# STORMWATER

## MASTER PLAN REPORT

September 2015

**Prepared For:**

**Nibley City Corporation**
455 West 3800 South
Nibley, UT 84321

**Prepared by:**

**J-U-B ENGINEERS, Inc.**
1047 South 100 West,
Suite 180
Logan, UT 84321

# TABLE OF CONTENTS


**EXECUTIVE SUMMARY** ........ **3**

**REPORT** ........ **5**

**I. INTRODUCTION** ........ **5**

A. Background ........ 5

B. Tasks ........ 5

**II. EXISTING SYSTEM EVALUATION** ........ **6**

A. Introduction ........ 6

B. Existing System Mapping ........ 6

C. Existing System Key Modeling Methods and Assumptions ........ 7

D. Existing System Evaluation Conclusions ........ 8

**III. MASTER PLAN & RELIEF ALTERNATIVES** ........ **10**

A. Introduction ........ 10

B. Master Plan Key Modeling Methods and Assumptions ........ 10

C. Future Build-out Model Development ........ 10

D. Build-out Ponds ........ 11

1. Temporary Ponds ........ 11

2. Future City Ponds ........ 11

3. Future Developer Ponds ........ 12

E. Build-out Pipes ........ 12

F. Build-out Projects ........ 12

G. Low Impact Development Alternatives ........ 14

**IV. STORM WATER MS4 REGULATIONS** ........ **14**

**V. CONCLUSIONS & RECOMMENDATIONS** ........ **15**

A. Conclusions ........ 15

B. Recommendations ........ 15

# LIST OF TABLES, FIGURES AND GRAPHS

Table II-1: Existing Detention/RetentionPond Performance ........ 9

Table III-1: Proposed Build-out Projects ........ 13

# APPENDICES

Appendix A: Report Figures

Figure 1: Existing Storm Drain System Map

Figure 2: Land Use Map

Figure 3: Storm Drain System Build-out Map

# EXECUTIVE SUMMARY

## Introduction

Nibley City hired J-U-B ENGINEERS, Inc. (J-U-B) to evaluate the capacity of the existing storm drain collection system and propose system improvements to accommodate projected growth. This master plan provides direction for the construction of system improvements to continue serving the residents of Nibley City in the future. The following tasks were completed as part of the evaluation and are further described in the master plan report.

- Mapped the existing storm drain system using Geographic Information Systems (GIS) mapping software with data that was collected by City staff.
- Created a storm drain computer model scenario to simulate the existing flows in the existing system that result from a 25 year 1 hour storm event to determine if there are any existing system deficiencies.
- Created a storm drain model scenario to simulate the projected runoff flows created under build-out conditions assuming regional detention ponds will be utilized in the system.
- Sized future pipes and regional ponds to serve the entire City at build-out.

## Conclusions and Recommendations

The following overall conclusions and recommendations are based on the results of this master plan:

### *Conclusions*

- The existing collection system has adequate capacity for a 25 year 1 hour storm.
- Some of the existing drainage sumps are plugged and no longer function properly.
- While the ponds in the system did not overtop in the existing model during the design storm, they could overtop in a larger storm.
- City staff reported that many of the existing ponds do not drain well and residents complain that they always have water in them.
- Construction of a collection system to serve at build-out will require a large amount of piping and regional detention ponds. The estimated cost to design and construct the build-out system is $30,307,500.

## *Recommendations*

- Monitor and repair existing sumps as needed to maintain functionality.
- Evaluate low impact design alternatives and adopt development standards to reduce runoff from new development. This may in turn reduce the future infrastructure costs.
- Follow the conceptual plan identified in this report for future system additions until low impact design alternatives can be evaluated and integrated into the city design standards and master plan.

# I. INTRODUCTION

## A. Background

The Nibley City Stormwater collection system is diverse and changing over time. As development occurs, the existing canals, ditches, and fields are being replaced with homes, businesses and roads. An understanding of the existing system and how it functions is important for future expansion, operation and maintenance.

Nibley City has grown very quickly over the last 15 years with 3.5% growth rate. The new developments are increasing the runoff from the previous undeveloped sites and are adding infrastructure to convey the stormwater away from the development. Nibley needs a plan to follow as the growth continues. The City hired J-U-B ENGINEERS, Inc. (J-U-B) to study and complete this storm drain master plan.

