on monitoring, sampling and recording timesteps, and the number of meters required to obtain reliable data at a site. (Meeting minutes from the workshops are available in Appendix D.) After awarding the subcontract to ADS in early August, a kickoff meeting was held on August 19 to discuss administrative and technical issues and to finalize the meter locations. Several complicating issues such as lack of access to overflow weirs and low flow velocities were raised, and the schedule was stretched to allow time for further investigation of site sketches, photos, and city maps. Once the chosen locations were communicated to ADS, installations began. A few sites had to be relocated due to poor monitoring conditions such as sediment or turbulence.

In a few parts of New Haven, sewer separation projects are under design, and construction is imminent. The areas include Livingston Street; Orange Street Phase II; Orange, Bishop, and Clinton; Humphrey Street; Wooster Square; and Elm Haven. These areas will be included in the hydraulic model as separated areas. Because monitoring will occur while these areas are still served by combined sewers, only one of the overflow regulators (#010) impacted by ongoing projects will be monitored. The measurements can then serve as a "before" picture of the combined system that could potentially be paired with an "after" picture after separation has been completed.

The monitoring program is expected to have a duration of 90 days, between September 12 and December 10, 1997. During that time it is hoped that many different size storms will occur, from those that can be completely caught by the collection system and conveyed to the WPCF, to those that cause CSOs throughout the city. It is anticipated that storms of different sizes will trigger different patterns of overflows. Having more complete knowledge of which overflow locations have CSOs during specific storms will be helpful during model calibration.

Rain Gauges

Four rain gauges were installed in secure areas throughout New Haven. Since the flow data will be used to calibrate models that estimate flow based on precipitation input, it is critical to obtain rainfall data during the same period that flow monitoring occurs. The gauges that have been installed are much closer to the monitoring sites than other long-term gauges that exist, and they will provide supplemental data. Table 2 describes the locations of the four rain gauges.

Table 2. *Rain Gauge Locations*

Rain Gauge ID Number	Site	Location
RG1	Edgewood School	West Rock Ave and Edgewood Ave
RG2	Boulevard Pump Station	Sea St and S. Water St
RG3	Albertus Magnus College	Huntington St and Winchester Ave
RG4	Police Substation	295 Blatchley Ave

The gauges are spread out to provide information about the spatial variability of precipitation within the study area. As an example, Figure 1 shows a graph for rainfall recorded at four gauges for July to September, 1996. The summer period is typically a time when spatial variation is at its greatest with isolated thundershowers that do not cover a large area. The gauge locations are Lake Whitney (just north of City boundary), Wepawaug Reservoir (2 miles southwest), Lake Dawson (2 miles northwest), and the East Shore Water Pollution Control Facility. For comparison, Figure 2 shows the same gauges for April to June, 1997, when less spatial variation was observed (data sets were not complete during this period).

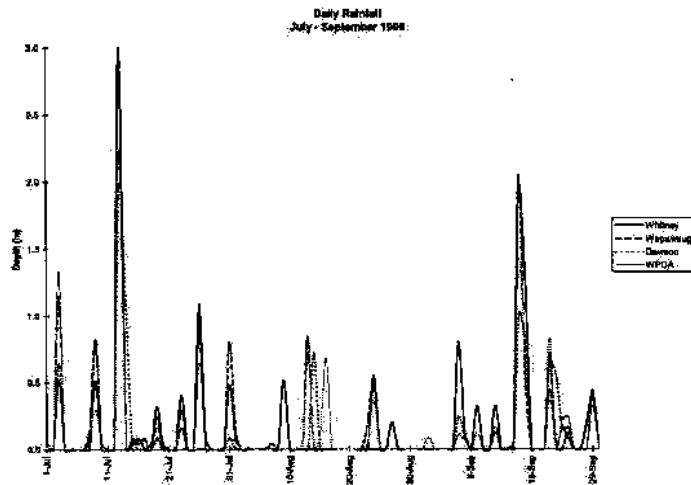


Figure 1. *Variation between rain gauges in summer 1996.*

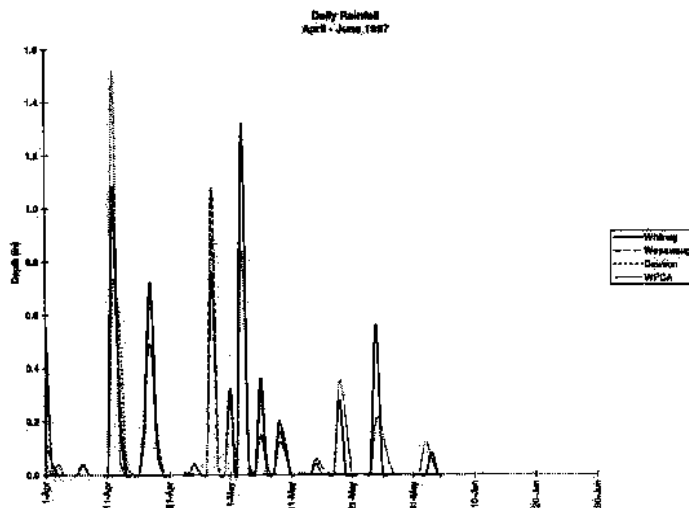


Figure 2. *Variation between rain gauges in Spring 1997 was less pronounced than that in the previous summer.*

Flow Meters

At many of the flow-monitoring sites, the meters were installed in a manner which will allow quantifying the flows in the interceptor and the overflow pipes. However, at some sites such a configuration was not possible, and one type of measurement had to be chosen over the other. Table 3 provides details about the locations of the 30 flow-monitoring sites and indicates what type of data is being collected at each site. The number of meters includes three in separated sewer areas, two in separated sewer areas with roof leader connections, and two in combined sewer areas.

Table 3. *Monitoring Locations*

Flow Meter Number	NPDES Regulator Number	Monitoring Location	Data Type
M2	002	E.T. Grasso Blvd @ Lamberton St	Interceptor, overflow
M3	003	E.T. Grasso Blvd @ Orange Ave	Interceptor, overflow
M4	004	E.T. Grasso Blvd @ Legion Ave	Interceptor, overflow
M5a	005	E.T. Grasso Blvd @ Derby St (combined sewer)	Local inflow (combined)
M5b	005	E.T. Grasso Blvd @ Derby St (overflow pipe)	Overflow
M6	006	Whalley Ave @ Fitch St	Interceptor, overflow
M8	008	Munson St @ Orchard St	Interceptor, overflow
M9	009	Grand Ave @ James St	Interceptor, overflow
M10	010	East St @ I-91	Interceptor, overflow
M14a	014	Trumbull St @ Orange St (combined sewer)	Interceptor
M14b	014	Trumbull St @ Orange St (storm sewer)	Overflow
M15a	015	James Street Siphon (combined sewer)	Interceptor
M15b	015	James Street Siphon (overflow pipe)	Overflow
M16	016	Poplar St @ River St	Overflow
M18	018	Lombard St @ N. Front St	Interceptor, overflow
M19a	019	Pine St @ N. Front St (combined sewer)	Interceptor, overflow
M19b	019	Pine St @ N. Front St (overflow pipe)	Overflow
M20	020	Quinnipiac Ave @ Clifton St	Interceptor, overflow
M21	021	East St Pump Station	Overflow
M22	022	Allen Place	Interceptor, overflow
M24	024	Boulevard Pump Station @ Sea Street	Overflow
M25a	025	Union Ave Pump Station	Overflow

Table 3. (continued)

Flow Meter Number	NPDES Regulator Number	Monitoring Location	Data Type
M25b		Temple St @ George St	Interceptor, overflow
S1		Lowin Ave south of Fountain St	Local inflow (separated)
S2		Anthony St south of Whalley Ave	Local inflow (separated)
S3		Chapel St east of Alden Ave	Local inflow (separated)
RL1		Division St east of Winchester Ave	Local inflow (separated with roof leader connections)
RL2		State St northeast of George St	Local inflow (separated with roof leader connections)
C1		Poplar St south of Grand Ave	Local inflow (combined)
C2		Orchard St between Davenport and Sylvan	Local inflow (combined)

Appendix A provides a map showing the approximate metering location for each of the flow meters and rain gauges. It includes the locations of the permanent flow meters on the boundaries of New Haven and the rain gauges outside the city. Appendix B contains site sketches, including the meter installation configurations, for each regulator being monitored. Draft results showing plots of flow, depth, and velocity are presented in Appendix C.

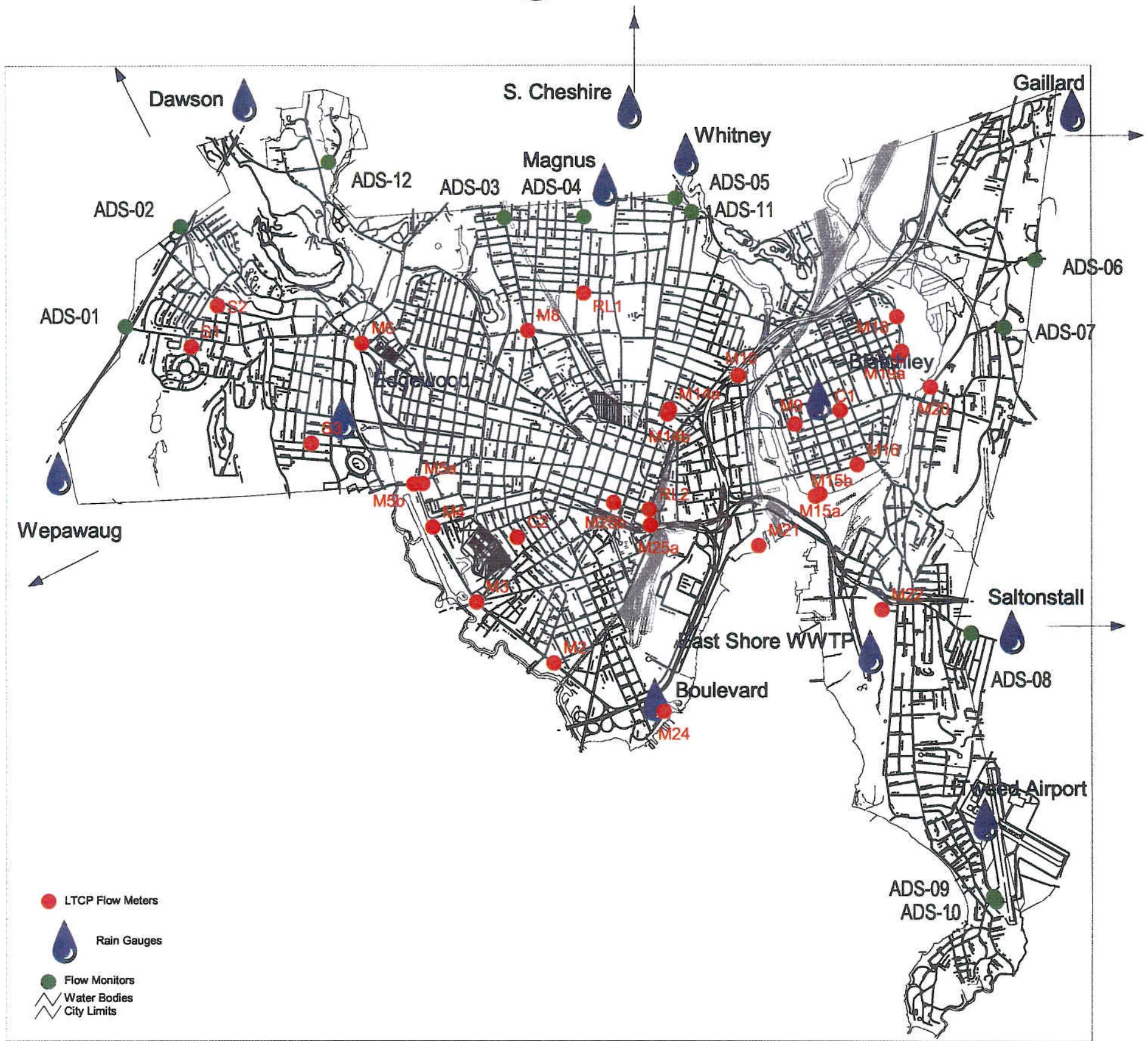
Summary

The ultimate goal of the data management plan and the monitoring program is to provide data which can be used to both calibrate and validate the hydrologic and hydraulic models being developed for the Long-Term CSO Control Project. This memorandum has indicated the intents for these two segments of the project. At the conclusion of the monitoring program, Technical Memorandum #5 will report the results of the program including a description of the data observed in the field and statistical summaries and graphs.

Appendix A

Map



Monitoring Locations

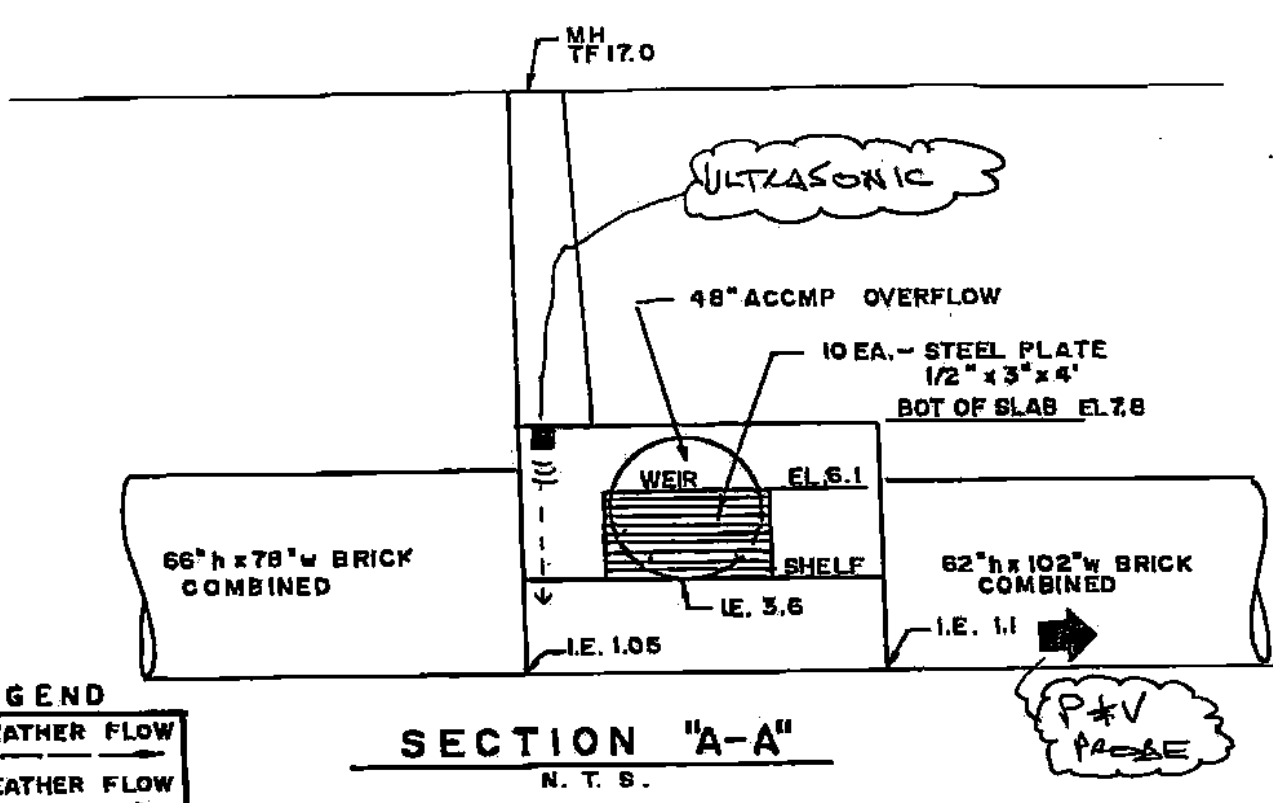
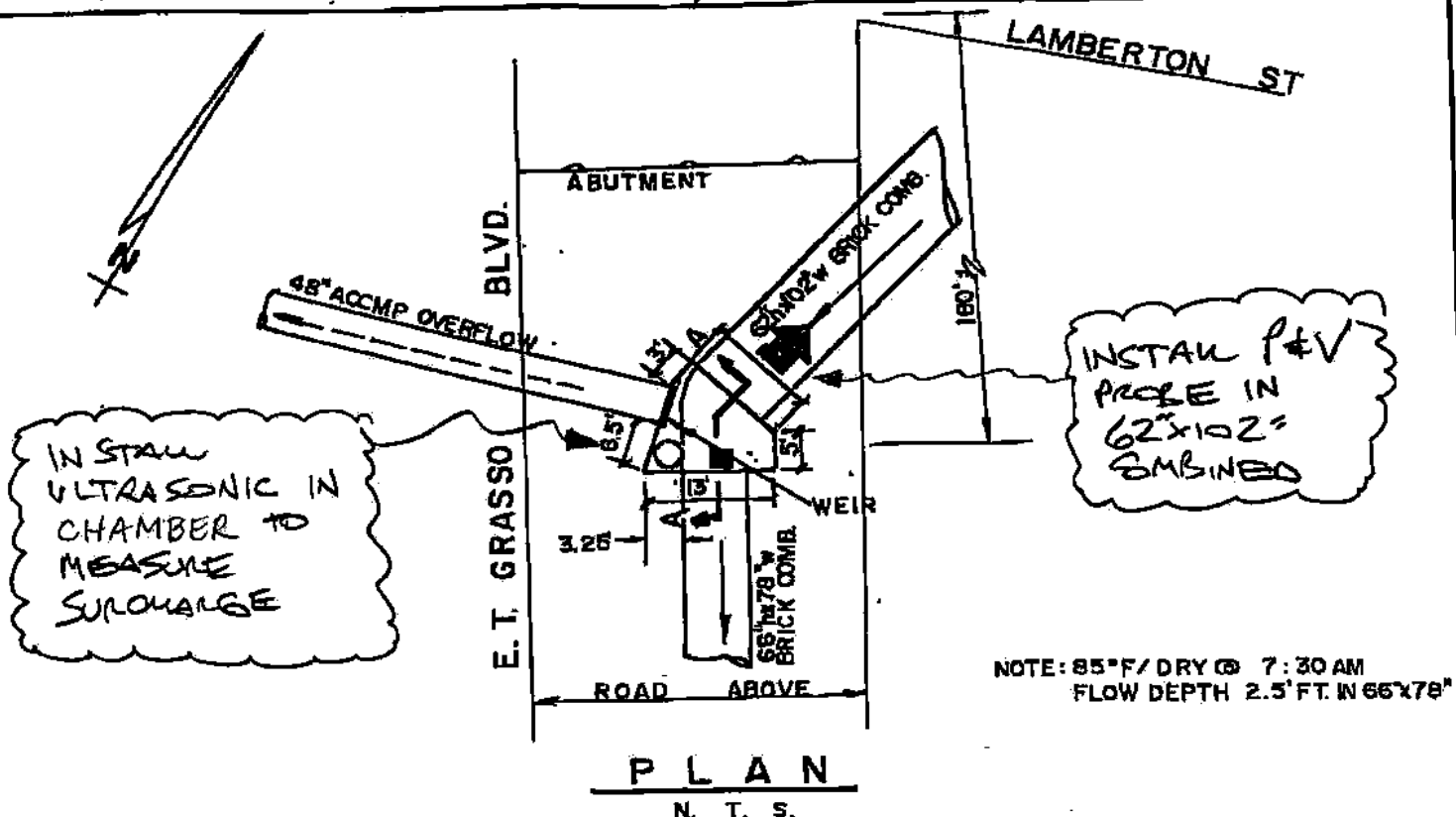


Appendix B

Site Sketches

LEGEND:

-  pressure, velocity probe
(indicates direction of probe)
-  ultrasonic depth meter



LEGEND

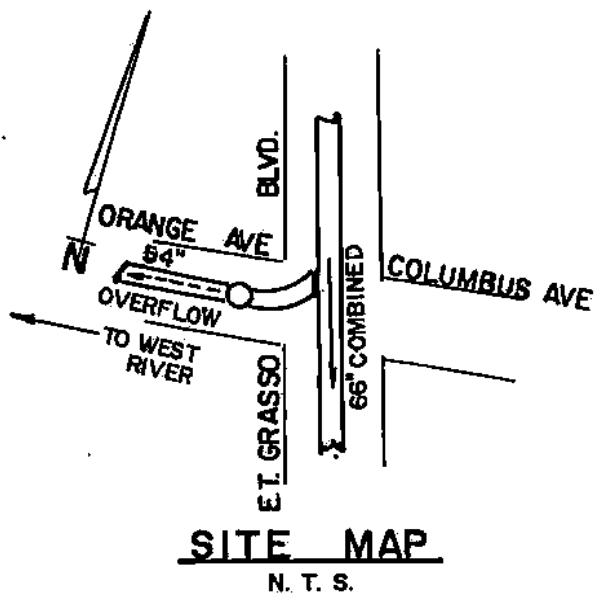
WET WEATHER FLOW →

DRY WEATHER FLOW →

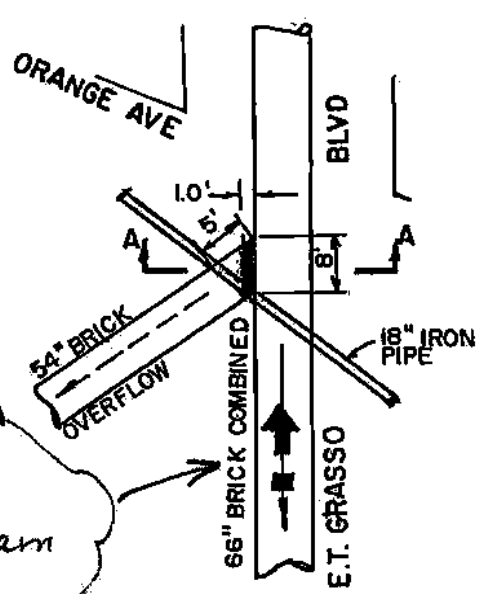
OVERFLOW NO. OB 3/002
E.T. GRASSO BLVD @ LAMBERTSON ST.
NEW HAVEN, CONNECTICUT

DATE: 7-31-97
 JOB NO. 1146
 SHT. NO. 22

NOTE: MMW = +3.31 or 2.8 FEET BELOW WEIR
 USE DEPTH IN STRUCTURE TO ESTIMATE
 SURFLOW FREQUENCY & RATES

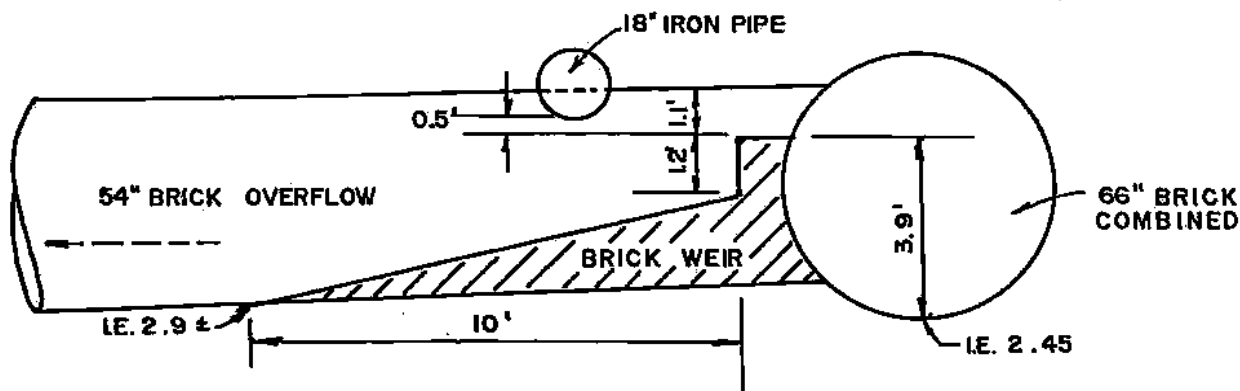


INSTALL
P, V, S, U IN
66" combined
50' downstream
of weir



NOTE: 80° F / DRY @ 2:00 PM
FLOW DEPTH 3' FT IN 66"

ROAD GRADE 12.0±



LEGEND

WET WEATHER FLOW

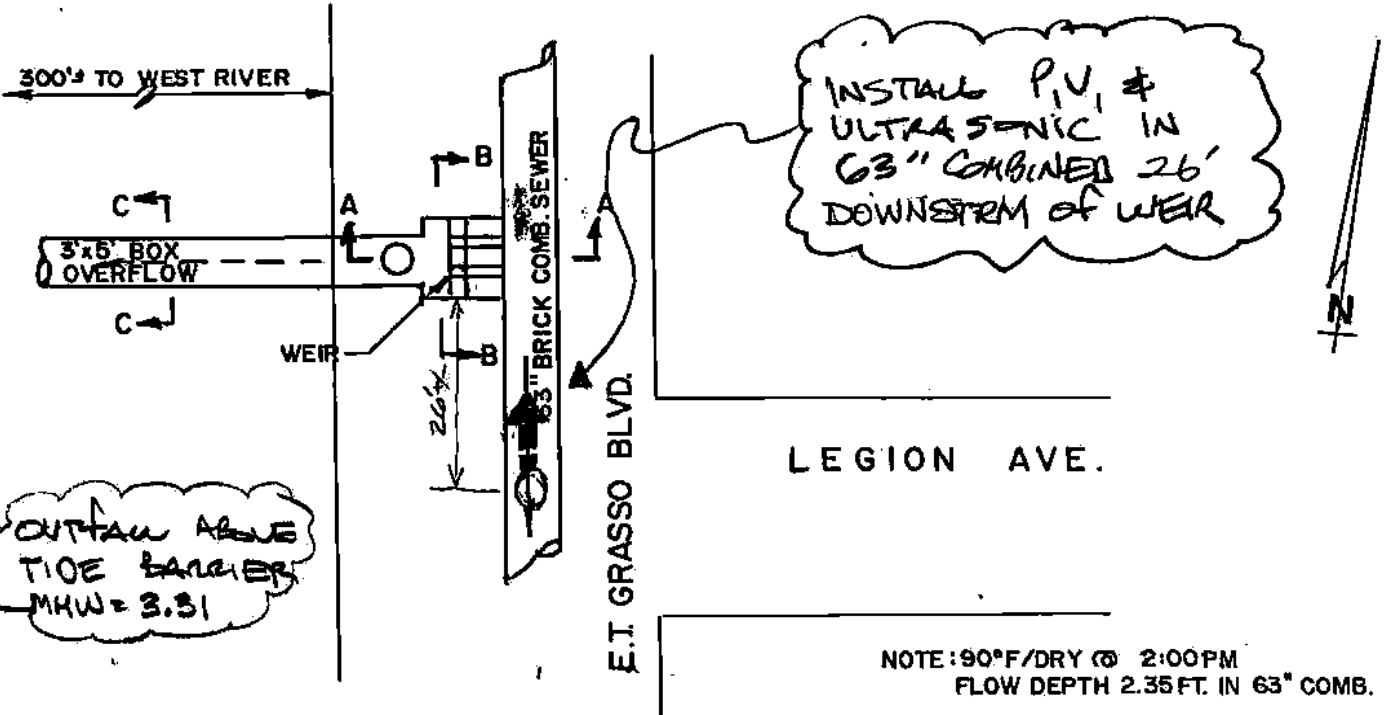
DRY WEATHER FLOW

OVERFLOW NO. 0 B 4 / 003
E. T. GRASSO BLVD @ ORANGE AVE
NEW HAVEN, CONNECTICUT

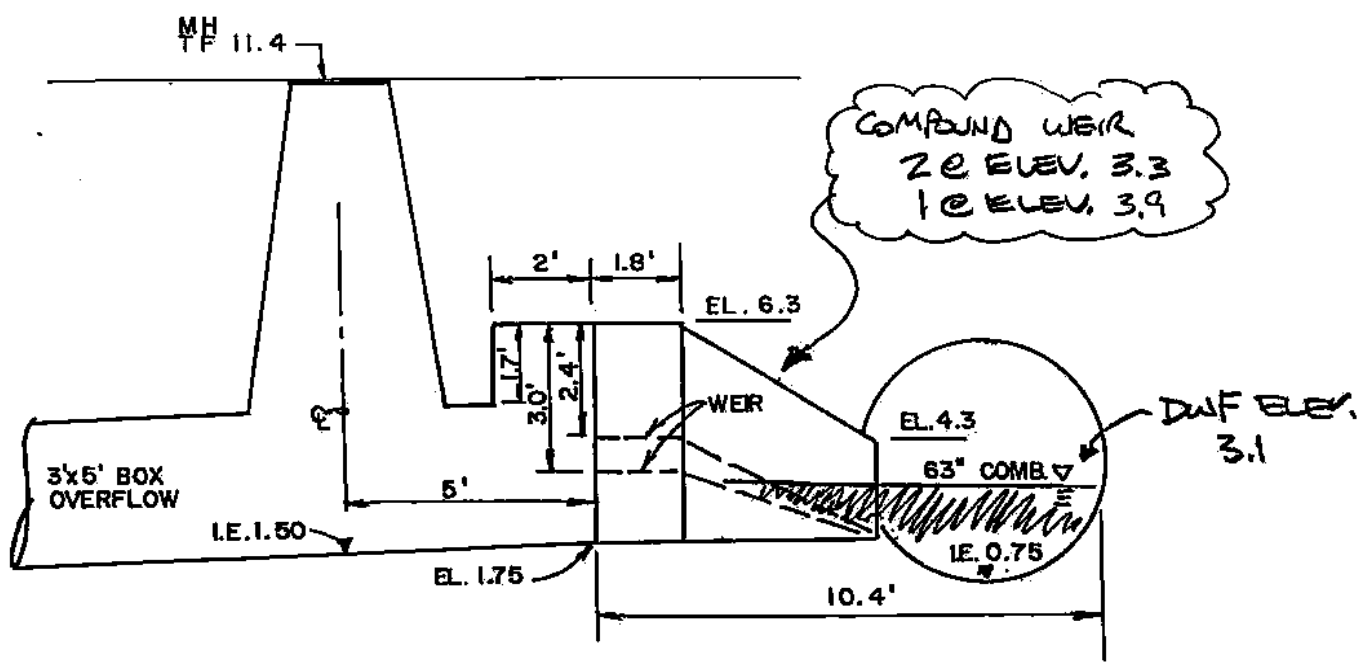
DATE: 7-30-97

JOB NO. 1146

SHT. NO. 21



PLAN
N. T. S.



SECTION A-A
N. T. S.

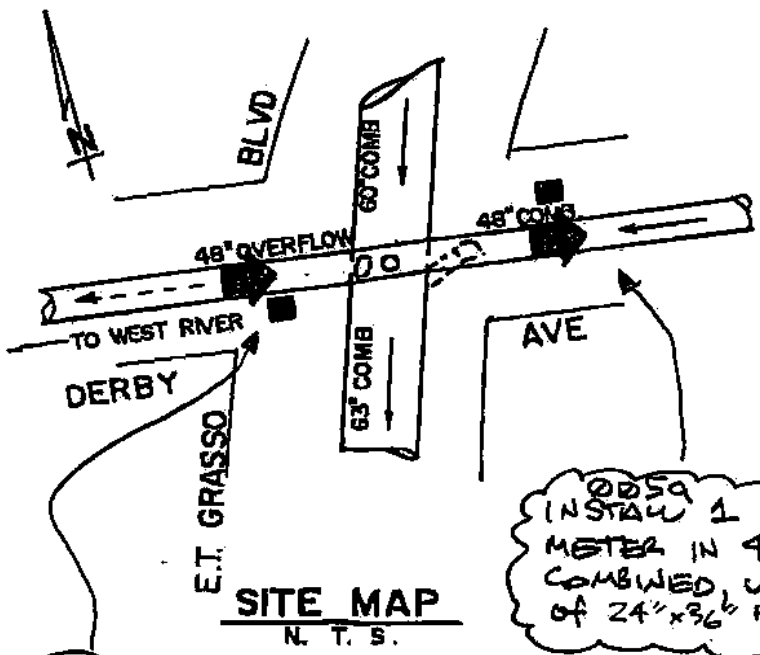
LEGEND

WET WEATHER FLOW	→
DRY WEATHER FLOW	→

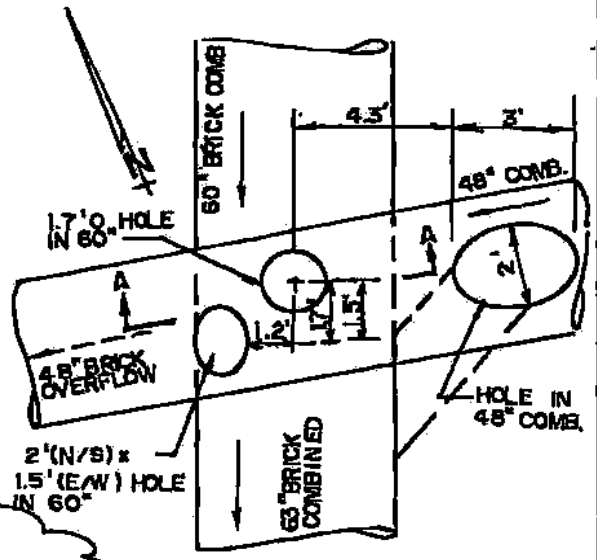
ALTERNATE INSTALLATION: ONLY ULTRASONIC IN 3'x5' BOX OFF

OVERFLOW NO. OB 5 / 004
E.T. GRASSO BLVD. @ LEGION AVE.
NEW HAVEN, CONNECTICUT

DATE: 7-17-97
 JOB NO. 1146
 SHT. NO. 18-1



SITE MAP
N. T. S.

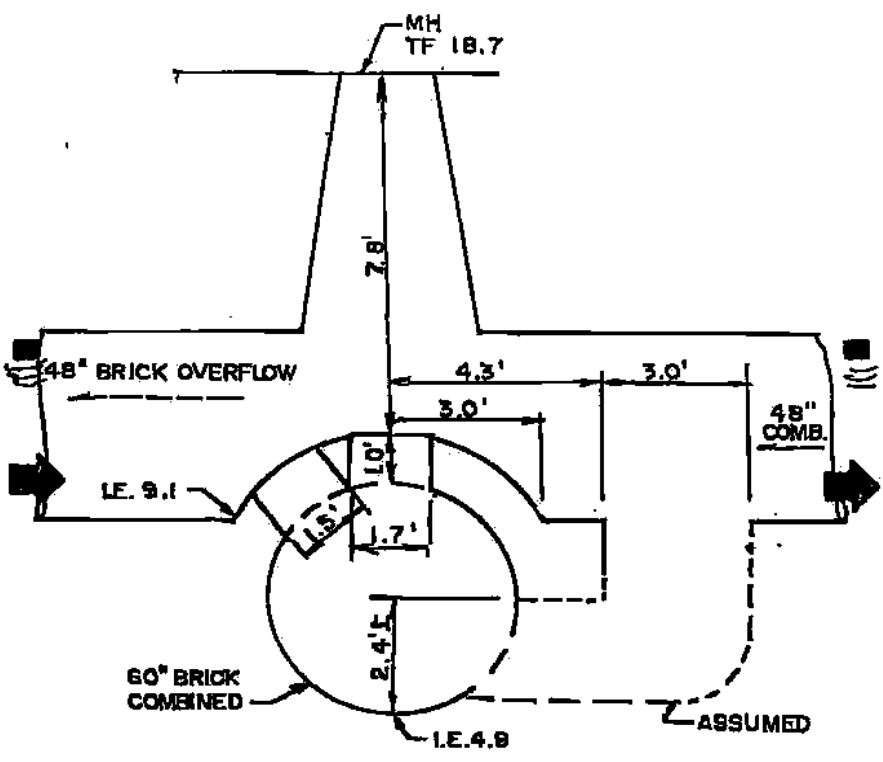


PLAN
N. T. S.

0059
INSTALL 1
METER IN 48"
COMBINED, UPSTREAM
OF 24" x 36" HOLE

0056
INSTALL 1 METER
IN 48" OVERFLOW

NOTE: 72°F / DRY CO. 10:00 AM.
FLOW DEPTH 1.6' FT IN 60"



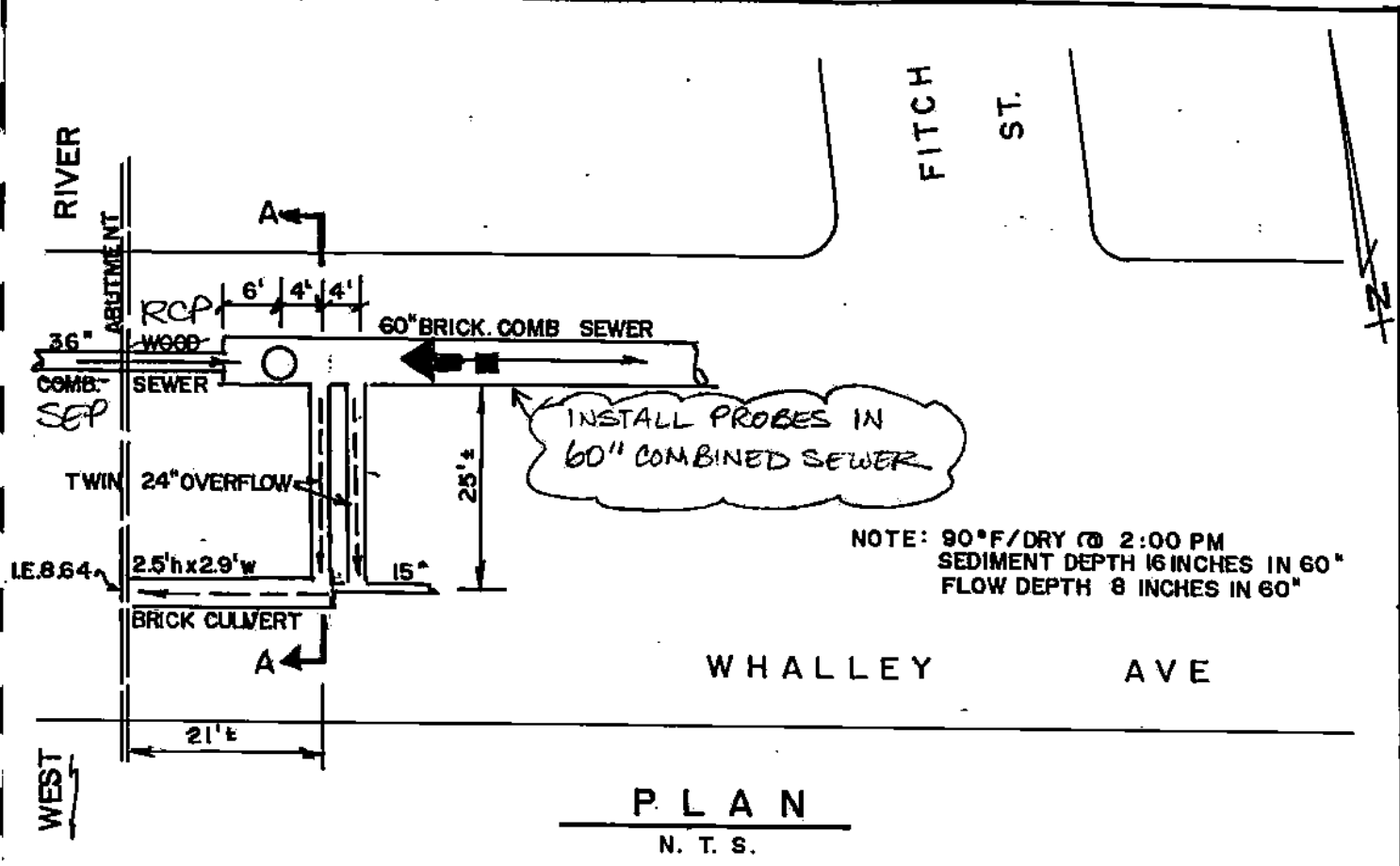
SECTION "A-A"
N. T. S.

LEGEND

WET WEATHER FLOW	→
DRY WEATHER FLOW	→

OVERFLOW NO. OB-1/005
E.T. GRASSO BLVD @ DERBY AVENUE
NEW HAVEN, CONNECTICUT

DATE: 8-20-97
JOB NO. 1146
SHT. NO. 23

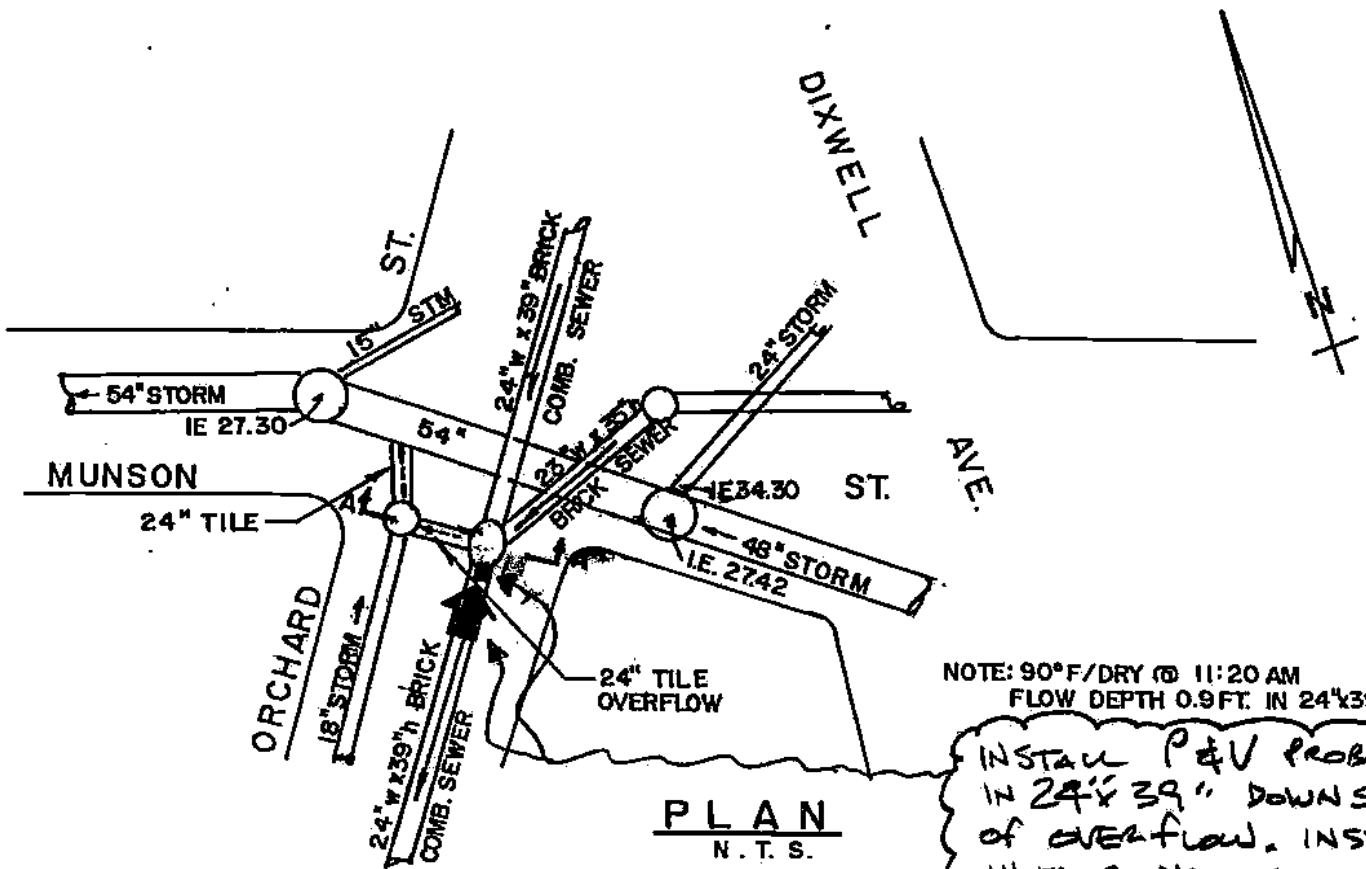


LEGEND

WET WEATHER FLOW	→
DRY WEATHER FLOW	→

OVERFLOW NO. 006
WHALLEY AVE @ FITCH ST.
NEW HAVEN, CONNECTICUT

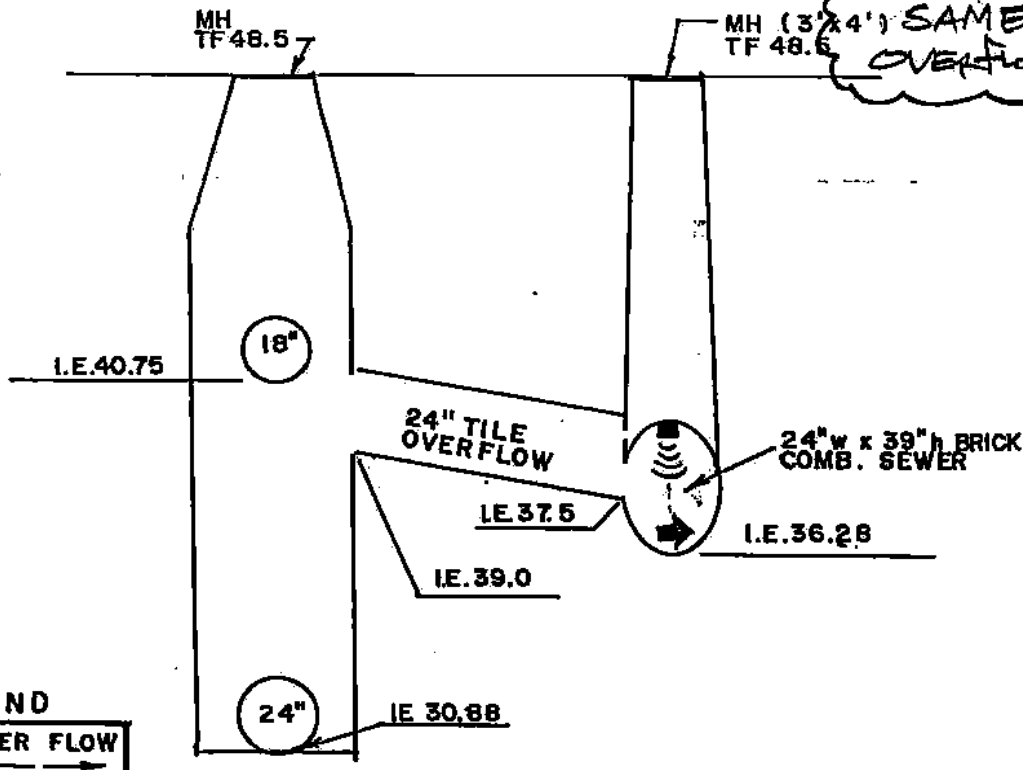
DATE: 7-15-97
 REV. 9-15-97
 JOB NO. 1146
 SHT. NO. 14



NOTE: 90°F/DRY @ 11:20 AM
FLOW DEPTH 0.9 FT. IN 24"x39"

INSTALL P&V PROBE
IN 24"x39" DOWNSTREAM
OF OVERFLOW. INSTALL
ULTRASONIC IN
SAME TO ESTIMATE
OVERFLOW VOL. & FREQ

PLAN
N. T. S.



