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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/Lmicrograms 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
pCi/L or pCi/L pico curies per liter
TU..... toxicity units
ntu nephelometric turbidity units
°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
ndnot detected
NA not analyzed (when in a data column)
NRnot required
NSnot sampled

CHEMICAL TERMS & ABBREVIATIONS:

AAAtomic Absorption Spectroscopy
BOD.....Biochemical Oxygen Demand
CN⁻Cyanide
COD.....Chemical Oxygen Demand
Cr⁶⁺Hexavalent Chromium
D.O.Dissolved Oxygen
DDDDichlorodiphenyldichloroethane
.....(a.k.a. TDE-
tetrachlorodiphenylethane)
DDE.....Dichlorodiphenyldichloroethylene
DDT.....Dichlorodiphenyltrichloroethane
FeCl₃.....Ferric Chloride
G&OGrease and Oil
GCGas chromatography.
GC-ECDElectron Capture Detector
GC-FID.....Flame Ionization Detector
GC-FPD.....Flame Photometric Detector
GC-MSMass Spectroscopy
H₂S.....Hydrogen Sulfide
HgMercury
ICIon Chromatography
ICP-AESInductively Coupled Plasma-
Atomic Emission Spectroscopy

MDLMethod Detection Limit
MSDMass Spectroscopy Detector
NH₃Ammonia
NH₃-N.....Ammonia Nitrogen
NH₄⁺Ammonium ion
NO₃⁻Nitrate
PADPulsed Amperometric Detector
PCBPolychlorinated Biphenyls
PO₄³⁻Phosphate
SO₄²⁻Sulfate
SS.....Suspended Solids
TBTTributyl tin
TCHTotal Chlorinated Hydrocarbons
(i.e. chlorinated pesticides &
PCB's)
TCLPToxicity Characteristic Leaching
Procedure
TDSTotal Dissolved Solids
TSTotal Solids
TVSTotal 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 / CH ₂ Cl ₂ continuous extraction, GC-MSD	HP-6890GC / 5973MSD Capillary DB-5.625	(a) 625
Benzidines	Basic / CH ₂ Cl ₂ continuous extraction, GC-MSD	HP-6890GC / 5973MSD Capillary DB-5.625	(a) 625
Chlorinated Compounds	CH ₂ Cl ₂ extraction, GC-ECD	Varian 3800 GC-ECD RTX-5/60m : RTX-1701/60m Varian 3800-Saturn 2000 DB-XLB	(a) 608
Dioxin	CH ₂ Cl ₂ extraction, GC/MS/MS	Varian Saturn -MS-MS Varian 3800 GC	(a) 8280A
Organophosphorus Pesticides	CH ₂ Cl ₂ extraction, hexane exchange, GC-PFPD	Varian 3800 GC-PFPD RTX-1 :RTX-50	(a) 622
Phenolic Compounds	Acidic / CH ₂ Cl ₂ 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	CH ₂ Cl ₂ 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

LIVID 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.

LIVID 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 / CH ₂ Cl ₂ continuous extraction, GC-MSD	HP-6890GC / 5973MSD Capillary DB-5.625	(a) 625 (b)
Benzidines	Basic / CH ₂ Cl ₂ continuous extraction, GC-MSD	HP-6890GC / 5973MSD Capillary DB-5.625	(a) 625
Chlorinated Compounds	CH ₂ Cl ₂ extraction, GC-ECD	Varian 3800 GC-ECD RTX-5/60m : RTX-1701/60m Varian 3800-Saturn 2000 DB-XLB	(c) 8081 A
PCBs	CH ₂ Cl ₂ extraction, GC-ECD	Varian 3800 GC-ECD RTX-5/60m : RTX-1701/60m Varian 3800-Saturn 2000 DB-XLB	(c) 8082
Dioxin	CH ₂ Cl ₂ extraction	Varian GC-MS/MS	(c) 8280A
Organophosphorus Pesticides	CH ₂ Cl ₂ extraction, hexane exchange, GC-PFPD	Varian 3800 GC-PFPD RTX-1 : RTX-50	(a) 622
Phenolic Compounds	Acidic / CH ₂ Cl ₂ 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	CH ₂ Cl ₂ 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	

¹Reference 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 C°	Denver PI-314, Mettler AB204	(i) 2540 B
Solids, Total-Volatile	Gravimetric @ 500 C°	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
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¹Reference 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	CH ₂ Cl ₂ /Acetone sonication extraction, GC-MSD	Agilent-7890GC / 5975MSD Capillary DB-5.625	(c) 8270 C (c) 3550 A
Chlorinated Compounds	CH ₂ Cl ₂ extraction, GC-ECD	Varian 3800 GC-ECD RTX-5/60m : RTX-1701/60m Varian 3800-Saturn 2000 DB-XLB	(c) 8081 A
PCBs	CH ₂ Cl ₂ extraction, GC-ECD	Varian 3800 GC-ECD RTX-5/60m : RTX-1701/60m Varian 3800-Saturn 2000 DB-XLB	(c) 8082
Dioxin	Outside Contact (Test America)	GC-MS	(a) 8290
Organophosphorus Pesticides	CH ₂ Cl ₂ extraction, hexane exchange, GC-PFPD	Varian 3800 GC-PFPD DB-1/30m DB-608/30m	(c) 8141 A
Phenolic Compounds	CH ₂ Cl ₂ / 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	CH ₂ Cl ₂ 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 C°	AND HM-120	(g) 2540 B
Solids, Total-Volatile	Gravimetric @ 500 C°	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	CH ₂ Cl ₂ / Acetone ASE GC-MSD	Agilent-7890GC / 5975MSD Capillary DB-5.625	(c) 8270 C (b) 3545A
Chlorinated Compounds	CH ₂ Cl ₂ extraction, GC-ECD/MS/MS	Varian Saturn GC-ECD/MS/MS DBXLB/60m	(c) 8081 A 3545A
PCBs as Congeners	CH ₂ Cl ₂ extraction, GC-ECD/MS/MS	Varian Saturn GC-ECD/MS/MS DBXLB/60m	(c) 8082 3545A
Organophosphorus Pesticides	CH ₂ Cl ₂ extraction, hexane exchange, GC-PFPD	Varian 3800 GC-PFPD RTX-1 : RTX-50	(c) 8141 A
Tri, Di, and Monobutyl Tin	CH ₂ Cl ₂ 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 Freezezone 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 / CH ₂ Cl ₂ ASE extraction, GC-MSD	Dionex ASE-200 Agilent-7890GC/5975 MSD Capillary DB-5625	(c) 3545 / 8270 C
Chlorinated Compounds	CH ₂ Cl ₂ extraction, GC-ECD/MS/MS	Varian 3800 GC Saturn 2000 MS-Ion Trap DB-XLB/60m	(c) 3545 / 8081 A
PCBs	CH ₂ Cl ₂ extraction, hexane exchange, GC-ECD/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 - 2011

CONSTITUENT	Frequency	Sample Type	Permit Required		Comments
			Influent	Effluent	
Process Control					
Biochemical Oxygen Demand -Total	Daily	Composite	X	X	Monday-Friday Same meter used
Biochemical Oxygen Demand -Soluble	Daily	Composite			
Chemical Oxygen Demand	Weekly	Composite			
Conductivity	Weekly	Composite			
Floating Particulates	Daily	Composite	X	X	
Flow	Daily		X	X	
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	Req. Frequency=Monthly
Sb, Be, Tl	Weekly	Composite	X	X	
Fe	Weekly	Composite			
Ions					
Alkalinity	Weekly	Composite			By calculation
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			
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 8280A
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. Reported in the monthly Toxicity Testing Report by the Biology Section
Toxicity (Acute & Chronic)	Monthly	Composite	X		

D. Laboratories Contributing Results used in this report.

- | | |
|---|--|
| <p>i. Metropolitan Wastewater Chemistry Laboratory (EPA Lab Code: CA00380, ELAP Certificate: 1609)
5530 Kiowa Drive
La Mesa, CA 91942
(619)668-3212
<i>All results except those listed below.</i></p> <p>ii. Point Loma Wastewater Chemistry Laboratory (EPA Lab Code: CA01435, ELAP Certificate: 2474)
1902 Gatchell Road
San Diego, CA 92106
(619)221-8765
<i>Process control analyses and wet methods for the plant.</i></p> <p>iii. North City Wastewater Chemistry Laboratory (EPA Lab Code: CA01436, ELAP Certificate: 2477)
4949 Eastgate Mall
San Diego, CA 92121
(858)824-6009
<i>Process control analyses and wet methods for the plant.</i></p> <p>iv. Metro Biosolids Center Chemistry Laboratory (EPA Lab Code: CA01437, ELAP Certificate: 2478)
5240 Convoy Street
San Diego, CA 92111
(858)614-5834
<i>Process control analyses and wet methods for the plant.</i></p> <p>v. South Bay Water Reclamation Plant (EPA Lab Code: CA01460, ELAP Certificate: 2539)
2411 Dairy Mart Road
San Diego, CA 92173
619.428.7349
<i>Process control analyses and wet methods for the plant.</i></p> <p>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
<i>Total Organic Carbon in Wastewater</i></p> | <p>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
<i>Microbiology</i></p> <p>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
<i>Bioassays</i></p> <p>ix. Frontier Analytical Laboratory (EPA Lab Code:CA014455, NELAP- Certificate: 02113CA)
5172 Hillsdale Circle
El Dorado Hills, CA95762
(916) 934-0900</p> <p>x. Test America
2800 George Washington Way
Richland, WA 99354-1613
CA ELAP Certification: 2425
Telephone# (509) 375-3131
<i>Gross Alpha/Beta Radioactivity</i></p> <p>xi. Test America
2960 Foster Creighton Drive
Nashville, TN 37204
NELAP Certification: 01168CA
Telephone# (615) 726-0177</p> |
|---|--|
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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. Blom, 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 37,282 samples received in the Laboratory in 2011, approximately 33% were Quality Control (QC) samples, such as blanks, check samples, standard reference materials, etc. 118 different analyses were performed throughout the year resulting in 262,329 analytical determinations. Of the determinations, 113,016 (~43%) 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 2011 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 Analyses 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 Analyses 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 Analyses 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 Analyses 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 MWW 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	2411 Dairy 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 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, 2011 - December 31, 2011.¹⁷

The sample distribution for 2011 is not significantly changed from 2010. 262,329 analytical determinations were made on 37,282 samples received by the Laboratory in 2011(see table A.). Of these 12,176 or 33% were Quality Control (QC) samples. 12.6% were blanks and 20.0% check or reference samples.

