WORK MEETING AGENDA OF THE CITY COUNCIL OF LAYTON, UTAH

PUBLIC NOTICE is hereby given that the City Council of Layton, Utah, will hold a regular public meeting in the Council Conference Room in the City Center Building, 437 North Wasatch Drive, Layton, Utah, commencing at **5:30 PM on August 18, 2016.**

Item:

1. Update - Storm Drain Master Plan and Impact Fees

2. Presentation - New Layton City Website

3. Discussion - Naming and Grand Opening of New Park - 3500 North Redtail Way

4. Mayor's Report

In the event of an absence of a full quorum, agenda items will be continued to the next regularly scheduled meeting.

This meeting may involve the use of electronic communications for some of the members of the public body. The anchor location for the meeting shall be the Layton City Council Chambers, 437 North Wasatch Drive, Layton City. Members at remote locations may be connected to the meeting telephonically.

Notice is hereby given that by motion of the Layton City Council, pursuant to Title 52, Chapter 4 of the Utah Code, the City Council may vote to hold a closed meeting for any of the purposes identified in that Chapter.

Date: _____ **By:** _____

Thieda Wellman, City Recorder

LAYTON CITY does not discriminate on the basis of race, color, national origin, sex, religion, age or disability in the employment or the provision of services. If you are planning to attend this public meeting and, due to a disability, need assistance in understanding or participating in the meeting, please notify Layton City eight or more hours in advance of the meeting. Please contact Kiley Day at 437 North Wasatch Drive, Layton, Utah 84041, 801.336.3825 or 801.336.3820.

LAYTON CITY COUNCIL MEETING
AGENDA ITEM COVER SHEET

Item Number: 1.

Subject:
Update - Storm Drain Master Plan and Impact Fees

Background:
Mr. Woody Woodruff, Layton City Engineer, Mr. Nathan Wright and Mr. Keith Larson of Bowen & Associates, Inc. will update the Council on the Storm Drain Master Plan and Impact Fees.

Alternatives:
N/A

Recommendation:
N/A

Storm Drain Master Plan, Impact Fee Facilities Plan, Impact Fee Analysis, and Rate Study

August 2016

Prepared by:

Bowen Collins & Associates, Inc.
CONSULTING ENGINEERS

Prepared for:

Layton City

STORM DRAIN MASTER PLAN

August 2016

Project No. 342-13-01

DRAFT

Prepared for:

Layton City

Prepared by:

Bowen Collins & Associates, Inc.
CONSULTING ENGINEERS

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CHAPTER 1
INTRODUCTION AND BACKGROUND

INTRODUCTION

The City of Layton (City) retained Bowen Collins & Associates (BC&A) to prepare this master plan for the City's storm drain system. The City determined that a new storm drain master plan was needed before a new Capital Facilities Plan could be completed.

The primary purpose of this Storm Drain Master Plan is to provide recommended improvements to resolve existing and projected future deficiencies in the City of Layton storm drain system based on the City's adopted General Plan. The resulting Impact Fee Facilities Plan (IFFP) will be used to establish Impact Fees for the City.

This document is a working document. Some of the recommended improvements identified in this report are based on the assumption that development and/or potential annexation will occur in a certain manner. If future growth or development patterns change significantly from those assumed and documented in this report, the recommendations may need to be revised. The status of development should be reviewed at least every five years. This report and the associated recommendations should also be updated every five years.

SCOPE OF SERVICES

The general scope of this project involved a thorough analysis of City's storm drain system and its ability to meet the present and future storm drain needs of its residents. As part of this project, BC&A completed the following tasks:

Task 5: Establish appropriate rainfall depths for the hydrologic model for a storm with a 10% probability of occurring in any given year (10-yr Storm). The Farmer Fletcher storm distribution was used for master planning purposes to simulate a cloudburst type storm which is typical for storms along the Wasatch front. Import storm drain system infrastructure from the City's Geographic Information System (GIS) database into an Info SWMM software model. Develop a hydrologic computer model of the study area for land use conditions, using City zoning and land use information. Develop sub catchment boundaries for the use of this model. Develop parameters for these sub catchments. Insert detention basins with the associated stage storage curves.

Task 6: Modify Existing Conditions Hydraulic model (Task 5) for future conditions based on the City's zoning and land use information.

Task 7: Use model results to identify existing storm drain system deficiencies.

Task 8: Use model results to identify future storm drain system deficiencies.

Task 9: Use the results of the modeling tasks to develop a list of recommended storm drain trunkline and detention facility improvements that are needed to provide the desired level of service to the City.

Task 10: Prioritize recommended improvements in order to develop a detailed 10-year IFFP. Develop prioritized list of improvements beyond 10 years. Assist with notification requirements.

Task 11: Develop a user-friendly report that summarizes the results of the study, references clear, concise figures and tables, and documents the procedures that were used to develop the Storm Drain Master Plan.

This report is prepared as part of Task 11.

AUTHORIZATION

Layton contracted the services of BC&A to prepare this Storm Drain System Capital Facilities Plan in March of 2013. The facility plan study and associated report were completed in August 2016.

PROJECT STAFF

The project work was performed by the BC&A team members listed below. Team members' roles on the project are also listed. The project was completed in BC&A's Draper, Utah office. Questions may be addressed to Matt Stayner, Project Manager at (801) 495-2224.

Keith Larson	Principal-In-Charge
Matt Stayner	Project Manager
Nathan Wright	Project Engineer
Mike Hilbert	Word Processing

CHAPTER 2
EXISTING SYSTEM DESCRIPTION

SERVICE AREA

The City of Layton, which was first incorporated as a town in 1920, is located about 20 miles North of Salt Lake City. The topography of the majority of the City slopes from East to West and North to South towards the Great Salt Lake. Figure 2-1 shows the approximate planning extent of Layton along with the City's storm water collection system components.

STORM DRAINAGE PIPES

Table 2-1 lists the recorded length of existing pipe in the City's storm drain system as documented in the City's GIS as of May 2014. Trunklines consisted of pipes with a minimum diameter of 15 inches that had a total length of 313,494 feet.

Table 2-1
Layton Storm Drain Pipe Lengths

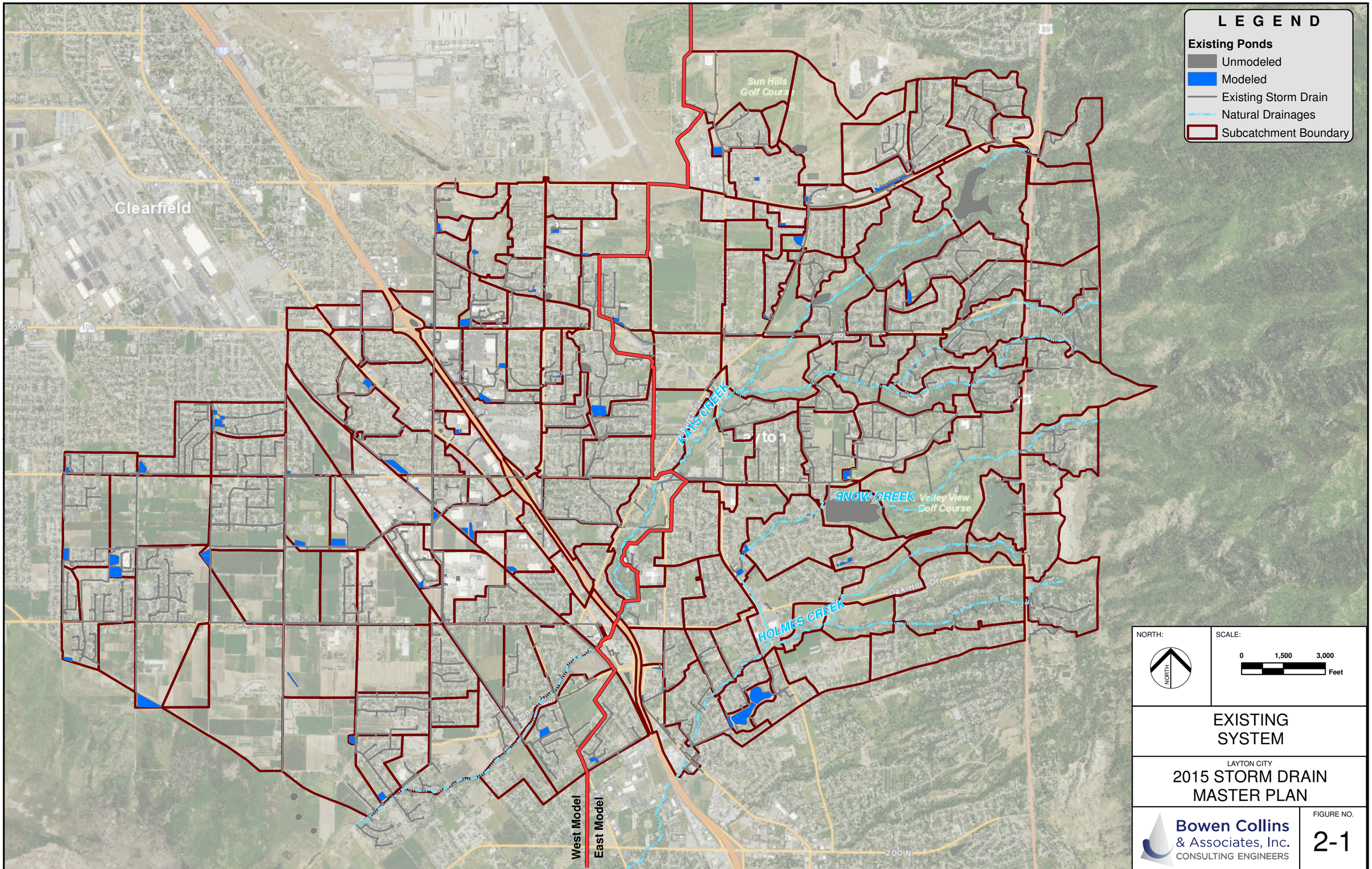
Diameter (in)	Length (ft)	Length (mi)
<12"	20,505	3.9
12"-17"	346,986	65.7
18"-23"	98,870	18.7
24"-29"	78,241	14.8
30"-35"	47,875	9.1
36"-41"	56,606	10.7
42"-47"	12,338	2.3
48"	14,367	2.7
>48"	1,260	0.2
Total	**677,048**	**128.2**

DETENTION BASINS

There are over 130 detention facilities in the existing storm drain system. The majority of these detention facilities are local detention basins and were not modeled in this study. The primary purpose of the detention facilities is to attenuate peak storm water discharges. Many of the detention facilities serve the dual purpose of a recreational park. Figure 2-1 shows the existing detention facilities included in the InfoSWMM model.

CREEKS

There are 7 natural creeks in Layton City that convey storm water runoff from the Wasatch mountains to the Great Salt Lake, including Kays Creek, Middle Fork Kays Creek, North Fork Kays Creek, South Fork Kays Creek, Holmes Creek, North Fork Holmes Creek, and Snow Creek.



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The capacity of the creeks has been evaluated by FEMA for the 100-year storm runoff event. See the FEMA Flood Insurance Study for Davis County for details. The purpose of this study was to evaluate the capacity of the local storm drain facilities in the 10-year event. Therefore, it was assumed the creeks have adequate capacity for the local storm drain in the 10-year storm event, and there are no backwater effects from the creeks on the local storm drain.

CHAPTER 3
HYDROLOGIC ANALYSIS

Layton City was divided into two hydrologic study areas for the purposes of this master plan update, an East Study area and a West Study area. A hydrologic computer model was developed for both study areas in InfoSWMM, Suite 12.0, for the purpose of estimating storm water runoff volume and peak discharges generated by a design cloudburst event. InfoSWMM uses an Environmental Protection Agency Storm Water Management Model (EPA-SWMM) engine to perform computations. As with EPA-SWMM, InfoSWMM has the capability to model the hydrologic and hydraulic components of storm water runoff, and was used to model both in this study. See Chapter 4 for a description of the hydraulic modeling.

The model development process includes delineating drainage basins, estimating hydrologic parameters, developing a design storm and calibrating the model. Each one of these steps is described below.

DRAINAGE BASIN DELINEATION

The first step in developing a computer hydrologic model is to delineate drainage basins and subcatchments. Two InfoSWMM models were develop for this study – an East Study Area and a West Study Area (See Figure 3-1). Layton City provided BC&A with 674 subcatchments which were combined into 191 larger subcatchments which were included in the models. Subcatchment boundaries associated with the hydrologic models are shown in Figure 3-1.

HYDROLOGIC MODEL PARAMETERS

The following hydrologic model parameters were used to develop the InfoSWMM computer model.

Hydrology Method

In the InfoSWMM software there are multiple options for Hydrology Method. The EPA-SWMM non-linear reservoir method was used in this study. The EPA-SWMM non-linear reservoir method is the same method EPA-SWMM uses. This method requires "subcatchment width" and slope as input parameters. The subcatchment width was calculated using one of InfoSWMM's built in functions:

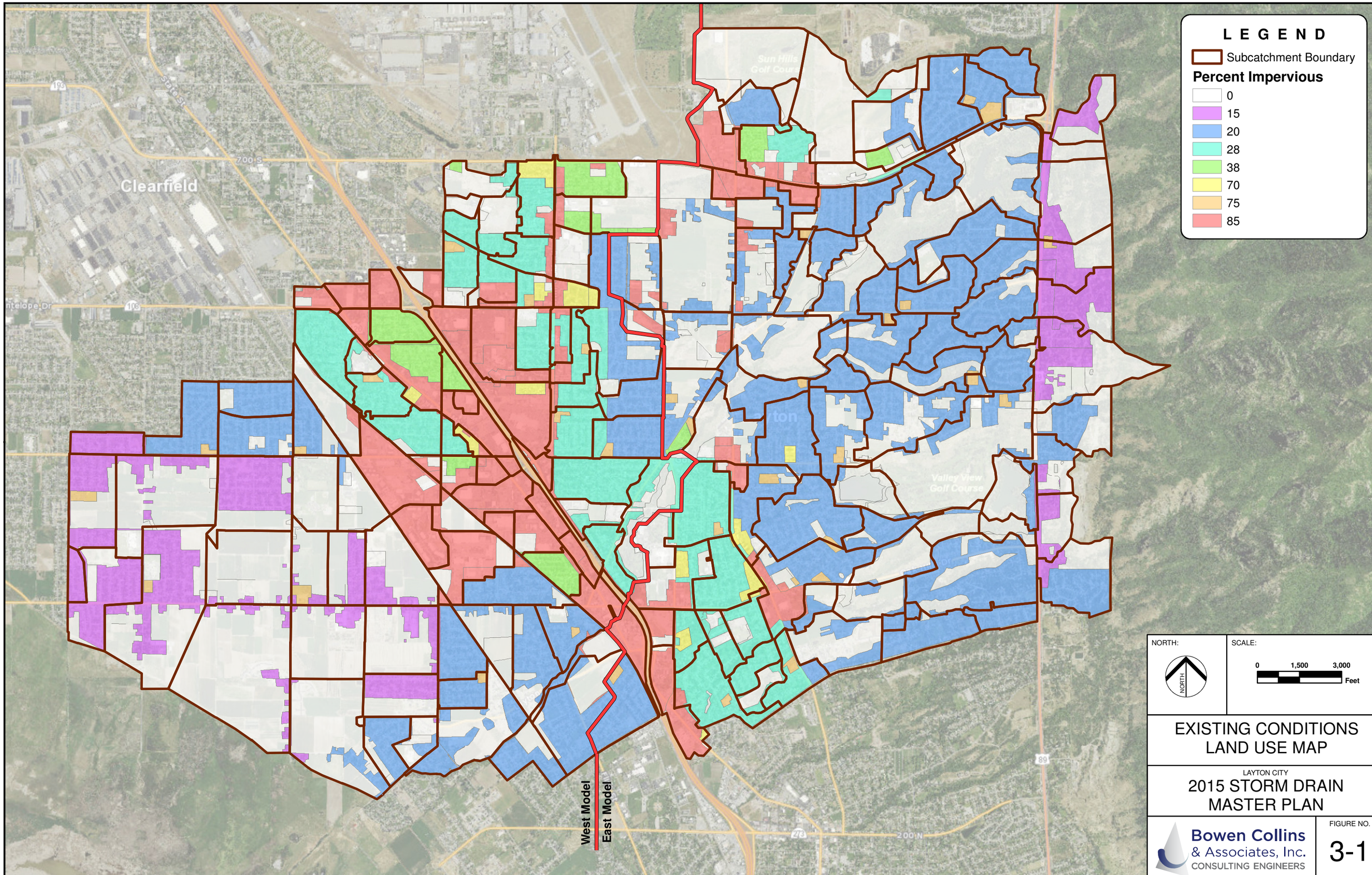
$$W = k * \text{Area}^{0.5}$$

Where:

W – Subcatchment Width

k – Coefficient

Area – Area (acres)



EXISTING CONDITIONS
LAND USE MAP

LAYTON CITY
2015 STORM DRAIN
MASTER PLAN

Bowen Collins
& Associates, Inc.
CONSULTING ENGINEERS

FIGURE NO.
3-1

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Several values of *k* were use throughout the City. See "Model Calibration" on page 3-4 for additional information.

Loss Method

The SCS Curve Number method was used in InfoSWMM to calculate infiltration losses (see Natural Resources Conservation Service (NRCS) TR-55 publication for additional information). This method requires the input of a composite Curve Number and the percent impervious for each subcatchment.

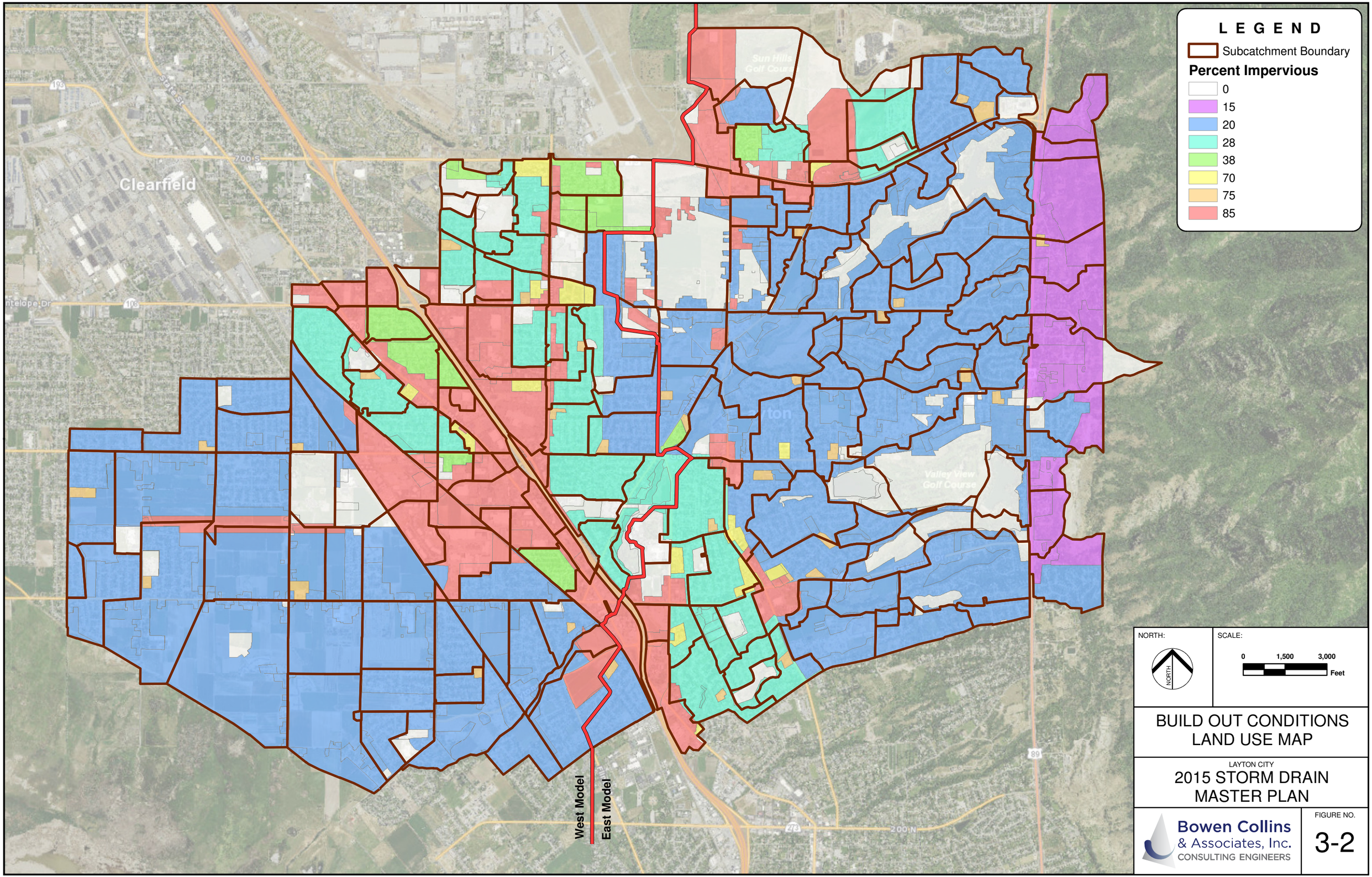
Composite Curve Number. Curve Numbers were estimated for each subcatchment based on soil type and vegetative ground cover. The hydrologic soil type was obtained from the NRCS Soil Survey Geographic (SSURGO) dataset. Table 3-1 shows the Curve Numbers used in this study based on soil type and as assumed vegetative ground cover for developed areas. Figure A-2 shows the different soil types used for Layton City.

Table 3-1
SCS Curve Number

Soil Type	Curve Number*
A	39
B	61
C	74
D	80

* From Table 2-2 in TR-55 "Open Space – Grass Cover 75%"

Directly-Connected Impervious Area. The amount of directly-connected impervious area for existing conditions was estimated using the 2012 High Resolution Orthophotography (HRO). Each Land Use type was analyzed and the estimated impervious area was recorded. The amount of directly-connected impervious area was also estimated for full build-out conditions based on land use from the General Plan. For areas that are currently undeveloped, the General Plan was used in conjunction with Table 3-2 to estimate the impervious area. See Figures 3-1 and 3-2 for existing and future Land Use for Layton City.



BUILD OUT CONDITIONS
LAND USE MAP

LAYTON CITY
2015 STORM DRAIN
MASTER PLAN

Bowen Collins
& Associates, Inc.
CONSULTING ENGINEERS

FIGURE NO.
3-2

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Table 3-2
Average Imperviousness Based on Land Use

General Plan Land Use Type	Directly Connected Impervious Area (DCIA) (Percent)
Open Space\Public Facilities	0
Low Density 0-3 Units	15-20
Low Density 2-4 Units	20
Low Density 3-6 Units	28
Medium Density 6-12 Units	38
Medium Density 8-16 Units	38
High Density Over 16 Units	70
Church	75
Business\Research Park	85
Commercial	85
Manufacturing	85
Mixed Use	85
MU-TOD	85
Professional Business	85

Slope. The slope for each subcatchment was calculated using 2' contour data provided by Layton City. The average slope for each subcatchment was calculated using tools within InfoSWMM. Average subcatchment slopes ranged throughout the city from 0.9% to 39%.

DESIGN STORM PARAMETERS

As the storm depth for the city changed from the East to the West, two storm depths were used. The parameters for the design storm are described below:

- Storm Duration:
  - Storm Drain Pipelines: 3-Hour
  - Detention Basins: 6-Hour
- Storm Distribution:
  - Storm Drain Pipelines: Modified Farmer and Fletcher
  - Detention Basins: NOAA Atlas 14
- Recurrence Interval:
  - Storm Drain Pipelines: 10-Year Storm
  - Detention Basins: 100-Year Storm

- Storm Depth (From NOAA Atlas 14):

10-Year:	1.26	inches (West)
10-Year:	1.39	inches (East)
100-Year:	2.48	inches (West)
100-Year:	2.73	inches (East)

Model Calibration

The final step in the hydrologic modeling process is model calibration. In general, calibration of a hydrologic model of an urban area refers to the process of adjusting parameters to achieve results consistent with available reference information in nearby areas rather than adjusting for actual measured discharge observations in the study area.

Calibration Target Range

A study was performed in 1989 by the U.S. Geological Survey, to help understand typical discharges for urban drainages along the Wasatch Front. The study was printed as the Water-Resources Investigations Report 89-4095 entitled, "Peak-Flow Characteristics of Small Urban Drainages along the Wasatch Front Utah". This report was used as a basis for estimating reasonable unit discharges for the subcatchments of Layton City and can be found in Appendix C.

Subcatchment Width

The subcatchment width is the theoretical width of the overland flow. For the purpose of this report the subcatchment width was calculated using the following methods to get reasonable unit discharges. The values used for k were to help calibrate the model based on the report stated above. Figure 3-3 shows the uncalibrated model results for each subcatchment modeled. Figure 3-4 shows the calibrated model having adjusted the subcatchment width for impervious areas greater than 60 percent.

- Lower impervious areas (DCIA less than 60): $k = 0.2$
- Higher impervious areas (DCIA greater than 60): $k = 0.45$

Figure 3-3: Uncalibrated Model Results

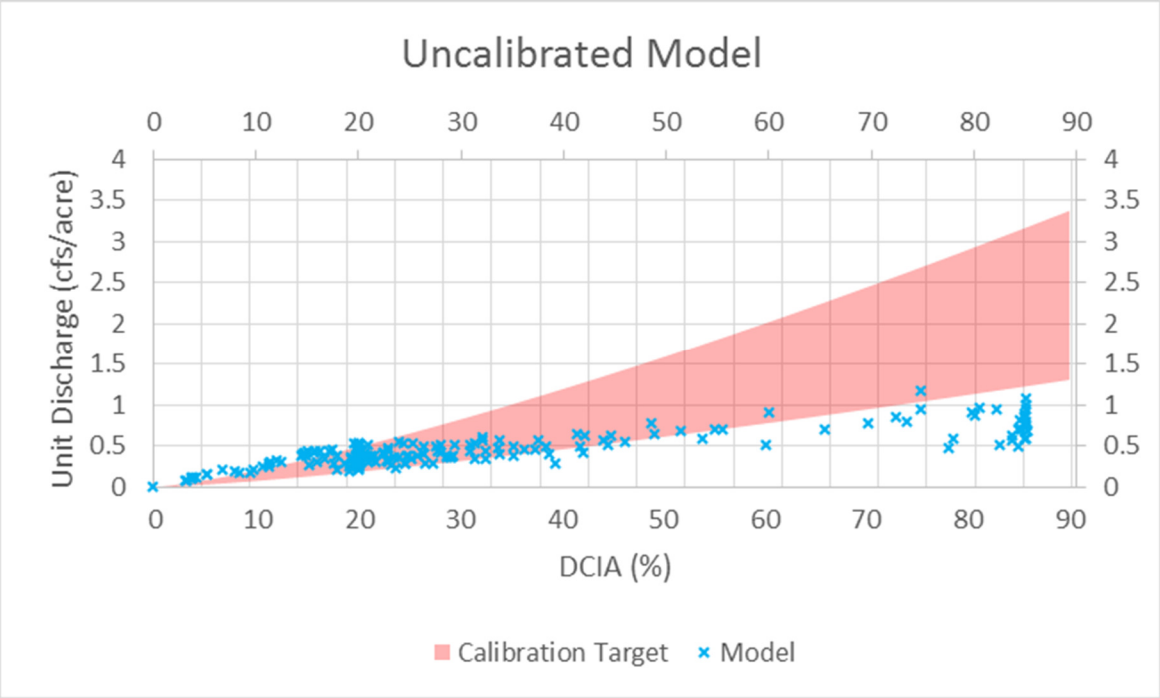
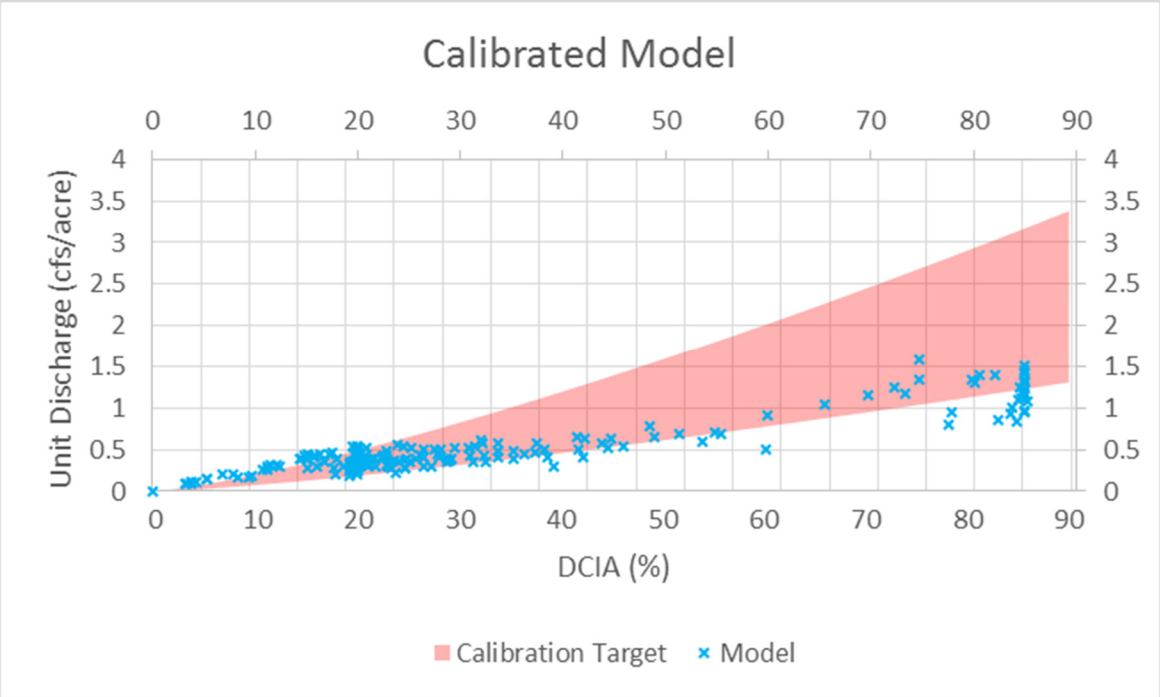


Figure 3-4: Calibrated Model Results



HYDROLOGIC MODELING ASSUMPTIONS

The following assumptions were also made in completing the hydrologic analyses of the study area:

1. Rainfall return frequency is equal to associated runoff return frequency.
2. Design storm rainfall has a uniform spatial distribution over the watershed.
3. Normal (SCS Type II) antecedent soil moisture conditions exist at the beginning of the design storm.
4. The hydrologic computer model adequately simulates watershed response to precipitation.
5. Hydrologic parameters for non-developable areas were assumed to have normal mid-summer vegetation cover, free from recent fire damage.
6. Runoff produced by the 10-yr storm event can collect in each detention basin and eventually flow into the City Facilities.

Existing Inlet Capacity Issues

The collective assumption was made that there are enough existing storm drain inlets in each subcatchment to collect runoff from a 10-year design storm event. In areas where ponding or flooding occurs, the inlet capacity should be evaluated and additional inlets should be added if necessary.

CHAPTER 4
HYDRAULIC MODELING

A hydraulic computer model of the study area was developed in InfoSWMM for the purpose of routing storm water runoff and estimating the capacity of the existing storm drain facilities. InfoSWMM uses an EPA-SWMM engine to perform hydraulic computations. As with EPA-SWMM, InfoSWMM can be used to model the hydrologic and hydraulic components of the study. See Chapter 3 for a description of the hydrologic modeling.

GEOMETRIC MODEL DEVELOPMENT

There are two major types of data required to create a hydraulic model of a storm drain system: geometric data and flow data. Geometric data consists of all information in the model needed to represent the physical characteristics of the system, including pipelines, open channels and detention basins. Flow data is part of the hydrologic analysis reported in Chapter 3.

Modeled Pipelines

It was not economically feasible to model all of the storm drain pipes in Layton City's system. As smaller pipes are added to the model, the more refined the analysis becomes, but this requires additional time, effort, and expense. Hence, it is important to consider the required accuracy and available budget when selecting the storm drain pipes to model. This analysis has correspondingly been limited to the major trunk lines in the City servicing multiple developments. Project level improvements serving single developments have not been included at this time.

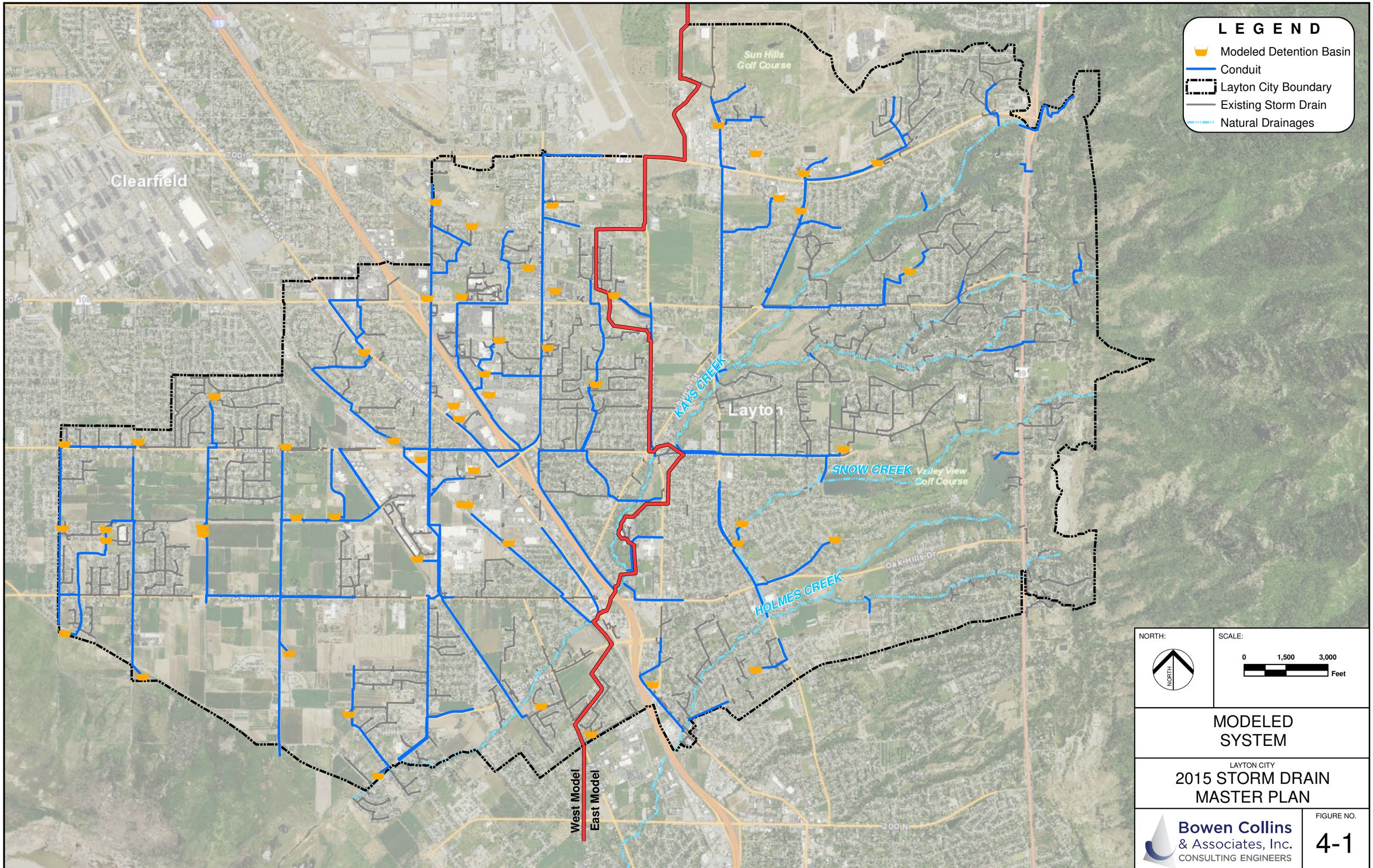
Information on the physical characteristics of the pipes included in the model was collected and assembled by Layton City personnel. A basic framework for the model was developed using Layton's GIS records. The City's GIS database included information on the diameter, length, material, and location of each pipe included in the model. Rim elevations were collected by a City survey crew. Inverts based on measure downs were included as well.

Creeks

Creeks in Layton City were evaluated by FEMA in a separate study. As stated in Chapter 2 creeks were assumed to cause no backwater in the storm drain system.

Detention Basins

Stage-storage curves were provided by City personnel for the detention basins and were entered into the model. Orifice information, including size, location, or lack thereof, was provided by the City, and was included in the existing conditions model. If a detention facility does not currently have an orifice, it is recommended that a flow control gate be installed to regulate flow. Therefore, an outlet or an orifice was included on all detention facilities in the future conditions model. Future detention basins were modeled with a synthetic stage storage curve and an outlet that released the appropriate flow rate. Figure 4-1 presents the modeled existing detention basins.



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Detention facilities are either local or regional. For the most part Layton City detains flows using regional detention facilities. In conversations with Layton City personnel it was determined that non single family residential development having high impervious areas would be detained to 0.2 cfs/acre. This would include all commercial, industrial, and high density residential developments. Requiring detention for development with high impervious areas leads to a similar peak runoff per acre of development.

Profiles

Profiles for each existing trunkline were examined for unusual data (ie adverse slopes, diameter contractions, etc.) and any areas identified as concerns were field verified by City personnel. Updated data was provided by City personnel and entered into the model.

CHAPTER 5
SYSTEM EVALUATION

With the development and calibration of a hydraulic storm drain model, it is possible to simulate storm drain system operating conditions for both existing and future conditions. The purpose of this chapter is to document the hydraulic performance evaluation of the collection system and identify potential hydraulic deficiencies.

EVALUATION CRITERIA AND LEVEL OF SERVICE

To define deficiencies in the system, the desired level of service for each of the storm drain components needs to be defined.

Storm Drain Conveyance Facilities

Storm drain conveyance facilities are generally designed to convey the 10-year storm event without flooding. Future storm drain pipes are also not to be smaller than 15 inches in diameter. In the event that storm water discharge is greater than the 10-year event, an overflow should be designed to convey flows to a major conveyance such as the roadway or major drainage channel.

Detention Basins

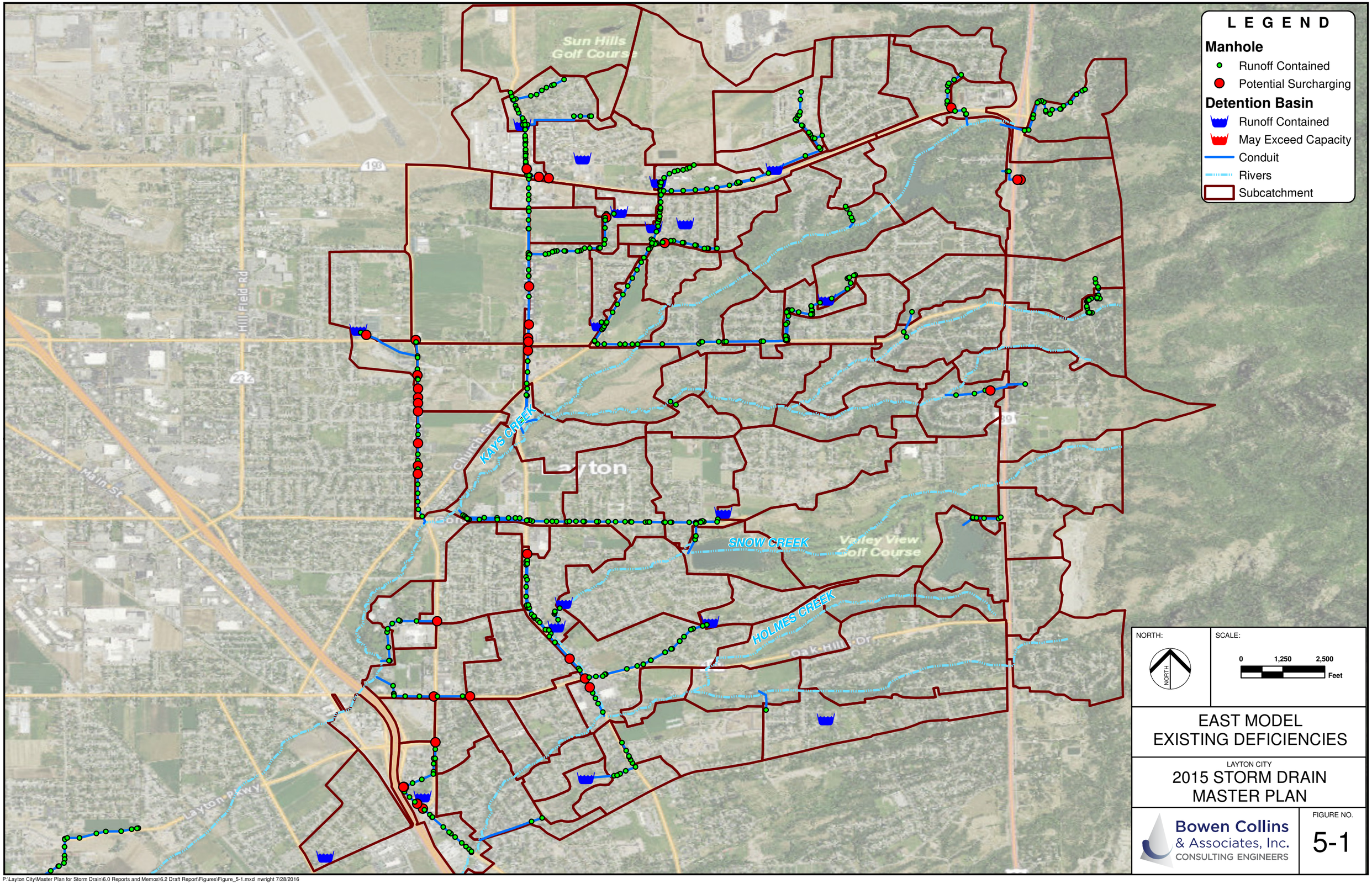
Detention facilities should be designed to have capacity for the 100-year design storm event, and have an emergency overflow that directs water away from private property in an event larger than the design storm. Typically the overflow will convey flows to the streets or another major drainage channel.

EXISTING CONVEYANCE SYSTEM ANALYSIS

Figures 5-1 and 5-2 show the deficiencies in the storm drain system under existing development conditions. As can be seen from the Figures, both detention basins and trunklines were found to be deficient throughout the city. Significant deficiencies are especially apparent in the downtown area.

FUTURE CONVEYANCE SYSTEM ANALYSIS

A few of the existing storm drain collection trunks in Layton are undersized for ultimate development conditions. Additional trunks will need to be constructed in order to resolve these problems. Also, there are several detention basins that need to be added/modified. Chapter 6 discusses conceptual improvements that will be needed to serve the growing areas of Layton.



