VIII. Appendices

A. Terms and Abbreviations used in this Report
B. Methods of Analysis
C. Frequency of Analysis and Type of Sample
D. Laboratories contributing Results used in this report
E. QA Summary Report
F. Staff Contributing to this Report
G. System wide calculation definition
H. Annual Flow Calibration Report

A. Terms and Abbreviations used in this Report

Along with standard abbreviations the following is a list of local/uncommon abbreviations and terms for the readers' reference.

PLANT TERMS

U.S.EPA - United States Environmental Protection Agency.
NPDES - National Pollutant Discharge Elimination System.
WWTP - Wastewater Treatment Plant.
WRP - Water Reclamation Plant.
PLWWTP - Pt. Loma Wastewater Treatment Plant
PLR - Point Loma Raw (influent to the plant).
PLE - Point Loma Effluent (effluent from the plant).
N-1-P - North Digester Number 1, Primary, Pt. Loma
N-2-P - North Digester Number 2, Primary, Pt. Loma
C-1-P - Central Digester Number 1, Primary, Pt. Loma
C-2-P - Central Digester Number 2, Primary, Pt. Loma
S-1-P - South Digester Number 1, Primary, Pt. Loma
S-2-P - South Digester Number 2, Primary, Pt. Loma
Dig 7 - Digester Number 7, Primary, Pt. Loma
Dig 8 - Digester Number 8, Primary, Pt. Loma
DIG COMP - Digested Biosolids Composite; a composite of grabs taken from each of the in-service digesters.
RAW COMP - A Composite of Raw Sludge taken over the preceding 24 hrs.
NCWRP - North City Water Reclamation Plant
N01-PS_INF - The plant primary Influent from Pump Station 64
N01-PEN - The plant primary Influent from the Penasquitos pump station.
N30-DFE - Disinfected Final Effluent
N34-REC WATER - Reclaimed Water.
N10-PSP COMB - raw sludge
N15-WAS LCP - Waste Activated Sludge – low capacity pumps
MBC - Metro Biosolids Center
MBCDEWCN - Metro Biosolids Center Dewatering Centrifuges; typically the dewatered biosolids from these.
MBC_COMBCN - MBC Combined Centrate; the centrate from all the dewatering centrifuges. (The return stream from MBC to the sewer system.)
MBC_NC_DSL - North City to Metropolitan Biosolids Center (MBC) Digested Sludge Line.
Dig 1 - MBC Digester number 1.
Dig 2 - MBC Digester number 2.
Dig 3 - MBC Digester number 3.
Biosolids - In most cases Biosolids and digested (a processed) Sludge is synonymous.
Field Replicate - Separate samples collected at approximately the same time from the same sample site.

UNITS

mg/L ..... milligrams per liter
ug/L .....micrograms per liter = 0.001 mg/L
ng/L ..... nanograms per liter = 0.001 ug/L
mg/Kg..... milligrams per kilogram
ug/Kg..... micrograms per kilogram
ng/Kg..... nanograms per kilogram
pg/L ..... picograms per liter
pg/Kg.....picograms per kilogram
pc/L or pCi/L ..... pico curies per liter
TU..... toxicity units
ntu..... nephelometric turbidity units
^{o}C ..... degrees Celsius = degrees centigrade
MGD..... million gallons per day
umhos/cm. . ..... micromhos per centimeter
uS.....microsiemens = umhos
mils/100 mL..... millions per 100 milliliters
nd.....not detected
NA .....not analyzed (when in a data column)
NR .....not required
NS.....not sampled

CHEMICAL TERMS & ABBREVIATIONS:

AA .....Atomic Absorption Spectroscopy
BOD.....Biochemical Oxygen Demand
CN^{-}.....Cyanide
COD.....Chemical Oxygen Demand
Cr^{6+} .....Hexavalent Chromium
D.O. .....Dissolved Oxygen
DDD .....Dichlorodiphenyldichloroethane
.....(a.k.a. TDE-tetrachlorodiphenylethane)
DDE.....Dichlorodiphenyldichloroethylene
DDT.....Dichlorodiphenyltrichloroethane
$FeCl_3$.....Ferric Chloride
G&O .....Grease and Oil
GC .....Gas chromatography.
GC-ECD .....Electron Capture Detector
GC-FID.....Flame Ionization Detector
GC-FPD.....Flame Photometric Detector
GC-MS .....Mass Spectroscopy
H_2S.....Hydrogen Sulfide
Hg .....Mercury
IC.....Ion Chromatography
ICP-AES.....Inductively Coupled Plasma-Atomic Emission Spectroscopy
MDL .....Method Detection Limit
MSD .....Mass Spectroscopy Detector
NH_3.....Ammonia
NH_3-N.....Ammonia Nitrogen
NH_4^{+} .....Ammonium ion
NO_3^{-} .....Nitrate
PAD .....Pulsed Amperometric Detector
PCB .....Polychlorinated Biphenyls
PO_4^{3-} .....Phosphate
SO_4^{2-} .....Sulfate
SS.....Suspended Solids
TBT .....Tributyl tin
TCH.....Total Chlorinated Hydrocarbons (i.e. chlorinated pesticides & PCB's)
TCLP .....Toxicity Characteristic Leaching Procedure
TDS .....Total Dissolved Solids
TS .....Total Solids
TVS .....Total Volatile Solids
VSS.....Volatile Suspended Solids

B. Methods of Analysis

WASTEWATER INFLUENT and EFFLUENT (General)

Analyte	Description	Instrumentation	Reference[1]
Alkalinity	Selected Endpoint Titration	Mettler DL-21 & 25 Titrator Orion 950	(i) 2320 B
Ammonia Nitrogen	Distillation and Titration	Buchi Distillation Unit K-314, B-324, K-350 Orion 950 pH Meter Mettler DL25 titrator	(i) 4500-NH3 B & C
Biochemical Oxygen Demand (BOD-5 Day)	Dissolved Oxygen Meter with Dissolved Oxygen Probe	YSI-5000 DO Meter YSI-5100 DO Meter YSI 59 DO Meter (5905 Probe)	(i) 5210 B
Biochemical Oxygen Demand (BOD-Soluble)	Dissolved Oxygen Probe	YSI-5000 DO Meter YSI-5100 DO Meter YSI 59 DO Meter (5905 Probe)	(i) 5210 B
Chemical Oxygen Demand (COD)	Closed Reflux / Colorimetric	Hach DR-2010 UV/Vis spectrophotometer	HACH 8000
Conductivity	Conductivity Meter with Wheatstone Bridge probe	YSI-3100, YSI-3200, Orion 115A,Orion 250, Accumet Model 150	(g) 2510 B
Cyanide	Acid Digest/Distil./Colorimetric	Hach DR-4000/Vis	(i) 4500-CN E
Floating Particulates	Flotation Funnel	Mettler AX-105 Mettler AG 204 Balance	(g) 2530 B
Flow	Continuous Meter	Gould (pressure sensor), ADS (sonic sensor), or Venturi (velocity sensor)	
Hardness; Ca, Mg, Total	ICP-AES / Calculation	TJA IRIS	(a) 200.7 (h) 2340 B
Kjeldahl Nitrogen (TKN)	Macro-Digestion / Titration	Labconco digestion block Buchi B-324 distiller & Mettler DL25 titrator	(i)Digestion= 4500-Norg B
Oil and Grease	Hexane Extraction / Gravimetric	Mettler AX-105 Balance	(a) 1664A
Organic Carbon (TOC)	Catalytic Oxidation / IR Water Production Laboratory)	Shimadzu ASI-5000	(f) 5310 B
pH	Hydrogen+Reference Electrode	Various models of pH meters.	(i) 4500-H+ B
Radiation (alpha & beta)	Alpha Spectroscopy Gamma Spectroscopy	Canberra 7401 (alpha) Canberra GC25185 (beta)	(h) 7110 B
Solids, Dissolved-Total	Gravimetric @ 180°C using analytical balance	Mettler AG204,AX105,AB204	(i) 2540 C
Solids, Settleable	Volumetric	Imhoff Cone	(i) 2540 F
Solids, Suspended-Total	Gravimetric @ 103-105°C	Mettler AG204,AX105,AB204	(i) 2540 D
Solids, Suspended-Volatile	Gravimetric @ 500°C	Mettler AG204,AX105,AB204	(i) 2540 E
Solids, Total	Gravimetric @ 103-105°C	Mettler AG204,AX105,AB204	(a) 160.3
Solids, Total-Volatile	Gravimetric @ 500°C	Mettler AG204,AX105,AB204	(a) 160.4
Temperature	Direct Reading	Fisher Digital Thermometer	(g) 2550 B
Turbidity	Nephelometer Turbidimeter	Hach 2100-N Meter Hach 2100-AN Meter	(g) 2130 B
Bromide, Chloride, Fluoride, Nitrate, Phosphate, Sulfate	Ion Chromatography	Dionex ICS-3000	(d) 300.0

[1] Reference listing is found following this listing of analytical methods.

WASTEWATER INFLUENT and EFFLUENT (Metals)

Analyte	Description	Instrumentation	Reference[1]
Aluminum	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.7
Antimony	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.7
Arsenic	Hydride Generation / AA	TJA Solaar M6	(h) 3114 C
Barium	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.7
Beryllium	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.7
Boron	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.7
Cadmium	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.7
Calcium	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.7
Chromium	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.7
Cobalt	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.7
Copper	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.7
Iron	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.7
Lead	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.7
Lithium	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.7
Magnesium	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.7
Manganese	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.7
Mercury	Thermal / AA	Milestone DMA80	(g) 3112 B
Mercury	Cold Vapor Generation / AF	Leeman Hydra Gold	(w) 1613E and 245.7
Molybdenum	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.7
Nickel	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.7
Potassium	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.7
Selenium	Hydride Generation / AA	TJA Solaar M6	(h) 3114 C
Silver	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.7
Sodium	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.7
Thallium	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.7
Vanadium	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.7
Zinc	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.7

[1] Reference listing is found following this listing of analytical methods.

WASTEWATER INFLUENT and EFFLUENT (Organics)

Analyte	Description	Instrumentation	Reference[1]
Acrolein and Acrylonitrile	Purge & Trap, GC-MSD	O-I Analytical Eclipse 4660/4552 Agilent-6890NGC /5973N MSD Capillary J&W DB-624	(c) 8260 B
Base/Neutral Extractables	Basic / CH2Cl2 continuous extraction, GC-MSD	HP-6890GC / 5973MSD Capillary DB-5.625	(a) 625
Benzidines	Basic / CH2Cl2 continuous extraction, GC-MSD	HP-6890GC / 5973MSD Capillary DB-5.625	(a) 625
Chlorinated Compounds	CH2Cl2 extraction, GC-ECD	Bruker 450-GC 300-MS TQ Mass Spectrometer DB-XLB	(a) 608
Dioxin	CH2Cl2 extraction, GC/MS/MS	Varian Saturn -MS-MS Varian 3800 GC	(a) 8280A
Organophosphorus Pesticides	CH2Cl2 extraction, hexane exchange, GC-PFPD	Varian 3800 GC-PFPD RTX-1 :RTX-50	(a) 622
Phenolic Compounds	Acidic / CH2Cl2 continuous extraction, GC-MSD	HP-6890GC / 5973MSD Capillary DB-5.625	(a) 625
Purgeables (VOCs)	Purge & Trap, GC-MSD	O-I Analytical Eclipse 4660/4552 Agilent-6890NGC /5973N MSD Capillary J&W DB-624	(a) 8260B
Tri, Di, and Monobutyl Tin	CH2Cl2 extraction, derivatization, hexane exchange, GC-FPD	Varian 3400 GC-FPD DB-1/30m : RTX-50	(l)

[1] Reference listing is found following this listing of analytical methods.

LIQUID SLUDGE: Raw, Digested, and Filtrate (General)

Analyte	Description	Instrumentation	Reference[1]
Alkalinity	Selected Endpoint Titration	Mettler DL-25 Titrator Orion 950	(g) 2320 B
Cyanide	Acid Digest-Distil / Colorimetric	Hach DR/4000V	(h) 4500-CN E
pH	Hydrogen+Reference Electrode	Various models of pH meters.	(c) 9010 B
Radiation (alpha & beta)	Alpha Spectroscopy Gamma Spectroscopy	Canberra 7401 (alpha) Canberra GC25185 (beta)	(h) 7110 B
Sulfides	Acid Digest-Distil / Titration	Class A Manual Buret	(c) 9030 B
Sulfides, reactive	Distillation / Titration	Class A Manual Buret	(c) 7.3.4.2
Solids, Total	Gravimetric @ 103-105°C	Mettler PB 4002-S Mettler PG 5002-S Mettler AB204	(i) 2540 B
Solids, Total-Volatile	Gravimetric @ 500°C	Mettler PB 4002-S Mettler PG 5002-S Mettler AB204	(i) 2540 E

LIQUID SLUDGE: Raw, Digested, and Filtrate (Metals)

Analyte	Description	Instrumentation	Reference[1]
Aluminum	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Antimony	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Arsenic	Hydride Generation / AA	TJA Solaar M6	(c) 7062
Beryllium	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Barium	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Boron	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Cadmium	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Chromium	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Cobalt	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Copper	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Iron	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Lead	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Manganese	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Mercury	Thermal / AA	Milestone DMA80	(c) 7471 A and 747.3
Mercury	TD / AA	Milestone DMA80	(c) 7471 A
Molybdenum	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Nickel	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Selenium	Hydride Generation / AA	TJA Solaar M6	(c) 7742
Silver	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Thallium	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Vanadium	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Zinc	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B

[1] Reference listing is found following this listing of analytical methods.

LIQUID SLUDGE: Raw, Digested, and Decant (Organics)

Analyte	Description	Instrumentation	Reference[1]
Acrolein and Acrylonitrile	Purge & Trap, GC-MSD	O-I Analytical Eclipse 4660/4552 Agilent-6890NGC /5973N MSD Capillary J&W DB-624	(c) 8260 B (b)
Base/Neutral Extractables	Basic / CH2Cl2 continuous extraction, GC-MSD	HP-6890GC / 5973MSD Capillary DB-5.625	(a) 625 (b)
Benzidines	Basic / CH2Cl2 continuous extraction, GC-MSD	HP-6890GC / 5973MSD Capillary DB-5.625	(a) 625
Chlorinated Compounds	CH2Cl2 extraction, GC-ECD	Bruker 450-GC 300-MS TQ Mass Spectrometer DB-XLB	(c) 8081 A
PCBs	CH2Cl2 extraction, GC-ECD	Bruker 450-GC 300-MS TQ Mass Spectrometer DB-XLB	(c) 8082
Dioxin	CH2Cl2 extraction	Varian GC-MS/MS	(c) 8280A
Organophosphorus Pesticides	CH2Cl2 extraction, hexane exchange, GC-PFPD	Varian 3800 GC-PFPD RTX-1 : RTX-50	(a) 622
Phenolic Compounds	Acidic / CH2Cl2 continuous extraction, GC-MSD	HP-6890GC / 5973MSD Capillary DB-5.625	(a) 625 (b)
Purgeables (VOCs)	Purge & Trap, GC-MSD	O-I Analytical Eclipse 4660/4552 Agilent-6890NGC /5973N MSD Capillary J&W DB-624	(c) 8260 B (b)
Tri, Di, and Monobutyl Tin	CH2Cl2 extraction, derivatization, hexane exchange, GC-FPD	Varian 3400 GC-FPD DB-1/30m : RTX-50	(l)

LIQUID SLUDGE: Raw, Digested, and Decant (Digester Gases)

Analyte	Description	Instrumentation	Reference[1]
Methane	Gas Chromatography	SRI 8610C GC EG&G 100AGC	(i) 2720 C
Carbon Dioxide	Gas Chromatography	SRI 8610C GC EG&G 100AGC	(i) 2720 C
Hydrogen Sulfide	Colorimetric	Draeger H2S 2/a	

[1] Reference listing is found following this listing of analytical methods.

