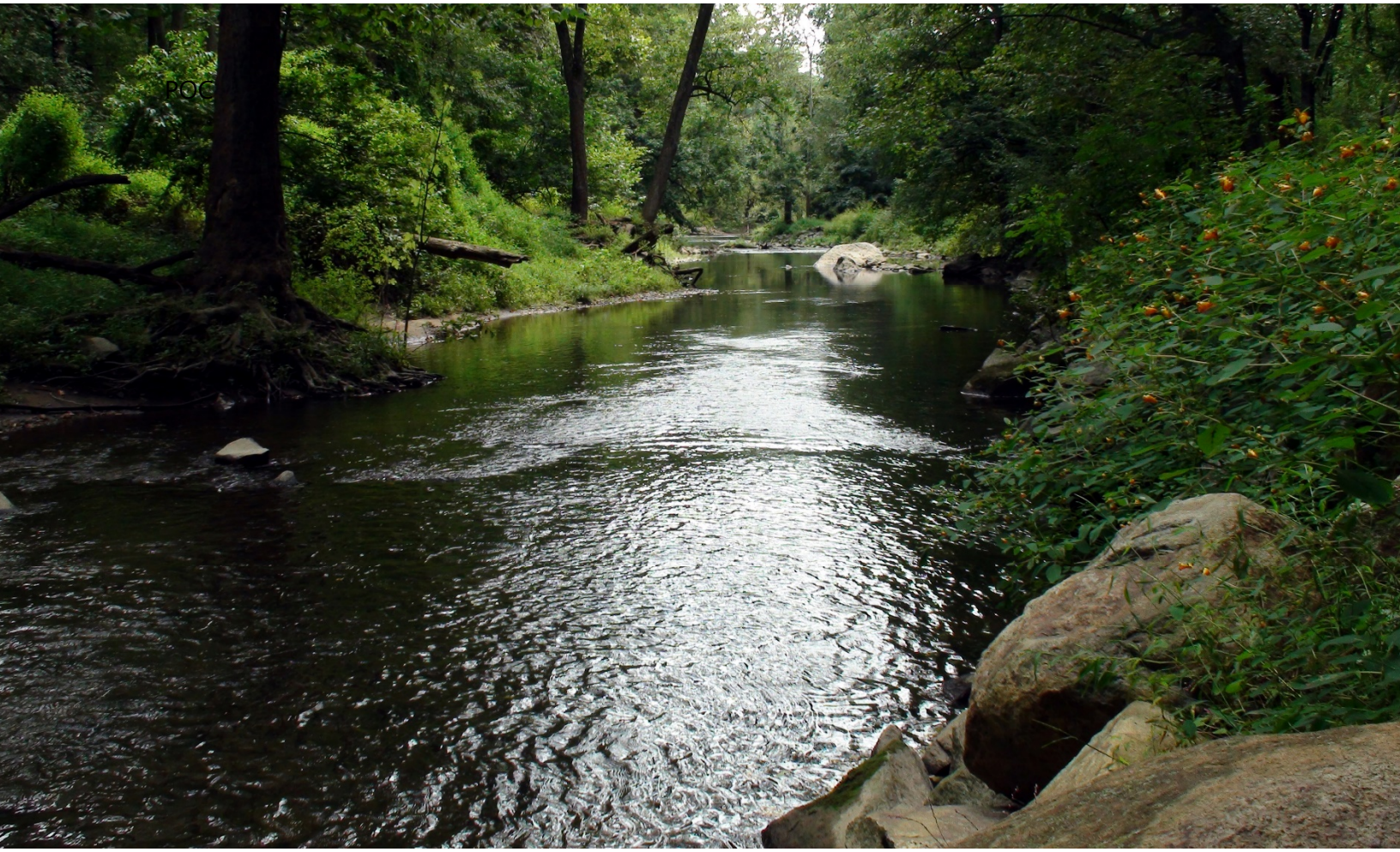


Delaware County Regional Water Quality Control Authority (DELCORA)

CSO Long-Term Control Plan Update

APPENDICES
VOLUME 3 of 4

December 11, 2025

DELCORA | TYLin

TABLE OF CONTENTS

VOLUME 1 OF 4

1 INTRODUCTION, OVERVIEW AND HISTORICAL REVIEW 1-1

1.1 INTRODUCTION 1-1

1.1.1 PURPOSE OF CSO LTCP UPDATE 1-2

1.2 REGULATORY REQUIREMENTS 1-2

1.2.1 CSO CONTROL POLICY REQUIREMENTS 1-2

1.2.2 LONG TERM CONTROL PLAN APPROACH 1-4

1.2.3 CONSENT DECREE REQUIREMENTS 1-7

1.2.4 REPORT SUBMISSIONS 1-8

1.2.5 NINE MINIMUM CONTROLS 1-10

1.2.6 EARLY ACTION CSO CONTROL MEASURES 1-10

1.3 WATER QUALITY STANDARDS 1-10

1.3.1 RECEIVING WATER USE DESIGNATIONS AND GENERAL WATER QUALITY STANDARDS 1-10

1.3.2 2014 PENNSYLVANIA INTEGRATED WATER QUALITY MONITORING AND ASSESSMENT REPORT (303(D) LIST) 1-11

1.3.3 PA CODE CHAPTER 25 §93.9G 1-11

1.3.4 DRBC'S WATER QUALITY REGULATIONS AND PA CODE CHAPTER 25 §93.7 1-12

1.3.5 DRBC'S 2014 DELAWARE RIVER AND BAY WATER QUALITY ASSESSMENT 1-12

1.4 WATERSHEDS 1-13

1.5 OVERVIEW OF DELCORA'S FACILITIES 1-13

1.5.1 CITY OF CHESTER CSO SYSTEM 1-14

1.5.2 DELCORA'S TREATMENT FACILITIES 1-17

1.6 OVERVIEW OF DELCORA'S SERVICE AREAS 1-22

1.6.1 EASTERN SERVICE AREA 1-22

1.6.2 WESTERN SERVICE AREA 1-23

1.7 IMPLEMENTATION OF THE ORIGINAL LTCP 1-24

2 IDENTIFICATION OF SENSITIVE AREAS AND POLLUTANTS OF CONCERN..... 2-1

2.1 BACKGROUND 2-1

2.2 REGULATORY REQUIREMENTS 2-1

2.2.1 CONSENT DECREE REQUIREMENTS 2-1

2.2.2 Requirements of the USEPA's CSO Control Policy and Sensitive Areas Definition 2-2
2.2.3 Priority Areas Definition 2-2
2.3 Summary of Sensitive Areas and Priority Areas 2-3
2.3.1 LTCP Addressing Sensitive and Priority Areas 2-4
2.4 Regulatory Requirements for the Identification of Pollutants of Concern 2-6
2.4.1 Sources of Information 2-6
2.4.2 Delaware River Regulatory Requirements 2-7
2.4.2.1 2014 PA Integrated Water Quality Monitoring and Assessment Report (303(d) list) 2-7
2.4.2.2 Designated Critical Uses and Specific Water Quality Criteria from PA Code 2-9
2.4.2.3 Designated Zone and Water Quality Regulations from the DRBC 2-10
2.4.2.4 DRBC Evaluation of Use Attainment Status 2-12
2.4.3 Chester Creek Regulatory Requirements 2-13
2.4.3.1 2014 PA Integrated Water Quality Monitoring and Assessment Report (303(d) list) 2-13
2.4.4 Discussion of the Pollutants of Concern and Parameters of Potential Concern 2-21
2.4.4.1 Fecal Coliform Bacteria 2-21
2.4.4.2 Enterococcus Bacteria 2-22
2.4.4.3 Escherichia Coli Bacteria 2-22
2.4.4.4 Metals 2-23
2.4.4.5 Identified Pollutants of Concern 2-24

3 Typical Hydrologic Period 3-1
3.1 Introduction 3-1
3.1.1 DELCORA's Consent Decree 3-1
3.1.2 Typical Year for CSO LTCPU Development 3-1
3.1.3 Methodology of Typical Year Selection 3-2
3.2 Typical Year Selection for DELCORA 3-3
3.2.1 Annual Rainfall and River Flow Analysis 3-3
3.2.2 Ranking Analysis 3-3
3.2.3 Selected Hydrologic Period 3-4

4 SEWER SYSTEM HYDROLOGIC AND HYDRAULIC MODEL UPDATE AND CALIBRATION 4-1
4.1 INTRODUCTION 4-1
4.1.1 REGULATORY REQUIREMENTS 4-1
4.2 DELCORA'S FACILITIES AND SERVICE AREAS 4-3
4.3 RAINFALL AND FLOW MONITORING 4-3
4.3.1 WET WEATHER EVENT SELECTION FOR MODEL CALIBRATION AND VALIDATION FLOW ANALYSIS 4-8
4.4 MODEL UPDATE 4-8
4.4.1 MODEL UPDATE METHODOLOGY 4-8
4.4.2 MODEL REFINEMENT 4-9
4.4.2.1 DELINEATION OF MODEL AREA AND COMBINED AREA 4-10
4.4.2.2 MODEL NETWORK EXTENSION 4-16
4.4.3 SUMMARY 4-18
4.5 H&H MODEL CALIBRATION AND VALIDATION 4-22
4.5.1 MODEL CALIBRATION AND VALIDATION 4-22

5 WATER QUALITY MONITORING AND MODELING 5-1
5.1 INTRODUCTION 5-1
5.1.1 REGULATORY REQUIREMENTS 5-1
5.2 WATER QUALITY MONITORING AND SAMPLING 5-1
5.2.1 WATER QUALITY WORK PLAN AND QUALITY ASSURANCE PROJECT PLAN DEVELOPMENT 5-1
5.2.2 SAMPLING AND ANALYSIS PLAN OVERVIEW 5-2
5.2.3 SAMPLING LOCATIONS 5-3
5.2.4 ANALYTICAL PARAMETERS 5-5
5.2.5 SAMPLING RESULTS 5-5
5.3 WATER QUALITY MODEL 5-6
5.3.1 MODEL DESCRIPTION AND DEVELOPMENT 5-6
5.3.2 MODEL CALIBRATION 5-7
5.3.3 APPLICATION OF THE WQ MODEL TO SUPPORT THE LTCPU DEVELOPMENT 5-9
5.3.4 BASELINE RESULTS 5-10
5.4 WATER QUALITY MONITORING AND MODELING FINDINGS 5-11

6 EXISTING SERVICE AREA CHARACTERIZATION 6-1

6.1 BACKGROUND 6-1
6.2 REGULATORY REQUIREMENTS FOR THE EXISTING SERVICE AREA CHARACTERIZATION 6-1
6.2.1 CONSENT DECREE REQUIREMENTS FOR THE EXISTING SERVICE AREA CHARACTERIZATION 6-1
6.2.2 REQUIREMENTS FROM THE USEPA'S CSO CONTROL POLICY 6-2
6.3 OVERVIEW OF DELCORA'S FACILITIES 6-3
6.4 CHARACTERISTICS OF THE MODEL AREA SEWER SYSTEM 6-3
6.4.1 SOURCES OF COLLECTION SYSTEM DATA 6-3
6.4.2 OVERVIEW OF SEWER SYSTEM CHARACTERISTICS 6-4
6.4.3 CHARACTERISTICS OF SEPARATED SEWER AREAS 6-4
6.4.4 CHARACTERISTICS OF COMBINED SEWER SYSTEM 6-4
6.4.5 OVERALL CONFIGURATION 6-5
6.4.6 FLOW DIVERSION STRUCTURES AND CSO REGULATORS 6-9
6.4.7 INTERCEPTORS 6-13
6.4.8 CSO OUTFALLS 6-13
6.4.9 DRAINAGE AREAS AND SUBCATCHMENTS 6-14
6.5 FORCE MAINS 6-14
6.6 COLLECTION OF WRTP OPERATIONAL DATA 6-17
6.7 CHARACTERISTICS OF THE RECEIVING WATERS 6-19
6.7.1 PHYSICAL CHARACTERISTICS 6-19
6.8 HYDROLOGIC AND HYDRAULIC MODELING 6-23

7 PUBLIC PARTICIPATION 7-1
7.1 EXPECTATIONS OF THE CSO POLICY 7-1
7.2 PUBLIC MEETINGS AND ENGAGEMENT TOOLS 7-2
7.3 MEETING SCHEDULE 7-2
7.3.1 INPUTS DURING THE PUBLIC PARTICIPATION PROCESS 7-2
7.3.2 FACILITIES DESCRIPTION AND LOCATION 7-3
7.3.3 RESPONSIVENESS SUMMARY 7-3
7.3.4 PUBLIC ENGAGEMENT TOOLS 7-4
7.3.5 PUBLIC MEETING DESCRIPTIONS 7-4
7.3.6 MEETING ADVERTISEMENTS 7-9
7.4 STAKEHOLDER MEMBERS AND MEETINGS 7-10
7.4.1 SELECTION OF MEMBERS 7-10

7.4.2 Meeting Site Format and Time 7-11
7.5 Public Information Plan 7-12
7.5.1 Notices and Advertisements 7-12
7.5.2 Public Education and Involvement 7-12
7.6 Public Participation Program Other Meetings 7-15

8 Preliminary Screening of CSO Control Technologies 8-1
8.1 Introduction 8-1
8.2 Long Term Control Plan Approach 8-2
8.3 Water Quality and CSO Control Goals 8-3
8.4 Development of CSO Control Technologies 8-6
8.4.1 Evaluation Methodology Used for This Study 8-7
8.4.2 Identification of Potential Control Technologies 8-7
8.5 Source Controls 8-8
8.5.1 Green Infrastructure 8-8
8.5.2 Green Roofs 8-12
8.5.3 Blue Roofs 8-13
8.5.4 Rainwater Harvesting 8-14
8.5.5 Permeable Pavements 8-15
8.5.6 Planter Boxes 8-16
8.5.7 Bioswales 8-18
8.5.8 Free-Form Rain Gardens 8-18
8.6 Collection System Control 8-20
8.6.1 Infiltration/Inflow Reduction 8-20
8.6.2 Combined Sewer Separation 8-20
8.6.3 Additional Conveyance 8-23
8.6.4 Outfall Consolidation/Relocation 8-23
8.6.5 Regulator Modifications 8-23
8.6.6 Real Time Control 8-23
8.7 Storage 8-24
8.7.1 Pipeline Storage 8-24
8.7.2 Tunnel Storage 8-24
8.7.3 Tank Storage 8-27
8.8 Treatment Technologies 8-27

8.8.1 Disinfection & Satellite Treatment 8-27
8.8.2 Additional Treatment Capacity - WRTP 8-28
8.8.3 Recommended Control Technologies for Evaluation 8-29
8.9 Preliminary Siting of CSO Control Technologies 8-30

9 Evaluation and Selection of CSO Control Alternatives 9-1
9.1 Introduction 9-1
9.2 CSO Control Policy Alternatives Analysis Requirements 9-1
9.3 Alternatives Analysis Approach 9-4
9.3.1 Consent Decree Requirement Approach 9-4
9.3.2 Targeted Approach 9-5
9.4 Cost/Performance Evaluation of CSO Control Alternatives 9-7
9.5 Non-Monetary Factors for CSO Control Alternatives 9-8
9.6 Development of CSO Control Technology Alternatives 9-8
9.6.1 Consent Decree Approach Control Alternatives 9-9
9.6.2 Targeted Control Alternatives 9-9
9.7 Alternatives for Final Analysis 9-10
9.7.1 Technology Descriptions for Alternative Final Analysis 9-11
9.7.1.1 Sewer Separation 9-13
9.7.1.2 Regulator Modifications 9-13
9.7.1.3 CSO 5 Partial Combined Sewer Separation 9-17
9.7.1.4 West End Interceptor Expansion to PS-6 9-17
9.7.1.5 Parallel Delaware River Interceptor 9-17
9.7.2 Alternative 1 – Tunnel Storage within the Combined Sewer System 9-18
9.7.3 Alternative 2 – Tank Storage 9-20
9.7.4 Alternative 3 – Tunnel Storage and Green Stormwater Infrastructure 9-21
9.7.5 Alternative 4 –Tank Storage and Green Stormwater Infrastructure 9-22
9.7.6 Alternative 5 – Plant Expansion 9-24
9.7.7 Alternative 6 – Sewer Separation 9-26
9.7.8 Alternative 7 – Regulator Modifications 9-27
9.7.9 Alternative 8 – Tank Storage and Regulator Modifications 9-28
9.7.10 Alternative 9 – Green Stormwater Infrastructure and Regulator Modifications 9-29

9.7.11 Alternative 10 – Regulator Modifications and CSO 5 Partial Combined Sewer Separation 9-30
9.7.12 Alternative 11 – Regulator Modifications and West End Interceptor Expansion to PS-6 9-31
9.7.13 Alternative 12 – Regulator Modifications, West End Interceptor Expansion to PS-6, and Parallel Delaware River Interceptor 9-32
9.7.14 Alternative 13 – Tank Storage, Regulator Modifications, West End Interceptor Expansion to PS-6, and Parallel Delaware River Interceptor 9-33
9.7.15 Alternative 14 – Tank Storage, Green Stormwater Infrastructure, Regulator Modifications, CSO 5 Partial Combined Sewer Separation, West End Interceptor Expansion to PS-6, and Parallel Delaware River Interceptor 9-34
9.7.16 Alternative 15 – Green Stormwater Infrastructure, Regulator Modifications, CSO 5 Partial Combined Sewer Separation, West End Interceptor Expansion to PS-6, and Parallel Delaware River Interceptor 9-35
9.7.17 Alternative 16 – Satellite Treatment and Storage Tunnel Re-evaluation . 9-37
9.7.18 Alternative 17 – Eastern Service Area Tunnel 9-44
9.8 CSO Control Technology Knee of the Curve (KOTC) Analysis 9-47
9.9 The Clean Creeks Program (The Selected CSO Control Plan) 9-52
9.10 Anticipated Water Quality Improvements for the Selected Control Alternative 9-60
9.11 Separate Sewer System Infiltration and Inflow 9-63
9.12 Comprehensive Separate Sewer System Infiltration and Inflow Control Program 9-64
9.13 DELCORA Sewer System Infiltration Inflow Control Program 9-65

10 Implementation of the CSO LTCP Update 10-1
10.1 Introduction 10-1
10.2 Financial Environment 10-1
10.3 Long-Term Control Plan Implementation 10-3
10.3.1 Performance Criteria 10-3
10.3.2 LTCP Progress prior to the Consent Decree (August 2015) 10-4
10.3.3 Current LTCP Progress following the Consent Decree (As of December 2024) 10-6
10.3.4 Implementation of the Clean Creeks Program 10-7

11 POST-CONSTRUCTION MONITORING PLAN 11-1
11.1 INTRODUCTION 11-1
11.2 PURPOSE AND SCOPE 11-1
11.3 PERFORMANCE CRITERIA AND COMPLIANCE ASSESSMENT 11-2
11.4 POST-CONSTRUCTION COMPLIANCE MONITORING DATA COLLECTION 11-3
11.5 DATA MANAGEMENT AND QA/QC 11-4
11.6 PERFORMANCE ASSESSMENT 11-4
11.6.1 APPROACH 11-4
11.6.2 CORRECTIVE ACTION PLAN 11-5
11.6.3 REPORTING 11-5
11.6.4 EVALUATION OF ADDITIONAL DELAWARE RIVER CONTROLS 11-5
11.7 FUTURE REGULATORY REQUIREMENTS 11-6
11.8 PUBLIC NOTIFICATION 11-6

12 REVISION OF OPERATION AND MAINTENANCE PLANS 12-1
12.1 CURRENT OPERATION AND MAINTENANCE PLAN 12-1
12.2 OPERATION AND MAINTENANCE PROGRAM UPDATES FOR CSO CONTROL MEASURES 12-2
12.3 STAFFING NEEDS 12-3

LIST OF TABLES

Table ES-1-1: DELCORA's Proposed Clean Creeks Program Construction Costs (April 2025 Dollars) 5
Table ES-1-2: Proposed Project Milestone Deadlines 6
Table ES-1-3: Reporting Requirements 8
Table 1-1: Required Reports Submitted and Approved by USEPA to Date 1-8
Table 1-2: Required Reports Submitted and Under Review by USEPA 1-9
Table 1-3: DELCORA Service Area Distribution 1-17
Table 1-4: Permitted CSOs in the City of Chester[(1)] 1-18
Table 1-5: Completed CSO LTCP Projects 1-25
Table 2-1: 2014 DRBC Integrated Assessment for Zone 4 of the Delaware River 2-12
Table 2-2: PA Fish Consumption Advisory Summary for PCBs in the Delaware River 2-13
Table 2-3: List of Pollutants of Concern (POC) 2-24
Table 4-1: Summary of Consent Decree Section V.A.14 4-1
Table 4-2: Metersheds in the H&H Model 4-3
Table 4-3: Calibration and Validation Rainfall Events 4-8
Table 4-4: Model Area 4-14
Table 4-5: Summary of Revised H&H Model 4-18
Table 4-6: Wet Weather Events Used for Model Calibration and Validation 4-25
Table 5-1: Analytical and Field Parameters 5-5
Table 5-2: Water Quality Standards for Comparisons with Model Results 5-9
Table 5-3: Number of Months Exceeding the Monthly Geomean Water Quality Standard 5-10
Table 6-1: Subcatchments in the Model Area Sewer System 6-6
Table 6-2: CSO Regulator Information 6-11
Table 7-1: Public Meetings, Locations and Meeting Dates 7-3
Table 7-2: Stakeholders Meetings and Meeting Dates 7-12
Table 8-1: Water Quality Standards in the Receiving Streams 8-3
Table 8-2: Existing Conditions Percent Capture 8-6
Table 8-3: Capture Goals for LTCPU Compliance – Percent Capture 8-6
Table 8-4: Source Control Alternatives 8-9
Table 8-5: Collection System Alternatives 8-21
Table 8-6: Storage and Treatment Alternatives 8-25
Table 8-7: Selected Alternative Technologies Summary 8-29
Table 8-8: Preliminary Siting of CSO Alternative Control Technologies 8-31
Table 9-1: Current Conditions Percent Volume Capture by Segment 9-5
Table 9-2: Current Conditions Percent Volume Capture 9-5
Table 9-3: Current Conditions Number of Overflows by Regulator 9-6
Table 9-4: Current Conditions Overflow Volumes by Regulator (MG) 9-6
Table 9-5: Proposed Regulator Modifications (Alternatives 7 through 16) 9-15
Table 9-6: Alternatives for Final Analysis 9-18
Table 9-7: Capital and Life Cycle Costs by Overflow for Alternative 1 9-19
Table 9-8: Capital and Life Cycle Costs by Overflow for Alternative 2 9-21

Table 9-9: Capital and Life Cycle Costs by Overflow for Alternative 3 9-22
Table 9-10: Capital and Life Cycle Costs by Overflow for Alternative 4 9-24
Table 9-11: Capital and Life Cycle Costs by Overflow for Alternative 5 Wet Weather Blending 9-25
Table 9-12: Capital and Life Cycle Costs by Overflow for Alternative 5 BIOACTIFLO 9-25
Table 9-13: Capital and Life Cycle Costs by Overflow for Alternative 5 Equalization Basin 9-25
Table 9-14: Capital and Life Cycle Costs by Overflow for Alternative 6 9-26
Table 9-15: Capital and Life Cycle Costs by Overflow for Alternative 7 9-27
Table 9-16: Capital and Life Cycle Costs by Overflow for Alternative 8 9-28
Table 9-17: Capital and Life Cycle Costs by Overflow for Alternative 9 9-29
Table 9-18: Capital and Life Cycle Costs by Overflow for Alternative 10 9-30
Table 9-19: Capital and Life Cycle Costs by Overflow for Alternative 11 9-31
Table 9-20: Capital and Life Cycle Costs by Overflow for Alternative 12 9-32
Table 9-21: Capital and Life Cycle Costs by Overflow for Alternative 13 9-34
Table 9-22: Capital and Life Cycle Costs by Overflow for Alternative 14 9-35
Table 9-23: Capital and Life Cycle Costs by Overflow for Alternative 15 9-36
Table 9-24: Percent Capture and Costs for Alternative 16 9-43
Table 9-25: Alternative 16 CSO Control Technologies 9-44
Table 9-26: Percent Capture and Costs for Alternative 17 9-47
Table 9-27: Capital Costs by Control Technology Project 9-48
Table 9-28: Alternative Life Cycle Cost by Overflow per Year and Wet Weather Capture Percentage 9-50
Table 9-29: The Clean Creeks Program 9-56
Table 9-30: Clean Creeks Program Average Overflow Frequency during Typical Year 9-57
Table 9-31: Baseline and New Alternatives' System Wide Average Overflow Volume for Typical Year 9-58
Table 9-32: Percent Capture by Watershed for Typical Year 9-58
Table 9-33: Baseline and Selected CSO Control Plan Average Frequency of Overflows for Typical Year (Rainfall in/yr) 9-59
Table 9-34: Baseline and Selected CSO Control Plan Average Volume of Overflows (MG/year) for Typical Year (Rainfall in/yr) 9-59
Table 10-1: DELCORA Service Area Improvements Since 1999 LTCP to 2015 10-5
Table 10-2: DELCORA Service Area Improvements Since Consent Decree 10-6
Table 10-3: DELCORA's Proposed Clean Creeks Program Construction Costs (April 2025 Dollars) 10-9
Table 10-4: Proposed Project Milestone Deadlines 10-11
Table 10-5: Reporting Requirements 10-12
Table 11-1: Proposed Post-Construction Monitoring Plan 11-3

LIST OF FIGURES

Figure ES-1-1: Summary of Delaware River Enterococcus Loads by Source Type 2

Figure 1-1: Baseline Summary of Delaware River Enterococcus Loads by Source Type 1-6
Figure 1-2: Watershed Boundaries 1-13
Figure 1-3: DELCORA's Conveyance System 1-15
Figure 1-4: DELCORA's Service Areas 1-16
Figure 1-5: Location of Regulators and CSO Outfalls with Drainage Areas 1-19
Figure 1-6: Schematic of Chester CSO System 1-20
Figure 1-7: Western Regional Treatment Plant Schematic 1-21
Figure 2-1: Non-Attaining Streams and TMDL Streams within DELCORA's Service Area 2-8
Figure 2-2: Methodology Flowchart for POC and POPC Determination 2-14
Figure 3-1: Ranking Score of 3-year Periods, 1984-2013 3-3
Figure 4-1: CSS Area Delineation in the 2012 H&H Model 4-11
Figure 4-2: Model Area Delineation 4-13
Figure 4-3: CSS Area Delineation in the Revised Model 4-15
Figure 4-4: Updated H&H Model Layout 4-21
Figure 4-5: Updated H&H Model Layout – CSS Area 4-22
Figure 4-6: Flow Meter Schematic 4-24
Figure 4-7: Model Calibration Hydrograph (Example Plot) 4-26
Figure 4-8: Model Calibration 1:1 Plots (Example Plot) 4-26
Figure 5-1: Receiving Water, Combined Sewer Overflow (CSO), and Stormwater (SW) Monitoring Locations 5-4
Figure 5-2: Water Quality Model Extent and Related Features 5-8
Figure 5-3: Schematic of Applicable POC Water Quality Standards 5-9
Figure 5-4: Percent of Bacteria Load by Source 5-12
Figure 6-1: Force Mains 6-16
Figure 6-2: DELCORA WRTP Influent Flow (3/16 – 6/16) 6-17
Figure 6-3: DELCORA WRTP Influent Flow (7/16 – 9/16) 6-17
Figure 6-4: DELCORA WRTP Influent Flow (10/16 – 12/16) 6-18
Figure 6-5: DELCORA WRTP Influent Flow (1/17 – 4/17) 6-18
Figure 6-6: Zones of the Delaware River and Bay 6-20
Figure 6-7: Locations of Elevation Measurements in Chester and Ridley Creeks 6-21
Figure 7-1: Photographs of Public Meeting Nos. 2 and 3 7-6
Figure 7-2: Photographs of Public Meeting No. 4 7-8
Figure 7-3: Advertisement for the First Public Meeting 7-10
Figure 7-4: Chain-of-Custody Form 7-14
Figure 8-1: Percent Capture Calculation Example 8-4
Figure 8-2: Hydrograph Clipping (Example Plot) 8-5
Figure 8-3: Example Green Roof Section 8-13
Figure 8-4: Rain Barrels 8-14
Figure 8-5: Example Permeable Sidewalk Section 8-15
Figure 8-6: Example Permeable Alley Section 8-16
Figure 8-7: Example Permeable Parking Lane Section 8-16
Figure 8-8: Example Planter Bumpout Section 8-17

Figure 8-9: Example Bioswale Detail 8-18
Figure 8-10: Example Rain Garden Section 8-19
Figure 9-1: Schematic of Tunnel Storage Grouping 9-12
Figure 9-2: Schematic of Tank Storage Grouping 9-12
Figure 9-3: CSO Regulator #10 Modifications 9-16
Figure 9-4: Tunnel Storage and Transmission Locations within the Combined Sewer System (Alt 1) 9-19
Figure 9-5: Tank Storage and Transmission Locations (Alt 2) 9-20
Figure 9-6: GI, Tunnel Storage and Transmission Locations (Alt 3) 9-22
Figure 9-7: GI, Tank Storage, and Transmission Locations (Alt 4) 9-23
Figure 9-8: Interceptor Improvements for Plant Expansion (Alt 5) 9-24
Figure 9-9: Total Sewer Separation (Alt 6) 9-26
Figure 9-10: Regulator Modifications (Alt 7) 9-27
Figure 9-11: Regulator Modifications w/ Storage Tanks (Alt 8) 9-28
Figure 9-12: Regulator Modifications w/ CSO 18 Green Infrastructure (Alt 9) 9-29
Figure 9-13: Regulator Modifications w/ CSO 5 Partial Sewer Separation (Alt 10) 9-30
Figure 9-14: Regulator Modifications w/ West End Interceptor Extension (Alt 11) 9-31
Figure 9-15: Regulator Modifications w/ WEI Expansion & DRI 30" Parallel Interceptor (Alt 12) . 9-32
Figure 9-16: Regulator Modifications w/ WEI Expansion, DRI PI, and Tank Storage (Alt 13) 9-33
Figure 9-17: Regulator Modifications w/ DRI BN, DRI PI, CSO 18 GI, CSO 5 PSS and Tank Storage (Alt 14) 9-35
Figure 9-18: Regulator Modifications w/DRI BN, DRI PI, CSO 18 GI, and CSO 5 PSS (Alt 15) 9-36
Figure 9-19: Schematic of Satellite Treatment at Chester Pump Station 9-39
Figure 9-20: Satellite Treatment at Chester Pump Station – Site Plan 9-42
Figure 9-21: Alternative 16 Improvements 9-43
Figure 9-22: Alternative 17 Improvements 9-47
Figure 9-23: Knee-of-the-Curve Life Cycle Cost by Capture Percentages 9-51
Figure 9-24: DELCORA CSS at completion of the Clean Creeks Program 9-57
Figure 9-25: CSO Volumes Discharged (3-yr typical year period) 9-61
Figure 9-26: All Sources' Fecal Coliform Contributions for the Baseline Condition 9-61
Figure 9-27: All Sources' Fecal Coliform Contributions for Alternative 7 9-62
Figure 9-28 All Sources' Fecal Coliform Contributions for Alternative 15 9-62

APPENDICES

This Long Term Control Plan Update was developed as a series of technical reports submitted to the USEPA and/or PADEP for their review and comment. Although these documents served as the basis for the final LTCPU, specific aspects of the final LTCPU Report have changed since the original technical reports were written. As such, these reference documents included as appendices here can be used to gain a deeper understanding of the methodologies used in

developing the Final LTCPU Report. Appendix Z has been included as a reference for the reader to follow the history of the LTCPU.

VOLUME 2 OF 4

Appendix A - Alternatives Evaluation Approach Report (Final), April 2016

Appendix B - Applicable Water Quality Standards Master Table

Appendix C - Identification of Sensitive Areas and Pollutants of Concern Report, May 2016

Appendix D - Hydrologic and Hydraulic Model Update and Calibration Plan (Final), October 2015

Appendix E - Typical Hydrologic Period Report (Final), Updated April 2016

Appendix F - Sewer System Hydrologic and Hydraulic Model Report, June 2017 with revised Appendix C updated March 1, 2018 to address USEPA comments

Appendix G - Rainfall and Flow Monitoring Quarterly Reports:

Quarterly Report No. 1, July 2016

Quarterly Report No. 2, October 2016,

Quarterly Report No. 3, January 2017

Quarterly Report No. 4, April 2017

Appendix H - Water Quality Modeling and Monitoring Work Plan, Updated July 2017

Appendix I - Water Quality Monitoring and Modeling Quality Assurance Project Plan (QAPP), Updated July 2017

Appendix J - Water Quality Model Report (Includes Sampling and Monitoring Report), February 2018

VOLUME 3 OF 4

Appendix K - Existing Service Area Characterization Report (Final), August 2017

Appendix L - Public Participation Plan (Final), Updated April 2016

Appendix M - Public Meeting Notes, Presentations and Comments with Responses

Appendix N - Corvias Green Stormwater Infrastructure Evaluation, November 2017

Appendix O - DELCORA Alternatives Analysis Contingency Breakdown and DELCORA Alternatives Analysis Opinion of Probably Cost Methodology Memos

Appendix P - WRTP Process and Hydraulic Evaluation, April 2011

Appendix Q - Draft Feasibility Study for Pipe Repairs from M.H. 329 to M.H. 3070 and Combination Flow Mitigation for C.S.O. No. 18, December 2016

~~Appendix R - Draft Financial Capability Assessment Report (Final), Revised April 2017~~ No longer in use, see 2022 FCA document in Appendix Y

~~Appendix S - FCA Supplement, August 2017~~ No longer in use, see 2022 FCA document in Appendix Y

Appendix T - Updated Model Calibration and Validation Results for Sewer System Hydrologic and Hydraulic Model Report and Existing Service Area Characterization Report, dated July 2018

VOLUME 4 OF 4

Appendix U - Updated Model Calibration and Validation Results for Sewer System Hydrologic and Hydraulic Model Report and Existing Service Area Characterization Report, dated June 2020
Appendix V - Atlantic Sturgeon Status Review Team. 2007. Status Review of Atlantic sturgeon (Acipenser oxyrinchus oxyrinchus). Report to National Marine Fisheries Service, Northeast Regional Office. February 23, 2007, 174 pp.
Appendix W - Percent Capture Calculation Methodology and Percent Capture by Watershed Memorandum
Appendix X - Additional Communications with USEPA
Appendix Y - Financial Capabilities Assessment Report (Final), December 2022
Appendix Z - Chronological History of the DELCORA CSO LTCPU Program

APPENDIX K

EXISTING SERVICE AREA CHARACTERIZATION REPORT

- DELCORA Existing Service Area Characterization Report (Final) dated August 2017
- USEPA Approval of the Existing Service Area Characterization Report dated April 16, 2018

Note: This Appendix includes a report by Greeley & Hansen which rebranded to TYLin in 2023.

Delaware County Regional Water Quality Control Authority (DELCORA)
CSO Long Term Control Plan Update

Existing Service Area Characterization Report (Final)

August 2017

GREELEY AND HANSEN

REPORT SIGNATURE COVER SHEET

Signature of this cover signifies agreement with the content of the DELCORA Existing Service Area Characterization Report.

I certify under penalty of law that the document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

DELCORA MANAGEMENT		
Executive Director	Signature	8/8/17 Date
DELCORA ENGINEERING		
Director of Engineering	Signature	8/8/17 Date
DELCORA OPERATIONS AND MAINTENANCE		
Director of Operation and Maintenance	Signature	8/8/2017 Date

REVISION CONTROL

REV. NO.	DATE ISSUED	PREPARED BY	DESCRIPTION OF CHANGES

Table of Contents

Section 1 Introduction 1-1
1.1 Introduction 1-1
1.2 Regulatory Requirements 1-1
1.2.1 Requirements from the USEPA's CSO Control Policy 1-2
1.3 Contents of this Report 1-3

Section 2 Overview of DELCORA's Facilities and Service Areas 2-1
2.1 Overview of DELCORA's Facilities 2-1
2.2 DELCORA's Service Areas 2-4
2.2.1 Eastern Service Area 2-4
2.2.2 Western Service Area 2-5
2.3 Model Area 2-5
2.4 Watersheds 2-8
2.5 DELCORA's Treatment Facilities 2-8

Section 3 Characteristics of the Model Area Sewer System 3-1
3.1 Introduction 3-1
3.2 Sources of Collection System Data 3-1
3.3 Overview of Sewer System Characteristics 3-1
3.4 Characteristics of Separated Sewer Areas 3-2
3.5 Characteristics of Combined Sewer System 3-2
3.5.1 Overall Configuration 3-2
3.5.2 Sewer Mains 3-6
3.5.3 Flow Diversion Structures and CSO Regulators 3-6
3.5.3.1 Flow Diversion Structure Components 3-13
3.5.4 Interceptors 3-14
3.5.5 CSO Outfalls 3-16
3.5.6 Drainage Areas and Subcatchments 3-16
3.5.7 Percent Imperviousness 3-16
3.5.8 Depression Storage 3-17
3.5.9 Soil Infiltration Parameters 3-17
3.6 Collection System Pump Stations and Force Mains 3-18
3.6.1 Force Mains 3-19

Section 4 Collection of Precipitation and Sewer Flow Data 4-1
4.1 Introduction 4-1
4.2 Rainfall Monitoring and Analysis 4-1
4.3 Rain Event Summary 4-3
4.4 Gauge-Adjusted, Radar Estimated Precipitation 4-4
4.5 Flow Monitoring 4-4
4.6 Dry Weather Flow (DWF) Analysis 4-14

Table of Contents

4.7 Wet Weather Flow Analysis 4-17
4.8 Wet Weather Event Selection for Model Calibration and Validation Flow Analysis....4-18
4.9 Flow Monitoring Data Summary 4-18
4.10 Collection of WRTP Operational Data 4-19
4.11 Summary 4-20

Section 5 Characteristics of the Receiving Waters 5-1
5.1 Physical Characteristics 5-1
5.2 Watershed Drainage Basins 5-5
5.3 Pollutants of Concern 5-6
5.4 Receiving Water Use Designations and Applicable Water Quality Standards 5-6
5.4.1 2014 PA Integrated Water Quality Monitoring and Assessment Report (303(d) list)....5-7
5.4.2 PA Code Title 25 §93.9g 5-8
5.4.3 DRBC's Water Quality Regulations and PA Code Title 25 §93.7 5-8
5.4.4 DRBC's 2014 Delaware River and Bay Water Quality Assessment 5-8
5.5 Delaware River 5-8
5.5.1 2014 PA Integrated Water Quality Monitoring and Assessment Report (303(d) list)....5-8
5.5.2 Designated Critical Uses and Specific Water Quality Criteria from PA Code 5-9
5.5.3 Designated Zone and Water Quality Regulations from the DRBC 5-11
5.5.4 DRBC Evaluation of Use Attainment Status 5-12
5.5.4.1 Water Contact Recreation 5-13
5.5.4.2 Aquatic Life 5-13
5.5.4.3 Fish Consumption 5-13
5.6 Chester Creek 5-14
5.6.1 2014 PA Integrated Water Quality Monitoring and Assessment Report (303(d) list)....5-14
5.6.2 Designated Critical Uses and Specific Water Quality Criteria from PA Code 5-15
5.7 Ridley Creek 5-15
5.7.1 2014 PA Integrated Water Quality Monitoring and Assessment Report (303(d) list)....5-15
5.7.2 Designated Critical Uses and Specific Water Quality Criteria from PA Code: 5-16
5.8 Pollutants of Concern in the Receiving Waters 5-16
5.8.1 Consent Decree Requirements for the Determination of POCs 5-16
5.8.2 Methodology for Determination of the POCs 5-17
5.8.3 Summary of the Identified POCs for each Receiving Water 5-18
5.9 Identification of Sensitive Areas 5-19
5.9.1 Regulatory Requirements 5-19
5.9.1.1 Consent Decree Requirements 5-19
5.9.1.2 Requirements of the USEPA's CSO Control Policy and Sensitive Areas Definition....5-19
5.9.1.3 Priority Areas Definition 5-20
5.9.2 Summary of Sensitive and Priority Areas 5-20
5.9.2.1 Summary of Sensitive Areas 5-20
5.9.2.2 Summary of Priority Areas 5-22
5.9.2.3 Other Considerations 5-22

Table of Contents

Section 6 Collection of Water Quality Data 6-1
6.1 Background 6-1
6.2 Regulatory Requirements 6-1
6.2.1 Consent Decree Requirements 6-1
6.3 Overview of Historical Water Quality Monitoring 6-2
6.3.1 Historic Water Quality Sampling 6-3
6.4 Overview of the Water Quality Monitoring Program 6-7
6.4.1 Water Quality Monitoring Objectives 6-7
6.4.2 Water Quality Sampling Locations 6-7
6.4.3 Analytical Parameters 6-13
6.4.4 Sampling Schedule and Dates 6-13
6.4.4.1 Dry Weather Sampling 6-13
6.4.4.2 Wet Weather Sampling 6-15
6.4.4.3 In situ Measurements (Receiving Water Only) 6-17
6.4.5 QAPP Overview 6-17
6.5 Receiving Water Quality Results 6-18

Section 7 Typical Hydrologic Period 7-1
7.1 Introduction 7-1
7.1.1 DELCORA's Consent Decree 7-1
7.1.2 Typical Year for CSO LTCP Development 7-1
7.1.3 Climate Change Considerations 7-2
7.1.4 Methodology of Typical Year Selection 7-2
7.2 Typical Year Selection for DELCORA 7-4
7.2.1 Annual Rainfall and River Flow Statistics 7-4
7.2.2 Three-year Rainfall and River Flow Analysis 7-4
7.2.3 Ranking Analysis 7-4
7.2.4 Top 5 Ranked 3-year Hydrologic Periods 7-5
7.2.5 Selected Hydrologic Period 7-6
7.2.6 Additional Information on Statistical Analysis of Rainfall Data 7-7

Section 8 Hydrologic and Hydraulic Modeling 8-1
8.1 Background 8-1
8.2 H & H Modeling Capabilities 8-2
8.2.1 Combined Sewer System Model 8-2
8.3 Data Collected 8-3
8.4 H & H Model Development 8-3
8.4.1 H & H Model Inputs 8-3
8.4.2 Rainfall Data 8-4
8.4.3 Subcatchment Areas 8-4
8.4.4 Percent Imperviousness 8-4
8.4.5 Subcatchment Widths 8-4

Table of Contents

8.4.6 Overland Slope 8-4
8.4.7 Depression Storage 8-5
8.4.8 Manning's "n" Roughness Coefficient....8-5
8.4.9 Separate Sewer Areas 8-5
8.4.9.1 Rainfall Derived Infiltration and Inflow (RDII) 8-5
8.4.10 Soil Infiltration....8-6
8.4.11 Sewer Mains 8-6
8.4.12 Manholes....8-7
8.4.13 CSO Outfalls 8-7
8.4.14 Flow Diversion Structure 8-8
8.4.15 Weirs....8-8
8.5 Summary....8-9
8.6 H & H Model Calibration....8-13
8.6.1 Dry Weather Flow Calibration 8-16
8.6.2 Wet Weather Calibration 8-16
8.7 H & H Model Validation 8-17
8.8 H & H Model Results....8-18

Section 9 References 9-1

Section 10 Abbreviations 10-1

Appendix A CSO Regulator Structure Characteristics 10-1

Appendix B H&H Model Calibration and Validation Results 10-1

Appendix C H&H Model Results for Typical Hydrologic Period 10-1

Appendix D Water Quality Sampling Results 10-1

List of Tables

Table 1-1 DELCORA Existing Service Area Characterization Report.... 1-4
Table 2-1: Model Area.... 2-6
Table 3-1: Subcatchments in the Model Area Sewer System 3-8
Table 3-2: CSO Regulator Information.... 3-11
Table 3-3: Horton Infiltration Parameters 3-18
Table 4-1: Top 10 Rainfall Events.... 4-3
Table 4-2: Flow Monitoring Locations 4-5
Table 4-3: Metersheds in the H&H Model 4-9
Table 4-4: Calibration and Validation Rainfall Events 4-18
Table 5-1: Summary of the 2014 DRBC Integrated Assessment for Zone 4.... 5-13
Table 5-2: PA Fish Consumption Advisory Summary for PCBs in the Delaware River.... 5-14

Table of Contents

Table 6-1: List of Pollutants of Concern (POC) ... 6-3
Table 6-2: Tributary Receiving Water Sampling Locations ... 6-10
Table 6-3: Main Stem Receiving Water Sampling Locations ... 6-11
Table 6-4: CSO and Stormwater Sampling Locations ... 6-12
Table 6-5: Analytical and Field Parameters ... 6-13
Table 6-6: Observed River and Creek Flow Statistics ... 6-14
Table 7-1: Hydrologic Period Ranking Parameters ... 7-3
Table 7-2: Top 5 Ranked Hydrologic Periods ... 7-5
Table 7-3: Rainfall Return Frequency Summary for the Top 5 Ranked Hydrologic Periods ... 7-6
Table 7-4: Rank of Hydrologic Period 1994-1996 from Various Rainfall Data Set ... 7-6
Table 7-5: Ten Largest Storms and Return Frequencies in 1994 ... 7-8
Table 7-6: Ten Largest Storms and Return Frequencies in 1995 ... 7-8
Table 7-7: Ten Largest Storms and Return Frequencies in 1996 ... 7-9
Table 8-1: Manning's Roughness Coefficient for Sewer Mains ... 8-7
Table 8-2: Summary of Revised H&H Model ... 8-9
Table 8-3: Wet Weather Events for Model Calibration and Validation ... 8-17

List of Figures

Figure 2-1: DELCORA Conveyance System ... 2-2
Figure 2-2: DELCORA Service Area ... 2-3
Figure 2-3: DELCORA LTCP Model Area ... 2-7
Figure 2-4: Watershed Boundaries ... 2-9
Figure 2-5: Western Regional Treatment Plant CSO Schematic ... 2-10
Figure 3-1: DELCORA Model Area Subcatchments ... 3-3
Figure 3-2: DELCORA CSS Area Subcatchments (Enlarged) ... 3-4
Figure 3-3: Schematic of Chester CSO System ... 3-5
Figure 3-4: CSS Area Delineation ... 3-7
Figure 3-5: Flow Diversion Structure Schematic ... 3-15
Figure 3-6: Hydrologic Soil Groups for CSS Area ... 3-21
Figure 3-7: Pump Stations Included in the H&H Model ... 3-22
Figure 3-8: Force Mains ... 3-23
Figure 4-1: Rain Gauge Locations ... 4-2
Figure 4-2: DELCORA Flow Meters ... 4-7
Figure 4-3: Enlarged Map of Flow Meters ... 4-8
Figure 4-4: Flow Monitoring Schematic ... 4-13
Figure 4-5: Hydrograph to Show Dry Weather Flow ... 4-14
Figure 4-6: Dry Weather Flow Balance Schematic ... 4-15
Figure 4-7: Average Monthly DWF ... 4-16
Figure 4-8: Weekday and Weekend Dry Weather Flow Diurnal Pattern ... 4-16
Figure 4-9: Hydrographs of Flow Meters in Separated Area (Example Plot) ... 4-17
Figure 4-10: DELCORA WRTP Influent Flow ... 4-19

Table of Contents

Figure 4-11: DELCORA WRTP Influent Flow 4-19
Figure 4-12: DELCORA WRTP Influent Flow 4-20
Figure 4-13: DELCORA WRTP Influent Flow 4-20
Figure 5-1: Zones of the Delaware River and Bay 5-2
Figure 5-2: Locations of Creek Elevation Measurements in Chester and Ridley Creeks 5-2
Figure 5-3: Comparison of Chester Creek bed elevation measurements 5-4
Figure 5-4: Comparison of Ridley Creek Bed Elevation Measurements 5-4
Figure 5-5: Non-Attaining Streams and TMDL Streams within DELCORA's Service Area 5-10
Figure 5-6: Sensitive and Priority Areas 5-21
Figure 6-1: Historical Flow and Water Quality Sampling Locations Near DELCORA Service Area 6-5
Figure 6-2: Receiving Water (RW), Combined Sewer (CSO) and Stormwater (SW) Monitoring Locations 6-8
Figure 7-1: Historical Annual Rainfall at Philadelphia International Airport 7-2
Figure 7-2: Ranking Score of 3-year Period, 1984-2013 7-5
Figure 7-3: Annual Rainfall 1983 - 2013 7-7
Figure 8-1: RTK Unit Hydrographs 8-6
Figure 8-2: Updated H&H Model Layout 8-14
Figure 8-3: Updated H&H Model Layout – CSS Area 8-15

Section 1 Introduction

1.1 Introduction

The Delaware County Regional Water Quality Control Authority (DELCORA) is a municipal wastewater authority that owns, operates and maintains collection systems that serve approximately a half-million people in southeastern Pennsylvania, including 45 municipalities in Delaware and Chester Counties, and is responsible for the collection, transmission, treatment and disposal of approximately 65 million gallons per day (MGD) of wastewater generated in southeastern Pennsylvania. DELCORA operates a Combined Sewer System (CSS) that is comprised of sewer sections that accept both stormwater and sanitary wastewater, which is treated at DELCORA's Western Regional Treatment Plant (WRTP).

Under National Pollutant Discharge Elimination System (NPDES) Permit No. PA0027103, DELCORA is authorized to discharge from the Western Regional Treatment Plant (Outfall 001), four stormwater outfalls at the WRTP (028-031) and from twenty-six (26) combined sewer overflow (CSO) regulators that discharge to twenty-five (25) CSO outfalls (002-027, 032, 033), and then discharge to the Delaware River, Chester Creek and/or Ridley Creek. CSOs are point source discharges that must be provided control measures in accordance with the Federal Clean Water Act and the 1994 National CSO Policy. CSO are allowed to discharge only when flows in the CSS exceed the conveyance or treatment capacities of the system during wet weather periods, and dry weather overflows are prohibited.

DELCORA is in the process of developing a Long Term Control Plan (LTCP) Update for the Combined Sewer System as part of a Consent Decree entered with the United States Environmental Protection Agency (USEPA or EPA) and the Pennsylvania Department of Environmental Protection (PADEP or DEP). Paragraph V.A.16 of the Consent Decree requires DELCORA to submit an Existing Service Area Characterization Report to the USEPA and PADEP for review and approval.

This Existing Service Area Characterization Report has been prepared to fulfill the requirements of Paragraph V.A.16 of the Consent Decree, and of the federal CSO Control Policy Section II.C.1 – Characterization, Monitoring and Modeling of the Combined Sewer System. This Service Area Characterization Report presents the results to characterize, monitor and model DELCORA's combined sewer system, and incorporates the conclusions about Sensitive Areas that were previously determined in DELCORA's report *Identification of Sensitive Areas and Pollutants of Concerns* (Greeley and Hansen, 2016c).

1.2 Regulatory Requirements

On August 17, 2015, a Consent Decree was lodged in the United States District Court for the Eastern District of Pennsylvania that requires DELCORA to complete and submit a revised and updated Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP) to the United States Environmental Protection Agency (USEPA or EPA) and the Pennsylvania Department of Environmental Protection (PADEP or DEP) for review and approval. Consent Decree Paragraph V.A.16 (Existing Service Area Characterization) requires that within two years after the Date of Lodging of the Consent Decree, DELCORA shall submit to the USEPA and PADEP a System Characterization Report for review and

approval. Details of the Consent Decree requirements and the associated regulatory requirements for the Existing Service Area Characterization are respectively found below in Sections 1.2.1.
Requirements from the Consent Decree

The primary requirements for the Existing Service Area Characterization Report are established in the Consent Decree. Paragraph V.A.16 of the Consent Decree, Existing Service Area Characterization, states that:

> *"Not later than two years (24) months after the Date of Lodging of the Consent Decree, DELCORA shall submit a characterization of the Model Area that includes all of the information required by CSO Control Policy Section II.C.1 and associated guidance to Plaintiffs for review and approval in accordance with the requirements of Section VI (Review and Approval of Submittals). The characterization shall include, but not be limited to, the following:*
>
> *DELCORA shall use the updated, calibrated, and validated H&H Model to characterize the expected volume, frequency, and duration of CSO discharge events from each CSO during the Typical Year, based on an inter-event period of twelve (12) hours;*
>
> *DELCORA shall incorporate the results of its investigation of Sensitive Areas;*
>
> *DELCORA shall provide a characterization of current water quality in its Receiving waters, based upon all available sampling data, and its efforts to identify POCs.*
>
> *The characterization submitted pursuant to this paragraph shall include the entire model Area, including the hydrology (i.e., runoff) from and within the entire Model Area."*

Additionally, the Consent Decree requires Rainfall and Flow Monitoring in Paragraph V.A.14.d. that:

> *"Rainfall and flow monitoring that shall be carried out in accordance with current good industry practice for a period of at least twelve (12) months, in accordance with the schedule included in the approved plan. Rainfall data shall be obtained at a minimum effective density of 1 gauge/virtual radar-based gauge per square kilometer, for the entire Model Area. Flow monitoring shall be carried out using sufficient monitors to allow the accurate characterization of dry and wet weather flows for the entire Model Area, and the response of each CSO to wet weather flows."*

1.2.1 Requirements from the USEPA's CSO Control Policy

Additional requirements for the Existing Service Area Characterization Report are established in the USEPA's CSO Control Policy (USEPA, 1994). Section II.C.1 of the CSO Control Policy "Characterization, Monitoring and Modeling of the Combined Sewer System" states:

> *"In order to design a CSO control plan to adequately meet the requirements of the CWA, a permittee should have a thorough understanding of its sewer system, the response of the system to various precipitation events, the characteristics of the overflows, and the water quality impacts that result from CSOs. The permittee should adequately characterize through monitoring,*

modelling, and other means as appropriate, for a range of storm events, the response of its sewer system to wet weather events including the number, location and frequency of CSOs volume, concentration and mass of pollutants discharged and the impacts of the CSOs on the receiving waters and their designated uses."

The CSO Control Policy states that the major elements of a sewer system characterization include:

Rainfall Records

"The permittee should examine the complete rainfall record for the geographic area of its existing CSS using sound statistical procedures and best available data. The permittee should evaluate flow variations in the receiving water body to correlate between CSOs and receiving water conditions."

Combined Sewer System Characterization

"The permittee should evaluate the nature and extent of its sewer system through evaluation of available sewer system records, field inspections and other activities necessary to understand the number, location and frequency of overflows and their location relative to sensitive areas and to pollution sources in the collection system, such as indirect significant industrial users."

CSO Monitoring

"The permittee should develop a comprehensive, representative monitoring program that measures the frequency, duration, flow rate, volume and pollutant concentration of CSO discharges and assesses the impact of the CSOs on the receiving waters."

Modeling

"Modeling of a sewer system is recognized as a valuable tool for predicting sewer system response to various wet weather events and assessing water quality impacts when evaluating different control strategies and alternatives. EPA supports the proper and effective use of models, where appropriate, in the evaluation of the nine minimum controls and the development of the long-term CSO control plan."

1.3 Contents of this Report

To satisfy the requirements of DELCORA's Consent Decree and of the CSO Control Policy, this Existing Service Area Characterization Report provides a comprehensive characterization of DELCORA's combined sewer system and of the CSS monitoring and modeling that DELCORA has completed. In addition to describing the characteristics of the wastewater collection system, this report presents the results of DELCORA's rainfall and flow monitoring programs, its receiving water monitoring program, and the results from the H&H model from the typical year for the Combined Sewer System.

Table 1-1 lists the individual sections of the Report and contents.

Table 1-1 DELCORA Existing Service Area Characterization Report

Section	Description
Section 1 Introduction	This section introduces DELCORA's system, the Consent Decree requirements, requirements from the USEPA's CSO Control Policy, as well as individual sections of the Plan.
Section 2 Overview of DELCORA's Facilities and Service Areas	This section provides an overview of DELCORA's facilities, a description of DELCORA's Service Areas, an overview of DELCORA's treatment facilities, and an overview of DELCORA's combined sewer system within the City of Chester.
Section 3 Characteristics of the Model Area Sewer System	This section describes the details of the combined sewer system and includes the physical characteristics and attributes of DELCORA's Sewer System. These include system configuration, regulator, manhole; pump stations and force main characteristics.
Section 4 Collection of Precipitation and Sewer Flow Data	This section presents the results of DELCORA's efforts to collect precipitation monitoring data for locations throughout the areas served by DELCORA's Sewer System. It also presents the results of DELCORA's efforts to collect flow monitoring data in the combined sewer system and in the receiving waters. It presents the dry weather and wet weather flow data for DELCORA's Sewer System.
Section 5 Characteristics of the Receiving Waters and Watersheds	This section provides an overview of the location, physical characteristics, waterbody classifications and analysis of the current water quality of DELCORA's receiving waters. This section also incorporates the results of DELCORA's investigation of Sensitive Areas, and their relative location to the CSOs.
Section 6 Collection of Water Quality Data	This section presents the results of DELCORA's investigation into the current water quality in the receiving waters. This section also presents the CSO water quality data resulting from DELCORA's CSO Monitoring Program.
Section 7 Typical Hydrologic Period	This section summarizes the typical hydrologic period to be used for modeling based on previously submitted *Typical Hydrologic Period Report.*
Section 8 Hydrologic and Hydraulic Modeling	This section provides an overview of the Hydrologic and Hydraulic Model of the combined sewer system that DELCORA has developed. It also presents the results from the modeling of DELCORA's sewer system and the expected volume, frequency, and duration of CSO discharge events from each CSO during the Typical Hydrologic Period.

Section 2 Overview of DELCORA's Facilities and Service Areas

2.1 Overview of DELCORA's Facilities

DELCORA owns and operates an extensive conveyance system of pump stations, force mains, and sewers that provide the core infrastructure for the transmission of wastewater to treatment facilities in Delaware County and the City of Philadelphia as shown diagrammatically in Figure 2-1. The total service area served by DELCORA, as shown on Figure 2-2, is approximately 82,977 acres and illustrates that DELCORA serves a significant and widespread portion of Delaware County. To support the service area, DELCORA owns and operates over 129 miles of separate and combined sewers and over 14 miles of large-diameter (>24-inch) force mains. Included in the 129 miles of sewers are: 11.7 miles of an interceptor system; 3,209 manholes; and twenty-six (26) combined sewer regulators that discharge to twenty-five (25) combined sewer outfalls, as CSO Regulators #009 and #010 both discharge to CSO Outfall #009. The combined sewer area simulated in DELCORA's Hydrologic and Hydraulic (H&H) model is located within the City of Chester and consists of a drainage area of approximately 1,506 acres. It comprises approximately half of Chester City's serviced area. The location of Chester City's service area is illustrated on Figure 2-2.

DELCORA has characterized its service areas as "Eastern" and "Western." Historically, the Eastern service area discharged to the Philadelphia Water Department's Southwest Water Pollution Control Plant (PSWPCP) while the Western Service Area discharged to DELCORA's Western Regional Treatment Plant (WRTP). In 2002, DELCORA completed the installation of a force main that connects the Eastern Service Area's Central Delaware Pump Station (CDPS) to the Chester Force Main. This connection allows DELCORA to send flow from the CDPS to the WRTP. Dry weather flow and a portion of the wet weather flow from the Central Delaware County Authority in the Eastern Service Area now discharges to the WRTP while only those CDPS flows above 20 MGD are to be directed to the PWD-SWPCP. Figure 2-1 shows the interconnections in DELCORA's system. The left side of the figure indicates the Western Service Area and the right side indicates the Eastern Service Area. This interconnectivity coupled with the legal agreements DELCORA maintains with the municipalities and conveyance authorities in Delaware County creates the complicated legal/financial framework under which DELCORA operates.

Under its National Pollutant Discharge Elimination System (NPDES) Permit No. PA0027103, issued and administered by the PADEP, DELCORA is authorized to discharge from the Western Regional Treatment Plant (Outfall #001), four storm water outfalls at the WRTP (028-031) and from the 26 CSO regulators (#002-#005, #007-#026, #032 and #033) that ultimately discharge to the Delaware River, Chester Creek and/or Ridley Creek. There are a total of 26 combined sewer overflow (CSO) regulators listed with 25 discharge points (Regulators 009 and 010 both discharge at Outfall 009) in DELCORA's existing NPDES Permit.

Figure 2-1: DELCORA Conveyance System

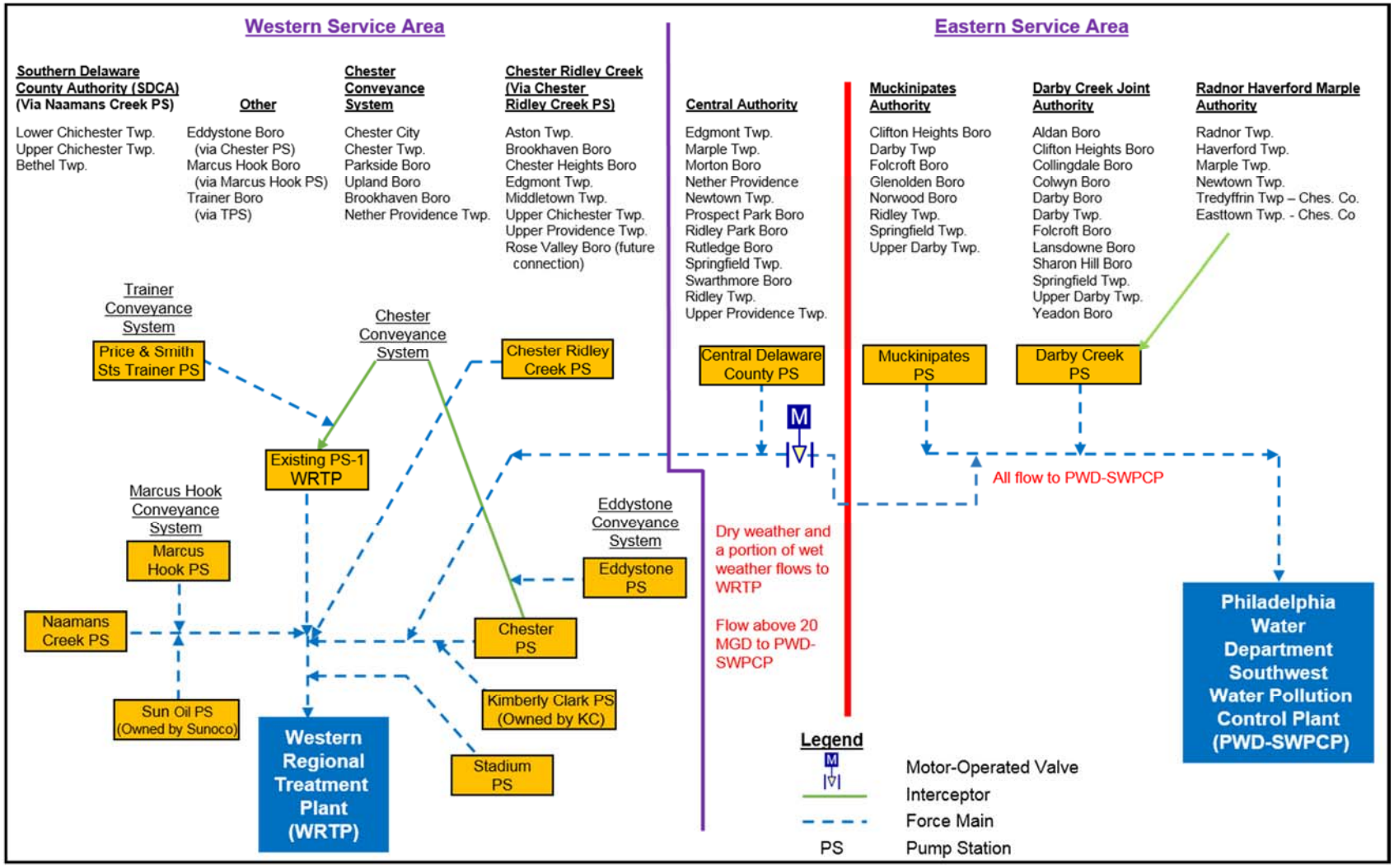
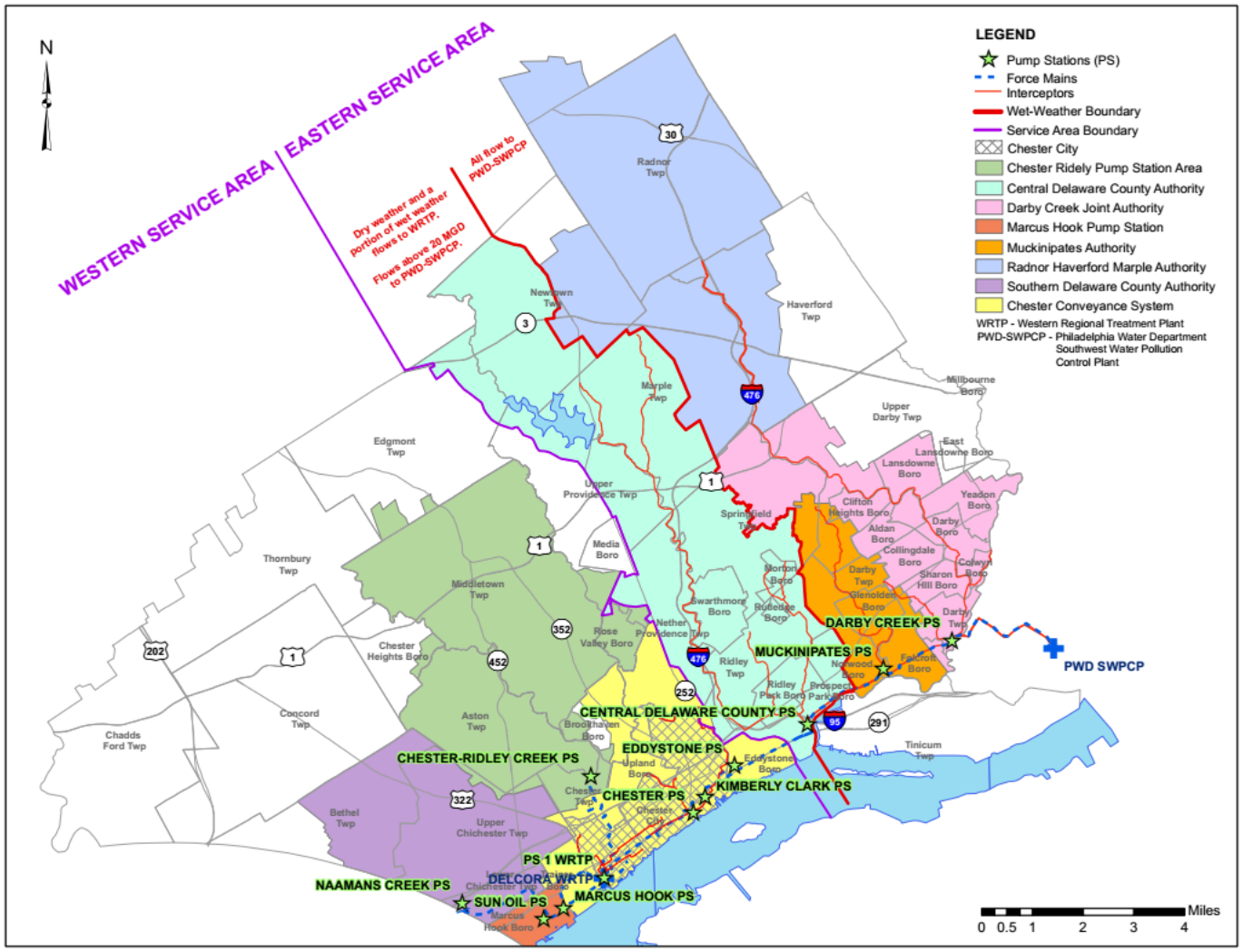


Figure 2-2: DELCORA Service Area



2.2 DELCORA's Service Areas

As mentioned previously and depicted in Figure 2-2, DELCORA serves a significant and widespread portion of Delaware County. To support this service area, DELCORA owns and operates over 137 miles of gravity sewers and over 14 miles of large-diameter (>24-inch) force mains. Historically, DELCORA has characterized its service areas as "Eastern" and "Western." The Western Service Area discharges to the Western Regional Treatment Plant. The Eastern Service Area discharges to the Philadelphia Southwest Water Pollution Control Plant (PSWPCP). In 2002, DELCORA completed the installation of a force main that connects the Eastern Service Area's Central Delaware Pump Station (CDPS) to the Chester Force Main. This connection allows DELCORA to send flow from the CDPS to the WRTP. Flows above 20 MGD are to be directed to the PWD-SWPCP. As such, dry weather flow and a portion of the wet weather flow from the Central Delaware County Authority in the Eastern Service Area are discharged to the WRTP.

2.2.1 Eastern Service Area

The Eastern Service Area is composed of four subareas that are served by conveyance authorities. These areas are the Radnor Haverford Marple (RHM) Authority, Darby Creek Joint Authority (DCJA), Muckinipates Authority (MA), and Central Delaware County Authority (CDCA) and are delineated in Figure 2-2. Each of these authorities has a legal agreement with their member municipalities to dispose of their wastewater. In turn, DELCORA has legal agreements with each of the authorities, except RHM, to receive and dispose of the collected wastewater. RHM discharges to the DCJA.

DELCORA owns and operates three large pump stations that serve DELCORA's Eastern Service Area; they are the Central Delaware County Pump Station, the Muckinipates Pump Station, and the Darby Creek Pump Station. These pump stations are designed to pump the wastewater from DELCORA's Eastern Service Area to the Philadelphia Southwest Water Pollution Control Plant for treatment. Originally constructed in the 1970s, the Central Delaware Pump Station (serving CDCA) is rated for 40 MGD. As originally designed, the Central Delaware pump station discharges though a 1.9-mile, 36-inch-diameter prestressed concrete cylinder pipe (PCCP) force main that runs northeast toward the Muckinipates Pump Station. The next pump station is the 24-MGD Muckinipates Pump Station (serving MA). Here the force main increases to 48 inches in diameter and continues approximately 1.65 miles northeast to the Darby Creek Pump Station. Upon reaching the 60-MGD Darby Creek Pump Station (serving DCJA and RHM), the force main increases in diameter to 66 inches and continues approximately 2.5 miles on to PSWPCP.

The operation of the Central Delaware Pump Station (CDPS) had been modified in 2002 to allow for flow from the CDPS to be discharged to the WRTP. Currently, wastewater flows up to 20 MGD are discharged to WRTP and the wastewater flows in excess of 20 MGD are conveyed to PWD-SWPCP.

2.2.2 Western Service Area

DELCORA's Western Service Area is also shown in Figure 2-2. DELCORA owns and operates the collection system in the following communities in the Western service area:

Chester City
Chester Township[1]
Marcus Hook Borough
Parkside Borough
Rose Valley Borough[2]
Upland Borough
Trainer Borough

DELCORA does not own or operate the collection system in the following communities in the Western Service Area:

Brookhaven Borough
Lower Chichester Township
Nether Providence Township
Eddystone Borough

2.3 Model Area

As described in the Consent Decree, the characterization report will evaluate the Model Area comprising those areas hydraulically connected to the WRTP. Section V.A.14.b of the Consent Decree describes the Model Area as follows:

> *"… all areas tributary to the entire Collection System, as well as all areas tributary to all municipal wastewater collection and transmission systems that are, as of the date the LTCP is submitted, hydraulically connected to, or that directly or indirectly influence flow to, the CSOs and/or the WRTP, regardless of who owns or operates the system(s), including but not limited to the entire "Western Service Area" and "Eastern Service Area" depicted on Figure 1-2 of the Long-Term Control Plan submitted by DELCORA in April 2012, and attached as Appendix A hereto (collectively, the "Model Area")."*

As shown in the schematic of DELCORA's conveyance system (see Figure 2-1), the conveyance system is divided into the Western Service Area and the Eastern Service Area. The Western Service Area discharges to DELCORA's WRTP and is therefore included in the Model Area. The Eastern Service Area is served by three pumps stations: the Central Delaware Pump Station, the Muckinipates Pump Station and the Darby Creek Pump Station. Up to 20 MGD (which includes both dry and wet weather flows) from the Central Delaware Pump Station can be pumped to, and thus is hydraulically connected to, DELCORA's WRTP. Therefore, municipalities connected to the Central Delaware Pump Station are

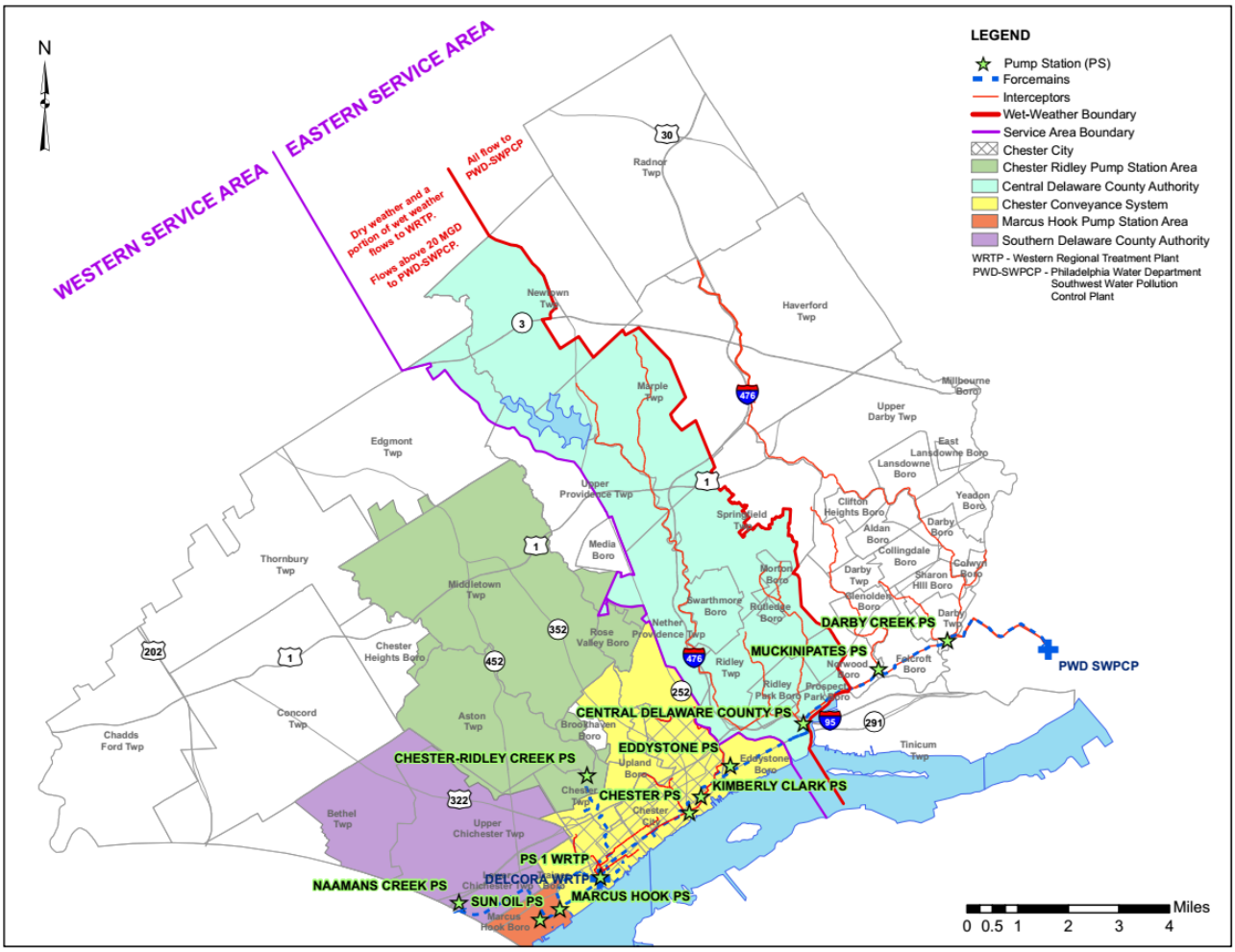
[1] DELCORA owns only a portion of the collection system in Chester Township.
[2] Rose Valley Borough collection system discharges to its own treatment plant and a portion is discharged to the WRTP via Nether Providence's collection system.

considered part of the Model Area. Sewage from the Muckinipates Pump Station and the Darby Creek Pump Station flows to the PWD-SWPCP rather than to the WRTP. Therefore, municipalities connected to these pump stations are not hydraulically connected to the WRTP and do not directly or indirectly influence CSOs or flow to the WRTP, and, therefore, are not considered part of the Model Area. In summary, the Model Area includes the municipalities in the Western Service Area plus those municipalities in the Eastern Service Area that are connected to the Central Delaware Pump Station, as described in Table 2-1. The Model Area is illustrated in Figure 2-3.

Table 2-1: Model Area

Municipality	Service Area
Aston Township	Western
Bethel Township*	Western (SDCA)
Brookhaven Borough*	Western
Chester City	Western
Chester Township	Western
Eddystone Borough	Western
Edgmont Township*	Eastern (CDCA)
Lower Chichester Township	Western
Marcus Hook Borough	Western
Marple Township*	Eastern (CDCA)
Middletown Township	Western
Morton Borough	Eastern (CDCA)
Nether Providence Township	Eastern (CDCA) and Western
Newtown Township*	Eastern (CDCA)
Parkside Borough	Western
Prospect Park Borough	Eastern (CDCA)
Ridley Park Borough	Eastern (CDCA)
Ridley Township*	Eastern (CDCA)
Rose Valley Borough	Western
Rutledge Borough	Eastern
Springfield Township*	Eastern (CDCA)
Swarthmore Borough	Eastern (CDCA)
Trainer Borough	Western
Upland Borough	Western
Upper Chichester Township	Western (SDCA)
Upper Providence Township*	Eastern (CDCA) and Western
*Indicates that only a portion of the municipality contributes flow to WRTP CDCA: Central Delaware County Authority SDCA: Southern Delaware County Authority	

Figure 2-3: DELCORA LTCP Model Area



2.4 Watersheds

The watersheds of concern for the Model Area include portions of the Delaware River, Chester Creek and Ridley Creek watersheds. Figure 2-4 illustrates the watershed boundaries along with the boundaries of the Model Area.

2.5 DELCORA's Treatment Facilities

DELCORA's primary treatment facility is the WRTP located at 3201 W. front Street in Chester, PA. The WRTP is a permitted 44 MGD activated sludge treatment plant, shown schematically in Figure 2-5. The PADEP and the Delaware River Basin Commission (DRBC) have approved the re-rate of the WRTP to 50 MGD. DELCORA will need to extend the WRTP discharge outfall approximately 455 feet into the Delaware River to meet DRBC regulatory requirements for a re-rate to 50 MGD. Peak capacity at the WRTP is approximately 110 MGD. Based on data obtained for the period 18 March 2016 to 1 May 2017, the annual average dry weather flow to the WRTP is approximately 28 MGD. This facility treats all wastewater from the Model Area, including all flows from the Western Service Area as well as up to 20 MGD from the Central Delaware County Authority.

All wastewater from the Muckinipates Authority, Darby Creek Joint Authority, and the Radnor Haverford Marple Authority are transported to the PSWPCP for treatment and disposal. The Central Delaware Pump Station can direct flow to the WRTP via the Central Diversion Force Main or to the PSWPCP. DELCORA has an agreement with the City of Philadelphia for the disposal of wastewater. This agreement specifies DELCORA's flow thresholds to the PSWPCP to be an annual average of 50 MGD, a daily maximum of 75 MGD, and an instantaneous peak flow of 100 MGD. Flows above these thresholds are subject to exceedance charges.

DELCORA also purchased the Rose Valley Treatment Plant in 2009. The Rose Valley Treatment Plant is permitted at 0.13 MGD and is located in Delaware County. On March 1, 2010, DELCORA purchased the Riverside Treatment Plant in Pocopson Township, Chester County. It is permitted at 0.045 MGD.

Figure 2-4: Watershed Boundaries

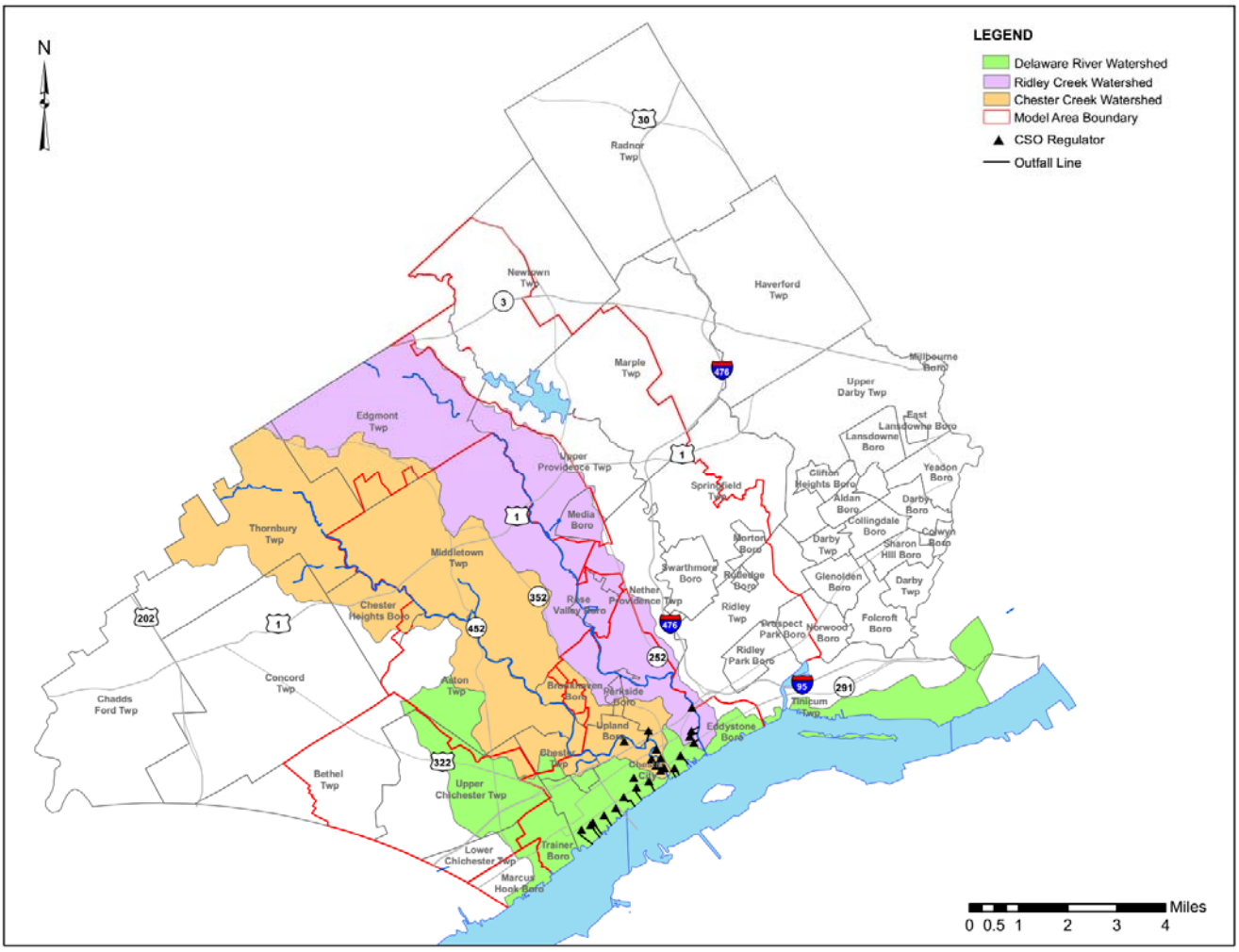
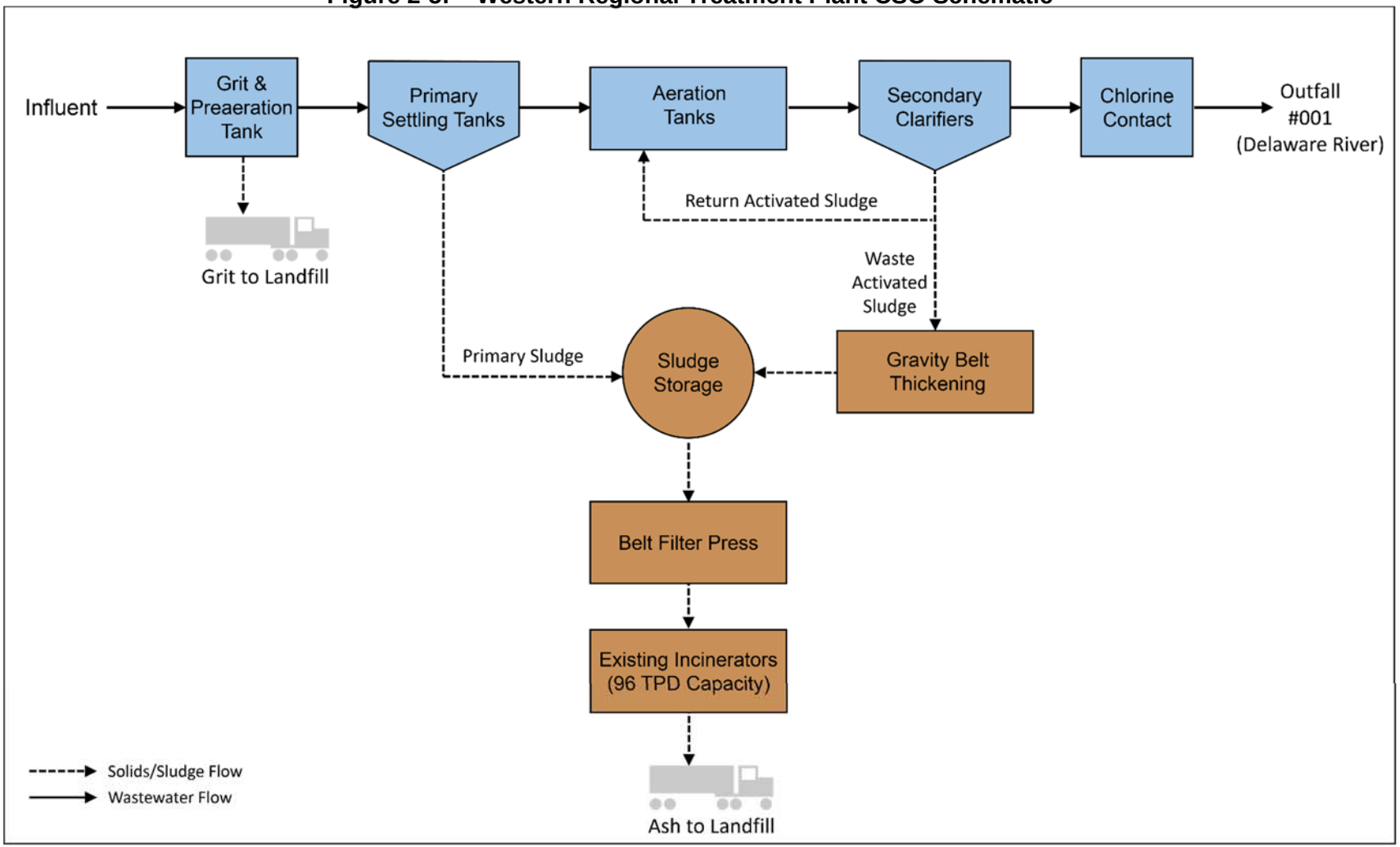


Figure 2-5: Western Regional Treatment Plant CSO Schematic



Section 3 Characteristics of the Model Area Sewer System

3.1 Introduction

This section presents an investigation of the collection system to meet the requirements of Section II.C.1.b, Combined Sewer System Characterization, of the USEPA's CSO Control Policy. Section II.C.1.b requires DELCORA to evaluate the nature and extent of the sewer system through evaluation of available sewer records and inspections necessary to understand the number, location and frequency of overflows, and their locations relative to Sensitive Areas and to pollution sources in the collection system.

3.2 Sources of Collection System Data

The characteristics and attributes of DELCORA's collection system were determined through the collection, assessment, and evaluation of existing data and information, as part of the implementation of the *Hydrologic and Hydraulic Model Update and Calibration Plan* (Greeley and Hansen, 2015).

Data and information on the collection system were obtained from several sources including DELCORA's input, DELCORA's Geographic Information System (GIS), as-built record drawings, design drawings and field surveys.

3.3 Overview of Sewer System Characteristics

The wastewater collection system within the Model Area consists of separated storm and sanitary sewer piping in some areas and combined sewer system piping in other areas. The Model Area covers approximately 50,000 acres, with approximately 48,540 acres served by separated storm and sanitary systems while only 1,463 acres are served by a combined sewer system. The combined sewer system is located entirely within the City of Chester. However, the City of Chester also has areas that are served by separated storm and sanitary piping or are direct drainage. The remaining areas of the Model Area outside of the City of Chester are all served by separated storm and sanitary sewer piping.

In separated areas, the sanitary sewers convey wastewater to the WRTP for treatment and stormwater runoff is collected through storm sewers and discharged directly to the receiving waters.

Within the City of Chester's combined sewer areas, however, sanitary and storm sewers are combined into the same pipe. During dry weather, the sanitary wastewater is conveyed to the WRTP. During large storms, the stormwater runoff causes the carrying capacity of these combined sewers to be exceeded, and part of this combined flow may discharge directly to the receiving waters without undergoing any treatment.

Sewersheds (subcatchments) are delineated based on the drainage network and area characteristics. Each sewershed has a dry weather and a wet weather flow input to the model network. The model network comprises 114 sewersheds (subcatchments), including 53 combined and 61 separated subcatchments.

3.4 Characteristics of Separated Sewer Areas

Sanitary sewers within the separated areas deliver flow to the WRTP through connections to DELCORA's sewers and through connections to DELCORA's pump station. In many cases, DELCORA does not own or operate the sanitary sewers in separated areas. Consequently, detailed information regarding the characteristics of sanitary sewers from the separated areas is not included in this Report. For modeling purposes, the separated areas will be treated as node inputs to the H&H Model. Flow inputs at the nodes will be derived as described in Sections 4 and 8. Key characteristics necessary for developing flow inputs include delineation of subcatchment boundaries (see Figures 3-1 and 3-2) and areas (see Table 3-1).

3.5 Characteristics of Combined Sewer System

As noted in Section 2.1, the combined portion of DELCORA's sewer system is located within the City of Chester (City), and it comprises approximately half of the City's serviced area. The combined wastewater/stormwater system in the City is complicated by the fact that parts of the system are owned, operated and maintained by two governmental entities, the City and DELCORA. DELCORA owns, operates and maintains the parts of the system that convey wastewater, such as the street sewers, collectors, interceptors, and CSO regulators and CSO outfalls. The City owns, operates and maintains the inlets, stormwater-only sewers that connect to the combined sewer system and any stormwater-only outfalls. The City is also responsible for the maintenance and cleaning of the streets, planning, zoning, and development controls.

The CSS system in the City of Chester has several key components that all impact how the system operates. These key components are the local street sewers, combined collector sewers, CSO regulators, interceptors, and outfalls. The system starts with local street sewers that take flow from houses and businesses as well as the stormwater inlets that drain the streets. These local street sewers typically range in size from 12" to 24" in diameter. The local street sewers discharge to combined collector sewers (shown in Figure 2-1) which flow to the CSO regulators. The combined collector sewers are larger pipes typically range in size from 18" to 72" in diameter and connect directly to the CSO regulator.

Generally, in the CSO drainage areas, flows from the separate sanitary sewers flow into the combined sewers. Flows from the combined sewers in the collection system flow to the regulator structures where dry weather flow and a portion of wet weather flow are diverted into the interceptors. The remainder of the wet weather flow that exceeds the capacity of the interceptors is discharged directly to the closest receiving water (Delaware River, Chester Creek or Ridley Creek) through the CSO outfalls.

3.5.1 Overall Configuration

A schematic of the CSS was developed to facilitate the development, calibration, and validation of the H&H Model. The schematic illustrates the relationship between all major regulators, interceptors, outfalls, pump stations, force mains and other major appurtenances. The schematic also includes the location of the flow meters, and provides and good understanding of the relationship between the flow meters. The schematic of the collection system components is shown on Figure 3-3.

Figure 3-1: DELCORA Model Area Subcatchments

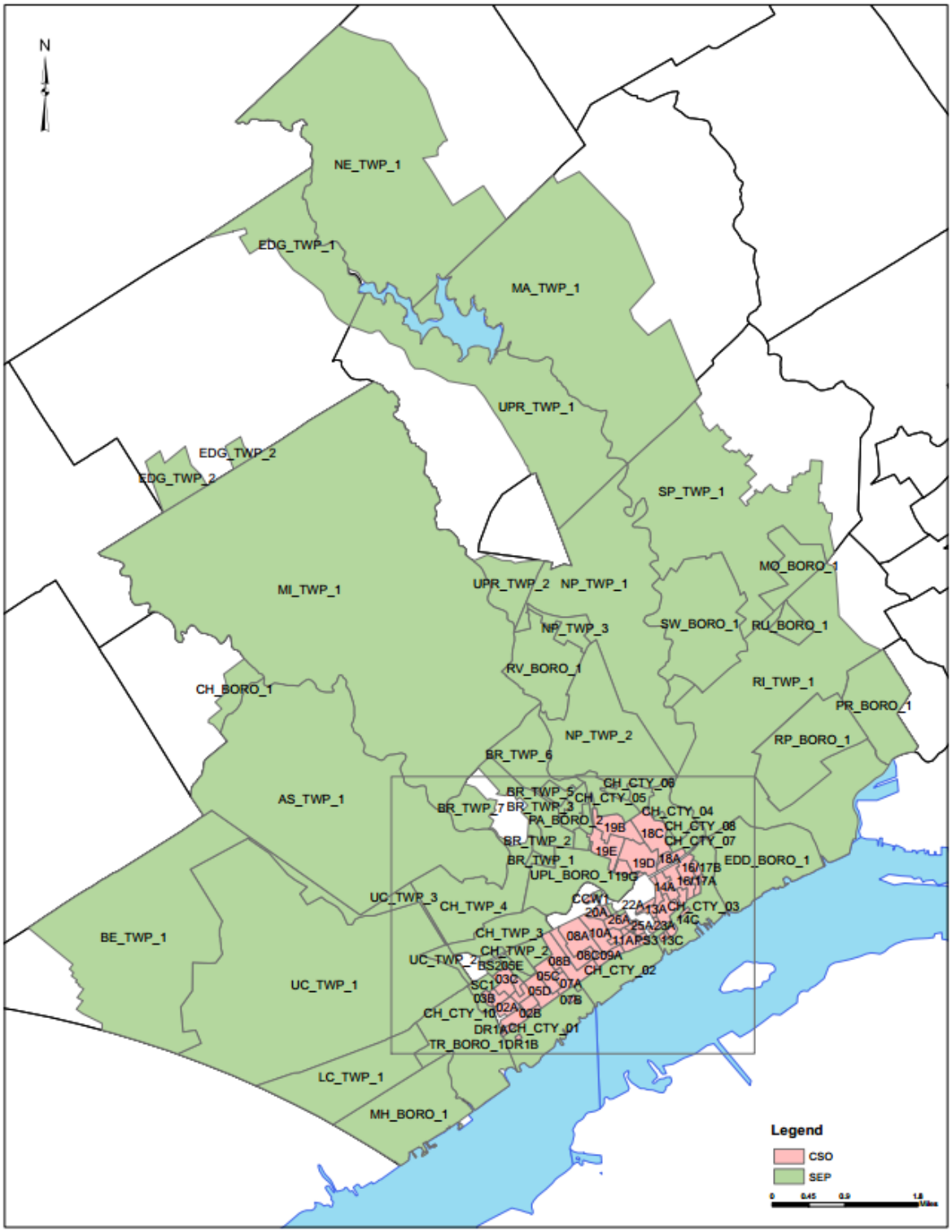


Figure 3-2: DELCORA CSS Area Subcatchments (Enlarged)

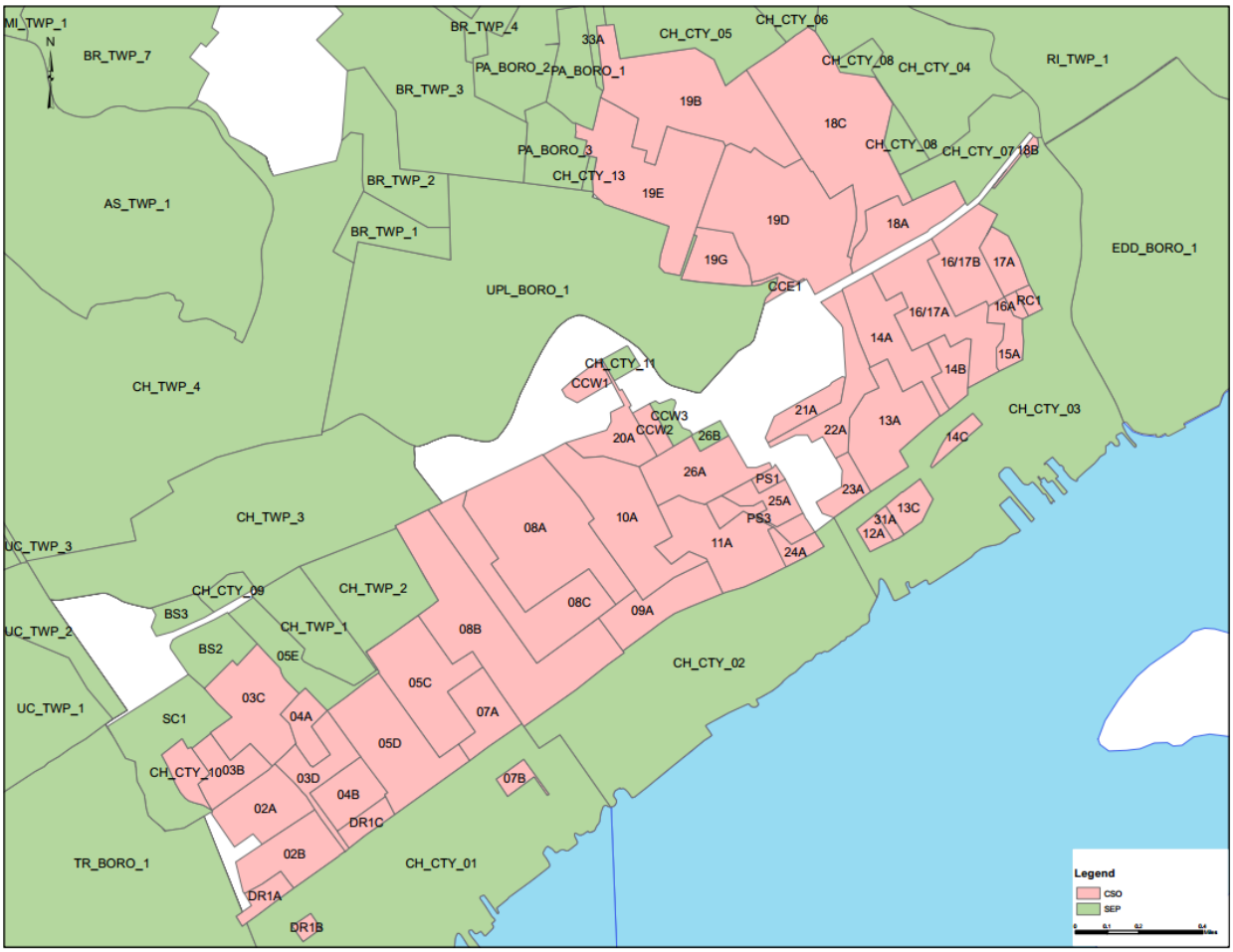


Figure 3-3: Schematic of Chester CSO System

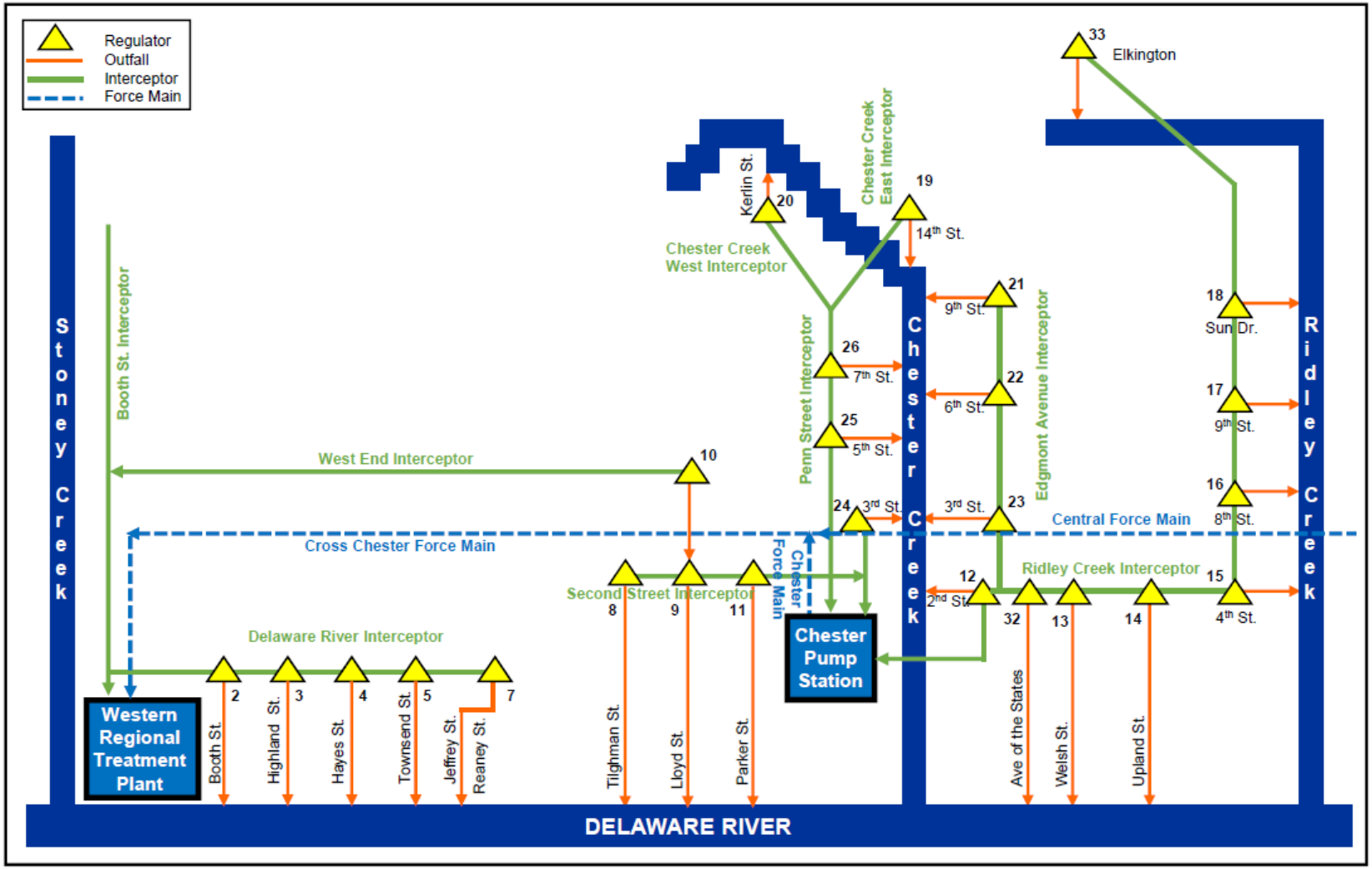


Figure 3-4 depicts the locations of DELCORA's CSO regulators and outfalls. Figure 3-4 also depicts the various drainage subcatchments that flow to each of the CSO regulators. Information about the 26 CSO drainage areas including their subcatchments, total acreage and combined sewer acreage are shown depicted in Table 3-1. Together Figure 3-4 and Table 3-1 also provide a sewer system characterization and illustrate the breakdown of each outfall and how each drainage area has combined sewers and separate sewers.

3.5.2 Sewer Mains

Sewer data was collected from DELCORA's GIS in support of the work to develop and update and calibrate the H&H model. Most of the pipe input characteristics, including upstream and downstream nodes, dimension, shape, number of barrels, and flap gate information, were found or estimated from record drawings, design drawings and sewer gravity main GIS shapefiles. If sewer main information was not available, sewer length was estimated in GIS geometry measurement; sewer size were assumed based on upstream and downstream sewers; sewer upstream and downstream offsets were estimated based on sewer connectivity assuming constant slope. Conduit ID was inherited from the 2012 H&H Model and new IDs were provided for the pipes not in the 2012 H&H Model.

Manhole information, including invert and rim elevations, were found or estimated from record drawings, design drawings, and the sewer manhole shape file. For water tight manholes or manholes with bolted down covers, a surcharge depth of 50-ft will be applied. Manhole ID was inherited from the name of the manhole in the sewer GIS. The naming convention is "MH_XXXX". Manhole input information was updated based on the latest available GIS information.

3.5.3 Flow Diversion Structures and CSO Regulators

The Chester CSO system contains 26 permitted CSO regulators as listed in Table 3-2. The CSO regulators and outfalls serve as combined sewer reliefs necessitated by stormwater entering the sewer system and exceeding the hydraulic capacity of the sewers and/or treatment plant. Wet weather flows in excess of the collection system's capacity are discharged to the Delaware River, Chester Creek or Ridley Creek. Although there are 26 regulators, there are only 25 CSO discharge locations, as CSO #010 discharges to the Delaware River through CSO #009. Table 3-2 shows that eleven of the outfalls, CSO Outfalls #002, 003, 004, 005, 007, 008, 009, 011, 013, 014, and 032, discharge excess wet weather flows into the Delaware River. Nine of the outfalls, CSO Outfalls #012, 019, 020, 021, 022, 023, 024, 025 and 026, discharge excess wet weather flows into the Chester Creek. The remaining five designated outfalls, Outfall #015, 016, 017, 018 and 033[3] , discharge excess wet weather flows into the Ridley Creek.

Since the approval of the first LTCP in 1999, DELCORA has under-taken a program to replace and/or rehabilitate CSO regulators and tide gates in the City of Chester CSO system. In some cases, regulators have been eliminated. The modifications DELCORA committed to in the 1999 LTCP include a complete

[3] DELCORA's NPDES permit includes 26 regulators. After the NPDES permit was issued, CSO regulator 033 was disconnected from the CSS.

Figure 3-4: CSS Area Delineation

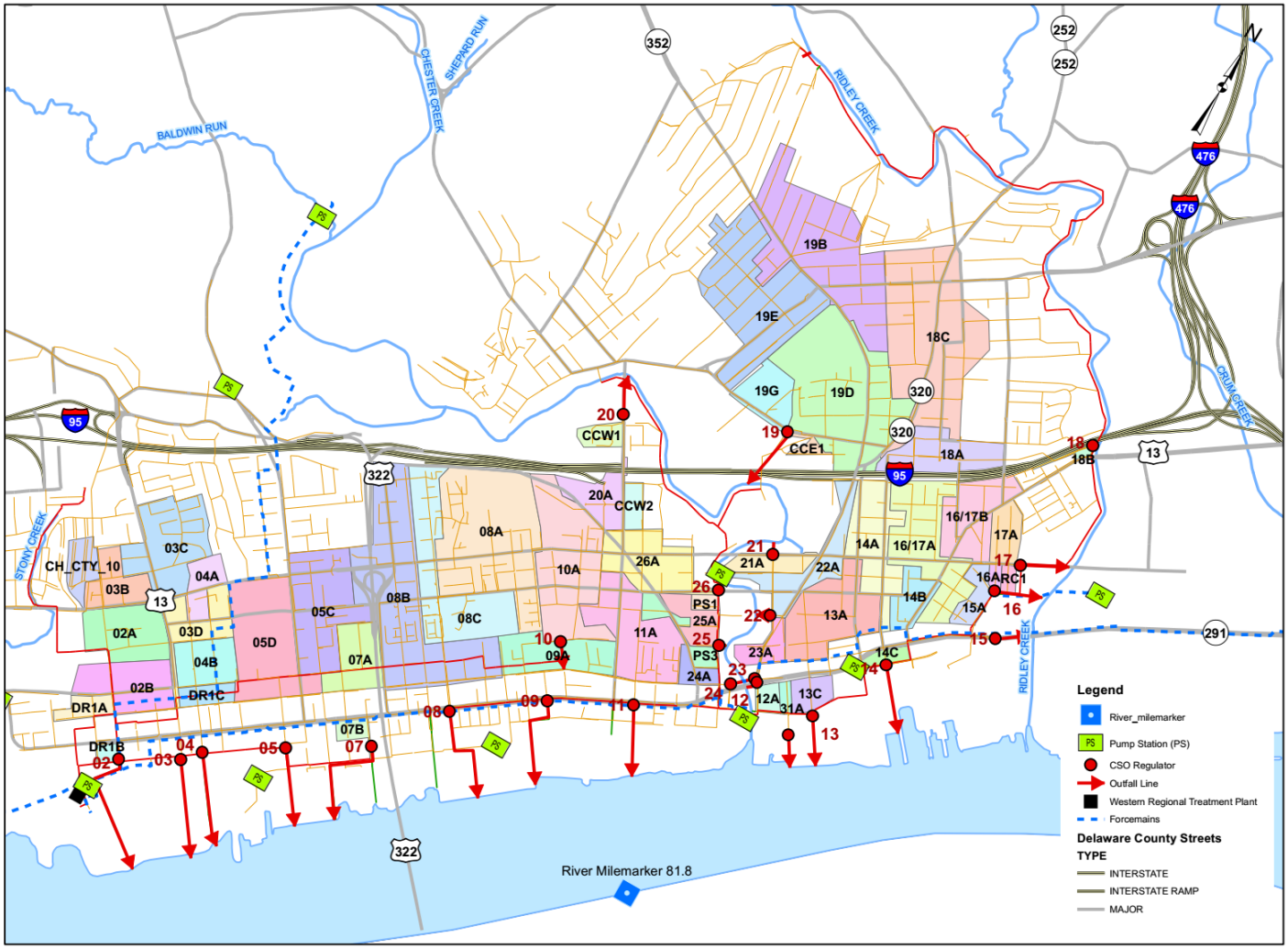


Table 3-1: Subcatchments in the Model Area Sewer System

CSO Regulator/Interceptor/ Pump Station	Subarea	Collection System Type	Area/Subarea (ac)	Total Area (ac)	Municipality
Regulator 2	02A	CSS	29	58	Chester City
	02B	CSS	29		Chester City
Regulator 3	03B	CSS	19	87	Chester City
	03C	CSS	43		Chester City
	03D	CSS	20		Chester City
Regulator 4	04A	CSS	12	31	Chester City
	04B	CSS	19		Chester City
Regulator 5	05C	CSS	49	233	Chester City
	05D	CSS	53		Chester City
	05E	Separate	27		Chester City
	CH_TWP_2	Separate	59		Chester Twp
	CH_CTY_9	Separate	7		Chester City
	CH_TWP_1	Separate	38		Chester Twp
Regulator 7	07A	CSS	21	26	Chester City
	07B	CSS	5		Chester City
Regulator 8	08A	CSS	89	237	Chester City
	08B	CSS	96		Chester City
	08C	CSS	52		Chester City
Regulator 9	09A	CSS	27	27	Chester City
Regulator 10	10A	CSS	60	60	Chester City
Regulator 11	11A	CSS	44	44	Chester City
Regulator 12	12A	CSS	5	5	Chester City
Regulator 13	13A	CSS	41	50	Chester City
	13C	CSS	9		Chester City
Regulator 14	14A	CSS	35	53	Chester City
	14B	CSS	13		Chester City
	14C	CSS	5		Chester City
Regulator 15	15A	CSS	10	10	Chester City
Regulator 16/17	16/17A	CSS	46	77	Chester City
	16/17B	CSS	31		Chester City
Regulator 16	16A	CSS	2	2	Chester City
Regulator 17	17A	CSS	12	12	Chester City
Regulator 18	18A	CSS	28	130	Chester City
	18B	CSS	2		Chester City
	18C	CSS	100		Chester City
Regulator 19	18C	Separate	100	421	Chester City
	19B	CSS	88		Chester City
	19D	CSS	94		Chester City
	19E	CSS	76		Chester City
	19G	CSS	18		Chester City
	PA_BORO_1	Separate	28		Parkside Boro
	CH_CTY_08	Separate	17		Chester City
Regulator 20	20A	CSS	18	18	Chester City
Regulator 21	21A	CSS	11	11	Chester City
Regulator 22	22A	CSS	27	27	Chester City
Regulator 23	23A	CSS	10	10	Chester City
Regulator 24	24A	CSS	6	6	Chester City
Regulator 25	25A	CSS	12	12	Chester City

CSO Regulator/Interceptor/ Pump Station	Subarea	Collection System Type	Area/Subarea (ac)	Total Area (ac)	Municipality
Regulator 26	26A	CSS	33	37	Chester City
	26B	Separate	4		Chester City
Regulator 32	31A	CSS	3	3	Chester City
Chester Creek Interceptor East	CCE1	CSS	3	3	Chester City
Chester Creek Interceptor West	CCW1	CSS	7	552	Chester City
	CCW2	CSS	6		Chester City
	CCW3	Separate	5		
	CH_CTY_11	Separate	5		Chester City
	PA_BORO_3	Separate	27		Parkside Boro
	BR_TWP_1	Separate	27		Brookhaven Boro
	BR_TWP_2	Separate	49		Brookhaven Boro
	CH_CTY_13	Separate	2		Parkside Boro
	UPL_BORO_1	Separate	424		Upland Boro
2nd Street Interceptor	CH_CTY_02	Separate	238	238	Chester City
Penn Street Interceptor	PS1	CSS	3	13	Chester City
	PS3	CSS	10		Chester City
Ridley Creek Interceptor	RC1	CSS	3	2,327	Chester City
	CH_CTY_03	Separate	276		Chester City
	33A	Separate	9		Chester City
	CH_CTY_04	Separate	137		Chester City
	CH_CTY_05	Separate	124		Chester City
	CH_CTY_06	Separate	44		Chester City
	CH_CTY_07	Separate	44		Chester City
	BR_TWP_6	Separate	327		Brookhaven Boro
	NP_TWP_2	Separate	991		Nether Providence Twp
	PA_BORO_2	Separate	71		Parkside Boro
	BR_TWP_3	Separate	236		Brookhaven Boro
	BR_TWP_4	Separate	21		Brookhaven Boro
	BR_TWP_5	Separate	44		Brookhaven Boro
Stony Creek Interceptor	SC1	CSS	54	54	Chester City
West End Interceptor	DR1A	CSS	8	1,023	Chester City
	DR1C	CSS	7		Chester City
	CH_CTY_10	CSS	11		Chester City
	TR_BORO_1	Separate	669		Trainer Boro
	CH_TWP_3	Separate	245		Chester Twp
	UC_TWP_2	Separate	51		Upper Chichester Twp
	BS2	CSS	22		Chester City
	BS3	CSS	10		Chester City
Delaware River Interceptor	DR1B	CSS	3	332	Chester City
	CH_CTY_01	Separate	329		Chester City
Eddystone Pump Station	EDD_BORO_1	Separate	664	664	Eddystone Boro
Central Delaware Pump Station	RI_TWP_1	Separate	2,806	18,806	Ridley Twp
	RP_BORO_1	Separate	679		Ridley Park Boro
	RU_BORO_1	Separate	90		Rutledge Boro
	SP_TWP_1	Separate	2,208		Springfield Twp
	SW_BORO_1	Separate	898		Swarthmore Boro
	UPR_TWP_1	Separate	1,722		Upper Providence Twp
	PR_BORO_1	Separate	477		Prospect Park Boro
	MO_BORO_1	Separate	238		Morton Boro

CSO Regulator/Interceptor/ Pump Station	Subarea	Collection System Type	Area/Subarea (ac)	Total Area (ac)	Municipality
	NE_TWP_1	Separate	3,422		Newtown Twp
	NP_TWP_1	Separate	1,927		Nether Providence Twp
	EDG_TWP_1	Separate	735		Edgmont Twp
	MA_TWP_1	Separate	3,604		Marple Twp
Chester Ridley Creek Pump Station	UC_TWP_3	Separate	192	14,513	Upper Chichester Twp
	UPR_TWP_2	Separate	248		Upper Providence Twp
	RV_BORO_1	Separate	471		Rose Valley Boro
	NP_TWP_3	Separate	110		Nether Providence Twp
	AS_TWP_1	Separate	3,732		Aston Twp
	CH_TWP_4	Separate	593		Chester Twp
	EDG_TWP_2	Separate	258		Edgmont Twp
	MI_TWP_1	Separate	8,612		Middletown Twp
	BR_TWP_7	Separate	156		Brookhaven Boro
	CH_BORO_1	Separate	141		Chester Heights Boro
Marcus Hook Pump Station	LC_TWP_1	Separate	700	1,401	Lower Chichester Twp
	MH_BORO_1	Separate	701		Marcus Hook Boro
Naamans Creek Pump Station	BE_TWP_1	Separate	2,500	6,528	Bethel Twp
	UC_TWP_1	Separate	4,028		Upper Chichester Twp

Table 3-2: CSO Regulator Information

CSO Regulator No.	CSO Regulator Location	CSO Receiving Water	Latitude	Longitude	CSO Regulator Type	Regulator Replacement Status
002	Front & Booth	Delaware River	39°49'30"N	75°23'31"W	Brown & Brown	Replaced 2010
003	Front & Highland	Delaware River	39°49'34"N	75°23'11"W	Brown & Brown	Replaced 2010
004	Front & Hayes	Delaware River	39°50'36"N	75°23'07"W	McNulty	In Progress; Anticipated Completion Fall 2017
005	Front & Townsend	Delaware River	39°49'46"N	75°22'53"W	Brown & Brown	Replaced
007	Delaware & Reaney	Delaware River	39°49'51"N	75°22'45"W	Brown & Brown	Replaced
008	2nd & Tilghman	Delaware River	39°50'05"N	75°22'22"W	Brown & Brown	Replaced
009	2nd & Lloyd	Delaware River	39°50'14"N	75°22'10"W	Brown & Brown	Replaced
010*	5th & Pusey	Delaware River	39°50'26"N	75°22'19"W	Brown & Brown	Replaced
011	2nd & Parker	Delaware River	39°50'26"N	75°21'54"W	Brown & Brown	Replaced
012	2nd & Edgmont	Chester Creek	39°50'42"N	75°21'38"W	Brown & Brown	Replaced
013	2nd & Welsh	Delaware River	39°50'37"N	75°21'17"W	Brown & Brown	Replaced
014	3rd & Upland	Delaware River	39°50'50"N	75°21'05"W	Brown & Brown	Replaced
015	4th & Melrose	Ridley Creek	39°51'03"N	75°20'48"W	Brown & Brown	2022
016	8th & McDowell	Ridley Creek	39°51'15"N	75°20'53"W	Brown & Brown	Replaced
017	9th & Campbell	Ridley Creek	39°51'16"N	75°20'51"W	Brown & Brown	2021
018	Sun Dr. & Hancock	Ridley Creek	39°51'47"N	75°20'57"W	Brown & Brown	Scheduled for 2017
019	14th & Crozer Hospital	Chester Creek	39°51'24"N	75°21'54"W	Brown & Brown	2024
020	Kerlin & Finland	Chester Creek	39°51'24"N	75°22'27"W	Brown & Brown	Replaced
021	9th & Sproul	Chester Creek	39°51'08"N	75°21'49"W	Brown & Brown	Replaced
022	6th & Sproul	Chester Creek	39°50'56"N	75°21'47"W	Brown & Brown	Replaced
023	3rd & Edgmont	Chester Creek	39°50'45"N	75°21'42"W	Brown & Brown	Replaced
024	3rd & Dock	Chester Creek	39°50'44"N	75°21'43"W	Brown & Brown	Replaced
025	5th & Penn	Chester Creek	39°50'49"N	75°21'50"W	Brown & Brown	Replaced

CSO Regulator No.	CSO Regulator Location	CSO Receiving Water	Latitude	Longitude	CSO Regulator Type	Regulator Replacement Status
026	7th & Penn	Chester Creek	39°50'58"N	75°21'55"W	Brown & Brown	Replaced
032	2nd & Avenue of the States	Delaware River	39°50'34"N	75°21'25"W	No CSO Regulator	Removed Mechanisms
033	Elkington Blvd. and Ridley Creek	Ridley Creek	39°52'22"N	75°22'29"W	No CSO Regulator	See Notes
Notes: - CSO Regulator 010 discharges at Outfall 009. - CSO Regulators 006 ad 007 have been disconnected from CSS and removed from NPDES permit - CSO Regulator 033 has been disconnected from the CSS but had not been removed from NPDES permit at the date of this Report						

replacement of the mechanism, installation of a monitoring system to determine if flow is passing over the CSO regulator diversion weir to the outfall, and conversion of the CSO regulators to Type A. After installation of the first CSO regulator monitoring systems, DELCORA determined that the monitoring system improves system operation and significantly reduces dry-weather overflows by notifying operators at the WRTP that flow is passing over the diversion weir. (If it is not raining, this notification is indication of a dry-weather overflow and DELCORA dispatches a maintenance crew to correct the situation.) After this determination, DELCORA installed the monitoring system on all CSO regulators even though it was not required until the CSO regulator was replaced. DELCORA continues to use this system and it provides critical information to maintain proper operation of the CSO regulators.

As indicated in Table 3-2, the majority of the City's CSO regulators are Brown & Brown type regulators. The original CSO regulators were Type B regulators in which the regulator gate position is controlled by the level in the trunk sewer entering the CSO regulator chamber. As part of its regulator replacement program DELCORA is replacing the regulators with Type A regulators in which the gate position is controlled by the level in the interceptor. This allows for the interceptor to operate at full capacity thus maximizing amount of flow being sent to the WRTP for treatment. Flow that cannot enter the interceptor because it is at capacity, passes over the CSO regulator diversion weir and into the outfall for release to the receiving water.

The updated model includes twenty-five[1] (25) CSO regulators, which were modeled as weirs and orifices. The configuration of CSO regulators was obtained from both record drawings and field surveys.

3.5.3.1 Flow Diversion Structure Components

The key components required for modeling these structures include float-operated gates, orifice plates and diversion weirs. Schematic representations of the flow diversion structures are shown in Figure 3-5. Table 3-2 lists basic information for each of DELCORA's 26 CSO regulators. Appendix A contains the data collected for each CSO regulator structure in the collection system that was utilized in the updated H&H Model. Appendix A, Table A-1, shows the invert elevation of the outfall pipe at the regulator and the invert elevation of the outfall pipe at the receiving stream.

Regulator Gates

Characteristics of the regulator gates were obtained from as-built drawings and field surveys. The gates are rectangular, covering rectangular openings except at Regulator #004, which is circular. The gates open and close based on their associated floats. Settings for opening and closing of the gates based on levels in the float chamber and regulator limit settings were obtained as part of the characterization survey. All regulator gates are modeled as side-type orifices and have been assigned a discharge coefficient of 0.65. For cases where the regulator float and gate have been removed, dry weather flow and some portion of the wet weather flow will pass through the opening previously covered by the now removed gate. Flow through this opening will be modeled as an orifice. When weather flow exceeds the capacity of the orifice, the level in the sewer will continue to rise until it is high enough for a portion of the flow to pass over the weir and discharge through the associated outfall. Regulator gate ID is named according to the CSO regulator points. For example, the regulator gate for CSO regulator 003 is named "REG_003_Gate." A summary of regulator gate characteristics is shown in Appendix A, Table A-2.

Orifices

Most of the regulators include an orifice between the regulator gate and the downstream interceptor. All orifices in the collection system are side orifice type, rectangular in shape and were assigned a discharge coefficient of 0.65. The dimensions are based on record drawings.

A summary of the orifice data used in the model is contained in Appendix A, Table A-3. The updated H&H model has 20 orifices. All orifices are side type and are rectangular in shape. Regulators 004, 015, 017 018 and 032 do not have an orifice plate. Regulators 006, 027 and 033 are no longer connected to the CSS and therefore do not have any orifices, weirs or outfalls included in the H&H model. The orifice ID used in the H&H model is named according to the CSO overflow points. For example, the orifice for CSO 03 is named "REG_03_Orifplate".

Weirs

Characteristics for the diversion weirs were obtained from record drawings and were field verified as necessary. All weirs were found to be of the transverse type with no end contractions. All weirs are assigned a discharge coefficient of 3.33. Weir ID will be named according to the CSO overflow points. For example, the weir for CSO 03 will be named "Weir_03". A summary of the weir data used in the model is contained in Appendix A, Table A-4.

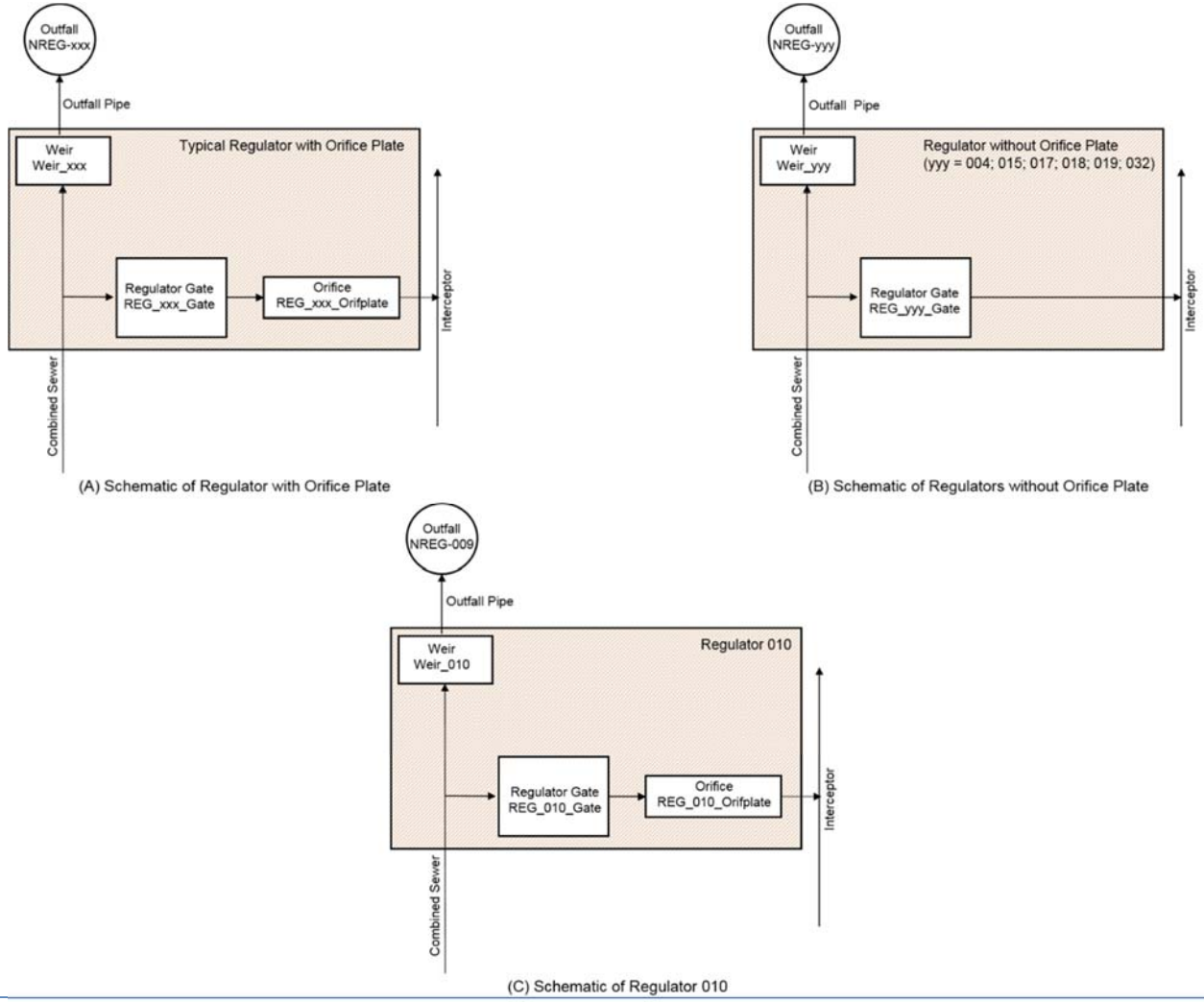
3.5.4 Interceptors

The interceptors convey flow from the CSO regulators to the WRTP or to the Chester Pump Station, which discharges directly to the WRTP. The interceptors shown on Figure 2-3 vary in size from 24" to 72" in diameter. Any flow entering the interceptor system will eventually reach the WRTP for treatment.

Figure 3-3 is a schematic of the Chester CSO system and shows the outfalls and the interceptors that are connected to each CSO. Specifically as diagrammed in Figure 3-3, the relationship between DELCORA's interceptors and outfalls are as follows:

- The Delaware River Interceptor conveys dry weather flow and a portion of wet weather flow from CSO Service Areas 002, 003, 004, 005 and 007 into the Booth Street Interceptor that then leads to the WRTP.
- The Second Street Interceptor conveys dry weather flow and a portion of wet weather flow from CSO Service Areas 008, 009, 011 and 024 to the Chester Pump Station, which is then pumped to the WRTP.
- The West End Interceptor conveys dry weather flow and a portion of wet weather flow from CSO Service Area 010 into the Booth Street Interceptor and then to the WRTP.
- The Ridley Creek Interceptor conveys dry weather flow and a portion of wet weather flow from CSO Service Areas 012, 013, 014, 015, 016, 017, 018 and 032 to the Chester Pump Station, which pumps the flow to the WRTP.

Figure 3-5: Flow Diversion Structure Schematic



- The Edgmont Avenue Interceptor conveys dry weather flow and a portion of wet weather flow from CSO Service Areas 021, 022 and 023 into the Ridley Creek Interceptor and from there to the Chester Pump Station and then to the WRTP.
- The Chester Creek East Interceptor and the Chester Creek West Interceptor respectively convey the dry weather flow and a portion of the wet weather flow from CSO Service Areas 019 and 020. These two interceptors then both flow into the Penn Street Interceptor that also conveys the dry weather flow and a portion of wet weather flow from CSO Service Areas 025 and 026 to the Chester Pump Station, which pumps the flow to the WRTP.

3.5.5 CSO Outfalls

Outfalls are the discharge points at the receiving streams. The outfalls can either be free outfalls without any boundary conditions or the outfalls can have a boundary condition that the head needs to overcome for outflow to occur. The outfalls in the DELCORA's collection system are mostly in the tidal river reach. Therefore, appropriate tidal stages from NOAA data were used to set boundary conditions. Outfalls can have a flap gate or other backflow device at the end to prevent backflow.

CSO outfalls will be simulated as outfall nodes in the model. Outfall ID will be named according to the CSO regulator overflow points. For example, the outfall for CSO regulator 002 will be named "NREG-002". The inverts of outfalls were estimated based on record drawings and design drawings.

A summary of the outfall data used in the model is contained in Appendix A, Table A-5. One regulator (Regulator 010) does not have its own outfall, but rather discharges through the same outfall (Outfall 009) as Regulator 009. Also, Regulator 033 has been disconnected from the CSS and, therefore, its outfall is not included in the updated H&H model. As a result, there are a total of 25 CSO outfalls in the updated H&H model.

3.5.6 Drainage Areas and Subcatchments

Each of the 25 CSO regulators has a unique drainage area associated with it. A CSO drainage area is defined as the entire surface area contributing overland wet weather flow to a specific CSO. Subcatchments are smaller drainage basins located within the overall CSO drainage area. Subcatchments are more useful when developing a model, because the area is smaller and it becomes more site-specific. Subcatchment boundaries were determined from sewer system maps and local topography. GIS software was then used to estimate the acreage within a subcatchment boundary. There are a total of 53 subcatchments within DELCORA's 25 drainage areas of the CSS. An overall configuration of the CSS drainage areas is presented in Figure 3-4. This figure shows the boundaries of each of the 25 CSO regulator drainage areas (subcatchments), as well the combined and separated portions of these service areas. Table 3-1 presented a listing of the subcatchment areas associated with each CSO regulator, and the type of collection system (CSS or separated) within the subcatchment.

3.5.7 Percent Imperviousness

Areas that are impervious to rainfall infiltration, like pavement and rooftops, generate the most runoff in urban settings. Percent imperviousness is the fraction or percentage of a particular subcatchment that is covered by impervious materials like parking lots, streets, and rooftops. The percent of directly

connected impervious area is the ratio of hydraulically connected impervious areas (parking lots, streets, etc.) to the total subcatchment area. Directly connected impervious areas are effectively connected to the sewer collection system. As a result, runoff from these areas is completely captured by the collection system. Runoff from the rest of the impervious area is deemed not to be captured by the system due to various potential reasons including, but not limited to, drains to pervious areas/creeks/streams, limited number and capacity of stormwater inlets, and bypassing. For model construction, the percent imperviousness was calculated using the high resolution land cover raster published by the Chesapeake Conservancy (Chesapeake Conservancy, 2017) as well as the land use shapefile published in 2015 by the Delaware Valley Regional Planning Commission as the initial inputs. Then, the impervious percentage values were adjusted during the model calibration process (see Section 7) to best simulate the observed hydrologic response over the selection of precipitation events.

For the separated areas within the City of Chester, the initial percent imperviousness was set at 0% because the impervious area in the separated area is not contributing runoff to the CSS, therefore it is not effectively connected. Subcatchment parameters mentioned hereafter were set at default values for the separated subcatchments.

3.5.8 Depression Storage

Depression storage is the rainfall abstraction volume that must be filled prior to the occurrence of runoff. It represents the loss (initial abstraction) caused by surface ponding, surface wetting, etc. The initial values of depression storage were set to 0.05 for impervious surfaces and 0.15 for pervious surfaces. Typical depression storage values are 0.05-0.10 for impervious surfaces and 0.10-0.30 for pervious surfaces. Depression storage is an empirical value and may be treated as a calibration parameter, especially to adjust runoff volumes.

In the model, the subcatchment was divided into three subareas: pervious area with depression storage, impervious area with depression storage, and impervious area without depression storage. The initial percent of the impervious area without depression storage was set to 0.10.

3.5.9 Soil Infiltration Parameters

Soil information is needed to estimate infiltration in the pervious areas of the CSS. The rate of infiltration is a function of soil properties and antecedent soil conditions. Infiltration parameters influence the runoff hydrograph from the combined sewer system subcatchments by absorbing rainfall into the soil. The infiltration capacity of the soil is exceeded when the soil becomes saturated during continuous simulation and heavy precipitation. When soil saturation is reached, most of the subsequent rainfall becomes runoff making the pervious areas behave as impervious areas.

Three infiltration methods are available in the software: the Horton method, Green-Ampt method, or Natural Resources Conservation Service (NRCS) Curve Number method. The Horton method has been extensively used for similar type of modeling work and it was used in this modeling effort to estimate infiltration. The required soil parameters for Horton method include:

- Maximum Infiltration rate (in/hr)
- Minimum Infiltration Rate (in/hr)

- Decay Constant (/hr)
- Drying time (d)
- Maximum Infiltration Volume Possible (inch)

To determine the Horton infiltration parameters, a soil map was first obtained from the NRCS (USDA, 2017). The soil types were then correlated to standard hydrologic soil groups.[4] A map of the hydrologic soil groups found in the CSS is presented in Figure 3-6. Hydrologic soil groups found in DELCORA's CSS are groups A, B, C, B/D and C/D. Horton's infiltration parameters for these soil groups were estimated based on typical values from literature and are shown in Table 3-3.

Table 3-3: Horton Infiltration Parameters

Horton Infiltration Parameter	Soil A	Soil B	Soil C	Soil B/D	Soil C/D
Max Infiltration Rate (in/hr)	5	3	2	2	1.5
Min Infiltration Rate (in/hr)	1.18	0.43	0.2	0.22	0.06
Decay Constant (1/hr)	4	4	4	4	4
Drying Time (d)	2	3	8	8	10.5
Max Volume (in)	14	13.2	12.5	9.8	7.0

3.6 Collection System Pump Stations and Force Mains

Major pump stations in the Western Service Area and the Central Delaware Pump Station in the Eastern Service Area were added to the updated model, as well as force mains connecting the pump stations to the WRTP. The list of the pump stations included in the H&H Model is as follows:

- Chester PS (CPS)
- Existing PS-1 (EPS-1)
- Marcus Hook PS (MHPS)
- Naamans Creek PS (NCPS)
- Eddystone PS (EDPS)
- Central Delaware PS (CDPS)
- Chester Ridley Creek PS (CRPS)
- Sun Oil PS (Owned by Sunoco) (SPS)
- Kimberly Clark PS (Owned by KC) (KCPS)

[4] Soil types can be categorized into standard hydrologic soil groups A, B, C and D, with group A having the lowest runoff potential and group D having the highest runoff potential. Dual rated groups are group D in their natural state, but can behave according to the first letter if the area is drained. Additional information regarding hydrologic soil group descriptions can be found in the Appendix.

The following pump stations were excluded from the H&H Model:

- Price & Smith Street Trainer PS
- Stadium PS

Flow from the Price & Smith Street Trainer PS discharges to the downstream existing PS-1 Pump Station (EPS-1) where it is re-pumped. The updated H&H model assumes that all flow from subcatchments associated with the Price and Smith Street Trainer PS can be treated as an input to EPS-1.
Flow from the Stadium PS is sanitary sewage with no wet weather flow. The Stadium PS discharges flow only during events held at the stadium. Due to the limited flow, its sporadic nature and the lack of wet weather flow, the Stadium PS is expected to have negligible effect on the wet weather capacity of the CSS. Therefore, the Stadium PS was not included in the H&H Model.

DELCORA owns or operates a number of lift stations that contribute to the Western Service Area and whose flows are handled by the above list of pumps stations. It was determined that the behavior of these lift stations would not require modeling and that inflow can be assumed to equal outflow to the downstream conduit.

Figure 3-7 presents a map of the pump stations that are included within the updated H&H model.

3.6.1 Force Mains

DELCORA's Model Area include several force mains to convey flow from various pump stations to the WRTP.

- Chester Force Main
- Central Force Main
- Chester-Ridley Creek Force Main
- Naaman's Creek Force Main
- Marcus Hook/Sun Oil Force Main
- Eddystone Force Main
- Kimberly Clark Force Main.
- Existing Pump Station Force Main

The 40-MGD Chester Pump Station discharges to the Chester Force Main which then runs to the WRTP as a 54-inch diameter ductile iron force main.

The Central Delaware Pump Station (CDPS) discharges through two force mains, one of which connects to the Model Area and the WRTP while the other delivers flow to PSWPCP. The force main to the Model Area is referred to as the Central Force Main and is a 3.4-mile, 24-inch ductile iron force main which subsequently connects to the Chester Force Main. This connection allows DELCORA to send up to 27 MGD of flow from the CDPS to the WRTP, however, DELCORA's operating policy limits this flow to 20 MGD, with flows above this point to be directed to PSWPCP. Only the force main connecting to the Model Area is included in the updated H&H model.

A schematic representation showing the force mains can be found in Figure 3-3. A map showing the location of the force mains is depicted in Figure 3-8.

Figure 3-6: Hydrologic Soil Groups for CSS Area

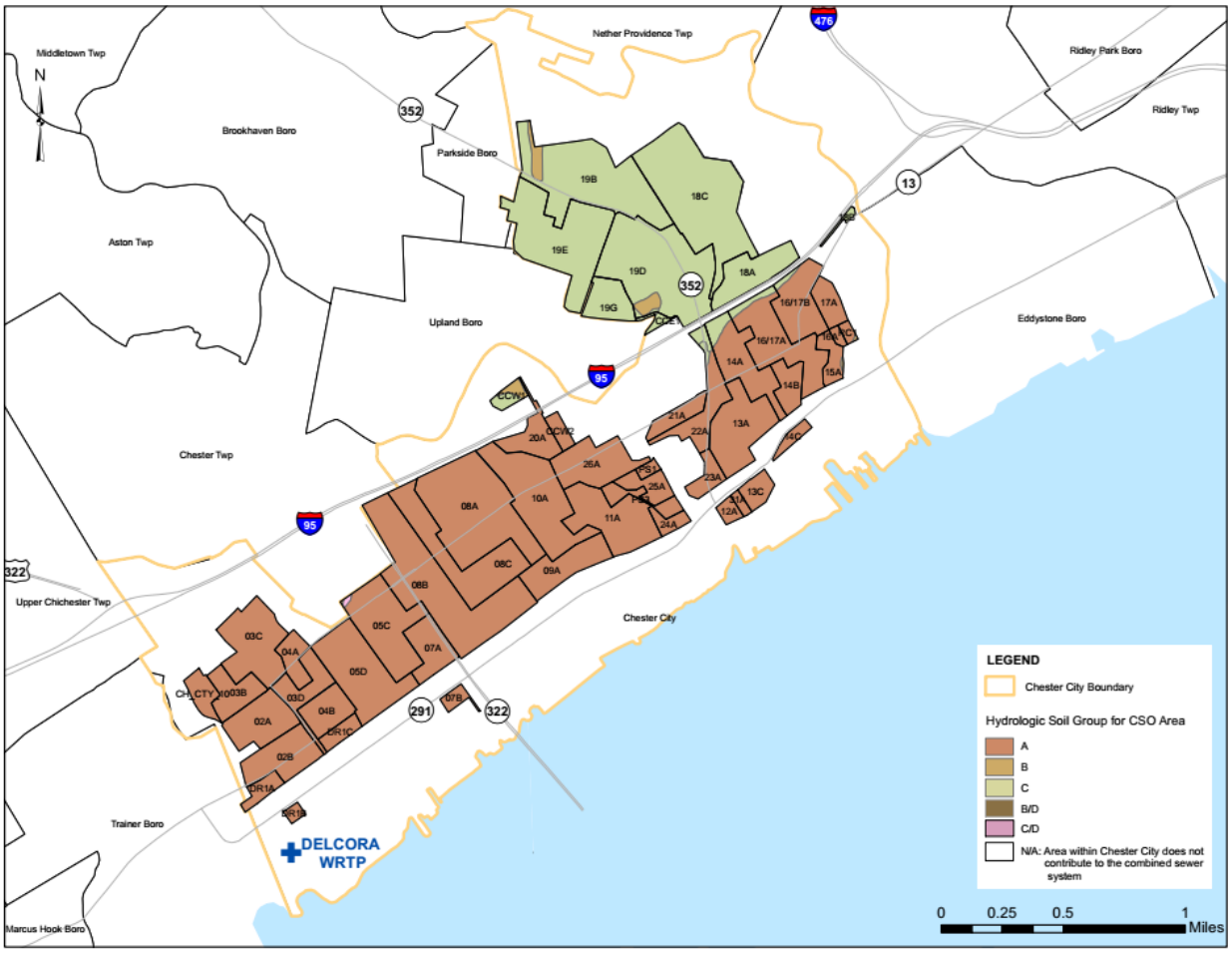


Figure 3-7: Pump Stations Included in the H&H Model

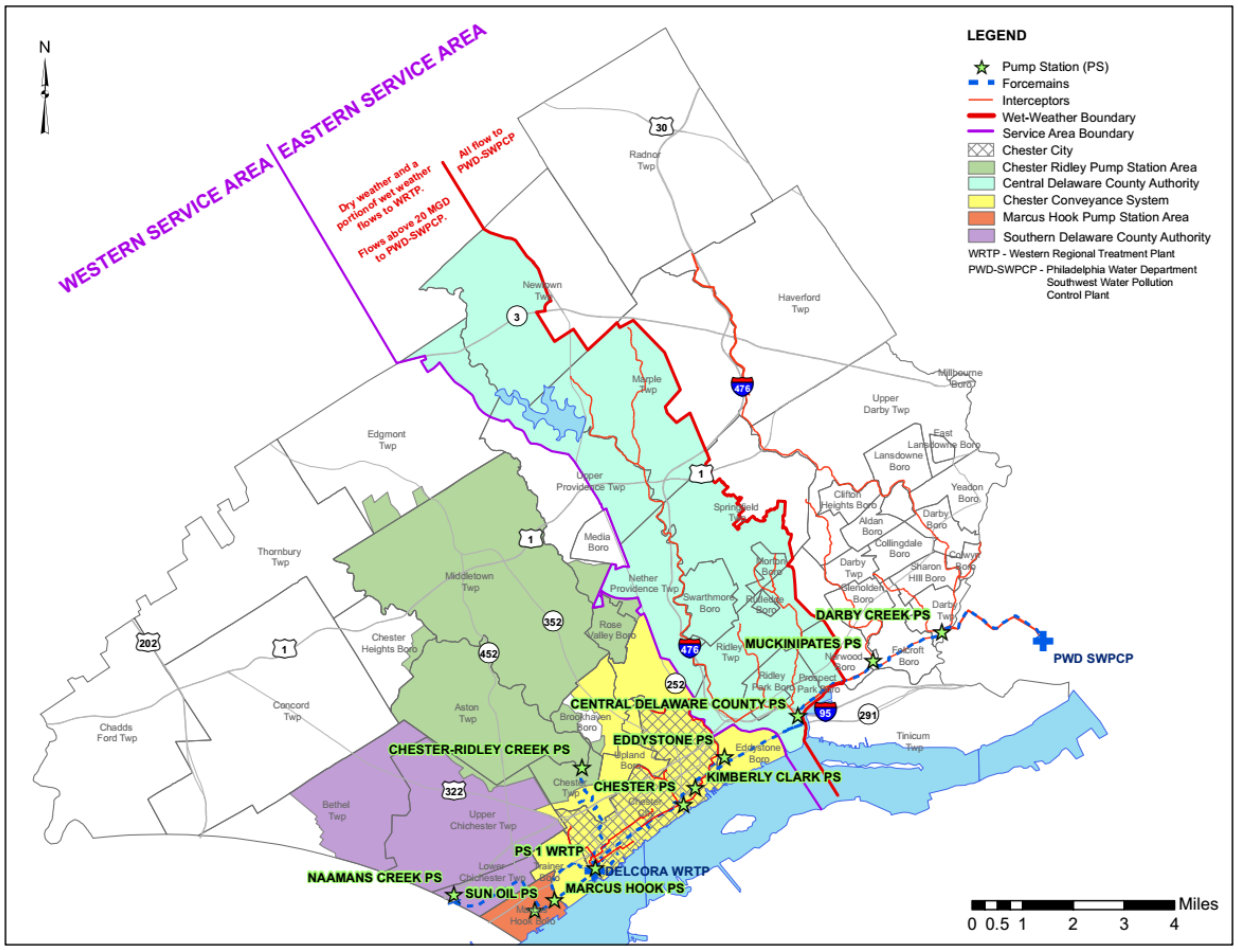
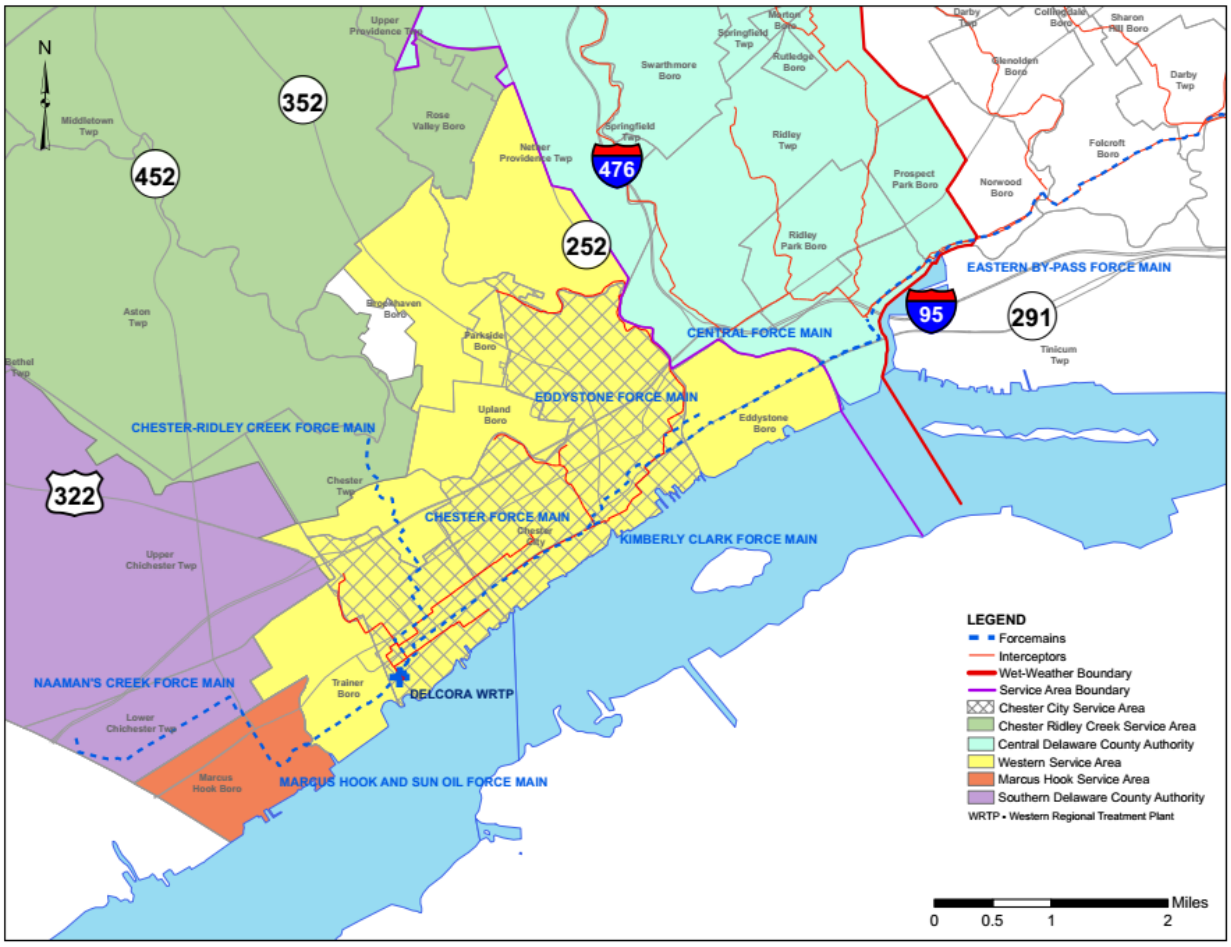


Figure 3-8: Force Mains



Section 4 Collection of Precipitation and Sewer Flow Data

4.1 Introduction

This section presents information on the collection of precipitation and sewer flow data to meet the requirements of Section V.A.14.d of the Consent Decree, and Paragraphs II.A.C.1.a and b of the USEPA's CSO Control Policy. Section V.A.14.d of the Consent Decree requires DELCORA to conduct rainfall monitoring in accordance with current good industry practice for a period of at least (12) months.

The rainfall and flow monitoring program was developed to provide adequate data for the development, calibration and validation of the H&H Model. The goals of this program were met by collecting rainfall and flow monitoring data for just over 12 months, from March 18, 2016 to April 4, 2017. Rainfall and flow monitoring data were collected on a monthly basis with quarterly reports were submitted to US EPA on August 28, 2016; November 1, 2016; February 1, 2017; and May 1, 2017. DELCORA considers Consent Decree requirements to be met due to no comments from US EPA and PA DEP.

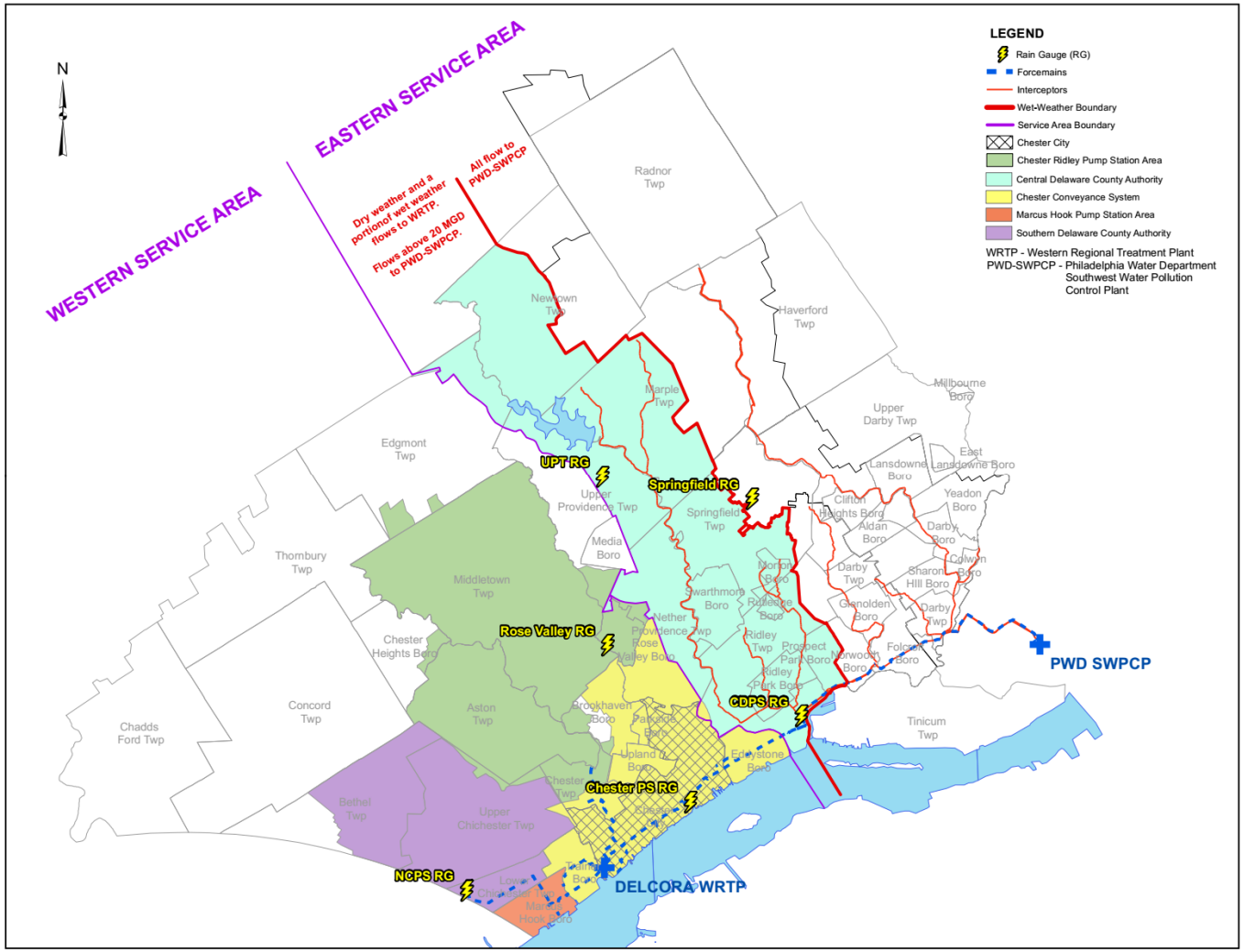
After it was carefully reviewed and analyzed, the data was deemed adequate to facilitate the development, calibration and validation of the H&H Model. This section contains a summary of the rainfall and flow monitoring program and discusses the network of rainfall and flow monitoring instrumentation, outlines the monitoring program, and describes how the data collected for the rainfall and flow monitoring program was analyzed for use in the H&H Model calibration and validation. Additional details can be found in the rainfall and flow monitoring quarterly reports, in the *Hydrologic and Hydraulic Model Update and Calibration Plan* (Greeley and Hansen, 2015), and in the *Sewer System Hydrologic and Hydraulic Model Report* (Greeley and Hansen, 2017c).

4.2 Rainfall Monitoring and Analysis

A total of six (6) rain gauges were used for the monitoring program. As depicted in Figure 4-1, the gauges are stationed at the following locations:

- Rose Valley
- Chester Pump Station (CPS)
- Naaman's Creek Pump Station (NCPS)
- Springfield
- Upper Providence Township (UPT)
- Central Delaware County Pump Station (CDPS)

Figure 4-1: Rain Gauge Locations



Five out of six of the gauges provided data at 5 minute intervals. One rain gauge provided data on 15-minute intervals. The gauge rainfall data from the six rain gauges installed throughout the DELCORA service area was analyzed and used to:

- Document rainfall and flow monitoring locations,
- Overview flow monitoring data quality,
- Analyze rainfall data to identify dry weather and wet weather conditions and to characterize individual rainfall event for precipitation depth, duration, maximum intensity, and return frequency,
- Analyze flow data to determine dry weather flow and diurnal pattern, wet weather flow and peak factor, and system response to wet weather events, and
- Determine the wet weather events for H&H Model calibration and validation.

An inter-event time of 48 hours was used to identify individual rainfall events. The inter-event time specifies the minimum duration in which precipitation does not occur. Based on this criterion, a dry weather time period and the number of total rainfall events were identified. The rainfall events during the flow monitoring periods had a wide variation in terms of total depth, intensity, duration, and antecedent conditions to provide a large dataset for balanced model calibration and validation.

4.3 Rain Event Summary

The rainfall events were characterized by event start time, event end time, rainfall depth, duration, maximum intensity, and return frequency. As an initial screening criterion, rainfall events with a minimum of 0.9 inches of rainfall were identified. Further screening based on requiring at least two dry days prior to the event resulted in an initial list of ten (10) candidate events for calibration and validation as listed in Table 4-1 below.

Table 4-1: Top 10 Rainfall Events

Event	Event Start	Event End	Chester-PS Rainfall (in)	Duration (hr)	Max Intensity (in/hr)
E1	5/29/16 19:00	5/30/16 5:00	1.82	11.00	0.78
E2	9/28/16 12:00	9/30/16 10:00	2.36	47.00	0.37
E3	11/29/16 7:00	11/29/16 20:00	1.08	14.00	0.21
E4	3/30/17 21:00	4/1/17 3:00	1.83	31.00	0.25
E5	5/21/16 11:00	5/22/16 21:00	1.71	35.00	0.33
E6	7/28/16 15:00	7/29/16 9:00	1.26	19.00	0.74
E7	9/19/16 8:00	9/19/16 16:00	0.96	9.00	0.42
E8	3/13/16 18:00	3/14/16 14:00	1.08	21.00	0.25
E9	5/6/16 4:00	5/7/16 11:00	1.18	32.00	0.24
E10	10/8/16 14:00	10/9/16 11:00	1.00	22.00	0.15

4.4 Gauge-Adjusted, Radar Estimated Precipitation

According to the Consent Decree, rainfall data to be used for calibration and validation of the model *"…shall be obtained at a minimum effective density of 1 gauge/virtual radar-based gauge per kilometer"*. In order to achieve this density, Gauge-Adjusted Radar Rainfall (GARR) was employed. The rain gauges used to complete the flow monitoring program and choose the wet weather events used in calibration and validation were also used in the GARR analysis which provided effective spatial coverage of the entire Model Area. GARR data was provided for each of the subbasins in the Model Area. This rainfall data was input as a time series into the H&H Model for calibration and validation. An in-depth explanation of the use of GARR data in both the H&H Model and the Water Quality Model can be found in the *Sewer System Hydraulic and Hydrologic Report* and the *Water Quality Monitoring and Modeling Quality Assurance Project Plan*, respectively (Greeley and Hansen, 2017c), (Greeley and Hansen, 2017b).

4.5 Flow Monitoring

DELCORA owns and operates a flow monitoring network across the DELCORA Service Area. The monitoring network includes various types of flow meters located throughout DELCORA's Eastern Service Area and Western Service Area, at the WRTP, in each of the Pump Stations, and at the tie-in points where other municipal collection systems tie-into the collection system. Seven existing flow meters in the separated area (outside the CSO area), eight existing flow meters at pump stations and one existing flow meter at WRTP were used for the calibration and validation of the H&H Model. In addition, temporary flow meters were installed at 38 new locations to characterize surface runoff from the combined area and CSO discharges. The locations of flow meters installed specifically for the flow monitoring program and the H&H Model calibration and validation can be categorized into the following five categories:

1. Located on the influent pipe to CSO regulators, this is to measure the influent flow to CSO regulators and for combined area runoff calibration. Sixteen (16) meters were installed for this category.
2. Located on the effluent pipe and overflow pipe of CSO regulators, this is to measure the CSO overflows and calibrate CSO regulator parameters. Twelve (12) meters were installed for this category. They are on the effluent and overflow pipe of CSOs 02, 03, 05, 08, 14, & 19.
3. Located on the side-line from the combined areas (flows from the combined area tie into interceptor instead of CSO regulator). This is to measure flows from the combined area and to calibrate combined area runoff parameters. Two (2) meters were installed for this category.
4. Located upstream of the combined area, this is to measure flows from the upstream separated area for RDII characterization. Three (3) meters were installed for this category.
5. Located in the main interceptors to measure level and flows in the major interceptors. Five (5) meters were installed for this category.

Table 4-2 lists the flow meter locations and location categories of the meters. Figures 4-2 and 4-3 show the locations of the flow meters that were used for H&H Model calibration and validation. After initial installation of the new temporary flow meters, difficulties were encountered at Manhole MH3029. The site was severely surcharged during field investigation. Meanwhile it was found that at Manhole MH3002 (four manholes upstream of MH3029, approximately 800 feet upstream) another existing flow meter (Ridley Creek MH-28) was already installed for DELCORA. Instead of installing a new temporary flow meter around the site, the existing meter Ridley Creek MH-28 was used for the flow monitoring program.

Data was gathered from a total of 55 flow meters, 38 of which were newly installed as part of the flow monitoring program.

Table 4-2: Flow Monitoring Locations

Flow Meter	Approximate Location	Category
In-02	Influent pipe to CSO 02 Regulator	On the influent pipe to regulator
In-03	Influent pipe to CSO 03 Regulator	On the influent pipe to regulator
In-05	Influent pipe to CSO 05 Regulator	On the influent pipe to regulator
In-08	Influent pipe to CSO 08 Regulator	On the influent pipe to regulator
In-09	Influent pipe to CSO 09 Regulator	On the influent pipe to regulator
In-10	Influent pipe to CSO 10 Regulator	On the influent pipe to regulator
In-11	Influent pipe to CSO 11 Regulator	On the influent pipe to regulator
In-13	Influent pipe to CSO 13 Regulator	On the influent pipe to regulator
In-14	Influent pipe to CSO 14 Regulator	On the influent pipe to regulator
In-16	Influent pipe to CSO 16 Regulator	On the influent pipe to regulator
In-17	Influent pipe to CSO 17 Regulator	On the influent pipe to regulator
In-18	Influent pipe to CSO 18 Regulator	On the influent pipe to regulator
In-19-1	Influent pipe to CSO 19 Regulator (from East)	On the influent pipe to regulator
In-19-2	Influent pipe to CSO 19 Regulator (from West)	On the influent pipe to regulator
In-25	Influent pipe to CSO 25 Regulator	On the influent pipe to regulator
In-26	Influent pipe to CSO 26 Regulator	On the influent pipe to regulator
INT- 2nd St	2nd Street Interceptor	On the interceptor pipe
INT-DRI	Delaware River Interceptor	On the interceptor pipe
INT-Ridley 2	Ridley Creek Interceptor	On the interceptor pipe
INT-Ridley 3	Ridley Creek Interceptor	On the interceptor pipe
INT-West End	West End Interceptor	On the interceptor pipe
Side-1	Side line on Penn St. to 2nd St. Interceptor	On the side-line from the combined area
Side-2	Side line on Highland Ave. to West End Interceptor	On the side-line from the combined area
Sep-1	Upstream of the CSO 02 Drainage	On the separated area
Sep-2	Upstream of the CSO 05 Drainage	On the separated area
Sep-3	Upstream from Upland Borough	On the separated area
Sep-4 (Existing MH-28 after first quarterly report)	Upstream from Eastern Chester	On the separated area
CSO-02	Outfall pipe from CSO 02 Regulator	On the outfall pipe

Flow Meter	Approximate Location	Category
CSO-03	Outfall pipe from CSO 03 Regulator	On the outfall pipe
CSO-05	Outfall pipe from CSO 05 Regulator	On the outfall pipe
CSO-08	Outfall pipe from CSO 08 Regulator	On the outfall pipe
CSO-14	Outfall pipe from CSO 14 Regulator	On the outfall pipe
CSO-19	Outfall pipe from CSO 19 Regulator	On the outfall pipe
Eff-02	Effluent pipe for CSO-02 Regulator	On the effluent pipe
Eff-03	Effluent pipe for CSO-03 Regulator	On the effluent pipe
Eff-05	Effluent pipe for CSO-05 Regulator	On the effluent pipe
Eff-08	Effluent pipe for CSO-08 Regulator	On the effluent pipe
Eff-14	Effluent pipe for CSO-14 Regulator	On the effluent pipe
Eff-19	Effluent pipe for CSO-19 Regulator	On the effluent pipe
BR MH-1 (Existing)	Upstream from Brookhaven MH-1	On the separated area
BR MH-3 (Existing)	Downstream from Brookhaven MH-3	On the separated area
BR MH-5 (Existing)	Downstream from Brookhaven MH-5	On the separated area
BR MH-6 (Existing)	Downstream from Brookhaven MH-6	On the separated area
RC MH-26 (Existing)	Ridley Creek Interceptor	On the interceptor pipe
RC MH-30 (Existing)	Ridley Creek Interceptor	On the interceptor pipe
RC MH-32 (Existing)	Ridley Creek Interceptor	On the interceptor pipe
WRTP (Existing)	At WRTP	At WRTP

Figure 4-2: DELCORA Flow Meters

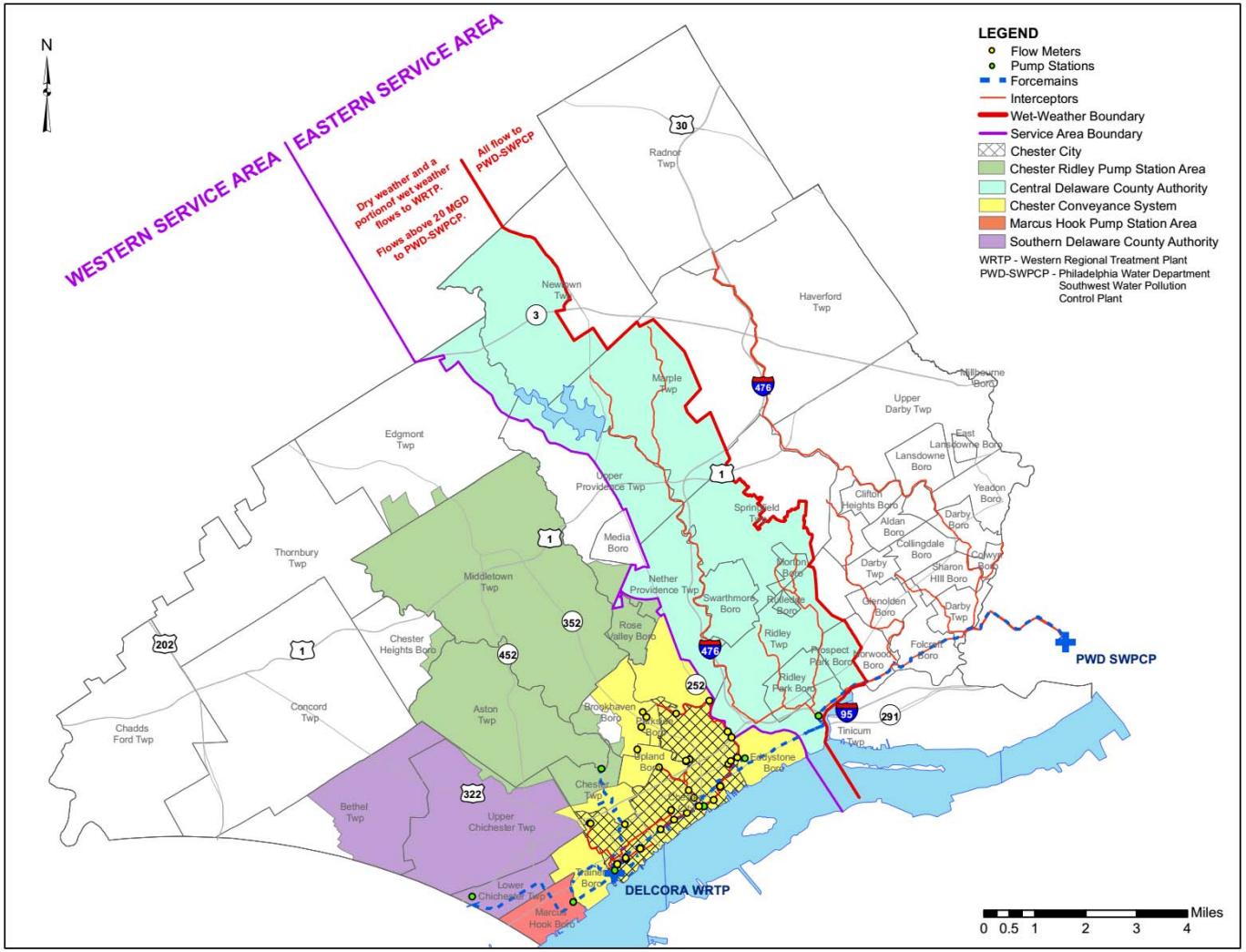
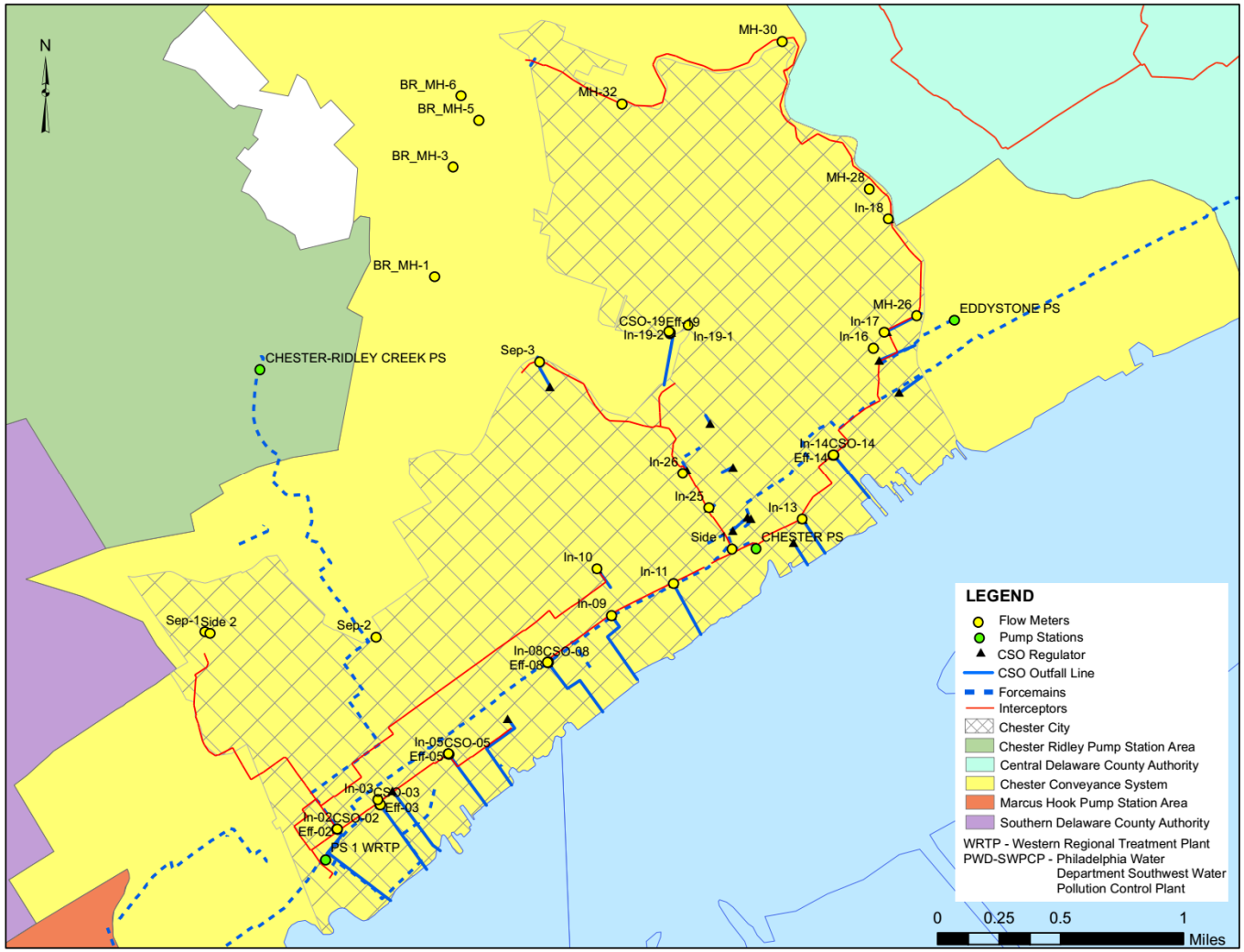


Figure 4-3: Enlarged Map of Flow Meters



The network of flow meters can be grouped to define metersheds where flow from a given area discharges through a common flowmeter. Subcatchments associated with each metershed are shown in Table 4-3 along with the associated metershed acreage. Rainfall and flow data gathered for each metershed will be used to calibrate the associated subcatchments in the H&H Model.

Table 4-3: Metersheds in the H&H Model

Metershed ID	Subcatchment ID	Metershed Area (ac)
BR_MH-1	BR_TWP_2	49
BR_MH-3	BR_TWP_3	236
BR_MH-5	BR_TWP_4	21
BR_MH-6	BR_TWP_5	44
In-02	02A	112
	02B	
	SC1	
In-03	03B	82
	03C	
	03D	
In-05	05C	161
	05D	
	CH_TWP_2	
In-08	08A	237
	08B	
	CH_CTY_12	
In-09	09A	27
In-10	10A	60
In-11	11A	44
In-13	13A	50
	13C	
In-14	14A	53
	14B	
	14C	
In-16	16A	2
In-16,In-17	16/17A	77
	16/17B	
In-17	17A	12
In-18	18A	130
	18B	

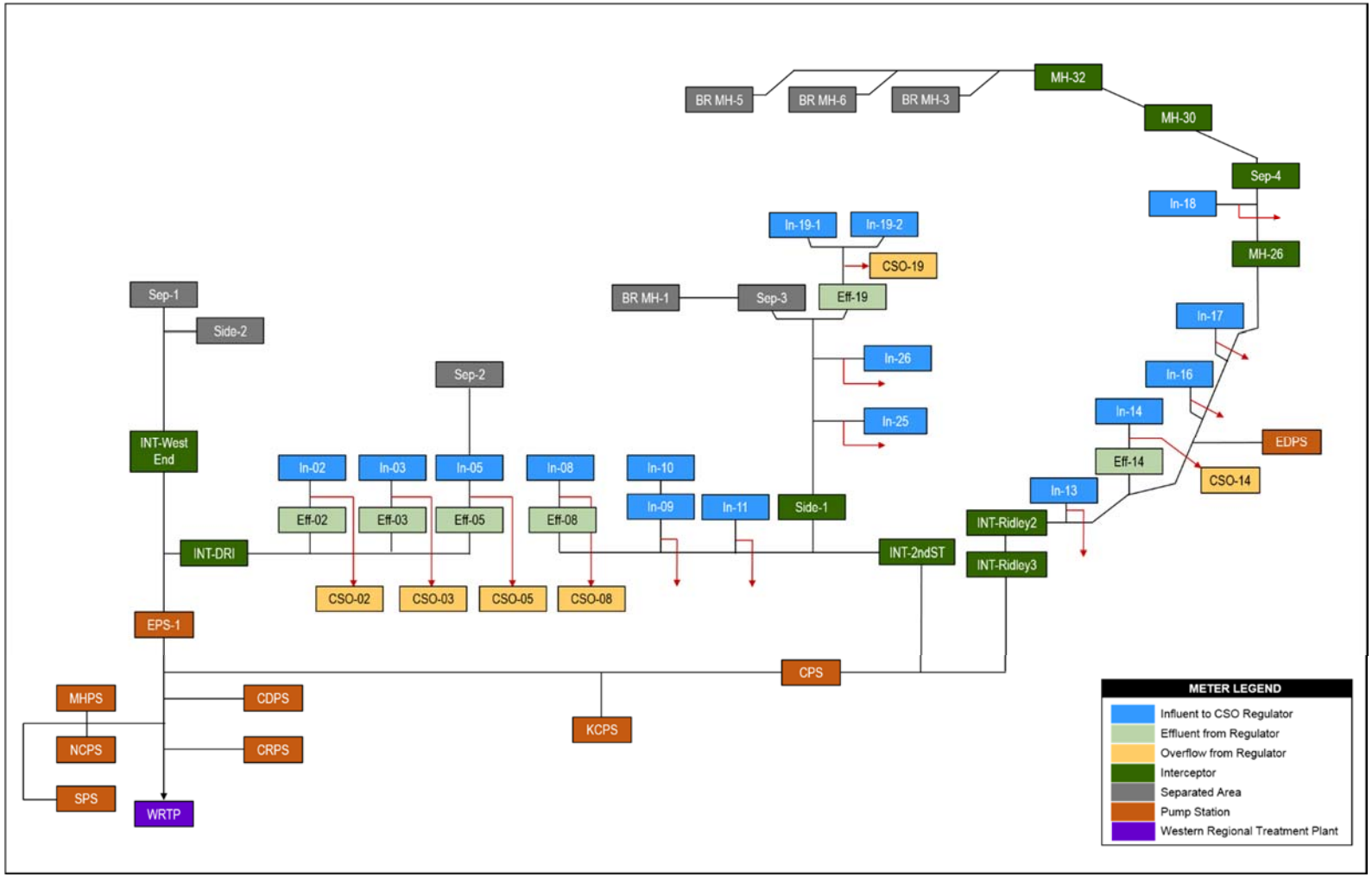
Metershed ID	Subcatchment ID	Metershed Area (ac)
	18C	
In-19-1	18C	327
	CH_CTY_08	
	19B	
	19D	
	PA_BORO_1	
In-19-2	19E	94
	19G	
In-25	25A	12
In-26	26A	37
	26B	
INT-2nd St	24A	6
INT-DRI	04A	57
	04B	
	07A	
	07B	
INT-Ridley 2	15A	16
	31A	
	RC1	
INT-Ridley 3	21A	53
	22A	
	23A	
	12A	
INT-West End	DR1A	26
	DR1C	
	CH_CTY_10	
MH-26	CH_CTY_07	44
MH-28 (Sep-4)	CH_CTY_04	137
MH-30	CH_CTY_06	1,035
	NP_TWP_2	
MH-32	PA_BORO_2	531
	33A	
	BR_TWP_6	
	CH_CTY_05	
Central PS (PS-1)	CH_CTY_02	514

Metershed ID	Subcatchment ID	Metershed Area (ac)
	CH_CTY_03	
Eddystone PS (PS-10)	EDD_BORO_1	664
Marcus Hook PS (PS-11)	LC_TWP_1	1,401
	MH_BORO_1	
Naamans Creek PS (PS-15)	BE_TWP_1	6,528
	UC_TWP_1	
Chester Ridley Creek PS (PS-24*)	EDG_TWP_2	14,513
	MI_TWP_1	
	NP_TWP_3	
	RV_BORO_1	
	UPR_TWP_2	
	AS_TWP_1	
	BR_TWP_7	
	CH_BORO_1	
	CH_TWP_4	
	UC_TWP_3	
Existing PS-1 (PS-3)	TR_BORO_1	1,001
	DR1B	
	CH_CTY_01	
Central Delaware PS Total and Central Delaware PS to WRTP (PS-7)	EDG_TWP_1	18,806
	MA_TWP_1	
	MO_BORO_1	
	NE_TWP_1	
	NP_TWP_1	
	PR_BORO_1	
	RI_TWP_1	
	RP_BORO_1	
	RU_BORO_1	
	SP_TWP_1	
	SW_BORO_1	
	UPR_TWP_1	
Sep-1	CH_TWP_3	296
	UC_TWP_2	
Sep-2	CH_CTY_09	45
	CH_TWP_1	

Metershed ID	Subcatchment ID	Metershed Area (ac)
Sep-3	BR_TWP_1	480
	CH_CTY_13	
	PA_BORO_3	
	UPL_BORO_1	
Side-1	20A	52
	CCE1	
	CCW1	
	CCW2	
	PS1	
	PS3	
	CH_CTY_11	
Side-2	BS3	32
	BS2	

A schematic of the collection system was created to facilitate the development, calibration and validation of the H&H Model and is shown below as Figure 4-4. The schematic illustrates the relationship between all major trunk sewers, force mains, interceptors, pump stations, and other major appurtenances. The schematic also includes the location of the flow meters, and provides and good understanding of the relationship between them. Figures of the diversion structure configurations were also developed to help give a better understanding of the collection system.

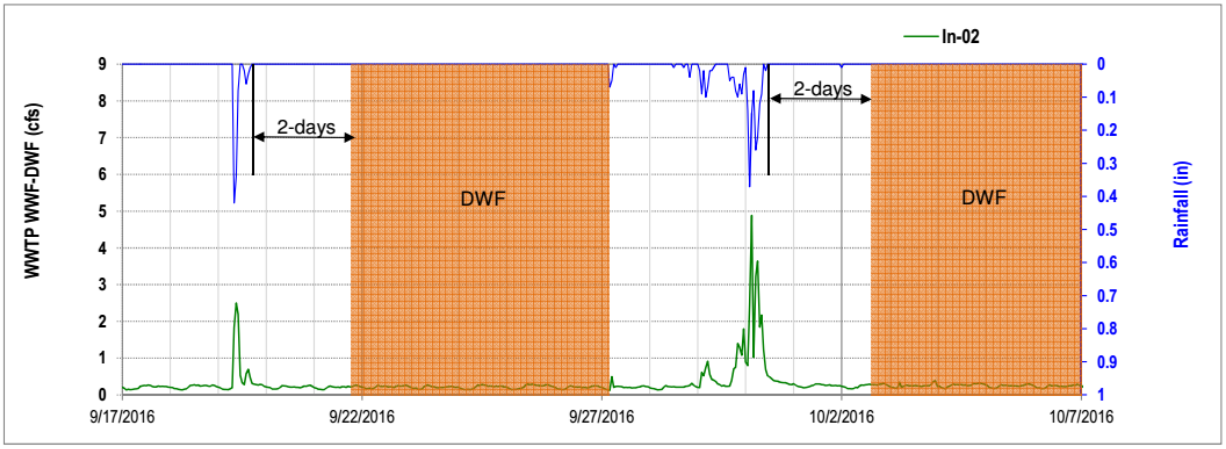
Figure 4-4: Flow Monitoring Schematic



4.6 Dry Weather Flow (DWF) Analysis

A "dry weather" condition was defined as a period with no precipitation that begins 48 hours after the last wet weather event ends and lasts until the beginning of the next precipitation event (i.e. the rain gauge read a 0.01 inch value). Dry weather flow (DWF) periods based on this definition are illustrated in the hydrograph shown in Figure 5-4**.**

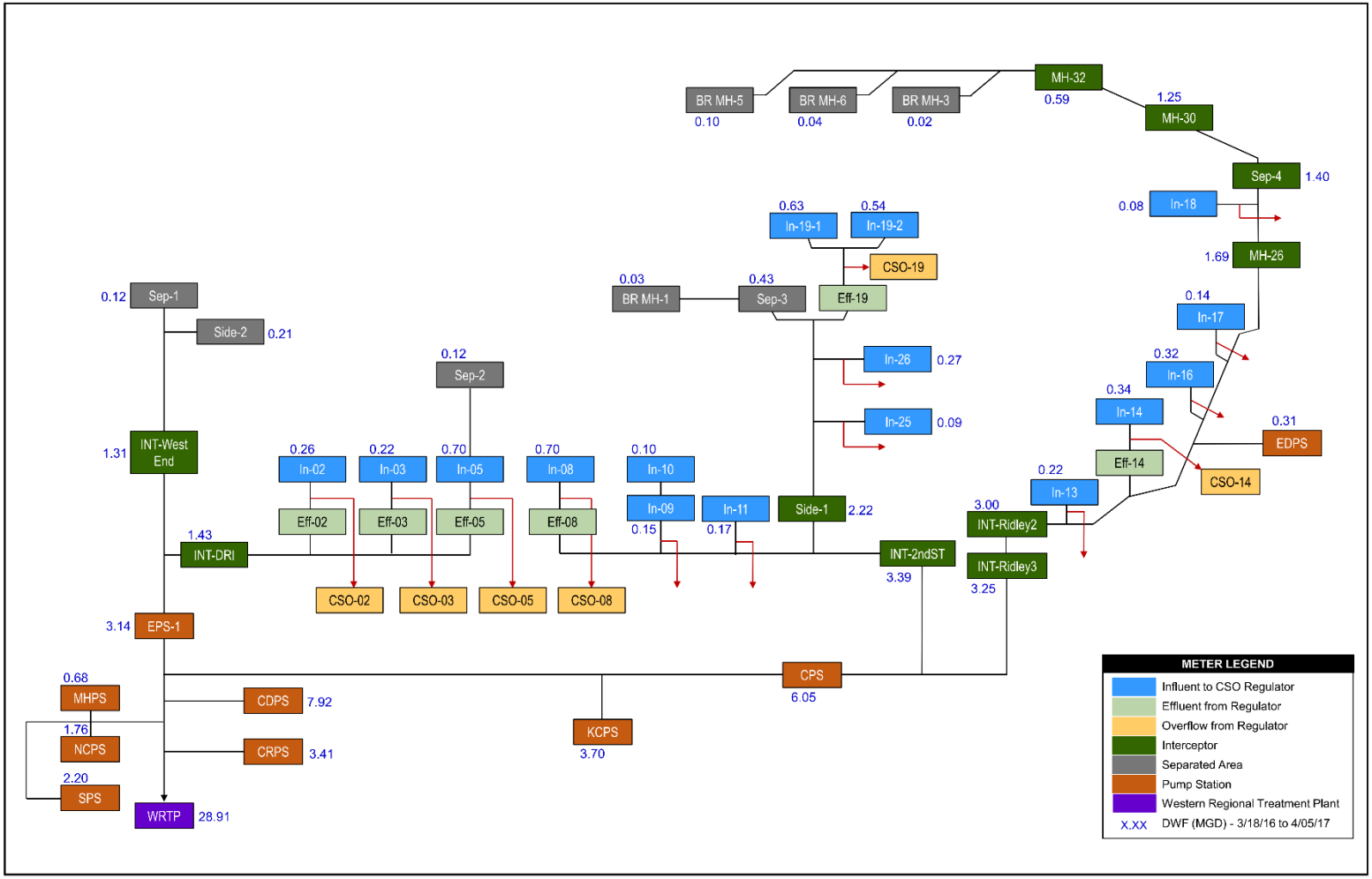
Figure 4-5: Hydrograph to Show Dry Weather Flow



Overall hourly average DWF was calculated by taking the average of the monitored DWF for each hour during the flow monitoring period. Monthly DWF was calculated by averaging the DWF for each month during the flow monitoring period. The overall hourly and monthly DWFs for all monitoring sites were analyzed and used as inputs in the H&H Model.

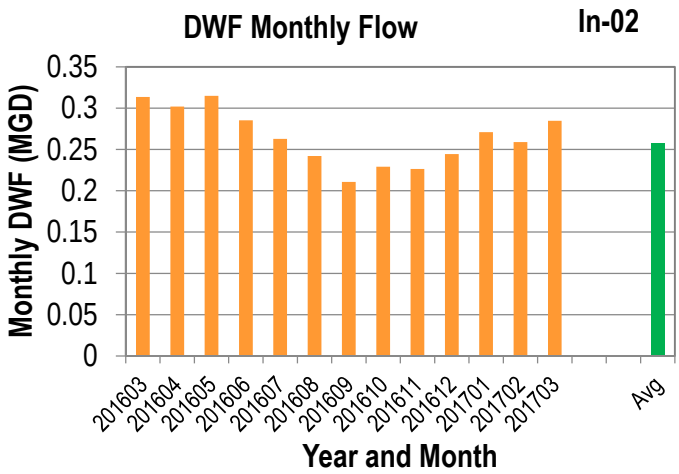
The DWFs for the one year monitoring period are also shown in the schematic in Figure 4-6. Each value displayed next to each flow meter represents the DWF overall average (in MGD) for one quarter. These values were ultimately averaged and input into the model as the overall annual average DWF. Generally the downstream dry weather flow is greater than the upstream locations for all of the meters. For meters immediately upstream and downstream of CSO regulators, the upstream and downstream dry weather flows should be similar.

Figure 4-6: Dry Weather Flow Balance Schematic



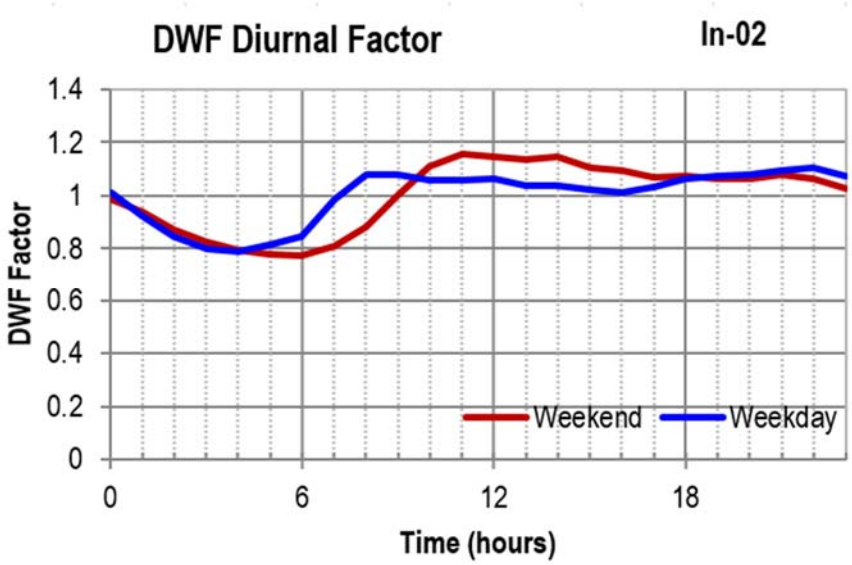
Monthly DWFs were calculated during the DWF analysis by averaging the overall DWF during each month. Average monthly DWFs were input into the model along with the overall annual averages for each flow meter. Figure 4-7 below shows the monthly DWFs input into the model for meter In-02.

Figure 4-7: Average Monthly DWF



The DWFs vary throughout the day, with the highest flows normally occurring around noon and the lowest rates between midnight and early morning. Flow data from the dry weather periods were used to develop a diurnal pattern for each flow meter. Diurnal patterns were analyzed for both weekdays and weekends. In the plot shown on Figure 4-8, the weekend DWF peak and valley have a 3-hour lag compared to the weekday pattern. The weekday and weekend diurnal patterns were input into the model along with the overall annual average values discussed above.

Figure 4-8: Weekday and Weekend Dry Weather Flow Diurnal Pattern

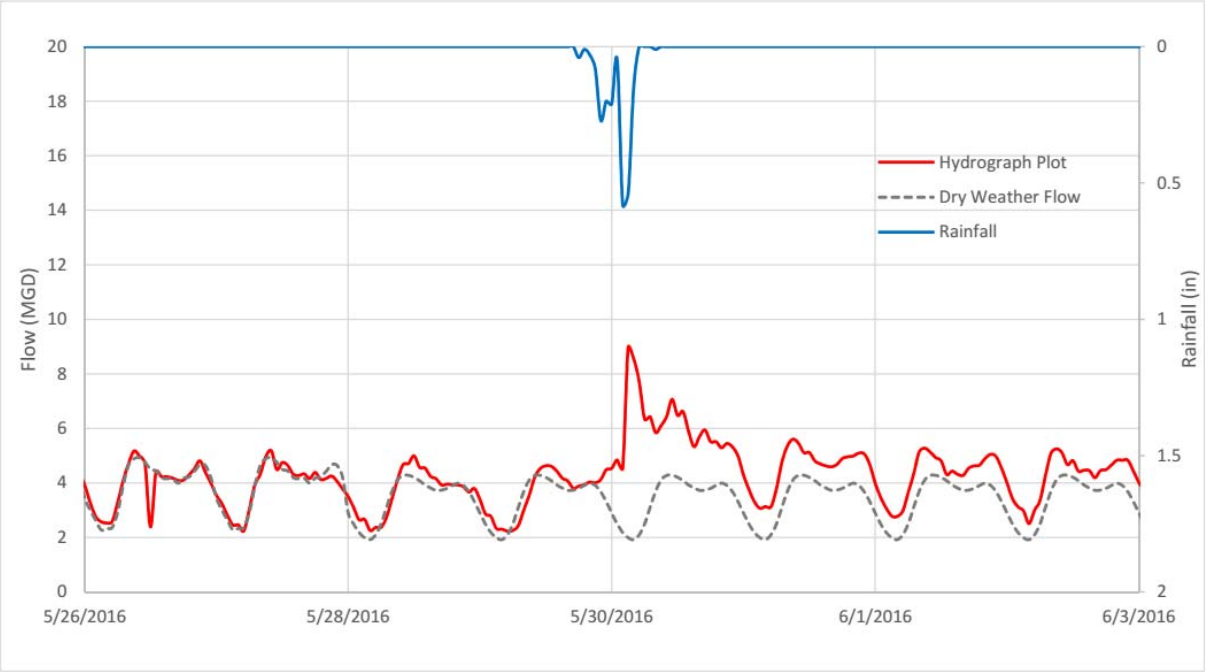


4.7 Wet Weather Flow Analysis

Wet weather flows are the combination of dry weather flows and additional flows that enter the system during wet weather conditions. The additional flows are from combined area surface runoff and RDII. Inflow normally occurs when rainfall enters the system through direct connections such as roof leaders, yard drains, catch basins, sump pumps, manhole covers and frame seals or indirect connections with storm sewers. Inflow is usually recognized graphically by large magnitude, short duration spikes immediately following a rain event. Infiltration occurs during wet weather conditions when water enters a sewer system from the ground through means which include, but not limited to, deteriorated pipes, pipe joints, connections, or manholes. It is significantly influenced by the size and duration of the rainfall event. Infiltration is often recognized graphically by a gradual increase in flow after a wet weather event. The increased flow typically sustains for a short period after rainfall has stopped and then gradually drops off.

The peaking factor represents the ratio of the peak wet weather flow to the average dry weather flow. Usually, an hourly peaking factor is used to represent the wet weather peaking factor. Peaking factors were analyzed for each flow monitoring site. The peaking factors in the separated area can be used to determine the extent of the RDII within a particular basin. Figure 4-9 is a flow hydrograph plot showing an hourly peaking factor of approximately 4.5 for the monitoring site. This high peaking factor indicates that a significant amount of RDII enters the collection system. The immediate flow increase shortly after the rainfall indicates significant inflow into the collection pipes, and the long tail back to the base flow indicates infiltration occurrence at the site as well.

Figure 4-9: Hydrographs of Flow Meters in Separated Area (Example Plot)



4.8 Wet Weather Event Selection for Model Calibration and Validation Flow Analysis

Based on the rainfall and flow monitoring data analysis, the rainfall events shown in Table 4-4 were selected for model calibration and validation. The events were selected from the top ten rain events that are shown in Table 4-1. The calibration and validation events cover variations in terms of rainfall depth, intensity, duration and antecedent conditions.

Table 4-4: Calibration and Validation Rainfall Events

Event	Start	End	Chester-PS Rainfall (in)	Duration (hr)	Max Intensity (in/hr)
E1	5/29/16 19:00	5/30/16 5:00	1.82	11.00	0.78
E2	9/28/16 12:00	9/30/16 10:00	2.36	47.00	0.37
E3	11/29/16 7:00	11/29/16 20:00	1.08	14.00	0.21
E4	3/30/2017 21:00	4/1/20170 3:00	1.83	31.00	0.25
E5	5/21/16 11:00	5/22/16 21:00	1.71	35.00	0.33
E6	7/28/16 15:00	7/29/16 9:00	1.26	19.00	0.74

Storms were chosen from the top ten rain events based first on their accumulation, with larger depths being preferred. But, if a rain event had a preceding storm, it was lowered in rank. Events with varying durations were chosen so that variations in length of time of a storm could be calibrated in the model. Higher intensity storms were chosen over lower intensity storms. But, again, if an event had a preceding storm, it was lowered in rank.

The amount of rainfall that accumulated at the Chester Pump Station rain gauge during event 2 was the largest at 2.36 inches. Event 2 also had the longest duration at 47 hours. However, event 1 had the highest intensity at 0.78 inches per hour.

4.9 Flow Monitoring Data Summary

The majority of the flow meters measured flow, level and velocity data for each flow monitoring site at 5-minute intervals, other flow meters measured the same parameters in 15 minute intervals. Metering data was analyzed for dry weather flows (DWF) and wet weather flows (WWF) for each monitoring site.

The DWF was ultimately used as inputs into the model. Overall annual average DWFs, average monthly DWFs, and weekday and weekend diurnal patterns were input into the model for each flow meter in the combined area. The WWF were used to calibrate the model output. Model data was compared side by side with metered data for each wet weather event for each flow meter.

4.10 Collection of WRTP Operational Data

In addition to flow data collected from the flow meters located in the collection system, flow data from DELCORA's WRTP influent flow meter was obtained for the same time period. A summary of the plant flow data is shown in Figures 4-10-through 4-13.

Figure 4-10: DELCORA WRTP Influent Flow

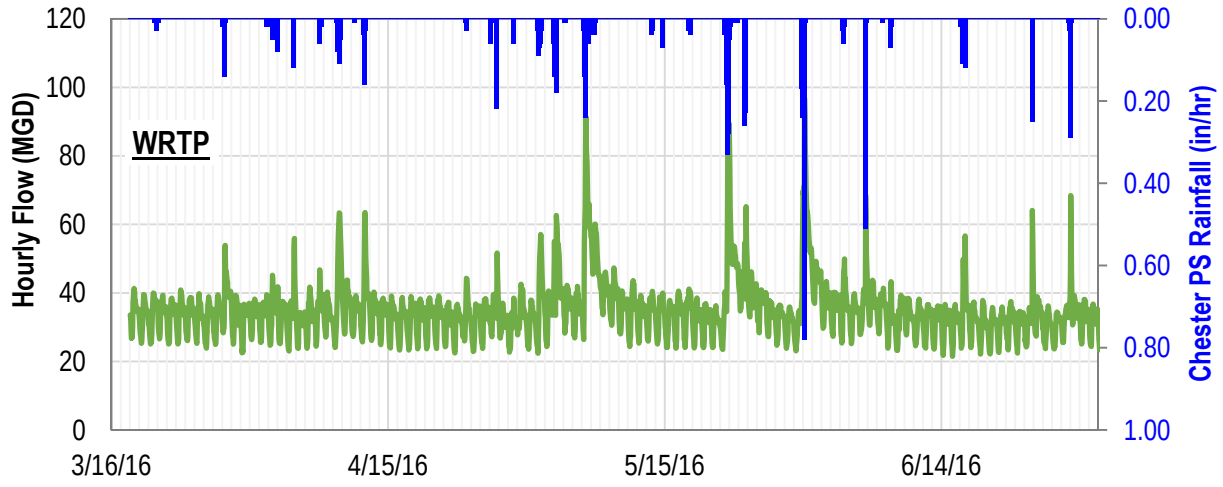


Figure 4-11: DELCORA WRTP Influent Flow

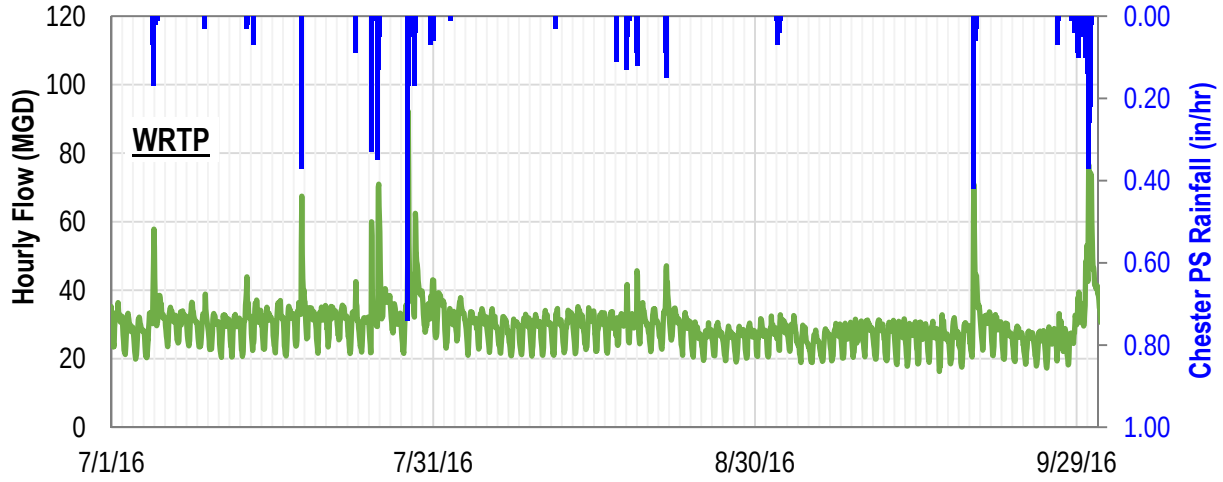


Figure 4-12: DELCORA WRTP Influent Flow

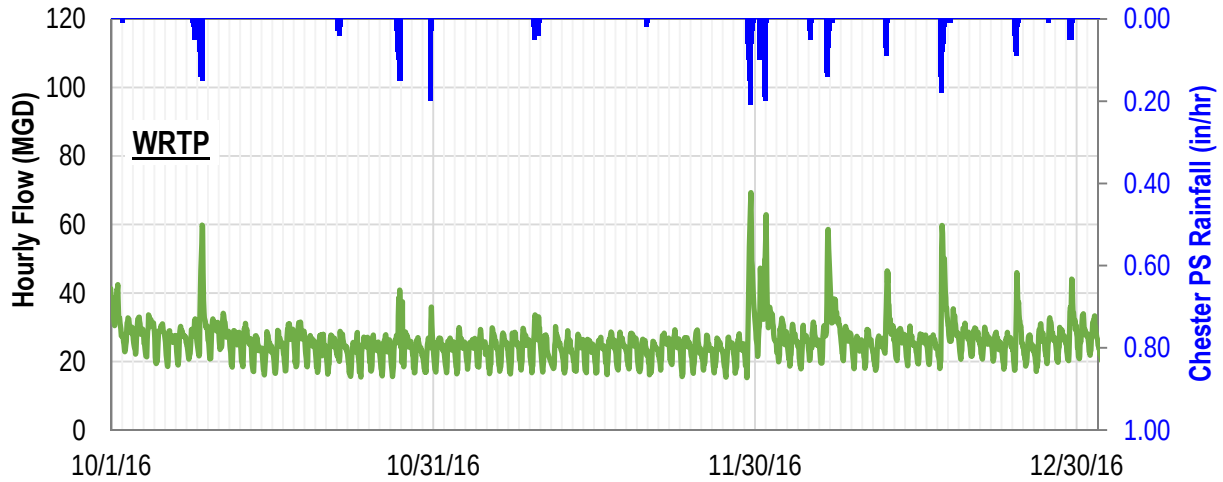
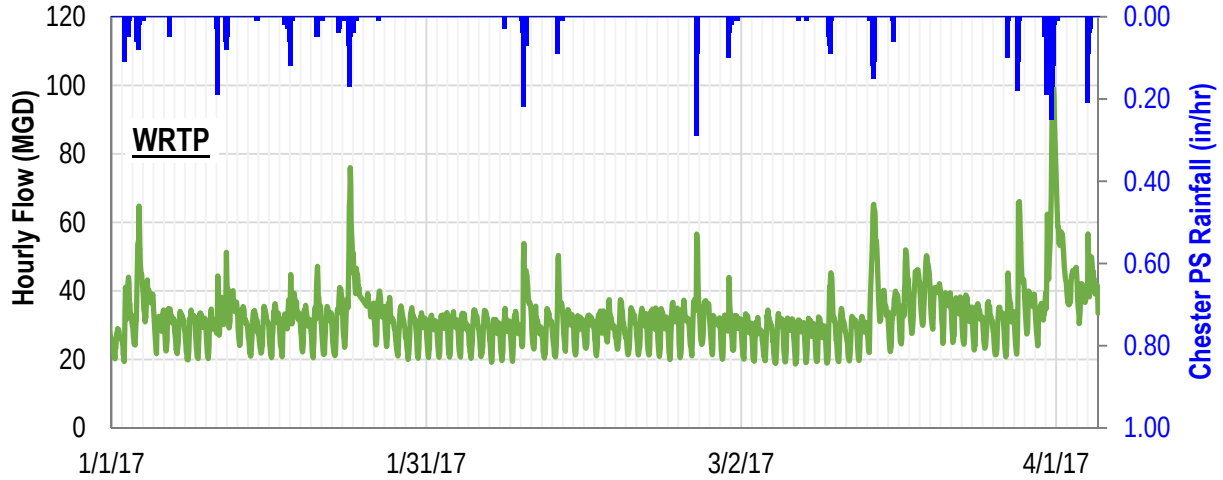


Figure 4-13: DELCORA WRTP Influent Flow



4.11 Summary

The rainfall and flow monitoring program was developed to provide adequate data for the development, calibration and validation of the H&H and Water Quality Models. The goals of this program were met with the collection of the flow monitoring and rainfall data for more than 12 months.

Rainfall data was collected for five rain gauges throughout the Model Area. The Chester rain gauge was analyzed to determine which wet weather events would be used for model calibration. All rain gauge data was ultimately compared with GARR data as a quality check. The GARR data was input into the model as rainfall data.

The flow meter data was analyzed based on the rainfall patterns and then input into the model as overall annual average DWF, average monthly DWFs, and weekday and weekend diurnal curves for each meter in the combined area. To calibrate the model, model-generated data was compared to the metered-data hydrographs for each wet weather event for each flow meter.

Section 5 Characteristics of the Receiving Waters

5.1 Physical Characteristics

The CSS discharges to portions of the Delaware River and two of its tributaries, Chester Creek and Ridley Creek. These receiving waters are located in the tidal portion of the Delaware River Basin, which stretches from the mouth of the Delaware Bay (River Mile 0) to Trenton (River Mile 133.4). The segment of the Delaware River directly impacted by DELCORA's CSO discharges is Zone 4, which extends from River Mile 78.8 to River Mile 95.0 (see Figure 5-1). Chester Creek is located at River Mile 82.93 and Ridley Creek at River Mile 83.8. These creeks are tidally influenced tributaries to the Delaware River. For Chester Creek, the tidal portion extends from the mouth of the tributary at Delaware River upstream to Kerlin Street in Chester City while for Ridley Creek, the tidal portion extends from the mouth of the tributary at the Delaware River upstream to MacDade Boulevard in Chester City (PAFBC, 2017).

In March 2017, an elevation (bathymetric) survey was conducted by LimnoTech for the lower portions of Chester and Ridley Creeks. Figure 5-2 shows the transect locations where elevation measurements were collected. Reaches surveyed included the lower 2.75 miles of Chester Creek and 3.25 miles of Ridley Creek to their discharge into the Delaware River. Transects were collected on ¼-mile interval spacing. Access to the creeks on the upper portions, generally greater than 1 mile upstream, was by wading where the bottom was shallow and firm. The portions below 1 mile were too deep and soft to be accessed on foot and a john boat with tagline was utilized.

Each creek cross section was surveyed at approximately five locations across the bed, water surface, bank toe, and bank top. Access to the entire upland bank at transect locations was not always possible; so the closest points safely accessed to the bank toe were surveyed.

Elevation measurements from this survey were compared with similar elevation data from a 1977 Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) of the creeks (FEMA, 2015). Though the FEMA study was completed several decades ago, it serves as a useful check on the accuracy and sufficiency of the bathymetric survey data. Figures 5-3 and 5-4 compare the LimnoTech survey data with the FEMA data.

In Chester Creek, the LimnoTech bed elevations are substantially higher (about five to ten feet) than FEMA elevations. Higher contemporary creek elevations influence both the degree of tidal exchange in the lower reaches of the creeks, and travel times of upland runoff and base flow to the Delaware River. To check for potential bias in the LimnoTech measurements, the LimnoTech measurements of water surface elevation were compared to similar data maintained by NOAA at a nearby tide gage (Philadelphia gage, #8545240). These measurements of water surface elevation agreed well (within two inches) which is a strong indication that the LimnoTech creek bed elevations are not biased high.

Figure 5-1: Zones of the Delaware River and Bay

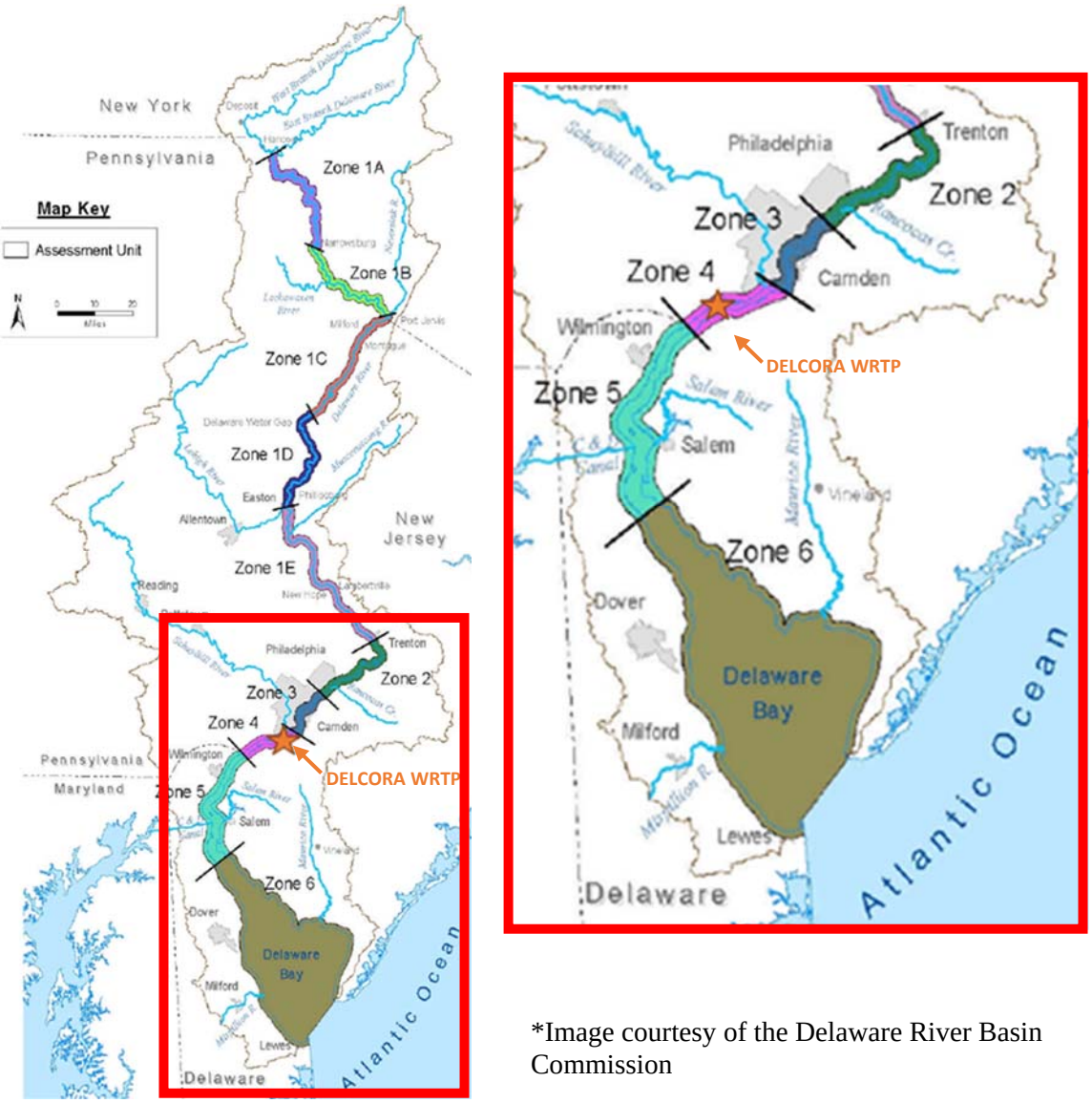


*Image courtesy of the Delaware River Basin Commission

Figure 5-2: Locations of Creek Elevation Measurements in Chester and Ridley Creeks

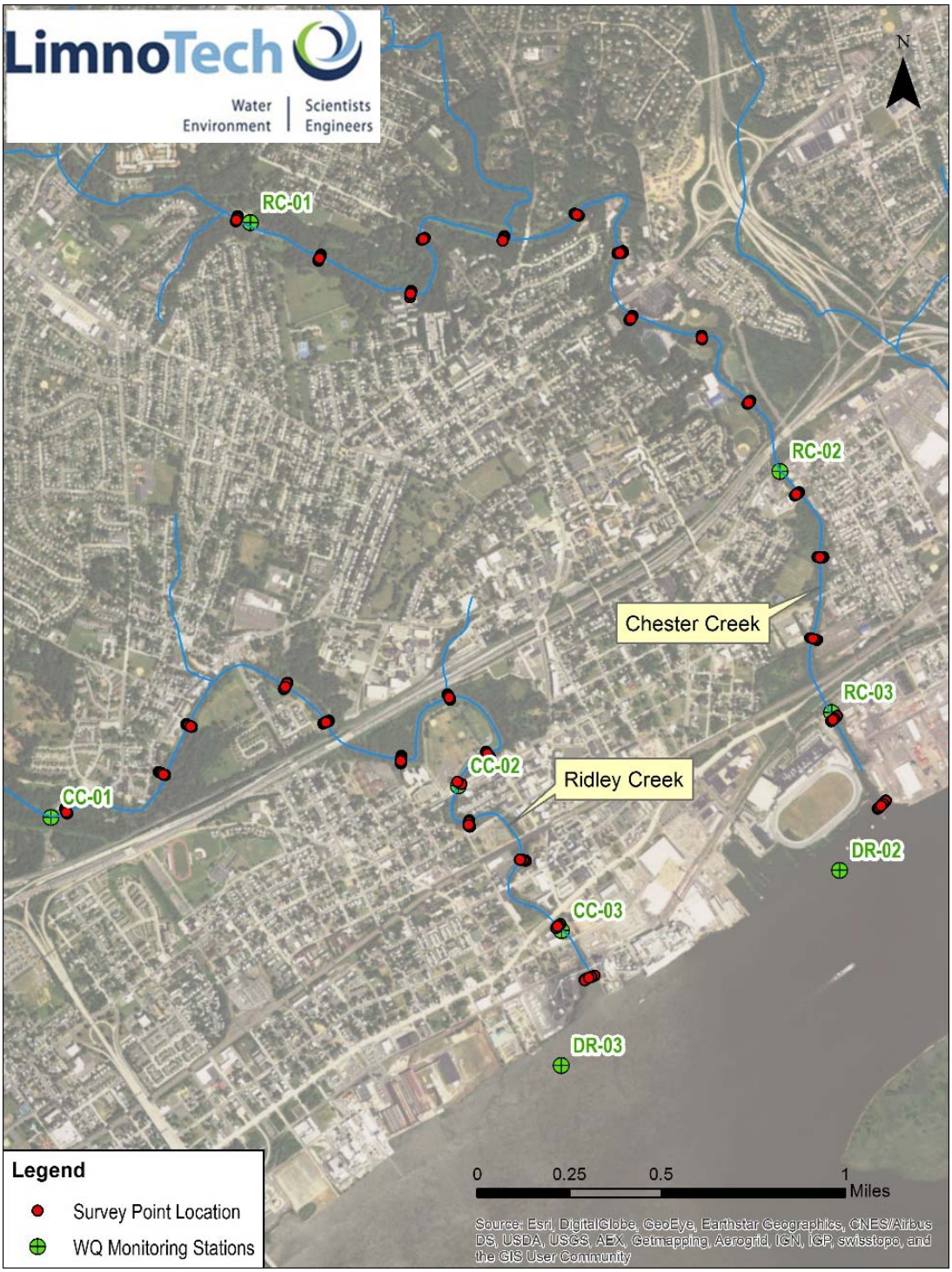


Figure 5-3: Comparison of Chester Creek bed elevation measurements

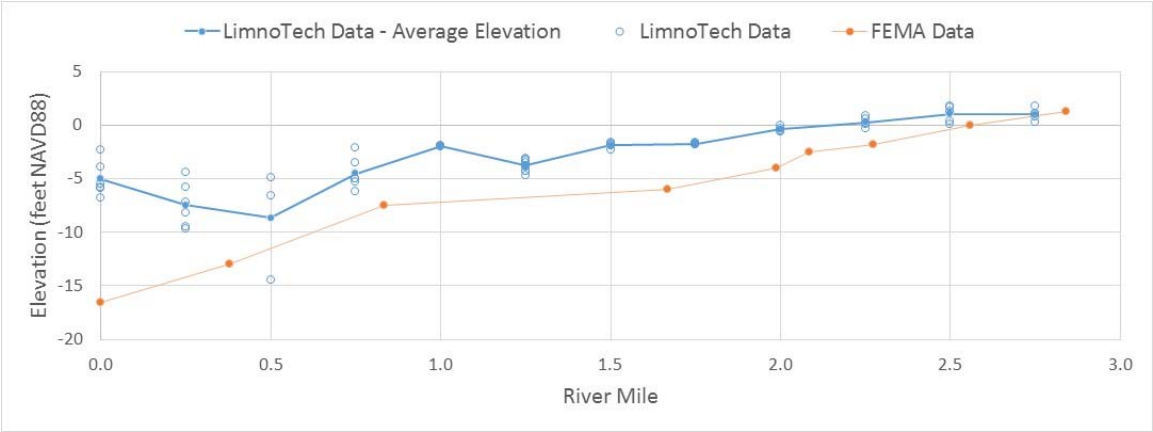
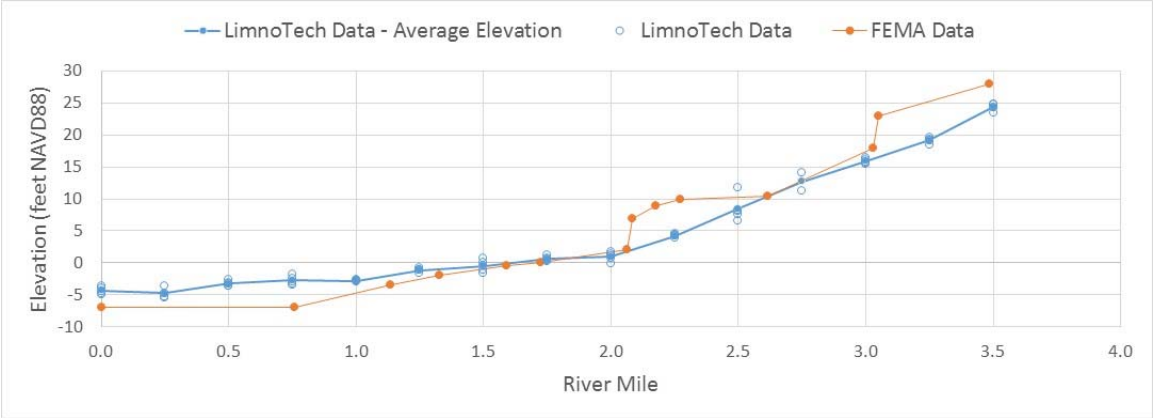


Figure 5-4: Comparison of Ridley Creek Bed Elevation Measurements



Higher creek bed elevations near the Chester Creek mouth are an indication that soft sediments have accumulated there since the 1970s. The highest observed peak flow in Chester Creek occurred a few years before the FEMA survey (in 1971, peak flow of 21,000 cfs) while recent peak flows have been significantly lower (average peak flow of 4,000 cfs in the last ten years) (USGS, 2017). Lower contemporary peak flows may have allowed for the accumulation of soft sediments in the lower reaches of Chester Creek.

