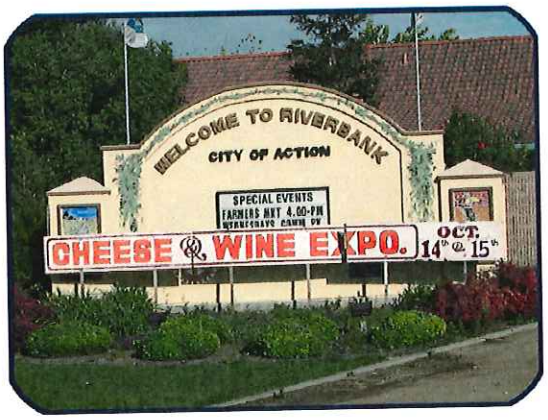
CITY OF RIVERBANK
2007 SEWER COLLECTION SYSTEM
MASTER PLAN



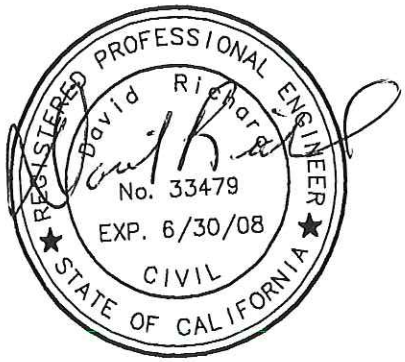
VOLUME TWO

NOVEMBER 2007

NOLTE

BEYOND ENGINEERING

CITY OF RIVERBANK
2007 SEWER COLLECTION SYSTEM MASTER PLAN



Volume Two

November 2007

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APPENDIX A

EVALUATION OF WASTEWATER GENERATION FACTORS, PEAKING FACTORS, AND INFLOW/INFILTRATION RATES

MAY 2007

The City of Riverbank (City) is experiencing an increasing population which is currently about 22,000 people (March 2007). The existing City limits encompass approximately 2,400 acres, with the City's sphere of influence incorporating an additional 1,200 ac. The October 2006 City utility billing statement indicated 6,162 sewer connections. This represents an annual increase of 4% or 243 sewer connections in the period October 2005 to October 2006. The previous annual increase was 400 sewer connections in the period October 2004 to October 2005.

In 2001, a Sewer Master Plan (2001 Master Plan) was completed for the City. The current General Plan expands the areas that will be served by the sewer system from those previously identified in the 2001 Master Plan. A comprehensive 2007 Sewer Collection System Master Plan and existing sewer system model are being prepared to assess the impacts of new growth and to identify and size required system improvements. These tools will allow the City to plan, coordinate, and phase required system upgrades with multiple developments. The 2007 Master Plan includes reviewing wastewater generation factors, peaking factors, and inflow and infiltration rates for the sewer collection system. As part of that evaluation, SFE Global monitored wastewater flow at five locations in the City's sewer collection system for a period of approximately 9 1/2 weeks from February 16, 2007 to April 25, 2007 (Appendix A). This Appendix summarizes the results of the flow monitoring, compares the results to previously used wastewater flow estimating factors, and offers conclusions from the flow monitoring study regarding those factors.

Background

The 2001 Master Plan used the following assumptions for wastewater generation factors, peaking factors, and inflow and infiltration rates:

1. Average Dry Weather Flow (ADWF) – 100 gallons per capita per day

2. Peaking Factor – 2.5 including Infiltration and Inflow (I/I)

ADWF typically includes a base wastewater flow and a component of I/I. The base wastewater flow is generated by the different land uses within the collection system. I/I is composed of several components, but in general is in direct response to rainfall that occurs over a sewered area. Infiltration is the portion of wastewater flow from groundwater making its way into the sewers located below the groundwater table. The flow is fairly constant throughout the year and only fluctuates with significant changes in the groundwater elevation. Inflow consists of storm water that enters the sewer collection system through leaks.

ADWF can be predicted using General Plan land use information and wastewater generation factors (WGF) for the corresponding land use.

Dry weather flows will vary throughout the day, typically exhibiting peaks during the late morning and early evening, with the lowest flows in the early morning. A sewer collection system should be sized to accommodate peak hourly flows expected in the system. To determine the peak hourly flow, two factors are used. A diurnal peaking factor (peaking factor; PF), the ratio of the peak hour flow to the average dry weather flow, is used to determine the Peak Dry Weather Hourly Flow (PDWF). An I/I rate, in units of gallons per day per acre (gpd/acre), is multiplied by the collection area and added to the estimated PDWF to determine the Peak Wet Weather Flow (PWWF) expected within the system.

Wastewater Generation Factors (WGFs)

WGFs for existing and future land uses defined in the General Plan have been established in previous technical memoranda for the City [1]. As part of this Appendix, ADWF will be predicted using the established factors for specific existing catchment areas. The predicted values will then be compared to measured ADWFs from the results of the flow monitoring program. Table 1 summarizes the WGFs used in this Appendix.

TABLE 1
CITY OF RIVERBANK
2007 SEWER COLLECTION SYSTEM MASTER PLAN
WASTEWATER GENERATION FACTORS FOR EXISTING LAND USES [1]

LAND USE	LAND USE DESCRIPTION	WGF (GPD/ACRE)
BGOS (OS)	Buffer Greenway Open Space (Open Space)	0
IBP (I)	Industrial-Business Park (Industrial)	300
LDR	Low Density Residential	600
MDR	Medium Density Residential	1500
MUORR (C)	Mixed Use Office Retail Residential, Non-Residential (Commercial)	1400
P	Park	1400
SC	School-Civic	200

Catchment Zones

Flow monitoring was conducted to aid in accomplishing three goals: 1) compare ADWF flow projections with actual data; 2) determine an appropriate PF to use for wastewater flow projections; and 3) determine an I/I rate to use for wastewater flow projections. With the help of City personnel, five separate Catchment Zones were selected for flow monitoring within the City's existing collection system, as shown in Plate A. A Catchment Zone is an area where wastewater flow is directed to one major trunk sewer or pump station. Therefore, total flow from

a known area (the Catchment Zone) can be monitored at one location. By defini
Zones, a location for installing flow monitoring equipment could be selected and i
information for the area could be collected for use in projecting ADWFs. The charac
these Catchment Zones are briefly described in this section.

Existing land use information for the City was available from previous water supply studies
Plate B shows the assumed land uses for developed parcels. Plate B also includes the estimate
areas within the Catchment Zones that are currently undeveloped, not connected to the sewer
system, or which were not included for wastewater flow due to the location of the flow
monitoring equipment.

Catchment Zone 1

Catchment Zone 1 is very large zone located west of the railroad tracks and includes the
Crossroads Business Park and most of the area served by the Crawford Road Pump Station. The
boundaries of the catchment zone are defined by the Modesto Irrigation District (MID) Drainage
Canal, Claribel Road, and Oakdale Road. The majority of the zone is newer medium density
residential housing (MDR). Table 2 presents a breakdown of the different land uses within
Catchment Zone 1 and the percentage of the wastewater flow contributing area that each land
uses represents.

TABLE 2
CITY OF RIVERBANK
2007 SEWER COLLECTION SYSTEM MASTER PLAN
CATCHMENT ZONE 1 - LAND USE SUMMARY

Land Use	Land Use Description	Net Area (acres)	Percentage of Total[a] (%)
C	Commercial	48.2	16.9
MDR	Medium Density Residential	221.3	83.1

[a] Includes only flow contributing areas. Open Space (OS) has a WGF of 0 and is excluded.

Catchment Zone 2

Catchment Zone 2 is located in eastern Riverbank and includes mostly medium density
residential areas located in the area of Hawaii, Arizona, Nevada, Dakota, Kentucky, and
Avenues, which all feed into a main trunk line on Terminal Avenue. Table 3 presents a s
of the different land uses within Catchment Zone 2.

TABLE 3
CITY OF RIVERBANK
2007 SEWER COLLECTION SYSTEM MASTER PLAN
CATCHMENT ZONE 2 - LAND USE SUMMARY

Land Use	Land Use Description	Net Area (acres)	Percentage of Total[a] (%)
P	Park	1.6	1.5
MDR	Medium Density Residential	93.2	98.5

[a] Includes only flow contributing areas. Open Space (OS) has a WGF of 0 and is excluded.

Catchment Zone 3

Catchment Zone 3 is located east of Catchment Zone 2 and includes the areas up to Claus Road. The majority of the catchment zone is medium density residential with some areas of low density residential. From discussions with City personnel and field investigations, Catchment Zone 3 is known to have some cross-connections with storm drain lines. Table 4 presents a percentage breakdown of the different wastewater flow contributing land uses within the zone.

TABLE 4
CITY OF RIVERBANK
2007 SEWER COLLECTION SYSTEM MASTER PLAN
CATCHMENT ZONE 3 - LAND USE SUMMARY

Land Use	Land Use Description	Net Area (acres)	Percentage of Total[a] (%)
P	Park	13.6	15.6
SC	School – Civic	5.3	0.9
LDR	Low Density Residential	13.9	6.8
MDR	Medium Density Residential	62.2	76.7

[a] Includes only flow contributing areas. Open Space (OS) has a WGF of 0 and is excluded.

Catchment Zone 4

The majority of Catchment Zone 4 can be generally described as the northeast part of the existing City of Riverbank as well as the oldest part of the City. The zone is mostly medium density residential. The limits of Catchment Zone 4 can be described as south of the Stanislaus River and north of Sierra Avenue. Table 5 presents a percentage breakdown of the different land uses within the zone.

TABLE 5
CITY OF RIVERBANK
2007 SEWER COLLECTION SYSTEM MASTER PLAN
CATCHMENT ZONE 4 - LAND USE SUMMARY

Land Use	Land Use Description	Net Area (acres)	Percentage of Total[a] (%)
P	Park	5.4	4.5
SC	School – Civic	16.5	2.0
LDR	Low Density Residential	23.3	8.5
MDR	Medium Density Residential	93.2	85.0

[a] Includes only flow contributing areas. Open Space (OS) has a WGF of 0 and is excluded.

Catchment Zone 5

Catchment Zone 5 is located in the northwest section of the City. The zone includes a large commercial area located along State Route (SR) 108 and medium density residential housing throughout. Table 6 presents a percentage breakdown of the different land uses which contribute flow to the zone.

TABLE 6
CITY OF RIVERBANK
2007 SEWER COLLECTION SYSTEM MASTER PLAN
CATCHMENT ZONE 5 - LAND USE SUMMARY

Land Use	Land Use Description	Net Area (acres)	Percentage of Total[a] (%)
SC	School – Civic	7.5	0.3
MDR	Medium Density Residential	268.6	78.0
C	Commercial	68.6	18.6
P	Park	11.3	3.1

[a] Includes only flow contributing areas. Open Space (OS) has a WGF of 0 and is excluded.

Projected ADWF by Catchment Zone

An ADWF was projected for Catchment Zones 1-5 using previously presented WGFs and land use information (see Appendix B). Table 7 presents the projected ADWF for each zone.

TABLE 7
CITY OF RIVERBANK
2007 SEWER COLLECTION SYSTEM MASTER PLAN
PROJECTED ADWF BY CATCHMENT ZONE

Catchment Zone	Projected ADWF (mgd)
1	0.40
2	0.14
3	0.12
4	0.16
5	0.52

Flow Monitoring

SFE Global installed flow monitoring equipment in five manholes within the City's collection system and recorded data from February 16, 2007 to April 25, 2007. The locations where flow was monitored are shown in Plate A and descriptions of the locations are provided in Table 8. The flow monitoring location number corresponds to the Catchment Zone monitored at that location.

TABLE 8
CITY OF RIVERBANK
2007 SEWER COLLECTION SYSTEM MASTER PLAN
FLOW MONITORING LOCATIONS

Location	Location Description	Meter Used
M1	Crawford and Gold Fever	ISCO 2150 Area Velocity Meter
M2	Patterson and Third	SFE CCW w/ ISCO Area Velocity Meter
M3	Sierra and Fifth	ISCO 2150 Area Velocity Meter
M4	Santa Fe and Second	SFE CCW w/ ISCO Area Velocity Meter
M5	SR 108 and Prestwick	ISCO 2150 Area Velocity Meter

Flow data was logged every 5 minutes for the majority of the project. SFE Global staff visited the sites regularly to perform site maintenance and download the data loggers. More detailed information regarding the flow monitoring can be found in Appendix A.

Rainfall Monitoring

Data from a rain gauge located at the City Wastewater Treatment Plant was collected during the same period as the flow monitoring data, February 2007 to April 2007. The approximate location of the rain gauge is shown in Plate A.

Days of significant rainfall during the flow monitoring study are listed in Table 9. A day of significant rainfall was defined as having more than 0.25 inches of rain recorded. Significant rainfall days were used in the analysis of the flow monitoring results to determine an appropriate I/I rate.

TABLE 9
CITY OF RIVERBANK
2007 SEWER COLLECTION SYSTEM MASTER PLAN
SIGNIFICANT RAIN DAYS DURING FLOW MONITORING PERIOD

Date	Rainfall (inches)
February 22, 2007	0.46
February 25, 2007	0.42
February 26, 2007	0.28
March 20, 2007	0.31
April 11, 2007	0.28
April 22, 2007	0.44

Analysis of Flow Monitoring Results

Flow monitoring data were totaled on a daily basis, averaged for one hour periods, and separated into dry weather and wet weather categories. Unusually high or low flow data were not used in the analysis.

Due to the following reasons, limited data was used from Catchment Zone 1: inconsistencies with known wet weather days, unrecorded data during wet weather days, periodic negative flow readings, and other irregularities. Based on discussions with SFE Global personnel, some inaccurate data can be attributed to "ragging". This occurs when something, such as a rag, becomes lodged on the monitoring equipment.

Dry weather data were defined as the ten lowest total flow days with no rainfall. Table 10 summarizes the average dry weather daily flows for Catchment Zones 1-5. Appendix C includes graphs of the average hour flows for Catchment Zones 1-5 on average dry weather days. For each Catchment Zone, the PF (the ratio of peak hourly flow, in gpm, to the average dry weather flow, in gpm) was determined and is also presented in Table 10.

TABLE 10
CITY OF RIVERBANK
WASTEWATER COLLECTION SYSTEM MASTER PLAN
ADWF AND DRY WEATHER PEAKING FACTOR FOR CATCHMENT ZONES 1-5

Catchment Zone	ADWF (mgd)	Peaking Factor (PF)
1	0.327	1.48
2	0.126	1.31
3	0.167	1.50
4	0.119	1.32
5	0.500	1.43

Figure 1 presents the relationship between the peaking factors and ADWFs obtained from the flow monitoring study. Because of the low flowrates at the monitoring sites and for comparison, included in the figure is the recommended PF curve used in the City of Manteca 2006

Wastewater Collection System Master Plan [3]. Typically, the PF will be larger for lower ADWFs (less than 5 mgd). This type of relationship occurs because areas with higher flow tend to be larger and have a greater attenuation of diurnal peaks through the extended collection system. Because the flow range for the City is not broad enough to extrapolate this relationship, a peaking factor of 1.5 will be used.

An I/I rate was estimated by determining the peak hour flow on a significant rainfall day and subtracting the average dry weather flow for the corresponding hour (Appendix D). Table 11 summarizes the estimated I/I rates by Catchment Zone. Catchment Zone 5 has the lowest I/I rate of 811 gpd/acre, while Catchment Zone 1 had the highest I/I rate of 1,580 gpd/acre. The I/I rate calculated for Catchment Zone 1 is not comparable to the other zones due to the nature of the data collected. Catchment Zones 3 and 4's I/I rates were comparable because both zones are in older parts of the City where some cross-connections are known to occur. To be conservative and assuming that the I/I rates for new development will be similar to Catchment Zones 2 and 5, an I/I rate of 1,000 gpd/acre is recommended.

TABLE 11
CITY OF RIVERBANK
WASTEWATER COLLECTION SYSTEM MASTER PLAN
CALCULATED I/I RATES FOR CATCHMENT ZONES 1-5

Catchment Zone	I/I Rate (gpd/acre)
1	1,580
2	840
3	2,445
4	2,758
5	811

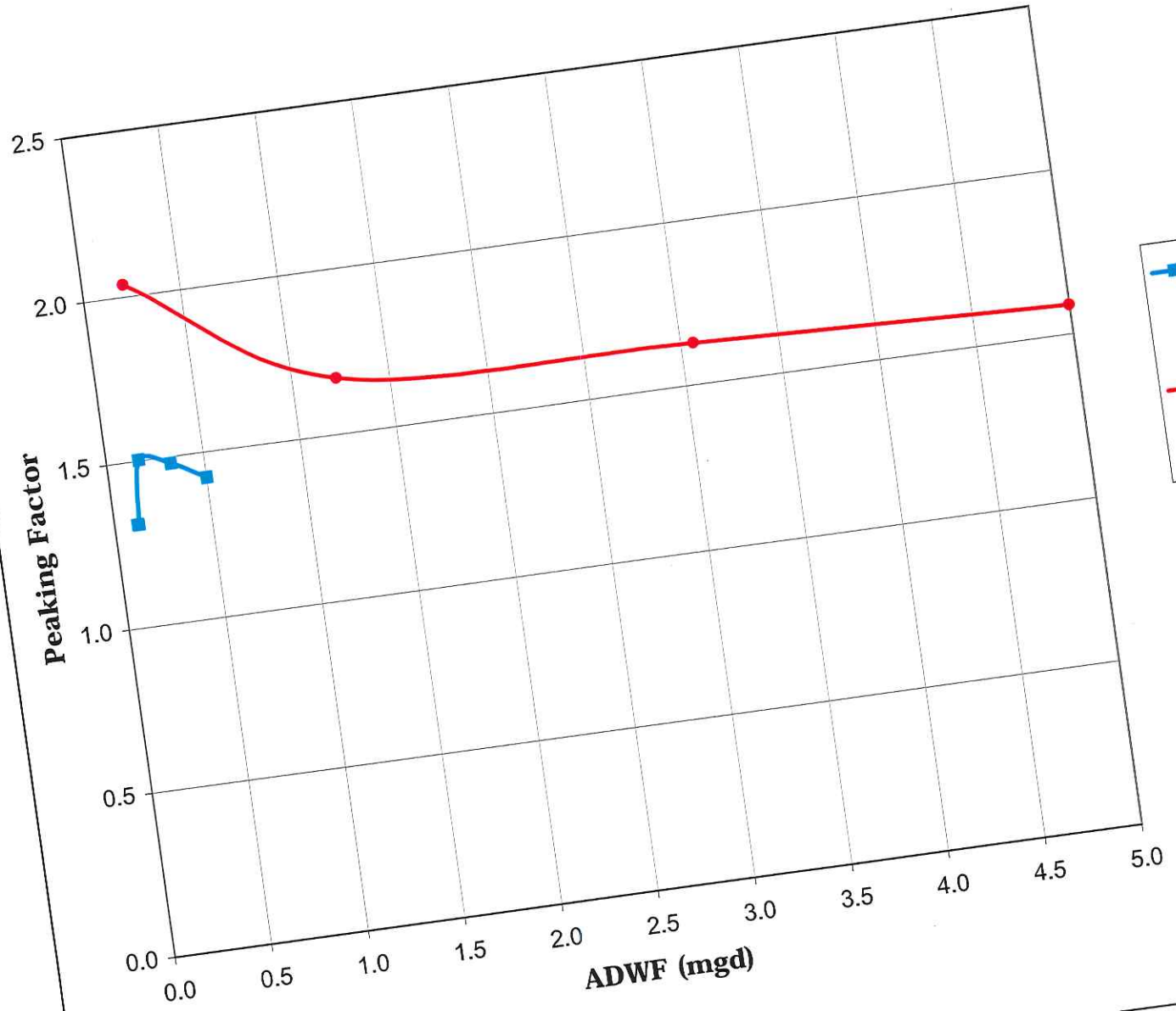

Figure 1

City of Riverbank
2007 Sewer Collection System

Peaking Factor Curve

N:\sa0154218\Excel\SFE Flow Monitoring\PEAKING FACTORS.xls

Comparison of Projected and Measured ADWFs

Table 12 compares the projected and measured ADWFs for Catchment Zones 1-5. The following sections discuss the results of the comparison by Catchment Zone.

TABLE 12
CITY OF RIVERBANK
WASTEWATER COLLECTION SYSTEM MASTER PLAN
COMPARISON OF PROJECTED AND ACTUAL ADWF
BY CATCHMENT ZONE

Catchment Zone	Measured ADWF (mgd)	Projected ADWF (mgd)	Measured/Projected ADWF (%)
1	0.33	0.40	82.5
2	0.13	0.14	92.9
3	0.17	0.12	142.7
4	0.12	0.16	75.0
5	0.50	0.52	96.2

Projected ADWFs were based on catchment zone boundaries and assumptions regarding existing land use.

Catchment Zone 1

The measured ADWF was 82.5 percent of the projected ADWF. Catchment Zone 1 includes the City's newest development- both residential and commercial. Discrepancies between the measured and projected flows can be partially attributed to limited knowledge regarding the extent new development is presently occupied.

Catchment Zone 2

Catchment Zone 2 is primarily a residential zone. The measured ADWF was 92.9 percent of the value for the projected ADWF. The homogeneous residential characteristic of Catchment Zone 2 validates the assumptions made for MDR land use and its corresponding WGF.

Catchment Zone 3

The ratio of the measured to projected ADWF in Catchment Zone 3 was 142.7 percent. The majority of the land in Catchment Zone 3 is residential; however, the sewer system is known to be cross-connected with the storm drain system. The disparity between projected and measured ADWF values is reflective of the addition stormwater flow. If no improvements are implemented to eliminate the cross-connections, WGFs for this catchment zone may need to be adjusted to account for stormwater inflow.

Catchment Zone 4

The measured and projected ADWF for Catchment Zone 4 were similar. The difference between projected and measured ADWFs could be a result of assumptions made regarding the existing City system or existing land use, however wastewater flow projections for this zone support the continued use of the proposed WGFs.

Catchment Zone 5

The ratio of measured to projected ADWF for Catchment Zone 5 was 96.2 percent. This zone has a higher percentage of general commercial areas. The projections were very similar to measured ADWFs and support the WGFs for commercial land use areas.

Conclusions

Based on the results of the flow monitoring study, the following conclusions are offered:

1. WGFs for residential development previously submitted in technical memoranda [2] to the City appear valid.

2. Peaking factors measured in the field were less than previously assigned values that included I/I.

3. I/I values were high in older areas and areas with known cross-connections. An I/I rate of 1,000 gpd/acre would be conservative for future development.

References

[1] *City of Riverbank 2007 Sewer Collection System Master Plan, Summary of Proposed Design Criteria, Technical Memorandum*, Nolte Associates, Inc., April 2007.

[2] *City of Riverbank Water Supply Study and Updated Water Master Plan, Buildout Projections of Water Demands, Technical Memorandum,* Nolte Associates, Inc., April 2007.

[3] *City of Manteca Wastewater Collection System Master Plan Update, Revised Draft,,* Nolte Associates, Inc., August 2006.

APPENDIX A

CITY OF RIVERBANK, CALIFORNIA
SANITARY SEWER FLOW MONITORING
2007

FINAL REPORT PREPARED BY SFE GLOBAL

City of Riverbank
Sanitary Sewer Flow Monitoring 2007
SFE File #C81-01

Final Report

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1.0 INTRODUCTION

This report provides details of the sanitary sewer flow monitoring project conducted within the City of Riverbank by SFE Global, under the direction of Mr. Reid Johnson, Project Manager, of Nolte Associates. Enclosed are the results of flow monitoring performed on five sanitary sewer sites and six pump stations. The sites were installed and commenced logging on February 16th, 2007. The sites collected flow data for a duration of two months until they were removed on April 25th, 2007.

Site #	Location	Meter Used
C80-01-01	Crawford Rd & Gold Fever Dr	ISCO 2150 Area Velocity Meter
C80-01-02	Patterson Rd & E of 3rd St	SFE CCW w ISCO 2150 Area Velocity Meter
C80-01-03	Sierra Rd & 5th St	ISCO 2150 Area Velocity Meter
C80-01-04	Santa Fe St & 2nd St	SFE CCW w ISCO 2150 Area Velocity Meter
C80-01-05	Hwy 108 & Prestwick Rd	ISCO 2150 Area Velocity Meter
C80-01-PS1	Candlewood Pump Station	Pump Logger
C80-01-PS2	Estelle Lift Station	Pump Logger
C80-01-PS3	Jackson Pump Station	Pump Logger
C80-01-PS4	Roselle Pump Station	Pump Logger
C80-01-PS5	Terminal Pump Station	Pump Logger
C80-01-PS6	Townsend Pump Station	Pump Logger

Mr. Paul Loving, as Project Manager represented SFE Global during this project.

2.0 MONITORING PROGRAM

Prior installing flow monitoring stations, SFE performed detailed site assessments of each potential site to determine the most appropriate flow monitoring device in achieving optimal results. Factors such as pipe size, channel condition, site location, and site hydraulics were all considered and documented while performing site assessments. See Appendix #2 of this report for site assessment details.

