# Nibley City


# Water Master Plan

*"Water is the lifeblood of our bodies, our economy, our nation, and our well-being."*

*-Stephen Johnson*

**prepared for:** *Nibley City*

**date:** *adopted by Nibley City Council - March 29, 2012*

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# Nibley City
# Water Master Plan

**March 2012**

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## EXECUTIVE SUMMARY

Nibley City requested Cache-Landmark Engineering to update the City's Water Master Plan. This Master Plan will review the existing water system, water rights and sources, and make recommendations in order to meet future water demands for the next eighteen years (Year 2030). Additionally, a forty year water demand was determined to meet the Division of Water Rights requirement for future water right extensions.

Based on Nibley City's projected growth rate of 3.26 %, Nibley City is projected to grow in the next 18 years from 1,782 equivalent residential connections (ERCs) in the year 2011 up to 2,874 ERCs in the year 2030 (Section 2.0). Nibley City in the year 2030 will need the source capacity and water rights to divert up to 12.41 cfs (5,569 gpm) (Section 4.0) and the ability to divert 2,720 acre-feet/per year (a-f/yr) (Section 3.0). Nibley City currently has three water rights, which allow for the diversion of up to 8.474 cfs (3,803 gpm) and an annual diversion limitation of 2,767.4 a-f/yr. Nibley City will be required to apply for additional flow rate to meet the future needs.

Nibley City can meet future water demands by continuing to acquire water rights/shares as development occurs and by maximizing the current water rights and shares the City owns. These water rights/shares will be utilized with the proposed 12$^{th}$ West Well and proposed county water right change application (WR 25-10833) that will be utilized for the proposed well.

Currently, three sources (Yeates Spring, 4000 South Well, and Nelson Well) supply culinary water to Nibley City. The average daily use (2011) is approximately 2,113 gpm. The projected average daily use is 3,360 gpm in the year 2030. The current peak day demand is approximately 3,500 gpm. The projected peak day demand is 5,564 gpm (2030). The City's three sources have a capacity to supply 3,560 gpm (see Table 10). The City will need two additional sources to meet the future water demands.

The City has three reservoirs in service for a storage capacity of 3.35 MG (million gallons). The City will need a storage capacity of 4.61 MG in the year 2030 (Section 6.0). With the current City growth the City will exceed capacity and will need a new reservoir within the next eight years (2020).

A model using Haestad Methods software was created to model Nibley City's water distribution system. The model was calibrated with existing conditions to evaluate the current system. The model was run with 2011 peak and average demands showing that the existing system can maintain peak flows and fire flows with the all three sources except at some dead ends and smaller lines (see Section 7.0).

Furthermore, the model was used to predict how the distribution system would perform with future water demands for the year 2030. The model revealed the existing distribution system couldn't maintain fire flows with future water demands (2030). This problem is due to the lack of water supply (sources). This water supply shortage can be

corrected with new sources (see Section 8.0). To meet the 2030 water demands the City will be required to have two new sources and additional storage tank.

A comparison was made between the three well sites: 1) 1200 West and 3400 S 2) the Nibley Regional Park (640 West and 4000 S) and 3) 1200 West and 3000 South. Different scenarios were consider with the three wells. It was determined the first well that will be required to be constructed would be 1200 West at 3400 South. The model showed the second well would be the Regional Park Well (640 West and 4000 South).

There are several improvements that Nibley City can complete that will allow the City to provide the additional water needed for future growth (2030) and improve the water system. The following recommendations listed below are listed according to priority and the approximate year for the project is listed in parenthesis.

1. Install new 20" ~ 24" culinary well and pump house on 1200 West at 3400 S. (2012) . Construct a pump house at the well head. Install 12" water main from 3400 South to 3200 South.
2. Complete 12" loop on Johnson Rd. (2012)
3. Upsize residential water lines on along 1200 W corridor from 8" to 12". (2012 ~2020)
4. Install a 2 ~ 3 million gallon reservoir tank at proposed Regional Park on 640 West. Install Booster Pump Station with the proposed tank. (2018)
5. Continue to require water rights/shares as development occurs.
6. Install 12" water main from SR-165 to 250 West on 4000 South.
7. Complete a loop for Scott Farms, 3850 S, 3700 S and 2200 S (Clear Creek) as development occurs.
8. Install fourth culinary well at the Regional Park. (2022)
9. Install booster pump as development occurs south of existing City boundaries on Hollow Rd or east of Blacksmith Fork River. This can be resolved with annexation agreements as development occurs.