Table A. Samples	2011	2011
	Number of Samples	Percent of total samples
Customer/Environmental samples	25,106	67.34%
Quality Control (QC) samples	12,176	32.66%
Total Samples	37,282	100.00%

QC Samples:

Blanks:

FIELD_BLANK	194	0.52%
REAGENT_BLANK	16	0.04%
TRIP BLANK	2	0.01%
METHOD_BLANK	4,501	12.07%
Total Blanks:	4,713	12.64%

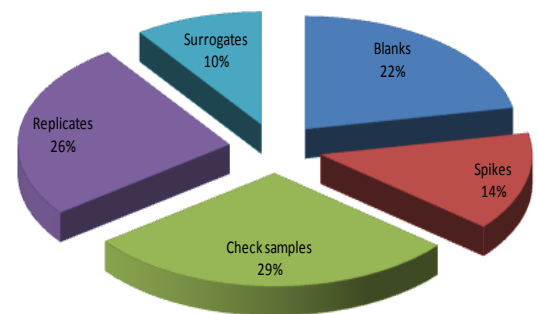
Check samples:

External Check samples	4,450	11.94%
Internal Check samples	2,967	7.96%
Spike Check samples	34	0.09%
SRMs (Standard Reference Material)	12	0.03%
Total Check Samples:	7,463	20.02%
Total QC Samples:	12,176	32.66%

High levels of QC are used for laboratory determinations. 43% of the 262,329 determinations were QC (e.g. blanks, lab replicates, matrix spikes, surrogates, etc.). If calculated for the 256,348 customer determinations only, the percentage increases to 44%.

2.3% of total analytical determinations or 0.5% 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

**Distribution of QC in Analyses
2011**

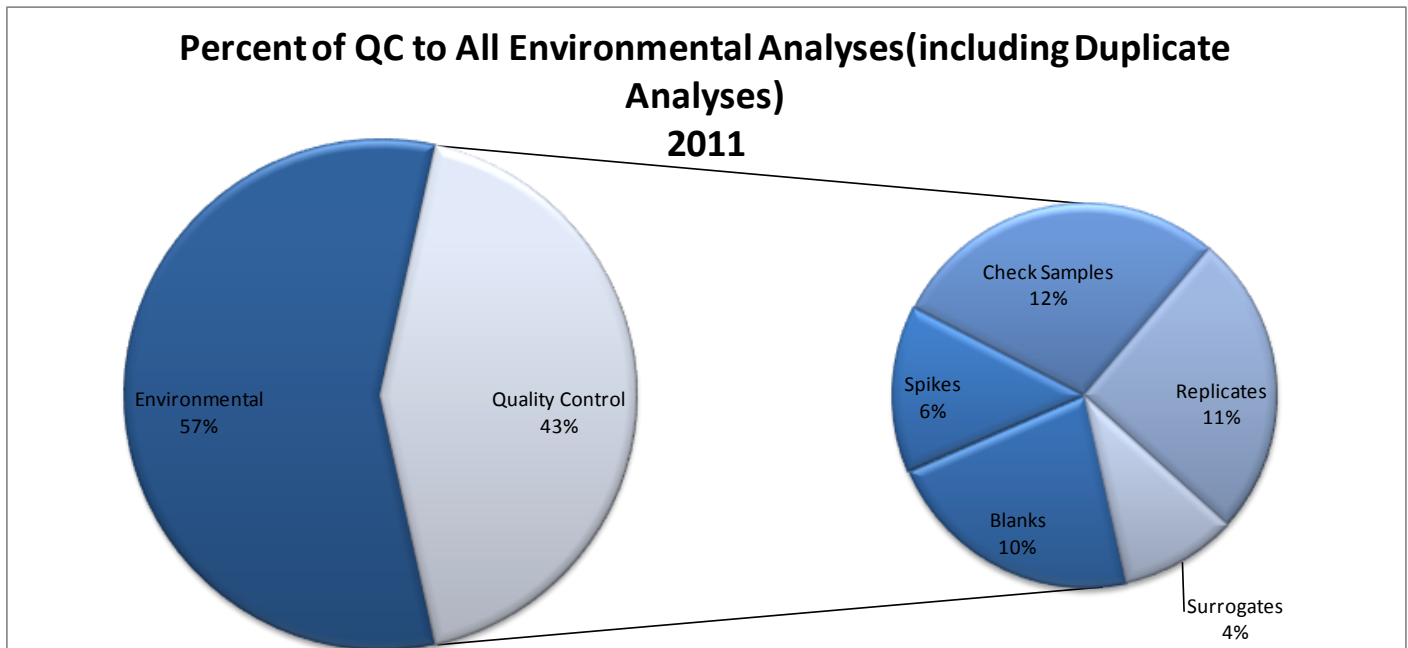


¹⁷ Data counts (metrics) were obtained on March 28, 2012 and do not include analyses that were underway, but incomplete as of that time. All table data is based on samples collected between January 1, 2011 and December 31, 2011. This data summary is comprehensive; includes all laboratory analyses work for all customers, projects, and programs unless otherwise indicated.

determination.

Table A.2. Analyses (results) - 2011

	Number	Percent of total
Total number of analytes/results determined:	262,329	NA
Total results not complete ² :	351	0.1%
No. of results for Customer/ Environmental Samples ^{1,3}:	256,348	97.7%
Total number of rejected results:	5,981	2.31%
No. of results for blanks ³ :	24,808	9.5%
No. of results for matrix spikes ³ :	15,902	6.1%
No. of results for Check samples ³ :	32,416	12.4%
No. of results for Replicates ³ :	28,846	11.0%
No. of results for surrogates ³ :	11,044	4.2%
Total QC analyses run ³ :	113,016	43.1%
Total in-house analyses completed ² :	258,463	



1 – matrix spike, replicates, surrogates are also part of the total for Customer/Environmental samples.

2 – as of March 28, 2012.

3 – percent of QC samples calculated from grand total of 262,329.

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:	14,309	
Total number of rejected analytical batches:	66	0.46%
Incomplete batches (as of March 28, 2011):	0	0.00%

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.

Laboratory	Results from sub-contracted laboratory	
	Analytes	% of Total in-house Analytes
Test America	338	0.13%
Frontier Labs	3079	1.19%
Water Quality, City of San Diego	74	0.03%
Total sub-contracted laboratory results:	3,491	1.35%

QA Plan:

A copy of our Laboratory's current Quality Assurance Plan is included as Attachment 3. The Quality Assurance Plan was updated in September 2011.

Performance Testing (PT) Studies for 2011:

The Wastewater Chemistry Laboratories participates in required ELAP and U.S.EPA PT studies throughout the year. We participated in 9 PT studies in 2011. Each of our geographically separated laboratory facilities participated individually (as required by ELAP). All PT studies were purchased from ERA 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 2011 are summarized in the following tables.

DMRQA (Discharge Monitoring Report – Quality Assurance)

The State of California did not conduct a regular DMR-QA study this year; 2011

Excerpt from state letter:

-----Original message-----

From: Bill Ray <bray@waterboards.ca.gov>

To: "Meyer, Steve" <SMeyer@sandiego.gov>

Sent: Fri, Mar 4, 2011 23:09:36 GMT +00:00

Subject: Re: Out of Office: DMR-QA Waiver information and participation.

Thank you for the information.

The State is not conducting a regular DMR-QA study this year. Please perform those PT samples your in-house lab needs for Certification purposes and instruct all of your contract labs to do the same. Both in-house and contract labs need to tell their respective PT providers to submit the information to the State Board. The preferred method is electronically in the form of the standard EPA data file transfer format and a scanned PDF of the report to this e-mail.

Alvarado Wastewater Chemistry Laboratory: See attachment 5 for copy of reports.

ERA Study	Number of Analytes	Number of Acceptable results	Success Rate (%)
SOIL-74	155	153	99%
SOIL-75	43	43	100%
WP-193	63	61	97%
WP-194	60	59	98%
WP-195	4	4	100%
WP-196	1	1	100%
WP-197	31	31	98%
WP-198	1	1	100%
WP-199	2	2	100%
Total analytes:	360	Overall:	98.6%

North City Chemistry Laboratory: See attachment 6 for copy of reports.

ERA Study	Number of Analytes	Number of Acceptable results	Success Rate (%)
WP-195	14	14	100%
Total analytes:	14	Overall:	100%

Metro Biosolids Center (MBC) Chemistry Laboratory: See attachment 7 for copy of reports.

ERA Study	Number of Analytes	Number of Acceptable results	Success Rate (%)
WP-196	9	9	100%
Total analytes:	9	Overall:	100%

Pt. Loma Wastewater Chemistry Laboratory: See attachment 8 for copy of reports.

ERA Study	Number of Analytes	Number of Acceptable results	Success Rate (%)
WP-193	15	14	100%
WP-198	1	1	100%
Total analytes:	16	Overall:	100%

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

ERA Study	Number of Analytes	Number of Acceptable results	Success Rate (%)
WP-194	14	14	100%
WP-195	1	1	100%
WP-199	1	1	100%
Total analytes:	16	Overall:	100%