SFE installed flow monitoring stations in accordance with the approved site assessment documentation. Each meter had been calibrated and set to log data at a 5-minute interval. To ensure proper operation of stations, a regular maintenance schedule was adhered to for the duration of the project. During each site maintenance inspection conducted by SFE, corresponding meter and field readings were obtained and recorded on the field maintenance sheet. These readings provided an indication of the accuracy and operation of the meters. See Appendix #2 of this report for the field report sheets detailing site inspection information, calibrations, and depth verifications.

Confined space entry procedures and general site/traffic safety was adhered to during site installation and site maintenance. SFE utilizes the "DBI SALA" rescue system, a 2800 CFM air induction device and TMX 412 gas air quality monitors. All of our staff members are thoroughly trained and certified in confined space entry procedures. Certificates are available upon request.

A thorough traffic control plan and safety plans were established and used by SFE Global crews where required.

2.1 SANITARY SEWER FLOW MONITORING LOCATIONS

Site C81-01-01 – Crawford Rd & Gold Fever Dr: SFE installed an ISCO 2150 Area Velocity Meter within the manhole to monitor flow from the 18 inch diameter pipe. Flow was calculated using a site-specific depth vs. flow lookup table. Flow monitoring results demonstrated good data was collected from the monitoring station. Monitoring duration was from February 16th to April 25th, 2007. All equipment was removed from site.

Site C81-01-02 – Patterson Rd & E of 3rd St: SFE installed a 350mm Custom Compound Weir and an ISCO 2150 Area Velocity Meter and submerged pressure depth transducer within the manhole to monitor flow from the 12 inch diameter pipe. Flow monitoring results demonstrated good data was collected from the monitoring station. Monitoring duration was from February 16th to April 25th, 2007. All equipment was removed from site.

Site C81-01-03 – Sierra Dr & 5th St: SFE installed an ISCO 2150 Area Velocity Meter within the manhole to monitor flow from the 24 inch diameter pipe. Flow was calculated using a site-specific depth vs. flow lookup table. Flow monitoring results demonstrated good data was collected from the monitoring station. Monitoring duration was from February 15th to April 25th, 2007. All equipment was removed from site.

Site C81-01-04 – Santa Dr St & 2nd St: SFE installed a 600mm Custom Compound Weir and an ISCO 2150 Area Velocity Meter within the manhole to monitor flow from the 6 inch diameter pipe. Flow was calculated using a site-specific depth vs. flow lookup table. Flow monitoring results demonstrated good data was collected from the monitoring station. Monitoring duration was from February 15th to April 25th, 2007. All equipment was removed from site.

Site C81-01-05 – Hwy 108 & Prestwick Rd: SFE installed an ISCO 2150 Area Velocity Meter within the manhole to monitor flow from the 24.5 inch diameter pipe. Flow was calculated using a site-specific depth vs. flow lookup table. Flow monitoring results demonstrated good data was collected from the monitoring station. Monitoring duration was from February 15th to April 25th, 2007. All equipment was removed from site.

2.2 PUMP STATION MONITORING LOCATIONS

SFE used Controlotron Transit Time Dataloggers to perform flow testing at 6 lift stations as detailed by the client. Flow testing was successful in pump stations including Estelle, Jackson, Roselle, and pump #2 at the Terminal station. SFE was unsuccessful at pump #1 at Terminal as well as both of the pumps at Townsend. Pipe conditions such as heavy buildup inside the pipe were suspected as being the likely cause. SFE crew was unable to gain access to the Candlewood Pump Station due to the metal grate being welded down. Efforts were made to contact the client in order to gain access to the station, but these efforts were unsuccessful. Below are the observations attained from the testing performed at each station. Onset motor control event loggers were used to log the on/off cycles of the separate pumps.

Site C81-01-PS1 – Candlewood Pump Station: SFE installed a Pump Logger at the site to record the start and stop times of the pump motor. Results were collected from the monitoring station, but no processing was done to the data. City workers were performing maintenance at the site and needed to remove the Pump Logger from February 20th to April 25th, 2007. Monitoring duration was from January 30th, 2007 to February 3rd, 2007. All equipment was removed from site.

Site C81-01-PS2 – Estelle Lift Station: SFE installed a Pump Logger at the site to record the start and stop times of the pump motor. Results were collected from the monitoring station, but no processing was

done to the data. Monitoring duration was from February 20th to April 25th, 2007. All equipment was removed from site.

Site C81-01-PS3 – Jackson Pump Station: SFE installed a Pump Logger at the site to record the start and stop times of the pump motor. Results were collected from the monitoring station, but no processing was done to the data. Monitoring duration was from February 20th to April 25th, 2007. All equipment was removed from site.

Site C81-01-PS4 – Roselle Pump Station: SFE installed a Pump Logger at the site to record the start and stop times of the pump motor. Results were collected from the monitoring station, but no processing was done to the data. Monitoring duration was from February 20th to April 25th, 2007. All equipment was removed from site.

Site C81-01-PS5 – Terminal Pump Station: SFE installed a Pump Logger at the site to record the start and stop times of the pump motor. Results were collected from the monitoring station, but no processing was done to the data. Monitoring duration was from February 20th to April 25th, 2007. All equipment was removed from site.

Site C81-01-PS6 – Townsend Pump Station: SFE installed a Pump Logger at the site to record the start and stop times of the pump motor. Results were collected from the monitoring station, but no processing was done to the data. Monitoring duration was from February 20th to April 25th, 2007. All equipment was removed from site.

Appendix #1 of this report includes technical information on the equipment utilized. Appendix #2 includes site photos & field reports. Also enclosed with this report is a CD with data summaries and hydrographs for each site, along with a copy of this report.

Report End
May, 2007

Appendix 1

Technical Information

SFE's Custom Compound Weir Technology was first developed in 1983. This system consists of the following two components:

- A customized primary device (Custom Compound Weir or CCW), which provides a predictable relationship of "head" versus "flow".
- A water level sensor and data logger

Testing & Awards

The relationship between "head" and "flow" for the primary device was initially established in a hydraulics lab in conjunction with the Canadian Centre for Inland Waterways (CCIW) and published in a report prepared for a local utility. In subsequent years the monitoring techniques were further refined and additional laboratory work was carried out for the primary device. In 1988 the Association of Consulting Engineers in their annual national engineering awards program recognized the work with an Award of Merit.

Any level sensing device may be used reliably measure flows including ultrasonic level indicators, pressure transducers and floats. The system was designed to make it economically feasible for even small utilities to be able to operate a network of stations for a long duration - the low operating costs & high accuracy/reliability prevailing over other measurement systems.

Self-Cleaning

The primary device has a rectangular notch, which then flares out into a "V" section and then a rectangular upper portion. The notch and "V" section have chamfered 38 mm thick "lips" which make them self-cleaning and result in a very high weir flow coefficient.

The self-cleaning properties of these weirs have been amply field proven over the past 18 years at approximately 2200 such stations. Each of our Custom Compound Weirs is custom designed by an open channel hydraulics specialist for the manhole, chamber or channel configuration it is to be used in.

Low Flow Accuracy

For sewers up to 534 mm diameter the notch is typically 100 mm wide and 140 mm deep. This results in a flow rate of roughly 1.0 l/s for a head of 25 mm. Since a 2.5 psi pressure transducer or narrow beam ultrasonic indicator is usually capable of measuring water levels within +/- ¼", flow rates down to 1.0 l/s can readily be measured (a special unit has previously been designed to measure pre-treated wastewater flow rates down to 0.001 l/s).

No Sewer Backups

The lower notch magnifies the variation of the water level with small changes in flow rate (e.g. for the base flow regime). The overall primary device or "weir" normally has an opening greater than the pipe cross sectional area and capacities greater than that of the sewer in which they are placed.

Any Size, Any Shape

SFE has installed custom compound weirs in sewers from 0.15 m to 3.6 m as well as in varying sizes of pond outlets, creeks, WWTP's, etc. Custom designing the primary device for the manhole or channel in which it will be placed means that you have considerable control over the final flow regime. This has allowed many difficult hydraulic situations to be handled including bends, junctions, slopes over 10%, drop connections, and drops in the main pipe invert.

Velocity Measurements Not Required

One of the major advantages of SFE's Custom Compound Weir is that it only requires a depth sensor and logger; a velocity sensor is not used. Many of the problems associated with sewer flow monitoring are related to the velocity sensor and the need to measure average velocity. Velocity sensors are prone to fouling with subsequent "drifting" of the signal whereas pressure sensors will still accurately register variations in water level even if they have debris on them.

No "In the flow" Probes

The use of SFE's Custom Compound Weir further improves the performance of pressure sensors since they no longer represent an effective obstruction in the flow (they are installed behind the weir). They will always have a reasonable "head" on them as the weir lip elevation maintains a minimum depth of 100 mm behind the weir. As pressure transducers are much less accurate when depths approach zero; this situation becomes a problem for Area-Velocity (AV)) type meters in small pipes where base flow rates are low.

Less Expensive

"Level only" monitors such as those used with our Custom Compound Weir are less expensive than AV meters and need less power to operate. Flow profiling is needed for conventional AV meters to ensure that the velocity sensed at a point or across a band of flow is properly transformed into average velocity across the pipe section. Since the Custom Compound Weir does not use velocity, profiling becomes redundant.

High Accuracy

Dye dilution and full-scale lab comparisons have been conducted and the results have been excellent. In most cases +/- 5% is readily achievable without special attention.

Temporary or Permanent

The Custom Compound Weir's are normally located in the manhole chamber about 300 mm from the downstream end.

Material	Life Expectancy	Uses
Lumber/Lexan	1 week to several years	Short Term (E.g. I/I Study)
Plywood	Up to 2 years	Temporary
Pressure Treated Lumber	5 to 8 years	Semi-Permanent
Lexan and 3/16 Stainless	50 Years	Permanent

No Surcharges

Is there a possibility of sewer surcharges causing basement flooding because of the use of such primary devices or weirs? The question has been raised many times over the past 18 years and was addressed on a project when the Custom Compound Weir was first designed in 1984. The purpose of that first project was to determine the cause of persistent sewer related basement flooding. The client was very concerned that the study procedures did not create more flooding since two Custom Compound Weir stations were just downstream of the area receiving the flooding. The design and placement of the Custom Compound Weirs addressed this as follows:

- Each CCW was located in a manhole and not in the pipe, approximately 300 mm from the downstream end so that if the weir were to ever get blocked it could simply overflow safely. (This event has never occurred).
- For manholes with a chamber larger than the pipe (i.e. 450 mm pipe in standard 1065 mm manhole), the weir opening is greater than the pipe area. The flow over the weir is also at critical depth and therefore at a higher velocity than normally occurs in the pipe itself. As a result, the weir capacity is much greater than the pipe capacity in most installations.

- A rating curve was provided for a demo weir that has the standard opening used in pipes up to 450 mm. Table 1 below shows the flow capacity of this weir configuration at selected heads versus the full flow capacity of selected pipe sizes up to 450 mm at a 0.25 % grade. The comparison illustrates that the CCW capacity can be much greater than the pipe capacity.

Flow Capacity of Standard Small Pipe Configuration at Selected Heads		**Full Flow Capacity of Selected Pipes @ 0.25 % Grade**	
Head (mm.)	**Flow (l/s)**	**Pipe Diameter (mm.)**	**Capacity (l/s)**
25	1	200	16
140	12	250	30
200	22	300	48
318	63	380	88
508	145	450	143
610	230		

Laboratory Tested

Hydraulic model testing conducted at the Canada Centre for Inland Waters, provided the opportunity of observing the pipe / weir / manhole performance as the flow rates in the system were increased to the point that it surcharged. As the system started to surcharge, the "control" shifted from the weir to the downstream pipe and there was essentially no drop in the water surface across the weir (i.e. under surcharge, the weir was not influencing the water levels upstream).

Custom Designs

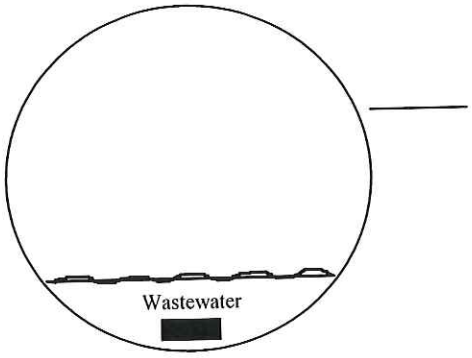
Every Custom Compound Weir is custom designed with a rectangular low flow notch and chamfered lips to give it a high weir flow coefficient. This means that it passes a greater flow for a given head than normal sharp crested weirs. Custom designed means specific concerns are addressed at specific sites.

Area Velocity Meter - Calibration & Verification of Monitor Sensors

Pipe Conduit Measurements

The measurement and condition of all sites were recorded during meter installation.

General Site Installation



Velocity Probe Meter was field calibrated according to the manufacturer's methodology and data was verified utilizing SFE Standard Protocol as outlined below.

Depth Verification: Depth verification was conducted at site and all data is included on the field report. Five depth measurements from the meter and tape measure are obtained simultaneously at sequential time intervals and recorded on the field worksheet. The lowest and highest measurements are discarded. The remaining 3 measurements must be within 0.5 in. of each other. The averaged monitor reading must be within 5% of the averaged field measurement to be acceptable.

Velocity Verification: Depth and Velocity profiles were performed utilizing a Marsh McBirney Flow Mate point velocity meter. This instrument uses the Faraday principle to measure water velocity flowing over three electrodes. This allows an accurate velocity to be measured in a small area of the total flow.

SFE standard procedure is to use the 2-D method to determine average velocity. Numerous measurements are taken from the invert to water surface at the left, center and right thirds of the pipe. These measurements are averaged with the inclusion of readings taken from the upper left and right corner of flow.

SFE's alternate procedure when the pipe diameter is small or flow is insufficient is to use the .9-Vmax method. Point velocity readings are taken throughout the cross section of flow. The highest repeatable velocity obtained is multiplied by 0.9 to determine average velocity. This average velocity is then correlated to the average velocity reading from the meter and must be within 10%.

Velocity profiles were conducted and obtained for all sites.

Appendix 2

Site Information
Including Photos, Field Reports

Site Assessment

CLIENT FLOW MONITORING #: Site 1
NAME: Nolte Associates — Nolte - Manteca
Date / Time: 02/16/07 10:02 AM

SFE PROJECT #: C81-01
SFE SITE #: C81-01-01

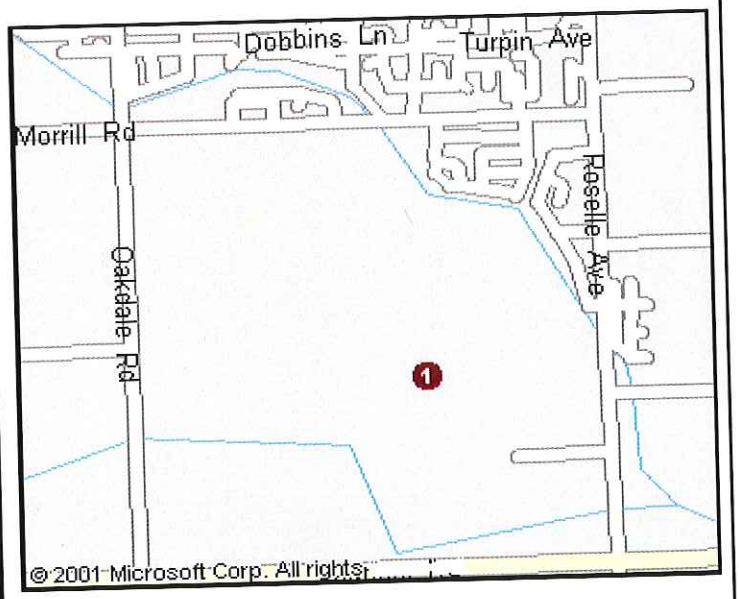
Project Specific Information

Client Name:	Nolte Associates	
End User Name:	Nolte - Manteca	
Project Name:	Riverbank Sewer Flow Monitoring	
Client Contact:	Reid Johnson	(209) 239-9080
Field Contact:	Jason Scott	(916) 837-8009
SFE PM Contact:	Paul Loving	(604) 992-6792

Site Location Information

Client Manhole #:	N/A
Address (Location):	Crawford Rd & Gold Fever Dr
City, State:	Riverbank, CA
GPS (North - West):	N 37° 43.092 W 120° 56.653
Landmarks:	
Additional Information:	Street not shown on Map

Map of Area



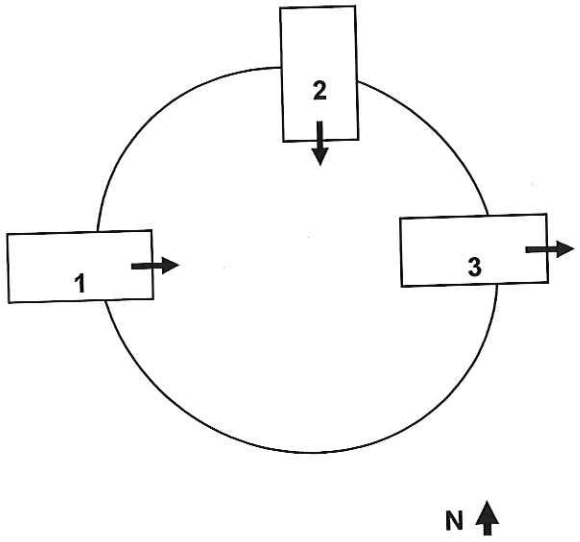
Site Equipment

Install / Remove Date:	02/16/07	04/25/07
Meter Make & Model:	ISCO 2150	
Level Type:	Pressure	
Velocity Type:	Average	
Primary Device:	Pipe	
Wireless:	No	
Redundancy:	No	
Logging Rate:	5min	

Site Profile

Pipe #1 Size:	18	Inches
Pipe #2 Size:	18	Inches
Pipe #3 Size:	N/A	Inches
Pipe #4 Size:	N/A	Inches
Manhole Depth:	308.25	Inches
Laterals / Rungs:	Yes	No
Additional Information:	Sensor installed in Pipe #1	

Manhole Layout



Traffic Control Requirements

Provider:	SFE
Condition	Local
Frequency:	Install / Maintenance / Removal
Speed Limit:	25 MPH
# of Lanes Effected:	2
Lane Configuration:	Intersection
Additional Information:	

Notes

1 This is a Very deep hole.
2

Site Hydraulics

Date & Time:	02/16/07	10:02 AM
Depth:	8	Inches
Velocity:	1.5	FPS
Turbulent:	No	
Surcharge:	No	
Silting:	No	
Solids:	No	

Notes

3
4

CLIENT FLOW MONITORING #: Site 1
NAME: Nolte Associates Nolte - Manteca
Date / Time: 02/16/07 10:02 AM

SFE PROJECT #: C81-01
SFE SITE #: C81-01-01

Picture 1

Picture 2

Picture 3

Notes

1
2
3

Area Velocity Site Installation Form

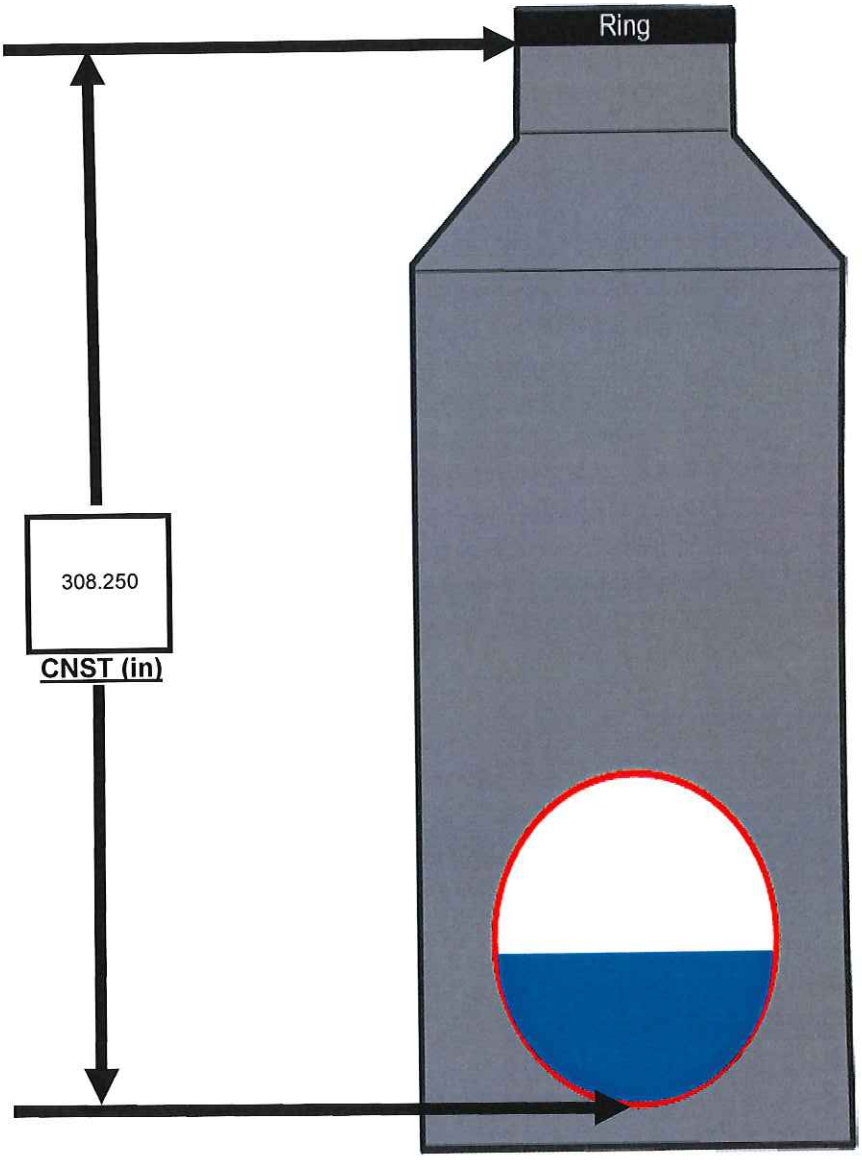
CLIENT FLOW MONITORING #: Site 1
NAME: Nolte Associates Nolte - Manteca
Date / Time: 02/16/07 11:14 AM

SFE PROJECT #: C81-01
SFE SITE #: C81-01-01
Technician 1: Jason Scott (916) 837-8009
Technician 2: John Garcia

Meter Depth vs.. Field Depth Calibration / Verification

Reading Number	Date	Time	Field Meas (in.)	Meter Depth (in)	Comments (Zero Meter Level before Installation)
Initial	2/16/2007	11:14	4.375	3.430	Pre Adjust
1	2/16/2007	11:17	4.375	4.340	
2	2/16/2007	11:22	4.500	4.410	
3	2/16/2007	11:27	4.250	4.250	
Average			4.375	4.330	

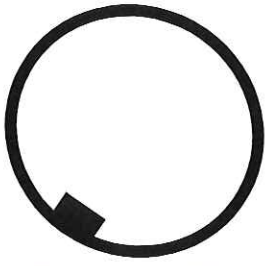
* Three Continuous Measurements Within 0.5 Inches
* Average Meter vs (WL1 and WL2) Within 5%



Manhole Depth (in) = CNST
308.250

Pipe Diameters (in)

Pipe 1	18
Pipe 2	18
Pipe 3	N/A
Pipe 4	N/A



Sensor Location

CLIENT FLOW MONITORING #: Site 1
NAME: Nolte Associates Nolte-Manteca

SFE PROJECT #: C81-01
SFE SITE #: C81-01-01

FIELD MAINTENANCE RECORD

LEGEND

DL - DOWNLOAD
CB - CHG BATTERY
V - VERIFY
LA - LEVEL ADJUST
PC - PROGRAM COMPLETE
PM - PROG. METER
VIS - VISUAL
VP - VELOCITY PROFILE

SITE#:	C81-01-01	CONSTANT	308.25
LOCATION:	Crawford & Gold Fever Dr		
STUDY:	Riverbank Sewer Flow Monitoring		
DEVICE:	AV	METER #	ISCO 40

DATE	TIME	METER TIME	METER DEPTH	FIELD MEAS	METER VEL	FIELD VEL-VIS	FLOW	BATT OLD	BATT NEW	SILT	MTR RUN	MTC BY	COMMENTS
M/D/YY	HH:MM	HH:MM	in.	in.	fps	fps	gpm	V	V	in.	Y/N	(INIT.)	
2/16/2007	11:27	11:27	4.25	4.25	0.87	N/A	124	N/A	11.9	0	Y	JFS	New Install
3/2/2007	12:07	12:07	3.45	3.75	0.97	N/A	103	11.2	N/A	0	Y	JFS	No data from 22Feb to 2Mar. Now logging
3/14/2007	13:39	12:39	3.48	3.75	0.92	N/A	102	11.1	N/A	0	Y	JFS	
3/29/2007	11:03	10:02	4	4.125	1.02	N/A	156	11	N/A	0	Y	JFS	
4/12/2007	12:24	0:00	4.19	4.75	0.99	N/A	139	11	N/A	0	Y	SB	
4/25/2007	10:02	9:01	4	3.95	3.75	N/A	135	10.5	N/A	0	Y	SB	PRE REMOVAL