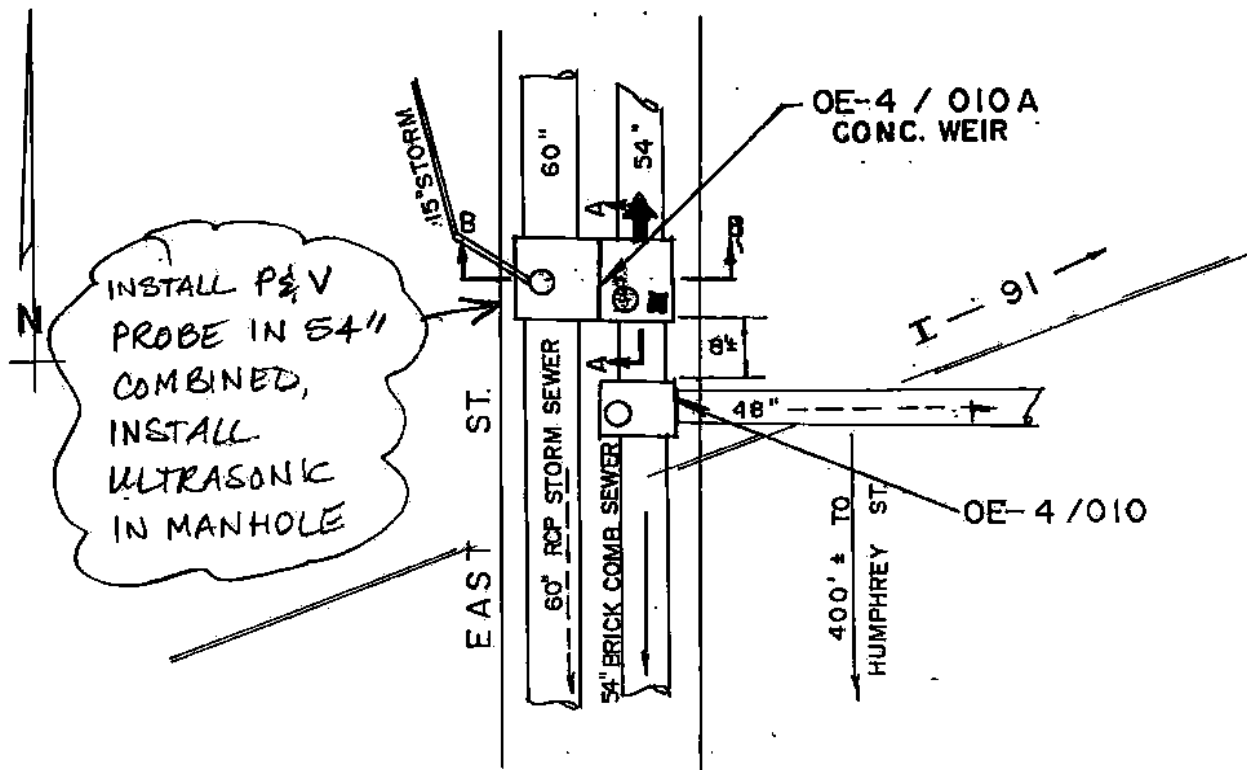
SECTION A-A
N. T. S.

LEGEND

WET WEATHER FLOW
DRY WEATHER FLOW

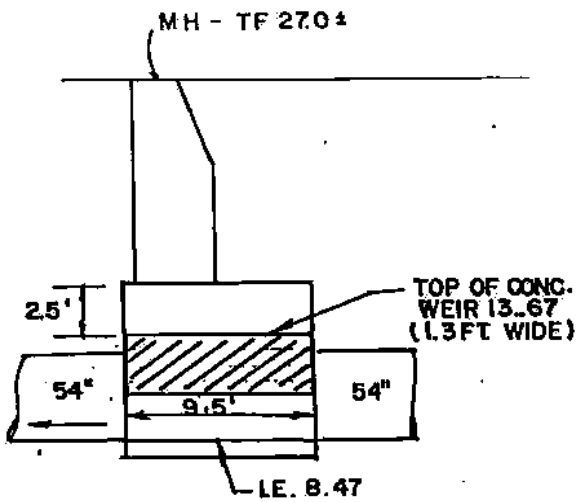
OVERFLOW NO. OBI A/008
MUNSON ST. @ ORCHARD ST.
NEW HAVEN, CONNECTICUT

DATE: 7-15-97
JOB NO. 1146
SHT. NO. 13



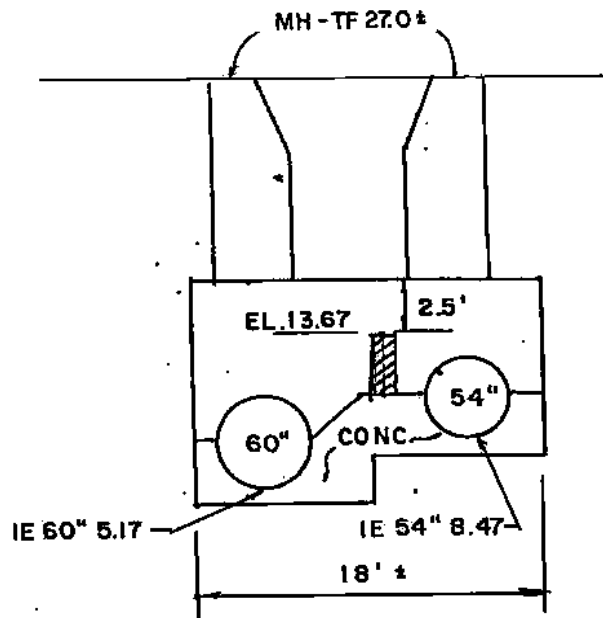
PLAN

N. T. S.



SECTION A-A

N. T. S.



SECTION B-B

N. T. S.

LEGEND

WET WEATHER FLOW
 DRY WEATHER FLOW

**OVERFLOW NO. OE4/010A
 EAST STREET @ I-91
 NEW HAVEN, CONNECTICUT**

DATE: 9-9-97
 REV 9-5-97
 JOB NO. 1146
 SHT. NO. 25

I-91 OFF RAMP

I-91 ON RAMP

STREET

ORANGE

TRUMBULL STREET

48" RCP PLUGGED

66" BRICK COMB. SEWER

48" RCP OVERFLOW
CONC. WEIR

106" w x 68" h RCP STORM SEWER

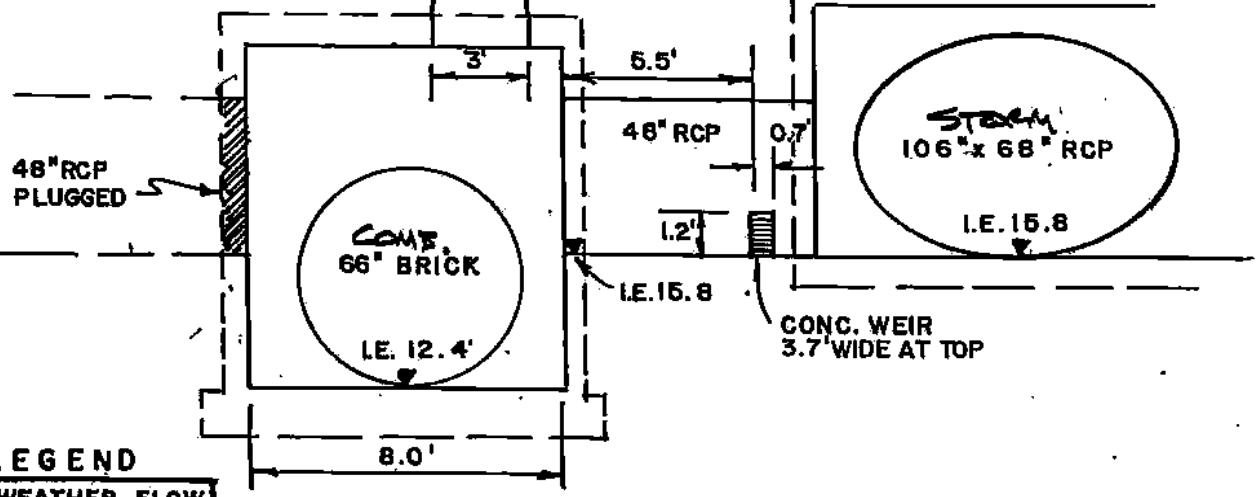
NOTE: 80°F / DRY @ 2:30 PM
FLOW DEPTH 0.7 FT IN 66"

PLAN

N. T. S.

INSTALL 2-METERS
1 IN 66" COMBINED
1 IN 106" STORM
USE GAH TO ESTIMATE
FLOW THROUGH 48"
OVERFLOW

MH (5.6' x 8')
TF 25.4



SECTION A-A

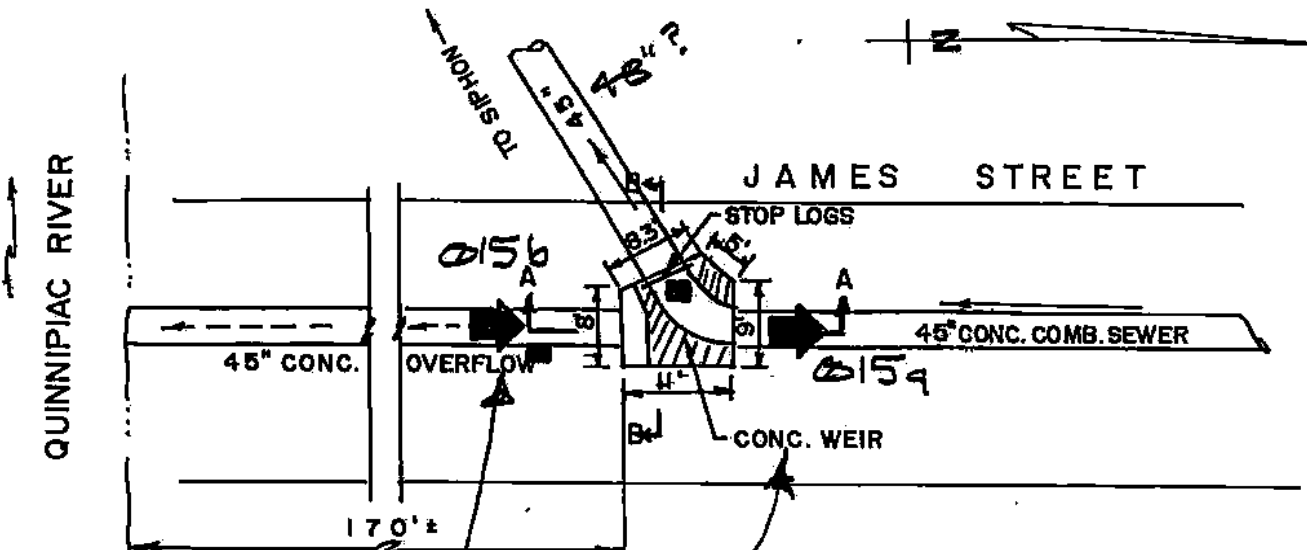
N. T. S.

LEGEND



OVERFLOW NO. 0E6A/014
TRUMBULL ST. @ ORANGE ST.
NEW HAVEN, CONNECTICUT

DATE: 7-10-92
JOB NO. 1146
SHT. NO. 8

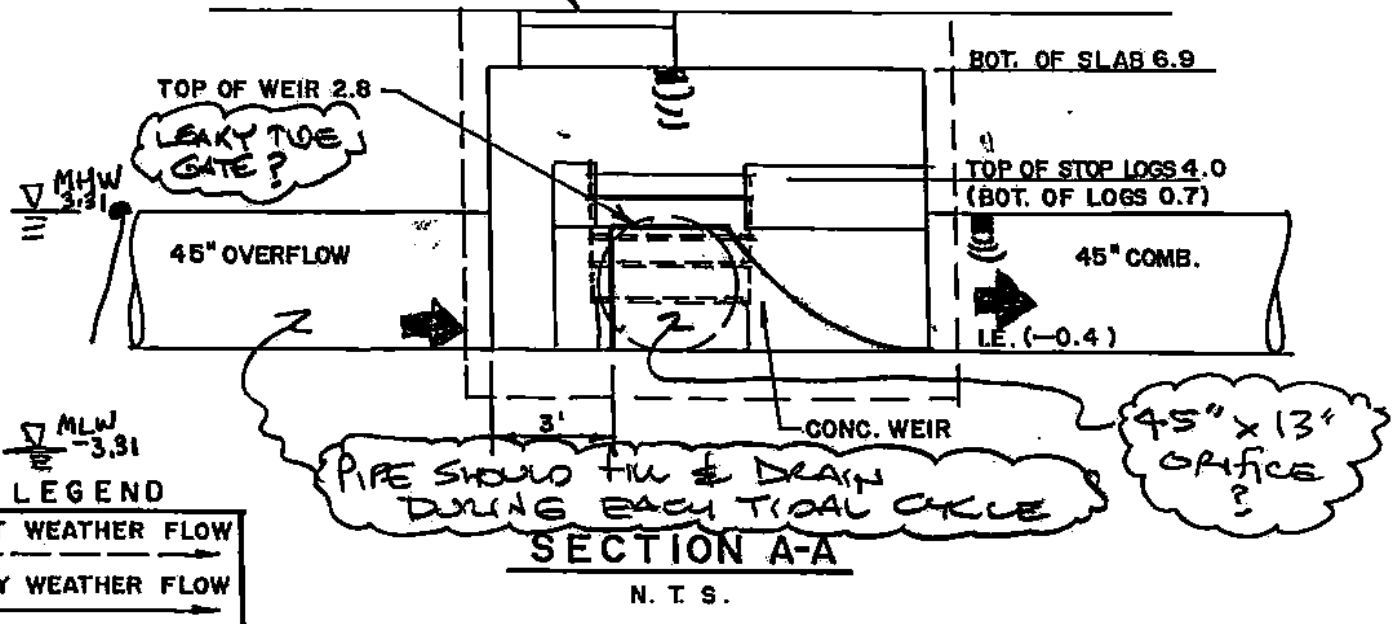
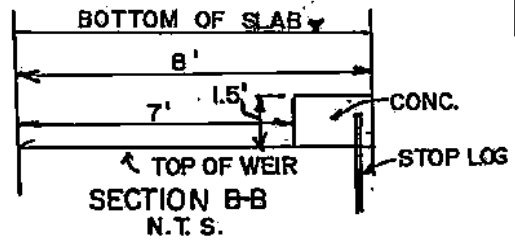


INSTALL 2 METERS.
 INSTALL P+V PROBE FOR 1ST
 METER IN 45" COMBINED.
 INSTALL ULTRASONIC FOR 1ST
 METER IN SAME.

INSTALL SECOND
 METER IN 45"
 OVERFLOW WITH
 ULTRASONIC IN
 MANHOLE OVER WEIR.

NOTE: 85°F / DRY @ 2:00 PM
 FLOW DEPTH 0.6 FT IN 45" COMB.
 RAIN - 0.61" IN., 24 HRS TO 5:00 PM
 FLOW DEPTH 3.7 FT IN 45" @ 3:30 PM
 FLOWING OVER WEIR

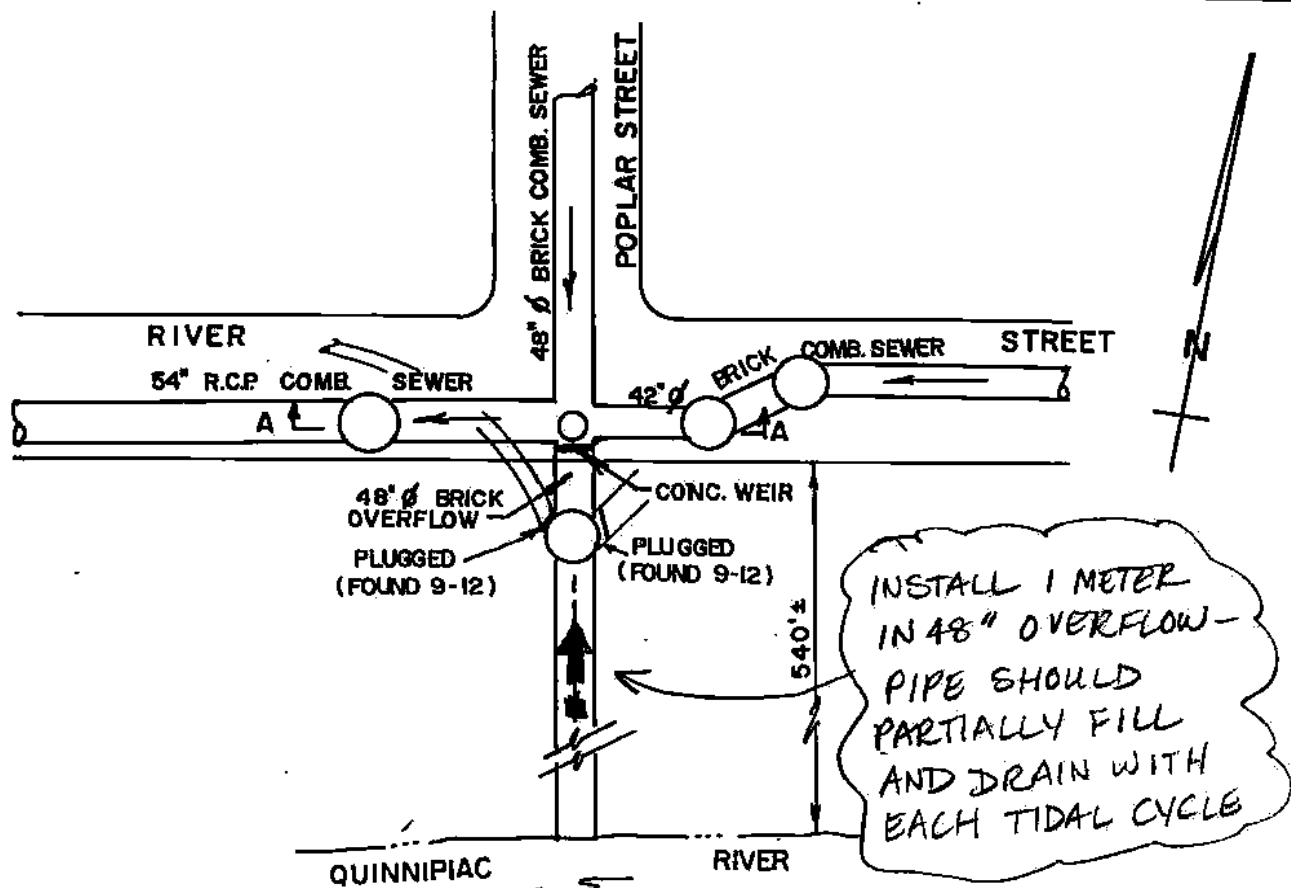
PLAN
 N. T. S.



SECTION A-A
 N. T. S.

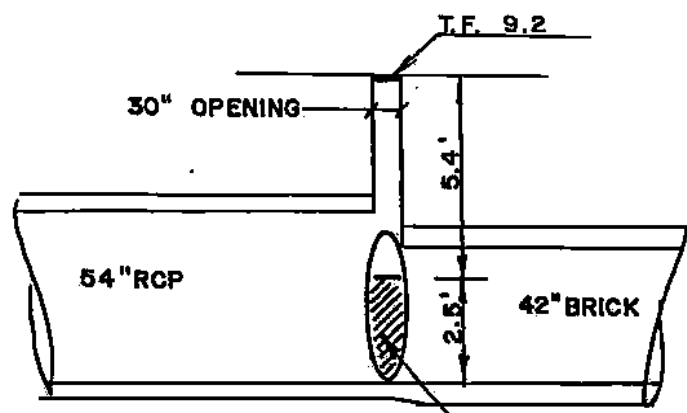
OVERFLOW NO. OS 6/015
JAMES STREET SIPHON
NEW HAVEN, CONNECTICUT

DATE: 7-7-97
 JOB NO. 1146
 SHT. NO. 12



PLAN
N. T. S.

NOTE: 80° F/DRY @ 11:00 AM
FLOW DEPTH 2.4 FT.
RAIN- 0.61", 24 HRS.
TO 5:00 PM
FLOW DEPTH @ 3:45 PM 3.3 FT



IE. 1.3 (ALL PIPES)

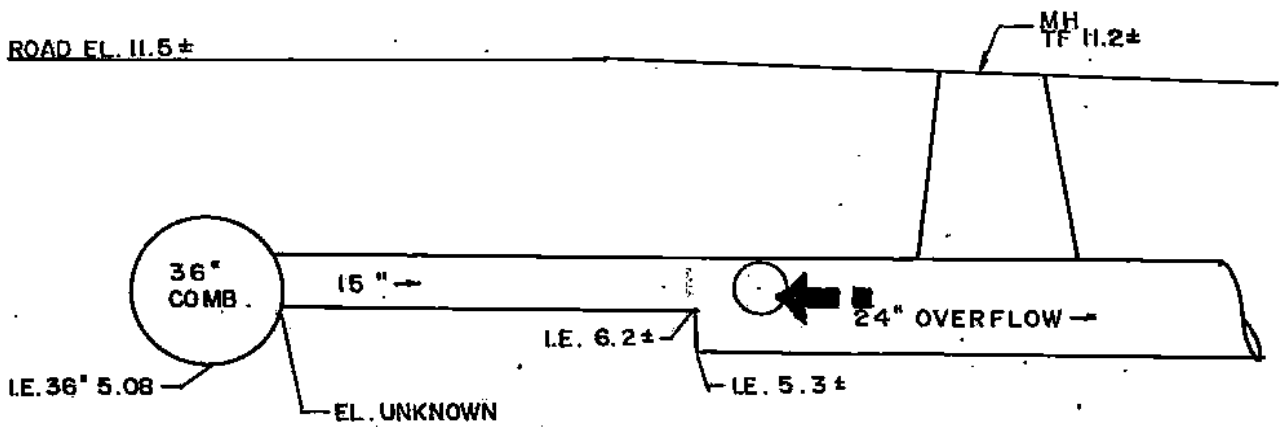
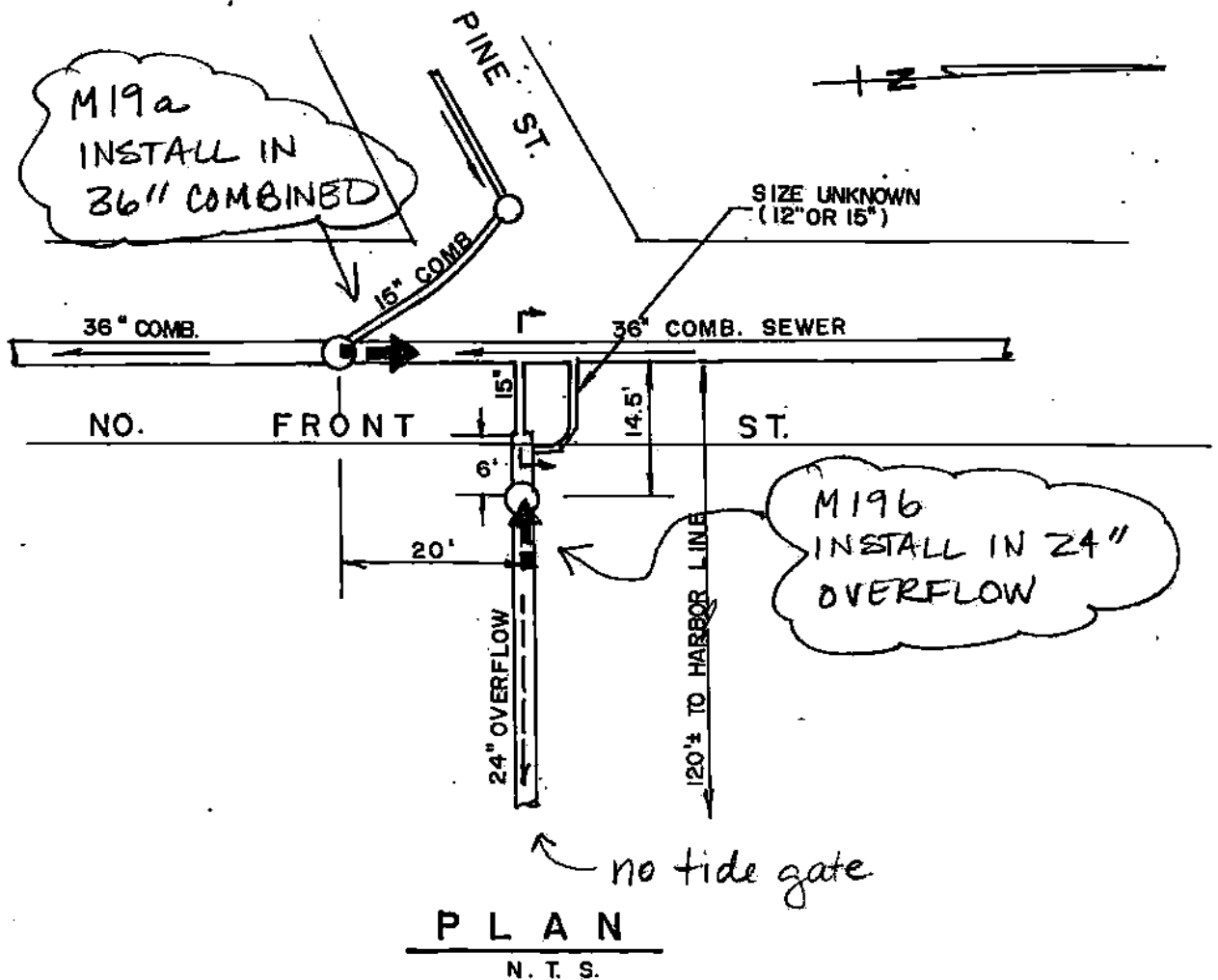
12" THICK CONC. WEIR IN
DOWNSTREAM 48" BRICK
SEWER (TOP OF WEIR ELEV. 3.8)
WEIR IS 3.8' FT. WIDE AT TOP

LEGEND
WET WEATHER FLOW
DRY WEATHER FLOW

SECTION A-A
N. T. S.

OVERFLOW NO. OS-5/016
POPLAR ST. @ RIVER ST.
NEW HAVEN, CONNECTICUT

DATE: 7-7-97
REV. 7-18-97
JOB NO. 1146
SHT. NO. 1



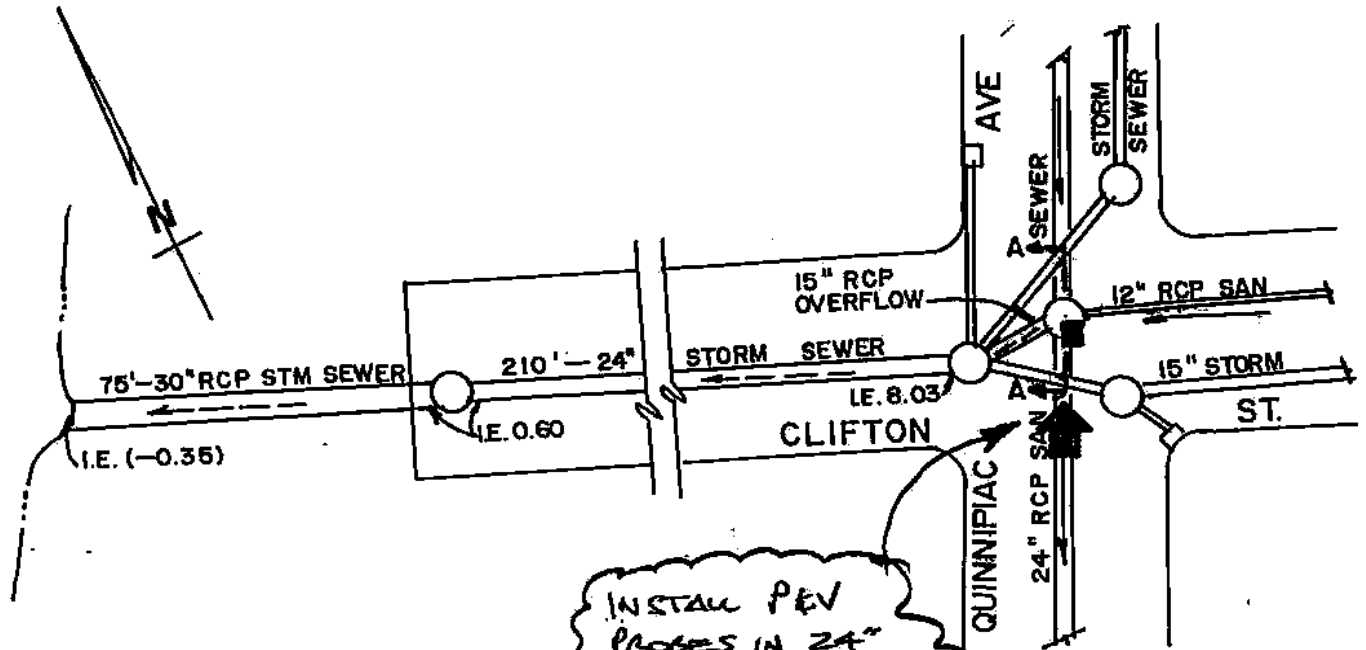
LEGEND

WET WEATHER FLOW	
DRY WEATHER FLOW	

OVERFLOW NO. 019
NO. FRONT ST. @ PINE ST.
NEW HAVEN, CONNECTICUT

DATE: 9-11-97
 JOB NO. 1146
 SH. NO. 26

QUINNIPIAC RIVER

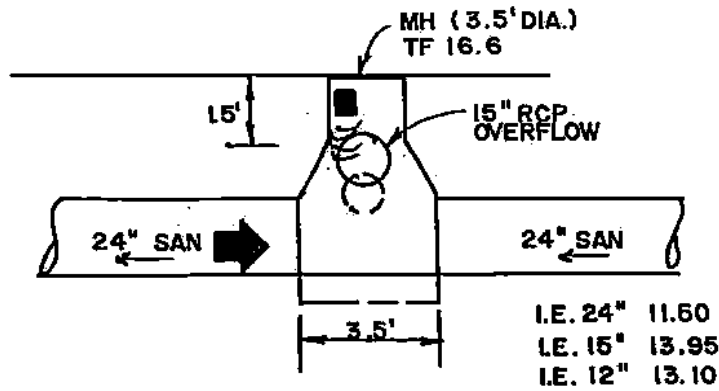


NOTE: 80°F/DRY @ 4:00 PM
 FLOW DEPTH IN 24" = 6" IN.

INSTALL PEV
 PROBES IN 24"
 SANITARY DOWNSTREAM
 OF MANHOLE -
 INSTALL ULTRASONIC
 IN MANHOLE TO
 MEASURE SURCHARGE

PLAN.

N. T. S.



SECTION A-A

N. T. S.

LEGEND

WET WEATHER FLOW
 DRY WEATHER FLOW

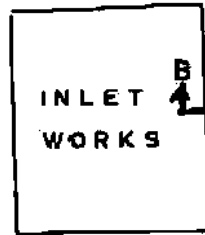
OVERFLOW NO. 020
 CLIFTON ST. @ QUINNIPIAC AVE
 NEW HAVEN, CONNECTICUT

DATE: 7-8-97
 JOB NO. 1146
 SHT. NO. 3

LONG WHARF DR.



5.7'h x 5.2'w CONC. COMBINED SEWER



2' Ø COVER

5.7'h x 5.2'w OVERFLOW

SITE MAP

N. T. S.

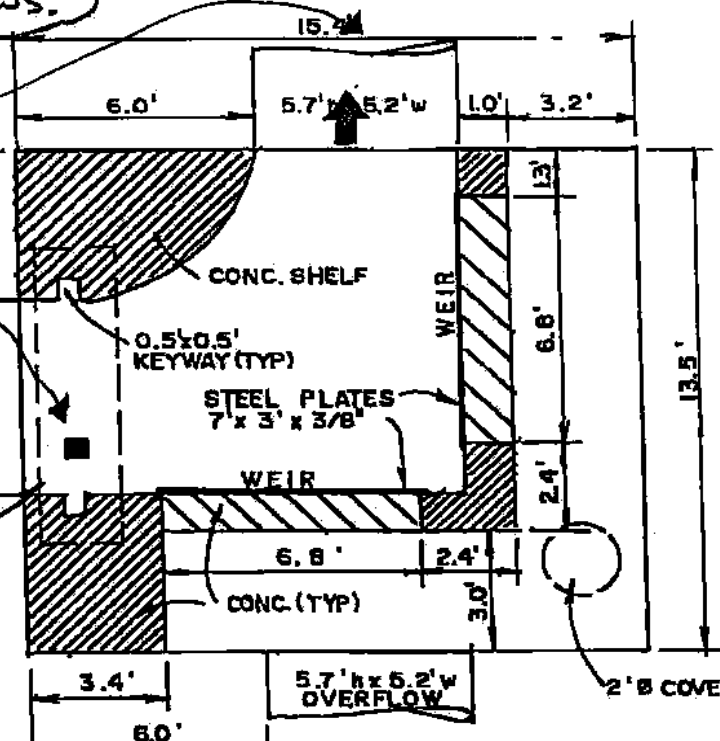
WEIR ELEV. = 6.34
MHW = 3.31

INSTALL ULTRASONIC IN CHAMBER. USE DEPTH OVER WEIR TO ESTIMATE OVERFLOWS.

INSTALL P/V PROBE IN INLET PIPE

5.7'h x 5.2'w CONC. TO INLET WORKS

2'x8' COVER



PLAN

N. T. S.

LEGEND

WET WEATHER FLOW

DRY WEATHER FLOW

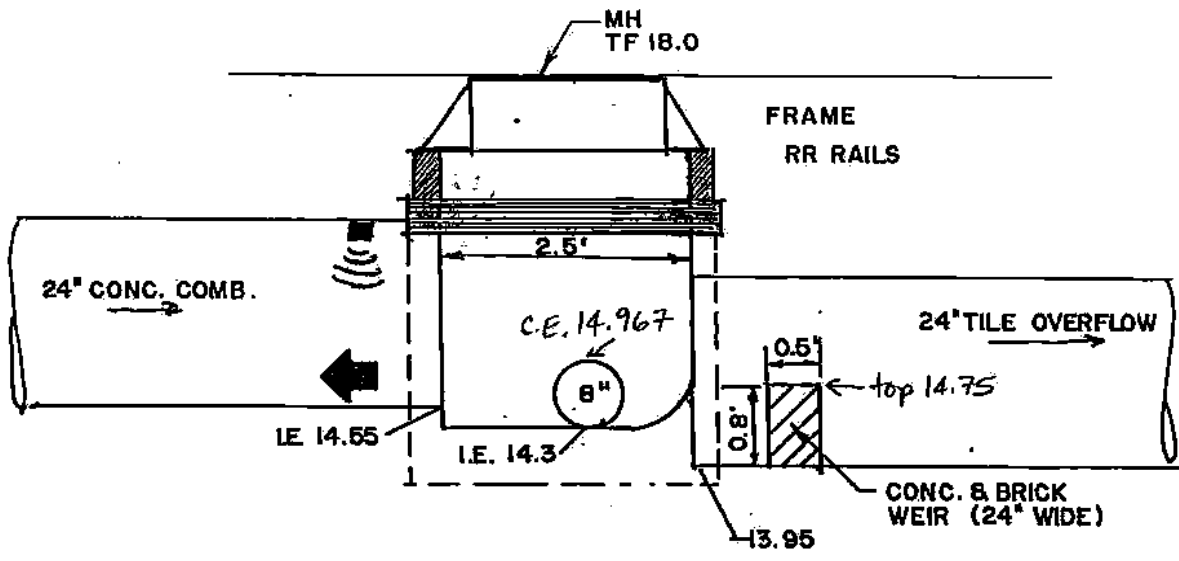
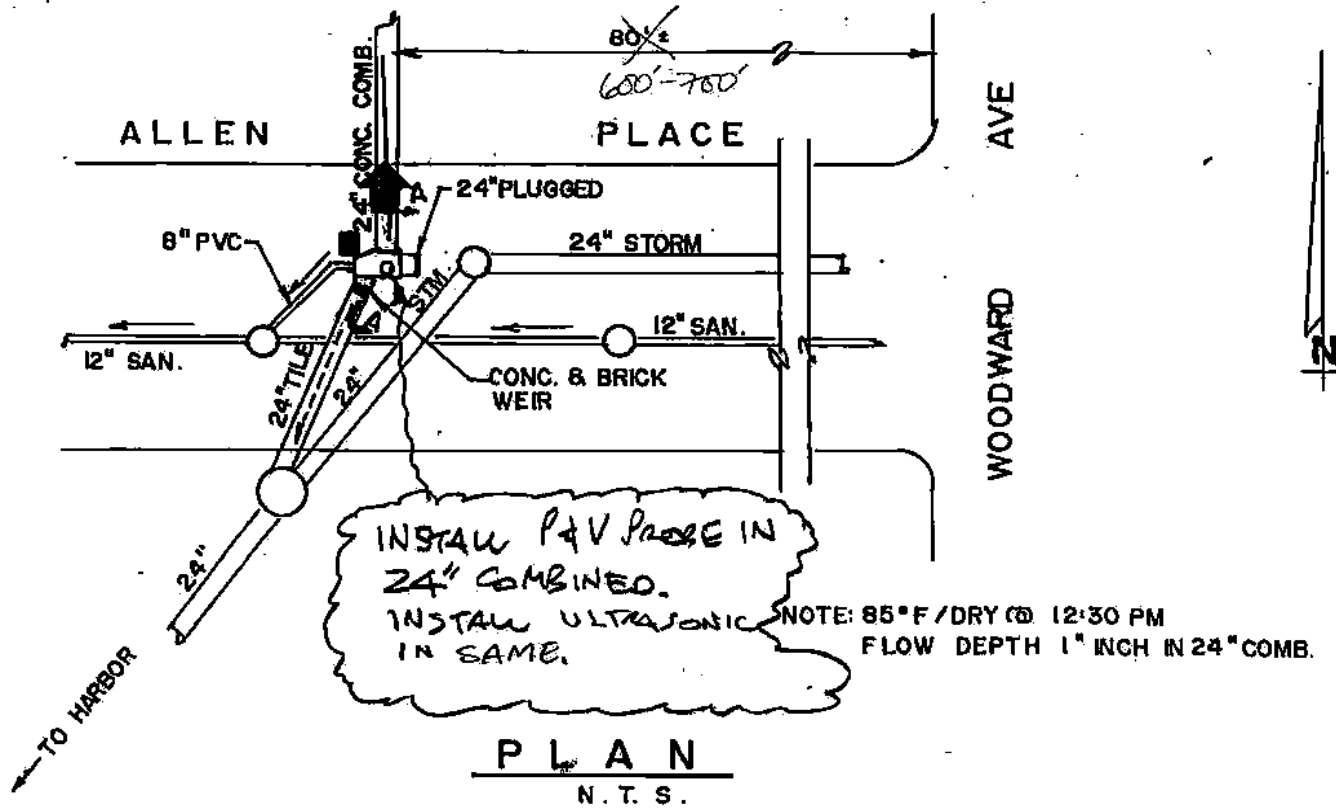
OVERFLOW NO. 021
EAST ST. PUMP STATION
NEW HAVEN, CONNECTICUT

DATE: 7-31-97

JOB NO. 1146

SHT. NO. 20-1

NOTE: WPCA RECORDS FLOW THROUGH PUMP STATION.



