STORM DRAINAGE MASTER PLAN

(HAL Project No.: 089.22.100)

November 2015

HANSEN ALLEN & LUCE inc
ENGINEERS

THE CITY OF WEST JORDAN

STORM DRAINAGE MASTER PLAN

(HAL Project No.: 089.22.100)

PROFESSIONAL ENGINEER
Nov 9, 15
No. 165467-2202
GREGORY J.
POOLE
STATE OF UTAH

Gregory J. Poole, P.E.
Principal, Project Manager

HANSEN ALLEN & LUCE inc
ENGINEERS

November 2015

ACKNOWLEDGMENTS

Several individuals contributed to the successful completion of this study. We sincerely appreciate the cooperation, assistance, and expertise provided by members of the project team:

The City of West Jordan
Tim Heyrend – Utilities Engineer
David Murphy – Capital Projects Manager
Roger Payne – Engineering Manager for Utilities
Jared Millgate – Stormwater Supervisor

Hansen, Allen & Luce, Inc.
Gregory J. Poole
Gordon L. Jones
Joseph G. Hawkes
Celinda J. Jensen
Michael C. Price

ABBREVIATIONS AND UNITS

ac	acre
ac-ft	acre-foot
cfs	cubic foot per second (ft^3/s)
CIP	Capital Improvement Plan
CMP	corrugated metal pipe
E	east
EPA	US Environmental Protection Agency
FF	Farmer–Fletcher (1971) storm distribution
ft	foot
GBEA	Great Basin Experimental Area
GIS	geographic information system
HAL	Hansen, Allen & Luce, Inc.
HEC	Hydrologic Engineering Center (U.S. Army Corps of Engineers)
HMS	Hydrologic Modeling System
ID	identification
in.	inch
irr	irrigation
mi	mile
N	north
NOAA	National Oceanic and Atmospheric Administration
NRCS	National Resources Conservation Service (formerly SCS)
RR	railroad
s	second
S	south
SCS	Soil Conservation Service (now NRCS)
SWMM	Storm Water Management Model
TR-55	Technical Release 55 (NRCS 1986)
USGS	U.S. Geological Survey
W	west
w/	with
w/o	without
xing	crossing
yr	year

TABLE OF CONTENTS

ACKNOWLEDGMENTS ..... **i**
ABBREVIATIONS AND UNITS ..... **ii**
TABLE OF CONTENTS ..... **iii**
LIST OF TABLES iv
LIST OF FIGURES iv

CHAPTER 1 – INTRODUCTION **1-1**
PURPOSE 1-1
BACKGROUND 1-1
AUTHORIZATION 1-1
STUDY AREAS 1-1

CHAPTER 2 – EXISTING STORM DRAINAGE SYSTEM **2-1**
NATURAL DRAINAGES 2-1
Jordan River 2-1
Barney's Creek 2-1
Barney's Wash 2-1
Dry Wash 2-1
Clay Hollow 2-1
Unnamed Wash 1 2-2
Unnamed Wash 2 2-2
Bingham Creek 2-2
IRRIGATION CONVEYANCES 2-2
Welby Jacob Canal 2-2
Utah Lake Distributing Canal 2-2
Utah Salt Lake Canal 2-3
South Jordan Canal 2-3
North Jordan Canal 2-3
FLOWS OUTSIDE OF WEST JORDAN 2-3
STORM DRAINAGE FACILITIES 2-3
Collection and Conveyance 2-4
Detention 2-4

CHAPTER 3 – METHODOLOGY **3-1**
HYDROLOGY 3-1
Design Frequencies 3-1
Design Storms 3-1
DEVELOPMENT OF THE HYDROLOGIC MODELS 3-2
Subbasin Area 3-3
Hydrologic Soil Group 3-4
Land Use 3-4
Impervious Area 3-5
SCS Curve Number 3-5
Subbasin Width 3-5
Links 3-6
DESIGN FLOW RATES 3-7
CAPACITY ANALYSIS 3-7

CHAPTER 4 – STORM DRAINAGE ANALYSIS **4-1**

DEFICIENCIES 4-1

CHAPTER 5 – CAPITAL IMPROVEMENT PLAN 5-1
PREFERRED DRAINAGE PLAN DEVELOPMENT 5-1
PRECISION OF COST ESTIMATES 5-1
ESTIMATED CONSTRUCTION COSTS 5-2
CAPITAL IMPROVEMENT PLAN 5-2
SUMMARY OF CAPITAL IMPROVEMENTS 5-14
OPERATIONAL RECOMMENDATIONS 5-14
Flow Outside of West Jordan 5-14
Minimum Pipe Diameter 5-14
Inventory 5-14
Irrigation and Storm Drain Conveyances 5-15
Watch and Maintenance Recommendations 5-15
Storm Drainage Master Plan Updates 5-15

REFERENCES R-1

APPENDIX A - System Data
APPENDIX B - Capital Projects List
APPENDIX C - Cost Data

LIST OF TABLES

Table 2-1 Additional Flows 2-3
Table 3-1 Modeled Rainfall Depths 3-2
Table 3-2 Land Uses in West Jordan 3-4
Table 3-3 Land Use Characteristics 3-6
Table 4-1 Storm Drainage Deficiencies 4-1
Table 5-1 Capital Improvement Plan 5-3
Table 5-2 Capital Improvement Plan Summary 5-14

LIST OF FIGURES

Figure 1-1 Study Area and Major Basins ..... After 1-1
Figure 2-1 Existing Storm Drainage System ..... After 2-1
Figure 2-2 Detailed Existing Storm Drainage System Northwest Quadrant ..... After 2-4
Figure 2-3 Detailed Existing Storm Drainage System Northeast Quadrant ..... After 2-4
Figure 2-4 Detailed Existing Storm Drainage System Southwest Quadrant ..... After 2-4
Figure 2-5 Detailed Existing Storm Drainage System Southeast Quadrant ..... After 2-4
Figure 2-6 Northwest Quadrant Modeled Detention Basins ..... After 2-4
Figure 2-7 Northeast Quadrant Modeled Detention Basins ..... After 2-4
Figure 2-8 Southwest Quadrant Modeled Detention Basins ..... After 2-4
Figure 2-9 Southeast Quadrant Modeled Detention Basins ..... After 2-4
Figure 3-1 Farmer Fletcher 2nd Quartile Dimensionless Distribution 3-2
Figure 3-2 Natural Resources Conservation Service Soil Data ..... After 3-4
Figure 3-3 Urban Storm Drainage Design Criteria ..... After 3-7
Figure 3-4 Model 10 Year Storm Maximum Flow Results Northwest Quadrant ..... After 3-7
Figure 3-5 Model 10 Year Storm Maximum Flow Results Northeast Quadrant ..... After 3-7
Figure 3-6 Model 10 Year Storm Maximum Flow Results Southwest Quadrant ..... After 3-7
Figure 3-7 Model 10 Year Storm Maximum Flow Results Southeast Quadrant ..... After 3-7
Figure 4-1 Storm Drainage Deficiencies ..... After 4-4
Figure 5-1 Storm Drainage Capital Improvement Projects ..... After 5-13

CHAPTER 1 – INTRODUCTION

PURPOSE

This Storm Drainage Master Plan (Master Plan) for the City of West Jordan (City) presents technical activities to manage and regulate stormwater runoff caused by development and to help mitigate flooding and environmental impacts. The Master Plan will educate developers, private property owners, City staff, and elected officials regarding the capability and needs of the City's stormwater system. The Master Plan examines the existing storm drainage system. Existing deficiencies are identified and the preferred solution alternatives are presented with conceptual cost estimates. A Capital Improvement Plan (CIP) is developed with master plan projects.

Computer models were developed as part of the Master Plan to simulate runoff during storm events in the City. Not only were the models vital tools in analyzing the stormwater situation for the master plan, but they will allow the City to continue to update and analyze for potential drainage deficiencies and facilitate conceptual design of future projects.

BACKGROUND

Located along the Wasatch Front in central Salt Lake County, Utah, the City of West Jordan extends from the Jordan River to the Oquirrh Mountains and from 6600 South to 9400 South. The terrain has a vertical relief of approximately 1,300 ft from the foothills to the West to the Jordan River on the East. Soil types range from permeable desert sands to fine lacustrine silts and clays. Land use varies from dense urban developments to undeveloped farmland and foothills. The City was incorporated in 1941 and continues to experience growth and development to the West. In an ongoing effort dealing with growth and redevelopment, the City desires to plan an effective drainage system to manage nuisance water, prevent flooding, and protect downstream waters from adverse quality and quantity impacts.

AUTHORIZATION

The City of West Jordan selected Hansen, Allen & Luce to prepare the Master Plan. The Master Plan has been completed in accordance with the agreement between the City of West Jordan and HAL dated July 28, 2014. The Master Plan was completed under the direction of and in cooperation with City staff.

STUDY AREAS

The study area for the Master Plan includes the incorporated area of West Jordan, flows from West Valley City, Taylorsville, South Jordan, and unincorporated areas of Salt Lake County. Approximately 17,700 acres directly tributary to the City's storm drainage system are hydrologically modeled to determine the runoff. Areas outside of the City boundaries are introduced into the storm drainage system as hydrographs based on hydrologic studies for their respective areas.

The City of West Jordan requested that a Capital Improvement Plan for the area north of 7800 South (north area) be completed first to expedite project designs for specific problem areas along 7000 South. Areas south of 7800 South (including storm drains in 7800 South) were analyzed after the CIP for the north area was completed. The study area and major drainage boundaries are shown on Figure 1-1.

CHAPTER 2 – EXISTING STORM DRAINAGE SYSTEM

This section discusses the features that make up the storm drainage facilities in West Jordan. Figure 2-1 shows the existing storm drainage system including natural drainages and major irrigation facilities.

NATURAL DRAINAGES

The City of West Jordan incorporates several natural drainages in the storm drain system. Natural drainages in the City generally flow from west to east or from south to north. The natural drainages serve as outlets for the City's storm drainage system, but in some locations the natural drainages contribute flow to the City's storm drainage system.

Jordan River

The Jordan River is the largest natural drainage in Salt Lake County and is the final outlet for all storm runoff from the City. The Jordan River runs from south to north on the far east side of the City.

Barney's Creek

Barney's Creek originates in the Oquirrh Mountains and terminates at the Airport Detention Basin near 7800 South and Jordan Landing Boulevard where the flows enter the City's storm drainage system. Barney's Creek receives flow from the Unnamed Wash 2, Unnamed Wash 1, Clay Hollow, Barney's Wash, and Dry Wash. After flows from Barney's Creek discharge into the Airport Detention Basin, they are conveyed to the Jordan River in a storm drainage trunk line in 7800 South.

Barney's Wash

Barney's Wash originates in the lower Oquirrh Mountains and flows northeast where it enters the City's storm drain system at approximately 5600 West and New Bingham Highway. Flows from Barney's Wash converge with Barney's Creek near Airport Road and New Bingham Highway.

Dry Wash

Dry Wash is a small drainage that originates in the foothills of the Oquirrh Mountains in the northwest corner of the City. Dry Wash enters the City's storm drain system near 5600 West 7600 South at a newly constructed detention basin. The Dry Wash flows are then conveyed through the storm drain system to Barney's Creek and the Airport Detention Basin.

Clay Hollow

Clay Hollow originates in the Oquirrh Mountains and terminates at a confluence with Barney's Creek. Clay Hollow flows into a detention basin at 8200 South and 5800 West with Barney's Creek, but continues on separately from Barney's Creek as an overflow channel.

Unnamed Wash 1

Unnamed Wash 1 is defined for the purposes of this master plan to be the drainage south of Clay Hollow and north of Unnamed Wash 2 terminating at Barney's Creek upstream from the detention basin at 5800 West and 8200 South.

Unnamed Wash 2

Unnamed Wash 2 is defined for the purposes of this master plan to be the drainage south of Unnamed Wash 1 and north of Barney's Creek, terminating at Barney's Creek just east of Highway 111.

Bingham Creek

Bingham Creek originates high in the Oquirrh Mountains and flows east through the Kennecott Copper Pit, South Jordan, and West Jordan where it terminates at the Jordan River. In order to control the water quality of the creek downstream of the copper mine, Rio Tinto Kennecott retains all flows leaving the copper pit in several large retention ponds. Consequently, only areas downstream of the retention ponds contribute to flows entering West Jordan in Bingham Creek. Although Bingham Creek is conveyed in several locations through box culverts and pipes, it generally retains the same alignment as the original drainage and is an open channel.

IRRIGATION CONVEYANCES

Irrigation canals, ditches, and diversion structures are common in West Jordan. In older parts of the City, irrigation ditches and pipes also act as storm drain conveyances during storm events. Several of the irrigation canals also act as outlets for parts of the storm drain system. Many of the canals have overflow structures where the canals cross large storm drain lines. The overflow structures remove flows from the canals to compensate for storm drain discharge to the canals upstream of the structures. This protects the structural integrity of the canals by helping to protect against canal overflows.

Irrigation ditches are not ideal conveyances for stormwater because they are designed to distribute irrigation water rather than collect stormwater. Ditch capacities decrease from upstream to downstream, while runoff flows increase from upstream to downstream. Water quality, debris, sediment, liability, and canal maintenance are problems associated with use of the ditches to convey stormwater.

Welby Jacob Canal

The Welby Jacob Canal enters the south side of West Jordan at 4000 West. The canal has an overflow structure where it crosses the trunk storm drain in 9000 South. The canal terminates into the City's storm drain system at 8480 South.

Utah Lake Distributing Canal

The Utah Lake Distributing Canal enters West Jordan's southern boundary at approximately 3200 West and leaves the City at 6200 South and 3800 West. The canal delivers irrigation water to lands south of 7400 South. The canal north of this point is used to detain runoff until it is reintroduced into the storm drainage system near 7000 South. The canal has overflow structures into Bingham Creek and into the trunk storm drain in 7800 South.

Utah Salt Lake Canal

The Utah Salt Lake Canal enters West Jordan near Tanya Avenue at approximately 9350 South and leaves the City near Handcart Park at 2700 West and 6600 South. The canal has overflow structures into Bingham Creek and into storm drains in 7800 South. The Utah Salt Lake Canal has several storm drains that outfall to the canal, as well as several irrigation turnouts from the canal.

South Jordan Canal

The South Jordan Canal enters West Jordan near Redwood Road and 9400 South and leaves the City near Redwood Road and Cole Lane. The canal has overflow structures into Bingham Creek and into storm drains in 7800 South. The South Jordan Canal has several storm drains that outfall to the canal, as well as several irrigation turnouts from the canal.

North Jordan Canal

The North Jordan Canal originates near the southeast corner of West Jordan and parallels the Jordan River until it leaves the City near Bateman Point Drive and 6800 South. The Canal has overflow structures near 8750 South, near 8500 South, and into the storm drain in 7800 South.

FLOWS OUTSIDE OF WEST JORDAN

There are several locations where flow from entities bordering West Jordan enters the West Jordan storm drain system. Table 2-1 shows the locations where significant inflows into the West Jordan storm drain system were modeled.

Table 2-1
Additional Flows

Location*	Pipe Diameter	Originating Entity	10-Year Peak Flow
6305 S and 3980 W	48 inch	Taylorsville City	140 cfs
6200 S and Cougar Ln	36 inch	Salt Lake County (Kearns)	11 cfs
6200 S and 5600 W	36 inch	Salt Lake County (Kearns)	95 cfs
Basin at Cedar Hill Rd and Empress Ln	6 inch orifice	Salt Lake County	1.3 cfs
Angus Dr and Westland Dr	18 inch	South Jordan City	4.2 cfs

*The location refers to the point where inflow was added to the model as an external inflow.

Additional flow rates were determined from the Copper City Master Storm Drain Plan (Bush and Gudgell, Inc., 1979) and were input as external flow hydrographs. If flow rate data was unavailable, the incoming pipe was modeled with full flow to simulate an assumed peak flow condition.

STORM DRAINAGE FACILITIES

As part of this Master Plan, efforts were made to complete an inventory of the storm drainage facilities in West Jordan. The City had compiled inventory data prior to July 28, 2014 (original inventory), and identified manholes and inlets in the original inventory that needed to be surveyed. Hansen, Allen, and Luce, completed a select inventory survey of over 1,700 manholes and inlets identified by the City in order to provide data for new developments and obtain elevation data on manholes missing elevations. The storm drain inventory was updated

with a GIS inventory from the City and direction from the Stormwater Supervisor. Additional surveying was performed by the City on some of the storm drainage facilities.

Some pipe diameters and invert elevations were not able to be determined by City Staff due to facility accessibility, so simplifying assumptions were made to create the model. Junctions and links with estimated values are identified in the GIS inventory. Although the inventory provided in this master plan is mostly complete, efforts should be made to continue to update and correct the inventory with surveyed values.

Collection and Conveyance

The City of West Jordan has over 200 miles of storm drain pipes with a wide range of sizes. The City has an estimated 5140 inlets that introduce runoff into the storm drains. The storm drain system also relies on natural drainages, roadside swales, and irrigation conveyances to convey runoff to the Jordan River.

Data collected by HAL in the select inventory survey consisted of point locations, point descriptions, point elevations, measure down depths at each point, conveyance location, conveyance shape, and conveyance size. The select inventory information was used to update the conveyance elements in the GIS database. The collection and conveyance system with associated pipe diameters can be seen on Figures 2-2 through 2-5.

A combo box is a feature that acts as a manhole and a curb inlet. The original inventory treated combo boxes as two separate nodes with a connecting link. However, combo boxes are a single feature and do not contain a pipe between the inlet grate and the manhole lid. In the updated inventory combo boxes are treated as a single feature in order to reduce the inventory size and better model hydraulics through the system.