NOTES:

Site Assessment

CLIENT FLOW MONITORING #:	**Site 2**	
NAME:	**Nolte Associates**	**Nolte - Manteca**
Date / Time:	02/16/07	12:25 PM

SFE PROJECT #:	**C81-01**
SFE SITE #:	**C81-01-02**

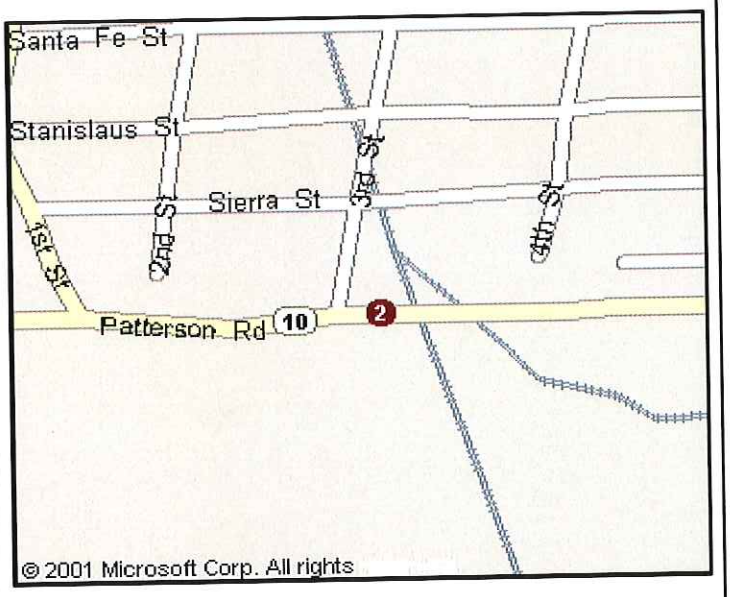
Project Specific Information

Client Name:	Nolte Associates	
End User Name:	Nolte - Manteca	
Project Name:	Riverbank Sewer Flow Monitoring	
Client Contact:	Reid Johnson	(209) 239-9080
Field Contact:	Jason Scott	(916) 837-8009
SFE PM Contact:	Paul Loving	(604) 992-6792

Site Location Information

Client Manhole #:	N/A
Address (Location):	Patterson Rd, Just E. of 3rd St
City, State:	Riverbank, CA
GPS (North - West):	N 37° 43.958 W 120° 56.101
Landmarks:	In Front of Dura Bilt
Additional Information:	

Map of Area



Traffic Control Requirements

Provider:	SFE
Condition	Moderate
Frequency:	Install / Maintenance / Removal
Speed Limit:	40 MPH
# of Lanes Effected:	1
Lane Configuration:	Road
Additional Information:	

Notes

1

2

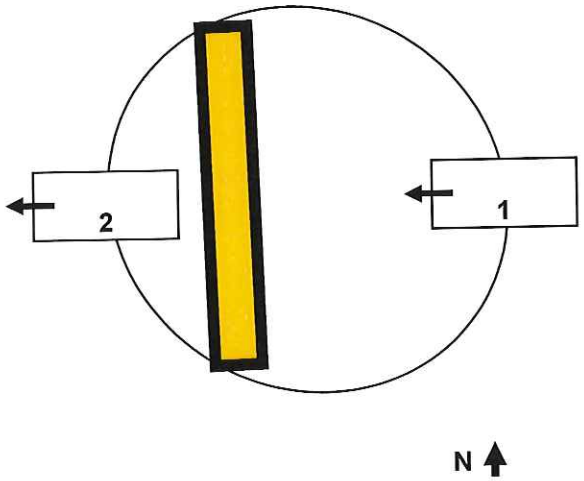
Site Equipment

Install / Remove Date:	02/16/07	04/25/07
Meter Make & Model:	ISCO 2150	
Level Type:	Pressure	
Velocity Type:	Average	
Primary Device:	Weir	
Wireless:	No	
Redundancy:	No	
Logging Rate:	5min	

Site Profile

Pipe #1 Size:	12	Inches
Pipe #2 Size:	12	Inches
Pipe #3 Size:	N/A	Inches
Pipe #4 Size:	N/A	Inches
Manhole Depth:	177.625	Inches
Laterals / Rungs:	Yes	No
Additional Information:	Not Catching Lateral	

Manhole Layout



Site Hydraulics

Date & Time:	02/16/07	12:25 PM
Depth:	3	Inches
Velocity:	1	FPS
Turbulent:	Yes	
Surcharge:	No	
Silting:	No	
Solids:	No	

Notes

3

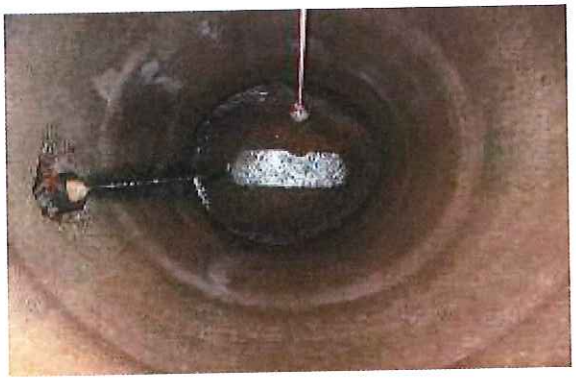
4

CLIENT FLOW MONITORING #: Site 2
NAME: Nolte Associates Nolte - Manteca
Date / Time: 02/16/07 12:25 PM

SFE PROJECT #: C81-01
SFE SITE #: C81-01-02

Picture 1

Picture 2



Picture 3

Picture 4

Notes

1
2
3

CCW Installation Form

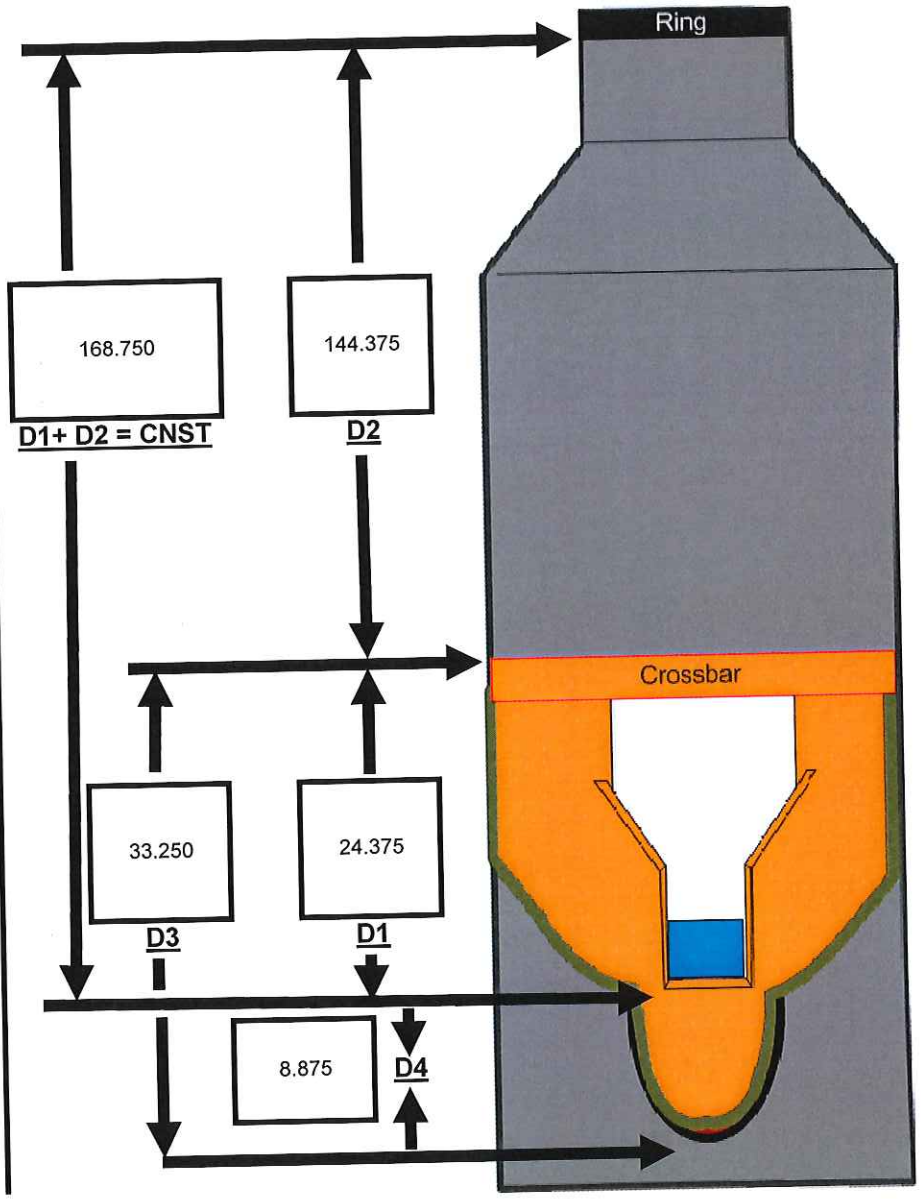
CLIENT FLOW MONITORING #: Site 2
NAME: Nolte Associates Nolte - Manteca
Date / Time: 02/16/07 2:25 PM

SFE PROJECT #: C81-01
SFE SITE #: C81-01-02
Technician 1: Jason Scott (916) 837-8009
Technician 2: John Garcia

Meter Depth vs.. Field Depth Calibration / Verification

Reading Number	Date	Time	Field Meas (in.)	Meter Depth (in)	Comments (Zero Meter Level before Installation)
Initial	2/16/2007	14:25	3.375	11.480	Pre Adjust
1	2/16/2007	14:28	3.000	3.140	
2	2/16/2007	14:32	3.125	3.170	
3	2/16/2007	14:35	3.125	3.210	
Average			3.080	3.170	

* Three Continuous Measurements Within 0.5 Inches
* Average Meter vs (WL1 and WL2) Within 5%



Manhole Depth (in) (D2+D3)
177.625

Pipe Diameters (in)

Pipe 1	12
Pipe 2	12
Pipe 3	N/A
Pipe 4	N/A

D4=Invert to Weir Lip (D3-D1)
8.875

Obvert to Weir Lip
2

MAINTENANCE SHEET

CLIENT FLOW MONITORING #: Site 2
NAME: Nolte Associates Nolte-Manteca

SFE PROJECT #: C81-01
SFE SITE #: C81-01-02

FIELD MAINTENANCE RECORD

SITE#:	C81-01-02	CONSTANT	168.75
LOCATION:	Patteson E. of 3rd St		
STUDY:	Riverbank Sewer Flow Monitoring		
DEVICE:	WEIR	METER #	ISCO 46

LEGEND

DL - DOWNLOAD
CB - CHG BATTERY
V - VERIFY
LA - LEVEL ADJUST
PC - PROGRAM COMPLETE
PM - PROG. METER
VIS - VISUAL
VP - VELOCITY PROFILE

DATE	TIME	METER TIME	METER DEPTH	FIELD MEAS	METER VEL	FIELD VEL-VIS	FLOW	BATT OLD	BATT NEW	SILT	MTR RUN	MTC BY	COMMENTS
M/D/YY	HH:MM	HH:MM	in.	in.	fps	fps	gpm	V	V	in.	Y/N	(INIT.)	
2/16/2007	14:35	14:25	3.21	3.125	0.26	N/A	89	N/A	11.7	0	Y	JFS	New Install
3/2/2007	12:23	12:23	3.76	3.875	*	N/A	110	11	N/A	0	Y	JFS	
3/14/2007	13:53	12:53	4.06	4	0.65	N/A	123	10.8	N/A	0	Y	JFS	
3/29/2007	11:32	10:32	3.58	3.25	0.35	N/A	103	10.8	N/A	0	Y	JFS	
4/12/2007	12:38	11:40	4.34	4.075	*	N/A	137	10.7	N/A	0	Y	SB	
4/25/2007	10:37	9:37	3.92	3.5	*	N/A	117	10.3	N/A	0	Y	SB	PRE REMOVAL

NOTES:

Site Assessment

CLIENT FLOW MONITORING #:	**Site 3**	
NAME:	**Nolte Associates**	**Nolte - Manteca**
Date / Time:	02/15/07	3:00 PM

SFE PROJECT #:	**C81-01**
SFE SITE #:	**C81-01-03**

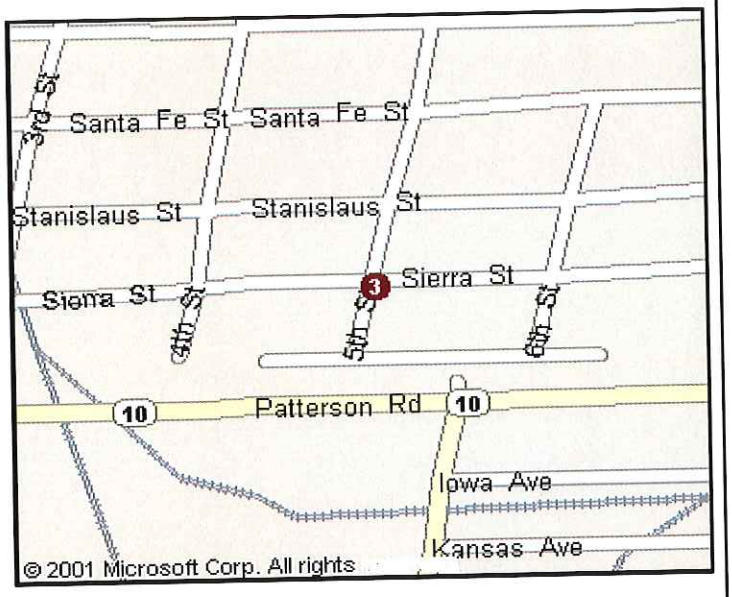
Project Specific Information

Client Name:	Nolte Associates	
End User Name:	Nolte - Manteca	
Project Name:	Riverbank Sewer Flow Monitoring	
Client Contact:	Reid Johnson	(209) 239-9080
Field Contact:	Jason Scott	(916) 837-8009
SFE PM Contact:	Paul Loving	(604) 992-6792

Site Location Information

Client Manhole #:	N/A
Address (Location):	5th St & Sierra St
City, State:	Riverbank, CA
GPS (North - West):	N 37° 44.040 W 120° 55.952
Landmarks:	
Additional Information:	N37.7340855619 W120.93239307

Map of Area



Traffic Control Requirements

Provider:	SFE
Condition	Local
Frequency:	Install / Maintenance / Removal
Speed Limit:	25 MPH
# of Lanes Effected:	1
Lane Configuration:	Intersection
Additional Information:	

Notes

1

2

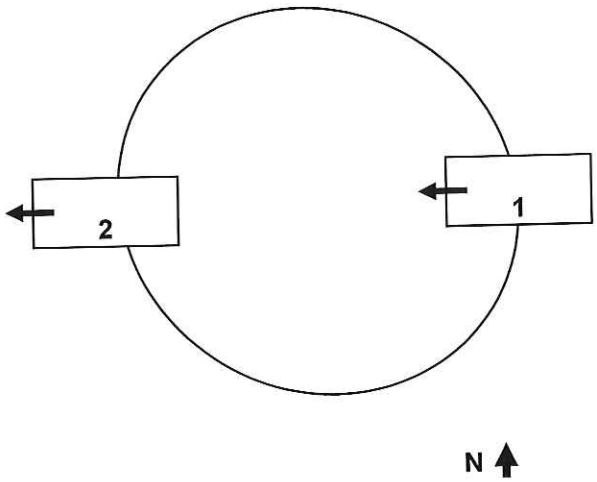
Site Equipment

Install / Remove Date:	02/15/07	04/25/07
Meter Make & Model:	ISCO 2150	
Level Type:	Pressure	
Velocity Type:	Average	
Primary Device:	Weir	
Wireless:	No	
Redundancy:	No	
Logging Rate:	5min	

Site Profile

Pipe #1 Size:	24	Inches
Pipe #2 Size:	24	Inches
Pipe #3 Size:	N/A	Inches
Pipe #4 Size:	N/A	Inches
Manhole Depth:	207.5	Inches
Laterals / Rungs:	No	No
Additional Information:	Sensor installed in Pipe #1	

Manhole Layout



Site Hydraulics

Date & Time:	02/15/07	3:00 PM
Depth:	4	Inches
Velocity:	1	FPS
Turbulent:	No	
Surcharge:	No	
Silting:	No	
Solids:	No	

Notes

3

4

CLIENT FLOW MONITORING #: Site 3
NAME: Nolte Associates Nolte - Manteca
Date / Time: 02/15/07 3:00 PM

SFE PROJECT #: C81-01
SFE SITE #: C81-01-03

Picture 1

Picture 2

Picture 3

Picture 4

Notes

1
2
3

Area Velocity Site Installation Form

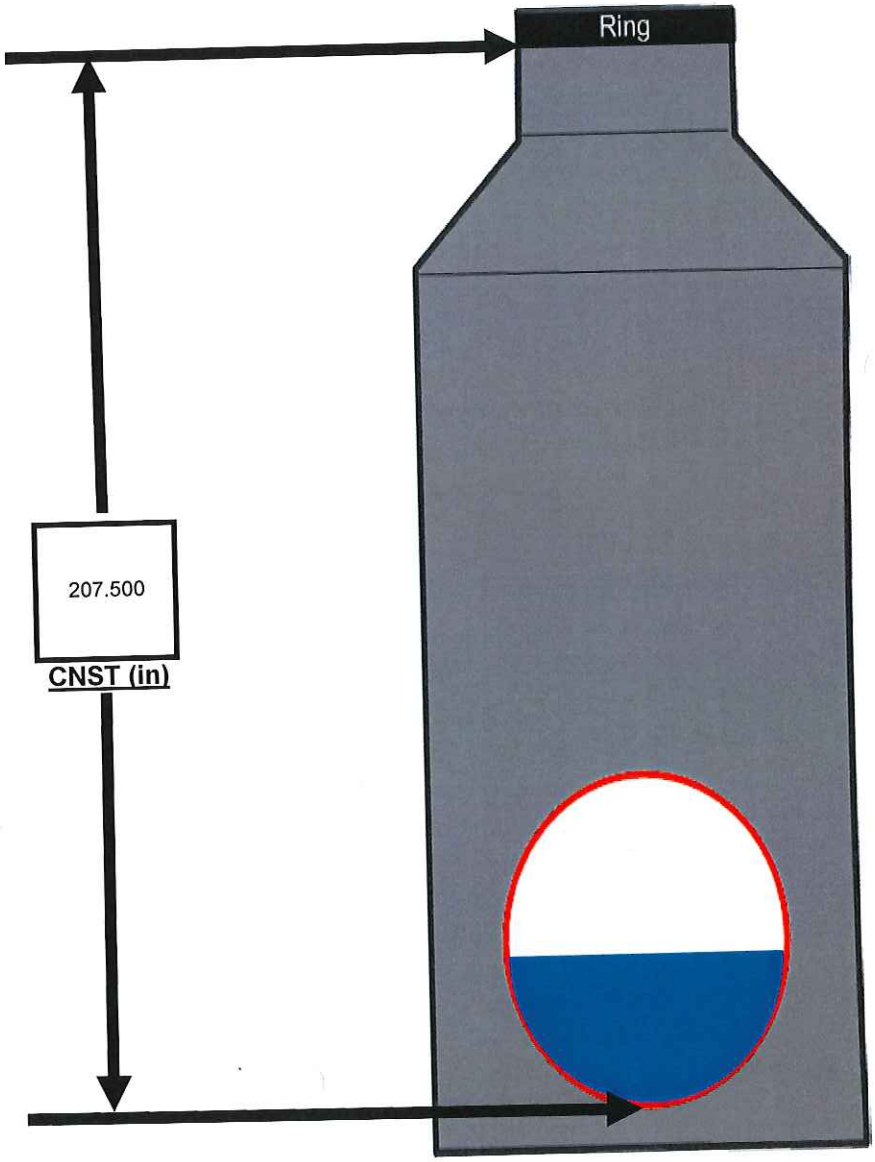
CLIENT FLOW MONITORING #: Site 3
NAME: Nolte Associates Nolte - Manteca
Date / Time: 02/15/07 4:11 PM

SFE PROJECT #: C81-01
SFE SITE #: C81-01-03
Technician 1: Jason Scott (916) 837-8009
Technician 2: John Garcia

Meter Depth vs.. Field Depth Calibration / Verification

Reading Number	Date	Time	Field Meas (in)	Meter Depth (in)	Comments (Zero Meter Level before Installation)
Initial	2/15/2007	16:11	3.625	3.220	Pre Adjust
1	2/15/2007	16:11	3.750	3.620	
2	2/15/2007	16:15	3.750	3.610	
3	2/15/2007	16:18	3.750	3.610	
Average			3.750	3.610	

* Three Continuous Measurements Within 0.5 Inches
* Average Meter vs (WL1 and WL2) Within 5%



Manhole Depth (in) = CNST
207.500

Pipe Diameters (in)

Pipe 1	24
Pipe 2	24
Pipe 3	N/A
Pipe 4	N/A

Sensor Location

Velocity Profile Form

CLIENT FLOW MONITORING #:	**Site 3**	**SFE PROJECT #:**	**C81-01**
NAME:	**Nolte Associates** / **Nolte - Manteca**	**SFE SITE #:**	**C81-01-03**
Date / Time:	02/15/07	4:05 PM	

Pipe Diameter (in):	24	**PV Meter**	Marsh Mcbirney
Weather	Sunny	**AV Meter:**	ISCO 2150

2-D Method

Depth from Invert (in)	Left Corner	Left	Center	Right	Right Corner
Average all readings					

0.9 Vmax Method

If depth is less than 4", use Max measured velocity x 0.9
Use above 2-D method as preferred method when possible

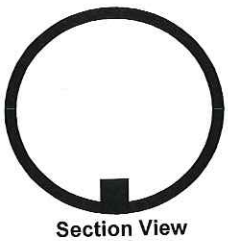
Max	0.88	**Max * 0.9**	0.79	

Velocity Profile Summary

Profile Average fps	Meter Reading fps	Meter Coeff.	Depth of Flow (in)	Time	
0.79	0.87	N/A	3.75	16:05	

Meter Location and Orientation

Sensor Location



Section View

Comments:

CLIENT FLOW MONITORING #: Site 3
NAME: Nolte Associates Nolte-Manteca

SFE PROJECT #: C81-01
SFE SITE #: C81-01-03

FIELD MAINTENANCE RECORD

SITE#:	C81-01-03	CONSTANT	207.5
LOCATION:	Sierra & 5th St		
STUDY:	Riverbank Sewer Flow Monitoring		
DEVICE:	AV	METER #	ISCO 47

LEGEND

DL - DOWNLOAD
CB - CHG BATTERY
V - VERIFY
LA - LEVEL ADJUST
PC - PROGRAM COMPLETE
PM - PROG. METER
VIS - VISUAL
VP - VELOCITY PROFILE

DATE	TIME	METER TIME	METER DEPTH	FIELD MEAS	METER VEL	FIELD VEL-VIS	FLOW	BATT OLD	BATT NEW	SILT	MTR RUN	MTC BY	COMMENTS
M/D/YY	HH:MM	HH:MM	in.	in.	fps	fps	gpm	V	V	in.	Y/N	(INIT.)	
2/15/2007	16:18	16:18	3.61	3.75	1.15	N/A	152	10.5	N/A	0	Y	JFS	New Install
3/2/2007	12:36	12:36	5.04	5	1.24	N/A	267	10.4	N/A	0	Y	JFS	
3/14/2007	14:03	13:03	3.77	4.25	0.94	N/A	137	10	N/A	0	Y	JFS	
3/29/2007	11:42	10:42	3.6	3.875	1.04	N/A	129	10.3	N/A	0	Y	JFS	
4/12/2007	12:56	12:52	4.42	4.875	1.14	N/A	253	9.9	12	0	Y	SB	
4/25/2007	11:22	10:21	3.87	4.25	0.92	N/A	133	11.5	N/A	0	Y	SB	PRE REMOVAL

NOTES:

Site Assessment

CLIENT FLOW MONITORING #:	**Site 4**	
NAME:	**Nolte Associates**	**Nolte - Manteca**
Date / Time:	02/15/07	11:00 AM