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## APPENDICES

## 1.0 INTRODUCTION

Nibley City has experienced very significant growth in the last ten years (year 2000 ~2010) and the City has more than doubled their population in the last decade (see Table 1). Like all other communities, as growth and development takes place, additional culinary water sources, water rights, water storage, and distribution must be developed to support the growth. Nibley City requested Cache-Landmark Engineering to update the City's current culinary water master plan (Cache-Landmark, 2005) and to recommend improvements in order to meet future water demands for the next eighteen years (year 2030).

In 1935 Nibley City was incorporated. At the same time the culinary water system was started with Yeates Spring as the single water source. The current water system comprises of three different water sources, Nelson Well (2006), 4000 South Well (1968), and Yeates Spring (1935). In addition, the system has three storage tanks located southwest of Yeates Spring on property located on the west bench above Hollow Road. The water distribution system has water lines ranging from 4" to 18". Currently, the water system serves approximately 1,570 water users as of December 2011. Most of the water users are residential homes (1,516). The other fifty-four (54) water users are commercial, institutional (schools and the City) , stock watering, and industrial.

This Master Plan will evaluate the City's current water system and make recommendations (see Section 10.0) to meet future water demands. This report will review the City's water use (Section 3.0), water source (section 5.0), water storage (Section 6.0), and water distribution (Section 7.0). In addition, this report will develop a 40 year plan for the City's Water Rights (Section 4.0) and discuss three well alternatives (Section 8.0) to provide additional water capacity to the system.

## 2.0 GROWTH PROJECTION

To determine future water needs (water rights and source) a reasonable growth prediction must be determined. The Nibley City population in the year 2000 was 2,045 according to the 2000 Census. In the ten-year period from 1990 to 2000 the City experienced an increase of 75.2 % in population (5.77% a year) (Nibley City, 2003).

However, Nibley City has grown at a significantly higher rate during the past ten years. According to the 2010 Census, the population has increased to 5,438. Thus, during the ten-year period from 2000 to 2010 the City experienced an increase of 165.9% in population (16.6% per year).

Although Nibley City has recently experienced a large growth rate; the growth rate of 3.26% will be used for this report as the number of building permits and development has decreased significantly in the last couple of years. The City has been averaging approximately 50 building permits per year for the last few years. The 3.26% growth is between 50~70 building permits a year through the planning year of 2030. Table 1 (Page 2) shows the population history and projections.

Table 1: Growth Projections

| Year | Population |
|---|---|
| 1970 | 367 |
| 1980 | 1,036 |
| 1990 | 1,167 |
| 1994 | 1,579 |
| 1997 | 1,803 |
| 2000 | 2,045 |
| 2010 | 5,438[1] |
| 2015 | 6,304[2] |
| 2020 | 7,308[2] |
| 2030 | 9,822[2] |
| 2050 | 17,739[2] |

1—2010 Census.
2—$F=P(1+I)^N$ where F= future population (2015), P = present population (2010), I = growth rate (3.26 %), N = Years

For planning purposes, this report will use water connections and equivalent residential connections (ERC's) to determine current and future water demands. Table 2 below shows the existing and projected number of connections for the next forty years (Year 2050) based on the 3.26% growth rate per year.

Table 2: Residential Connection Projections (2050)

| Year | Residential Connections | Other Connections[1] | ERC[3] |
|---|---|---|---|
| 2000 | 574 | 19 | |
| 2004 | 915 | 19[2] | |
| 2011 | 1,516 | 54 | 1,782 |
| 2015 | 1,788 | 59 | 2,066 |
| 2020 | 2,099 | 69 | 2,395 |
| 2030 | 2,874 | 95 | 3,218 |
| 2050 | 5,496 | 180 | 5,813 |

1—Other connections are the commercial, institutional, stock watering, city connections.
2—The number of other connections in 2004 and prior years did not account for the City Connections (parks, etc.). After 2004 the City started to account these connections in the other connection category. This explains the significant jump in the number of connections.
3--ERC connections is based on the current water use of the other connections. See Section 3.0 and Appendix B for water use and the calculation for the ERC calculation.

## 3.0 CURRENT AND FUTURE WATER USE

This section will discuss the current and future water use of the water system. The City diverted 1506.1 acre-feet (a-f) in the Year 2011 (Note: One (1) acre-foot is equal to 325,828 gallons per year). Table 3 illustrates the amount of water diverted (a-f) from each of the three City sources since the Year 1999.