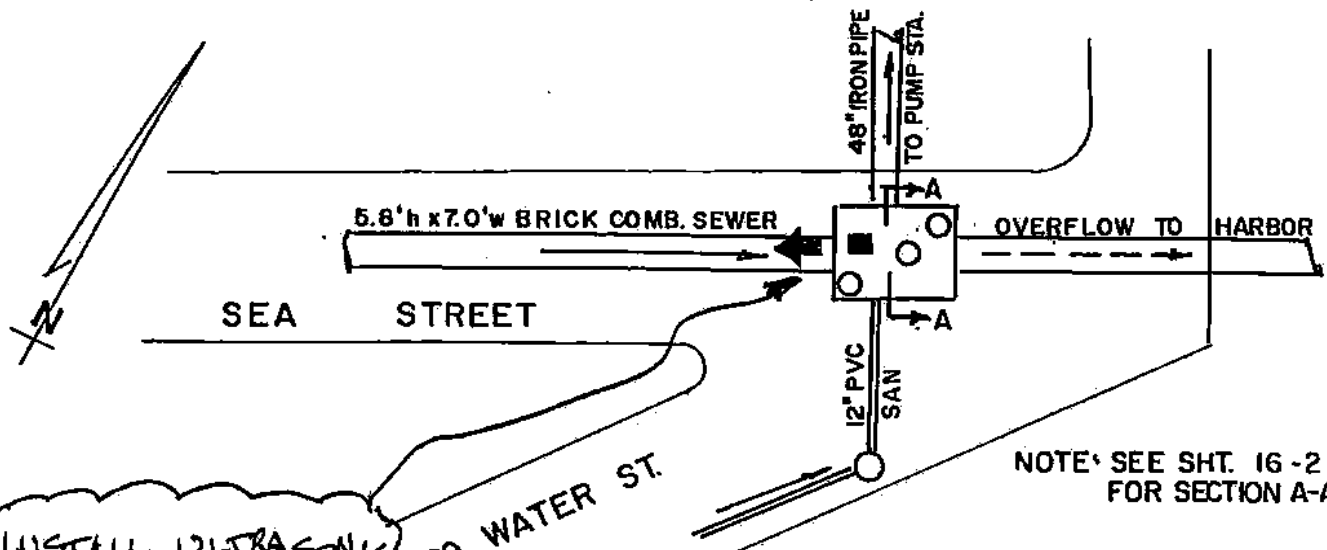
LEGEND

WET WEATHER FLOW

DRY WEATHER FLOW

OVERFLOW NO. 022
ALLEN PLACE
NEW HAVEN, CONNECTICUT

DATE: 7-23-97
JOB NO. 1146
SHT. NO. 17



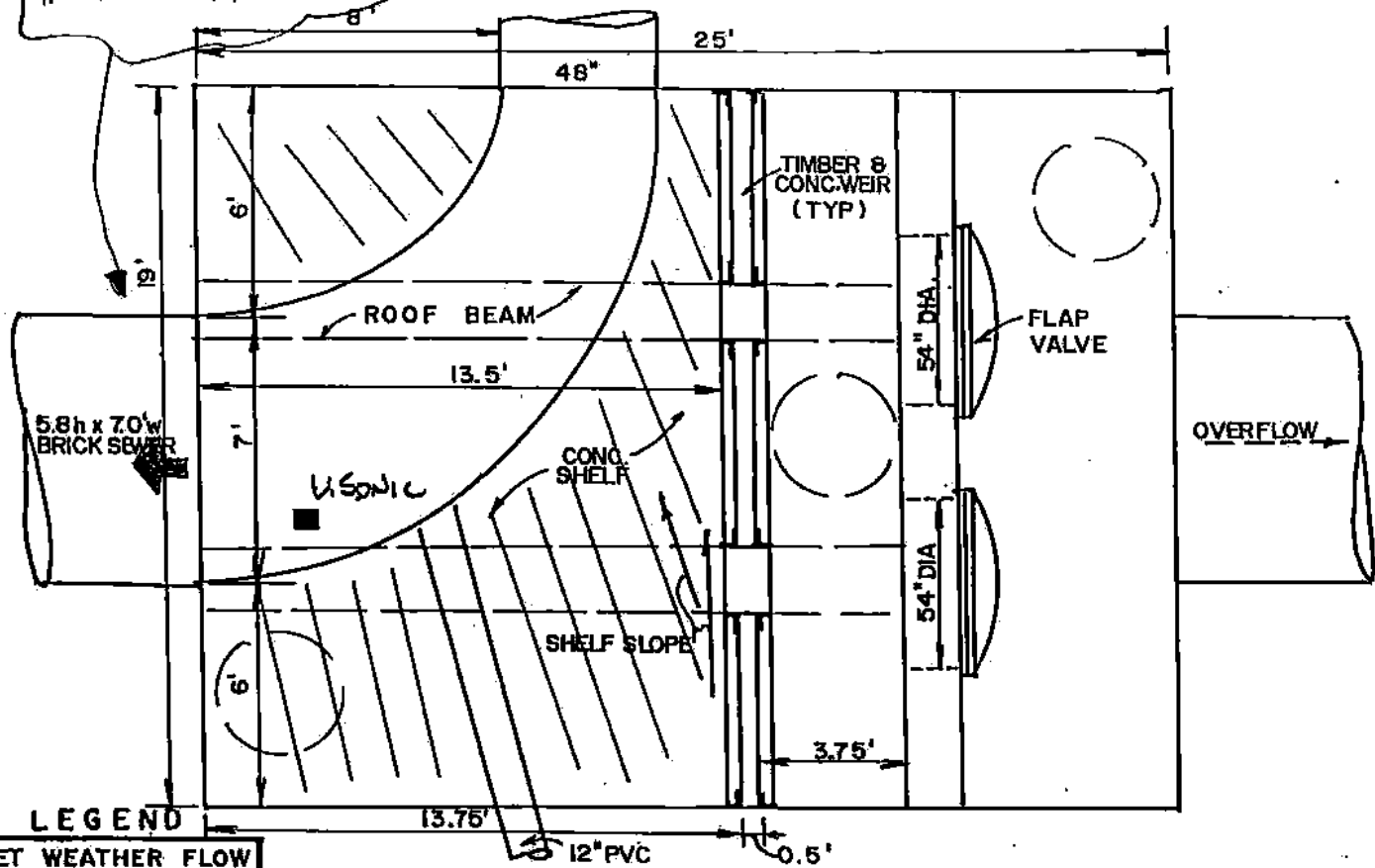
NOTE: SEE SHT. 16-2 FOR SECTION A-A

SITE MAP
N. T. S.

INSTALL ULTRASONIC IN CHAMBER.
PUMPSTATION FLOW RECORDED BY WPCA

INSTALL P&V PROBE IN INLET PIPE.

WEIRS @ ELEV. 4.6
MHW = 3.31



LEGEND

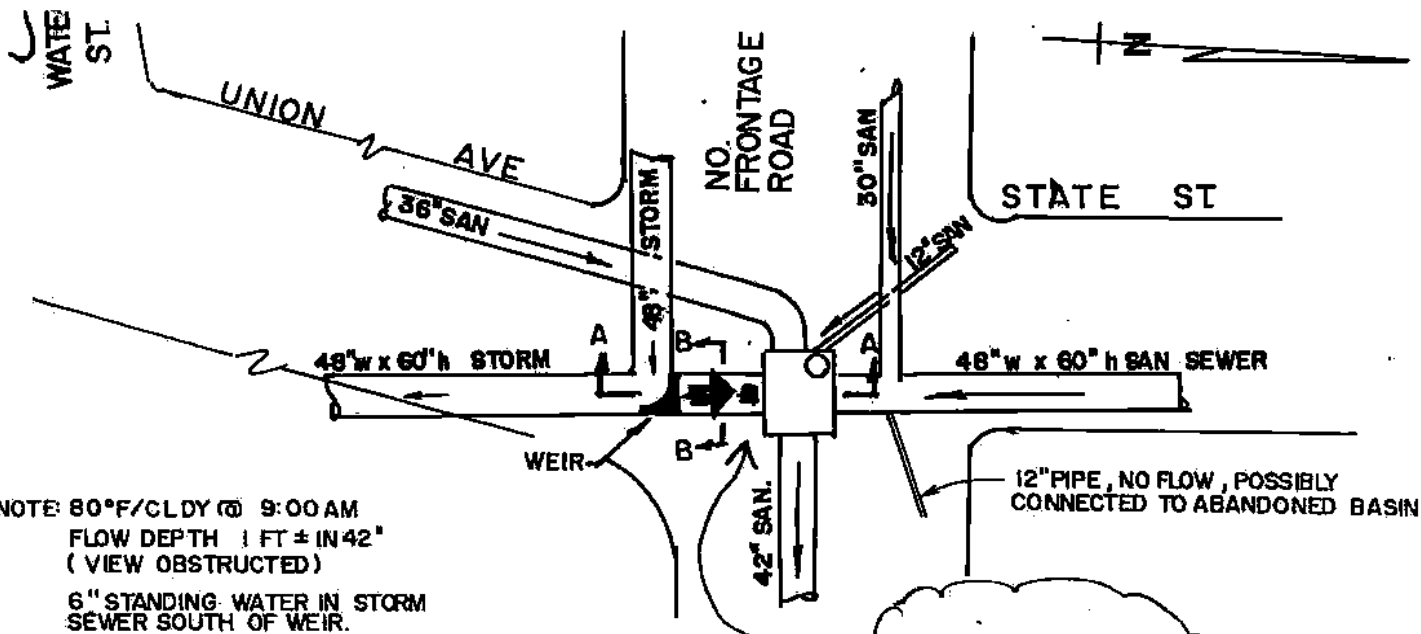
WET WEATHER FLOW

DRY WEATHER FLOW

PLAN - INSIDE CHAMBER
N.T.S.

OVERFLOW NO. OB 2/024
SEA ST. @ SO. WATER ST.
NEW HAVEN, CONNECTICUT

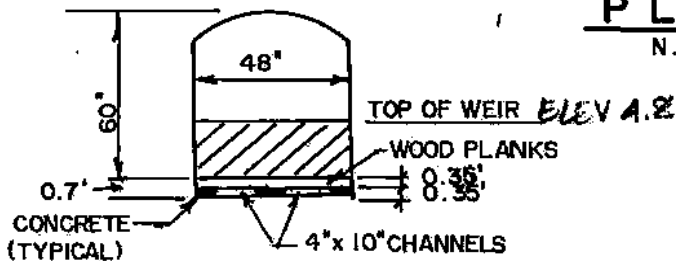
DATE: 7-17-97
JOB NO. 1146
SHT. NO. 16-1



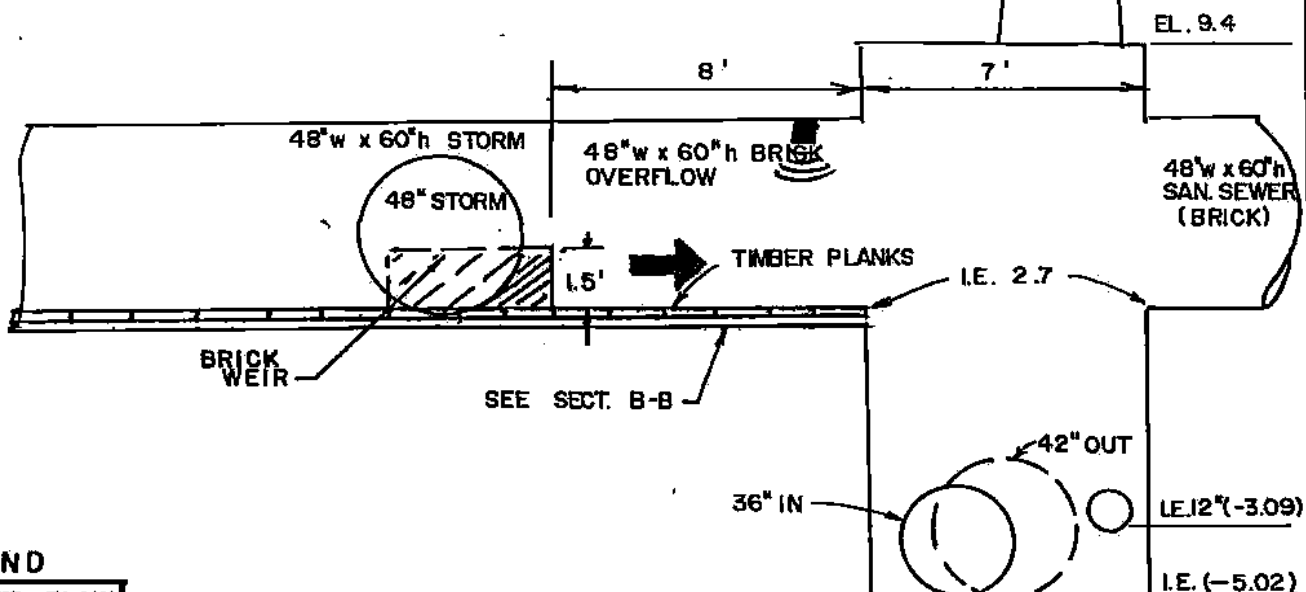
NOTE: 80°F/CLDY @ 9:00 AM
 FLOW DEPTH 1 FT ± IN 42"
 (VIEW OBSTRUCTED)
 6" STANDING WATER IN STORM
 SEWER SOUTH OF WEIR.

PLAN
 N. T. S.

INSTALL ALL
 IN 48" x 60"
 STORM PIPE
 (NORMALLY
 DRY)



SECTION B-B
 N. T. S.

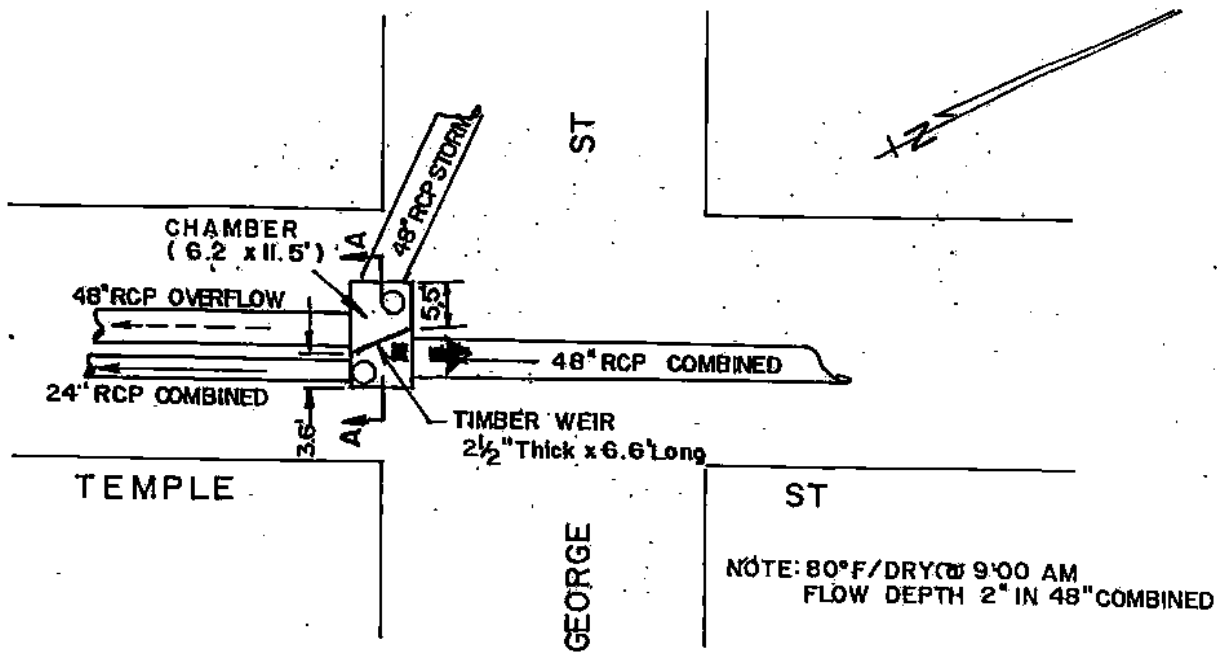


LEGEND
 WET WEATHER FLOW
 DRY WEATHER FLOW

SECTION A-A
 N. T. S.

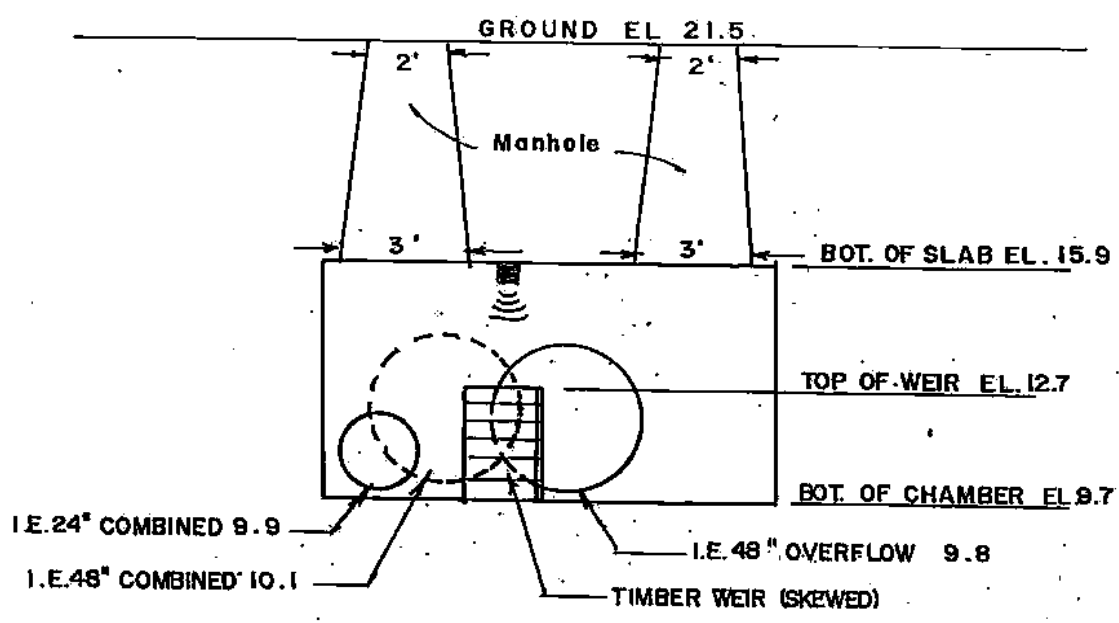
OVERFLOW NO. OE 9/025
UNION AVE @ STATE ST.
NEW HAVEN, CONNECTICUT

DATE: 7-16-97
 REV. 9-15-97
 JOB NO. 1146
 SHT. NO. 15



NOTE: 80°F/DRY @ 9:00 AM
FLOW DEPTH 2" IN 48" COMBINED

P L A N
N. T. S.



SECTION "A-A"
N. T. S.

LEGEND

WET WEATHER FLOW	
DRY WEATHER FLOW	

OVERFLOW NO. OE-9B/025
TEMPLE ST. @ GEORGE ST.
NEW HAVEN, CONNECTICUT

DATE: 8-15-97
JOB NO. 1146
SHT. NO. 24

Appendix C

Interim Results

ADS ENVIRONMENTAL SERVICES, INC.

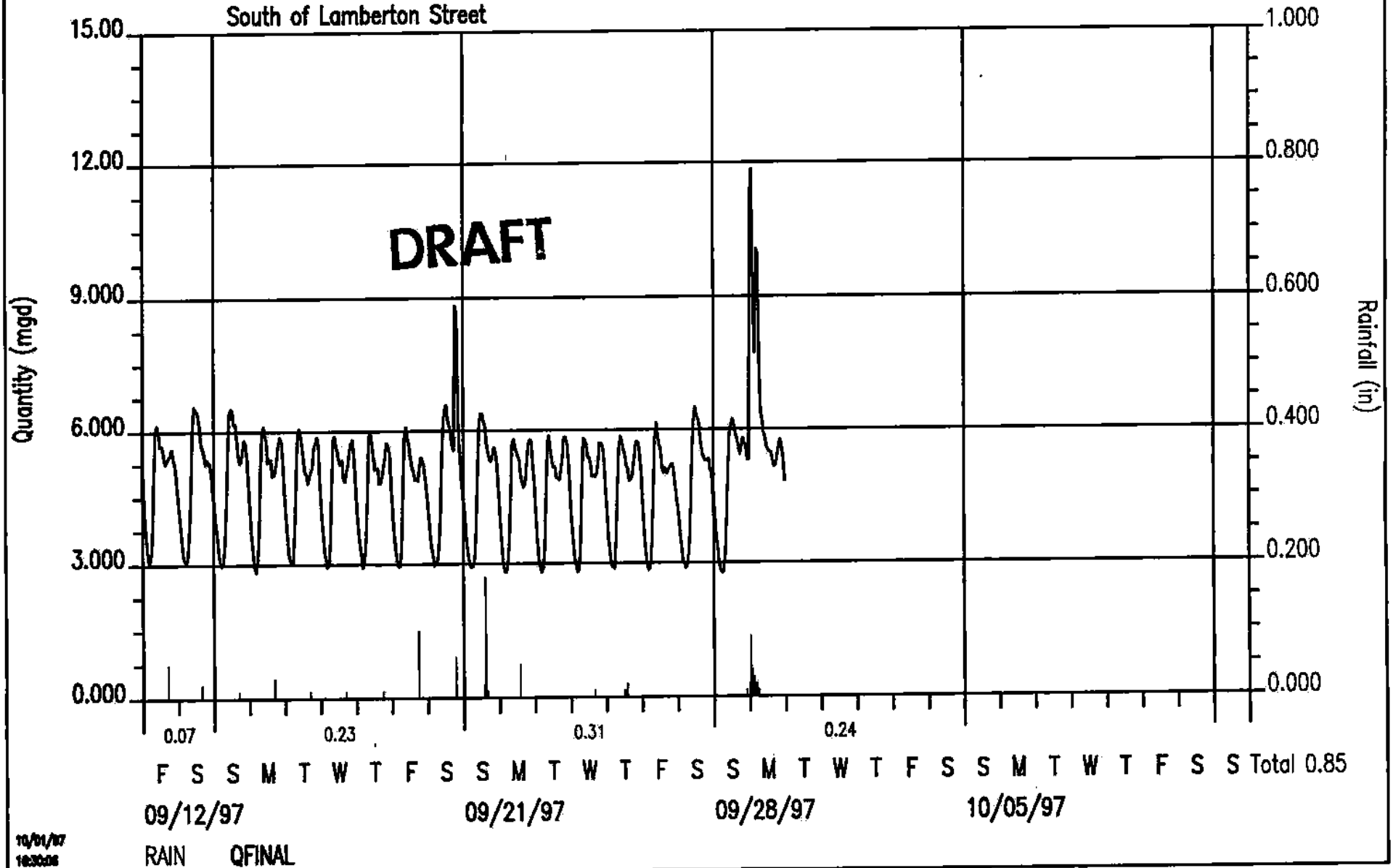
NHCSO_M2

Under Et Grasso Blvd.,

South of Lamberton Street

New Haven, CT

DRAFT



ADS ENVIRONMENTAL SERVICES, INC.

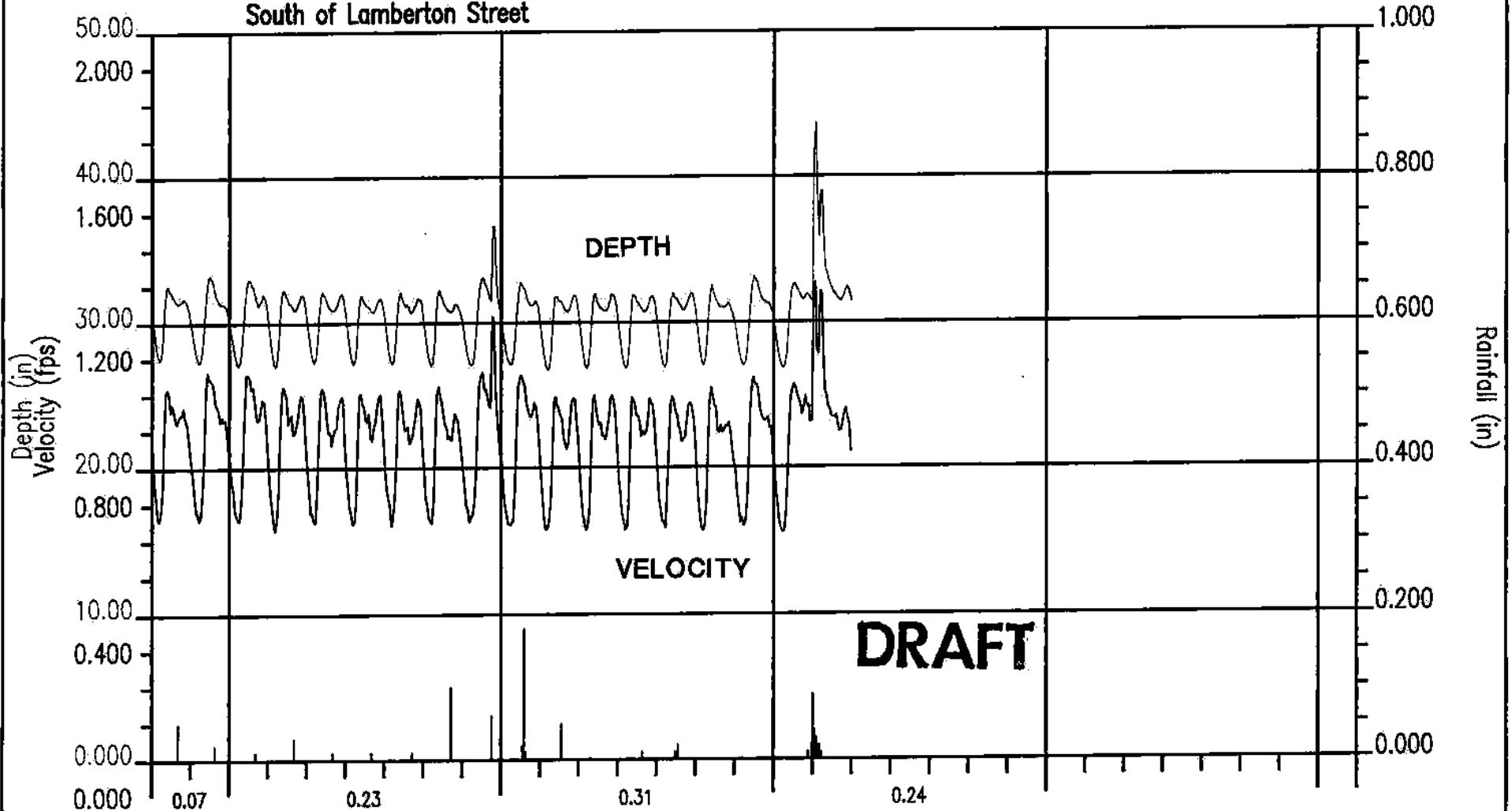
NHCSO_M2

Under Et Grasso Blvd.,

New Haven, CT

DRAFT

South of Lambertson Street



F S S M T W T F S S M T W T F S S M T W T F S S Total 0.85
 09/12/97 09/21/97 09/28/97 10/05/97

10/01/97
15:38:14

RAIN AVGUDEPTH VELOCITY

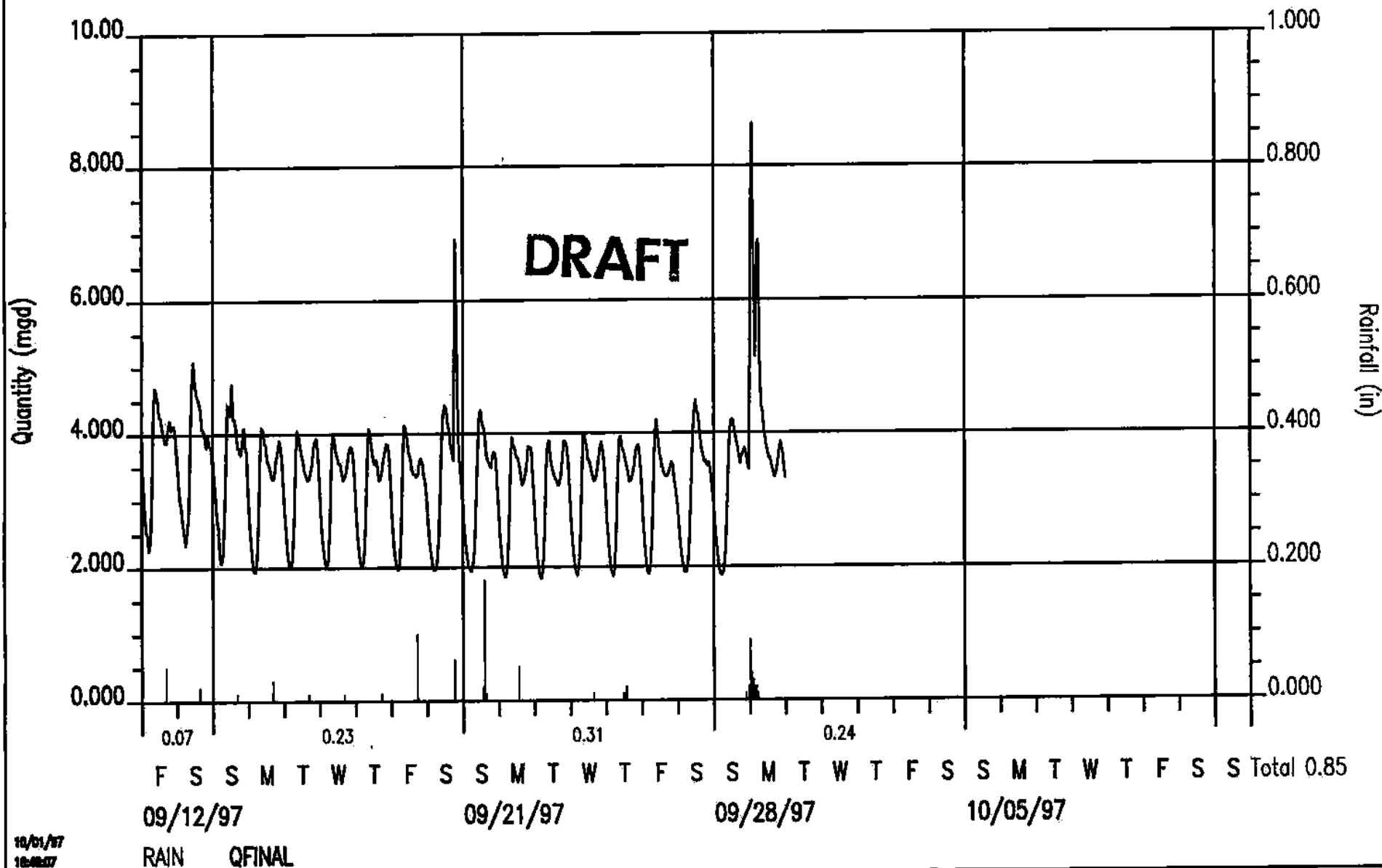
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M3

Orange Avenue and Et Grasso Blvd.

New Haven, CT

DRAFT



10/01/97
10:00:07

RAIN QFINAL

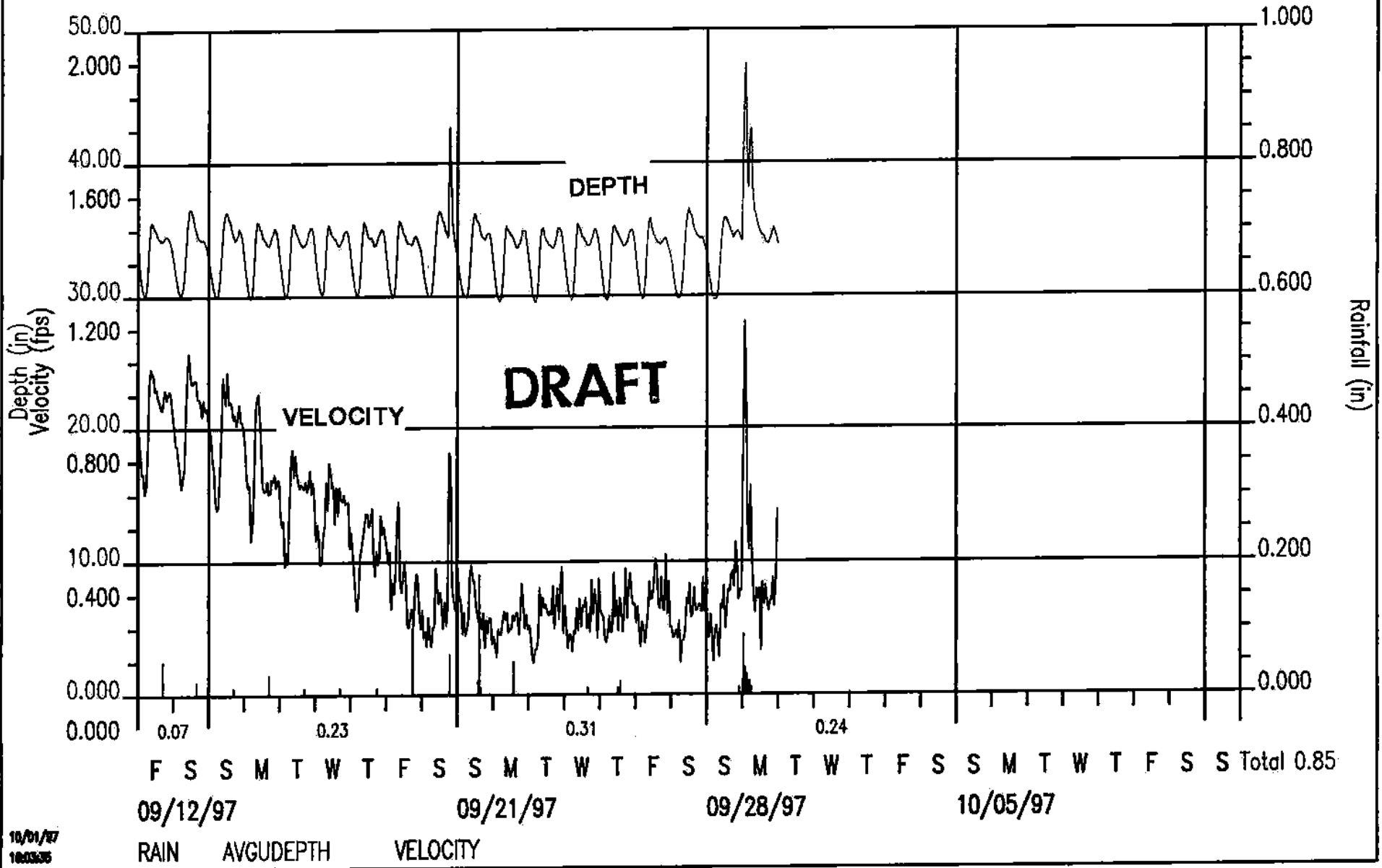
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M3

Orange Avenue and Et Grasso Blvd.

New Haven, CT

DRAFT



10/01/97
180336

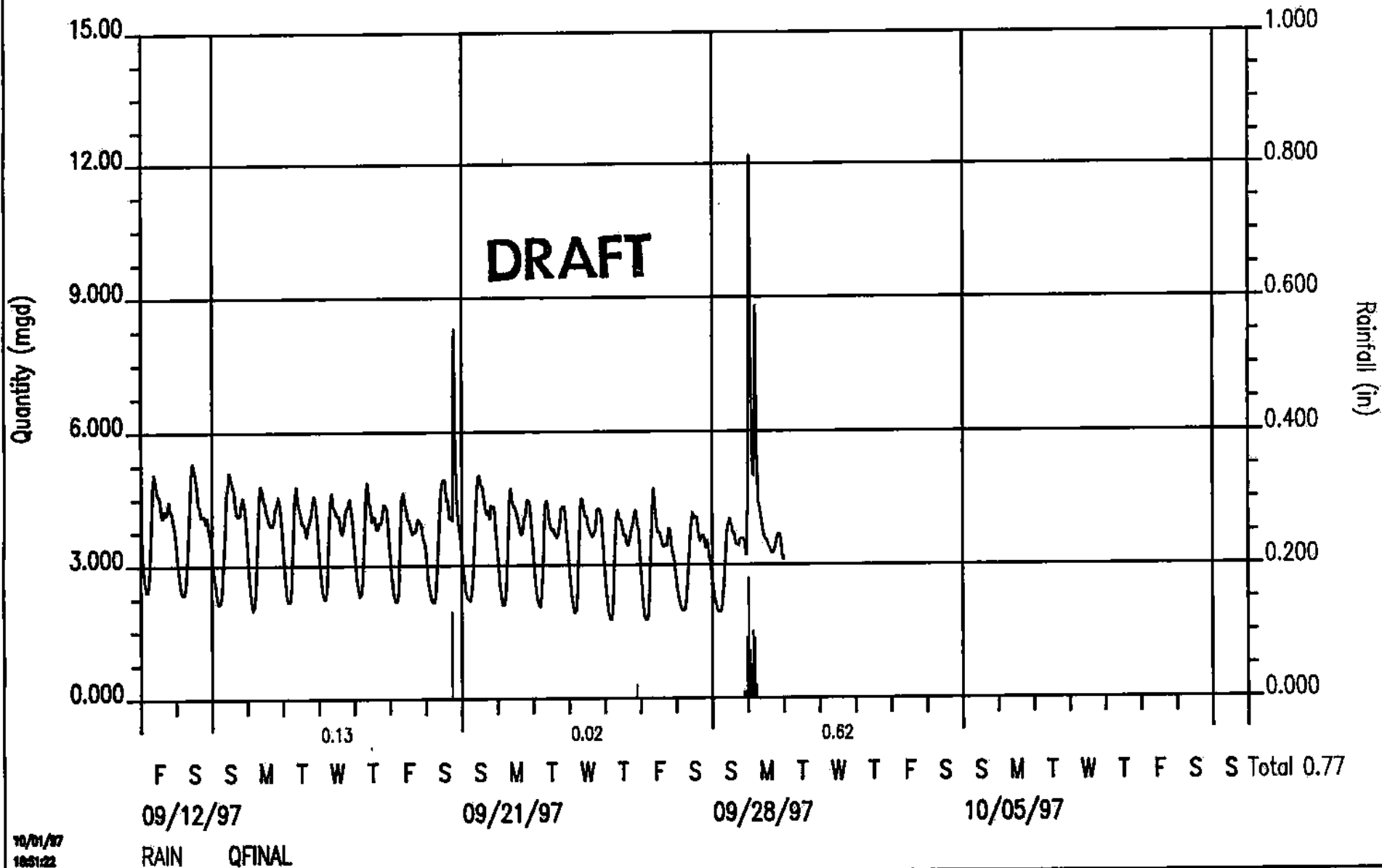
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M4

Legion Avenue and Et Grasso Blvd.

New Haven, CT

DRAFT



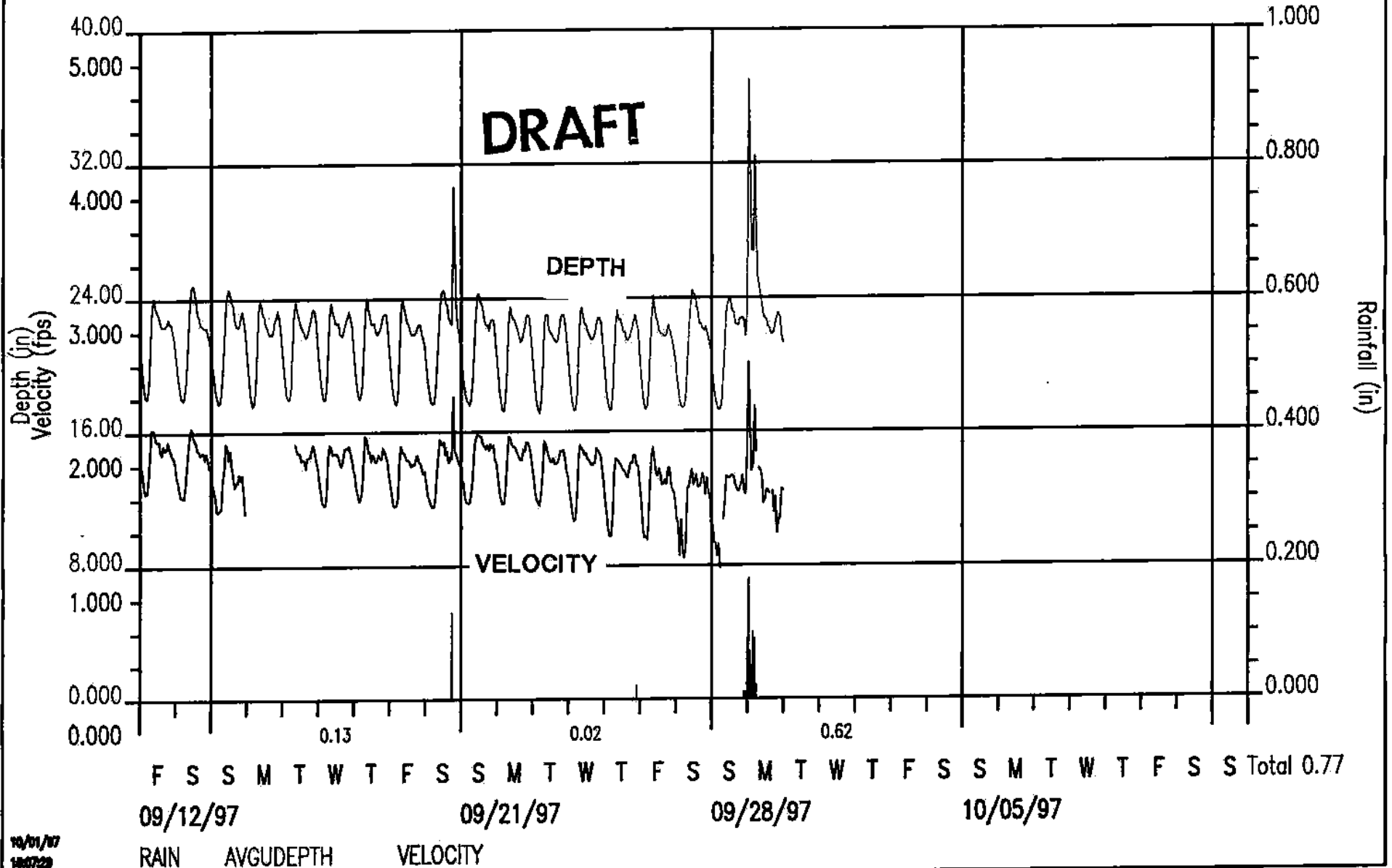
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M4

Legion Avenue and Et Grasso Blvd.