SFE PROJECT #:	**C81-01**
SFE SITE #:	**C81-01-04**

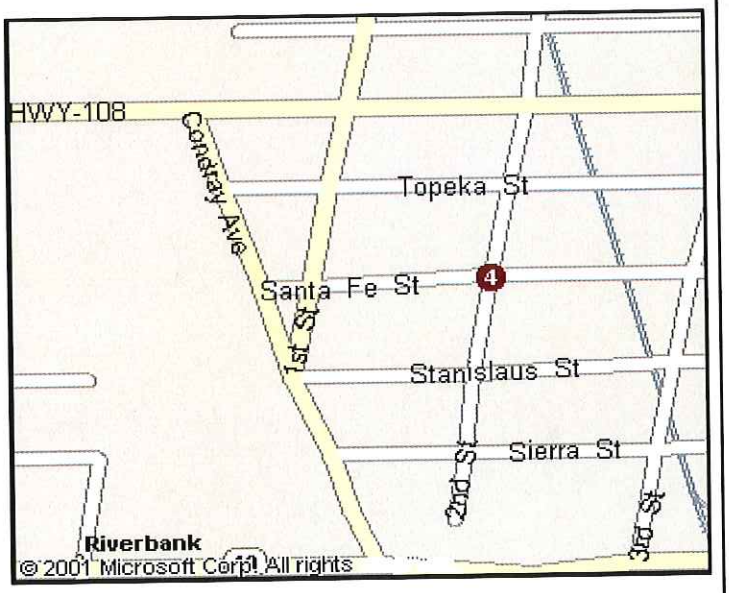
Project Specific Information

Client Name:	Nolte Associates	
End User Name:	Nolte - Manteca	
Project Name:	Riverbank Sewer Flow Monitoring	
Client Contact:	Reid Johnson	(209) 239-9080
Field Contact:	Jason Scott	(916) 837-8009
SFE PM Contact:	Paul Loving	(604) 992-6792

Site Location Information

Client Manhole #:	N/A
Address (Location):	Santa Fe St & 2nd St
City, State:	Riverbank, CA
GPS (North - West):	N 37° 44.160 W 120° 56.239
Landmarks:	
Additional Information:	N37.73602011729 W120.9373927

Map of Area



Traffic Control Requirements

Provider:	SFE
Condition	Local
Frequency:	Install / Maintenance / Removal
Speed Limit:	25 MPH
# of Lanes Effected:	
Lane Configuration:	Intersection
Additional Information:	

Notes

1

2

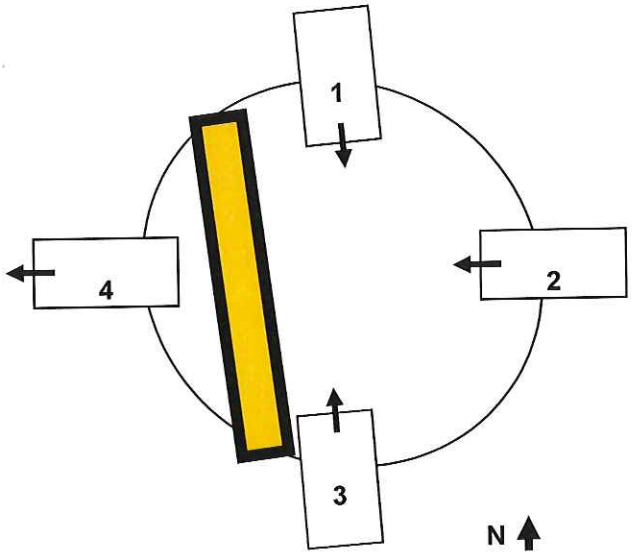
Site Equipment

Install / Remove Date:	02/15/07	04/25/07
Meter Make & Model:	ISCO 2150	
Level Type:	Pressure	
Velocity Type:	Average	
Primary Device:	Weir	
Wireless:	No	
Redundancy:	No	
Logging Rate:	5min	

Site Profile

Pipe #1 Size:	6	Inches
Pipe #2 Size:	10.5	Inches
Pipe #3 Size:	8	Inches
Pipe #4 Size:	10.5	Inches
Manhole Depth:	127.500	Inches
Laterals / Rungs:	Yes	No
Additional Information:		

Manhole Layout



Site Hydraulics

Date & Time:	02/15/07	11:00 AM
Depth:	4	Inches
Velocity:	1.5	FPS
Turbulent:	Yes	
Surcharge:	No	
Silting:	No	
Solids:	No	

Notes

3

4

CLIENT FLOW MONITORING #: Site 4
NAME: Nolte Associates Nolte - Manteca
Date / Time: 02/15/07 11:00 AM

SFE PROJECT #: C81-01
SFE SITE #: C81-01-04

Picture 1

Picture 2

Picture 3

Picture 4

Notes

1
2
3

CCW Installation Form

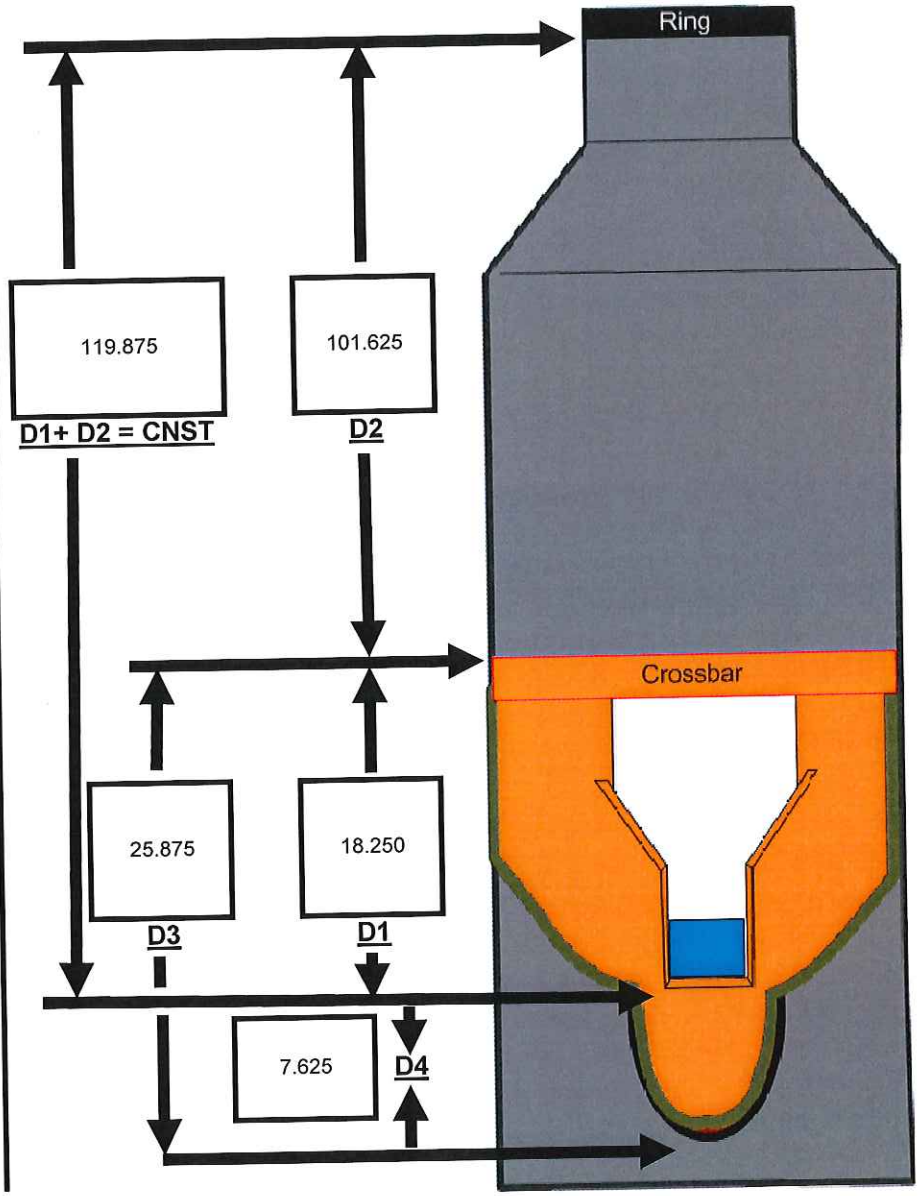
CLIENT FLOW MONITORING #: Site 4
NAME: Nolte Associates Nolte - Manteca
Date / Time: 02/15/07 1:02 PM

SFE PROJECT #: C81-01
SFE SITE #: C81-01-04
Technician 1: Jason Scott (916) 837-8009
Technician 2: John Garcia

Meter Depth vs.. Field Depth Calibration / Verification

Reading Number	Date	Time	Field Meas (in)	Meter Depth (in)	Comments (Zero Meter Level before Installation)
Initial	2/15/2007	13:02	2.625	9.560	Pre Adjust
1	2/15/2007	13:03	2.375	2.430	
2	2/15/2007	13:07	2.125	2.300	
3	2/15/2007	13:12	2.125	2.250	
Average			2.210	2.330	

* Three Continuous Measurements Within 0.5 Inches
* Average Meter vs (WL1 and WL2) Within 5%



Manhole Depth (in) (D2+D3)
127.500

Pipe Diameters (in)

Pipe 1	6
Pipe 2	10.5
Pipe 3	8
Pipe 4	10.5

D4=Invert to Weir Lip (D3-D1)
7.625

Obvert to Weir Lip
N/A

CLIENT FLOW MONITORING #: Site 4
NAME: Nolte Associates Nolte-Manteca

SFE PROJECT #: C81-01
SFE SITE #: C81-01-04

FIELD MAINTENANCE RECORD

SITE#:	C81-01-04	CONSTANT	119.875
LOCATION:	Santa Fe & 2nd St		
STUDY:	Riverbank Sewer Flow Monitoring		
DEVICE:	WEIR	METER #	ISCO 51

LEGEND

DL - DOWNLOAD
CB - CHG BATTERY
V - VERIFY
LA - LEVEL ADJUST
PC - PROGRAM COMPLETE
PM - PROG. METER
VIS - VISUAL
VP - VELOCITY PROFILE

DATE	TIME	METER TIME	METER DEPTH	FIELD MEAS	METER VEL	FIELD VEL-VIS	FLOW	BATT OLD	BATT NEW	SILT	MTR RUN	MTC BY	COMMENTS
M/D/YY	HH:MM	HH:MM	in.	in.	fps	fps	gpm	V	V	in.	Y/N	(INIT.)	
2/15/2007	13:12	13:12	2.25	2.125	0.27	N/A	102	N/A	11.8	0	Y	JFS	New Install
3/2/2007	12:43	12:43	2.18	2.25	*	N/A	96	11.1	N/A	0	Y	JFS	
3/14/2007	14:12	13:12	2.04	2	*	N/A	88	10.6	N/A	0	Y	JFS	
3/29/2007	11:59	10:59	2.55	2.125	*	N/A	122	10.2	N/A	0	Y	JFS	
4/12/2007	1:03	12:04	2.31	2.125	*	N/A	105	10.9	N/A	0	Y	SB	
4/25/2007	11:45	10:44	2.92	2.5	*	N/A	134	9.6	N/A	0	Y	SB	PRE REMOVAL

NOTES:

Site Assessment

CLIENT FLOW MONITORING #: Site 5
NAME: Nolte Associates — Nolte - Manteca
Date / Time: 02/15/07 10:00 AM

SFE PROJECT #: C81-01
SFE SITE #: C81-01-05

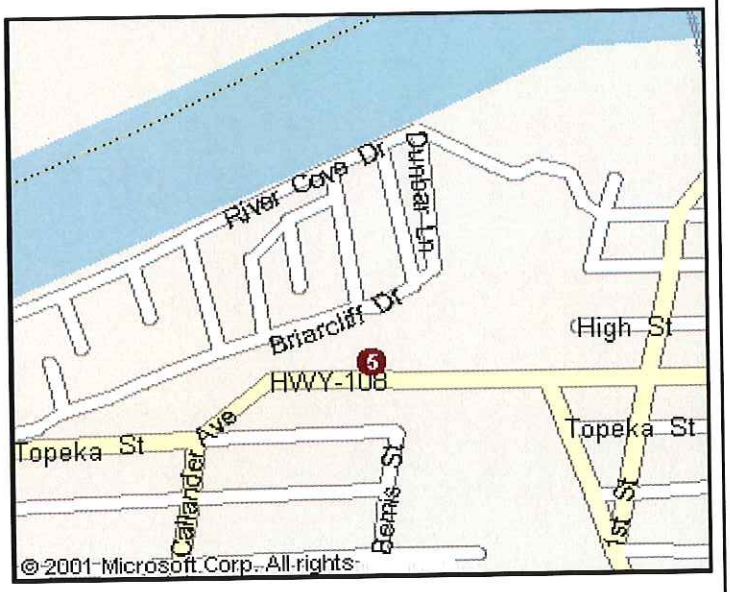
Project Specific Information

Client Name:	Nolte Associates	
End User Name:	Nolte - Manteca	
Project Name:	Riverbank Sewer Flow Monitoring	
Client Contact:	Reid Johnson	(209) 239-9080
Field Contact:	Jason Scott	(916) 837-8009
SFE PM Contact:	Paul Loving	(604) 992-6792

Site Location Information

Client Manhole #:	N/A
Address (Location):	Hwy 108 & Prestwick Dr
City, State:	Riverbank, CA
GPS (North - West):	N 37° 44.294 W 120° 56.632
Landmarks:	Road not shown on map
Additional Information:	N37.7381582512 W120.9437656

Map of Area



Traffic Control Requirements

Provider:	SFE
Condition	Local
Frequency:	Install / Maintenance / Removal
Speed Limit:	25 MPH
# of Lanes Effected:	2
Lane Configuration:	Road
Additional Information:	

Notes

1 Very deep manhole
2

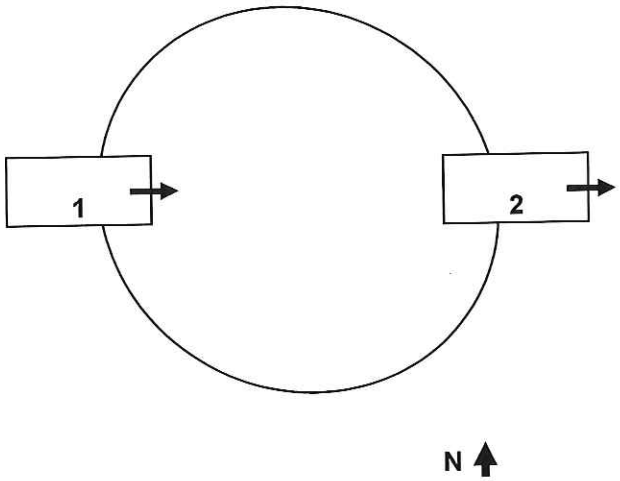
Site Equipment

Install / Remove Date:	02/15/07	04/25/07
Meter Make & Model:	ISCO 2150	
Level Type:	Pressure	
Velocity Type:	Average	
Primary Device:	Pipe	
Wireless:	No	
Redundancy:	No	
Logging Rate:	5min	

Site Profile

Pipe #1 Size:	24.5	Inches
Pipe #2 Size:	24.5	Inches
Pipe #3 Size:	N/A	Inches
Pipe #4 Size:	N/A	Inches
Manhole Depth:	282.750	Inches
Laterals / Rungs:	No	No
Additional Information:	Sensor installed in Pipe #1	

Manhole Layout



Site Hydraulics

Date & Time:	02/15/07	10:00 AM
Depth:	8	Inches
Velocity:	1.5	FPS
Turbulent:	No	
Surcharge:	No	
Silting:	No	
Solids:	No	

Notes

3
4

CLIENT FLOW MONITORING #: Site 5
NAME: Nolte Associates Nolte - Manteca
Date / Time: 02/15/07 10:00 AM

SFE PROJECT #: C81-01
SFE SITE #: C81-01-05

Picture 1

Picture 2

Picture 3

Picture 4

Notes

1
2
3

Area Velocity Site Installation Form

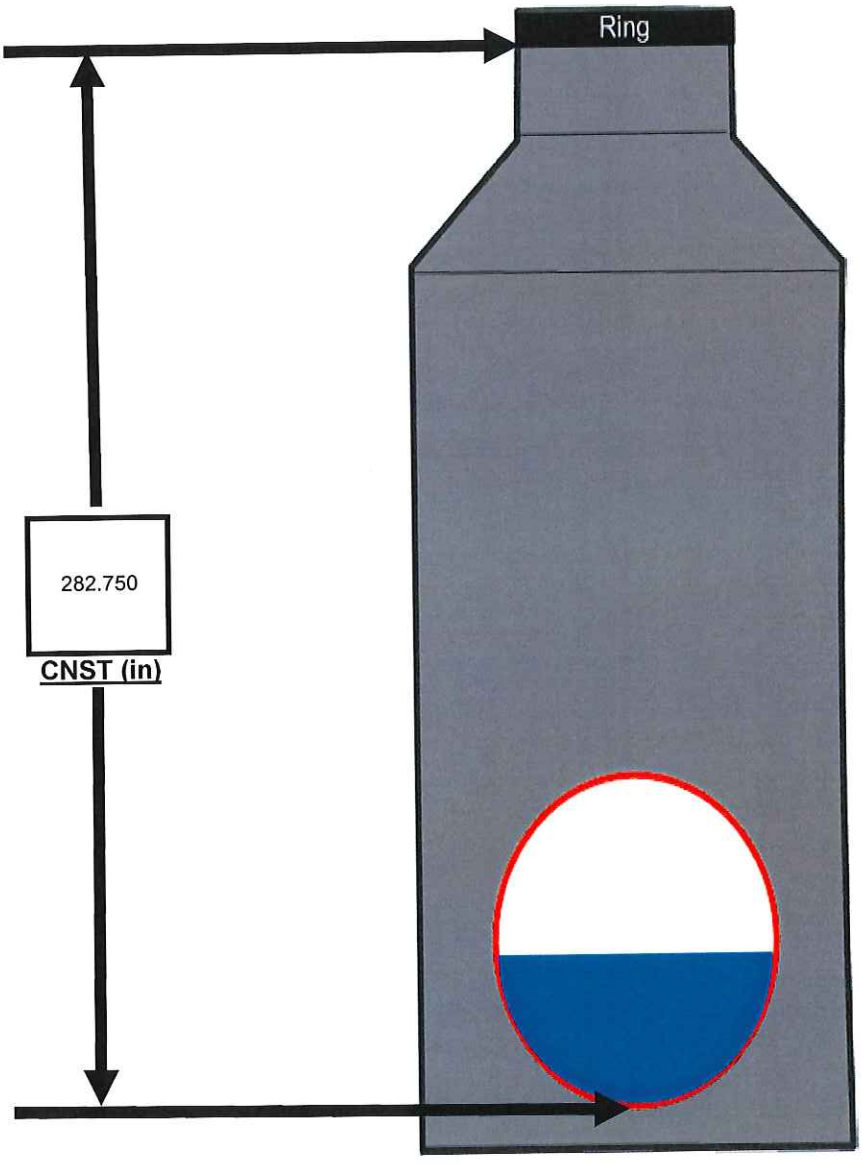
CLIENT FLOW MONITORING #: Site 5
NAME: Nolte Associates — Nolte - Manteca
Date / Time: 02/15/07 10:30 AM

SFE PROJECT #: C81-01
SFE SITE #: C81-01-05
Technician 1: Jason Scott (916) 837-8009
Technician 2: John Garcia

Meter Depth vs.. Field Depth Calibration / Verification

Reading Number	Date	Time	Field Meas (in)	Meter Depth (in)	Comments (Zero Meter Level before Installation)
Initial	2/15/2007	10:31	6.500	4.240	Pre Adjust
1	2/15/2007	10:32	6.375	6.450	
2	2/15/2007	10:34	6.375	6.430	
3	2/15/2007	10:38	6.375	6.400	
Average			6.375	6.430	

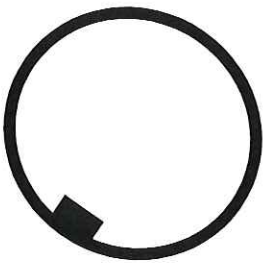
* Three Continuous Measurements Within 0.5 Inches
* Average Meter vs (WL1 and WL2) Within 5%



Manhole Depth (in) = CNST
282.750

Pipe Diameters (in)

Pipe 1	24.5
Pipe 2	24.5
Pipe 3	N/A
Pipe 4	N/A



Sensor Location

CLIENT FLOW MONITORING #: Site 5
NAME: Nolte Associates Nolte-Manteca

SFE PROJECT #: C81-01
SFE SITE #: C81-01-05

FIELD MAINTENANCE RECORD

LEGEND

DL - DOWNLOAD PC - PROGRAM COMPLETE
CB - CHG BATTERY PM - PROG. METER
V - VERIFY VIS - VISUAL
LA - LEVEL ADJUST VP - VELOCITY PROFILE

SITE#:	C81-01-05	CONSTANT	282.75
LOCATION:	Hwy 108 & Prestwick Rd		
STUDY:	Riverbank Sewer Flow Monitoring		
DEVICE:	AV	METER #	SFE 10

DATE	TIME	METER TIME	METER DEPTH	FIELD MEAS	METER VEL	FIELD VEL-VIS	FLOW	BATT OLD	BATT NEW	SILT	MTR RUN	MTC BY	COMMENTS
M/D/YY	HH:MM	HH:MM	in.	in.	fps	fps	gpm	V	V	in.	Y/N	(INIT.)	
2/15/2007	10:58	10:58	6.4	6.375	1.41	N/A	433	N/A	11.8	0	Y	JFS	New Install
3/2/2007	12:52	12:52	5.96	6	1.38	N/A	382	11.2	N/A	0	Y	JFS	
3/14/2007	14:32	13:32	6.02	6	1.59	N/A	448	11	N/A	0	Y	JFS	
3/29/2007	12:00	11:00	6.11	6.25	1.64	N/A	481	10.8	N/A	0	Y	JFS	
4/12/2007	1:13	12:14	6.66	6.25	1.72	N/A	529	10.8	N/A	0	Y	SB	
4/25/2007	12:21	11:20	6.22	6.125	1.23	N/A	363	10.8	N/A	0	Y	SB	PRE REMOVAL

NOTES:

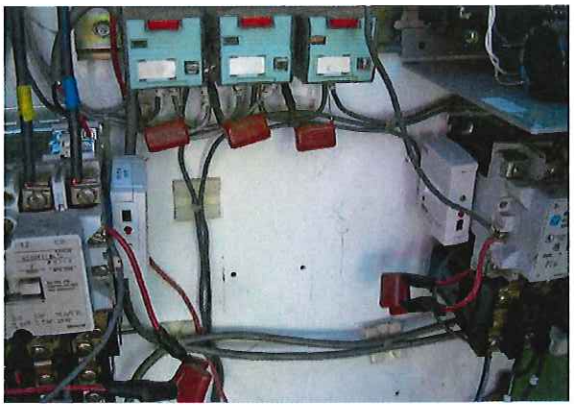
MAINTENANCE SHEET

CLIENT FLOW MONITORING #: Candlewood PS, P1
NAME: Nolte Associates Nolte - Manteca
Date / Time: 02/20/07
Location: Candlewood Pumpstation
GPS: N 37° 44.143 W 120° 57.409

SFE PROJECT #: C81-01
SFE SITE #: C81-01-01-P1
Technician 1: Adrian Marshall
Technician 2:

Pump Station Logger Install/Maintenance

Date M/D/YY	Actual Time HH:MM	Logger Time HH:MM	Download O.K.	Launch O.K.	Comments
2/20/2007			N/A	Yes	New Install
3/2/2007	10:30	10:30	Yes	Yes	
3/14/2007					Loggers not on pump
3/29/2007	10:16	9:16	Yes	Yes	Loggers Back, not sure of
					dates in data
4/12/2007	11:02	11:02	Yes	Yes	
4/25/2007	11:07	11:07	Yes	Yes	PRE REMOVAL



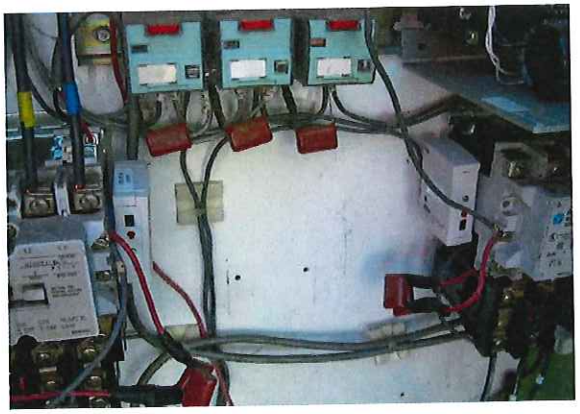
MAINTENANCE SHEET

CLIENT FLOW MONITORING #: Candlewood PS, P2
NAME: Nolte Associates — Nolte - Manteca
Date / Time: 02/20/07
Location: Candlewood Pumpstation
GPS: N 37° 44.143 W 120° 57.409

SFE PROJECT #: C81-01
SFE SITE #: C81-01-01-P2
Technician 1: Adrian Marshall
Technician 2:

Pump Station Logger Install/Maintenance

Date M/D/YY	Actual Time HH:MM	Logger Time HH:MM	Download O.K.	Launch O.K.	Comments
2/20/2007			N/A	Yes	New Install
3/2/2007	10:34	10:34	Yes	Yes	
3/29/2007	10:20	9:20	Yes	Yes	Loggers Back, not sure of dates in data
4/12/2007	11:10	11:10	Yes	Yes	
4/25/2007	11:08	11:08	Yes	Yes	PRE REMOVAL