DRIED SLUDGE: Metro Biosolids Center (General)

Analyte	Description	Instrumentation	Reference[1]
Cyanide	Acid Digest-Distillation Colorimetric	Hach DR/4000V UV/Vis	(c) 9010 A and 9014
Cyanide Reactive	Distillation / Colorimetric	Hach DR/4000V UV/Vis	(c) 7.3.3.2 and 9014
pH	Hydrogen+Reference Electrode	Various models of pH meters.	(c) 9045 C
Radiation (alpha & beta)	Alpha Spectroscopy Gamma Spectroscopy	Canberra 7401 (alpha) Canberra GC25185 (beta)	(h) 7110 B
Sulfides	Acid Digest-Distil / Titration	Class A Manual Buret	(c) 9030 B and 9034
Sulfides, reactive	Distillation / Titration	Class A Manual Buret	(c) 7.3.4.2 and 9034
Solids, Total	Gravimetric @ 103-105 Cº	Denver PI-314, Mettler AB204	(i) 2540 B
Solids, Total-Volatile	Gravimetric @ 500 Cº	Denver PI-314, Mettler AB204	(i) 2540 E

DRIED SLUDGE: Metro Biosolids Center (Metals)

Analyte	Description	Instrumentation	Reference[1]
Aluminum	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Antimony	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Arsenic	Hydride Generation / AA	TJA Solaar M6	(c) 7062
Barium	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Beryllium	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Boron	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Cadmium	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Chromium	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Cobalt	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Copper	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Iron	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Lead	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Manganese	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Mercury	Thermal / AA	Milestone DMA80	(c) 7471 A
Mercury	TD / AA	Leeman Hydra Gold	(c) 7471 A
Molybdenum	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Nickel	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Selenium	Hydride Generation / AA	TJA Solaar M6	(c) 7742
Silver	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Thallium	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Vanadium	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Zinc	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B

Waste Extraction Test (WET)	Extraction with Sodium Citrate ICP-AES	Burrel wrist action shaker TJA IRIS	(j) Section 66261.100

[1] Reference listing is found following this listing of analytical methods.

DRIED SLUDGE: Metro Biosolids Center (Organics)

Analyte	Description	Instrumentation	Reference[1]
Acrolein and Acrylonitrile	Purge & Trap, GC-MSD	O-I Analytical Eclipse 4660/4552 Agilent-6890NGC /5973N MSD Capillary J&W DB-624	(c) 8260 B
Base/Neutral Extractables	CH2Cl2 /Acetone sonication extraction, GC-MSD	Agilent-7890GC / 5975MSD Capillary DB-5.625	(c) 8270 C (c) 3550 A
Chlorinated Compounds	CH2Cl2 extraction, GC-ECD	Bruker 450-GC 300-MS TQ Mass Spectrometer DB-XLB	(c) 8081 A
PCBs	CH2Cl2 extraction, GC-ECD	Bruker 450-GC 300-MS TQ Mass Spectrometer DB-XLB	(c) 8082
Dioxin	Outside Contact (Test America)	GC-MS	(a) 8290
Organophosphorus Pesticides	CH2Cl2 extraction, hexane exchange, GC-PFPD	Varian 3800 GC-PFPD DB-1/30m DB-608/30m	(c) 8141 A
Phenolic Compounds	CH2Cl2 / Acetone sonication extraction, GC-MSD	HP-5890GC / 5972MSD Agilent-78906GC / 5975MSD Capillary DB-5.625	(c) 8270 C (c) 3550 A
Purgeables (VOCs)	Purge & Trap, GC-MSD	O-I Analytical Eclipse 4660/4552 Agilent-6890NGC /5973N MSD Capillary J&W DB-624	(c) 8260 B
Tri, Di, and Monobutyl Tin	CH2Cl2 extraction, derivatization, hexane exchange, GC-FPD	Varian 3400 GC-FPD DB-1/30m DB-608/30m	(l)
Total Nitrogen (TN)	Combustion / GC-TCD	Carlo-Erba NC-2500 Porapak QS	(m) 9060

[1] Reference listing is found following this listing of analytical methods.

OCEAN SEDIMENT (General)

Analyte	Description	Instrumentation	Reference[1]
Biochemical Oxygen Demand (BOD-5 Day)	Dissolved Oxygen Probe	YSI-5000 DO Meter	(g) 5210 B
Particle Size	Coarse fraction by sieve; fine fraction by laser scatter	Horiba LA-920	(q) 3-380
Sulfides	Acid Digest-Distil / IC-PAD	Dionex ICS3000-PAD(Ag)	(k)
Solids, Total	Gravimetric @ 103-105 Cº	AND HM-120	(g) 2540 B
Solids, Total-Volatile	Gravimetric @ 500 Cº	AND HM-120	(g) 2540 E
Total Organic Carbon (TOC) and Total Nitrogen (TN)	Combustion / GC-TCD	Carlo-Erba NC-2500 Porapak QS	(c) 9060 (m)

OCEAN SEDIMENT (Metals)

Analyte	Description	Instrumentation	Reference[1]
Aluminum	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Antimony	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Arsenic	Hydride Generation / AA	TJA Solaar M6	(c) 7062
Beryllium	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Cadmium	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Chromium	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Copper	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Iron	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Lead	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Manganese	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Mercury	Thermal / AA	Milestone DMA80	(c) 7471 A
Mercury	Cold Vapor Generation / AF	Leeman Hydra Gold	(c) 7471 A
Nickel	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Selenium	Hydride Generation / AA	TJA Solaar M6	(c) 7742
Silver	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Thallium	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Tin	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B
Zinc	Acid Digestion / ICP-AES	TJA IRIS	(c) 6010 B

OCEAN SEDIMENT (Organics)

Analyte	Description	Instrumentation	Reference[1]
Base/Neutral Extractables	CH2Cl2 / Acetone ASE GC-MSD	Agilent-7890GC / 5975MSD Capillary DB-5.625	(c) 8270 C (b) 3545A
Chlorinated Compounds	CH2Cl2 extraction, GC-MS/MS	Varian 3800 GC Saturn 2000 MS-Ion Trap DB-XLB/60m	(c) 8081 A 3545A
PCBs as Congeners	CH2Cl2 extraction, GC-MS/MS	Varian 3800 GC Saturn 2000 MS-Ion Trap DB-XLB/60m	(c) 8082 3545A
Organophosphorus Pesticides	CH2Cl2 extraction, hexane exchange, GC-PFPD	Varian 3800 GC-PFPD RTX-1 : RTX-50	(c) 8141 A
Tri, Di, and Monobutyl Tin	CH2Cl2 extraction, derivatization, hexane exchange, GC-FPD	Varian 3400 GC-FPD DB-1/30m : RTX_50	(l)

[1] Reference listing is found following this listing of analytical methods.

FISH TISSUE: Liver, Muscle, and Whole (General)

Analyte	Description	Instrumentation	Reference[1]
Solids, Total	Freeze Drying Gravimetric	Labconco Freezone 6 Mettler AG-104 Balance	(n)
Lipids	Hexane/Acetone Extraction Gravimetric	Dionex ASE-200 Mettler AG-104 Balance	(o)

FISH TISSUE: Liver, Muscle, and Whole (Metals)

Analyte	Description	Instrumentation	Reference[1]
Aluminum	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.3 / 200.7
Antimony	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.3 / 200.7
Arsenic	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.3 / 200.7
Beryllium	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.3 / 200.7
Cadmium	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.3 / 200.7
Chromium	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.3 / 200.7
Copper	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.3 / 200.7
Iron	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.3 / 200.7
Lead	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.3 / 200.7
Manganese	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.3 / 200.7
Mercury	Thermal / AA	Milestone DMA80	(e) 7473
Mercury	Cold Vapor Generation / AF	Leeman PS Hydra Gold	(w) 1631E
Nickel	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.3 / 200.7
Selenium	Hydride Generation / AA	TJA Solaar M6	(c) 7742
Silver	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.3 / 200.7
Thallium	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.3 / 200.7
Tin	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.3 / 200.7
Zinc	Acid Digestion / ICP-AES	TJA IRIS	(e) 200.3 / 200.7

FISH TISSUE: Liver, Muscle, and Whole (Organics)

Analyte	Description	Instrumentation	Reference[1]
Base/Neutral Extractables	Basic / CH2Cl2 ASE extraction, GC-MSD	Dionex ASE-200 Agilent-7890GC/5975 MSD Capillary DB-5625	(c) 3545 / 8270 C
Chlorinated Compounds	CH2Cl2 extraction, GC- MS/MS	Varian 3800 GC Saturn 2000 MS-Ion Trap DB-XLB/60m	(c) 3545 / 8081 A
PCBs	CH2Cl2 extraction, hexane exchange, GC- MS/MS	Varian 3800 GC Saturn 2000 MS-Ion Trap DB-XLB/60m	(c) 3545 / 8082

1 Reference listing is found following this listing of analytical methods.

Method References: Methods of Analysis Used to Produce the Data Presented in this Report.

a) Methods for Chemical Analysis of Water and Wastes,
EPA, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio,
March 1979 (EPA-600/4-79-020), 1983 Revision, and March 1984 (EPA-600/4-84-017).

b) U.S. EPA Contract Laboratory Program, Statement of Work for Organic Analysis,
Multi-Media, Multi-Concentration, 7/85 revision and 1/91 revision.

c) Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,
U.S. EPA Office of Solid Waste and emergency Response,
Washington, D.C. 20460, November 1986, SW-846, Third Edition.
Revision 0 September 1994, December 1996, Revision 2

d) The Determination of Inorganic Anions in Water by Ion Chromatography,
Revision 2.1, August 1993

e) The Determination of Metals and Trace Elements in Water and Waste
Revision 4.4, EMMC Version, EMMC Methods Work Group, 1994

f) Standard Methods for the Examination of Water and Wastewater,
APHA, AWWA, WPCF, 17th Edition, 1989.

g) Standard Methods for the Examination of Water and Wastewater,
APHA, AWWA, WPCF, 18th Edition, 1992.

h) Standard Methods for the Examination of Water and Wastewater,
APHA, AWWA, WPCF, 19th Edition, 1995.

i) Standard Methods for the Examination of Water and Wastewater,
APHA, AWWA, WPCF, 20th Edition, 1998.

j) Criteria for Identification of Hazardous and Extremely Hazardous Wastes,
California Code of Regulations (CCR), Title 22.

k) DIONEX AU 107, R.D.Rocklin and E.L.Johnson, ANAL. CHEM., 1986, 55, 4

l) Adaptation of method by the Naval Ocean Systems Center, San Diego, Marine Environment Branch, San Diego, CA 92152-5000

m) ”TOC/TN in Marine Sediments...”, SCCWRP Annual Report, 1990-1991, and 1991-1992.

n) ”A Guide to Freeze Drying for the Laboratory...”, LABCONCO, 3-53-5/94-Rosse-5M-R3, 1994.

o) ”Lipids Content in Fish Tissues via Accelerated Solvent Extraction...”,WWChem, EMTS/MWWD, 1998

v) Procedures for Handling and Chemical Analysis of Sediment and Water Samples,
Russel H. Plumb, Jr., May 1981, EPA/Corp of Engineers Technical Committee on
Criteria for Dredged and Fill Material, EPA Contract 4805572010.

w) Method 1631, Revision E:,
Mercury in water by oxidation, purge and trap, and cold vapor atomic fluorescence spectrometry

C. Frequency of analysis and Type of Sample - 2012

CONSTITUENT	Frequency	Sample Type	Permit Required		Comments
			Influent	Effluent	
Process Control					
Biochemical Oxygen Demand -Total	Daily	Composite	X	X	
Biochemical Oxygen Demand -Soluble	Daily	Composite			Monday-Friday
Chemical Oxygen Demand	Weekly	Composite			
Conductivity	Weekly	Composite			
Floating Particulates	Daily	Composite	X	X	
Flow	Daily		X	X	Same meter used
Oil and Grease	Daily	Grab	X	X	
pH	Daily	Grab	X	X	
Settleable Solids	Daily	Grab	X	X	
Temperature	Daily	Grab	X	X	
Total Dissolved Solids	Daily	Composite	X	X	
Total Solids	Weekly	Composite			
Total Suspended Solids	Daily	Composite	X	X	
Total Volatile Solids	Weekly	Composite			
Turbidity	Daily	Composite	X	X	
Volatile Suspended Solids	Daily	Composite	X	X	
Metals					
As,Cd,Cr,Cu,Pb,Hg,Ni,Se,Ag,Zn	Weekly	Composite	X	X	
Sb, Be, Tl	Weekly	Composite	X	X	Req. Frequency=Monthly
Fe	Weekly	Composite			
Ions					
Alkalinity	Weekly	Composite			
Ammonia-Nitrogen	Weekly	Composite	X	X	
Anions (F-,Cl-,Br-,SO42-,NO3-,PO43-)	Weekly	Composite			
Cations (Ca2+, Mg2+, Li+,Na+,K+)	Weekly	Composite			
Cyanide	Weekly	Composite	X	X	
Hardness (Total, Ca, Mg)	Weekly	Composite			By calculation
Organic Priority Pollutants					
Acrolein and Acrylonitrile	Monthly	Grab	X	X	Method 8260
Base/Neutral Compounds	Monthly	Composite	X	X	Method 625
Benzidines	Monthly	Composite	X	X	Method 625
Dioxin	Monthly	Composite	X	X	Method 1613
Pesticides, chlorinated	Monthly	Composite	X	X	
Pesticides, organophosphorus	Semi-Annual	Composite			
Phenols, non-chlorinated	Weekly	Composite	X	X	Method 625
Phenols, chlorinated	Weekly	Composite	X	X	Method 625
Polychlorinated Biphenyls	Weekly	Composite	X	X	
Purgeable (Volatile) Compounds	Monthly	Grab	X	X	Method 8260
Tri, Di, & monobutyl tins	Monthly	Composite	X	X	
Miscellaneous					
Radiation	Monthly	Composite	X	X	Performed by a contract lab.
Toxicity (Acute & Chronic)	Monthly	Composite	X		Reported in the monthly Toxicity Testing Report by the Biology Section

D. Laboratories Contributing Results used in this report.

i. Metropolitan Wastewater Chemistry Laboratory (EPA Lab Code: CA00380, ELAP Certificate: 1609)
5530 Kiowa Drive
La Mesa, CA 91942
(619)668-3212
All results except those listed below.

ii. Point Loma Wastewater Chemistry Laboratory (EPA Lab Code: CA01435, ELAP Certificate: 2474)
1902 Gatchell Road
San Diego, CA 92106
(619)221-8765
Process control analyses and wet methods for the plant.

iii. North City Wastewater Chemistry Laboratory (EPA Lab Code: CA01436, ELAP Certificate: 2477)
4949 Eastgate Mall
San Diego, CA 92121
(858)824-6009
Process control analyses and wet methods for the plant.