New Haven, CT

DRAFT



10/01/97
14:07:29

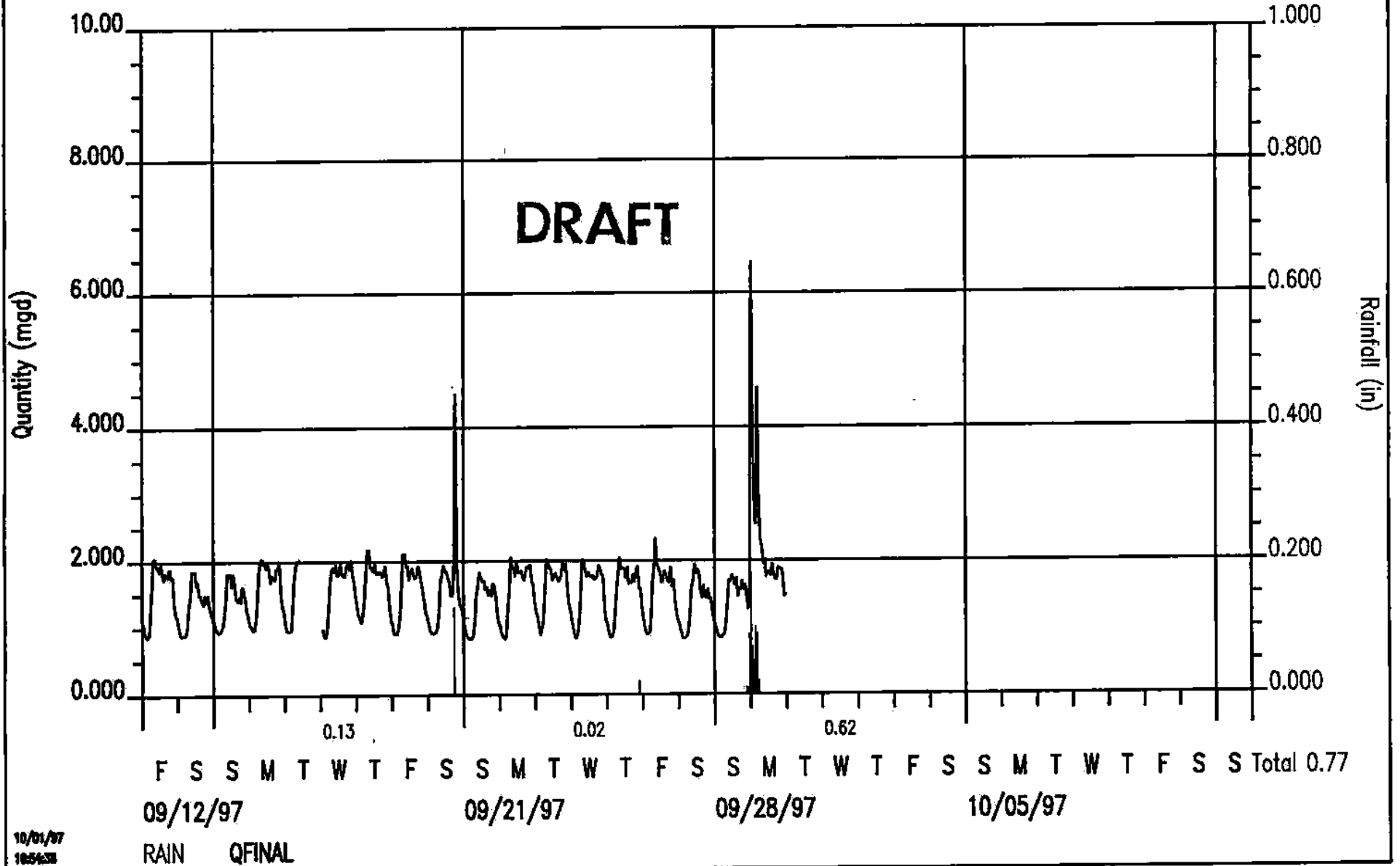
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M5A

Derby Avenue and Et Grasso Blvd.

New Haven, CT

DRAFT



10/01/97
10:56:38

RAIN QFINAL

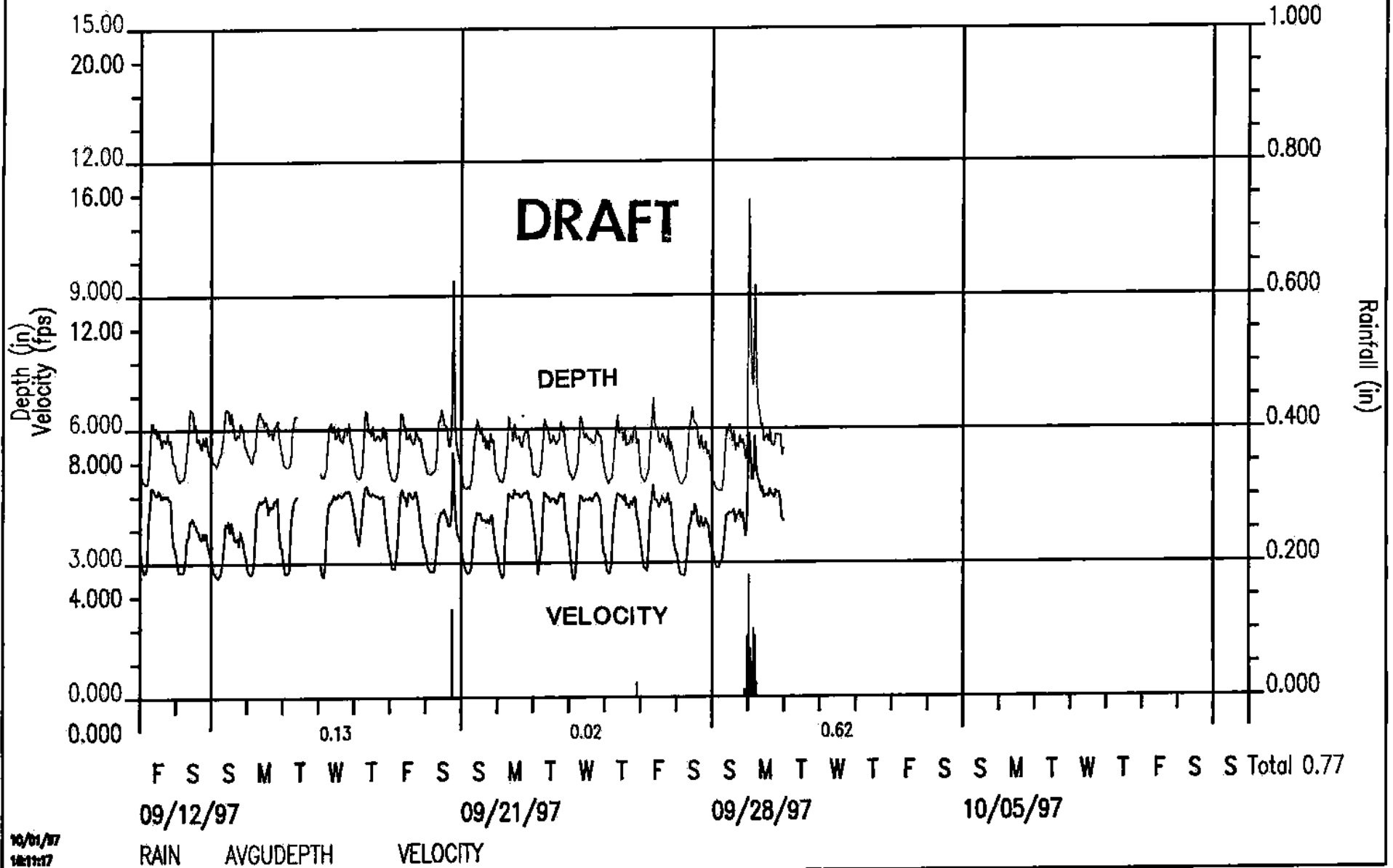
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M5A

Derby Avenue and Et Grasso Blvd.

New Haven, CT

DRAFT



10/01/97
10:11:17

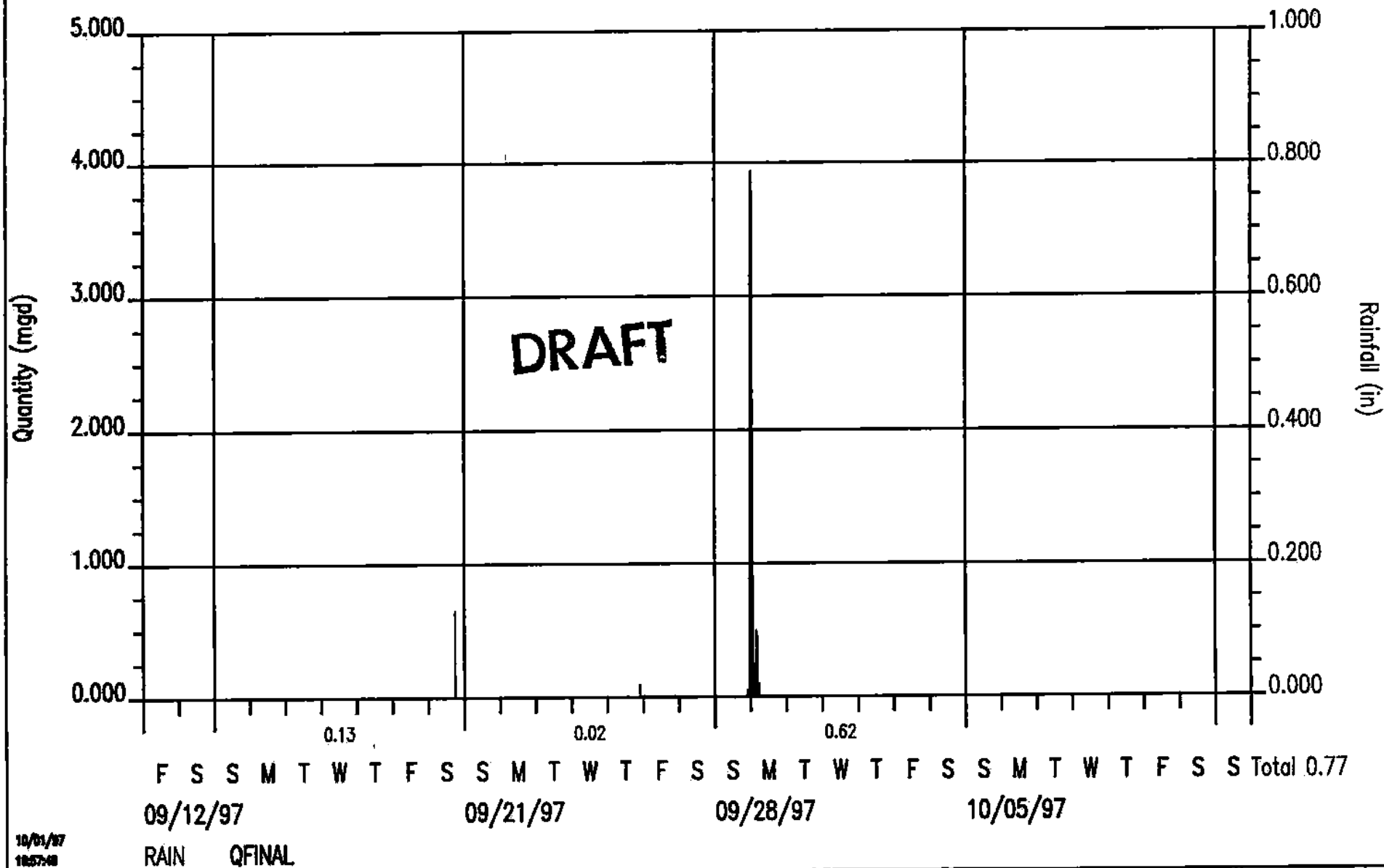
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M5B

Derby Avenue and Et Grasso Blvd.

New Haven, CT

DRAFT



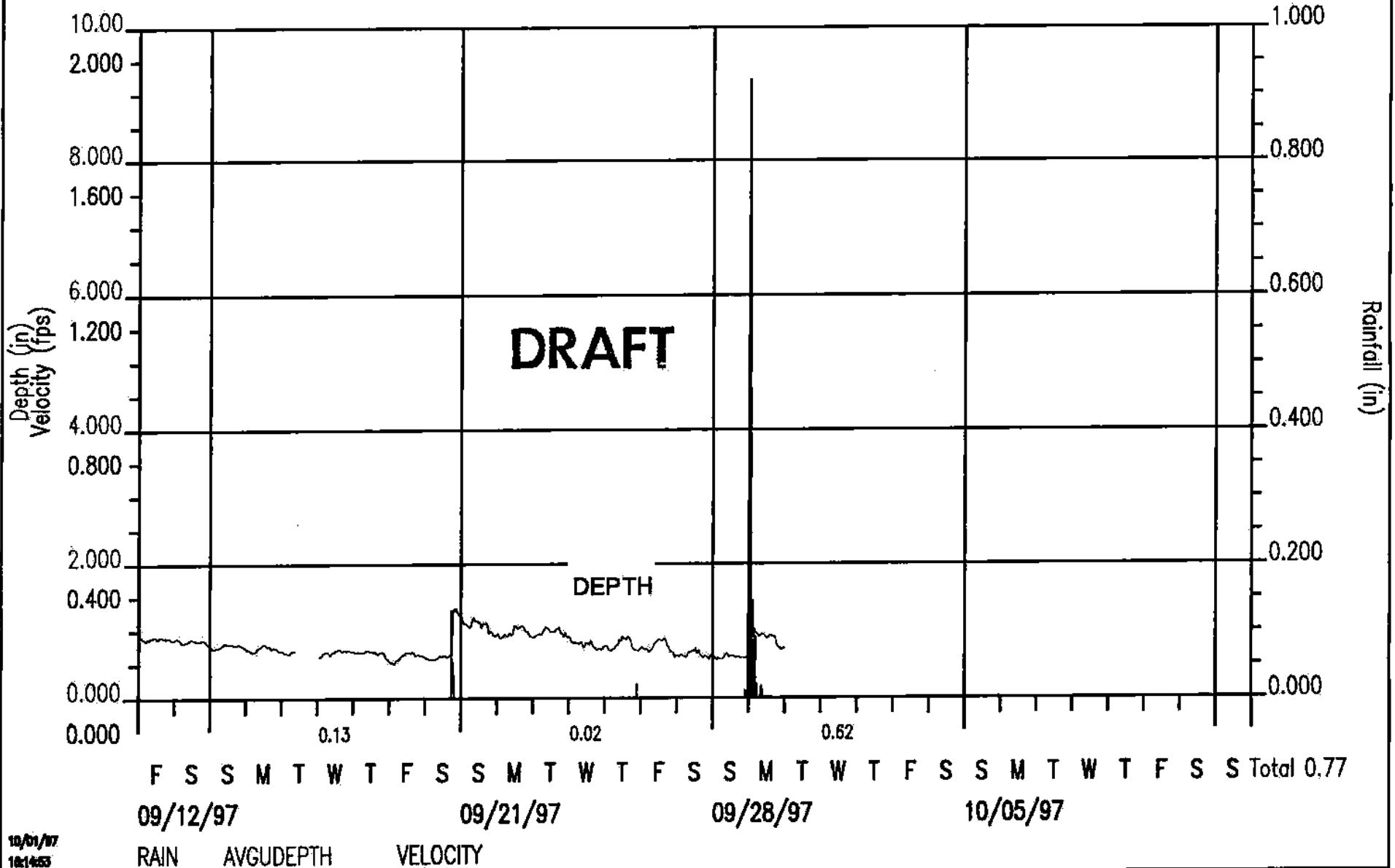
ADS ENVIRONMENTAL SERVICES, INC.

DRAFT

NHCSO_M5B

Derby Avenue and Et Grasso Blvd.

New Haven, CT



10/01/97
10:14:53

RAIN AVGUDEPTH VELOCITY

ADS ENVIRONMENTAL SERVICES, INC.

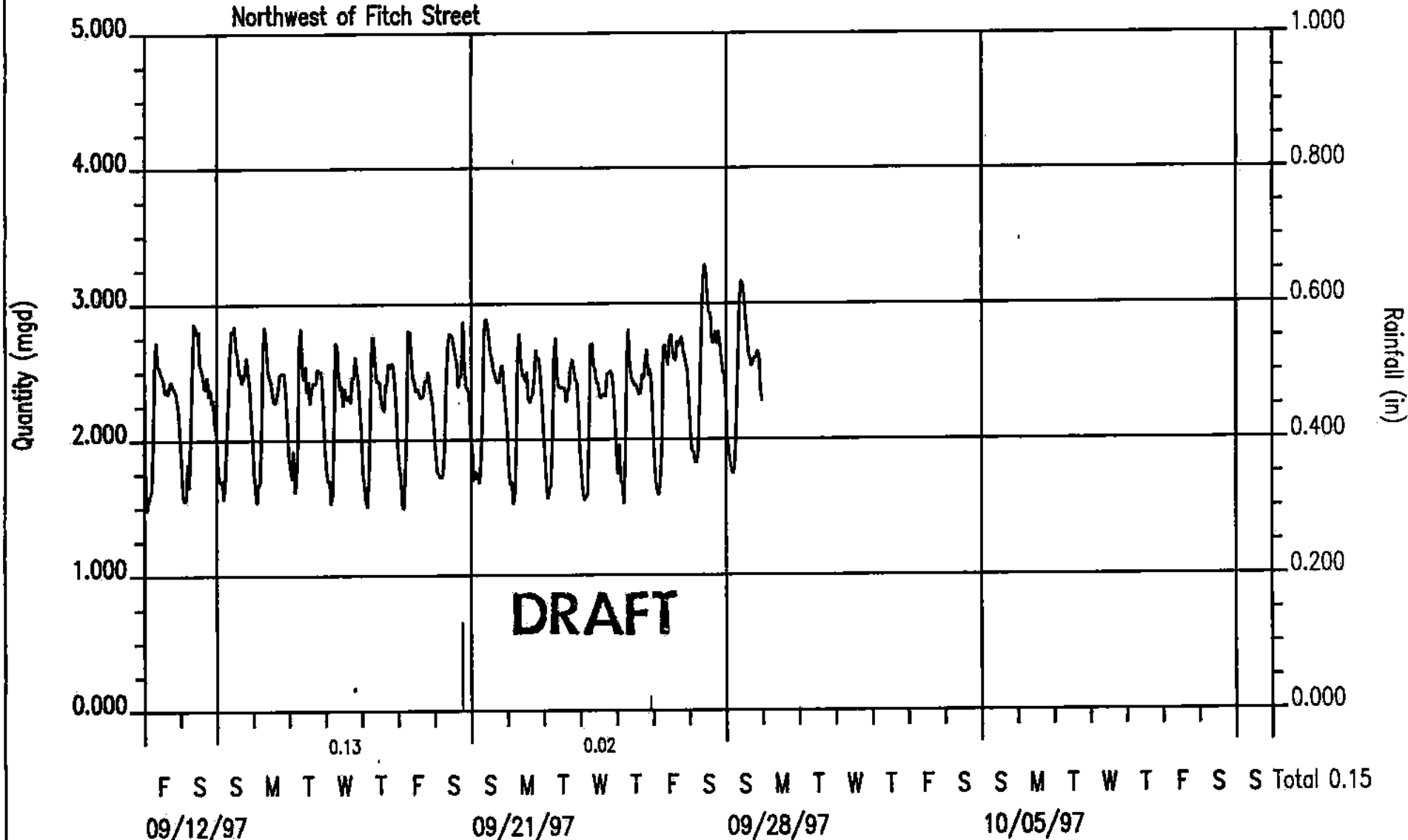
NHCSO_M6

Whalley Avenue,

Northwest of Fitch Street

New Haven, CT

DRAFT



10/01/97
07:51:03

RAIN QFINAL

ADS ENVIRONMENTAL SERVICES, INC.

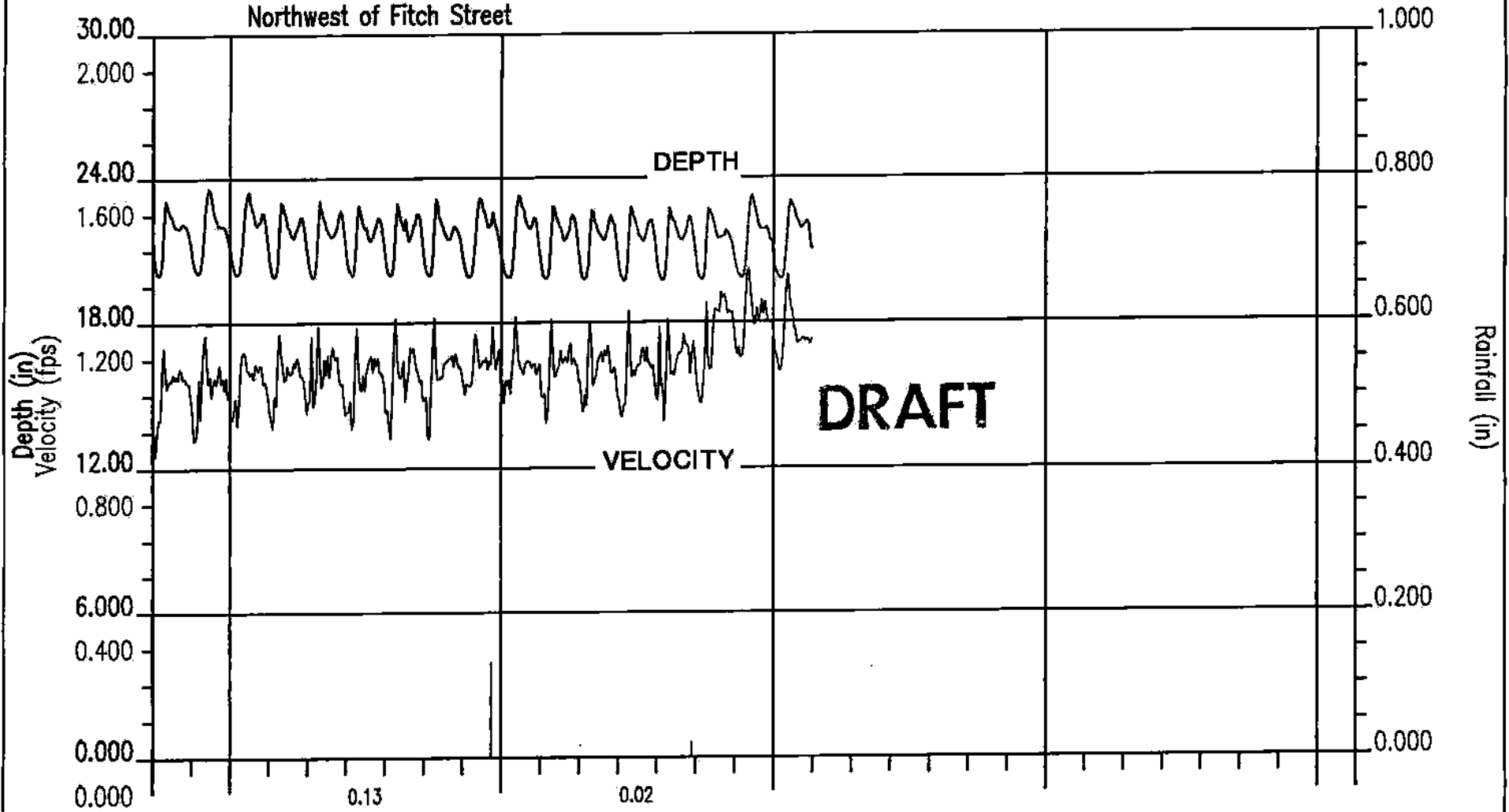
DRAFT

NHCSO_M6

Whalley Avenue,

New Haven, CT

Northwest of Fitch Street



Depth (in)
Velocity (fps)

Rainfall (in)

DRAFT

F S S M T W T F S S M T W T F S S M T W T F S S Total 0.15
09/12/97 09/21/97 09/28/97 10/05/97

09/20/97
12:45:10

RAIN AVGUDEPTH VELOCITY

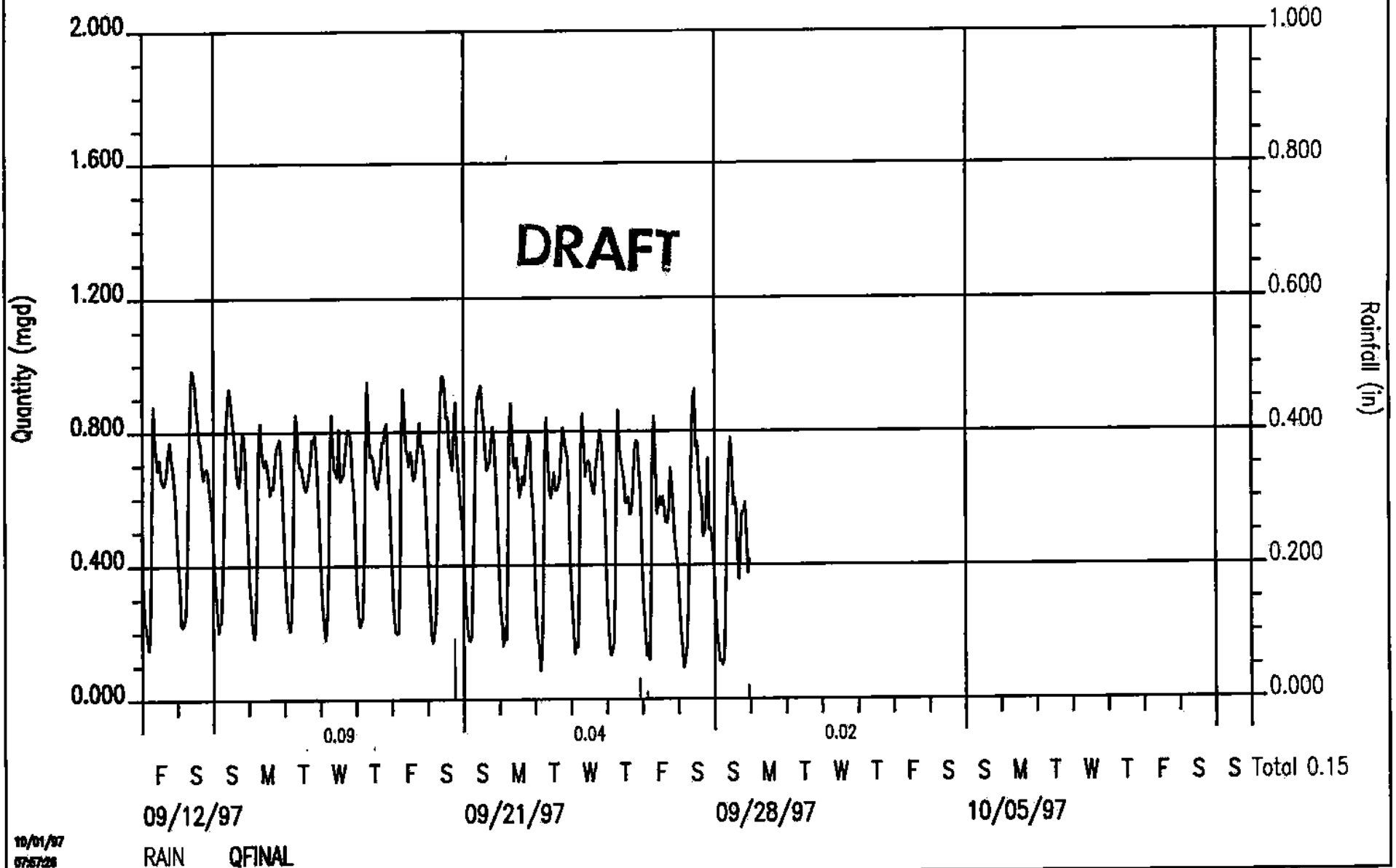
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M8

Orchard Street and Munson Street

New Haven, CT

DRAFT



10/01/97
07:57:28

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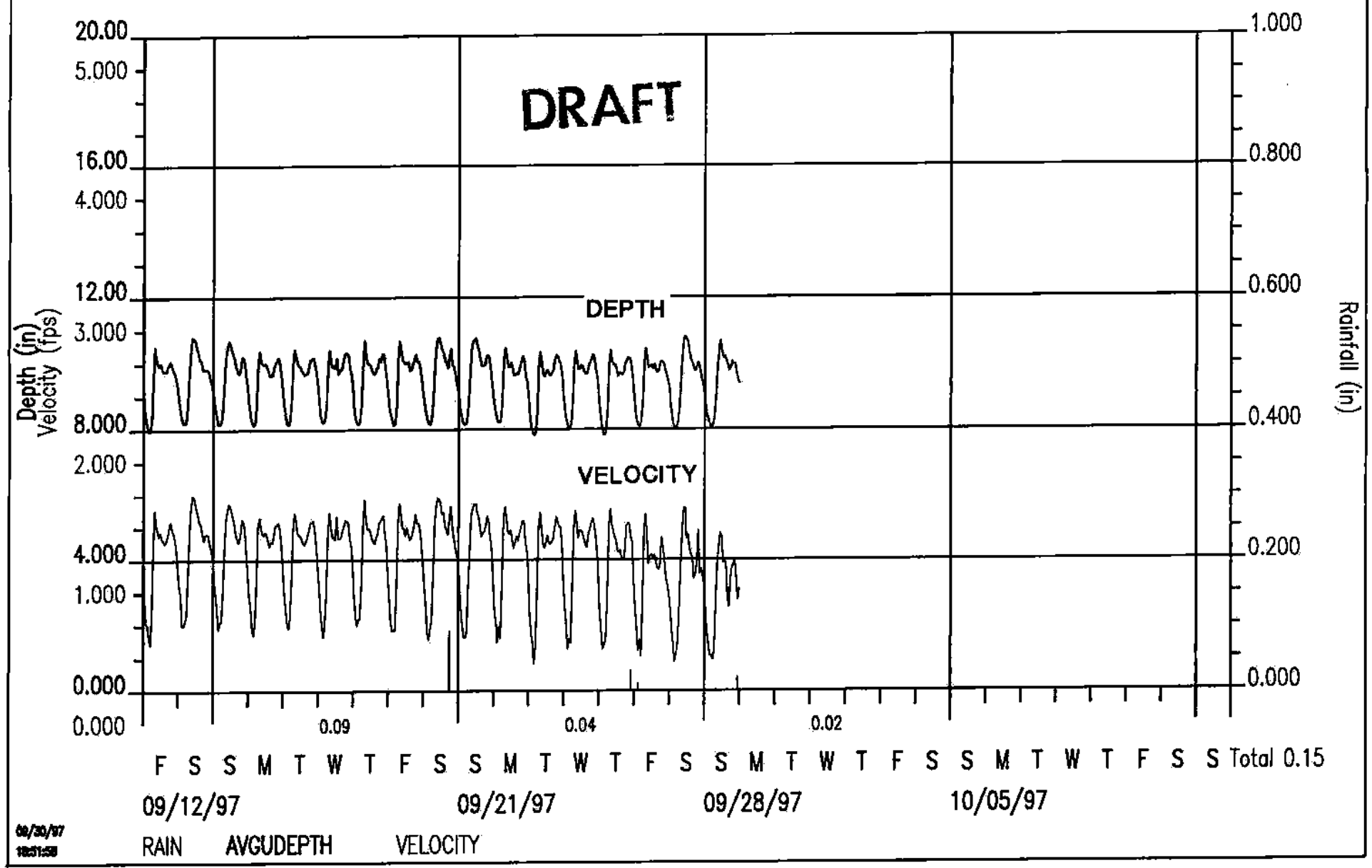
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M8

Orchard Street and Munson Street

New Haven, CT

DRAFT

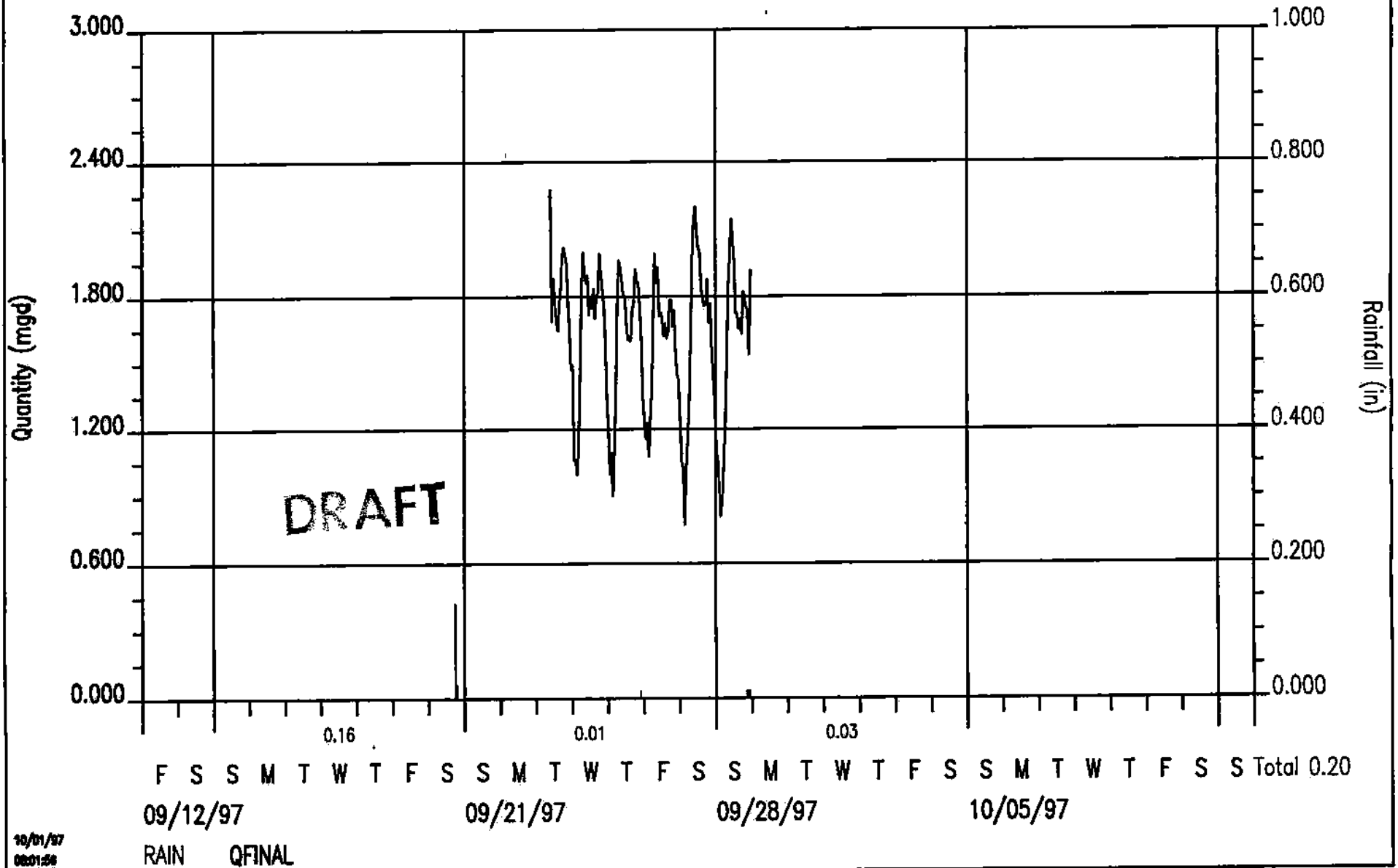


09/30/97
10:51:58

ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M9

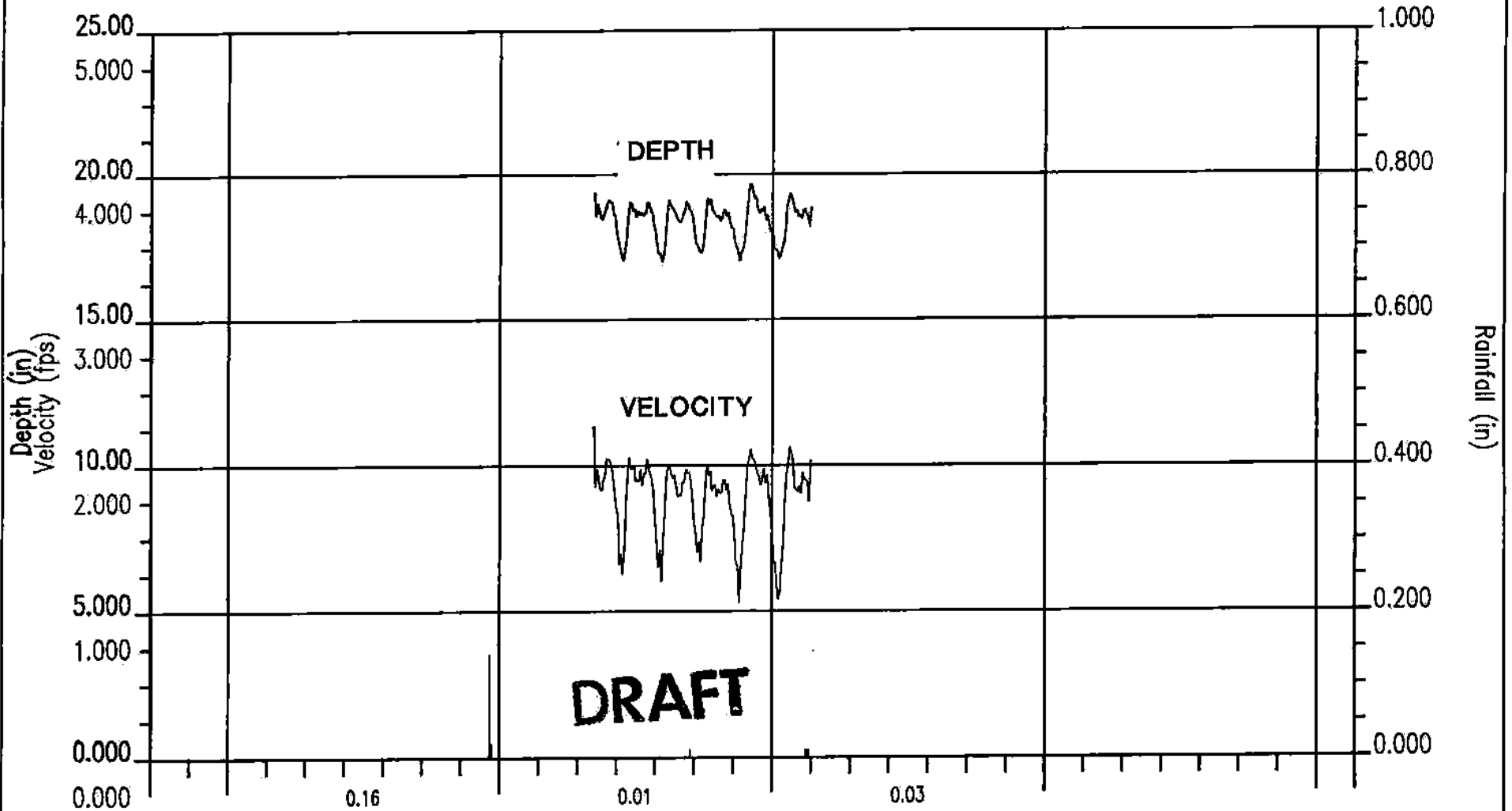
DRAFT



10/01/97
08:01:58

NHCSO_M9

DRAFT



F S S M T W T F S S M T W T F S S M T W T F S S Total 0.20
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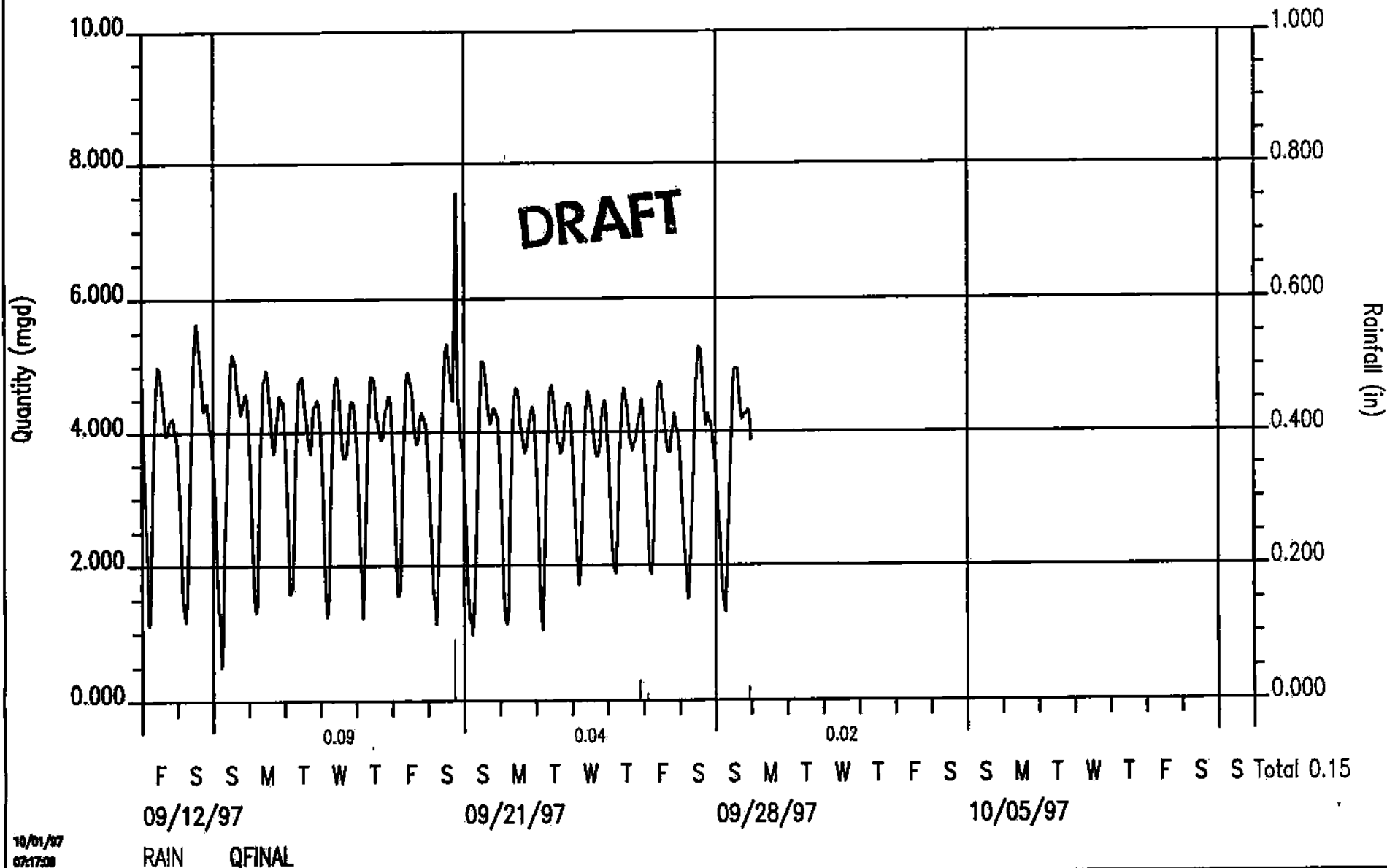
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M10

On East Street Under the I-91 Overpass

New Haven, CT

DRAFT



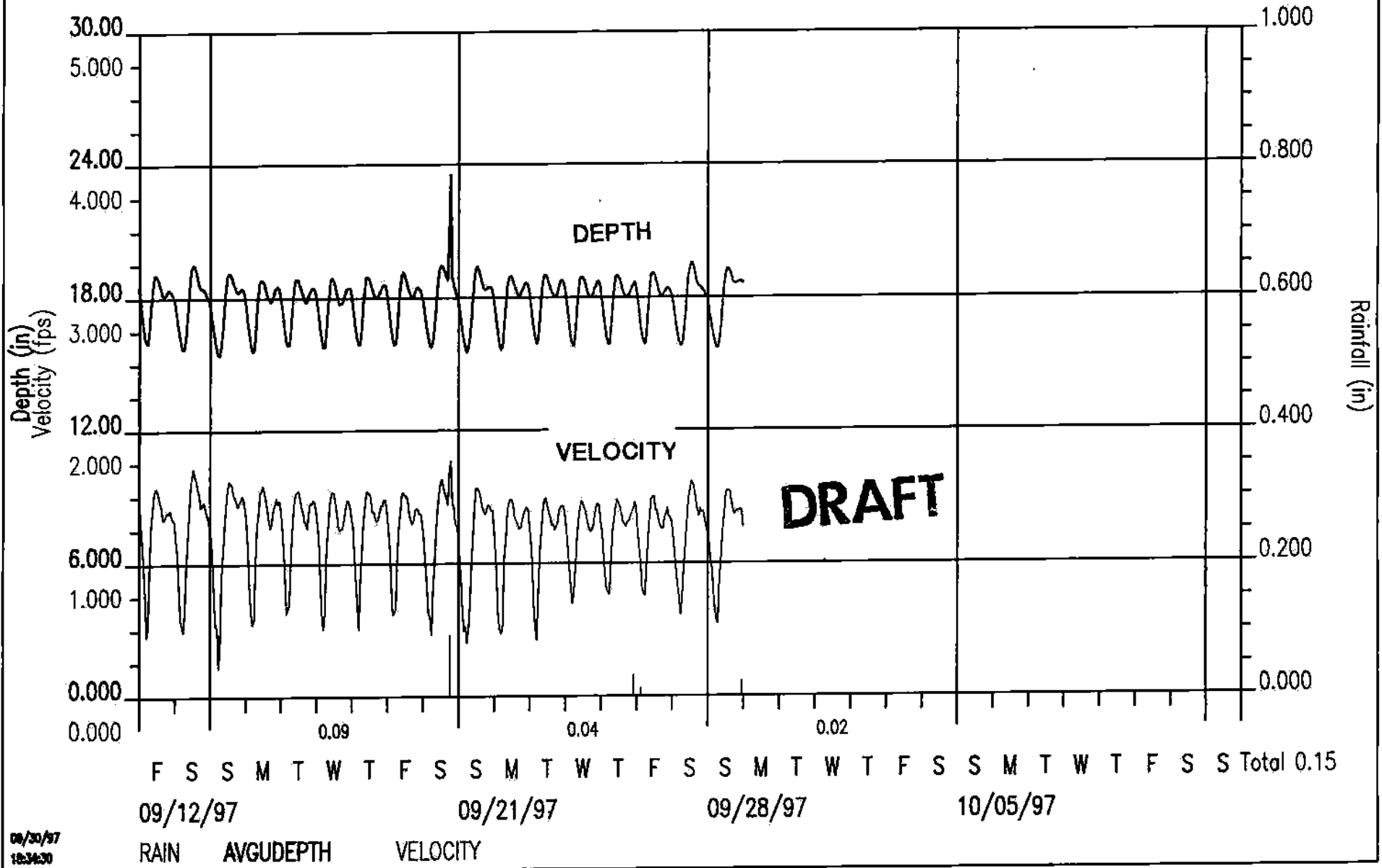
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M10