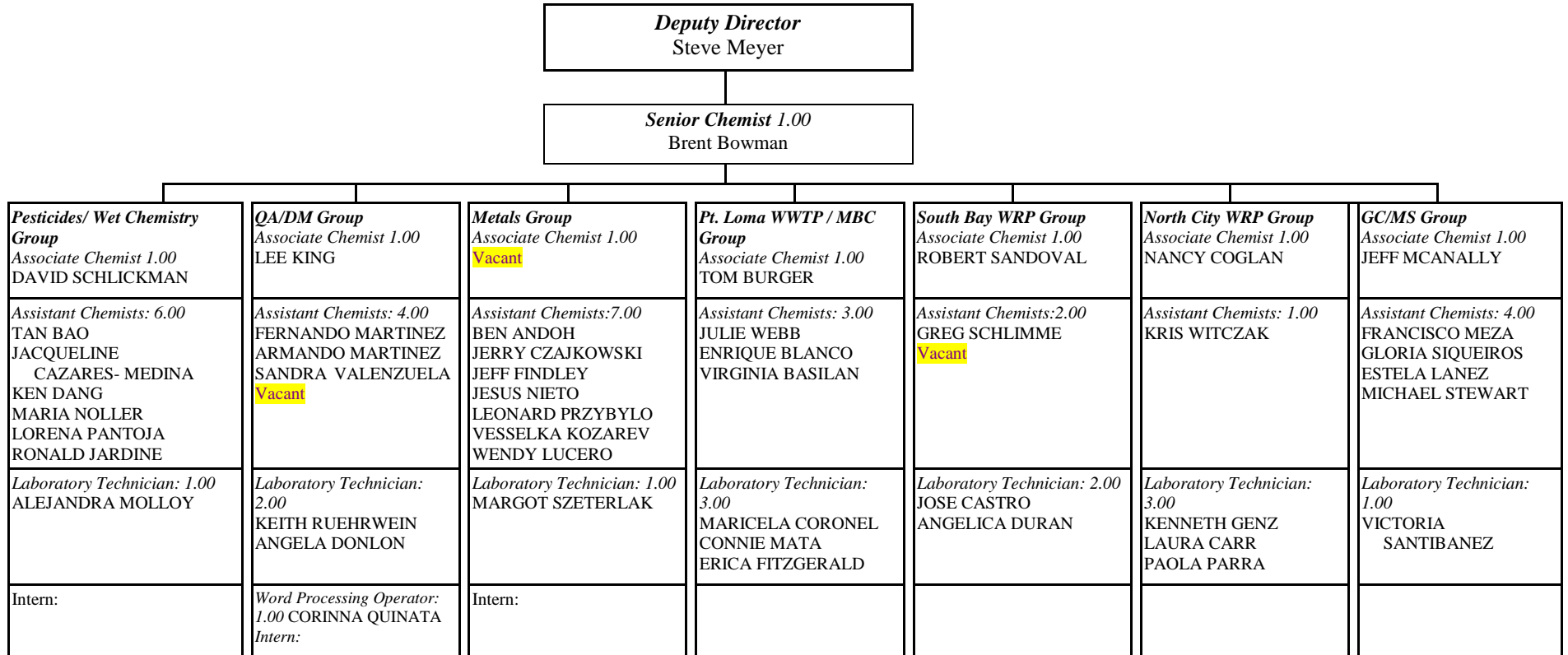
F. Staff contributing to this Report

Staff Contributing to this Report in 2011

Initials	ID	First Name	Last Name	Signature
BOA	BOA	Ben	Andoh	<i>Benjamin Andoh</i>
TB	TSB	Tan	Bao	<i>Tan Bao</i>
VB	VEB	Virginia	Basilan	<i>VB</i>
EB	BTX	Enrique	Blanco	<i>Enrique Blanco</i>
BGB	N8B	Brent	Bowman	<i>Brent Bowman</i>
TB	TMB	Tom	Burger	<i>Tom B. Burger</i>
LC	UEC	Laura	Carr	<i>Laura Carr</i>
JC	G3C	Jose	Castro	<i>Jose Castro</i>
JCM	U8C	Jacqueline	Cazares-Medina	<i>Jacqueline Cazares Medina</i>
NC	NLC	Nancy	Coglan	<i>Nancy Coglan</i>
MC	M5C	Maricela	Coronel	<i>Maricela Coronel</i>
JCM	G8C	Jerry	Czajkowski	<i>Jerry Czajkowski</i>
KD	KOD	Ken	Dang	<i>Ken Dang</i>
AMD	ADONLON	Angela	Donlon	<i>Angela Donlon</i>
ACD	AD4	Angelica	Duran	<i>Angelica Duran</i>
JTF	JRF	Jeff	Findley	<i>Jeff Findley</i>
EFITZ	EFITZGERALD	Erica	Fitzgerald	<i>Erica Fitzgerald</i>
KG	KG3	Kenneth	Genz	<i>Kenneth Genz</i>
RJ	RCJ	Ron	Jardine	<i>Ron Jardine</i>
LK	LNK	Lee	King	<i>Lee King</i>
VK	VK4	Vesselka	Kozarev	<i>V. Kozarev</i>
EL	EVL	Estela	Lanez	<i>Estela Lanez</i>
WL	WL7	Wendy	Lucero	<i>Wendy Lucero</i>
AM	M5U	Armando	Martinez	<i>Armando Martinez</i>
FM	YBM	Fernando	Martinez	<i>Fernando Martinez</i>
CGM	M4M	Connie	Mata	<i>Connie Mata</i>
FML	IZM	Francisco	Meza	<i>Francisco Meza</i>
JM	G7M	Jeff	McAnally	<i>Jeff McAnally</i>
AM	AM9	Alejandra	Molloy	<i>Alejandra Molloy</i>
JN	IEN	Jesus	Nieto	<i>Jesus Nieto</i>
MN	MGZ	Maria	Noller	<i>Maria Noller</i>
LP	LJP	Lorena	Pantoja	<i>Lorena Pantoja</i>
PP	PPARRA	Paola	Parra	<i>Paola Parra</i>
LP	LXP	Leonard	Przybylo	<i>Leonard Przybylo</i>
CAQ	CQ5	Corinna	Quinata	<i>Corinna Quinata</i>
KR	KRV	Keith	Ruehrwein	<i>Keith Ruehrwein</i>
RS	NDS	Robert	Sandoval	<i>Robert Sandoval</i>
VS	VS7	Victoria	Santibanez	<i>Victoria Santibanez</i>
DWS	DXS	David	Schlickman	<i>David Schlickman</i>
GS	GTS	Greg	Schlimme	<i>Greg Schlimme</i>
GLS	HIR	Gloria	Siqueiros	<i>Gloria Siqueiros</i>
MRS	MWS	Michael	Stewart	<i>Michael Stewart</i>
MIS	S49	Margot	Szeterlak	<i>Margot Szeterlak</i>
SV	SCV	Sandra	Valenzuela	<i>Sandra Valenzuela</i>
JW	AIW	Julie	Webb	<i>Julie Webb</i>
KLW	KLW	Kristof	Witczak	<i>Kristof Witczak</i>

Figure 1. Chemistry Laboratory Organization Chart.

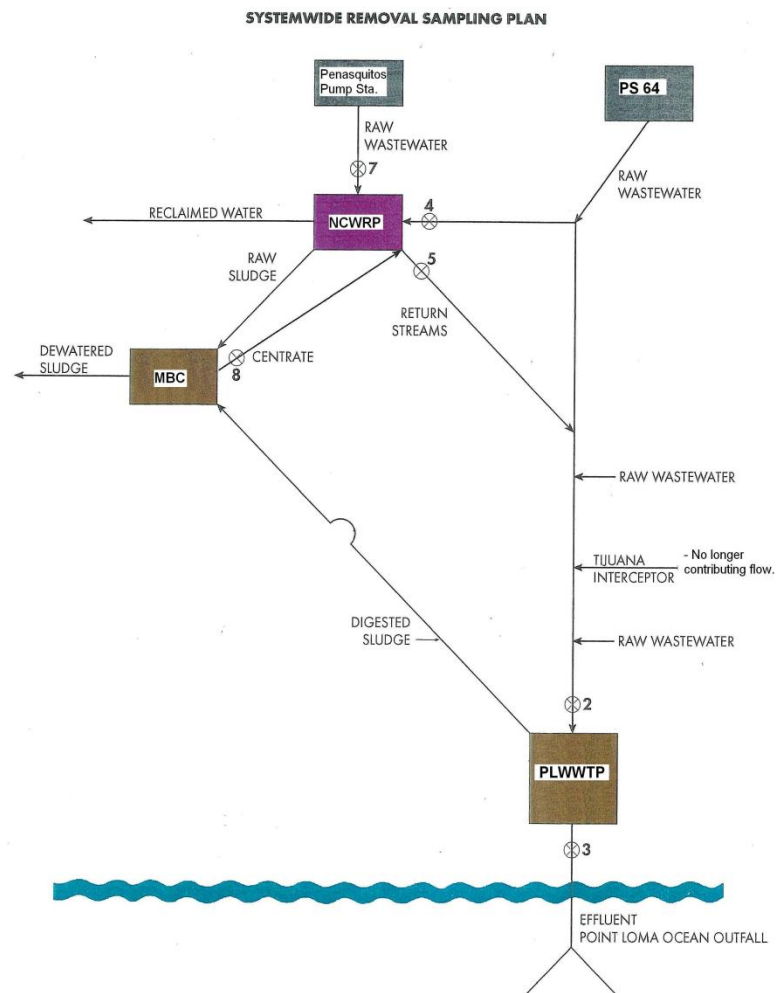
Public Utilities Department
 Environmental Monitoring and Technical Services Division
 Wastewater Chemistry Services



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 calculation¹⁸. 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.

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

$\Sigma \text{System Influent} - \Sigma \text{Return Streams}$

Where,

System Influent = Point Loma Wastewater Treatment Plant Influent,
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 BOD₅ 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 BOD₅ 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 MWH completed the annual Gould Flow Metering System Certification in March 2011.



POINT LOMA WASTEWATER TREATMENT PLANT 2011 Gould Flow Metering System Certification

March 2012



**City of San Diego, California
Metropolitan Wastewater Department**



**Certification of the Gould Flow Metering System
at the
Point Loma Wastewater Treatment Plant
2011**

Prepared For:

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Prepared By:

V&A
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San Diego, CA 92127
March 2012
<Ref. 07-0589>

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Appendix D. Field Notes

1 INTRODUCTION

1.1 Background

The Point Loma Wastewater Treatment Plant (Pt. 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 2011 was approximately 154 mgd. There are currently three independent flow measurement systems in place:

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

The influent flow at the Pt. Loma WWTP is measured by four Parshall flumes at the Headworks of the Pt. Loma WWTP. There are two 6-foot flumes designated as C-1 and C-2, and two 8-foot 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 are 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 Pt. 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) subtracted from the measured and known distance from the sensor face to the flume channel invert. 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 being measured. 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 2011, V&A was retained by Brown and Caldwell to evaluate the measurement of ADF influent to the Pt. 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 Pt. Loma WWTP. This certification includes verifying that the Gould devices are accurately recording flow, within acceptable tolerances ($\pm 5\%$ 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 and Witness Inspection – Perform a field review of the Gould metering system with regards to the appropriateness of the instrumentation configuration, data collection and reporting systems. Provide witness inspection 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 data of flow depth 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 in developing the Draft Report that will be delivered to the City. V&A will provide three hardcopies of the Draft Report to Brown and Caldwell, two for the City and one for Brown and Caldwell's files, along with 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, 2011 through December 31, 2011.
2. All equipment and labor necessary to remove, test and reinstall each of the Gould transducers and suspension brackets for 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 2011 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	359	363	321	359	317
Average	155.88	154.68	152.83	-0.77%	-1.98%
Minimum	135.46	134.83	138.47	-11.73%	-11.21%
Maximum	220.17	215.02	214.37	8.46%	18.77%
Standard Deviation	11.29	11.04	11.89	2.19%	2.35%

**Table 3-2
Gould Maximum and Minimum ADF Percent Difference**

	Date	Average Daily Flow (ADF) (mgd)			Percent Difference (%)	
		Gould	PS-2	ADS	PS-2 vs. Gould	ADS vs. Gould
Minimum	7/27/2011	135.46	141.31	140.87	4.32%	3.99%
Maximum	3/21/2011	220.17	203.93	210.55	-7.38%	-4.37%

There were a total of 44 days when the data reported by the ADS meters were known to be non-representative of the actual flow values. The City was aware that there were issues with the ADS meters and communication lines for the N1, N2, and C2 flumes on those days. In order to get a clear picture of the performance of the Gould meters, the ADS data in question was omitted from this analysis. Note also that Gould data was not available six days throughout the year due to problems with the Distributed Control System (DCS). In addition, all data from September 8th was omitted because it was the day of a power outage throughout San Diego County and parts of Orange County, Baja California, and Arizona.