iv. Metro Biosolids Center Chemistry Laboratory (EPA Lab Code: CA01437, ELAP Certificate: 2478)
5240 Convoy Street
San Diego, CA 92111
(858)614-5834
Process control analyses and wet methods for the plant.

v. South Bay Water Reclamation Plant (EPA Lab Code: CA01460, ELAP Certificate: 2539)
2411 Dairy Mart Road
San Diego, CA 92173
619.428.7349
Process control analyses and wet methods for the plant.

vi. City of San Diego - Water Quality Laboratory (EPA Lab Code: CA00080, ELAP Certificate: 1058)
5530 Kiowa Drive
La Mesa, CA 91942
(619)668-3237
Total Organic Carbon in Wastewater

vii. City of San Diego - Marine Microbiology and Vector Management (EPA LabCode: CA01393, ELAP Certificate: 2185)
4918 Harbor Drive, Suite 101
San Diego, CA 92106
(619) 758-2311
Microbiology

viii. City of San Diego - Toxicity Bioassay Laboratory (EPA Lab Code: CA01302, ELAP Certificate: 1989)
4918 Harbor Drive, Suite 101
San Diego, CA 92106
(619) 758-2347
Bioassays

ix. Frontier Analitical Laboratory (EPA Lab Code:CA014455, NELAP- Certificate: 02113CA)
5172 Hillsdale Circle
El Dorado Hills, CA95762
(916) 934-0900

x. Test America (EPA Lab code: WA00023, CA ELAP Certification: 2425
2800 George Washington Way
Richland, WA 99354-1613
Telephone# (509) 375-3131
Gross Alpha/Beta Radioactivity

xi. Test America
2960 Foster Creighton Drive
Nashville, TN 37204
NELAP Certification: 01168CA
Telephone# (615) 726-0177

E. QA Report Summary

(excerpt from our Quality Assurance/Quality Control Report for Calendar Year 2010, March 30, 2011)

Summary and Overview:

The Wastewater Chemistry Services Section, Metropolitan Wastewater Department, City of San Diego performs most of the NPDES and other permit and process control chemical and physical testing for the City of San Diego E.W. Bloom, Pt. Loma Wastewater Treatment Plant (PLWWTP), North City Water Reclamation Plant (NCWRP), South Bay Water Reclamation Plant (SBWRP), and the Metro Biosolids Center (MBC). We also perform the chemical/physical testing of ocean sediment and fish tissue samples for the Ocean monitoring program for the City of San Diego (PLWWTP Ocean Outfall and SBWRP Ocean Outfall) and the International Boundary and Water Commission, International Treatment Plant outfall. We also perform environmental testing for various customers, both internal to the City of San Diego and for other agencies.

The QA/QC activities of the Laboratory are comprehensive and extensive. Of the 34,284 samples received in the Laboratory in **2012**, approximately **25.81%** were Quality Control (QC) samples, such as blanks, check samples, standard reference materials, etc. 120 different analyses were performed throughout the year resulting in 269,636 analytical determinations. Of the determinations, 110,808 (~**41.1%**) were QC determinations (e.g. blanks, lab. replicates, matrix spikes, surrogates, etc.) used to determine the accuracy, precision, and performance of each analysis and batch.

We have 5 separate laboratory facility locations, each with its own California ELAP (Environmental Laboratory Accreditation Program) certification for the fields of testing required under California regulations. This is a rigorous program involving continuing independent blind performance testing, biannual comprehensive audits, and extensive documentation requirements. Each of the 5 laboratory facilities in the Metropolitan Wastewater (Metro) Department are independently certified and copies of those certifications are included at Attachment 1. California ELAP certifies fields of testing (methods/analytes) only for Water, Wastewater, and Hazardous materials for which methods are published in the Federal Register or specifically approved in regulation by U.S.EPA. Additionally, the Laboratory performs analyses using methods for which certification does not exist, such as ocean sediment and sea water determinations. Those methods have been developed in-house, derived from or in collaboration with other scientific laboratories (e.g. Scripps Institute of Oceanography, Southern California Coastal Water Research Project, et. al.) and have been used extensively in multi-agency EPA and State sponsored studies over the past several years. Many methods of analysis developed for matrices and applications not within ELAP jurisdiction have been adapted from ELAP listed methods. In all cases, we apply generally accepted standards of performance and quality control to methods.

Additionally, the operating division and all Metro Department Laboratories maintained International Standards Organization (ISO) 14001 Environmental Management Systems certification.

Contract laboratories are also required to use only approved methods for which they hold certification for, and/or are approved by the appropriate regulatory agency (e.g. SDRWQCB). Copies of their certifications are included as Attachment 2.

The following report summarizes the QA/QC activities during 2012 and documents the laboratory information and certifications for those laboratories which provided data used in NPDES and other permit monitoring or environmental testing during the year.

Laboratories Contributing Results used in this report.

Laboratory Name	EPA Lab Code	ELAP Cert.#	Address	Phone #	Contribution
Alvarado Wastewater Chemistry Laboratory	CA00380	1609	5530 Kiowa Drive L Mesa, CA 91942	(619)668-3212	All results except those listed below.
Pt. Loma Wastewater Chemistry Laboratory	CA01435	2474	1902 Gatchell Road San Diego, CA 92106	(619)221-8765	Process Control Ananlyses and wet mehtod for the treatment plant.
North City Wastewater Chemistry Laboratory	CA01436	2477	4949 Eastgate Mall San Diego, CA 92121	(858)824-6009	Process Control Ananlyses and wet mehtod for the treatment plant.
Metro Biosolids Center Chemistry Laboratory	CA01437	2478	5240 Convoy Street San Diego, CA 92111	(858)614-5834	Process Control Ananlyses and wet mehtod for the treatment plant.
South Bay Wastewater Chemistry Laboratory	CA00080	2539	2411 Dairy Mart Road San Diego, CA 92173	(619)428-7349	Process Control Ananlyses and wet mehtod for the treatment plant.
City of San Diego Water Quality Laboratory	CA01393	1058	5530 Kiowa Drive La Mesa, CA 91942	(619)668-3237	Total Organic Carbon in Wastewater
City of San Diego-Marine Microbiology	CA01302	2185	2392 Kincaid Road San Diego, CA 92101	(619)758-2312	Microbiology
City of San Diego Toxicology Laboratory		1989	2392 Kincaid Road San Diego, CA 92101	(619)758-2341	Bioassays
TestAmerica Laboratories, Inc		2425	2800 George Washington Way, Richland, WA 99354	(509)375-3131	Gross Alpha/Beta Radioactivity
TestAmerica Nashville Division		01168CA	2960 Foster Creighton Drive Nashville, TN 37204	(615)756-0177	Herbicides
Frontier Analytical Laboratory		02113CA	5172 Hillsdale Circle El Dorado Hills, CA 95762	(916)934-0900	Dioxin/Furan Wastewater and Solids

Facilities & Scope:

The Wastewater Chemistry Services Section (WCS) comprises five geographically separated laboratories. The Section's main laboratory facilities and headquarters located at the Alvarado Joint Laboratory building in La Mesa and the four satellite wastewater chemistry laboratories located at MWWD treatment plants maintain individual California Department of Health Service, Environmental Laboratory Accreditation Program (ELAP) certification in their respective Fields of Testing (FoT). Each laboratory has its own U.S.EPA Lab Code as shown in the following table.

Laboratory Facility	Laboratory	Address	Phone	EPA Lab. Code	ELAP Cert. No.
Alvarado Laboratory	Wastewater Chemistry Laboratory	5530 Kiowa Drive, La Mesa CA 91942	619.668.3215	CA00380	1609
Point Loma Satellite Lab	Pt. Loma Wastewater Chemistry Laboratory	1902 Gatchell Rd., San Diego, CA 92106	619.221.8765	CA01435	2474
North City Water Reclamation Plant Satellite Lab	North City Wastewater Chemistry Laboratory	4949 Eastgate Mall, San Diego, CA 92121	858.824.6009	CA01436	2477
Metro Biosolids Center Satellite Lab	Metro Biosolids Center Wastewater Chemistry Lab	5240 Convoy Street, San Diego, CA 92111	858.614.5834	CA01437	2478
South Bay Water Reclamation Plant Satellite Lab	South Bay Wastewater Chemistry Laboratory	2411Dairy Mart Rd., San Diego CA 92154	619.428.7349	CA01460	2539

The information presented in this report applies to the Wastewater Chemistry Services Section, including all of the laboratories listed above, unless specified otherwise. The main laboratory at Alvarado is the main office for the WCS and contains the most extensive laboratory facilities of the several laboratories. Along with a variety of process control and wet chemistry analyses, this facility also handles all of the trace metals, pesticides/organics determinations, and other analyses. The satellite laboratories are primarily dedicated to process control, wet chemistry, and other analyses directly related to the support of the operations of the co-located wastewater treatment plant.

The Wastewater Chemistry Services Section performs most of the NPDES and other permit and process control chemical and physical testing for the:

- E.W. Blom, Pt. Loma Wastewater Treatment Plant (PLWWTP), NPDES Permit No. CA0107409/ Order No. R9-2009-0001, including the ocean monitoring program.
- North City Water Reclamation Plant (NCWRP), Order No. 97-03.
- Metro Biosolids Center (MBC), no permit, but monitoring requirements contained in Permit No. R9-2009-0001.
- South Bay Water Reclamation Plant (SBWRP), NPDES Permit No.CA0109045/ Order No. 2006-067.
- Ocean monitoring program for the International Boundary and Water Commission, International Treatment Plant.
- Other environmental testing for various customers, both internal to the City of San Diego and other public agencies.

A small portion of the required monitoring testing was sub-contracted out to laboratories certified by ELAP for those analyses, specifically;

- Gross alpha- and Beta radiations are analyzed by Test America Laboratories, Inc., Richland Division
- Herbicides are analyzed by Test America Laboratories, Inc, Nashville Division
- Total organic carbon (TOC) in water are analyzed by the Water Quality Laboratory, City of San Diego, Water Department.
- Dioxin and Furans in solids and wastewater are analyzed by Frontier Analytical Laboratory.

Copies of these laboratories' ELAP certifications are included as Attachment 2. The City of San Diego pays for additional QC samples (replicates, blanks, and spikes) as a routine quality check on contracted laboratory work. This is beyond the usual and customary practices with contract laboratory work.

Ocean monitoring:

While there are no recognized State certifications for laboratory analyses of marine environmental samples (e.g. seawater, sediments, various tissues, etc.), the City of San Diego has been a leader in the development and standardization of analytical methods for determinations in these areas.

Many of the methods are novel approaches developed after extensive research and development from other published work (e.g. organo-tin analyses, sediment grain size, etc.) or adaptations of exiting EPA methods (e.g. SW 846 Method 8082 for PCB congeners in sediments, etc.). In all of these cases we participate in extensive inter-laboratory calibration studies. Some of the most extensive studies have involved the participation of several public, academic/research, and private laboratories under the umbrella of the Southern California Coastal Water Research Project (SCCWRP). These programs are repeated periodically as part of the Southern California Bight Regional Monitoring/Survey Project. This is a massive sampling and monitoring program participated in by all of the major Publicly Owned Treatment Works (POTWs), California Water Resource Control Boards, and research organizations.

Our laboratory is a reference (referee) laboratory for the NRCC (National Research Council of Canada) CARP-2 Certified Reference Material (CRM) for fish tissue. This was adopted as the standard reference material for QC QA for the Southern California Bight Regional Project. This sample is also used world-wide as a standard reference material. We have worked with NIST to develop a West Coast marine sediment and fish tissue standard reference material (SRM).

QA/QC Activities Summary:

Report for January 1, 2012 - December 31, 2012.[17]
The sample distribution for 2012 is not significantly changed from 2011. **269,029** analytical determinations were made on **34,284** samples received by the Laboratory in 2012(see table A.). Of these **8,850** or **25.81%** were Quality Control (QC) samples. **13.85%** were blanks and **11.97%** check or reference samples.

	2012 Number of Samples	2012 Percent of total samples
Table A. Samples		
Customer/Environmental samples	**25,434**	**74.19%**
Quality Control (QC) samples	**8,850**	**25.81%**
Total Samples	**34,284**	**100.00%**
QC Samples:		
Blanks:		
FIELD_BLANK	**193**	**0.56%**
REAGENT_BLANK	**18**	**0.05%**
TRIP BLANK	**0**	**0.00%**
METHOD_BLANK	**4,536**	**13.23%**
Total Blanks:	**4,747**	**13.85%**
Check samples:		
External Check samples	**2,345**	**6.84%**
Internal Check samples	**1,710**	**4.99%**
SRMs (Standard Reference Material)	**48**	**0.14%**
Total Check Samples:	**4,103**	**11.97%**
Total QC Samples:	**8,850**	**25.81%**

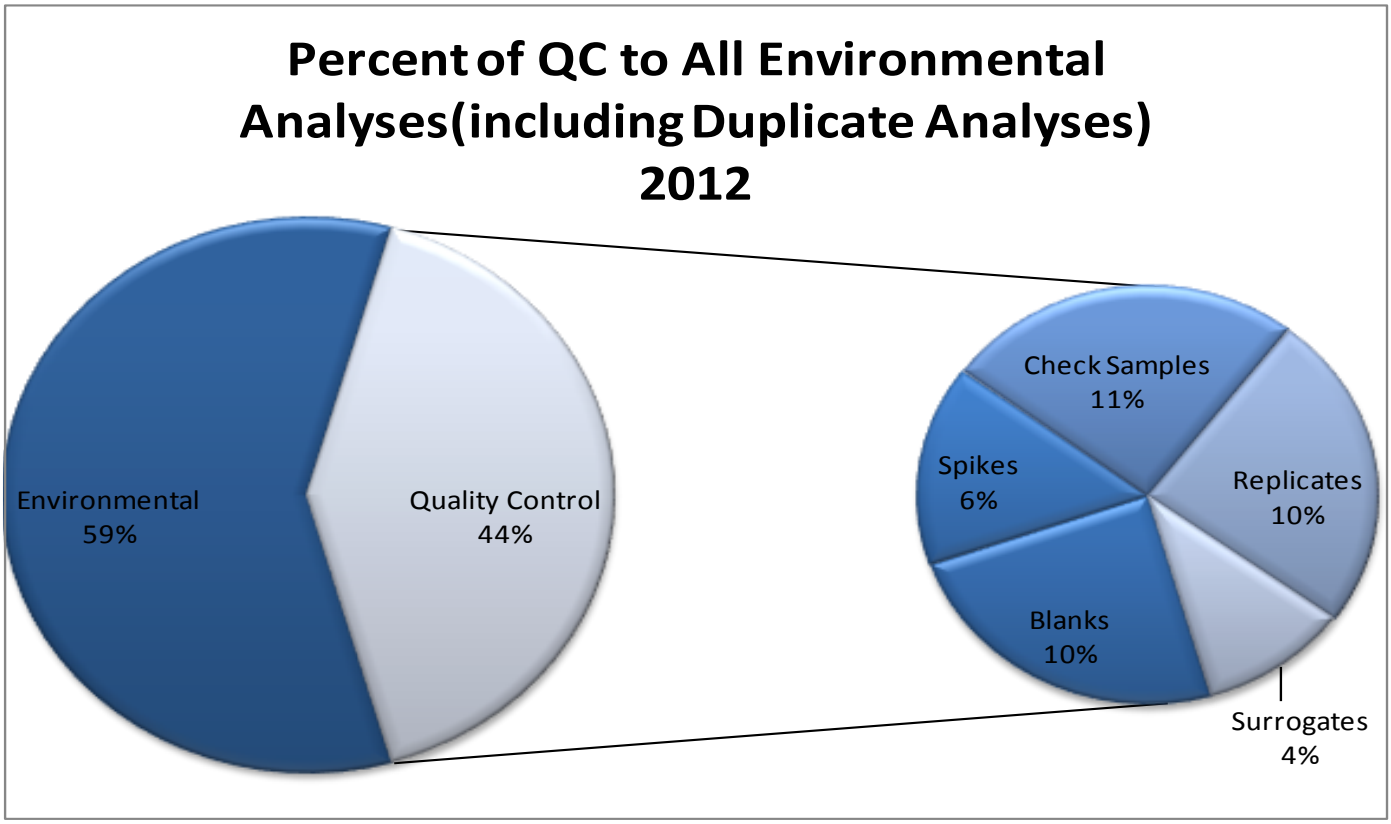
levels of QC are used for laboratory determinations. **41.1%** of the **269,029** determinations were QC (e.g. blanks, lab replicates, matrix spikes, surrogates, etc.). If calculated for the **260,894** customer determinations only, the percentage increases to **42.5%**.