The City directed J-U-B to evaluate a system that would serve the entire city at build-out with regional detention ponds. The regional ponds would be mostly built in city parks and would serve multiple subdivisions/developments.

## B. Tasks

The following tasks were completed as part of this master plan and the outcomes and results are documented in this report:

- Survey and map the existing collection system. The City collected the inverts and pipe sizes.
- Complete an aerial LiDAR survey to create a topographic map.
- Evaluate the existing system to determine current capacity status.
- Identify and create a list of projects needed to serve the City at build-out assuming regional ponds will be constructed.
- Provide an overall list of conclusions and recommendations drawn from the master plan study.

A central component of these tasks is the use of computer modeling software to simulate current and future stormwater system capacity. The software and planning parameters (see KEY ASSUMPTIONS) used for this study are discussed in greater detail in the following sections.

# II. EXISTING SYSTEM EVALUATION

## A. Introduction

The evaluation of the existing storm drain collection system included mapping the system and creating a computer hydrology and hydraulic model to simulate the actual collection system and runoff conditions. The model was built using InfoSWMM Version 5.1 software created by Innovyze. InfoSWMM is fully integrated into ArcGIS which allows for easy assimilation of other city mapping that is contained in GIS shape files. The ArcGIS software used was Version 10.2.2.

The model is used to calculate the runoff from drainage basins (subcatchments) which are delineated based on existing contours and roadways. The model routes flows from the subcatchments into the pipes and then hydraulically routes them through the piping network to either an outfall or detention or retention pond. The model allows the pipes in the system to be evaluated to assess the existing hydraulic conditions.

## B. Existing System Mapping

The existing storm drain collection system has been mapped as part of this project based on existing data. Meetings were held with City staff during the model creation to review locations of the main drainage channels and outfalls, as well as detention/retention ponds and identify how varying aspects of the storm drain system function.

An overview of the existing storm drain collection system is given in Figure 1 in Appendix A (See Appendix A for all report figures). The following items are shown in the figure:

- Storm drain pipes
- Existing detention and retention ponds
- Existing City boundary
- Aerial image of the City
- Street labels
- Drainage sumps
- Computer modeling

The computer hydraulic model was created to simulate the existing system flow conditions and to check the capacity of the system under projected future flow conditions. Unlike a sewer system that uses flow meters to calibrate the model, storm drain modeling requires the knowledge of those that operate or manage the storm drain system to provide input into areas that flood and areas that do not. It provides a "gut check" to determine if the model is accurate or needs model input assumption adjustments.

## C. Existing System Key Modeling Methods and Assumptions

A computer model of a storm drain system is based on assumptions that characterize the area and system components. The key assumptions used in the Existing System Model are as follows:

- The SCS curve number method was used to calculate the runoff from each subcatchment. The SCS method uses curve numbers to represent the characteristics of a subcatchment. A higher curve number represents a soil and land use type that does not allow infiltration (ex. Road curve number=98); a lower curve number correlates to a soil and land use type that does allow infiltration (eg. Soil type A and Park = 59)

- A composite curve number was calculated for each subcatchment using soil data and the most current zoning map. Each soil type/land use combination was given a curve number. The percentage of that soil/land use combination compared to the total subcatchment area was calculated. The composite curve number is calculated as a weighted average of all the soil/land use type combinations within its boundaries.

- Rim elevations for manholes, catch basins and junction boxes were estimated based on the Lidar survey data which is accurate to 6 inches. The difference in elevation from rim elevations to flow lines was collected by the City by measuring each manhole, storm drain catch basin, and storm drain box.

- The design storm for the model is a 25 year 1 hour storm event and rainfall depths were taken from the NOAA Atlas 14 website.

- Existing pipe sizes were measured by the City and input into GIS before being converted to the pipe layer within the model.

- The existing scenario only modeled developed areas with infrastructure. Open fields were not modeled.

- Main drainage ways and ditches were added to the model to convey flows past HWY 89 or to another discharge location.

- Detention/retention basins were created in the model from contours to determine the amount of storage within each basin. Outlet information was added to the model based on data that was collected by the City.

- The capacities of the retention and detention ponds are based on full ponds without any freeboard.

- The existing system discharges stormwater at several locations into existing irrigation ditches and canals. These ditches and canals were **NOT** modeled to verify that they provide adequate capacity.