On East Street Under the I-91 Overpass

New Haven, CT

DRAFT



09/30/97
16:34:30

RAIN AVGUDEPTH VELOCITY

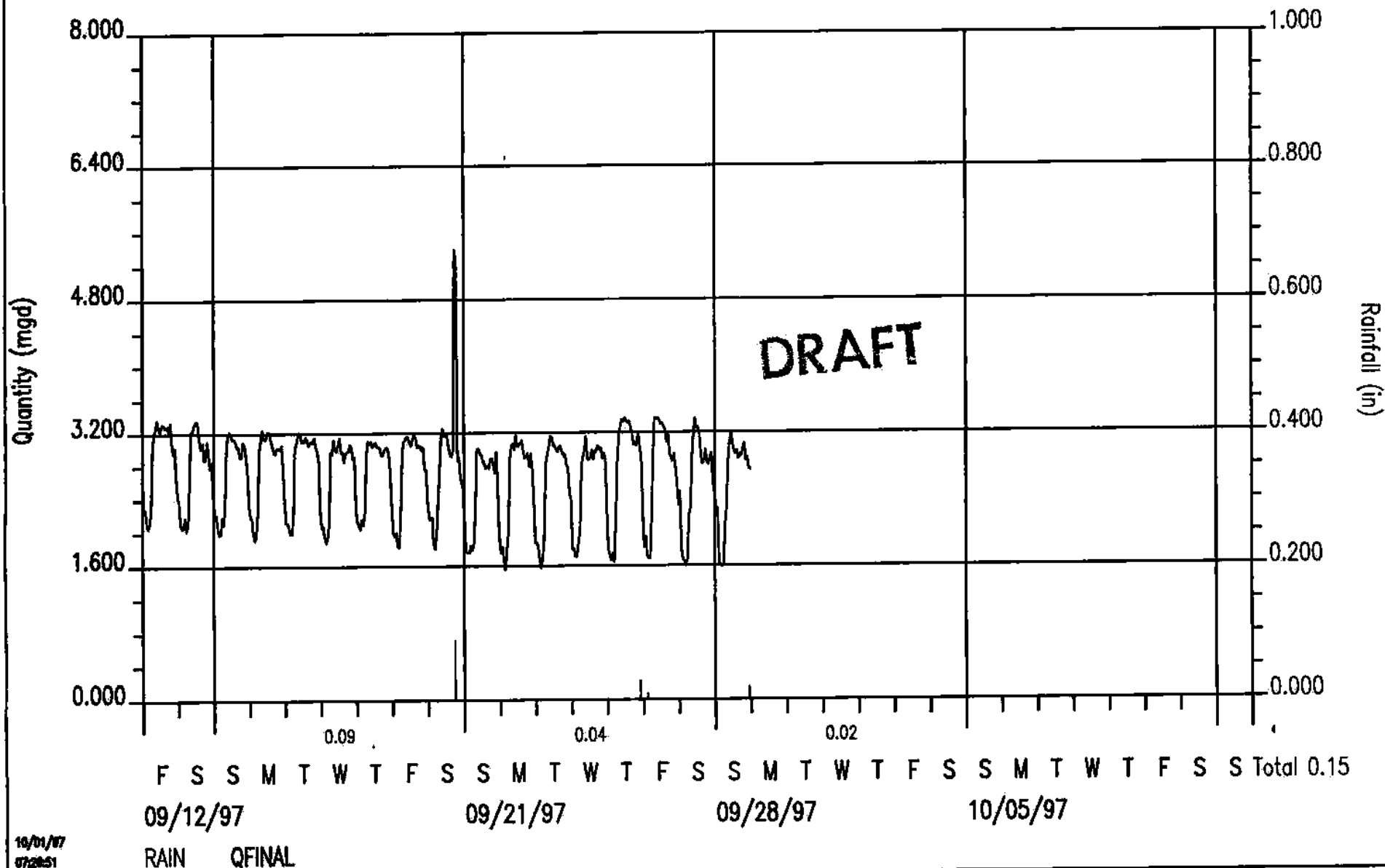
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M14A

Trumbull Street, East of Orange Street

New Haven, CT

DRAFT



10/01/97
07:28:51

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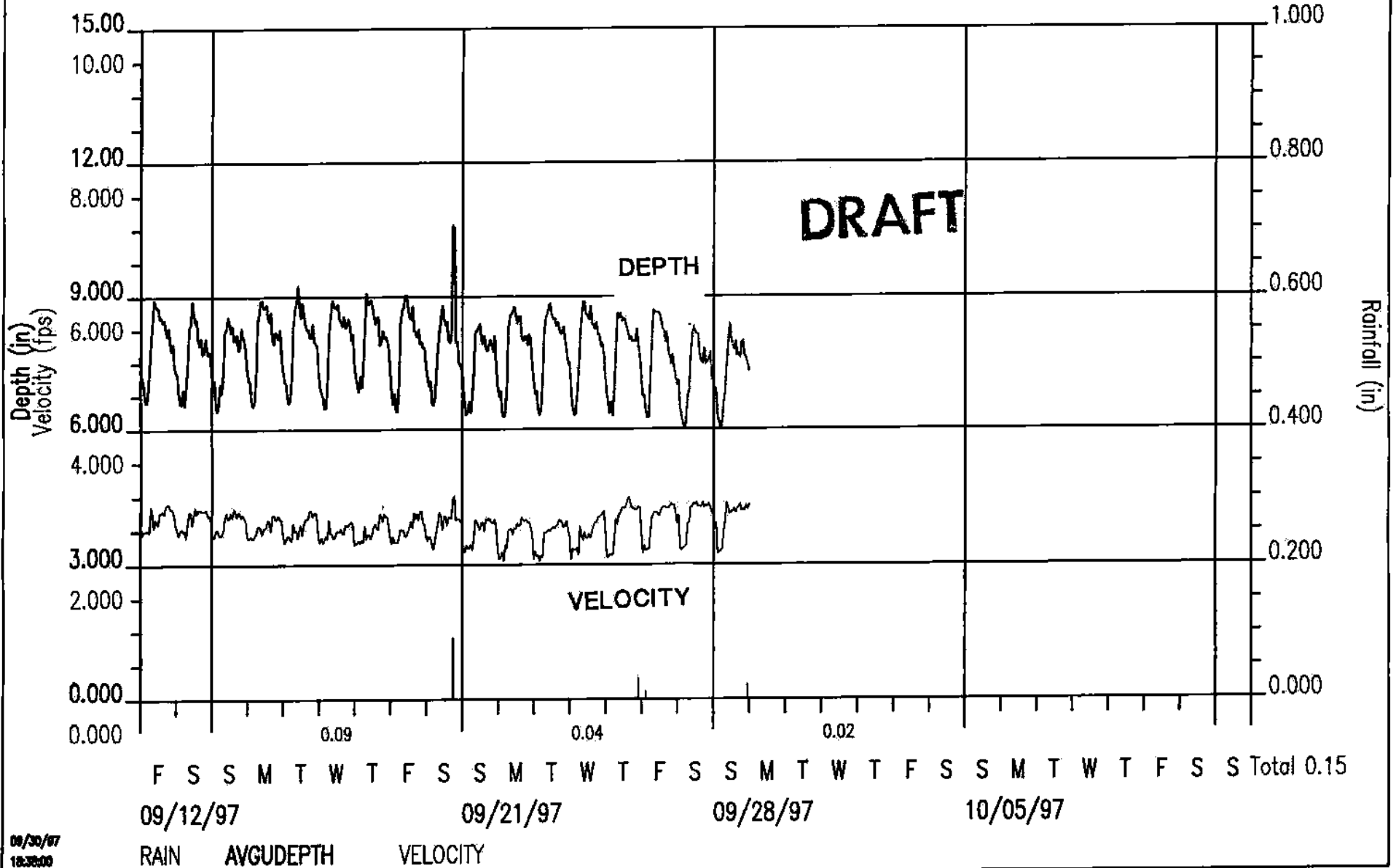
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M14A

Trumbull Street, East of Orange Street

New Haven, CT

DRAFT



09/30/97
10:30:00

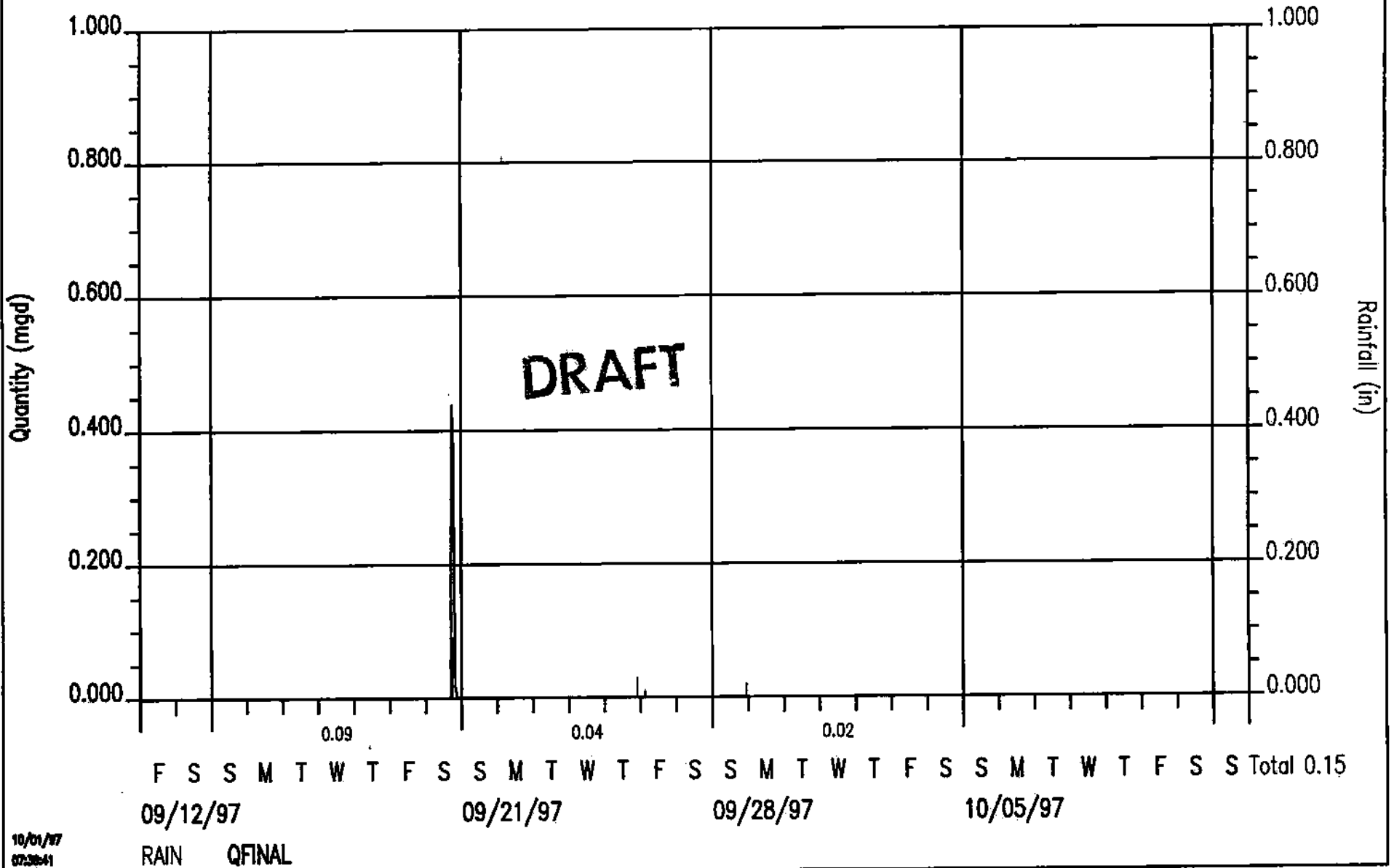
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M14B

Trumbull Street, East of Orange Street

New Haven, CT

DRAFT



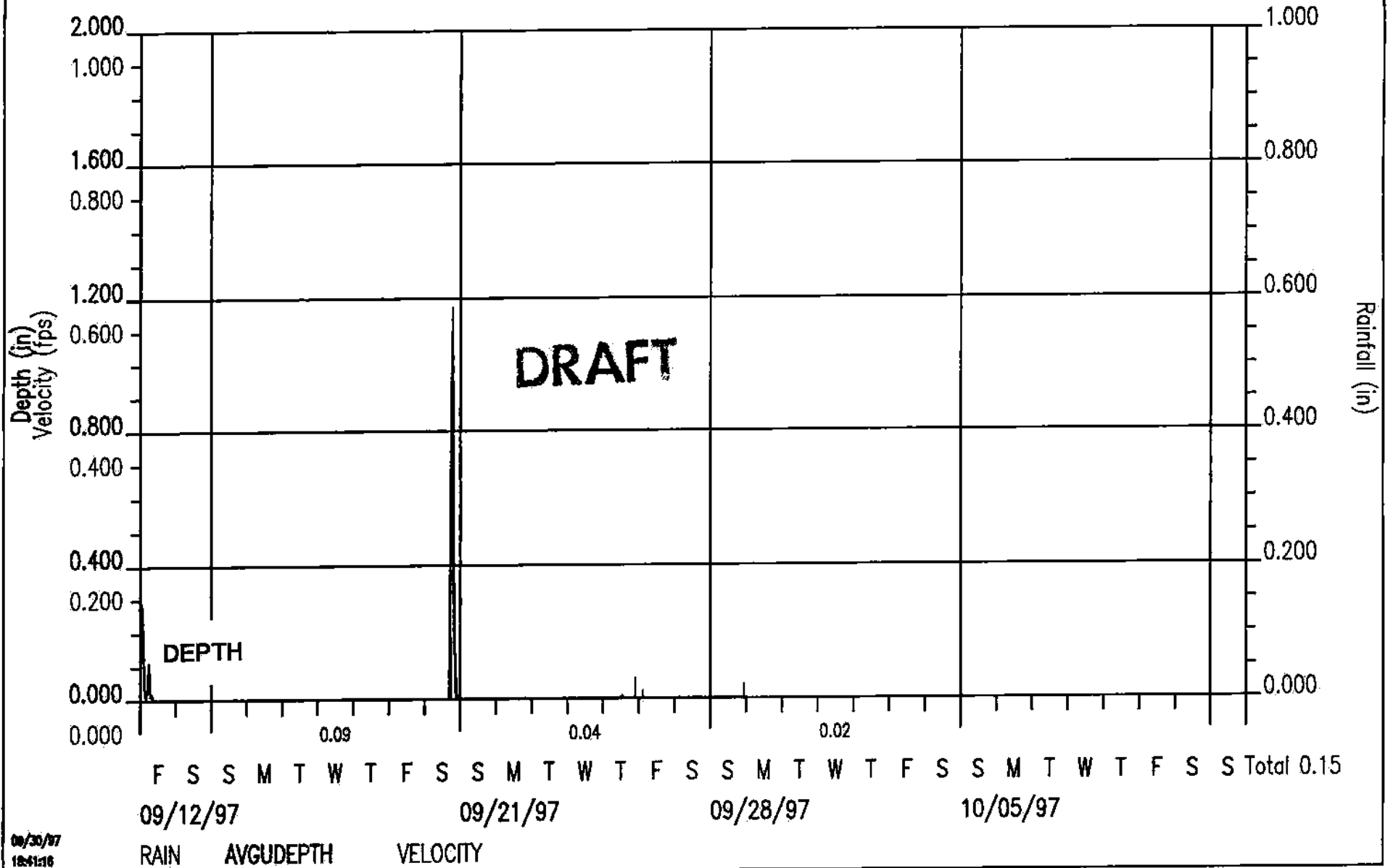
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M14B

Trumbull Street, East of Orange Street

New Haven, CT

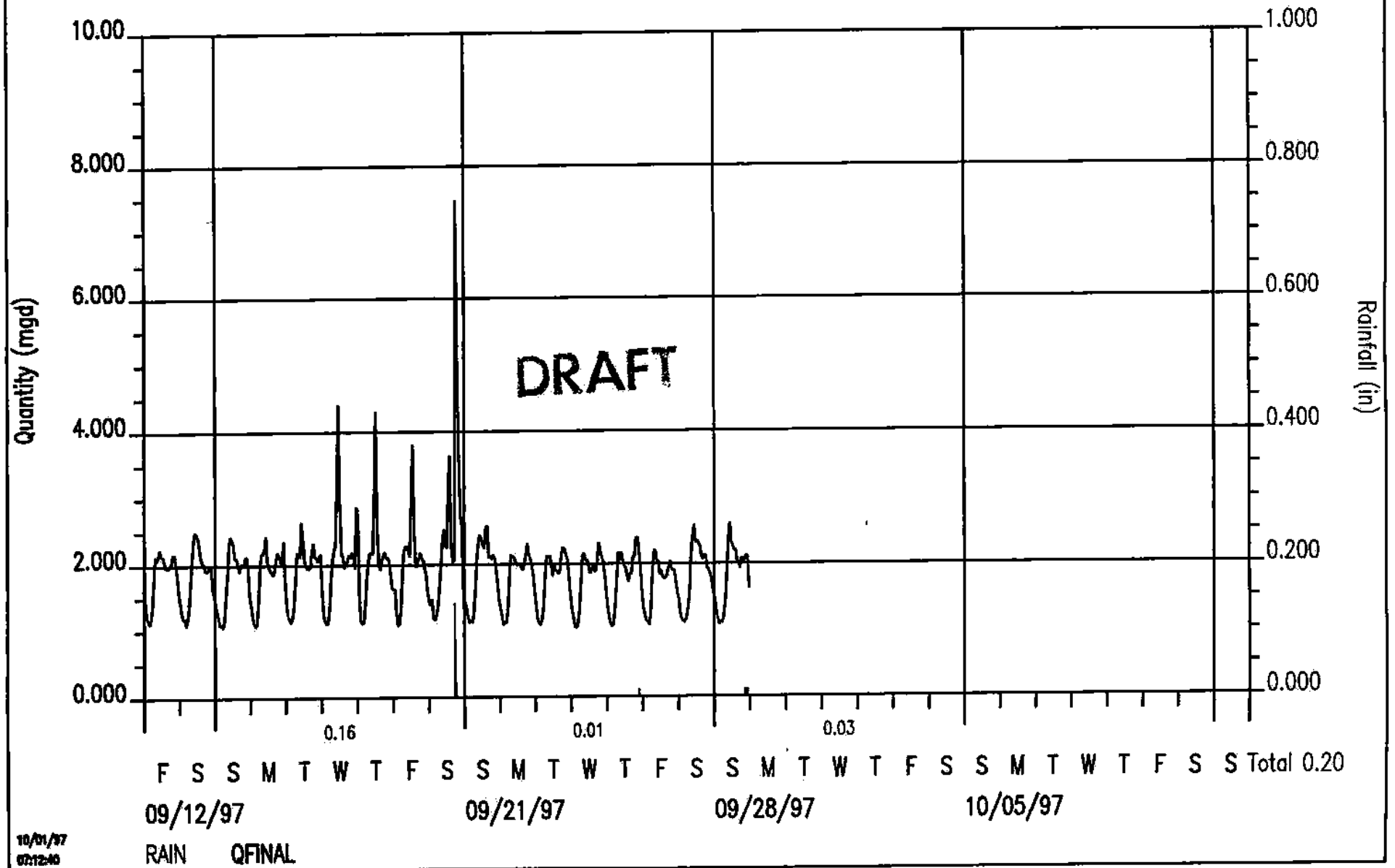
DRAFT



NHCSO_M15A

James Street, South of River Street

New Haven, CT



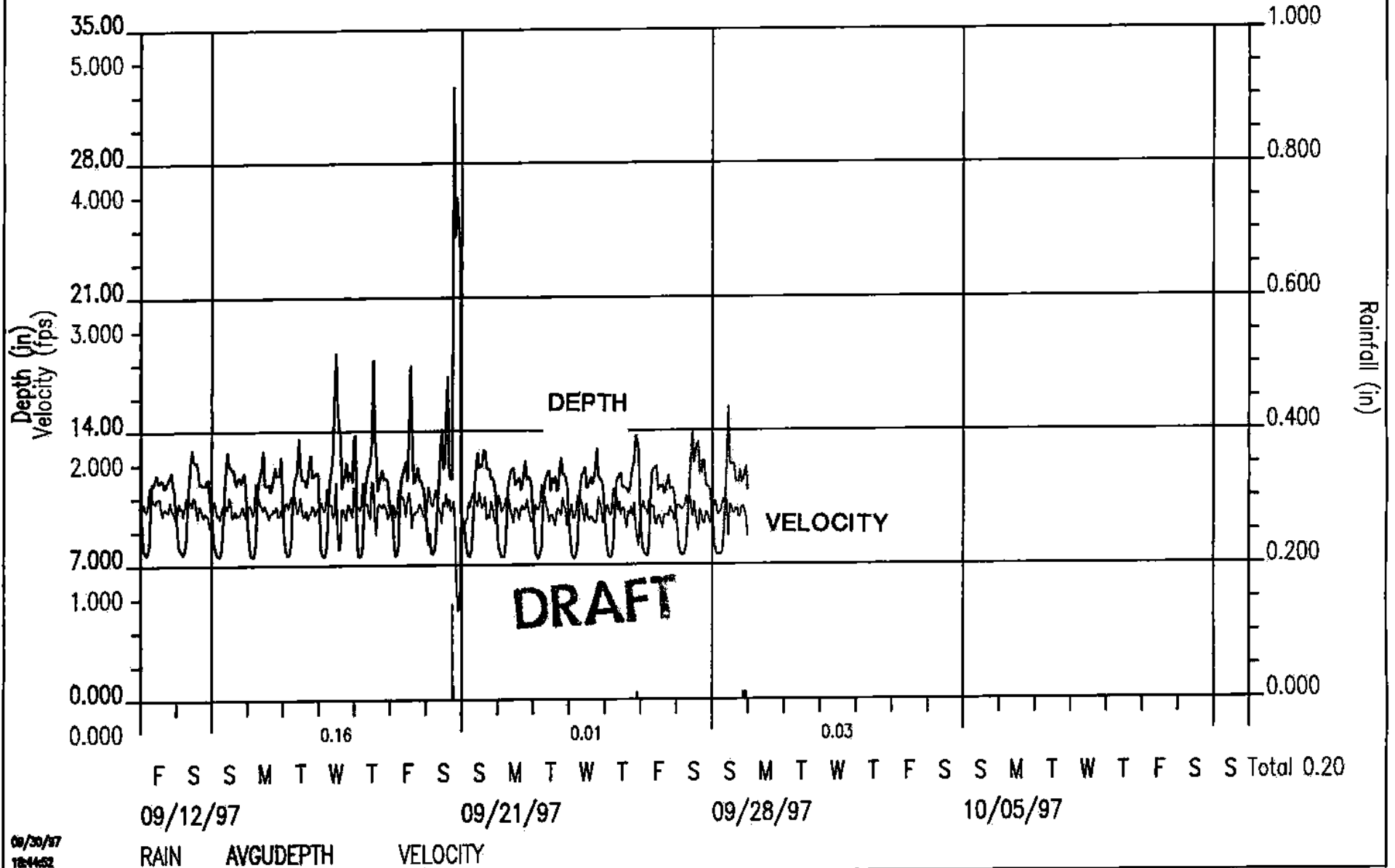
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M15A

James Street, South of River Street

New Haven, CT

DRAFT



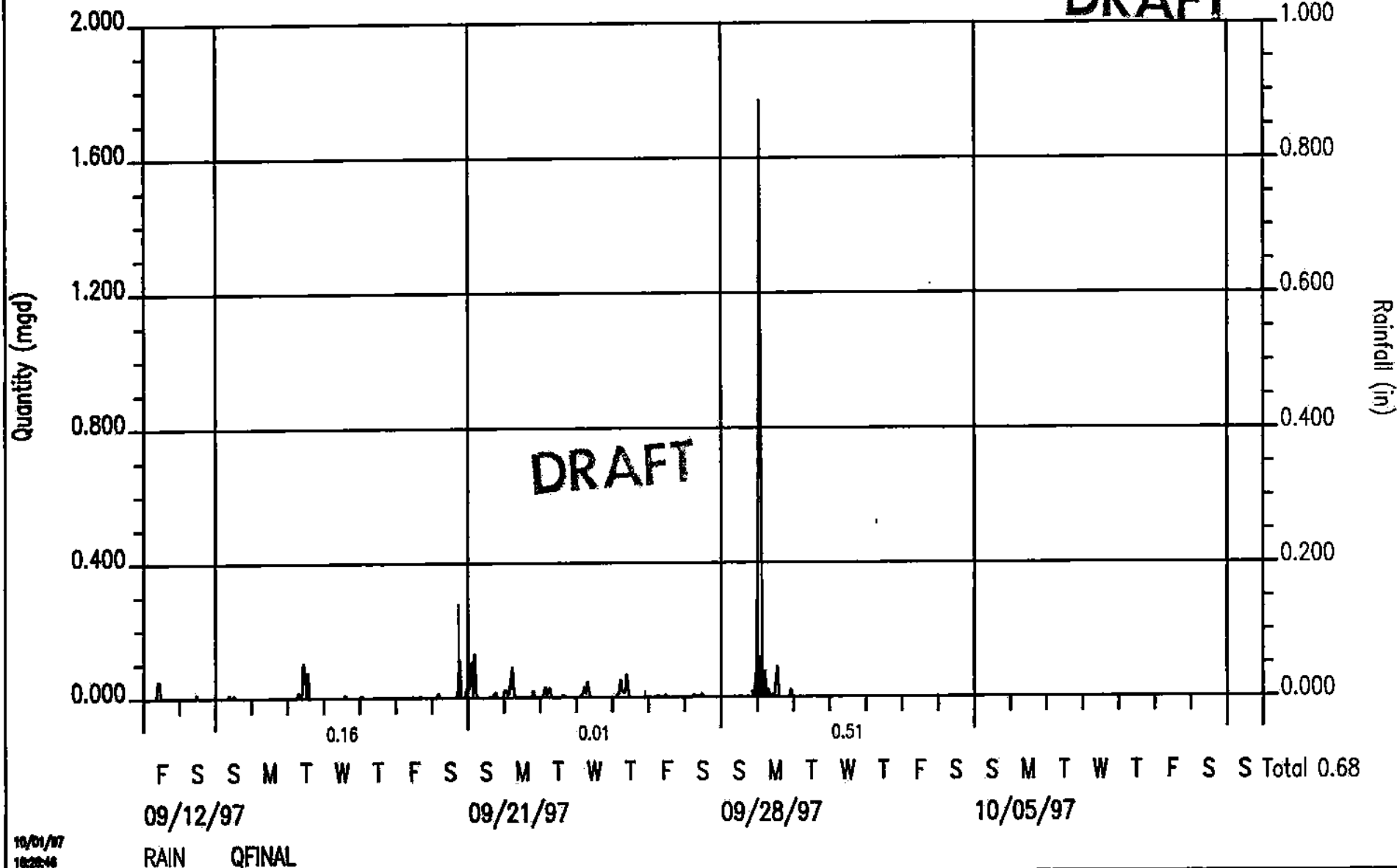
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M15B

James Street, South of River Street

New Haven, CT

DRAFT



10/01/97
10:29:46

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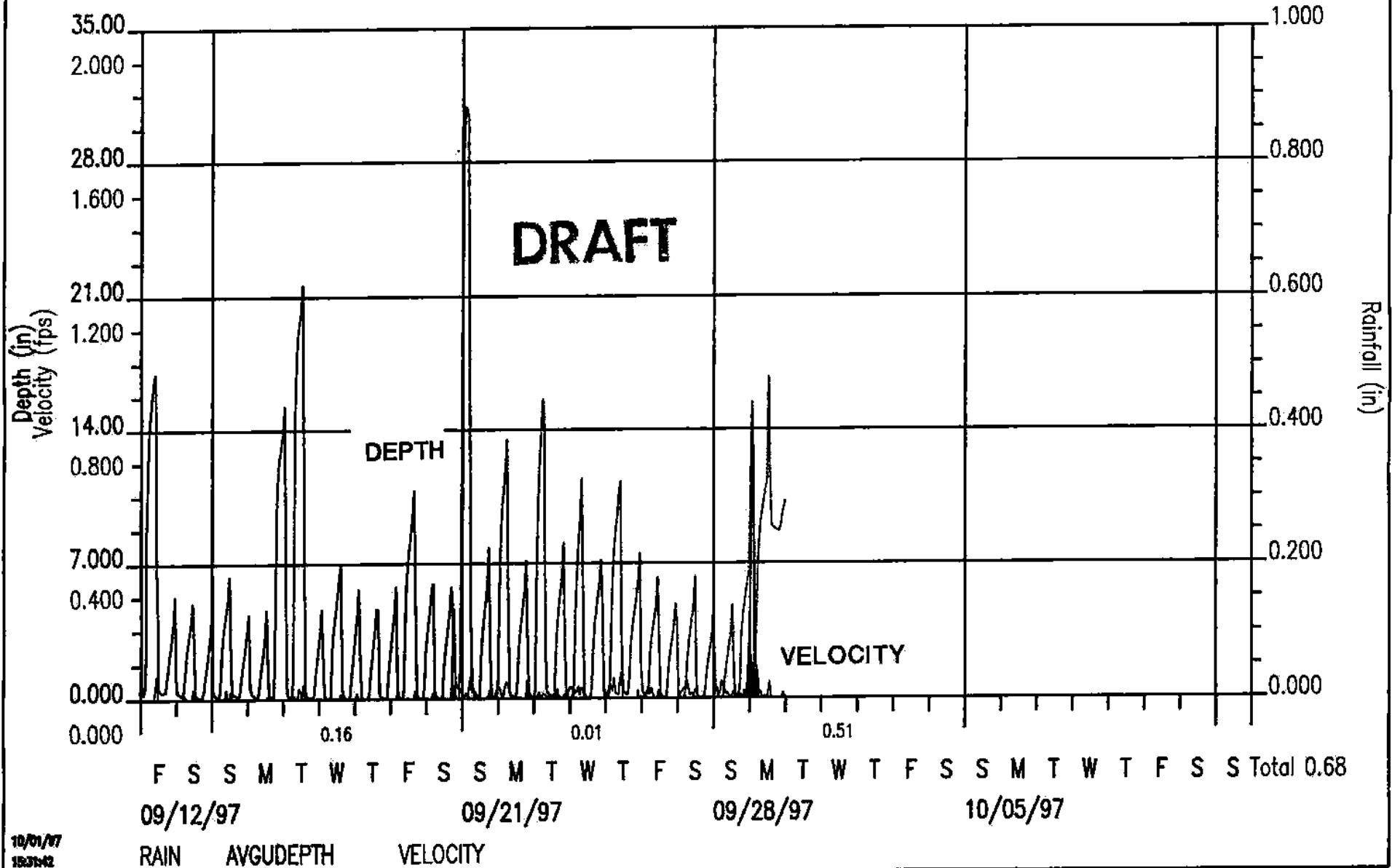
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M15B

James Street, South of River Street

New Haven, CT

DRAFT



10/01/97
18:31:42

RAIN AVGUDEPTH VELOCITY

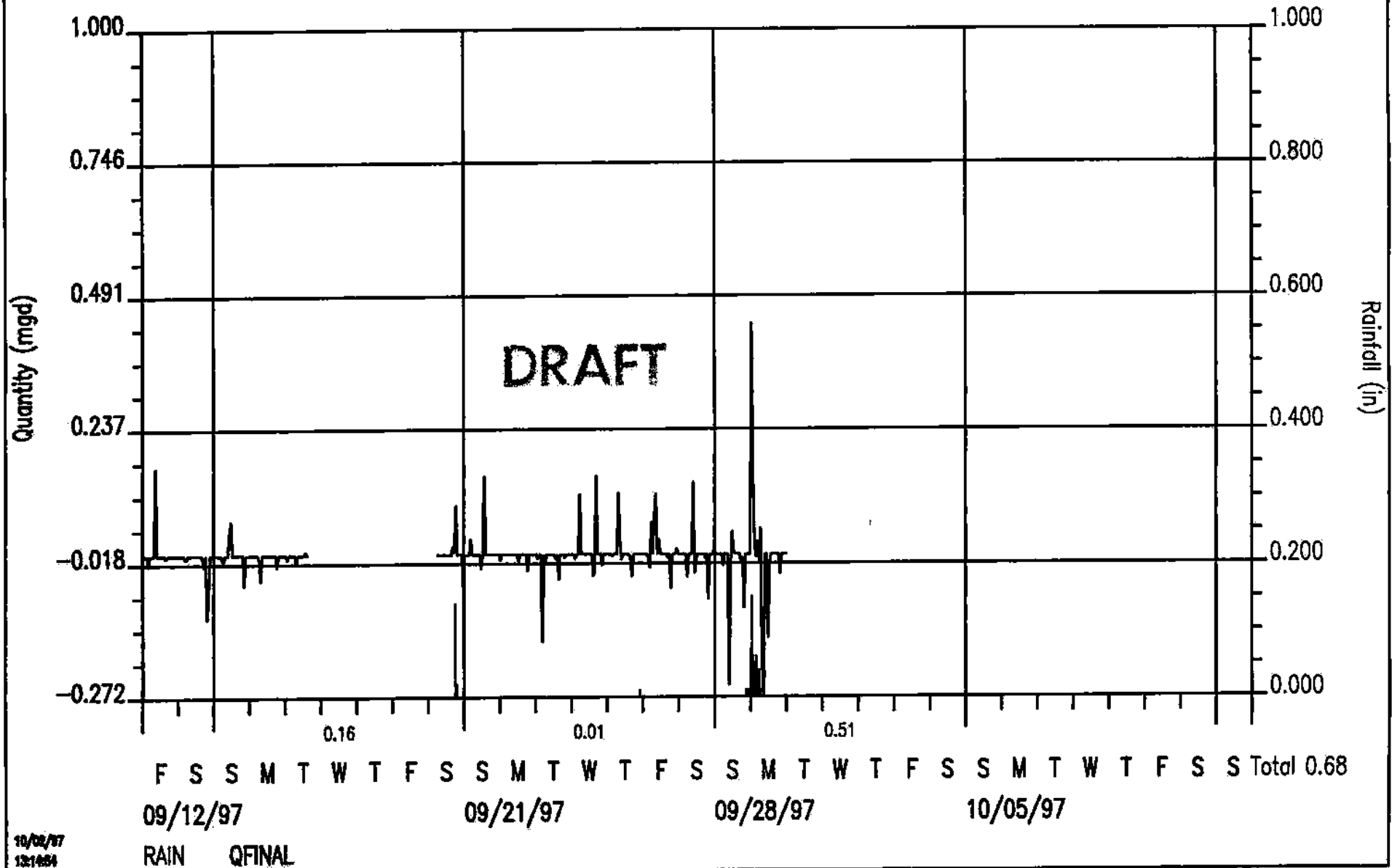
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M16

Poplar Street and River Street

New Haven, CT

DRAFT



10/02/97
13:16:04

RAIN QFINAL

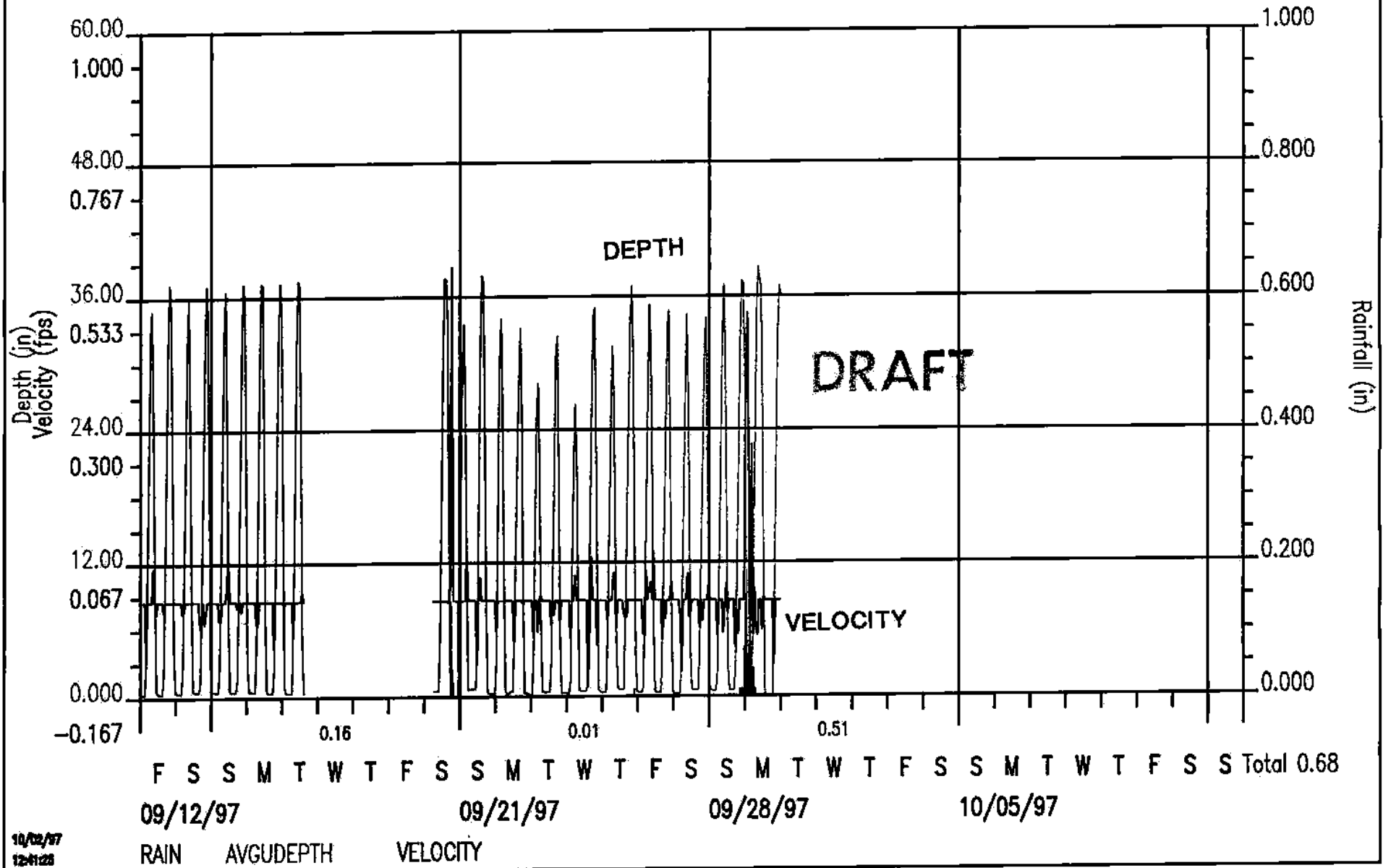
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M16

Poplar Street and River Street

New Haven, CT

DRAFT



ADS ENVIRONMENTAL SERVICES, INC.

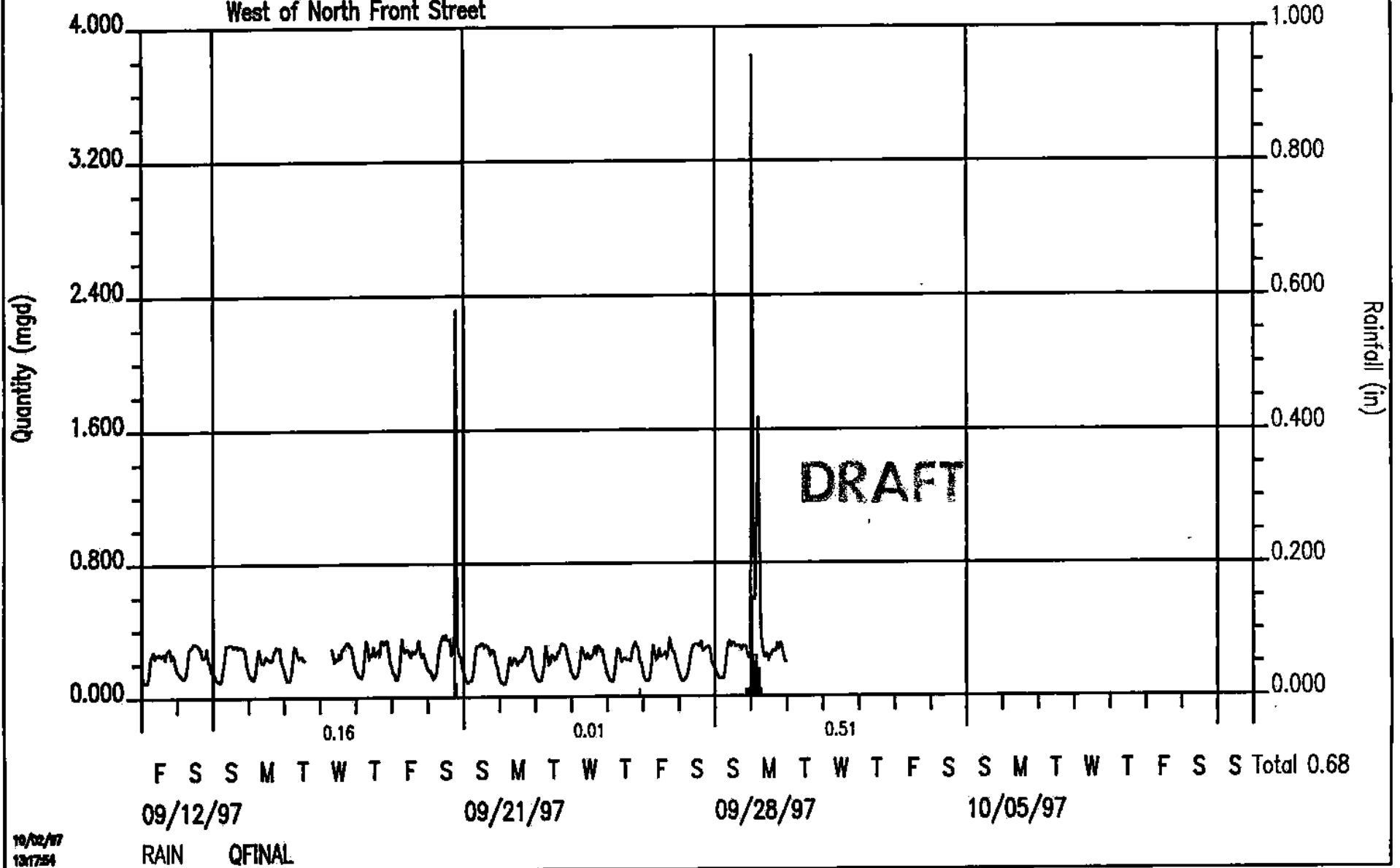
NHCSO_M18

13 Lombard Street,

New Haven, CT

DRAFT

West of North Front Street



10/02/97
13:17:54

RAIN QFINAL

ADS ENVIRONMENTAL SERVICES, INC.