3.37% of total analytical determinations or of analytical batches did not meet internal QA review due to a variety of criteria, e.g. unsuccessful calibration, unacceptable QC performance, etc. Samples having analytical determinations that were rejected are reanalyzed, or, if that is not possible, the data is either not reported or reported but flagged as having not met data quality objectives and may not be suitable for compliance determination.

17 Data counts (metrics) were obtained on March 21, 2013 and do not include analyses that were underway, but incomplete as of that time. All table data is based on samples collected between January 1, 2012 and December 31, 2012. This data summary is comprehensive; includes all laboratory analyses work for all customers, projects, and programs unless otherwise indicated.

Table A.2. Analyses (results) - 2012

	Number	Percent of total
Total number of analytes/results determined:	269,636	NA
Total results not complete [2]:	4,155	1.5%
No. of results for Customer/ Environmental Samples[1,3]:	260,894	96.8%
Total number of rejected results:	8,742	3.37%
No. of results for blanks[3]:	26,661	9.9%
No. of results for matrix spikes[3]:	17,215	6.4%
No. of results for Check samples[3]:	28,063	10.4%
No. of results for Replicates[3]:	27,151	10.1%
No. of results for surrogates[3]:	11,718	4.3%
Total QC analyses run[3] :	110,808	**41.1%**
Total in-house analyses completed [2]:	**259,764**	



1 – matrix spike, replicates, surrogates are also part of the total for Customer/Environmental samples.
2 – as of March 21, 2013.
3 – percent of QC samples calculated from grand total of **269,029**.

NOTE: Analysis, for the purposes of the metrics used in this report generally refer to each analyte determined in each sample in a batch. For example, an analysis (determination) of several metals in a sample (e.g. iron, nickel, lead) would total as 3 analyses in the expression of totals such as those in the Analyses table on the preceding page. This method of calculation has been used for many years and, with batch and method, is useful comparative measure of laboratory performance and is one of the fundamental constants in applying quality control measures.

	No. of Batches	Percent of total
Total number of analytical batches:	**13,885**	
Total number of rejected analytical batches:	**38**	**0.27%**
Incomplete batches (as of March 21, 2013):	**19**	**0.14%**

Outside laboratories

A small number of permit required analyses are contracted out, including gross alpha- & Beta- radiation, and Total Organic Carbon in wastewater as summarized below. Herbicides analysis contracted to Test America Laboratory.

Results from sub-contracted labs.		
Laboratory	Analytes	% of Total in-house Analytes
Test America	320	0.12%
Frontier Laboratory	4,692	1.81%
Water Quality, City of San Diego	98	0.04%
Total outside results:	**5,110**	**1.97%**

QA Plan:

A copy of our Laboratory's current Quality Assurance Plan is included as Attachment 3. The Quality Assurance Plan was updated in March 2013.

Performance Testing (PT) Studies for 2012:

The Wastewater Chemistry Laboratories participates in required ELAP and U.S.EPA PT studies throughout the year. We participated in 8 PT studies in 2012. **Each of our geographically separated laboratory facilities participated individually (as required by ELAP). PT studies were purchased from Wibby and Phenova and were successfully completed. When results submitted were determined to be outside of study acceptance limits the laboratory reviewed internal** protocols, modified procedures were necessary and **participated in a subsequent study for the analytes in question. A PT study was completed with satisfactory results for all analytes by in-house chemistry laboratories.**

The results of the Laboratory PT studies for 2012 are summarized in the following tables.

Alvarado Wastewater Chemistry Laboratory: See attachment 4 for copy of reports.

PT Study	Number of Analytes	Number of Acceptable results	Success Rate (%)
SOIL-0412	111	110	99.1%
SOIL-0712	47	47	100%
WP-0312	22	22	97%
WP-0512	2	1	50%
WP-0612	72	70	97.2%
WP-0712	22	22	100%
WP-0812	32	32	100%
WP-1012	3	3	100%
Total analytes:	309	**Overall:**	98.1%

North City Chemistry Laboratory: See attachment 5for copy of reports.

PT Study	Number of Analytes	Number of Acceptable results	Success Rate (%)
WP-0812	1	1	100%
WP-0412	17	16	94.1
Total analytes:	18	**Overall:**	100%

Metro Biosolids Center (MBC) Chemistry Laboratory: See attachment 6for copy of reports.

PT Study	Number of Analytes	Number of Acceptable results	Success Rate (%)
WP-0412	10	10	100%
Total analytes:	10	**Overall:**	100%

Pt. Loma Wastewater Chemistry Laboratory: See attachment 7 for copy of reports.

PT Study	Number of Analytes	Number of Acceptable results	Success Rate (%)
WP-0412	13	13	100%
Total analytes:	13	**Overall:**	1300%

South Bay Wastewater Chemistry Laboratory: See attachment 9 for copy of reports.

PT Study	Number of Analytes	Number of Acceptable results	Success Rate (%)
WP-0212	13	13	100%
WP-0312	11	11	100%
WP-0412	2	2	100%
Total analytes:	26	**Overall**	100%

F. Staff contributing to this Report

Staff Contributing to this Report in 2012

Initials	ID	First Name	Last Name	Signature
BOA	BANDOH	Ben	Andoh	
TB	TBAO	Tan	Bao	
VB	VBASILAN	Virginia	Basilan	
EB	EBLANCO	Enrique	Blanco	
BGB	BBOWMAN	Brent	Bowman	
TB	TMB	Tom	Burger	
LC	LCARR	Laura	Carr	
JC	JCASTRO	Jose	Castro	
JCM	JCAZARES	Jacqueline	Cazares-Medina	
NC	NCOGLAN	Nancy	Coglan	
SC	SCORIA	Salvador	Coria	
MC	MCORONEL	Maricela	Coronel	
JCM	JCZAJKOWSKI	Jerry	Czajkowski	
KD	KDANG	Ken	Dang	
AMD	ADONLON	Angela	Donlon	
BD	BDONAHUE	Brad	Donahue	
HHD	HDUCKETT	Heather	Duckett	
ACD	ADURAN	Angelica	Duran	
JTF	JFINDLEY	Jeff	Findley	
EFITZ	EFITZGERALD	Erica	Fitzgerald	
KG	KGENZ	Kenneth	Genz	
RJ	RJARDINE	Ron	Jardine	
LK	LKING	Lee	King	
VK	VKOZAREV	Vesselka	Kozarev	
EL	ELANEZ	Estela	Lanez	
WL	WLUCERO	Wendy	Lucero	
AM	AMARTINEZ	Armando	Martinez	
FM	FMARTINEZ	Fernando	Martinez	
CGM	CMATA	Connie	Mata	
FML	IZM	Francisco	Meza	
JM	JMCANALLY	Jeff	McAnally	
AM	AM9	Alejandra	Molloy	
JN	JNIETO	Jesus	Nieto	
MN	MNOLER	Maria	Noller	
LP	LPANTOJA	Lorena	Pantoja	
PP	PPARRA	Paola	Parra	
LP	LPRZYBYLO	Leonard	Przybylo	
CAQ	CQUINATA	Corinna	Quinata	
KR	KRUEHRWEIN	Keith	Ruehrwein	
RS	RSANDOVAL	Robert	Sandoval	
VS	VSANTIBANEZ	Victoria	Santibanez	
DWS	DSCHLICKMAN	David	Schlickman	
GS	GSCHLIMME	Greg	Schlimme	
GLS	GSIQUEIROS	Gloria	Siqueiros	
MRS	MSTEWART	Michael	Stewart	
MIS	MSZETERLAK	Margot	Szeterlak	
SV	SVALENZUELA	Sandra	Valenzuela	
JW	JWEBB	Julie	Webb	
KLW	KWITCZAK	Kristof	Witczak	

Figure 1. Chemistry Laboratory Organization Chart.

Public Utilities Department
Environmental Monitoring and Technical Services Division
Wastewater Chemistry Services

Deputy Director
Steve Meyer

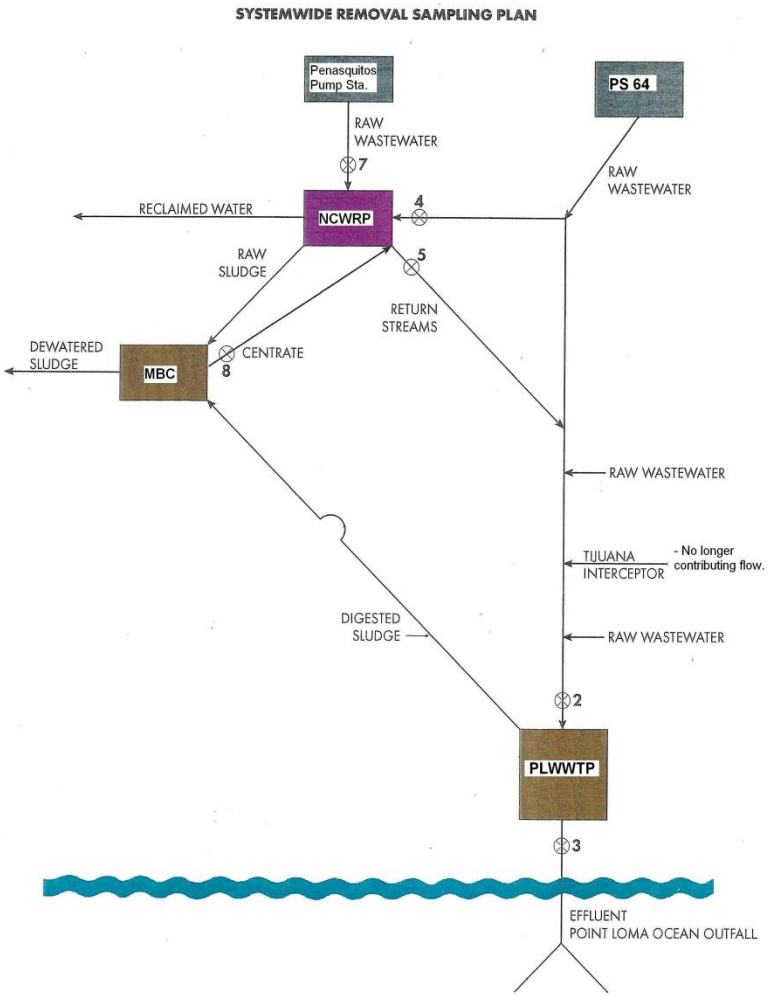
Senior Chemist *1.00*
Brent Bowman

Pesticides/ Wet Chemistry Group	***QA/DM Group***	***Metals Group***	***Pt. Loma WWTP / MBC Group***	***South Bay WRP Group***	***North City WRP Group***	***GC/MS Group***
Associate Chemist 1.00 DAVID SCHLICKMAN	*Associate Chemist 1.00* LEE KING	*Associate Chemist 1.00* ROBERT SANDOVAL	*Associate Chemist 1.00* SALVADOR CORIA	*Associate Chemist 1.00* SANDRA VALENZUELA	*Associate Chemist 1.00* NANCY COGLAN	*Associate Chemist 1.00* JEFF MCANALLY
Assistant Chemists: 6.00 TAN BAO JACQUELINE CAZARES- MEDINA KEN DANG LORENA PANTOJA RONALD JARDINE Vacant	*Assistant Chemists: 4.00* FERNANDO MARTINEZ ARMANDO MARTINEZ WENDY LUCERO Vacant	*Assistant Chemists:7.00* BEN ANDOH JERRY CZAJKOWSKI JEFF FINDLEY JESUS NIETO LEONARD PRZYBYLO VESSELKA KOZAREV Vacant	*Assistant Chemists: 3.00* JULIE WEBB ENRIQUE BLANCO VIRGINIA BASILAN	*Assistant Chemists:2.00* GREG SCHLIMME Vacant	*Assistant Chemists: 1.00* KRIS WITCZAK	*Assistant Chemists: 4.00* MARIA NOLLER GLORIA SIQUEIROS ESTELA LANEZ MICHAEL STEWART
Laboratory Technician: 1.00 MARICELA CORONEL	*Laboratory Technician: 1.00* KEITH RUEHRWEIN	*Laboratory Technician: 1.00* MARGOT SZETERLAK	*Laboratory Technician: 4.00* CONNIE MATA ERICA FITZGERALD BRAD DONAHUE Vacant	*Laboratory Technician: 2.00* JOSE CASTRO ANGELICA DURAN	*Laboratory Technician: 3.00* KENNETH GENZ LAURA CARR PAOLA PARRA	*Laboratory Technician: 1.00* VICTORIA SANTIBANEZ
Intern:	*Word Processing Operator: 1.00* CORINNA QUINATA *Intern:*	Intern:				

G. System-wide calculation definition

System-wide removals are a practical extension of the "Adjusted Removals" previously reported. Adjusted removals were used to determine removal efficiency of TSS and BOD, during the period when biosolids dewatering occurred at Fiesta Island. The wastewater removed by dewatering (e.g. belt filter press or drying bed decant) was returned to the Point Loma WWTP headworks and contained a certain amount of solids. In order to account for the removal and return of TSS and BOD, on a complete mass-balance basis, the Adjusted Removals were determined. That calculation was relatively straight forward and included removing the contribution to the Pt. Loma WWTP influent of the returned stream. The calculation was done on a mass balance basis to fully account for the solids and BOD contributions returned back to the system.

With the replacement of Fiesta Island biosolids processing by the Metro Biosolids Center (MBC) and the addition of the NCWRP (North City Water Reclamation Plant) in the Metro System, the removal and return of solids to Pt. Loma WWTP was complicated by the addition of multiple inputs and outputs to the system. To calculate the system-wide removals, the net total inputs and outputs were determined and included in the updated calculation[18]. The determination of System-wide removals is represented by Equation 1 on the next page. This simplified diagram graphically shows the relationships of the input and output streams. The Tijuana interceptor (emergency connection) has not contributed flows since September 2003. The South Bay Water Reclamation Plant (SBWRP) is not shown since it currently has no net contribution or solids removal.



