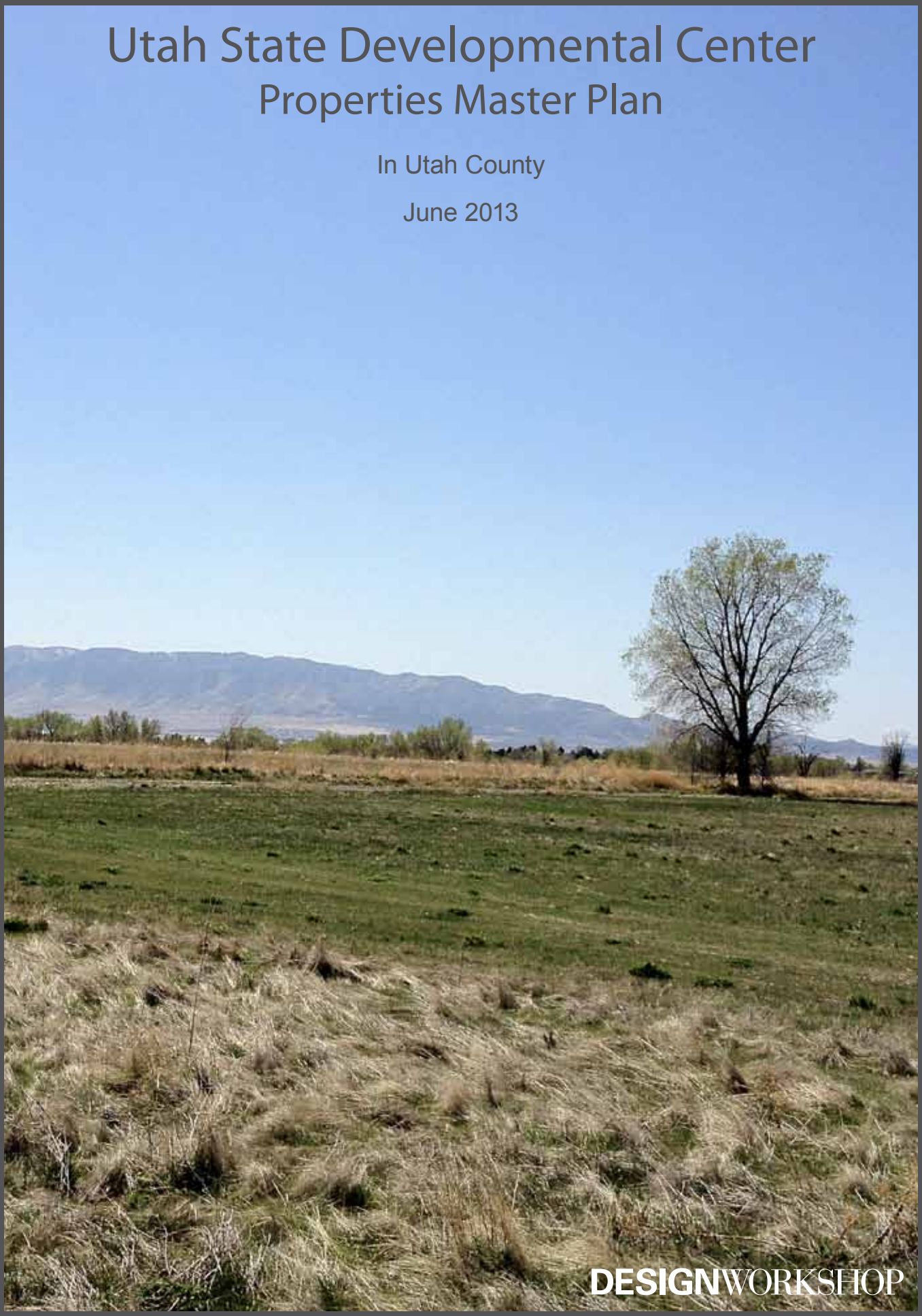
Utah State Developmental Center
Properties Master Plan

In Utah County

June 2013



DESIGNWORKSHOP

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DESIGNWORKSHOP

Civil Engineer:

Stantec

Transportation Planner:

FEHR PEERS

EXECUTIVE SUMMARY

The Utah State Developmental Center (USDC) or Developmental Center properties master plan is a vision for potential future development on the northern portion of the Developmental Center's holdings and in Utah County.