Table 3: Water Diversion 1999-2009

| Year | 4000 South Well (a-f) | Yeates Spring (a-f) | Nelson Well | Total Diversion (a-f) |
|---|---|---|---|---|
| 1999 | 116.9 | 479.4 | - | 596.3 |
| 2000 | 288.8 | 530.5 | - | 819.3 |
| 2001 | 308.7 | 497.7 | - | 806.4 |
| 2002 | 317.5 | 501.0 | - | 818.5 |
| 2004 | 565.4 | 507.0 | - | 1,072.4 |
| 2005 | 473.3 | 579.8 | - | 1,053.1 |
| 2006 | 25.3 | 702.0 | 575.6 | 1,302.9 |
| 2007 | 0.0 | 540.0 | 782.9 | 1,322.9 |
| 2008 | 611.0 | 458.3 | 376.7 | 1,446.0 |
| 2009 | 474.7 | 453.5 | 339.5 | 1,267.7 |
| 2010 | 373.7 | 447.9 | 804.6 | 1,626.2 |
| 2011 | 304.7 | 570.2 | 631.2 | 1,506.1 |

As previously mentioned, Nibley City currently serves 1,516 residential connections and 54 other connections. Some of these other connections are large water users (LWU). Table 4 identifies the large water users in Nibley City by type and the water usage (metered) in 2011. The table calculates the equivalent residential connection (ERC) for each type of water use based on the residential average water usage (0.845 a-f) over the last six years. The average water use is based upon the average water usage of the residential connections and the system losses that occur throughout the system. Appendix B has more detail of the City's Water Usage since 2006.

Table 4: Large Water Users (2011)

| Type of Connection | Number of Connections | Average Yearly Water Usage (a-f)[1] | Equivalent Residential Connection (ERC) [2] |
|---|---|---|---|
| Commercial | 12 | 15.9 | 29 |
| Industrial | 3 | 5.0 | 9 |
| Institutional | 16 | 84.0 | 152 |
| Stock watering | 2 | 17.2 | 31 |
| Other (City) | 21 | 24.9 | 45 |
| **Total** | **54** | **147** | **266** |

1—Average yearly water usage is the metered water usage of each connection.

2—The average water system loss is equal to approximately 29%. Therefore the system diverts more water than is measured through each connection. The ERC is calculated by the average water use with the propionate share of the system loss.

Table 5 shows the future water use by multiplying the average water use by the projected number of connections. The projected water use is the annual water diversion required from the City's water sources and water rights.

Table 5: Projected Water Use

| Year | Number of Connections (ERC) | Annual Water Diversion (a-f/yr) |
|---|---|---|
| 2011 | 1,782 | 1,506 |
| 2015 | 2,066 | 1,746 |
| 2020 | 2,395 | 2,024 |
| 2030 | 3,218 | 2,720 |
| 2050 | 5,813 | 4,912 |

1—Projected annual water diversion is equal to number of ERC multiplied by 0.845 a-f. See Appendix B for more detail.

Table 6 shows the future water diversion and depletion that will be required to satisfy its demand up to the year 2050. The annual diversion is the amount of water diverted from the City's water sources and depletion is the amount of water that is not returned to the hydrologic system. The depletion amount will be used to calculate the water right requirements described in Section 4.0.

Table 6: Projected Water Depletion (2050)

| Year | Number of Connections (ERC) | Indoor Depletion (a-f/yr) | Outdoor Depletion (a-f/yr) | Annual Depletion (a-f/yr) |
|---|---|---|---|---|
| 2011 | 1,782 | 257.4 | 451.7 | 709.1 |
| 2015 | 2,066 | 298.4 | 523.7 | 822.1 |
| 2020 | 2,395 | 346.0 | 607.1 | 953.1 |
| 2030 | 3,218 | 464.8 | 815.7 | 1,280.5 |
| 2050 | 5,813 | 839.7 | 1,473.6 | 2,313.3 |

1— Indoor Diversion = 1,782 x 0.45 a-f/connection/yr. Indoor Depletion = 1,782 x 0.45 a-f/conn./yr x 32.1%. The indoor depletion (32.1%) is calculated as 13% indoor plus 22% of the remaining 87% is depleted at the Logan WWTP (Hughes, 1996).
2—Outdoor Diversion = (1,782)(0.395 a-f /ERC/yr). Outdoor Depletion = 65% of diversion. The depletion is based on 1.22 a-f/acre/yr of the net irrigation requirement (depletion) for turf at Logan (see page 249 of Research Report 145, Consumptive Use of Irrigated Crops in Utah, Utah Agricultural Experiment Station, Utah State University, Logan, Utah).

## 4.0 WATER RIGHTS

Nibley City's water rights currently authorize diversions from two wells (4000 South Well and Nelson Well) and one diversion from Yeates Spring. Table 7 lists the City's current (active) water rights used to divert water into the culinary system. The City has additional water rights and shares it has acquired through purchase or as development has

occurred in the last ten years. An inventory of all the water rights and water shares is included in Appendix C.