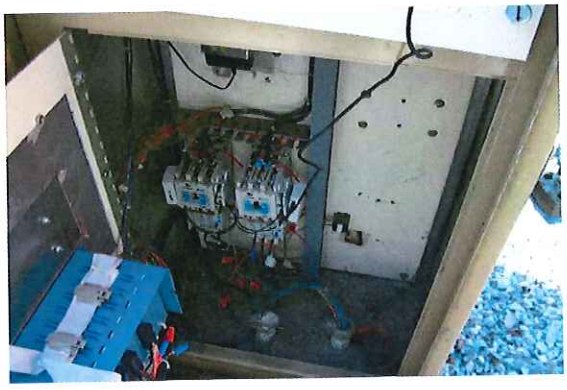
MAINTENANCE SHEET

CLIENT FLOW MONITORING #: Colony Manor PS, P1
NAME: Nolte Associates Nolte - Manteca
Date / Time: 02/20/07
Location: Estelle Lift Station
GPS: N 37° 43.851 W 120° 57.247

SFE PROJECT #: C81-01
SFE SITE #: C81-01-02-P1
Technician 1: Adrian Marshall
Technician 2:

Pump Station Logger Install/Maintenance

Date M/D/YY	Actual Time HH:MM	Logger Time HH:MM	Download O.K.	Launch O.K.	Comments
2/20/2007			N/A	Yes	New Install
3/2/2007	10:43	10:43	Yes	Yes	
3/14/2007	10:57	9:57	Yes	Yes	
3/29/2007	10:31	9:31	Yes	Yes	
4/12/2007	11:23	11:24	Yes	Yes	
4/25/2007	11:17	11:17	Yes	Yes	PRE REMOVAL



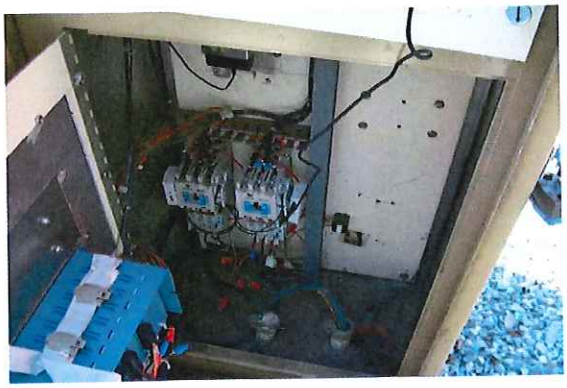
MAINTENANCE SHEET

CLIENT FLOW MONITORING #: Colony Manor PS, P2
NAME: Nolte Associates — Nolte - Manteca
Date / Time: 02/20/07
Location: Estelle Lift Station
GPS: N 37° 43.851 W 120° 57.247

SFE PROJECT #: C81-01
SFE SITE #: C81-01-02-P2
Technician 1: Adrian Marshall
Technician 2:

Pump Station Logger Install/Maintenance

Date M/D/YY	Actual Time HH:MM	Logger Time HH:MM	Download O.K.	Launch O.K.	Comments
2/20/2007			N/A	Yes	New Install
3/2/2007	10:46	10:46	Yes	Yes	
3/14/2007	11:00	10:00	Yes	Yes	
3/29/2007	10:28	9:28	Yes	Yes	
4/12/2007	11:28	11:28	Yes	Yes	
4/25/2007	11:18	11:18	Yes	Yes	PRE REMOVAL



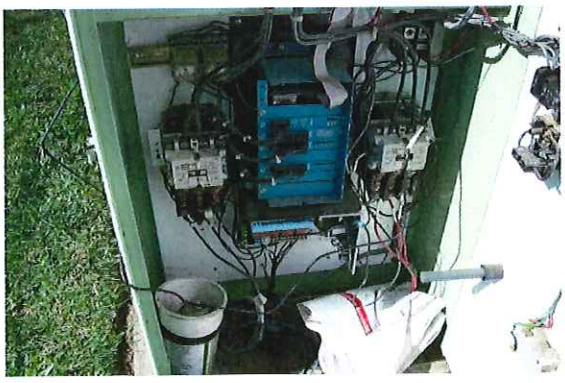
MAINTENANCE SHEET

CLIENT FLOW MONITORING #: Jackson PS, P1
NAME: Nolte Associates Nolte - Manteca
Date / Time: 02/20/07
Location: Jackson Pumpstation
GPS:

SFE PROJECT #: C81-01
SFE SITE #: C81-01-03-P1
Technician 1: Adrian Marshall
Technician 2:

Pump Station Logger Install/Maintenance

Date M/D/YY	Actual Time HH:MM	Logger Time HH:MM	Download O.K.	Launch O.K.	Comments
2/20/2007			N/A	Yes	New Install
3/2/2007	10:55	10:55	Yes	Yes	
3/14/2007	11:57	10:57	Yes	Yes	
3/29/2007	10:38	9:38	Yes	Yes	
4/12/2007	11:35	11:35	Yes	Yes	
4/25/2007	11:22	11:22	Yes	Yes	PRE REMOVAL



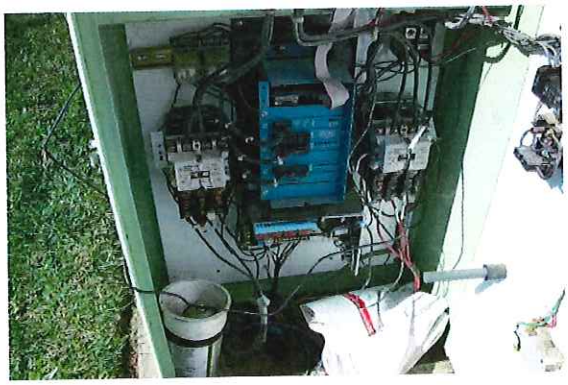
MAINTENANCE SHEET

CLIENT FLOW MONITORING #: Jackson PS, P2
NAME: Nolte Associates Nolte - Manteca
Date / Time: 02/20/07
Location: Jackson Pumpstation
GPS:

SFE PROJECT #: C81-01
SFE SITE #: C81-01-03-P2
Technician 1: Adrian Marshall
Technician 2:

Pump Station Logger Install/Maintenance

Date M/D/YY	Actual Time HH:MM	Logger Time HH:MM	Download O.K.	Launch O.K.	Comments
2/20/2007			N/A	Yes	New Install
3/2/2007	10:57	10:57	Yes	Yes	
3/14/2007	12:01	11:01	Yes	Yes	
3/29/2007	10:40	9:41	Yes	Yes	
4/12/2007	11:36	11:36	Yes	Yes	
4/25/2007	11:23	11:23	Yes	Yes	PRE REMOVAL



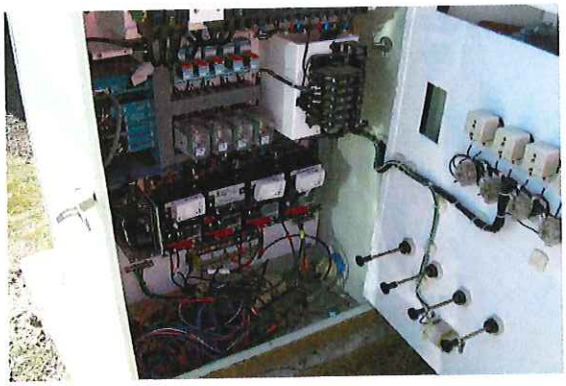
MAINTENANCE SHEET

CLIENT FLOW MONITORING #: Roselle PS, P1
NAME: Nolte Associates Nolte - Manteca
Date / Time: 02/20/07
Location: Roselle Pumpstation
GPS: N 37° 43.574 W 120° 56.431

SFE PROJECT #: C81-01
SFE SITE #: C81-01-04-P1
Technician 1: Adrian Marshall
Technician 2:

Pump Station Logger Install/Maintenance

Date M/D/YY	Actual Time HH:MM	Logger Time HH:MM	Download O.K.	Launch O.K.	Comments
2/20/2007			N/A	Yes	New Install
3/2/2007	11:11	11:11	Yes	Yes	
3/14/2007	12:40	11:40	Yes	Yes	
3/29/2007	10:47	9:48	Yes	Yes	
4/12/2007	11:46	11:46	Yes	Yes	
4/25/2007	10:30	10:30	Yes	Yes	PRE REMOVAL



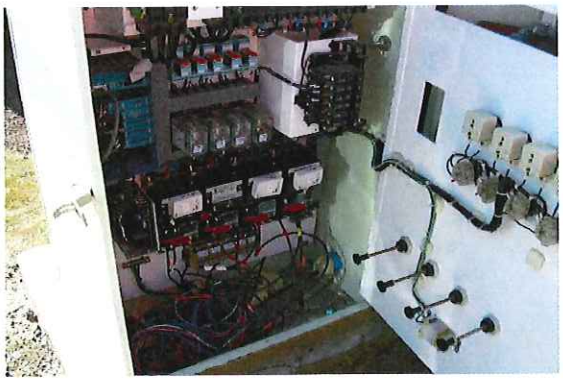
MAINTENANCE SHEET

CLIENT FLOW MONITORING #: Roselle PS, P2
NAME: Nolte Associates Nolte - Manteca
Date / Time: 02/20/07
Location: Roselle Pumpstation
GPS: N 37° 43.574 W 120° 56.431

SFE PROJECT #: C81-01
SFE SITE #: C81-01-04-P2
Technician 1: Adrian Marshall
Technician 2:

Pump Station Logger Install/Maintenance

Date M/D/YY	Actual Time HH:MM	Logger Time HH:MM	Download O.K.	Launch O.K.	Comments
2/20/2007			N/A	Yes	New Install
3/2/2007	11:18	11:18	Yes	Yes	
3/14/2007	12:42	11:42	Yes	Yes	
3/29/2007	10:49	9:49	Yes	Yes	
4/12/2007	11:46	11:46	Yes	Yes	
4/25/2007	10:33	10:33	Yes	Yes	PRE REMOVAL



MAINTENANCE SHEET

CLIENT FLOW MONITORING #: Roselle PS, P3
NAME: Nolte Associates Nolte - Manteca
Date / Time: 02/20/07
Location: Roselle Pumpstation
GPS: N 37° 43.574 W 120° 56.431

SFE PROJECT #: C81-01
SFE SITE #: C81-01-04-P3
Technician 1: Adrian Marshall
Technician 2:

Pump Station Logger Install/Maintenance

Date M/D/YY	Actual Time HH:MM	Logger Time HH:MM	Download O.K.	Launch O.K.	Comments
2/20/2007			N/A	Yes	New Install
3/2/2007	11:21	11:21	Yes	Yes	
3/14/2007	12:44	11:44	Yes	Yes	
3/29/2007	10:51	9:51	No	Yes	Logger did not get launched.
					No data
4/12/2007	11:50	11:50	Yes	Yes	
4/25/2007	10:35	10:35	Yes	Yes	PRE REMOVAL

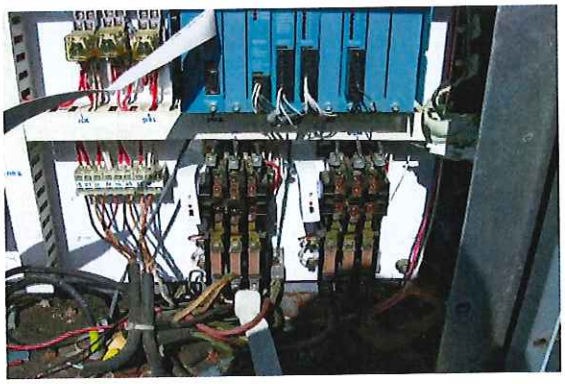
MAINTENANCE SHEET

CLIENT FLOW MONITORING #: Terminal PS, P1
NAME: Nolte Associates Nolte - Manteca
Date / Time: 02/20/07
Location: Terminal Pumpstation
GPS: N 37° 43.477 W 120° 55.878

SFE PROJECT #: C81-01
SFE SITE #: C81-01-05-P1
Technician 1: Adrian Marshall
Technician 2:

Pump Station Logger Install/Maintenance

Date M/D/YY	Actual Time HH:MM	Logger Time HH:MM	Download O.K.	Launch O.K.	Comments
2/20/2007			N/A	Yes	New Install
3/2/2007	11:35	11:35	Yes	Yes	
3/14/2007	13:08	12:08	Yes	Yes	
3/29/2007	11:15	10:15	Yes	Yes	
4/12/2007	11:59	11:59	Yes	Yes	
4/25/2007	10:43	10:43	Yes	Yes	PRE REMOVAL



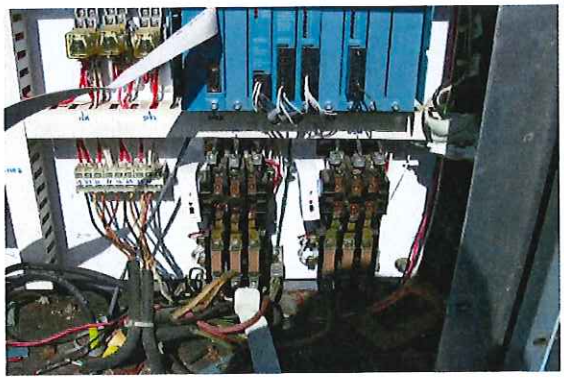
MAINTENANCE SHEET

CLIENT FLOW MONITORING #: Terminal PS, P2
NAME: Nolte Associates Nolte - Manteca
Date / Time: 02/20/07
Location: Terminal Pumpstation
GPS: N 37° 43.477 W 120° 55.878

SFE PROJECT #: C81-01
SFE SITE #: C81-01-05-P2
Technician 1: Adrian Marshall
Technician 2:

Pump Station Logger Install/Maintenance

Date M/D/YY	Actual Time HH:MM	Logger Time HH:MM	Download O.K.	Launch O.K.	Comments
2/20/2007			N/A	Yes	New Install
3/2/2007	11:37	11:37	Yes	Yes	
3/14/2007	13:09	12:09	Yes	Yes	
3/29/2007	11:17	10:17	Yes	Yes	
4/12/2007	12:01	12:01	Yes	Yes	
4/25/2007	10:45	10:45	Yes	Yes	PRE REMOVAL



MAINTENANCE SHEET

CLIENT FLOW MONITORING #: Townsend PS, P1
NAME: Nolte Associates Nolte - Manteca
Date / Time: 02/20/07
Location: Townsend Pumpstation
GPS: N 37° 43.371 W 120° 55.604

SFE PROJECT #: C81-01
SFE SITE #: C81-01-06-P1
Technician 1: Adrian Marshall
Technician 2:

Pump Station Logger Install/Maintenance

Date M/D/YY	Actual Time HH:MM	Logger Time HH:MM	Download O.K.	Launch O.K.	Comments
2/20/2007			N/A	Yes	New Install
3/2/2007	11:46	11:46	Yes	Yes	
3/14/2007	13:18	12:18	Yes	Yes	
3/29/2007	11:22	10:22	Yes	Yes	
4/12/2007	12:10	12:10	Yes	Yes	
4/25/2007	10:53	10:53	Yes	Yes	PRE REMOVAL

MAINTENANCE SHEET

CLIENT FLOW MONITORING #: Townsend PS, P2
NAME: Nolte Associates Nolte - Manteca
Date / Time: 02/20/07
Location: Townsend Pumpstation
GPS: N 37° 43.371 W 120° 55.604

SFE PROJECT #: C81-01
SFE SITE #: C81-01-06-P2
Technician 1: Adrian Marshall
Technician 2:

Pump Station Logger Install/Maintenance

Date M/D/YY	Actual Time HH:MM	Logger Time HH:MM	Download O.K.	Launch O.K.	Comments
2/20/2007			N/A	Yes	New Install
3/2/2007	11:50	11:50	Yes	Yes	
3/14/2007	13:20	12:20	Yes	Yes	
3/29/2007	11:23	10:24	Yes	Yes	
4/12/2007	12:11	12:11	Yes	Yes	
4/25/2007	10:55	10:55	Yes	Yes	PRE REMOVAL

APPENDIX B

PROJECTED ADWF CALCULATIONS BY CATCHMENT ZONE

TABLE B-1
CITY OF RIVERBANK
2007 SEWER COLLECTION SYSTEM MASTER PLAN
LAND USES AND PROJECTED ADWF
CATCHMENT ZONE 1

Land Use	Land Use Description	Net Area (acres)	WGF (gpd/acre)	ADWF (gpd)
C	Commercial	48.2	1400	67,432
MDR	Medium Density Residential	221.3	1500	331,968
TOTAL		269.5		399,400

TABLE B-2
CITY OF RIVERBANK
2007 SEWER COLLECTION SYSTEM MASTER PLAN
LAND USES AND PROJECTED ADWF
CATCHMENT ZONE 2

Land Use	Land Use Description	Net Area (acres)	WGF (gpd/acre)	ADWF (gpd)
P	Park	1.6	1400	2,189
MDR	Medium Density Residential	93.2	1500	139,847
TOTAL		94.8		142,036

TABLE B-3
CITY OF RIVERBANK
2007 SEWER COLLECTION SYSTEM MASTER PLAN
LAND USES AND PROJECTED ADWF
CATCHMENT ZONE 3

Land Use	Land Use Description	Net Area (acres)	WGF (gpd/acre)	ADWF (gpd)
P	Park	13.6	1400	18,982
SC	School – Civic	5.3	200	1,052
LDR	Low Density Residential	13.9	600	8,337
MDR	Medium Density Residential	62.2	1500	93,231
TOTAL		95		121,603

TABLE B-4
CITY OF RIVERBANK
2007 SEWER COLLECTION SYSTEM MASTER PLAN
LAND USES AND PROJECTED ADWF
CATCHMENT ZONE 4

Land Use	Land Use Description	Net Area (acres)	WGF (gpd/acre)	ADWF (gpd)
P	Park	5.4	1400	3,291
SC	School – Civic	16.5	200	6,397
LDR	Low Density Residential	23.3	600	13,970
MDR	Medium Density Residential	93.2	1500	139,847
TOTAL		138.4		2.91

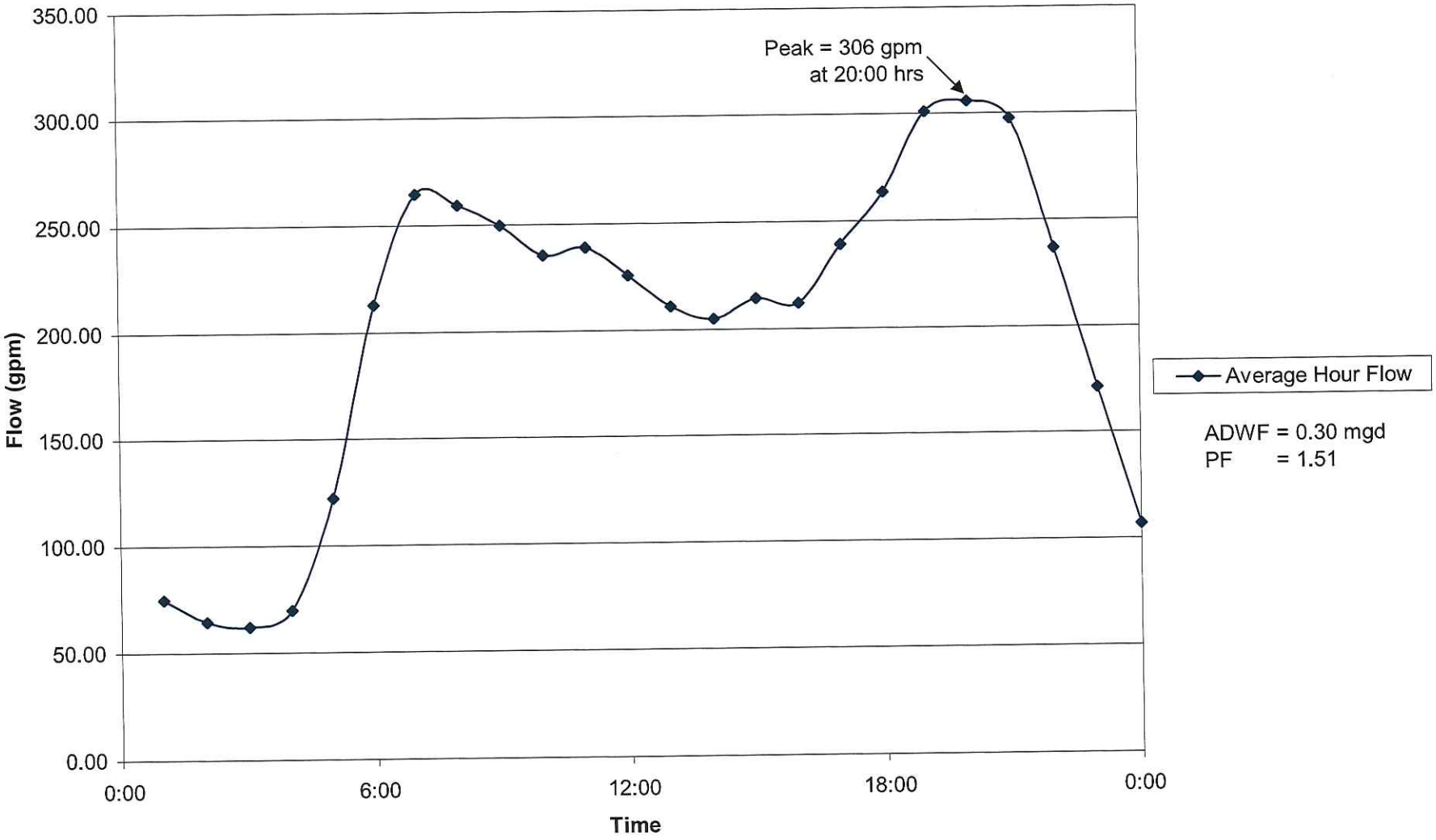
TABLE B-5
CITY OF RIVERBANK
2007 SEWER COLLECTION SYSTEM MASTER PLAN
LAND USES AND PROJECTED ADWF
CATCHMENT ZONE 5

Land Use	Land Use Description	Net Area (acres)	WGF (gpd/acre)	ADWF (gpd)
SC	School – Civic	7.5	200	1,508
MDR	Medium Density Residential	268.6	1500	402,857
C	Commerical	68.6	1400	95,998
P	Park	11.3	1400	15,868
--	Non-flow contributing areas	2.1	0	0.00
TOTAL		358.1		516,231