Detention

The City maintains several detention facilities. Stage storage curves for the detention basins were estimated using the 2013-2014 0.5 meter LiDAR data (AGRC, 2014). In the northern half of the City 32 detention basins are modeled while 101 detention basins are modeled in the southern half of the City. Some detention basins were not modeled because basin attributes could not be determined from available information. If the detention basin attributes could not be determined, runoff from the area was modeled to be detained to approximately 0.2 cfs per acre. Also, some detention basins did not have information about the orifice size. The modeled detention basins can be seen on Figures 2-6 through 2-9. The detention basins on Figures 2-6 through 2-9 are colored based on the entity that owns or manages the basin. City Owned Detention basins are owned and managed by West Jordan City, Other Entity's Detention basins are owned or managed by nearby Cities or Salt Lake County, Private Detention basins are installed by private developers, and the ownership status of the Unknown Detention basins could not be readily determined from the provided GIS data. More information on the detention basins is available in Appendix A.

CHAPTER 3 – METHODOLOGY

The project team adopted a workshop approach with City staff to determine the design criteria, study areas, analysis processes, deficiencies, alternatives, and solutions. This section describes the methodology followed in developing the Master Plan.

HYDROLOGY

Design Frequencies

The City selected design storm frequencies of 10-year (10% chance of being equaled or exceed in any given year) and 100-year (1% chance of being equaled or exceeded in any given year) for this study. Criteria included:

- 10-year design capacity for the initial drainage system. The initial drainage system includes storm drains, gutters, and roadside ditches.
- 100-year capacity where flooding of homes may occur.
- 100-year capacity on major detention/retention limited to storm drain hydraulic capacities.

Design Storms

Storm distributions used in this Plan were derived from the Farmer–Fletcher (FF) distribution for 1, 3, and 6 hr storms and the Great Basin Experimental Area (GBEA) distribution for 12 and 24 hr storms.

Thirteen separate gauging stations in the Great Basin Experimental Area, ranging in elevation from 5,500 ft to over 10,000 ft, were maintained for varying periods of time from 1919 to 1965. Fifteen gauging stations were maintained in the Davis County Experimental Watershed (ranging in elevation from 4,350 ft to 9,000 ft) for varying periods of time between 1939 and 1968. After analyzing the data, Farmer and Fletcher (1971) found that “more than 50 percent of the storm rainfall depth occurs in 25 percent of the storm periods” and that “usually more than half of the total depth of rain is delivered as burst rainfall.” Farmer and Fletcher developed design storm distributions which have been accepted by governmental entities including Salt Lake County and Davis County as the characteristic distributions for storms in Utah of short duration (generally 6 hr or less).

The work of Farmer and Fletcher was expanded in 1985 to develop a longer-duration rainfall distribution from the GBEA data. For the derivation of the design 24 hr rainfall event, a storm was defined “as a period of continuous or intermittent precipitation delivering at least 0.1 inches of rainfall during which time dry periods without rainfall did not exceed four hours.” Storms having durations between 20 and 28 hr were accepted to be representative of a 24 hr storm duration. The 24 hr storms were screened to include only storms which contained rainfall meeting the burst criteria of having over 50% of the precipitation occurring in less than 25% of the time. Storms meeting the burst criteria were further categorized in accordance with which quartile of the storm the burst had occurred (i.e. the first, second, third, or fourth quarter of the storm period). Identified storms were used to develop a 24 hr design storm distribution for use in Utah. A sensitivity analysis for all storm distributions developed shows the 3rd quartile storm distribution to produce the higher runoff peaks. The GBEA 3rd quartile storm distribution includes a burst of rainfall with an approximate 10% of the 24 hr total falling within a 30 min period. In a

similar comparison, the SCS Type II distribution allows approximately 62% of the total precipitation to occur within the same period. Because the distribution was based on local data, the GBEA distribution is believed to be the best available storm distribution for Utah storms lasting between 6 and 24 hr. The Farmer Fletcher 2nd Quartile distribution can be seen on Figure 3-1.

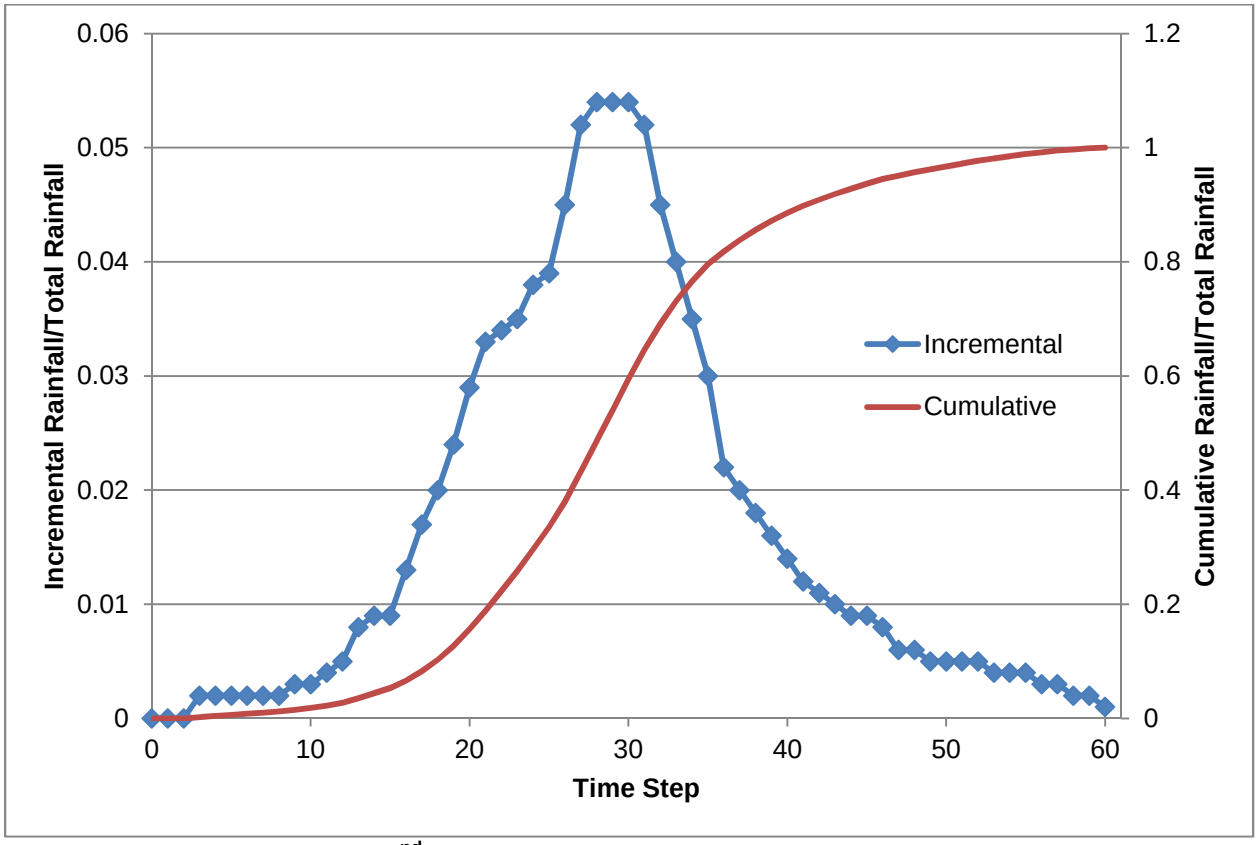

Figure 3-1 Farmer Fletcher 2nd Quartile Dimensionless Distribution

Precipitation depths were obtained from *NOAA Atlas 14: Precipitation-Frequency Atlas of the United States* (Bonnin et al. 2004; NOAA 2013).

The design storm rainfall depths modeled for this Master Plan are seen in Table 3-1.

Table 3-1
Modeled Rainfall Depths

Storm Frequency	1 hr	3 hr	6 hr	12 hr	24 hr
10-yr Rainfall Amount (in)*	0.86	1.06	1.28	1.57	1.76
100-yr Rainfall Amount (in)*	1.70	1.88	2.02	2.38	2.50

*All rainfall amounts are from NOAA Atlas 14.

DEVELOPMENT OF THE HYDROLOGIC MODELS

As part of the Master Plan, HAL developed a computer model for each study area to simulate runoff during storm events. The City requested that Innovyze's InfoSWMM software be used to model the storm drainage system. InfoSWMM is a "dynamic, geospatial wastewater and

stormwater modeling and management software application" (Innovyze, 2014). InfoSWMM utilizes the EPA's SWMM model for hydrologic and hydraulic modeling and combines that with an ArcMap interface where geographic information systems (GIS) can be used for mapping and schematic purposes.

A drainage basin, also called a subbasin, watershed or catchment, is an area in which all rainfall or snowmelt runoff will collect to a common point (the lowest point in the basin). Drainage basin boundaries depend upon both the topography and the location of storm drainage facilities. Subbasin characteristics developed for this plan were based on field observation, aerial imagery, soil data, GIS mapping, land use information from the City, and engineering literature. Important subbasin characteristics described below include 1) area, 2) hydrologic soil group, 3) percentage of impervious area, 4) SCS curve number, 5) Subbasin width, and 6) overland flow characteristics. Much of the methodology is documented in *Technical Release 55: Urban Hydrology for Small Watersheds* (NRCS, 1986), hereafter referred to as TR-55.

Subbasin Area

The amount of runoff is proportional to the area of the subbasin. Subbasin boundaries depend upon both topography and location of storm drainage facilities. The City's original intent with the master plan was to provide a subbasin for each inlet in the City using the InfoSWMM software. Subbasins were delineated for a small trial area using InfoSWMM's Subcatchment Manager Watershed delineation tool to determine if autodelineation was a feasible method for efficiently delineating subbasins. The Subcatchment Manager uses ArcMap's spatial analyst tools to automatically generate subbasin boundaries based on a digital elevation model (DEM).

ArcMap's spatial analyst uses the digital elevation model as a grid to determine which direction runoff from a single grid will flow. The unit runoff from each grid is accumulated as it is routed through the DEM. Low spots in the DEM, referred to as sinks, are automatically filled to the lowest surrounding elevation in order to route the unit runoff through the entire DEM. Filling the sinks is necessary in order to prevent the delineation of many irrelevant subbasins for every sink. The accumulation of unit runoff is used to determine which grids are tributary to a single point, thus creating a subbasin. It is important to note that the step of filling sinks in the DEM can create flow paths that may differ from the original topography.

The autodelineated basins for the trial area were discussed in a review meeting with the City early in the master plan process. Even though many of the subbasin delineations produced by the InfoSWMM process contained inaccuracies due to filling sinks in the DEM, the City determined that the delineations were sufficiently precise for master plan purposes. The InfoSWMM delineated subbasins were manually edited in some select areas, but due to the number of autodelineated subbasins, the boundaries of each subbasin could not be manually verified. Therefore, inaccuracies in some of the subbasin boundaries are expected and should be reviewed and refined in future modeling efforts. The average subbasin size for the 9,223 automatically delineated subbasins in the City is approximately 3 acres.

The 2013-2014 0.5 meter LiDAR data from the Utah Automated Geographic Reference Center (AGRC, 2014) was used to automatically delineate the subbasins. The DEM was acquired between the fall of 2013 and spring of 2014. The DEM has elevation data for each 0.5 meter by 0.5 meter grid. To test the accuracy of the DEM, ten random points from the AGRC DEM were compared with the Hansen, Allen, and Luce inventory survey. The standard deviation of the difference between the two data sets is 2.4 inches.

Hydrologic Soil Group

Hydrologic soil group is a general indication of a soil's infiltration capacity and is a key determinant of runoff behavior. The Natural Resources Conservation Service (NRCS) has classified soils into four hydrologic groups A, B, C, and D. Soils of group A have the highest infiltration rate and therefore produce the least amount of runoff. Group A soils include permeable gravels and well-drained sands. Group B soils have moderate infiltration rates and moderately fine or coarse textures. Group C soils have a lower infiltration rate and finer textures, sometimes with a layer that impedes infiltration. Nonnative topsoil used for landscaping is typically considered group C. Developed portions of each study area were assumed to have a minimum of nonnative group C soils. Soils of group D have the lowest infiltration rate and produce the highest amount of runoff. Group D soils include fine silts, fine, clays, and other soils with low infiltration rates. Soil groups are described in TR-55 (NRCS, 1986).

Although all four soil groups are found in the City, Group D soils are the most prevalent in the City. Soil data for this study originated from the NRCS Web Soil Survey (NRCS 2013). A soil map of the City is shown in Figure 3-2. The hydrologic soil group is a factor used to determine the curve number for each subbasin.

Land Use

A GIS shapefile showing the designated land uses for the City was provided by West Jordan. The land use shapefile was used to determine the attributes of the subbasins based on the land use type. Table 3-2 shows the various land uses provided by West Jordan with a description.

Table 3-2
Land Uses in West Jordan

Land Use Type	Description
Agricultural Open Space	Open crop fields, pasture, some outbuildings
Airport	Airport, buildings, open areas, runways
Community Commercial	General commercial, parking lots, buildings, some vacant lots
Neighborhood Commercial	Gas stations, light commercial, some open space
Professional Office	Office developments, buildings, parking lots, vacant lots
Regional Commercial	Big box stores, strip malls, some undeveloped lots
Transit Oriented Development	High density residential/commercial
Light Industrial	Vacant lots, parking lots, large buildings
Future Park	Undeveloped open space, future parks
Mixed Use	Undeveloped open space, some buildings
Parks and Open Land	Parks, canals, groomed open space
Public Facilities	Schools, water tanks, athletic fields
Research Park	Industrial buildings, vacant and undeveloped lots
High Density Residential	Small single family residential (generally <0.25 ac)
Low Density Residential	Single family residential (>0.25 ac), open space
Medium Density Residential	Single family residential (approximately 0.25 ac), open space
Very High Density Residential	Large apartment or condo developments
Very Low Density Residential	Residential lots >1 ac (up to 10 ac), crop fields and pasture

Impervious Area

Impervious areas within each subbasin were estimated using the type of land uses within each subbasin. There are two types of impervious area: directly connected impervious areas and unconnected impervious areas. Directly connected impervious areas provide a direct path for runoff to a conveyance such as a pipe, gutter, or channel. Directly connected impervious areas often include roadways, parking lots, driveways, and roofs. Runoff from unconnected impervious areas must cross a pervious area before reaching the drainage node for the subbasin. Examples of unconnected impervious areas include sidewalks that are not adjacent to the curb, patios, sheds, and usually some portion of house roofs.

It is important to distinguish between directly connected and unconnected impervious areas. Runoff from the directly connected impervious areas reaches the drainage conveyance system quickly and usually determines the magnitude of the peak flow rate. Impervious areas such as backyard patios which drain to grassed or landscaped areas have much less impact on peak runoff.

Unconnected impervious area for residential land use is included in the pervious area with a composite curve number based on an area-weighted average. Impervious percentages for non-residential land use areas were estimated from TR-55. The directly connected impervious area is included explicitly in the subbasin characteristics as a percentage. See Table 3-3 for the criteria for the impervious percentage assigned to each land use.

SCS Curve Number

Each subbasin was assigned an SCS curve number based on hydrologic soil group, land use, and ground cover type as outlined in Chapter 2 of TR-55 (NRCS, 1986). The curve number describes the relationship between precipitation and runoff for the pervious and unconnected impervious portions of the subbasin. Curve numbers range from 0 to 100. Areas that are more pervious have lower curve numbers. For example, a well vegetated subbasin with sandy soils and little unconnected impervious area would have a lower curve number than a poorly vegetated subbasin with clay soils and a significant amount of unconnected impervious area. The vegetation condition and unconnected impervious area were determined based on the land use. See Table 3-3 for the criteria for the curve number assignment.

Subbasin Width

The subbasin width is calculated using the subbasin area and the longest overland flow length within the subbasin. The longest overland flow length is the longest distance runoff would travel before becoming channelized in a natural drainage or curb and gutter. In residential areas this is usually defined as the distance from the back of a lot to the curb and gutter. In non-urban areas the maximum suggested overland flow length is 500 feet (Rossman, 2010). For subbasins with various land use types, an areal composite overland flow length is generated. The width is defined as the area of the subbasin divided by the composite overland flow length. See Table 3-3 for the assumed overland flow lengths for each land use type.

Table 3-3 shows the criteria for the characteristics of the land use types.

Table 3-3
Land Use Characteristics

Simplified Land Use Type	Overland Flow Length (ft)	Directly Connected Impervious Area	Curve Number by Soil Type			
			A*	B*	C	D
Agricultural Open Space	200	0%	49	69	79	84
Airport	200	30%	36	61	74	80
Commercial	50	85%	94	94	94	95
Light Industrial	50	72%	81	88	91	93
Open Space	300	0%	49	69	79	84
Parks and Open Land	300	0%	74	74	74	80
Public Facilities	50	50%	74	74	74	80
Research Park	50	50%	39	61	74	80
Residential High Density	100	41%	86	86	86	89
Residential Low Density	140	30%	81	81	81	85
Residential Medium Density	120	36%	84	84	84	88
Residential Very High Density	90	65%	90	90	90	92
Residential Very Low Density	200	17%	76	76	76	81

*Landuse areas with imported topsoil use a minimum curve number of the C type soil.

Links

Conveyances (called links in SWMM and InfoSWMM) convey runoff between the junctions in the model. Typical conveyances include pipes, box culverts, ditches, canals, natural channels, outlet pipes, orifice plates, weirs, pumps, and in some cases gutters. Conveyance characteristics for each model were defined using City input, aerial imagery, 1 ft contours, and data from the system inventory which identified conveyances. This information is used in the model to perform the hydraulic analysis for timing and routing of storm runoff hydrographs.
Some uncertainty is associated with modeled drainage paths. In the eastern part of the City stormwater conveyances frequently coincide with irrigation pipes and ditches. Flow paths in irrigation conveyances can be altered by gates and diversions, complicating the modeling of flow paths.