Table 7: Water Rights

| W.R. Number | Status | Priority | Source | Flow (cfs) | a-f (Limitation) |
|---|---|---|---|---|---|
| 25-2167 | Cert | 1914 | Yeates Spring | 0.75 | 543.1 |
| 25-6680 | Cert | 1975 | 4000 South Well | 0.724 | 524.3 |
| 25-9048 | App | 2004 | Nelson Well, 4000S Well | 7.0[1] | 1,700 |
| | | | **TOTAL** | **8.474** | **2,767.4** |

1—The water right has a diversion rate of 7.0 cfs, however the right is limited to 4.45 cfs (2,000 gpm) from Nelson Well.
2—The limitation of this right is limited to 1,700 a-f however the City is required to provide mitigation water through water rights or shares. An inventory of the current mitigation is included in Appendix C.

The State of Utah (SOU) Division of Drinking Water (DDW) requires that water sources legally meet peak day demand and average yearly demand (DDW, 2011). In other words, the City cannot exceed the water right flow rate (cfs) or the withdrawal limitation (a-f). Table 7 shows limitations of the three City water sources.

In Section 3.0 (Table 5) the future water need (a-f) is 2,720 acre-feet (Year 2030). With the existing water rights in Table 7, the City will meet the DDW requirements for average yearly demand (a-f). However, the City will be required to have sufficient water rights or shares to mitigate the depletion of water right 25-9078. The State Engineer required the City to have mitigation water for the approval of water right 25-9078. As shown in Appendix C the City currently has 1,537 a-f of mitigation water. The City will need to continue to acquire water rights and water shares to meet the State Engineer's approval requirement.

The second requirement for the water right is to meet the flow rate on the peak day. Table 8 shows the existing peak day demand (Year 2011) and the projected peak demand.

Table 8: Projected Peak Day Demand

| Year | Number of Connections (ERC) | Indoor Demand cfs (gpm) | Outdoor Demand cfs (gpm) | Total Demand |
|---|---|---|---|---|
| 2011 | 1,782 | 2.94 (1,320) | 3.93 (1,764) | 6.87 (3,084) |
| 2015 | 2,066 | 3.41 (1,530) | 4.55 (2,045) | 7.96 (3,575) |
| 2020 | 2,395 | 3.95 (1,774) | 5.28 (2,371) | 9.23 (4,145) |
| 2030 | 3,218 | 5.31 (2,383) | 7.10 (3,186) | 12.41(5,569) |
| 2050 | 5,813 | 9.59 (4,306) | 12.82 (5,755) | 22.41(10,061) |

1—Indoor peak day demand is based on 800 gpd per ERC (pumping 18 hrs a day).
2—Outdoor peak demand 3.96 gpm/irrigated acre (0.25 irrigated acres per connection). The irrigated acres are based on the peak demand in July from the City's current water use (3.04 MGD) and the future land use to be approximately 14,000 sf per lot.

Currently the City meets the peak day demand; however it will exceed this demand within the next six years (2,198 ERC). The City can meet future water demand throughout the City, by continuing to transfer shares or rights from agricultural use to culinary use as development occurs. In addition, the City will need to maximize the current rights and shares the City owns. Table 9 below lists the current number of shares the City owns in irrigation companies. A water right inventory of all the water shares and water rights owned by the City is included in Appendix C. This inventory lists the shares and rights with the current use or the proposed action to maximize the water to the best beneficial use.

Table 9: Water Shares

| Canal Company | Shares (2005) | Shares (2011) |
|---|---|---|
| Clear Creek Irrigation | 86.5 | 86.5 |
| Nibley Blacksmith Irrigation | 67 | 246.92 |
| College Irrigation | 60 | 266 |
| Spring Creek | | 23.5 |
| Logan-Providence | | 18 |
| **Total** | **213** | **544.42** |

Cache Landmark Engineering is working with College Irrigation and Cache County to finalize a change application of the County Water Right (25-10833). This application will utilize the College Irrigation shares as mitigation and will add two points of diversion (wells) to the City system. It is anticipated the diversion points will be the proposed well on 3400 S and 1200 West and the Regional Park (see Section 8.0).

## 5.0 WATER SOURCE

The State DDW also requires water sources to physically meet peak water demands and average yearly demands. Table 10 lists the current capacity of the City's three water sources. The source capacity is maximum capacity of the source. For a spring, such as Yeates Spring, the requirement is the minimal flow rate the City can depend on. Yeates Spring the last five years has produced flow rates in the range of approximately 200 gpm to 550 gpm. The Spring's low flows are from November to June and the Spring peaks in July and August. The historical minimal flow rate of 200 gpm was determined as the source capacity of the Springs.