18 Calculations are performed by a computer database application working with Metro System flow and concentration data.

Equation 1.

$$\text{System-wide \%Removal} = \frac{(\Sigma\text{System Influents}) - (\Sigma\text{Return Streams}) - (\Sigma\text{Outfall Discharge})}{\Sigma\text{System Influents} - \Sigma\text{Return Streams}} \times 100\%$$

Where,

System Influents	=	Point Loma Wastewater Treatment Plant Influents, NCWRP Influent Pump Station (i.e. Pump station 64), NCWRP Influent from Penasquitos Pump Station
Return Streams	=	NCWRP Filter Backwash, NCWRP Plant Drain, NCWRP Secondary Effluent, NCWRP Un-disinfected Filtered Effluent Bypass, NCWRP Final Effluent Metro Biosolids Center Centrate

The TSS and BOD_5 concentrations, together with the flow rate, of each stream are measured daily and mass emissions (pounds a day) for each stream determined. The above formula is applied on the resultant mass balances and the system-wide removals calculated for each day. In the event that a data value (e.g. flow rate measurement, TSS concentration or BOD_5 concentration) is not available for a stream, the median value for the previous calendar year for that stream is used as a surrogate number to allow completion of the calculation. The annual averages and summaries in the system-wide data tables are derived (arithmetic mean) from the monthly averages of the daily calculated mass emissions values and removal rates.

H. Annual Flow Calibration Report

The firm of V&A completed the annual Gould Flow Metering System Certification in March 2013.

POINT LOMA WASTEWATER TREATMENT PLANT

2012 Gould Flow Metering System Certification

March 2013

V&A

City of San Diego, California
Metropolitan Wastewater Department

City of San Diego
PUBLIC UTILITIES
Water & Wastewater

Certification of the Gould Flow Metering System at the Point Loma Wastewater Treatment Plant 2012

Prepared For:

BROWN AND CALDWELL
9665 Chesapeake Drive, Suite 201
San Diego, CA 92123

Prepared By:

V&A
11011 Via Frontera, Suite C
San Diego, CA 92127
March 2013
<Ref. 07-0589>

TABLE OF CONTENTS

DESCRIPTION PAGE NO.

FIGURES

PHOTOS

APPENDIX A. MONTHLY AVERAGE DAILY FLOW TABLES

APPENDIX B. Annual Average Daily Flow Tables: Summary

Appendix C. Flow Meter Calibration Data

Appendix D. Field Notes

1 INTRODUCTION

1.1 Background

The Point Loma Wastewater Treatment Plant (Point Loma WWTP) is located in San Diego, California, on the Point Loma peninsula, near the Cabrillo National Monument. The design capacity of this plant is approximately 240 million gallons of wastewater per day (mgd). The average daily flow (ADF) for calendar year 2012 was approximately 148 mgd. There are currently three independent flow measurement systems in place:

1. Gould Flow Metering System at Point Loma WWTP
2. Controlotron Ultrasonic Flow Meters at Pump Station 2 (PS-2)
3. ADS Ultrasonic Flow Metering System at Point Loma WWTP

The influent flow at the Point Loma WWTP is measured using four Parshall flumes at the Headworks of the Point Loma WWTP. There are two 6-foot wide flumes designated as C-1 and C-2, and two 8-foot wide flumes designated as N-1 and N-2. Water depth in each flume is measured by two independent meters.

Gould flow meters measure flow depth directly via hydrostatic pressure measurement. The Gould flow metering system consists of pressure transducers housed in stilling wells located adjacent to each of the Parshall flumes. The Gould flow meters measure depth of flow in the flumes, which is then converted to flow values by computer software.

At PS-2, Controlotron ultrasonic flow meters are located on each of the eight pump discharge pipes. The flows from each pump are totaled to calculate the average daily flow to the Point Loma WWTP.

Meters provided by ADS measure flow depth indirectly via ultrasonic measurement of the distance to the flow surface below the meter sensor (transducer). This distance is subtracted from the measured and known distance from the sensor face to the flume channel invert to provide depth of water in the flume. The ADS flow metering system uses ultrasonic depth sensors located over each of the Parshall flumes to measure the distance from the sensors to the liquid surface. The ADS software then calculates depth of flow, and ultimately daily flow, from the depth versus discharge rating curves for each flume.

Although there are three independent sources that record flow data, only flow data recorded by the Gould flow metering system is officially reported to the Regional Water Quality Control Board (RWQCB).

1.2 Purpose of Study

Every year, the City of San Diego (City) is required to provide a report of total plant flow to the RWQCB and to the United States Environmental Protection Agency (USEPA). As part of this review for calendar year 2012, V&A was retained by Brown and Caldwell to observe the measurement of ADF influent to the Point Loma WWTP and evaluate any discrepancies that may exist among the Gould, ADS and PS-2 flow metering systems.

2 SCOPE OF WORK

2.1 Scope of Work by V&A

V&A was retained by Brown and Caldwell for certification of four Gould Flow Metering devices located at the Point Loma WWTP. This certification includes verifying that the Gould devices are accurately recording flow, within acceptable tolerances (±5% from theoretical values), through the Parshall flumes by performing the following tasks:

1. Data Review and Analysis – Examine existing flow data for the Gould, ADS and PS-2 metering systems. Update and analyze the flow data for the Gould, ADS and PS-2 metering systems for reporting discrepancies between the systems and report on the findings.

2. Field Review – Perform a field review of the Gould system with regards to the appropriateness of the instrumentation configuration, data collection and reporting systems. Observe and assist City personnel in performing static confirmation testing of the calibration of each Gould transducer and electronic data recording system over the full depth range of the flume using the City's test cylinder. Collect simulated flow data reported through the flow recording system located in the Engineering Building with assistance from City staff. Compare the simulated data to the theoretically calculated flow depth data through the Parshall flume.

3. Draft Report(s) – Prepare a Preliminary Draft Report for Brown and Caldwell's review regarding the results of the inspections together with conclusions and recommendations. The Preliminary Draft will be provided in electronic format only (i.e., no hardcopies). Brown and Caldwell will provide V&A with comments to the Preliminary Draft Report. V&A will address Brown and Caldwell's comments to develop the Final Report that will be delivered to the City. V&A will provide seven hardcopies of the Final Report to Brown and Caldwell for delivery to the City, as well as one electronic copy in PDF format.

2.2 Scope of Work by City of San Diego

The City provided the following items to assist in the completion of this work:

1. Daily flow data from the Gould, ADS and PS-2 flow measurement systems from January 1, 2012 through December 31, 2012.

2. All equipment and labor necessary to remove, test and reinstall each of the Gould transducers and suspension brackets at each of the four flumes examined.

3 REVIEW OF EXISTING DATA

3.1 Data Sources

Flow data from the City's Gould, ADS, and PS-2 flow metering systems for the 2012 calendar year is attached in Appendix A. Each monthly summary table includes the average daily flow rate (ADF), along with the maximum daily flow rate, minimum daily flow rate and standard deviation of all the daily flow rates. The yearly data that is included in Appendix B is summarized in Table 3-1. Note that the minimum value for one sensor did not necessarily occur on the same day as the minimum values for the other sensors. Likewise, the minimum percent difference may not have occurred on the same day as the minimum ADF. The same is true for the maximum values. Table 3-2 presents the percent difference for each of the metering systems for the dates on which the minimum and maximum Gould ADF values occurred.

Table 3-1
Yearly Average Daily Flow Percent Difference

Item	Average Daily Flow (ADF) (mgd)			Percent Difference (%)	
	Gould	PS-2	ADS	PS-2 vs. Gould	ADS vs. Gould
Days Available	346	366	271	346	253
Average	148.15	147.12	147.31	-0.44%	-1.31%
Minimum	133.23	133.49	95.52	-27.53%	-32.92%
Maximum	191.47	191.75	184.218	6.53%	5.20%
Standard Deviation	7.59	6.76	8.25	3.18%	4.13%

Table 3-2
Gould Maximum and Minimum Average Daily Flow Percent Difference

	Date	Average Daily Flow (ADF) (mgd)			Percent Difference (%)	
		Gould	PS-2	ADS	PS-2 vs. Gould	ADS vs. Gould
Minimum	11/23/12	133.23	133.49	131.14	0.19%	-1.57%
Maximum	11/16/12	191.47	138.75	136.70	-27.53%	-28.61%

There were a total of 95 days during the year when the data reported by the ADS meters were known to be non-representative of the actual flow values. On 90 of those days, the discrepancies were due to the introduction of the Interim Grit Processing facility hydrogritters and separators. The return flow coming from the Interim Grit Processing facility hydrogritters and separators is discharged downstream of the flumes. When the facility came on line in May 2012, the turbulence created by the flow dropping into the C2 and N2 channel was resulting in non-representative readings. City personnel worked with ADS to get this error corrected. This involved moving the ADS meters to the upstream side of the flumes and installing noise dampening cones around the meters. The return flow has since been reconfigured for operational reasons and now is discharged into the N2 and C1 Channels. On five days accurate data was not available due to a C1 line break which was also related to the introduction of the Interim Grit

Processing facility hydrogritters and separators. In order to get a clear picture of the performance of the Gould meters, the ADS data in question for these 95 days were omitted from this analysis.

Note also that Gould data was not available on 20 days during the year due to problems with the Distributed Control System (DCS). While the plant was upgrading its control system from the previously installed Westinghouse Process Controls to the newly installed Ovation™ expert DCS by Emerson Process Management the Gould flow meters flow data were not stored by the DCS Historian therefore ADS measurements were used during the time of the upgrade and changeover. As the new Ovation system was being brought on line the City worked with the Emerson Process Management to export the Gould data from the Historian and import the data into Ovation.

Table 3-3 compares the yearly average daily flow data for the Gould system in 2011 and 2012. It shows that the 2012 Gould system average daily flow decreased approximately 5% from the previous year.

Table 3-3
2010 - 2011 Gould System Average Daily Flow Comparison

Gould System Average Daily Flow (mgd)			
	2011	2012	% Change
Average	155.88	148.15	-4.96%
Minimum	135.46	133.23	-1.65%
Maximum	220.17	191.47	-13.04%

3.2 Data Analysis

Using the information in Appendix A, V&A performed a graphical analysis of the daily flow data and generated Figures 3-1 through 3-5 below. Data analysis was conducted using visual and statistical procedures. The Gould flow data was used as the prime measurement for the statistical comparisons.

Comparison of flow rates measured by the three different systems was conducted using average daily flow values only. Verification of the flume rating tables was not performed as part of the test and calibration process. Due to backwater effects and flume submergence problems at flume depths below 3.0 inches, the Gould system was programmed to report zero flow at that minimum depth.

The percent difference in measured flow between systems was calculated as follows:

PS-2 system: (PS-2 – Gould)/Gould x 100
ADS system: (ADS – Gould)/Gould x 100

3.2.1 2012 Flow Hydrograph

Plotting the ADF for each of the three measuring systems on one graph allows for a visual comparison of the three meters for the 2012 calendar year. There were no readings from the Gould flow meter from October 16 through October 29 due to the upgrade and changeover from the Westinghouse Process Control and data storage system to the newly installed Ovation system. Figure 3-1 shows that the average daily flow measured by the Gould flow meter varied from a minimum of 133 mgd on November 23 to a maximum of 191 mgd on November 16. The variance between the Gould, PS-2 and ADS flow meters was relatively constant throughout the year with the exception of the 23 day period following the upgrade and changeover from the Westinghouse Process Control and data storage system to the Ovation system. The readings of the ADS were known to be in error for much of May through August due to the introduction of interim grit processing water. The problem was discovered and resolved at the plant. These data have been omitted from Figure 3-1.

Figure 3-1. 2012 Flow Hydrograph

3.2.2 Percent Difference in Recorded Flow vs. Time (PS-2/Gould Flow Meters)

A graph of the percent difference versus time for the PS-2 and Gould measuring systems for the 2012 calendar year is shown in Figure 3-2. The difference between the average daily flow recorded by the PS-2 and Gould flow meters varied from -27.53% on November 16 to 6.53% on November 10.

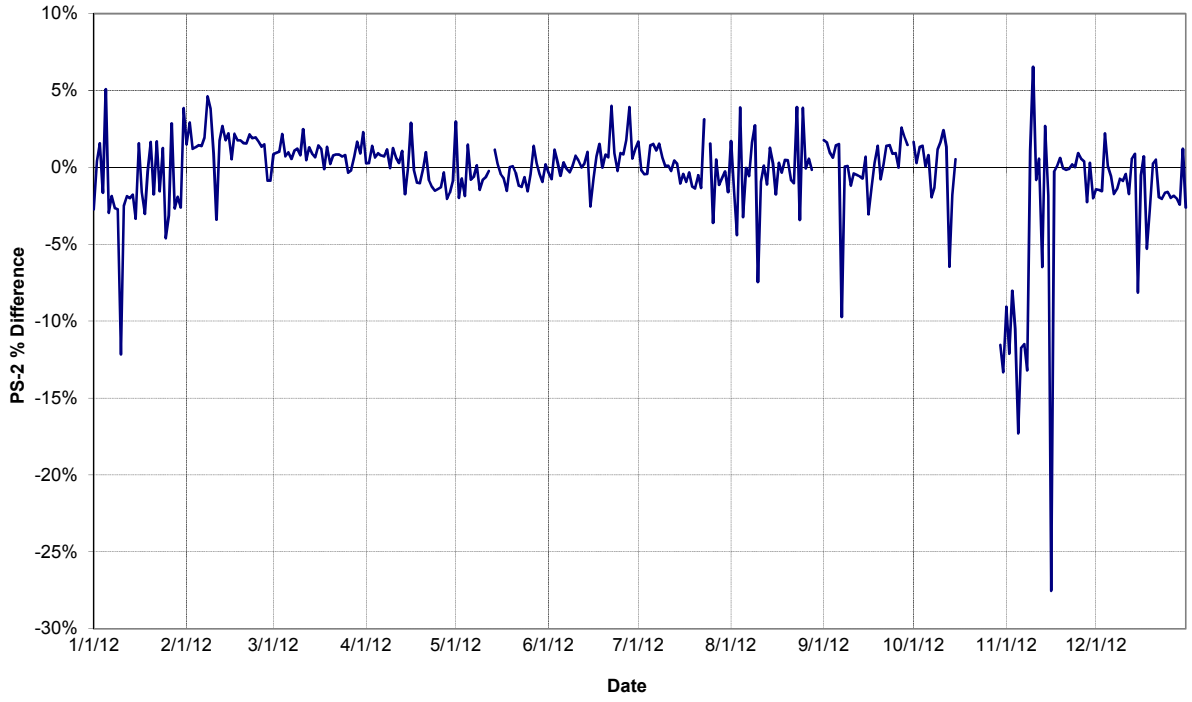


Figure 3-2. Percent Difference in Recorded Flow (PS-2/Gould Flow Meters) vs. Time

3.2.3 Scatter Plot of Percent Difference Between PS-2 and Gould Flow Meters

A scatter plot of the percent difference between the ADF reported by the PS-2 and Gould meters is shown in Figure 3-3. This figure shows that the percent difference between the two meters is relatively consistent at approximately ±5% for flows between 133 mgd and 170 mgd.