Unlike HEC-HMS, SWMM and InfoSWMM will limit flow through conduits based on the conduit's capacity. For example, if a subbasin has a peak flow of 10 cfs while the conduit only has a capacity of 6 cfs, flooding would occur at the upstream node and the conduit would be limited to its peak capacity under surcharged conditions. The upstream node would experience flooding near 4 cfs. This is helpful when analyzing how the system actually functions, but can hinder efforts to determine the potential peak flows at a point. During the design process conveyances can be modified with a group edit to drastically increase the size of the conduits so that the peak flows are not restricted and specific points in the system experience the maximum possible flows during a precipitation event. This method was used for select master plan projects in order to better represent the potential flow from upstream runoff.

Nodes

In the model, nodes are points where conveyances or subbasins connect. Nodes generally represent manholes, inlets, outfalls, dividers, detention basins, or points where multiple conveyances combine. Nodes contain elevation data which determines the elevation of attached conveyances. Nodes also have depth data to determine if the point is experiencing flooding due to surcharging conditions.

Flooding at nodes can be handled in several ways. If the surface ponding option is used, the volume of water at a node above the maximum depth is stored at the node and released back into the system once surcharging conditions recede. If the surface ponding option is not used, any flooding is lost from the system. In order to conservatively estimate the volume of water entering storage nodes, the surface ponding option was used in this Master Plan.

DESIGN FLOW RATES

The model computes hydrographs for each subbasin, conveyance, and junction. The City storm drainage system was analyzed with the 10-year 1, 3, 6, 12, and 24 hour precipitation events. Select areas requiring the piping network to convey 100-year precipitation events were modeled accordingly. Generally, the 10-year 1 hour storm is the controlling design storm for the majority of the features of the storm drainage system. For large detention basins and their associated features, the 24 hr storm event is often the controlling storm event.

Because of the way the model handles flooding at nodes, 100-year storms are only modeled for features expected to carry 100-year storm flows. Most storm drain systems anticipate surcharging during 100-year storm events and rely on gutter and surface flow to convey excess runoff to the outlet.

A schematic of the urban storm drainage criteria is shown on Figure 3-3.

CAPACITY ANALYSIS

The SWMM and InfoSWMM model has the ability to determine the water depth, flow rate, and capacity of conveyances during the precipitation event. This detailed analysis includes calculating surcharged conditions and backwater effects if the Dynamic Wave routing method is selected. This capability makes the SWMM engine a very useful tool in analyzing the hydraulic capability of a storm drainage system. Figures 3-4 through 3-7 show the maximum flow in the modeled conduits for the 10 year frequency storms (maximum flow as compared between the 1 hour, 3 hour, 6 hour, 12 hour, and 24 hour storms).

CHAPTER 4 – STORM DRAINAGE ANALYSIS

The West Jordan Storm Drain System was analyzed using the model, observations from City staff and best management practices for the industry.

DEFICIENCIES

Deficiencies were identified based on input from City staff and on results from the model. Locations where the City had experienced flooding were analyzed in the model to determine the cause of the flooding. For example, a cul-de-sac that frequently floods could have issues with inlet capacity, pipe capacity, backwater effects, runoff from areas not directly tributary to the cul-de-sac, or the curb and gutter configuration.

Generally storm drain systems are designed to carry the peak 10-year runoff event, with the 100-year runoff event being conveyed in the storm drain and in the roadway. It was determined that for the existing West Jordan Storm Drainage system, full pipe flow is acceptable with minor surcharging being contained in the curb and gutter system.

Table 4-1 and Figure 4-1 summarize the drainage deficiencies identified in this study. Each deficiency has a Problem ID (used in this study), a location description, and problem definition.

Not all deficiencies necessitate capital improvements. Because storm drain systems are designed to convey the 10-year event, a 10-year event will produce flows at or near the pipe capacity of the system. Some nodes in the model identified areas of surcharging which were determined to not be a deficiency because the surcharging is contained in the curb and gutter system. A pipe at capacity or a surcharged node in the model was only added to the deficiency list if flooding was significant in the model and/or City staff had identified previous flooding at the location. After identifying the deficiencies in Table 4-1, the project team and City staff met in a series of workshops to discuss which deficiencies warranted action. Deficiencies identified as not warranting action will be monitored by City staff for flooding.

Table 4-1
Storm Drainage Deficiencies

Deficiency ID	Location	Problem Description
1	7000 South from 3000 West to the Jordan River	Existing storm drains along 7000 South discharges into the South Jordan Canal and the Jordan River. Plans to discharge flows along 7000 South only to the Jordan River show that storm drains east of the South Jordan Canal do not have sufficient capacity to convey flows to Bateman pond. Additional plans to convey flows from Constitution Park to the Jordan River will also increase flows above the capacity of existing storm drains in 7000 South.
2	3200 West and 6880 South, 6920 South, and 6960 South	City staff and modeling has identified flooding in this area, especially in the downhill cul-de-sac in 6960 South. Inadequate pipe capacity, low surface elevations, and conflicts with the outlet structure of the Constitution Park detention basin contribute to flooding.
3	7480 South and Autumn Drive	City staff has identified local flooding issues here in the past.
4	Paddington Road from New World Drive to Millerberg Way	Conflicts with the inlet works into Constitution Park detention basin create backwater effects that flood Paddington Way.

Deficiency ID	Location	Problem Description
5	3200 West from 7545 South to Constitution Park	Pipes have inadequate slopes/elevation head to convey storm flows. Spill elevations into Constitution Park create backflow conditions for inflows into the detention basin.
6	Harvest Ridge Drive between 7400 South and Jordan Meadows Lane	City staff has identified flooding issues here in the past. The existing storm drain has low slopes and the required head to spill into the Jordan Meadows detention basin creates backwater effects. The area is a low spot in the curb and gutter system.
7	Executive Drive between 7265 South and Richland Circle	City staff has identified flooding issues here in the past. The existing storm drain has low slopes. Flows are over pipe capacity. The area is a low spot in the curb and gutter system, and ponding flows flood downhill driveways on the east side of the road. There are also connection issues between dual irrigation and storm drain lines.
8	Straw Circle	City staff has identified flooding issues here in the past. The required head to spill into the Harvest Park detention basin creates backwater effects. The area is a low spot in the curb and gutter system and has a downsloping driveway.
9	6645 South and 2200 West	Piped storm drain daylights to an open ditch which is frequently clogged with weeds, debris, and leaves.
10	7055 South and 1115 West	City staff has identified erosion issues at the west end of 7055 South at this location. Inlets do not connect into the storm drain system.
11	Temple Drive from 6790 South to Storm Drainage near 7000 South	City staff has identified that this area lacks storm drain conveyances.
12	Drake Lane and Redwood Road	City staff has identified that ADS pipes crossing Redwood Road are damaged and need replaced.
13	7600 South and Redwood Road	City staff has identified that ADS pipes crossing Redwood Road are damaged and need replaced.
14	Camelot Way and 7175 South	City staff has identified flooding in a low spot of curb and gutter. The inlets tie into irrigation/storm drain lines in backyards and lack an access manhole.
15	Harvest Lane from 2200 West to 2290 West	City staff has identified flooding in this area. Modeling shows that storm drain may have adverse grades and act as a bubble up in Arthur Drive.
16	Sunrise Place 1655 West	Isolated storm drainage in the strip mall bubbles up in the road and floods the strip mall parking lot.
17	6600 South and Clernates Drive	The system along 6600 south from Beargrass Road to the intersection of Clernates and along Clernates from 6600 South to Wake Robin Drive is generally overcapacity in a 10-year event. This is causing water to flow in the surficial street system where it is unable to be tracked by the model. This accounts for City observations of inlet capacity issues in this area which the model reveals are more of a pipe capacity issue.
18	7000 South between Thorndale Way and Orion Hill Road and the neighborhoods directly south	Pipes are generally at or just over capacity with surcharging at most inlets.
19	5030 West and Pawnee Drive	The system along Pawnee Drive and 5030 West is generally overcapacity and causes surcharging during the 10-year storm event. This area has not been known to cause excessive issues in the past.
20	5820 West and Discovery Drive	City staff has identified problems with an overgrowth of weeds in the detention facility.
21	Approximately 7660 South from Sunrise Place to Temple Drive	Modeling shows that the existing storm drain/irrigation piping has insufficient capacity to convey flows to the North Jordan Canal.

Deficiency ID	Location	Problem Description
22	Skyview Detention Basin	Flooding downstream occurs when outlet gate valve is fully open. The Basin is in Taylorsville, receives flow from West Jordan, and discharges into the West Jordan Storm Drain System.
23	Olympic Pointe Basin	The detention basin collects a significant amount of sediment and debris from Bangerter Highway.
24	7800 South Wetland Ponds	Maintenance staff has noted excessive sediment collection between the 2nd and 3rd ponds. Ponds do not have an effective access to remove sediment.
25	4000 West from 8390 South to 7800 South	City staff has identified that the corrugated metal pipe in the west side of the road has deteriorated and needs repair.
26	8518 South and Festival Way	Low slopes lead to flooding at this location. There is no surface outlet here so pipes must carry the 100-year event.
27	Nike Drive and 4000 West	Current pipe configuration leads to flows in Nike Drive entering against flows in 4000 West.
28	Axel Park Road from 5750 West to Bagley Park Road	The City has received flooding complaints from businesses in this area. Currently there is no storm drain in Axel Park Road. The closest downstream storm drain inlets show significant flooding in the model. The cross street waterways at Hawley Park Road are in need of repair.
29	4950 West from Park Vale Drive to 7670 South	Low slopes and pipe capacities in 4950 W Drive prevent flows in 4950 West south of Wood Spring Drive from flowing north.
30	Dannon Way from 5650 West to West Ridge Academy	The roadside drainage ditch lacks sufficient capacity to convey runoff from this area.
31	3400 West from Lady Dove Lane to 9200 South	This area does not have any storm drainage or curb and gutter and lacks a direct path to West Jordan's storm drain system.
32	8200 South and 1500 West	Sediment from Bingham Creek frequently clogs the outlet of the storm drain from 8200 South and 1500 West. The storm drain enters the creek at a very low elevation.
33	2200 West from 7970 South to 7850 South	Several small diameter drain pipes open flow into the Veterans Memorial Park and are functionally inadequate.
34	Heritage Park Detention Basin	The outlet pipe from the Heritage Park Detention Basin does not connect to Bingham Creek and "dead-ends" into the ground, drastically reducing its capacity.
35	Okubos Detention Basin	The basin always has water in it because of the elevation of the outlet structure in relation to the South Jordan Canal.
36	7800 South from 3200 West to 3000 West	The storm drain manholes in this area are made out of corrugated metal pipe and need to be replaced. The 27-inch pipe needs to be slip lined.
37	8948 South and 1240 West	Storm drain ends in a bubble up at this location. Drainage from businesses to the west flow into the curb and gutter of 1240 West.
38	7780 South and 2700 West	A French drain in the west side of the road needs to be tied into the storm drain system.
39	8660 South and 1841 West	The existing Cajean Estates retention basin does not connect to the storm drain system.
40	Vista West Detention Basin	Weed, leaves, and debris frequently clog the inlet box into the Vista West Detention Basin.
41	6400 West from 9000 South to Placer Mine Lane	The road has a low point in the middle of this area which experiences significant runoff from the undeveloped fields to the west.
42	Village Dell Drive and Park Vale Drive	The model and topography show that this area could experience flooding, especially in 100-year events due to the lack of a surface flow pathways.

Deficiency ID	Location	Problem Description
43	Leo Park Road and Hawley Park Road	The cross street waterway is in need of repair.
44	Clay Hollow from the Mountain View Corridor upstream to the box culvert under 7800 South	The natural channel has very steep and deep banks in this area, posing a obstacle in development plans and a danger to residents. The City prefers to leave this as an open channel.
45	Cougar Pond to railroad pipe crossing	Open swales flow into the culvert under the railroad and into the existing storm drain 24 inch pipe. The open swales are also used as the outlet for Cougar Pond. The open swales collect garbage and weeds which then clog up the inlet into the storm drain pipe.
46	9100 South 1510 West	Storm drain pipe dead ends and floods street
47	Discovery and Charter Roads to 5600 West Pond	Local flooding above the existing swale through a yard
48	7000 South and 4600 West to Airport Road	Lacks storm drain pipe
49	Valley West Road 3900 South to 3715 West	Local flooding and road damage from water ponding
50	7400 South 6500 West to 6200 West	Developer Trunkline in Future Road

CHAPTER 5 – CAPITAL IMPROVEMENT PLAN

This Capital Improvement Plan (CIP) presents the problems, alternatives, and recommendations identified in the study to improve storm drainage in the City of West Jordan. The CIP was developed from the hydrologic models, deficiency analysis, and workshops with County personnel.

PREFERRED DRAINAGE PLAN DEVELOPMENT

The project team held a series of workshops with City staff to evaluate the need for drainage improvements based on the deficiencies identified in Chapter 4. Selection of the preferred alternative for each problem was a process of evaluation and refinement rather than a simple choice between alternatives.

The process of selecting a preferred alternative included:

- reviewing the list of storm drainage inadequacies,
- pre-screening drainage inadequacies,
- brainstorming possible solutions,
- screening alternatives based on feasibility and public acceptance,
- developing alternatives,
- comparing cost and function, and
- selecting the preferred alternative.

Design criteria included:

- 10-year minimum capacity
- 100-year capacity where homes may be frequently flooded
- 100-year capacity on regional detention basins (limited to hydraulic capacity of existing pipe)

PRECISION OF COST ESTIMATES

When considering cost estimates, there are several levels or degrees of precision depending on the purpose of the estimate and the percentage of detailed design that has been completed. The following levels of precision are typical:

Type of Estimate	Precision
Master Planning	±50%
Preliminary Design	±30%
Final Design or Bid	±10%

For example, at the master planning level (or conceptual or feasibility design level), if a project is estimated to cost $1,000,000, then the precision or reliability of the cost estimate would typically be expected to range between approximately $500,000 and $1,500,000. While this may seem very imprecise, the purpose of master planning is to develop general sizing, location, cost, and scheduling information on a number of individual projects that may be designed and constructed over a period of many years. Master planning also typically includes the selection of common design criteria to help ensure uniformity and compatibility among future individual projects. Details such as the exact capacity of individual projects, the level of redundancy, the

location of facilities, the alignment and depth of pipelines, the extent of utility conflicts, the cost of land and easements, the construction methodology, the types of equipment and material to be used, the time of construction, interest and inflation rates, permitting requirements, etc., are typically developed during the more detailed levels of design.

At the preliminary or 10% design level, some of the aforementioned information will have been developed. Major design decisions such as the size of facilities, selection of facility sites, pipeline alignments and depths, and the selection of the types of equipment and material to be used during construction will typically have been made. At this level of design the precision of the cost estimate for a $1,000,000 project would typically be expected to range between approximately $700,000 and $1,300,000.

After the project has been completely designed and is ready to bid, all design plans and technical specifications will have been completed and nearly all of the significant details about the project should be known. At this level of design, the precision of the cost estimate for the same $1,000,000 project would typically be expected to range between approximately $900,000 and $1,100,000.

The flows and pipe diameters provided in the following Capital Improvement Plan (CIP) descriptions are approximate and are for planning purposes only. A detailed hydrologic and hydraulic analysis shall be performed during the design process of the projects to identify final design and sizing.

ESTIMATED CONSTRUCTION COSTS

Cost estimates are based on conceptual-level engineering. Unit construction costs were estimated based on construction cost indices (ENR 2015), communication with material suppliers, heavy construction data references (RSMeans 2014), and HAL's experience with similar construction. Engineering cost estimates given in this study should be regarded as conceptual and appropriate for use as a planning guide. Only during final design can a definitive and more accurate estimate be provided. A detailed cost estimate of each alternative is provided in Appendix C.

CAPITAL IMPROVEMENT PLAN

Table 5-1 presents the recommended capital improvements which are shown on Figure 5-1. The CIP was completed in two phases. Due to construction schedules, the northern half of the City was analyzed first and had the CIP completed first. The southern half of the City was analyzed secondly. Table 5-1 contains the projects for the entire City.

Projects from the previous Master Plan were reviewed and included in the CIP. The projects from the 2007 Master Plan include projects for West Jordan City, Developers, and Other Agencies. Costs were updated to 2015 dollars using the ENR Cost Index (ENR, 2015).

The criteria for determining the priority of a project was based on existing flooding, detention storage problems, combined storm drain and irrigation issues, replacement of corrugated metal pipe, development roads, and capacity, in that order. Additional criteria taken into account included system performance (40%), economic development (10%), timing and coordination with UDOT and other road projects (15%), operational control (10%), and funding (25%).
The priority number and fiscal year (FY) was provided by West Jordan City.