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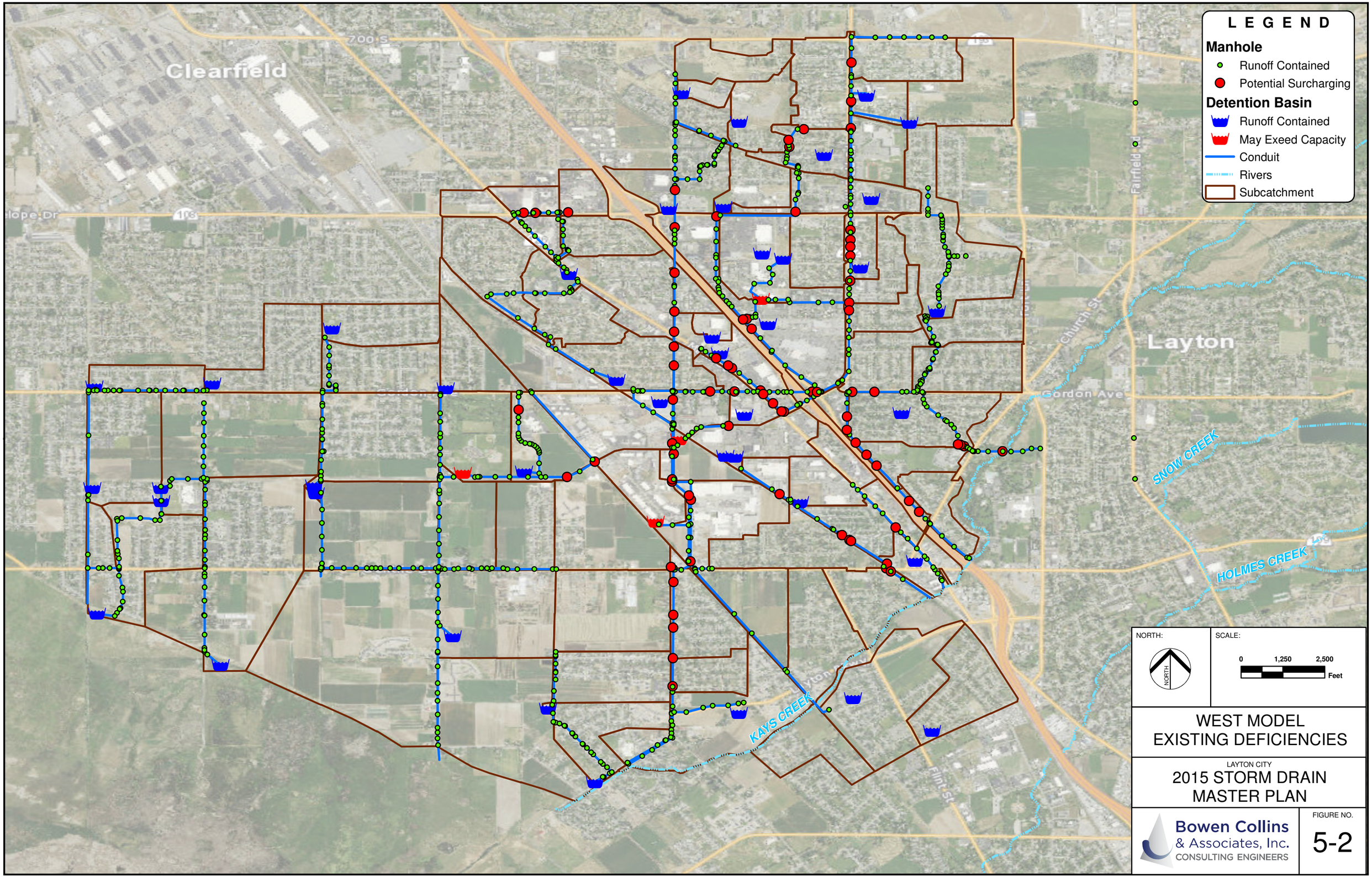

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CHAPTER 6
RECOMMENDED SYSTEM IMPROVEMENTS

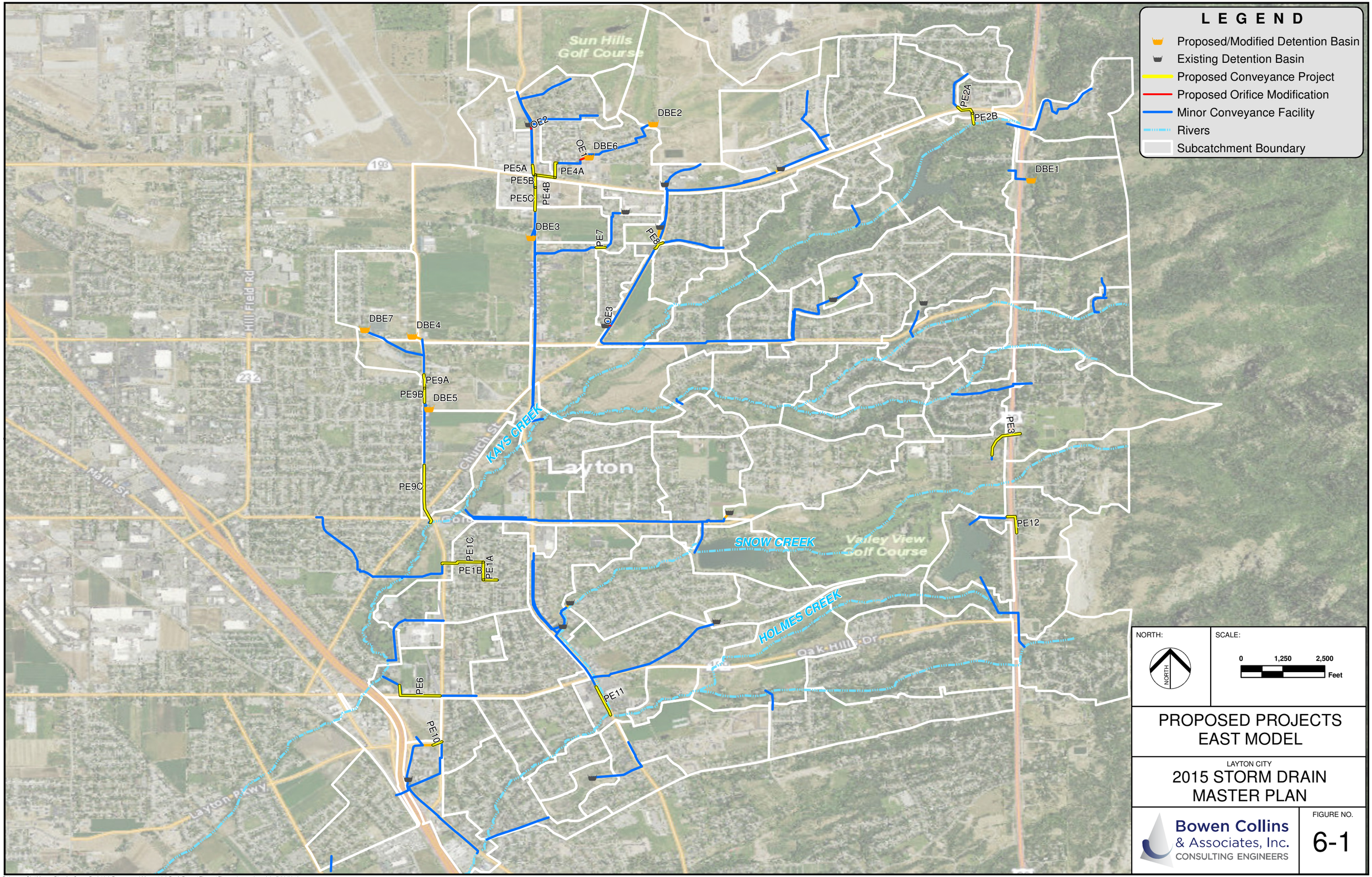
The InfoSWMM model was used to evaluate various alternatives for mitigating the identified existing deficiencies and sizing future storm drain facilities under projected future development conditions. This chapter describes the storm drain improvements, based on estimated runoff and ground slopes.

RECOMMENDED PIPELINE IMPROVEMENTS

Figures 6-1 and 6-2 shows the location of recommended pipeline improvements that are needed to meet future growth in Layton. Table 6-1 summarizes the cost of the proposed pipe improvements in 2015 dollars.

Table 6-1
Storm Drain Trunkline Improvements

Project ID	Project Location	Total Estimated Cost	Future 10-Year Flow/ Release Rate (cfs)	Size (in)	Description
PE1A	Kirk St. and Valeria Dr.	$65,200	6.5	18	New 18" to convey North 60% of Lay27
PE1B	Valeria Dr. and Kingston Ave.	$116,700	10.5	24	New 24" to convey North 60% of Lay27
PE1C	Marva Ave. and Fort Ln.	$290,800	25	36	New 36" to convey North 60% of Lay27
PE2A	~2650 E and Highway 193	$134,100	67	36	Upsize 24" to 36" pipe. Fix adverse section of Pipe
PE2B	~2650 E and Highway 193	$111,900	67	42	Upsize 30" to 42" pipe.
PE3	Highway 89 & 1500 N	$231,100	24	24	New 24" Pipe with UDOT expansion of Highway 89.
PE4A	Quail Ridge Rd. and Highway 193	$206,000	21	24	Upsize 15" to 24" Pipe and adjust orifice plate from 24" to 12" at 900 E 3000 N Pond
PE4B			28		
PE5A	Fairfield Road and Hwy. 193	$84,300	43	30	Parallel 30" + flow in existing pipe = 54 cfs
PE5B	Fairfield Road and Hwy 193	$106,600	49	36	Parallel 36" + flow in existing pipe = 80 cfs
PE5C	Fairfield Road and ~2800 N	$177,700	33	30	Parallel 30" + flow in existing pipe = 121 cfs
PE6	Gentile St. and Wasatch Dr.	$309,800	28	30	Parallel 30" + flow in existing pipe =78 cfs
PE7	1100 E 2525 N	$40,600	9	18	Parallel 18" + flow in existing pipe = 17 cfs
PE8	2550 N & Church St.	$55,700	24	24	Parallel 24" + flow in existing pipe = 34 cfs. Fix flat slopes.
PE9A	1800 N & Fort Ln.	$91,700	25	24	Upsize 18" to 24" Pipe
PE9B	1625 N & Fort Ln.	$110,800	61	30	Upsize 18" to 30" Pipe
PE9C	1150 N & Fort Ln.	$389,600	30	24	Parallel 24" + flow in existing pipe = 44 cfs. Limit flows in existing Pipe to 14 cfs for downstream capacity limitations



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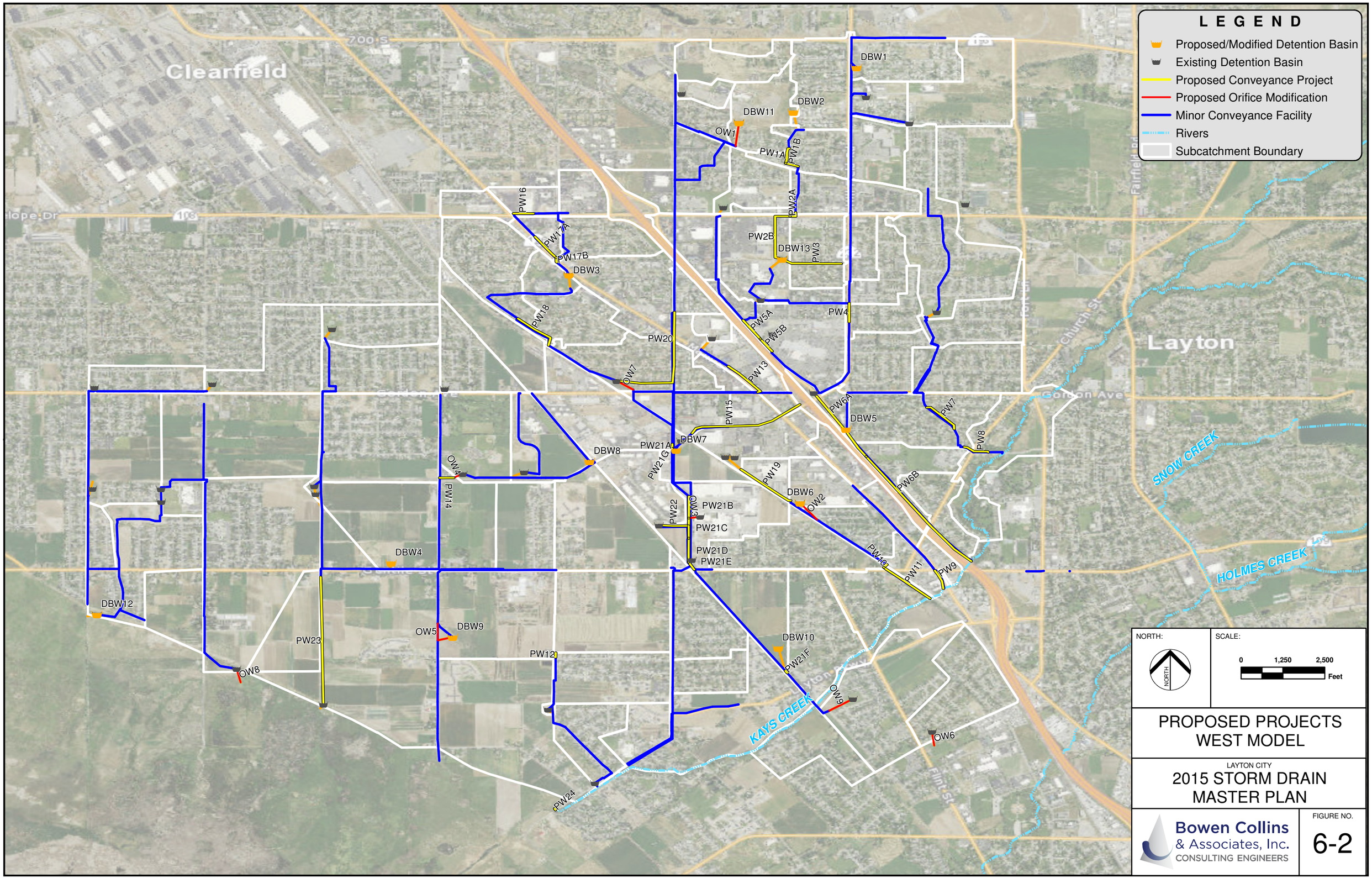

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Project ID	Project Location	Total Estimated Cost	Future 10-Year Flow/ Release Rate (cfs)	Size (in)	Description
PE10	Fort Ln and Main St.	$68,000	13	24	New 24" inlet to detention basin plus outlet to west having a 9" orifice. Redirect water from North to DB.
PE11	Fairfield Rd. & 200 S	$404,100	106	54	Upsize 36" to 54" Pipe
PE12	Highway 89 & 1000 N	$147,000	25	24	New 24" Pipe with UDOT expansion of Highway 89.
PW1A	675 W 2325 N	$117,400	35	30	Upsize 18" to 30"
PW1B	675 W 2325 N	$70,100	18	27	Parallel 27" + flow in existing pipe = 35 cfs
PW2A	650 W & Antelope Dr.	$54,800	31	27	Parallel 27" + flow in existing pipe = 62 cfs. Disconnect pipe to West to force flows south to Detention Pond
PW2B	700 W & Antelope Dr.	$422,100	62	30	New 30" to take flows South to Detention Pond
PW3	Paul Ave. & Forbes Ave	$289,600	17	24	New 24" to convey North section of Lay47 to Detention Pond
PW4	Hill Field Road & 1400 N	$209,100	107	48	Upsize 36" to 48" Pipe & install weir on line to west to keep flows in Hill Field
PW5A	Ring Road	$189,500	38	36	Upsize 24" to 36"
PW5B	Ring Road	$128,700	60	36	Upsize 24" to 36"
PW6A	Hill Field Rd to Bamberger Trail	$424,000	100	48	New 48" to convey flows from Hill Field Interchange
PW6B	Bamberger Trail to Kays Creek	$751,250	100	48	New Parallel 48" to convey flows from Hill Field Interchange. Connect to Parallel line to relieve flooding caused by future flows.
PW7	Hill Blvd & Diamond St.	$201,500	17	24	New Parallel 24" + flow in existing pipe = 34 cfs
PW8	Golden Ave. & Church St.	$169,200	32	36	New Parallel 36" + flow in existing pipe = 54 cfs
PW9	Main St. & Gentile St.	$148,700	35	30	Parallel 30" + flow in existing pipe = 74 cfs
PW10	Grove St. & Trax	$158,400	17	30	Parallel 30" + flow in existing pipe = 34 cfs. Jack and Bore under Trax.
PW11	Gentile St. & Trax	$368,800	28	36	Parallel 36" + flow in existing pipe = 34 cfs. Limit flows in existing pipe to 6 cfs.
PW12	500 S 1700 W	$39,000	36	36	Upsize 27" to 36" Pipe
PW13	Main St. & 1100 N	$231,000	18	24	Parallel 24" + flow in existing pipe = 34 cfs
PW14	2200 West & Hill Field Rd.	$78,700	17	36	Upsize 15" to 36" Pipe
PW15	Hill Field Rd West of Interchange	$573,200	13	24	New 24" Line to convey runoff from Hill Field Interchange to Deseret Industries where a parallel existing 21" pipeline begins. The combined flow = 30 cfs.
PW16	Antelope Dr. & Main St.	$126,100	15	30	Parallel 30" + flow in existing pipe = 26 cfs

Project ID	Project Location	Total Estimated Cost	Future 10-Year Flow/ Release Rate (cfs)	Size (in)	Description
PW17A	Main St. & Camelot Dr.	$163,300	20	24	Parallel 24" + flow in existing Pipe =58 cfs
PW17B	Main St. & Camelot Dr.	$36,500	40	30	Parallel 30" + flow in existing Pipe = 70 cfs
PW18	Celia Way & 1375 N	$242,100	15	24	Parallel 24" + Flow in existing pipe = 46
PW19	500 N & Trax	$306,200	11	24	Upsize 18" to 24" Pipe
PW20	Angel St. & Main St.	$1,007,300	96	42	Parallel 42" + flow in existing pipe = 113 cfs (Max Release into Hill Field Line should be 17 cfs) Route through Greenleaf Pond.
PW21A	Angel St. & Hill Field	$27,600	22	24	Parallel 24" + flow in existing pipe = 59 cfs (Additional 17 cfs in Hill Field Line)
PW21B	Sugar St. & 300 N	$159,600	26	30	Parallel 30" + flow in existing pipe = 39 cfs (Additional 17 cfs in Hill Field Line
PW21C	Sugar St. & 250 N	$148,700	47	30	Parallel 30" + flow in existing pipe = 61 cfs (Additional 17 cfs in Hill Field Line)
PW21D	Sugar St. & 100 N	$232,800	63	42	Parallel 42" + flow in existing pipe = 82 cfs (Additional 17 cfs in Hill Field Line)
PW21E	Sugar St. & Gentile St. (A)	$95,000	56	48	Parallel 48" + flow in existing pipe = 83 cfs
PW21F	Rail Trail & Weaver Ln.	$31,700	48	48	Parallel 48" + flow in existing pipe = 95 cfs
PW21G	Angel St. & Hill Field	$33,500	56	42	New 42" Line to connect to future Pond
PW22	Wolf Peak Pond Outlet	$220,000	10	24	Parallel 24" + flow in existing pipe = 23 cfs
PW23	2700 W & Gentile Rd.	$1,250,400	95	42	Replace 2700 West channel with new 42" pipe as part of roadway improvements.
PW24	Weaver Ln. & Kays Creek	$196,700	750*	6 x 20	Replace existing culvert with 6'x20' box culvert
	TRUNKLINE TOTAL	**$12,044,250**			

* Flow rate pending approval from Flood Control Authority.

DETENTION FACILITY IMPROVEMENTS

Figures 6-1 and 6-2 shows the location of recommended detention basin improvements that are needed to meet future growth in Layton. Table 6-2 lists the recommended detention volumes and costs for detention facilities in Layton. It also lists any needed inlet/outlet modifications.

Table 6-2
Detention Facility Improvements

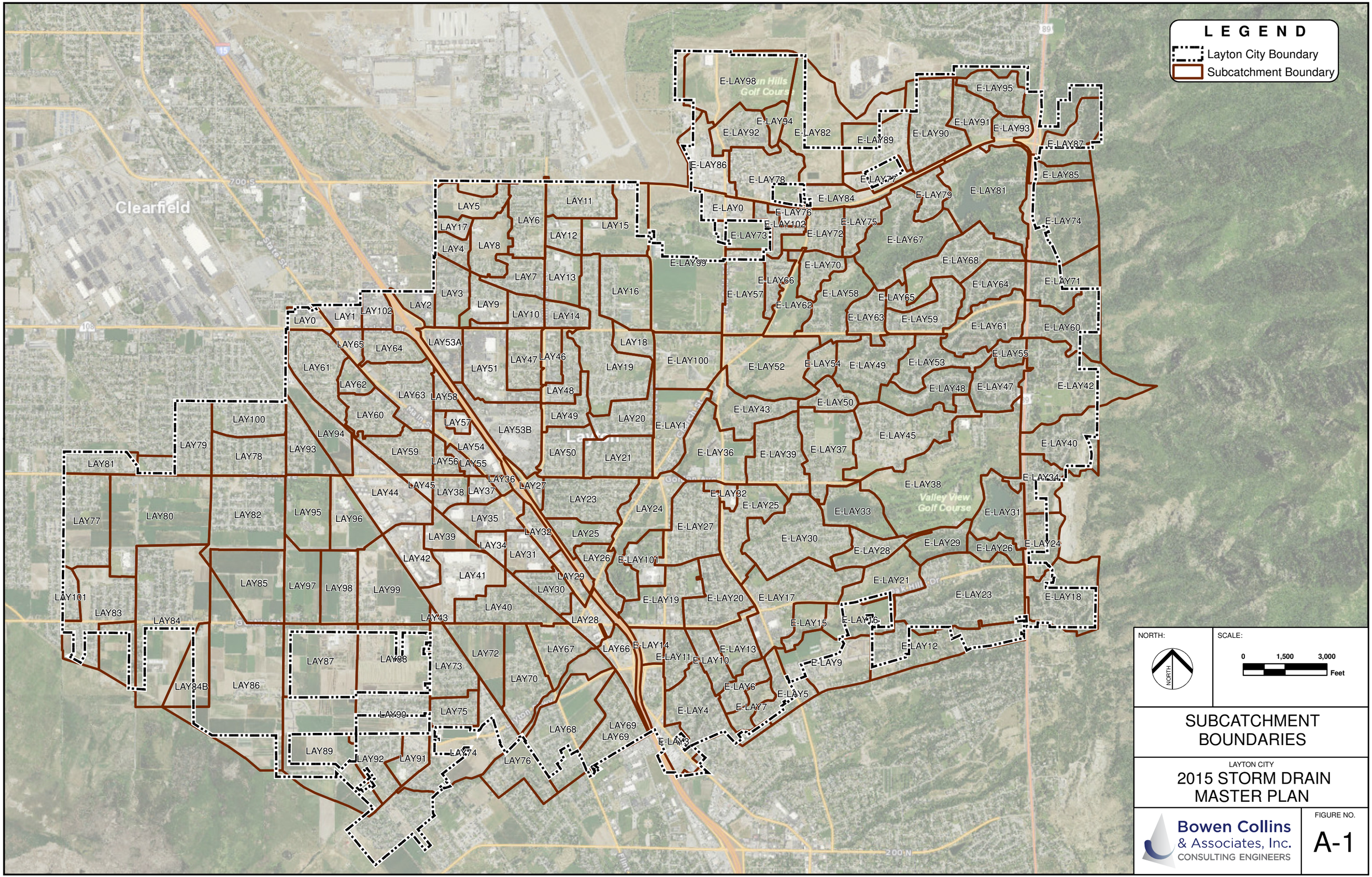
Project ID	Project Location	Total Estimated Cost	Future 100-Year Flow/Release Rate (cfs)	Size (AF)	Description
DBE1	2900 N & Hwy 89	$228,100	11	1.5	New Detention Pond
DBE2	3150 N & 1350 E	$1,343,200	5	11.8	New Detention Pond
DBE3	Love Ln. & Fairfield Rd.	$668,900	35	5.7	New Detention Pond Release = 35 cfs, low flow = 26 cfs , parallel pipe = 15 cfs
DBE4	Antelope Dr. & Fort Ln.	$331,900	7	2.7	New Detention Pond
DBE5	Fort Ln. & 1625 N	$902,400	14.5	7.3	New Detention Pond Release = 14.5 cfs, low flow = 6 cfs
DBE6	3050 N &110 E	$79,300	8.5	1.6	Upsize Existing 2.5 AF Pond to 4.1 AF
DBE7	Antelope Dr. & 75 E	$51,800	8	0.5	Upsize Existing 1.3 AF Pond to 1.8 AF
DBW1	Hill Field Rd & 2800 N	$254,100	10.5	2.2	New Detention Pond
DBW2	650 W & 2600 N	$344,700	11	3.0	New Detention Pond
DBW3	Vae View Park Main St. & Ralph St.	$837,600	7.5	8.0	Upsize Existing Pond from 6.9 AF to 14.9 AF and reduce Orifice to 10"
DBW4	Gentile & 2450 W	$565,200	13.5	3.7	New Detention Pond
DBW5	400 W & Francis Ave	$137,200	7.5	0.9	New Detention Pond
DBW6	King St. & Railroad	$97,500	9.5	1.6	Upsize Existing Pond from 1.9 AF to 3.5 AF
DBW7	Hill Field Rd. and Sugar St.(South)	$1,256,400	21	16.3	New Detention Pond Release = 21 cfs, low flow = 5 cfs, parallel pipe = 12 cfs. Pond north of Hill Field Rd. to be hydraulically connected.
DBW8	Hill Field Rd & ~1600 W	$854,400	25	11.3	New Detention Pond
DBW9	2200 W 500 S	$720,900	10.5	6.8	Upsize Existing Pond from 1.5AF to 8.3 AF(See OW5 for flow rates)
DBW10	Weaver Ln. 650 W	$383,800	11	2.8	New Detention Pond
DBW11*	Weber State Pond	$-	4.5	0.9	Upsize existing 1.3 AF pond to 2.2 AF. Change orifice from 15” to 10”
DBW12	Bluff Rd Outfall	$111,300	16	1.9	Upsize Existing Pond from 1.2AF to 3.1 AF
DBW13	North Conference Pond	$248,300	4.5	6.6	Upsize Existing Pond from 7.8 AF to 14.4 AF
	DETENTION TOTAL	**$9,417,000**			

Project ID	Project Location	Total Estimated Cost	Future 100-Year Flow/Release Rate (cfs)	Size (in)	Description
OE1	3050 N & 1100 E	$19,200	8.5	12	Downsize from 24" to 12"
OE2	Fairfield Rd. & 3200 N	$19,200	8.5	12	Reduce Orifice size to 12" + low flow pipe = 13 cfs
OE3	2125 N & Church St.	$19,200	9.5	18	Upsize Outlet from 15" to 18"
OW1	Weber State Pond	$19,200	4.5	10	Downsize 15" to 10"
OW2	301 N & Trax	$19,200	9.5	24	Upsize 18" to 24"
OW3	Sugar St. and Marshall Way (Smiths)	$19,200	25	27	Connect Ponds to Layton Storm Drain Lines (Private)
OW4	2200 West & Hill Field Rd.	$19,200	27	36	Upsize 15" to 36"
OW5	2200 West & 400 S	$38,400	10.5	15	Pond release = 10 cfs, Low flow = 7 cfs.
OW6	Flint St. & Phillips St.	$19,200	8	15	Upsize 12" to 15"
OW7	Greenleaf Pond	$19,200	8.5	12	Downsize 24" to 12". Dredge pond to increase Capacity from 33 AF to 36.2 AF
OW8	3200 W & 600 S	$19,200	16.5	21	Upsize orifice from 18" to 21"
OW9	175 W & 700 S	$19,200	21	36	Upsize orifice from 24" to 36"
	ORIFICE TOTAL	**$249,600**			

* Weber State is responsible for upsizing the existing pond.

For a detailed cost estimate of each of the recommended improvements, see appendix B.

APPENDIX A
HYDROLOGIC DATA



SUBCATCHMENT BOUNDARIES

LAYTON CITY

2015 STORM DRAIN MASTER PLAN

Bowen Collins & Associates, Inc.
CONSULTING ENGINEERS

FIGURE NO.

A-1

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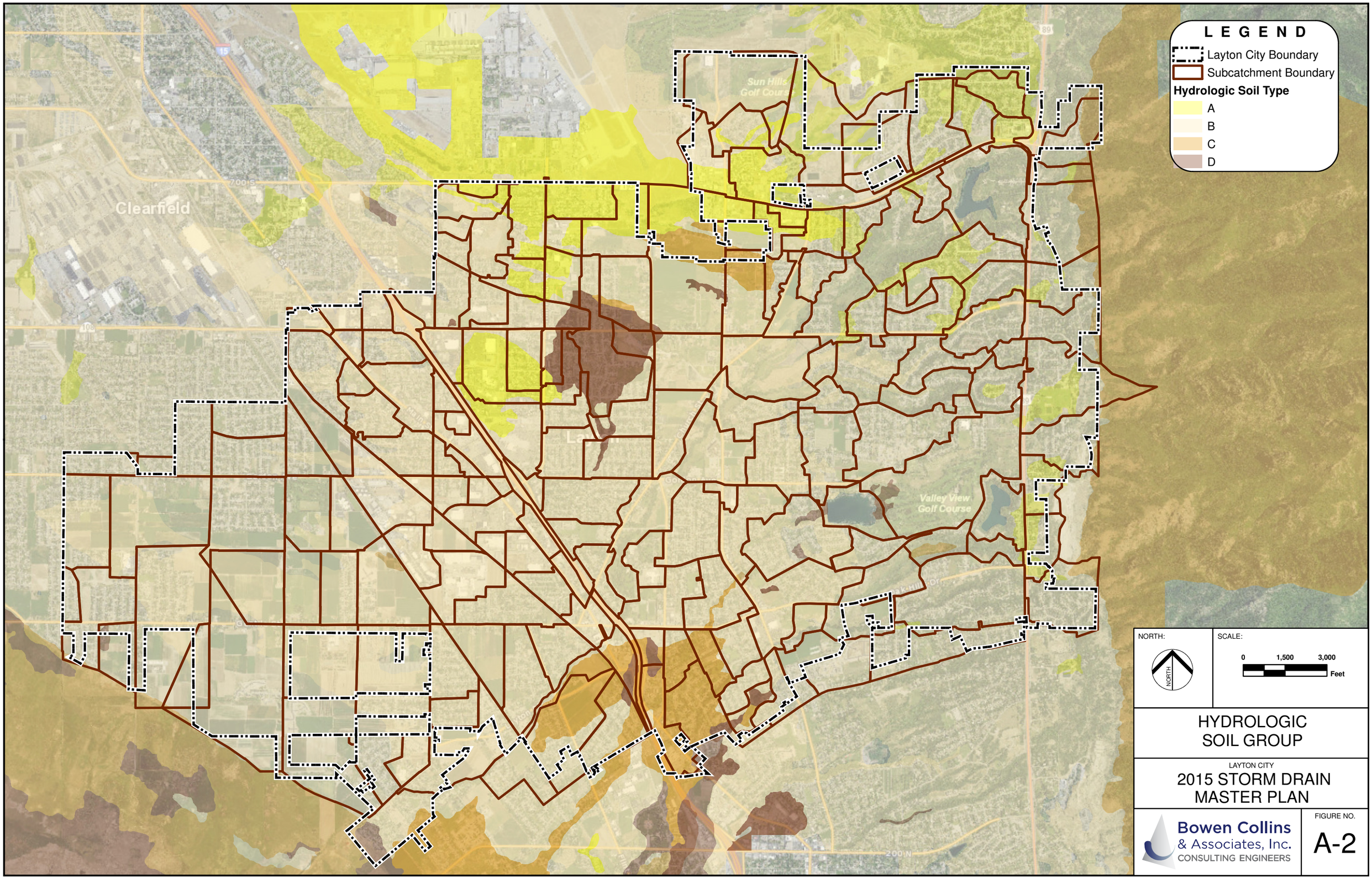

HYDROLOGIC SOIL GROUP

LAYTON CITY
2015 STORM DRAIN MASTER PLAN

Bowen Collins & Associates, Inc.
CONSULTING ENGINEERS

FIGURE NO.
A-2

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APPENDIX B
COST ESTIMATE

Table 1
Conceptual Cost Estimate Unit Cost Summary
Layton Storm Drainage Plan

Description	Unit	Size	Unit Cost
Detention Basins			
Property Acquisition	Acre		$140,000
Excavation and Hauling	Cubic Yard		$15
Landscaping (Non-irrigated Native)	Square Foot		$0.30
Landscaping (Irrigated Turfgrass)	Square Foot		$2.60
Inlet Apron	Lump Sum		$7,000
Outlet Structure	Lump Sum		$16,000
Emergency Spillway	Lump Sum		$5,000
Riprap	Lump Sum		$20,000
Storm Drain Pipelines			
Permanent Easement Acquisition	Acre		$70,000
18-inch RCP	Linear Foot	18	$95
24-inch RCP	Linear Foot	24	$105
27-inch RCP	Linear Foot	27	$120
30-inch RCP	Linear Foot	30	$130
36-inch RCP	Linear Foot	36	$155
42-inch RCP	Linear Foot	42	$190
48-inch RCP	Linear Foot	48	$230
54-inch RCP	Linear Foot	54	$265
60-inch RCP	Linear Foot	60	$300
66-inch RCP	Linear Foot	66	$335
72-inch RCP	Linear Foot	72	$380
78-inch RCP	Linear Foot	78	$440
84-inch RCP	Linear Foot	84	$495
90-inch RCP	Linear Foot	90	$550
96-inch RCP	Linear Foot	96	$600
Manhole	Each		$4,200
Catch Basin	Each		$3,000
Traffic Control	Linear Foot		$18
Storm Drain Culvert Road Crossings for Creeks and Washes			
Pipe Culvert	See RCP Storm Drain Costs Above		
3' X 6' Box Culvert (2-5 feet of cover)	Lump Sum		$60,000
Headwalls	Lump Sum		$4,800
Riprap	Lump Sum		$64,000
Traffic Control	Lump Sum		$5,300
Asphalt Road Repair	Linear Foot		(Pipe Diameter [in feet] + 5') * $7
Channel Construction			
Excavation and Hauling	Cubic Yard		$14
Landscaping (Non-irrigated Native)	Square Yard		$2
Riprap	Cubic Yard		$35
Other			
Mobilization/Traffic control	5%		5 Percent of Construction Cost
Contingency	10%		10 Percent of Construction Cost
Engineering, Legal, and Administration	10%		10 Percent of Construction Cost

Table 2
Conceptual Cost Estimate - Pipes
Layton Storm Drainage Capital Facility Plan

Project Identifier	Pipe Length (ft)	Diameter (in)	Catch Basin / Inlet Box (EA)	Junction Box / Manhole (EA)	Outlet Works (EA)	Subtotal Cost	Mobilization/Traffic control	Construction Cost Subtotal	Contingency (10%)	Engineering, Legal, Admin. (10%)	Estimated Project Cost (includes Contingency, Engineering, Admin, and Legal Fees)
PE1A	320	18	1	1	0	$ 52,160	$ 2,608	$ 54,768	$ 5,216	$ 5,216	$ 65,200
PE1B	540	24	2	1	0	$ 93,360	$ 4,668	$ 98,028	$ 9,336	$ 9,336	$ 116,700
PE1C	1000	36	3	3	0	$ 232,600	$ 11,630	$ 244,230	$ 23,260	$ 23,260	$ 290,800
PE2A	460	36	2	1	0	$ 107,260	$ 5,363	$ 112,623	$ 10,726	$ 10,726	$ 134,100
PE2B	330	42	1	1	0	$ 89,535	$ 4,477	$ 94,012	$ 8,954	$ 8,954	$ 111,900
PE3	1060	24	3	3	0	$ 184,840	$ 9,242	$ 194,082	$ 18,484	$ 18,484	$ 231,100
PE4	930	24	3	3	0	$ 164,820	$ 8,241	$ 173,061	$ 16,482	$ 16,482	$ 206,000
PE5A	330	30	1	1	0	$ 67,425	$ 3,371	$ 70,796	$ 6,743	$ 6,743	$ 84,300
PE5B	370	36	1	1	0	$ 85,270	$ 4,264	$ 89,534	$ 8,527	$ 8,527	$ 106,600
PE5C	700	30	2	2	0	$ 142,150	$ 7,108	$ 149,258	$ 14,215	$ 14,215	$ 177,700
PE6	1200	30	4	4	0	$ 247,800	$ 12,390	$ 260,190	$ 24,780	$ 24,780	$ 309,800
PE7	210	18	1	0	0	$ 32,505	$ 1,625	$ 34,130	$ 3,251	$ 3,251	$ 40,600
PE8	270	24	1	0	0	$ 44,580	$ 2,229	$ 46,809	$ 4,458	$ 4,458	$ 55,700
PE9A	410	24	2	1	0	$ 73,340	$ 3,667	$ 77,007	$ 7,334	$ 7,334	$ 91,700
PE9B	430	30	2	1	0	$ 88,675	$ 4,434	$ 93,109	$ 8,868	$ 8,868	$ 110,800
PE9C	1790	24	5	5	0	$ 311,660	$ 15,583	$ 327,243	$ 31,166	$ 31,166	$ 389,600
PE10	230	24	1	0	1	$ 54,420	$ 2,721	$ 57,141	$ 5,442	$ 5,442	$ 68,000
PE11	910	54	3	3	0	$ 323,265	$ 16,163	$ 339,428	$ 32,327	$ 32,327	$ 404,100
PE12	670	24	2	2	0	$ 117,580	$ 5,879	$ 123,459	$ 11,758	$ 11,758	$ 147,000
PW1A	480	30	2	1	0	$ 97,800	$ 4,890	$ 102,690	$ 9,780	$ 9,780	$ 117,400
PW1B	300	27	1	1	0	$ 58,425	$ 2,921	$ 61,346	$ 5,843	$ 5,843	$ 70,100
PW2A	250	27	1	0	0	$ 45,688	$ 2,284	$ 47,972	$ 4,569	$ 4,569	$ 54,800
PW2B	1730	30	5	5	0	$ 351,725	$ 17,586	$ 369,311	$ 35,173	$ 35,173	$ 422,100
PW3	1380	24	4	4	0	$ 241,320	$ 12,066	$ 253,386	$ 24,132	$ 24,132	$ 289,600
PW4	560	48	2	1	0	$ 174,280	$ 8,714	$ 182,994	$ 17,428	$ 17,428	$ 209,100
PW5A	680	36	2	2	0	$ 157,880	$ 7,894	$ 165,774	$ 15,788	$ 15,788	$ 189,500
PW5B	460	36	2	1	0	$ 107,260	$ 5,363	$ 112,623	$ 10,726	$ 10,726	$ 128,700
PW6A	2250	48	6	7	0	$ 706,650	$ 35,333	$ 741,983	$ 70,665	$ 70,665	$ 424,000
PW6B	3930	48	10	13	1	$ 1,252,090	$ 62,605	$ 1,314,695	$ 125,209	$ 125,209	$ 751,250
PW7	950	24	3	3	0	$ 167,900	$ 8,395	$ 176,295	$ 16,790	$ 16,790	$ 201,500
PW8	600	36	2	2	0	$ 141,000	$ 7,050	$ 148,050	$ 14,100	$ 14,100	$ 169,200
PW9	600	30	2	2	0	$ 123,900	$ 6,195	$ 130,095	$ 12,390	$ 12,390	$ 148,700
PW10	120	30	1	0	0	$ 132,000	$ 6,600	$ 138,600	$ 13,200	$ 13,200	$ 158,400
PW11	1320	36	4	4	0	$ 307,320	$ 15,366	$ 322,686	$ 30,732	$ 30,732	$ 368,800
PW12	140	36	1	0	0	$ 32,540	$ 1,627	$ 34,167	$ 3,254	$ 3,254	$ 39,000
PW13	1110	24	3	3	0	$ 192,540	$ 9,627	$ 202,167	$ 19,254	$ 19,254	$ 231,000
PW14	320	36	1	1	0	$ 65,600	$ 3,280	$ 68,880	$ 6,560	$ 6,560	$ 78,700
PW15	2720	24	7	9	0	$ 477,680	$ 23,884	$ 501,564	$ 47,768	$ 47,768	$ 573,200
PW16	520	30	2	1	0	$ 105,100	$ 5,255	$ 110,355	$ 10,510	$ 10,510	$ 126,100
PW17A	790	24	2	2	0	$ 136,060	$ 6,803	$ 142,863	$ 13,606	$ 13,606	$ 163,300
PW17B	150	30	1	0	0	$ 30,375	$ 1,519	$ 31,894	$ 3,038	$ 3,038	$ 36,500
PW18	1170	24	3	3	0	$ 201,780	$ 10,089	$ 211,869	$ 20,178	$ 20,178	$ 242,100
PW19	1470	24	4	4	0	$ 255,180	$ 12,759	$ 267,939	$ 25,518	$ 25,518	$ 306,200
PW20	3100	42	8	10	0	$ 839,450	$ 41,973	$ 881,423	$ 83,945	$ 83,945	$ 1,007,300
PW21A	130	24	1	0	0	$ 23,020	$ 1,151	$ 24,171	$ 2,302	$ 2,302	$ 27,600
PW21B	650	30	2	2	0	$ 133,025	$ 6,651	$ 139,676	$ 13,303	$ 13,303	$ 159,600
PW21C	600	30	2	2	0	$ 123,900	$ 6,195	$ 130,095	$ 12,390	$ 12,390	$ 148,700
PW21D	720	42	2	2	0	$ 194,040	$ 9,702	$ 203,742	$ 19,404	$ 19,404	$ 232,800
PW21E	260	48	1	0	0	$ 79,180	$ 3,959	$ 83,139	$ 7,918	$ 7,918	$ 95,000
PW21F	80	48	1	0	0	$ 26,440	$ 1,322	$ 27,762	$ 2,644	$ 2,644	$ 31,700
PW21G	100	42	1	0	0	$ 27,950	$ 1,398	$ 29,348	$ 2,795	$ 2,795	$ 33,500
PW22	1050	24	3	3	0	$ 183,300	$ 9,165	$ 192,465	$ 18,330	$ 18,330	$ 220,000
PW23	3790	42	10	12	1	$ 1,042,005	$ 52,100	$ 1,094,105	$ 104,201	$ 104,201	$ 1,250,400
PW24	80	6x20	0	0	2	$ 163,913	$ 8,196	$ 172,109	$ 16,391	$ 16,391	$ 196,700
										Pipe Subtotal:	**$ 12,044,250**

Table 3
Conceptual Cost Estimate - Detention Basins
Layton Storm Drainage Capital Facility Plan

Project Identifier	Volume (acre-ft)	Footprint (acre)	Excavation and Hauling (yd^3)	Landscaping	Inlet Apron	Outlet Structure	Emergency Spillway	Land Acquisition	Contingency (10%)	Engineering, Legal, Admin. (10%)	Estimated Project Cost (includes Contingency, Engineering, Admin, and Legal Fees)
DBE1	1.5	0.8	$ 47,288	$ 9,801	$ 7,000	$ 16,000	$ 5,000	$ 105,000	$ 19,000	$ 19,000	**$ 228,100**
DBE2	11.8	4.7	$ 371,995	$ 61,415	$ 7,000	$ 16,000	$ 5,000	$ 657,955	$ 111,900	$ 111,900	**$ 1,343,200**
DBE3	5.7	2.3	$ 179,693	$ 29,862	$ 7,000	$ 16,000	$ 5,000	$ 319,922	$ 55,700	$ 55,700	**$ 668,900**
DBE4	2.7	1.1	$ 85,118	$ 13,951	$ 7,000	$ 16,000	$ 5,000	$ 149,461	$ 27,700	$ 27,700	**$ 331,900**
DBE5	7.3	3.2	$ 230,133	$ 42,167	$ 7,000	$ 16,000	$ 5,000	$ 451,739	$ 75,200	$ 75,200	**$ 902,400**
DBE6	1.6	0.8	$ 27,660	$ 10,454	$ 7,000	$ 16,000	$ 5,000	$ -	$ 6,600	$ 6,600	**$ 79,300**
DBE7	0.5	0.3	$ 11,933	$ 3,267	$ 7,000	$ 16,000	$ 5,000	$ -	$ 4,300	$ 4,300	**$ 51,800**
DBW1	2.2	0.7	$ 69,355	$ 9,762	$ 7,000	$ 16,000	$ 5,000	$ 104,579	$ 21,200	$ 21,200	**$ 254,100**
DBW2	3.0	1.1	$ 94,575	$ 14,065	$ 7,000	$ 16,000	$ 5,000	$ 150,683	$ 28,700	$ 28,700	**$ 344,700**
DBW3	8.0	2.7	$ 252,200	$ 35,669	$ 7,000	$ 16,000	$ 5,000	$ 382,126	$ 69,800	$ 69,800	**$ 837,600**
DBW4	3.7	2.1	$ 116,643	$ 27,862	$ 7,000	$ 16,000	$ 5,000	$ 298,492	$ 47,100	$ 47,100	**$ 565,200**
DBW5	0.9	0.4	$ 28,373	$ 4,950	$ 7,000	$ 16,000	$ 5,000	$ 53,032	$ 11,400	$ 11,400	**$ 137,200**
DBW6	1.6	0.2	$ 50,440	$ 2,871	$ 7,000	$ 16,000	$ 5,000		$ 8,100	$ 8,100	**$ 97,500**
DBW7	16.3	3.3	$ 513,858	$ 43,123	$ 7,000	$ 16,000	$ 5,000	$ 461,983	$ 104,700	$ 104,700	**$ 1,256,400**
DBW8	11.3	2.1	$ 356,233	$ 27,981	$ 7,000	$ 16,000	$ 5,000	$ 299,771	$ 71,200	$ 71,200	**$ 854,400**
DBW9	6.8	2.3	$ 214,370	$ 30,593	$ 7,000	$ 16,000	$ 5,000	$ 327,744	$ 60,100	$ 60,100	**$ 720,900**
DBW10	2.8	1.3	$ 88,270	$ 17,373	$ 7,000	$ 16,000	$ 5,000	$ 186,124	$ 32,000	$ 32,000	**$ 383,800**
DBW11*	0.9	0.5	$ 28,373	$ 5,881	$ 7,000	$ 16,000	$ 5,000	$ -	$ 6,200	$ 6,200	**$ -**
DBW12	1.9	0.4	$ 59,898	$ 4,840	$ 7,000	$ 16,000	$ 5,000	$ -	$ 9,300	$ 9,300	**$ 111,300**
DBW13	6.6	3.3	$ 135,793	$ 43,124	$ 7,000	$ 16,000	$ 5,000	$ -	$ 20,700	$ 20,700	**$ 248,300**
											$ 9,417,000
OE1		0	$ -	$ -	$ -	$ 16,000	$ -	$ -	$ 1,600	$ 1,600	**$ 19,200**
OE2		0	$ -	$ -	$ -	$ 16,000	$ -	$ -	$ 1,600	$ 1,600	**$ 19,200**
OE3		0	$ -	$ -	$ -	$ 16,000	$ -	$ -	$ 1,600	$ 1,600	**$ 19,200**
OW1		0	$ -	$ -	$ -	$ 16,000	$ -	$ -	$ 1,600	$ 1,600	**$ 19,200**
OW2		0	$ -	$ -	$ -	$ 16,000	$ -	$ -	$ 1,600	$ 1,600	**$ 19,200**
OW3		0	$ -	$ -	$ -	$ 16,000	$ -	$ -	$ 1,600	$ 1,600	**$ 19,200**
OW4		0	$ -	$ -	$ -	$ 16,000	$ -	$ -	$ 1,600	$ 1,600	**$ 19,200**
OW5		0	$ -	$ -	$ -	$ 32,000	$ -	$ -	$ 3,200	$ 3,200	**$ 38,400**
OW6		0	$ -	$ -	$ -	$ 16,000	$ -	$ -	$ 1,600	$ 1,600	**$ 19,200**
OW7		0	$ -	$ -	$ -	$ 16,000	$ -	$ -	$ 1,600	$ 1,600	**$ 19,200**
OW8		0	$ -	$ -	$ 1	$ 16,000	$ -	$ -	$ 1,600	$ 1,600	**$ 19,200**
OW9		0	$ -	$ -	$ 2	$ 16,000	$ -	$ -	$ 1,600	$ 1,600	**$ 19,200**
											$ 249,600
											$ 9,666,600

*Weber State responsible for upsize of Pond

APPENDIX C
RUNOFF CALIBRATION REPORT

PEAK-FLOW CHARACTERISTICS OF SMALL URBAN DRAINAGES ALONG THE WASATCH FRONT, UTAH

By K. L. Lindskov and K. R. Thompson

U.S. GEOLOGICAL SURVEY

Water-Resources Investigations Report 89-4095

Prepared in cooperation with the

UTAH DEPARTMENT OF TRANSPORTATION

Salt Lake City, Utah

1989

DEPARTMENT OF THE INTERIOR

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U.S. GEOLOGICAL SURVEY

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CONVERSION FACTORS

Most values in this report are given in inch-pound units. The conversions factors are shown to obtain metric equivalents to four significant figures.