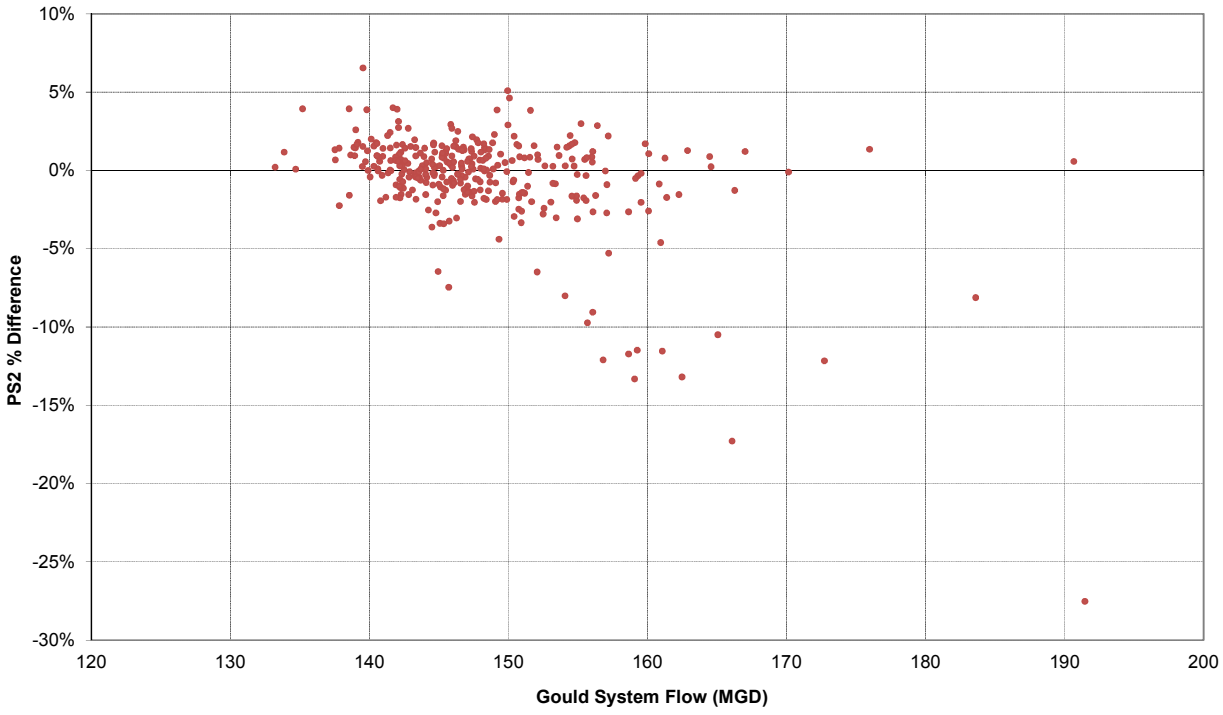


Figure 3-3. Scatter Plot of Percent Difference Between PS-2 and Gould Flow Meters

3.2.4 Percent Difference in Recorded Flow vs. Time (ADS/Gould Flow Meters)

A plot of the percent difference in recorded flow of the ADS and Gould flow meters versus time for the 2012 calendar year is shown in Figure 3-4. The difference between the average daily flow recorded by the ADS and Gould flow meters varied from -32.92% on October 1 to 5.20% on November 10. As noted in Section 3.1, there were 95 days when representative data was not available from the ADS flow meters, and 20 days when flow data from the Gould flow meters was not available.

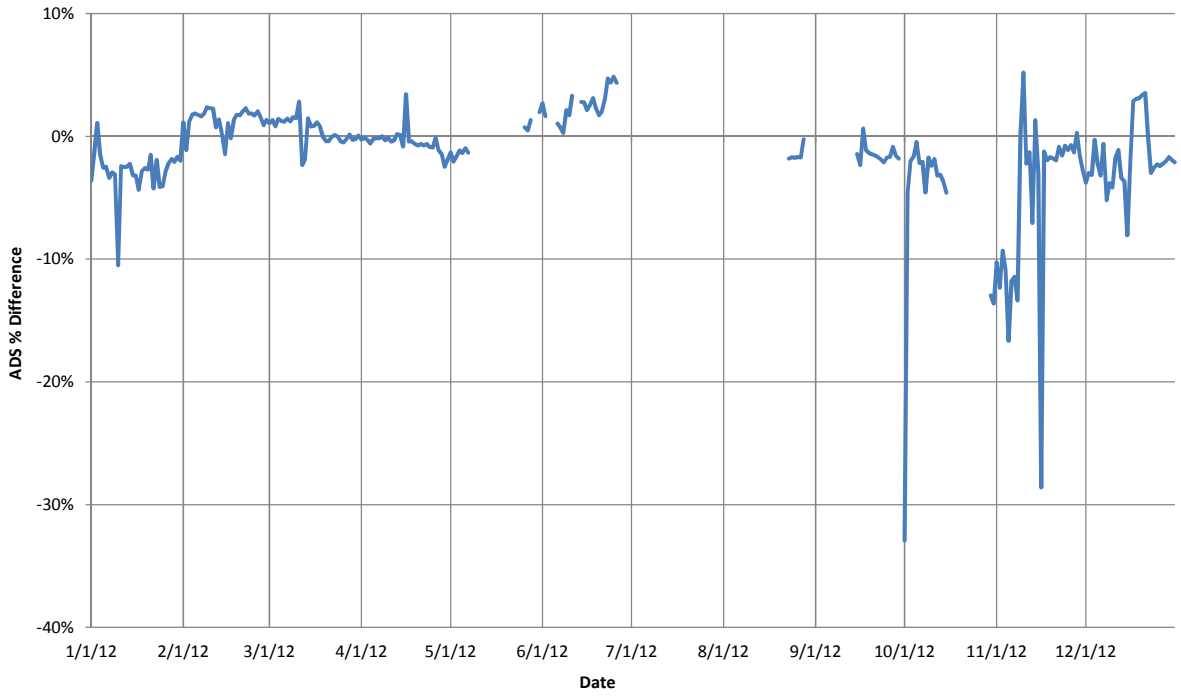


Figure 3-4. Percent Difference in Recorded Flow (ADS/Gould Flow Meters) vs. Time

3.2.5 Scatter Plot of Percent Difference Between ADS and Gould Flow Meters

A scatter plot of the percent difference between the ADF reported by the ADS and Gould flow meters is shown in Figure 3-5. This figure shows that the percent difference between the two meters was relatively consistent at approximately ±5% for flows between 133 mgd and 170 mgd.

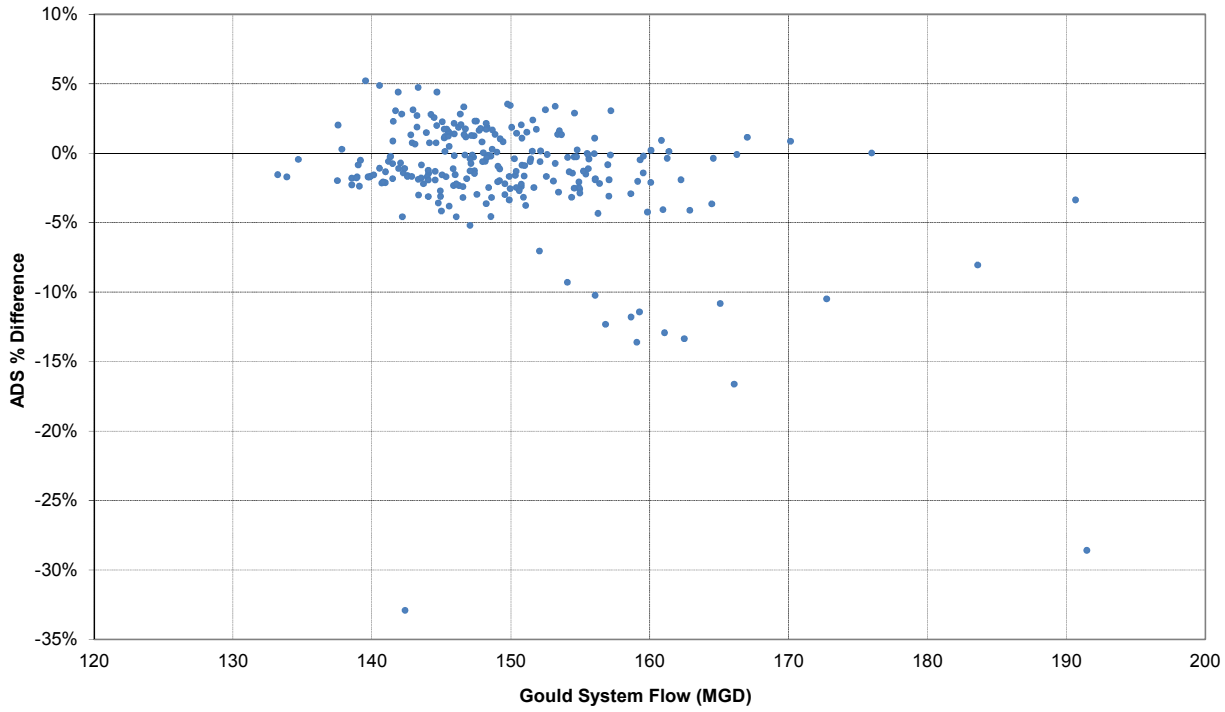


Figure 3-5. Scatter Plot of Percent Difference Between ADS and Gould Flow Meters

4 FIELD TEST AND FLOW ANALYSIS

4.1 Test Set up

A static test and calibration of the four Parshall flumes and data transmitting systems was performed by Point Loma WWTP personnel and observed by V&A representatives on February 6, 2013. The following instruments, test equipment, and reports were used during the test:

- Test Cylinder
- Gould Flow Meter Transducers (4 units)
- Fluke 45 Multimeter
- Operator Station (Computer)
- Gould Flow Meter Transducer Calibration Reports
- Fluke Multimeter Calibration Reports

The following photos show the procedure that was used to test each of the four flumes:

1. The Gould flow meter transducer was removed, cleaned and inserted into the static water well.
2. The transducer was connected to the multimeter, which measured the depth in milliamperes (mA).
3. The transducer was connected to the Operator Station for actual flow data.

Photo 4-1: Topside View of the Four Partial Flumes

Photo 4-2: Gould Transducer in Operational Configuration

Photo 4-3: Transducer is Removed From Flume

Photo 4-4: Transducer is Cleaned

Photo 4-6: Test Cylinder Used for Testing

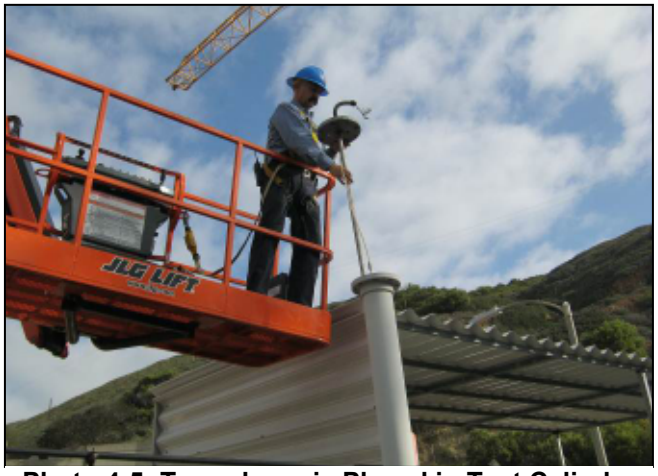


Photo 4-5: Transducer is Placed in Test Cylinder

Photo 4-7: Water Level is Measured

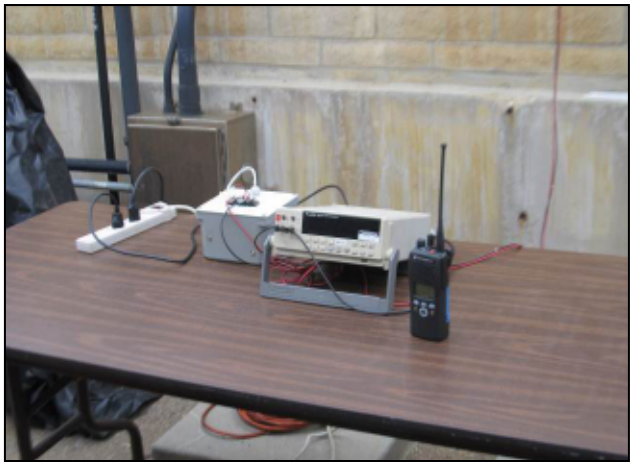


Photo 4-8: Fluke 45 Dual Display Meter

Photo 4-9: Water Level and Fluke Meter Readings are Radioed to Operator

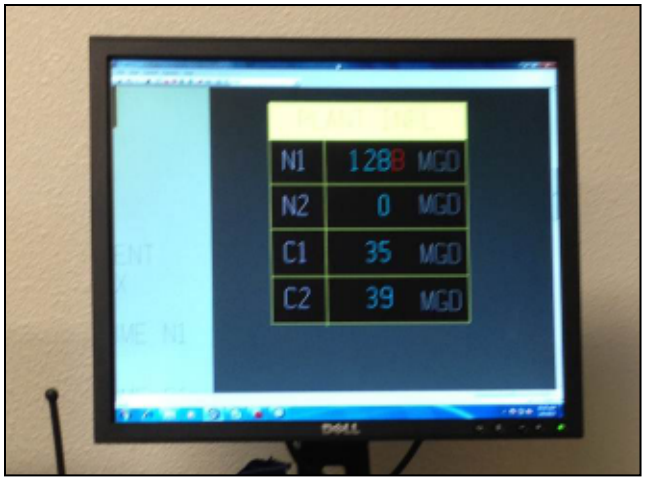


Photo 4-10: Operator Station Displays Gould Flow Meter Transducer Readings

4.2 Test and Calibration

The Gould flow meter transducers were tested and calibrated using the Fluke 45 multimeter shown above. The multimeter was calibrated so that a reading of 5.33 mA would correspond to zero inches of water depth and a reading of 20 mA would correspond to 36 inches of water depth.

The transducers were linked to the Operator Station computers, located in the Point Loma WWTP Engineering Building. The computers calculated flow values from the current (mA) measurements. At the beginning of each of the four tests, the water well depth was zero inches. The water depth was increased in 9-inch increments until it reached a full depth of 36 inches. At each 9-inch interval, both the flow values and the multimeter readings were recorded. After reaching full depth, the water level was then reduced by 9-inch increments until the water depth was returned to zero inches.

Table C-1, in Appendix C, compares the data collected in the field to the calculated theoretical values. The flow readings from flumes N-1 and N-2 at 9-inches of depth were significantly different from the theoretical values. All other differences were less than 2% for all of the flumes.

Appendix D contains a copy of the handwritten record of the flow values and the multimeter readings at each 9-inch increment.

4.3 Flow Analysis

The discharge relationship for the Parshall flumes is given by the following equation:

$$Q = Kb(H)^n \qquad (1)$$

Where $n = 1.522(b)^{0.026}$
b = width, feet (ft)
K = 4 for b > 4
H = height of water flume floor, feet (ft)
Q = Flow, cubic feet per second (cfs)
(1 cfs = 0.646 mgd)

The computer program receiving the Gould transducer readings uses the above equation to produce the output flow values. To compare the computer-generated values with the theoretical values, the dimensional widths of the Parshall flumes were obtained from design drawings provided by City personnel. The design values of 6 feet and 8 feet, for the C and N channels respectively, were used in the equation to obtain the theoretical flow values.

For C-1 and C-2, the following equation was used to calculate the flow in mgd:

$$Q = (4)(6)(0.646)(H)^{1.594}$$
$$= 15.504(H)^{1.594}$$

For N-1 and N-2, the following equation was used to calculate the flow in mgd:

$$Q = (4)(8)(0.646)(H)^{1.607}$$
$$= 20.672(H)^{1.607}$$

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

1) No major discrepancies were found between the Gould and PS-2 flow meters for the 2012 calendar year. Comparison data for the Gould and ADS flow meters was not available for a total of 113 days during the year, but the excluded data do not impact the results of this analysis.
2) Based on the existing data, it is certified that the Gould meters are measuring and recording flow accurately and within ±5% of the calculated theoretical values.
3) The percent differences between the theoretical and measured values of flow for the Gould flow meters are within ±5% of one another and show no significant variance above or below the ADF.
4) The three flow metering systems generally provide comparable results, considering the limits of the error sources and measurement accuracies of the technologies used.