Another significant observation from the LimnoTech data is that a pipe crossing near river mile 1.0 in Chester Creek created a high point in the creek bed profile. This high point acts to slightly reduce upstream water currents during lower flow conditions. This would tend to lengthen travel times of bacteria.

In Ridley Creek the LimnoTech data show a more constant bed slope between river miles 2.0 and 3.5 than the FEMA data. This is because low head dams existed in the 1970s near river miles 2.0 and 3.0, but are no longer in place. These dams previously acted to accumulate sediments in their shallow upstream pools, but when the dams were no longer present these accumulated sediments were likely washed away downstream.

These comparisons between the LimnoTech survey data, the historical FEMA data, and the NOAA tide gage, show consistency and provide confidence in the data collected. These comparison also help to identify locations where the creek bed has changed in the last several decades in ways that would influence creek hydraulics and pollutant transport.

The Delaware River bathymetric survey information was obtained online from National Oceanic and Atmospheric Administration (NOAA) website.

- NOAA, 2009. Hydrographic Survey H12149. Pennsylvania and New Jersey. Delaware River. Data obtained online at: https://www.ngdc.noaa.gov/nos/H12001-H14000/H12149.html
- NOAA, 2009. Hydrographic Survey H12150. Pennsylvania and New Jersey. Delaware River. Data obtained online at: https://www.ngdc.noaa.gov/nos/H12001-H14000/H12150.html

The survey was conducted in 2009, although other surveys conducted by NOAA over time (going back several decades) will also be used to construct the bathymetry datasets for the Water Quality Model. This information will serve to assist in determining tidal currents and mixing within the Delaware River Estuary as part of the Water Quality Modeling.

5.2 Watershed Drainage Basins

The Chester Creek and Ridley Creek watersheds extend from the mouth of the tributaries upstream through Delaware County and into Chester County, well beyond the boundaries of DELCORA's Model Area. The extent of the watersheds within Delaware County is illustrated in Figure 2-4, along with the boundaries of DELCORA's Model Area.

5.3 Pollutants of Concern

This section provides a summary of the current water quality in DELCORA's receiving waters based on DELCORA's efforts to identify Pollutants of Concerns, in order to meet the requirements of Section V.A.16.c of the Consent Decree. To satisfy this Consent Decree requirement, DELCORA submitted the *Identification of Sensitive Areas and Pollutants of Concern Report* (Greeley and Hansen, 2016c), which was approved by PA DEP and US EPA on October 13, 2016. The remainder of Section 5 is based on this approved report.

DELCORA's CSOs discharge to three receiving waters - the Delaware River, the Chester Creek and the Ridley Creek – all of which are within the Delaware Estuary portion of the Delaware River Basin. As part of the *Identification of Sensitive Areas and Pollutants of Concern Report* (Greeley and Hansen, 2016c), DELCORA conducted a literature review to determine the applicable water quality standards (WQS) for each of the three receiving water bodies, the designated uses for the water bodies, the primary causes of impairment, and the Total Maximum Daily Load (TMDL) status of the water bodies (if any).

Requirements of the USEPA's CSO Guidance Document

Section 2.5.3.3 of the USEPA's CSO Guidance document states that to assess the impacts of wet weather runoff, the water quality of the receiving waters should be understood for normal dry weather periods. The water quality data that is collected during dry weather conditions provides a basis for comparing the data collected during wet weather conditions. The CSO Guidance Document says:

> *"Receiving water monitoring should include identified parameters of concern. These parameters typically include those previously identified for combined sewage and CSO monitoring.*
>
> - *pH*
> - *BOD*
> - *TDS*
> - *TSS*
> - *Nutrients*
> - *Metals*
> - *Indicator bacteria*
>
> *Knowledge of the site-specific water quality concerns could expand the list to include dissolved oxygen, toxics, biological assessment, and sediment."*

5.4 Receiving Water Use Designations and Applicable Water Quality Standards

Information about the applicable water quality standards (WQS), the designated uses and the impairment status for the three receiving water bodies impacted by DELCORA's CSOs were obtained from the PADEP's 2014 Integrated Water Quality Monitoring and Assessment Report (or "303(d) list"), the Pennsylvania Code, the Delaware River Basin Commission's (DRBC's) Water Quality Regulations (WQRs) and from the DRBC's 2014 Delaware River and Bay Water Quality Assessment (DRBC, 2014).

5.4.1 2014 PA Integrated Water Quality Monitoring and Assessment Report (303(d) list)

The primary source of information about the causes of impairment, and the Total Maximum Daily Load (TMDL) status of the water bodies (if any) is the 2014 PA Integrated Water Quality Monitoring and Assessment Report (PA Integrated Report), which satisfies Pennsylvania's requirement of both Section 303(d) and 305(b) of the Clean Water Act (CWA). The PA Integrated Report lists all impaired surface waters within Pennsylvania that are not attaining designated and existing uses, even after appropriate and required pollution control technologies have been applied. A TMDL is designed to reduce pollutant loads to impaired waters and enable these waters to meet water quality standards.

The Integrated Report uses a five-part categorization (lists) of water according to their use attainment status. The categories represent varying levels of use attainment, ranging from Category 1, where all designated water uses are met to Category 5, where impairment by pollutants required the development of a TMDL to correct. Each segment of the waterbody is placed into one of these five categories. "Impairment" of a receiving water body is indicated to exist for a particular parameter if the parameter appears in Categories 4A and 5, as they indicate the need for a TMDL in the receiving water body and the limiting of additional loadings for those parameters.

The PADEP's website explains the categories as follows:

- *Category 1:* *Waters attaining all designated uses.*
- *Category 2:* *Waters where some, but not all, designated uses are met. Attainment status of the remaining designated uses maybe unknown because data are insufficient to categorize a water body consistent with the states' listing methodology or may be impaired.*
- *Category 3:* *Waters for which there are insufficient or no data and information to determine, consistent with the state's listing methodology, if designated uses are met.*
- *Category 4:* *Waters impaired for one or more designated use but not needing a TMDL. States may place these waters in one of the following three subcategories:*
  - *Category 4A: TMDL is approved.*
  - *Category 4B: Expected to meet all designated uses within a reasonable timeframe (three years).*
  - *Category 4C: Not impaired by a pollutant.*
- *Category 5:* *Waters impaired for one or more designated uses by any pollutant and requiring the development of a TMDL. Category five includes waters shown to be impaired as the result of biological assessment used to evaluate aquatic life even if the specific pollutant is not known unless the state can demonstrate that non-pollutant stressors cause impairment or that no pollutant(s) causes or contribute to the impairment*."

The Category 5 list constitutes the Section 303(d) list that the USEPA will approve or disapprove under the CWA. For the purposes of the determination of Pollutants of Concern, Categories 4A and 5 are the relevant categories as they indicate the need for a TMDL in the receiving water body and the limiting of additional loadings for those parameters. All of the lists are sorted by an 8-digit Hydrologic Unit Code (HUC) that is particular for the water body of interest. For DELCORA's drainage area, the HUC for the

Lower Delaware River (02040202) was used for searching the data in the PA Integrated Report for all three of DELCORA's receiving water bodies.

5.4.2 PA Code Title 25 §93.9g

The primary source of information for the Critical Use Designation for each section of the three receiving water bodies is 25 Pa. Code §93.9g – Drainage List. The relevant Critical Use Designations for DELCORA's receiving water bodies include Warm Water Fishes (WWF), Migratory Fishes (MF), Trout Stocking (TSF), and Water Contact Sports/Recreation (WC).

- The "WWF" designation indicates the maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat.
- The "MF" designation indicates the passage, maintenance and propagation of anadromous and catadromous fishes and other fishes which move to or from flowing waters to complete their life cycle in other waters.
- The "TSF" designation indicates maintenance of stocked trout from February 15 to July 31 and maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat.
- The "WC" designation indicates the use of the water for swimming and related activities.

5.4.3 DRBC's Water Quality Regulations and PA Code Title 25 §93.7

The applicable water quality standards for the three receiving water bodies are found in the Delaware River Basin Commission's Water Quality Regulations, and in Water Quality Criteria lists found in 25 Pa. Code §93.7 and §93.8c. For the Delaware River, the water quality standards are dictated by the DRBC's WQRs that have primacy over the standards in the PA Code. The water quality standards in the PA Code apply to the non-tidal portions of the Chester Creek and Ridley Creek, and to the Delaware River if there is no standard listed for a particular parameter in the DRBC's WQRs.

5.4.4 DRBC's 2014 Delaware River and Bay Water Quality Assessment

The DRBC's 2014 Delaware River and Bay Water Quality Assessment (DRBC, 2014) reports the extent to which waters of the Delaware River and Bay are attaining designated uses in accordance with Delaware River Basin Commissions' Water Quality Regulations for the period October 1, 2008 through September 30, 2013. The 2014 Assessment involves the comparison of key water quality parameters with the applicable DRBC water quality regulations. The states of Pennsylvania, New Jersey, Delaware and New York consider the DRBC's Assessment report as part of their determinations as to whether sections of the Delaware River should be listed on the state 303(d) list for a certain pollutant.

5.5 Delaware River

5.5.1 2014 PA Integrated Water Quality Monitoring and Assessment Report (303(d) list)

The 2014 PA Integrated Water Quality and Assessment Report ("the 303(d) List") lists a 61.02 mile segment of the Lower Delaware River in Category 4A as having an approved TMDL for polychlorinated biphenyls (PCBs) from an unknown source related to its fish consumption use. The USEPA approved a

TMDL for PCBs for Zone 2 through Zones 5 in 2003, and a second PCB TMDL was approved for Zone 6 in 2006. The TMDLs for PCBs encompass the Delaware River Estuary and stretch from the mouth of the Delaware River upstream to the Trenton, NJ /Morrisville, PA Bridge. The segment of the Delaware River having an approved TMDL for PCBs is shown in yellow in the map in Figure 5-5, which was derived from the PADEP's eMapPA website.

While the Delaware River is impaired from PCBs, the PCBs are not normally associated with CSOs. Given this reason, and the fact that the PCB impairment begins well upstream of DELCORA's service area – PCBs were screened as not being a Pollutant of Concern (POC). Furthermore, the additional CSO sampling results from November/December 2015 showed that PCBs were found to be at a lower concentration than the Reporting Detection Limit (RDL). For this additional reason it was determined that PCBs are not associated with DELCORA's CSO discharges.

5.5.2 Designated Critical Uses and Specific Water Quality Criteria from PA Code

The Critical Uses for the Delaware River in the area of DELCORA's CSO discharges are designated in Pa. Code §93.9. All stretches of the Delaware River in this area are designated as Warm Water Fishes (WWF) (maintenance only) and Migratory Fishes (MF) (passage only). Additionally the Delaware River has a Water Contact (WC) designation downstream of River Mile 81.8, which is located directly adjacent to the City of Chester between CSO #009 and #011.

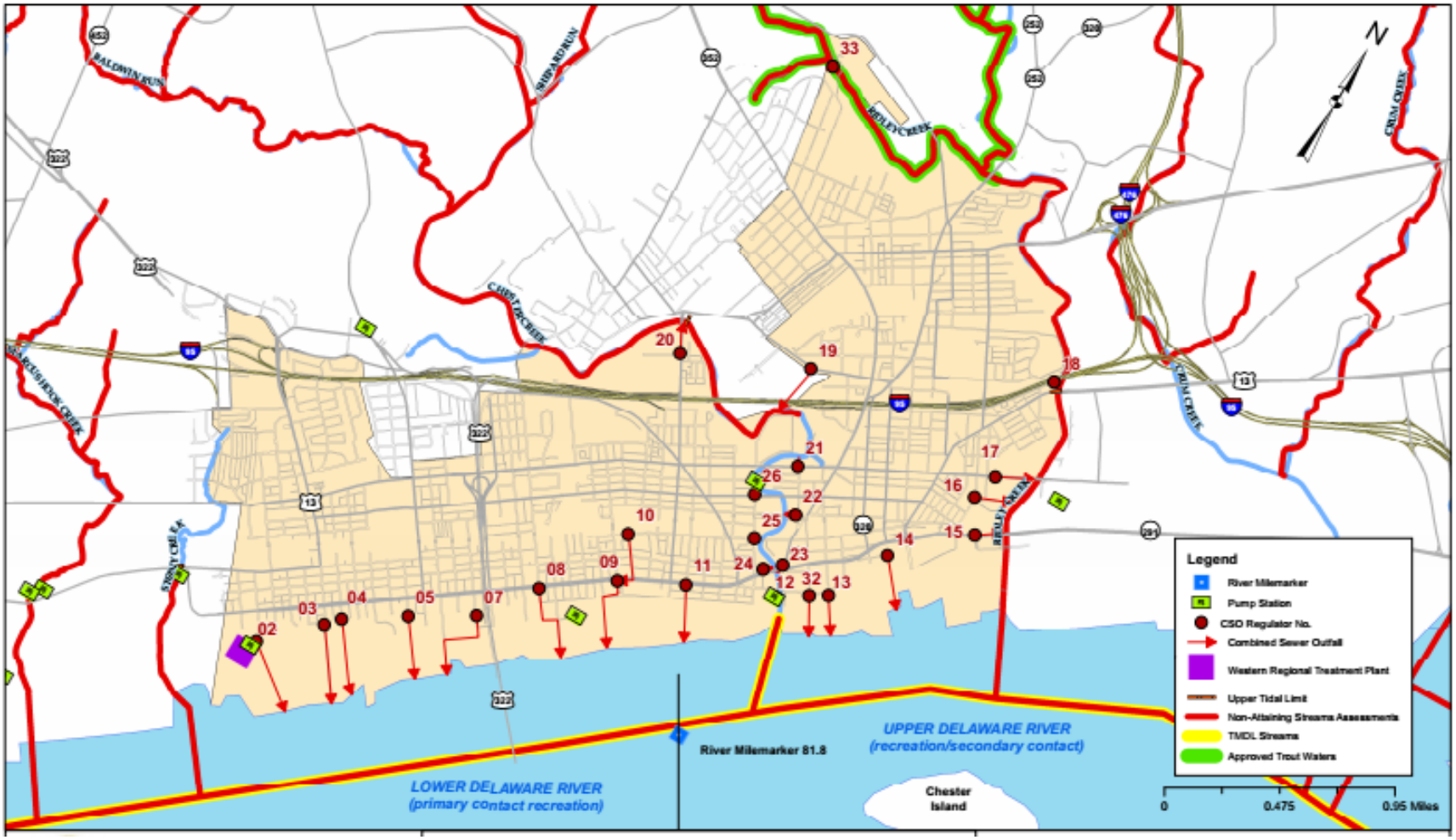
For WC-designated waters, 25 Pa. Code §93.7 establishes the following as the water quality criterion for fecal coliform bacteria:

- Fecal Coliform – A geometric mean of 200 colonies per 100 mL during the swimming season (May 1 through September 30) based on a minimum of five samples collected during a 30-day period. For the remainder of the year, the maximum fecal coliform level shall be a geometric mean of 2,000 colonies/100 mL based on a minimum of five samples collected during a 30-day period. There are no fecal coliform bacteria criteria for the Delaware River or tributaries that are not designated as WC waters or for Potable Water Supply (PWS).

For WWF and MF waters the WWF designation is the more restrictive of the two, and 25 Pa. Code §93.7 establishes the following additional standards for WWF waters:

- Dissolved Oxygen – The minimum value for dissolved oxygen must be above 5.0 mg/L, with the 7-day average value above 5.5 mg/L
- Alkalinity – A minimum of 20 mg/L as CaCO3, except where naturally occurring conditions are less
- Ammonia Nitrogen – the maximum total ammonia nitrogen concentration (in mg/L) at all times shall be the numerical value given by un-ionized ammonia nitrogen (NH3-N) x (log-1[pKT-pH] + 1)
- Iron – 30-day average 1.5 mg/L as total recoverable
- pH – From 6.0 to 9.0 inclusive

Figure 5-5: Non-Attaining Streams and TMDL Streams within DELCORA's Service Area



- Temperature – A table is included within 25 Pa. Code §93.7 for maximum water temperatures in the receiving water body at various times of the year
- Total Residual Chlorine – Four-day average 0.011 mg/L; 1-hour average 0.019 mg/L

5.5.3 Designated Zone and Water Quality Regulations from the DRBC

25 Pa. Code §93.9 lists the DRBC regulations for Water Quality Zone 4 as exceptions to PA Code's specific water quality criteria. The DRBC's water quality regulations have primacy over the standards in the PA Code for the Delaware River.

The DRBC defines Zone 4 as that part of the Delaware River extending from R.M. 78.8 to R.M. 95.0, the Pennsylvania-Delaware state boundary line to the upstream side of the Philadelphia Navy Yard, including the tidal portions of the tributaries thereof. The DRBC states that the quality of Zone 4 waters shall be maintained in a safe and satisfactory condition for the following uses:

- Industrial water supplies after reasonable treatment
- Maintenance of resident fish and other aquatic life
- Passage of anadromous fish
- Wildlife
- Recreation - secondary contact above R.M. 81.8
- Recreation (all water-contact sports) below R.M. 81.8
- Navigation

The DRBC's Stream Quality Objectives for Zone 4 are as follows:

1. Dissolved Oxygen
   - 24-hour average concentration shall not be less than 3.5 mg/L.
   - During the periods from April 1 to June 15, and September 16 to December 31, the DO shall not have a seasonal average less than 6.5 mg/L.

2. Temperature shall not exceed:
   - 5°F (2.8°C) above the average 24-hour temperature gradient displayed during the 1961-66 period, or
   - A maximum of 86°F (30.0°C), whichever is less.

   (NOTE: The DRBC's 2014 Delaware River and Bay Water Quality Assessment states that *"atmospheric temperatures and meteorological conditions are strong drivers of water temperature. DRBC previously demonstrated that water temperatures are strongly liked to air temperatures, and that a notable increase in air temperatures is observable between the temperature gradient period (1961-1966) and the current period. At present, we [i.e., DRBC] lack the tools to determine which portion of the exceedance is attributable to potentially controllable anthropogenic thermal inputs, and which portion is due to metrological drivers beyond our control"*.

3. pH between 6.5 and 8.5 inclusive, unless outside this range due to natural conditions.

4. Phenols maximum 0.02 mg/l, unless exceeded due to natural conditions.

5. Threshold Odor Number not to exceed 24 at 60°C.

6. Synthetic Detergents. (M.B.A.S.). Maximum 30- day average 1.0 mg/L.

7. Radioactivity
   - Alpha emitters - maximum 3 pc/L (picocuries per liter);
   - Beta emitters - maximum 1,000 pc/L.

8. Bacteria
   - Fecal Coliform
     - Above R.M. 81.8: maximum geometric average 770 per 100 milliliters
     - Below R.M. 81.8: maximum geometric average 200 per 100 milliliters
   - Enterococcus
     - Above R.M. 81.8: maximum geometric average 88 per 100 milliliters
     - Below R.M. 81.8: maximum geometric average 33 per 100 milliliters

9. Total Dissolved Solids not to exceed 133% of background.
   (NOTE: The background TDS concentration is at present undefined, according to the DRBC's 2014 Delaware River and Bay Water Quality Assessment.)

10. Turbidity unless exceeded due to natural conditions.
    - Maximum 30-day average 40 units (NTU)
    - Maximum 150 NTU

11. Alkalinity between 20 and 120 mg/L.

12. Toxic Pollutants
    - Applicable criteria to protect the taste and odor of ingested water and fish are presented in the DRBC's WQRs Table 4.
    - Applicable freshwater stream quality objectives for the protection of aquatic life are presented in the DRBC's WQRs Table 5.
    - Applicable freshwater stream quality objectives for the protection of human health are presented in the DRBC's WQRs Tables 6 and 7.

5.5.4 DRBC Evaluation of Use Attainment Status

Table 5-1 presents a summary of Table 23 from the DRBC's 2014 Delaware River and Bay Water Quality Assessment for Zone 4 of the Delaware River. Zone 4 is the portion of the Delaware River directly impacted by DELCORA's CSO discharges and it extends from R.M. 95.0 to R.M. 78.8, the

Pennsylvania-Delaware state line including the tidal portions of the tributaries thereof. The extent of Zone 4 can be seen in Figure 5-1.

Table 5-1: Summary of the 2014 DRBC Integrated Assessment for Zone 4 of the Delaware River

Zone	Designated Use			
	Aquatic Life	Drinking Water	Recreation	Fish Consumption
4	NS	N/A	S	NS

Notes:
N/A - Not applicable
NS - The Designated Use is not supported
S - The Designated Use is supported

5.5.4.1 Water Contact Recreation

Table 5-1 shows that the designated use for Water Contact Recreation is being attained for the Delaware River below R.M. 81.8.

5.5.4.2 Aquatic Life

Table 5-1 shows that the designated use for Aquatic Life is not being attained. According to the DRBC's Assessment report (DRBC, 2014), *"the composite aquatic life assessment for 2014 yields a result of "Not Supporting" for all assessment units* (or zones). *It is important to note, however, that this result is largely driven by the requirement to categorize as not meeting criteria any assessment unit* (or zone) *with 1 exceedance plus 1 confirmatory exceedance."*

The DRBC's Assessment Report also states: *"Data showed multiple exceedances of aluminum acute and chronic freshwater objectives for the support of aquatic life in Zone 4. Of 35 surface water samples tested for aluminum in Zone 4 during the assessment period, 34 exceeded the chronic criterion and 8 exceeded the acute criterion at 21PA_WQX-WQN0182 near Marcus Hook, PA. No exceedances of aluminum were reported in Zones 2, 3, 5 and 6."* As part of the Recommendations for Future Action at the end of the report, the DRBC states that the *"exceedances of aluminum criteria in Zone 4 warrant further attention"*.

5.5.4.3 Fish Consumption

Table 5-2 shows that the designated use for Fish Consumption is not being attained. The DRBC's 2014 Delaware River and Bay Water Quality Assessment report states that their assessment criterion for fish consumption is based on the presence of fish consumption advisories from the four Basin states for the mainstem of the Delaware River. If a fish consumption advisory is present, this resulted in the DRBC making an assessment of "not supporting the designated use".

The Assessment report states that the violation criteria for PCBs is also supported by the presence of measureable concentrations of PCBs in the river that exceeded the surface water quality standard.

Twenty-two mainstem channel sites were sampled for PCBs in 2012, from Biles Channel near Trenton, NJ to the ocean boundary between Cape May and Lewis. It was found that all of the samples exceeded the current PCB water quality criteria of 16 µg/L for the protection of human health from carcinogenic effects.

The 2016 Commonwealth of Pennsylvania Fish Consumption Advisories for Zones 2, 3, and 4 of the Delaware River (Trenton, NJ/Morrisville, PA Bridge to PA/DE border) are as shown below in Table 5-2. These advisories identify PCBs as a pollutant of concern in fish tissue.

Table 5-2: PA Fish Consumption Advisory Summary for PCBs in the Delaware River

Fish Species	Meal Frequency	Contaminant
White Perch	1 meal/month	PCB
Flathead Catfish	1 meal/month	PCB
Channel Catfish	1 meal/month	PCB
Striped Bass: over 28 inches in length	1 meal/month	PCB
Carp	6 meals/year	PCB
American Eel	Do Not Eat	PCB

5.6 Chester Creek

5.6.1 2014 PA Integrated Water Quality Monitoring and Assessment Report (303(d) list)

Chester Creek is listed in Category 5 of the 2014 Pennsylvania Integrated Water Quality Monitoring and Assessment Report as not meeting its recreational use due to pathogens, and for not meeting its aquatic life use due to siltation. "Pathogens" were listed in 2006 for three segments totaling 0.94 miles, and a TMDL is anticipated in 2019. The source for the pathogens is listed as "unknown", and these three stream segments are all well upstream of DELCORA's service area. Therefore it appears that the noted impairment of the Chester Creek due to pathogens is not related to DELCORA's CSO discharges.

"Siltation" was listed in 2014 for four segments of the creek totaling 18.41 miles, and a TMDL is anticipated in 2027. The source for the siltation was identified as "urban runoff/storm sewers". The majority of Chester Creek is not attaining its designated use for aquatic life due to siltation, and the vast majority of these impaired segments are located upstream of DELCORA's service area and are shown in red in the map in Figure 5-5. However, one of DELCORA's CSO outfalls does discharge to the furthest downstream segment of the Chester Creek that is impaired by siltation, which is Outfall #020 near Kerlin Street and Finland Drive. Siltation is measured by the water quality parameter Turbidity with units of Nephelometric Turbidity Units (NTU). The impacts of DELCORA's CSO discharges on the levels of Turbidity within the impaired sections of the Chester Creek have been evaluated further and are discussed herein.

For the Chester Creek, the 2014 PA Integrated Water Quality & Assessment Report shows the creek to be impaired for Aquatic Life from siltation, with Urban Runoff/Storm Sewers identified as the source. The impairment of the Chester Creek by siltation primarily occurs upstream of DELCORA's service area as shown in Figure 5-5. The term "Siltation" is not defined in the 2014 PA Integrated Water Quality & Assessment Report, but through various sources could be defined as:

> *"the pollution of water by fine particulate terrestrial clastic material, with a particle size dominated by silt or clay. It refers both to the increased concentration of suspended sediments, and to the increased accumulation (temporary or permanent) of fine sediments on bottoms where they are undesirable. Siltation is most often caused by soil erosion or sediment spill."*

There is not a water quality standard for "siltation", however, siltation can be considered as closely related to the widely used water quality parameter of "Turbidity", which is associated with CSO discharges. For this reason "Turbidity" was reviewed further as a surrogate for siltation to determine if it might be considered as a POC. Per available USEPA STORET data, the Turbidity concentrations on the Chester Creek was found to be below the WQS and therefore siltation was screened-out as not being a POC.

Category 4A lists a 0.81-mile segment of Chester Creek at its mouth that does not meet its designated use for fish consumption due to PCBs from an unknown source, and for which a TMDL for PCBs was issued in 2006. This is shown in yellow in the map in Figure 5-5 and is related to the TMDL for PCBs in the Delaware River Estuary.

5.6.2 Designated Critical Uses and Specific Water Quality Criteria from PA Code

The Critical Uses for the Chester Creek in the area of DELCORA's CSO discharges are designated in 25 Pa. Code §93.9. All stretches of the Chester Creek in this area are designated as Warm Water Fishes (WWF) (maintenance only) and Migratory Fishes (MF) (passage only). The same specific water quality criteria apply to the WWF and MF Critical Use designations for Chester Creek as apply for the Delaware River.

5.7 Ridley Creek

5.7.1 2014 PA Integrated Water Quality Monitoring and Assessment Report (303(d) list)

Ridley Creek is listed in Category 5 of the 2014 Pennsylvania Integrated Water Quality Monitoring and Assessment Report as not meeting its aquatic life use due to siltation. The "Siltation" was listed in 2012 for five segments totaling 26.76 miles, and a TMDL is anticipated in 2025. The source for the siltation was identified as "unknown" or from "urban runoff/storm sewers".

In actuality, it appears that the majority of Ridley Creek is not attaining its designated use for aquatic life due to siltation, and the vast majority of these impaired segments are located well upstream of DELCORA's service area and are shown in red in the map in Figure 5-5. However, all of Ridley Creek within DELCORA's service area is shown as impaired for aquatic life due to siltation. As with the

Chester Creek, the Ridley Creek is listed in the 2014 PA Integrated Water Quality & Assessment Report as impaired for Aquatic Life from siltation, with Urban Runoff/Storm Sewers identified as the source.

However as noted for the Chester Creek, there is not a water quality standard for "siltation" but it can be considered as closely related to the widely used water quality parameter of "Turbidity", which is associated with CSO discharges. Per available USEPA STORET data, the Turbidity concentration for the Ridley Creek was found to be below the WQS and therefore siltation was screened-out as not being a POC.

5.7.2 Designated Critical Uses and Specific Water Quality Criteria from PA Code:

The Critical Uses for the Ridley Creek in the area of DELCORA's CSO discharges are designated in 25 Pa. Code §93.9. All stretches of the Ridley Creek in this area are designated as Warm Water Fishes (WWF) (maintenance only), Migratory Fishes (MF) (passage only), or Trout Stocking (TSF). The TSF stretch only applies in the sections of the Ridley Creek upstream of the Chestnut Street bridge crossing.

The same specific water quality criteria apply to the WWF and MF Critical Use designations for Ridley Creek as apply to the Chester Creek and Delaware River, except for the parameters of Dissolved Oxygen and Temperature – which are more stringent in the TSF stretch because of the high oxygen needs of trout.

Specifically, for TSF waters 25 Pa. Code §93.7 establishes the following additional standards:

- Dissolved Oxygen – For the period February 15 to July 31 of any year, the minimum value for dissolved oxygen must be above 5.0 mg/L, with the 7-day average value above 6.0 mg/L. For the remainder of the year, the minimum value for dissolved oxygen must be above 5.0 mg/L, with the 7-day average value above 5.5 mg/L.
- Temperature – A separate table is included within 25 Pa. Code §93.7 for maximum water temperatures in the receiving water body at various times of the year for TSF waters.

5.8 Pollutants of Concern in the Receiving Waters

As part of the requirements of the Consent Decree, DELCORA was tasked to identify the Pollutants of Concern associated with it CSOs into the Delaware River, Chester Creek and Ridley Creek. The result of these investigations were documented in DELCORA's *Identification of Sensitive Areas and Pollutants of Concern* Report. This section summarizes the Pollutant of Concerns that were determined for each of DELCORA's receiving waters.

5.8.1 Consent Decree Requirements for the Determination of POCs

For the Identification of Pollutants of Concern, Section V.A.11 of the Consent Decree specifically states:

> *"For each of its Receiving Waters, DELCORA shall review existing water quality data and recent PADEP CWA § 303(d) listings to identify POCs. Even if a water body has not been formally listed as out of compliance with its water quality standards and designated uses, if available data indicate such impairment exists and such impairment involves pollutants associated with CSOs, DELCORA shall consider the related pollutants to be POCs."*

5.8.2 Methodology for Determination of the POCs

In the effort to identify the Pollutants of Concerns related to its CSO discharges, DELCORA reviewed the 2014 PA Integrated Water Quality Monitoring and Assessment Report (303(d) List), the historic sampling data for the influent to the Western Regional Treatment Plant, the USEPA's Storage and Retrieval (STORET) Data repository, historic water quality sampling data from the Chester and Ridley Creeks, and additional sampling results from the CSOs that were taken in November and December of 2015.

For the identification of the POCs, DELCORA took an inclusive approach to determine that all relevant water quality parameters were appropriately considered and evaluated. The first step was to develop a comprehensive list of the overall "Parameters Considered", which was then further evaluated and refined to determine the list of the applicable POCs. Development of the list of Parameters Considered was meant to cast a wide net as the first step towards identifying any parameters that might possibly be of concern.

The initial list of the Parameters Considered was compiled from six (6) primary reference sources from the USEPA, PADEP and the DRBC. The Parameters Considered list initially consisted of those specific parameters listed in the USEPA's CSO Guidance Document. Additional parameters were added from the parameters requiring sampling per DELCORA's NPDES permit, from the PA Code's specific water quality criteria for DELCORA's three receiving water bodies, from the DRBC's Water Quality Regulations for Zone 4 of the Delaware River, from the 2014 PA Integrated Water Quality Monitoring and Assessment Report (a.k.a. "303(d) List"), and from the DRBC's 2014 Delaware River and Bay Water Quality Assessment report (DRBC, 2014). Once the initial list of Parameters Considered was developed, additional parameters were added onto the list if they had been detected during the historical sampling data of the influent to the WRTP, and in the existing CSO monitoring data (as required by the NPDES permit). One year's worth of DELCORA's plant influent historical sampling data from September 1, 2014 through September 1, 2015 was collected and analyzed to identify additional Parameters Considered.

To help narrow the list of the Parameters Considered additional wet weather sampling at the CSOs was required. The additional sampling occurred on November 19th and December 1st, 2015 at the three CSO locations DELCORA is required to regularly monitor; the Chester Pump Station wet well, CSO #018 at Sun Drive and Hancock Street, and at CSO #019 at 14th Street and Crozer Hospital. The CSO sampling results were used to confirm if the Parameters Considered were actually prevalent in DELCORA's CSO discharges. If a parameter on the Parameters Considered list was not detected in the November and December 2015 wet weather sampling of the CSOs, those parameters were not considered further as POCs.

For each of the remaining Parameters Considered, the receiving stream water quality data from the USEPA STORET data warehouse for the years 2010 through 2015 was compared to the applicable WQS to check for exceedances. Both the acute and chronic conditions for the Parameters Considered were reviewed, where applicable, to determine if there had been exceedances of the applicable water quality standards. The segments of the Delaware River, Chester Creek and Ridley Creek have unique water quality standards that apply to them depending on the regulating authority, their designated uses, and the specific location within the waterbody. The Delaware River was broken down into two sections for the evaluation; one for the Delaware River upstream of R.M 81.8 ("upper Delaware") and the second for the Delaware River downstream of R.M 81.8 ("lower Delaware") based on the Water Contact Recreation

designated use for the Delaware River below R.M. 81.8 and the more stringent requirements associated with primary contact.

Once the Parameters Considered list was narrowed using the November/December 2015 additional sampling results at the CSOs, the parameters remaining on the narrowed list of Parameters Considered were further evaluated to determine if they are Pollutants of Concern. A parameter was considered to be a "Pollutant of Concern" for a water body if more than 10% of the samples taken exceeded the applicable water quality standard. This criteria was based on guidance provided by the USEPA, which recommends a "greater than 10% exceedance percentage" for determining that waters only partially meet their designated use for aquatic life support. If a parameter was determined to be a POC, it is to be further investigated through additional receiving water quality monitoring and modeling. A parameter was considered to be only a "Parameter of Potential Concern" (POPC) if 2 – 10% of the samples taken exceeded the applicable water quality standard, and any identified POPCs are to continue to be monitored and re-evaluated should the monitoring show their concentrations to increase over time.

5.8.3 Summary of the Identified POCs for each Receiving Water

Three (3) POCs were determined and these include Fecal Coliform bacteria, Enterococcus bacteria and E. coli bacteria. These three POCs apply to each of DELCORA's three receiving waters; the Delaware River, Chester Creek and Ridley Creek. These three POCs are parameters typically associated with CSO discharges, and the list of the POCs is summarized below. The concentrations of these identified POCs in the Delaware River, Chester Creek and Ridley Creek have been further investigated through the receiving water quality monitoring and modeling, subsequently described in Section 6 of this report.

The identified POCs for each of the receiving water bodies are listed below.

- For the lower Delaware River (Downstream of R.M. 81.8)
  - Fecal Coliform Bacteria
  - Enterococcus Bacteria
  - E. coli Bacteria
- For the upper Delaware River (Upstream of R.M. 81.8)
  - Fecal Coliform Bacteria
  - Enterococcus Bacteria
  - E. coli Bacteria
- For the Chester Creek
  - Fecal Coliform Bacteria
  - Enterococcus Bacteria
  - E. coli Bacteria
- For the Ridley Creek
  - Fecal Coliform Bacteria
  - Enterococcus Bacteria
  - E. coli Bacteria

No Parameters of Potential Concern were identified.

5.9 Identification of Sensitive Areas

This section presents information on the identification of Sensitive Areas to meet the requirements of Section V.A.16.b of the Consent Decree, and Paragraph II.A.C.1.b of the USEPA's CSO Control Policy. The information in this section is summarized from the Sensitive Areas investigation originally presented in DELCORA's report *Identification of Sensitive Areas and Pollutants of Concern Report* (Greeley and Hansen, 2016c).

5.9.1 Regulatory Requirements

5.9.1.1 Consent Decree Requirements

For the Identification of Sensitive Areas, Section V.A.11 of the Consent Decree states:

> *"For each of its Receiving Waters, DELCORA shall contact appropriate agencies, access available data sources, and collect additional data as necessary to identify Sensitive Areas. DELCORA shall fully document all such contacts and the associated responses, and all additional investigations carried out to identify Sensitive Areas. DELCORA shall also identify any additional areas that, while not Sensitive Areas, have been identified by DELCORA as being appropriate for prioritization ("Priority Areas")."*
>
> *Additionally, "For each of its Receiving Waters, DELCORA shall conduct community outreach and appropriate studies to determine whether and to what extent primary contact recreation is occurring in each Receiving Water, and shall fully document its outreach and study methods, and its findings."*

5.9.1.2 Requirements of the USEPA's CSO Control Policy and Sensitive Areas Definition

The USEPA's CSO Control Policy (59 Fed Reg 75 [April 19, 1994]: 18688-18698) "expects a permittee's long-term CSO control plan to give the highest priority to controlling overflows to sensitive areas" (Section II.C.3). The CSO Control Policy states the six (6) criteria for defining an area as a "Sensitive Area" include:

1. Designated Outstanding National Resource Waters
2. National Marine Sanctuaries
3. Waters with threatened or endangered species and their habitat
4. Waters with primary contact recreation
5. Public drinking water intakes or their designated protected areas
6. Shellfish beds

The CSO Control Policy states that if Sensitive Areas are present and impacted, the LTCP should include provisions to:

- Prohibit new or significantly increased overflows
- Eliminate or relocate overflows wherever physically possible and economically achievable
- Treat overflows where necessary
- Where elimination or treatment is not achievable, reassess impacts each permit cycle

Sensitive Areas should be considered prior to the evaluation of CSO control alternatives. This allows a CSO community to identify and estimate costs for controls that could eliminate or relocate CSOs from Sensitive Areas where pollutant loadings pose a high environmental or public health risk and where control efforts should be focused.

5.9.1.3 Priority Areas Definition

The term "Priority Areas" is not specifically defined by the USEPA in the Consent Decree nor in the CSO Control Policy or Guidance Document. For the purposes of this report, the term "Priority Areas" is defined as follows:

> *"Areas having some environmental significance but not to the level of "sensitive areas" as defined in the federal CSO Control Policy. These priority areas may include: public access areas (i.e., near marinas, schools, playgrounds, parks, or athletic fields); or use of shallow streams for recreational activity, with something less than full contact (i.e., wading)".*

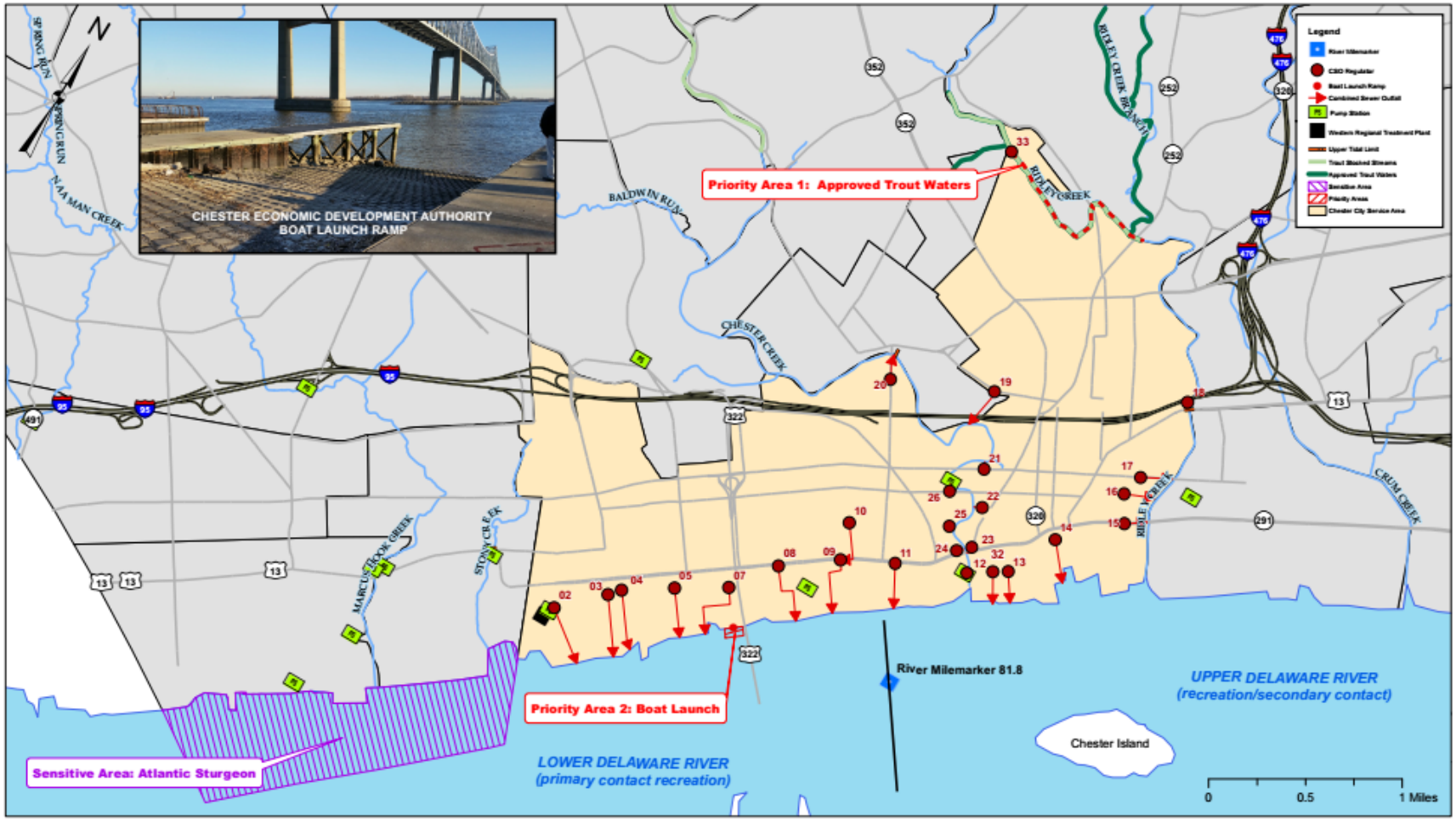
5.9.2 Summary of Sensitive and Priority Areas

The six criteria for Sensitive Areas identified in the CSO policy were evaluated for the Delaware River, Chester Creek and Ridley Creek within DELCORA's service area including reaches upstream of the CSOs. Special consideration was given to areas downstream and within the tidal influence of DELCORA's CSOs as any potential Sensitive Areas within hydraulic proximity to outfalls that may be impacted by their discharge. A comprehensive review of online databases, correspondence with regulatory agencies and local environmental organizations, and responses to the public survey was conducted to identify potential Sensitive Areas and Priority Areas within the CSS portion of the collection system. A summary of the findings for areas within the project boundary is presented below. A map of the sensitive and priority areas is shown in Figure 5-6. Additional details can be found in the report *Identification of Sensitive Areas and Pollutants of Concern Report* (Greeley and Hansen, 2016c).

5.9.2.1 Summary of Sensitive Areas

The habitat for year-of-young Atlantic Sturgeon downstream of CSO #002 in the Delaware River meets the Sensitive Area criteria for Endangered or Threatened species. The Atlantic Sturgeon is listed as a threatened species by the US Fish and Wildlife Service with documented habitat in the Delaware River downstream approximately one-half mile downstream of DELCORA's most southern outfall.

Figure 5-6: Sensitive and Priority Areas



There are no Outstanding National Resource Waters nor National Marine Sanctuaries within the project area. Shellfish beds are located well downstream of the CSO locations and are outside the project boundaries. There are numerous drinking water intakes in the geographical area but none are located in close proximity downstream of DELCORA's CSOs on the Delaware River. No drinking water intake locations were found that meet the criteria of a Sensitive Area.

5.9.2.2 Summary of Priority Areas

Priority Areas include areas having some environmental significance but not to the level of "Sensitive Areas" as defined in the federal CSO Control Policy. Two Priority Areas were identified:

- Approved trout waters in Ridley Creek
- Chester Economic Development Authority's boat launch in Chester City

The northern reaches of Ridley Creek within DELCORA's service area are designated as Approved Trout Waters and Trout Stocked Streams. The portion of the approved trout waters from CSO #033 downstream to Chestnut Street (see Figure 5-6) is considered a Priority Area because of this special environmental use.

The boat launch located between CSO #007 and #008 along the Delaware River is located within the portion of the waterbody rated for primary contact. The boat launch is considered a Priority Area due to its location to CSO #007 and #008.

5.9.2.3 Other Considerations

Bald eagles are known to nest in the vicinity of the project area. While the Bald Eagle has been removed from the Federal list of threatened and endangered species, the Bald Eagle along with the Golden Eagle continues to be protected under the Bald and Golden Eagle Protection Act (BGEPA) and the Migratory Bird Treaty Act (MBTA). These Acts prohibit anyone to "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest, disturb, or otherwise harm eagles, their nests, or their eggs". Under the BGEPA, "disturb" means to agitate or bother a Bald or Golden Eagle to a degree that causes, or is likely to cause, based on the best scientific information available: (1) injury to an eagle; (2) decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior; or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior. Since the Bald Eagle has been removed from the Federal list of threatened and endangered species, the Sensitive Area criteria for Threatened or Endangered Species does not apply to the project study area. However, it is acknowledged that these species require special consideration. During the development of CSO abatement alternatives, the project will be evaluated for project size, location and layout in order to comply with the BGEPA and MBTA.

Section 6 Collection of Water Quality Data

6.1 Background

The USEPA CSO Control Policy Section II.C.4 states that the long term CSO control plan should adopt one of the two approaches, Presumptive or Demonstration Approach, for CSO controls sufficient to meet CWA requirements. The DELCORA *Alternatives Evaluation Approach Report* (Greeley and Hansen, 2016b) was submitted to the USEPA and the PADEP in April 2016 proposing to utilize the Demonstration Approach for the DELCORA receiving streams. The USEPA approved this report thereby approving the demonstration approach for each receiving stream in October 2016.

Consent Decree requires that if DELCORA utilizes the Demonstration Approach in one or more of its Receiving Waters, then it is to establish a Monitoring Program to collect any additional data needed to facilitate the development, calibration, and validation of the Receiving Stream Water Quality Modeling Program, once the existing data have been assessed. The calibrated and validated Water Quality Model will be used to evaluate Typical Hydrologic Period in-stream conditions for each identified Pollutant of Concern, previously identified in DELCORA's *Identification of Sensitive Areas and Pollutants of Concern Report* (Greeley and Hansen, 2016c).

This section presents the results of the Water Quality Monitoring Program and includes water quality data collected from CSO discharges, storm water discharges, and from the three receiving waters. The Water Quality Monitoring Program was run concurrently with the Rain fall and Flow Monitoring Program in the spring of 2017. The goal of this program was to collect water quality data for the calibration and validation of the Water Quality receiving stream model. The final sampling results analysis is being conducted at this time and will be included in the final Water Quality Sampling Report and the final Water Quality Modeling Report to be issued August 2017 and February 2018 respectively. This Section also includes summary information previously presented in DELCORA's *Water Quality Monitoring and Modeling Work Plan* (Greeley and Hansen, 2017a) and *Water Quality Monitoring and Modeling Quality Assurance Project Plan* (Greeley and Hansen, 2017).

6.2 Regulatory Requirements

6.2.1 Consent Decree Requirements

Paragraphs V.A.10.e and V.A.10.f of the Consent Decree require that the development of the LTCP include:

V.A.10.e.	*Develop and implementation of a Water Quality Model*
V.A.10.f	*Characterization of the service area and the Receiving Waters as required by CSO Control Policy Paragraph II.C.1 and associated guidance.*

Consent Decree Paragraph V.A.15.a.(iv) specifically requires that:

> *"For each water body in which the Demonstration Approach is to be used, the Water Quality Model Plan shall address:*
> *i. Background, Scope and Purpose, Description of System;*
> *ii. Water quality modeling software to be employed;*
> *iii. Model configuration and development, including reaches to be modeled, and segmentation and boundary conditions;*
> *iv. Calibration and validation (dry weather and wet weather, including events and data to be employed, detailed information regarding all additional data collection activities (if needed), quantitative and qualitative calibration criteria, and utilization of H&H Model outputs;*
> *v. Use of the Water Quality Model to evaluate Typical Year instream conditions for each identified pollutant of concern;*
> *vi. Schedule for model development and implementation, including integration into LTCP development consistent with other dates required pursuant to the Consent Decree."*

The Consent Decree further specifies that within sixty (60) days after the approved Water Quality Model Plan is fully implemented according to the schedule included therein, DELCORA shall submit to EPA and PADEP a Water Quality Model Report for review and approval which shall specifically address each item set forth in Paragraph 15(a)(i)-(vi). Per the Water Quality Model Work Plan schedule, the Water Quality Model Report will be submitted February 2018 and will address the items mentioned above including Water Quality Modeling sampling results and assessment.

6.3 Overview of Historical Water Quality Monitoring

The Water Quality Monitoring Program (WQMP) was designed to collect data that will be used to assess water quality concerns identified in the Delaware River watershed and its tributaries, Chester Creek and Ridley Creek, in the vicinity of Chester, PA. Pollutants of concern (POCs) are identified in the *Identification of Sensitive Areas and Pollutants of Concern Report* (Greeley and Hansen, 2016c) which was approved by US EPA on October 13, 2016. Table 6-1 below lists the POCs that were identified for the receiving streams and were approved for further investigation through water quality monitoring and modeling. The POCs are *Fecal coliform*, *Escherichia coli (E. coli)*, and *Enterococcus* and are the primary focus of the WQMP.

Table 6-1: List of Pollutants of Concern (POC)

No.	Upper Delaware River		Lower Delaware River		Chester Creek		Ridley Creek	
Pollutants of Concern (>10% of observed samples exceed WQS)								
1	Fecal Coliform[(b)]	100%	Fecal Coliform[(b)]	100%	Fecal Coliform[(a),(b)]	100%	Fecal Coliform[(a),(b)]	100%
2	Enterococcus [(b),(c)]	100%	Enterococcus [(b),(c)]	100%	Enterococcus [(b),(c)]	100%	Enterococcus [(b),(c)]	100%
3	E. coli[(c)]	100%	E. coli[(c)]	100%	E. coli[(c)]	100%	E. coli[(c)]	100%

[(a)] Based on historical sampling conducted in 2010 upstream and downstream of CSO outfalls only on Chester and Ridley Creeks.
[(b)] Fecal Coliform and Enterococcus are listed as POCs due to both being parameters typically associated with CSOs.
[(c)] DRBC regulations are available for Enterococcus and it is typically associated with CSOs and therefore it is included as a POC. However, in consultation with PADEP Enterococcus could be replaced with E. coli bacteria in the future (based on the anticipation that national standards on E. coli will be adopted in Pennsylvania) and therefore E.coli is also included as a POC.

In completing the initial step of characterizing the watershed, historical data was compiled, reviewed and assessed to determine the need to augment existing data to address the watershed issues identified. This review indicated that one of the POCs, *E. coli*, has not been sampled in all the receiving waters and the data that have been collected for the remaining POCs were of insufficient frequency and spatial density to be useful in the modeling process.

6.3.1 Historic Water Quality Sampling

The Water Quality Model requires robust flow and water quality datasets to build confidence in its use as a tool for CSO planning. Data are needed in the modeled receiving waters for use in model calibration and validation as well as for the predominant wet weather sources, such as DELCORA's CSOs and the City of Chester's MS4 runoff to estimate pollutant loadings to the model. The existing water quality data were reviewed for their adequacy in meeting the data needs of the water quality model for the POCs (fecal coliform, *E. coli*, and *Enterococcus*). The review indicated that Chester Creek and Ridley Creek have limited POC data. Although the Delaware River has more extensive POC data, it lacks the temporal frequency needed to characterize wet weather impacts from DELCORA's CSOs.

It would have been difficult to constrain the Water Quality Model's representation of DELCORA's sources on the receiving waters without additional monitoring data designed specifically for calibrating and validating a robust water quality model. Existing flow data were also reviewed for adequacy; reports of mean daily stream discharge are available from several stream gages along the Delaware River and in tributaries near the DELCORA service area, ranging from as early as 1912 to the present. The existing flow and water quality data are described in this section.

Flow data for the Delaware River and tributaries in the DELCORA service area were obtained from the USGS National Water Information System. Reports of mean daily stream discharge were

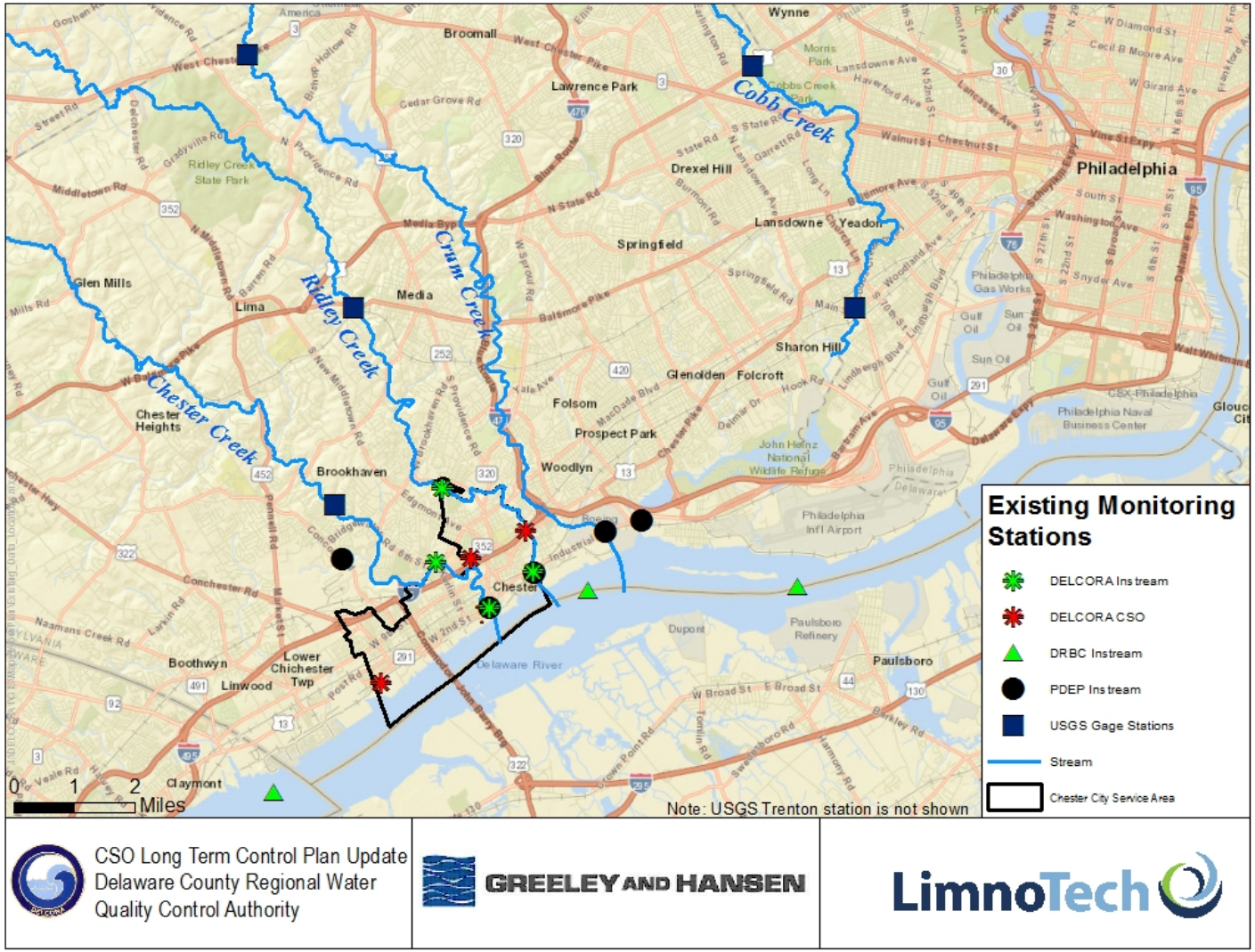
available from five stream gages in DELCORA service area measuring daily mean discharge: Crum Creek near Newtown Square, PA (1980-2016); Chester Creek near Chester, PA (1931-2016); Ridley Creek near Media, PA (1986-2016); Cobbs Creek at U.S. Highway No. 1 at Philadelphia, PA (1964-2016); and Cobbs Creek at Mt. Moriah Cemetery, Philadelphia, PA (2005-2016). Though not in service area, mean daily discharge data were also obtained from the gage at the Delaware River at Trenton, NJ (1912-2016) because it is expected that these data will be used to inform the upstream boundary for the hydraulic portion of the water quality model. The USGS Pennsylvania Water Science Center has conducted water quality sampling at various points in the state. However, none of their sampling locations are near to the DELCORA service area or local waterways.

Monthly effluent data from DELCORA's WWTP are available from the Pennsylvania Department of Environmental Protection's (PADEP) eDMR website (*www.dep.pa.gov/edmr*). Reported data include monthly geometric mean and instantaneous maximum values for fecal coliform from 2009 through 2016. PADEP also monitors water quality of tidal streams that empty into the Delaware River, through the Pennsylvania Water Quality Tributary Project funded by the Delaware River Basin Commission (DRBC). This program monitored for fecal coliform levels in Chester Creek, Ridley Creek, Darby Creek, Crum Creek, and others twice annually from 2007-2010. PADEP also operates the PA Surface Water Quality Monitoring Network, through which Baldwin Run (a tributary to Chester Creek) was sampled monthly for fecal coliform from 1998-1999.

The Delaware River Basin Commission operates its Boat Run program to monitor ambient, sampling for *E. coli*, *Enterococcus*, and fecal coliform at various sites along the Delaware River (Figure 6-1). Samples were collected from each station between one and three times each month from March through November every year since 1999. Through this program, data are available at three sites near DELCORA: Eddystone (2005-2016), Paulsboro (1999-2016), and Marcus Hook (1999-2016).

Since 2009, DELCORA has also done their own sampling at CSO outfall sites and in receiving waters. In 2010, a survey was conducted to measure fecal coliform levels in Ridley and Chester Creeks during wet and dry weather. There were two sample sites in each creek, and over the course of the study, six surveys were conducted. Four surveys occurred during dry weather, one during a wet event, and one during a wet event after a storm. During each survey, one sample was collected at each site. In 2009, DELCORA began sampling in the CSO system as required by their NPDES permit. Four outfalls and pump stations were sampled once annually for fecal coliform from 2009-2011, and three outfalls were sampled once annually for fecal coliform from 2012-2014. In 2015, four outfalls and pump stations were sampled for fecal coliform and *Enterococcus*, on three separate occasions. *E. coli* was not measured in any of these surveys.

Figure 6-1: Historical Flow and Water Quality Sampling Locations Near DELCORA Service Area



The extent of the historical water quality data and its adequacy to support the Water Quality Model development and calibration can be summarized as follows:

- Some CSO water quality data had been collected but mostly for fecal coliform. There were no CSO data for *E. coli*. Another limitation in the CSO data is that the CSO samples did not coincide with in-stream sampling, making it difficult to directly link CSO loads to in-stream impacts.
- No water quality sampling for the POCs had been done of the stormwater runoff in the separated areas of the DELCORA service area.
- The Delaware River had the most data of the receiving waters and it had data for all three POCs. However, the data were collected at regular intervals, independent of weather condition, and typically only one sample per location per survey was collected. These periodic sampling events do not provide enough data to characterize DELCORA loads on the river.
- The tributaries (Chester Creek and Ridley Creek) have been sampled sporadically and rarely within the tidal zone adjacent to DELCORA's service area. Wet weather data collected by DELCORA, consisting of only one sample per event, were not sufficient to characterize the magnitude and duration of the POCs' pollutographs over a storm event. Data are most robust for fecal coliform. There was less data for *Enterococcus* and none for *E. coli*. In addition, no sampling had been conducted in these tributaries since 2010.

DELCORA's Water Quality Monitoring Program conducted during Spring 2017 builds on the water quality sampling that had already been done while addressing the limitations identified in the historical data. The WQMP included a comprehensive monitoring assessment of all of the POCs to characterize loads and in-stream conditions, and these data were used to inform the Water Quality Model development, calibration and validation.

There has not been routine, on-going monitoring for the pollutants of concern in the tributary waterways adjacent to the DELCORA service area. The Delaware River Basin Commission samples the Delaware River near Chester approximately once a month between April and October. The analysis of these samples includes fecal coliform, *E. coli*, and *Enterococcus*, which are the pollutants of concern (POCs).

6.4 Overview of the Water Quality Monitoring Program

6.4.1 Water Quality Monitoring Objectives

The Water Quality Monitoring Program (WQMP) is designed to collect data that will be used to develop and calibrate watershed and receiving water quality models that will be used to assess water quality concerns for the POCs identified in the *Identification of Sensitive Areas and Pollutants of Concern Report* (Greeley and Hansen, 2016c). The report identified three indicator bacteria (fecal coliform, *Escherichia coliform* (*E. coli*), and enterococcus) as pollutants of concern (POC) that are potentially impacting receiving water quality during CSO discharges in all three of the receiving waters (Delaware River, Chester Creek and Ridley Creek).

Existing water quality data provides insight into the conditions in the river and streams in the project area but are of insufficient frequency and spatial density to fully support the modeling process. In addition, *E. coli*, one of the identified POCs, was not monitored in the available data. The water quality monitoring objectives are to collect water quality data for the POCs during dry and wet weather event periods that can be used to characterize the bacteria sources in the Delaware River watershed in the vicinity of the City of Chester, PA, and to calibrate and validate the Water Quality Model, consistent with the Consent Decree requirements in Paragraph V.A.15.a. Additional in situ parameters that included salinity, temperature and conductivity were collected to inform the development of the Water Quality Model.

The collection of new water quality data was required to address the shortcomings of the historical water quality data by:

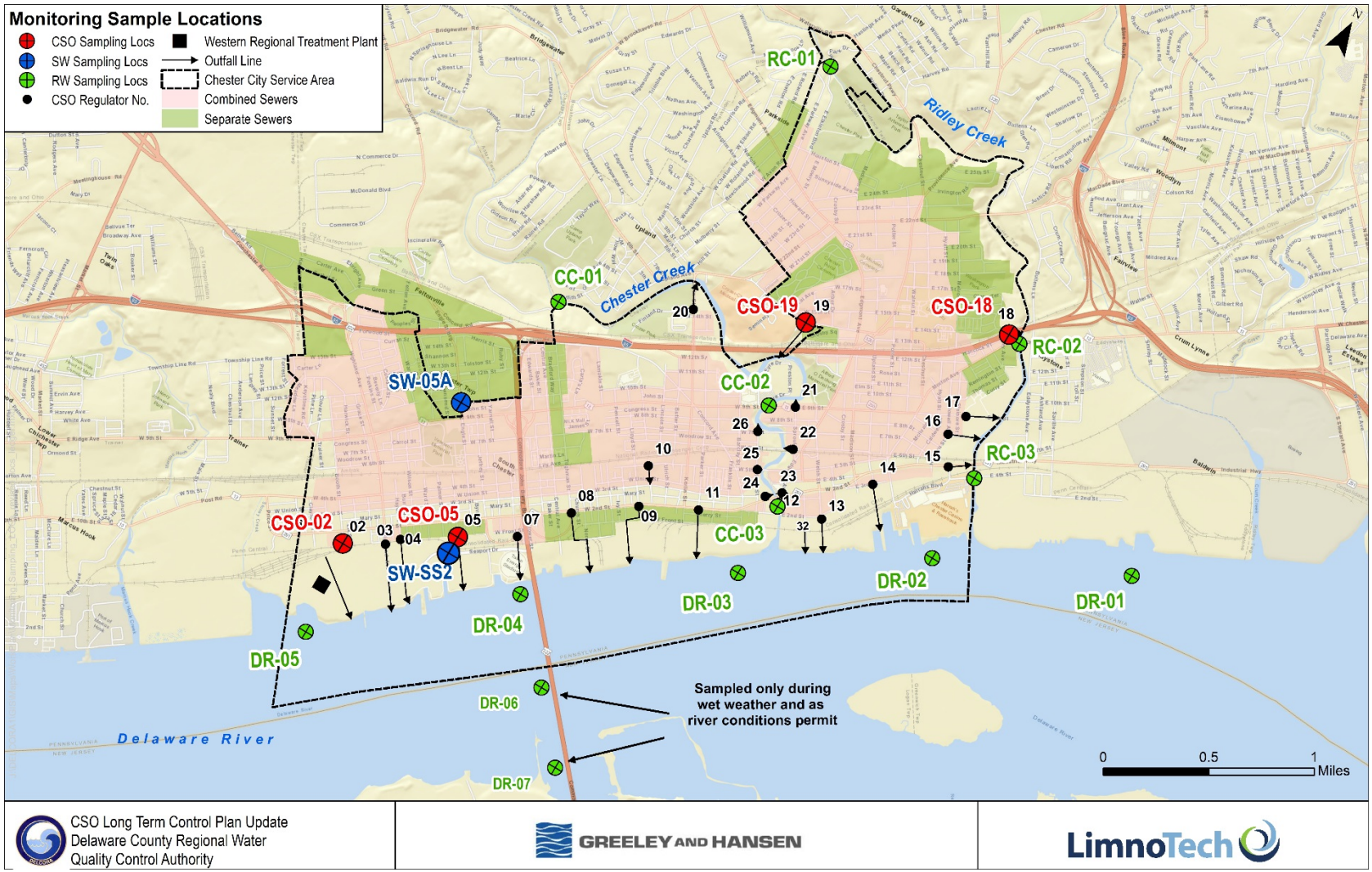
- Providing the frequency needed for in-stream concentrations (multiple samples spaced over several days) during wet weather to calibrate fecal coliform, *E. coli* and *Enterococcus* concentrations in the Receiving Water Quality Model;
- Providing wet weather event data for a range of storm conditions to calibrate and validate the Receiving Water Quality Model;
- Capturing the effects of the wet weather event throughout the CSO model area;
- Providing better constraints on calculated loads from storm water, tributary, and CSO sources than when using historical data

6.4.2 Water Quality Sampling Locations

Water quality monitoring was undertaken at thirteen (13) in-stream locations (seven of which are Delaware River sampling locations), four (4) CSO locations in the DELCORA combined sewer system area, and two (2) stormwater locations in the City of Chester municipal separate storm sewer system, as shown in Figure 6-2. Water quality monitoring and sampling was conducted as follows:

- Eleven (11) in-stream locations in the vicinity of the DELCORA CSO area were sampled for water quality for (3) dry weather events; one of which was targeted for collection during a tributary low-flow period (less than 25th percentile flow). The mid-stream and far-shore Delaware River locations were not sampled during the dry weather surveys because it was expected that water quality in the river is relatively uniform laterally due to

Figure 6-2: Receiving Water (RW), Combined Sewer (CSO) and Stormwater (SW) Monitoring Locations



the lack of active sources during dry weather. Grab samples and *in situ* measurements were collected at each location during each event.

- All thirteen (13) in-stream locations were sampled for water quality using grab samples and in situ monitoring for three (3) discrete wet weather events, according to the surface water quality monitoring program protocols described in the Monitoring Work Plan;
- Up to four (4) CSO and two (2) stormwater outfall locations were sampled for water quality for the same three (3) discrete wet weather events according to the outfall monitoring program protocols described in the Monitoring Work Plan. Samples for all outfalls were collected as grab samples.

The sampling events were planned to be distributed across the sampling season, which is assumed to be March through June 2017. Additionally, bathymetry surveys in the lower portion of the Chester and Ridley Creek were conducted to inform the development of the Water Quality Model.

Monitoring locations were selected to characterize the watershed at a sub-watershed level, recognizing various political and hydrologic features, land uses and potential pollutant sources. Site selection and analytical parameters were designed to characterize stormwater outfalls, CSOs, tributaries upstream and within the Chester CSO discharge area, and the main stem of the Delaware River in the project area. The sampling locations are shown in Figure 6-2 and listed in Tables 6-2, 6-3 and 6-4.

Tables 2-1, 2-2 and 2-3 include summaries of the rationales for each sampling location selected. The Chester Creek and Ridley Creek locations were selected to distinguish, to the extent possible, between upstream, stormwater and Chester CSO pollutant loads. The Delaware River sampling locations provided a characterization of water quality entering the Chester CSO area from either tidal direction as well as water quality within the CSO discharge area. During wet weather, three samples were collected across the transect corresponding to the DR-03 sampling location during each sampling round, when sampling across the river was feasible, to characterize lateral variability in the Delaware River during storm events.

The CSO sampling locations were selected based on their outfall discharge location, relatively high frequency of overflow, their overflow volume, and their accessibility. The stormwater sampling locations were selected to characterize the water quality associated with the predominant land uses (residential and commercial/industrial) in the study area. Each stormwater sampling location is in an area that is representative of the land use elsewhere in the City's stormwater area.

Table 6-2: Tributary Receiving Water Sampling Locations

Station ID	Easting[1]	Northing[1]	Receiving Water	Type	Description	Rationale
CC-01	243291.419	371541.259	Chester Creek	Tributary	Chester Creek at Upland-Incinerator Rd.	Upstream of all City sources and upstream of tidal influence
CC-02	248598.992	372750.444	Chester Creek	Tributary	Chester Creek at North Eyre Rd[2]	Characterize impacts from non-CSO urban runoff sources
CC-03	250712.383	369489.807	Chester Creek	Tributary	Chester Creek at E 2nd St.	Characterize impacts from all CSOs discharging to Chester Creek
RC-01	243755.086	380967.554	Ridley Creek	Tributary	Ridley Creek at East Brookhaven Road	Upstream of all City sources and upstream of tidal influence
RC-02	253932.835	376122.878	Ridley Creek	Tributary	Ridley Creek at Chester Pike	Characterize impacts from non-CSO urban runoff sources
RC-03	254545.954	372628.232	Ridley Creek	Tributary	Ridley Creek at East 4th St.	Characterize impacts from all CSOs discharging to Ridley Creek

Notes:
[1] Northing/Easting are referenced to NAD 1983 State Plane New Jersey FIPS 2900 Feet
[2] 9th Street may be used as sampling location if conditions for sampling from the bank at North Eyre St. are deemed unsafe.

Table 6-3: Main Stem Receiving Water Sampling Locations

Station ID	Easting[1]	Northing[1]	Receiving Water	Type	Description	Rationale
DR-01	259153.030	372425.510	Delaware River	Main stem	Delaware River between Ridley Creek and Crum Creek	"Upstream" of DELCORA's CSO discharges[2]
DR-02	250456.388	367784.535	Delaware River	Main stem	Delaware River between CSO-14 and Ridley Creek	Characterize Ridley Creek impacts on Delaware River, in the upper Delaware River (Secondary contact area)
DR-03	245922.404	364715.470	Delaware River	Main stem	Delaware River between CSO-11 and Chester Creek	Characterize Chester Creek impacts on Delaware River, in the upper Delaware River (Secondary contact area)
DR-03-MID[3]	252036.389	365265.510	Delaware River	Main stem	Delaware River mid-stream along the transect of DR-03	Characterize lateral variability in the Delaware River during storm events
DR-03-LDB[3]	253703.965	362951.038	Delaware River	Main stem	Delaware River far shore (left descending bank) along the transect of DR-03	Characterize lateral variability in the Delaware River during storm events
DR-04	241663.723	361297.935	Delaware River	Main stem	Delaware River at the boat launch off Highway 322	Priority area, in the lower Delaware River (Primary contact area)
DR-05	254551.896	370426.118	Delaware River	Main stem	Delaware River between CSO-002 and Stony Creek	"Downstream" of DELCORA's CSO discharges[2], in the Atlantic sturgeon sensitive area

Notes:

[1] Northing/Easting are referenced to NAD 1983 State Plane New Jersey FIPS 2900 Feet

[2] "Upstream" and "downstream" subject to tidal conditions at time of sampling

[3] These locations will be sampled during the wet weather events only, when river conditions permit. POC concentrations are assumed to be laterally well-mixed during dry weather due to the absence of significant pollutant sources.

Table 6-4: CSO and Stormwater Sampling Locations

Station ID	Easting	Northing	Receiving Water	Type	Description	Rationale
CSO-19	248984.7240	374039.747	Chester Creek	CSO	14th and Crozer Hospital	Discharges to Chester Creek, one of the largest volume CSOs in DELCORA system
CSO-05	243892.0527	365166.574	Delaware River	CSO	Front and Townsend	Discharges to Delaware River, one of the largest volume CSOs in DELCORA system
CSO-02	241439.9527	363646.588	Delaware River	CSO	Front and Booth	Aggregates cumulative effect of CS conditions, one of the volume CSOs in DELCORA system
CSO-18	253767.9703	376303.599	Ridley Creek	CSO	Sun Drive and Hancock St.	Discharges to Ridley Creek
SW-05A	242360.2937	368165.917	Chester Creek	SW		Characterize runoff quality from predominantly residential area representative of the residential portion of the study area
SW-SS2	248649.2079	368230.704	Delaware River	SW		Characterize runoff quality from predominantly commercial/industrial area representative of the commercial/industrial portion of the study area
Note: The sampling locations will be finalized once a sampling contractor has been selected and potential sampling locations are assessed with respect to accessibility, feasibility, safety, and representativeness. The northing/eastings information will likely be updated prior to the initiation of the Sampling Program. Northing/Easting are referenced to NAD 1983 State Plane New Jersey FIPS 2900 Feet						

6.4.3 Analytical Parameters

All of the in-stream dry and wet weather samples were analyzed for the parameters shown in Table 6-5: Analytical and Field Parameters. The outfall samples were analyzed for only *E. coli*, *Enterococcus* and fecal coliform.

Table 6-5: Analytical and Field Parameters

Parameter	Description	Sampling Program	Type of Measurement
E. coli	Escherichia coli	Dry, Wet	Grab
Enterococcus	Enterococcus sp.	Dry, Wet	Grab
Fecal Coliform	Fecal coliform	Dry, Wet	Grab
wTemp	Water temperature	Dry, Wet, Receiving Water Only	In-situ
Cond	Conductivity	Dry, Wet, Receiving Water Only	In-situ
Salinity	Salinity	Dry, Wet, Receiving Water Only	In-situ

6.4.4 Sampling Schedule and Dates

6.4.4.1 Dry Weather Sampling

The collection of water quality samples was performed for three (3) dry weather (DW) events; with one dry weather sampling event occurring during a low-flow period (less than 25th percentile flow) in Chester Creek and Ridley Creek. Below are the River and Creeks flows for during each of the dry weather sampling events. Table 6-6 below presents the Delaware River, Chester Creek and Ridley Creek flow during each dry weather sampling event. Dry Weather Sampling Event 3 is closest to the 25th percentile river flow.

Table 6-6: Observed River and Creek Flow Statistics

Water Body	Gage Identification	Gage Description	25th Percentile Flow	Dry Weather Event 1		Dry Weather Event 2		Dry Weather Event 3	
			(cfs)	(cfs)	Percentile	(cfs)	Percentile	(cfs)	Percentile
Delaware River	USGS 01463500	Delaware River at Trenton, NJ	4,600	13,323	70.1	16,306	78.1	10,862	62.1
Chester Creek	USGS 01477000	Chester Creek near Chester, PA	41	75.7	60.5	63.9	50.7	46.8	32.2
Ridley Creek	USGS 01476480	Ridley Creek at Media, PA	18	29.4	49	25.0	41.7	19.0	27.5

Source:
- 25th percentile flow (cfs) and percentile for each water body is courtesy of the U.S. Geological Survey (USGS) StreamStats (https://streamstats.usgs.gov/ss/)
- Observed flow data (cfs) for each Dry Weather Event is courtesy of the following current/historical observations link on the National Water Information System (NWIS) webpage:
  Delaware River: https://nwis.waterdata.usgs.gov/nwis/inventory/?site_no=01463500
  Chester Creek: https://nwis.waterdata.usgs.gov/nwis/inventory/?site_no=01477000
  Ridley Creek: https://nwis.waterdata.usgs.gov/nwis/inventory/?site_no=01476480

Two rounds of sampling were conducted for each dry weather survey: one round was completed during ebb (outgoing) tide and the second round was completed during flood (incoming) tide. The following table summarizes the dates of the DW events.

DW Sampling Event	Event Date
DW-1	3/23/2017
DW-2	5/10/2017
DW-3	6/13/2017

These events were distributed across the sampling season, of March through June 2017. The criteria used to define a dry weather event are as follows:

- No precipitation within the upstream watershed at least 48 hours before the event
- No precipitation forecasted for a minimum of three days; and

Dry weather event samples were taken at eleven (11) locations:

- **Three (3) locations on Chester Creek** intended to characterize water quality upstream of DELCORA's service area as well as in the portion of the creek adjacent to DELCORA's CSO discharges and the area adjacent to the City of Chester outside the combined sewer service area. Additionally, because DELCORA's CSO discharges are within the tidal extent of the Delaware Bay River, the downstream sampling locations were intended to also reflect these tidal influences on water quality.

- **Three (3) locations on Ridley Creek** intended to characterize water quality upstream of DELCORA's service area as well as in the portion of the creek adjacent to DELCORA's CSO discharges and the area adjacent to the City of Chester outside the combined sewer service area. Additionally, because DELCORA's CSO discharges are within the tidal extent of the Delaware Bay, the downstream sampling locations were intended to also reflect these tidal influences on water quality
- **Five (5) locations on the Delaware River** intended to characterize water quality in the vicinity of DELCORA's CSO discharges. Sampling locations were selected to separate to the extent possible the effect of DELCORA's CSOs on water quality from other sources contributing pollutants to the waterways. Sampling was conducted near the shoreline adjacent to the City of Chester.

The locations of these sample stations are shown in Figure 6-2, and details for these stations are provided in Tables 6-2, 6-3 and 6-4. The set of parameters for which the samples were analyzed is provided in Table 6-5. In-situ measurements of physical parameters, such as salinity, temperature, and conductivity were collected at each sampling location with a YSI sonde. .In the Delaware River, *in situ* measurements were made at three depths at each sampling location during each round of sampling.

6.4.4.2 Wet Weather Sampling

The collection of water quality samples was performed for three (3) wet weather events. The purpose of the wet weather sampling was to characterize the impact of CSO discharges and non-CSO source runoff on in-stream water quality. The wet weather events spanned a range of precipitation, flow and seasonal conditions. One of the wet weather sampling events was also chosen as a calibration event for the H&H Model and the Water Quality Model.

The goal was to sample storms of at least 0.5 inches of precipitation. The criteria used to define a wet weather event included:

- No precipitation within the upstream watershed 48 hours before the event;
- Forecasts for a 60% (or greater) chance of rain over the entire DELCORA project area; and,
- Approximately 0.50 inches of rainfall forecasted over a six-hour period.

The following table lists the dates that each wet weather sampling event occurred:

WW Sampling Event	Event Date
WW-1	3/31/2017
WW-2	5/5/2017
WW-3	5/22/2017

Wet weather event samples were taken at all 13 in-stream locations as well as at six source locations in the intervals described below:

- **Six (6) In-Stream Tributary Sampling Locations:** Three (3) locations were on the Chester Creek and three (3) locations were on the Ridley Creek. The locations were the same locations

used for the dry weather surveys. Tributary locations were sampled up to five times per event at the following approximate intervals: Hour 0.5-2.5, Hour 4.5-6.5, Hour 8.5-10.5, Hour 14.5-16.5, and Hour 22-24. Sampling intervals were defined by the start of rainfall rather than CSO or SSO activation. A total of 30 samples was collected during each wet weather sampling event from in-stream locations. One field blank and one field duplicate was collected during each event to be used as field quality control (QC).

- **Seven (7) In-Stream Delaware River Locations:** Seven locations were on the Delaware River and were sampled up to ten times per event at the following approximate intervals: Hour 0, Hour 2, Hour 4, Hour 6, Hour 9, Hour 12, Hour 15, Hour 18, Hour 21, and Hour 24 intervals were defined by the start of rainfall rather than CSO or SSO activation. The frequency of sampling was intended to capture in-stream impacts in the vicinity of DELCORA's service area from both DELCORA's CSOs as well as upstream sources. Two additional locations on the Delaware River, one at mid-stream and one near the far shore, were added to characterize lateral variability in water quality during storm event conditions, when sampling across the river was feasible. The sampling regimen was also designed to allow a semi-quantitative mass balance to be computed over a complete tidal cycle. A total of 70 samples were collected during each wet weather sampling event. If river conditions were unsafe for sampling (e.g. small craft advisories, heavy barge traffic, etc.), sampling was suspended for one or more locations and/or sampling rounds. One field blank and one field duplicate was collected during each event to be used for field QC. Final selection of sampling locations and sampling intervals was determined prior to the start of the sampling program and based on logistic considerations (e.g. can seven locations be sampled and dropped off to a courier within the 3 hour sampling window), safety and accessibility to the Delaware River, and available resources. For some of the sampling events some of the planned intervals samples were not obtained if the storm event stopped before the designated sample time or if the boat could not reach the location due to restrictions on the Delaware River.
- **Six (6) Outfall Locations:** Sampling was conducted at two (2) stormwater outfalls and four (4) combined sewer overflow outfalls. The CSO and stormwater sampling locations were finalized prior to the initiation of the sampling program based on accessibility of sampling, safety of sampling personnel, equipment risk, and available resources. Each of the outfall locations had eight sets of samples collected for each event at the following intervals: 1st flush, 30 minutes, and 60 minutes, 2 hours, 4 hours, 8 hours, 12 hours, 24 hours. Samples were collected from CSO-05, CSO -02 and CSO-18 and during each wet weather sampling event, and if all monitored outfalls discharge for 24 hours. If a location was not flowing, no sample was collected. However, the actual number of samples was less than the amount indicated since not all the monitored outfalls discharged for the full 24 hour monitoring period. One field blank and one field duplicate were collected during each event to be used as field QC.

The locations of these stations are shown in Figure 6-2. Details for these stations are provided in Tables 6-2, 6-3 and 6-4. The set of parameters for which the samples were analyzed are summarized in Table 6-5. *In-situ* measurements were not collected at the outfall locations.

Sampling crews conducted all wet weather event sampling using the protocols described in the DELCORA's *Water Quality Monitoring and Modeling Quality Assurance Project Plan* (Greeley and Hansen, 2017b). Samples were delivered to the laboratory and analyzed for the parameters shown in Table 6-5: Analytical and Field Parameters.

Determination to mobilize for a Wet Weather Event was a collaborative effort between Greeley and Hansen, LimnoTech, Eurofin (Lab) and DELCORA field sampling team. The intent was to identify a storm that was at least ½ inch rainfall and a 4 to 6 hour window in which a wet weather event may commence 24 hours in advance to assist in mobilization of the sampling crews meeting the requirements stated above for a WW event.

6.4.4.3 In situ Measurements (Receiving Water Only)

Instantaneous water quality measurements (such as salinity, temperature, and conductivity) using field instruments was also collected at the receiving water locations as specified in the *Water Quality Monitoring and Modeling Work Plan* (Greeley and Hansen, 2017a). These measurements, along with calibration and maintenance, were conducted following the SOPs for Water Quality Field Measurements in the Work Plan. Field instruments were calibrated before initiating monitoring activities for each event and a post-monitoring calibration check was conducted at the end of the event.

Salinity, temperature, and conductivity were measured at all in-stream sampling locations using a YSI 6920 sonde during both wet and dry sampling events, prior to sample collection. Whenever possible in the Chester Creek and Ridley Creek, measurements were made mid-channel at mid-depth. Whenever possible in the Delaware River, measurements were made at the surface, mid-depth and near the bottom.

6.4.5 QAPP Overview

Prior to the start of the spring 2017 water quality sampling activities, DELCORA submitted to the EPA and PADEP its *Water Quality Monitoring and Modeling Quality Assurance Project Plan* (Greeley and Hansen, 2017b). This Quality Assurance Project Plan (QAPP) was developed to meet the requirements of the DELCORA Consent Decree Paragraph Section V.A.15.a.(iv) requiring detailed information regarding all additional data collection and water quality modeling activities. The purpose of the QAPP was to document the necessary procedures required to assure that the project is executed in a manner consistent with applicable USEPA guidance documents and with generally accepted and approved quality assurance objectives. The QAPP was organized in accordance with the basic groups and subgroup elements discussed in the USEPA guidance for QAPPs. The four basic groups include project management (Group A); data generation and acquisition (Group B); assessment and oversight (Group C); and data validation and usability activities (Group D). The groups are subdivided into elements covering specific topics related to each group. The Section and Subsection headings of this QAPP include references to the USEPA QAPP Guidance group letters and element numbers to facilitate cross-reference with the Guidance.

The QAPP integrates quality control policies and project-specific work tasks to successfully conduct water quality monitoring and modeling to support the CSO Long Term Control Plan update. Greeley & Hansen served as the contracting authority for the project and provided overall project management. LimnoTech served as the technical advisor for the sampling program and provided the data integration and interaction role. The field contractor, Weston conducted the actual sampling program, and the laboratory contractor, Eurofins, performed laboratory analysis for the project.

The QAPP was designed and organized in terms of compliance with USEPA requirements. It was the overall intent of the QAPP to provide professional guidelines for activities by all personnel on the project and to ensure that quality assurance/quality control QA/QC procedures are followed.

6.5 Receiving Water Quality Results

The identified pollutant of concerns for the Delaware River, Chester Creek and Ridley Creek are the same three indicator bacteria; fecal coliform, *Escherichia coliform* (*E. coli*), and enterococcus. Consequently, the Water Quality Monitoring Program primarily focused on the concentrations of these three parameters.

Water Quality Sampling has been completed; however, the results are currently being reviewed for quality assurance and analyzed. A summary of the sampling results are presented in Appendix D of this report; however, the analysis and conclusions are currently being conducted and will be presented in the final Water Quality Sampling Report and the final Water Quality Modeling Report.

Section 7 Typical Hydrologic Period

7.1 Introduction

7.1.1 DELCORA's Consent Decree

According to the Consent Decree between the USEPA, PADEP, and DELCORA, DELCORA shall submit to Plaintiffs a report or technical memorandum describing DELCORA's statistical evaluation of long-term local rainfall patterns and the identification of an appropriate typical period for LTCP development purposes. To satisfy this Consent Decree requirement, DELCORA submitted the *Typical Hydrologic Period Report* (Greeley and Hansen, 2016a), which was approved by PADEP and USEPA on May 23, 2016. The remainder of Section 7 is based on this approved report.

The statistical evaluation in the *Typical Hydrologic Period Report* (Greeley and Hansen, 2016a) utilizes local long-term rainfall record from the Philadelphia International Airport. It considers various appropriate rain year characteristics, including distributions of event rainfall totals, event durations, and peak and average rainfall intensities.

7.1.2 Typical Year for CSO LTCP Development

Precipitation generates urban storm water, combined sewer overflows (CSOs), and increased wet weather flows to the wastewater treatment plant. These will contribute bacteria and pollutants to the Delaware River and its tributaries. The effect of these contributors on the Delaware River mainly depends on the magnitude and duration of rainfall events and on the prevailing ambient river conditions controlling dilution and transport of the pollutants. This variability and complexity poses a significant challenge for assessing the performance of wet weather and CSO control alternatives.

In accordance with the USEPA CSO Control Policy (CSO Policy), dated April 19, 1994, the CSO control alternatives should be assessed on a "system-wide, annual average basis". This is accomplished by continuous simulation using a typical hydrologic period for the combined sewer system (CSS) and receiving water quality modeling applications. The CSO Policy supports continuous simulation modeling, i.e., using long-term rainfall records rather than records for individual storms. Long-term continuous rainfall records enable simulations to be based on a sequence of storms so that the additive effect of storms occurring close together can be examined. They also enable storms with a range of characteristics to be included.

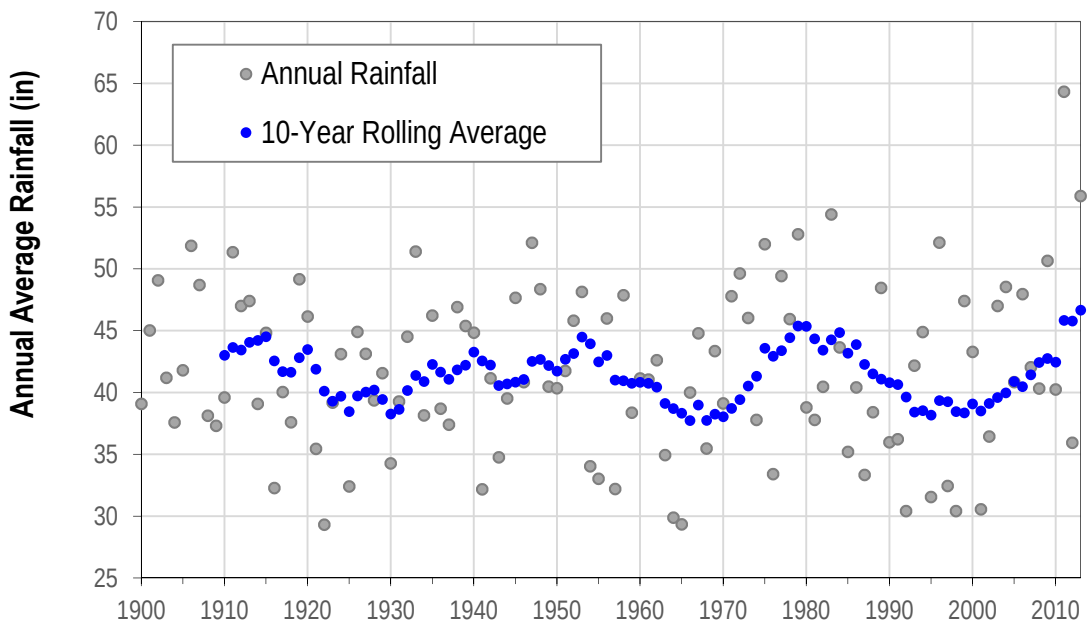
Typically, a 3- to 5-year period is evaluated to balance between manageable model simulation time and representation of various rainfall/river conditions. In this study, a 3-year period is deemed most appropriate considering the modeling complexity. The representative three-year period is intended to contain a relatively wet year, a dry year and an average year. Average year conditions are defined as the arithmetic average of the predictions for the selected period.

7.1.3 Climate Change Considerations

Average U.S. precipitation has increased since 1900, but there are regional differences, with some areas having larger increases, and others, decreases. Local climate change should be considered when selecting appropriate data records for the typical period analysis.
Rainfall data from the Philadelphia International Airport were obtained from the National Oceanic and Atmospheric Administration (NOAA). Hourly rainfall data is available from 1900 through 2013. This provides sufficient data to evaluate climate change in the area. Figure 7-1 shows annual rainfall from 1900 to 2013. A 10-year rolling average trend line is also shown in the figure for characterizing long-term precipitation pattern. In the past 114 years, annual rainfall ranges from 29.3 to 64.33 inches, with the wettest year in 2011. The 10-year rolling average rainfall indicates that precipitation in the area runs through various dry and wet cycles, however with more extreme conditions (dry and wet) in recent years.

Considering the climate change, it is determined that the typical period for the LTCPU be selected based on statistical analysis of rainfall records in recent 30 years (i.e., 1984-2013).

Figure 7-1: Historical Annual Rainfall at Philadelphia International Airport



7.1.4 Methodology of Typical Year Selection

The typical hydrologic period is selected to provide representative and unbiased approximations of expected future conditions in terms of both averages and historical variability. Representativeness is assessed using objective criteria for each of the ambient factors (i.e., river flow and rainfall). As indicated in the previous section, the selection of the typical hydrologic period is based on the historical records in the past 30 years from 1984 through 2013.

The following datasets are used for the analysis of the typical hydrologic period:

- Hourly precipitation data for the National Climate Data Center gauge at Philadelphia International Airport for 1984 - 2013.
- Daily Delaware River stream flow data from the U.S. Geological Survey gauge at Trenton, NJ (USGS 01463500) for 1984 - 2013. This is the closest USGS gauge that with daily river flow available.

Key criteria parameters used in the evaluation are listed in Table 7-1. Each parameter is given a weighting factor to describe the individual importance on the averageness of the analyzed time period. The parameters that are given the highest impact weighting include the following:

- The total annual rainfall depth, which drives the total runoff volume.
- The maximum peak intensity, which usually defines the biggest overflow event.
- The median Delaware River flow; the impact of sewer overflows on the water quality of the receiving water is dependent on the magnitude of the flows in river, and in the project area, intense local rainfall events are typically independent from watershed wide high flow events.

Table 7-1: Hydrologic Period Ranking Parameters

Key Parameter	Weighting Factor	Comments
Annual rainfall depth	25.0%	Important for evaluating annual overflow volume
Number of events > 0.1” rainfall depth	2.5%	Typically storms over 0.1” would start to cause surface runoff
Number of events > 0.25” rainfall depth	2.5%	Previous model indicates system overflows at storms over 0.25”
Number of events > 1.5” rainfall depth	7.5%	Storms to be controlled to meet potential presumption approach
Number of back-to-back events	5.0%	Important for evaluating the antecedent conditions
Maximum peak intensity	20.0%	Storms with high intensity causes overflows
Average rainfall duration	2.5%	Important for evaluating wet weather durations
Average rainfall intensity	5.0%	Important for evaluating overall rainfall intensity
Delaware River flow - 25th percentile	2.5%	Important for evaluating dilution power of the Delaware River flow for water quality
Delaware River flow - 50th percentile	25.0%	
Delaware River flow - 75th percentile	2.5%	

7.2 Typical Year Selection for DELCORA

7.2.1 Annual Rainfall and River Flow Statistics

30-year hourly precipitation data (1984 - 2013) from the Philadelphia International Airport was analyzed to evaluate all individual rainfall events in the period. An inter-event time (IET) of 6 hours (i.e. minimum dry time of 6 hours between rainfall events was used to differentiate between individual events. Precipitation periods with a total rainfall volume of greater than 0.1 inch were counted as rainfall events. If the next rainfall event's starting time is within one day of the previous rainfall event's ending time, these two rainfall events are considered as back-to-back rainfall events. All rainfall events for the data period were analyzed for duration, inter-event duration, total rainfall amount, as well as maximum and average rainfall intensities. A total of 1,934 rainfall events were counted for the period of 1984 - 2013.

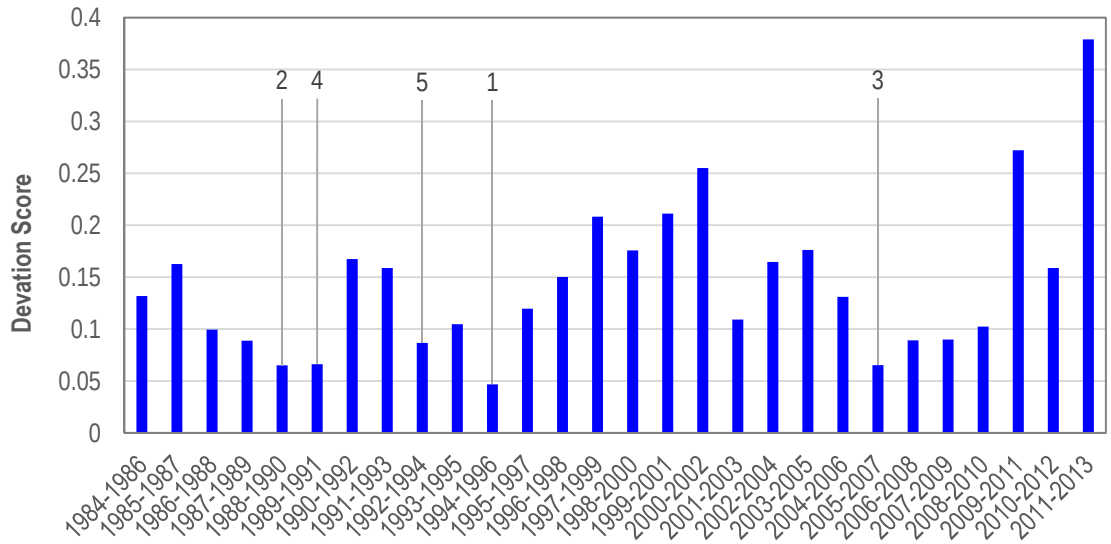
7.2.2 Three-year Rainfall and River Flow Analysis

Once annual rainfall and river flow statistic were determined for the 30 year period, three-year rainfall and river flow characteristics were developed based on an annual average of the three consecutive years. The goal of using a three-year analysis period was to find a period that had a relatively dry year, a relatively wet year, and a relatively average year. That way, any evaluations done using the typical hydrologic period have a more diverse spectrum of wet weather events and dry weather periods.

7.2.3 Ranking Analysis

With the weighting factors listed in Table 7-1, a deviation score was developed for each individual period. The 3-year periods were then ranked based on the deviation score. The lower the deviation score (Figure 7-2 Y-axis), the higher the rank for the hydrologic period (i.e., the closer it is to the average condition). Figure 7-2 shows the ranking results of the 28 hydrologic periods, with a ranking of 1 being the highest and a ranking of 28 being the lowest ranked hydrologic period. Hydrologic period 1994-1996 is ranked No.1 because it has the lowest deviation score of 0.047.

Figure 7-2: Ranking Score of 3-year Period, 1984-2013



7.2.4 Top 5 Ranked 3-year Hydrologic Periods

Based on the ranking analysis, the top 5 ranked hydrologic periods are:

- Rank 1: 1994-1996
- Rank 2: 1988-1990
- Rank 3: 2005-2007
- Rank 4: 1989-1991
- Rank 5: 1992-1994

Table 7-2 shows rainfall and river flow statistics for these top ranked hydrologic periods.

Table 7-2: Top 5 Ranked Hydrologic Periods

Rank	Year	Rainfall								Delaware River Flow (cfs)		
		Annual Rainfall (in)	Max Rainfall Intensity (in/hr)	Average Rainfall Intensity (in/hr)	Average Rainfall Duration (hr)	Events ≥0.10 in.	Events ≥0.25 in.	Events ≥1.5 in.	Back-to-Back Event	25th Percentile	50th Percentile	75th Percentile
1	1994-1996	42.9	1.50	0.08	10.1	65	47	5	7	5,611	9,710	16,775
2	1988-1990	41.0	1.69	0.08	10.5	63	44	5	10	5,598	8,338	13,925
3	2005-2007	43.6	1.55	0.09	10.6	61	45	6	10	6,030	10,450	17,533
4	1989-1991	40.2	1.50	0.08	10.8	63	45	5	10	5,187	8,043	14,467
5	1992-1994	39.2	1.50	0.08	10.6	64	41	5	8	5,070	7,760	13,167
Average 1984-2013		**41.3**	**1.53**	**0.08**	**10.7**	**62**	**44**	**5**	**9**	**5,540**	**9,325**	**15,770**

Rainfall return frequency during 1988 through 2013 was analyzed to understand the distribution of the large rainfall events with return frequencies above 1-year. Table 7-3 summarizes quantity of large rainfall events with return frequencies for the top 5 ranked hydrologic periods.

- All of the top 5 hydrologic periods have a 25-yr storm.
- Hydrologic period 1994-1996 (Rank 1) contains one 25-yr storm, one 10-yr storm and three 1-year storm. Hydrologic period 1988-1990 (Rank 2) contains one 25-yr storm, one 10-yr storm, three 2-year storm and one 1-year storm.
- Hydrologic period 1994-1996 (Rank 1) is more conservative because its annual average rainfall amount of 42.9" is slightly greater than the 30-yr average. It is considered a better option than hydrologic period 1988-1990 (Rank 2), which has a slightly less annual rainfall than the average.

Table 7-3: Rainfall Return Frequency Summary for the Top 5 Ranked Hydrologic Periods

Rank	Year	Quantity of Rainfall Events with Return Frequency above				
		25-yr	10-yr	5-yr	2-yr	1-yr
1	1994-1996	1	1			3
2	1988-1990	1	1		3	1
3	2005-2007	1	1		2	4
4	1989-1991	1			2	3
5	1992-1994	1	1			3

The analysis was also conducted with an IET of 12 hours, and the top five ranked hydrologic periods. The top four hydrologic periods based on the IET of 12 hours are the same as the analysis based on the IET of 6 hours, which include the 3-year period 1994 - 1996 remaining as Rank 1.

7.2.5 Selected Hydrologic Period

The 3-year period 1994-1996 (Rank 1) will be used as the typical hydrologic period for the CSO LTCPU. This period contains a wide range of storms and antecedent conditions. The hydrologic period of 1994-1996 is also evaluated for longer historical rainfall records up to 100 years. It is ranked No. 1 for the 50-years record and No. 2 for the 100-year records (Table 7-4).

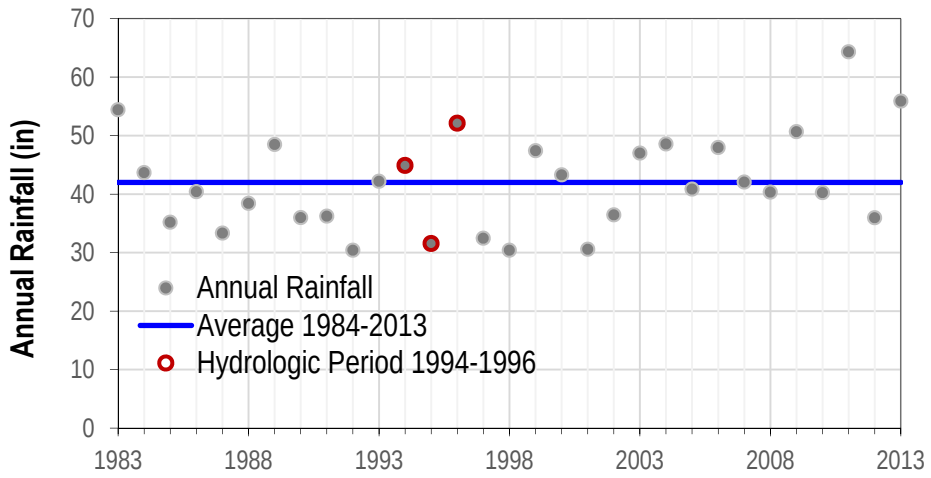
Table 7-4: Rank of Hydrologic Period 1994-1996 from Various Rainfall Data Set

	30-year Rainfall Records, 1984-2013	50-year Rainfall Records, 1964-2013	100-year Rainfall Records, 1914-2013
Rank of 1994-1996	1	1	2 (1925-1927 as Rank 1)

7.2.6 Additional Information on Statistical Analysis of Rainfall Data

Figure 7-3 shows annual rainfall and average annual rainfall for years 1983-2013. The hydrologic period 1994-1996 contains a relatively wet year (1996 with 52.1 inches), a dry year (1995 with 31.6 inches) and a year close to average conditions (1994 with 44.9 inches).

Figure 7-3: Annual Rainfall 1983 - 2013



Characteristics of the top 10 storms (by rainfall depth) in each year of the hydrologic period 1994-1996 are shown in Tables 7-5, 7-6 and 7-7.

Table 7-5: Ten Largest Storms and Return Frequencies in 1994

Top 10 Rainfall Event	Rainfall Start Date and Time	Rainfall Volume (in)	Rainfall Duration (hr)	Max Rainfall Intensity (in/hr)	Rainfall Return Period
1	7/18/1994 7:00	3.45	4	1.5	25-yr
2	7/14/1994 15:00	2.89	7	1.41	10-yr
3	3/9/1994 11:00	2.00	27	0.37	< 1 year
4	8/21/1994 19:00	1.76	18	0.49	< 1 year
5	3/28/1994 0:00	1.41	37	0.14	< 1 year
6	5/7/1994 15:00	1.37	15	0.25	< 1 year
7	3/2/1994 9:00	1.32	22	0.14	< 1 year
8	1/27/1994 19:00	1.15	20	0.2	< 1 year
9	7/27/1994 17:00	1.11	8	0.49	< 1 year
10	1/17/1994 10:00	1.07	18	0.18	< 1 year

Table 7-6: Ten Largest Storms and Return Frequencies in 1995

Top 10 Rainfall Event	Rainfall Start Date and Time	Rainfall Volume (in)	Rainfall Duration (hr)	Max Rainfall Intensity (in/hr)	Rainfall Return Period
1	10/4/1995 18:00	1.82	33	0.54	< 1 year
2	10/27/1995 20:00	1.81	13	0.5	< 1 year
3	9/16/1995 22:00	1.6	13	0.24	< 1 year
4	1/6/1995 18:00	1.43	11	0.27	< 1 year
5	1/20/1995 0:00	1.25	10	1	< 1 year
6	10/20/1995 21:00	1.21	16	0.52	< 1 year
7	3/8/1995 17:00	1.16	8	0.29	< 1 year
8	10/14/1995 7:00	1.12	21	0.25	< 1 year
9	2/3/1995 22:00	1.04	15	0.2	< 1 year
10	7/17/1995 22:00	1.00	4	0.48	< 1 year

Table 7-7: Ten Largest Storms and Return Frequencies in 1996

Top 10 Rainfall Event	Rainfall Start Date and Time	Rainfall Volume (in)	Rainfall Duration (hr)	Max Rainfall Intensity (in/hr)	Rainfall Return Period
1	12/13/1996 13:00	3.03	33	0.27	1-yr
2	8/12/1996 19:00	2.34	13	0.52	1-yr
3	9/16/1996 14:00	2.26	16	0.38	< 1 year
4	10/18/1996 16:00	2.22	19	0.54	1-yr
5	7/12/1996 15:00	2.11	22	0.4	< 1 year
6	12/1/1996 7:00	1.62	23	0.56	< 1 year
7	6/29/1996 22:00	1.61	17	0.26	< 1 year
8	11/25/1996 23:00	1.58	10	0.38	< 1 year
9	7/31/1996 20:00	1.48	4	1.03	< 1 year
10	10/8/1996 10:00	1.32	11	0.24	< 1 year

Section 8 Hydrologic and Hydraulic Modeling

This section describes the development and application of the Hydrologic and Hydraulic Model for DELCORA's combined sewer system. This model will aid in the identification and evaluation of a range of potential water pollution treatment/control alternatives for use as part of DELCORA's Combined Sewer Overflow Long-Term Control Plan Update (CSO LTCPU).

8.1 Background

Since 1997, DELCORA has conducted annual modeling of the CSS using the USEPA's Storm Water Management Model (SWMM) to estimate overflows to its receiving waters. SWMM is a dynamic rainfall-runoff simulation model that can simulate single-event or continuous runoff quantity and quality from primarily urban areas. The model simulates the time-varying process of rainfall onto land surfaces, the conversion of rainfall to infiltration, evaporation, or surface runoff, and the routing of mixed stormwater runoff and sanitary sewage through the collection system. This model is also referred to as DELCORA's Hydrologic and Hydraulic (H&H) model.

The original DELCORA H&H model was developed and calibrated for the 1999 LTCP, but it did not include the entirety of DELCORA's service areas. The original model included one (1) rain gage located at the WRTP, 67 subcatchment areas, 29 outfall nodes (CSO outfalls), 736 storage nodes (sewer manholes), 735 conduit links (sewer mains) and 34 orifice links (CSO regulators), but no pump stations and force mains were included.

The model was set up to simulate monthly CSO discharges with reasonable continuity error in EPASWMM 5.0. The model had been updated and expanded over the years to account for changes in the combined sewer system, but it had not been re-calibrated during the development of the 2012 revisions to the LTCP.

Monthly CSO overflow estimates using the model are reported to the PADEP as part of DELCORA's Annual Municipal Wasteload Management Report (Chapter 94 Report) and monthly with the PADEP electronic Discharge Monitoring Report (e-DMR). The H & H Model is also used as a scenario model to evaluate potential upgrades to the CSO system.

The original DELCORA H&H model was developed and calibrated for the 1999 LTCP. The model was updated and expanded over the years to account for changes in the CSO system, but it was not re-calibrated during the development of the 2012 LTCP (Weston, 2012). Section V.A.14 of the 2015 Consent Decree requires DELCORA to update and calibrate the H&H Model to include hydrologic representations of all areas tributary to the Model Area. The project team reviewed the 2012 model in order to:

- Assess adequacy of the original model for use in DELCORA's LTCPU.
- Identify gaps with the original model in meeting the requirements in the Consent Decree.
- Identify updates required to reflect current hydrologic and hydraulic conditions of DELCORA's collection system.
- Determine refinements needed for the model update.

Results from the review of the 2012 H&H Model were presented in the *Hydrologic and Hydraulic Model Update and Calibration Plan* (Greeley and Hansen, 2015). DELCORA completed the expansion and revisions to the H&H model in the summer of 2017, and it now includes all of Model Area and more accurately reflects the current collection system conditions. .

The revised H&H model uses Gauge Adjusted Radar Rainfall (GARR) data to estimate the frequency and volume of CSO overflows and to evaluate long-term strategies for minimizing CSO overflows. Precipitation breaks of at least 12 hours are used to establish separate storm events.

8.2 H & H Modeling Capabilities

The H & H Model simulates runoff from the CSO service areas into the sewers and then routes the flow through the major trunk sewers, CSO regulator structures, and the interceptors to the Western Regional Treatment Plant. A number of hydraulic modeling software packages are available, including EPA SWMM5, InfoSWMM, InfoWorks, Mike Urban and PCSWMM. For this H&H Model update, EPA SWMM, Version 5.0, Build 5.0.022 and Innovyze InfoSWMM Version 14.5 Update 4 were selected as the modeling software. EPA SWMM5 is a fully dynamic model and has been used extensively throughout the United States and abroad to assess CSO, flooding and water quality issues. It can be applied to simulate single events or long periods of time in a continuous mode. It can estimate runoff flow from several subcatchment basins and route the flow through the sewer system to treatment facilities or to the receiving waters. InfoSWMM uses the current EPA SWMM 5 engine as its computational solution and is fully integrated with ArcGIS which provides greater flexibility of importing model network from existing GIS database and preparing initial model inputs from existing datasheets. InfoSWMM was used during the model development and the calibration phase.

8.2.1 Combined Sewer System Model

The InfoSWMM model has the following capabilities for modeling DELCORA's combined sewer system:

- A user-friendly, ArcGIS integrated graphical interface for cost-effective use and updating.
- A physical based model with model formulations explicitly linked to actual conditions in the field as input by the user.
- Simulates the hydraulic conditions of the modeled trunk sewers, interceptors, gravity sewers, force mains, pump stations, and treatment plant during dry and wet weather.
- Evaluates CSO control alternatives and interceptor capacities.
- Can be periodically updated to reflect the implementation of the CSO control plan and increased development within the service areas.
- Estimates of Run-off from combined sewer areas.
- Estimates wet weather flows from separate sewered areas (rainfall derived inflow and infiltration (RDII)).
- Real-Time Control operations.
- Technical and regulatory credibility (developed from U.S. EPA SWMM software).

8.3 Data Collected

The data requirements needed for the sewer system model include

- Physical characteristics of the sewer system, which are used to configure the model specifically for DELCORA's collection system. (The physical characteristics of the sewer system are described in Section 3 of this report)
- Land use data, which influences the amount of runoff delivered to the sewer system. (See information presented in Section 3 of this report)
- Rainfall data, which are used as inputs to the model. (The collection of rainfall data is for validation and calibration is described in Section 4 of this report. Rainfall data for use as the typical hydrologic period is described in Section 7 of this Report)
- Flow monitoring data, which are used to calibrate and validate the collection system model output. (The collection of flow monitoring data is described in Section 4 of this report)

The model update is based on information obtained from a variety of sources including DELCORA's input, GIS, record drawings and field survey. Other documents pertaining to standard/actual operating procedures for CSO regulators, pump stations and the WRTP were also used to set up real time controls in the model. The model network consists of all major interceptors and force mains and extends to all active overflow points. The datum for the model is NGVD 29.

8.4 H & H Model Development

The development of a sewer system model is complicated and includes many components. The following paragraphs describe how the data described in the previous section are used in the model development.

8.4.1 H & H Model Inputs

Inputs to the Model include rainfall data and the hydrologic watershed parameters. The watershed parameters pertains to the combined sewer service areas only and were as follows:

- Subcatchment areas
- Percent imperviousness (pavement, rooftops, and structures impervious to rainfall infiltration)
- Subcatchment widths
- Overland slope within the subcatchments
- Depression storage within the subcatchments
- Manning's roughness coefficient for overland flow
- Soil infiltration of rainfall in pervious areas
- Base flow

The rainfall data and watershed parameters are described in the following subsections.

8.4.2 Rainfall Data

Rainfall data within the model represent the average precipitation that falls on an area within a defined time interval. Rainfall data was entered in the model as total rainfall or rainfall intensity occurring within a time interval. The rainfall time interval can be as short as a minute or as long as an hour. Generally, the model results satisfactorily match observed flow monitor data when the rainfall input time interval is at a minimum of 15 minutes. Actual rainfall data recorded at 5-minute frequency were entered into the model for model calibration.

8.4.3 Subcatchment Areas

Subcatchment areas are the discrete surface areas that contribute runoff and overland flow to the combined sewers. Delineation of subcatchments was described in Section 3 of this Report. The model represents a subcatchment as a polygon area with the overland slope perpendicular to the subcatchment width. The point where the runoff enters the sewer is called the point of concentration (receiving node). The major trunk sewers from each CSO service area along with all interceptor sewers and CSO regulators were incorporated into the model.

8.4.4 Percent Imperviousness

The initial percent imperviousness for the combined area was calculated as described in Section 3 of this Report. Then, the impervious percentage values were adjusted during the model calibration process to best simulate the observed hydrologic response over the selection of precipitation events. All open areas not tributary to the sewer system were measured from the aerial photographs and subtracted from the subcatchment areas. The open areas are considered non-point sources, which drain directly to the receiving waters.

8.4.5 Subcatchment Widths

Subcatchment width affects the shape of the runoff hydrograph and is generally an H&H model calibration parameter. Higher peak flow rates and more immediate response to a storm event are simulated when the subcatchment width is increased for the same subcatchment. The initial inputs for the subcatchment width were determined by dividing the total area of the subcatchment by the representative overland flow length in the subcatchment. These initial inputs were adjusted based on model calibration comparisons to data.

8.4.6 Overland Slope

Overland slope is a measure of the steepness of the land in the subcatchments. It is a model input and affects the travel time of overland flow, peak runoff rate, and runoff volume. Steeper slope decreases the travel time, increases the peak runoff rate and increases the runoff volume. The slope of a subcatchment should reflect the average slope along the pathway of overland flow to inlet locations. For the combined sewer subcatchments, slopes from the 2012 H&H model were retained for use in the updated model.

8.4.7 Depression Storage

Some rainfall on the pervious and impervious areas is held in small depressions rather than becoming part of the overland flow. It is defined as the amount of incidental surface depressions that must be filled before runoff typically begins. Initial values for depression storage were described in Section 3 of this Report. For all practical purposes, depression storage is difficult to measure and is typically adjusted during the calibration process.

8.4.8 Manning's "n" Roughness Coefficient

Overland flow travels slower or faster depending on the roughness of the surface in the subcatchment. The higher the roughness coefficient, the greater the friction and the slower the flow travels. Again, this is a model parameter that cannot be practically measured. A typical range of Manning's "n" suggested by the SWMM is 0.011-0.024 for impervious area and 0.06-0.80 for pervious area. The initial values were set to 0.013 for impervious surfaces and 0.15 for pervious surfaces. Roughness is an empirical value and may be treated as a calibration parameter if necessary.

8.4.9 Separate Sewer Areas

The DWF for each separate sewer service area was determined as described in Section 4 and input into the model at the appropriate combined sewer node. To estimate the wet weather impacts on the separate sewer service areas, the flow monitoring data collected during the monitoring program was evaluated.

8.4.9.1 Rainfall Derived Infiltration and Inflow (RDII)

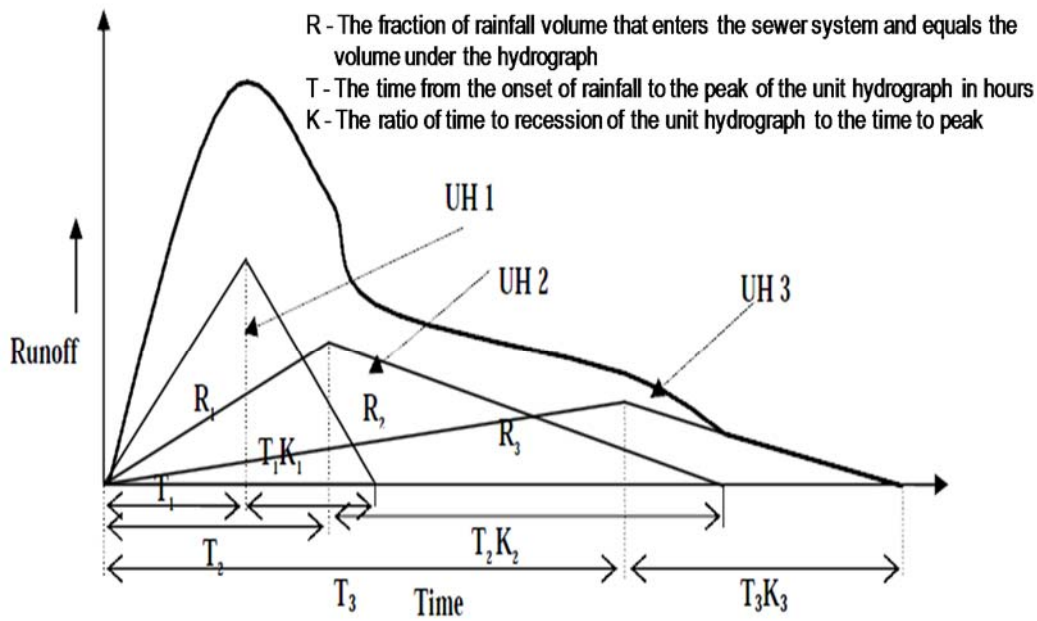
The model uses the RTK unit hydrograph (UH) to estimate RDII into the separated area sewer systems. As shown in Figure 8-1 (Muleta & Boulos, 2008), a RTK UH set contains up to three hydrographs: one for a short-term response (UH1), one for an intermediate-term response (UH2), and one for a long-term response (UH3). UH1 represents the most rapidly responding inflow component and has a short T value, UH2 includes both inflow and infiltration and has a longer T value, and UH3 includes infiltration that may continue long after the storm event has ended and has the longest T value. The unit hydrograph is defined by the following three parameters:

- R: the fraction of rainfall volume that enters the sewer system and equals to the volume under the hydrograph,
- T: the time from the onset of rainfall event to the peak of the unit hydrograph in hours, and
- K: the ratio of time to recession of the unit hydrograph to the time to peak.

The same set of RDII parameters were applied in the same metershed because of the availability of the flow hydrograph for model calibration. The initial values of RTK were estimated using the RDII Analyst tool in the InfoSWMM. The RTK values are calibration parameters to be refined during model calibration.

Rainfall and sewershed area information was needed for RDII calibration. Subcatchment areas were estimated as described in Section 3. Rainfall and flow data from the monitoring program (see Section 4) were used for the calibration.

Figure 8-1: RTK Unit Hydrographs



Source: M.K. Muleta and P.F. Boulos, Analysis and Calibration of RDII and Design of Sewer Collection Systems, ASCE Conference Proceedings 316, 642 (2008)

8.4.10 Soil Infiltration

Infiltration parameters modestly influence the runoff hydrograph from the combined sewer system subcatchments by reflecting rainfall absorption into the soil. The H&H model uses the Horton method with infiltration parameters determined based on evaluation of soil types as described in Section 3.

8.4.11 Sewer Mains

Sewer mains are the conveyance element and were simulated as conduits in the model. The following input information was entered into the H&H model:

- Conduit ID
- Shape
- Number of barrels
- Upstream and downstream nodes
- Upstream and downstream offset
- Dimension (length, diameter/depth)
- Manning's roughness coefficient
- Minor loss coefficient (entry loss, exit loss, average loss)
- Flap gate installed or not (set at no flap gate for most of the sewer mains)

Most of the pipe input parameters, including upstream and downstream nodes, dimension, shape, number of barrels, and flap gate information, were found or estimated from record drawings, design drawings and sewer gravity main GIS shapefiles. For pipes that do not begin or end at the invert of the upstream or downstream node, an offset value was provided to describe the difference from the invert of the pipe to the invert of the upstream or downstream node.

Manning's roughness coefficient is related to the pipe material. The initial input of the Manning's n for different materials is summarized in Table 8-1. The Manning's n may be changed during calibration to account for minor loss or additional sediment depositions in the pipe.

The initial minor loss for pipe will be set at zero for most pipes. For those pipes with sharp turns, a higher minor loss was applied.

Table 8-1: Manning's Roughness Coefficient for Sewer Mains

Pipe Material	Manning's N
Polyvinyl Chloride (PVC)	0.011
Reinforced Concrete Pipe (RCP)	0.013
Ductile Iron (DI)	0.013
Cast Iron (CI)	0.013
Corrugated Metal Pipe (CMP)	0.020
Masonry	0.025
Unknown	0.013

8.4.12 Manholes

Sewer manholes were simulated as junction nodes in the model. The following information was entered into the H&H model:

- Node ID
- Invert
- Maximum Depth (approximated as the difference from manhole rim and manhole invert)
- Surcharge Depth

8.4.13 CSO Outfalls

CSO outfalls will be simulated as outfall nodes in the model. The following information was entered into the model:

- Outfall ID
- Type (free, normal, fixed stage, tidal stage, time series, stage-flow, flap gate)
- Invert
- Boundary conditions

Outfall characteristics were described in Section 3.

8.4.14 Flow Diversion Structure

As described in Section 3, most of the flow diversion structures are similar to Brown and Brown type regulators. The key components required for modeling these structures were described in Section 3.

Regulator Gates

Regulator gates will be simulated as orifices in the updated model. The following information was entered into the model:

- Regulator Gate ID
- Upstream and downstream nodes
- Type
- Shape (two shapes: circle, rectangular)
- Dimension (Height, Width)
- Discharge Coefficient

Characteristics of the regulator gates were described in Section 3. All regulator gates are modeled as rectangular except for REG_004_Gate which is modeled as a circular orifice. The updated model includes real time control rules for opening and closing of the gates based on levels in the float chamber and regulator limit settings

Orifices

Characteristics of the orifice plates are described in Section 3. The following information was entered into the model:

- Orifice ID
- Upstream and downstream nodes
- Type (two types: side, bottom)
- Shape (two shapes: circle, rectangular)
- Dimension (Height, Width, Crest Height)
- Discharge Coefficient

8.4.15 Weirs

Diversion weirs will be simulated as weirs in the model. Characteristics of the weirs are described in Section 3. The following information was entered into the model:

- Weir ID
- Upstream and downstream nodes
- Type (four potential weir types: transverse, sideflow, V-notch, trapezoidal)
- Dimension (Height, Weir Length, Weir Crest Height)
- Coefficient of Discharge
- Number of End Contractions

8.5 Summary

The 2012 H&H model was updated as described above. A summary of the key revisions is presented in Table 8-2. The detailed layout of the updated model is shown in Figure 8-2 and Figure 8-3.

Table 8-2: Summary of Revised H&H Model

Review Item	2012 Model Review Observation	Comments	Updated Model
Model Software	- EPA SWMM 5.0		Innovyze InfoSWMM version 14.5
Vertical Datum	- NAVD 88	- To be verified	- NGVD29
General Sub Models	- EPASWMM for the runoff model - Horton Equation for the infiltration model - Hydrodynamic wave for the flow routing model	- All these choices are commonly seen in collection system modeling practices	
Rain Gauge	- One (1) rain gage, located at the Western Regional Treatment Plant (WRTP)	- One rain gauge is not sufficient for the entire service area in the model	- Seven (7) rain gauges, as shown in Section 2 - Additional GARR analysis performed
Service Area	- 67 subcatchments, all for combined area - One set of Horton infiltration parameters are applied to most of the subcatchments (66 out of 67 subcatchments) - The infiltration parameters applied in the model is equivalent to infiltration parameters for soil type C/D	- All service area including separated area that contribute flow to the DELCORA collection system should be included in the model - Combined area delineation will be checked to include any changes along the years - Soil type need to be checked to verify Horton infiltration parameters in all subcatchments	- 114 subcatchments, 53 for combined area and 61 for separated areas - Combined area was modified to include newly separated areas. - Horton infiltration parameters applied to 56 out of 114 subcatchments - Horton infiltration parameters varied based on identified soil types -

Review Item	2012 Model Review Observation	Comments	Updated Model
Sewer Manhole	- 736 storage nodes. - All sewer manholes are simulated as storage units in the model. - The majority of the storage units (732 out of the 736) have a diameter of 4-ft, and the rest (4 units) have a surface area of 100 square feet (sf.) (equivalent to 10'x10'). - All storage units are set-up with a ponding area of 9,999 sf. to allow excess water to collect atop of the nodes and be re-introduced into the system as conditions permit.	- Sewer manholes will be simulated as common junction node - This will help with SSO evaluation in the collection system	- 860 common junction nodes. - The majority of the common junction nodes (836 out of the 860) have a diameter of 4-ft, and the rest (4 units) have a surface area of 100 square feet (sf.) (equivalent to 10'x10'). - There are 35 imaginary junctions created to receive flow from the subcatchments gravity network not included in the model network
CSO Outfall	- 29 outfall nodes - All CSO outfalls are free outfall	- All outfalls are located in the Delaware River in the tidal reach, a tidal stage instead of free outfall should be assigned to the outfalls - Outfall ID 101 has dry weather input of 1.76 cfs, it represents WRTP in the model	- 24 CSO outfall nodes - Tidal data is assigned to 24 outfalls using time series - Wherever tide gates are installed, a real time control is applied

Review Item	2012 Model Review Observation	Comments	Updated Model
Sewer Mains	- 735 conduit links. - Negative slopes at Nodes 73803 and 70709 not matching the GIS. - Pipe connectivity is not consistent with the GIS in Subcatchment EA1, 25A. - Pipe size and connectivity is not consistent with the GIS around Node: 5201242, 5201234. - Pipe size is not consistent with the GIS around Node: 52018-52015. - Pipe size is not consistent with the GIS around Node: 531-527, 522-517, 516-513, 510020301-5100202, 403-NCPS, 40801-40801A, 32405-32404, and 1110402-11103. - Pipe size and slope are not consistent with the GIS around Node: 422-4140. - NREG06 outfall pipe direction is opposite.	- All the negative slopes and inconsistencies need to be checked with the most updated GIS and record drawings during the model update	- 817 conduit links. - 45 imaginary conduit links created to receive flows from subcatchment gravity network not included in the model

Review Item	2012 Model Review Observation	Comments	Updated Model
CSO Regulators	- 34 orifice links. - All CSO regulators are simulated using orifices to intercept dry weather flows and partial wet weather flows to the collection system, and with elevated conduits to convey extra flows to the CSO outfalls. - Approximately 75% of the orifices (25 out of 34) are modeled with Real Time Control (RTC) to mimic regulator gate opening based on level. - None of the regulator diverting weir structures is simulated in the model.	- Diverting weir structures need to be added in the model - The slopes of all overflow pipes connected to the CSO outfalls need to verified - All orifice opening dimensions verified will be verified - All the RTC rules regulating orifice opening will be verified with actual operation	- 44 orifice links. - CSO regulators are simulated using orifices and float-operated gates to intercept dry weather flows and partial wet weather flows to the collection system, and with conduits set a verified inverts to convey extra flows to the CSO outfalls. Exceptions occur at several regulators where orifices have been removed and at one regulator where the float and gate have been removed. - Approximately 57% of the orifices (25 out of 45) are modeled with Real Time Control (RTC) to mimic regulator gate opening based on level. - Regulator diverting weir structures added to the model. - All regulator characteristics were verified using record drawings excepting Regulator 17 which was field verified.
Pump Station	- No pump station is included in the model	- All pump stations that contribute flow to the DELCORA collection system should be added to the model, with related force mains	- Pump stations added to model. - Related force mains added to model

Review Item	2012 Model Review Observation	Comments	Updated Model
Dry Weather Flow	- 94 dry weather flow (DWF) inputs - Total DWF is 7.01 MGD - No diurnal curve - DWF does not include all the separated service areas that contribute to the DELCORA system -	- DWF should be updated to include all the service areas that contribute to the DELCORA system - Weekday and weekend diurnal curve should be included in the model to effectively simulate dry weather diurnal pattern	- 114 dry weather flow (DWF) inputs - Total DWF is 29.57 MGD - DWF analysis was performed on all flow meters in separated and combined areas as well as pump stations - Weekday and weekend diurnal curves were generated as well as overall, weekday, weekend and monthly DWF factors.
RDII	- No rainfall-derived infiltration/inflow (RDII) element was found in the model	- RDII should be included in the model to estimate reasonable wet weather inflow from RDII	- RDII was included in the model to estimate reasonable wet weather inflow from RDII

8.6 H & H Model Calibration

Model credibility is developed through model calibration and validation. Model calibration involves application of the model to known external inputs (e.g., rainfall), evaluation of the model's ability to replicate monitored conditions (e.g., flow and volume), and adjustment of key model parameters as needed until an acceptable level of agreement is reached between simulated and monitored conditions.

The collection system H&H Model was calibrated in conjunction with the flow monitoring and sampling program. The H & H Model was calibrated by running the model with rainfall data collected from selected storms and then comparing the calculated results to the actual flow monitoring data collected. The model parameters were adjusted and the process repeated until the calculated results approximated the actual flow monitor measurements. Goals for the model calibration included:

- To match visually the shape of the curve between model and flow monitor.
- To match model runoff volumes (volume under curve) to actual runoff volumes.
- To match model runoff peak flow rates to actual runoff peak flow rates.

Once the model was calibrated to the selected storms, at least one additional storm was run through the model to validate that the model was sufficiently calibrated.

Figure 8-2: Updated H&H Model Layout

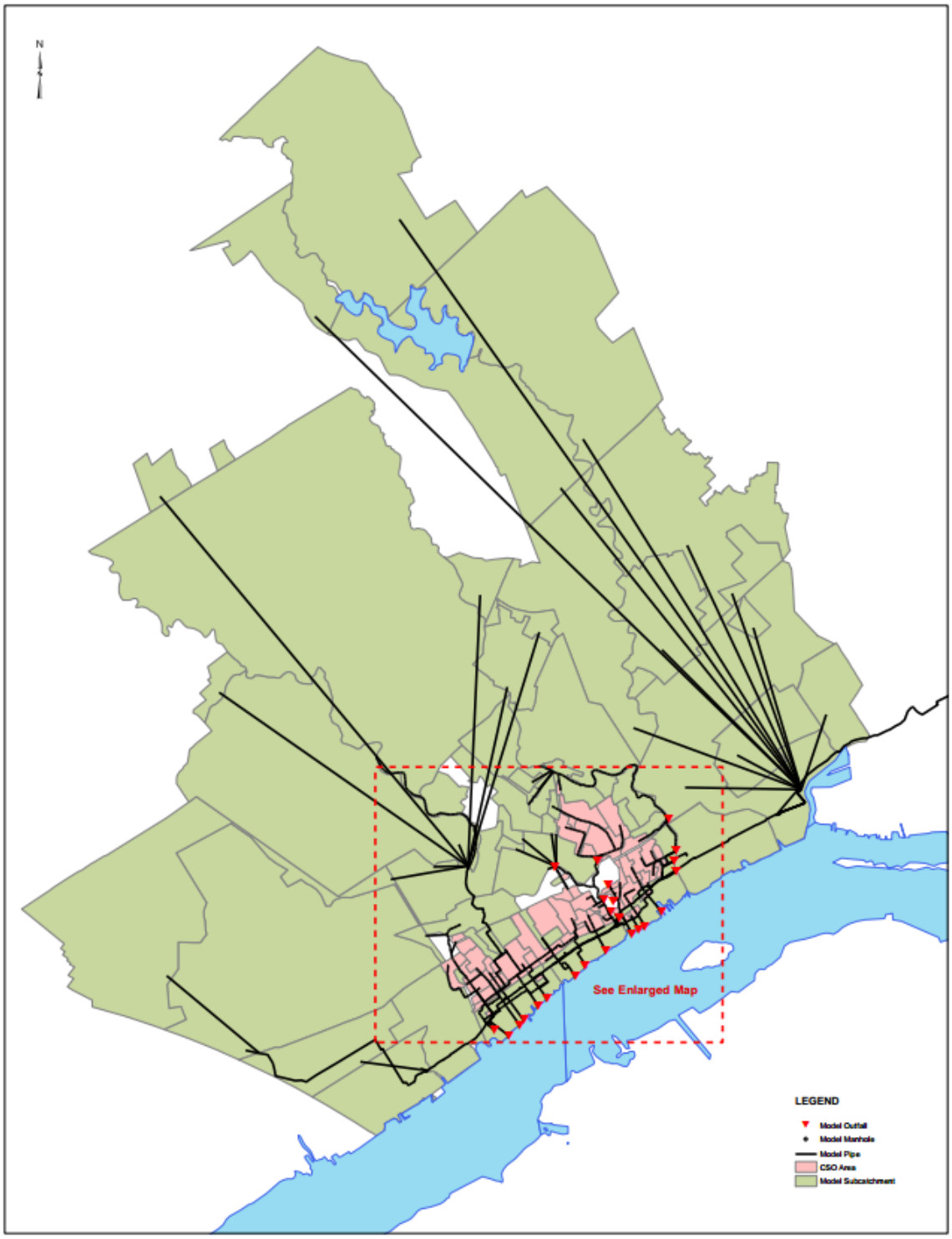
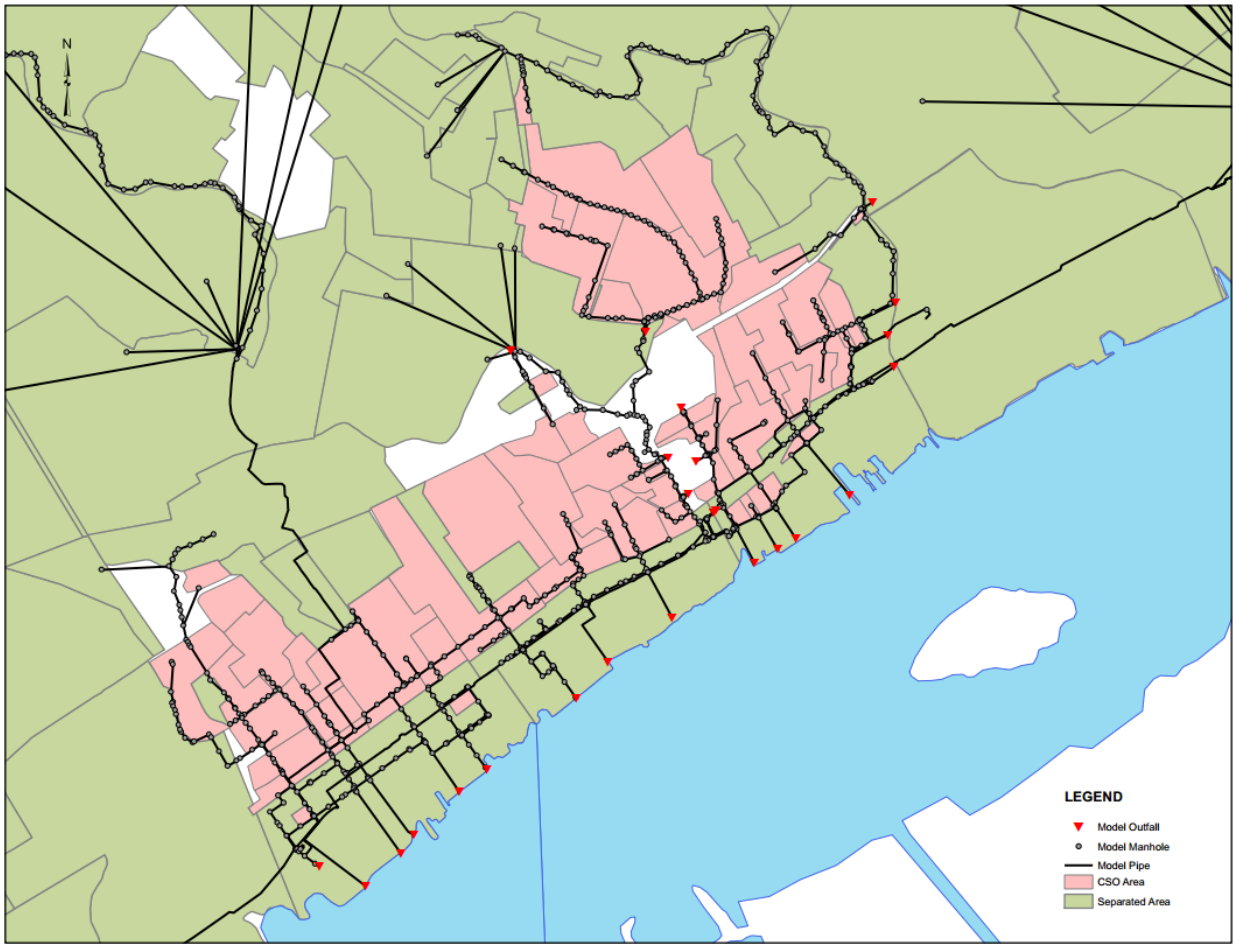


Figure 8-3: Updated H&H Model Layout – CSS Area



8.6.1 Dry Weather Flow Calibration

Dry weather flow (DWF) analysis was based on the rainfall and flow monitoring results. DWF distribution in the collection system was based on land use data. Weekday, weekend and monthly diurnal factors from the DWF analysis were applied for each flow meter service area. Upstream meters in the system were calibrated first, then flows through the system to the pumps stations and to the WRTP were balanced. Figure 4-4 shows the arrangement of the meters in the system and meter identification.

DWF calibration will adhere to industry standards and the criteria below:

- The simulated hydrograph should match the general observed hydrograph shape,
- The simulated time of peaks and troughs will be within 1 hour of the observed,
- The simulated peak flow will be within 10% of the observed flow, and
- The simulated flow volume over 24 hours will be within 10% of observed flow.

The dry weather calibration shows that model and the flow monitors are not all within the goal of ten percent. There are a number of reasons for the differences. The accuracy of flow monitors in large pipes is reduced as the flows get smaller. The dry weather flows are very small, especially in comparison to the wet weather flows. Dry weather flow also has a diurnal curve. The model does not replicate the dry weather flow diurnal curve, but takes the average of the diurnal curve and uses that as a constant dry weather flow. This could cause some discrepancy between the model and metered flows.

After the dry weather calibration was considered to be satisfactory, the model was calibrated for wet weather periods as described below.

8.6.2 Wet Weather Calibration

Wet weather flow (WWF) includes surface runoff from the combined area, RDII from the entire service area, and connected rooftops, if any, from the separated area. RDII parameters will be developed based on the separated area, and surface runoff parameters will be adjusted for the combined area to calibrate the system response to the wet weather conditions.

Four (4) wet weather events were selected for wet weather calibration. Final selections include wet weather events with various rainfall intensities and volume. Larger storm events will have more weighting factor in the calibration process because the large events are the ones that dominate the total overflow volume.

WWF calibration will adhere to industry standards and the criteria below:

- The simulated hydrograph should match the general observed hydrograph shape,
- The simulated time of peaks and troughs will be similar having regard to the duration of the event,
- The simulated peak flow for significant peaks will be within the range of -10% to +10%,
- The simulated flow volume will be within the range of -10% to +10%,

The four storms were selected for calibration of the collection system model met all the desired storm characteristics as describe in Section 4 of this Report. The May 29, 2016 storm was a 1.82-inch storm with a duration of approximately 11 hours and a maximum intensity of 0.78 in/hr. The September 28, 2016 storm was a 2.36-inch storm with a duration of 47 hours and a maximum intensity of 0.37 inches/hour. The November 29, 2016 storm was a 1.08 inch storm with a duration of 14 hours and a maximum intensity of 0.21 in/hr. The July 28, 2016 rain event was a 1.26-inch storm with a duration on 19 hours and a maximum intensity of 0.74 in/hr. Data on these storms is in shown in Table 8-3.

Table 8-3: Wet Weather Events for Model Calibration and Validation

Event ID	Start Time	Stop Time	Rainfall Duration (hr)	Rainfall Depth* (inches)	Max. Intensity (in/hr)	Used in Calibration	Used in Validation
E1	5/29/16 19:00	5/30/16 5:00	11.00	1.82	0.78	C	
E2	9/28/16 12:00	9/30/16 10:00	47.00	2.36	0.37	C	
E3	11/29/16 7:00	11/29/16 20:00	14.00	1.08	0.21	C	
E4	3/30/17 21:00	4/1/17 3:00	31.00	1.83	0.25		V
E5	5/21/16 11:00	5/22/16 21:00	35.00	1.71	0.33		V
E6	7/28/16 15:00	7/29/16 9:00	19.00	1.26	0.74	C	
*At Chester PS rain gauge							

The figures in Appendix B show the observed and simulated flow for the model calibration. Also included in Appendix B are plots of modeled versus monitored (i.e., observed) volumes and peak flows. A well calibrated model will result in plotted values that are close to a one-to-one relationship. These one-to-one plots can be found in Appendix B.

8.7 H & H Model Validation

According to USEPA's Guidance on Monitoring and Modeling (1999), "validation is the process of testing the calibrated model using one or more independent data set(s) of rainfall data." DELCORA's sewer system model was validated with rainfall from two rain events (May 21, 2016 and March 30, 2017). The May 21, 2016 rain event was a 1.71-inch storm with a duration of 35 hours and a maximum intensity of 0.33 in/hr. The March 30, 2017 storm was a 1.83 inch storm with a duration of 31 hours and a maximum intensity of 0.25 in/hr. The rainfall data for these storms is shown on Table 8-3 above. These storms were chosen for their size, intensity and because there were no rain events for five days before the storm. The figures in Appendix B show the observed and simulated flows for the model validation.

Also included in Appendix B are plots of modeled versus monitored (i.e., observed) volumes and peak flows. A well-calibrated model will result in plotted values that are close to a one to one relationship. These one-to-one plots can be found in Appendix B.

8.8 H & H Model Results

Following calibration, the typical hydrologic period (1994 to 1996) was used as the rainfall input to the H&H model. The hourly rainfall for the period 1994 to 1996 had been previously determined to be representative of annual average conditions with respect to rainfall amount (volume), number of rainfall events per year, rainfall duration, and rainfall intensity and has been discussed in Section 7.

A summary of estimated volume, frequency and duration of CSO discharge events based from the calibrated H&H model using the typical hydrologic period is presented in Appendix C. The total annual average CSO overflow volume was approximately 300 MG for the typical hydrologic period. The dry weather flows and their monthly factors in the calibration model are based on the flow monitoring period (March 2016 through March 2017). For future model application, the dry weather flows should be based on future flow projections and the monthly factors should be adjusted accordingly.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

MAR 01 2016

Mr. Robert Willert, Executive Director
Delaware County Regional Quality Control Authority
100 East Fifth Street
Chester, PA 19013

RE: Civil Action 2:15-cv-04652-RB

Dear Mr. Willert:

The United States Environmental Protection Agency (EPA) has received the Delaware County Regional Quality Control Authority (DELCORA) Hydrologic and Hydraulic Model Update and Calibration Plan. EPA has consulted with the Pennsylvania Department of the Environment (PaDEP).

EPA hereby approves the plan with the understanding that the term "two days" as stated in paragraph 5.1.2.1 (Dry Weather Overflow Analysis) shall mean 48 hours.

Thank you for your continued cooperation with this matter. Please do not hesitate to contact me at (215)814-2097 if you have any questions.

Sincerely,

Andrew F. Seligman, Environmental Scientist
Water Enforcement Branch

cc: R. Smolski, EPA
P. Yeany, EPA
M. DeSantis, DELCORA

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

MAY 23 2016

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Michael J. DiSantis, Director
Operations & Maintenance
Delaware County Regional Quality Control Authority
100 East Fifth Street
Chester, PA 19013

RE: Civil Action 2:15-cv-04652-RB

Dear Mr. Disantis:

The United States Environmental Protection Agency (EPA) has received the Delaware County Regional Quality Control Authority (DELCORA) Typical Hydrologic Period Report (Updated April 2016). EPA has consulted with the Pennsylvania Department of the Environment (PaDEP). EPA hereby approves the subject plan.

Thank you for your continued cooperation with this matter. Please do not hesitate to contact me at (215) 814-2097 if you have any questions.

Sincerely,

Andrew F. Seligman, Environmental Scientist
Water Enforcement Branch

cc: R. Smolski, EPA
P. Yeany, EPA
M. DiSantis, DELCORA
S. O'Neil, PaDEP SERO
J. Fields, PaDEP SERO

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

OCT 1 3 2016

Mr. Robert Willert, Executive Director
Delaware County Regional Quality Control Authority
100 East Fifth Street
Chester, PA 19013

RE: Civil Action 2:15-cv-04652-RB

Dear Mr. Willert:

The United States Environmental Protection Agency (EPA) has received the Delaware County Regional Quality Control Authority (DELCORA) Alternatives Evaluation Approach Report (AEAR) dated April 27, 2016. EPA understands DELCORA has chosen the "Demonstration Approach" and hereby approves the AEAR.

Sincerely,

Andrew F. Seligman, Environmental Scientist
Water Enforcement Branch

cc: R. Smolski, EPA
P. Yeany, EPA
M. DeSantis, DELCORA

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Mr. Robert Willert, Executive Director
Delaware County Regional Quality Control Authority
100 East Fifth Street
Chester, PA 19013

OCT 13 2016

RE: Civil Action 2:15-cv-04652-RB

Dear Mr. Willert:

The United States Environmental Protection Agency (EPA) has received the Delaware County Regional Quality Control Authority (DELCORA) Revised Identification of Sensitive Area Analysis (RISAA) dated May 13, 2016. EPA has consulted with the Pennsylvania Department of the Environment (PaDEP). EPA hereby approves the RISAA.

Sincerely,

Andrew F. Seligman, Environmental Scientist
Water Enforcement Branch

cc: R. Smolski, EPA
P. Yeany, EPA
M. DeSantis, DELCORA

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DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL AUTHORITY
P.O. Box 999 • Chester, PA 19016-0999

June 30, 2017

FED EX – NEXT DAY

Chief, Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
601 D Street NW
Washington, DC 20004
Re: DOJ No. 90-5-1-1-10972

Philip Yeany
Office of Regional Counsel (3RC20)
U.S. EPA, Region 3
1650 Arch Street
Philadelphia, PA 19103-2029

Chief
NPDES Enforcement Branch (3WP42)
Water Protection Division
U.S. EPA, Region 3
1650 Arch Street
Philadelphia, PA 19103-2029

Program Manager – Clean Water Program
PA DEP
Southeast Regional Office
2 East Main Street
Norristown, PA 19401

RE: Civil Action Number Case 2:15-cv-04652-RB
& DOJ Case Number 90-5-1-1-10972
Sewer System Hydrologic and Hydraulic Model Report

Dear Sir/Madam:

By this letter, the Delaware County Regional Water Quality Control Authority is enclosing a copy of the above mentioned report in accordance with the requirements of the Consent Decree.

If there are any questions, please contact me. Thank you.

Sincerely,

Michael J. DiSantis
Director of Operations & Maintenance

MJD:bab
enclosure

ADMINISTRATION
☐610-876-5523
☐FAX: 610-876-2728

CUSTOMER SERVICE/BILLING
☐610-876-5526
☐FAX: 610-876-1460

PURCHASING & STORES
☐610-876-5523
☐FAX: 610-497-7959

PLANT & MAINTENANCE
☐610-876-5523
☐FAX: 610-497-7950

X:\Consent Decree 2015\Phase 1 - FCAW - Task 5 - Hydrologic-Hydraulic Model\DOJ-EPA-PADEP-Hydrologic & Hydraulic Model Report - 6-30-2017.doc

cc: via email
Margaret Hill, Blank Rome
Marlene Finizio, Greeley and Hansen
Michael Hope, Greeley and Hansen
Ed Bothwell, DELCORA
Michael DiSantis, DELCORA
John Pileggi, DELCORA
Robert Willert, DELCORA
Charles Hurst, DELCORA
File – Consent Order – LTCP CSO

Section 10 Abbreviations

BGEPA:	Bald and Golden Eagle Protection Act
CDCA:	Central Delaware County Authority
CDPS:	Central Delaware Pump Station
CPS:	Chester Pump Station
CRPS:	Chester Ridley Pump Station
CSO:	Combined Sewer Overflow
CSS:	Combined Sewer System
CWA:	Clean Water Act
DCJA:	Darby Creek Joint Authority
DELCORA:	Delaware County Municipal Utilities Authority
DEP:	Pennsylvania Department of Environmental Protection
DRBC:	Delaware River Basin Commission
e-DMR:	electronic Discharge Monitoring Report
EDPS:	Eddystone Pump Station
EPS:	Existing Pump Station
ESI:	Environmental Sensitivity Index
GIS:	Geographic Information System
H&H:	Hydrologic and Hydraulic
KCPS:	Kimberly Clark Pump Station
LTCP:	Long Term Control Plan
LTCPU:	Long-Term Control Plan Update
MBTA:	Migratory Bird Treaty Act
MDL:	Method Detection Limit
MF:	Migratory Fishes
MGD:	Million Gallons per Day
MHPS:	Marcus Hook Pump Station
NCPS:	Naamans Creek Pump Station
NPDES	National Pollutant Discharge Elimination System
NRCS:	Natural Resources Conservation Service
NTU:	Nephelometric Turbidity Units
PA Integrated Report:	PA Integrated Water Quality Monitoring and Assessment Report
PADEP:	Pennsylvania Department of Environmental Protection
PCBs:	Polychlorinated Biphenyls
PCCP:	Prestressed Concrete Cylinder Pipe
POC:	Pollutant of Concern
POPC:	Parameter of Potential Concern
PSWPCP:	Philadelphia Water Department’s Southwest Water Pollution Control Plant
QA/QC:	Quality Assurance/Quality Control
QAPP:	Quality Assurance Project Plan
R.M.:	River Mile
RHM:	Radnor Haverford Marple Authority
SPS:	Sunoco Pump Station
STORET:	Storage and Retrieval for Water Quality Data
TMDL:	Total Maximum Daily Load

TSF:	Trout Stocking
UH:	Unit Hydrograph
USEPA or EPA:	United States Environmental Protection Agency
WQMP:	Water Quality Monitoring Program
WQR:	Water Quality Regulations
WQS:	Water Quality Standards
WRTP:	Western Regional Treatment Plant
WWF:	Warm Water Fishes

Appendix A CSO Regulator Structure Characteristics

Table A-1: CSO Outfall Characteristics Summary

Outfall No.	CSO Receiving Water	Invert at Regulator	Invert at Receiving Stream
002	Delaware River	7.00	-3.5
003	Delaware River	7.98	-3.5
004	Delaware River	8.80	-3.5
005	Delaware River	4.74	-4.5
007	Delaware River	0.81	0.21
008	Delaware River	2.79	0.01
009	Delaware River	2.61	-4
010*	Delaware River	22.5	*
011	Delaware River	7.09	-4
012	Chester Creek	1.46	-2
013	Delaware River	1.86	-4
014	Delaware River	-1.09	-4
015	Ridley Creek	0.52	-3
016	Ridley Creek	0.11	-5
017	Ridley Creek	0.09	0.09
018	Ridley Creek	6.28	-5.0
019	Chester Creek	18.00	12.28
020	Chester Creek	8.78	-4
021	Chester Creek	5.78	-1.5
022	Chester Creek	11.5	-3.5
023	Chester Creek	1.33	-3.0
024	Chester Creek	1.21	-4.0
025	Chester Creek	-1.08	-4.0
026	Chester Creek	9.00	-4.0
032	Delaware River	1.00	-4.0
033	Ridley Creek	N/A	N/A

Notes:
*CSO regulator 010 discharges at Outfall 009.
N/A: Not Applicable

Table A-2: Regulator Gates Characteristics

Regulator Gate ID No.	Dimensions		Invert EL (ft.)
	Height	Width	
002	5.0 in.	7.5 in.	6.29
003	7.5 in.	7.75 in	7.18
004	8.0 in. dia.	N/A	7.89
005	12.0 in.	12.0 in.	3.99
007	5.0 in.	6.00 in.	0.50
008	7.5 in.	12.375 in.	2.63
009	5.0 in.	7.5 in.	2.45
010*	7.5 in.	15.375 in.	21.50
011	5.0 in.	9.25 in.	6.99
012	2.50	9.25 in.	0.50
013	7.5 in.	7.75 in.	0.84
014	12.0 in.	15.00 in.	-2.50
015	5.0 in.	6.00 in.	0.46
016	7.5 in.	12.375 in.	-0.55
017	5.0 in.	6.00 in.	0.09
018	5.0 in.	6.00 in.	6.06
019	7.5 in.	15.38 in.	16.89
020	7.5 in.	7.75 in.	8.06
021	7.5 in.	7.75 in.	4.56
022	5.00 in.	6.00 in.	10.47
023	7.5 in.	7.75 in.	0.50
024	5.0 in.	9.25 in.	0.50
025	5.0 in.	6.00 in	-2.25
026	7.5 in.	12.375 in.	7.91
032	*	*	-0.20
033	N/A	N/A	N/A
*Gate removed; no data for gate opening dimensions. Regulator modeled as pipe with same diameter as upstream sewer			

Table A-3: Orifice Characteristics

Orifice ID No.	Orifice Type	Dimensions		Invert EL (ft.)
		Height	Width	
002	Side	4 5/8 in.	6 in.	5.78
003	Side	6 ¼ in.	7 in.	6.68
004	None	N/A No Orifice Plate		N/A
005	Side	7 ½ in.	12 in.	3.49
007	Side	3 ½ in.	5 in.	0
008	Side	6 7/8 in.	18 in.	2.13
009	Side	3 ½ in.	8 in.	1.95
010*	Side	10.563 in.	15 in.	21.09
011	Side	5 7/8 in.	8 in.	6.49
012	Side	4 5/8 in.	14 in.	0.00
013	Side	4 ½ in.	16 in.	0.34
014	Side	7 ½ in.	16 in	-3
015	None	N/A No Orifice Plate		N/A
016	Side	9 1/8 in.	30 in.	-1.05
017	None	N/A No Orifice Plate		N/A
018	None	N/A No Orifice Plate		N/A
019	None	N/A No Orifice Plate		N/A
020	Side	12.15 in.	8 in.	7.41
021	Side	11.33 in.	15 in.	4.47
022	Side	2.9 in.	8 in.	9.97
023	Side	5.75 in.	14 in.	0.00
024	Side	7.5 in.	16 in.	-2.75
025	Side	4.61 in.	5 in.	7.41
026	Side	7.69 in.	30 in.	
032	None	N/A No Orifice Plate		N/A

Orifice ID No.	Orifice Type	Dimensions	Invert EL
033	N/A	N/A No longer connected to CSS	N/A

Table A-4: Weir Characteristics

Weir ID No.	Dimensions		
	Height	Length	Crest Height
002	2.50 ft.	2.24 ft.	1.21 in.
003	2.50 ft.	2.24 ft.	1.30 in.
004	2.74 ft.	1.69 ft.	1.17 in.
005	3.50 ft.	2.65 ft.	1.25 in.
007	3.50 ft.	2.65 ft.	0.81 in.
008	4.98 ft.	3.54 ft.	1.23 in.
009	3.25 ft.	3.12 ft.	0.94 in.
010*	2.50 ft.	2.24 ft.	1.50 in.
011	2.44 ft.	3.9 ft.	1.76 in.
012	1.58 ft.	1.73 ft.	1.46 in.
013	3.40 ft.	2.65 ft.	1.62 in.
014	2.75 ft.	2.52 ft.	2.33 in.
015	2.79 ft.	1.53 ft.	0.27 in.
016	3.58 ft.	4.51 ft.	2.08 in.
017	2.17 ft.	2.63 ft.	0.96 in.
018	4.33 ft.	2.58 ft.	0.25 in.
019	3.17 ft.	2.05 ft.	1.44 in.
020	2.50 ft.	2.24 ft.	1.44 in.
021	0.63 ft.	1.48 ft.	1.72 in.
022	2.53 ft.	2.24 ft.	1.53 in.
023	1.50 ft.	2.24 ft.	1.25 in.
024	3.00 ft.	2.45 ft.	1.13 in
025	2.50 ft.	2.24 ft.	1.67 in.
026	0.95 ft.	2.43 ft.	2.64 in.
032	2.75 ft.	1.66 ft.	1.54 in.
033	N/A	N/A	N/A
*Height (H) measured from weir crest to pipe crown; Crest Height (H) measured from invert of upstream node to weir crest			

Table A-5: Permitted CSOs in the City of Chester

Name of Receiving Stream	CSO Regulator/Outfall	Interceptor/CSO Regulator Location	Latitude	Longitude
Delaware River	002	Front and Booth	39°49’30”N	75°23’31”W
Delaware River	003	Front and Highland	39°49’34”N	75°23’11”W
Delaware River	004	Front and Haves	39°50’36”N	75°23’07”W
Delaware River	005	Front and Townsend	39°49’46”N	75°22’53”W
Delaware River	007	Delaware and Reaney	39°49’51”N	75°22’45”W
Delaware River	008	2nd and Tilghman	39°50’05”N	75°22’22”W
Delaware River	009	2nd and Lloyd	39°50’14”N	75°22’10”W
Delaware River(1)	010	5th and Pusey	39°50’26”N	75°22’19”W
Delaware River	011	2nd and Parker	39°50’26”N	75°21’54”W
Delaware River	013	2nd and Welsh	39°50’37”N	75°21’17”W
Delaware River	014	3rd and Upland	39°50’50”N	75°21’05”W
Delaware River(2)	032	2nd and Avenue of The States	39°50’34”N	75°21’25”W
Chester Creek	012	2nd and Edgmont	39°50’42”N	75°21’38”W
Chester Creek	019	14th and Crozer Hospital	39°51’24”N	75°21’54”W
Chester Creek	020	Kerlin and Finland	39°51’24”N	75°22’27”W
Chester Creek	021	9th and Sproul	39°51’08”N	75°21’49”W
Chester Creek	022	6th and Sproul	39°50’56”N	75°21’47”W
Chester Creek	023	3rd and Edgmont	39°50’45”N	75°21’42”W
Chester Creek	024	3rd and Dock	39°50’44”N	75°21’43”W
Chester Creek	025	5th and Penn	39°50’49”N	75°21’50”W
Chester Creek	026	7th and Penn	39°50’58”N	75°21’55”W
Ridley Creek	015	4th and Melrose	39°51’03”N	75°20’48”W
Ridley Creek	016	8th and McDowell	39°51’15”N	75°20’53”W
Ridley Creek	017	9th and Campbell	39°51’16”N	75°20’51”W
Ridley Creek	018	Sun Drive and Hancock Street	39°51’47”N	75°20’57”W

Name of Receiving Stream	CSO Regulator/Outfall	Interceptor/CSO Regulator Location	Latitude	Longitude
Ridley Creek(2)	033	Elkington Boulevard and Ridley Creek	39°52’22”N	75°22’29”W

Notes:
(1) CSO Regulator #010 discharges to the Delaware River through CSO Outfall #009.
(2) No mechanical regulator used for this outfall.

Appendix B H&H Model Calibration and Validation Results

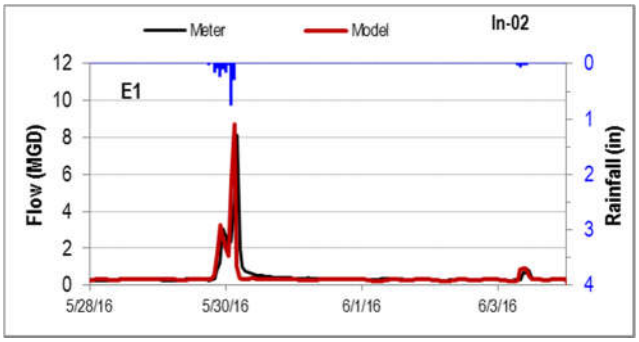
H&H MODEL CALIBRATION AND VALIDATION RESULTS
APPENDIX B TABLE OF CONTENTS

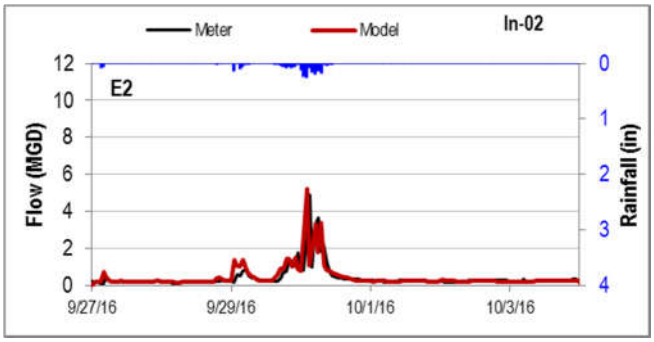
Flow Meter No.	Page No.
In-02	1
CSO-02	3
In-03	5
CSO-03	7
In-05	9
CSO-05	11
In-08	13
CSO-08	15
In-09	17
In-10	19
In-11	21
In-13	23
In-14	25
CSO-14	27
In-16	29
In-17	31
In-18	33
In-19-1	35
In-19-2	37
CSO-19	39
In-25	41
In-26	43
INT-2nd St	45
INT-DRI	47
INT-Ridley 2	49
INT-Ridley 3	51
INT-WEI	53
Sep-1	55
Sep-2	57
Sep-3	59
Sep-4	61
Side-1	63
Side-2	65
RC MH-26	67
RC MH-30	69
RC MH-32	71

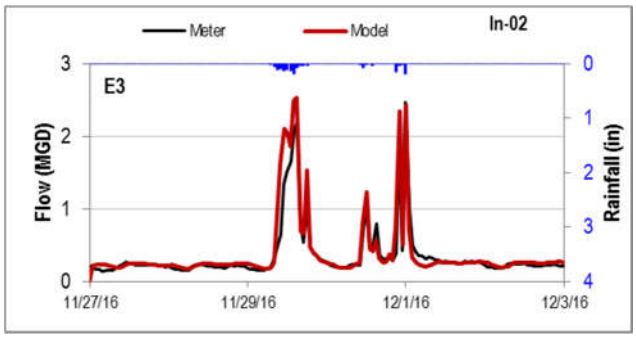
Flow Meter No.	Page No.
CPS	73
EPS-1	75
NCPS	77
CRPS	79
CDPS	81
CDPS to WRTP	83
EDPS	85
MHPS	87
BH MH-01	89
BH MH-03	91
BH MH-05	93
BH-MH-06	95
WRTP	97

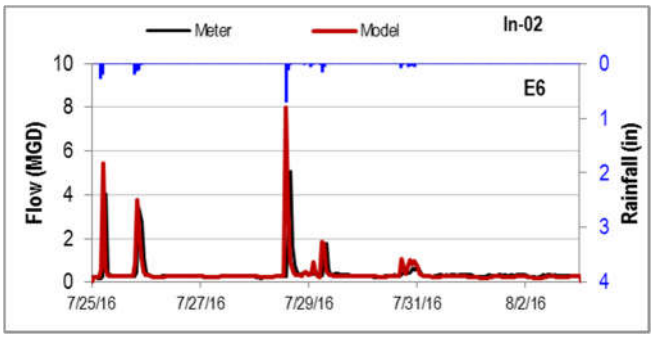
FLOW METER IN-02 MODEL CALIBRATION AND VALIDATION RESULTS

In-02 Model Calibration Results (Metered and Modeled Flow)

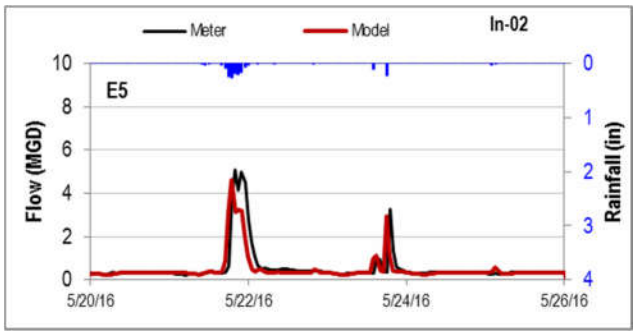


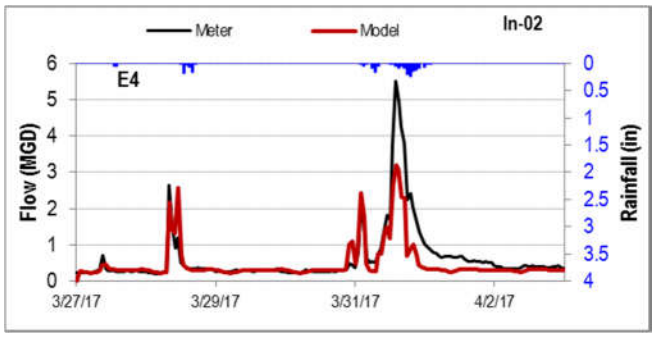




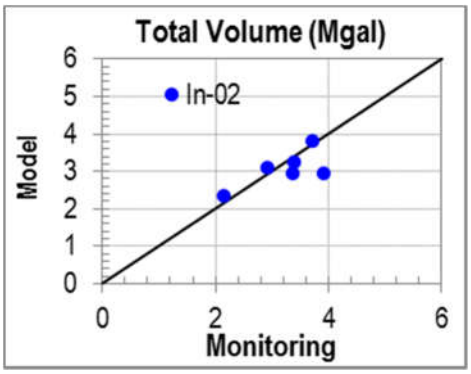


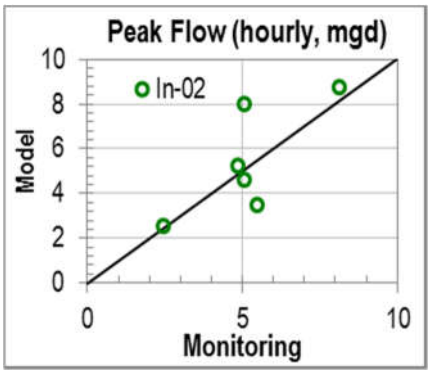
In-02 Model Validation Results (Metered and Modeled Flow)





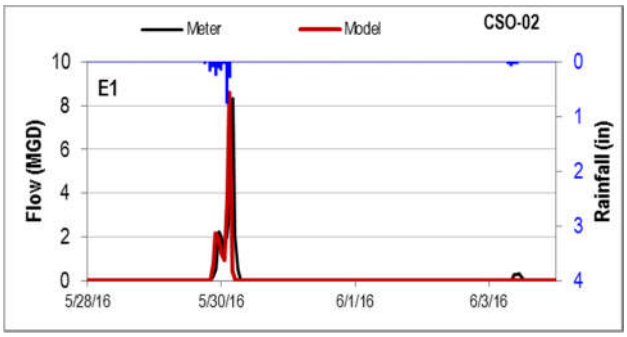
In-02 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

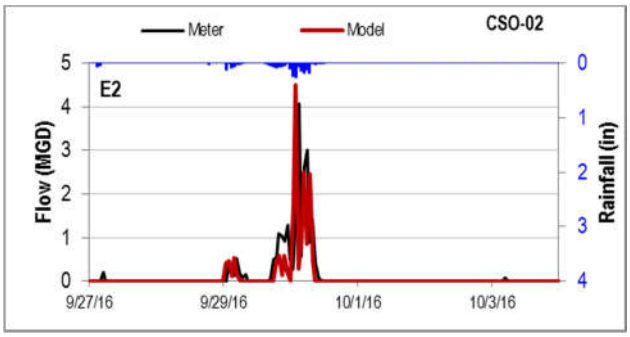


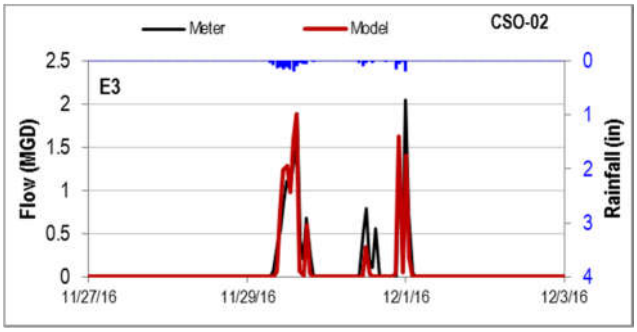


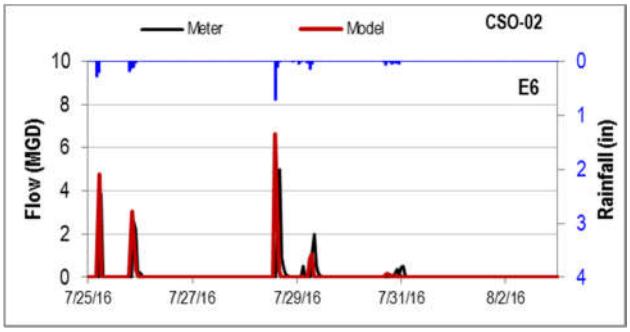
FLOW METER CSO-02 MODEL CALIBRATION AND VALIDATION RESULTS

CSO-02 Model Calibration Results (Metered and Modeled Flow)

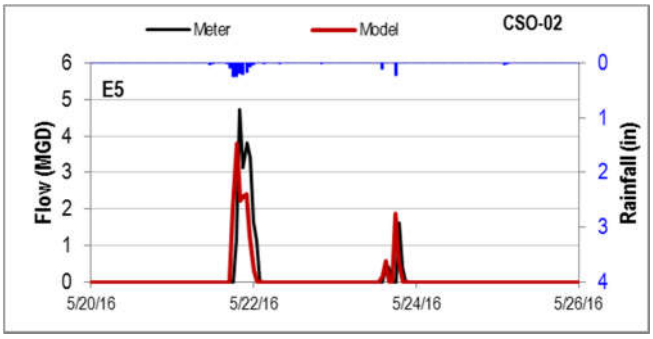


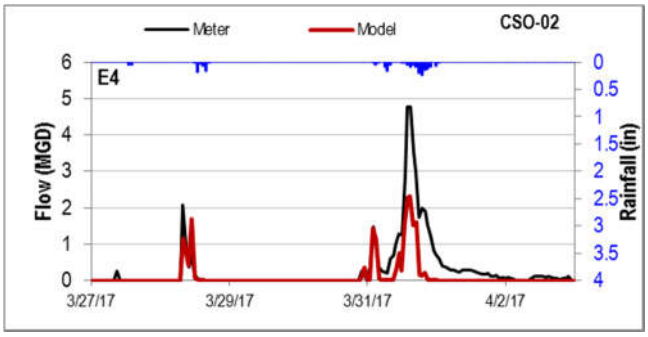




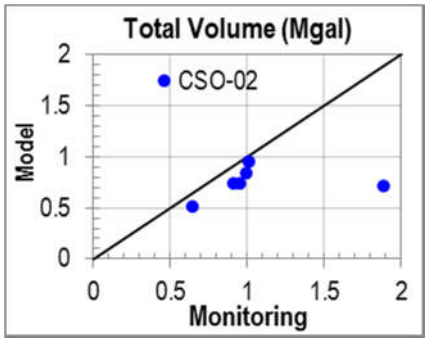


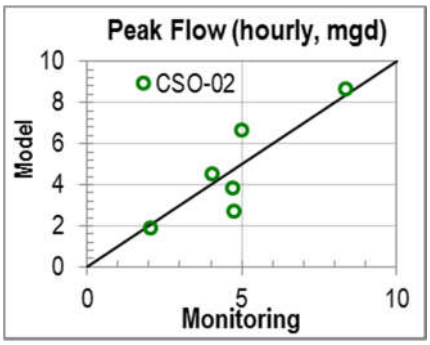
CSO-02 Model Validation Results (Metered and Modeled Flow)





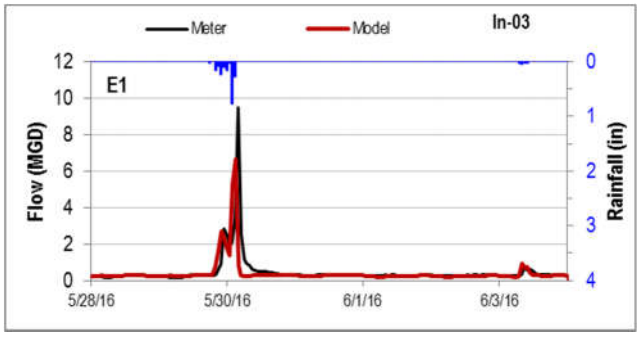
CSO-02 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

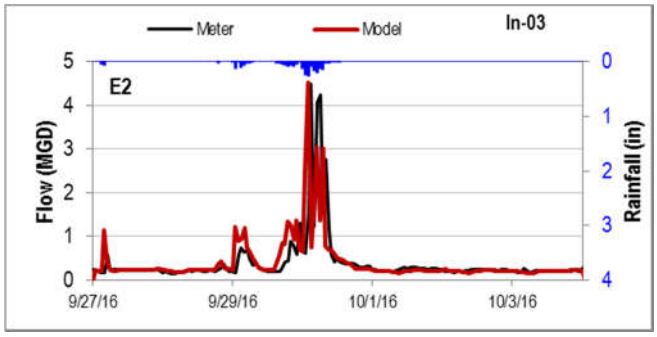


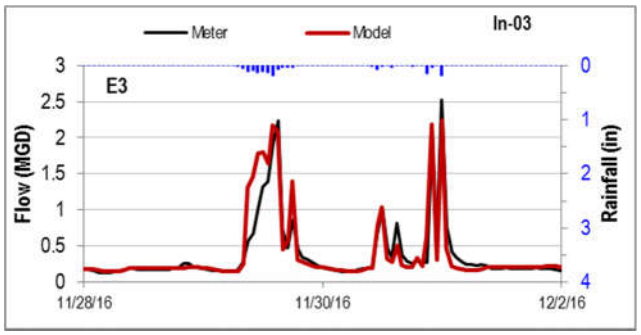


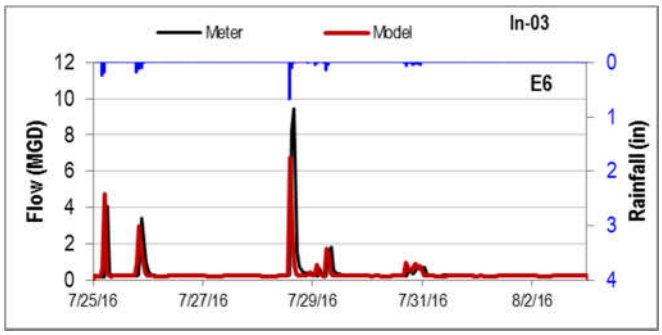
FLOW METER IN-03 MODEL CALIBRATION AND VALIDATION RESULTS

In-03 Model Calibration Results (Metered and Modeled Flow)

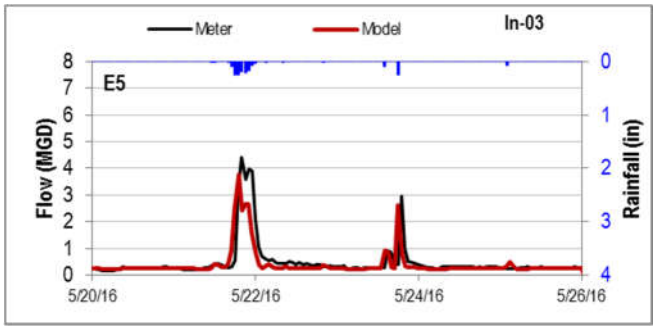


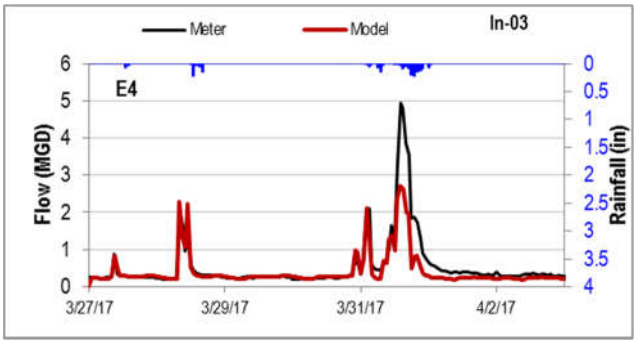




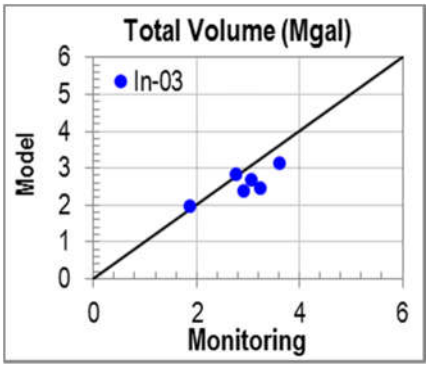


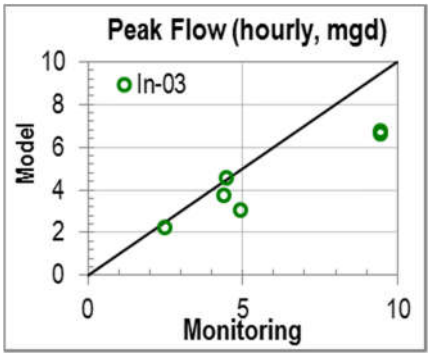
In-03 Model Validation Results (Metered and Modeled Flow)





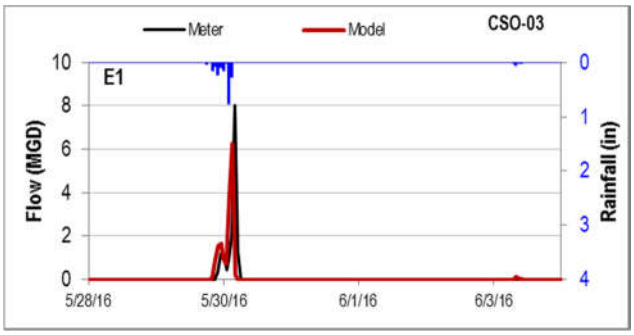
In-03 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

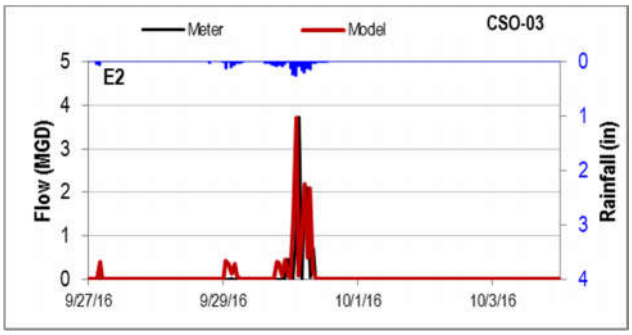


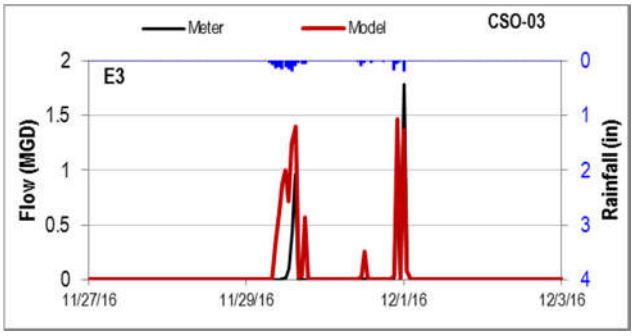


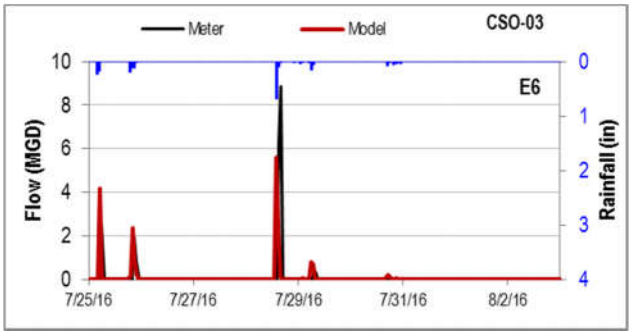
FLOW METER CSO-03 MODEL CALIBRATION AND VALIDATION RESULTS

CSO-03 Model Calibration Results (Metered and Modeled Flow)

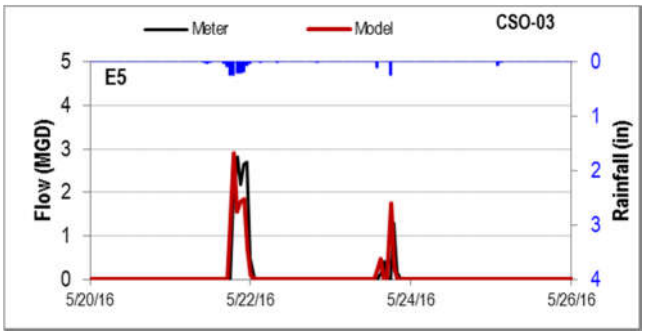


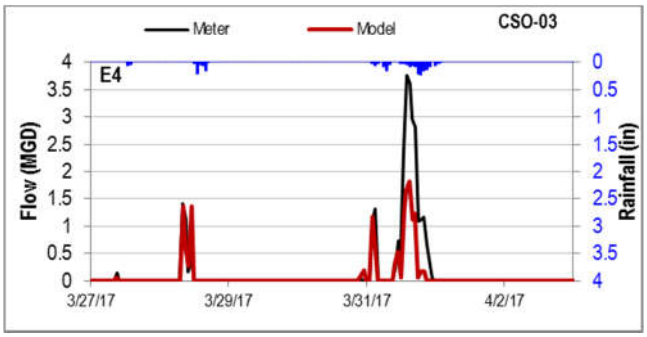




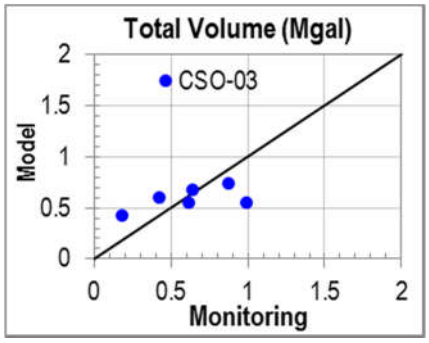


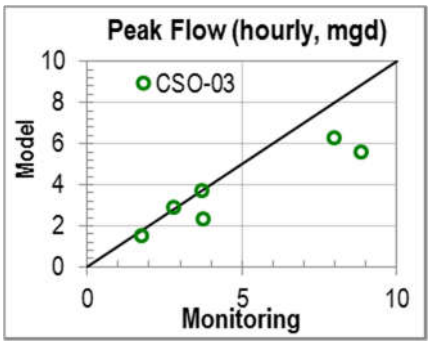
CSO-03 Model Validation Results (Metered and Modeled Flow)





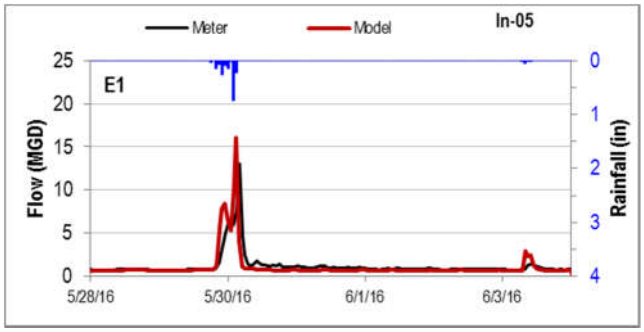
CSO-03 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

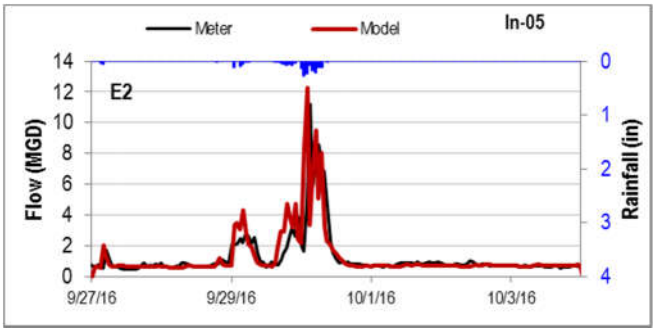


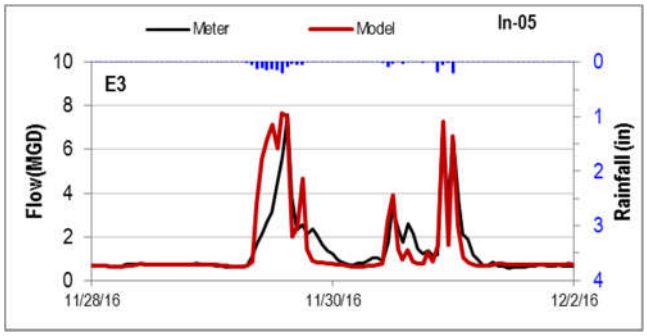


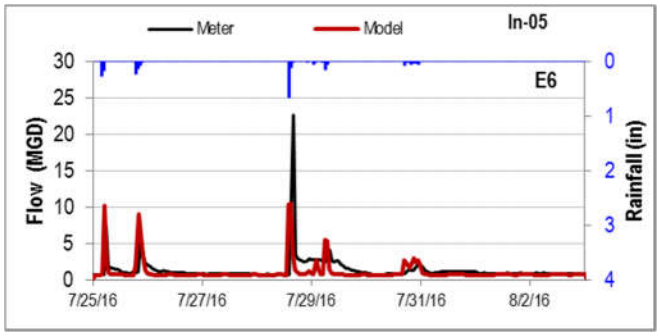
FLOW METER IN-05 MODEL CALIBRATION AND VALIDATION RESULTS

In-05 Model Calibration Results (Metered and Modeled Flow)

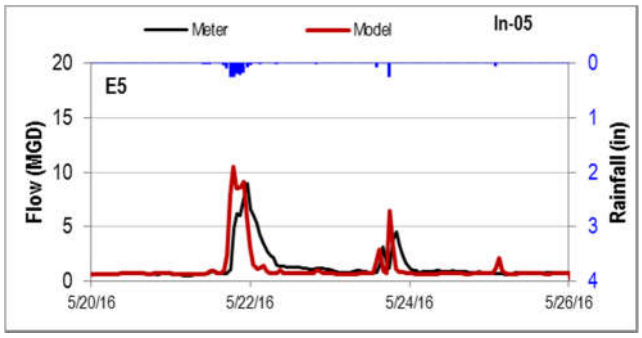


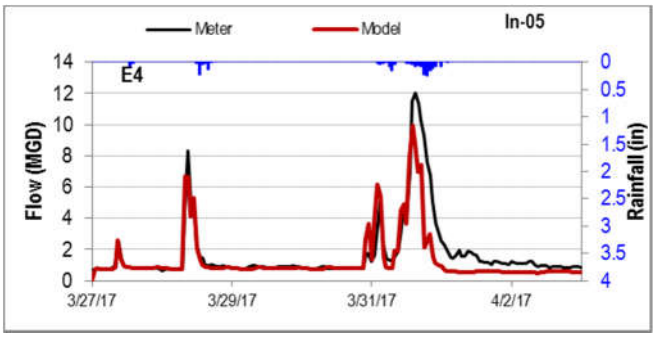




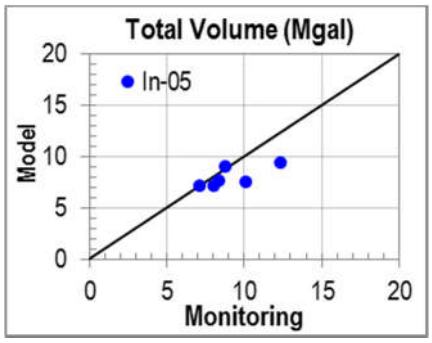


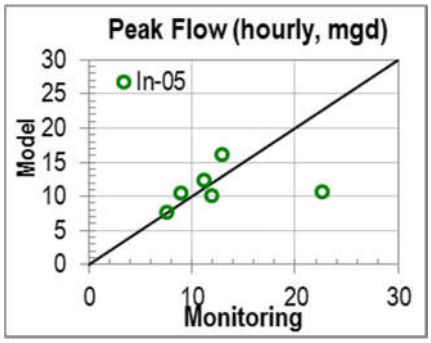
In-05 Model Validation Results (Metered and Modeled Flow)





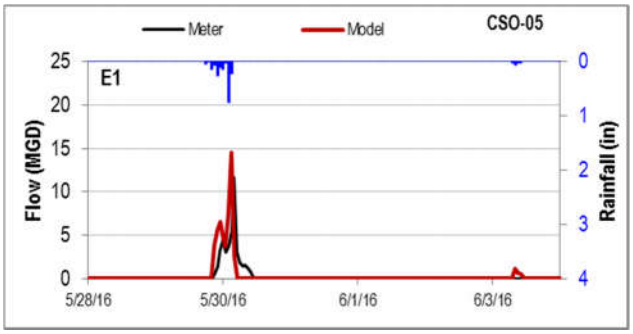
In-05 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

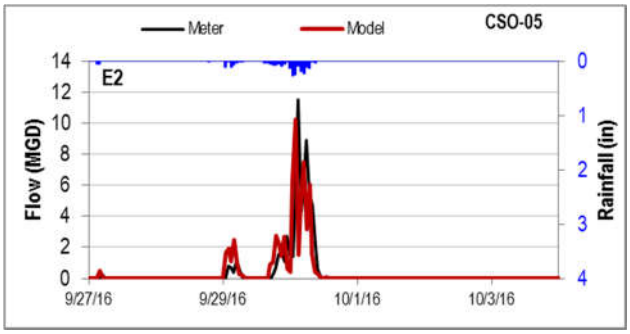


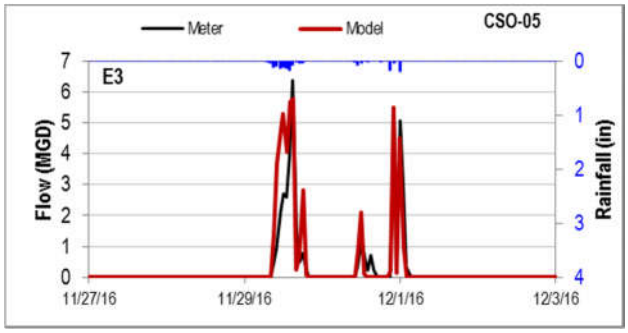


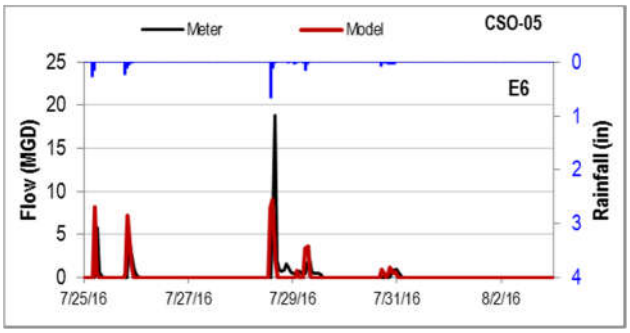
FLOW METER CSO-05 MODEL CALIBRATION AND VALIDATION RESULTS

CSO-05 Model Calibration Results (Metered and Modeled Flow)

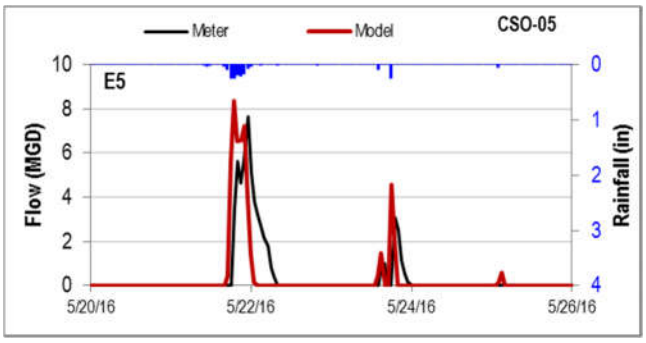


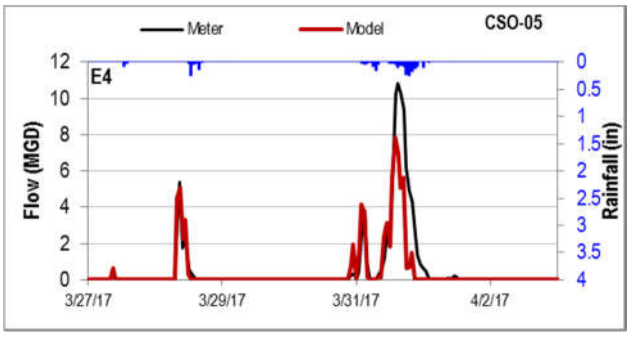




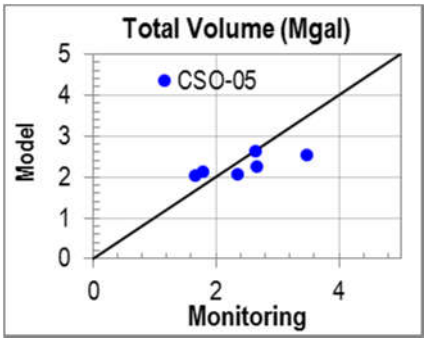


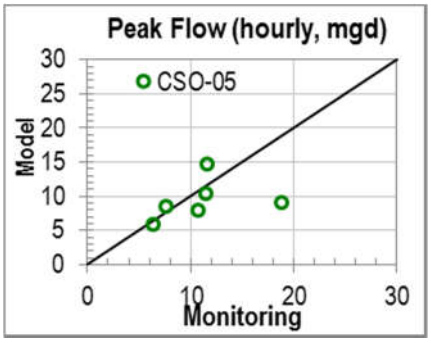
CSO-05 Model Validation Results (Metered and Modeled Flow)





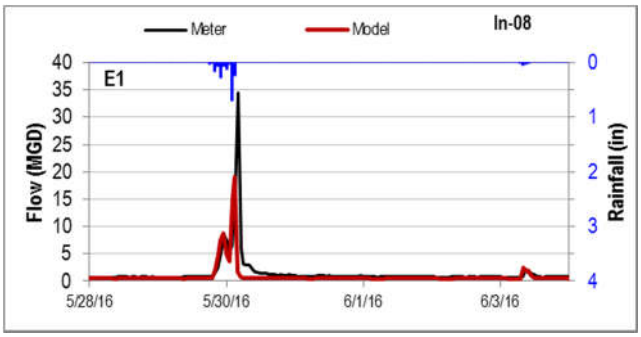
CSO-05 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

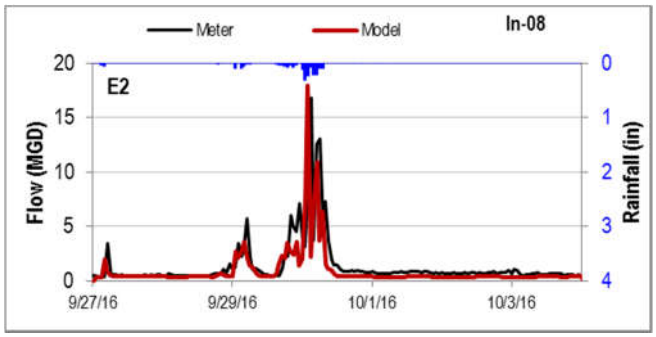


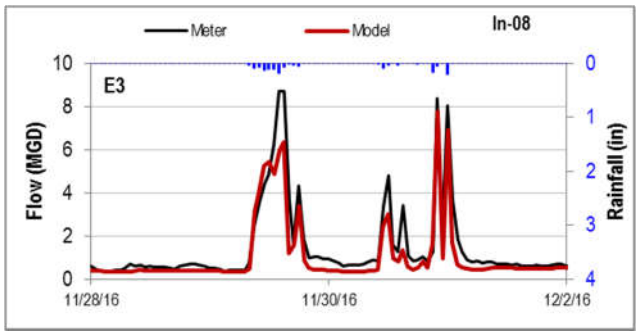


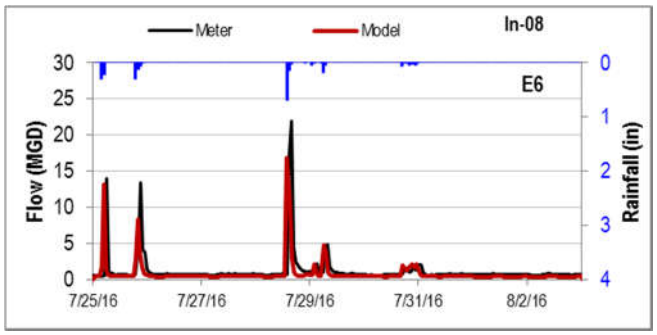
FLOW METER IN-08 MODEL CALIBRATION AND VALIDATION RESULTS

In-08 Model Calibration Results (Metered and Modeled Flow)

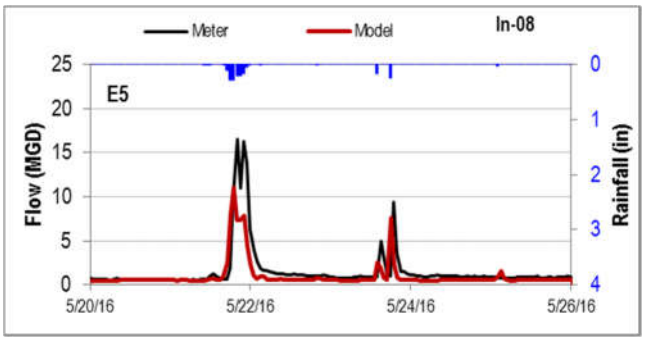


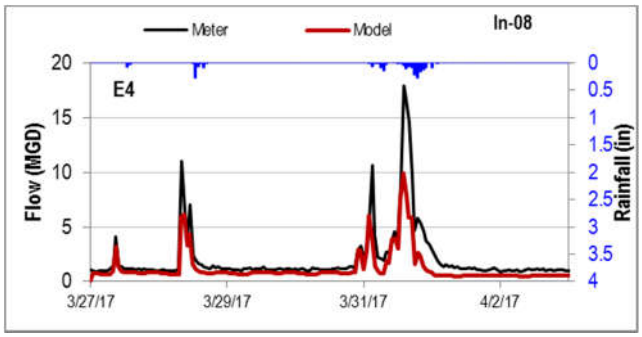




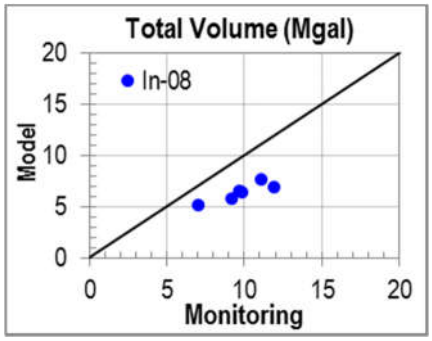


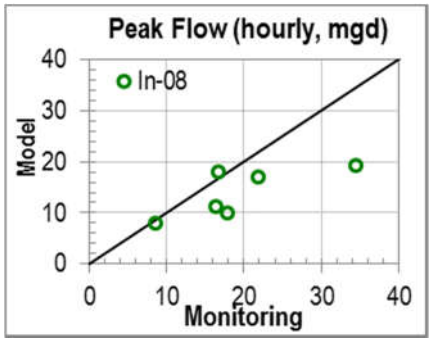
In-08 Model Validation Results (Metered and Modeled Flow)





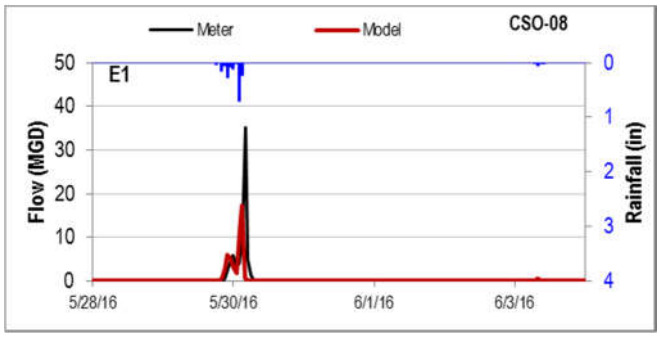
In-08 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

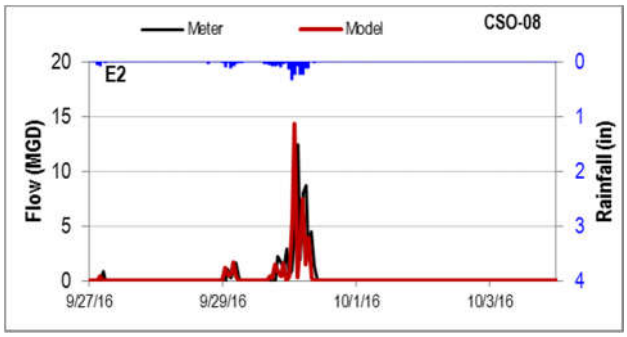


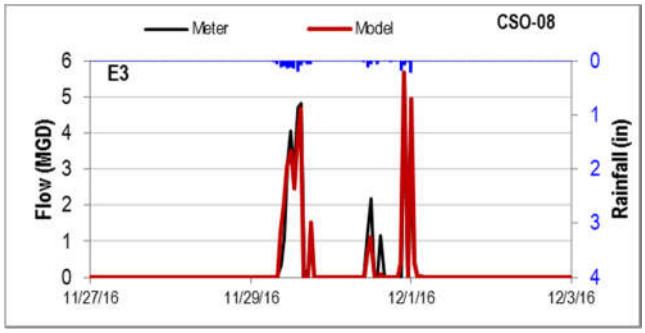


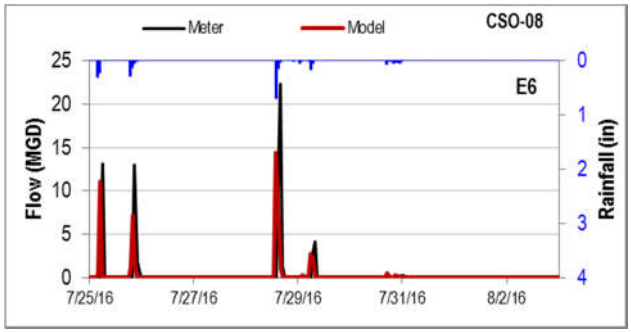
FLOW METER CSO-08 MODEL CALIBRATION AND VALIDATION RESULTS

CSO-08 Model Calibration Results (Metered and Modeled Flow)

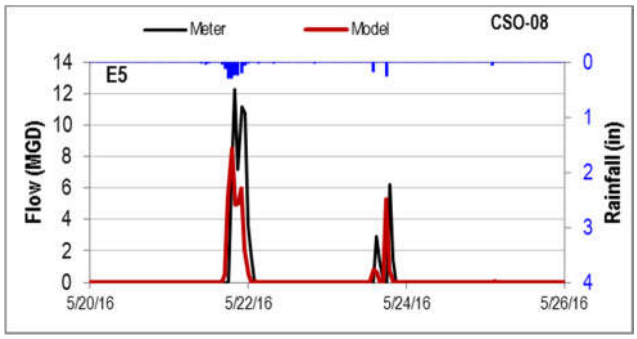


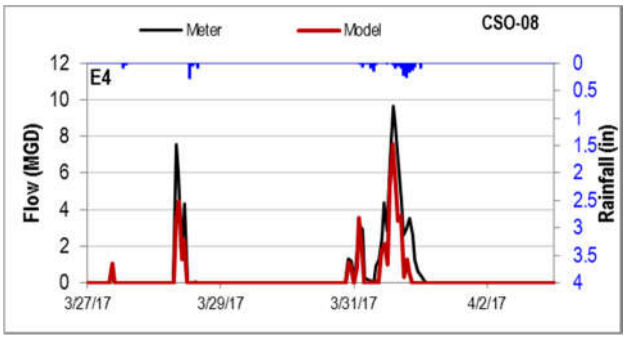




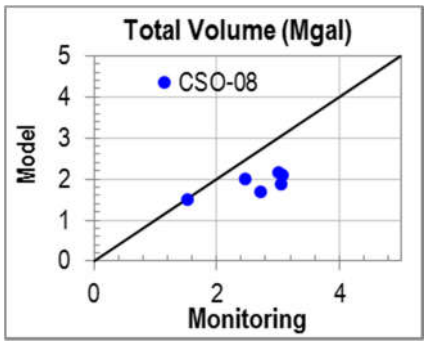


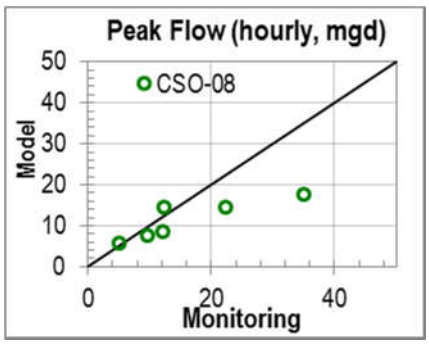
CSO-08 Model Validation Results (Metered and Modeled Flow)





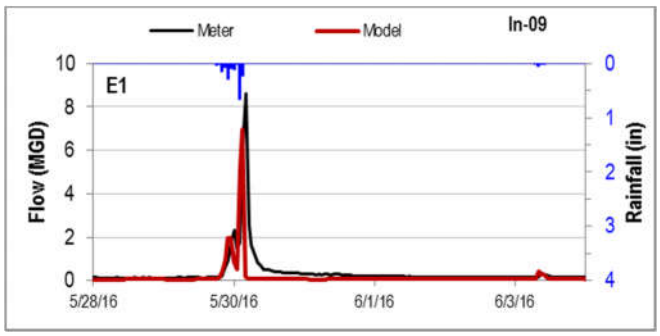
CSO-08 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

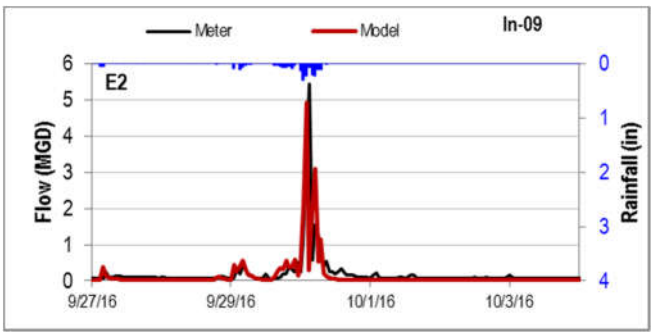


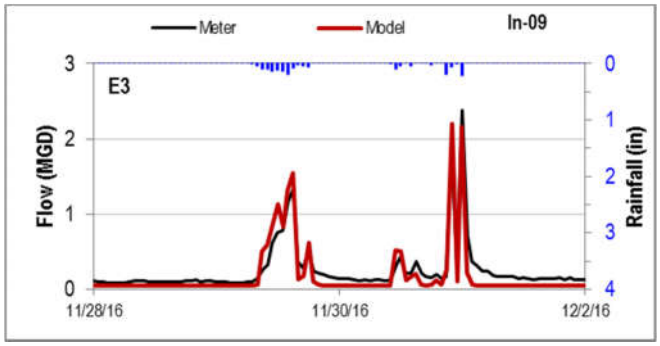


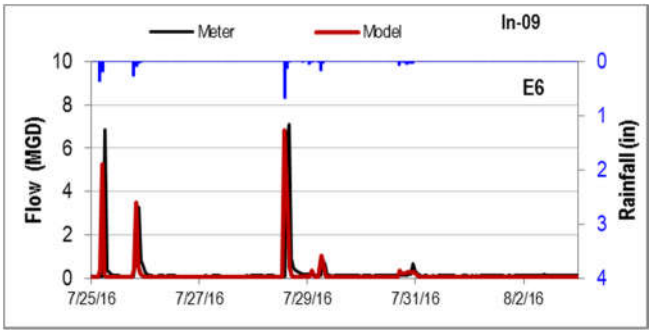
FLOW METER IN-09 MODEL CALIBRATION AND VALIDATION RESULTS

In-09 Model Calibration Results (Metered and Modeled Flow)

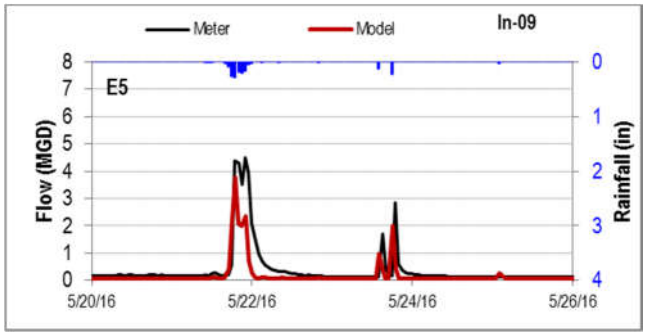


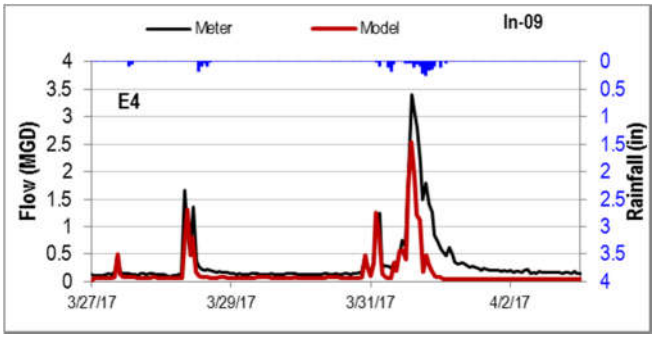




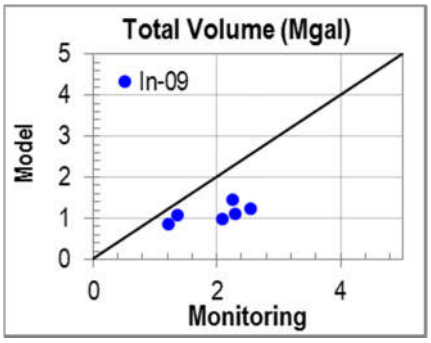


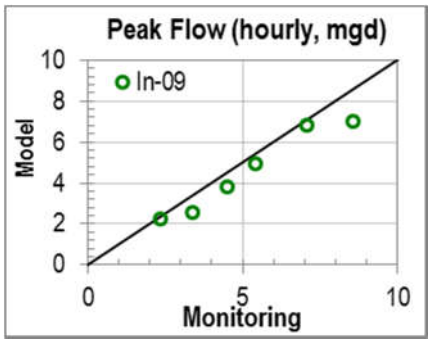
In-09 Model Validation Results (Metered and Modeled Flow)





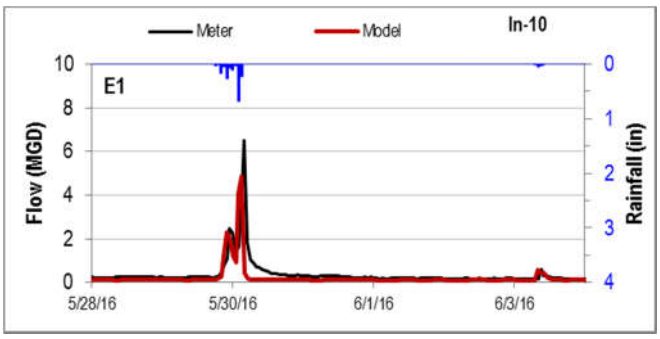
In-09 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