Table 5-1
Capital Improvement Plan

Project ID	Deficiency ID	Location	Problem Description	Preferred Solution	Project ($)	Impact Fee	Priority
West Jordan City Projects							
1	1	7000 South from 3000 West to the Jordan River	Existing storm drains along 7000 South discharges into the South Jordan Canal and the Jordan River. Plans to discharge flows along 7000 South only to the Jordan River show that storm drains east of the South Jordan Canal do not have sufficient capacity to convey flows to Bateman pond. Additional plans to convey flows from Constitution Park to the Jordan River will also increase flows above the capacity of existing storm drains in 7000 South.	Install trunk line from Constitution Park consisting of 125 feet of 36-inch pipe, 4,670 feet of 42-inch pipe, 2,320 feet of 48-inch pipe, 3,380 feet of 60-inch pipe, 300 feet of 7x4 foot box culvert, and 1,610 feet of 66-inch pipe including outlet works. Route flows in the trunk line through the Bicentennial detention basin and rework the detention basin's inlet and outlet structures accordingly.	$6,132,000	Not Eligible	3 FY2015-16 & FY2016-17
2	2	3200 W and 6880 South, 6920 South, and 6960 South	City and modeling has identified flooding in this area, especially in the downhill cul-de-sac in 6960 South. Inadequate pipe capacity, low surface elevations, and conflicts with the outlet structure of the Constitution Park detention basin contribute to flooding.	Install 42-inch interceptor storm drain in 3370 West, 6880 South, 3300 West, and 7000 South from 6775 South to Constitution Park. Separate the inlets in 6880 South, 6920 South, and 6960 South by installing a new parallel storm drain in 3200 West which bypasses the detention basin and connects to Project 1.	$1,323,000	Not Eligible	1 FY2014-15
3	2, 4, 5	3200 W and 6880 South, 6920 South, and 6960 South	City and modeling has identified flooding in this area, especially in the downhill cul-de-sac in 6960 South. Inadequate pipe capacity, low surface elevations, and conflicts with the outlet structure of the Constitution Park detention basin.	Lower Constitution Park base elevations by 2 feet, reconstruct incoming spill structures and piping so flows into the basin spill at or near the basin's lowest elevation, and reconstruct outlet works with a minimum 14-inch diameter orifice plate.	$1,296,000	Not Eligible	6 FY2016-17

Project ID	Deficiency ID	Location	Problem Description	Preferred Solution	Project ($)	Impact Fee	Priority
4	7	Executive Drive between 7265 South and Richland Circle	City has identified flooding issues here in the past. The existing storm drain has low slopes. Modeling reveals that 10-year flows are over pipe capacity. The area is a low spot in the curb and gutter system, and ponding flows flood downhill driveways on the east side of the road. There are also connection issues between dual irrigation and storm drain lines.	Increase street inlet capacity and upsize existing 24-inch pipe to a 36 inch pipe with 30-inch pipe at the south end of Executive Drive. This solution should be done in conjunction with Project 11.	$544,000	Not Eligible	11 FY2017-18
5	8	Straw Circle	City has identified flooding issues here in the past. The required head to spill into the Harvest Park detention basin creates backwater effects. The area is a low spot in the curb and gutter system and has a downsloping driveway.	Due to elevation limitations with the outfall to the canal, piping solutions will have minimal effectiveness in alleviating the problems seen in Straw Circle. Surface drainage is likely critical to drainage in this area and appears to function sufficiently until flows reach the end of Straw Circle. The preferred solution should convey surface flows to the detention basin through a street-to-detention spillway with additional re-grading at the homes most affected by surface flows.	$26,000	Not Eligible	2 FT2014-15
6	9	6645 South and 2200 West	Piped storm drain daylights to an open ditch which is frequently clogged with weeds, debris, and leaves.	Install 27-inch storm drain to replace the open ditch and continue 27-inch along 2200 West to alleviate surcharging.	$267,000	Not Eligible	
7	10	7055 South and 1115 West	City has identified erosion issues at the west end of 7055 South at this location. Inlets do not connect into the storm drain system.	Replace inlets and connect to new 7000 South storm drain.	$54,000	Not Eligible	4 FY2015-16
8	11	Temple Drive from 6790 South to Storm Drainage near 7000 South	City has identified that this area lacks storm drain conveyances.	Install and upsize storm drains in 1300 West from Bateman Point Drive to 7000 South to 18-inch pipe.	$217,000	Not Eligible	8 FY2018-19

Project ID	Deficiency ID	Location	Problem Description	Preferred Solution	Project ($)	Impact Fee	Priority
9	12	Drake Lane and Redwood Road	City has identified that ADS pipes crossing Redwood Road are damaged and need replaced.	Install new pipes by pipe bursting or similar trenchless construction.	$154,000	Not Eligible	
10	13	7600 South and Redwood Road	City has identified that ADS pipes crossing Redwood Road are damaged and need replaced.	Install new pipes by pipe bursting or similar trenchless construction.	$131,000	Not Eligible	
11	14	Camelot Way and 7175 South	City has identified flooding in a low spot of curb and gutter. The inlets tie into irrigation/storm drain lines in backyards and lack and access manhole.	Install new 30-inch storm drain with inlets in Camelot Way from 7125 South to the new trunk line in 7000 South.	$250,000	Not Eligible	15 FY2018-19
12	15	Harvest Lane from 2200 West to 2290 West	City has identified flooding in this area. Modeling shows that storm drain may have adverse grades and act as bubble up in Arthur Drive.	Install new 21-inch storm drain in 2200 West from Harvest Lane to 7200 South (approximately) with 18-inch pipe and inlets at the intersection of 2200 West and Harvest Lane.	$153,000	Not Eligible	29 FY2022-23
13	16	Sunrise Place 1655 West	Isolated storm drainage in the strip mall bubbles up in the road and floods the strip mall parking lot.	Install new 18-inch storm drain from the existing bubble up grate in Sunrise Place to the existing 18-inch storm drain in Sunrise Place East.	$91,000	Not Eligible	27 FY2021-22
14	6	Harvest Ridge Drive between 7400 South and Jordan Meadows Lane	City has identified flooding issues here in the past. The existing storm drain has low slopes and the required head to spill into the Jordan Meadows detention basin creates backwater effects. The area is also a low spot in the curb and gutter system.	Install new 24-inch storm drain that will be disconnected from the other storm drain line coming to the detention from the west. This will alleviate the backwater effects in Harvest Ridge Drive.	$162,000	Not Eligible	17 FY2019-20
15	3	7480 South and Autumn Drive	City has identified local flooding issues here in the past.	Due to lack of surface options without causing flooding to adjacent homes, this solution should include 100-year storm event capacity. Upsize existing 15-inch outfall to the canal with a 30-inch with increased inlet capacity and add 18-inch storm drain with inlets in Spring Drive.	$78,000	Not Eligible	16 FY2018-19

Project ID	Deficiency ID	Location	Problem Description	Preferred Solution	Project ($)	Impact Fee	Priority
16	17	6600 South and Clernates Drive	The system along 6600 south from Beargrass Road to the intersection of Clernates and along Clernates from 6600 South to Wake Robin Drive is generally overcapacity in a 10-year event. This is causing water to flow in the surficial street system where it is unable to be tracked by the model. This accounts for City observations of inlet capacity issues in this area – which the model reveals are more of a pipe capacity issue.	Upsize piping in the area to be able to convey 10-year flows in the pipe without surcharging. Pipes generally are upsized from 30-inch to 42-inch within the project area along 6600 South and south on Clernates to Saguaro.	$955,000	Not Eligible	
17	21	Approximately 7660 South from Sunrise Place to Temple Drive	Modeling shows that the existing storm drain/irrigation piping has insufficient capacity to convey flows to the North Jordan Canal.	Upsize storm drain piping to 21-inch following the existing storm/irrigation alignment.	$392,000	Not Eligible	
18	24	7800 South Wetland Ponds	Maintenance staff has noted excessive sediment collection between the 2nd and 3rd ponds. Ponds do not have an effective access to remove sediment.	Stabilize slope and add access road between the 2nd and 3rd pond for heavy equipment access during cleaning and sediment removal. Fix control gate from the North Jordan Canal.	$100,000	Not Eligible	13 FY2018-19
19	25, 27	4000 West from 8390 South to 7800 South	City staff has identified that the corrugated metal pipe in the west side of the road has deteriorated and needs repair. Current pipe configuration leads to flows in Nike Drive entering against flows in 4000 West.	Upsize existing storm drain in the west side of the road to 24-inch diameter from 8380 South to Nike Drive, to 30-inch diameter from Nike Drive to 7875 South, and to 18-inch diameter from 7875 South to 7800 South.	$640,000[2]	Not Eligible	24 FY2021-22

Project ID	Deficiency ID	Location	Problem Description	Preferred Solution	Project ($)	Impact Fee	Priority
20	26	8518 South and Festival Way	Low slopes lead to flooding at this location. There is no surface outlet here so pipes must carry the 100-year event.	Replace and lower the culvert under the railroad with a 36-inch diameter pipe. Replace the 15-inch pipe across Bingham View Drive with a 24-inch pipe and increase inlet capacity. Review surface flow options to accommodate 100-year events in case inlets or pipes are clogged. Lower the detention basin at Dora Lee Park to a minimum depth of 4662.5 feet (1.5 feet) with gradual grading, new outlet structure, and new landscaping. Evaluate proper orifice plate sizing at Dora Lee Park.	$260,000	Not Eligible	23 FY2020-21
21	28	Axel Park Road from 5750 West to Bagley Park Road	The City has received flooding complaints from businesses in this area. Currently there is no storm drain in Axel Park Road. The closest downstream storm drain inlets show significant flooding in the model.	Install new 24-inch pipe in Axel Park Road west of Hawley Park Road and install new 30-inch pipe in Axel Park Road from Hawley Park Road, down Bagley Park Road and across Old Bingham Highway to the drainage ditch.	$898,000	Not Eligible	19 FY2020-21
22	29, 42	4950 West from Park Vale Drive to 7670 South	Low slopes and pipe capacities in 4950 W Drive prevent flows in 4950 West south of Wood Spring Drive from flowing north.	Add 5 18-inch storm drain pipes with inlets from the north side of 7800 South to the existing storm drain pipes on the south side of 7800 South to prevent water from flowing north along 4950 West. Evaluate proper orifice plate sizing at Bridal Creek detention basin.	$69,000	Not Eligible	9 FY2015-16

Project ID	Deficiency ID	Location	Problem Description	Preferred Solution	Project ($)	Impact Fee	Priority
23	30	Dannon Way from 5650 West to West Ridge Academy	The roadside drainage ditch lacks sufficient capacity to convey runoff from this area.	Install 24-inch pipe in Dannon Way from Hawley Park Road west to the existing 24-inch line, and install 36-inch pipe from Hawley Park Road east to the existing 36-inch pipe at West Ridge Academy.	$643,000	Not Eligible	
24	31	3400 West from Lady Dove Lane to 9200 South	This area does not have any storm drainage or curb and gutter and lacks a direct path to West Jordan's storm drain system.	Install 750 feet of 18-inch pipe in 3400 West and connect to the existing storm drain in the turn-around east of the Salt Lake Community College. Install 1,900 linear feet of curb and gutter in 3400 West from Lady Dove Lane to the Salt Lake Community College.	$158,000	Not Eligible	12 FY2017-18
25	32	8200 South and 1500 West	Sediment from Bingham Creek frequently clogs the outlet of the storm drain from 8200 South and 1500 West. The storm drain enters the creek at a very low elevation.	Cut back the 18-inch pipe and install outlet structure with apron. Cutting back the pipe will increase the outlet elevation, and the concrete outlet structure will reduce sediment deposit and ease maintenance efforts.	$7,000	Not Eligible	
26	33	2200 West from 7970 South to 7850 South	Several small diameter drain pipes open flow into the Veterans Memorial Park and are frequently clogged.	Install 18-inch pipe in 2200 West from 7970 South (the southernmost existing 6-inch drain) to 7800 South.	$160,000	Not Eligible	
27	34	Heritage Park Detention Basin	The outlet pipe from the Heritage Park Detention Basin does not connect to Bingham Creek and "dead-ends" into the ground, drastically reducing its capacity.	Install 18-inch pipe from the Heritage Park Detention Basin to Bingham Creek with outlet structure into the Creek.	$14,000	Not Eligible	
28	35	Okubos Detention Basin	The basin always has water in it because of the elevation of the outlet structure in relation to the South Jordan Canal.	Replace outlet structure at the Okubos Detention Basin and install a check valve to prevent backflow from the South Jordan Canal.	$30,000	Not Eligible	

Project ID	Deficiency ID	Location	Problem Description	Preferred Solution	Project ($)	Impact Fee	Priority
29	36	7800 South from 3200 West to 3000 West	The storm drain manholes in this area are made out of corrugated metal pipe and need to be replaced. The 27-inch pipe needs to be slip lined.	Replace the four manholes with concrete. Slip line the 27-inch pipe from Jordan Landing Blvd to 3100 West.	$750,000[2]	Not Eligible	22 FY2020-21
30	37	8948 South and 1240 West	Storm drain ends in a bubble up at this location. Drainage from businesses to the west flow into the curb and gutter of 1240 West.	Install 18-inch pipe from the bubble up in 1240 West to the existing storm drain in 9000 South.	$43,000	Not Eligible	21 FY2020-21
31	39	8660 South and 1841 West	The existing Cajean Estates retention basin does not connect to the storm drain system.	Install 18-inch pipe from the storm drain in Gardner Lane near Shulsen Lane to the Existing storm drain in Redwood Road.	$127,000	100%	18 FY2020-21
32	43	Leo Park Road and Hawley Park Road	The cross street waterway is in need of repair.	Replace existing waterway with a new waterway and resurface roadway so waterway approach accommodates heavy traffic.	$10,000	Not Eligible	7 FY2016-17
33	44	Clay Hollow from the Mountain View Corridor upstream to the box culvert under 7800 South	The natural channel has very steep and deep banks in this area, posing a obstacle in development plans and a danger to residents. The City prefers to keep this as an open channel.	Install 6-foot by 4-foot box culvert in Clay Hollow from the Mountain View Corridor upstream to the box culvert under 7800 South.	$1,763,000	Not Eligible	FY2017-18
70	46	9100 South 1510 West	Storm drain pipe dead ends and floods street	Install underground retention chamber	$65,000[2]	NA	FY2015-16
71	47	Discovery and Charter Roads to 5600 West Pond	Local flooding above the existing swale through a yard	Install vault and 24 and 30-inch pipe to the 5600 West Pond	$75,000[2]	NA	8 FY2015-16
72	48	7000 South and 4600 West to Airport Road	Lacks storm drain pipe	New 24-inch storm drain pipe under the railroad tracks to Airport Road	$275,000[2]	NA	10 FY2016-17

Project ID	Deficiency ID	Location	Problem Description	Preferred Solution	Project ($)	Impact Fee	Priority
73	25	4000 West 8390 South to 7900 South	Irrigation Pipe made of corrugated metal is leaking underneath the roadway	Slip-line the 24" corrugated pipe	$300,000[2]	NA	28 FY2022-23
74	49	Valley West Road 3900 South to 3715 West	Local flooding and road damage from water ponding	Install 1,850 LF of 18-inch pipe in Valley West, 284 LF in 3780 West, and 12 inlets	$375,000[2]	NA	26 FY2021-22
79	City Identified	Wasatch Meadows Dr from TRAX to Teton Estates Dr	High flows in TRAX drainage channel drain to 9000 South	Connect UTA TRAX drainage channel to storm drain in Wasatch Meadows Dr and replace 1,690 ft of storm drain pipe with 30-inch RCP to Teton Estates Dr	$220,000[2]	25%	
				West Jordan City Projects Subtotal	**$19,207,000**	**$182,000**	
2007 Master Plan West Jordan City Projects							
34	2007 MP[1]	Barney's Creek U-111	West Jordan City Detention Project Identified in 2007 Master Plan	Construct 66.3 ac-ft detention basin (DB278)	$4,693,000	100%	
35	2007 MP[1]	1500 West	West Jordan City Culvert Project Identified in 2007 Master Plan	Install 12-foot by 5-foot box culvert (BINC23B)	$338,000	Not Eligible	
36	2007 MP[1]	9300 South 800 West	West Jordan City Culvert Project Identified in 2007 Master Plan	Install 24-inch RCP Canal Crossing (TR28B)	$160,000	Not Eligible	
37	2007 MP[1]	Prosperity Road	West Jordan City Trunkline Project Identified in 2007 Master Plan	Install 18-inch RCP (T420)	$164,000	100%	FY2016-17
38	2007 MP[1]	Dannon Way	West Jordan City Trunkline Project Identified in 2007 Master Plan	Install 30-inch RCP (T426, T431)	$186,000	6%	30 FY2022-23
39	2007 MP[1]	Leo Park Road	West Jordan City Trunkline Project Identified in 2007 Master Plan	Install 18-inch RCP (T450A)	$348,000	37%	25 FY2021-22
40	2007 MP[1]	2700 West	West Jordan City Trunkline Project Identified in 2007 Master Plan	Install 15-inch and 30-inch RCP (T158A, T158B, T159C)	$426,000	Not Eligible	20 FY2020-21
				2007 Master Plan West Jordan City Projects Subtotal	**$6,315,000**	**$4,997,000**	

Project ID	Deficiency ID	Location	Problem Description	Preferred Solution	Project ($)	Impact Fee	Priority
Developer Projects							
41	2007 MP[1]	9800 South Hwy 111	Developer Detention Project Identified in 2007 Master Plan	Construct 5.6 ac-ft detention basin (DB404)	$633,000	100%	
42	2007 MP[1]	9500 South 6800 West	Developer Detention Project Identified in 2007 Master Plan	Construct 10.8 ac-ft detention basin (DB406)	$1,135,000	100%	
43	2007 MP[1]	Wells Park Road	Developer Trunkline Project Identified in 2007 Master Plan	Install 18-inch and 24-inch RCP (T416, T413B)	$367,000	100%	
44	2007 MP[1]	7400 West	Developer Culvert Project Identified in 2007 Master Plan	Install 54-inch RCP (BARC277)	$207,000	100%	
45	2007 MP[1]	6600 West	Developer Culvert Project Identified in 2007 Master Plan	Install 24-inch RCP (BARC281)	$160,000	100%	
46	2007 MP[1]	6800 West	Developer Culvert Project Identified in 2007 Master Plan	Install 48-inch RCP (BARW291)	$198,000	100%	
47	2007 MP[1]	7600 West	Developer Culvert Project Identified in 2007 Master Plan	Install 42-inch RCP (BARW297)	$187,000	100%	
48	2007 MP[1]	9400 South	Developer Culvert Project Identified in 2007 Master Plan	Install 42-inch RCP (BARW300)	$187,000	100%	
49a	2007 MP[1]	9000 South	Developer Trunkline Project Identified in 2007 Master Plan	Install 5,100 LF of 18-inch RCP (T293, T292A)	$1,115,000	100%	
49b	2007 MP[1]	9000 South	Developer Trunkline Project Identified in 2007 Master Plan	Install 1,850 LF of 30-inch RCP (T291A)	$550,000	100%	
49c	2007 MP[1]	9000 South	Developer Trunkline Project Identified in 2007 Master Plan	Install 2,650 LF of 36-inch RCP (T290A)	$895,000	100%	
50a	2007 MP[1]	6800 West	Developer Trunkline Project Identified in 2007 Master Plan	Install 900 LF of 24-inch RCP (T300B, T291B)	$234,000	100%	
50b	2007 MP[1]	6800 West	Developer Trunkline Project Identified in 2007 Master Plan	Install 1,900 LF of 30-inch RCP (T406)	$565,000	100%	
51	2007 MP[1]	7300 West	Developer Culvert Project Identified in 2007 Master Plan	Install 36-inch RCP (UNW2273)	$176,000	100%	