- Not all of the storm drain lines in the City were modeled. The pipes needed to route flows from the delineated subcatchment to the outfall, detention, or retention pond were modeled.

## D. Existing System Evaluation Conclusions

The results of the existing collection system modeling and evaluation offer some conclusions:

- The majority of the existing pipes have capacity to handle existing flows produced by a 25 year 1 hour storm event. The exception to this is a 4" pipe at the end of the cul-de-sac on 2775 W and approximately 540 W. This pipe needs to be upsized to the minimum Nibley City storm drain pipe size.

- There are several sumps through the system which often are inundated during storms.

- All of the existing detention/retention ponds (Figure 1) have adequate capacity to hold a 25 year 1 hour storm event. Table 2-1 lists each pond and information about how full each pond is during the design storm. The ponds that currently have excess capacity could support either a larger storm event or provide storage for future development.

*Table II-1: Existing Detention/Retention Pond Performance*

| Detention/Retention Pond ID | At or Below Capacity | Max. % Full[2] | Maximum Depth modeled (ft) | Total Pond Depth (ft)[1] | Remaining Available Depth[2] (ft) |
|---|---|---|---|---|---|
| 2500S1350W (STOR-70) | Below Capacity | 78.2 | 2.3 | 3.0 | 0.7 |
| NIBLEYGARDENS2 | Below Capacity | 76.8 | 1.8 | 2.3 | 0.5 |
| PARK | Below Capacity | 72.6 | 1.0 | 1.3 | 0.3 |
| PETERSONSTORE2 | Below Capacity | 70.2 | 2.6 | 3.2 | 0.6 |
| NIBLEYGARDENS1 | Below Capacity | 68.5 | 5.5 | 6.0 | 0.5 |
| CLEARCREEK1 | Below Capacity | 67.1 | 1.4 | 1.8 | 0.4 |
| STONEBRIDGE-TEMP | Below Capacity | 63.4 | 1.0 | 1.5 | 0.5 |
| 720W_3480S | Below Capacity | 61.1 | 1.0 | 1.5 | 0.5 |
| CITYOFFICEPOND | Below Capacity | 56.9 | 1.1 | 2.0 | 0.9 |
| FOXBOROUGHWEST | Below Capacity | 55.5 | 3.3 | 4.2 | 0.9 |
| SUNRISE5 | Below Capacity | 55.2 | 1.9 | 3.2 | 1.3 |
| MEADOWVIEW2 | Below Capacity | 53.1 | 0.7 | 1.3 | 0.6 |
| BUSSINESSPARK2 | Below Capacity | 50.3 | 1.4 | 2.0 | 0.7 |
| WESTWOOD | Below Capacity | 48.0 | 1.8 | 3.0 | 1.2 |
| 2100S US89 (STOR-194) | Below Capacity | 47.4 | 1.1 | 2.0 | 0.9 |
| 2850S_450W | Below Capacity | 46.2 | 1.6 | 2.0 | 0.4 |
| SUNRISE2 | Below Capacity | 40.9 | 2.9 | 3.3 | 0.4 |
| CLEARCREEK4 | Below Capacity | 40.0 | 1.4 | 3.0 | 1.6 |
| MEADOWVIEW | Below Capacity | 38.6 | 0.7 | 1.6 | 0.9 |
| CLEARCREEK2 | Below Capacity | 37.4 | 3.0 | 3.6 | 0.6 |
| 1350W3200S | Below Capacity | 37.1 | 1.3 | 3.0 | 1.7 |
| BUSINESSPARK4 | Below Capacity | 36.0 | 1.7 | 3.0 | 1.3 |
| BUSINESSCOMPLEX | Below Capacity | 34.0 | 5.5 | 7.0 | 1.5 |
| COTTAGE | Below Capacity | 31.0 | 1.2 | 3.3 | 2.1 |
| HERITAGESCHOOL | Below Capacity | 30.7 | 0.5 | 1.5 | 1.0 |
| CHURCH2600_S_2 | Below Capacity | 30.2 | 0.4 | 1.0 | 0.6 |
| CHURCH_2840_SOUTH | Below Capacity | 24.8 | 0.4 | 1.4 | 1.0 |
| ANDERSONESTATES2 | Below Capacity | 24.2 | 0.7 | 2.6 | 1.9 |
| MAVERICK | Below Capacity | 24.1 | 1.1 | 2.5 | 1.4 |
| PETERSONSTORE1 | Below Capacity | 22.2 | 0.3 | 1.0 | 0.7 |
| BROOKFIELD | Below Capacity | 21.4 | 1.0 | 3.7 | 2.7 |
| 2200SUS89 (STOR-196) | Below Capacity | 21.1 | 0.6 | 2.0 | 1.5 |
| FOXBOROUGHEAST | Below Capacity | 19.7 | 2.6 | 4.5 | 1.9 |
| ASHBERRY2 | Below Capacity | 19.4 | 0.6 | 2.4 | 1.8 |
| ANDERSONESTATES | Below Capacity | 18.5 | 0.5 | 2.3 | 1.8 |
| ASHBERRY1 | Below Capacity | 18.4 | 0.7 | 3.2 | 2.5 |
| CHURCH2600_S_1 | Below Capacity | 15.2 | 0.6 | 2.3 | 1.7 |
| CLEARCREEK3 | Below Capacity | 15.2 | 2.1 | 3.7 | 1.6 |
| ZOLLINGERWEST | Below Capacity | 15.2 | 2.4 | 4.0 | 1.6 |
| ZOLLINGEREAST | Below Capacity | 11.9 | 2.5 | 4.4 | 1.9 |
| CHURCHHERRITAGEHILLS | Below Capacity | 10.2 | 3.6 | 6.3 | 2.7 |
| SUNRISE4 | Below Capacity | 8.7 | 0.4 | 4.0 | 3.6 |
| BUSSINESSPARK1 | Below Capacity | 8.5 | 3.7 | 6.1 | 2.4 |
| BUSSINESSPARK3 | Below Capacity | 6.8 | 1.0 | 4.0 | 3.0 |
| VOLLEYBALLPIT | Below Capacity | 6.3 | 0.5 | 2.0 | 1.5 |
| SUNRISE1 | Below Capacity | 5.0 | 0.2 | 3.0 | 2.8 |
| SUNRISE3 | Below Capacity | 5.0 | 0.2 | 3.0 | 2.8 |
| SHADOWBROOK | Below Capacity | 0.2 | 1.4 | 4.5 | 3.1 |