Table 3-3 compares the yearly average daily flow data for the Gould system in 2010 and 2011. It shows that the Gould system average daily flow was the same in 2010 and 2011.

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

Gould System Average Daily Flow (mgd)			
	2010	2011	% Change
Average	155.88	155.88	0.00%
Minimum	140.06	135.46	-3.28%
Maximum	318.34	220.17	-30.84%

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 reported by the flow monitoring systems occurred only at average daily flow levels. 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 at that minimum depth.

The percent difference of any data type between systems was calculated as follows:

$$\text{PS-2 system: } (PS-2 - \text{Gould}) / \text{Gould} \times 100$$

$$\text{ADS system: } (ADS - \text{Gould}) / \text{Gould} \times 100$$

3.2.1 2011 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 2011 calendar year. The average daily flow recorded by the Gould flow meter varied from a minimum of 135 mgd in July to a maximum of 220 mgd in March. Figure 3-1 shows that the variance between the Gould, PS-2 and ADS flow meters was relatively constant throughout the year.

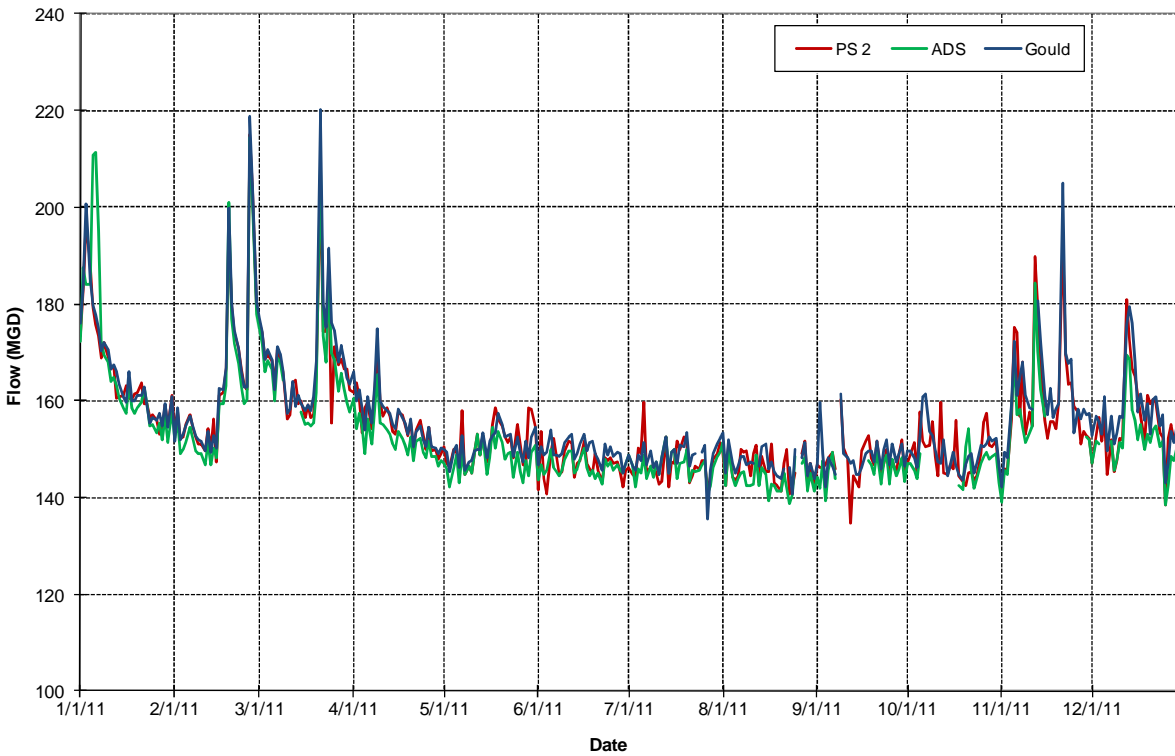


Figure 3-1. 2011 Flow Hydrograph

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 system for the 2011 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 -11.73% in March to 8.46% in October.

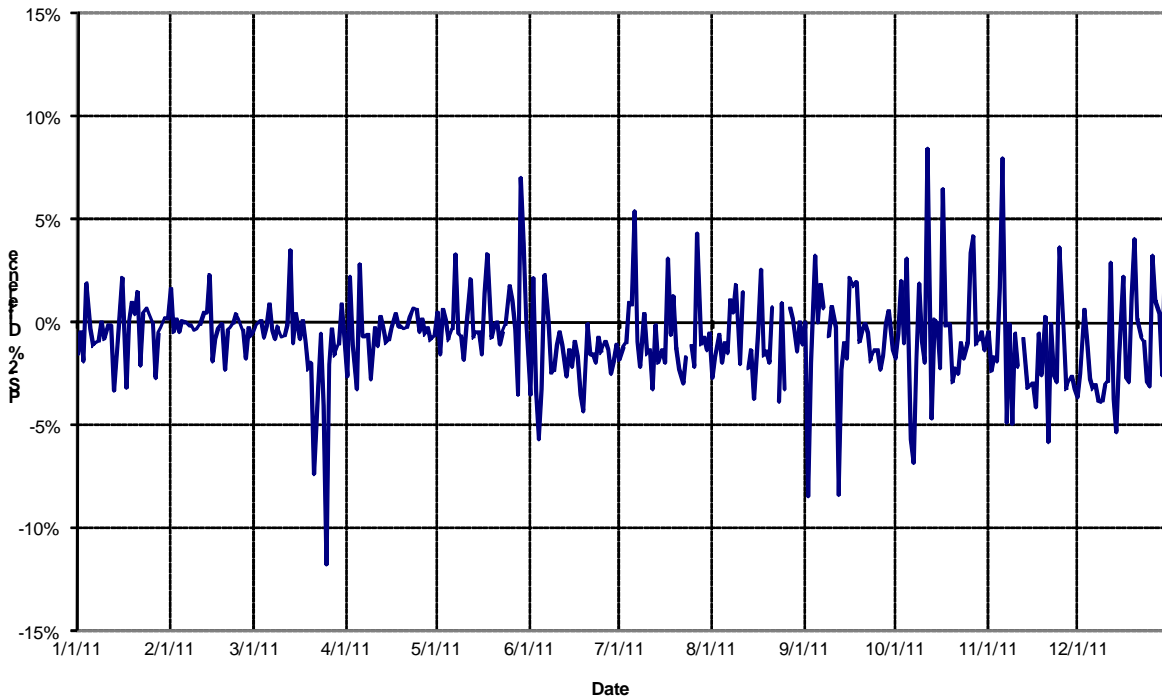


Figure 3-2. Percent Difference in Recorded Flow (PS-2/Gould Flow Meters) vs. Time

3.2.3 Scatter Plot of Percent Difference Between PS-2 and Gould Influent 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 $\pm 5\%$ for flows between 126 mgd and 220 mgd.

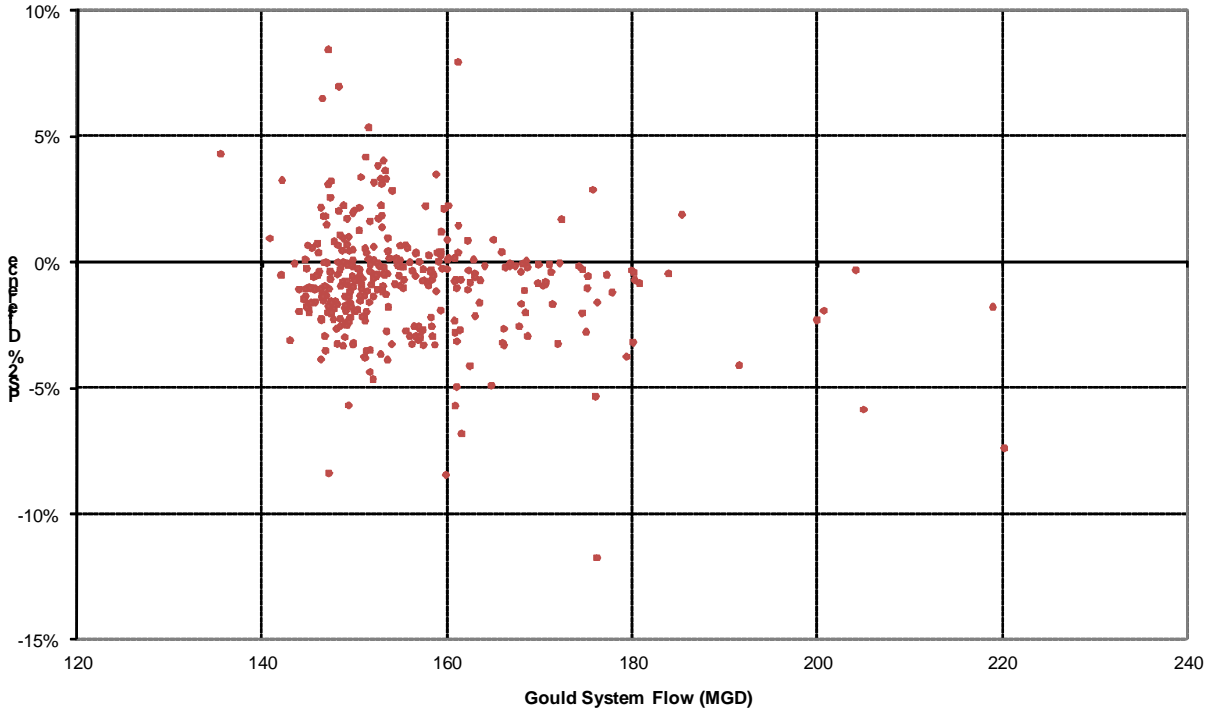


Figure 3-3. Scatter Plot of Percent Difference Between PS-2 and Gould Influent Flow Meters

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 measuring systems versus time for the 2011 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 -30.96% in March to 18.77% in January. As noted in Section 3.1, there were 44 days when the ADS meters were known to report non-representative data.