Table 10: Source Capacity

| Water Source | Capacity (cfs) | Capacity (gpm) |
|---|---|---|
| Yeates Spring | 0.45 | 200 |
| 4000 S Well | 3.11 | 1,400 |
| Nelson Well | 4.37 | 1,960 |
| **Total** | **7.93** | **3,560** |

Table 11 shows the average daily flows of the current water sources. Yeates Spring is currently supplying 37.9% of the City's flow (2011). In previous years the Spring serve as the major source for the City. As development and growth occur the two wells will supply the majority of the flow. As mentioned in Section 4.0 Table 8, the City will need to meet a peak demand of 12.41 cfs (5,569 gpm). The capacity of the existing sources will not meet the future water demands. The City will need additional sources with a minimum flow rate of 2,000 gpm (4.45 cfs).

Table 11: Average Yearly Flows 1999-2011

| Year | 4000 South Well (gpm) | Yeates Spring (gpm) | Nelson Well (gpm) | Total Avg. Flow (gpm) |
|---|---|---|---|---|
| 1999 | 71.2 | 292.9 | - | 364.1 |
| 2000 | 177.5 | 328.9 | - | 506.4 |
| 2001 | 189.4 | 308.6 | - | 498.0 |
| 2002 | 196.8 | 310.4 | - | 507.2 |
| 2003 | 326.0 | 272.7 | - | 598.7 |
| 2004 | 350.5 | 314.3 | - | 664.8 |
| 2005 | 293.4 | 359.4 | - | 652.8 |
| 2006 | 15.7 | 435.2 | 356.8 | 807.7 |
| 2007 | 0.0 | 334.8 | 485.3 | 820.1 |
| 2008 | 378.8 | 284.1 | 233.5 | 896.4 |
| 2009 | 294.3 | 281.1 | 210.4 | 785.8 |
| 2010 | 231.6 | 277.7 | 498.8 | 1008.1 |
| 2011 | 188.9 | 353.5 | 391.3 | 933.7 |

1—Table 11 is a summary of Table 3 in gpm over the entire day.

The Nelson Well was completed in the fall of 2004 and began to be utilized in 2006. The initial master plan for the Nelson Well was to provide a backup well for the system and additional water supply to meet peak water demands. As the water system has grown, the Nelson Well has become the main source during peak demands. Under the current scenario the Nelson Well was to breakdown during the summer the City would not meet demands and required to reduce or ration outdoor irrigation until the source became operational. The City needs to develop additional sources for backup and supply (Year 2012).

## 6.0 WATER STORAGE

The City is required to have storage for equalization, fire suppression, and if deemed necessary emergency storage. The equalization must satisfy average day demands for indoor and outdoor use. The fire suppression is based on the local fire authority and building structures. All three tanks are located adjacent to each other on Hollow Road southwest of Yeates Springs. Table 12 below shows Nibley City's current storage capacity.

Table 12: Current Water Storage 2011

| Name | Location | Capacity (MG) | Year Built |
|---|---|---|---|
| Reservoir #1 | Hollow Road | 0.35 | 1982 |
| Reservoir #2 | Hollow Road | 1.0 | 1991 |
| Storage Tank | Hollow Road | 2.0 | 2011 |
| | **Total** | **3.35** | |

Source: Nibley City (2011)

The minimum requirement for fire suppression is 1,000 gpm for two (2) hours (120,000 gallons). Nibley's commercial sector has grown and if the commercial sector continues to grow the requirement for fire suppression will increase to a larger flow rate. The fire flow requirement for buildings is based on the type and size of building. Typically, the building code requires a fire sprinkler system if the building is over 10,000 square feet (Depending on use). Cache-Landmark Engineering recommends the City plan for 2,500 gpm fire flow for two hours to accommodate commercial buildings up to 10,000 square feet (s-f). In addition, the City Building Department needs to require fire sprinkler systems for buildings over 10,000 s-f. A fire suppression of 2,500 gpm for two hours is equal to 300,000 gallons.

Table 13 shows the projected storage requirements for Nibley City. At this time there is no need for emergency storage or excess fire suppression due to the Nelson Well and the emergency (backup) generator. This backup system can count towards the storage requirement as long as the well capacity exceeds the peak demand. The portion that exceeds peak demand is the only portion that may be counted for emergency storage and fire suppression. Currently, the Nelson Well is being used at 90% capacity during the summer peak periods, therefore only 10% of the capacity (200 gpm) could count towards emergency storage.