The purpose is to provide a development strategy that provides a long-term and perpetual revenue source to the Developmental Center and services for people with disabilities through lease agreements and developed parcel sales.

The vision is for a mixed-use community with a real estate program composition that maximizes the potential for lease-able property with the intent of keeping as much land as possible.

The planning process for the development of this vision included a market assessment, utility assessment and plan, transportation assessment and numerous meetings with the USDC Strategic Planning Committee.

The following master plan is the result of those efforts. This plan yields the following:

- 255 Single-Family residential lots including 28 senior single-family lots
- 630 apartments
- 50 townhomes
- 200 senior apartments
- 134,000 square feet of retail
- 40,200 square feet of office

The composition of the plan includes the following attributes:

- Two alternative alignments for the planned Murdock Connector road.
- Village Center near existing commercial in north east of site.
- Multi-family facing the North County Boulevard and site arterial.

- Strong openspace component.
- Connections to the Murdock Canal Trail and other regional trails.

1.0 INTRODUCTION

The Introduction is organized into the following categories:

1.1 Context

1.2 Site

1.3 Zoning

1.4 Purpose

1.5 Goals

1.6 Process

1.0 Introduction

1.1 CONTEXT

The project site is located east of I-15, up against the Wasatch Front Mountain Range and north of Utah Lake.

The major population centers surrounding the site include Provo and Orem to the South and Salt Lake City to the North.

State Route (SR) 92 runs past the site to the north and is a major arterial with an interchange on Interstate 15. SR 92 leads to American Fork Canyon, which is considered to be a scenic destination with assets like the Alpine Loop Road, Timpanogos Cave National Monument and Sundance Resort.

The most convenient access to the site from Interstate 15 is via SR 92 and the North County Boulevard, also known as 900 West in American Fork City and the 4800 West in Highland City.

The project area is bounded by American Fork City to the South, Highland City to the North and Cedar Hills to the East.