Project ID	Deficiency ID	Location	Problem Description	Preferred Solution	Project ($)	Impact Fee	Priority
52	2007 MP[1]	Parallel to Hwy 111	Developer Culvert Project Identified in 2007 Master Plan	Install 42-inch RCP (UNW2271B)	$550,000	100%	
53	2007 MP[1]	7300 West	Developer Culvert Project Identified in 2007 Master Plan	Install 30-inch RCP (UNW1272A)	$168,000	100%	
54	2007 MP[1]	7200 West	Developer Culvert Project Identified in 2007 Master Plan	Install 30-inch RCP (UNW1272B)	$168,000	100%	FY2018-19
55	2007 MP[1]	7700 West to 7400 West	Developer Culvert Project Identified in 2007 Master Plan	Install 24-inch RCP (DRYW211)	$497,000	100%	FY2016-17
56	2007 MP[1]	7700 South from Hwy 111 to Kennecott RR	Developer Culvert Project Identified in 2007 Master Plan	Install 36-inch RCP (DRYW209)	$422,000	100%	
57	2007 MP[1]	7400 West to Hwy 111	Developer Culvert Project Identified in 2007 Master Plan	Install 30-inch RCP (DRYW210A)	$1,097,000	100%	
58	2007 MP[1]	Kennecott RR at 7000 South to 7100 South	Developer Culvert Project Identified in 2007 Master Plan	Install 36-inch RCP (DRYW216)	$324,000	100%	
59	2007 MP[1]	6100 West	Developer Culvert Project Identified in 2007 Master Plan	Install 54-inch RCP (DRYW220)	$207,000	100%	FY2020-21
60	2007 MP[1]	7600 South	Developer Culvert Project Identified in 2007 Master Plan	Install 30 and 42-inch RCP (DRYW108A)	$701,000	100%	FY2020-21
61	2007 MP[1]	6500 West	Developer Trunkline Project Identified in 2007 Master Plan	Install 18-inch RCP (T413A)	$283,000	100%	
62	2007 MP[1]	9800 South	Developer Trunkline Project Identified in 2007 Master Plan	Install 24-inch RCP (T404)	$143,000	100%	
63	2007 MP[1]	Hwy 111	Developer Trunkline Project Identified in 2007 Master Plan	Install 18-inch RCP (T405, T299A)	$425,000	100%	
64	2007 MP[1]	9400 South	Developer Trunkline Project Identified in 2007 Master Plan	Install 24-inch RCP (T299B, T300A)	$1,037,000	100%	
65	2007 MP[1]	Hwy 111	Developer Trunkline Project Identified in 2007 Master Plan	Install 36-inch RCP (T292B)	$573,000	100%	

Project ID	Deficiency ID	Location	Problem Description	Preferred Solution	Project ($)	Impact Fee	Priority
66	2007 MP[1]	7100 West and 7800 South	Developer Trunkline Project Identified in 2007 Master Plan	Install 24-inch RCP (T233, T234)	$416,000	100%	FY2020-21
67	2007 MP[1]	7400 South, Hwy 111, and 7500 South	Developer Trunkline Project Identified in 2007 Master Plan	Install 24 and 36-inch RCP (T214A, T214B, T231)	$1,121,000	100%	
68	2007 MP[1]	6400 West	Developer Trunkline Project Identified in 2007 Master Plan	Install 18-inch RCP (T217B, T217A)	$566,000	100%	
69	2007 MP[1]	7400 South and 6600 West	Developer Trunkline Project Identified in 2007 Master Plan	Install 36-inch RCP (T230, T216A, T216B)	$978,000	100%	
78	50	7400 South 6500 West to 6200 West	Developer Trunkline in Future Road	Install 500 LF of 15, 630 LF of 18, and 970 LF of 24-inch pipe in 7400 South, connect to existing pipe under the Mountain View Corridor	$300,000[2]	100%	
				Developer Projects Subtotal	**$16,585,000**	**$16,278,000**	
2007 Master Plan Other Agency Projects							
75	2007 MP[1]	6600 South	Other Agency Trunkline Project Identified in 2007 Master Plan	Install 24 and 30-inch RCP (T203, T303, T304)	$1,912,000	NA	
76	2007 MP[1]	5450 West Old Bingham Hwy	Other Agency Culvert Project Identified in 2007 Master Plan	Replace with 42-inch RCP (OBH3A)	$187,000	NA	
77	2007 MP[1]	9000 South Old Bingham Hwy	Other Agency Culvert Project Identified in 2007 Master Plan	Replace with 36-inch RCP (OBH81B)	$353,000	NA	
				2007 Master Plan Other Agency Projects Subtotal	**$2,452,000**	**$0**	
				Total Cost	**$44,559,000**	**$21,764,000**	

1. Project description, location, and cost from the 2007 Storm Drainage Plan Update (Bowen, Collins & Associates, 2007).
2. Cost data provided by West Jordan City.

SUMMARY OF CAPITAL IMPROVEMENTS

Costs of the Capital Improvements are summarized in Table 5-2.

Table 5-2
Capital Improvement Plan Summary

Project ID Range	Projects	Cost ($)	Impact Fee Eligible
1-33, 70-74, & 79	West Jordan City Projects	$19,207,000	$182,000
34-40	2007 Master Plan West Jordan City Projects	$6,315,000	$4,997,000
41-69 & 78	Developer Projects	$16,585,000	$16,585,000
75-77	2007 Master Plan Other Agency Projects	$2,452,000	$0
	Total Cost	**$44,559,000**	**$21,764,000**

An additional table showing the projects listed by priority can be reviewed in Appendix B.

OPERATIONAL RECOMMENDATIONS

Flow Outside of West Jordan

As discussed in Chapter 2, several surrounding areas outside of West Jordan City have runoff that enters the West Jordan storm drain system. The inflows at 6305 South and 3980 West enters Taylorsville's Skyview detention basin. However, Skyview detention basin drains into West Jordan Storm Drain facilities. Therefore, the operations of Skyview detention basin and the incoming flows north of 6200 South affects West Jordan's storm drain system. Currently, outflow from the Skyview detention basin is controlled by a submerged 15 inch diameter gate valve which is opened slightly to control flows. If the gate valve is fully open flooding downstream will occur during storm events. Conversely, if the gate valve is closed, large storm events could fill and spill out of Skyview detention.

It is therefore recommended that the City of West Jordan enter into interlocal agreement with Taylorsville regarding operations of Skyview Detention Basin and seek their cooperation concerning a future study on the outlet works of the basin (Deficiency 22). The same efforts should be made to enter into interlocal agreements with other storm drain entities that have runoff which enters West Jordan's storm drain system and could adversely impact the system.

Minimum Pipe Diameter

Many of the storm drain pipes in West Jordan are 15 inches in diameter or less. Modeling of the system shows that generally the 15 inch pipes do not have the capacity to convey the 10-year 1 hr flows. It is therefore recommended that the City make 18 inch pipe the minimum for City owned storm drain systems.

Inventory

This Master Plan consolidated different inventories of the West Jordan Storm Drain Master Plan. The previous inventories included an inventory contained in an InfoSWMM model and a GIS inventory of the system. Multiple inventories increase the likelihood of incorrect or outdated

information being used and also require more time to maintain. Therefore, it is recommended that the City maintain and update a master GIS inventory of the storm drainage system. The storm drainage model should be maintained and updated based upon the master GIS inventory. The GIS inventory should be maintained separate from the InfoSWMM model to increase accessibility to the inventory by City personnel. Updates should occur as information about additional land use, conveyance, capacity, and detention data become available.

Irrigation and Storm Drain Conveyances

Several older areas of the West Jordan Storm Drainage System have conveyances which serve as both storm drain facilities and irrigation facilities. The dual storm drain and irrigation conveyances generally lack the capacity to convey the 10-year flow through the system. Therefore, it is recommended that an ongoing effort be made to separate storm drainage conveyances from local irrigation conveyances in addition to the recommended projects in the Capital Improvement Plan.

Watch and Maintenance Recommendations

In addition to the existing storm drainage system maintenance, it is recommended that deficiencies 9, 20, 23, 24, 32, 40, and 45 be addressed through more frequent maintenance. A maintenance schedule for these deficiencies could include removing debris, sediment, and clearing weed growth as needed to keep the drainage facilities functioning or until corrective CIP projects can be completed.

Deficiencies identified as not warranting action include 18, 19, 38, and 41. These deficiencies should be monitored for future flooding. If conditions become unacceptable, a project should be added to the CIP to remedy the deficiency. Deficiency 41 is expected to be remedied as the fields west of 6400 West and 8850 South are developed and runoff is routed to Barney's Wash.

Storm Drainage Master Plan Updates

The storm drainage master plan should be periodically reviewed and updated dependent upon change and new development, at least every 5 years.

REFERENCES

AGRC (Utah Automated Geographic Reference Center). 2014. Various GIS data layers. http://gis.utah.gov/data/.

Bonnin, Geoffrey M., Deborah Martin, Bingzhang Lin, Tye Parzybok, Michael Yekta, and David Riley. 2004. *NOAA Atlas 14: Precipitation-Frequency Atlas of the United States* vol. 1, ver. 5: Semiarid Southwest. Silver Spring, Md.: National Oceanic and Atmospheric Administration. http://www.nws.noaa.gov/oh/hdsc/PF_documents/Atlas14_Volume1.pdf.

Bowen, Collins & Associates. 2007. *West Jordan City 2007 Master Drainage Plan Update*. Draper, Utah: Bowen, Collins & Associates.

Bush and Gudgell, Inc. 1979. *Copper City – Master Storm Drain*. Salt Lake City, Utah: Bush and Gudgell, Inc.

ENR (Engineering News Record). 2015. "Current Cost Indices." Accessed March 2015. http://enr.construction.com/economics/.

Farmer, Eugene E., and Joel E. Fletcher. 1971. "Precipitation Characteristics of Summer Storms at High-Elevation Stations in Utah." Intermountain Research Station Research Paper INT-RP-110. Ogden, Utah: USDA Forest Service.

Innovyze. 2014. *InfoSWMM Modeling Made Easy Overview*. Broomfield, Colorado: Innovyze Corporate Headquarters. http://www.innovyze.com/products/infoswmm/.

Maidment, David R., ed. 1993. *Handbook of Hydrology.* New York: McGraw Hill.

NOAA (National Oceanic and Atmospheric Administration). 2014. Precipitation Frequency Data Server. National Weather Service, Hydrometeorological Design Studies Center. http://dipper.nws.noaa.gov/hdsc/pfds/.

NRCS (Natural Resource Conservation Service). 1986. *Technical Release 55: Urban Hydrology for Small Watersheds* (TR-55). Washington, D.C.: U.S. Department of Agriculture. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1044171.pdf.

NRCS (Natural Resource Conservation Service). 2014. *Web Soil Survey*. Washington, D.C.: U.S. Department of Agriculture. http://websoilsurvey.nrcs.usda.gov/. Accessed November 24, 2014.

Rossman, Lewis A. 2010. *Storm Water Management Model User's Manual Version 5.0*. Cincinnati, OH: United States Environmental Protection Agency.

RSMeans. 2015. *Heavy Construction Cost Data 2015.* Norwell, Mass.: RSMeans.

APPENDIX A

System Data

Client: City of West Jordan
Project: Storm Drainage Master Plan
Feature: Detention Basin Attributes
Project No.: 089.22.100

HANSEN ALLEN & LUCE inc ENGINEERS

Model ID	Name	Model	Estimated Spill Capacity ac-ft	Invert Elevation ft	Spill Elevation ft	Min Surface Elevation ft	Depth ft	Maximum 10 year Flows Inflow cfs	Storm Duration	Outflow cfs	Storm Duration
DB73	Cougar Park	North	80.3	4636.6	4645.6	4636.6	9.0	496	1 hr	48	12 hr
10433	Airport	South	65.8	4566.2	4579.3	4569.4	9.8	233	3 hr	81	24 hr
DB257	8200	South	61.4	4808.9	4825.3	4808.9	16.5	459	12 hr	165	12 hr
DB285	Ron Wood	South	51.9	4872.4	4886.2	4872.4	13.7	213	1 hr	171	12 hr
DB95	Sky View	North	50.5	4546.5	4555.4	4546.5	8.9	235	3 hr	46	3 hr
HDB-8841	*from drawings	South	33.2	4788.5	4806.8	4793.0	13.7	145	1 hr	84	1 hr
HDB-8717		South	31.0	4933.0	4944.1	4933.0	11.1	118	1 hr	38	6 hr
JCT-4814		South	28.2	4806.7	4818.6	4808.9	9.7	78	1 hr	12	6 hr
DB144	Constitution Park	North	16.7	4469.0	4472.8	4469.5	3.3	70	1 hr	35	12 hr
11951		South	15.3	4649.8	4661.5	4653.8	7.7	181	1 hr	46	24 hr
HDB-8798		South	14.6	4659.9	4667.9	4659.9	8.0	72	1 hr	50	6 hr
DB446		South	11.6	4879.7	4888.3	4879.7	8.5	41	1 hr	26	24 hr
JCT-1838	Sycamores	South	11.3	5037.1	5049.5	5040.6	8.9	45	1 hr	31	1 hr
HDB-8454		South	10.2	5060.3	5065.5	5060.3	5.2	155	12 hr	61	24 hr
LDB203	Unknown County	North	9.7	4893.1	4907.7	4898.9	8.8	1.3	1 hr	1.4	24 hr
HDB-8601		South	9.4	4860.6	4869.7	4860.6	9.0	26	1 hr	22	3 hr
OFALL-131		South	9.4	4883.0	4891.3	4883.6	7.7	23	1 hr	9.5	3 hr
20021	Browns Meadow 2	South	9.3	4474.6	4479.6	4474.6	5.1	7.9	3 hr	5.5	24 hr
390	Olympic Pointe	North	9.0	4493.4	4505.5	4499.9	5.5	27	1 hr	2.1	3 hr
OFALL-28		South	8.6	4661.3	4685.4	4675.5	9.8	105	1 hr	64	1 hr
OFALL-38	Bateman Pond	North	8.0	4319.2	4328.9	4323.5	5.4	168	3 hr	162	3 hr
HF-8430		South	8.0	4471.4	4474.9	4471.4	3.5	32	3 hr	23	12 hr
472		South	7.7	4572.0	4580.8	4574.1	6.7	1.3	12 hr	1.3	12 hr
DB81	Teton Estates Park	South	6.7	4644.6	4660.5	4647.7	12.8	174	1 hr	174	1 hr
11212		South	6.1	4656.4	4662.4	4656.4	6.0	58	6 hr	4.9	1 hr
HF-7996	Discovery	North	5.8	4899.3	4906.2	4899.6	6.6	44	1 hr	2.1	12 hr
LDB267	Oaks 14	South	5.0	4995.2	4999.8	4995.2	4.7	24	1 hr	13	12 hr
20017	Okubos	South	4.8	4408.5	4419.3	4415.7	3.6	39	1 hr	29	1 hr
JCT-3902		South	4.2	4590.1	4598.6	4590.6	8.0	179	1 hr	179	1 hr
357	Harvest Park	North	4.1	4407.0	4412.9	4409.9	3.0	45	1 hr	15	24 hr
DB128	Dixie Park	North	4.0	4519.0	4524.7	4522.5	2.2	30	1 hr	5.0	12 hr
HDB-8491		South	3.9	4943.6	4952.7	4943.6	9.1	22	1 hr	3.7	24 hr
01	Canal Overflow	North	3.9	4550.7	4554.3	4550.7	3.6	31	1 hr	7.0	24 hr
JCT-4752	Oaks East	South	3.6	4874.4	4880.4	4875.9	4.5	16	1 hr	14	1 hr
DB27		South	3.6	4363.0	4368.9	4363.0	6.0	56	1 hr	7.8	12 hr
10589	Bridal Creek	South	3.4	4716.7	4724.5	4721.7	2.8	43	1 hr	14	24 hr
HDB-9010		South	3.3	4525.6	4528.5	4525.6	2.9	43	1 hr	4.8	24 hr
182	Browns Meadow 1	South	3.1	4468.7	4477.8	4473.0	4.8	9.2	1 hr	7.9	1 hr
199	Vista West	South	3.1	4608.2	4615.3	4608.2	7.0	87	1 hr	90	1 hr
HDB-8487	Maples	South	3.0	4961.8	4970.6	4964.8	5.9	39	1 hr	22	3 hr
10730	Park Village	South	3.0	4675.5	4685.6	4681.7	3.9	56	1 hr	12	12 hr
DB114		South	2.7	4566.8	4574.6	4566.8	7.8	185	1 hr	184	1 hr
20011	Bicentennial Park	North	2.6	4374.3	4380.0	4376.8	3.2	10	1 hr	5.9	1 hr
DUMDB127	Unknown Airport	North	2.6	4595.5	4604.4	4600.7	3.7	71	1 hr	23	12 hr
740	Highlands	North	2.5	4329.6	4340.6	4336.0	4.7	41	1 hr	27	3 hr
HDB-8536	Bloomfield Farms	South	2.5	4796.1	4803.7	4796.1	7.5	22	1 hr	12	12 hr
268	Camelot	North	2.5	4383.2	4387.8	4386.0	1.8	22	1 hr	5.8	3 hr
HDB-8597		South	2.5	4852.9	4857.9	4852.9	5.1	81	1 hr	21	3 hr
516		South	2.2	4577.4	4581.0	4577.4	3.6	0.0	6 hr	0.0	24 hr
225	Meadow Green Farms Park	South	2.2	4466.7	4474.4	4471.5	2.9	25	1 hr	20	1 hr
HAL-3665		South	2.1	4932.7	4936.7	4932.6	4.1	6.1	1 hr	1.1	6 hr
HF-7995		North	2.0	4799.2	4805.8	4799.2	6.6	44	1 hr	3.5	12 hr
HDB-8550		South	1.9	4712.3	4716.7	4712.3	4.4	36	1 hr	28	1 hr
DUMDB122		North	1.9	4562.3	4566.6	4562.3	4.4	18	1 hr	3.5	1 hr
HAL-2651		South	1.8	4386.9	4392.0	4389.6	2.4	27	1 hr	11	1 hr
HDB-8571		South	1.7	4816.0	4827.3	4816.0	11.3	155	12 hr	122	12 hr
307	Jordan Meadows	North	1.7	4410.6	4415.0	4413.5	1.5	83	1 hr	5.7	1 hr
JCT-426		South	1.6	4453.1	4458.9	4455.3	3.6	8.7	1 hr	4.1	1 hr
JCT-80	Shadow Mountain	North	1.6	4721.1	4725.7	4722.2	3.5	27	1 hr	0.1	24 hr
HAL-2506		South	1.6	5031.3	5035.5	5032.4	3.1	8.4	12 hr	7.9	1 hr
HDB-8901		South	1.4	4554.3	4561.2	4554.3	6.9	192	3 hr	191	3 hr
HDB-8899		South	1.4	4555.8	4563.8	4555.8	8.0	192	1 hr	189	3 hr
JCT-64	West Jordan 3	South	1.4	4773.3	4777.7	4773.3	4.4	34	1 hr	33	12 hr
HF-7995B		North	1.4	4799.0	4805.8	4799.0	6.8	55	1 hr	28	1 hr
HDB-9158	Cemetery Pond	South	1.3	4340.6	4342.9	4340.6	2.3	11	1 hr	6.3	1 hr
JCT-422		South	1.2	4446.4	4451.7	4448.0	3.7	13	1 hr	6.7	1 hr
HDB-8858		South	1.2	4611.5	4617.0	4611.5	5.5	20	1 hr	8.5	3 hr
DB26	Plum Creek	South	1.1	4355.3	4358.6	4357.5	1.1	25	1 hr	14	1 hr