*Notes:*

1. *Total depth may include the depth of the pond inlet box which may be lower than the pond invert.*
2. *This value does NOT include freeboard in the pond.*

# III. MASTER PLAN & RELIEF ALTERNATIVES

## A. Introduction

The master planning portion of the study involves applying future growth projections in the model, within the study area, to identify conceptual system detention ponds and pipes needed for the projected build-out flows. Build-out is defined as the future condition when all of the areas within the study area are developed to the land use densities shown in Figure 2 included in Appendix A.

## B. Master Plan Key Modeling Methods and Assumptions

The following key assumptions were used for the build-out master plan model:

- Regional detention ponds and associated piping will be built by the City in large areas that are currently undeveloped.
- Smaller ponds will be constructed by developers for the smaller undeveloped areas as they develop. These smaller areas are typically located around areas that are already developed.
- The annual population growth rate is 3.5%, which is the same growth rate that was used in the sewer master plan and was provided by the City.
- The estimated build-out population served by the collection system is 12,570 based on the planned densities. It is estimated that the build-out population will be reached in year 2059 based on the assumed growth rate.
- The ground surface layer was created in the model using Light Detection and Ranging (LIDAR) data that was provided by Aerographics, Inc.
- The master plan study area covers the area within the study area boundary as shown in Figure 1 in Appendix A.
- Stormwater runoff from future developments will be limited to 0.1 cfs per acre based on the current Nibley City storm drain standards.

## C. Future Build-out Model Development

A build-out system was laid out to take advantage of the natural slope of the land and low-lying areas. For example, the future storm drain trunk lines installed to serve the undeveloped areas in the south part of the City will most likely flow into the slough located west of 1500 West in order to take advantage of the natural ground slope from east to west.

A detailed land survey will be required during design of the future pipes to ensure that they can connect to the existing collection system without the use of pumps. The final decision on storm drain service to these areas will be determined by Nibley City policy and land development activity.

## D. Build-out Ponds

The ponds required to serve the City at build-out are separated into three categories:

- Temporary
- Future City
- Future Developer

The ponds that are needed to serve the City at build-out are shown in the Storm Drain System Build-out Figure 3 in (Appendix A).