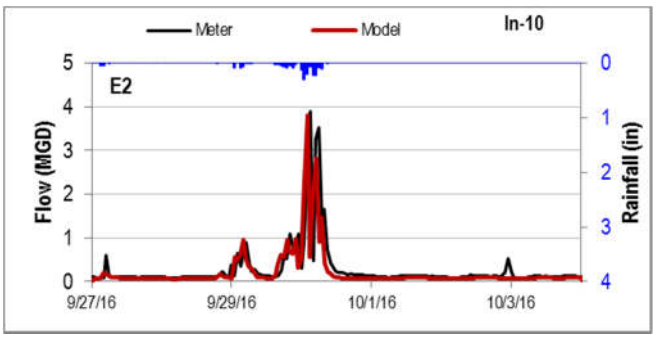


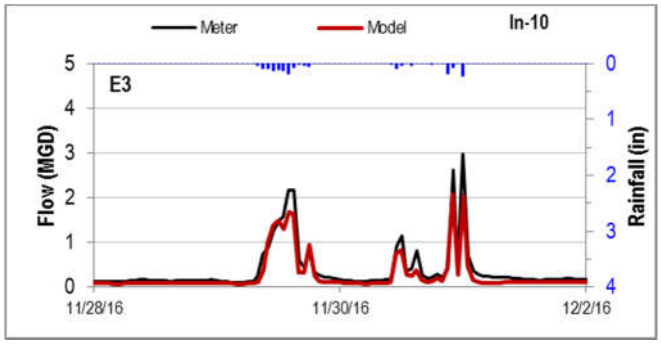


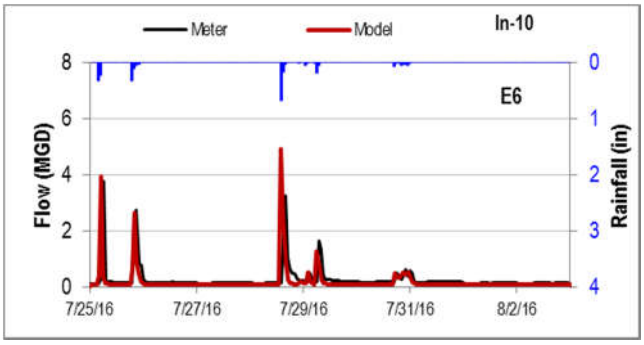
FLOW METER IN-10 MODEL CALIBRATION AND VALIDATION RESULTS

In-10 Model Calibration Results (Metered and Modeled Flow)

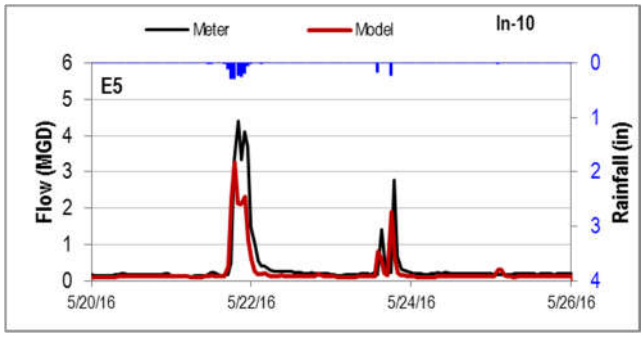


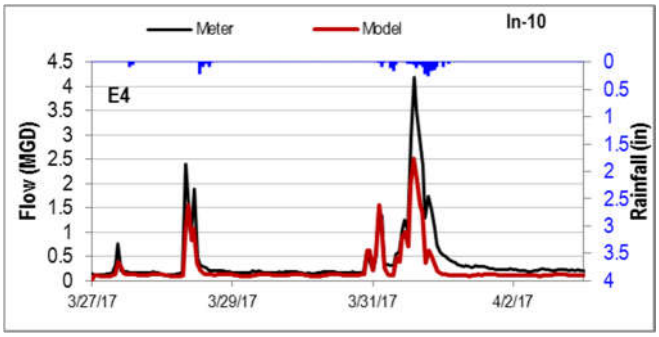




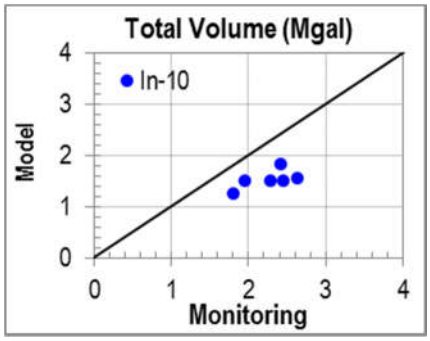


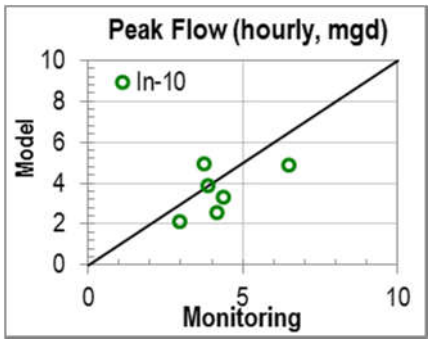
In-10 Model Validation Results (Metered and Modeled Flow)





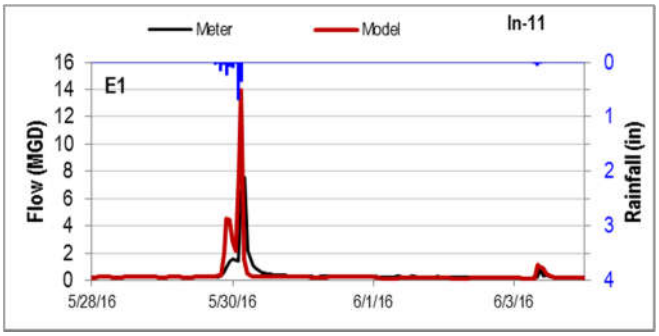
In-10 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

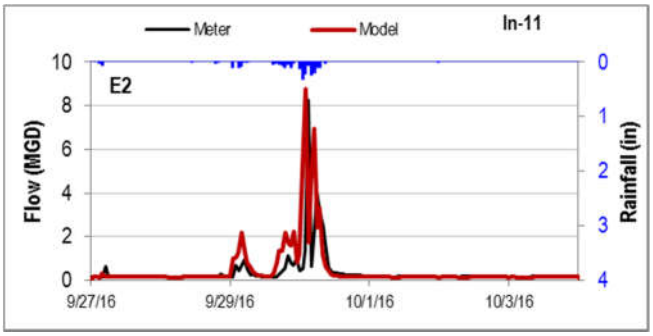


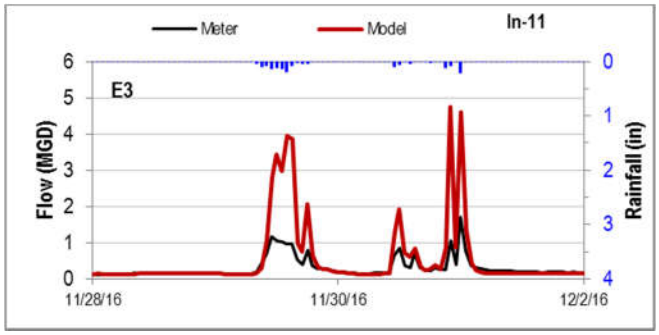


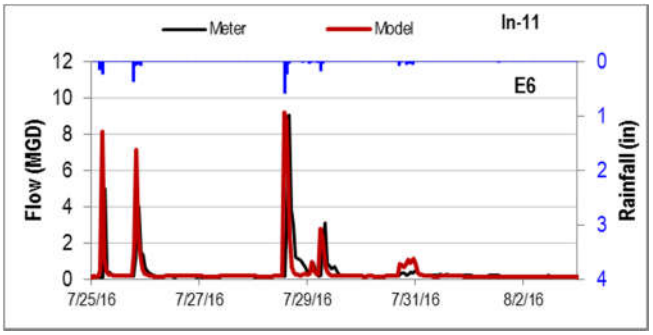
FLOW METER IN-11 MODEL CALIBRATION AND VALIDATION RESULTS

In-11 Model Calibration Results (Metered and Modeled Flow)

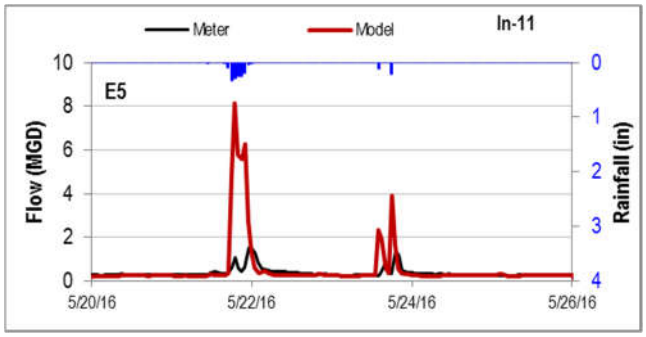


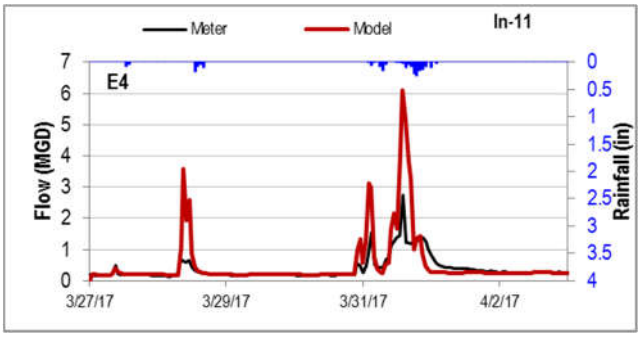




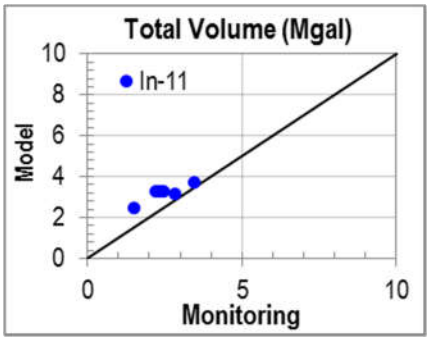


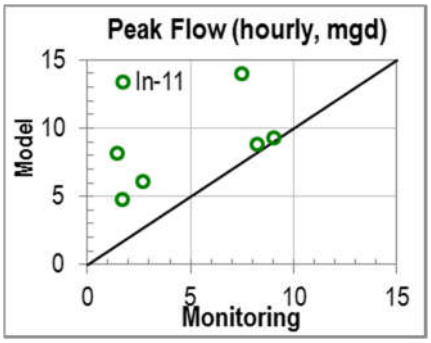
In-11 Model Validation Results (Metered and Modeled Flow)





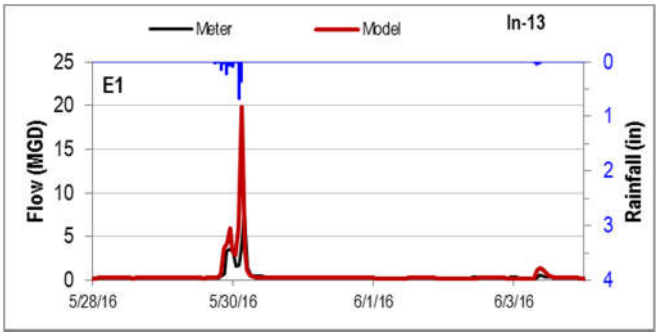
In-11 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

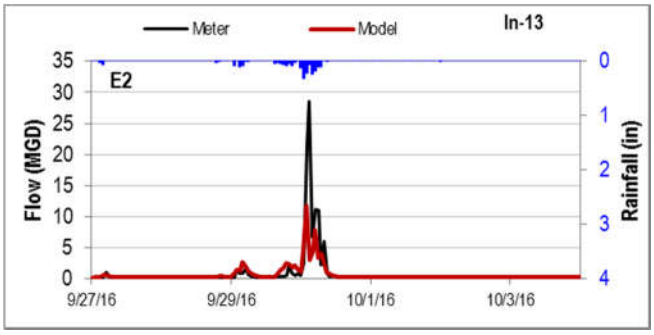


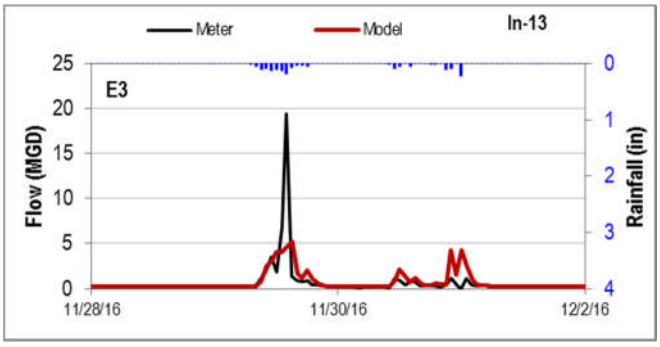


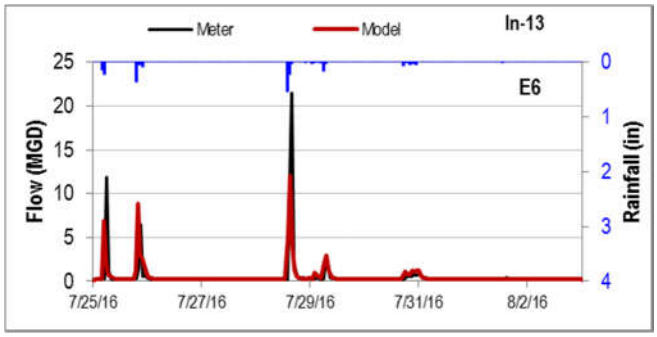
FLOW METER IN-13 MODEL CALIBRATION AND VALIDATION RESULTS

In-13 Model Calibration Results (Metered and Modeled Flow)

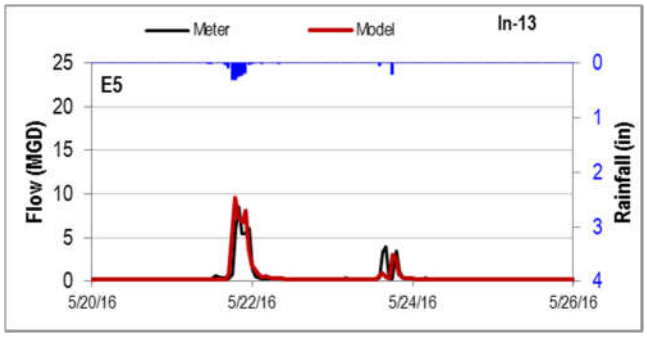


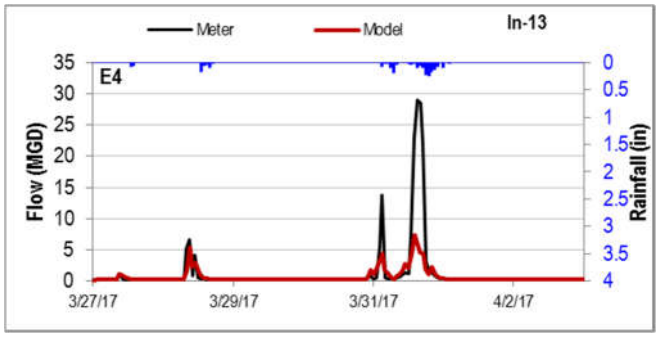




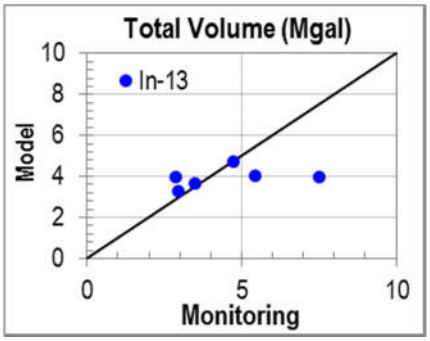


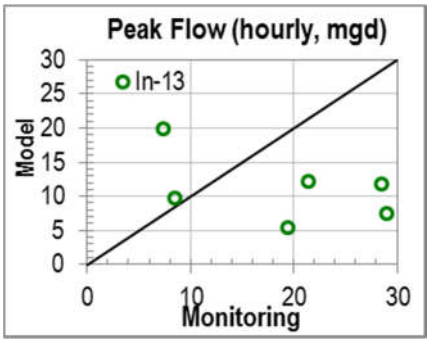
In-13 Model Validation Results (Metered and Modeled Flow)





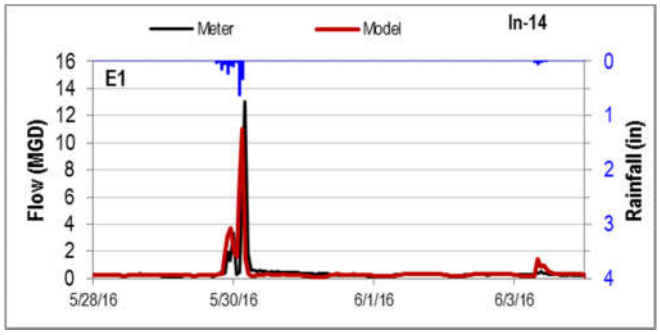
In-13 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

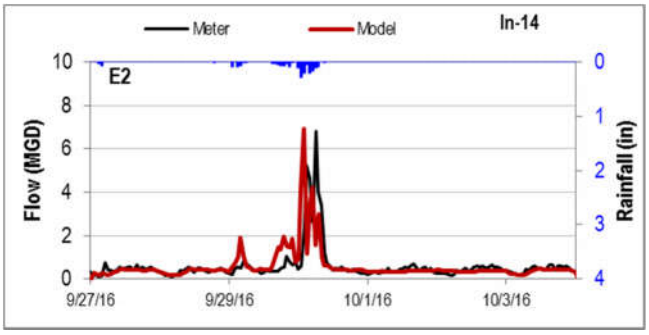


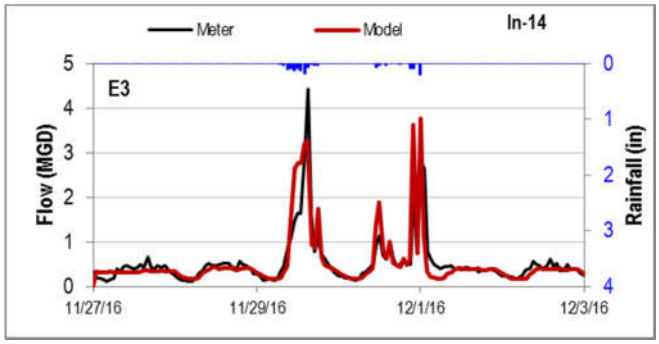


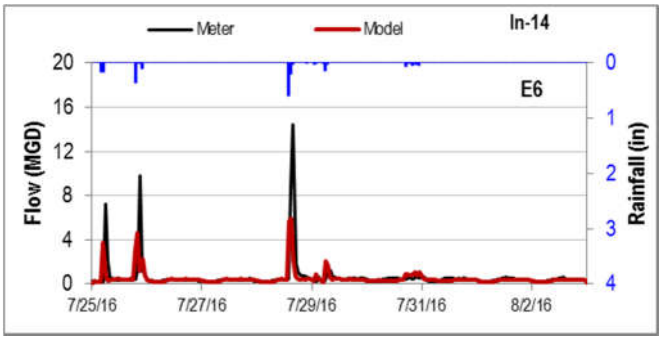
FLOW METER IN-14 MODEL CALIBRATION AND VALIDATION RESULTS

In-14 Model Calibration Results (Metered and Modeled Flow)

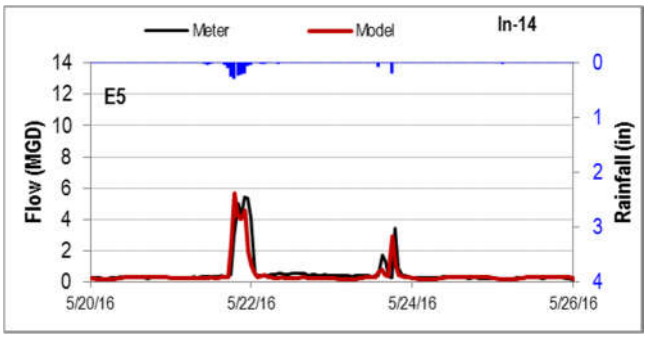


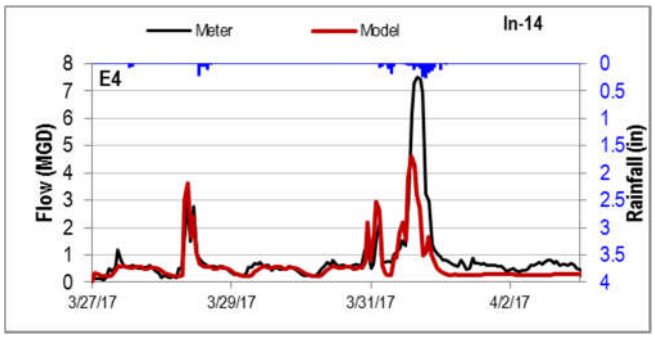




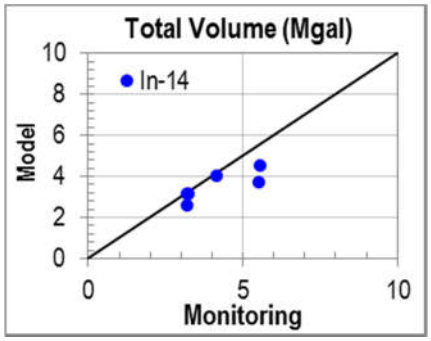


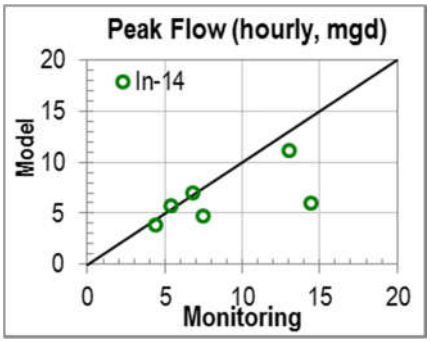
In-14 Model Validation Results (Metered and Modeled Flow)





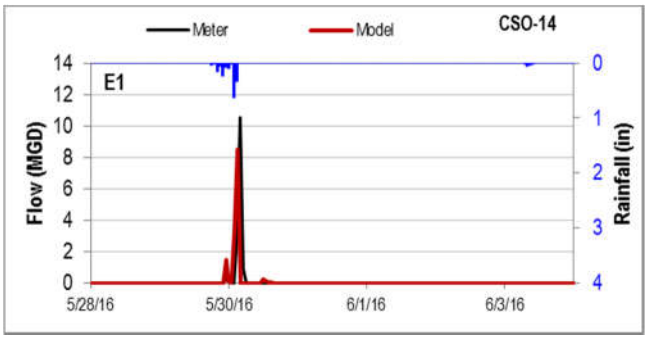
In-14 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

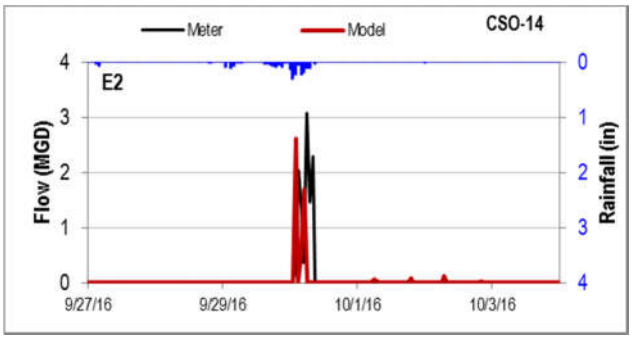


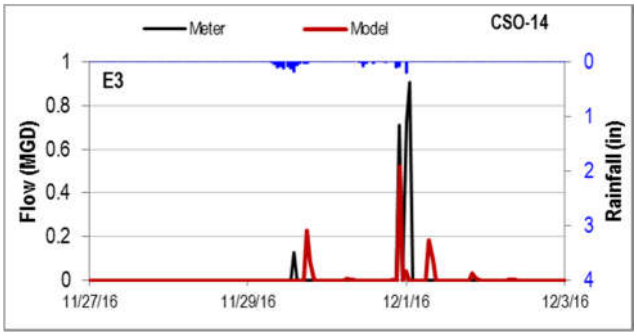


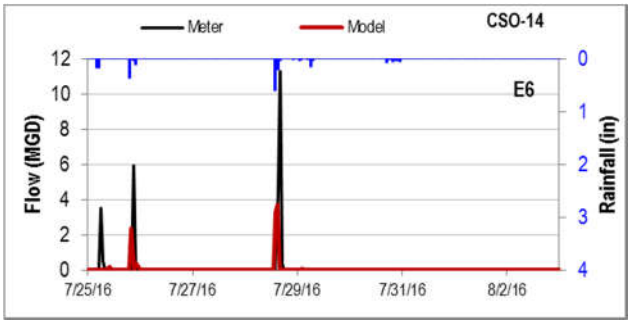
FLOW METER CSO-14 MODEL CALIBRATION AND VALIDATION RESULTS

CSO-14 Model Calibration Results (Metered and Modeled Flow)

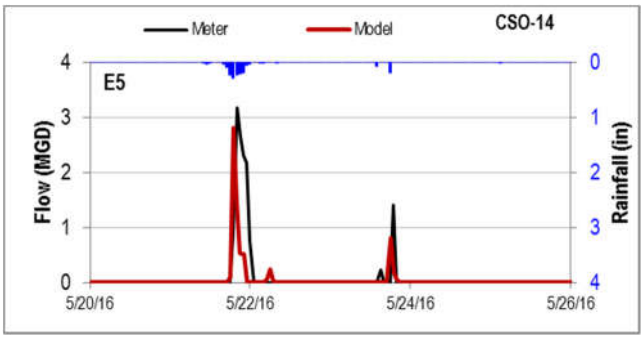


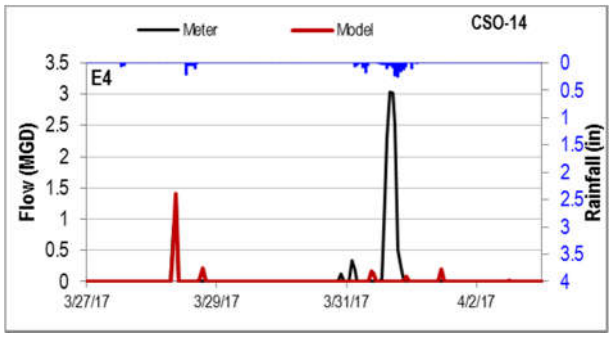




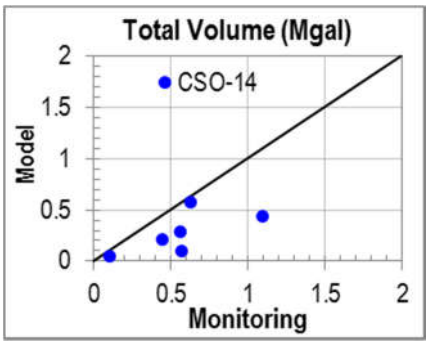


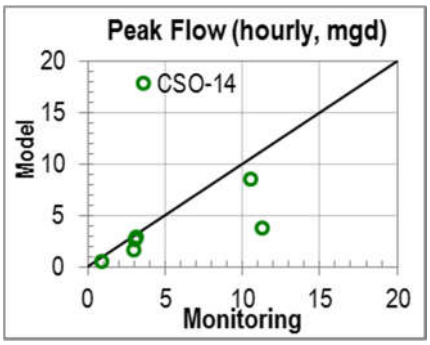
CSO-14 Model Validation Results (Metered and Modeled Flow)





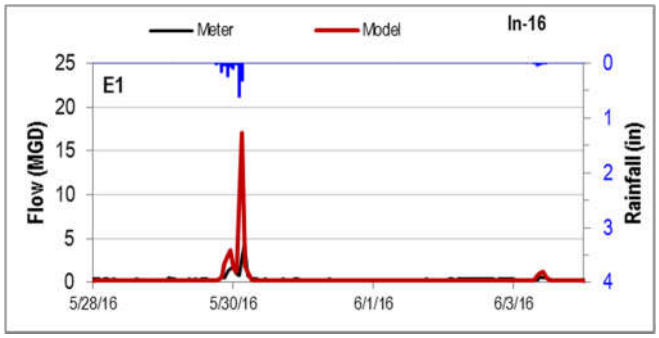
CSO-14 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

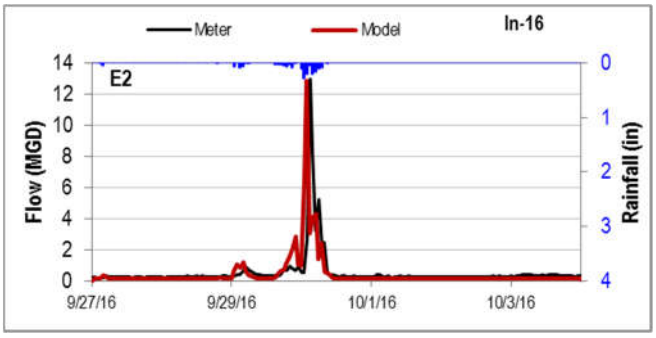


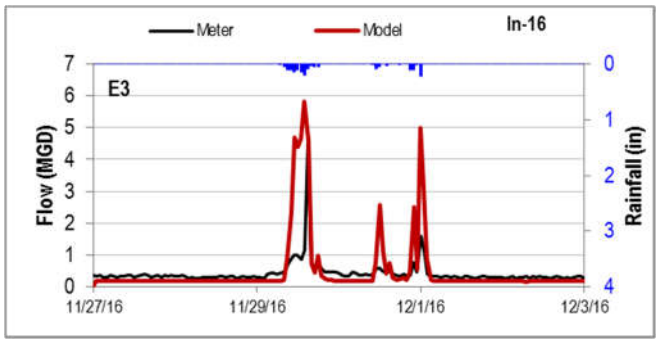


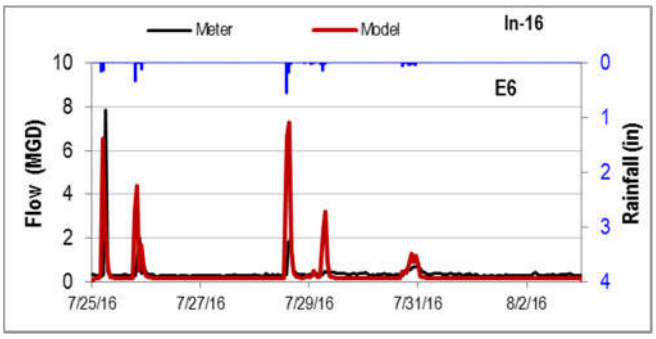
FLOW METER IN-16 MODEL CALIBRATION AND VALIDATION RESULTS

In-16 Model Calibration Results (Metered and Modeled Flow)

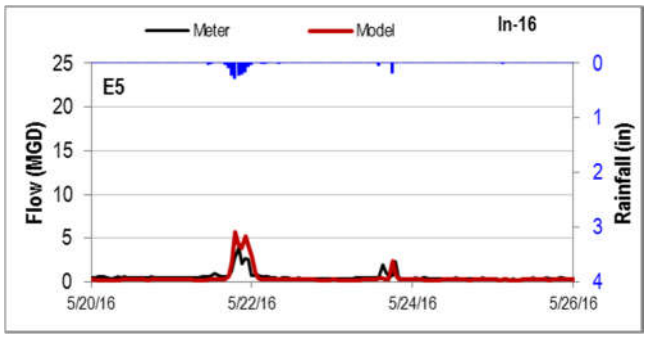


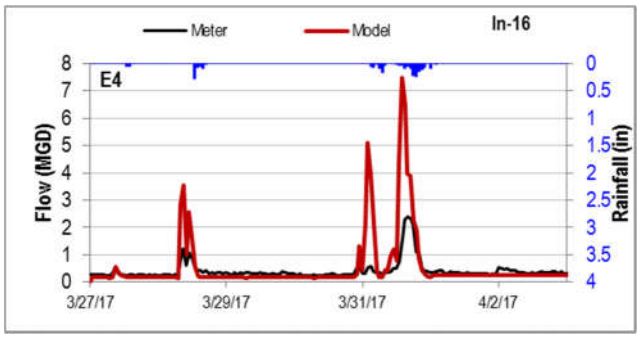




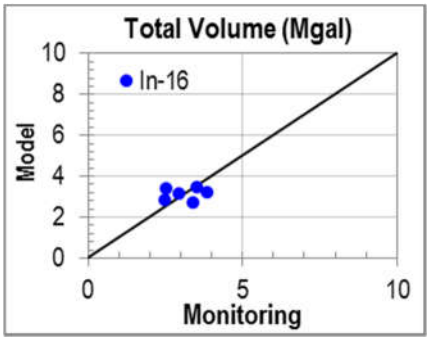


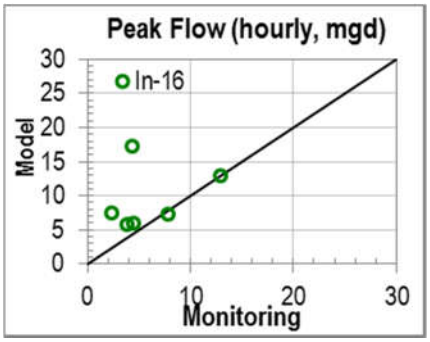
In-16 Model Validation Results (Metered and Modeled Flow)





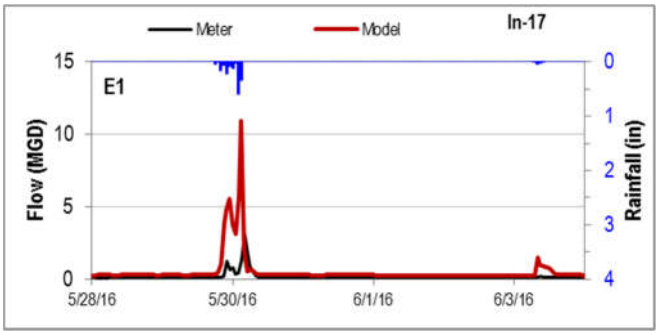
In-16 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

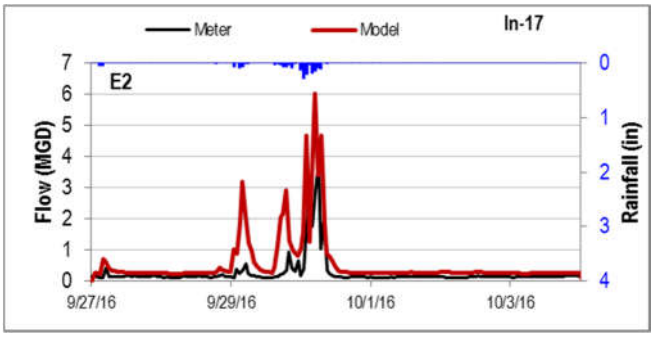


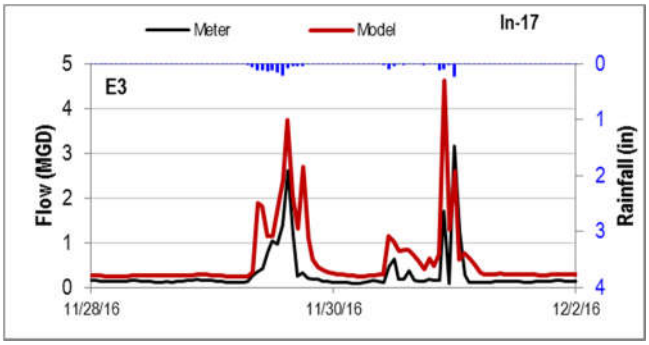


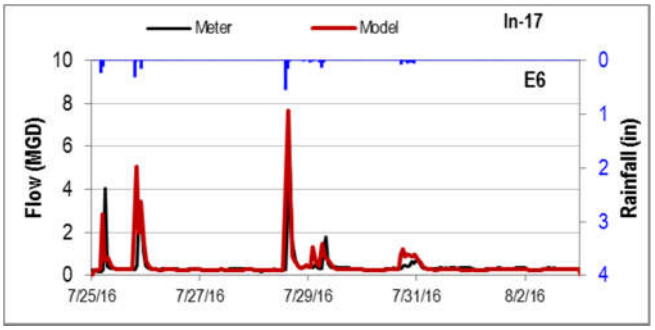
FLOW METER IN-17 MODEL CALIBRATION AND VALIDATION RESULTS

In-17 Model Calibration Results (Metered and Modeled Flow)

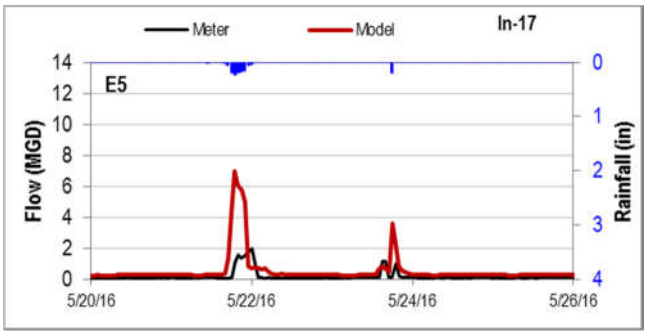


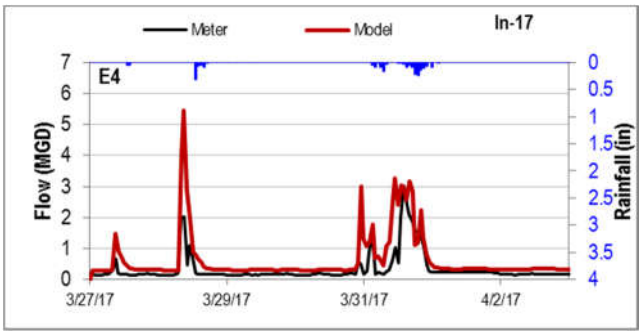




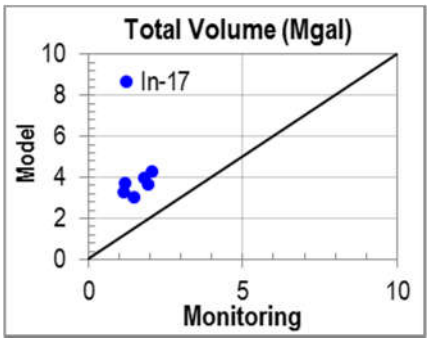


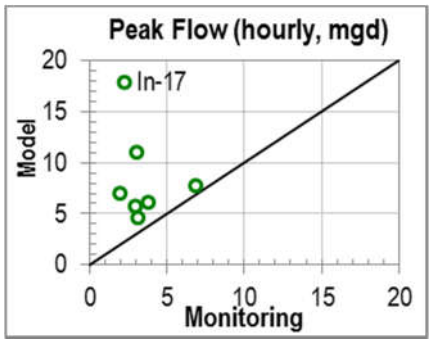
In-17 Model Validation Results (Metered and Modeled Flow)





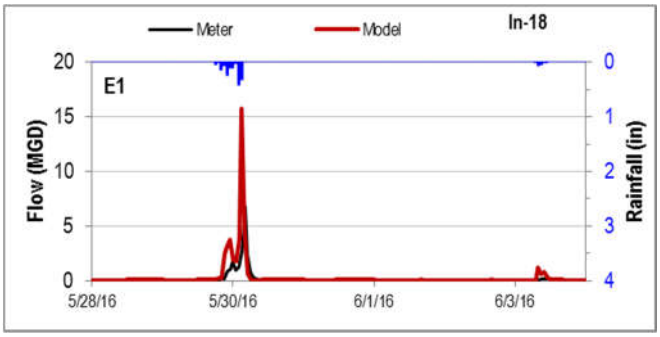
In-17 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

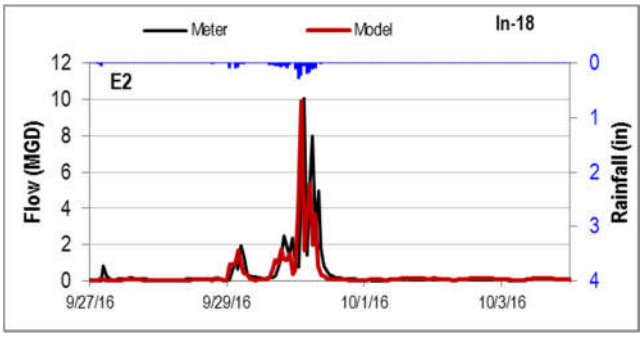


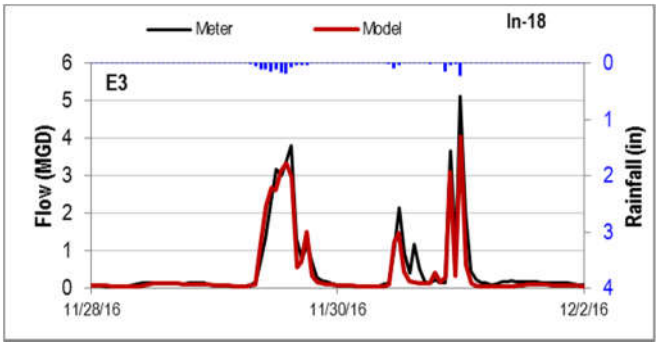


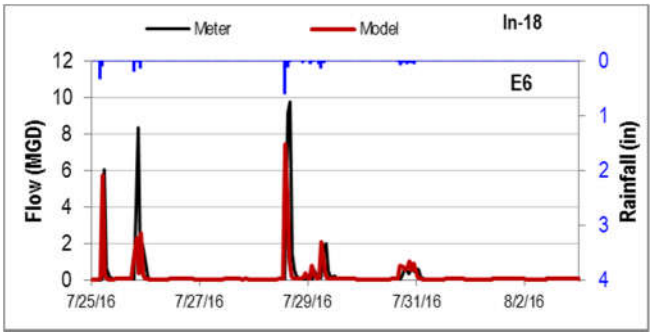
FLOW METER IN-18 MODEL CALIBRATION AND VALIDATION RESULTS

In-18 Model Calibration Results (Metered and Modeled Flow)

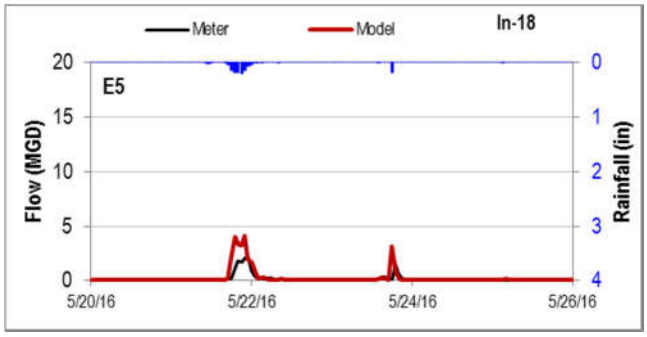


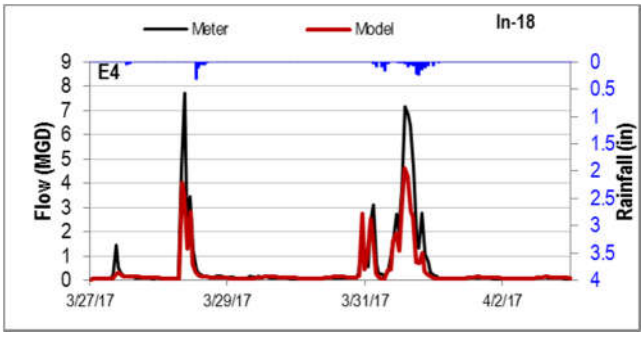




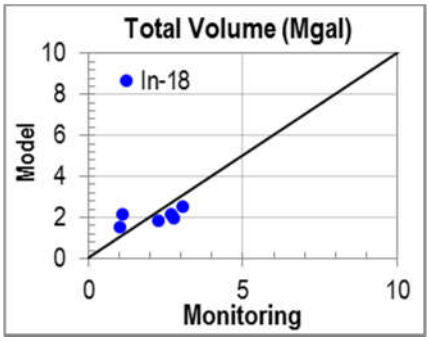


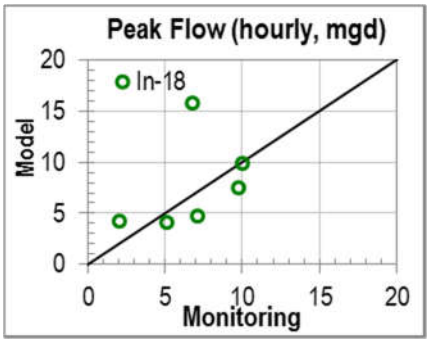
In-18 Model Validation Results (Metered and Modeled Flow)





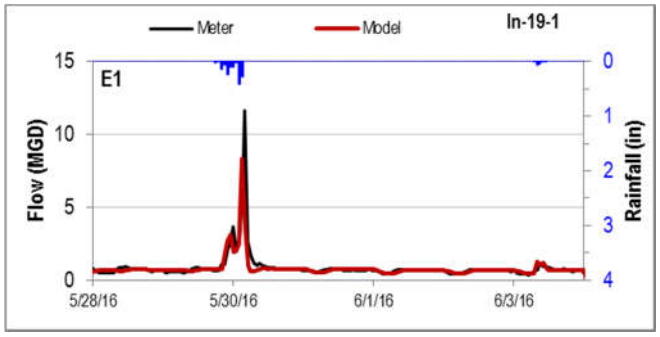
In-18 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

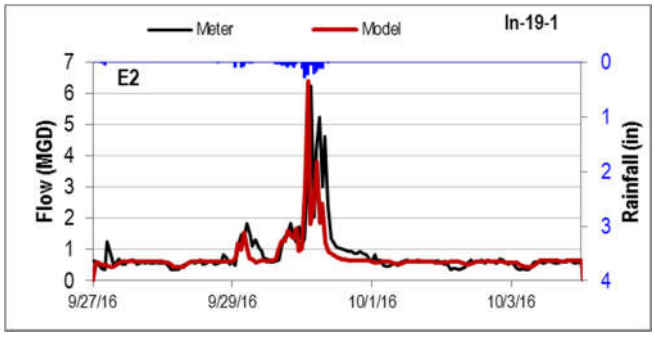


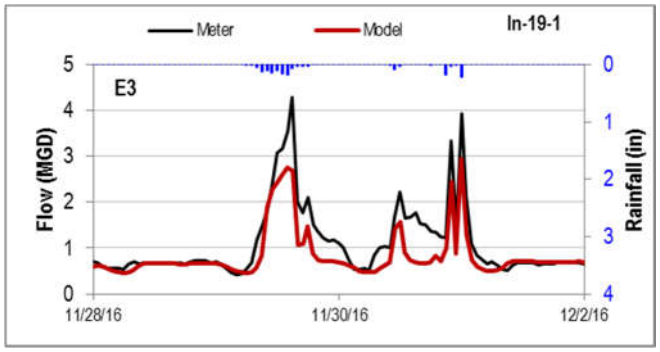


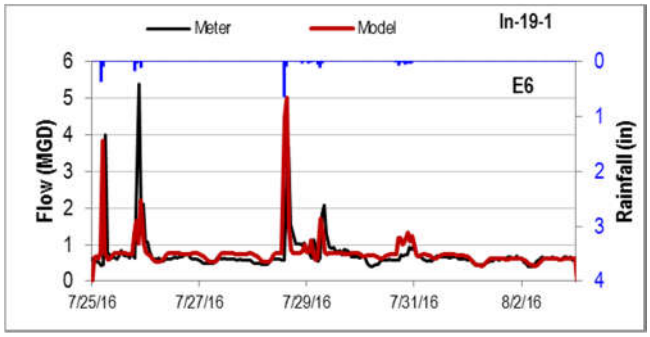
FLOW METER IN-19-1 MODEL CALIBRATION AND VALIDATION RESULTS

In-19-1 Model Calibration Results (Metered and Modeled Flow)

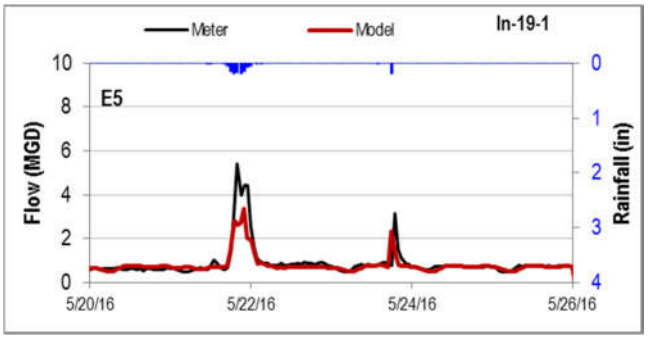


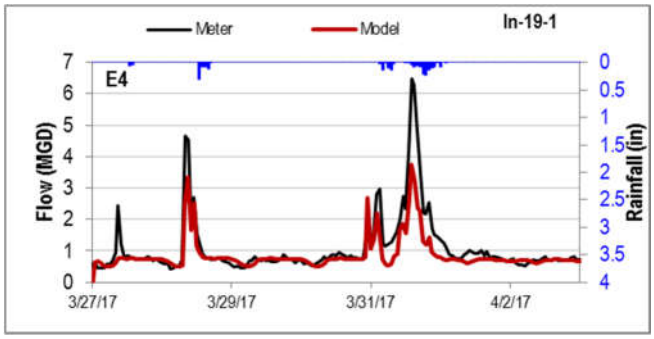




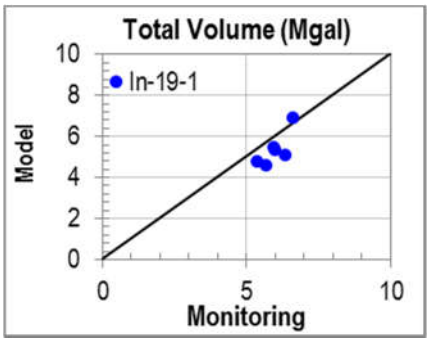


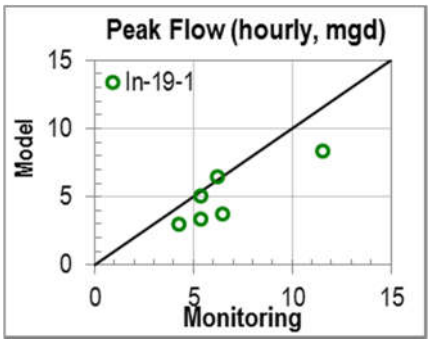
In-19-1 Model Validation Results (Metered and Modeled Flow)





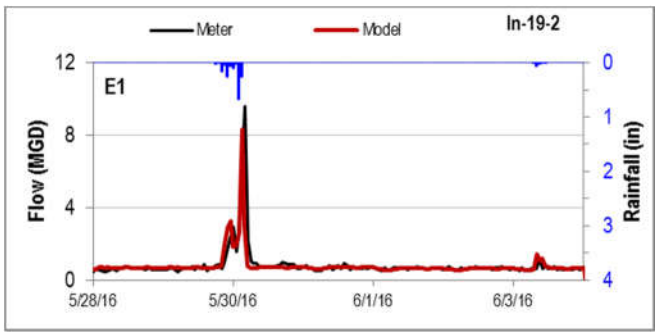
In-19-1 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

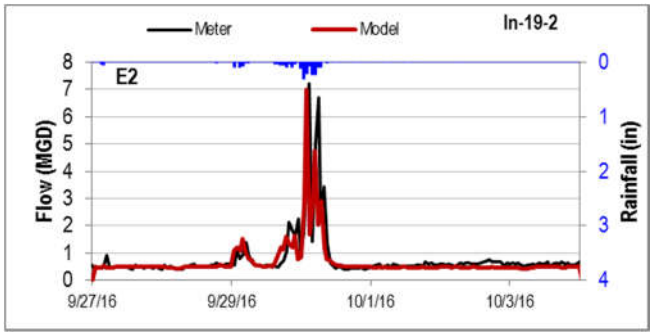


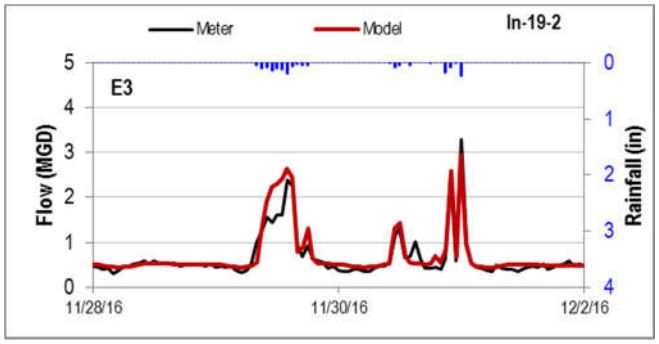


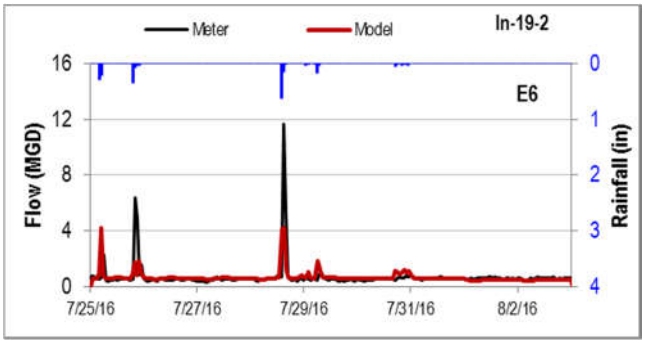
FLOW METER IN-19-2 MODEL CALIBRATION AND VALIDATION RESULTS

In-19-2 Model Calibration Results (Metered and Modeled Flow)

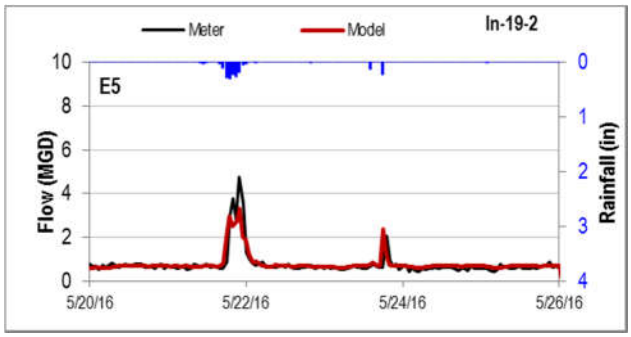


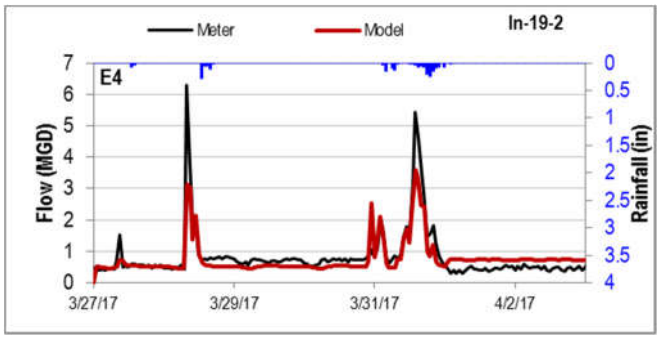




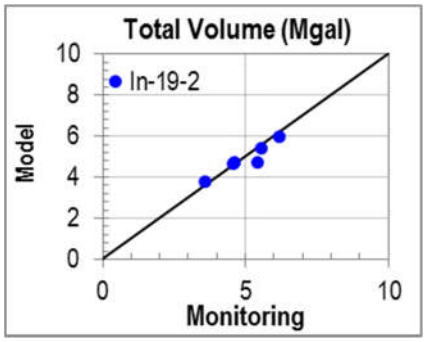


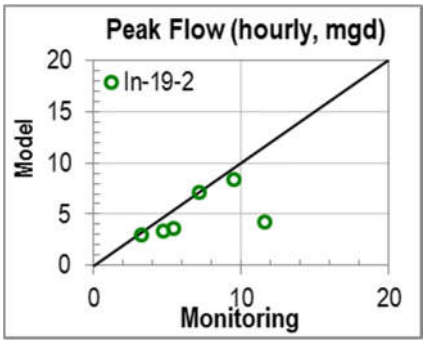
In-19-2 Model Validation Results (Metered and Modeled Flow)





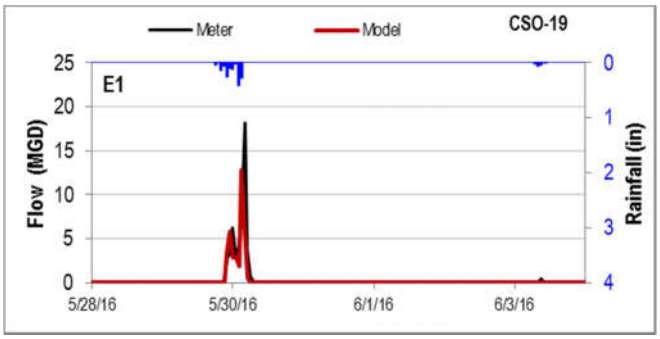
In-19-2 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

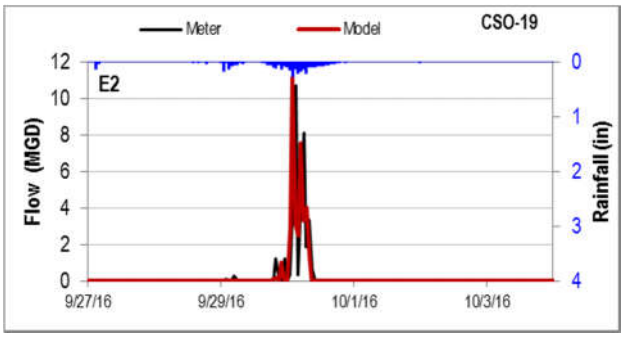


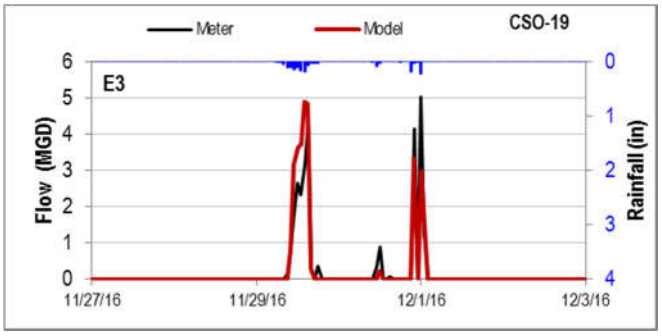


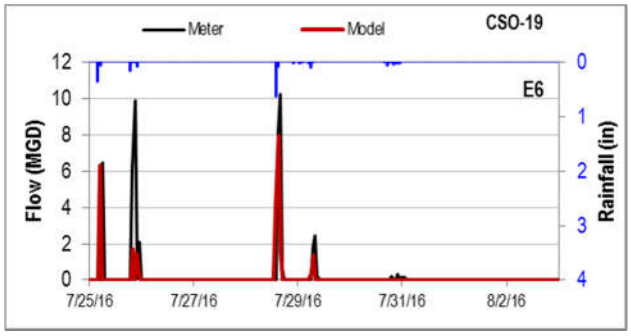
FLOW METER CSO-19 MODEL CALIBRATION AND VALIDATION RESULTS

CSO-19 Model Calibration Results (Metered and Modeled Flow)

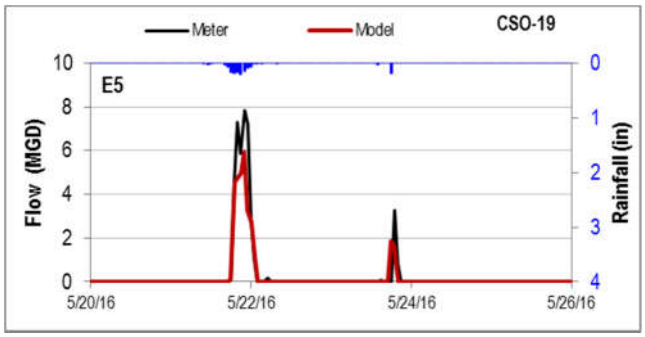


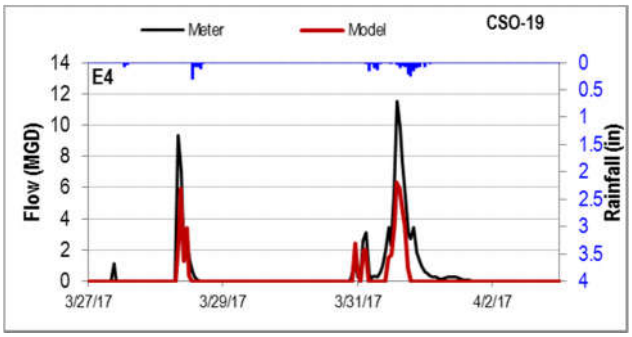




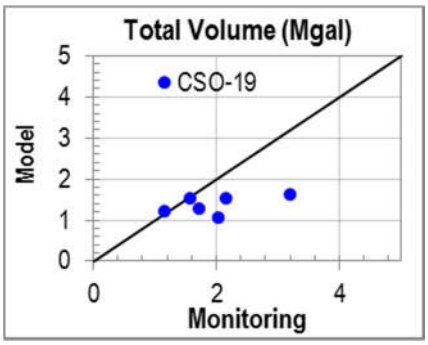


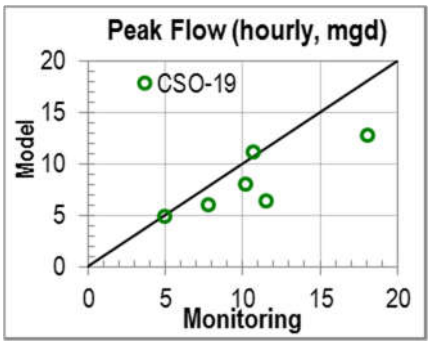
CSO-19 Model Validation Results (Metered and Modeled Flow)





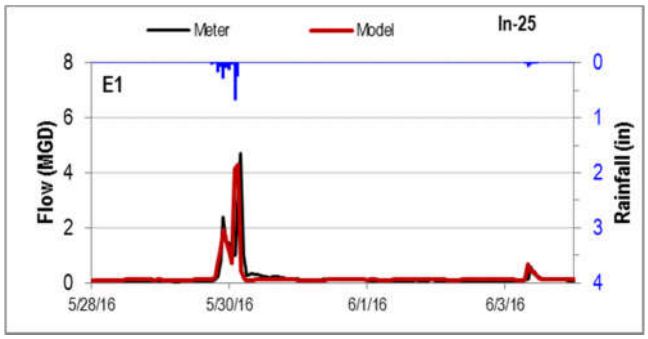
CSO-19 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

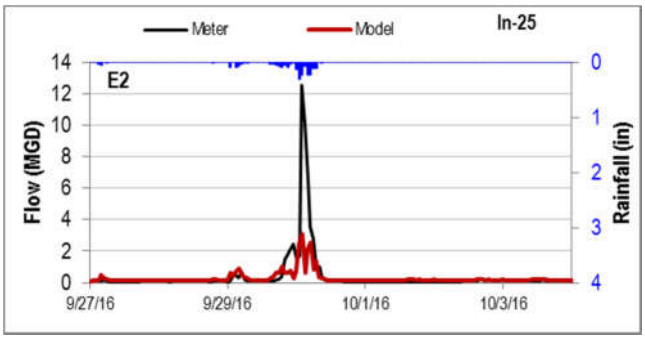


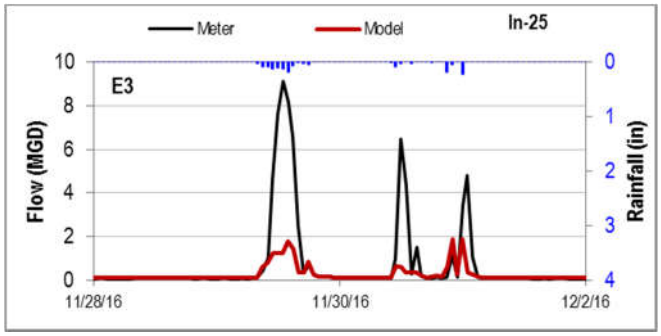


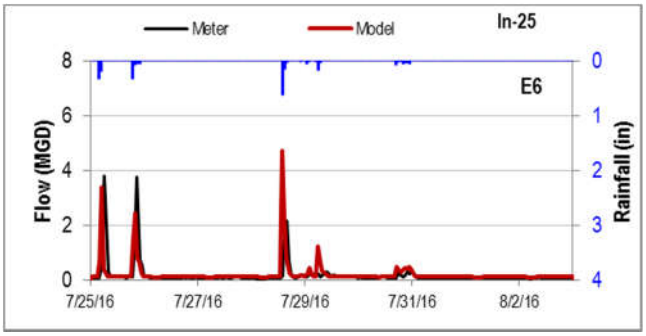
FLOW METER IN-25 MODEL CALIBRATION AND VALIDATION RESULTS

In-25 Model Calibration Results (Metered and Modeled Flow)

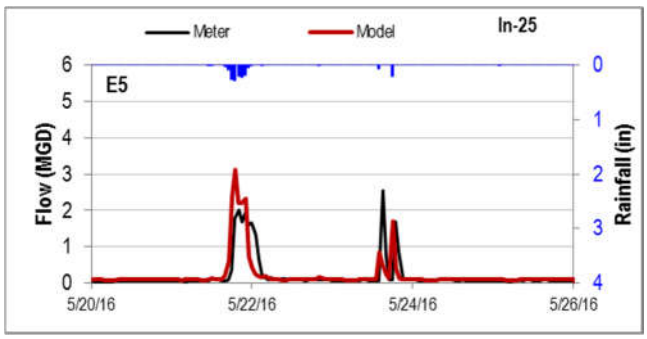


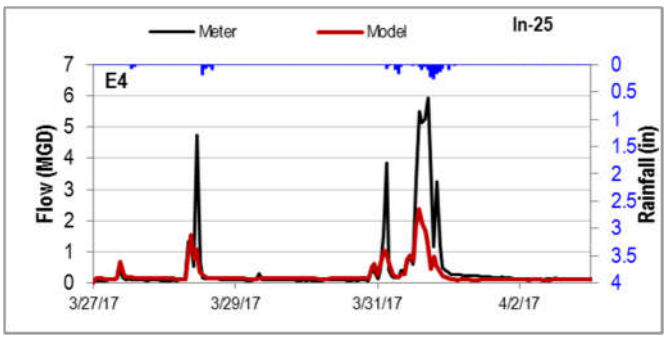




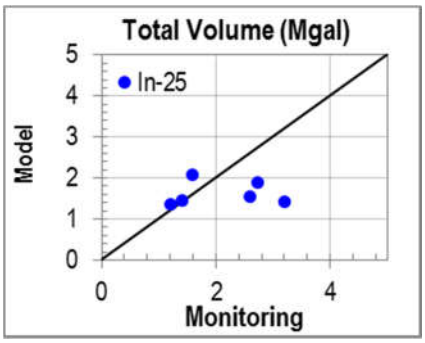


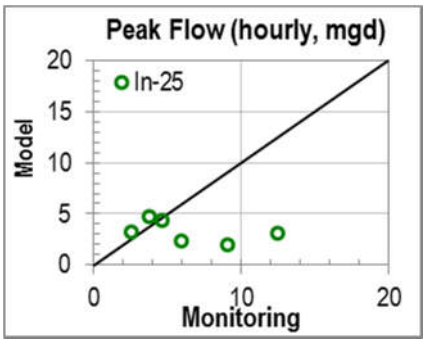
In-25 Model Validation Results (Metered and Modeled Flow)





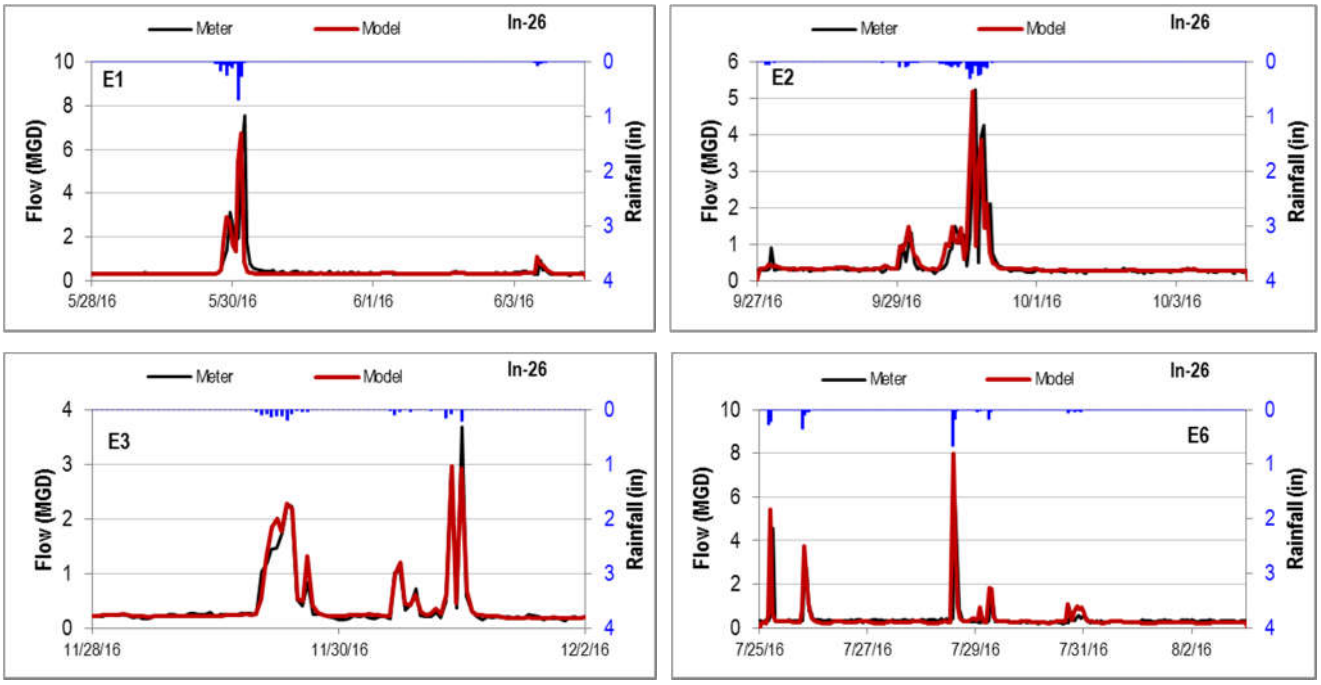
In-25 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)



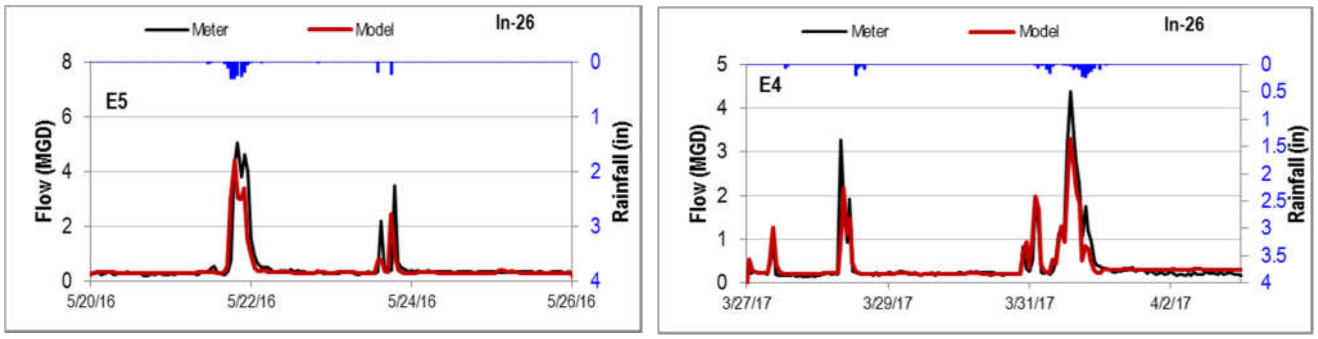


FLOW METER IN-26 MODEL CALIBRATION AND VALIDATION RESULTS

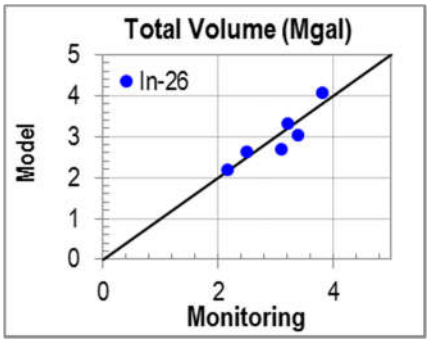
In-26 Model Calibration Results (Metered and Modeled Flow)

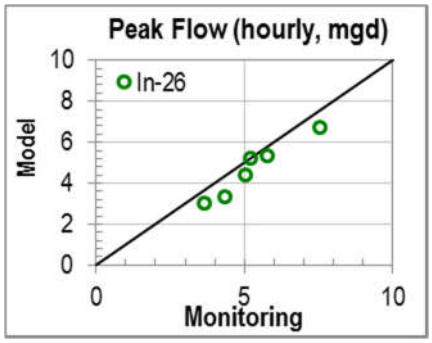


In-26 Model Validation Results (Metered and Modeled Flow)



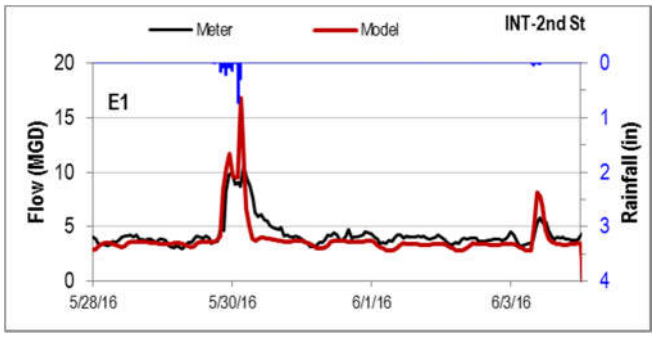
In-26 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

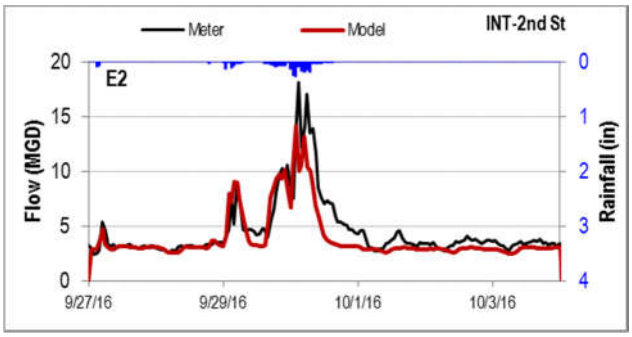


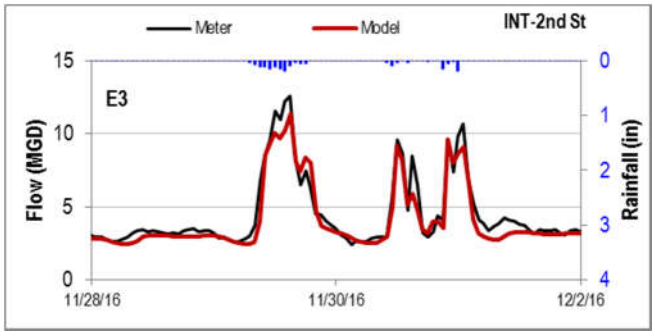


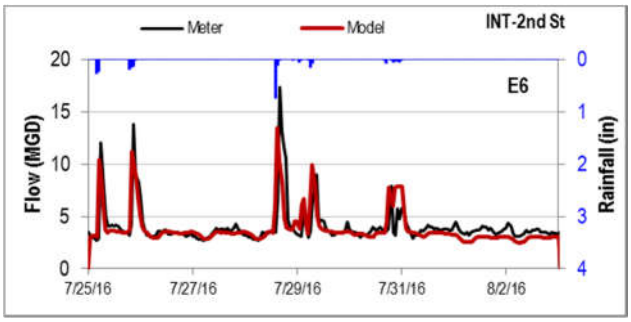
FLOW METER INT-2nd St MODEL CALIBRATION AND VALIDATION RESULTS

INT-2nd St Model Calibration Results (Metered and Modeled Flow)

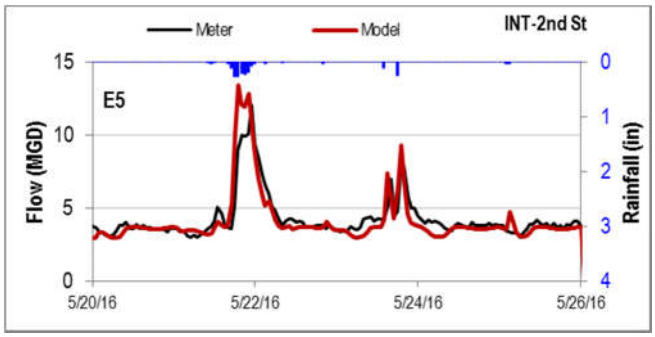


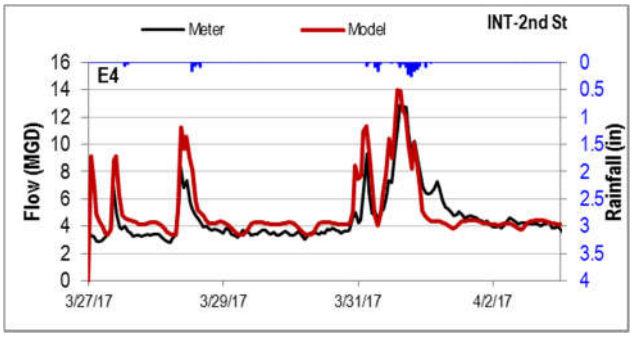




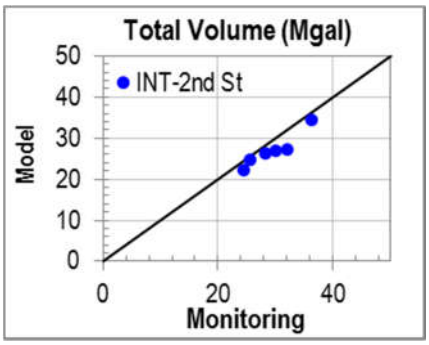


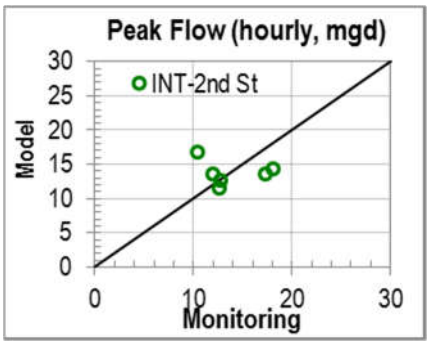
INT-2nd St Model Validation Results (Metered and Modeled Flow)





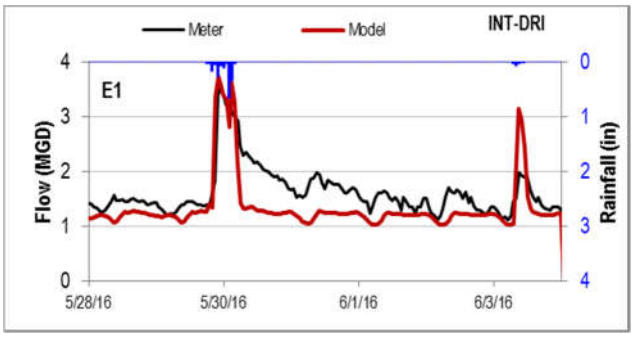
INT-2nd St Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

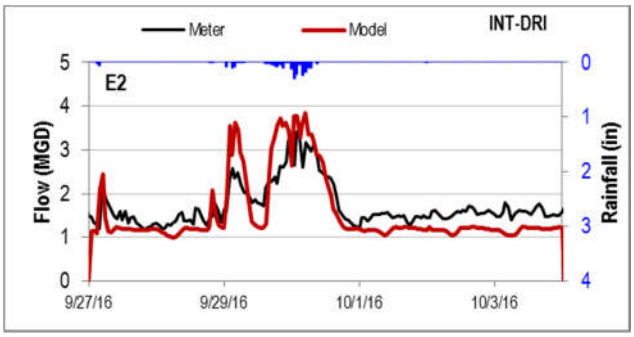


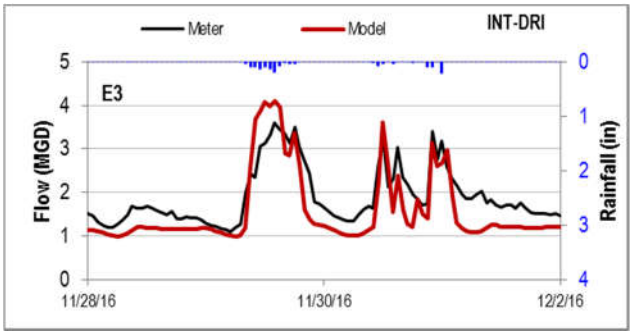


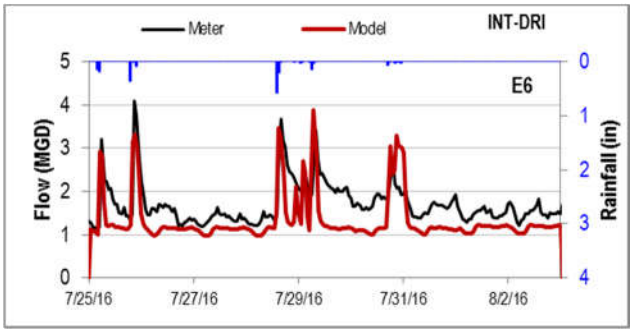
FLOW METER INT-DRI MODEL CALIBRATION AND VALIDATION RESULTS

INT-DRI Model Calibration Results (Metered and Modeled Flow)

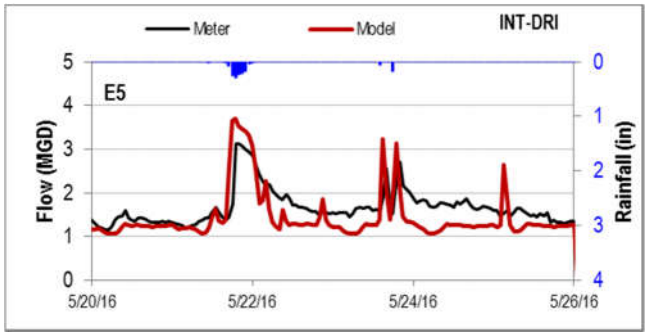


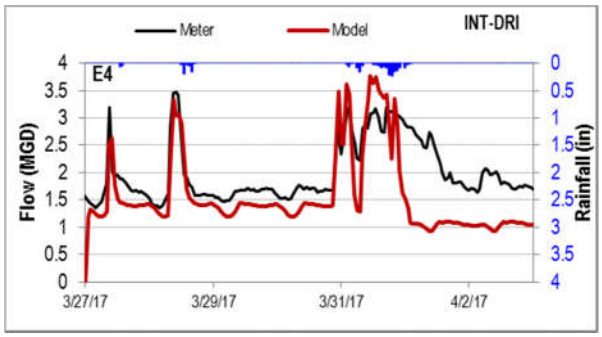




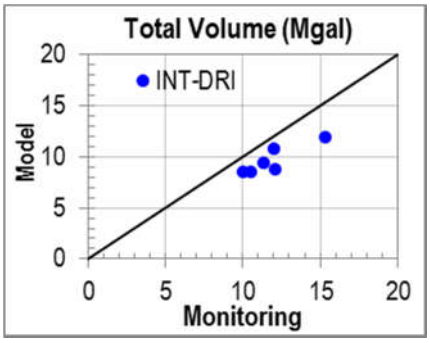


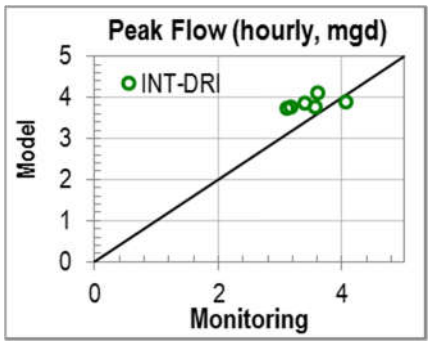
INT-DRI Model Validation Results (Metered and Modeled Flow)





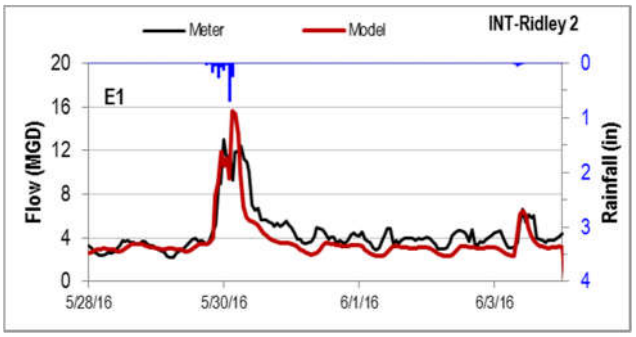
INT-DRI Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

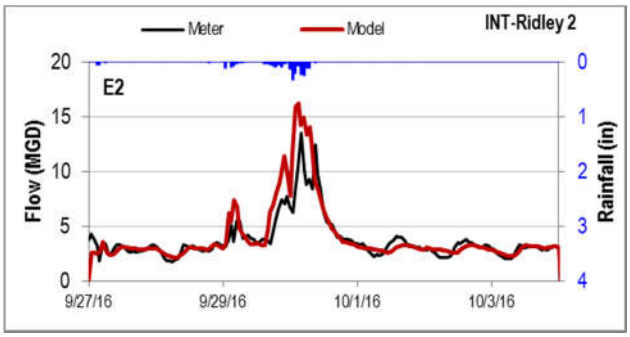


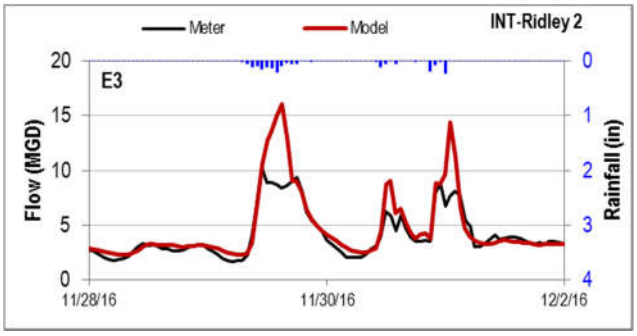


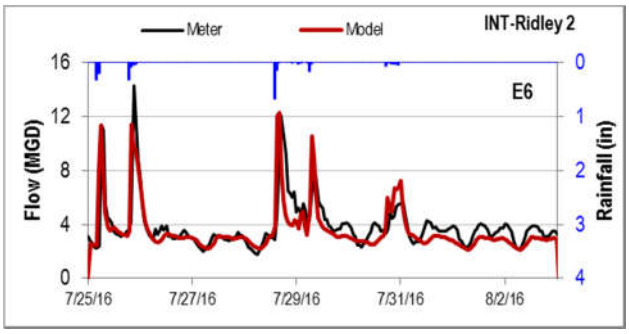
FLOW METER INT-Ridley 2 MODEL CALIBRATION AND VALIDATION RESULTS

INT-Ridley 2 Model Calibration Results (Metered and Modeled Flow)

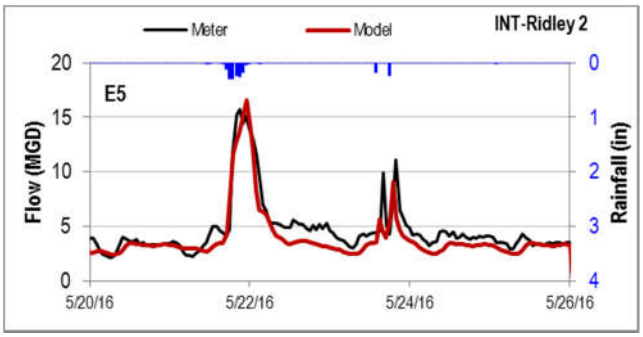


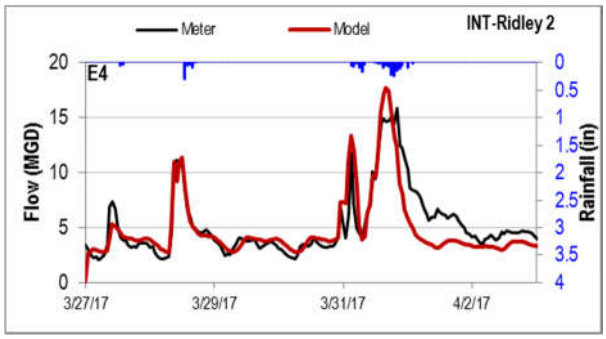




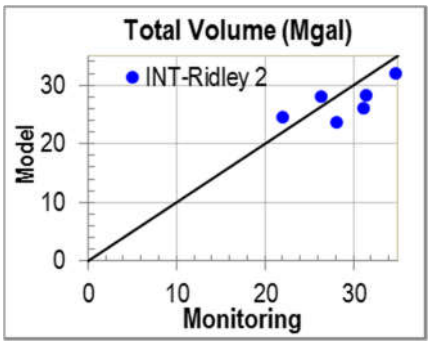


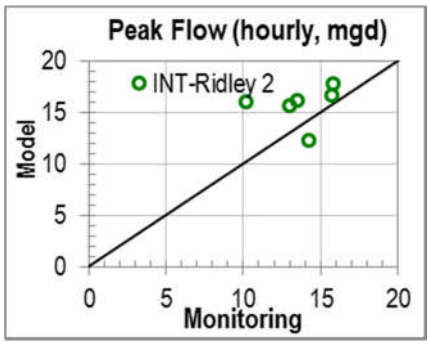
INT-Ridley 2 Model Validation Results (Metered and Modeled Flow)





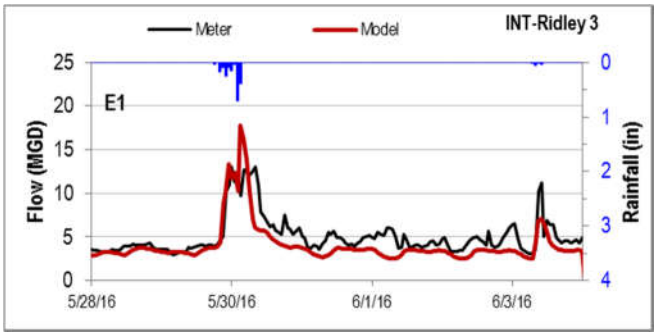
INT-Ridley-2 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

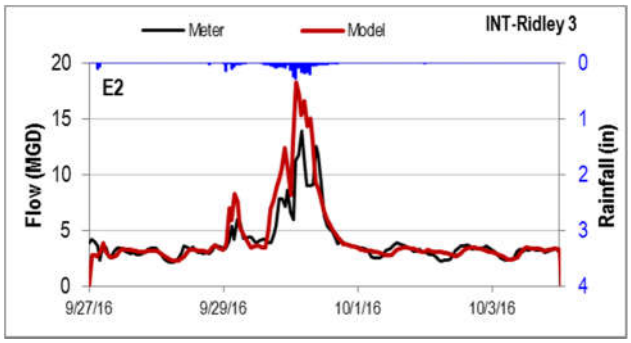


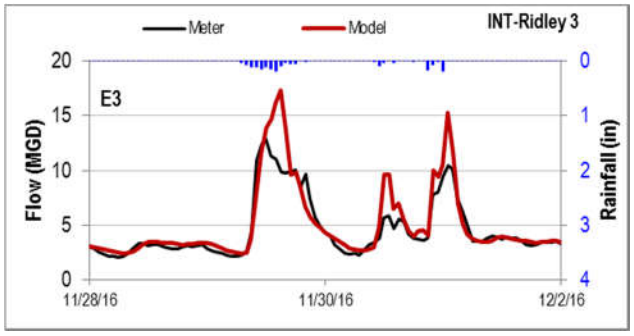


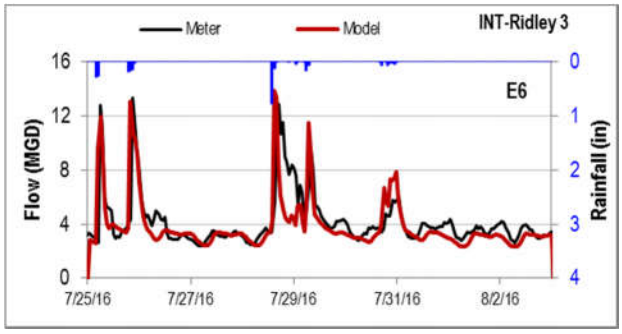
FLOW METER INT-Ridley 3 MODEL CALIBRATION AND VALIDATION RESULTS

INT-Ridley 3 Model Calibration Results (Metered and Modeled Flow)

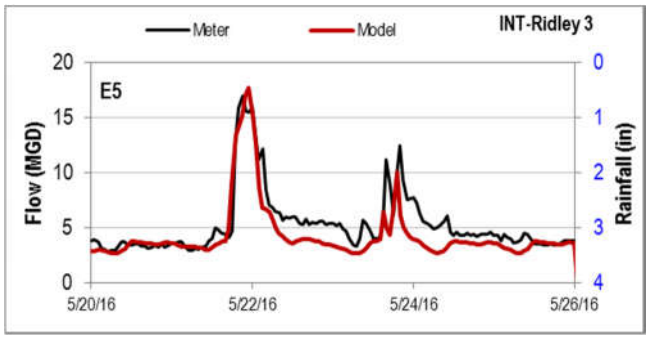


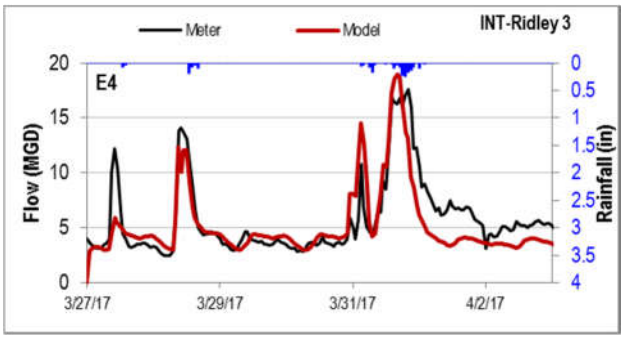




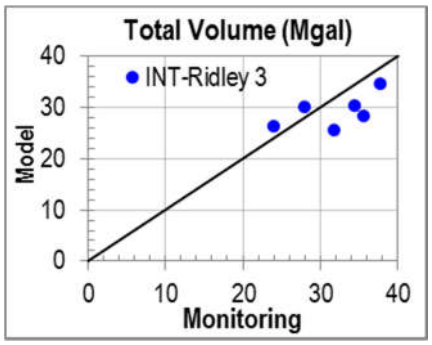


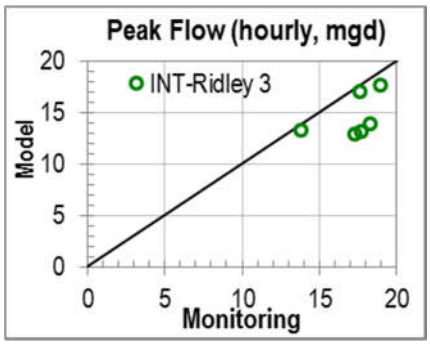
INT-Ridley 3 Model Validation Results (Metered and Modeled Flow)





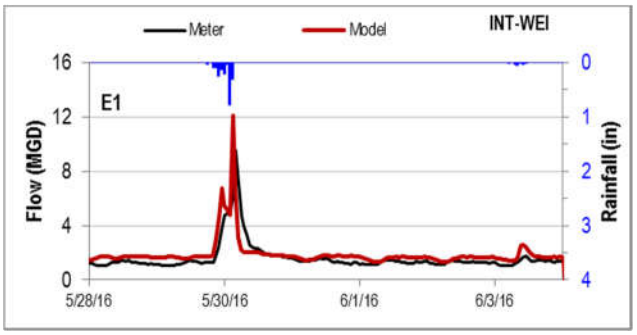
INT-Ridley 3 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

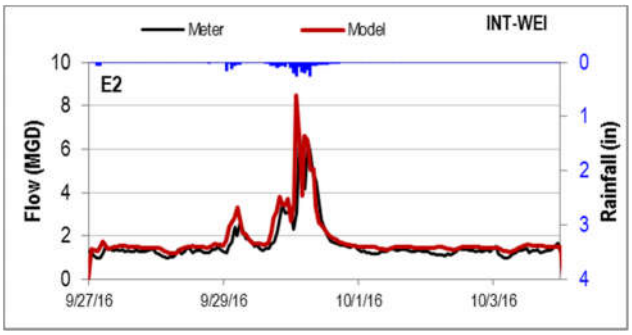


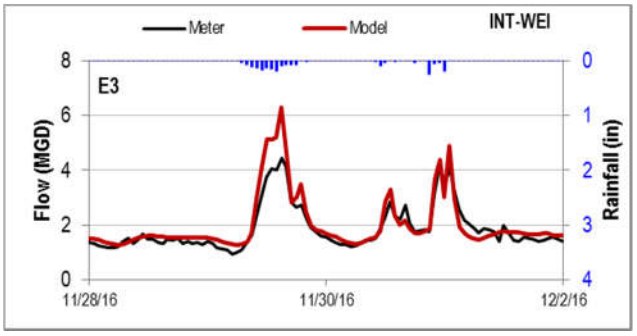


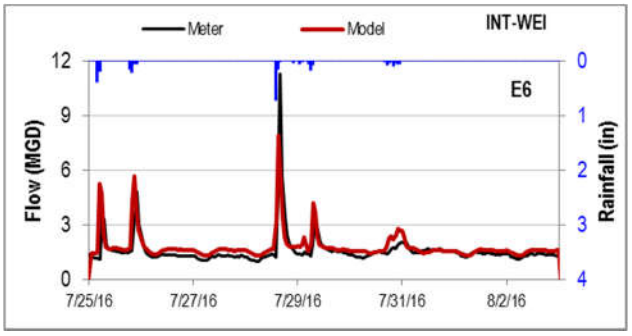
FLOW METER INT-WEI MODEL CALIBRATION AND VALIDATION RESULTS

INT-WEI Model Calibration Results (Metered and Modeled Flow)

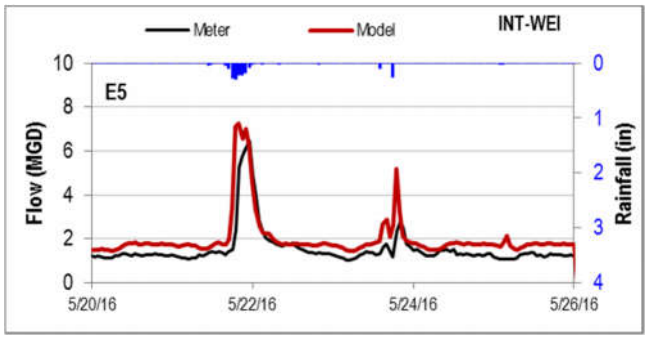


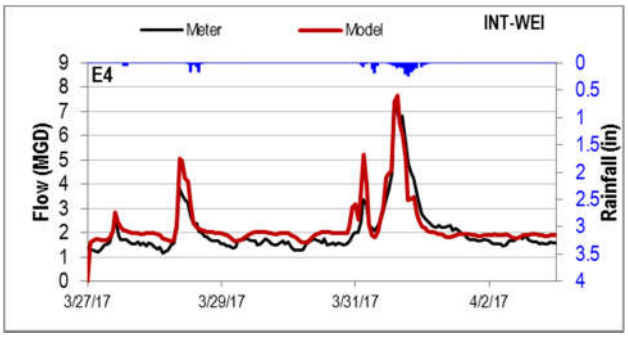




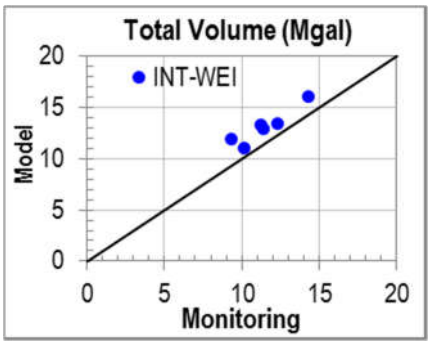


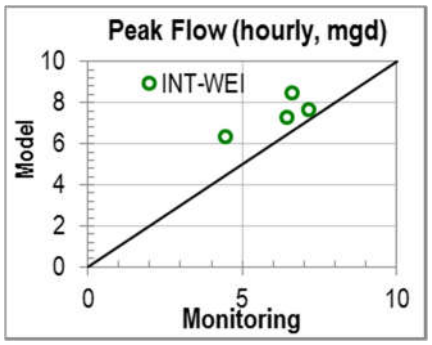
INT-WEI Model Validation Results (Metered and Modeled Flow)





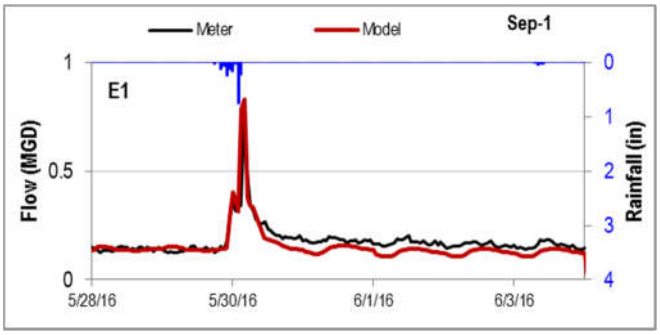
INT-WEI Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

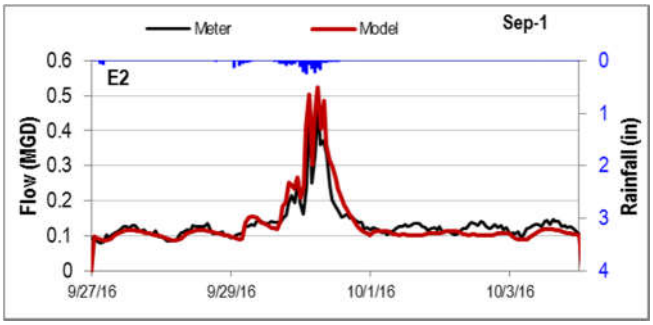


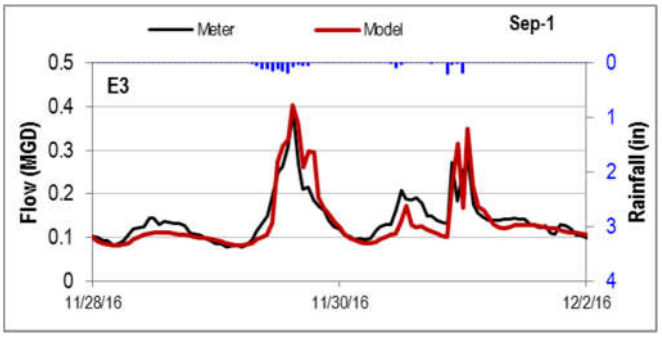


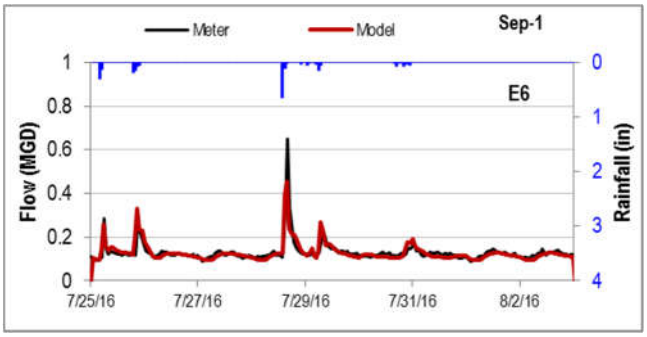
FLOW METER Sep-1 MODEL CALIBRATION AND VALIDATION RESULTS

Sep-1 Model Calibration Results (Metered and Modeled Flow)

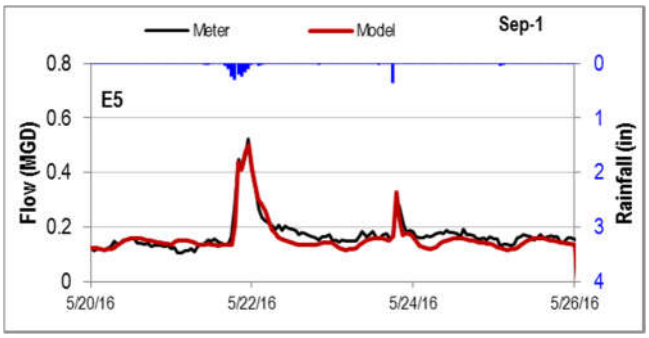


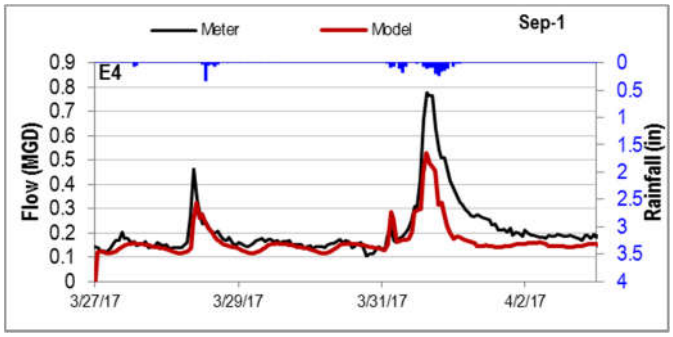




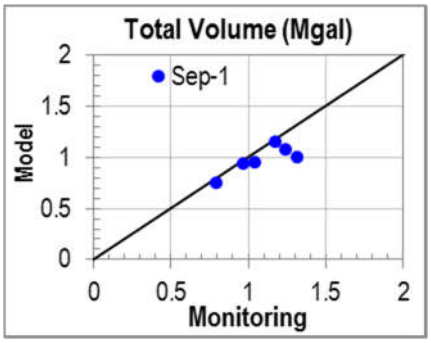


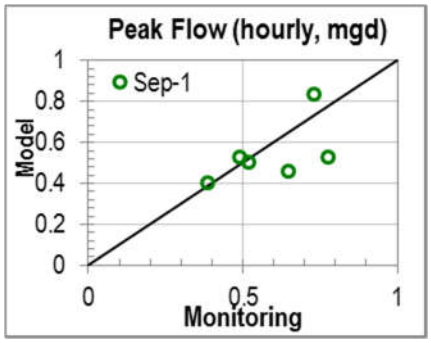
Sep-1 Model Validation Results (Metered and Modeled Flow)





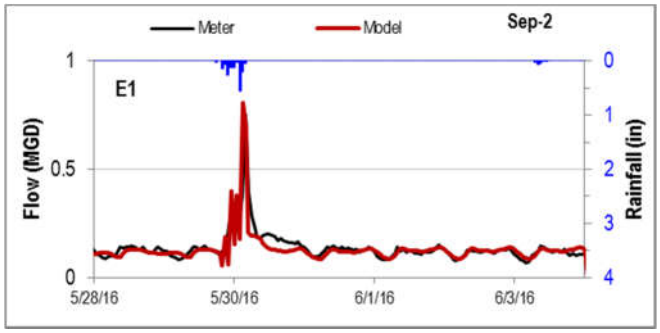
Sep-1 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

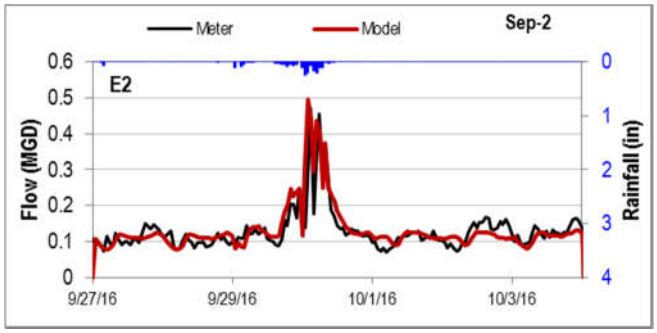


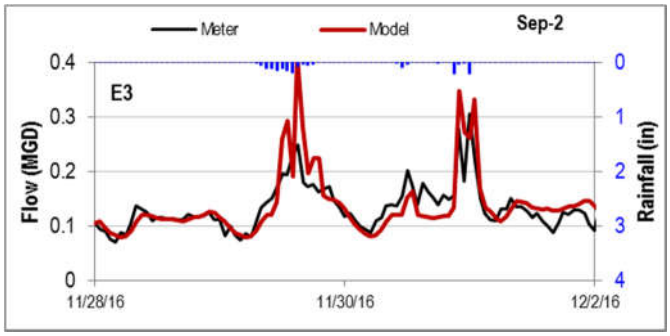


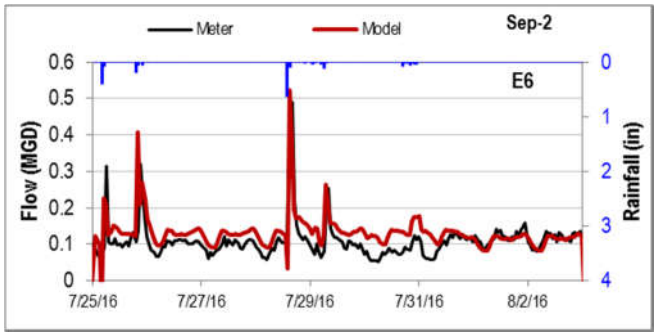
FLOW METER Sep-2 MODEL CALIBRATION AND VALIDATION RESULTS

Sep-2 Model Calibration Results (Metered and Modeled Flow)

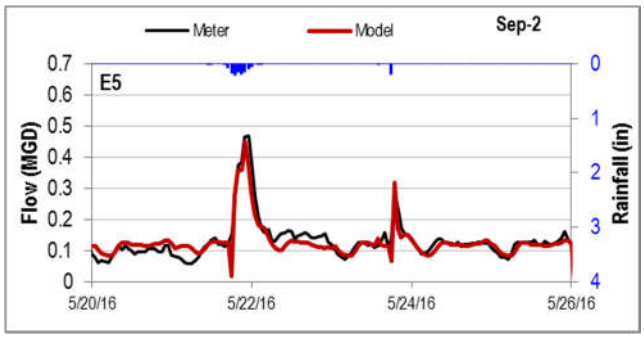


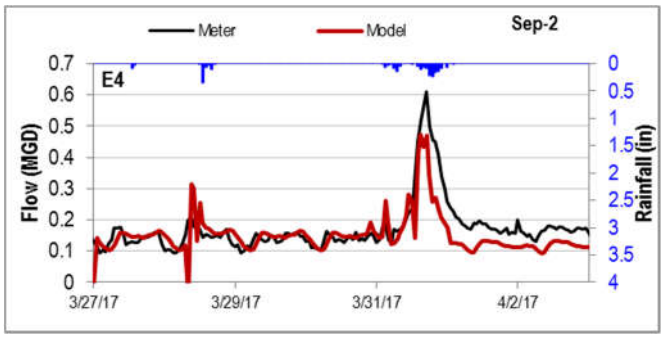




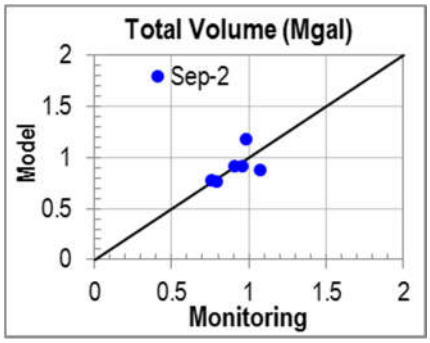


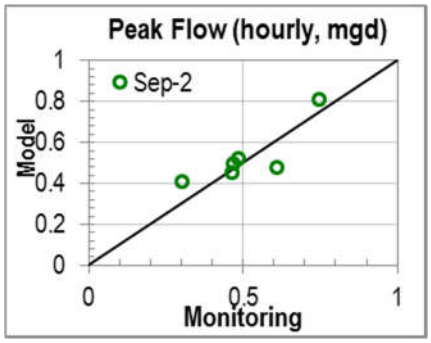
Sep-2 Model Validation Results (Metered and Modeled Flow)





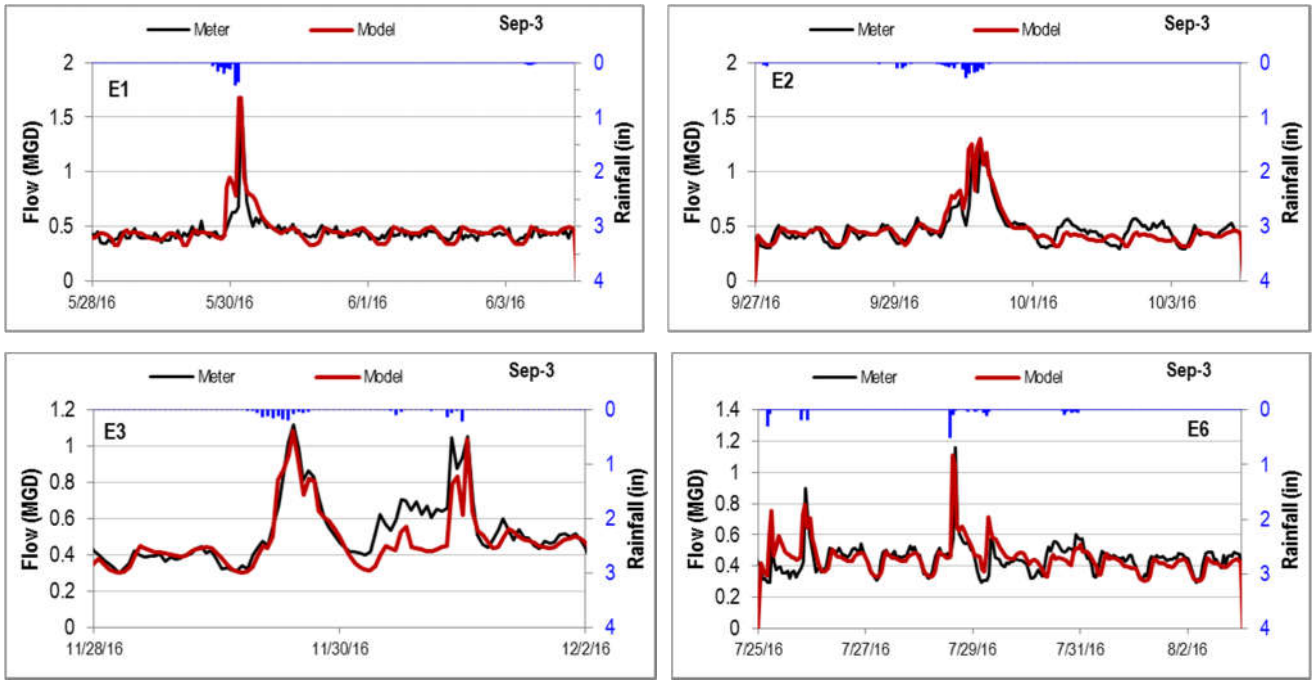
Sep-2 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)



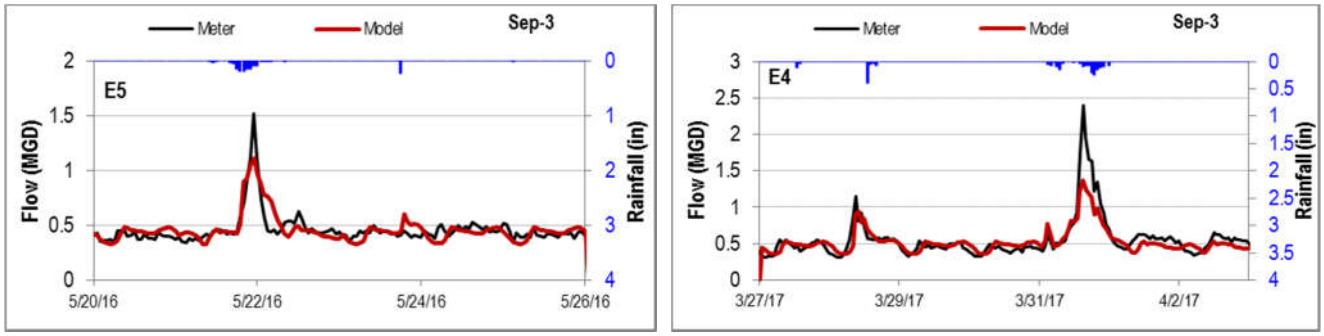


FLOW METER Sep-3 MODEL CALIBRATION AND VALIDATION RESULTS

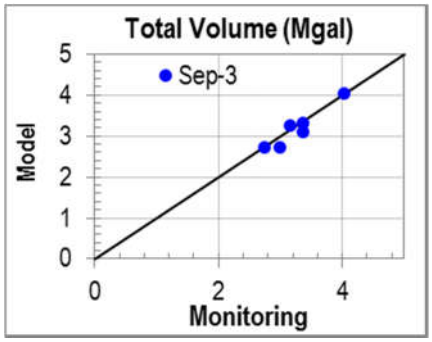
Sep-3 Model Calibration Results (Metered and Modeled Flow)

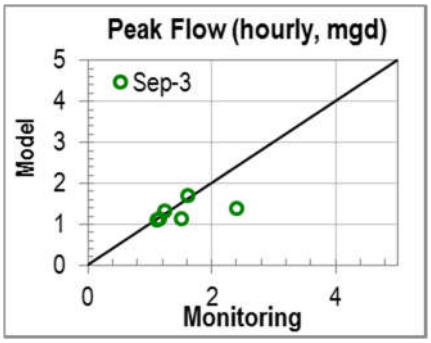


Sep-3 Model Validation Results (Metered and Modeled Flow)



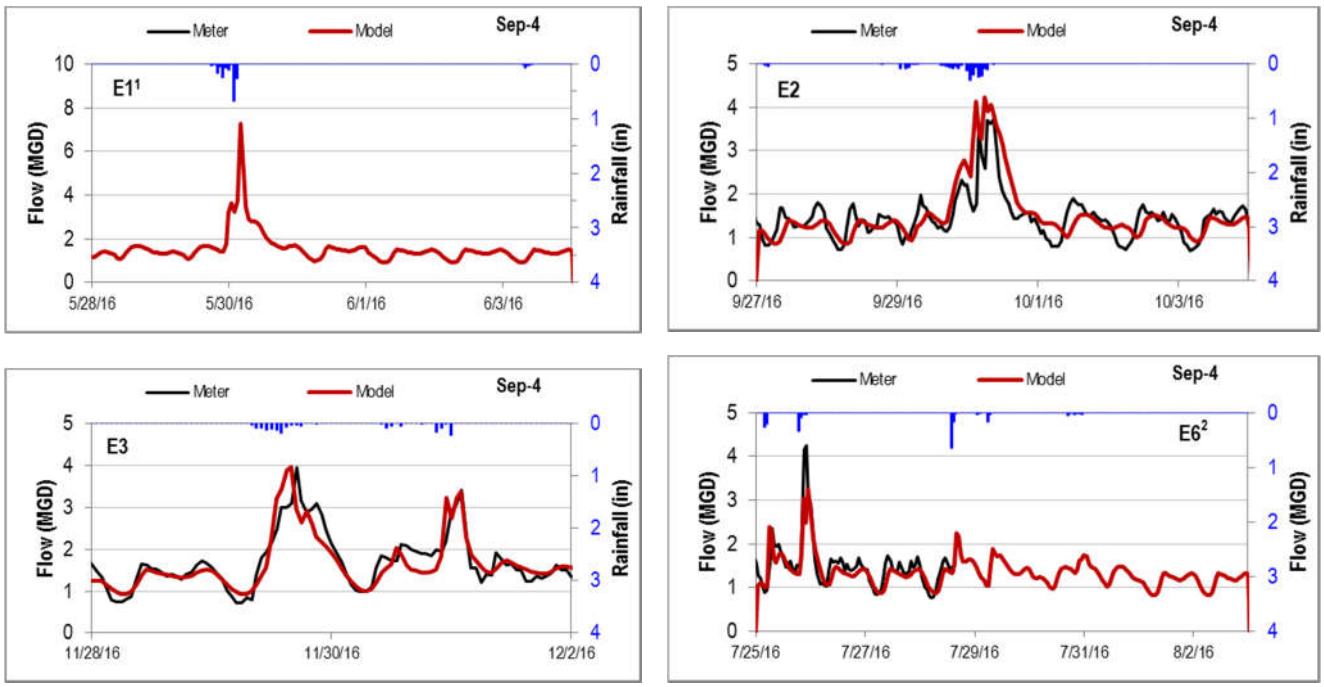
Sep-3 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)



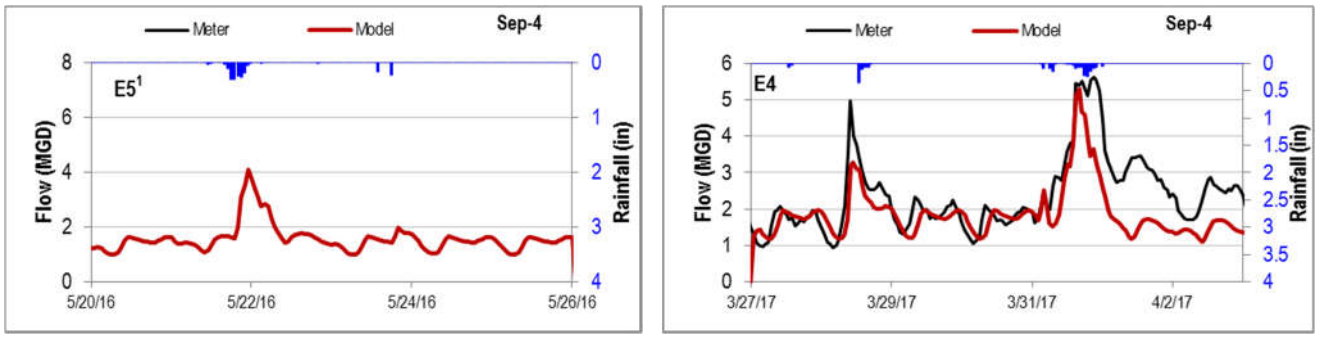


FLOW METER Sep-4 MODEL CALIBRATION AND VALIDATION RESULTS

Sep-4 Model Calibration Results (Metered and Modeled Flow)

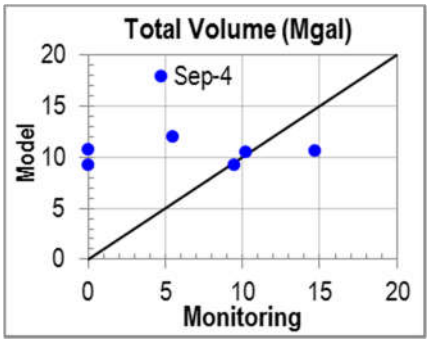


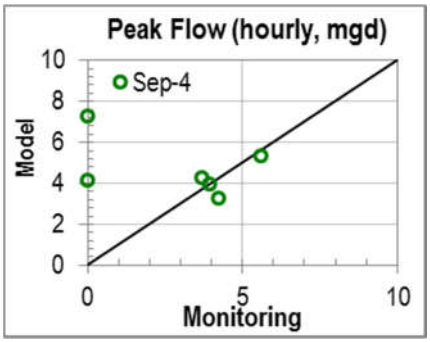
Sep-4 Model Validation Results (Metered and Modeled Flow)



NOTE:
[1] Flow Meter installed June 2016.
[2] Flow Meter was taken out of service for maintenance.

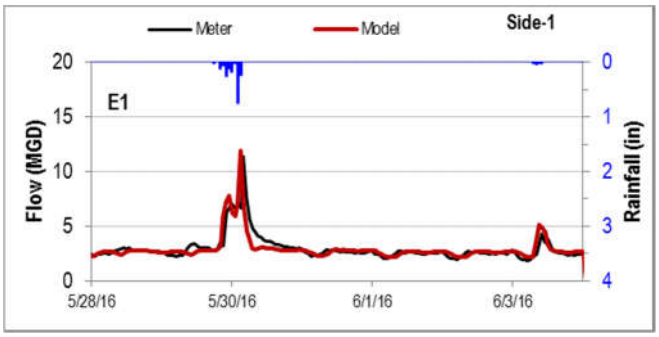
Sep-4 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

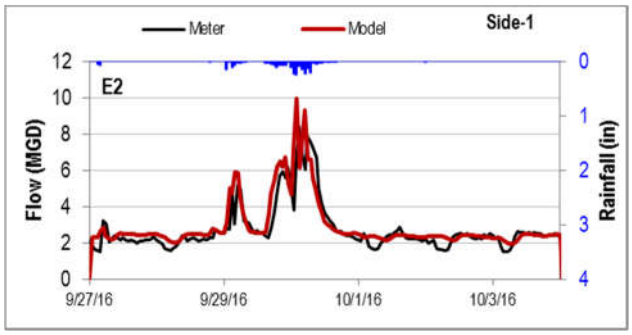


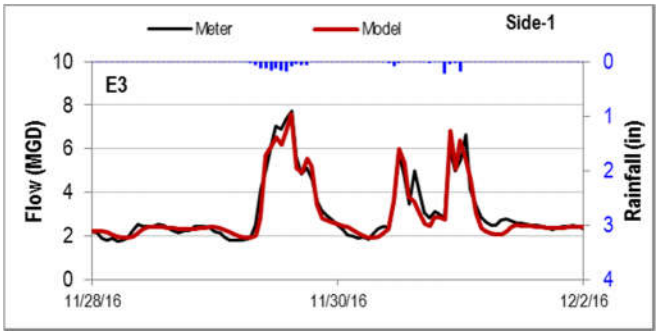


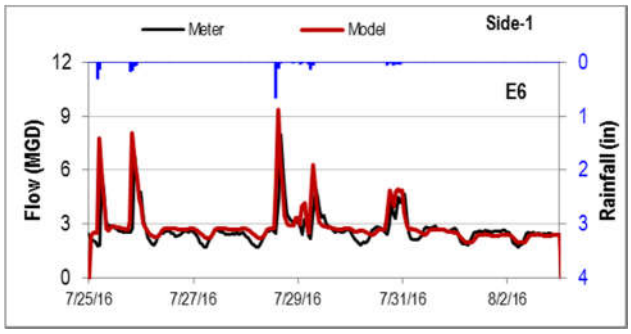
FLOW METER Side-1 MODEL CALIBRATION AND VALIDATION RESULTS

Side-1 Model Calibration Results (Metered and Modeled Flow)

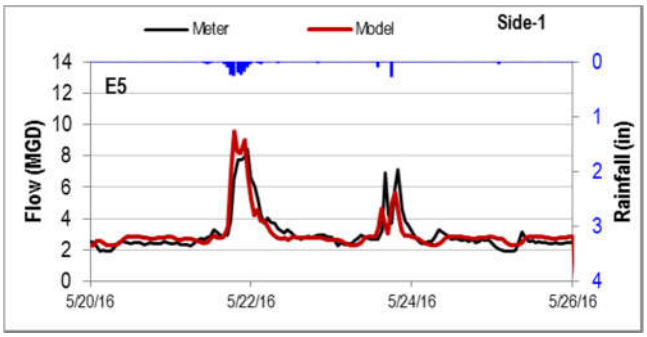


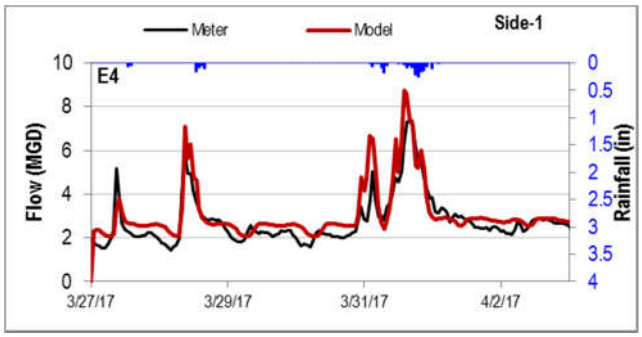




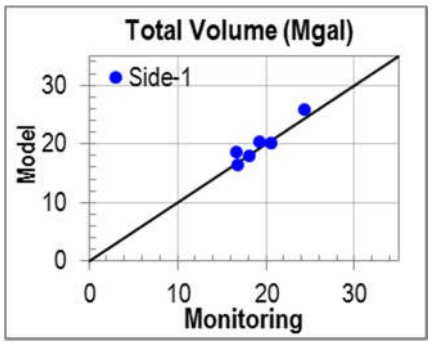


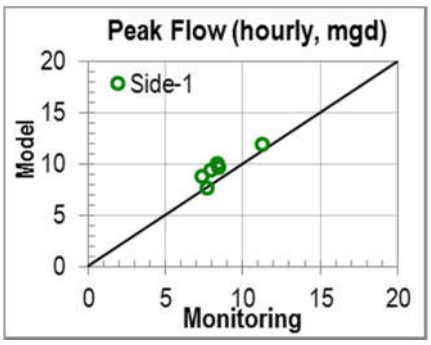
Side-1 Model Validation Results (Metered and Modeled Flow)





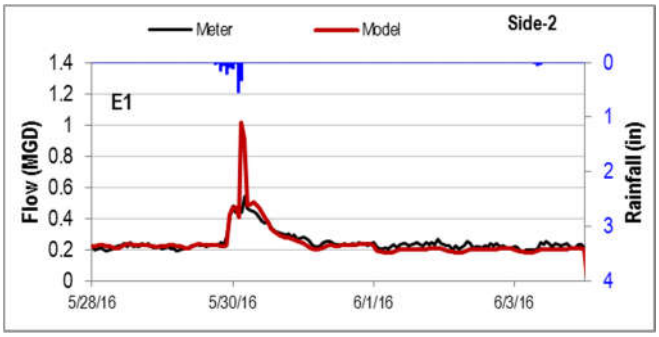
Side-1 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

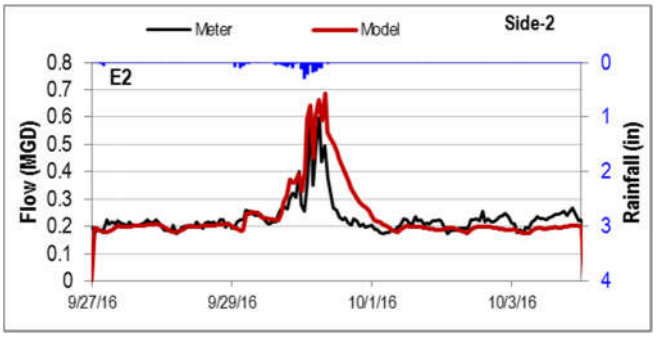


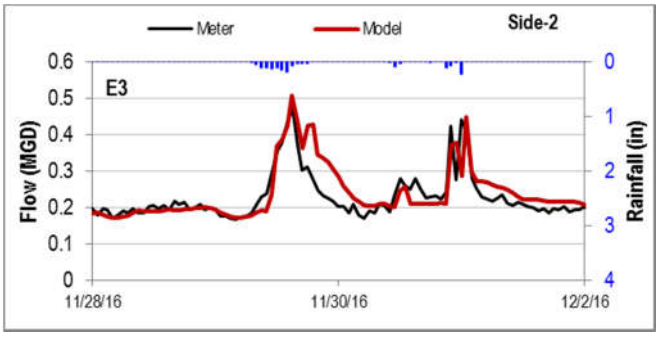


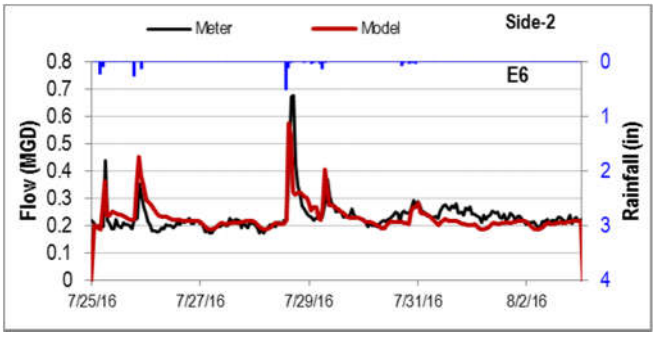
FLOW METER Side-2 MODEL CALIBRATION AND VALIDATION RESULTS

Side-2 Model Calibration Results (Metered and Modeled Flow)

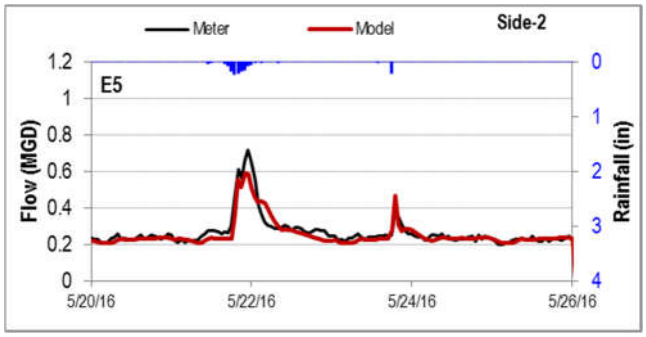


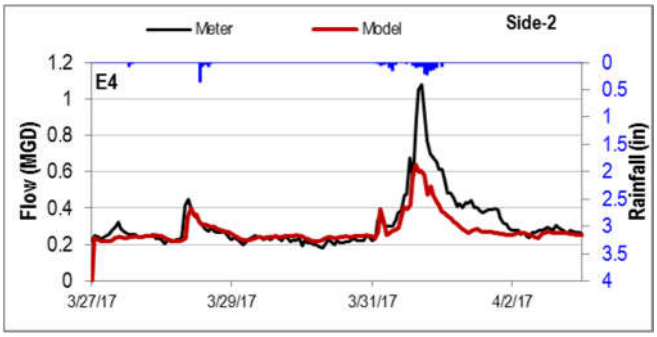




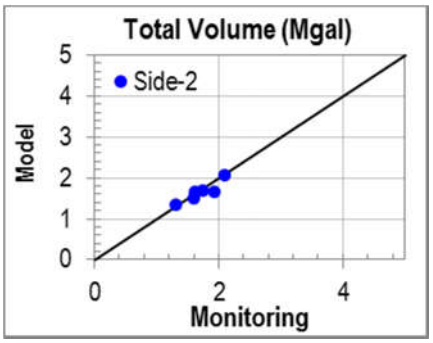


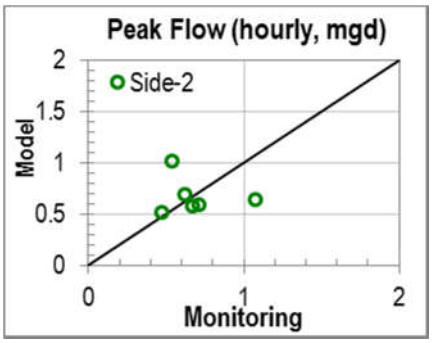
Side-2 Model Validation Results (Metered and Modeled Flow)





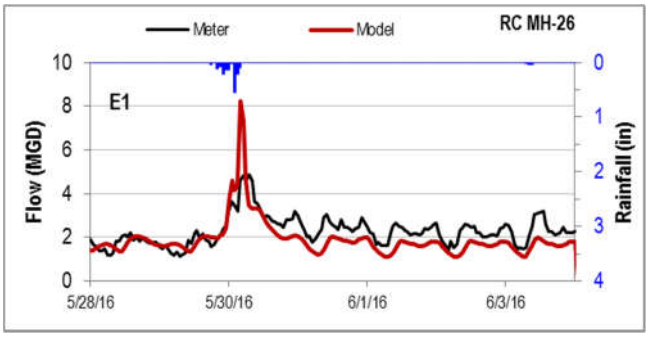
Side-2 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

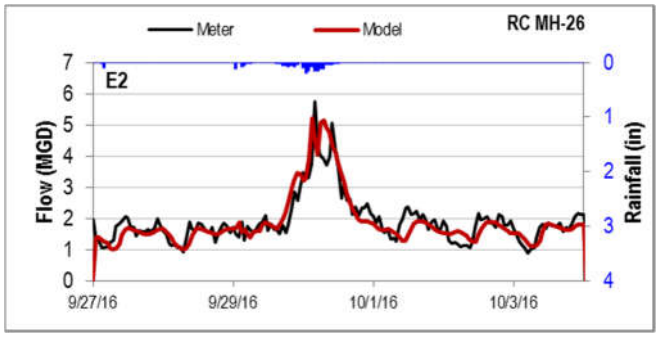


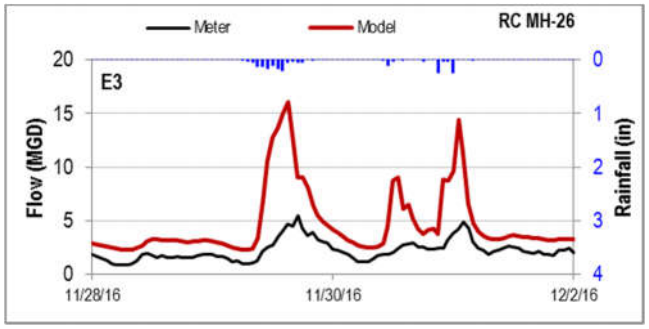


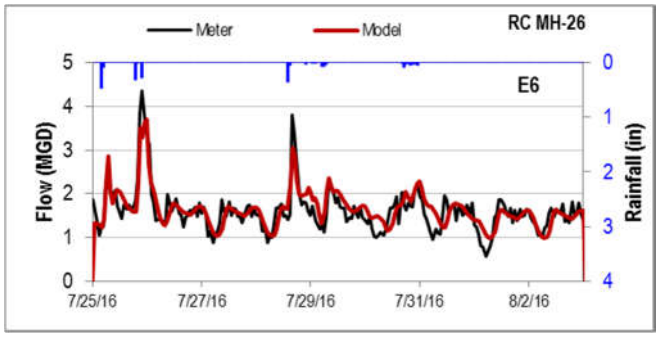
FLOW METER RC MH-26 MODEL CALIBRATION AND VALIDATION RESULTS

RC MH-26 Model Calibration Results (Metered and Modeled Flow)

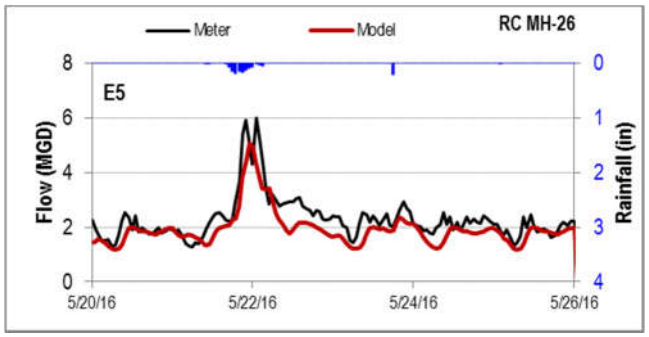


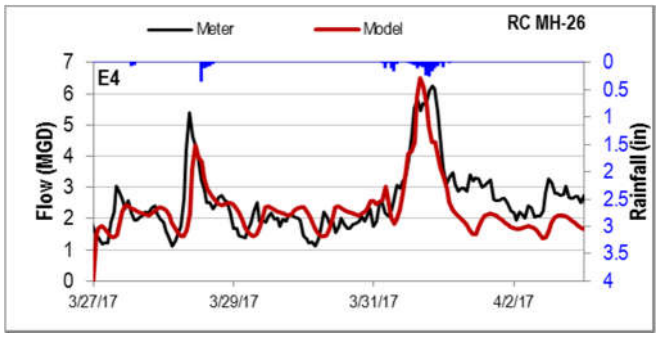




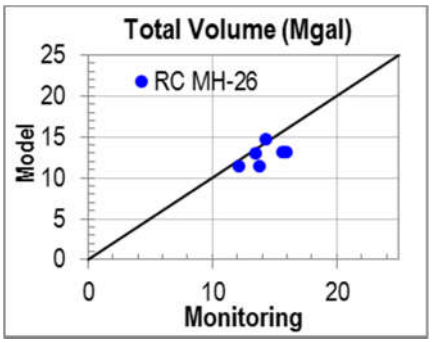


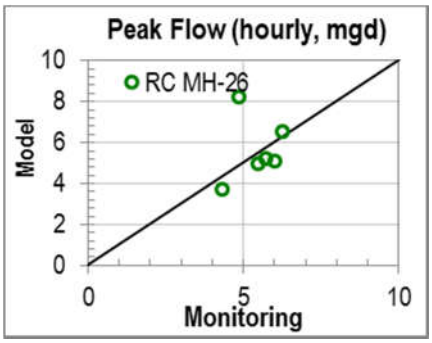
RC MH-26 Model Validation Results (Metered and Modeled Flow)





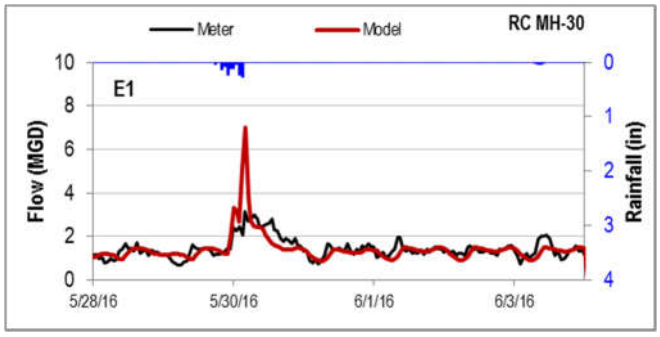
RC MH-26 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

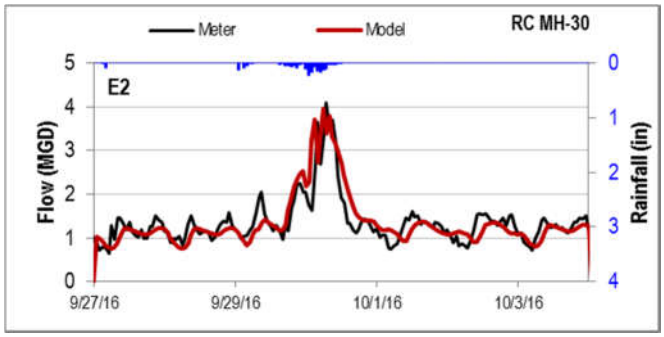


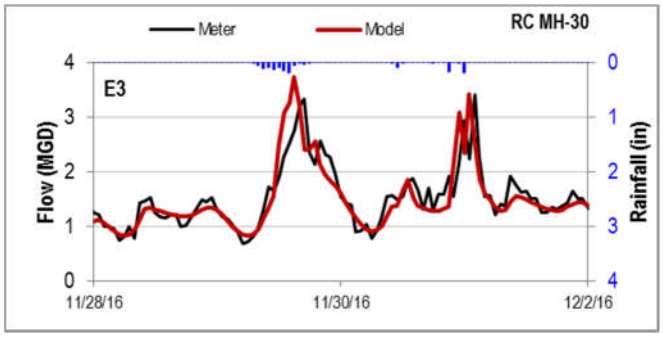


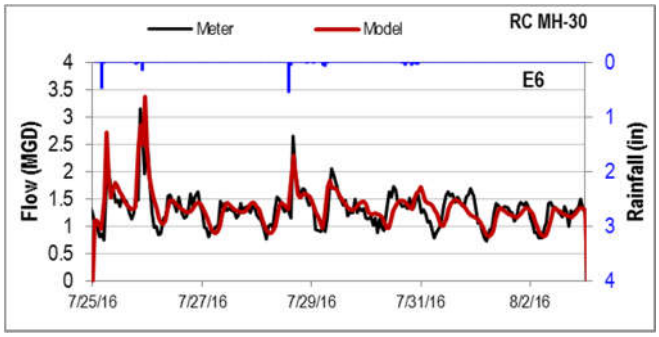
FLOW METER RC MH-30 MODEL CALIBRATION AND VALIDATION RESULTS

RC MH-30 Model Calibration Results (Metered and Modeled Flow)

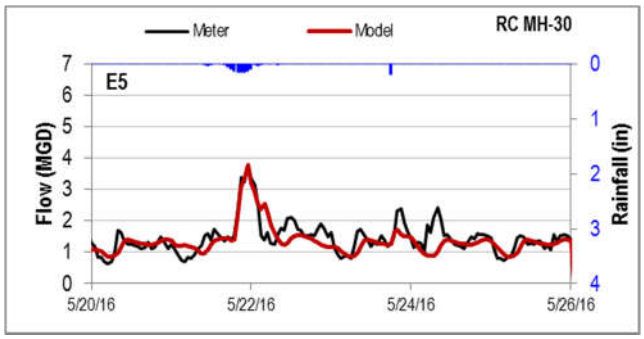


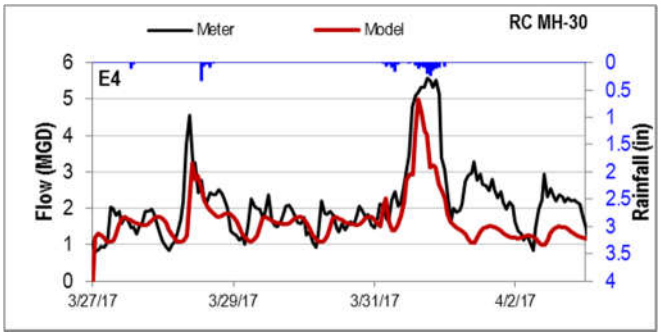




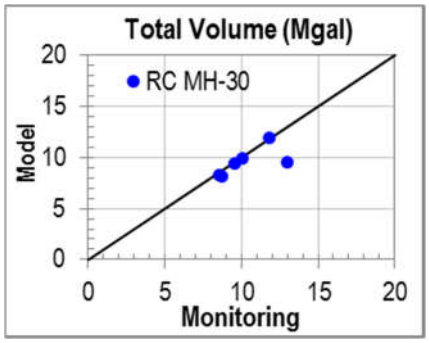


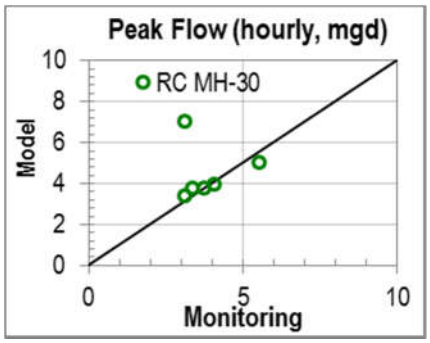
RC MH-30 Model Validation Results (Metered and Modeled Flow)





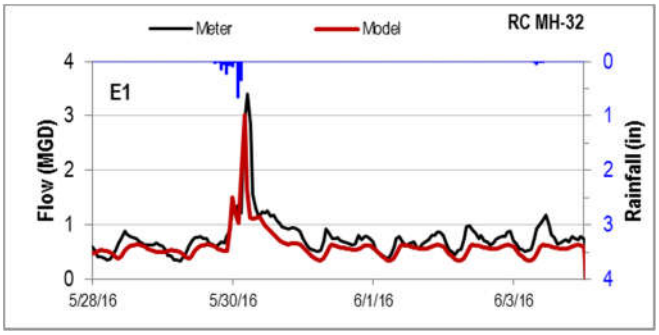
RC MH-30 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

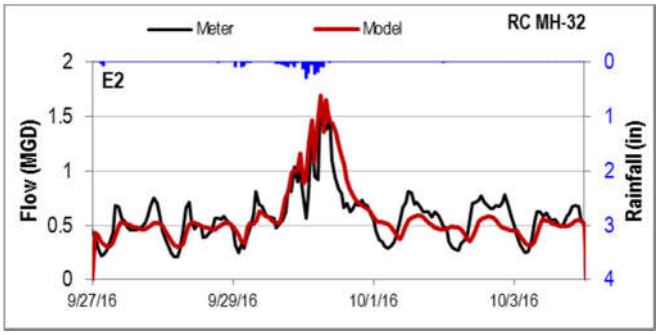


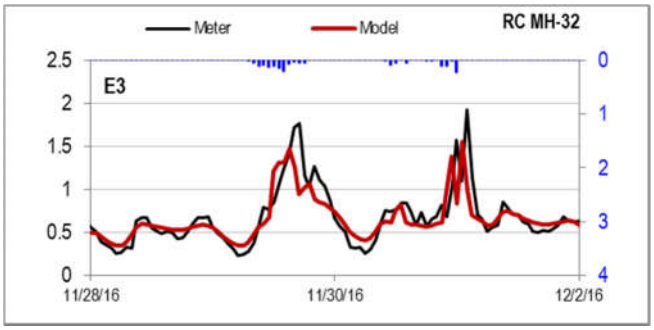


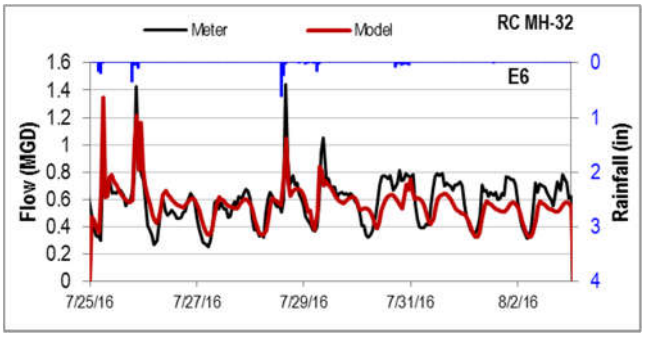
FLOW METER RC MH-32 MODEL CALIBRATION AND VALIDATION RESULTS

RC MH-32 Model Calibration Results (Metered and Modeled Flow)

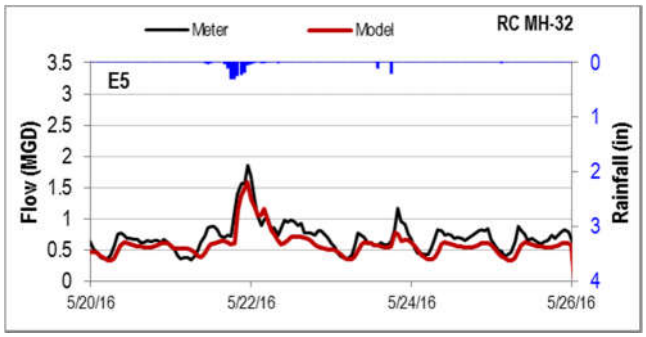


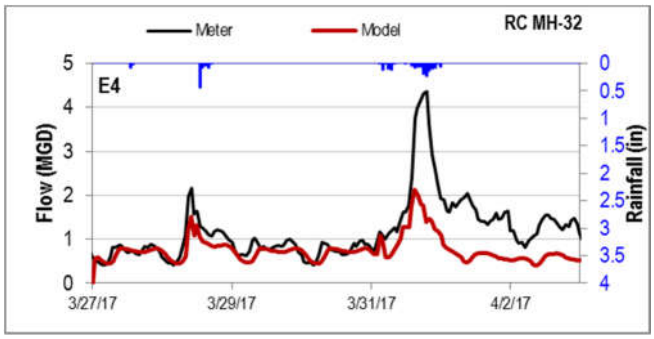




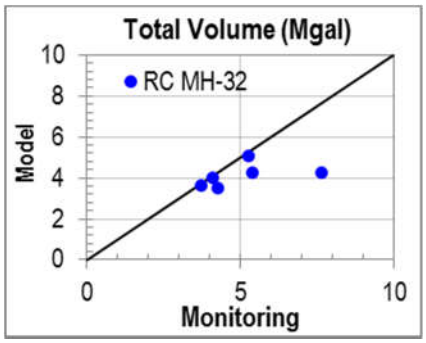


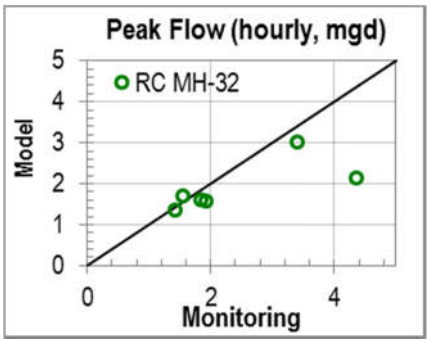
RC MH-32 Model Validation Results (Metered and Modeled Flow)





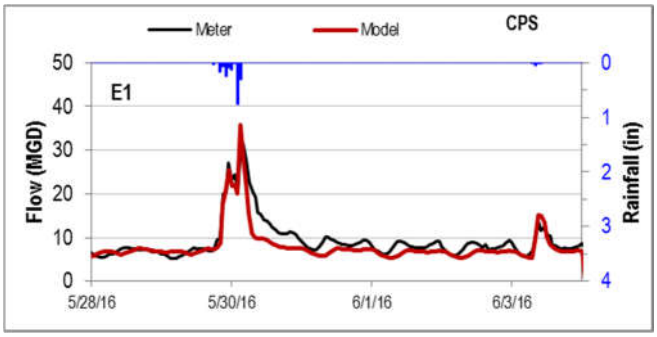
RC MH-32 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

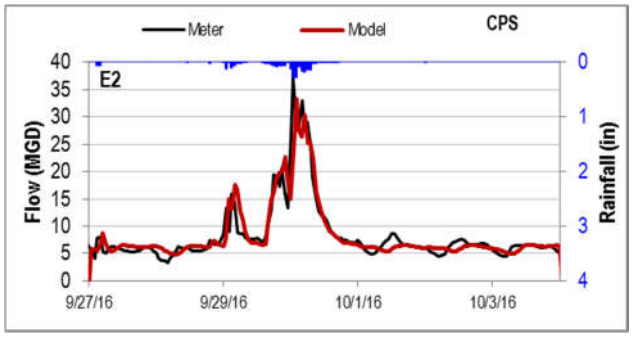


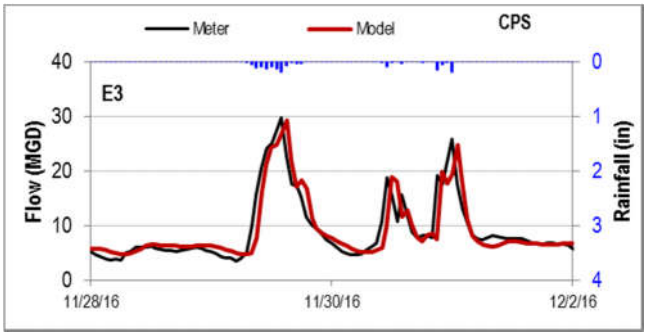


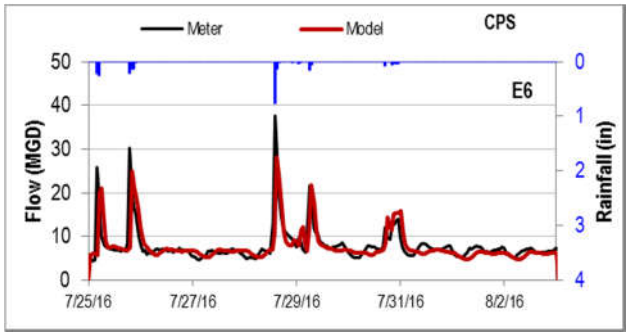
FLOW METER CPS MODEL CALIBRATION AND VALIDATION RESULTS

CPS Model Calibration Results (Metered and Modeled Flow)

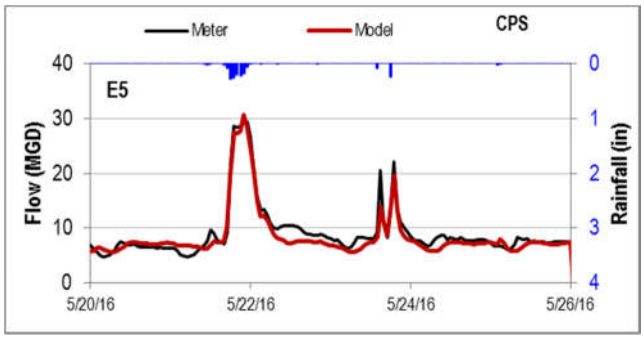


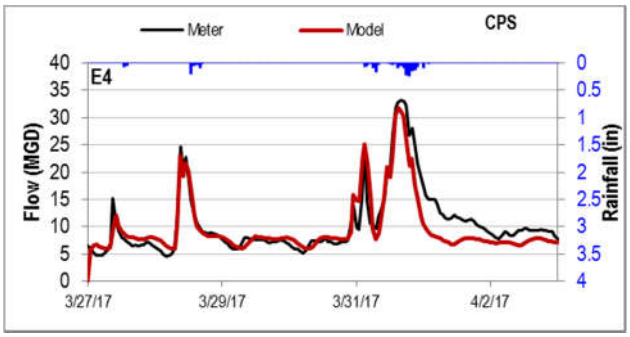




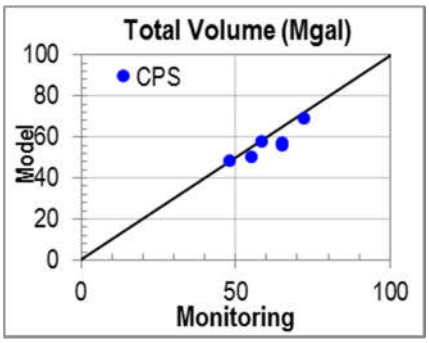


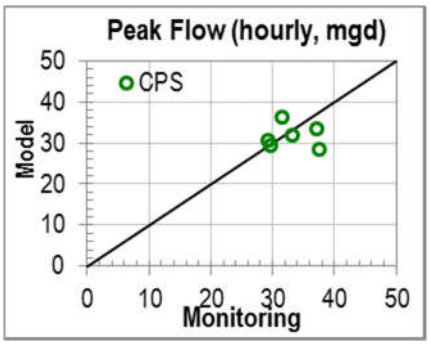
CPS Model Validation Results (Metered and Modeled Flow)





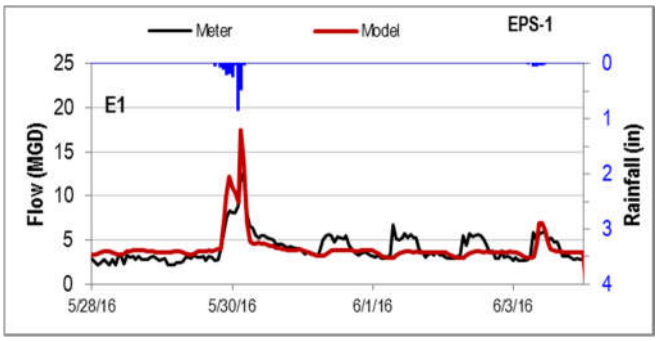
CPS Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

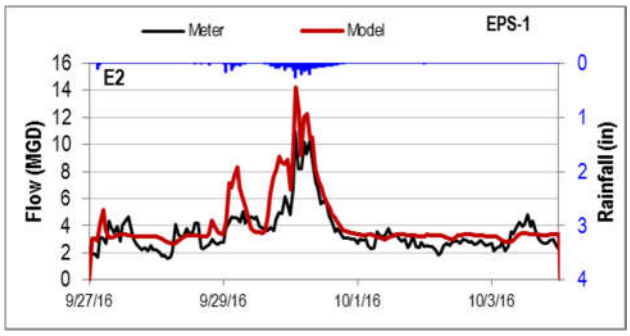


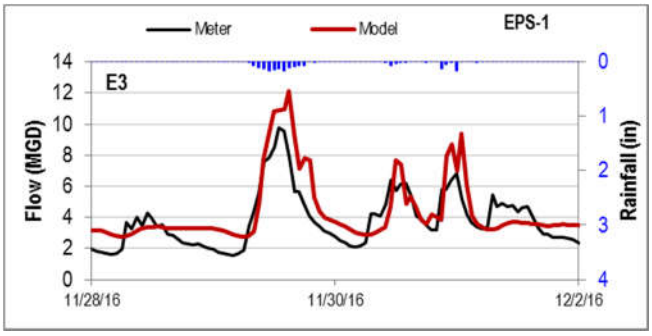


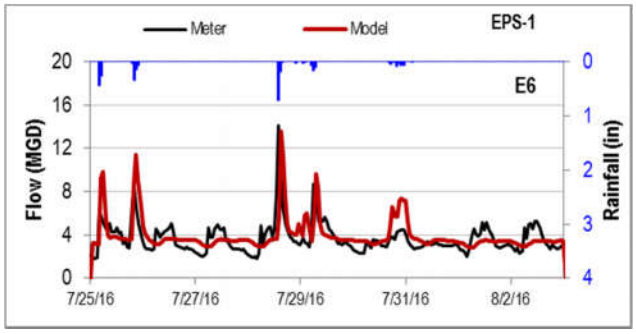
FLOW METER EPS-1 MODEL CALIBRATION AND VALIDATION RESULTS

EPS-1 Model Calibration Results (Metered and Modeled Flow)

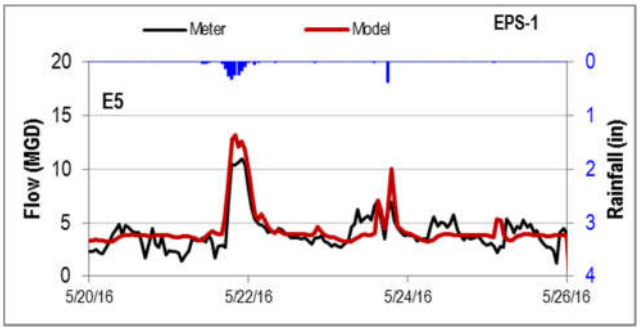


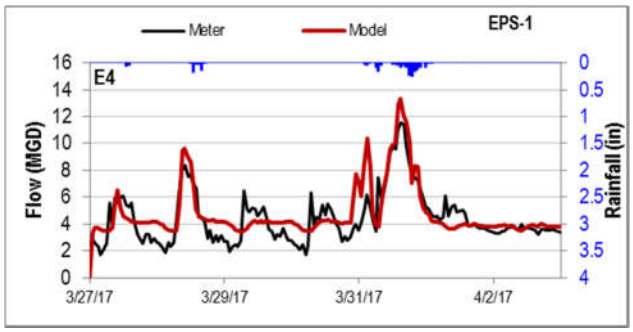




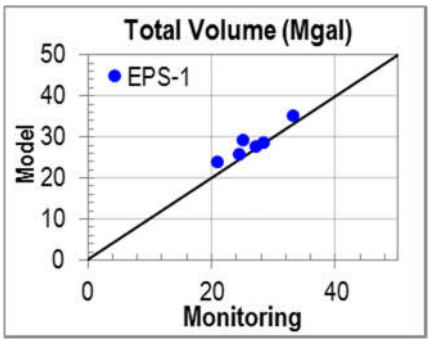


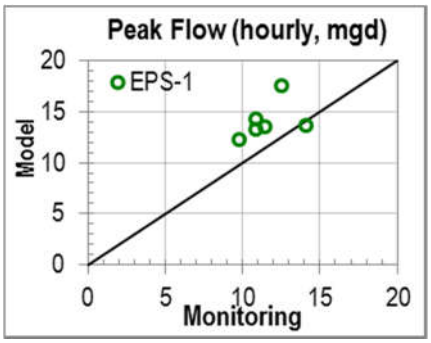
EPS-1 Model Validation Results (Metered and Modeled Flow)





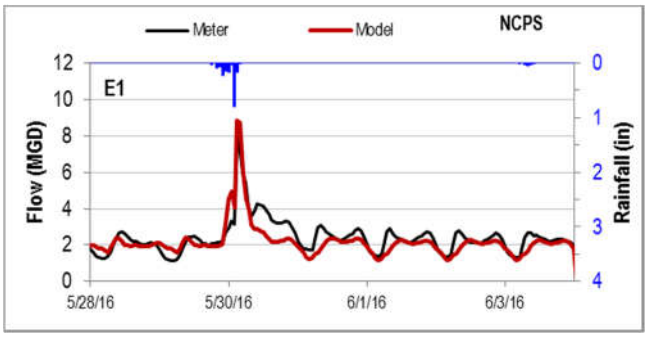
EPS-1 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

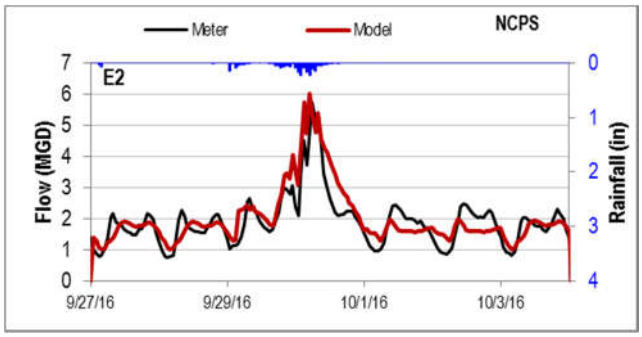


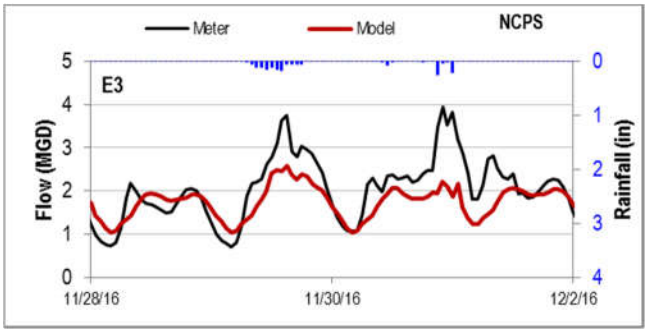


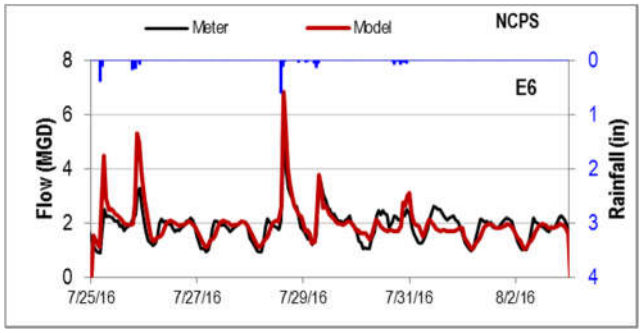
FLOW METER NCPS MODEL CALIBRATION AND VALIDATION RESULTS

NCPS Model Calibration Results (Metered and Modeled Flow)

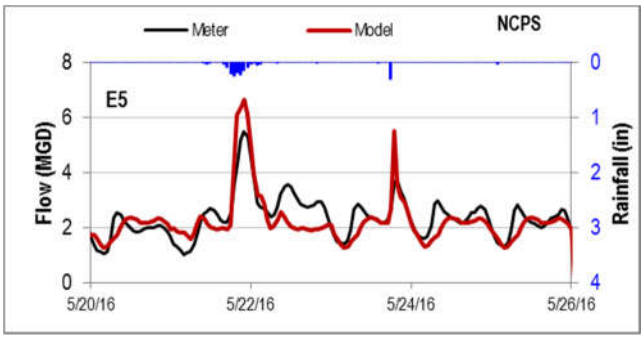


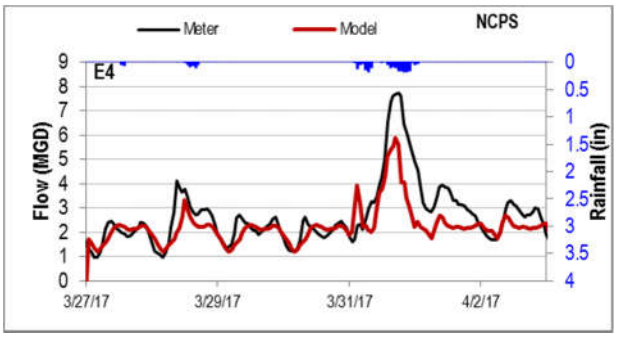




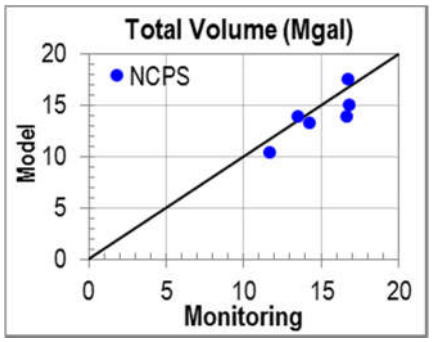


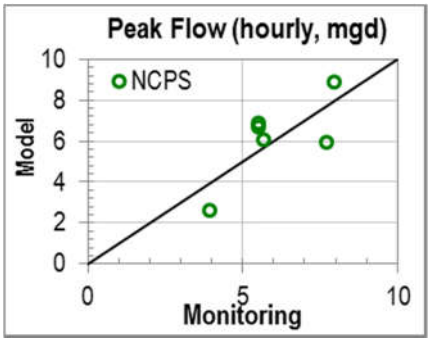
NCPS Model Validation Results (Metered and Modeled Flow)





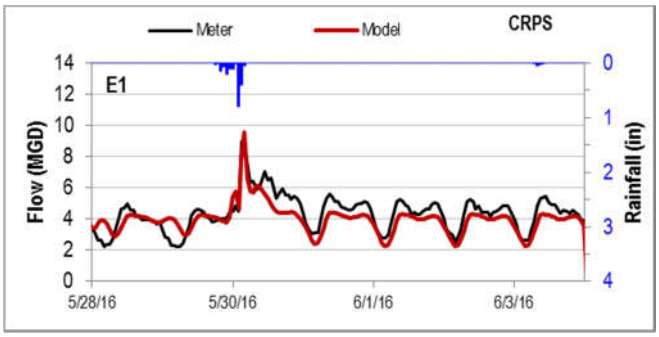
NCPS Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

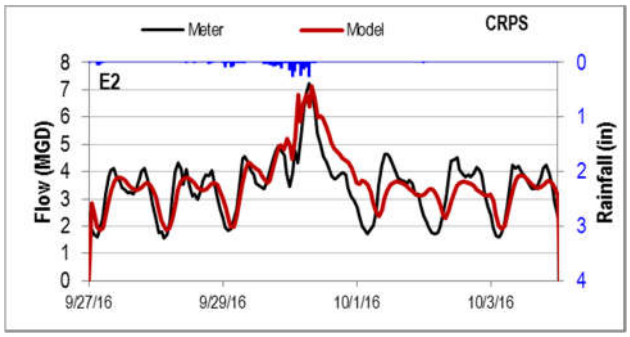


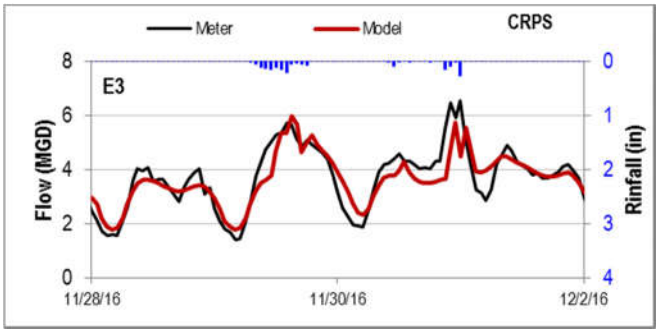


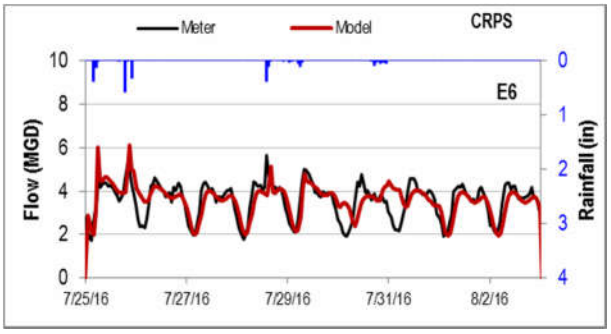
FLOW METER CRPS MODEL CALIBRATION AND VALIDATION RESULTS

CRPS Model Calibration Results (Metered and Modeled Flow)

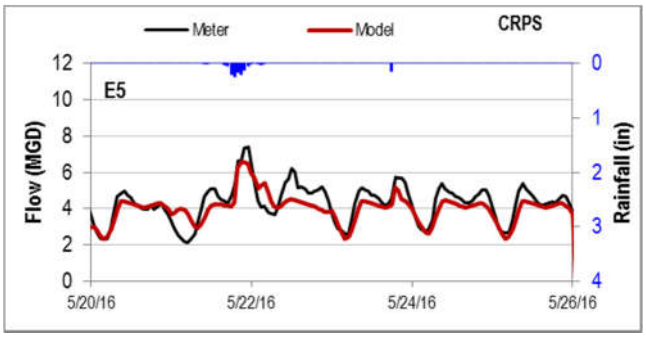


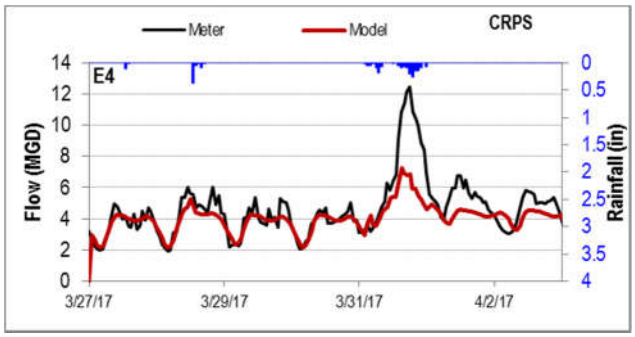




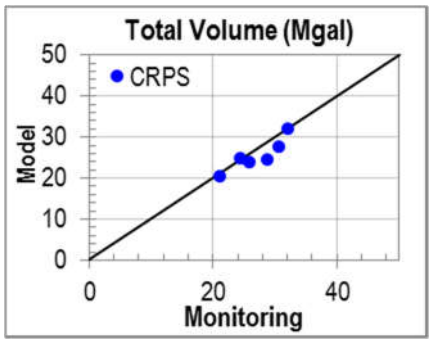


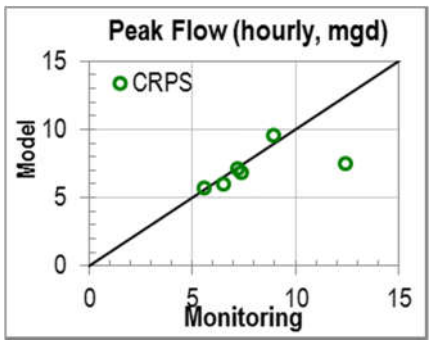
CRPS Model Validation Results (Metered and Modeled Flow)





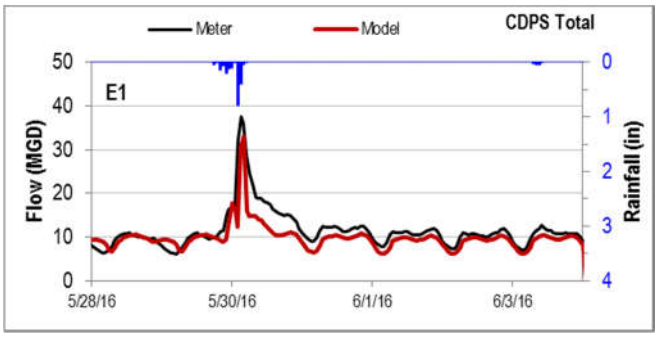
CRPS Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

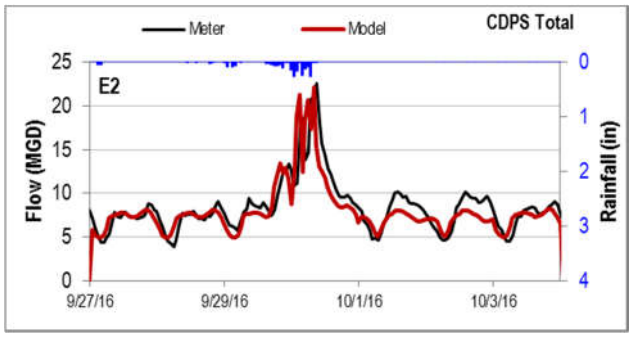


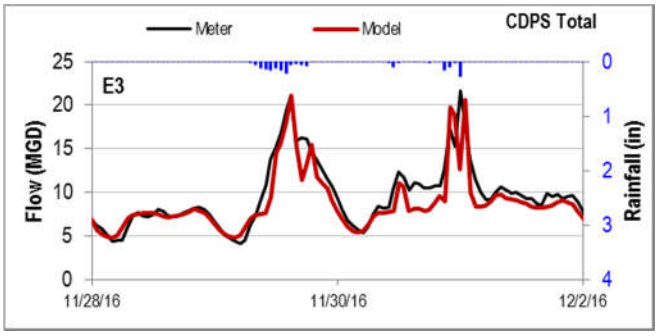


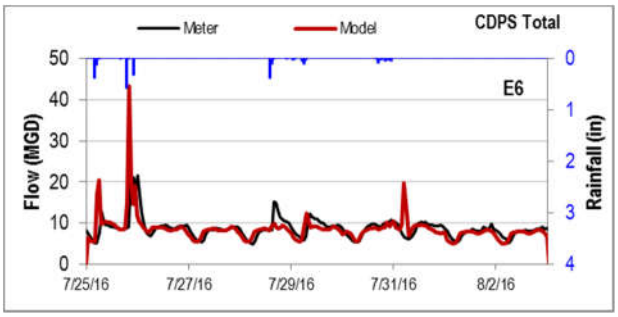
FLOW METER CDPS TOTAL MODEL CALIBRATION AND VALIDATION RESULTS

CDPS Total Model Calibration Results (Metered and Modeled Flow)

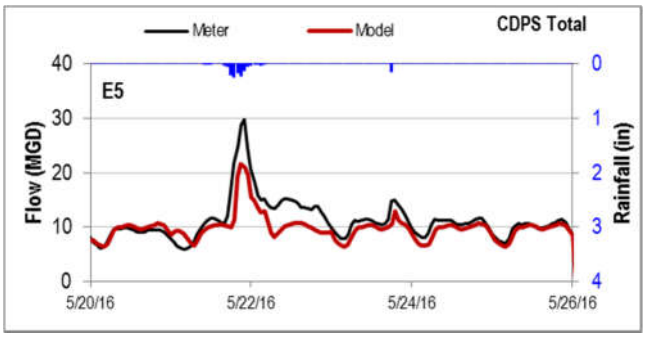


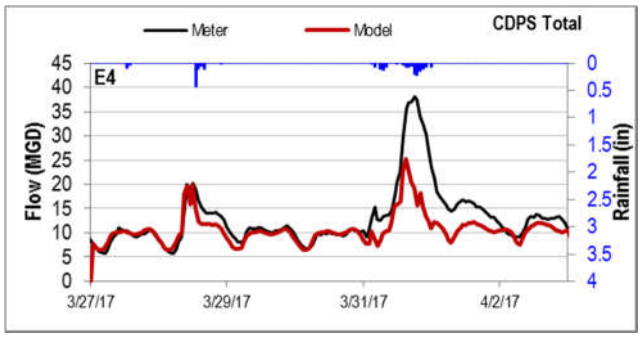




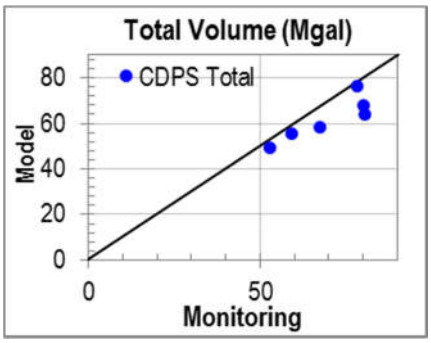


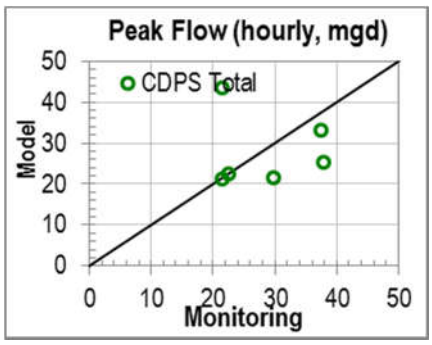
CDPS Total Model Validation Results (Metered and Modeled Flow)





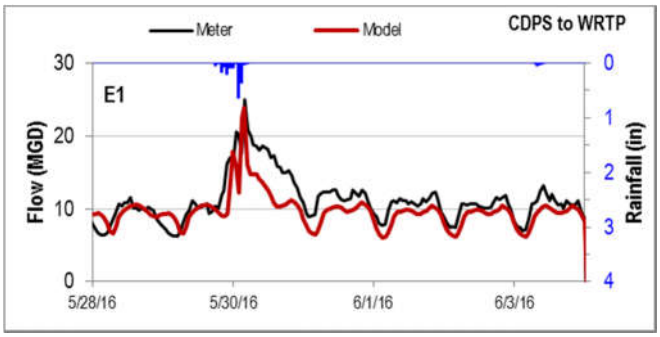
CDPS Total Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

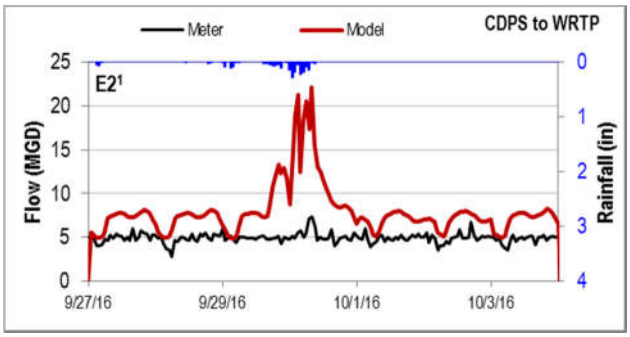


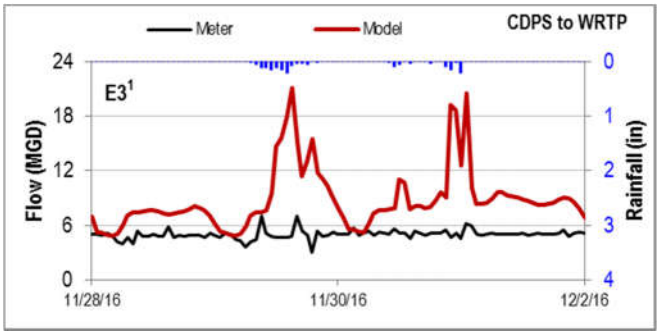


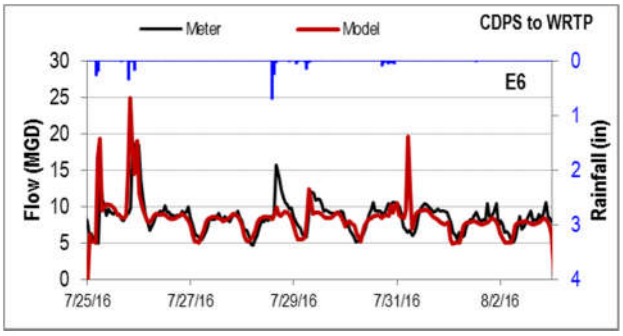
FLOW METER CDPS TO WRTP MODEL CALIBRATION AND VALIDATION RESULTS

CDPS to WRTP Model Calibration Results (Metered and Modeled Flow)

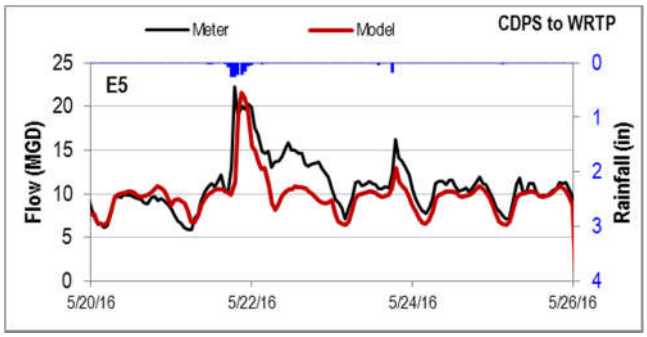


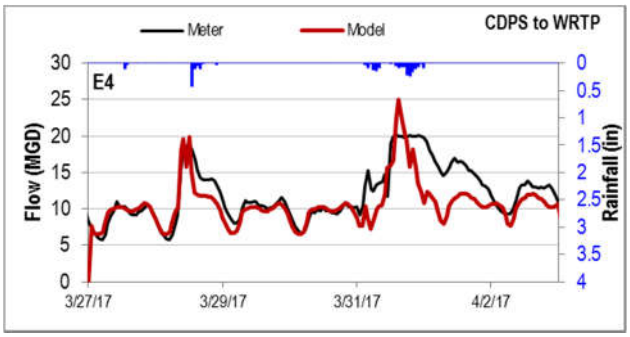






CDPS to WRTP Model Validation Results (Metered and Modeled Flow)

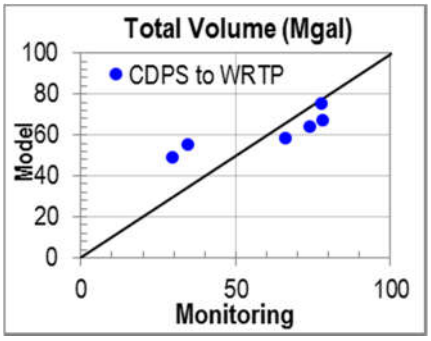


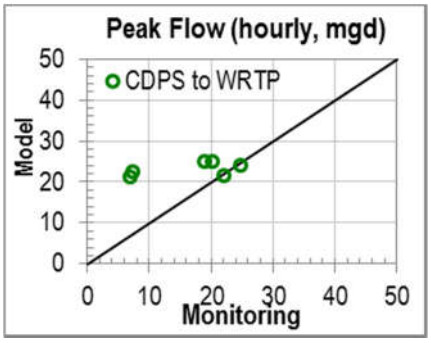


NOTE:

[1] During this storm, CDPS Flow to the plant was capped due to the aeration replacement project.

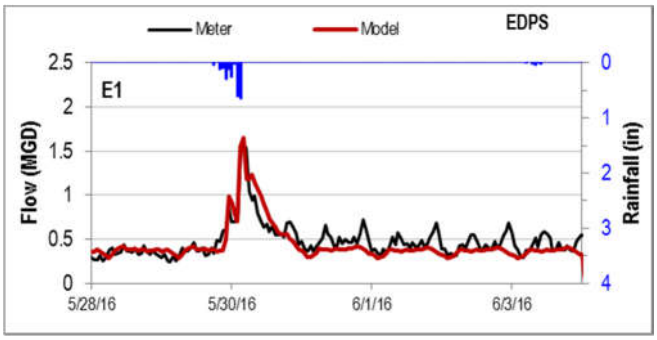
CDPS to WRTP Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

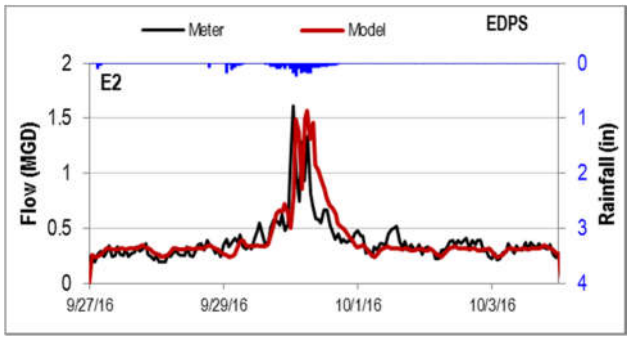


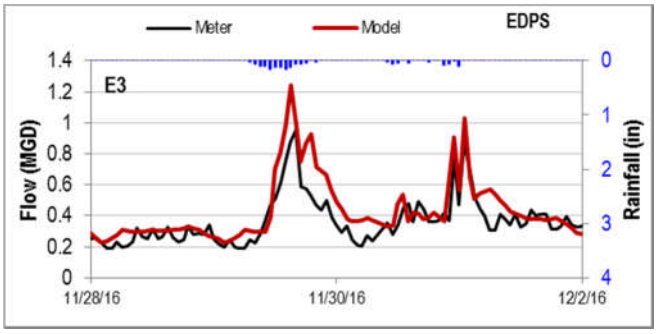


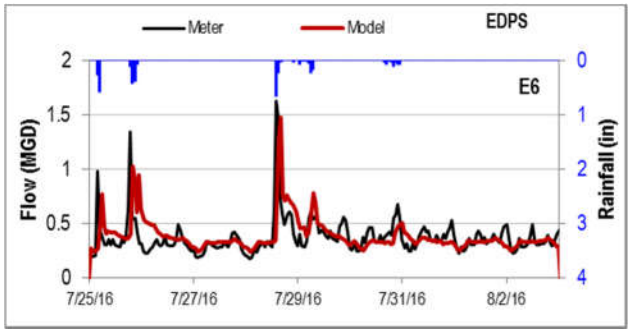
FLOW METER EDPS MODEL CALIBRATION AND VALIDATION RESULTS

EDPS Model Calibration Results (Metered and Modeled Flow)

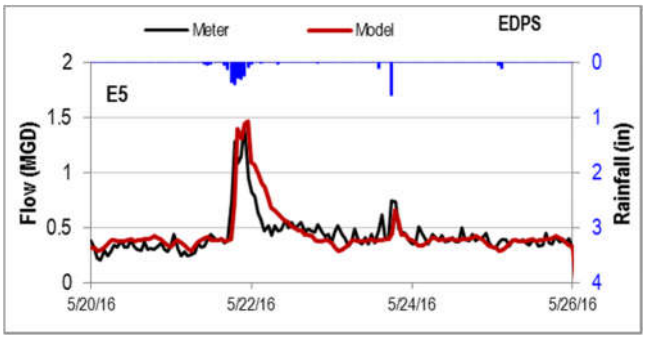


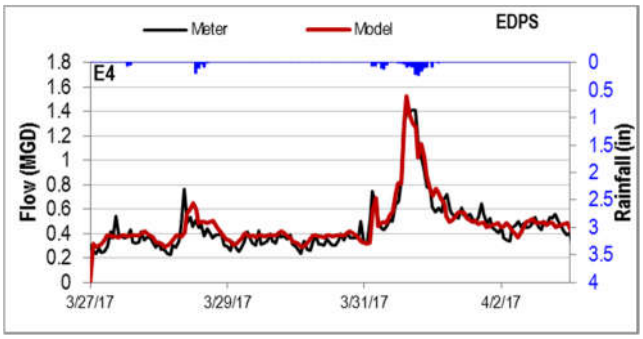




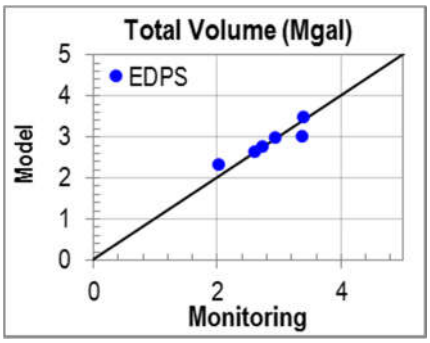


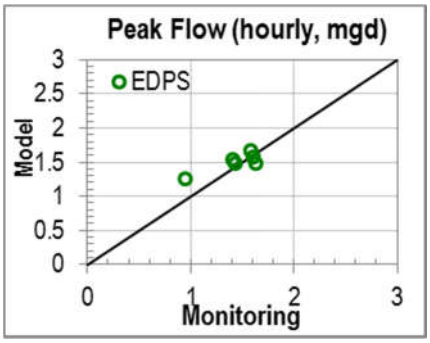
EDPS Model Validation Results (Metered and Modeled Flow)





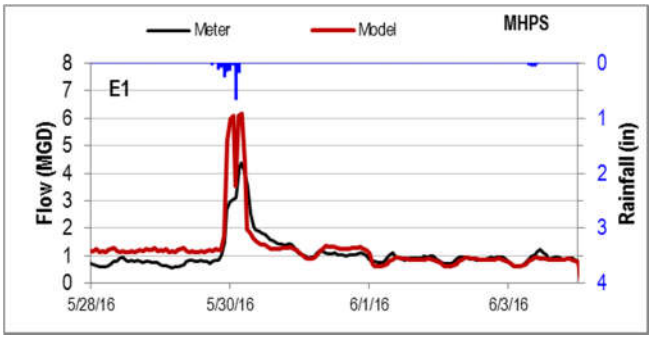
EDPS Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

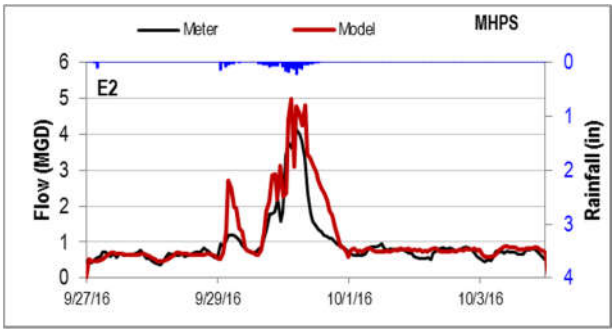


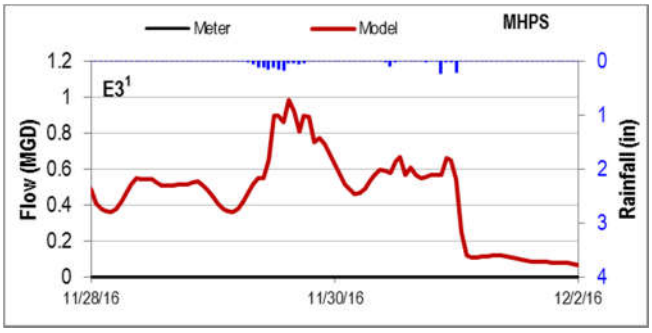


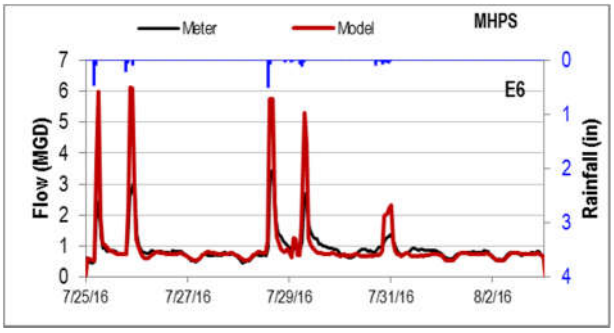
FLOW METER MHPS MODEL CALIBRATION AND VALIDATION RESULTS

MHPS Model Calibration Results (Metered and Modeled Flow)

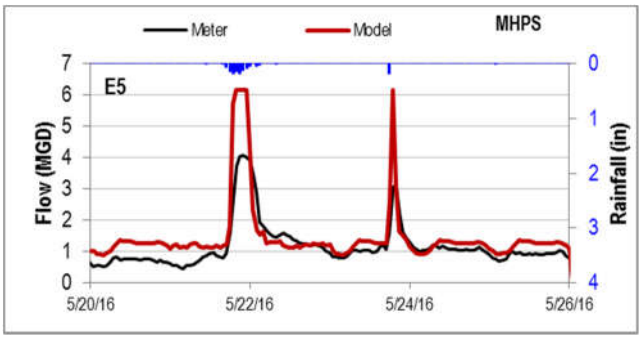


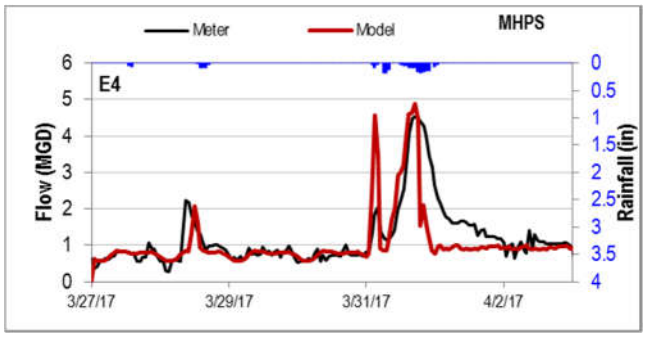






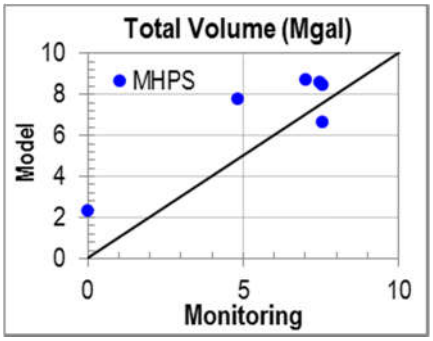
MHPS Model Validation Results (Metered and Modeled Flow)

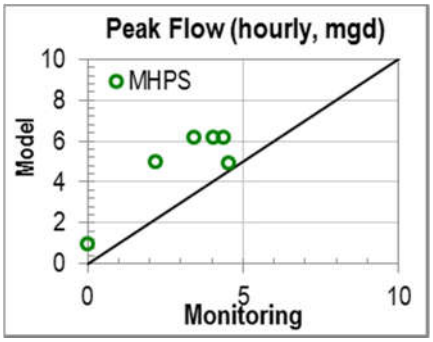




NOTE:
[1] Pump Station Meter data not available from November 22, 2016 to December 22, 2016.

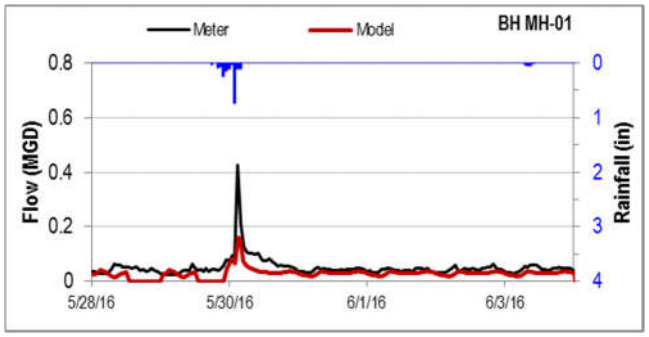
MHPS Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

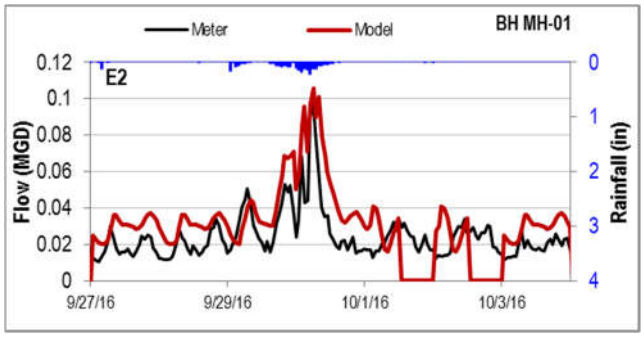


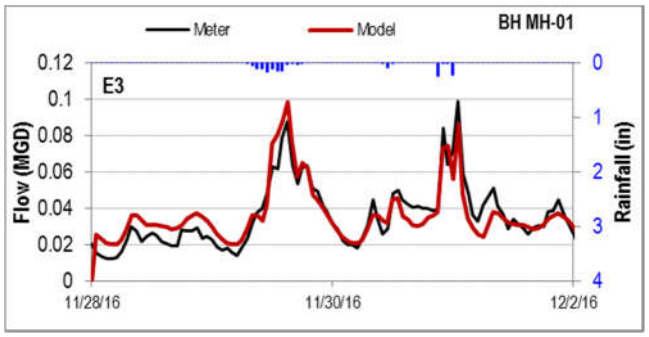


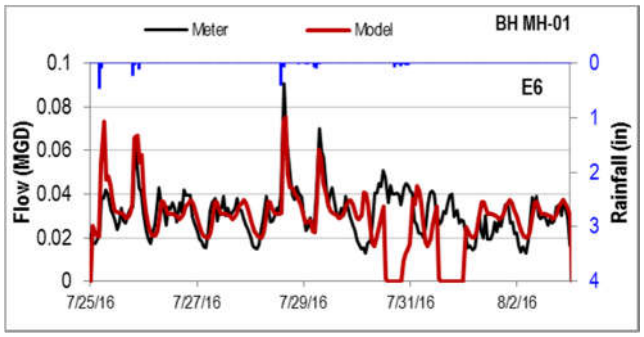
FLOW METER BH MH-01 MODEL CALIBRATION AND VALIDATION RESULTS

BH MH-01 Model Calibration Results (Metered and Modeled Flow)

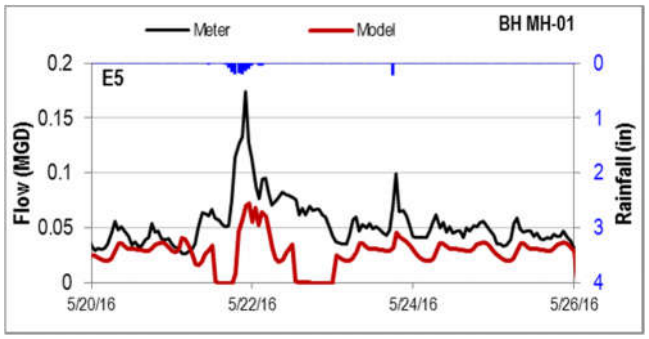


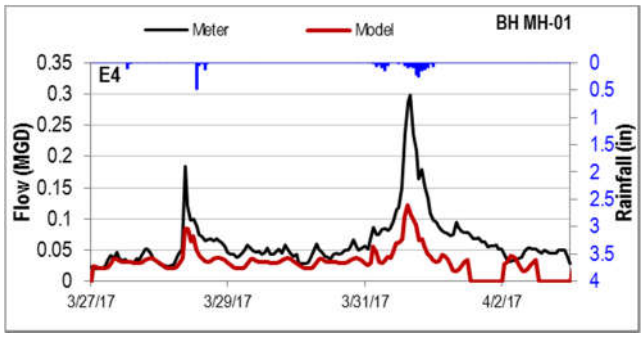




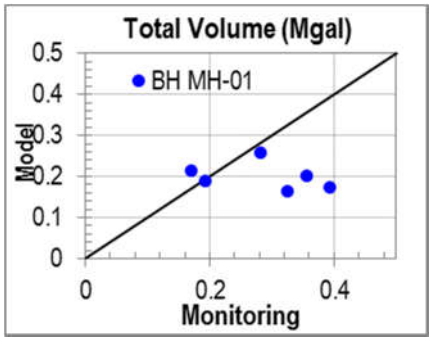


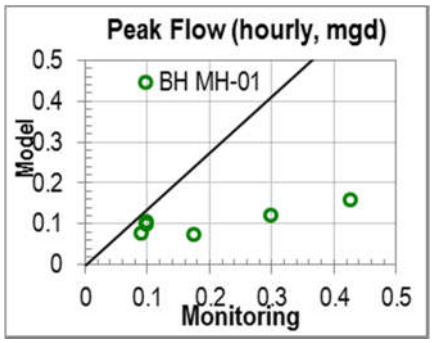
BH MH-01 Model Validation Results (Metered and Modeled Flow)





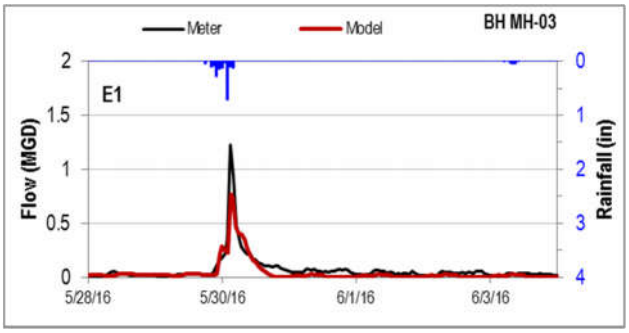
BH MH-01 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

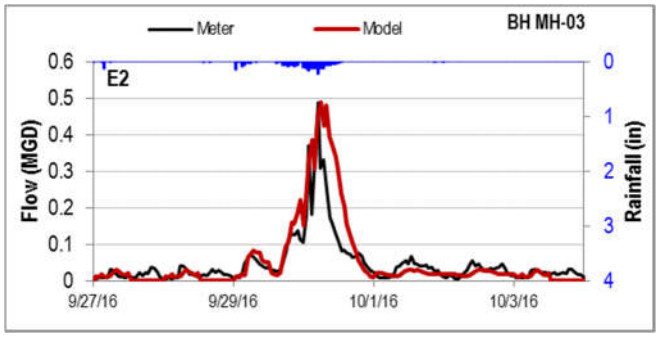


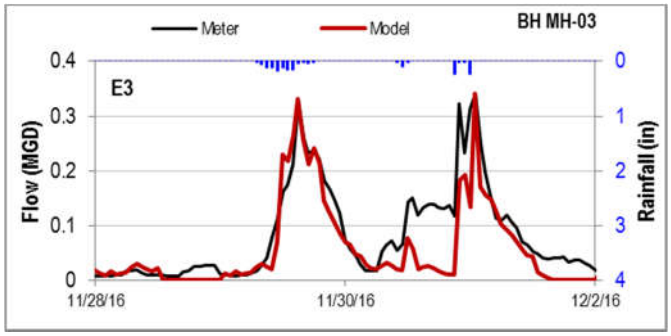


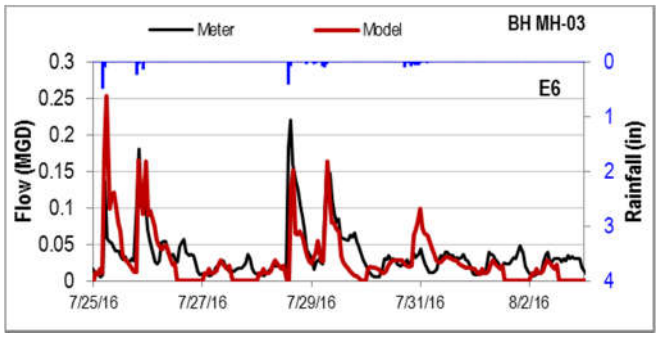
FLOW METER BH MH-03 MODEL CALIBRATION AND VALIDATION RESULTS

BH MH-03 Model Calibration Results (Metered and Modeled Flow)

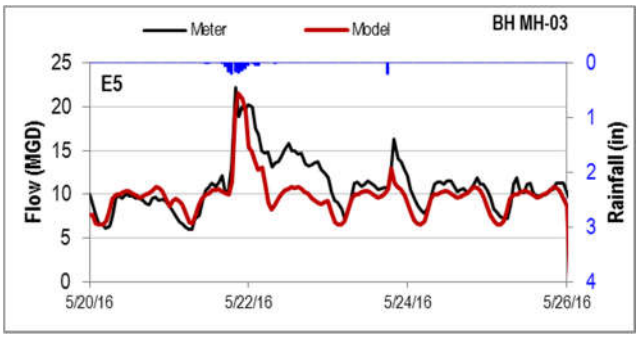


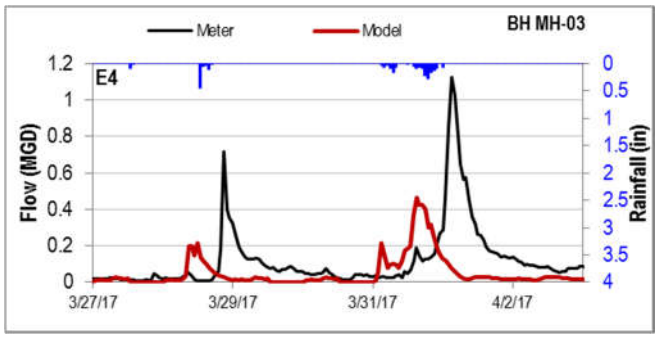




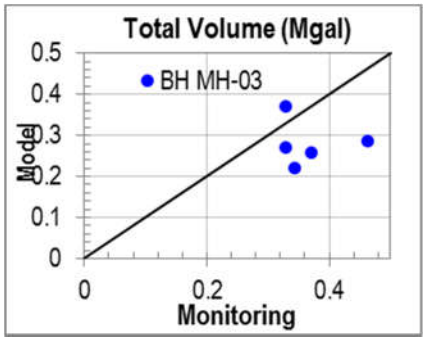


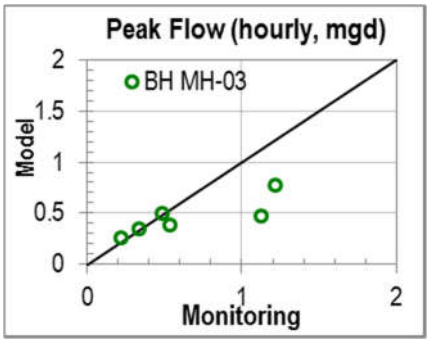
BH MH-03 Model Validation Results (Metered and Modeled Flow)





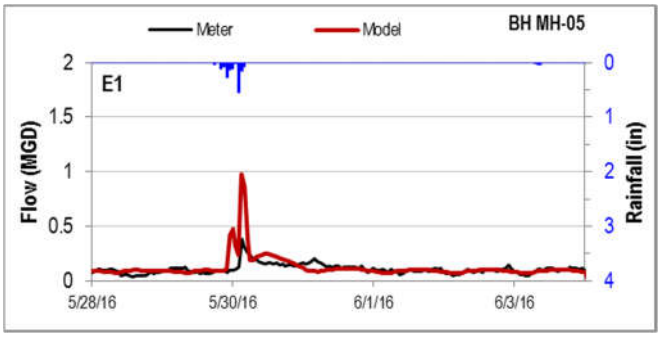
BH MH-03 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

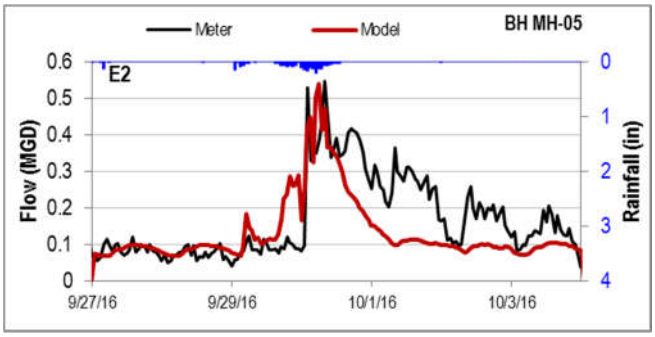


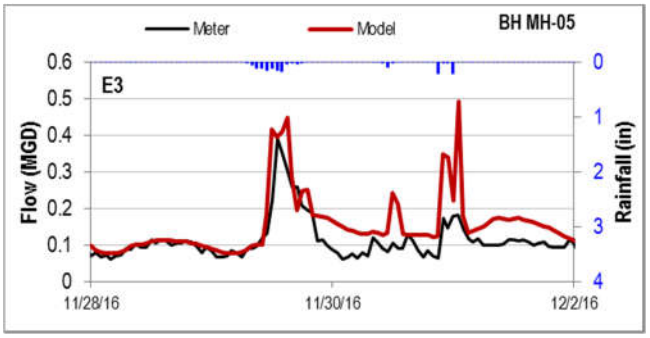


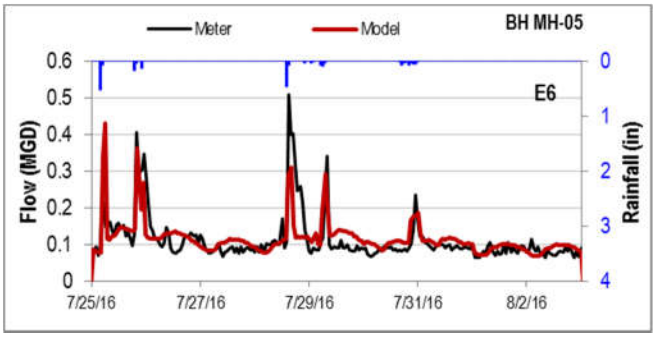
FLOW METER BH MH-05 MODEL CALIBRATION AND VALIDATION RESULTS

BH MH-05 Model Calibration Results (Metered and Modeled Flow)

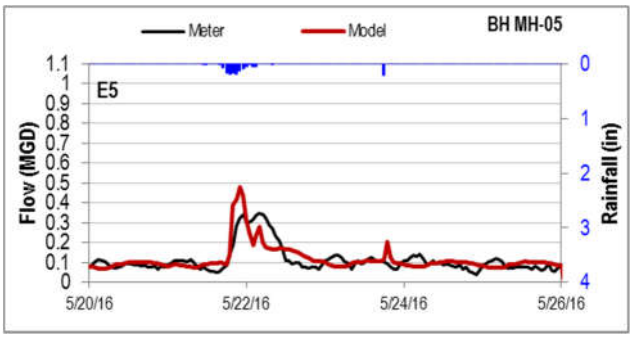


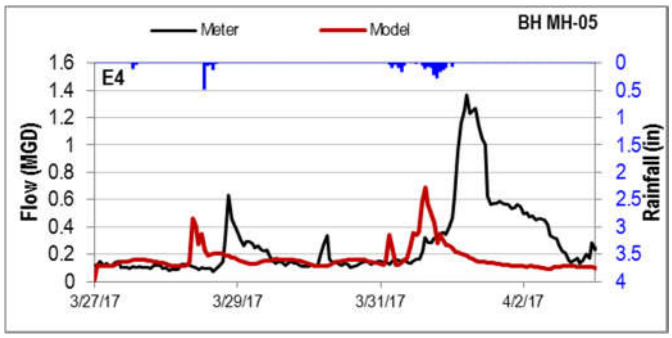




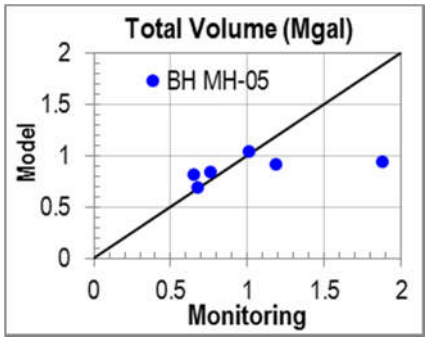


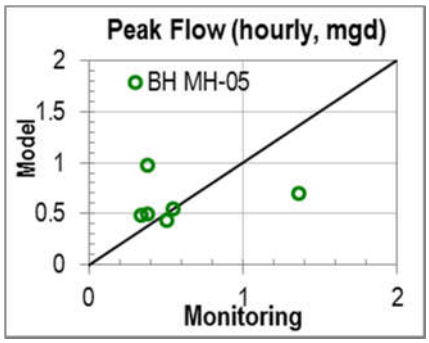
BH MH-05 Model Validation Results (Metered and Modeled Flow)





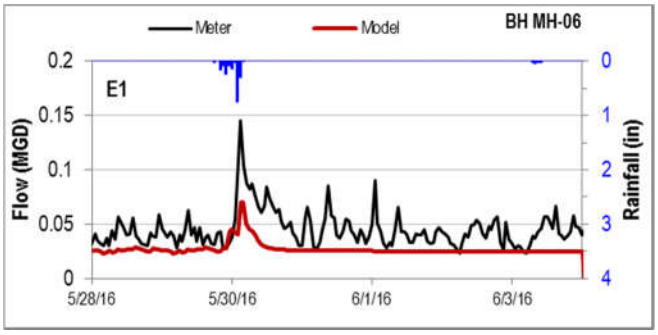
BH MH-05 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

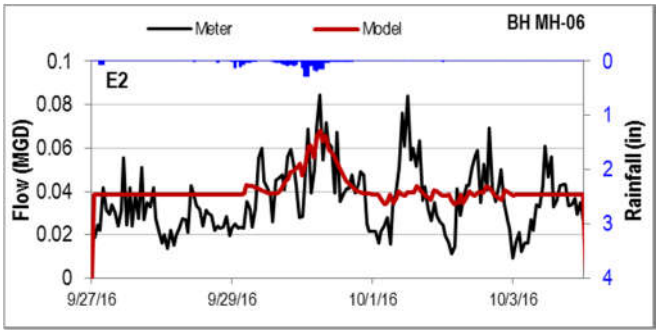


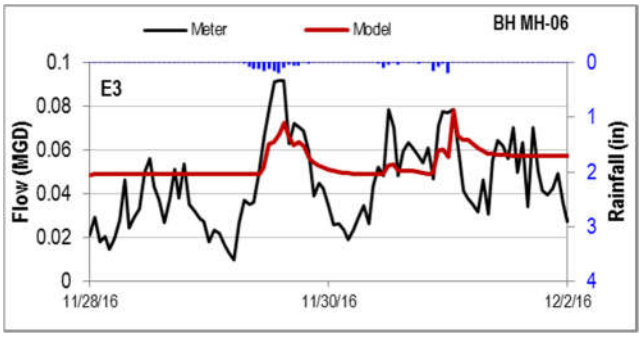


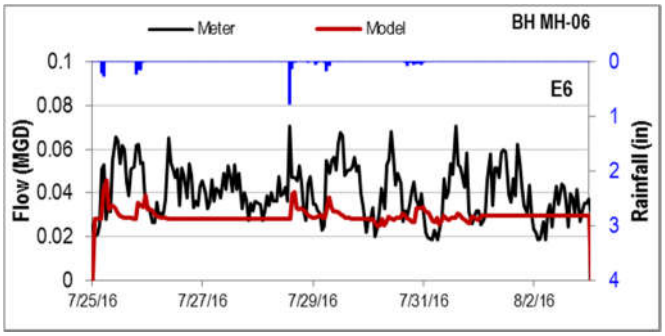
FLOW METER BH MH-06 MODEL CALIBRATION AND VALIDATION RESULTS

BH MH-06 Model Calibration Results (Metered and Modeled Flow)

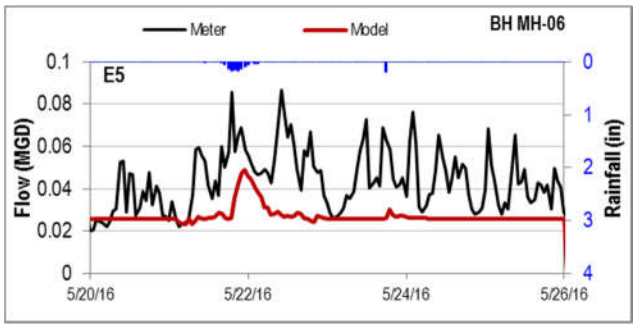


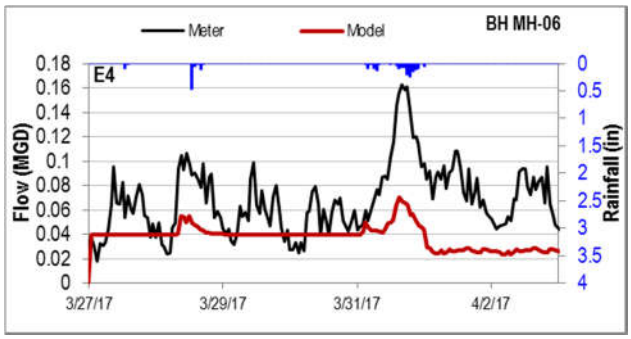




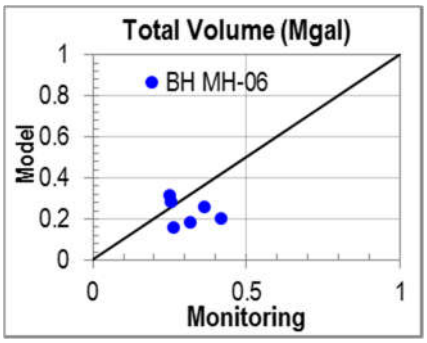


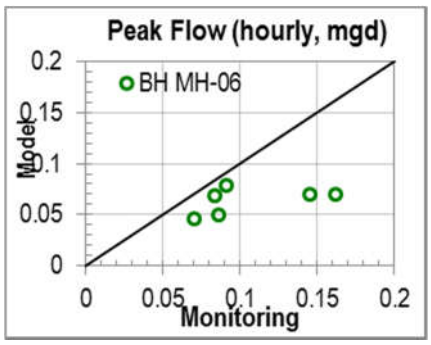
BH MH-06 Model Validation Results (Metered and Modeled Flow)





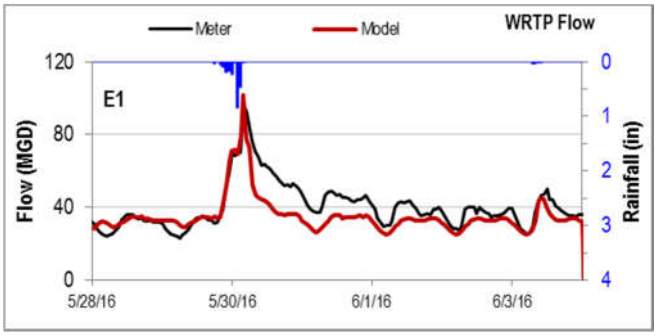
BH MH-06 Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)

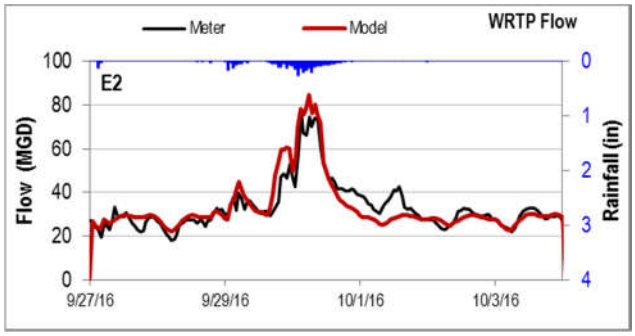


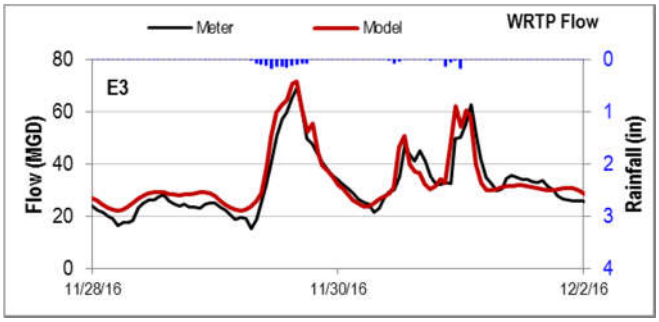


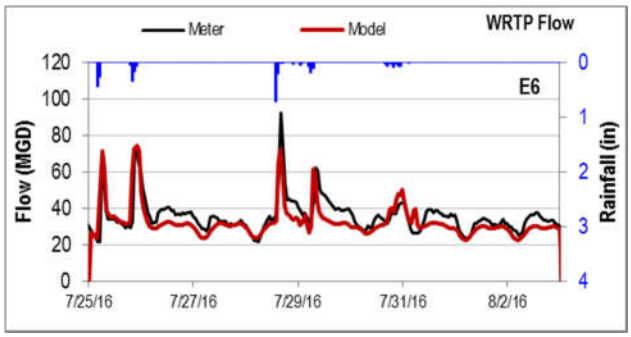
FLOW METER WRTP Flow MODEL CALIBRATION AND VALIDATION RESULTS

WRTP Flow Model Calibration Results (Metered and Modeled Flow)

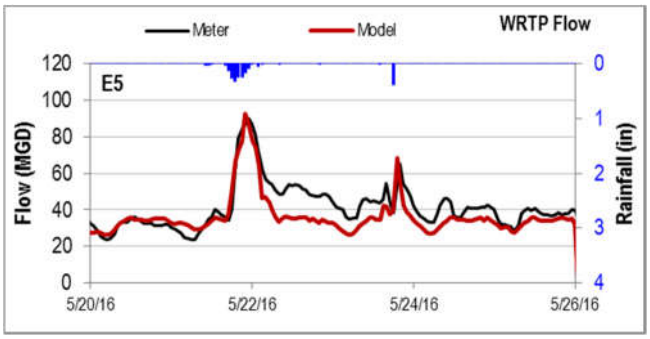


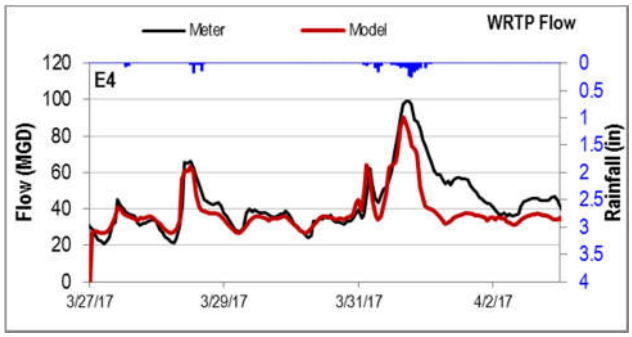




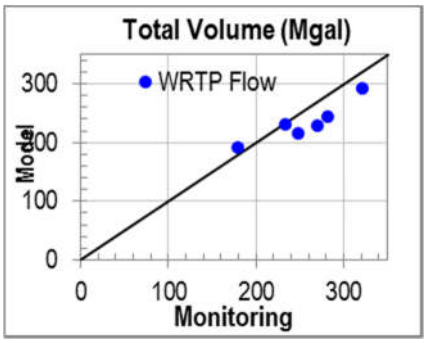


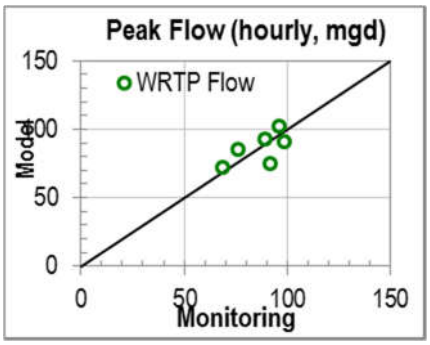
WRTP Flow Model Validation Results (Metered and Modeled Flow)





WRTP Flow Overall Model Calibration and Validation Results (Volume and Flow 1:1 Plots)





Appendix C H&H Model Results for Typical Hydrologic Period

2017 Calibrated and Validated Model Results

Overflow Frequency (occurrence)

	Rainfall	NREG02	NREG03	NREG04	NREG05	NREG07	NREG08	NREG09	NREG11	NREG12	NREG13	NREG14	NREG15	NREG16	NREG17	NREG18	NREG19	NREG20	NREG21	NREG22	NREG23	NREG24	NREG25	NREG26	NREG32
1994	45.0	53	51	21	73	43	63	41	62	2	53	30	64	27	76	90	42	36	36	53	21	0	55	21	0
1995	31.4	47	43	14	61	35	52	34	54	1	47	24	55	20	69	79	35	28	1	46	14	0	49	13	0
1996	52.1	65	61	28	78	54	70	53	70	1	66	37	72	33	88	103	54	45	1	65	26	0	68	26	0
Average	42.8	55	52	21	71	44	62	43	62	1	55	30	64	27	78	91	44	36	13	55	20	0	57	20	0

Overflow Volume (MG)

	Rainfall	NREG02	NREG03	NREG04	NREG05	NREG07	NREG08	NREG09	NREG11	NREG12	NREG13	NREG14	NREG15	NREG16	NREG17	NREG18	NREG19	NREG20	NREG21	NREG22	NREG23	NREG24	NREG25	NREG26	NREG32	TOTAL
1994	45.0	13.1	9.8	3.4	42.3	2.2	35.7	8.5	26.7	0.1	24.5	8.2	2.0	10.8	39.6	37.1	37.1	3.7	3.7	5.4	0.7	0.0	9.5	3.3	0.0	327
1995	31.4	8.3	6.1	2.4	29.9	1.3	22.4	4.5	17.8	0.0	16.4	4.0	1.3	4.2	28.3	20.5	20.9	1.7	0.0	3.4	0.2	0.0	6.2	1.1	0.0	201
1996	52.1	15.4	11.5	4.3	53.6	2.5	41.2	8.7	32.0	0.0	30.3	7.4	2.4	7.7	48.5	38.6	44.0	3.4	0.0	6.3	0.4	0.0	11.2	1.8	0.0	371
Average	42.8	12.3	9.2	3.4	41.9	2.0	33.1	7.3	25.5	0.0	23.8	6.5	1.9	7.6	38.8	32.1	34.0	2.9	1.2	5.0	0.4	0.0	9.0	2.0	0.0	300

Overflow Duration (Hour)

	Rainfall	NREG02	NREG03	NREG04	NREG05	NREG07	NREG08	NREG09	NREG11	NREG12	NREG13	NREG14	NREG15	NREG16	NREG17	NREG18	NREG19	NREG20	NREG21	NREG22	NREG23	NREG24	NREG25	NREG26	NREG32
1994	45.0	359	274	99	553	222	606	226	457	7	352	133	398	84	758	1029	251	127	127	294	51	0	352	51	0
1995	31.4	270	204	82	406	169	449	174	339	2	256	92	299	60	559	820	178	103	2	228	36	0	257	35	0
1996	52.1	441	337	161	605	299	699	306	522	2	437	196	470	127	830	1094	329	194	2	358	74	0	422	74	0
Average	42.8	357	272	114	521	230	585	235	439	4	348	140	389	90	716	981	253	141	44	293	54	0	344	53	0

Year	Total WRTP Flow (MG) during wet conditions (precipitation time+6 hr)[1]	Total Overflow (MG)	Total Wet Weather Flow (MG)	Wet Weather Capture
1994	1,293	327	1,620	80%
1995	962	201	1,163	83%
1996	1,531	371	1,902	80%
Average	**1,262**	**300**	**1,562**	**81%**

[1]Volume of combined sewage captured/treated is based on WRTP flow during precipitation events greater than 0.1 inch (including precipitation duration and 6 hours after precipitation)

Appendix D Water Quality Sampling Results

Water Quality Monitoring Program: Overview of Raw Results[1]

Parameter	Event Type	Location	Minimum Value (#/100ml)	Maximum Value (#/100ml)	Average Value (#/100ml)	No. of Samples
E. COLI	DRY	Chester Creek	10	470	130	18
		Delaware River	1	45	17	27
		Ridley Creek	2	1,900	265	16
	WET	Chester Creek	40	22,000	4,937	45
		Delaware River	2	6,900	207	143
		Ridley Creek	56	87,000	5,690	45
		CSO	25,000	1,780,000	254,403	67
		Stormwater	36	156,000	16,248	38
ENTEROCOCCUS	DRY	Chester Creek	8	190	70	18
		Delaware River	1	320	21	22
		Ridley Creek	6	900	167	16
	WET	Chester Creek	40	41,000	9,584	44
		Delaware River	2	40,000	476	141
		Ridley Creek	20	31,000	8,112	45
		CSO	4,800	3,220,000	193,961	67
		Stormwater	1,091	505,000	72,206	38
FECAL COLIFORM	DRY	Chester Creek	4	1,200	361	17
		Delaware River	2	54	27	30
		Ridley Creek	4	3,800	709	18
	WET	Chester Creek	52	44,000	7,134	45
		Delaware River	2	10,000	250	145
		Ridley Creek	44	103,000	7,646	45
		CSO	15,300	1,630,000	165,486	67
		Stormwater	20	1,480,000	54,081	38

Notes:

1. Sampling results currently undergoing QA/QC, summary statistics may change pending QA/QC results.

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GREELEY AND HANSEN

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Orig: B. Willert

APR 16 2018

RECEIVED
APR 19 2018
By 2018-0507

Mr. Robert Willert, Executive Director
Delaware County Regional Quality Control Authority
100 East Fifth Street
Chester, PA 19013

RE: Civil Action 2:15-cv-04652-RB

Dear Mr. Willert:

The United States Environmental Protection Agency (EPA) has received the Delaware County Regional Quality Control Authority (DELCORA) Existing Service Area Characterization Report dated August 15, 2017. EPA accepts and approves the subject report.