Multiply	By	To obtain
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
foot (ft)	0.3048	meter (m)
inch (in.)	25.40	millimeter (mm)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)

PEAK-FLOW CHARACTERISTICS OF SMALL URBAN DRAINAGES ALONG THE WASATCH FRONT, UTAH

By K. L. Lindskov and K. R. Thompson

ABSTRACT

Designers and planners for local, State, and Federal agencies need up-to-date methods for determining peak-flow frequency relations for urban drainages along the Wasatch Front, Utah. This report summarizes methods used to develop equations that estimate peak flows for small urban drainages along the Wasatch Front.

Rainfall and runoff data collected from eight urban drainages along the Wasatch Front during 1984-86 were used to calibrate a Distributed Routing Rainfall-Runoff model called DR3M-II for each drainage. Long-term rainfall data collected during 1948-83 at the National Weather Service station at the Salt Lake City Airport were used with the calibrated models to estimate peak-flow data for 1948-83 for each of the eight drainages. Log-Pearson fits were made to the peak-flow data and were used to estimate peak-flow frequency relations for each drainage.

Mathematical equations were developed that relate peak flows for recurrence intervals of 2, 5, 10, 25, 50, and 100 years for small urban drainages, to basin characteristics. Data entry to the equations requires determination of basin slope, drainage area, and percentage of impervious area.

Paired stations on Little Cottonwood Creek near Salt Lake City were used to help determine the effects of intervening urban drainage on peaks of larger streams that originate in the mountains. In general, peaks on larger streams caused by snowmelt and peaks caused by rainfall (where urban areas may have a significant effect) did not occur simultaneously.

INTRODUCTION

Population increases and urban expansion have increased concern about adequate design of highway and street drainage structures within the urban environment. About two-thirds of Utah's population resides along the Wasatch Front, which extends from Brigham City on the north to Nephi on the south (fig. 1). The Wasatch Front includes the western flank of the Wasatch Range and the densely populated eastern part of adjoining valleys at the base of the range. Population along the Wasatch Front has increased considerably since 1960. In Salt Lake County (fig. 2), which includes a large part of the population, there was a 61-percent increase from 1960 to 1980 (U.S. Bureau of the Census, 1963; 1980). Population increased 13 percent from 1980 to 1985, and a similar future increase is anticipated (Utah Office of Planning and Budget, Data Resources Section, 1987).

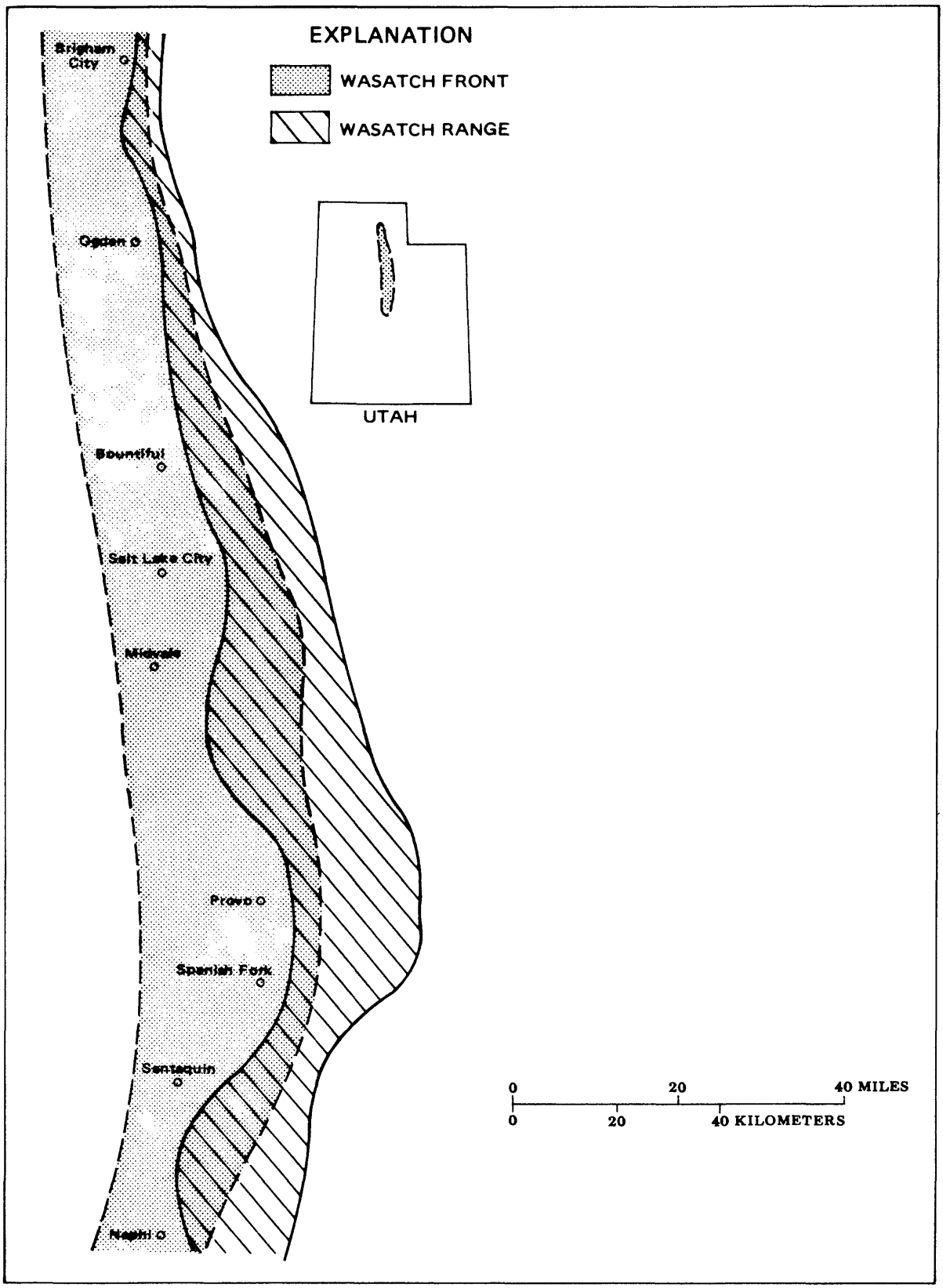

Figure 1.--Location of the Wasatch Front and the associated part of the Wasatch Range.

Two types of flooding are common in urban areas of the Wasatch Front. Intense rainfall produces most of the peak flows for urban drainages that originate below an altitude of 5,500 feet, and snowmelt produces most of the peak flows in streams that originate above an altitude of 7,000 feet. The higher-altitude streams originate in mountainous areas east of the Wasatch Front. Equations listed in Thomas and Lindskov (1983) were developed for natural streams in rural areas and are useful for computing peak-flow characteristics for the mountain streams. However, adequate hydrologic data were not available in 1983 to develop equations for computing peak-flow characteristics for urban drainages.

Designers and planners for local, State, and Federal agencies need up-to-date methods of determining peak-flow characteristics for urban drainages along the Wasatch Front. The Utah Department of Transportation, an agency responsible for design of many drainage structures in the area, recognized this need for improved methods and, because adequate local hydrologic data were not available for developing the methods, entered into a cooperative agreement with the U.S. Geological Survey to obtain these data.

Purpose and Scope

This report describes the results of a study to obtain and interpret hydrologic data for representative urban drainages along the Wasatch Front for use in determining peak-flow frequency relations needed for adequate design of drainage structures. The specific objectives are: (1) Establish short-term streamflow partial-record gages on selected urban drainages and use the data to calibrate rainfall-runoff models that can be used with long-term rainfall records to estimate the long-term peak flows needed to develop peak-flow frequency relations for the gaged drainages, (2) develop methods for determining peak flow for selected recurrence intervals for ungaged urban drainages by relating peak-flow values for the gaged drainages to basin characteristics, and (3) compare peak flow at two existing continuous-record gaging stations in order to determine whether peak flow resulting from snowmelt in the mountains occurs simultaneously with that resulting from rainfall on the intervening urban areas.

Approach

As part of this study, 11 small urban drainages were instrumented to obtain rainfall and flow data during the summers of 1984-86 for use in calibrating rainfall-runoff models. However, problems with instrumentation and the short time period resulted in insufficient data for two of the drainages, and the contributing area could not be defined adequately for one drainage. Thus, data from only 8 of the 11 drainages were used for this report.

The U.S. Geological Survey rainfall-runoff model (DR3M-II)(Alley and Smith, 1982) was calibrated for each of the eight drainages. The drainages ranged from 0.085 to 0.87 square mile and had different degrees of relief and impervious area. The eight calibrated models then were used to generate peak flows for each drainage. Rainfall data were digitized in 5-minute intervals from charts for one to four storms per year during 1948-83 for the National

Weather Service station at the Salt Lake City Airport, and these data were entered into the model for each drainage. Log-Pearson Type III distribution (U.S. Water Resources Council, 1981) was used to estimate annual peak-flow data for each drainage. Peak flows having recurrence intervals ranging from 2 to 100 years were calculated and are presented in this report.

Peak-flow values for selected recurrence intervals for the eight drainages were related to basin characteristics to develop equations for computing peak-flow frequency relations for ungaged, urban drainages along the Wasatch Front. Equations developed for the urban drainages represent small urban drainages originating below an altitude of 5,500 feet where most peak flow results from intense rainfall. Another situation exists in streams that originate in the mountainous areas above 5,500 feet. These streams, which have annual peak flows resulting mostly from snowmelt, flow through urban areas to larger rivers or directly to Great Salt Lake. Downstream reaches of these streams can receive large peak flows from either snowmelt in the mountains or from rainfall runoff on the intervening urban areas. Peak streamflow data for two continuous-record gaging stations on Little Cottonwood Creek were compared to determine whether the two types of peak flow occur simultaneously.

DATA USED FOR ANALYSIS OF PEAK-FLOW CHARACTERISTICS

Short-Term Network Instrumented to Obtain Rainfall and Flow Data for Calibrating Models

Eleven urban drainages were instrumented to obtain 5-minute rainfall and flow data during the summers of 1984-86 for use in calibrating the rainfall-runoff models. However, problems with instrumentation and the short time period resulted in insufficient data for two drainages, and the contributing area could not be defined adequately for one drainage. Thus, data from only eight of the drainages were used in model calibration. Location for each of the eight partial-record stations is shown in figure 2. Contributing drainage area and location of station are shown in figures 3 to 10.

Rainfall data and stage data (for determining flow) were recorded by digital recorders in 5-minute intervals for the summer months. Between 10 to 29 flow hydrographs were available for analysis. Daily mean flows were not computed for any of the stations. Concurrent rainfall data generally were obtained near the flow-measuring station for each of the drainages. The drainage area, basin slope, effective impervious area, and number of storms used for model calibration are summarized in table 1 for the eight drainages for which rainfall-runoff models were calibrated. Basin characteristics and how they were determined are explained in the "Definitions of Selected Basin Characteristics" section. Descriptions for each of the drainages are given in the "Physical and Basin Characteristics of Eight Urban Drainages" section.

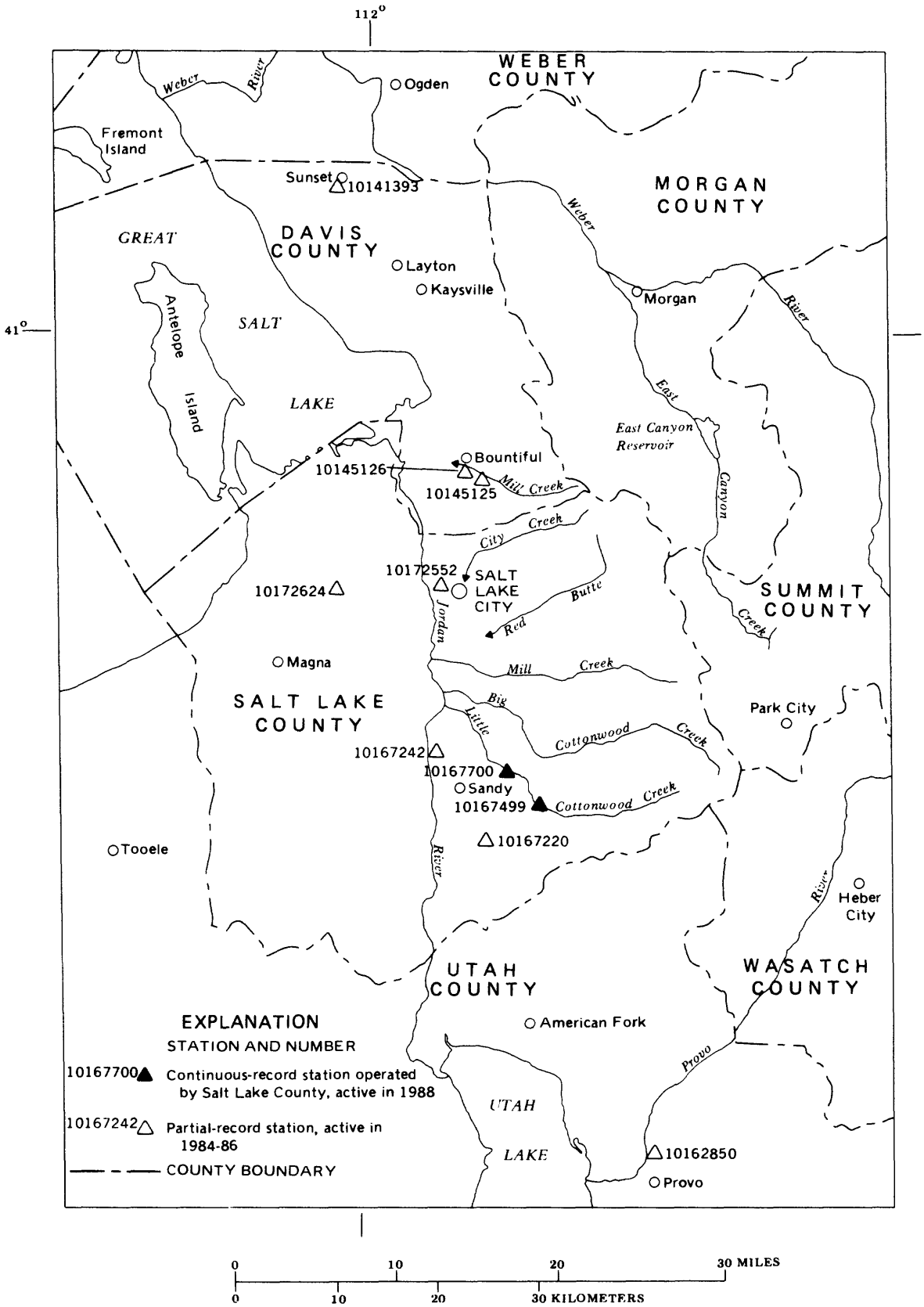

Figure 2.—Location of two stations on Little Cottonwood Creek and eight stations on storm drains.

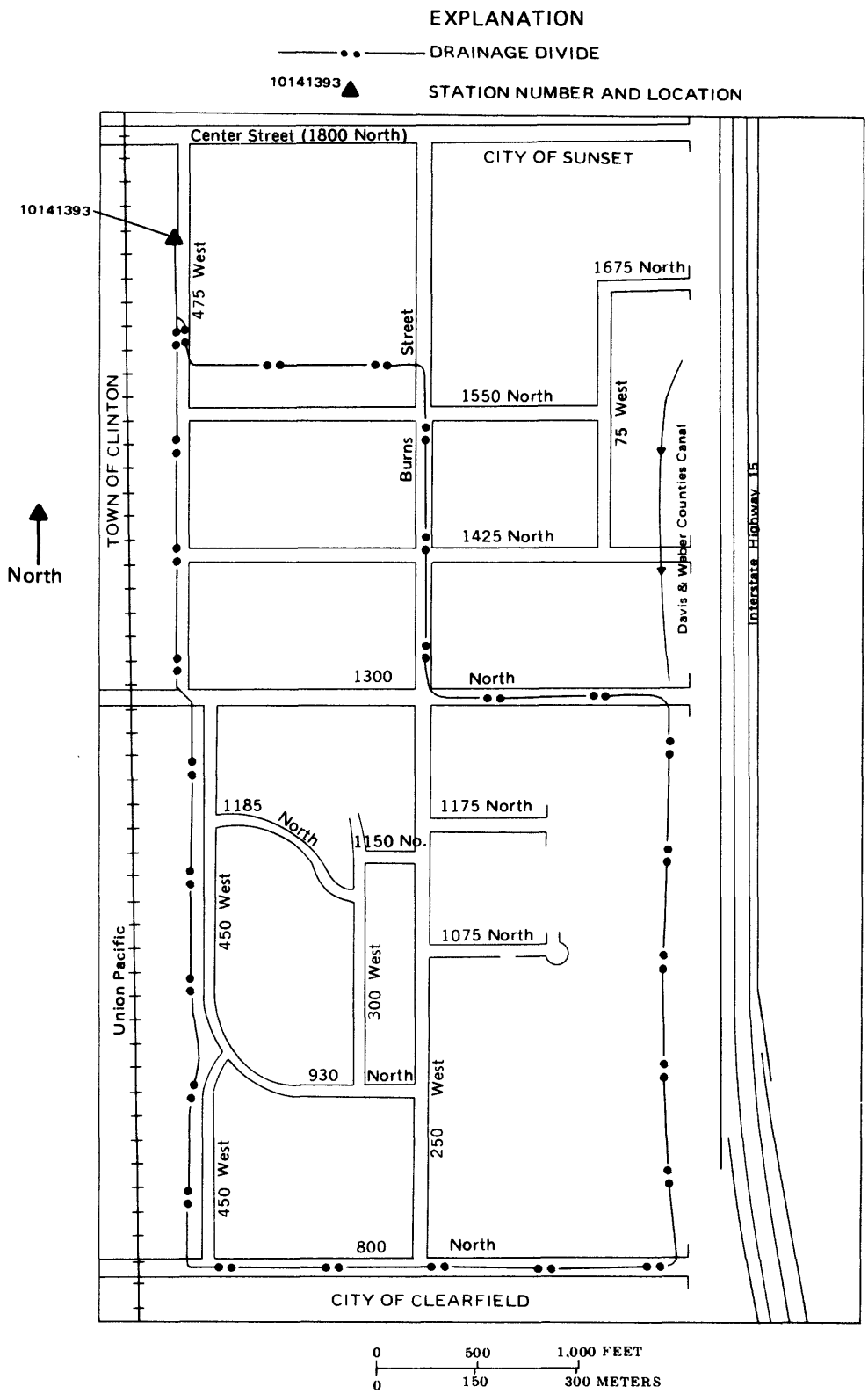

Figure 3.—Contributing drainage area and location of station 10141393.

EXPLANATION

DRAINAGE DIVIDE

10145125 STATION NUMBER AND LOCATION

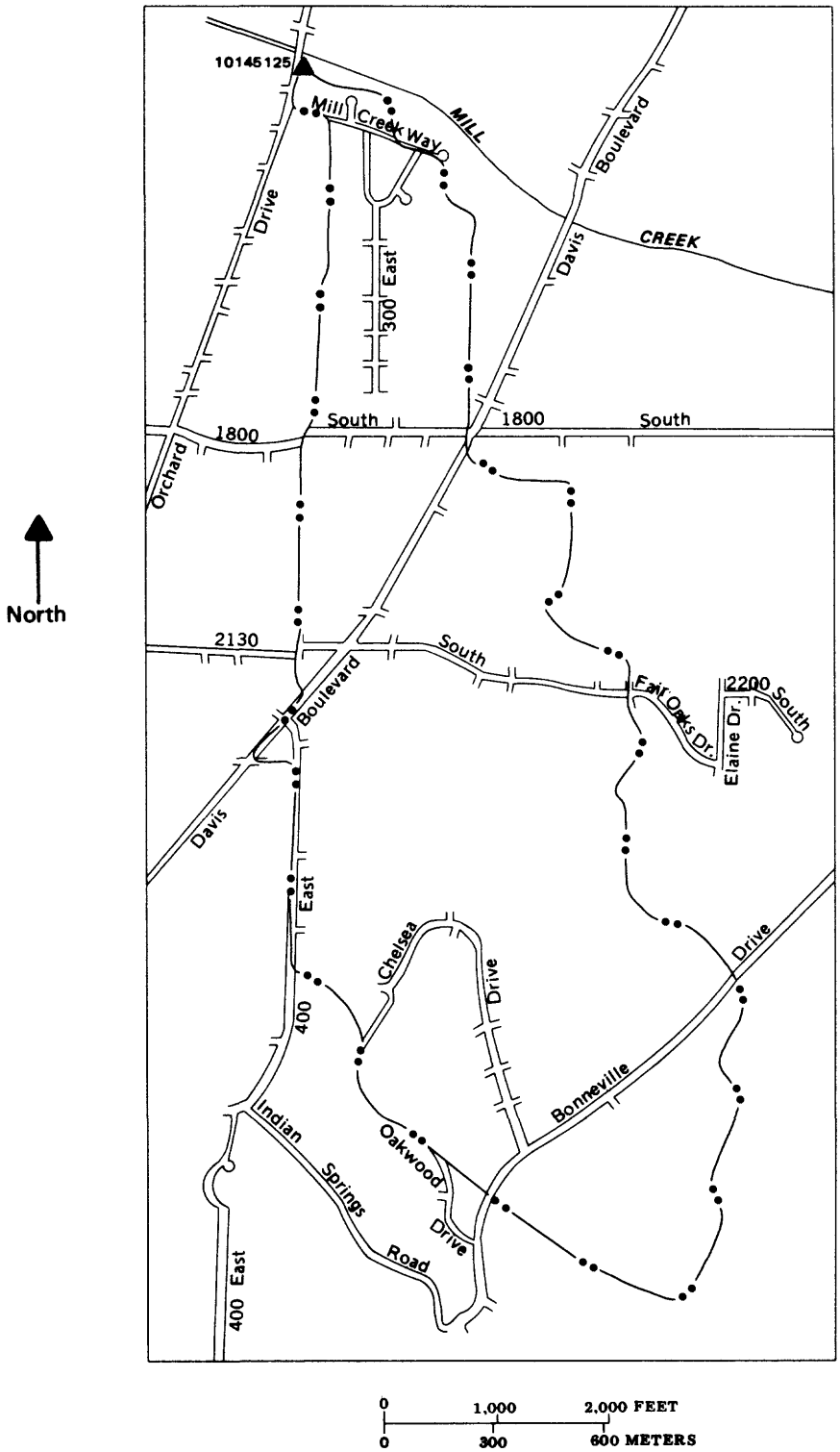

Figure 4.—Contributing drainage area and location of station 10145125.

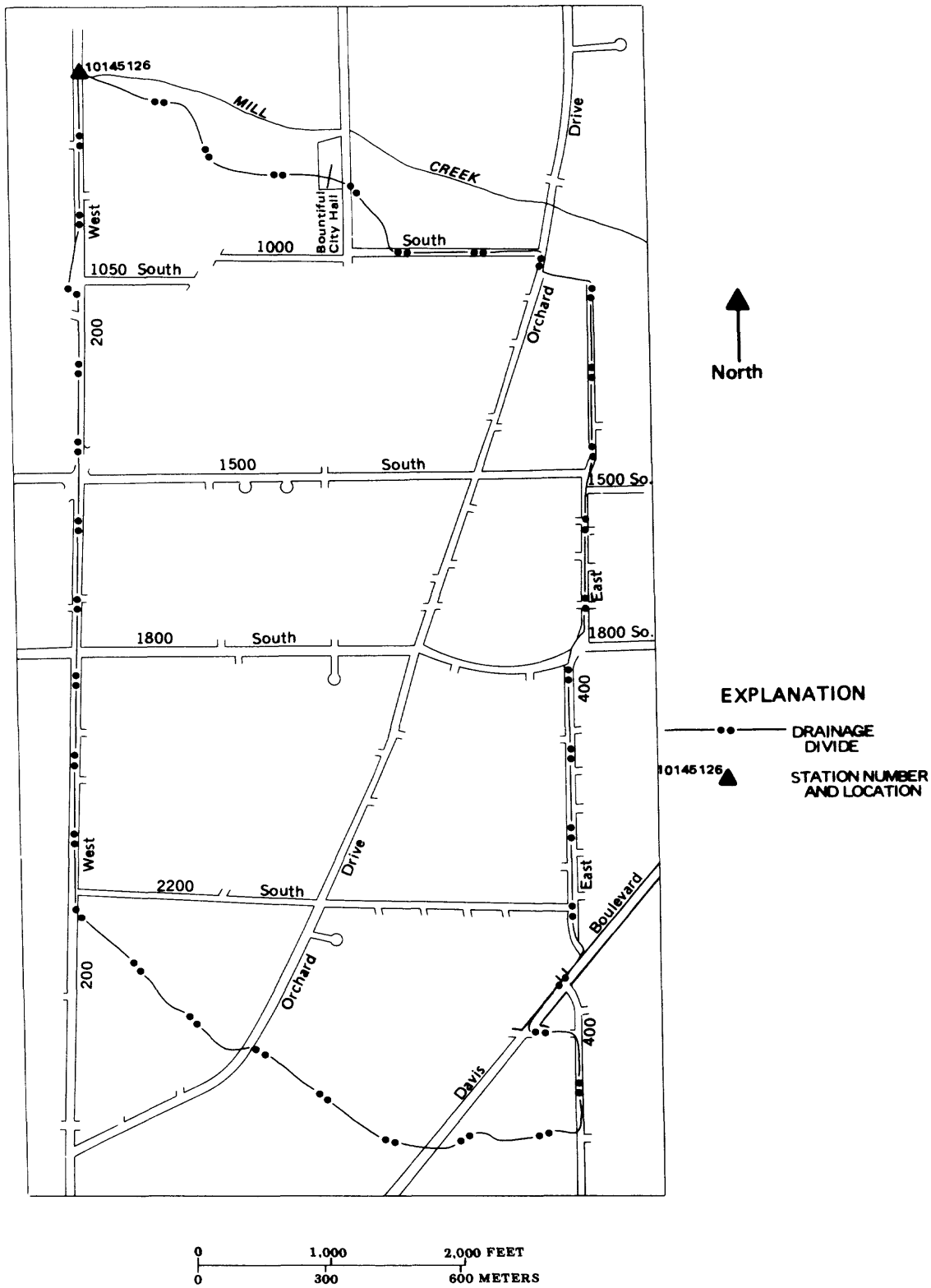

Figure 5.—Contributing drainage area and location of station 10145126.

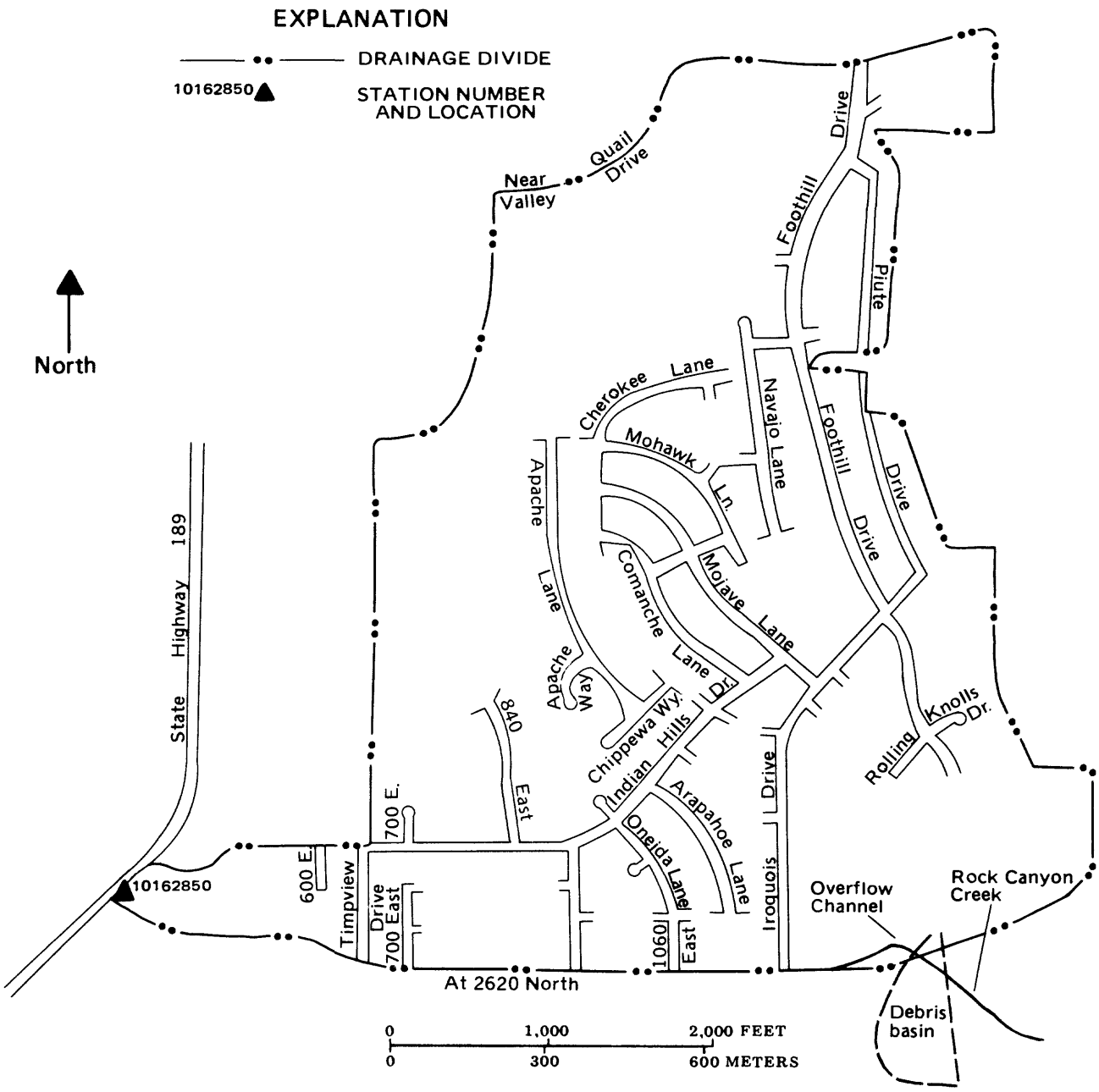

Figure 6.--Contributing drainage area and location of station 10162850.

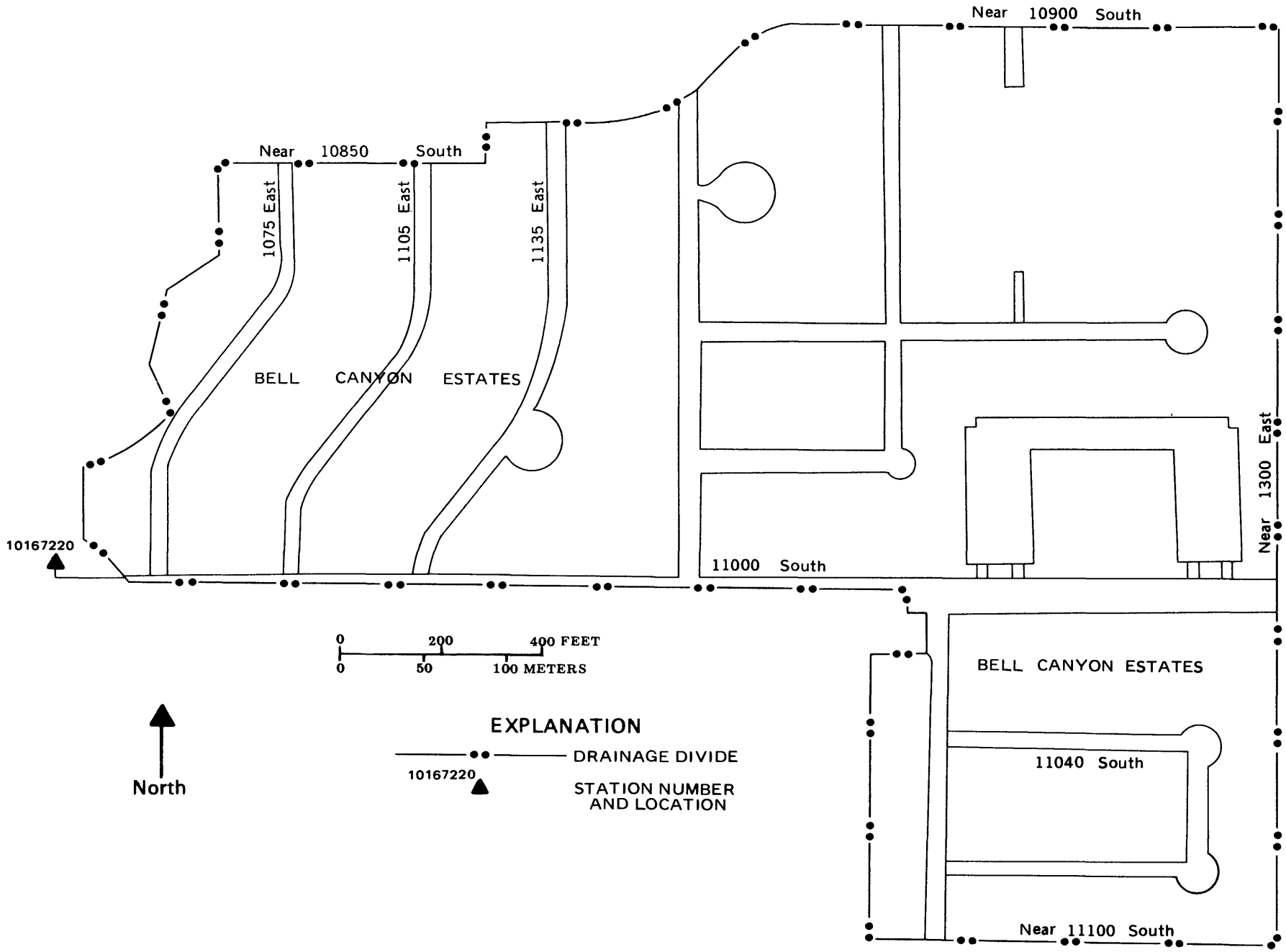

Figure 7.--Contributing drainage area and location of station 10167220.

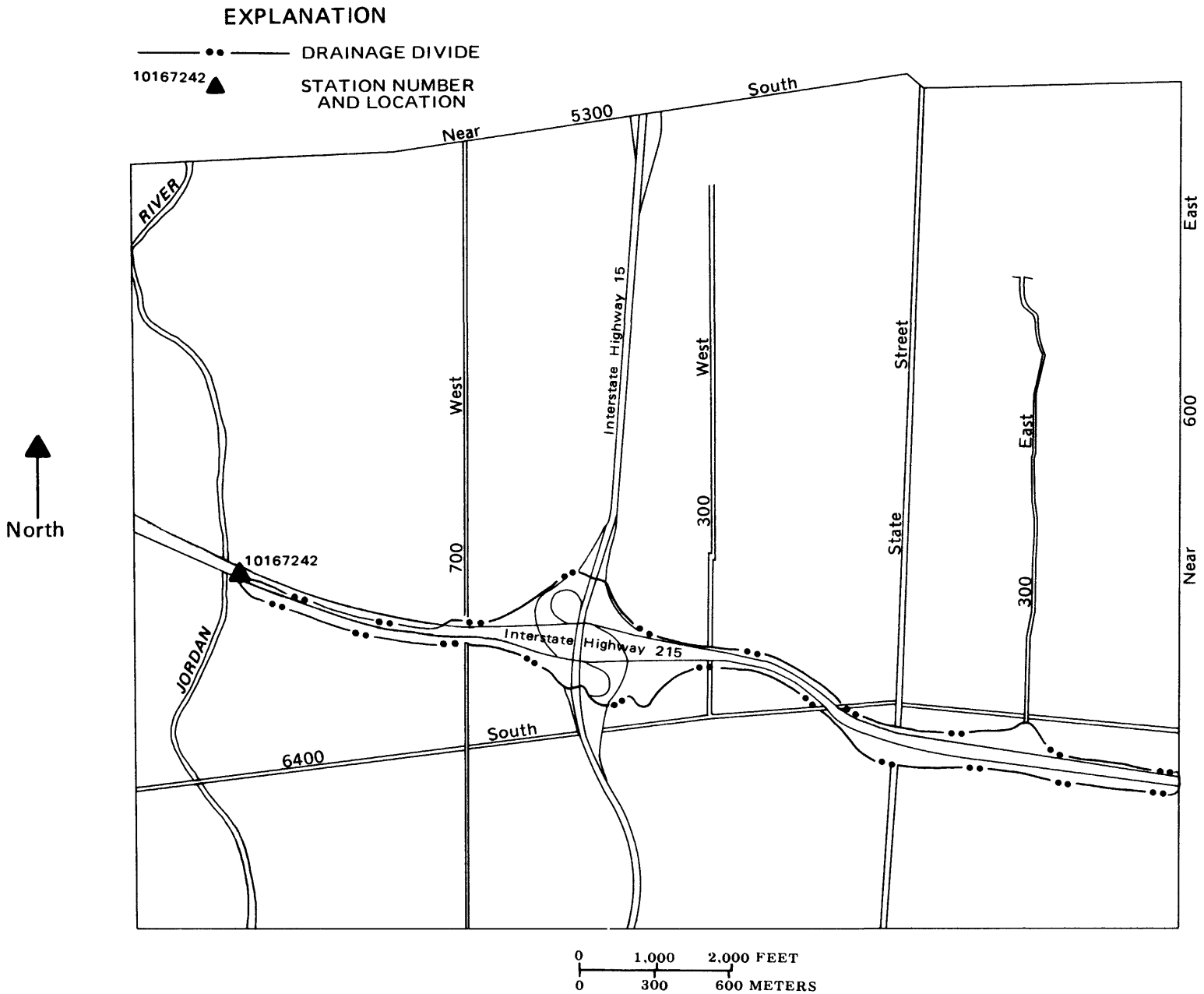

Figure 8.--Contributing drainage area and location of station 10167242.

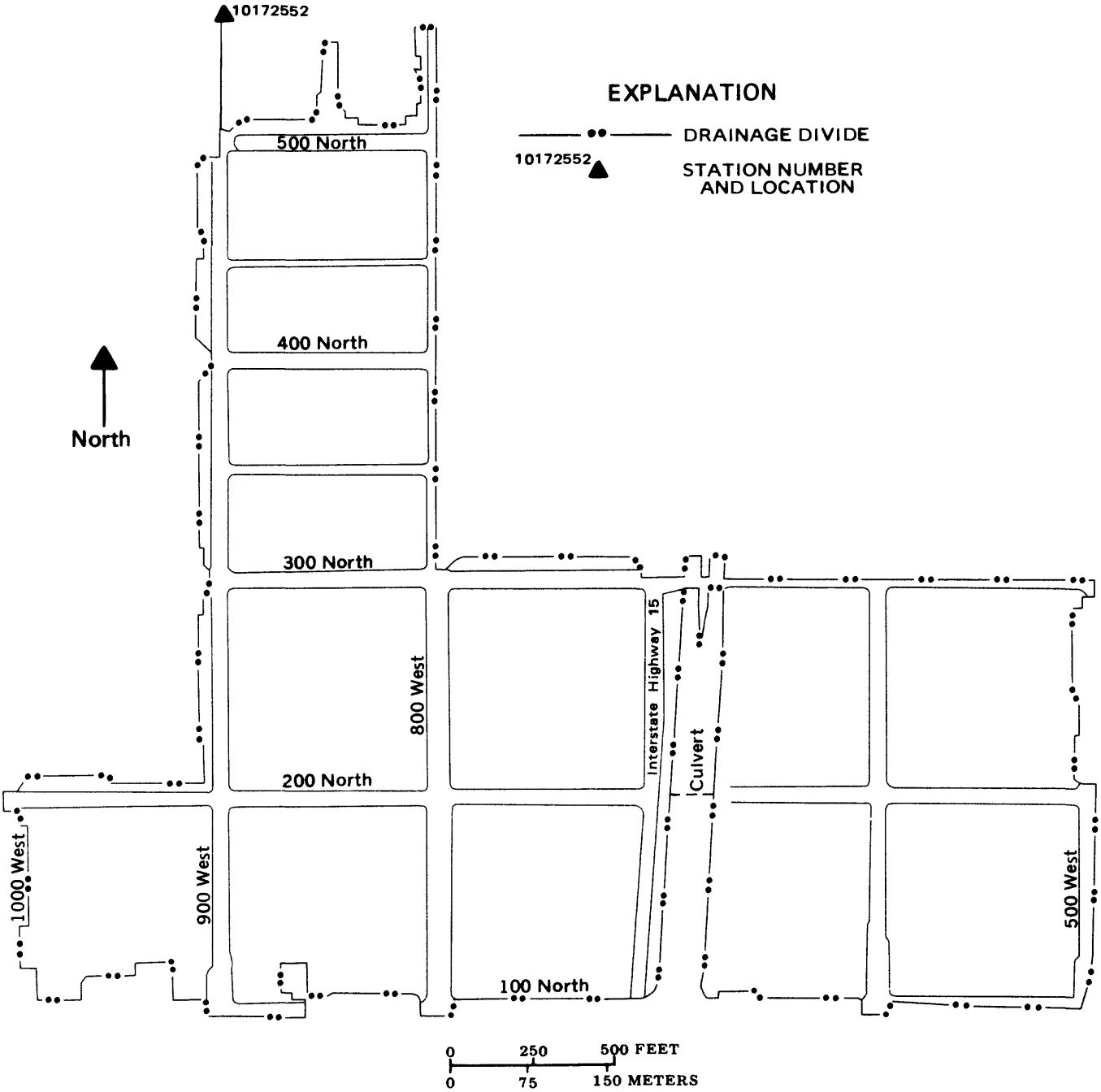

Figure 9.--Contributing drainage area and location of station 10172552.

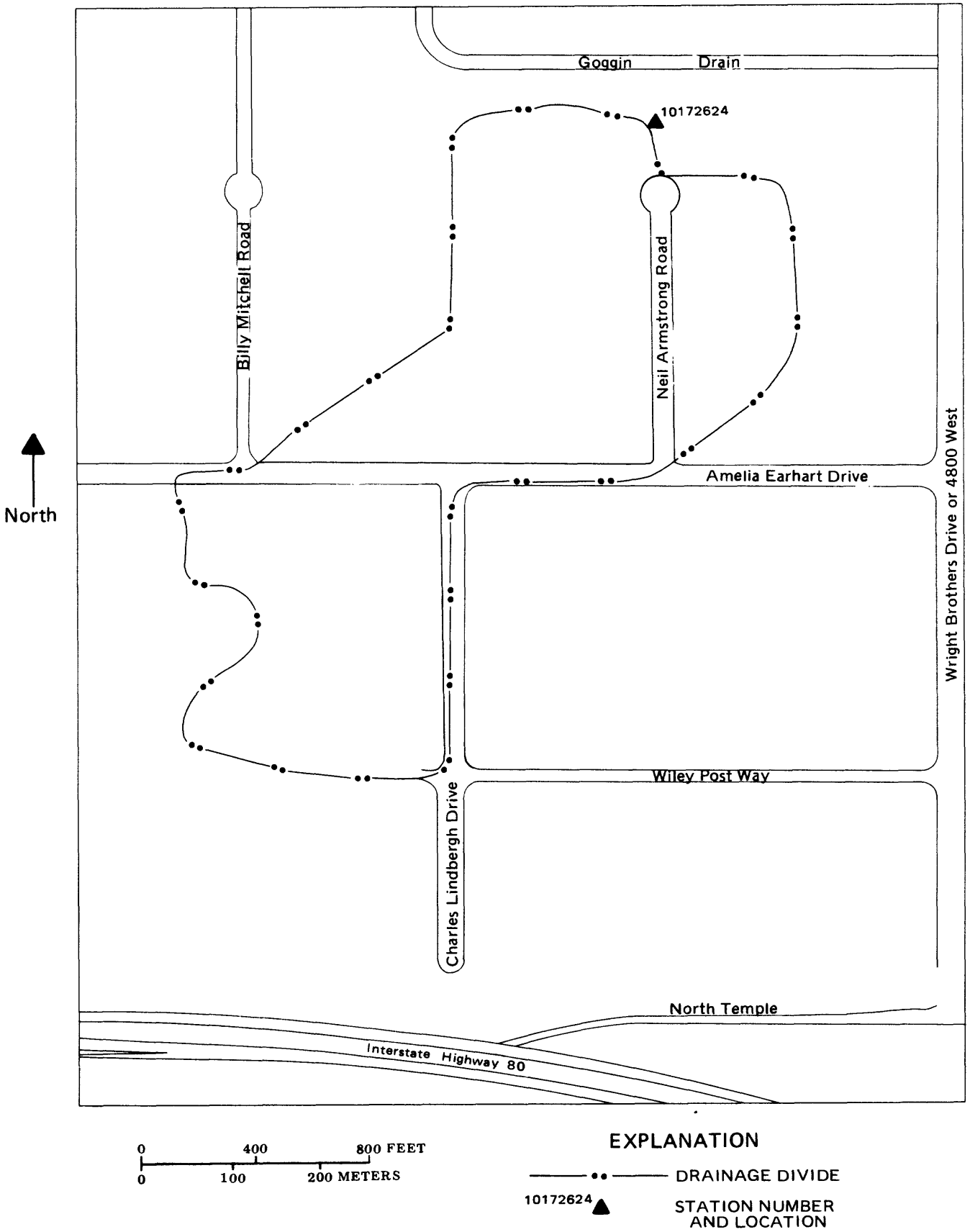

Figure 10.--Contributing drainage area and location of station 10172624.