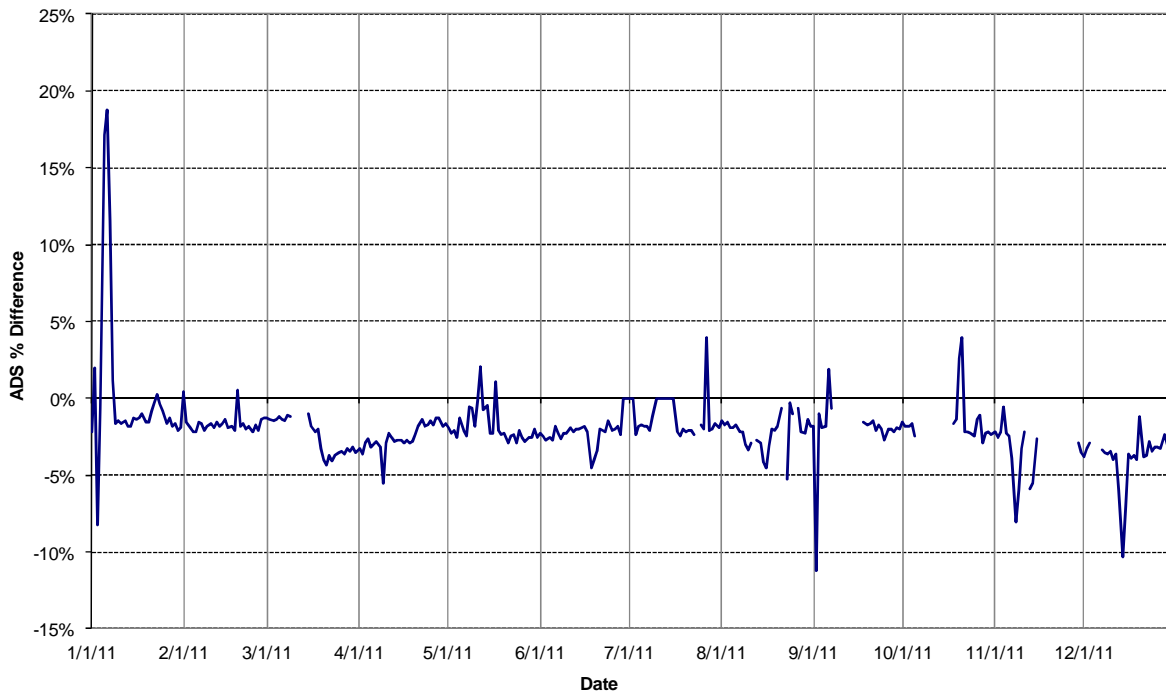


Figure 3-4. Percent Difference in Recorded Flow (ADS/Gould Flow Meters) vs. Time

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

A scatter plot of the percent difference between the ADF reported by the ADS and Gould is shown in Figure 3-5. This figure shows that the percent difference between the two meters was relatively consistent between 0% and -5% for flows between 142 mgd and 220 mgd.

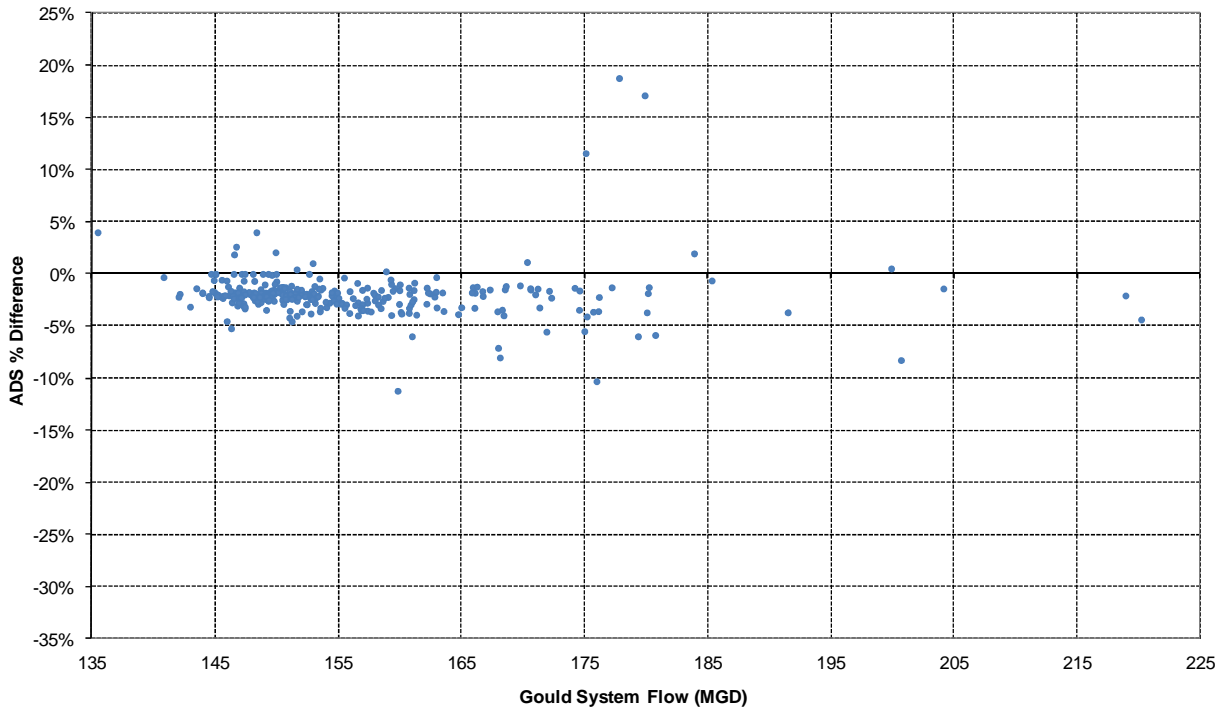


Figure 3-5. Scatter Plot of Percent Difference Between ADS and Gould Influent Flow Meters

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 Pt. Loma WWTP personnel and witnessed by V&A representatives on February 1, 2012. The following instruments, test equipment, and reports were used during the test:

- ❖ Static water well
- ❖ Gould Transducers (4 units)
- ❖ Hewlett Packard Multimeter (Model 34401A)
- ❖ Operator Station (Computer)
- ❖ Gould Transducer Calibration Reports
- ❖ Hewlett Packard Multimeter Calibration Reports

The following photos show procedure was used to test each of the four flumes (Note that Photo 4-1 and Photo 4-2 were also used in the 2010 report):

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



Photo 4-1: Gould Transducer in Operational Configuration



Photo 4-2: Flume Access After Transducer Has Been Removed



Photo 4-3: Transducer Being Moved to Testing Well



Photo 4-4: Transducer is Inserted Into Static Water Well for Testing



Photo 4-5: Calibration Test Equipment Configuration

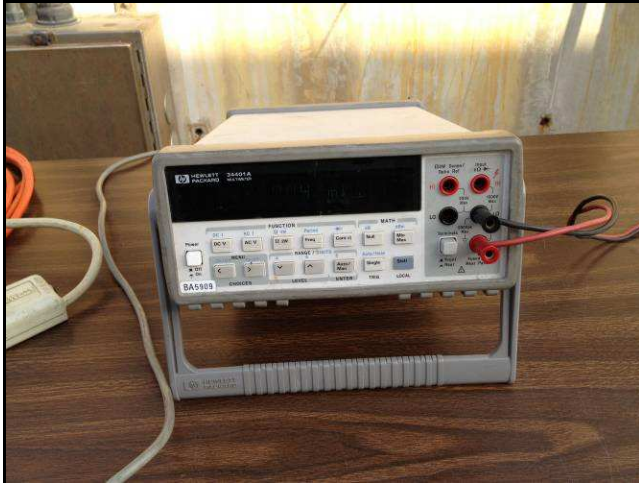


Photo 4-6: Hewlett Packard Multimeter

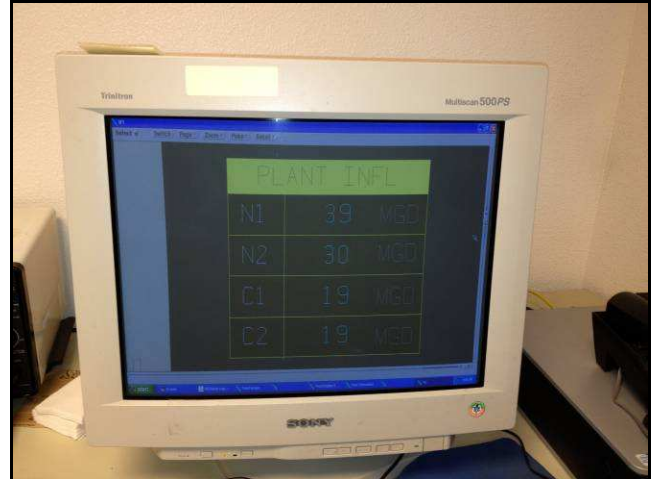


Photo 4-7: Operator Station Displays Plant Influent Readings

4.2 Test and Calibration

The Gould transducers were tested and calibrated using the Hewlett Packard multimeter shown above. The multimeter was calibrated so that a reading of 5.33 mA would correspond to 0 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 Pt. Loma WWTP Engineering Building. The computers calculated flow values from the mA current measurements. At the beginning of each of the four tests, the water well depth was 0 inches. The water depth was increased in 9-inch increments until it reached a full depth of 36 inches. At each 9-inch interval, a measurement of both the flow value and the multimeter reading was recorded. After reaching full depth, the water level was then reduced by 9-inch increments until the water depth was returned to 0 inches.