Model ID	Name	Model	Estimated Spill Capacity	Invert Elevation	Spill Elevation	Min Surface Elevation	Depth	Maximum 10 year Flows			
								Inflow	Storm	Outflow	Storm
			ac-ft	ft	ft	ft	ft	cfs	Duration	cfs	Duration
HDB-9171		South	1.1	4354.5	4360.8	4354.5	6.3	20	1 hr	3.8	1 hr
HF-7986		North	1.1	4641.9	4644.0	4641.9	2.1	8.7	1 hr	2.8	24 hr
OFALL-41		South	1.0	4377.1	4385.3	4378.9	6.5	11	1 hr	5.1	12 hr
HDB-8450		South	1.0	5023.4	5027.9	5023.4	4.5	9.4	1 hr	0.9	12 hr
HAL-3698		South	1.0	4986.2	4989.9	4986.8	3.1	16	1 hr	8.7	3 hr
HDB-8561	Copperfield 2	South	0.99	4933.3	4937.7	4933.3	4.4	9.4	1 hr	8.8	1 hr
HDB-8555		South	0.99	4702.2	4708.1	4702.2	5.9	13	1 hr	8.4	3 hr
HDB-9009		South	0.94	4524.9	4528.8	4524.9	4.0	53	1 hr	44	1 hr
JCT-56	Wheatland	South	0.93	4659.7	4664.5	4659.7	4.8	9.8	1 hr	2.9	1 hr
HDB-8505	Bloomfield Heights 2	South	0.92	4898.0	4906.7	4902.0	4.7	24	1 hr	6.1	6 hr
LDB222	Siena Vista	North	0.91	4809.1	4816.2	4811.6	4.6	25	1 hr	6.0	6 hr
OFALL-77		South	0.89	4909.6	4912.5	4909.6	3.0	24	1 hr	16	1 hr
OFALL-89		South	0.84	4440.7	4450.7	4446.3	4.4	6.1	1 hr	5.2	3 hr
1210	Linsey Park	South	0.80	4555.8	4557.9	4555.8	2.0	7.6	24 hr	7.6	24 hr
HDB-8857	Heritage Park	South	0.73	4587.3	4598.8	4588.8	9.9	24	1 hr	18	1 hr
DB148	Handcart	North	0.70	4466.0	4469.7	4468.2	1.5	9.2	1 hr	8.7	1 hr
HF-8082		North	0.67	4572.8	4579.6	4575.6	4.0	6.2	1 hr	4.3	1 hr
10773		South	0.64	4574.1	4580.5	4576.8	3.7	20	1 hr	15	1 hr
HF-8026		North	0.61	4650.2	4657.8	4651.9	5.9	5.5	1 hr	1.1	1 hr
JCT-4710		South	0.60	4924.6	4934.6	4929.7	4.9	1.4	1 hr	1.3	1 hr
OFALL-27	Trimble Creek	South	0.59	4359.7	4366.7	4362.2	4.5	6.5	1 hr	2.2	1 hr
HAL-3638		South	0.54	4706.2	4714.3	4709.9	4.4	6.7	1 hr	1.5	1 hr
625		North	0.52	4335.4	4342.2	4339.9	2.3	21	1 hr	7.5	1 hr
HDB-8898		South	0.52	4568.8	4574.8	4568.8	6.0	1.8	1 hr	2.7	1 hr
HAL-2505		South	0.52	5029.1	5038.9	5034.7	4.2	6.5	1 hr	5.7	1 hr
HDB-8486	Maples 7740s 6700w	South	0.48	4999.5	5003.8	4999.5	4.3	16	1 hr	4.1	1 hr
HDB-8552		South	0.47	4697.4	4701.4	4697.4	3.9	7.9	1 hr	8.1	1 hr
HDB-9167		South	0.41	4503.7	4508.5	4503.7	4.8	23	3 hr	22	3 hr
STOR-20		South	0.41	4507.4	4512.9	4507.4	5.4	33	1 hr	22	3 hr
1168		South	0.40	4714.4	4723.8	4719.2	4.6	7.7	1 hr	5.4	1 hr
HAL-3610		North	0.39	4348.2	4355.4	4350.2	5.2	9.4	1 hr	2.5	1 hr
3136		South	0.37	4974.9	4980.9	4977.3	3.6	23	1 hr	22	1 hr
JCT-4046		South	0.36	4794.1	4798.5	4795.3	3.2	8.9	1 hr	8.9	1 hr
1490	River Oaks	South	0.35	4301.4	4307.9	4304.7	3.2	16	3 hr	11	24 hr
HDB-8521		South	0.34	4763.8	4767.2	4763.8	3.4	9.6	1 hr	9.7	1 hr
HDB-8463		South	0.34	4975.9	4983.0	4980.0	3.0	59	1 hr	53	3 hr
HDB-9107		South	0.34	4438.2	4440.3	4438.2	2.1	8.5	1 hr	3.4	1 hr
1140		South	0.34	4729.4	4735.2	4729.4	5.9	1.9	1 hr	1.9	1 hr
11256	Dora Lee Park	South	0.34	4662.2	4665.4	4663.9	1.4	7.3	1 hr	7.5	3 hr
HDB-8900		South	0.32	4555.7	4563.7	4560.7	3.0	2.5	3 hr	1.6	1 hr
HDB-8496		South	0.29	4940.3	4945.2	4940.3	5.0	11	1 hr	11	1 hr
10994		South	0.28	4689.2	4691.8	4689.2	2.6	3.3	1 hr	3.5	1 hr
STOR-18		South	0.27	4498.4	4505.6	4500.0	5.6	22	3 hr	11	1 hr
HDB-9128		South	0.27	4363.1	4366.0	4363.1	2.9	8.3	1 hr	4.9	1 hr
JCT-856	Three Forks	South	0.23	4933.5	4938.5	4935.2	3.3	7.2	1 hr	7.2	1 hr
HDB-8559	Copperfield 3	South	0.23	4930.2	4933.6	4930.2	3.3	15	1 hr	9.1	1 hr
JCT-2086		North	0.19	4526.6	4535.8	4529.5	6.3	2.5	1 hr	0.3	24 hr
JCT-4222	Woodward Estates	South	0.16	4350.8	4355.3	4352.2	3.1	6.9	1 hr	6.9	1 hr
11938		South	0.16	4626.1	4631.8	4629.4	2.4	9.0	1 hr	6.7	1 hr
JCT-3542		North	0.15	4408.3	4411.7	4408.3	3.4	19	1 hr	14	3 hr
HAL-3618		South	0.14	4724.8	4732.3	4728.4	3.9	3.1	1 hr	1.1	1 hr
HDB-8504	Bloomfield Heights 1	South	0.14	4897.5	4905.5	4900.9	4.7	7.6	1 hr	1.8	1 hr
1599		South	0.14	5017.0	5019.6	5017.0	2.7	4.5	1 hr	1.0	1 hr
1641	Maples Private 4	South	0.13	5010.8	5014.0	5012.5	1.5	5.1	1 hr	6.2	1 hr
HF-8024		North	0.12	4651.8	4656.7	4653.3	3.4	7.8	1 hr	1.5	1 hr
HDB-8882		South	0.10	4514.1	4519.6	4517.6	2.0	27	1 hr	0.6	24 hr
JCT-2092		North	0.10	4527.7	4537.5	4534.0	3.5	15	1 hr	2.5	1 hr
HF-8424		South	0.08	4469.4	4471.5	4469.4	2.1	3.4	1 hr	2.5	1 hr
1642	Maples Private 3	South	0.08	5012.5	5016.8	5014.9	2.0	13	1 hr	13	1 hr
HF-8023		North	0.08	4656.3	4659.4	4656.3	3.1	6.7	1 hr	2.4	1 hr
HDB-9130		South	0.07	4361.6	4363.6	4361.6	2.0	3.2	1 hr	1.5	1 hr
HDB-8485	Maples Private 7740s	South	0.06	4999.5	5001.1	4999.5	1.6	6.1	1 hr	6.1	1 hr
10859		South	0.06	4565.8	4577.2	4575.4	1.9	8.0	1 hr	7.9	1 hr
JCT-984	Cajean Estates	South	0.03	4399.4	4403.1	4402.2	0.9	6.8	1 hr	6.9	1 hr

APPENDIX B

Capital Projects List

Capital Projects List									
Future West Jordan City Projects									
Project ID	Deficiency ID	Priority		Location	Problem Description	Preferred Solution	Project ($)	Impact Fee Eligibility	Impact Fee Cost
Stormwater Detention Facilities									
3	2, 4, 5	6	FY2016-17	3200 W and 6880 South, 6920 South, and 6960 South	City and modeling has identified flooding in this area, especially in the downhill cul-de-sac in 6960 South. Inadequate pipe capacity, low surface elevations, and conflicts with the outlet structure of the Constitution Park detention basin.	Lower Constitution Park base elevations by 2 feet, reconstruct incoming spill structures and piping so flows into the basin spill at or near the basin's lowest elevation, and reconstruct outlet works with a minimum 14-inch diameter orifice plate.	$1,296,000	Not Eligible	0
20	26	23	FY2020-21	8518 South and Festival Way	Low slopes lead to flooding at this location. There is no surface outlet here so pipes must carry the 100-year event.	Replace and lower the culvert under the railroad with a 36-inch diameter pipe. Replace the 15-inch pipe across Bingham View Drive with a 24-inch pipe and increase inlet capacity. Review surface flow options to accommodate 100-year events in case inlets or pipes are clogged. Lower the detention basin at Dora Lee Park to a minimum depth of 4662.5 feet (1.5 feet) with gradual grading, new outlet structure, and new landscaping. Evaluate proper orifice plate sizing at Dora Lee Park.	$260,000	Not Eligible	0
34	New Detention Pond			Barney's Creek U-111	West Jordan City Detention Project Identified in 2007 Master Plan	Construct 66.3 ac-ft detention basin (DB278)	$4,693,000	100%	$ 4,693,000
41	New Detention Pond			9800 South Hwy 111	Detention Project Identified in 2007 Master Plan	Construct 5.6 ac-ft detention basin (DB404)	$633,000	100%	$ 633,000
42	New Detention Pond			9500 South 6800 West	Detention Project Identified in 2007 Master Plan	Construct 10.8 ac-ft detention basin (DB406)	$1,135,000	100%	$ 1,135,000
Creek Culvert Facilities									
35	New Culvert			1500 West Bingham Creek	West Jordan City Culvert Project Identified in 2007 Master Plan	Install 12-foot by 5-foot box culvert (BINC23B)	$338,000	Not Eligible	0
36	New Culvert			9300 South 800 West	West Jordan City Culvert Project Identified in 2007 Master Plan	Install 24-inch RCP under Canal to discharge to Jordan River (TR28B)	$160,000	Not Eligible	0
Stormwater Trunkline Facilities									
2	2	1	FY2014-15	3200 W and 6880 South, 6920 South, and 6960 South	City and modeling has identified flooding in this area, especially in the downhill cul-de-sac in 6960 South. Inadequate pipe capacity, low surface elevations, and conflicts with the outlet structure of the Constitution Park detention basin contribute to flooding.	Install 42-inch interceptor storm drain in 3370 West, 6880 South, 3300 West, and 7000 South from 6775 South to Constitution Park. Separate the inlets in 6880 South, 6920 South, and 6960 South by installing a new parallel storm drain in 3200 West which bypasses the detention basin and connects to Project 1.	$1,323,000	Not Eligible	0
5	8	2	FY2014-15	Straw Circle	City has identified flooding issues here in the past. The required head to spill into the Harvest Park detention basin creates backwater effects. The area is a low spot in the curb and gutter system and has a downsloping driveway.	Due to elevation limitations with the outfall to the canal, piping solutions will have minimal effectiveness in alleviating the problems seen in Straw Circle. Surface drainage is likely critical to drainage in this area and appears to function sufficiently until flows reach the end of Straw Circle. The preferred solution should convey surface flows to the detention basin through a street-to-detention spillway with additional inlets and pipe connection with bubble up box in the basin.	$26,000	Not Eligible	0

Project ID	Deficiency ID	Priority		Location	Problem Description	Preferred Solution	Project ($)	Impact Fee Eligibility	Impact Fee Cost
1	1	3	FY2015-16 & 2016-17	7000 South from 3000 West to the Jordan River	Existing storm drains along 7000 South discharges into the South Jordan Canal and the Jordan River. Plans to discharge flows along 7000 South only to the Jordan River show that storm drains east of the South Jordan Canal do not have sufficient capacity to convey flows to Bateman pond. Additional plans to convey flows from Constitution Park to the Jordan River will also increase flows above the capacity of existing storm drains in 7000 South.	Install trunk line from Constitution Park consisting of 125 feet of 36-inch pipe, 4,670 feet of 42-inch pipe, 2,320 feet of 48-inch pipe, 3,380 feet of 60-inch pipe, 300 feet of 7x4 foot box culvert, and 1,610 feet of 66-inch pipe including outlet works. Route flows in the trunk line through the Bicentennial detention basin and rework the detention basin's inlet and outlet structures accordingly.	$6,132,000	Not Eligible	0
7	10	4	FY2015-16	7055 South and 1115 West	City has identified erosion issues at the west end of 7055 South at this location. Inlets do not connect into the storm drain system.	Replace inlets and connect to new 7000 South storm drain.	$54,000	Not Eligible	0
72	New Trunkline	10	FY2016-17	70th South 4600 West to Airport Rd.	No Storm Drain Pipe.	New 24" Storm Drain Pipe under the Railroad Tracks to Airport Road.	$275,000	Not Eligible	0
22	29, 42	9	FY2015-16	4950 West from Park Vale Drive to 7670 South	Low slopes and pipe capacities in 4950 W Drive prevent flows in 4950 West south of Wood Spring Drive from flowing north.	Add 5 18-inch storm drain pipes with inlets from the north side of 7800 South to the existing storm drain pipes on the south side of 7800 South to prevent water from flowing north along 4950 West. Evaluate proper orifice plate sizing at Bridal Creek detention basin.	$69,000	Not Eligible	0
71	New Trunkline	8	FY2015-16	Intersection of Discovery and Charter Rds. To 5600 West Pond	Local flooding above the existing swale through a yard.	Install vault and 24" and 30" Drain pipe to the 5600 West pond.	$75,000	Not Eligible	0
4	7	11	FY2017-18	Executive Drive between 7265 South and Richland Circle	City has identified flooding issues here in the past. The existing storm drain has low slopes. Modeling reveals that 10-year flows are over pipe capacity. The area is a low spot in the curb and gutter system, and ponding flows flood downhill driveways on the east side of the road. There are also connection issues between dual irrigation and storm drain lines.	Increase street inlet capacity and upsize existing 24-inch pipe to a 36 inch pipe with 30-inch pipe at the south end of Executive Drive. This solution should be done in conjunction with Project 11.	$544,000	Not Eligible	0
8	11	14	FY2018-19	Temple Drive from 6790 South to Storm Drainage near 7000 South	City has identified that this area lacks storm drain conveyances.	Install and upsize storm drains in 1300 West from Bateman Point Drive to 7000 South to 18-inch pipe.	$217,000	Not Eligible	0
11	14	15	FY2018-19	Camelot Way and 7175 South	City has identified flooding in a low spot of curb and gutter. The inlets tie into irrigation/storm drain lines in backyards and lack and access manhole.	Install new 30-inch storm drain with inlets in Camelot Way from 7125 South to the new trunk line in 7000 South.	$250,000	Not Eligible	0
15	3	16	FY2018-19	7480 South and Autumn Drive	City has identified local flooding issues here in the past.	Due to lack of surface options without causing flooding to adjacent homes, this solution should include 100-year storm event capacity. Upsize existing 15-inch outfall to the canal with a 30-inch with increased inlet capacity and add 18-inch storm drain with inlets in Spring Drive.	$78,000	Not Eligible	0
24	31	12	FY2017-18	3400 West from Lady Dove Lane to 9200 South	This area does not have any storm drainage or curb and gutter and lacks a direct path to West Jordan's storm drain system.	Install 750 feet of 18-inch pipe in 3400 West and connect to the existing storm drain in the turn-around east of the Salt Lake Community College. Install 1,900 linear feet of curb and gutter in 3400 West from Lady Dove Lane to the Salt Lake Community College.	$158,000	Not Eligible	0