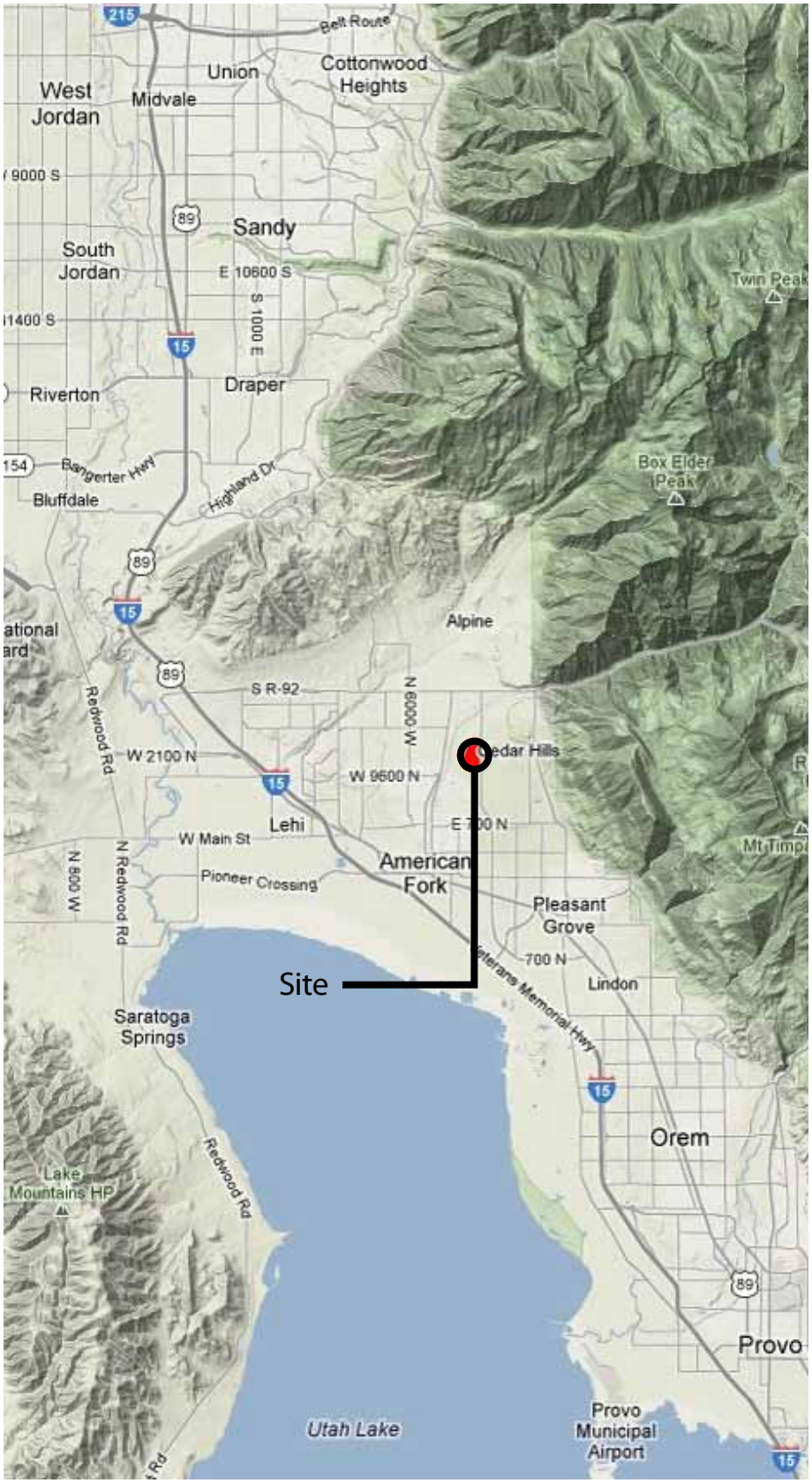


Figure 1: Context Diagram

1.0 Introduction

1.2 SITE

The Utah State Developmental Center campus is located in American Fork, Utah. The focus of this project is the properties owned by the Developmental Center, which lie north of the campus. Specifically, this project focuses on the property located in Highland City.

The North County Boulevard defines the east edge of the property. To the north is Lone Peak High School, to the west is open space, including Highland Glen Park and Fox Hollow Golf Course. To the south is Developmental Center owned agricultural property, the Developmental Center campus and the Mt. Timpanogos LDS Temple.

Existing land uses surrounding the property are mostly openspace, with some school, institutional and commercial on the northeast side of the site. A Walmart is located across from Lone Peak High School and some additional pad retail establishments are being developed in that vicinity.

Murdock Pipeline owns an easement through the property running east to west where a future regional trail will be built.

Figure 2: Site Context

Figure 3: Site Map (Utah County GIS)

1.0 Introduction

1.3 ZONING

A Highland City general plan update citing future land uses, adopted on February 19, 2008, shows the site as mixed-use. (There does not appear to be a zoning description for that land use within Highland City.)

It is assumed that a mix of residential, commercial (including office and retail) and civic uses will be justifiable within the future mixed-use designation.

It is recommended that the USDC entitle the property for the intended uses in this master plan. A significantly higher property value will result from the entitlement, thus benefitting the Developmental Center with higher prices on for-sale properties.