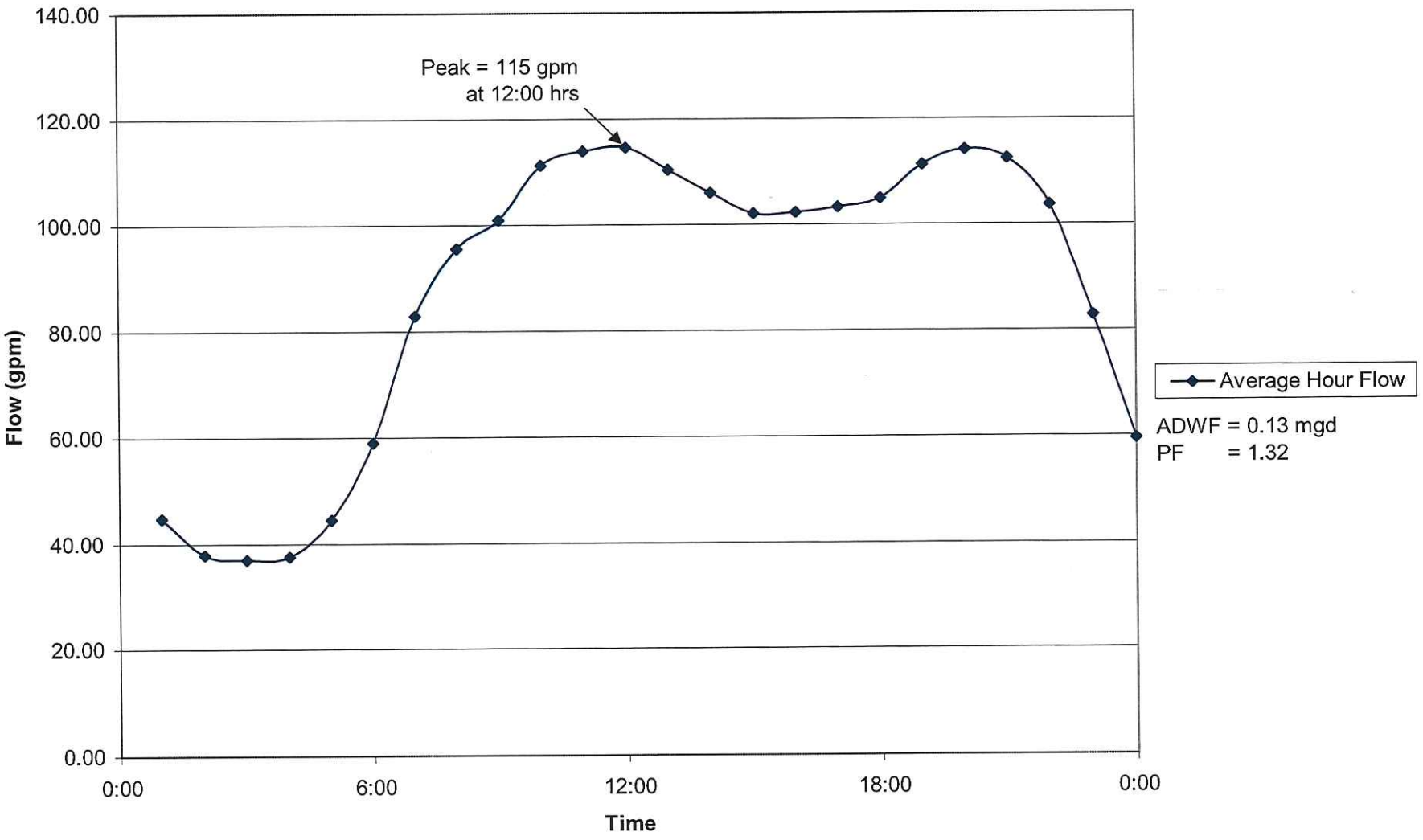
APPENDIX C

AVERAGE DRY WEATHER FLOW GRAPHS FROM 2007 FLOW MONITORING STUDY

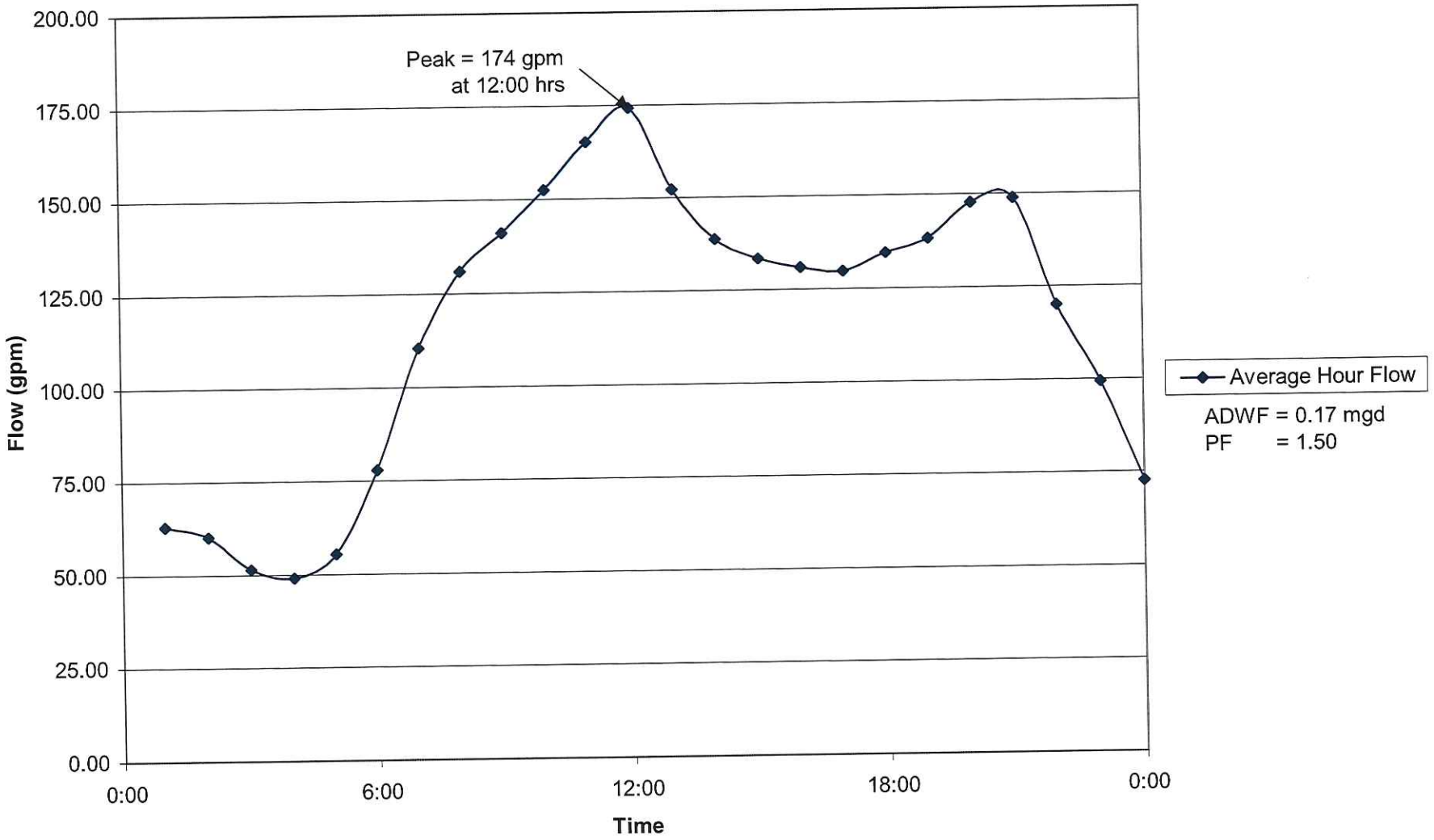
S1
Average Dry Weather Flow

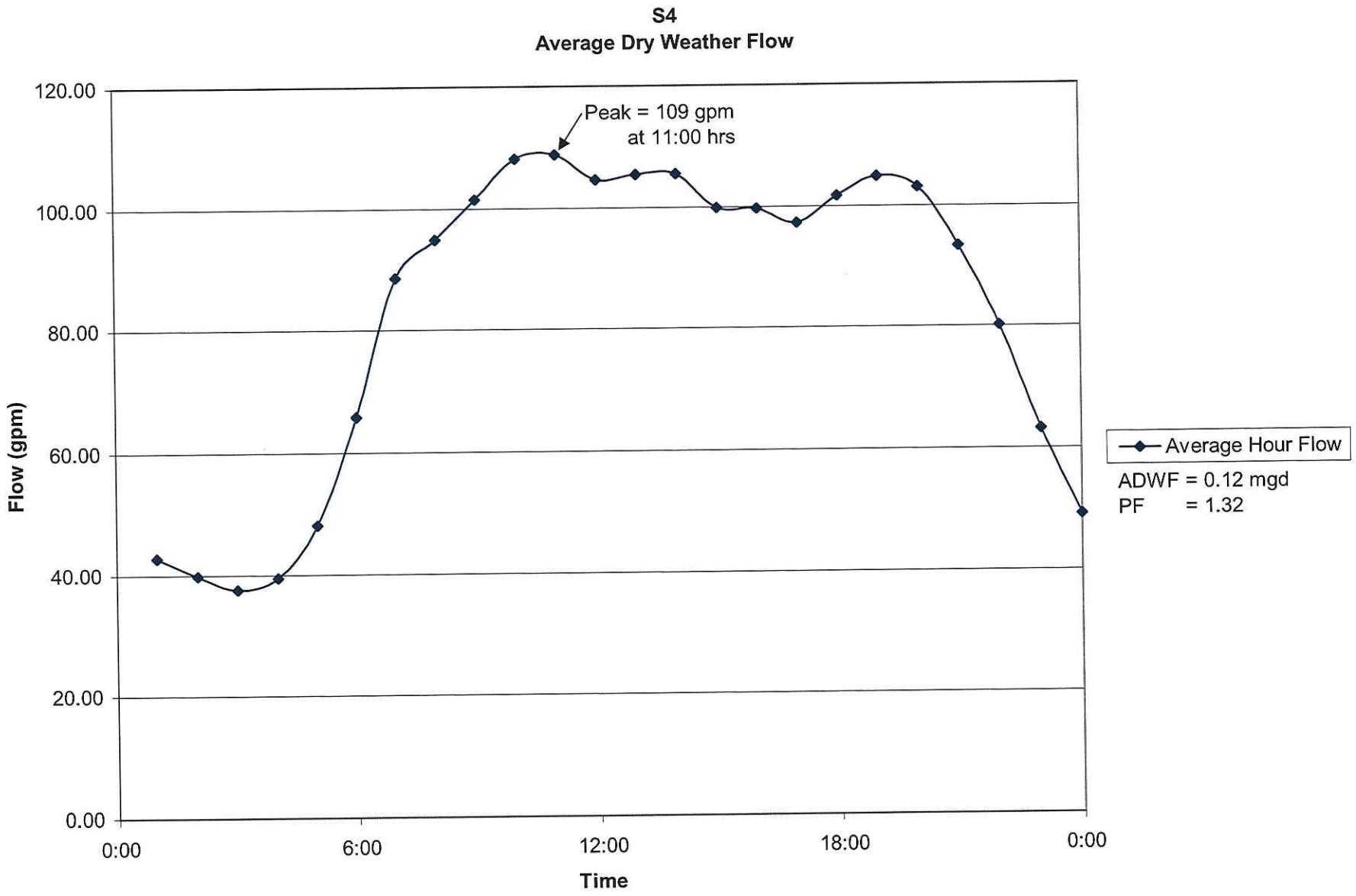


S2
Average Dry Weather Flow

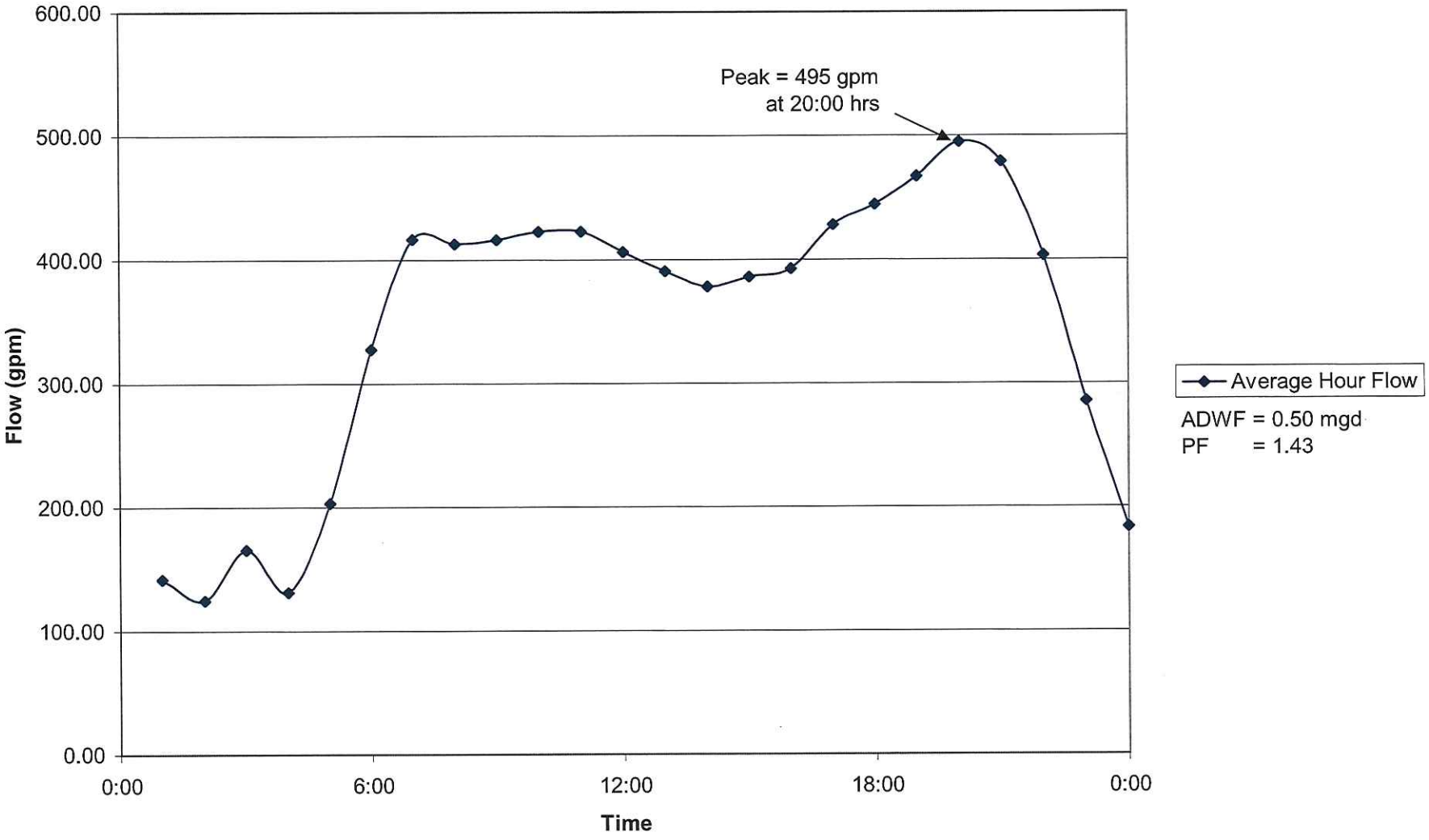


S3
Average Dry Weather Flow




S4
Average Dry Weather Flow
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Flow (gpm)
Peak = 109 gpm
at 11:00 hrs
0:00
6:00
12:00
18:00
0:00
Time
Average Hour Flow
ADWF = 0.12 mgd
PF = 1.32

S5
Average Dry Weather Flow



APPENDIX D

I/I RATE CALCULATIONS

Table D-1

City of Riverbank
2007 Sewer Collection System Master Plan
I/I Rate Calculations Summary

Catchment Zone	Date and Approximate Time Peak Wet Weather Average Hour Flow Recorded	Peak Wet Weather Average Hour Flow Recorded (gpm)	ADWF Average Hour Flow for Corresponding Hour (gpm)	I/I (gpm)	I/I (gpd)	Contributing Area (acres)	I/I Rate (gpd/acre)
1	March 4, 11:00	624	269	356	512,222	324.29	1,580
2	April 23, 20:00	170	114	56	80,706	96.10	840
3	March 1, 10:00	334	153	181	260,903	106.71	2,445
4	March 20, 15:00	365	100	265	382,000	138.34	2,761
5	April 21, 11:00	644	423	221	319,000	392.75	812
Average							1,688

APPENDIX B

LAND USE AND SEWER FLOW PROJECTIONS DATA

TABLE B-1
CITY OF RIVERBANK 2007 SEWER COLLECTION SYSTEM MASTER PLAN
LAND USE WITHIN CITY LIMITS BY GEOGRAPHIC AREA

Category	Existing System (ac)	Existing System at Buildout (ac)
RESIDENTIAL		
Medium Density Residential (MDR)		
MDR #1	206.0	206.0
IN #1		3.0
IN #2		14.5
MDR #2	335.3	335.3
IN #3		2.1
IN #4		3.8
IN #6		8.2
IN #7		2.4
IN #8		4.7
IN #9		4.7
MDR #3	359.3	359.3
IN #5		2.4
IN #10		15.5
MDR #4	444.0	444.0
IN #12		1.3
IN #13		3.2
IN #14		5.1
IN #15		
IN #16		1.9
IN #17		2.0
IN #18		1.6
IN #19		4.8
IN #20		5.4
MDR #5		14.3
MDR #6	53.2	53.2
IN #11		2.0
MDR #7		21.7
MDR #8		6.3
MDR #9	28.8	28.8
Total Areas for Medium Density Residential=	*1426.5*	*1557.5*
Low Density Residential (LDR)		
LDR #1	99.2	99.2
LDR #2	21.1	21.1
LDR #3	27.8	27.8
LDR #4	31.1	
LDR #5	46.9	
LDR #6	23.5	
Total Areas for Low Density Residential=	*249.6*	*148.1*
Total Areas for Residential =	*1676.0*	*1705.6*

Category	Existing System (ac)	Existing System at Buildout (ac)
COMMERCIAL		
Commercial (C)		
C #1	122.4	122.4
C #2	20.2	20.2
C #3	68.8	68.8
C #4		6.3
C #5		1.1
Total Areas for Commercial =	*211.5*	*218.8*
INDUSTRIAL		
Industrial (I)		
I #1	208.9	208.9
I #2		35.0
Total Areas for Industrial =	*208.9*	*244.0*
GOVERNMENT		
School (SC)		
SC #1	7.5	7.5
SC #2		10.8
SC #3	16.5	16.5
SC #4	5.3	5.3
SC #5	40.2	40.2
Total Areas for Government =	*69.4*	*80.2*
OTHER		
Park (PK)		
PK #1	5.9	5.9
PK #2	5.4	5.4
PK #3	1.8	1.8
PK #4	0.8	0.8
PK #5	1.6	1.6
PK #6	1.6	1.6
PK #7	12.0	12.0
PK #8	4.6	4.6
PK #9	5.4	5.4
Total Areas for Other =	*39.0*	*39.0*

Category	Existing System (ac)	Existing System at Buildout (ac)
OPEN SPACE (Future Parks)		
Open Space (OS)		
OS #1	4.9	4.9
OS #2	1.3	1.3
OS #3	3.2	3.2
OS #4	2.1	2.1
OS #5	1.1	1.1
OS #6	17.2	17.2
Total Areas for Open Space =	*29.8*	*29.8*
Total Areas (ac) =	**2235**	**2317**

TABLE B-2
CITY OF RIVERBANK 2007 SEWER COLLECTION SYSTEM MASTER PLAN
WASTEWATER GENERATION OF EXISTING SEWER SYSTEM

Category	Gross Area (ac)	Net Area (ac)	Density (Units/ac)	DUs	Wastewater Generation Factor (gpd/acre)	Average Flow (gpd)
RESIDENTIAL						
Medium Density Residential (MDR)						
MDR #1	206.0	144.2	5.5	793	1500	216,254
IN #1						
IN #2						
MDR #2	335.3	234.7	6.0	1408	1500	352,067
IN #3						
IN #4						
IN #6						
IN #7						
IN #8						
IN #9						
MDR #3	359.3	251.5	6.5	1635	1500	377,223
IN #5						
IN #10						
MDR #4	444.0	310.8	6.0	1865	1500	466,156
IN #12						
IN #13						
IN #14						
IN #15						
IN #16						
IN #17						
IN #18						
IN #19						
IN #20						
MDR #5						
MDR #6	53.2	37.3	6.0	224	1500	55,906
IN #11						
MDR #7						
MDR #8						
MDR #9	28.8	20.1	5.5	111	1500	30,190
Total Areas for Medium Density Res. =	*1426*	*999*			*Medium Density Residential =*	*1,497,796 gpd*
Low Density Residential (LDR)						
LDR #1	99.2	99.2				0
LDR #2	21.1	21.1	2.3	48	600	12,647
LDR #3	27.8	27.8	1.5	42	600	16,675
LDR #4	31.1	31.1				0
LDR #5	46.9	46.9				0
LDR #6	23.5	23.5	1.5	35	600	14,082
Total Areas for Low Density Res.=	*250*	*250*			*Low Density Residential =*	*43,404 gpd*
Total Areas for Residential =	*1676*	*1248*			*Residential =*	*1,541,200 gpd*
COMMERCIAL						
Commercial (C)						
C #1	122.4	85.7			1400	119,997
C #2	20.2	14.1			1400	19,807
C #3	68.8	48.2			1400	67,432
C #4						
C #5						
Total Areas for Commercial =	*211*	*148*			*Commercial =*	*207,237 gpd*

Category	Gross Area (ac)	Net Area (ac)	Density (Units/ac)	DUs	Wastewater Generation Factor (gpd/acre)	Average Flow (gpd)
INDUSTRIAL						
Industrial (I)						
I #1	208.9	146.3			300	43,879
I #2						
Total Areas for Industrial =	*209*	*146*			*Industrial =*	*43,879 gpd*
GOVERNMENT						
School (SC)						
SC #1	7.5	7.5			200	1,508
SC #2						
SC #3	16.5	16.5			200	3,291
SC #4	5.3	5.3			200	1,052
SC #5	40.2	40.2			200	8,035
Total Areas for Government =	*69*	*69*			*Government =*	*13,886 gpd*
OTHER						
Park (PK)						
PK #1	5.9	5.9			1400	8,301
PK #2	5.4	5.4			1400	7,509
PK #3	1.8	1.8			1400	2,580
PK #4	0.8	0.8			1400	1,122
PK #5	1.6	1.6			1400	2,189
PK #6	1.6	1.6			1400	2,206
PK #7	12.0	12.0			1400	16,776
PK #8	4.6	4.6			1400	6,397
PK #9	5.4	5.4			1400	7,567
Total Areas for Other =	*39*	*39*			*Other =*	*54,649 gpd*
OPEN SPACE						
Open Space (OS)						
OS #1	4.9	4.9			0	0
OS #2	1.3	1.3			0	0
OS #3	3.2	3.2			0	0
OS #4	2.1	2.1			0	0
OS #5	1.1	1.1			0	0
OS #6	17.2	17.2			0	0
Total Areas for Open Space =	*30*	*30*			*Open Space =*	*0 gpd*
Total Areas for Existing System =	**2235**	**1681**	**acres**		**Total Existing System =**	**1,860,851 gpd**
					Total Annual Flow =	**2,084 ac-ft/yr**

TABLE B-3
CITY OF RIVERBANK 2007 SEWER COLLECTION SYSTEM MASTER PLAN
WASTEWATER GENERATION OF EXISTING SEWER SYSTEM AT BUILD-OUT

Category	Gross Area (ac)	Net Area (ac)	Density (Units/ac)	DUs	Wastewater Generation Factor (gpd/acre)	Average Flow (gpd)
RESIDENTIAL						
Medium Density Residential (MDR)						
MDR #1	206.0	144.2	5.5	793	*2100*	302,756
IN #1	3.0	2.1	6.0	13	2500	5,271
IN #2	14.5	10.1	6.0	61	2500	25,368
MDR #2	335.3	234.7	6.0	1408	*2450*	575,043
IN #3	2.1	1.5	6.0	9	2500	3,723
IN #4	3.8	2.7	6.0	16	2500	6,661
IN #6	8.2	5.7	6.0	34	2500	14,299
IN #7	2.4	1.7	6.0	10	2500	4,275
IN #8	4.7	3.3	6.0	20	2500	8,309
IN #9	4.7	3.3	6.0	20	2500	8,265
MDR #3	359.3	251.5	6.5	1635	2500	628,705
IN #5	2.4	1.7	6.0	10	2500	4,209
IN #10	15.5	10.9	6.0	65	2500	27,147
MDR #4	444.0	310.8	6.0	1865	*2000*	621,541
IN #12	1.3	0.9	6.0	5	2500	2,202
IN #13	3.2	2.2	6.0	13	2500	5,543
IN #14	5.1	3.6	6.0	21	2500	8,940
IN #16	1.9	1.3	6.0	8	2500	3,262
IN #17	2.0	1.4	6.0	8	2500	3,537
IN #18	1.6	1.1	6.0	7	2500	2,816
IN #19	4.8	3.4	6.0	20	2500	8,453
IN #20	5.4	3.8	6.0	23	2500	9,404
MDR #5	14.3	10.0	6.0	60	2500	25,052
MDR #6	53.2	37.3	6.0	224	2500	93,176
IN #11	2.0	1.4	6.0	8	2500	3,479
MDR #7	21.7	15.2	6.0	91	2500	37,973
MDR #8	6.3	4.4	6.0	27	2500	11,112
MDR #9	28.8	20.1	5.5	111	2500	50,316
Total Areas for Medium Density Res. =	*1558*	*1090*			*Medium Density Residential =*	*2,500,839 gpd*
Low Density Residential (LDR)						
LDR #1	99.2	99.2			1500	148,816
LDR #2	21.1	21.1	2.3	48	*600*	12,647
LDR #3	27.8	27.8	1.5	42	*600*	16,675
Total Areas for Low Density Res.=	*148*	*148*			*Low Density Residential =*	*178,138 gpd*
Total Areas for Residential =	*1706*	*1238*			*Residential =*	*2,678,977 gpd*
COMMERCIAL						
Commercial (C)						
C #1	122.4	85.7			*1360*	116,569
C #2	20.2	14.1			1200	16,978
C #3	68.8	48.2			1200	57,799
C #4	6.3	4.4			1200	5,268
C #5	1.1	0.8			1200	909
Total Areas for Commercial =	*219*	*153*			*Commercial =*	*197,522 gpd*