5.2 Recommendations

1) V&A recommends that the City continue to use Gould flow meter transducers as their primary flow measuring devices.

References

(1) Lin, Shundar. (2001) Water and Wastewater Calculations Manual, Pg. 302-306

Appendix A

Monthly Average Daily Flow Tables

Table A-1
City of San Diego
Point Loma Wastewater Treatment Plant
Average Daily Flow
January 2012

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
1/1/12	144.79	140.84	139.57
1/2/12	147.39	148.00	145.51
1/3/12	145.22	147.50	146.80
1/4/12	147.40	144.97	145.22
1/5/12	149.96	157.57	146.12
1/6/12	150.42	145.98	146.69
1/7/12	149.90	147.10	144.84
1/8/12	158.65	154.44	154.01
1/9/12	157.08	152.79	152.19
1/10/12	172.74	151.72	154.61
1/11/12	150.76	147.01	147.11
1/12/12	148.42	145.64	144.72
1/13/12	151.67	148.64	147.90
1/14/12	150.75	148.09	147.38
1/15/12	150.93	145.88	146.12
1/16/12	154.39	156.80	149.47
1/17/12	156.29	153.76	149.50
1/18/12	153.44	148.79	149.11
1/19/12	154.96	154.54	150.95
1/20/12	150.61	153.11	146.53
1/21/12	155.41	152.67	153.06
1/22/12	159.85	162.55	153.05
1/23/12	162.27	159.74	159.14
1/24/12	162.90	164.94	156.18
1/25/12	160.97	153.54	154.41
1/26/12	154.98	150.16	150.52
1/27/12	156.40	160.87	152.96
1/28/12	156.10	151.94	153.22
1/29/12	154.92	151.94	151.70
1/30/12	150.96	147.02	148.45
1/31/12	149.20	154.96	146.23
Total	4769.71	4703.49	4633.26
Average	153.86	151.73	149.46
Daily Low	144.79	140.84	139.57
Daily High	172.74	164.94	159.14
Std Dev	5.88	5.59	4.18

Table A-2
City of San Diego
Point Loma Wastewater Treatment Plant
Average Daily Flow
February 2012

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
2/1/12	146.76	148.95	148.44
2/2/12	145.86	150.12	144.20
2/3/12	147.36	149.13	149.19
2/4/12	148.30	150.23	150.94
2/5/12	148.30	150.44	151.08
2/6/12	146.74	148.78	149.30
2/7/12	147.73	150.60	150.14
2/8/12	150.08	157.02	152.86
2/9/12	151.59	157.39	155.19
2/10/12	147.54	148.87	150.93
2/11/12	145.08	140.15	148.35
2/12/12	144.63	147.15	145.69
2/13/12	145.94	149.86	147.94
2/14/12	154.78	157.52	155.14
2/15/12	154.45	157.86	152.21
2/16/12	156.05	156.87	157.71
2/17/12	157.19	160.62	156.96
2/18/12	148.88	151.48	150.88
2/19/12	147.84	150.44	150.45
2/20/12	151.85	154.24	154.44
2/21/12	150.76	153.10	153.82
2/22/12	147.42	150.57	150.80
2/23/12	146.24	149.00	148.95
2/24/12	143.26	146.06	145.94
2/25/12	148.23	150.74	150.75
2/26/12	146.43	148.40	149.43
2/27/12	153.52	155.80	155.98
2/28/12	160.86	159.46	162.33
2/29/12	153.38	152.05	155.43
Total	4337.03	4402.88	4395.47
Average	149.55	151.82	151.57
Daily Low	143.26	140.15	144.20
Daily High	160.86	160.62	162.33
Std Dev	4.20	4.53	3.97

Table A-3
City of San Diego
Point Loma Wastewater Treatment Plant
Average Daily Flow
March 2012

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
3/1/12	150.82	152.12	152.43
3/2/12	153.66	155.12	155.70
3/3/12	149.45	151.00	150.68
3/4/12	150.43	153.69	152.56
3/5/12	147.18	148.24	149.02
3/6/12	145.26	146.68	146.97
3/7/12	145.59	146.38	147.70
3/8/12	145.51	147.06	147.27
3/9/12	145.50	147.27	147.77
3/10/12	151.17	152.36	153.42
3/11/12	146.37	150.00	150.49
3/12/12	145.90	146.58	142.49
3/13/12	146.84	148.75	144.13
3/14/12	143.93	145.20	146.05
3/15/12	147.94	148.91	149.12
3/16/12	141.51	143.53	142.73
3/17/12	167.03	169.04	168.93
3/18/12	170.15	169.95	171.58
3/19/12	175.99	178.34	175.99
3/20/12	164.58	164.96	163.95
3/21/12	161.27	162.53	160.65
3/22/12	156.02	157.33	155.94
3/23/12	151.56	152.82	151.75
3/24/12	155.51	156.59	155.47
3/25/12	155.64	156.89	154.98
3/26/12	159.33	158.77	158.55
3/27/12	159.55	159.24	159.20
3/28/12	152.15	153.20	152.37
3/29/12	154.58	157.15	154.13
3/30/12	148.57	149.92	148.25
3/31/12	149.00	152.41	149.10
Total	4737.96	4782.03	4759.36
Average	152.84	154.26	153.53
Daily Low	141.51	143.53	142.49
Daily High	175.99	178.34	175.99
Std Dev	8.22	8.04	8.05

Table A-4
City of San Diego
Point Loma Wastewater Treatment Plant
Average Daily Flow
April 2012

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
4/1/12	154.74	155.15	154.33
4/2/12	152.63	153.05	152.46
4/3/12	147.32	149.37	146.87
4/4/12	148.17	149.12	147.30
4/5/12	145.95	147.29	145.67
4/6/12	148.40	149.56	148.17
4/7/12	147.24	148.30	147.02
4/8/12	148.03	149.74	148.05
4/9/12	148.28	148.21	147.81
4/10/12	146.71	148.54	146.50
4/11/12	150.27	151.20	149.65
4/12/12	154.10	154.54	153.62
4/13/12	160.10	161.79	160.42
4/14/12	161.40	158.59	161.59
4/15/12	156.98	156.91	155.66
4/16/12	149.97	154.30	155.11
4/17/12	151.46	151.25	150.83
4/18/12	147.07	145.60	146.47
4/19/12	151.40	149.85	150.45
4/20/12	147.15	146.97	146.04
4/21/12	152.11	153.62	151.16
4/22/12	153.20	151.92	152.07
4/23/12	147.98	146.11	147.06
4/24/12	150.80	148.51	149.48
4/25/12	151.00	148.87	149.63
4/26/12	166.28	164.14	166.09
4/27/12	155.59	155.06	153.83
4/28/12	159.55	156.28	157.26
4/29/12	154.92	152.38	151.08
4/30/12	157.09	155.65	154.07
Total	4565.89	4561.87	4545.75
Average	152.20	152.06	151.53
Daily Low	145.95	145.60	145.67
Daily High	166.28	164.14	166.09
Std Dev	5.05	4.53	5.00

Table A-5
City of San Diego
Point Loma Wastewater Treatment Plant
Average Daily Flow
May 2012

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
5/1/12	155.23	159.85	153.21
5/2/12	149.08	146.11	145.99
5/3/12	150.34	149.24	147.92
5/4/12	149.22	146.44	147.51
5/5/12	154.21	156.48	152.11
5/6/12	149.09	147.90	147.66
5/7/12	150.39	149.45	148.41
5/8/12	148.01	148.21	*
5/9/12	151.18	148.97	*
5/10/12	146.04	144.89	*
5/11/12	143.70	142.79	*
5/12/12	146.37	146.03	*
5/13/12	**	146.79	*
5/14/12	142.26	143.89	*
5/15/12	144.80	145.13	*
5/16/12	146.89	146.24	*
5/17/12	147.98	146.90	*
5/18/12	146.92	144.67	*
5/19/12	148.45	148.46	*
5/20/12	147.48	147.59	*
5/21/12	146.65	146.14	*
5/22/12	146.96	145.21	*
5/23/12	145.49	143.65	*
5/24/12	145.99	145.05	*
5/25/12	142.83	140.61	*
5/26/12	144.15	143.50	145.21
5/27/12	145.57	147.59	146.27
5/28/12	146.64	147.04	148.59
5/29/12	145.25	144.63	***
5/30/12	144.57	143.21	***
5/31/12	144.67	144.96	147.53
Total	4416.41	4547.62	1630.40
Average	147.21	146.70	148.22
Daily Low	142.26	140.61	145.21
Daily High	155.23	159.85	153.21
Std Dev	3.00	3.71	39.62

** Channels C2 and N2 readings were in error due to the introduction of interim grit processing water.*

*** DCS problem*

**** C1 Line Break*

Table A-6
City of San Diego
Point Loma Wastewater Treatment Plant
Average Daily Flow
June 2012

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
6/1/12	143.25	142.78	147.12
6/2/12	148.69	147.55	151.15
6/3/12	144.71	146.38	**
6/4/12	145.86	146.34	**
6/5/12	147.65	146.84	**
6/6/12	149.25	149.74	150.78
6/7/12	142.90	142.79	143.95
6/8/12	148.67	148.18	149.08
6/9/12	148.24	148.37	151.41
6/10/12	145.39	146.49	147.89
6/11/12	146.62	147.29	151.48
6/12/12	145.32	145.31	*
6/13/12	139.50	139.83	*
6/14/12	142.15	143.58	146.13
6/15/12	144.26	140.60	148.25
6/16/12	145.93	144.93	149.05
6/17/12	144.49	145.52	148.18
6/18/12	142.98	145.16	147.43
6/19/12	141.56	141.52	144.79
6/20/12	145.23	146.44	147.73
6/21/12	137.57	138.48	140.34
6/22/12	141.70	147.37	146.02
6/23/12	143.34	144.66	150.11
6/24/12	144.69	144.36	151.04
6/25/12	140.56	141.87	147.40
6/26/12	141.90	143.09	148.11
6/27/12	140.49	142.97	*
6/28/12	135.21	140.51	*
6/29/12	140.75	141.55	*
6/30/12	139.88	141.61	*
Total	4308.73	4332.11	3107.44
Average	143.62	144.40	147.97
Daily Low	135.21	138.48	140.34
Daily High	149.25	149.74	151.48
Std Dev	3.38	2.86	2.75

** *C1 Line Break*

* *Channel N2 readings were in error due to the introduction of interim grit processing water.*

Table A-7
City of San Diego
Point Loma Wastewater Treatment Plant
Average Daily Flow
July 2012

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
7/1/2012	144.62	147.06	*
7/2/2012	143.33	143.09	*
7/3/2012	143.60	142.96	*
7/4/2012	140.06	139.48	*
7/5/2012	138.99	140.97	*
7/6/2012	146.23	148.44	*
7/7/2012	143.69	145.28	*
7/8/2012	146.07	148.32	*
7/9/2012	141.55	142.44	*
7/10/2012	148.93	149.05	*
7/11/2012	143.84	144.00	*
7/12/2012	142.34	142.00	*
7/13/2012	142.78	143.41	*
7/14/2012	147.34	147.70	*
7/15/2012	145.12	143.59	*
7/16/2012	143.33	142.73	*
7/17/2012	145.99	144.59	*
7/18/2012	140.92	140.45	*
7/19/2012	146.83	145.01	*
7/20/2012	147.18	145.15	*
7/21/2012	145.92	145.15	*
7/22/2012	147.53	145.56	*
7/23/2012	142.11	146.54	*
7/24/2012	**	142.50	*
7/25/2012	140.33	142.50	*
7/26/2012	144.51	139.27	*
7/27/2012	142.21	142.94	*
7/28/2012	142.46	140.83	*
7/29/2012	146.05	145.07	*
7/30/2012	146.38	145.99	*
7/31/2012	145.32	142.97	*
Total	4325.54	4465.04	*
Average	144.18	144.03	*
Daily Low	138.99	139.27	*
Daily High	148.93	149.05	*
Std Dev	2.49	2.57	*

** Channel N2 readings were in error due to the introduction of interim grit processing water.*

*** DCS power outage*

Table A-8
City of San Diego
Point Loma Wastewater Treatment Plant
Average Daily Flow
August 2012

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
8/1/11	140.56	142.97	*
8/2/11	142.30	140.11	*
8/3/11	149.33	142.75	*
8/4/11	142.01	147.55	*
8/5/11	145.75	141.02	*
8/6/11	140.63	140.58	*
8/7/11	147.81	146.96	*
8/8/11	144.61	146.96	*
8/9/11	142.10	145.98	*
8/10/11	145.72	134.85	*
8/11/11	141.93	140.61	*
8/12/11	140.61	140.76	*
8/13/11	142.23	140.66	*
8/14/11	146.68	148.56	*
8/15/11	140.34	140.70	*
8/16/11	142.22	139.71	*
8/17/11	143.82	144.25	*
8/18/11	144.67	144.18	*
8/19/11	144.12	144.82	*
8/20/11	145.77	146.43	*
8/21/11	146.57	145.37	*
8/22/11	142.15	140.70	*
8/23/11	138.56	143.99	136.04
8/24/11	145.35	140.38	142.88
8/25/11	139.83	145.24	137.40
8/26/11	149.89	149.77	147.36
8/27/11	139.73	140.50	137.34
8/28/11	141.35	141.12	141.01
8/29/11	**	142.29	138.24
8/30/11	**	140.34	140.12
8/31/11	**	142.78	140.95
Total	4016.65	4432.89	1261.33
Average	143.45	143.00	140.15
Daily Low	138.56	134.85	136.04
Daily High	149.89	149.77	147.36
Std Dev	2.98	3.23	3.48

** Channels C1 and N2 readings were in error due to the introduction of interim grit processing water.*

*** DCS problem*

Table A-9
City of San Diego
Point Loma Wastewater Treatment Plant
Average Daily Flow
September 2012

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
9/1/11	139.18	141.65	138.45
9/2/11	141.96	144.26	*
9/3/11	138.67	140.02	*
9/4/11	141.89	142.79	*
9/5/11	137.83	139.79	*
9/6/11	139.54	141.68	*
9/7/11	155.70	140.53	*
9/8/11	142.50	142.57	*
9/9/11	146.68	146.81	*
9/10/11	145.34	143.62	*
9/11/11	143.38	142.81	*
9/12/11	143.51	142.81	*
9/13/11	142.20	141.37	*
9/14/11	142.41	141.37	*
9/15/11	142.27	143.26	140.24
9/16/11	146.27	141.80	142.85
9/17/11	143.12	141.31	144.02
9/18/11	142.36	142.76	140.77
9/19/11	141.00	142.97	139.08
9/20/11	144.09	142.96	141.97
9/21/11	146.00	146.26	143.72
9/22/11	143.99	146.02	141.55
9/23/11	143.35	145.44	140.64
9/24/11	140.97	142.23	137.97
9/25/11	138.95	140.23	136.55
9/26/11	139.93	139.90	137.59
9/27/11	139.03	142.63	137.83
9/28/11	140.15	142.93	137.95
9/29/11	138.91	140.94	136.40
9/30/11	**	146.80	139.90
Total	4131.16	4280.51	2377.48
Average	142.45	142.68	139.85
Daily Low	137.83	139.79	136.40
Daily High	155.70	146.81	144.02
Std Dev	3.51	1.99	2.40