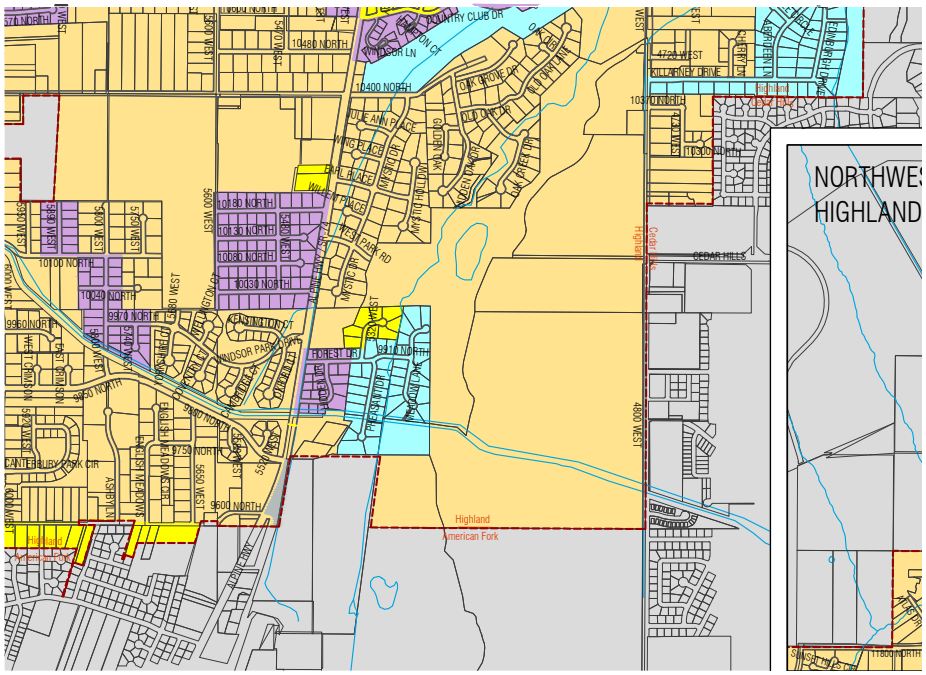


Figure 4: Existing Zoning (Highland City)

R-1-40

Conditional Use R-1-40

Non-Conforming R-1-40

Figure 5: Future Land Uses (Highland City)

Mixed-Use

School

Low Density Residential

1.0 Introduction

1.4 PURPOSE

The purpose for this planning exercise is to provide a master plan vision for the property that is vetted by the Utah State Developmental Center, and which fits within the parameters of existing site conditions, existing market conditions, site access and zoning.

The second part of the purpose is to provide a development strategy that provides a long-term and perpetual revenue source to the Developmental Center and services for people with disabilities through lease agreements and developed parcel sales.

1.5 GOALS

Design Workshop is committed to creating places that meet today's needs and that are sustainable environments for all time. To do so we practice a methodology called DW Legacy Design®. This proprietary process seeks to imbue every project with a balance between environmental sensitivity, community connections, artistic beauty and economic viability.

Projects that achieve this harmony are enduring places that make a difference for clients, society and the well-being of the planet and leave a legacy for future generations.

The planning team met with the Strategic Planning Committee for this project on several different occasions to talk through planning goals for this project. The goals were separated into the Legacy Design categories and the following diagrams are the results of that process.

Environment
- Connect to the Murdock Pipeline Trail and Art Dye Trail
- Preserve existing trails
- Conserve green space
- Consider community supported agriculture and community gardens
- Preserve views to mountains
- Provide an open space buffer around the campus
- Provide open space systems in the master plan
- Consider mandating a minimum LEED Silver energy and environmental standard for all new buildings