Table 1.--Summary of selected basin characteristics, selected DR3M-II model parameters, and statistical comparison of measured and model-simulated volumes and peaks

Station number	Drainage area (square miles)	Basin slope (percent)	Effective impervious area (percent)	Number of storms used for model calibration	Number of overland-flow segments	Number of pipe and channel segments	Average standard error of estimate (percent)		R-squared (percent)	
							Volumes	Peaks	Volumes	Peaks
10141393	0.28	3.5	30	27	3	3	39.0	45.5	87.6	81.1
10145125	.80	15	22	19	6	7	29.0	36.0	91.4	86.6
10145126	.87	5.0	25	24	4	5	39.5	50.0	87.0	80.3
10162850	.66	9.5	23	18	7	5	37.5	37.0	91.2	86.9
10167220	.093	8.6	27	10	3	3	69.5	53.0	70.7	65.9
10167242	.20	7.9	38	29	3	4	31.0	41.0	90.7	71.4
10172552	.23	.6	31	20	2	3	30.5	39.5	94.8	89.3
10172624	.085	.3	57	20	3	6	23.5	30.5	88.4	77.8

Definitions of Selected Basin Characteristics

Drainage area (DA).--Drainage area is the area, in square miles, of the drainage basin planimetered from city and county maps depicting topography, storm-drain networks, streets, and aerial photography. Scales range from 1 inch equals 200 feet to 1 inch equals 1,000 feet. Onsite determinations were made for boundaries when drainage-area divides were not readily identifiable from using the maps.

Basin slope (BS).--Basin slope is the average slope for the drainage basin, in percent. City and county aerial photographs having 2- to 5-foot contour intervals were used to determine this characteristic. The formula described by Wisler and Brater (1959) was used to determine the basin slope for each of the eight drainages gaged for this study. For the larger drainages, a grid was used to segment the entire drainage area into smaller subareas of equal size, and the basin slope was calculated as an average of the slopes of 20 or more randomly selected subareas.

Another simplified method for estimating the basin slope is to establish a grid over a map of the drainage area. The grid should have 20 or more intersections within the drainage area. The slope of a short segment of line normal to the contours can be determined at each grid intersection, and the basin slope can be estimated as an average of the individual values.

Effective impervious area (EIA).--Effective impervious area is that part of the drainage area, in percent, that is impervious to the infiltration of rain and drains directly by curb, gutter, or channel to a storm drain. It does not include the area of rooftops that discharge on lawns. It does include areas of paved roads and streets, paved parking lots and driveways, and some rooftops and sidewalks. Aerial photographs having scales ranging

from 1 inch equals 200 feet to 1 inch equals 1,000 feet were used to determine this characteristic.

Physical and Basin Characteristics of Eight Urban Drainages

Station 10141393, storm drain, 480 feet south of 1800 North 475 West Sunset.--Station 10141393 (fig. 3) is at lat 41°08'27", long 112°02'04", in NW¼NW¼SE¼ sec. 26, T. 5 N., R. 2 W., Davis County, Hydrologic Unit 16020102. The drainage area, which is outlined in figure 3, is 0.28 square mile. The area is bounded by about 475 West on the west, by about 800 North on the south, by a line near Interstate Highway 15 on the southeast, by about 250 West on the northeast, and by about 1550 North on the north. The area is mostly residential except for a park and some open fields in the southeast part. The basin slope is 3.5 percent, and the effective impervious area is 30 percent.

Station 10145125, storm drain to Mill Creek, east of Orchard Drive, Bountiful.—Station 10145125 (fig. 4) is at lat 40°52'49", long 111°52'19", in SW¼SW¼NW¼ sec. 29, T. 2 N., R. 1 E., Davis County, Hydrologic Unit 16020102, about 100 feet upstream of Mill Creek at Orchard Drive. The drainage area, which is outlined in figure 4, is 0.80 square mile. The area is bounded by about 400 East on the west, by a line near Oakwood Drive and extending just beyond Bonneville Drive on the south, by a line extending from Davis Boulevard near 1800 South to the southeast corner beyond Bonneville Drive on the east, and by a line near Mill Creek on the north. The area is mostly residential except for the southern part near Bonneville Drive. The basin slope is 15 percent, and the effective impervious area is 22 percent.

Station 10145126, storm drain to Mill Creek, 620 South 200 West, Bountiful.—Station 10145126 (fig. 5) is at lat 40°52'59", long 111°53'06", in SW¼NE¼NW¼ sec. 30 , T. 2 N., R. 1 E., Davis County, Hydrologic Unit 16020102, 10 feet upstream from Mill Creek at 200 West. The drainage area, which is outlined on figure 5, is 0.87 square mile. The area is bounded by about 200 West on the west, by a line across Orchard Drive beyond 2200 South on the south, by about 400 East on the east, and by a line just south of Mill Creek on the north. A large part of the area is residential, and the remainder is mostly large office buildings and parking lots. The basin slope is 5.0 percent, and the effective impervious area is 25 percent.

Station 10162850, Rock Creek overflow channel, east of State Highway 189, Provo.--Station 10162850 (fig. 6) is at lat 40°16'11", long 111°39'08", in SE¼SW¼NW¼ sec. 30, T. 6 S., R. 3 E., Utah County, Hydrologic Unit 16020203, just upstream of the confluence with a storm drain, 55 feet upstream of State Highway 189, about 2 miles north of Brigham Young University Campus, Provo, Utah. The drainage area, which is outlined in figure 6, is 0.66 square mile. The area includes the urban area downstream of the debris basin on Rock Canyon Creek. Flow from snowmelt in Rock Canyon Creek will fill the debris basin and contribute to the overflow channel. However, for this study, Rock Canyon Creek did not contribute to the overflow channel for any of the summer storms used to calibrate the model. The drainage area is bounded by about 2620 North on the south, by a line beyond Iroquois Drive on the southeast, by developments along the mountain front on the east and northeast, by a line south of Quail Valley Drive on the north, by a line near Timpview Drive on the west, and by a line near State Highway 189 on the southwest. Most of the area

is residential except for a few open fields. The basin slope is 9.5 percent, and the effective impervious area is 23 percent.

Station 10167220, Bells Canyon conduit, 1000 East 11000 South, Sandy.—Station 10167220 (fig. 7) is at lat 40°33'07", long 111°51'41", in SW¼SW¼SE¼ sec. 17, T. 3 S., R. 1 E., Salt Lake County, Hydrologic Unit 16020204, 100 feet east of the 1000 East and 11000 South intersection in Sandy. The drainage area, which is outlined in figure 7, is 0.093 square mile. The area is bounded by a line near 1075 East and 11000 South on the southwest, by a line near 11100 South and 1300 East on the southeast, by a line near 1300 East and 10900 South on the northeast, and by a line near 10850 South and 1075 East on the northwest. The area is mostly residential except for some open fields in the northwest part. The basin slope is 8.6 percent, and the effective impervious area is 27 percent.

Station 10167242, Interstate Highway 215 median storm drain to right bank of Jordan River, near Salt Lake City.--Station 10167242 (fig. 8) is at lat 40°38'19", long 111°55'13", in NE¼NE¼NW¼ sec. 23, T. 2 S., R. 1 W., Salt Lake County, Hydrologic Unit 16020204, in the median strip of Interstate Highway 215 about 250 feet upstream from where the drain discharges to the Jordan River. The drainage area, which is outlined in figure 8, is 0.20 square mile. The area includes the eastbound lanes of Interstate Highway 215 and the median strip from near the gage east for about 3,000 feet, both the eastbound and westbound lanes and the median east for another 400 feet to near 700 West, most of the Interstate Highway 215 interchange with Interstate Highway 15 and State Street from about 700 West to 300 East, and both the eastbound and westbound lanes and the median from 300 East to about 600 East. The segment of Interstate Highway 215 completed since 1986 to 1300 East was not used for this study. The area is mostly highway right-of-way, and consists of pavement, grass, and bare soil in the median and on some embankments. The basin slope is 7.9 percent, and the effective impervious area is 38 percent.

Station 10172552, Ninth West conduit, 536 North 900 West, Salt Lake City.--Station 10172552 (fig. 9) is at lat 40°46'53", long 111°54'58", in SE¼NW¼NE¼ sec. 35, T. 1 N., R. 1 W., Salt Lake County, Hydrologic Unit 16020204, on the east side of 900 West, 300 feet north of the 500 North and 900 West intersection in Salt Lake City. The drainage area, which is outlined in figure 9, is 0.23 square mile. The area is bounded by about 500 North and 900 West on the northwest; by about 200 North, 1000 West, and 100 North on the southwest; by 100 North, east across Interstate Highway 15 to 500 West on the south; by 500 West between 100 North and 300 North on the southeast; and by 800 West and 500 North on the northeast. Most of Interstate Highway 15 that crosses the area does not contribute. More than one-half of the area is residential, about one-quarter is commercial, and the remainder is mostly open fields including one small park. The basin slope is 0.6 percent, and the effective impervious area is 31 percent.

Station 10172624, storm drain, 250 feet above Goggin Drain, near Neil Armstrong Road, International Center, Salt Lake City.—Station 10172624 (fig. 10) is at lat 40°46'46", long 112°00'29", in NW¼SE¼NE¼ sec. 36, T. 1 N., R. 2 W., Salt Lake County, Hydrologic Unit 16020204, on the right bank at the north end of Neil Armstrong Road (4955 West) in the International Center, 2 miles west of Salt Lake City International Airport. The drainage area, which is outlined in figure 10, is 0.085 square mile. The general area is bounded by a

line between Neil Armstrong Road and Goggin Drain on the north near the station, by a line extending west between Billy Mitchell Road and Neil Armstrong Road and then south-southwest to near the intersection of Billy Mitchell Road and Amelia Earhart Drive, by a line extending from Amelia Earhart Drive south to near Wiley Post Way, by near Wiley Post Way east to Charles Lindberg Drive, by Charles Lindberg Drive north to Amelia Earhart Drive, by Amelia Earhart Drive east to Neil Armstrong Road, and by a line extending beyond Neil Armstrong Road northeast about one-half block and then north and west to the station. The area is mainly commercial and has large parking lots and warehouses. However, there are considerable lawns and some unlined drains. The basin slope is 0.3 percent, and the effective impervious area is 57 percent.

Long-Term Rainfall and Evaporation Data Used to Simulate Peak Flow

Long-term daily rainfall and evaporation data are required for use with the calibrated model for each drainage basin to simulate peak flow for a longer period of record for frequency analysis. For this study, daily rainfall data were obtained for 1948-83 for the National Weather Service Forecast Center station at the airport. Daily pan-evaporation data also were entered for the National Weather Service stations at Utah Lake at Lehi and Brigham Young University at Provo.

Long-term rainfall data for durations less than a day also are needed for use with the calibrated model for each drainage basin. For this study, copies of the original precipitation charts for major storms at the Salt Lake City International Airport station were obtained from the National Climatic Data Center in Asheville, N.C., for 1948-83. First, the major storms, 1 to 4 per year, were selected from a list provided by Robert W. Lichty (U.S. Geological Survey, written commun., 1985). Second, the major-storm dates and precipitation totals that Lichty provided were compared with the dates and values of hourly precipitation, published monthly since 1951. All storms having 0.1 inch of rain or more per hour were examined to make sure all major storms were considered, and a few additional storms were included. Storm-rainfall data on the hourly precipitation charts were tabulated at 5-minute intervals, and a total of 63 storms were used in the analysis.

Long-Term Data for Little Cottonwood Creek Used for Comparing Peak Flow at Canyon Mouth with That at a Downstream Station Including Urban Drainage

Peak-flow data for stations 10167499, Little Cottonwood Creek (channel only) near Salt Lake City, and 10167700, Little Cottonwood Creek at 2050 East, near Salt Lake City were selected to compare the magnitude of peak flow at the canyon mouth, which results primarily from snowmelt, with that at a downstream station, which includes runoff from intervening urban drainage. This comparison is discussed in the "Comparison of Peak Flow for Little Cottonwood Creek at Canyon Mouth with That at a Downstream Station Including Urban Drainage" section.

DATA ANALYSIS

Description of Rainfall-Runoff Model

Storm-flow hydrographs were simulated for all urban drainages using the Distributed Routing Rainfall-Runoff model called DR3M-II. DR3M-II is a deterministic, distributed-parameter model that combines rainfall-excess components developed by Dawdy and others (1972) with kinematic-wave routing presented by LeClerc and Schaake (1973). The DR3M-II model is described in detail by Alley and Smith (1982). Daily and unit rainfall and daily pan evaporation are used in the simulation of storm-flow hydrographs.

Rainfall-excess components in DR3M-II include soil-moisture accounting, impervious and pervious area rainfall excess, and parameter optimization. Infiltration and soil-moisture accounting parameters used by DR3M-II to account for the effect of antecedent conditions on infiltration are listed in table 2.

Table 2.--Parameters for infiltration and soil-moisture accounting for the DR3M-II model
(Alley and Smith, 1982, p. 18)

Infiltration parameters

KSAT—Effective saturated value of hydraulic conductivity, in inches per hour.
PSP—Suction at wetting front for soil moisture at field capacity, in inches.
RGF—Ratio of suction at wetting front for soil moisture at wilting point to that at field capacity.

Soil-moisture-accounting parameters

BMSN—Available soil water at field capacity, in inches.
EVC—Pan coefficient for converting measured pan evaporation to potential evapotranspiration.
RR—Proportion of daily rainfall that infiltrates soil for period of simulation, excluding unit days.

Rainfall excess is routed over pervious areas and two types of impervious areas: (1) Effective impervious areas where flow is routed directly into the channel drainage system, and (2) noneffective impervious areas where flow is routed onto the surrounding pervious areas. A user-specified rainfall, usually ranging from about 0.02 to 0.05 inch, is retained on impervious areas. Rain falling on noneffective impervious areas is assumed to instantaneously run off uniformly onto the surrounding pervious area.

The optimization procedure for calibrating the soil-moisture and infiltration parameters is based on a trial-and-error procedure that changes a parameter value and recomputes an objective function using the revised parameter value. If results at the end of an iteration show a decrease in the value of the objective function, an improvement in model calibration is

assumed and the new parameter value is accepted; if not, the previous value is retained.

The routing components of the DR3M-II model are determined by the kinematic-wave theory for routing flows over a given drainage basin. A basin is approximated by the DR3M-II model by a set of segments that jointly represent the drainage features of the basin. Two types of segments are used in this report: (1) Overland-flow segments and (2) channel segments. Overland-flow segments receive uniformly distributed lateral inflow from rainfall excess and represent a rectangular plane of a given size, slope, roughness, and percent imperviousness. Channel segments are used to represent natural or manmade conveyances, such as gutters or storm-sewer pipes.

Several assumptions are necessary for the kinematic-wave equations for overland-flow and channel routing, according to Alley and Smith (1982). The major assumptions are listed below:

1. Disturbances are allowed to propagate only in the downstream direction. The model, therefore, does not account for backwater effects or flow reversal.

2. The capacity of circular-pipe segments is limited to nonpressurized flow.

3. Rainfall excess is uniformly distributed over an overland-flow segment.

4. Pervious and impervious parts of a segment are uniformly distributed over the segment.

5. The complex uneven topography of the natural catchment can be approximated by rectangular planes.

6. Rainfall excess does not infiltrate as it moves overland. Once rainfall excess is computed, it must end up in a channel.

7. When rainfall ceases, infiltration ceases.

8. Lateral inflows to channels are uniformly distributed. In an urban environment, however, lateral inflows may enter through a gutter rather than uniformly.

9. Changes in flow from laminar to turbulent or vice versa will not occur.

10. Rainfall on noneffective impervious areas is instantaneously and uniformly distributed over the pervious area of the segment.

Calibration and Verification of Models

Each basin was divided into overland-flow and channel segments that represented a simplified description of the basin topography and drainage system. Basin characteristics, such as drainage area, basin slope, and effective impervious area, and a roughness coefficient, similiar to

Manning's n (Alley and Smith, 1982, p. 25), were entered into the model. Rainfall and flow data, processed in 5-minute intervals, were entered into the model as well as daily rainfall and daily evaporation. Effective impervious area and soil-moisture-accounting parameters were then optimized by the model. Simulated storm-flow hydrographs for each basin were calibrated and verified by comparing simulated runoff volume and peak flow with measured runoff volume and peak flow.

Detailed Description of Model Calibration for Station 10172624

A detailed description of model calibration for station 10172624 is presented in this section. Model calibration procedures for the other stations were similiar to that presented here.

Station 10172624, in an area known as the International Center, measures flow from an industrialized area. Basin characteristics, such as drainage area, basin slope, effective impervious area, and a roughness coefficient, were determined for the area using aerial photographs, maps, engineering drawings, and on-site inspections. Once basin characteristics were determined and entered into the model, the optimization procedure for the effective impervious area and the infiltration and soil-moisture-accounting parameters began.

All optimization was completed using a single overland-flow segment and a single channel segment that represented the entire basin as recommended by Alley and Smith (1982, p. 63). Only one parameter was optimized at a time. EAC was optimized first using only small storms that contribute runoff largely from the effective impervious areas. EAC is a factor by which the initial value of effective impervious area is multiplied. The final optimized value of EAC was 0.76 for this station. The initial value of the effective impervious area was multiplied by the EAC factor, resulting in a new effective impervious area value. Any adjustment to the effective impervious areas is offset in the model by an adjustment to the noneffective impervious areas in order to maintain a constant total drainage area. The model uses a factor called a RAT value to make this adjustment. The RAT value is the sum of the noneffective impervious and pervious areas divided by the pervious areas. The RAT value for this basin was 1.64 after EAC was optimized.

Infiltration and soil-moisture-accounting parameters were optimized one at a time, holding the remaining parameters constant. Values for parameters held constant were either best estimates or previously optimized values. The optimized value for KSAT was 0.49 and that for PSP was 4.45. Values suggested by Alley and Smith (1982) were used for the remaining parameters. These values are 10 for RGF, 5 for BMSN, 0.70 for EVC, and 0.80 for RR. These parameters were not optimized.

Routing is the final step of calibration. Overland-flow and channel segments were determined for the basin. Each segment represented a simplified description of the basin topography and drainage system. Overland flow was divided into three segments, and the drainage system was divided into six segments, two pipe segments and four channel segments (figs. 11 and 12). Physical characteristics for each segment were determined and entered into the model. Twenty storms, collected over a 2-year period, were used for model

calibration and verification. The storms were divided into two representative data sets of 10 storms each. The first data set was used in model calibration, and the second was used in model verification. The model was calibrated using the first data set by comparing measured peaks and volumes with simulated peaks and volumes. The model was adjusted until it produced the best approximation of the measured peaks and volumes. The second data set was entered to the model to verify model calibration. Generally accepted error criteria for simulated runoff volumes and peaks are within 50 percent if the simulated volume or peak is less than that measured and within 100 percent if the simulated volume or peak is greater than that measured (Doyle and Miller, 1980, p. 18; Shade, 1984, p. 12). For the 20 storms used in model calibration and verification, the only peak exceeding this criteria was for a storm on September 21, 1984 (table 3).

Model Calibration for the Other Stations

Models for the other stations were calibrated using the same techniques described for station 10172624. Several factors affected how well different basins could be calibrated. Summer rainstorms in the Wasatch Front area typically are small in areal extent and intense. Rain from a storm may be recorded at the rain gage, but not fall on major parts of a basin or vice versa. This was particularly noticeable for basins on the bench areas near the Wasatch Mountains. Also, snowstorms or hailstorms interfered with the rain-gage operation. During intense rainstorms, water may flow into or out of a drainage segment by overflowing gutters or crossing the crown in a street, ordinarily the boundaries of drainage segments. This was particularly noticeable in basins that had steep overland-flow segments. Some basins, such as the section of Interstate Highway 215 (station 10167242), had complex drainage systems that were greatly simplified for inclusion in the model.

A summary of selected basin characteristics and model parameter results is presented in table 1. The standard error and R-squared values for volumes and peaks were derived after the data had been log transformed.

Estimating Peak Flow for 1948-83

Long-term rainfall data for 1948-83, including all daily and 5-minute interval values for major storms (1 to 4 per year), and daily evaporation data, were used with each calibrated model to simulate estimates of long-term peak flows for each of the eight urban drainages. All data used to calibrate the models and the data used with the calibrated models to simulate peak flows for 1948-83 are discussed in the "Data Used for Analysis of Peak-Flow Characteristics" section.

Peak flows simulated for major storms during 1948-83 for station 10172624, storm drain, 250 feet above Goggin Drain, near Neil Armstrong Road, International Center, Salt Lake City, are listed in table 4. Peak flows also were simulated for each of the other seven urban drainages. Peak-flow data for all eight drainages were entered into the Peak-Flow File of the U.S. Geological Survey's National Water-Data Storage and Retrieval System (WATSTORE) for use in frequency analysis. The WATSTORE system consists of several computer files in which data are grouped and stored by common characteristics and data-collection frequencies. Instruction on the use of the Peak-Flow File appears in U.S. Geological Survey, 1979.

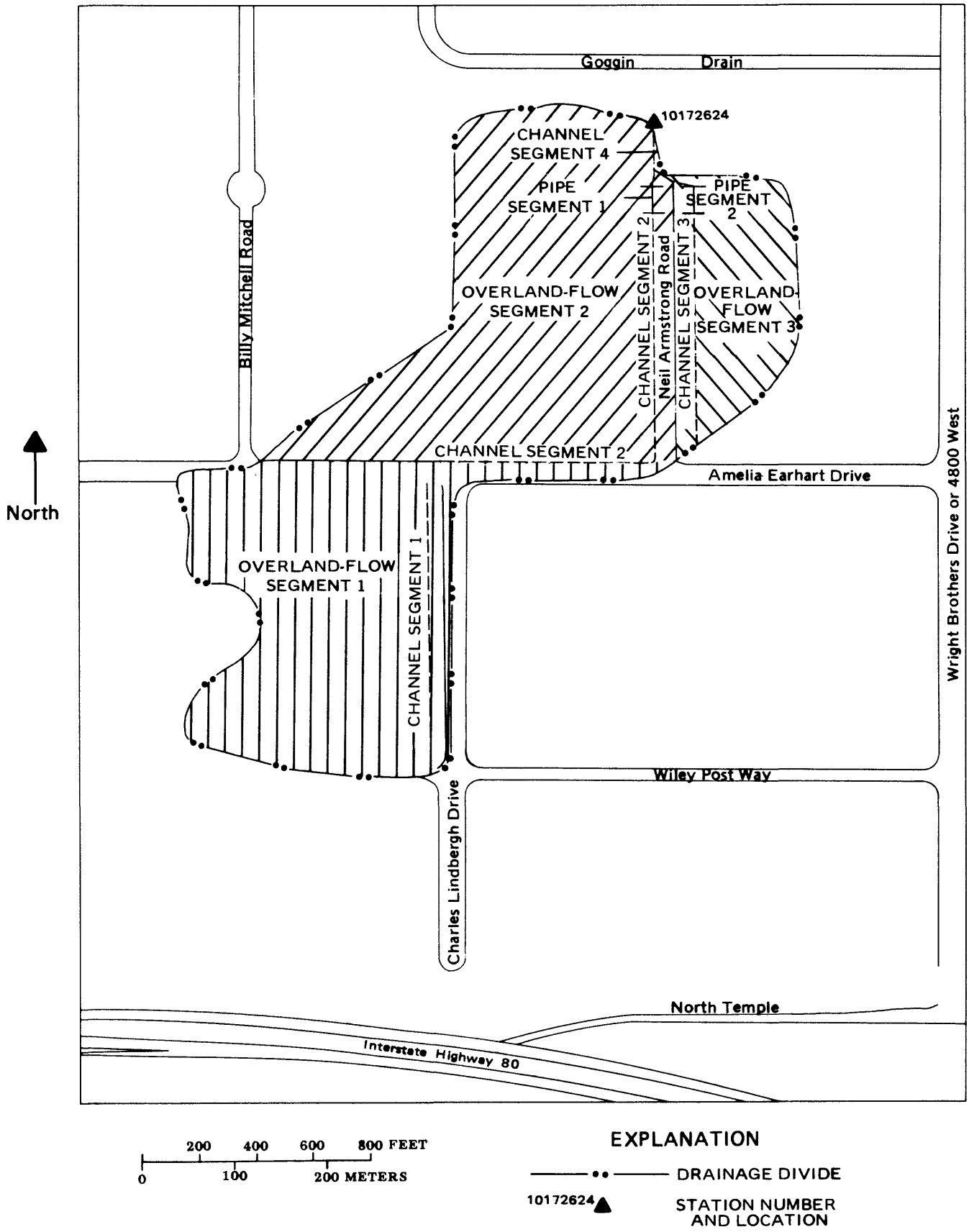

Figure 11.--Generalized outline of drainage features, overland-flow segments, and pipe and channel segments used to develop model for station 10172624.

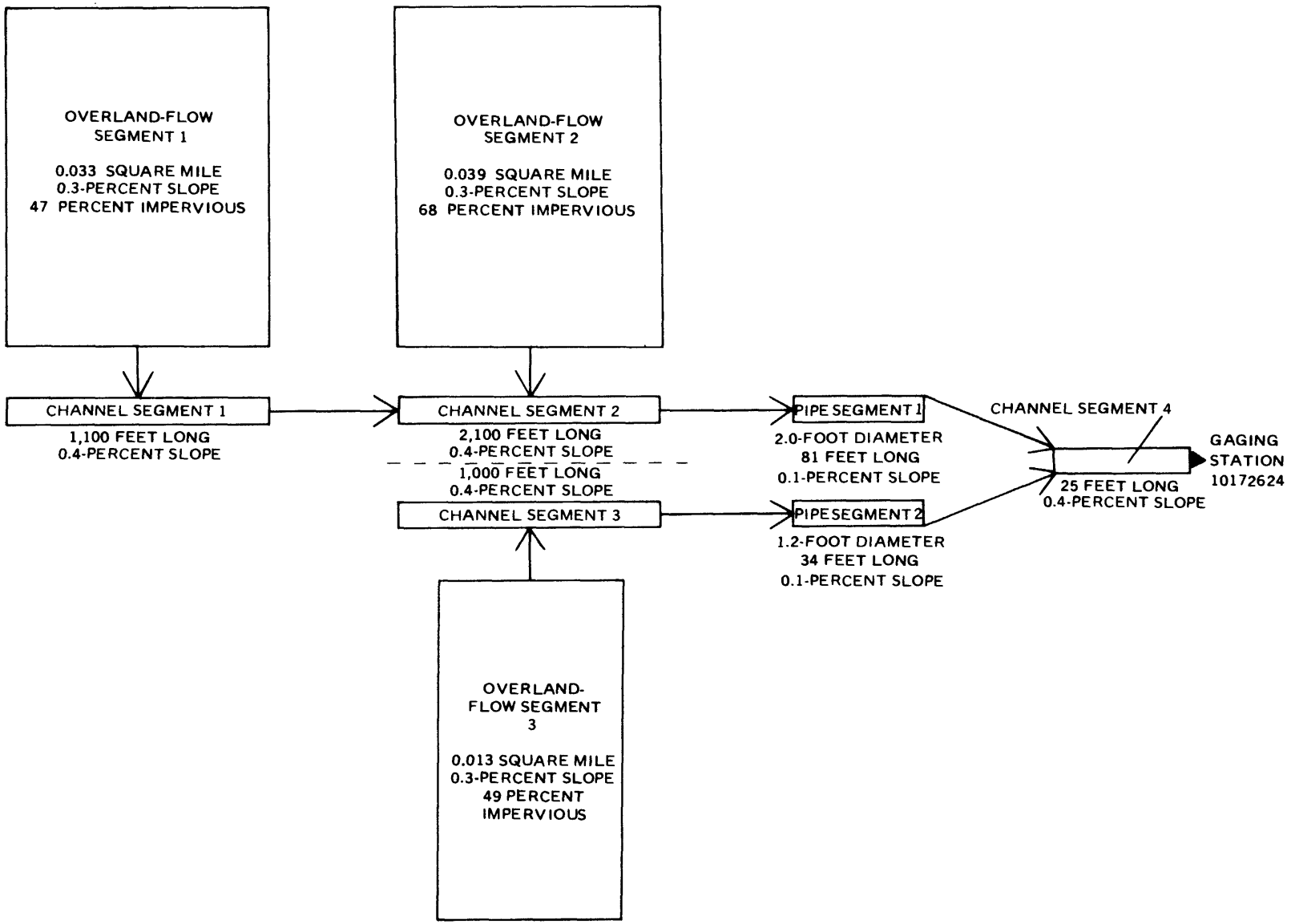

Figure 12.—Schematic of drainage features, overland-flow segments, and pipe and channel segments used to develop model for station 10172624.

Table 3.—Measured and simulated volumes and peaks at station 10172624, storm drain, 250 feet above Goggin Drain, near Neil Armstrong Road, International Center, Salt Lake City

Storm date	Volumes			Peaks		
	Measured (inches)	Simulated (inches)	Percent error	Measured (inches)	Simulated (inches)	Percent error
06/07/84	0.204	0.226	10.8	6.37	6.29	-1.3
06/09/84	.111	.109	-1.8	2.77	2.70	-2.5
07/28/84	.229	.208	-9.2	6.45	6.6	2.3
08/16/84	.393	.334	-15.0	10.97	9.76	-11.0
09/06/84	.106	.135	27.4	1.62	2.07	27.8
09/11/84	.121	.114	-5.8	3.02	2.52	-16.5
09/20/84	.058	.074	27.6	1.74	2.02	16.1
09/21/84	.073	.044	-39.7	2.32	1.03	-55.6
09/23/84	.198	.185	-6.6	3.85	4.10	6.5
10/01/84	.104	.071	-31.7	2.52	1.55	-38.5
10/02/84	.081	.112	38.3	3.15	4.71	49.5
10/11/84	.521	.652	25.1	6.95	9.75	40.3
10/26/84	.185	.183	-1.1	2.68	3.08	14.9
07/17/85	.093	.127	36.5	4.04	5.95	47.3
07/22/85	.277	.268	-3.2	9.12	9.76	7.0
09/11/85	.332	.362	9.0	4.84	5.59	15.5
09/18/85	.460	.462	.4	4.84	4.13	-14.7
10/06/85	.281	.310	10.3	4.89	5.08	3.9
10/21/85	.231	.317	37.2	3.24	4.24	30.8
11/05/85	.132	.167	26.5	3.14	3.97	26.4

Table 4.--Peak flows simulated for 63 storms during 1948-83 for station 10172624, storm drain, 250 feet above Goggin Drain, near Neil Armstrong Road, International Center, Salt Lake City

Date	Simulated peak flow (cubic feet per second)
06/21/48	13.1
09/18/48	2.74
11/16/48	4.79
03/23/49	4.54
08/23/49	2.22
09/09/49	7.63
02/06/50	7.85
07/09/50	13.7
09/03/51	.94
07/30/52	28.8
07/26/53	2.78
08/01/53	8.56
08/08/54	49.9
07/24/55	14.0
06/15/56	12.0
08/29/57	18.8
04/22/58	17.6
08/19/59	8.21
08/22/60	20.0
08/15/61	13.5
10/27/61	3.39
07/12/62	72.2
03/15/63	8.58
09/23/64	9.28
04/23/65	9.51
07/21/65	11.5
09/14/66	7.46
07/16/67	23.9
08/08/68	25.8
08/13/68	12.1
07/29/69	24.6
09/04/70	8.72
08/29/71	22.4
09/30/71	7.73
09/28/72	6.03

Table 4.--Peak flows simulated for 63 storms during 1948-83 for station 10172624, storm drain, 250 feet above Goggin Drain, near Neil Armstrong Road, International Center, Salt Lake City--Continued

Date	Simulated peak flow (cubic feet per second)
09/01/73	3.05
09/07/73	11.3
04/09/74	7.55
08/06/74	8.12
03/22/75	9.00
04/25/75	5.43
10/07/75	5.93
04/25/76	9.61
07/17/76	15.9
07/30/76	19.2
08/05/77	15.3
08/26/77	3.92
09/14/77	21.6
03/31/78	5.30
09/17/78	9.04
07/22/79	3.70
10/19/79	3.14
01/14/80	11.6
05/14/80	4.49
07/01/80	16.6
06/02/81	2.97
10/07/81	6.32
10/10/81	2.70
10/28/81	5.57
07/28/82	41.3
09/26/82	11.3
05/11/83	6.60
08/17/83	5.75

Peak-Flow Frequency Relations for Eight Gaged Drainages

The 63 peak flows generated from the calibrated models, using long-term rainfall records for 1948-83, were stored in the Peak-Flow File of WATSTORE. However, only the 36 annual peak flows were considered in developing frequency relations for each of the eight urban drainages. A log-Pearson Type-III frequency distribution was fitted to each series of simulated peak flows in accordance with U.S. Water Resources Council (1981) recommendations. Graphical fits were compared to mathematical fits (log-Pearson Type-III) and were used for two of the eight drainages. The weighted skew option was chosen using the generalized skew coefficient map in U.S. Water Resources Council (1981). The generalized skew on this map was developed for data from rural drainages and may not be representative of peak flows for some urban drainages. However, more data for urban drainages along the Wasatch Front are needed to define representative skew coefficients for peak flow from rainfall.

The peak-flow frequency relation shown in figure 13 is an example for station 10172624, storm drain, 250 feet above Goggin Drain, near Neil Armstrong Road, International Center, Salt Lake City. Only 35 points are plotted in figure 13 because one low outlier was not used. Peak-flow frequency relations for the eight urban drainages are summarized in table 5 for recurrence intervals of 2, 5, 10, 25, 50, and 100 years. As shown in table 5, the 100-year peak flow ranged from 68 cubic feet per second for station 10172624, storm drain, 250 feet above Goggin Drain, near Neil Armstrong Road, International Center, Salt Lake City, to 222 cubic feet per second for station 10145125, storm drain to Mill Creek, east of Orchard Drive, Bountiful.

Developing Relations for Estimating Peak-Flow Frequency for Ungaged Urban Drainages

Multiple-regression techniques were used to develop relations between the 2-, 5-, 10-, 25-, 50-, and 100-year peak-flows (table 5) and the basin characteristics of drainage area, basin slope, and effective impervious area. This type of multiple-regression analysis provided a mathematical equation of the relation between a single dependent variable (peak-flow for indicated recurrence interval) and one or more independent variables (basin characteristics). This analysis also provides a measure of the accuracy of the relation (the standard error of estimate). The resulting equations (table 6) have the following form:

$$Q_T = a(DA)^{b1}(BS)^{b2}(EIA)^{b3}$$

where Q_T = peak-flow, in cubic feet per second, for indicated recurrence interval T, in years;
DA = drainage area, in square miles;
BS = basin slope, in percent;
EIA = effective impervious area, in percent.

Q_T is the dependent variable, and DA, BS, and EIA are the independent variables (see "Physical and Basin Characteristics of Eight Urban Drainages" section). The constant, a, and coefficients, b1-b3, are derived from the regression analysis.

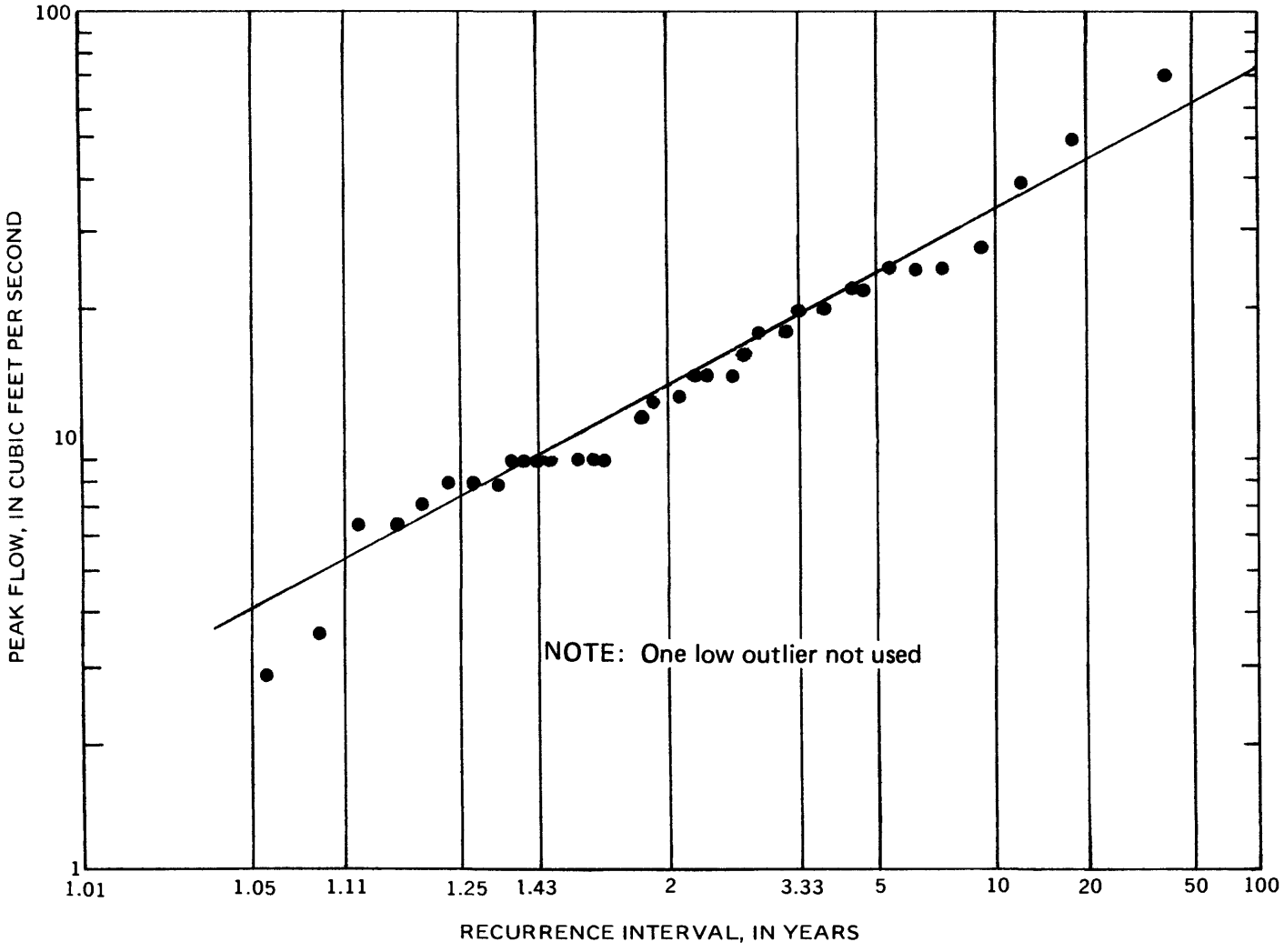

Figure 13.--Magnitude and frequency of simulated annual peak flows at station 10172624, storm drain, 250 feet above Goggin Drain, near Neil Armstrong Road, International Center, Salt Lake City.

Table 5.--Peak-flow frequency relations from simulated annual peak flows for eight urban drainages using record for 1948-83

Station number	Station name	Peak flow (cubic feet per second) for indicated recurrence interval (years)					
		2	5	10	25	50	100
10141393	Storm drain, 480 feet south of 1800 North 475 West, Sunset	28.3	61.0	88.7	129	163	200
10145125	Storm drain to Mill Creek, east of Orchard Drive, Bountiful	38.6	71.3	99.1	142	179	222
10145126	Storm drain to Mill Creek, 620 South 200 West, Bountiful	26.8	49.4	68.3	96.6	121	149
10162850	Rock Creek overflow channel, east of State Highway 189, Provo	21.1	39.1	55.0	80.7	104	132
10167220	Bells Canyon conduit, 1000 East 11000 South, Sandy	20.0	33.0	48.0	70.0	83.0	100
10167242	Interstate Highway 215 median storm drain to right bank of Jordan River, near Salt Lake City	33.0	58.7	78.7	107	130	155
10172552	Ninth West conduit, 536 North 900 West, Salt Lake City	7.1	15.0	22.0	37.0	50.0	70.0
10172624	Storm drain, 250 feet above Goggin Drain, near Neil Armstrong Road, International Center, Salt Lake City	13.0	23.4	32.0	44.8	55.8	68.0

Table 6.—Regression equations for peak flows of selected recurrence intervals

[Q, peak flow, in cubic feet per second; DA, drainage area, in square miles; BS, basin slope, in percent; EIA, effective impervious area, in percent]

Recurrence interval (years)	Equation	Average standard error of estimate (percent)
2	$Q = 0.068\ DA^{0.282} BS^{0.488} EIA^{1.60}$	27
5	$Q = 0.219\ DA^{0.319} BS^{0.432} EIA^{1.48}$	31
10	$Q = 0.575\ DA^{0.285} BS^{0.410} EIA^{1.29}$	32
25	$Q = 66.1\ DA^{0.093} BS^{0.243}$	33
50	$Q = 89.5\ DA^{0.128} BS^{0.219}$	32
100	$Q = 120\ DA^{0.158} BS^{0.194}$	29

The multiple-regression procedure (Ryan and others, 1985, p. 236), which is used to evaluate all possible combinations of the independent variables, was used to determine whether all three independent variables (drainage area, basin slope, and effective impervious area) provided the best equation. Because of the small range in the drainage area and effective impervious area values, some judgment was used to retain some of the variables even though there was little improvement in the relation for the larger recurrence-interval peak flows. Effective impervious area did not improve the relation for the 25-, 50-, and 100-year peak flows and, therefore, is not included in table 6 for these the equations.

Peak-flow values computed for the 2- and 100-year recurrence intervals from the equations in table 6 are compared in figures 14 and 15 to values in table 5 from frequency analysis of the station data. The average standard error of estimate was 27 percent for the 2-year peak flow and 29 percent for the 100-year peak flow. The equal-value lines in figures 14 and 15 indicate that errors are fairly evenly distributed throughout the range.

Regression equations in table 6 should provide reasonable estimates of peak-flows for urban drainages along the Wasatch Front with similar drainage areas, basin slopes, and effective impervious areas. However, the limitations in accuracy need to be considered when using the equations in table 6. The small number of drainages used to develop these equations may limit their accuracy. In addition, the equations may not provide accurate estimates for drainages having basin characteristics outside the range of those used to develop the equations. The range of basin characteristics used to develop the equations is summarized in table 7.

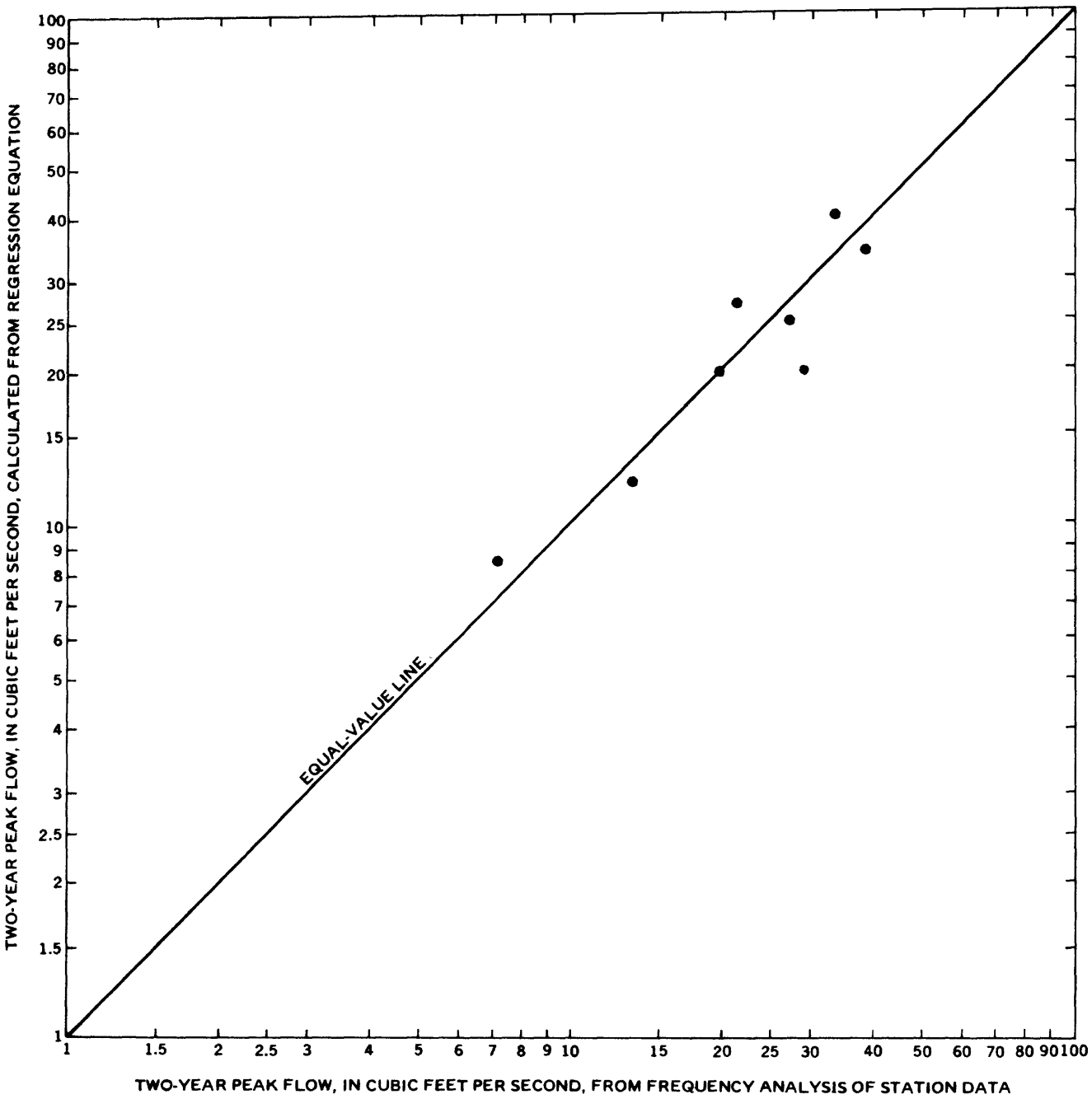

Figure 14.--Relation of 2-year peak flow from regression equation to that obtained from frequency analysis of station data for eight urban drainages.