With the recent addition of the new reservoir Nibley City currently has sufficient storage to meet state requirements. The City will exceed the state requirement in eight years (Year 2020). The City will need to construct at least a two million gallon reservoir. The location of the proposed water reservoir tank is discussed in the well alternative section 8.0. The storage requirement listed below does not consider the proposed well or the existing Nelson Well excess capacity.

Table 13: Projected Storage Requirements (2040)

| Year | Connections ERCs | Equalization Demand (MG) | Fire Suppression (MG) | Storage Requirement (Million gallons) |
|---|---|---|---|---|
| 2011 | 1,782 | 2.39 | 0.3 | 2.69 |
| 2015 | 2,066 | 2.77 | 0.3 | 3.07 |
| 2020 | 2,395 | 3.21 | 0.3 | 3.51 |
| 2030 | 3,218 | 4.31 | 0.3 | 4.61 |
| 2040 | 4,435 | 5.94 | 0.3 | 6.24 |

## 7.0 WATER DISTRIBUTION SYSTEM ANALYSIS

A model was developed using Haestad Methods WaterCAD. A skeleton of the system was developed from existing maps and discussion with Nibley City personnel. Fire hydrants were located throughout the City to establish correct elevations to calibrate the model to existing conditions. In addition, fire hydrant flow test were performed at selected areas within the City to calibrate the model.

The model was run with existing conditions and projected water demands. The following sections describe the performance of the water system during different scenarios. It is difficult to predict where development will occur but an effort was made to determine the demand on the existing and proposed water system. Using existing zoning, available developable land, and existing subdivisions an estimated demand was established for each area.

The model was run to test the available fire flow for the existing water system. In general, fire flows are met best at nodes that are associated with bigger pipes, lower elevations, and are not dead ends. Non-favorable fire flow conditions occur with smaller pipes, higher elevations, and at dead ends.

### *7.1 Existing Water System*

The existing water system was modeled to determine how the system is performing. The model was calibrated with the fire hydrant elevations and flow tests. The model results are in Appendix D. The peak flow demand applied to the system was 3,500 gpm (7.80 cfs)

The water system performed sufficient with all three sources. As area that did not meet the minimum fire flow of 1,000gpm is listed below:

- Top of Hollow Road (South of existing springs and tank)
- Scott Farms
- Hillside Drive
- 3850 S and 250 E

*7.2 Future Water System (2030)*

The model was used to predict how the distribution system would perform with future water demands in the year 2030. A peak day flow rate of 5,564 gpm (8.9 cfs) was applied to the existing system. The existing water system did not maintain fire flows with future water demands (2030). The main problems were due to an insufficient water supply (sources). The improvements listed below were made to the existing system and model with the future peak demands (see Appendix F for results). The water system with the improvements met the future demands.

- Additional well located on 12th West and 3400 S
- Additional 2.0 million gallon reservoir tank at 640 West Regional Park
- Additional well located on 12th West and 3400 S
- 18" water main from 400 West to 640 West
- 12" water main along 640 West
- 12" water main along Johnson Road to tie existing infrastructure.

The City will also need continued maintenance on the water system. As this occurs the following recommendations listed below will improve the efficiency of the water system.

- Complete the Increase the line size of 4000 S from 10" main to a 12" main
- Complete loops on 2200 S, Scott Farms, 3850 S, and 3700 S.
- Install a booster for Hollow Rd as additional properties are annexed (east of Hollow Road) into the City
- Increase the line size on Hillside Dr.

*7.3 Model Scenarios*

A comparison was made between three different well sites to evaluate the location and the effect on the water system. The results of the alternatives are in Appendix E. The next section will discuss the alternatives in more detail.

## 8.0 WELL SITE ALTERNATIVES

As mentioned in previous sections the City needs an additional source and water tank to meet the future water demands of the City. This section will describe the three different alternatives for the proposed water source. The scope of this section is only to evaluate the potential sites as how it relates to the existing water system and the required infrastructure necessary to construct the alternative. To meet the requirements of the State to approve a potential source is beyond the scope of this report and will require further evaluation into the other selection criteria such as water quality, geologic, and hydrologic conditions. The three possible alternatives are described in this section and listed in the preferred order to be completed.

1. **Alternative One**—Construct a well at 1200 West at 3400 West. Construct a 12" distribution line from 3400 South to 3200 South.