### 1. Temporary Ponds

The City has identified a methodology for building City-owned retention ponds by requiring temporary ponds to be installed before a large regional facility can be installed. This allows time for the City to develop a plan for installing the permanent pond. For the City to build and use a regional detention facility the temporary pond would need to be constructed with the first development. As subsequent developments occur, additional or replacement temporary ponds must be constructed to serve the additional phasing of the development. As development nears completion, the City-owned pond will be constructed and the developer will provide the infrastructure to connect the entire development to the City-owned pond as the temporary ponds are eliminated.

### 2. Future City Ponds

There are many large undeveloped areas within the planning boundary that will develop in the future. The City council decided to model and plan a storm drain system that utilizes regional detention facilities where possible. The large undeveloped areas can utilize regional ponds through proper planning and coordination with developers. Regional ponds allow the City to create parks and more efficient ways of maintaining the property when compared to smaller, private ponds. For the City to build and use a regional detention facility the regional pond would need to be constructed with the first development and then subsequent developments could be tied into it. The pond itself could be phased by size, but would need to be installed with the first development. As more phases or subdivisions are added the pond size would be increased accordingly.

**3. Future Developer Ponds**

Smaller undeveloped pieces of land are scattered around the City between areas that are currently developed. These areas will need to have detention facilities constructed when they are developed. These will be smaller ponds because they serve smaller areas. For the build-out system, it is assumed that these ponds will be paid for and be constructed by developers. The developer detention facilities were limited to smaller undeveloped parcels where tying into a larger City owned regional ponds was not feasible.

## E. Build-out Pipes

Large pipes will be needed to transport flows between the future City ponds and on to the natural drainage ways (Figure 3). Most of these pipes will run from the east to the west as most of the natural drainages are on the west side of the study area.

## F. Build-out Projects

The future City ponds and the pipes needed to connect the ponds and convey runoff water to the natural drainage ways are split into numbered projects (Figure 3). These projects are also listed in Table 3-1 with a description and the associated opinions of probable cost.

*Table III-1: Proposed Build-out Projects*

| *BUILD-OUT: PROPOSED FUTURE PROJECTS* | | |
|---|---|---|
| *Project #* | PROJECT DESCRIPTION | OPINION OF PROBABLE COST |
| *1* | Regional Basin and Piping (2600 South 1350 West) | $ 2,773,300 |
| *2* | 3200 S Nibley City office basin expansion for future development | $ 2,700 |
| *3* | 3200 S Connect developer piping to slough (3200 S/1600 West to Slough) | $ 705,900 |
| *4* | Regional Basin and Piping (2800 S US-89) | $ 480,600 |
| *5* | Main Street Piping (Main Street/4000 South to 3200 South) | $ 2,061,800 |
| *6* | Regional Basin and Piping (2700 South 90 West) | $ 213,600 |
| *7* | Regional Basin and Piping (2900 South 550 West) | $ 89,700 |
| *8* | Regional Basin and Piping (3000 South 400 West) | $ 78,400 |
| *9* | Regional Basin and Piping (3000 South 900 West) | $ 115,400 |
| *10* | Regional Basin and Piping (3000 South 1100 West) | $ 67,200 |
| *11* | Regional Basin and Piping (3000 South 1300 West) | $ 215,300 |
| *12* | Future Development Piping (3200 South 1275 West) | $ 361,400 |
| *13* | Regional Basin and Piping (2800 South 1600 West) | $ 521,000 |
| *14* | Regional basin and Piping (2500 South 1350 West) | $ 445,500 |
| *15* | Regional Basin and Piping (2500 South US-89) | $ 180,400 |
| *16* | Regional Basin and Piping (2250 South 1300 West) | $ 194,300 |
| *17* | Regional Basin and Piping (2200 South US-89) | $ 986,500 |
| *18* | Regional Basin and Piping (2100 South 800 West) | $ 474,900 |
| *19* | Regional Basin and Piping (3200 South US-89) | $ 238,500 |
| *20* | Regional Basin and Piping (3200 South 1900 West) | $ 1,263,500 |
| *21* | Regional Basin and Piping (3390 South 1200 West) | $ 138,600 |
| *22* | Regional Basin and Piping (3500 South US-89) | $ 293,100 |
| *23* | Regional Basin and Piping (3300 South 1900 West) | $ 1,135,000 |
| *24* | Regional Basin and Piping (3400 South 1500 West) | $ 430,200 |
| *25* | Regional Basin and Piping (3600 South 2400 West) | $ 385,800 |
| *26* | Regional Basin and Piping (3650 South 1900 West) | $ 1,640,000 |
| *27* | Regional Basin and Piping (3600 South 1500 West) | $ 237,100 |
| *28* | Regional Basin and Piping (3500 South 1000 West) | $ 261,900 |
| *29* | Regional Basin and Piping (3650 South 640 West) | $ 87,200 |
| *30* | Regional Basin and Piping (3750 South 640 West) | $ 939,700 |
| *31* | Regional Basin and Piping (4000 South 2000 West) | $ 1,643,300 |
| *32* | Regional Basin and Piping (4000 South 1900 West) | $ 1,271,500 |
| *33* | Regional Basin and Piping (4000 South 1500 West) | $ 429,200 |
| *34* | Regional Basin and Piping (4000 South 1200 West) | $ 459,200 |
| *35* | Regional Basin and Piping (4000 South 700 West) | $ 293,400 |
| *36* | Regional Basin and Piping (4200 South 200 West) | $ 1,662,900 |
| *37* | Regional Basin and Piping (3400 South 950 West) | $ 1,383,400 |
| *38* | Regional Basin and Piping (3570 South 640 West) | $ 3,038,700 |
| *39* | Regional Basin and Piping (4000 South 475 West) | $ 3,014,500 |
| *40* | Regional Basin and Piping (2600 South 250 West) | $ 92,900 |
| | *TOTAL FUTURE TRUNK LINE COSTS* | $ 30,307,500 |