Sincerely,

Andrew F. Seligman, Environmental Scientist
Water Enforcement Branch

cc: P. Yeany, EPA
M. DeSantis, DELCORA
Tom Magee, PaDEP, SERO
C. Hurst, DELCORA

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Customer Service Hotline: 1-800-438-2474

APPENDIX L

PUBLIC PARTICIPATION PROGRAM PLAN

- DELCORA Public Participation Plan (Final) dated October 2015 (Updated April 2016)
- USEPA Approval of the Public Participation Plan (PPP) dated April 28, 2016

Note: This Appendix includes a report by Greeley & Hansen which rebranded to TYLin in 2023.

Delaware County Regional Water Quality Control Authority (DELCORA)
CSO Long Term Control Plan Update

PUBLIC PARTICIPATION PLAN
(Final)

October 2015
(Updated April 2016)

GREELEY AND HANSEN

REPORT SIGNATURE COVER SHEET

Signature of this cover signifies agreement with the content of the DELCORA Public Participation Plan.

DELCORA MANAGEMENT		
Executive Director	Signature	10/19/15 Date
DELCORA ENGINEERING		
Director of Engineering	Signature	10/19/15 Date
(type in other as needed / delete row if unused)	Signature	Date
DELCORA OPERATIONS AND MAINTENANCE		
Director of Operation and Maintenance	Signature	10/19/15 Date
(type in other as needed / delete row if unused)	Signature	Date
	Signature	Date
	Signature	Date

REVISION CONTROL

REV. NO.	DATE ISSUED	PREPARED BY	DESCRIPTION OF CHANGES
1	1/26/16	Greeley and Hansen	• Updated Section 2.2. Revised DELCORA's e-mail address and phone number. • Revised Attachment B4 - Website Screenshot.
2	3/30/16	Greeley and Hansen	Updated Public Participation Plan to address USEPA and PaDEP comments received on February 18, 2016. • Revised Executive Summary to address comments • Revised Section 1.3 to address comments • Revised Section 2.3, 2.4 and 2.6 to address comments Revised Section 4.2 to address comments • Revised Attachment B1 – DELCORA Stakeholder's Presentation dated March 15, 2016.

Table of Contents

Executive Summary **1**

Section 1 Introduction **1-1**
1.1 Background of DELCORA's Facilities 1-1
1.2 Purpose of Public Participation Plan 1-2
1.3 Public Participation Plan Overview 1-2

Section 2 Public Meetings and Engagement Tools **2-1**
2.1 Objective 2-1
2.2 Inputs During Public Participation Process 2-1
2.3 Facilities Description and Location 2-1
2.4 Responsiveness Summary 2-2
2.5 Public Engagement Tools 2-2
2.6 Public Meeting Descriptions 2-3
2.7 Meeting Schedule 2-7
2.8 Meeting Advertisement 2-8

Section 3 Stakeholder Members **3-1**
3.1 Purpose 3-1
3.2 Selection of Members 3-1
3.3 Meeting Site, Format and Time 3-2

Section 4 Public Information Plan **4-1**
4.1 Notices and Advertisements 4-1
4.2 Public Education and Involvement 4-1

List of Tables

Table 2-1: Public Meeting Schedule 2-8

List of Figures

Figure 1-1: DELCORA Conveyance System 1-3
Figure 1-2: DELCORA Service Area 1-4

List of Attachments

Attachment A: Implementation Schedule
Attachment B: Public Education Tools and Public Outreach Materials
- Attachment B1: DELCORA Stakeholders' Presentation dated August 18, 2015
- Attachment B2: Public Education Brochures (7 Brochures)
- Attachment B3: Sample Press Release
- Attachment B4: DELCORA's CSO LTCPU Website (Sample Screen Shot)

Attachment C: Pennsylvania Sunshine Act
Attachment D: PA Right-to-Know Law Act 3 of 2008

Executive Summary

BACKGROUND

The Delaware County Regional Water Quality Control Authority (DELCORA) is a municipal authority originally organized under the Pennsylvania Municipal Authorities Act of 1945 (P.L. 382), as amended and supplemented, pursuant to action taken by the Delaware County Council on October 20, 1971. Under County of Delaware Ordinance 2002-1, the term of existence of DELCORA was extended to January 15, 2052.

DELCORA is in the process of developing a Long Term Control Plan (LTCP) for the Combined Sewer System (CSS) as part of a Consent Decree entered with the United States Environmental Protection Agency (USEPA) and the Pennsylvania Department of Environmental Protection (PADEP). As part of this comprehensive effort, a Public Participation Program is being implemented to inform, seek input from, and educate the public (i.e., private citizens, businesses, special interest groups, local government, State government, and the Federal government) in the decision-making process for selecting and developing the appropriate LTCP CSO controls for the CSS.

PURPOSE

The purpose of this report is to document DELCORA's Public Participation Plan (PPP) for the LTCPU. The PPP shall describe how DELCORA will inform and solicit input to its updated LTCP from stakeholders, including the public, customer communities and the regulatory agencies.

The goals of the PPP during the development of the CSO LTCPU include addressing requirements of the United States Environmental Protection Agency (USEPA) Combined Sewer Overflow (CSO) Control Policy (dated April 19, 1994) by *"employing a process that actively involves the affected public in the decision-making to select the long-term CSO controls. The affected public includes rate payers, industrial users of the sewer system, persons who reside downstream from the CSOs, persons who use and enjoy these downstream waters, and any other interested persons."* Additionally, in accordance with Section V.A.17 (page 19) of the Consent Decree between the United States of America, the Commonwealth of Pennsylvania, Department of Environmental Protection, and DELCORA, which was lodged on August 17, 2015, the PPP *shall describe in detail how DELCORA will inform and solicit input to its updated LTCP from stakeholders, including the public, customer communities and the regulatory agencies. The plan shall specifically describe how the LTCP update process will: (i) address the impact of DELCORA's CSOs and LTCP on environmental justice populations, (ii) seek input from communities that may have historically borne a disproportionate share of the negative environmental consequences resulting from DELCORA;s CSOs, and (iii) ensure that the LTCP and selected CSO Control Measures will not impose a disproportionate share of negative*

environmental consequences on such communities in the future. The plan shall also include a schedule for DELCORA's implementation of the plan.

To be consistent with the requirements of the EPA CSO Control Policy and the Consent Decree, this PPP has been prepared to specifically describe how the LTCP update process will:

i. *Address the impact of DELCORA's CSOs and LTCP on environmental justice communities.*

ii. *Seek input from communities that may have historically borne a disproportionate share of the negative environmental consequences resulting from DELCORA's CSOs.*

iii. *Ensure that the LTCP and selected CSO Control Measures will not impose a disproportionate share of negative environmental consequences on such communities in the future.*

iv. *Include a schedule for DELCORA's implementation of the plan.*

PUBLIC AND STAKEHOLDER MEETINGS

The USEPA "Combined Sewer Overflows Guidance for Long-Term Control Plan," dated August 1995, indicates that public participation and Agency interactions should occur at the following steps of the LTCP development process:

1. System Characterization
2. Development and Evaluation of Alternatives for CSO Controls
3. Selection and Implementation of the Long-Term Plan

This PPP has been developed to actively involve the affected public in each of the above steps via Public Participation Meetings and other methods as further described herein. In addition to these minimum requirements, one additional Public Participation Meeting will be considered prior to the required meetings (listed above) to inform the public early in the planning process about the scope and goals of the program. In summary, the Public Participation Meetings to be held will be as follows:

Meeting No. 1: Scope and Purpose of the Study
Meeting No. 2: System Characterization
Meeting No. 3: Development and Evaluation of Alternatives for CSO Controls
Meeting No. 4: Selection and Implementation of the Long-Term Plan

In addition to the above stated Public Participation Meetings, DELCORA will also be holding stakeholder meetings with various agencies, authorities, and special interest groups throughout the course of the LTCP program.

Beyond the above referenced Public Participation Meetings and Stakeholder Meetings, a concerted effort will also be made to make the public aware of the CSO LTCPU development process and to actively involve and educate them about CSO issues and the selection of the CSO control elements through various media, including the following:

1. Update and Educational Material in Sewer Bills
2. CSO Website
3. CSO Newsletters in the form of mail inserts and/or emails
4. Handouts
5. Literature and Documentation will be made available by DELCORA at municipal buildings and public library

Section 1 Introduction

1.1 Background of DELCORA's Facilities

Delaware County Regional Water Quality Control Authority (DELCORA) is responsible for the safe collection, transmission, treatment and disposal of approximately 65 million gallons per day (MGD) of wastewater generated in southeastern Pennsylvania. DELCORA's facilities serve residential, commercial, institutional, and industrial customers in Delaware County. DELCORA owns and operates an extensive system of pump stations, force mains, and sewers that provide the core infrastructure for the transmission of wastewater to treatment facilities in Delaware County and the City of Philadelphia as shown diagrammatically in Figure 1-1. The total service area served by DELCORA is approximately 82,977 acres, as shown on Figure 1-2, which illustrates that DELCORA serves a significant and widespread portion of Delaware County. The combined sewer area simulated in the original model, also shown in Figure 1-2, is located within the Chester City. It comprises approximately 49% of the Chester City's serviced area. To support the service area, DELCORA owns and operates over 129 miles of separate and combined sewers. Included in the 129 miles of sewers are: 11.7 miles of an interceptor system; 3,209 manholes; and twenty-five (25) combined sewer outfall regulators controlling storm overflows.

Historically, DELCORA has characterized its service areas as "Eastern" and "Western." The Western service area discharges to the Western Regional Treatment Plant (WRTP). The Eastern service area discharges to the Philadelphia Water Department's Southwest Water Pollution Control Plant (PWD-SWPCP). In 2002, DELCORA completed the installation of a force main that connects the Eastern Service Area's Central Delaware Pump Station (CDPS) to the Chester Force Main. This connection allows DELCORA to send flow from the CDPS to the WRTP. Flows above 20 MGD are to be directed to the PWD-SWPCP. As such, dry weather flow and a portion of the wet weather flow from the Central Delaware County Authority in the Eastern Service Area are discharged to the WRTP.

Under National Pollutant Discharge Elimination System (NPDES) Permit No. PA0027103, issued and administered by the Pennsylvania Department of Environmental Protection (PADEP), DELCORA is authorized to discharge from the Western Regional Treatment Plant (Outfall 001), four storm water outfalls at the WRTP (028-031) and from 26 combined sewer overflow (CSO) outfalls (002-026, 032, 033) that ultimately discharge to the Delaware River, Chester Creek and/or Ridley Creek.

There are a total of 26 combined sewer overflow (CSO) outfalls listed with 25 discharge points (Outfalls 009 and 010 both discharge at Outfall 009) in DELCORA's existing NPDES Permit.

1.2 Purpose of Public Participation Plan

The purpose of this Public Participation Plan (PPP) is to present and document DELCORA's Public Participation Program for the LTCPU. The PPP outlines the methods that DELCORA will utilize to actively facilitate public involvement in the decision-making process to develop and select the long term CSO controls.

The goals of the PPP during the development of the CSO LTCPU include addressing requirements of the United States Environmental Protection Agency (USEPA) Combined Sewer Overflow (CSO) Control Policy (dated April 19, 1994) by *"employing a process that actively involves the affected public in the decision-making to select the long-term CSO controls. The affected public includes rate payers, industrial users of the sewer system, persons who reside downstream from the CSOs, persons who use and enjoy these downstream waters, and any other interested persons."* Additionally, in accordance with Section V.A.17 (page 19) of the Consent Decree between the United States of America, the Commonwealth of Pennsylvania, Department of Environmental Protection, and DELCORA, which was lodged on August 17, 2015, the PPP *shall describe in detail how DELCORA will inform and solicit input to its updated LTCP from stakeholders, including the public, customer communities and the regulatory agencies. The plan shall specifically describe how the LTCP update process will: (i) address the impact of DELCORA's CSOs and LTCP on environmental justice populations, (ii) seek input from communities that may have historically borne a disproportionate share of the negative environmental consequences resulting from DELCORA;s CSOs, and (iii) ensure that the LTCP and selected CSO Control Measures will not impose a disproportionate share of negative environmental consequences on such communities in the future. The plan shall also include a schedule for DELCORA's implementation of the plan.*

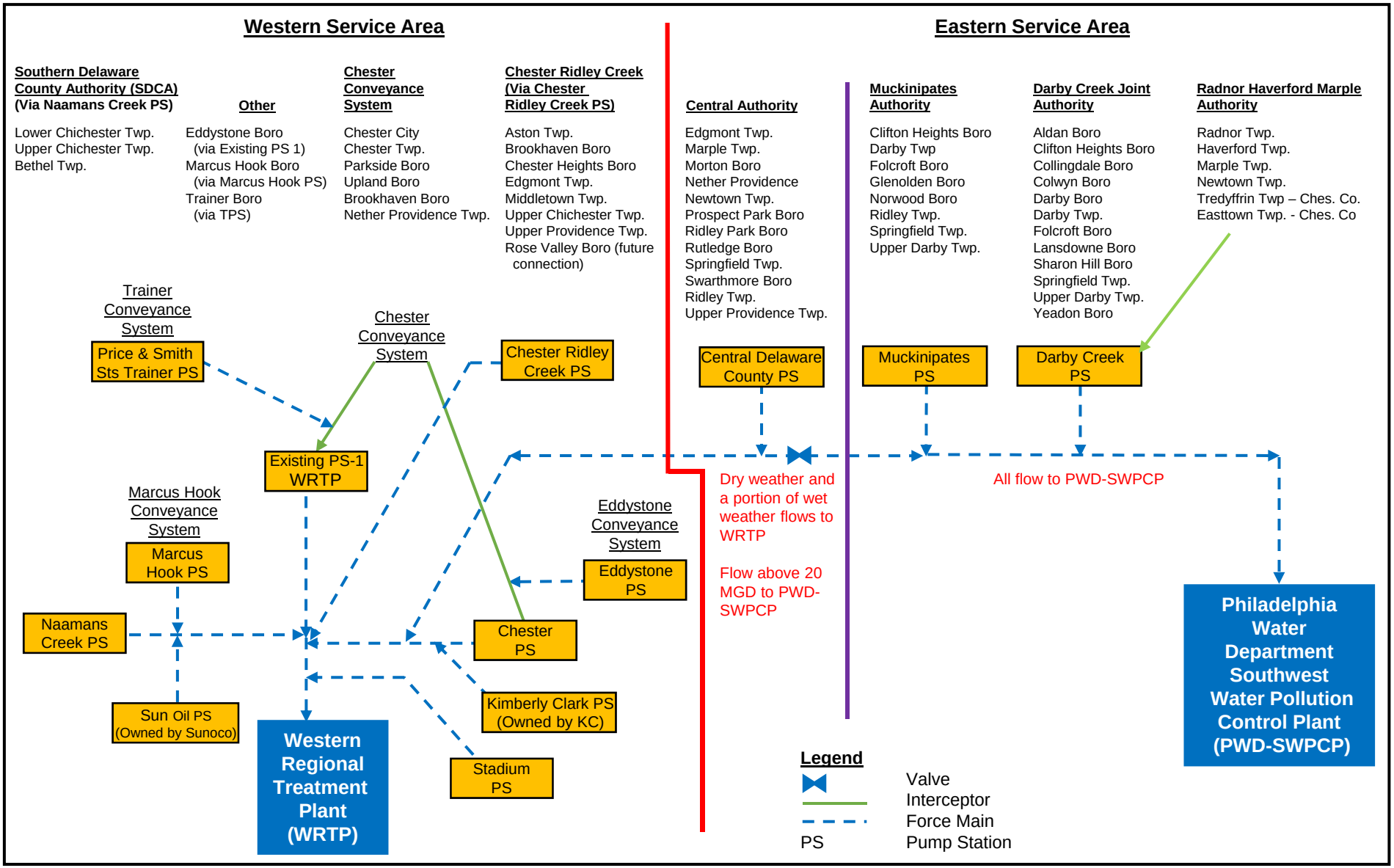
1.3 Public Participation Plan Overview

As part of the Long Term Control Plan Update (LTCPU), this Public Participation Plan (PPP) has been developed to involve key decision makers as described in Section 3.2 for developing and selecting appropriate LTCP objectives for the CSS communities.

To be consistent with the requirements of the EPA CSO Control Policy and the Consent Decree, this PPP has been prepared to specifically describe how the LTCP update process will:

i. *Address the impact of DELCORA's CSOs and LTCP on environmental justice communities.*

ii. *Seek input from communities that may have historically borne a disproportionate share of the negative environmental consequences resulting from DELCORA's CSOs.*



CSO Long-Term Control Plan
Delaware County Regional Water Quality Control Authority

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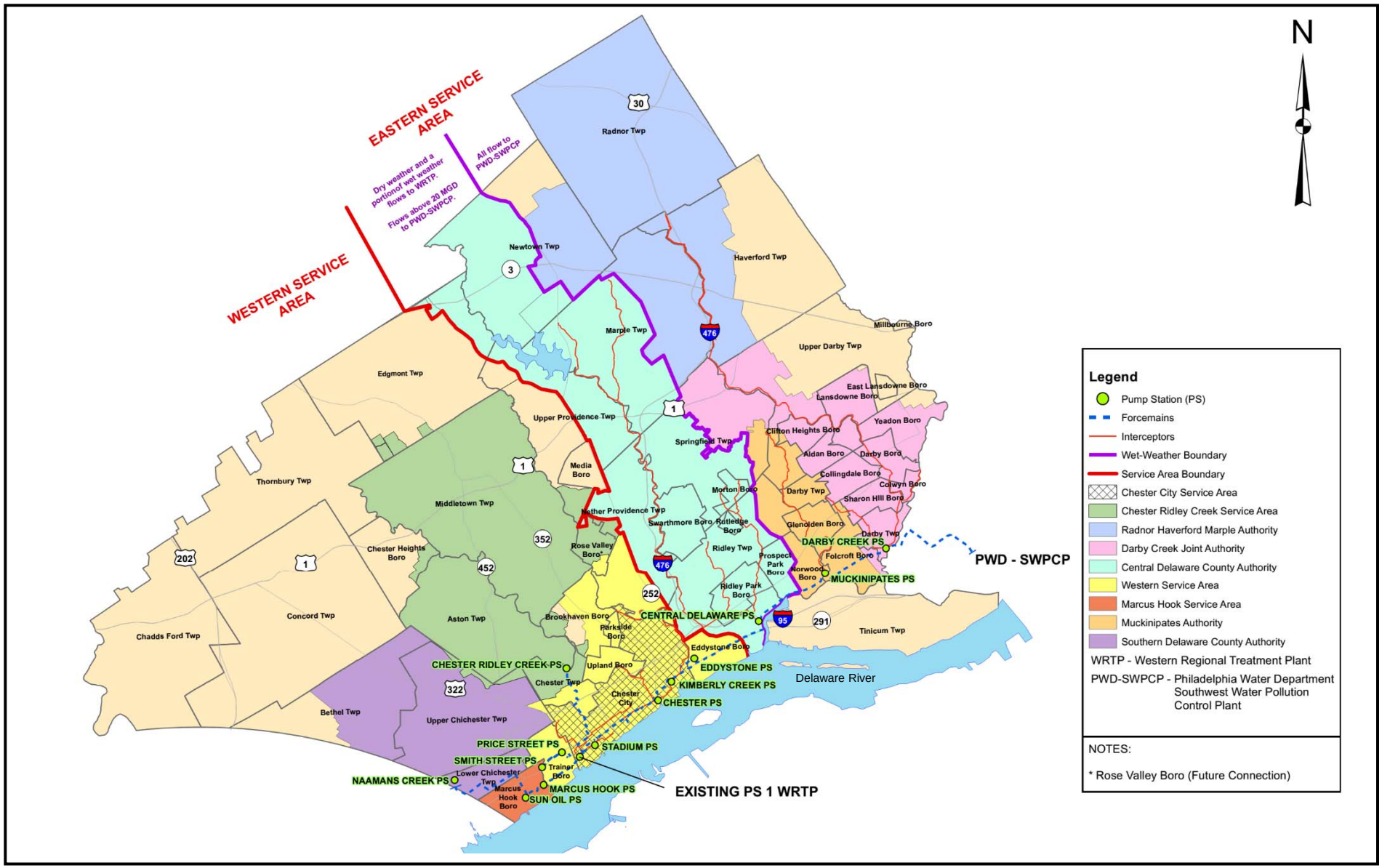
WESTON SOLUTIONS
Restoring Resource Efficiency

Figure 1-1
DELCORA'S CONVEYANCE SYSTEM



CSO Long-Term Control Plan

Delaware County Regional Water Quality Control Authority

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Figure 1-2
DELCORA'S SERVICE AREA

iii. *Ensure that the LTCP and selected CSO Control Measures will not impose a disproportionate share of negative environmental consequences on such communities in the future.*

iv. *Include a schedule for DELCORA's implementation of the plan.*

The USEPA "Combined Sewer Overflows Guidance for Long-Term Control Plan," dated August 1995, indicates that public participation and Agency interactions should occur at the following steps of the LTCP development process:

1. System Characterization
2. Development and Evaluation of Alternatives for CSO Controls
3. Selection and Implementation of the Long-Term Plan

This PPP has been developed to actively involve the affected public in each of the above steps via Public Participation Meetings and other methods as further described herein. In addition to these minimum requirements, one additional Public Participation Meeting will be considered prior to the required meetings (listed above) to inform the public early in the planning process about the scope and goals of the program. In summary, the Public Participation Meetings to be held will be as follows:

Meeting No. 1: Scope and Purpose of the Study
Meeting No. 2: System Characterization
Meeting No. 3: Development and Evaluation of Alternatives for CSO Controls
Meeting No. 4: Selection and Implementation of the Long-Term Plan

In addition to the above stated Public Participation Meetings, DELCORA will also be holding stakeholder meetings with various agencies, authorities, and special interest groups throughout the course of the LTCPU program.

Beyond the above referenced Public Participation Meetings and Stakeholder Meetings, a concerted effort will also be made to make the public aware of the CSO LTCPU development process and to actively involve and educate them about CSO issues and the selection of the CSO control elements through various media, include the following:

1. Update and Educational Material in Sewer Bills
2. CSO Website
3. CSO Newsletters
4. Handouts
5. Literature and Documentation

During the course of the LTCPU development and selection process, the public will have the opportunity to be informed, participate in discussions, and provide input through the above meetings.

Section 2 Public Meetings and Engagement Tools

2.1 Objective

The main objective of public meetings and the engagement tools that will be implemented are to foster public awareness and actively facilitate public involvement by taking into consideration public input during the decision making process and selection of the final long term CSO controls.

2.2 Inputs During Public Participation Process

During the public participation process, DELCORA and the Engineering and Program Management Consultant, Greeley and Hansen, will present Public Outreach Material and receive questions and comments.

DELCORA will maintain a website containing information about the Authority and the CSO system. Residents can also report problems or concerns with DELCORA through requests for information. Requests for information will be directed to DELCORA at 610-876-5523 and DELCORA can also be reached by email at ltcpinfo@delcora.org. Comments may also be received through DELCORA's CSO LTCPU website at www.delcora.org.

The comments received will be given consideration during the progress of the program and for the development and selection of the CSO controls.

2.3 Facilities Description and Location

The public meetings will be held at the following four locations. The exact time and location of the meetings will be advertised in advance of the meetings and as described in Section 2.6.

1. **Chester City Hall**
   Address: 1 E. 4th Street Chester, PA 19013

2. **Ridley Township Municipal Building**
   Address: 100 MacDade Boulevard Folsom, PA 19033

3. **Chester City Hall**
   Address: 1 E. 4th Street Chester, PA 19013

4. **Aston Township Administration Building**
   Address: 5021 Pennell Road, Aston, PA 19014

The public meeting locations will be held at different locations in order to maximize the likelihood of attendance for residents and stakeholders. The facilities will have ample meeting space. These locations serve a vital role in Delaware County as the central meeting place and serves as a gathering place for the local community, as well as the hosting of numerous public events, including public information meetings, and are all free to the public.

2.4 Responsiveness Summary

After each public meeting, a Responsiveness Summary will be prepared. Each Responsiveness Summary will include notifications and information that will be made available to the public at the following meeting. This will include a summary of the meeting presentation and attendance; statements, comments, and questions raised by the public, followed by DELCORA's responses.

When preparing the Responsiveness Summary, special attention will be given to address the public statements, comments, and questions, along with DELCORA's responses.

A final copy of the Responsiveness Summary will be provided and reviewed at the subsequent public meeting and a copy will also be placed on DELCORA's CSO LTCPU website. In addition to this the responsiveness summary will also be available at an offline repository location at municipal buildings and/or public library.

2.5 Public Engagement Tools

The public engagement program will be developed in collaboration with DELCORA and the Engineering and Program Management Consultant. This program will include multiple tools nested in primarily the two following strategies:

1. Direct Engagement Strategy

   This strategy will be implemented at the Public Meetings, as well as the Stakeholder Meetings, and will address the complex issues of the LTCP program by providing an opportunity for public participation that is active, interactive, encouraging people to provide ideas and comments and continue to learn about DELCORA's CSO LTCPU program and its objectives. The rationale behind DELCORA's CSO LTCPU will be discussed with the public as part of the engagement program. This strategy will involve stakeholder interactions, use of public meeting talking points, and education based presentations in-line with the requirements of the development process of the LTCP.

2. Digital Engagement Strategy

   This strategy will actively engage the public in providing feedback and comments through the use of digital technology. This will help provide ample information when

people want to know more about the program and its progress. The use of the DELCORA website with a CSO link and notification updates will broaden the range of people that can participate in this program. DELCORA's website will add new content on a regular basis and DELCORA will keep the website updates with the progress milestones of the LTCPU. People will be encouraged to participate by leaving comments or inputs. Informational materials could be posted on the website, as well. This could include advertisements for public meetings, information from communities and other stakeholders, the Responsiveness Summaries from the Public Meetings, project areas and photos, construction notices, as well as key project dates and milestones.

2.6 Public Meeting Descriptions

It is anticipated that there will be four public engagement meetings and each meeting will include elements of the strategies listed above. Meetings will be developed to sync with the needs of the development of the LTCPU. The key points that will be addressed through these public engagement strategies include the following in order to be consistent with the USEPA "Combined Sewer Overflows Guidance for Long-Term Control Plan," dated August 1995:

1. System Characterization
2. Development and Evaluation of Alternatives for CSO Controls
3. Selection and Implementation of the Long-Term Plan

The first public meeting will be used to brief the public on the history, scope and purpose of the study and to obtain their general views on the study. At this meeting a general presentation with information on DELCORA and its CSO LTCPU program will be given to the public. This meeting will provide an effective forum to obtain inputs from interested individuals and organizations. The power point presentation will be provided to the public for review a week in advance of the meeting. The presentation materials will be available for access to the public on DELCORA's CSO LTCPU website under the Combined Sewer System tab.

The second public meeting will focus on updating the public on the scope of activities that make-up system characterization, analysis of existing data and development of the monitoring and modeling programs, identification and status of implementation of the Nine Minimum Controls, and the process for evaluating alternative CSO controls. DELCORA and the Engineering and Program Management Consultant will focus on providing a power-point presentation with hand-outs with the following information to the public as it is developed during this phase, as relevant:

- Scope of monitoring and assessment programs for system characterization
- The watershed approach to CSO control planning
- Identification of watersheds in the CSO area
- Identification and quantification of non-CSO sources
- Existing sewer system conditions and problems (e.g., flooding, basement backups)

- Quantification of CSO flows and loads and impacts of CSOs on receiving waters
- Results of CSS and receiving water monitoring programs
- Development and calibration of the CSS and receiving water models
- Identification and implementation status of the NMC
- Process for evaluating alternatives

DELCORA will interact between various municipal and permitting authorities to reach agreement on the data, information and analysis that is needed to support the development of long-term CSO control plan and review of applicable water quality standards (WQS) as well as implementation procedures. This agreement on the data as well as the power-point presentation will be provided to the public for review a week in advance of the meeting.

The goals of the third public meeting will be to actively involve the public in the development of the alternative solutions that protect the receiving streams, as well as to consider the financial impacts to the community as a whole. During this third Public Meeting, DELCORA and the Engineering and Program Management Consultant will provide a power-point presentation with handouts. The opportunity for citizens to be actively involved in the development of alternatives that provide solutions to protect the local waterways will be provided. Any suggestions, comments and financial impacts to the community will be considered. The following key information will be presented to the public:

- Water quality goals for each receiving water segment
- CSO control goals for each receiving water segment as developed under the presumption and/or demonstration approach options
- Types of control alternatives available to meet CSO control goals
- CSO control alternatives identified to meet the control goals
- Process of evaluating and comparing various alternatives for CSO control

DELCORA will continue to fund and implement the CSO control measures that are currently being implemented under the 1999 LTCP to reduce the frequency, volume, and pollutant load of CSO discharges to local waterways. Additionally, early action CSO control projects will continue to be identified and implemented, where appropriate. Additional CSO control alternatives would be selected based on their water quality impacts, their ease of implementation, and their cost effectiveness. During the Public Participation process, various CSO control measures investigated through engineering analysis will be presented at the third public meeting by the Engineering and Program Management Consultant on behalf of DELCORA. The type and features of the CSO control measures to be considered for each element of the LTCPU would also be based on the nature of the problem, project constraints, and analysis of existing data. Some of the major CSO mitigation measures that would be considered are listed below:

- Capacity Recovery in the existing CSS
- CSO Regulator Improvement Program
- Sewer System Cleaning/Flushing to avoid backups

- Sewer/ CSO Regulator replacement
- Tide Gate Maintenance or replacement
- Reduction of FOG in the sewers
- Outfall Maintenance Program;
- Private Property I/I Elimination
- Outfall Combined Wastewater Diversion and Separation
- Outfall Consolidation, Relocation, or Elimination
- Additional Conveyance Systems
- Inlet Replacement Program
- Downspout Disconnect Program

Presentations will be provided to the public and other listed stakeholders (as discussed in Section 3) on the various advantages and disadvantages of these control measures for further inputs and comments.

The fourth public meeting will discuss and present progress on the development and selection of the alternatives for implementation of the Long-Term Plan. Once the alternatives have been evaluated in detail, but prior to selection of specific CSO controls, the public will be informed of each alternative and ranked based on preference in a draft report. The results of the evaluation will be summarized in an executive summary. The extent of implementation of each alternative evaluated will be based on public input. The schedule and financing method will also be described in the report prior to selection.

During the CSO control measures evaluation stage, alternative measures that can reduce the impact of CSO discharges will typically fall into one of the following four categories:

1. Source Control Technologies/Alternatives - eliminating or preventing pollution before it is created.

2. Collection System Control Reducing Technologies/Alternatives – reducing the discharge volume, concentration, or frequency.

3. Storage Technologies/Alternatives - capturing all or some of the discharge and then releasing for treatment.

4. Treatment Technologies/Alternatives - treating as much as possible.

After assembling a list of possible control alternatives, the necessary preliminary screening will be conducted in order to better evaluate which control alternatives have the highest potential to protect receiving water quality. The selected alternatives will be screened against evaluation

criteria that were selected based upon characteristics of CSO discharges that are measurable and can impact the receiving water. The preliminary screening criteria are as follows:

- Flow reduction
- BOD reduction
- DO improvement
- Settleable solids removal
- Bacteria reduction
- Floatables reduction
- Toxic materials reduction
- Implementation and operation factors

The final CSO control alternatives will be prioritized based on their potential to reduce the CSO discharge frequency and pollutant load to each water body, their cost effectiveness, and on the financial capability. The following impact points will be considered while implementing the final CSO control alternatives:

- CSO Impacts - Sensitive Areas
- CSO Impacts - Water Quality Objectives
- CSO Impacts - Pollutant Load by Water Body
- CSO Control Technology - Pollutant Load Reduction by Water Body
- CSO Control Technology - Cost Effectiveness

During this meeting, the alternative rankings will be presented and discussed thoroughly. The technical solutions will be presented in a simple format with information covering background of project, description of facility, level of control needed, any impacts, and mitigation measures to be taken, as well as the cost. Graphs will be used to present each alternative along with benefits, resource requirements and cost.

DELCORA will continue to interact with municipal and permitting authorities even in this phase with sharing of technical information. CSO control measure performance will be discussed with regulatory authorities to reach agreement. DELCORA will consult with permitting authorities to ensure consistency with the CSO Control Policy provisions regarding CSOs occurring in sensitive areas and show that all reasonable options in developing a list of final alternatives for evaluation have been studied while incorporating all identified concerns.

During all meetings, an agenda will be developed, distributed to the public and followed during the presentations. One person will be designated to take meeting notes and collect public comment sheets so all views are recorded. In addition, written comments from the public will be accepted until one month after the date of the public meetings described above. As previously discussed, after each public meeting, a Responsiveness Summary will be prepared. Each Responsiveness Summary will include notifications and information that will be made available to the public at the following meeting, as well as on DELCORA's CSO LTCPU website.

DELCORA will submit to the regulatory authorities any technical memorandums, interim reports, meeting minutes, and the Responsiveness Summary for comments. Once comments are received, DELCORA will respond to each agency.

Information will be presented to the public in the most understandable manner and in a format that is most appropriate for the public. Any technical information or complex charts will be avoided. Additionally a review of the responsiveness summary from the prior meetings will occur at the second, third and fourth public meetings.

The presentation materials will be available for access to the public at offline repositories as stated in the Executive Summary and DELCORA's CSO LTCPU website under Combined Sewer System tab at least a week in advance of all scheduled meetings. Public will be notified for these materials through the public notice for the meetings.

The public's input will be actively solicited by receiving questions and comments as it relates to the presentation. Public will be advised that there will be an opportunity to raise questions, provide comments and give ideas at the meeting as well. Public will be informed that they have 30 days to submit questions and comments. Last slide of every presentation will have contact information to submit questions and comments. A copy of each presentation will be provided as handout to the participants. At each public meeting public can submit comments and ideas will be solicited.

Public will be informed through a notice in the form of an advertisement prior to the scheduled meetings to raise comments and questions. The public will be encouraged to ask questions as the presentation proceeds and will be asked to provide any comments in writing, as well. Comments arising from all public meeting presentations can be submitted by one of the following methods within 30 days after the scheduled meeting:

- By Mail:
  DELCORA
  P.O. Box 999
  Chester, PA 19016-0999
- By Phone: 610-876-5523
- By Email: ltcpinfo@delcora.org.
- By Website: www.delcora.org.

2.7 Meeting Schedule

Public meetings will be held over the course of the LTCPU development effort to describe how DELCORA will inform and actively solicit input to its updated LTCPU from stakeholders, including the public, customer communities, and the regulatory agencies. Public meetings will be held as described in Section 2.6. The proposed schedule for these meetings is as follows (subject to coordination with USEPA):

Table 2-1: Public Meeting Schedule

Meetings	Description	Scheduled
Meeting No. 1	Scope and Purpose of the Study	1st Quarter of 2016
Meeting No. 2	System Characterization	3rd Quarter of 2017
Meeting No. 3	Development and Evaluation of Alternatives for CSO Controls	4th Quarter of 2017
Meeting No. 4	Selection and Implementation of the Long-Term Plan	3rd Quarter of 2018

The detailed meeting schedule for the implementation of the PPP has been attached herein as Attachment A.

2.8 Meeting Advertisement

The public will be invited through advertisements on DELCORA's CSO LTCPU website in advance.

The public meeting notice will also be advertised in the following local newspapers or circulations:

1. Chester Spirit
2. Delaware County Daily Times
3. Philadelphia Inquirer
4. Press Newspaper

Per the requirements of Pennsylvania's Sunshine Act (provided herein as Attachment C), DELCORA will give public notice of its meetings not less than three (3) days in advance of the meeting and shall give public notice of its remaining meetings. DELCORA shall also give public notice of any special meeting or rescheduled meeting at least 24 hours in advance of the time of the convening of the meeting specified in the notice.

The definition of the "Public Notice" per Pennsylvania's Sunshine Act is as follows:

"(1) For a meeting:

(i) Publication of notice of the place, date and time of a meeting in a newspaper of general circulation, as defined by 45 Pa.C.S. Â§ 101 (relating to definitions), which is published and circulated in the political subdivision where the meeting will be held, or in a newspaper of general circulation

which has a bona fide paid circulation in the political subdivision equal to or greater than any newspaper published in the political subdivision.

(ii) Posting a notice of the place, date and time of a meeting prominently at the principal office of the agency holding the meeting or at the public building in which the meeting is to be held.

(iii) Giving notice to parties under section 709(c) (relating to public notice).

(2) For a recessed or reconvened meeting:

(i) Posting a notice of the place, date and time of the meeting prominently at the principal office of the agency holding the meeting or at the public building in which the meeting is to be held.

(ii) Giving notice to parties under section 709(c).”

Section 3 Stakeholder Members

3.1 Purpose

In addition to the Public Meetings and Engagement Tools as described in Section 2, a group comprising of stakeholder members will be formed for this PPP. The stakeholder meetings will be held on an as-needed basis throughout the course of the LTCP program. These meetings will provide an opportunity for active input and consultation on the LTCP development process. These meetings will also provide an effective forum for an in-depth exchange of information, ideas, and results as the LTCP process moving forward.

3.2 Selection of Members

To reflect a balance of perspectives, stakeholder members may consist of representatives from the public, customer communities, regulatory agencies, and special interest groups. The list of stakeholders considered by DELCORA is provided below. These members will provide inputs through stakeholder meetings. DELCORA will be scheduling independent meetings with each of these stakeholders. These meetings will be beyond the public meetings that are described in Section 2 of this PPP. Presentations will be made to these stakeholders throughout the CSO LTCPU program. A sample copy of this presentation has been provided herein as Attachment B1.

1. Darby Creek Joint Authority
2. Central Delaware County Authority
3. Muckinipates Authority
4. Delaware River Basin Commission
5. Radnor, Haverford, Marple Authority
6. Southern Delaware County Authority
7. Southwest Delaware County Municipal Authority
8. Middletown Township Sewer Authority
9. Chester Environmental Partnership
10. Department of Environmental Protection - Southeast Regional Office
11. Delaware County Planning Department
12. State Elected Officials
13. Local Municipal Officials
14. National Association for the Advancement of Colored People (NAACP)
15. Chester City Council
16. Pennsylvania Resource Council
17. Chester, Ridley & Crum Creek Watershed Association
18. Chester Water Authority (CWA)
19. Delaware County Public Relations Department

20. Delaware Riverkeeper
21. PA Sea Grant
22. Delaware County Council
23. Delaware County Chamber of Commerce
24. Industrial Contributors
25. Chester Business Association

The contact information for the stakeholders will be maintained accurately in a database throughout the project. The potential stakeholders will be identified by DELCORA and the Engineering and Program Management Consultant.

3.3 Meeting Site, Format and Time

Meetings will convene in a meeting room at a predetermined and mutually agreed upon location. The location of the meeting will be coordinated with the Stakeholder member(s). Some of these meetings will also be held at DELCORA's Western Regional Treatment Plant (WRTP). DELCORA will chair each meeting and provide an update on the progress and status of current issues. The following public participation team members from DELCORA may be present at the meetings:

1. Bob Willert – Executive Director
   a. Email: willertr@delcora.org
   b. Contact Number: 610-876-5523 ext. 110

2. Ed Bothwell – Director of Engineering
   a. Email: bothwelle@delcora.org
   b. Contact Number: 610-876-5523 ext. 216

3. Michael DiSantis – Director of Operations & Maintenance
   a. Email: disantism@delcora.org
   b. Contact Number: 610-876-5523 ext. 264

4. Robert Powell – Business Development & Strategic Planning Manager
   a. Email: powellr@delcora.org
   b. Contact Number: 610-876-5523 ext. 127

5. John Pileggi – Controller
   a. Email: pileggij@delcora.org
   b. Contact Number: 610-876-5523 ext. 118

The meeting will then be opened for discussion, questions, and comments. DELCORA will provide the stakeholder an opportunity to sign-up to receive updates on the project and information covering items like agenda and educational materials.

Following each meeting, a brief summary of the meeting will be prepared and distributed to all participants.

Section 4 Public Information Plan

4.1 Notices and Advertisements

To encourage public awareness of, and involvement in, the public meetings, notifications and background information will be made available to the public at least three (3) days prior to each meeting as required by Pennsylvania's Sunshine Act (provided herein as Attachment C). Access to public information will be provided as required by the Pennsylvania Right-to-Know Law Act 3 of 2008 (provided herein as Attachment D).

Sample copies of Public Education and Outreach Materials have been provided under Attachments B1, B2, B3 and B4. These material samples include Stakeholders' powerpoint presentation, public education brochures, newspaper press release and a sample screen shot of what the DELCORA's CSO LTCPU website may look like.

Announcements will be communicated to the public through the following media devices:

- Local Newspapers: Advance notices of public meetings will be published in at least four local newspapers in accordance with Pennsylvania's Sunshine Act (see Section 2.8).

- Internet Websites: Notices of the public meetings will also be placed on DELCORA's website with a CSO LTCPU Link (www.delcora.org).

- Notice by Mail: A list of citizens and representatives of businesses, interest groups, federal government, local government, regulatory agencies, neighboring jurisdictions, and inter-jurisdictional agencies will be developed and accumulated as the study progresses. Any person or group who provided a name and address will be added to the list. Persons on the mailing list will be sent special notices of upcoming public meetings, as well as the responsiveness summaries for each meeting.

4.2 Public Education and Involvement

A concerted effort will be made to make the public aware of the CSO LTCPU development process and to actively involve and educate them about CSO issues through the following media:

1. Updates and Educational Material in Sewer Bills – A public meeting notice will be prepared and this mailing insert will be included in sewer bills mailed out to DELCORA customers.

The topics discussed in the mailing insert will be as follows:

- Definition of combined sewers and how they function
- Explanation of the LTCPU development effort
- Invitation for the public to become involved and provide input
- Illustration of how a combined sewer system functions
- Reporting of any dry weather overflows
- The role of littering in causing dry weather overflows
- Illustrations of how a CSO regulator structure functions during dry and wet weather

2. CSO Website – DELCORA will create a special section of its Internet website devoted exclusively to CSO issues. This section of the website will be called "Combined Sewer System". The website will include information on the nature of CSOs, maps showing the location of outfalls, descriptions of the LTCPU development process, CSO monitoring results, information on pollution prevention, ways in which the public can get involved, previous meeting responsiveness summaries, and an option to post comments or questions on the program. Notices for public meetings will also be posted on the website. The website will provide a means to sign up to receive any newsletters. A downloadable copy of the newsletter will be uploaded to the CSO website as well.

3. CSO Newsletters – Project updates will be sent out to the mailing list created through the first public meeting, as well as subsequent requests from the public and interested stakeholders. The mailing lists will be developed using the sign-in sheets and also all the billed customers. The sign-in sheet will include a means to opt for a preferred method for receiving or not newsletters. The preferred options would be a digital copy by email or a hardcopy by mail. The topics discussed in these newsletters will include the following:

   - Explanation of combined sewers, CSO's, and the LTCPU process
   - Schedule for public meetings
   - Netting system demonstration project
   - Monitoring program update and illustration

4. Handouts - For each public meeting and stakeholder meeting, handouts will be prepared regarding information presented. These handouts will be made available to everyone who attends. These handouts will be designed for the general audience and serve to provide an overview of the LTCP update. These documents will provide information on the history, background, and approach taken by DELCORA to control CSOs, and will include information on how members of the public and interested

stakeholders can actively provide input and/or comments. These documents will be uploaded to the CSO LTCPU section of the DELCORA website, as well.

5. Literature and Documentation – Responsiveness summaries for the public meetings will be prepared for each public meeting. These summaries will also include responses to any comments received from previous meetings. These documents will be made available at the next meeting and uploaded to the CSO LTCPU section of the DELCORA website. Literature and Documentation will also be made available by DELCORA at the following municipal building and public library locations:

DELCORA Administration Building
100 East Fifth Street
Chester, PA 19013

J. Lewis Crozer Library
620 Engle Street
Chester, PA 19013

Marcus Hook Municipal Building
1015 Green Street
Marcus Hook, PA 19061

Ridley Township Building
100 MacDade Blvd.
Folsom, PA 19033

Upland Borough Office
224 Castle Avenue
Brookhaven, PA 19015

Chester Township
1150 Engle Street
Chester, PA 19013

6. Presentations to Stakeholder Members – Presentations will be made to other selected DELCORA stakeholder members as listed below. A sample copy of this presentation has been provided herein as Attachment B1.

- Darby Creek Joint Authority
- Central Delaware County Authority
- Muckinipates Authority
- Delaware River Basin Commission

- Radnor, Haverford, Marple Authority
- Southern Delaware County Authority
- Southwest Delaware County Municipal Authority
- Middletown Township Sewer Authority
- Chester Environmental Partnership
- Department of Environmental Protection - Southeast Regional Office
- Delaware County Planning Department
- State Elected Officials
- Local Municipal Officials
- National Association for the Advancement of Colored People (NAACP)
- Chester City Council
- Pennsylvania Resource Council
- Chester, Ridley & Crum Creek Watershed Authority
- Chester Water Authority (CWA)
- Delaware County Public Relations Department
- Delaware Riverkeeper
- PA Sea Grant
- Delaware County Council
- Delaware County Chamber of Commerce
- Industrial Contributors
- Chester Business Association

Presentation materials will cover introduction and progress on the LTCPU program. The purpose of these meetings are to actively solicit input from the stakeholder members at each phase of the program and present progress in the scheduled meetings.

ATTACHMENT A

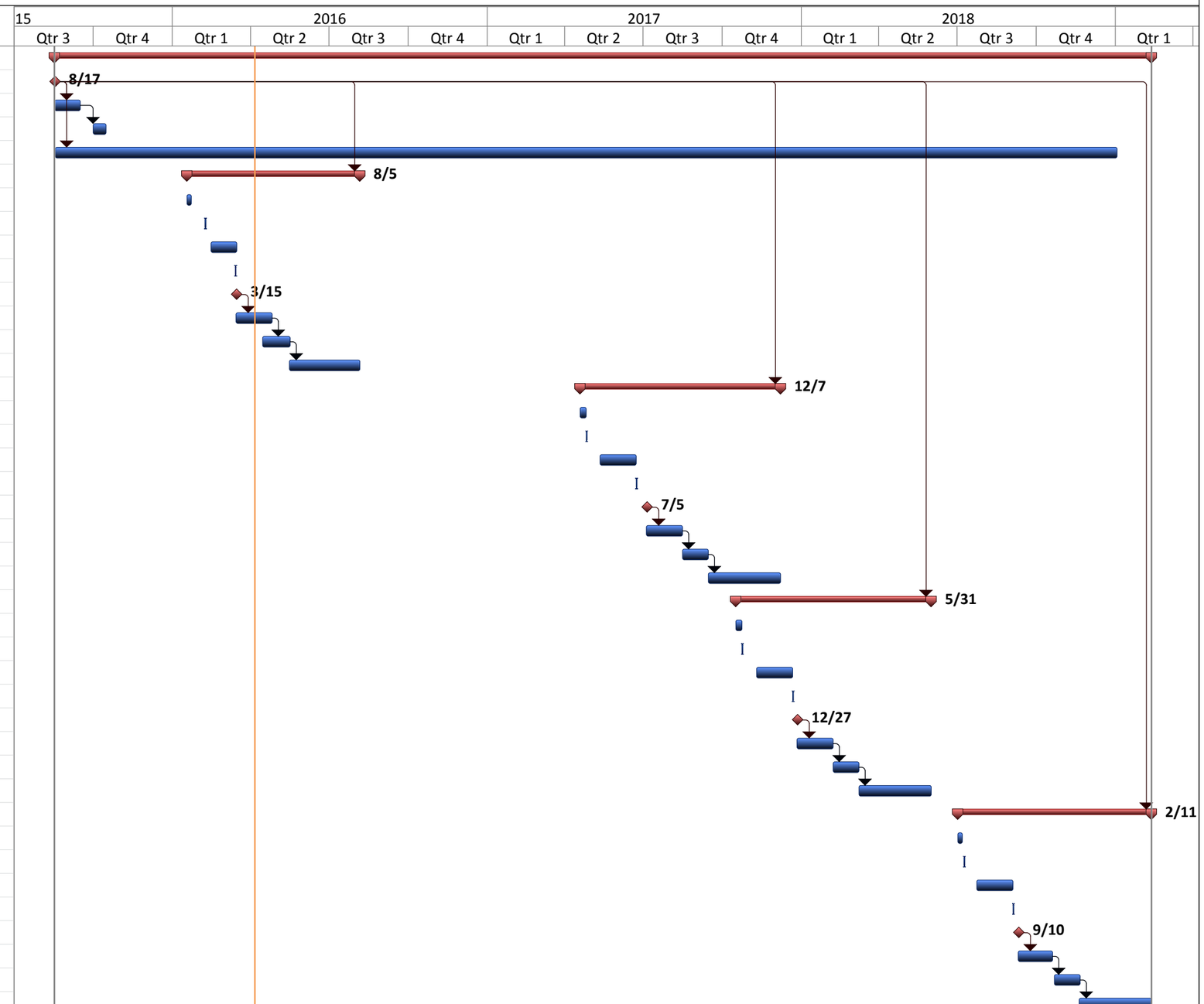
IMPLEMENTATION SCHEDULE

DELCORA

PUBLIC PARTICIPATION IMPLEMENTATION SCHEDULE

Greeley and Hansen LLC

ID	Task Name	Duration
1	**Public Participation Plan during the course of CSO LTCP**	**911 days**
2	**Consent Decree Lodging Date**	**1 day**
3	Draft Plan Development	22 days
4	Final Plan Development	11 days
5	**Stakeholder Meetings (As Required)**	882 days
6	**Public Meeting 1: Discuss Scope and Purpose of the Study**	**145 days**
7	Draft Public Notice	5 days
8	Send Notice to Paper	1 day
9	Advertise Meeting (per Pennsylvania Sunshine Act)	22 days
10	Review Documentation with DELCORA	1 day
11	**Public Meeting 1: Scope and Purpose of the Study**	**1 day**
12	Receive Public comments on website	30 days
13	Regulatory Agency Coordination and Review meeting with DELCORA	22 days
14	Address Public comments on website	60 days
15	**Public Meeting 2: System Characterization**	**167 days**
16	Draft Public Notice	5 days
17	Send Notice to Paper	1 day
18	Advertise Meeting (per Pennsylvania Sunshine Act)	30 days
19	Review Documentation with DELCORA	1 day
20	**Public Meeting 2: System characterization**	**1 day**
21	Receive Public comments on website	30 days
22	Regulatory Agency Coordination and Review meeting with DELCORA	22 days
23	Address Public comments on website	60 days
24	**Public Meeting 3: Development and Evaluation of Alternatives for CSO Controls**	**163 days**
25	Draft Public Notice	5 days
26	Send Notice to Paper	1 day
27	Advertise Meeting (per Pennsylvania Sunshine Act)	30 days
28	Review Documentation with DELCORA	1 day
29	**Public Meeting 3: Development and Evaluation of Alternatives for CSO Controls**	**1 day**
30	Receive Public comments on website	30 days
31	Regulatory Agency Coordination and Review meeting with DELCORA	22 days
32	Address Public comments on website	60 days
33	**Public Meeting 4: Selection and Implementation of the Long-Term Plan**	**161 days**
34	Draft Public Notice	5 days
35	Send Notice to Paper	1 day
36	Advertise Meeting (per Pennsylvania Sunshine Act)	30 days
37	Review Documentation with DELCORA	1 day
38	**Public Meeting 4: Selection and Implementation of the Long-Term Plan**	**1 day**
39	Receive Public comments on website	30 days
40	Regulatory Agency Coordination and Review meeting with DELCORA	22 days
41	Address Public comments on website	60 days



GREELEY AND HANSEN | Task | Milestone | Summary | Subask | Deadline | Progress

ATTACHMENT B

PUBLIC EDUCATION TOOLS AND PUBLIC OUTREACH MATERIALS

ATTACHMENT B1

DELCORA STAKEHOLDERS' PRESENTATION DATED March 15, 2016

Delaware County Regional Water Quality Control Authority
DELCORA
Delaware County, PA

Combined Sewer Overflow - Long Term Control Plan Update

DELCORA

Public Participation Meeting No. 1

LTCPU Scope and Purpose

March 15, 2016

Chester City Hall Community Room

1 E. 4th Street, Chester, PA

Public Participation Plan Goals

- DELCORA's goals and objectives for the Public Participation Program are to :
  - Inform and solicit input to its updated LTCP from stakeholders, including the public, customer communities and the regulatory agencies
  - Educate the public
  - Address public concerns

Delaware County Regional Water Quality Control Authority
DELCORA
Delaware County, PA

General Information

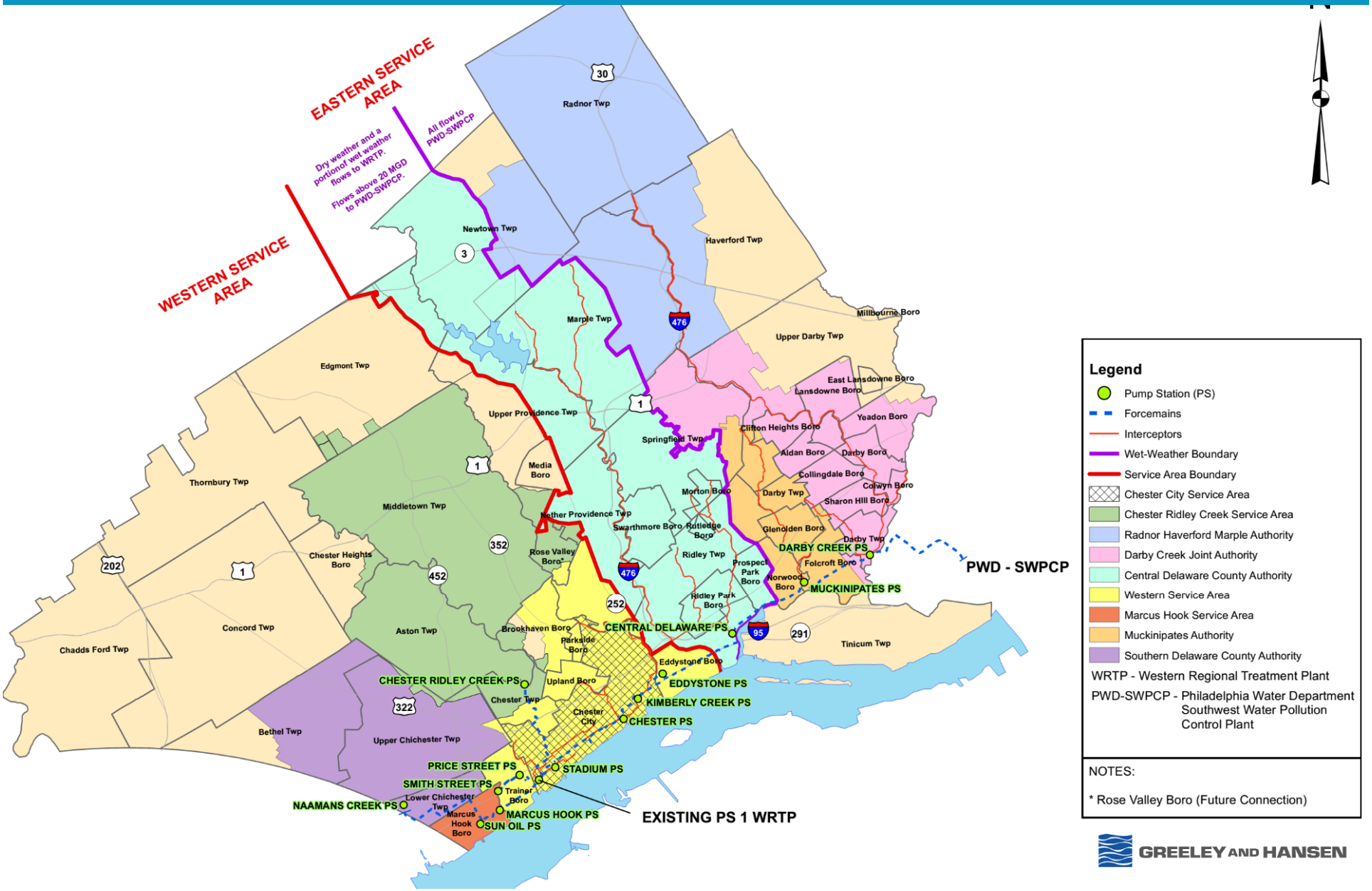
- DELCORA is the Delaware County Regional Water Quality Authority, established in 1971, responsible for collecting, conveying and treating wastewater in the greater Philadelphia Area including 42 Municipalities in Delaware and Chester County.

DELCORA Mission

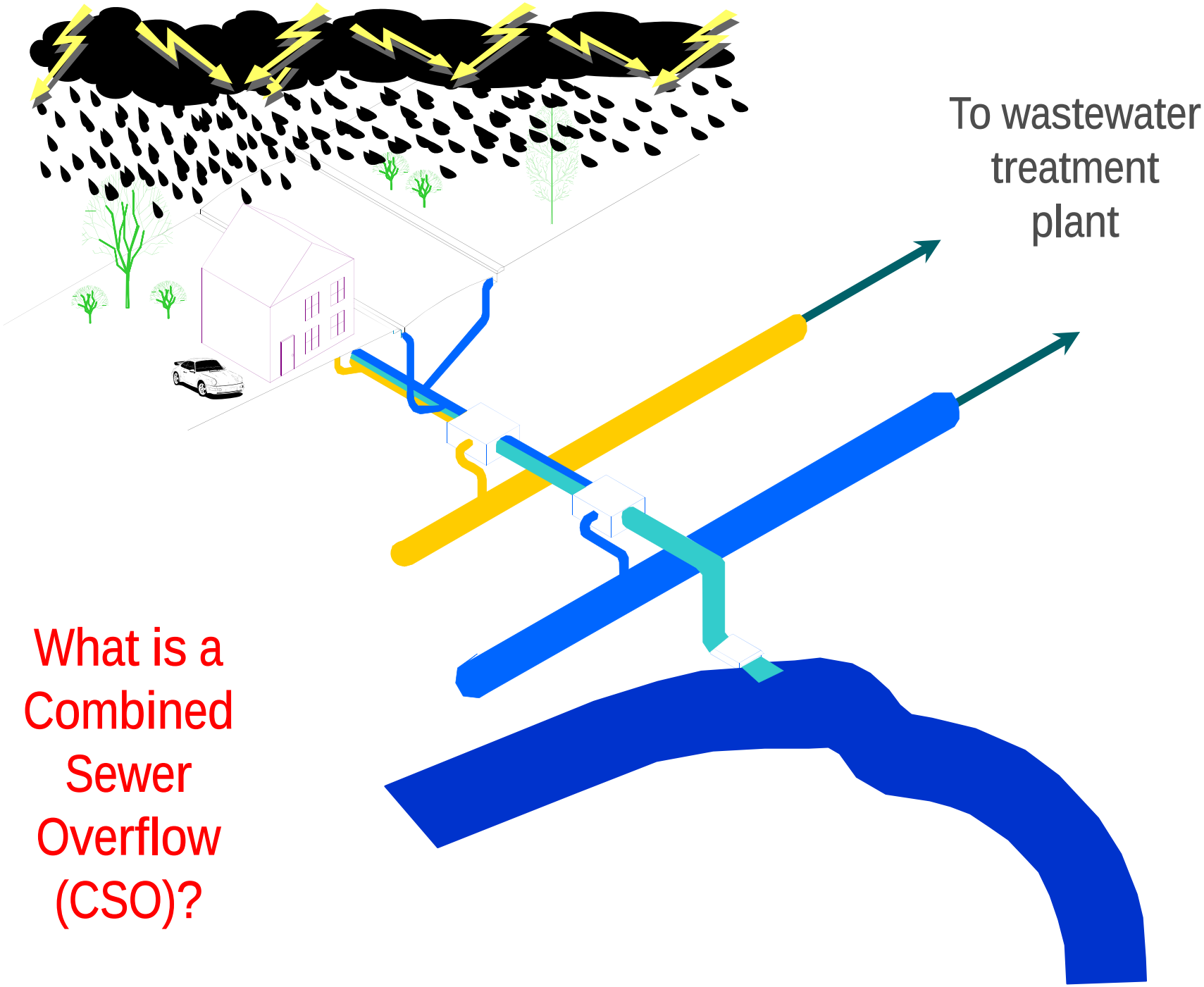
"Provide environmentally responsible and cost effective wastewater management services to the citizens, businesses, and industries of Southeastern Pennsylvania"

Delaware County Regional Water Quality Control Authority
DELCORA
Delaware County, PA

DELCORA Service Area



GREELEY AND HANSEN



What is a Combined Sewer Overflow (CSO)?

Definitions

- **LTCP:** The Long Term Control Plan is the document that lays out how DELCORA will maintain the outfalls and reduce the flow and/or treat the discharge from the outfalls to the water ways to meet the requirements of the Clean Water Act.
- **Sanitary Sewer:** The system that contains only waste from bathrooms, sinks, washers etc.
- **Storm Sewer:** Run off from streets.
- **Combined Sewer System:** Pipe that has both sanitary sewage and storm water in it.
- **Combined Sewer Overflow:** An overflow is the relief point in the combined sewer system that allows the extra flow when it rains to be discharged directly to streams and rivers.
- EPA: United States Environmental Protection Agency
- DEP: Pennsylvania Department of Environmental Protection

History of Combined Sewer System

- In the early 1900's the City of Chester's Combined Sewer System was constructed.
  - This was, at the time, a typical engineering practice in Urban areas.
- In 1971 DELCORA became the owner of the existing Sanitary and Combined Sewer System in the City of Chester.
- Discharges from CSOs are authorized through the National Pollutants Discharge Elimination System (NPDES) permit during Wet Weather Flow.

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DELCORA Combined Sewer Area

History of EPA LTCPs

- LTCP Consent Decrees/Order for various wastewater systems not only throughout Pennsylvania, but the entire country.
  - Washington DC, New York City, Richmond,
- Current Pennsylvania communities already impacted by LTCP Consent Decree Costs & Fines:
  - Williamsport
  - Scranton
  - Harrisburg
  - Pittsburgh

Delaware County Regional Water Quality Control Authority
DELCORA
Delaware County, PA

Philadelphia LTCP

- DELCORA is currently contributing to the Philadelphia LTCP.
  - Philadelphia's LTCP has an overall price tag of over $2 Billion over 25 years.
  - DELCORA's proportionate share of the Philadelphia LTCP is $178 million over 15 years due to the term of our contract with Philadelphia.

DELCORA LTCP Background

- In 1999 in response to increased environmental regulations, DELCORA implemented an LTCP for the DELCORA Combined Sewer System in the City of Chester.
- The LTCP identified capital improvements and operation and maintenance practices to reduce overflows.
- From 1999-2009 DELCORA spent in excess of $5 million on improvements and contributions to the City of Chester that resulted in decreased volume of overflows, reduced debris in overflows, provided remote monitoring of the system, and improved routine maintenance.
- In 2009, the DEP and EPA determined that DELCORA's LTCP was no longer in compliance with increased regulations of the Clean Water Act. In response, DELCORA began working with DEP and EPA to update the LTCP.

LTCP Background (Continued)

- In 2012, DELCORA submitted a revised LTCP to DEP and EPA.
- A key element in DELCORA's revised plan position was that the CSOs are only found in the City of Chester and the financial burden on the City of Chester residents must be considered.
- In 2014, DEP and EPA determined that DELCORA's revised LTCP required further evaluation and development so the Department of Justice was assigned to pursue a Consent Decree.

DELCORA Consent Decree

- The Consent Decree was agreed to by DELCORA on July 1, 2015 and signed into effect by the Dept. of Justice (DOJ) in November 2015. The Consent Decree is a legally binding agreement between DELCORA, EPA , and DEP in which DELCORA agrees to update the current LTCP.
- Generally, the Consent Decree consists of:
  - Compliance Measures
  - Milestones for plan update and implementation
  - Civil penalty
  - Stipulated penalties for non-compliance
- DELCORA has been given 42 months (3½ years) to develop a plan and 20 total years to implement the plan. When projects are complete and on-line, sewer fee charges will include costs for the updated LTCP.

Delaware County Regional Water Quality Control Authority
DELCORA
Delaware County, PA

LTCPU Summary – Where We Are

- Hired expert consultants with a good track record as well as experience specifically related to the LTCP.
  - Greeley & Hansen: Engineering Consultant for the LTCP
  - Municipal & Financial Services Group: Rate Model Consultant
  - Blank Rome: Law Firm
- 100% compliance to date with Consent Decree
  - Submitted to date :
    - Public Participation Plan
    - Hydrologic and Hydraulic Model Update and Calibration Plan
    - Typical Hydrologic Period Plan
    - Semi-Annual Report
    - Sensitive Areas and Pollutants of Concern Report
  - To be Submitted by May 17, 2016
    - Draft FCA and Alternative Evaluation Report

Financial Capability Assessment (FCA)

- The Consent Decree requires DELCORA to submit a DRAFT FCA by May 17, 2016 and FINAL FCA at the end of the project.
- Financial Capability Assessment's (FCA's) purpose is to determine the affordability of the LTCP.
- Develop fair, equitable, and legal cost share for conveyance, storage, and treatment of wet weather flows

Delaware County Regional Water Quality Control Authority
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Delaware County, PA

Financial Capability Assessment (FCA)

Financial Capability Matrix

Permittee Financial Capability Indicators Score (Socioeconomic, Debt & Financial Indicators)	Residential Indicator (Cost Per Household as a % of MHI)		
	Low (1.0% and Below)	Mid-Range (Between 1.0% and 2.0%)	High (2.0% and Above)
Weak (1.5 and Below)	Medium Burden	High Burden	High Burden
Mid-Range (Between 1.5 and 2.5)	Low Burden	Medium Burden	High Burden
Strong (2.5 and Above)	Low Burden	Low Burden	Medium Burden

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Delaware County, PA

LTCPU Summary – Next Phase

- Sampling
- Flow Monitoring and Precipitation Monitoring Installation
- Data Analysis
- Model Development
- System Characterization
- Development and Evaluation of Alternatives for CSO Controls
- Selection and Implementation of the Long-Term Plan
- Continued Public and Stakeholder Involvement

Delaware County Regional Water Quality Control Authority
DELCORA
Delaware County, PA

Future Public Meetings

- **2nd Meeting**

  Topic: System Characterization
  When: 3rd Quarter 2017
  Where: Ridley Township Municipal Building
  100 MacDade Boulevard; Folsom, PA 19033

- **3rd Meeting**

  Topic: Development and Evaluation of Alternatives for CSO Controls
  When: 4th Quarter 2017
  Where: Chester City Hall
  1 E. 4th Street; Chester, PA 19103

Delaware County Regional Water Quality Control Authority
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Delaware County, PA

Public Meetings (Continued)

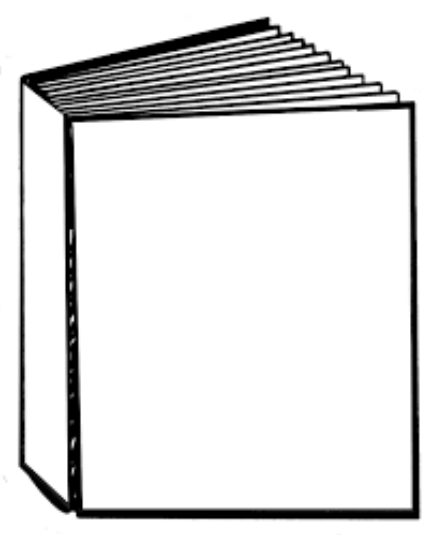
- **4th Meeting**

  Topic: Selection and Implementation of the Long-Term Plan
  When: 3rd Quarter 2018
  Where: Aston Township Administration Building
  5021 Pennell Road; Aston, PA 19014

Delaware County Regional Water Quality Control Authority
DELCORA
Delaware County, PA

Literature and Documentation

- Literature and documentation will be made available by DELCORA at the following public locations and on the DELCORA website:
  - **DELCORA Administration Building**
    100 East Fifth Street; Chester, PA 19013
  - **Lewis Crozer Library**
    620 Engle Street; Chester, PA 19013
  - **Marcus Hook Municipal Building**
    1015 Green Street; Marcus Hook, PA 19061
  - **Ridley Township Building**
    100 MacDade Blvd.; Folsom, PA 19033
  - **Upland Borough Office**
    224 Castle Avenue; Brookhaven, PA 19015
  - **Chester Township**
    1150 Engle Street; Chester, PA 19013



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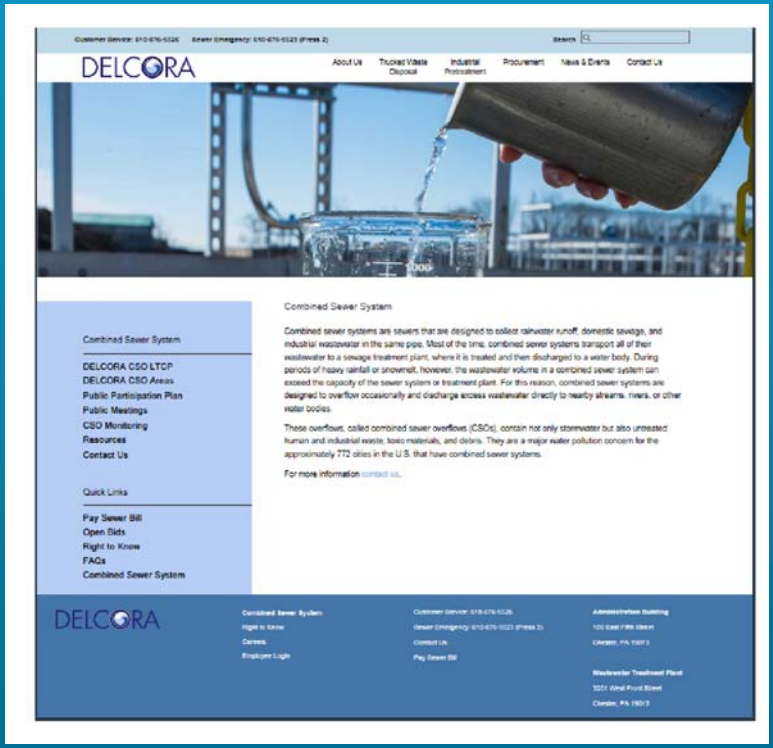
Delaware County, PA

DELCORA WEBSITE



www.delcora.org

Delaware County Regional Water Quality Control Authority
DELCORA
Delaware County, PA

CONTACT DELCORA

- Mail Address:
  - DELCORA
    P.O. Box 999
    Chester, PA 19016-0999
- Email: ltcpinfo@delcora.org
- On the WEB: www.delcora.org
- General Phone Number: 610-876-5523
- Newsletter
- Sign-Up Sheet

-Thank You-

Delaware County Regional Water Quality Control Authority
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Delaware County, PA

Discussion - Q&A

ATTACHMENT B2

PUBLIC EDUCATION BROCHURES (7 Brochures)

2011

100 East Fifth Street
P.O. Box 999
Chester, PA 19016-0999

DELCORA CSO LONG TERM CONTROL PLAN 2011

PLAN UPDATE

Community Education Series

What is a Combined Sewer Overflow (CSO)?

Some communities collect both rainwater runoff and sanitary wastewater in the same sewer. These are called "Combined Sewers". Sometimes when it rains, sewers do not have enough capacity to carry all the rainwater and wastewater and the treatment plant is not large enough to treat the total combined flow. In these situations, the combined wastewater overflows untreated into the nearest body of water, streams or rivers, creating a combined sewer overflow.

In the case of storm water from the street, whatever litter, also known as floatables, that is in the street washes into the CSO and either to the treatment plant or directly into our community's streams, rivers, and water bodies. Inlets help to keep trash and other floatables out of the sewer system.

PROGRAM ACTIVITIES

Under the current CSO Long Term Control Plant (LTCP), DELCORA provides $75,000.00 per year to the City of Chester to replace storm-water inlets. The DELCORA program will act in concert with the City's efforts to replace the inlets with a PennDOT approved type M inlet. Inlets are the openings adjacent to the roadway curb that direct stormwater runoff to the sewer system. The type M inlet is installed in the roadway. It has steel grates that prevent trash from entering the sewer.

Inlets are replaced to reduce the amount of litter and other floatables that enter the sewer system. These pollutants clog the system, causing sewer backups, and increase treatment costs by adding non-biodegradable material to the waste stream. Replacement helps keep our streams and waterways cleaner.

DELCORA also replaces the regulators in the sewer system to maximize flow to the treatment plant. Regulators direct the wastewater to the treatment plants. To date DELCORA has replaced 15 of 25 regulators.

The US Environmental Protection Agency (EPA) ordered DELCORA to update its LTCP. The new plan was submitted February 1, 2011. EPA Approval is pending. New technologies were investigated and cost estimates were prepared. It is likely that sewer rates will increase as a result.

DELCORA'S LONG TERM CONTROL PLAN

- Identifies all Combined Sewer Overflow (CSO) Locations
- Prohibits all dry weather discharges
- Requires proper operation and maintenance of all CSO flow control regulators
- Requires an Inlet Replacement Program
- Maximizes flow treated at the Plant
- Schedules replacement of all CSO regulators over a 20 year period
- Outlines a detailed monitoring and upkeep schedule of all CSO regulators
- Develops implementation for a sewer cleaning program targeting segments with the greatest CSO impact
- Requires a Public Education program. A meeting was held November 17, 2011.

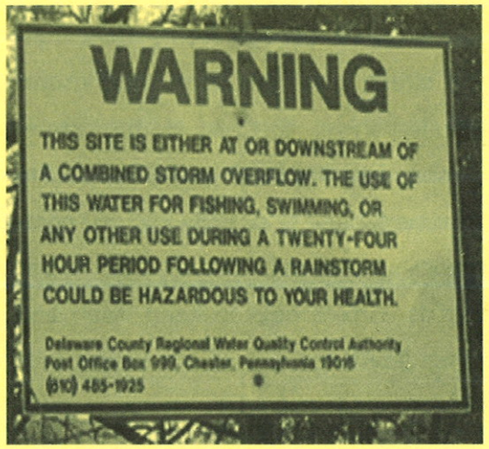
What are the benefits of the CSO Long Term Control Plan?

- A cleaner & healthier environment to live and work in.
- A planned program of level expenditures, helping to keep sewer rates stable. However, the USEPA's required update of the Plan may require more upgrades of the sewer system. It is likely that rates will increase.
- Citizen response, participation and input.
- A better citizen understanding of why the program is needed.
- Regular, monitored cleaning and repair of our sewer system.
- Improved stewardship of our water resources.

LEARN TO IDENTIFY CSO OUTFALLS

There are 28 CSO outfalls in the Chester area; thirteen drain to the Delaware River, ten to the Chester Creek and five to the Ridley Creek.

All outfalls are marked by a sign.



How you can help.

- Disconnect your downspouts from your sewer lateral.
- Don't litter! Keep trash out of sewer inlets.
- Keep grease, fats, and oils out of your drains.
- Use environment friendly cleaning agents and cleansers.
- Properly dispose of hazardous wastes.
- Dispose of prescription drugs and personal care products properly.
- Conserve your water usage.
- Learn more about CSO's.
- Remember—Clean water is everybody's business.

Want to learn more?

DELCORA welcomes and encourages your input. Additionally, tours of the treatment plant can be arranged for civic, school or church groups.

If you would like to review a complete copy of the 2011 proposed DELCORA CSO Long Term Control Plan 2011, please call or fill out the form below and mail to "Administration/CSO Information". We will gladly schedule a time during daily business hours when you can visit our Administrative offices and review the plan.

NAME_____

ADDRESS_____

_____

TELEPHONE_____

◊ I'D LIKE TO READ THE DELCORA CSO LONG TERM CONTROL PLAN.

MAIL TO:
DELCORA
ADMINISTRATION/CSO INFO.
100 EAST FIFTH STREET
PO BOX 999
CHESTER, PA 19016-0999

Phone: 610-876-5523
Fax: 610-876-2728
Email: CSOinfo@delcora.org
www.delcora.org

2004

Special thanks to the City of Lynchburg, Virginia, and Blair Communications for help with this brochure.

This brochure was prepared under Cooperative Agreement Assistance #CX824505 between the Water Environment Federation (WEF) and the U.S. Environmental Protection Agency. For more information about sewer backups, overflows, and downspout disconnection, contact your local sewer system authority, or

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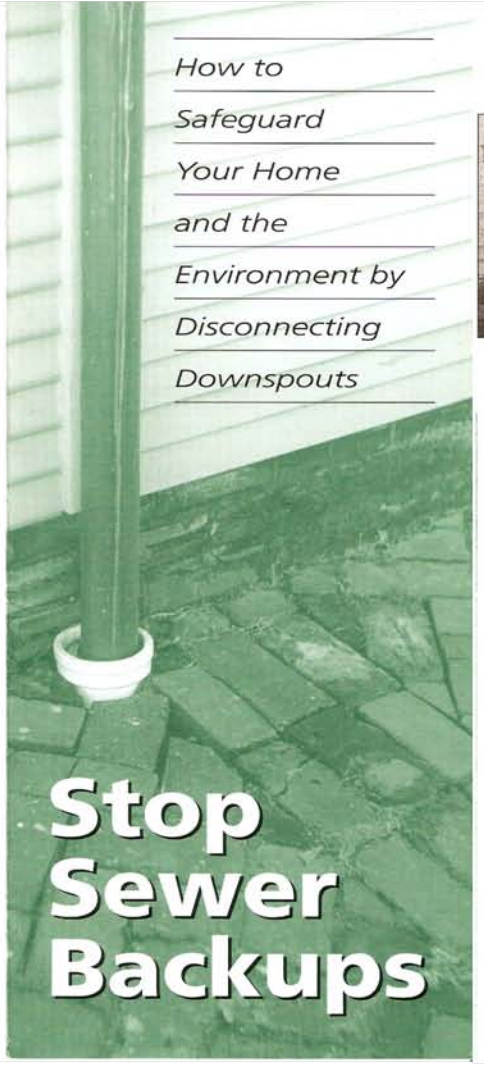


How to Safeguard Your Home and the Environment by Disconnecting Downspouts

Stop Sewer Backups

Connected downspouts — what are they?

Many older homes, especially in cities, have gutters connected directly to the sanitary sewer. This means that rain from the roof runs directly into the sewer. Not all downspouts that look like this picture are connected to the sanitary sewer; some may empty into a storm drain. Call your local sewer system authority or public works department to find out if your connected downspout empties into the sanitary sewer.

Why is this a problem?

The problem is too much water. Sanitary sewer systems can only handle a certain amount of water. During a rainstorm, water gets into the sewer from connected downspouts and other sources. When there is too much water for the system, the excess has to go somewhere, and that somewhere is often somebody's basement, a manhole, or a nearby creek or river. Municipalities have a legal requirement to stop water from overflowing out of sewers. Even if the water does not overflow, it's still a problem, because the wastewater treatment plant has to treat the extra water.

Why should you care?

Sewage backups and overflows are messy, costly, and a threat to health and the environment.

Cleaning house. When there is a sewer backup into a house, the homeowner may have to pay the cost to clean up, repair damage, and replace ruined carpets and furniture. Basic homeowner's insurance often does not cover this damage (unless the policy has an added clause or "rider").

Health. Raw sewage contains microorganisms that can cause diseases such as hepatitis, giardiasis, and gastroenteritis.

Long term environmental damage. Raw sewage in streams and lakes can cause illnesses in fish, kill aquatic life, and make the water unusable for swimming, fishing, and as a drinking water source.

Higher costs mean higher utility rates. The utility ends up treating the extra water, and may even have to increase the size of the treatment plant. The utility may also have to pay fines when raw sewage is released to the environment. Increased utility costs are passed along to consumers as rate increases.

What can you do?

You should check to see whether disconnecting your home's downspouts can help solve the problem. Disconnection is usually a simple, relatively inexpensive process. The steps are shown on the inside of this brochure. Your local sewer system authority or public works department should be able to tell whether your downspouts are connected to the sanitary sewer and, if so, whether disconnection makes sense.

You can also let other people know why downspouts need to be disconnected and how sewer overflows cost the entire community.

How to Disconnect Your Downspout

Check Before You Start

The steps outlined below are general guidelines for disconnecting downspouts and do not apply in all situations. Contact your local sewer system authority or public works department to see what specific guidance is available and to obtain information on local conditions, materials, and regulations. You may want, or be required, to hire a professional contractor or plumber to do the work. In some areas, an inspection of the disconnection is also required. Be aware, too, that some municipalities discourage or prohibit downspout disconnection due to local zoning or concerns about runoff.

Use of the information provided in this brochure is voluntary. The organizations that prepared this brochure assume no responsibility for consequences arising from its use and specifically disclaim all liability for damages of any kind arising out of or resulting from the use of the information in this brochure.

1. Tools and materials you are likely to need:

- safety glasses
- work gloves
- hammer
- chisel
- hacksaw
- measuring tape
- screw driver
- trowel or other digging tools
- bucket (for concrete)
- spare gutter pipe
- splash block
- gutter "elbows" or other discharge devices
- flexible/corrugated pipe
- concrete mix (or other permanent, weatherproof sealant)
- plastic boot cap

2. Safety

Make sure that you have the safety equipment that you need, including work gloves and safety glasses. Many disconnections involve hammering and sawing which can be hazardous to your eyes. Aluminum gutters can be extremely sharp after being cut, so protect your hands with work gloves.

3. Call before digging

If you bury part of your discharge pipe, remember that even digging a shallow trench can sever a utility line. To be safe, call your local utilities (most jurisdictions have a "call before you dig" hot line) to make sure you avoid digging near service lines.

Disconnection Steps

STEP 1 — Remove downspout from boot

Unless your gutter downspout can be easily lifted out of the boot, you'll need to cut it just a few inches above the boot—making sure that you've left enough room for the downspout "elbow" or other end-of-pipe device.

© Blair Communications

© Blair Communications

STEP 2 — Remove the boot (Optional)

You can leave the boot in place, or remove the boot for a more finished look. To remove the boot, cut it with a hacksaw, or hammer and chisel. Be sure to wear safety glasses, and remove sharp edges that remain on the pipe after cutting.

STEP 3 — Seal the boot

The boot must be permanently sealed to keep water from entering the sewer line. There are different ways to seal the pipe so before proceeding, check to find out what approach is recommended for your area. Some jurisdictions suggest the following method:

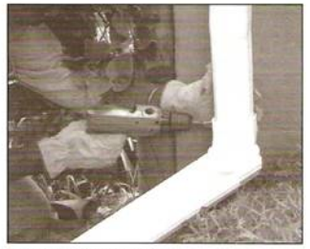
© Blair Communications

The pipe can be sealed with concrete or other material that makes a permanent, weatherproof seal. Before starting, check the pipe to make sure that you will not block any other junction (such as your washing machine draining into the same pipe). Then push balled-up newspaper tightly three or four inches down into the boot. Make sure that the fit is snug, otherwise the concrete could actually block the sewer. Carefully pour the concrete or other material that gives a permanent weatherproof seal into the pipe, and smooth the top surface.

Other areas do not recommend using newspaper and suggest the use of friction or sewer plugs, which are often available from licensed contractors.

STEP 4 — Redirect rainwater with end-of-pipe device(s)

The last step is to redirect the rainwater away from the house. The exact approach depends on individual conditions. It is important that the rainwater discharges a safe distance from your foundation (three or four feet is usually enough), that the runoff is not a nuisance to your neighbors, or causes other problems, like discharging across a sidewalk so that ice forms in the winter.



© Blair Communications

Sometimes all that is needed is an "elbow" pipe to the bottom of the gutter downspout and a plastic or concrete splashblock. Other situations (such as sloping ground) may require a different solution. There are a number of devices available designed to channel the rainwater away from your home (ask a hardware store to recommend the best one for your needs).

Check with your local sewer system authority or public works department for other redirection options in your area.

Disconnection is usually a simple, relatively inexpensive process.

Special Situations

Steep Slopes

© Blair Communications

If the gutter is next to a steep slope, be careful that the discharge from the new downspout will not wash away soil on the hillside. There are two ways to avoid this: attach a pipe long enough to drain the rainwater to a safe area, or install an attachment that controls how fast water comes out of the gutter. Always make sure that you are not draining water onto a neighbor's property and that runoff from your downspouts does not cause erosion or flooding of your neighbor's yard. Do not discharge stormwater too close to your property line.

© Blair Communications

Extended Boot

Some older homes have boots that extend several feet above the ground. You can leave the boot in place and permanently seal the top of the pipe (step 3) or you can remove the tall boot. If you remove the boot, you will usually need to install a new section of gutter pipe and then an end-of-pipe device (step 4).

Inadequate Drainage

Some gutters may be located on very flat ground with no place for the water to drain. One solution is to pipe the water safely away from the house with a pipe attached to the downspout's "elbow." Another option is to use a device that will disperse the water enough so that it doesn't form a puddle. Make sure that it is draining away from your foundation.

2006

- ✓ **Look for and check your** *sewer cleanout.* The cleanout usually is a small pipe, about 4 inches in diameter, outside your house or business that is used to access the service lateral for cleaning the sewer line. You can find it near the house, where the service lateral comes out, and/or near the street, where the service lateral connects to the main sewer line. Make sure the cap to the cleanout pipe is on and has not been damaged by a lawn mower or something else. Replace missing caps; otherwise, rain can get into the sewer line, causing it to overflow.

- ✓ **Avoid pouring grease down your sink.** When the grease cools in the sewer line, it can form clogs and blockages, which then can cause the sewer to overflow or back up into buildings. The grease also can contribute to restricted flow in your home plumbing and service laterals, resulting in costly repairs.

- ✓ **Avoid planting trees and shrubs above or near the service lateral** that runs from your building to the street. Roots can enter and clog sewers, causing them to back up and overflow.

- ✓ **Learn about your local sewer system.** Contact your local sewer authority or department of public works, and ask them to describe how the system works. Ask for the general location of the main sewer lines and treatment plant(s) and what type of monitoring is being conducted to detect SSOs.

- ✓ **Support local programs that aim to improve the way your sanitary sewer system is maintained and operated.** Proper operation and maintenance of the sanitary sewer system are key to preventing the damage caused by SSOs and prolong the life of the sewer system, saving taxpayer dollars.

This brochure is provided by Citizens Environmental Research Institute and funded by the U.S. Environmental Protection Agency, Cooperative Agreement Assistance I.D. No. CX824853-01. For more information about SSO's contact:

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Chester, PA 19016-5523
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DELCORA

TOP SEVEN TERMS FOR BETTER UNDERSTANDING SSOs:

1. *INFILTRATION.* The water entering a sanitary sewer system through pipe joints, line breaks or cracks.

2. *INFLOW.* Rainwater from roofs, pavements, yards, manholes, and manhole covers that flows directly into a sanitary sewer.

3. *SERVICE LATERAL.* The sewer pipe that connects a house or other building to the main sewer line in the street.

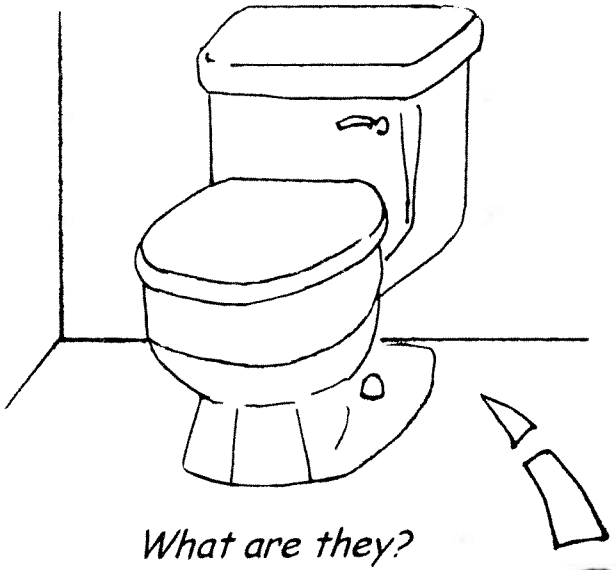
4. *SEWER CLEANOUT.* A small pipe with a cap, located near the place in a house or other building where the service lateral enters. The cleanout is used to free blockages that may form in the service lateral.

5. *PATHOGENS.* Organisms in raw sewage that cause diseases, including choiera, dysentery, hepatitis, and gastroenteritis.

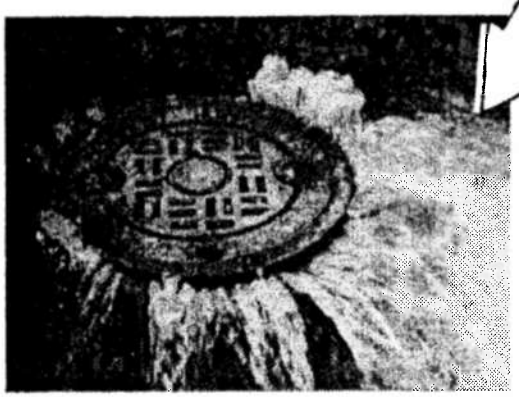
6. *MANHOLE & MANHOLE COVER.* A structure, usually found in a street, parking area, or sidewalk, that is used to provide access to the main underground sewer lines.

7. *COLLECTION SYSTEM.* The series of progressively larger pipes through which sewage is carried from homes and businesses to a treatment plant. The collection system includes service laterals and the main sewer lines.

SANITARY SEWER OVERFLOWS



What are they?
Why are they a problem?
What can we do about them?

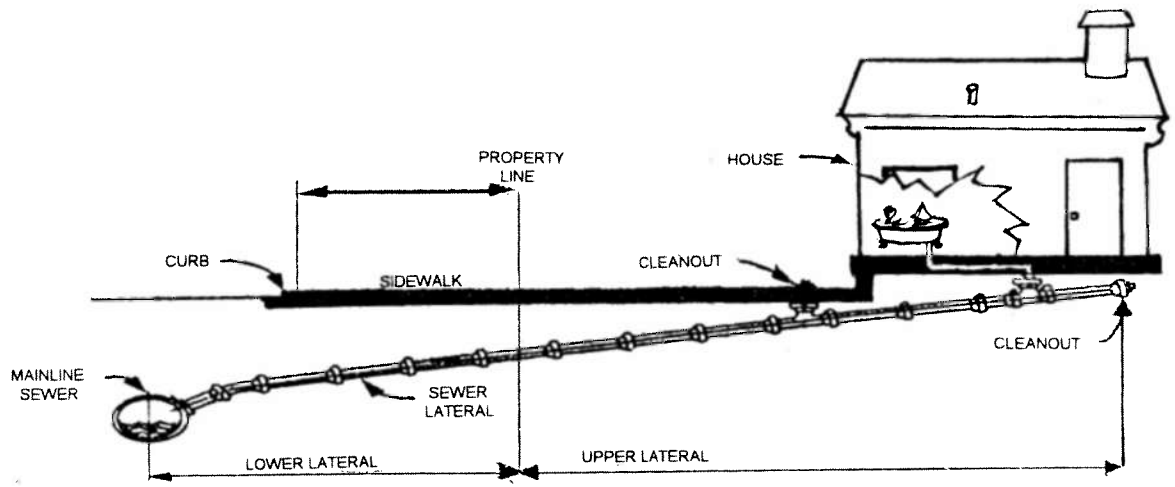


A Citizens Guide

What is a Separate Sanitary Sewer and what is its purpose?

A *Separate Sanitary Sewer* collects and carries household and industrial sewage from individual buildings such as homes and commercial businesses through a series of progressively larger sewer pipes called the *collection system*. A *separate* sanitary sewer system is different from a *combined* system, which carries sewage and storm water runoff together. Separate sanitary sewer systems are not designed to carry rain water.

The primary purpose of a separate sanitary sewer is to protect public health and the environment. Raw sewage contains disease-causing organisms, which can make people sick if they become directly exposed. Raw sewage also can contain toxic chemicals and offensive odors. The sanitary sewer system carries the raw sewage away from homes and businesses to a treatment plant, where most of the harmful organisms are destroyed, odors are controlled, and the level of toxic chemicals is reduced.

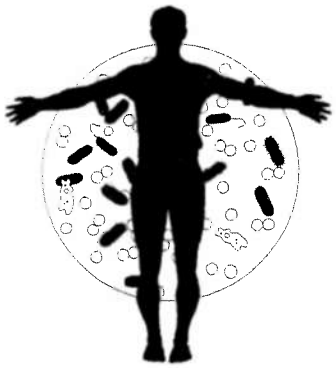


Service lateral, upper and lower lateral boundaries, and typical lateral components.

United States Environmental Protection Agency, Seminar Publication, *National Conference on Sanitary Sewer Overflows*, April 24-26, 1995, Washington, D.C.

Why are Sanitary Sewer Overflows a public health, environmental and economic problem?

Sanitary Sewer Overflows (SSOs) occur when raw or partially diluted sewage is discharged from a sewer collection system before it reaches the sewage treatment plant. SSOs threaten public health because they can cause people to be directly exposed to disease-causing germs called *pathogens*, such as *E. coli* and *Cryptosporidium*, which are present in sewage. SSOs also can have negative impacts on the natural environment, causing poor water quality in lakes, rivers and streams, and polluting groundwater, which may be used for drinking water purposes. SSOs can cause economic damage as well, hurting water-dependent businesses, such as commercial fishing and tourism. SSOs that result in basement flooding not only are unhealthy, but also are extremely unpleasant and costly to clean up. Where these chronically occur, property values may be reduced.



How might you be contributing to the problem of SSOs?

Many property owners are not aware that the maintenance of the sewer line connection between a home or a business (i.e. "upper lateral" in figure) and the main sewer line in the street usually is their responsibility. When poorly constructed or improperly maintained, these connections, called *service laterals,* frequently cause raw sewage to back up in basements.

The connection of roof-gutter downspouts or sump-pump drains directly to the service lateral adds excess water to the main sewer lines, and can contribute to raw sewage being discharged into the streets (**SSO**) and other public areas. Homes and small businesses, such as restaurants, can contribute to SSOs by disposing grease into the sewer line. When grease cools, it can form blockages, which then cause the sewer to overflow.

What should you do when you identify an SSO?

Make sure that people are kept away from the area of the overflow, typically a *manhole* cover. This is especially important for children and pets who may play near the overflow area (e.g. street, public park, or local stream). Report the sewer overflow immediately to the local health department, the sewer operator, and the state environmental agency. Precautions then can be taken by them to reduce the risk of public exposure to raw sewage by monitoring the impact of the overflow and ensuring proper cleanup.

What can you do to prevent and reduce SSOs?

You can prevent and reduce SSOs if you:

- ✓ **Make sure the basement sump pump does not connect to your sewage drain pipes or to a sink or floor drain in your basement.** Such connections are illegal. The water from these pumps can overload the sewer, causing it to overflow raw sewage into a stream, the street, or someone else's basement.

- ✓ **Inspect the gutters** on your house or business to see if the downspout connects to a sewer line. Such connections are illegal in many communities. **If the gutters are connected to the sewer line, have them disconnected—the runoff water from the roof can contribute to an SSO.**

2008

What Restaurant and Building Owners Need to Know About Grease Traps or Interceptors

Restaurants, large buildings, such as apartment complexes; and other commercial establishments may have grease traps or interceptors that keep grease out of the sewer system. For a grease trap or interceptor to work correctly, it must be properly

1. **Designed (sized and manufactured to handle the amount that is expected),**
2. **Installed (level, vented, etc.), and**
3. **Maintained (cleaned and serviced on a frequent basis).**

Solids should never be put into grease traps or interceptors. Routine, often daily, maintenance of grease traps and interceptors is needed to ensure that they properly reduce or prevent blockages.

Be cautious of chemicals and additives (including soaps and detergents) that claim to dissolve grease. Some of these additives simply pass grease down pipes where it can clog the sewer lines in another area.

This brochure was prepared under Cooperative Agreement Assistance #CX824505-01-0 between the Water Environment Federation (WEF) and the U.S. Environmental Protection Agency. For more information, contact your local sewer system authority or the

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Fat-Free Sewers

How to Prevent Fats, Oils, and Greases from Damaging Your Home and the Environment

Fats, Oils, and Greases aren't just bad for your arteries and your waistline; they're bad for sewers, too.

Sewer overflows and backups can cause health hazards, damage home interiors, and threaten the environment. An increasingly common cause of overflows is sewer pipes blocked by grease. Grease gets into the sewer from household drains as well as from poorly maintained grease traps in restaurants and other businesses.

Where does the grease come from?

Most of us know grease as the byproduct of cooking. Grease is found in such things as:

- Meat fats
- Lard
- Cooking oil
- Shortening
- Butter and margarine
- Food scraps
- Baking goods
- Sauces
- Dairy products

Too often, grease is washed into the plumbing system, usually through the kitchen sink. Grease sticks to the insides of sewer pipes (both on your property and in the streets). Over time, the grease can build up and block the entire pipe.

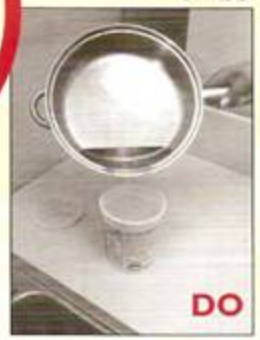
Home garbage disposals do not keep grease out of the plumbing system. These units only shred solid material into smaller pieces and do not prevent grease from going down the drain.

Commercial additives, including detergents, that claim to dissolve grease may pass grease down the line and cause problems in other areas.

© James L. Graham, Jr., P.E.

The results can be:

- Raw sewage overflowing in your home or your neighbor's home;
- An expensive and unpleasant cleanup that often must be paid for by **you, the homeowner;**
- Raw sewage overflowing into parks, yards, and streets;
- Potential contact with disease-causing organisms; and
- An increase in operation and maintenance costs for local sewer departments, which causes higher sewer bills for customers.



© NYCDEP

What we can do to help

The easiest way to solve the grease problem and help prevent overflows of raw sewage is to keep this material out of the sewer system in the first place.

There are several ways to do this.

1) Never pour grease down sink drains or into toilets.
2) Scrape grease and food scraps from trays, plates, pots, pans, utensils, and grills and cooking surfaces into a can or the trash for disposal (or recycling where available).
3) Do not put grease down garbage disposals. Put baskets/strainers in sink drains to catch food scraps and other solids, and empty the drain baskets/strainers into the trash for disposal.
4) Speak with your friends and neighbors about the problem of grease in the sewer system and how to keep it out. Call your local sewer system authority if you have any questions.

2009

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Preserving & Enhancing the Global Water Environment

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www.wef.org

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HS1802 6/2008

Drug-Free Drains

You can help protect our water from pharmaceuticals and personal care products!

You can help

protect our water from pharmaceuticals and personal care products!

Every day the average adult uses nine personal care products that contain 126 unique compounds that could end up in our water. In addition to traces of products like shampoo, toothpaste, sunscreen, and cosmetics, minute amounts of prescription and over-the-counter drugs also make their way into water. They should be limited or prevented from entering our environment.

Due to our increased use of these products and greater analytical sensitivity, very tiny amounts of compounds and drugs can be detected in conventional treatment plant outflow and end up in creeks, streams, and rivers. While there is no evidence these traces pose a risk to human health, scientists can sometimes find interference with aquatic organisms, and studies continue. Meanwhile, it's prudent to control what we put into water, and everyone's help is important.

In addition to following product recommendations for use and disposal and decreasing use when possible, you can help keep water clean by simply not flushing unused medication down the toilet! Controlling what goes down the drain is the easiest and most effective way to protect the environment, and you can start today!

Help keep our drains drug-free!

For more information on how to dispose of household products, please visit:

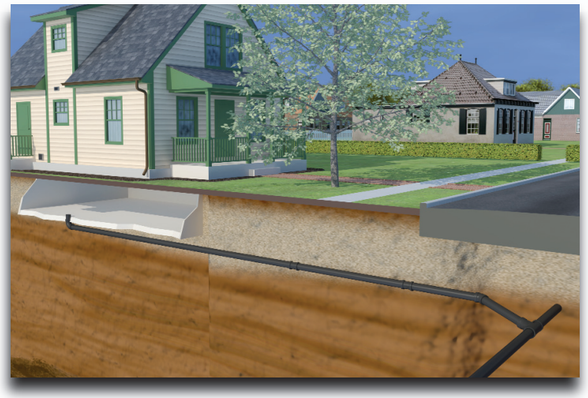
http://www.wef.org/AboutWater/ForThePublic/FactSheets/FactSheetDocuments/HouseholdWaste.htm

Visit the White House Office of National Drug Control Policy consumer guidance for the Proper Disposal of Prescription Drugs at

http://www.whitehousedrugpolicy.gov/drugfact/factsht/proper_disposal.html

Every year Delaware County residents pay millions of dollars to treat rainwater in the sanitary sewer systems!

That's tens of thousands of dollars wasted each week and it's paid for through your sewer fees!



Your sewer lateral is the pipe from your house to the sewer main in your street. You own the sewer lateral under your yard.

Leaky sewer laterals, connected downspouts, and sump pumps allow rainwater to enter the sanitary sewer system.

Once that rainwater mixes with the sewage, it must be treated at the sewage treatment plant.

You are responsible for properly maintaining your sewer lateral to stop rainwater from entering the sanitary sewer system.

A well-maintained lateral protects public health and the environment and can help you save money.

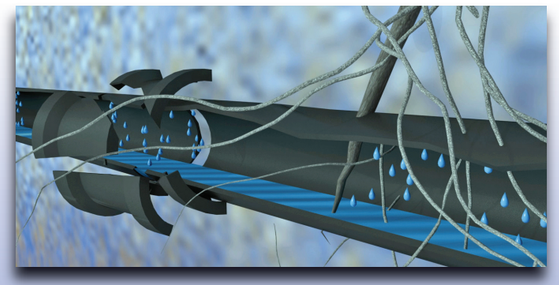
Sewer laterals need to be inspected periodically. If you have not inspected, repaired, or replaced your lateral, it could be failing.

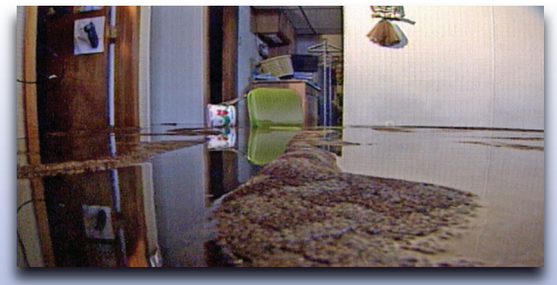
Failing laterals have old-age cracks, loose pipe joints, and tree roots, which let rainwater into the sewer system.

Rainwater also enters the lateral through connected downspouts, basement sump pumps, foundation drains, and driveway drains.

When rainwater is allowed into your lateral, the sewer mains can overload, leading to a backup of raw sewage in basements.

Sewage is foul smelling, very difficult to clean up, and it can make your family very sick. It is a nightmare if sewage backs up into a house, damaging furniture, children's toys, irreplaceable family photos, or an entertainment/recreational area.





DELCORA
100 East Fifth Street
P.O. Box 999
Chester, PA 19016-0999

Stop Throwing Money down the Drain!

How to Safeguard your Home, Community, and Environment

Sewage treatment plants are designed to treat the wastewater from the homes, businesses, and industries in your community. But when connected downspouts, sump pumps, and leaky laterals let rainwater into the system, the extra water can overload the sewage treatment facility.

If extra water overwhelms the treatment facility, raw sewage may overflow manholes into the streets.

Raw sewage may even be discharged from the treatment facility directly into streams and rivers in your community.

Raw sewage in public areas can make people very sick! And raw sewage in creeks and streams is an environmental disaster!

A qualified plumber can find problems in your sewer lateral and help find any improper connections using one of the following techniques:

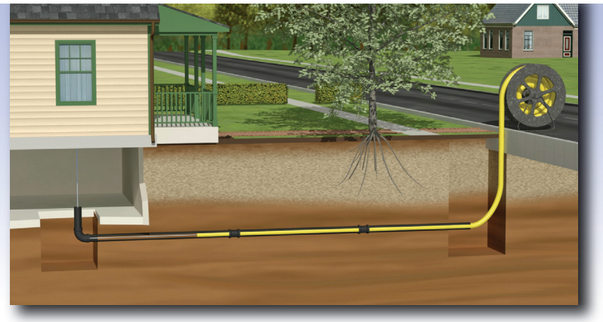
- **Visual inspection** - A special camera is pushed through your lateral. The plumber can view the lateral's interior on a video screen and see any problems.

- **Dye testing** - A non-toxic dye is dripped into locations around your house, including downspouts and the soil above the lateral. Dye appearing in nearby manholes indicates problems.

- **Smoke testing** - A special, non-toxic smoke is pumped from the sewer main into your lateral and monitored to see where the smoke appears. Smoke escaping from the pipe up through the ground indicates a break in the pipe. Smoke escaping from the downspout indicates an improper connection.

If a downspout or sump pump is connected to your lateral, you must have it disconnected.

If your lateral has cracks, loose pipe joints, or tree roots, you must have it repaired or replaced.



You can have your lateral repaired in several ways:

- **Open cut excavation** is the traditional method of digging out your lateral for removal and replacement.

- **Slip lining** (pictured left) does not require extensive excavation. A winch pulls a flexible, liner pipe into place inside your existing pipe.

- **Pipe bursting** is like slip lining except a small, metal ram is pulled through your existing pipe. The ram breaks the pipe and pushes the pieces into the soil, pulling a new pipe into place behind it.

- **CIPP (cured-in-place pipe)** involves a felt tube, saturated with glue, being inflated inside your existing damaged pipe. Once the glue has set, the felt tube liner is left in place and the repair is complete.

As laterals age without being inspected or repaired, the cost goes up to treat rainwater and the chance increases for a sewage backup in your basement.

Everyone knows how important it is to maintain your property and home. It is just as important to maintain your sewer lateral even though you cannot see it.

You must inspect your sewer lateral to ensure that you are not contributing to the problem.

The Delaware County Regional Water Quality Control Authority (DELCORA) exists to protect and improve the quality of life of our communities.

For more information, contact:

DELCORA
100 East Fifth Street
P.O. Box 999
Chester, PA 19016-0999

Or

Your Local Sewer Agency
You may find the address on your sewer bill or in the phonebook

Or watch a free video on the internet: www.delcora.org

Function of Sump Pumps & Downspouts

Rainwater can enter the basement through many sources. The job of a sump pump is to divert the water from inside your basement to a location outside of the house. A sump pump is usually installed in a sump pit which stores the water. When this water reaches a certain level, it triggers the sump pump which pumps the water back outside, away from the house. A downspout's purpose is to direct water from the roof gutters away from the house.

The Problem of Inflow

Inflow is caused by improperly connected foundation (footing) drains, sump pumps, and downspouts. Instead of directing the clear rain water outside and away from the house, it directs the water into the sanitary sewer system. Inflow is a problem because it creates an extra water burden for the sanitary sewer system, and when this system is overloaded, sewage can back up into our streets, buildings, and your home. It also means that our utility bills are higher because we are collectively paying for the unnecessary treatment of clean water!

Rules and Regulations

Inflow is a problem for all of Delaware County's communities and sanitary sewer systems. All municipalities have adopted ordinances which make it illegal to have improper connections to the sanitary sewer. Fees and other enforcement measures can be used to achieve compliance. To avoid fines make sure your sump pumps and downspouts discharge properly.

Homeowners have an impact on preventing or causing the problem of inflow. Your community and neighbors are relying on you to take responsibility for making sure that your connections are not contributing to the problem.

For more information regarding what is being done about inflow in your community, contact your local municipality or sewer author-

DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL AUTHORITY
100 EAST FIFTH STREET
CHESTER, PA 19013
WWW.DELCORA.ORG
610-876-5523

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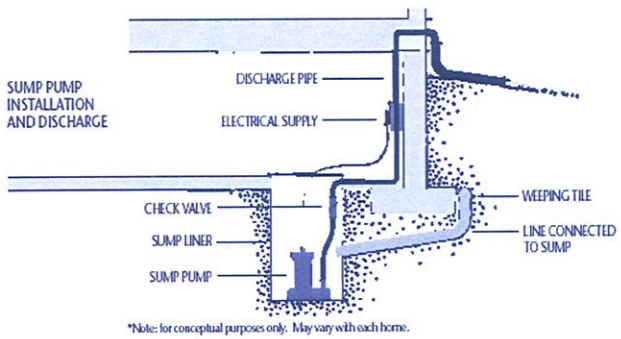
FARIBAULT COUNTY SOIL AND WATER CONSERVATION DISTRICT
BLUE EARTH, MN 56013
www.faribaultcountyswcd.com

Disconnecting & Redirecting Your Sump Pump & Downspouts

In wet weather it only takes a few improperly connected sump pumps to cause a sanitary sewer backup into basements, streets and waterways.

How Do I Know If My Sump Pump Is Improperly Connected?

Your sump pump is improperly connected to the sanitary sewer if it is connected to the drain or sink in your basement. Unless you are sure your basement drain is not connected to the sanitary sewer, your sump pump is probably improperly connected.



Proper sump pump discharge connections are to the outside of the house only!

How Do I Know If My Downspout Is Improperly Connected?

If your downspouts disappear into the ground rather than discharging into your yard, they may be connected to the sanitary sewer. While connections to the *storm* sewer are permitted, connections to the *sanitary* sewer must be disconnected and redirected.

Downspouts that look like this could be connected to the sanitary sewer.

Disconnecting Your Sump Pump

If your sump pump discharges to the sanitary system in any way, the discharge must be re-directed out of the sanitary sewer system. The change could be as simple as directing the discharge outside the house through a hose. If you aren't familiar with the work, contact a plumbing professional, your local municipality, or your sewer authority for more information.

Each household or business that redirects their stormwater out of the sanitary sewer helps solve the problem of sewage backing up into basements, streets, and waterways.

Disconnecting Your Downspout

Disconnecting your downspout from the sanitary sewer is easy to do yourself.

1. Cut the downspout, leaving enough space to insert the elbow.

2. Tightly cap the end of the pipe sticking out of the ground that leads to the sanitary sewer.

3. Attach an elbow to the end of the downspout and use an appropriate extension to direct the water away from your home.

Where Should I Direct the Flow of My Disconnected Sump Pump and Downspout?

Water should be discharged away from your house or it may seep back into your basement. It should flow to an area where it can seep into the ground or be stored for later use. Direct flow to:

Raingarden

Lawn

Trees

Rain Barrel

Never direct stormwater into a sanitary sewer or onto a neighboring property!

ATTACHMENT B3

SAMPLE PRESS RELEASE

August 18, 2015

DELCORA Enters Agreement with EPA to Invest in Major Infrastructure Improvements in City of Chester

Authority will seek to reduce overflows from City's combined wastewater system

Chester, PA - The Delaware County Regional Water Quality Control Authority (DELCORA) announced today that is has entered into a settlement agreement with the Environmental Protection Agency (EPA) to make improvements to the combined sewer and stormwater drainage system in the City of Chester to address issues related to the overflow of the system during high rain events.

Under the consent decree, negotiated in good faith by and between DELCORA and the EPA, DELCORA has 42 months to develop a long-term plan to control and reduce overflows from the City of Chester's combined sewer and stormwater system and 20 years to implement the plan. Contrary to public reports stating the project could cost up to $200 million, DELCORA said it has not determined the cost of the long-term control plan and would be unable to do so for up to another three years when development of the plan is completed.

DELCORA inherited Chester's antiquated system in 1971 when it took over the operations of wastewater treatment from the City. The system was constructed in the early 1900s and the combined sewer system – which includes one pipe that combines both sewer and stormwater runoff – was a typical engineering practice at the time in urban areas.

When DELCORA assumed control of the system in the 1970s, discharges from the system were in compliance with the agency's permits, but as new technologies have developed in recent years, the EPA has become more stringent in its interpretation of the Clean Water Act as it relates to combined sewer systems. Over the past several years, the EPA has entered into consent decrees and issued civil penalties for wastewater systems in many urban communities in Pennsylvania and across the country, including Philadelphia, Williamsport, Scranton, Harrisburg, and Pittsburgh.

Currently, the City of Philadelphia is in the process of implementing a $2 billion long-term control plan following its consent decree with the EPA. DELCORA is funding $178 million over 15 years for the improvements because part of its wastewater system flows into the City's system.

"We take our commitment to the environment and our customers very seriously," said Robert Willert, Executive Director of DELCORA. "During a 10-year period, from 1999 to 2009 DELCORA developed a long-term control plan and invested $5 million in infrastructure improvements to address the issues of overflows during rain events that impacted the combined wastewater system in Chester."

Willert said that the $5 million infrastructure investment included upgrades to regulators, which control the flow and discharge of wastewater during rain events. DELCORA also paid the City of Chester $750,000 to put in place new storm water inlets on city streets that help stop trash and debris from flowing into the combined system, which could lead to backups and the unnecessary discharge of wastewater from the system.

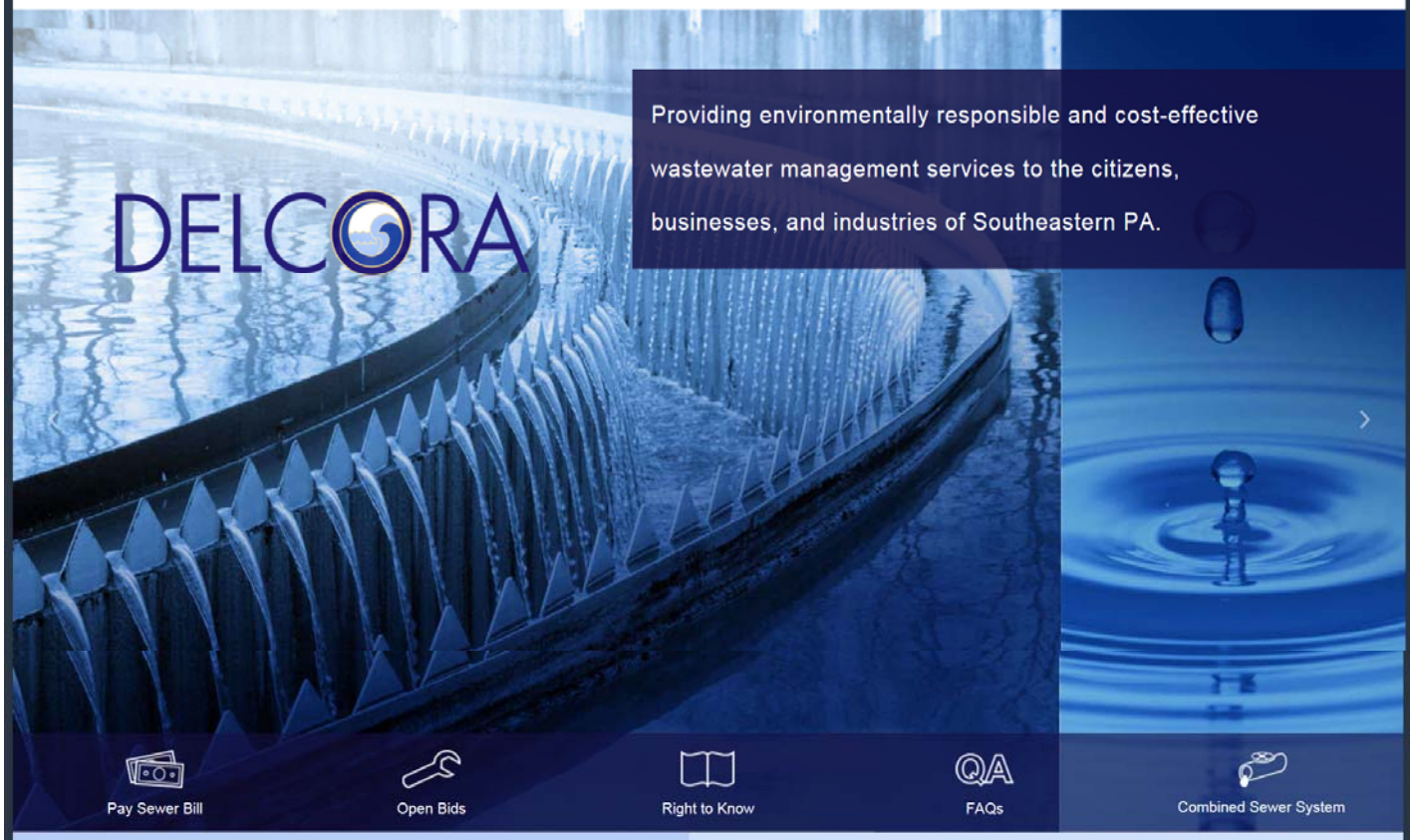
Willert noted that industrial wastewater is kept separate from the combined system and that DELCORA has worked to mitigate the problem by requiring that new projects – such as PPL Park and the reconstruction of Route 291 – divert water to a separate stormwater system that is distinct from the combined system that exists throughout most of Chester.

DELCORA has brought on a team of experts to help develop the long-term control plan, including an engineering firm that specializes in the issue of combined wastewater systems and a municipal and financial service firm to help develop a rate model for customers to fund the needed improvements. Under the consent decree with the EPA, DELCORA will also pay a $1.375 million penalty to the state and federal government.

The Delaware County Regional Water Quality Control Authority (DELCORA) is a municipal authority that owns, operates, and maintains wastewater facilities that serve approximately 500,000 people in the greater Philadelphia area, including 42 municipalities in Delaware and Chester Counties.

ATTACHMENT B4

DELCORA'S CSO LTCPU WEBSITE
(Sample Screen Shot)



About DELCORA

Delaware County residents and businesses generate over 100 million gallons of wastewater every day. This wastewater must be collected, conveyed, and treated in a safe, effective way to prevent the contamination of our community's streams, rivers, and general water supply. DELCORA has been providing this vital function to our communities for over three decades. As a result, the citizens of our region enjoy clean, healthy water.

News & Events

DELCORA Enters Agreement with EPA

August 18, 2015 Chester, PA – The Delaware County Regional Water Quality Control Authority (DELCORA) announced today that it has entered into a settlement agreement with the Environmental Protection Agency (EPA) to make improvements to the combined sewer and stormwater drainage system in the City of Chester to address issues related to the overflow of the system during [...]

Read More

Edgmont's public sewer system to be finished in fall

By Susan L. Serbin, Times Correspondent The public sewer system along the West Chester Pike and Providence Road corridors is in the final stages of construction, with activities continuing through the summer months and into the early fall. After years on a wish list, supervisors put into action a comprehensive plan for a build out [...]

Read More

Administration Building
100 East Fifth Street
Chester, PA 19013

Wastewater Treatment Plant
3201 West Front Street
Chester, PA 19013

Combined Sewer System

DELCORA CSO LTCP
DELCORA CSO Areas
Public Participation Plan
Public Meetings
CSO Monitoring
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FAQs
Combined Sewer System

Combined Sewer System

Combined sewer systems are sewers that are designed to collect rainwater runoff, domestic sewage, and industrial wastewater in the same pipe. Most of the time, combined sewer systems transport all of their wastewater to a sewage treatment plant, where it is treated and then discharged to a water body. During periods of heavy rainfall or snowmelt, however, the wastewater volume in a combined sewer system can exceed the capacity of the sewer system or treatment plant. For this reason, combined sewer systems are designed to overflow occasionally and discharge excess wastewater directly to nearby streams, rivers, or other water bodies.

These overflows, called combined sewer overflows (CSOs), contain not only stormwater but also untreated human and industrial waste, toxic materials, and debris. They are a major water pollution concern for the approximately 772 cities in the U.S. that have combined sewer systems.

For more information contact us.

Administration Building
100 East Fifth Street
Chester, PA 19013

Wastewater Treatment Plant
3201 West Front Street
Chester, PA 19013

ATTACHMENT C

PENNSYLVANIA SUNSHINE ACT

Provided by the Pennsylvania Freedom of Information Coalition
www.pafoic.org

As amended September 5, 2011

Pennsylvania's Sunshine Act

Act of October 15, 1998, P.L. 729, No. 93
as amended by Act of July 15, 2004, P.L. 743, No. 88
As amended by Act of June 30, 2011, No. 56

65 Pa.C.S.A. § 701 et seq.

An act requiring public agencies to hold certain meetings and hearings open to the public; and providing penalties.

TABLE OF CONTENTS

Section 701. **Short title of chapter**
Section 702. **Legislative findings and declarations**
Section 703. **Definitions**
Section 704. **Open meetings**
Section 705. **Recording of votes**
Section 706. **Minutes of meetings, public records and recording of meetings**
Section 707. **Exceptions to open meetings**
Section 708. **Executive sessions**
Section 709. **Public notice**
Section 710. **Rules and regulations for conduct of meetings**
Section 710.1. **Public participation**
Section 711. **Use of equipment during meetings**
Section 712. **General Assembly meetings covered**
Section 713. **Business transacted at unauthorized meeting void**
Section 714. **Penalty**
Section 714.1. **Attorney fees**
Section 715. **Jurisdiction and venue of judicial proceedings**
Section 716. **Confidentiality**

The General Assembly of the Commonwealth of Pennsylvania hereby enacts as follows:

Section 701. Short title of chapter

This chapter shall be known and may be cited as the Sunshine Act.

Section 702. Legislative findings and declaration

(a) **Findings.** The General Assembly finds that the right of the public to be present at all meetings of agencies and to witness the deliberation, policy formulation and decisionmaking of agencies is vital to the enhancement and proper functioning of the democratic process and that secrecy in public affairs undermines the faith of the public in government and the public's effectiveness in fulfilling its role in a democratic society.

(b) **Declarations.** The General Assembly hereby declares it to be the public policy of this Commonwealth to insure the right of its citizens to have notice of and the right to attend all meetings of agencies at which any agency business is discussed or acted upon as provided in this chapter.

Section 703. Definitions

The following words and phrases when used in this chapter shall have the meanings given to them in this section unless the context clearly indicates otherwise:

"Administrative action." The execution of policies relating to persons or things as previously authorized or required by official action of the agency adopted at an open meeting of the agency. The term does not, however, include the deliberation of agency business.

"Agency." The body, and all committees thereof authorized by the body to take official action or render advice on matters of agency business, of all the following: the General Assembly, the executive branch of the government of this Commonwealth, including the Governor's Cabinet when meeting on official policymaking business, any board, council, authority or commission of the Commonwealth or of any political subdivision of the Commonwealth or any State, municipal, township or school authority, school board, school governing body, commission, the boards of trustees of all State-aided colleges and universities, the councils of trustees of all State-owned colleges and universities, the boards of trustees of all State-related universities and all community colleges or similar organizations created by or pursuant to a statute which declares in substance that the organization performs or has for its purpose the performance of an essential governmental function and through the joint action of its members exercises

governmental authority and takes official action. The term shall include the governing board of any nonprofit corporation which by a mutually binding legal written agreement with a community college, or State-aided, State-owned or State-related institution of higher education is granted legally enforceable supervisory and advisory powers regarding the degree programs of the institution of higher education. The term does not include a caucus or a meeting of an ethics committee created under rules of the Senate or House of Representatives.

"Agency business." The framing, preparation, making or enactment of laws, policy or regulations, the creation of liability by contract or otherwise or the adjudication of rights, duties and responsibilities, but not including administrative action.

"Caucus." A gathering of members of a political party or coalition which is held for purposes of planning political strategy and holding discussions designed to prepare the members for taking official action in the General Assembly.

"Conference." Any training program or seminar, or any session arranged by State or Federal agencies for local agencies, organized and conducted for the sole purpose of providing information to agency members on matters directly related to their official responsibilities.

"Deliberation." The discussion of agency business held for the purpose of making a decision.

"Emergency meeting." A meeting called for the purpose of dealing with a real or potential emergency involving a clear and present danger to life or property.

"Executive session." A meeting from which the public is excluded, although the agency may admit those persons necessary to carry out the purpose of the meeting.

"Litigation." Any pending, proposed or current action or matter subject to appeal before a court of law or administrative adjudicative body, the decision of which may be appealed to a court of law.

"Meeting." Any prearranged gathering of an agency which is attended or participated in by a quorum of the members of an agency held for the purpose of deliberating agency business or taking official action.

“Official action.”

(1) Recommendations made by an agency pursuant to statute, ordinance or executive order.

(2) The establishment of policy by an agency.

(3) The decisions on agency business made by an agency.

(4) The vote taken by any agency on any motion, proposal, resolution, rule, regulation, ordinance, report or order.

“Political subdivision.” Any county, city, borough, incorporated town, township, school district, intermediate unit, vocational school district or county institution district.

”Public notice.”

(1) For a meeting:

(i) Publication of notice of the place, date and time of a meeting in a newspaper of general circulation, as defined by 45 Pa.C.S. Â§ 101 (relating to definitions), which is published and circulated in the political subdivision where the meeting will be held, or in a newspaper of general circulation which has a bona fide paid circulation in the political subdivision equal to or greater than any newspaper published in the political subdivision.

(ii) Posting a notice of the place, date and time of a meeting prominently at the principal office of the agency holding the meeting or at the public building in which the meeting is to be held.

(iii) Giving notice to parties under section 709(c) (relating to public notice).

(2) For a recessed or reconvened meeting:

(i) Posting a notice of the place, date and time of the meeting prominently at the principal office of the agency holding the meeting or at the public building in which the meeting is to be held.

(ii) Giving notice to parties under section 709(c).

“Special meeting.” A meeting scheduled by an agency after the agency’s regular schedule of meetings has been established.

Section 704. Open meetings

Official action and deliberations by a quorum of the members of an agency shall take place at a meeting open to the public unless closed under section 707 (relating to exceptions to open meetings), 708 (relating to executive sessions) or 712 (relating to General Assembly meetings covered).

Section 705. Recording of votes

In all meetings of agencies, the vote of each member who actually votes on any resolution, rule, order, regulation, ordinance or the setting of official policy must be publicly cast and, in the case of roll call votes, recorded.

Section 706. Minutes of meetings, public records and recording of meetings

Written minutes shall be kept of all open meetings of agencies. The minutes shall include:

(1) The date, time and place of the meeting.

(2) The names of members present.

(3) The substance of all official actions and a record by individual member of the roll call votes taken.

(4) The names of all citizens who appeared officially and the subject of their testimony.

Section 707. Exceptions to open meetings

(a) **Executive session**. An agency may hold an executive session under section 708 (relating to executive sessions).

(b) **Conference**. An agency is authorized to participate in a conference which need not be open to the public. Deliberation of agency business may not occur at a conference.

(c) **Certain working sessions**. Boards of auditors may conduct working sessions not open to the public for the purpose of examining, analyzing, discussing and deliberating the various accounts and records with respect to which such boards are responsible, so long as official action of a board with respect to such records and accounts is taken at a meeting open to the public and subject to the provisions of this chapter.

Section 708. Executive sessions

(a) **Purpose**. An agency may hold an executive session for one or more of the following reasons:

(1) To discuss any matter involving the employment, appointment, termination of employment, terms and conditions of employment, evaluation of performance, promotion or disciplining of any specific prospective public officer or employee or current public officer or employee employed or appointed by the agency, or former public officer or employee, provided, however, that the individual employees or appointees whose rights could be adversely affected may request, in writing, that the matter or matters be discussed at an open meeting. The agency's decision to discuss such matters in executive session shall not serve to adversely affect the due process rights granted by law, including those granted by Title 2 (relating to administrative law and procedure). The provisions of this paragraph shall not apply to any meeting involving the appointment or selection of any person to fill a vacancy in any elected office.

(2) To hold information, strategy and negotiation sessions related to the negotiation or arbitration of a collective bargaining agreement or, in the absence of a collective bargaining unit, related to labor relations and arbitration.

(3) To consider the purchase or lease of real property up to the time an option to purchase or lease the real property is obtained or up to the time an agreement to purchase or lease such property is obtained if the agreement is obtained directly without an option.

(4) To consult with its attorney or other professional advisor regarding information or strategy in connection with litigation or with issues on which identifiable complaints are expected to be filed.

(5) To review and discuss agency business which, if conducted in public, would violate a lawful privilege or lead to the disclosure of information or confidentiality protected by law, including matters related to the initiation and conduct of investigations of possible or certain violations of the law and quasi-judicial deliberations.

(6) For duly constituted committees of a board or council of trustees of a State-owned, State-aided or State-related college or university or community college or of the Board of Governors of the State System of Higher Education to discuss matters of academic admission or standings.

(b) **Procedure.** The executive session may be held during an open meeting, at the conclusion of an open meeting, or may be announced for a future time. The reason for holding the executive session must be announced at the open meeting occurring immediately prior or subsequent to the executive session. If the executive session is not announced for a future specific time, members of the agency shall be notified 24 hours in advance of the time of the convening of the meeting specifying the date, time, location and purpose of the executive session.

(c) **Limitation.** Official action on discussions held pursuant to subsection (a) shall be taken at an open meeting. Nothing in this section or section 707 (relating to exceptions to open meetings) shall be construed to require that any meeting be closed to the public, nor shall any executive session be used as a subterfuge to defeat the purposes of section 704 (relating to open meetings).

Section 709. Public notice

(a) **Meetings.** An agency shall give public notice of its first regular meeting of each calendar or fiscal year not less than three days in advance of the meeting and shall give public notice of the schedule of its remaining regular meetings. An agency shall give public notice of each special meeting or each rescheduled regular or special meeting at least 24 hours in advance of the time of the convening of the meeting specified in the notice. Public notice is not required in the case of an emergency meeting or a conference. Professional licensing boards within the Bureau of Professional and Occupational Affairs of the Department of State of the Commonwealth shall include in the public notice each matter involving a proposal to revoke, suspend or restrict a license.

(b) **Notice**. With respect to any provision of this chapter that requires public notice to be given by a certain date, the agency, to satisfy its legal obligation, must give notice in time to allow it to be published or circulated within the political subdivision where the principal office of the agency is located or the meeting will occur before the date of the specified meeting.

(c) **Copies**. In addition to the public notice required by this section, the agency holding a meeting shall supply, upon request, copies of the public notice thereof to any newspaper of general circulation in the political subdivision in which the meeting will be held, to any radio or television station which regularly broadcasts into the political subdivision and to any interested parties if the newspaper, station or party provides the agency with a stamped, self-addressed envelope prior to the meeting.

(d) **Meeting of the General Assembly in Capitol Complex**. Notwithstanding any provision of this section to the contrary, in case of sessions of the General Assembly, all meetings of legislative committees held within the Capitol Complex where bills are considered, including conference committees, all legislative hearings held within the Capitol Complex where testimony is taken and all meetings of legislative commissions held within the Capitol Complex, the requirement for public notice thereof shall be complied with if, not later than the preceding day:

> (1) The supervisor of the newsroom of the State Capitol Building in Harrisburg is supplied for distribution to the members of the Pennsylvania Legislative Correspondents Association with a minimum of 30 copies of the notice of the date, time and place of each session, meeting or hearing.
>
> (2) There is posting of the copy of the notice at public places within the Main Capitol Building designated by the Secretary of the Senate and the Chief Clerk of the House of Representatives.

(e) **Announcement**. Notwithstanding any provision of this chapter to the contrary, committees may be called into session in accordance with the provisions of the Rules of the Senate or the House of Representatives and an announcement by the presiding officer of the Senate or the House of Representatives. The announcement shall be made in open session of the Senate or the House of Representatives.

Section 710. Rules and regulations for conduct of meetings

Nothing in this chapter shall prohibit the agency from adopting by official action the rules and regulations necessary for the conduct of its meetings and the maintenance of order. The rules and regulations shall not be made to violate the intent of this chapter.

Section 710.1 Public participation

(a) **General rule**. Except as provided in subsection (d), the board or council of a political subdivision, or of an authority created by a political subdivision shall provide a reasonable opportunity at each advertised regular meeting and advertised special meeting for residents of the political subdivision or of the authority created by a political subdivision or for taxpayers of the political subdivision or of the authority created by a political subdivision or for both, to comment on matters of concern, official action or deliberation which are or may be before the board or council prior to taking official action. The board or council has the option to accept all public comment at the beginning of the meeting. If the board or council determines that there is not sufficient time at a meeting for residents of the political subdivision or of the authority created by a political

subdivision or for taxpayers of the political subdivision or of the authority created by the political subdivision or for both to comment, the board or council may defer the comment period to the next regular meeting or to a special meeting occurring in advance of the next regular meeting.

(b) **Limitation on judicial relief**. If a board or council of a political subdivision or an authority created by a political subdivision has complied with the provisions of subsection (a), the judicial relief under section 713 (relating to business transacted at unauthorized meeting void) shall not be available on a specific action solely on the basis of lack of comment on that action.

(c) **Objection**. Any person has the right to raise an objection at any time to a perceived violation of this chapter at any meeting of a board or council of a political subdivision or an authority created by a political subdivision.

(d) **Exception**. The board or council of a political subdivision or of an authority created by a political subdivision which had, before Jan. 1, 1993, established a practice or policy of holding special meetings solely for the purpose of public comment in advance of advertised regular meetings shall be exempt from the provisions of subsection (a).

Section 711. Use of equipment during meetings

(a) **Recording devices**. Except as provided in subsection (b), a person attending a meeting of an agency shall have the right to use recording devices to record all the proceedings. Nothing in this section shall prohibit the agency from adopting and enforcing reasonable rules for their use under section 710 (relating to rules and regulations for conduct of meetings).

(b) **Rules of the Senate and House of Representatives.** The Senate and House of Representatives may adopt rules governing the recording or broadcast of their sessions and meetings and hearings of committees.

Section 712. General Assembly meetings covered

Notwithstanding any other provision, for the purpose of this chapter, meetings of the General Assembly which are covered are as follows: all meetings of committees where bills are considered, all hearings where testimony is taken and all sessions of the Senate and the House of Representatives. Not included in the intent of this chapter are caucuses or meetings of any ethics committee created pursuant to the Rules of the Senate or the House of Representatives.

Section 713. Business transacted at unauthorized meeting void

A legal challenge under this chapter shall be filed within 30 days from the date of a meeting which is open, or within 30 days from the discovery of any action that occurred at a meeting which was not open at which this chapter was violated, provided that, in the case of a meeting which was not open, no legal challenge may be commenced more than one year from the date of said meeting. The court may enjoin any challenged action until a judicial determination of the legality of the meeting at which the action was adopted is reached. Should the court determine that the meeting did not meet the requirements of this chapter, it may in its discretion find that any or all official action taken at the meeting shall be invalid. Should the court determine that the meeting met the requirements of this chapter, all official action taken at the meeting shall be fully effective.

Section 714. Penalty

(a) **Fines and costs.** Any member of any agency who participates in a meeting with the intent and purpose by that member of violating this chapter commits a summary offense and shall, upon conviction, be sentenced to pay:

(1) For a first offense, the costs of prosecution plus a fine of at least $100 and, in the discretion of the sentencing authority, of not more than $1,000.

(2) For a second or subsequent offense, the costs of prosecution plus a fine of at least $500 and, in the discretion of the sentencing authority, of not more than $2,000.

(b) **Payment.** An agency shall not make a payment on behalf of or reimburse a member of an agency for a fine or cost resulting from the member's violation of this section.

Section 714.1. Attorney fees

If the court determines that an agency willfully or with wanton disregard violated a provision of this chapter, in whole or in part, the court shall award the prevailing party reasonable attorney fees and costs of litigation or an appropriate portion of the fees and costs. If the court finds that the legal challenge was of a frivolous nature or was brought with no substantial justification, the court shall award the prevailing party reasonable attorney fees and costs of litigation or an appropriate portion of the fees and costs.

Section 715. Jurisdiction and venue of judicial proceedings

The Commonwealth Court shall have original jurisdiction of actions involving State agencies and the courts of common pleas shall have original jurisdiction of actions involving other agencies to render declaratory judgements or to enforce this chapter by injunction or other remedy deemed appropriate by the court. The action may be brought by any person where the agency whose act is complained of is located or where the act complained of occurred.

Section 716. Confidentiality

All acts and parts of acts are repealed insofar as they are inconsistent with this chapter, excepting those statutes which specifically provide for the confidentiality of information. Those deliberations or official actions which, if conducted in public, would violate a lawful privilege or lead to the disclosure of information or confidentiality protected by law, including matter related to the investigation of possible or certain violations of the law and quasi-judicial deliberations, shall not fall within the scope of this chapter.

ATTACHMENT D

PA RIGHT-TO-KNOW LAW ACT 3 OF 2008

Pennsylvania's New Right to Know Law

Act 3 of 2008, as signed by Gov. Edward G. Rendell on February 14, 2008
Effective January 1, 2009

AN ACT

Providing for access to public information, for a designated open-records officer in each Commonwealth agency, local agency, judicial agency and legislative agency, for procedure, for appeal of agency determination, for judicial review and for the Office of Open Records; imposing penalties; providing for reporting by State-related institutions; requiring the posting of certain State contract information on the Internet; and making related repeals.

TABLE OF CONTENTS

Chapter 1. Preliminary Provisions

Section 101. Short title.

Section 102. Definitions.

Chapter 3. Requirements and Prohibitions

Section 301. Commonwealth agencies.

Section 302. Local agencies.

Section 303. Legislative agencies.

Section 304. Judicial agencies.

Section 305. Presumption.

Section 306. Nature of document.

Chapter 5. Access

Section 501. Scope of chapter.

Section 502. Open-records officer.

Section 503. Appeals officer.

Section 504. Regulations and policies.

Section 505. Uniform form.

Section 506. Requests.

Section 507. Retention of records.

Chapter 7. Procedure

Section 701. Access.

Section 702. Requests.

Section 703. Written requests.

Section 704. Electronic access.

Section 705. Creation of record.

Section 706. Redaction.

Section 707. Production of certain records.

Section 708. Exceptions for public records.

Chapter 9. Agency Response

Section 901. General rule.

Section 902. Extension of time.

Section 903. Denial.

Section 904. Certified copies.

Section 905. Record discard.

Chapter 11. Appeal of Agency Determination

Section 1101. Filing of appeal.

Section 1102. Appeals officers.

Chapter 13. Judicial Review

Section 1301. Commonwealth agencies, legislative agencies judicial agencies.

Section 1302. Local agencies.

Section 1303. Notice and records.

Section 1304. Court costs and attorney fees.

Section 1305. Penalties.

Section 1306. Immunity.

Section 1307. Fee limitations.

Section 1308. Prohibition.

Section 1309. Practice and procedure.

Section 1310. Office of Open Records.

Chapter 15. State-Related Institutions

Section 1501. Definition.

Section 1502. Reporting.

Section 1503. Contents of report.

Section 1504. Copies and posting.

Chapter 17. State Contract Information

Section 1701. Submission and retention of contracts.

Section 1702. Public availability of contracts.

Chapter 31. Miscellaneous Provisions

Section 3101. Applicability.

Section 3101.1. Relation to other law or judicial actions.

Section 3101.2. Severability.

Section 3102. Repeals.

Section 3103. References.

Section 3104. Effective date.

The General Assembly of the Commonwealth of Pennsylvania hereby enacts as follows:

CHAPTER 1. PRELIMINARY PROVISIONS

Section 101. Short title.

This act shall be known and may be cited as the Right-to-Know Law.

Section 102. Definitions.

The following words and phrases when used in this act shall have the meanings given to them in this section unless the context clearly indicates otherwise:

"Administrative proceeding." A proceeding by an agency the outcome of which is required to be based on a record or documentation prescribed by law or in which a statute or regulation is particularized in application to individuals. The term includes an appeal.

"Agency." A Commonwealth agency, a local agency, a judicial agency or a legislative agency.

"Aggregated data." A tabulation of data which relate to broad classes, groups or categories so that it is not possible to distinguish the properties of individuals within those classes, groups or categories.

"Appeals officer." As follows:

(1) For a Commonwealth agency or a local agency, the appeals officer designated under section 503(a).

(2) For a judicial agency, the individual designated under section 503(b).

(3) For a legislative agency, the individual designated under section 503(c).

(4) For the Attorney General, State Treasurer, Auditor General and local agencies in possession of criminal investigative records, the individual designated under section 503(d).

"Commonwealth agency." Any of the following:

(1) Any office, department, authority, board, multistate agency or commission of the executive branch; an independent agency; and a State-affiliated entity. The term includes:

(i) The Governor's Office.

(ii) The Office of Attorney General, the Department of the Auditor General and the Treasury Department.

(iii) An organization established by the Constitution of Pennsylvania, a statute or an executive order which performs or is intended to perform an essential governmental function.

(2) The term does not include a judicial or legislative agency.

"Confidential proprietary information." Commercial or financial information received by an agency:

(1) which is privileged or confidential; and

(2) the disclosure of which would cause substantial harm to the competitive position of the person that submitted the information.

"Financial record." Any of the following:

(1) Any account, voucher or contract dealing with:

(i) the receipt or disbursement of funds by an agency; or

(ii) an agency's acquisition, use or disposal of services, supplies, materials, equipment or property.

(2) The salary or other payments or expenses paid to an officer or employee of an agency, including the name and title of the officer or employee.

(3) A financial audit report. The term does not include work papers underlying an audit.

"Homeland security." Governmental actions designed to prevent, detect, respond to and recover from acts of terrorism, major disasters and other emergencies, whether natural or manmade. The term includes activities relating to the following:

(1) emergency preparedness and response, including preparedness and response activities by volunteer medical, police, emergency management, hazardous materials and fire personnel;

(2) intelligence activities;

(3) critical infrastructure protection;

(4) border security;

(5) ground, aviation and maritime transportation security;

(6) biodefense;

(7) detection of nuclear and radiological materials; and (8) research on next-generation securities technologies.

"Independent agency." Any board, commission or other agency or officer of the Commonwealth, that is not subject to the policy supervision and control of the Governor. The term does not include a legislative or judicial agency.

"Judicial agency." A court of the Commonwealth or any other entity or office of the unified judicial system.

"Legislative agency." Any of the following:

(1) The Senate.

(2) The House of Representatives.

(3) The Capitol Preservation Committee.

(4) The Center for Rural Pennsylvania.

(5) The Joint Legislative Air and Water Pollution Control and Conservation Committee.

(6) The Joint State Government Commission.

(7) The Legislative Budget and Finance Committee.

(8) The Legislative Data Processing Committee.

(9) The Independent Regulatory Review Commission.

(10) The Legislative Reference Bureau.

(11) The Local Government Commission.

(12) The Pennsylvania Commission on Sentencing.

(13) The Legislative Reapportionment Commission.

(14) The Legislative Office of Research Liaison.

(15) The Legislative Audit Advisory Commission.

"Legislative record." Any of the following relating to a legislative agency or a standing committee, subcommittee or conference committee of a legislative agency:

(1) A financial record.

(2) A bill or resolution that has been introduced and amendments offered thereto in committee or in legislative session, including resolutions to adopt or amend the rules of a chamber.

(3) Fiscal notes.

(4) A cosponsorship memorandum.

(5) The journal of a chamber.

(6) The minutes of, record of attendance of members at a public hearing or a public committee meeting and all recorded votes taken in a public committee meeting.

(7) The transcript of a public hearing when available.

(8) Executive nomination calendars.

(9) The rules of a chamber.

(10) A record of all recorded votes taken in a legislative session.

(11) Any administrative staff manuals or written policies.

(12) An audit report prepared pursuant to the act of June 30, 1970 (P.L.442, No.151) entitled, "An act implementing the provisions of Article VIII, section 10 of the Constitution of Pennsylvania, by designating the Commonwealth officers who shall be charged with the function of auditing the financial transactions after the occurrence thereof of the Legislative and Judicial branches of the government of the Commonwealth, establishing a Legislative Audit Advisory Commission, and imposing certain powers and duties on such commission."

(13) Final or annual reports required by law to be submitted to the General Assembly.

(14) Legislative Budget and Finance Committee reports.

(15) Daily Legislative Session Calendars and marked calendars.

(16) A record communicating to an agency the official appointment of a legislative appointee.

(17) A record communicating to the appointing authority the resignation of a legislative appointee.

(18) Proposed regulations, final-form regulations and final-omitted regulations submitted to a legislative agency.

(19) The results of public opinion surveys, polls, focus groups, marketing research or similar efforts designed to measure public opinion funded by a legislative agency.

"Local agency." Any of the following:

(1) Any political subdivision, intermediate unit, charter school, cyber charter school or public trade or vocational school.

(2) Any local, intergovernmental, regional or municipal agency, authority, council, board, commission or similar governmental entity.

"Office of Open Records." The Office of Open Records established in section 1310.

"Personal financial information." An individual's personal credit, charge or debit card information; bank account information; bank, credit or financial statements; account or PIN numbers and other information relating to an individual's personal finances.

"Privilege." The attorney-work product doctrine, the attorney-client privilege, the doctor-patient privilege, the speech and debate privilege or other privilege recognized by a court interpreting the laws of this Commonwealth.

"Public record." A record, including a financial record, of a Commonwealth or local agency that:

(1) is not exempt under section 708;

(2) is not exempt from being disclosed under any other Federal or State law or regulation or judicial order or decree; or

(3) is not protected by a privilege.

"Record." Information, regardless of physical form or characteristics, that documents a transaction or activity of an agency and that is created, received or retained pursuant to law or in connection with a transaction, business or activity of the agency. The term includes a document, paper, letter, map, book, tape, photograph, film or sound recording, information stored or maintained electronically and a data-processed or image- processed document.

"Requester." A person that is a legal resident of the United States and requests a record pursuant to this act. The term includes an agency.

"Response." Access to a record or an agency's written notice to a requester granting, denying or partially granting and partially denying access to a record.

"Social services." Cash assistance and other welfare benefits, medical, mental and other health care services, drug and alcohol treatment, adoption services, vocational services and training, occupational training, education services, counseling services, workers' compensation services and unemployment compensation services, foster care services, services for the elderly, services for individuals with disabilities and services for victims of crimes and domestic violence.

"State-affiliated entity." A Commonwealth authority or Commonwealth entity. The term includes the Pennsylvania Higher Education Assistance Agency and any entity established thereby, the Pennsylvania Gaming Control Board, the Pennsylvania Game Commission, the Pennsylvania Fish and Boat Commission, the Pennsylvania Housing Finance Agency, the Pennsylvania Municipal Retirement Board, the State System of Higher Education, a community college, the Pennsylvania Turnpike Commission, the Pennsylvania Public Utility Commission, the Pennsylvania Infrastructure Investment Authority, the State Public School Building Authority, the Pennsylvania Interscholastic Athletic Association and the Pennsylvania Educational Facilities Authority. The term does not include a State-related institution.

"State-related institution." Includes:

(1) Temple University.

(2) The University of Pittsburgh.

(3) The Pennsylvania State University.

(4) Lincoln University.

"Terrorist act." A violent or life-threatening act that violates the criminal laws of the United States or any state and appears to be intended to:

(1) intimidate or coerce a civilian population;

(2) influence the policy of a government; or

(3) affect the conduct of a government by mass destruction, assassination or kidnapping.

"Trade secret." Information, including a formula, drawing, pattern, compilation, including a customer list, program, device, method, technique or process that:

(1) derives independent economic value, actual or potential, from not being generally known to and not being readily ascertainable by proper means by other persons who can obtain economic value from its disclosure or use; and

(2) is the subject of efforts that are reasonable under the circumstances to maintain its secrecy.

The term includes data processing software obtained by an agency under a licensing agreement prohibiting disclosure.

CHAPTER 3. REQUIREMENTS AND PROHIBITIONS

Section 301. Commonwealth agencies.

(a) Requirement. — A Commonwealth agency shall provide public records in accordance with this act.

(b) Prohibition. — A Commonwealth agency may not deny a requester access to a public record due to the intended use of the public record by the requester unless otherwise provided by law.

Section 302. Local agencies.

(a) Requirement. — A local agency shall provide public records in accordance with this act.

(b) Prohibition. — A local agency may not deny a requester access to a public record due to the intended use of the public record by the requester unless otherwise provided by law.

Section 303. Legislative agencies.

(a) **Requirement.** — A legislative agency shall provide legislative records in accordance with this act.

(b) **Prohibition.** — A legislative agency may not deny a requester access to a legislative record due to the intended use of the legislative record by the requester.

Section 304. Judicial agencies.

(a) **Requirement.** — A judicial agency shall provide financial records in accordance with this act or any rule or order of court providing equal or greater access to the records.

(b) **Prohibition.** — A judicial agency may not deny a requester access to a financial record due to the intended use of the financial record by the requester.

Section 305. Presumption.

(a) **General rule.** — A record in the possession of a Commonwealth agency or local agency shall be presumed to be a public record. The presumption shall not apply if:

(1) the record is exempt under section 708;

(2) the record is protected by a privilege; or

(3) the record is exempt from disclosure under any other Federal or State law or regulation or judicial order or decree.

(b) **Legislative records and financial records.** — A legislative record in the possession of a legislative agency and a financial record in the possession of a judicial agency shall be presumed to be available in accordance with this act. The presumption shall not apply if:

(1) the record is exempt under section 708;

(2) the record is protected by a privilege; or

(3) the record is exempt from disclosure under any other Federal or State law, regulation or judicial order or decree.

Section 306. Nature of document.

Nothing in this act shall supersede or modify the public or nonpublic nature of a record or document established in Federal or State law, regulation or judicial order or decree.

CHAPTER 5. ACCESS

Section 501. Scope of chapter.

This chapter applies to all agencies.

Section 502. Open-records officer.

(a) **Establishment.** —

(1) An agency shall designate an official or employee to act as the open-records officer.

(2) For a legislative agency other than the Senate or the House of Representatives, the open-records officer designated by the Legislative Reference Bureau shall serve as the open-records officer. Notwithstanding paragraph (1), a political party caucus of a legislative agency may appoint an open-records officer under this section.

(b) **Functions.** —

(1) The open-records officer shall receive requests submitted to the agency under this act, direct requests to other appropriate persons within the agency or to appropriate persons in another agency, track the agency's progress in responding to requests and issue interim and final responses under this act.

(2) Upon receiving a request for a public record, legislative record or financial record, the open-records officer shall do all of the following:

(i) Note the date of receipt on the written request.

(ii) Compute the day on which the five-day period under section 901 will expire and make a notation of that date on the written request.

(iii) Maintain an electronic or paper copy of a written request, including all documents submitted with the request until the request has been fulfilled. If the request is denied, the written request shall be maintained for 30 days or, if an appeal is filed, until a final determination is issued under section 1101(b) or the appeal is deemed denied.

(iv) Create a file for the retention of the original request, a copy of the response, a record of written communications with the requester and a copy of other communications. This subparagraph shall only apply to Commonwealth agencies.

Section 503. Appeals officer.

(a) **Commonwealth agencies and local agencies.** — Except as provided in subsection (d), the Office of Open Records established under section 1310 shall designate an appeals officer under section 1101(a)(2) for all:

(1) Commonwealth agencies; and

(2) local agencies.

(b) **Judicial agencies.** — A judicial agency shall designate an appeals officer to hear appeals under Chapter 11.

(c) **Legislative agencies.** —

(1) Except as set forth in paragraph (2), the Legislative Reference Bureau shall designate an appeals officer to hear appeals under Chapter 11 for all legislative agencies.

(2) Each of the following shall designate an appeals officer to hear appeals under Chapter 11:

(i) The Senate.

(ii) The House of Representatives.

(d) **Law enforcement records and Statewide officials. —**

(1) The Attorney General, State Treasurer and Auditor General shall each designate an appeals officer to hear appeals under Chapter 11.

(2) The district attorney of a county shall designate one or more appeals officers to hear appeals under Chapter 11 relating to access to criminal investigative records in possession of a local agency of that county. The appeals officer designated by the district attorney shall determine if the record requested is a criminal investigative record.

Section 504. Regulations and policies.

(a) **Authority. —** An agency may promulgate regulations and policies necessary for the agency to implement this act. The Office of Open Records may promulgate regulations relating to appeals involving a Commonwealth agency or local agency.

(b) **Posting. —** The following information shall be posted at each agency and, if the agency maintains an Internet website, on the agency's Internet website:

(1) Contact information for the open-records officer.

(2) Contact information for the Office of Open Records or other applicable appeals officer.

(3) A form which may be used to file a request.

(4) Regulations, policies and procedures of the agency relating to this act.

Section 505. Uniform form.

(a) **Commonwealth and local agencies. —** The Office of Open Records shall develop a uniform form which shall be accepted by all Commonwealth and local agencies in addition to any form used by the agency to file a request under this act. The uniform form shall be published in the Pennsylvania Bulletin and on the Office of Open Record's Internet website.

(b) **Judicial agencies. —** A judicial agency or the Administrative Office of Pennsylvania Courts may develop a form to request financial records or may accept a form developed by the Office of Open Records.

(c) **Legislative agencies. —** A legislative agency may develop a form to request legislative records or may accept the form developed by the Office of Open Records.

Section 506. Requests.

(a) **Disruptive requests. —**

(1) An agency may deny a requester access to a record if the requester has made repeated requests for that same record and the repeated requests have placed an unreasonable burden on the agency.

(2) A denial under this subsection shall not restrict the ability to request a different record.

(b) **Disaster or potential damage. —**

(1) An agency may deny a requester access:

(i) when timely access is not possible due to fire, flood or other disaster; or

(ii) to historical, ancient or rare documents, records, archives and manuscripts when access may, in the professional judgment of the curator or custodian of records, cause physical damage or irreparable harm to the record.

(2) To the extent possible, the contents of a record under this subsection shall be made accessible to a requester even when the record is physically unavailable.

(c) **Agency discretion. —** An agency may exercise its discretion to make any otherwise exempt record accessible for inspection and copying under this chapter, if all of the following apply:

(1) Disclosure of the record is not prohibited under any of the following:

(i) Federal or State law or regulation.

(ii) Judicial order or decree.

(2) The record is not protected by a privilege.

(3) The agency head determines that the public interest favoring access outweighs any individual, agency or public interest that may favor restriction of access.

(d) **Agency possession.** —

(1) A public record that is not in the possession of an agency but is in the possession of a party with whom the agency has contracted to perform a governmental function on behalf of the agency, and which directly relates to the governmental function and is not exempt under this act, shall be considered a public record of the agency for purposes of this act.

(2) Nothing in this act shall be construed to require access to any other record of the party in possession of the public record.

(3) A request for a public record in possession of a party other than the agency shall be submitted to the open records officer of the agency. Upon a determination that the record is subject to access under this act, the open records officer shall assess the duplication fee established under section 1307(b) and upon collection shall remit the fee to the party in possession of the record if the party duplicated the record.

Section 507. Retention of records.

Nothing in this act shall be construed to modify, rescind or supersede any record retention policy or disposition schedule of an agency established pursuant to law, regulation, policy or other directive.

CHAPTER 7 PROCEDURE

Section 701. Access.

(a) **General rule.** — Unless otherwise provided by law, a public record, legislative record or financial record shall be accessible for inspection and duplication in accordance with this act. A record being provided to a requester shall be provided in the medium requested if it exists in that medium; otherwise, it shall be provided in the medium in which it exists. Public records, legislative records or financial records shall be available for access during the regular business hours of an agency.

(b) **Construction.** — Nothing in this act shall be construed to require access to any computer either of an agency or individual employee of an agency.

Section 702. Requests.

Agencies may fulfill verbal, written or anonymous verbal or written requests for access to records under this act. If the requester wishes to pursue the relief and remedies provided for in this act, the request for access to records must be a written request.

Section 703. Written requests.

A written request for access to records may be submitted in person, by mail, by e-mail, by facsimile or, to the extent provided by agency rules, any other electronic means. A written request must be addressed to the open-records officer designated pursuant to section 502. Employees of an agency shall be directed to forward requests for records to the open-records officer. A written request should identify or describe the records sought with sufficient specificity to enable the agency to ascertain which records are being requested and shall include the name and address to which the agency should address its response. A written request need not include any explanation of the requester's reason for requesting or intended use of the records unless otherwise required by law.

Section 704. Electronic access.

(a) **General rule.** — In addition to the requirements of section 701, an agency may make its records available through any publicly accessible electronic means.

(b) **Response.** —

(1) In addition to the requirements of section 701, an agency may respond to a request by notifying the requester that the record is available through publicly accessible electronic means or that the agency will provide access to inspect the record electronically.

(2) If the requester is unwilling or unable to access the record electronically, the requester may, within 30 days following receipt of the agency notification, submit a written request to the agency to have the record converted to paper. The agency shall provide access to the record in printed form within five days of the receipt of the written request for conversion to paper.

Section 705. Creation of record.

When responding to a request for access, an agency shall not be required to create a record which does not currently exist or to compile, maintain, format or organize a record in a manner in which the agency does not currently compile, maintain, format or organize the record.

Section 706. Redaction.

If an agency determines that a public record, legislative record or financial record contains information which is subject to access as well as information which is not subject to access, the agency's response shall grant access to the information which is subject to access and deny access to the information which is not subject to access. If the information which is not subject to access is an integral part of the public record, legislative record or financial record and cannot be separated, the agency shall redact from the record the information which is not subject to access, and the response shall grant access to the information which is subject to access. The agency may not deny access to the record if the information which is not subject to access is able to be redacted. Information which an agency redacts in accordance with this subsection shall be deemed a denial under Chapter 9.

Section 707. Production of certain records.

(a) **General rule.** — If, in response to a request, an agency produces a record that is not a public record, legislative record or financial record, the agency shall notify any third party that provided the record to the agency, the person that is the subject of the record and the requester.

(b) **Requests for trade secrets.** — An agency shall notify a third party of a request for a record if the third party provided the record and included a written statement signed by a representative of the third party that the record contains a trade secret or confidential proprietary information.

Notification shall be provided within five business days of receipt of the request for the record. The third party shall have five business days from receipt of notification from the agency to provide input on the release of the record. The agency shall deny the request for the record or release the record within ten business days of the provision of notice to the third party and shall notify the third party of the decision.

(c) **Transcripts.** —

(1) Prior to an adjudication becoming final, binding and nonappealable, a transcript of an administrative proceeding shall be provided to a requester by the agency stenographer or a court reporter, in accordance with agency procedure or an applicable contract.

(2) Following an adjudication becoming final, binding and nonappealable, a transcript of an administrative proceeding shall be provided to a requester in accordance with the duplication rates established in section 1307(b).

Section 708. Exceptions for public records.

(a) **Burden of proof.** —

(1) The burden of proving that a record of a Commonwealth agency or local agency is exempt from public access shall be on the Commonwealth agency or local agency receiving a request by a preponderance of the evidence.

(2) The burden of proving that a legislative record is exempt from public access shall be on the legislative agency receiving a request by a preponderance of the evidence.

(3) The burden of proving that a financial record of a judicial agency is exempt from public access shall be on the judicial agency receiving a request by a preponderance of the evidence.

(b) **Exceptions.** — Except as provided in subsections (c) and (d), the following are exempt from access by a requester under this act:

(1) A record the disclosure of which:

(i) would result in the loss of Federal or State funds by an agency or the Commonwealth; or

(ii) would be reasonably likely to result in a substantial and demonstrable risk of physical harm to or the personal security of an individual.

(2) A record maintained by an agency in connection with the military, homeland security, national defense, law enforcement or other public safety activity that if disclosed would be reasonably likely to jeopardize or threaten public safety or preparedness or public protection activity or a record that is designated classified by an appropriate Federal or State military authority.

(3) A record, the disclosure of which creates a reasonable likelihood of endangering the safety or the physical security of a building, public utility, resource, infrastructure, facility or information storage system, which may include:

(i) documents or data relating to computer hardware, source files, software and system networks that could jeopardize computer security by exposing a vulnerability in preventing, protecting against, mitigating or responding to a terrorist act;

(ii) lists of infrastructure, resources and significant special events, including those defined by the Federal Government in the National Infrastructure Protections, which are deemed critical due to their nature and which result from risk analysis; threat assessments; consequences assessments; antiterrorism protective measures and plans; counterterrorism measures and plans; and security and response needs assessments; and

(iii) building plans or infrastructure records that expose or create vulnerability through disclosure of the location, configuration or security of critical systems, including public utility systems, structural elements, technology, communication, electrical, fire suppression, ventilation, water, wastewater, sewage and gas systems.

(4) A record regarding computer hardware, software and networks, including administrative or technical records, which, if disclosed, would be reasonably likely to jeopardize computer security.

(5) A record of an individual's medical, psychiatric or psychological history or disability status, including an evaluation, consultation, prescription, diagnosis or treatment; results of tests, including drug tests; enrollment in a health care program or program designed for participation by persons with disabilities, including vocation rehabilitation, workers' compensation and unemployment compensation; or related information that would disclose individually identifiable health information.

(6) (i) The following personal identification information:

(A) A record containing all or part of a person's Social Security number; driver's license number; personal financial information; home, cellular or personal telephone numbers; personal e-mail addresses; employee number or other confidential personal identification number.

(B) A spouse's name; marital status, beneficiary or dependent information.

(C) The home address of a law enforcement officer or judge.

(ii) Nothing in this paragraph shall preclude the release of the name, position, salary, actual compensation or other payments or expenses, employment contract, employment-related contract or agreement and length of service of a public official or an agency employee.

(iii) An agency may redact the name or other identifying information relating to an individual performing an undercover or covert law enforcement activity from a record.

(7) The following records relating to an agency employee:

(i) A letter of reference or recommendation pertaining to the character or qualifications of an identifiable individual, unless it was prepared in relation to the appointment of an individual to fill a vacancy in an elected office or an appointed office requiring Senate confirmation.

(ii) A performance rating or review.

(iii) The result of a civil service or similar test administered by a Commonwealth agency, legislative agency or judicial agency. The result of a civil service or similar test administered by a local agency shall not be disclosed if restricted by a collective bargaining agreement. Only test scores of individuals who obtained a passing score on a test administered by a local agency may be disclosed.

(iv) The employment application of an individual who is not hired by the agency.

(v) Workplace support services program information.

(vi) Written criticisms of an employee.

(vii) Grievance material, including documents related to discrimination or sexual harassment.

(viii) Information regarding discipline, demotion or discharge contained in a personnel file. This subparagraph shall not apply to the final action of an agency that results in demotion or discharge.

(ix) An academic transcript.

(8) (i) A record pertaining to strategy or negotiations relating to labor relations or collective bargaining and related arbitration proceedings. This subparagraph shall not apply to a final or executed contract or agreement between the parties in a collective bargaining procedure.

(ii) In the case of the arbitration of a dispute or grievance under a collective bargaining agreement, an exhibit entered into evidence at an arbitration proceeding, a transcript of the arbitration or the opinion. This subparagraph shall not apply to the final award or order of the arbitrator in a dispute or grievance procedure.

(9) The draft of a bill, resolution, regulation, statement of policy, management directive, ordinance or amendment thereto prepared by or for an agency.

(10) (i) A record that reflects:

(A) The internal, predecisional deliberations of an agency, its members, employees or officials or predecisional deliberations between agency members, employees or officials and members, employees or officials of another agency, including predecisional deliberations relating to a budget recommendation, legislative proposal, legislative amendment, contemplated or proposed policy or course of action or any research, memos or other documents used in the predecisional deliberations.

(B) The strategy to be used to develop or achieve the successful adoption of a budget, legislative proposal or regulation.

(ii) Subparagraph (i)(A) shall apply to agencies subject to 65 Pa.C.S. Ch. 7 (relating to open meetings) in a manner consistent with 65 Pa.C.S. Ch. 7. A record which is not otherwise exempt from access under this act and which is presented to a quorum for deliberation in accordance with 65 Pa.C.S. Ch. 7 shall be a public record.

(iii) This paragraph shall not apply to a written or Internet application or other document that has been submitted to request Commonwealth funds.

(iv) This paragraph shall not apply to the results of public opinion surveys, polls, focus groups, marketing research or similar effort designed to measure public opinion.

(11) A record that constitutes or reveals a trade secret or confidential proprietary information.

(12) Notes and working papers prepared by or for a public official or agency employee used solely for that official's or employee's own personal use, including telephone message slips, routing slips and other materials that do not have an official purpose.

(13) Records that would disclose the identity of an individual who lawfully makes a donation to an agency unless the donation is intended for or restricted to providing remuneration or personal tangible benefit to a named public official or employee of the agency, including lists of potential donors compiled by an agency to pursue donations, donor profile information or personal identifying information relating to a donor.

(14) Unpublished lecture notes, unpublished manuscripts, unpublished articles, creative works in progress, research-related material and scholarly correspondence of a community college or an institution of the State System of Higher Education or a faculty member, staff employee, guest speaker or student thereof.

(15) (i) Academic transcripts

(ii) Examinations, examination questions, scoring keys or answers to examinations. This subparagraph shall include licensing and other examinations relating to the qualifications of an individual and to examinations given in primary and secondary schools and institutions of higher education.

(16) A record of an agency relating to or resulting in a criminal investigation, including:

(i) Complaints of potential criminal conduct other than a private criminal complaint.

(ii) Investigative materials, notes, correspondence, videos and reports.

(iii) A record that includes the identity of a confidential source or the identity of a suspect who has not been charged with an offense to whom confidentiality has been promised.

(iv) A record that includes information made confidential by law or court order.

(v) Victim information, including any information that would jeopardize the safety of the victim.

(vi) A record that, if disclosed, would do any of the following:

(A) Reveal the institution, progress or result of a criminal investigation, except the filing of criminal charges.

(B) Deprive a person of the right to a fair trial or an impartial adjudication.

(C) Impair the ability to locate a defendant or codefendant.

(D) Hinder an agency's ability to secure an arrest, prosecution or conviction.

(E) Endanger the life or physical safety of an individual.

This paragraph shall not apply to information contained in a police blotter as defined in 18 Pa.C.S. § 9102 (relating to definitions) and utilized or maintained by the Pennsylvania State Police, local, campus, transit or port authority police department or other law enforcement agency or in a traffic report except as provided under 75 Pa.C.S. § 3754(b) (relating to accident prevention investigations).

(17) A record of an agency relating to a noncriminal investigation, including:

(i) Complaints submitted to an agency.

(ii) Investigative materials, notes, correspondence and reports.

(iii) A record that includes the identity of a confidential source, including individuals subject to the act of December 12, 1986 (P.L.1559, No.169), known as the Whistleblower Law.

(iv) A record that includes information made confidential by law.

(v) Work papers underlying an audit.

(vi) A record that, if disclosed, would do any of the following:

(A) Reveal the institution, progress or result of an agency investigation, except the imposition of a fine or civil penalty, the suspension, modification or revocation of a license, permit, registration, certification or similar authorization issued by an agency or an executed settlement agreement unless the agreement is determined to be confidential by a court.

(B) Deprive a person of the right to an impartial adjudication.

(C) Constitute an unwarranted invasion of privacy.

(D) Hinder an agency's ability to secure an administrative or civil sanction.

(E) Endanger the life or physical safety of an individual.

(18) (i) Records or parts of records, except time response logs, pertaining to audio recordings, telephone or radio transmissions received by emergency dispatch personnel, including 911 recordings.

(ii) This paragraph shall not apply to a 911 recording, or a transcript of a 911 recording, if the agency or a court determines that the public interest in disclosure outweighs the interest in nondisclosure.

(19) DNA and RNA records.

(20) An autopsy record of a coroner or medical examiner and any audiotape of a postmortem examination or autopsy, or a copy, reproduction or facsimile of an autopsy report, a photograph, negative or print, including a photograph or videotape of the body or any portion of the body of a deceased person at the scene of death or in the course of a postmortem examination or autopsy taken or made by or caused to be taken or made by the coroner or medical examiner. This exception shall not limit the reporting of the name of the deceased individual and the cause and manner of death.

(21) (i) Draft minutes of any meeting of an agency until the next regularly scheduled meeting of the agency.

(ii) Minutes of an executive session and any record of discussions held in executive session.

(22) (i) The contents of real estate appraisals, engineering or feasibility estimates, environmental reviews, audits or evaluations made for or by an agency relative to the following:

(A) The leasing, acquiring or disposing of real property or an interest in real property.

(B) The purchase of public supplies or equipment included in the real estate transaction.

(C) Construction projects.

(ii) This paragraph shall not apply once the decision is made to proceed with the lease, acquisition or disposal of real property or an interest in real property or the purchase of public supply or construction project.

(23) Library and archive circulation and order records of an identifiable individual or groups of individuals.

(24) Library archived and museum materials, or valuable or rare book collections or documents contributed by gift, grant, bequest or devise, to the extent of any limitations imposed by the donor as a condition of the contribution.

(25) A record identifying the location of an archeological site or an endangered or threatened plant or animal species if not already known to the general public.

(26) A proposal pertaining to agency procurement or disposal of supplies, services or construction prior to the award of the contract or prior to the opening and rejection of all bids; financial information of a bidder or offeror requested in an invitation for bid or request for proposals to demonstrate the bidder's or offeror's economic capability; or the identity of members, notes and other records of agency proposal evaluation committees established under 62 Pa.C.S. § 513 (relating to competitive sealed proposals).

(27) A record or information relating to a communication between an agency and its insurance carrier, administrative service organization or risk management office. This paragraph shall not apply to a contract with an insurance carrier, administrative service organization or risk management office or to financial records relating to the provision of insurance.

(28) A record or information:

(i) identifying an individual who applies for or receives social services; or

(ii) relating to the following:

(A) the type of social services received by an individual;

(B) an individual's application to receive social services, including a record or information related to an agency decision to grant, deny, reduce or restrict benefits, including a quasi-judicial decision of the agency and the identity of a caregiver or others who provide services to the individual; or

(C) eligibility to receive social services, including the individual's income, assets, physical or mental health, age, disability, family circumstances or record of abuse.

(29) Correspondence between a person and a member of the General Assembly and records accompanying the correspondence which would identify a person that requests assistance or constituent services. This paragraph shall not apply to correspondence between a member of the General Assembly and a principal or lobbyist under 65 Pa.C.S. Ch. 13A (relating to lobbyist disclosure).

(30) A record identifying the name, home address or date of birth of a child 17 years of age or younger.

(c) Financial records. — The exceptions set forth in subsection (b) shall not apply to financial records, except that an agency may redact that portion of a financial record protected under subsection (b)(1), (2), (3), (4), (5), (6), (16) OR (17). An agency shall not disclose the identity of an individual performing an undercover or covert law enforcement activity.

(d) Aggregated data. — The exceptions set forth in subsection (b) shall not apply to aggregated data maintained or received by an agency, except for data protected under subsection (b)(1), (2), (3), (4) or (5).

(e) Construction. — In determining whether a record is exempt from access under this section, an agency shall consider and apply each exemption separately.

CHAPTER 9 AGENCY RESPONSE

Section 901. General rule.

Upon receipt of a written request for access to a record, an agency shall make a good faith effort to determine if the record requested is a public record, legislative record or financial record and whether the agency has possession, custody or control of the identified record, and to respond as promptly as possible under the circumstances existing at the time of the request. All applicable fees shall be paid in order to receive access to the record requested. The time for response shall not exceed five business days from the date the written request is received by the open-records officer for an agency. If the agency fails to send the response within five business days of receipt of the written request for access, the written request for access shall be deemed denied.

Section 902. Extension of time.

(a) **Determination.** — Upon receipt of a written request for access, the open-records officer for an agency shall determine if one of the following applies:

(1) the request for access requires redaction of a record in accordance with section 706;

(2) the request for access requires the retrieval of a record stored in a remote location;

(3) a timely response to the request for access cannot be accomplished due to bona fide and specified staffing limitations;

(4) a legal review is necessary to determine whether the record is a record subject to access under this act;

(5) the requester has not complied with the agency's policies regarding access to records;

(6) the requester refuses to pay applicable fees authorized by this act; or

(7) the extent or nature of the request precludes a response within the required time period.

(b) **Notice.** —

(1) Upon a determination that one of the factors listed in subsection (a) applies, the open-records officer shall send written notice to the requester within five business days of receipt of the request for access under subsection (a).

(2) The notice shall include a statement notifying the requester that the request for access is being reviewed, the reason for the review, a reasonable date that a response is expected to be provided and an estimate of applicable fees owed when the record becomes available. If the date that a response is expected to be provided is in excess of 30 days, following the five business days allowed for in section 901, the request for access shall be deemed denied unless the requester has agreed in writing to an extension to the date specified in the notice.

(3) If the requester agrees to the extension, the request shall be deemed denied on the day following the date specified in the notice if the agency has not provided a response by that date.

Section 903. Denial.

If an agency's response is a denial of a written request for access, whether in whole or in part, the denial shall be issued in writing and shall include:

(1) A description of the record requested.

(2) The specific reasons for the denial, including a citation of supporting legal authority.

(3) The typed or printed name, title, business address, business telephone number and signature of the open-records officer on whose authority the denial is issued.

(4) Date of the response.

(5) The procedure to appeal the denial of access under this act.

Section 904. Certified copies.

If an agency's response grants a request for access, the agency shall, upon request, provide the requester with a certified copy of the record if the requester pays the applicable fees under section 1307.

Section 905. Record discard.

If an agency response to a requester states that copies of the requested records are available for delivery at the office of an agency and the requester fails to retrieve the records within 60 days of the agency's response, the agency may dispose of any copies which have not been retrieved and retain any fees paid to date.

CHAPTER 11. APPEAL OF AGENCY DETERMINATION

Section 1101. Filing of appeal.

(a) **Authorization.** —

(1) If a written request for access to a record is denied or deemed denied, the requester may file an appeal with the Office of Open Records or judicial, legislative or other appeals officer designated under section 503(d) within 15 business days of the mailing date of the agency's response or within 15 business days of a deemed denial. The appeal shall state the grounds upon which the requester asserts that the record is a public record, legislative record or financial record and shall address any grounds stated by the agency for delaying or denying the request.

(2) Except as provided in section 503(d), in the case of an appeal of a decision by a Commonwealth agency or local agency, the Office of Open Records shall assign an appeals officer to review the denial.

(b) **Determination.** —

(1) Unless the requester agrees otherwise, the appeals officer shall make a final determination which shall be mailed to the requester and the agency within 30 days of receipt of the appeal filed under subsection (a).

(2) If the appeals officer fails to issue a final determination within 30 days, the appeal is deemed denied.

(3) Prior to issuing a final determination, a hearing may be conducted. The determination by the appeals officer shall be a final order. The appeals officer shall provide a written explanation of the reason for the decision to the requester and the agency.

(c) **Direct interest.** —

(1) A person other than the agency or requester with a direct interest in the record subject to an appeal under this section may, within 15 days following receipt of actual knowledge of the appeal but no later than the date the appeals officer issues an order, file a written request to provide information or to appear before the appeals officer or to file information in support of the requester's or agency's position.

(2) The appeals officer may grant a request under paragraph (1) if:

(i) no hearing has been held;

(ii) the appeals officer has not yet issued its order; and

(iii) the appeals officer believes the information will be probative.

(3) Copies of the written request shall be sent to the agency and the requester.

Section 1102. Appeals officers.

(a) **Duties.** — An appeals officer designated under section 503 shall do all of the following:

(1) Set a schedule for the requester and the open- records officer to submit documents in support of their positions.

(2) Review all information filed relating to the request. The appeals officer may hold a hearing. A decision to hold or not to hold a hearing is not appealable. The appeals officer may admit into evidence testimony, evidence and documents that the appeals officer believes to be reasonably probative and relevant to an issue in dispute. The appeals officer may limit the nature and extent of evidence found to be cumulative.

(3) Consult with agency counsel as appropriate.

(4) Issue a final determination on behalf of the Office of Open Records or other agency.

(b) **Procedures.** — The Office of Open Records, a judicial agency, a legislative agency, the Attorney General,

Auditor General, State Treasurer or district attorney may adopt procedures relating to appeals under this chapter.

(1) If an appeal is resolved without a hearing, 1 Pa. Code Pt. II (relating to general rules of administrative practice and procedure) does not apply except to the extent that the agency has adopted these chapters in its regulations or rules under this subsection.

(2) If a hearing is held, 1 Pa. Code Pt. II shall apply unless the agency has adopted regulations, policies or procedures to the contrary under this subsection.

(3) In the absence of a regulation, policy or procedure governing appeals under this chapter, the appeals officer shall rule on procedural matters on the basis of justice, fairness and the expeditious resolution of the dispute.

CHAPTER 13. JUDICIAL REVIEW

Section 1301. Commonwealth agencies, legislative agencies and judicial agencies.

(a) **General rule.** — Within 30 days of the mailing date of the final determination of the appeals officer relating to a decision of a Commonwealth agency, a legislative agency or a judicial agency issued under section 1101(b) or the date a request for access is deemed denied, a requester or the agency may file a petition for review or other document as might be required by rule of court with the Commonwealth Court. The decision of the court shall contain findings of fact and conclusions of law based upon the evidence as a whole. The decision shall clearly and concisely explain the rationale for the decision.

(b) **Stay.** — A petition for review under this section shall stay the release of documents until a decision under subsection (a) is issued.

Section 1302. Local agencies.

(a) **General rule.** — Within 30 days of the mailing date of the final determination of the appeals officer relating to a decision of a local agency issued under section 1101(b) or of the date a request for access is deemed denied, a requester or local agency may file a petition for review or other document as required by rule of court with the court of common pleas for the county where the local agency is located. The decision of the court shall contain findings of fact and conclusions of law based upon the evidence as a whole. The decision shall clearly and concisely explain the rationale for the decision.

(b) **Stay.** — A petition for review under this section shall stay the release of documents until a decision under subsection (a) is issued.

Section 1303. Notice and records.

(a) **Notice.** — An agency, the requester and the Office of Open Records or designated appeals officer shall be served notice of actions commenced in accordance with section 1301 or 1302 and shall have an opportunity to respond in accordance with applicable court rules.

(b) **Record on appeal.** — The record before a court shall consist of the request, the agency's response, the appeal filed under section 1101, the hearing transcript, if any, and the final written determination of the appeals officer.

Section 1304. Court costs and attorney fees.

(a) **Reversal of agency determination.** — If a court reverses the final determination of the appeals officer or grants access to a record after a request for access was deemed denied, the court may award reasonable attorney fees and costs of litigation or an appropriate portion thereof to a requester if the court finds either of the following:

(1) the agency receiving the original request willfully or with wanton disregard deprived the requester of access to a public record subject to access or otherwise acted in bad faith under the provisions of this act; or

(2) the exemptions, exclusions or defenses asserted by the agency in its final determination were not based on a reasonable interpretation of law.

(b) **Sanctions for frivolous requests or appeals.** — The court may award reasonable attorney fees and costs of litigation or an appropriate portion thereof to an agency or the requester if the court finds that the legal challenge under this chapter was frivolous.

(c) **Other sanctions.** — Nothing in this act shall prohibit a court from imposing penalties and costs in accordance with applicable rules of court.

Section 1305. Civil penalty.

(a) **Denial of access.** — A court may impose a civil penalty of not more than $1,500 if an agency denied access to a public record in bad faith.

(b) **Failure to comply with court order.** — An agency or public official who does not promptly comply with a court order under this act is subject to a civil penalty of not more than $500 per day until the public records are provided.

Section 1306. Immunity.

(a) **General rule.** — Except as provided in sections 1304 and 1305 and other statutes governing the release of records, no agency, public official or public employee shall be liable for civil penalties resulting from compliance or failure to comply with this act.

(b) **Schedules.** — No agency, public official or public employee shall be liable for civil or criminal damages or penalties under this act for complying with any written public record retention and disposition schedule.

Section 1307. Fee limitations.

(a) **Postage.** — Fees for postage may not exceed the actual cost of mailing.

(b) **Duplication.** —

(1) Fees for duplication by photocopying, printing from electronic media or microfilm, copying onto electronic media, transmission by facsimile or other electronic means and other means of duplication shall be established:

(i) by the Office of Open Records, for Commonwealth agencies and local agencies;

(ii) by each judicial agency; and

(iii) by each legislative agency.

(2) The fees must be reasonable and based on prevailing fees for comparable duplication services provided by local business entities.

(3) Fees for local agencies may reflect regional price differences.

(4) The following apply to complex and extensive data sets, including geographic information systems or integrated property assessment lists.

(i) Fees for copying may be based on the reasonable market value of the same or closely related data sets.

(ii) Subparagraph (i) shall not apply to:

(A) a request by an individual employed by or connected with a newspaper or magazine of general circulation, weekly newspaper publication, press association or radio or television station, for the purpose of obtaining information for publication or broadcast; or

(B) a request by a nonprofit organization for the conduct of educational research.

(iii) Information obtained under subparagraph (ii) shall be subject to paragraphs (1), (2) and (3).

(c) **Certification.** — An agency may impose reasonable fees for official certification of copies if the certification is at the behest of the requester and for the purpose of legally verifying the public record.

(d) **Conversion to paper.** — If a record is only maintained electronically or in other nonpaper media, duplication fees shall be limited to the lesser of the fee for duplication on paper or the fee for duplication in the original media as provided by subsection (b) unless the requester specifically requests for the record to be duplicated in the more expensive medium.

(e) **Enhanced electronic access.** — If an agency offers enhanced electronic access to records in addition to making the records accessible for inspection and duplication by a requester as required by this act, the agency may establish user fees specifically for the provision of the enhanced electronic access, but only to the extent that the enhanced electronic access is in addition to making the records accessible for inspection and duplication by a requester as required by this act. The user fees for enhanced electronic access may be a flat rate, a subscription fee for a period of time, a per-transaction fee, a fee based on the cumulative time of system access or any other reasonable method and any combination thereof. The user fees for enhanced electronic access must be reasonable, must be approved by the Office of Open Records and may not be established with the intent or effect of excluding persons from access to records or duplicates thereof or of creating profit for the agency.

(f) **Waiver of fees.** — An agency may waive the fees for duplication of a record, including, but not limited to, when:

(1) the requester duplicates the record; or

(2) the agency deems it is in the public interest to do so.

(g) **Limitations.** — Except as otherwise provided by statute, no other fees may be imposed unless the agency necessarily incurs costs for complying with the request, and such fees must be reasonable. No fee may be imposed for an agency's review of a record to determine whether the record is a public record, legislative record or financial record subject to access in accordance with this act.

(h) **Prepayment.** — Prior to granting a request for access in accordance with this act, an agency may require a requester to prepay an estimate of the fees authorized under this section if the fees required to fulfill the request are expected to exceed $100.

Section 1308. Prohibition.

A policy or regulation adopted under this act may not include any of the following:

(1) A limitation on the number of records which may be requested or made available for inspection or duplication.

(2) A requirement to disclose the purpose or motive in requesting access to records.

Section 1309. Practice and procedure.

The provisions of 2 Pa.C.S. (relating to administrative law and procedure) shall not apply to this act unless specifically adopted by regulation or policy.

Section 1310. Office of Open Records.

(a) **Establishment.** — There is established in the Department of Community and Economic Development an Office of Open Records.

The office shall do all of the following:

(1) Provide information relating to the implementation and enforcement of this act.

(2) Issue advisory opinions to agencies and requesters.

(3) Provide annual training courses to agencies, public officials and public employees on this act and 65 Pa.C.S. Ch. 7 (relating to open meetings).

(4) Provide annual, regional training courses to local agencies, public officials and public employees.

(5) Assign appeals officers to review appeals of decisions by Commonwealth agencies or local agencies, except as provided in section 503(d), filed under section 1101 and issue orders and opinions. The office shall employ or contract with attorneys to serve as appeals officers to review appeals and, if necessary, to hold hearings on a regional basis under this act. Each appeals officer must comply with all of the following:

(i) Complete a training course provided by the Office of Open Records prior to acting as an appeals officer.

(ii) If a hearing is necessary, hold hearings regionally as necessary to ensure access to the remedies provided by this act.

(iii) Comply with the procedures under section 1102(b).

(6) Establish an informal mediation program to resolve disputes under this act.

(7) Establish an Internet website with information relating to this act, including information on fees, advisory opinions and decisions and the name and address of all open records officers in this Commonwealth.

(8) Conduct a biannual review of fees charged under this act.

(9) Annually report on its activities and findings to the Governor and the General Assembly. The report shall be posted and maintained on the Internet website established under paragraph (7).

(b) **Executive director.** — Within 90 days of the effective date of this section, the Governor shall appoint an executive director of the office who shall serve for a term of six years. Compensation shall be set by the Executive Board established under section 204 of the act of April 9, 1929 (P.L.177, No.175), known as The Administrative Code of 1929. The executive director may serve no more than two terms.

(c) **Limitation.** — The executive director shall not seek election nor accept appointment to any political office during his tenure as executive director and for one year thereafter.

(d) **Staffing.** — The executive director shall appoint attorneys to act as appeals officers and additional clerical, technical and professional staff as may be appropriate and may contract for additional services as necessary for the performance of the executive director's duties. The compensation of attorneys and other staff shall be set by the Executive Board. The appointment of attorneys shall not be subject to the act of October 15, 1980 (P.L.950, No.164), known as the Commonwealth Attorneys Act.

(e) **Duties.** — The executive director shall ensure that the duties of the Office of Open Records are carried out and shall monitor cases appealed to the Office of Open Records.

(f) **Appropriation.** — The appropriation for the office shall be in a separate line item and shall be under the jurisdiction of the executive director.

CHAPTER 15. STATE-RELATED INSTITUTIONS

Section 1501. Definition.

As used in this chapter, "State-related institution" means any of the following:

(1) Temple University.

(2) The University of Pittsburgh.

(3) The Pennsylvania State University.

(4) Lincoln University.

Section 1502. Reporting.

No later than May 30 of each year, a State-related institution shall file with the Governor's Office, the General Assembly, the Auditor General and the State Library the information set forth in section 1503.

Section 1503. Contents of report.

The report required under section 1502 shall include the following:

(1) Except as provided in paragraph (4), all information required by Form 990 or an equivalent form, of the United States Department of the Treasury, Internal Revenue Service, entitled the Return of Organization Exempt From Income Tax, regardless of whether the State-related institution is required to file the form by the Federal Government.

(2) The salaries of all officers and directors of the State-related institution.

(3) The highest 25 salaries paid to employees of the institution that are not included under paragraph (2).

(4) The report shall not include information relating to individual donors.

Section 1504. Copies and posting.

A State-related institution shall maintain, for at least seven years, a copy of the report in the institution's library and shall provide free access to the report on the institution's Internet website.

CHAPTER 17. STATE CONTRACT INFORMATION

Section 1701. Submission and retention of contracts.

(a) **General rule.** — Whenever any Commonwealth agency, legislative agency or judicial agency shall enter into any contract involving any property, real, personal or mixed of any kind or description or any contract for personal services where the consideration involved in the contract is $5,000 or more, a copy of the contract shall be filed with the Treasury Department within ten days after the contract is fully executed on behalf of the Commonwealth agency, legislative agency or judicial agency or otherwise becomes an obligation of the Commonwealth agency, legislative agency or judicial agency. The provisions of this chapter shall not apply to contracts for services protected by a privilege. The provisions of this chapter shall not apply to a purchase order evidencing fulfillment of an existing contract but shall apply to a purchase order evidencing new obligations. The following shall apply:

(1) Each Commonwealth agency, legislative agency and judicial agency shall submit contracts in a form and structure mutually agreed upon by the Commonwealth agency, legislative agency or judicial agency and the State Treasurer.

(2) The Treasury Department may require each Commonwealth agency, legislative agency or judicial agency to provide a summary with each contract, which shall include the following:

(i) Date of execution.

(ii) Amount of the contract.

(iii) Beginning date of the contract.

(iv) End date of the contract, if applicable.

(v) Name of the agency entering into the contract.

(vi) The name of all parties executing the contract.

(vii) Subject matter of the contract.

Each agency shall create and maintain the data under this paragraph in an ASCII-delimited text file, spreadsheet file or other file provided by Treasury Department regulation.

(b) **Retention.** — Every contract filed pursuant to subsection (a) shall remain on file with the Treasury Department for a period of not less than four years after the end date of the contract.

(c) **Accuracy.** — Each Commonwealth agency, legislative agency and judicial agency is responsible for verifying the accuracy and completeness of the information that it submits to the State Treasurer. The contract provided to the Treasury Department pursuant to this chapter shall be redacted in accordance with applicable provisions of this act by the agency filing the contract to the Treasury Department.

(d) **Applicability.** — The provisions of this act shall not apply to copies of contracts submitted to the Treasury Department, the Office of Auditor General or other agency for purposes of audits and warrants for disbursements under section 307, 401, 402 or 403 of the act of April 9, 1929 (P.L.343, No.176), known as The Fiscal Code.

Section 1702. Public availability of contracts.

(a) **General rule.** — The Treasury Department shall make each contract filed pursuant to section 1701 available for public inspection either by posting a copy of the contract on the Treasury Department's publicly accessible Internet website or by posting a contract summary on the department's publicly accessible Internet website.

(b) **Posting.** — The Treasury Department shall post the information received pursuant to this chapter in a manner that allows the public to search contracts or contract summaries by the categories enumerated in section 1701(a)(2).

(c) **Request to review or receive copy of contract.** — The Treasury Department shall maintain a page on its publicly accessible Internet website that includes instructions on how to review a contract on the Internet website.

(d) **Paper copy.** — A paper copy of a contract may be requested from the agency that executed the contract in accordance with this act.

CHAPTER 31. MISCELLANEOUS PROVISIONS

Section 3101. Applicability.

This Act shall apply to requests for information made after December 31, 2008.

Section 3101.1. Relation to other laws.

If the provisions of this act regarding access to records conflict with any other federal or state law, the provisions of this act shall not apply.

Section 3101.2. Severability.

All provisions of this act are severable.

Section 3102. Repeals.

Repeals are as follows:

(1) The General Assembly declares as follows:

(i) The repeal under paragraph (2)(i) is necessary to effectuate Chapter 17.

(ii) The repeals under paragraph (2)(ii) and (iii) are necessary to effectuate this act.

(2) The following acts and parts of acts are repealed:

(i) Section 1104 of the act of April 9, 1929 (P.L.177, No.175), known as The Administrative Code of 1929.

(ii) The act of June 21, 1957 (P.L.390, No.212), referred to as the Right-to-Know Law.

(iii) 62 Pa.C.S. § 106.

Section 3103. References.

Notwithstanding 1 PA.C.S. § 1937(B), a reference in a statute or regulation to the act of June 21, 1957 (P.L.390, No.212), referred to as the Right-to-Know Law, shall be deemed a reference to this act.

Section 3104. Effective date.

This act shall take effect as follows:

(1) The following provisions shall take effect immediately:

(i) Sections 101, 102 and 1310.

(ii) This section.

(2) Chapters 15 and 17 and sections 3102(1)(I) and 3102(2)(I) shall take effect July 1, 2008.

(3) The remainder of this act shall take effect January 1, 2009.

###

Greeley and Hansen LLC
1700 Market Street, Suite 2130
Philadelphia, PA 19103
(215) 563-3460
www.greeley-hansen.com

GREELEY AND HANSEN

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

APR 28 2016

CERTIFIED MAIL

Mr. Robert Willert, Executive Director
Delaware County Regional Quality Control Authority
100 East Fifth Street
Chester, PA 19013

RE: Civil Action 2:15-cv-04652-RB

Dear Mr. Willert:

The United States Environmental Protection Agency (EPA) has received the revised Delaware County Regional Quality Control Authority (DELCORA) Public Participation Plan (PPP) dated April 14, 2016. EPA has consulted with the Pennsylvania Department of the Environment (PADEP). EPA accepts the revised PPP and therefore it is now approved.

Sincerely,

Andrew F. Seligman, Environmental Scientist
Water Enforcement Branch

cc: R. Smolski, EPA
P. Yeany, EPA
M. DeSantis, DELCORA
Jen Field, PADEP, SERO

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APPENDIX M

PUBLIC MEETING NOTES, PRESENTATIONS, AND COMMENTS

- **DELCORA Public Meeting No. 1**
  - Public Meeting No. 1 Notice - Tuesday, March 15, 2016
  - Meeting Notes
  - Responses to Public Comments
  - Sign-In Sheet
  - Public Comment Form
  - Presentation
- **DELCORA Public Meeting No. 2**
  - Public Meeting No. 2 Notice - Tuesday, June 27, 2017
  - Meeting Notes
  - Responses to Public Comments
  - Sign-In Sheet
  - Public Comment Form
  - Presentation
- **DELCORA Public Meeting No. 3**
  - Public Meeting Notice No. 3 - Tuesday, December 5, 2017
  - Meeting Notes
  - Responses to Public Comments
  - Sign-In Sheet
  - Public Comment Form
  - Presentation
- **DELCORA Meeting No. 4**
  - Public Meeting Notice No. 4 - Wednesday, September 26, 2018
  - Meeting Notes
  - Sign-In Sheet
  - Public Comment Form
  - Presentation
- **DELCORA Meeting No. 5**
  - Public Meeting Notice No. 5 – Tuesday, June 9, 2020
  - Meeting Notes
  - Responses to Public Comments
  - Sign-In Sheet
  - Presentation

Note: This Appendix includes mention of Greeley & Hansen which rebranded to TYLin in 2023.

COMBINED SEWER OVERFLOW (CSO)
LONG-TERM CONTROL PLAN UPDATE (LTCPU)
PUBLIC MEETINGS

Please join DELCORA for a series of public meetings on our Combined Sewer Overflow Long-Term Control Plan Update.

Learn about DELCORA's combined sewer system and the proposed strategies for significantly reducing combined sewer overflows to our rivers and streams. Please give us your feedback on items discussed at the scheduled meeting below.

1ST MEETING

TOPIC: Scope and Purpose of the Study
WHEN: Tuesday, March 15, 2016 at 6:00 PM (EST)
WHERE: Chester City Hall
Community Room (Room entrance facing Rt 291)
1 E. 4th Street, Chester, PA - 19013

General Email: ltcpinfo@delcora.org
General Phone Number: 610-876-5523

DELCORA Long Term Control Plan Update

PUBLIC MEETING NO. 1 NOTES

Meeting Title: PUBLIC MEETING NO 1

Date / Time: March 15, 2016 6:00 PM

Prepared By: Marlene Finizio

Location: Chester City Hall

Reviewed By: Michael Hope

Distributed: 4/12/16

Attendees:

Edwin Bothwell, DELCORA
Michael DiSantis, DELCORA
John Pileggi, DELCORA
Robert Willert, DELCORA
Lindsey Isler, DELCORA

Michael Hope, Greeley and Hansen
Marlene Finizio, Greeley and Hansen
See also Public Sign in Sheet

DELCORA held the first of a series of Long Term Control Plan Update (LTCPU) Public Meetings on Tuesday, March 15, 2016. The first public meeting was held to present to the public the Scope of Work and Purpose of the LTCP Update. DELCORA's goal of each public meeting is to inform and solicit input to its updated LTCP from stakeholders, including the public, customer communities and the regulatory agencies. The public meeting was held to as part of the Public Participation Plan. There were approximately 6 individuals from the public in attendance.

The following items were discussed and presented at the first public meeting:

- DELCORA General Introduction and Opening Remarks
- DELCORA Public Participation Plan Program Goals
- Review of DELCORA Service Area
- Combined Sewer Overflow (CSO) Definition and History
- History of Other USEPA LTCPs
- Background of DELCORA Long-Term Control Plan (LTCP)
- Review of DELCORA Consent Decree (CD) Requirements
- Financial Capabilities Assessment (FCA)
- Summary of Where We Are and Next Phase
- Listing of Future Public Meetings
- Public Locations for Review of Available Literature and Documentation
- Contact Information for DELCORA, Questions and DELCORA Website

A representative from the Chester Environmental Planning (CEP) was in attendance and commented on the meeting schedule. DELCORA indicated to the Chester Environmental Planning (CEP) that another meeting may be scheduled in May. **See the attached Public Comment and Response sheet.**

OTHER:

DELCORA will check other meeting locations to make sure that a screen is available.

ACTION ITEMS:

1. DELCORA will make the schedule for the LTCP Update Program available on their website.
2. DELCORA will upload the public meeting notes with sign in sheet to their website.
3. DELCORA will check other meeting locations to make sure that a screen is available.

ATTACHMENTS

- Responses to Public Comments
- Public Sign-In Sheet
- Handouts - Comment Form
- Public Meeting Powerpoint Presentation

DELAWARE COUNTY REGIONAL WATER QUALITY AUTHORITY

LONG TERM CONTROL PLAN UPDATE

PUBLIC PARTICIPATION MEETING NO. 1
LTCPU SCOPE AND PURPOSE
March 15, 2016

RESPONSES TO PUBLIC COMMENTS

1. Comment: Why is there so much time between First and Second Public meetings?

   Response: ***The DELCORA Long Term Control Plan Update program was initiated in August 2015 along with the lodging of the DELCORA USEPA Consent Decree. Each Public Meeting was scheduled in coordination with Milestones in the program.***

   The first public meeting was held in March 2016 to allow time to develop substantial documentation and a schedule for discussion and presentation. The March 15th LTCPU kick-off meeting was to introduce the LTCPU program scope and purpose to the public.

   The second public meeting is scheduled in the 3rd quarter of 2017 to coincide with the system characterization milestone. Per the Public Participation Plan, DELCORA will hold a minimum of four (4) public meetings; however, other meetings will be scheduled as needed. DELCORA indicated that another meeting may be held in May 2016.

   The most important public meeting will be the third meeting to get input from the public on the LTCPU alternatives. This third meeting will be held in Chester City. The first meeting with USEPA was in January 2016.

2. Comment: Will there be timeline in the document handout?

   Response: ***A basic project schedule showing the timeline will be posted on the DELCORA website.***

DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL AUTHORITY
CSO Long Term Control Plan Update

DELCORA Public Participation Meeting #1 — Tuesday, March 15, 2016 Chester City Hall, Chester Pa.

	Name (First & Last)	Street Address	City	State	ZIP Code	Email Address	Receive Updates EMAIL	Receive Updates MAIL
1	Irena R. Byrd	3033 W. 6th St	Chester	PA	19013	treebee0908@gmail	x	
2	John Pileggi	512 E. 19TH ST	Chester	PA	19013			x
3	John Johnson	2539 Lindsay St	Chester	PA	19013	johnjohnson19013@yahoo.com	✓	
4	John & Delores Shelton	138 E 18 St	Chester	PA	19013	drsdst720@hotmail	✓	
5	Livia Smith	1 Fourth St	Chester	PA	19013	lsmith@chestercity.com	✓	
6	Erin Smist	110 Deerfield Ln.	Malvern	PA	19355	esmist@suburbanrealtorsalliance.com		
7	S.J. Dennis		Chester	PA	19013			
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								

Date Rec'd.:		Log No.:		Comment No.:	

DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL AUTHORITY

Public Participation Meeting No. 1
LTCPU Scope and Purpose
March 15, 2016

CLOSING DATE: All Comments Must Be Received 30 calendar days from Public Meeting Date (by April 14, 2016)

1) Responses to public comments will be published within 60 days of the public meeting date (by May 15, 2016). Responses will be posted on the DELCORA Website. Comments may be submitted at the public meeting or by one of the following options:

Email: **ltcpinfo@delcora.org**

On the WEB: **www.delcora.org**

Phone: (610) 876-5523

Mail Address: DELCORA
P.O. Box 999
Chester, PA 19016-0999

2) **PLEASE TYPE OR PRINT CLEARLY**. Forms will be returned if they contain unreadable information.

Name:				Date:	
Jurisdiction/Company:					
Address:					
City:		State:		Zip:	
Phone:		Ext:		Fax:	
Email:					

3) Signature: _____

4). Please provide comments below. Provide additional sheets as needed.