Table 14: Cost Estimation—Alternative One

| Item | Description | Qty | Units | Unit Price | Amount |
|---|---|---|---|---|---|
| 1 | Construct 24" Well 400 ft ~ 600 ft. deep. | 1 | LS | $300,000 | $ 300,000 |
| 2 | Construct 12" water supply line (3200 S) | 1,400 | LF | $55.00 | $ 77,000 |
| 3 | Construct pump house | 1 | LS | $ 250,000 | $ 250,000 |
| 4 | Upgrade Telemetry | 1 | LS | $75,000 | $75,000 |
| Total Cost | | | | | **$702,000** |

This alternative consists of a new well located on City property at approximately 3400 South on 1200 West. The well will be the a 20" to 24" casing to a depth between 400 and 600 feet deep. The anticipated capacity of the well is 2,500 gpm. An new water main will need to be installed from 3400 S to 3200 S. This alternative performed slightly better than the Alternative Three Well at 3000 S. The results are shown in Appendix E.

2. **Alternative Two**—Construct a well on the new Nibley Regional Park at 640 West and 4000 South.

Table 15: Cost Estimation—Alternative Two

| Item | Description | Qty | Units | Unit Price | Amount |
|---|---|---|---|---|---|
| 1 | Construct 24" Well 400 ft ~ 600 ft. deep. | 1 | LS | $300,000 | $ 300,000 |
| 2 | Construct Pump House | 1 | LS | $ 250,000 | $ 250,000 |
| 3 | Construct 12" along 640 S | 5,500 | LF | $ 55.00 | $412,500 |
| 4 | Construct 18" along 4000 S | 2,200 | LF | $ 75.00 | $165,000 |
| 5 | Upgrade Telemetry | 1 | LS | $75,000 | $75,000 |
| 6 | Three Phase Power | 1 | LS | $75,000 | $75,000 |
| Total Cost | | | | | **$1,202,500** |

This alternative consists of a new well located on the proposed City Regional Park located at 640 West and 4000 South. The well will be the a 20" to 24" casing to a depth between 400 and 600 feet deep. The anticipated capacity of the well is 2,500 gpm. This alternative is the most costly alternative and will require infrastructure to connect to the existing system.

The site will require the water mains to be installed on 640 West and 4000 S. A 18" water main is proposed to be installed on 4000 South back to the existing 18" water main on 400 West and a 12" water main from 4000 S to 3200 S on 640 West. The advantage of this site is the well can be utilized to supply the proposed fields and supply the city water system. It is anticipated this site will be utilized for future storage tank site because of location and the ability to fill the tank from this well, existing wells, and the new proposed

12th West Well. The storage tank can also be utilized for the water supply for the park.

3. **Alternative Three**—Construct a well on 3000 South and 1200 West.

Table 16: Cost Estimation—Alternative Three

| Item | Description | Qty | Units | Unit Price | Amount |
|---|---|---|---|---|---|
| 1 | Construct 24" Well 400 ft ~ 600 ft. deep. | 1 | LS | $300,000 | $ 300,000 |
| 2 | Construct 12" water supply line to 1200 West | 500 | LF | $55.00 | $ 27,500 |
| 3 | Construct pump house | 1 | LS | $ 250,000 | $ 250,000 |
| 4 | Upgrade Telemetry | 1 | LS | $75,000 | $75,000 |
| Total Cost | | | | | **$652,500** |

This alternative consists of a new well located on City property at approximately 3000 South on 1200 West. The well will be the a 20" to 24" casing to a depth between 400 and 600 feet deep. The anticipated capacity of the well is 2,500 gpm. An new water main will need to be installed from well site to 1200 West. This alternative is the less costly, however there are some concerns with the proposed site.

The disadvantages of this site is that is located adjacent to existing College Irrigation well that will require the well to be deeper to alleviate interference between the two wells. In addition, the existing City Parcel and detention ponds will require the well to be located away from 1200 West and there will need to be 100 foot (diameter) buffer around the well head for source protection. This alternative is a possible future site when or if the irrigation abandons the existing well.

## 9.0 EXISTING SYSTEM CAPACITY AND CURRENT WATER RATES

*9.1 Existing System Capacity*

Table 17 below summarizes the excess capacity of the existing water system. As shown the excess capacity of the existing water system is 27.4%. The excess capacity can be used to determine a portion of the impact fee used to service current debt service.

Table 17: Existing Water System Capacity

| | Existing | Capacity | Excess Capacity (%) |
|---|---|---|---|
| Water Rights | 1,782 ERCs | 3,275 ERCs | 45.5 % |
| Source Capacity | 3,084 gpm | 3,560 gpm | 13.4 % |
| Storage Capacity | 2.58 MG | 3.35 MG | 37.3 % |
| Distribution Capacity | 3,084 gpm | 3,560 gpm | 13.4 % |
| **Total Excess Capacity** | | | **27.4 %** |

*9.2 Current Cache Valley Water Rates*

Table 18 shows different water rates for various cities in Cache Valley. The Table below accounts for culinary water rates and does not account for a secondary water system.