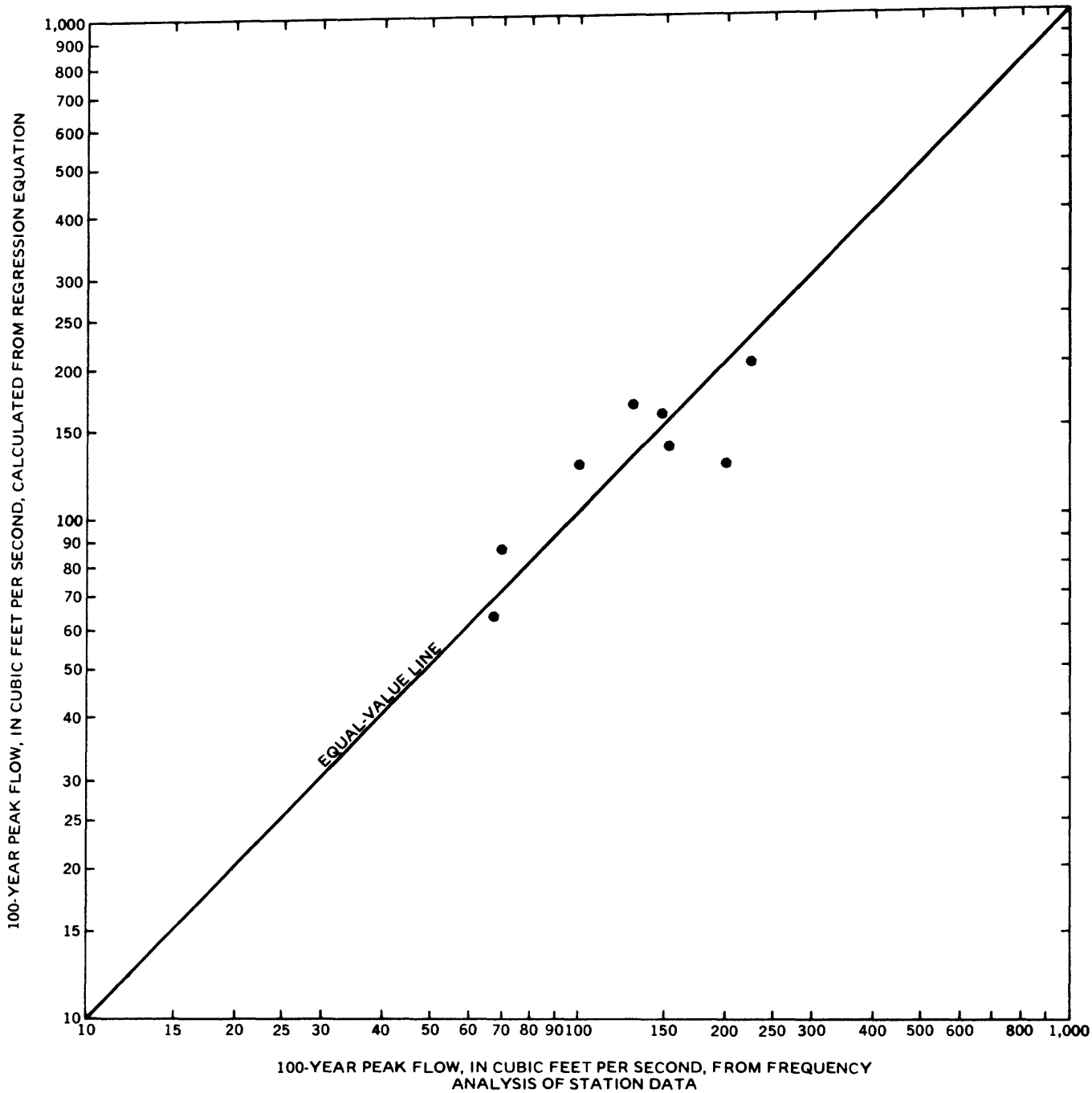

Figure 15.--Relation of 100-year peak flow from regression equation to that obtained from frequency analysis of station data for eight urban drainages.

Table 7.--Range of basin characteristics used to develop regression equations

Basin characteristics	Range in values
Drainage area (DA) (square miles)	0.085-0.87
Basin slope (BS) (percent)	0.3-15
Effective impervious area (EIA)(percent)	22-57

Comparison of Peak Flow for Little Cottonwood Creek at Canyon Mouth with That at a Downstream Station Including Urban Drainage

Designers need to consider peak flow from intervening urban drainage to adjust the peak flow of larger streams at the canyon mouth in order to determine peak-flow frequency relations at downstream locations within the urban areas. Results from this study show that larger peak flows on small urban drainages generally occur during mid-July to mid-September from intense shorter-duration rainfall from thunderstorms. Results are supported by considering the 10 largest peak flows from the 63 simulated by the models (table 4); all these peak flows occurred between July and September. In contrast, annual peak flows in the larger streams generally occur during late May to early July (fig. 16). These peak flows generally result from mountain snowmelt.

A comparison of annual peak flow for Little Cottonwood Creek at the canyon mouth (drainage area = 27.4 square miles) to that for a downstream station (drainage area = 33.8 square miles) that includes 6.4 square miles of intervening urban drainage is shown in figure 16. Data in figure 16 show that annual peaks at the downstream station are similar to those at the upstream station and indicate that the intervening urban drainages do not substantially increase flows as compared to those at the canyon mouth. In contrast, data in figure 17, which compares peak flow for August-September, indicate that the intervening drainage may be the main source of peak flows at the downstream station during August-September when intense thunderstorms are likely to occur. The contrast is further explained by comparing the peak-flow data in figures 16 and 17 for 1987. During 1987, the annual peak flow (fig. 16) was 255 cubic feet per second at upstream station 10167499 and 231 cubic feet per second at downstream station 10167700. These annual peak flows occurred on May 18 as a result of mountain snowmelt and define a slightly greater annual peak flow for the upstream station. However, from August through September 1987 (fig. 17), the peak flow was 39 cubic feet per second at the downstream station compared to 12 cubic feet per second at the upstream station.

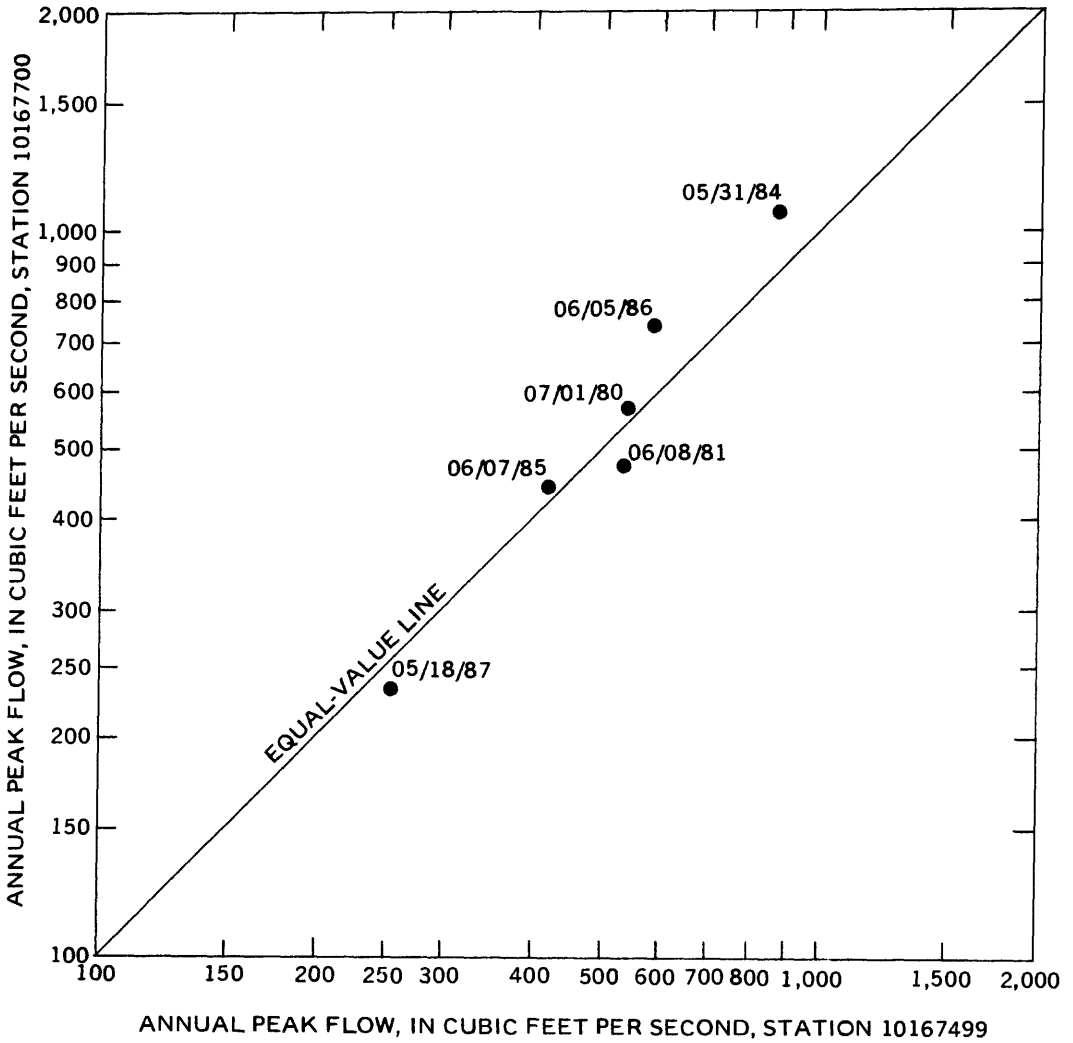

Figure 16.--Relation of annual peak flow at station 10167700, Little Cottonwood Creek at 2050 East, near Salt Lake City, to that at station 10167499, Little Cottonwood Creek (channel only) near Salt Lake City.

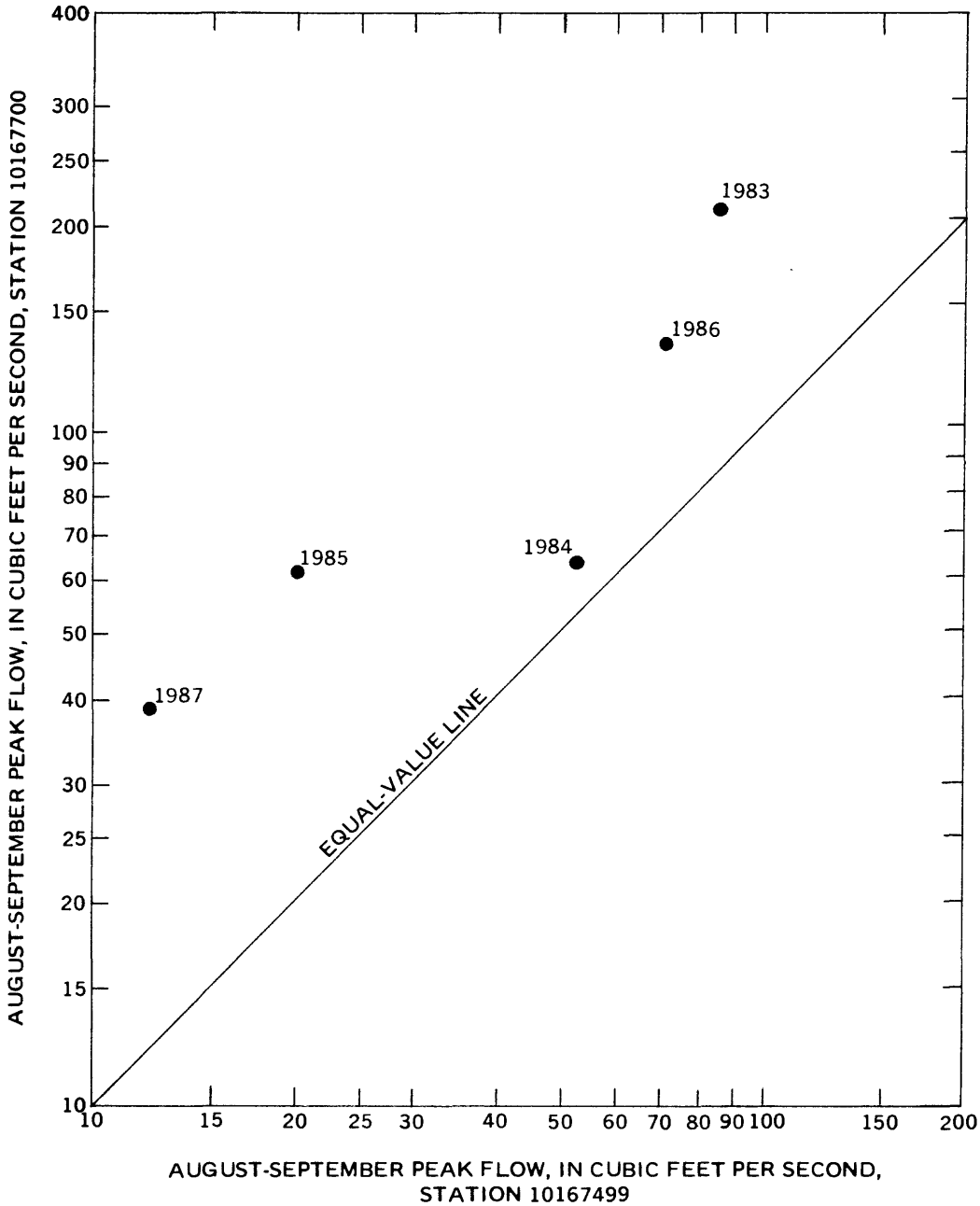

Figure 17.--Relation of August-September peak flow at station 10167700, Little Cottonwood Creek at 2050 East, near Salt Lake City, to that at station 10167499, Little Cottonwood Creek (channel only) near Salt Lake City.

NEED FOR FUTURE WORK

Questions remain about how to combine rainfall- and snowmelt-derived peak flows. Streams that originate in the mountains above an altitude of 7,000 feet and flow through the urban areas can be expected to experience peak flows from both rainfall and snowmelt. Possibly, data need to be obtained from a network of two gages on a reach of one of the larger streams in combination with data from several gages that measure contributions from intervening urban drainages. These data and concurrent rainfall data could be used to calibrate hydrologic models at each gage, and the results could be used with a routing model to simulate longer records for use in frequency analysis.

Data for larger drainages within the urban area also would be useful in order to better define the equations in table 6. However, it is difficult to find large drainages that do not receive flow from major canals.

SUMMARY

Designers and planners for local, State, and Federal agencies need up-to-date methods of determining peak-flow frequency relations for urban drainages along the Wasatch Front, Utah. Methods used to develop equations for estimating peak-flow frequency relations for small urban drainages along the Wasatch Front are summarized in this report.

Rainfall and flow data, collected during 1984-86 from eight urban drainages in the Wasatch Front area, were used to calibrate the Distributed Routing Rainfall-Runoff model (DR3M-II) for each of the eight drainages. Rainfall and flow data, available in 5-minute intervals, were used in the model because of the intense, short duration rainfall common in the area. The DR3M-II models then were used to generate 36 annual peak flows for the eight urban drainages using rainfall data collected from 1948-83 at the National Weather Service station at the Salt Lake City Airport. These rainfall data were digitized into 5-minute intervals from copies of original recorder charts. Log-Pearson type III distribution fits were made to these annual peak-flow data for each drainage, and peak flows for recurrence intervals of 2, 5, 10, 25, 50, and 100 years were calculated.

Multiple-regression techniques were used to develop relations between the 2-, 5-, 10-, 25-, 50-, and 100-year peak-flows and the basin characteristics of drainage area, basin slope, and effective impervious area. The eight drainage basins instrumented during this study had drainage areas ranging from 0.085 to 0.87 square mile, basin slopes ranging from 0.3 to 15 percent, and effective impervious area ranging from 22 to 57 percent.

The multiple-regression techniques produced a series of equations that can be used to estimate peak flows for recurrence intervals of 2, 5, 10, 25, 50, and 100 years at ungaged urban drainages in the Wasatch Front area. The average standard error of estimate for the regression equations ranged from 27 to 33 percent. The equations may not provide accurate results for drainages having basin characteristics outside the ranges used to develop the equations.

Peak flows resulting from snowmelt and peak flows resulting from intense rainfall on small urban drainages are compared at two stations on Little Cottonwood Creek near Salt Lake City. Generally, peak flows resulting from snowmelt and peak flows resulting from intense rainfall on urban drainages did not occur simultaneously. Questions remain about how to combine rainfall- and snowmelt-derived peak flows. Streams that originate in the mountains above an altitude of 7,000 feet and flow through the urban area can be expected to experience peak flows from both rainfall and snowmelt. Additional study is needed to address the effects of combining peak flows from snowmelt with peak flows from rainfall.

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STORM DRAIN IMPACT FEE FACILITIES PLAN

August 2016

Project No. 342-13-01

DRAFT

Prepared for:

Layton City

Prepared by:

Bowen Collins & Associates, Inc.
CONSULTING ENGINEERS

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EXECUTIVE SUMMARY

INTRODUCTION

Layton City has retained Bowen Collins & Associates (BC&A) to prepare an impact fee facility plan (IFFP) for the storm drain utility. The purpose of an IFFP is to identify demands placed upon City facilities by future development and evaluate how these demands will be met by the City. The IFFP is also intended to outline the improvements which may be funded through impact fees.

WHY IS AN IFFP NEEDED?

The IFFP provides a technical basis for assessing updated impact fees throughout the City. This document will address the future infrastructure needed to serve the City with regard to current land use planning. The existing and future capital projects documented in this IFFP will ensure that level of service standards are maintained for all existing and future residents who reside within the service area. Local governments must pay strict attention to the required elements of the Impact Fee Facilities Plan which are enumerated in the Impact Fees Act (Title 22 Chapter 36a of the Utah Code).

PROJECTED FUTURE GROWTH

To evaluate the use of existing capacity and the need for future capacity, it is first necessary to calculate the demand associated with existing development and projected growth. Using available information for existing development and expected growth, projected growth in developed acreage for the City's 10-year growth projections are summarized in Table ES-1.

Table ES-1
Projected 10-Year Developed Acreage

Development Type	Acreage
Existing Development (Acres)	11,272
10-Year Development (Acres)	1,389
Greater than 10-Year Development (Acres)	2,783
Total Developed Acreage at Buildout	**15,444**

EXISTING CAPACITY AVAILABLE TO SERVE FUTURE GROWTH

Projected future growth will be met through a combination of available excess capacity in existing facilities and construction of additional capacity in new facilities. The calculated percentage of existing capacity currently in use by existing development is 80.6 percent. Growth during the next 10 years is calculated to use an additional 6.9 percent, with the remaining 12.5 percent of existing capacity to be used by growth beyond the 10-year planning window.

REQUIRED SYSTEM IMPROVEMENTS

Beyond available existing capacity, additional improvements required to serve new growth are summarized in Table ES-2.

Table ES-2
Impact Fee Facilities Plan - Costs Required for Future Growth

Project ID	Project Location	Construction Year	Estimated 2015 Construction Cost	Percent of Cost Attributable to: Existing	10-Year Growth	Growth Beyond 10 Years
PE3	Highway 89 & 1500 N	2025	$231,100	24.54%	61.86%	13.60%
PE4	Quail Ridge Road and Hwy 193	2021	$206,000	33.90%	54.19%	11.91%
PE5A	Fairfield Road and Hwy 193	2018	$84,300	35.50%	52.88%	11.62%
PE5B	Fairfield Road and Hwy 193	2018	$106,600	36.91%	51.72%	11.37%
PE5C	Fairfield Road and ~2800 N	2018	$177,700	36.91%	51.72%	11.37%
PE10	Fort Ln and Main St	2025	$68,000	91.03%	7.35%	1.62%
PE11	Fairfield Rd & 200 S	2017	$404,100	92.30%	6.31%	1.39%
PE12	Highway 89 & 1000 N	2018	$147,000	42.73%	46.95%	10.32%
DBE2	3150 N & 1350 E	2022	$1,343,200	5.54%	77.44%	17.02%
DBE6	3050 N &110 E	2025	$79,300	33.90%	54.19%	11.91%
OE1	3050 N & 1100 E	2020	$19,200	33.90%	54.19%	11.91%
PW6A	Hill Field Rd to Bamberger Trail	2016	$424,000	86.38%	11.17%	2.45%
PW6B	Bamberger Trail to Kays Creek	2016	$751,250	86.38%	11.17%	2.45%
PW14	2200 West & Hill Field Rd	2024	$78,700	64.49%	29.11%	6.40%
PW23	2700 West & Gentile Rd	2023	$1,250,400	45.14%	44.97%	9.89%
PW24	Kays Creek and Weaver Ln	2017	$196,700	70.28%	24.36%	5.36%
DBW4	Gentile St & 2450 W	2021	$565,200	47.27%	43.23%	9.50%
DBW7	Hill Field Rd and Sugar St (South)	2019	$1,256,400	89.69%	8.45%	1.86%
DBW9	2200 W 500 S	2024	$720,900	12.65%	71.60%	15.75%
DBW10	Weaver Ln 650 W	2018	$383,800	13.79%	70.67%	15.54%
DBW12	Bluff Rd Outfall	2021	$111,300	37.86%	50.94%	11.20%
DBW13	North Conference Pond	2020	$248,300	93.75%	5.12%	1.13%
OW4	2200 West & Hill Field Rd	2024	$19,200	64.49%	29.11%	6.40%
OW5	2200 West & 400 S	2017	$38,400	12.66%	71.60%	15.74%
		10- Year Capital Project Total	**$8,911,050**	**50.12%**	**40.89%**	**8.99%**
Master Plan Update		2021	$81,500	0%	100%	0%
		10-Year Total Cost	**$8,992,550**	**49.66%**	**41.43%**	**8.91%**

To satisfy the requirements of state law, Table ES-2 provides a breakdown of the percentage of the project costs attributed to existing and future users. For future use, capacity has been divided between capacity to be used by growth within the 10-year planning window of this IFFP and capacity that will be available for growth beyond the 10-year window.

SECTION 1
INTRODUCTION

Layton City has retained Bowen Collins & Associates (BC&A) to prepare an impact fee facility plan (IFFP) for storm drain services provided by the City. The purpose of an IFFP is to determine the public facilities required to serve development resulting from new development activity. The IFFP is also intended to outline the improvements which may be funded through impact fees.

Requirements for the preparation of an IFFP are outlined in Title 11, Chapter 36a of the Utah Code (the Impact Fees Act). Under these requirements, an IFFP shall accomplish the following for each facility:

1. Identify the existing level of service
2. Establish a proposed level of service
3. Identify excess capacity to accommodate future growth at the proposed level of service
4. Identify demands placed upon existing public facilities by new development
5. Identify the means by which demands from new development will be met
6. Consider the following additional issues
    a. revenue sources to finance required system improvements
    b. necessity of improvements to maintain the proposed level of service
    c. need for facilities relative to planned locations of schools

The following sections of this report have been organized to address each of these requirements.

SECTION 2
EXISTING LEVEL OF SERVICE (11-36A-302.1.A.I)

Level of service is defined in the Impact Fees Act as "the defined performance standard or unit of demand for each capital component of a public facility within a service area". This section discusses the level of service being currently provided to existing users.

PERFORMANCE STANDARD

The performance standard defines the level of service the City has established to satisfy City and/or State performance requirements. There is no minimum State standard for storm drain as there are with some other utilities. Every city desires to protect their residents and infrastructure from flooding and attempts to balance the cost of storm drainage improvements with the amount of flow in the streets. The evaluation criteria for this study was provided by Layton City personnel as documented in their Storm Drain Master Plan. The level of service adopted by Layton City is similar to the level of service provided by neighboring cities.

Storm Drain Conveyance

Storm drain pipelines are not allowed to flood into the street during the 10-year storm event. In the event that storm water discharge is greater than the 10-year event, the pipes will pressurize and eventually flood in the streets. It is important to note that roadways become the major storm water conveyance facility during storms that are larger than the 10-year design event, and should be designed to convey flows up to the 100-year event. Storm drain pipe materials and minimum sizes are defined in the "Layton City Development Guidelines and Design Standards".

While the City does use some open channels for storm drain conveyance, no open channel costs are proposed to be recovered as part of impact fees. As a result, open channels will not be considered further as part of this IFFP.

Detention Basins

Detention facilities are routinely used in the City to reduce maximum flow rates. In Layton City, both regional and local detention facilities are used. Regional basins need to have capacity for the 100-year storm and are used to detain flows from all types of developments. Local detention basins have been designated as project level improvements to be constructed by a single developer or consortium of neighboring developers. Local detention is required for areas having an impervious area greater than the typical single lot residential unit, to allow for similar rates of runoff from all development types. All detention basins should have an emergency overflow, designed to convey runoff from storms larger than the design storm event that directs water toward secondary conveyance facilities, such as a right-of-way or open channel, and away from private property and areas of potential property damage.

Design Storm Parameters

The design storm defines how much precipitation falls and at what rate for a projected precipitation event. Rainfall data for system evaluation is based on the National Oceanic and

Atmospheric Administration (NOAA) Atlas 14. This data is commonly used by professionals in the industry, and has been shown to produce accurate results in studies conducted in neighboring communities. The Farmer Fletcher Storm distribution was used for storm drain conveyance facilities, to simulate a cloudburst event which is typical to the Wasatch Front area in Northern Utah. The NOAA Atlas 14 distribution was used for sizing detention facilities.

UNIT OF DEMAND

Layton City policy requires development with impervious areas larger than typical single lot residential to detain 0.2 cfs per acre. Requiring detention in areas with high impervious areas results in all development, regardless of type, having a similar demand on the storm drainage system on a per acre basis. This means that demand for the calculation of impact fees can be on the basis of a total acres developed, independent of the type of development.

SECTION 3
PROPOSED LEVEL OF SERVICE (11-36A-302.1.A.II)

The proposed level of service is the performance standard used to evaluate system needs in the future. The Impact Fee Act indicates that the proposed level of service may:

1. diminish or equal the existing level of service; or
2. exceed the existing level of service if, independent of the use of impact fees, the City implements and maintains the means to increase the level of service for existing demand within six years of the date on which new growth is charged for the proposed level of service.

No changes in the level of service are proposed for Layton City. Future facilities will be constructed to meet the same performance standards identified for the existing level of service.

SECTION 4
EXCESS CAPACITY TO ACCOMMODATE FUTURE GROWTH (11-36A-302.1.A.III)

Projected future growth will be met through a combination of available excess capacity in existing facilities and construction of additional capacity in new facilities.

EXISTING STORM DRAIN INFRASTRUCTURE

Existing storm drain infrastructure in Layton City includes conveyance pipelines, open channels, and detention basins. As noted previously, open channels are considered as project level improvements and will not be included in the calculation of impact fees. In areas where existing facilities exist, future growth will utilize a portion of excess capacity in existing facilities.

EXISTING DEMAND AND DETERMINATION OF EXCESS CAPACITY

To calculate the percentage of existing capacity to be used by future growth in existing facilities, existing and future development patterns were examined. The method used to calculate excess capacity available for use by future development is as follows:

- **Group Facilities as Necessary for Analysis –** While Layton has good records of past projects and can document actual expenditures for many storm drain facilities, the available records do not identify the specific locations of all projects. As a result, it is necessary to group some facilities for analysis purposes.
- **Calculate Potential Drainage Area of the Facilities –** The drainage area contributing to each facility or group of facilities was calculated for both existing and future development scenarios (see Section 5).
- **Identify Existing Development –** Based on GIS records and available aerial photography, existing developed areas within each drainage area have been identified.
- **Identify 10-year Growth** – Population projections were made for Layton City through buildout. Projects selected for the next 10-years are based on areas where projected growth is expected.
- **Calculate Percent of Excess Capacity Used by 10-year Growth** – The percent of excess capacity being used in each facility was calculated by dividing the growth in use in the facility (10-year developed area less existing developed area) by the maximum use of capacity at buildout (total drainage area for the facilities).
- **Calculate Cost Weighted Average for System** – Each facility in the system has a different quantity of excess capacity to be used by future growth. To develop an estimate of excess capacity for the system as a whole, the capacities of each of these facilities and their contribution to the system as a whole must be considered. To do this, each component has been weighted based on its calculated actual cost. The capacity of the system as a whole is then calculated as the sum of the weighted capacity used by future growth divided by the sum of total weighted capacity in the system.

Based on the method described above, the calculated percentage of existing capacity currently in use by existing development is 80.6 percent. Growth during the next 10 years is calculated to use an additional 6.9 percent, with the remaining 12.5 percent of existing capacity to be used by growth beyond the 10-year planning window.

In considering available capacity in existing storm drain facilities, it should be remembered that available capacity can only serve growth in the areas for which it was constructed. In other words, an existing pipeline that has available capacity for future growth in one area of the City can provide no benefit for projected growth in another area of the City. Thus, it is very common for projects to be needed in one area, even though available capacity may exist in another area. By following the procedure to calculate use of capacity as described above, only the existing capacity that will actually be used by 10-year growth has been identified as reimbursable through impact fees.

SECTION 5
DEMANDS PLACED ON FACILITIES BY NEW DEVELOPMENT (11-36A-302.1.A.IV)

The planning period to be used for this IFFP is 10 years. Table 5-1 lists the population projections for the city for the 10-year planning window. The population projections are based on projections from the Governor's Office of Management and Budget (GOMB).

Table 5-1
Projected 10-Year Growth

Year	Layton City Population Projection
2015	73,452
2025	84,818
Buildout	107,598

CONVERSION OF GROWTH AND DEVELOPMENT PROJECTIONS TO DEVELOPED ACRES

To evaluate the use of existing capacity and the need for future capacity, it is first necessary to calculate the acreage associate with existing development and projected growth. Using available information for existing development, BC&A calculated the average acreage associated with existing and future development. Using population projections, the acreage for 10-year and greater than 10-year growth were estimated. Table 5-2 lists the acreage associated with existing, 10-year, and greater than 10-year growth.

Table 5-2
Average Developed Acreage for Existing and Future Development

Development Type	Acreage
Existing Development (Acres)	11,272
10-Year Development (Acres)	1,389
Greater than 10-Year Development (Acres)	2,783
Total Developed Acreage at Buildout	**15,444**

As shown in Table 5-2, it is projected that approximately 1,390 acres of new development will occur over the next 10 years. It should be emphasized that this is a gross developed acres and includes all components of development including lots, open space and roads, both public and private. Inherent to land development is the creation of impervious areas, such as paved roads, parking lots, driveways, and rooftops. However, the implementation of local detention for areas with high impervious areas, will lead to similar peak runoff for each acre regardless of development type.

SECTION 6
INFRASTRUCTURE REQUIRED TO MEET DEMANDS OF NEW DEVELOPMENT (11-36A-302.1.A.V)

To satisfy the requirements of state law, demand placed upon system facilities by future development was projected using the process outlined below.

1. **Existing Capacity** – The capacities of the existing facilities were evaluated using a hydraulic storm water model as part of the master plan.
2. **Existing Deficiencies** – Existing deficiencies in the system were looked for by comparing defined levels of service against calculated capacities.
3. **Future Demand** - The demand that future development will place on the system was estimated based on development projections as discussed in Section 5.
4. **Future Deficiencies** - Future deficiencies in the storm drain infrastructure were identified based on the defined level of service.
5. **Recommended Improvements** – Needed storm drain improvements were identified to resolve the projected deficiencies.

The steps listed above describe the "demands placed upon existing public facilities by new development activity at the proposed level of service; and… the means by which the political subdivision or private entity will meet those growth demands" (Section 11-36a-302-1.a of the Utah Code).

10-YEAR IMPROVEMENT PLAN

Planned improvements to satisfy level of service requirements for projected demands at build out have been identified in the City's Storm Drain Master Plan. These improvements will be constructed in phases as development occurs. Only infrastructure to be constructed within a ten year horizon will be considered in the calculation of these impact fees to avoid uncertainty surrounding improvements further into the future.

To identify improvements to be built within the 10-year window, prioritization of projects was based on the magnitude of flooding which could occur. The highest priority projects were added to the City's 10-year improvement plan. Table 6-1 summarizes the projects that are projected to be needed within the next ten years. The location of these projects is shown in Figure 6-1.

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Table 6-1
Summary of Future Storm Drain Impact Fee Facility Improvements

Project ID	Project Location	Construction Year	Pipe Length (ft)	Diameter (in)	Volume (ac-ft)	Project Expense - 2015 Dollars	Construction Year Expense
PE3	Hwy 89 & 1500 N	2025	1060	24	-	$231,100	$301,533
PE4	Quail Ridge Road and Hwy 193	2021	930	24	-	$206,000	$238,810
PE5A	Fairfield Rd & Hwy 193	2018	330	30	-	$84,300	$89,434
PE5B	Fairfield Rd & Hwy 193	2018	370	36	-	$106,600	$113,092
PE5C	Fairfield Rd & 2800 N	2018	700	30	-	$177,700	$188,522
PE10	Fort Ln & Main St	2025	230	24	-	$68,000	$88,725
PE11	Fairfield Rd & 200 S	2017	910	54	-	$404,100	$416,223
PE12	Hwy 89 & 1000 N	2018	670	24	-	$147,000	$155,952
PW6A	Hill Field Rd to Bamberger	2016	2250	48	-	$424,000	$424,000
PW6B	Bamberger Trail	2016	3930	48	-	$751,250	$758,462
PW14	2200 W & Hill Field Rd	2024	320	36	-	$78,700	$99,695
PW23	2700 West & Gentile Rd	2023	3790	42	-	$1,250,400	$1,563,670
PW24	Kays Creek and Weaver Ln	2017	80	6'X20'	-	$196,700	$202,601
DBE2	3150 N & 1350 E	2022	-	-	11.8	$1,343,200	$1,618,286
DBE6	3050 N &110 E	2025	-	-	1.6	$79,300	$103,469
DBW4	Gentile St & 2450 W	2021	-	-	3.7	$565,200	$655,222
DBW7	Hill Field Rd & Sugar St	2019	-	-	16.3	$1,256,400	$1,384,435
DBW9	2200 W & 500 S	2024	-	-	6.8	$720,900	$935,132
DBW10	Weaver Ln & 650 W	2018	-	-	2.8	$383,800	$407,173
DBW12	Bluff Rd Outfall	2021	-	-	1.9	$111,300	$129,027
DBW13	North Conference Pond	2020	-	-	6.6	$248,300	$279,464
OE1	3050 N &110 E	2020	-	12	-	$19,200	$21,610
OW4	2200 West & Hill Field Rd	2024	-	36	-	$19,200	$24,322
OW5	2200 West & 400 S	2017	-	15	-	$38,400	$39,552
					Total Project Cost	**$8,911,050**	**$10,238,411**

It should be noted that Table 6-1 only includes those projects with components of cost that are eligible to be included in the impact fee calculation. Other storm drain projects that may be completed over the next ten years but have not been shown in the table include: projects for maintenance and repair (to be paid for by existing users), enclosure of historic open channels for property owner convenience (to be paid for by property owner), and project level improvements (to be paid for by individual developers).

PROJECT COST ATTRIBUTABLE TO FUTURE GROWTH

To satisfy the requirements of state law, Table 6-2 provides a breakdown of the impact fee facility projects and the percentage of the project costs attributed to existing and future users. As defined in Section 11-36-304, the impact fee facilities plan should only include "the proportionate share of the costs of public facilities [that] are reasonably related to the new development activity." While some projects from the capital facilities plan are required to meet future growth, some projects also provide benefit to existing users. Projects that benefit existing users include those projects addressing existing capacity deficiencies, maintenance related projects, or projects increasing the level of service for existing users.

For some projects, the division of costs between existing and future users is easy because 100 percent of the project costs can be attributed to one category or the other (e.g. infrastructure needed solely to serve new development can be 100 percent attributed to new growth). For projects needed to address both existing deficiencies and new growth, the costs were divided based on the area the pipe serves. For example, if a pipe is to be replaced and will cost $100,000 and it serves an area that was 80 percent developed. Existing users would be responsible to pay $80,000, while future users would be responsible for $20,000.

The method used to calculate flows associated with each type of development is as follows:

- **Calculate Potential Drainage Area of the Facilities –** The total drainage area contributing to each project at buildout was calculated.
- **Identify Existing Development –** Based on GIS records and available aerial photography, existing developed areas within each drainage area were identified.
- **Identify 10-year Growth** – Using population projections, the area associated with growth in the 10-year window has been calculated.
- **Calculate Percent of Excess Capacity Used by Future Growth** – The percent of capacity being used in each facility was calculated by dividing the developable area of each type (existing, 10-year, and beyond 10-year) contributing to each facility by the total drainage area for the project.

Table 6-2
Impact Fee Facilities Plan - Costs Required for Future Growth

Project ID	Project Location	Construction Year	Estimated 2015 Construction Cost	Percent of Cost Attributable to: Existing	10-Year Growth	Growth Beyond 10 Years
PE3	Highway 89 & 1500 N	2025	$231,100	24.54%	61.86%	13.60%
PE4	Quail Ridge Road and Hwy 193	2021	$206,000	33.90%	54.19%	11.91%
PE5A	Fairfield Road and Hwy 193	2018	$84,300	35.50%	52.88%	11.62%
PE5B	Fairfield Road and Hwy 193	2018	$106,600	36.91%	51.72%	11.37%
PE5C	Fairfield Road and ~2800 N	2018	$177,700	36.91%	51.72%	11.37%
PE10	Fort Ln and Main St	2025	$68,000	91.03%	7.35%	1.62%
PE11	Fairfield Rd & 200 S	2017	$404,100	92.30%	6.31%	1.39%
PE12	Highway 89 & 1000 N	2018	$147,000	42.73%	46.95%	10.32%
DBE2	3150 N & 1350 E	2022	$1,343,200	5.54%	77.44%	17.02%
DBE6	3050 N &110 E	2025	$79,300	33.90%	54.19%	11.91%
OE1	3050 N & 1100 E	2020	$19,200	33.90%	54.19%	11.91%
PW6A	Hill Field Rd to Bamberger Trail	2016	$424,000	86.38%	11.17%	2.45%
PW6B	Bamberger Trail to Kays Creek	2016	$751,250	86.38%	11.17%	2.45%
PW14	2200 West & Hill Field Rd	2024	$78,700	64.49%	29.11%	6.40%
PW23	2700 West & Gentile Rd	2023	$1,250,400	45.14%	44.97%	9.89%
PW24	Kays Creek and Weaver Ln	2017	$196,700	70.28%	24.36%	5.36%
DBW4	Gentile St & 2450 W	2021	$565,200	47.27%	43.23%	9.50%
DBW7	Hill Field Rd and Sugar St (South)	2019	$1,256,400	89.69%	8.45%	1.86%
DBW9	2200 W 500 S	2024	$720,900	12.65%	71.60%	15.75%
DBW10	Weaver Ln 650 W	2018	$383,800	13.79%	70.67%	15.54%
DBW12	Bluff Rd Outfall	2021	$111,300	37.86%	50.94%	11.20%
DBW13	North Conference Pond	2020	$248,300	93.75%	5.12%	1.13%
OW4	2200 West & Hill Field Rd	2024	$19,200	64.49%	29.11%	6.40%
OW5	2200 West & 400 S	2017	$38,400	12.66%	71.60%	15.74%
		10- Year Capital Project Total	**$8,911,050**	**50.12%**	**40.89%**	**8.99%**
Master Plan Update		2021	$81,500	0%	100%	0%
		10-Year Total Cost	**$8,992,550**	**49.66%**	**41.43%**	**8.91%**

It should be noted that Table 6-2 does not include bond costs related to paying for impact fee eligible improvements. These costs, if any, should be added as part of the impact fee analysis.

PROJECT COST ATTRIBUTABLE TO 10 YEAR GROWTH

Included in Table 6-2 is a breakdown of capacity associated with growth through the next 10 years and for growth beyond 10 years. A challenge with Storm Drain infrastructure is that it is not cost effective to add capacity in small increments. Once a pipeline is being built, it needs to

be built to satisfy long-term capacity needs. As a result, the improvements proposed in the impact fee facility plan will include capacity for growth beyond the 10-year planning window. To most accurately evaluate the cost of providing service for growth during the next ten years, added consideration has been given to evaluating how much of each improvement will be used in the next 10 years. This has been done following the same methodology as described above.

BASIS OF CONSTRUCTION COST ESTIMATES

The costs of construction for projects to be completed within ten years have been estimated based on past BC&A experience with projects of a similar nature. Pipeline project costs are based on average per foot costs for pipes of a similar nature. Costs include consideration of other components of the storm drain system including manholes, catch basins, and surface restoration as appropriate for each project.

SECTION 7
ADDITIONAL CONSIDERATIONS

MANNER OF FINANCING (11-36A-302.2)

The City may fund the infrastructure identified in this IFFP through a combination of different revenue sources.

Federal and State Grants and Donations

Impact fees cannot reimburse costs funded or expected to be funded through federal grants and other funds that the City has received for capital improvements without an obligation to repay. Grants and donations are not currently contemplated in this analysis. If grants become available for constructing facilities, impact fees will need to be recalculated and an appropriate credit given. Any existing infrastructure funded through past grants will be removed from the system value during the impact fee analysis. It should be noted that UDOT is responsible for half of the project cost of Projects P-6a and P-6b. The fees shown in this report show only the City's responsibility for these projects. The total projected cost for each of these projects (including the UDOT contribution) is actually twice what is shown.

Bonds

None of the costs contained in this IFFP include the cost of bonding. The cost of bonding required to finance impact fee eligible improvements identified in the IFPP may be added to the calculation of the impact fee. This will be considered in the impact fee analysis.

Interfund Loans

Because infrastructure must generally be built ahead of growth, there often arises situations in which projects must be funded ahead of expected impact fee revenues. In some cases, the solution to this issue will be bonding. In others, funds from existing user rate revenue will be loaned to the impact fee fund to complete initial construction of the project and will be reimbursed later as impact fees are received. Consideration of potential interfund loans will be included in the impact fee analysis and should also be considered in subsequent accounting of impact fee expenditures.

Impact Fees

It is recommended that impact fees be used to fund growth-related capital projects as they help to maintain the proposed level of service and prevent existing users from subsidizing the capital needs for new growth. Based on this IFFP, an impact fee analysis will be able to calculate a fair and legal fee that new growth should pay to fund the portion of the existing and new facilities that will benefit new development.

Developer Dedications and Exactions

Developer exactions are not the same as grants. Developer exactions may be considered in the inventory of current and future infrastructure. If a developer constructs a system improvement or dedicates land for a system improvement identified in this IFFP, or dedicates a public facility that is recognized to reduce the need for a system improvement, the developer will be entitled to an appropriate credit against that particular developer's impact fee liability or a proportionate reimbursement.

If the value of the credit is less than the development's impact fee liability, the developer will owe the balance of the liability to the City. If the recognized value of the improvements/land dedicated is more than the development's impact fee liability, the City must reimburse the difference to the developer.

It should be emphasized that the concept of impact fee credits pertains to system level improvements only. For project level improvement (i.e. projects not identified in the impact fee facility plan), developers will be responsible for the construction of the improvements without credit against the impact fee. No developer dedications are expected for storm drain infrastructure.

NECESSITY OF IMPROVEMENTS TO MAINTAIN LEVEL OF SERVICE (11-36A-302.3)

According to State statute, impact fees cannot be used to correct deficiencies in the City's system and must be necessary to maintain the proposed level of service established for all users. Only those facilities or portions of facilities that are required to maintain the proposed level of service for future growth have been included in this IFFP. This will result in an equitable fee as future users will not be expected to fund any portion of the facilities that will benefit existing residents.