Comment 1 _____

_____

_____

_____

_____

Comment 2 _____

_____

_____

_____

_____

Comment 3 _____

_____

_____

_____

_____

Delaware County Regional Water Quality Control Authority
DELCORA
Delaware County, PA

Combined Sewer Overflow - Long Term Control Plan Update

DELCORA

Public Participation Meeting No. 1

LTCPU Scope and Purpose

March 15, 2016

Chester City Hall Community Room

1 E. 4th Street, Chester, PA

Delaware County Regional Water Quality Control Authority
DELCORA
Delaware County, PA

Public Participation Plan Goals

- DELCORA's goals and objectives for the Public Participation Program are to :
  - Inform and solicit input to its updated LTCP from stakeholders, including the public, customer communities and the regulatory agencies
  - Educate the public
  - Address public concerns

Delaware County Regional Water Quality Control Authority
DELCORA
Delaware County, PA

General Information

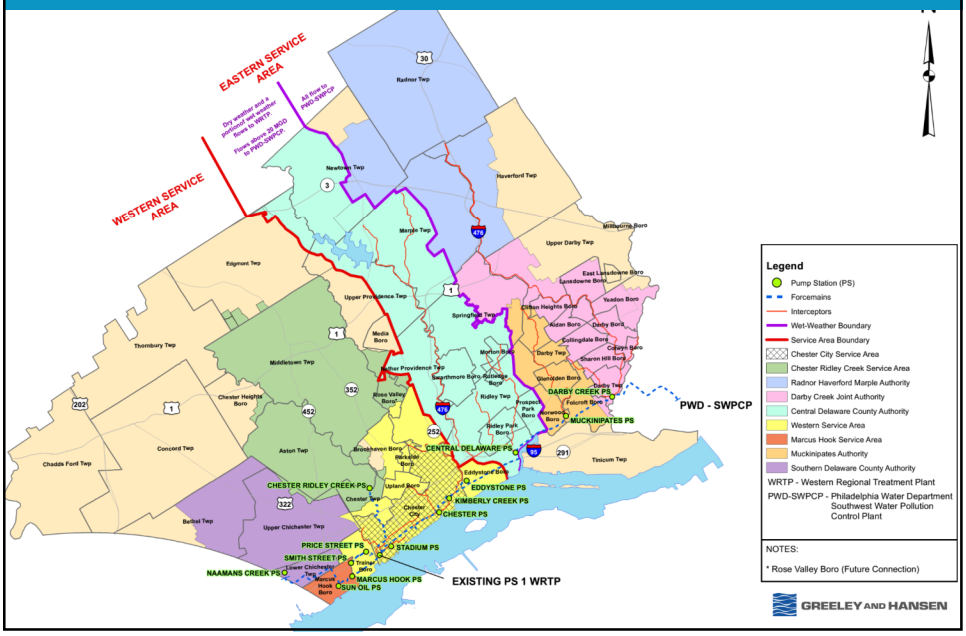
- DELCORA is the Delaware County Regional Water Quality Authority, established in 1971, responsible for collecting, conveying and treating wastewater in the greater Philadelphia Area including 42 Municipalities in Delaware and Chester County.

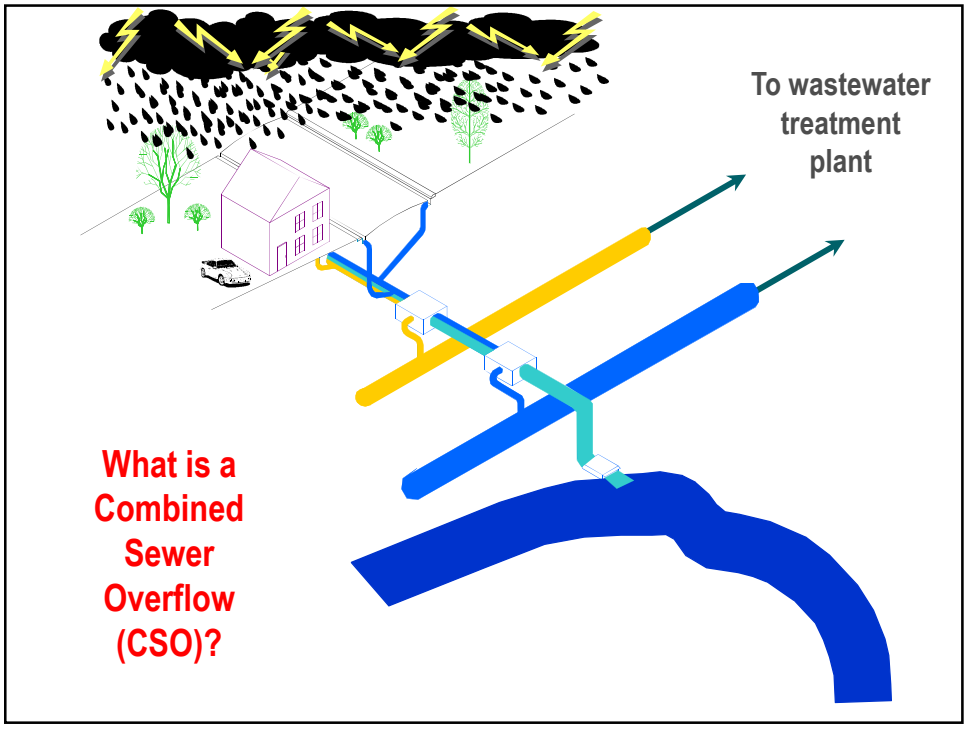
DELCORA Mission

"Provide environmentally responsible and cost effective wastewater management services to the citizens, businesses, and industries of Southeastern Pennsylvania"

Delaware County Regional Water Quality Control Authority
DELCORA
Delaware County, PA

DELCORA Service Area





Delaware County Regional Water Quality Control Authority
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Delaware County, PA

Definitions

- **LTCP:** The Long Term Control Plan is the document that lays out how DELCORA will maintain the outfalls and reduce the flow and/or treat the discharge from the outfalls to the water ways to meet the requirements of the Clean Water Act.
- **Sanitary Sewer:** The system that contains only waste from bathrooms, sinks, washers etc.
- **Storm Sewer:** Run off from streets.
- **Combined Sewer System:** Pipe that has both sanitary sewage and storm water in it.
- **Combined Sewer Overflow:** An overflow is the relief point in the combined sewer system that allows the extra flow when it rains to be discharged directly to streams and rivers.
- EPA: United States Environmental Protection Agency
- DEP: Pennsylvania Department of Environmental Protection

Delaware County Regional Water Quality Control Authority
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Delaware County, PA

History of Combined Sewer System

- In the early 1900's the City of Chester's Combined Sewer System was constructed.
  - This was, at the time, a typical engineering practice in Urban areas.
- In 1971 DELCORA became the owner of the existing Sanitary and Combined Sewer System in the City of Chester.
- Discharges from CSOs are authorized through the National Pollutants Discharge Elimination System (NPDES) permit during Wet Weather Flow.

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DELCORA Combined Sewer Area

Delaware County Regional Water Quality Control Authority
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History of EPA LTCPs

- LTCP Consent Decrees/Order for various wastewater systems not only throughout Pennsylvania, but the entire country.
  - Washington DC, New York City, Richmond,
- Current Pennsylvania communities already impacted by LTCP Consent Decree Costs & Fines:
  - Williamsport
  - Scranton
  - Harrisburg
  - Pittsburgh

Delaware County Regional Water Quality Control Authority
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Delaware County, PA

Philadelphia LTCP

- DELCORA is currently contributing to the Philadelphia LTCP.
  - Philadelphia's LTCP has an overall price tag of over $2 Billion over 25 years.
  - DELCORA's proportionate share of the Philadelphia LTCP is $178 million over 15 years due to the term of our contract with Philadelphia.

Delaware County Regional Water Quality Control Authority
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DELCORA LTCP Background

- In 1999 in response to increased environmental regulations, DELCORA implemented an LTCP for the DELCORA Combined Sewer System in the City of Chester.
- The LTCP identified capital improvements and operation and maintenance practices to reduce overflows.
- From 1999-2009 DELCORA spent in excess of $5 million on improvements and contributions to the City of Chester that resulted in decreased volume of overflows, reduced debris in overflows, provided remote monitoring of the system, and improved routine maintenance.
- In 2009, the DEP and EPA determined that DELCORA's LTCP was no longer in compliance with increased regulations of the Clean Water Act. In response, DELCORA began working with DEP and EPA to update the LTCP.

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LTCP Background (Continued)

- In 2012, DELCORA submitted a revised LTCP to DEP and EPA.
- A key element in DELCORA's revised plan position was that the CSOs are only found in the City of Chester and the financial burden on the City of Chester residents must be considered.
- In 2014, DEP and EPA determined that DELCORA's revised LTCP required further evaluation and development so the Department of Justice was assigned to pursue a Consent Decree.

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Delaware County, PA

DELCORA Consent Decree

- The Consent Decree was agreed to by DELCORA on July 1, 2015 and signed into effect by the Dept. of Justice (DOJ) in November 2015. The Consent Decree is a legally binding agreement between DELCORA, EPA , and DEP in which DELCORA agrees to update the current LTCP.
- Generally, the Consent Decree consists of:
  - Compliance Measures
  - Milestones for plan update and implementation
  - Civil penalty
  - Stipulated penalties for non-compliance
- DELCORA has been given 42 months (3½ years) to develop a plan and 20 total years to implement the plan. When projects are complete and on-line, sewer fee charges will include costs for the updated LTCP.

Delaware County Regional Water Quality Control Authority
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Delaware County, PA

LTCPU Summary – Where We Are

- Hired expert consultants with a good track record as well as experience specifically related to the LTCP.
  - Greeley & Hansen: Engineering Consultant for the LTCP
  - Municipal & Financial Services Group: Rate Model Consultant
  - Blank Rome: Law Firm
- 100% compliance to date with Consent Decree
  - Submitted to date :
    - Public Participation Plan
    - Hydrologic and Hydraulic Model Update and Calibration Plan
    - Typical Hydrologic Period Plan
    - Semi-Annual Report
    - Sensitive Areas and Pollutants of Concern Report
  - To be Submitted by May 17, 2016
    - Draft FCA and Alternative Evaluation Report

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Delaware County, PA

Financial Capability Assessment (FCA)

- The Consent Decree requires DELCORA to submit a DRAFT FCA by May 17, 2016 and FINAL FCA at the end of the project.
- Financial Capability Assessment's (FCA's) purpose is to determine the affordability of the LTCP.
- Develop fair, equitable, and legal cost share for conveyance, storage, and treatment of wet weather flows

Delaware County Regional Water Quality Control Authority
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Delaware County, PA

Financial Capability Assessment (FCA)

Financial Capability Matrix

Permittee Financial Capability Indicators Score (Socioeconomic, Debt & Financial Indicators)	Residential Indicator (Cost Per Household as a % of MHI)		
	Low (1.0% and Below)	Mid-Range (Between 1.0% and 2.0%)	High (2.0% and Above)
Weak (1.5 and Below)	Medium Burden	High Burden	High Burden
Mid-Range (Between 1.5 and 2.5)	Low Burden	Medium Burden	High Burden
Strong (2.5 and Above)	Low Burden	Low Burden	Medium Burden

Delaware County Regional Water Quality Control Authority
DELCORA
Delaware County, PA

LTCPU Summary – Next Phase

- Sampling
- Flow Monitoring and Precipitation Monitoring Installation
- Data Analysis
- Model Development
- System Characterization
- Development and Evaluation of Alternatives for CSO Controls
- Selection and Implementation of the Long-Term Plan
- Continued Public and Stakeholder Involvement

Delaware County Regional Water Quality Control Authority
DELCORA
Delaware County, PA

Future Public Meetings

- **2nd Meeting**

  Topic: System Characterization
  When: 3rd Quarter 2017
  Where: Ridley Township Municipal Building
  100 MacDade Boulevard; Folsom, PA 19033

- **3rd Meeting**

  Topic: Development and Evaluation of Alternatives for CSO Controls
  When: 4th Quarter 2017
  Where: Chester City Hall
  1 E. 4th Street; Chester, PA 19103

Delaware County Regional Water Quality Control Authority
DELCORA
Delaware County, PA

Public Meetings (Continued)

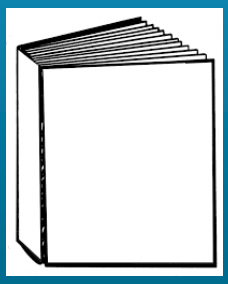
- **4th Meeting**

  Topic: Selection and Implementation of the Long-Term Plan
  When: 3rd Quarter 2018
  Where: Aston Township Administration Building
  5021 Pennell Road; Aston, PA 19014

Delaware County Regional Water Quality Control Authority
DELCORA
Delaware County, PA

Literature and Documentation

- Literature and documentation will be made available by DELCORA at the following public locations and on the DELCORA website:
  - **DELCORA Administration Building**
    100 East Fifth Street; Chester, PA 19013
  - **Lewis Crozer Library**
    620 Engle Street; Chester, PA 19013
  - **Marcus Hook Municipal Building**
    1015 Green Street; Marcus Hook, PA 19061
  - **Ridley Township Building**
    100 MacDade Blvd.; Folsom, PA 19033
  - **Upland Borough Office**
    224 Castle Avenue; Brookhaven, PA 19015
  - **Chester Township**
    1150 Engle Street; Chester, PA 19013



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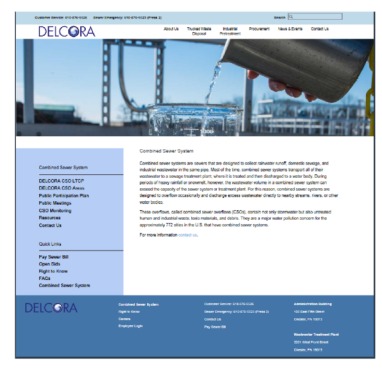
DELCORA
Delaware County, PA

DELCORA WEBSITE



www.delcora.org

Delaware County Regional Water Quality Control Authority
DELCORA
Delaware County, PA

CONTACT DELCORA

- Mail Address:
  - DELCORA
    P.O. Box 999
    Chester, PA 19016-0999
- Email: ltcpinfo@delcora.org
- On the WEB: www.delcora.org
- General Phone Number: 610-876-5523
- Newsletter
- Sign-Up Sheet

-Thank You-

Delaware County Regional Water Quality Control Authority
DELCORA
Delaware County, PA

Discussion - Q&A

COMBINED SEWER OVERFLOW (CSO)
LONG-TERM CONTROL PLAN UPDATE (LTCPU)
PUBLIC MEETINGS

Please join DELCORA for a series of public meetings on our Combined Sewer Overflow Long-Term Control Plan Update.

Learn about DELCORA's combined sewer system and the proposed strategies for significantly reducing combined sewer overflows to our rivers and streams. Please give us your feedback on items discussed at the scheduled meeting below.

2ND MEETING

TOPIC: Scope and Purpose of the Study
WHEN: Tuesday, June 27, 2017 at 6:00 PM (EST)
WHERE: Ridley Township Municipal Building
100 MacDade Boulevard, Folsom, PA 19033

General Email: ltcpinfo@delcora.org
General Phone Number: 610-876-5523

DELCORA Long Term Control Plan Update
PUBLIC MEETING NO. 2 NOTES

Meeting Title: PUBLIC MEETING NO 2

Date / Time: June 27, 2017 6:00 PM

Prepared By: Marlene Finizio

Location: Ridley Township Municipal Building
100 E. MacDade Boulevard
Folsom, PA

Reviewed By: Michael Hope

Distributed: 7/12/17

Attendees:
Robert Willert, DELCORA
Charles Hurst, DELCORA
Michael DiSantis, DELCORA
John Pileggi, DELCORA
Lindsey Isler, DELCORA

Michael Hope, Greeley and Hansen
Marlene Finizio, Greeley and Hansen
See also Public Sign in Sheet

DELCORA held the Second of a series of Long Term Control Plan Update (LTCPU) Public Meetings on Tuesday, June 27, 2017 at the Ridley Township Municipal Building, 100 E. MacDade Boulevard, Folsom, PA. The second public meeting was held to present to the public the LTCPU System Characterization for the LTCP Update. DELCORA's goal of each public meeting is to inform and solicit input to its updated LTCP from stakeholders, including the public, customer communities and the regulatory agencies. The public meeting was held to as part of the Public Participation Plan. There were approximately 6 individuals from the public in attendance. One representative from the University of Pennsylvania was present at the meeting.

The following items were discussed and presented at the first public meeting:

- DELCORA General Introduction and Opening Remarks
- DELCORA Public Participation Plan Program Goals
- Review of DELCORA Service Area
- Combined Sewer Overflow (CSO) Definition and History
- History of Other USEPA LTCPs
- Background of DELCORA Long-Term Control Plan (LTCP)
- Review of DELCORA Consent Decree (CD) Requirements
- Financial Capabilities Assessment (FCA)
- Summary of Where We Are and Next Phase
- LTCPU System Characterization
- LTCPU Sensitive Areas
- Listing of Future Public Meetings
- Public Locations for Review of Available Literature and Documentation
- Contact Information for DELCORA, Questions and DELCORA Website

Poster Boards were situated at the door of the Ridley Township Municipal Building to encourage public attendance and direct the public to the meeting room. Photos of Public Meeting No. 2 are shown below. **See the attached Public Comment and Response sheet.**

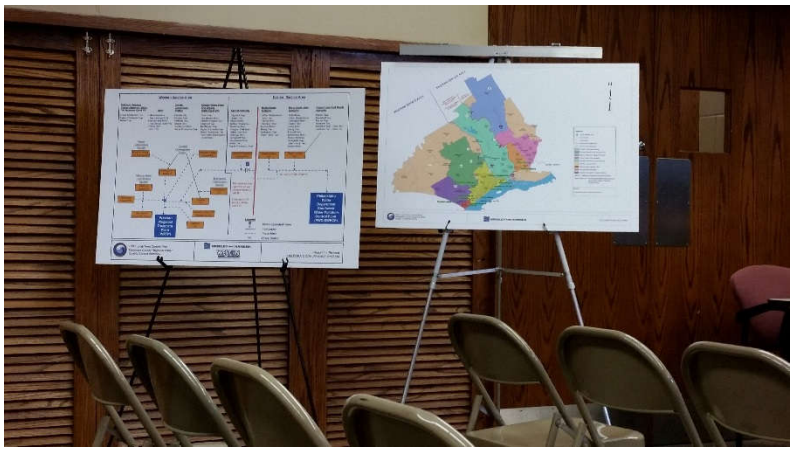
DELCORA Long Term Control Plan Update
PUBLIC MEETING NO. 2 NOTES

ACTION ITEMS:

1. DELCORA will upload the public meeting notes with sign in sheet to their website.

ATTACHMENTS

- Public Sign-In Sheet
- Handouts at the meeting
- Responses to Public Comments
- Posterboards
- Public Meeting No. 2 PowerPoint Presentation



DELAWARE COUNTY REGIONAL WATER QUALITY AUTHORITY

LONG TERM CONTROL PLAN UPDATE

PUBLIC PARTICIPATION MEETING NO. 2
LTCPU DEVELOPMENT AND EVALUATION OF ALTERNATIVES FOR CSO CONTROLS
June 27, 2017

RESPONSES TO PUBLIC COMMENTS

1. Comment: How often does it happen that flow is sent to the WRTP from Central Pump Station?

   Response: ***Only when it rains and the flow is over 20 MGD at the Pump Station.***

2. Comment: Are any of the industrial users such as Kimberly Clark or Sun Oil impacting the CSO's System?

   Response: ***All Industries connect to the WRTP via force main. No, the industrial discharges do not have an impact on the CSO area or contribute to the CSOs.***

3. Comment: There is no primary contact on the Delaware? I have seen water skiing in this area.

   Response: ***South of mile marker 81.8, the Delaware River is designated for primary contact. The Delaware River is designated for secondary contact north of mile marker 81.8.***

4. Comment: Is fishing allowed from the embankment?

   Response: ***The Coast Guard does not allow fishing in this area.***
   (Doctor Marilyn Howarth): The Delaware River is not a body of water that fish should be eaten from.

5. Comment: Is there contact at the boat dock?

   Response: ***The boat launch is in the primary contact area of the Delaware River.***

6. Comment: Are water sampling results from both wet and dry weather sampling available for public review?

   Response: ***Sampling results are not currently available but will be published in the Water Quality Modeling Report when it is completed. The report will be available to the public on the DELCORA website.***

7. Comment: You mentioned that water quality information was gathered from the community groups. Which ones were used and how did you reach out?

Response: ***The information is available on STORIT website.***

8. Comment: Did you ask Sierra Club for Data?

Response: ***Only Federal or State databases were used.***

9. Comment: What are the beneficial uses of the receiving streams?

Response: ***The Ridley and Chester Creeks are both designated for secondary contact.***

10. Comment: Is there swimming or drinking water use?

Response: ***There are no drinking water intakes in the streams. Also, no swimming or full body immersion is allowed.***

11. Comment: Are the Chester and Ridley Creeks impaired by nutrients?

Response: ***They are impaired by siltation.***

12. Comment: Are you going to continue rainfall and flow monitoring?

Response: ***DELCORA is not anticipating doing any additional flow monitoring at this time. Sampling will resume after the CSO controls are implemented, to verify that the alternatives are reducing the quantity and frequency of CSOs.***

13. Comment: Philadelphia's LTCP that promotes the use of green infrastructure has gotten a lot of positive recognition. Are these types of projects good for Chester?

Response: ***Yes. DELCORA is working with the City of Chester to develop a GI plan. Their consultant is working with DELCORA to evaluate Green Infrastructure. Green Infrastructure is required to be evaluated by the Consent Decree. At this time, we are not sure how many alternatives will be Green Infrastructure, but it is an option that is being looked at.***

DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL AUTHORITY
CSO Long Term Control Plan Update

DELCORA Public Participation Meeting #2 — Tuesday, June 27, 2017 Ridley Township Municipal Bldg.; Folsom, PA

	Name (First & Last)	Street Address	City	State	ZIP Code	Email Address	Receive Updates: EMAIL	Receive Updates: MAIL
1	MICHAEL HOPE					mhope@greeley-hansen.com		
2	Thomas McKean					mckeant@psu.edu		
3	Marilyn Howarth	VPEIVN	Phila	PA		howarthmv@gmail.com		
4	Charles Hurst							
5	John Pilegge		Chester	PA				
6	John Scott			jscott@coventer.com		~~johnscott@cyrha.com~~		
7	Erin Smist					esmist@suburbanrealtorsalliance.com		
8	Ann Fowler	1350 Edgmont Ave	Chester	PA		AMF12@PSU.EDU	✓	
9	Jachyn Rhoads	"	Chester	PA		jmd61@psu.edu	✓	
10	MARLENE FINIZIO					mfinizio@greeley-hansen.com		
11								
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Date Rec'd.:		Log No.:		Comment No.:	

DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL AUTHORITY

Public Participation Meeting No. 2
LTCPU System Characterization
June 27, 2017

CLOSING DATE: All Comments Must Be Received 30 calendar days from Public Meeting Date (by July 27, 2017)

1) Responses to public comments will be published within 60 days of the public meeting date (by May 15, 2016). Responses will be posted on the DELCORA Website. Comments may be submitted at the public meeting or by one of the following options:

Email: **ltcpinfo@delcora.org**

On the WEB: **www.delcora.org**

Phone: (610) 876-5523

Mail Address: DELCORA
P.O. Box 999
Chester, PA 19016-0999

2) **PLEASE TYPE OR PRINT CLEARLY**. Forms will be returned if they contain unreadable information.

Name:				Date:	
Jurisdiction/Company:					
Address:					
City:		State:		Zip:	
Phone:		Ext:		Fax:	
Email:					

3) Signature: _____

4). Please provide comments below. Provide additional sheets as needed.

Comment 1 _____

_____

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Comment 2 _____

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Comment 3 _____

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Delaware County Regional Water Quality Control Authority
DELCORA
Delaware County, PA

Combined Sewer Overflow - Long Term Control Plan Update

DELCORA

Public Participation Meeting No. 2

LTCPU System Characterization

June 27, 2017

Ridley Township Municipal Building

100 East MacDade Boulevard, Folsom, PA

Delaware County Regional Water Quality Control Authority
DELCORA
Delaware County, PA

Public Participation Plan Goals

- DELCORA's Goals and Objectives for the Public Participation Program are to :
  - Inform and Solicit Input to Updated LTCP from Stakeholders, including Public, Customer Communities and Regulatory Agencies
  - Educate the Public
  - Address Public Concerns

2

Delaware County Regional Water Quality Control Authority
DELCORA
Delaware County, PA

General Information

- DELCORA is the Delaware County Regional Water Quality Control Authority, established in 1971, responsible for collecting, conveying and treating wastewater in the greater Philadelphia Area including 42 Municipalities in Delaware and Chester County.

DELCORA Mission

"Provide environmentally responsible and cost effective wastewater management services to the citizens, businesses, and industries of Southeastern Pennsylvania"

3

Delaware County Regional Water Quality Control Authority
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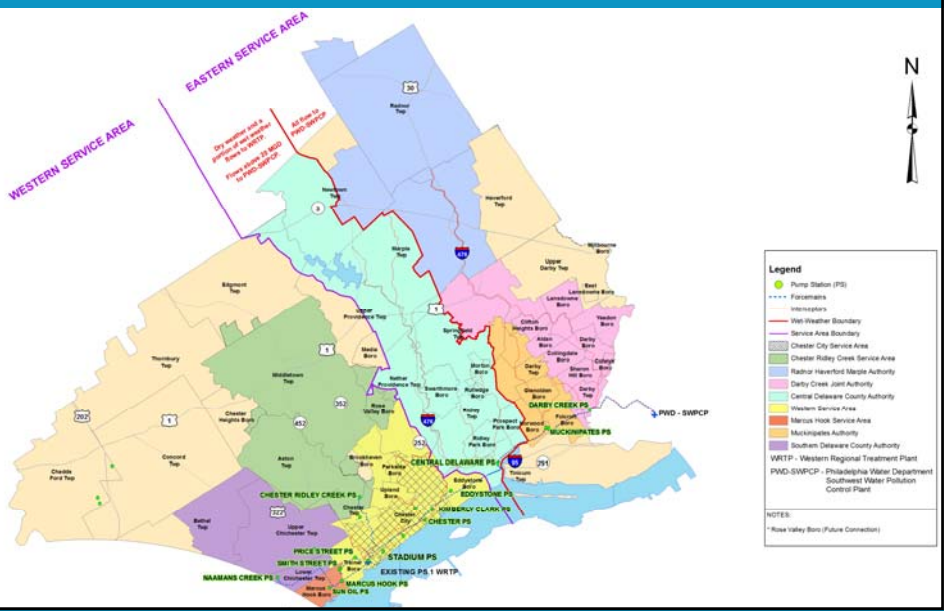
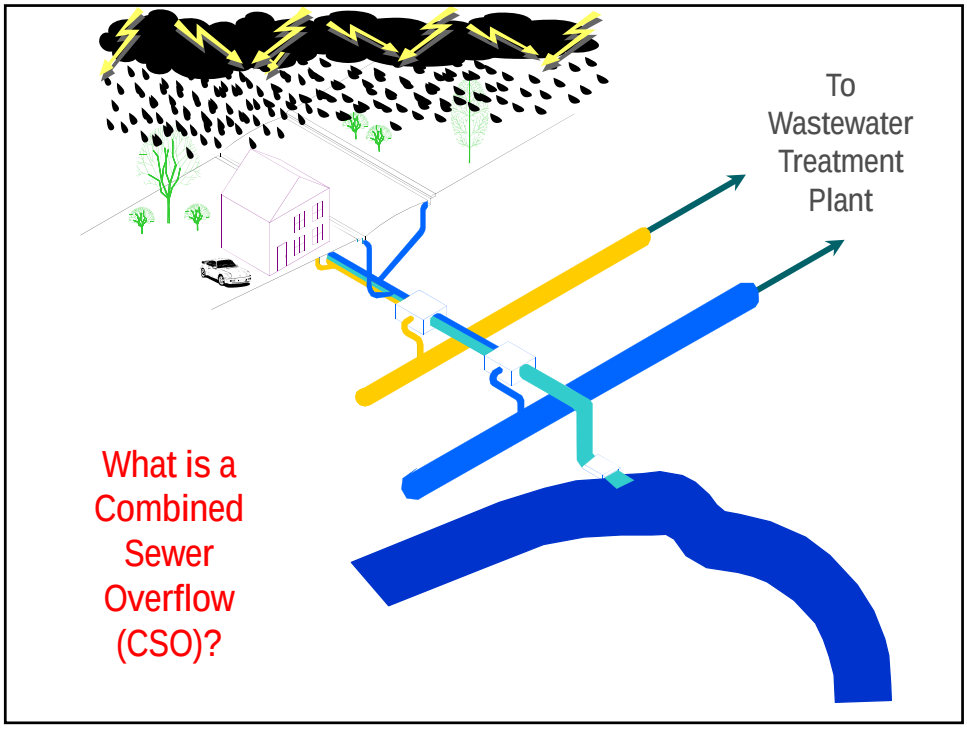
Delaware County, PA

DELCORA Service Area





Delaware County Regional Water Quality Control Authority
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Definitions

- **LTCP:** The Long Term Control Plan is the document that lays out how DELCORA will maintain the outfalls and reduce the flow and/or treat the discharge from the outfalls to the water ways to meet the requirements of the Clean Water Act.
- **Sanitary Sewer:** The system that contains only waste from bathrooms, sinks, washers etc.
- **Storm Sewer:** Run off from streets.
- **Combined Sewer System:** Pipe that has both sanitary sewage and storm water in it.
- **Combined Sewer Overflow:** An overflow is the relief point in the combined sewer system that allows the extra flow when it rains to be discharged directly to streams and rivers.
- USEPA: United States Environmental Protection Agency
- PADEP: Pennsylvania Department of Environmental Protection

6

Delaware County Regional Water Quality Control Authority
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Delaware County, PA

History of Combined Sewer System

- In the early 1900's the City of Chester's Combined Sewer System was constructed.
  - This was, at the time, a typical engineering practice in Urban areas.
- In 1971 DELCORA became the owner of the existing Sanitary and Combined Sewer System in the City of Chester.
- Discharges from CSOs are authorized through the National Pollutants Discharge Elimination System (NPDES) permit during Wet Weather Flow.

7

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DELCORA Combined Sewer Area

Delaware County Regional Water Quality Control Authority
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History of EPA LTCPs

- LTCP Consent Decrees/Order for Various Wastewater Systems not only Throughout Pennsylvania, but Entire Country
  - Washington DC, New York City, Richmond
- Current Pennsylvania Communities Already Impacted by LTCP Consent Decree Costs & Fines:
  - Williamsport
  - Scranton
  - Harrisburg
  - Pittsburgh

9

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Philadelphia LTCP

DELCORA is Currently Contributing to Philadelphia LTCP

- *The Philadelphia LTCP is currently being re-negotiated with EPA. The initial amount of the Philadelphia LTCP was approximately $2.2 billion. A recent Philadelphia bond document stated that the revised cost could be around $4.5 billion. It is uncertain what the outcome of the negotiations will be.*
- *DELCORA's proportionate share of Philadelphia's LTCP is dependent on the results of the Philadelphia – EPA negotiation. DELCORA's initial share as of 2013 was approximately $175 million. DELCORA is waiting for Philadelphia to confirm its revised cost. The term of the DELCORA - PWD contract runs from 2013 to 2028.*

10

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DELCORA LTCP Background

- In 1999 in response to increased environmental regulations, DELCORA implemented an LTCP for the DELCORA Combined Sewer System in the City of Chester.
- The LTCP identified capital improvements and operation and maintenance practices to reduce overflows.
- From 1999-2009 DELCORA spent in excess of $5 million on improvements and contributions to the City of Chester that resulted in decreased volume of overflows, reduced debris in overflows, provided remote monitoring of the system, and improved routine maintenance.
- In 2009, the DEP and EPA determined that DELCORA's LTCP was no longer in compliance with increased regulations of the Clean Water Act. In response, DELCORA began working with DEP and EPA to update the LTCP.

11

Delaware County Regional Water Quality Control Authority
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LTCP Background (Continued)

- In 2012, DELCORA submitted a revised LTCP to DEP and EPA.
- A key element in DELCORA's revised plan position was that the CSOs are only found in the City of Chester and the financial burden on the City of Chester residents must be considered.
- In 2014, DEP and EPA determined that DELCORA's revised LTCP required further evaluation and development so the Department of Justice was assigned to pursue a Consent Decree.

12

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DELCORA Consent Decree

- The Consent Decree was agreed to by DELCORA on July 1, 2015 and signed into effect by the Dept. of Justice (DOJ) in November 2015. The Consent Decree is a legally binding agreement between DELCORA, EPA , and DEP in which DELCORA agrees to update the current LTCP.
- Generally, the Consent Decree consists of:
  - Compliance Measures
  - Milestones for Plan Update and Implementation
  - Civil Penalty
  - Stipulated Penalties for Non-Compliance
- DELCORA has been given 42 months (3½ years) to develop a plan and 20 total years to implement the plan. When projects are complete and on-line, sewer fee charges will include costs for the updated LTCP.

13

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LTCPU Summary – Where We Are

- Hired Expert Consultants with Good Track Records as Well as Experience Specifically Related to LTCP
  - Greeley & Hansen: Engineering Consultant for the LTCP
  - Municipal & Financial Services Group: Rate Model Consultant
  - Blank Rome: Law Firm
- 100% Compliance to Date with Consent Decree
  - Reports Submitted to Date :
    - Public Participation Plan
    - Hydrologic and Hydraulic Model Update and Calibration Plan
    - Typical Hydrologic Period Plan
    - Semi-Annual Reports for 2015 and 2016
    - Sensitive Areas and Pollutants of Concern Report

14

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LTCPU Summary – Where We Are

- 100% Compliance to Date with Consent Decree (Continued)
  - Reports Submitted to Date (Continued):
    - Draft Financial Capabilities Assessment (FCA) Report
    - Alternative Evaluation Approach
    - Rainfall and Flow Monitoring Quarterly Reports for 1st , 2nd, 3rd, and 4th Quarters
    - Water Quality Monitoring and Modeling Work Plan
    - Water Quality Monitoring and Modeling Quality Assurance Project Plan

15

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Financial Capability Assessment (FCA)

- The Consent Decree Requires DELCORA to Submit a DRAFT FCA by May 17, 2016 and a FINAL FCA at End of Project. The Draft FCA was submitted on May 13, 2016.
- FCA's Purpose is to Determine Affordability of LTCP
- Develop Fair, Equitable, and Legal Cost Share for Conveyance, Storage and Treatment of Wet Weather Flows

16

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Financial Capability Assessment (FCA)

Financial Capability Matrix

Permittee Financial Capability Indicators Score (Socioeconomic, Debt & Financial Indicators)	Residential Indicator (Cost Per Household as a % of MHI)		
	Low (1.0% and Below)	Mid-Range (Between 1.0% and 2.0%)	High (2.0% and Above)
Weak (1.5 and Below)	Medium Burden	High Burden	High Burden
Mid-Range (Between 1.5 and 2.5)	Low Burden	Medium Burden	High Burden
Strong (2.5 and Above)	Low Burden	Low Burden	Medium Burden

17

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LTCPU Status – Next Phase

- Rainfall and Flow Monitoring - **Completed**
- Dry Weather and Wet Weather Water Quality Sampling - **Completed**
- Data Analysis - **Under Development**
- Hydrologic and Hydraulic Model Development - **Under Development**
- Water Quality Model Development - **Under Development**
- System Characterization - **Under Development**
- Development and Evaluation of Alternatives for CSO Controls - **Under Development**
- Selection and Implementation of the Long Term Plan Alternatives – **2018**
- Continued Public and Stakeholder Involvement – **Ongoing**

18

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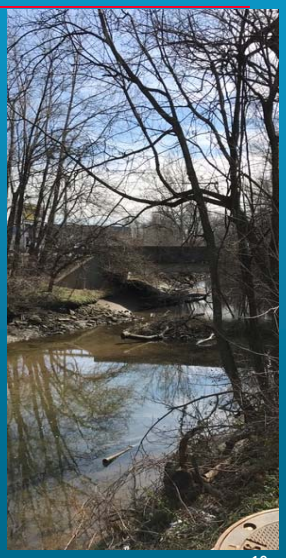
LTCPU System Characterization

- Regulatory Requirements
- DELCORA Model Area
- Model Area Characteristics
- Receiving Water Characteristics
- Combined Sewer System Modeling
- Water Quality Modeling



19

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LTCPU System Characterization

- Regulatory Requirements
  - Consent Decree: *"Not later than two years (24) months after the Date of Lodging of the Consent Decree, DELCORA shall submit a characterization of the Model Area that includes all of the information required by CSO Control Policy Section II.C.1 and associated guidance…"*
  - CSO Control Policy (USEPA, 1994). Section II.C.1 of the CSO Control Policy: *"In order to design a CSO control plan to adequately meet the requirements of the CWA, a permittee should have a thorough understanding of its sewer system, the response of the system to various precipitation events, the characteristics of the overflows, and the water quality impacts that result from CSOs. The permittee should adequately characterize through monitoring, modelling, and other means as appropriate, for a range of storm events, the response of its sewer system to wet weather events including the number, location and frequency of CSOs volume, concentration and mass of pollutants discharged and the impacts of the CSOs on the receiving waters and their designated uses."*

20

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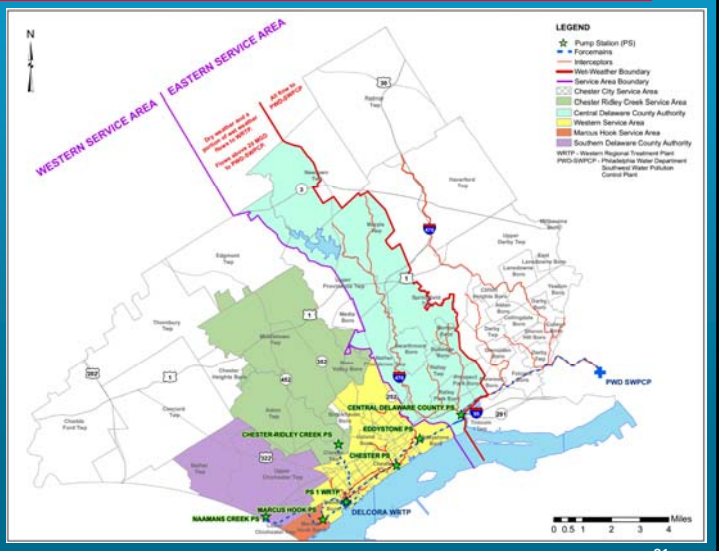
LTCPU System Characterization

Model Area

- Combined Sewer Area – Chester City
- Separated Sewer Areas – Separate Sanitary Sewer System and Separate Storm Water include Western and Central



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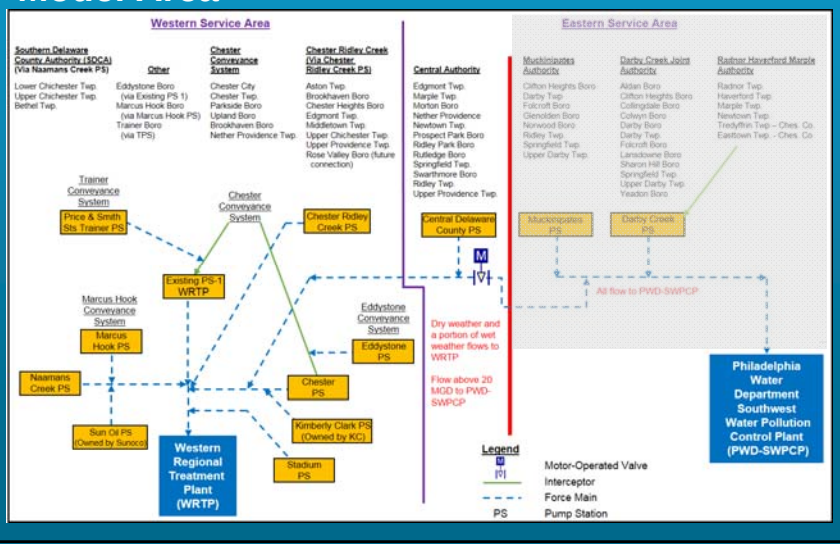
LTCPU System Characterization

Model Area



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LTCPU System Characterization

Model Area Characteristics

- Land Characteristics
  - Pervious vs. Impervious
  - Storm Water Infiltration vs. Runoff
- Obtain Collection System Data - DELCORA Existing Sewer Maps, Design Drawings and Field Surveys
- Collection System Piping
- Collection System Pump Stations – 7 Pump Stations
- Collection System Subcatchments – 55 CSO Subcatchments, 56 Separated Sewer Subcatchments
- Collection System CSO Regulator Structures
- CSO Regulator Improvement Program - 80% of Regulators Upgraded

23

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LTCPU System Characterization

26 Regulators and 25 CSO Outfalls

Name of Receiving Stream	CSO Regulator/Outfall	Interceptor/CSO Regulator Location
Delaware River	002	Front and Booth
Delaware River	003	Front and Highland
Delaware River	004	Front and Haves
Delaware River	005	Front and Townsend
Delaware River	007	Delaware and Reaney
Delaware River	008	2nd and Tilghman
Delaware River	009	2nd and Lloyd
Delaware River(1)	010	5th and Pusey
Delaware River	011	2nd and Parker
Delaware River	013	2nd and Welsh
Delaware River	014	3rd and Upland
Delaware River(2)	032	2nd and Avenue of The States
Chester Creek	012	2nd and Edgmont
Chester Creek	019	14th and Crozer Hospital
Chester Creek	020	Kerlin and Finland
Chester Creek	021	9th and Sproul
Chester Creek	022	6th and Sproul
Chester Creek	023	3rd and Edgmont
Chester Creek	024	3rd and Dock
Chester Creek	025	5th and Penn
Chester Creek	026	7th and Penn
Ridley Creek	015	4th and Melrose
Ridley Creek	016	8th and McDowell
Ridley Creek	017	9th and Campbell
Ridley Creek	018	Sun Drive and Hancock Street
Ridley Creek(2)	033	Elkington Boulevard and Ridley Creek

Notes:

(1) CSO Regulator #010 Discharges to Delaware River through CSO Outfall #009

(2) No Mechanical Regulator Used for this Outfall

(3) Regulator No Longer Connected to Combined Sewer System, but has not yet been Deleted from NPDES Permit

24

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LTCPU System Characterization

- Receiving Water Characteristics
- Receiving Waters: Delaware River (Downstream of R.M. 81.8), Delaware River (Upstream of R.M. 81.8), Chester Creek, and Ridley Creek
- Parameters Considered: DRBC WQR, PA Code, NPDES Permit, CSO Guidance Document, 303(d) List, Detected at Plant Influent.
- Identified Pollutants of Concern (POCs) for each Receiving Water Body
  - Fecal Coliform Bacteria
  - Enterococcus Bacteria
  - Escherichia Coli (E. Coli) Bacteria

25

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LTCPU System Characterization

- Combined Sewer System Modeling
  - Based on EPA Storm Water Management Model (SWMM)
- Simulates Runoff and Flow of Sewage Through Collection System During Storm Events
- Used to Estimate Existing (Baseline) CSO Discharge Volume to Receiving Water Bodies
- Used to Evaluate Effect of Proposed CSO Control Alternatives on CSO Discharge Volume
  - Helps Evaluate Effectiveness of Proposed Alternative

26

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LTCPU System Characterization

- Water Quality Modeling
  - Software - Environmental Fluid Dynamics Code (EFDC)
- Simulate Effect of CSOs on Water Quality of Receiving Streams under Existing Conditions (Baseline)
- Used to Evaluate Effect of Proposed CSO Control Alternatives on Water Quality

27

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LTCPU System Characterization

- Final System Characterization Report
  - Submit Report to USEPA by August 2017
  - Baseline H&H Modeling Results
- Final Water Quality Modeling Results Report Complete and Submitted by February 2018

28

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LTCPU Sensitive Areas

- Sensitive Areas
- Conducted Survey to Assist in Designated Use Determination Per Consent Decree
- The CSO Control Policy states the six (6) criteria for defining an area as a "Sensitive Area" include:
  1. Designated Outstanding National Resource Waters
  2. National Marine Sanctuaries
  3. Waters with Threatened or Endangered Species and Their Habitat
  4. Waters with Primary Contact Recreation
  5. Public Drinking Water Intakes or Their Designated Protected Areas
  6. Shellfish Beds

29

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LTCPU Sensitive Areas

Sensitive Areas

30

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Future Public Meetings

- **3nd Meeting – December 5, 2017**

  Topic: **Development and Evaluation of Alternatives for CSO Controls**
  When: 4th Quarter 2017
  Where: Chester City Hall
  1 E. 4th Street; Chester, PA 19103

- **4th Meeting**

  Topic: **Selection and Implementation of the Long-Term Plan**
  When: 3rd Quarter 2018
  Where: Aston Township Administration Building
  5021 Pennell Road; Aston, PA 19014

31

Delaware County Regional Water Quality Control Authority
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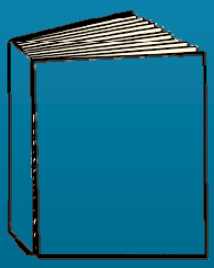
Literature and Documentation

- Literature and Documentation will be Made Available by DELCORA at the Following Public Locations and on the DELCORA Website:
  - **DELCORA Administration Building**
    100 East Fifth Street; Chester, PA 19013
  - **Lewis Crozer Library**
    620 Engle Street; Chester, PA 19013
  - **Marcus Hook Municipal Building**
    1015 Green Street; Marcus Hook, PA 19061
  - **Ridley Township Building**
    100 MacDade Blvd.; Folsom, PA 19033
  - **Upland Borough Office**
    224 Castle Avenue; Brookhaven, PA 19015
  - **Chester Township**
    1150 Engle Street; Chester, PA 19013



32

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DELCORA WEBSITE

www.delcora.org

33

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CONTACT DELCORA

- **Mail Address:**
  - **DELCORA**
    P.O. Box 999
    Chester, PA 19016-0999
- **Email: ltcpinfo@delcora.org**
- **On the WEB: www.delcora.org**
- **General Phone Number: 610-876-5523**
- **Newsletter**
- **Sign-Up Sheet**

-Thank You-

34

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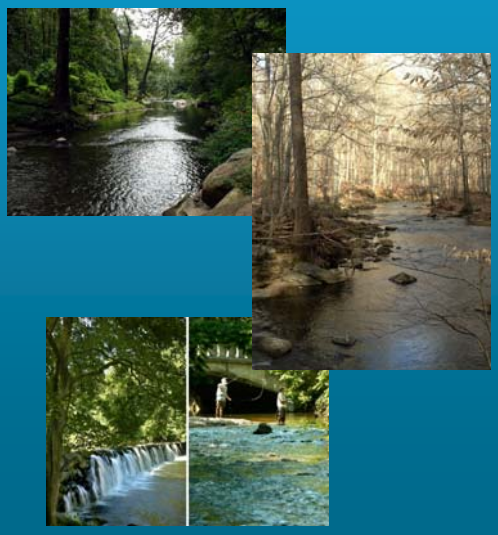
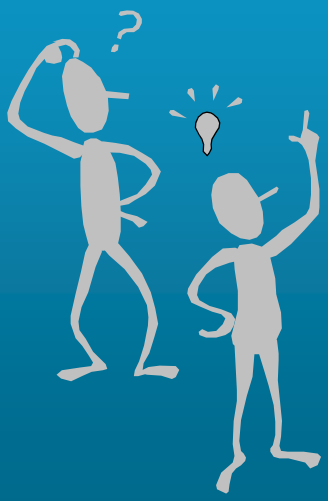
Discussion - Q&A





35

COMBINED SEWER OVERFLOW (CSO)
LONG-TERM CONTROL PLAN UPDATE (LTCPU)
PUBLIC MEETINGS

Please join DELCORA for a series of public meetings on our Combined Sewer Overflow Long-Term Control Plan Update.

Learn about DELCORA's combined sewer system and the proposed strategies for significantly reducing combined sewer overflows to our rivers and streams. Please give us your feedback on items discussed at the scheduled meeting below.

3rd MEETING

TOPIC:	**Development and Evaluation of Alternatives for CSO Controls**
WHEN:	**Tuesday, December 5, 2017 at 6:00 PM (EST)**
WHERE:	**Chester City Hall** **Community Room (Room entrance facing Rt 291)** **1 E. 4th Street, Chester, PA - 19013**

General Email: ltcpinfo@delcora.org
General Phone Number: 610-876-5523

DELCORA Long Term Control Plan Update
PUBLIC MEETING NO. 3 NOTES

Meeting Title: PUBLIC MEETING NO 3

Date / Time: December 05, 2017 6:00 PM

Prepared By: Marlene Finizio

Location: Chester City Hall

Reviewed By: Michael Hope

Distributed: 12/13/17

Attendees:

Charles Hurst, DELCORA
John Pileggi, DELCORA
Robert Willert, DELCORA
Lindsey Isler, DELCORA

Michael Hope, Greeley and Hansen
Marlene Finizio, Greeley and Hansen
See Attached Public Sign in Sheet

DELCORA held the 3rd Long Term Control Plan Update (LTCPU) Public Meetings on Tuesday, December 05, 2017. The third public meeting was held to present to the public LTCPU Development and Evaluation of Alternatives for CSO Controls of the LTCP Update. DELCORA's goal of each public meeting is to inform and solicit input to its updated LTCP from stakeholders, including the public, customer communities and the regulatory agencies. The public meeting was held to as part of the Public Participation Plan.

The following items were discussed and presented at the third public meeting:

1. DELCORA General Introduction and Opening Remarks
2. DELCORA Public Participation Plan Program Goals
3. Review of DELCORA Service Area and Combined Sewer Area
4. Chester City Municipal Separate Storm Sewer System (MS$) area
5. Combined Sewer System VS separate Sewer system
6. LTCP Summary – Completed
7. LTCPU 42-Month Program Schedule & Milestones
8. LTCPU Alternative Evaluation
9. Review of National CSO policy Requirements
10. Review of DELCORA Consent Decree (CD) Requirements
11. Review of USEPA CSO Guidance for LTCP's
12. Review of the Preliminary Screening purpose and methodology
13. Preliminary Screening requirements of the Consent Decree. Retain technologies as required by Consent Order regardless of ranking.
    - Partial and Complete Separation of Sewer
    - Deep Tunnel Storage
    - Expansion of Primary and Secondary Capacity of WRTP
    - Green Infrastructure
14. Alternatives Evaluation and Next Steps
15. LTCP Program Schedule
16. LTCPU Consent Decree Early Action Item
17. Future Public Meetings
18. Literature and Documentation –
    - Listing of Future Public Meetings
    - Public Locations for Review of Available Literature and Documentation

19. DELCORA Website Information address and information available on their website.
20. Contact Information for DELCORA, Questions and DELCORA Website

A lengthy question and comments session occurred after the presentation was completed. The list of questions/ comments with responses to comments is attached.

There were approximately 37 individuals from the public in attendance including Mayor of the Chester City. Individuals from Chester City Council, Chester City Engineer and Chester

See attached Public Comment and Response sheet.

ACTION ITEMS:

1. DELCORA will make the schedule for the LTCP Update Program available on their website.
2. DELCORA will upload the public meeting notes with sign in sheet to their website.

ATTACHMENTS

- Responses to Public Comments
- Public Sign-In Sheet
- Handouts - Comment Form
- Public Meeting PowerPoint Presentation

DELAWARE COUNTY REGIONAL WATER QUALITY AUTHORITY

LONG TERM CONTROL PLAN UPDATE

PUBLIC PARTICIPATION MEETING NO. 3
LTCPU DEVELOPMENT AND EVALUATION OF ALTERNATIVES FOR CSO CONTROLS
December 5, 2017

RESPONSES TO PUBLIC COMMENTS

1. Comment: How is the City of Chester's stormwater management plan different from DELCORA's plan that was just presented?

   Response: ***The green area on the right of the figure is the separate sewer area. The City of Chester owns the stormwater infrastructure in this area and it is controlled by The City's Stormwater Authority. The pink area on the left of the figure is the combined sewer area. DELCORA owns and operates the combined sewers and is responsible for treating the combined sewage that enters this system. DELCORA is tasked with reducing combined sewer overflows from the EPA and PADEP, which is the purpose of the Long Term Control Plan presented at this meeting. DELCORA is not involved with controlling separated stormwater.***

2. Comment: Where does the new [City of Chester] Stormwater Authority come into play?

   Response: ***DELCORA is charged with operating and maintaining the combined sewers and cannot answer for the Stormwater Authority.***

3. Comment: Will a percentage of what is paid on our sewer bills go toward the DELCORA CSO Long Term Control Plan?

   Response: ***Yes. Development and implementation of the LTCP has a financial cost. We are working with EPA to determine what those costs will be, but we expect them to be significant. As a proactive measure, DELCORA is putting money aside to pay for the LTCP now and using come of that money to upgrade the pump station.***

4. Comment: That makes sense. So, in other words the rates will go up over time?

   Response: ***That is correct.***

5. Comment: Does the City have a stormwater plan?

   Response: ***Yes, but only the Chester City Stormwater Authority can speak to their plan. DELCORA coordinated with the Chester City Engineer to delineate the separated sewer areas from the combined sewer areas using various field techniques. This work was mandated by the EPA and DOJ as part of the Consent Decree.***

6. Comment: Thank you for the presentation, it was very informative. How did the Long Term Control Plan come about? Was it mandated by the EPA and the Department of Justice that you do this? Was there a fine involved?

Response: ***As mentioned at the top of the presentation, DELCORA reached a consent decree with the USEPA and PADEP and enforced by the DOJ, requiring DELCORA to submit an updated Long Term Control Plan. DELCORA did receive fines, but they were revised. CSO remediation can become very costly, so DELCORA has consistently advocated for the residents and businesses of Chester. At the same time, DELCORA is working toward meeting the requirements of the Consent Decree.***

7. Comment: If expansion at the WRTP was a viable option and was approved by the EPA and DEP, where would the funding come from? Would the cost be spread across customers?

Response: ***DELCORA will examine many options for funding, but it usually falls on the customers. And it's not just the City of Chester customers, but any customer who is connected to DELCORA's sewer system.***

8. Comment: With DELCORA's nearly 50 years' experience it seems like the perfect option is to expand.

Response: ***Plant expansion is one of many options that DELOCRA is looking at. It may seem like the most appropriate option on the surface, but a deeper understanding of all alternatives is needed first. That is the purpose of this meeting: to inform the public of the options that DELCORA is looking at for CSO control. Many of these alternatives may be more than DELCORA is capable of implementing. So the next step is to examine each option that is acceptable to the EPA and DEP and narrow down the list by performance and cost effectiveness. It's not the just City of Chester, but it's all of Delaware County that will be charged with this cost. That is the basis for how much money we need to spend according to the EPA and PADEP.***

9. Comment: I agree that the best option seems like expanding the WRTP. It makes a lot more sense because citizens can see where you are investing their money and it is a lot more tangible than some other options.

Response: ***DELCORA is seriously looking at that option and has discussed it with several consulting engineers.***

10. Comment: Could you give a better estimate of the cost to install separate lines throughout the city?

Response: ***It would be a large number. Factored in with the geography of the City and the configuration of the system means that actually implementing this solution would be very difficult. Across the country there are hundreds of communities like Chester with combined systems. By and large these communities don't really separate unless it's a really conducive situation for separation. For instance, the area by Memorial park would be a good area for it because it can be done without a lot of impact on the neighborhood and the cost would be manageable. But most of the CSO communities, they're building tunnels, storage tanks, and some of the other things we talked about because separation is costly and can have a huge community impact.***

11. Comment: Which is safer to citizens' health, a combined sewer system or a separated system? What causes a 'Flint' problem? Is living in a combined sewer area a cause for concern?

Response: ***Flint is on everyone's minds right now. The good news for the City of Chester is that its drinking water comes from miles away. From a public health perspective, there are hundreds of communities that have combined systems. The mere presence of a combined system doesn't pose a public health threat. What poses a significant health risk in Flint is bad chemistry corroding existing drinking water distribution pipes. As you can see on this map of Delaware County, Chester is the only part of Delaware County that has these combined sewers and they are not used to convey drinking water.***

12. Comment: Is stormwater coming from upstream communities affecting runoff in the City of Chester because we are downstream from those communities?

Response: ***Stormwater from upstream communities generally does not make it into Chester or into the combined sewer system. For instance Ridley is prone to flooding during heavy rainfall but drains to Darby Creek, which runs right into the Delaware. The stormwater runoff from these areas does not run along the ground and make it into Chester's system. They have a separate pipe system that takes it to the creeks. These communities have MS4 permits to discharge stormwater into the creeks and are responsible to make sure that their wastewater is not getting into the stormwater system.***

13. Comment: If the plant were expanded, would the entire service area be part of the payment?

Response: ***It depends on which residents and businesses would be tied in to the system. DELCORA has been looking at different options. Although there would be a certain cost to build facilities, the thought is that a portion of that cost would be offset by redirecting the flow from the Central and Eastern Service areas that currently goes to Philadelphia.***

14. Comment: Where is your plant located?

Response: ***On the Delaware River waterfront at Booth Street.***

15. Comment: What is the focus of this plan for Chester?

Response: ***With this LTCP DELCORA's main focus is on the health and financial stability of its stakeholders. The focus for Chester is to limit the CSOs, which will in turn limit the amount of bacteria that goes into the streams, by capturing more flow and treating it safely and economically. Untreated wastewater can make you sick and hurt your pocketbooks.***

16. Comment: There is talk about cutting regulations at the federal level. What if they cut back your regulations?

Response: ***The bottom line is that we are bound by EPA and PADEP regulations. We need to work with these regulators to allow us to implement innovative solutions, such as blending at the WRTP. There are examples of that in other states. So if it is a safe, effective, and cost-effective solution we need to work with the regulators to advocate for what makes sense for our stakeholders, regardless of the political climate.***

17. Comment: What's the ratio of the area DELCORA is handling versus the City of Chester?

Response: ***We have been working very well with the City of Chester. Starting five years ago, DELCORA has had regular meetings with the City to collaborate and work on different projects to separate sewers. An example is the [Route] 291 project that was completed by DELCORA and the City of Chester. Working together allows us to get more bang for our buck.***

18. Comment: How much are we paying for Long Term Control currently?

Response: ***Right now DELCORA is just paying for the engineering cost to come up with all of these alternatives and produce a finished Long Term Control Plan. The capital cost of the LTCP will be determined when the LTCP is finished.***

19. Comment: How much of the engineering cost is being charged back to your customers?

Response: ***So far, none of it is because it's a capital plan with a capital cost. We are waiting for the project to be finished before we start charging the customers.***

20. Comment: What did Chester do with the $750,000 you gave them to put in new stormwater inlets?

Response: ***As part of the 1999 Long Term Control Plan we had in place, DELCORA paid the City $75,000 a year over a number of years to replace the stormwater inlets. So, from 1999 to about 2009-2010 at $75,000 a year, that totaled approximately $750,000. With that money the City replaced a certain amount of stormwater inlets per year. The new inlets have grates over them which are designed to prevent trash such as water bottles from going into the sewers and going into the streams. Once trash collects in these areas it is very difficult and costly to clean.***

Response: *(City Engineer) As the City engineer, I administered one year of that project myself. And we replaced about 16 inlets with that $75,000.*

21. Comment: What's going on with the pollution reduction plan?

Response: *(City Engineer): There is a pollution reduction plan, yes. The city has adopted a pollution reduction plan. It was presented in July and sent to the state in September.*

Response: ***If you have those types of questions, you can go to the city and they have those types of documents. They have an open records policy, so can look at the documents firsthand.***

22. Comment: Who cleans the stormwater inlets/grates?

Response: ***The City cleans the box [inlet] and grate. DELCORA cleans the CSO regulators and combined sewers.***

23. Comment: Unfortunately from the perspective of the residents, everything seems like it is addressing the same problem but each entity is charging a different fee. I understand there is storm sewers and combined sewers. But I do not understand why there is a City stormwater fee if we are paying DELCORA to address the stormwater issue in these areas.

Response: ***DELCORA is trying to address the stormwater that is going into its combined sewer collection system that causes CSOs. DELCORA cannot speak to the questions relating to the City of Chester Stormwater Authority or other entities.***

DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL AUTHORITY
CSO Long Term Control Plan Update
Public Participation Meeting #3

Tuesday, December 5, 2017
Chester City Hall Community Room, 1 E. 4th Street, Chester, PA 19013

	Name (First & Last)	Street Address	City	State	ZIP Code	Email Address	Receive Updates EMAIL	Receive Updates MAIL
1	John Pileggi	512 E. 19TH St	Chester	PA	19013			x
2	JAY VASELL	7 PEMBROKE	MEDIA	PA	19063	jpvasellegmail.com	✓	
3	MONIR Z AHMED	783 E. 24th St	Chester	PA	19013	—	—	x
4	Pamela Caulk	100 Gray St, Chester	Chester	PA	19013	—		
5	Gabriel INGRAM	2218 W 12th ST	Chester twp	PA	19013	—	—	✓
6	Marguerite Stratum	465 Jeffrey St	Chester	Pa	19013			
7	Barbara Bohannon	615 Jeffrey St	Chester	Pa	19013	barbmcb50@yahoo.com		✓
8	Elroy A LEWIS	702 Villa Drive	Chester	PA	19013	elroylewis@comcast.net	✓	
9	Vince DeL Rossi	100 Pennell St	Chester	PA	19013	Vince@Healthnet.com	✓	
10	Annette Pyatt	2503 Bethel Rd	Chester	PA	1913	adpyatt@comcast.net	✓	
11	Lisa Gaffney	1 Fourth Street	Chester	PA	19013	LRG@CEDA.CC	✓	
12	Leonna Jones	1111 Terrill St	Chester	PA	19013	—		
13	William Hatcher	717 Villa Dr	Chester	PA	19013	WJHatcher@AOL.		
14	Pete Littlehan	419 Avenue of States.	Chester	PA	19013	Pete.Littlehan@corvias.com		
15	TROY Hunt	419 Avenue of States	Chester	PA	19013	TROY.Hunt@CORVIAS.com		
16	GEORGE HASSEL	ONE UNIVERSITY PLACE	CHESTER	PA	19013	GEHASSEL@WIDENER.EDU	✓	
17	YANNEISIS Johnson	W 6th St.	Chester	PA	19013	yanneisis.johnson79@gmail.	✓	
18	Karla Beaver	914 Butler St	Chester	PA	19013	Beaverskarla		—
19	Jayne Beaver	"	"	"	"	Jazyladyl4@gmail.com	—	
20	Adora Purnell	706 Ward St	Chester	PA	19013	apurnell.ap@gmail.com		
21	Charles Hurst	113 Fawn Cir	Horsham	PA	19041	hurstc@delaware.org		

2/3

	Tuesday, December 5, 2017 Chester City Hall Community Room, 1 E. 4th Street, Chester, PA 19013					Receive Updates	
	Name (First & Last)	Street Address	City	State	ZIP Code	Email Address	EMAIL	MAIL
22	Martin West	1 Fourth St	Chester	Pa	19013	mwest@chestercity.com		
23	[illegible]	1037 1/2 W 8th St.	Chester	Pa	19013	tkirkland@chestercity.com		
24	Joan Neal	1704 W. 7th St.	Chester	PA	19013	JNEAL@Chestercity.com		
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	Tuesday, December 5, 2017 Chester City Hall Community Room, 1 E. 4th Street, Chester, PA 19013					Receive Updates	
	Name (First & Last)	Street Address	City	State	ZIP Code	Email Address	EMAIL	MAIL
46	[illegible]	3001 W 9th	[illegible]	Pa	—	—		
47	Bob Bradam	214 Dock St	Chester	Pa				
48	Darrell Jones	City Hall	Chester	Pa				
49	Ti Tappeglen	City Hall	Chester	Pa				
50	John Delores Shelton	"	"	"				
51	Elizabeth Williams	304 [illegible] Chester	Chester	Pa				
52	Robert Smeechenski	308 W 24th ST	Chester	PA				
53	S.J. Dennis	218 Arbor Circle	Chester	PA				
54	LIVIA SMITH	930 E 18th St	Chester	PA				
55	Trena R. Byrd	3033 N. 6th St	Chester	PA				
56	James Hatcher	1835 W 6th Street	Chester	PA				
57	MICHAEL O. REGOSA	2201 W 3RD STREET	CHESTER	PA				
58	Shakuura Randolph	633. E. 19th street	Chester	PA				
59	MIKE HOPE							
60	MARLENE FINZILO							
61	LINDSEY ISLER							
62	ROBERT WILLERT							
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Date Rec'd.:		Log No.:		Comment No.:	

DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL AUTHORITY

Public Participation Meeting No. 3

LTCPU Development and Evaluation of Alternatives for CSO Controls
December 5, 2017

CLOSING DATE: All Comments Must Be Received 30 calendar days from Public Meeting Date (by January 5, 2018)

1) Responses to public comments will be published within 60 days of the public meeting date (by February 5, 2018). Responses will be posted on the DELCORA Website. Comments may be submitted at the public meeting or by one of the following options:

Email: **ltcpinfo@delcora.org**

On the WEB: **www.delcora.org**

Phone: (610) 876-5523

Mail Address: DELCORA
P.O. Box 999
Chester, PA 19016-0999

2) **PLEASE TYPE OR PRINT CLEARLY**. Forms will be returned if they contain unreadable information.

Name:				Date:	
Jurisdiction/Company:					
Address:					
City:		State:		Zip:	
Phone:		Ext:		Fax:	
Email:					

3) Signature: _____

4). Please provide comments below. Provide additional sheets as needed.

Comment 1 _____

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Comment 2 _____

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Comment 3 _____

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Combined Sewer Overflow - Long Term Control Plan Update

DELCORA

Public Participation Meeting No. 3

LTCPU Development and Evaluation of Alternatives for CSO Controls

December 5, 2017

Chester City Hall Community Room

1 E. 4th Street, Chester, PA

General Information

- DELCORA is the Delaware County Regional Water Quality Control Authority, established in 1971, responsible for collecting, conveying and treating wastewater in the greater Philadelphia Area including 42 Municipalities in Delaware and Chester County.

DELCORA Mission

"Provide environmentally responsible and cost effective wastewater management services to the citizens, businesses, and industries of Southeastern Pennsylvania"

Why Are We Here?

- From 1999-2009 DELCORA spent in excess of $5 million on improvements and contributions to the City of Chester that resulted in decreased volume of overflows, reduced debris in overflows, provided remote monitoring of the system, and improved routine maintenance.
- In 2009, the DEP and EPA determined that DELCORA's LTCP was no longer in compliance with increased regulations of the Clean Water Act. In response, DELCORA began working with DEP and EPA to update the LTCP.
- In 2014, DEP and EPA determined that DELCORA's revised LTCP required further evaluation and development.
- In 2015 DELCORA signed with EPA the Long Term Control Plan Consent Decree.

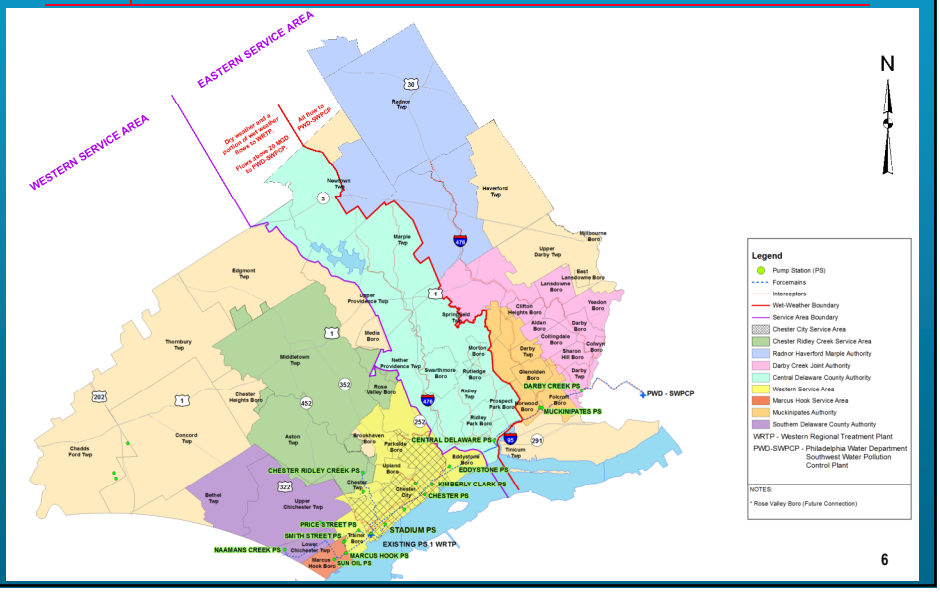
Public Participation Plan Goals

- DELCORA's Goals and Objectives for the Public Participation Program are to:
  - Inform and Solicit Input to Updated LTCP from Stakeholders, including Public, Customer Communities and Regulatory Agencies
  - Educate the Public
  - Address Public Concerns

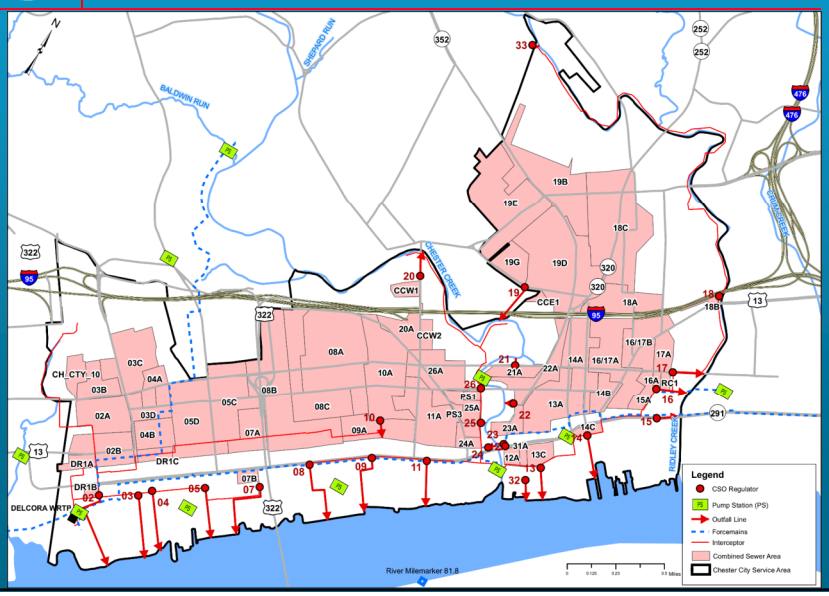
Scope of Meeting

- This Public Meeting (12/5/17) is to:
  - Review DELCORA Service Area
  - Summarize Current Status of LTCP
  - Describe CSO Control Technologies
  - Describe Next Steps Towards Development of Long Term Control Plan Update
  - Questions and Comments

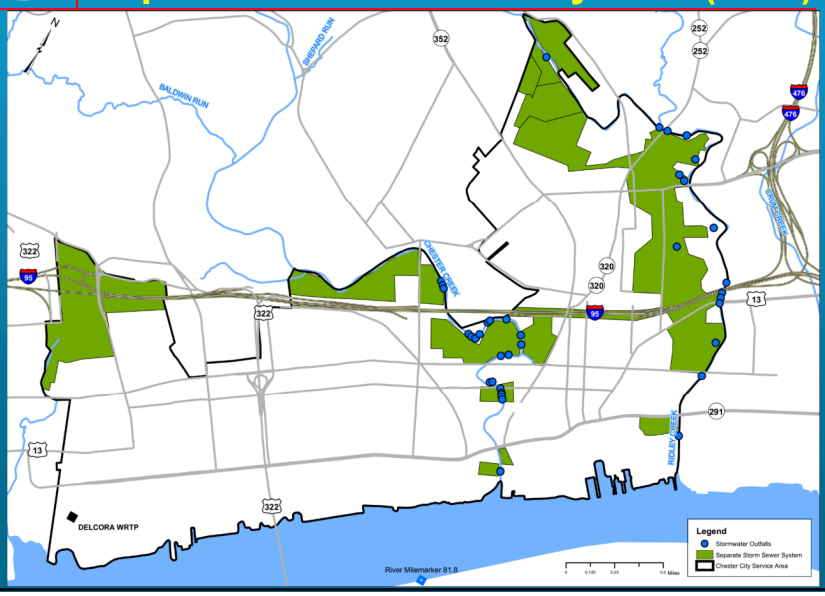
DELCORA Service Area



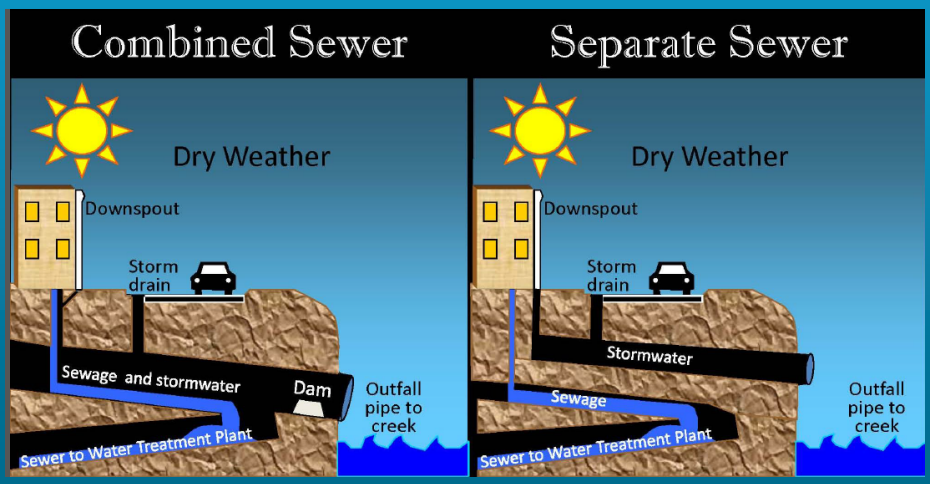
DELCORA Combined Sewer Area



Chester City Municipal Separate Storm Sewer System (MS4)

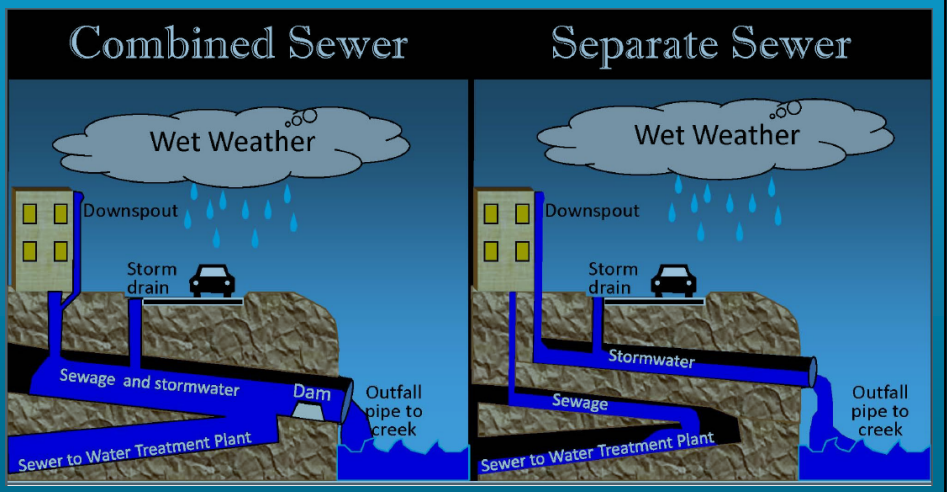


Combined Sewer System vs. Separated Sewer System



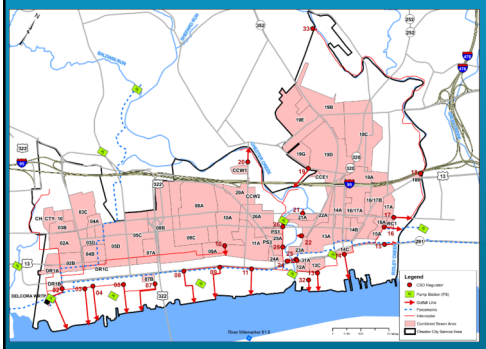
Source: City of Alexandria,
https://www.alexandriava.gov/uploadedFiles/tes/oeq/CSSPermitInfoMeetingandPublicHearingPresentation08052013.pdf

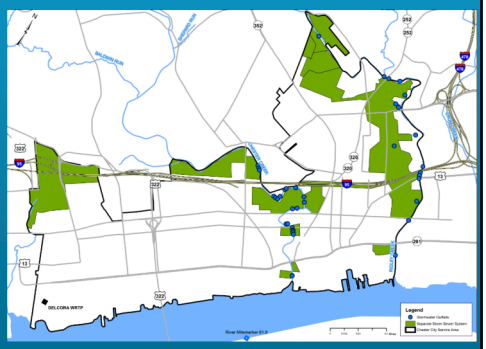
Combined Sewer System vs. Separated Sewer System



Source: City of Alexandria,
https://www.alexandriava.gov/uploadedFiles/tes/oeq/CSSPermitInfoMeetingandPublicHearingPresentation08052013.pdf

Combined Sewer vs. Storm Sewer System



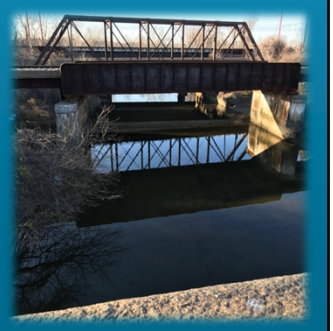


LTCPU Summary - Completed

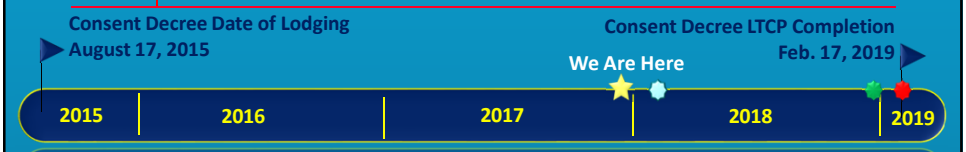
- Hired Expert Consultants with Good Track Records as Well as Experience Specifically Related to LTCP
  - Greeley & Hansen: Engineering Consultant for the LTCP
  - Municipal & Financial Services Group: Rate Model Consultant
  - Blank Rome: Law Firm
- **100% Compliant to Date with Consent Decree**
  - **Reports Submitted to Date**
    - ✓ Public Participation Plan
    - ✓ Hydrologic and Hydraulic (H&H) Model Update and Calibration Plan
    - ✓ Typical Hydrologic Period Plan
    - ✓ Semi-Annual Reports for 2015, 2016 & 2017
    - ✓ Sensitive Areas and Pollutants of Concern Report

LTCPU Summary - Completed

- 100% Compliant - Reports Submitted to Date (Continued):
  - ✓ Draft Financial Capabilities Assessment (FCA) Report
  - ✓ Alternative Evaluation Approach
  - ✓ Rainfall and Flow Monitoring Quarterly Reports for 1st , 2nd, 3rd, and 4th Quarters
  - ✓ Water Quality Monitoring and Modeling Work Plan
  - ✓ Water Quality Monitoring and Modeling Quality Assurance Project Plan
  - ✓ Study Area Collection System Model Report
  - ✓ Existing Service Area Characterization Report



LTCPU 42-Month Program Schedule & Milestones



Reports to Be Completed:

- ★ Public Participation Meeting - December 5, 2017
- ⬢ Water Quality Monitoring and Modeling Report - Feb. 17, 2018
- ⬢ Early Action Item, Complete PS-6 - December 2018
- ⬢ Updated LTCP Final Report - Feb. 17, 2019
  - Includes Development and Comparison of Alternatives
- ⬢ Updated Nine Minimum Controls Plan - Feb. 17, 2019

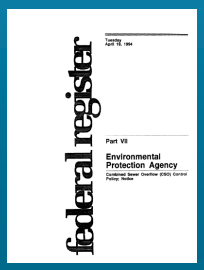
⬢ Consent Decree Due Dates

LTCPU Alternatives Evaluation

- Review Regulatory Requirements
- Purpose of Preliminary Screening of CSO Alternatives
- Available Technologies
- Review Preliminary Screening Evaluation Method
- Alternatives Evaluation Next Steps
- Schedule
- Questions and Comments

National CSO Policy Requirements

- National CSO Policy
  - Consider reasonable range of alternatives.
  - Consider expansion of POTW secondary and primary capacity.
  - Sufficient to Make Reasonable Assessment of Cost and Performance
  - Selected Controls should be sufficient to meet CWA requirements.

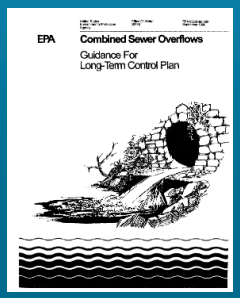


Consent Decree Requirements

- Consent Decree
  - *Consists of:*
    - *Technology screening process*
    - *Detailed evaluation of specific CSO control alternatives*
    - *Selection of an appropriate range of proposed CSO controls to achieve compliance with the Clean Water Act."*
    - *Does not consider cost-effectiveness (at the preliminary screening phase)*
- Specific technologies considered feasible by Consent Decree and must be carried forward for further evaluation.
  - Partial and Complete Separation of Sewers
  - Deep Tunnel Storage
  - Expansion of Primary and Secondary Capacity of WRTP
  - Green Infrastructure

USEPA CSO Guidance for LTCPs

- CSO Guidance for Long Term Control Plan
  - *"Can include technologies, operating strategies, public policies and regulations, or other measures that would contribute to some aspect of CSO control. Control measures can generally be classified under one of the following categories:*
    - *Source Controls*
    - *Collection System Controls*
    - *Storage Technologies*
    - *Treatment Technologies"*



Preliminary Screening

- Purpose of Preliminary Screening
  - Identify alternatives that best meet CSO Control Alternatives with least overall impacts and are worthy of additional evaluation.
    - Meet regulatory requirements.
    - Reduce Pollutants of Concern (bacteria) and/or volume reduction.

Preliminary Screening

- Pollutants of Concern (POCs) Approved by USEPA
- Bacteria: Fecal Coliform, E. Coli, and Enterococcus
- Other Sources of Bacteria from Tributary Flows to Chester and Ridley Creeks:
  - Pets, Wildlife, Livestock and Stormwater Runoff (Urban and Agricultural)

Preliminary Screening

- Methodology
  - Develop comprehensive list of technologies for each type of CSO Control Measure (Source, Collection System, Storage, Treatment).
  - Assign levels of effectiveness at reaching CSO Control Goals for reduction in bacteria or CSO volume

High | Medium | Low | None

Preliminary Screening

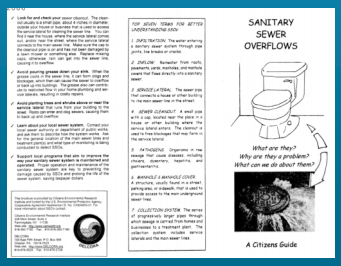
- High — Significant Impact on CSO Control Goal and is Among Best Technologies Available
- Medium — Effective at Achieving CSO Control Goal but is Not Considered Among Most Effective
- Low — Minor Impact on CSO Control Goal
- None — Zero or Negative Effect on CSO Control Goals

Preliminary Screening

- Retain technology if level of effectiveness is “HIGH” or “MEDIUM” based on volume or bacteria reduction.
- Retain technologies as required by Consent Order regardless of ranking.
  - Partial and Complete Separation of Sewers
  - Deep Tunnel Storage
  - Expansion of Primary and Secondary Capacity of WRTP
  - Green Infrastructure
- Develop alternatives from retained technologies.

Source Control

- Impact Quality or Quantity of Runoff Entering CSS; Reduce Volumes, Peak Flows or Pollutant Discharge
- Source Control Alternatives
  - Stormwater Management
  - Public Education and Outreach
  - Ordinance Enforcement
  - Good Housekeeping
  - Green Infrastructure
    - Buildings
    - Impervious Areas
    - Pervious Areas

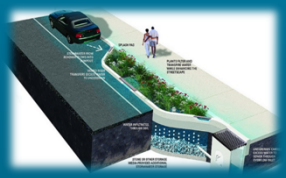


Green Infrastructure

- Green Infrastructure is an approach to water management that protects, restores or mimics the natural water cycle.
- Treats stormwater locally at the source.
- Includes rain gardens, bioswales, permeable pavement, green roofs, downspout disconnections, etc.

Green Infrastructure: Community Impacts

- **Environmental Impact:** Low Bacteria and Medium Volume Reduction
- **Social Impact**
  - Potential Development of Green Spaces in Areas Without It
  - Bioswales may reduce parking and narrow streets.
- **Financial Impact:** Costs of green infrastructure have been higher than gray; may have an impact on rates if used for LTCP compliance



Examples of Green Infrastructure Projects

Collection System Control Technology

- Reduce CSO volume and frequency by removing or diverting stormwater runoff to maximize capacity of collection system.
- Collection System Control Technology Alternatives
  - Inflow/Infiltration Control
  - Operation and Maintenance
  - Combined Sewer Separation
  - Combined Sewer Optimization

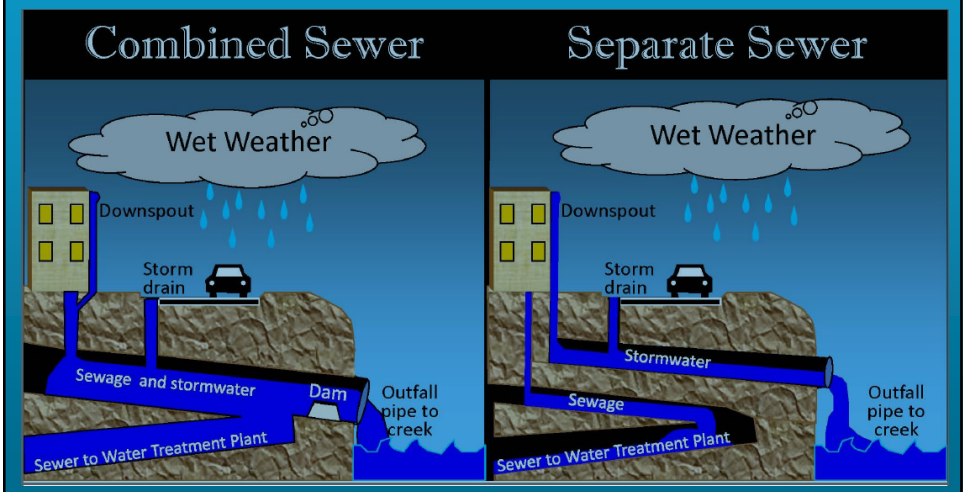
Inflow and Infiltration Reduction

- I&I is water that enters Collection System through cracks, joints, etc.
- Rainfall and Groundwater Driven
- Some I&I is expected
- If removed, frees up capacity that would otherwise be available for combined sewage and adds to CSOs.

Inflow and Infiltration: Community Impacts

- **Environmental Impact:** Low Bacteria Reduction and Medium Volume Reduction
- **Social Impact:** Repairs on Private Property Required by Homeowners
- **Financial Impact:** Can be cost effective if sources of I/I are easily identified.

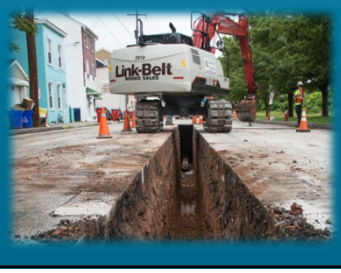
Combined Sewer Separation



Source: City of Alexandria, https://www.alexandriava.gov/uploadedFiles/tes/oeq/CSSPermitInfoMeetingandPublicHearingPresentation08052013.pdf

Combined Sewer Separation: Community Impacts

- **Environmental Impact:** Highly Effective in Reducing CSOs
- **Social Impact:** Disruptive to Affected Areas Due to Street Closures and Construction Access
- **Financial Impacts**
  - High Costs Due to Street Construction and Replacement
  - Long Construction Duration



Storage Technology

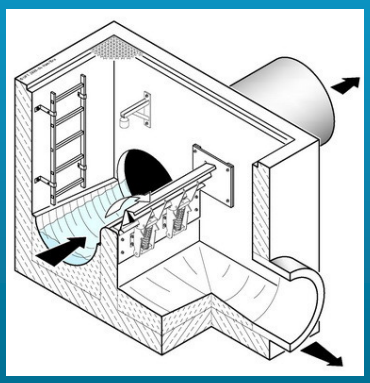
- Reduce overflows by capturing and storing excess wet weather flows.
- Control release of combined sewage back into system once treatment and conveyance capacity have been restored.
- Does not prevent water from entering Combined Sewer System or treat bacterial loads in CSO discharge; effective at reducing or eliminating CSO events.
- Storage Technology Alternatives
  - In Line Storage
  - Off Line Storage

Increased Collection System Storage

- Capture and hold volume until conveyance and treatment capacity return.
  - In line storage uses existing collection system for storage.
  - Off line storage includes the construction of Storage Tanks and Tunnels.

In Line Storage: Community Impacts

- **Environmental Impact:** High Bacteria and High Volume Reduction
- **Social Impact:** Minimal Impact on Community During Construction
- **Financial Impact:** Very Cost Effective Using Existing Infrastructure



Bending weir in regulator structure

Off-Line Storage: Community Impacts

Deep Tunnels

- **Environmental Impact:** Highly Effective in Reducing CSOs
- **Social Impact:** Construction Disturbances at Each Shaft Location which May be Sited in Locations to Minimize Public Disturbance
- **Financial Impact:** Cost Effective at High Removal Volumes

Off-Line Storage: Community Impacts

Storage Tanks

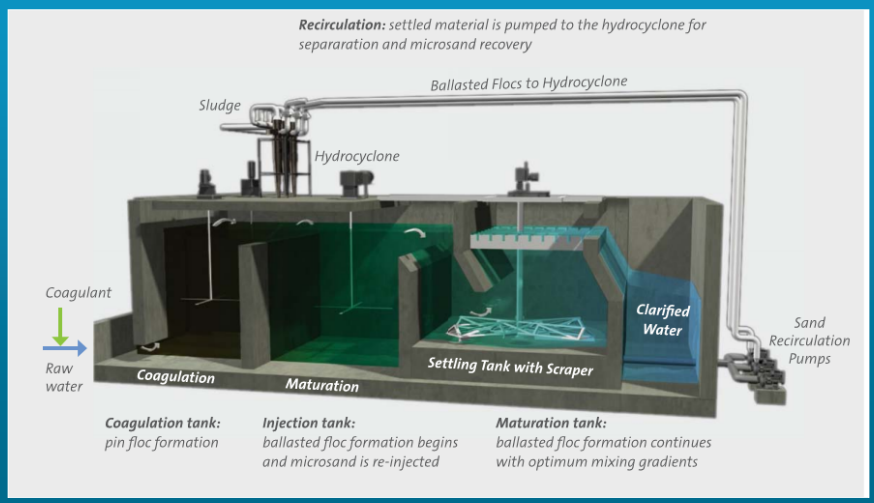
- **Environmental Impact:** Highly Effective in Reducing CSOs
- **Social Impact:**
  - Construction Disturbances at Tank Location Only
  - Can be Buried Under Playgrounds, Parking Lots or Other Community Structures
- Financial Impact: Cost Effective at High Removal Volumes

Examples of Storage Tank Projects from Methuen Construction Co.

Treatment Technology

- Reduce pollutant loads to receiving waters by treating wet weather flows.
- Addresses different pollutant constituents like settleable solids, floatables or bacteria.
- LTCPU will contain provisions for handling, treatment and ultimate disposal of sludge and residuals.
- Treatment Technology Alternatives
  - CSO Facility - Satellite Treatment
  - WRTP - Additional Treatment Plant Capacity, Wet Weather Blending
  - Industrial - Industrial Pretreatment

Satellite Treatment of CSO Discharge



Satellite Treatment Facility: Community Impacts

- **Environmental Impact:** High reduction of bacteria and CSO volume with disinfection
- **Social Impact:** Construction in collection system isolated to selected site.
- **Financial Impact:** Additional cost required for treatment equipment and disinfection.

Treatment or Storage at WRTP

- Convey additional flow to WRTP for treatment; Plant is already at Wet Weather Capacity so would require plant expansion.
- Use Study Area Collection System Model to evaluate sending additional flow to WRTP in order to consider potential overflow reduction.

Secondary Treatment Bypass

- Convey additional flow to WRTP for treatment.
- Blend primary treated effluent with secondary/biological treated effluent.
- Alleviates plant expansion needs to handle additional flows.
- Additional conveyance required.

Improvements at WRTP: Community Impacts

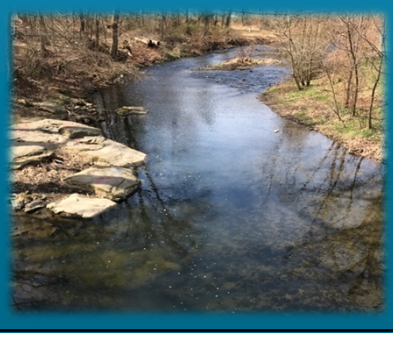
- Environmental Impact: High Bacteria and CSO volume reduction
- Social Impact:
  - No repairs on private property
  - Minimal street closures
- Financial Impact: Cost Effective Due to Available Land on Existing Plant Site and Shared Services with Existing Plant Operations

Alternatives Evaluation Next Steps

- LTCP CSO Control Alternative Evaluation
  - Alternatives Development and Modeling
  - Alternatives Cost / Performance Evaluation
  - Rating, Ranking and Recommendation
  - Financial Plan

LTCPU Program Schedule

- Consent Decree Deadlines and Schedule
  - Final Water Quality Monitoring and Modeling Report submitted by February 2018.
  - Final LTCPU Report due to USEPA by February 2019.
  - Early Action Items - End of 2018



LTCPU Consent Decree Early Action Item

- Consent Decree requires Early Action Combined Sewer Overflow Control Measures to reduce Combined Sewer Overflows.
- New Pump Station - PS-6
  - Increased Capacity of Existing Pump Station at Western Regional Treatment Plant
  - Anticipated $15 Million Construction Cost
  - To be Completed by December 31, 2018

LTCPU Consent Decree Early Action Items

Future Public Meetings

- **4th Meeting**

  Topic: **Selection and Implementation of the Long-Term Plan**

  When: 3rd Quarter 2018

  Where: Aston Township Administration Building
  5021 Pennell Road; Aston, PA 19014

Literature and Documentation

- Literature and Documentation will be Made available by DELCORA at the following public locations and on the DELCORA Website:
  - **DELCORA Administration Building**
    100 East Fifth Street; Chester, PA 19013
  - **Lewis Crozer Library**
    620 Engle Street; Chester, PA 19013
  - **Marcus Hook Municipal Building**
    1015 Green Street; Marcus Hook, PA 19061
  - **Ridley Township Building**
    100 MacDade Blvd.; Folsom, PA 19033
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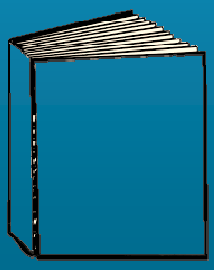
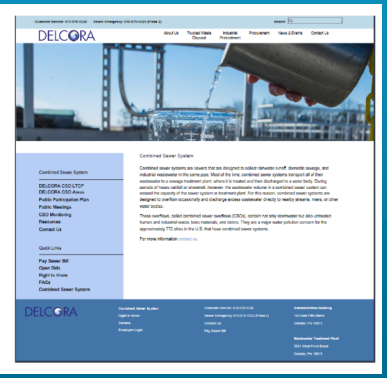


DELCORA Website



www.delcora.org

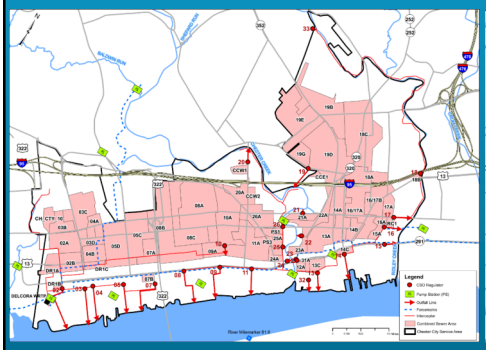
CONTACT DELCORA

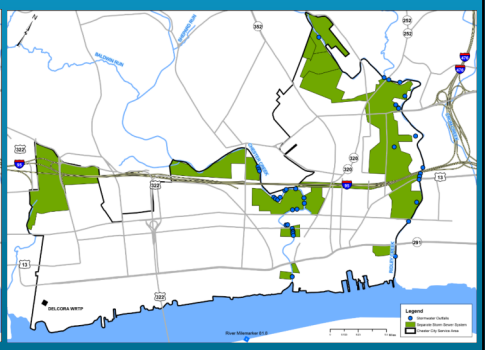
- Mail Address
  - DELCORA
    P.O. Box 999
    Chester, PA 19016-0999
- Email: ltcpinfo@delcora.org
- On the WEB: www.delcora.org
- General Phone Number: 610-876-5523
- Newsletter
- Sign-Up Sheet

-Thank You-

Discussion - Q&A

Combined Sewer vs. Chester City's MS4





End of Presentation

COMBINED SEWER OVERFLOW (CSO)
LONG-TERM CONTROL PLAN UPDATE (LTCPU)
PUBLIC MEETINGS

Please join DELCORA for a series of public meetings on our Combined Sewer Overflow Long-Term Control Plan Update.

Learn about DELCORA's combined sewer system and the proposed strategies for significantly reducing combined sewer overflows to our rivers and streams. Please give us your feedback on items discussed at the scheduled meeting below.

4th MEETING

TOPIC:	**Selection and Implementation of the Long-Term Plan**
WHEN:	**Wednesday, September 26, 2018 at 5:00-6:30 PM EST)**
WHERE:	**Aston Township Administration Building** **5021 Pennell Road, Aston, PA 19014** **General Email: ltcpinfo@delcora.org** **General Phone Number: 610-876-5523**

DELCORA Long Term Control Plan Update
PUBLIC MEETING NO. 4 NOTES

Meeting Title: PUBLIC MEETING NO 4

Date / Time: September 26, 2018 5:00 PM

Prepared By: Marcus Mathieson

Location: Aston Township Admin. Bldg.

Reviewed By: Jean Malfronte

Distributed: 9/26/18

Attendees:

Charles Hurst, DELCORA
John Pileggi, DELCORA
Mike DiSantis, DELCORA
Lindsey Isler, DELCORA

Michael Hope, Greeley and Hansen
Jean Malafronte, Greeley and Hansen
Marcus Mathieson, Greeley and Hansen
See Attached Public Sign in Sheet

DELCORA held the 4th Long Term Control Plan Update (LTCPU) Public Meetings on Wednesday, September 26, 2018 at 5:00 PM at the Aston Township Admin. Bldg. The fourth Public was originally advertised as starting at 6:00 however the start time had to be adjusted to 5:00 PM. The meeting was re-advertised to inform residents that the start was adjusted to 5:00 PM. The forth public meeting was held to present to the public LTCPU Development and Evaluation of Alternatives for CSO Controls of the LTCP Update. DELCORA's goal of each public meeting is to inform and solicit input to its updated LTCP from stakeholders, including the public, customer communities and the regulatory agencies. The public meeting was held to as part of the Public Participation Plan.

The following items were discussed and presented at the fourth public meeting:

1. DELCORA General Introduction and Opening Remarks
2. DELCORA Public Participation Plan Program Goals
3. Review of DELCORA Service Area and Combined Sewer Area
4. Chester City Municipal Separate Storm Sewer System (MS4) area
5. Combined Sewer System VS separate Sewer system
6. LTCPU 42-Month Program Schedule & Milestones
7. LTCP Completed Early Action Items and System Improvements to Date
8. Review of National CSO Policy Requirements for the Alternative Analysis
9. LTCPU Alternative Analysis
10. "Knee-of-the-Curve" Analysis and the Recommended Plan for the Selected Alternative
11. LTCP Implementation Schedule and Milestones
12. Available Literature and Documentation Locations for Public Review
13. DELCORA Website Information address and information available on their website.
14. Contact Information for DELCORA, Questions and DELCORA Website

<u>There were no individuals from the public in attendance.</u> Meeting was adjourned at approximately 5:30. There were two DELCORA consultants that arrived at the meeting location after adjournment. DELCORA met separately with the two consultants on November 1, 2018 and provided a hardcopy of the Public Meeting No. 4 presentation and handout materials and reviewed the materials with them. They had no

questions or feedback that would influence the LTCPU. They signed the meeting sign-in sheet, see attached.

A Public Briefing Document was posted on the website and delivered to the repositories 2 weeks before this meeting. The Public Briefing Document summarized the DELCORA Recommended Long Term Control Plan to address Combined Sewer Overflows in Chester, Pennsylvania where necessary. Also covered in the summary were the following key issues: (1) an overview of the DELCORA System and Wet Weather Issues, (2) a summary of progress to date, (3) response to public comments to date, (4) review of sensitive areas, (5) the range of alternatives considered, (6) DELCORA's recommended overflow control plan, (7) the implementation schedule and, (8) post construction monitoring of the overflow control program.

There were no questions from the public relating to the public briefing document posted on the Website or mailed.

ACTION ITEMS:

1. DELCORA will upload the public meeting notes with sign in sheet to their website.

ATTACHMENTS

- Public Sign-In Sheet
- Handouts - Comment Form
- Public Meeting Powerpoint Presentation

DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL AUTHORITY
CSO Long Term Control Plan Update
Public Participation Meeting #4

Wednesday, September 26, 2018

Aston Township Administration Building, 5021 Pennell Road, Aston, PA 19014

	Name (First & Last)	Street Address	City	State	ZIP Code	Email Address	Receive Updates EMAIL	Receive Updates MAIL
1	John Pileggi	512 E. 19TH St	Chester	PA	19013	jpileggi2011@gmail.com		
2	Charles Hurst	113 Fawn Ln	Havertown	PA	19041	charlesnhurst@gmail.com		
3	Jean Reichenter	118 Fenwick Rd	Cherry Hill	NJ	08034	jean.reich@yahoo.com		
4	Lindsey Amadio	100 E. 5TH ST	Chester	PA	19013			
5	Marcus Mathieson	207 Walnut Hill Ln	Havertown	PA	19083	mr.marmathieson@gmail.com		
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Date Rec'd.:		Log No.:		Comment No.:	

DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL AUTHORITY

Public Participation Meeting No. 4

Selection and Implementation of the Long-Term Plan
September 26, 2018

CLOSING DATE: All Comments Must Be Received 30 calendar days from Public Meeting Date (by October 26, 2018)

1) Responses to public comments will be published within 60 days of the public meeting date (by November 26, 2018). Responses will be posted on the DELCORA Website. Comments may be submitted at the public meeting or by one of the following options:

Email: **ltcpinfo@delcora.org**

On the WEB: **www.delcora.org**

Phone: (610) 876-5523

Mail Address: DELCORA
P.O. Box 999
Chester, PA 19016-0999

2) **PLEASE TYPE OR PRINT CLEARLY**. Forms will be returned if they contain unreadable information.

Name:				Date:	
Jurisdiction/Company:					
Address:					
City:		State:		Zip:	
Phone:		Ext:		Fax:	
Email:					

3) Signature: _____

4). Please provide comments below. Provide additional sheets as needed.

Comment 1 _____

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Comment 2 _____

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Comment 3 _____

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Combined Sewer Overflow - Long Term Control Plan Update

DELCORA

Public Participation Meeting No. 4

LTCPU Development and Evaluation of Alternatives for CSO Controls

September 26, 2018

Aston Township Administration Building

5021 Pennell Road, Aston, PA 19014

General Information

- DELCORA is the Delaware County Regional Water Quality Control Authority, established in 1971, responsible for collecting, conveying and treating wastewater in the greater Philadelphia Area including 42 Municipalities in Delaware and Chester County.

DELCORA Mission

"Provide environmentally responsible and cost effective wastewater management services to the citizens, businesses, and industries of Southeastern Pennsylvania"

2

Why Are We Here?

- In April 1999, DELCORA adopted their Long Term Control Plan (LTCP) to comply with the Clean Water Act requirements for the Combined Sewer Overflow (CSO) control policy.
- In 2009, the Department of Environmental Protection (DEP) and Environmental Protection Agency (EPA) determined that DELCORA's LTCP was no longer in compliance with increased regulations of the Clean Water Act. In response, DELCORA began working with DEP and EPA to update the LTCP.
- In 2014, DEP and EPA determined that DELCORA's revised LTCP required further evaluation and development.
- In 2015 DELCORA signed with EPA the Long Term Control Plan Consent Decree.

3

Public Participation Plan Goals

- DELCORA's Goals and Objectives for the Public Participation Program are to:
  - Inform and Solicit Input to Updated LTCP from Stakeholders, including Public, Customer Communities and Regulatory Agencies
  - Educate the Public
  - Address Public Questions/Comments

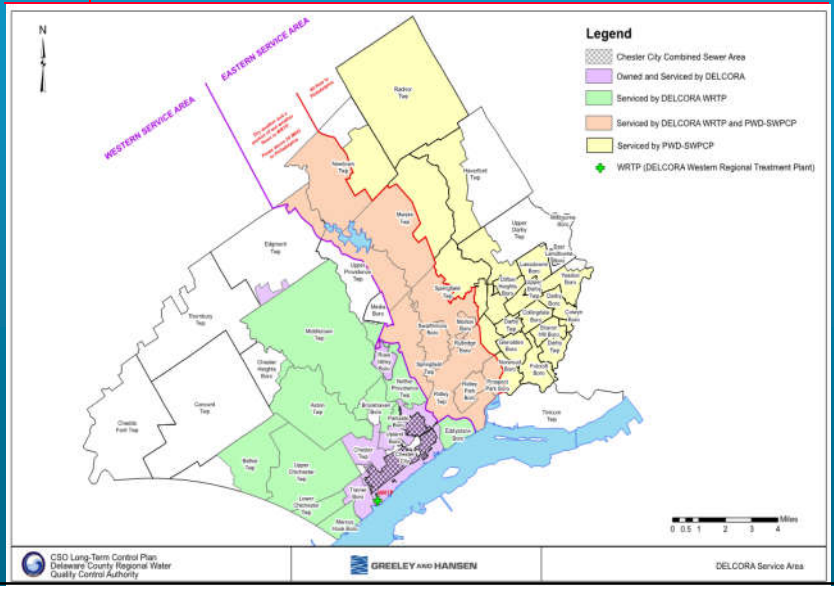
4

Scope of Meeting

- This Public Meeting (9/26/18) is to:
  - Overview DELCORA Service Area
  - Summarize Work of LTCP Addressing Wet Weather Issues Up to this Point
  - Describe CSO Control Alternatives Evaluation
  - Describe Next Steps Towards Development of Long Term Control Plan Update (LTCPU)
  - Questions and Comments

5

DELCORA Service Area



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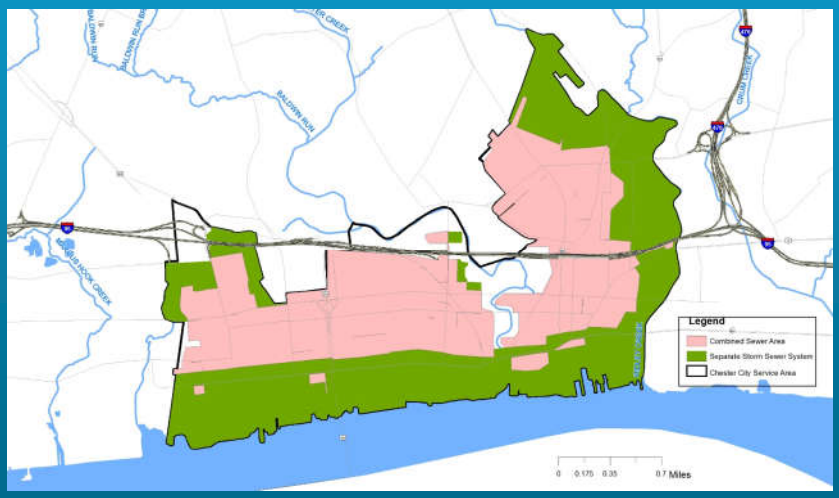
Chester City Service Area



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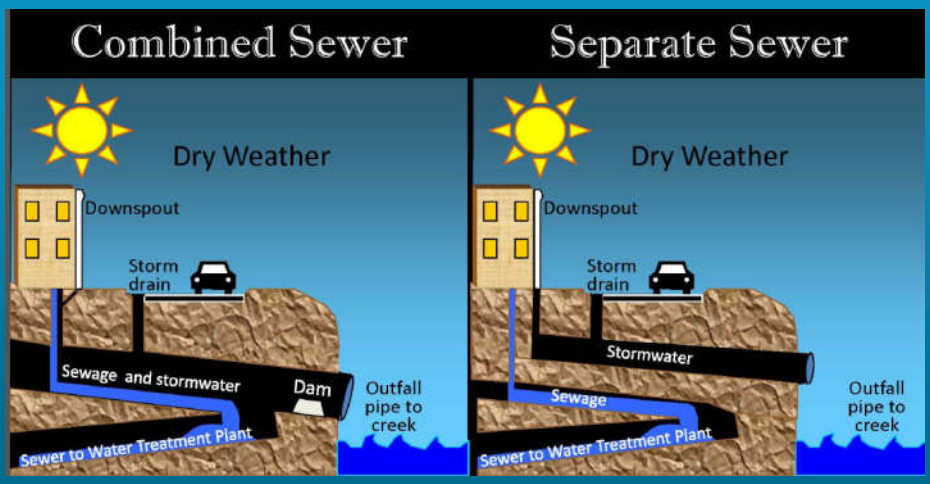
Combined Sewer System vs. Separated Sewer System



Source: City of Alexandria, https://www.alexandriava.gov/uploadedFiles/tes/oeq/CSSPermitInfoMeetingandPublicHearingPresentation08052013.pdf

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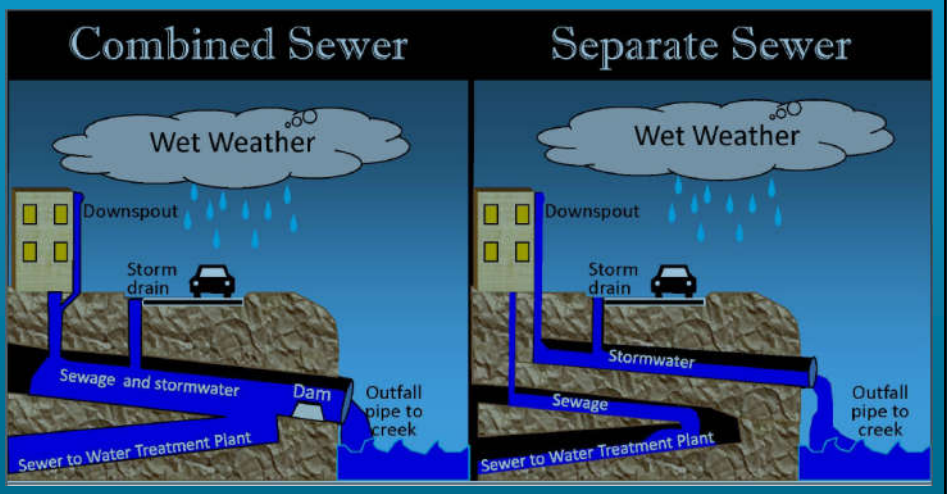
Combined Sewer System vs. Separated Sewer System



Source: City of Alexandria, https://www.alexandriava.gov/uploadedFiles/tes/oeq/CSSPermitInfoMeetingandPublicHearingPresentation08052013.pdf

9

LTCPU 42-Month Program Schedule

Consent Decree Date of Lodging
August 17, 2015

Consent Decree LTCP Completion
Feb. 17, 2019

Since the lodging of the Consent Decree in August of 2015, DELCORA has met important milestones in the program:

2016

- Selected a plan to decrease CSOs and evaluated the financial ability of the community to pay for it.
- Identified the bacteria responsible for the pollution, and high-priority areas for CSO reduction.

2017

- An evaluation of historical rainfall on the existing sewer system was conducted. This would help identify the impacts of new technologies.

2018

- Pump Station “PS-6” completed and held last public meeting.

2019

- Submit final reports to the EPA.

10

Early Action Items

- A new pump station near the DELCORA treatment plant was required to be placed in operation by Dec 2018.
  - New Pump Station PS-6 was placed in operation on September 5th, 2018

- Over $150M has been spent on system improvement projects since the original LTCP in 1999.

11

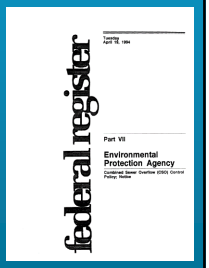
Improvement Costs to Date

- From 1999-2018 DELCORA spent in excess of $150 Million on overall system improvements and contributions to the City of Chester that resulted in decreased volume of overflows, reduced debris in overflows, provided remote monitoring of the system, and improved routine maintenance.
  - Partially separating flow to a CSO regulator
  - Purchasing property for further plant expansion
  - Replacement of older CSO regulator models
  - Research, repair, & replacement for leaking pipes
  - Annual informational flyers mailed to customers

12

National CSO Policy Requirements

- National CSO Policy pertaining to the Alternatives Analysis provides guidance to develop the LTCPU:
  - To meet one of the following (Presumption Approach):
    - No more than an average of 4 overflows a year
    - *Elimination or capture for treatment of at least 85% of combined sewage volume during wet weather events*
    - Elimination or removal of pollutants identified causing water quality impairment during wet weather events



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LTCPU Alternatives Analysis

- Review Regulatory Requirements
- Describe, screen and compare technologies that can be used to achieve the most economically feasible approach to reducing CSOs that meets water quality standards
- Specific technologies must be considered

14

LTCPU Alternatives Analysis

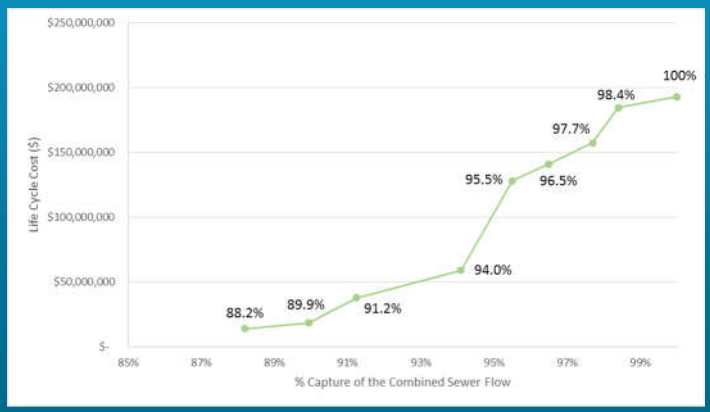
- Elimination or capture of 85% of wet weather flows entering the collection system on a system wide, typical year basis.
  - This level of control is presumed to meet WQS (subject to verification monitoring post-construction).
- Looked at 15 combinations of technologies to reduce CSOs (includes required technologies as per consent order)
- The costs associated for completing all projects in an alternative, as well as their upkeep and operation for 20 years was estimated – this is called the Life Cycle Cost

15

"Knee-of-the-Curve" Analysis

Capture % vs Cost

Knee-of-the Curve Graph for Selected Alternatives



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Selected CSO Control Technologies

- DELCORA's recommended plan has 3 parts based on the Knee-of-the-Curve Analysis:
  - **88% - Regulator Control Improvements** - Regulator Modifications alone will provide enough CSO control to meet 85% wet weather capture.
  - **94% - Targeted Overflow Reduction** - Further CSO control technologies can target the most frequent CSO areas, but is dependent on financing and plant expansion. Address continued minimization of excessive I/I in areas upstream of the CSO system.
  - **Adaptive Management** - Adapting future projects based on the performance of the completed control technologies.

17

Components of the Selected Alternative

- The alternative providing over 90% capture costs $59.3M ($101M inclusive of 20 year life cycle costs) with:
  - Regulator Modifications
  - Rehabilitation & extension of the West End Interceptor
  - Building a parallel Delaware River Interceptor
  - Partially separating combined sewers north of Veterans Memorial Park
  - Green Stormwater Infrastructure in high frequency CSO areas
- This alternative provides the most affordable and cost-effective CSO control benefits.
- The boat ramp along the Delaware River is a public access point and the wet weather discharge from the adjacent outfall is addressed in this alternative.

18

Selected CSO Control Technologies

Regulator Control Improvements	Life Cycle Costs (Millions $)
Regulator Modifications Estimate	$ 14.2
Targeted Overflow Reduction	
Parallel Delaware River Interceptor	$ 3.6
WE Interceptor Rehab & Extension	$ 2.5
CSO-5 Partial Sewer Separation	$ 4.5
CSO 18 & 19 Green Infrastructure	$ 11.8
Arboretum Tank	$ 10.0
Monitoring and Modeling	$ 5.0
Public Outreach	$ 3.0
Plant Expansion/Upgrade	$ 28.8
Real-Time Control	$ 2.9
Adaptive Management	
Adaptive Management Estimate	$ 10.0
Program Operation Costs	$ 5.0
Total	$ 101.3

19

Implementation of the LTCPU

- Regulator Control Improvements are ongoing.
- Targeted Overflow Reduction projects can be fully implemented within the next 10 years, but depend on:
  - If excessive upstream flow into leaking pipes can be affordably addressed.
  - Eastern Service Area costs do not upset Chester's financial capability.
  - Recommended DELCORA treatment plant expansion approval by the PADEP and USEPA.

20

LTCPU 20-Year Implementation Schedule & Milestones

Consent Decree Date of Lodging
August 17, 2015

Consent Decree LTCP Completion
August 17, 2035

2020 2025 2030 2035

Milestones:

- Early Action Item, Completed PS-6 - September 2018
- Public Participation Meeting - September 26, 2018
- Updated LTCP Final Report & Update NMCs Plan - Feb. 17, 2019
- Regulator Control Improvements and Targeted Overflow Reduction Projects Complete – completed within10 years from regulatory approval
- All projects complete and fully operational; DELCORA is meeting all requirements of the Consent Decree - August 17, 2035

21

Literature and Documentation

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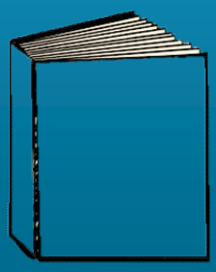

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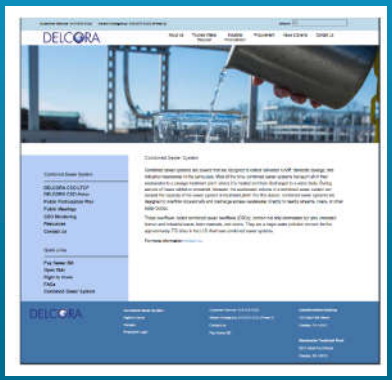
DELCORA Website



www.delcora.org

23

CONTACT DELCORA

- Mail Address
  - DELCORA
    100 East 5th Street
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- Email: ltcpinfo@delcora.org
- On the WEB: www.delcora.org
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- Newsletter
- Sign-Up Sheet

-Thank You-

24

Discussion - Q&A

25

End of Presentation

26

COMBINED SEWER OVERFLOW (CSO)
LONG-TERM CONTROL PLAN UPDATE (LTCPU)
PUBLIC MEETINGS

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Learn about DELCORA's combined sewer system and the proposed strategies for significantly reducing combined sewer overflows to our rivers and streams. Please give us your feedback on items discussed at the scheduled meeting below.

5th MEETING

TOPIC:	**Selection and Implementation of the Long-Term Control Plan**
WHEN:	**Tuesday, June 9, 2020 at 6:00 PM EST**
WHERE:	**Virtual Meeting through Zoom** **Join from PC, MAC, Linux, iOS or Android**

Register in advance for this meeting:

https://us02web.zoom.us/meeting/register/tZYtcu6prD0qEtUrqGNxLfOhm1Zrce_AUqHI

After registering, you will receive a confirmation email containing information about joining the meeting. People can also participate in this meeting listed above by telephone by calling one of the following phone numbers:

1-312-626-6799, 1-929-205-6099, 1-253-215-8782, 1-301-715-8592, 1-346-248-7799, 1-669-900-6833.

Zoom Meeting Id: 820 5712 6081
Password: 524577
General Email: ltcpinfo@delcora.org
General Phone Number: 610-876-5523

DELCORA Long Term Control Plan Update
PUBLIC MEETING NO. 5 NOTES

Meeting Title: PUBLIC MEETING NO. 5

Date / Time: June 9, 2020 6:00 PM

Prepared By: Lavanya Ramasubramanian

Location: Virtual Meeting

Reviewed By: Michael Hope

Distributed: 06/10/2020

Attendees:

Charles Hurst, DELCORA
John Pileggi, DELCORA
Robert Willert, DELCORA
Lindsey Amadio, DELCORA
Michael DiSantis, DELCORA

Michael Hope, Greeley and Hansen
Lavanya Ramasubramanian, Greeley and Hansen
Marcus Mathieson, Greeley and Hansen
See Attached Public Sign in Sheet

DELCORA held the 5th Long Term Control Plan Update (LTCPU) Public Meetings on Tuesday, June 09, 2020. Due to the global COVID-19 pandemic, this meeting was a virtual meeting. This public meeting was held to present to the public LTCPU Development and Evaluation of Alternatives for CSO Controls of the LTCP Update. DELCORA's goal of each public meeting is to inform and solicit input to its updated LTCP from stakeholders, including the public, customer communities and the regulatory agencies.

The following items were discussed and presented at the fifth public meeting:

1. DELCORA General Introduction and Opening Remarks
2. DELCORA Public Participation Plan Program Goals
3. Review of DELCORA Service Area and Combined Sewer Area
4. Chester City Municipal Separate Storm Sewer System (MS4) area
5. Combined Sewer System VS Separate Sewer system
6. LTCPU 42-Month Program Schedule & Milestones
7. LTCP Completed Early Action Items and System Improvements to Date
8. Review of National CSO Policy Requirements for the Alternative Analysis
9. LTCPU Alternative Analysis
10. Proposed 2020 CSO Control Plan
11. Discussion of Proposed CSO Controls
12. LTCP Implementation Schedule and Milestones
13. Available Literature and Documentation Locations for Public Review
14. DELCORA Website Information address and information available on their website.
15. Contact Information for DELCORA, Questions and DELCORA Website

A question and comments session occurred after the presentation was completed. The list of questions/ comments with responses to comments is attached.

There were approximately 18 individuals from the public in attendance.

See attached Public Comment and Response sheet.

ACTION ITEMS:

1. DELCORA will make the schedule for the LTCP Update Program available on their website.

2. DELCORA will upload the public meeting notes with sign in sheet to their website.

ATTACHMENTS

- Responses to Public Comments/Questions
- Public Attendance Sheet
- Public Meeting PowerPoint Presentation

DELAWARE COUNTY REGIONAL WATER QUALITY AUTHORITY

LONG TERM CONTROL PLAN UPDATE

PUBLIC PARTICIPATION MEETING NO. 5
LTCPU DEVELOPMENT AND EVALUATION OF ALTERNATIVES FOR CSO CONTROLS
June 10, 2020

RESPONSES TO PUBLIC COMMENTS

1. Comment: Does Haverford Township and Upper Darby have combined sewers and how is their sewer flow handled?

   Response: ***Haverford Township and Upper Darby does not have any combined sewers. The flows from these areas are treated at the Philadelphia Water Department's Southwest Wastewater Pollution Control Plant (PWD-SWWPCP). The flows from the eastern portion of these areas are conveyed to PWD-SWWPCP directly, while flows from the western portion are received at the Darby Creek Pump Station, owned and operated by DELCORA and conveyed to PWD-SWWPCP for treatment.***

2. Comment: After sewer separation, what happens to the existing pipe?

   Response: ***During sewer separation, a new pipe is installed to take the storm water while the existing pipe is left in place to receive and convey only sanitary flow. DELCORA will maintain the sanitary sewer pipe.***

DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL AUTHORITY
CSO Long Term Control Plan Update
Public Participation Meeting #5

Tuesday, June 9, 2020
Virtual Meeting

	Name (First, Last)
1	Lindsey Amadio
2	Michael Hope
3	John Pileggi
4	Anne Buchanan
5	Charles Hurst
6	Jean Malafronte
7	Lavanya Ramasubramanian
8	Michael DiSantis
9	610-527-3706 - Julianne Winters
10	Mark Bubel
11	202-441-0639
12	Renee Cree
13	Michael Greenwald
14	Marcus Mathieson
15	Ken Hemphill
16	Mark Bubel
17	610-565-3365 - Joann Williams
18	Clyde Wilber
19	Nicole Lasorda
20	Robert Willert
21	Philip Yeany - EPA
22	Parthenia Izzard
23	610-637-5741
24	610-547-7605 - Pastor Strand
25	267-253-0972 - Alice Wright
26	Kathleen Peterson
27	John Butler
28	John Lucas

Combined Sewer Overflow - Long Term Control Plan Update

DELCORA

Public Participation Meeting No. 5

LTCPU Development and Evaluation of Alternatives for Combined Sewer Overflow Controls

June 9, 2020

Virtual Meeting

General Information

- DELCORA is the Delaware County Regional Water Quality Control Authority, established in 1971, responsible for collecting, conveying and treating wastewater in the greater Philadelphia Area including 42 Municipalities in Delaware and Chester County.

DELCORA Mission

"Provide environmentally responsible and cost effective wastewater management services to the citizens, businesses, and industries of Southeastern Pennsylvania"

2

Scope of Meeting

- This Public Meeting (6/9/20) is to:
  - Overview DELCORA Service Area
  - Present the proposed Control Sewer Overflow Control Plan
  - Describe Next Steps Towards Development of Long Term Control Plan Update (LTCPU)
  - Questions and Comments

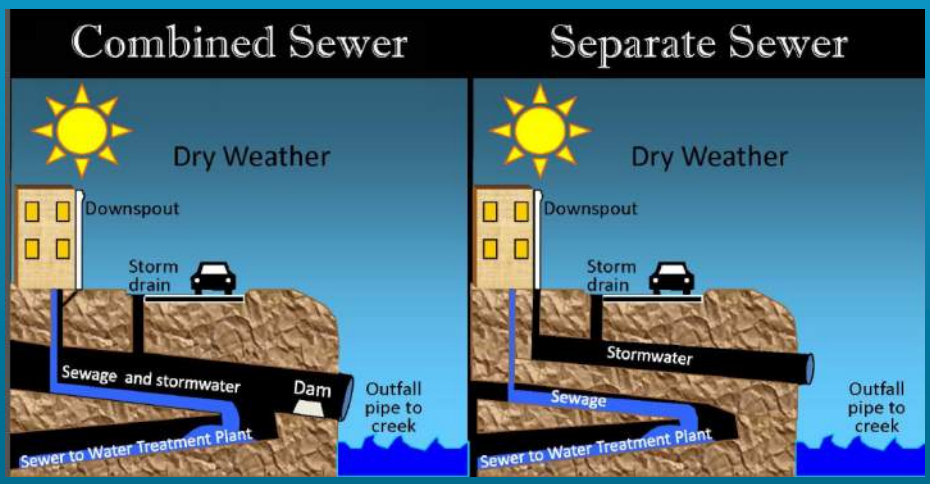
3

Public Participation Program Goals

- DELCORA's Goals for the Public Participation Program are to:
  - Inform and Solicit Input to proposed CSO Control Plan from Stakeholders, including Public, Customer Communities and Regulatory Agencies
  - Educate the Public
  - Address Public Questions/Comments

4

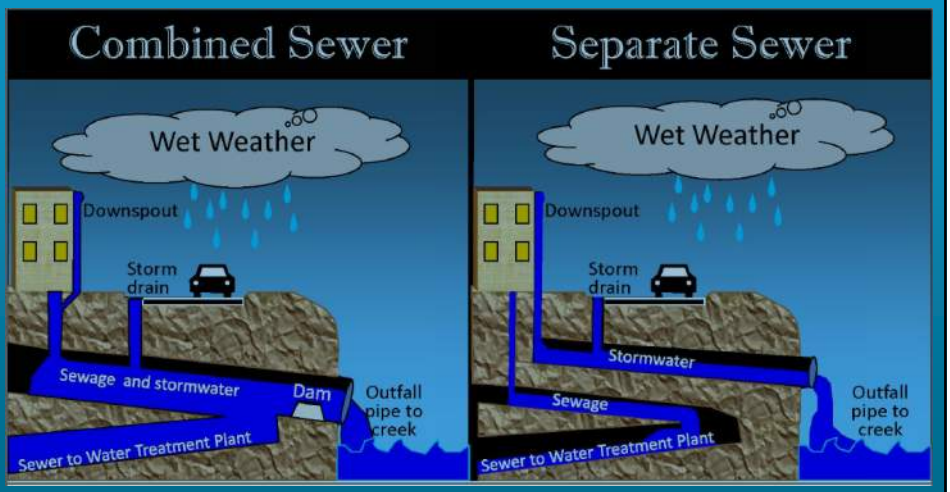
Combined Sewer System vs. Separated Sewer System



Source: City of Alexandria,
https://www.alexandriava.gov/uploadedFiles/tes/oeq/CSSPermitInfoMeetingandPublicHearingPresentation08052013.pdf

5

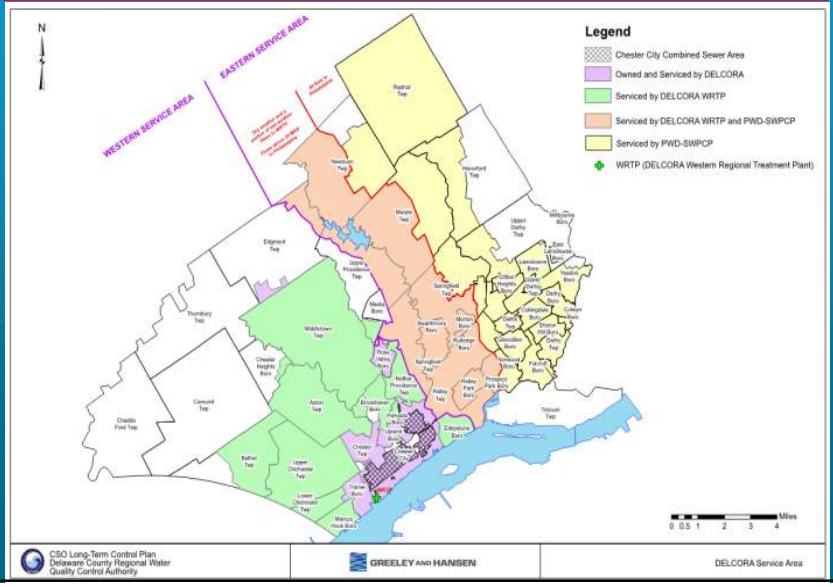
Combined Sewer System vs. Separated Sewer System



Source: City of Alexandria,
https://www.alexandriava.gov/uploadedFiles/tes/oeq/CSSPermitInfoMeetingandPublicHearingPresentation08052013.pdf

6

DELCORA Service Area



7

Chester City Service Area

8

LTCPU Program Schedule

Consent Decree Date of Lodging
August 17, 2015

Consent Decree LTCP Submittal
Feb. 17, 2019

5th Public Meeting
June 2020

2015 | 2016 | 2017 | 2018 | 2019 | 2020

Since the lodging of the Consent Decree in August of 2015, DELCORA has met important milestones in the program:

2016
- Selected a plan to decrease CSOs and evaluated the financial capability of the community to pay for it.
- Identified the bacteria responsible for the pollution, and high-priority areas for CSO reduction.

2017
- An evaluation of historical rainfall on the existing sewer system was conducted. This would help identify the impacts of new technologies.

2018
- Pump Station "PS-6" completed and held 4th public meeting.

2019
- Submitted final reports to the EPA.

2020
- Hold 5th Public Meeting to present Proposed CSO Control Plan and submit final revised report to EPA and DEP.

9

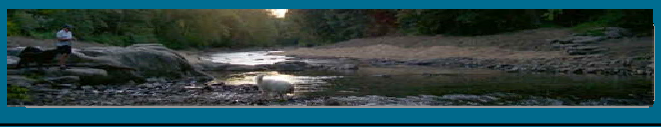
Early Action Items

- A new pump station near the DELCORA treatment plant was required to be placed in operation by Dec 2018.
  - New Pump Station PS-6 was placed in operation on September 5, 2018
  - New PS-6 moves more wet weather flow into the plant

10

Improvement Costs to Date

- From 1999-2018 DELCORA invested in excess of $100 Million
  - Includes
    - overall system improvements
    - contributions to the City of Chester
  - Resulted in
    - decreased volume of overflows,
    - reduced debris in overflows,
    - remote monitoring of the system,
    - improved routine maintenance.



Partially separating flow to a CSO regulator

Purchasing property for further plant expansion

Replacement of older CSO regulator models

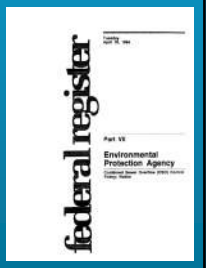
Research, repair, & replacement for leaking pipes

Annual informational flyers mailed to customers

11

National CSO Policy Requirements

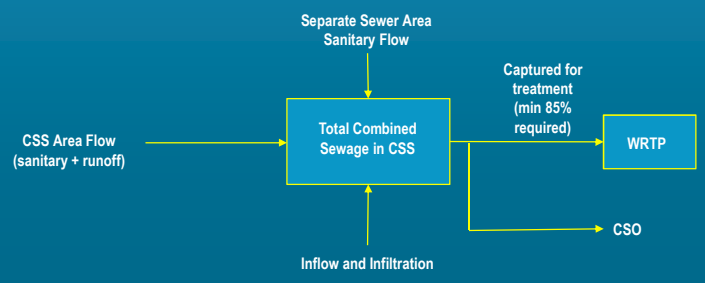
- National CSO Policy provides guidance to develop the LTCPU:
  - To meet one of the following (Presumption Approach):
    - No more than an average of 4 overflows a year
    - *Elimination or capture for treatment of at least 85% of combined sewage volume during wet weather events*
    - Elimination or removal of pollutants identified causing water quality impairment during wet weather events



12

What is Percent Capture?

- Percent of Combined Sewer System (CSS) volume captured for treatment during precipitation events
  - Precipitation event – Precipitation period + Period for CSS to drain
    - Period for CSS to drain
      - Period for runoff to pass through CSS (approx. 6-12 hours)
      - Time until flow returns to Dry Weather Flow



13

LTCPU Alternatives Analysis

- Elimination or capture of 85% of wet weather flows entering the collection system on a system wide, typical year basis.
  - This level of control is presumed to meet Water Quality Standards (subject to verification monitoring post-construction).
- Looked at over 15 combinations of technologies to reduce CSOs (includes required technologies as per consent decree)
- Estimated the costs associated for completing all projects in an alternative (Capital Cost) plus the cost of maintenance and operation for 20 years (Life Cycle Cost)

14

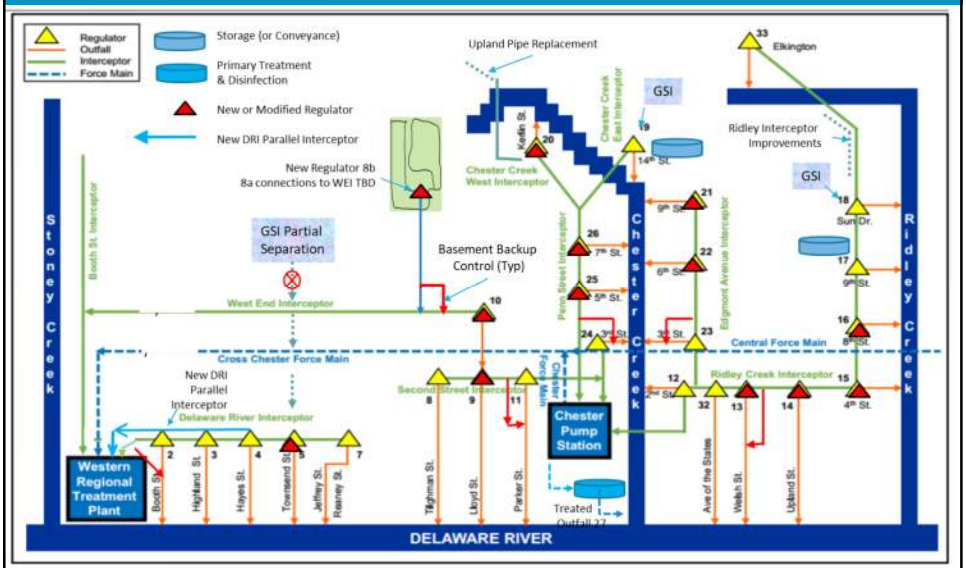
Proposed 2020 CSO Control Plan

- Developed based on inputs from Public Outreach, other public meetings, PADEP/EPA Review
- Require specific action to address unauthorized Combined Sewer Overflows and Sanitary System Overflows
- Require at least 85% capture in the Ridley Creek, Chester Creek and Delaware River
- Address high overflow frequency at certain priority CSO outfalls

15

DRAFT 2020 LTCP Elements

(Pump Station Improvements not shown)



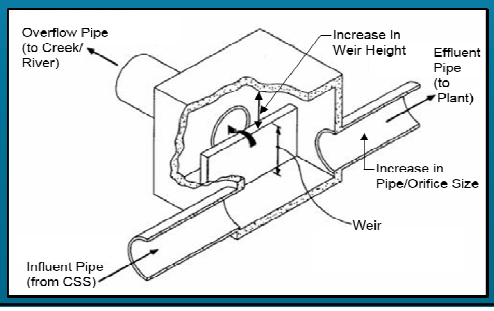
Discussion of Proposed CSO Controls

- Regulator Modifications
- Parallel Conveyance/Pipe Extension
- Diversion Piping
- Sewer Separation
- Storage
- Satellite Treatment
- Treatment Plant Improvements
- Management of Unauthorized Releases
- Green Stormwater Infrastructure (GSI)

17

Proposed CSO Control Plan: Regulator Modifications

- Target Areas - Ridley Creek, Chester Creek and Delaware River Watersheds
- Regulator modifications at 16 locations to maximize flow to the treatment plant using existing infrastructure.
- Can raise weir height or increase the size of effluent pipes (to interceptor), orifices, or gates.
- Allows more flow to enter the collection system and prevents CSOs during smaller storms.



Proposed CSO Control Plan: Parallel Conveyance/Pipe Extension

- Target Areas – Delaware River Watershed
- A parallel conveyance pipe along Front St. from Hayes St. to Clayton St.
  - Increases CSS volume capture and reduces overflow
- Restoration and extension of an existing line at Clayton and Front Streets.
  - Relieves bottleneck and allows more CSS volume capture

19

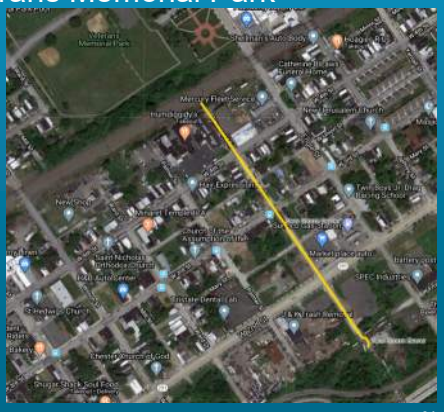
Proposed CSO Control Plan: Diversion Pipe

- Target Area – Delaware River Watershed
  - The boat ramp along the Delaware River is a public access point with an adjacent outfall (CSO-08)
  - Installing a diversion pipe at Tilghman Street and 7th Street to divert flows during storms to the West End Interceptor on 4th Street

20

Proposed CSO Control Plan: Sewer Separation

- Target Areas – Delaware River Watershed
- Installation of new piping to separate the combined sewer area north of Veterans Memorial Park
- Reduce flooding at Veteran's Memorial Park
- Reduction of sanitary discharges to receiving water
- Increased storm water discharge to receiving waters

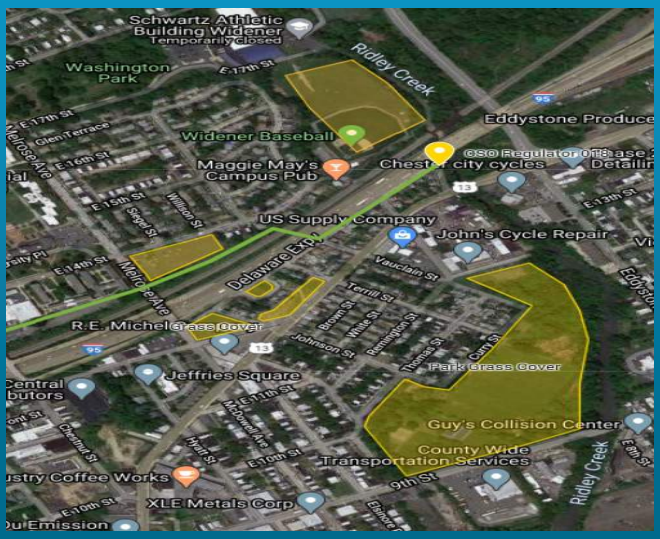


21

Proposed CSO Control Plan: Combined Sewer Storage

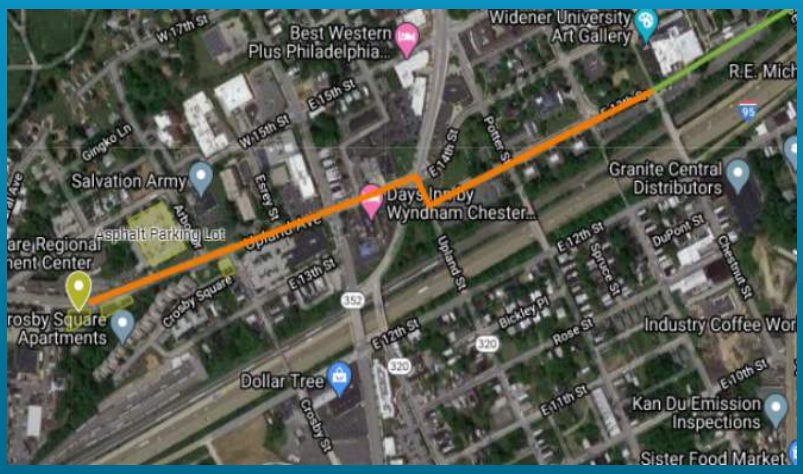
- Target Areas – Ridley Creek Watershed, Chester Creek Watershed
- Combined sewer storage at CSO-18 and CSO-19.
- Alternative 1 - Replace the storage at CSO 19 with a pump out to a larger tank at CSO-18
- Alternative 2 – Replace the storage at CSO 19 and CSO-18 with a pump out to Eastern Service Area (ESA) via Microtunnel
- Opportunities for synergies with other capital programs to reduce storage

Storage Tank Potential Locations



23

Storage Tank Alternative for CSO 19



24

Below Grade Storage Tank (Example Photos)

25

Above Grade Storage Tank (Example Photos)

Proposed CSO Control Plan:
Satellite Treatment at Chester Pump Station

- Used to treat excess wet weather flow
- Primary treatment, Screening and Disinfection in one unit
- Small footprint
- Low maintenance

Source: Hydro International, https://hydro-int.com/sites/default/files/storm_king.pdf

27

Proposed CSO Control Plan:
Treatment Plant Improvements

- Installation of real-time motor operated valves and controls in the regulators and conveyance system to handle increased flows.
- Treatment plant modifications increase ability to handle excess wet weather flow treatment.

28

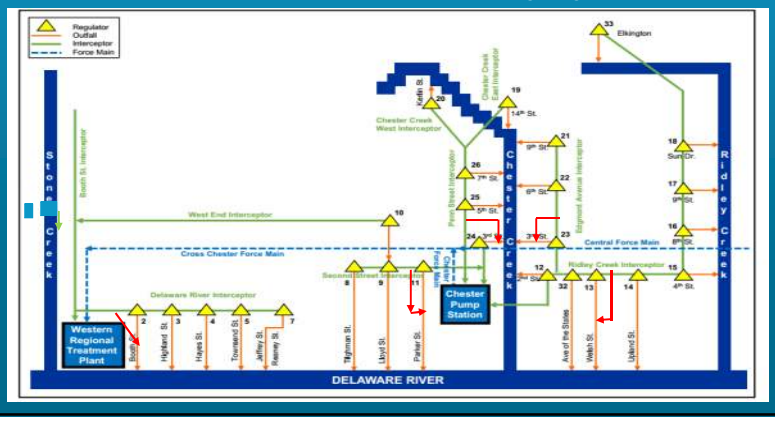
Proposed CSO Control Plan: CDPS and Upland Borough

- Unauthorized Releases Control
  - New Crum Creek Pump Station
    - Addresses overflows at the DELCORA Central Delaware Pump Station (CDPS). This will reduce flows to the CDPS and reduce the incidence of Sanitary System Overflows at the CDPS.
    - New pump station will have peak capacity of 24 MGD and will be located at the site of the existing pump station.
  - Relief sewer pipe in Upland Borough
    - Installation of a relief sewer line will mitigate unauthorized releases in Upland Borough.

29

Proposed CSO Control Plan: Basement Backup Control

- Unauthorized Releases Control (con't)
  - Basement Backup Control
    - Basement backup control structures to prevent surcharging of interceptors and basement backup during large storm events.



30

Proposed CSO Control Plan: Inflow/Infiltration Controls

- Unauthorized Releases Control - Old Mill Pump Station
  - Inflow – Water entering sanitary sewers through inappropriate connections
  - Infiltration – Groundwater entering sanitary sewers through defective pipe joints and cracked pipes.
  - Inflow/Infiltration (I/I) controls including manhole rehabilitation, public sewer lining, and pump station capacity increases will be implemented based on the results of the I/I studies.

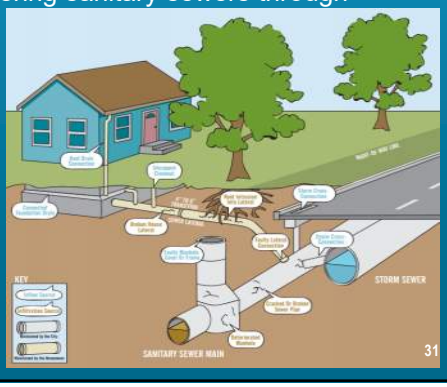


Image source: http://www.goldenvalleymn.gov/homeyard/utilities/pdf/ii-culprits.pdf

31

Proposed CSO Control Plan: Taylor Arboretum

- Unauthorized Releases Control
  - Taylor Arboretum Modifications
    - This will be addressed through an adaptive plan
    - Regulator and overflow modifications at CSO Regulators 18 and 33 to reduce surcharge conditions in the Ridley Creek Interceptor
    - Evaluation/implementation of manhole modifications to address additional surcharging
    - Evaluation/implementation of controls to address excessive inflow/infiltration

32

Proposed CSO Control Plan
Green Stormwater Infrastructure (GSI)

- Additional Controls:
  - Approach to stormwater management that protects, restores, or mimics the natural water cycle (American Rivers, 2016)
  - Reduces and treats stormwater at its source while delivering environmental, social, and economic benefits
  - GSI Elements include –
    - Downspout Disconnection, Rainwater Harvesting, Rain Gardens, Planter Boxes, Bioswales, Permeable Pavements, Green Streets and Alleys Green
      Parking Green Roofs
  - Potential GSI locations North of I-95, near Veteran's Memorial Park and other possible sites being considered.

33

Property Impacts

- Exact project locations not selected
- Many projects in public Right-of-Way
- Some properties being considered are owned by commercial or public entities, including but not limited to parks
- Some properties being considered are privately owned and may have homes

34

CSO Improvements on Private Property

- Approach for projects proposed on private property
  - Notify landowners of proposed improvements
  - Communicate project requirements/alternatives
  - Develop land/easement offer of compensation
  - Communicate land/easement offer
  - Discuss concerns
  - Negotiate land/easement offer and concerns
  - Finalize land/easement paperwork
  - Construct CSO Improvements

35

Proposed CSO Control Plan

	Capital Cost ($M)	LCC
Regulator Control Improvement		
Regulator Modifications	$4.70	$13.00
Targeted Overflow Reduction		
Parallel Delaware River Interceptor	$3.30	$3.40
West End Interceptor Rehab & Extension	$2.50	$2.60
Sewer Separation with Green/Gray Infrastructure	$10.30	$12.10
RCI Arboretum Modifications	$7.40	$17.50
Upland Relief Sewer Line	$0.80	$1.00
Rose Valley I/I Controls	$3.10	$3.10
Monitoring and Modeling	$5.10	$5.10
Public Outreach	$3.10	$3.10
Real Time Control	$0.40	$2.90
Crum Creek Pump Station	$8.80	$8.80
CSO Storage	$22.2	$33.9
Tilghman St Diversion	$0.70	$0.70
Basement Backup Controls	$1.00	$1.10
Satellite Treatment at Chester Pump Station	$33.50	$54.30
Project Management	$5.10	$5.10
Total	**$112.00**	**$167.70**

36

Proposed CSO Control Plan: Post Construction Monitoring Period

- Conduct post-construction monitoring after CSO control technologies are implemented to determine if they are operating as intended.
- Higher frequency overflows will be evaluated during monitoring for additional improvements, if necessary.
- Financial capabilities for additional improvements will also be considered during the monitoring.

37

Implementation of the LTCPU

- Regulator Control Improvements are ongoing.
- Targeted Overflow Reduction projects can be fully implemented within 12 years of regulatory approval, but depend on:
  - If excessive upstream flow into leaking pipes can be affordably addressed.
  - Eastern Service Area costs do not upset ratepayers' financial capability.
  - Recommended DELCORA treatment plant expansion approval by the PADEP and USEPA.
  - COVID-19 impacts may result in impacts to LTCP affordability.

38

LTCPU 20-Year Implementation Schedule & Milestones

Consent Decree Date of Lodging
August 17, 2015

Consent Decree LTCP Completion
August 17, 2035

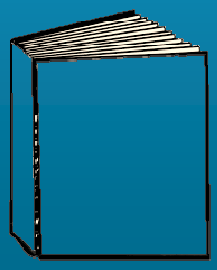
Milestones:

- Early Action Item, Completed PS-6 - September 2018
- Updated LTCP Final Report & Update NMCs Plan - Feb. 17, 2019
- Public Participation Meeting – June 9, 2020
- Regulator Control Improvements and Targeted Overflow Reduction Projects Complete – completed within 12 years from regulatory approval
- Estimated completion of all LTCP projects - August 17, 2035

39

Literature and Documentation

- Literature and Documentation will be made available by DELCORA at the following public locations and on the DELCORA Website:
  - **DELCORA Administration Building**
    100 East Fifth Street; Chester, PA 19013
  - **Lewis Crozer Library**
    620 Engle Street; Chester, PA 19013
  - **Marcus Hook Municipal Building**
    1015 Green Street; Marcus Hook, PA 19061
  - **Ridley Township Building**
    100 MacDade Blvd.; Folsom, PA 19033
  - **Upland Borough Office**
    224 Castle Avenue; Brookhaven, PA 19015
  - **Chester Township**
    1150 Engle Street; Chester, PA 19013



40

DELCORA Website

www.delcora.org

41

CONTACT DELCORA

- Mail Address
  - DELCORA
    100 East 5th Street
    Chester, PA 19013
- Email: ltcpinfo@delcora.org
- On the WEB: www.delcora.org
- General Phone Number: 610-876-5523
- Newsletter
- Sign-Up Sheet

-Thank You-

42

Discussion - Q&A

43

End of Presentation

44

APPENDIX N

CORVIOUS GREEN STORMWATER INFRASTRUCTURE EVALUATION

- DELCORA Corvius Green Stormwater Infrastructure (GSI) Evaluation dated November 2017

Note: This Appendix includes mention of Greeley & Hansen which rebranded to TYLin in 2023.

DELCORA

SAC Corvias

Green Stormwater Infrastructure (GSI) Evaluation

Delaware County Regional Water Quality Control Authority (DELCORA)

November
2017

Executive Summary

The Delaware County Regional Water Quality Control Authority (DELCORA) is a municipal wastewater authority that owns, operates, and maintains collection systems that serve southeastern Pennsylvania, including the City of Chester. In 2015, DELCORA and the United States Environmental Protection Agency (EPA) entered a consent decree which mandated DELCORA to develop and implement a Long Term Control Plan (LTCP) to control combined sewer overflow (CSO) discharges. The LTCP strategy requires an evaluation of all CSO control options, including green stormwater infrastructure (GSI).

This report identifies potential areas that are suitable for implementation of GSI and evaluates the areas based on several factors such as life-cycle costs, the ability to develop effective GSI, availability of land, and combined sewer overflow control levels achieved. As part of a parallel effort by the Stormwater Authority of the City of Chester (SAC), additional factors were investigated such as environmental and socioeconomic impacts and benefits to minority and low income neighborhoods. This evaluation includes an applicability and performance assessment of proposed GSI control measures that considers unique sewershed-specific features such as diversion structures/outfalls, receiving waters, and land uses. Finally, this evaluation accounts for and assesses long-term, continual operation and maintenance of proposed GSI.

The top-scoring GSI sites resulting from the evaluation are summarized below, together with the estimated footprint areas, storage volumes, and construction and O&M costs:

Summary of Top-Scoring GSI Sites					
	Providence Avenue Regional Management (CSO 18)	Crozer Street Green Street (CSO 19)	Widener University & Walnut Street (CSO 18)	Edgmont Avenue Green Street (CSO 19)	Estimated Totals
GSI Footprint Area	5,500 sq ft	18,100 sq ft	65,306 sq ft	36,875 sq ft	125,781 sq ft
GSI Storage Volume	31,350 cu ft	33,405 cu ft	60,544 cu ft	67,042 cu ft	192,341 cu ft
Construction Cost Estimate	$600,000	$1.9M	$3.6M	$3.9M	$10.0M
Annual O&M Cost Estimate	$15,000	$15,000	$50,000	$30,000	$110,000

The work described in this report was performed by HDR Engineering, Inc. (HDR) for DELCORA and in conjunction with SAC and Corvias, a private entity assisting SAC to implement a Community-Based Public Private Partnership (CBP3) for their Stormwater Controls Program.

Table of Contents

1.0 Introduction 1
2.0 Project Area Definition 2
3.0 Site Identification 3
4.0 Site Screening 4
5.0 Opportunity Evaluation 6
6.0 Evaluation Results 7
7.0 Site Investigation Overview 8
8.0 GSI Concept Overviews 9
8.1 Approach 9
8.2 Assumptions 10
8.3 Concept Summaries for Top-Scoring Sites 11

List of Figures

Figure 1: CSO 18, 19, and 22 Tributary Areas 2
Figure 2: Sites with Potential for GSI 4
Figure 3: Locations of High-Potential GSI Sites 6

List of Tables

Summary of Top-Scoring GSI Sites i
Table 1: Project Area Data Received 3
Table 2: High-Potential GSI Sites based on Screening 5
Table 3: Project Evaluation Categories and Criteria 6
Table 4: Evaluation Results 8
Table 5: Summary of GSI Concepts 12

Acronyms and Abbreviations

CBP3	Community-Based Public-Private Partnership
CSO	Combined Sewer Overflow
DELCORA	Delaware County Regional Water Quality Control Authority
DVRPC	Delaware Valley Regional Planning Commission
EPA	United States Environmental Protection Agency
FEMA	Federal Emergency Management Agency
GSI	Green Stormwater Infrastructure
GIS	Geographic Information Systems
LiDAR	Light Detection and Ranging
LTCP	Long Term Control Plan
MS4	Municipal Separate Storm Sewer System
NCSS	National Cooperative Soil Survey
NRCS	Natural Resources Conservation Service
O&M	Operation and Maintenance
PADEP	Pennsylvania Department of Environmental Protection
SAC	Stormwater Authority of Chester

1.0 Introduction

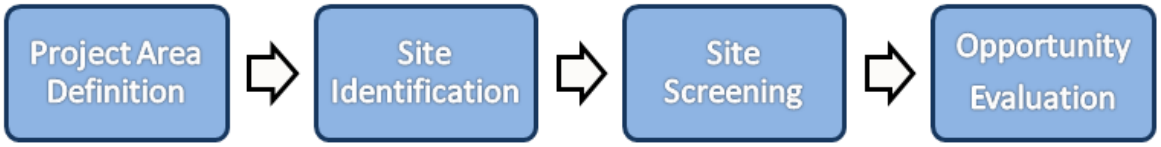
The Delaware County Regional Water Quality Control Authority (DELCORA) operates and maintains publicly-owned treatment works in the City of Chester, Pennsylvania, which collects stormwater and wastewater from residential, commercial, and industrial sources. The collection system has 28 combined sewer overflow (CSO) outfalls that discharge into the Delaware River, Chester Creek, and Ridley Creek.

In 2015, a United States Environmental Protection Agency (EPA) consent decree required DELCORA to evaluate and implement measures to reduce CSO discharges to improve water quality in the Delaware River, Chester Creek, and Ridley Creek.

Concurrently, a Community-Based Public-Private Partnership (CBP3) is being established between the Stormwater Authority of the City of Chester (SAC) and Corvias to plan, design, manage, operate, maintain, and finance the retrofitting of impervious surfaces through the use of integrated green stormwater infrastructure (GSI) practices for a planned 30-year period.

This report summarizes the investigation and evaluation tasks carried out to identify GSI projects in combined sewer system areas of Chester that will help DELCORA meet its consent decree goals.

The evaluation steps detailed in this report and illustrated below were primarily desktop analyses which included collecting baseline data for the project area, identifying and screening parcels with the highest potential for GSI, and evaluating and scoring the top sites.



The following sections detail the opportunity evaluation procedure and the steps undertaken to develop concepts for the sites with the highest potential for GSI.

2.0 Project Area Definition

For the initial evaluation, DELCORA advised that reducing the CSO volumes of outfalls 18, 19, and 22 is the highest priority. The tributary areas to these outfalls are shown in Figure 1 below. During a project meeting held on September 15, 2017, DELCORA shared their plans to separate the tributary to CSO 22 and eventually eliminate the outfall altogether. To prevent any conflict with the separation effort, this report focuses only on opportunities within the tributary areas of CSO 18 and 19.

Source: CSO Tributary Boundary GIS Layer (DELCORA/Greeley and Hansen, 2017)

Figure 1: CSO 18, 19, and 22 Tributary Areas

Reports, documents, and Geographic Information System (GIS) data, as shown in Table 1, were collected from multiple sources to form a baseline understanding of the project area and DELCORA's infrastructure.

It is understood that GIS information for catch basins is not available. Additional information can be collected, as feasible and necessary, during subsequent site investigations if these concepts are advanced to the design phase.

In general, the information received was adequate to carry out the evaluation steps and develop the concepts detailed in this report.

Table 1: Project Area Data Received		
Data/Document	**Source**	**Date**
Green Stormwater Infrastructure Plan	Delaware Valley Regional Planning Commission (DVRPC)	Authored June 2017
DELCORA Consent Decree	Delaware County Regional Water Quality Control Authority (DELCORA)	Dated June 2015
Vision 2020 Climate Adaptation Planning Elements Report	Chester Hazards and Climate Project Team	Authored June 2014
CSO Tributary Boundary GIS Layer	DELCORA/Greeley and Hansen	Received June 2017
CSO Modeling Data for Typical Year	DELCORA	Dated March 2016
Chester Impervious Coverage GIS Layers	AKRF	Received May 2017
CSO Network GIS Layers	DELCORA	Received April 2017
Chester Parcel GIS Layer	Delaware County Board of Assessments	Received April 2017
Chester City Planning GIS Layers: • Libraries, Post Offices, Schools, County and Municipal Boundaries, Cemeteries, Electrical Lines • Transportation Centers, Abandoned Rail Lines, Road Centerlines • Protected and Developed Lands • Rivers, Lakes, Ponds, Streams, Wetlands, Floodplains FEMA (2015), Open Spaces and Recreation	Delaware County Planning Department	Received May 2017
Other Public GIS Layers: • LiDAR Imagery • Contours • Watersheds • Land Use • Historical Markers • NCSS Soil Data	Online – public domain	Downloaded April 2017

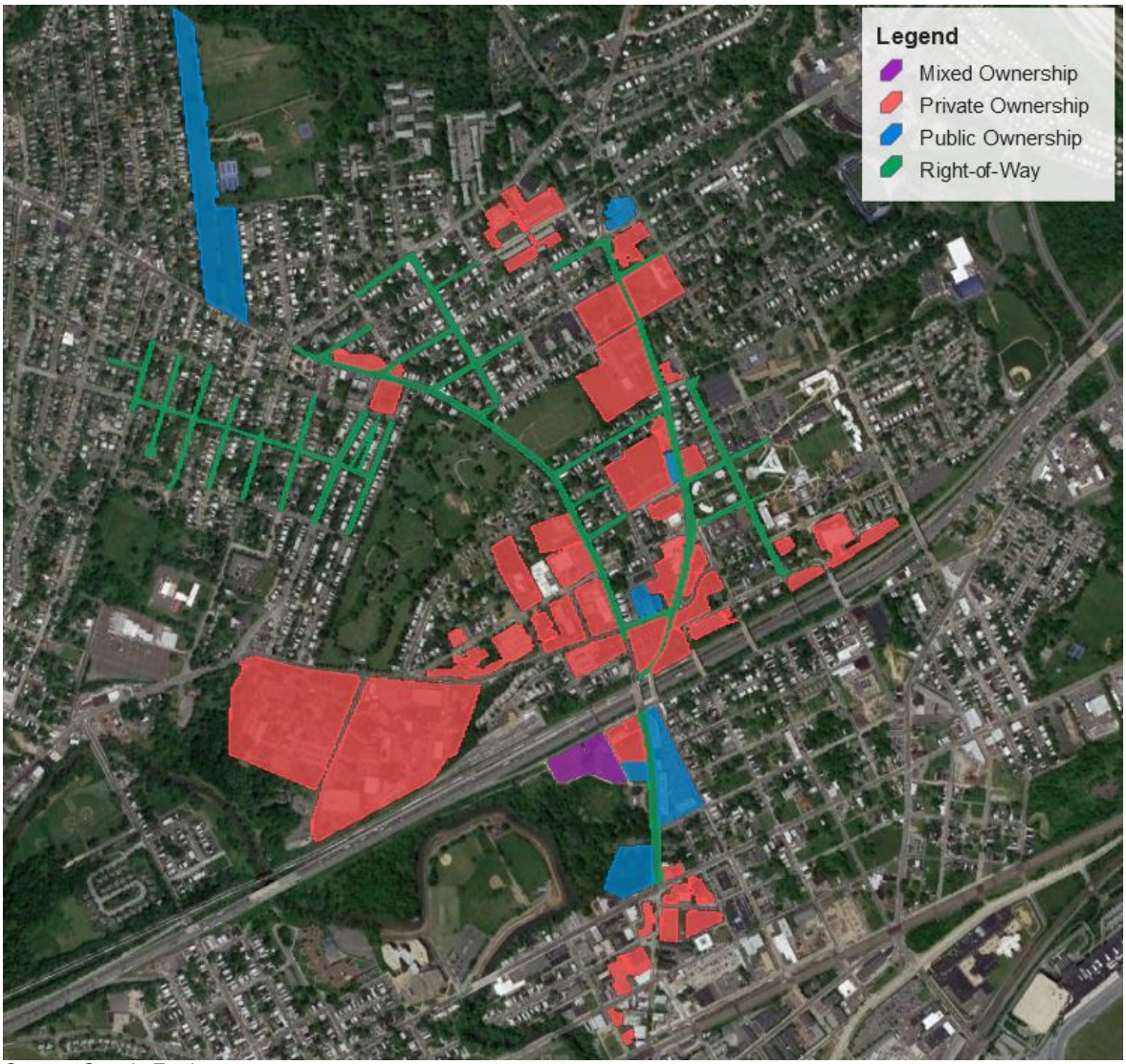
3.0 Site Identification

Using the above information, the first evaluation step involved reviewing parcel data to identify large impervious surfaces and open spaces within the project limits which generate significant runoff to the combined sewer. These sites include:

- Large vacant lots
- Right-of-way corridors greater than 40’ wide
- Large publicly-owned parcels or groups of parcels
- Parks and open spaces

- Large private parcels with significant impervious surfaces.

This evaluation step resulted in 61 sites with significant tributary areas that could be managed by GSI practices. These sites are mapped below in Figure 2. This map is color-coded based on ownership type: right-of-way (green), private (red), public (blue), mixed public and private (purple).



Source: Google Earth

Figure 2: Sites with Potential for GSI

4.0 Site Screening

For the screening phase, the 61 sites identified in the previous step were reviewed to determine which sites generated the largest volume of stormwater runoff. These sites have the greatest potential for reducing the volume of water entering the combined sewer system.

During heavy rainfall, all surface types generate runoff which drain to the combined systems and can contribute to CSO events. While impervious surfaces generate a higher rate of runoff, large areas of pervious surfaces can also generate significant runoff volumes. For this reason, the

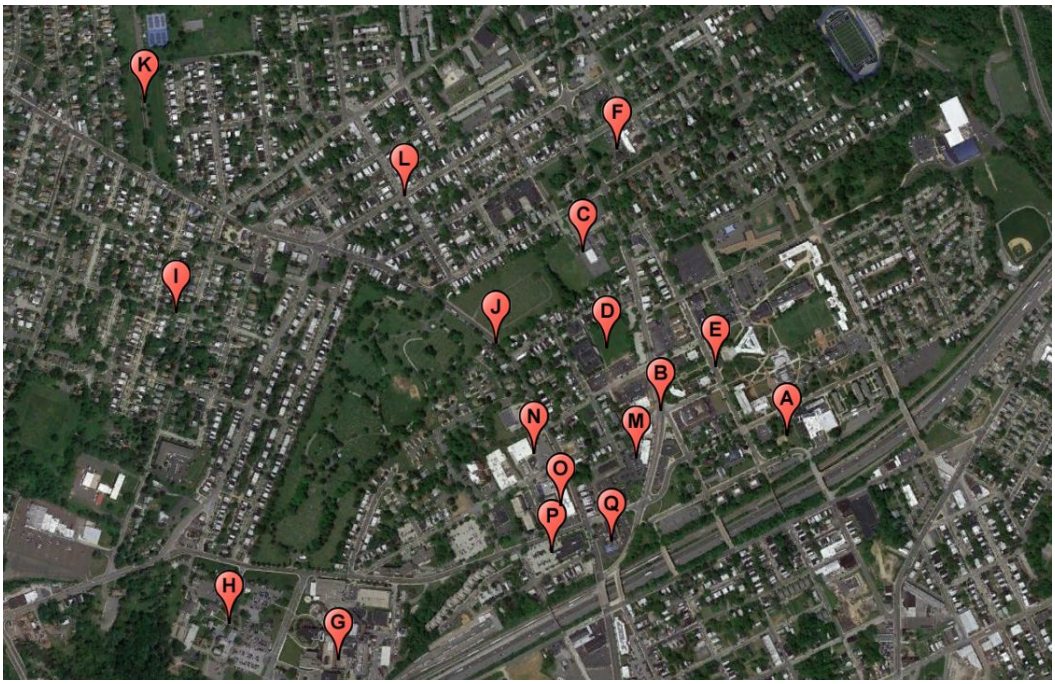
evaluation specifically targets impervious surfaces, but also considers large pervious areas such as parks and playing fields.

An equivalent acre value was used to calculate a site's total runoff volume. The equivalent acreage of a site was found by adding one quarter of the pervious tributary area to the impervious tributary area. The 0.25 coefficient is a conservative multiplier based on Natural Resources Conservation Service (NRCS) runoff curve numbers for open spaces and lawns with an additional factor of safety to maintain the emphasis on impervious surfaces.

The top sites, based on this screening and organized by CSO outfall tributary area, are listed in Table 2 and mapped in Figure 3. The following locations were also identified in CSO 22, but were subsequently removed from consideration, as noted in Section 1.

- Madison Street Parking Lot,
- Edgmont Avenue South, and
- E12th/Crosby Triangle.

Table 2: High-Potential GSI Sites based on Screening
CSO 18
A. Widener University B. Providence Avenue C. Drexel Neumann Academy D. Smedley Allied Health High School E. Walnut Street F. UHS Keystone Health Center
CSO 19
G. Crozer-Chester Medical Center H. Crozer Seminary I. Crozer Street J. Edgmont Avenue K. Chester Park Vacant Lots L. Madison Street M. Best Western N. Family Dollar O. Widener Partnership School P. 1350 Edgmont Office Building Q. Days Inn



Source: Google Earth

Figure 3: Locations of High-Potential GSI Sites

5.0 Opportunity Evaluation

To evaluate and rank the top sites identified above, a spreadsheet tool was created for scoring various criteria from four primary categories: CSO Volume Reduction, Project Feasibility, Site Suitability, and Community Benefits. Each category consists of defining criteria and is weighted to emphasize important priorities, as detailed in Table 3.

Table 3: Project Evaluation Categories and Criteria	
Weight: 50%	**CSO Volume Reduction**
• CSO Effective Tributary Area Managed	
Weight: 25%	**Project Feasibility**
• Design Complexity • Constructability • Utility Conflicts / Constraints (Visual Assessment) • Environmental Remediation (Proximity to Environmental Risk Sites) • Operations and Maintenance Implementation	
Weight: 15%	**Site Suitability**
• Available Land for GSI Practices • Public Safety	
Weight: 10%	**Community Benefits**
• Revitalize Depressed Areas (Social Justice) • Catalyst for New Business and Commerce • Provide Recreation & Education • Environmental Improvement (Greening)	

The ratings for each criterion were based on quantifiable metrics when possible in order to normalize and compare the scoring across all projects. Other ratings such as "Design Complexity" and "Constructability" were based on experience implementing similar GSI practices in other urban areas nationwide. Because the most important categories have heavier weighting, the scores for these criteria had greater consequence for the overall total.

The following data and documents guided the scoring in this evaluation:

- CSO Tributary Maps from DELCORA/Greeley and Hansen to confirm location within the priority CSO tributaries.
- Demographic maps from *Vision 2020 Climate Adaptation Planning Elements* report to determine impact to impoverished areas, location of high-population densities, and proximity to environmental risk zones.
- Google Earth to perform desktop analysis and measure tributary and impervious areas.

For the purpose of this evaluation, it was assumed that the following types of GSI practices would likely be considered for each project during next steps and, specifically, concept development:

- **Bioretention** – vegetated practices within a public or private parcel
- **Tree trenches** – linear tree pits with integrated subsurface storage for runoff
- **Green streets** – combination of right-of-way bioretention or tree trenches, green curb extensions or medians, permeable pavement, and bike paths (where feasible)
- **Permeable pavement** – concrete, brick, or asphalt surfaces that allow runoff to infiltrate to subsurface storage media
- **Green roofs** – vegetated detention layers on flat roof surfaces
- **Subsurface storage** – underground facilities that typically manage stormwater diverted from subsurface drainage structures such as downspouts or separate stormwater pipes. These practices can be designed to infiltrate the stored stormwater or slow-release it back to the system.

6.0 Evaluation Results

Using the information detailed previously, a rating was given for each of the above criteria and entered into the spreadsheet evaluation tool. The spreadsheet then aggregated the scores and applied the weighting factors to each category to derive the total score out of a maximum of 100.

The results for each of the top sites are listed in Table 4 from highest total score to lowest. The table also includes each category score out of the weighted total.

Table 4: Evaluation Results

	Category Scores				
	CSO Volume Reduction	Project Feasibility	Site Suitability	Community Benefits	Total
Project	**50.0**	**25.0**	**15.0**	**10.0**	**100.0**
Providence Avenue	50.0	21.5	11.3	5.3	**88.0**
Crozer Street	50.0	18.0	13.5	4.5	**86.0**
Widener University	50.0	18.5	10.5	6.5	**85.5**
Edgmont Avenue	50.0	14.5	13.5	7.3	**85.3**
Crozer Seminary	50.0	18.0	10.5	3.5	**82.0**
Crozer-Chester Medical Center	50.0	13.5	9.0	4.8	**77.3**
Chester Park	35.0	20.0	11.3	7.5	**73.8**
Madison Street Parking Lot	33.0	19.5	13.5	4.0	**70.0**
Drexel Neumann Academy	25.0	19.5	10.5	6.8	**61.8**
Walnut Street	23.0	17.0	13.5	5.8	**59.3**
Smedley Allied Health High School	23.0	19.5	9.0	7.5	**59.0**
UHS Keystone Center	18.0	19.5	10.5	4.3	**52.3**
Widener Partnership School	16.0	18.0	10.5	7.5	**52.0**
Best Western	17.0	19.5	9.8	4.8	**51.0**
1350 Edgmont Office Building	16.0	19.5	10.5	4.8	**50.8**
Family Dollar	16.0	18.0	10.5	4.8	**49.3**
Days Inn	14.0	19.5	10.5	4.8	**48.8**

For each category column, the highest scores are green, the middle scores are yellow, and the lowest scores are red. The maximum score for each category is listed below the category header. Total scores are out of a maximum of 100.

After initial scoring and during the project meeting held on September 15, 2017, DELCORA advised that Crozer Seminary and Crozer-Chester Medical Center should be assumed to be separately sewered. As a result, these sites were subsequently removed from consideration for this evaluation. DELCORA also requested that Walnut Street be combined with the Widener University concept.

After reviewing the results, DELCORA agreed to proceed with site investigations for the top sites as scored:

- Providence Avenue
- Crozer Street
- Widener University / Walnut Street
- Edgmont Avenue

7.0 Site Investigation Overview

Following the identification of the top four scored opportunities, site investigations were completed to gather further information on each site to inform concept development. The investigations focused on completing the below activities:

- Taking representative site photographs
- Locating surface drainage features such as catch basins, drains, manholes, ditches, and channels
- Recording high and low points, site contours, and other features that may affect surface flow
- Delineating tributary area boundaries within each opportunity area

- Identifying site constraints that may affect GSI construction, functionality, and maintenance such as limited accessibility, site usage and constraints, and existing trees and vegetation.

The information gathered during the site investigations contributed to the development of the proposed GSI concepts presented in Section 8.

8.0 GSI Concept Overviews

8.1 Approach

The approach to developing the proposed GSI concepts is a high-level adaptation of techniques used for GSI planning nationwide. The step-by-step process is detailed below.

The first step was to delineate the tributary for each opportunity area. The **total tributary area** is defined as all the surface area that contributes stormwater runoff to a termination point such as a drain, low point, or waterbody. Tributary areas should be delineated to account for all site runoff from both impervious and pervious surfaces.

After delineating the tributaries, the **total runoff volumes** were determined based on a design storm depth of 1.5 inches. This depth is consistent with design guidance for publicly-funded GSI projects as part of CSO control programs in other cities in the region. The total runoff volume was then calculated by multiplying the design storm depth by the effective tributary area (impervious tributary area plus 25% of the pervious tributary area).

Using the site investigation information, the most suitable GSI types were selected for each area. The preferred option is to utilize vegetated solutions such as **bioretention**. Vegetated solutions offer many co-benefits such as beautification, shading and temperature reduction, environmental enhancement, and relative ease of maintenance.

Where vegetated practices are not feasible due to accessibility issues, traffic and pedestrian usage, or line-of-site constraints, **permeable pavement** was recommended. Permeable pavement practices offer fewer co-benefits, but can be installed in places where vegetated features are not feasible.

Green stormwater infrastructure practices in the right-of-way were considered **green streets**. These practices consist of a combination of bioretention, permeable pavement, and other amenities such as pedestrian crossings and bike lanes. The exact configuration of these components should be finalized during the detailed design stage.

Subsurface storage was the last option considered. These practices manage stormwater in underground chambers and are not visible on the surface; therefore they offer few additional co-benefits. However, in cases of drainage diversions or disconnections, subsurface storage can be used to efficiently manage large volumes of runoff from a regional system by infiltrating the water into the surrounding soil or discharging it back to the combined sewer at a lower peak rate of runoff.

GSI **footprint areas** within each concept were then estimated based on the available space observed during the site investigations. In the right-of-way, GSI practices were assumed to have an average width of five feet, situated within the parking lanes or road

shoulders. Onsite, the GSI footprint areas were sized to maximize the storage volume, up to the total runoff volume, based on site constraints such as available space and mature trees. Estimation of GSI footprint areas for this evaluation did not consider survey or subsurface conditions that may limit siting or sizing of GSI, as this data would be collected as part of design activities.

Based on industry best practices, the ratio of tributary area to footprint area was limited to a maximum of 5:1 for permeable pavements and 20:1 for bioretention where feasible. Higher ratios may require additional pretreatment features or increased maintenance frequencies.

GSI **storage volumes** were estimated using the footprint areas, typical cross-sections, and design components for the respective GSI type. Note that due to site limitations, storage volumes were not always sufficient to manage the total runoff volume.

From the estimated footprint sizes, conceptual cost estimates were established based on typical costs per square foot for construction and maintenance. See Section 8.2 for cost estimation assumptions.

8.2 Assumptions

The concepts presented in Section 8.3 are based solely on the information detailed in this report, information gathered during the site investigation, and direction given by DELCORA.

The tributary and GSI footprint areas are approximate and only based on the available information and observations during the site investigations. At this stage, it is assumed that all open space identified during site investigations will be available to install GSI practices. For this report, only static storage volumes were estimated and infiltration was not taken into account.

During design, the tributary areas and GSI locations will need to be fully investigated and amended as necessary. This may include adding, removing, and modifying GSI practices based on geotechnical investigations, topographic survey, utility coordination, and cost/benefit analyses.

Conceptual cost estimates summarized in Section 8.3 are based on estimated construction and maintenance costs per square foot of GSI footprint. These rates are summarized below (all costs are in current dollars):

- $90-$105 per square foot to construct GSI practices (bioretention or permeable pavement, respectively) within the right-of-way.
- $30-$35 per square foot to construct GSI practices (bioretention or permeable pavement, respectively) within public and private parcels.
- $0.75-$1.25 per square foot **annually** to maintain GSI practices (permeable pavement or bioretention, respectively).
- Subsurface storage cost estimates were based on footprint size, volume of excavation required, and assumed level-of-effort for annual maintenance.

The differences in costs are due to increased expenses when working in the right-of-way and the variability of costs per GSI type. These figures do not include additional costs

such as mobilization, traffic control, utility relocations, or surface amenities. These estimates are based on recent trends in urban GSI development and are considered reasonable for the purposes of preliminary budgeting. The costs shall be confirmed during the detailed design of individual projects.

8.3 Concept Summaries for Top-Scoring Sites

Concepts for the four highest-scoring GSI opportunity areas are summarized in Table 5 below. The cost estimates for construction and operations and maintenance (O&M) included below are conceptual-level only as described in Section 8.2.

Table 5: Summary of GSI Concepts

1 Providence Avenue Regional Management

Proposed GSI: Subsurface Storage

Total Tributary Area: 33.2 acres
- Impervious Area: 30.1 acres
- Pervious Area: 3.1 acres

Total Runoff Volume: 168,215 CF

GSI Footprint Area: 5,500 SF
GSI Storage Volume: 31,350 CF

Construction Cost Estimate: $600,000
Annual O&M Cost Estimate: $15,000

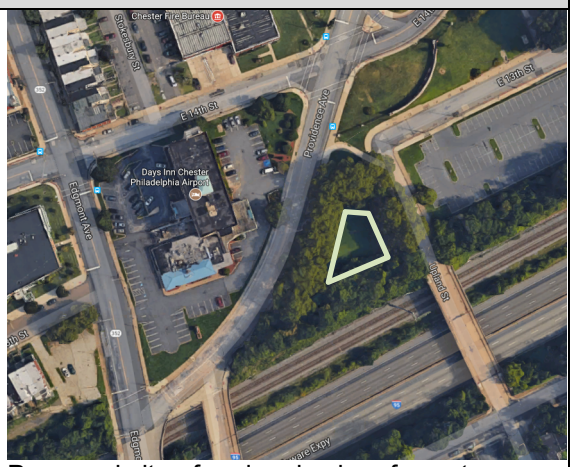
Summary:
DELCORA survey records show the separate stormwater system in this area collects runoff from a tributary area of 33.2 acres and flows south down Providence Avenue. The separate system discharges to the CSO 18 combined sewer system just north of the proposed site in the grassed triangle.

This concept would divert the separate stormwater flow to a regional storage facility installed underground in the grassed triangle area east of Providence Ave, before it enters the CSO 18 combined sewer system. Due to mature trees, the available footprint area for the subsurface storage is approximately 5,500 square feet, which is not sufficient to manage the total runoff volume.

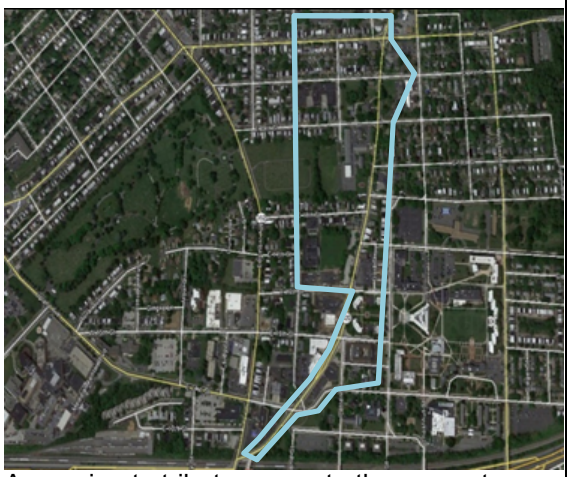
Records from the City of Chester show that this triangle area is owned by Widener University, so a procurement or easement would need to be coordinated with the University. The location and inverts of the existing separate sewer connection and soil infiltration rates will affect the design and need to be confirmed in a subsequent phase.

Overall, this site may be able to manage a large volume of runoff in a relatively small area. While the GSI practices would be underground, surface features or amenities could be added during design and construction to provide community benefits such as benches and other passive recreation. However, due to the small and remote site, co-benefit potential may be minimal.

Secondary options include expanding the subsurface storage to the adjacent parking lot or to the grassed area to the north to increase storage capacity.



Proposed site of regional subsurface storage in grassed traingle


Approximate tributary area to the separate stormwater system in Providence Ave

Grassed triangle viewed from the north

2 Crozer Street Green Street

Proposed GSI: Green Streets

Total Tributary Area: 42.4 acres
- Impervious Area: 25.3 acres
- Pervious Area: 17.1 acres

Total Runoff Volume: 161,276 CF

GSI Footprint Area: 18,100 SF
- Bioretention: 3,000 SF
- Permeable Pavement 15,100 SF

GSI Storage Volume: 33,405 CF
- Bioretention 6,225 CF
- Permeable Pavement 27,180 CF

Construction Cost Estimate: $1.9M
Annual O&M Cost Estimate: $15,000

Summary:
Crozer Street runs east and west through a residential zone in the CSO 19 tributary area. Available data shows that this street is at a low point, receiving stormwater runoff from adjacent streets and properties.

Right-of-way bioretention practices are proposed at the intersections in Crozer Street and its cross-streets. These will be bumped out into the roadway just upstream of the existing catch basins.

Due to the large tributary area, permeable pavement is also proposed in the shoulders of Crozer Street to increase the storage capacity.

This concept is favorable because it lies entirely within publicly-owned property in low-density, residential areas. The lower relative elevation of Crozer Street also allows the GSI practices to collect runoff from a large area.

This site can also provide community co-benefits such as traffic calming, pedestrian safety, street-level landscaping, and neighborhood beautification.

Crozer Street is narrow in some portions and lined with mature trees, so exact sizes and locations of GSI practices will need to be confirmed after topographic survey during the design phase.

Proposed Crozer Street GSI concept area

Approximate tributary area to the concept

Typical intersection on Crozer Street

3 Widener University / Walnut Street

Proposed GSI: Permeable Pavement

Total Tributary Area: 14.1 acres
- Impervious Area: 11.2 acres
- Pervious Area: 2.9 acres

Total Runoff Volume: 64,978 CF

GSI Footprint Area: 65,306 SF
GSI Storage Volume: 60,544 CF

Construction Cost Estimate: $3.6M
Annual O&M Cost Estimate: $50,000

Summary:
Widener University campus offers many opportunities to collect and manage runoff from impervious areas in the CSO 18 tributary area.

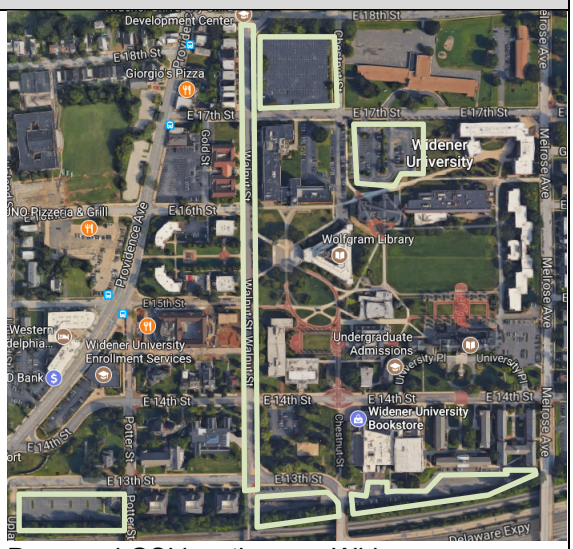
During site visits, several potential locations with large impervious areas were identified. The proposed locations include five parking lots and the right-of-way of Walnut Street, which runs north and south through the campus.

Due to vehicular and pedestrian traffic, parking constraints, and site limitations, the proposed GSI practices are permeable pavements. Both in the parking lots and within the right-of-way, permeable pavement can be installed within existing parking spaces. Brick pavers are recommended in order to be consistent with the campus aesthetics.

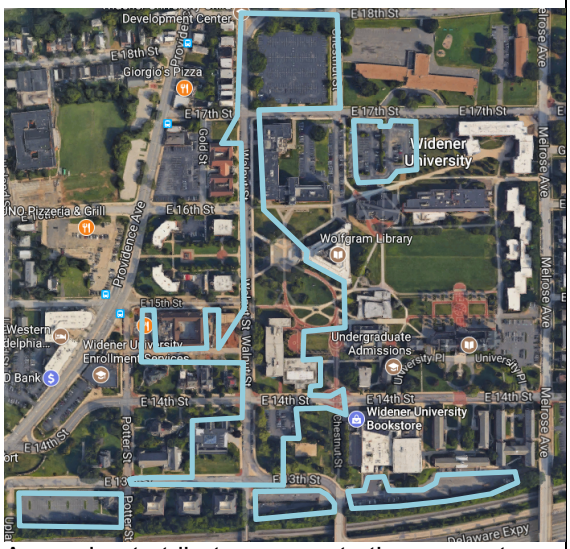
There may be opportunities for bioretention within the wider sections of Walnut Street, around the perimeter of the parking lots, or within the grassed plazas on campus. These opportunities will need to be identified after topographic survey during the design phase. Any designs on private property or affecting campus parking would need to be coordinated with Widener University.

The CSO 18 tributary area boundaries will also need to be confirmed prior to design to ensure that these areas are not separately sewered.

In general, there are several GSI opportunities across the Widener University campus. Widener University could also make an excellent community partner as DELCORA moves forward with their CSO LTCP program.



Proposed GSI locations on Widener campus



Approximate tributary areas to the concepts

On Walnut St. looking north to E 16th St.

4 Edgmont Avenue Green Street

Proposed GSI: Green Streets

Total Tributary Area: 20.8 acres
- Impervious Area: 13.3 acres
- Pervious Area: 7.5 acres

Total Runoff Volume: 82,864 CF

GSI Footprint Area: 36,875 SF
- Bioretention: 2,425 SF
- Permeable Pavement 34,450 SF

GSI Storage Volume: 67,042 CF
- Bioretention 5,032 CF
- Permeable Pavement 62,010 CF

Construction Cost Estimate: $3.9M
Annual O&M Cost Estimate: $30,000

Summary:
Edgmont Avenue runs north and south through Chester and bisects much of the CSO 19 tributary area and is also a main route from the residential areas to the central business district.

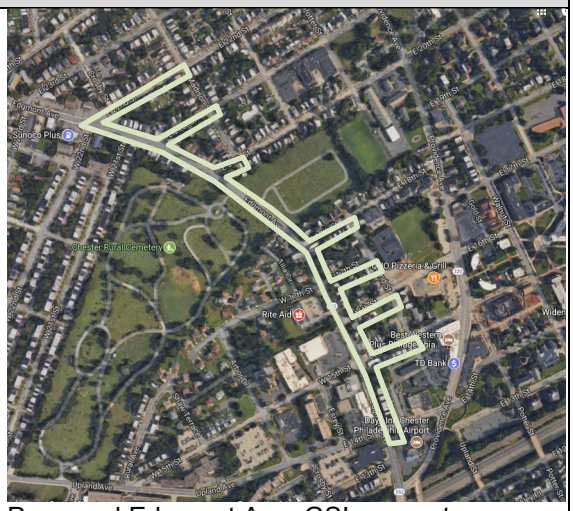
The stormwater runoff in this area is generated by the impervious right-of-way and the adjacent commercial and residential properties.

Due to the narrow streets, parking limitations, and space constraints, permeable pavement is proposed for most of this concept along the shoulders of Edgmont Avenue and its side streets.

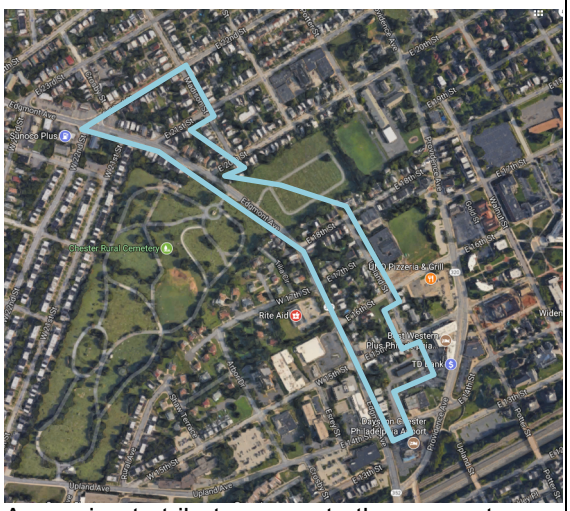
Bioretention practices are proposed in the wider roadway section adjacent to the cemetery and at the larger intersections.

Due to connectivity potential, other amenities such as bike paths may be considered during design, but may not be feasible due to narrow streets.

Actual location and sizes of features would be finalized during design and subject to City of Chester requirements.



Proposed Edgmont Ave. GSI concept area



Approximate tributary area to the concept

Looking north at wider sections of Edgmont Avenue near the cemetery

APPENDIX O

DELCORA ALTERNATIVES ANALYSIS CONTINGENCY BREAKDOWN

- DELCORA Alternatives Analysis Opinion of Probable Cost Methodology Memorandum dated June 21, 2018

Note: This Appendix includes a memorandum by Greeley & Hansen which rebranded to TYLin in 2023.

GREELEY AND HANSEN

MEMO

Date: June 21, 2018

To: DELCORA Project File

C: -

From: Brian R. Olson, P.E., CFM, CPESC

Subject: DELCORA Alternatives Analysis Opinion of Probable Cost Methodology

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The purpose of this memorandum is to provide background about the methodology used to estimate costs for the CSO Control Technologies utilized in the DELCORA Alternatives Analysis.

The opinions of probable construction cost are considered Level 5 estimates, as designated by The Association for the Advancement of Cost Engineering (AACE) Recommended Practice No. 18R-97. The accuracy range for Class 5 estimates is generally within a range of fifty percent less (50%) to one-hundred percent more (100%) than the actual cost. To develop the present worth values of Alternatives, the primary components of the Alternative opinion of probable construction cost methodology is:

- Identify appropriate Alternative cost line items;
- Generate operation and maintenance costs along with contingency and other cost factor percentages; and
- Generate capital and life-cycle cost curves;

Capital Cost Sources and Cost Factors

The sources to develop capital costs include the following:

- Greeley and Hansen project data
- RS Means
- Manufacturer's cost data
- EPA project cost data and cost curves
- South Bend, Indiana CSO Long Term Control Plan Optimization Final Report (South Bend)
- Alexandria, Virginia CSS Long Term Control Plan Update Alternatives – Alternatives Evaluation: Sewer Separation
- Washington Sanitary Sewer Commission: Bladensburg Trunk Sewer Preliminary Design Report
- Anderson, Indiana CSO Long Term Control Plan: Basis for Cost Estimate (Anderson, Indiana)
- Capital Region City Beautiful Water Program Plan: Basis of Cost Opinions (Capital Region)
- District of Columbia Water and Sewer Authority Combined Sewer System Long Term Control Plan Final Report
- Passaic Valley Sewerage Commission Long Term Control Plan Technical Guidance Manual (PVSC TGM)
- The Sewer Authority of the City of Scranton Combined Sewer Overflow Long Term Control Plan (Scranton LTCP)
- Combined Sewer Overflow Long Term Control Plan Update – Basis for Cost Estimates, City of Elkhart, Indiana (Elkhart, Indiana)
- DELCORA Green Stormwater Infrastructure Evaluation – Corvias
- Cost Estimates for Regulator Modification – Waterware

- Long-Term CSO Control Plan – Weston Solutions

All cost items are adjusted to January 2018 dollars accounting for inflationary, escalation, and interest costs using the Engineering News Record Construction Cost Index (ENR-CCI). This index tracks the United States cost of labor and common construction materials on a monthly basis.

The following Table 1 lists capital improvement cost factors that are applied to the capital cost to obtain, in addition to the operation and maintenance present value, the full cost to implement the Alternative.

Table 1: Capital Improvement Cost Factors

Capital Improvement Cost Factor	**Escalation Factor**
Overhead and Profit	15% of Capital Cost
Bonds and Insurance	3% of Capital Cost
Mobilization/Demobilization	5% of Capital Cost
Engineering	10% of Construction Cost
Permitting	3% of Construction Cost
Contingency Factors	**Percent of Capital Cost**
Pipe Installation – Heavy Utilities	45%
Pipe Installation – Light Utilities	30%
Tank/Storage Conduit – Heavy Utilities	50%
Tank/Storage Conduit – Light Utilities	30%
Green Infrastructure – Heavy Utilities	40%
Green Infrastructure – Light Utilities	25%
Regulator/Real Time Control – Difficult Modification	25%
Regulator/Real Time Control – Simple Modification	15%
Pump Station – Difficult Installation	45%
Pump Station – Simple Installation	30%
WWTP Upgrade – Difficult Modification	50%
WWTP Upgrade – Simple Modification	30%
Sewer Separation – Heavy Utilities	45%
Sewer Separation – Light Utilities	30%
Disinfection – Difficult Installation	40%
Disinfection – Simple Installation	25%
Settling/Separation – Difficult Installation	40%
Settling/Separation – Simple Installation	25%

Quantity take offs have not been performed as part of the cost breakdown, such as for clearing and grading, filling, excavation, and restoration. These line items are considered to be part of the contingency factor.

Capital and Life-Cycle Cost Estimates

Control Technology costs can be highly variable due to site constraints, location, and overall feasibility and ease of construction. As previously stated, the cost curves and equations developed are for AACE Level 5 planning purposes only. As further details for the implementation of the Control Technologies present themselves, a more detailed cost breakdown can be completed.

Cost Escalation Factor

In the subsequent capital cost estimate analyses, all costs are escalated to January 2018 using the Engineering News Record Construction Cost Index (ENR-CCI) for Philadelphia. The ENR-CCI value used for January 2018, Philadelphia is 12979.40. In the event base costs are given as a national ENR-CCI escalated value, the following equation is utilized to convert costs to January 2018, Philadelphia.

January 2018, Philadelphia = Original cost * (12979.40/Original National ENR-CCI)

In the event base costs are given as a local Philadelphia cost, the following equation is utilized to convert costs to January 2018, Philadelphia.

January 2018, Philadelphia = Original cost * (12979.40/Original Philadelphia ENR-CCI)

Operation and Maintenance Costs

Operation and maintenance (O&M) costs were estimated by first using the following methodology:

- Operation
  - Labor costs and requirements for the various CSO Control Technologies were based on the average cost of maintaining a single operating post manned by one operator on a 24-hour, year round basis. Local operations labor is approximately $53.60/hour, including fringe benefits. Assuming an eight hour workday, with three shifts per day, for 365 days per year, the average cost for a Continuous Operating Post (COP) would be $470,000. The number of COPs needed for operations purposes can be seen in Table 2 below.
- Maintenance
  - Costs taken as a percentage of the construction cost, as seen in Table X below.

Table 2: O&M Cost Basis

Item	**Unit**	**Cost Basis (per year)**
Operation		
Green Infrastructure	-	Included in maintenance cost, see below.
High Rate Clarification	COP	2.0
Pump Station Up to 100 MGD Over 100 MGD	 COP COP	 0.5 2.0
Storage	COP	0.5
Tunnels	COP	1.0
Conveyance Pipelines/Sewer Separation	-	Included in maintenance cost, see below.
Maintenance		
Green Infrastructure Permeable Pavement Bioretention	 SQ-FT SQ-FT	 $0.75 $1.25
High Rate Clarification	% of construction cost	3.0%
Pump Station	% of construction cost	3.0%
Storage	% of construction cost	3.0%
Tunnels	% of construction cost	1.0%
Conveyance Pipelines/Sewer Separation	% of construction cost	0.25%

*Pump station operation for storage and tunnels included in storage and tunnel operation. Only add pump station operation costs if standalone pump station.

This initial method was used to calculate total life-cycle costs when utilizing the capital cost curves. However, per the Consent Decree, it is required to formulate life-cycle cost curves. To do this, operation costs have to be converted to a per-unit basis instead of being calculated on an annual basis. This was calculated by first iterating the percentage of operations cost per unit and then melding that into an overall life-cycle cost per unit. Once the life-cycle cost curve was formulated, the same capital cost curve x-axis units were used to come up with a corresponding total life-cycle cost. Final capital and life-cycle costs were near exact to each other or within a small percentage. This then provided the evidence that the percentage used for operations cost for the per-unit basis was correct.

Present-Worth Calculations

To combine O&M and construction costs for each Control Technology, present worth calculations have to be completed. For this, a discount rate of 2.75% is used (taken from the Rate for Federal Water Projects, NRCS Economics, Department of the Interior) with a life span of 20 years. The following equation is then utilized to calculate the present worth factor to convert from annual O&M costs to present worth.

(P/A, i%, n) = ((1+i)^n -1)/((i(1+i)^n)

This is then multiplied by the annual O&M costs and then added to the construction costs to obtain the total life cycle cost. Salvage value is considered to be $0, as it is assumed no resale value will result from the Control Technologies utilized.

Cost Curve Construction

Once cost curves have been formulated for both capital and life-cycle costs, they are utilized to calculate the full cost of implementation from a life-cycle perspective. Sewer separation is calculated on a per CSO area basis by utilizing the appropriate cost curve. By applying the area of each of the combined sewer areas into the cost curve, the total cost to separate each CSO is summed together to come up with a final life-cycle cost. Sewer separation is presumed to only occur to eliminate all overflows from the combined sewer system.

Both storage tanks and tunnel storage are sized for the required Consent Decree overflow amounts of 0, 2, 4, 6, 8, and 12 overflow events per Typical Year by using results from H&H modeling which includes Pump Station 6 (PS6) is inserted into the associated model. CSO areas are subsequently grouped together to formulate feasible pairings so storage can be lumped together. The locations of storage tanks and tunnels was determined for overall feasibility of installation and size depending on the characteristics of the surrounding area (width of road, location next to buildings, etc.). The locations of utilities (electrical, gas, etc.) is not known, however it is presumed utilities are a large factor considering the combined sewer area is set in an urban location. This is taken into consideration within the contingency added into the overall life-cycle cost. Overall storage volume for each overflow event is determined, with the appropriate cost curve utilized to calculate the associated life-cycle cost. To get flow to the storage tanks and tunnels, transmission mains have to be installed. To calculate the size of the transmission mains, the peak discharges from each regulator was determined. For each group, the max discharge from each regulator was then determined. Using Mannings equation, the diameter was solved for to come up with the correct pipe size based on full flow. A minimum slope was used by determining the shallowest slope along the proposed transmission main schematic, which allowed for a more conservative approach to calculate the diameter of the pipe flowing full. Once the installed pipe diameter was calculated, the appropriate cost curve was used to calculate the total life cycle cost to install the storage tank and tunnel

for each overflow event per Typical Year. Plant expansions also used new or improved conveyance lines, as well as improved pumping capacities to handle increased flow to the WRTP based on the EPA-SWMM modeling. For tunnels, drop shafts were considered in the cost. A drop shaft was assumed to be needed at the beginning and end of every tunnel, and at points where the direction of the pipe changed laterally. Green infrastructure costs were also implemented from the work completed by Corvias, and were added on to the total life-cycle cost calculated for the various Control Technologies.

The following, except for green infrastructure, are the capital and life-cycle cost curves utilized to come up with overall costs for the various Control Technologies.

Green Infrastructure

Opinions of probable construction cost have been developed for the project area by Corvias in a memorandum titled "Green Stormwater Infrastructure (GSI) Evaluation" dated November 2017. In the memorandum Corvias completed an opinion of probable construction cost for proposed green infrastructure Control Technologies in CSO areas 18 and 19. These Technologies consist of permeable pavement, subsurface storage, and green streets/bioretention. According to the memorandum,

"Conceptual cost estimates…are based on estimated construction and maintenance costs per square foot of GSI footprint. These rates are summarized below.

- *$90-105 per square foot to construct GSI practices (bioretention or permeable pavement, respectively) within the right-of-way.*
- *$30-35 per square foot to construct GSI practices (bioretention or permeable pavement, respectively) within public and private parcels.*
- *$0.75-1.25 per square foot annually to maintain GSI practices (permeable pavement or bioretention, respectively)*

The differences in costs are due to increased expenses when working in the right-of-way and the variability of costs per GSI type."

These costs above are in November 2017 dollars, local to Philadelphia, and do not include items such as mobilization, traffic control, utility relocations, or surface amenities.

The overall analysis consists of utilizing the sited green infrastructure Control Technologies proposed by Corvias and does not implement further practices on a systemwide basis. The Consent Decree requirements do not dictate using green infrastructure on a global basis, but rather that they be incorporated in some fashion within the analysis. Given the above costs, and escalated to January 2018 dollar values (Philadelphia) with maintenance included, the following Table 3 gives green infrastructure costs on a per square foot basis.

Table 3: Green Infrastructure Opinion of Probable Construction Cost

Green Infrastructure Practice	**Cost Per Square Foot**
Bioretention – within right-of-way	$91.30
Bioretention – within public and private parcels	$31.30
Permeable pavement – within right-of-way	$105.80
Permeable pavement – within public and private parcels	$35.80

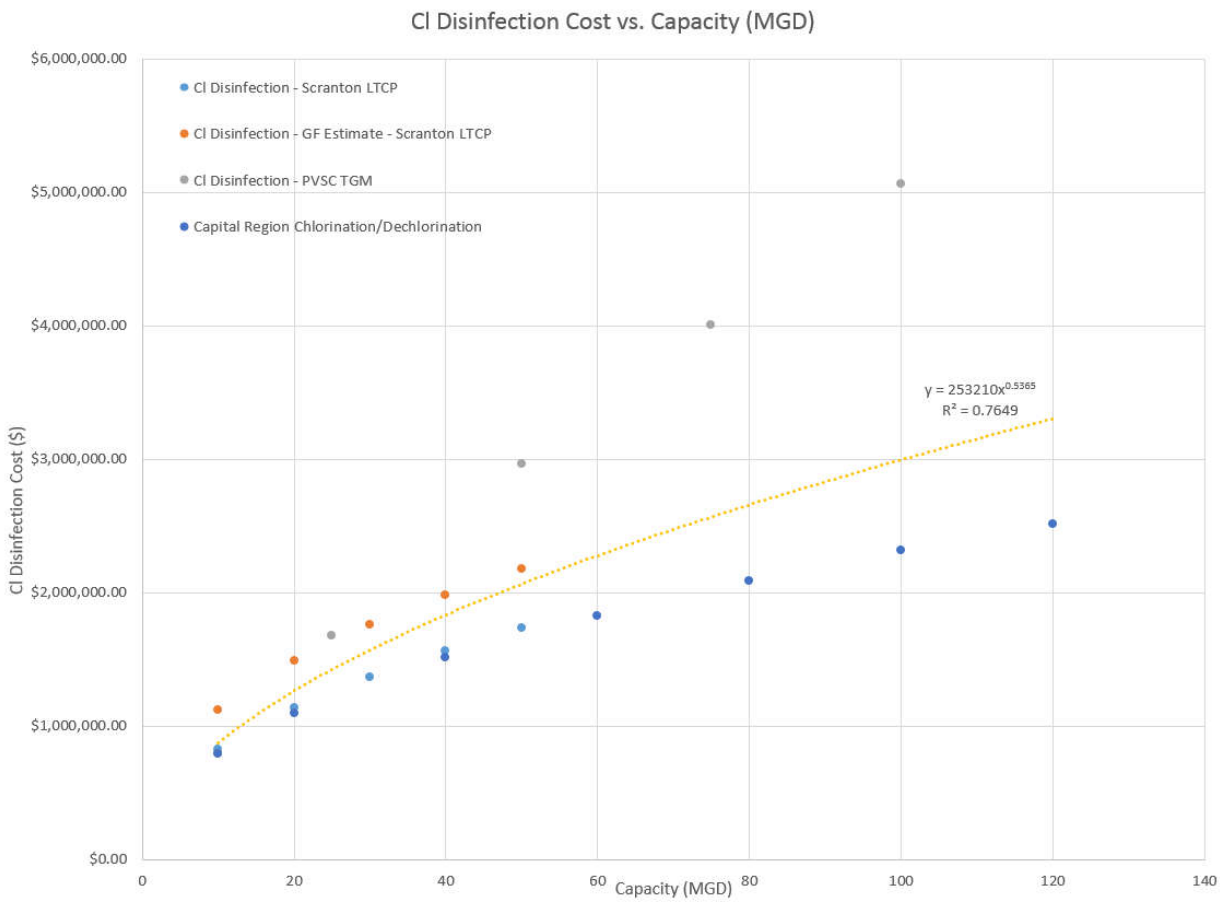
Chlorine Disinfection

The use of chlorine disinfection is recommended for use at satellite high-rate treatment facilities. Data sources include cost curve information from Capital Region, Scranton LTCP, and PVSC TGM. All include the use of chlorine in some form to disinfect stored combined sewer overflow after being treated at a satellite treatment facility. In addition, all sources cross reference equipment costs as obtained from equipment manufacturers. The resulting capital cost curve for chlorine disinfection is the following:

Y = 253,210*x^.5365

Where Y equals the total cost in million dollars and x equals treatment capacity in MGD. This trendline equation can be seen in Figure 1 below, and shows a medium to high R^2 correlation value.

Figure 1: Chlorine Disinfection Capital Cost vs. Capacity (MGD)

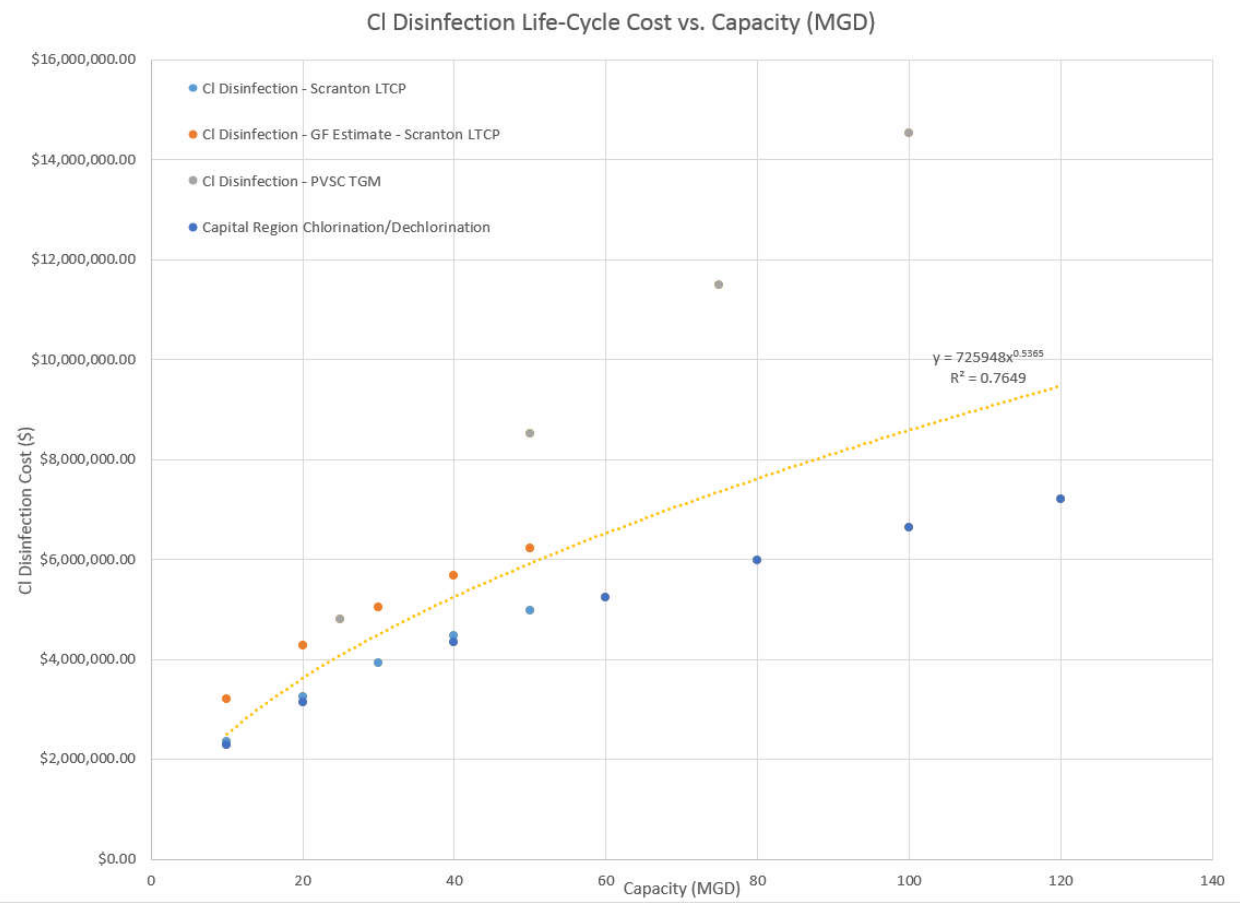


The resulting life-cycle cost curve for chlorine disinfection is the following:

Y = 725,948*x^.5365

Where Y equals the total cost in million dollars and x equals treatment capacity in MGD. This trendline equation can be seen in Figure 2 below, and shows a medium to high R^2 correlation value.

Figure 2: Chlorine Disinfection Life-Cycle Cost vs. Capacity (MGD)



Settling/Separation

Vortex separation is the method utilized for developing cost curves for settling/separation. More specifically cost data is taken from various data sources listed in Section 11.4.2.1 for Storm King, Hydroves, and Sansep separators. The basic premise of a vortex separator is that it produces a self-induced swirling action that encourages the settling of solids at the bottom of the unit, which are then sent to a wastewater treatment plant for treatment. The reason why these separators are so attractive to install is due to its low overall footprint, ease of maintenance, and it overall being a simple process from an operating standpoint. In the development of the cost curve, all sources cross reference equipment manufacturers to ensure accuracy. The resulting capital cost curve for the Storm King unit is the following:

Y=95,305*x+750,265

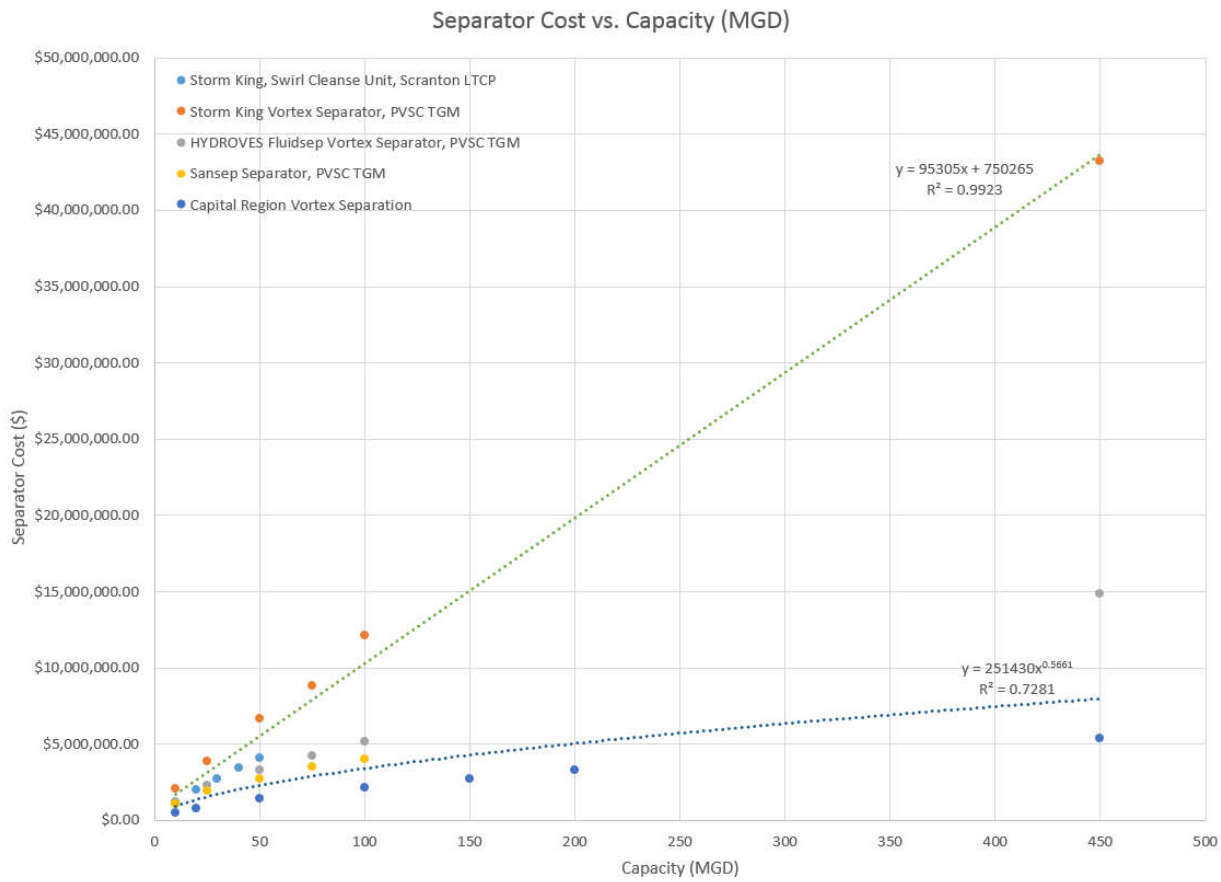
Where Y equals the total cost in million dollars and x equals treatment capacity in MGD.

The resulting capital cost curve for remaining types of settling/separation units, such as the Hydroves and Sansep Separators, is the following:
Y=251,430*X^0.5661

Where Y equals the total cost in million dollars and x equals treatment capacity in MGD.

These trendline equations can be seen in Figure 3 below, with both showing a medium to high R^2 correlation value.

Figure 3: Separator Capital Cost vs. Capacity (MGD)



The resulting life-cycle cost curve for the Storm King unit is the following:

Y=273,236*x+2*10^6

Where Y equals the total cost in million dollars and x equals treatment capacity in MGD.