Table C-1, in Appendix C, compares the data collected in the field to the calculated theoretical values. The flow readings from flume C-1 at 9-inches of depth were 8% below the theoretical value. All other percent differences were less than 2% for all of the flumes. The City immediately removed the transducer from service and replaced it with one that reads correctly.

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:

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

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 were used in the equation to obtain the theoretical flow values.

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

$$\begin{aligned} Q &= (4)(6)(0.646)(H)^{1.594} \\ &= 15.504(H)^{1.594} \end{aligned}$$

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

$$\begin{aligned} Q &= (4)(8)(0.646)(H)^{1.607} \\ &= 20.672(H)^{1.607} \end{aligned}$$

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

- 1) No major discrepancies were found between the Gould and PS-2 metering devices for the 2011 calendar year. Comparison data for the Gould and ADS meters was not available for a total of 44 days during the year, but the non-representative data does not impact the results of this analysis.
- 2) Instrumentation test set-up, data collection and reporting systems meet the requirement directed by Brown & Caldwell.
- 3) Based on the existing data, it is certified that the Gould meters are recording flow accurately and within $\pm 5\%$ of the calculated theoretical values.
- 4) The percentage differences between the theoretical and practical flow for each of the flows are within $\pm 5\%$ of one another and show no distinctive variance above or below the average daily flow.
- 5) The three flow metering systems generally provide comparable results, considering the limits of the technologies used.

5.2 Recommendations

- 1) V&A recommends that the City continue to use Gould 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 2011

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
1/1/11	176.16	173.38	172.25
1/2/11	183.88	183.07	187.50
1/3/11	200.67	196.82	184.09
1/4/11	185.31	188.85	184.14
1/5/11	179.87	179.31	210.65
1/6/11	177.79	175.69	211.17
1/7/11	175.08	173.31	195.35
1/8/11	170.32	168.75	172.25
1/9/11	172.11	172.07	169.31
1/10/11	170.60	169.16	168.05
1/11/11	166.69	166.49	163.94
1/12/11	167.29	167.09	164.79
1/13/11	166.08	160.63	163.06
1/14/11	163.44	160.83	160.52
1/15/11	160.71	161.02	158.59
1/16/11	159.60	163.00	157.43
1/17/11	165.91	160.63	163.80
1/18/11	159.99	160.18	158.39
1/19/11	159.96	161.42	157.46
1/20/11	161.12	161.76	158.62
1/21/11	161.17	163.55	159.81
1/22/11	162.95	159.49	162.44
1/23/11	158.87	159.49	159.25
1/24/11	155.46	156.54	154.91
1/25/11	156.53	157.11	155.17
1/26/11	155.92	155.94	153.34
1/27/11	157.34	153.12	155.27
1/28/11	154.75	153.96	152.00
1/29/11	159.41	159.03	156.83
1/30/11	154.45	154.74	151.28
1/31/11	160.77	161.03	157.68
Total	5160.21	5137.46	5179.33
Average	166.46	165.72	167.08
Daily Low	154.45	153.12	151.28
Daily High	200.67	196.82	211.17
Std Dev	10.72	10.42	15.93

Table A-2
City of San Diego
Point Loma Wastewater Treatment Plant
Average Daily Flow
February 2011

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
2/1/11	151.62	154.11	152.28
2/2/11	158.47	157.75	156.03
2/3/11	152.02	152.18	149.06
2/4/11	153.16	152.42	149.81
2/5/11	154.85	155.00	151.43
2/6/11	156.94	156.98	154.53
2/7/11	154.66	154.46	152.18
2/8/11	152.65	152.45	149.52
2/9/11	151.86	151.21	149.07
2/10/11	151.57	151.06	149.03
2/11/11	149.76	149.53	146.84
2/12/11	153.57	154.26	151.25
2/13/11	149.36	150.05	146.68
2/14/11	152.82	156.30	150.28
2/15/11	150.29	147.46	148.29
2/16/11	162.44	161.16	159.39
2/17/11	162.28	161.77	159.38
2/18/11	166.73	166.65	163.20
2/19/11	199.88	195.33	200.92
2/20/11	180.13	179.43	176.79
2/21/11	174.57	174.10	171.79
2/22/11	170.99	170.85	167.64
2/23/11	165.84	166.54	162.89
2/24/11	162.80	162.98	159.25
2/25/11	162.92	162.22	160.12
2/26/11	218.90	215.02	214.37
2/27/11	204.12	203.52	201.27
2/28/11	180.21	178.97	177.92
Total	4605.39	4593.76	4531.20
Average	164.48	164.06	161.83
Daily Low	149.36	147.46	146.68
Daily High	218.90	215.02	214.37
Std Dev	17.79	16.91	17.78

Table A-3
City of San Diego
Point Loma Wastewater Treatment Plant
Average Daily Flow
March 2011

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
3/1/11	177.19	176.31	174.91
3/2/11	174.18	173.92	171.85
3/3/11	168.52	168.62	166.02
3/4/11	170.58	169.29	168.24
3/5/11	168.60	168.29	166.62
3/6/11	162.18	163.60	160.03
3/7/11	171.18	170.54	168.76
3/8/11	169.75	168.36	167.87
3/9/11	166.24	165.94	164.22
3/10/11	157.47	156.34	*
3/11/11	158.25	157.14	*
3/12/11	164.02	163.80	*
3/13/11	158.75	164.32	*
3/14/11	160.97	159.35	*
3/15/11	159.29	159.96	157.74
3/16/11	157.84	156.53	154.98
3/17/11	159.02	159.10	155.51
3/18/11	157.94	156.48	154.79
3/19/11	160.74	157.01	155.50
3/20/11	168.42	165.07	161.73
3/21/11	220.17	203.93	210.55
3/22/11	180.04	174.35	173.40
3/23/11	175.17	174.22	168.02
3/24/11	191.49	183.67	184.42
3/25/11	176.10	155.44	169.81
3/26/11	174.54	171.05	168.53
3/27/11	167.91	167.29	161.87
3/28/11	171.33	168.50	165.81
3/29/11	168.29	166.42	162.49
3/30/11	164.98	166.48	159.70
3/31/11	163.54	162.37	157.71
Total	5244.66	5173.69	4331.06
Average	169.18	166.89	166.58
Daily Low	157.47	155.44	154.79
Daily High	220.17	203.93	210.55
Std Dev	12.28	9.69	11.41

** ADS values are non-representative. Maintenance was performed.*

Table A-4
City of San Diego
Point Loma Wastewater Treatment Plant
Average Daily Flow
April 2011

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
4/1/11	166.05	161.67	160.64
4/2/11	160.06	163.68	154.21
4/3/11	162.15	160.40	157.51
4/4/11	158.60	153.42	154.48
4/5/11	154.03	158.44	149.11
4/6/11	160.87	159.79	156.13
4/7/11	155.28	154.22	150.95
4/8/11	162.98	162.03	157.74
4/9/11	174.97	170.13	165.37
4/10/11	159.93	159.53	155.32
4/11/11	158.75	156.93	155.12
4/12/11	157.96	158.40	153.94
4/13/11	157.34	156.91	152.99
4/14/11	155.22	153.65	150.95
4/15/11	154.28	152.98	150.04
4/16/11	158.24	157.76	153.59
4/17/11	156.59	157.19	152.31
4/18/11	155.23	154.96	150.77
4/19/11	153.10	152.82	148.84
4/20/11	156.18	155.66	152.55
4/21/11	150.47	150.06	147.69
4/22/11	153.71	153.98	151.63
4/23/11	154.91	155.96	152.13
4/24/11	152.01	152.97	149.35
4/25/11	150.53	149.78	148.27
4/26/11	154.46	154.65	151.74
4/27/11	150.47	149.51	148.61
4/28/11	150.28	149.91	148.38
4/29/11	149.06	147.77	146.39
4/30/11	150.11	149.05	147.68
Total	4693.81	4674.21	4574.41
Average	156.46	155.81	152.48
Daily Low	149.06	147.77	146.39
Daily High	174.97	170.13	165.37
Std Dev	5.48	4.95	4.18

Table A-5
City of San Diego
Point Loma Wastewater Treatment Plant
Average Daily Flow
May 2011

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
5/1/11	149.78	150.53	146.97
5/2/11	149.42	147.06	146.01
5/3/11	145.35	146.21	142.28
5/4/11	149.76	149.91	145.90
5/5/11	150.70	149.36	148.78
5/6/11	146.10	145.59	143.09
5/7/11	152.75	157.85	149.07
5/8/11	145.53	144.71	144.71
5/9/11	147.32	146.35	146.35
5/10/11	147.69	144.97	144.97
5/11/11	149.60	149.45	149.45
5/12/11	149.90	153.01	153.01
5/13/11	149.97	148.90	148.90
5/14/11	153.46	152.78	152.78
5/15/11	148.07	147.36	144.76
5/16/11	151.51	149.12	148.09
5/17/11	152.92	155.06	154.49
5/18/11	153.34	158.44	150.16
5/19/11	157.28	156.14	153.54
5/20/11	155.00	154.76	151.44
5/21/11	152.44	152.41	147.99
5/22/11	152.88	151.26	149.19
5/23/11	153.10	152.42	149.49
5/24/11	148.48	148.24	144.22
5/25/11	152.52	155.21	149.32
5/26/11	149.31	150.83	145.47
5/27/11	147.29	146.76	143.15
5/28/11	151.64	146.35	147.74
5/29/11	148.24	158.61	144.45
5/30/11	152.48	158.36	149.43
5/31/11	154.60	154.45	150.66
Total	4668.43	4682.45	4585.86
Average	150.59	151.05	147.93
Daily Low	145.35	144.71	142.28
Daily High	157.28	158.61	154.49
Std Dev	2.92	4.29	3.23

Table A-6
City of San Diego
Point Loma Wastewater Treatment Plant
Average Daily Flow
June 2011