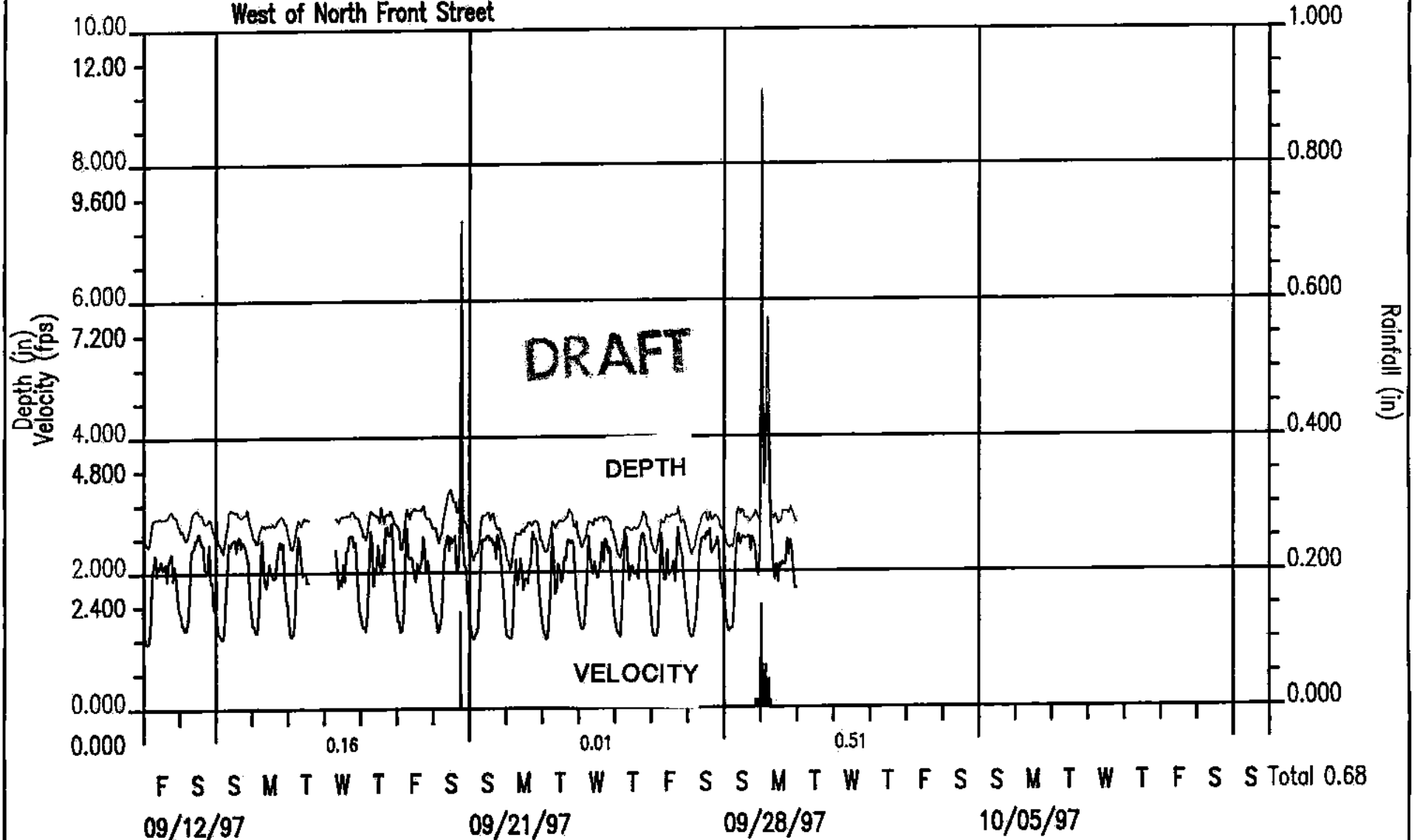
NHCSO_M18

13 Lombard Street,

New Haven, CT

DRAFT

West of North Front Street



10/02/97
12:00:04

RAIN AVGUDEPTH VELOCITY

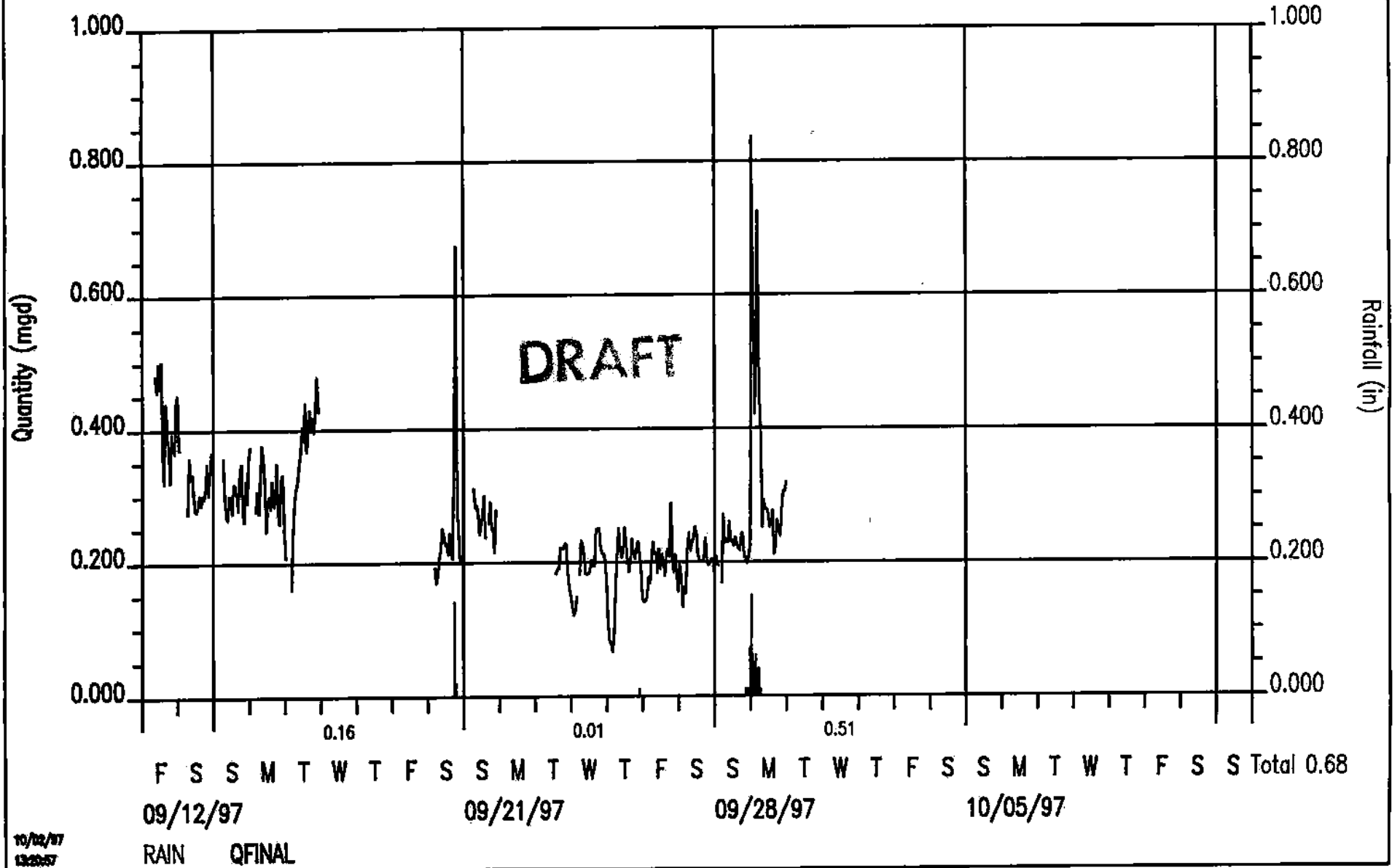
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M19A

Front Street and Pine Street

New Haven, CT

DRAFT



10/12/97
13:23:57

RAIN QFINAL

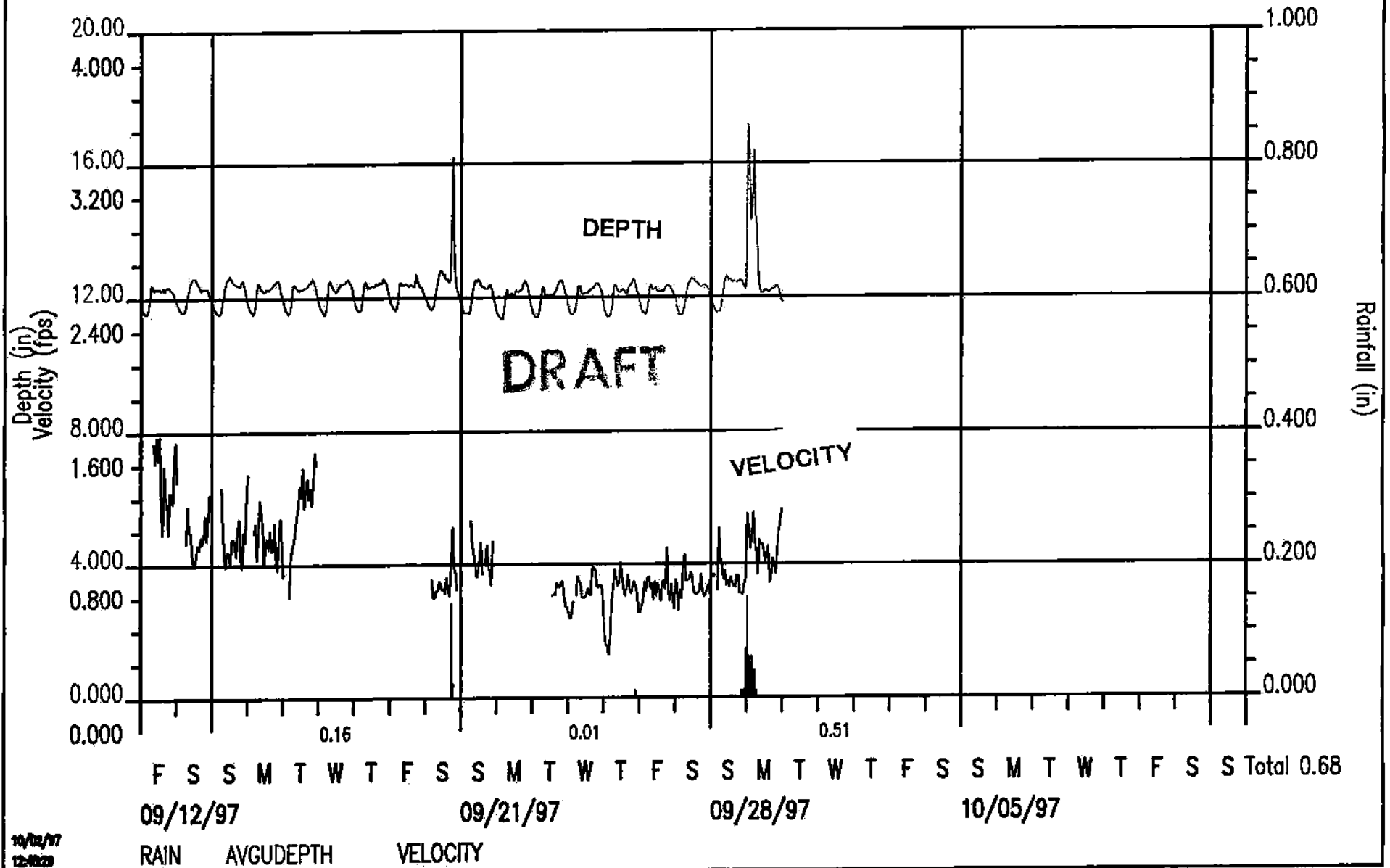
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M19A

Front Street and Pine Street

New Haven, CT

DRAFT



10/02/97
12:00:20

RAIN AVGDEPTH VELOCITY

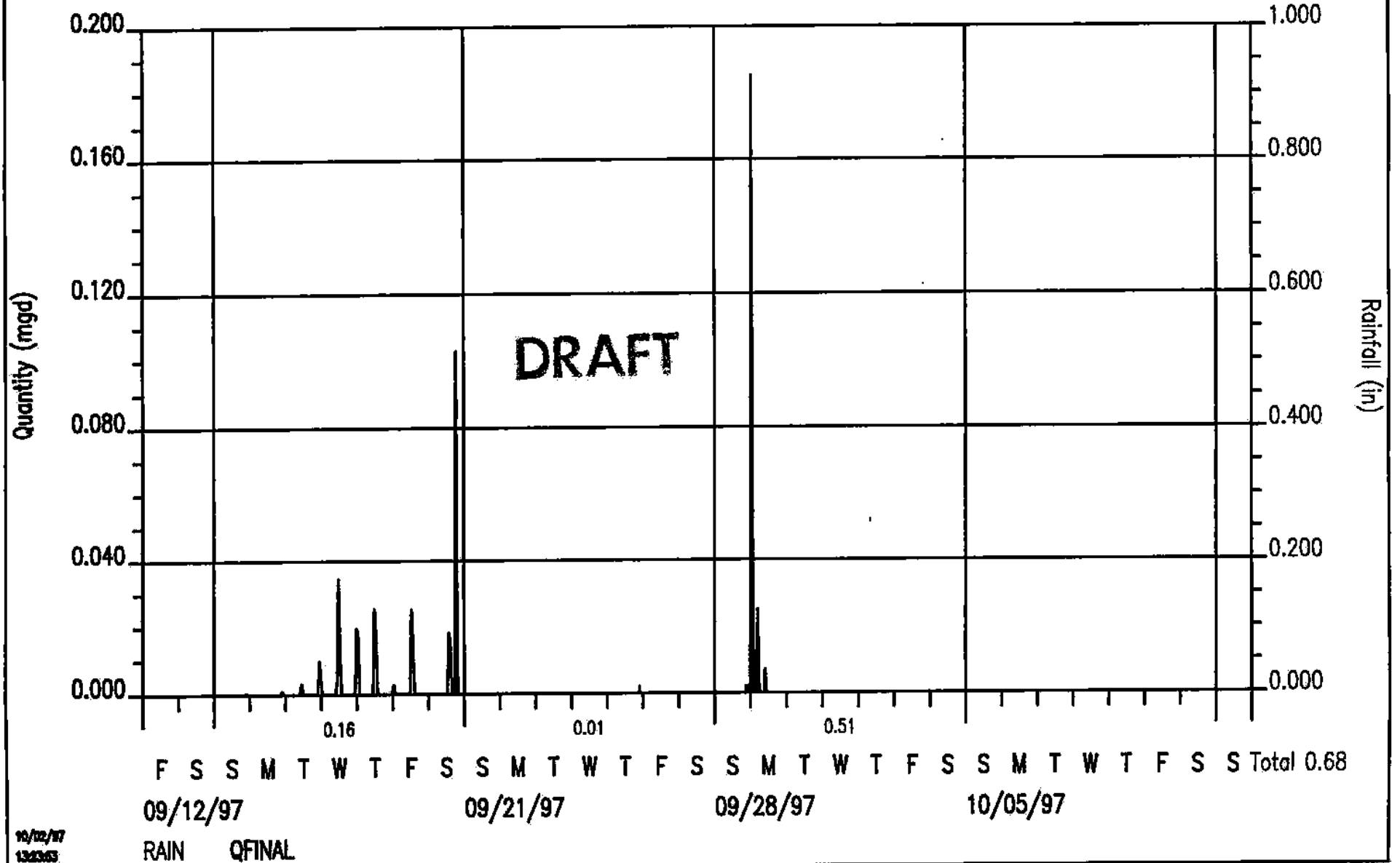
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M19B

Front Street and Pine Street

New Haven, CT

DRAFT



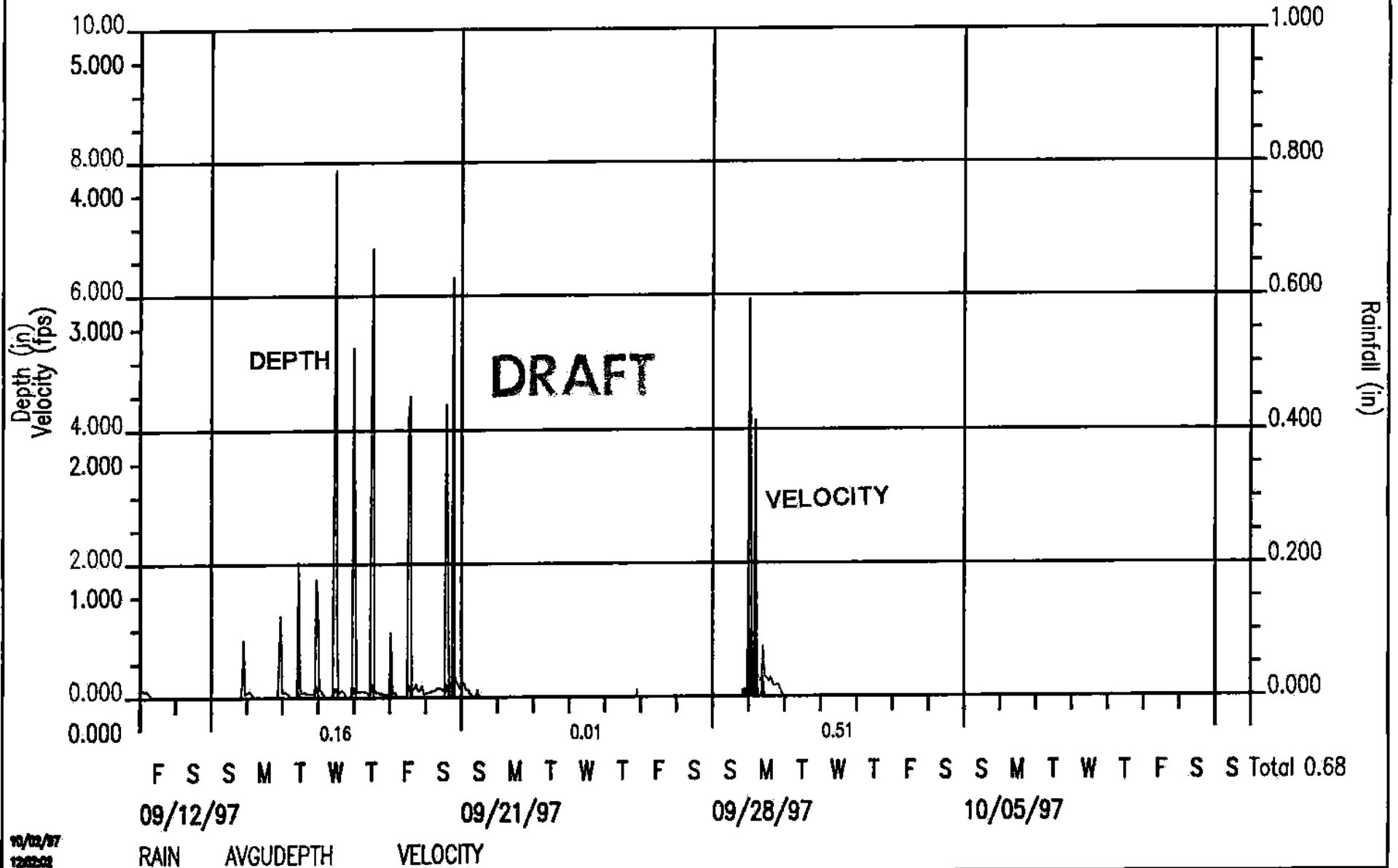
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M19B

Front Street and Pine Street

New Haven, CT

DRAFT



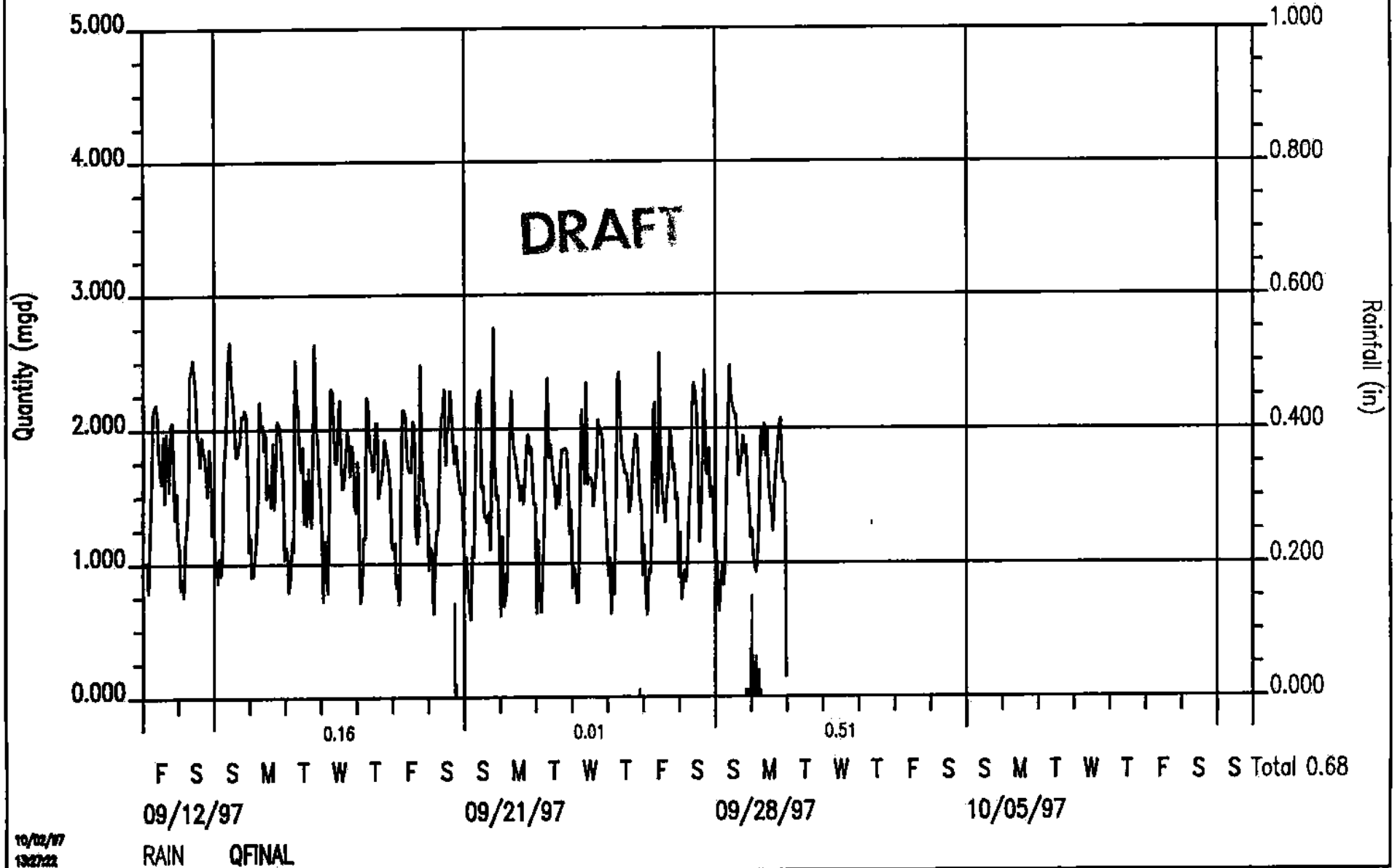
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M20

Quinnipiac Avenue and Clifton Street

New Haven, CT

DRAFT



10/02/97
132722

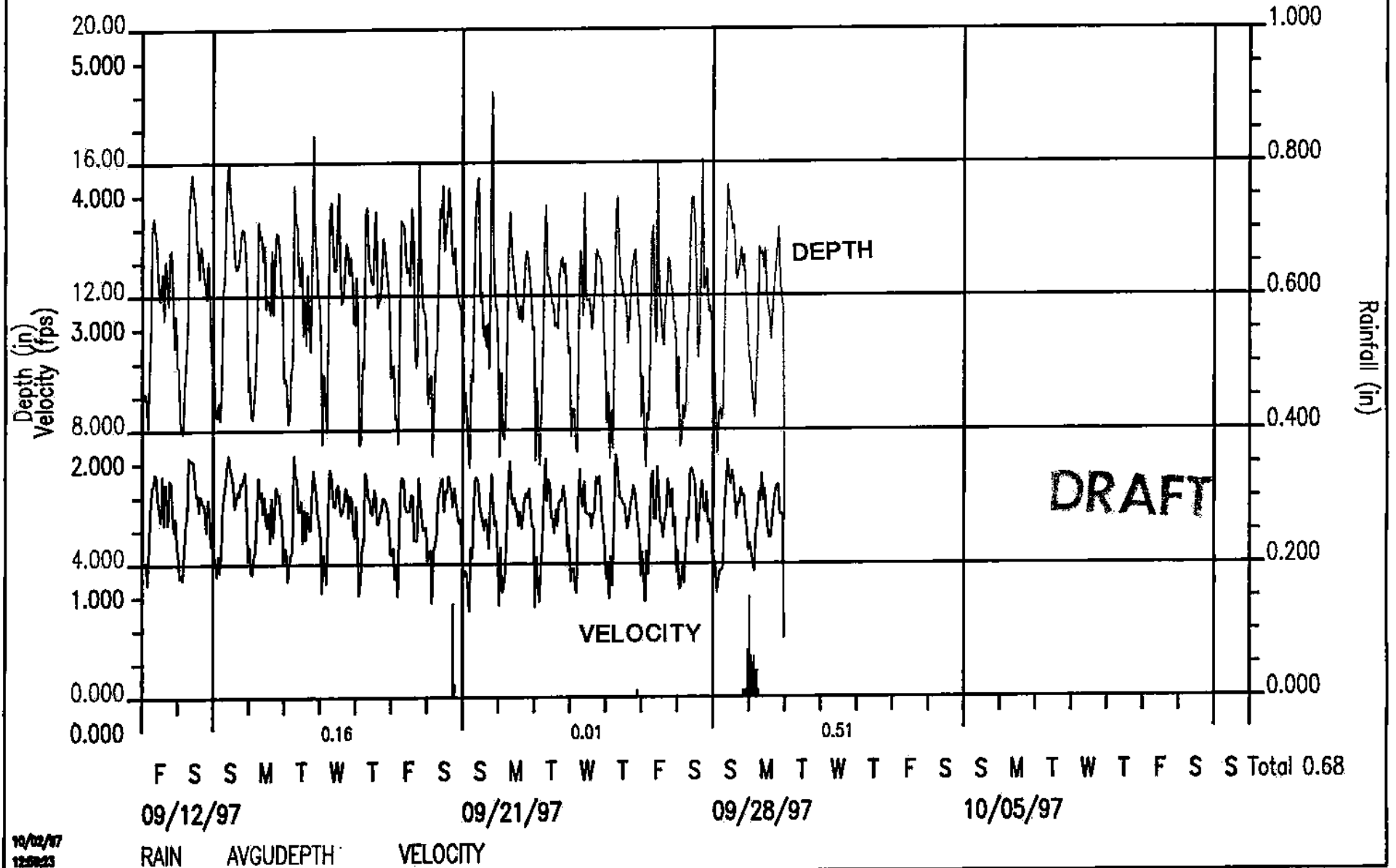
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M20

Quinnipiac Avenue and Clifton Street

New Haven, CT

DRAFT



10/12/97
12:58:23

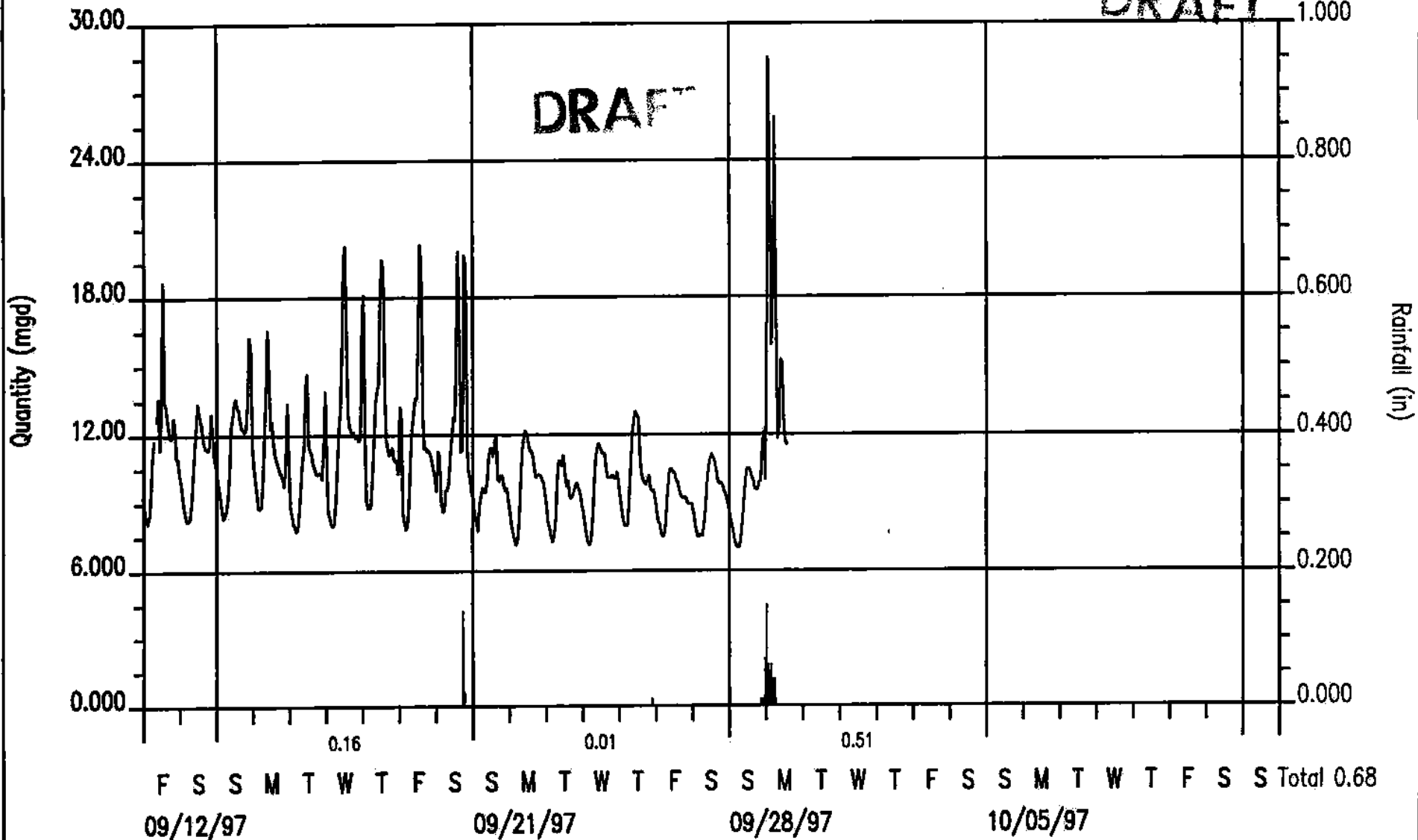
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M21

East Street Pump Station

New Haven, CT

DRAFT



10/02/97
12:35:30

RAIN QFINAL

Total 0.68

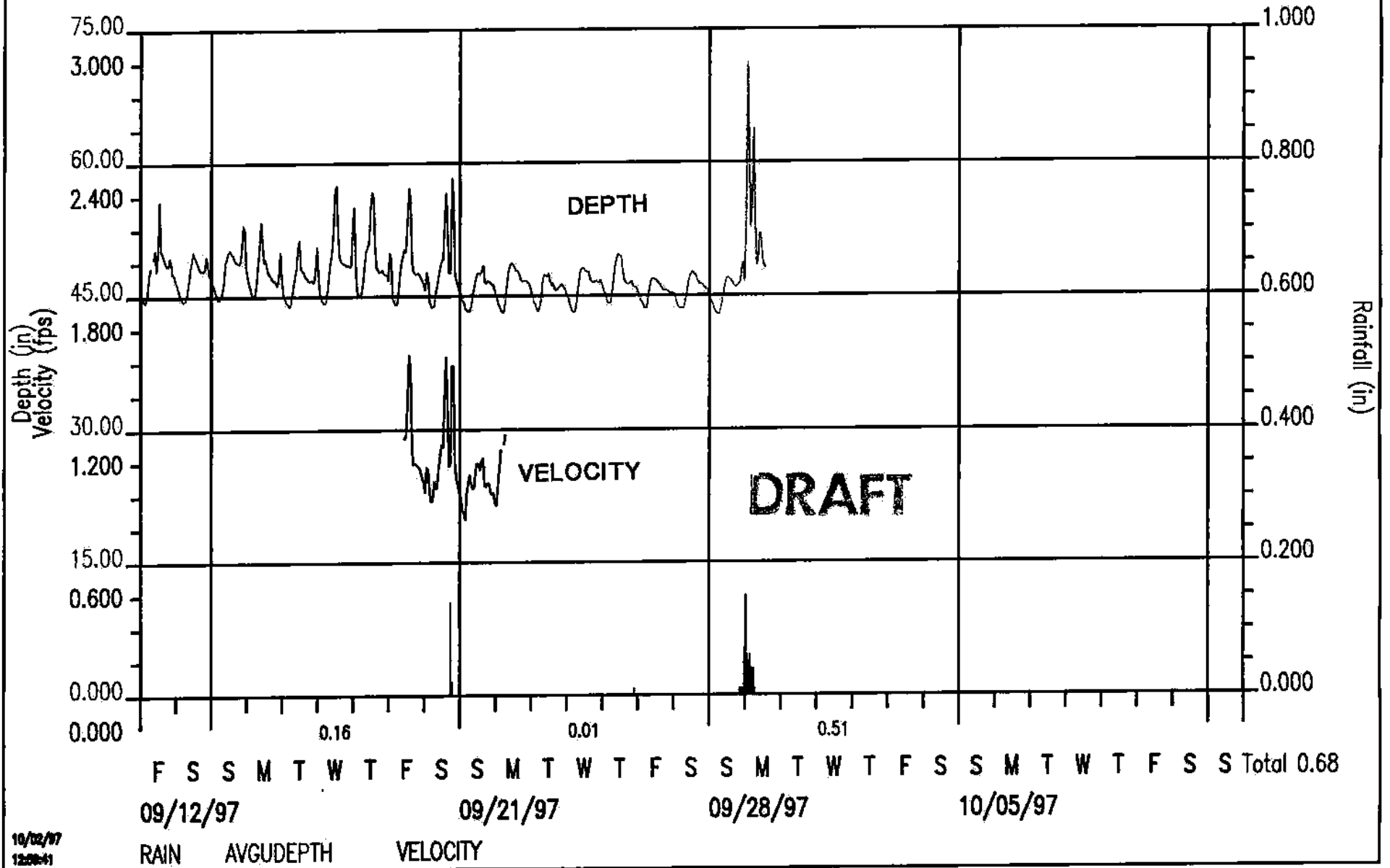
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M21

East Street Pump Station

New Haven, CT

DRAFT



10/02/97
12:00:41

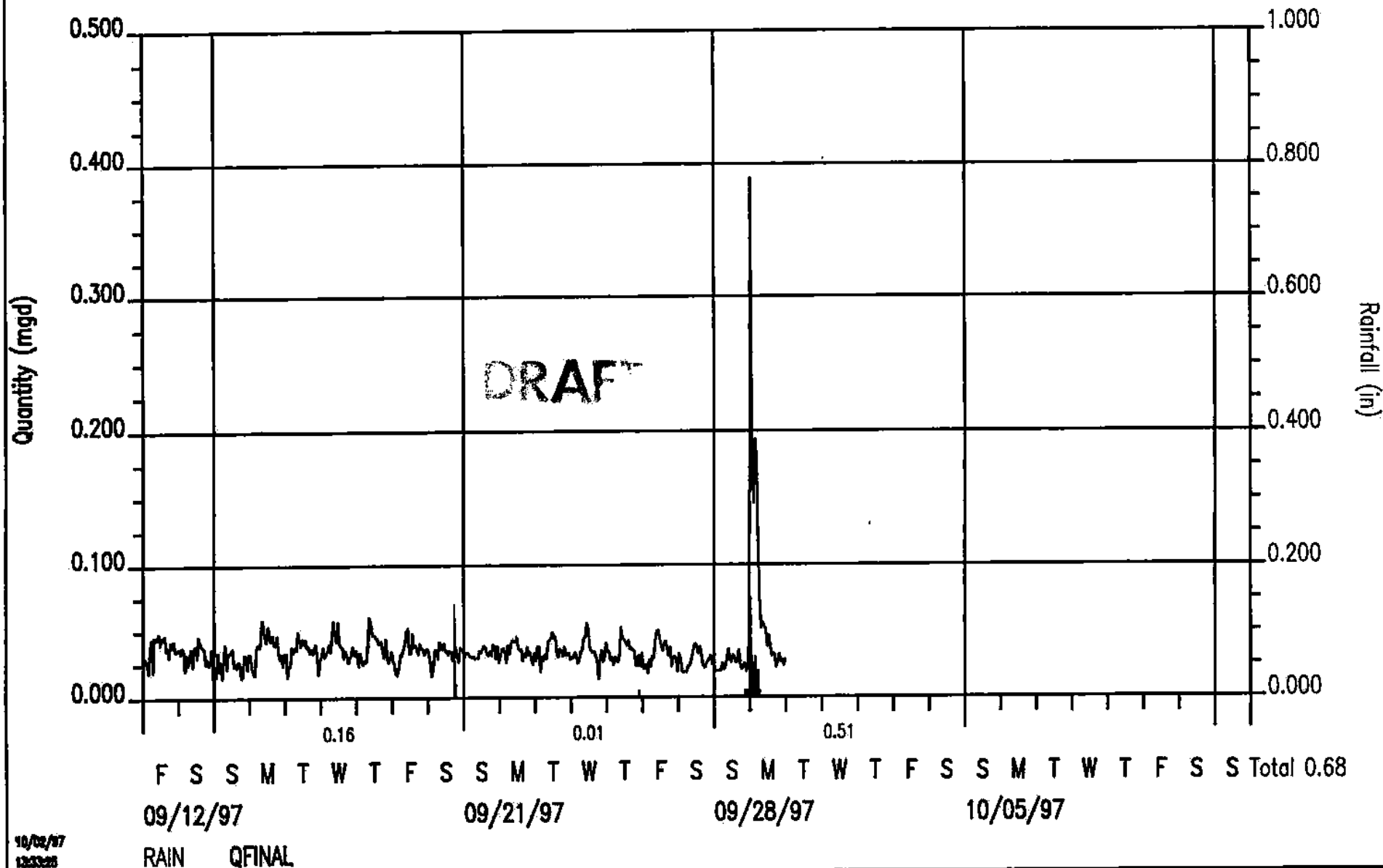
RAIN AVGUDEPTH VELOCITY

ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M22
30 Allen Place

New Haven, CT

DRAFT

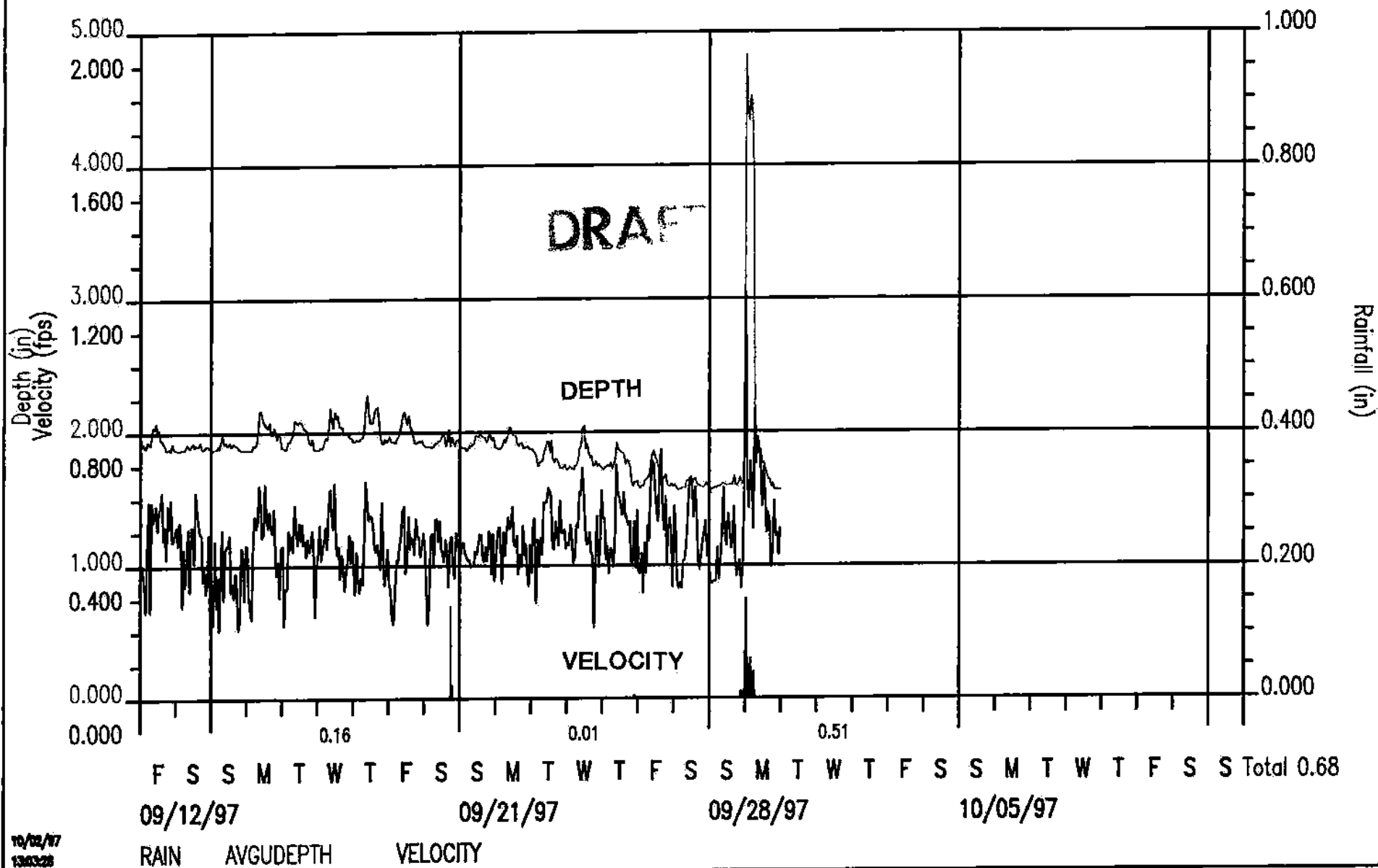


ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M22
30 Allen Place

New Haven, CT

DRAFT



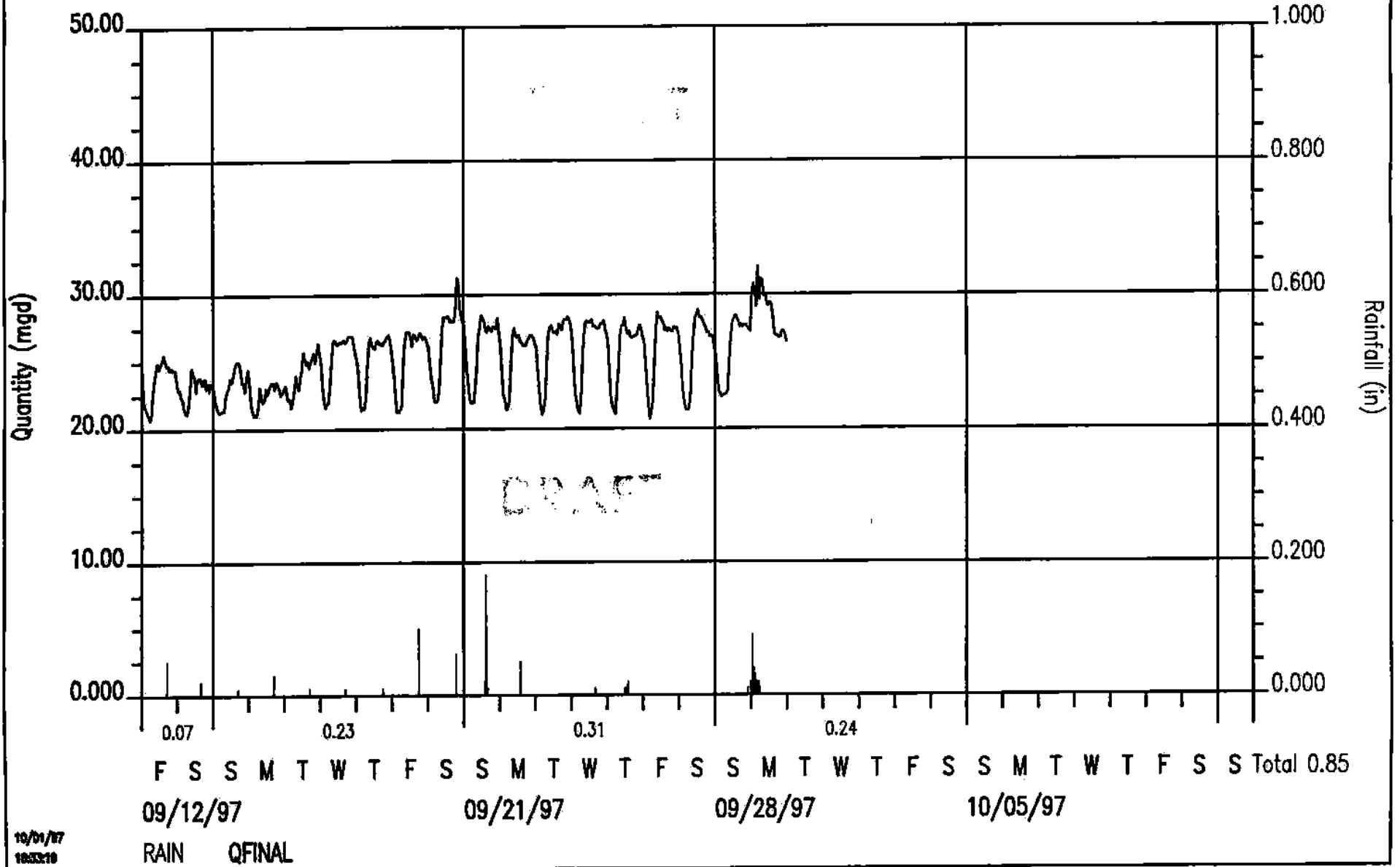
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M24