The estimates in table 3-1 include costs for the City to purchase and build the City owned detention facilities. The detention facilities could be combined, but the pipes between the master plan detention facilities would need to be remodeled. The developer detention facilities are not included in Table 3-1.

## G. Low Impact Development Alternatives

The above analysis identified the piping, detention and retention projects needed to serve the City using regional detention ponds. Several meetings were held between J-U-B and city staff members during the master plan process in order to guide the master plan. J-U-B identified the projects that would be needed to serve the city at build-out. At that time conceptual opinions of probable cost were created to construct the needed build-out projects. At the time JUB and the city met and it was determined that the city should investigate Low impact development alternatives. Because of this approach, all of the build-out projects are listed in one table

The costs are large. Because of this, the City should investigate low impact development alternatives in place of constructing the regional pond system. In some areas the City may need to install pipes and ponds. However, the City should investigate the following LID options to determine which options work best for the conditions in Nibley City.

- Sampling of LID Options
    - Drainage/retention swells in park strips
    - Change the onsite runoff allowance from 0.1 cfs per acre to no allowed runoff.
    - Maintainable Sumps
    - On site retention ponds
    - Medians in roads with swells
    - Permeable pavements
    - Underground park strip detention storage
- Bio-retention
- Road design

## H. Stormwater MS4 Regulations

Nibley is a Municipal Separate Stormwater Sewer System (MS4) community which required to meet the requirements under the phase stormwater permit. The MS4 permit states:

"All Permittees shall develop, implement and enforce a program…for the hydrology associated with new development to mirror the pre-development hydrology of the previously undeveloped site…"

This means that as new development occurs the runoff from new development must match the pre-existing runoff peak flow rate and total volume. This typically would require a pond that not only provides detention to decrease the post development peak flow rate to match the pre-developed peak runoff flowrate, but also a certain amount of retention to decrease the post development total runoff volume to the predevelopment total runoff volume.

# IV. CONCLUSIONS & RECOMMENDATIONS

The following overall conclusions and recommendations are based on the results of this master plan:

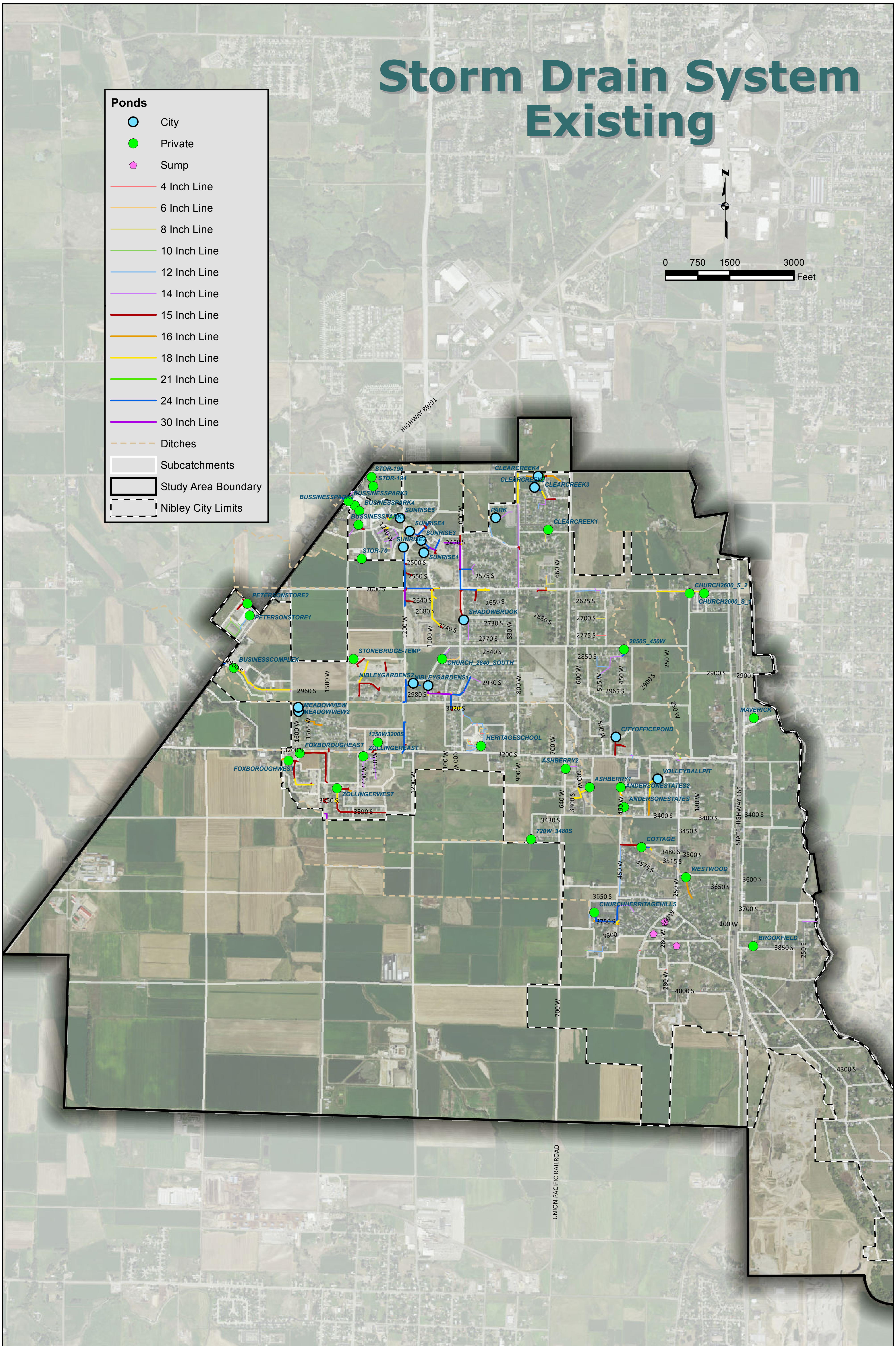
## A. Conclusions

- The existing collection system has adequate capacity to convey flows from a 25 year 1 hour storm event without significant flooding.
- A large amount of regional piping will be needed to utilize the regional pond alternative.
- The land for regional detention ponds will need to be purchased before development to secure storage locations.