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
6/1/11	146.80	141.65	143.48
6/2/11	150.45	153.73	146.71
6/3/11	148.70	143.76	144.66
6/4/11	149.29	140.82	145.53
6/5/11	153.96	148.97	149.84
6/6/11	148.77	152.14	146.10
6/7/11	148.74	148.78	145.37
6/8/11	148.41	144.67	144.53
6/9/11	148.94	145.37	145.57
6/10/11	151.31	149.58	147.81
6/11/11	152.41	151.71	149.51
6/12/11	152.99	151.21	149.62
6/13/11	147.98	144.08	144.99
6/14/11	148.92	146.92	145.98
6/15/11	150.98	147.70	148.04
6/16/11	152.99	151.51	150.16
6/17/11	149.49	146.99	146.19
6/18/11	151.22	145.91	144.35
6/19/11	151.62	145.02	145.54
6/20/11	149.15	149.06	144.00
6/21/11	147.85	145.59	144.94
6/22/11	145.70	143.43	142.66
6/23/11	151.21	148.25	147.98
6/24/11	148.69	147.57	146.50
6/25/11	150.56	148.28	147.47
6/26/11	148.43	147.05	145.53
6/27/11	149.35	147.35	146.62
6/28/11	149.08	145.39	145.55
6/29/11	145.02	142.31	145.02
6/30/11	147.15	145.60	147.15
Total	4486.14	4410.41	4387.40
Average	149.54	147.01	146.25
Daily Low	145.02	140.82	142.66
Daily High	153.96	153.73	150.16
Std Dev	2.11	3.19	1.90

Table A-7
City of San Diego
Point Loma Wastewater Treatment Plant
Average Daily Flow
July 2011

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
7/1/11	148.87	146.20	148.87
7/2/11	146.50	144.71	146.50
7/3/11	145.61	144.12	142.24
7/4/11	148.72	150.17	146.01
7/5/11	147.73	148.97	145.18
7/6/11	151.47	159.61	148.68
7/7/11	146.71	145.34	144.01
7/8/11	149.51	146.26	146.39
7/9/11	146.05	146.63	144.28
7/10/11	147.40	145.14	147.40
7/11/11	144.67	142.74	144.67
7/12/11	148.06	143.29	148.06
7/13/11	152.62	152.40	152.62
7/14/11	145.04	142.17	145.04
7/15/11	149.30	147.29	149.30
7/16/11	149.96	147.05	149.96
7/17/11	147.09	151.66	143.93
7/18/11	150.81	149.85	147.14
7/19/11	150.44	152.36	147.48
7/20/11	153.32	151.39	150.02
7/21/11	146.35	143.00	143.27
7/22/11	148.89	144.47	145.75
7/23/11	148.99	146.46	145.46
7/24/11	*	145.95	145.72
7/25/11	149.43	147.69	146.80
7/26/11	150.76	147.51	147.70
7/27/11	135.46	141.31	140.87
7/28/11	145.63	144.06	142.52
7/29/11	149.10	148.01	146.07
7/30/11	151.02	149.02	148.55
7/31/11	152.30	151.46	149.36
Total	4447.80	4566.28	4539.82
Average	148.26	147.30	146.45
Daily Low	135.46	141.31	140.87
Daily High	153.32	159.61	152.62
Std Dev	3.34	3.85	2.60

* DCS was down

Table A-8
City of San Diego
Point Loma Wastewater Treatment Plant
Average Daily Flow
August 2011

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
8/1/11	153.41	149.21	151.24
8/2/11	144.94	142.53	142.41
8/3/11	151.98	151.01	149.67
8/4/11	147.02	144.11	144.27
8/5/11	145.03	143.58	142.32
8/6/11	146.57	144.36	143.98
8/7/11	148.36	149.99	145.18
8/8/11	148.61	149.31	145.32
8/9/11	146.81	149.51	142.35
8/10/11	147.40	144.40	142.52
8/11/11	146.92	149.14	142.72
8/12/11	*	150.81	148.90
8/13/11	146.36	143.10	142.38
8/14/11	150.55	148.55	146.22
8/15/11	151.02	145.38	144.69
8/16/11	145.95	145.22	139.34
8/17/11	147.33	151.14	142.76
8/18/11	145.23	142.90	142.34
8/19/11	144.48	142.40	141.42
8/20/11	143.97	141.17	141.30
8/21/11	145.93	147.02	145.00
8/22/11	*	149.79	142.00
8/23/11	146.30	140.67	138.66
8/24/11	140.81	142.16	140.38
8/25/11	149.83	145.02	148.39
8/26/11	**	**	**
8/27/11	148.18	149.20	147.18
8/28/11	151.46	151.68	148.10
8/29/11	144.49	142.40	141.26
8/30/11	146.95	146.92	145.00
8/31/11	143.96	142.43	141.40
Total	4119.81	4385.12	4318.68
Average	147.14	146.17	143.96
Daily Low	140.81	140.67	138.66
Daily High	153.41	151.68	151.24
Std Dev	2.80	3.48	3.11

** DCS power outage*
*** Bad data at all metering locations*

Table A-9
City of San Diego
Point Loma Wastewater Treatment Plant
Average Daily Flow
September 2011

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
9/1/11	146.84	146.88	144.23
9/2/11	159.81	146.33	141.90
9/3/11	149.03	146.14	147.53
9/4/11	142.12	146.77	139.41
9/5/11	148.14	148.17	145.51
9/6/11	146.55	149.25	149.28
9/7/11	144.89	145.89	144.02
9/8/11	**	**	**
9/9/11	161.42	160.32	*
9/10/11	149.09	150.17	*
9/11/11	148.33	147.89	*
9/12/11	147.14	134.83	*
9/13/11	147.67	144.33	*
9/14/11	144.72	143.21	*
9/15/11	144.76	142.21	*
9/16/11	146.30	149.50	*
9/17/11	149.14	151.75	*
9/18/11	149.76	152.73	147.50
9/19/11	149.53	148.08	146.90
9/20/11	147.30	146.75	144.85
9/21/11	151.63	151.51	149.48
9/22/11	145.81	145.05	142.82
9/23/11	150.06	147.19	147.42
9/24/11	151.96	149.91	148.90
9/25/11	146.90	144.96	142.84
9/26/11	151.06	147.56	148.01
9/27/11	147.41	145.04	144.53
9/28/11	149.16	149.00	145.93
9/29/11	151.09	151.94	148.18
9/30/11	146.39	144.38	143.41
<hr/>			
Total	4314.00	4277.74	2912.63
Average	148.76	147.51	145.63
Daily Low	142.12	134.83	139.41
Daily High	161.42	160.32	149.48
Std Dev	4.00	4.32	2.74

** ADS
 communication
 problem*
*** County-wide
 power outage*

Table A-10
City of San Diego
Point Loma Wastewater Treatment Plant
Average Daily Flow
October 2011

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
10/1/11	149.56	146.92	147.19
10/2/11	149.68	148.89	146.98
10/3/11	148.23	151.28	145.51
10/4/11	146.26	144.75	143.87
10/5/11	152.88	157.65	149.17
10/6/11	160.81	151.66	*
10/7/11	161.50	150.51	*
10/8/11	153.59	150.88	*
10/9/11	152.85	155.71	*
10/10/11	149.82	148.38	*
10/11/11	147.44	144.51	*
10/12/11	147.11	159.56	*
10/13/11	151.94	144.90	*
10/14/11	144.60	144.78	*
10/15/11	146.67	146.66	*
10/16/11	149.31	145.94	*
10/17/11	146.46	156.01	*
10/18/11	144.77	144.43	142.37
10/19/11	143.47	143.41	141.50
10/20/11	146.71	142.42	150.54
10/21/11	148.35	145.03	154.28
10/22/11	149.15	145.46	145.91
10/23/11	145.16	143.70	142.02
10/24/11	147.11	144.56	143.78
10/25/11	150.71	149.14	147.07
10/26/11	150.61	155.72	148.57
10/27/11	151.17	157.52	149.47
10/28/11	152.39	150.76	147.97
10/29/11	151.75	150.40	148.37
10/30/11	152.28	151.53	149.01
10/31/11	146.51	144.55	143.06
Total	4638.84	4617.61	2786.65
Average	149.64	148.96	146.67
Daily Low	143.47	142.42	141.50
Daily High	161.50	159.56	154.28
Std Dev	4.11	4.87	3.33

* N2 meter communication errors

Table A-11
City of San Diego
Point Loma Wastewater Treatment Plant
Average Daily Flow
November 2011

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
11/1/11	142.03	141.32	138.91
11/2/11	149.34	145.84	145.61
11/3/11	148.11	145.65	144.82
11/4/11	159.24	156.21	158.39
11/5/11	172.29	175.24	168.35
11/6/11	161.11	173.95	157.21
11/7/11	164.73	156.69	158.38
11/8/11	168.12	168.04	154.64
11/9/11	160.97	153.03	151.34
11/10/11	158.43	157.59	153.22
11/11/11	158.21	154.77	154.78
11/12/11	**	189.84	184.39
11/13/11	180.73	179.25	170.15
11/14/11	171.89	166.35	162.37
11/15/11	160.99	155.96	156.71
11/16/11	156.99	152.27	*
11/17/11	162.42	155.75	*
11/18/11	156.52	155.69	*
11/19/11	158.29	154.27	*
11/20/11	159.26	159.72	*
11/21/11	204.92	192.95	*
11/22/11	169.80	169.66	*
11/23/11	167.73	163.47	*
11/24/11	168.64	163.70	*
11/25/11	153.26	158.86	*
11/26/11	158.10	157.54	*
11/27/11	156.13	151.07	*
11/28/11	158.37	153.73	*
11/29/11	156.95	152.81	152.37
11/30/11	157.36	152.21	151.81
Total	4700.94	4813.43	2663.43
Average	162.10	160.45	156.67
Daily Low	142.03	141.32	138.91
Daily High	204.92	192.95	184.39
Std Dev	11.39	12.09	10.59

* C2 Meter being replaced

** DCS down

Table A-12
City of San Diego
Point Loma Wastewater Treatment Plant
Average Daily Flow
December 2011

Date	Gould (mgd)	PS-2 (mgd)	ADS (mgd)
12/1/11	152.76	147.18	146.96
12/2/11	156.87	152.89	151.75
12/3/11	155.63	156.55	151.08
12/4/11	153.01	151.57	*
12/5/11	160.78	156.30	*
12/6/11	149.77	144.87	*
12/7/11	156.79	152.00	151.60
12/8/11	151.06	145.32	145.71
12/9/11	153.50	147.55	148.00
12/10/11	156.86	152.09	151.39
12/11/11	156.59	152.01	150.33
12/12/11	175.69	180.79	169.31
12/13/11	179.33	172.63	168.60
12/14/11	175.96	166.60	157.85
12/15/11	167.97	165.22	156.06
12/16/11	157.63	161.18	151.95
12/17/11	161.33	157.01	155.02
12/18/11	155.90	151.32	150.04
12/19/11	159.29	161.24	153.01
12/20/11	153.07	159.26	151.29
12/21/11	160.12	160.38	154.01
12/22/11	160.73	159.55	154.73
12/23/11	154.84	153.41	150.43
12/24/11	157.00	152.40	151.54
12/25/11	142.96	138.54	138.47
12/26/11	147.41	152.20	142.79
12/27/11	153.54	155.05	148.56
12/28/11	151.22	151.81	147.59
12/29/11	156.37	152.40	151.68
12/30/11	152.03	156.88	146.59
12/31/11	155.50	151.27	150.44
Total	4881.49	4817.48	4246.79
Average	157.47	155.40	151.67
Daily Low	142.96	138.54	138.47
Daily High	179.33	180.79	169.31
Std Dev	7.96	8.27	6.29