South Water Street and Sea Street

New Haven, CT

DRAFT



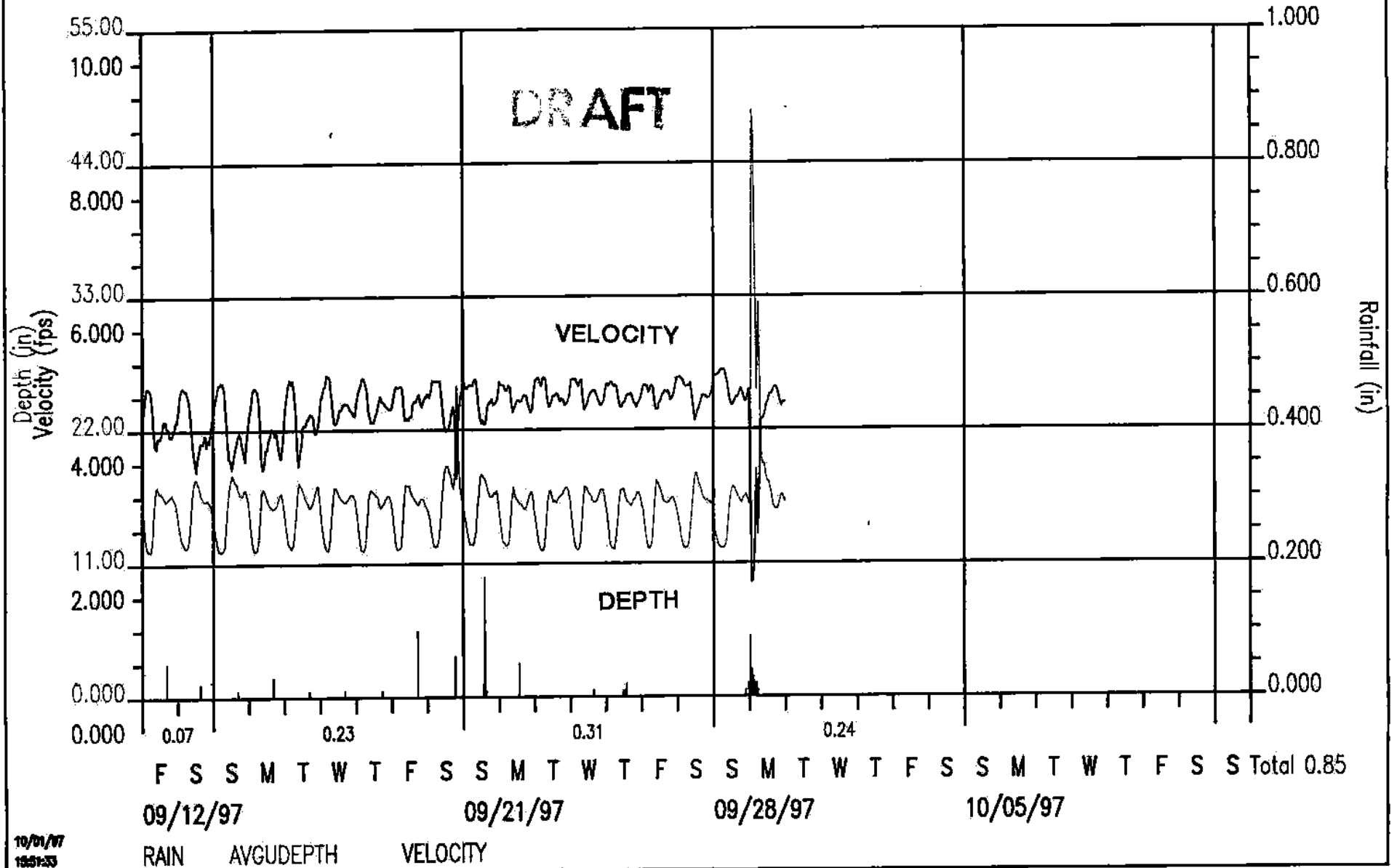
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M24

South Water Street and Sea Street

New Haven, CT

DRAFT



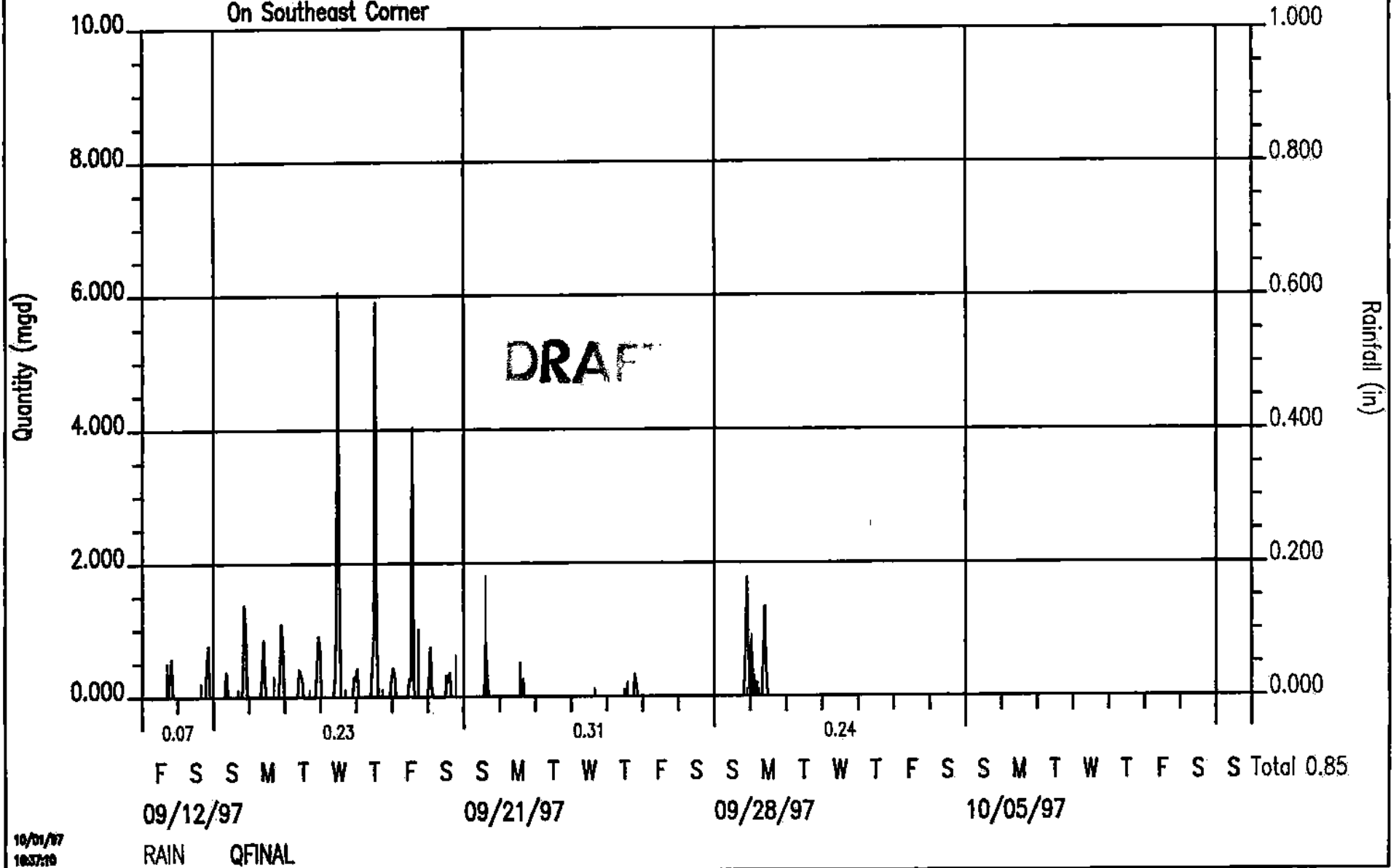
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_M25A

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On Southeast Corner

New Haven, CT

DRAFT



10/01/97
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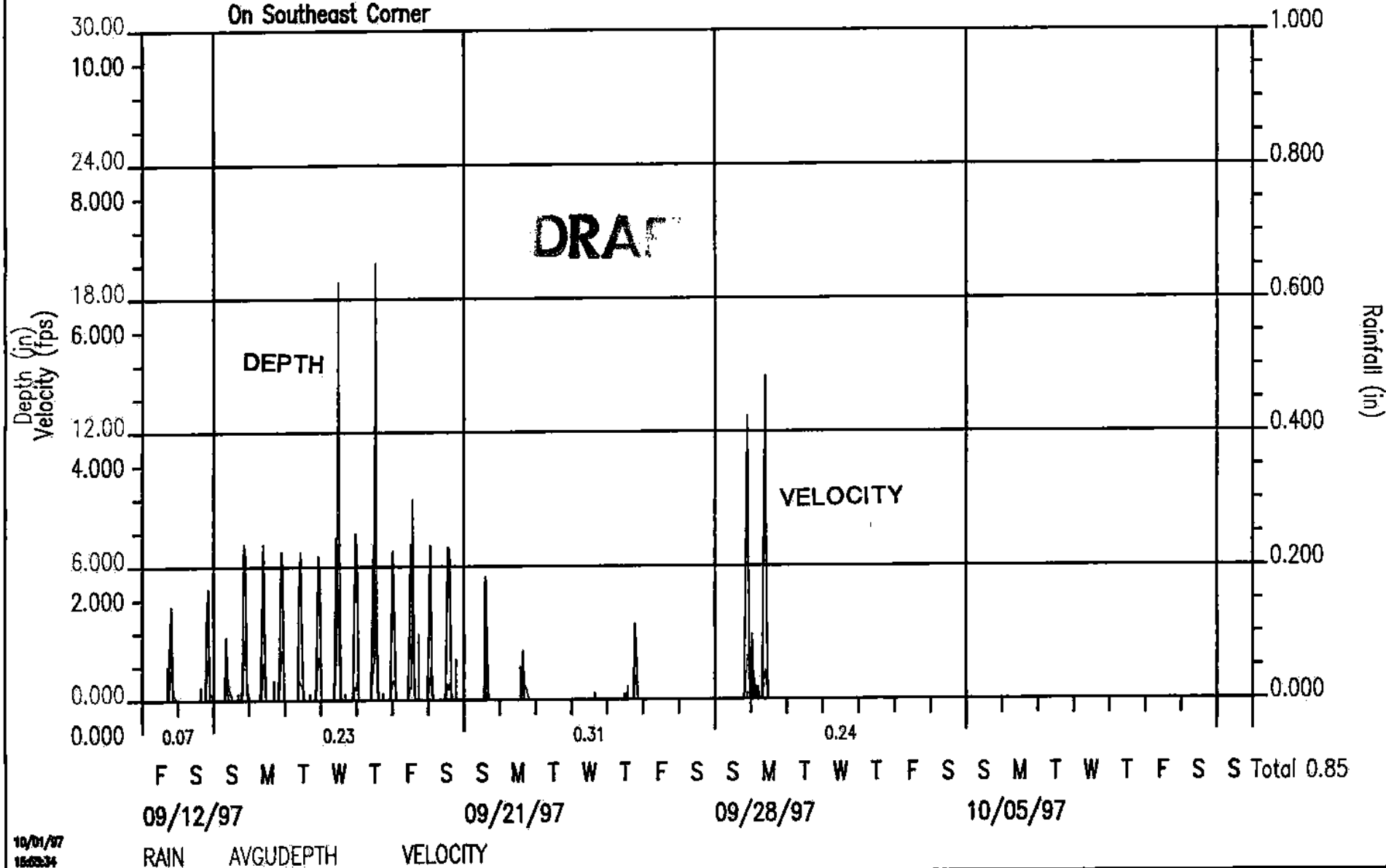
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NHCSO_M25A

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On Southeast Corner

New Haven, CT

DRAFT



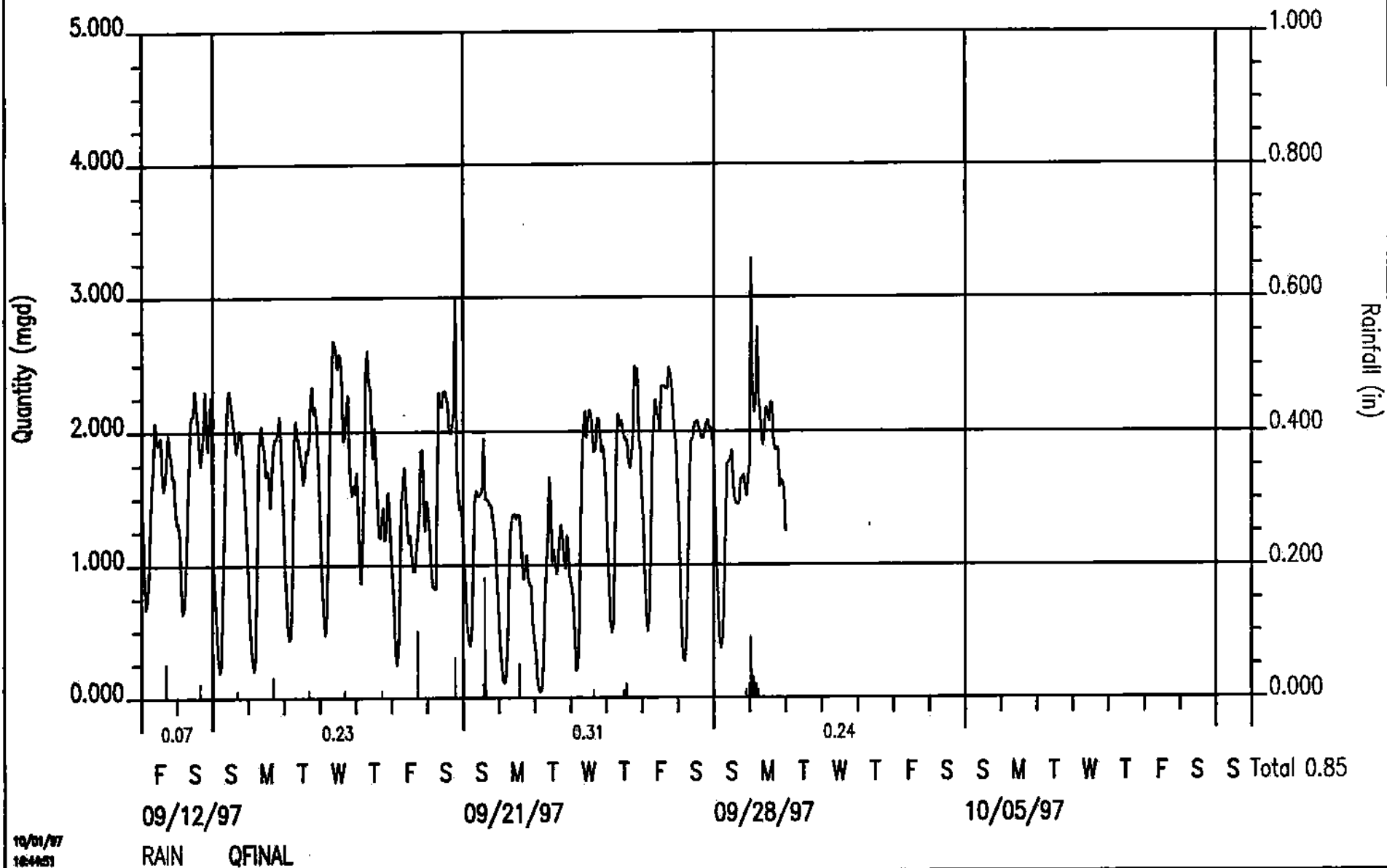
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NHCSO_M25B

Temple Street and George Street

New Haven, CT

DRAFT



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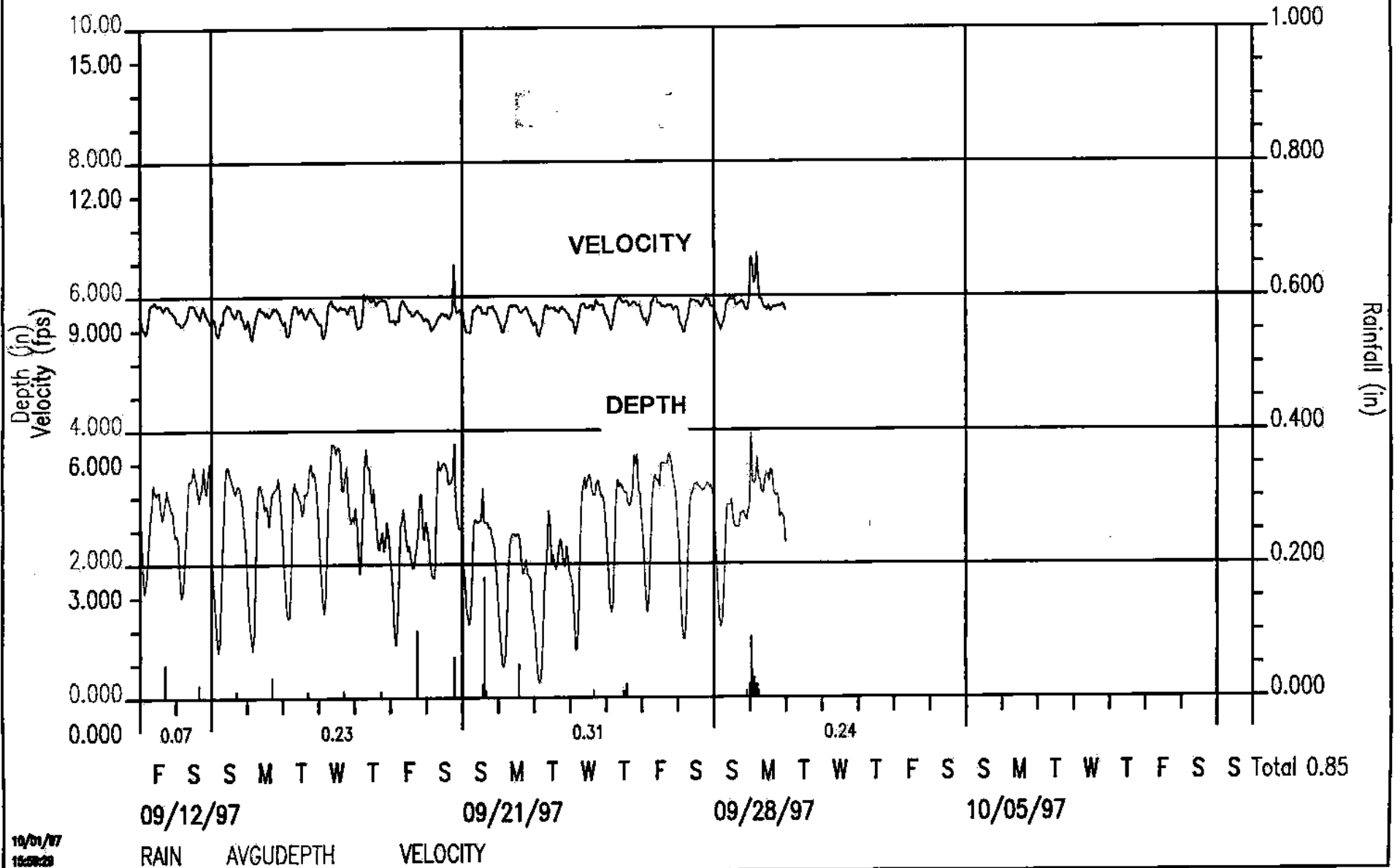
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NHCSO_M25B

Temple Street and George Street

New Haven, CT

DRAFT



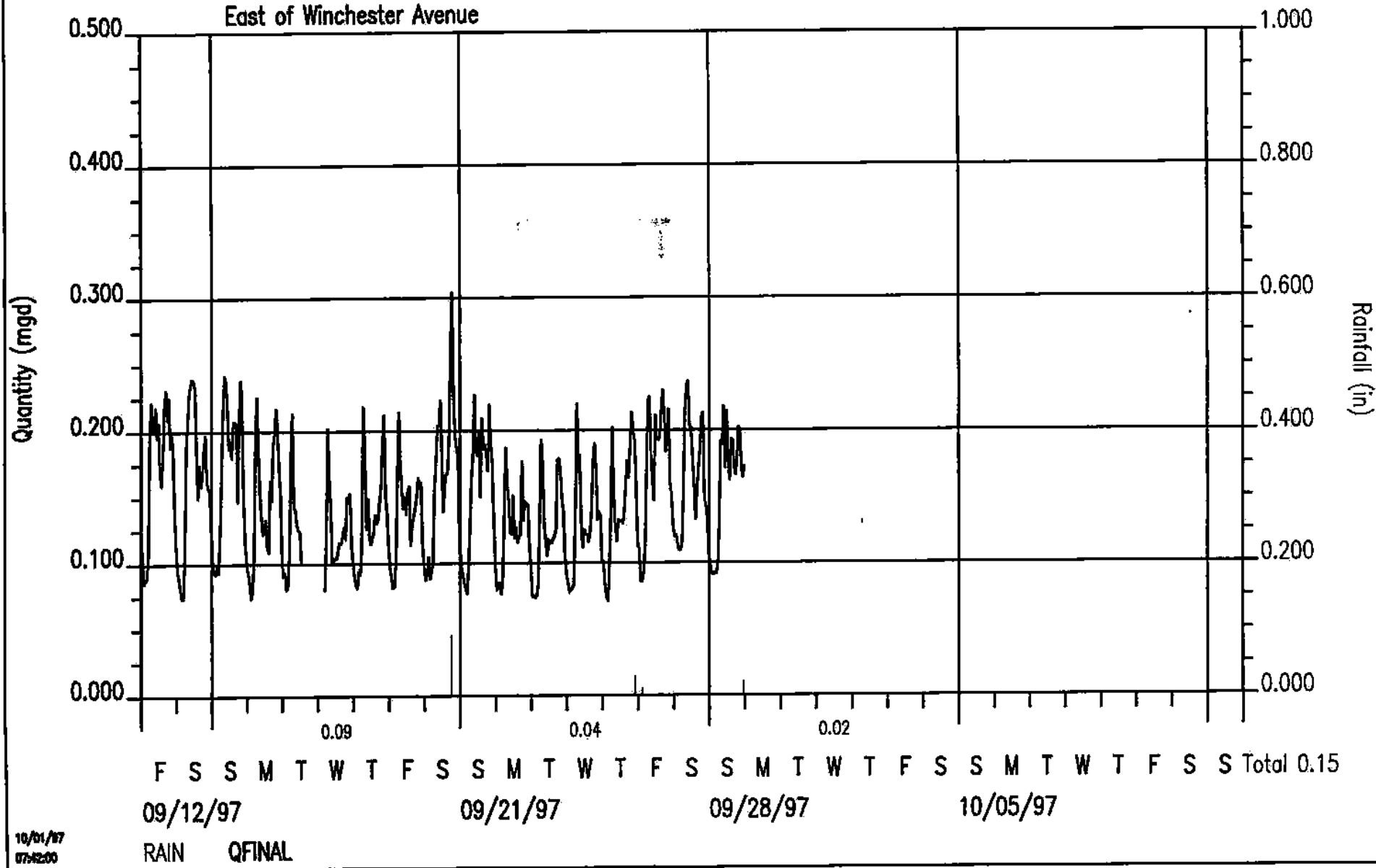
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ADS ENVIRONMENTAL SERVICES, INC.

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East of Winchester Avenue

New Haven, CT

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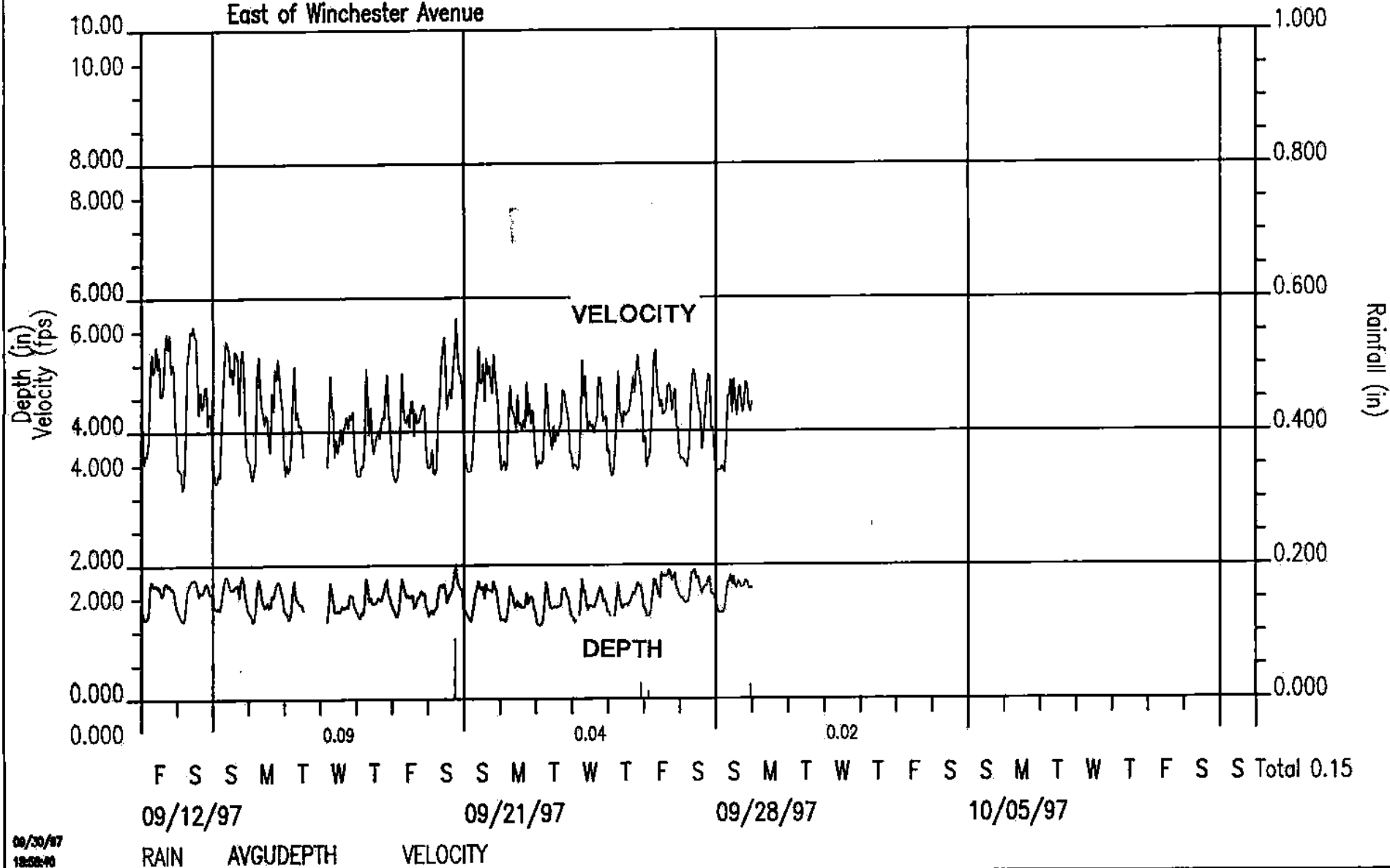
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ADS ENVIRONMENTAL SERVICES, INC.

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Division Street,
East of Winchester Avenue

New Haven, CT

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ADS ENVIRONMENTAL SERVICES, INC.

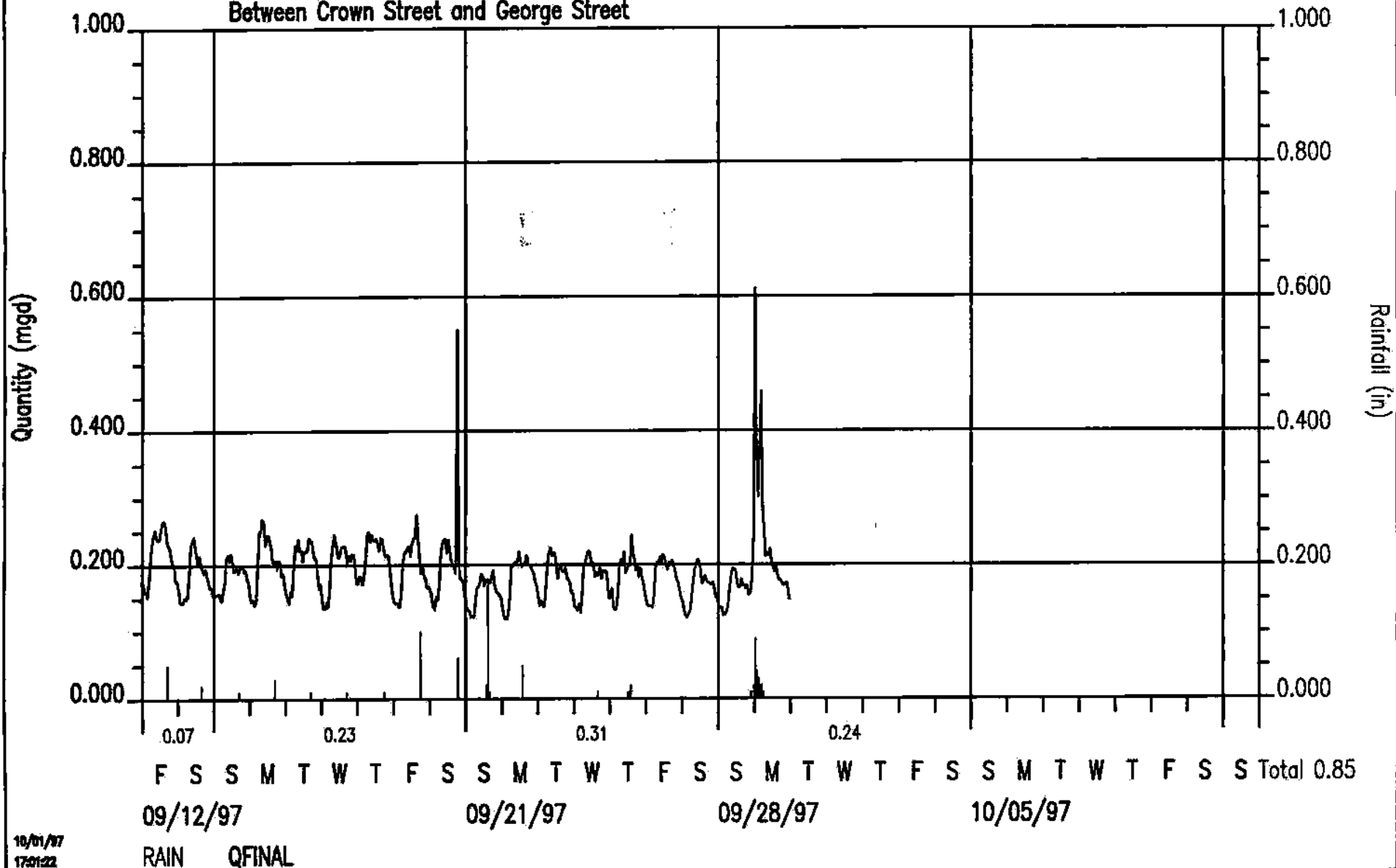
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New Haven, CT

DRAFT

Between Crown Street and George Street



10/01/97
17:01:22

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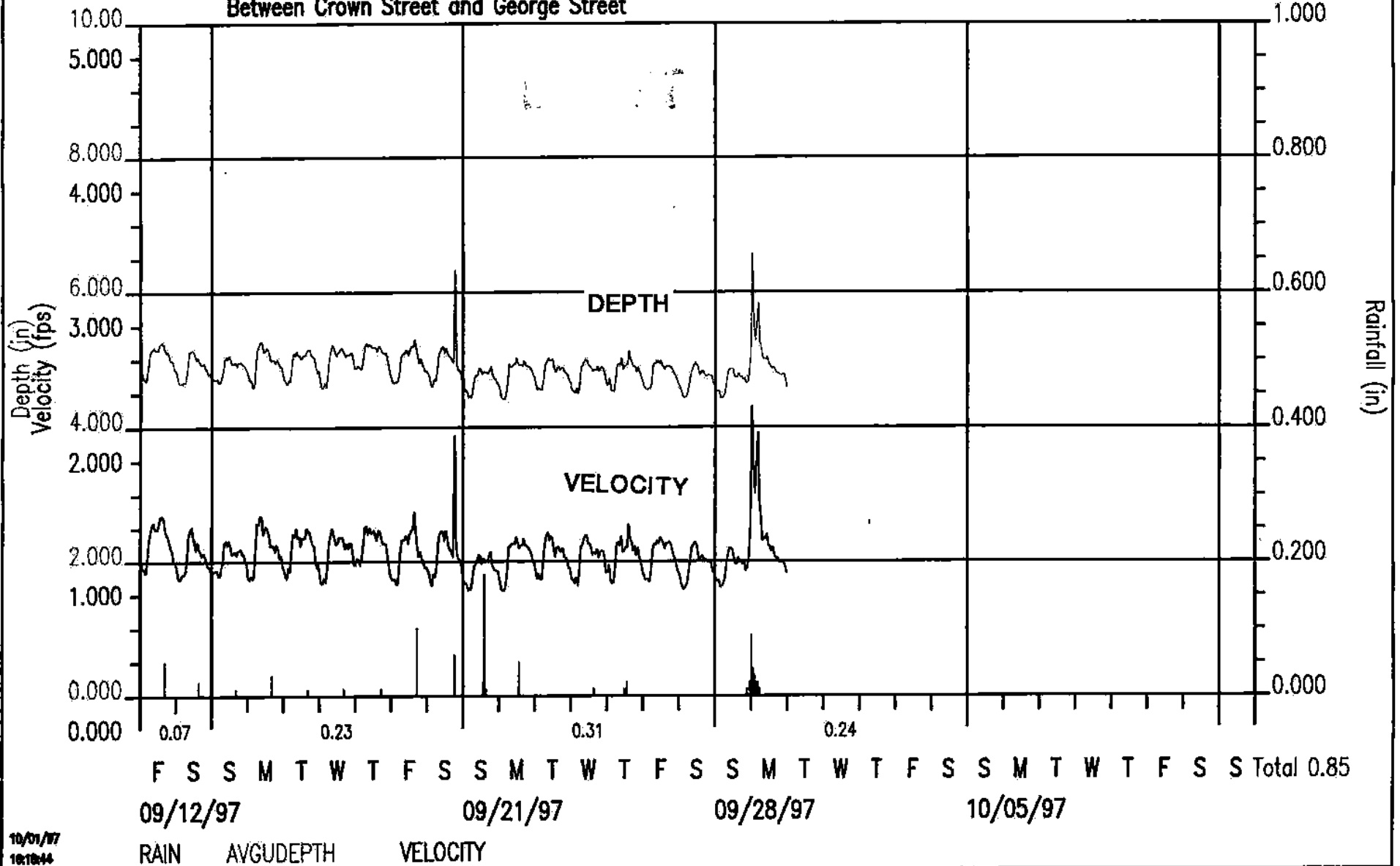
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210 State Street,

New Haven, CT

DRAFT

Between Crown Street and George Street



10/01/97
10:18:44

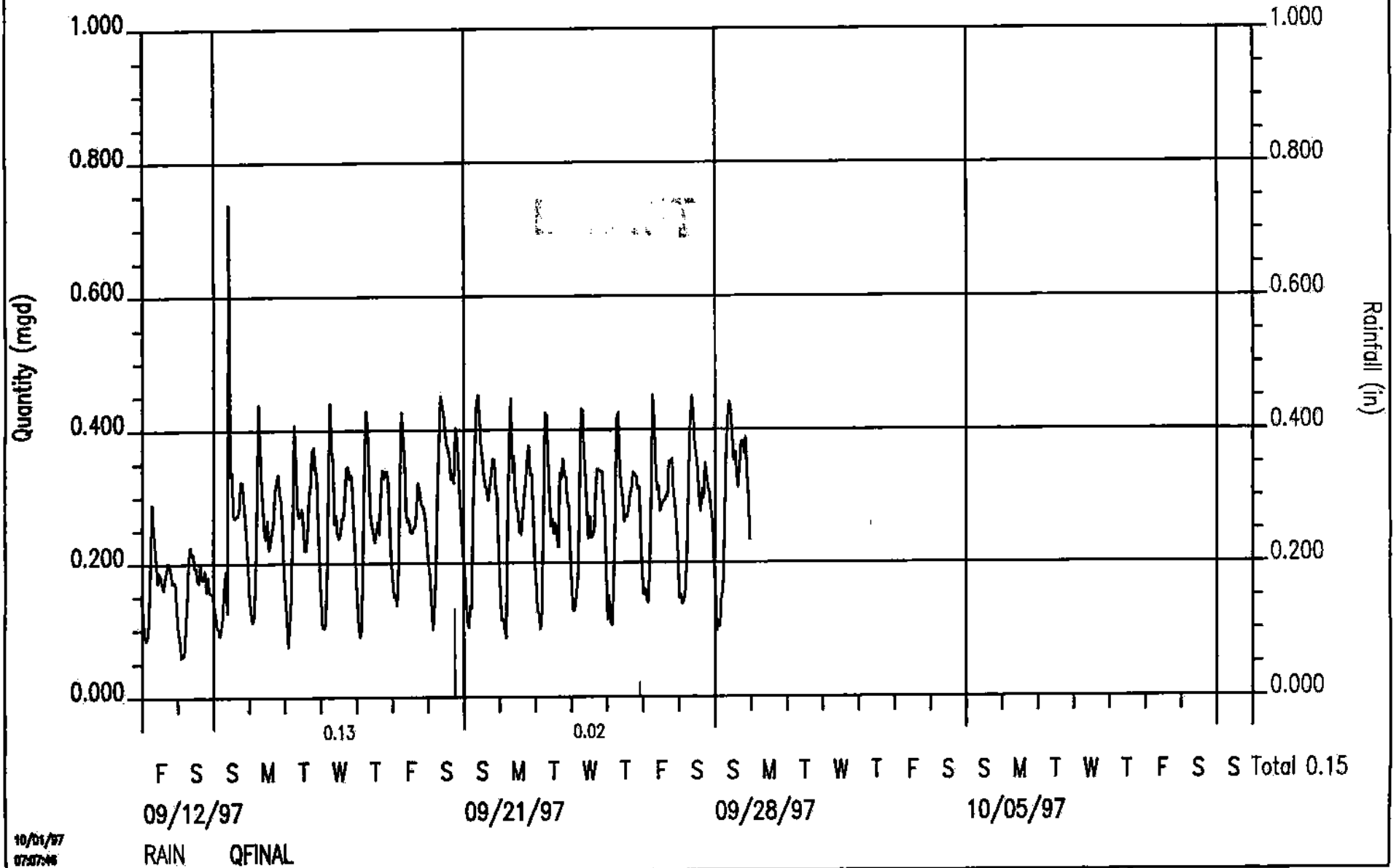
ADS ENVIRONMENTAL SERVICES, INC.