Project ID	Deficiency ID	Priority		Location	Problem Description	Preferred Solution	Project ($)	Impact Fee Eligibility	Impact Fee Cost
14	6	17	FY2019-20	Harvest Ridge Drive between 7400 South and Jordan Meadows Lane	City has identified flooding issues here in the past. The existing storm drain has low slopes and the required head to spill into the Jordan Meadows detention basin creates backwater effects. The area also has a rolling curb and gutter system and needs high back curb installed.	Install new 24-inch storm drain that will be disconnected from the other storm drain line coming to the detention from the west. This will alleviate the backwater effects in Harvest Ridge Drive.	$162,000	Not Eligible	0
31	39	18	FY2020-21	8660 South and 1841 West	The existing Cajean Estates retention basin does not connect to the storm drain system.	Install 18-inch pipe from the storm drain in Gardner Lane near Shulsen Lane to the Existing storm drain in Redwood Road.	$127,000	100%	127000
21	28	19	FY2020-21	Axel Park Road from 5750 West to Bagley Park Road	The City has received flooding complaints from businesses in this area. Currently there is no storm drain in Axel Park Road. The closest downstream storm drain inlets show significant flooding in the model.	Install new 24-inch pipe in Axel Park Road west of Hawley Park Road and install new 30-inch pipe in Axel Park Road from Hawley Park Road, down Bagley Park Road and across Old Bingham Highway to the drainage ditch.	$898,000	Not Eligible	0
40	New Trunkline	20	FY2020-21	2700 West	West Jordan City Trunkline Project Identified in 2007 Master Plan	Install 15-inch and 30-inch RCP (T158A, T158B, T159C)	$426,000	Not Eligible	0
19	25, 27	24	FY2021-22	4000 West from 8390 South to 7800 South	City staff has identified that the corrugated metal pipe in the west side of the road has deteriorated and needs repair. Current pipe configuration leads to flows in Nike Drive entering against flows in 4000 West.	Upsize existing storm drain in the west side of the road to 24-inch diameter from 8380 South to Nike Drive, to 30-inch diameter from Nike Drive to 7875 South, and to 18-inch diameter from 7875 South to 7800 South.	$640,000	Not Eligible	0
39	New Trunkline	25	FY2021-22	Leo Park Road	West Jordan City Trunkline Project Identified in 2007 Master Plan	Install 18-inch RCP (T450A)	$348,000	37%	$ 128,760
74	New Trunkline	26	FY2021-22	Valley West Rd (8800 S) 3900 West to 3715 W	Local flooding and road damage from water ponding.	Install 1850 LF of 18" pipe in Valley West, 284 LF in 3780 W., and 12 inlets	$375,000	Not Eligible	0
13	16	27	FY2021-22	Sunrise Place 1655 West	Isolated storm drainage in the strip mall bubbles up in the road and floods the strip mall parking lot.	Install new 18-inch storm drain from the existing bubble up grate in Sunrise Place to the existing 18-inch storm drain in Sunrise Place East.	$91,000	Not Eligible	0
73	Slipline Pipe	28	FY2022-23	4000 West 8390 South to 7900 South	Irrigation Pipe made of corrugated metal is leaking underneath the roadway	Slip-line the 24" corrugated pipe	$300,000	Not Eligible	0
12	15	29	FY2022-23	From Harvest Lane to 2290 West in 2200 West	City has identified flooding in this area. Modeling shows that storm drain may have adverse grades and act as bubble up in Arthur Drive.	Install new 21-inch storm drain in 2200 West from Harvest Lane to 7200 South (approximately) with 18-inch pipe and inlets at the intersection of 2200 West and Harvest Lane.	$153,000	Not Eligible	0
38	New Trunkline	30	FY2022-23	Dannon Way	West Jordan City Trunkline Project Identified in 2007 Master Plan	Install 30-inch RCP (T426)	$186,000	6%	$ 11,160
6	9			6645 South and 2200 West	Piped storm drain daylights to an open ditch which is frequently clogged with weeds, debris, and leaves.	Install 27-inch storm drain to replace the open ditch and continue 27-inch along 2200 West to alleviate surcharging.	$267,000	Not Eligible	0
9	12			Drake Lane and Redwood Road	City has identified that ADS pipes crossing Redwood Road are damaged and need replaced.	Install new pipes by pipe bursting or similar trenchless construction.	$154,000	Not Eligible	0
10	13			7600 South and Redwood Road	City has identified that ADS pipes crossing Redwood Road are damaged and need replaced.	Install new pipes by pipe bursting or similar trenchless construction.	$131,000	Not Eligible	0

Project ID	Deficiency ID	Priority		Location	Problem Description	Preferred Solution	Project ($)	Impact Fee Eligibility	Impact Fee Cost
16	17			6600 South and Clernates Drive	The system along 6600 south from Beargrass Road to the intersection of Clernates and along Clernates from 6600 South to Wake Robin Drive is generally overcapacity in a 10-year event. This is causing water to flow in the surficial street system where it is unable to be tracked by the model. This accounts for City observations of inlet capacity issues in this area – which the model reveals are more of a pipe capacity issue.	Upsize piping in the area to be able to convey 10-year flows in the pipe without surcharging. Pipes generally are upsized from 30-inch to 42-inch within the project area along 6600 South and south on Clernates to Saguaro.	$955,000	Not Eligible	0
17	21			Approximately 7660 South from Sunrise Place to Temple Drive	Modeling shows that the existing storm drain/irrigation piping has insufficient capacity to convey flows to the North Jordan Canal.	Upsize storm drain piping to 21-inch following the existing storm/irrigation alignment.	$392,000	Not Eligible	0
23	30			Dannon Way from 5650 West to West Ridge Academy	The roadside drainage ditch lacks sufficient capacity to convey runoff from this area.	Install 24-inch pipe in Dannon Way from Hawley Park Road west to the existing 24-inch line, and install 36-inch pipe from Hawley Park Road east to the existing 36-inch pipe at West Ridge Academy.	$643,000	Not Eligible	0
26	33			2200 West from 7970 South to 7850 South	Several small diameter drain pipes open flow into the Veterans Memorial Park and are frequently clogged.	Install 18-inch pipe in 2200 West from 7970 South (the southernmost existing 6-inch drain) to 7800 South.	$160,000	Not Eligible	0
27	34			Operations project, Heritage Park Detention Basin	The outlet pipe from the Heritage Park Detention Basin does not connect to Bingham Creek and "dead-ends" into the ground, drastically reducing its capacity.	Install 18-inch pipe from the Heritage Park Detention Basin to Bingham Creek with outlet structure into the Creek.	$14,000	Not Eligible	0
Stormwater Operations Projects									
70	New Retention Pond	5	FY2015-16 Operations	9100 South 1510 West	Storm drain pipe dead ends and bubbles up into the street, and floods a home.	Underground Retention Chambers	$65,000	Not Eligible	0
32	43	7	FY2016-17	Leo Park Road and Hawley Park Road	The cross street waterway is in need of repair.	Replace existing waterway with a new waterway and resurface roadway so waterway approach accommodates heavy traffic.	$10,000	Not Eligible	0
18	24	13	FY2018-19	Operations Project, 7800 South Wetland Ponds	Maintenance staff has noted excessive sediment collection between the 2nd and 3rd ponds. Ponds do not have an effective access to remove sediment.	Stabilize slope and add access road between the 2nd and 3rd pond for heavy equipment access during cleaning and sediment removal. Fix control gate from the North Jordan Canal.	$100,000	Not Eligible	0
30	37	21	FY2020-21 Operations	8948 South and 1240 West	Storm drain ends in a bubble up at this location. Drainage from businesses to the west flow into the curb and gutter of 1240 West.	Install 18-inch pipe from the bubble up in 1240 West to the existing storm drain in 9000 South.	$43,000	Not Eligible	0
29	36	22	FY2020-21	7800 South from 3200 West to 3000 West	The storm drain manholes in this area are made out of corrugated metal pipe and need to be replaced. The 27-inch pipe needs to be slip lined.	Replace the four manholes with concrete. Slip line the 27-inch pipe from Jordan Landing Blvd to 3100 West.	$750,000	Not Eligible	0
25	32			Operations Project, 8200 South and 1500 West	Sediment from Bingham Creek frequently clogs the outlet of the storm drain from 8200 South and 1500 West. The storm drain enters the creek at a very low elevation.	Cut back the 18-inch pipe and install outlet structure with apron. Cutting back the pipe will increase the outlet elevation, and the concrete outlet structure will reduce sediment deposit and ease maintenance efforts.	$7,000	Not Eligible	0
28	35			Operations project, Okubos Detention Basin	The basin always has water in it because of the elevation of the outlet structure in relation to the South Jordan Canal.	Replace outlet structure at the Okubos Detention Basin and install a check valve to prevent backflow from the South Jordan Canal.	$30,000	Not Eligible	0
						Master Plan West Jordan City Projects Subtotal	**$ 25,143,000**		**$ 6,727,920**

Project ID	Deficiency ID	Priority	Location	Problem Description	Preferred Solution	Project ($)	Impact Fee Eligibility	Impact Fee Cost
Future Development Projects								
Creek Culvert Facilities								
33	44	FY2017-18	Clay Hollow from the Mountain View Corridor upstream to the box culvert under 7800 South	The natural channel has very steep and deep banks in this area, posing an obstacle for development to build. The City prefers to leave this as an open channel.	Install 6-foot by 4-foot box culvert in Clay Hollow from the Mountain View Corridor upstream to the box culvert under 7800 South.	$1,763,000	Not Eligible	$ -
44	New Culvert		7400 West	Developer Culvert Project Identified in 2007 Master Plan	Install 54-inch RCP (BARC277)	$207,000	100%	$ 207,000
45	New Culvert		6600 West	Developer Culvert Project Identified in 2007 Master Plan	Install 24-inch RCP (BARC281)	$160,000	100%	$ 160,000
46	New Culvert		6800 West	Developer Culvert Project Identified in 2007 Master Plan	Install 48-inch RCP (BARW291)	$198,000	100%	$ 198,000
47	New Culvert		7600 West	Developer Culvert Project Identified in 2007 Master Plan	Install 42-inch RCP (BARW297)	$187,000	100%	$ 187,000
48	New Culvert		9400 South	Developer Culvert Project Identified in 2007 Master Plan	Install 42-inch RCP (BARW300)	$187,000	100%	$ 187,000
51	New Culvert		7300 West	Developer Culvert Project Identified in 2007 Master Plan	Install 36-inch RCP (UNW2273)	$176,000	100%	$ 176,000
52	New Culvert		Parallel to Hwy 111	Developer Culvert Project Identified in 2007 Master Plan	Install 42-inch RCP (UNW2271B)	$550,000	100%	$ 550,000
53	New Culvert		7300 West	Developer Culvert Project Identified in 2007 Master Plan	Install 30-inch RCP (UNW1272A)	$168,000	100%	$ 168,000
54	New Culvert	FY2018-19	7200 West	Developer Culvert Project Identified in 2007 Master Plan	Install 30-inch RCP (UNW1272B)	$168,000	100%	$ 168,000
55	New Culvert	FY2016-17	7700 West to 7400 West	Developer Culvert Project Identified in 2007 Master Plan	Install 24-inch RCP (DRYW211)	$497,000	100%	$ 497,000
56	New Culvert		7700 South from Hwy 111 to Kennecott RR	Developer Culvert Project Identified in 2007 Master Plan	Install 36-inch RCP (DRYW209)	$422,000	100%	$ 422,000
57	New Culvert		7400 West to Hwy 111	Developer Culvert Project Identified in 2007 Master Plan	Install 30-inch RCP (DRYW210A)	$1,097,000	100%	$ 1,097,000
58	New Culvert		Kennecott RR at 7000 South to 7100 South	Developer Culvert Project Identified in 2007 Master Plan	Install 36-inch RCP (DRYW216)	$324,000	100%	$ 324,000
59	New Culvert	FY2020-21	6100 West	Developer Culvert Project Identified in 2007 Master Plan	Install 54-inch RCP (DRYW220)	$207,000	100%	$ 207,000
60	New Culvert	FY2020-21	7600 South	Developer Culvert Project Identified in 2007 Master Plan	Install 30 and 42-inch RCP (DRYW108A)	$701,000	100%	$ 701,000
Stormwater Trunkline Facilities								
37	New Trunkline	FY2016-17	Prosperity Road	Developer Trunkline Project Identified in 2007 Master Plan	Install 750 LF 18-inch RCP (T420)	$164,000	100%	$ 164,000
43	New Trunkline		Wells Park Road	Developer Trunkline Project Identified in 2007 Master Plan	Install 700 LF of 18-inch and 850 LF of 24-inch RCP (T416, T413B)	$367,000	100%	$ 367,000
49a	New Trunkline		9000 South	Developer Trunkline Project Identified in 2007 Master Plan	Install 5,100 LF 18-inch RCP (T293, T292A)	$1,115,000	100%	$ 1,115,000
49b	New Trunkline		9000 South	Developer Trunkline Project Identified in 2007 Master Plan	Install 1,850 LF of 30-inch RCP (T291A)	$550,000	100%	$ 550,000
49c	New Trunkline		9000 South	Developer Trunkline Project Identified in 2007 Master Plan	Install 2,650 LF of 36-inch RCP (T290A)	$895,000	100%	$ 895,000
50a	New Trunkline		6800 West	Developer Trunkline Project Identified in 2007 Master Plan	Install 900 LF of 24-inch RCP (T300B, T291B)	$234,000	100%	$ 234,000
50b	New Trunkline		6800 West	Developer Trunkline Project Identified in 2007 Master Plan	Install 1,900 LF of 30-inch RCP (T406)	$565,000	100%	$ 565,000
61	New Trunkline		6500 West	Developer Trunkline Project Identified in 2007 Master Plan	Install 1300 LF 18-inch RCP (T413A)	$283,000	100%	$ 283,000
62	New Trunkline		9800 South	Developer Trunkline Project Identified in 2007 Master Plan	Install 24-inch RCP (T404)	$143,000	100%	$ 143,000

Project ID	Deficiency ID	Priority		Location	Problem Description	Preferred Solution	Project ($)	Impact Fee Eligibility	Impact Fee Cost
63	New Trunkline			Hwy 111	Developer Trunkline Project Identified in 2007 Master Plan	Install 1,750 LF of 18-inch RCP (T405, T299A)	$425,000	100%	$ 425,000
64	New Trunkline			9400 South	Developer Trunkline Project Identified in 2007 Master Plan	Install 4,000 LF of 24-inch RCP (T299B, T300A)	$1,037,000	100%	$ 1,037,000
65	New Trunkline			Hwy 111	Developer Trunkline Project Identified in 2007 Master Plan	Install 1,700 LF of 36-inch RCP (T292B)	$573,000	100%	$ 573,000
66	New Trunkline		FY2020-21	7100 West and 7800 South	Developer Trunkline Project Identified in 2007 Master Plan	Install 1,600 LF of 24-inch RCP (T233, T234)	$416,000	100%	$ 416,000
67	New Trunkline			7400 South, Hwy 111, and 7500 South	Developer Trunkline Project Identified in 2007 Master Plan	Install 2500 LF of 24-inch and 1400 LF of 36-inch RCP (T214A, T214B, T231)	$1,121,000	100%	$ 1,121,000
68	New Trunkline			6400 West	Developer Trunkline Project Identified in 2007 Master Plan	Install 2600 LF of 18-inch RCP (T217B, T217A)	$566,000	100%	$ 566,000
69	New Trunkline			7400 South and 6600 West	Developer Trunkline Project Identified in 2007 Master Plan	Install 2700 LF of 36-inch RCP (T230, T216A, T216B)	$978,000	100%	$ 978,000
78	New Trunkline			7400 South 6500 West to 6200 West, Pipe complete under the MVC	Developer Trunkline in Future Road	Install 500 LF of 15, 630 LF of 18, and 970 LF of 24-inch pipe in 7400 South, connect to existing pipe under the Mountain View Corridor.	$300,000	100%	$ 300,000
						Master Plan Developer Projects Subtotal	**$16,744,000**		**$ 14,981,000**
						Total West Jordan Master Plan Costs	**$41,887,000**		**$ 21,708,920**
Other Agency Projects									
76	New Culvert			5450 West Old Bingham Hwy	Other Agency Culvert Project Identified in 2007 Master Plan	Replace with 42-inch RCP (OBH3A)	$187,000	NA	
77	New Culvert			9000 South Old Bingham Hwy	Other Agency Culvert Project Identified in 2007 Master Plan	Replace with 36-inch RCP (OBH81B)	$353,000	NA	
75	New Trunkline			6600 South	Other Agency Trunkline Project Identified in 2007 Master Plan	Install 24 and 30-inch RCP (T203, T303, T304)	$1,912,000	NA	
						Master Plan Other Agency Projects Subtotal	**$2,452,000**		