SCHOOL RELATED INFRASTRUCTURE (11-36A-302.2)

As part of the noticing and data collection process for this plan, information was gathered regarding future school district and charter school development. Where the City is aware of the planned location of a school, required public facilities to serve the school have been included in the impact fee analysis.

NOTICING AND ADOPTION REQUIREMENTS (11-36A-502)

The Impact Fees Act requires that entities must publish a notice of intent to prepare or modify any IFFP. If an entity prepares an independent IFFP rather than include a capital facilities element in the general plan, the actual IFFP must be adopted by enactment. Before the IFFP can be adopted, a reasonable notice of the public hearing must be published in a local newspaper at least 10 days before the actual hearing. A copy of the proposed IFFP must be made available in each public library within the City during the 10 day noticing period for public review and inspection. Utah Code requires that the City must post a copy of the ordinance in at least three places. These places may include the City offices and the public libraries within the City's jurisdiction. Following the 10-day noticing period, a public hearing will be held, after which the City may adopt, amend and adopt, or reject the proposed IFFP.

SECTION 8
IMPACT FEE CERTIFICATION (11-36A-306.1)

This IFFP has been prepared in accordance with Utah Code Title 11, Chapter 36a (the "Impact Fees Act"), which prescribes the laws pertaining to the imposition of impact fees in Utah. The accuracy of this report relies upon the planning, engineering, and other source data, which was provided by the City and their designees.

In accordance with Utah Code Annotated, 11-36a-306(1), Bowen Collins & Associates makes the following certification:

I certify that this impact fee facility plan:

1. Includes only the costs of public facilities that are:
    a. allowed under the Impact Fees Act; and
    b. actually incurred; or
    c. projected to be incurred or encumbered within six years after the day on which each impact fee is paid;
2. Does not include:
    a. costs of operation and maintenance of public facilities;
    b. costs for qualifying public facilities that will raise the level of service for the facilities, through impact fees, above the level of service that is supported by existing residents; or
    c. an expense for overhead, unless the expense is calculated pursuant to a methodology that is consistent with generally accepted cost accounting practices and the methodological standards set forth by the federal Office of Management and Budget for federal grant reimbursement; and
3. Complies in each and every relevant respect with the Impact Fees Act.

STORM DRAIN IMPACT FEE ANALYSIS

August 2016

Project No. 342-13-01

DRAFT

Prepared for:

Layton City

Prepared by:

Bowen Collins & Associates, Inc.
CONSULTING ENGINEERS

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EXECUTIVE SUMMARY

INTRODUCTION

Layton City has retained Bowen Collins & Associates (BC&A) to prepare an impact fee analysis (IFA) for its storm drain system based on a recently completed impact fee facility plan. An impact fee is a one-time fee, not a tax, imposed upon new development activity as a condition of development approval to mitigate the impact of the new development on public infrastructure. The purpose of an IFA is to calculate the allowable impact fee that may be assessed to new development in accordance with Utah code.

WHY ASSESS AN IMPACT FEE?

As new users join a system, they add demands that must be satisfied through new facilities or use of excess capacity in existing facilities. Until all required projects are completed and new development is utilizing the full capacity of existing facilities, the City can assess an impact fee to recover its cost of latent capacity available to serve the future development. The general impact fee methodology divides the available capacity of existing and future capital projects between existing and future users based on their projected demands.

HOW ARE IMPACT FEES CALCULATED?

A fair impact fee is calculated by dividing the cost of existing and future facilities by the amount of new growth that will benefit from the unused capacity. Only the capacity that is needed to serve the projected growth within the next ten years is included in the fee. Costs used in the calculation of impact fees include:

- New facilities required to maintain (but not exceed) the proposed level of service identified in the IFFP; only those expected to be built within ten years are considered in the final calculations of the impact fee.
- Historic costs of existing facilities that will serve new development
- Cost of professional services for engineering, planning, and preparation of the impact fee facilities plan and impact fee analysis

Costs not used in the impact fee calculation

- Operational and maintenance costs
- Cost of facilities constructed beyond 10 years
- Cost of facilities funded by grants, developer contributions, or other funds which the City is not required to repay
- Cost of renovating or reconstructing facilities which do not provide new capacity or needed enhancement of services to serve future development

IMPACT FEE CALCULATION

Impact fees for this analysis were calculated by dividing the proportional cost of facilities required to service 10-year growth by the amount of growth expected over the next 10-years. This is done for each of the major component categories in the system.

To facilitate calculation, impact fees are often defined in terms of gross acre. Calculated impact fees by component are summarized in Table ES-1.

Table ES-1
Impact Fee Calculation per Gross Area

Sewer Collection System Components	Total Cost of Component	% Serving 10-year Growth	Cost Serving 10-year Growth	10-year Acres Served	Cost Per Gross Acre
Collection Facilities					
Existing Facilities	$17,289,434	6.92%	$1,196,613	1,389	$861.73
Existing Facility Interest Costs Outstanding	$0	0%	$0	1,389	$0.00
10-year Projects	$8,911,050	40.89%	$3,644,010	1,389	$2,624.21
10-Year Project Interest Costs	$0	0%	$0	1,389	$0.00
Subtotal	**$26,200,484**		**$4,840,623**		**$3,485.94**
Other					
Impact Fee Studies	$81,500	100%	$81,500	1389	$58.69
Subtotal	**$81,500**		**$81,500**		**$58.69**
Total	**$26,281,984**		**$4,922,123**		**$3,544.63**

The total impact fee per developed area can be calculated by adding up the fee for each type of system component. This is separate from any additional charges levied by the City for hookup costs or for other reasonable permit and application fees.

RECOMMENDED IMPACT FEE

The total calculated impact fee is summarized in Table ES-2. This is the legal maximum amount that may be charged as an impact fee. A lower amount may be adopted if desired, but a higher fee is not allowable under the requirements of Utah Code. The fee shown in table ES-1 is a cost per gross acre. This is the amount that would be charged if the impact fee is collected at the time each plat is approved. As stated in the master plan runoff associated with each site is estimated to be approximately equal. For this reason impact fees will be charged on a gross acre basis regardless of the zoning type.

Table ES-2
Recommended Impact Fee per Acre

	Total Cost
Gross Acre Impact Fee (All Zoning Types)*	$3,544.63

*Areas having large pervious areas may be adjusted as described in section 5.

SECTION 1
INTRODUCTION

Layton City has retained Bowen Collins & Associates (BC&A) to prepare an impact fee analysis (IFA) for its storm drain system based on a recently completed impact fee facility plan. An impact fee is a one-time fee, not a tax, imposed upon new development activity as a condition of development approval to mitigate the impact of the new development on public infrastructure. The purpose of an IFA is to calculate the allowable impact fee that may be assessed to new development in accordance with Utah code.

Requirements for the preparation of an IFA are outlined in Title 11, Chapter 36a of the Utah code (the Impact Fees Act). Under these requirements, an IFA shall accomplish the following for each facility:

1. Identify the impact of anticipated development activity on existing capacity and system improvements required to maintain the established level of service
2. Demonstrate how the impacts are reasonably related to anticipated development activity
3. Estimate the proportionate share of:
    a. Costs of existing capacity that will be recouped
    b. Costs of impacts on system improvements that are reasonably related to the new development activity
4. Identify how the impact fee was calculated
5. Consider the following additional issues
    a. Manner of financing improvements
    b. Dedication of system improvements
    c. Extraordinary costs of servicing newly developed properties
    d. Time-price differential

The following sections of this report have been organized to address each of these requirements.

SECTION 2
IMPACT ON SYSTEM (11-36A-304.1.A & B)

Growth within the City's service area, and projections of storm water flows resulting from said growth is discussed in detail in the City's Master Plan and Impact Fee Facilities Plan. For the purposes of impact fee calculation, growth in the system has been expressed in terms of gross acres. Growth in gross acres projected for the service area is summarized in Table 2-1.

Table 2-1
Average Developed Acreage for Existing and Future Development

Development Type	Acreage
Existing Development (Acres)	11,272
10-Year Development (Acres)	1,389
Greater than 10-Year Development (Acres)	2,783
Total	**15,444**

As indicated in the table, projected growth for the 10-year planning window of this impact fee analysis is 1,389 gross acres. In order to maintain the established level of service, projected future growth will be met through a combination of available excess capacity in existing facilities and construction of additional capacity in new facilities.

SECTION 3
RELATION OF IMPACTS TO ANTICIPATED DEVELOPMENT
(11-36A-304.1.C)

To satisfy the requirements of state law, it is necessary to show that all impacts identified in the impact fee analysis are reasonably related to the anticipated development activity. This has been documented in detail in Impact Fee Facilities Plan. In short, only that capacity directly associated with demand placed upon existing system facilities by future development has been identified as an impact of the development. The steps completed to identify the impacts of anticipated development are as follows.

1. **Existing Development** – The demand existing development places on the system was estimated based on GIS records and available aerial photography.
2. **Existing Capacity** – The capacities of existing facilities were calculated based on the level of service criteria established for each type of facility in the Impact Fee Facilities Plan.
3. **Existing Deficiencies** – Existing deficiencies in the system were looked for by comparing defined levels of service against calculated capacities. Where existing deficiencies existed, projects were identified to eliminate the deficiencies. Costs associated with existing deficiencies were not assigned to impacts of development.
4. **Future Development** - The demand future development will place on the system was estimated based on development projections as discussed in Section 2.
5. **Future Demand Use of Existing Capacity** – Whenever possible, excess capacity in existing facilities has been used to serve future demands. Where this occurs, the amount of capacity used by future growth has been calculated as described in detail in the Impact Fee Facilities Plan.
6. **Future Deficiencies** – Where excess capacity is inadequate to meet projected demands, future deficiencies in the system were identified using the same established level of service criteria used for existing demands.
7. **Recommended Improvements** – Needed system improvements were identified to meet demands associated with future development.

SECTION 4
PROPORTIONATE SHARE ANALYSIS (11-36A-304.D)

A comprehensive proportionate share analysis associated with anticipated future development and its impact on the system was completed as part of the Impact Fee Facilities Plan. A summary of that analysis is contained here with additional discussion of the costs of facilities impacted by growth.

EXCESS CAPACITY TO ACCOMMODATE FUTURE GROWTH

Defining existing system capacity in terms of a single number is difficult. As part of the Impact Fee Facilities Plan, the calculated percentage of existing capacity in system facilities used by existing users, growth during the 10 year planning window, and growth beyond the 10 year planning window is summarized in Table 4-1.

Table 4-1
Use of Existing Capacity

	Collection
Existing	80.6%
10-year Growth	6.9%
Growth Beyond 10 Years	12.5%
Total	100%

EXISTING SYSTEM INFRASTRUCTURE COSTS

To calculate the value of excess capacity in the existing system, BC&A first looked at the value of all existing facilities. Layton City has on record the actual construction costs of existing components of the City's storm drain system since 2004, which totals $17,289,483.88. These are actual costs and were obtained from a storm drain fund report for the City through fiscal year ending 2014. This report can be seen in Appendix A.

It should be noted that the impact fee eligible cost identified above represent only a portion of the total system value. System costs not included in the total include facilities with a service life of less than 10 years, project level improvements serving single developments, and improvements not paid for by the City (e.g. projects funded through grants, developer dedications, etc.). In this study, public facility costs already incurred by the City will be included in the impact fee only to the extent that new growth will be served by the previously constructed improvements.

REIMBURSEMENT AGREEMENTS

No reimbursement agreements existing within the system that will affect the impact fee calculation.

FUTURE IMPROVEMENTS

In addition to using available existing capacity, demand associated with projected future development will be met through the construction of additional capacity in new facilities. A primary focus of the Impact Fee Facilities Plan was the identification of projects required to serve new development. The results of the Impact Fee Facilities Plan are summarized in Table 4-2. Included in the table are the costs of each required project and the portion of costs associated with development.

Table 4-2
Impact Fee Eligible Capital Projects

Project ID	Project Location	Project Expense- 2015 Dollars	10-Year Growth	Cost Attributable to 10-Year Future Growth
PE3	Highway 89 & 1500 N	$231,100	62%	$142,948.53
PE4	Quail Ridge Road and Hwy 193	$206,000	54%	$111,629.48
PE5A	Fairfield Road and Hwy 193	$84,300	53%	$44,577.63
PE5B	Fairfield Road and Hwy 193	$106,600	52%	$55,128.37
PE5C	Fairfield Road and ~2800 N	$177,700	52%	$91,897.86
PE10	Fort Ln and Main St	$68,000	7%	$4,997.32
PE11	Fairfield Rd & 200 S	$404,100	6%	$25,498.39
PE12	Highway 89 & 1000 N	$147,000	47%	$69,016.61
DBE2	3150 N & 1350 E	$1,343,200	77%	$47,347.92
DBE6	3050 N &110 E	$79,300	54%	$83,891.81
OE1	3050 N & 1100 E	$19,200	54%	$22,911.34
PW6A	Hill Field Rd to Bamberger Trail	$424,000	11%	$1,040,172.19
PW6B	Bamberger Trail to Kays Creek	$751,250	11%	$42,971.93
PW14	2200 West & Hill Field Rd	$78,700	29%	$244,343.95
PW23	2700 West & Gentile Rd	$1,250,400	45%	$562,259.71
PW24	Kays Creek and Weaver Ln	$196,700	24%	$47,918.03
DBW4	Gentile St & 2450 W	$565,200	43%	$106,177.07
DBW7	Hill Field Rd and Sugar St (South)	$1,256,400	8%	$516,173.32
DBW9	2200 W 500 S	$720,900	72%	$271,235.81
DBW10	Weaver Ln 650 W	$383,800	71%	$56,700.53
DBW12	Bluff Rd Outfall	$111,300	51%	$12,723.22
DBW13	North Conference Pond	$248,300	5%	$10,404.30
OW4	2200 West & Hill Field Rd	$19,200	29%	$5,589.55
OW5	2200 West & 400 S	$38,400	72%	$27,494.88
Total		**$8,911,050**	**40.9%**	**$3,644,010**

SECTION 5
IMPACT FEE CALCULATION (11-36A-304.1.E)

Using the information contained in the previous sections, impact fees can be calculated by dividing the proportional cost of facilities required to service 10-year growth by the amount of growth expected over the next 10-years. This is done for each of the major system components identified previously. Calculated impact fees by component are summarized in Table 5-1.

Table 5-1
Impact Fee Calculation per Gross Acre

Sewer Collection System Components	Total Cost of Component	% Serving 10-year Growth	Cost Serving 10-year Growth	10-year Acres Served	Cost Per Gross Acre
Collection Facilities					
Existing Facilities	$17,289,434	6.92%	$1,196,613	1,389	$861.73
Existing Facility Interest Costs Outstanding	$0	0%	$0	1,389	$0.00
10-year Projects	$8,911,050	40.89%	$3,644,010	1,389	$2,624.21
10-Year Project Interest Costs	$0	0%	$0	1,389	$0.00
Subtotal	**$26,200,484**		**$4,840,623**		**$3,485.94**
Other					
Impact Fee Studies	$81,500	100%	$81,500	1389	$58.69
Subtotal	**$81,500**		**$81,500**		**$58.69**
Total	**$26,281,984**		**$4,922,123**		**$3,544.63**

The total impact fee per gross acre can be calculated by adding up the fee for each type of system component. This is separate from any additional charges levied by the City for hookup costs or for other reasonable permit and application fees.

BONDING INTEREST COSTS

In addition to construction costs, Table 5-1 includes rows for the cost of bond interest expense where applicable. This includes any outstanding interest costs on existing facilities where new growth will benefit from excess capacity and future interest costs for bonds required to build projects needed for growth as identified in the Impact Fee Facilities Plan. Similar to project construction costs, only that portion of interest expense associated with capacity for growth should be included in the impact fee calculation. In the case of this IFA, there are no outstanding bond costs on existing infrastructure or projected bonds for future projects.

IMPACT FEE STUDIES

Utah code allows for the cost of planning and engineering associated with impact fee calculations to be recovered as part of impact fee. This study includes the cost of the master plan, IFFP and IFA as part of the reimbursable impact fee costs. A comprehensive review of the impact fee study should also be performed every three to five years.

RECOMMENDED IMPACT FEE

The total calculated impact fee is summarized in Table ES-2. This is the legal maximum amount that may be charged as an impact fee. A lower amount may be adopted if desired, but a higher fee is not allowable under the requirements of Utah Code. The fee shown in Table 5-2 is a cost per gross acre. This is the amount that would be charged if the impact fee is collected at the time each plat is approved. As stated in the master plan runoff associated with each site is estimated to be approximately equal. For this reason impact fees will be charged on a gross acre basis regardless of the zoning type.

Table 5-2
Recommended Impact Fee

	Total Cost
Gross Acre Impact Fee (All Zoning Types)	$3,544.63

In certain circumstances, an adjusted impact fee can be assessed for properties with large pervious areas which will release significantly less flow per acre than the average property. In these rare cases, the portion of the property with exclusively pervious land uses (such as schools with playing fields) can be removed prior to calculating the effective lot size. This reduced lot size can then be used to calculate the fee on a per acre basis as shown above.

SECTION 6
ADDITIONAL CONSIDERATIONS (11-36A-304.2)

MANNER OF FINANCING (11-36A-304.2.A-E)

As part of this Impact Fee Analysis, it is important to consider how each facility has been or will be paid for. Potential infrastructure funding includes a combination of different revenue sources.

User Charges

Because infrastructure must generally be built ahead of growth, there often arises situations in which projects must be funded ahead of expected impact fee revenues. In some cases, the solution to this issue will be bonding. In others, funds from existing user rate revenue will be loaned to the impact fee fund to complete initial construction of the project and will be reimbursed later as impact fees are received. Consideration of interfund loans should be considered in subsequent accounting of impact fee expenditures.

Special Assessments

Where special assessments exist, the impact fee calculation must take into account funds contributed. No special assessments exist for this analysis.

Bonds

None of the costs contained in the IFFP included bonding. Where City financial plans identify bonding will be required to finance impact fee eligible improvements, the portion of bond cost and interest expense attributable to future growth has been added to the calculation of the impact fee. The City currently has no eligible storm water bonds.

Impact Fee Fund Balance

The City does carry a current balance in its impact fee fund. In this analysis, the capacity associated with the development that paid these impact fees has been accounted for as part of existing system demand. As a result, it would be inappropriate to use any portion of the current balance towards projects benefiting future growth. It should be noted that the City does have an obligation under the law to spend or encumber these funds within a six year window of their collection. However, these expenditures will be independent of capacity associated with future growth and are correspondingly not show as a source of financing for the impact fee eligible expenditures identified in this report.

General Taxes

If taxes are used to pay for infrastructure, they should be accounted for in the impact fee calculation. Specifically, any contribution made by property owners through taxes should be credited toward their available capacity in the system. In this case, no taxes are proposed for the construction of infrastructure.

Federal and State Grants and Donations

Impact fees cannot reimburse costs funded or expected to be funded through federal grants and other funds that the City has received for capital improvements without an obligation to repay. Grants and donations are not currently contemplated in this analysis. If grants become available for constructing facilities, impact fees will need to be recalculated and an appropriate credit given. Any existing infrastructure funded through past grants has been removed from the system value during the impact fee analysis. It should be noted that UDOT is responsible for half of the project cost of Projects P-6a and P-6b. The fees shown in this report show only the City's responsibility for these projects. The total projected cost for each of these projects (including the UDOT contribution) is actually twice what is shown.

DEDICATION OF SYSTEM IMPROVEMENTS (11-36A-304.2.F)

Developer exactions may be considered in the inventory of current and future infrastructure. If a developer constructs facility or dedicates land, the value of the dedication is credited against that particular developer's impact fee liability.

If the recognized value of the credit is less than the development's impact fee liability, the developer will owe the balance of the liability to the City. If the recognized value of the improvements/land dedicated is more than the development's impact fee liability, the City must reimburse the difference to the developer.

It should be emphasized that the concept of impact fee credits pertains to system level improvements only. For project level improvement (i.e. projects not identified in the impact fee facility plan), developers will be responsible for the construction of the improvements without credit against the impact fee.

EXTRAORDINARY COSTS (11-36A-304.2.G)

The impact fee act indicates the analysis should include consideration of any extraordinary costs of servicing newly developed properties. In cases where one area of potential growth may cost significantly more to service than all other growth, a separate service area may be warranted. No areas with extraordinary costs have been identified as part of this analysis.

TIME-PRICE DIFFERENTIAL (11-36A-304.2.H)

Utah code requires consideration of time-price differential in order to create fairness for amounts paid at different times. Per the requirements of the code, existing infrastructure value is based on actual historical costs.

NOTICING AND ADOPTION REQUIREMENTS (11-36A-504)

The Impact Fees Act requires that entities must publish a notice of intent to prepare or modify any IFA. Before the resulting impact fee can be adopted, the City must:

- Provide notice in accordance with Section 10-9a-205 of State Code. This includes reasonable notice of a public hearing published in a local newspaper at least 10 days before the actual hearing.
- A copy of the IFA and proposed impact fee enactment must be made available on the City's website or posted in each public library within the service area during the notice period for public review and inspection.
- Following the noticing period, a public hearing will be held, after which the IFA and impact fee enactment may be adopted, amended and adopted, or rejected.

SECTION 7
IMPACT FEE CERTIFICATION (11-36A-306.2)

This IFA has been prepared in accordance with Utah Code Title 11, Chapter 36a (the "Impact Fees Act"), which prescribes the laws pertaining to the imposition of impact fees in Utah. The accuracy of this report relies upon the planning, engineering, and other source data, which was provided by the City and their designees.

In accordance with Utah Code Annotated, 11-36a-306(2), Bowen Collins & Associates, makes the following certification:

I certify that the attached impact fee analysis:

1. Includes only the costs of public facilities that are:
    a. allowed under the Impact Fees Act; and
    b. actually incurred; or
    c. projected to be incurred or encumbered within six years after the day on which each impact fee is paid;
2. Does not include:
    a. costs of operation and maintenance of public facilities;
    b. costs of qualifying public facilities that will raise the level of service for the facilities, through impact fees, above the level of service that is supported by existing residents; or
    c. an expense for overhead, unless the expense is calculated pursuant to a methodology that is consistent with generally accepted cost accounting practices and the methodological standards set forth by the federal Office of Management and Budget for federal grant reimbursement; and
3. Complies in each and every relevant respect with the Impact Fees Act.

APPENDIX A
EXISTING STORM DRAIN
PROJECT COST

Table A-1
Total Costs per Year

Year	Total Project Costs	
2004	$1,640,360	
2005	$1,368,430	
2006	$5,011,996	
2007	$2,336,413	
2008	$1,095,160	
2009	$884,677	
2010	$1,429,845	
2011	$970,455	
2012	$854,188	
2013	$759,597	County gave 150000 for Kays Creek Project
2014	$938,313	County gave 150000 for Holmes Creek Project
Total	**$17,289,434**	

Table A-2

2004 Storm Drain Project Costs

Storm sewer projects Fund 53

Project #		TRANSFER FROM FUND 49	BUDGET NEW YEAR	BUDGET TRANSFERS	BUDGET AMEND	TRANSFER OPERATIONS	NET BUDGET	Budget Sources General	Budget Sources User Fee	Budget Sources SS1 Impact	Budget Sources SS2 Impact	Budget Sources SS3 Impact	Expended General	Expended User Fees	Expended SS1 Impact	Expended SS2 Impact	Expended SS3 Impact	Expended Spent		Balances by Source General	Balances by Source User Fees	Balances by Source SS1 Impact	Balances by Source SS2 Impact	Balances by Source SS3 Impact	Balances by Source Balance
01011	LaDonna Mesa	40,795.59	150,000.00	-68,903.50			121,892.09	40,795.59	81,096.50				40,795.59	81,096.50						0.00	0.00	0.00	0.00	0.00	0.00
03001	Gordon Ave - Fairfield to 1250 E	225,414.21		-44,427.92			180,986.29	180,986.29					180,986.29							0.00	0.00	0.00	0.00	0.00	0.00
03050	Cherry Ln - 1000 E to 1350 E land drain	70,000.00		82,992.04			152,992.04	120,131.92	32,860.12				115,922.93	32,860.12						4,208.99	0.00	0.00	0.00	0.00	4,208.99
03051	Rosewood Ln	40,546.59		94,296.00			134,842.59	34,842.59	100,000.00				34,842.55	100,000.00					C	0.04	0.00	0.00	0.00	0.00	0.04
03011	Adams Park detention pond	119,277.56		-47,860.12			71,417.44		71,417.44					71,417.44						0.00	0.00	0.00	0.00	0.00	0.00
03013	Adamswood Dr detention pond		200,000.00				200,000.00		188,000.00	12,000.00				5,602.50						0.00	182,397.50	12,000.00	0.00	0.00	194,397.50
03015	1650 E; 2050 N to 2200 N		100,000.00	-16,096.50			83,903.50		83,903.50					702.83						0.00	83,200.67	0.00	0.00	0.00	83,200.67
03016	Oak Forest park detention pond		150,000.00				150,000.00		150,000.00					13,109.14						0.00	136,890.86	0.00	0.00	0.00	136,890.86
03017	Boulder Dr		100,000.00				100,000.00		100,000.00											0.00	100,000.00	0.00	0.00	0.00	100,000.00
		496,033.95	700,000.00	0.00	0.00	0.00	1,196,033.95	376,756.39	807,277.56	12,000.00	0.00	0.00	372,547.36	304,788.53	0.00	0.00	0.00	0.00		4,209.03	502,489.03	12,000.00	0.00	0.00	518,698.06
01021	Bamberger ROW-Golden to Kays Cr	121,414.07		-30,494.53			90,919.54		88,074.67		2,844.87			88,074.67		2,844.87				0.00	0.00	0.00	0.00	0.00	0.00
03020	Vae View Detention Pond	253,977.10					253,977.10	253,977.10					203,475.72							50,501.38	0.00	0.00	0.00	0.00	50,501.38
710.001	Conference center detention and lines			30,494.53	53,500.00		83,994.53	13,500.00	70,494.53					207,480.01						13,500.00	-136,985.48	0.00	0.00	0.00	-123,485.48
03023	Vae View subdivision repairs		275,000.00				275,000.00		275,000.00					2,328.49						0.00	272,671.51	0.00	0.00	0.00	272,671.51
03024	1280 N; Sherman to Reid		75,000.00				75,000.00		75,000.00					3,095.63						0.00	71,904.37	0.00	0.00	0.00	71,904.37
03025	225 W to 1800 N		100,000.00		-40,000.00		60,000.00		60,000.00					1,115.63						0.00	58,884.37	0.00	0.00	0.00	58,884.37
03022	Eastview detention pond		50,000.00				50,000.00		50,000.00					26,989.12						0.00	23,010.88	0.00	0.00	0.00	23010.88
		375,391.17	500,000.00	0.00	13,500.00	0.00	888,891.17	267,477.10	618,569.20	0.00	2,844.87	0.00	203,475.72	329,083.55	0.00	2,844.87	0.00	0.00		64,001.38	289,485.65	0.00	0.00	0.00	353,487.03
.002	Easement Purchase to lake (2)	64,107.25		-37,213.30			26,893.95					26,893.95					18,197.72			0.00	0.00	0.00	0.00	8,696.23	8,696.23
.003	Detention Pond	175,000.00		-175,000.00			0.00													0.00	0.00	0.00	0.00	0.00	0.00
03032	3200 W Detention Basin			305,000.00			305,000.00					305,000.00					716.34			0.00	0.00	0.00	0.00	304,283.66	304,283.66
03031	2000 W-1000 S to Lake	229,249.64		-85,471.58			143,778.06					143,778.06					71,215.25			0.00	0.00	0.00	0.00	72,562.81	72,562.81
03053	Gordon Ave; 2000 W to 2500 W		235,000.00	135,000.00			370,000.00		170,000.00			200,000.00		129,806.14			200,000.00			0.00	40,193.86	0.00	0.00	0.00	40,193.86
03033	Detention Pond		150,000.00	-142,315.12			7,684.88					7,684.88					7,684.88			0.00	0.00	0.00	0.00	0.00	0.00
		468,356.89	385,000.00	0.00	0.00	0.00	853,356.89	0.00	170,000.00	0.00	0.00	683,356.89	0.00	129,806.14	0.00	0.00	297,814.19	0.00		0.00	40,193.86	0.00	0.00	385,542.70	425,736.56
																									1,297,921.65
	Totals	1,339,782.01	1,585,000.00	0.00	13,500.00	0.00	2,938,282.01	644,233.49	1,595,846.76	12,000.00	2,844.87	683,356.89	576,023.08	763,678.22	0.00	2,844.87	297,814.19	0.00		68,210.41	832,168.54	12,000.00	0.00	385,542.70	1,297,921.65

Table A-3

2005 Storm Drain Project Costs

Storm sewer projects Fund 53

								Budget Sources					Expended						Balances by Source					
		CARRYOVER	BUDGET	BUDGET	BUDGET	TRANSFER	NET																	
Project #		BUDGET	NEW YEAR	TRANSFERS	AMEND	OPERATIONS	BUDGET	General	User Fee	SS1 Impact	SS2 Impact	SS3 Impact	General	User Fees	SS1 Impact	SS2 Impact	SS3 Impact		General	User Fees	SS1 Impact	SS2 Impact	SS3 Impact	Balance
03050	Cherry Ln - 1000 E to 1350 E land drain	4,208.99		-4,208.99			0.00		0.00	0								C	0.00	0.00	0.00	0.00	0.00	0.00
03013	Adamswood Dr detention pond	194,397.50		-139,865.96	15,000.00		69,531.54	0.00	57,531.54	12,000.00				57,531.56	12,000.00			C	0.00	-0.02	0.00	0.00	0.00	-0.02
03015	1650 E; 2050 N to 2200 N	83,200.67		-14,145.65			69,055.02	0.00	69,055.02	0				69,055.02				C	0.00	0.00	0.00	0.00	0.00	0.00
03016	Oak Forest park detention pond	136,890.86		-131,940.97			4,949.89	0.00	4,949.89	0				4,949.89				C	0.00	0.00	0.00	0.00	0.00	0.00
03017	Boulder Dr	100,000.00		75,000.00		-23,272.55	151,727.45	0.00	151,727.45	0				151,727.45				C	0.00	0.00	0.00	0.00	0.00	0.00
04010	Oak Forest improvements		500,000.00	54,550.91		13,272.55	567,823.46		567,823.46					211,830.82					0.00	355,992.64	0.00	0.00	0.00	355,992.64
03019	Church St detention pond			156,245.41			156,245.41		156,245.41					156,245.41				C	0.00	0.00	0.00	0.00	0.00	0.00
							0.00																	
		518,698.02	500,000.00	-4,365.25	15,000.00	-10,000.00	1,019,332.77	0.00	1,007,332.77	12,000.00	0.00	0.00	0.00	651,340.15	12,000.00	0.00	0.00		0.00	355,992.62	0.00	0.00	0.00	355,992.62
03020	Vae View Detention Pond	50,501.38		-9,728.62			40,772.76	40,772.76	0.00				40,772.76					C	0.00	0.00	0.00	0.00	0.00	0.00
710.001	Conference center detention and lines	-123,485.48			163,600.00		40,114.52	13,500.00	26,614.52				13,478.61	26,614.52				C	21.39	0.00	0.00	0.00	0.00	21.39
03023	Vae View subdivision repairs	272,671.51		191,398.37			464,069.88	10,000.00	454,069.88					4,275.37					10,000.00	449,794.51	0.00	0.00	0.00	459,794.51
03024	1280 N; Sherman to Reid	71,904.37		-71,398.37			506.00	0.00	506.00					506.00				C	0.00	0.00	0.00	0.00	0.00	0.00
03025	225 W to 1800 N	58,884.37		9,394.49			68,278.86	0.00	68,278.86					1,982.47					0.00	66,296.39	0.00	0.00	0.00	66,296.39
03022	Eastview detention pond	23,010.88					23,010.88		23,010.88					15,859.91					0.00	7,150.97	0.00	0.00	0.00	7,150.97
04021	Whispering Willows 36" line		160,000.00	-150,000.00			10,000.00	10,000.00					2,410.01						7,589.99	0.00	0.00	0.00	0.00	7,589.99
04020	W Hill Field Rd detention @ 11200 W		150,000.00	-149,665.87			334.13		334.13					334.13				C	0.00	0.00	0.00	0.00	0.00	0.00
	Church St/Green St upgrade		70,000.00	-70,000.00			0.00												0.00	0.00	0.00	0.00	0.00	0.00
04050	HAFB east gate line - storm drain/land drain		212,000.00	100,000.00			312,000.00	212,000.00	100,000.00					61,292.73					212,000.00	38,707.27	0.00	0.00	0.00	250,707.27
							0.00												0.00	0.00	0.00	0.00	0.00	0
		353,487.03	592,000.00	-150,000.00	163,600.00	0.00	959,087.03	286,272.76	672,814.27	0.00	0.00	0.00	56,661.38	110,865.13	0.00	0.00	0.00		229,611.38	561,949.14	0.00	0.00	0.00	791,560.52
.002	Easement Purchase to lake (2)	8,696.23					8,696.23	0.00	0.00	0.00	0.00	8,696.23					8,696.23	C	0.00	0.00	0.00	0.00	0.00	0.00
03032	3200 W Detention Basin	304,283.66				26,656.86	330,940.52	0.00	126.60	0.00	0.00	330,813.92					274,311.31		0.00	126.60	0.00	0.00	56,502.61	56,629.21
03031	2000 W-1000 S to Lake	72,562.81				-27,048.53	45,514.28	0.00	0.00	0.00	0.00	45,514.28					45,514.28	C	0.00	0.00	0.00	0.00	0.00	0.00
03053	Gordon Ave; 2000 W to 2500 W	40,193.86				-126.60	40,067.26	0.00	40,067.26	0.00	0.00	0.00		40,067.26				C	0.00	0.00	0.00	0.00	0.00	0.00
04030	Detention pond 500 N 2700 W		200,000.00	150,000.00		518.27	350,518.27		150,000.00			200,518.27					153,348.88		0.00	150,000.00	0.00	0.00	47,169.39	197,169.39
760.005	Detention pond 750 S and 100 W			15,625.00			15,625.00		15,625.00					15,625.00				C		0.00				
							0.00													0.00				
		425,736.56	200,000.00	165,625.00	0.00	0.00	791,361.56	0.00	205,818.86	0.00	0.00	585,542.70	0.00	55,692.26	0.00	0.00	481,870.70		0.00	150,126.60	0.00	0.00	103,672.00	253,798.60
	Totals	1,297,921.61	1,292,000.00	11,259.75	178,600.00	-10,000.00	2,769,781.36	286,272.76	1,885,965.90	12,000.00	0.00	585,542.70	56,661.38	817,897.54	12,000.00	0.00	481,870.70		229,611.38	1,068,068.36	0.00	0.00	103,672.00	1,401,351.74
								2,769,781.36					1,368,429.62											
																		C	21.39	-0.02				21.37
													Total Expended Cost	1,368,429.62										1,401,330.37

Table A-4

2006 Storm Drain Project Costs

Storm sewer projects Fund 53

Project #		CARRYOVER BUDGET	BUDGET NEW YEAR	BUDGET TRANSFERS	BUDGET AMEND	TRANSFER OPERATIONS	NET BUDGET	Budget Sources General	Budget Sources User Fee	Budget Sources SS1 Impact	Budget Sources SS2 Impact	Budget Sources SS3 Impact	Expended General	Expended User Fees	Expended SS1 Impact	Expended SS2 Impact	Expended SS3 Impact		Balances by Source General	Balances by Source User Fees	Balances by Source SS1 Impact	Balances by Source SS2 Impact	Balances by Source SS3 Impact	Balances by Source Balance
760.000.04010	Oak Forest improvements	355,992.64	500,000.00	150,000.00			1,005,992.64	122,000.00	794,992.64	89,000.00				723,537.96	89,000.00				122,000.00	71,454.68	0.00	0.00	0.00	193,454.68
760.003	Marva Avenue		150,000.00	-150,000.00			0.00											c	0.00	0.00	0.00	0.00	0.00	0.00
760.004	Developer payment for Adamswood			30,220.00	79,780.00		110,000.00	79,780.00	30,220.00				79,780.00	30,220.00				c	0.00	0.00	0.00	0.00	0.00	0.00
		355,992.64	650,000.00	30,220.00	79,780.00	0.00	1,115,992.64	201,780.00	825,212.64	89,000.00	0.00	0.00	79,780.00	753,757.96	89,000.00	0.00	0.00		122,000.00	71,454.68	0.00	0.00	0.00	193,454.68
760.000.03023	Vae View/Camelot subdivision repairs	459,794.51	500,000.00	136,321.65			1,096,116.16	10,000.00	786,116.16		300,000.00		4,776.06	786,116.16		300,000.00		c	5,223.94	0.00	0.00	0.00	0.00	5,223.94
760.000.03025	225 W to 1800 N	66,296.39		-25,947.18			40,349.21		40,349.21					40,349.21				c	0.00	0.00	0.00	0.00	0.00	0.00
760.000.03022	Eastview detention pond	7,150.97		-5,374.47			1,776.50		1,776.50					1,776.50				c	0.00	0.00	0.00	0.00	0.00	0.00
760.000.04021	Whispering Willows 36" line	7,589.99		0.00			7,589.99	7,589.99										c	7,589.99	0.00	0.00	0.00	0.00	7,589.99
760.000.04050	HAFB east gate line - storm drain/land drain	250,707.27		-36,973.08			213,734.19	212,000.00	1,734.19				212,000.00	1,734.19				c	0.00	0.00	0.00	0.00	0.00	0.00
760.000.05051	Gentile, Main to 2200 West		400,000.00	119,780.00	139,000.00		658,780.00	139,000.00	419,780.00		100,000.00			350,018.09		100,000.00			139,000.00	69,761.91	0.00	0.00	0.00	208,761.91
		791,539.13	900,000.00	187,806.92	139,000.00	0.00	2,018,346.05	368,589.99	1,249,756.06	0.00	400,000.00	0.00	216,776.06	1,179,994.15	0.00	400,000.00	0.00		151,813.93	69,761.91	0.00	0.00	0.00	221,575.84
760.000.03032	3200 W Detention Basin	56,629.21					56,629.21		126.60			56,502.61					41,420.80	c	0.00	126.60	0.00	0.00	15,081.81	15,208.41
760.000.04030	Detention pond 500 N 2700 W	197,169.39		-105,000.00			92,169.39		45,000.00			47,169.39		29,208.17			47,169.39		0.00	15,791.83	0.00	0.00	0.00	15,791.83
760.007	Detention pond 2700 W and 500 N		150,000.00	-150,000.00			0.00												0.00	0.00	0.00	0.00	0.00	0.00
760.000.05051	Gentile, Main to 2200 West	275,000.00			1,841,351.00		2,116,351.00	1,841,351.00	75,000.00			200,000.00	1,893,268.04	75,000.00			200,000.00		-51,917.04	0.00	0.00	0.00	0.00	-51,917.04
760.000.05054	Phillips Street Improvements				10,418.00		10,418.00	10,418.00					6,621.50					c	3,796.50	0.00	0.00	0.00	0.00	3,796.50
							0.00												0.00	0.00				
							0.00																	
		528,798.60	150,000.00	-255,000.00	1,851,769.00	0.00	2,275,567.60	1,851,769.00	120,126.60	0.00	0.00	303,672.00	1,899,889.54	104,208.17	0.00	0.00	288,590.19		-48,120.54	15,918.43	0.00	0.00	15,081.81	-17,120.30
	Totals	1,676,330.37	1,700,000.00	-36,973.08	2,070,549.00	0.00	5,409,906.29	2,422,138.99	2,195,095.30	89,000.00	400,000.00	303,672.00	2,196,445.60	2,037,960.28	89,000.00	400,000.00	288,590.19		225,693.39	157,135.02	0.00	0.00	15,081.81	397,910.22
								5,409,906.29					5,011,996.07											
																		C	16,610.43				15,081.81	31,692.24
													Total Expended	5,011,996.07										366,217.98
																				Add left over general and SS3 project money to Gentile project				31,692.24
																							Carry over	397,910.22

Table A-5
2007 Storm Drain Project Costs

Storm sewer projects Fund 53

Project #		6/30/2007 CARRYOVER BUDGET	BUDGET NEW YEAR	BUDGET MODIFICATION PRIOR YEAR	BUDGET TRANSFERS	BUDGET AMEND	NET BUDGET	Budget Sources General	Budget Sources User Fee	Budget Sources SS1 Impact	Budget Sources SS2 Impact	Budget Sources SS3 Impact	Expended General	Expended User Fees	Expended SS1 Impact	Expended SS2 Impact	Expended SS3 Impact		Balances by Source General	Balances by Source User Fees	Balances by Source SS1 Impact	Balances by Source SS2 Impact	Balances by Source SS3 Impact	Balance
760.000.04010	Oak Forest improvements	193,454.68	100,000.00		23,084.50	160,000.00	476,539.18	305,084.50	171,454.68				201,278.52	171,454.68				c	103,805.98	0.00	0.00	0.00	0.00	103,805.98
760.005.06010	1275 E Gentile and Alpine Circle		150,000.00			120,000.00	270,000.00	120,000.00	150,000.00				25,249.90	150,000.00					94,750.10	0.00	0.00	0.00	0.00	94,750.10
760.006	Detention pond, Highway 193, 1000 E		500,000.00		-286,500.00		213,500.00		0.00	213,500.00									0.00	0.00	213,500.00	0.00	0.00	213,500.00
		193,454.68	750,000.00	0.00	-263,415.50	280,000.00	960,039.18	425,084.50	321,454.68	213,500.00	0.00	0.00	226,528.42	321,454.68	0.00	0.00	0.00		198,556.08	0.00	213,500.00	0.00	0.00	412,056.08
760.000.05051	Gentile, Main to 1200 West	208,761.91	398,237.00	-139,000.00			467,998.91	102,737.00	173,261.91		192,000.00			157,965.66		192,000.00			102,737.00	15,296.25	0.00	0.00	0.00	118,033.25
760.007	Detention pond, 2275 N 650 W		400,000.00		-188,500.00	-67,575.00	143,925.00		143,925.00					143,925.00				c	0.00	0.00	0.00	0.00	0.00	0.00
							0.00												0.00	0.00	0.00	0.00	0.00	0.00
		208,761.91	798,237.00	-139,000.00	-188,500.00	-67,575.00	611,923.91	102,737.00	317,186.91	0.00	192,000.00	0.00	0.00	301,890.66	0.00	192,000.00	0.00		102,737.00	15,296.25	0.00	0.00	0.00	118,033.25
760.000.04030	Detention pond 500 N 2700 W	15,791.83			-23,084.50	105,000.00	97,707.33	81,915.50	15,791.83				81,915.50	15,791.83				c	0.00	0.00	0.00	0.00	0.00	0.00
760.000.05051	Gentile, Main to 2200 West	-20,098.20	1,820,614.00	-1,841,351.00		379,000	338,164.80					338,164.80	26,653.20				338,164.80		-26,653.20	0.00	0.00	0.00	0.00	-26,653.20
710.001	Pond property 2200 W				475,000.00	981.00	475,981.00	981.00	475,000.00				981.00	475,000.00				c	0.00	0.00	0.00	0.00	0.00	0.00
760.000.07051	West Hill Field Road					575,000.00	575,000.00	575,000.00					285,302.97						289,697.03	0.00	0.00	0.00	0.00	289,697.03
730.001	Meadow Green pond share					71,000.00	71,000.00	71,000.00					70,730.24					c	269.76	0.00	0.00	0.00	0.00	269.76
		-4,306.37	1,820,614.00	-1,841,351.00	451,915.50	1,130,981.00	1,557,853.13	728,896.50	490,791.83	0.00	0.00	338,164.80	465,582.91	490,791.83	0.00	0.00	338,164.80		263,313.59	0.00	0.00	0.00	0.00	263,313.59
	Totals	397,910.22	3,368,851.00	-1,980,351.00	0.00	1,343,406.00	3,129,816.22	1,256,718.00	1,129,433.42	213,500.00	192,000.00	338,164.80	692,111.33	1,114,137.17	0.00	192,000.00	338,164.80		564,606.67	15,296.25	213,500.00	0.00	0.00	793,402.92
			3,766,761.22	1,786,410.22		3,129,816.22		3,129,816.22					2,336,413.30											
													Total Expended	2,336,413.30				C	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!
																								#REF!
																							Carry over	#REF!