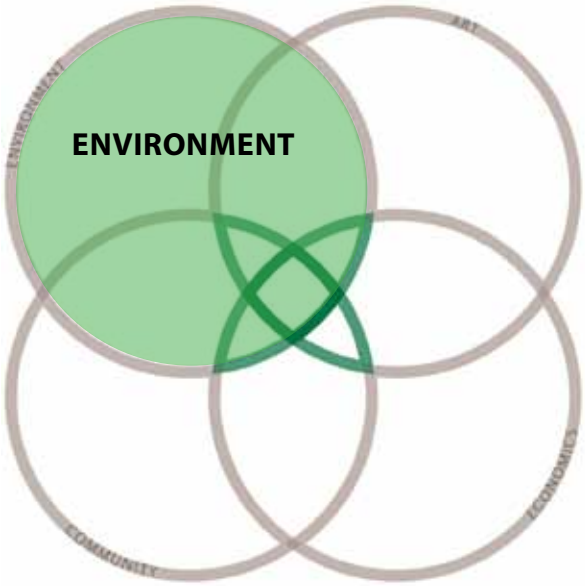


Figure 6: Legacy Design Environment Diagram

Community
- Allow for the re-establishment of the farm animal therapy program
- Provide activities for people with disabilities
- Provide subtle safety and security for the campus
- Provide a trail from the campus to the Highland Glen Park
- Consider a location for a safe facility
- Provide connections and linkages from the campus in the master plan
- Provide an accessible, walkable, mixed-use community
- Community should be something the Developmental Center can be proud of

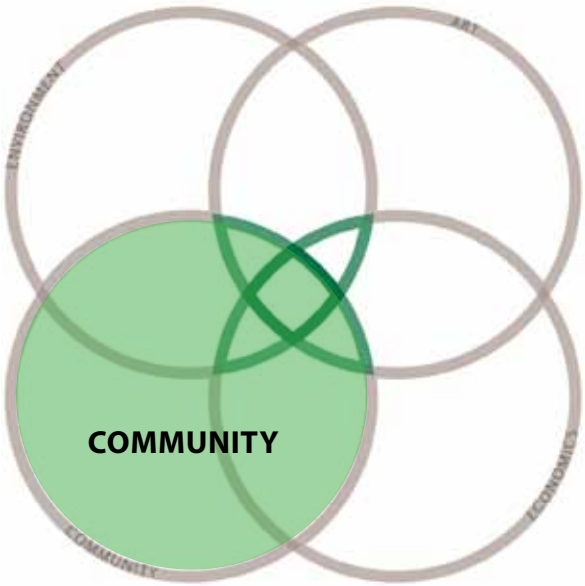


Figure 7: Legacy Design Community Diagram

1.0 Introduction

Economics

• Provide long-term funding for services for people with disabilities

• Baseline economic value is the value of the land projected over time + agricultural return

• Provide a phased projection for potential annual revenue

• Explore a potential strategy for capturing revenue from existing water rights

• Develop an appropriate strategy for lease vs. sell leaning heavily towards majority lease