** ADS metering problem*

*** DCS problem*

Table A-10
City of San Diego
Point Loma Wastewater Treatment Plant
Average Daily Flow
October 2012

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
10/1/11	142.39	144.74	95.52
10/2/11	142.20	142.61	135.68
10/3/11	137.53	139.34	134.79
10/4/11	142.57	144.58	140.24
10/5/11	134.71	134.80	134.10
10/6/11	140.72	141.85	137.66
10/7/11	140.82	138.08	137.89
10/8/11	148.57	146.62	141.77
10/9/11	133.89	135.44	131.58
10/10/11	139.11	141.41	135.78
10/11/11	141.50	144.91	138.89
10/12/11	148.62	150.60	143.87
10/13/11	144.95	135.57	140.43
10/14/11	148.25	145.59	142.84
10/15/11	146.08	146.86	139.39
10/16/11	*	142.62	146.95
10/17/11	*	139.58	136.61
10/18/11	*	140.11	149.54
10/19/11	*	143.75	171.97
10/20/11	*	141.19	141.47
10/21/11	*	145.79	146.59
10/22/11	*	155.40	158.82
10/23/11	*	139.84	139.45
10/24/11	*	141.52	146.31
10/25/11	*	134.04	136.78
10/26/11	*	139.69	138.23
10/27/11	*	145.52	144.87
10/28/11	*	142.18	137.46
10/29/11	*	140.29	138.57
10/30/11	161.08	142.47	140.23
10/31/11	159.08	137.88	137.42
Total	2452.07	4404.87	4341.70
Average	144.24	142.09	140.05
Daily Low	133.89	134.04	95.52
Daily High	161.08	155.40	171.97
Std Dev	7.39	4.57	11.33

** Flow data not available due to migration from the Westinghouse system to the Ovation system*

Table A-11
City of San Diego
Point Loma Wastewater Treatment Plant
Average Daily Flow
November 2012

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
11/1/11	156.08	141.94	140.09
11/2/11	156.83	137.84	137.49
11/3/11	154.08	141.73	139.74
11/4/11	165.08	147.75	147.19
11/5/11	166.09	137.36	138.45
11/6/11	158.66	140.05	139.93
11/7/11	159.28	140.98	141.07
11/8/11	162.49	141.04	140.77
11/9/11	145.27	146.86	145.43
11/10/11	139.56	148.68	146.82
11/11/11	146.08	144.89	142.84
11/12/11	147.07	147.90	145.17
11/13/11	152.07	142.20	141.34
11/14/11	142.81	146.65	144.68
11/15/11	143.37	140.72	139.03
11/16/11	191.47	138.75	136.70
11/17/11	144.07	143.69	142.28
11/18/11	144.07	144.19	141.28
11/19/11	142.57	143.44	140.17
11/20/11	143.56	143.47	140.98
11/21/11	144.57	144.33	141.76
11/22/11	143.57	143.43	142.35
11/23/11	133.23	133.49	131.14
11/24/11	141.50	141.52	140.41
11/25/11	140.56	141.87	139.01
11/26/11	142.07	142.88	141.07
11/27/11	144.56	145.12	142.66
11/28/11	137.85	134.73	138.23
11/29/11	145.06	145.49	142.77
11/30/11	144.93	142.03	140.98
Total	4478.46	4275.02	4231.81
Average	149.28	142.50	141.06
Daily Low	133.23	133.49	131.14
Daily High	191.47	148.68	147.19
Std Dev	11.50	3.63	3.17

Table A-12
City of San Diego
Point Loma Wastewater Treatment Plant
Average Daily Flow
December 2012

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
12/1/11	151.08	148.93	145.38
12/2/11	149.58	147.38	145.11
12/3/11	144.07	141.84	139.54
12/4/11	141.33	144.45	140.93
12/5/11	143.72	143.84	140.55
12/6/11	146.57	145.73	141.87
12/7/11	141.19	138.75	140.35
12/8/11	147.08	145.01	139.42
12/9/11	145.57	144.49	140.02
12/10/11	145.01	143.73	138.95
12/11/11	142.87	142.25	140.45
12/12/11	141.93	139.48	140.35
12/13/11	190.67	191.75	184.22
12/14/11	164.48	165.91	158.45
12/15/11	183.62	168.69	168.82
12/16/11	159.15	158.31	155.91
12/17/11	154.60	155.71	159.05
12/18/11	157.22	148.90	162.02
12/19/11	152.51	148.24	157.24
12/20/11	153.20	153.58	158.35
12/21/11	149.77	150.52	155.06
12/22/11	155.59	152.58	155.41
12/23/11	147.57	144.54	143.18
12/24/11	154.58	152.02	150.67
12/25/11	138.57	136.35	135.40
12/26/11	146.57	143.65	143.03
12/27/11	149.58	146.81	146.26
12/28/11	153.07	149.95	149.97
12/29/11	152.57	148.87	149.99
12/30/11	156.08	157.95	153.07
12/31/11	160.09	155.92	156.71
Total	4719.49	4656.14	4635.71
Average	152.24	150.20	149.54
Daily Low	138.57	136.35	135.40
Daily High	190.67	191.75	184.22
Std Dev	11.22	10.64	10.66

Appendix B

Annual Average Daily Flow Tables: Summary

Table B-1
City of San Diego
Point Loma Wastewater Treatment Plant
Annual Average Daily Flow
2012

Month	Gould (mgd)	PS-2 (mgd)	ADS (mgd)	Percent Difference: PS-2 vs. Gould	Percent Difference: ADS vs. Gould
January	153.86	151.73	149.46	-1.39%	-2.86%
February	149.55	151.82	151.57	1.52%	1.35%
March	152.84	154.26	153.53	0.93%	0.45%
April	152.20	152.06	151.53	-0.09%	-0.44%
May	147.21	146.70	148.22	-0.35%	0.68%
June	143.62	144.40	147.97	0.54%	3.03%
July	144.18	144.03	n/a	-0.10%	n/a
August	143.45	143.00	140.15	-0.32%	-2.30%
September	142.45	142.68	139.85	0.16%	-1.83%
October	144.24	142.09	140.05	-1.49%	-2.90%
November	149.28	142.50	141.06	-4.54%	-5.51%
December	152.24	150.20	149.54	-1.34%	-1.78%
2012 Average	148.15	147.12	147.31	-0.44%	-1.31%
2012 Minimum	133.23	133.49	95.52	-27.53%	-32.92%
2012 Maximum	191.47	191.75	184.22	6.53%	5.20%

Appendix C

Flow Meter Calibration Data

Table C-1
City of San Diego
Point Loma Wastewater Treatment Plant
Calibration Test Data: February 6, 2013

Flume ID	Level (in)	Measured Current (mA)	Theoretical Current (mA)	Percent Difference: Measured vs. Theoretical	Measured Flow (mgd)	Theoretical Flow (mgd)	Percent Difference: Measured vs. Theoretical
C-1	0	5.403	5.33	1.37%	0	0.00	NA
	9	8.098	8.00	1.23%	10	9.80	2.04%
	18	12.076	12.00	0.63%	30	29.59	1.39%
	27	16.062	16.00	0.39%	57	56.47	0.94%
	36	20.072	20.00	-0.18%	90	89.33	0.75%
	27	16.042	16.00	-0.36%	57	56.47	0.94%
	18	12.040	12.00	-0.59%	30	29.59	1.39%
	9	8.047	8.00	-0.85%	10	9.80	2.04%
	0	5.393	5.33	-0.13%	0	0.00	NA
C-2	0	5.402	5.33	1.35%	0	0.00	NA
	9	8.157	8.00	1.96%	10	9.80	2.04%
	18	12.136	12.00	1.13%	30	29.59	1.39%
	27	16.156	16.00	0.97%	57	56.47	0.94%
	36	20.133	20.00	0.66%	91	89.33	1.87%
	27	16.124	16.00	0.77%	57	56.47	0.94%
	18	12.126	12.00	1.05%	30	29.59	1.39%
	9	8.084	8.00	1.05%	10	9.80	2.04%
	0	5.389	5.33	1.11%	0	0.00	NA
N-1	0	5.333	5.33	0.06%	0	0.00	NA
	9	7.970	8.00	-0.38%	12	13.02	-7.83%
	18	11.956	12.00	-0.37%	38	39.66	-4.19%
	27	15.951	16.00	-0.31%	74	76.09	-2.75%
	36	19.965	20.00	-0.18%	119	120.81	-1.50%
	27	15.943	16.00	-0.36%	74	76.09	-2.75%
	18	11.929	12.00	-0.59%	38	39.66	-4.19%
	9	7.932	8.00	-0.85%	12	13.02	-7.83%
	0	5.323	5.33	-0.13%	0	0.00	NA
N-2	0	5.383	5.33	0.99%	0	0.00	NA
	9	8.119	8.00	1.49%	15	13.02	15.21%
	18	12.092	12.00	0.77%	41	39.66	3.38%
	27	16.114	16.00	0.71%	78	76.09	2.51%
	36	20.095	20.00	0.47%	123	120.81	1.81%
	27	16.069	16.00	0.43%	78	76.09	2.51%
	18	12.065	12.00	0.54%	41	39.66	3.38%
	9	8.070	8.00	0.88%	14	13.02	7.53%
	0	5.423	5.33	1.74%	0	0.00	NA

Appendix D

Field Notes

Sylvia Seibel

City of San Diego
Point Loma Treatment Plant
Calibration Test Data
February 6, 2013
Log Sheet

Flume ID	Level (in)	Measured Voltage (mA)	Theoretical Voltage (mA)	Measured Flow (MGD)	Theoretical Flow (MGD)
C-1	0	5.403	5.33	0	0.00
	9	8.098	8.00	10	9.80
	18	12.076	12.00	30	29.59
	27	16.062	16.00	57	56.47
	36	20.072	20.00	90	89.33
	27	16.042	16.00	57	56.47
	18	12.040	12.00	30	29.59
	9	8.047	8.00	10	9.80
	0	5.393	5.33	0	0.00
C-2	0	5.402	5.33	-0	0.00
	9	8.157	8.00	10	9.80
	18	12.136	12.00	30	29.59
	27	16.156	16.00	57	56.47
	36	20.133	20.00	91	89.33
	27	16.124	16.00	57	56.47
	18	12.126	12.00	30	29.59
	9	8.084	8.00	10	9.80
	0	5.389	5.33	-0	0.00

City of San Diego
Point Loma Treatment Plant
Calibration Test Data
February 6, 2013
Log Sheet

Flume ID	Level (in)	Measured Voltage (mA)	Theoretical Voltage (mA)	Measured Flow (MGD)	Theoretical Flow (MGD)
N-1	0	5.333	5.33	-0	0.00
	9	7.970	8.00	12	13.02
	18	11.956	12.00	38	39.66
	27	15.951	16.00	74	76.09
	36	19.965	20.00	119	120.81
	27	15.943	16.00	74	76.09
	18	11.929	12.00	38	39.66
	9	7.932	8.00	12	13.02
	0	5.323	5.33	-0	0.00
N-2	0	5.383	5.33	0	0.00
	9	8.119	8.00	15	13.02
	18	12.092	12.00	41	39.66
	27	16.114	16.00	78	76.09
	36	20.095	20.00	123	120.81
	27	16.069	16.00	78	76.09
	18	12.065	12.00	41	39.66
	9	8.070	8.00	14	13.02
	0	5.423	5.33	0	0.00

Meter Last Calibration: 1/25/13

SN: 5045224

meter: Fluke 45 Dual display mete. Calibration 1/25/13
SN: 5045224 Sylvia, Oliver, Tim, Mike, Denis.

2/6/13

PF ~~Pump~~ N1

level (in)	(Reading mA/DC)
0	5.333 mA
9	7.970 mA
18	11.956 mA
27	15.951 mA
36	19.965 mA
27	15.943 mA
18	11.929 mA
9	7.932 mA
0	5.323 mA

PF C1

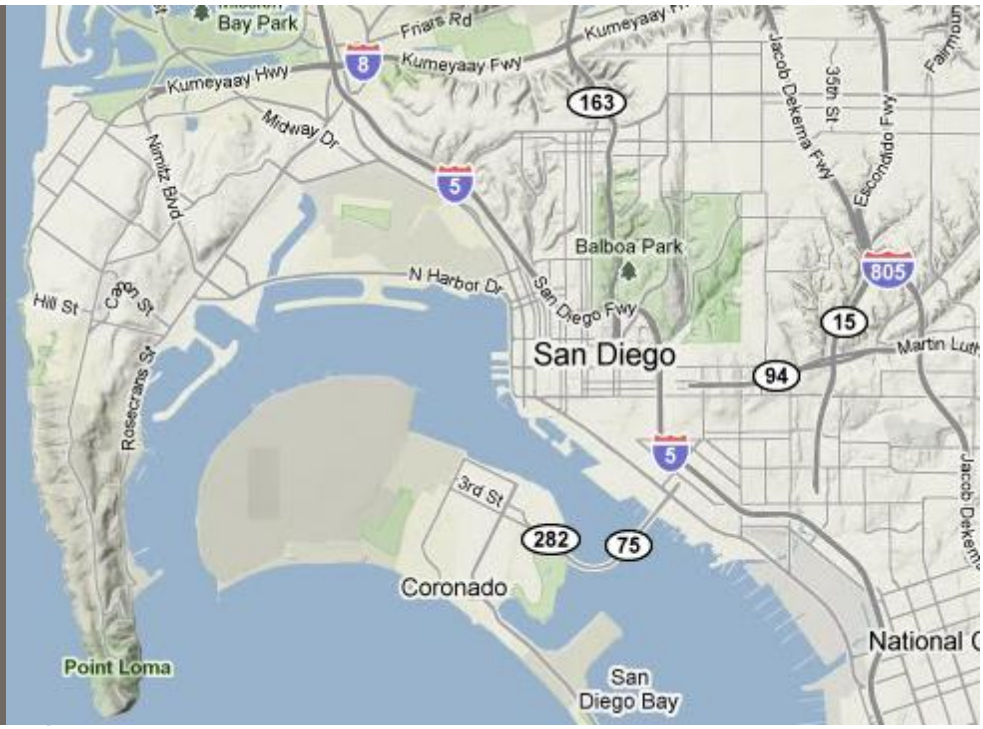
level (in)	Reading (mA/DC)
0	5.403
9	8.096
18	12.076
27	16.062
36	20.072
27	16.042
18	12.040
9	8.047
0	5.393

PF N2

0	5.383
9	8.119
18	12.092
27	16.114
36	20.095
27	16.069
18	12.065
9	8.070
0	5.423

PF C2

0	5.402
9	8.157
18	12.136
27	16.156
36	20.133
27	16.124
18	12.126
9	8.084
0	5.389



V&A

Oakland
155 Grand Avenue, Suite 700
Oakland, CA 94612
510.903.6600 **Tel**
510.903.6601 **Fax**

San Diego
11011 Via Frontera, Suite C
San Diego, CA 92127
858.576.0226 **Tel**
858.576.0004 **Fax**

Seattle
14900 Interurban Avenue, Suite 268
Seattle, WA 96818
206.674.4560 **Tel**
206.674.4561 **Fax**

Houston
8220 Jones Road, Suite 500
Houston, TX 77065
713.840.6490 **Tel**
713.840.6491 **Fax**

vaengineering.com