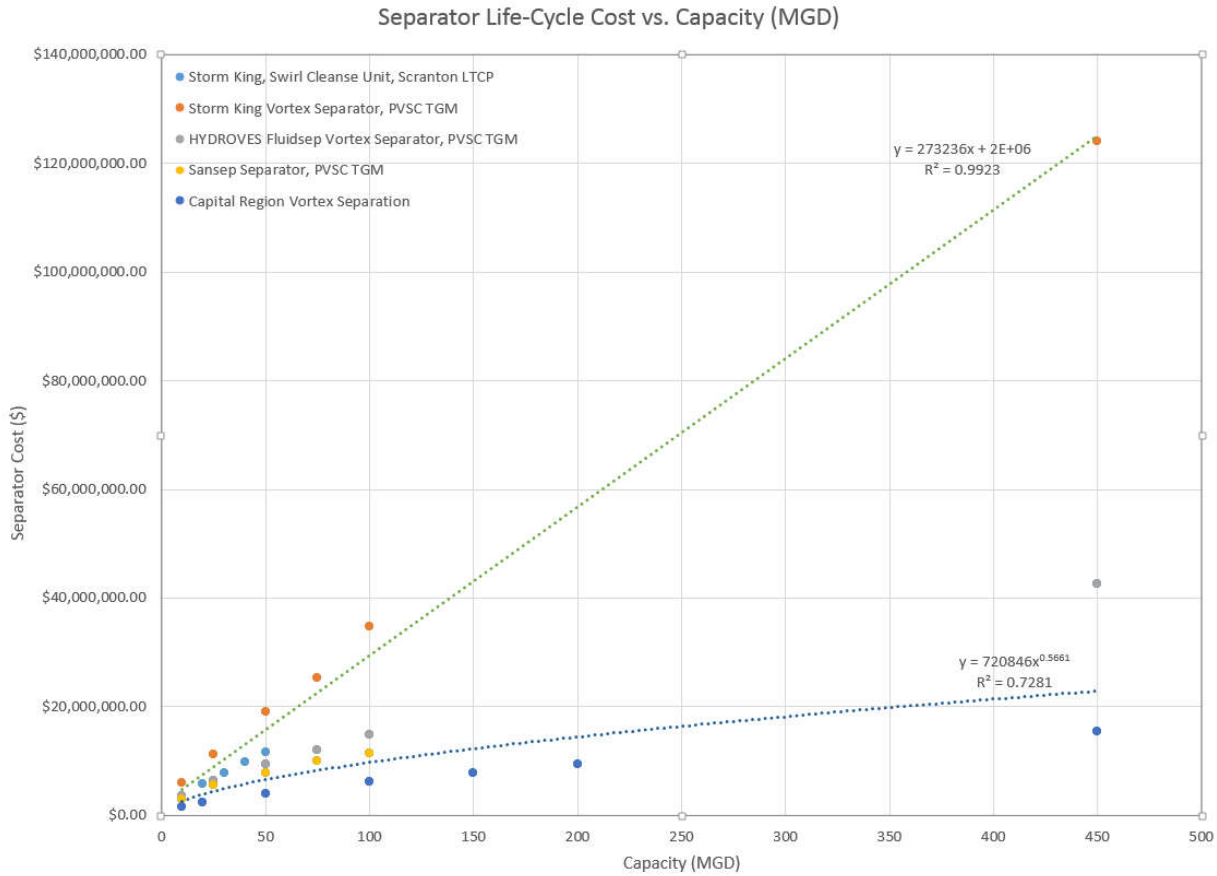
The resulting life-cycle cost curve for remaining types of settling/separation units, such as the Hydroves and Sansep Separators, is the following:

Y=720,846*X^0.5661

Where Y equals the total cost in million dollars and x equals treatment capacity in MGD.

These trendline equations can be seen in Figure 4 below, with both showing a medium to high R^2 correlation value.

Figure 4: Separator Life-Cycle Cost vs Capacity (MGD)



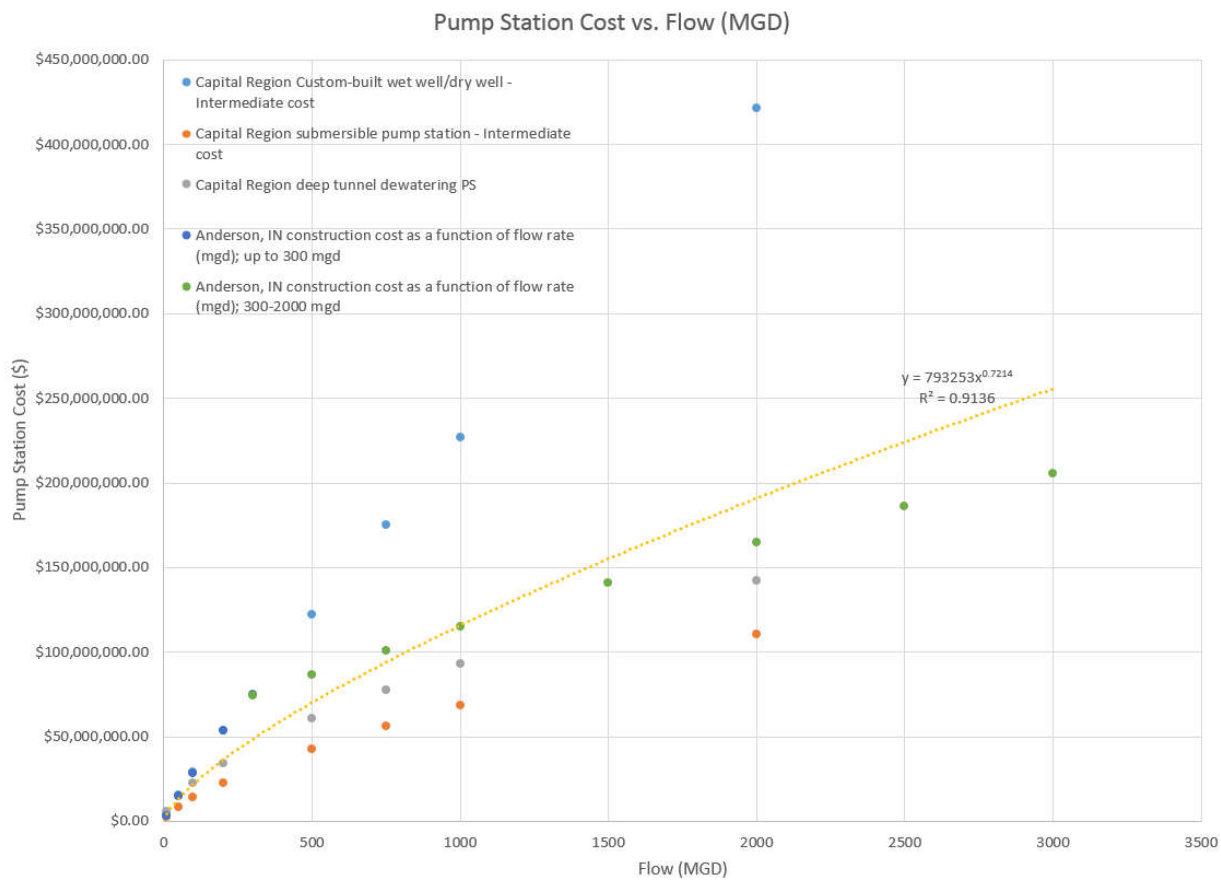
Pump Station

All pump stations in the cost analysis are assumed to be constructed as stand-alone structures and not part of a larger treatment or storage facility and are necessary in order to convey flow from satellite treatment facilities or storage locations. Data sources include cost curve information from Capital Region and Anderson, Indiana. Both sources of data include cost data from actual facilities and EPA cost curves. The Capital Region costs classifies the pump stations as either built wet-well/dry-well facilities or submersible facilities along with giving a range of low, intermediate, and high cost curves to cover the wide variety of pump station installation applications. For the purposes of this exercise the intermediate cost curves were utilized. The resulting capital cost curve for pump stations is the following:

Y=793,253*X^0.7214

Where Y equals the total pump station cost and x equals flow capacity in MGD. The trendline equation can be seen in Figure 5 below, showing a relatively high R^2 correlation value.

Figure 5: Pump Station Capital Cost vs. Flow (MGD)

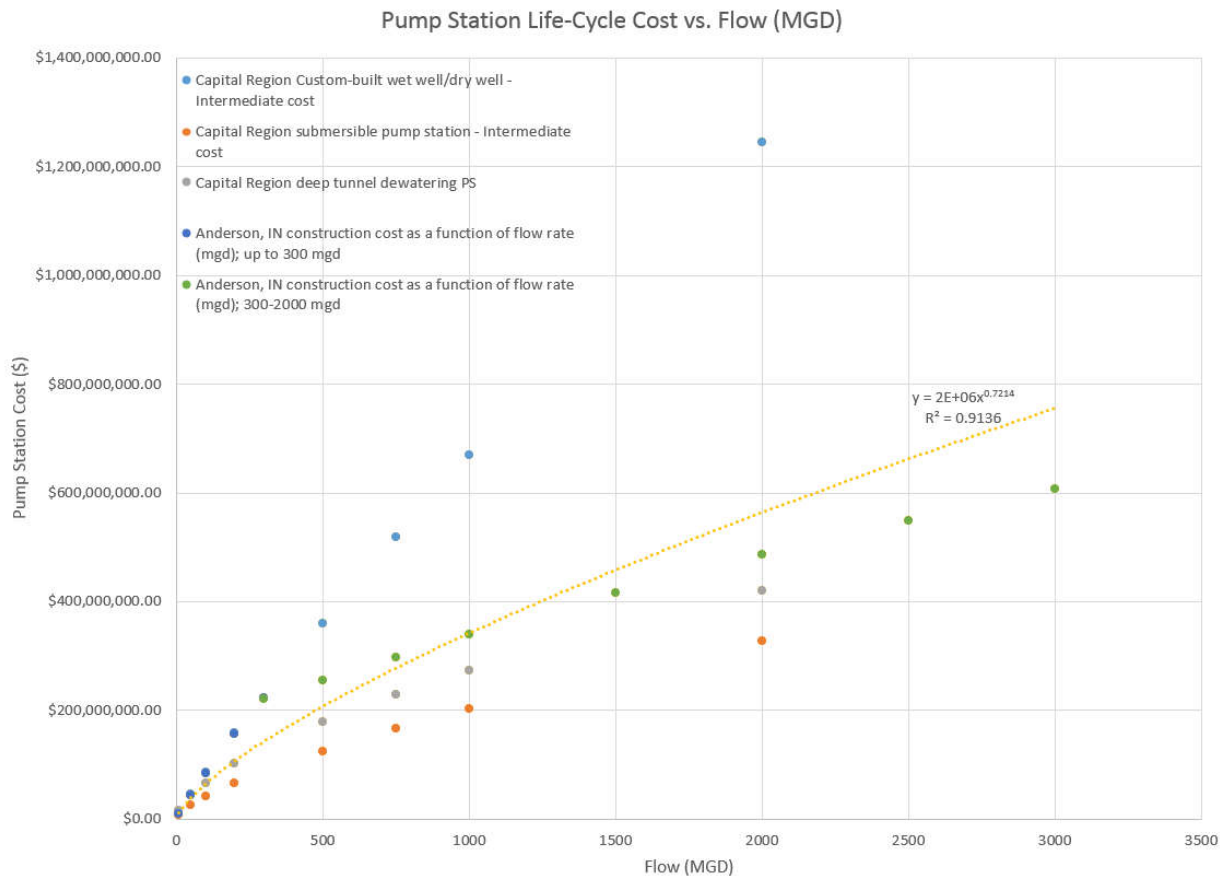


The resulting life-cycle cost curve for pump stations is the following:

Y=2*10^6*X^0.7214

Where Y equals the total pump station cost and x equals flow capacity in MGD. The trendline equation can be seen in Figure 6 below, showing a relatively high R^2 correlation value.

Figure 6: Pump Station Life-Cycle Cost vs. Flow (MGD)



Installed Offline Storage – 15-ft and 22-ft Side-Wall Depth

The purpose of offline storage as a Control Technology in this project is to store flow during peak discharges when interceptors can no longer handle additional flow. Offline storage tanks are located so as to not be on the typical dry weather flow path and only be utilized when needed during wet weather. When free to accept additional flow, the interceptors can slowly accept this additional offline storage and allow it to re-enter the conveyance system. It is assumed that these offline storage volumes would both be fed and discharge via gravity, thus making it a cheaper alternative as pump stations are not needed. However, detailed design is needed to figure out whether this is in fact the case (not needing pump stations).

Cost data is taken from the PVSC TGM. Additional data was mined from Capital Region and Scranton LTCP, however this data did not match up well with the PVSC TGM data. Based on engineering judgment, it was decided to proceed with using cost data from the PVSC TGM. The data utilized for this estimate is for concrete tanks that is inclusive of all ancillary facilities for an offline storage tank. The resulting capital cost curve for installed offline storage – 15-ft side-wall depth is the following:

Y=3E+06*x + 2E+06

Where Y equals the total in million dollars and x equals the tank capacity in MG.

The resulting capital cost curve for installed offline storage – 20-ft side-wall depth is the following:

Y=2E+06*x + 4E+06

Where Y equals the total in million dollars and x equals the tank capacity in MG.

These trendline equations can be seen in Figure 7 and 8 below, with both showing high R^2 correlation.

Figure 7: Installed Offline Storage Capital Cost – 15-ft Side-Wall Depth

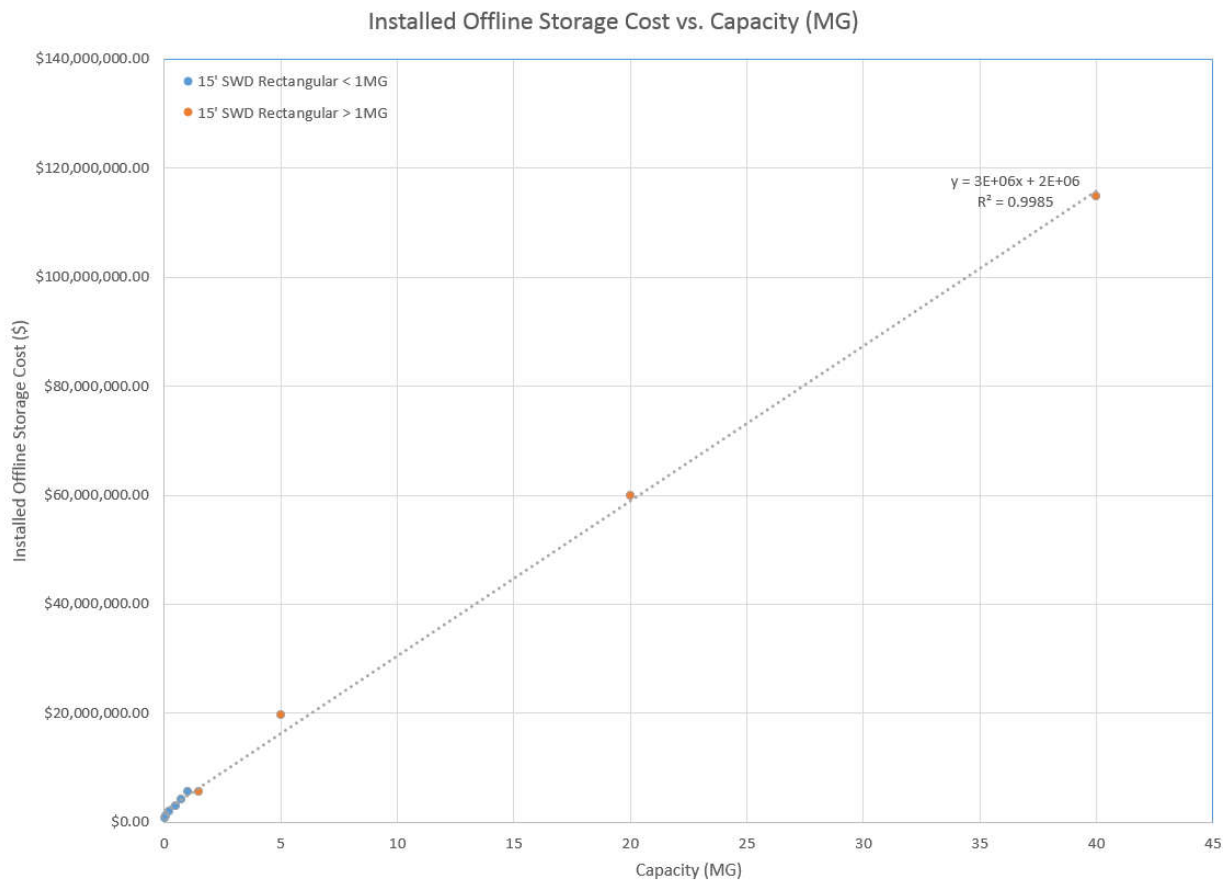
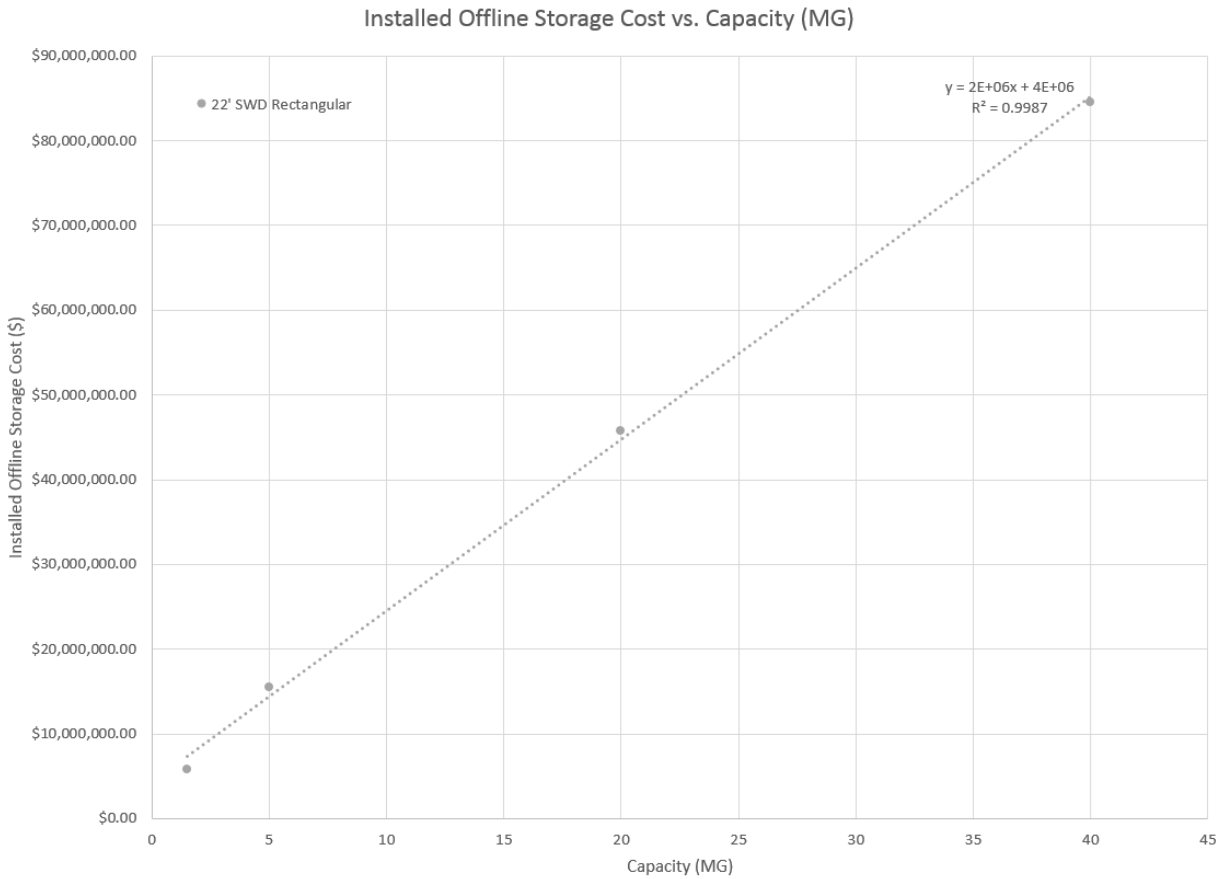


Figure 8: Installed Offline Storage Capital Cost – 22-ft Side-Wall Depth



The resulting life-cycle cost curve for installed offline storage – 15-ft side-wall depth is the following:

Y=8E+06*x +6E+06

Where Y equals the total in million dollars and x equals the tank capacity in MG.

The resulting capital cost curve for installed offline storage – 22-ft side-wall depth is the following:

Y=6E+06*x + 1E+07

Where Y equals the total in million dollars and x equals the tank capacity in MG.

These trendline equations can be seen in Figure 9 and 10 below, with both showing high R^2 correlation.

Figure 9: Installed Offline Storage 15' SWD Life-Cycle Cost vs Capacity (MG)

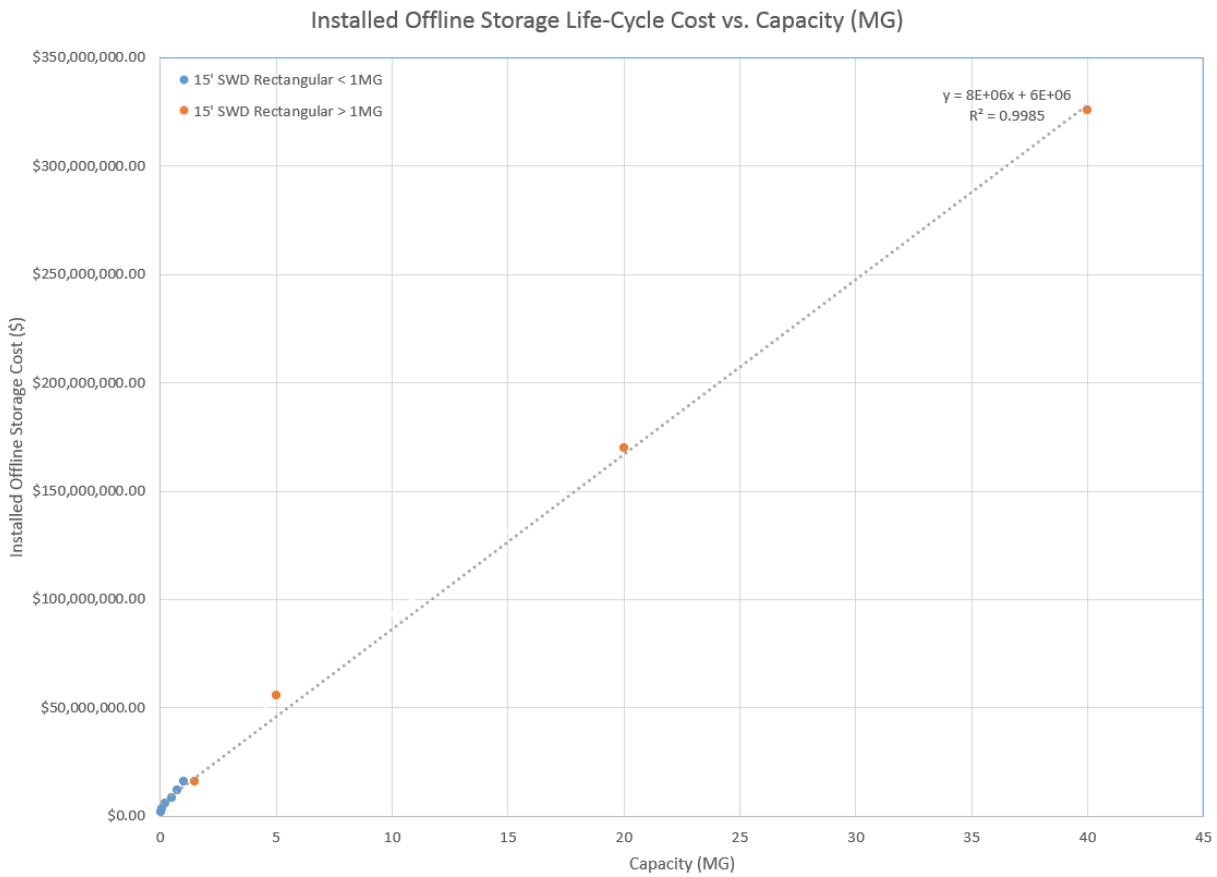
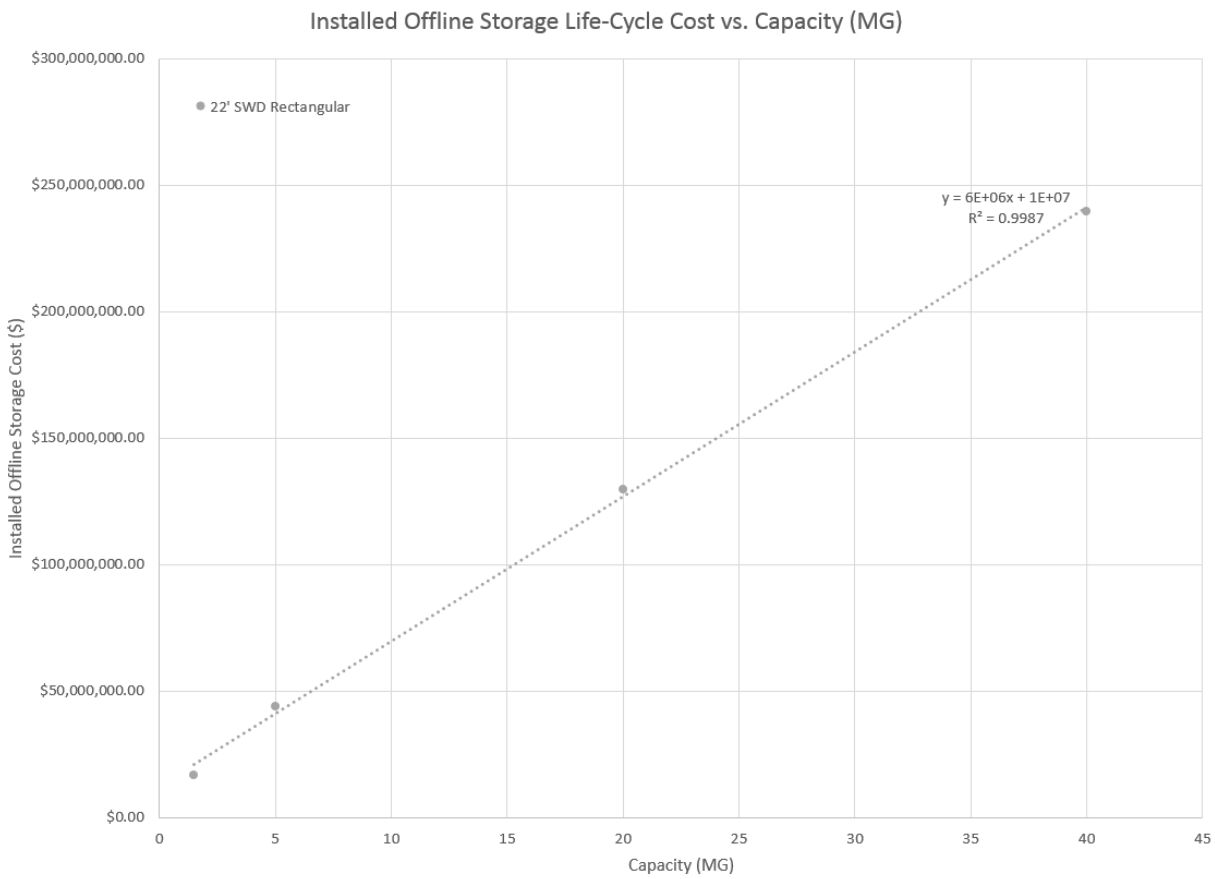


Figure 10: Installed Offline Storage 22' SWD Life-Cycle Cost vs Capacity (MG)



Deep Tunnel Storage

Deep tunnel storage is one of the global Consent Decree requirements that has to be investigated as part of the Alternatives Analysis. Due to the overall complexity of drilling deep tunnels for storage use, this alternative has multiple cost curves to take into account different scenarios. Specific examples include soft ground both below and above groundwater and tunneling within rock for tunnels less than 10,000-ft in length. Similar in use to offline storage, the capture and storage of CSO discharges takes place so as to limit volume within the combined sewer system during wet weather events. Data sources include cost curve information from PVSC TGM and Anderson, Indiana with cost information taken from previously completed projects. It should be noted that drop shafts are not included as part of the per linear foot cost of deep tunneling. The resulting capital cost curve equation for tunneling less than 10,000-ft in soft ground below groundwater is:

Y=263.25*x + 1,652.9

Where Y equals pipe cost per linear foot and x is the size of tunnel in feet.

The resulting capital cost curve equation for tunneling less than 10,000-ft in soft ground above groundwater is:

Y=1,359.1*e^0.0645*x

Where Y equals pipe cost per linear foot and x is the size of the tunnel in feet.

The resulting capital cost curve equation for tunneling less than 10,000-ft in rock is:

Y=203.43*x + 1,273.7

Where Y equals pipe cost per linear foot and x is the size of the tunnel in feet.

The resulting capital cost curve equation for tunneling greater than 10,000-ft is:

Y=187.93*x + 148.3

Where Y equals pipe cost per linear foot and x is the size of the tunnel in feet.

The trendline equations for the above show medium to very high R^2 correlation values.

Figure 11: Deep Tunnel < 10,000-ft Pipe Cost Per Linear Foot vs. Size (feet)

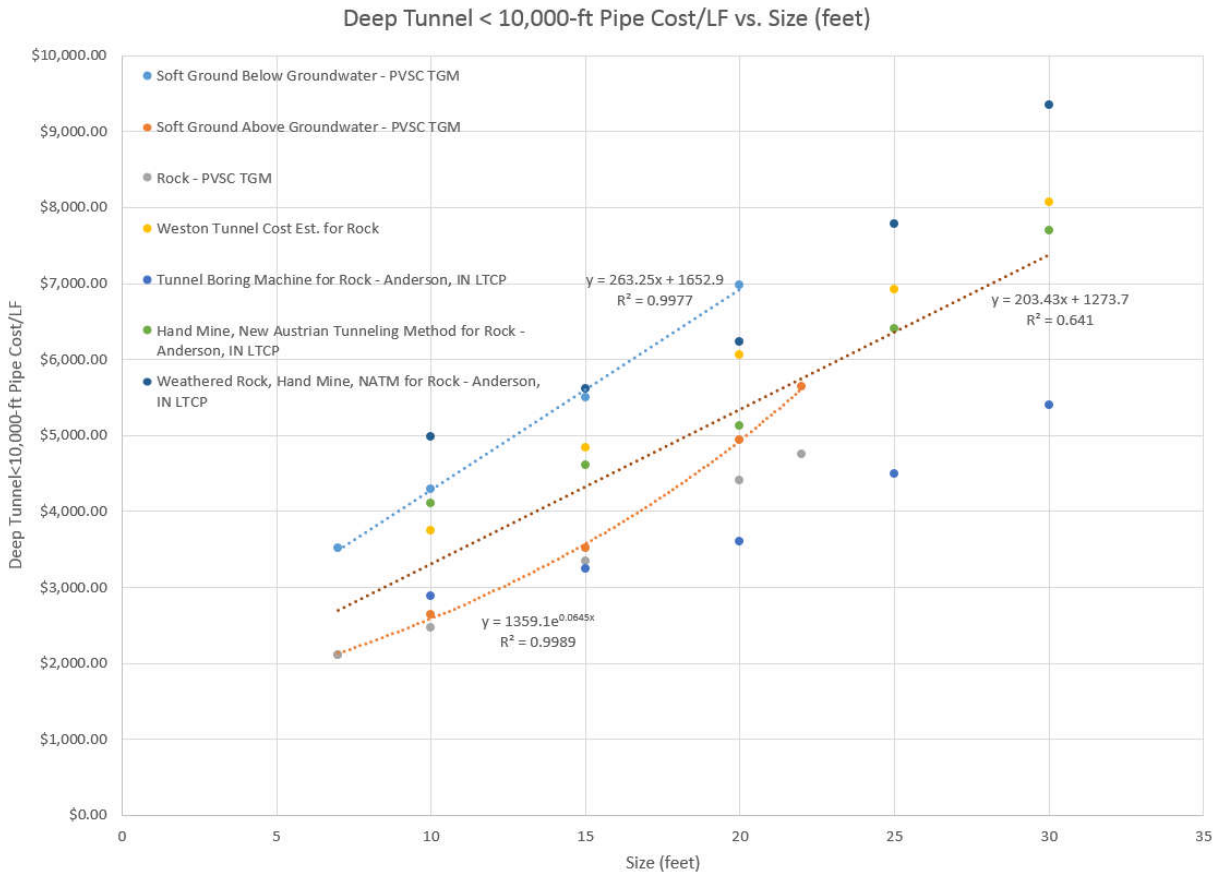
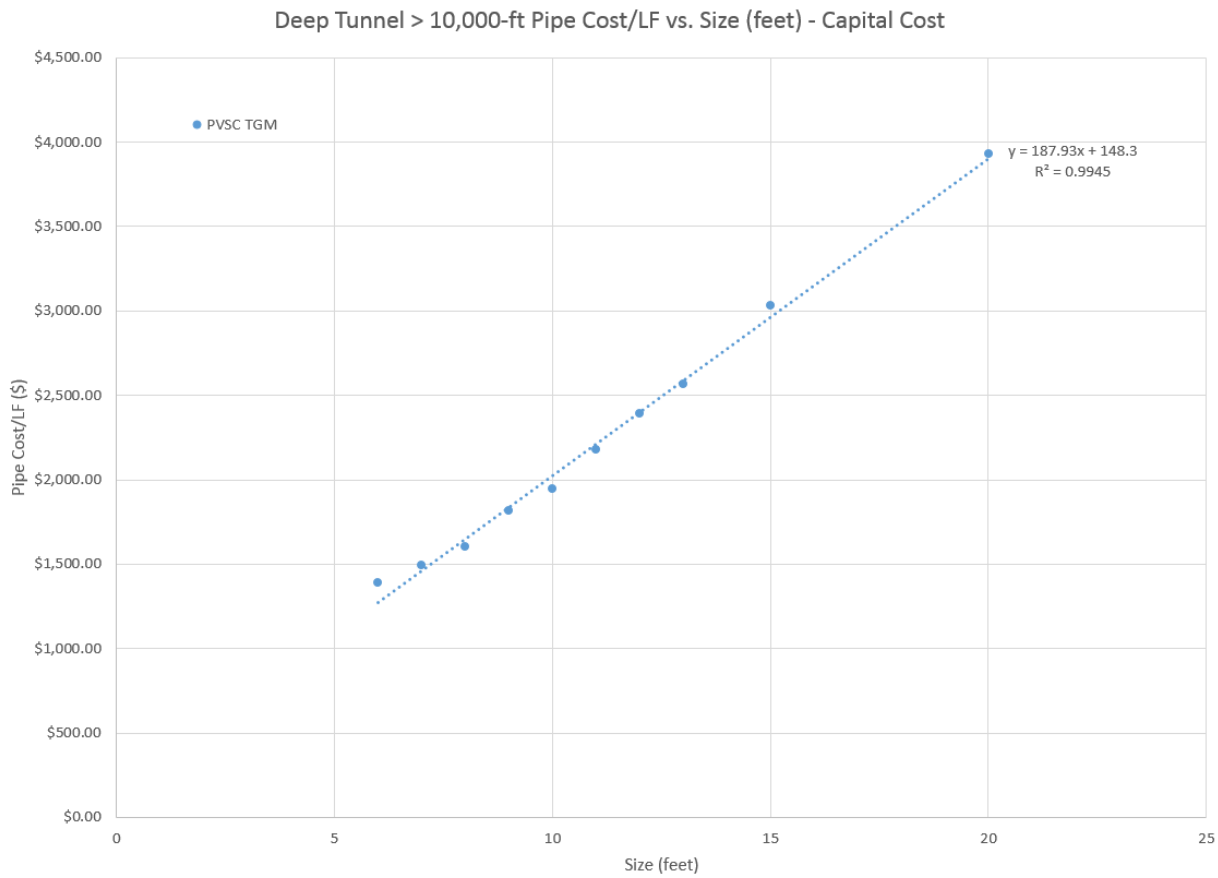


Figure 12: Deep Tunnel > 10,000-ft Pipe Cost Per Linear Foot vs. Size (feet)



The resulting life-cycle cost curve equation for tunneling less than 10,000-ft in soft ground below groundwater is:

Y=623.16*x + 3,912.6

Where Y equals pipe cost per linear foot and x is the size of tunnel in feet.

The resulting life-cycle cost curve equation for tunneling less than 10,000-ft in soft ground above groundwater is:

Y=3,217.3*e^0.0645*x

Where Y equals pipe cost per linear foot and x is the size of the tunnel in feet.

The resulting capital cost curve equation for tunneling less than 10,000-ft in rock is:

Y=481.55*x + 3,015.2

Where Y equals pipe cost per linear foot and x is the size of the tunnel in feet.

The resulting life-cycle cost curve equation for tunneling greater than 10,000-ft is:

Y=444.85*x + 351.04

Where Y equals pipe cost per linear foot and x is the size of the tunnel in feet.

The trendline equations for the above show medium to very high R^2 correlation values.

Figure 13: Deep Tunnel<10,000-ft Pipe Life-Cycle Cost/LF vs. Size (feet)

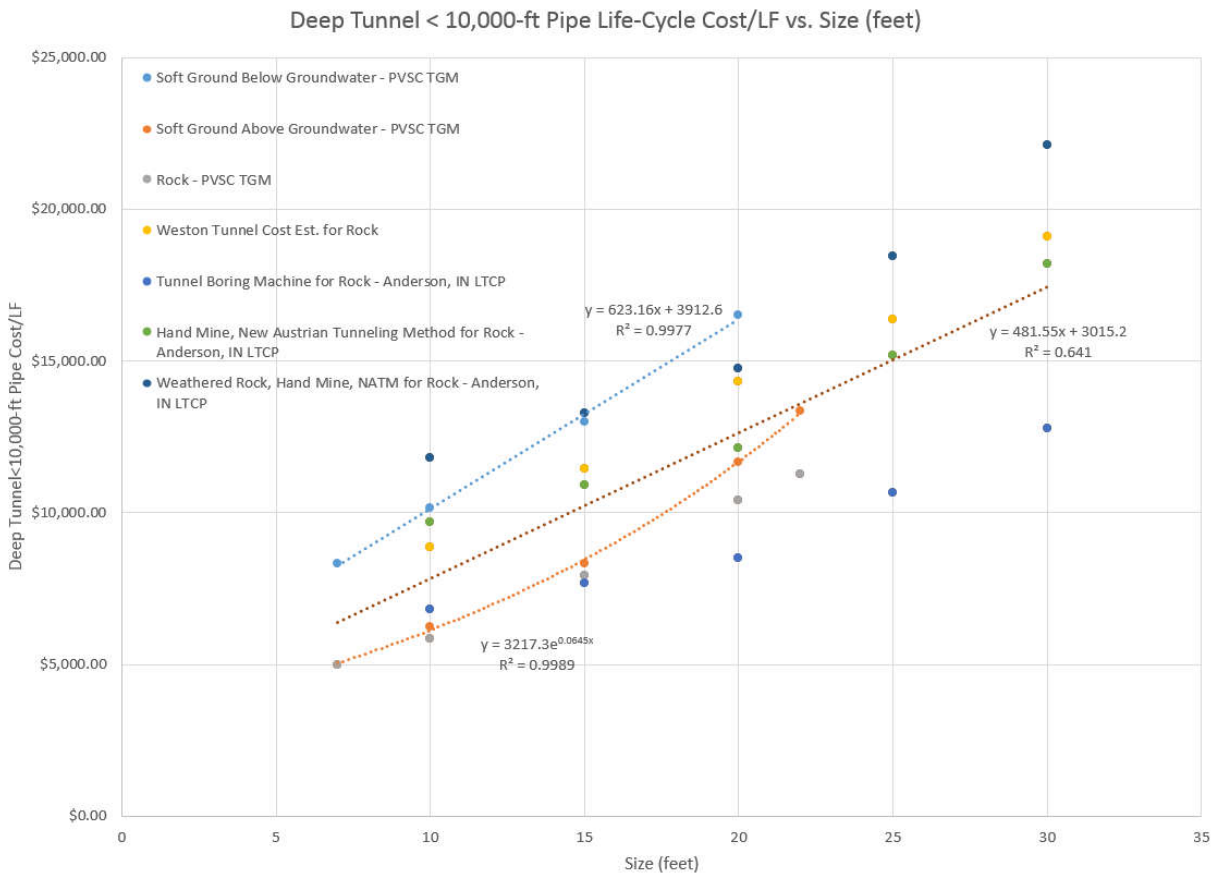
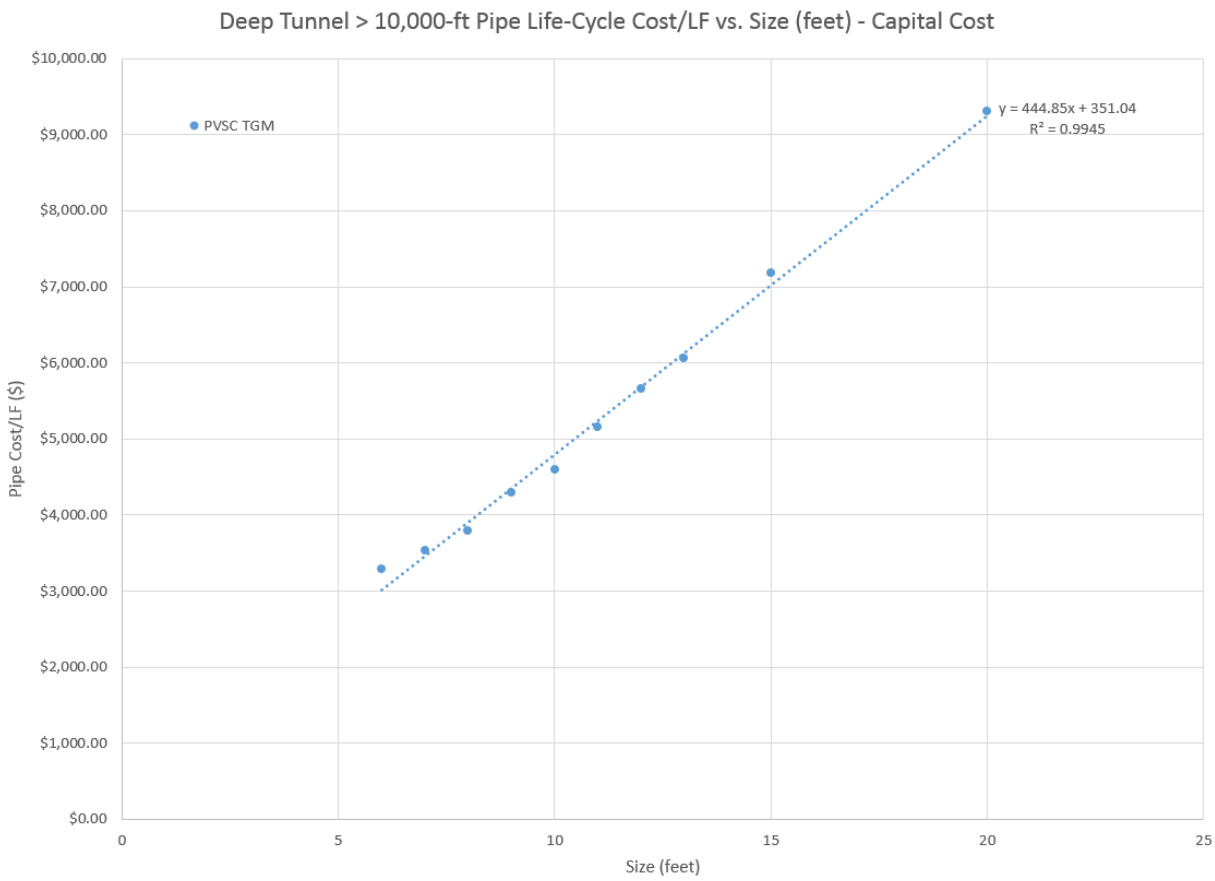


Figure 14: Deep Tunnel>10,000-ft Pipe Life-Cycle Cost/LF vs. Size (feet)



In addition, the use of tunnel drop shafts is needed to convey flow from the ground elevation down to tunnel level. Drop shafts vary in depth depending on the application and typically include tangential inlets, the drop shaft itself, and a deaeration chamber. Cost curves were developed for drop shafts as well, which include cost for tangential inlets and the deaeration chamber in addition to the drop shaft. Data sources for the drop shaft cost curves are PVSC TGM and Anderson, Indiana LTCP. It should be noted that two cost curves exist as the data sources were for different depths of drop shafts from which the data was collected. PVSC TGM assumes no greater than 30-ft depth, whereas Anderson, Indiana assumes a 50-ft depth. The capital cost curve for PVSC TGM – no greater than 30-ft depth is the following:

$Y=1{,}305.2*\ln(x) - 130.89$

Where Y equals cost per vertical foot of drop shaft and x equals flow capacity of the drop shaft in MGD.

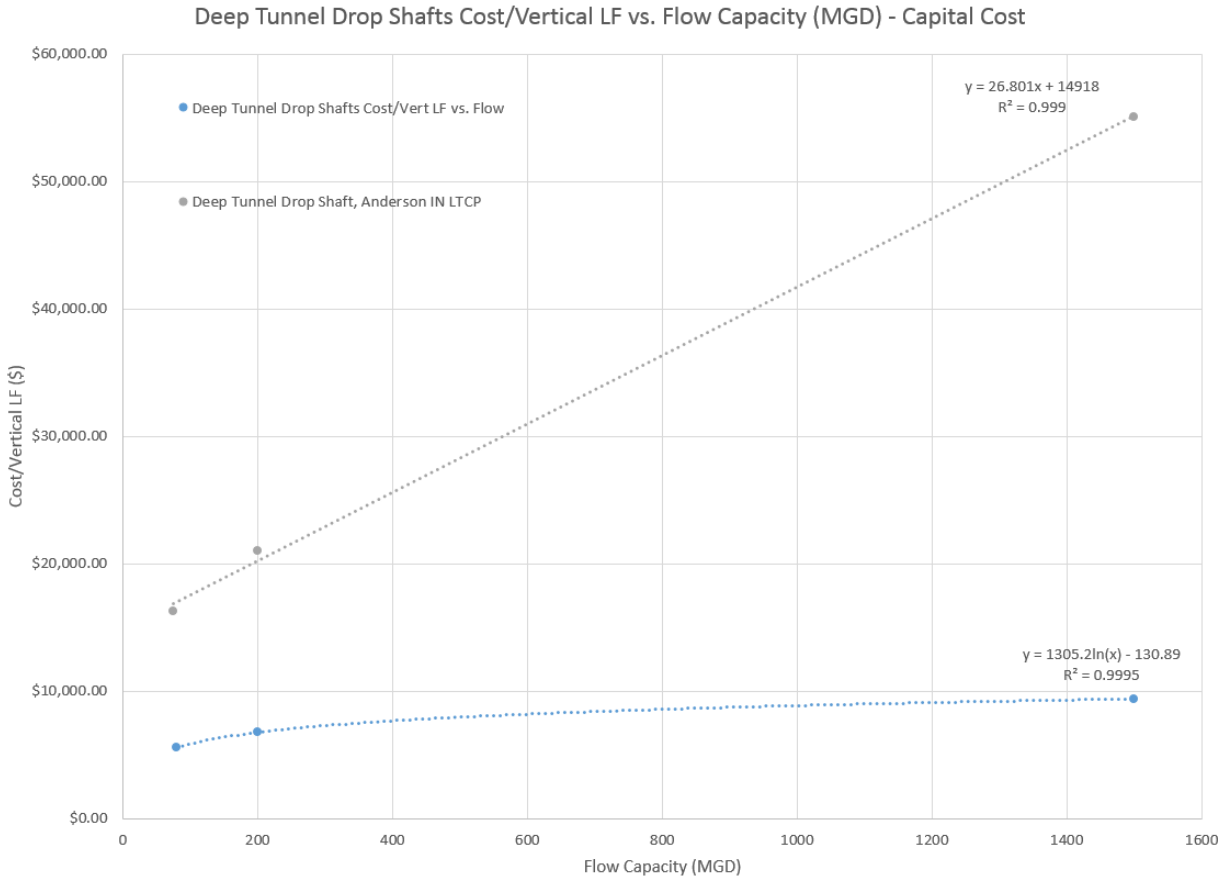
The capital cost curve for Anderson, Indiana – 50-ft depth is the following:

$Y=26.801*x + 14{,}918$

Where Y equals cost per vertical foot of drop shaft and x equals flow capacity of the drop shaft in MGD.

The trendline equations for the above slow very high R^2 correlation values.

Figure 15: Deep Tunnel Drop Shafts Cost/Vertical Foot vs Flow Capacity (MGD)



The cost curve for PVSC TGM – no greater than 30-ft depth is the following:

Y=3,089.6*ln(x) – 309.84

Where Y equals cost per vertical foot of drop shaft and x equals flow capacity of the drop shaft in MGD.

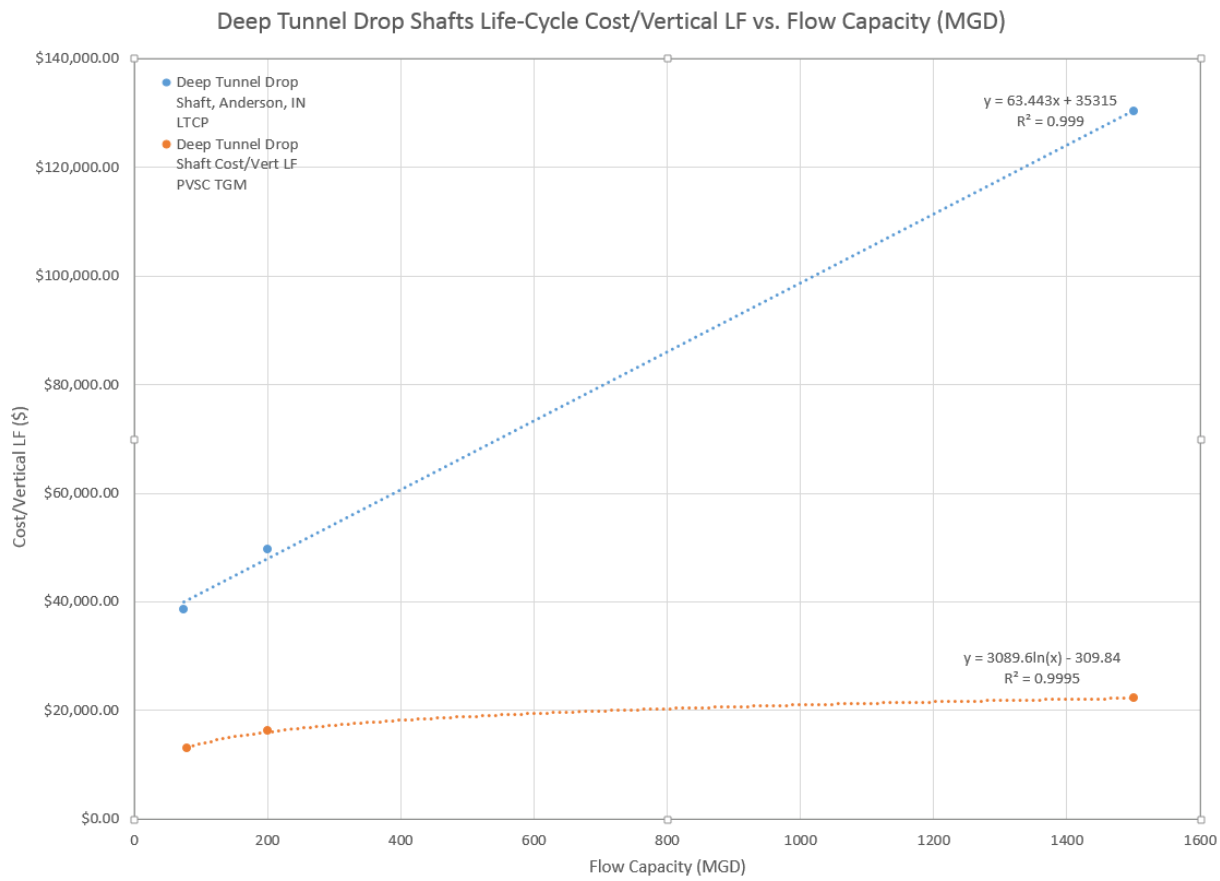
The cost curve for Anderson, Indiana – 50-ft depth is the following:

Y=63.443*x + 35,315

Where Y equals cost per vertical foot of drop shaft and x equals flow capacity of the drop shaft in MGD.

The trendline equations for the above slow very high R^2 correlation values.

Figure 16: Deep Tunnel Drop Shafts Life-Cycle Cost/Vertical LF vs. Flow Capacity (MGD)



Installed Pipe

Pipe installation consists of the means of transmitting CSO discharges to storage areas along with placing parallel interceptor piping to add conveyance where needed. This method of pipe installation does not consist of pipeline storage as deep tunnel storage does. To divert excess flow into a parallel interceptor a diversion structure would be needed, which is not accounted for in these cost curves. In addition, the cost curve takes into account the cost to install the pipe, but does not take into account restoration of the pipe installation. Data sources include cost curve information from PVSC TGM, Anderson, Indiana and Scranton LTCP. Due to pipe needing to be installed at various depths because of utilities and existing connections to pipes, cost curves for various depths of pipes are given at 10-, 15-, 20-, and 25-ft depths. The resulting capital cost curve for installed pipe at 10-ft depth is the following:

Y=10.696*x + 12.935

Where Y equals pipe cost per linear foot and x equals the size of pipe in inches.

The resulting capital cost curve for installed pipe at 15-ft depth is the following:

Y=297.84*e^0.0182*x

Where Y equals pipe cost per linear foot and x equals the size of pipe in inches.

The resulting capital cost curve for installed pipe at 20-ft depth is the following:

443.63*e^0.0167*x

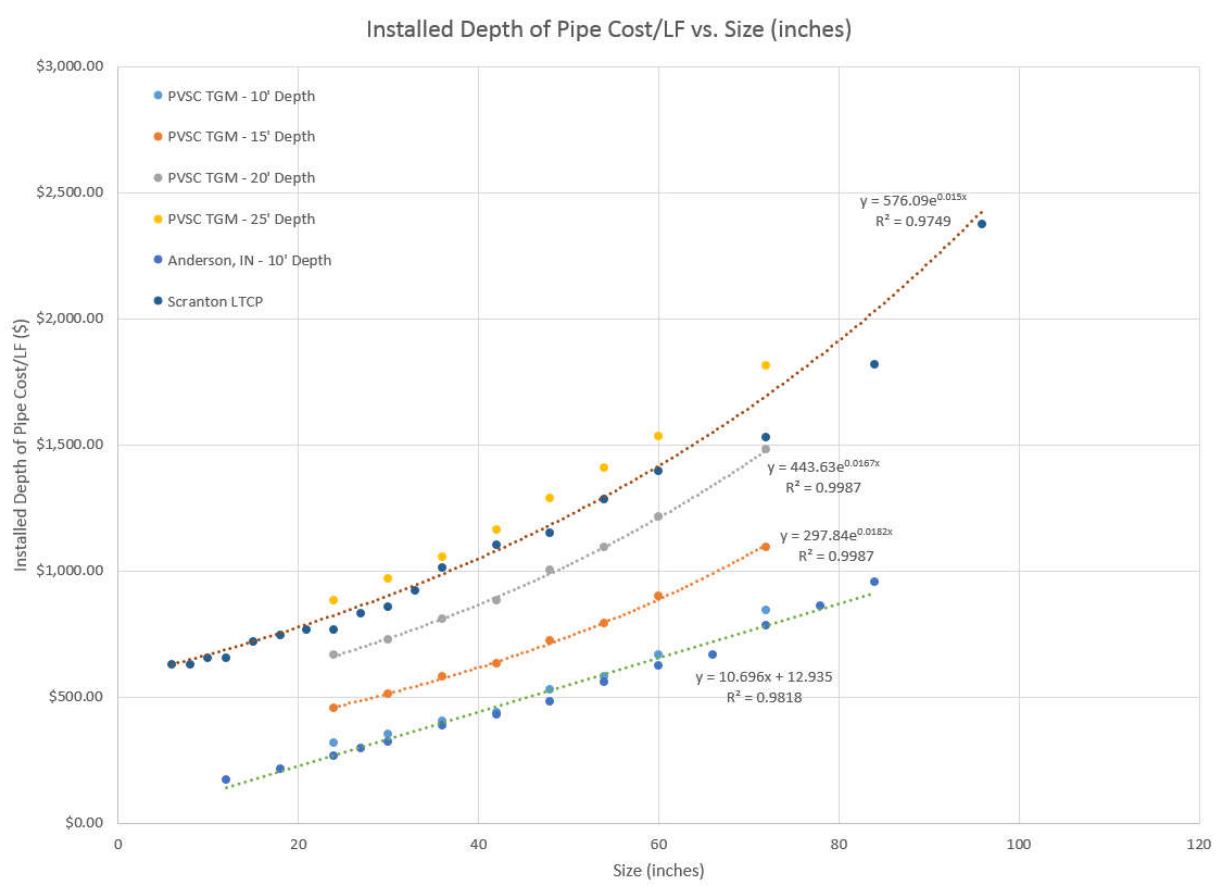
Where Y equals pipe cost per linear foot and x equals the size of pipe in inches.

The resulting capital cost curve for installed pipe at 25-ft depth is the following:

Y=576.09*e^0.015*x

The trendline equations for the above show very high R^2 correlation values.

Figure 17: Installed Depth of Pipe Capital Cost/Linear Foot vs. Size (inches)



The resulting capital cost curve for installed pipe at 10-ft depth is the following:

Y=20.882*x + 13.166

Where Y equals pipe cost per linear foot and x equals the size of pipe in inches.

The resulting capital cost curve for installed pipe at 15-ft depth is the following:

Y=584.47*e^0.0182*x

Where Y equals pipe cost per linear foot and x equals the size of pipe in inches.

The resulting capital cost curve for installed pipe at 20-ft depth is the following:

Y=870.55*e^0.0167*x

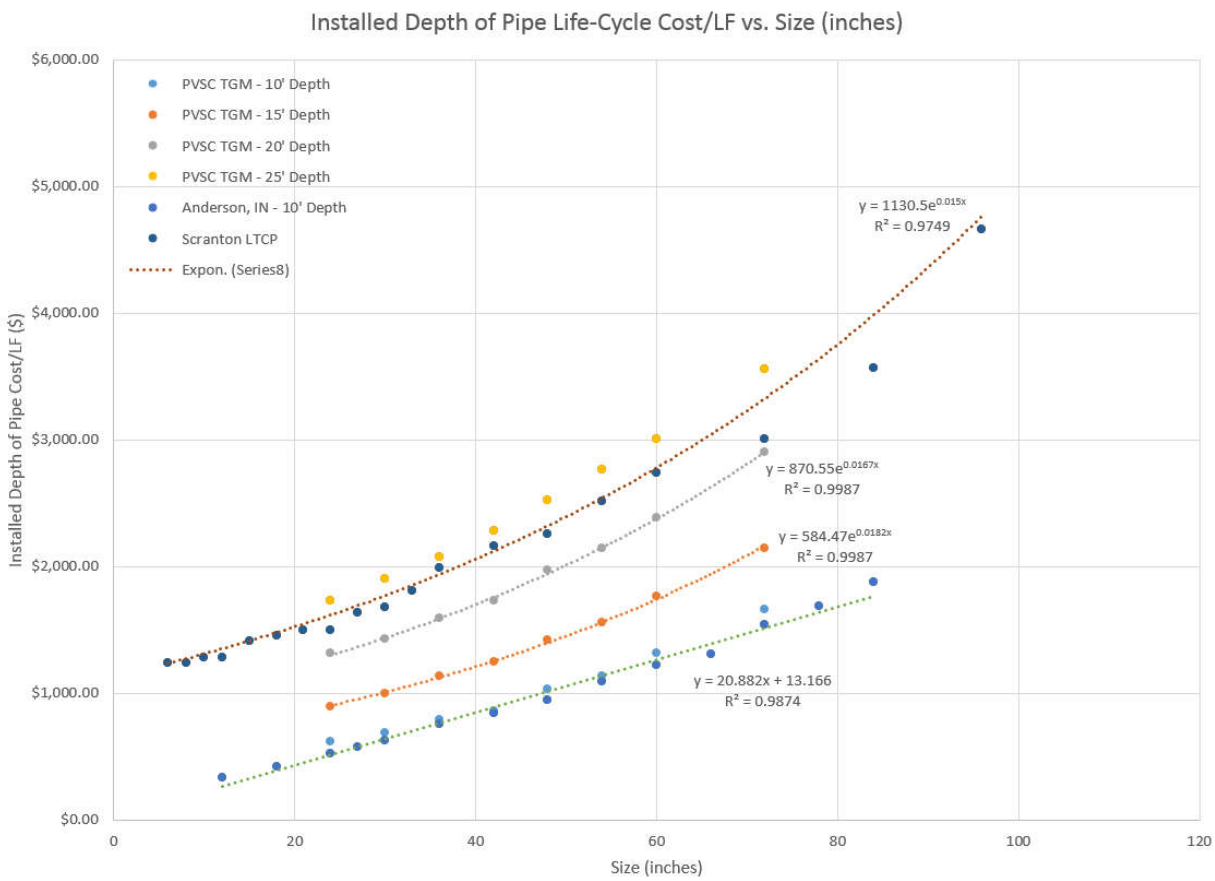
Where Y equals pipe cost per linear foot and x equals the size of pipe in inches.

The resulting capital cost curve for installed pipe at 25-ft depth is the following:

Y=1130.5*e^0.015*x

The trendline equations for the above show very high R^2 correlation values.

Figure 18: Installed Depth of Pipe Life-Cycle Cost/Linear Foot vs. Size (inches)



Wet Weather Blending

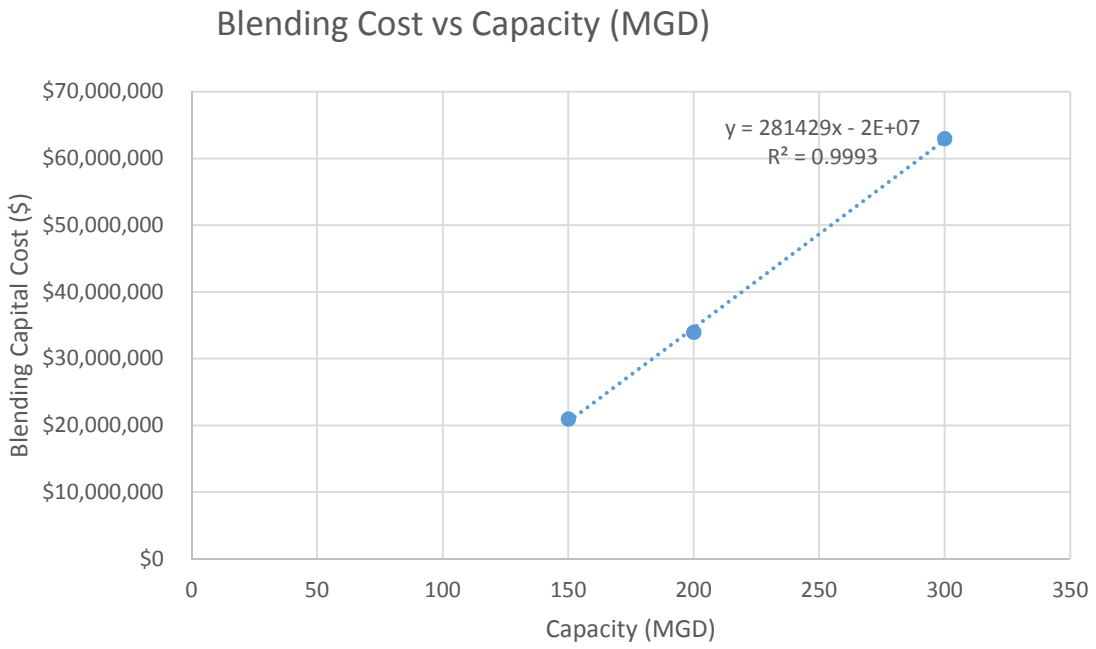
In the wet weather blending option, the additional wet weather flow undergoes the preliminary and primary treatment and then is directly conveyed to the disinfection process. The blended additional wet weather flow with the fully treated and disinfected flow is then discharged. The Wet Weather Blending option alone may not be able to meet the effluent quality standards and will achieve 78% TSS and 56% CBOD removal.

For estimation of the probable costs, 3 flow scenarios of 150, 200 and 300 MGD were considered for expansion of the plant's wet weather treatment capacity. Data sources for the budgetary capital cost estimate of 200 and 300 MGD scenarios include DELCORA Long-Term CSO Control Plan – Weston Solutions. The same costs have been adjusted for the 150 MGD flow scenario. The total capital cost used for cost curve construction does not include the chemical cost for chemically enhanced primary treatment, CEPT. The resulting capital cost curve for blending is the following:

$Y = 281429x – 2E+07$

Where Y equals the total cost in million dollars and x equals treatment capacity in MGD. This trendline equation can be seen in Figure 19 below, and shows a high R^2 correlation value.

Figure 19. Blending Capital Cost vs Capacity



BIOACTIFLO

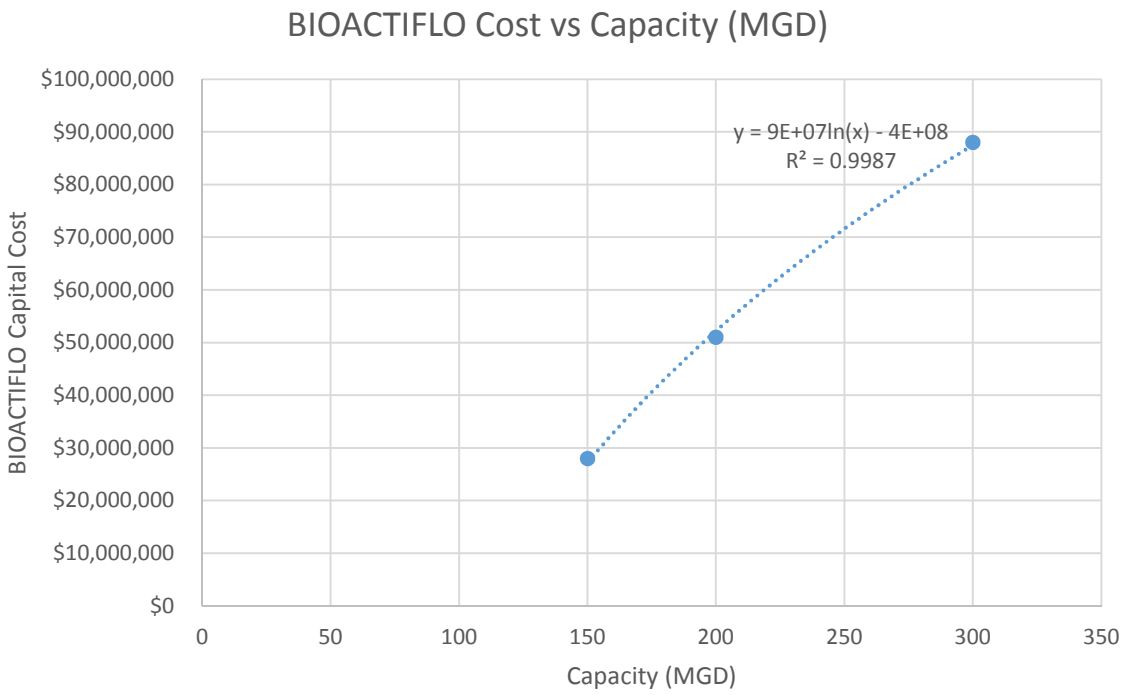
The BIOACTIFLO is a modified version of blending and provides enhanced treatment of additional wet weather flow through the combination of high rate biological treatment as well as high rate ballasted settling to meet the regulatory effluent standards. The additional wet weather flow that does not receive biological treatment in the plant's activated sludge process is treated by temporarily routing return activate sludge to a small aeration tank that is a part of the BIOACTIFLO process to achieve high rate biological treatment. The estimated effluent CBOD and TSS concentrations for BIOACTIFLO option are ≤ 25 mg/L and ≤ 30 mg/L respectively

Again, for the estimation of the probable costs, 3 flow scenarios of 150, 200 and 300 MGD were considered for expansion of the plant's wet weather treatment capacity to draw a comparison between the BIOACTIFLO and Blending option. Data sources for the budgetary capital cost estimate of 200 and 300 MGD flow scenarios include DELCORA Long-Term CSO Control Plan – Weston Solutions. The same costs have been adjusted to get the cost for 150 MGD scenario. The resulting capital cost curve for BIOACTIFLO is the following:

$Y = 395714x – 3E+07$

Where Y equals the total cost in million dollars and x equals treatment capacity in MGD. This trendline equation can be seen in Figure 20, and shows a high R^2 correlation value.

Figure 20: BIOACTIFLO Capital Cost vs Capacity



For any plant expansion costs, equivalent piping and pump additions or improvements to convey the proposed improvements must also be added for each alternative.

High Rate Clarification System (Actiflo)

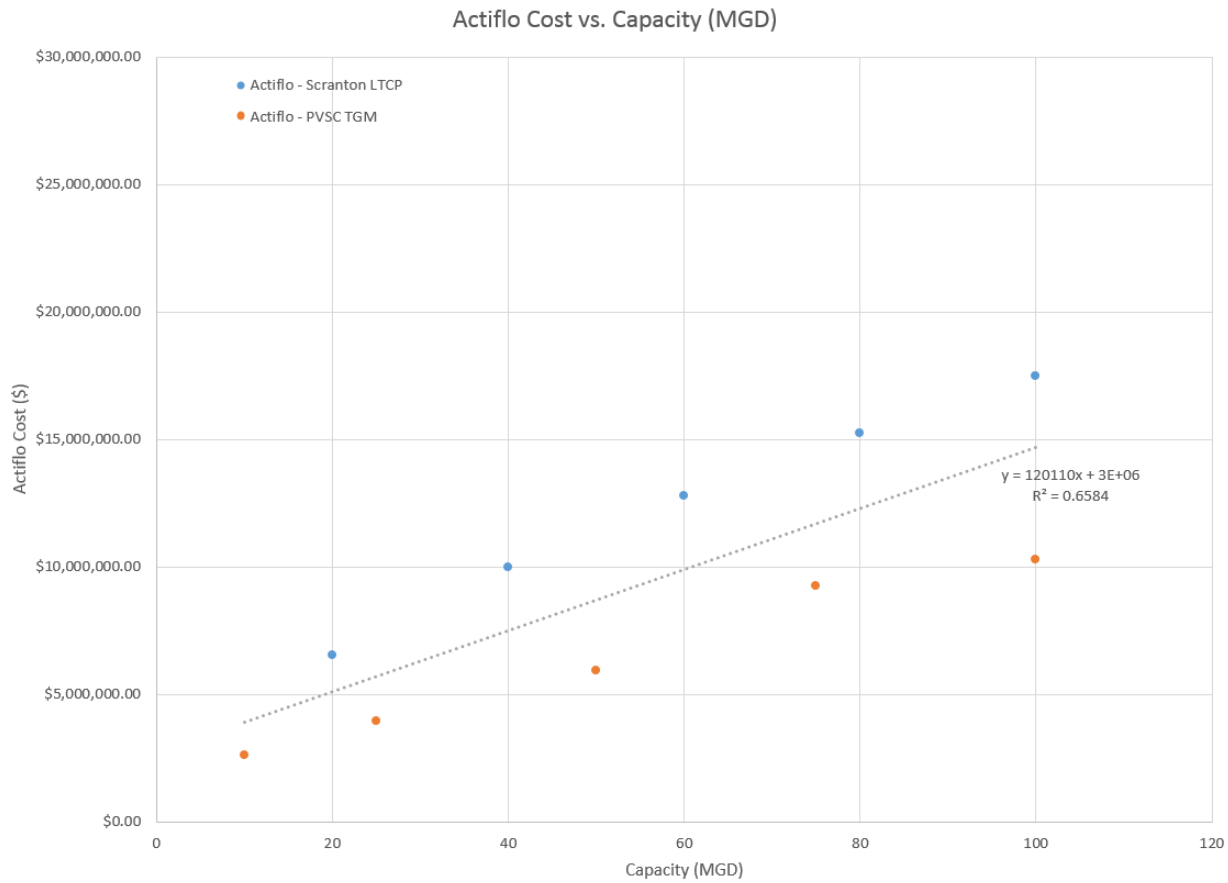
High rate clarification systems are to be used in the event primary treatment is needed at storage areas. These systems provide treatment at a quicker rate than conventional treatment systems along with having a decreased footprint. More specifically, a ballasted flocculation system increases the settling velocity of solids with the use of fine sands, polymer and coagulants. Actiflo® is a manufacturer of ballasted flocculation systems in particular. Data sources include cost curve information from PVSC TGM and Scranton LTCP with information from previous projects and actual installed costs being part of this data compilation. The resulting capital cost curve equation for high rate clarification systems is:

Y=120,110*x + 3E+06

Where Y equals the total Actiflo cost and x equals capacity in MGD.

The trendline equation for the above shows medium R^2 correlation.

Figure 21: Actiflo Capital Cost vs. Capacity (MGD)



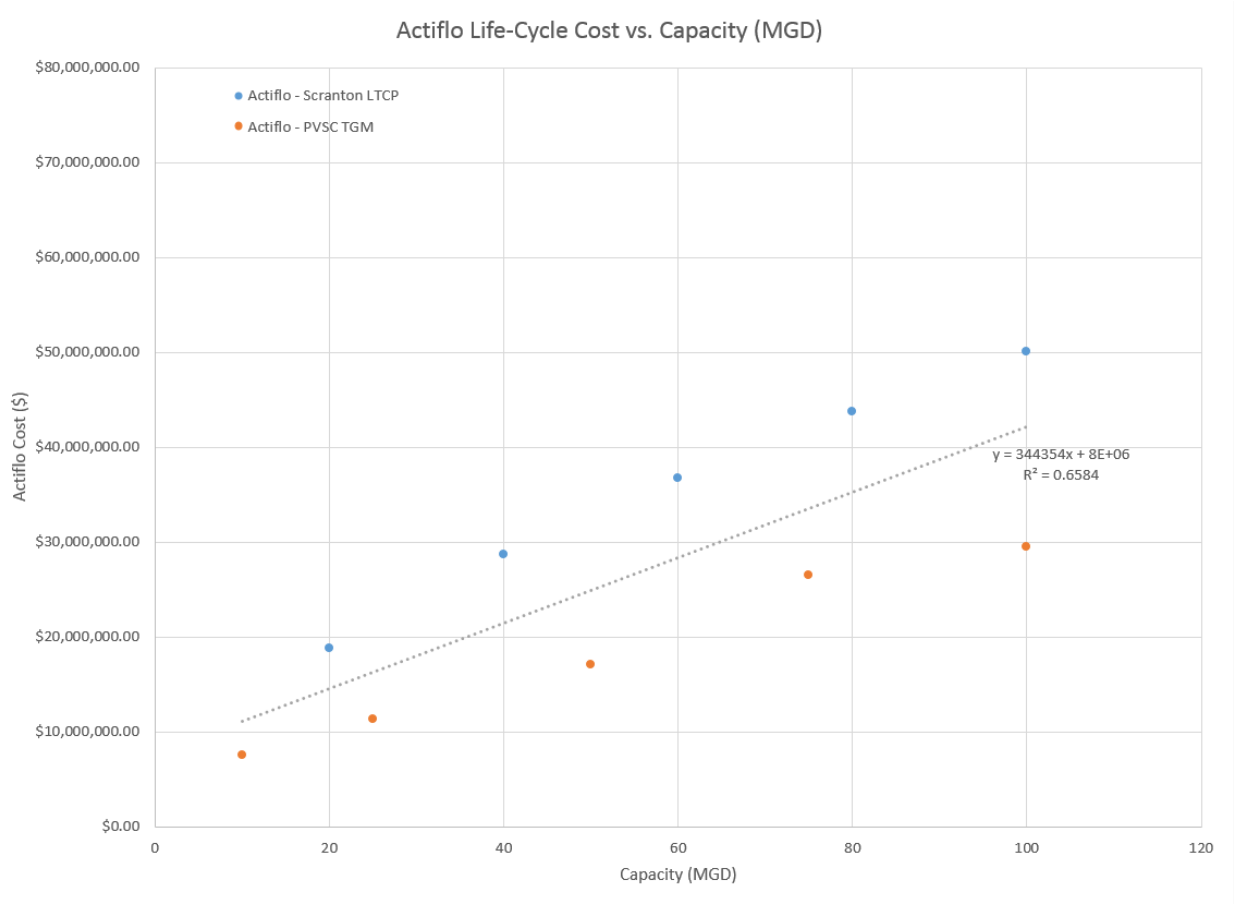
The resulting life-cycle cost curve equation for high rate clarification systems is:

Y=344,354*x + 8E+06

Where Y equals the total Actiflo cost and x equals capacity in MGD.

The trendline equation for the above shows medium R^2 correlation.

Figure 22: Actiflo Life-Cycle Cost vs. Capacity (MGD)


Actiflo Life-Cycle Cost vs. Capacity (MGD)
Actiflo - Scranton LTCP
Actiflo - PVSC TGM
y = 344354x + 8E+06
R² = 0.6584
Actiflo Cost ($)
$80,000,000.00
$70,000,000.00
$60,000,000.00
$50,000,000.00
$40,000,000.00
$30,000,000.00
$20,000,000.00
$10,000,000.00
$0.00
0
20
40
60
80
100
120
Capacity (MGD)

Regulator Modification

Regulator modification is a lower-cost option for existing regulators to passively reduce CSO overflow and maximize flow to the existing interceptors. Each CSO regulator is modified in different ways to achieve this goal, but the different modifications used in this report are increasing overflow weir height, increasing the regulator gate opening, increasing the orifice plate opening, and increasing the outflow pipe diameter to the connecting interceptor. The weir height increase allows the regulator to utilize the existing upstream pipe as temporary storage, while also utilizing the connecting interceptor's flow capacity better during storm events. Waterware is currently replacing or modifying the existing regulators for DELCORA, and was contacted for cost estimates on the regulator modifications listed above. The modifications focused on improving the regulator itself, and excluded external items which could vary greatly depending on each structure, including outflow pipe replacement, permitting, traffic control, asphalt paving, access cover replacement, and labor associated with these items. Since the greatest cost involves the regulator gate modification, three inclusive costs were given based on the size of standard gate sizes:

12" x 12" = $175,000
15" x 15" = $180,000
18" x 18" = $215,000

Waterware gave a high-end cost for access covers at $2,000, and labor costs for a general purpose laborer with a Superintendent supervising the work is $4,750 per week. Assuming each regulator takes a week or work to modify, the cost is rounded up to $10,000 to account for traffic control, asphalt paving, and scaffolding for the access covers, all of which can vary depending on the location and depth of each CSO and decrease with scale. Installed pipe costs were used to estimate the outflow pipe replacement.

The increase in flow to the receiving interceptors will increase flow to the WRTP, and so wet weather treatment costs may also be incorporated into the regulator modification costs for each alternative as needed. The actual need for plant expansion may be mitigated by additional CSO control technologies, however, and a study during post-construction monitoring should be conducted to determine the actual needs of the WRTP.

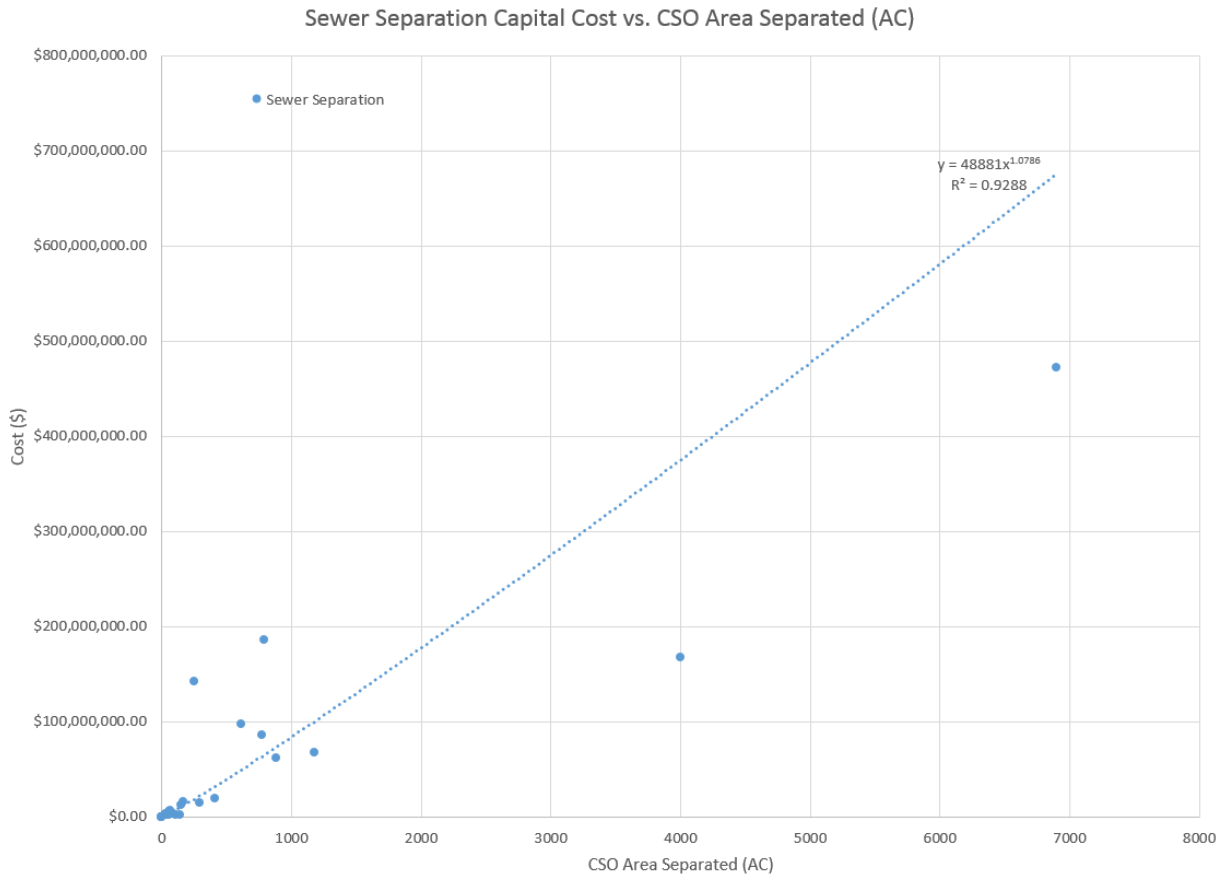
Sewer Separation

Sewer separation is utilized in combined sewer systems to ultimately reduce the amount of flow reaching the WRTP by eliminating stormwater from discharging into the system. This is usually done by installing new storm sewer pipe instead of sanitary pipe as sanitary pipe is usually deeper than storm sewer, thus causing it to cost more. In this specific analysis, the sewer separation cost curve is utilized for the Consent Decree analysis. A previous cost estimate was prepared to separate CSO 5, however this just involved installing a storm sewer along a strategic location to intercept stormwater flow as opposed to separating an entire area. The sewer separation cost curve uses construction cost estimates and bids from Elkhart, Indiana. The resulting capital cost curve for sewer separation is the following:

Y=48,881*x^1.0786

Where Y equals sewer separation cost and x equals the total area being separated. The trendline equation can be seen in Figure X below, showing a high R^2 correlation value.
Figure 23: Sewer Separation Capital Cost vs CSO Area Separated (AC)

Figure 23: Sewer Separation Capital Cost vs. CSO Area Separated (AC)

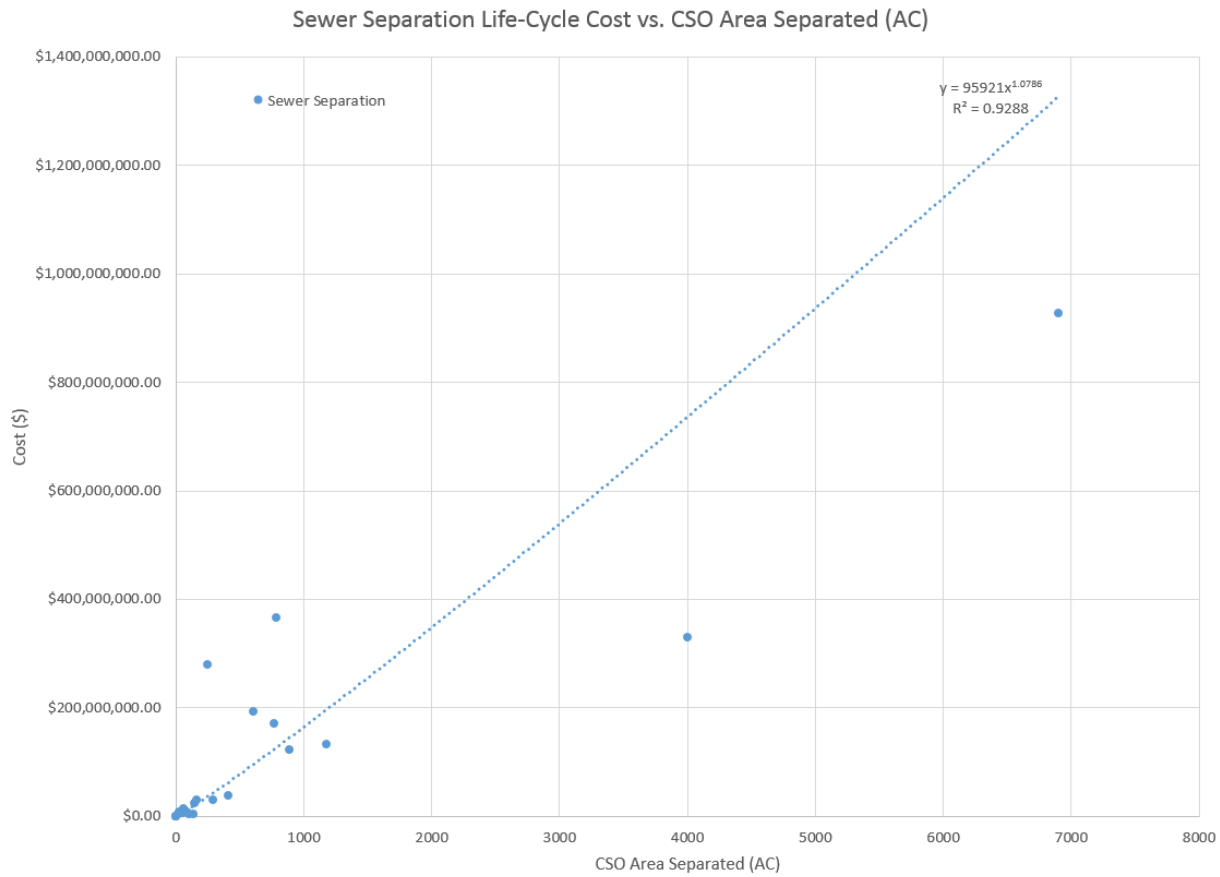


The resulting life-cycle cost curve for sewer separation is the following:

Y=95,921*x^1.0786

Where Y equals sewer separation cost and x equals the total area being separated in acres. The trendline equation can be seen in Figure X below, showing a high R^2 correlation value.

Figure 24: Sewer Separation Life-Cycle Cost vs CSO Area Separated (AC)



For the partial sewer separation in the regulator 5 CSS, Remington & Vernick provided two preliminary project estimates. We utilized the higher estimate, and added bonding and insurance, mobilization, and permitting costs to reach $4,400,000 for the project.

APPENDIX P

WRTP PROCESS AND HYDRAULIC EVALUATION

- DELCORA Western Regional Treatment Plant Process and Hydraulic Evaluation dated April 2011 prepared by Weston Solutions, Inc.

DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL AUTHORITY

WESTERN REGIONAL TREATMENT PLANT

PROCESS AND HYDRAULIC EVALUATION

APRIL 2011

Prepared by:

Weston Solutions, Inc.
1400 Weston Way
P. O. Box 2653
West Chester, PA 19380

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TABLE OF CONTENTS

1. INTRODUCTION 1-1
- 1.1 BACKGROUND 1-1
- 1.2 SCOPE OF EVALUATION 1-2
- 1.3 CURRENT FACILITIES 1-3
  - 1.3.1 Description 1-3
  - 1.3.2 Performance 1-5

2. BASIS OF EVALUATION 2-1
- 2.1 INFLUENT CHARACTERISTICS 2-1
- 2.2 EFFLUENT LIMITATIONS 2-5

3. HYDRAULIC EVALUATION 3-1
- 3.1 FORWARD FLOW 3-1
  - 3.1.1 Approach 3-1
  - 3.1.2 Maximum Forward Flow Analysis (Individual Treatment Processes) 3-1
  - 3.1.3 Maximum Forward Flow Analysis (Entire Treatment Works) 3-4
  - 3.1.4 60, 80, 104 and 144MGD Forward Flow Analyses (Entire Treatment Works) 3-6
- 3.2 RETURN FLOWS 3-6
  - 3.2.1 Approach 3-6
  - 3.2.2 Return Activated Sludge 3-6
  - 3.2.3 Waste Activated Sludge 3-10

4. PROCESS EVALUATION 4-1
- 4.1 APPROACH 4-1
- 4.2 GRIT SYSTEM 4-2
  - 4.2.1 Existing System Description 4-2
  - 4.2.2 Design Guidelines 4-2
  - 4.2.3 Evaluation 4-2
- 4.3 PRIMARY CLARIFICATION 4-3
  - 4.3.1 Existing System Description 4-3
  - 4.3.2 Current Performance 4-3
  - 4.3.3 Design Guidelines 4-3
  - 4.3.4 Evaluation 4-4
- 4.4 ACTIVATED SLUDGE SYSTEM 4-6
  - 4.4.1 Aeration Basins 4-6
  - 4.4.2 Aeration System 4-11
- 4.5 SECONDARY CLARIFICATION 4-16
  - 4.5.1 Description 4-16
  - 4.5.2 Design Guidelines 4-17

TABLE OF CONTENTS (CONT.)

4.5.3 Evaluation 4-17
4.5.4 Options 4-19
4.6 POST AERATION TANKS 4-23
4.7 DISINFECTION 4-23
4.7.1 Chlorine Contact System 4-23
4.7.2 Chlorine Feed System 4-24
4.7.3 Summary 4-26
4.8 SOLIDS HANDLING 4-27
4.8.1 Solids Quantities 4-27
4.8.2 Thickening 4-28
4.8.3 Sludge Holding Tanks 4-30
4.8.4 Dewatering 4-31

5. SUMMARY 5-1
5.1 SUMMARY OF CAPACITY 5-1
5.2 RECOMMENDED UPGRADES TO PROVIDE 60 MGD AVERAGE CAPACITY 5-1
5.2.1 Activated Sludge System 5-1
5.2.2 Secondary Clarifier System 5-8
5.2.3 Disinfection System 5-9
5.2.4 Dewatering System 5-10
5.2.5 Summary of Upgrades 5-11
5.3 NEW OUTFALL DIFFUSER 5-11
5.3.1 Description 5-11
5.3.2 Cost 5-12

6. REFERENCES 6-1

APPENDICES
A - Projected Wastewater Characteristics
B - Discussion with DRBC Regarding $CBOD_{20}$ Waste Load Allocation
C - Hydraulic Calculations

LIST OF TABLES

Table 1-1 WRTP Performance January 2007 - November 2009 Average Flow Conditions 1-5
Table 2-1 Estimated Wastewater Characteristics for Capacity Evaluation 2-2
Table 2-2 Estimated Daily Peak Load Factors 2-2
Table 3-1 Maximum Forward Flow Analysis (Individual Treatment Processes) 3-2
Table 3-2 Return Activated Sludge Guidelines 3-9
Table 4-1 Grit System 4-2
Table 4-2 Summary of Primary Clarifier System Performance 4-3
Table 4-3 Primary Clarifier System 4-4
Table 4-4 Summary of Aeration Basin Operating Parameters January 2007 - November 2009 4-6
Table 4-5 Existing Aeration Basin System 4-8
Table 4-6 Oxygen Requirements for BOD_5 Removal 4-13
Table 4-7 Oxygen Requirements for Combined BOD_5 Removal and Nitrification at 60 MGD 4-14
Table 4-8 Aeration Requirements at 60 MGD 4-15
Table 4-9 Secondary Clarifier Dimensions 4-17
Table 4-10 Secondary Clarifier Design Criteria 4-18
Table 4-11 Secondary Clarifier System Area Proportioned Flow Split 4-18
Table 4-12 Secondary Clarifier System Flow Split Based on PIP Hydraulic Analysis 4-19
Table 4-13 Chlorine Contact Time as Compared to PADEP Guidelines 4-24
Table 4-14 Design Criteria Chlorine Feed Systems 4-25
Table 4-15 Minimum Chlorine Dosing Capacity 4-25
Table 4-16 Chlorine Feed Requirements 4-26
Table 4-17 Design Criteria DAF Systems 4-30
Table 4-18 Estimated DAF Operating Loadings at 60 MGD 4-30
Table 4-19 Loading Criteria BFP Systems 4-32
Table 4-20 Estimated Sludge Quantity 4-32
Table 4-21 Belt Filter Press Solids Loading Rates 4-33
Table 4-22 Belt Filter Press Hydraulic Loading Rates 4-33
Table 5-1 Order of Magnitude Estimate of Cost Activated Sludge System 5-8
Table 5-2 Order of Magnitude Estimate of Cost Secondary Clarifier System 5-9
Table 5-3 Order of Magnitude Estimate of Cost Disinfection System 5-10
Table 5-4 Order of Magnitude Estimate of Cost Dewatering System 5-11
Table 5-5 Order of Magnitude Estimate of Cost Combined Upgrades 5-11
Table 5-6 Order of Magnitude Estimate of Cost Outfall Diffuser System 5-12

LIST OF FIGURES

Figure 1-1 WRTP Existing Block Flow Diagram 1-4
Figure 2-1 DELCORA Flow Diagram..... 2-3
Figure 3-1 Hydraulic Profile of the Wastewater Processes 3-1
Figure 3-2 Hydraulic Profile of the Wastewater Processes (60MGD to 144MGD)..... 3-7
Figure 3-3 Existing RAS Flow and Pipe Velocities (60MGD to 144MGD)..... 3-11
Figure 3-4 Proposed RAS Flow and Pipe Velocities (60MGD to 144MGD) 3-12
Figure 3-5 Existing WAS Flow and Pipe Velocities (60MGD to 144MGD)..... 3-13
Figure 5-1 WRTP Conceptual Block Flow Diagram..... 5-2
Figure 5-2 WRTP Conceptual Layout Plan..... 5-3
Figure 5-3 WRTP Conceptual Layout Aerial 5-5

1. INTRODUCTION

This report presents an evaluation of the Delaware County Regional Water Quality Control Authority (DELCORA) Western Regional Treatment Plant (WRTP). DELCORA has requested that WESTON prepare an evaluation of the treatment process and hydraulic capacity of the WRTP.

1.1 BACKGROUND

In February 2000, DELCORA completed a Process Improvement Project (PIP) evaluation for its Western Regional Treatment Plant (WRTP) (WESTON 2000). The PIP evaluated the forward flow processes at the WRTP to identify process and operational efficiencies, determine the limiting hydraulic capacity of the plant, and evaluate the treatment capabilities of each unit process.

The results of the PIP evaluation showed the maximum hydraulic capacity of the WRTP was limited by the Aeration Basins, at a peak flow of at 137.4 MGD, with all basins in operation. If one basin is out of service, the hydraulic capacity is reduced to 102.1 MGD. The PIP also concluded that the biological treatment capacity of the WRTP was limited by the secondary clarifiers at 44.1 MGD (average flow) and the aeration basins at 45.5 MGD. The secondary clarifier limitation identified in the PIP was based on exceeding certain Pennsylvania Department of Environmental Protection (PADEP) design guidelines at peak flow, corresponding to average or rated flows above 44.1 MGD.

Since the completion of the PIP report, improvements to the aeration system have been implemented, resulting in increased treatment capacity to 50 MGD for the activated sludge components at the previously projected loadings.

In February 2003, WESTON prepared a report titled "Western Regional Treatment Plant Re-Rate to 50 MGD, Report on PADEP Guidelines" (WESTON, 2003). This report demonstrated that the performance of the aeration basins and clarifiers was not adversely impacted even while certain PADEP guidelines were not met, and that alternative loading factors may be more appropriate for design and operation of the system. This justification was further supported by

actual tested performance of the clarifiers under peak loading conditions. As a result of this study, PADEP has approved the re-rate of the WRTP to 50 MGD.

1.2 SCOPE OF EVALUATION

DELCORA is now pursuing additional flow for the WRTP through both strategic planning in the existing Western Region Service Area and potentially increasing the WRTP service area. Therefore, DELCORA desires to further evaluate the forward flow and solids handling processes at the WRTP for the purpose of identifying treatment capacity limitations. This evaluation will assume a target average daily flow of 60 MGD and utilize the most current loading data.

This report evaluates each unit process in the WRTP in order to estimate each unit's ultimate treatment capacity and its ability to accommodate the target 60 MGD (average flow). The end result of this evaluation is an assessment of whether the plant can accommodate 60 MGD and, if not, what upgrades are needed to meet that target. The assessment has been conducted utilizing recent influent loading data and, where appropriate, assumed loading values for the additional future flows. While the previous PIP evaluated forward flow processes, this evaluation includes thickening and dewatering processes as well. An evaluation of the incinerator system has not been included in this scope.

As compared to the PIP, and as discussed in the sections that follow, there are three main factors that may affect the capacity of the existing WRTP component.

1. The intended increase in average flow to 60 MGD.
2. An increase in wastewater strength since the time the PIP was completed. For example the PIP was based on a raw wastewater BOD_5 of approximately 127 mg/L at the then-rated capacity of 44 MGD. By comparison, data for the years 2006-2009, summarized in Section 2.1, shows an average influent BOD_5 of 199 mg/L. Allowing for future contributions (discussed in Section 2.1) this study is based on a projected influent BOD_5 of 208 mg/L.
3. An anticipated requirement for future nitrification, as discussed in Section 2.2. Nitrification requires lower loadings on the aeration basin and secondary clarifiers and therefore the capacity of these units at lower required loading is reduced.

A fourth factor that has an effect on these calculations is that the short-term peak factors were higher than were used in the PIP.

1.3 CURRENT FACILITIES

1.3.1 Description

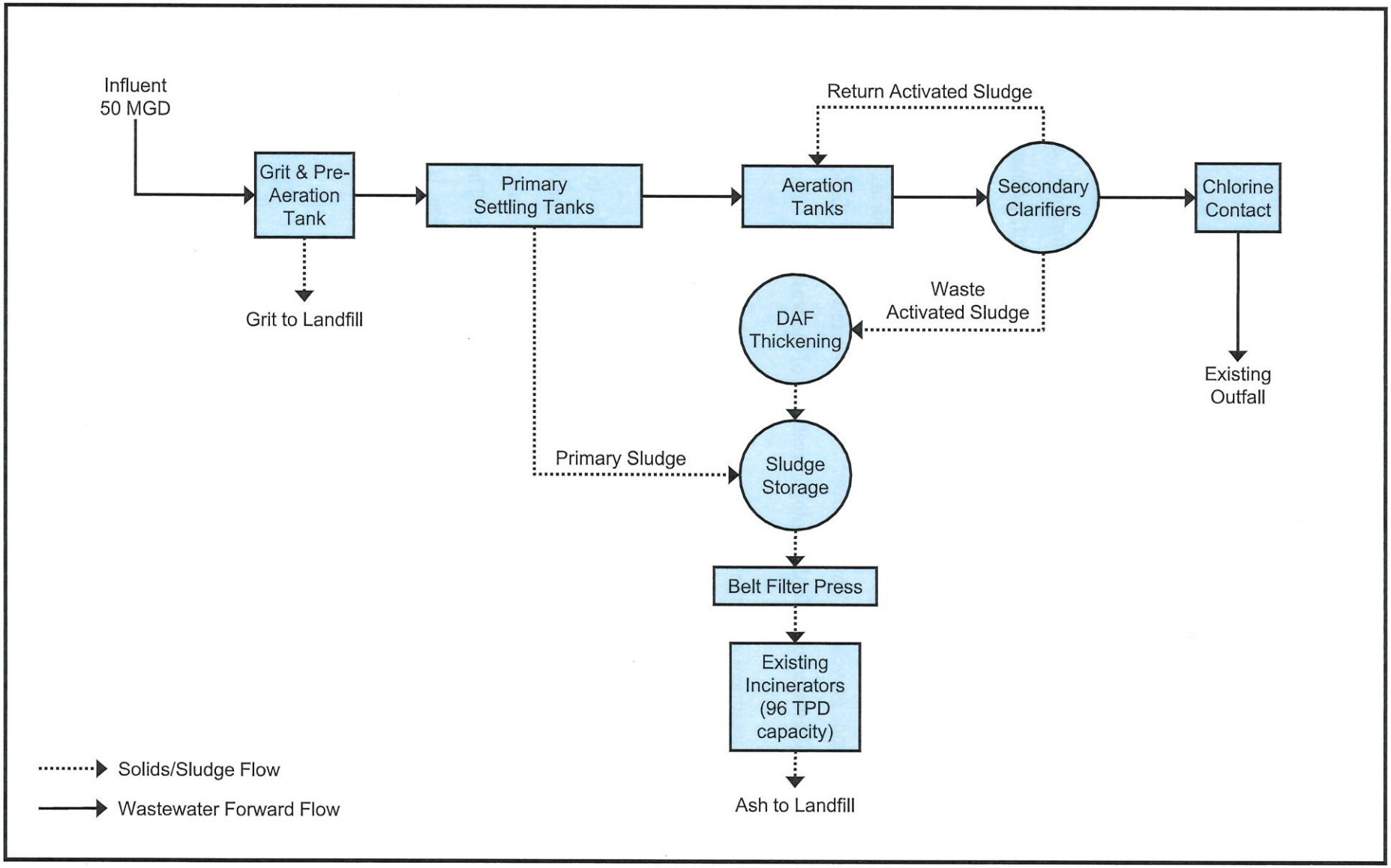
The DELCORA Western Regional Treatment Plant (WRTP) has a permitted treatment capacity of 50 million gallons per day (MGD). The treatment process is commonly described as "Activated Sludge Treatment." The overall process includes pre-treatment, primary treatment, secondary treatment, and final treatment steps (Figure 1-1).

Municipal and industrial wastewater enters the WRTP and proceeds to the pre-treatment step. Pre-treatment consists of aerated grit removal and pre-aeration tanks. During pre-treatment inorganic solids (sand, gravel, etc.) are removed from the wastewater for disposal and air is introduced to the wastewater to aid in the biologic treatment of the waste.

During the primary treatment step, the wastewater passes through eight parallel primary settling tanks where organic and inorganic settleable solids (sludge) are removed and disposed. Oil, grease, and other floatables are skimmed off of the tanks and also removed for disposal.

Effluent from the primary settling tanks is directed to the four aeration tanks in the secondary treatment step. Here air is introduced to the wastewater to add oxygen and provide mixing to maintain bacteria and organic material in suspension (mixed liquor). As a result, dissolved and suspended organic material is synthesized into new biomass (activated sludge). The mixed liquor is then conveyed to the five secondary clarifiers. Settled activated sludge is continuously removed from the secondary clarifiers and returned to the aeration tanks to support the treatment process or, if not needed, it is "wasted" and sent to sludge holding tanks for subsequent treatment and disposal.

The final treatment step is composed of chlorination tanks where the water is disinfected prior to discharge to the Delaware River.



WRTP Process and Hydraulic Evaluation

Delaware County Regional Water Quality Control Authority

WESTON SOLUTIONS
Restoring Resource Efficiency

FIGURE 1-1
WRTP EXISTING BLOCK FLOW DIAGRAM

1.3.2 Performance

Table 1-1 summarizes WRTP performance during the period January 2007 – November 2009.

Table 1-1
WRTP Performance
January 2007 - November 2009
Average Flow Conditions

Parameter	Influent	Final Effluent	Removal Efficiency, %
Flow, MGD	36.65	36.35	NA
BOD_5, mg/L	199	5.85	97
TSS, mg/L	252	7.07	97
TKN, mg/L	19.7	2.8	86
Ammonia Nitrogen, mg/L	10.7	1.2	89

NA – Not Applicable

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2. BASIS OF EVALUATION

2.1 INFLUENT CHARACTERISTICS

An understanding of current performance data (influent and effluent characteristics) and operating conditions (i.e., MLSS/MLVSS, aeration rates, RAS/WAS data and similar) is needed to evaluate the performance of the existing WRTP systems relative to conventional benchmarks and to help assess the potential effects of additional loads on that performance. In addition, the influent flow and wastewater characteristics for the evaluation must be estimated to calculate unit process capacities. The WRTP receives a mixture of domestic and industrial/commercial wastewaters (Figure 2-1). The peak flow factors and characteristics of the wastewater in the future will be affected by whether the incremental future flow is primarily domestic or industrial.

To accomplish this task, WESTON reviewed operating data for the period January 2007 through November 2009 to understand current flow conditions at the WRTP. For the incremental flow up to the target values, WESTON reviewed with DELCORA the possible sources of the flow and developed estimates of waste characteristics from those sources. The following contributions were projected.

- DELCORA's current flow from its existing service area is, on average, 36.65 MGD.
- The Southwest Delaware County Municipal Authority (SWDCMA) may close its wastewater treatment plant with DELCORA assuming its flow. The SWDCMA plant is rated at 6 MGD average flow, and it is assumed that all flow would be routed to the WRTP.
- The remaining flow up to the target 60 MGD (17.35 MGD) is assumed to come from additional but as yet not defined sources and is assumed to consist of typical medium strength domestic sanitary wastewater.

A combination of DELCORA data, limited data from SWDCMA and literature characteristics for sanitary wastewater was used to develop a weighted average characteristic for this evaluation. The calculations are summarized in Appendix A. Table 2-1 summarizes the results of this estimate.

Table 2-1
Estimated Wastewater Characteristics for Capacity Evaluation

Parameter	Influent Characteristics
Flow, MGD	60
BOD_5, mg/L	208
COD, mg/L	484
TSS, mg/L	250
Total Nitrogen, mg/L	28
Ammonia Nitrogen, mg/L	16
Oil and Grease, mg/L	48
Alkalinity, as CaCO3, mg/L	100

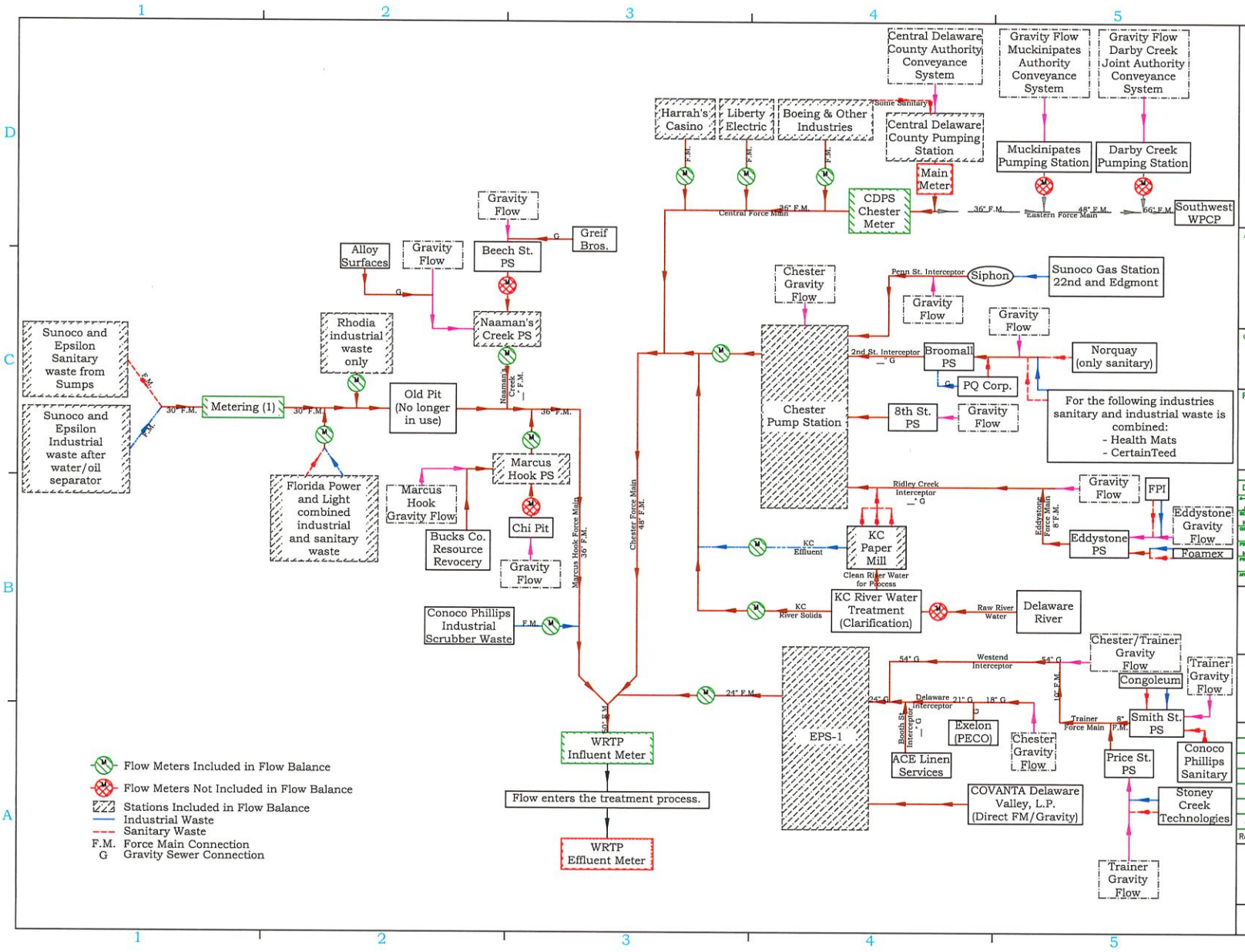
Table 2-2 summarizes daily peak factors based on DELCORA's current data.

Table 2-2
Estimated Daily Peak Load Factors Based on DELCORA Influent Data, 2007-2009 (All Factors are the Ratio of the Indicated Value to the Average Value)

Parameter	Flow	BOD_5 Load	TSS Load	Total Nitrogen Load
Maximum	2.35	3.05	3.15	1.89
99th Percentile	1.74	2.05	2.28	1.88
95th Percentile	1.33	1.53	1.61	1.35

Based on these data, this evaluation assumes a maximum daily flow of 104.5 MGD corresponding to the upper 99th percentile daily peak flow. Process calculations are also based on the upper 99th percentile BOD_5, TSS and Nitrogen loadings where appropriate. This is considered to provide a conservative basis for estimating capacity without overdesign for extreme events.

An analysis of hourly flow data (which affects hydraulic sizing of certain process units) for the period of January 2007 to November 2009 would suggest an hourly peak factor of approximately 2.4 (based on an upper 99th percentile hourly flow of 88.5 MGD and the long term average flow of 36.65 MGD.) Extending this peak factor to the target flow of 60 MGD would indicate a peak



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Architect-Engineer

Consultants

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MANAGEMENT BLOCK
DELCORA CONTRACT:

A-E APPROVALS	DATE
JMC	3/07
DESIGNED	
EB, KS, CF, BK, CVH, JP, JS	3/07
DRAWN	
PROJ. ENG.	
KS	3/07
PROJ. MGR.	
APPROVED	

Flow Balance Marking

Rev.	Date	Description
A	3/07	Issue for Approval

DELCORA Flow Diagram with Marked Flow Balance

DELCORA Flow
Sheet 1 of 1

CADFILE: Flow Diagram with Marked Flow Balance.dwg

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currently limited by influent pumping capacity to approximately 110 MGD, based on historically observed flow values. This would imply a mechanically limited peak factor at 60 MGD of approximately 1.84. However, since the mechanical limitation could be resolved in the future, DELCORA has directed that this limit not be used as the estimate for peak flow. Therefore, this evaluation assumes the 1.74 (upper 99th percentile) daily flow peak factor (Table 2-2) applies to daily flow up to 60 MGD and an hourly peak flow of 144 MGD (2.4 peaking factor based on upper 99th percentile value.)

PADEP design guidelines also use maximum monthly flow for some parameters. An estimate of maximum monthly average flow was calculated from 30 day averages of the daily flow data as provided by DELCORA. This estimated maximum monthly average flow for the period January 2007- November 2009 was 48.4 MGD. This corresponds to a maximum month to average peak factor of 1.33 and a maximum monthly flow of 80 MGD at the target 60 MGD average flow.

These peak values are considered to be relatively conservative. In general, pecking factors tend to decline at higher flow and it is possible that the peaking factors at the target for of 60 MGD may be somewhat lower than at the current average flow. In addition the peaking factors used in this report are based on upper 99th percentile values of the historic data. Because of these factors, the capacities estimated in this report are generally considered to be somewhat conservative.

2.2 EFFLUENT LIMITATIONS

Projected effluent limitations were evaluated to establish the performance standard the WRTP must meet under future conditions. In principle, this could be based on one of several assumed scenarios for the future, including:

- The continuation of existing mass based NPDES permit limits on BOD_5: This scenario would result in progressively lower concentration-based effluent limits as flows increase. (It should be noted however, that based on discussions between DELCORA and DRBC, DELCORA anticipates the current BOD_5 limit will be changed to a $CBOD_5$ limit during the next NPDES permit renewal.)
- The assumption that additional mass allocations can be obtained, such that the current concentration based limits would remain in effect.

- Nutrient (nitrogen and phosphorus) removal requirements. Nutrient limits have not historically applied on the main stem of the Delaware River. However at DELCORA's direction, WESTON has previously evaluated these options for DELCORA with respect to expanding the WRTP, constructing a new WWTP for Eastern Delaware County, and for certain potential satellite plants that could be constructed on smaller streams within the County, for which nutrient limitations may be applied in the near future.

- The potential for toxic Water Quality Based Effluent Limits (WQBELs) in the future could be considered. DELCORA does not at present have such limits imposed in the NPDES permit. If they were likely to be imposed in the future, several options may need to be considered including

  - Revision of local limits to more specifically control industrial inputs

  - Possible additional (tertiary) treatment, or,

  - Since many WQBELs allow for a mixing zone in the river as part of a compliance strategy, outfall modifications is a way to provide necessary dilution.

  It should be noted that DELCORA is currently designing an outfall extension into the Delaware River to address effluent mixing requirements based upon discussions with the DRBC, The new outfall will provide increase mixing and may affect the likelihood of WQBELS in the future.

Based on discussion with DELCORA the following determinations were made with respect to these options:

- With respect to BOD_5 limitation, WESTON, at DELCORA's direction, contacted the Delaware River Basin commission to determine whether an additional allocation would be obtained when DELCORA took over the Southwest Delaware County treatment plant. A record of this conversation is provided as Appendix B. Based on that discussion, it is assumed for this study that no additional allocation would be provided. Applying the existing mass allocation to the future flow of 60 mg/L would require an effluent BOD_5 concentration of 14 mg/L

- DELCORA anticipates an ammonia limit in the futures. For purposes of this evaluation an ammonia limit of 8 mg/L ammonia-nitrogen (NH_3-N) was adopted. DELCORA does not at present see a corresponding limit on phosphorus as a nutrient in the future.

- WQBELS will not be considered in this evaluation, but now may be placed in the NPDES permit with the pending rerate to 50 MGD.

3. HYDRAULIC EVALUATION

Section 4 of this report identifies the limiting element(s) for each unit process involving the forward flow of the treatment process In addition the capacity of the return activated sludge (RAS) and waste activated sludge (WAS) piping has been estimated. Information regarding equipment type and size was taken from as-built drawings provided by DELCORA.

3.1 FORWARD FLOW

3.1.1 Approach

Forward flow through the pre-aeration, primary clarification, activated sludge secondary clarification and disinfection processes was estimated based on gravity flow from one unit process to the next, accounting for head losses in the system (i.e. piping losses). Figure 3-1 depicts the hydraulic profile of the forward flow processes with the main points of analysis annotated.

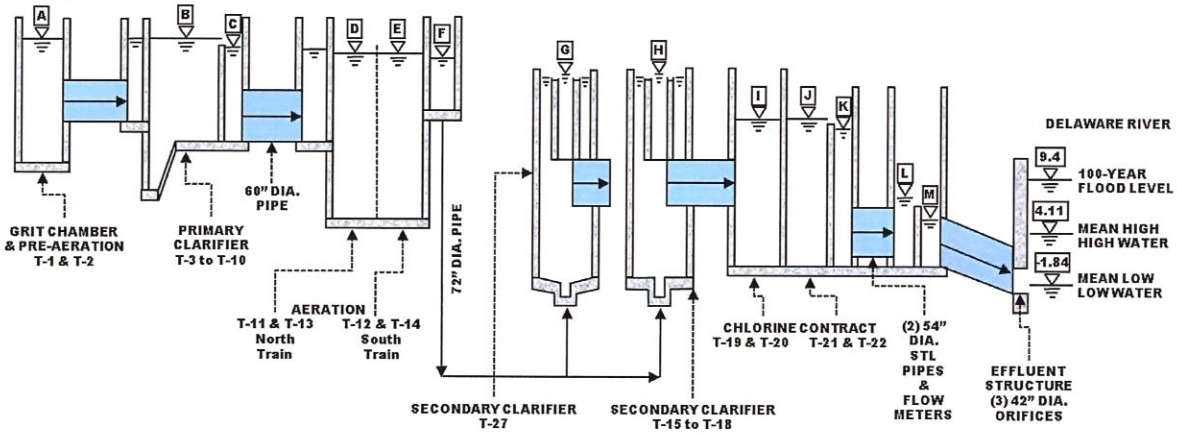


Figure 3-1 Hydraulic Profile of the Wastewater Processes

In general, the criterion adopted for this evaluation was to assume, at a minimum, free fall over weirs and outlet structures between unit process tanks. Piping losses are based on the data for piping and fittings as summarized in the PIP report and verified from record drawings.

3.1.2 Maximum Forward Flow Analysis (Individual Treatment Processes)

This analysis estimates the maximum forward flow for the pre-aeration, primary clarification, activated sludge secondary clarification and disinfection processes independently. Forward flow

through each process was increased until the effluent water elevation reached the top of its v-notch weirs (where applicable) or the influent water elevation reached 1 inch below the effluent weir of the preceding process. This analysis maintained the assumption of freefall over weirs and outlet structures as described in Section 3.1.1. Results of the individual process analysis are summarized in Table 3-2 and discussed further in the following four sections.

Maximum forward flow on an individual process basis is not limited by the capacity of downstream process flow capacities. Therefore the maximum forward flow through the entire treatment works differs from this analysis because it is controlled by the most flow limited process. Analysis of the treatment works as a whole is presented in Section 3.1.3.

Table 3-1
Maximum Forward Flow Analysis (Individual Treatment Processes)

PROCESS	MAXIMUM FORWARD FLOW, (MGD)	
Pre-aeration Tank and Primary Clarifier	169.3	
Aeration Basin	95.5(1)	108.6(2)
Secondary Clarifiers(3)	135.5(1)	118.2(2)
Chlorine Contact Tanks	131.1	

1. Maximum aeration basin effluent weir setting (EL. 20.30ft)
2. Minimum aeration basin effluent weir setting (EL. 19.32ft)
3. Maximum water surface elevation so backwater does not exceed 1" below aeration basin effluent weir setting.

3.1.2.1 Pre-aeration Tank and Primary Clarifier

The water level in the primary settling tanks (T-3 through T-10) is set by the 2.5 inch 90° v-notch weirs with a bottom elevation of 24.64 ft (point B). Maximum flow through the primary settling tanks is assumed to occur at the top of the v-notch weir (EL. 24.85 ft). At this elevation, each of the 5,288 notches flows at 22.23 gpm for a total maximum flow of 169.3 MGD. Head loss through the grit and pre-aeration tanks (T-1 & T-2) is estimated at 0.1 ft for 169.3 MGD forward flow. This results in a water surface elevation of 24.95 ft in the grit and pre-aeration tanks (point A). The calculations of maximum forward flow through individual unit processes are included in Appendix C.

Flow over the primary effluent weirs can be influenced by the water elevation in the primary effluent channel. Flow over the weir will be reduced if the water in the effluent channel

approaches the weir bottom; therefore it is assumed that the maximum water elevation in the primary effluent channel is 1 inch below the bottom of the v-notch weir or elevation 24.56 ft (point C).

3.1.2.2 Aeration Basin

The current configuration directs flow from the primary effluent channel through a 60 inch diameter steel influent pipe and into two parallel trains of aeration basins (T-11 to T-13 and T-12 to T14). The water levels in the aeration basins (points D and E) are set by eight 12 foot adjustable weirs with a maximum crest elevation of 20.30 ft and minimum elevation of 19.32 ft. Assuming a sludge recycle ratio of 0.53 and that the effluent weir is set at its maximum elevation, 95.5 MGD of forward flow will pass through the aeration basins without exceeding the maximum water elevation in the primary effluent channel of 24.56 ft (point C).

When the effluent weir is set at its minimum elevation, 108.6 MGD will pass through the aeration basins without exceeding the maximum water elevation in the primary effluent channel. The calculations of maximum forward flow through individual unit processes are included in Appendix C.

3.1.2.3 Secondary Clarifiers

The max flow through the secondary settling tanks is assumed to occur at the top of the 2.5 inch 90° v-notch weir. The maximum forward flow apportioned by weir capacity alone is 46.3 MGD for T-15 through T-18 and 44.5 MGD for T-27. This flow however is not proportional to the clarifier area as required for process optimization. Control valves are required to balance the flow by clarifier area to 31.2% for T-27 and 17.2% through each of the four remaining clarifiers.

Assuming a recycle ratio of 0.53 and that maximum flow occurs at the top of the v-notch weir, the maximum area apportioned forward flow is 142.6 MGD; however this exceeds the maximum water elevation (point F) of 1 inch below the aeration basin effluent weir at its maximum setting. A flow of 135.5 MGD can pass through the secondary clarifiers without exceeding the maximum crest elevation of the aeration basin effluent weir (EL. 20.30 ft) and a flow of 118.2 MGD can pass through the secondary clarifiers without exceeding the minimum weir setting (EL. 19.32 ft).

Depending on the position of the aeration basin effluent weir the aeration basins and secondary clarifiers are the hydraulically limiting segments and therefore control the maximum forward flow of the entire treatment works. The calculations of maximum forward flow through individual unit processes are included in Appendix C. The forward flow analysis of the entire treatment works is presented in Section 3.1.3. This analysis assumes that the aeration basin effluent weir is set at its highest position (EL. 20.30 ft).

3.1.2.4 Chlorine Contact Tanks

The maximum flow through the chlorine contact tanks was calculated based on three criteria: (1) the influent water elevation at the outfall structure was limited to 1 inch below the crest of the magnetic flowmeter weir (point M); (2) the water elevation in the chlorine contact tank effluent channel was limited to 1 inch below the crest of the chlorine contact tank effluent weirs (point K); and (3) the water elevation in the secondary clarifier effluent channel was limited to 1 inch below the secondary clarifier effluent weirs (points G_{out} and H_{out}). This analysis includes all piping losses and a high tide river elevation of 3.2 ft. To maximize contact time, the adjustable chlorine contact tank effluent weirs were assumed to be in the highest position (EL. 12.65 ft)

A flow of 131.1 MGD was found to meet all three criteria. Maximum flow was limited by the water elevation in the chlorine contact tank effluent channel due to the constriction of flow through the single 54 inch magnetic flowmeter. At this flow the influent water elevations in the secondary clarifier effluent channel and at the outfall structure were more than an inch below the maximum elevations. The calculations of maximum forward flow through individual unit processes are included in Appendix C.

3.1.3 Maximum Forward Flow Analysis (Entire Treatment Works)

This analysis estimates the maximum forward flow of the entire treatment works as a whole. When the aeration basin effluent weir is set at its highest position (EL. 20.30 ft), the aeration basins are the hydraulically limiting segment with a maximum forward flow of 95.5 MGD. When the aeration basin effluent weir is set at its lowest position (EL. 19.32 ft), the aeration basins are still the hydraulically limiting segment with a maximum forward flow of 108.6 MGD. These flows maintain the assumption of freefall over all weirs and outlet structures as described in Section 3.1.1. These results are discussed further in the following sections.

Figure 3-2 shows the water elevations in each treatment process at 95.5 MGD and 108.6 MGD as well as water elevations at the target flow of 60 MGD, the maximum monthly flow of 80 MGD, the maximum daily flow of 104 MGD and the maximum hourly flow of 144 MGD. The calculations of forward flow through the entire treatment works are included in Appendix C.

3.1.3.1 Pre-aeration Tank and Primary Clarifier

At a flow of 95.5 MGD, the water surface elevation within the primary clarifier is 24.81 ft which is below the top of the v-notch weir (point B). The water surface elevation in the grit and pre-aeration tanks is 25.23 ft (point A). At a flow of 108.6 MGD, the water surface elevation within the primary clarifier is 24.81 ft which is below the top of the v-notch weir (point B). The water surface elevation in the grit and pre-aeration tanks is 25.36 ft (point A).

3.1.3.2 Aeration Basin

At a flow of 95.5 MGD, the water elevation in the primary effluent channel is 24.56 ft (point C) which is at the maximum elevation of 24.56 ft. At a flow of 108.6 MGD, the water elevation in the primary effluent channel is 24.56 ft (point C) which is at the maximum elevation of 24.56 ft.

3.1.3.3 Secondary Clarifiers

At a flow of 95.5 MGD and a recycle ratio of 0.53, the water elevation in the aeration basin effluent channel (18.09 ft) is more than 1 inch below the bottom of the aeration basin effluent weir (point F). At a flow of 108.6 MGD and a recycle ratio of 0.53, the water elevation in the aeration basin effluent channel (18.72 ft) is more than 1 inch below the bottom of the aeration basin effluent weir (point F).

3.1.3.4 Chlorine Contact Tanks

At a flow of 95.5 MGD, the water elevation in the secondary clarifier effluent channels (14.42 ft and 14.29 ft), the contact tank effluent channel (10.59 ft), and the outfall structure (3.83 ft) are all more than 1 inch below the maximum water elevation (points G_{out}, H_{out}, K, and M). At a flow of 108.6 MGD, the water elevation in the secondary clarifier effluent channels (14.47 ft and 14.33 ft), the contact tank effluent channel (10.68 ft), and the outfall structure (3.85 ft) are all more than 1 inch below the maximum water elevation (points G_{out}, H_{out}, K, and M).

3.1.4 60, 80, 104 and 144MGD Forward Flow Analyses (Entire Treatment Works)

Maximum forward flow through the entire treatment works is limited to 95.5 MGD by the assumption of freefall over weirs and outlet structures. Therefore the freefall assumption also holds for the target flow of 60 MGD, the maximum monthly flow of 80 MGD, the maximum daily flow of 104 MGD, and the maximum hourly flow of 144 MGD.

At a maximum hourly flow of 144 MGD, however, water elevations would back up in the system and flood over the top of wall (EL. 27.0 ft) of the grit chamber and primary clarifiers. Similarly, the aeration basin effluent weirs (point F) would be flooded by almost 3 inches, the secondary clarifier effluent weirs (points G_{out} and H_{out}) would be flooded by 5 inches, and the chlorine contact tank effluent weirs (point K) would be flooded by over 9 inches.

The walls of the grit chamber and primary clarifiers would have to be raised by 31.6 inches to avoid flooding at 144 MGD. The highest forward flow that would not overflow the grit chamber and primary clarifiers is 119 MGD. Lowering the aeration basin effluent weirs to their minimum position would allow 128.5 MGD forward flow before overtopping these tanks. However the maximum forward flow in the secondary clarifiers under these conditions is 118.2 (Table 3-1) which makes the secondary clarifiers the hydraulically limiting segment.

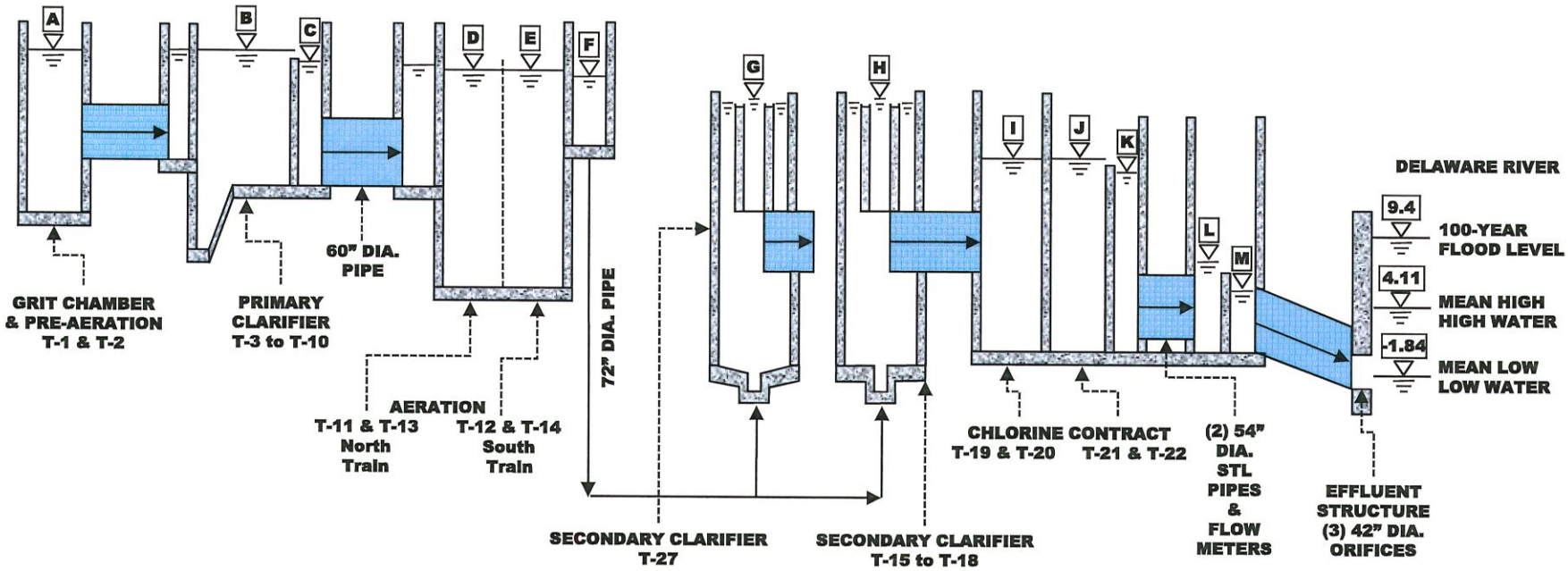
3.2 RETURN FLOWS

3.2.1 Approach

Return activated sludge (RAS) and waste activated sludge (WAS) are pumped to the aeration basins and the DAF system respectively. The capacity of the RAS and WAS systems was evaluated assuming a typical flow velocity of 5 feet per second (which generally represent reasonable head losses). Higher velocities, if needed, may be achievable at higher losses.

3.2.2 Return Activated Sludge

RAS is collected from secondary clarifiers T-15 to T-18 and pumped via RAS pumps P-11 and P-12 (in Pump Station PS-3) to aeration basins T-11 to T-14. RAS from secondary clarifier T-27 is pumped via RAS pump P-63 and P-64 (in PS-5) into the common RAS line with between PS-3 and aeration basins T-11 to T-14.



Condition	Flow	Water Level Elevation (ft)														
		Grit Chamber	Primary	Primary Effluent	North Basin	South Basin	Basin Effluent	Secondary Clarifiers				Chlorine Contact			Outfall Weir	
	MGD	T-1 & T-2	T-3 to T-10		T-11 & T-13	T-12 & T-14		T-27		T-15 to T-18		T-19 & T-20	T-21 & T-22	D/S Weir		
		A	B	C	D	E	F	G (in)	G (out)	H (in)	H (out)	I	J	K	L	M
Max. Free Fall EL.	--	--	24.85	24.56	--	--	20.22	15.71	15.42	15.55	15.42	--	--	12.57	--	6.92
Max. Aeration Basin Effluent Weir EL.	95.5	25.23	24.81	24.56	21.02	21.18	18.09	15.68	14.42	15.58	14.29	13.43	13.43	10.59	8.85	3.83
Min. Aeration Basin Effluent Weir EL.	108.6	25.36	24.81	24.56	20.08	20.31	18.72	15.69	14.47	15.59	14.33	13.44	13.44	10.68	8.87	3.85
Ave. Daily	60	24.94	24.78	22.49	20.95	20.83	16.44	15.65	13.63	15.60	13.57	13.22	13.22	9.04	8.35	3.45
Max Monthly Ave.	80	25.09	24.79	23.52	20.99	21.04	17.15	15.67	14.05	15.63	13.95	13.34	13.34	9.86	8.64	3.64
Max Daily	104	25.67	25.18	25.18	21.05	21.25	18.21	15.68	14.64	15.67	14.49	13.48	13.48	11.02	8.96	3.94
Max Hourly	144	29.55	28.64	28.64	21.16	21.54	20.47	15.71	15.83	15.71	15.57	13.68	13.68	13.39	9.43	4.62

WRTP Process and Hydraulic Evaluation

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FIGURE 3-2

WRTP HYDRAULIC PROFILE

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Conventional design guidelines (PADEP, Ten States Standards) recommend a return activated sludge flow between 100% to 150% of the forward flow based on the type of treatment (Table 3-2). Assuming the target flow of 60 MGD and the maximum monthly flow of 80 MGD, this would indicate a return sludge capacity of up to 80 MGD to meet design guidelines for BOD_5 removal and 120 MGD for nitrification.

Table 3-2
Return Activated Sludge Guidelines

Parameter	Guideline		
	1 PADEP	2 Ten States	
	Conventional Biol. Treatment:	Conventional Biol. Treatment:	Single Stage Nitrification:
Recommended Return Activated Sludge Flow	100% Maximum Monthly Flow	100% Forward Flow	150% Forward Flow

Assuming a maximum RAS pipe flow velocity of 5 feet per second for long pipe runs, the single 36 inch diameter RAS line between PS-3 and the common RAS line limits the maximum total flow from secondary clarifiers T-15 through T-18 to 22.8 MGD. At a maximum velocity of 5 feet per second, the single 24 inch diameter RAS collection line under T-27 limits the maximum flow from secondary clarifier T-27 to 10.2 MGD. Similarly, the single 42 inch diameter common RAS line conveying flow from all secondary clarifiers limits maximum total flow to 31.1 MGD at 5 feet per second. Assuming a sludge recycle ratio of 0.53, the maximum forward flow through the plant is limited to 58.5 MGD by the single 42 inch common RAS line. Figure 3-3 shows flow velocities at several points in the RAS lines for flows of 60 MGD, 80 MGD, 104 MGD and 144 MGD. Evaluation of the PS-3 and PS-5 pump curves and the PAS system curves indicated that there is adequate pumping capacity up to the maximum daily forward flow of 104 MGD.

The analysis in the previous paragraph is based on the existing process configuration. As discussed in Section 4, additional aeration basins and an additional secondary clarifier will be required to meet the 60 MGD objective. In this case additional RAS lines would be needed.

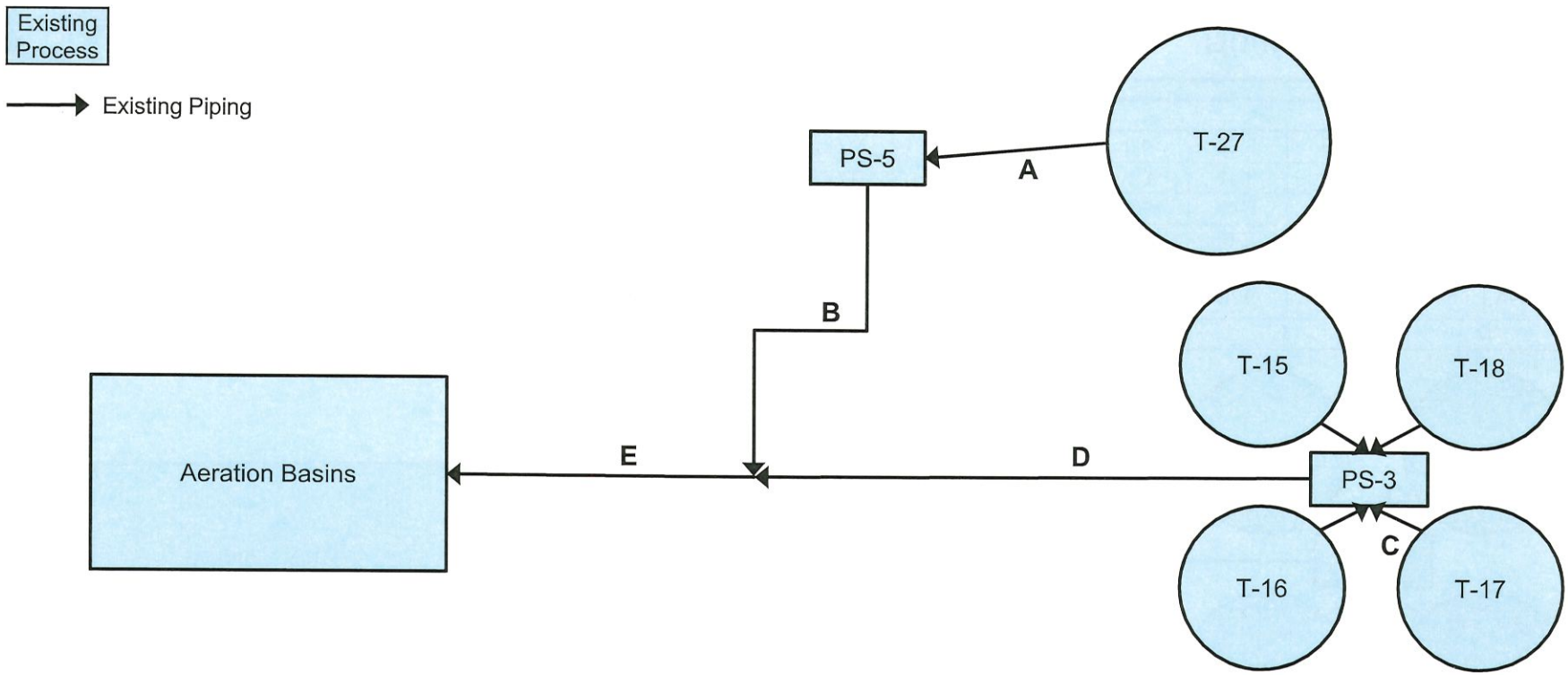
Addition of a new secondary clarifier (T-28) and new RAS lines from clarifiers T-27 and T-28 to a new aeration basin reduces the flow velocities in the RAS lines and increases the maximum

forward flow through the plant. Figure 3-4 shows flow velocities at several points in the existing and proposed RAS lines for flows of 60 MGD, 80 MGD, 104 MGD, and 144 MGD.

3.2.3 Waste Activated Sludge

Waste activated sludge is collected from secondary clarifiers T-15 to T-18 and pumped via WAS pumps in Pump Station PS-3 to dissolved air flotation DAF thickener tanks T-23 to T-26. WAS is collected from secondary clarifier T-27 and pumped via the pump in Pump Station PS-5 into the common WAS line with between PS-3 and the DAF thickener tanks.

Assuming a maximum pipe flow velocity of 5 feet per second for long pipe runs, the two 10 inch diameter WAS pump discharge lines in PS-3 have the smallest pipe diameters and therefore limit maximum total WAS flow from secondary clarifiers T-15 through T-18 to 3.5 MGD. At a maximum velocity of 5 feet per second, the single 12 inch diameter WAS line in PS-5 limits the maximum WAS flow from secondary clarifier T-27 to 2.5 MGD. Assuming a sludge waste rate of 0.017, the maximum forward flow through the plant is limited to 150 MGD by the single 12 inch common WAS line. Figure 3-5 shows flow velocities at several points in the WAS lines for flows of 60 MGD, 80 MGD, 104 MGD, and 144 MGD.



Forward Flow (MGD)	A		B		C		D		E	
	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)
60	9.9	4.9	9.9	4.9	5.5	3.9	21.9	4.8	31.8	5.1
80	13.2	6.5	13.2	6.5	7.3	5.2	29.2	6.4	42.4	6.8
104	17.2	8.5	17.2	8.5	9.5	6.7	37.9	8.3	55.1	8.9
144	23.8	11.7	23.8	11.7	13.1	9.3	52.5	11.5	76.3	12.3

WRTP Process and Hydraulic Evaluation

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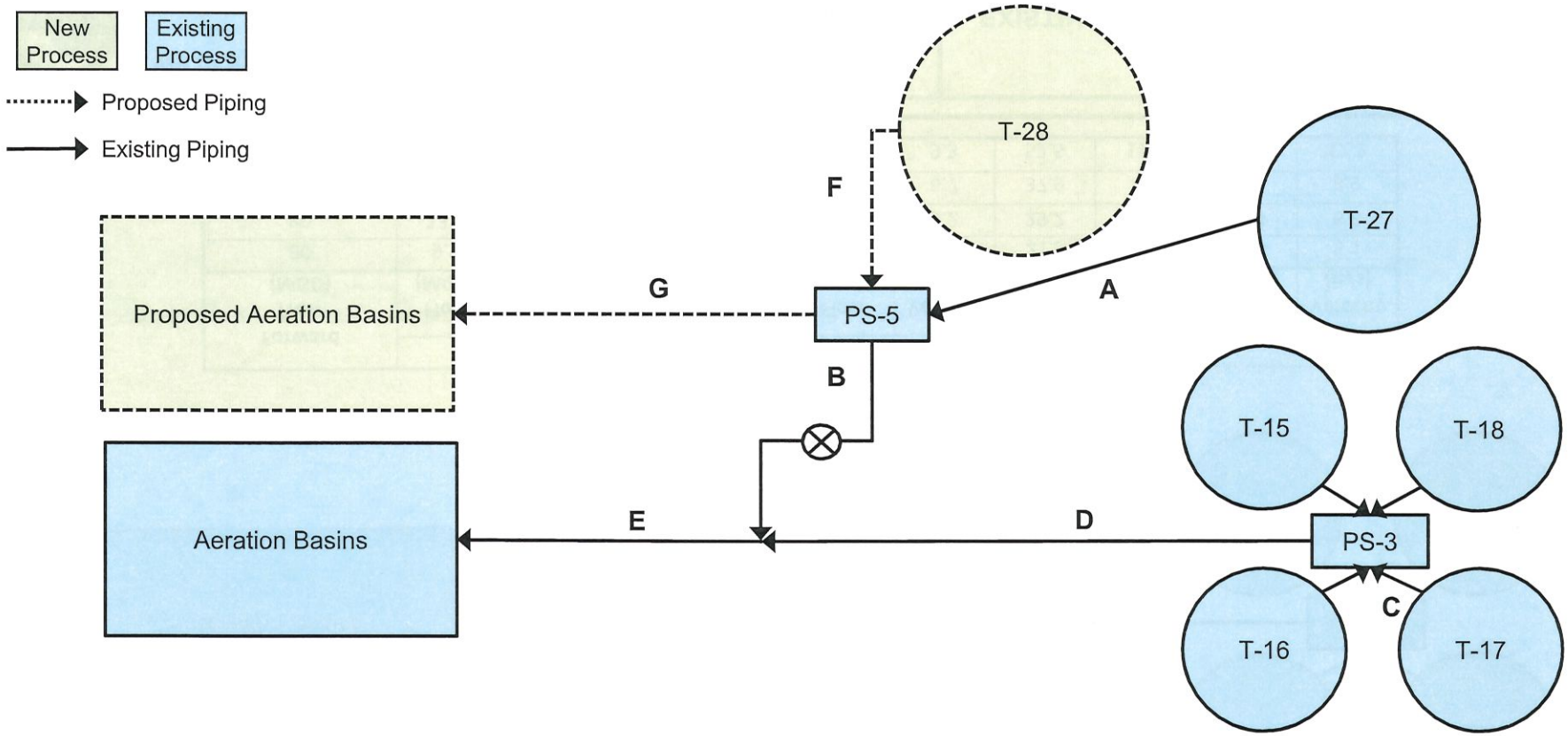
FIGURE 3-3
EXISTING RAS FLOW AND PIPE VELOCITIES (60MGD TO 144MGD)



Forward Flow (MGD)	A		B		C		D		E		F		G	
	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)
60	7.0	3.5	0.0	0.0	3.9	2.8	15.6	3.4	15.6	2.5	9.2	3.6	16.2	2.6
80	9.4	4.6	0.0	0.0	5.2	3.7	20.7	4.5	20.7	3.3	12.3	4.8	21.7	3.5
104	12.2	6.0	0.0	0.0	6.7	4.8	27.0	5.9	27.0	4.3	16.0	6.2	28.2	4.5
144	16.9	8.3	0.0	0.0	9.3	6.6	37.3	8.2	37.3	6.0	22.1	8.6	39.0	6.3

WRTP Process and Hydraulic Evaluation

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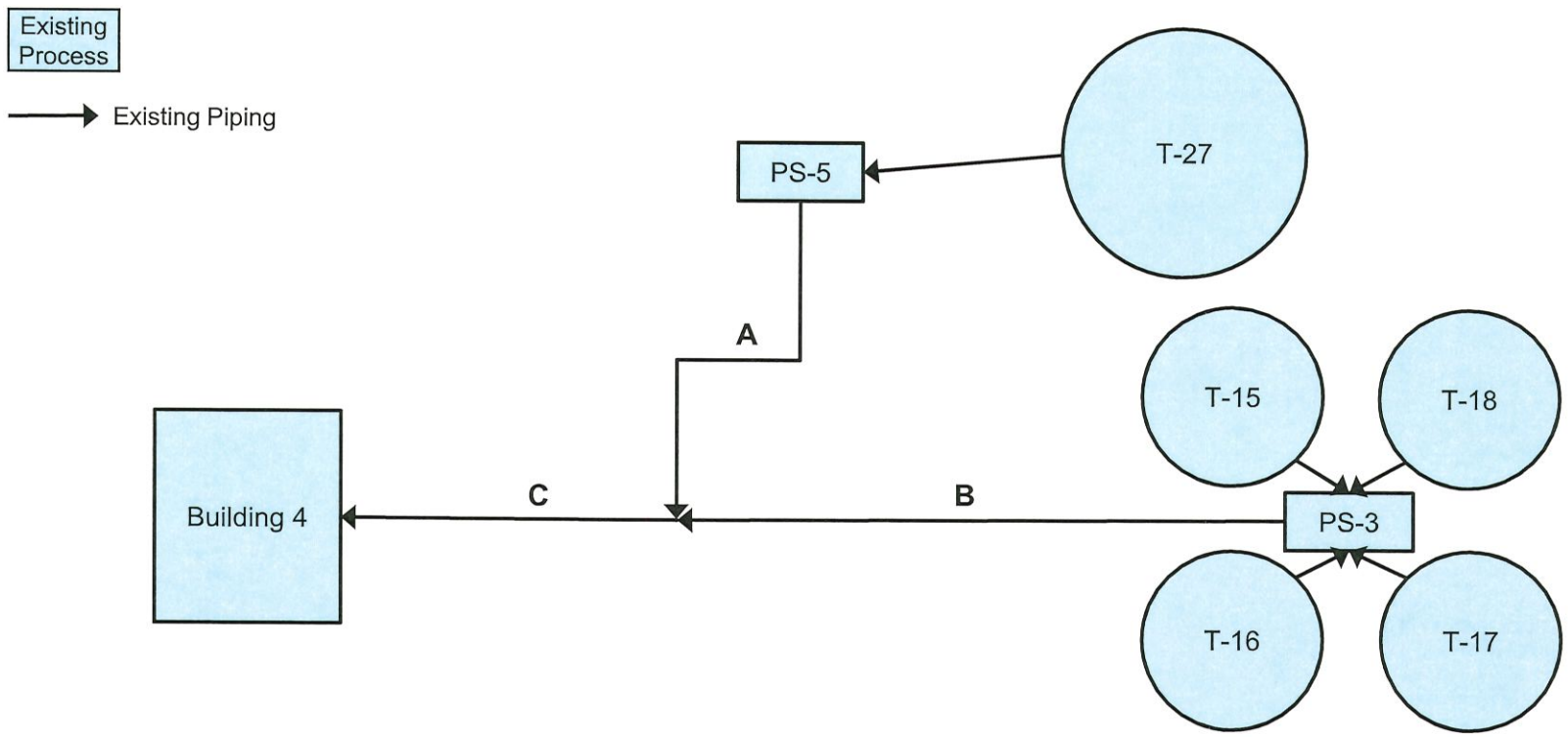
FIGURE 3-4

PROPOSED RAS FLOW AND PIPE VELOCITIES (60MGD to 144MGD)



Forward Flow (MGD)	A		B		C	
	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)
60	0.3	0.6	0.7	1.4	1.0	2.0
80	0.4	0.8	0.9	1.8	1.4	2.7
104	0.6	1.1	1.2	2.4	1.8	3.5
144	0.8	1.5	1.7	3.3	2.4	4.8

WRTP Process and Hydraulic Evaluation

Delaware County Regional Water Quality Control Authority

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Restoring Resource Efficiency

FIGURE 3-5
EXISTING WAS FLOW AND PIPE VELOCITIES (60MGD TO 144MGD)

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4. PROCESS EVALUATION

4.1 APPROACH

WESTON used the data presented in Section 2 to support process calculations to estimate the capacity of individual unit processes and the WRTP as a whole. As a starting point, these calculations have been compared to existing conventional design criteria and guideline documents:

1. Pennsylvania Department of Environmental Protection (PADEP), Bureau of Water Quality Protection, *Domestic Wastewater Facilities Manual, a Guide for the Preparation of Applications, Reports and Plans*, PADEP 362-0300-001, 1997.

2. Great Lakes-Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers. *Recommended Standards for Wastewater Facilities*, 2004 Edition, ("Ten States")

3. Water Environment Federation (WEF) *Design of Municipal Wastewater Treatment Plants, Manual of Practice 8 (MOP-8)*, 1992

4. Metcalf and Eddy, *Wastewater Engineering, Treatment, Disposal, Reuse*, Fourth Edition 2003, ("M&E").

While the above sources provide baseline design criteria, it is also recognized that they are, for the most part, relatively conservative and that in some cases varying from those guidelines may be appropriate. For example, the WRTP's re-rate to 50 MGD is based in part upon a demonstration that the WRTP's clarifiers could operate successfully at flow values exceeding PADEP design guidelines.

WESTON evaluated the unit processes that could potentially limit the forward-flow processing rate at the WRTP. These processes include:

- Aerated Grit and Pre-aeration System
- Primary Clarifiers
- Aeration Tanks
- Secondary Clarifiers
- Disinfection System
  - Chlorine Contact Tanks
  - Chlorine Evaporators and Chlorinators

The following biosolids handling processes were considered:

- Sludge thickening by Dissolved Air Flotation (DAF)

- Sludge dewatering by Belt Filter Presses (BFP)

4.2 GRIT SYSTEM

4.2.1 Existing System Description

The WRTP has two aerated grit and pre-aeration tanks at the WRTP. These tanks are divided into a grit chamber (approximately one third of each tank) and a pre-aeration chamber (approximately two thirds of each tank). The grit chamber tanks are each 31.6 feet long and 30 feet wide, and have a side water depth of 15.75 feet.

4.2.2 Design Guidelines

Design criteria for grit chambers are typically based on hydraulic detention time (HRT).

4.2.3 Evaluation

Table 4-1 provides estimated values of design parameters for the WRTP grit chambers in comparison to design criteria.

Table 4-1
Grit System

Parameter	Guideline				WRTP at 60 MGD
	1 PADEP	2 Ten States	3 WEF MOP 8	4 M&E	
Peak Flow minimum HRT (minutes) (2)	Note 1	3-5	3 (typ.)	3 (typ.)	2.23

Notes:
1. To be based on particle size to be removed.
2. Peak hourly flow.

Based on these results the peak flow HRT in the grit system falls below most guidelines, although as noted PADEP allows for the tank to be sized based on the actual particle size distribution. HRT at average flow is 5.4 minutes. The effect of short retention time at peak flow would suggest some carryover of additional grit to the primary clarifiers particularly at peak flows. However, these calculations are based on that portion of the grit/pre-aeration tanks that are actually designed and equipped for grit separation (and which have a grit removal mechanism) (i.e. approximately 1/3 of the total grit/pre-aeration volume). It is likely that grit

would continue to separate in the remaining volume as well. This would likely reduce the grit carryover to the primary tanks. The principal concern with this is that, without grit removal equipment in these portions of the pre-aeration tanks, removal of the settled grit to maintain performance and provide for grit disposal would be more difficult.

Another option to reduce grit loading of the WRTP would be to improve grit removal at the pump stations serving the WRTP or at other remote locations.

4.3 PRIMARY CLARIFICATION

4.3.1 Existing System Description

There are eight primary clarifiers at the WRTP. Each primary clarifier tank is rectangular in shape, with a length of 155.5 feet, a width of 41.5 feet, and a side water depth averaging 9.50 feet. Each settling tank has a total weir length of 350 feet.

This evaluation assumes all eight primary clarifier tanks are operated in parallel, with influent flow split evenly among all tanks.

4.3.2 Current Performance

Primary clarifiers treating municipal wastewater can typically remove 50 to 70% of the suspended solids and 25 to 40% of the BOD_5 (M&E). The primary clarifier system performs very well at current flows (average 36.65 MGD) and loading conditions. Key performance parameters are summarized in Table 4-2.

Table 4-2
Summary of Primary Clarifier System Performance
January 2007 - November 2009
(Average Flow 36.65 MGD)

Parameter	Influent, mg/L	Effluent, mg/L	Removal Efficiency (%)
BOD_5	199	122	38
TSS	252	97	59

4.3.3 Design Guidelines

Design criteria for primary clarifiers are based on surface overflow rate, weir overflow rate and hydraulic retention time.

4.3.4 Evaluation

Table 4-3 provides estimated values of design parameters for the WRTP primary clarifiers in comparison to design criteria.

Table 4-3
Primary Clarifier System

Parameter		Guideline				WRTP at 60 MGD, 2.4 hourly peak factor
		1 PADEP	2 Ten States	3 WEF MOP 8[1]	4 M&E	
Surface Overflow Rate, gpd/sf	Average	1,000	1,000	NS[2]	800-1200 (1000 typical)	1,162
	Peak hourly	2,500	1,500-2,000	NS	2,000-3,000 (2,500 typical)	2,789
Weir Loading Rate, gpd/ft	Average	15,000[3]	NS	NS	10,000-40,000 (20,000 typical)	21,430 (average) 28,570 (max. monthly
	Peak hourly	NS	30,000	15,000 (typ.)	NS	51,430
Hydraulic Retention Time, hours	Average	NS	NS	NS	1.5-2.5 (2.0 typical)	1.47
	Peak hourly	NS	NS	NS	ND	0.61

Notes:
NS: Not specified.
1. In many cases MOP 8 does not provide criteria but refers to other literature values.
2. At maximum monthly flow rate.

The primary clarifier system is at the upper end of conventional design parameters at 60 MGD design average flow based on the surface overflow rates, and does not meet PADEP design criteria for WLR.

Among these design criteria the surface overflow rate is the more critical performance parameter. The surface overflow rate (SOR) is an upward flow velocity and particles having a settling velocity greater that the SOR will, in theory, be removed. Therefore maintaining SOR values within conventional ranges is the more critical factor in ensuring adequate removal of solids prior to the aeration basins.

By contrast weir overflow rate is related to the approach velocity of the water to the weirs; too high a velocity could tend to entrain some solids and carry them over the weir. However as noted in previous reports (WESTON 2003) weir overflow rate is generally considered of relatively minor importance in the performance of settling tanks and WEF MOP 8 notes that

"...weir rates have little effect on the performance of primary clarifiers especially with side wall depths in excess of 12 feet." (The WRTP clarifiers are 8.75 to 10.25 feet deep).

The primary clarifier system essentially meets typical criteria for HRT at 60 MGD average flow.

The Report on DEP Guidelines (WESTON 2003) summarized data from August 1999 when half of the clarifiers were out of service for maintenance and the remaining clarifiers consequently operated at high loadings (see Table 6, WESTON 2003). These results indicated that at maximum daily flows of almost 54 MGD and peak flow rates on the maximum day of 96 MGD the performance of the primary clarifier system was excellent at effective SOR values of 1,256 gpd/sf and WLRs as high as 23,164 gpd/ft. These values are slightly higher than the estimated values at the target flow of 60 MGD as noted in Table 4-3 and suggest that the primary clarifiers may operate at those conditions with little negative effect on performance.

At 60 MGD, however, the primary clarifier system will approach the upper range of typical practice and some decrease in efficiency may be expected. To provide a conservative basis for evaluation of the activated sludge system, it is assumed that at the target flow of 60 MGD the removal efficiency of the primary clarifier system is slightly lower than at the current flow, (50% for TSS and 30% for BOD_5).

DELCORA evaluated Chemically Enhanced Primary Treatment (CEPT) by addition of chemical coagulant to the primacy clarifier system, for two reasons:

1. As a possible means of addressing process upsets that interfere with primary settling. This might be done on either a short term (i.e. temporary) basis or by the installation of a permanent system.
2. Recent recommendations from an energy study by AECOM that DELCORA consider CEPT to increase primary BOD_5 removal and thus potentially reduce aeration power requirements.

While it is expected that CEPT could in fact increase BOD_5 and TSS removal in the primary system and assist with these goals, a preliminary evaluation of cost indicated that it would not be cost effective to do so on a continuous basis.

4.4 ACTIVATED SLUDGE SYSTEM

The activated sludge system includes the aeration basins and the aeration system blowers and diffusers.

4.4.1 Aeration Basins

4.4.1.1 Existing System Description

There are four aeration tanks at the WRTP. These tanks are square in shape, with a length of 136 feet, a width of 136 feet, and a side water depth of 18.1 feet. Various flow combinations are possible with the four tanks including a complete mix configuration. Typical operation uses two trains of two tanks each, providing essentially a complete mix activated sludge (CMAS) configuration.

Conventional design and operating criteria for aeration basins are based on hydraulic retention time, organic loading rate, food to microorganism ratio (F:M) and mixed liquor suspended solids MLSS levels. Current operating parameters for the system are summarized in Table 4-4.

Table 4-4
Summary of Aeration Basin Operating Parameters
January 2007 - November 2009
(Average Flow 36.65 MGD)

Parameter		Value
MLSS, mg/L		3,383
F:M, lb BOD_5/lb MLVSS		0.165
HRT, hours		6.6
SRT [(1)], days, MLVSS basis		10.5
Waste Activated Sludge (WAS)	Flow, MGD	0.263
	Concentration, mg/L)	10,776
Return Activated Sludge (RAS)	Flow, MGD	19.27
	Concentration, mg/L	10,776
	Recycle Ratio, α	0.53

Notes:
1. Solids retention time.

A previous process model by Envitreat (Envitreat 2009) estimated a SRT of 15.4 days at 36.8 MGD average flow and an F:M value of 0.122 (VSS basis) using operating data from November 2006 to October 2008. According to the Envitreat report MLSS during the period averaged 3608 mg/L as compared to 3383 during the current evaluation.

A denitrification evaluation by Gannett Fleming (Gannett Fleming 2009) estimated a sludge age of 11 days at 38.21 MGD at an MLSS value of 3,565 mg/L, based on data from 2006-2008. The Gannet Fleming report indicated the SRT was based on MLSS rather than MLVSS. Assuming 80% VSS, the calculated 11 day SRT (MLSS basis) corresponds to approximately 8.8 days (MLVSS basis).The Gannet Fleming report did not include an estimated F:M value. However, based on data provided in Tables 4 and 5 and allowing for a VSS fraction of 0.8, an F:M value of 0.134 would be estimated.

This process evaluation considers the four aeration basins to be operating as a complete mix activated sludge system. The previous PIP evaluated multiple flow configurations for the activated sludge process, including so-called "reverse" flow wherein the influent would be directed to the second tank in each train (tanks T-12 and T-14 respectively) and back through the first tank in each train (tanks T-11 and T-13 respectively). This scenario is considered unlikely and therefore it will not be evaluated in this analysis.

While this section considers process capacity, it should be noted that the hydraulic capacity is between 95.5 MGD and 108.6 MGD depending on the effluent weir setting (see Table 3-1), the aeration basins cannot accommodate the estimated peak hourly flow of 144 MGD (60 MGD with a 2.4 peak factor.). This is relevant in that any option to increase process capacity in the existing tanks would still face this hydraulic limitation. This may effectively limit options for increasing activated sludge capacity to those which rely on new aeration basins.

4.4.1.2 Comparison to Standard Design Criteria

4.4.1.2.1 Design Guidelines

As noted above, conventional design and operating criteria for aeration basins are based on hydraulic retention time, organic loading rate, food to microorganism ratio (F:M) and mixed liquor suspended solids (MLSS) levels.

4.4.1.2.2 Evaluation under Conventional Design Guidelines

Table 4-5 provides estimated values of design parameters for the WRTP aeration system chambers in comparison to design criteria. Operation at 60 MGD will exceed all conventional criteria for nitrification and be at the upper limits of criteria for BOD_5 removal. Operation at 50

MGD average flow will continue to be above PADEP guidelines but is within other conventional design criteria for BOD5 removal. The Process Improvement Project Report (WESTON 2000) also concluded that treatment at 50 MGD would exceed certain PADEP guidelines. As noted below these guidelines are generally conservative. Typical criteria for nitrification would be exceeded at 50 MGD average flow.

Table 4-5
Existing Aeration Basin System

Parameter		Guideline				WRTP at 50 MGD	WRTP at 60 MGD
		1 PADEP	2 Ten States	3 WEF MOP 8	4 M&E		
Hydraulic Retention Time	BOD_5 Removal(1)	6(2)	NS	NS	3-5	3.62	3.02 (2)
	Nitrification (3)	12	NS	NS	6-15		
Solids Retention time, days	BOD_5 Removal(1)		NS	3-5	5-15	5.4	4.6
	Nitrification(3)		NS	5-15	8-20		
Maximum Organic Loading Rate lb/ BOD_5/1,000 cf/day	BOD_5 Removal(1)	40(4)	40	NS	50-120	93.1	112(5)
	Nitrification (3)	20(4)	15	NS	5-20		
F:M, lb BOD_5/lb MLVSS/day	BOD_5 Removal(1)	0.2- 0.5	0.2-0.5	0.2-0.4	0.2-0.6	0.55	0.66(5)
	Nitrification (3)	0.08-0.16	0.05-0.1	NS	0.1-0.25		
MLSS, mg/L	BOD_5 Removal(1)	1,000-3,000	1,000-3,000	1,500-3,000	1,500-4,000	~3,400(5)	~3,400(5)
	Nitrification (3)	2,000-5,000	3,000-5,000	NS	1,500-3,500		

Notes:
NS: Not specified
1. Complete mix activated sludge, using air for aeration (vs. pure oxygen).
2. At maximum monthly flow.
3. Combined carbon oxidation – nitrification.
4. Based on maximum daily BOD_5 load to the aeration tank.
5. At upper 99th permit daily BOD_5 peak, 30% primary BOD_5 removal, 3,400 mg/L MLSS and 0.8 volatile fraction.
6. Typical value under current operating conditions.
7. In many cases MOP 8 does not provide criteria but refers to other literature values.

4.4.1.3 Process Design Calculations

As noted previously, design guidelines in standard references are generally conservative. In order to refine the estimated capacity of the aeration basin and adequately consider the particular properties of DELCORA wastewater, a process design calculation was performed using

conventional design models (USEPA 1975, M&E 1991) which are based on nitrification kinetics.

4.4.1.3.1 Assumptions

Input parameters for the model are based on the influent data presented in Table 2-1. Kinetic coefficients for the nitrification process were based on literature values.

The nitrification process is significantly affected by water temperature. For this analysis it was assumed that the future ammonia-nitrogen limit would be applied year round (rather than being seasonally adjusted as was commonly done in the past.) DELCORA reports wintertime minimum temperatures under current conditions as above 60 degrees F (15.6 degrees C) due in part to warm water input from industrial sources, and anticipates that even with a somewhat higher future contribution of cooler municipal wastewaters, the winter temperature is likely to remain above 60 degrees F. Therefore the design calculation was performed at 60 degrees F (15.6 degrees C) winter water temperature as the most conservative case.

4.4.1.3.2 Results

The design calculations indicated that a solids residence time (SRT) of approximately 11 days would be suitable. At current MLSS levels this results in a design hydraulic residence time of approximately 8.5 hours. At the target flow of 60 MGD a total aeration basin volume of approximately 21 MG would be needed under these conditions.

Comparison to Table 4-4shows that the current operation provides an SRT of 10-11 days at 36.65 MGD average flow. Under these conditions the plant typically nitrifies reasonably well.

The process model used conservative assumptions and additional modeling might be used to refine the final estimate. However, the essential conclusion is that the existing aeration basins are well short of providing adequate capacity for the 60 MGD nitrification scenario.

Furthermore, the design calculations indicate that the intended SRT would be achieved at a mixed liquor (MLSS) level of approximately 3,400 mg/L in the indicated reactor volume. Assuming the biomass continues to settle similar to current conditions, such that the recycle concentration can be maintained at approximately 10,000 mg/L, this would require a recycle

ratio (Q_R/Q) of approximately 0.51, (i.e. a recycle rate approximately 51% of the forward flow rate). This value is well below the general design guidelines of 100 to 150%.

4.4.1.4 Options

The most critical design parameter for nitrification is the solids residence time. In this regard a higher throughput could possibly be achieved in the fixed aeration volume by operating at significantly higher MLVSS levels. The WRTP currently operates at a MLSS level of approximately 3,400 mg/L (estimated to provide 2,270 mg/L MLVSS). The ability to significantly increase MLSS (and MLVSS) in the current configuration (e.g., by increasing recycle) is likely limited. Based on historical data (Gannett Fleming, 2009, Envitreat 2009), MLSS levels in the range of 3,600 mg/L were maintained at flows of approximately 36-38 MGD. Even if this value could be maintained at 60 MGD, it would likely not be sufficient to provide the desired operating conditions for nitrification. Options for doing this within the existing aeration basins may include (1) conversion to an integrated fixed film activated sludge (IFAS) process and (2) conversion to a membrane bioreactor (MBR) process.

However as noted above the existing basins also have a hydraulic limitation. At the future peak hourly flow (144 MGD) the water level in the primary effluent channel would approach the bottom of the weir, which was established in the hydraulic analysis as the limiting case. If additional basins are needed to address this hydraulic limitation, conversion to IFAS or MBR may be less favorable than adding new conventional activated sludge basins. Furthermore if additional basins are provided other activated sludge process options, such as step feed and plug flow configurations, could possibly be considered to optimize the aeration volume.

The hydraulic analysis (Section 3) indicates that the flow split between the two trains with all sluice gate valves open is not equal, with approximately 59% of the flow passing through the south train (Tanks T-13 and T-14) and 41% through the north train (T-11 and T-12). At maximum loadings particularly it will be important to balance the flow between the trains. This would presumably be done by adjusting the sluice gate valves on the south train to divert more flow to the north train. It should be noted that throttling the two gates to the south train may have some effect on upstream hydraulics. Since the upstream criterion in the hydraulic analysis was free fall over the primary clarifier weirs (a maximum elevation in the clarifier effluent channel

below the weir v-notch) it is possible that throttling the south train may result in peak flow levels exceeding this criterion.

4.4.2 Aeration System

4.4.2.1 Existing System Description

DELCORA replaced its surface aerators with a submerged diffuser aeration system. The system consists of submerged aeration diffusers and piping grid, centrifugal blowers, dissolved oxygen (DO) control system, interconnection ductwork, electrical controls and blower building. The submerged diffusers are high efficiency flat panel membrane diffusers manufactured by Parkson Corporation. The Parkson panels operate at a low air flux rate and have large floor coverage. The centrifugal blowers have a high efficiency rating and are manufactured by Turblex Corporation. The dissolved oxygen control system modulates the quantity of air and the main header air pressure in response to changing DO concentrations in the aeration basin and is also manufactured by Turblex Corporation. The aeration system was designed to reduce the electricity consumption and operating costs as compared to the surface aerators. Provisions were included in the design for future flow expansion at the WRTP to an influent flow of 50 MGD at then-projected loadings. Also included in the design was the provision for the addition of a fourth blower if needed for flow expansion above 50 MGD. To accommodate the fourth blower, the interconnecting ducting was sized for the increased compressed air flow rate, space was reserved in the blower and electrical rooms for the blower and its motor starter, and the electrical substation was sized for a fourth blower motor.

4.4.2.1.1 Blowers

The design air requirement was 10,200 scfm at average flow and 20,200 scfm at peak load. Average and peak design conditions were based on current operating data at that time.

The blower configuration uses two operating blowers and one installed spare blower. The proposed blowers are sized at 11,000 scfm each for a total capacity of 22,000 scfm (with one unit in reserve.)

4.4.2.1.2 Diffusers

Each basin contains 175 Parkson aeration panels arranged in groups of 25 for a total of 700 panels. The diffuser system was designed for the 50 MGD design basis. They are designed to pass a total of 10,350 scfm at average conditions and 20,200 scfm for the maximum condition (at the 50 MGD design basis.)

In addition there are provisions to place additional panels in each basin without revision to air piping if necessary to accommodate potential future flows above 50 MGD.

The basins were considered complete mix reactors. To provide homogeneous conditions in the tank, the aeration panels were spaced throughout the tank. However, toward the influent side of the tanks, additional panels were placed.

The Parkson diffuser panels are 4 ft by 12 ft long. The diffuser membrane is polyurethane. The airflow flux rate varies from 0.31 scfm/sf at the average flow rate to 0.72 scfm/sf at the maximum flow rate.

4.4.2.2 Comparison to Standard Design Criteria

4.4.2.2.1 Design Guidelines

PADEP and 10 States Standards guidelines for the design of aeration systems include the following narrative criteria:

- Aeration equipment should be capable of supplying 1.1 pounds of oxygen per pound of BOD_5 removed at maximum BOD_5 loadings (PADEP guidelines specify maximum daily BOD_5 while 10 States Standards refer to peak hourly BOD_5 loads). These references further recommend 4.6 pounds of oxygen per pound of TKN removed at maximum loads.
- Dissolved oxygen should be maintained at a minimum of 2.0 mg/l.
- The blowers shall be provided in multiple units, so arranged and in such capacities as to meet the maximum air demand with the single largest unit out of service. The design shall also provide for varying the volume of air delivered in proportion to the load demand of the plant.

4.4.2.2.2 Evaluation

As noted above the existing aeration system was designed for BOD_5 removal at 50 MGD (with provisions for expansion).

This evaluation considers both BOD_5 removal at current and projected influent conditions and the anticipated requirement for nitrification. The nitrification process exerts a significant oxygen demand, typically estimated at 4.57 lb of oxygen per lb of nitrogen, (as compared to 1.1 lb oxygen per lb BOD_5 removed). Note that the theoretical 4.57 lb O_2 value is rounded to 4.6 lb in the design guidelines.

Table 4-6 summarizes the average and peak oxygen requirements for BOD_5 removal alone (i.e. without nitrification). Also provided for comparison are the total oxygen requirements used for the design of the existing aeration system (WESTON 2003b). These values assume 100% BOD_5 and TKN removal at average conditions and 95% removal at peak load conditions. In addition, these calculations assume a minimum DO in the aeration basins of 2.0 mg/L.

Table 4-6
Oxygen Requirements for BOD_5 Removal

	Aeration System Design Basis 50 MGD Average Flow		Current Loadings 60 MGD Average Flow	
	BOD_5 Load removed lb/day	Oxygen Requirement, lb./day	BOD_5 Load removed lb/day	Oxygen Requirement, lb./day
Average	41,300(1)	45,430(2)	72,830(1)	80,115(2)
Peak day	68,780(3)	75,658(2)	141,840(3)	156,080(3)

Notes:
1. Assumes 100% BOD_5 and TKN removal at average load conditions.
2. Assumes 1.1 lb oxygen per lb BOD_5.
3. Assumes 95% BOD_5 and TKN removal at 99th percentile peak load condition.

The significant increase in total oxygen demand for BOD_5 removal results from both the increase in flow (from 50 MGD to 60 MGD) and the substantial increase in waste strength since the time of the previous evaluations. The PIP report and the aeration design were based on a raw wastewater strength in the range of 160 mg/L BOD_5. The recent historical DELCORA waste strength is approximately 199 mg/L BOD_5 (Table 1-1) and the projected waste strength allowing for future contributions is 208 mg/L BOD_5 (Table 2-1).

The total oxygen demand for a combined carbon oxidation/nitrification system can be estimated from the following equation:

$$O_2, \text{ lb/day} = Q(kSo + 4.57\ TKN) \times 8.34$$

where
- Q = flow, MGD
- k = conversion factor, lb O_2/lb BOD_5
- So = BOD_5, mg/L
- TKN = Total Kjeldahl Nitrogen, mg/L

The total oxygen demand for BOD_5 removal and combined BOD_5 removal./nitrification are summarized in Table 4-7.

Table 4-7
Oxygen Requirements for Combined
BOD_5 Removal and Nitrification at 60 MGD

	Total Oxygen Demand, lb/day		
	BOD_5 Removal	**Nitrification**	**Total**
Average Daily Load	80,115	56,885	137,000
Peak Daily Load	156,080	101,550	257,630

The aeration requirements to satisfy this demand is based on the design criteria with respect to water temperature and DO level, and the oxygen transfer characteristics of the aeration equipment. Oxygen transfer characteristics are based on data from Parkson. It is understood that the original aeration panels are being replaced with ones of a modified design. Parkson was consulted to determine whether the oxygen transfer characteristics of the new panel will differ from the original used for the design. Parkson responded that while testing is proceeding, the characteristics of the new panels are expected to be the same as the origin. Therefore data presented in the design report were used for this evaluation.

Table 4-8 summarizes the air supply requirement to meet the demand shown in Table 4-7.

Table 4-8
Aeration Requirements at 60 MGD

	Total Air Requirement, scfm		
	BOD_5 Removal	Nitrification	Total
Average Daily Load	21,270	15,090	36,360
Peak Daily Load (1)	41,420	26,950	68,370

Notes:
1. Assumes 95% BOD5 and TKN removal at 99th percentile peak load condition

Table 4-8 demonstrates that the existing system would not provide adequate capacity even with the fourth blower installed, With the fourth blower installed the maximum aeration provided would be ~33,000 scfm with one unit offline per PADEP guidelines.

Under current average flow conditions, (i.e. approximately 36.65 MGD), two blowers are adequate for nitrification at average flow conditions 18,300 scfm required). Calculated airflow rates indicate a shortfall at the 99th percentile peak loading condition (36,360 scfm required)

BOD5 removal alone (consistent with the current NPDES permit) would of course require significantly less air. However unless process operating conditions (primarily solids retention time) were modified to prevent nitrification, the nitrification demand will consume oxygen.

As noted in Section 4.4.2.1.2, the diffuser system was designed for a maximum flux rate of 0.72 scfm/ft^2 of diffuser area, assuming two blowers in operation at the required peak airflow rate of 20,200 scfm. If the third existing blower were operating (a maximum air flow rate of approximately 33,000 scfm), the flux rate would increase to approximately 1.18 scfm/ft^2 with the existing panels. If, as noted, in Section 4.4.2.1.2, 25 additional panels were installed in each basin using the existing piping, the maximum flux rate with three existing blowers, would be approximately 1.03 scfm/ft^2. Flux rates at peak nitrification conditions, assuming additional blower capacity were provided, may exceed the capacity of the panels. (At the time of publication flux rate curves were not available from the manufacturer. Actual flux rates and performance should be confirmed with the manufacturer.)

As noted in Section 4.4.1, it would be necessary to add aeration basins to meet nitrification requirements. With all eight basins (existing and new) using panel diffusers the peak air flow rate of 68,370 scfm would result in a peak flux rate of approximately 0.92 scfm/ft^2 (assuming the

additional panels are not installed in the existing basins and comparable floor coverage in the new basins). As noted above, at the time of publication flux rate curves were not available from the manufacturer. Since transfer efficiency is affected by flux rate, the actual oxygen transfer efficiency of the new panels, when available from the manufacturer, should be reviewed to confirm performance. If oxygen transfer drops significantly at these higher flux rates, additional blower capacity beyond that estimated above would be needed.

It should be noted that the above values are based on maximum daily loads as calculated from DELCORA data. As noted above, some guidelines recommend aeration to meet maximum hourly loads. Based on standard references, hourly peak load factors may be higher than the daily factors shown in Table 2-2. However data to assess hourly BOD_5 and nitrogen loads (i.e. diurnal fluctuations in influent BOD_5 and TKN) are not normally collected.

4.5 SECONDARY CLARIFICATION

4.5.1 Description

There are five secondary clarifiers at the WRTP. Four clarifiers (Tanks T-15, T-16, T-17, and T-18) have a 130-foot diameter and one clarifier (Tank T-27) has a diameter of 175-feet.

The four smaller clarifiers were included in the original design of the plant while the fifth larger clarifier was added in 1994. Return sludge from the four smaller units is drawn from the bottom well of each clarifier while the larger clarifier uses a suction pipe withdrawal mechanism.

Flow is distributed among the five clarifiers using control valves. Optimally, the flow to each clarifier should be proportioned according to surface area of the tank. As discussed in the PIP report (WESTON 2000), this was not possible with the original weir configuration for Tank T-27 (Clarifier 5). Of the total clarifier surface area, tank T-27 represents 31 percent of the total surface area and clarifiers T-15 to T-18 represent 17 percent of the total surface area each. However using the original weir configuration, tank T-27 had a maximum flow capacity of 24.9 MGD and each of the four smaller clarifiers has a maximum capacity of 25.9 MGD. The analysis of the flow distribution to the secondary clarifiers from the PIP report indicated that the flow would be distributed rather evenly without throttling the control valves to the tans. Under these conditions Tank T-27 would receive 21 percent of the total flow, tanks T-16 and T-18

would receive 19 percent of the total flow each, and tanks T-15 and T-17 would receive 20.5 percent of the total peak flow each.

In 2004 a study was conducted to analyze the flow split among the five final clarifiers and develop recommendations for flow balancing. Since that time DELCORA has implemented adjustments to the weir settings and it is estimated, based on flow meter data, that the intended area proportioned flow spilt can now be obtained. The tables that follow provide the estimated capacity both at the area proportioned split and at the original flow split to illustrate that impact of this difference. Since the secondary clarifiers are likely to be a limiting point in the effort to achieve the 60 MGD target flow it will be appropriate to reconfirm the ability to split flow as necessary.

4.5.2 Design Guidelines

Design criteria for secondary clarifiers are based on SOR, weir overflow rate and solids loading rate. For purposes of this evaluation, Table 4-9 provides the relevant characteristics of the five clarifiers.

Table 4-9
Secondary Clarifier Dimensions

Clarifier	Diameter, ft	Surface Area, sf	Weir Length, ft	Volume, gallons
T-15	130	13,279	728	1,489,856
T-16	130	13,279	728	1,489,856
T-17	130	13,279	728	1,489,856
T-18	130	13,279	728	1,489,856
T-27	175	24,063	1,438	3,671,745
Total		**77,177**	**4,350**	**9,631,169**

4.5.3 Evaluation

Table 4-10 summarizes design guidelines for secondary clarifiers. Table 4-11 provides estimated values of design parameters for the WRTP secondary clarifiers in comparison to design criteria, assuming that the flow is split proportionally among the five clarifiers based on their surface area (in this case the SOR and WLR). Table 4-12 summarizes the operating values at 60 MGD for each tank based on the estimated actual flow split from the hydraulic analysis.

Table 4-10
Secondary Clarifier Design Criteria

Parameter		Guideline			
		1 PADEP	2 Ten States	3 WEF MOP 8 (6)	4 M&E
Surface Overflow Rate, gpd/sf(1)	Average	800	NS(7)	400-700	400-700
	Peak	1,200(2)	1,200	1,000-1,600	1,000-1,600
Weir Loading Rate, gpd/ft	Average	15,000(3)	NS	NS	NS
	Peak		30,000	NS	30,000
Solids Loading Rate, lb/day/sf	Average	30(4)	NS	NS	20-30
	Peak	50(2,4)	35(3,5)	NS	48

Notes:
NS: Not Specified
1. Based on influent flow only.
2. At peak hourly flow.
3. At maximum monthly flow.
4. Based on mixed liquor flow (wastewater + return flow).
5. Peak loading rate for single stage nitrification.
6. In many cases MOP 8 does not provide criteria but refers to other literature values.

Table 4-11
Secondary Clarifier System
Area Proportioned Flow Split

		T-15	T-16	T-17	T-18	T-27
Flow Fraction		0.172	0.172	0.172	0.172	0.312
Surface Overflow Rate, gpd/sf	Average	777	777	777	777	777
	Peak	1,866	1,866	1,866	1,866	1,866
Weir Loading Rate, gpd/ft	Average	15,470	15,470	15,470	15,470	15,470
	Peak	37,123	37,123	37,123	37,123	37,123
Solids loading rate, lb/day/sf (2)	Average	34	34	34	34	34
	Peak	81	81	81	81	81

Notes:
1. assumes 60 MGD design average flow and 144 MGD peak hourly flow.
2. assumes 3,400 mg/l MLSS.

Table 4-12
Secondary Clarifier System
Flow Split Based on PIP Hydraulic Analysis

		T-15	T-16	T-17	T-18	T-27
	Flow Fraction	0.205	0.19	0.205	0.19	0.21
Surface Overflow Rate, gpd/sf	Average	926	859	926	859	524
	Peak	2,220	2,060	2,220	2,060	1260
Weir Loading Rate, gpd/ft	Average	16,887	15,651	16,887	15,651	8,761
	Peak	40,540	37,560	40,530	37,560	21,030
Solids Loading rate, lb/day/sf (2)	Average	40	37	40	37	20
	Peak	96	90	96	90	55

Notes:
1. assumes 60 MGD design average flow and 144 MGD peak hourly flow.
2. assumes 3,400 mg/L MLSS.

Comparison of Table 4-8 and Table 4-9 indicates the following:

- At the target 60 MGD, the surface overflow rate exceeds design guidelines under either flow split scenario
- However if the flow is not balanced to split proportionally (i.e., if the flow split identified by the hydraulic analysis exists at 60 MGD), the SOR values for the smaller clarifiers are further above typical performance criteria (the larger clarifier, T-27 is within design guidelines under both cases since it is receives a smaller proportion of flow relative to its size).
- The effect of not balancing the clarifiers may result in reduced performance of the smaller four clarifiers at the target flow of 60 MGD.

As noted in Section 3.1.2.2 the current estimated peak hydraulic flow capacity of the aeration basins is 108.7 MGD. If the aeration basin hydraulic limitations were addressed without adding additional clarifiers the situation above would apply.

4.5.4 Options

The secondary clarifier system will exceed conventional design guidelines at the target flow of 60 MGD. An obvious method to resolve this would be to add additional clarifier capacity. However an alternate approach would be to evaluate the potential for optimizing the performance of the existing clarifier system, prior to incurring the capital cost of additional clarifiers. There may be two basic components to this process:

1. Determining the true settling characteristics of the sludge to determine whether higher than typical design parameters can be used. This could be done by field testing for sludge settleability characteristics ("solids flux" testing) and/or by clarifier stress testing (some of which has already been done as noted below).

2. Correcting any hydraulic limitations in the clarifiers, to ensure the full settling characteristics of the sludge can be exploited.

4.5.4.1 Sludge Settling and Thickening

Surface overflow rates and solids loading rates are determined by the settling characteristics of the sludge. Typical clarifier design criteria are based on typical sludge settling rates. For a good settling sludge, higher than typical design values may be used. There are already several lines of evidence suggesting that WRTP sludge characteristics may support higher than normal settling rates (and as noted below some of these data were used to support the re-rate of 50 MGD).

1. The 2003 "Report on DEP Guidelines" (WESTON 2003a) discussed historical data regarding effluent TSS during high loading periods and concluded that good performance was achieved at higher than normal overflow rates. Solids loading rate was within design guidelines so no such determination was necessary).

2. Stress Testing. Clarifier stress testing was conducted by DELCORA in November 2009 by directing additional flow to clarifiers T-16 and T-18. Solids removal remained good at flow rates up to approximately 22 MGD. When flow was increased to approximately 27.5 MGD effluent TSS began to increase and the sludge blanket level rose. These results indicate that on a short term basis peak loading rates in the range of 1600 gpd/sf may be acceptable. The Sludge Volume Index (SVI) on the day of testing was reported at 72. This indicates good settling characteristics (typically SVI values less than 100 are considered good.) Preliminary stress testing was also conducted in T-16 and T-8 on September 12, 206 and on T-27 on October 21, 2008. Results from these tests were variable and may have been affected by operating conditions during the test.

Additional testing to establish the actual operating range of the clarifiers could include (1) additional, and possibly longer term, stress testing and (2) solids flux testing. A procedure for

the latter is termed "State Point Analysis" and consists of bench scale solids flux rate testing. Solids flux rates are interpreted graphically in terms of overflow and underflow (RAS/WAS) rates to establish the range of acceptable loading rates for the clarifiers.

One possible limit on the use of the State Point Analysis procedure is the possibility that settling characteristics at 60 MGD (with a somewhat different wastewater composition) may differ from the current conditions and therefore the result of testing on the current sludge may not be fully representative. State Point Analysis is a procedure to evaluate clarifier performance in terms of its hydraulic operation (overflow and under flow rates) and the site specific settling characteristics of the sludge. It is conducted by performing site specific settling velocity tests at varying solids concentrations to establish a solids flux rate curve for the plant under various conditions. The flux rate relationship is graphically superimposed on the overflow and underflow rate curves to indicate whether the clarifier operating point (the "state point") is within acceptable ranges for the measured flux rate(s). These data may be used to adjust operating parameters or to determine the need for additional clarifiers.

4.5.4.2 Hydraulic Conditions

Hydraulic limitations in clarifiers may affect performance. While some hydraulic limitations may be inherent in the design of the clarifier tank, others could be possible be addressed by retrofits to existing clarifiers (it should be noted that at present there are no definitive data to indicate that the DELCORA clarifiers currently have such limitations).

One such modification is the use of density current baffles (one version of which is the Stamford Baffle, currently installed on DELCORA clarifier T-16. Such baffles have been demonstrated in a number of cases to substantially improve the performance of primary and secondary clarifiers. These are intended to address upward density currents along the clarifier wall carrying solids to the weir. They consist of baffle plates installed in the tank to intercept and redirect upward currents away from the weir and back into the center of the clarifier. As noted above clarifier T-16 has baffles installed. Long-term testing could be considered to evaluate whether its performance differs from the other clarifiers, although at the current low loadings the differences may not be apparent. Side by side comparison during the stress test did not indicate a clear effect of the baffles; in fact the effluent TSS values for T-16 were somewhat more variable than

those for T-18 at intermediate flow rates up to ~26 MGD but somewhat better at flow over 27 MGD. It is possible but not yet known that the decline in clarifier T-18 performance above 27 MGD was attributable at least in part to currents and, if so, baffles may assist in addressing this limitation.

Additional modifications that could be considered if warranted by testing could include Energy dissipating inlets and modifications to the sludge collection and withdrawal system.

These modifications could assist in taking full advantage of the settling characteristics of the sludge but would not provide an inherent improvement in those characteristics.

At present there are no definitive data to indicate whether such modifications would be of value at the DELCORA WRTP. Additional testing, such as dye testing in conjunction with stress testing to evaluate currents, could be considered to investigate this possibility.

Discussion with DELCORA during this project did however identify one potential concern. It was reported that the recycle sludge pumps in T-27 sometimes draw the feed well dry, inferring that the sludge withdraw piping on the clarifier cannot keep up with the intended RAS rate; specifically it was inferred that additional sludge withdrawal pipes may be needed; the range of RAS flow over which this occurs and the depths of the sludge blanket has not been investigated for this study. However the manufacturer of the T-27 clarifier mechanism (EIMCO) was contacted by WESTON regarding this possibility. The manufacturer indicated that the reported condition could occur because the withdrawal piping capacity is in fact low or because the withdrawal pipes are mounted too close to the bottom of the tank. Potential corrective actions could be, (1) to install additional withdrawal pipes, (2) to install larger withdrawal pipes and (3) to ensure that the pipes are mounted at the appropriate distance from the floor. EIMCO also advised that a previous evaluation had been conducted for T-27. WESTON has requested EIMCO to provide additional information on the approach to investigating and resolving this issue.

As a follow-up, WESTON again contacted the equipment manufacturer Ovivo (formerly EIMCO) on February 23, 2011 to request any documentation on the previous evaluation. On March 4, 2011, Ovivo advised that the only available documentation from the test were headloss

calculations and that the possibility of vortexing of the sludge collection box had been discussed. No additional information is available from the manufacturer on this test.

4.6 POST AERATION TANKS

There are two post-aeration tanks at the WRTP. The tanks are square with a length of 48.5 feet, width of 48.5 feet, and side water depth of 11.5 feet.

These tanks are not currently needed for aeration because the current NPDES permit does not specify a minimum dissolved oxygen level in the effluent (effluent DO is not a regulated parameter). In addition, turbulence over the chlorine contact tank weir and in the effluent chamber introduces dissolved oxygen to the effluent.

It should be noted that PADEP guidelines specify that post aeration to meet DO requirements (if such are imposed in the future) should be done after the chorine contact tank. The current WRTP configuration, however, places the post aeration tanks prior to the chlorine contact chambers. Under current permit conditions this is not an issue but modifications could be required if DO limits are imposed in the future.

4.7 DISINFECTION

4.7.1 Chlorine Contact System

4.7.1.1 Description

There are two chlorine contact tanks at the WRTP. The tanks are rectangular with a length of 116 feet, width of 36 feet, and side water depth of 12.5 feet. The tanks are baffled to provide a long flow path and prevent short circuiting, to help in providing adequate contact time. There are also two post-aeration tanks at the WRTP as noted above.

Based on the results of the PIP report, it was determined that it was desirable to operate one of the post-aeration tanks as a chlorine contact chamber to process a maximum peak flow rate of 94.0 MGD.

4.7.1.2 Design Guidelines

The effectiveness of chlorination is a function of chlorine dosage and contact time. As a guideline, however, PADEP specifies a minimum contact time of 15 minutes at peak hourly flow or 30 minutes at maximum monthly average flow, assuming adequate mixing. Other standard references (M&E, 1991) indicate that 15 minutes at peak flow is a commonly accepted value. As discussed below contact time and chlorine dosage should be considered together.

4.7.1.3 Evaluation

Table 4-13 shows the contact time at (1) peak hourly flow and (2) maximum monthly average flow using all four tanks (two chlorine contact tanks and two post aeration tanks) for chlorine contact chambers.

Table 4-13
Chlorine Contact Time as Compared to PADEP Guidelines

	Peak Hourly Flow		Maximum Monthly Flow	
	Required	Provided	Required	Provided
Hydraulic Retention Time, minutes	15	11.8	30	16.4

As shown in Table 4-13 chlorine contact time at the target flow of 60 MGD, at the estimated peaking factors, does not meet PADEP Guidelines.

4.7.2 Chlorine Feed System

4.7.2.1 Description

DELCORA uses a gas chlorination system. One ton chlorine cylinders located in the chlorine storage room within Building B-3 supply chlorine to a chlorine evaporator/feed system. The evaporator/chlorinator room currently has four Wallace and Tiernan (W&T) series 50-200 evaporative units and four W&T V-2000, V-NOTCH chlorinators. The V-2000 series has a range of capacities. The particular units at the WRTP include two units at 5,000 lb/day each and two units at 2,000 lb/day each.

4.7.2.2 Design Guidelines

Typical design guidelines for applied chlorine dosage are provided in Table 4-14.

Table 4-14
Design Criteria
Chlorine Feed Systems

Parameter	Guideline			
	1 PADEP[1]	2 Ten States	3 WEF MOP 8[2]	4 M&E
Chlorine Dosage, mg/L	8	8	NS	2-8

Notes:
1. Minimum dosing capacity.
2. MOP-8 refers to Ten States and M&E, as well as the Chlorine Handbook which provides a range of 6-9 mg/L.

More specifically PADEP guidelines specify that disinfection capacity "shall be adequate to produce an effluent that will meet the fecal coliform limits specified by the Department for that installation. Required disinfection capacity will vary, depending on the uses and points of application of the disinfection chemical. For domestic wastewater, the following minimum dosing capacity may be used as a guide in sizing chlorination facilities."

Table 4-15
Minimum Chlorine Dosing Capacity

Type of Treatment	Chlorine Dosage mg/L
Trickling Filter and Rotating Biological Contactor Effluent	12
Waste Stabilization Pond Effluent	12
Activated Sludge Plant Effluent	8
Tertiary Filtration Effluent	6
Nitrified Effluent	6

PADEP Guidelines do not specify the flow at which these guideline dosages apply. PADEP also specifies that standby equipment of sufficient capacity should be available to replace the largest unit during shutdowns.

4.7.2.3 Evaluation

Table 4-16 summarizes the chlorine feed required for average and peak flow conditions at the target flow of 60 MGD. Assuming one of the larger (5,000 lb/day) feed units is out of service (per PADEP guidelines) the total chlorination capacity is 9,000 lb/day. Based on the values in

Table 4-16, the chlorination feed system has adequate capacity to meet PADEP dosage guidance at average and maximum monthly demands with the largest unit out of service but cannot meet the peak hourly demand.

Table 4-16
Chlorine Feed Requirements

Flow		Chlorine Feed Requirement, lb/day
Condition	Value, MGD	
Average	60	4002
Maximum Monthly	80	5336
Peak Hourly	144	9604

4.7.3 Summary

The existing chlorine feed system has adequate capacity to meet PADEP dosage guidelines at average conditions at the target 60 MGD flow scenario but not for the peak hourly flow. The chlorine contract tank does not meet criteria for chlorine contact time.

If the PADEP design guideline for chlorine feed capacity is to be met an additional chlorine evaporator and chlorinator would be required. However as summarized above PADEP guidelines require disinfection adequate to meet permit requirements. The WRTP typically uses a dosage well below state guidelines with satisfactory performance. This is achieved at a contact time of 38.6 minutes at average flow (16 minutes at peak hourly flow) if all four tanks are used. It is possible therefore that adequate performance could be achieved at a dosage lower than 8 mg/L in the future as well. However the interrelationships between dosage and contact time must be considered.

Disinfection is a function of chlorine dosage and contact time. It might be possible to use a higher chlorine dosage to maintain disinfection efficiency. The maximum applied dosage that could be achieved from the existing system with one unit out of service, (9,000 lb/day total capacity) is approximately 7.5 mg/L at peak hourly flow. While not meeting PADEP guidelines this value is within the range of typical dosages provided by other data and, given the WRTP's past performance, it may be sufficient to provide disinfection *if adequate contact time can be provided.* Since the actual dosage needed depends also on the characteristics of the wastewater,

testing would be warranted to determine whether this dosage provides adequate disinfection performance.

An additional factor to be considered, however, is the WRTP's effluent limit on chlorine residual (0.5 mg/L monthly average, 1.0 mg/L instantaneous maximum). If the higher applied dosage results in an exceedance of the current (and assumed future) TRC limit a dechlorination step would be needed to meet the TRC limit.

4.8 SOLIDS HANDLING

4.8.1 Solids Quantities

Evaluation of solids handling (thickening and dewatering) requires first an estimate of total solids produced in the system.

A typical value for total sludge production from a municipal WWTP is on the order of 1950 pounds of dry solids per day per million gallons of flow, (based upon 1250 lb/MG of primary solids and 700 lb/MG of waste activated sludge (WAS) (M&E, Table 12-7).) This is 0.975 tons dry solids per million gallons of flow (dt/MG).

The following provide estimates of total sludge at the WRTP:

- Waste activated sludge is estimated at 21450 lb/day (based on DELCORA data for WAS sludge pumped from PS-3 and PS-5).
- There are currently two ways to estimate primary solids:
    - Based on data provided by DELCORA for the years 2007 through November 2009, the daily primary sludge production would be estimated at approximately 47,400 lb/day (assuming 36.65 MGD influent flow at 252 mg/L TSS and 59% primary removal efficiency).
    - However primary sludge pumping data indicates a total primary sludge volume of approximately 70,500 /lb/day (169,000 gpd at 5% total solids)

The total sludge quantity is approximately 66,950- lb/day or 0.91 dt/MG at the current average flow using the primary performance data and 91,950 lb/day, (45.98 dt/day) or approximately 1.25 dt/MG of influent flow, using the sludge pumping data

DELCORA's data for sludge fed to the incinerators indicates an average value of 44.2 dt/day for the period Jan 2007-mid November 2009. This would be an apparent value on the order of 1.21 dt/MG and is in reasonable agreement with the total value based on primary sludge pumping data. (Note that this value would also include trucked-in sludge and would normally be slightly higher than the WRTP-generated quantity.) It is assumed that the trucked in sludge quantities will remain approximately the same in the future, and their effect on the total sludge will diminish.

The observed production is based on current influent conditions. As shown in Table 1-2, the future BOD_5 loading is projected to be slightly (5%) higher. This will increase the WAS quantity slightly.

For purpose of this evaluation therefore an overall future sludge generation rate of 1.25 dt/MG is assumed.

Since the thickeners are only used for WAS, this does not affect the DAF analysis.

4.8.2 Thickening

4.8.2.1 Description

The WRTP uses dissolved air flotation (DAF) for thickening the waste activated sludge (WAS) prior to dewatering and thickening. (According to Catania Engineering Associates Drawing 80700-001, sheet 102, primary sludge could be diverted to the DAFs or to the holding tanks; but the DAFs are not used for the primary sludge.)

The system includes four DAF tanks (T-23, T-24, T-25, and T-26) located in Building B-4, each 20 ft wide and 64.5 ft long (in the flotation zone) with a maximum water depth of approximately 10.6 ft. Each DAF tank has its own pressure retention tank; two compressors are provided for the system. Recycle/utility water is fed to the pressure retention tanks; the pressurized water/dissolved air mixture is mixed with influent sludge just prior to entry to the DAF tanks where separation takes place in the flotation zone. Chemical addition (polymer) is used to assist in thickening. The floated solids are removed by a skimmer system. The DAF system dates to the early 1970's.

DELCORA reports that only two of the four DAF tanks can be used for sludge thickening capacity. One cannot be used as a DAF unit because its pressure retention tank no longer meets code requirements for a pressure vessel. This tank is used, with atmospheric air, to separate grease (essentially air flotation, vs. DAF operation.). Of the remaining three DAF tanks, DELCORA reports that, typically, one is out of service and often used to provide repair parts to the other two. Therefore this evaluation assumes that two duty DAF tanks are available for WAS thickening.

4.8.2.2 Current Performance

DAF units typically produce thickened sludge with concentrations up to 4% (40,000 mg/L). Data provided by DELCORA indicates an average of 26,600 gallons per day of "biosolids" pumped from building B-4. Assuming 4% thickened solids, this volume would constitute approximately 8,870 lb/day of solids, which is too low to account for the daily WAS value (~ 21454 lb/day). Capture of the daily WAS in the pumped value would suggest a very high DAF float concentration. Additional evaluation of these values could be of use to confirm existing performance. However DELCORA is in the process of evaluating options for modifying or replacing the thickening system due to the above-noted age and mechanical issues. Therefore this evaluation considers the potential capacity of the DAFs at conventional design values.

4.8.2.3 Design Criteria

General design criteria for DAF units used to thicken WWTP sludge are based primarily on solids loading and hydraulic loading per square foot of tank area. Typical values are provided in Table 4-17.

Table 4-17
Design Criteria
DAF Systems

Parameter		Guideline			
		1 PADEP	2 Ten States	3 WEF MOP 8	4 M&E
Solids loading rate, lb/day/sf	without chemical addition	20	NS	9.6-24	14-30
	with chemical addition	40	NS	"50-100% increase	Up to 45
Hydraulic loading rate, gpm/sf		0.8	NS	0.5-2	0.2-4

Notes:
NS: Not Specified

4.8.2.4 Evaluation

Based upon current data and at the target flow of 60 MGD and the influent conditions in Table 1-2 the estimated WAS loading to the DAF would be approximately 38,400 lb/day of slides and 460,600 gpd of WAS. Peak loads would be approximately 75,000 lb/day and 899,600 gpd. Table 4-18 provides estimated operating values for solids loading rate and hydraulic loading rate at the target value of 60 MGD.

Table 4-18
Estimated DAF Operating Loadings at 60 MGD

Parameter	Value at average loading	Value at peak loading
Solids Loading Rate, lb/day/sf	14.9	29
Hydraulic loading rate, gpm/sf (1)	0.13	0.25

Notes:
1. assumes estimated WAS at 60 MGD settles to 10,000 mg/L.

4.8.3 Sludge Holding Tanks

The WRTP has four (4) tanks (ET-1, ET-2, ET-3, and ET-4) currently used for sludge holding (note these tanks were originally designed as digesters prior to construction of the incinerator. Based upon the design drawings (Catania Engineering Associates, Dwg. 80700-101) each tank is 52 ft in diameter with a 18.5 ft wall height and 16 ft SWD and a 6 ft cone bottom. The estimated

liquid volume for each tank is approximately 250,000 gallons and the combined liquid capacity is approximately 1,000,000 gallons.

The primary sludge is pumped from the primary clarifiers and stored in one of the four sludge storage tanks. The waste activated sludge (WAS) is thickened in the dissolved air flotation (DAF) system. The trucked in grease is also separated in one of the DAF tanks (as noted above, under atmospheric conditions). The WAS and thickened grease are then combined and stored in tank ET-2. This system was recently modified to allow the WAS/grease to be metered into the incinerator feed to help control localized hotspot resulting from the high-BTU value grease in the system. The trucked in sludge is also directed to one of the holding tanks.

4.8.4 Dewatering

4.8.4.1 Description

The WRTP uses belt filter presses (BFPs) for dewatering primary, secondary and trucked-in sludge. There are three (3) Ashbrook 2-meter BFPs installed in building B-3 with space allotted for a fourth BFP.

4.8.4.2 Current Performance

The sludge is pumped from the sludge storage tanks to any one or more of three belt filter presses. Sludge cake from the belt presses have ranged generally from 21% to 26% solids. This indicates good dewatering characteristics of the sludge and good performance by the belt filter presses.

4.8.4.3 Design Criteria

Typical operating values for BFPs, depending on sludge type and feed concentrations are summarized in Table 4-19.

Table 4-19
Loading Criteria
BFP Systems

Parameter	Guideline			
	1 PADEP	2 Ten States	3 WEF MOP 8	4 M&E
Solids loading rate, lb/meter/hour	NS	NS	396-704	200-1,500
Hydraulic throughput, gal/meter/min	NS	NS	20.6-50.7	25-100

NS: Not Specified

Note that PADEP design guidelines do not specify loading rates but do state that the number of mechanical dewatering units "should be sufficient to dewater the sludge produced with one unit out of service. If standby dewatering facilities are not available, adequate storage facilities equivalent to a three-month sludge production, or other means of sludge disposal shall be provided." Even if all sludge was thickened prior to storage the existing WRTP storage tank system does not provide the specified three month capacity.

4.8.4.4 Evaluation

At the conservatively projected sludge generation rate of 1.25 dt/MG the estimated sludge load is summarized in Table 4-20. The peak value is based on the peak day data since short term peaks (i.e. hourly peaks) will not have a major effect on sludge quantity and could be accommodated in the storage system.

Table 4-20
Estimated Sludge Quantity

	Daily Sludge	
	Dt/day	Gallons per day (1)
Average	75	449,800
Peak Daily	165(2)	992,400

Notes:
1. Assumes thickened sludge at 4% total solids.
2. Assumes peak sludge load is determined by peak BOD_5 and TSS loading factors.

Table 4-21 summarizes BFP solids loading rates for average and maximum conditions. Table 4-22 summarizes hydraulic loading rates.

Table 4-21
Belt Filter Press Solids Loading Rates

Condition	Solids Loading Rate, lb/m/day		
	Two Operating 24 hours per day, One Standby[1]	Three Operating 24 hours per day, One Standby [2]	Four Operating 24 hours per day (peak only)
Average	1,560	1,040	--
Peak Daily	3,450	2,300	1,730

Notes:
1. Current condition with three installed BFP.
2. Assumes fourth BFP is installed.

Table 4-22
Belt Filter Press Hydraulic Loading Rates

Condition	Hydraulic Loading Rate, gal/m/min		
	Two Operating 24 hours per day, One Standby[1]	Three Operating 24 hours per day, One standby [2]	Four Operating 24 hours per day (peak only)
Average	78	52	NA[3]
Peak Daily	172	114	86

Notes:
1. Current condition with three installed BFP.
2. Assumes fourth BFP is installed.
3. Not applicable; a spare press is intended at average conditions.

Overall these data indicate that the three existing presses would not be adequate at the target flow of 60 MGD. If a fourth press is added loading rates for three operating presses are within normal ranges. Even with the fourth press operating on peak days, the loading rate is high. However it is possible a combination of four operating presses and optimal use of storage could be used to accommodate this peak day.

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5. SUMMARY

5.1 SUMMARY OF CAPACITY

Based upon the process evaluation, the WRTP does not have sufficient capacity to meet the target conditions (60 MGD capacity). While some of the limitation is based on the increased flow (and the increased wastewater strength over the past several years) an additional and significant constraint is the possible need to nitrify in the future. The effect of the nitrification requirement most directly impacts the aeration basins, the aeration system and the secondary clarifier capacity, where significantly additional capacity is required for nitrification as compared to BOD_5 removal.

5.2 RECOMMENDED UPGRADES TO PROVIDE 60 MGD AVERAGE CAPACITY

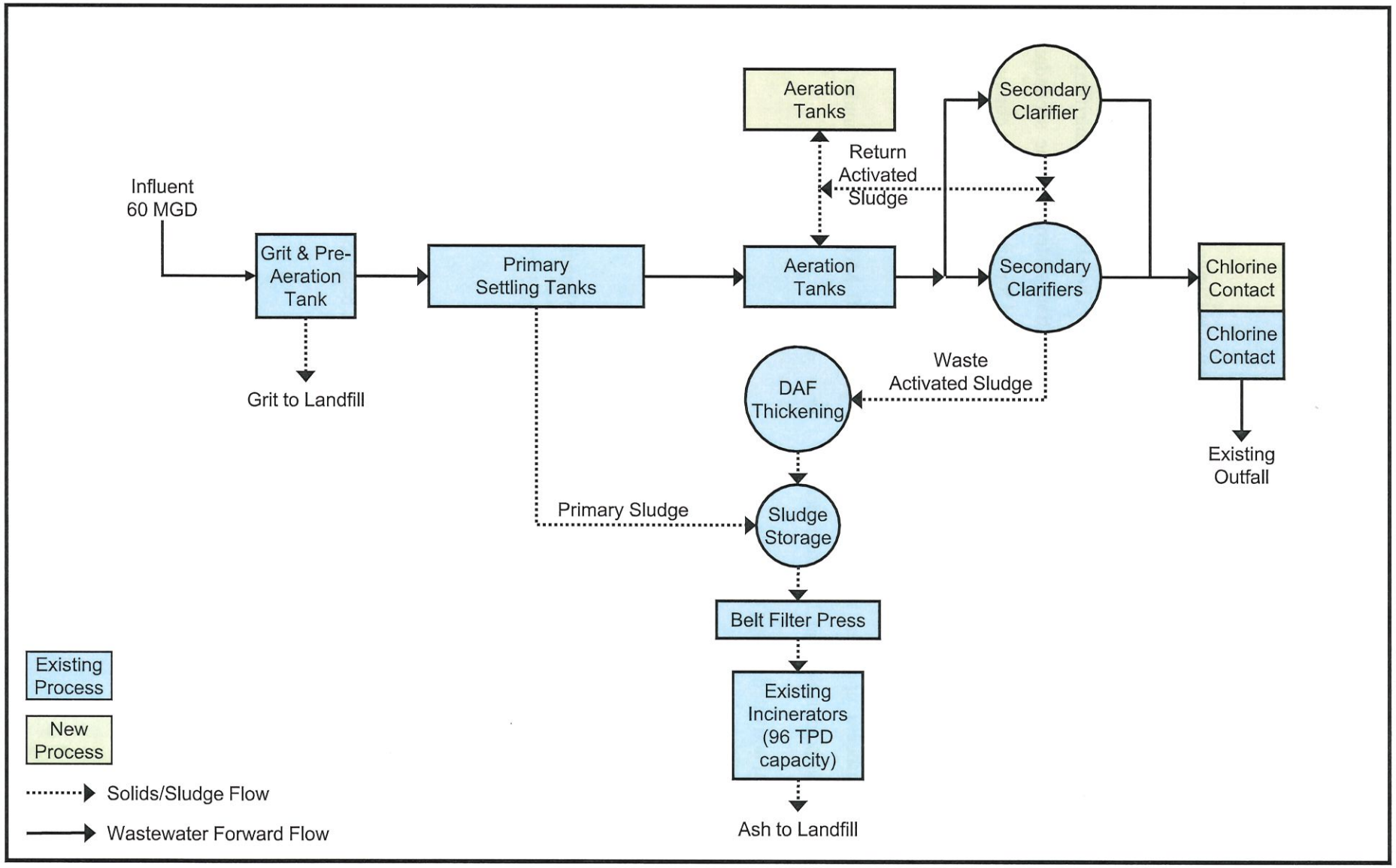
The following process upgrades would be needed to provide 60 MGD capacity under the conditions summarized in Section 2 of this report:

- Additional activated sludge capacity
  - Aeration basins
  - Aeration system
- Secondary clarification system
- Disinfection system
- Dewatering system

A conceptual block flow diagram is shown in Figure 5-1. The following sections outline the nature of these upgrades and provide an estimate of their cost. Figure 5-2 and Figure 5-3 provide conceptual layouts for these upgrades.

5.2.1 Activated Sludge System

Additional activated sludge capacity is needed to provide for BOD_5 removal and nitrification at 60 MGD average flow. This would include both additional aeration basin capacity and additional aeration (blowers).



WRTP Process and Hydraulic Evaluation

Delaware County Regional Water Quality Control Authority

WESTON SOLUTIONS
Restoring Resource Efficiency

FIGURE 5-1
WRTP CONCEPTUAL BLOCK FLOW DIAGRAM

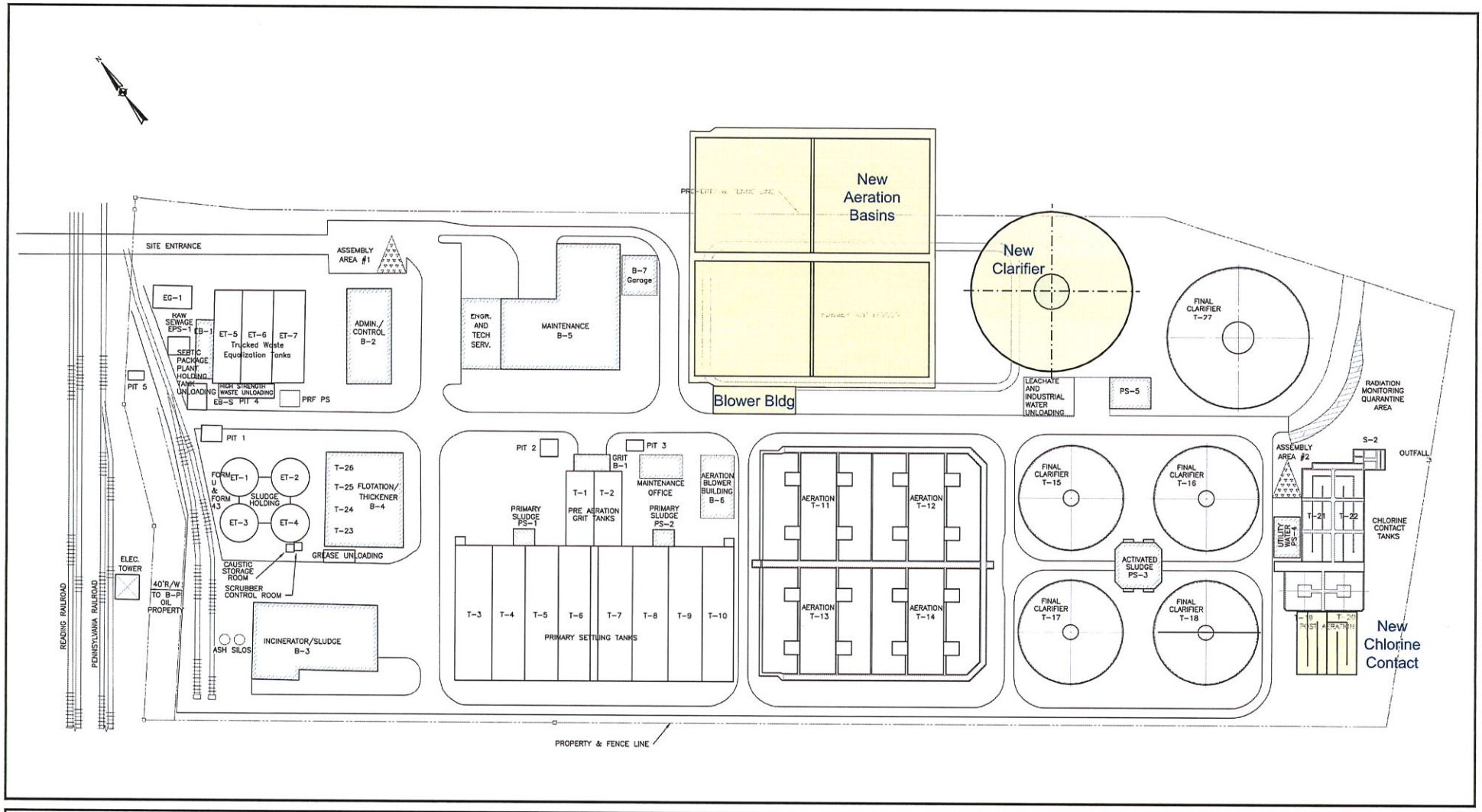


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FIGURE 5-2

WRTP CONCEPTUAL LAYOUT PLAN

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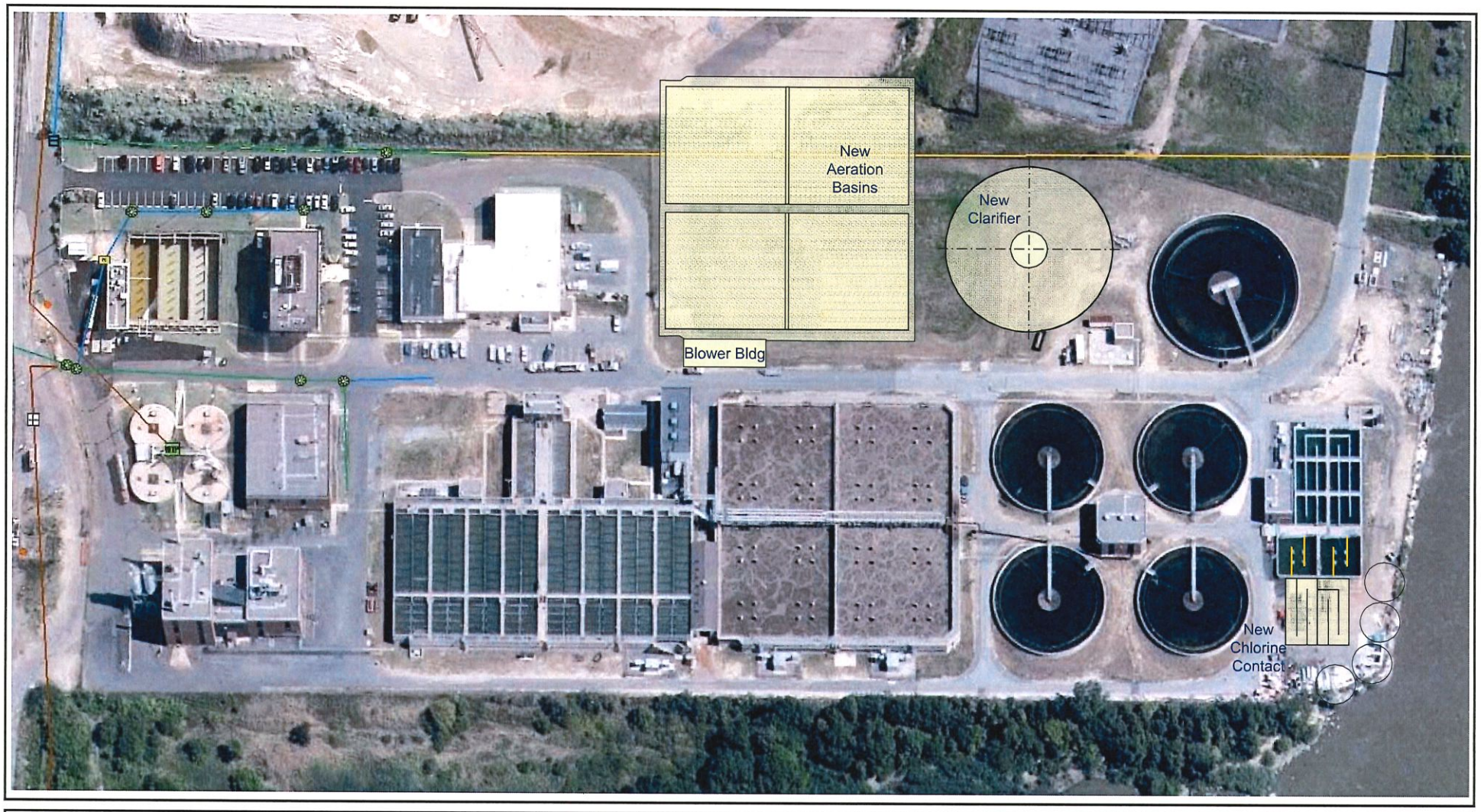

WRTP Process and Hydraulic Evaluation

Delaware County Regional Water
Quality Control Authority

WESTON SOLUTIONS
Restoring Resource Efficiency

FIGURE 5-3

WRTP CONCEPTUAL LAYOUT AERIAL

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Based upon preliminary process calculations, a total aeration volume of approximately 21 million gallons would be needed at operating conditions (MLSS, SRT) comparable to those currently used (which are providing for nitrification). As noted in Section 4, conversion to MBR or IFAS configurations could be considered; however this evaluation assumes expansion with a conventional activated sludge system.