Table A-6
2008 Storm Drain Project Costs

Storm sewer projects Fund 53

Project #		6/30/2008 CARRYOVER BUDGET	BUDGET NEW YEAR	BUDGET MODIFICATION PRIOR YEAR	BUDGET TRANSFERS	BUDGET AMEND	NET BUDGET	Budget Sources General	User Fee	SS1 Impact	SS2 Impact	SS3 Impact	Expended General	User Fees	SS1 Impact	SS2 Impact	SS3 Impact		Balances by Source General	User Fees	SS1 Impact	SS2 Impact	SS3 Impact	Balance	C/O Projects
760.005.06010	1500 E Gentile and Alpine Circle	94,750.10			-21,592.15		73,157.95	73,157.95					19,199.23					c	53,958.72	0.00	0.00	0.00	0.00	53,958.72	
760.006	Detention pond, Highway 193, 1000 E	213,500.00					213,500.00			213,500.00									0.00	0.00	213,500.00	0.00	0.00	213,500.00	213,500.00
760.007	North Fairfield Rd. Hwy 193 to 3400 N		75,000.00				75,000.00			75,000.00									0.00	0.00	75,000.00	0.00	0.00	75,000.00	75,000.00
760.001	Developer payment				129,291.59		129,291.59	129,291.58					129,291.59					c	-0.01	0.00	0.00	0.00	0.00	-0.01	
							0.00												0.00	0.00	0.00	0.00	0.00	0.00	0.00
		308,250.10	75,000.00	0.00	107,699.44	0.00	490,949.54	202,449.53	0.00	288,500.00	0.00	0.00	148,490.82	0.00	0.00	0.00	0.00		53,958.71	0.00	288,500.00	0.00	0.00	342,458.71	288,500.00
760.000.05051	Gentile, Main to 1200 West	118,033.25			-116,633.25		1,400.00	1,400.00	0.00				1,400.00					c	0.00	0.00	0.00	0.00	0.00	0.00	
760.008	1425 North, Frontage Rd to 550 W		126,500.00				126,500.00	46,200.00			80,300.00							c	46,200.00	0.00	0.00	80,300.00	0.00	126,500.00	
760.009	Detention pond, Hill Field and 1200 W				500.75		500.75		500.75				500.75					c	-500.75	500.75	0.00	0.00	0.00	0.00	
							0.00												0.00	0.00	0.00	0.00	0.00	0.00	0.00
		118,033.25	126,500.00	0.00	-116,132.50	0.00	128,400.75	47,600.00	500.75	0.00	80,300.00	0.00	1,900.75	0.00	0.00	0.00	0.00		45,699.25	500.75	0.00	80,300.00	0.00	126,500.00	0.00
760.000.07051	West Hill Field Road	289,697.03	628,109.00		-240,000.00	-575,000.00	102,806.03	102,806.03				0.00	102,760.28					c	45.75	0.00	0.00	0.00	0.00	45.75	
760.000.05051	Gentile, Main to 2200 West	-26,653.20			26,653.20		0.00					0.00						c	0.00	0.00	0.00	0.00	0.00	0.00	
760.000.08051	Gentile, 2200 W to 2700 W		445,000.00		47,706.73		492,706.73	260,903.43	14,795.50			217,007.80	257,556.63	14,795.50			217,007.80		3,346.80	0.00	0.00	0.00	0.00	3,346.80	3,346.80
760.010	Developer pmt, 3700 W line				27,482.00		27,482.00	27,482.00					27,482.00					c	0.00	0.00	0.00	0.00	0.00	0.00	
760.011	Detention pond payback				65,882.72		65,882.72	65,882.72					65,882.72					c	0.00	0.00	0.00	0.00	0.00	0.00	
710.001	Property 2200 W				7,910.00		7,910.00	7,910.00					7,908.61					c	1.39	0.00	0.00	0.00	0.00	1.39	
760.007	Detention pond 2700 W 500 N				210,000.00	51,500.00	261,500.00	51,500.00				210,000.00	41,375.00				210,000.00	c	10,125.00	0.00	0.00	0.00	0.00	10,125.00	
		263,043.83	1,073,109.00	0.00	145,634.65	-523,500.00	958,287.48	516,484.18	14,795.50	0.00	0.00	427,007.80	502,965.24	14,795.50	0.00	0.00	427,007.80		13,518.94	0.00	0.00	0.00	0.00	13,518.94	3,346.80
	Budgeted fund balance				-137,201.59	211,779.00																			
	Totals	689,327.18	1,274,609.00	0.00	0.00	-311,721.00	1,577,637.77	766,533.71	15,296.25	288,500.00	80,300.00	427,007.80	653,356.81	14,795.50	0.00	0.00	427,007.80		113,176.90	500.75	288,500.00	80,300.00	0.00	482,477.65	291,846.80
								1,577,637.76					1,095,160.11												
																		C	109,830.10	500.75	0.00	80,300.00	0.00	190,630.85	
													Total Expended	1,095,160.11										291,846.80	
																							Carry over	291,846.80	

Table A-7

2009 Storm Drain Project Costs

Storm sewer projects Fund 53		6/30/2009																										C/O
		CARRYOVER	BUDGET	BUDGET	BUDGET	NET		Budget Sources							Expended							Balances by Source							Projects
Project #		BUDGET	NEW YEAR	TRANSFERS	AMEND	BUDGET		General	User Fee	SS1 Impact	SS2 Impact	SS3 Impact	Developers		General	User Fees	SS1 Impact	SS2 Impact	SS3 Impact	Developers		General	User Fees	SS1 Impact	SS2 Impact	SS3 Impact	Developers	Balance	
760.006	Detention pond, Highway 193, 1000 E	213,500.00				213,500.00				213,500.00							0.00					0.00	0.00	213,500.00	0.00	0.00	0.00	213,500.00	213,500.00
760.007	North Fairfield Rd. Hwy 193 to 3400 N	75,000.00				75,000.00				75,000.00							0.00					0.00	0.00	75,000.00	0.00	0.00	0.00	75,000.00	75,000.00
760.000.09053	N Fairfield Rd. Hwy 193 to 3400 N				548,092.00	548,092.00			190,000.00				358,092.00			47,270.96						0.00	142,729.04	0.00	0.00	0.00	358,092.00	500,821.04	500,821.04
760.010.09010	Gordon Ave, Ash Dr, 1100 E		950,000.00			950,000.00			950,000.00	0.00						387,242.46						0.00	562,757.54	0.00	0.00	0.00	0.00	562,757.54	562,757.54
						0.00																0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		288,500.00	950,000.00	0.00	548,092.00	1,786,592.00		0.00	1,140,000.00	288,500.00	0.00	0.00	358,092.00		0.00	434,513.42	0.00	0.00	0.00	0.00		0.00	705,486.58	288,500.00	0.00	0.00	358,092.00	1,352,078.58	1,352,078.58
760.009	Detention pond Hillfield/1200 West		150,000.00			150,000.00			60,000.00		90,000.00											0.00	60,000.00	0.00	90,000.00	0.00	0.00	150,000.00	150,000.00
						0.00																0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0.00	150,000.00	0.00	0.00	150,000.00		0.00	60,000.00	0.00	90,000.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00		0.00	60,000.00	0.00	90,000.00	0.00	0.00	150,000.00	150,000.00
760.000.08051	Gentile, 2200 W to 3200 W	3,346.80	647,641.00			650,987.80		3,346.80	506,432.69			141,208.31			3,346.80	208,855.36			141,208.31		C	0.00	297,577.33	0.00	0.00	0.00	0.00	297,577.33	
760.011	Detention pond payback agreement		70,000.00			70,000.00		70,000.00														70,000.00	0.00	0.00	0.00	0.00	0.00	70,000.00	70,000.00
760.000.09054	3200 W and Hillfield Rd					0.00										96,753.44						0.00	-96,753.44	0.00	0.00	0.00	0.00	-96,753.44	(96,753.44)
		3,346.80	717,641.00	0.00	0.00	720,987.80		73,346.80	506,432.69	0.00	0.00	141,208.31	0.00		3,346.80	305,608.80	0.00	0.00	141,208.31	0.00		70,000.00	200,823.89	0.00	0.00	0.00	0.00	270,823.89	-26,753.44
	Budgeted fund balance																												
	Totals	291,846.80	1,817,641.00	0.00	548,092.00	2,657,579.80		73,346.80	1,706,432.69	288,500.00	90,000.00	141,208.31	358,092.00		3,346.80	740,122.22	0.00	0.00	141,208.31	0.00		70,000.00	966,310.47	288,500.00	90,000.00	0.00	358,092.00	1,772,902.47	1,475,325.14
Corrections made 11/9/2009 because of lower actual impact fee revenues								2,657,579.80							884,677.33														
															Total Expended	884,677.33													

Table A-8

2010 Storm Drain Project Costs

Storm sewer projects Fund 53		6/30/2010																									C/O
June 30 2010		CARRYOVER	BUDGET	BUDGET	BUDGET	NET	Budget Sources						Expended							Balances by Source							Projects
Project #		BUDGET	NEW YEAR	TRANSFERS	AMEND	BUDGET	General	User Fee	SS1 Impact	SS2 Impact	SS3 Impact	Developers	General	User Fees	SS1 Impact	SS2 Impact	SS3 Impact	Developers		General	User Fees	SS1 Impact	SS2 Impact	SS3 Impact	Developers	Balance	
760.006	Detention pond, Highway 193, 1000 E	213,500.00		-32,000.00		181,500.00			181,500.00										C	0.00	0.00	181,500.00	0.00	0.00	0.00	181,500.00	
760.007	North Fairfield Rd. Hwy 193 to 3400 N	75,000.00		-75,000.00		0.00													C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
760.000.09053	N Fairfield Rd. Hwy 193 to 3400 N	500,821.04		114,965.43		615,786.47		142,729.04	75,000.00			398,057.43		95,627.94	75,000.00			398,057.43	C	0.00	47,101.10	0.00	0.00	0.00	0.00	47,101.10	
760.010.09010	Gordon Ave, Ash Dr, 1100 E	562,757.54		32,000.00		594,757.54		562,757.54	32,000.00					559,296.11	32,000.00				C	0.00	3,461.43	0.00	0.00	0.00	0.00	3,461.43	
760.013	Payback - Chadwick Farms		15,000.00			15,000.00		7,000.00	8,000.00					5,000.00						0.00	2,000.00	8,000.00	0.00	0.00	0.00	10,000.00	10,000.00
760.013	City Center parking lot					0.00													C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
		1,352,078.58	15,000.00	39,965.43	0.00	1,407,044.01	0.00	712,486.58	296,500.00	0.00	0.00	398,057.43	0.00	659,924.05	107,000.00	0.00	0.00	398,057.43		0.00	52,562.53	189,500.00	0.00	0.00	0.00	242,062.53	10,000.00
760.009	Detention pond Hillfield/1200 West	150,000.00				150,000.00		60,000.00		90,000.00						1,218.63				0.00	60,000.00	0.00	88,781.37	0.00	0.00	148,781.37	148,781.37
760.010.09021	Stanford Ave.; Marilyn to UP tracks		175,000.00			175,000.00	175,000.00						1,905.25							173,094.75	0.00	0.00	0.00	0.00	0.00	173,094.75	173,094.75
		150,000.00	175,000.00	0.00	0.00	325,000.00	175,000.00	60,000.00	0.00	90,000.00	0.00	0.00	1,905.25	0.00	0.00	1,218.63	0.00	0.00		173,094.75	60,000.00	0.00	88,781.37	0.00	0.00	321,876.12	321,876.12
760.011	Detention pond payback agreement	70,000.00				70,000.00	70,000.00													70,000.00	0.00	0.00	0.00	0.00	0.00	70,000.00	70,000.00
760.000.09054	3200 W and Hillfield Rd	-96,753.44	300,000.00			203,246.56		203,246.56						204,178.32					C	0.00	-931.76	0.00	0.00	0.00	0.00	-931.76	
760.013.09031	Chelsie Park Pond work			57,250.00		57,250.00	57,250.00						57,560.93						C	-310.93	0.00	0.00	0.00	0.00	0.00	-310.93	
		-26,753.44	300,000.00	57,250.00	0.00	330,496.56	127,250.00	203,246.56	0.00	0.00	0.00	0.00	57,560.93	204,178.32	0.00	0.00	0.00	0.00		69,689.07	-931.76	0.00	0.00	0.00	0.00	68,757.31	70,000.00
	Budgeted fund balance																										
	Totals	1,475,325.14	490,000.00	97,215.43	0.00	2,062,540.57	302,250.00	975,733.14	296,500.00	90,000.00	0.00	398,057.43	59,466.18	864,102.37	107,000.00	1,218.63	0.00	398,057.43		242,783.82	111,630.77	189,500.00	88,781.37	0.00	0.00	632,695.96	401,876.12
							2,062,540.57						1,429,844.61						C	-310.93	49,630.77	181,500.00	0.00	0.00	0.00	230,819.84	
													Total Expended	1,429,844.61													

Table A-9
2011 Storm Drain Project Costs

Storm sewer projects Fund 53
June 30 2011

Project #		6/30/2010 CARRYOVER BUDGET	BUDGET NEW YEAR	BUDGET TRANSFERS	BUDGET AMEND	NET BUDGET	Budget Sources: General	User Fee	SS1 Impact	SS2 Impact	SS3 Impact	Developers	Expended: General	User Fees	SS1 Impact	SS2 Impact	SS3 Impact	Developers		Balances by Source: General	User Fees	SS1 Impact	SS2 Impact	SS3 Impact	Developers	Balance	C/O Projects
760.013	Payback - Chadwick Farms	10,000.00				10,000.00		2,000.00	8,000.00										C	0.00	2,000.00	8,000.00	0.00	0.00	0.00	10,000.00	
760.000.10055	Kays Creek Drive, 1750 E to 1825 E		430,000.00			430,000.00		330,000.00	100,000.00					198,914.43	100,000.00				C	0.00	131,085.57	0.00	0.00	0.00	0.00	131,085.57	
760.014	Holmes Creek Res. Erosion Repair		50,000.00			50,000.00		50,000.00												0.00	50,000.00	0.00	0.00	0.00	0.00	50,000.00	50,000.00
760.016.10013	Fairfield/Adamswood Detention Pond		260,000.00			260,000.00			260,000.00						491.25					0.00	0.00	259,508.75	0.00	0.00	0.00	259,508.75	259,508.75
760.017.10012	Chapel Hills Line Replacement		200,000.00			200,000.00		200,000.00						1,266.25						0.00	198,733.75	0.00	0.00	0.00	0.00	198,733.75	198,733.75
760.018	City Center Parking Lot		75,000.00			75,000.00		75,000.00						78,588.29					C	0.00	-3,588.29	0.00	0.00	0.00	0.00	-3,588.29	
		10,000.00	1,015,000.00	0.00	0.00	1,025,000.00	0.00	657,000.00	368,000.00	0.00	0.00	0.00	0.00	278,768.97	100,491.25	0.00	0.00	0.00		0.00	378,231.03	267,508.75	0.00	0.00	0.00	645,739.78	508,242.50
760.009	Detention pond Hillfield/1200 West	148,781.37				148,781.37		60,000.00		88,781.37										0.00	60,000.00	0.00	88,781.37	0.00	0.00	148,781.37	148,781.37
760.010.09021	Stanford Ave.; Marilyn to UP tracks	173,094.75				173,094.75	173,094.75						243,200.90						C	-70,106.15	0.00	0.00	0.00	0.00	0.00	-70,106.15	
760.011	So. I-15; 200 E/Larsen Lane		60,000.00			60,000.00		60,000.00						18,252.00					C	0.00	41,748.00	0.00	0.00	0.00	0.00	41,748.00	
760.012.10054	Layton Parkway; Flint to Angel Street **		370,000.00			370,000.00		162,442.47		207,557.53						139,438.85				0.00	162,442.47	0.00	68,118.68	0.00	0.00	230,561.15	230,561.15
760.013.09021	1280 North; Holt Subdivision Line		300,000.00			300,000.00		300,000.00						190,303.10					C	0.00	109,696.90	0.00	0.00	0.00	0.00	109,696.90	
		321,876.12	730,000.00	0.00	0.00	1,051,876.12	173,094.75	582,442.47	0.00	296,338.90	0.00	0.00	243,200.90	208,555.10	0.00	139,438.85	0.00	0.00		-70,106.15	373,887.37	0.00	156,900.05	0.00	0.00	460,681.27	379,342.52
760.011	Detention pond payback agreement	70,000.00				70,000.00	70,000.00												C	70,000.00	0.00	0.00	0.00	0.00	0.00	70,000.00	
						0.00														0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		70,000.00	0.00	0.00	0.00	70,000.00	70,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		70,000.00	0.00	0.00	0.00	0.00	0.00	70,000.00	0.00
	Budgeted fund balance												0.00														
	Totals	401,876.12	1,745,000.00	0.00	0.00	2,146,876.12	243,094.75	1,239,442.47	368,000.00	296,338.90	0.00	0.00	243,200.90	487,324.07	100,491.25	139,438.85	0.00	0.00		-106.15	752,118.40	267,508.75	156,900.05	0.00	0.00	1,176,421.05	887,585.02
							2,146,876.12						970,455.07						C	-106.15	280,942.18	8,000.00	0.00	0.00	0.00	288,836.03	
													Total Expended	970,455.07				Carryover Amounts		0.00	471,176.22	259,508.75	156,900.05	0.00	0.00	887,585.02	

** Revenue shortfall caused a change in budget source by $121,778.47

Table 10
2012 Storm Drain Project Costs

Storm sewer projects Fund 53
June 30 2012

Project #		6/30/2011 CARRYOVER BUDGET	BUDGET NEW YEAR	BUDGET TRANSFERS	BUDGET AMEND	NET BUDGET	Budget Sources: General	User Fee	SS1 Impact	SS2 Impact	SS3 Impact	Developers	Expended: General	User Fees	SS1 Impact	SS2 Impact	SS3 Impact	Developers		Balances by Source: General	User Fees	SS1 Impact	SS2 Impact	SS3 Impact	Developers	Balance	C/O Projects
SS1 - East																											
53.5301.760.016.10013	Fairfield/Adamswood Detention Pond	259,508.75	0.00	-1,100.00		258,408.75			258,408.75						69,299.16					0.00	0.00	189,109.59	0.00	0.00	0.00	189,109.59	189,109.59
53.5301.760.021.11010	Chapel Hills Line Replacement	198,733.75	200,000.00			398,733.75		398,733.75						793.48						0.00	397,940.27	0.00	0.00	0.00	0.00	397,940.27	397,940.27
53.5301.760.000.10055	Kays Creek Drive - 1750 E to 1825 E			20,000.00		20,000.00		20,000.00						19,115.84					C	0.00	884.16	0.00	0.00	0.00	0.00	884.16	
53.5301.760.019	Holmes Creek, Oakhills to Highway 89	50,000.00	175,000.00			225,000.00		50,000.00	175,000.00					0.00	0.00					0.00	50,000.00	175,000.00	0.00	0.00	0.00	225,000.00	225,000.00
53.5301.760.020	Fort Lane - Gentile to Main		700,000.00	-170,000.00		530,000.00		330,000.00	200,000.00					0.00	0.00				C	0.00	330,000.00	200,000.00	0.00	0.00	0.00	530,000.00	
53.5301.760.020.11041	Fort Lane Storm Sewer Line			170,000.00		170,000.00			170,000.00						156,578.80				C	0.00	0.00	13,421.20	0.00	0.00	0.00	13,421.20	
53.5301.760.022	Developer payback agreement			1,100.00		1,100.00			1,100.00						1,100.00					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
53.5301.760.023.12055	Cottonwood Drive, 1525 North					0.00								339.00						0.00	-339.00	0.00	0.00	0.00	0.00	-339.00	(339.00)
		508,242.50	1,075,000.00	20,000.00	0.00	1,603,242.50	0.00	798,733.75	804,508.75	0.00	0.00	0.00	0.00	20,248.32	226,977.96	0.00	0.00	0.00		0.00	778,485.43	577,530.79	0.00	0.00	0.00	1,356,016.22	811,710.86
SS2 - Central																											
53.5302.760.009.11020	Detention pond Hillfield/1200 West	148,781.37				148,781.37		60,000.00		88,781.37						73,253.98			C	0.00	60,000.00	0.00	15,527.39	0.00	0.00	75,527.39	
53.5302.760.012.10054	Layton Parkway; Flint to Angel Street **	230,561.15	240,000.00			470,561.15		342,442.47		128,118.68				313,098.83		128,118.68				0.00	29,343.64	0.00	0.00	0.00	0.00	29,343.64	29,343.64
53.5302.760.014.10054	Angel Street, Layton Parkway to Weaver Lane		27,000.00			27,000.00		27,000.00						27,434.89					C	0.00	-434.89	0.00	0.00	0.00	0.00	-434.89	
53.5302.760.015	Conference Center pond improvements		35,000.00			35,000.00		35,000.00						55.00						0.00	34,945.00	0.00	0.00	0.00	0.00	34,945.00	34,945.00
		379,342.52	302,000.00	0.00	0.00	681,342.52	0.00	464,442.47	0.00	216,900.05	0.00	0.00	0.00	340,588.72	0.00	201,372.66	0.00	0.00		0.00	123,853.75	0.00	15,527.39	0.00	0.00	139,381.14	64,288.64
SS3 - West																											
53.5303.760.014.10054	Detention pond payback agreement	-	65,000.00			65,000.00					65,000.00						65,000.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						0.00														0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		-	65,000.00	0.00	0.00	65,000.00	0.00	0.00	0.00	0.00	65,000.00	0.00	0.00	0.00	0.00	0.00	65,000.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Budgeted fund balance																										
	Totals	887,585.02	1,442,000.00	20,000.00	0.00	2,349,585.02	0.00	1,263,176.22	804,508.75	216,900.05	65,000.00	0.00	0.00	360,837.04	226,977.96	201,372.66	65,000.00	0.00		0.00	902,339.18	577,530.79	15,527.39	0.00	0.00	1,495,397.36	875,999.50
							2,349,585.02						854,187.66						C	0.00	390,449.27	213,421.20	15,527.39	0.00	0.00	619,397.86	
													Total Expended Co	854,187.66				Carryover Amounts		0.00	511,889.91	364,109.59	0.00	0.00	0.00	875,999.50	

** Revenue shortfall caused a change in budget source by $121,778.47

Table A-11
2013 Storm Drain Project Costs

Storm sewer projects Fund 53
June 30 2013

Project #		6/30/2013 CARRYOVER BUDGET	BUDGET NEW YEAR	BUDGET TRANSFERS	BUDGET AMEND	NET BUDGET	Budget Sources: General	User Fee	SS1 Impact	SS2 Impact	SS3 Impact	Developers	Expended: General	User Fees	SS1 Impact	SS2 Impact	SS3 Impact	Developers		Balances by Source: General	User Fees	SS1 Impact	SS2 Impact	SS3 Impact	Developers	Balance	C/O Projects
SS1 - East																											
53.5301.760.016.10013	Fairfield/Adamswood Detention Pond	189,109.59			-85,000.00	104,109.59			104,109.59										C	0.00	0.00	104,109.59	0.00	0.00	0.00	104,109.59	
53.5301.760.021.11010	Chapel Hills Line Replacement	397,940.27			14,977.73	412,918.00		412,918.00						246,440.66						0.00	166,477.34	0.00	0.00	0.00	0.00	166,477.34	166,477.34
53.5301.760.000.12010	Kays Creek Storm Drain Project				175,000.00	175,000.00		175,000.00						175,000.00						0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
53.5301.760.019	Holmes Creek, Oakhills to Highway 89	225,000.00			150,000.00	375,000.00		200,000.00	175,000.00					0.00	88,971.40					0.00	200,000.00	86,028.60	0.00	0.00	0.00	286,028.60	286,028.60
53.5301.760.022	Developer payback agreement		112,200.00		26,691.68	138,891.68		138,891.68						138,891.68						0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
53.5301.760.015	Misc. Storm Drain Repair projects		100,000.00			100,000.00		100,000.00						61,967.30						0.00	38,032.70					38,032.70	38,032.70
53.5301.760.020.11041	Fort Lane Storm Sewer Line																			0.00	0.00					0.00	0.00
53.5301.760.023.12055	Cottonwood Drive, 1525 North	(339.00)	115,000.00			114,661.00			114,661.00						115,858.75				C	0.00	0.00	-1,197.75	0.00	0.00	0.00	-1,197.75	
53.5301.760.026.13012	Pinewood Dr. 2500 E. to 2800 E.					0.00								222.20						0.00	-222.20	0.00	0.00	0.00	0.00	-222.20	(222.20)
		811,710.86	327,200.00	0.00	281,669.41	1,420,580.27	0.00	1,026,809.68	393,770.59	0.00	0.00	0.00	0.00	622,521.84	204,830.15	0.00	0.00	0.00		0.00	404,287.84	188,940.44	0.00	0.00	0.00	593,228.28	490,316.44
SS2 - Central																											
53.5302.760.012.10054	Layton Parkway; Flint to Angel Street **	29,343.64				29,343.64		29,343.64						362.73					C	0.00	28,980.91	0.00	0.00	0.00	0.00	28,980.91	
53.5302.760.015	Conference Center pond improvements	34,945.00			-14,977.73	19,967.27		19,967.27						19,967.27					C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
		64,288.64	0.00	0.00	-14,977.73	49,310.91	0.00	49,310.91	0.00	0.00	0.00	0.00	0.00	20,330.00	0.00	0.00	0.00	0.00		0.00	28,980.91	0.00	0.00	0.00	0.00	28,980.91	0.00
SS3 - West																											
53.5303.760.015	Misc. Storm Drain Repairs		50,000.00			50,000.00		50,000.00						11,914.79						0.00	38,085.21	0.00	0.00	0.00	0.00	38,085.21	38,085.21
53.5303.760.016	Developer reimbursements		50,000.00			50,000.00					50,000.00						50,000.00		C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
		-	100,000.00	0.00	0.00	100,000.00	0.00	50,000.00	0.00	0.00	50,000.00	0.00	0.00	11,914.79	0.00	0.00	50,000.00	0.00		0.00	38,085.21	0.00	0.00	0.00	0.00	38,085.21	38,085.21
	Budgeted fund balance																										
	Totals	875,999.50	427,200.00	0.00	266,691.68	1,569,891.18	0.00	1,126,120.59	393,770.59	0.00	50,000.00	0.00	0.00	654,766.63	204,830.15	0.00	50,000.00	0.00		0.00	471,353.96	188,940.44	0.00	0.00	0.00	660,294.40	528,401.65
							1,569,891.18						909,596.78						Closed (C)	0.00	-28,980.91	-102,911.84	0.00	0.00	0.00	-131,892.75	
													Total Expended	909,596.78					Carryover Amounts	0.00	442,373.05	86,028.60	0.00	0.00	0.00	528,401.65	

Table A-12
2014 Storm Drain Project Costs

Storm sewer projects Fund 53
June 30 2014

Project #		6/30/2014 CARRYOVER BUDGET	BUDGET NEW YEAR	BUDGET TRANSFERS	BUDGET AMEND	NET BUDGET	Budget Sources: General	User Fee	SS1 Impact	SS2 Impact	SS3 Impact	Developers	Expended: General	User Fees	SS1 Impact	SS2 Impact	SS3 Impact	Developers	Balances by Source: General	User Fees	SS1 Impact	SS2 Impact	SS3 Impact	Developers	Balance	Closed Reconciling	C/O Projects
SS1 - East																											
53.5301.760.024.13014	East Gentile, 700 N to 1000 N		50,000.00			50,000.00		50,000.00						25,696.00					0.00	24,304.00	0.00	0.00	0.00	0.00	24,304.00		24,304.00
53.5301.760.027.13013	Quail Point, Hillsboro, Snow Creek		175,000.00			175,000.00		175,000.00						129,827.06					0.00	45,172.94	0.00	0.00	0.00	0.00	45,172.94		45,172.94
53.5301.760.028	Gordon, 2000 East		70,000.00			70,000.00			70,000.00						70,024.14				0.00	0.00	-24.14	0.00	0.00	0.00	-24.14	24.14	0.00
53.5301.760.029.13017	Detention pond, Boynton Road 75 S		320,000.00			320,000.00			320,000.00						2,400.31				0.00	0.00	317,599.69	0.00	0.00	0.00	317,599.69		317,599.69
53.5301.760.021.11010	Chapel Hills Line Replacement	166,477.34	100,000.00			266,477.34		266,477.34						264,459.43					0.00	2,017.91	0.00	0.00	0.00	0.00	2,017.91		2,017.91
53.5301.760.019	Holmes Creek, Oakhills to Highway 89	286,028.10				286,028.10		200,000.00	86,028.10					6,157.35	86,028.10				0.00	193,842.65	0.00	0.00	0.00	0.00	193,842.65		193,842.65
53.5301.760.015	Misc. Storm Drain Repair projects	38,032.70	100,000.00			138,032.70		138,032.70						22,176.06					0.00	115,856.64					115,856.64	-2697.46	113,159.18
53.5301.760.026.13012	Pinewood Dr. 2500 E. to 2800 E.	(222.20)	300,000.00			299,777.80		299,777.80						231,772.69					0.00	68,005.11	0.00	0.00	0.00	0.00	68,005.11		68,005.11
		490,315.94	1,115,000.00	-	-	1,605,315.94	0.00	1,129,287.84	476,028.10	0.00	0.00	0.00	0.00	680,088.59	158,452.55	0.00	0.00	0.00	0.00	449,199.25	317,575.55	0.00	0.00	0.00	766,774.80		764,101.48
SS2 - Central																											
53.5302.760.016.13020	285 West, 1675 N to 1925 N		220,000.00			220,000.00		220,000.00						190,295.95					0.00	29,704.05	0.00	0.00	0.00	0.00	29,704.05		29,704.05
		-	220,000.00	0.00	0.00	220,000.00	0.00	220,000.00	0.00	0.00	0.00	0.00	0.00	190,295.95	0.00	0.00	0.00	0.00	0.00	29,704.05	0.00	0.00	0.00	0.00	29,704.05		29,704.05
SS3 - West																											
53.5303.760.015	Misc. Storm Drain Repairs	38,085.21				38,085.21		38,085.21						9,475.88					0.00	28,609.33	0.00	0.00	0.00	0.00	28,609.33		28,609.33
53.5303.760.016	Developer reimbursements		50,000.00			50,000.00					50,000.00						50,000.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00
		38,085.21	50,000.00	0.00	0.00	88,085.21	0.00	38,085.21	0.00	0.00	50,000.00	0.00	0.00	9,475.88	0.00	0.00	50,000.00	0.00	0.00	28,609.33	0.00	0.00	0.00	0.00	28,609.33		28,609.33
	Budgeted fund balance																										
	Totals	528,401.15	1,385,000.00	0.00	0.00	1,913,401.15	0.00	1,387,373.05	476,028.10	0.00	50,000.00	0.00	0.00	879,860.42	158,452.55	0.00	50,000.00	0.00	0.00	507,512.63	317,575.55	0.00	0.00	0.00	825,088.18		822,414.86
							1,913,401.15						1,088,312.97														
													Total Expended	1,088,312.97													

Closed ('C)	0.00	#REF!	-24.14										
Carryover Amounts	0.00	#REF!	317,551.41	0.00	0.00	0.00	825,088.18						

STORM DRAIN RATE STUDY

August 2016

Project No. 342-13-01

DRAFT

Prepared for:

Layton City

Prepared by:

Bowen Collins & Associates, Inc.
CONSULTING ENGINEERS

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SECTION 1
PROJECTED REVENUE NEEDS

INTRODUCTION

Layton City has retained Bowen, Collins & Associates (BC&A) to update its storm drain rates. The purpose of this study is to update City's storm drain rate based on changes in demand patterns and system revenue requirements that have occurred since the last study. The rate study will calculate detailed rates for the next five years and present a longer term finance plan to achieve the City's primary objectives of:

- Maintaining high quality, reliable storm drain service at affordable prices for customers;
- Maintaining stable revenue generation adequate to fund system needs; and
- Minimizing the City's long-term costs by avoiding debt where possible.

Implementing the recommendations contained in this report will help Layton City keep its storm drain utility system adequately funded to maintain its current infrastructure and keep pace with its currently approved capital improvements plan.

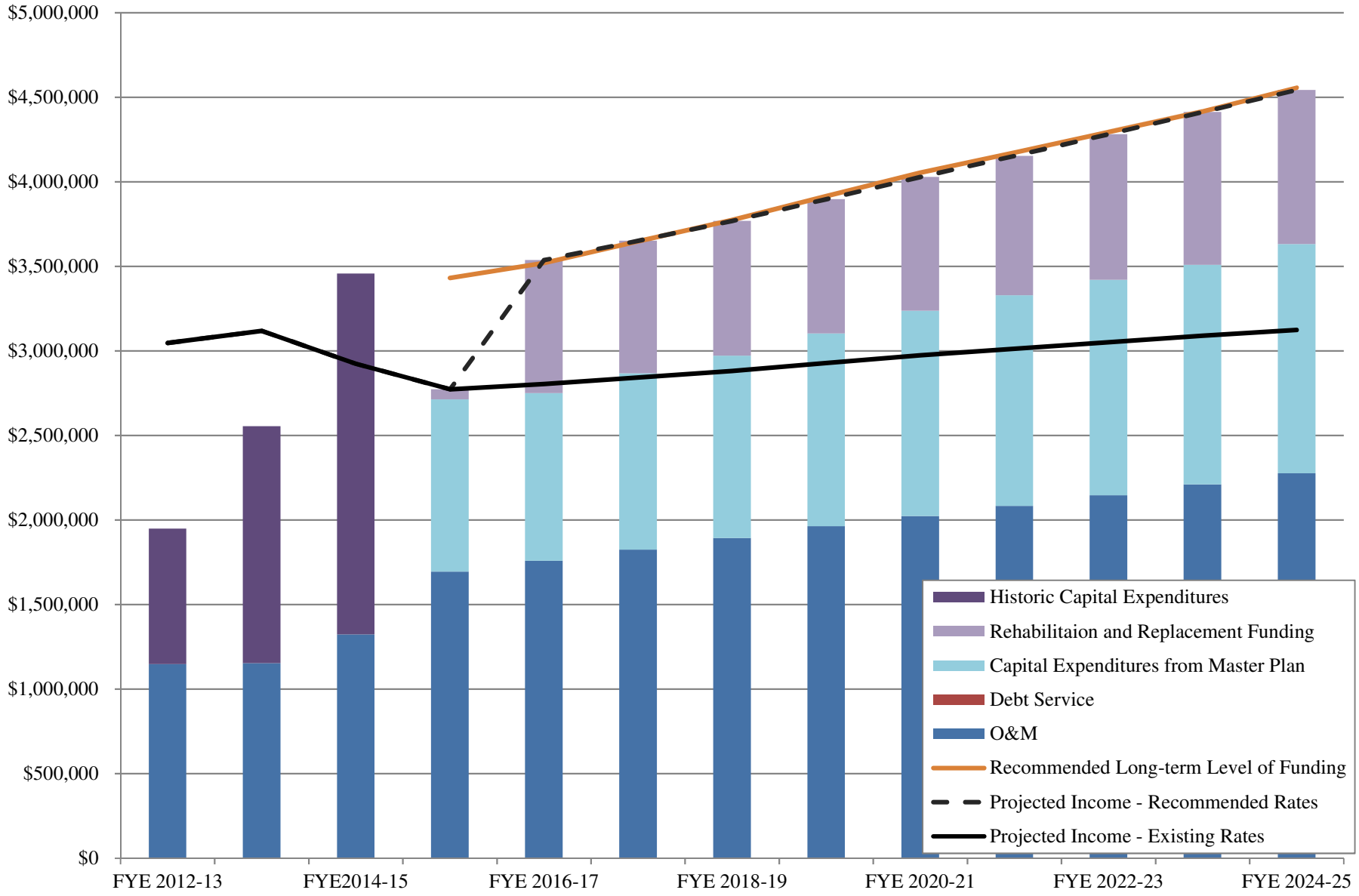
PROJECTED REVENUE NEEDS

Before calculating detailed rates for individual customer classes, it is important to consider the overall plan for meeting the future revenue needs of the City. The first step in this process is to project future expenditures. Historic and projected expenditures for the City for fiscal years 2012-13 through 2024-25 are shown in Figure 1-1.

Tables containing the values used to generate these figures are contained in Appendices A-B. Future expenditures can be grouped into four categories:

- **Operation and Maintenance Expenditures –** These are the annual costs of running the system. They include items such as salary and benefit costs for City staff, equipment and supplies, power costs, and all other costs associated with doing business throughout the year. Operation and maintenance (O&M) costs are relatively constant from year to year and tend to follow the rate of inflation. Some of the largest O&M costs are employee wages and repair of storm drain lines.
- **Debt Service Expenditures –** These are the costs paid toward bonds taken out by the City in previous years. These costs are easily predictable because they are tied to set payment schedules for each bond. The City currently has no outstanding debt service costs.
- **Capital Improvement Expenditures –** These are costs for constructing new facilities within the City. This can include completely new facilities or replacement of existing facilities. Capital improvement expenditures are usually the most volatile of expenditure categories. Because O&M and debt service costs are basically fixed, budgets are usually balanced by increasing or decreasing capital improvement expenditures as necessary. While some fluctuation in the funding of capital improvements is acceptable from year to year, the overall health of the system will depend on adequately funding this portion of the

Figure 1-1
10-Year Revenue and Expenditures - Storm Drain



budget over the long term. The current capital improvement budget shown in the figure is based on the City's recently completed storm drain master plan and associated capital facility plan.

- **Rehabilitation and Replacement Expenditures –** Also included in the table are expenditures for rehabilitation and replacement of the existing storm drain system. As with most things, each component of storm drain system has a finite service life. As such, it is necessary to continually budget money for the rehabilitation or replacement of these system components. If adequate funds are not set aside for regular system renewal, the system will fall into disrepair and be incapable of providing the level of service customers in the City expect.

  To maintain the utility in good operating condition, it is recommended that the City's annual investment into the system (including debt service costs and capital improvements) be approximately equal to the replacement value of the system divided by its estimated service life. The estimated replacement value of the City's storm drain system is $82 million. Based on an approximate service life of 67 years, we would recommend the City budget approximately 1.5 percent of replacement costs ($1,250,000) per year for capital investment in its storm drain system. As discussed in the category above, a large portion of this total will go toward constructing those projects identified in the capital facilities plan. However, the remaining amount will be available for rehabilitation and replacement of existing facilities.

10-YEAR BUDGET PLAN

With the expected expenditures outlined above, it is possible to prepare a future budget plan. A budget plan has been developed for the storm drain utility and is shown on top of projected expenditures in Figure 1-1. The process of creating this budget plan was as follows:

1. **Identify projected revenue based on existing storm drain rates –** Using the City's existing storm drain rates, BC&A calculated the revenue the City could expect to receive over the next 10 years if no changes are made to existing rates. These projections include consideration of future system growth. As can be seen in Figure 1-1, projected revenue based on existing rates will need to be increased in 2016-17 to meet the projected budget demands of the city through fiscal year 2020-21. It is recommended that rates be increased by 31 percent in fiscal year 2016-17 and continue with 2 percent increases each subsequent year to continue meeting the long term funding goal.
2. **Identify recommended level of funding based on long-term system needs** – The City's projected long-term level of funding based on all O&M and system investment needs is shown in Figure 1-1. As can be seen in the figure, the City's historic level of investment in the system is slightly below the long-term recommendations in the immediate future. By fiscal year 2016-17, the City will need to increase rates by 31 percent and continue increasing its rates gradually in order to keep up with inflation and continue to meet the City's long-term needs for the system.
3. **Create a plan to transition from existing revenue to revenue adequate to support long-term system needs** – In order to continue meeting the projected revenue for the city it is recommended that the rates be increased by 31 percent at the beginning of fiscal year 2016-

17. In subsequent years a 2 percent per year increase is recommended to keep up with the increasing costs to run the system. The recommended rate increases for Layton City over the next 10 years are presented in Table 1-1.

Table 1-1
Recommended Annual Rate Revenue Increase for 10-Year Budget Plan

Year	Storm Drain Percent Increase
2015-16	0.0%
2016-17	31.0%
2017-18	2.0%
2018-19	2.0%
2019-20	2.0%
2020-21	2.0%
2021-22	2.0%
2022-23	2.0%
2023-24	2.0%
2024-25	2.0%

SECTION 2
STORM DRAIN RATE ANALYSIS

In Section 1, a 10-year budget plan was developed for the storm drain systems. Based on this overall budget plan, detailed rates can now be calculated. The purpose of this chapter is to calculate detailed storm drain rates for the next 5 years based on the overall budget plan.

This analysis focuses on four major tasks:

1. **Projecting Future Connections:** Future storm drain connections were estimated by examining current developed acres and by projecting system growth for the next several years.
2. **Calculating Revenue Requirements:** Total revenue requirements for the system were projected for the next several years based on the budget plan outlined in Section 1. Non-rate revenue (including impact fee revenue) was deducted from the total to give the net revenue requirement to be recovered from rate payers.
3. **Cost Allocation:** This analysis follows the essential principles of cost-of-service rate calculation methodologies and divides costs between two customer service characteristics: volume related costs and customer related costs.
4. **Rate Design:** Rates were calculated to generate the required rate revenue.

The remainder of this report details the results of each of these four major tasks. Detailed rate tables from the model used to develop the rate recommendations are located in Appendix B.

KEY ASSUMPTIONS

The results presented in this report are based on the following assumptions:

1. The storm drain fund will continue to be an enterprise-type fund.

2. This rate study is based on projections of future system operation, maintenance, and improvement costs. These projections are based on current economic conditions and regulatory requirements. Because conditions may change over time, it is recommended that Layton City review the rates annually to determine if adjustments are needed to provide a revenue stream that will adequately fund operation and maintenance costs as well as needed capital improvements. It is also recommended that a comprehensive review and updating of storm drain rates be undertaken in three to five years so that the basic analytical foundations of this study can be re-evaluated.

PROJECTING STORM DRAIN USE

Historic Drainage Area

Layton City provides storm drain service to over 18,000 accounts as shown in Table 2-1. To estimate the potential for storm drainage from each of these accounts, Table 2-1 also summarizes

the total impervious area associated with each customer class. Average drainage areas were then estimated for each customer class.

Table 2-1
Drainage Area Summary

Customer Class	Impervious Area (acres)	Accounts	Average Impervious Area (Square Feet/account)
Residential	1,256.3	17,328	3,158
Commercial	1,722.4	958	78,317
Total	**2,978.7**	**18,286**	

It should be noted here that a decision has been made to base this analysis on impervious area. This is one of two common methods of looking at potential for storm drainage. The other common method is to consider total lot size. For this study, impervious area has been used to match historic billing practices.

Projected Accounts

Layton City has historically seen a wide range of growth rates depending on economic conditions in the area. Current projections available from the City project growth of between 1.57 to 1.70 percent per year over the next 6 years. Projected growth rates and number of accounts by customer type are summarized in Table 2-2.

Table 2-2
Projected Accounts Summary

	FYE 2015-16	FYE 2016-17	FYE 2017-18	FYE 2018-19	FYE 2019-20	FYE 2020-21
	1.70%	**1.67%**	**1.64%**	**1.62%**	**1.59%**	**1.57%**
Residential	17,623	17,917	18,211	18,506	18,800	19,095
Commercial	974	991	1,007	1,023	1,039	1,056
Total	**18,597**	**18,908**	**19,218**	**19,529**	**19,839**	**20,151**

Projected Developed Area

Future impervious areas were estimated to grow at the same rate as population growth as is shown in Table 2-2. Using this methodology, the projected growth in impervious area is shown in Table 2-3.

Table 2-3
Impervious Area Summary

Customer Class	Average Drainage Area per Account (Square Feet)	Total Drainage Area (Square Feet)					
		FYE 2015-16	FYE 2016-17	FYE 2017-18	FYE 2018-19	FYE 2019-20	FYE 2020-21
Residential	3,158	55,654,743	56,584,177	57,512,158	58,443,855	59,373,112	60,305,270
Commercial	78,317	76,280,817	77,612,207	78,865,280	80,118,353	81,371,426	82,702,816
Total		**131,935,560**	**134,196,384**	**136,377,438**	**138,562,208**	**140,744,538**	**143,008,086**

CALCULATING REVENUE REQUIREMENTS

Non-Rate Revenue

The projected non-rate revenue for the planning period is summarized in Table 2-4. Non-Rate Revenue may include items such as service charges, net interest income, lease income, and loss on disposal of assets. However, in the case of the Layton storm drain utility, impact fees were the only non-rate revenue identified. It should be noted that revenue shown in the table assumes adoption of the impact fees recommended in the City's recent completed Impact Fee Analysis.

Table 2-4
Projected Non-Rate Revenue

	FYE 2015-16	FYE 2016-17	FYE 2017-18	FYE 2018-19	FYE 2019-20	FYE 2020-21
Impact Fees	**$446,978**	**$438,008**	**$439,218**	**$438,424**	**$447,865**	**$453,598**

City Expenditures

The projected City expenditures for the planning period are summarized in Table 2-5. Included in the table are the projected total costs for the three major categories of expenditures: operations and maintenance, debt service, and capital expenditures. Each of these categories is discussed in more detail in following sections.

Table 2-5
Projected Revenue Requirements

Item	FYE 2015-16	FYE 2016-17	FYE 2017-18	FYE 2018-19	FYE 2019-20	FYE 2020-21
O&M	$1,694,389	$1,758,319	$1,824,501	$1,892,922	$1,963,737	$2,022,649
Debt Services	$0	$0	$0	$0	$0	$0
Capital	$1,018,004	$991,637	$1,042,392	$1,079,354	$1,139,292	$1,213,938
Total Expenditures	**$2,712,393**	**$2,749,956**	**$2,866,893**	**$2,972,276**	**$3,103,029**	**$3,236,587**

Operation and Maintenance Costs

The projected operation and maintenance (O&M) costs for the City have been taken from the City's budget year for 2015-16. A detailed list of all O&M budget categories is included as part of the rate model in Appendix B. Beyond 2015-16, it has been assumed that most of these O&M cost categories will increase at a rate equal to half the system growth rate in each year and an assumed inflation rate of 3.0 percent (e.g. budget growth in 2016-17 = 1.67 %/2 + 3% = 3.84%).

Debt Service Costs

Layton City currently has no projected debt service costs for the storm drain system.

Capital Improvement Costs

As identified in the City's capital facility plan, there are multiple storm drain capital projects which will be completed during the next 6 years. Over the next 6 years there will be approximately $950,000-$1,250,000 per year on capital facility projects. The list of projects proposed to be completed in the next 6 years along with a cost for each project can be seen in Appendix B.