Category	Gross Area (ac)	Net Area (ac)	Density (Units/ac)	DUs	Wastewater Generation Factor (gpd/acre)	Average Flow (gpd)
INDUSTRIAL						
Industrial (I)						
I #1	208.9	146.3			1500	219,395
I #2	35.0	24.5			*300*	7,352
Total Areas for Industrial =	*244*	*171*			*Industrial =*	*226,747 gpd*
GOVERNMENT						
School (SC)						
SC #1	7.5	7.5			*223*	1,677
SC #2	10.8	10.8			425	4,596
SC #3	16.5	16.5			*200*	3,291
SC #4	5.3	5.3			425	2,235
SC #5	40.2	40.2			425	17,075
Total Areas for Government =	*80*	*80*			*Government =*	*28,875 gpd*
OTHER						
Park (PK)						
PK #1	5.9	5.9			400	2,372
PK #2	5.4	5.4			400	2,146
PK #3	1.8	1.8			*1200*	2,212
PK #4	0.8	0.8			*1400*	1,122
PK #5	1.6	1.6			400	625
PK #6	1.6	1.6			400	630
PK #7	12.0	12.0			400	4,793
PK #8	4.6	4.6			*1400*	6,397
PK #9	5.4	5.4			400	2,162
Open Space (OS) (Converted to Parks)						
OS #1	4.9	4.9			0	0
OS #2	1.3	1.3			0	0
OS #3	3.2	3.2			0	0
OS #4	2.1	2.1			0	0
OS #5	1.1	1.1			0	0
OS #6	17.2	17.2			0	0
Total Areas for Other =	*69*	*69*			*Other =*	*22,460 gpd*
Total Areas for Existing System =	**2317**	**1711**	**acres**		**Total Existing and Future =**	**3,154,580 gpd**
					Total Annual Flow =	**3,534 ac-ft/yr**

TABLE B-4
CITY OF RIVERBANK 2007 SEWER COLLECTION SYSTEM MASTER PLAN
GENERAL PLAN WASTEWATER GENERATION AT BUILDOUT

Category	Gross Area (ac)	Net Area (ac)	Density (Units/ac)	DUs	Wastewater Generation Factor (gpd/acre)	Average Flow (gpd)
PLANNING SUB-AREA 1						
Buffer Greenway Open Space						
BGOS7	8.0	8.0			0	0
BGOS10	3.4	3.4			0	0
BGOS11	51.8	51.8			0	0
BGOS15	31.0	31.0			0	0
BGOS16	9.1	9.1			0	0
High Density Residential						
HDR10	25.8	18.1	18.0	325	4000	72,237
Infill Opp Area						
IOA1	214.2					
IOA Downtown Non-Residential		*9.6*			2225	21,387
IOA Downtown Residential (HDR)		*10.4*	*18.0*	*187.9*	2225	23,223
IOA2	163.7					
IOA West Riverbank Non-Residential		*3.1*			1850	5,798
IOA West Riverbank Residential (HDR)		*14.5*	*18.0*	*260.7*	1850	26,790
IOA3	63.8					
IOA West Riverbank Non-Residential		*1.2*			1850	2,259
IOA West Riverbank Residential (HDR)		*5.6*	*18.0*	*101.6*	1850	10,438
Medium Density Residential						
MDR20	46.9	32.8	10.0	328	2500	82,103
School-Civic						
SC11	1.7	1.7			425	710
SC12	2.0	2.0			425	868
Total Areas for Planning Sub-Area 1 =	*621*	*202*			*Planning Sub-Area 1 =*	*245,813* *gpd*
PLANNING SUB-AREA 2						
Agricultural Resource Conservation Area						
ARCA2	577.3	577.3			0	0
Buffer Greenway Open Space						
BGOS4	6.5	6.5			0	0
BGOS5	35.7	35.7			0	0
BGOS8	5.2	5.2			0	0
Clustered Rural Residential						
CRR1	161.1	161.1	0.2	32	100	16,108
CRR2	108.0	108.0	0.2	22	100	10,799
CRR3	56.8	56.8	0.2	11	100	5,676
CRR4	20.9	20.9	0.2	4	100	2,089
High Density Residential						
HDR4	4.5	3.1	18.0	56	4000	12,547
HDR11	4.6	3.2	18.0	58	4000	12,873
Low Density Residential						
LDR4	109.0	76.3	5.0	381	1500	114,449
LDR5	69.1	48.4	5.0	242	1500	72,603
LDR6	70.9	49.6	5.0	248	1500	74,433
LDR7	12.5	8.7	5.0	44	1500	13,109
LDR8	49.9	34.9	5.0	174	1500	52,345
LDR13	3.8	2.6	5.0	13	1500	3,947
Medium Density Residential						
MDR4	33.1	23.2	10.0	232	2500	58,008
MDR5	59.4	41.5	10.0	415	2500	103,869
MDR6	24.2	16.9	10.0	169	2500	42,314
MDR7	20.1	14.1	10.0	141	2500	35,173
MDR8	12.5	8.8	10.0	88	2500	21,939
MDR18	12.7	8.9	10.0	89	2500	22,192
MDR19	8.8	6.1	10.0	61	2500	15,342
Mixed Use Office Retail Residential						
MUORR4	4.5					

Category	Gross Area (ac)	Net Area (ac)	Density (Units/ac)	DUs	Wastewater Generation Factor (gpd/acre)	Average Flow (gpd)
MUORR Non-Residential		2.5			1760	4,482
MUORR Residential		0.6	18.0	11	1760	1,121
MUORR6	2.5					
MUORR Non-Residential		1.4			1760	2,450
MUORR Residential		0.3	18.0	6	1760	613
Multi Use Recreation						
MUR3	14.4	14.4			425	6,141
MUR4	9.6	9.6			425	4,097
MUR5	2.4	2.4			425	1,012
MUR6	1.9	1.9			425	788
Park						
P7	29.5	29.5			400	11,792
P8	9.9	9.9			400	3,966
P9	2.2	2.2			400	874
P11	5.3	5.3			400	2,109
School-Civic						
SC4	5.4	5.4			425	2,304
SC5	5.1	5.1			425	2,172
Total Areas for Planning Sub-Area 2 =	*1,559*	*1,409*			*Planning Sub-Area 2 =*	*733,735* *gpd*
PLANNING SUB-AREA 3						
Buffer Greenway Open Space						
BGOS9	4.2	4.2			0	0
BGOS14	17.6	17.6			0	0
Clustered Rural Residential						
CRR5	117.1	117.1	0.2	23	100	11,711
CRR8	6.9	6.9	0.2	1	100	690
High Density Residential						
HDR5	3.2	2.2	18.0	40	4000	8,846
Industrial-Business Park						
IBP1	30.5	21.3			1500	31,992
IBP2	161.1	112.8			1500	169,154
IBP3	51.5	36.1			1500	54,091
IBP4	8.6	6.0			1500	9,070
IBP5	11.6	8.2			1500	12,229
Low Density Residential						
LDR9	69.9	48.9	5.0	245	1500	73,356
LDR15	20.6	14.4	5.0	72	1500	21,665
Medium Density Residential						
MDR9	17.5	12.2	10.0	122	2500	30,589
MDR10	38.2	26.7	10.0	267	2500	66,800
MDR11	10.2	7.2	10.0	72	2500	17,921
MDR12	19.2	13.4	10.0	134	2500	33,516
Mixed Use Office Retail Residential						
MUORR5	29.3					
MUORR Non-Residential		20.5			1200	24,644
Multi Use Recreation						
MUR7	12.4	12.4			425	5,276
Park						
P10	0.4	0.4			400	141
P12	1.7	1.7			400	686
P13	1.0	1.0			400	387
P14	1.0	1.0			400	387
P15	2.0	2.0			400	784
Total Areas for Planning Sub-Area 3 =	*636*	*494*			*Planning Sub-Area 3 =*	*573,937* *gpd*
PLANNING SUB-AREA 4						
Agricultural Resource Conservation Area						
ARCA3	120.4	120.4			0	0

Category	Gross Area (ac)	Net Area (ac)	Density (Units/ac)	DUs	Wastewater Generation Factor (gpd/acre)	Average Flow (gpd)
Buffer Greenway Open Space						
BGOS2	9.6	9.6			0	0
BGOS3	19.7	19.7			0	0
BGOS13	22.1	22.1			0	0
Clustered Rural Residential						
CRR6	489.0	489.0	0.2	98	100	48,896
High Density Residential						
HDR6	4.8	3.4	18.0	61	4000	13,524
HDR7	5.3	3.7	18.0	67	4000	14,818
HDR8	4.1	2.9	18.0	52	4000	11,587
HDR9	5.4	3.8	18.0	68	4000	15,046
Low Density Residential						
LDR10	506.6	354.6	5.0	1,773	1500	531,915
LDR11	32.1	22.5	5.0	112	1500	33,702
LDR12	1.6	1.1	5.0	6	1500	1,706
Medium Density Residential						
MDR13	33.0	23.1	10.0	231	2500	57,708
MDR14	26.4	18.5	10.0	185	2500	46,163
MDR15	20.1	14.1	10.0	141	2500	35,242
MDR16	123.7	86.6	10.0	866	2500	216,422
MDR17	31.8	22.2	10.0	222	2500	55,623
Mixed Use Office Retail Residential						
MUORR7	5.0					
MUORR Non-Residential		2.8			1760	4,940
MUORR Residential		0.7	18.0	13	1760	1,235
MUORR8	6.1					
MUORR Non-Residential		3.4			1760	6,051
MUORR Residential		0.9	18.0	15	1760	1,513
MUORR9	60.2					
MUORR Non-Residential		42.1			1200	50,573
Multi Use Recreation						
MUR8	90.9	90.9			425	38,623
Park						
P16	1.0	1.0			400	416
P17	1.5	1.5			400	598
P18	5.2	5.2			400	2,098
P19	1.1	1.1			400	431
P20	19.2	19.2			400	7,684
P21	4.9	4.9			400	1,966
P22	5.0	5.0			400	2,003
P23	12.7	12.7			400	5,100
P24	4.9	4.9			400	1,966
P25	1.0	1.0			400	414
P26	2.1	2.1			400	826
P27	1.0	1.0			400	414
P28	1.0	1.0			400	414
P29	2.1	2.1			400	826
P30	2.7	2.7			400	1,066
School-Civic						
SC6	14.9	14.9			425	6,339
SC7	15.6	15.6			425	6,650
SC8	2.1	2.1			425	876
SC9	21.1	21.1			425	8,960
SC10	81.1	81.1			425	34,469
Total Areas for Planning Sub-Area 4 =	*1,818*	*1,558*			*Planning Sub-Area 4 =*	*1,268,803* *gpd*
PLANNING SUB-AREA 5						
Agricultural Resource Conservation Area						
ARCA1	483.0	483.0			0	0
ARCA4	39.9	39.9			0	0
Buffer Greenway Open Space						
BGOS1	147.2	147.2			0	0

Category	Gross Area (ac)	Net Area (ac)	Density (Units/ac)	DUs	Wastewater Generation Factor (gpd/acre)	Average Flow (gpd)
BGOS6	5.8	5.8			0	0
BGOS12	22.7	22.7			0	0
Clustered Rural Residential						
CRR7	306.8	306.8	0.2	61	100	30,678
High Density Residential						
HDR2	7.0	4.9	18.0	89	4000	19,673
HDR3	8.1	5.6	18.0	102	4000	22,571
Low Density Residential						
LDR2	167.3	117.1	5.0	586	1500	175,691
LDR3	79.5	55.6	5.0	278	1500	83,424
LDR14	39.4	27.6	5.0	138	1500	41,336
Medium Density Residential						
MDR2	103.1	72.2	10.0	722	2500	180,432
MDR3	15.1	10.6	10.0	106	2500	26,475
Mixed Use Office Retail Residential						
MUORR1	3.1					
MUORR Non-Residential		1.7			1760	3,067
MUORR Residential		0.4	18.0	8	1760	767
MUORR2	38.4					
MUORR Non-Residential		21.5			1760	37,877
MUORR Residential		5.4	18.0	97	1760	9,469
MUORR3	8.6					
MUORR Non-Residential		4.8			1760	8,453
MUORR Residential		1.2	18.0	22	1760	2,113
Multi Use Recreation						
MUR2	7.6	7.6			425	3,247
Park						
P2	4.9	4.9			400	1,976
P3	1.1	1.1			400	439
P4	1.0	1.0			400	414
P5	8.1	8.1			400	3,232
P6	1.2	1.2			400	474
School-Civic						
SC2	2.1	2.1			425	899
SC3	12.8	12.8			425	5,449

Total Areas for Planning Sub-Area 5 = *1,514* *1,373*

Planning Sub-Area 5 = *658,158* *gpd*

Total Areas for General Plan = **6,148** **5,036** **acres**

Total General Plan = **3,480,446** **gpd**

+ Existing City Buildout Flow = 3,154,580 gpd

6,635,026 gpd

Total Annual Flow = **7,432** **ac-ft/yr**

TABLE B-5
CITY OF RIVERBANK 2007 SEWER COLLECTION SYSTEM MASTER PLAN
PROJECTED FLOWS BY MAJOR COLLECITON AREA

Land Use	Gross Acres	Net Acres	WGF	ADWF (GPD)	PWWF (MGD)
CENTRAL RIVERBANK					
Sewer Shed 6					
BGOS11	10.655	10.655	0	0.000	
C #3	68.808	48.166	1200	57798.981	
C #4	6.271	4.390	1200	5267.895	
C #5	1.082	0.757	1200	908.727	
MDR #3	281.994	197.396	2500	493489.850	
MDR #5	14.316	10.021	2500	25052.319	
MDR #7	21.699	15.189	2500	37973.152	
MDR #8	6.350	4.445	2500	11111.938	
MDR #9	28.752	20.127	2500	50316.477	
OS #1	4.865	4.865	0	0.000	
OS #3	3.226	3.226	0	0.000	
OS #5	1.108	1.108	0	0.000	
SC #2	10.814	10.814	425	4595.844	
SC11	1.671	1.671	425	709.997	
SC12	2.042	2.042	425	867.922	
	452.998			688093.101	1.829
Sewer Shed 7					
BGOS10	3.400	3.400	0	0.000	
BGOS11	23.189	23.189	0	0.000	
HDR10	25.799	18.059	4000	72237.315	
LDR #1	99.210	99.210	1500	148815.599	
	151.598			221052.914	0.594
Sewer Shed 10					
IN #14	5.109	3.576	2500	8940.146	
IN #17	2.021	1.415	2500	3537.322	
IN #18	1.609	1.127	2500	2816.472	
IN #19	4.830	3.381	2500	8453.231	
IN #20	5.374	3.762	2500	9403.759	
MDR #4	131.468	92.028	2000	184055.737	
MDR20	46.916	32.841	2500	82102.591	
PK #6	1.576	1.576	400	630.386	
PK #7	11.983	11.983	400	4793.140	
SC #4	5.258	5.258	425	2234.753	
	216.145			306967.537	0.830
Sewer Shed 13					
BGOS11	7.067	7.067	0	0.000	
BGOS15	9.382	9.382	0	0.000	
C#1	17.966	12.576	1360	17103.717	
IOA2	59.747	6.428	1850	11891.710	
IOA3	45.998	4.949	1850	9155.117	
IN#1	3.012	2.108	2500	5270.971	

Land Use	Gross Acres	Net Acres	WGF	ADWF (GPD)	PWWF (MGD)
IN#2	3.750	2.625	2500	6561.872	
IN#3	2.127	1.489	2500	3723.089	
IN#4	3.806	2.664	2500	6661.008	
IN#5	2.405	1.684	2500	4209.120	
IN#6	8.171	5.720	2500	14299.099	
IN#10	15.513	10.859	2500	27147.176	
MDR#1	154.412	108.088	2100	226985.353	
MDR#2	177.363	124.154	2450	304176.893	
MDR#3	77.266	54.086	2500	135215.006	
PK#1	5.929	5.929	400	2371.791	
PK#9	5.405	5.405	400	2162.048	
SC#1	7.538	7.538	223	1677.306	
	501.112			778611.274	2.058
Sewer Shed 14					
BGOS11	10.856	10.856	0	0.000	
BGOS15	21.666	21.666	0	0.000	
BGOS7	1.260	1.260	0	0.000	
C #1	104.480	73.136	1360	99464.793	
C #2	20.212	14.148	1200	16977.815	
I#1	198.706	139.094	1500	208641.732	
I#2	5.191	24.508	300	7352.488	
IN #2	10.746	7.522	2500	18805.977	
IN #7	2.443	1.710	2500	4275.327	
IN #8	4.748	3.324	2500	8308.844	
IN #9	4.723	3.306	2500	8265.255	
IN #11	1.988	1.391	2500	3478.748	
IN #12	1.259	0.881	2500	2202.445	
IN #13	3.167	2.217	2500	5542.631	
IN #16	1.864	1.305	2500	3261.645	
IOA1	210.799	19.729	2225	43896.940	
IOA2	103.987	11.187	1850	20696.787	
IOA3	17.606	1.894	1850	3504.146	
MDR #2	157.940	110.558	2450	270866.347	
MDR #4	312.489	218.742	2000	437484.933	
MDR #6	53.244	37.270	2500	93176.211	
MDR18	12.681	8.877	2500	22191.774	
MDR19	8.767	6.137	2500	15341.657	
LDR #2	21.079	21.079	600	12647.383	
LDR #3	27.791	27.791	600	16674.876	
OS #2	1.306	1.306	0	0.000	
OS #4	2.061	2.061	0	0.000	
OS #6	2.153	2.153	0	0.000	
SC#3	16.456	16.456	200	3291.267	
PK #3	1.843	1.843	1200	2211.846	
PK #4	0.802	0.802	1400	1122.121	
PK #8	4.570	4.570	1400	6397.479	
PK #5	1.564	1.564	400	625.473	
	1018.053			1336706.940	3.691
Sewer Shed 15					

Land Use	Gross Acres	Net Acres	WGF	ADWF (GPD)	PWWF (MGD)
BGOS7	6.720	6.720	0	0.000	
I#1	10.241	7.169	1500	10753.020	
IOA1	3.423	0.320	2225	712.763	
MDR#1	51.545	36.081	2100	75770.597	
OS#6	17.221	17.221	0	0.000	
PK#2	5.364	5.364	400	2145.510	
	91.091			89381.890	0.270
Sewer Shed 16					
	0.000			0.000	
	0.000			0.000	0.000
CENTRAL RIVERBANK SUBTOTAL				*3420813.655*	*9.273*
WEST RIVERBANK					
Sewer Shed 1					
BGOS1	147.178	147.178	0	0.000	
BGOS12	22.736	22.736	0	0.000	
BGOS6	5.816	5.816	0	0.000	
CRR7	306.781	306.781	100	30678.107	
HDR3	8.061	5.643	4000	22571.066	
HDR2	7.026	4.918	4000	19672.934	
LDR14	39.368	27.557	1500	41335.923	
LDR2	167.325	117.128	1500	175691.281	
LDR3	79.451	55.616	1500	83424.033	
MDR2	103.104	72.173	2500	180431.523	
MDR3	15.128	10.590	2500	26474.696	
MUORR1	3.112	2.178	1760	3834.160	
MUORR2	38.431	26.902	1760	47346.815	
MUORR3	8.576	6.003	1760	10566.093	
MUR2	7.641	7.641	425	3247.278	
P2	4.939	4.939	400	1975.635	
P3	1.097	1.097	400	438.866	
P4	1.036	1.036	400	414.452	
P5	8.080	8.080	400	3232.191	
P6	1.186	1.186	400	474.418	
SC2	2.115	2.115	425	898.683	
SC3	12.822	12.822	425	5449.463	
	991.010			658157.617	2.307
Sewer Shed 2					
CRR6	488.956	488.956	100	48895.620	
	488.956			48895.620	0.587
Sewer Shed 3					
BGOS13	7.307	7.307	0	0.000	
BGOS3	19.730	19.730	0	0.000	
HDR6	4.830	3.381	4000	13524.446	
HDR7	5.292	3.705	4000	14818.153	
LDR10	427.946	299.562	1500	449342.826	
MDR13	32.976	23.083	2500	57707.823	

Land Use	Gross Acres	Net Acres	WGF	ADWF (GPD)	PWWF (MGD)
MDR14	26.379	18.465	2500	46162.861	
MDR15	20.139	14.097	2500	35242.393	
MDR17	31.784	22.249	2500	55622.744	
MUORR7	5.013	3.509	1760	6175.511	
MUR8	90.877	90.877	425	38622.703	
P16	1.041	1.041	400	416.496	
P17	1.494	1.494	400	597.566	
P18	5.245	5.245	400	2097.895	
P19	1.078	1.078	400	431.269	
P21	4.914	4.914	400	1965.670	
P22	5.007	5.007	400	2002.809	
P27	1.036	1.036	400	414.452	
P28	1.036	1.036	400	414.452	
P29	2.066	2.066	400	826.226	
SC10	81.103	81.103	425	34468.669	
SC8	2.062	2.062	425	876.478	
SC9	21.082	21.082	425	8959.858	
	799.437			770691.299	2.341
Sewer Shed 4					
BGOS13	14.787	14.787	0	0.000	
HDR8	4.138	2.897	4000	11586.855	
LDR10	43.235	30.264	1500	45396.554	
LDR12	1.625	1.137	1500	1706.187	
P20	19.209	19.209	400	7683.678	
SC6	14.915	14.915	425	6338.939	
	97.909			72712.213	0.243
Sewer Shed 5					
BGOS2	9.615	9.615	0	0.000	
HDR9	5.374	3.762	4000	15046.267	
LDR10	35.522	24.866	1500	37298.600	
LDR11	32.097	22.468	1500	33701.769	
MDR16	123.670	86.569	2500	216421.773	
MUORR8	6.140	4.298	1760	7563.888	
MUORR9	60.206	42.144	1200	50572.667	
P23	12.749	12.749	400	5099.567	
P24	4.914	4.914	400	1965.670	
P25	1.036	1.036	400	414.452	
P26	2.066	2.066	400	826.226	
P30	2.665	2.665	400	1065.988	
SC7	15.648	15.648	425	6650.348	
	311.701			376627.215	1.065
WEST RIVERBANK SUBTOTAL				*1927083.965*	*6.543*
EAST RIVERBANK					
Sewer Shed 8					
CRR5	117.114	117.114	100	11711.371	
IBP1	30.469	21.328	1500	31992.475	
IBP2	161.099	112.769	1500	169154.242	

Land Use	Gross Acres	Net Acres	WGF	ADWF (GPD)	PWWF (MGD)
IBP3	51.515	36.061	1500	54091.196	
LDR9	69.863	48.904	1500	73356.376	
MDR10	38.171	26.720	2500	66799.751	
MDR12	19.152	13.407	2500	33516.331	
MUR7	12.415	12.415	425	5276.391	
P13	0.966	0.966	400	386.587	
P14	0.966	0.966	400	386.587	
P15	1.961	1.961	400	784.241	
	503.693			447455.549	1.399
Sewer Shed 9					
BGOS14	17.580	17.580	0	0.000	
BGOS5	4.495	4.495	0	0.000	
BGOS8	0.653	0.653	0	0.000	
BGOS9	4.191	4.191	0	0.000	
CRR3	56.756	56.756	100	5675.570	
CRR4	20.887	20.887	100	2088.652	
CRR8	6.903	6.903	100	690.309	
HDR4	4.481	3.137	4000	12547.208	
HDR5	3.159	2.212	4000	8846.120	
HDR11	4.598	3.218	4000	12873.073	
IBP4	8.638	6.047	1500	9070.106	
IBP5	11.647	8.153	1500	12229.440	
LDR15	20.634	14.444	1500	21665.385	
LDR6	70.888	49.622	1500	74432.915	
LDR7	12.485	8.739	1500	13108.763	
LDR8	49.853	34.897	1500	52345.439	
LDR13	3.759	2.631	1500	3946.850	
MDR11	10.240	7.168	2500	17920.791	
MDR7	20.099	14.069	2500	35173.462	
MDR8	12.537	8.776	2500	21939.408	
MDR9	17.479	12.235	2500	30588.730	
MUORR4	4.548	3.183	1760	5602.552	
MUORR5	29.338	20.536	1200	24643.520	
MUORR6	2.486	1.740	1760	3062.807	
MUR6	1.855	1.855	425	788.228	
P10	0.351	0.351	400	140.574	
P11	5.273	5.273	400	2109.366	
P12	1.715	1.715	400	686.053	
P9	2.184	2.184	400	873.612	
SC5	5.110	5.110	425	2171.899	
SC #5	40.177	40.177	425	17075.331	
	454.998			392296.162	1.240
Sewer Shed 11					
BGOS5	31.191	31.191	0	0.000	
CRR1	76.973	76.973	100	7697.265	
CRR2	11.465	11.465	100	1146.468	
LDR4	13.631	9.542	1500	14312.900	
LDR5	69.146	48.402	1500	72603.234	
MDR4	33.148	23.203	2500	58008.220	

Land Use	Gross Acres	Net Acres	WGF	ADWF (GPD)	PWWF (MGD)
MDR5	59.354	41.548	2500	103869.002	
MDR6	24.180	16.926	2500	42314.189	
MUR4	9.640	9.640	425	4096.930	
MUR5	2.380	2.380	425	1011.699	
P8	9.915	9.915	400	3965.837	
SC4	5.420	5.420	425	2303.659	
	346.442			311329.405	0.969
Sewer Shed 12					
BGOS4	6.503	6.503	0	0.000	
CRR1	84.109	84.109	100	8410.854	
CRR2	96.528	96.528	100	9652.774	
LDR4	95.368	66.758	1500	100136.328	
MUR3	14.449	14.449	425	6140.736	
P7	29.480	29.480	400	11791.869	
	326.436			136132.562	0.599
EAST RIVERBANK SUBTOTAL				*1287213.678*	*4.206*
TOTALS	6751.577			6635111.298	21.498