## B. Recommendations

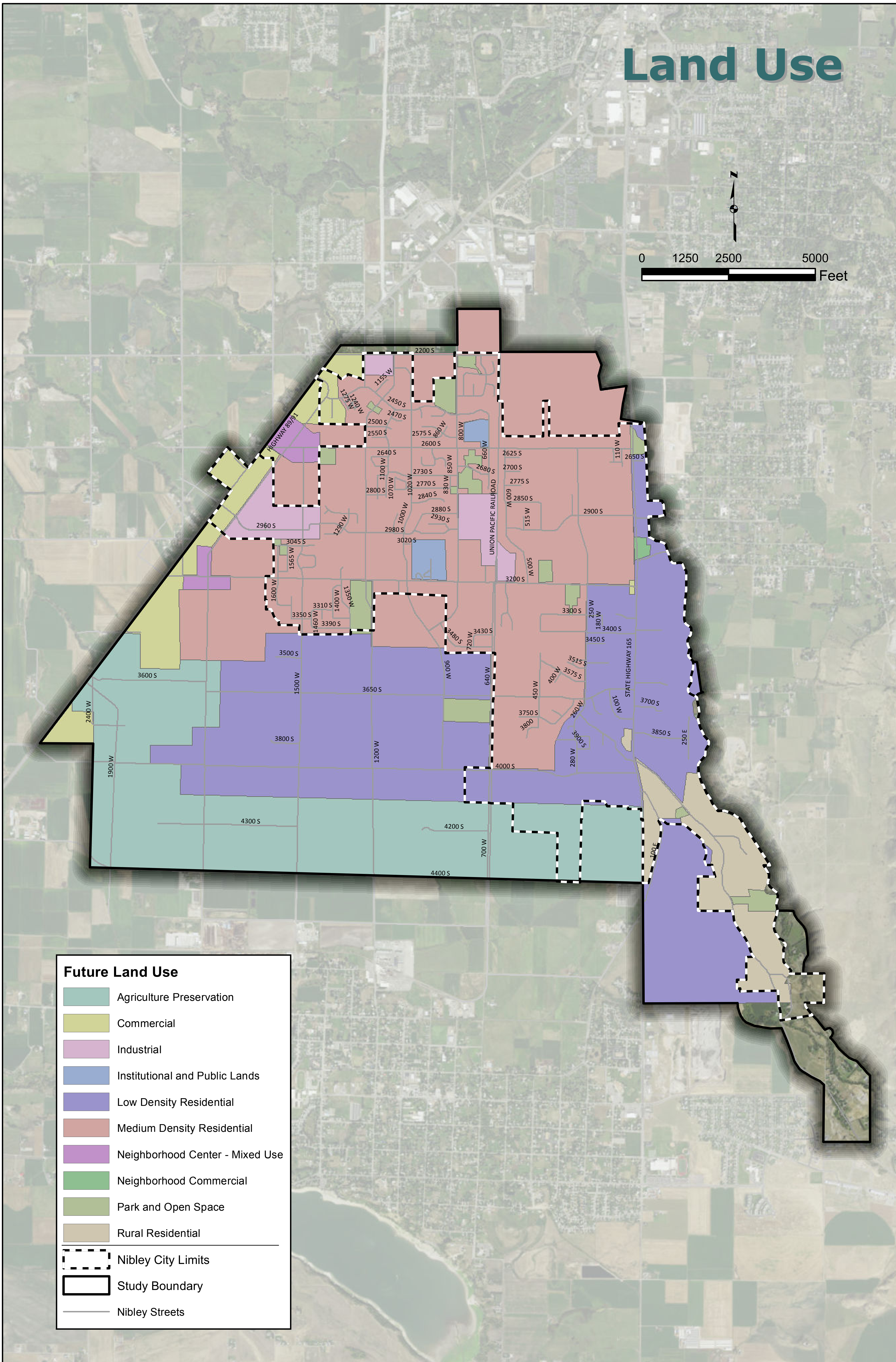
- Investigate low impact development (LID) options and identify LID practices to minimize or eliminate runoff from future developments.
- Change the current City development standards to implement approved LID practices.
- Where LID strategies will not work, follow the recommended collection system.
- Update the stormwater master plan to incorporate the approved LID practices.
- Develop an Impact Fee Facilities Plan (IFFP) to adjust stormwater fees to finance the needed improvements.
- Develop design standards to guide developers to meet the city's MS4 permit requirements to match pre-existing runoff conditions.

# Appendix A




STORMWATER MASTER PLAN

FIGURE 1


Land Use
0
1250
2500
5000
Feet
Future Land Use
Agriculture Preservation
Commercial
Industrial
Institutional and Public Lands
Low Density Residential
Medium Density Residential
Neighborhood Center - Mixed Use
Neighborhood Commercial
Park and Open Space
Rural Residential
Nibley City Limits
Study Boundary
Nibley Streets
HIGHWAY 89/91
UNION PACIFIC RAILROAD
STATE HIGHWAY 165

# Storm Drain System Buildout