DRAFT

NHCSO_S1

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New Haven, CT

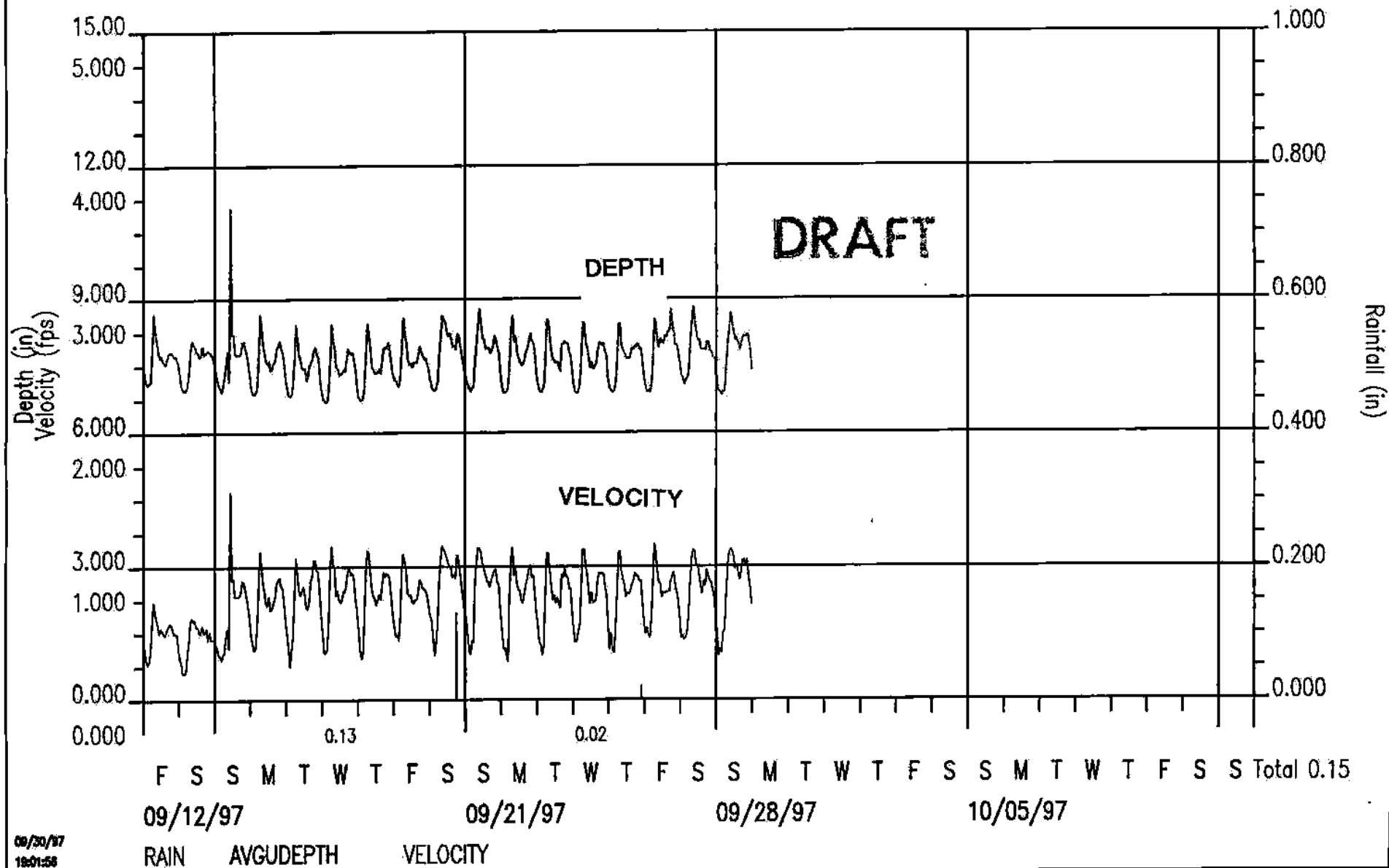


ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_S1

130 Lowin Avenue

New Haven, CT



09/30/97
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ADS ENVIRONMENTAL SERVICES, INC.

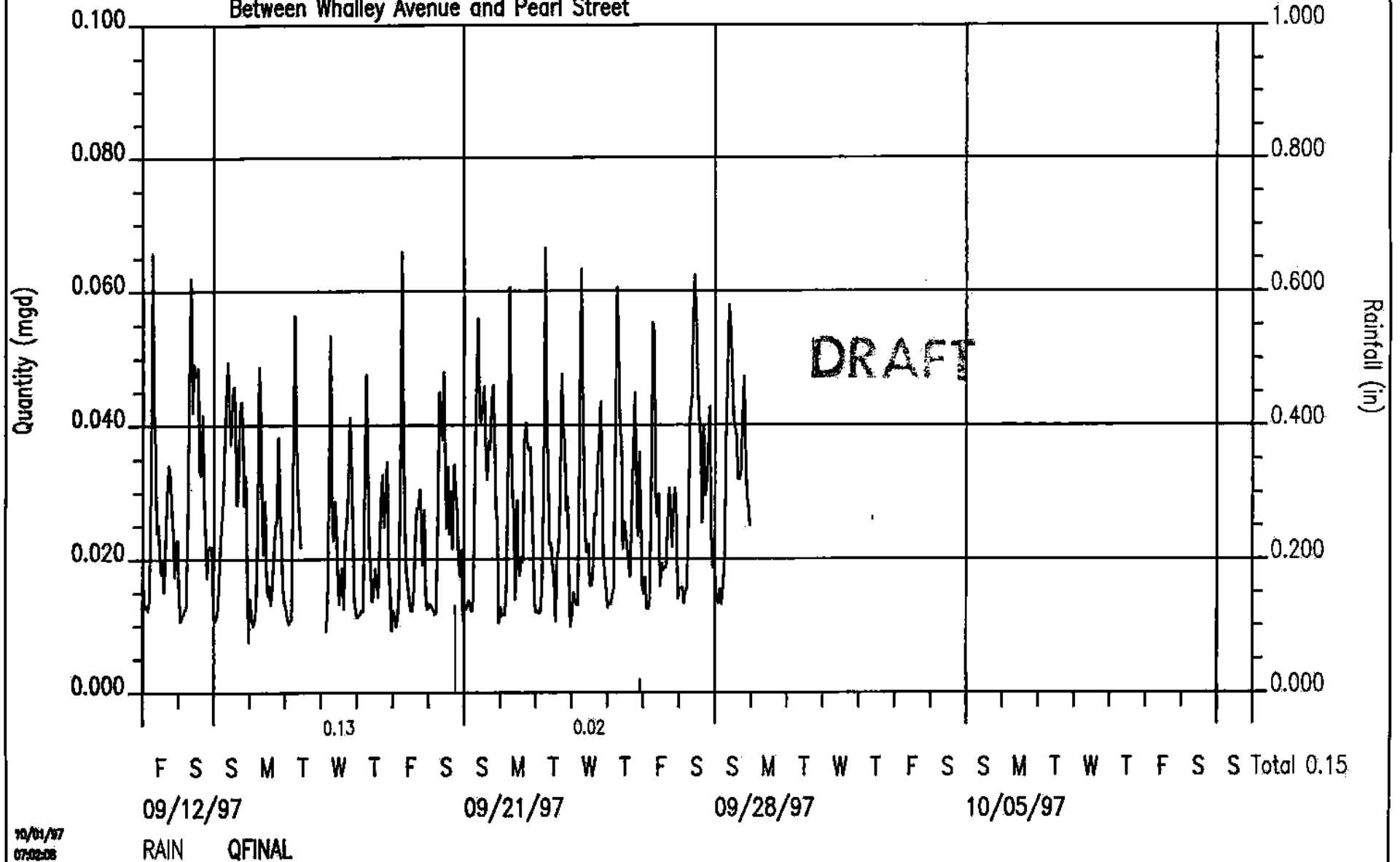
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New Haven, CT

DRAFT

Between Whalley Avenue and Pearl Street



ADS ENVIRONMENTAL SERVICES, INC.

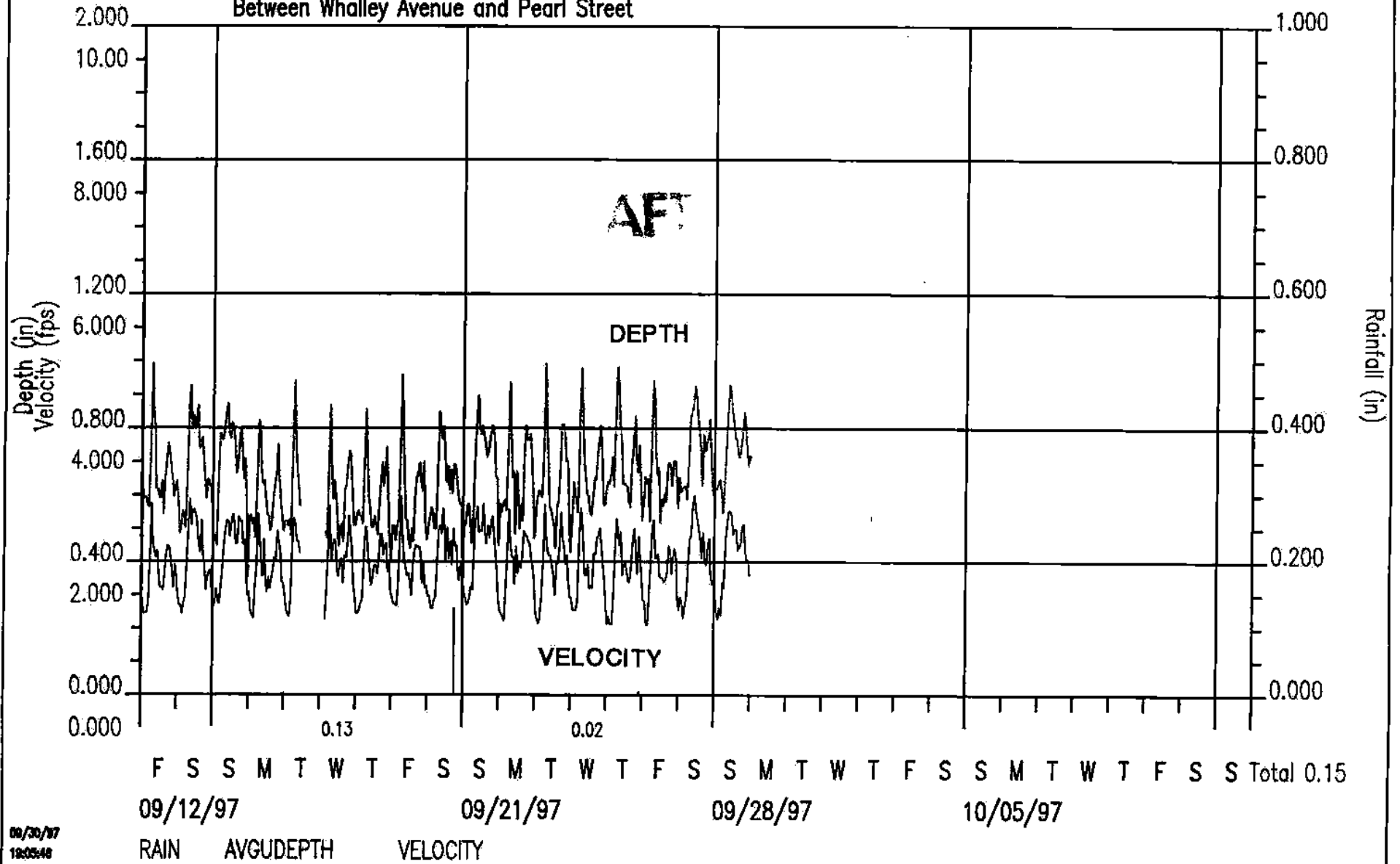
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New Haven, CT

DRAFT

Between Whalley Avenue and Pearl Street



09/30/97
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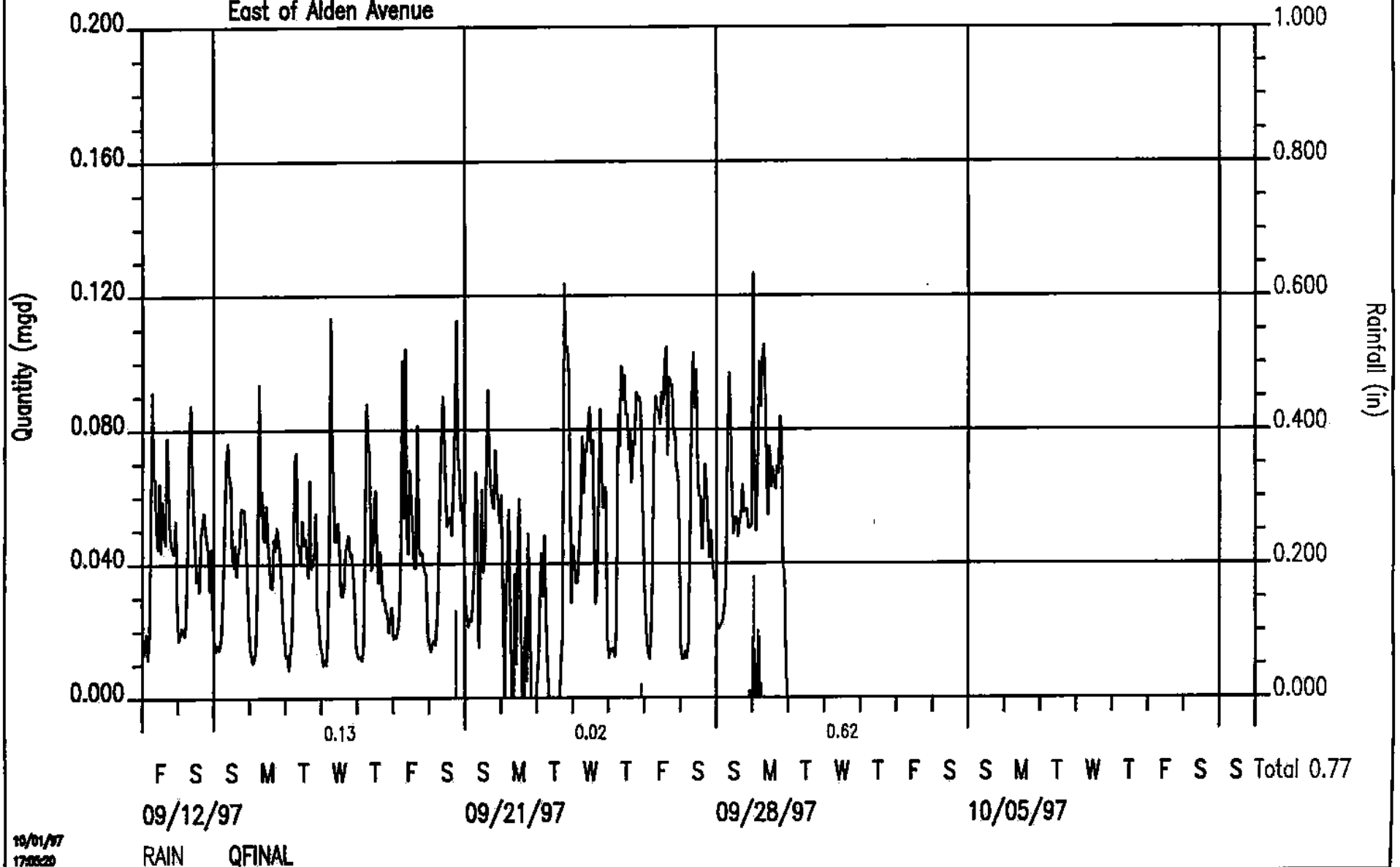
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NHCS0_S3

2010 Chapel Street,
East of Alden Avenue

New Haven, CT

DRAFT



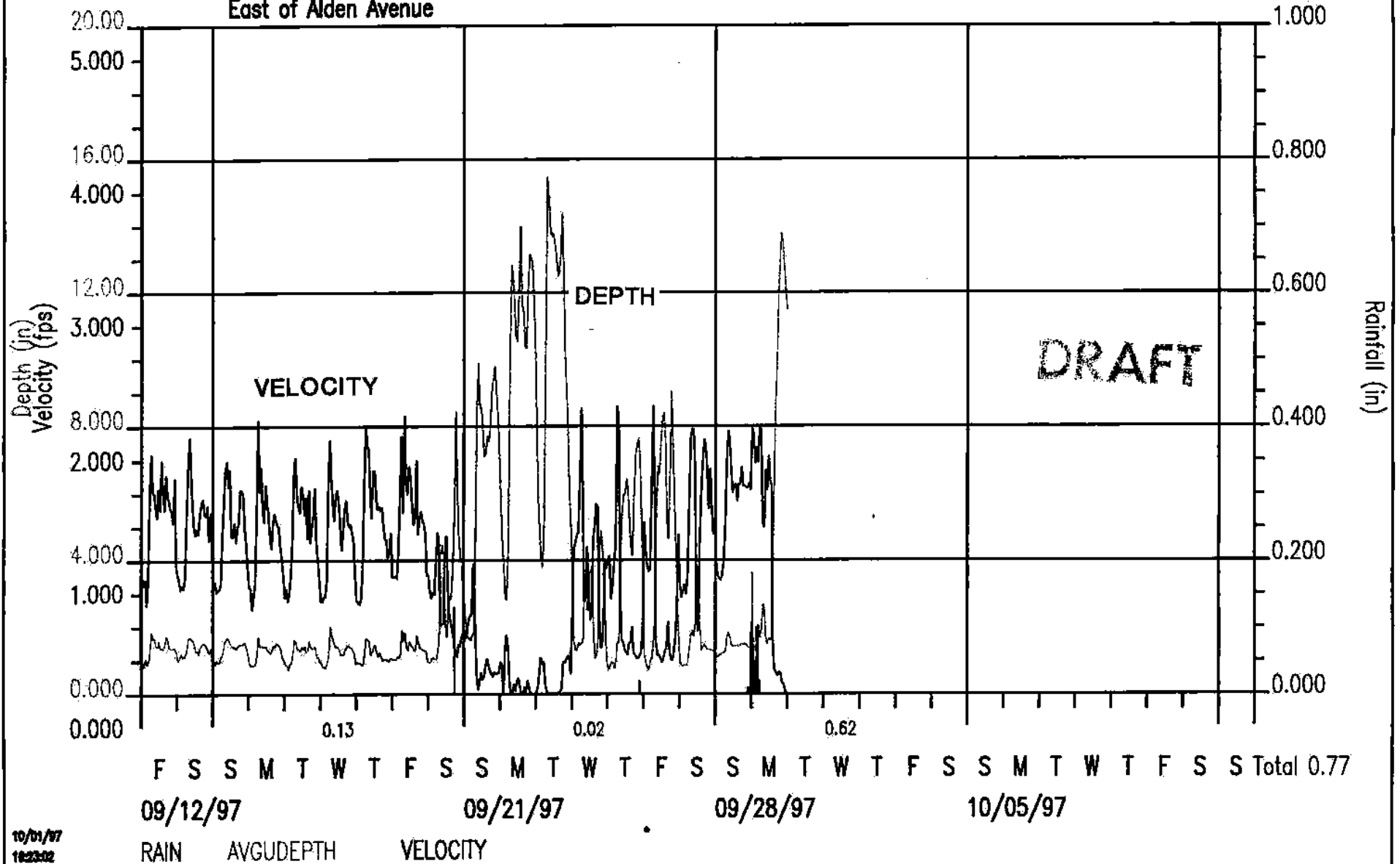
ADS ENVIRONMENTAL SERVICES, INC.

NHCSO_S3

2010 Chapel Street,
East of Alden Avenue

New Haven, CT

DRAFT



10/01/97
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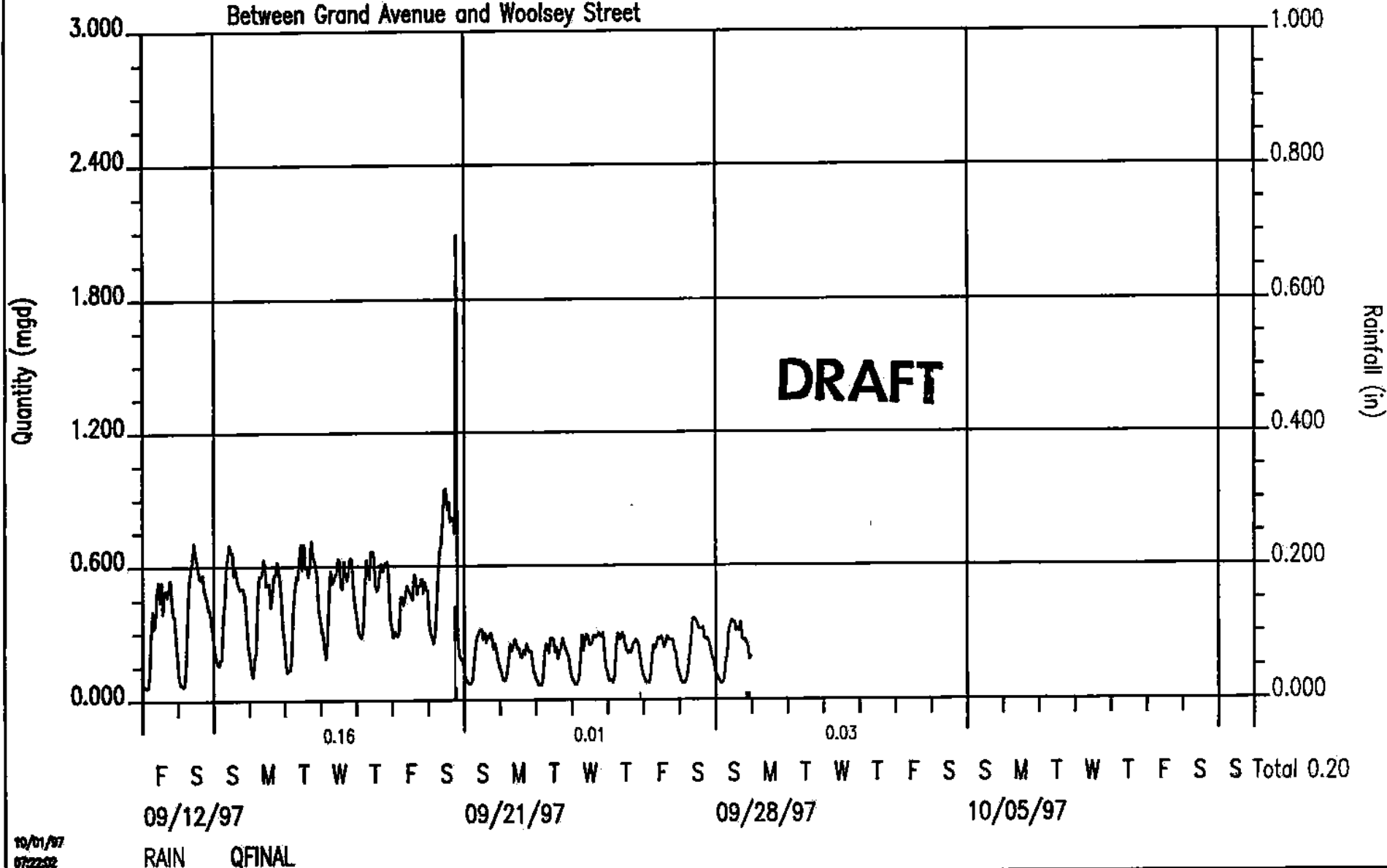
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NHCSO_C1

244 Poplar Street,

New Haven, CT

Between Grand Avenue and Woolsey Street



10/01/97
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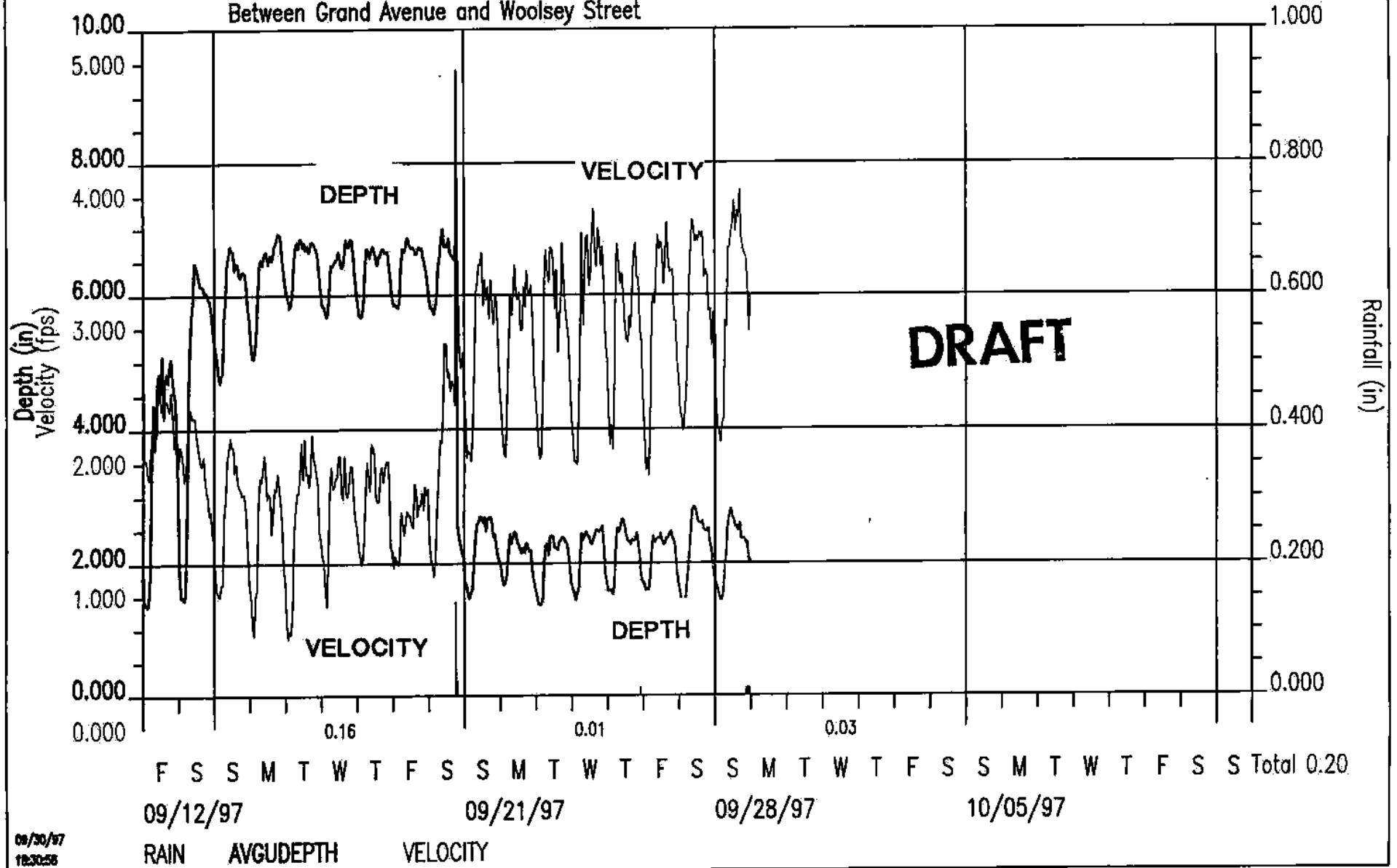
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244 Poplar Street,

New Haven, CT

DRAFT

Between Grand Avenue and Woolsey Street



09/30/97
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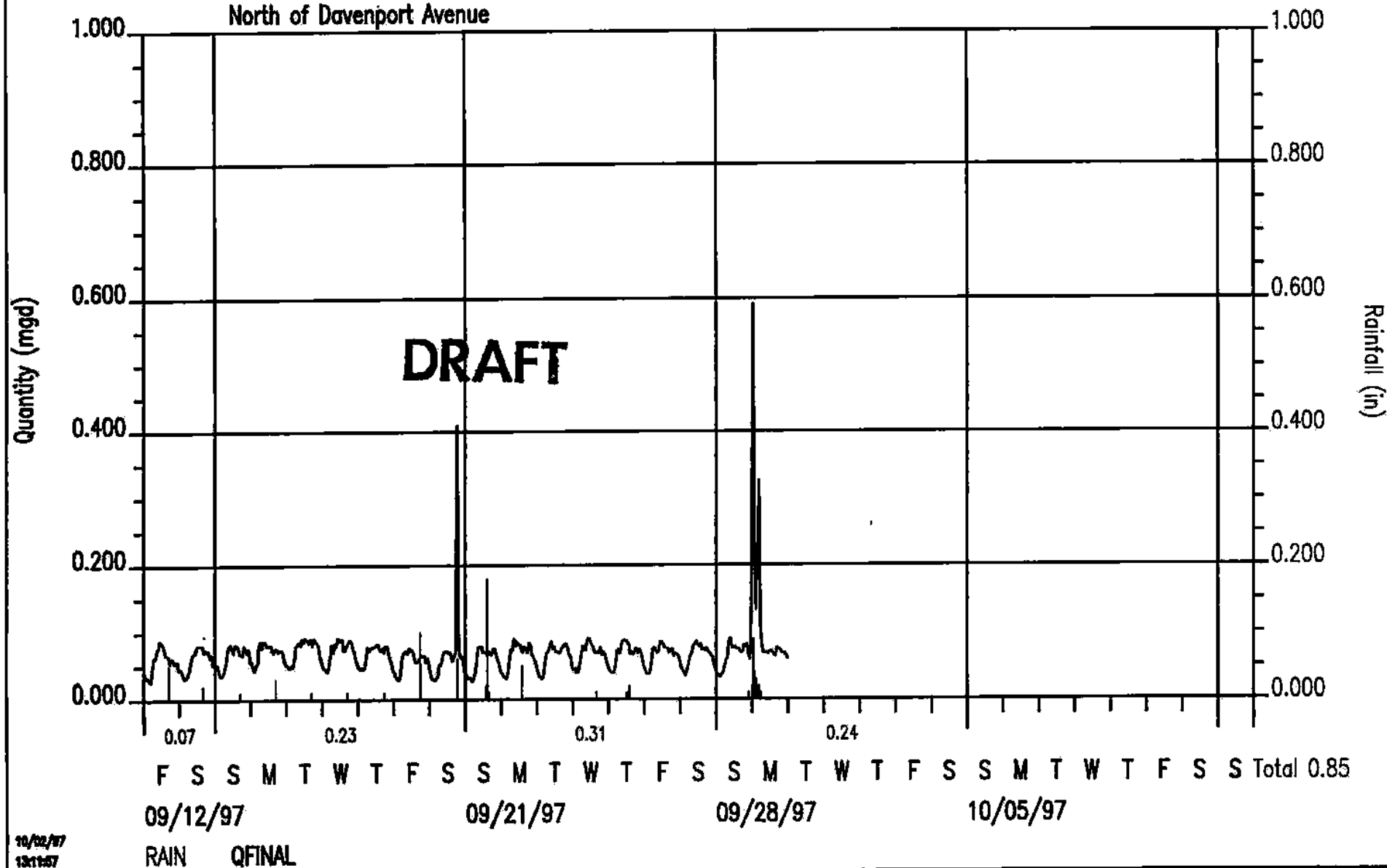
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Orchard Street,

North of Davenport Avenue

New Haven, CT

DRAFT



10/02/97
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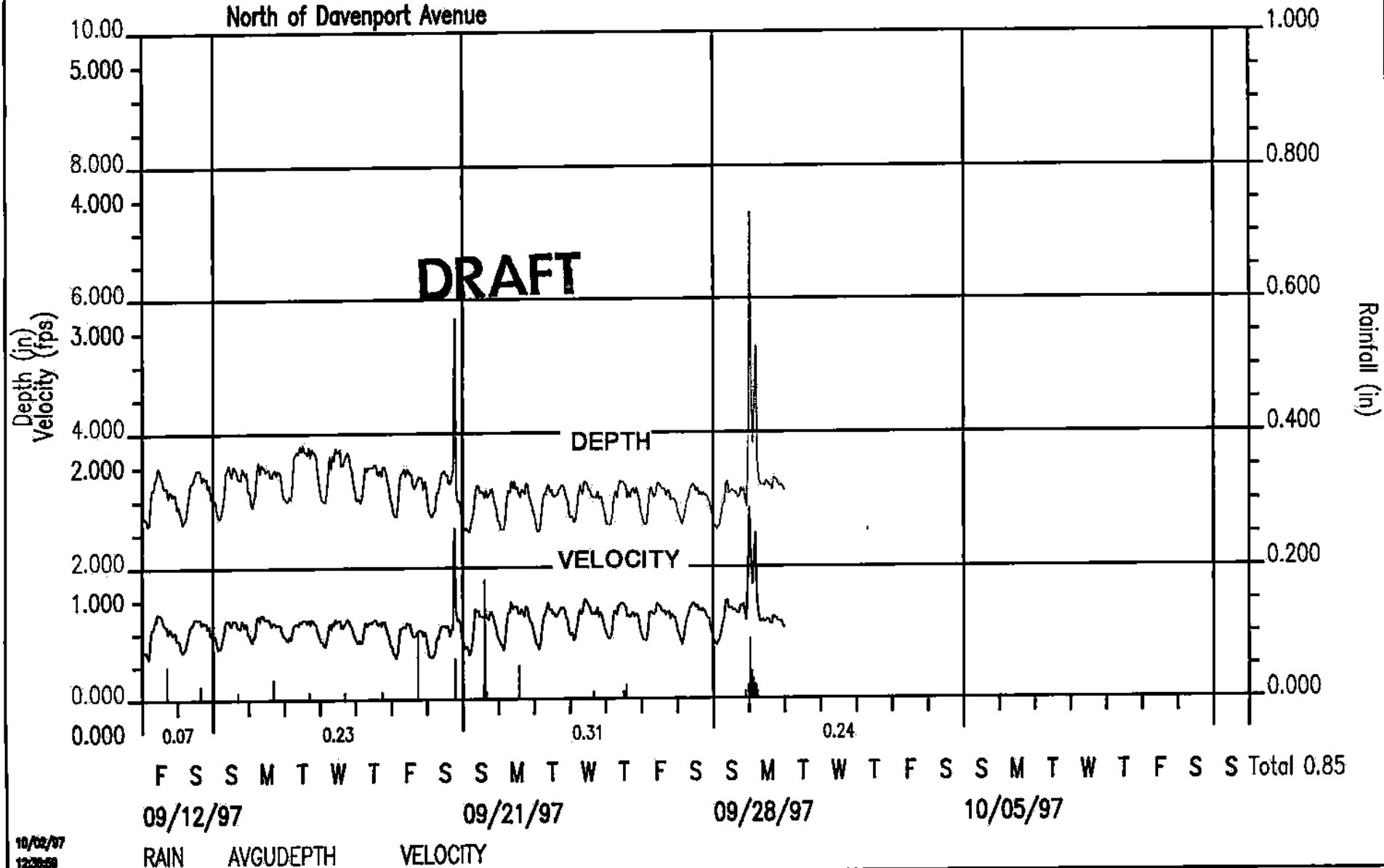
NHCS0_C2

Orchard Street,

New Haven, CT

DRAFT

North of Davenport Avenue



10/02/97
12:36:59

Appendix D

Meeting Minutes

ATTENDEES: Rich Cleary/City of New Haven
Ray Smedberg/WPCA
Henry Goetz/WPCA
Michael O'Brien/DEP
David Archard/ADS
Paul Casey/Utility Pipeline Service
George Harrington/Utility Pipeline
Peter von Zweck/CH2M HILL
Perrin Bowling/CH2M HILL
Bangalore Neelakantiah/UIC
Warren Baethge/UIC

MEETING DATE: July 16, 1997

LOCATION: United International Corporation

MINUTES BY: Perrin Bowling/CH2M HILL

COPY: Attendees
Cliff Bowers/CH2M HILL

DATE: August 5, 1997

SUBJECT: New Haven Long Term CSO Plan (LTCP)- Monitoring Workshop

Peter presented a general background for the Long-Term CSO Control Project and identified the purposes of the workshop, which included discussing the following items: project goals supported by monitoring data, the approach to the monitoring program, available data sources, and remaining data needs; identifying a plan for obtaining the required data; and obtaining consensus and support from the steering committee. He discussed the structure of the system models and how the monitoring program supports the development and calibration of the model and the characterization of receiving waters and provides data to be incorporated into the GIS. He noted that data are needed to help identify contributions of flow from runoff, base sanitary flow, infiltration, and rainfall-derived inflow and infiltration (RDII), and to characterize hydraulics/conveyance. Some data are already available for these components, and more will be obtained. Data are also needed to characterize impairments and sources of flow to receiving waters (CSO, WWTP, stormwater, nonpoint sources).

Perrin described the existing data and showed meter/gauge locations on maps. Henry and Dave commented that some water quality data is available from ADS' monitoring and suggested that Bill Root be contacted. A discussion of water quality data followed. Perrin noted that data are available or can be obtained from parallel projects and similar studies for CSOs, stormwater, and WWTP (Peter stated that sampling is not likely to provide new insights). However, the receiving water characteristics and impairments do not have much supporting data; CH2M HILL is in the process of assessing the data that have been gathered over the past few months, and this information will be available at the August 13 workshop on water quality and regulations.

Perrin showed statistics and charts for rain and flow data to provide information about seasonal impacts on monitoring. She showed that from a "rain" perspective, it is not likely to matter whether monitoring occurs in the fall or in the spring. However, flows at the WWTP tend to be higher during the spring, although there is not a significant variation exhibited. Consensus was reached that a fall monitoring program should be pursued.

Perrin described the database format that was proposed. A question about monitoring timesteps was put to the audience (especially the potential subcontractors). Both ADS and UPS said that flows and rain could be monitored and logged in any timestep chosen. In general it was felt that it would not be prudent to have a timestep greater than 15 minutes. It was stated that the timestep depends on individual site characteristics, basin size, and the datafile size preferred.

The workshop was then opened for the discussion on locations of meters. CH2M HILL asked whether they can achieve the purposed of the monitoring program with only one meter per regulator. ADS and UPS responded that in many cases, this would be possible; however, due to the fact that site conditions and designs vary (e.g. tidal influences, large number of inflow pipes), it would have to be determined on a site-specific basis. It was stated that it would be preferable to put a meter in all inflow and outflow pipes to aid in diagnostics if there were a bad calibration. UPS suggested that the field surveys being done by Cardinal be concentrated in the lower (closer to harbor) parts of the system so that tidal influences could be investigated in time for the RFP's issuance. ADS and UPS said they would like to make a field visit to see the potential sites. Henry okayed the potential locations in separated areas based on his knowledge of the sewerage system. Henry noted that many areas on the hill have cross-connections, though they probably are not needed or used. Henry said that it is not worth putting meters in sites along Front St. in Fair Haven because of low flow velocities. Mike wanted to know if OF020 is in a separated or combined area. Henry said that Cardinal is doing a study at OF020 which includes metering. Ray said Woodbridge has high inflow, and Hamden has tidal and wet weather impacts. Ray wondered whether surveys by Cardinal were including tide gates; he noted one site has a 0.5 - 0.75 mile long pipe between the regulator and the tide gates.

Summary

Consensus was that the monitoring program should be pursued this fall, and both ADS and UPS felt that the timeline was reasonable for obtaining data starting September 1. In general, the potential monitoring sites were accepted, although field conditions might dictate changes. Site sketches from Cardinal's field surveys will be helpful to subcontractor when they are available. RFP will be issued within next couple of weeks. Some potential data sources were identified. Data assessment will be presented at August 13 workshop.

If you have any comments or corrections related to these minutes, please contact Perrin Bowling at 617/523-2260.

MEETING MINUTES

CH2MHILL

ATTENDEES: Rich Cleary/City of New Haven
Larry Smith/City of New Haven
Ray Smedberg/WPCA
Henry Goetz/WPCA
William Root/WPCA
David Archard/ADS
Tom Ryan/ADS
Peter von Zweck/CH2M HILL
Perrin Bowling/CH2M HILL
Bangalore Neelakantiah/UIC
Ravi Keerthy/UIC

MEETING DATE: August 19, 1997

LOCATION: Water Pollution Control Authority offices

MINUTES BY: Perrin Bowling/CH2M HILL

COPY: Attendees
Cliff Bowers/CH2M HILL
Chris Goz/CH2M HILL

DATE: August 20, 1997

SUBJECT: New Haven Long Term CSO Plan (LTCP)- Monitoring Kickoff Meeting

ADMINISTRATIVE ISSUES

Contact numbers for emergency situations were discussed. The WPCA's emergency phone number of (203) 466-5260 was added to the list.

ADS presented a package which includes their Safety and Health Policy, list of key personnel, and schedule for the project. It was noted that Tom Ryan is the Project Manager for ADS and the main point of contact.

ADS noted that the allowance provided in the contract of \$5,000 for police detail is probably too low. Peter stressed the importance of safety and asked that an estimate of the increase be provided to him. Tom said that his initial estimate was \$10,000.

ADS notified CH2M HILL that United International Corporation has been added as an Additional Insured to the Insurance Certificate as requested, and the original certificate is in the mail.

The content expected in the Calibration/Maintenance/Quality Control (CMQC) Reports was discussed. CH2M HILL explained that they want to keep track of how the meters are working and whether any modifications, relocations, etc. were required. These reports should be 1-2 pages in length. They can be faxed on a weekly basis to Neel at United International Corporation, who will then pass them on to CH2M HILL.

ADS asked what the content of the Interim Report should be and stated that a full-fledged report provided after only two weeks of data collection would require the analysts to focus on duties other than those usually performed early in the project. CH2M HILL stated that the reason for wanting the Interim Report so quickly is to get a look at the data and ensure that the results will be as desired. It was agreed that the Interim Report does not need to be fancy or extensive; rather, providing hydrographs, flow depth and velocity plots, electronic files, and hard copies of data at each site will be sufficient.

Calibration of meters was discussed. ADS noted that their usual procedure involves the initial calibration and examination of data for consistency, which would lead to probably about 3 calibrations in the 3-month period. Peter stated that the contract requires weekly calibration checks because of the potential for drift. ADS replied that drift is a problem with pressure sensors but not so much with ultrasonic level meters. It was agreed that initially the calibration will be checked weekly and that it may be decided that intermittent times can be longer as the project continues.

CH2M HILL's reasoning behind requesting that ADS recommend a flow value (from either continuity or Manning's equation) in the data files was explained to be varying site conditions that impact whether Manning's equation is applicable; ADS' expert judgment of the most representative value will be helpful.

Invoicing procedures were discussed briefly. It was agreed that ADS should send a draft invoice so CH2M HILL can approve the format. Invoicing will be done on a monthly basis. CH2M HILL's accounting period ends on the last Friday of the month.

TECHNICAL ISSUES

Timesteps for monitoring were discussed. It was agreed that 5 minutes is the shortest time period needed and that a 5-minute timestep would allow for aggregation to 15-minute or hourly timesteps if desired. It was noted that reports and plots can use aggregated data.

Several site sketches were examined in an attempt to decide upon the best configuration for the installation of meters. The following information was noted during these examinations; many of the observations were offered by Henry Goetz:

OF002 (Boulevard @ Lamberton St.)

Regulator is subject to tidal influence
Average depth of flow is approximately 3 ft
There is about 8"-12" of silt in the interceptor

OF003 (Boulevard @ Orange Ave.)

No manhole (MH) at weir; however, there is a MH on the overflow pipe.
The outfall is upstream of the tide gates on the West River; therefore probably no tidal influence
The weir is only 1.1' from the crown of the OF pipe (therefore interceptor access is difficult)
Average depth of flow is approximately 3 ft
There is about 6"-8" of silt
OF pipe is normally dry
Henry has information about tidal elevations at this location

OF004 (Boulevard @ Legion Ave.)

Elevations don't make sense - old City datum? Neel will check with Cardinal.
Legion Ave has been relocated, sewer line no longer under the roadway (MH access might be difficult)
Henry questions whether the 63" combined interceptor is really a circular cross-section

OF006 (Whalley Ave. @ Fitch St.)

36" wood combined sewer shown on sketch is really a 36" RCP sanitary sewer line

OF014 (Trumbull St. @ Orange St.)

106" x 68" storm sewer is currently underutilized

OF015 (James St. Siphon)

45" conduit to siphon is really 48"
Weir is below normal high tide level

OF016 (Poplar St. @ River St.)

Velocities are just a trickle
Sewer line is affected by James St. Siphon
There is an old flap valve at the outfall but it doesn't work anymore
OF pipe is affected by tide

After several hours of examining individual sites, it was decided that better maps would be helpful to identify alternative locations for access or installations. Such maps would provide information about manholes near the regulator sites if additional access is required and also address some of the questions that were raised today.

To address all the issues adequately, the schedule has been revised as follows:

August 20-26: Henry and Neel working together to gather information and develop maps

By August 22: Peter to confirm preferred meter locations and provide a list of "no-brainer" installation sites to Neel and ADS

August 25-26: Neel to complete mapping

August 27-29: ADS to make site investigations, starting with no-brainer sites.

September 2: ADS to start installations on no-brainer sites

September 3: Conference call @ 9 am to confirm proposed field changes and installations at difficult sites

It was discussed that after the conference call, installations will be made quickly and monitoring will start as soon as possible, with a target date of having all sites running between September 8 and 10.

If you have any comments or corrections related to these minutes, please contact Perrin Bowling at 617/523-2260.