Four new aeration basins would be constructed to the north of the existing system in the area occupied by the former ash lagoon. The new tanks would be pile-supported concrete structures. The foot print would be slightly larger than the existing to provide 11 million gallons of capacity as compared to 10 MG in the existing. As shown on Figure 5-2 and Figure 5-3, this upgrade, along with others, would likely require expansion to the property to the north of the current site. In an effort to reduce this impact the basins could be rectangular as compared to the current square configuration. However space constraints are also present to the east and west (including the need for additional clarification).

5.2.1.1 Aeration Capacity

The total aeration capacity required for nitrification at the 99th percentile peak loads is estimated at approximately 53,900 scfm. This would require additional aeration capacity. Adding four (4) additional blowers in addition to the existing three blowers at 11,000 scfm each would provide a total capacity of 66,000 scfm, slightly less than the calculated value. However, these estimates are based upon preliminary information and the final sizing will need to be determined during preliminary design. It is possible to use slightly larger blowers for the new units with appropriate controls to balance total air flow among the eight aeration basins. For purposes of this budgetary estimate, it is assumed that the four new blowers of the same configuration as the existing would be used. In order to provide for full aeration capacity with one unit offline, per PADEP guidelines, a sixth blower would be needed.

Therefore this upgrade would include three new blowers; a new blower building, similar to the existing, would be constructed. The new aeration basins would use the same panel diffusers as the existing. The building would be a pile-supported foundation with precast panel walls. Another option would be to expand the existing Aeration Blower Building (B-6) and provide an overhead duct to the new aeration basins. Depending upon the space requirements of the

additional blowers, the relocation of other facilities (e.g., Maintenance Office) may be required to accommodate an expansion of B-6.

5.2.1.2 Cost

An order of magnitude estimate for cost for the upgraded activated sludge system is provided in Table 5-1.

Table 5-1
Order of Magnitude Estimate of Cost
Activated Sludge System

Item	Total Cost
Aeration Basins Tankage	$11,700,000
Aeration Basin Pilings	$1,200,000
Blower Control Building, including foundations and pilings	$850,800
Blowers, Installed	$2,163,100
Diffused Aeration System, in basin	$1,765,000
Aeration Header Piping	$645,000
Influent Pipe	$300,000
Influent Pipe Support Pilings	$90,000
Tank Inlet Sluice Gates	$100,000
Subtotal	**$18,813,900**
Power Distribution @ 15%	$2,822,085
Electrical and Controls @2%	$376,378
Total Construction Cost (rounded)	**$22,012,263**

5.2.2 Secondary Clarifier System

5.2.2.1 Description

One additional clarifier would be provided making a total of six units. In order to reduce loading rates for the system the new clarifier would be 200 ft in diameter. For purposes of this evaluation it is assumed the clarifier type would be the overall configuration as T-27.

The new clarifier would be constructed to the west of clarifier T-27 and would tie into pump station PS-5. The new tank would be a pile-supported concrete structure. The feed to the six clarifiers would be modifies to allow the correct area-proportioned flow split among the units and the return from the six clarifiers together would be modified as necessary to provide the necessary RAS split between the old and new aeration basins. As shown on Figure 5-2 and

Figure 5-3 the new clarifier would also require an expansion of the site to the north of the current WRTP property.

5.2.2.2 Cost

An order of magnitude estimate for cost for the upgraded activated sludge system is provided in Table 5-2.

Table 5-2
Order of Magnitude Estimate of Cost
Secondary Clarifier System

Item	Total Cost
Clarifier Tankage	$2,990,000
Clarifier Pilings	$480,000
Clarifier Equipment	$542,000
Piping (Influent, Effluent, RAS, WAS)	$1,410,000
Pipe Support Pilings (Influent, Effluent, RAS, WAS)	$630,000
Pumps (WAS, RAS)	$600,000
Subtotal	**$6,652,000**
Power Distribution(1)	--
Instrumentation and Controls @2%	$133,040
Total Construction Cost (rounded)	**$6,785,000**

Notes:
1. Assumed existing.

5.2.3 Disinfection System

5.2.3.1 Description

The expanded chlorination system would include additional chlorine contact tanks to provide the required contract time and one additional chlorine evaporator/chlorinator.

The new chlorine contact tanks would be constructed on the south side of the post aeration tanks (Figure 5-2 and Figure 5-3) and the system would be modified to allow flow from the new tanks then through the existing. Some demolition in the area south of the post aeration tanks would be needed construct the new tanks. Baffles would be installed in the post aeration tanks to better provide the flow path desired for chlorination and minimize short circuiting. The new tanks would be pile-supported concrete structures.

As shown on Figure 5-2 and Figure 5-3, space in this area for construction is limited, and construction near the existing bulkhead would be complicated.

The new chlorine evaporators and chlorinator would be installed in the chlorine room (in Building B-3).

5.2.3.2 Cost

An order of magnitude estimate for cost for the upgraded activated sludge system is provided in Table 5-3.

Table 5-3
Order of Magnitude Estimate of Cost
Disinfection System

Item	Total Cost
Demolition	$50,000
Chlorine Contact Tank	$1,100,000
Chlorine Contact Tank Pilings	$80,000
Chlorine Evaporator	$14,000
Chlorinator	$8,000
Chlorine Feed Piping	$200,000
Subtotal	**$1,452,000**
Power Distribution(1)	
Electrical and Controls, Is	$10,000
Total Construction Cost (rounded)	**$1,462,000**

Notes:
1. Assumed existing.

5.2.4 Dewatering System

5.2.4.1 Description

To provide the required dewatering capacity with one unit off line, a fourth 2-meter belt filter press would be installed in the filter press room in Building B-3. Space was allotted in this room for a fourth filter press and modifications to the building are therefore not required for this addition.

5.2.4.2 Cost

An order of magnitude estimate for cost for the upgraded activated sludge system is provided in Table 5-4.

Table 5-4
Order of Magnitude Estimate of Cost
Dewatering System

Item	Total Cost
Belt Filter Press, Installed	$335,000
Total Installed Cost (rounded)	**$335,000**

5.2.5 Summary of Upgrades

Table 5-5 provides a summary of the total estimated cost for all process upgrades to provide the target 60 MGD capacity.

Table 5-5
Order of Magnitude Estimate of Cost
Combined Upgrades

Item		Total Cost
Activated Sludge System		$21,496,500
Secondary Clarifier System		$6,785,000
Disinfection System		$1,462,000
Dewatering System		$335,000
Subtotal		**$30,078,200**
Engineering and Legal	20%	$6,015,700
Contingency	25%	$7,519,625
Total (rounded)		**$43,614,000**

5.3 NEW OUTFALL DIFFUSER

5.3.1 Description

In addition the process upgrades discussed above DELCORA is investigating the possible need for an outfall diffuser system. Effluent from the WRTP is currently discharged through three 42-inch diameter openings essentially at the property bulkhead. A new outfall pipe and diffuser would be used to extend the discharge further into the river and better mix the discharge into the stream flow. This would be useful to help address possible future effluent limits that would be based on in-stream quality criteria (primarily Water Quality Based Effluent Limitations (WQBEL's) which may in the future be required to meet DRBC Water Quality Criteria. This section prices an order or magnitude cost for an outfall diffuser system. It should be noted that the degree of mixing required for any particular WQBEL parameter has not been established.

Once the mixing objectives are quantified the design of the diffuser to provide that mixing would be based on, generally by dilution modeling using, for example, the Tidal Cormix model.

5.3.2 Cost

For purposes of this preliminary evaluation it is assumed that a new outfall would be constructed approximately 455 ft into the river, roughly perpendicular to the bulkhead. The outfall would be a pile supported pipe to control settling into the anticipated soft river bottom in the area.

Based upon these assumed design parameters, an order of magnitude estimate for cost for the upgraded activated sludge system is provided in Table 5-6.

Table 5-6
Order of Magnitude Estimate of Cost
Outfall Diffuser System

Item	Total Cost
New Outfall and Diffuser	$2,330,000
Admin / Legal (2%)	$46,600
Contingency (15%)	$349,500
Bond / Insurance (4%)	$93,200
Total Installed Cost (rounded)	**$2,819,300**

6. REFERENCES

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Weston Solutions, 2003b, *Delaware County Regional Water Quality Control Authority, Aeration Systems Upgrade, Permit Modification, Supplemental Information to Accompany the Part II Application, Part II Permit Design Engineer's Report,* November 27,2002

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APPENDIX A

PROJECTED WASTEWATER CHARACTERISTICS

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Table A-1 summarizes the data for the capacity evaluation. This estimate uses a weighted average approach to estimate the combined characteristics at 60 MGD from the three main anticipated wastewater sources: DELCORA's existing sources, the Southwest Delaware County Municipal Authority (SWDCMA) and other future flows.

Table A-1
Estimated Wastewater Characteristics for Capacity Evaluation

Parameter	Source			Weighted Average Characteristics (rounded)
	DELCORA	SWDCMA	Other Future Sources (1)	
Flow, MGD	36.65	6	17.35	
BOD_5, mg/L	199	317	190	208
COD, mg/L	471	718	430	484
TSS, mg/L	252	351	210	250
Total Nitrogen, mg/L	19.7	40	40	28
Ammonia Nitrogen, mg/L	10.7	25	25	16
Oil and Grease, mg/L	21.6	90	90	48
Alkalinity, as $CaCO_3$, mg/L	90	90	90	90

Notes:
1. Parameter values from M&E, Fourth Edition, 2003, Table 3-15.

Wastewater Flow

Average daily waste water flows included:

- Existing DELCORA flow, approximately 36.65 MGD average based on January 2007-November 2009 data.
- Anticipated SWDCMA flow using the full rated capacity of 6 MGD. Based on the Chapter 94 Report, the projected 2013 flow is 5.8 MGD. It is assumed DELCORA would take over the full rated capacity of 6 MGD.
- Remaining flow from other sources up to a maximum of 60 MGD daily average.

Wastewater Characteristics;

The following estimates were used:

- For those parameters for which DELCORA has influent data (BOD_5, COD, Total Nitrogen, Ammonia, Oil and Grease), the values in Table A-1 are the averages based on 2007-2009 data.
- For the SWDCMA plant, the BOD_5 value is based upon the projected 2013 BOD_5 loading (15,346 lb/day) and the projected 2013 flow of 5.8 MGD. It is assumed the concentration will remain the same as the flow increases to the rated 6 MGD.
- For all other flow, this evaluation uses typical medium strength wastewater characteristic values from Metcalf and Eddy, Wastewater Engineering, Fourth Edition 2003, Table 3-15. Note that PADEP's Municipal WWTP guidance and Recommended Standards for Wastewater Facilities, 2004 Edition ("Ten States Standards") do not provide constituent data to be used for planning. (PADEP guidance for BOD_5 only provides loads on a per capita basis.) Ten States Standards references M&E Fourth Edition waste strength data in Appendix A (related to septage handling and treatment).
- The those parameters for DELCORA for which data are not available have been estimated from the M&E data using the ratio of DELCORA's BOD_5 (199 mg/L) to the M&E value (220 mg/L), assuming that the other parameters would vary in proportion to the BOD_5 levels. The same procedure was used for SWDCMA data except for nitrogen and O& G levels for which, at DELCORA's recommendation the M&E values were used.

Assumed alkalinity values are provided because the nitrification evaluation would need to consider whether there is adequate alkalinity in the system.

APPENDIX B

DISCUSSION WITH DRBC REGARDING $CBOD_{20}$ WASTE LOAD ALLOCATION

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1400 Weston Way
West Chester, PA 19380

MEMO

10 December 2009

To: Rob Hindt

From: Bill Lowe, Weston Solutions, Inc.

Subj: Possible transfer of DRBC $CBOD_{20}$ Waste Load Allocation to WRTP

I spoke with Steve Walsh of DRBC regarding whether, if one plant closes and connects to another, the closing facility's $CBOD_{20}$ Waste Load Allocation (WLA) would be transferred to the receiving facility. I did not identify the specific situation or the plants involved. Since the answer to the question depends in part on where the plants are, I indicated only that the facilities would be in Zones 4 or 5 of the estuary (DELCORA's WRTP is in Zone 4).

As a point of clarification the $CBOD_{20}$ WLAs are applied only to plants discharging to the estuary, i.e. the Delaware River or the tidal portions of its tributaries. For plants located on the non-tidal portions of tributaries, the BOD_5 limits are based on DRBC's Water Quality Criteria for those tributaries.

SCENARIO 1: Assuming both plants discharge to the estuary and therefore have WLAs:

- In general the receiving plant would get some or all of the allocation from the closing plant.
- How much of a closing plant's allocation would be transferred to the receiving plant depends where the plants are located.
    - If they are located in the same Zone and if that Zone has capacity remaining, the receiving plant could get all or most of the closing plant's allocation. (This is the case for Zone 4 where DELCORA is located and may have been the situation when, for example, the Muckinapates and Darby Creek Plants were closed in 1977).
    - By contrast, in Zone 2, which is already over-allocated, the receiving plant would probably not get the allocation.
- If both plants discharge to the estuary but in different Zones, the transfer of allocation would not likely be linear, since the available capacity in the two Zones may differ.

SCENARIO 2: Assuming the closing plant does not discharge to a tidal tributary:

- If the closing plant discharges to a non tidal tributary, such that it doesn't have an allocation, then whether the receiving plant's allocation is adjusted for taking the new load would be case-specific.

In general if the receiving plant has room in its existing allocation to accommodate the closing plant, they probably won't increase the allocation. Basically this situation would require them to review the case to make a determination.
Based upon my review of the existing Waste Load Allocation document (revision dated 1 October 2000) it does not appear that the Southwest plant has an allocation. I infer it does not discharge to a tidal portion of a tributary. If this is the case then I think Scenario 2 above would apply.

As a matter of information DRBC also advises that they are working on a revision to the waste load allocation document and it will likely be promulgated in 2010.

APPENDIX C

HYDRAULIC CALCULATIONS

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Maximum Forward Flow Analysis (Individual Processes): Pre-aeration Tank and Primary Clarifier

Primary Clarifier

Weir Type	90°	V-notch
Notch Spacing	6	inches
Weir Length	2,644	feet
No. of Notches	5,288	
Bottom Weir EL.	24.64	feet
Max Weir Head	**2.50**	inches
Max W.L.EL. in Primary	24.85	feet
Flow/Notch	22.23	gpm
Max Flow	**169.3**	MGD

Grit and Pre-aeration Tanks

Estimated Head Loss	
(2) 6ft sluice gates	0.1
(2) Grit Chambers	
(2) 8ft slide gates	
Influent Flume	
(2) 2ft slide gates	

W.L.EL. Grit & Pre-aeration Tanks (ft) **24.95**

Maximum Forward Flow Analysis (Individual Processes): Aeration Basins - Minimum Effluent Weir Elevation

North Train = T -11 and T -12 operating in series
South Train = T-13 and T -14 operating in series

Forward Flow	**108.6**	MGD
Recycle Ratio	**0.53**	
Recycle Rate	**57.6**	MGD
Total Flow	166.2	
Friction Factor 'C'	100	

Head Loss Through 60-in Daimeter Steel Influent Pipe

	Total Flow %	Pipe Flow %	Pipe Flow (MGD)	Velocity (ft/sec)	Equivalent Length (Feet) Horiz. Pipe	90 ° Elbow	Thru-Tee	Gate Valve	Branch - Tee	Sluice Gate	hf	Influent Box	Pipe Entrance	Pipe Exit	Delta Z	Total Head
To B	**0.391**	1.000	109	8.56	86	450					2.63		0.888			**4.24**
		0.391	42	3.35					300	40	0.29			0.17	0.26	
To C	**0.206**	1.000	109	8.56	86	450					2.63		0.888			**4.25**
		0.609	66	5.21	70		100				0.33					
		0.206	22	1.76					300	40	0.09			0.05	0.26	
To D	**0.212**	1.000	109	8.56	86	450					2.63		0.888			**4.25**
		0.609	66	5.21	70		100				0.33					
		0.403	44	3.45	80		100	40			0.20					
		0.212	23	1.81					300	40	0.09	**0.051**		0.05		
To E	**0.191**	1.000	109	8.56	86	450					2.63		0.888			**4.25**
		0.609	66	5.21	70		100				0.33					
		0.403	44	3.45	80		100	40			0.20					
		0.191	21	1.64	70		100				0.04					
		0.191	21	1.64					300	40	0.08	**0.042**		0.04		

Check: **1.000**

Discharge from (4) 12-ft Rectangular Effluent Weirs Per Trair

	Total Flow (MGD)	Weir Head (ft)	Minimum Crest EL. (ft)	Basin W.L. EL. (ft)
South Train (B,C)	99	0.99	19.32	20.31
North Train (D,E)	67	0.76	19.32	20.08

Max WL EL in primary effluent channel (ft)	24.56
W.L. EL. In Primary Effluent Channel (ft)	**24.56**

OK!

Maximum Forward Flow Analysis (Individual Processes): Secondary Clarifiers - Minimum Aeration Basin Effluent Weir Elevation

Forward Flow	**118.2**	MGD
Recycle Ratio (α)	**0.53**	
Recycle Rate	**62.6**	MGD
Total Flow:	180.8	

W.L. EL in Clarifiers

	Area (ft^2)	% Area	Apportioned Flow (gpm)	Circumference (ft) Inboard Trough Inner[1]	Circumference (ft) Inboard Trough Outer[2]	Circumference (ft) Perlferal[3]	Flow per Notch (gpm)	Weir Head (ft)	Bottom V-Notch EL. (ft)	Max W.L. EL. (ft)	Clarifier W.L. EL. (ft)	
T-27	24053	31.2%	25592	446	465	533	18.4	0.19	15.50	15.71	**15.69**	OK!
T-15	13273	17.2%	14123	360	364	NA	9.8	0.15	15.34	15.55	**15.49**	OK!
T-16	13273	17.2%	14123	360	364	NA	9.8	0.15	15.34	15.55	**15.49**	OK!
T-17	13273	17.2%	14123	360	364	NA	9.8	0.15	15.34	15.55	**15.49**	OK!
T-18	13273	17.2%	14123	360	364	NA	9.8	0.15	15.34	15.55	**15.49**	OK!
Total:	77146	100%	82083									

1. 6-inch v-notch spacing
2. 24-inch v-notch spacing on T-27 only
3. 24-inch v-notch spacing on T-27 only

Flow Rate	118.2	MGD
Flow Rate	82,083	gpm
Friction Factor 'C'	100	

	Line Size (in)	Area Apportioned Flow %	Flow Rate (MGD)	Velocity (ft/sec)	Equivalent Length (Feet) Horiz. Pipe	90 ° Elbow	45 ° Elbow	Thru-Tee	Branch -Tee	Gate Valve	Control Valve	Head Loss (Feet) friction loss (ft)	Reducer	Enlarger	Pipe Entrance	Pipe Exit	CV Head	Weir Head	Total Head	Bottom V-Notch EL. (ft)	Clarifier W.L. EL.
To T-27	72	31.2%	37	2.02	287.5		384	120				0.22			0.049			0.19	**3.53**	15.50	15.69
	42		37	5.93	237.5	210	112			26.7	63	2.44	0.08			0.55	**0.00**				
To T-15	72	17.2%	81	4.45	150				360			0.21			0.240			0.26	**3.53**	15.34	15.60
	42		20	3.27	110	105	56					0.34				0.17					
	36		20	4.45	10					22.7	55	0.23	0.05	0.012			**2.02**				
To T-16	72	17.2%	81	4.45	150			120				0.22	0.02		0.240			0.26	**3.53**	15.34	15.60
	54		41	3.96	45				270			0.42									
	42		20	3.27	110	105	56					0.34				0.17					
	36		20	4.45	10					22.7	55	0.23	0.04	0.012			**1.58**				
To T-17	72	17.2%	81	4.45	150				360			0.21			0.240			0.26	**3.53**	15.34	15.60
	42		20	3.27	110	105	56					0.34				0.17					
	36		20	4.45	10					22.7	55	0.23	0.05	0.012			**2.02**				
To T-18	72	17.2%	81	4.45	150			120				0.22	0.02		0.240			0.26	**3.53**	15.34	15.60
	54		41	3.96	45				270			0.42									
	42		20	3.27	110	105	56					0.34				0.17					
	36		20	4.45	10					22.7	55	0.23	0.04	0.012			**1.58**				
Check:		100.0%																			

Maximum Allowable Aeration Basin Effluent W.L. EL. (ft)	19.22	
Aeration Basin Effluent W.L EL. (ft)	**19.22**	OK!

Maximum Forward Flow Analysis (Individual Processes): Chlorine Contact Tanks

Flow Rate	131.1	MGD
Flow Rate	91,042	gpm
Friction Factor 'C'	100	

Check water surface elevation in the secondary clarifier effluent channel

	Max Crest Elevation (ft)	Total Weir Length (ft)	Wier Head (ft)	Contact Tank W.L. EL (ft)
Contact Tank Effluent Weir	12.65	40	0.96	13.61

					Equivalent Pipe Length (Feet)			Head Loss (Feet)							
	Line Size (in)	Area Apportioned Flow %	Flow Rate (MGD)	Velocity (ft/sec)	Horiz. Pipe	90 ° Elbow	45 ° Elbow	hf (ft)	Pipe Entrance	Expansion	Pipe Exit	Total Head	Bottom V-Notch EL. (ft)	Max Clarifier Effluent W.L. EL. (ft)	Clarifier Effluent W.L. EL. (ft)	
T-27 Effluent	42	31.2%	41	6.57	25	125	55	0.93	0.34	0.03		1.80	15.50	15.42	**15.42**	OK!
	60		41	3.22	190		240	0.35			0.16					
T-15 Effluent	42	17.2%	23	3.63	140	125	80	0.40	0.10	0.01		1.58	15.34	15.26	**15.20**	OK!
	60		45	3.55	35			0.11								
	60		90	7.11	50			0.17			0.78					
T-16 Effluent	42	17.2%	23	3.63	30	125	80	0.24	0.10	0.01		1.58	15.34	15.26	**15.20**	OK!
	60		90	7.11	50			0.45			0.78					
T-17 Effluent	42	17.2%	23	3.63	140	125	80	0.40	0.10	0.01		1.58	15.34	15.26	**15.20**	OK!
	60		45	3.55	35			0.11								
	60		90	7.11	50			0.17			0.78					
T-18 Effluent	42	17.2%	23	3.63	30	125	80	0.24	0.10	0.01		1.58	15.34	15.26	**15.20**	OK!
	60		90	7.11	50			0.45			0.78					
	Check:	100.0%														

Check water elevation in the chlorine contact tank effluent channel

	Line Size (in)	Flow Rate (MGD)	Velocity (ft/sec)	Pipe Entrance	Pipe Exit	Total Head (ft)
Single Mag Meter Losses	54	131	12.75	1.26	2.02	3.28

	Min Crest Elevation (ft)	Flow Rate (MGD)	Weir Length (ft)	Wier Head (ft)	MeterTank W.L. EL (ft)
Outfal Weir	7.00	131	11	2.28	9.28

Crest Contact Tank Effluent Weir Elevation (ft)	12.65	
Max Outfall W.L. EL. Elevation (ft)	12.57	
W.L. EL. Downstream of Contact Tank Weir (ft)	**12.56**	OK!

Check influent water elevation at the outfall structure

High Tide Elevation (ft)	3.2
Outfall Pipe Invert (ft)	-3

	Line Size (in)	Flow Rate (MGD)	Velocity (ft/sec)	Pipe Entrance	Pipe Expansion	Pipe Exit	Total Head (ft)
Triple Outfall Pipe Losses	42	44	7.03	0.38	0.03	0.77	1.18

Crest Outfall Weir Elevation (ft)	7.00	
W.L. EL. Downstream of Outfall Weir (ft)	**4.38**	OK!

Maximum Forward Flow Analysis (Entire Treatment Works): Pre-aeration Tank and Primary Clarifier

Primary Clarifier

Maximum Forward Flow	**95.5**	MGD

Downstream

Weir Type	90°	V-notch	given				
Notch Spacing	6	inches	given				
Weir Length	2644	feet	given				
No. of Notches	5288		given				
Flow/Notch	12.54	gpm	calc				
Bottom Weir EL.	24.64	feet	given				
Weir Head	1.99	inches	calc	OK!			
W.L.EL. Primary Settling Forward Flow	24.81	feet	calc				
W.L.EL. Primary Settling Backwater	24.56	feet	calc				
Max of forward flow and backwater	24.81	feet	calc				
Slide gate area 2'x2'	4.0	ft^2	given				
Flow per gate (12 gates)	7.96	MGD	calc				
Head loss through gate	0.3953	ft	calc (submerged rectangular orifice)				
Influent Flume WL EL	25.201	ft	calc				
Invert slide gate (8'x5')	21.2	ft	given				
Slide gate width	8	ft	given				
Preaeration Tank WL EL for given Q	25.2239	ft		2xQgate=	95.5	MDG	match? (submerged weir)
Head loss through gate	0.0229	ft	calc				
Baffle Wall Crest Elevation	22.75	ft	given				
Baffle Length	30	ft	given				
Grit Tank WL EL for given Q	25.2262	ft		2xQbaffle=	95.4	MDG	match? (submerged weir)
Head loss over baffle	0.0023	ft	calc				
Invert slide gates (6'x5.5')	21.5	ft	given				
Slide gate width	6.0	ft	given				
Grit Tank Influent WL EL for given Q	25.2883	ft		2xQgate=	95.5	MDG	match? (submerged weir)
Head loss through gate	0.0621	ft	calc				

Upstream

Maximum Forward Flow Analysis (Individual Processes): Aeration Basins - Maximum Effluent Weir Elevation

North Train = T -11 and T -12 operating in series
South Train = T-13 and T -14 operating in series

Forward Flow	**95.5**	MGD
Recycle Ratio (α)	**0.53**	
Recycle Rate	**50.6**	MGD
Total Flow	146.1	
Friction Factor 'C'	100	

Head Loss Through 60-in Daimeter Steel Influent Pipe

last turn discharge

	Total Flow %	Pipe Flow %	Pipe Flow (MGD)	Velocity (ft/sec)	Equivalent Length (Feet) Horiz. Pipe	90° Elbow	Thru-Tee	Gate Valve	Branch - Tee	Sluice Gate	hf	Influent Box	Pipe Entrance	Pipe Exit	Delta Z	Total Head
To B	**0.386**	1.000	96	7.53	86	450					2.07		0.686			**3.37**
		0.386	37	2.90					300	40	0.23			0.13	0.26	
To C	**0.187**	1.000	96	7.53	86	450					2.07		0.686			**3.37**
		0.615	59	4.63	70		100				0.27					
		0.187	18	1.41					300	40	0.06			0.03	0.26	
To D	**0.226**	1.000	96	7.53	86	450					2.07		0.686			**3.37**
		0.615	59	4.63	70		100				0.27					
		0.428	41	3.22	80		100	40			0.18					
		0.226	22	1.70					300	40	0.08	0.045		0.04		
To E	**0.202**	1.000	96	7.53	86	450					2.07		0.686			**3.37**
		0.615	59	4.63	70		100				0.27					
		0.428	41	3.22	80		100	40			0.18					
		0.202	19	1.52	70		100				0.03					
		0.202	19	1.52					300	40	0.07	0.036		0.04		

Check: **1.000**

Discharge from (4) 12-ft Rectangular Effluent Weirs Per Train

	Total Flow (MGD)	Weir Head (ft)	**Maximum** Crest EL. (ft)	Basin W.L. EL. (ft)
South Train (B,C)	84	0.88	20.3	21.18
North Train (D,E)	62	0.72	20.3	21.02

Max WL EL in primary effluent channel (ft)	24.56
W.L. EL. In Primary Effluent Channel (ft)	**24.56**

OK!

Maximum Forward Flow Analysis (Individual Processes): Secondary Clarifiers - Maximum Aeration Basin Effluent Weir Elevation

Forward Flow	**135.5**	MGD
Recycle Ratio	**0.53**	
Recycle Rate	**71.8**	MGD
Total Flow:	207.3	

W.L. EL in Clarifiers

	Area (ft^2)	% Area	Apportioned Flow (gpm)	Circumference (ft) Inboard Trough Inner[1]	Outer[2]	Periferal[3]	Flow per Notch (gpm)	Weir Head (ft)	Bottom V-Notch EL. (ft)	Max W.L. EL. (ft)	Clarifier W.L. EL. (ft)	
T-27	24053	31.2%	29338	446	465	533	21.1	0.20	15.50	15.71	**15.70**	OK!
T-15	13273	17.2%	16190	360	364	NA	11.2	0.16	15.34	15.55	**15.50**	OK!
T-16	13273	17.2%	16190	360	364	NA	11.2	0.16	15.34	15.55	**15.50**	OK!
T-17	13273	17.2%	16190	360	364	NA	11.2	0.16	15.34	15.55	**15.50**	OK!
T-18	13273	17.2%	16190	360	364	NA	11.2	0.16	15.34	15.55	**15.50**	OK!
Total:	77146	100%	94097									

1. 6-inch v-notch spacing
2. 24-inch v-notch spacing on T-27 only
3. 24-inch v-notch spacing on T-27 only

Flow Rate	135.5	MGD
Flow Rate	94,097	gpm
Friction Factor 'C'	100	

	Line Size (in)	Area Apportioned Flow %	Flow Rate (MGD)	Velocity (ft/sec)	Equivalent Length (Feet) Horiz. Pipe	90 ° Elbow	45 ° Elbow	Thru-Tee	Branch -Tee	Gate Valve	Control Valve	Head Loss (Feet) friction loss (ft)	Reducer	Enlarger	Pipe Entrance	Pipe Exit	CV Head	Weir Head	**Total Head**	Bottom V-Notch EL. (ft)	Clarifier W.L. EL.
To T-27	72	31.2%	42	2.31	287.5		384	120				0.28			0.065			0.20	**4.52**	15.50	15.70
	42		42	6.79	237.5	210	112			26.7	63	3.15	0.11			0.72	**0.00**				
To T-15	72	17.2%	93	5.10	150				360			0.27			0.315			0.28	**4.52**	15.34	15.62
	42		23	3.75	110	105	56					0.44				0.22					
	36		23	5.10	10					22.7	55	0.30	0.06	0.016			**2.63**				
To T-16	72	17.2%	93	5.10	150			120				0.28	0.03		0.315			0.28	**4.52**	15.34	15.62
	54		47	4.54	45				270			0.54									
	42		23	3.75	110	105	56					0.44				0.22					
	36		23	5.10	10					22.7	55	0.30	0.05	0.016			**2.05**				
To T-17	72	17.2%	93	5.10	150				360			0.27			0.315			0.28	**4.52**	15.34	15.62
	42		23	3.75	110	105	56					0.44				0.22					
	36		23	5.10	10					22.7	55	0.30	0.06	0.016			**2.63**				
To T-18	72	17.2%	93	5.10	150			120				0.28	0.03		0.315			0.28	**4.52**	15.34	15.62
	54		47	4.54	45				270			0.54									
	42		23	3.75	110	105	56					0.44				0.22					
	36		23	5.10	10					22.7	55	0.30	0.05	0.016			**2.05**				
Check:	100.0%																				

Maximum Allowable Aeration Basin Effluent W.L. EL. (ft)	20.22	
Aeration Basin Effluent W.L EL. (ft)	**20.22**	OK!

Maximum Forward Flow Analysis (Individual Processes): Aeration Basins - Maximum Effluent Weir Elevation

North Train = T -11 and T -12 operating in series
South Train = T-13 and T -14 operating in series

Forward Flow	**144.0**	MGD
Recycle Ratio (α)	**0.53**	
Recycle Rate	**76.3**	MGD
Total Flow	220.3	
Friction Factor 'C'	100	

Head Loss Through 60-in Daimeter Steel Influent Pipe

last turn discharge

	Total Flow %	Pipe Flow %	Pipe Flow (MGD)	Velocity (ft/sec)	Equivalent Length (Feet) Horiz. Pipe	90° Elbow	Thru-Tee	Gate Valve	Branch - Tee	Sluice Gate	hf	Influent Box	Pipe Entrance	Pipe Exit	Delta Z	Total Head
To B	**0.402**	1.000	144	11.35	86	450					4.43		1.561			**7.09**
		0.402	58	4.56					300	40	0.52			0.32	0.26	
To C	**0.233**	1.000	144	11.35	86	450					4.43		1.561			**7.09**
		0.598	86	6.79	70		100				0.54					
		0.233	34	2.64					300	40	0.19			0.11	0.26	
To D	**0.192**	1.000	144	11.35	86	450					4.43		1.561			**7.09**
		0.598	86	6.79	70		100				0.54					
		0.365	53	4.14	80		100	40			0.28					
		0.192	28	2.18					300	40	0.13	0.074		0.07		
To E	**0.173**	1.000	144	11.35	86	450					4.43		1.561			**7.10**
		0.598	86	6.79	70		100				0.54					
		0.365	53	4.14	80		100	40			0.28					
		0.173	25	1.96	70		100				0.05					
		0.173	25	1.96					300	40	0.11	0.060		0.06		

Check: **1.000**

Discharge from (4) 12-ft Rectangular Effluent Weirs Per Train

	Total Flow (MGD)	Weir Head (ft)	**Maximum** Crest EL. (ft)	Basin W.L. EL. (ft)
South Train (B,C)	140	1.24	20.3	21.54
North Train (D,E)	80	0.86	20.3	21.16

Max WL EL in primary effluent channel (ft)	24.56
W.L. EL. In Primary Effluent Channel (ft)	**28.64**

FAIL!

144MGD Forward Flow Analysis: Secondary Clarifiers

Forward Flow	144.0	MGD
Recycle Ratio	0.53	
Recycle Rate	76.3	MGD
Total Flow:	220.3	

W.L. EL in Clarifiers

	Area (ft^2)	% Area	Apportioned Flow (gpm)	Circumference (ft) Inboard Trough Inner[1]	Outer[2]	Periferal[3]	Flow per Notch (gpm)	Weir Head (ft)	Bottom V-Notch EL. (ft)	Max W.L. EL. (ft)	Clarifier W.L. EL. (ft)	
T-27	24053	31.2%	31178	446	465	533	22.4	0.21	15.50	15.71	**15.71**	OK!
T-15	13273	17.2%	17205	360	364	NA	11.9	0.16	15.34	15.55	**15.50**	OK!
T-16	13273	17.2%	17205	360	364	NA	11.9	0.16	15.34	15.55	**15.50**	OK!
T-17	13273	17.2%	17205	360	364	NA	11.9	0.16	15.34	15.55	**15.50**	OK!
T-18	13273	17.2%	17205	360	364	NA	11.9	0.16	15.34	15.55	**15.50**	OK!
Total:	77146	100%	100000									

1. 6-inch v-notch spacing
2. 24-inch v-notch spacing on T-27 only
3. 24-inch v-notch spacing on T-27 only

Flow Rate	144.0	MGD
Flow Rate	100,000	gpm
Friction Factor 'C'	100	

	Line Size (in)	Area Apportioned Flow %	Flow Rate (MGD)	Velocity (ft/sec)	Equivalent Length (Feet) Horiz. Pipe	90 ° Elbow	45 ° Elbow	Thru-Tee	Branch -Tee	Gate Valve	Control Valve	Head Loss (Feet) friction loss (ft)	Reducer	Enlarger	Pipe Entrance	Pipe Exit	CV Head	Weir Head	Total Head	Bottom V-Notch EL. (ft)	Clarifier W.L. EL.
To T-27	72	31.2%	45	2.46	287.5		384	120				0.31			0.073			0.21	**5.05**	15.50	15.71
	42		45	7.22	237.5	210	112			26.7	63	3.52	0.12			0.81	**0.00**				
To T-15	72	17.2%	99	5.42	150				360			0.30			0.356			0.28	**5.05**	15.34	15.62
	42		25	3.98	110	105	56					0.49				0.25					
	36		25	5.42	10					22.7	55	0.34	0.07	0.018			**2.95**				
To T-16	72	17.2%	99	5.42	150			120				0.31	0.04		0.356			0.28	**5.05**	15.34	15.62
	54		50	4.82	45				270			0.60									
	42		25	3.98	110	105	56					0.49				0.25					
	36		25	5.42	10					22.7	55	0.34	0.06	0.018			**2.31**				
To T-17	72	17.2%	99	5.42	150				360			0.30			0.356			0.28	**5.05**	15.34	15.62
	42		25	3.98	110	105	56					0.49				0.25					
	36		25	5.42	10					22.7	55	0.34	0.07	0.018			**2.95**				
To T-18	72	17.2%	99	5.42	150			120				0.31	0.04		0.356			0.28	**5.05**	15.34	15.62
	54		50	4.82	45				270			0.60									
	42		25	3.98	110	105	56					0.49				0.25					
	36		25	5.42	10					22.7	55	0.34	0.06	0.018			**2.31**				
Check:		100.0%																			

Maximum Allowable Aeration Basin Effluent W.L. EL. (ft)	20.22
Aeration Basin Effluent W.L EL. (ft)	**20.76**

FAIL!

144MGD Forward Flow Analysis: Chlorine Contact Tanks

Flow Rate	144	MGD
Flow Rate	100,000	gpm
Friction Factor 'C'	100	

Check water surface elevation in the secondary clarifier effluent channel

	Max Crest Elevation (ft)	Total Weir Length (ft)	Wier Head (ft)	Contact Tank W.L. EL (ft)
Contact Tank Effluent Weir	12.65	40	1.03	13.68

					Equivalent Pipe Length (Feet)			Head Loss (Feet)								
	Line Size (in)	Area Apportioned Flow %	Flow Rate (MGD)	Velocity (ft/sec)	Horiz. Pipe	90 ° Elbow	45 ° Elbow	hf (ft)	Pipe Entrance	Expansion	Pipe Exit	Total Head	Bottom V-Notch EL. (ft)	Max Clarifier Effluent W.L. EL. (ft)	Clarifier Effluent W.L. EL. (ft)	
T-27 Effluent	42	31.2%	45	7.22	25	125	55	1.11	0.40	0.03		2.15	15.50	15.42	**15.83**	FAIL!
	60		45	3.54	190		240	0.41			0.19					
T-15 Effluent	42	17.2%	25	3.98	140	125	80	0.48	0.12	0.01		1.90	15.34	15.26	**15.57**	FAIL!
	60		50	3.90	35			0.13								
	60		99	7.81	50			0.21			0.95					
T-16 Effluent	42	17.2%	25	3.98	30	125	80	0.28	0.12	0.01		1.90	15.34	15.26	**15.57**	FAIL!
	60		99	7.81	50			0.54			0.95					
T-17 Effluent	42	17.2%	25	3.98	140	125	80	0.48	0.12	0.01		1.90	15.34	15.26	**15.57**	FAIL!
	60		50	3.90	35			0.13								
	60		99	7.81	50			0.21			0.95					
T-18 Effluent	42	17.2%	25	3.98	30	125	80	0.28	0.12	0.01		1.90	15.34	15.26	**15.57**	FAIL!
	60		99	7.81	50			0.54			0.95					
	Check:	100.0%														

Check water elevation in the chlorine contact tank effluent channel

	Line Size (in)	Flow Rate (MGD)	Velocity (ft/sec)	Pipe Entrance	Pipe Exit	Total Head (ft)
Single Mag Meter Losses	54	144	14.01	1.52	2.44	3.96

	Min Crest Elevation (ft)	Flow Rate (MGD)	Weir Length (ft)	Wier Head (ft)	MeterTank W.L. EL (ft)
Outfal Weir	7.00	144	11	2.43	9.43

Crest Contact Tank Effluent Weir Elevation (ft)	12.65
Max Outfall W.L. EL. Elevation (ft)	12.57
W.L. EL. Downstream of Contact Tank Weir (ft)	**13.39**

FAIL!

Check influent water elevation at the outfall structure

High Tide Elevation (ft)	3.2
Outfall Pipe Invert (ft)	-3

	Line Size (in)	Flow Rate (MGD)	Velocity (ft/sec)	Pipe Entrance	Pipe Expansion	Pipe Exit	Total Head (ft)
Triple Outfall Pipe Losses	42	48	7.72	0.46	0.04	0.92	1.42

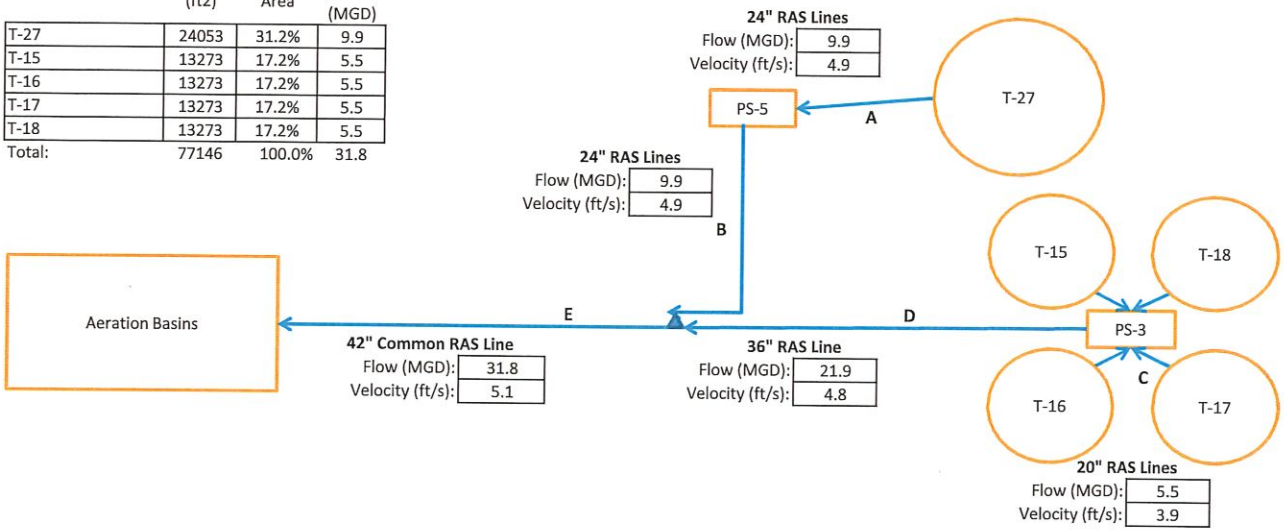
Crest Outfall Weir Elevation (ft)	7.00
W.L. EL. Downstream of Outfall Weir (ft)	**4.62**

OK!

Existing RAS Flow Analysis

Max Forward Flow	60	MGD
Recycle Ratio (α)	0.53	
Max Return Flow	31.8	MGD

	Area (ft2)	% Area	RAS Flow (MGD)
T-27	24053	31.2%	9.9
T-15	13273	17.2%	5.5
T-16	13273	17.2%	5.5
T-17	13273	17.2%	5.5
T-18	13273	17.2%	5.5
Total:	77146	100.0%	31.8

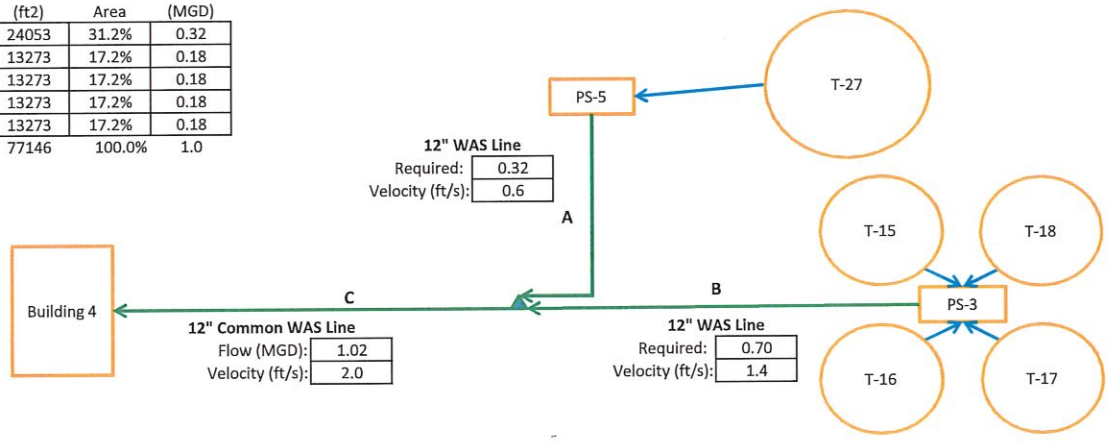


Forward Flow (MGD)	A		B		C		D		E	
	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)
60	9.9	4.9	9.9	4.9	5.5	3.9	21.9	4.8	31.8	5.1
80	13.2	6.5	13.2	6.5	7.3	5.2	29.2	6.4	42.4	6.8
104	17.2	8.5	17.2	8.5	9.5	6.7	37.9	8.3	55.1	8.9
144	23.8	11.7	23.8	11.7	13.1	9.3	52.5	11.5	76.3	12.3

Existing WAS Flow Analysis

Max Forward Flow	60	MGD
Waste Ratio	0.017	
Max Return Flow	1.0	MGD

	Area (ft2)	% Area	RAS Flow (MGD)
T-27	24053	31.2%	0.32
T-15	13273	17.2%	0.18
T-16	13273	17.2%	0.18
T-17	13273	17.2%	0.18
T-18	13273	17.2%	0.18
Total:	77146	100.0%	1.0

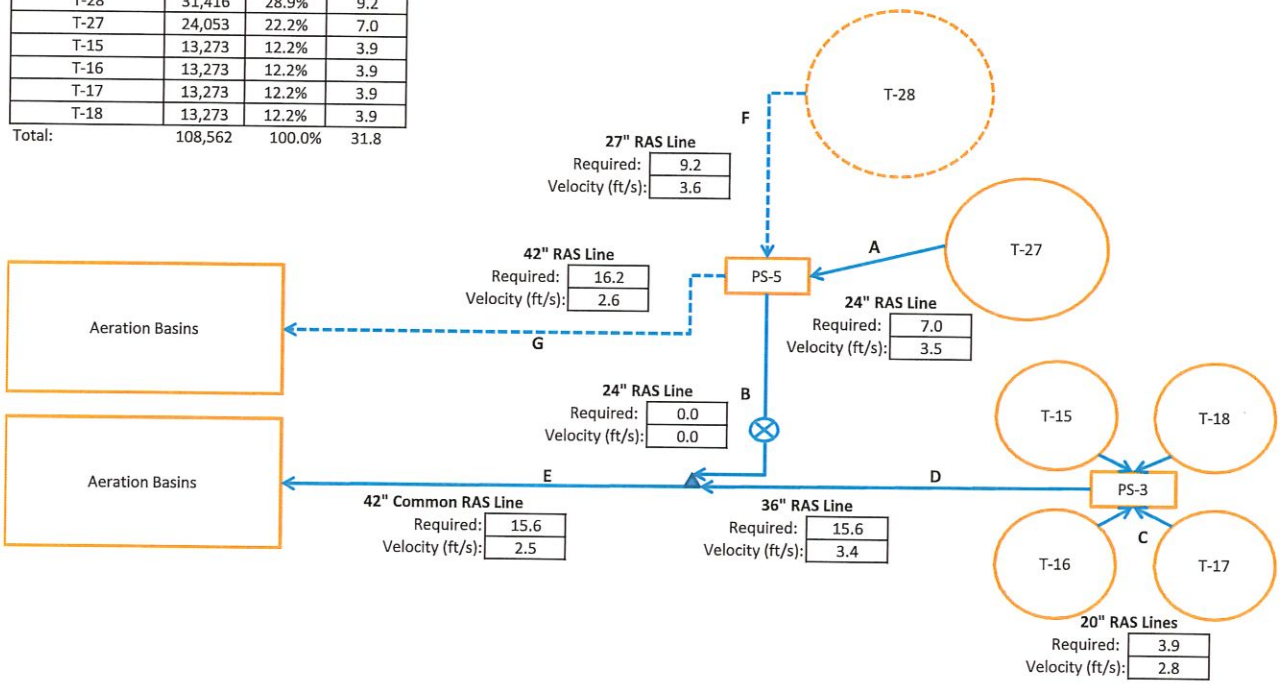


Forward Flow (MGD)	A		B		C	
	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)
60	0.3	0.6	0.7	1.4	1.0	2.0
80	0.4	0.8	0.9	1.8	1.4	2.7
104	0.6	1.1	1.2	2.4	1.8	3.5
144	0.8	1.5	1.7	3.3	2.4	4.8

Proposed RAS Flow Analysis

Forward Flow	60.0	
Recycle Ratio (α)	0.53	
Max Return Flow	31.8	MGD

	Area (ft2)	% Area	RAS Flow (MGD)
T-28	31,416	28.9%	9.2
T-27	24,053	22.2%	7.0
T-15	13,273	12.2%	3.9
T-16	13,273	12.2%	3.9
T-17	13,273	12.2%	3.9
T-18	13,273	12.2%	3.9
Total:	108,562	100.0%	31.8

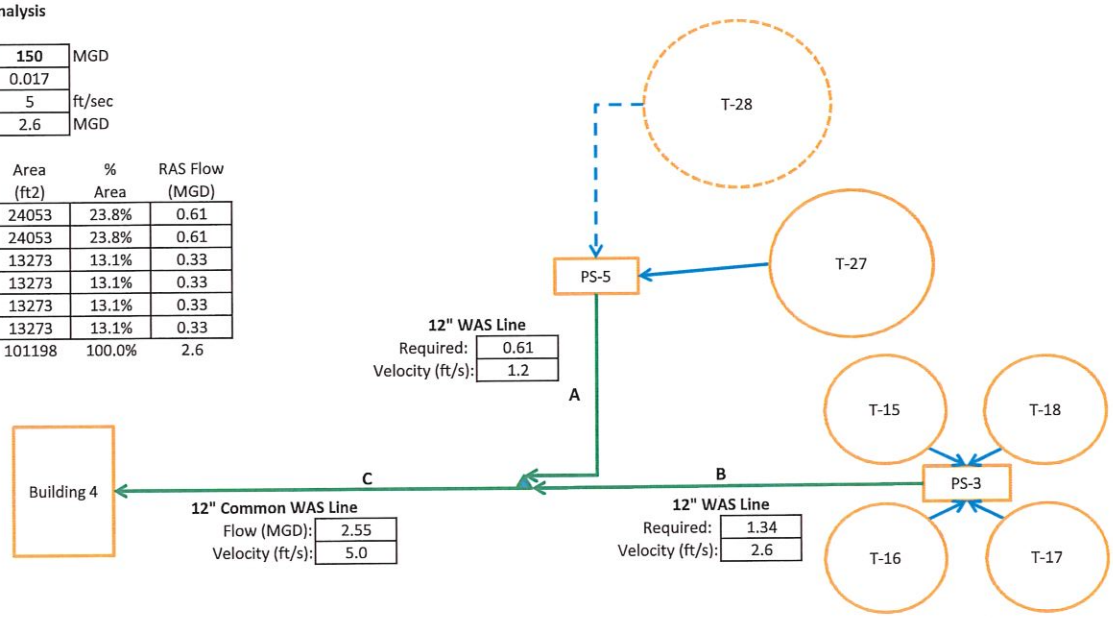


Forward Flow (MGD)	A		B		C		D		E		F		G	
	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)
60	7.0	3.5	0.0	0.0	3.9	2.8	15.6	3.4	15.6	2.5	9.2	3.6	16.2	2.6
80	9.4	4.6	0.0	0.0	5.2	3.7	20.7	4.5	20.7	3.3	12.3	4.8	21.7	3.5
104	12.2	6.0	0.0	0.0	6.7	4.8	27.0	5.9	27.0	4.3	16.0	6.2	28.2	4.5
144	16.9	8.3	0.0	0.0	9.3	6.6	37.3	8.2	37.3	6.0	22.1	8.6	39.0	6.3

Proposed WAS Flow Analysis

Max Forward Flow	**150**	MGD
Waste Ratio	0.017	
Max Velocity	5	ft/sec
Max Return Flow	2.6	MGD

	Area (ft2)	% Area	RAS Flow (MGD)
T-27	24053	23.8%	0.61
T-27	24053	23.8%	0.61
T-15	13273	13.1%	0.33
T-16	13273	13.1%	0.33
T-17	13273	13.1%	0.33
T-18	13273	13.1%	0.33
Total:	101198	100.0%	2.6



Forward Flow (MGD)	A		B		C	
	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)	Flow (MGD)	Velocity (ft/s)
60	0.6	1.2	1.3	2.6	2.6	5.0
80	0.4	0.8	0.9	1.8	1.4	2.7
104	0.6	1.1	1.2	2.4	1.8	3.5

APPENDIX Q

DRAFT FEASIBILITY STUDY FOR PIPE REPAIRS

- DELCORA Draft Feasibility Study for Pipe Repairs from M.H. 329 to M.H. 3070 and Combination Flow Mitigation for C.S.O. No. 18 dated December 23, 2016 prepared by Gilmore and Associates, Inc.

DRAFT

FEASIBILITY STUDY

FOR

PIPE REPAIRS FROM

M.H. 329 TO M.H. 3070 AND

COMBINATION FLOW MITIGATION FOR C.S.O. NO. 18

PREPARED FOR THE

DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL AUTHORITY

(DELCORA)

G&A PROJECT NO. 16-05053

DRAFT: DECEMBER 23, 2016

GILMORE & ASSOCIATES, INC.
ENGINEERING & CONSULTING SERVICES

OVERALL TABLE OF CONTENTS

1.0 FEASIBILITY STUDY

2.0 EXECUTIVE SUMMARY REPORT

3.0 APPENDIX

APPENDIX LIST

Appendix A ..... DELCORA SEWER SEPARATION ROUTE REQUEST
Appendix B ..... CSO 18 STORMWATER SEPARATION PLANS
Appendix C ..... DELCORA GIS PLAN
Appendix D .....DRAINAGE COMPUTATIONS FOR SELECT OPTIONS
Appendix E .....CHESTER CITY HISTORICAL MAPS AND PLANS
Appendix F ..... PENNDOT HISTORICAL MAPS AND PLANS
Appendix G .....PLANS PROVIDED BY OTHERS
Appendix H .....FEMA FLOOD INSURANCE STUDY-CHESTER CREEK

DRAFT

DRAFT

FEASIBILITY STUDY

FOR

PIPE REPAIRS FROM M.H. 329 TO M.H. 3070

AND COMBINATION FLOW MITIGATION FOR CSO 18

PREPARED FOR

Delaware County Regional Water Quality Control Authority (DELCORA)
100 EAST FIFTH STREET
CHESTER, PA 19013

FILE NO. 16-05053

DRAFT: DECEMBER 23, 2016

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TABLE OF CONTENTS

1.0 INTRODUCTION 1

3.0 GENERAL DESCRIPTION OF CSO 18 and ASSOCIATED FACILITIES 5

4.0 GENERAL DESCRIPTION CSO 19 and ASSOCIATED FACILITIES 6

5.0 EVALUATION METHODOLOGY 7

5.1 3-D MODEL 7

5.2 IDENTIFICATION OF STUDIED AREAS OF INTEREST 8

5.3 IDENTIFICATION AND EVALUATION OF OPTIONS 9

6.0 MODEL LIMITATIONS 10

7.0 PROJECT MITIGATION OPTIONS 11

7.1 DESCRIPTIONS OF MITIGATION OPTIONS 12

7.2 OPTION EVALUATION 14

8.0 SELECT ALTERNATE ASSESSMENT 23

9.0 FEASIBILITY STUDY RECOMMENDATIONS 28

11.0 STUDY CRITERIA AND ASSUMPTIONS 30

APPENDIX LIST

Appendix A	Sewer Separation Route request from DELCORA
Appendix B	CSO 18 Stormwater Separation plans
Appendix C	DELCORA GIS Plan
Appendix D	Drainage Computations for Select Options
Appendix E	Chester City Historical Maps and Plans
Appendix F	PennDOT Historical Plans
Appendix G	Plans provided by Others
Appendix H	FEMA Flood Insurance Study - Chester Creek

FEASIBILITY STUDY FOR ELIMINATION OF CSO 18

1.0 INTRODUCTION

Gilmore & Associates, Inc. (G&A) has been tasked by the Delaware County Regional Water Quality Control Authority (DELCORA) with investigating the feasibility of removing the stormwater component of the overall sewer flow to Combined Sewer Outfall (CSO) 18. The combined sewer outfall is located on the southern side of the I-95 Bridge over Ridley Creek adjacent to the intersection of Hancock Street and Sun Drive. The removal of stormwater runoff to CSO 18 would permit the elimination of the CSO and permit the remaining sanitary sewer component of the CSO 18 sewer system to be introduced exclusively into the Ridley Creek Interceptor. A map of the general project area is shown in Figure 1. DELCORA has requested that options for redirecting stormwater flow toward both Ship Creek & Chester Creek and Ridley Creek be investigated for feasibility.

Currently, the combined sewer system that discharges to CSO 18 is extensive, with facilities extending to the southwest along I-95, through Widener University, along 13th Street and then northward on Providence Avenue to the vicinity of 22nd street. These facilities include a variety of separate storm sewer components and combined sewer components consisting of various materials, some dating back to the original development of the area. The CSO 18 storm drainage area crosses watersheds with the Providence Avenue portion being directed to Ridley Creek whereas Ship Creek & Chester Creek are the natural discharge points for stormwater runoff. The stormwater drainage area and combined sewer service areas connect to a 68"x43" reinforced concrete pipe (RCP) sewer main that serves as the primary collector of the CSO 18 system. This RCP main has signs of deterioration and is in need of repair in a key location beneath the I-95 highway.

Overall, the removal of CSO 18 from DELCORA's service area would serve to mitigate several issues that exist within the current infrastructure. The multiple benefits of the elimination of stormwater runoff flows from CSO 18 include: 1) reduction of sewage volume required to be conveyed by the Ridley Interceptor and associated conveyance appurtenances; 2) reduction of sewage requiring treatment at the treatment plant; 3) possible mitigation of the 68"x43" combined sewer pipe structural issues, and; 4) overall reduction of untreated combined sewage discharged into natural waterways from the DELCORA sewer network.

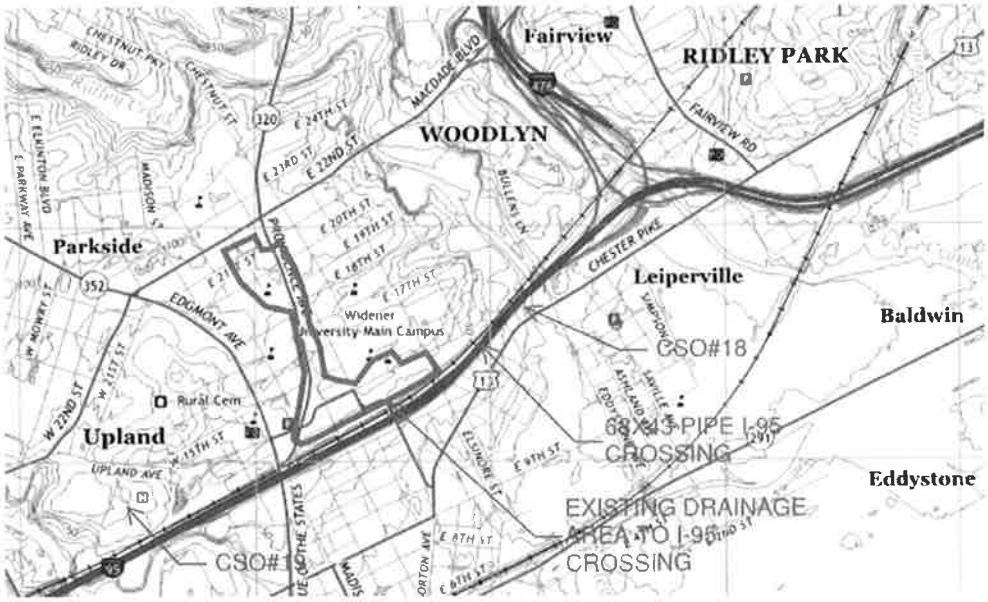

Figure 1 – Project Location Map (Excerpt from U.S.G.S. map)

DRAFT

2.0 PROJECT BACKGROUND

G&A was originally introduced to CSO 18 by DELCORA via our investigation of a structural issue within the 68"x43" sewer main located beneath I-95. However, the combination of potentially complex repair and mitigation options associated with that sewer crossing, and DELCORA's ongoing monitoring of the issue, led to a shift in focus from an immediate structural repair-only solution to a desire by DELCORA for a more comprehensive solution to address global issues inherent with the stewardship of operating and maintaining the current infrastructure considering both the pipe repairs and CSO elimination.

As with most infrastructures, the existing sewer system is subject to long and short term maintenance requirements and updating to meet the requirements of modern regulations and environmental protection standards. The complexity of these issues often hampers planning and global mitigation efforts, but the CSO 18 sewage network appears to contain a unique mix of existing elements that appear to allow for development of a workable solution.

One of the possible design solutions for mitigation involves redirecting storm runoff from Providence Avenue toward the original discharge point of CSO 19. For the preparation of this study, G&A was tasked with investigating portions of the CSO 19 network in order to help delineate the boundary between CSO 18 and 19 and help identify suitable routes for stormwater redirection.

G&A utilized several sources of information for this investigation. None of the sources were comprehensive and each provided only a small portion to add to understanding of the overall system. Two (2) site visits were made by G&A survey crews to determine the as-constructed existing conditions of the pipe networks. It should be noted that information gathered from these survey visits was limited by difficult site conditions including deep manhole depths, live and large active flows, inaccessible manhole lids, and oversized structures with limited access. These survey visits were completed

within a limited time frame for exploratory purposes only.

G&A utilized the following resources and site investigations to obtain information on the existing sewer system(s) within the studied areas of interest for this assignment:

- information provided by DELCORA for the I-95 crossing including video monitoring of pipe run between existing MH-329 and MH-3070;
- June 2, 2016 site visit and June 22, 2016 confined space entry into MH-3070 to investigate pipe condition issues within the I-95 crossing between MH-329 and MH-3070;
- GIS data files provided by DELCORA of their global conveyance network.
- construction plans for S.R. 1018 for original construction of I-95; procured though PennDOT;
- construction plans for S.R. 225, Section 17 (Providence Ave) for road widening and storm sewer improvements; procured through PennDOT;
- 9/14/2016 field survey of various sewer structures with observation of flow and pipe connections when possible;
- 10/5/2016 follow-up field survey of various sewer structures;
- various record plans and construction drawings procured from the Chester City Engineer's office;
- Lidar contour information available from GIS networks;
- aerial mapping provided by Delaware County.

G&A notes that this list is not comprehensive with regard to all information that may be available for the studied areas of interest. Additional information is required to develop a design solution for CSO mitigation and preparation of construction plans & specifications.

The following are descriptions of CSO 18 and CSO 19 networks as currently recognized by G&A:

3.0 GENERAL DESCRIPTION OF CSO 18 and ASSOCIATED FACILITIES

Upon review of the available information regarding CSO 18, networks of combined sewers were noted as being constructed in the early 20th century and generally followed street layout and drainage areas to Ridley Creek and the Delaware River. It appears that some of the local combined sewers in the 13th and Potter/Chestnut/Walnut Street areas may have extended south into 12th Street prior to the construction of the 68"x43" RCP sewer and I-95.

Construction plans for the PennDOT LR 225 project dated 1976-77 indicate that the original sewer system within Providence Avenue was a combined system and may have been connected to both CSO 19 and CSO 18. The improvement plan from this era shows road widening for Providence Avenue with a new separate storm sewer system that was then connected directly to the 68"x43" RCP run to CSO 18. The sanitary portion of the sewer remained within Providence Ave. PennDOT plans show an interconnection of sanitary sewer with both CSO 18 and CSO 19 (Sheet 22 of 29) but G&A field survey observations suggest that the sanitary flows are now directed toward CSO 19 only.

Earlier plans from 1973 indicate that a storm sewer system was installed along Potter Street from 18th Street north of 22nd Street. This system was connected to the Providence Street combined sewer and later tied into the LR 225 project's storm sewer of 1977.

Details contained in the PennDOT SR 1018 plans indicate that the 68"x43" sewer was constructed prior to installation of I-95. The depth of the existing pipe does not appear to have been modified by I-95 construction. Presumably, CSO 18 may have been created in its current form when the 68"x43" sewer was constructed. Although the construction date of the 68"x43" sewer is not identified on the construction plans, the size of this sewer suggests that local combined sewers along 13th Street, and between Potter and Walnut Streets, were connected to CSO 18 prior to I-95 construction.

A portion of the 68"x43" sewer runs between Widener University and the I-95 corridor. Limited information was available for the Widener University site, but the depth of the 68"x43" pipe and the deep cut of I-95 suggest that the southern side of Widener University drains to, and is serviced by, CSO 18.

4.0 GENERAL DESCRIPTION CSO 19 and ASSOCIATED FACILITIES

Similar to CSO 18, networks of combined sewers were constructed in the early 20th century within the CSO 19 drainage area that generally followed street alignment and Ship Creek/Chester Creek drainage areas to the Delaware River. The original eastern portion of the drainage area to CSO 19 appears to have included the Providence Avenue corridor as well as areas farther east near the Widener University Campus. Drainage areas to the north generally include 22nd Street, following Edgemont Ave. in the northwest direction. As previously mentioned, it appears that some of the local combined sewer runs in the 13th Street and Potter/Chestnut/Walnut Street areas may have extended south into 12th Street prior to the construction of the 68"x43" RCP sewer and I-95.

The following is a list of the known components of the CSO 18 combined sewer system. This list is based on information reviewed during this investigation:

1. CSO Regulator 18 and associated outfall to Ridley Creek;
2. the Ridley Creek sanitary sewer interceptor;
3. a 3,000+ foot 68"x43" elliptical RCP pipe, installed with the longer pipe axis in the vertical direction, running from the intersection of 13th Street and Providence Avenue to CSO Regulator 18. This pipe run is the main trunk line of CSO 18;
4. the crossing of the 68"x43" RCP under I-95;
5. the Providence Avenue separate storm sewer system and its connection to the 68"x43" RCP at Providence Avenue and 13th Street;
6. connection of storm and sanitary sewers to the 68"x43" RCP through the

original combined sewer system and within local streets located north of I-95 and east of Providence Avenue;

7. collection of stormwater runoff and sanitary sewage from the Widener University campus;
8. collection of sanitary sewage along Hancock Street, south of the I-95 crossing;
9. collection of stormwater runoff from street inlets along local streets south of the I-95 crossing;
10. connection of a small stormwater runoff network within I-95 that connects to the 68"x43".

The CSO 19 component investigation was limited to facilities along the Upland/14th Streets corridor. The following is a list of the known components of the CSO 19 combined sewer system. This list is based on information procured during this investigation.

1. Ship Creek and its man-made components;
2. CSO Regulator 19 and associated outfall to Ship Creek;
3. the Chester Creek East Interceptor;
4. the combined sewer main within Upland/14th Streets running from Providence Avenue to CSO 19;
5. separate storm facilities within Upland/14th Streets.

5.0 EVALUATION METHODOLOGY

5.1 3-D MODEL

For this study, G&A utilized existing records, survey information, GIS information, LIDAR contour information, and aerial mapping in conjunction with 3-dimensional (3-D) AutoCAD mapping to build a working digital model of existing features. The digital 3-D model is updated continually as new information is gathered, and this model is used as

a tool to evaluate multiple sources of information and create views of the various project conditions and constraints.

G&A evaluated the information that was available for this study to create a 3-D model of existing utilities within the project areas. Survey work performed by G&A was utilized to tie-in data points that were included in the various sources in order to normalize the vertical datum.

The 3-D model of existing utilities was combined with LIDAR and aerial information to create a working digital model and used as the basis for this engineering feasibility study. The working model was used to develop conceptual site plans and profiles to assist with feasibility evaluation. We note that the working model continues to evolve as additional information is obtained. Ideally, if a suitable solution for CSO mitigation is reached and funded, this model can serve as the basis for engineering design.

From the model created for DELCORA, drainage areas to specific points of interest were calculated and pipe sizes determined for feasibility of re-routing storm sewer along select alternate routes.

5.2 IDENTIFICATION OF STUDIED AREAS OF INTEREST

In order to evaluate options for CSO 18, the overall stormwater drainage area and sanitary sewage sources were studied for the areas affecting mitigation options.

Areas for the study included stormwater runoff drainage areas, overall sewer service areas, and pipe networks of CSO 18 as well as CSO 19, located to the west of Providence Avenue. Identification of these areas and layout of pipe networks within these areas were key components of this study. This information contributed to the determination of overall flows to CSOs, pipe sizes for alternate pipe runs, and potential routes for alternate pipe runs. Additionally, the separate storm and sanitary systems

that are located within E. 14th Street and run toward Maggie May's and the Widener ball field were considered during the evaluation. These systems are in the general vicinity of routing options for CSO 18 components.

Based on G&A's investigative effort to date, the areas contributing to CSO 18 appear to be bounded by (clockwise in plan-view starting at CSO 18) Hancock Street, the 68"x43" RCP I-95 crossing, the I-95 highway, Providence Avenue, Upland Avenue, 22nd Street, portions of the block between Walnut and Chestnut Streets, portions of Widener University, the I-95 highway and returning to CSO 18 at Sun Drive and Hancock Street. See Appendix B for additional information regarding this area.

CSO 19 is located within the headwaters of Ship Creek, which is a small tributary to Chester Creek. The CSO 19 drainage area shares its eastern drainage boundary with the western boundary of CSO 18.

5.3 IDENTIFICATION AND EVALUATION OF OPTIONS

Options for CSO 18 mitigation were developed with assistance from and in coordination with DELCORA and are based primarily on the information that was furnished for the study by both DELCORA and obtained G&A from other sources.

A list of options is contained in Section 7.0. Evaluation of each option includes the following considerations:

1. overall level of constructability;
2. overall cost potential;
3. future maintenance considerations;
4. potential permitting issues;
5. overall benefit with regard to DELCORA's consent decree.

6.0 MODEL LIMITATIONS

The working digital 3-D model of existing conditions is based upon limited information and is subject to verification in the field. Some of the known issues with information obtained as part of this study include:

- survey work completed for feasibility was performed on a cursory basis to gain an understanding of the general layout of existing conditions. Most of the structures identified in the field require confined space entry for detailed survey including sizing of structures, confirmation of inverts of pipe connections, sizes and types of connected pipes, information on internal weirs and possible plugs for abandoned pipe systems;
- reference plans obtained from the Chester City Engineer do not represent an exhaustive search of information available from the city records. A complete catalog of city record information was not available and information included in the model is based upon a limited amount of research time;
- some information obtained from the referenced sources conflicts with other information that is available and may not reflect as-constructed conditions. All information included in developing the model should be considered approximate at this feasibility study stage.

Issues for final design consideration include the following:

- full separation of sanitary facilities from the Providence Avenue separate storm sewer system has not been verified;
- historical plans and DELCORA GIS information do not provide definitive flow directions of stormwater runoff or flow directions from existing inlet connections for some areas. Areas of Chestnut Street, 17th Street and Upland Road north of Providence Avenue, but south of 18th Street, are currently areas where the least information is known or verified. The

feasibility study provides assumptions based on known information, but final design is dependent upon collection and evaluation of additional information;

- full connectivity and flow direction of the original combined sewer system within Providence Avenue is assumed to be toward CSO 19 based on DELCORA GIS records and visual observations made in the field. However, there is conflicting information on some of the reference plans that suggest some connectivity may exist with the CSO 18 system;
- a Pennsylvania One-Call notification was made by G&A for feasibility purposes and to help identify major utility conflicts. However, the 3-D model does not include a full investigation of non-sewer utilities such as gas, water, communications, electric and other miscellaneous services that may be present. Additional investigation is required for final design;
- configuration of historical CSO conditions in the vicinity of Upland Avenue and Ship Creek is unknown. This could potentially affect layout of the Route B option.

7.0 PROJECT MITIGATION OPTIONS

Current project direction was driven in part by mitigation options that were investigated for the initial structural issue at the 68"x43" RCP I-95 crossing. Further coordination with DELCORA evolved into including storm re-routing along "Route A" and "Route B" as generally described in Appendix A.

Overall, in order to meet the design goal of CSO 18 elimination, separation of storm runoff is required from any flow that enters the Ridley Creek Interceptor. Route A and Route B were proposed by DELCORA as possible routes for separation of stormwater from the CSO 18 sanitary flow. DELCORA also expressed an interest in eliminating the 68"x43" RCP I-95 crossing altogether. In pursuit of a workable solution the following project mitigation options were considered for storm and sanitary discharge flow within the CSO 18 drainage area:

7.1 DESCRIPTIONS OF MITIGATION OPTIONS

A. The following mitigation options for sanitary sewage separation were considered:

Option 1 - Remove sanitary flow from the 68"x43" sewer main at MH 329 and re-route in a northerly direction to the existing separate sanitary sewer within E 14th Street.

Option 2 - Remove sanitary flow from the 68"x43" sewer main via a pump station, and lift to a point along E 14th Street to the existing separate sanitary sewer within E 14th Street.

Option 3 - Remove storm sewer runoff from the 68"x43" sewer main and route sanitary sewage through the existing 68"x43" RCP I-95 crossing via a new 8" or 12" sanitary sewer installed and grouted within the existing pipe.

B. The following storm sewer separation options were investigated with discharge to Ridley Creek:

Option 4 - As shown in Appendix A, remove storm runoff from the 68"x43" sewer main from a point east of Walnut Street and re-direct along Melrose Avenue to E 14th Street, and then along E 14th Street down to Ridley Creek to a point near the existing I-95 storm outlet located just north of the railroad bridge (a/k/a "Route A").

Option 5 - Remove storm runoff from the entire existing CSO 18 drainage area from the 68"x43" sewer main and re-direct along Melrose Avenue, similar to and following the route described in Option 4.

Option 6 - Separation of storm runoff from the existing 68x43" sewer main above MH329 and place a second pipe, only for storm runoff conveyance, above the new separate sanitary sewer conduit described in Option 3 to fully utilize the existing 68"x43" RCP I-95 crossing and address the existing structural issue. A new storm conduit would be run along Hancock Street to convey the I-95 crossing flows as well as those introduced within Hancock St. The existing headwall along Ridley Creek would be utilized for outfall. Route B would be used in order to limit pipe size for this Option and raise the invert to work with the proposed I-95 crossing modification.

C. The following options are storm routings along Route B. Note that installation of additional storm pipes may be required along Upland Ave and Walnut Streets to separate storm runoff from combined sewers contained in these streets:

Option 7 - Route B as shown in Appendix A without additional separation area from CSO 19.

Option 8 – Option 7 with revised storm runoff routing to follow Upland St. to a discharge point within Ship Creek.

Option 9 – Option 8 including the additional CSO 19 separation drainage area as depicted in Appendix A. There is limited information available for this area at this time. However, a larger pipe size will be necessary than that required for Option 7 and Option 8.

D. The following option is for structural repair of the 68"x43" RCP I-95 crossing only, with no combined sewer flow mitigation other than within the partially collapsed RCP between M.H. 329 and M.H. 3070:

Option 10 – Repair and rehabilitation of the existing 68"x43" RCP crossing under I-95 between M.H. 329 and M.H. 3070. This option includes installation of two

(2) doghouse manholes at strategic locations, to be determined via a detailed study, between existing M.H. 329 and M.H. 3070 and probable modification of both existing manholes to facilitate construction of repairs and rehabilitation of the existing 68"x43" RCP I-95 crossing. Temporary bypass of the sanitary sewer flow will be required during construction of the expected repairs. It is anticipated that the temporary bypass system will be installed within the existing 68"x43" RCP after the pipe is temporary shored internally (and externally where necessary). The existing pipe will be repaired, new casing pipes will be installed and the remaining annular space will be fully grouted between the exterior of the casing pipes and the interior of the existing 68"x43" RCP for the full length of this pipe run between M.H. 329 and M.H. 3070. Significant traffic control will be required along with coordination with the County, City of Chester, the railroad, local property owners, businesses and Widener University. Jurisdictional agency permitting will be required.

7.2 OPTION EVALUATION

Option 1

This option includes removing sanitary sewage flows from MH-329 and re-routing flow via a new gravity sewer to an existing separate sanitary sewer system within E 14th Street.

Pros

This routing would eliminate the need for sanitary sewage to be discharged through the 68"x43" RCP under I-95.

Cons

This option does not appear to be desirable or cost-effective based on the elevations of sanitary services located within the CSO 18 drainage area when compared to the elevation of sanitary facilities within E 14th Street.

Current Study Status

Other sanitary sewage options appear to be less costly and more feasible.

Option 2

This option introduces a pump station to re-route sanitary sewage flows to E. 14th Street and down to DELCORA's existing separated sanitary sewer.

Pros

This option would eliminate the need for sanitary sewage to be discharged through the 68"x43" RCP under I-95.

Cons

Currently, the volume of sanitary sewage required to be lifted via pump station is unknown. Portions of the existing separate system within E. 14th Street would require detailed assessment for adequacy to convey additional flows.

Current Study Status

This option adds long term operations and maintenance costs to the system with the introduction of a pump station. Additional information is required for comprehensive assessment.

Option 3

This option includes making no changes to the conveyance of sanitary sewage except maintaining the existing 68"x43" RCP I-95 crossing with a repair including am 8" to 12" sanitary sewer pipe grouted within the existing 68"x43" main and revising the CSO 18 regulator to eliminate the existing storm outfall to Ridley Creek.

Pros

This option appears to be relatively simple. Grouting of the existing 68"x43" RCP I-95 crossing may be robust enough to reduce long term maintenance issues to tolerable levels.

Cons

Pipe size for sanitary sewer must be verified. The 68"x43" RCP I-95 crossing will remain.

Current Study Status

This is currently the recommended sanitary sewer mitigation option.

Option 4

This option includes collecting overland storm runoff from the parking area behind the Widener University Center and Residence Hall/ROTC building that is located adjacent to I-95 and providing conveyance along Route A. Also, this option would intercept existing conduits that collect drainage from the Widener University grounds.

Pros

The stormwater drainage area is small enough to limit the required size of pipe to 30". Connection to existing conveyance pipes is currently unknown, but connections will be limited to conveyance pipes located behind the referenced Widener Buildings making re-routing of the storm water drainage relatively easy. This option would eliminate the requirement for storm runoff to be directed through the existing 68"x43" RCP I-95 crossing.

Cons

The elevation of the Widener parking lot lowers the overall proposed storm system to a depth that will require shallow pipe slope and 15 ft. – 20 ft. deep cuts in some locations along Melrose Avenue and portions of E. 14th Street. The proposed pipe installation along this route may be hampered by clearance issues at the low end of E. 14th Street (near Maggie May's) and there appears to be a difficult pinch point along the access road to Ridley Creek created by the recently constructed Widener ball field, the Railroad Right-of-Way and two existing sewer conduits - one that conveys I-95 storm runoff and one that conveys separate City sanitary sewage. Also, a new outfall at Ridley Creek may be difficult to permit and construct based upon the steep embankments and existing erosion that are present.

Current Study Status

This option is included in the overall alternate analysis but is currently not preferred over Option 6.

Option 5

This option is similar to Option 4 except that the entire existing CSO 18 drainage area was considered to be conveyed along Route A.

Pros

This option may eliminate the need for Route B to be considered. This option would eliminate the requirement for storm runoff to be directed through the existing 68"x43" RCP I-95 crossing.

Cons

The pipe size required would most likely be large, 54" or 60", and the routing limitations may not permit this large pipe size. A much lower pipe invert would be needed to capture the Providence Avenue system thus increasing the depth of cuts required to install new conduit.

Current Study Status

This option appears to be less desirable than other studied options due to routing and pipe size limitations.

Option 6

This option is similar to Option 4, but includes expanding on the re-use of the existing 68"x43" RCP I-95 crossing and utilization of the existing Ridley Creek outfall in lieu of re-routing storm runoff to E. 14th Street and a new outfall near the ball field.

Pros

Proposed storm pipe size and length is minimized compared to the original Route A; disturbance to residential streets is minimized; re-use of existing outfall will minimize permitting for the Ridley Creek outfall; existing storm sewer within Hancock St. can be replaced with the proposed system.

Cons

Existing 68"x43" RCP I-95 crossing will remain.

Current Study Status

This is currently one of the recommended storm water re-routing options.

Option 7

This option includes re-directing the Providence Ave. storm water system and the storm runoff component of Upland St. and Walnut St. toward Ship Creek via E. 14th Street.

Pros

Providence Avenue runoff would be directed back toward Ship Creek/Chester Creek which appears to replicate the original design of the Providence Ave. storm water system. This routing minimizes construction issues for storm routing toward Ridley Creek.

Cons

It is currently unknown to what extent permitting will be required for this storm water re-direction. FEMA computations for Chester/Ridley Creek may or may not already account for this runoff direction within the "AE" flood zone areas shown on current Flood Insurance Rate Maps (FIRMs). A detailed study is necessary to evaluate this storm flow component for the studied drainage area. The route along 13th Street includes private property and will most likely require easements.

Current Study Status

Option 8 appears to be more desirable.

Option 8

This option is similar to Route B shown in Appendix A but with a routing less likely to require easements and less right-of-way conflicts.

Pros

Same as Option 7 with fewer easement and/or right-of-way conflicts.

Cons

Same as Option 7

Current Study Status

This is currently a recommended option, but additional information is needed to study and address potential FEMA issues.

Option 9

This option adds the "Potential Additional Separation Area" noted for Route B as shown in Appendix A.

Pros
Additional drainage area will be removed from CSO 18 or CSO 19

Cons
The extent of existing facilities and prospective connections are unknown at this time.

Current Study Status
Larger pipe sizes can be used to accommodate more drainage runoff in this direction. More information is required. A detailed study is needed.

Option 10

This option considers repairs, rehabilitation to the partially collapsed 68"x43" RCP I-95 crossing and separation of combined flow only within the existing RCP from M.H. 329 to M.H. 3070.

Pros
This option is the least immediate cost option; combined flow will be separated within the existing pipe; the fully grouted 68"x43" RCP will be relatively maintenance-free after it is repaired and grouted. Storm and sanitary flows are separated within the 68"x43" I-95 crossing and can be conveyed downstream from M.H. 3070 in separate storm water and sanitary sewer if and when that combined flow is eventually separated.

Cons
Combined flow will only be separated within the existing 68"x43" RCP I-95 crossing; extensive traffic control will be necessary particularly at and near the existing M.H. 329 and M.H. 3070 as well as at I-95 and streets feeding I-95; confined space requirements apply for the project; equipment access is restricted; jurisdictional agency, County, State, Federal & Local coordination and approvals are necessary; storm water & sanitary sewer are still conveyed under I-95.

Current Study Status
Detailed information for the pipe sizes for carrier and casing pipes is needed for both the storm water and sanitary sewer pipes. This Option is considered to be a

recommended Alternate due to its least-cost status. A "no Action" option is not viable since the existing pipe is partially collapsed and in need of repair and rehabilitation.

The following includes additional commentary regarding select sanitary and storm sewer Options:

Option 3

Assuming stormwater flow is removed from MH 329, the structural issue within the 68"x43" RCP I-95 crossing can be mitigated by grouting-in a smaller pipe that will accommodate sanitary sewer flows only. This option will require but minimize disruption to the traveling public that use the I-95 corridor. Grouting of the existing pipe will improve the strength of the crossing to a point that future maintenance costs will be reduced as well.

Option 4

From initial feasibility evaluation computations, storm runoff from Route A areas can be conveyed within a single 30" HDPE pipe installed at a minimum of 0.005 ft/ft slope, or a 24" HDPE pipe with a minimum of 0.015 ft/ft slope. With regard to the original "Route A", it appears that such a pipe could be routed via the originally suggested alignment.

However, there are several design, construction and cost issues associated with this mitigation option. Given the elevation of the Widener University Center parking area, the upstream end of the new storm sewer would need to be set at an elevation of approximately 46 ft. Using the 30" HDPE and 0.005 ft/ft slope there would be an extended length of significant trench cut within Melrose Ave. and E 14th St. Excavation depths up to 20 feet +/- with temporary shoring would be required along the collector road and residential street.

The existing condition from Maggie May's to Ridley Creek is such that there may be obstruction issues with existing pipe systems that include a PennDOT storm main and DELCORA sanitary sewer main that connects to the Ridley Interceptor. It also appears

that a recently constructed ball field for Widner University encroaches upon the sewer right(s)-of-way in that area. The ball field, railroad right-of-way and embankment taper to approximately 10 ft to 15 ft for a limited distance (see Figure 2), further restricting access at this location.

Attempting to abate or resolve the issues mentioned above will increase costs and reduce the desirability of proceeding with Option 4.

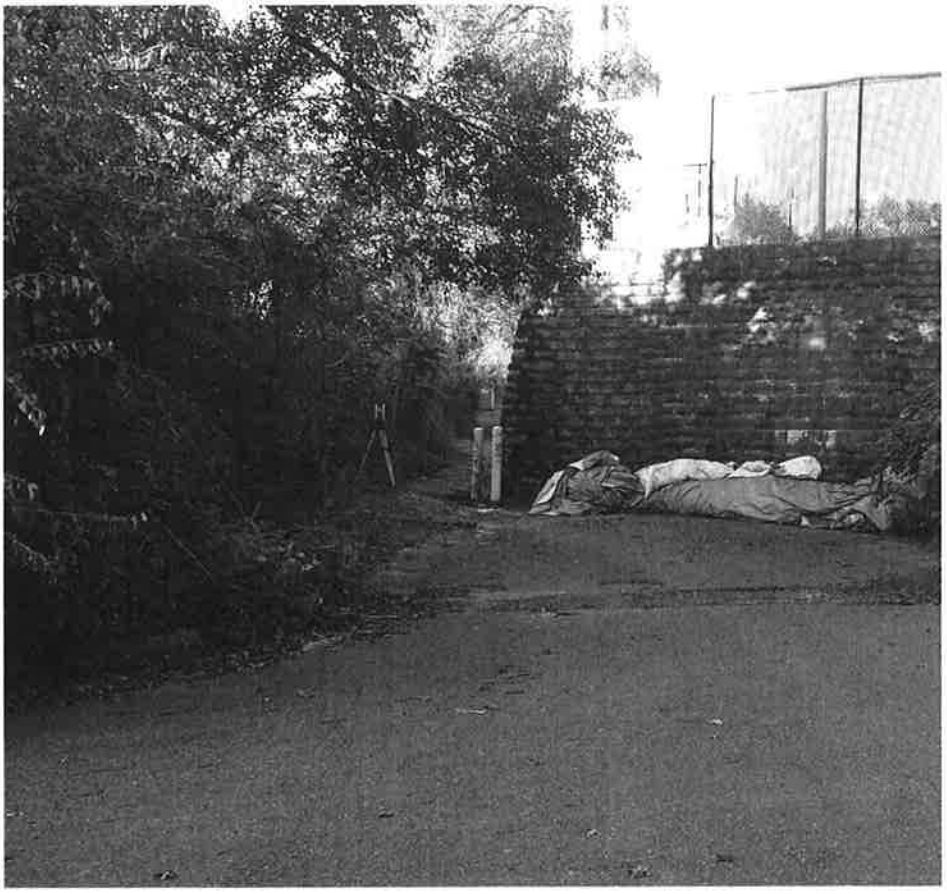

Figure 2 – View from Ridley Creek of ball field/Railroad R.O.W. Restriction for Route A (Option 4)

Option 6

This alternate is similar to Option 4 from Walnut Street to Melrose Avenue. At this point, the proposed route heads toward MH 329 and the existing 68"x43" RCP I-95 crossing. Utilizing a 24" pipe with 0.015 ft/ft slope, it is possible to select a route to place the proposed pipe through the existing 68"x43" RCP I-95 crossing. Additionally, an alternate sanitary sewer pipe of 8"-12" diameter will fit in the same existing I-95 crossing while maintaining virtually the same existing route towards Ridley Creek. New manholes adjacent to MH-329 and MH-3070 would serve as introduction and removal points for the proposed stormwater conduit. Along Hancock Street, this alternate could replace the existing separate stormwater pipes and ultimately utilize the existing CSO 18 outfall along Ridley Creek.

Option 8

Storm sewer runoff toward Route B is anticipated to include (as shown on the Overall Site Plan in Appendix B):

1. storm runoff from the combined sewer system within Potter and Walnut Streets;
2. the existing storm sewer system within Providence Avenue.

From initial feasibility evaluation computations, storm runoff from these areas can be conveyed within a single 48" RCP pipe installed at a minimum of 0.015 ft/ft slope. The initial pipe run from Walnut Street to Upland Street can be conveyed within a 36" diameter at a minimum slope of 0.005 ft/ft.

With regard to "Route B", it appears that such a pipe could be routed utilizing the originally suggested alignment with the exception that Upland Street would be included as part of the proposed alignment in lieu of W. 13th Street.

The outlet of this pipe would be near the original regulator for CSO 19 and within the portion of Ship Creek that remains an open channel.

Note that the introduction of new storm flow to Ship Creek/Chester Creek may potentially increase flood levels in those waterways during certain flood stages. Further investigation is needed to verify FEMA flood computations provided in the FEMA Flood Insurance Study (FIS) and determine what drainage areas were utilized in the preparation of the current Flood Rate Insurance Maps (FIRM). With the re-routing of storm runoff from Route B serving to potentially restore the natural drainage areas, it is possible that the current FIRM may be based upon the assumption that the storm flow from Route B already reaches the proposed location.

8.0 SELECT ALTERNATE ASSESSMENT

From the list of mitigation options and initial option evaluation, select sanitary and storm routing options have been identified as preferred methods for mitigation. More than one option is required in order to achieve full mitigation for CSO 18. Two separate groups of preferred options are combined under Alternate 1 and Alternate 2. These alternatives may provide for full mitigation at CSO 18. For comparison purposes, an additional Alternate 3 is also included for consideration as a least-cost option. Alternate 3 differs from the first two in that it is not a full CSO mitigation option and is limited to be a solution to the structural issue at the existing 68"x43" I-95 crossing. Conceptual layout for the options utilized in Alternate 1 and Alternate 2 are depicted on plans included in Appendix B.

The following is a general description of each Alternate:

Alternate 1

This alternate includes Option 3, Option 4 and Option 8. The target outcome of Alternate 1 is CSO 18 mitigation by removing stormwater inflow from the existing

68"x43" combined sewer main via "Route A" and "Route B" with storm discharge to Ridley Creek and Ship Creek, respectively.

As referenced in Appendix B, the overall scope of work includes removal of Providence Avenue stormwater flow as well as storm flow from the existing local street combined sewer system and conveyance to a new endwall within Ship Creek via either a new 36"or 48" separate storm pipe installed within 13th Street and Upland Street. This referenced inflow area comprises the overall stormwater drainage area of CSO 18 west of Chestnut Street, shown on Sheet 2 of G&A mitigation plans with green hatching. The work scope also includes removal of stormwater runoff from the Widener University area (depicted as red hatched area on Sheet 2) and conveyance via a new 30" conduit along Melrose Avenue, down 14th Street, and through the access road adjacent to the Widener ball field to a new stormwater outfall at Ridley Creek. Additional right-of-way may be required as well as a structural solution to support the encroaching ball field retaining wall along the access road. Route A is depicted in red on Sheet 2.

Sanitary sewage would remain within the existing 68"x43" sewer main. Structural mitigation of the existing partially collapsed 38"x43" RCP I-95 crossing would include introduction of a smaller sized pipes installed within the existing RCP to be sized for existing sanitary flow and grouted into the RCP pipe as a permanent structural repair.

Stormwater within Hancock Street would be redirected to the existing the CSO 18 outfall within the Ridley Creek stream.

The existing CSO regulator would be abandoned or modified to include sanitary sewer outflow exclusively to the Ridley Interceptor.

Alternate 2

This alternate includes Option 3, Option 6 and Option 8. The target outcome of Alternate 2 is CSO 18 mitigation via removal of stormwater inflow from the 68"x43" combined sewer main via a revised "Route A" and "Route B" with stormwater discharge to Ridley Creek and Ship Creek, respectively.

Sanitary sewage would remain within the existing 68"x43" sewer main. Structural mitigation of the existing partially collapsed 38"x43" RCP I-95 crossing would include introduction of a smaller sized pipes installed within the existing RCP to be sized for existing sanitary flow and grouted into the RCP pipe as a permanent structural repair.

As referenced in Appendix B, the work scope includes removal of Providence Avenue stormwater flow as well as stormwater flow from the existing local street combined sewer system and conveyance to a new endwall within Ship Creek via either a new 36" or 48" separate stormwater pipe installed within 13th Street and Upland Street. This referenced inflow area comprises the overall stormwater drainage area of CSO 18 west of Chestnut Street, shown on Sheet 2 of G&A mitigation plans with green hatching. The work scope also includes also includes remove storm runoff from the Widener University area (depicted as the red hatched area on Sheet 2) and conveyance via a new 24" pipe

installed adjacent to the existing 68"x43" sewer main route to a new manhole located adjacent to existing MH 329. The new 24" pipe would then run above the referenced grouted-in sanitary pipe within the existing 68"x43" RCP I-95 crossing and then out to a new manhole located adjacent to existing MH 3070. Re-aligned stormwater pipe would then replace the existing 15" stormwater pipe located within Hancock Street, with new connections for runoff from existing Hancock St., and be routed to the existing CSO 18 outfall. This revised Route A is depicted in blue on Sheet 2.

Stormwater within Hancock Street would be redirected to the existing CSO 18 Endwall within the Ridley Creek stream bank.

The existing CSO regulator would be abandoned or modified to include sanitary sewer outflow exclusively to the Ridley Interceptor.

Alternate 3

This alternate includes Option 10. The target outcome of Alternate 3 includes Structural repairs to partially collapsed 68"x43" RCP at I-95 crossing and combined flow separation in the existing partially collapsed 68"x43" RCP main as part of the repair procedure for this pipe.

Two (2) doghouse manholes would be installed at strategic locations between existing MH 329 and MH 3070 as determined during the design phase for repairs to the existing partially collapsed 68"x43" RCP main. Temporary supports and shoring would then be installed within the existing partially collapsed 68"x43" RCP main. Sanitary sewage

would be temporarily bypassed through a system installed within the existing 68"x43" RCP main so that a new 12" diameter sewer main could be installed within the existing 68"x43" RCP main. The existing 68"x43" RCP main would then be partially grouted to an elevation approximately 6" higher than the top of the new 12" diameter sanitary sewer pipe. A storm sewer pipe would then be installed at an elevation above the 12" diameter pipe. After completing this storm sewer pipe installation, the remaining annular space within the 68"x43" RCP main would be grouted solid. This flow separation would eliminate combined flow within the existing 68"x43" RCP main and serve as the permanent repair to the partially collapsed existing 68"x43" RCP main.

Operation and Maintenance Statement

Future operation and maintenance costs of all three alternatives are anticipated to be similar to existing with the following exceptions:

- the existing 68"x43" RCP I-95 crossing, by virtue of fully-grouting the RCP around the proposed storm and sanitary pipes the repaired RCP, is expected to provide a 100+ year usable life.

- elimination of stormwater flow through existing CSO 18 pipes will be a benefit to future operation and maintenance costs of the sanitary sewer system.

9.0 FEASIBILITY STUDY RECOMMENDATIONS

After review of all of the received documents, known parameters, preliminary calculations, and mitigation options, G&A recommends that Alternate 2 be pursued by DELCORA for further consideration and design. The corresponding stormwater options for this Alternate are depicted in Blue and Green on the plans provided in Appendix B.

10.0 ESTIMATED COSTS

Estimated costs for the three alternates are as follows:

Alternate 1

$5.5-$6.5 million

Alternate 2

$4.5-$5.5 million

Alternate 3

$2.5-$3.4 million

These estimated costs are based upon the current value of construction and projected forward through December 31, 2018. No additional escalation is accounted for in the estimates. Costs of permits and other fees paid to the jurisdictional agencies are excluded from the cost estimate. Taxes are not included.

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11.0 STUDY CRITERIA AND ASSUMPTIONS

- unknowns of the existing storm and sanitary facility locations and depths of system components as described in the full report;
- unknown locations of all other existing utilities and potential conflicts for proposed routing Alternates;
- unknown resolution of flood elevation status of Chester Creek and whether Route B can, or must be, justified through: A) existing FEMA Flood Insurance Study means and methods; B) additional Hydrologic and Hydraulic study; C) storage and attenuation of proposed storm discharge from Route B;
- the potential for environmentally sensitive issues (wetlands, bog and/or red-belly turtles, plant species, etc. that may be uncovered with a PNDI search and/or additional site investigation) within Ship Creek that would need mitigation;
- study of the existing enclosed portion of Ship Creek located under the existing railroad and I-95 for flows introduced from Route B;
- acceptance (or lack of acceptance) of new stormwater facilities for dedication to the City of Chester;
- unknown extent of lands (if any) that would require acquisition of right-of-way, construction and/or permanent easements, etc., in order to carry out any of the studied options or alternates;
- granting of applicable jurisdictional agency permits that are required to perform the work contemplated within this study;
- permission of PennDOT, USDOT and affected municipalities to perform the work

via detours, lane outages, lane and ramp restrictions, redirection of traffic, temporary traffic control and work zone traffic control, as may be required to complete the project on and under I-95, Providence Road and local collector roadways;

- permission of the railroad to perform work at or near their facilities;
- permission of local property Owners and Widener University to perform the work contemplated within and/or adjacent to their properties;
- anticipated extensive coordination with existing utility owners and service providers to avoid facility conflicts, obstructions and service interruptions;
- anticipated extensive coordination with local businesses and the general public regarding the project and potential impacts to the local community and traveling public.

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DRAFT EXECUTIVE SUMMARY REPORT

OF

FEASIBILITY STUDY FOR PIPE REPAIRS FROM M.H. 329 TO M.H. 3070 AND COMBINATION FLOW MITIGATION FOR CSO 18

PREPARED FOR

DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL AUTHORITY (DELCORA)
100 EAST FIFTH STREET
CHESTER, PENNSYLVANIA

FILE NO. 16-05053

DRAFT: DECEMBER 23, 2016

PREPARED BY:

Gilmore & Associates, Inc.
Engineers • Land Surveyors • Planners • GIS Consultants
65 E. Butler Avenue, Suite 100
New Britain, PA 18901
(215) 345-4330

TABLE OF CONTENTS

1.0 ISSUE STATEMENT 1

2.0 SELECT ALTERNATE ASSESSMENT .....

2.1 ALTERNATE 1 - ROUTE A AND ROUTE B STORMWATER SEPARATION 2

2.2 ALTERNATE 2 – REVISED ROUTE A AND ROUTE B STORMWATER SEPARATION ... 3

2.3 ALTERNATE 3 - I-95 CROSSING SOLUTION WITH NO CSO MITIGATION 4

3.0 OPERATION & MAINTENANCE STATEMENT 5

4.0 STUDY CRITERIA AND ASSUMPTIONS 6

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1.0 ISSUE STATEMENT

DELCORA is assessing corrective measures to repair a structural failure issue within a partially collapsed combined sewer main located within the combined sewer system tributary to the outfall designated by DELCORA as CSO 18. The structural issue is located within a portion of a 68"x43" reinforced concrete sewer main that crosses below route I-95.

CSO 18 includes storm runoff from a drainage area of approximately 78 acres and includes sanitary service inflows collected from Providence Avenue to Ridley Creek within an approximate corridor bounded to the north and south by 14th Street & Hancock Street. The CSO 18 area main facility components include:

- the 68"x43" RCP sewer main;
- a combined sewage regulator located at Hancock and Sun Streets;
- the Ridley Creek sewage interceptor;
- the CSO 18 overflow outfall into Ridley Creek;
- inflow networks including:
    - the Providence Avenue storm sewer network;
    - historic combined sewer networks within local streets that connect to the 68"X43" combined sewer main;
    - storm and sanitary connections from Widener University including lawn and parking lot inlets on University grounds.

Gilmore & Associates, Inc. has been tasked with investigating possible solutions to repair structural issues within the I-95 crossing of the 68"x43" main as well as possible elimination of CSO 18. Solutions to be investigated include a structural repair limited to the subject sewer main and possible mitigation (removal) of the entire CSO 18 network by separating storm and sanitary sewer components in accordance with the Consent Decree among DELCORA, the US EPA and the PA DEP.

Several options for mitigation of sanitary sewage flow and stormwater runoff separation have been identified as described in the full report. Three (3) select Alternates are provided herein that combine preferred options from the full report together in order to provide mitigation scenarios that are currently the most feasible based upon our investigation to date.

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2.1 ALTERNATE 1 - ROUTE A AND ROUTE B STORMWATER SEPARATION

TARGET OUTCOME

CSO 18 mitigation through removal of stormwater inflow from 68"x43" combined sewer main via "Route A" and "Route B" with storm discharge to Ridley Creek and Ship Creek, respectively.

STUDIED SOLUTION

Option 3, Option 4 and Option 8 from the Feasibility Study

Remove Providence Avenue storm network flow as well as storm flow from the existing local street combined sewer system and convey to a new endwall within Ship Creek via a new 36"/48" separate sewer along 13th Street and Upland street. This referenced inflow area comprises the overall stormwater drainage area of CSO 18 west of Chestnut Street shown on Sheet 2 of G&A mitigation plans with green hatching. Remove storm runoff from the Widener University area (depicted as red hatched area on Sheet 2) and convey via a new 30" conduit along Melrose Avenue, down 14th Street, and through the access road adjacent to the Widener ball field to a new storm endwall at Ridley Creek. Right of way may be required and/or a structural solution to the encroaching ball field retaining wall along the access road. Route A is depicted in red on Sheet 2.

Sanitary sewage would remain within the existing 68"x43" sewer main. I-95 crossing structural mitigation would include introduction of a smaller sized conduit within the crossing to be sized for existing sanitary flows and grouted into the larger pipe as a permanent structural fix.

Stormwater within Hancock Street would be rerouted to the existing CSO 18 Endwall within the Ridley Creek bank.

The existing CSO regulator would be abandoned or revised to include outflow exclusively to the Ridley Interceptor.

ESTIMATED COST RANGE (PRELIMINARY)

$5.5 million to $6.5 million

END OF ALTERNATE 1 SUMMARY

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2.2 ALTERNATE 2 – REVISED ROUTE A AND ROUTE B STORMWATER SEPARATION

TARGET OUTCOME

CSO 18 mitigation through removal of stormwater inflow from 68"x43" combined sewer main via a revised "Route A" and "Route B" with storm discharge to Ridley Creek and Ship Creek, respectively.

STUDIED SOLUTION

Option 3, Option 6 and Option 8 from the Feasibility Study

Sanitary sewage would remain within the existing 68"x43" sewer main. I-95 crossing structural mitigation would include introduction of a smaller sized conduit within the crossing to be sized for existing sanitary flows and grouted into the larger pipe as a permanent structural fix.

Remove Providence Avenue storm network flow as well as storm flow from the existing local street combined sewer system and convey to a new endwall within Ship Creek via a new 36"/48" separate storm sewer along 13th Street and Upland street. This referenced inflow area comprises the overall stormwater drainage area of CSO 18 west of Chestnut Street shown on Sheet 2 of G&A mitigation plans with green hatching. Remove storm runoff from the Widener University area (depicted as red hatched area on Sheet 2) and convey via new 24" conduit adjacent to the existing 68"x43" sewer main route to a new manhole located adjacent to existing MH 329. The new 24" conduit would then run above the referenced grouted-in sanitary pipe within the I-95 crossing and then out to a new manhole located adjacent to existing MH 3070. New conduit would then replace the existing 15" storm pipe located within Hancock Street, with new connections for existing Hancock St. runoff, and be routed to the existing endwall of CSO 18. This revised Route A is depicted in blue on Sheet 2.

Stormwater within Hancock Street would be rerouted to the existing CSO 18 Endwall within the Ridley Creek bank.

The existing CSO regulator would be abandoned or revised to include outflow exclusively to the Ridley Interceptor.

ESTIMATED COST RANGE (PRELIMINARY)

$4.5 million to $5.5 million

END OF ALTERNATE 2 SUMMARY

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2.3 ALTERNATE 3 - I-95 CROSSING SOLUTION WITH NO CSO MITIGATION

TARGET OUTCOME

Combined flow separation in the existing partially collapsed 68"x43" RCP main as part of the repair procedure for this pipe. Structural repairs to partially collapsed 68"x43" RCP at I-95 crossing

STUDIED SOLUTION

Two (2) doghouse manholes would be installed at strategic locations between existing MH 329 and MH 3070 as determined during the design phase for repairs to the existing partially collapsed 68"x43" RCP main. Temporary supports and shoring would then be installed within the existing partially collapsed 68"x43" RCP main. Sanitary sewage would be temporarily bypassed through a system installed within the existing 68"x43" RCP main so that a new 12" diameter sewer main could be installed within the existing 68"x43" RCP main. The existing 68"x43" RCP main would then be partially grouted to an elevation approximately 6" higher than the top of the new 12" diameter sanitary sewer pipe. A storm sewer pipe would then be installed at an elevation above the 12" diameter pipe. After completing this storm sewer pipe installation, the remaining annular space within the 68"x43" RCP main would be grouted solid. This flow separation would eliminate combined flow within the existing 68"x43" RCP main and serve as the permanent repair to the partially collapsed existing 68"x43" RCP main.

ESTIMATED COST RANGE (PRELIMINARY)

$2.5 million to $3.4 million

END OF ALTERNATE 3 SUMMARY

DRAFT

3.0 OPERATION &MAINTENANCE STATEMENT

Future operation and maintenance (O&M) costs of all three alternates are anticipated to be similar to the existing O&M costs with the following exceptions:

- The I-95 crossing, by virtue of installation of new carrier pipes and fully grouting the existing 68"x43" RCP main, is expected to provide a 100+ year usable life for this component of the system,.

- Elimination of stormwater flow through existing CSO 18 conduits will likely reduce future O&M costs of the sanitary sewer system.

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4.0 STUDY CRITERIA AND ASSUMPTIONS

- unknowns of the existing storm and sanitary facility locations and depths of system components as described in the full report;
- unknown locations of all other existing utilities and potential conflicts for proposed routing Alternates;
- unknown resolution of flood elevation status of Chester Creek and whether Route B can, or must be, justified through: A) existing FEMA Flood Insurance Study means and methods; B) additional Hydrologic and Hydraulic study; C) storage and attenuation of proposed storm discharge from Route B;
- the potential for environmentally sensitive issues (wetlands, bog and/or red-belly turtles, plant species, etc. that may be uncovered with a PNDI search and/or additional site investigation) within Ship Creek that would need mitigation;
- study of the existing enclosed portion of Ship Creek located under the existing railroad and I-95 for flows introduced from Route B;
- acceptance (or lack of acceptance) of new stormwater facilities for dedication to the City of Chester;
- unknown extent of lands (if any) that would require acquisition of right-of-way, construction and/or permanent easements, etc., in order to carry out any of the studied options or alternates;
- granting of applicable jurisdictional agency permits that are required to perform the work contemplated within this study;
- permission of PennDOT, USDOT and affected municipalities to perform the work via detours, lane outages, lane and ramp restrictions, redirection of traffic, temporary traffic control and work zone traffic control, as may be required to complete the project on and under I-95, Providence Road and local collector roadways;
- permission of the railroad to perform work at or near their facilities;
- permission of local property Owners and Widener University to perform the work contemplated within and/or adjacent to their properties;
- anticipated extensive coordination with existing utility owners and service providers to avoid facility conflicts, obstructions and service interruptions;
- anticipated extensive coordination with local businesses and the general public regarding the project and potential impacts to the local community and traveling public.

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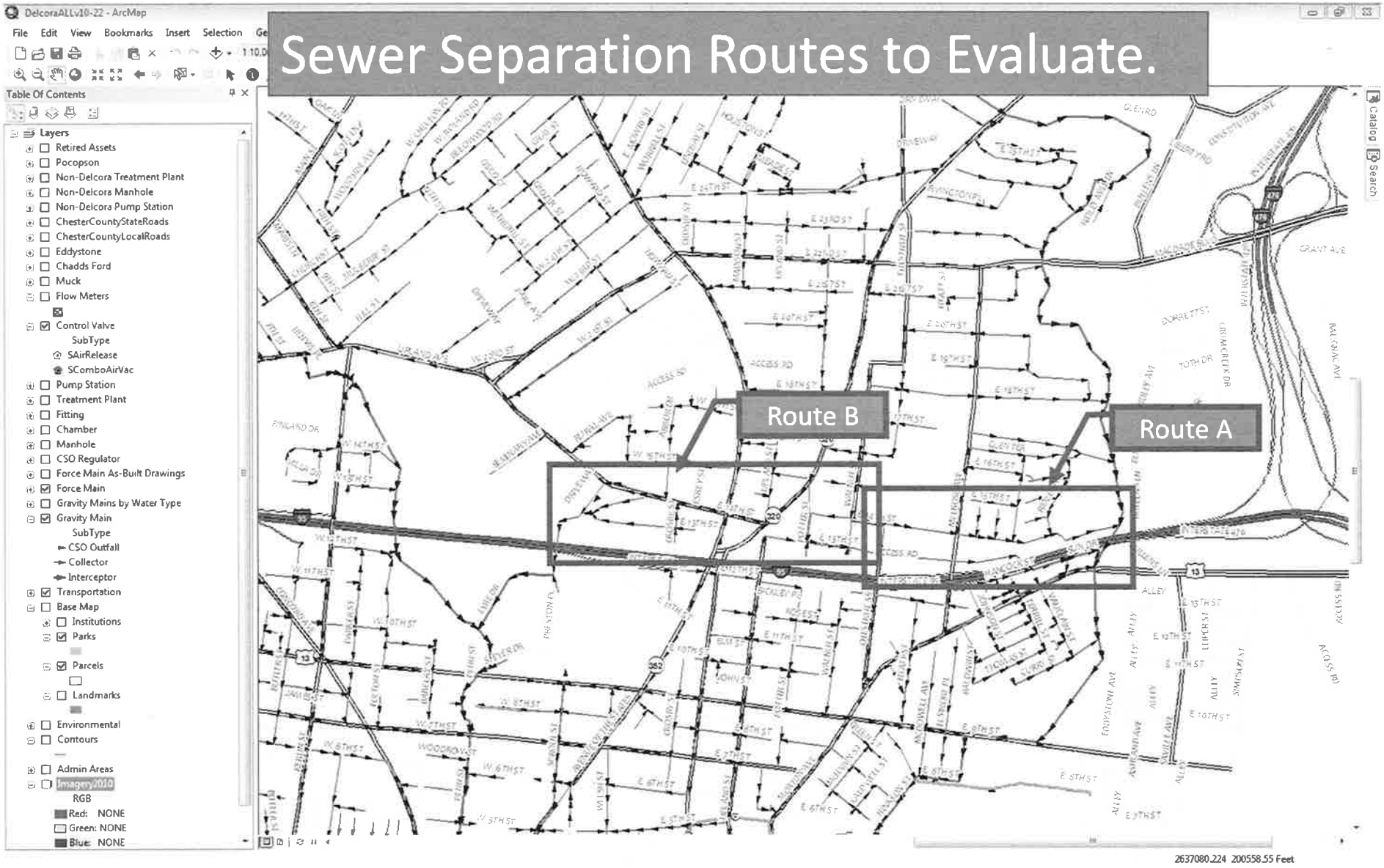
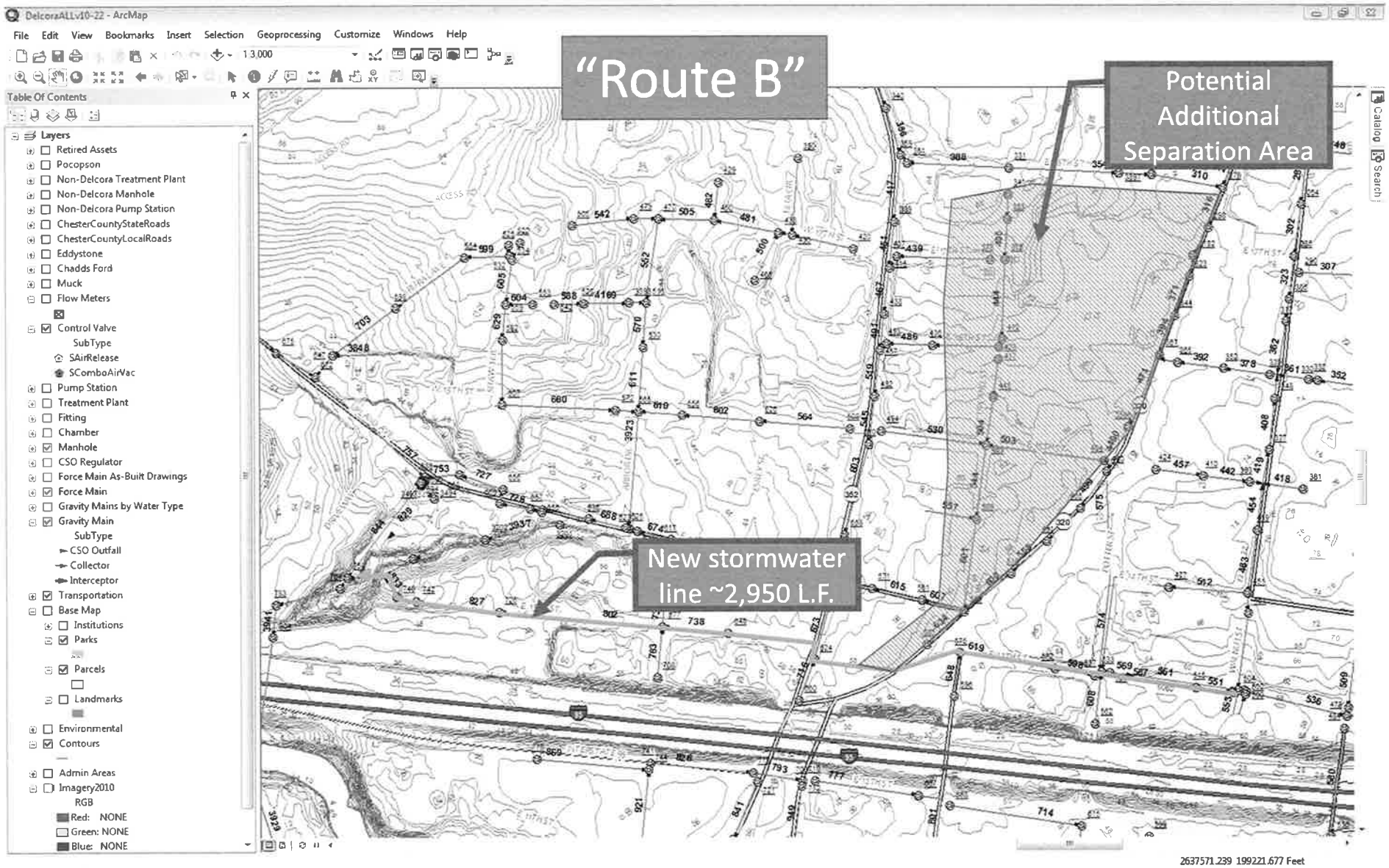
APPENDIX A

SEWER SEPARATION ROUTE REQUEST FORM DELCORA

Sewer Separation Routes to Evaluate.

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Pocopson
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Non-Delcora Manhole
Non-Delcora Pump Station
ChesterCountyStateRoads
ChesterCountyLocalRoads
Eddystone
Chadds Ford
Muck
Flow Meters
Control Valve
SubType
SAirRelease
SComboAirVac
Pump Station
Treatment Plant
Fitting
Chamber
Manhole
CSO Regulator
Force Main As-Built Drawings
Force Main
Gravity Mains by Water Type
Gravity Main
SubType
CSO Outfall
Collector
Interceptor
Transportation
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Parcels
Landmarks
Environmental
Contours
Admin Areas
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"Route B"
Potential Additional Separation Area
New stormwater line ~2,950 L.F.
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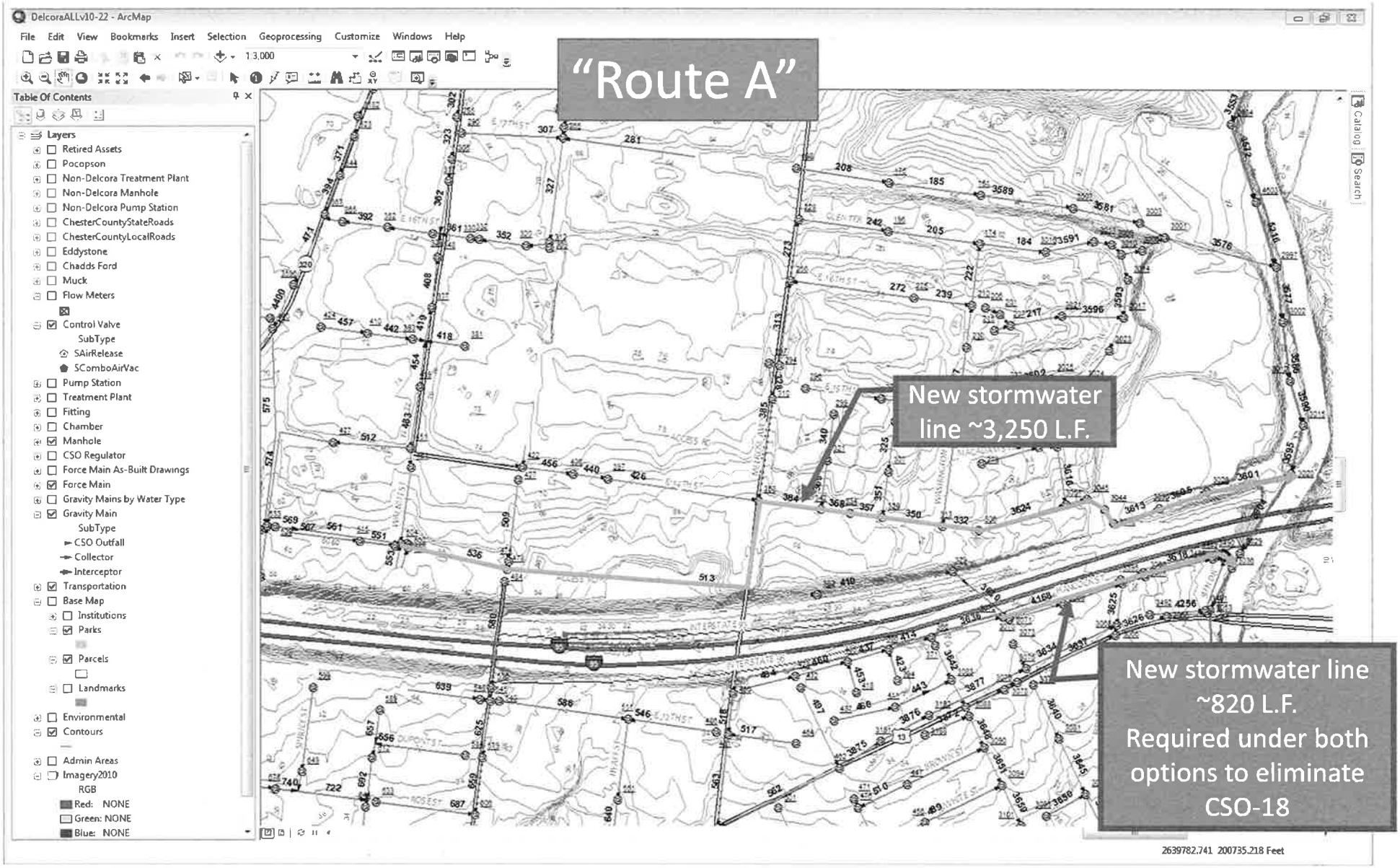
DelcoraALLv10-22 - ArcMap
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SComboAirVac
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Force Main
Gravity Mains by Water Type
Gravity Main
SubType
CSO Outfall
Collector
Interceptor
Transportation
Base Map
Institutions
Parks
Parcels
Landmarks
Environmental
Contours
Admin Areas
Imagery2010
RGB
Red: NONE
Green: NONE
Blue: NONE
"Route A"
New stormwater line ~3,250 L.F.
New stormwater line ~820 L.F. Required under both options to eliminate CSO-18
2639782.741 200735.218 Feet

APPENDIX B

CSO 18 MITIGATION CONCEPT PLANS

APPENDIX C

DELCORA GIS PLAN

APPENDIX D

DRAINAGE COMPUTATIONS FOR SELECT OPTIONS

CHAPTER 7, APPENDIX A

FIELD MANUAL FOR PENNSYLVANIA DESIGN RAINFALL INTENSITY CHARTS FROM NOAA ATLAS 14 VERSION 3 DATA

7A.0 INTRODUCTION

Previously used procedures to estimate design rainfall intensities, usually obtained from the *U.S. Weather Bureau Technical Paper No. 40* (Hershfield, 1961) or the *1986 Field Manual of PennDOT Storm-Intensity-Duration-Frequency Charts PDT-IDF* (Aron et al., 1986), have been updated in this appendix. The regional rainfall design curves in this Pennsylvania field manual were developed from frequency analyses based on hourly records from 278 daily and 139 hourly rainfall gages in Pennsylvania plus gages in surrounding states for a period of record from April 1, 1863 through December 31, 2000. The analysis leading to the design curves is fully described in this Appendix.

In performing the PDT-IDF analysis, it was found that there were regional differences in rainfall patterns between storm durations. For example, the lowest intensities and amounts for the five (5) minute storms are located in north central PA, whereas the lowest intensities and amounts for the twenty-four (24) hour storm are located in western PA. It was determined that one rainfall region map would not adequately represent the rainfall patterns. Therefore, the maps were developed based upon storm duration and frequency as shown in Table 7A.1.

7A.1 PROCEDURE FOR FINDING DESIGN INTENSITY VALUES

A. Objective. To obtain the design rainfall or return periods from 1 to 100-years and durations from 5 minutes to 24 hours and to obtain the 500-year, 24-hour precipitation.

Step 1 Determine the rainfall duration of the storm that will need to be analyzed. For the rational method, the required storm duration will be equal to the time-of-concentration.

Step 2 From Table 7A.1, determine what Rainfall Region Map should be utilized for the design storm duration of interest.

Table 7A.1 Appropriate Rainfall Region Map for each Storm Duration and Frequency

	Frequency							
Duration	**1 year**	**2 year**	**5 year**	**10 year**	**25 year**	**50 year**	**100 year**	**500 year**
5 min	C	C	C	C	B	B	B	-
10 min	C	C	C	C	C	C	C	-
15 min	A	A	A	A	C	C	C	-
30 min	A	A	A	A	A	C	C	-
60 min	A	A	A	A	A	C	C	-
2 hr	E	E	E	E	E	E	E	-
3 hr	E	E	E	E	E	E	E	-
6 hr	D	D	D	D	D	D	D	-
12 hr	F	F	F	F	F	F	F	-
24 hr	F	F	F	F	F	F	F	F

Step 3 Locate the area of interest on the Pennsylvania map for the Map determined in Step 2 (Figures 7A.1 through 7A.6) and note the region into which this area falls.

Figure 7A.1 Map A. 15-, 30- and 60-minute durations for storms occurring with an ARI of 1-, 2-, 5-, 10-years and 30- and 60-minute durations for storms occurring with an ARI of 25-years.

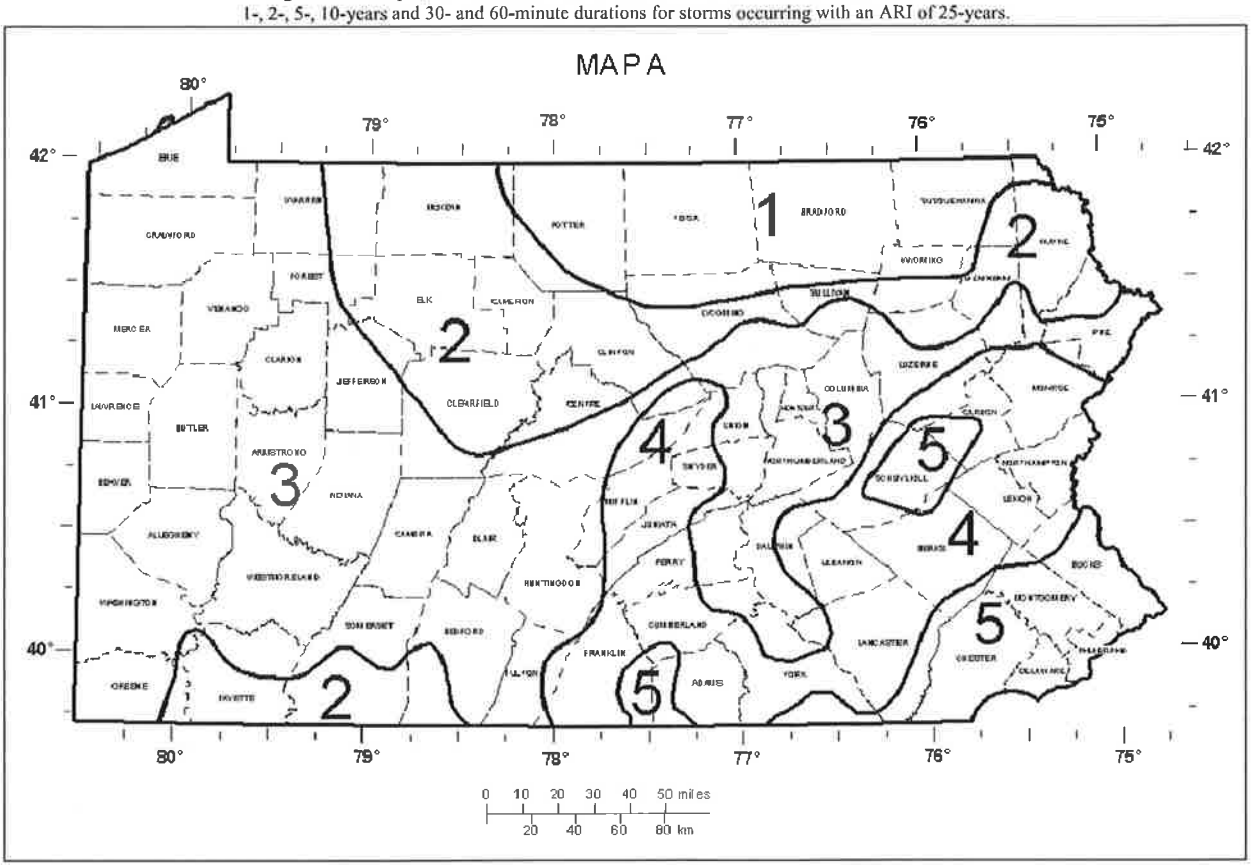


Figure 7A.2 Map B. 5-minute durations for storms occurring with an ARI of 25-, 50- and 100-years.

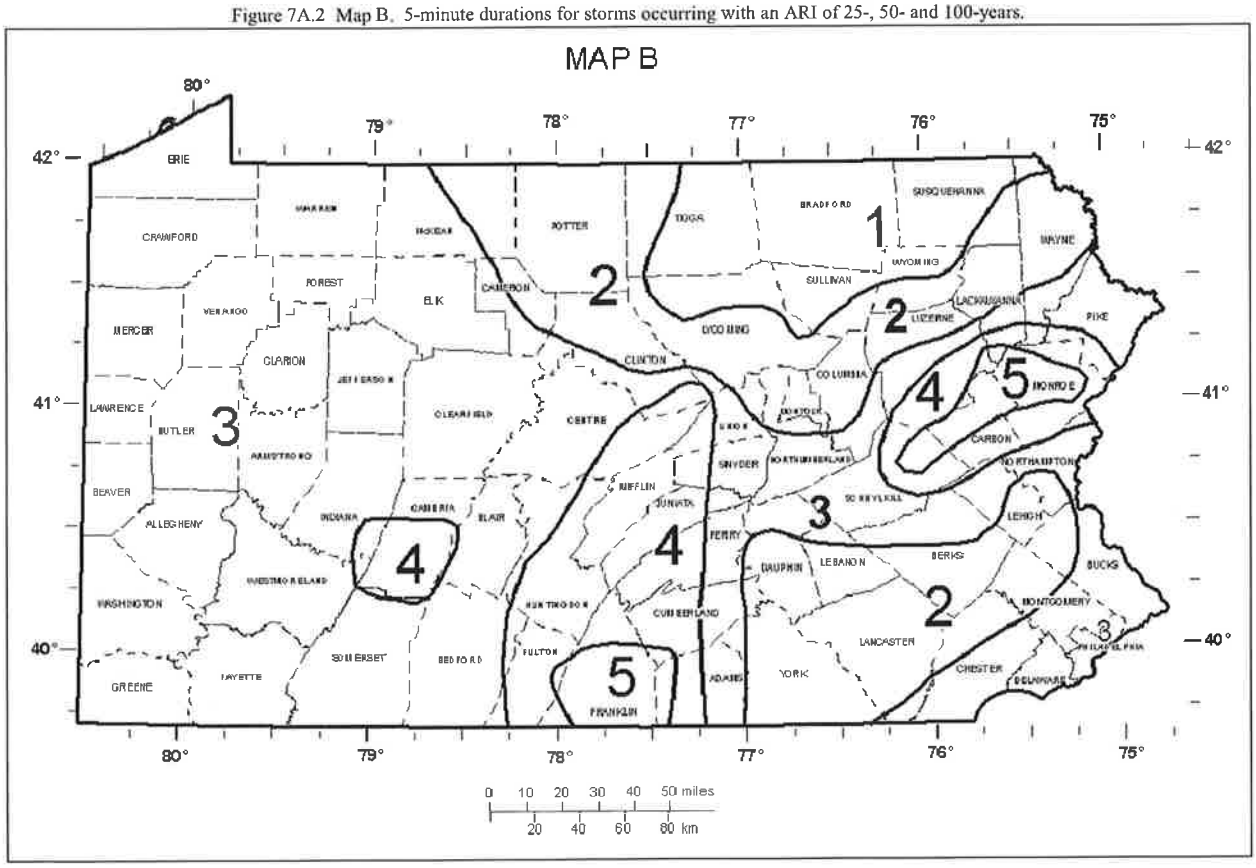


Figure 7A.3 Map C. 5- and 10-minute durations for storms occurring with an ARI of 1-, 2-, 5-, and 10-years, 10- and 15-minute durations for storms occurring with an ARI of 25-years and 10-, 15-, 30-, 60-minute durations for storms occurring with an ARI of 50- and 100-years.

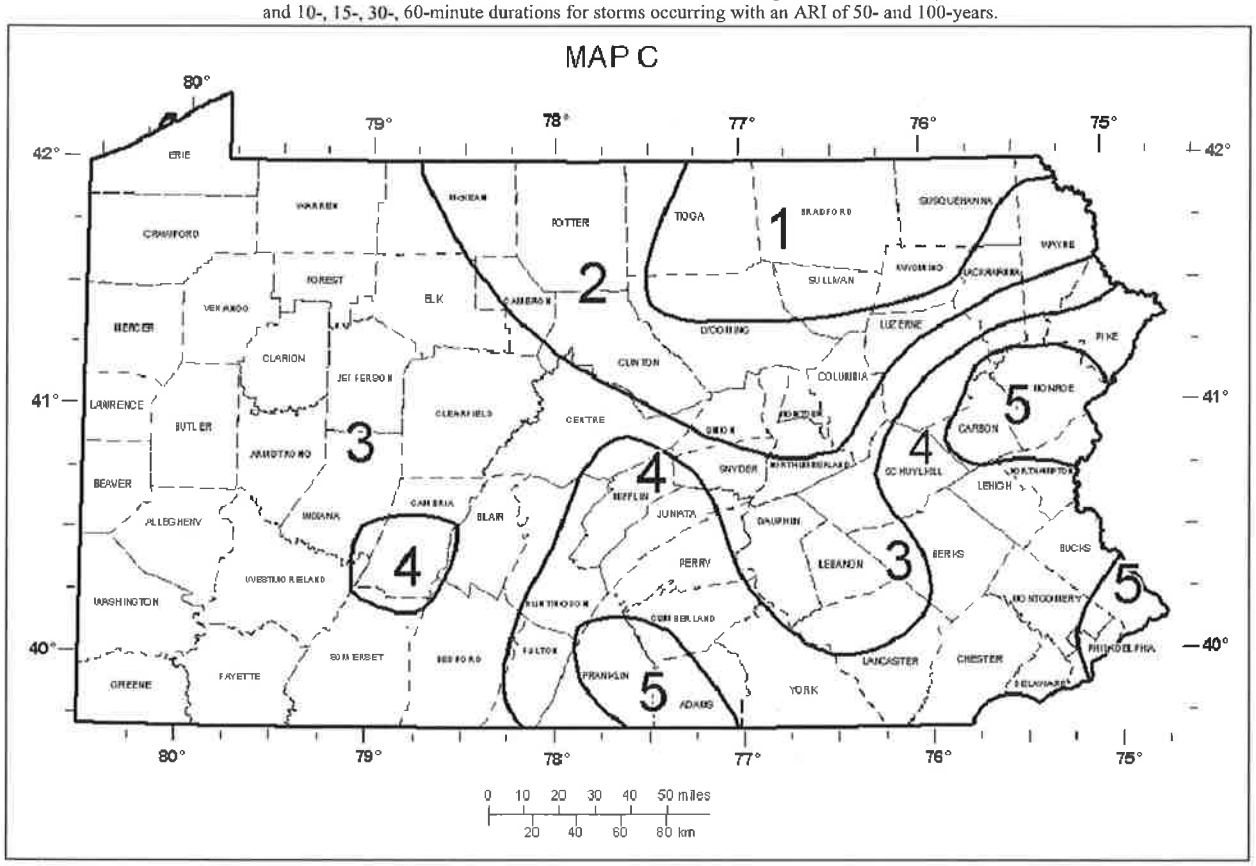


Figure 7A.12(a) Rainfall Intensity for 1- through 100-year Storms for Region 3 (U.S. Customary).

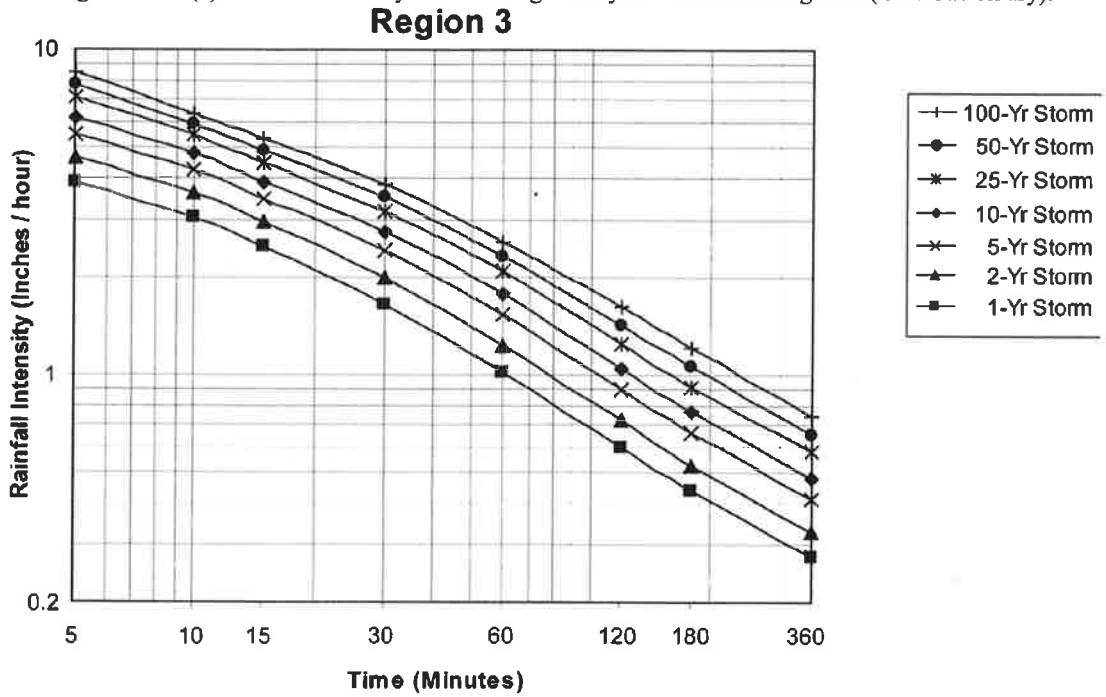


Figure 7A.12(b) Rainfall Amount for 1- through 100-year Storms for Region 3 (U.S. Customary).

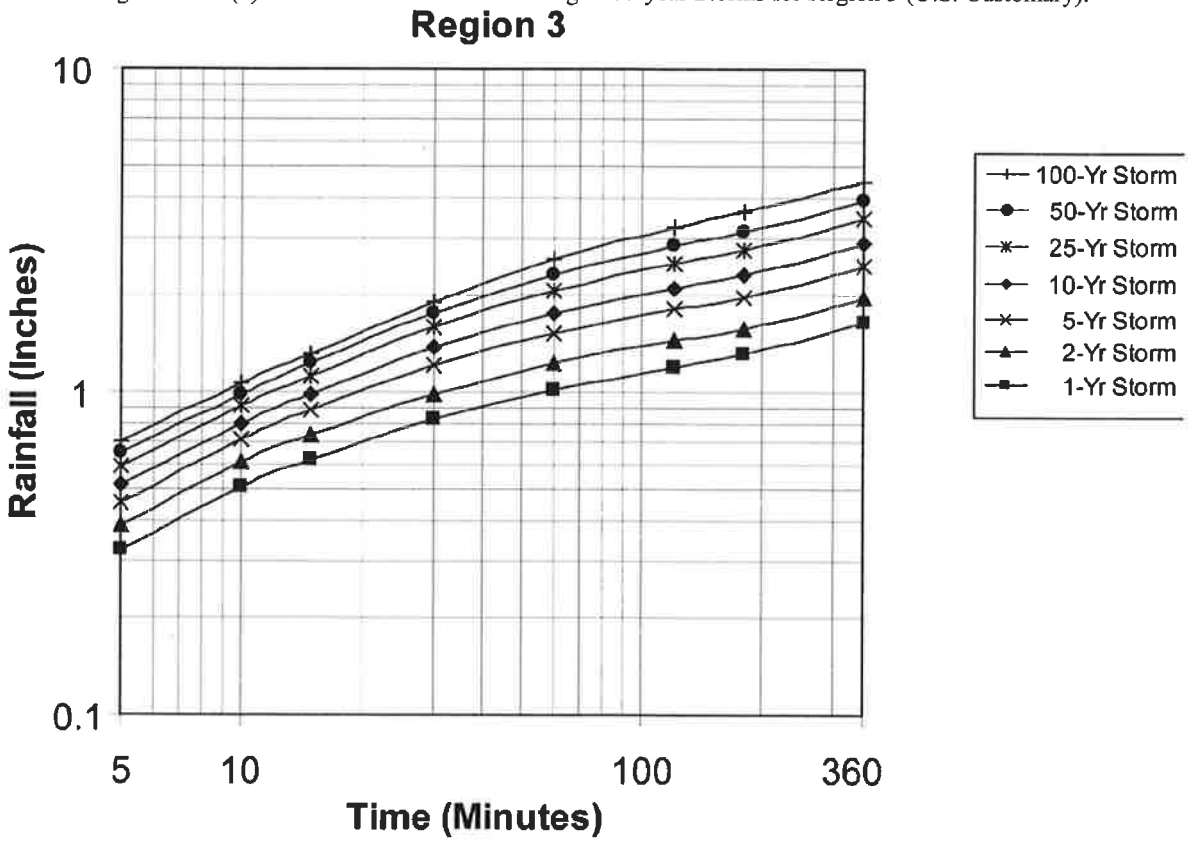


Figure 7A.14(a) Rainfall Intensity for 1- through 100-year Storms for Region 4 (U.S. Customary).

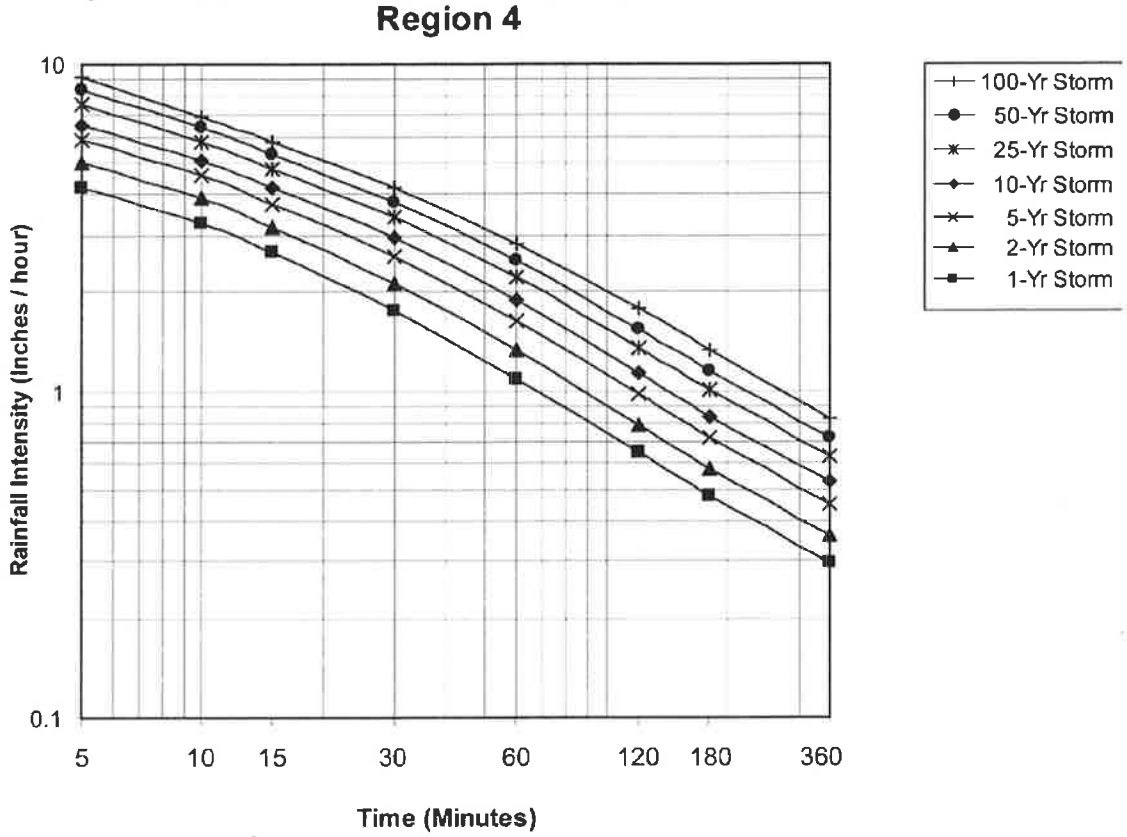


Figure 7A.14(b) Rainfall Amount for 1- through 100-year Storms for Region 4 (U.S. Customary).

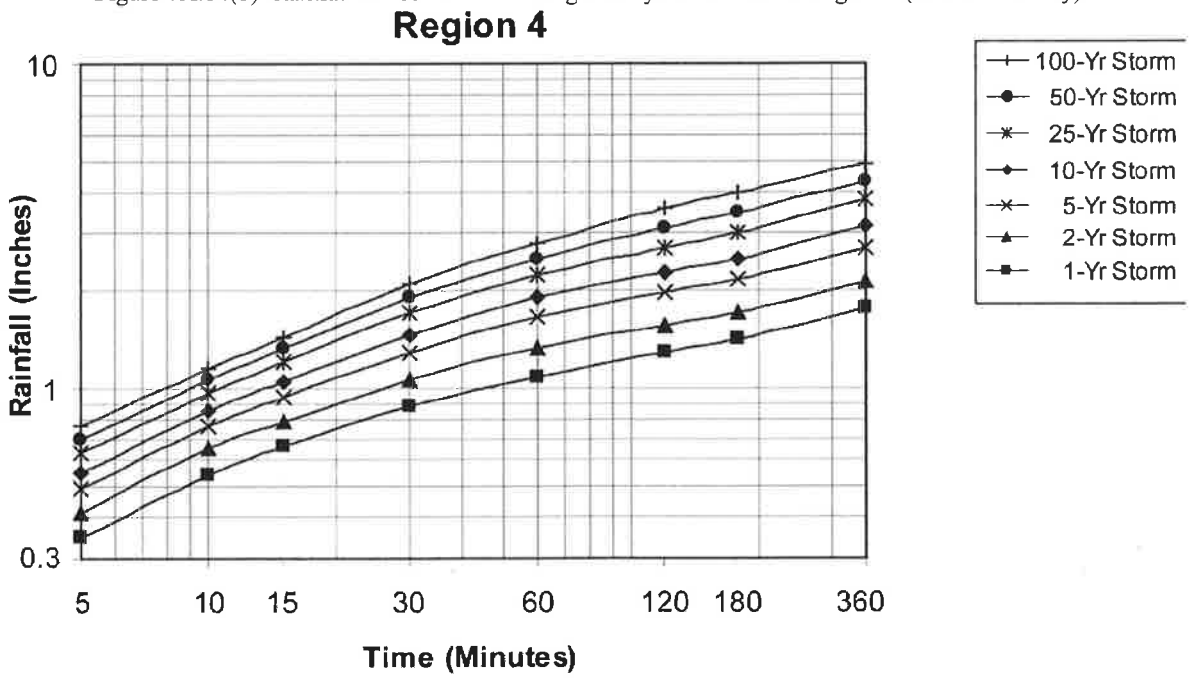


Figure 7A.16(a) Rainfall Intensity for 1- through 100-year Storms for Region 5 (U.S. Customary).

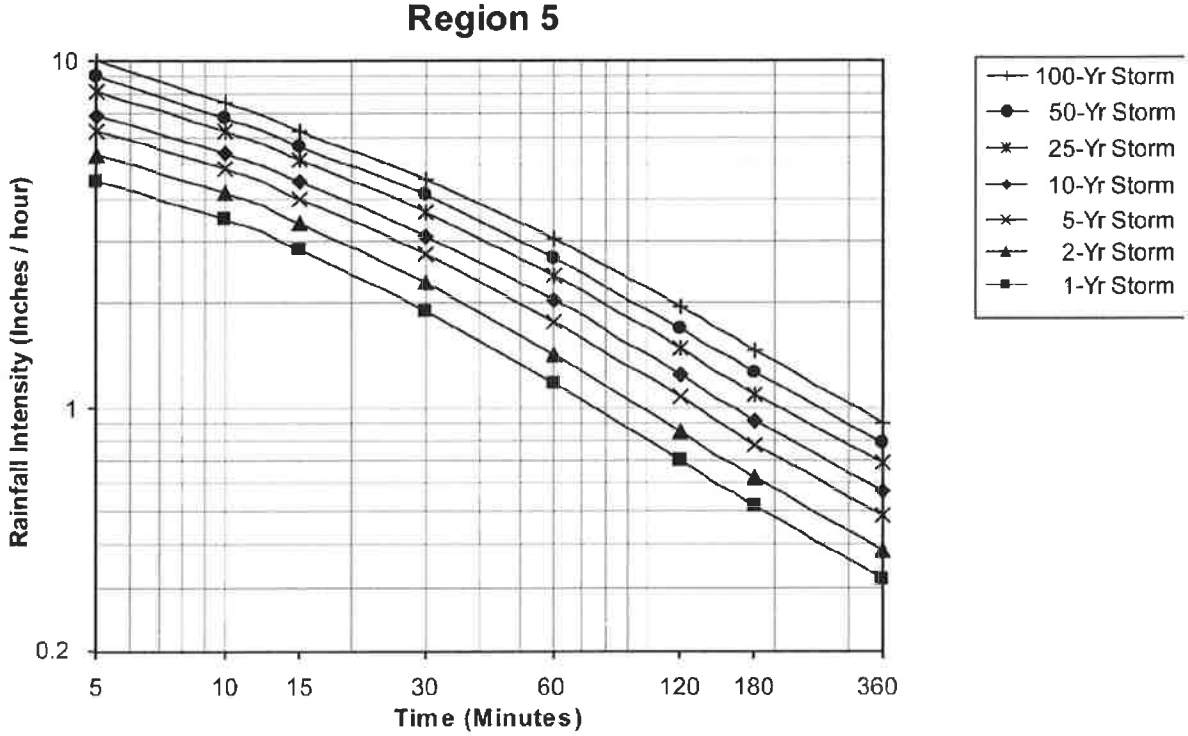
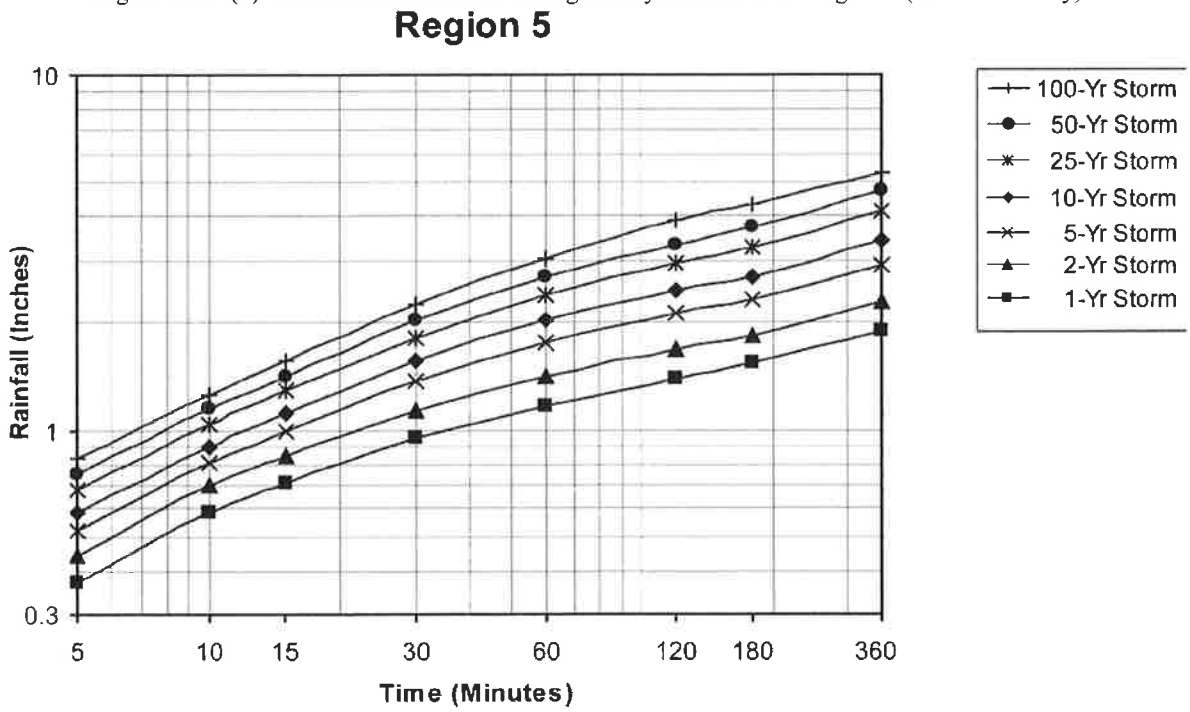


Figure 7A.16(b) Rainfall Amount for 1- through 100-year Storms for Region 5 (U.S. Customary).



STORM DRAINAGE AREA AND PIPE COMPUTATION - 100 YR STORM
SYSTEM - ROUTE A

OVERLAND FLOW Tc COMPUTATION

Tc(hr)=	0.08	hr
Tc(min)=	5	MIN
I(@ tc)=	**8.5**	in/hr (From PADOT Region 3)

DRAINAGE AREA COMPUTATION

TOTAL AREA(SF)		316000	SF
		7.3	AC
APPROX IMPERV(SF)	50%	158000	SF
APPOX LAWN(SF)	50%	158000	SF

DRAINAGE AREA PEAK RUNOFF COMPUTATION @ MH 329

68X43 CS - DRAINAGE AREA/ PEAK Q				
Cover Type	C	Area (SF)	Area (AC)	
Impervious	0.6	158000	3.627	
Lawn (B)	0.35	158000	3.627	
Total Area			**7.3**	
Rational 'C'			0.475	
I (IN/HR)	**8.5**	Q (CFS) =	**29.29**	cfs 100 YR @ MH 329

PROPOSED STORM DIVERSION PIPE DESIGN COMPUTATION

HDPE PIPE SIZE (PROPOSED): **24** in diameter

Q= 1.49/n * A * R^0.67 * S^0.5

L=		FEET
DELTA ELEV=		FEET
S=	0.015	FT/FT
n=	0.011	
R=	0.5	
A=	3.14	

PIPE CAPACITY = **32.74** cfs

PIPE CAPACITY > REQUIRED Q? YES

P:\STRUCTURAL\2016\16-05053-DELCORA\7.0 CALCS & ENGINEERING\Report\Storm Separation Report\Computation Files\Computation Source files\DRAINAGE AREA TO ROUTE A

STORM DRAINAGE AREA AND PIPE COMPUTATION - 100 YR STORM
SYSTEM - ROUTE A

OVERLAND FLOW Tc COMPUTATION

Tc(hr)=	0.08	hr
Tc(min)=	5	MIN
I(@ tc)=	**8.5**	in/hr (From PADOT Region 4)

DRAINAGE AREA COMPUTATION

TOTAL AREA(SF)		316000	SF
		7.3	AC
APPROX IMPERV(SF)	60%	189600	SF
APPOX LAWN(SF)	40%	126400	SF

DRAINAGE AREA PEAK RUNOFF COMPUTATION @ MH 329

68X43 CS - DRAINAGE AREA/ PEAK Q				
Cover Type	C	Area (SF)	Area (AC)	
Impervious	0.6	189600	4.353	
Lawn (B)	0.35	126400	2.902	
Total Area			**7.3**	
Rational 'C'			0.500	
I (IN/HR)	**8.5**	Q (CFS) =	**30.83**	cfs 100 YR @ MH 329

PROPOSED STORM DIVERSION PIPE DESIGN COMPUTATION

HDPE PIPE SIZE (PROPOSED): **24** in diameter

Q= 1.49/n * A * R^0.67 * S^0.5

L=	0	FEET
DELTA ELEV=	0	FEET
S=	0.015	FT/FT
n=	0.011	
R=	0.5	
A=	3.14	

PIPE CAPACITY = **32.74** cfs

PIPE CAPACITY > REQUIRED Q?	YES

P:\STRUCTURAL\2016\16-05053-DELCORA\7.0 CALCS & ENGINEERING\Report\Storm Separation Report\Computation Files\Computation Source files\DRAINAGE AREA TO ROUTE A

STORM DRAINAGE AREA AND PIPE COMPUTATION - 100 YR STORM
SYSTEM - ROUTE A

OVERLAND FLOW Tc COMPUTATION

Tc(hr)=	0.08	hr
Tc(min)=	5	MIN
I(@ tc)=	**8.5**	in/hr (From PADOT Region 4)

DRAINAGE AREA COMPUTATION

TOTAL AREA(SF)		316000	SF
		7.3	AC
APPROX IMPERV(SF)	70%	221200	SF
APPOX LAWN(SF)	30%	94800	SF

DRAINAGE AREA PEAK RUNOFF COMPUTATION @ MH 329

68X43 CS - DRAINAGE AREA/ PEAK Q				
Cover Type	C	Area (SF)	Area (AC)	
Impervious	0.6	221200	5.078	
Lawn (B)	0.35	94800	2.176	
Total Area			**7.3**	
Rational 'C'			0.525	
I (IN/HR)	**8.5**	Q (CFS) =	**32.37**	cfs 100 YR @ MH 329

PROPOSED STORM DIVERSION PIPE DESIGN COMPUTATION

HDPE PIPE SIZE (PROPOSED): **24** in diameter

Q= 1.49/n * A * R^0.67 * S^0.5

L=	0	FEET
DELTA ELEV=	0	FEET
S=	0.015	FT/FT
n=	0.011	
R=	0.5	
A=	3.14	

PIPE CAPACITY = **32.74** cfs

PIPE CAPACITY > REQUIRED Q?	YES

STORM DRAINAGE AREA AND PIPE COMPUTATION - 100 YR STORM
SYSTEM - ROUTE A

OVERLAND FLOW Tc COMPUTATION

Tc(hr)=	0.08	hr
Tc(min)=	5	MIN
I(@ tc)=	**8.5**	in/hr (From PADOT Region 3)

DRAINAGE AREA COMPUTATION

TOTAL AREA(SF)		316000	SF
		7.3	AC
APPROX IMPERV(SF)	50%	158000	SF
APPOX LAWN(SF)	50%	158000	SF

DRAINAGE AREA PEAK RUNOFF COMPUTATION @ MH 329

68X43 CS - DRAINAGE AREA/ PEAK Q				
Cover Type	C	Area (SF)	Area (AC)	
Impervious	0.6	158000	3.627	
Lawn (B)	0.35	158000	3.627	
Total Area			**7.3**	
Rational 'C'			0.475	
I (IN/HR)	**8.5**	Q (CFS) =	**29.29**	cfs 100 YR @ MH 329

PROPOSED STORM DIVERSION PIPE DESIGN COMPUTATION

HDPE PIPE SIZE (PROPOSED): **30** in diameter

Q= 1.49/n * A * R^0.67 * S^0.5

L=		FEET
DELTA ELEV=		FEET
S=	0.005	FT/FT
n=	0.011	
R=	0.625	
A=	4.9063	

PIPE CAPACITY = **34.298** cfs

PIPE CAPACITY > REQUIRED Q?	YES

P:\STRUCTURAL\2016\16-05053-DELCORA\7.0 CALCS & ENGINEERING\Report\Storm Separation Report\Computation Files\Computation Source files\DRAINAGE AREA TO ROUTE A

STORM DRAINAGE AREA AND PIPE COMPUTATION - 100 YR STORM
SYSTEM - ROUTE A

OVERLAND FLOW Tc COMPUTATION

Tc(hr)=	0.08	hr
Tc(min)=	5	MIN
I(@ tc)=	**8.5**	in/hr (From PADOT Region 4)

DRAINAGE AREA COMPUTATION

TOTAL AREA(SF)		316000	SF
		7.3	AC
APPROX IMPERV(SF)	60%	189600	SF
APPOX LAWN(SF)	40%	126400	SF

DRAINAGE AREA PEAK RUNOFF COMPUTATION @ MH 329

68X43 CS - DRAINAGE AREA/ PEAK Q				
Cover Type	C	Area (SF)	Area (AC)	
Impervious	0.6	189600	4.353	
Lawn (B)	0.35	126400	2.902	
Total Area			**7.3**	
Rational 'C'			0.500	
I (IN/HR)	**8.5**	Q (CFS) =	**30.83**	cfs 100 YR @ MH 329

PROPOSED STORM DIVERSION PIPE DESIGN COMPUTATION

HDPE PIPE SIZE (PROPOSED): **30** in diameter

Q= 1.49/n * A * R^0.67 * S^0.5

L=	0	FEET
DELTA ELEV=	0	FEET
S=	0.005	FT/FT
n=	0.011	
R=	0.625	
A=	4.9063	

PIPE CAPACITY = **34.298** cfs

PIPE CAPACITY > REQUIRED Q?	YES

P:\STRUCTURAL\2016\16-05053-DELCORA\7.0 CALCS & ENGINEERING\Report\Storm Separation Report\Computation Files\Computation Source files\DRAINAGE AREA TO ROUTE A

STORM DRAINAGE AREA AND PIPE COMPUTATION - 100 YR STORM
SYSTEM - ROUTE A

OVERLAND FLOW Tc COMPUTATION

Tc(hr)=	0.08	hr
Tc(min)=	5	MIN
I(@ tc)=	**8.5**	in/hr (From PADOT Region 4)

DRAINAGE AREA COMPUTATION

TOTAL AREA(SF)		316000	SF
		7.3	AC
APPROX IMPERV(SF)	70%	221200	SF
APPOX LAWN(SF)	30%	94800	SF

DRAINAGE AREA PEAK RUNOFF COMPUTATION @ MH 329

68X43 CS - DRAINAGE AREA/ PEAK Q				
Cover Type	C	Area (SF)	Area (AC)	
Impervious	0.6	221200	5.078	
Lawn (B)	0.35	94800	2.176	
Total Area			**7.3**	
Rational 'C'			0.525	
I (IN/HR)	**8.5**	Q (CFS) =	**32.37**	cfs 100 YR @ MH 329

PROPOSED STORM DIVERSION PIPE DESIGN COMPUTATION

HDPE PIPE SIZE (PROPOSED): **30** in diameter

Q= 1.49/n * A * R^0.67 * S^0.5

L=	0	FEET
DELTA ELEV=	0	FEET
S=	0.005	FT/FT
n=	0.011	
R=	0.625	
A=	4.9063	

PIPE CAPACITY = **34.298** cfs

PIPE CAPACITY > REQUIRED Q?	YES

DELCORA

Address/TMP 16-05053

Chester City, Delaware County, PA 11/8/2016

Time of Concentration Computations

Route B Bottom

P2= 3.2 inches

Flow Type	Variables					Flow Time
Sheet Flov	n			L	S	T
				feet		hours
1		0.24		165	0.04	0.269
Shallow C	Surface	Gradient		L	Velocity	
		ft/ft		feet	fps	
2	Unpaved	0.014		96	1.9	0.014
2	Paved	0.013		0	2.3	0.000
Channel F	Mannings	Hyd.Radius	Gradient	L	Velocity	
	n	R	S - ft/ft	feet	fps	
3	0.013	0.38	0.015	603	7.3	0.023
4	0.013	1.00	0.008	2045	10.3	0.055
Totals				2909		0.361

STORM DRAINAGE AREA AND PIPE COMPUTATION - 100 YR STORM
SYSTEM - ROUTE B TOP

OVERLAND FLOW Tc COMPUTATION

Tc(hr)=	0.23	hr
Tc(min)=	14	MIN
I(@ tc)=	7	in/hr (From PADOT Region 4)

DRAINAGE AREA COMPUTATION

TOTAL AREA(SF)		465250	SF
		10.7	AC
APPROX IMPERV(SF)	50%	232625	SF
APPOX LAWN(SF)	50%	232625	SF

DRAINAGE AREA PEAK RUNOFF COMPUTATION @ MH 329

68X43 CS - DRAINAGE AREA/ PEAK Q				
Cover Type	C	Area (SF)	Area (AC)	
Impervious	0.6	232625	5.340	
Lawn (B)	0.35	232625	5.340	
Total Area			**10.7**	
Rational 'C'			0.475	
I (IN/HR)	**7**	Q (CFS) =	**35.51**	cfs 100 YR @ MH 329

PROPOSED STORM DIVERSION PIPE DESIGN COMPUTATION

HDPE PIPE SIZE (PROPOSED): **36** in diameter

Q= 1.49/n * A * R^0.67 * S^0.5

L=		FEET
DELTA ELEV=		FEET
S=	0.005	FT/FT
n=	0.013	
R=	0.75	
A=	7.065	

PIPE CAPACITY = **47.221** cfs

PIPE CAPACITY > REQUIRED Q? YES

P:\STRUCTURAL\2016\16-05053-DELCORA\7.0 CALCS & ENGINEERING\Report\Storm Separation Report\Computation Files\Computation Source files\DRAINAGE AREA TO ROUTE B TOP

STORM DRAINAGE AREA AND PIPE COMPUTATION - 100 YR STORM
SYSTEM - ROUTE B TOP

OVERLAND FLOW Tc COMPUTATION

Tc(hr)=	0.23	hr
Tc(min)=	14	MIN
I(@ tc)=	7	in/hr (From PADOT Region 4)

DRAINAGE AREA COMPUTATION

TOTAL AREA(SF)		465250	SF
		10.7	AC
APPROX IMPERV(SF)	60%	279150	SF
APPOX LAWN(SF)	40%	186100	SF

DRAINAGE AREA PEAK RUNOFF COMPUTATION @ MH 329

68X43 CS - DRAINAGE AREA/ PEAK Q				
Cover Type	C	Area (SF)	Area (AC)	
Impervious	0.6	279150	6.408	
Lawn (B)	0.35	186100	4.272	
Total Area			**10.7**	
Rational 'C'			0.500	
I (IN/HR)	**7**	Q (CFS) =	**37.38**	cfs 100 YR @ MH 329

PROPOSED STORM DIVERSION PIPE DESIGN COMPUTATION

HDPE PIPE SIZE (PROPOSED): **36** in diameter

Q= 1.49/n * A * R^0.67 * S^0.5

L=	0	FEET
DELTA ELEV=	0	FEET
S=	0.005	FT/FT
n=	0.013	
R=	0.75	
A=	7.065	

PIPE CAPACITY = **47.221** cfs

PIPE CAPACITY > REQUIRED Q?	YES

P:\STRUCTURAL\2016\16-05053-DELCORA\7.0 CALCS & ENGINEERING\Report\Storm Separation Report\Computation Files\Computation Source files\DRAINAGE AREA TO ROUTE B TOP

STORM DRAINAGE AREA AND PIPE COMPUTATION - 100 YR STORM
SYSTEM - ROUTE B TOP

OVERLAND FLOW Tc COMPUTATION

Tc(hr)=	0.23	hr
Tc(min)=	14	MIN
I(@ tc)=	7	in/hr (From PADOT Region 4)

DRAINAGE AREA COMPUTATION

TOTAL AREA(SF)		465250	SF
		10.7	AC
APPROX IMPERV(SF)	70%	325675	SF
APPOX LAWN(SF)	30%	139575	SF

DRAINAGE AREA PEAK RUNOFF COMPUTATION @ MH 329

68X43 CS - DRAINAGE AREA/ PEAK Q				
Cover Type	C	Area (SF)	Area (AC)	
Impervious	0.6	325675	7.476	
Lawn (B)	0.35	139575	3.204	
Total Area			**10.7**	
Rational 'C'			0.525	
I (IN/HR)	**7**	Q (CFS) =	**39.25**	cfs 100 YR @ MH 329

PROPOSED STORM DIVERSION PIPE DESIGN COMPUTATION

HDPE PIPE SIZE (PROPOSED): **36** in diameter

Q= 1.49/n * A * R^0.67 * S^0.5

L=	0	FEET
DELTA ELEV=	0	FEET
S=	0.005	FT/FT
n=	0.013	
R=	0.75	
A=	7.065	

PIPE CAPACITY = **47.221** cfs

PIPE CAPACITY > REQUIRED Q? YES

P:\STRUCTURAL\2016\16-05053-DELCORA\7.0 CALCS & ENGINEERING\Report\Storm Separation Report\Computation Files\Computation Source files\DRAINAGE AREA TO ROUTE B TOP

STORM DRAINAGE AREA AND PIPE COMPUTATION - 100 YR STORM
SYSTEM - ROUTE B BOTTOM

OVERLAND FLOW Tc COMPUTATION

Tc(hr)=	0.36	hr
Tc(min)=	22	MIN
I(@ tc)=	**4.9**	in/hr (From PADOT Region 4)

DRAINAGE AREA COMPUTATION

TOTAL AREA(SF)		3089000	SF
		70.9	AC
APPROX IMPERV(SF)	50%	1544500	SF
APPOX LAWN(SF)	50%	1544500	SF

DRAINAGE AREA PEAK RUNOFF COMPUTATION @ MH 329

68X43 CS - DRAINAGE AREA/ PEAK Q				
Cover Type	C	Area (SF)	Area (AC)	
Impervious	0.6	1544500	35.457	
Lawn (B)	0.35	1544500	35.457	
Total Area			**70.9**	
Rational 'C'			0.475	
I (IN/HR)	**4.9**	Q (CFS) =	**165.05**	cfs 100 YR @ MH 329

PROPOSED STORM DIVERSION PIPE DESIGN COMPUTATION

HDPE PIPE SIZE (PROPOSED): **48** in diameter

Q= 1.49/n * A * R^0.67 * S^0.5

L=		FEET
DELTA ELEV=		FEET
S=	0.013	FT/FT
n=	0.011	
R=	1	
A=	12.56	

PIPE CAPACITY = **193.98** cfs

PIPE CAPACITY > REQUIRED Q?	YES

P:\STRUCTURAL\2016\16-05053-DELCORA\7.0 CALCS & ENGINEERING\Report\Storm Separation Report\Computation Files\Computation Source files\DRAINAGE AREA TO ROUTE B

STORM DRAINAGE AREA AND PIPE COMPUTATION - 100 YR STORM
SYSTEM - ROUTE B BOTTOM

OVERLAND FLOW Tc COMPUTATION

Tc(hr)=	0.36	hr
Tc(min)=	22	MIN
I(@ tc)=	**4.9**	in/hr (From PADOT Region 4)

DRAINAGE AREA COMPUTATION

TOTAL AREA(SF)		3089000	SF
		70.9	AC
APPROX IMPERV(SF)	60%	1853400	SF
APPOX LAWN(SF)	40%	1235600	SF

DRAINAGE AREA PEAK RUNOFF COMPUTATION @ MH 329

68X43 CS - DRAINAGE AREA/ PEAK Q				
Cover Type	C	Area (SF)	Area (AC)	
Impervious	0.6	1853400	42.548	
Lawn (B)	0.35	1235600	28.365	
Total Area			**70.9**	
Rational 'C'			0.500	
I (IN/HR)	**4.9**	Q (CFS) =	**173.74**	cfs 100 YR @ MH 329

PROPOSED STORM DIVERSION PIPE DESIGN COMPUTATION

HDPE PIPE SIZE (PROPOSED): **48** in diameter

Q= 1.49/n * A * R^0.67 * S^0.5

L=	0	FEET
DELTA ELEV=	0	FEET
S=	0.013	FT/FT
n=	0.011	
R=	1	
A=	12.56	

PIPE CAPACITY = **193.98** cfs

PIPE CAPACITY > REQUIRED Q?	YES

APPENDIX R

DRAFT FCA REPORT

- DELCORA Draft Financial Capability Assessment Report (Final) dated May 2016 (Revised April 2017)
- Long-Term CSO Control Plan – City of Chester Combined Sewer system revised April 2012 and edited through September 16, 2013 prepared by Weston Solutions, Inc.
- USEPA Letter Providing Comments on the Draft Financial Capability Assessment Report dated August 25, 2017
- DELCORA Letter to USEPA Responding to Comments Provided in USEPA Letter dated August 25, 2017

Note: This Appendix includes a report from Greeley & Hansen which rebranded to TYLin in 2023

Delaware County Regional Water Quality Control Authority (DELCORA)
CSO Long Term Control Plan Update

Draft Financial Capability Assessment Report

(Final)

May 2016
(Revised April 2017)

GREELEY AND HANSEN

REPORT SIGNATURE COVER SHEET

Signature of this cover signifies agreement with the content of the DELCORA Identification of Sensitive Areas and Pollutants of Concern Report.

I certify under penalty of law that the document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

DELCORA MANAGEMENT		
Executive Director	Signature	5/9/16 Date
DELCORA ENGINEERING		
Director of Engineering	Signature	5/9/16 Date
DELCORA OPERATIONS AND MAINTENANCE		
Director of Operation and Maintenance	Signature	5/9/16 Date

REVISION CONTROL

REV. NO.	DATE ISSUED	PREPARED BY	DESCRIPTION OF CHANGES
1	11/17/16	Greeley and Hansen/ DELCORA	• Updated Table of Content and List of Appendices. • Page ES-4: Updated Table ES-2 to address USEPA comments. • Page ES-5: Updated Table ES-3. • Page ES-6: Updated Tables ES-4 and ES-5. • Page 1-4: Updated Section 1.1, model area description to address USEPA description. • Page 1-4: Updated Section 1.1.1 conveyance system description to address USEPA description. • Page 1-5: Updated Table 1-1 to include Service Area. • Page 4-6: Updated Table 4-2 to address USEPA comments. • Page 4-7: Updated Section 4.4.2. • Page 4-8: Updated Table 4-3 to address USEPA comments. • Page 5-4: Updated Section 5.2, Line 402: Debt of Overlapping Entities. • Page 5-5: Updated Section 5.2. • Page 5-6: Updated Table 5-4. • Page 5-8: Updated Table 5-6. • Page 5-9: Updated Table 5-7. • Page 5-11: Updated Table 5-9. • Page 5-12: Updated Table 5-10. • Page 7-1: Updated Section 7 References • Appendix 1, Page 1: Revised table to address USEPA comments. • Appendix 1, Page 4, Revised tables. • Added Appendices 6 through 13
2	4/21/17	Greeley and Hansen/ DELCORA	• Updated Table of Contents and List of Appendices. • Page ES-2: Updated Figure ES-1. • Page ES-5: Updated Table ES-3 (Worksheet 1). • Page ES-6: Updated Table ES-4 (Worksheet 2). • Page ES-7: Updated Table ES-5 (Worksheet 10). • Page 1-4: Updated DELCORA's share of PWD LTCP cost (paragraph 1). • Page 1-4: Corrected spelling of Muckinipates (last paragraph). • Page 4-2: Revised last paragraph of Section 4.1.2. • Page 4-4 Updated Figure 4-1. • Page 4-5: Added Section 4.3 (description of basis for storm water costs). • Page 4-6: Updated text for Cost per Household. • Page 4-6: Updated Table 4-2 (Worksheet 1) to include estimate of storm water costs. • Page 4-8: Updated Table 4-3 (Worksheet 2) to include estimate of storm water costs. • Page 5-8: Corrected spelling error.

			• Page 5-9: Corrected spelling error. • Appendix 1, Pages 1 and 2: Updated Table 1 and Table 2 (Worksheet 1) to include storm water costs. • Appendix 1, Pages 3 and 4: Updated Table 3 and Table 4 (Worksheet 2) to include storm water costs. • Appendix 1, Page 12: Updated Table 12, added Table 13. • Appendix 8: Inserted Delaware County CAFR. • Appendix 13: Revised Figure A13-1 and text. • Appendix 14: Added new Appendix 14 in response to EPA concerns.

Table of Contents

Executive Summary 1
Purpose 1
CSO LTCP Cost Allocation to Separate Sewer System 1
Financial Health of Chester City 3
Financial indicator 3
Residential indicator 4
Financial Capability Matrix Score 6

Section 1 Introduction 1-1
1.1 Description of the DELCORA Service Area 1-1
1.1.1 Model Area 1-4

Section 2 Consent Decree Requirements and EPA Guidance 2-1
2.1 Consent Decree Requirements 2-1
2.2 EPA Guidance 2-1
2.2.1 Two-phase Assessment 2-1
2.2.2 EPA FCA Framework (2014) 2-2

Section 3 Assumptions 3-1
3.1 Schedule and Planning Period 3-1
3.2 Funding Sources 3-1
3.3 Interest Rate 3-1
3.4 Inflation 3-1
3.4.1 Operation and Maintenance Costs 3-1
3.4.2 Median Household Income 3-1
3.5 Future Regulatory Requirements 3-2

Section 4 Financial Capabilities Assessment – Phase 1 4-1
4.1 Cost per Household (Worksheet 1) 4-1
4.1.1 Current Costs 4-1
4.1.2 Projected Costs 4-2
4.1.2.1 Projected Cost for DELCORA 4-3
4.2 Residential Share of Costs 4-5

Table of Contents

4.3 Projected MS4 Storm Water Costs 4-5
4.4 Cost per Household 4-6
4.5 Development of the Residential Indicator (Worksheet 2) 4-6
4.5.1 Household Income Distribution 4-7
4.5.2 Median Household Income 4-7
4.5.3 Residential Indicators 4-7

Section 5 Financial Capabilities Assessment – Phase 2 5-1
5.1 Worksheet 3 – Bond Rating 5-1
5.2 Worksheet 4 - Net Debt as Percent of Full Market Property Value 5-3
5.3 Worksheet 5 – Unemployment Rate 5-6
5.4 Worksheet 6 – Median Household Income 5-7
5.5 Worksheet 7 – Property Tax Revenues as percent of Full Market Value 5-8
5.6 Worksheet 8 – Property Tax Revenue Collection Rate 5-9
5.7 Worksheet 9 - Summary of Financial Capability Indicators 5-10
5.8 Worksheet 10 - Overall Financial Capability Matrix 5-11

Section 6 Conclusions 6-1

Section 7 References 7-1

List of Tables

Table ES-1: CSO Volume as Percent of Total Wet Weather Volume 2
Table ES-2: Worksheet 9 - Summary of Financial Capability Indicators 4
Table ES-3: Worksheet 1 - Cost per Household 5
Table ES-4: Worksheet 2 - Median Household Income 6
Table ES-5: Worksheet 10 - Overall Financial Capability Matrix 7
Table 1-1: Model Area 1-5
Table 2-1: Financial Capability Matrix 2-2
Table 3-1: Comparison of Rates of Change for CPI-U versus MHI 3-2
Table 4-4-1: CSO Volume as Percent of Total Wet Weather Volume 4-4
Table 4-2: Worksheet 1 - Cost per Household 4-6
Table 4-3: Worksheet 2 - Median Household Income 4-8
Table 5-1: Worksheet 3 - Bond Rating 5-2
Table 5-2: Summary of General Obligation Bond Ratings 5-3
Table 5-3: Overlapping Entities – School Districts 5-4

Table of Contents

Table 5-4: Worksheet 4 – Overall Net Debt as a Percent of Full Market Property Value 5-5
Table 5-5: Worksheet 5 - Unemployment Rate 5-6
Table 5-6: Worksheet 6 - Median Household Income 5-7
Table 5-7: Worksheet 7 – Property Tax Revenues as percent of Full Market Value 5-8
Table 5-8: Worksheet 8 – Property Tax Revenue Collection Rate 5-9
Table 5-9: Worksheet 9 - Summary of Financial Capability Indicators 5-10
Table 5-10: Worksheet 10 - Overall Financial Capability Matrix 5-11

List of Figures

Figure ES-1: Basis for Estimating Wet Weather Flow from Separate Sewer Areas 2
Figure 1-1: DELCORA's Conveyance System 1-2
Figure 1-2: DELCORA's Service Area 1-3
Figure 4-1: Basis for Estimating Wet Weather Flow from Separate Sewer Areas 4-4

List of Appendices

Appendix 1: FCA Worksheets for Municipalities in Model Area
Appendix 2: EPA FCA Framework 2014
Appendix 3: Consumer Price Index Analysis
Appendix 4: Inflation of Median Household Income
Appendix 5: Sewer Rate Setting Information
Appendix 6: Municipal Annual Audit and Financial Reports (MAAFR)
Appendix 7: City of Chester 2012 Property Tax Revenues
Appendix 8: Debt for Overlapping Entities
Appendix 9: Real Estate Assessments
Appendix 10: Tax Rates
Appendix 11: Bureau of Labor Statistics Data
Appendix 12: U.S. Census/American Community Survey Data
Appendix 13: Flow Allocation
Appendix 14: Worksheet Details

Executive Summary

The Delaware County Regional Water Quality Control Authority (DELCORA) is a municipal authority originally organized under the Pennsylvania Municipal Authorities Act of 1945 (P.L. 382), as amended and supplemented, pursuant to action taken by the Delaware County Council on October 20, 1971. Under County of Delaware Ordinance 2002-1, the term of existence of DELCORA was extended to January 15, 2052.

DELCORA prepared and submitted their original Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP) to the PADEP in 1999. This LTCP was subsequently approved by the PADEP, and DELCORA had started to implement the CSO control elements selected in the LTCP. In 2009, the United States Environmental Protection Agency (USEPA) informed DELCORA that the original LTCP was not in compliance with the requirements of the USEPA's CSO Policy. As such, DELCORA prepared and submitted a revised LTCP in February 2012. Subsequent to the receipt of the revised LTCP, DELCORA and the USEPA had corresponded various times including requests for additional information from the USEPA in accordance with Section 308 of the Clean Water Act. A Consent Decree was ultimately executed between DELCORA, the Pennsylvania Department of Environmental Protection (PADEP) and USEPA, and was approved by the Federal District Court on November 10, 2015. The Consent Decree requires a revised LTCP to be prepared based on an agreed upon schedule, which will include interim deliverables and milestones.

Purpose

DELCORA is developing a Long Term Control Plan (LTCP) Update for the Combined Sewer System (CSS) as required by the Consent Decree. The Consent Decree requires the preparation of a Draft Financial Capabilities Assessment (FCA) including information on sewer rate setting, median household income (MHI) and number of households in the LTCP Model Area which must be submitted within nine (9) months of the Date of Lodging of the Consent Decree.

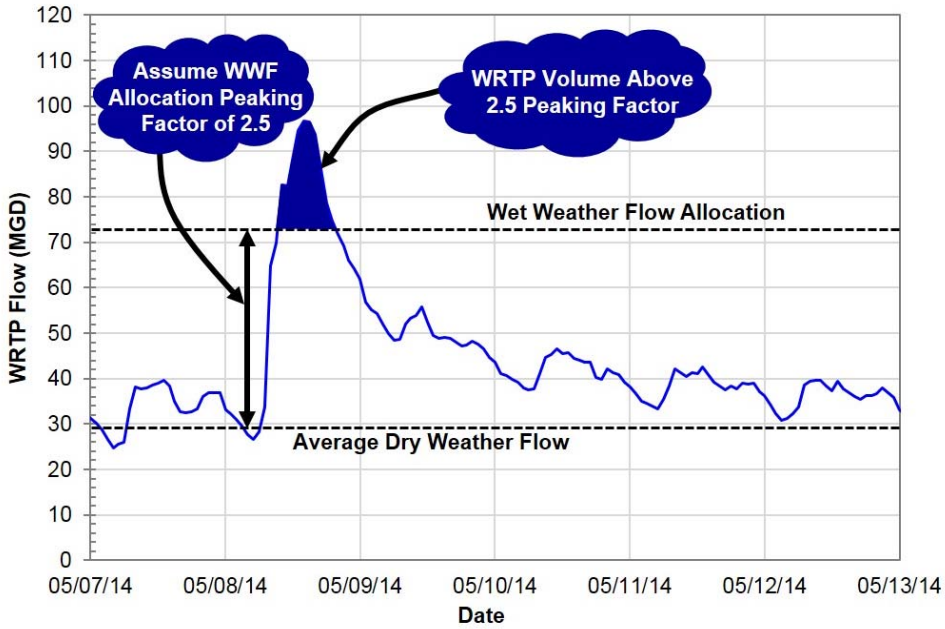
The Draft FCA has been prepared in advance of the completion of the revised LTCP. Therefore, final CSO control alternatives and their associated capital improvement costs have not been determined. The Draft FCA is based on an analysis of the affordability for the affected residential communities as measured by the Residential Index. The Final FCA, which is to be submitted after evaluation of CSO controls, will include planning level estimated costs for the identified alternatives that can then be contrasted with the results of the estimated affordability analysis.

CSO LTCP Cost Allocation to Separate Sewer System

DELCORA's system serves a variety of customers from numerous municipalities in Delaware County, PA. The majority of the sewer systems within the Model Area have separated sanitary sewers, with the exception of a portion of Chester City, which is served by combined sewers. DELCORA has service agreements with the authorities, major industries, and a few municipalities. There are service agreements that indicate that the discharger will not share in any CSO related costs, because there was no direct discharge to the combined sewer system. However, most agreements indicate that authority, industry, or municipality shall not discharge excess wet weather flow to the DELCORA WRTP. Thus, for the purpose of the Draft FCA, the allocation of CSO LTCP costs to the separate sewer system is based on

separate sewer system's share of the total Wet Weather Flow (WWF) volume. The separate sewer system's share is based on WRTP's WWF volume above a peaking factor 2.5. Figure ES-1 shows an example WRTP's WWF volume from a single storm event in May 2014.

Figure ES-1: Basis for Estimating Wet Weather Flow from Separate Sewer Areas



To estimate the total wet weather volumes shown in Table ES-1, the WRTP's WWF volumes from all storms above a peaking factor of 2.5 within the year were totaled and added to the annual CSO volume discharged.

Table ES-1: CSO Volume as Percent of Total Wet Weather Volume

Year	WRTP WWF Volume above 2.5 Peak Factor (MG)	CSO Volume (MG)	Total Wet Weather Volume (MG)	Percent CSO
2009	24.2	785	809.2	97%
2010	39.3	696	735.3	95%
2011	30.0	1144	1174.0	97%
2012	6.6	538	544.6	99%
2013	13.5	744	757.5	98%
Average	22.7	781.4	804.1	97%

Table ES-1 indicates that the separate sewer system has about a 3% to 5% share of the total wet weather volume. Further hydraulic evaluations are required to better understand the separate sewer system flows and refine the separate sewer system share of the CSO LTCP costs. Therefore for this Draft FCA, it is assumed 15 percent of CSO LTCP costs would be allocated to the separate sewer system and 85 percent of the CSO LTCP costs would allocated to combined sewer system in Chester City. For the final FCA, the updated hydrologic and hydraulic (H&H) model will be used to improve the estimate of CSO attributable to Chester City and to the remainder of the Model Area.

Financial Health of Chester City

The City of Chester is a financially distressed municipality as defined by the 1987 Financially Distressed Municipalities Act 47 (Act 47). After several years of budget deficits, Chester City Council adopted the 1996 Recovery Plan, which presented nearly 200 actions steps toward fiscal recovery. Chester City continued to have budget deficits. Subsequent recovery plans have been submitted in 2006 and 2013. While opening the Harrah's Racetrack and Casino in January 2007 has improved the financial conditions in Chester City, the budget problem has not been resolved. The City remains in the Act 47 program until financial health improves.

Financial indicator

In accordance with EPA's 1997 Guidance for Financial Capability, Table ES-2 shows the factors used to develop the financial indicator. The average score for the financial indicator was calculated by dividing the sum of the scores by the number of entries. The overall financial capability for the Model Area corresponds to a "Strong" rating. However, due to financial distressed conditions and consistent with the 2013 Recovery Plan, Chester City's overall financial capability is "Weak". EPA's 1997 Guidance for Financial Capability indicates that Chester City would have a "high burden" if the residential annual sewer bill is between 1.0 percent and 2.0 percent of Median Household Income (MHI). For the purpose of this Draft FCA, Chester City's affordability is based on 85 percent share of the CSO LTCP and a Chester City annual sewer bill at 1.6 percent of MHI.

Table ES-2: Worksheet 9 - Summary of Financial Capability Indicators

Indicator	Chester City			Model Area			Line Number
	Actual Value	Financial Indicator	Score	Actual Value	Financial Indicator	Score	
A. Bond Rating (Line 303)	A (Suspended 1/6/2014)	Mid-Range	2	AA	Strong	3	901
B. Overall Net Debt as a Percent of Full Market Property Value (Line 405)	13.4%	Weak	1	4.0%	Mid-Range	2	902
C. Unemployment Rate (Line 501)	8.6%	Weak	1	4.8%	Mid-Range	2	903
D. Household Income (Line 601)	28,350	Weak	1	71,601	Strong	3	904
E. Property Tax Revenues as a Percent of Full Market Property Value (Line 703)	1.2%	Strong	3	0.4%	Strong	3	905
F. Property Tax Revenue Collection Rate (Line 803)	81.7%	Weak	1	97.5%	Mid-range	2	906
G. Permittee Indicators Score			1.5			2.5	907
H. Financial Indicator			Weak			Strong	

Residential indicator

The CSO LTCP will be designed and constructed as required to meet the Consent Decree deadline of August 2035 to the limit of Chester City's financial capability. Funding for the CSO LTCP is assumed to be through revenue bonds. As defined by Financial Indictor in Table ES-2 above and the Financial Capability Matrix in EPA's 1997 Guidance for Financial Capability (see Table 2-1 below), Chester City's financial capability is considered a "high burden" when the annual sewer bill is 1.25% of MHI. The Chester City annual sewer bill at 1.25% of MHI corresponds to approximately a cost of $25,500,000 for Chester City's share of CSO LTCP improvements. Therefore, assuming that 15% of the CSO LTCP costs are allocated to the separate system, the total cost of the CSO LTCP improvements would be approximately $30,000,000. The Cost per Household for Chester City and the DELCORA Model Area are shown in Table ES-3.

Table ES-3: Worksheet 1 - Cost per Household

Description	2035 Basis		2015 Basis		Line No.
	Chester City	Model Area	Chester City	Model Area	
A. DELCORA's Cost					
1. Current WWT and CSO Costs in millions					
a. Annual O&M Expenses (Excluding Depreciation)	$ 3.2	$ 16.7	$ 3.2	$ 16.7	100
b. Annual Debt Service (Principle plus Interest)	$ 0.1	$ 4.5	$ 0.1	$ 4.5	101
c. Current WWT and CSO Costs (Line 100 + Line 101)	$ 3.4	$ 21.3	$ 3.4	$ 21.3	102
2. Projected WWT and CSO Costs in millions (Year 2035 Dollars)					
a. Additional Annual O&M Expenses	$ 3.1	$ 18.2	$ 0.3	$ 3.8	103
b. Additional Annual Debt Service (Principle plus Interest)	$ 2.2	$ 3.5	$ 1.2	$ 2.1	104
c. Projected Additional WWT and CSO Costs (Line 103 + Line 104)	$ 5.3	$ 21.7	$ 1.5	$ 5.9	105
3. Total Current and Projected WWT and CSO Costs in millions (Line 102 + Line 105)	$ 8.7	$ 43.0	$ 4.9	$ 27.2	106a
B. Other Local Collection System Costs (Year 2035 Dollars)	--	$ 24.3	--	$ 15.6	106b
C. Total Current & Projected WWT & CSO Costs (Year 2035 Dollars)	$ 8.7	$ 67.2	$ 4.9	$ 42.7	106c
D. Annual Volume in 1,000 gallons	828,789	8,409,265	828,789	8,409,265	
E. Cost per 1,000 gallons	$ 10.4	$ 8.0	$ 5.9	$ 5.1	
F. Annual Residential Flow Per Household in 1,000 gallons	55	55	55	55	107
G. Equivalent Households	15,069	152,896	15,069	152,896	108
H. WWT and CSO Cost Per Household in dollars	$ 575	$ 440	$ 323	$ 279	109a
I Projected SW Costs Per Household	$ 79	$ 79	$ 44	$ 44	109b
J Total WWT, CSO and SW Cost Per Household	$ 653	$ 519	$ 366	$ 323	109c

WWT - Wastewater Treatment
CSO - Combined Sewer Overflow
SW - Stormwater

The Median Household Income for Chester City and the DELCORA Model Area are shown in Table ES-4. Based on EPA's 1997 Guidance for Financial Capability, the Chester City residential indicator benchmark rating is "Mid-Range".

Table ES-4: Worksheet 2 - Median Household Income

Description	2035 Basis		2015 Basis		Line No.
	Chester City	Model Area	Chester City	Model Area	
A. Median Household Income (MHI)					
1. MHI Based on 5-yr ACS, in 2013 dollars	$ 27,249	$ 68,821	$ 27,249	$ 68,821	201
2. Year of MHI Estimate: 2013	2013	2013	2013	2013	
3. FCA Analysis Year: 2035	2035	2035	2015	2015	
4. MHI Inflation Rate: 2%					
5. MHI Adjustment Factor	1.55	1.55	1.04	1.04	
6. Adjusted MHI (Line 201 x Line 202)	$ 42,126	$ 106,396	$ 28,350	$ 71,601	203
B. Annual WWT and CSO Control Cost Per Household (CPH) - (Line 109)	$ 575	$ 440	$ 323	$ 279	204
C. Residential Indicator (CPH as % of MHI) - (Line 204/ Line 203 x 100)	1.6%	0.5%	1.3%	0.5%	205
D. Benchmark	Mid-Range	Low	Mid-Range	Low	

Financial Capability Matrix Score

Table ES-5 shows the Overall Financial Capability Matrix for Chester City and DELCORA Model Area. In accordance with EPA's 1997 Guidance for Financial Capability, Chester City will have a "high burden" if the CSO LTCP costs are $30,000,000 with an 85 percent Chester City share. The methodology presented herein will be followed for the final FCA and will be submitted with the LTCP Update. The assumed proportion of the CSO program cost for Chester City will be refined during the LTCP Update of the H&H model which will then be used to calculate the fraction of wet weather flow during CSO events attributable to each municipality.

Table ES-5: Worksheet 10 - Overall Financial Capability Matrix

Description	2035 Basis		2015 Basis		Line No.
	Chester City	Model Area	Chester City	Model Area	
1. Residential Indicator Score (Line 205)					
a. Actual Value	1.6%	0.5%	1.3%	0.5%	1001
b. Financial Impact	Mid-Range	Low	Mid-Range	Low	
2. Financial Capability Indictors Score (Line 907)					
a. Actual Value	1.5	2.5	1.5	2.5	1002
b. Financial Indicator	Weak	Strong	Weak	Strong	
3. Financial Capability Matrix Category	High Burden	Low Burden	High Burden	Low Burden	1003

Section 1 Introduction

The Delaware County Regional Water Quality Control Authority (DELCORA) is a municipal authority originally organized under the Pennsylvania Municipal Authorities Act of 1945 (P.L. 382), as amended and supplemented, pursuant to action taken by the Delaware County Council on October 20, 1971. Under County of Delaware Ordinance 2002-1, the term of existence of DELCORA was extended to January 15, 2052.

DELCORA prepared and submitted their original Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP) to the PADEP in 1999. This LTCP was subsequently approved by the PADEP, and DELCORA had started to implement the CSO control elements selected in the LTCP. In 2009, the United States Environmental Protection Agency (USEPA) informed DELCORA that the original LTCP was not in compliance with the requirements of the USEPA's CSO Policy. As such, DELCORA prepared and submitted a revised LTCP in February 2012. Subsequent to the receipt of the revised LTCP, DELCORA and the USEPA had corresponded various times including requests for additional information from the USEPA in accordance with Section 308 of the Clean Water Act. A Consent Decree was ultimately executed between DELCORA, the Pennsylvania Department of Environmental Protection (PADEP) and USEPA, and was approved by the Federal District Court on November 10, 2015. The Consent Decree requires a revised LTCP to be prepared based on an agreed upon schedule, which will include interim deliverables and milestones that must be met.

DELCORA is in the process of revising its Long Term Control Plan (LTCP) Update for the Combined Sewer System (CSS) as part of the 2015 Consent Decree. As part of this comprehensive effort, a Draft Financial Capabilities Assessment (FCA), including information on sewer rate setting, median household income (MHI) and number of households in the LTCP Model Area, must be submitted within nine (9) months of the Date of Lodging. The Consent Decree defines the Model Area as being those areas that are hydraulically connected to the DELCORA Western Regional Treatment Plant (WRTP), as further defined herein. This Draft FCA has been prepared in accordance with the USEPA guidance document entitled Guidance for Financial Capability Assessment and Schedule Development (USEPA, 1997).

1.1 Description of the DELCORA Service Area

DELCORA is responsible for the collection, transmission, treatment and disposal of approximately 65 million gallons per day (MGD) of wastewater generated in southeastern Pennsylvania. DELCORA's facilities serve residential, commercial, institutional, and industrial customers in Delaware County. DELCORA owns and operates an extensive system of pump stations, force mains, and sewers that provide the core infrastructure for the transmission of wastewater to treatment facilities in Delaware County and the City of Philadelphia as shown diagrammatically in Figure 1-1. The total service area served by DELCORA is approximately 82,977 acres, as shown on Figure 1-2, which illustrates that DELCORA serves a significant and widespread portion of Delaware County.

Figure 1-1: DELCORA's Conveyance System

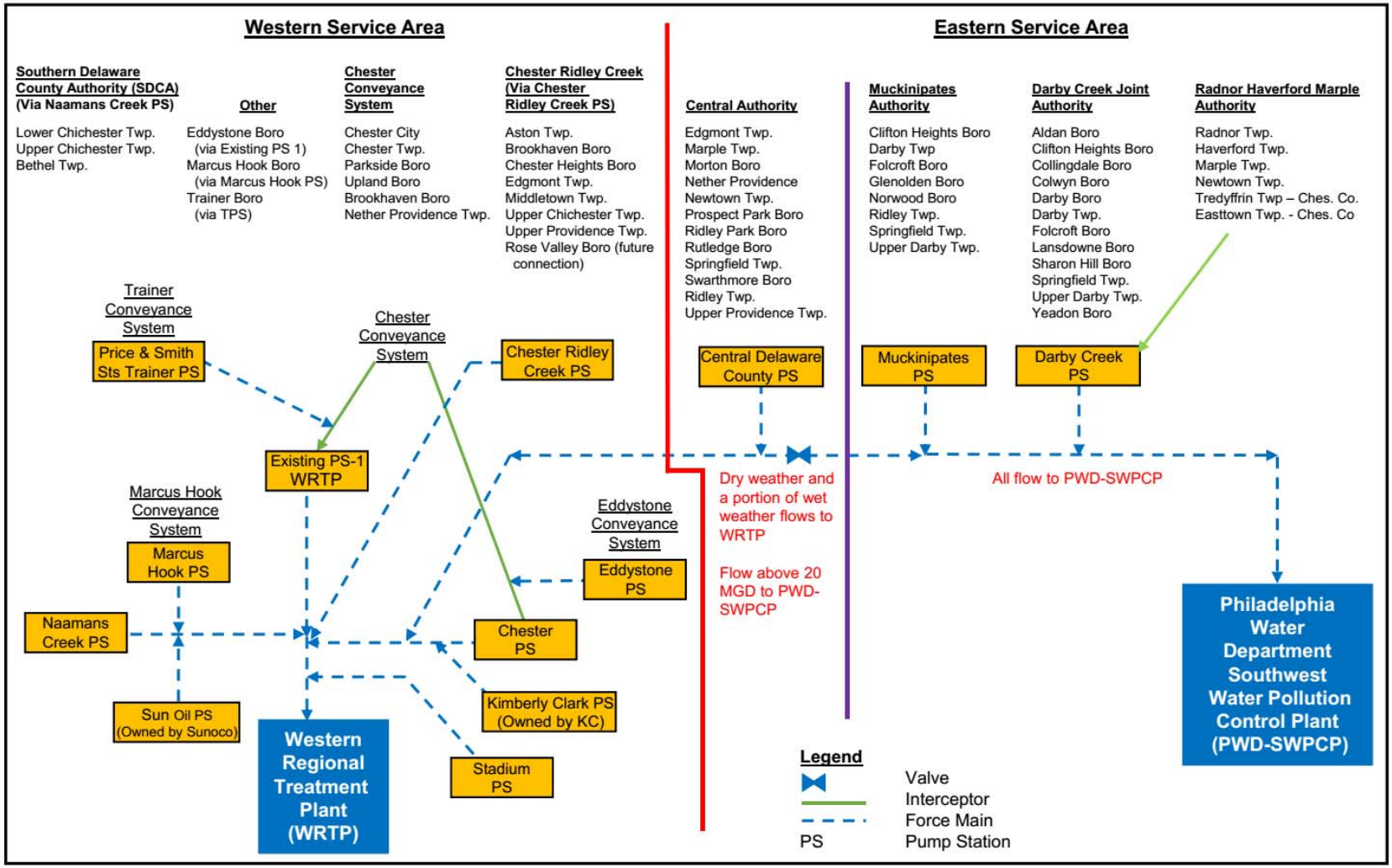
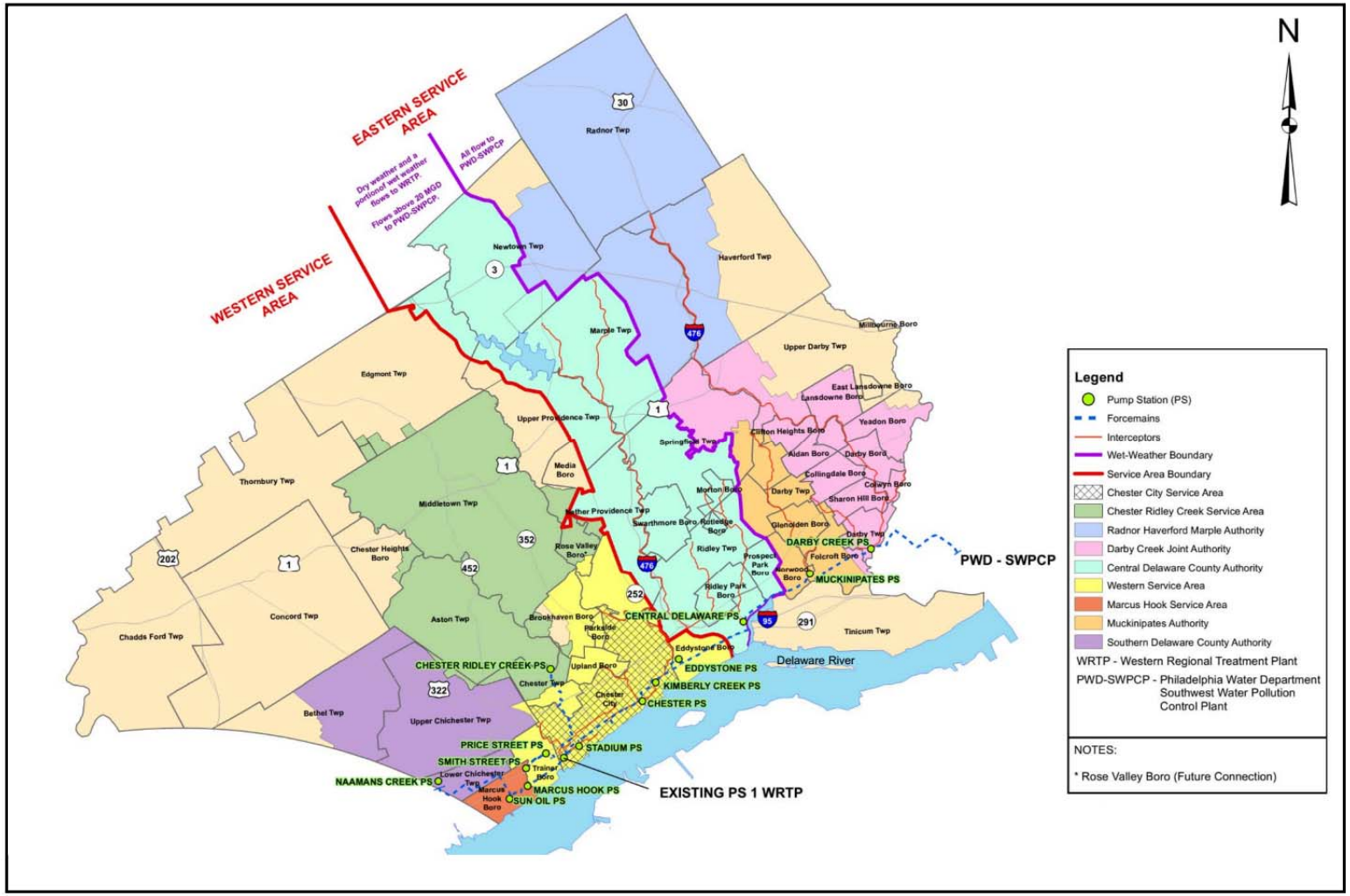


Figure 1-2: DELCORA's Service Area



Historically, DELCORA has characterized its service areas as "Eastern" and "Western". The Western service area discharges to DELCORA's WRTP. The Eastern service area discharges to the Philadelphia Water Department's Southwest Water Pollution Control Plant (PWD-SWPCP). Being hydraulically connected to the PWD-SWPCP, the Eastern Service Area will pay $427 million for a portion of the Philadelphia 25 year LTCP. In 2002, DELCORA completed the installation of a force main that connects the Eastern Service Area's Central Delaware Pump Station (CDPS) to the Chester Force Main. This connection allows DELCORA to send flow from the CDPS to the WRTP. Flows above 20 MGD are to be directed to the PWD-SWPCP. As such, dry weather flow and a portion of the wet weather flow from the Central Delaware County Authority in the Eastern Service Area are discharged to the WRTP.

Under National Pollutant Discharge Elimination System (NPDES) Permit No. PA0027103, issued and administered by the PADEP, DELCORA is authorized to discharge from the WRTP (Outfall 001), four storm water outfalls at the WRTP (028-031) and from 26 combined sewer overflow (CSO) outfalls (002-026, 032, 033) that ultimately discharge to the Delaware River, Chester Creek and/or Ridley Creek. There are a total of 26 combined sewer overflow (CSO) outfalls listed with 25 discharge points (Outfalls 009 and 010 both discharge at Outfall 009) in DELCORA's existing NPDES Permit.

The combined sewer area simulated in DELCORA's existing Hydrologic and Hydraulic (H&H) is located within Chester City and consists of a drainage area of approximately 1,150 acres. It comprises approximately half of Chester City's serviced area. To support this service area, DELCORA owns and operates over 129 miles of separate and combined sewers. Included in the 129 miles of sewers are: 11.7 miles of an interceptor system; 3,209 manholes; and twenty-five (25) combined sewer outfall regulators controlling storm overflows. The location of Chester City's service area is illustrated in Figure 1-2.

1.1.1 Model Area

As described in the Consent Decree, this Draft FCA will evaluate the Model Area comprising those areas hydraulically connected to the WRTP. Paragraph 14.b of the Consent Decree describes the Model Area as follows:

> *… all areas tributary to the entire Collection System, as well as all areas tributary to all municipal wastewater collection and transmission systems that are, as of the date the LTCP is submitted, hydraulically connected to, or that directly or indirectly influence flow to, the CSOs and/or the WRTP, regardless of who owns or operates the system(s), including but not limited to the entire "Western Service Area" and "Eastern Service Area" depicted on Figure 1-2 of the Long-Term Control Plan submitted by DELCORA in April 2012, and attached as Appendix A hereto (collectively, the "Model Area").*

As shown in the schematic of DELCORA's conveyance system (see Figure 1-1), the conveyance system is divided into the Western Service Area and the Eastern Service Area. The Western Service Area discharges to DELCORA's WRTP and is therefore included in the Model Area. The Eastern Service Area is served by three pumps stations: the Central Delaware Pump Station, the Muckinipates Pump Station and the Darby Creek Pump Station. Up to 20 MGD (which includes both dry and wet weather flows) from the Central Delaware Pump Station can be pumped to, and thus is hydraulically connected to, DELCORA's WRTP. Therefore, municipalities connected to the Central Delaware Pump Station are considered part of the Model Area. Sewage from the Muckinipates Pump Station and the Darby Creek Pump Station flows to the PWD-SWPCP rather than to the WRTP. Therefore, municipalities connected

to these pump stations are not hydraulically connected to the WRTP and do not directly or indirectly influence CSOs or flow to the WRTP, and, therefore, are not considered part of the Model Area. In summary, the Model Area includes the municipalities in the Western Service Area plus those municipalities in the Eastern Service Area that are connected to the Central Delaware Pump Station, as described in Table 1-1.

Table 1-1: Model Area

Municipality ID No.	Municipality	Service Area
1	Aston Township	Western
2	Bethel Township	Western
3	Brookhaven Borough	Western
4	Chester City	Western
5	Chester Township	Western
6	Eddystone Borough	Western
7	Edgmont Township	Eastern
8	Lower Chichester Township	Western
9	Marcus Hook Borough	Western
10	Marple	Eastern
11	Middletown Township	Western
12	Morton	Eastern
13	Nether Providence	Eastern and Western
14	Newtown Township	Eastern
15	Parkside Borough	Western
16	Prospect Park	Eastern
17	Ridley Park Borough	Eastern
18	Ridley Township	Eastern
19	Rose Valley Borough	Western
20	Rutledge	Eastern
21	Springfield	Eastern
22	Swarthmore	Eastern
23	Trainer Borough	Western
24	Upland Borough	Western
25	Upper Chichester Township	Western
26	Upper Providence Township	Eastern and Western

Section 2 Consent Decree Requirements and EPA Guidance

2.1 Consent Decree Requirements

The Consent Decree requires DELCORA to submit

> *…a draft Financial Capability Assessment (FCA)in accordance with CSO Control Policy Paragraph II.C.8 and "Combined Sewer Overflows- Guidance for Financial Capability Assessment and Schedule Development," EPA 832-B-97-004, February 1997 ("1997 FCA Guidance"), as such guidance has been interpreted by EPA, including but not limited to information on sewer rate setting and median household income and number of households in the entire Model Area (as defined in Paragraph 14.b above), as well as information on all other financial resources available to DELCORA.*

However, the Consent Decree also recognizes that the draft FCA is not final. Since the draft FCA is being prepared in advance of the revised LTCP, the Consent Decree also includes requirements for a final FCA:

> *Concurrent with the submission of the LTCP, DELCORA shall submit to Plaintiffs for review and approval in accordance with the requirements of Section VI (Review and Approval of Submittals) a proposed final FCA, including an implementation schedule for the proposed CSO controls in accordance with CSO Control Policy Paragraph II.C.8 and the 1997 FCA Guidance.*

2.2 EPA Guidance

Per the EPA's CSO Control Policy (USEPA, 1994), "*EPA recognizes that financial considerations are a major factor affecting the implementation of CSO controls. For that reason, this Policy allows consideration of a permittee's financial capability in connection with the long-term CSO control planning effort, WQS review, and negotiation of enforceable schedules.*" Subsequent to the 1994 CSO Control Policy, EPA developed guidance for financial capability assessment based on a two-phase process described in their Guidance for Financial Capability Assessment and Schedule Development (USEPA, 1997).

2.2.1 Two-phase Assessment

The EPA's 1997 FCA guidance document uses a two-phased approach in the assessment of the financial capability of a municipality. The first phase develops a "Residential Indicator" that determines the financial impact of the current and proposed CSO controls on residential users. The residential indicator is the cost per household (CPH) of current and proposed wastewater treatment and CSO controls divided by Median Household Income (MHI). EPA has established the following financial impact benchmarks for the residential indicator:

Financial Impact	Residential Indicator (CPH as % MHI)
Low	Less Than 1.0 Percent of MHI
Mid-Range	1.0 – 2.0 Percent of MHI
High	Greater than 2.0 Percent of MHI

The second phase in this assessment is used to determine a "Financial Capability Indicator", which shows the overall financial health of the Permittee. The financial capability indicator uses the following six indicators:

- Bond Ratings
- Overall Net Debt as a Percent of Full Market Property Value
- Unemployment Rate
- Median Household Income
- Property Tax Revenues as a Percent of Full Market Property Value
- Property Tax Collection Rate

A numerical score is assigned to each of the above indicators. The overall score is used to develop the overall financial capability indicator. The benchmarks for the overall financial capability indicator established by EPA are as follows:

Financial Impact Financial Capability Indicator	Overall Score
Weak	Below 1.5
Mid-Range	Between 1.5 and 2.5
Strong	Above 2.5

The residential and financial capability indictors are combined to assess the overall burden associated with funding CSO controls. The financial capability matrix, developed by EPA and shown in Table 2-1, is used to determine the overall level of burden on the Permittee and its residents.

Table 2-1: Financial Capability Matrix

Financial Capability Indicator	Residential Indicator (Cost Per Household as a % of MHI)		
	Low	Mid-Range	High
	(1.0% and Below)	(Between 1.0% and 2.0%)	(2.0% and Above)
Weak (1.5 and Below)	Medium Burden	High Burden	High Burden
Mid-Range (Between 1.5 and 2.5)	Low Burden	Medium Burden	High Burden
Strong (2.5 and Above)	Low Burden	Low Burden	Medium Burden

2.2.2 EPA FCA Framework (2014)

Subsequent to the 1997 FCA guidance document, EPA released the 2014 Financial Capability Assessment Framework (USEPA, 2014) to clarify the "…*flexibilities built into the existing guidance that local governments or authorities can use in assessing their financial capability, and the relationship between that assessment and consideration of schedules for permit and consent decree implementation.*" In addition to the standard worksheets of the two-phase approach described above, EPA's guidance also allows permittees "*to submit any additional documentation that would create a more accurate and complete picture of their capability*." The 2014 FCA Framework provides further explanation of this flexibility and of the type of information that may be used to illustrate the financial burdens of a locality.

As described in the 2014 FCA Framework, "*EPA will consider all CWA costs presented in the analysis described in the FCA Guidance"* such as "*…stormwater and wastewater; ongoing asset management or system rehabilitation programs; existing, CWA related capital improvement programs; collection systems and treatment facilities; and other CWA obligations required by state or other regulators. Where the costs of multiple CWA obligations are included in an FCA, each of those costs should be enumerated separately, so as to provide an understanding of how each contributes to the overall analysis."* Additional details of the 2014 FCA framework can be found in Appendix 2.

Section 3 Assumptions

3.1 Schedule and Planning Period

Based on the requirements of the Consent Decree, LTCP CSO control measures must be operational no later than August 2035 (20 years after the Date of Lodging). In alignment with this requirement, the Draft FCA Report assumes a planning period through the year 2035.

3.2 Funding Sources

Funding for the LTCP is assumed to be through revenue bonds. The inception dates described above define the years when a bond is issued and payments must start.

3.3 Interest Rate

The FCA is based on an assumed borrowing period of 20 years with a bond interest rate of 4 percent per year.

3.4 Inflation

3.4.1 Operation and Maintenance Costs

Based on the urban Consumer Price Index (CPI-U) produced by the Bureau of Labor Statistics, the long-term inflation rate (1913 to 2013) has been approximately three percent. For the period 1979-2013, the average annual change in the CPI-U has been 3.65 percent, although more recently (1999-2013) the average annual change in CPI-U has been roughly 2.4 percent. Operation and maintenance costs were assumed to increase at 3 percent per year.