* C2 Meter
being replaced

Appendix B

Annual Average Daily Flow Tables: Summary

Table B-1
City of San Diego
Point Loma Wastewater Treatment Plant
Annual Average Daily Flow
2011

Month	Gould (mgd)	PS-2 (mgd)	ADS (mgd)	Percent Difference: PS2 vs. Gould	Percent Difference: ADS vs. Gould
January	166.46	165.72	167.08	-0.44%	0.37%
February	164.48	164.06	161.83	-0.25%	-1.61%
March	169.18	166.89	166.58	-1.35%	-1.54%
April	156.46	155.81	152.48	-0.42%	-2.54%
May	150.59	151.05	147.93	0.30%	-1.77%
June	149.54	147.01	146.25	-1.69%	-2.20%
July	148.26	147.30	146.45	-0.65%	-1.22%
August	147.14	146.17	143.96	-0.66%	-2.16%
September	148.76	147.51	145.63	-0.84%	-2.10%
October	149.64	148.96	146.67	-0.46%	-1.99%
November	162.10	160.45	156.67	-1.02%	-3.35%
December	157.47	155.40	151.67	-1.31%	-3.68%
2011 Average	155.88	154.68	152.83	-0.77%	-1.98%
2011 Minimum	135.46	134.83	138.47	-11.73%	-11.21%
2011 Maximum	220.17	215.02	214.37	8.46%	18.77%

Appendix C

Flow Meter Calibration Data

Table C-1
City of San Diego
Point Loma Wastewater Treatment Plant
Calibration Test Data: February 1, 2012

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	5.390	5.33	1.13%	-1	0.00	NA
	9	8.067	8.00	0.84%	9	9.80	-8.16%
	18	12.045	12.00	0.37%	29	29.59	-1.99%
	27	16.035	16.00	0.22%	56	56.47	-0.83%
	36	20.017	20.00	0.08%	89	89.33	-0.37%
	27	16.008	16.00	0.05%	56	56.47	-0.83%
	18	12.014	12.00	0.12%	29	29.59	-1.99%
	9	8.025	8.00	0.31%	9	9.80	-8.16%
C-2	0	5.395	5.33	1.22%	-1	0.00	NA
	0	5.233	5.33	-1.82%	0	0.00	NA
	9	7.957	8.00	-0.54%	10	9.80	2.04%
	18	11.930	12.00	-0.58%	29	29.59	-1.99%
	27	15.943	16.00	-0.36%	56	56.47	-0.83%
	36	19.948	20.00	-0.26%	89	89.33	-0.37%
	27	15.947	16.00	-0.33%	56	56.47	-0.83%
	18	11.960	12.00	-0.33%	29	29.59	-1.99%
N-1	9	7.960	8.00	-0.50%	10	9.80	2.04%
	0	5.238	5.33	-1.73%	0	0.00	NA
	0	5.302	5.33	-0.53%	0	0.00	NA
	9	7.888	8.00	-1.40%	13	13.02	-0.15%
	18	11.891	12.00	-0.91%	39	39.66	-1.66%
	27	15.892	16.00	-0.68%	75	76.09	-1.43%
	36	19.896	20.00	-0.52%	119	120.81	-1.50%
	27	15.875	16.00	-0.78%	75	76.09	-1.43%
N-2	18	11.870	12.00	-1.08%	39	39.66	-1.66%
	9	7.867	8.00	-1.66%	13	13.02	-0.15%
	0	5.298	5.33	-0.60%	0	0.00	NA
	0	5.278	5.33	-0.98%	0	0.00	NA
	9	7.999	8.00	-0.01%	13	13.02	-0.15%
	18	11.962	12.00	-0.32%	39	39.66	-1.66%
	27	15.933	16.00	-0.42%	75	76.09	-1.43%
	36	19.934	20.00	-0.33%	120	120.81	-0.67%
N-2	27	15.890	16.00	-0.69%	75	76.09	-1.43%
	18	11.874	12.00	-1.05%	39	39.66	-1.66%
	9	7.901	8.00	-1.24%	13	13.02	-0.15%
	0	5.275	5.33	-1.03%	0	0.00	NA

Appendix D

Field Notes

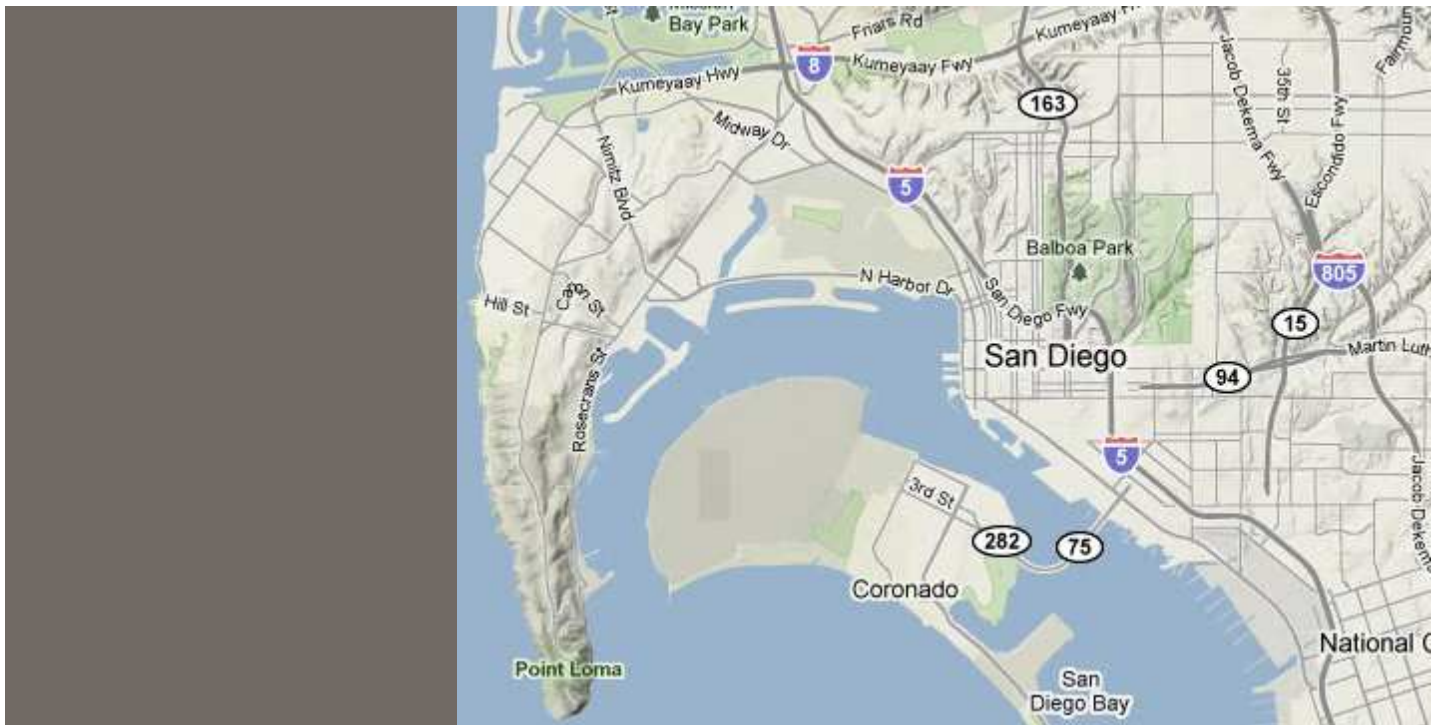
City of San Diego
Point Loma Treatment Plant
Calibration Test Data
February 1, 2011
Log Sheet

Flume ID	Level (in)	Measured Voltage (mA)	Theoretical Voltage (mA)	Measured Flow (MGD)	Theoretical Flow (MGD)
N-1	0	5.302	5.33	-0	0.00
	9	7.888	8.00	13	13.02
	18	11.891	12.00	39	39.66
	27	15.892	16.00	75	76.09
	36	19.896	20.00	119	120.81
	27	15.875	16.00	75	76.09
	18	11.870	12.00	39	39.66
	9	7.867	8.00	13	13.02
	0	5.298	5.33	-0	0.00
N-2	0	5.278	5.33	0	0.00
	9	7.999	8.00	13	13.02
	18	11.962	12.00	39	39.66
	27	15.933	16.00	75	76.09
	36	19.934	20.00	120	120.81
	27	15.890	16.00	75	76.09
	18	11.874	12.00	39	39.66
	9	7.901	8.00	13	13.02
	0	5.275	5.33	0	0.00

Last Calibration: 1/11/12
 HP Multimeter SN: US36094347
 model: 34401A

City of San Diego
 Point Loma Treatment Plant
 Calibration Test Data
 February 1, 2012
 Log Sheet

Flume ID	Level (in)	Measured Voltage (mA)	Theoretical Voltage (mA)	Measured Flow (MGD)	Theoretical Flow (MGD)
C-1	0	5.390	5.33	-1	0.00
	9	8.067	8.00	9	9.80
	18	12.045	12.00	29	29.59
	27	16.035	16.00	56	56.47
	36	20.017	20.00	89	89.33
	27	16.008	16.00	56	56.47
	18	12.014	12.00	29	29.59
	9	8.025	8.00	9	9.80
	0	5.395	5.33	-1	0.00
C-2	0	5.283	5.33	-0	0.00
	9	7.957	8.00	10	9.80
	18	11.930	12.00	29	29.59
	27	15.943	16.00	56	56.47
	36	19.948	20.00	89	89.33
	27	15.947	16.00	56	56.47
	18	11.960	12.00	89 29	29.59
	9	7.960	8.00	29 10	9.80
	0	5.238	5.33	-0	0.00



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