APPENDIX C

Cost Data

AVERAGE STORM DRAIN SYSTEM COST PER FOOT

Diameter (in)	Diameter (ft)	Outside Diameter (ft)	Pipe Material & Installation (1)	Excavation	Imported Bedding Installed	Hauling Excess Native Mat'l	Trench Backfill Installed (3)	Trench Box per Day (2)	Average Daily Output	Trench Box Cost	Top Trench Width (ft)	Road Repair Width (ft)	Asphalt Cost	Manhole Cost	Inlet Cost	Curb & Gutter Cost	Utility Relocation	Trench Dewatering (4)	Total Cost per Foot of Pipe	Cost Out of Street (3)
15	1.3	1.46	37.50	5.13	15.24	4.89	0.90	210.00	150	1.40	4.86	8.86	35.13	9.20	20.25	0.00	0	0.00	130	96
18	1.5	1.75	45.00	5.77	17.24	5.72	0.96	210.00	132	1.59	5.15	9.15	36.12	0.00	20.25	0.00	0	0.00	133	98
21	1.8	2.04	52.00	6.46	19.29	6.62	1.02	210.00	120	1.75	5.44	9.44	37.11	9.20	20.25	0.00	0	0.00	154	118
24	2.0	2.33	62.00	7.18	21.39	7.58	1.08	210.00	100	2.10	5.73	9.73	38.10	9.20	20.25	0.00	0	0.00	169	132
27	2.3	2.63	87.50	7.94	23.54	8.60	1.13	210.00	92	2.28	6.03	10.03	39.08	9.20	20.25	0.00	0	0.00	200	162
30	2.5	2.92	95.00	8.74	25.73	9.69	1.19	210.00	88	2.39	6.32	10.32	40.07	9.20	20.25	0.00	0	0.00	212	174
33	2.8	3.21	108.50	9.58	27.98	10.84	1.25	210.00	76	2.76	6.61	10.61	41.06	9.20	20.25	0.00	0	0.00	231	192
36	3.0	3.50	122.00	10.46	30.27	12.05	1.31	210.00	72	2.92	6.90	10.90	42.04	15.70	20.25	0.00	0	0.00	257	217
42	3.5	4.08	149.00	12.33	35.00	14.66	1.42	210.00	72	2.92	7.48	11.48	44.02	15.70	20.25	0.00	0	0.00	295	253
48	4.0	4.67	172.00	14.35	39.92	17.53	1.54	210.00	64	3.28	8.07	12.07	45.99	21.70	20.25	0.00	0	0.00	337	292
54	4.5	5.25	210.50	16.53	45.03	20.65	1.65	210.00	54	3.89	8.65	12.65	47.96	21.70	20.25	0.00	0	0.00	388	342
60	5.0	5.83	249.00	18.87	50.34	24.02	1.77	210.00	48	4.38	9.23	13.23	49.94	32.00	20.25	0.00	0	0.00	451	403
66	5.5	6.42	297.00	21.36	55.84	27.64	1.89	210.00	44	4.77	9.82	13.82	51.91	32.00	20.25	0.00	0	0.00	513	463
72	6.0	7.00	345.00	24.01	61.54	31.51	2.00	210.00	40	5.25	10.40	14.40	53.89	32.00	20.25	0.00	0	0.00	575	524
78	6.5	7.58	400.00	26.81	67.43	35.64	2.12	210.00	36	5.83	10.98	14.98	55.86	32.00	20.25	0.00	0	0.00	646	593
84	7.0	8.17	455.00	29.77	73.51	40.02	2.23	210.00	32	6.56	11.57	15.57	57.83	32.00	20.25	0.00	0	0.00	717	662
6' x 3' box	6.0	6.00	315.00	19.57	41.67	25.03	1.80	210.00	140	1.50	9.40	13.40	50.50	9.20	20.25	0.00	0	0.00	485	436
8' x 8' box	8.0	8.00	475.00	28.91	53.58	38.74	2.20	210.00	100	2.10	11.40	15.40	57.27	9.20	20.25	0.00	0	0.00	687	633

Reference: 2015 RSMeans Heavy Construction Cost Data
Updated: 9/2014 RBS; 3/2015 GLJ

Assumptions:

N	**Total Import Trench Backfill? (Y/N)**
N	**Dewatering? (Y/N)**
Y	**Catch Basins & Inlets? (Y/N)**
	One side of street C&G is regraded (30' street).
10	v:1h trench side slope (use trench boxes)
3	' average depth to top of pipe
0.33	' thick asphalt road covering
0.75	' thick untreated base course
250	' Average distance between manholes
3	+ Outside Diameter = Bottom trench width
1	' bedding over pipe
0.5	' bedding under pipe
1.5	Inlets per 100 ft of pipe
30%	of curb & gutter is on radius
N	**Include Utility Relocation? (Y/N)**
N	**Include Curb and Gutter? (Y/N)**
43.4%	Inflation since 1998. Used in updating Utility Relocation costs from 1998 tab. Rate from Consumer Price Index (CPI) by US Bureau of Labor Statistics. See http://data.bls.gov/cgi-bin/cpicalc.pl
87.4%	RSMeans City Cost Index for Salt Lake City. NOT USED here.

Costs:

$ 5.82	/CY Native Trench backfill - 31 23 16.13: 3020 $2.93 plus compcation 31 23 23.23: $1.26; convert from loose to compacted volume. $4.19/LCY * 1.39 LCY/ECY
$ 35.72	/CY Imported Select Fill recent bid including haul off of excess plus imported (10 miles one way) = $23.15 + $12.57 = $35.72
$ 6.15	/CY Excavation - 31 23 16.13 1375: 10-14 ft deep, 1 CY excavator, Trench Box.
$ 30.45	/SY 4" Asphalt Pavement - 32 12 16.13: 9" Bank run gravel base course ($23.15/CY), 2" Binder ($9.50/SY), 2" Wear ($10.55/SY [4"=$20.05/SY]) and Hauling ($9.20/LCY * 1.39LCY/ECY * 0.361CY/SY)
$ 2.58	/LF 4" Asphalt cutting - 02 41 19.25: Saw cutting asphalt up to 3" deep ($1.65/LF), each additional inch of depth ($0.93/LF)
$ 2,300.00	/EA 4' Manhole (for pipes =< 2.5' diameter) - 33 49 13.10: Precast 8' deep ($2,300/ea), each add'l foot of depth ($280/VLF)
$ 3,925.00	/EA 5' Manhole (for pipes > 2.5' and <= 3.5') -33 49 13.10: Precast 8' deep ($3,925/ea), each add'l foot of depth ($470/VLF)
$ 5,425.00	/EA 6' Manhole (for pipes > 3.5' and <= 4.5') - 33 49 13.10: Precast 8' deep ($5,425/ea), each add'l foot of depth ($655/VLF)
$ 8,000.00	/EA Manholes (for pipes > 4.5')
$ 1,350.00	/EA Catch basins -33 44 13.13: Curb inlet frame, grate, and curb box, Large 24" x 36" heavy duty
$ 13.97	/LF Curb & Gutter - 32 16 13.13: Steel forms, 24" wide, straight ($12.20/LF) and radius ($14.10). Plus 8" road base ($23.15 /cy or $1.20/lf) Calculated based on percentage of C&G on radius.
$ 10.01	/CY Hauling - 31 23 23.20: 20 CY dump truck, line 4622 and conversion from loose to compacted volume. $7.20/LCY * 1.39 LCY/ECY
$ 210.00	/day Trench Box (7' deep, 16' x 8',31 52 16.10 4500)
$ 28.00	/CY Stabilization Gravel - recent bid
$ 1,107.00	/day Dewatering - 31 23 19.20: 4" diaphragm pump, 8 hrs attended ($980/day). Second pump ($127/day)

NOTES:

(1) Assumes Class 3 RCP (33 41 13.60). 33", 54", 66", & 78" costs were estimated by linear interpolation between sizes. Costs for these sizes may be much higher because they are odd sizes.
(2) 7' deep trench box (16' x 8') - on page 263
(3) Backfill Material & Installation assumes in street. For out of street unit costs, the backfill material cost has been added in place of base course and asphalt.
(4) Dewatering assumes 1' stabilization gravel at the bottom of the trench plus dewatering pumps
(5) Conversion from loose to compacted volumes assumes 125 PCF for compacted density and 90 PCF for loose density. Or (125 PCF/ECY)/(90 PCF/LCY) = 1.39 LCY/ECY
(6) Conversion from cubic yards to square yards for hauling of asphalt paving assumed a total thickness of 13". 3 ft x 3 ft x (13 in)/(12 in/ft) = 0.361 CY/SY

Abbreviations:

VLF	vertical lineal foot
PCF	pounds per cubic foot
LCY	loose cubic yard
ECY	embankment cubic yard

West Jordan City Storm Drain Master Plan Project Costs

Project ID #	Description	Size	unit	Quantity	unit	Unit Cost	Construction Cost	30% - Eng. & Contingency	Total Cost	Percent Existing	Existing Cost	Future Cost
16	New SD Line - in street	42	inch	2100	ft	$289	$606,900					
	New SD Line - in street	54	inch	335	ft	$381	$127,635					
						Project Total	**$734,535**	**$220,361**	**$954,896**	**100%**	**$954,896**	**$0**
15	New SD Line - out of street	30	inch	114	ft	$167	$19,038					
	New SD Line - out of street	18	inch	385	ft	$91	$35,035					
	New inlets	1	ea	2	ea	$3,000	$6,000					
						Project Total	**$60,073**	**$18,022**	**$78,095**	**100%**	**$78,095**	**$0**
14	Harvest Ridge Drive	24	inch	500	ft	$162	$81,000					
							$81,000	**$24,300**	**$162,000**	**100%**	**$162,000**	**$0**
4	New SD Line - in street	18	inch	36	ft	$126	$4,536					
	New SD Line - in street	30	inch	785		$206	$161,710					
	New SD Line - in street	36	inch	1008	ft	$250	$252,000					
						Project Total	**$418,246**	**$125,474**	**$543,720**	**100%**	**$543,720**	**$0**
5	Regrade cul-de-sac	1	ea	1	ea	$20,000	$20,000					
						Project Total	**$20,000**	**$6,000**	**$26,000**	**100%**	**$26,000**	**$0**
6	New SD Line - in street	27	inch	1063	ft	$193	$205,159					
						Project Total	**$205,159**	**$61,548**	**$266,707**	**100%**	**$266,707**	**$0**
7	New SD Line - in street	18	inch	332	ft	$126	$41,832					
						Project Total	**$41,832**	**$12,550**	**$54,382**	**100%**	**$54,382**	**$0**
8	New SD Line - in street	18	inch	1323	ft	$126	$166,698					
						Project Total	**$166,698**	**$50,009**	**$216,707**	**100%**	**$216,707**	**$0**
9	Redwood Road boring 36" casing 30" HDPE at Drake	30	inch	120	ft	$965	$115,800					
	Surface Restoration for Bore Pits						$2,750					
						Project Total	**$118,550**	**$35,565**	**$154,115**	**100%**	**$154,115**	**$0**
10	Redwood Road boring 30" casing 24" HDPE @ 7600 South	24	inch	120	ft	$780	$93,600					
	Surface Restoration for Bore Pits						$7,500					
						Project Total	**$101,100**	**$30,330**	**$131,430**	**100%**	**$131,430**	**$0**
11	New SD line - in street	30	inch	934	ft	$206	$192,404					
						Project Total	**$192,404**	**$57,721**	**$250,125**	**100%**	**$250,125**	**$0**
12	New SD Line - in street	18	inch	72	ft	$126	$9,072					
	New SD Line - in street	21	inch	737	ft	$147	$108,339					
						Project Total	**$117,411**	**$35,223**	**$152,634**	**100%**	**$152,634**	**$0**
13	New SD line - in street	18	inch	557	ft	$126	$70,182					
						Project Total	**$70,182**	**$21,055**	**$91,237**	**100%**	**$91,237**	**$0**
3	Lower pond - excavaton and surface restoration			1	ea	$950,780	$950,780					
	new low flow piping	18	inch	170	ft	$91	$15,470					
	new inlet and outlet structures			1	ea		$31,000					
						Project Total	**$997,250**	**$299,175**	**$1,296,425**	**100%**	**$1,296,425**	**$0**
2	New SD Line - in street	18	inch	336	ft	$126	$42,336					
	New SD Line - in street	24	inch	459	ft	$162	$74,358					
	New SD Line - out of street	24	inch	199	ft	$125	$24,875					
	New SD Line - in street	30	inch	255	ft	$206	$52,530					
	New SD Line - in street	36	inch	310	ft	$225	$69,750					
	New SD Line - in street	42	inch	1188	ft	$289	$343,332					
	New SD Line - in street	48	inch	1243	ft	$330	$410,190					
						Project Total	**$1,017,371**	**$305,211**	**$1,322,582**	**100%**	**$1,322,582**	**$0**

Project ID #	Description	Size	unit	Quantity	unit	Unit Cost	Construction Cost	30% - Eng. & Contingency	Total Cost	Percent Existing	Existing Cost	Future Cost
1	New SD Line - in street	36	inch	125	ft	$250	$31,250					
	New SD Line - in street	42	inch	4670	ft	$289	$1,349,630					
	New SD Line - in street	48	inch	2320	ft	$330	$765,600					
	New SD Line - in street	60	inch	3380	ft	$444	$1,500,720					
	Box Culvert	7x4	feet	300	ft	$850	$255,000					
	New SD Line - in street	66	inch	1610	ft	$506	$814,660					
						Project Total	**$4,716,860**	**$1,415,058**	**$6,131,918**	**100%**	**$6,131,918**	**$0**
17	New SD Line - in street	21	inch	2049	ft	$147	$301,203					
						Project Total	**$301,203**	**$90,361**	**$391,564**	**100%**	**$391,564**	**$0**
18	Add Maintenance Access to 7800 S Detention	1	ea	1	ea	$50,000	$50,000					
	Fix control gate from the North Jordan Canal	1	ea	1	ea	$27,000	$27,000					
						Project Total	**$77,000**	**$23,100**	**$100,100**	**100%**	**$100,100**	**$0**
19	New SD Line - in street	24	inch	900	ft	$162	$145,800					
	New SD Line - in street	30	inch	2400	ft	$206	$494,400					
	New SD Line - in street	18	inch	550	ft	$126	$69,300					
						Project Total	**$709,500**	**$212,850**	**$922,350**	**100%**	**$922,350**	**$0**
20	New SD Line - in street	24	inch	36	ft	$162	$5,832					
	Culvert - boring under railroad	36	inch	125	ft	$900	$112,500					
	Excavation (1.5 acres x 1.5 feet = 3,630 c.y.)	2.25	ac-ft	3630	cy	$8	$29,040					
	Landscaping for 1.5 acres	1.5	ac	1.5	ac	$22,000	$33,000					
	Oulet structure	1	ea	1	ea	$20,000	$20,000					
						Project Total	**$200,372**	**$60,112**	**$260,484**	**100%**	**$260,484**	**$0**
21	New SD Line - in street	24	inch	1210	ft	$162	$196,020					
	New SD Line - in street	30	inch	2400	ft	$206	$494,400					
						Project Total	**$690,420**	**$207,126**	**$897,546**	**100%**	**$897,546**	**$0**
22	New SD Line - in street	18	inch	400	ft	$133	$53,200					
	New SD Line - in street	24	inch	0	ft	$162	$0					
						Project Total	**$53,200**	**$15,960**	**$69,160**	**100%**	**$69,160**	**$0**
23	New SD Line - in street	24	inch	550	ft	$162	$89,100					
	New SD Line - in street	36	inch	1620	ft	$250	$405,000					
						Project Total	**$494,100**	**$148,230**	**$642,330**	**100%**	**$642,330**	**$0**
24	New SD Line - in street	18	inch	750	ft	$126	$94,500					
	Install curb and gutter on both sides of the road	1	ea	1900	ft	$14	$26,600					
						Project Total	**$121,100**	**$36,330**	**$157,430**	**100%**	**$157,430**	**$0**
25	Install Concrete Outlet Structure and Apron	1	ea	1	ea	$5,000	$5,000					
						Project Total	**$5,000**	**$1,500**	**$6,500**	**100%**	**$6,500**	**$0**
26	New SD Line - in street	18	inch	975	ft	$126	$122,850					
						Project Total	**$122,850**	**$36,855**	**$159,705**	**100%**	**$159,705**	**$0**
27	New SD Line - out of street	18	inch	115	ft	$91	$10,465					
						Project Total	**$10,465**	**$3,140**	**$13,605**	**100%**	**$13,605**	**$0**
28	Replace SD Line - out of street	18	inch	100	ft	$91	$9,100					
	Overflow Structure	1	ea	1	ea	$8,000	$8,000					
	Tideflex Valve neoprene 35-1	18	inch	1	ea	$5,300	$5,300					
						Project Total	**$22,400**	**$6,720**	**$29,120**	**100%**	**$29,120**	**$0**
29	Replace 4 manholes	6	ft	4	ea	$5,425	$21,700					
	Slip line 27 inch line (with 24-inch HDPE)	24	inch	6425	ft	$26	$163,838					
						Project Total	**$185,538**	**$55,661**	**$241,199**	**100%**	**$241,199**	**$0**
30	New SD Line - in street	18	inch	260	ft	$126	$32,760					
						Project Total	**$32,760**	**$9,828**	**$42,588**	**100%**	**$42,588**	**$0**
31	New SD Line - in street	18	inch	770	ft	$126	$97,020					

Project ID #	Description	Size	unit	Quantity	unit	Unit Cost	Construction Cost	30% - Eng. & Contingency	Total Cost	Percent Existing	Existing Cost	Future Cost
31						**Project Total**	**$97,020**	**$29,106**	**$126,126**	**100%**	**$126,126**	**$0**
32	Waterway replacement	1	ea	1	ea	$7,700	$7,700					
						Project Total	**$7,700**	**$2,310**	**$10,010**	**100%**	**$10,010**	**$0**
33	Clay Hollow Conduit	6x4	ft	3110	ft	$436	$1,355,960					
						Project Total	**$1,355,960**	**$406,788**	**$1,762,748**	**0%**	**$0**	**$1,762,748**
						Totals	**$13,545,259**	**$4,063,578**	**$17,665,536**		**$15,902,788**	**$1,762,748**