3.4.2 Median Household Income

Compared to the CPI-U, MHIs generally have not kept pace with inflation. When evaluating the affordability of the LTCP program, the impact of wage stagnation should be considered since the buying power of the residential users will be diminished over time, resulting in an increase in the Residential Indicator. Comparing changes in the CPI-U to changes in the MHI shows that the MHI increased at slower rate than the CPI-U (see Table 3-1). For Delaware County, the annualized rise in MHI was 1.7 percentage points lower than the rise in CPI-U for the period 1979-2013 while for the same period, Chester City's MHI rose at 1.05 percentage points less than the CPI-U. For the period 1999-2013, the annualized rise in MHIs with respect to CPI-U was 0.67 percentage points lower for Delaware County and 2.0 percentage points lower for Chester City, respectively.

Table 3-1: Comparison of Rates of Change for CPI-U versus MHI

Time Period	Annualized Rate of Change in CPI-U	Delaware County		Chester City	
		Annualized Rate of Change in Delaware Co. MHI	Difference Between CPI-U and MHI Rates of Change	Annualized Rate of Change in Chester City MHI	Difference Between CPI-U and MHI Rates of Change
1979-2013	3.65%	1.93%	1.72%	2.60%	1.05%
1999-2013	2.44%	1.77%	0.67%	0.44%	2.00%

Overall, Delaware County MHI rose at 0.67-1.72 percentage points slower than the CPI-U, depending on the time period analyzed. Similarly, Chester City's MHI rose at 1.05- 2.00 percentage points lower than the CPI-U. In this Draft FCA, it is assumed that MHI will not keep pace with inflation. Using the long-term average inflation of 3 percent and assuming the MHI lags behind inflation by one percentage point, the assumed inflation rate for MHI will be 2 percent. Additional information regarding historical CPI-U and MHI can be found in Appendices 3 and 4.

3.5 Future Regulatory Requirements

The financial capability assessment is based on currently known regulatory requirements and currently known capital improvement projects. **No allowance has been made for potential costs that may be necessitated by future regulatory requirements that have not yet been enacted. It should be recognized that any such future regulatory requirements create a risk to the permittee's ability to fund future mandates alongside of LTCP requirements**.

Section 4 Financial Capabilities Assessment – Phase 1

This subsection calculates the cost per household and MHI, analyzes the distribution of household income, and develops the residential indicator. Per EPA guidance (EPA, 1997), the Phase 1 analysis includes two worksheets:

- Worksheet 1 – Cost per Household
- Worksheet 2 – Residential indicator

The structure of the worksheets is most suitable for permittees that are municipalities with sole responsibility for wastewater and sewer costs within its service area. DELCORA, however, differs from this situation in that it is a regional authority rather than a municipality. The service area encompasses multiple municipalities and also includes other authorities that act as intermediaries between DELCORA and residents of the municipalities. Each of these entities (DELCORA, intermediary authorities and municipalities) may impose costs on residential consumers. In general, residential billing can be divided into the following categories:

- Residents billed directly by DELCORA, with DELCORA being the sole source of wastewater and sewer costs;
- Residents billed directly by DELCORA, with both DELCORA and the local municipality being sources of wastewater and sewer costs;
- Residents billed by their local municipality, with both DELCORA and the local municipality being sources of wastewater and sewer costs. In this situation, the municipality passes along DELCORA's costs to the resident as part of the local municipality's bill; and
- Residents billed by their local municipality, with DELCORA and the local municipality being sources of wastewater and sewer costs and with an additional Authority located between DELCORA and the municipality also being a source of wastewater and sewer costs. In this situation, the municipality passes along DELCORA's and the intermediary Authority's costs to the resident as part of the local municipality's bill.

4.1 Cost per Household (Worksheet 1)

4.1.1 Current Costs

Current costs are comprised of existing operation and maintenance (O&M) expenses and debt service (principle and interest), while projected wastewater treatment and CSO costs were developed based on assumptions for future O&M and debt service for anticipated capital improvement projects. Costs for DELCORA's operation are based on 2015 rates (see Appendix 5 for description of rate policies). Within areas where DELCORA owns the collection system sewers and bills customers for collection and conveyance, costs are determined by multiplying the 2015 rates by the customer usage.

Determination of wastewater and storm water costs within the Model Area is complicated by the fact that DELCORA is not the only entity responsible for wastewater, sanitary sewer, combined sewer and storm sewer related costs. In some portions of the Model Area, there are additional costs due to other wastewater authorities and municipalities. In general, cost structures can be divided into the following categories:

- Areas where DELCORA is responsible for wastewater, sanitary and combined sewer costs;
- Areas where DELCORA is responsible for wastewater and some sewer costs, with municipalities responsible for additional sewer and storm water costs; and
- Areas where DELCORA is responsible for wastewater and some sewer costs; municipalities responsible for additional sewer and storm water costs; and another authority is responsible for additional sewer costs.

Determining costs at the municipality level is challenging due to the varying methods that each municipality uses for charging users. In some cases, municipality financial reports contain line item entries for wastewater revenues and for storm water revenues. However, some municipalities do not report these individual line items. Some state that costs are subsidized by other budgetary categories. It is possible that such costs are lumped together into line items other than wastewater and storm water and therefore not readily apparent. Given the number of entities imposing charges on the residential consumers and the absence of reported costs in some of the entities' financial reports, an alternative method of estimating current costs will be used.

In areas where DELCORA does not own the local collection sewers, it was assumed that DELCORA's unit costs for collection within the western service area can be used as a surrogate for the collection costs incurred by these municipalities. The unit cost was multiplied by each respective municipality's usage (i.e., flow) to estimate their wastewater collection costs. Current storm water costs have not been included in this analysis due to inconsistent reporting of these costs. However, for the final FCA to be submitted with the revised LTCP, the municipality storm water costs will be further evaluated to determine how they are accounted for and appropriate costs will be added to the final FCA.

4.1.2 Projected Costs

Projected costs are not limited to the costs for the LTCP Program. DELCORA, other Authorities served by DELCORA, and the local municipalities served by DELCORA all have projected costs related to their wastewater, sewer and storm water systems for items such as required improvements, replacement costs, and upgrades due to future regulatory requirements that are not related to the LTCP program. For each of these entities, costs for such projected capital improvement projects may result in additional burdens to the residents in the Model Area and, therefore, must be accounted for in the FCA. Such projected costs would include debt service for future projects as well as additional operation and maintenance (O&M) for any new infrastructure created by future projects. Debt service and O&M for projected costs will be based on the following assumptions:

- Projected Annual O&M: 1.5 percent of Capital Cost
- Project Debt Service: 20 year bond at 4 percent interest.

4.1.2.1 Projected Cost for DELCORA

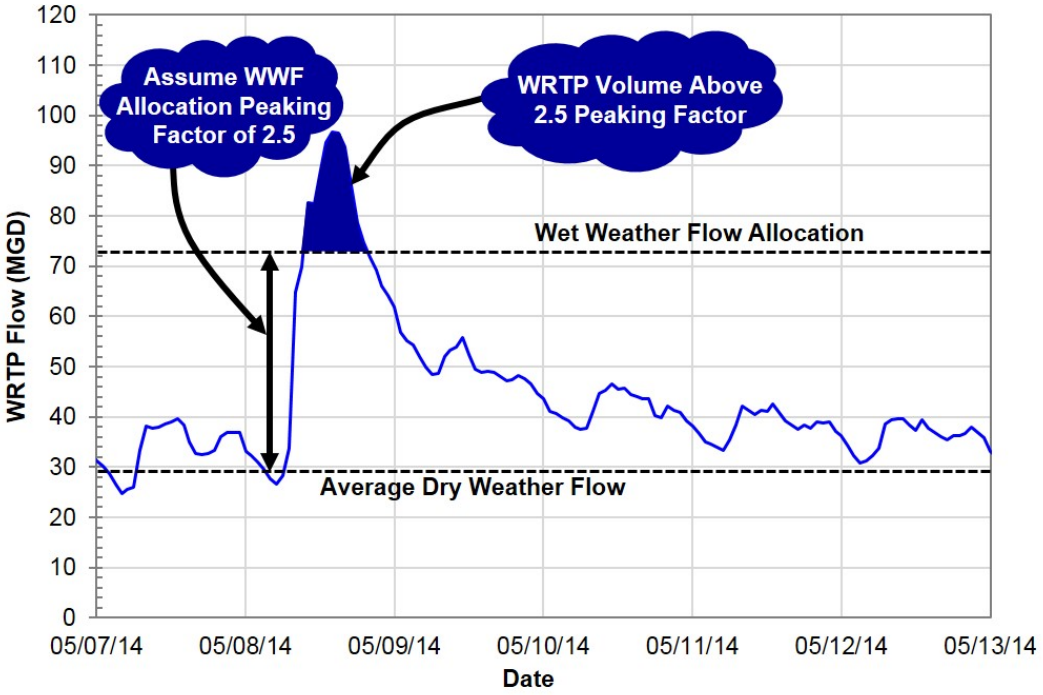
LTCP Costs

Because this Draft FCA is being prepared prior to the completion of the revised LTCP, final LTCP project alternatives have not yet been identified nor have cost estimates for such projects been completed. The approach taken for this Draft FCA is based on an evaluation of affordability as described in Executive Summary. In order to complete EPA's FCA methodology to calculate the residential indicators we need to establish a hypothetical LTCP cost. As derived in the Executive Summary above, LTCP cost estimate of $30,000,000 has been assumed. Associated operation and maintenance costs are based on the assumptions described in Section 3.

DELCORA's prior LTCP allocated all of the costs associated with the CSO projects to Chester City, which is the only customer with a combined sewer system. Per the Consent Decree, this Draft FCA will evaluate the Model Area comprising those areas hydraulically connected to the WRTP (see Section 1 for description of Model Area). Accordingly, allocation of costs for CSO abatement has been revised to distribute costs not to Chester City alone but rather to the Model Area customers in proportion to their contribution to CSO volume as well as excess volume generated from separate sewer communities within the Model Area during wet weather.

DELCORA's system serves a variety of customers from numerous municipalities in Delaware County, PA. The majority of the sewer systems within the Model Area have separated sanitary sewers, with the exception of a portion of Chester City, which is served by combined sewers. DELCORA has service agreements with the authorities, major industries, and a few municipalities. There are service agreements that indicate that the discharger will not share in any CSO related costs, because there was no direct discharge to the combined sewer system. However, most agreements indicate that authority, industry, or municipality shall not discharge excess wet weather flow to the DELCORA WRTP. Thus, for the purpose of the Draft FCA, the allocation of CSO LTCP costs to the separate sewer system is based on separate sewer system's share of the total Wet Weather Flow (WWF) volume. The separate sewer system's share is based on WRTP's WWF volume above a peaking factor 2.5. Figure 4-1 shows an example WRTP's WWF volume from a single storm event in May 2014.

Figure 4-1: Basis for Estimating Wet Weather Flow from Separate Sewer Areas



To estimate the total wet weather volumes shown in Table 4-1, the WRTP's WWF volumes from all storms above a peaking factor of 2.5 within the year were totaled and added to the annual CSO volume discharged.

Table 4-4-1: CSO Volume as Percent of Total Wet Weather Volume

Year	WRTP WWF Volume above 2.5 Peak Factor (MG)	CSO Volume (MG)	Total Wet Weather Volume (MG)	Percent CSO
2009	24.2	785	809.2	97%
2010	39.3	696	735.3	95%
2011	30.0	1144	1174.0	97%
2012	6.6	538	544.6	99%
2013	13.5	744	757.5	98%
Average	22.7	781.4	804.1	97%

Table 4-1 indicates that the separate sewer system has about a 3% to 5% share of the total wet weather volume. Further hydraulic evaluations are required to better understand the separate sewer system flows and refine the separate sewer system share of the CSO LTCP costs. Therefore for this Draft FCA, it is assumed 15 percent of CSO LTCP costs would be allocated to the separate sewer system and 85 percent of the CSO LTCP costs would allocated to combined sewer system in Chester City. For the final FCA, the updated hydrologic and hydraulic (H&H) model will be used to improve the estimate of CSO attributable to Chester City and to the remainder of the Model Area.

DELCORA Capital Improvement Costs

Projected costs for DELCORA's capital improvement programs were developed based on DELCORA's Capital Improvement Plan (CIP) which covers a 20-year planning period. Projected costs for DELCORA's CIP projects are shared by DELCORA customers based on the respective service agreements. Costs for some projects are allocated to specific customers when the project solely addresses the needs of those specific customers. Costs were also evaluated to determine the fraction of costs allocated to residential customers within any larger customer grouping.

4.2 Residential Share of Costs

To estimate the residential cost per household, an average annual water usage rate of 55,000 gallons/ household was used. This value is based on the residential water consumption for the Delaware County municipalities served by the Chester Water Authority (CWA) for the period 2010-2015. This usage multiplied by the number of households was used to estimate the residential share of the total usage for each entity.

4.3 Projected Municipal Separate Storm Sewer System (MS4) Storm Water Costs

Municipalities in DELCORA's service area will be subject to increased storm water (SW) costs as they implement MS4 requirements. No data is currently available from these municipalities. As a placeholder cost based on Richmond, VA annual SW cost of $45 per household (2016 dollars) will be used. Also, it will be assumed that costs will increase at an inflation rate of 3 percent per year. As Pennsylvania's communities develop their MS4 programs, data specific to the municipalities in DELCORA's service area may become available. For the final FCA to be submitted as part of the LTCP Update, SW costs will be re-evaluated and updated.

4.4 Cost per Household

Dividing the residential share of the WWT, CSO control and SW costs by the number of households approximates the annual cost per household as presented in Table 4-2.

Table 4-2: Worksheet 1 - Cost per Household

Description	2035 Basis		2015 Basis		Line No.
	Chester City	Model Area	Chester City	Model Area	
A. DELCORA's Cost					
1. Current WWT and CSO Costs in millions					
a. Annual O&M Expenses (Excluding Depreciation)	$ 3.2	$ 16.7	$ 3.2	$ 16.7	100
b. Annual Debt Service (Principle plus Interest)	$ 0.1	$ 4.5	$ 0.1	$ 4.5	101
c. Current WWT and CSO Costs (Line 100 + Line 101)	$ 3.4	$ 21.3	$ 3.4	$ 21.3	102
2. Projected WWT and CSO Costs in millions (Year 2035 Dollars)					
a. Additional Annual O&M Expenses	$ 3.1	$ 18.2	$ 0.3	$ 3.8	103
b. Additional Annual Debt Service (Principle plus Interest)	$ 2.2	$ 3.5	$ 1.2	$ 2.1	104
c. Projected Additional WWT and CSO Costs (Line 103 + Line 104)	$ 5.3	$ 21.7	$ 1.5	$ 5.9	105
3. Total Current and Projected WWT and CSO Costs in millions (Line 102 + Line 105)	$ 8.7	$ 43.0	$ 4.9	$ 27.2	106a
B. Other Local Collection System Costs (Year 2035 Dollars)	--	$ 24.3	--	$ 15.6	106b
C. Total Current & Projected WWT & CSO Costs (Year 2035 Dollars)	$ 8.7	$ 67.2	$ 4.9	$ 42.7	106c
D. Annual Volume in 1,000 gallons	828,789	8,409,265	828,789	8,409,265	
E. Cost per 1,000 gallons	$ 10.4	$ 8.0	$ 5.9	$ 5.1	
F. Annual Residential Flow Per Household in 1,000 gallons	55	55	55	55	107
G. Equivalent Households	15,069	152,896	15,069	152,896	108
H. WWT and CSO Cost Per Household in dollars	$ 575	$ 440	$ 323	$ 279	109a
I Projected SW Costs Per Household	$ 79	$ 79	$ 44	$ 44	109b
J Total WWT, CSO and SW Cost Per Household	$ 653	$ 519	$ 366	$ 323	109c

WWT - Wastewater Treatment
CSO - Combined Sewer Overflow
SW - Stormwater

4.5 Development of the Residential Indicator (Worksheet 2)

Per USEPA guidance, the Residential Indicator (RI) is developed by dividing the cost per household (CPH) (from Table 4-3) by the median household income (MHI). The RI is intended as a means to judge

the residential economic burden resulting from payments for wastewater, sewer and storm water treatment and services.

4.5.1 Household Income Distribution

Household Income Distribution

Although the benchmark criteria for the residential indicator established by USEPA is based on MHI, the MHI is not representative of the distribution of income for the DELCORA Model Area. According to the U.S. Census Bureau's American Community Survey, 10 percent of the population in the Model Area have annual incomes that are below the poverty level while 33 percent of the population in the City of Chester have annual incomes that are below the poverty level. For the Model Area, this percentage is approximately two-thirds of the national poverty rate of 15.5 percent and approximately three-quarters of the Pennsylvania rate of 13.3 percent. For Chester City, this percentage is significantly higher at more than double compared to the Pennsylvania and the national value. Thus, the Model Area MHI alone may not be the most representative income bracket for determining the financial impact of increased CSO controls on the residential user in the poorer areas served by DELCORA. Therefore, the residential indicator has been developed for Chester City as well as the Model Area.

4.5.2 Median Household Income

The MHI for the City of Chester was estimated to be approximately $27,249 in 2013 dollars by the U.S. Census Bureau's American Community Survey (ACS). This was adjusted to Year 2035 using two percent inflation as described in Section 3 above, resulting in an adjusted MHI of $42,126.

The MHI for the DELCORA Model Area was estimated to be approximately $68,821 in 2013 using data from the ACS. The Model Area MHI is based on a weighted average of individual municipality MHIs using the number of households as the weighting factor. This weighted MHI was adjusted to Year 2035 using two percent inflation as described in Section 3 above, resulting in an adjusted MHI of $106,396.

4.5.3 Residential Indicators

The Median Household Income for Chester City and the DELCORA Model Area are shown in Table 4-3. Based on EPA's 1997 Guidance for Financial Capability, the Chester City residential indicator benchmark rating is "Mid-Range".

Table 4-3: Worksheet 2 - Median Household Income

Description	2035 Basis		2015 Basis		Line No.
	Chester City	Model Area	Chester City	Model Area	
A. Median Household Income (MHI)					
1. MHI Based on 5-yr ACS, in 2013 dollars	$ 27,249	$ 68,821	$ 27,249	$ 68,821	201
2. Year of MHI Estimate: 2013	2013	2013	2013	2013	
3. FCA Analysis Year: 2035	2035	2035	2015	2015	
4. MHI Inflation Rate: 2%					
5. MHI Adjustment Factor	1.55	1.55	1.04	1.04	
6. Adjusted MHI (Line 201 x Line 202)	$ 42,126	$ 106,396	$ 28,350	$ 71,601	203
B. Annual WWT, CSO Control and SW Cost Per Household (CPH) - (Line 109)	$ 653	$ 519	$ 366	$ 323	204
C. Residential Indicator (CPH as % of MHI) - (Line 204/ Line 203 x 100)	1.6%	0.5%	1.3%	0.5%	205
D. Benchmark	Mid-Range	Low	Mid-Range	Low	

WWT - Wastewater Treatment
CSO - Combined Sewer Overflow
SW - Stormwater

Section 5 Financial Capabilities Assessment – Phase 2

The Phase 2 financial capability indicator was determined by scoring selected indicators that reflect the debt burden, socioeconomic conditions and financial operations. The current debt burden was assessed, as well as the ability to issue new debt to finance CSO controls, by evaluating the bond rating and the overall net debt as a percentage of full market property value. Socioeconomic conditions were evaluated by determining the unemployment rate and MHI. The financial operations were evaluated by assessing the property tax collection rate efficiency and the property tax revenues as a percentage of full market property value. Each of these factors are assigned a rating of "Weak", "Mid-Range" or "Strong" based on national benchmarks identified in the USEPA guidance document.

The scoring system used to develop the financial capability indicator assigns a numerical score to the national benchmarks as follows:

National Benchmark Rating	Score
Weak	1
Mid-Range	2
Strong	3

5.1 Worksheet 3 – Bond Rating

Per USEPA guidance, Worksheet 3 focuses on the bond rating of the permittee (DELCORA). However, the guidance is written as if the permittee is a municipality with taxing authority. DELCORA is an authority established to serve a community comprised of numerous municipalities in Delaware County, PA. As an authority, funding can be raised through revenue bonds, but not general obligation bonds. DELCORA does not have taxing authority nor does it have authority to require the municipalities in its service area to obtain general obligation bonds or to establish taxes for the payment of costs related to DELCORA's LTCP. Therefore, Table 5-1 summarizes Worksheet 3 based on municipalities' general obligation bond rating.

Table 5-1: Worksheet 3 - Bond Rating

Description	DELCORA	Chester City	Model Area	Line No.
A. Most Recent General Obligation Bond Rating				
1. Date		2012		
2. Rating agency		S&P	S&P	
3. Most recent rating		A (Suspended 1/6/2014)	AA	301
B. Most Recent Revenue Sewer Bond				
1. Date	2015			
2. Rating agency (Moody's or S&P)	Moody's			
3. Most recent rating	Aa3			302
C. Summary bond rating	Aa3	A (Suspended 1/6/2014)	AA	303
D. Benchmark				
1. Numerical Financial Indicator	3	2	3	
2. Financial Indicator	Strong	Mid-Range	Strong	

The City of Chester's "A" bond rating was withdrawn by S&P in 2014 due to lack of providing an audit for 2011. Therefore, it is expected that S&P will reduce the bond rating, which will place Chester City in the "Mid-Range" benchmark category. Of the 27 service area municipalities, ten have received bond ratings in the past five years. Table 5-2 below shows the bond ratings for those municipalities which have a bond rating in the past five years. Nine out of ten have a "strong" rating while the other has a "mid-range" rating. The composite rating based on a household weighted average is "strong".

Table 5-2: Summary of General Obligation Bond Ratings

Municipality	General Obligation Bond	Date	Rating Agency	Most Recent Rating	Category
Aston Township		10/1/2013	S&P	AA	3
Bethel Township		2014	Kroll	A+	3
Brookhaven Borough		Jan-14	S&P	AA-	3
City of Chester			S&P	Rating withdrawn 2014	
Eddystone Borough*		6/11/2014	S&P	BBB+	2
Marple		4/9/15	S&P	AA	3
Ridley Township			S&P	A+	3
Swarthmore			S&P	AA	3
Upland Borough	Series 2012 GO Notes	10/29/14	Kroll	A-	3
Upper Chichester Township			S&P	AA-	3
Upper Providence Township			S&P	AA-	3
Weighted Composite Rating					3

5.2 Worksheet 4 - Net Debt as Percent of Full Market Property Value

Worksheet 4 focuses on the debt repaid through property tax with respect to property value within the Model Area and is intended as a measure of a local government's ability to issue additional debt. Although this metric is not directly applicable to DELCORA as the permittee, since DELCORA is not a municipality with taxing power, Worksheet 4 has been prepared based on the methodology described below.

Line 401: Direct Net Debt

The City of Chester's Direct Debt was obtained from their 2012 Independent Audit, which was published in late 2014 (City of Chester, 2014). The other municipality general obligation debt was obtained from Municipal Annual Audit and Financial Reports (MAAFR) available on the State of Pennsylvania web site (PA MunStats, 2015). The most recent year available for most municipalities in the Model Area was for 2013, although there were some cases where 2013 reports were not available.

Where a municipality was only partly enclosed within the Model Area, the data was pro-rated based on the fraction of land area within the Model Area. This assumes that the number of households is evenly distributed within the municipality.

Line 402: Debt of Overlapping Entities

Overlapping entities with the authority to issue general obligation debt funded through property taxes were also included in the analysis of Worksheet 4. In some cases, the overlapping entity's geographic boundaries are not contiguous with a specific municipality. For example, a school district may serve more than one municipality within the Model Area. In these situations, the overlapping entity's debt assigned to a particular municipality was allocated based on the fraction of fair market value within each entity. Also, in cases where a portion of the overlapping entity falls outside of the Model Area, the overlapping entities debt was further pro-rated based on land area within the Model Area.

The overlapping entities identified include Delaware County and local school districts. Debt for Delaware County was obtained from their Comprehensive Annual Financial Report (year ended Dec. 31, 2013). Debt for school districts was based on end of fiscal year 2013-2014 information obtained from Pennsylvania state web site (PA Portal, 2015). Chester-Upland School District debt is based on information found in the 2011 bond statement for Chester Upland School District project (Chester Upland School District, 2011). A list of school districts overlapping with the Model Area is presented in the Table 5-3 below.

Table 5-3: Overlapping Entities – School Districts

Municipality	School District
Aston Township	Penn Delco
Bethel Township	Garnet Valley
Brookhaven Borough	Penn Delco
Chester City	Chester-Upland
Chester Township	Chester Upland
Eddystone Borough*	Ridley
Edgmont Township	Rose Tree Media
Lower Chichester Township	Chi Chester
Marcus Hook Borough	Chi Chester
Marple	Marple Newtown
Middletown Township	Rose Tree Media
Morton	Springfield
Nether Providence Township (partial)	Wallingford - Swarthmore
Newtown Township	Marple Newtown
Parkside Borough	Penn Delco
Prospect Park	Interboro
Ridley Park Borough	Ridley
Ridley Township	Ridley
Rose Valley Borough	Wallingford - Swarthmore
Rutledge	Wallingford Swarthmore
Springfield	Springfield
Swarthmore	Wallingford Swarthmore
Trainer Borough	Chi Chester
Upland Borough	Chester-Upland
Upper Chichester Township	Chi Chester
Upper Providence Township	Rose Tree Media

The results for worksheet 4 are presented in Table 5-4. Chester City has a rating of 1, which is considered "Weak". Viewed as a composite, the Model Area also would have an EPA rating of 2 which is considered mid-range. However, the Model Area is not a municipality and would not be able to incur debt. Individual municipalities within the Model Area would be capable of incurring debt through bonds, but the municipalities are not the permittee.

Table 5-4: Worksheet 4 – Overall Net Debt as a Percent of Full Market Property Value

	Description	Chester City	Model Area	Line No.
A	Direct Net Debt (G.O. Bonds Excluding Double-Barreled Bonds) within service area	$ 22,948,627	$ 83,347,338	401
B.	Debt of Overlapping Entities (Proportionate Share of Multijurisdictional Debt)	$ 46,181,397	$ 527,927,412	402
C.	Overall Net Debt (Line 401 + Line 402)	$ 69,130,024	$ 611,274,750	403
D.	Market Value of Property within Service Area	$ 516,553,848	$ 15,181,969,459	404
E.	Overall Net Debt as a Percentage of Full Market Property Value (Line 403/Line 404*100)	13.4%	4.0%	
F.	Benchmark			
	1. Financial Indicator	Weak	Mid-Range	
	2. Numerical Financial Indicator	**1**	**2**	

5.3 Worksheet 5 – Unemployment Rate

The Bureau of Labor Statistics does not report unemployment for municipalities with populations smaller than 25,000. Because only two of the municipalities in the Model Area are above this size limit, an estimate of the Model Area unemployment could not be developed. Instead, the Delaware County unemployment rate will be used as a surrogate for the Model Area. As shown in Table 5-5, the Delaware County unemployment rate is 0.3 percentage point above than the national unemployment rate, resulting in a mid-range rating. The Chester City's unemployment is 3.5 percentage points higher than the national unemployment. As such, Chester City's rating is considered weak.

Table 5-5: Worksheet 5 - Unemployment Rate

Description	Chester City	Model Area	Line No.
A. Unemployment Rate - Municipality Source: Homefacts, Bureau of Labor and Statistics	8.6%	--	501
B. Unemployment Rate - Delaware County Source: Bureau of Labor and Statistics	4.8%	4.8%	502
C. Average national unemployment rate Source: Bureau of Labor and Statistics	5.1%	5.1%	503
D. Benchmark			
1. Municipality Rate minus National Rate	3.5%	-0.3%	
2. Financial Indicator	Weak	Mid-range	
3. Numerical Financial Indicator	1	2	

5.4 Worksheet 6 – Median Household Income

Worksheet 6 compares the national MHI to the local MHI as a measure of the local community's earning capacity. Communities with an MHI more than 25 percent below the national MHI are rated as weak, communities with 25 percent of the MHI are rated as mid-range and communities more than 25 percent above the national MHI are rated as strong. As shown in Table 5-6, the Model Area is rated as strong with respect to the national MHI. Despite the model area as a whole being strong, this does not accurately portray the financial impact for each municipality. The Model Area has municipalities with a wide range of earning capacity. Chester City, the largest municipality in the Model Area, is rated as weak and falls significantly below the national MHI at almost half of the national value.

Table 5-6: Worksheet 6 - Median Household Income

Description	Chester City	Model Area	Line No.
A. Locality			
1. Municipality Median Household Income	$ 27,249	$ 68,821	
Source: US Census			
2. MHI Adjustment Factor			
a. Year of MHI Estimate	2013	2013	
b. FCA Analysis Year	2015	2015	
c. MHI Inflation Rate	2.0%	2.0%	
d. MHI Adjustment Factor	1.04	1.04	
3. Adjusted MHI	$ 28,350	$ 71,601	601
B. National			
1. National Median Household Income	$ 53,046	$ 53,046	602
Source: US Census			
2. MHI Adjustment Factor			
a. Year of MHI Estimate	2013	2013	
b. FCA Analysis Year	2015	2015	
c. MHI Inflation Rate	2.0%	2.0%	
d. MHI Adjustment Factor	1.04	1.04	603
3. Adjusted MHI	$ 55,189	$ 55,189	604
C. Benchmark			
1. Percent difference in MHI for U.S. and Municipality	-49%	30%	
2. Financial Indicator	Weak	Strong	
3. Numerical Financial Indicator	1	3	

5.5 Worksheet 7 – Property Tax Revenues as percent of Full Market Value

Worksheet 7 (see Table 5-7) provides a measure of the property tax burden and gives an indication of the ability of the community to support additional debt. While it is recognized that DELCORA does not have the ability to impose taxes to fund the CSO LTCP program, the analysis for Worksheet 7 has been prepared in accordance with EPA's guidance document (USEPA, 1997). The Model Area and Chester City receive a strong rating for this indicator. It should be noted that while Chester City has strong rating, this indicator does not reflect the true ability of Chester City to increase revenue from property taxes. For the purpose of the Draft FCA, Chester City will be shown as strong. However, it is recommended that Chester City be considered weak and studied further in final FCA. The Chester City property tax information is based on the 2012 Independent Audit, which was published in December of 2014 (City of Chester, 2014). For the remaining municipalities, property tax revenues were obtained from the MAAFRs (PA MunStats, 2015).

Table 5-7: Worksheet 7 – Property Tax Revenues as percent of Full Market Value

Description	Chester City	Model Area	Line No.
A. Full Market Property Value (Line 404)	$ 516,553,848	$ 19,803,029,357	701
B. Property Tax Revenue	$ 6,283,197	$ 70,889,731	702
C. Property Tax Revenue as a Percent of Full Market Property Value (702 / 701 x100%)	1.22%	0.36%	703
D. Benchmark			
1. Financial Indicator	Strong	Strong	
2. Numerical Financial Indicator	3	3	

5.6 Worksheet 8 – Property Tax Revenue Collection Rate

Worksheet 8 provides a measure of the property tax collection rate and the efficiency of the tax collection system. It also provides an indication of the acceptability of tax levels to residents. As shown in Table 5-8 the Model Area is rated as strong.

The City of Chester City is empowered by Pennsylvania to perform its own property assessments which results in assessed values that differ from Delaware County's assessment of the property in the City of Chester. Property taxes levied by the City of Chester are based on their own assessed values. The Chester City property tax information is based on the 2012 Independent Audit, which was published in December of 2014 (City of Chester, 2014). Assessments for other municipalities was obtained from the Pennsylvania State Tax Equalization Board web site (PA STEB/TED, 2015).

As shown in Table 5-8, the City of Chester's tax revenue collection rate is rated as weak. The 2013 Recovery Plan (City of Chester, 2013) also indicated that the reported collection rate of about 82 percent was consistent for the years 2005-2010. Therefore, the 2013 Recovery Plan support's Chester City "weak" rating.

Table 5-8: Worksheet 8 – Property Tax Revenue Collection Rate

Description	Chester City	Model Area	Line No.
A. Property Tax Revenues Collected (Line 702)	$ 6,283,197	$ 57,211,528	801
B. Levied Property Tax	$ 7,694,586	$ 58,699,061	802
C. Property Tax Revenue Collection Rate (Line 801/ Line 802 x 100)	81.7%	97.5%	803
D. Benchmark			
1. Financial Indicator	Weak	Mid-range	
2. Numerical Financial Indicator	1	2	

5.7 Worksheet 9 - Summary of Financial Capability Indicators

The average score for the financial indicator was calculated by dividing the sum of the scores by the number of entries. Table 5-9 summarizes the factors used to develop the financial capability indicator. The overall financial capability for the Model Area corresponds to a "Strong" rating. However, due to financial distressed conditions, Chester City's overall financial capability is "Weak".

Table 5-9: Worksheet 9 - Summary of Financial Capability Indicators

	Chester City			Model Area			
Indicator	Actual Value	Financial Indicator	Score	Actual Value	Financial Indicator	Score	Line Number
A. Bond Rating (Line 303)	A (Suspended 1/6/2014)	Mid-Range	2	AA	Strong	3	901
B. Overall Net Debt as a Percent of Full Market Property Value (Line 405)	13.4%	Weak	1	4.0%	Mid-Range	2	902
C. Unemployment Rate (Line 501)	8.6%	Weak	1	4.8%	Mid-Range	2	903
D. Household Income (Line 601)	28,350	Weak	1	71,601	Strong	3	904
E. Property Tax Revenues as a Percent of Full Market Property Value (Line 703)	1.2%	Strong	3	0.4%	Strong	3	905
F. Property Tax Revenue Collection Rate (Line 803)	81.7%	Weak	1	97.5%	Mid-range	2	906
G. Permittee Indicators Score			1.5			2.5	907
H. Financial Indicator			Weak			Strong	

5.8 Worksheet 10 - Overall Financial Capability Matrix

The financial capability assessment combines the results from both the residential and financial capability indicators to determine the overall burden imposed on the residents. The financial capability matrix score is shown in Table 5-10 for the Model Area.

Table 5-10: Worksheet 10 - Overall Financial Capability Matrix

Description	2035 Basis		2015 Basis		Line No.
	Chester City	Model Area	Chester City	Model Area	
1. Residential Indicator Score (Line 205)					
a. Actual Value	1.4%	0.4%	1.1%	0.4%	1001
b. Financial Impact	Mid-Range	Low	Mid-Range	Low	
2. Financial Capability Indictors Score (Line 907)					
a. Actual Value	1.5	2.5	1.5	2.5	1002
b. Financial Indicator	Weak	Strong	Weak	Strong	
3. Financial Capability Matrix Category	High Burden	Low Burden	High Burden	Low Burden	1003

As shown in Table 5-10, the composite Model Area will have a “low” burden, while Chester City residents will have an overall “High Burden”.

Section 6 Conclusions

As this Draft FCA is being prepared prior to the start of the LTCP Update, final LTCP project alternatives have not yet been identified nor have cost estimates for such projects been completed. With that in mind and in accordance with EPA's 1997 Guidance for Financial Capability, Chester City will have a "high burden" if the CSO LTCP costs are $30,000,000 with an 85 percent Chester City share. The methodology presented herein will be followed for the final FCA and will be submitted with the LTCP Update. It is recommended that the assumed proportional of the CSO program cost for Chester City be refined during the LTCP Update of the H&H model which will then be used to calculate the fraction of wet weather flow during CSO events attributable to each municipality.

Section 7 References

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Appendix 1: FCA Worksheets for Municipalities in Model Area

Appendix 1, Table 1: Cost per Household – Worksheet 1 (2035 Dollar Basis)

Description	Chester City	Parkside Borough	Upland Borough	Chester Township (DELCORA)	Trainer Borough	Marcus Hook Borough	Brookhaven Borough (wholesale)	Nether Providence Township (wholesale)	Southern	Eddystone Borough	Lower Chichester Township	Southwest	Central Delaware County Authority	Model Area	Line Number
A. DELCORA's Cost															
1. Current WWT and CSO Costs in millions															
a. Annual O&M Expenses (Excluding Depreciation)	$ 3.2	$ 0.2	$ 0.5	$ 0.2	$ 0.1	$ 0.2	$ 0.5	$ 0.6	$ 1.3	$ 0.2	$ 0.3	$ 2.4	$ 7.0	$ 16.7	100
b. Annual Debt Service (Principle plus Interest)	$ 0.1	$ 0.0	$ 0.0	$ 0.0	$ 0.2	$ 0.1	$ 0.5	$ 0.6	$ 0.4	$ 0.1	$ 0.1	$ 1.9	$ 0.5	$ 4.5	101
c. Current WWT and CSO Costs (Line 100 + Line 101)	$ 3.4	$ 0.2	$ 0.6	$ 0.2	$ 0.3	$ 0.3	$ 1.0	$ 1.2	$ 1.7	$ 0.3	$ 0.3	$ 4.3	$ 7.5	$ 21.3	102
2. Projected WWT and CSO Costs in millions (Year 2035 Dollars)															
a. Additional Annual O&M Expenses	$ 3.1	$ 0.1	$ 0.4	$ 0.1	$ 0.1	$ 0.2	$ 0.4	$ 0.5	$ 1.0	$ 0.2	$ 0.2	$ 1.9	$ 9.9	$ 18.2	103
b. Additional Annual Debt Service (Principle plus Interest)	$ 2.2	$ 0.0	$ 0.0	$ 0.0	$ 0.1	$ 0.0	-$ 0.3	-$ 0.4	$ 0.1	$ 0.0	$ 0.0	-$ 0.1	$ 1.8	$ 3.5	104
c. Projected Additional WWT and CSO Costs (Line 103 + Line 104)	$ 5.3	$ 0.2	$ 0.5	$ 0.1	$ 0.2	$ 0.2	$ 0.1	$ 0.1	$ 1.1	$ 0.2	$ 0.2	$ 1.9	$ 11.8	$ 21.7	105
3. Total Current and Projected WWT and CSO Costs in millions (Line 102 + Line 105)	$ 8.7	$ 0.3	$ 1.0	$ 0.3	$ 0.5	$ 0.5	$ 1.1	$ 1.3	$ 2.7	$ 0.5	$ 0.6	$ 6.2	$ 19.2	$ 43.0	106a
B. Other Local Collection System Costs (Year 2035 Dollars)	--	--	--	--	--	--	$ 1.1	$ 1.2	$ 2.7	$ 0.5	$ 0.5	$ 5.6	$ 12.7	$ 24.3	106b
C. Total Current and Projected WWT and CSO Costs (Year 2035 Dollars)	$ 8.7	$ 0.3	$ 1.0	$ 0.3	$ 0.5	$ 0.5	$ 2.2	$ 2.5	$ 5.4	$ 1.0	$ 1.1	$ 11.8	$ 31.9	$ 67.2	106c
D. Annual Volume in 1,000 gallons	828,789	43,409	133,793	41,196	37,605	54,980	316,951	367,693	795,568	145,250	163,501	1,679,000	3,801,530	8,409,265	
E. Cost per 1,000 gallons	$ 10.4	$ 7.8	$ 7.8	$ 7.8	$ 13.2	$ 9.5	$ 6.8	$ 6.8	$ 6.8	$ 6.8	$ 6.8	$ 7.0	$ 8.4	$ 8.0	
F. Annual Residential Flow Per Household in 1,000 gallons	55	55	55	55	55	55	55	55	55	55	55	55	55	55	107
G. Equivalent Households	15,069	789	2,433	749	684	1,000	5,763	6,685	14,465	2,641	2,973	30,527	69,119	152,896	108
H. WWT and CSO Cost Per Household Year (2035 dollars)	$ 575	$ 428	$ 428	$ 428	$ 725	$ 522	$ 374	$ 374	$ 374	$ 374	$ 374	$ 386	$ 462	$ 440	109a
I Projected SW Costs per Household (Year 2035 Dollars)	$ 79	$ 79	$ 79	$ 79	$ 79	$ 79	$ 79	$ 79	$ 79	$ 79	$ 79	$ 79	$ 79	$ 79	109b
J. Combined WWT, CSO and SW Cost Per Household (Year 2035 Dollars)	$ 653	$ 507	$ 507	$ 507	$ 804	$ 601	$ 453	$ 453	$ 453	$ 453	$ 453	$ 465	$ 541	$ 519	109c

WWT - Wastewater Treatment
CSO - Combined Sewer Overflow
SW - Stormwater

Appendix 1, Table 2: Cost Per Household – Worksheet 1 (2015 Dollar Basis)

	Description	Chester City	Parkside Borough	Upland Borough	Chester Township	Trainer Borough	Marcus Hook Borough	Brookhaven Borough (wholesale)	Nether Providence Township (wholesale)	Southern	Eddystone Borough	Lower Chichester Township	Southwest	Central Delaware County Authority	Model Area	Line Number
A.	DELCORA's Cost															
	1. Current WWT and CSO Costs in millions															
	a. Annual O&M Expenses (Excluding Depreciation)	$ 3.2	$ 0.2	$ 0.5	$ 0.2	$ 0.1	$ 0.2	$ 0.5	$ 0.6	$ 1.3	$ 0.2	$ 0.3	$ 2.4	$ 7.0	$ 16.7	100
	b. Annual Debt Service (Principle plus Interest)	$ 0.1	$ 0.0	$ 0.0	$ 0.0	$ 0.2	$ 0.1	$ 0.5	$ 0.6	$ 0.4	$ 0.1	$ 0.1	$ 1.9	$ 0.5	$ 4.5	101
	c. Current WWT and CSO Costs (Line + Line)	$ 3.4	$ 0.2	$ 0.6	$ 0.2	$ 0.3	$ 0.3	$ 1.0	$ 1.2	$ 1.7	$ 0.3	$ 0.3	$ 4.3	$ 7.5	$ 21.3	102
	2. Projected WWT and CSO Costs in millions (Year 2015 Dollars)															
	a. Additional Annual O&M Expenses	$ 0.3	$ 0.0	$ 0.0	$ 0.0	$ 0.0	$ 0.0	$ 0.0	$ 0.0	$ 0.0	$ 0.0	$ 0.0	$ 0.0	$ 3.5	$ 3.8	103
	b. Additional Annual Debt Service (Principle plus Interest)	$ 1.2	$ 0.0	$ 0.0	$ 0.0	$ 0.0	$ 0.0	-$ 0.2	-$ 0.2	$ 0.0	$ 0.0	$ 0.0	-$ 0.2	$ 1.4	$ 2.1	104
	c. Projected Additional WWT and	$ 1.5	$ 0.0	$ 0.0	$ 0.0	$ 0.0	$ 0.0	-$ 0.2	-$ 0.2	$ 0.0	$ 0.0	$ 0.0	-$ 0.2	$ 4.9	$ 5.9	105
	CSO Costs (Line 103 + Line 104)															
	3. Total Current and Projected WWT and															
	CSO Costs in millions (Line + Line)	$ 4.9	$ 0.2	$ 0.6	$ 0.2	$ 0.3	$ 0.3	$ 0.8	$ 1.0	$ 1.7	$ 0.3	$ 0.4	$ 4.2	$ 12.3	$ 27.2	106a
B.	Other Local Collection System Costs (Year 2015 Dollars)	--	--	--	--	--	--	$ 0.6	$ 0.7	$ 1.5	$ 0.3	$ 0.3	$ 3.1	$ 7.0	$ 15.6	106b
C.	Total Current and Projected WWT and CSO Costs (Year 2015 Dollars)	$ 4.9	$ 0.2	$ 0.6	$ 0.2	$ 0.3	$ 0.3	$ 1.4	$ 1.7	$ 3.2	$ 0.6	$ 0.7	$ 7.3	$ 19.3	$ 42.7	106c
D.	Annual Volume in 1,000 gallons	828,789	43,409	133,793	41,196	37,605	54,980	316,951	367,693	795,568	145,250	163,501	1,679,000	3,801,530	8,409,265	
E.	Cost per 1,000 gallons	$ 5.9	$ 4.4	$ 4.4	$ 4.4	$ 8.4	$ 6.4	$ 4.5	$ 4.5	$ 4.0	$ 4.0	$ 4.0	$ 4.3	$ 5.1	$ 5.1	
F.	Annual Residential Flow Per Household in 1,000 gallons	55	55	55	55	55	55	55	55	55	55	55	55	55	55	107
G.	Equivalent Households	15,069	789	2,433	749	684	1,000	5,763	6,685	14,465	2,641	2,973	30,527	69,119	152,896	108
H.	WWT and CSO Cost Per Household Year (2015 dollars)	$ 323	$ 244	$ 244	$ 244	$ 464	$ 350	$ 249	$ 249	$ 220	$ 220	$ 220	$ 238	$ 280	$ 279	109a
I	Projected SW Costs per Household (Year 2015 Dollars)	$ 44	$ 44	$ 44	$ 44	$ 44	$ 44	$ 44	$ 44	$ 44	$ 44	$ 44	$ 44	$ 44	$ 44	109b
J.	Combined WWT, CSO and SW Cost Per Household (Year 2015 dollars	$ 366	$ 288	$ 288	$ 288	$ 508	$ 393	$ 292	$ 292	$ 264	$ 264	$ 264	$ 282	$ 324	$ 323	109c

WWT - Wastewater Treatment
CSO - Combined Sewer Overflow
SW - Stormwater

Appendix 1, Table 3: Median Household Income – Worksheet 2 (2035 Dollar Basis)

		Retail Customers						Wholesale Customers		Western				Southwest					
										Southern									
	Description	Chester City	Parkside Borough	Upland Borough	Chester Township (DELCORA)	Trainer Borough	Marcus Hook Borough	Brookhaven Borough (wholesale)	Nether Providence Township (wholesale)	Bethel Township	Upper Chichester Township	Eddystone Borough	Lower Chichester Township	Aston Township	Brookhaven Borough	Chester Township (SW)	Middletown Township	Upper Providence Township	Line Number
A.	Median Household Income (MHI)																		
	1. MHI Based on 5-yr ACS, in 2013 dollars	$ 27,249	$ 51,103	$ 31,597	$ 44,353	$ 40,863	$ 39,167	$ 63,808	$ 98,608	$ 120,869	$ 68,294	$ 41,832	$ 53,460	$ 77,966	$ 63,808	$ 44,353	$ 85,593	$ 104,399	201
	2. Year of MHI Estimate: 2013																		
	3. FCA Analysis Year: 2035																		
	4. MHI Inflation Rate: 2%																		
	5. MHI Adjustment Factor	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	
	6. Adjusted MHI (Line 201 x Line 202)	$ 42,126	$ 79,004	$ 48,848	$ 68,569	$ 63,173	$ 60,551	$ 98,646	$ 152,446	$ 186,861	$ 105,581	$ 64,671	$ 82,648	$ 120,534	$ 98,646	$ 68,569	$ 132,325	$ 161,399	203
B.	Annual WWT, CSO and SW Control Cost Per Household (CPH) - (Line 109c)	$ 653	$ 507	$ 507	$ 507	$ 804	$ 601	$ 453	$ 453	$ 453	$ 453	$ 453	$ 453	$ 465	$ 465	$ 465	$ 465	$ 465	204a
C.	Residential Indicator (CPH as % of MHI) - (Line 204/ Line 203 x 100)	1.6%	0.6%	1.0%	0.7%	1.3%	1.0%	0.5%	0.3%	0.2%	0.4%	0.7%	0.5%	0.4%	0.5%	0.7%	0.4%	0.3%	205
D.	Financial Impact	Mid-Range	Low	Mid-Range	Low	Mid-Range	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	

		Central Delaware County Authority													
	Description	Edgmont Township	Marple Township (CDCA)	Morton	Nether Providence Township (CDCA)	Newtown Twp	Prospect Park	Ridley Park Borough	Ridley Township (CDCA)	Rutledge	Springfield	Swarthmore	Upper Providence Township (CDCA)	Model Area	Line Number
A.	Median Household Income (MHI)														
	1. MHI Based on 5-yr ACS, in 2013 dollars	$ 114,355	$ 74,503	$ 59,022	$ 98,608	$ 93,565	$ 67,143	$ 57,516	$ 62,500	$ 71,923	$ 92,468	$ 117,604	$ 104,399	$ 68,821	201
	2. Year of MHI Estimate: 2013														
	3. FCA Analysis Year: 2035														
	4. MHI Inflation Rate: 2%														
	5. MHI Adjustment Factor	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	
	6. Adjusted MHI (Line 201 x Line 202)	$ 176,791	$ 115,180	$ 91,247	$ 152,446	$ 144,650	$ 103,802	$ 88,919	$ 96,624	$ 111,191	$ 142,954	$ 181,813	$ 161,399	$ 106,396	203
B.	Annual WWT, CSO and SW Control Cost Per Household (CPH) - (Line 109c)	$ 541	$ 541	$ 541	$ 541	$ 541	$ 541	$ 541	$ 541	$ 541	$ 541	$ 541	$ 541	$ 519	204a
C.	Residential Indicator (CPH as % of MHI) - (Line 204/ Line 203 x 100)	0.3%	0.5%	0.6%	0.4%	0.4%	0.5%	0.6%	0.6%	0.5%	0.4%	0.3%	0.3%	0.5%	205
D.	Financial Impact	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	

WWT - Wastewater Treatment
CSO - Combined Sewer Overflow
SW - Stormwater

Appendix 1, Table 4: Median Household Income – Worksheet 2 (2015 Dollar Basis)

		Retail Customers						Wholesale Customers		Western				Southwest					
										Southern									
	Description	Chester City	Parkside Borough	Upland Borough	Chester Township (DELCORA)	Trainer Borough	Marcus Hook Borough	Brookhaven Borough (wholesale)	Nether Providence Township (wholesale)	Bethel Township	Upper Chichester Township	Eddystone Borough	Lower Chichester Township	Aston Township	Brookhaven Borough	Chester Township (SW)	Middletown Township	Upper Providence Township	Line Number
A.	Median Household Income (MHI)																		
	1. MHI Based on 5-yr ACS, in 2013 dollars	$ 27,249	$ 51,103	$ 31,597	$ 44,353	$ 40,863	$ 39,167	$ 63,808	$ 98,608	$ 120,869	$ 68,294	$ 41,832	$ 53,460	$ 77,966	$ 63,808	$ 44,353	$ 85,593	$ 104,399	201
	2. Year of MHI Estimate: 2013																		
	3. FCA Analysis Year	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	
	4. MHI Inflation Rate: 2%																		
	5. MHI Adjustment Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	
	6. Adjusted MHI (Line 201 x Line 202)	$ 28,350	$ 53,168	$ 32,874	$ 46,145	$ 42,514	$ 40,749	$ 66,386	$ 102,592	$ 125,752	$ 71,053	$ 43,522	$ 55,620	$ 81,116	$ 66,386	$ 46,145	$ 89,051	$ 108,617	203
B.	Annual WWT, CSO and SW Control Cost Per Household (CPH) - (Line 109c)	$ 366	$ 288	$ 288	$ 288	$ 508	$ 393	$ 292	$ 292	$ 264	$ 264	$ 264	$ 264	$ 282	$ 282	$ 282	$ 282	$ 282	204a
C.	Residential Indicator (CPH as % of MHI) - (Line 204/ Line 203 x 100)	1.3%	0.5%	0.9%	0.6%	1.2%	1.0%	0.4%	0.3%	0.2%	0.4%	0.6%	0.5%	0.3%	0.4%	0.6%	0.3%	0.3%	205
D.	Financial Impact	Mid-Range	Low	Low	Low	Mid-Range	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	

	Central Delaware County Authority													
Description	Edgmont Township	Marple Township (CDCA)	Morton	Nether Providence Township (CDCA)	Newtown Twp	Prospect Park	Ridley Park Borough	Ridley Township (CDCA)	Rutledge	Springfield	Swarthmore	Upper Providence Township (CDCA)	Model Area	Line Number
Median Household Income (MHI)														
1. MHI Based on 5-yr ACS, in 2013 dollars	$ 114,355	$ 74,503	$ 59,022	$ 98,608	$ 93,565	$ 67,143	$ 57,516	$ 62,500	$ 71,923	$ 92,468	$ 117,604	$ 104,399	$ 68,821	201
2. Year of MHI Estimate: 2013														
3. FCA Analysis Year	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	
4. MHI Inflation Rate: 2%														
5. MHI Adjustment Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	
6. Adjusted MHI (Line 201 x Line 202)	$ 118,975	$ 77,513	$ 61,406	$ 102,592	$ 97,345	$ 69,856	$ 59,840	$ 65,025	$ 74,829	$ 96,204	$ 122,355	$ 108,617	$ 71,601	203
Annual WWT, CSO and SW Control Cost Per Household (CPH) - (Line 109c)	$ 324	$ 324	$ 324	$ 324	$ 324	$ 324	$ 324	$ 324	$ 324	$ 324	$ 324	$ 324	$ 323	204a
Residential Indicator (CPH as % of MHI) - (Line 204/ Line 203 x 100)	0.3%	0.4%	0.5%	0.3%	0.3%	0.5%	0.5%	0.5%	0.4%	0.3%	0.3%	0.3%	0.5%	205
Financial Impact	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	

WWT - Wastewater Treatment
CSO - Combined Sewer Overflow
SW - Stormwater

Appendix 1, Table 5: Bond Rating – Worksheet 3

Description	DELCORA	Retail Customers						Wholesale Customers		Western				Southwest					Line Number
										Southern									
		Chester City	Parkside Borough	Upland Borough	Chester Township (DELCORA)	Trainer Borough	Marcus Hook Borough	Brookhaven Borough (wholesale)	Nether Providence Township (wholesale)	Bethel Township	Upper Chichester Township	Eddystone Borough	Lower Chichester Township	Aston Township	Brookhaven Borough	Chester Township (SW)	Middletown Township	Upper Providence Township	
A. Most Recent General Obligation Bond Rating																			
1. Date		2012		10/29/2014				Jan-14		2,014		6/11/2014		10/1/2013					
2. Rating agency		S&P		Kroll				S&P		Kroll	S&P	S&P		S&P	S&P			S&P	
3. Most recent rating		A (Suspended 1/6/2014)	-	A-	-	-	-	AA-	-	A+	AA-	BBB+	-	AA	AA	-	-	AA-	301
B. Most Recent Revenue (Water/Sewer or Sewer) Bond																			
1. Date	2015																		
2. Rating agency (Moody's or S&P)	Moody's																		
3. Bond insurance (y/n) (Revenue bonds only)																			
4. Most recent rating	Aa3																		302
C. Summary bond rating	Aa3	A (Suspended 1/6/2014)																	303
D. Benchmark																			
1. Numerical Financial Indicator	3	2		3				3		3	3	2		3	3			3	
2. Financial Indicator	Strong	Mid-Range		Strong				Strong		Strong	Strong	Mid-Range		Strong	Strong			Strong	

Description	Central Delaware County Authority												Model Area	Line Number
	Edgmont Township	Marple Township (CDCA)	Morton	Nether Providence Township (CDCA)	Newtown Twp	Prospect Park	Ridley Park Borough	Ridley Township (CDCA)	Rutledge	Springfield	Swarthmore	Upper Providence Township (CDCA)		
A. Most Recent General Obligation Bond Rating														
1. Date														
2. Rating agency		S&P						S&P			S&P	S&P	S&P	
3. Most recent rating	-	AA	-	-	-	-	-	A+	-	-	AA	AA-	AA	301
B. Most Recent Revenue (Water/Sewer or Sewer) Bond														
1. Date														
2. Rating agency (Moody's or S&P)														
3. Bond insurance (y/n) (Revenue bonds only)														
4. Most recent rating														302
C. Summary bond rating														303
D. Benchmark													AA	
1. Numerical Financial Indicator		3						3			3	3	3	
2. Financial Indicator		Strong						Strong			Strong	Strong	Strong	

Appendix 1, Table 6: Overall Net Debt as a Percent of Full Market Property Value - Worksheet 4

		Retail Customers						Wholesale Customers		Western				Southwest					
										Southern									
	Description	Chester City	Parkside Borough	Upland Borough	Chester Township (DELCORA)	Trainer Borough	Marcus Hook Borough	Brookhaven Borough (wholesale)	Nether Providence Township (wholesale)	Bethel Township	Upper Chichester Township	Eddystone Borough	Lower Chichester Township	Aston Township	Brookhaven Borough	Chester Township (SW)	Middletown Township	Upper Providence Township	Line Number
A	Direct Net Debt (G.O. Bonds Excluding Double-Barreled Bonds) within service area	$ 22,948,627	$ 498,976	$ 1,776,953	$ 0	$ 0	$ 1,776,603	$ 2,307,739	$ 1,561,757	$ 649,254	$ 4,874,480	$ 3,369,224	$ 0	$ 4,853,000	$ 646,656	$ 0	$ 10,650,000	$ 245,159	401
B.	Debt of Overlapping Entities (Proportionate Share of Multijurisdictional Debt)	$ 46,181,397	$ 6,388,154	$ 7,823,695	$ 7,497,564	$ 3,525,289	$ 6,164,971	$ 15,909,080	$ 19,722,217	$ 22,706,941	$ 49,666,084	$ 6,292,411	$ 5,259,349	$ 56,613,508	$ 4,810,249	$ 11,654,157	$ 33,420,942	$ 2,427,820	402
C.	Overall Net Debt (Line 401 + Line 402)	$ 69,130,024	$ 6,887,130	$ 9,600,648	$ 7,497,564	$ 3,525,289	$ 7,941,574	$ 18,216,818	$ 21,283,975	$ 23,356,195	$ 54,540,564	$ 9,661,635	$ 5,259,349	$ 61,466,508	$ 5,456,906	$ 11,654,157	$ 44,070,942	$ 2,672,978	403
D.	Market Value of Property within Service Area	$ 516,553,848	$ 140,432,669	$ 86,916,839	$ 82,419,118	$ 80,303,015	$ 140,432,669	$ 347,127,371	$ 406,831,393	$ 615,592,712	$ 1,131,350,161	$ 226,703,647	$ 119,803,390	$ 1,244,551,376	$ 97,269,279	$ 128,911,954	$ 1,546,015,387	$ 81,659,615	404
E.	Overall Net Debt as a Percentage of Full Market Property Value (Line 403/Line 404*100)	13.4%	4.9%	11.0%	9.1%	4.4%	5.7%	5.2%	5.2%	3.8%	4.8%	4.3%	4.4%	4.9%	5.6%	9.0%	2.9%	3.3%	
F.	Benchmark																		
	1. Financial Indicator	Weak	Mid-Range	Weak	Weak	Mid-Range	Weak	Weak	Weak	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Weak	Weak	Mid-Range	Mid-Range	
	2. Numerical Financial Indicator	**1**	**2**	**1**	**1**	**2**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**2**	**2**	

		Central Delaware County Authority													
	Description	Edgmont Township	Marple Township (CDCA)	Morton	Nether Providence Township (CDCA)	Newtown Twp	Prospect Park	Ridley Park Borough	Ridley Township (CDCA)	Rutledge	Springfield	Swarthmore	Upper Providence Township (CDCA)	Model Area	Line Number
A	Direct Net Debt (G.O. Bonds Excluding Double-Barreled Bonds) within service area	$ 0	$ 2,789,733	$ 673,250	$ 3,036,697	$ 1,363,458	$ 44,183	$ 1,196,806	$ 10,961,760	$ 161,482	$ 2,468,340	$ 2,637,000	$ 1,856,202	$ 83,347,338	401
B.	Debt of Overlapping Entities (Proportionate Share of Multijurisdictional Debt)	$ 2,112,371	$ 28,596,246	$ 3,119,755	$ 37,631,416	$ 22,604,026	$ 8,885,890	$ 11,257,040	$ 39,899,577	$ 2,459,330	$ 25,959,609	$ 25,637,840	$ 13,700,483	$ 527,927,412	402
C.	Overall Net Debt (Line 401 + Line 402)	$ 2,112,371	$ 31,385,979	$ 3,793,005	$ 40,668,113	$ 23,967,484	$ 8,930,073	$ 12,453,846	$ 50,861,337	$ 2,620,812	$ 28,427,949	$ 28,274,840	$ 15,556,685	$ 611,274,750	403
D.	Market Value of Property within Service Area	$ 80,946,490	$ 1,347,335,866	$ 155,311,247	$ 791,047,234	$ 1,058,481,188	$ 295,032,728	$ 405,569,802	$ 1,430,596,670	$ 52,079,034	$ 1,259,726,502	$ 542,909,677	$ 618,279,943	$ 15,181,969,459	404
E.	Overall Net Debt as a Percentage of Full Market Property Value (Line 403/Line 404*100)	2.6%	2.3%	2.4%	5.1%	2.3%	3.0%	3.1%	3.6%	5.0%	2.3%	5.2%	2.5%	4.0%	
F.	Benchmark														
	1. Financial Indicator	Mid-Range	Mid-Range	Mid-Range	Weak	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Weak	Mid-Range	Weak	Mid-Range	Mid-Range	
	2. Numerical Financial Indicator	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**2**	

Appendix 1, Table 7: Unemployment Rate - Worksheet 5

Description	Retail Customers						Wholesale Customers		Western				Southwest					Line Number
									Southern									
	Chester City	Parkside Borough	Upland Borough	Chester Township (DELCORA)	Trainer Borough	Marcus Hook Borough	Brookhaven Borough (wholesale)	Nether Providence Township (wholesale)	Bethel Township	Upper Chichester Township	Eddystone Borough	Lower Chichester Township	Aston Township	Brookhaven Borough	Chester Township (SW)	Middletown Township	Upper Providence Township	
A. Unemployment Rate - Municipality	8.6%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	501
Source: Homefacts,Bureau of Labor and Statistics																		
B. Unemployment Rate - Delaware County	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	502
Source: Bureau of Labor and Statistics																		
C. Average national unemployment rate	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	503
Source: Bureau of Labor and Statistics																		
D. Benchmark																		
1. Municipality Rate minus National Rate	3.5%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	
2. Financial Indicator	Weak	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Mid-Range	
3. Numerical Financial Indicator	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	

Description	Central Delaware County Authority												Model Area	Line Number
	Edgmont Township	Marple Township (CDCA)	Morton	Nether Providence Township (CDCA)	Newtown Twp	Prospect Park	Ridley Park Borough	Ridley Township (CDCA)	Rutledge	Springfield	Swarthmore	Upper Providence Township (CDCA)		
A. Unemployment Rate - Municipality	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.5%	4.8%	4.8%	4.8%	4.8%	--	501
Source: Homefacts,Bureau of Labor and Statistics														
B. Unemployment Rate - Delaware County	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	502
Source: Bureau of Labor and Statistics														
C. Average national unemployment rate	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	503
Source: Bureau of Labor and Statistics														
D. Benchmark														
1. Municipality Rate minus National Rate	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.6%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	
2. Financial Indicator	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Mid-Range	Mid-Range	
3. Numerical Financial Indicator	2	2	2	2	2	2	2	2	2	2	2	2	2	

Appendix 1, Table 8: Median Household Income Comparison - Worksheet 6

Description	Retail Customers						Wholesale Customers		Western				Southwest					Line Number
									Southern									
	Chester City	Parkside Borough	Upland Borough	Chester Township (DELCORA)	Trainer Borough	Marcus Hook Borough	Brookhaven Borough (wholesale)	Nether Providence Township (wholesale)	Bethel Township	Upper Chichester Township	Eddystone Borough	Lower Chichester Township	Aston Township	Brookhaven Borough	Chester Township (SW)	Middletown Township	Upper Providence Township	
A. Locality																		
1. Municipality Median Household Income	$ 27,249	$ 51,103	$ 31,597	$ 44,353	$ 40,863	$ 39,167	$ 63,808	$ 98,608	$ 120,869	$ 68,294	$ 41,832	$ 53,460	$ 77,966	$ 63,808	$ 44,353	$ 85,593	$ 104,399	
Source: US Census																		
2. MHI Adjustment Factor																		
a. Year of MHI Estimate	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	
b. FCA Analysis Year	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	
c. MHI Inflation Rate	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	
d. MHI Adjustment Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	
3. Adjusted MHI	$ 28,350	$ 53,168	$ 32,874	$ 46,145	$ 42,514	$ 40,749	$ 66,386	$ 102,592	$ 125,752	$ 71,053	$ 43,522	$ 55,620	$ 81,116	$ 66,386	$ 46,145	$ 89,051	$ 108,617	601
B. National																		
1. National Median Household Income	$ 53,046	$ 53,046	$ 53,046	$ 53,046	$ 53,046	$ 53,046	$ 53,046	$ 53,046	$ 53,046	$ 53,046	$ 53,046	$ 53,046	$ 53,046	$ 53,046	$ 53,046	$ 53,046	$ 53,046	602
Source: US Census																		
2. MHI Adjustment Factor																		
a. Year of MHI Estimate	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	
b. FCA Analysis Year	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	
c. MHI Inflation Rate	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	
d. MHI Adjustment Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	603
3. Adjusted MHI	$ 55,189	$ 55,189	$ 55,189	$ 55,189	$ 55,189	$ 55,189	$ 55,189	$ 55,189	$ 55,189	$ 55,189	$ 55,189	$ 55,189	$ 55,189	$ 55,189	$ 55,189	$ 55,189	$ 55,189	604
C. Benchmark																		
1. Percent difference in MHI for U.S. and Municipality	-49%	-4%	-40%	-16%	-23%	-26%	20%	86%	128%	29%	-21%	1%	47%	20%	-16%	61%	97%	
2. Financial Indicator	Weak	Mid-Range	Weak	Mid-Range	Mid-Range	Weak	Mid-Range	Strong	Strong	Strong	Mid-Range	Mid-Range	Strong	Mid-Range	Mid-Range	Strong	Strong	
3. Numerical Financial Indicator	1	2	1	2	2	1	2	3	3	3	2	2	3	2	2	3	3	

Description	Central Delaware County Authority												Model Area	Line Number
	Edgmont Township	Marple Township (CDCA)	Morton	Nether Providence Township (CDCA)	Newtown Twp	Prospect Park	Ridley Park Borough	Ridley Township (CDCA)	Rutledge	Springfield	Swarthmore	Upper Providence Township (CDCA)		
A. Locality														
1. Municipality Median Household Income	$ 114,355	$ 74,503	$ 59,022	$ 98,608	$ 93,565	$ 67,143	$ 57,516	$ 62,500	$ 71,923	$ 92,468	$ 117,604	$ 104,399	$ 68,821	
Source: US Census														
2. MHI Adjustment Factor														
a. Year of MHI Estimate	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	
b. FCA Analysis Year	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	
c. MHI Inflation Rate	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	
d. MHI Adjustment Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	
3. Adjusted MHI	$ 118,975	$ 77,513	$ 61,406	$ 102,592	$ 97,345	$ 69,856	$ 59,840	$ 65,025	$ 74,829	$ 96,204	$ 122,355	$ 108,617	$ 71,601	601
B. National														
1. National Median Household Income	$ 53,046	$ 53,046	$ 53,046	$ 53,046	$ 53,046	$ 53,046	$ 53,046	$ 53,046	$ 53,046	$ 53,046	$ 53,046	$ 53,046	$ 53,046	602
Source: US Census														
2. MHI Adjustment Factor														
a. Year of MHI Estimate	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	
b. FCA Analysis Year	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	
c. MHI Inflation Rate	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	
d. MHI Adjustment Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	603
3. Adjusted MHI	$ 55,189	$ 55,189	$ 55,189	$ 55,189	$ 55,189	$ 55,189	$ 55,189	$ 55,189	$ 55,189	$ 55,189	$ 55,189	$ 55,189	$ 55,189	604
C. Benchmark														
1. Percent difference in MHI for U.S. and Municipality	116%	40%	11%	86%	76%	27%	8%	18%	36%	74%	122%	97%	30%	
2. Financial Indicator	Strong	Strong	Mid-Range	Strong	Strong	Strong	Mid-Range	Mid-Range	Strong	Strong	Strong	Strong	Strong	
3. Numerical Financial Indicator	3	3	2	3	3	3	2	2	3	3	3	3	3	

Appendix 1, Table 9: Property Tax Revenues as a Percent of Full Market Property Value - Worksheet 7

	Retail Customers						Wholesale Customers		Western				Southwest					
									Southern									
Description	Chester City	Parkside Borough	Upland Borough	Chester Township (DELCORA)	Trainer Borough	Marcus Hook Borough	Brookhaven Borough (wholesale)	Nether Providence Township (wholesale)	Bethel Township	Upper Chichester Township	Eddystone Borough	Lower Chichester Township	Aston Township	Brookhaven Borough	Chester Township (SW)	Middletown Township	Upper Providence Township	Line Number
A. Full Market Property Value (Line 404)	$ 516,553,848	$ 91,130,712	$ 86,916,839	$ 211,331,072	$ 80,303,015	$ 140,432,669	$ 541,287,028	$ 1,242,612,683	$ 851,442,202	$ 1,131,350,161	$ 226,703,647	$ 119,803,390	$ 1,244,551,376	$ 541,287,028	$ 211,331,072	$ 1,546,015,387	$ 1,166,565,930	701
B. Property Tax Revenue	$ 6,283,197	$ 641,259	$ 149,028	$ 1,591,862	$ 1,181,121	$ 1,400,678	$ 1,664,327	$ 4,072,907	$ 1,313,687	$ 4,481,438	$ 1,045,996		$ 3,678,340	$ 1,664,327	$ 1,591,862	$ 1,798,790	$ 3,180,481	702
C. Property Tax Revenue as a Percent of	1.22%	0.70%	0.17%	0.75%	1.47%	1.00%	0.31%	0.33%	0.15%	0.40%	0.46%	0.00%	0.30%	0.31%	0.75%	0.12%	0.27%	703
Full Market Property Value (702 / 701 x100%)																		
D. Benchmark																		
1. Financial Indicator	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	
2. Numerical Financial Indicator	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	

	Central Delaware County Authority													
Description	Edgmont Township	Marple Township (CDCA)	Morton	Nether Providence Township (CDCA)	Newtown Twp	Prospect Park	Ridley Park Borough	Ridley Township (CDCA)	Rutledge	Springfield	Swarthmore	Upper Providence Township (CDCA)	Model Area	Line Number
A. Full Market Property Value (Line 404)	$ 674,554,080	$ 2,405,956,904	$ 155,311,247	$ 1,242,612,683	$ 2,116,962,376	$ 295,032,728	$ 405,569,802	$ 1,744,630,085	$ 52,079,034	$ 2,332,826,856	$ 542,909,677	$ 1,166,565,930	$ 19,803,029,357	701
B. Property Tax Revenue	$ 412,812	$ 7,321,267	$ 939,219	$ 4,072,907	$ 4,277,085	$ 1,840,540	$ 2,311,315	$ 10,454,725	$ 169,482	$ 8,679,467	$ 2,000,708	$ 4,492,831	$ 70,889,731	702
C. Property Tax Revenue as a Percent of	0.06%	0.30%	0.60%	0.33%	0.20%	0.62%	0.57%	0.60%	0.33%	0.37%	0.37%	0.39%	0.36%	703
Full Market Property Value (702 / 701 x100%)														
D. Benchmark														
1. Financial Indicator	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong	
2. Numerical Financial Indicator	3	3	3	3	3	3	3	3	3	3	3	3	3	

Notes:
N.D. indicates no data.
Full Market Property Values are not corrected for portions of municipalities that do not fall within DELCORA's service area.
Full Market Property Value for Lower Chichester Township was $119,803,390. However, Lower Chichester Township was not included because property tax revenue data was not available.

Appendix 1, Table 10: Property Tax Revenue Collection Rate - Worksheet 8

		Retail Customers						Wholesale Customers		Western				Southwest					
										Southern									
	Description	Chester City	Parkside Borough	Upland Borough	Chester Township (DELCORA)	Trainer Borough	Marcus Hook Borough	Brookhaven Borough (wholesale)	Nether Providence Township (wholesale)	Bethel Township	Upper Chichester Township	Eddystone Borough	Lower Chichester Township	Aston Township	Brookhaven Borough	Chester Township (SW)	Middletown Township	Upper Providence Township	Line Number
A.	Property Tax Revenues Collected (Line 702	$ 6,283,197	$ 641,259	$ 149,028	$ 1,591,862	$ 1,181,121	$ 1,400,678	$ 1,664,327	$ 4,072,907	$ 1,313,687	$ 4,481,438	$ 1,045,996		$ 3,678,340	$ 1,664,327	$ 1,591,862	$ 1,798,790	$ 3,180,481	801
B.	Levied Property Tax	$ 7,694,586	$ 645,042	$ 145,396	$ 1,477,322	$ 1,217,681	$ 1,433,237	$ 1,710,187	$ 4,088,365	$ 1,311,918	$ 4,413,476	$ 1,082,355		$ 3,676,201	$ 1,710,187	$ 1,477,322	$ 1,813,749	$ 3,221,019	802
C.	Property Tax Revenue Collection Rate (Line 801/ Line 802 x 100)	81.7%	99.4%	102.5%	107.8%	97.0%	97.7%	97.3%	99.6%	100.1%	101.5%	96.6%		100.1%	97.3%	107.8%	99.2%	98.7%	803
D.	Benchmark																		
	1. Financial Indicator	Weak	Strong	Strong	Strong	Mid-range	Mid-range	Mid-range	Strong	Strong	Strong	Mid-range		Strong	Mid-range	Strong	Strong	Strong	
	2. Numerical Financial Indicator	1	3	3	3	2	2	2	3	3	3	2		3	2	3	3	3	

		Central Delaware County Authority													
	Description	Edgmont Township	Marple Township (CDCA)	Morton	Nether Providence Township (CDCA)	Newtown Twp	Prospect Park	Ridley Park Borough	Ridley Township (CDCA)	Rutledge	Springfield	Swarthmore	Upper Providence Township (CDCA)	Model Area	Line Number
A.	Property Tax Revenues Collected (Line 702	$ 412,812	$ 7,321,267	$ 939,219	$ 4,072,907	$ 4,277,085	$ 1,840,540	$ 2,311,315	$ 10,454,725	$ 169,482	$ 8,679,467	$ 2,000,708	$ 3,180,481	$ 57,211,528	801
B.	Levied Property Tax	$ 417,145	$ 7,376,891	$ 960,233	$ 4,088,365	$ 3,831,186	$ 1,893,697	$ 2,357,063	$ 10,544,585	$ 177,270	$ 8,732,416	$ 2,026,604	$ 3,221,019	$ 58,699,061	802
C.	Property Tax Revenue Collection Rate (Line 801/ Line 802 x 100)	99.0%	99.2%	97.8%	99.6%	111.6%	97.2%	98.1%	99.1%	95.6%	99.4%	98.7%	98.7%	97.5%	803
D.	Benchmark														
	1. Financial Indicator	Strong	Strong	Mid-range	Strong	Strong	Mid-range	Strong	Strong	Mid-range	Strong	Strong	Strong	Mid-range	
	2. Numerical Financial Indicator	3	3	2	3	3	2	3	3	2	3	3	3	2	

Note:
Data not available for Lower Chichester Township

Appendix 1, Table 11: Summary of Financial Capability Indicators - Worksheet 9

Indicator	Chester City			Model Area			Line Number
	Actual Value	Financial Indicator	Score[1]	Actual Value	Financial Indicator	Score[1]	
A. Bond Rating (Line 303)	A (Suspended 1/6/2014)	Mid-Range	2	AA	Strong	3	901
B. Overall Net Debt as a Percent of Full Market Property Value (Line 405)	13.4%	Weak	1	4.0%	Mid-Range	2	902
C. Unemployment Rate (Line 501)	8.6%	Weak	1	4.8%	Mid-Range	2	903
D. Household Income (Line 601)	28,350	Weak	1	71,601	Strong	3	904
E. Property Tax Revenues as a Percent of Full Market Property Value (Line 703)	1.2%	Strong	3	0.4%	Strong	3	905
F. Property Tax Revenue Collection Rate (Line 803)	81.7%	Weak	1	97.5%	Mid-range	2	906
G. Permittee Indicators Score (Sum of Column B / Number of Entries)			1.5			2.5	907
H. Financial Indicator[2]			Weak			Strong	

Note:
1. Scoring Benchmarks
   - Weak: 1
   - Mid-Range: 2
   - Strong: 3
2. Financial Indicator Benchmarks
   - Weak 1.5 and Below
   - Mid-Range: Between 1.5 and 2.5
   - Strong: 2.5 and Above

Appendix 1, Table 12: Financial Capability Matrix Score - Worksheet 10 (2035 Dollar Basis)

Description	Chester City	Model Area	Line Number
1. Residential Indicator Score (Line 205)			
a. Actual Value	1.6%	0.5%	1001
b. Financial Impact	Mid-Range	Low	
2. Permittee Financial Capability Indictors Score (Line 907)			
a. Actual Value	1.5	2.5	1002
b. Financial Indicator	Weak	Strong	
3. Financial Capability Matrix Category	High Burden	Low Burden	1003

Appendix 1, Table 13: Financial Capability Matrix Score - Worksheet 10 (2015 Dollar Basis)

Description	Chester City	Model Area	Line Number
1. Residential Indicator Score (Line 205)			
a. Actual Value	1.3%	0.5%	1001
b. Financial Impact	Mid-Range	Low	
2. Permittee Financial Capability Indictors Score (Line 907)			
a. Actual Value	1.5	2.5	1002
b. Financial Indicator	Weak	Strong	
3. Financial Capability Matrix Category	High Burden	Low Burden	1003

Appendix 2: EPA FCA Framework 2014

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

NOV 2 4 2014

MEMORANDUM

SUBJECT: Financial Capability Assessment Framework for Municipal Clean Water Act Requirements

FROM: Ken Kopocis
Deputy Assistant Administrator
Office of Water (OW)

Cynthia Giles
Assistant Administrator
Office of Enforcement and Compliance Assurance (OECA)

TO: Regional Administrators
Regional Water Division Directors
Regional Enforcement Division Directors

In May of 2012, we distributed the Integrated Municipal Stormwater and Wastewater Planning Approach Framework (Integrated Planning Framework). Since that time, we have made solid progress in promoting integrated approaches to meet Clean Water Act (CWA) obligations. Thanks to the hard work of regional and headquarters staff, and the active engagement of cities, many of our enforcement settlements now embody integrated planning principles in the structure and schedule for injunctive relief or explicitly include integrated planning as part of the settlement. We have also seen an increasing number of municipalities and local authorities moving towards developing integrated plans to support the development of their NPDES permits. We have been working with EPA Regions and States to assist in that process.

As the implementation of the Integrated Planning Framework has progressed and evolved, we have been actively engaged with stakeholders on ways to build on our efforts. Those discussions found a natural focus on issues related to the financial capability of permittees working toward our shared goals of clean water. One consistent theme that emerged was the benefit of more clearly articulating the flexibility available under the existing guidance. EPA continues to be guided by the 1997 "Combined Sewer Overflows – Guidance for Financial Capability Assessment

and Schedule Development" (FCA Guidance) that provides an aid for assessing financial capability as part of negotiating schedules for implementing CWA requirements for municipalities and local authorities. The FCA Guidance also encourages permittees "to submit any additional documentation that would create a more accurate and complete picture of their financial capability" that may "affect the conclusion" of the analysis described in the guidance.

As part of EPA's commitment to implementing CWA objectives in a sustainable manner, we have developed the attached "Financial Capability Assessment Framework" (FCA Framework). The FCA Framework has been greatly informed by the comments and experiences of a variety of stakeholders and financial experts. The FCA Framework identifies the key elements EPA uses in working with permittees to evaluate how their financial capability should influence schedules. In addition, the FCA Framework provides examples of additional information that may help some communities provide a "more accurate and complete picture" of their financial capability as is envisioned in the FCA guidance. We will be posting the FCA Framework to our website as an important next step in the pursuit of integrated planning approaches and in our ongoing work with municipalities and local authorities to achieve our shared goals of protecting our nation's waters. While this memorandum releases the FCA Framework, we know that we will continue to learn and refine our understanding of the issues surrounding financial capability assessments as we use it moving forward. We will continue to look for ways to improve the Framework as we gain new insights and additional information.

We look forward to continue working with the Regions on these important issues and encourage you to contact Deborah Nagle, Director, Water Permits Division (nagle.deborah@epa.gov) and Mark Pollins, Director, Water Enforcement Division (pollins.mark@epa.gov) with any questions you might have.

Attachment

cc: Regional Permit and Enforcement Liaisons

FINANCIAL CAPABILITY ASSESSMENT FRAMEWORK

November 24, 2014

Purpose

The Environmental Protection Agency (EPA) is committed to working with state and local government partners to assist local municipalities and local authorities to meet Clean Water Act (CWA) obligations in a manner that recognizes the unique financial challenges that local jurisdictions face. This financial capability assessment framework is intended to provide additional examples and greater clarity on the flexibilities built into existing guidance that local governments or authorities can use in assessing their financial capability, and the relationship between that assessment and consideration of schedules for permit and consent decree implementation. This framework builds on the progress already made in the May 2012 "Integrated Municipal Stormwater and Wastewater Planning Approach Framework," and the experience gained from talking with communities about their financial capability in actual, on the ground circumstances. Integrated Planning has been helping in identifying a permittee's relative priorities for projects based on the relative importance of adverse impacts on human health and water quality and the municipality's financial capability.

Background

Local governments and authorities want to provide clean water for their communities, and they play an essential role in providing wastewater and stormwater infrastructure and services for their citizens, businesses and institutions. These municipal functions have been an important part of implementing the CWA to protect public health and improve water quality in streams, lakes, bays, and other waters nationwide. However, significant water quality challenges remain. Public officials remain strong supporters of the CWA goals and objectives by directing the public investments that are necessary to comply with the Act and to provide clean water for their citizens. Many local governments face complex water quality issues that are heightened by the need to address population growth or decline, increases in impervious surfaces, source water supply needs, and aging infrastructure. In recent years, many local governments and authorities have increased investments in their wastewater and stormwater infrastructure through capital projects to rehabilitate existing systems, improve operation and maintenance, and address additional regulatory requirements. As programs are implemented to improve water quality and attain CWA objectives, many state and local government partners find themselves facing difficult economic challenges with limited resources and financial capability. We recognize these challenging conditions and are working with states and local governments to develop and implement new approaches that will achieve water quality goals at lower costs and in a manner that addresses the most pressing problems first.

Long-term approaches to meeting CWA objectives should be sustainable and within a local government or authority's financial capability. The financial capability of these entities and other relevant factors are important to consider when developing appropriate schedules for infrastructure projects in permits or enforcement actions to help protect human health and the environment. EPA's financial capability assessment guidance, "Combined Sewer Overflows:

Guidance for Financial Capability Assessment and Schedule Development" (FCA Guidance) (EPA 832-B-97-004) provides a reference point to aid all parties in negotiating reasonable and effective schedules for implementing CWA requirements, and the flexibility to take into account local considerations that may not be fully captured by the approach detailed in the guidance. As described in more detail in this Framework, the guidance provides for consideration of the impact on residential rate payers and the financial capability of the permittee using a suite of indicators, as well as allowing schedules to be responsive to circumstances unique to that community, while advancing the mutual goal to protect clean water. The FCA Guidance encourages permittees to provide any additional information that would be useful in understanding those unique or atypical circumstances and how they may affect CWA schedules, so that all relevant information presented by a community can be taken into account to ensure that a full understanding of financial capability guides the development of schedules.

Financial Capability Assessment

The following are key elements of EPA's approach to the evaluation of the financial capability of municipalities to inform implementation schedules, both in permits and enforcement actions. The elements are fully compatible with the FCA Guidance, integrated planning approaches, and the flexibility embodied in both.

1. **The 1997 FCA Guidance identifies a valuable assessment that provides a common basis for financial burden discussions between the permittee, EPA and state NPDES authorities. Permittees have the option of submitting additional information that would create a more accurate and complete picture of their financial conditions.** The financial capability assessment described in the 1997 FCA Guidance identifies information that provides a basis for a general comparison of financial conditions between communities across the country and provides a consistent assessment of basic financial indicators as part of the overall analysis. Additional information that the community provides on its unique financial circumstances will be considered so that schedules take local considerations into account. Where appropriate, this information can result in schedules that are different than the schedules suggested by the baseline analysis suggested in the 1997 FCA Guidance.

2. **Financial capability is on a continuum.** Although the FCA Guidance approach categorizes financial burden as "high, medium, or low," this does not mean that schedules will be rigidly set according to the break points between the categories. For example, two communities whose total residential share of costs are 1.1% and 1.9% of median household income (MHI) are both categorized in the FCA Guidance as having a "medium" burden for the Residential Indicator (RI). All other things being equal, the appropriate schedules for those communities are likely to be different. Similarly, all other things being equal, two communities whose residential share of costs are 1.9% and 2.1% of MHI would be more likely to have similar overall compliance timeframes, even though one community is ranked as having a "medium" burden and the other as having a "high" burden. Finally, additional information submitted by the community may affect the length of the schedule regardless of where the community is on the "high, medium, and low" continuum.

3. **EPA will consider all CWA costs presented in the analysis described in the FCA Guidance**. EPA originally published the FCA Guidance to assist in negotiating schedules for communities with combined sewer systems, as these typically represent the most expensive CWA compliance issues. The FCA Guidance has since been recognized as equally suitable for considering other municipal CWA obligations as well, such as those related to separate sanitary sewer systems. With the release of EPA's 2012 Integrated Planning Framework, the Agency clarified that the financial capability analysis could include costs of: stormwater and wastewater; ongoing asset management or system rehabilitation programs; existing, CWA related capital improvement programs; collection systems and treatment facilities; and other CWA obligations required by state or other regulators. Where the costs of multiple CWA obligations are included in an FCA, each of those costs should be enumerated separately, so as to provide an understanding of how each contributes to the overall analysis.

4. **When presented, Safe Drinking Water Act (SDWA) obligations will be considered, primarily as additional information about a permittee's financial capability.** EPA believes that the SDWA obligations of a community can be an important consideration in establishing schedules for implementing integrated plans. EPA recognizes that both clean water and drinking water costs are often covered through charges on a single rate base. One component of a financial capability assessment includes an evaluation of the residential indicator that is based on only CWA costs as this best reflects the intended use of the metric and allows for comparisons with other communities. Drinking water costs may be reflected in other components of a financial capability assessment. For example, the financial capability indicator includes consideration of bond rating of the entity that issues debt to fund the permittee's capital project, which can be impacted by both wastewater and drinking water obligations for a permittee that provides both services. If a community has incurred general obligation debt associated with the SDWA, these obligations would be considered in the indicator "overall net debt as a percent of full market property value." In addition, as discussed below, additional information, including information regarding drinking water obligations, may be submitted for consideration in analyzing financial capability. To the extent that drinking water costs are not fully addressed by these other components, communities are encouraged to provide additional information about these costs.

5. **Communities should demonstrate how the CWA work included as costs in the financial capability assessment will be implemented, including appropriate assurances that those expenditures will be made.**

The Financial Capability Assessment Guidance and Examples of Additional Information that are Relevant to a Consideration of Financial Capability

The specific approaches laid out in the FCA Guidance provide a good foundation for the assessment of financial capability. As stated in the guidance and outlined in this Framework, communities can build on that foundation to include additional relevant information. The FCA Guidance presents a two-phased approach to assessing overall financial capability. The first phase assesses the impact on residential customers, and the first step is to calculate the portion of

the annual costs that would be borne by residential households for both current and projected Clean Water Act related expenses. The residential share of the annual costs of CWA obligations is then compared to the MHI of the service area. MHI is calculated using current census data and may be adjusted based on the current Consumer Price Index. Finally, the CWA compliance costs per household are divided by the adjusted MHI to calculate the residential indicator (RI). The FCA Guidance then identifies various ranges of RI scores as “low, mid-range or high” levels of burden. In situations where there are unique circumstances that would affect the conclusion of the first phase of the assessment, additional information documenting unique financial conditions may be submitted.

The second phase of the financial capability analysis assesses the financial strength of the permittee. Six indicators are used to evaluate the debt, socioeconomic and financial conditions that affect a permittee’s financial capability to implement CWA controls necessary for compliance with the Act. These include bond ratings, overall net debt as a percent of full market property value, unemployment rate, median household income, property tax revenue collection rate, and property taxes as a percent of full market property value. In the Guidance, EPA has established benchmarks for each of the six indicators showing whether the indicator reflects a “weak”, “mid-range”, or “strong” financial capability. These benchmarks are used to generate an overall score of a permittee’s financial capability.

The residential indicator calculated in phase one and the permittee capability indicators analyzed in phase two are evaluated together in a Financial Capability Matrix to assess the level of financial burden. The level of burden is then used to inform discussions to establish an appropriate schedule for meeting CWA obligations in permits and enforcement actions. EPA uses these indicators, including the annualized costs as a percent of MHI, to help assess when costs are reaching levels that may represent a high burden on ratepayers and that longer compliance timeframes are likely to be appropriate to spread the cost over a longer period. EPA does not view or use the Financial Capability Matrix as a rigid metric that points to a given schedule length or threshold over which the costs are unaffordable.

Permittees have suggested and the FCA Guidance recognizes that the two step analysis may not provide a complete representation of financial capability. As noted above, other relevant financial or demographic information presented that illustrates the unique or atypical circumstances faced by a permittee will also be considered in evaluating financial capability. The presentation of additional information can be very valuable in analyzing financial capability, and the submission of this type of information has become fairly common practice. For example, in many consent decree negotiations, additional information has resulted in the establishment of schedules that differ from the ones suggested by the baseline analysis described in the FCA Guidance.

Some examples of information that may be relevant in negotiating schedules to be included in permits and consent decrees are given below. In order for such information to adequately illustrate that a permittee’s situation is atypical, EPA encourages permittees to compare any additional information on their circumstances to national averages or to that of other permittees.

The examples given below are not intended to be a complete list, nor a list of factors that will be relevant in every community. Rather it provides an illustration of information that may prove useful in some instances.

Examples of Information Related to Residential Impacts:

1. Income distribution by quintile, geography or other breakdown, illustrating how income distribution in the service area differs from comparable data on the national level or for similar cities.

2. Where cities have adopted differential rates for low income customers, the income distribution that led to that rate structure.

3. Information about service area poverty rates and trends.

4. Projected, current and historical sewer, and stormwater fees as a percentage of household income, quintile, geography or other breakdown.

5. Information on sewer and water usage for various classes of ratepayers or by type of dwelling unit.

6. Information on the percent of households who own versus rent.

Examples of Information Related to Financial Strength:

1. Historical population trends or population projections.

2. Service area unemployment data and trends, or other labor market indicators, including unemployment on an absolute basis.

3. Rate or revenue models, including dynamic financial planning models showing the projections of impacts over the program period. All revenue sources tied to CWA obligations may be included as appropriate.

4. Rate determination studies used to develop and support recent rate increases.

5. Data and trends on late payments, disconnection notices, service terminations, uncollectable accounts, or revenue collection rates.

6. Historical increases in rates or other dedicated revenue streams.

7. State or local legal restrictions or limitations on property taxes, other revenue streams or debt levels.

8. Other costs or financial obligations, such as those that relate to drinking water or other infrastructure, that significantly affect a permittee's ability to raise revenue.

9. Circumstances that may affect a permittee's bond rating. For instance, incurring debt beyond certain thresholds may negatively impact the permittee's bond rating, thus reducing the ability to raise capital.

10. Financial plans that show the implications of incurring additional debt for a permittee's ability to secure financing, including projections of metrics such as debt ratios, debt service coverage, debt per customer, days of cash on hand, days

of working capital and other metrics used by rating agencies. Such data should be benchmarked to metrics such as rating agency medians and relative to similar entities. This will be especially relevant where the permittee does not have a bond rating.

11. Extraordinary stressors such as those from natural disasters, municipal bankruptcies, unusual capital market conditions, or other situations which impact a permittee's ability to raise revenue or acquire needed financing. When such stressors occur, they may also provide support for making changes to existing schedules.

Appendix 3: Consumer Price Index Analysis

Appendix 3: Consumer Price Index Analysis

The Consumer Price Index (CPI) as determined by the United States Bureau of Labor Statistics (BLS) can be used as a measure of inflation experienced by consumers in their day-to-day living expenses. The BLS urban CPI (CPI-U) was selected for use in the Draft FCA Report.

The CPI-U is produced monthly and provides a measure of the changes in the prices paid by urban consumers for a representative basket of goods and services. As stated by the BLS, the "CPI represents changes in prices of all goods and services purchased for consumption by urban households. User fees (such as water and sewer service) and sales and excise taxes paid by the consumer are also included. Income taxes and investment items (like stocks, bonds, and life insurance) are not included." Also, "The CPI-U includes expenditures by urban wage earners and clerical workers, professional, managerial, and technical workers, the self-employed, short-term workers, the unemployed, retirees and others not in the labor force."

Long-term inflation trends used in this report are based on CPI-U obtained from the BLS as shown in Table 1.

Appendix 3, Table 1: Historical CPI-U

Year	BLS CPI-U (January)
1913	9.8
1979	68.3
1999	164.3
2013	230.3

The annualized inflation for a given period of years was determined by assuming the inflation will be expressed as an effective annual rate that when compounded over the time period and multiplied by the initial CPI will yield the final year's CPI-U. The formula for determining the annualized inflation rate is:

$$APCC = \left[\left[\left(\frac{CPI_f}{CPI_i}\right)^{\left(\frac{1}{t}\right)}\right] - 1\right] * 100$$

where

APCC = annualized percent change in CPI-U
CPI_f = CPI-U value for final year of time period
CPI_i = CPI-U value for first initial year of time period
t = length of time period in years

Using this formula, the following percent changes in CPI-U were determined:

Appendix 3, Table 2: Change in CPI-U

Period Year	Initial CPI-U (January)	Final CPI-U (January)	Length of Time period in years	Calculated Percent Change in CPI-U as annual compound rate for indicated period
1913 - 2013	9.8	230.3	100	3.21 %
1979-2013	68.3	230.3	34	3.64 %
1999-2013	164.3	230.3	14	2.44 %

Appendix 4: Inflation of Median Household Income

Appendix 4: Inflation of Median Household Income

Long-term income inflation trends used in this report are based on median household income data obtained from the United States Census and American Community Survey as shown in Table 1.

Appendix 4, Table 1: Median Household Income

Year	Delaware County MHI	Chester City MHI
1979	33,430	11,513
1999	50,092	25,703
2013	64,041	27,249

The annualized inflation for a given period of years was determined by assuming the inflation will be expressed as an effective annual rate that when compounded over the time period and multiplied by the initial MHI will yield the final year's MHI. The formula for determining the annualized inflation rate is:

$$APCM = \left[\left[\left(\frac{MHI_f}{MHI_i}\right)^{\left(\frac{1}{t}\right)}\right] - 1\right] * 100$$

where

APCM = annualized percent change in MHI
MHI_f = MHI value for final year of time period
MHI_i = MHI value for first initial year of time period
t = length of time period in years

Using this formula, the following percent changes in MHI were determined:

Appendix 4, Table 2: Change in Delaware County MHI

Period Year	Initial MHI	Final MHI	Length of Time period in years	Calculated Percent Change in MHI as annual compound rate for indicated period
1979-2013	33,430	64,041	34	1.93%
1999-2013	50,092	64,041	14	1.77%

Appendix 4, Table 3: Change in Chester City MHI

Period Year	Initial MHI	Final MHI	Length of Time period in years	Calculated Percent Change in MHI as annual compound rate for indicated period
1979-2013	11,513	27,249	34	2.6%
1999-2013	25,703	27,249	14	0.44%

Appendix 5: Sewer Rate Setting Information

Appendix 5: Sewer Rate Setting Information

DELCORA Sewer Rate Setting Policy

DELCORA's rate setting and cost allocation is based on the following:

- All customers pay an equal rate for commonly shared costs, including Administration, common treatment, common collection, and common capital costs.
- Western customers pay their specific costs for collection and capital costs.
- Eastern customers pay their specific costs for collection, capital, and I&I costs.
- Costs for CSO abatement are allocated to the Model Area customers in proportion to their contribution to CSO volume as well as excess volume generated from separate sewer communities within the Model Area during wet weather.
- Industrial pretreatment is allocated to only the customers that incur those costs.
- Both Trainer and Marcus Hook pay their own specific debt costs
- The Southwest rate includes treatment, billing/admin, debt and debt coverage, an allocation of capital costs, as well as the operation of the pump station.

Appendix 6: Municipal Annual Audit and Financial Reports (MAAFR)

DCED-CLGS-30 (9-09)
Received by DCED: 06/02/2014

Department of Community & Economic Development
Governor's Center for Local Government Services
Commonwealth Keystone Building
400 North Street, 4th Floor
Harrisburg, PA 17120-0225
Ph: 888-223-6837 | fax: 717-783-1402

2013 MUNICIPAL ANNUAL AUDIT AND FINANCIAL REPORT

230064 ASTON TWP, DELAWARE COUNTY

DCED-CLGS-30 (9-09)

BALANCE SHEET

DCED-CLGS-30 (09-09)

ASTON TWP, DELAWARE County

BALANCE SHEET

December 31, 2013

		Governmental Funds				Proprietary Funds		Fid. Fund	Account Groups		Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	General Fixed Assets	General Long Term Debt	Memorandum Only
Assets and Other Debits											
100-120	Cash and Investments	3,295,230	215,093	1,052,858				13,390,715			17,953,896
140-144	Tax Receivable										
121-129, 145-149	Accounts Receivable (excluding taxes)							3,455			3,455
130.00	Due From Other Funds	12	2								14
131-139, 150-159	Other Current Assets							65,675			65,675
160-169	Fixed Assets										
180-189	Other Debits										
Total Assets and Other Debits		3,295,242	215,095	1,052,858				13,459,845			18,023,040

Liabilities and Other Credits											
210-229	Payroll Taxes and Other Payroll Withholdings	746									746
200-209, 231-239	All Other Current Liabilities										
230.00	Due To Other Funds	14									14

ASTON TWP, DELAWARE County

BALANCE SHEET

December 31, 2013

		Governmental Funds				Proprietary Funds		Fid. Fund	Account Groups		Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	General Fixed Assets	General Long Term Debt	Memorandum Only
Liabilities and Other Credits											
260-269	Long-Term-Liabilities							327,997			327,997
240-259	Current Portion of Long-Term Debt and Other Credits										
Total Liabilities and Other Credits		760						327,997			328,757
Fund and Account Group Equity											
281-284	Contributed Capital										
290.00	Investment in General Fixed Assets										
270-289	Fund Balance / Retained Earnings on 12/31	3,294,482	215,095	1,052,858							4,562,435
291-299	Other Equity							13,131,848			13,131,848
Total Fund and Account Group Equity		3,294,482	215,095	1,052,858				13,131,848			17,694,283

TOTAL LIABILITIES AND FUND AND ACCOUNT GROUP EQUITY	18,023,040

ASTON TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

REVENUES

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
Taxes									
301.00	Real Estate Taxes	3,139,965	122,968		415,407				3,678,340
305.00	Occupation Taxes (levied under municipal code)								
308.00	Residence Taxes (levied by cities of the 3rd Class)								
309.00	Regional Asset District Sales Tax (Allegheny County municipalities only)								
310.00	Per Capita Taxes								
310.10	Real Estate Transfer Taxes	252,387							252,387
310.20	Earned Income Taxes / Wage Taxes	3,341,827							3,341,827
310.30	Business Gross Receipts Taxes	803,983							803,983
310.40	Occupation Taxes (levied under Act 511)								
310.50	Local Services Tax **								
310.60	Amusement / Admission Taxes								
310.70	Mechanical Device Taxes	5,979							5,979
310.90	Other Local Tax Enabling Act / Act 511 / Taxes								
	Other: _____								
Total Taxes		7,544,141	122,968		415,407				8,082,516
Licenses and Permits									
320-322	All Other Licenses and Permits	59,084							59,084
321.80	Cable Television Franchise Fees	325,217							325,217
Total Licenses and Permits		384,301							384,301
Fines and Forfeits									
330-332	Fines and Forfeits	71,770							71,770
Total Fines and Forfeits		71,770							71,770

ASTON TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

REVENUES

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
Interest, Rents and Royalties									
341.00	Interest Earnings	4,345	322	2				1,968,061	1,972,730
342.00	Rents and Royalties	104,219							104,219
Total Interest, Rents and Royalties		108,564	322	2				1,968,061	2,076,949
Federal									
351.03	Highways and Streets								
351.09	Community Development								
351.00	All Other Federal Capital and Operating Grants								
352.01	National Forest								
352.00	All Other Federal Shared Revenue and Entitlements								
353.00	Federal Payments in Lieu of Taxes								
Total Federal									
State									
354.03	Highways and Streets								
354.09	Community Development								
354.15	Recycling / Act 101	82,111							82,111
354.00	All Other State Capital and Operating Grants								
355.01	Public Utility Realty Tax (PURTA)	9,270							9,270
355.02-355.03	Motor Vehicle Fuel Tax (Liquid Fuels Tax) and State Road Turnback		325,289						325,289
355.04	Alcoholic Beverage Licenses	4,200							4,200
355.05	General Municipal Pension System State Aid	252,483							252,483
355.07	Foreign Fire Insurance Tax Distribution		129,370						129,370
355.08	Local Share Assessment/Gaming Proceeds								

ASTON TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
REVENUES									
State									
355.09	Marcellus Shale Impact Fee Distribution								
355.00	All Other State Shared Revenues and Entitlements								
356.00	State Payments in Lieu of Taxes								
Total State		348,064	454,659						802,723
Local Government Units									
357.03	Highways and Streets	18,833							18,833
357.00	All Other Local Governmental Units Capital and Operating Grants	33,800							33,800
358.00	Local Government Unit Shared Payments for Contracted Intergovernmental Services								
359.00	Local Governmental Units and Authorities Payments in Lieu of Taxes								
Total Local Government Units		52,633							52,633
Charges for Service									
361.00	General Government	30,883							30,883
362.00	Public Safety	956,022							956,022
363.20	Parking								
363.00	All Other Charges for Highway & Street Services	12,809							12,809
364.10	Wastewater / Sewage (including connection / tapping fees, sewer usage charges, reserve capacity fee, etc.)								
364.30	Solid Waste Collection and Disposal Charge (trash)	1,103,000							1,103,000
364.60	Host Municipality Benefit Fee for Solid Waste Facility								
364.00	All Other Charges for Sanitation Services								
365.00	Health								
366.00	Human Services								
367.00	Culture and Recreation	12,135							12,135

ASTON TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
REVENUES									
Charges for Service									
368.00	Airports								
369.00	Bars								
370.00	Cemeteries								
372.00	Electric System								
373.00	Gas System								
374.00	Housing System								
375.00	Markets								
377.00	Transit Systems								
378.00	Water System								
379.00	All Other Charges for Service								
Total Charges for Service		2,114,849							2,114,849
Unclassified Operating Revenues									
383.00	Special Assessments								
386.00	Escheats (sale of personal property)								
387.00	Contributions and Donations from Private Sectors		5,333						5,333
388.00	Fiduciary Fund Pension Contributions							1,343,264	1,343,264
389.00	All Other Unclassified Operating Revenues	14,894						488	15,382
Total Unclassified Operating Revenues		14,894	5,333					1,343,752	1,363,979
Other Financing Sources									
391.00	Proceeds of General Fixed Asset Disposition		64,650						64,650
392.00	Interfund Operating Transfers			1,050	2,032				3,082
393.00	Proceeds of General Long-Term Debt								
394.00	Proceeds of Short Term-Debt								

ASTON TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
REVENUES									
Other Financing Sources									
395.00	Refunds of Prior Year Expenditures	24,933							24,933
Total Other Financing Sources		24,933	64,650	1,050	2,032				92,665
TOTAL REVENUES		10,664,149	647,932	1,052	417,439			3,311,813	15,042,385
EXPENDITURES									
General Government									
400.00	Legislative (Governing) Body	535,025							535,025
401.00	Executive (Manager or Mayor)								
402.00	Auditing Services / Financial Administration	11,600							11,600
403.00	Tax Collection	60,118							60,118
404.00	Solicitor / Legal Services	87,074							87,074
405.00	Secretary / Clerk								
406.00	Other General Government Administration	42,449							42,449
407.00	IT-Networking Services-Data Processing								
408.00	Engineering Services								
409.00	General Government Buildings and Plant	44,525							44,525
Total General Government		780,791							780,791
Public Safety									
410.00	Police	4,154,958	11,782						4,166,740
411.00	Fire	330,365	217,779						548,144
412.00	Ambulance / Rescue								
413.00	UCC and Code Enforcement	364,989							364,989
414.00	Planning and Zoning								
415.00	Emergency Management and Communications								

ASTON TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Public Safety									
416.00	Militia and Armories								
417.00	Examination of Licensed Occupations								
418.00	Public Scales (weights and measures)								
419.00	Other Public Safety								
Total Public Safety		4,850,312	229,561						5,079,873
Health and Human Services									
420.00-425.00	Health and Human Services	25,164							25,164
Total Health and Human Services		25,164							25,164
Public Works - Sanitation									
426.00	Recycling Collection and Disposal								
427.00	Solid Waste Collection and Disposal (garbage)	949,134							949,134
428.00	Weed Control								
429.00	Wastewater / Sewage Treatment and Collection								
Total Public Works - Sanitation		949,134							949,134
Public Works - Highways and Streets									
430.00	General Services - Administration	779,552							779,552
431.00	Cleaning of Streets and Gutters								
432.00	Winter Maintenance – Snow Removal	80,042							80,042
433.00	Traffic Control Devices	48,214							48,214
434.00	Street Lighting	28,464	121,433						149,897
435.00	Sidewalks and Crosswalks								
436.00	Storm Sewers and Drains	132,763							132,763

ASTON TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Public Works - Highways and Streets									
437.00	Repairs of Tools and Machinery								
438.00	Maintenance and Repairs of Roads and Bridges	23,259	210,744						234,003
439.00	Highway Construction and Rebuilding Projects								
Total Public Works - Highways and Streets		1,092,294	332,177						1,424,471
Other Public Works Enterprises									
440.00	Airports								
441.00	Cemeteries								
442.00	Electric System								
443.00	Gas System								
444.00	Markets								
445.00	Parking								
446.00	Storm Water and Flood Control								
447.00	Transit System								
448.00	Water System								
449.00	Water Transport and Terminals								
Total Other Public Works Enterprises									
Culture and Recreation									
451.00	Culture-Recreation Administration	227,511							227,511
452.00	Participant Recreation	236,842							236,842
453.00	Spectator Recreation								
454.00	Parks								
455.00	Shade Trees								
456.00	Libraries	35,420	35,340						70,760

ASTON TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Culture and Recreation									
457.00	Civil and Military Celebrations								
458.00	Senior Citizens' Centers								
459.00	All Other Culture and Recreation		60,400						60,400
Total Culture and Recreation		499,773	95,740						595,513
Community Development									
461.00	Conservation of Natural Resources								
462.00	Community Development and Housing	1,747							1,747
463.00	Economic Development								
464.00	Economic Opportunity								
465-469	All Other Community Development								
Total Community Development		1,747							1,747
Debt Service									
471.00	Debt Principal (short-term and long-term)				318,000				318,000
472.00	Debt Interest (short-term and long-term)	54,000			99,439				153,439
475.00	Fiscal Agent Fees	1,050							1,050
Total Debt Service		55,050			417,439				472,489
Employer Paid Benefits and Withholding Items									
481.00	Employer Paid Withholding Taxes and Unemployment Compensation								
482.00	Judgments and Losses								
483.00	Pension / Retirement Fund Contributions	1,241,324							1,241,324
484.00	Worker Compensation Insurance								

ASTON TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Employer Paid Benefits and Withholding Items									
487.00	Other Group Insurance Benefits								
Total Employer Paid Benefits and Withholding Items		1,241,324							1,241,324
Insurance									
486.00	Insurance, Casualty, and Surety								
Total Insurance									
Unclassified Operating Expenditures									
488.00	Fiduciary Fund Benefits and Refunds Paid							1,415,016	1,415,016
489.00	All Other Unclassified Expenditures	1,382						67,434	68,816
Total Unclassified Operating Expenditures		1,382						1,482,450	1,483,832
Other Financing Uses									
491.00	Refund of Prior Year Revenues	43,991							43,991
492.00	Interfund Operating Transfers	3,082							3,082
493.00	All Other Financing Uses								
Total Other Financing Uses		47,073							47,073
TOTAL EXPENDITURES		9,544,044	657,478		417,439			1,482,450	12,101,411
EXCESS/DEFICIT OF REVENUES OVER EXPENDITURES		1,120,105	-9,546	1,052				1,829,363	2,940,974

ASTON TWP

December 31, 2013

DEBT STATEMENT

OUTSTANDING BONDS AND NOTES
Listed below are all currently outstanding bond and note issues according to our files, excluding bond issues redeemed or refunded and defeased. Please show the principal payments and make any other necessary corrections and additions.

Purpose	Bond (B) Capital Lease (C) Lease Rental (L) Note (N)	Issue Year (yyyy)	Maturity Year (yyyy)	Original Amount of Issue	Outstanding Beginning of Year (1)	Principal Incurred This Year	Principal Paid This Year	Current Year Accretion on Compound Interest Bonds	Outstanding at Year End (1)	Plus (less) Unamortized Premium (Discount)	Total Balance
General Obligation Bonds and Notes											
GOB Series 2010	Bond	2010	2023	3,655,000	3,345,000		195,000		3,150,000		3,150,000
GOB Series 2012	Bond	2012	2025	1,826,000	1,826,000		123,000		1,703,000		1,703,000
Revenue Bonds and Notes											
DELVAL Loan for Fire Truck	Bond	2010	2026	100,000	89,000		6,000		83,000		83,000
Lease Rental Debt											
2010 Truck	Captial Leases	2010	2014	136,931	58,337		28,540		29,797		29,797
2013 Ford F350 Truck	Captial Leases	2013	2017	44,392	0	44,392	3,493		40,899		40,899
Three pieces of equipment	Captial Leases	2013	2018	63,297	0	63,297	6,890		56,407		56,407
Other											

(1) - excludes unamortized premium/discount

Total bonds and notes outstanding	5,063,103
Capitalized lease obligations	
Net debt	5,063,103

ASTON TWP, DELAWARE County

STATEMENT OF CAPITAL EXPENDITURES

December 31, 2013

Category	Capital Purchases	Capital Construction	Total
Electric			
Fire			
Gas System			
General Government	3,248		3,248
Health			
Housing			
Libraries			
Mass Transit			
Parks			
Police			
Recreation			
Sewer			
Solid Waste			
Streets / Highways	29,883		29,883
Water			
Other: _____			
Community Development			
TOTAL CAPITAL EXPENDITURES	33,131		33,131

EMPLOYEE COMPENSATION

Total salaries, wages, commissions, etc. paid this year (including all employees and elected officials) 3,844,959

Independent Public Accountant/Certified Public Accountant Submission Page
Opinion page was provided in lieu of signature page.

SIGNATURE AND VERIFICATION

Signed: Leitzell & Economidis, PC Appointed Auditor/CPA

DCED-CLGS-30 (9-09)

ASTON TWP, DELAWARE County
December 31, 2013

NOTES / COMMENTS

DCED-CLGS-30 (9-09)
Received by DCED: 03/15/2014

Department of Community & Economic Development
Governor's Center for Local Government Services
Commonwealth Keystone Building
400 North Street, 4th Floor
Harrisburg, PA 17120-0225
Ph: 888-223-6837 | fax: 717-783-1402

2013 MUNICIPAL ANNUAL AUDIT AND FINANCIAL REPORT

230095 BETHEL TWP, DELAWARE COUNTY

DCED-CLGS-30 (9-09)

BALANCE SHEET

DCED-CLGS-30 (09-09)

BETHEL TWP, DELAWARE County

BALANCE SHEET

December 31, 2013

		Governmental Funds				Proprietary Funds		Fid. Fund	Account Groups		Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	General Fixed Assets	General Long Term Debt	Memorandum Only
Assets and Other Debits											
100-120	Cash and Investments	1,310,260	284,005			186,143		23,496			1,803,904
140-144	Tax Receivable										
121-129, 145-149	Accounts Receivable (excluding taxes)										
130.00	Due From Other Funds										
131-139, 150-159	Other Current Assets										
160-169	Fixed Assets										
180-189	Other Debits										
Total Assets and Other Debits		1,310,260	284,005			186,143		23,496			1,803,904
Liabilities and Other Credits											
210-229	Payroll Taxes and Other Payroll Withholdings										
200-209, 231-239	All Other Current Liabilities							23,496			23,496
230.00	Due To Other Funds										

BETHEL TWP, DELAWARE County

BALANCE SHEET

December 31, 2013

		Governmental Funds				Proprietary Funds		Fid. Fund	Account Groups		Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	General Fixed Assets	General Long Term Debt	Memorandum Only
Liabilities and Other Credits											
260-269	Long-Term-Liabilities										
240-259	Current Portion of Long-Term Debt and Other Credits										
Total Liabilities and Other Credits								23,496			23,496
Fund and Account Group Equity											
281-284	Contributed Capital										
290.00	Investment in General Fixed Assets										
270-289	Fund Balance / Retained Earnings on 12/31	1,310,260	284,005			186,143					1,780,408
291-299	Other Equity										
Total Fund and Account Group Equity		1,310,260	284,005			186,143					1,780,408

TOTAL LIABILITIES AND FUND AND ACCOUNT GROUP EQUITY	1,803,904

BETHEL TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

REVENUES

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
Taxes									
301.00	Real Estate Taxes	1,191,906	121,781						1,313,687
305.00	Occupation Taxes (levied under municipal code)								
308.00	Residence Taxes (levied by cities of the 3rd Class)								
309.00	Regional Asset District Sales Tax (Allegheny County municipalities only)								
310.00	Per Capita Taxes								
310.10	Real Estate Transfer Taxes	329,513							329,513
310.20	Earned Income Taxes / Wage Taxes								
310.30	Business Gross Receipts Taxes								
310.40	Occupation Taxes (levied under Act 511)								
310.50	Local Services Tax **								
310.60	Amusement / Admission Taxes								
310.70	Mechanical Device Taxes								
310.90	Other Local Tax Enabling Act / Act 511 / Taxes								
	Other: _____								
Total Taxes		1,521,419	121,781						1,643,200
Licenses and Permits									
320-322	All Other Licenses and Permits	663							663
321.80	Cable Television Franchise Fees	199,493							199,493
Total Licenses and Permits		200,156							200,156
Fines and Forfeits									
330-332	Fines and Forfeits	15,167							15,167
Total Fines and Forfeits		15,167							15,167

BETHEL TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

REVENUES

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
Interest, Rents and Royalties									
341.00	Interest Earnings	1,419	383			260			2,062
342.00	Rents and Royalties	7,824							7,824
Total Interest, Rents and Royalties		9,243	383			260			9,886
Federal									
351.03	Highways and Streets								
351.09	Community Development								
351.00	All Other Federal Capital and Operating Grants								
352.01	National Forest								
352.00	All Other Federal Shared Revenue and Entitlements								
353.00	Federal Payments in Lieu of Taxes								
Total Federal									
State									
354.03	Highways and Streets								
354.09	Community Development								
354.15	Recycling / Act 101	12,004							12,004
354.00	All Other State Capital and Operating Grants								
355.01	Public Utility Realty Tax (PURTA)	2,021							2,021
355.02-355.03	Motor Vehicle Fuel Tax (Liquid Fuels Tax) and State Road Turnback		168,707						168,707
355.04	Alcoholic Beverage Licenses								
355.05	General Municipal Pension System State Aid								
355.07	Foreign Fire Insurance Tax Distribution	79,172							79,172
355.08	Local Share Assessment/Gaming Proceeds								

BETHEL TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
REVENUES									
State									
355.09	Marcellus Shale Impact Fee Distribution								
355.00	All Other State Shared Revenues and Entitlements								
356.00	State Payments in Lieu of Taxes								
Total State		93,197	168,707						261,904
Local Government Units									
357.03	Highways and Streets	2,700							2,700
357.00	All Other Local Governmental Units Capital and Operating Grants								
358.00	Local Government Unit Shared Payments for Contracted Intergovernmental Services								
359.00	Local Governmental Units and Authorities Payments in Lieu of Taxes								
Total Local Government Units		2,700							2,700
Charges for Service									
361.00	General Government	50,821							50,821
362.00	Public Safety	172,110							172,110
363.20	Parking								
363.00	All Other Charges for Highway & Street Services								
364.10	Wastewater / Sewage (including connection / tapping fees, sewer usage charges, reserve capacity fee, etc.)								
364.30	Solid Waste Collection and Disposal Charge (trash)					435,019			435,019
364.60	Host Municipality Benefit Fee for Solid Waste Facility								
364.00	All Other Charges for Sanitation Services								
365.00	Health								
366.00	Human Services								
367.00	Culture and Recreation	14,212							14,212

BETHEL TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
REVENUES									
Charges for Service									
368.00	Airports								
369.00	Bars								
370.00	Cemeteries								
372.00	Electric System								
373.00	Gas System								
374.00	Housing System								
375.00	Markets								
377.00	Transit Systems								
378.00	Water System								
379.00	All Other Charges for Service								
Total Charges for Service		237,143				435,019			672,162
Unclassified Operating Revenues									
383.00	Special Assessments								
386.00	Escheats (sale of personal property)								
387.00	Contributions and Donations from Private Sectors	1,075							1,075
388.00	Fiduciary Fund Pension Contributions								
389.00	All Other Unclassified Operating Revenues	6,344	710						7,054
Total Unclassified Operating Revenues		7,419	710						8,129
Other Financing Sources									
391.00	Proceeds of General Fixed Asset Disposition								
392.00	Interfund Operating Transfers								
393.00	Proceeds of General Long-Term Debt		222,000						222,000
394.00	Proceeds of Short Term-Debt								

BETHEL TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
REVENUES									
Other Financing Sources									
395.00	Refunds of Prior Year Expenditures	41,000							41,000
Total Other Financing Sources		41,000	222,000						263,000
TOTAL REVENUES		2,127,444	513,581			435,279			3,076,304
EXPENDITURES									
General Government									
400.00	Legislative (Governing) Body	46,021	38						46,059
401.00	Executive (Manager or Mayor)								
402.00	Auditing Services / Financial Administration	77,042							77,042
403.00	Tax Collection	61,255							61,255
404.00	Solicitor / Legal Services	40,433							40,433
405.00	Secretary / Clerk	49,773							49,773
406.00	Other General Government Administration	42,645							42,645
407.00	IT-Networking Services-Data Processing	19,348							19,348
408.00	Engineering Services	76,052							76,052
409.00	General Government Buildings and Plant	32,504							32,504
Total General Government		445,073	38						445,111
Public Safety									
410.00	Police	499,249							499,249
411.00	Fire	171,067	434,971						606,038
412.00	Ambulance / Rescue								
413.00	UCC and Code Enforcement	86,021							86,021
414.00	Planning and Zoning	28,973							28,973
415.00	Emergency Management and Communications								

BETHEL TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Public Safety									
416.00	Militia and Armories								
417.00	Examination of Licensed Occupations								
418.00	Public Scales (weights and measures)								
419.00	Other Public Safety								
Total Public Safety		785,310	434,971						1,220,281
Health and Human Services									
420.00-425.00	Health and Human Services								
Total Health and Human Services									
Public Works - Sanitation									
426.00	Recycling Collection and Disposal					58,129			58,129
427.00	Solid Waste Collection and Disposal (garbage)					325,401			325,401
428.00	Weed Control								
429.00	Wastewater / Sewage Treatment and Collection								
Total Public Works - Sanitation						383,530			383,530
Public Works - Highways and Streets									
430.00	General Services - Administration	77,506							77,506
431.00	Cleaning of Streets and Gutters								
432.00	Winter Maintenance – Snow Removal		25,289						25,289
433.00	Traffic Control Devices		6,488						6,488
434.00	Street Lighting		6,513						6,513
435.00	Sidewalks and Crosswalks								
436.00	Storm Sewers and Drains		3,300						3,300

BETHEL TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Public Works - Highways and Streets									
437.00	Repairs of Tools and Machinery	189	7,608						7,797
438.00	Maintenance and Repairs of Roads and Bridges	989	9,271						10,260
439.00	Highway Construction and Rebuilding Projects		57,183						57,183
Total Public Works - Highways and Streets		78,684	115,652						194,336
Other Public Works Enterprises									
440.00	Airports								
441.00	Cemeteries								
442.00	Electric System								
443.00	Gas System								
444.00	Markets								
445.00	Parking								
446.00	Storm Water and Flood Control								
447.00	Transit System								
448.00	Water System								
449.00	Water Transport and Terminals								
Total Other Public Works Enterprises									
Culture and Recreation									
451.00	Culture-Recreation Administration								
452.00	Participant Recreation								
453.00	Spectator Recreation								
454.00	Parks	34,061							34,061
455.00	Shade Trees								
456.00	Libraries		33,200						33,200

BETHEL TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Culture and Recreation									
457.00	Civil and Military Celebrations								
458.00	Senior Citizens' Centers								
459.00	All Other Culture and Recreation	3,000							3,000
Total Culture and Recreation		37,061	33,200						70,261
Community Development									
461.00	Conservation of Natural Resources								
462.00	Community Development and Housing								
463.00	Economic Development								
464.00	Economic Opportunity								
465-469	All Other Community Development								
Total Community Development									
Debt Service									
471.00	Debt Principal (short-term and long-term)	162,859	58,996						221,855
472.00	Debt Interest (short-term and long-term)	11,474	8,018						19,492
475.00	Fiscal Agent Fees		6,334						6,334
Total Debt Service		174,333	73,348						247,681
Employer Paid Benefits and Withholding Items									
481.00	Employer Paid Withholding Taxes and Unemployment Compensation								
482.00	Judgments and Losses								
483.00	Pension / Retirement Fund Contributions								
484.00	Worker Compensation Insurance	30,577							30,577

BETHEL TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Employer Paid Benefits and Withholding Items									
487.00	Other Group Insurance Benefits								
Total Employer Paid Benefits and Withholding Items		30,577							30,577
Insurance									
486.00	Insurance, Casualty, and Surety	77,100							77,100
Total Insurance		77,100							77,100
Unclassified Operating Expenditures									
488.00	Fiduciary Fund Benefits and Refunds Paid								
489.00	All Other Unclassified Expenditures	10,710							10,710
Total Unclassified Operating Expenditures		10,710							10,710
Other Financing Uses									
491.00	Refund of Prior Year Revenues	1,779	88			378			2,245
492.00	Interfund Operating Transfers								
493.00	All Other Financing Uses								
Total Other Financing Uses		1,779	88			378			2,245
TOTAL EXPENDITURES		1,640,627	657,297			383,908			2,681,832
EXCESS/DEFICIT OF REVENUES OVER EXPENDITURES		486,817	-143,716			51,371			394,472

BETHEL TWP

December 31, 2013

DEBT STATEMENT

OUTSTANDING BONDS AND NOTES
Listed below are all currently outstanding bond and note issues according to our files, excluding bond issues redeemed or refunded and defeased. Please show the principal payments and make any other necessary corrections and additions.

Purpose	Bond (B) Capital Lease (C) Lease Rental (L) Note (N)	Issue Year (yyyy)	Maturity Year (yyyy)	Original Amount of Issue	Outstanding Beginning of Year (1)	Principal Incurred This Year	Principal Paid This Year	Current Year Accretion on Compound Interest Bonds	Outstanding at Year End (1)	Plus (less) Unamortized Premium (Discount)	Total Balance
General Obligation Bonds and Notes											
2012 Note	Note	2012	2018	856,000	807,000	0	131,000		676,000		676,000
2013 Note - Fire Truck	Note	2013	2025	222,000	0	222,000			222,000		222,000
Revenue Bonds and Notes											
Lease Rental Debt											
Ford F-550 Truck	Note	2011	2013	38,637	19,790		19,790		0		0
Ford Crown Victoria	Note	2011	2013	44,691	22,996		22,996		0		0
Ford Interceptor SUV	Note	2012	2014	28,355	18,302		8,863		9,439		9,439
Ford F-550 Truck	Note	2012	2014	62,407	40,381		39,206		1,175		1,175
Other											

(1) - excludes unamortized premium/discount

Total bonds and notes outstanding	908,614
Capitalized lease obligations	
Net debt	908,614

BETHEL TWP, DELAWARE County

STATEMENT OF CAPITAL EXPENDITURES

December 31, 2013

Category	Capital Purchases	Capital Construction	Total
Electric			
Fire	434,701		434,701
Gas System			
General Government	12,902		12,902
Health			
Housing			
Libraries			
Mass Transit			
Parks			
Police	34,429		34,429
Recreation			
Sewer			
Solid Waste			
Streets / Highways	69,320	57,183	126,503
Water			
Other: _____			
Community Development			
TOTAL CAPITAL EXPENDITURES	551,352	57,183	608,535

EMPLOYEE COMPENSATION

Total salaries, wages, commissions, etc. paid this year (including all employees and elected officials) 606,684

Independent Public Accountant/Certified Public Accountant Submission Page

Opinion page was provided in lieu of signature page.

SIGNATURE AND VERIFICATION

Signed: Barbacane, Thornton & Company LLP Appointed Auditor/CPA

DCED-CLGS-30 (9-09)

BETHEL TWP, DELAWARE County

December 31, 2013

NOTES / COMMENTS

DCED-CLGS-30 (9-09)
Received by DCED: 03/18/2014

Department of Community & Economic Development
Governor's Center for Local Government Services
Commonwealth Keystone Building
400 North Street, 4th Floor
Harrisburg, PA 17120-0225
Ph: 888-223-6837 | fax: 717-783-1402

2013 MUNICIPAL ANNUAL AUDIT AND FINANCIAL REPORT

230153 BROOKHAVEN BORO, DELAWARE COUNTY

DCED-CLGS-30 (9-09)

BALANCE SHEET

DCED-CLGS-30 (09-09)

BROOKHAVEN BORO, DELAWARE County

BALANCE SHEET

December 31, 2013

		Governmental Funds				Proprietary Funds		Fid. Fund	Account Groups		Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	General Fixed Assets	General Long Term Debt	Memorandum Only
Assets and Other Debits											
100-120	Cash and Investments	1,469,894	101,791			1,512,669		359,113			3,443,467
140-144	Tax Receivable										
121-129, 145-149	Accounts Receivable (excluding taxes)										
130.00	Due From Other Funds	410,623									410,623
131-139, 150-159	Other Current Assets										
160-169	Fixed Assets										
180-189	Other Debits										
Total Assets and Other Debits		1,880,517	101,791			1,512,669		359,113			3,854,090
Liabilities and Other Credits											
210-229	Payroll Taxes and Other Payroll Withholdings										
200-209, 231-239	All Other Current Liabilities							343,468			343,468
230.00	Due To Other Funds		60,685			334,293		15,645			410,623

BROOKHAVEN BORO, DELAWARE County

BALANCE SHEET

December 31, 2013

		Governmental Funds				Proprietary Funds		Fid. Fund	Account Groups		Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	General Fixed Assets	General Long Term Debt	Memorandum Only
Liabilities and Other Credits											
260-269	Long-Term-Liabilities										
240-259	Current Portion of Long-Term Debt and Other Credits										
Total Liabilities and Other Credits			60,685			334,293		359,113			754,091
Fund and Account Group Equity											
281-284	Contributed Capital										
290.00	Investment in General Fixed Assets										
270-289	Fund Balance / Retained Earnings on 12/31	1,880,517	41,106			1,178,376					3,099,999
291-299	Other Equity										
Total Fund and Account Group Equity		1,880,517	41,106			1,178,376					3,099,999

TOTAL LIABILITIES AND FUND AND ACCOUNT GROUP EQUITY	3,854,090

BROOKHAVEN BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
REVENUES									
Taxes									
301.00	Real Estate Taxes	1,664,327							1,664,327
305.00	Occupation Taxes (levied under municipal code)								
308.00	Residence Taxes (levied by cities of the 3rd Class)								
309.00	Regional Asset District Sales Tax (Allegheny County municipalities only)								
310.00	Per Capita Taxes								
310.10	Real Estate Transfer Taxes	102,055							102,055
310.20	Earned Income Taxes / Wage Taxes	1,168,545							1,168,545
310.30	Business Gross Receipts Taxes	461,726							461,726
310.40	Occupation Taxes (levied under Act 511)								
310.50	Local Services Tax **								
310.60	Amusement / Admission Taxes								
310.70	Mechanical Device Taxes	15,720							15,720
310.90	Other Local Tax Enabling Act / Act 511 / Taxes								
	Other: _____								
Total Taxes		3,412,373							3,412,373
Licenses and Permits									
320-322	All Other Licenses and Permits	8,234							8,234
321.80	Cable Television Franchise Fees	179,125							179,125
Total Licenses and Permits		187,359							187,359
Fines and Forfeits									
330-332	Fines and Forfeits	44,924							44,924
Total Fines and Forfeits		44,924							44,924

BROOKHAVEN BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

REVENUES

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
Interest, Rents and Royalties									
341.00	Interest Earnings	3,831	328			3,333			7,492
342.00	Rents and Royalties	68,171							68,171
Total Interest, Rents and Royalties		72,002	328			3,333			75,663
Federal									
351.03	Highways and Streets								
351.09	Community Development								
351.00	All Other Federal Capital and Operating Grants								
352.01	National Forest								
352.00	All Other Federal Shared Revenue and Entitlements								
353.00	Federal Payments in Lieu of Taxes								
Total Federal									
State									
354.03	Highways and Streets								
354.09	Community Development								
354.15	Recycling / Act 101					33,148			33,148
354.00	All Other State Capital and Operating Grants								
355.01	Public Utility Realty Tax (PURTA)	4,211							4,211
355.02-355.03	Motor Vehicle Fuel Tax (Liquid Fuels Tax) and State Road Turnback		146,844						146,844
355.04	Alcoholic Beverage Licenses								
355.05	General Municipal Pension System State Aid	97,109							97,109
355.07	Foreign Fire Insurance Tax Distribution	58,972							58,972
355.08	Local Share Assessment/Gaming Proceeds								

BROOKHAVEN BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
REVENUES									
State									
355.09	Marcellus Shale Impact Fee Distribution								
355.00	All Other State Shared Revenues and Entitlements								
356.00	State Payments in Lieu of Taxes								
Total State		160,292	146,844			33,148			340,284
Local Government Units									
357.03	Highways and Streets	8,910							8,910
357.00	All Other Local Governmental Units Capital and Operating Grants								
358.00	Local Government Unit Shared Payments for Contracted Intergovernmental Services	11,008							11,008
359.00	Local Governmental Units and Authorities Payments in Lieu of Taxes								
Total Local Government Units		19,918							19,918
Charges for Service									
361.00	General Government	21,164							21,164
362.00	Public Safety	93,878							93,878
363.20	Parking								
363.00	All Other Charges for Highway & Street Services	4,604							4,604
364.10	Wastewater / Sewage (including connection / tapping fees, sewer usage charges, reserve capacity fee, etc.)					1,040,475			1,040,475
364.30	Solid Waste Collection and Disposal Charge (trash)	3,400				361,985			365,385
364.60	Host Municipality Benefit Fee for Solid Waste Facility								
364.00	All Other Charges for Sanitation Services								
365.00	Health	5,019							5,019
366.00	Human Services								
367.00	Culture and Recreation	39,610							39,610

BROOKHAVEN BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
REVENUES									
Charges for Service									
368.00	Airports								
369.00	Bars								
370.00	Cemeteries								
372.00	Electric System								
373.00	Gas System								
374.00	Housing System								
375.00	Markets								
377.00	Transit Systems								
378.00	Water System								
379.00	All Other Charges for Service								
Total Charges for Service		167,675				1,402,460			1,570,135
Unclassified Operating Revenues									
383.00	Special Assessments								
386.00	Escheats (sale of personal property)								
387.00	Contributions and Donations from Private Sectors	13,200							13,200
388.00	Fiduciary Fund Pension Contributions								
389.00	All Other Unclassified Operating Revenues	964							964
Total Unclassified Operating Revenues		14,164							14,164
Other Financing Sources									
391.00	Proceeds of General Fixed Asset Disposition								
392.00	Interfund Operating Transfers								
393.00	Proceeds of General Long-Term Debt								
394.00	Proceeds of Short Term-Debt								

BROOKHAVEN BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
REVENUES									
Other Financing Sources									
395.00	Refunds of Prior Year Expenditures	59,414							59,414
Total Other Financing Sources		59,414							59,414
TOTAL REVENUES		4,138,121	147,172			1,438,941			5,724,234
EXPENDITURES									
General Government									
400.00	Legislative (Governing) Body	64,911							64,911
401.00	Executive (Manager or Mayor)	5,004							5,004
402.00	Auditing Services / Financial Administration	50,065							50,065
403.00	Tax Collection	59,201							59,201
404.00	Solicitor / Legal Services	55,076							55,076
405.00	Secretary / Clerk	80,490							80,490
406.00	Other General Government Administration	3,015							3,015
407.00	IT-Networking Services-Data Processing								
408.00	Engineering Services	22,841	15,026						37,867
409.00	General Government Buildings and Plant	236,382							236,382
Total General Government		576,985	15,026						592,011
Public Safety									
410.00	Police	879,142							879,142
411.00	Fire	188,457							188,457
412.00	Ambulance / Rescue	12,499							12,499
413.00	UCC and Code Enforcement	86,665							86,665
414.00	Planning and Zoning	6,692							6,692
415.00	Emergency Management and Communications								

BROOKHAVEN BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Public Safety									
416.00	Militia and Armories								
417.00	Examination of Licensed Occupations								
418.00	Public Scales (weights and measures)								
419.00	Other Public Safety								
Total Public Safety		1,173,455							1,173,455
Health and Human Services									
420.00-425.00	Health and Human Services	21,548							21,548
Total Health and Human Services		21,548							21,548
Public Works - Sanitation									
426.00	Recycling Collection and Disposal								
427.00	Solid Waste Collection and Disposal (garbage)					378,263			378,263
428.00	Weed Control								
429.00	Wastewater / Sewage Treatment and Collection					824,920			824,920
Total Public Works - Sanitation						1,203,183			1,203,183
Public Works - Highways and Streets									
430.00	General Services - Administration	237,335							237,335
431.00	Cleaning of Streets and Gutters								
432.00	Winter Maintenance – Snow Removal	2,359	24,161						26,520
433.00	Traffic Control Devices	5,054	6,632						11,686
434.00	Street Lighting		74,314						74,314
435.00	Sidewalks and Crosswalks								
436.00	Storm Sewers and Drains		2,853						2,853

BROOKHAVEN BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Public Works - Highways and Streets									
437.00	Repairs of Tools and Machinery								
438.00	Maintenance and Repairs of Roads and Bridges		439						439
439.00	Highway Construction and Rebuilding Projects	118,907	40,000						158,907
Total Public Works - Highways and Streets		363,655	148,399						512,054
Other Public Works Enterprises									
440.00	Airports								
441.00	Cemeteries								
442.00	Electric System								
443.00	Gas System								
444.00	Markets								
445.00	Parking								
446.00	Storm Water and Flood Control								
447.00	Transit System								
448.00	Water System								
449.00	Water Transport and Terminals								
Total Other Public Works Enterprises									
Culture and Recreation									
451.00	Culture-Recreation Administration	97,940							97,940
452.00	Participant Recreation								
453.00	Spectator Recreation								
454.00	Parks								
455.00	Shade Trees	17,057							17,057
456.00	Libraries								

BROOKHAVEN BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Culture and Recreation									
457.00	Civil and Military Celebrations	19,192							19,192
458.00	Senior Citizens' Centers								
459.00	All Other Culture and Recreation								
Total Culture and Recreation		134,189							134,189
Community Development									
461.00	Conservation of Natural Resources								
462.00	Community Development and Housing								
463.00	Economic Development								
464.00	Economic Opportunity								
465-469	All Other Community Development								
Total Community Development									
Debt Service									
471.00	Debt Principal (short-term and long-term)	157,428				64,000			221,428
472.00	Debt Interest (short-term and long-term)	51,212				43,100			94,312
475.00	Fiscal Agent Fees								
Total Debt Service		208,640				107,100			315,740
Employer Paid Benefits and Withholding Items									
481.00	Employer Paid Withholding Taxes and Unemployment Compensation	59,889							59,889
482.00	Judgments and Losses								
483.00	Pension / Retirement Fund Contributions	410,913							410,913
484.00	Worker Compensation Insurance	136,214							136,214

BROOKHAVEN BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Employer Paid Benefits and Withholding Items									
487.00	Other Group Insurance Benefits	476,100							476,100
Total Employer Paid Benefits and Withholding Items		1,083,116							1,083,116
Insurance									
486.00	Insurance, Casualty, and Surety	93,158							93,158
Total Insurance		93,158							93,158
Unclassified Operating Expenditures									
488.00	Fiduciary Fund Benefits and Refunds Paid								
489.00	All Other Unclassified Expenditures								
Total Unclassified Operating Expenditures									
Other Financing Uses									
491.00	Refund of Prior Year Revenues								
492.00	Interfund Operating Transfers								
493.00	All Other Financing Uses								
Total Other Financing Uses									
TOTAL EXPENDITURES		3,654,746	163,425			1,310,283			5,128,454
EXCESS/DEFICIT OF REVENUES OVER EXPENDITURES		483,375	-16,253			128,658			595,780

BROOKHAVEN BORO

December 31, 2013

DEBT STATEMENT

OUTSTANDING BONDS AND NOTES
Listed below are all currently outstanding bond and note issues according to our files, excluding bond issues redeemed or refunded and defeased. Please show the principal payments and make any other necessary corrections and additions.

Purpose	Bond (B) Capital Lease (C) Lease Rental (L) Note (N)	Issue Year (yyyy)	Maturity Year (yyyy)	Original Amount of Issue	Outstanding Beginning of Year (1)	Principal Incurred This Year	Principal Paid This Year	Current Year Accretion on Compound Interest Bonds	Outstanding at Year End (1)	Plus (less) Unamortized Premium (Discount)	Total Balance
General Obligation Bonds and Notes											
Fire Truck	Note	2008	2023	150,000	111,960		9,428		102,532		102,532
Wastewater Renue Notes	Note	2010	2030	1,620,000	1,498,000		64,000		1,434,000		1,434,000
Series 2012	Note	2012	2025	2,210,000	2,210,000		148,000		2,062,000		2,062,000
Revenue Bonds and Notes											
Lease Rental Debt											
Other											

(1) - excludes unamortized premium/discount

Total bonds and notes outstanding	3,598,532
Capitalized lease obligations	
Net debt	3,598,532

BROOKHAVEN BORO, DELAWARE County

STATEMENT OF CAPITAL EXPENDITURES

December 31, 2013

Category	Capital Purchases	Capital Construction	Total
Electric			
Fire			
Gas System			
General Government	42,835		42,835
Health			
Housing			
Libraries			
Mass Transit			
Parks			
Police	4,446		4,446
Recreation	9,300		9,300
Sewer	44,245		44,245
Solid Waste			
Streets / Highways	31,482	17,430	48,912
Water			
Other: _____			
Community Development			
TOTAL CAPITAL EXPENDITURES	132,308	17,430	149,738

EMPLOYEE COMPENSATION

Total salaries, wages, commissions, etc. paid this year (including all employees and elected officials) 1,330,159

Independent Public Accountant/Certified Public Accountant Submission Page

Opinion page was provided in lieu of signature page.

SIGNATURE AND VERIFICATION

Signed: Leitzell & Economidis, PC Appointed Auditor/CPA

DCED-CLGS-30 (9-09)

BROOKHAVEN BORO, DELAWARE County

December 31, 2013

NOTES / COMMENTS

DCED-CLGS-30 (9-09)
Received by DCED: 12/31/2014

Department of Community & Economic Development
Governor's Center for Local Government Services
Commonwealth Keystone Building
400 North Street, 4th Floor
Harrisburg, PA 17120-0225
Ph: 888-223-6837 | fax: 717-783-1402

2012 MUNICIPAL ANNUAL AUDIT AND FINANCIAL REPORT

230182 CHESTER CITY, DELAWARE COUNTY

DCED-CLGS-30 (9-09)

BALANCE SHEET

DCED-CLGS-30 (09-09)

CHESTER CITY, DELAWARE County

BALANCE SHEET

December 31, 2012

		Governmental Funds				Proprietary Funds		Fid. Fund	Account Groups		Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	General Fixed Assets	General Long Term Debt	Memorandum Only
Assets and Other Debits											
100-120	Cash and Investments	2,321,358	2,696,229	455,812	3,070			50,470,713			55,947,182
140-144	Tax Receivable	1,388,251									1,388,251
121-129, 145-149	Accounts Receivable (excluding taxes)	4,954,544	51,461					96,963			5,102,968
130.00	Due From Other Funds	371,680									371,680
131-139, 150-159	Other Current Assets	161,393						23,422			184,815
160-169	Fixed Assets								22,747,878		22,747,878
180-189	Other Debits									68,048,814	68,048,814
Total Assets and Other Debits		9,197,226	2,747,690	455,812	3,070			50,591,098	22,747,878	68,048,814	153,791,588
Liabilities and Other Credits											
210-229	Payroll Taxes and Other Payroll Withholdings	1,466,118									1,466,118
200-209, 231-239	All Other Current Liabilities	2,053,617	834,742	2,419							2,890,778
230.00	Due To Other Funds		283,404								283,404

CHESTER CITY, DELAWARE County

BALANCE SHEET

December 31, 2012

		Governmental Funds				Proprietary Funds		Fid. Fund	Account Groups		Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	General Fixed Assets	General Long Term Debt	Memorandum Only
Liabilities and Other Credits											
260-269	Long-Term-Liabilities							3,884,919		65,399,406	69,284,325
240-259	Current Portion of Long-Term Debt and Other Credits									2,562,598	2,562,598
Total Liabilities and Other Credits		3,519,735	1,118,146	2,419				3,884,919		67,962,004	76,487,223
Fund and Account Group Equity											
281-284	Contributed Capital										
290.00	Investment in General Fixed Assets										
270-289	Fund Balance / Retained Earnings on 12/31	5,677,491	1,629,544	453,393	3,070			46,706,179	22,747,878	86,810	77,304,365
291-299	Other Equity										
Total Fund and Account Group Equity		5,677,491	1,629,544	453,393	3,070			46,706,179	22,747,878	86,810	77,304,365

TOTAL LIABILITIES AND FUND AND ACCOUNT GROUP EQUITY	153,791,588

CHESTER CITY, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2012

REVENUES

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
Taxes									
301.00	Real Estate Taxes	6,805,420	163,929		608,375				7,577,724
305.00	Occupation Taxes (levied under municipal code)								
308.00	Residence Taxes (levied by cities of the 3rd Class)								
309.00	Regional Asset District Sales Tax (Allegheny County municipalities only)								
310.00	Per Capita Taxes								
310.10	Real Estate Transfer Taxes								
310.20	Earned Income Taxes / Wage Taxes	8,103,760							8,103,760
310.30	Business Gross Receipts Taxes	1,269,229							1,269,229
310.40	Occupation Taxes (levied under Act 511)								
310.50	Local Services Tax **	228,950							228,950
310.60	Amusement / Admission Taxes								
310.70	Mechanical Device Taxes								
310.90	Other Local Tax Enabling Act / Act 511 / Taxes								
	Other: _____								
Total Taxes		16,407,359	163,929		608,375				17,179,663
Licenses and Permits									
320-322	All Other Licenses and Permits	674,180							674,180
321.80	Cable Television Franchise Fees	410,833							410,833
Total Licenses and Permits		1,085,013							1,085,013
Fines and Forfeits									
330-332	Fines and Forfeits	226,834							226,834
Total Fines and Forfeits		226,834							226,834

CHESTER CITY, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2012

REVENUES

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
Interest, Rents and Royalties									
341.00	Interest Earnings	58	1,635	105					1,798
342.00	Rents and Royalties	6,885,714							6,885,714
Total Interest, Rents and Royalties		6,885,772	1,635	105					6,887,512
Federal									
351.03	Highways and Streets								
351.09	Community Development								
351.00	All Other Federal Capital and Operating Grants	313,520	352,158						665,678
352.01	National Forest								
352.00	All Other Federal Shared Revenue and Entitlements								
353.00	Federal Payments in Lieu of Taxes								
Total Federal		313,520	352,158						665,678
State									
354.03	Highways and Streets								
354.09	Community Development								
354.15	Recycling / Act 101								
354.00	All Other State Capital and Operating Grants								
355.01	Public Utility Realty Tax (PURTA)	23,677							23,677
355.02-355.03	Motor Vehicle Fuel Tax (Liquid Fuels Tax) and State Road Turnback		607,478						607,478
355.04	Alcoholic Beverage Licenses	12,500							12,500
355.05	General Municipal Pension System State Aid	1,415,941							1,415,941
355.07	Foreign Fire Insurance Tax Distribution								
355.08	Local Share Assessment/Gaming Proceeds	5,195,982	307,386						5,503,368

CHESTER CITY, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2012

REVENUES

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
State									
355.09	Marcellus Shale Impact Fee Distribution								
355.00	All Other State Shared Revenues and Entitlements								
356.00	State Payments in Lieu of Taxes								
Total State		6,648,100	914,864						7,562,964
Local Government Units									
357.03	Highways and Streets								
357.00	All Other Local Governmental Units Capital and Operating Grants								
358.00	Local Government Unit Shared Payments for Contracted Intergovernmental Services								
359.00	Local Governmental Units and Authorities Payments in Lieu of Taxes	579,494							579,494
Total Local Government Units		579,494							579,494
Charges for Service									
361.00	General Government	445,697							445,697
362.00	Public Safety								
363.20	Parking								
363.00	All Other Charges for Highway & Street Services								
364.10	Wastewater / Sewage (including connection / tapping fees, sewer usage charges, reserve capacity fee, etc.)								
364.30	Solid Waste Collection and Disposal Charge (trash)	1,152,438							1,152,438
364.60	Host Municipality Benefit Fee for Solid Waste Facility	5,320,501							5,320,501
364.00	All Other Charges for Sanitation Services								
365.00	Health								
366.00	Human Services								
367.00	Culture and Recreation								

CHESTER CITY, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2012

REVENUES

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
Charges for Service									
368.00	Airports								
369.00	Bars								
370.00	Cemeteries								
372.00	Electric System								
373.00	Gas System								
374.00	Housing System								
375.00	Markets								
377.00	Transit Systems								
378.00	Water System								
379.00	All Other Charges for Service		15,996						15,996
Total Charges for Service		6,918,636	15,996						6,934,632
Unclassified Operating Revenues									
383.00	Special Assessments								
386.00	Escheats (sale of personal property)								
387.00	Contributions and Donations from Private Sectors							668,153	668,153
388.00	Fiduciary Fund Pension Contributions							2,265,018	2,265,018
389.00	All Other Unclassified Operating Revenues	431,843	12,787	936				41,553	487,119
Total Unclassified Operating Revenues		431,843	12,787	936				2,974,724	3,420,290
Other Financing Sources									
391.00	Proceeds of General Fixed Asset Disposition								
392.00	Interfund Operating Transfers	1,391,423	624,029		2,474,689				4,490,141
393.00	Proceeds of General Long-Term Debt								
394.00	Proceeds of Short Term-Debt								

CHESTER CITY, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2012

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
REVENUES									
Other Financing Sources									
395.00	Refunds of Prior Year Expenditures	2,434,426	654,745	92,606					3,181,777
Total Other Financing Sources		3,825,849	1,278,774	92,606	2,474,689				7,671,918
TOTAL REVENUES		43,322,420	2,740,143	93,647	3,083,064			2,974,724	52,213,998
EXPENDITURES									
General Government									
400.00	Legislative (Governing) Body								
401.00	Executive (Manager or Mayor)	1,249,851	257,664						1,507,515
402.00	Auditing Services / Financial Administration	508,724			179,099				687,823
403.00	Tax Collection	201,580							201,580
404.00	Solicitor / Legal Services	544,857							544,857
405.00	Secretary / Clerk	63,771							63,771
406.00	Other General Government Administration	665,801	179,032	67					844,900
407.00	IT-Networking Services-Data Processing	221,256							221,256
408.00	Engineering Services	197,868							197,868
409.00	General Government Buildings and Plant	1,735,358							1,735,358
Total General Government		5,389,066	436,696	67	179,099				6,004,928
Public Safety									
410.00	Police	13,123,944	214,096						13,338,040
411.00	Fire	8,307,845							8,307,845
412.00	Ambulance / Rescue								
413.00	UCC and Code Enforcement	403,910							403,910
414.00	Planning and Zoning	226,138							226,138
415.00	Emergency Management and Communications								

CHESTER CITY, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2012

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Public Safety									
416.00	Militia and Armories								
417.00	Examination of Licensed Occupations								
418.00	Public Scales (weights and measures)								
419.00	Other Public Safety		201,492	79,884					281,376
Total Public Safety		22,061,837	415,588	79,884					22,557,309
Health and Human Services									
420.00-425.00	Health and Human Services	484,940							484,940
Total Health and Human Services		484,940							484,940
Public Works - Sanitation									
426.00	Recycling Collection and Disposal								
427.00	Solid Waste Collection and Disposal (garbage)	1,169,176							1,169,176
428.00	Weed Control								
429.00	Wastewater / Sewage Treatment and Collection								
Total Public Works - Sanitation		1,169,176							1,169,176
Public Works - Highways and Streets									
430.00	General Services - Administration	1,067,953							1,067,953
431.00	Cleaning of Streets and Gutters								
432.00	Winter Maintenance – Snow Removal	1,600							1,600
433.00	Traffic Control Devices	37,921							37,921
434.00	Street Lighting	109,779	674,357						784,136
435.00	Sidewalks and Crosswalks								
436.00	Storm Sewers and Drains								

CHESTER CITY, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2012

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Public Works - Highways and Streets									
437.00	Repairs of Tools and Machinery								
438.00	Maintenance and Repairs of Roads and Bridges	129,024							129,024
439.00	Highway Construction and Rebuilding Projects			101,435					101,435
Total Public Works - Highways and Streets		1,346,277	674,357	101,435					2,122,069
Other Public Works Enterprises									
440.00	Airports								
441.00	Cemeteries								
442.00	Electric System								
443.00	Gas System								
444.00	Markets								
445.00	Parking								
446.00	Storm Water and Flood Control								
447.00	Transit System								
448.00	Water System								
449.00	Water Transport and Terminals								
Total Other Public Works Enterprises									
Culture and Recreation									
451.00	Culture-Recreation Administration	556,621							556,621
452.00	Participant Recreation	108,818							108,818
453.00	Spectator Recreation	641,370							641,370
454.00	Parks	641,370							641,370
455.00	Shade Trees								
456.00	Libraries								

CHESTER CITY, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2012

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Culture and Recreation									
457.00	Civil and Military Celebrations								
458.00	Senior Citizens' Centers								
459.00	All Other Culture and Recreation		291,579						291,579
Total Culture and Recreation		1,948,179	291,579						2,239,758
Community Development									
461.00	Conservation of Natural Resources								
462.00	Community Development and Housing								
463.00	Economic Development		307,232						307,232
464.00	Economic Opportunity								
465-469	All Other Community Development								
Total Community Development			307,232						307,232
Debt Service									
471.00	Debt Principal (short-term and long-term)	553,558		382,428	1,626,000				2,561,986
472.00	Debt Interest (short-term and long-term)	11,154		134,278	1,559,416				1,704,848
475.00	Fiscal Agent Fees								
Total Debt Service		564,712		516,706	3,185,416				4,266,834
Employer Paid Benefits and Withholding Items									
481.00	Employer Paid Withholding Taxes and Unemployment Compensation	1,158,898							1,158,898
482.00	Judgments and Losses								
483.00	Pension / Retirement Fund Contributions	2,310,792							2,310,792
484.00	Worker Compensation Insurance	1,799,140							1,799,140

CHESTER CITY, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2012

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Employer Paid Benefits and Withholding Items									
487.00	Other Group Insurance Benefits	2,140,404							2,140,404
Total Employer Paid Benefits and Withholding Items		7,409,234							7,409,234
Insurance									
486.00	Insurance, Casualty, and Surety	1,372,472							1,372,472
Total Insurance		1,372,472							1,372,472
Unclassified Operating Expenditures									
488.00	Fiduciary Fund Benefits and Refunds Paid							6,684,304	6,684,304
489.00	All Other Unclassified Expenditures		37,994					147,601	185,595
Total Unclassified Operating Expenditures			37,994					6,831,905	6,869,899
Other Financing Uses									
491.00	Refund of Prior Year Revenues								
492.00	Interfund Operating Transfers	3,066,004	1,416,344	7,793					4,490,141
493.00	All Other Financing Uses	846,762	219,670						1,066,432
Total Other Financing Uses		3,912,766	1,636,014	7,793					5,556,573
TOTAL EXPENDITURES		45,658,659	3,799,460	705,885	3,364,515			6,831,905	60,360,424
EXCESS/DEFICIT OF REVENUES OVER EXPENDITURES		-2,336,239	-1,059,317	-612,238	-281,451			-3,857,181	-8,146,426

CHESTER CITY

December 31, 2012

DEBT STATEMENT

OUTSTANDING BONDS AND NOTES
Listed below are all currently outstanding bond and note issues according to our files, excluding bond issues redeemed or refunded and defeased. Please show the principal payments and make any other necessary corrections and additions.

Purpose	Bond (B) Capital Lease (C) Lease Rental (L) Note (N)	Issue Year (yyyy)	Maturity Year (yyyy)	Original Amount of Issue	Outstanding Beginning of Year (1)	Principal Incurred This Year	Principal Paid This Year	Current Year Accretion on Compound Interest Bonds	Outstanding at Year End (1)	Plus (less) Unamortized Premium (Discount)	Total Balance
General Obligation Bonds and Notes											
Bond Issue 2007	Bond	2007	2010	4,000,000	2,657,055		382,428		2,274,627		2,274,627
Bond Issue 2010A	Bond	2010	2019	5,895,000	5,291,000		641,000		4,650,000		4,650,000
Bond Issue 2010B	Bond	2010	2025	2,985,000	3,768,000		236,000		3,532,000		3,532,000
Bond Issue 2011	Bond	2011	2016	3,720,000	3,720,000		744,000		2,976,000		2,976,000
Revenue Bonds and Notes											
Lease Rental Debt											
2004 Lease	Captial Leases	2004	2019	9,500,000	9,465,000		5,000		9,460,000		9,460,000
Other											

(1) - excludes unamortized premium/discount

Total bonds and notes outstanding	22,892,627
Capitalized lease obligations	
Net debt	22,892,627

CHESTER CITY, DELAWARE County

STATEMENT OF CAPITAL EXPENDITURES

December 31, 2012

Category	Capital Purchases	Capital Construction	Total
Electric			
Fire			
Gas System			
General Government			
Health			
Housing			
Libraries			
Mass Transit			
Parks			
Police	79,884		79,884
Recreation			
Sewer			
Solid Waste			
Streets / Highways		101,435	101,435
Water			
Other: _____			
Community Development			
TOTAL CAPITAL EXPENDITURES	79,884	101,435	181,319

EMPLOYEE COMPENSATION

Total salaries, wages, commissions, etc. paid this year (including all employees and elected officials) 18,182,886

ELECTED CONTROLLER'S/AUDITOR'S CERTIFIED OPINION

To the: Governing Body of the Municipality

President Judge of the Court of Common Pleas

Secretary of the Department of Community & Economic Development

I/We, the undersigned, the duly elected (or appointed replacement), qualified, and Acting Controller/Auditors of the CHESTER CITY have audited, adjusted and settled the various funds and account groups of the CHESTER CITY for the year ended December 31, 2012. My/Our audit, adjustment and settlement was made in accordance with law rather than with generally accepted auditing standards

(PLEASE CROSS OUT ONLY IF ON MODIFIED ACCRUAL/ACCRUAL BASIS)
This municipality's policy is to prepare its financial statements on the basis of cash receipts and disbursements; consequently, certain revenues and the related assets are recognized when received rather than when earned, and certain expenditures or expenses are recognized when paid rather than when a liability is incurred. Accordingly, the accompanying financial statements are not intended to present the financial position and results of operations of this municipality in conformity with generally accepted accounting principles.

These financial statements do not include all of the disclosures required by generally accepted accounting principles.

In my/our opinion, the aforementioned financial statements present the financial position of the various funds and account groups of the municipality of CHESTER CITY for the year ended December 31, 2012, and the results of operations of such funds in accordance with the law.

SIGNATURE AND VERIFICATION

Signed: Edith Blackwell Controller

Subscribed and sworn to before me this 5 day of January, 2015.

SEAL

Signed: _____

Witness (Controller)/Auditor (Auditors)

CHESTER CITY, DELAWARE County

December 31, 2012

NOTES / COMMENTS

DCED-CLGS-30 (9-09)
Received by DCED: 03/25/2014

Department of Community & Economic Development
Governor's Center for Local Government Services
Commonwealth Keystone Building
400 North Street, 4th Floor
Harrisburg, PA 17120-0225
Ph: 888-223-6837 | fax: 717-783-1402

2013 MUNICIPAL ANNUAL AUDIT AND FINANCIAL REPORT

230245 CHESTER TWP, DELAWARE COUNTY

DCED-CLGS-30 (9-09)

BALANCE SHEET

DCED-CLGS-30 (09-09)

CHESTER TWP, DELAWARE County

BALANCE SHEET

December 31, 2013

		Governmental Funds				Proprietary Funds		Fid. Fund	Account Groups		Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	General Fixed Assets	General Long Term Debt	Memorandum Only
Assets and Other Debits											
100-120	Cash and Investments	258,704	689,382	5,948		3,315		2,204,574			3,161,923
140-144	Tax Receivable										
121-129, 145-149	Accounts Receivable (excluding taxes)										
130.00	Due From Other Funds	20				5,806					5,826
131-139, 150-159	Other Current Assets										
160-169	Fixed Assets										
180-189	Other Debits										
Total Assets and Other Debits		258,724	689,382	5,948		9,121		2,204,574			3,167,749
Liabilities and Other Credits											
210-229	Payroll Taxes and Other Payroll Withholdings										
200-209, 231-239	All Other Current Liabilities										
230.00	Due To Other Funds	5,806	20								5,826

CHESTER TWP, DELAWARE County

BALANCE SHEET

December 31, 2013

		Governmental Funds				Proprietary Funds		Fid. Fund	Account Groups		Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	General Fixed Assets	General Long Term Debt	Memorandum Only
Liabilities and Other Credits											
260-269	Long-Term-Liabilities							60,046			60,046
240-259	Current Portion of Long-Term Debt and Other Credits										
Total Liabilities and Other Credits		5,806	20					60,046			65,872
Fund and Account Group Equity											
281-284	Contributed Capital										
290.00	Investment in General Fixed Assets										
270-289	Fund Balance / Retained Earnings on 12/31	252,918	689,362	5,948		9,121		2,144,528			3,101,877
291-299	Other Equity										
Total Fund and Account Group Equity		252,918	689,362	5,948		9,121		2,144,528			3,101,877

TOTAL LIABILITIES AND FUND AND ACCOUNT GROUP EQUITY	3,167,749

CHESTER TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
REVENUES									
Taxes									
301.00	Real Estate Taxes	1,458,282	133,580						1,591,862
305.00	Occupation Taxes (levied under municipal code)								
308.00	Residence Taxes (levied by cities of the 3rd Class)								
309.00	Regional Asset District Sales Tax (Allegheny County municipalities only)								
310.00	Per Capita Taxes								
310.10	Real Estate Transfer Taxes	112,812							112,812
310.20	Earned Income Taxes / Wage Taxes	1,241,875							1,241,875
310.30	Business Gross Receipts Taxes	241,189							241,189
310.40	Occupation Taxes (levied under Act 511)								
310.50	Local Services Tax **	44,935							44,935
310.60	Amusement / Admission Taxes								
310.70	Mechanical Device Taxes								
310.90	Other Local Tax Enabling Act / Act 511 / Taxes								
	Other: _____								
Total Taxes		3,099,093	133,580						3,232,673
Licenses and Permits									
320-322	All Other Licenses and Permits	71,885							71,885
321.80	Cable Television Franchise Fees	71,489							71,489
Total Licenses and Permits		143,374							143,374
Fines and Forfeits									
330-332	Fines and Forfeits	28,082							28,082
Total Fines and Forfeits		28,082							28,082

CHESTER TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

REVENUES

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
Interest, Rents and Royalties									
341.00	Interest Earnings		2					234,503	234,505
342.00	Rents and Royalties	17,270				21,655			38,925
Total Interest, Rents and Royalties		17,270	2			21,655		234,503	273,430
Federal									
351.03	Highways and Streets								
351.09	Community Development								
351.00	All Other Federal Capital and Operating Grants								
352.01	National Forest								
352.00	All Other Federal Shared Revenue and Entitlements								
353.00	Federal Payments in Lieu of Taxes								
Total Federal									
State									
354.03	Highways and Streets								
354.09	Community Development								
354.15	Recycling / Act 101								
354.00	All Other State Capital and Operating Grants		523,041						523,041
355.01	Public Utility Realty Tax (PURTA)	3,636							3,636
355.02-355.03	Motor Vehicle Fuel Tax (Liquid Fuels Tax) and State Road Turnback		70,867						70,867
355.04	Alcoholic Beverage Licenses								
355.05	General Municipal Pension System State Aid	92,253							92,253
355.07	Foreign Fire Insurance Tax Distribution	25,722							25,722
355.08	Local Share Assessment/Gaming Proceeds								

CHESTER TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
REVENUES									
State									
355.09	Marcellus Shale Impact Fee Distribution								
355.00	All Other State Shared Revenues and Entitlements	400							400
356.00	State Payments in Lieu of Taxes								
Total State		122,011	593,908						715,919
Local Government Units									
357.03	Highways and Streets	32,382							32,382
357.00	All Other Local Governmental Units Capital and Operating Grants								
358.00	Local Government Unit Shared Payments for Contracted Intergovernmental Services								
359.00	Local Governmental Units and Authorities Payments in Lieu of Taxes	44,999							44,999
Total Local Government Units		77,381							77,381
Charges for Service									
361.00	General Government	2,106							2,106
362.00	Public Safety	5,548							5,548
363.20	Parking								
363.00	All Other Charges for Highway & Street Services	7,895							7,895
364.10	Wastewater / Sewage (including connection / tapping fees, sewer usage charges, reserve capacity fee, etc.)								
364.30	Solid Waste Collection and Disposal Charge (trash)	219,228							219,228
364.60	Host Municipality Benefit Fee for Solid Waste Facility								
364.00	All Other Charges for Sanitation Services								
365.00	Health								
366.00	Human Services								
367.00	Culture and Recreation								

CHESTER TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
REVENUES									
Charges for Service									
368.00	Airports								
369.00	Bars								
370.00	Cemeteries								
372.00	Electric System								
373.00	Gas System								
374.00	Housing System								
375.00	Markets								
377.00	Transit Systems								
378.00	Water System								
379.00	All Other Charges for Service								
Total Charges for Service		234,777							234,777
Unclassified Operating Revenues									
383.00	Special Assessments								
386.00	Escheats (sale of personal property)								
387.00	Contributions and Donations from Private Sectors	4,500							4,500
388.00	Fiduciary Fund Pension Contributions							146,677	146,677
389.00	All Other Unclassified Operating Revenues								
Total Unclassified Operating Revenues		4,500						146,677	151,177
Other Financing Sources									
391.00	Proceeds of General Fixed Asset Disposition								
392.00	Interfund Operating Transfers		4,000						4,000
393.00	Proceeds of General Long-Term Debt								
394.00	Proceeds of Short Term-Debt								

CHESTER TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
REVENUES									
Other Financing Sources									
395.00	Refunds of Prior Year Expenditures	206,622							206,622
Total Other Financing Sources		206,622	4,000						210,622
TOTAL REVENUES		3,933,110	731,490			21,655		381,180	5,067,435
EXPENDITURES									
General Government									
400.00	Legislative (Governing) Body	161,800							161,800
401.00	Executive (Manager or Mayor)	380,318							380,318
402.00	Auditing Services / Financial Administration	37,791						8,200	45,991
403.00	Tax Collection	82,208							82,208
404.00	Solicitor / Legal Services	90,515							90,515
405.00	Secretary / Clerk								
406.00	Other General Government Administration								
407.00	IT-Networking Services-Data Processing								
408.00	Engineering Services	310,333							310,333
409.00	General Government Buildings and Plant	162,237							162,237
Total General Government		1,225,202						8,200	1,233,402
Public Safety									
410.00	Police	1,922,239							1,922,239
411.00	Fire		133,580						133,580
412.00	Ambulance / Rescue								
413.00	UCC and Code Enforcement	71,760							71,760
414.00	Planning and Zoning	3,022							3,022
415.00	Emergency Management and Communications		14						14

CHESTER TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Public Safety									
416.00	Militia and Armories								
417.00	Examination of Licensed Occupations								
418.00	Public Scales (weights and measures)								
419.00	Other Public Safety		1,107						1,107
Total Public Safety		1,997,021	134,701						2,131,722
Health and Human Services									
420.00-425.00	Health and Human Services								
Total Health and Human Services									
Public Works - Sanitation									
426.00	Recycling Collection and Disposal								
427.00	Solid Waste Collection and Disposal (garbage)	176,182							176,182
428.00	Weed Control								
429.00	Wastewater / Sewage Treatment and Collection								
Total Public Works - Sanitation		176,182							176,182
Public Works - Highways and Streets									
430.00	General Services - Administration	416,978							416,978
431.00	Cleaning of Streets and Gutters								
432.00	Winter Maintenance – Snow Removal								
433.00	Traffic Control Devices	4,937							4,937
434.00	Street Lighting	31,754							31,754
435.00	Sidewalks and Crosswalks								
436.00	Storm Sewers and Drains								

CHESTER TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Public Works - Highways and Streets									
437.00	Repairs of Tools and Machinery	1,342							1,342
438.00	Maintenance and Repairs of Roads and Bridges	33,179							33,179
439.00	Highway Construction and Rebuilding Projects		67,799						67,799
Total Public Works - Highways and Streets		488,190	67,799						555,989
Other Public Works Enterprises									
440.00	Airports								
441.00	Cemeteries								
442.00	Electric System								
443.00	Gas System								
444.00	Markets								
445.00	Parking								
446.00	Storm Water and Flood Control								
447.00	Transit System								
448.00	Water System								
449.00	Water Transport and Terminals								
Total Other Public Works Enterprises									
Culture and Recreation									
451.00	Culture-Recreation Administration	32,633							32,633
452.00	Participant Recreation					19,201			19,201
453.00	Spectator Recreation								
454.00	Parks								
455.00	Shade Trees								
456.00	Libraries								

CHESTER TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Culture and Recreation									
457.00	Civil and Military Celebrations								
458.00	Senior Citizens' Centers	3,130							3,130
459.00	All Other Culture and Recreation								
Total Culture and Recreation		35,763				19,201			54,964
Community Development									
461.00	Conservation of Natural Resources								
462.00	Community Development and Housing								
463.00	Economic Development	207,167							207,167
464.00	Economic Opportunity								
465-469	All Other Community Development								
Total Community Development		207,167							207,167
Debt Service									
471.00	Debt Principal (short-term and long-term)								
472.00	Debt Interest (short-term and long-term)								
475.00	Fiscal Agent Fees								
Total Debt Service									
Employer Paid Benefits and Withholding Items									
481.00	Employer Paid Withholding Taxes and Unemployment Compensation								
482.00	Judgments and Losses	36,811							36,811
483.00	Pension / Retirement Fund Contributions	110,879							110,879
484.00	Worker Compensation Insurance								

CHESTER TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Employer Paid Benefits and Withholding Items									
487.00	Other Group Insurance Benefits								
Total Employer Paid Benefits and Withholding Items		147,690							147,690
Insurance									
486.00	Insurance, Casualty, and Surety								
Total Insurance									
Unclassified Operating Expenditures									
488.00	Fiduciary Fund Benefits and Refunds Paid							111,764	111,764
489.00	All Other Unclassified Expenditures	2,288						4,582	6,870
Total Unclassified Operating Expenditures		2,288						116,346	118,634
Other Financing Uses									
491.00	Refund of Prior Year Revenues	93,109							93,109
492.00	Interfund Operating Transfers	4,000							4,000
493.00	All Other Financing Uses								
Total Other Financing Uses		97,109							97,109
TOTAL EXPENDITURES		4,376,612	202,500			19,201		124,546	4,722,859
EXCESS/DEFICIT OF REVENUES OVER EXPENDITURES		-443,502	528,990			2,454		256,634	344,576

CHESTER TWP

December 31, 2013

DEBT STATEMENT

OUTSTANDING BONDS AND NOTES
Listed below are all currently outstanding bond and note issues according to our files, excluding bond issues redeemed or refunded and defeased. Please show the principal payments and make any other necessary corrections and additions.

Purpose	Bond (B) Capital Lease (C) Lease Rental (L) Note (N)	Issue Year (yyyy)	Maturity Year (yyyy)	Original Amount of Issue	Outstanding Beginning of Year (1)	Principal Incurred This Year	Principal Paid This Year	Current Year Accretion on Compound Interest Bonds	Outstanding at Year End (1)	Plus (less) Unamortized Premium (Discount)	Total Balance
General Obligation Bonds and Notes											
Revenue Bonds and Notes											
Lease Rental Debt											
Other											

(1) - excludes unamortized premium/discount

Total bonds and notes outstanding	0
Capitalized lease obligations	
Net debt	0

CHESTER TWP, DELAWARE County

STATEMENT OF CAPITAL EXPENDITURES

December 31, 2013

Category	Capital Purchases	Capital Construction	Total
Electric			
Fire			
Gas System			
General Government			
Health			
Housing			
Libraries			
Mass Transit			
Parks			
Police	25,356		25,356
Recreation			
Sewer			
Solid Waste			
Streets / Highways			
Water			
Other: _____			
Community Development			
TOTAL CAPITAL EXPENDITURES	25,356		25,356

EMPLOYEE COMPENSATION

Total salaries, wages, commissions, etc. paid this year (including all employees and elected officials) 1,647,724

ELECTED CONTROLLER'S/AUDITOR'S CERTIFIED OPINION

To the: Governing Body of the Municipality

President Judge of the Court of Common Pleas

Secretary of the Department of Community & Economic Development

I/We, the undersigned, the duly elected (or appointed replacement), qualified, and Acting Controller/Auditors of the CHESTER TWP have audited, adjusted and settled the various funds and account groups of the CHESTER TWP for the year ended December 31, 2013. My/Our audit, adjustment and settlement was made in accordance with law rather than with generally accepted auditing standards

(PLEASE CROSS OUT ONLY IF ON MODIFIED ACCRUAL/ACCRUAL BASIS)
This municipality's policy is to prepare its financial statements on the basis of cash receipts and disbursements; consequently, certain revenues and the related assets are recognized when received rather than when earned, and certain expenditures or expenses are recognized when paid rather than when a liability is incurred. Accordingly, the accompanying financial statements are not intended to present the financial position and results of operations of this municipality in conformity with generally accepted accounting principles.

These financial statements do not include all of the disclosures required by generally accepted accounting principles.

In my/our opinion, the aforementioned financial statements present the financial position of the various funds and account groups of the municipality of CHESTER TWP for the year ended December 31, 2013, and the results of operations of such funds in accordance with the law.

SIGNATURE AND VERIFICATION

Signed: Dorothy Green Elected Auditor

Thelma Newcomb Elected Auditor

Subscribed and sworn to before me this 10 day of September, 2014.

SEAL

Signed: _____

Witness (Controller)/Auditor (Auditors)

CHESTER TWP, DELAWARE County

December 31, 2013

NOTES / COMMENTS

DCED-CLGS-30 (9-09)
Received by DCED: 08/20/2015

Department of Community & Economic Development
Governor's Center for Local Government Services
Commonwealth Keystone Building
400 North Street, 4th Floor
Harrisburg, PA 17120-0225
Ph: 888-223-6837 | fax: 717-783-1402

2013 MUNICIPAL ANNUAL AUDIT AND FINANCIAL REPORT

230483 EDDYSTONE BORO, DELAWARE COUNTY

DCED-CLGS-30 (9-09)

BALANCE SHEET

DCED-CLGS-30 (09-09)

EDDYSTONE BORO, DELAWARE County

BALANCE SHEET

December 31, 2013

		Governmental Funds				Proprietary Funds		Fid. Fund	Account Groups		Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	General Fixed Assets	General Long Term Debt	Memorandum Only
Assets and Other Debits											
100-120	Cash and Investments	95,384	77,290	7,543	3,855						184,072
140-144	Tax Receivable										
121-129, 145-149	Accounts Receivable (excluding taxes)										
130.00	Due From Other Funds										
131-139, 150-159	Other Current Assets	215,028									215,028
160-169	Fixed Assets										
180-189	Other Debits										
Total Assets and Other Debits		310,412	77,290	7,543	3,855						399,100
Liabilities and Other Credits											
210-229	Payroll Taxes and Other Payroll Withholdings	20,436									20,436
200-209, 231-239	All Other Current Liabilities	215,028									215,028
230.00	Due To Other Funds										

EDDYSTONE BORO, DELAWARE County

BALANCE SHEET

December 31, 2013

		Governmental Funds				Proprietary Funds		Fid. Fund	Account Groups		Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	General Fixed Assets	General Long Term Debt	Memorandum Only
Liabilities and Other Credits											
260-269	Long-Term-Liabilities										
240-259	Current Portion of Long-Term Debt and Other Credits										
Total Liabilities and Other Credits		235,464									235,464
Fund and Account Group Equity											
281-284	Contributed Capital										
290.00	Investment in General Fixed Assets										
270-289	Fund Balance / Retained Earnings on 12/31	74,948	77,290	7,543	3,855						163,636
291-299	Other Equity										
Total Fund and Account Group Equity		74,948	77,290	7,543	3,855						163,636

TOTAL LIABILITIES AND FUND AND ACCOUNT GROUP EQUITY	399,100

EDDYSTONE BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

REVENUES

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
Taxes									
301.00	Real Estate Taxes	997,055			48,941				1,045,996
305.00	Occupation Taxes (levied under municipal code)								
308.00	Residence Taxes (levied by cities of the 3rd Class)								
309.00	Regional Asset District Sales Tax (Allegheny County municipalities only)								
310.00	Per Capita Taxes								
310.10	Real Estate Transfer Taxes	15,762							15,762
310.20	Earned Income Taxes / Wage Taxes	1,249,993							1,249,993
310.30	Business Gross Receipts Taxes								
310.40	Occupation Taxes (levied under Act 511)								
310.50	Local Services Tax **	110,409							110,409
310.60	Amusement / Admission Taxes								
310.70	Mechanical Device Taxes								
310.90	Other Local Tax Enabling Act / Act 511 / Taxes								
	Other: _____								
Total Taxes		2,373,219			48,941				2,422,160
Licenses and Permits									
320-322	All Other Licenses and Permits	17,347							17,347
321.80	Cable Television Franchise Fees	36,205							36,205
Total Licenses and Permits		53,552							53,552
Fines and Forfeits									
330-332	Fines and Forfeits	68,937							68,937
Total Fines and Forfeits		68,937							68,937

EDDYSTONE BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

REVENUES

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
Interest, Rents and Royalties									
341.00	Interest Earnings	554	167	8	10				739
342.00	Rents and Royalties								
Total Interest, Rents and Royalties		554	167	8	10				739
Federal									
351.03	Highways and Streets								
351.09	Community Development								
351.00	All Other Federal Capital and Operating Grants								
352.01	National Forest								
352.00	All Other Federal Shared Revenue and Entitlements								
353.00	Federal Payments in Lieu of Taxes								
Total Federal									
State									
354.03	Highways and Streets								
354.09	Community Development								
354.15	Recycling / Act 101								
354.00	All Other State Capital and Operating Grants								
355.01	Public Utility Realty Tax (PURTA)	2,918							2,918
355.02-355.03	Motor Vehicle Fuel Tax (Liquid Fuels Tax) and State Road Turnback		41,189						41,189
355.04	Alcoholic Beverage Licenses								
355.05	General Municipal Pension System State Aid	46,612							46,612
355.07	Foreign Fire Insurance Tax Distribution	21,509							21,509
355.08	Local Share Assessment/Gaming Proceeds								

EDDYSTONE BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
REVENUES									
State									
355.09	Marcellus Shale Impact Fee Distribution								
355.00	All Other State Shared Revenues and Entitlements								
356.00	State Payments in Lieu of Taxes								
Total State		71,039	41,189						112,228
Local Government Units									
357.03	Highways and Streets								
357.00	All Other Local Governmental Units Capital and Operating Grants								
358.00	Local Government Unit Shared Payments for Contracted Intergovernmental Services	19,377							19,377
359.00	Local Governmental Units and Authorities Payments in Lieu of Taxes								
Total Local Government Units		19,377							19,377
Charges for Service									
361.00	General Government	2,659							2,659
362.00	Public Safety	552,820							552,820
363.20	Parking								
363.00	All Other Charges for Highway & Street Services								
364.10	Wastewater / Sewage (including connection / tapping fees, sewer usage charges, reserve capacity fee, etc.)		314,792						314,792
364.30	Solid Waste Collection and Disposal Charge (trash)	1,655							1,655
364.60	Host Municipality Benefit Fee for Solid Waste Facility								
364.00	All Other Charges for Sanitation Services								
365.00	Health								
366.00	Human Services								
367.00	Culture and Recreation								

EDDYSTONE BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
REVENUES									
Charges for Service									
368.00	Airports								
369.00	Bars								
370.00	Cemeteries								
372.00	Electric System								
373.00	Gas System								
374.00	Housing System								
375.00	Markets								
377.00	Transit Systems								
378.00	Water System								
379.00	All Other Charges for Service								
Total Charges for Service		557,134	314,792						871,926
Unclassified Operating Revenues									
383.00	Special Assessments								
386.00	Escheats (sale of personal property)								
387.00	Contributions and Donations from Private Sectors								
388.00	Fiduciary Fund Pension Contributions								
389.00	All Other Unclassified Operating Revenues								
Total Unclassified Operating Revenues									
Other Financing Sources									
391.00	Proceeds of General Fixed Asset Disposition								
392.00	Interfund Operating Transfers		84,578	397,665	179,892				662,135
393.00	Proceeds of General Long-Term Debt			450,000					450,000
394.00	Proceeds of Short Term-Debt				250,000				250,000

EDDYSTONE BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
REVENUES									
Other Financing Sources									
395.00	Refunds of Prior Year Expenditures								
Total Other Financing Sources			84,578	847,665	429,892				1,362,135
TOTAL REVENUES		3,143,812	440,726	847,673	478,843				4,911,054
EXPENDITURES									
General Government									
400.00	Legislative (Governing) Body	12,875							12,875
401.00	Executive (Manager or Mayor)	59,865							59,865
402.00	Auditing Services / Financial Administration	20,330							20,330
403.00	Tax Collection	9,216							9,216
404.00	Solicitor / Legal Services	60,717							60,717
405.00	Secretary / Clerk	32,011							32,011
406.00	Other General Government Administration	34,929							34,929
407.00	IT-Networking Services-Data Processing								
408.00	Engineering Services								
409.00	General Government Buildings and Plant	46,481		14,995					61,476
Total General Government		276,424		14,995					291,419
Public Safety									
410.00	Police	868,573							868,573
411.00	Fire	143,623		832,670					976,293
412.00	Ambulance / Rescue								
413.00	UCC and Code Enforcement	62,122							62,122
414.00	Planning and Zoning								
415.00	Emergency Management and Communications								

EDDYSTONE BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Public Safety									
416.00	Militia and Armories								
417.00	Examination of Licensed Occupations								
418.00	Public Scales (weights and measures)								
419.00	Other Public Safety								
Total Public Safety		1,074,318		832,670					1,906,988
Health and Human Services									
420.00-425.00	Health and Human Services								
Total Health and Human Services									
Public Works - Sanitation									
426.00	Recycling Collection and Disposal								
427.00	Solid Waste Collection and Disposal (garbage)	121,948							121,948
428.00	Weed Control								
429.00	Wastewater / Sewage Treatment and Collection		366,410						366,410
Total Public Works - Sanitation		121,948	366,410						488,358
Public Works - Highways and Streets									
430.00	General Services - Administration	105,424							105,424
431.00	Cleaning of Streets and Gutters								
432.00	Winter Maintenance – Snow Removal								
433.00	Traffic Control Devices		16,574						16,574
434.00	Street Lighting		37,922						37,922
435.00	Sidewalks and Crosswalks								
436.00	Storm Sewers and Drains								

EDDYSTONE BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Public Works - Highways and Streets									
437.00	Repairs of Tools and Machinery								
438.00	Maintenance and Repairs of Roads and Bridges		3,599						3,599
439.00	Highway Construction and Rebuilding Projects								
Total Public Works - Highways and Streets		105,424	58,095						163,519
Other Public Works Enterprises									
440.00	Airports								
441.00	Cemeteries								
442.00	Electric System								
443.00	Gas System								
444.00	Markets								
445.00	Parking								
446.00	Storm Water and Flood Control								
447.00	Transit System								
448.00	Water System								
449.00	Water Transport and Terminals								
Total Other Public Works Enterprises									
Culture and Recreation									
451.00	Culture-Recreation Administration	43,319							43,319
452.00	Participant Recreation								
453.00	Spectator Recreation								
454.00	Parks								
455.00	Shade Trees								
456.00	Libraries								

EDDYSTONE BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Culture and Recreation									
457.00	Civil and Military Celebrations								
458.00	Senior Citizens' Centers								
459.00	All Other Culture and Recreation								
Total Culture and Recreation		43,319							43,319
Community Development									
461.00	Conservation of Natural Resources								
462.00	Community Development and Housing								
463.00	Economic Development								
464.00	Economic Opportunity								
465-469	All Other Community Development								
Total Community Development									
Debt Service									
471.00	Debt Principal (short-term and long-term)				388,889				388,889
472.00	Debt Interest (short-term and long-term)				93,769				93,769
475.00	Fiscal Agent Fees								
Total Debt Service					482,658				482,658
Employer Paid Benefits and Withholding Items									
481.00	Employer Paid Withholding Taxes and Unemployment Compensation	49,086							49,086
482.00	Judgments and Losses								
483.00	Pension / Retirement Fund Contributions	173,207							173,207
484.00	Worker Compensation Insurance	128,381							128,381

EDDYSTONE BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Employer Paid Benefits and Withholding Items									
487.00	Other Group Insurance Benefits	495,449							495,449
Total Employer Paid Benefits and Withholding Items		846,123							846,123
Insurance									
486.00	Insurance, Casualty, and Surety	68,500							68,500
Total Insurance		68,500							68,500
Unclassified Operating Expenditures									
488.00	Fiduciary Fund Benefits and Refunds Paid								
489.00	All Other Unclassified Expenditures	3,292	4,287						7,579
Total Unclassified Operating Expenditures		3,292	4,287						7,579
Other Financing Uses									
491.00	Refund of Prior Year Revenues								
492.00	Interfund Operating Transfers	662,135							662,135
493.00	All Other Financing Uses								
Total Other Financing Uses		662,135							662,135
TOTAL EXPENDITURES		3,201,483	428,792	847,665	482,658				4,960,598
EXCESS/DEFICIT OF REVENUES OVER EXPENDITURES		-57,671	11,934	8	-3,815				-49,544

EDDYSTONE BORO

December 31, 2013

DEBT STATEMENT

OUTSTANDING BONDS AND NOTES
Listed below are all currently outstanding bond and note issues according to our files, excluding bond issues redeemed or refunded and defeased. Please show the principal payments and make any other necessary corrections and additions.

Purpose	Bond (B) Capital Lease (C) Lease Rental (L) Note (N)	Issue Year (yyyy)	Maturity Year (yyyy)	Original Amount of Issue	Outstanding Beginning of Year (1)	Principal Incurred This Year	Principal Paid This Year	Current Year Accretion on Compound Interest Bonds	Outstanding at Year End (1)	Plus (less) Unamortized Premium (Discount)	Total Balance
General Obligation Bonds and Notes											
Citizens Bank	Note	1999	2014	425,000	58,113		18,889		39,224		39,224
Firehouse Construction Note 2011 Series	Note	2011	2025	3,000,000	3,000,000		120,000		2,880,000		2,880,000
Firehouse Construction Note 2013 Series	Note	2013	2031	450,000	0	450,000			450,000		450,000
Revenue Bonds and Notes											
Tax Anticipation Note	Note	2013	2013	250,000	0	250,000	250,000		0		0
Lease Rental Debt											
Other											

(1) - excludes unamortized premium/discount

Total bonds and notes outstanding	3,369,224
Capitalized lease obligations	
Net debt	3,369,224

EDDYSTONE BORO, DELAWARE County

STATEMENT OF CAPITAL EXPENDITURES

December 31, 2013

Category	Capital Purchases	Capital Construction	Total
Electric			
Fire		832,670	832,670
Gas System			
General Government		14,995	14,995
Health			
Housing			
Libraries			
Mass Transit			
Parks			
Police			
Recreation			
Sewer			
Solid Waste			
Streets / Highways			
Water			
Other: _____			
Community Development			
TOTAL CAPITAL EXPENDITURES		847,665	847,665

EMPLOYEE COMPENSATION

Total salaries, wages, commissions, etc. paid this year (including all employees and elected officials) 1,157,793

Independent Public Accountant/Certified Public Accountant Submission Page

Opinion page was provided in lieu of signature page.

SIGNATURE AND VERIFICATION

Signed: John Hanna Appointed Auditor/CPA

DCED-CLGS-30 (9-09)

EDDYSTONE BORO, DELAWARE County

December 31, 2013

NOTES / COMMENTS

DCED-CLGS-30 (9-09)
Received by DCED: 03/18/2014

Department of Community & Economic Development
Governor's Center for Local Government Services
Commonwealth Keystone Building
400 North Street, 4th Floor
Harrisburg, PA 17120-0225
Ph: 888-223-6837 | fax: 717-783-1402

2013 MUNICIPAL ANNUAL AUDIT AND FINANCIAL REPORT

230515 EDGMONT TWP, DELAWARE COUNTY

DCED-CLGS-30 (9-09)

BALANCE SHEET

DCED-CLGS-30 (09-09)

EDGMONT TWP, DELAWARE County

BALANCE SHEET

December 31, 2013

		Governmental Funds				Proprietary Funds		Fid. Fund	Account Groups		Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	General Fixed Assets	General Long Term Debt	Memorandum Only
Assets and Other Debits											
100-120	Cash and Investments	775,144	19,793	1,079,795				354,510			2,229,242
140-144	Tax Receivable										
121-129, 145-149	Accounts Receivable (excluding taxes)										
130.00	Due From Other Funds										
131-139, 150-159	Other Current Assets										
160-169	Fixed Assets										
180-189	Other Debits										
Total Assets and Other Debits		775,144	19,793	1,079,795				354,510			2,229,242
Liabilities and Other Credits											
210-229	Payroll Taxes and Other Payroll Withholdings		436								436
200-209, 231-239	All Other Current Liabilities	164						215,673			215,837
230.00	Due To Other Funds										

EDGMONT TWP, DELAWARE County

BALANCE SHEET

December 31, 2013

		Governmental Funds				Proprietary Funds		Fid. Fund	Account Groups		Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	General Fixed Assets	General Long Term Debt	Memorandum Only
Liabilities and Other Credits											
260-269	Long-Term-Liabilities										
240-259	Current Portion of Long-Term Debt and Other Credits										
Total Liabilities and Other Credits		164	436					215,673			216,273
Fund and Account Group Equity											
281-284	Contributed Capital										
290.00	Investment in General Fixed Assets										
270-289	Fund Balance / Retained Earnings on 12/31	774,980	19,357	1,079,795				138,837			2,012,969
291-299	Other Equity										
Total Fund and Account Group Equity		774,980	19,357	1,079,795				138,837			2,012,969

TOTAL LIABILITIES AND FUND AND ACCOUNT GROUP EQUITY	2,229,242

EDGMONT TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

REVENUES

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
Taxes									
301.00	Real Estate Taxes	304,472	108,340						412,812
305.00	Occupation Taxes (levied under municipal code)								
308.00	Residence Taxes (levied by cities of the 3rd Class)								
309.00	Regional Asset District Sales Tax (Allegheny County municipalities only)								
310.00	Per Capita Taxes	12,625							12,625
310.10	Real Estate Transfer Taxes	167,017							167,017
310.20	Earned Income Taxes / Wage Taxes								
310.30	Business Gross Receipts Taxes								
310.40	Occupation Taxes (levied under Act 511)								
310.50	Local Services Tax **	71,750							71,750
310.60	Amusement / Admission Taxes								
310.70	Mechanical Device Taxes								
310.90	Other Local Tax Enabling Act / Act 511 / Taxes								
	Other: _____								
Total Taxes		555,864	108,340						664,204
Licenses and Permits									
320-322	All Other Licenses and Permits	7,600							7,600
321.80	Cable Television Franchise Fees	104,363							104,363
Total Licenses and Permits		111,963							111,963
Fines and Forfeits									
330-332	Fines and Forfeits	4,373							4,373
Total Fines and Forfeits		4,373							4,373

EDGMONT TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

REVENUES

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
Interest, Rents and Royalties									
341.00	Interest Earnings	3,572	142	2,442				27,656	33,812
342.00	Rents and Royalties	115,526							115,526
Total Interest, Rents and Royalties		119,098	142	2,442				27,656	149,338
Federal									
351.03	Highways and Streets								
351.09	Community Development								
351.00	All Other Federal Capital and Operating Grants								
352.01	National Forest								
352.00	All Other Federal Shared Revenue and Entitlements								
353.00	Federal Payments in Lieu of Taxes								
Total Federal									
State									
354.03	Highways and Streets								
354.09	Community Development								
354.15	Recycling / Act 101	19,080							19,080
354.00	All Other State Capital and Operating Grants								
355.01	Public Utility Realty Tax (PURTA)	702							702
355.02-355.03	Motor Vehicle Fuel Tax (Liquid Fuels Tax) and State Road Turnback		86,575						86,575
355.04	Alcoholic Beverage Licenses	1,400							1,400
355.05	General Municipal Pension System State Aid	10,485							10,485
355.07	Foreign Fire Insurance Tax Distribution	52,623							52,623
355.08	Local Share Assessment/Gaming Proceeds								

EDGMONT TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
REVENUES									
State									
355.09	Marcellus Shale Impact Fee Distribution								
356.00	State Payments in Lieu of Taxes	2,869							2,869
355.00	All Other State Shared Revenues and Entitlements								
Total State		87,159	86,575						173,734
Local Government Units									
357.03	Highways and Streets								
357.00	All Other Local Governmental Units Capital and Operating Grants	2,768							2,768
358.00	Local Government Unit Shared Payments for Contracted Intergovernmental Services	4,277							4,277
359.00	Local Governmental Units and Authorities Payments in Lieu of Taxes								
Total Local Government Units		7,045							7,045
Charges for Service									
361.00	General Government	97,756							97,756
362.00	Public Safety	133,518							133,518
363.20	Parking								
363.00	All Other Charges for Highway & Street Services								
364.10	Wastewater / Sewage (including connection / tapping fees, sewer usage charges, reserve capacity fee, etc.)								
364.30	Solid Waste Collection and Disposal Charge (trash)								
364.60	Host Municipality Benefit Fee for Solid Waste Facility								
364.00	All Other Charges for Sanitation Services								
365.00	Health								
366.00	Human Services								
367.00	Culture and Recreation	5,666							5,666

EDGMONT TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
REVENUES									
Charges for Service									
368.00	Airports								
369.00	Bars								
370.00	Cemeteries								
372.00	Electric System								
373.00	Gas System								
374.00	Housing System								
375.00	Markets								
377.00	Transit Systems								
378.00	Water System								
379.00	All Other Charges for Service	8,817							8,817
Total Charges for Service		245,757							245,757
Unclassified Operating Revenues									
383.00	Special Assessments		18,922						18,922
386.00	Escheats (sale of personal property)								
387.00	Contributions and Donations from Private Sectors	745		47,625					48,370
388.00	Fiduciary Fund Pension Contributions							11,854	11,854
389.00	All Other Unclassified Operating Revenues	4,859							4,859
Total Unclassified Operating Revenues		5,604	18,922	47,625				11,854	84,005
Other Financing Sources									
391.00	Proceeds of General Fixed Asset Disposition	6,870							6,870
392.00	Interfund Operating Transfers			466,048					466,048
393.00	Proceeds of General Long-Term Debt								
394.00	Proceeds of Short Term-Debt								

EDGMONT TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
REVENUES									
Other Financing Sources									
395.00	Refunds of Prior Year Expenditures								
Total Other Financing Sources		6,870		466,048					472,918
TOTAL REVENUES		1,143,733	213,979	516,115				39,510	1,913,337
EXPENDITURES									
General Government									
400.00	Legislative (Governing) Body	7,940							7,940
401.00	Executive (Manager or Mayor)	120,320		1,700					122,020
402.00	Auditing Services / Financial Administration	58,805							58,805
403.00	Tax Collection	8,624							8,624
404.00	Solicitor / Legal Services	89,377		5,768					95,145
405.00	Secretary / Clerk	72,760							72,760
406.00	Other General Government Administration	350							350
407.00	IT-Networking Services-Data Processing								
408.00	Engineering Services	57,500		19,479					76,979
409.00	General Government Buildings and Plant	49,002		2,893					51,895
Total General Government		464,678		29,840					494,518
Public Safety									
410.00	Police								
411.00	Fire	71,248	108,777						180,025
412.00	Ambulance / Rescue		15,412						15,412
413.00	UCC and Code Enforcement	82,730							82,730
414.00	Planning and Zoning	26,881							26,881
415.00	Emergency Management and Communications	1,636							1,636

EDGMONT TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Public Safety									
416.00	Militia and Armories								
417.00	Examination of Licensed Occupations								
418.00	Public Scales (weights and measures)								
419.00	Other Public Safety								
Total Public Safety		182,495	124,189						306,684
Health and Human Services									
420.00-425.00	Health and Human Services	1,850							1,850
Total Health and Human Services		1,850							1,850
Public Works - Sanitation									
426.00	Recycling Collection and Disposal	9,236							9,236
427.00	Solid Waste Collection and Disposal (garbage)								
428.00	Weed Control								
429.00	Wastewater / Sewage Treatment and Collection			212,715					212,715
Total Public Works - Sanitation		9,236		212,715					221,951
Public Works - Highways and Streets									
430.00	General Services - Administration								
431.00	Cleaning of Streets and Gutters	3,283							3,283
432.00	Winter Maintenance – Snow Removal	45,718							45,718
433.00	Traffic Control Devices	17,294							17,294
434.00	Street Lighting								
435.00	Sidewalks and Crosswalks								
436.00	Storm Sewers and Drains	17,257							17,257

EDGMONT TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Public Works - Highways and Streets									
437.00	Repairs of Tools and Machinery								
438.00	Maintenance and Repairs of Roads and Bridges	40,926							40,926
439.00	Highway Construction and Rebuilding Projects	2,769	99,541						102,310
Total Public Works - Highways and Streets		127,247	99,541						226,788
Other Public Works Enterprises									
440.00	Airports								
441.00	Cemeteries								
442.00	Electric System								
443.00	Gas System								
444.00	Markets								
445.00	Parking								
446.00	Storm Water and Flood Control								
447.00	Transit System								
448.00	Water System								
449.00	Water Transport and Terminals								
Total Other Public Works Enterprises									
Culture and Recreation									
451.00	Culture-Recreation Administration								
452.00	Participant Recreation	5,710							5,710
453.00	Spectator Recreation								
454.00	Parks								
455.00	Shade Trees								
456.00	Libraries	7,500							7,500

EDGMONT TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Culture and Recreation									
457.00	Civil and Military Celebrations								
458.00	Senior Citizens' Centers								
459.00	All Other Culture and Recreation	3,550							3,550
Total Culture and Recreation		16,760							16,760
Community Development									
461.00	Conservation of Natural Resources								
462.00	Community Development and Housing								
463.00	Economic Development								
464.00	Economic Opportunity								
465-469	All Other Community Development								
Total Community Development									
Debt Service									
471.00	Debt Principal (short-term and long-term)								
472.00	Debt Interest (short-term and long-term)								
475.00	Fiscal Agent Fees								
Total Debt Service									
Employer Paid Benefits and Withholding Items									
481.00	Employer Paid Withholding Taxes and Unemployment Compensation								
482.00	Judgments and Losses								
483.00	Pension / Retirement Fund Contributions	11,854							11,854
484.00	Worker Compensation Insurance	11,616							11,616

EDGMONT TWP, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Employer Paid Benefits and Withholding Items									
487.00	Other Group Insurance Benefits	86,280							86,280
Total Employer Paid Benefits and Withholding Items		109,750							109,750
Insurance									
486.00	Insurance, Casualty, and Surety	13,362							13,362
Total Insurance		13,362							13,362
Unclassified Operating Expenditures									
488.00	Fiduciary Fund Benefits and Refunds Paid							134	134
489.00	All Other Unclassified Expenditures	1,177							1,177
Total Unclassified Operating Expenditures		1,177						134	1,311
Other Financing Uses									
491.00	Refund of Prior Year Revenues								
492.00	Interfund Operating Transfers	193,948		272,100					466,048
493.00	All Other Financing Uses								
Total Other Financing Uses		193,948		272,100					466,048
TOTAL EXPENDITURES		1,120,503	223,730	514,655				134	1,859,022
EXCESS/DEFICIT OF REVENUES OVER EXPENDITURES		23,230	-9,751	1,460				39,376	54,315

EDGMONT TWP

December 31, 2013

DEBT STATEMENT

OUTSTANDING BONDS AND NOTES
Listed below are all currently outstanding bond and note issues according to our files, excluding bond issues redeemed or refunded and defeased. Please show the principal payments and make any other necessary corrections and additions.

Purpose	Bond (B) Capital Lease (C) Lease Rental (L) Note (N)	Issue Year (yyyy)	Maturity Year (yyyy)	Original Amount of Issue	Outstanding Beginning of Year (1)	Principal Incurred This Year	Principal Paid This Year	Current Year Accretion on Compound Interest Bonds	Outstanding at Year End (1)	Plus (less) Unamortized Premium (Discount)	Total Balance
General Obligation Bonds and Notes											
Revenue Bonds and Notes											
Lease Rental Debt											
Other											

(1) - excludes unamortized premium/discount

Total bonds and notes outstanding	0
Capitalized lease obligations	
Net debt	0

EDGMONT TWP, DELAWARE County

STATEMENT OF CAPITAL EXPENDITURES

December 31, 2013

Category	Capital Purchases	Capital Construction	Total
Electric			
Fire			
Gas System			
General Government	1,144	1,750	2,894
Health			
Housing			
Libraries			
Mass Transit			
Parks			
Police			
Recreation			
Sewer		212,715	212,715
Solid Waste			
Streets / Highways		99,541	99,541
Water			
Other: _____			
Community Development			
TOTAL CAPITAL EXPENDITURES	1,144	314,006	315,150

EMPLOYEE COMPENSATION

Total salaries, wages, commissions, etc. paid this year (including all employees and elected officials) 278,752

ELECTED CONTROLLER'S/AUDITOR'S CERTIFIED OPINION

To the: Governing Body of the Municipality

President Judge of the Court of Common Pleas

Secretary of the Department of Community & Economic Development

I/We, the undersigned, the duly elected (or appointed replacement), qualified, and Acting Controller/Auditors of the EDGMONT TWP have audited, adjusted and settled the various funds and account groups of the EDGMONT TWP for the year ended December 31, 2013. My/Our audit, adjustment and settlement was made in accordance with law rather than with generally accepted auditing standards

(PLEASE CROSS OUT ONLY IF ON MODIFIED ACCRUAL/ACCRUAL BASIS)
This municipality's policy is to prepare its financial statements on the basis of cash receipts and disbursements; consequently, certain revenues and the related assets are recognized when received rather than when earned, and certain expenditures or expenses are recognized when paid rather than when a liability is incurred. Accordingly, the accompanying financial statements are not intended to present the financial position and results of operations of this municipality in conformity with generally accepted accounting principles.

These financial statements do not include all of the disclosures required by generally accepted accounting principles.

In my/our opinion, the aforementioned financial statements present the financial position of the various funds and account groups of the municipality of EDGMONT TWP for the year ended December 31, 2013, and the results of operations of such funds in accordance with the law.

SIGNATURE AND VERIFICATION

Signed: Merves Amon & Barsz LLC Appointed Auditor/CPA

Subscribed and sworn to before me this 10 day of September, 2014.

SEAL

Signed: _____

Witness (Controller)/Auditor (Auditors)

EDGMONT TWP, DELAWARE County

December 31, 2013

NOTES / COMMENTS

DCED-CLGS-30 (9-09)
Received by DCED: 03/29/2014

Department of Community & Economic Development
Governor's Center for Local Government Services
Commonwealth Keystone Building
400 North Street, 4th Floor
Harrisburg, PA 17120-0225
Ph: 888-223-6837 | fax: 717-783-1402

2013 MUNICIPAL ANNUAL AUDIT AND FINANCIAL REPORT

230693 MARCUS HOOK BORO, DELAWARE COUNTY

DCED-CLGS-30 (9-09)

BALANCE SHEET

DCED-CLGS-30 (09-09)

MARCUS HOOK BORO, DELAWARE County

BALANCE SHEET

December 31, 2013

		Governmental Funds				Proprietary Funds		Fid. Fund	Account Groups		Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	General Fixed Assets	General Long Term Debt	Memorandum Only
Assets and Other Debits											
100-120	Cash and Investments	2,570,407	6,475	73,372	204,760						2,855,014
140-144	Tax Receivable										
121-129, 145-149	Accounts Receivable (excluding taxes)										
130.00	Due From Other Funds										
131-139, 150-159	Other Current Assets										
160-169	Fixed Assets										
180-189	Other Debits										
Total Assets and Other Debits		2,570,407	6,475	73,372	204,760						2,855,014

Liabilities and Other Credits											
210-229	Payroll Taxes and Other Payroll Withholdings	2,378									2,378
200-209, 231-239	All Other Current Liabilities	12,603									12,603
230.00	Due To Other Funds										

MARCUS HOOK BORO, DELAWARE County

BALANCE SHEET

December 31, 2013

		Governmental Funds				Proprietary Funds		Fid. Fund	Account Groups		Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	General Fixed Assets	General Long Term Debt	Memorandum Only
Liabilities and Other Credits											
260-269	Long-Term-Liabilities										
240-259	Current Portion of Long-Term Debt and Other Credits										
Total Liabilities and Other Credits		14,981									14,981
Fund and Account Group Equity											
281-284	Contributed Capital										
290.00	Investment in General Fixed Assets										
270-289	Fund Balance / Retained Earnings on 12/31	2,555,426	6,475	73,372	204,760						2,840,033
291-299	Other Equity										
Total Fund and Account Group Equity		2,555,426	6,475	73,372	204,760						2,840,033

TOTAL LIABILITIES AND FUND AND ACCOUNT GROUP EQUITY	2,855,014

MARCUS HOOK BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

REVENUES

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
Taxes									
301.00	Real Estate Taxes	1,304,639	19,644		76,395				1,400,678
305.00	Occupation Taxes (levied under municipal code)								
308.00	Residence Taxes (levied by cities of the 3rd Class)								
309.00	Regional Asset District Sales Tax (Allegheny County municipalities only)								
310.00	Per Capita Taxes								
310.10	Real Estate Transfer Taxes	197,249							197,249
310.20	Earned Income Taxes / Wage Taxes	863,282							863,282
310.30	Business Gross Receipts Taxes								
310.40	Occupation Taxes (levied under Act 511)								
310.50	Local Services Tax **	60,619							60,619
310.60	Amusement / Admission Taxes								
310.70	Mechanical Device Taxes								
310.90	Other Local Tax Enabling Act / Act 511 / Taxes								
	Other: _____								
Total Taxes		2,425,789	19,644		76,395				2,521,828
Licenses and Permits									
320-322	All Other Licenses and Permits	10,832							10,832
321.80	Cable Television Franchise Fees	43,382							43,382
Total Licenses and Permits		54,214							54,214
Fines and Forfeits									
330-332	Fines and Forfeits	35,073							35,073
Total Fines and Forfeits		35,073							35,073

MARCUS HOOK BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

REVENUES

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
Interest, Rents and Royalties									
341.00	Interest Earnings	2,758	8	104	121				2,991
342.00	Rents and Royalties								
Total Interest, Rents and Royalties		2,758	8	104	121				2,991
Federal									
351.03	Highways and Streets								
351.09	Community Development	8,691							8,691
351.00	All Other Federal Capital and Operating Grants	741							741
352.01	National Forest								
352.00	All Other Federal Shared Revenue and Entitlements								
353.00	Federal Payments in Lieu of Taxes								
Total Federal		9,432							9,432
State									
354.03	Highways and Streets								
354.09	Community Development								
354.15	Recycling / Act 101	2,701							2,701
354.00	All Other State Capital and Operating Grants	38,685							38,685
355.01	Public Utility Realty Tax (PURTA)	2,679							2,679
355.02-355.03	Motor Vehicle Fuel Tax (Liquid Fuels Tax) and State Road Turnback		42,109						42,109
355.04	Alcoholic Beverage Licenses	1,200							1,200
355.05	General Municipal Pension System State Aid	62,450							62,450
355.07	Foreign Fire Insurance Tax Distribution	16,423							16,423
355.08	Local Share Assessment/Gaming Proceeds								

MARCUS HOOK BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

REVENUES

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
State									
355.09	Marcellus Shale Impact Fee Distribution								
355.00	All Other State Shared Revenues and Entitlements								
356.00	State Payments in Lieu of Taxes								
Total State		124,138	42,109						166,247
Local Government Units									
357.03	Highways and Streets								
357.00	All Other Local Governmental Units Capital and Operating Grants	10,179							10,179
358.00	Local Government Unit Shared Payments for Contracted Intergovernmental Services			4,450	33,467				37,917
359.00	Local Governmental Units and Authorities Payments in Lieu of Taxes								
Total Local Government Units		10,179		4,450	33,467				48,096
Charges for Service									
361.00	General Government	3,208							3,208
362.00	Public Safety	511,626							511,626
363.20	Parking	13,979							13,979
363.00	All Other Charges for Highway & Street Services								
364.10	Wastewater / Sewage (including connection / tapping fees, sewer usage charges, reserve capacity fee, etc.)	6,297							6,297
364.30	Solid Waste Collection and Disposal Charge (trash)	7,312							7,312
364.60	Host Municipality Benefit Fee for Solid Waste Facility								
364.00	All Other Charges for Sanitation Services	1,061							1,061
365.00	Health								
366.00	Human Services								
367.00	Culture and Recreation	66,820							66,820

MARCUS HOOK BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
REVENUES									
Charges for Service									
368.00	Airports								
369.00	Bars								
370.00	Cemeteries								
372.00	Electric System								
373.00	Gas System								
374.00	Housing System								
375.00	Markets								
377.00	Transit Systems								
378.00	Water System								
379.00	All Other Charges for Service								
Total Charges for Service		610,303							610,303
Unclassified Operating Revenues									
383.00	Special Assessments								
386.00	Escheats (sale of personal property)								
387.00	Contributions and Donations from Private Sectors	302,500							302,500
388.00	Fiduciary Fund Pension Contributions								
389.00	All Other Unclassified Operating Revenues	36,062							36,062
Total Unclassified Operating Revenues		338,562							338,562
Other Financing Sources									
391.00	Proceeds of General Fixed Asset Disposition			15,881					15,881
392.00	Interfund Operating Transfers	350,000		69,644					419,644
393.00	Proceeds of General Long-Term Debt			350,000					350,000
394.00	Proceeds of Short Term-Debt								

MARCUS HOOK BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
REVENUES									
Other Financing Sources									
395.00	Refunds of Prior Year Expenditures			12,090					12,090
Total Other Financing Sources		350,000		447,615					797,615
TOTAL REVENUES		3,960,448	61,761	452,169	109,983				4,584,361
EXPENDITURES									
General Government									
400.00	Legislative (Governing) Body	48,704							48,704
401.00	Executive (Manager or Mayor)	66,977							66,977
402.00	Auditing Services / Financial Administration	49,054							49,054
403.00	Tax Collection	10,499							10,499
404.00	Solicitor / Legal Services	19,441							19,441
405.00	Secretary / Clerk	40,498							40,498
406.00	Other General Government Administration								
407.00	IT-Networking Services-Data Processing	3,718							3,718
408.00	Engineering Services	12,889							12,889
409.00	General Government Buildings and Plant	31,283							31,283
Total General Government		283,063							283,063
Public Safety									
410.00	Police	658,940		33,809					692,749
411.00	Fire	91,360		2,563					93,923
412.00	Ambulance / Rescue								
413.00	UCC and Code Enforcement	71,695							71,695
414.00	Planning and Zoning	9,411							9,411
415.00	Emergency Management and Communications								

MARCUS HOOK BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Public Safety									
416.00	Militia and Armories								
417.00	Examination of Licensed Occupations								
418.00	Public Scales (weights and measures)								
419.00	Other Public Safety								
Total Public Safety		831,406		36,372					867,778
Health and Human Services									
420.00-425.00	Health and Human Services	1,367							1,367
Total Health and Human Services		1,367							1,367
Public Works - Sanitation									
426.00	Recycling Collection and Disposal								
427.00	Solid Waste Collection and Disposal (garbage)	106,224							106,224
428.00	Weed Control								
429.00	Wastewater / Sewage Treatment and Collection	1,455							1,455
Total Public Works - Sanitation		107,679							107,679
Public Works - Highways and Streets									
430.00	General Services - Administration	188,557							188,557
431.00	Cleaning of Streets and Gutters								
432.00	Winter Maintenance – Snow Removal	234	4,934						5,168
433.00	Traffic Control Devices	24,586	4,442						29,028
434.00	Street Lighting	40,467	6,254						46,721
435.00	Sidewalks and Crosswalks								
436.00	Storm Sewers and Drains	27,633							27,633

MARCUS HOOK BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Public Works - Highways and Streets									
437.00	Repairs of Tools and Machinery								
438.00	Maintenance and Repairs of Roads and Bridges		2,250						2,250
439.00	Highway Construction and Rebuilding Projects		20,474						20,474
Total Public Works - Highways and Streets		281,477	38,354						319,831
Other Public Works Enterprises									
440.00	Airports								
441.00	Cemeteries								
442.00	Electric System								
443.00	Gas System								
444.00	Markets								
445.00	Parking								
446.00	Storm Water and Flood Control								
447.00	Transit System								
448.00	Water System								
449.00	Water Transport and Terminals								
Total Other Public Works Enterprises									
Culture and Recreation									
451.00	Culture-Recreation Administration								
452.00	Participant Recreation	92,640							92,640
453.00	Spectator Recreation								
454.00	Parks								
455.00	Shade Trees	9,715							9,715
456.00	Libraries	66,736							66,736

MARCUS HOOK BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Culture and Recreation									
457.00	Civil and Military Celebrations								
458.00	Senior Citizens' Centers								
459.00	All Other Culture and Recreation								
Total Culture and Recreation		169,091							169,091
Community Development									
461.00	Conservation of Natural Resources								
462.00	Community Development and Housing								
463.00	Economic Development			19,518					19,518
464.00	Economic Opportunity								
465-469	All Other Community Development								
Total Community Development				19,518					19,518
Debt Service									
471.00	Debt Principal (short-term and long-term)				78,975				78,975
472.00	Debt Interest (short-term and long-term)			2,915	37,331				40,246
475.00	Fiscal Agent Fees			1,785					1,785
Total Debt Service				4,700	116,306				121,006
Employer Paid Benefits and Withholding Items									
481.00	Employer Paid Withholding Taxes and Unemployment Compensation	56,936							56,936
482.00	Judgments and Losses								
483.00	Pension / Retirement Fund Contributions	291,440							291,440
484.00	Worker Compensation Insurance	53,552							53,552

MARCUS HOOK BORO, DELAWARE County

STATEMENT OF REVENUES AND EXPENDITURES

December 31, 2013

		Governmental Funds				Proprietary Funds		Fiduciary Fund	Total
		General Fund	Special Revenue (Including State Liquid Fuels)	Capital Projects	Debt Service	Enterprise	Internal Service	Trust and Agency	Memorandum Only
EXPENDITURES									
Employer Paid Benefits and Withholding Items									
487.00	Other Group Insurance Benefits	455,282							455,282
Total Employer Paid Benefits and Withholding Items		857,210							857,210
Insurance									
486.00	Insurance, Casualty, and Surety	90,994							90,994
Total Insurance		90,994							90,994
Unclassified Operating Expenditures									
488.00	Fiduciary Fund Benefits and Refunds Paid								
489.00	All Other Unclassified Expenditures								
Total Unclassified Operating Expenditures									
Other Financing Uses									
491.00	Refund of Prior Year Revenues	1,344							1,344
492.00	Interfund Operating Transfers	50,000	19,644	350,000					419,644
493.00	All Other Financing Uses								
Total Other Financing Uses		51,344	19,644	350,000					420,988
TOTAL EXPENDITURES		2,673,631	57,998	410,590	116,306				3,258,525
EXCESS/DEFICIT OF REVENUES OVER EXPENDITURES		1,286,817	3,763	41,579	-6,323				1,325,836

MARCUS HOOK BORO

December 31, 2013

DEBT STATEMENT

OUTSTANDING BONDS AND NOTES
Listed below are all currently outstanding bond and note issues according to our files, excluding bond issues redeemed or refunded and defeased. Please show the principal payments and make any other necessary corrections and additions.

Purpose	Bond (B) Capital Lease (C) Lease Rental (L) Note (N)	Issue Year (yyyy)	Maturity Year (yyyy)	Original Amount of Issue	Outstanding Beginning of Year (1)	Principal Incurred This Year	Principal Paid This Year	Current Year Accretion on Compound Interest Bonds	Outstanding at Year End (1)	Plus (less) Unamortized Premium (Discount)	Total Balance
General Obligation Bonds and Notes											
GON	Note	2003	2027	1,900,000	1,383,000		69,000		1,314,000		1,314,000
VLAP(PA)	Note	2004	2024	200,000	122,578		9,975		112,603		112,603
DVRFA	Note	2013	2023	350,000	0	350,000			350,000		350,000
Revenue Bonds and Notes											
Lease Rental Debt											
Other											

(1) - excludes unamortized premium/discount

Total bonds and notes outstanding	1,776,603
Capitalized lease obligations	
Net debt	1,776,603

MARCUS HOOK BORO, DELAWARE County

STATEMENT OF CAPITAL EXPENDITURES

December 31, 2013

Category	Capital Purchases	Capital Construction	Total
Electric			
Fire			
Gas System			
General Government			
Health			
Housing			
Libraries			
Mass Transit			
Parks			
Police	32,693		32,693
Recreation			
Sewer		6,150	6,150
Solid Waste			
Streets / Highways	12,982	30,149	43,131
Water			
Other: _____			
Community Development			
TOTAL CAPITAL EXPENDITURES	45,675	36,299	81,974

EMPLOYEE COMPENSATION

Total salaries, wages, commissions, etc. paid this year (including all employees and elected officials) 954,709

Independent Public Accountant/Certified Public Accountant Submission Page

Opinion page was provided in lieu of signature page.

SIGNATURE AND VERIFICATION

Signed: Barbacane, Thornton & Company LLP Appointed Auditor/CPA

DCED-CLGS-30 (9-09)

MARCUS HOOK BORO, DELAWARE County

December 31, 2013

NOTES / COMMENTS