APPENDIX C

SEWERCAD MODEL INPUT DATA

TABLE C-1
CITY OF RIVERBANK 2007 SEWER COLLECTION SYSTEM MASTER PLAN
SEWERCAD MODEL INPUT DATA: MANHOLES

Label	Rim Elevation (ft)	Manhole Bottom Elevation (ft)	Flow Input (gpd)
26	136.96	133.47	70,405.11
32	139.57	132.48	0
33	140.36	132.04	0
34	142.72	131.56	0
35	144.58	131.01	0
36	141.59	137.22	0
37	140.4	136.57	0
38	140.34	135.92	0
39	141.93	135.64	0
40	140.92	134.99	0
41	140.3	133.73	0
42	140.04	135.02	0
43	141.46	130.96	0
44	141.67	131.75	0
45	141.78	131.78	0
46	142.08	132.29	0
47	141.93	132.56	0
48	141.85	132.81	0
49	142.2	133.02	0
50	142.8	133.57	0
51	143.45	133.95	0
58	137.92	132.08	179,826.31
60	141.18	131.48	0
61	141.4	131.44	0
63	142.38	130.53	0
65	143.18	130.22	0
66	143.93	130.07	0
70	145.45	129.87	0
73	147.91	129.23	0
75	145.23	129.84	0
76	144.52	130.5	56,248.15
81	142.1	128.93	0
83	141.99	128.4	0
85	144.7	127.99	0
86	146.59	127.62	0
89	143.04	127.16	0
90	143.07	127.44	0
91	147.88	129.23	0
94	142.81	127.34	0
95	146.04	126.56	0
96	145.59	126.1	0
97	142.56	125.61	170,379.69
98	143.78	125.15	0
99	143.78	124.76	0
100	138.81	124.32	0
101	138.53	123.93	0

Label	Rim Elevation (ft)	Manhole Bottom Elevation (ft)	Flow Input (gpd)
103	143.44	130.84	0
104	141	130.12	0
105	141	129.37	0
106	141.69	128.97	0
107	140.55	127.96	0
108	140.52	127.65	0
109	141.81	133.48	0
111	138.95	126.93	309,666.89
112	137.66	126.58	1,211,681.86
113	137.96	125.03	0
114	139.06	124.71	0
115	138.7	124.45	0
117	138.63	122.32	0
122	137.21	123.64	0
125	137.18	129.11	0
126	140.69	130.34	467,256.00
127	142	131	0
128	142.43	131.45	0
129	142.97	132.09	0
130	141.87	133.26	0
131	143.72	135.1	0
132	141.98	137.35	0
133	143.14	138.04	0
134	145.42	140.34	0
135	145	141.1	0
136	144.4	141.77	0
137	149.88	142.54	0
229	135.63	128.41	588,816.13
233	134.39	128.09	0
234	134.69	127.98	0
236	137.42	127.63	0
238	137.89	127	0
239	137.97	127.05	0
242	137.89	126.74	0
243	137.98	126.38	0
246	138.09	125.96	0
250	135.68	125.35	0
253	137.79	129.34	0
298	137.08	131.81	727,713.71
299	138.31	131.05	0
300	137.41	130.47	0
301	136.97	130.42	0
302	135.94	130.26	0
303	134.85	129.84	0
304	135.27	129.48	0
307	138.29	128.05	0
310	142.29	137.08	0
313	142.63	138.52	0
314	142.46	138.86	279,341.95
328	140.5	127.77	0

Label	Rim Elevation (ft)	Manhole Bottom Elevation (ft)	Flow Input (gpd)
329	142.26	127.52	0
332	139.37	127.35	0
334	134.58	127.26	0
337	135.19	127.24	1,086,508.94
338	136.16	127.58	0
339	135.82	126.82	0
340	137.34	126.26	0
341	137.21	124.21	0
343	133.23	129.81	167,141.92
345	135.94	129.54	0
346	136.96	128	0
347	137.54	127.71	0
348	135.8	127.26	0
349	137.68	126.74	0
350	137.54	125.6	0
351	139.94	126.39	0
352	136.64	123.88	0
353	135.93	124.56	0
354	136.14	122.76	0
355	135.35	121.33	0
356	139.23	118.84	0
357	139.23	118.81	0
358	126.49	115.72	0
359	123.53	115.2	175,788.42
360	119.33	115.28	0
361	119.91	115.21	0
362	119.95	115.21	0
363	119.29	115.22	0
364	117.93	114.16	2,070,882.12
366	141.44	117.12	0
367	145.49	117.47	0
368	146.46	118.05	0
369	139.87	116.83	0
371	137.75	128.58	0
372	137.36	122.46	0
373	138.15	119.97	0
374	140.16	120.96	0
375	140.95	119.44	0
376	145.37	120.03	0
377	148.5	118.28	0
378	133.87	118.88	0
379	129.61	115.36	0
382	143.23	129.76	0
383	139.12	122.14	0
385	128.29	121.14	0

TABLE C-2
CITY OF RIVERBANK 2007 SEWER COLLECTION SYSTEM MASTER PLAN
SEWERCAD MODEL INPUT DATA: GRAVITY PIPE

Label	Section Size (in)	Length (ft)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)
CA-1	15	304	130.34	129.69	0.002138
CA-2	15	342	129.69	128.84	0.002485
CW-1	10	153	138.42	138.17	0.001634
CW-2	10	364	138.17	136.79	0.003791
CW-3	10	258	136.79	127.2	0.037171
ES-1	15	377	131.23	130.44	0.002095
ES-2	15	342	130.44	129.83	0.001784
ES-3	15	56	129.83	129.68	0.002679
ES-4	15	101	129.68	129.65	0.000297
ES-5	15	172	129.65	129.35	0.001744
ES-6	15	89.00	129.35	129.02	0.003708
ES-7	15	370	129.02	127.2	0.004919
JK-1	18	310	129.4	129.35	0.000161
JK-2	18	72	129.35	127.71	0.022778
JK-3	18	208	127.71	127.46	0.001202
JK-4	18	249	127.46	126.88	0.002329
JK-5	18	369	126.88	126.1	0.002114
KT-1	12	261	133.95	133.57	0.001456
KT-10	12	429	133.73	132.26	0.003427
KT-2	12	150	133.57	133.02	0.003667
KT-3	12	101	133.02	132.81	0.002079
KT-4	12	140	132.81	132.56	0.001786
KT-5	12	132.00	132.56	132.29	0.002045
KT-6	12	115	132.29	131.78	0.004435
KT-7	12	155	131.78	131.75	0.000194
KT-8	12	266	131.75	130.67	0.00406
KT-9	12	432	135.02	133.73	0.002986
P-185	21	91	123.78	123.64	0.001538
P-230	36	17	113.58	112.68	0.052941
P-66	24	22	113.87	112.68	0.054091
P-67	12	14.00	112.68	112.93	-0.017857
P-68	24	1,595.00	112.93	94.5	0.011555
P-70	15	101.00	128.58	116.83	0.116337
P-71	15	360	116.83	114.74	0.005806
P-72	36	331	116.44	113.58	0.00864
P-74	36	62	117.79	116.74	0.016935
P-75	36	76	116.74	116.44	0.003947
P-76	30	583	120.29	119.09	0.002058
P-77	30	264	119.09	118.62	0.00178
P-78	30	446	118.62	117.58	0.002332
P-79	30	193	117.58	116.74	0.004352
P-80	18	291	129.34	121.71	0.02622
P-81	30	65	121.71	121.37	0.005231
P-82	30	504	121.37	120.29	0.002143
P-83	10	61	123.29	120.29	0.04918
P-86	21	229	124.04	123.64	0.001747

Label	Section Size (in)	Length (ft)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)
P-93	21	33.00	123.78	121.71	0.062727
P-95	24	389	123.37	123.29	0.000206
P-97	15	396	122.07	120.54	0.003864
P-98	15	306	120.54	119.66	0.002876
P-99	15	413.00	119.66	117.79	0.004528
SF-1	10	515	142.54	141.77	0.001495
SF-10	12	480	131	129.85	0.002396
SF-11	12	478	129.85	128.76	0.00228
SF-12	12	131	128.76	122.81	0.04542
SF-13	12	167	131.45	131	0.002695
SF-2	10	349	141.77	141.1	0.00192
SF-3	10	352	141.1	140.34	0.002159
SF-4	12	1,305.00	140.34	138.04	0.001762
SF-5	12	610	138.04	137.35	0.001131
SF-6	12	565	137.35	135.1	0.003982
SF-7	12	468	135.1	133.26	0.003932
SF-8	12	454	133.26	132.09	0.002577
SF-9	12	480	132.09	131	0.002271
SR-1	12	1,245.00	129.76	127.44	0.001863
SR-2	12	15	127.44	126.83	0.040667
SR-3	24	632.00	126.83	126.2	0.000997
SR-4	24	561	126.2	125.79	0.000731
SR-5	24	477	125.79	125.19	0.001258
SR-6	24	436	125.19	124.7	0.001124
SR-7	24	485	124.7	124.3	0.000825
SR-8	24	482	124.3	123.93	0.000768
SR-9	24	364.00	123.93	123.37	0.001538
ST-1	10	519.00	127.58	126.82	0.001464
ST-2	10	348	126.82	126.26	0.001609
ST-3	10	833	126.26	124.21	0.002461
ST-4	10	830	124.21	120.29	0.004723
TF-1	10	330	137.22	136.57	0.00197
TF-2	10	331	136.57	135.92	0.001964
TF-3	10	329	135.92	135.64	0.000851
TF-4	10	325	135.64	134.99	0.002
TF-5	10	789	134.99	133.48	0.001914
TF-6	12	484	133.48	124.7	0.01814
TL-1	18	226	127.88	127.56	0.001416
TL-10	18	685	124.76	124.04	0.001051
TL-2	18	103	127.56	127.39	0.00165
TL-3	18	329	127.39	127.09	0.000912
TL-4	18	345	127.09	126.64	0.001304
TL-5	18	16	126.64	126.42	0.01375
TL-6	18	348	126.42	126.18	0.00069
TL-7	18	315	126.18	125.82	0.001143
TL-8	18	310	125.82	125.48	0.001097
TL-9	18	346	125.48	124.76	0.002081
TR-1	10	273	133.3	132.26	0.00381
TR-10	12	430	127.71	127.44	0.000628
TR-11	12	884	127.44	126.36	0.001222

Label	Section Size (in)	Length (ft)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)
TR-12	12	441	126.36	125.91	0.00102
TR-13	12	18.00	125.91	124.04	0.103889
TR-2	10	331	132.26	131.82	0.001329
TR-3	10	330	131.82	131.35	0.001424
TR-4	10	330.00	131.35	130.75	0.001818
TR-5	10	165	130.75	130.64	0.000667
TR-6	10	323	130.64	129.92	0.002229
TR-7	10	438	129.92	129.1	0.001872
TR-8	10	453	129.1	128.79	0.000684
TR-9	12	455	128.79	127.71	0.002374
TW-1	18	370	131.81	131.16	0.001757
TW-10	21	358	128.84	128.64	0.000559
TW-11	21	306	128.64	128.07	0.001863
TW-12	21	329	128.07	127.66	0.001246
TW-13	21	336	127.66	127.26	0.00119
TW-14	21	322	127.26	126.98	0.00087
TW-15	21	185	126.98	126.83	0.000811
TW-2	18	41	131.16	131.13	0.000732
TW-3	18	435	131.13	130.67	0.001057
TW-4	18	315	130.67	130.22	0.001429
TW-5	18	228	130.22	129.97	0.001096
TW-6	18	122	129.97	129.64	0.002705
TW-7	18	325	129.64	129.6	0.000123
TW-8	18	312	129.6	128.99	0.001955
TW-9	18	19.00	128.99	128.84	0.007895
ZP-1	18	328	127.2	126.96	0.000732
ZP-10	18	291	123.43	122.98	0.001546
ZP-11	18	310	122.98	121.97	0.003258
ZP-12	18	276	121.97	120.62	0.004891
ZP-13	18	327	120.62	118.16	0.007523
ZP-14	24	256	118.16	116.39	0.006914
ZP-15	24	77	116.39	115.57	0.010649
ZP-16	24	359.00	118.16	114.99	0.00883
ZP-17	24	268	114.99	113.95	0.003881
ZP-18	24	184	113.95	113.87	0.000435
ZP-19	24	187	113.87	113.7	0.000909
ZP-2	18	321	126.96	126.64	0.000997
ZP-20	18	14	114.74	113.58	0.082857
ZP-3	18	299	126.64	126.37	0.000903
ZP-4	18	313	126.37	125.74	0.002013
ZP-5	18	56	125.74	125.59	0.002679
ZP-6	18	331	126.1	125.47	0.001903
ZP-7	18	259	125.47	124.79	0.002625
ZP-8	18	375	124.98	124.79	0.000507
ZP-9	18	300	124.79	123.43	0.004533

APPENDIX D

SEWERCAD MODEL REPORT

TABLE D-2
CITY OF RIVERBANK 2007 SEWER COLLECTION SYSTEM MASTER PLAN
SEWERCAD MODEL REPORT: GENERAL PLAN LAND USE SCENARIO

Label	Section Size (in)	Length (ft)	Constructed Slope (ft/ft)	Total Flow (mgd)	Design Capacity (mgd)	Average Velocity (ft/s)	Flow/Design Capcity (%)
CA-1	15	304	0.002138	1.24	1.40075205	1.56	88.5
CA-2	15	342	0.002485	1.24	1.51021156	1.56	82.1
CW-1	10	153	0.001634	0.34689797	0.41532586	1.52	83.5
CW-2	10	364	0.003791	0.34689797	0.63263547	2.1	54.8
CW-3	10	258	0.037171	0.40689797	1.98090724	5.02	20.5
ES-1	15	377	0.002095	1.3152456	1.38670554	2.32	94.8
ES-2	15	342	0.001784	1.3152456	1.2793614	2.17	102.8
ES-3	15	56	0.002679	1.3852456	1.56780843	2.58	88.4
ES-4	15	101	0.000297	1.3852456	0.52208513	1.75	265.3
ES-5	15	172	0.001744	1.3852456	1.26513766	2.16	109.5
ES-6	15	89	0.003708	1.3852456	1.84460485	2.94	75.1
ES-7	15	370	0.004919	1.3852456	2.12459528	3.27	65.2
JK-1	18	310	0.000161	0.25663127	0.62559825	0.59	41
JK-2	18	72	0.022778	0.25663127	7.43441919	3.44	3.5
JK-3	18	208	0.001202	0.34663127	1.70777128	1.33	20.3
JK-4	18	249	0.002329	0.39663127	2.3774188	1.75	16.7
JK-5	18	369	0.002114	0.39663127	2.26477722	1.69	17.5
KT-1	12	261	0.001456	0.04	0.63750886	0.08	6.3
KT-10	12	429	0.003427	0.1	0.97801316	1.41	10.2
KT-2	12	150	0.003667	0.08	1.01169684	0.16	7.9
KT-3	12	101	0.002079	0.08	0.76183977	0.16	10.5
KT-4	12	140	0.001786	0.08	0.70602595	0.16	11.3
KT-5	12	132	0.002045	0.17	0.7556307	0.33	22.5
KT-6	12	115	0.004435	0.17	1.11263021	0.33	15.3
KT-7	12	155	0.000194	0.22	0.23243925	0.43	94.6
KT-8	12	266	0.004060	0.22	1.06459823	0.43	20.7
KT-9	12	432	0.002986	0.05	0.91299345	1.09	5.5
P-185	21	91	0.001538	1.91878336	2.91446916	2.29	65.8
P-230	36	17	0.052941	12.29811984	71.96723521	2.69	17.1
P-66	24	22	0.054091	2.57077484	24.67308608	1.27	10.4
P-67	12	14	-0.017857	14.86889468	-2.2326501	29.29	999
P-68	24	1595	0.011555	14.86889468	14.25455522	9.45	104.3
P-70	15	101	0.116337	0	10.33236231	0	0
P-71	15	360	0.005806	0	2.30814598	0	0
P-72	36	331	0.008640	12.29811984	29.07415117	2.69	42.3
P-74	36	62	0.016935	0.79	40.7039756	3.96	1.9
P-75	36	76	0.003947	12.29811984	19.65132579	2.69	62.6
P-76	30	583	0.002058	11.50811984	8.72658616	3.63	131.9
P-77	30	264	0.001780	11.50811984	8.11586848	3.63	141.8
P-78	30	446	0.002332	11.50811984	9.28832227	3.63	123.9
P-79	30	193	0.004352	11.50811984	12.68963188	3.63	90.7
P-80	18	291	0.026220	5.152	7.97640402	8.5	64.6
P-81	30	65	0.005231	7.07078336	13.91139926	5.03	50.8
P-82	30	504	0.002143	7.07078336	8.90398961	2.23	79.4
P-83	10	61	0.049180	4.13733648	2.27855963	11.74	181.6
P-86	21	229	0.001747	1.91878336	3.10547757	2.41	61.8

Label	Section Size (in)	Length (ft)	Constructed Slope (ft/ft)	Total Flow (mgd)	Design Capacity (mgd)	Average Velocity (ft/s)	Flow/Design Capcity (%)
P-93	21	33	0.062727	1.91878336	18.60991307	8.76	10.3
P-95	24	389	0.000206	4.13733648	1.52135836	2.04	272
P-97	15	396	0.003864	0.74	1.8829531	2.54	39.3
P-98	15	306	0.002876	0.74	1.62450856	2.28	45.6
P-99	15	413	0.004528	0.74	2.03838942	2.69	36.3
SF-1	10	515	0.001495	0	0.39728891	0	0
SF-10	12	480	0.002396	0.69	0.81779223	2.09	84.4
SF-11	12	478	0.002280	0.74	0.79783664	2.07	92.8
SF-12	12	131	0.045420	0.74	3.56071746	6.29	20.8
SF-13	12	167	0.002695	0.06	0.86728673	1.11	6.9
SF-2	10	349	0.001920	0	0.4501833	0	0
SF-3	10	352	0.002159	0.05	0.4774195	1	10.5
SF-4	12	1305	0.001762	0.1	0.70141224	1.11	14.3
SF-5	12	610	0.001131	0.25	0.56191976	1.23	44.5
SF-6	12	565	0.003982	0.36	1.0543425	2.14	34.1
SF-7	12	468	0.003932	0.41	1.04761248	2.21	39.1
SF-8	12	454	0.002577	0.46	0.8481637	1.95	54.2
SF-9	12	480	0.002271	0.58	0.79617275	1.97	72.8
SR-1	12	1245	0.001863	1.568	0.72123035	3.09	217.4
SR-2	12	15	0.040667	1.568	3.36925566	3.09	46.5
SR-3	24	632	0.000997	3.54733648	3.34944669	1.75	105.9
SR-4	24	561	0.000731	3.68733648	2.86795169	1.82	128.6
SR-5	24	477	0.001258	3.68733648	3.76251092	1.82	98
SR-6	24	436	0.001124	3.68733648	3.55644526	1.82	103.7
SR-7	24	485	0.000825	4.13733648	3.04663523	2.04	135.8
SR-8	24	482	0.000768	4.13733648	2.93926455	2.04	140.8
SR-9	24	364	0.001538	4.13733648	4.16106649	2.04	99.4
ST-1	10	519	0.001464	0.1	0.39317673	1.06	25.4
ST-2	10	348	0.001609	0.1	0.41216307	1.1	24.3
ST-3	10	833	0.002461	0.2	0.50970526	1.55	39.2
ST-4	10	830	0.004723	0.3	0.70610401	2.19	42.5
TF-1	10	330	0.001970	0.1	0.45599953	1.18	21.9
TF-2	10	331	0.001964	0.2	0.45531019	1.42	43.9
TF-3	10	329	0.000851	0.3	0.29974073	1.14	100.1
TF-4	10	325	0.002000	0.4	0.45949383	1.7	87.1
TF-5	10	789	0.001914	0.45	0.44948444	1.71	100.1
TF-6	12	484	0.018140	0.45	2.25029397	3.93	20
TL-1	18	226	0.001416	0.8625	1.85358343	1.82	46.5
TL-10	18	685	0.001051	1.3425	1.59702727	1.81	84.1
TL-2	18	103	0.001650	0.8625	2.00123098	1.92	43.1
TL-3	18	329	0.000912	0.8625	1.48748998	1.54	58
TL-4	18	345	0.001304	0.9425	1.77904969	1.8	53
TL-5	18	16	0.013750	1.0425	5.7762066	4.35	18
TL-6	18	348	0.000690	1.0425	1.29362193	1.45	80.6
TL-7	18	315	0.001143	1.0425	1.66528029	1.76	62.6
TL-8	18	310	0.001097	1.1425	1.63136064	1.77	70
TL-9	18	346	0.002081	1.1425	2.24708535	2.26	50.8
TR-1	10	273	0.003810	0.08628336	0.63416174	1.43	13.6
TR-10	12	430	0.000628	0.47628336	0.41866083	1.12	113.8
TR-11	12	884	0.001222	0.52628336	0.58398329	1.51	90.1

Label	Section Size (in)	Length (ft)	Constructed Slope (ft/ft)	Total Flow (mgd)	Design Capacity (mgd)	Average Velocity (ft/s)	Flow/Design Capcity (%)
TR-12	12	441	0.001020	0.57628336	0.53370545	1.42	108
TR-13	12	18	0.103889	0.57628336	5.38516766	7.85	10.7
TR-2	10	331	0.001329	0.18628336	0.37460799	1.21	49.7
TR-3	10	330	0.001424	0.28628336	0.38775432	1.38	73.8
TR-4	10	330	0.001818	0.38628336	0.43811018	1.62	88.2
TR-5	10	165	0.000667	0.47628336	0.26528889	1.35	179.5
TR-6	10	323	0.002229	0.47628336	0.48509821	1.83	98.2
TR-7	10	438	0.001872	0.47628336	0.44456428	1.7	107.1
TR-8	10	453	0.000684	0.47628336	0.26877968	1.35	177.2
TR-9	12	455	0.002374	0.47628336	0.81399335	1.91	58.5
TW-1	18	370	0.001757	0.23733648	2.06465354	0.21	11.5
TW-10	21	358	0.000559	1.81733648	1.7562633	1.17	103.5
TW-11	21	306	0.001863	1.85933648	3.20695493	1.2	58
TW-12	21	329	0.001246	1.85933648	2.62307145	1.2	70.9
TW-13	21	336	0.001190	1.85933648	2.56375487	1.2	72.5
TW-14	21	322	0.000870	1.85933648	2.19112534	1.2	84.9
TW-15	21	185	0.000811	1.90933648	2.11580631	1.23	90.2
TW-2	18	41	0.000732	0.27733648	1.33247806	0.24	20.8
TW-3	18	435	0.001057	0.35733648	1.60186406	0.31	22.3
TW-4	18	315	0.001429	0.57733648	1.86183997	0.51	31
TW-5	18	228	0.001096	0.57733648	1.63115019	0.51	35.4
TW-6	18	122	0.002705	0.57733648	2.56193687	0.51	22.5
TW-7	18	325	0.000123	0.57733648	0.54648681	0.51	105.6
TW-8	18	312	0.001955	0.57733648	2.17810589	0.51	26.5
TW-9	18	19	0.007895	0.57733648	4.37683524	0.51	13.2
ZP-1	18	328	0.000732	1.79214357	1.33247806	1.57	134.5
ZP-10	18	291	0.001546	2.30177484	1.93709594	2.31	118.8
ZP-11	18	310	0.003258	2.30177484	2.81171443	3.17	81.9
ZP-12	18	276	0.004891	2.30177484	3.44511491	3.7	66.8
ZP-13	18	327	0.007523	2.30177484	4.27252927	4.35	53.9
ZP-14	24	256	0.006914	2.30177484	8.82120641	4.15	26.1
ZP-15	24	77	0.010649	2.30177484	10.94770024	1.13	21
ZP-16	24	359	0.008830	2.30177484	9.96881968	4.53	23.1
ZP-17	24	268	0.003881	2.30177484	6.60861735	1.13	34.8
ZP-18	24	184	0.000435	2.30177484	2.21206261	1.13	104.1
ZP-19	24	187	0.000909	2.30177484	3.19863725	1.13	72
ZP-2	18	321	0.000997	1.86214357	1.55529882	1.85	119.7
ZP-20	18	14	0.082857	0	14.17935077	0	0
ZP-3	18	299	0.000903	1.86214357	1.48025882	1.75	125.8
ZP-4	18	313	0.002013	1.86214357	2.20998576	2.5	84.3
ZP-5	18	56	0.002679	1.86214357	2.54942937	1.63	73
ZP-6	18	331	0.001903	2.25877484	2.14905558	2.54	105.1
ZP-7	18	259	0.002625	2.30177484	2.52403832	2.91	91.2
ZP-8	18	375	0.000507	2.30177484	1.10879826	2.02	207.6
ZP-9	18	300	0.004533	2.30177484	3.31665422	3.6	69.4