Table 18: Cache Valley Water Rates (March 2011)

| City | Cost for 10,000 gallons | Cost for 40,000 gallons | Average Annual Cost |
|---|---|---|---|
| Nibley | $ 19.50 | $ 40.50 | $ 342.00 |
| North Logan | $ 22.81 | $ 69.91 | $ 556.32 |
| Logan | $ 22.90 | $ 54.50 | $ 456.00 |
| Wellsville | $ 24.00 | $ 33.00 | $ 336.00 |
| Providence | $ 23.25 | $ 32.25 | $ 315.00 |
| Hyrum | $ 12.00 | $30.00 | $252.00 |
| Smithfield | $ 15.00 | $35.00 | $300.00 |

## 10.0 CONCLUSIONS & RECOMMENDATIONS

The existing distribution system performs well when the supply is sufficient. As growth occurs Nibley City will need additional supply to meet future water demands. The additional water supply will come from additional well located on 12th West and additional storage tank and supply main from the proposed water reservoir site on the new Regional Park (640 West & 3400 S).

Nibley City's water rights have the ability to supply approximately 3,218 ERCs (2030), however an additional source and flow rate will need to be added to meet future demands. The City needs to continue to require water rights/shares as development occurs to allow the City to have water rights for future growth.

Nibley City currently has the storage capacity for approximately 2,300 ERCs (2020). With current growth rates the City will need additional storage in eight years. The additional 2.0 million gallon reservoir at the Regional Park will allow the City to have the storage capacity of approximately 3,760 ERCS

There are several capital improvements that Nibley City can complete that will allow the City to provide the additional water needed for future growth and to create an efficient water system. The following recommendations listed below according to priority and the approximate year for project.

1. Complete 20" or 24" well located on 3400 S and 12th West. (2012)
2. Construct a pump house with updated telemetry system. (2012)
3. Complete 12" loop on Johnson Rd. (2012)
4. Install a 2.0 million gallon reservoir tank at the Regional Park and install an 18" water main from the 400 West to 640 West. Install 12" water main from 4000 S to 3200 S. (2018)
5. Construct a 24" well located at the Regional Park. (2022)
6. Continue to require water rights/shares as development occurs to be utilized for the Nelson Well and the proposed 12th West Well.

The table below lists the preliminary project costs for recommended capital improvements.

Table 19: Projected Capital Improvements (2020)

| Item | Year | Description | Qty | Units | Unit Price | Amount |
|---|---|---|---|---|---|---|
| 1 | 2012 | Construct Well 3400 S 1200 W | 1 | LS | $300,000 | $300,000 |
| 2 | 2012 | Construct Pump House and Install Pump | 1 | LF | $250,000 | $250,000 |
| 3 | 2013 | Install 12" Water Line 3200 S to 3400 S on 1200 West | 1,400 | LF | $ 55.00 | $ 77,000 |
| 4 | 2013 | Upgrade Telemetry | 1 | LS | $75,000 | $75,000 |
| 5 | 2012~2022 | Upsize Residential Lines 8” to 12” Along 1200 West Corridor | 1 | LS | $160,000 | $160,000 |
| 6 | 2018 | Construct 2.0 ~3.0 million gallon reservoir and Booster Pump Station | 1 | LS | $2,350,000 | $2,350,000 |
| 7 | 2022 | Construct Well and Pump House at Regional Park | 1 | LS | $400,000 | $400,000 |
| Total Cost | | | | | | **$3,437,000** |

In addition, to the capital improvements listed above Cache-Landmark Engineering recommends the following maintenance projects be completed as funds become available or partner with developers when a project comes to the City.

- Upsize residential water lines from 8” to 12” on 1200 W from 3200 S to 2200 S.
- Install booster pump as development occurs south of existing City boundaries on Hollow Rd or east of Blacksmith Fork River. This can be resolved with annexation agreements as development occurs.
- Complete loops for Scott Farms, 3700 S, 3850 S and 2200 S (Clear Creek) as development occurs.

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# APPENDIX A

References Cited

# APPENDIX B

EXISTING & PROPOSED WATER USE

# APPENDIX C

WATER RIGHTS INVENTORY

# APPENDIX D

EXISTING WATER SYSTEM ANALYSIS

# APPENDIX F

PROPOSED WATER SYSTEM ANALYSIS
YEAR 2030