Included under the capital improvements budget is a section for the transfer of funds to or from the City's reserve fund. As noted in Section 1, there should be a budget of approximately $1,250,000 annually (increased with an assumed inflation rate of 3.0%) for investment into the system. Any money not spent on projects in the capital facility plan should be spent on other system rehabilitation and replacement projects. However, if specific rehabilitation and replacement projects are not immediately identified, this same total should be deposited in the utility's reserve fund. The reserve fund can then be used to smooth out total, overall capital expenditures in the City. With the City's philosophy of paying for improvements without bonding, it is expected that there will also be years in which excess funds are generated and added to the reserve, only to be drawn out in subsequent years for large projects. From a long-term perspective, the City should continue to invest the recommended amount into projects in the system such that the reserve fund's overall size does not appreciably increase due to these transfers.

CURRENT STORM DRAIN RATE REVENUE

Total annual projected rate revenues based on existing storm drain rates are shown in Table 2-6. It can be seen that the projected revenue from existing storm water rates will become increasingly insufficient to meet revenue requirements in the coming years. As described in Section 1, BC&A would recommend 31.0% increases in fiscal year 2016-17 and then a small annual increases of approximately 2.0% per year over the planning period in order to keep up with revenue requirements.

Table 2-6
Projected Revenue Based on Existing Storm Rates

	FYE 2015-16	FYE 2016-17	FYE 2017-18	FYE 2018-19	FYE 2019-20	FYE 2020-21
Projected Rate Revenue-Existing Rates	$2,326,137	$2,365,997	$2,404,451	$2,442,970	$2,481,446	$2,521,355
Projected Rate Revenue Requirements	$2,326,137	$3,099,456	$3,212,827	$3,329,583	$3,449,663	$3,575,246
Projected Difference	$0	($733,459)	($808,376)	($886,613)	($968,217)	($1,053,891)

COST ALLOCATIONS

As with the culinary water rate analysis, a key step is the allocation of costs to customer service characteristics. The allocation approach used in this rate update reflects the basic approaches recommended by AWWA.

Customer Service Characteristics

Customer service characteristics for the storm drain rate analysis are similar to those steps followed in a culinary water model, but simplified. Specifically, the customer service characteristics considered in this rate study are divided into two categories:

- volume characteristics (which includes total storm water flow), and
- customer characteristics (which include billing & administrative costs).

The first step in allocating costs is to divide each of the City's revenue requirements into these categories. This has been done in the storm drain rate model (see Tables 7 and 8 of Appendix B). In each case, these allocations are based on information provided by Layton City personnel, professional engineering judgment, and knowledge of system operations. Table 7 in Appendix B provides a division by customer service characteristics for O&M expenditures. Table 8 in Appendix B provides the same information for capital and bonding expenditures.

Using the percentages assigned to each budget category, the system revenue costs are distributed among the customer service characteristics. This is also shown in detail in the rate model. The total revenue requirement for each customer service characteristic is given in Table 10 of Appendix B. Table 11 of Appendix B shows the total cost allocation for each customer class.

COST-OF-SERVICE RATES

Existing monthly storm drain rates consist of a flat rate based on impervious area. Charges vary based on customer class, but only relative to how much impervious area is assumed for each

customer class. Customers are billed based on lot size and the defined impervious percentage for their customer class.

Based on cost-of-service principles and standard industry practices, BC&A would recommend just one modification be made to the existing structure:

- **Calculate the Fee Using Separate Billing/Admin and Volume Charges** – The storm drain rates can be calculated based on two components: monthly billing/admin charges and volumetric charges. The monthly billing/admin charge is the amount charged to existing users to be connected to the system, regardless of lot size or detention/retention needs. It includes cost associated with sending bills and administration costs associated with storm drain system. Volumetric charges are those charges assessed based on the amount of storm water produced by the customer.

Following this approach, the rate model was used to calculate new cost-of-service charges to meet projected revenue needs. These cost-of-service charges are shown in Table 2-7. The table includes a billing/admin charge that would be applied to each customer account along with a volume charge. Volume charges are based on the directly connected impervious area (DCIA).

Table 2-7
Calculated Monthly Storm Drain Cost-of-Service Charges

Cost-of-Service Rates	FYE 2015-16	FYE 2016-17	FYE 2017-18	FYE 2018-19	FYE 2019-20
Billing/Admin Charge ($/account)	$1.67	$1.70	$1.74	$1.77	$1.81
Volume Charge ($/DCIA)	$53.78	$73.39	$74.84	$76.33	$77.87

Based on the cost of service calculations shown in Table 2-7 storm drain rates for the two customer classes are identified in Table 2-8.

Table 2-8
Calculated Monthly Storm Drain Rates (Cost-of-Service)

	FYE 2015-16	FYE 2016-17	FYE 2017-18	FYE 2018-19	FYE 2019-20
Residential ($/Unit)	$5.56	$7.02	$7.17	$7.31	$7.45
Commercial (Per Connections)	$1.67	$1.70	$1.74	$1.77	$1.81
Commercial ($/DCIA)	$53.78	$73.39	$74.84	$76.33	$77.87

RECOMMENDED FUTURE RATES

As can be seen in Table 2-8, the calculated cost-of-service volume rates are a little less than the current volume rate of $64.00/DCIA. This suggest that customers with larger properties may be paying a little more than their true cost of service under existing rates. To remedy this issue, BC&A recommends transitioning from existing rates to cost-of-service rates. To avoid significant changes to any single customer's bill, it is probably prudent to make this transition gradually over the next several years. One potential approach to this transition is shown in Table 2-9.

Table 2-9
Recommended Monthly Storm Drain Rates

	FYE 2015-16	FYE 2016-17	FYE 2017-18	FYE 2018-19	FYE 2019-20
Residential ($/Unit)	$4.60	$7.02	$7.17	$7.31	$7.45
Commercial ($/DCIA)	$64.00	$74.33	$75.81	$77.32	$78.88

Under this transition plan, there would be no immediate move to charging a separate billing/admin charge to the City's commercial customers. Instead, the same basic rate structure would be followed. All residents would be charged the same monthly rate with commercial charged based on directly connected impervious area as defined in the City's current rate structure table.

Following the transition plan proposed, the City's recommended rate schedule for all user types is summarized in Table 2-10.

Table 2-10
Proposed Monthly Storm Drain Rates

	FYE 2015-16	FYE 2016-17	FYE 2017-18	FYE 2018-19	FYE 2019-20
Residential ($/Unit)	$4.60	$7.02	$7.17	$7.31	$7.45
Residential/PRUD (A Thru R-1-6)($/Unit)	$4.60	$7.02	$7.17	$7.31	$7.45
PRUD (R-2) ($/Acre)	$38.40	$44.60	$45.49	$46.39	$47.33
Multi-Family/PRUD (R-M and CTH) ($/Acre)	$44.80	$52.03	$53.07	$54.12	$55.22
Multi-Family (R($/Acre)	$38.40	$44.60	$45.49	$46.39	$47.33
Mobile Home Parks ($/Acre)	$44.80	$52.03	$53.07	$54.12	$55.22
Parks/Open Space (Private or Public) ($/Acre)	$12.80	$14.87	$15.16	$15.46	$15.78
Schools ($/Acre)	$25.60	$29.73	$30.32	$30.93	$31.55
Churches ($/Acre)	$44.80	$52.03	$53.07	$54.12	$55.22
Hospitals ($/Acre)	$57.60	$66.90	$68.23	$69.58	$70.99
Commercial (P-B,all C-P, C-H, MU-TOD) ($/Acre)	$57.60	$66.90	$68.23	$69.58	$70.99
Commercial (B-RP) ($/Acre)	$48.00	$55.75	$56.86	$57.99	$59.16
Manufacturing (M-1 and M-2) ($/Acre)	$57.60	$66.90	$68.23	$69.58	$70.99

SECTION 3
CONCLUSIONS AND RECOMMENDATIONS

Based on the analysis contained in the previous sections of this report, BC&A would recommend the following actions:

Transition Toward Cost-Of-Service Rates: A few small changes in approach to the current rate structure have been recommended in the previous section. This includes a gradual transition toward cost-of-service rates. Eventually this will include monthly base charges and volumetric charges based on lot size.

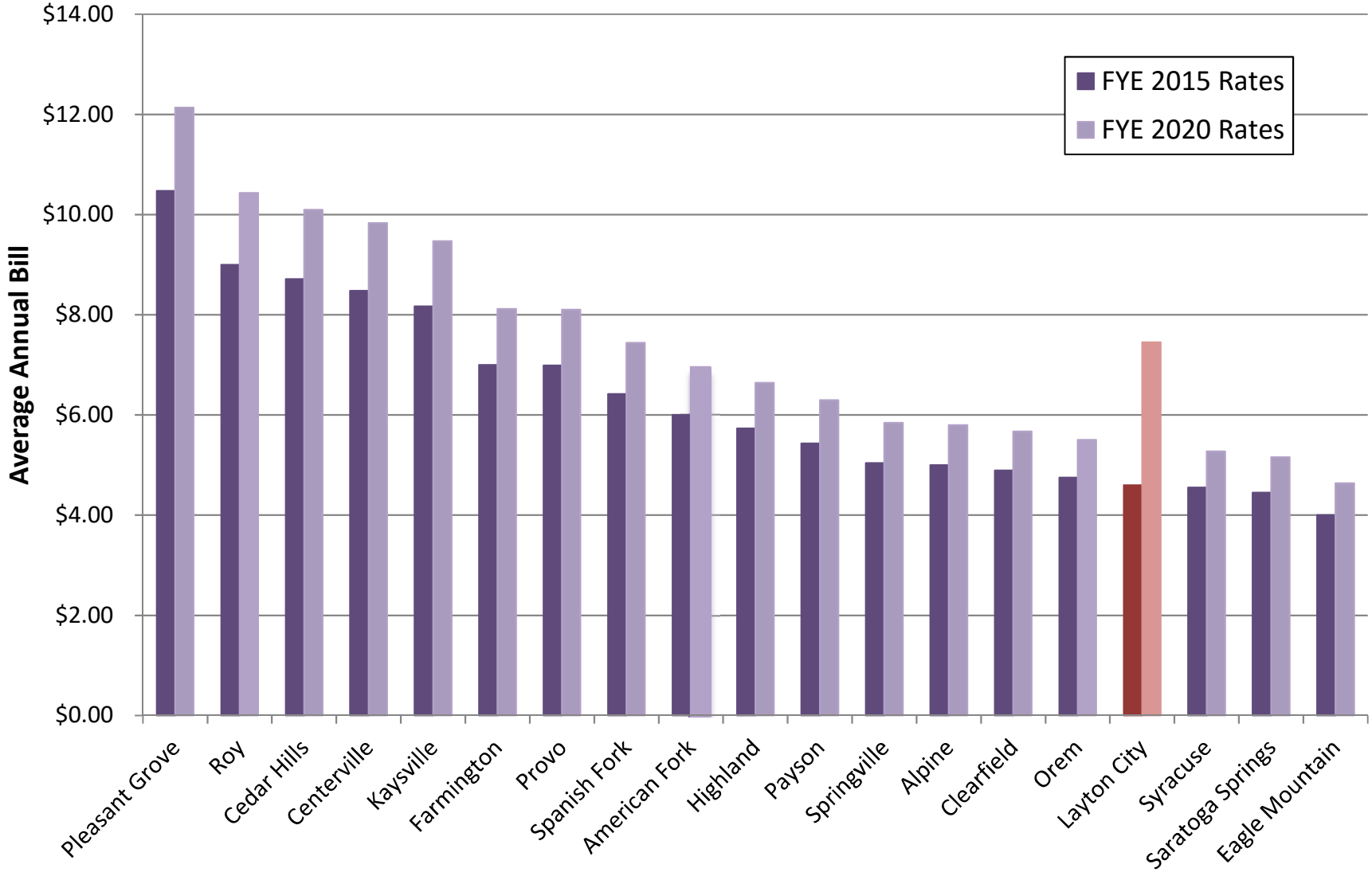
Adopt the Recommended Rate Increases: It is recommended that the Layton City adopt the proposed rate increases as summarized below in Tables 3-1. This equates to no change in the first year, and an increase in rate revenue of approximately 31 percent in fiscal year 2016-17 with 2 percent increases in subsequent years.

Table 3-1
Recommended Monthly Storm Drain Rates

	FYE 2015-16	FYE 2016-17	FYE 2017-18	FYE 2018-19	FYE 2019-20
Residential ($/Unit)	$4.60	$7.02	$7.17	$7.31	$7.45
Commercial ($/DCIA)	$64.00	$74.33	$75.81	$77.32	$78.88

For comparison purposes, Table 3-2 show the existing and proposed future rates for Layton City and other communities along the Wasatch Front. The table shows the average monthly bill that each municipality charges a residential connection for storm drain. For Layton City, the future rate shown assumes the City adopts the rates recommended in this report. For all other cities, future rates are simply based on a constant annual inflation of 3 percent. This likely underestimates future rates for most cities, but provides a starting point for comparison. This same information is shown graphically in Figure 3-1.

Figure 3-1
Comparison of Annual Storm Drain Rates, Average Residential Customer



*FYE 2018 rates based on annual increase to account for inflation only (3%)

Table 3-2
Storm Drain Monthly Rate Comparison

City	Cost per Average Residential Connection for FYE 2015	Cost per Average Residential Connection for FYE 2020[1]
Pleasant Grove	$10.47	$12.14
Roy	$9.00	$10.43
Cedar Hills	$8.71	$10.10
Centerville	$8.48	$9.83
Kaysville	$8.17	$9.47
Farmington	$7.00	$8.11
Provo	$6.99	$8.10
Spanish Fork	$6.42	$7.44
American Fork	$6.00	$6.96
Highland	$5.73	$6.64
Payson	$5.43	$6.29
Springville	$5.04	$5.84
Alpine	$5.00	$5.80
Clearfield	$4.89	$5.67
Orem	$4.75	$5.51
Layton City	$4.60	$7.45
Syracuse	$4.55	$5.27
Saratoga Springs	$4.45	$5.16
Eagle Mountain	$4.00	$4.64

[1]Assumes other City rates are inflated at 3.0% annually

As can be seen in the table, Layton City currently has rates in the lower third for storm drain when compared to other City's along the Wasatch Front. Even with the proposed increases identified in this report, it is expected that Layton City will be about average when compared to the other communities surveyed.

Consider Multiple Year Rate Schedules: It is recommended that Layton City pursue adopting multiple year rate schedules (up to the full rate schedule above). By adopting multiple year rate schedules, the City can program small annual increases to the storm drain rates consistent with the results of this report. This will help avoid large rate increases in future years and minimizes the potential for "rate shock" to customers. Small, affordable changes in rate levels and rate structures are more acceptable to the public and benefit the utility in terms of financial stability. If small changes are needed to this multiyear schedule in the future, the City can always revise these rates at that time.

Update This Rate Study Periodically: After the implementation of any change to the rate structure, we would suggest that the City monitor customer responses and demand patterns for a period of one year. Following this initial observation period, the change should be re-examined to determine if there should be any subsequent adjustments. A comprehensive review of this rate study should also be performed in three to five years. The projections, assumptions, and data contained in this report may need to be revised over time. For these reasons, it is prudent to update storm drain rates to ensure they are sufficient to meet system requirements, as well as maintain cost-of-service equity in charges to customers.

APPENDIX A
10-YEAR BUDGET PLAN

Table A-1
10-Year Budget Plan - Storm Drain

	Historic			Projected									
	Year			Year									
	FYE 2012-13	FYE 2013-14	FYE2014-15	FYE 2015-16	FYE 2016-17	FYE 2017-18	FYE 2018-19	FYE 2019-20	FYE 2020-21	FYE 2021-22	FYE 2022-23	FYE 2023-24	FYE 2024-25
Total Number of Accounts	17,642	17,964	18,286	18,597	18,908	19,218	19,529	19,839	20,151	20,467	20,729	20,995	21,264
% Growth from Previous Year	-	1.83%	1.79%	1.70%	1.67%	1.64%	1.62%	1.59%	1.57%	1.28%	1.28%	1.28%	1.28%
Expenditures													
O&M	*$1,147,654*	$1,153,167	$1,323,424	$1,694,389	$1,758,319	$1,824,501	$1,892,922	$1,963,737	$2,022,649	$2,083,329	$2,145,829	$2,210,203	$2,276,510
Debt Service	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Capital Expenditures	$801,787	$1,401,276	$2,133,664	$1,018,004	$991,637	$1,042,392	$1,079,354	$1,139,292	$1,213,938	$1,244,912	$1,274,506	$1,299,020	$1,354,712
Total Expenditures	*$1,949,441*	*$2,554,443*	*$3,457,088*	*$2,712,393*	*$2,749,956*	*$2,866,893*	*$2,972,277*	*$3,103,029*	*$3,236,588*	*$3,328,241*	*$3,420,335*	*$3,509,223*	*$3,631,222*
Historic Capital Expenditures	$801,787	$1,401,276	$2,133,664	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Capital Expenditures from Master Plan	$0	$0	$0	$1,018,004	$991,637	$1,042,392	$1,079,354	$1,139,292	$1,213,938	$1,244,912	$1,274,506	$1,299,020	$1,354,712
Income													
Connection Fees	$530,246	$908,384	$695,000	$446,978	$438,008	$439,218	$438,424	$447,865	$453,598	$459,404	$465,284	$471,240	$471,240
Other Non-Rate	$325,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Sales - Existing Rates	$2,191,977	$2,210,842	$2,229,148	$2,326,137	$2,365,997	$2,404,451	$2,442,970	$2,481,446	$2,521,355	$2,553,628	$2,586,314	$2,619,419	$2,652,948
Projected Income - Existing Rates	*$3,047,223*	*$3,119,226*	*$2,924,148*	*$2,773,115*	*$2,804,005*	*$2,843,668*	*$2,881,394*	*$2,929,311*	*$2,974,952*	*$3,013,032*	*$3,051,599*	*$3,090,659*	*$3,124,188*
System Investment Goal	$1,068,136	$1,119,674	$1,173,329	$1,228,475	$1,265,329	$1,303,289	$1,342,388	$1,382,660	$1,424,139	$1,466,864	$1,510,870	$1,556,196	$1,602,881
Recommended Long-term Level of Funding				$3,431,866	$3,519,467	$3,648,986	$3,774,988	$3,916,043	$4,053,758	$4,172,648	$4,293,951	$4,415,909	$4,556,747
										0.00	0.00	0.00	0.00
Recommended Rate Increases				0.0%	31.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Sales Revenue With Increase	$2,191,977	$2,210,842	$2,229,148	$2,326,137	$3,099,456	$3,212,827	$3,329,583	$3,449,663	$3,575,246	$3,693,429	$3,815,519	$3,941,645	$4,071,940
Projected Income - Recommended Rates	*$3,047,223*	*$3,119,226*	*$2,924,148*	*$2,773,115*	*$3,537,464*	*$3,652,045*	*$3,768,006*	*$3,897,528*	*$4,028,844*	*$4,152,833*	*$4,280,803*	*$4,412,885*	*$4,543,180*

APPENDIX B
DETAILED STORM DRAIN
RATE MODEL TABLES

Table B-1
Layton City - Storm Drain Rate Study
Historic Drainage Area
(acres)

	FYE 2012-13			*FYE 2013-14*			*FYE2014-15*				
Customer Class	**Impervious Area (acre)**	**Accounts**	**SF per Account**	**Impervious Area (acre)**	**Accounts**	**SF per ESU**	**Impervious Area (acre)**	**Accounts**	**SF per ESU**	**Planning SF/ESU**	**SF/ESU**
Residential	1,212	16,718	3,158.2	1,234	17,023	3,158.2	1,256	17,328	3,158.2	3,158.2	3158.2
Commercial	1,662	924	78,317.1	1,692	941	78,317.1	1,722	958	78,317.1	78,317.1	78317.1
Total	**2,874**	**17,642**	**81,475**	**2,926**	**17,964**	**81,475**	**2,979**	**18,286**	**81,475**	**81,475**	**81,475**

Table B-2
Layton City - Storm Drain Rate Study
Projected Acountss

		Number					
Customer Class		**FYE 2015-16**	**FYE 2016-17**	**FYE 2017-18**	**FYE 2018-19**	**FYE 2019-20**	**FYE 2020-21**
	% Growth	**1.70%**	**1.67%**	**1.64%**	**1.62%**	**1.59%**	**1.57%**
Residential		17,623	17,917	18,211	18,506	18,800	19,095
Commercial		974	991	1,007	1,023	1,039	1,056
Total		**18,597**	**18,908**	**19,218**	**19,529**	**19,839**	**20,151**

Table B-3
Layton City - Storm Drain Rate Study
Projected Drainage Area

	Planning	**Amount (Square Feet)**					
Customer Class	**SF/Acct.**	**FYE 2015-16**	**FYE 2016-17**	**FYE 2017-18**	**FYE 2018-19**	**FYE 2019-20**	**FYE 2020-21**
Residential	3,158.2	55,654,743	56,584,177	57,512,158	58,443,855	59,373,112	60,305,270
Commercial	78,317.1	76,280,817	77,612,207	78,865,280	80,118,353	81,371,426	82,702,816
Total		**131,935,560**	**134,196,384**	**136,377,438**	**138,562,208**	**140,744,538**	**143,008,086**

Table B-4
Layton City - Storm Drain Rate Study
Connection Fee Revenue

Impervious Area	Impact Fee ($/ERU)	Historic FYE 2013-14	Projected FYE2014-15	Projected FYE 2015-16	Projected FYE 2016-17	Projected FYE 2017-18	Projected FYE 2018-19	Projected FYE 2019-20
Per ERU	$3,544.63			$446,978	$438,008	$439,218	$438,424	$447,865
Total Impact Fee Revenue		**$908,384**	**$695,000**	**$446,978**	**$438,008**	**$439,218**	**$438,424**	**$447,865**

Table B-5
Layton City - Storm Drain Rate Study
Non-Rate Revenue (Including Connection Fees)

Assumed Inflation Rate = 3.0%

Item	Historic FYE 2013-14	Projected FYE2014-15	Projected FYE 2015-16	Projected FYE 2016-17	Projected FYE 2017-18	Projected FYE 2018-19	Projected FYE 2019-20
Operations							
Developer payments	$0	$0	$0	$0	$0	$0	$0
Sundry	$0	$0	$0	$0	$0	$0	$0
Total Operations Non-Rate Revenue	$0	$0	$0	$0	$0	$0	$0
Expansion and Replacement							
Impact fees - East area	$328,036	$500,000		$0	$0	$0	$0
Interest - East area	$0	$0		$0	$0	$0	$0
Impact fees - Central area	$43,372	$20,000		$0	$0	$0	$0
Interest - Central area	$0	$0		$0	$0	$0	$0
Impact fees - West area	$536,976	$175,000		$0	$0	$0	$0
Interest - West area	$0	$0		$0	$0	$0	$0
Impact Fees (Based on this study)			$446,978	$438,008	$439,218	$438,424	$447,865
Total Expansion Non-Rate Revenue	$908,384	$695,000	$446,978	$438,008	$439,218	$438,424	$447,865
Total Non-Rate Revenue	**$908,384**	**$695,000**	**$446,978**	**$438,008**	**$439,218**	**$438,424**	**$447,865**

Table B-6
Layton City - Storm Drain Rate Study
Revenue Requirements
Cash Basis

Item	% Growth	Historic FYE 2013-14	Projected FYE2014-15	Projected FYE 2015-16 (2015)	Projected FYE 2016-17 (2016)	Projected FYE 2017-18 (2017)	Projected FYE 2018-19 (2018)	Projected FYE 2019-20 (2019)
O&M								
Regular employees		$185,984	$190,072	$195,454	$202,920	$210,652	$218,646	$226,922
Temporary employees		$0	$0	$0	$0	$0	$0	$0
Overtime and extra		$2,323	$0	$0	$0	$0	$0	$0
Employee benefits		$94,758	$100,226	$107,627	$111,738	$115,996	$120,398	$124,955
Allocation for building maintenance		$6,341	$6,518	$4,860	$5,046	$5,238	$5,437	$5,642
Allocation from engineering		$238,433	$248,253	$253,687	$263,378	$273,413	$283,789	$294,530
Books, subscriptions, memberships		$0	$0	$0	$0	$0	$0	$0
Public notices		$0	$0	$0	$0	$0	$0	$0
Travel		$0	$0	$0	$0	$0	$0	$0
Office supplies, maintenance		$19,904	$27,100	$27,100	$28,135	$29,207	$30,316	$31,463
Equipment supplies, maintenance		$34,080	$16,347	$16,347	$16,971	$17,618	$18,287	$18,979
Buildings/grounds, maintenance		$0	$0	$0	$0	$0	$0	$0
Utilities		$1,757	$1,200	$1,612	$1,674	$1,737	$1,803	$1,872
Communications		$558	$564	$764	$793	$823	$855	$887
Repair storm sewer lines		$71,761	$237,195	$237,195	$246,256	$255,638	$265,340	$275,383
Administrative allocations		$7,439	$5,781	$8,815	$9,152	$9,500	$9,861	$10,234
Allocation from engineering		$12,388	$18,863	$19,413	$20,155	$20,922	$21,716	$22,538
Fleet and equipment expense				$350,000	$363,370	$377,214	$391,530	$406,349
Training		$0	$0	$0	$0	$0	$0	$0
Allocation from engineering		$7,625	$10,775	$10,775	$11,187	$11,613	$12,054	$12,510
Insurance and leases		$16,162	$18,068	$16,392	$17,018	$17,667	$18,337	$19,031
Collection fees & bad debts		$689	$1,250	$1,250	$1,298	$1,347	$1,398	$1,451
Credit card fees		$6,689	$4,000	$4,000	$4,153	$4,311	$4,475	$4,644
Miscellaneous supplies		$16,496	$17,500	$17,500	$18,169	$18,861	$19,576	$20,317
Miscellaneous services		$37,650	$37,650	$37,650	$39,088	$40,577	$42,117	$43,712
Master plan		$43,725	$27,129	$27,129	$28,165	$29,238	$30,348	$31,497
Transfer for payment in lieu of property tax		$92,103	$96,258	$97,046	$99,957	$102,956	$106,045	$109,226
Franchise taxes		$130,303	$132,651	$133,749	$138,858	$144,149	$149,619	$155,282
Facility rents		$125,899	$125,899	$125,899	$130,708	$135,688	$140,838	$146,168
Allocation from engineering		$100	$125	$125	$130	$135	$140	$145
Total O&M		**$1,153,167**	**$1,323,424**	**$1,694,389**	**$1,758,319**	**$1,824,501**	**$1,892,922**	**$1,963,737**
Debt Service								
Total Debt Service		**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Expansion and Replacement		**FYE 2013-14**	**FYE2014-15**	**FYE 2015-16**	**FYE 2016-17**	**FYE 2017-18**	**FYE 2018-19**	**FYE 2019-20**
Buildings		$0	$0	$0	$ -	$ -	$ -	$ -
Improvements other than buildings		$0	$0	$27,129	$ 27,943	$ 28,781	$ 29,645	$ 30,534
Equipment		$45,140	$56,750	$50,500	$ 52,015	$ 53,575	$ 55,183	$ 56,838
Allocation from engineering - equipment		$10,150	$12,500	$5,525	$ 5,691	$ 5,861	$ 6,037	$ 6,218
PE4A and PE4B	$ 206,000	$0	$0	$0				
Capital projects - East area		$1,096,214	$1,409,101					
Capital projects - Central area		$190,296	$354,704					
Capital projects - West area		$59,476	$300,609					
PE3	$ 231,100							
PE5A	$ 84,300	$ -	$ -			$ 89,434		
PE5B	$ 106,600	$ -	$ -	$ -		$ 113,092		
PE5C	$ 177,700	$ -	$ -	$ -		$ 188,522		
PE6	$ 309,800	$ -	$ -	$ -				$ 348,683
PE10	$ 68,000	$ -	$ -	$ -				
PE11	$ 404,100	$ -	$ -	$ -	$ 416,223			
PE13	$ 147,000					$ 155,952		
DBE2	$ 1,343,200	$ -	$ -					
DBE6	$ 79,300	$ -	$ -	$ -				
OE1	$ 19,200	$ -	$ -	$ -				$ 21,610
PW6A	$ 424,000	$ -	$ -	$ 424,000				
PW6B	$ 751,250	$ -	$ -	$ 510,850	$ 247,612			
PW14	$ 78,700	$ -	$ -	$ -				
PW23	$ 1,250,400							
PW24	$ 196,700				$ 202,601			
DBW4	$ 565,200	$ -	$ -	$ -				
DBW7	$ 1,256,400	$ -	$ -	$ -			$ 988,490	$ 395,945
DBW9	$ 720,900	$ -	$ -	$ -				
DBW10	$ 383,800	$ -	$ -	$ -		$ 407,173		
DBW12	$ 111,300	$ -	$ -	$ -				
DBW13	$ 248,300	$ -	$ -	$ -				$ 279,464
OW1	$ 19,200	$ -	$ -	$ -				
OW4	$ 19,200	$ -	$ -	$ -				
OW5	$ 38,400	$ -	$ -	$ -	$ 39,552			
Master Plan Update	$ 81,500							
Transfer to/(from) Reserve Fund				$ 60,722	$ 787,508	$ 785,152	$ 795,729	$ 794,499
Total Capital Outlays		**$ 1,401,276**	**$2,133,664**	**$1,078,726**	**$ 1,779,145**	**$1,827,544**	**$1,875,084**	**$1,933,791**
Total Revenue Requirements		**$ 2,554,443**	**$3,457,088**	**$2,773,115**	**$3,537,464**	**$3,652,045**	**$3,768,006**	**$3,897,528**
LESS:								
Operations Non-Rate Revenue		$0	$0	$0	$0	$0	$0	$0
Expansion Non-Rate Revenue		$908,384	$695,000	$446,978	$438,008	$439,218	$438,424	$447,865
Net Revenue Requirements		**$ 1,646,059**	**$ 2,762,088**	**$ 2,326,137**	**$ 3,099,456**	**$ 3,212,827**	**$ 3,329,583**	**$ 3,449,663**

Table B-7
Layton City - Storm Drain Rate Study
Cost Allocation Percentages to Service Characteristics

Item	Volume	Customer	Total
O&M			
Regular employees	80%	20%	100%
Temporary employees	80%	20%	100%
Overtime and extra	80%	20%	100%
Employee benefits	80%	20%	100%
Allocation for building maintenance	80%	20%	100%
Allocation from engineering	80%	20%	100%
Books, subscriptions, memberships	80%	20%	100%
Public notices	80%	20%	100%
Travel	80%	20%	100%
Office supplies, maintenance	0%	100%	100%
Equipment supplies, maintenance	80%	20%	100%
Buildings/grounds, maintenance	100%	0%	100%
Utilities	80%	20%	100%
Communications	50%	50%	100%
Repair storm sewer lines	80%	20%	100%
Administrative allocations	0%	100%	100%
Allocation from engineering	80%	20%	100%
Professional and technical	80%	20%	100%
Training	80%	20%	100%
Allocation from engineering	80%	20%	100%
Insurance and leases	80%	20%	100%
Collection fees & bad debts	0%	100%	100%
Credit card fees	0%	100%	100%
Miscellaneous supplies	80%	20%	100%
Miscellaneous services	80%	20%	100%
Master plan	80%	20%	100%
Transfer for payment in lieu of property tax	80%	20%	100%
Franchise taxes	80%	20%	100%
Facility rents	80%	20%	100%
Allocation from engineering	80%	20%	100%

Table B-8
Layton City - Storm Drain Rate Study
Fixed Assets Allocations to Service Characteristics

		Percent			*Allocated Amount*		
Item	**Assets**	**Volume**	**Customer**	**Total**	**Volume**	**Customer**	**Total**
Main Lines	$3,126,368	100%	0%	100%	$3,126,368	$0	$3,126,368
Total	**$3,126,368**				**$3,126,368**	**$0**	**$3,126,368**
Percent					**100.0%**	**0.0%**	**100.0%**

Table B-9
Layton City - Storm Drain Rate Study
Allocation of O&M Costs to Service Characteristics

	FYE2014-15			FYE 2015-16			FYE 2016-17			FYE 2017-18			FYE 2018-19			FYE 2019-20		
Item	**Volume**	**Customer**	**Total**	**Volume**	**Customer**	**Total**	**Volume**	**Customer**	**Total**	**Volume**	**Customer**	**Total**	**Volume**	**Customer**	**Total**	**Volume**	**Customer**	**Total**
O&M																		
Regular employees	$152,058	$38,014	$190,072	$156,363	$39,091	$195,454	$162,336	$40,584	$202,920	$168,521	$42,130	$210,652	$174,917	$43,729	$218,646	$181,537	$45,384	$226,922
Temporary employees	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Overtime and extra	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Employee benefits	$80,181	$20,045	$100,226	$86,102	$21,525	$107,627	$89,391	$22,348	$111,738	$92,796	$23,199	$115,996	$96,318	$24,080	$120,398	$99,964	$24,991	$124,955
Allocation for building maintenance	$5,214	$1,304	$6,518	$3,888	$972	$4,860	$4,037	$1,009	$5,046	$4,190	$1,048	$5,238	$4,349	$1,087	$5,437	$4,514	$1,128	$5,642
Allocation from engineering	$198,602	$49,651	$248,253	$202,950	$50,737	$253,687	$210,702	$52,676	$263,378	$218,730	$54,683	$273,413	$227,031	$56,758	$283,789	$235,624	$58,906	$294,530
Books, subscriptions, memberships	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Public notices	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Travel	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Office supplies, maintenance	$0	$27,100	$27,100	$0	$27,100	$27,100	$0	$28,135	$28,135	$0	$29,207	$29,207	$0	$30,316	$30,316	$0	$31,463	$31,463
Equipment supplies, maintenance	$13,078	$3,269	$16,347	$13,078	$3,269	$16,347	$13,577	$3,394	$16,971	$14,094	$3,524	$17,618	$14,629	$3,657	$18,287	$15,183	$3,796	$18,979
Buildings/grounds, maintenance	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Utilities	$960	$240	$1,200	$1,290	$322	$1,612	$1,339	$335	$1,674	$1,390	$347	$1,737	$1,443	$361	$1,803	$1,497	$374	$1,872
Communications	$282	$282	$564	$382	$382	$764	$397	$397	$793	$412	$412	$823	$427	$427	$855	$444	$444	$887
Repair storm sewer lines	$189,756	$47,439	$237,195	$189,756	$47,439	$237,195	$197,005	$49,251	$246,256	$204,511	$51,128	$255,638	$212,272	$53,068	$265,340	$220,306	$55,077	$275,383
Administrative allocations	$0	$5,781	$5,781	$0	$8,815	$8,815	$0	$9,152	$9,152	$0	$9,500	$9,500	$0	$9,861	$9,861	$0	$10,234	$10,234
Allocation from engineering	$15,090	$3,773	$18,863	$15,530	$3,883	$19,413	$16,124	$4,031	$20,155	$16,738	$4,184	$20,922	$17,373	$4,343	$21,716	$18,031	$4,508	$22,538
Fleet and equipment expense	$0	$0	$0	$280,000	$70,000	$350,000	$290,696	$72,674	$363,370	$301,772	$75,443	$377,214	$313,224	$78,306	$391,530	$325,079	$81,270	$406,349
Training	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Allocation from engineering	$8,620	$2,155	$10,775	$8,620	$2,155	$10,775	$8,949	$2,237	$11,187	$9,290	$2,323	$11,613	$9,643	$2,411	$12,054	$10,008	$2,502	$12,510
Insurance and leases	$14,454	$3,614	$18,068	$13,114	$3,278	$16,392	$13,615	$3,404	$17,018	$14,133	$3,533	$17,667	$14,670	$3,667	$18,337	$15,225	$3,806	$19,031
Collection fees & bad debts	$0	$1,250	$1,250	$0	$1,250	$1,250	$0	$1,298	$1,298	$0	$1,347	$1,347	$0	$1,398	$1,398	$0	$1,451	$1,451
Credit card fees	$0	$4,000	$4,000	$0	$4,000	$4,000	$0	$4,153	$4,153	$0	$4,311	$4,311	$0	$4,475	$4,475	$0	$4,644	$4,644
Miscellaneous supplies	$14,000	$3,500	$17,500	$14,000	$3,500	$17,500	$14,535	$3,634	$18,169	$15,089	$3,772	$18,861	$15,661	$3,915	$19,576	$16,254	$4,063	$20,317
Miscellaneous services	$30,120	$7,530	$37,650	$30,120	$7,530	$37,650	$31,271	$7,818	$39,088	$32,462	$8,115	$40,577	$33,694	$8,423	$42,117	$34,969	$8,742	$43,712
Master plan	$21,703	$5,426	$27,129	$21,703	$5,426	$27,129	$22,532	$5,633	$28,165	$23,391	$5,848	$29,238	$24,278	$6,070	$30,348	$25,197	$6,299	$31,497
Transfer for payment in lieu of property tax	$77,006	$19,252	$96,258	$77,637	$19,409	$97,046	$79,966	$19,991	$99,957	$82,365	$20,591	$102,956	$84,836	$21,209	$106,045	$87,381	$21,845	$109,226
Franchise taxes	$106,121	$26,530	$132,651	$106,999	$26,750	$133,749	$111,087	$27,772	$138,858	$115,319	$28,830	$144,149	$119,695	$29,924	$149,619	$124,226	$31,056	$155,282
Facility rents	$100,719	$25,180	$125,899	$100,719	$25,180	$125,899	$104,567	$26,142	$130,708	$108,551	$27,138	$135,688	$112,670	$28,168	$140,838	$116,935	$29,234	$146,168
Allocation from engineering	$100	$25	$125	$100	$25	$125	$104	$26	$130	$108	$27	$135	$112	$28	$140	$116	$29	$145
Total	**$1,028,065**	**$295,359**	**$1,323,424**	**$1,322,350**	**$372,039**	**$1,694,389**	**$1,372,227**	**$386,092**	**$1,758,319**	**$1,423,861**	**$400,640**	**$1,824,501**	**$1,477,242**	**$415,680**	**$1,892,922**	**$1,532,490**	**$431,247**	**$1,963,737**
Percent	**77.7%**	**22.3%**	**100.0%**	**78.0%**	**22.0%**	**100.0%**	**78.0%**	**22.0%**	**100.0%**	**78.0%**	**22.0%**	**100.0%**	**78.0%**	**22.0%**	**100.0%**	**78.0%**	**22.0%**	**100.0%**

Table B-10
Layton City - Storm Drain Rate Study
Revenue Requirements by Service Characteristics

	FYE2014-15			FYE 2015-16			FYE 2016-17			FYE 2017-18			FYE 2018-19			FYE 2019-20		
Item	**Volume**	**Customer**	**Total**	**Volume**	**Customer**	**Total**	**Volume**	**Customer**	**Total**	**Volume**	**Customer**	**Total**	**Volume**	**Customer**	**Total**	**Volume**	**Customer**	**Total**
O&M	$1,028,065	$295,359	$1,323,424	$1,322,350	$372,039	$1,694,389	$1,372,227	$386,092	$1,758,319	$1,423,861	$400,640	$1,824,501	$1,477,242	$415,680	$1,892,922	$1,532,490	$431,247	$1,963,737
Debt Service	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0.00	$0.00	$0
Capital Outlays	$2,133,664	$0	$2,133,664	$1,078,726	$0	$1,078,726	$1,779,145	$0	$1,779,145	$1,827,544	$0	$1,827,544	$1,875,084	$0	$1,875,084	$1,933,791	$0	$1,933,791
Less: Operations Non-Rate Revenue	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Less: Expansion Non-Rate Revenue	$695,000	$0	$695,000	$446,978	$0	$446,978	$438,008	$0	$438,008	$439,218	$0	$439,218	$438,424	$0	$438,424	$447,864.99	$0.00	$447,865
Total	**$2,466,729**	**$295,359**	**$2,762,088**	**$1,954,098**	**$372,039**	**$2,326,137**	**$2,713,364**	**$386,092**	**$3,099,456**	**$2,812,187**	**$400,640**	**$3,212,827**	**$2,913,902**	**$415,680**	**$3,329,583**	**$3,018,416**	**$431,247**	**$3,449,663**

Table B-11
Layton City - Storm Drain Rate Study
Cost Allocations to Customer Classes

	FYE2014-15			FYE 2015-16			FYE 2016-17			FYE 2017-18			FYE 2018-19			FYE 2019-20		
	Volume	**Customer**	**Total**	**Volume**	**Customer**	**Total**	**Volume**	**Customer**	**Total**	**Volume**	**Customer**	**Total**	**Volume**	**Customer**	**Total**	**Volume**	**Customer**	**Total**
Residential	$1,040,547	$279,889	$1,320,437	$823,949	$352,540	$1,176,489	$1,144,261	$365,861	$1,510,122	$1,186,146	$379,653	$1,565,799	$1,229,230	$393,911	$1,623,141	$1,272,839.78	$408,648	$1,681,488
Commercial	$1,426,182	$15,469	$1,441,651	$1,130,148	$19,499	$1,149,648	$1,569,103	$20,231	$1,589,334	$1,626,041	$20,987	$1,647,028	$1,684,672	$21,770	$1,706,442	$1,745,576.03	$22,599	$1,768,175
Total	**$2,466,729**	**$295,359**	**$2,762,088**	**$1,954,098**	**$372,039**	**$2,326,137**	**$2,713,364**	**$386,092**	**$3,099,456**	**$2,812,187**	**$400,640**	**$3,212,827**	**$2,913,902**	**$415,680**	**$3,329,583**	**$3,018,416**	**$431,247**	**$3,449,663**
Allocation Basis	Imp. Area	Account		Imp. Area	Account		Imp. Area	Account		Imp. Area	Account		Imp. Area	Account		Imp. Area	Account	

Table Rates B-12
Layton City - Storm Drain Rate Study
Existing Rates and Projected Revenue

Base Rate (per impervious acre)	Existing	FYE 2015-16	FYE 2016-17	FYE 2017-18	FYE 2018-19	FYE 2019-20
Residential	$64.00	$ 64.00	$ 64.00	$ 64.00	$ 64.00	$ 64.00
Commercial	$64.00	$ 64.00	$ 64.00	$ 64.00	$ 64.00	$ 64.00

Type	FYE 2015-16	FYE 2016-17	FYE 2017-18	FYE 2018-19	FYE 2019-20	FYE 2020-21
Residential	$981,241	$997,627	$1,013,988	$1,030,415	$1,046,799	$1,063,233
Commercial	$1,344,896	$1,368,369	$1,390,462	$1,412,555	$1,434,648	$1,458,121

Volume Rate	Existing	FYE 2016-17	FYE 2017-18	FYE 2018-19	FYE 2019-20	FYE 2020-21
Residential	$ -	$ -	$ -	$ -	$ -	$ -
Commercial	$ -	$ -	$ -	$ -	$ -	$ -

	FYE 2015-16	FYE 2016-17	FYE 2017-18	FYE 2018-19	FYE 2019-20	FYE 2020-21
Residential	$ -	$ -	$ -	$ -	$ -	$ -
Commercial	$ -	$ -	$ -	$ -	$ -	$ -

Revenue - Existing Rates							Revenue	$2,326,137	$2,365,997	$2,404,451	$2,442,970	$2,481,446	$2,521,355
Revenue Required							Revenue Req	$2,326,137	$3,099,456	$3,212,827	$3,329,583	$3,449,663	$3,575,246
Surplus/(Shortfall)								$0	($733,459)	($808,376)	($886,612)	($968,217)	($1,053,891)

Table Rates B-13
Layton City - Storm Drain Rate Study
Calculated Monthly Rates

Base Rate ($/account)	FYE 2015-16	FYE 2016-17	FYE 2017-18	FYE 2018-19	FYE 2019-20
Residential	$1.67	$1.70	$1.74	$1.77	$1.81
Commercial	$1.67	$1.70	$1.74	$1.77	$1.81

Volume Rate ($/1000 SF)	FYE 2015-16	FYE 2016-17	FYE 2017-18	FYE 2018-19	FYE 2019-20
Volume Component					
Residential	$1.23	$1.69	$1.72	$1.75	$1.79
Commercial	$1.23	$1.68	$1.72	$1.75	$1.79

Table Rates B-14
Layton City - Storm Drain Rate Study
Recommended Rates

Utility Fees (per month)	FYE 2015-16	FYE 2016-17	FYE 2017-18	FYE 2018-19	FYE 2019-20
Residential (Per Account)	$4.60	$7.02	$7.17	$7.31	$7.45
Commercial (Per 1000 SF)	$64.00	$74.33	$75.81	$77.32	$78.88

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LAYTON CITY COUNCIL MEETING
AGENDA ITEM COVER SHEET

Item Number: 2.

Subject:
Presentation - New Layton City Website

Background:
Mr. Ed Frazier, IT Director and Mr. Chris Schwartz, Programmer for the City, will present the new website for the City to the Mayor and Council.

Alternatives:
N/A

Recommendation:
N/A

LAYTON CITY COUNCIL MEETING
AGENDA ITEM COVER SHEET

Item Number: 3.

Subject:
Discussion - Naming and Grand Opening of New Park - 3500 North Redtail Way

Background:
N/A

Alternatives:
N/A

Recommendation:
N/A

LAYTON CITY COUNCIL MEETING
AGENDA ITEM COVER SHEET

Item Number: 4.

Subject:
Mayor's Report

Background:
N/A

Alternatives:
N/A

Recommendation:
N/A