• Provide employment opportunities for people with disabilities

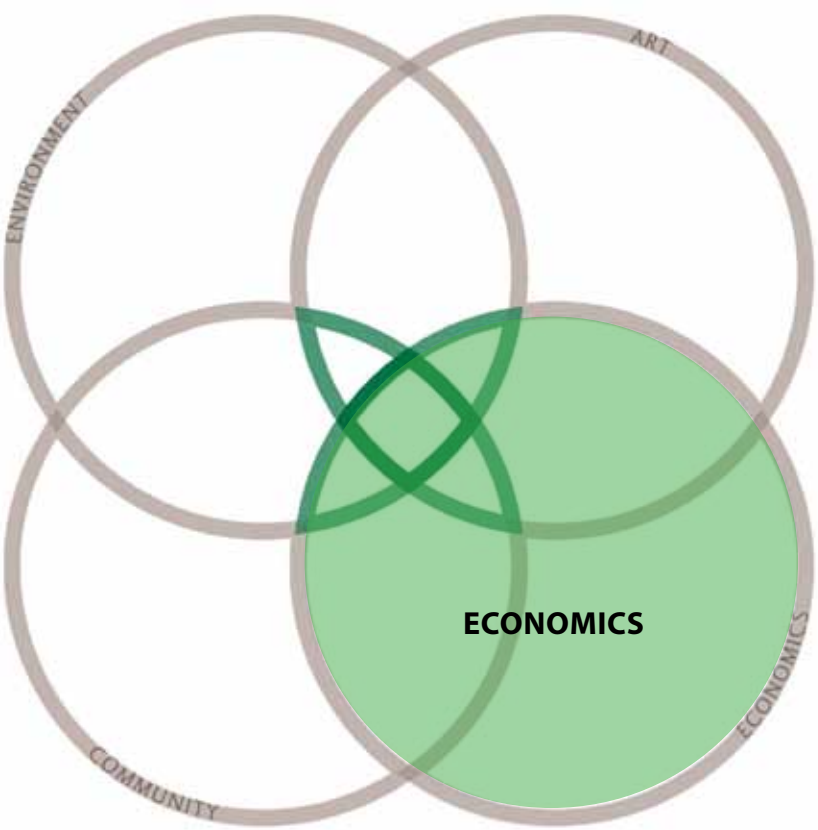


Figure 8: Legacy Design Economics Diagram

Art / Aesthetics

•The master plan should lay out a beautiful development with a nice open space system and high quality standards

•Integrate the history of the site – a farm, community gardens, a fair, milk and a meat processing plant have all been site uses

•The Community should be a magnet that draws people to it

•Preserve view corridors

•The aesthetic should not be trendy but timeless

•Branding will be important

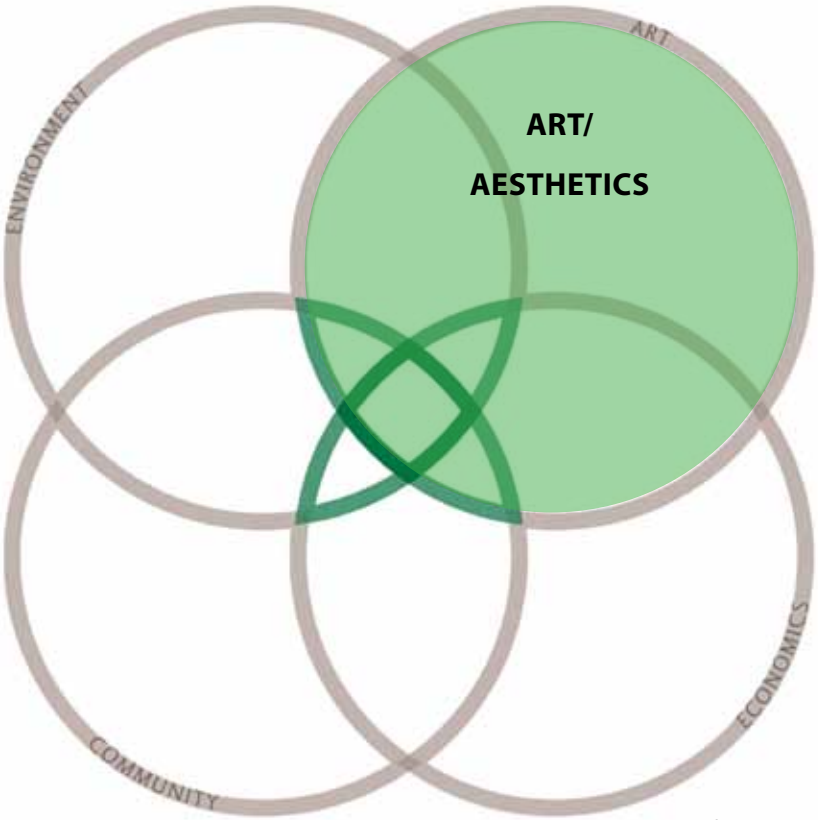


Figure 9: Legacy Design Art / Aesthetics Diagram

1.6 PROCESS

The planning team conducted the following process to arrive at the recommendations proposed in this document:

- **Existing Conditions Analysis:**
  An inventory of existing site conditions was conducted, including an analysis of views, slope, transportation and traffic conditions, existing utilities, opportunities and constraints.

- **Kick-Off Work Session:**
  An initial meeting was conducted with the Developmental Center Strategic Planning Committee for this project to identify project goals, site program ideas and critical success factors for the resulting product.

- **Market Assessment:**
  An assessment of existing market conditions was completed to identify market potential for residential products, retail uses and office uses. The intent was to identify the demographics and psychographics of the project contextual and niche real estate opportunities that are missing or under-served within the project area. The outcomes from the market assessment provide a preliminary site program and a foundation for a master plan.

- **Alternatives Development:**
  This next step in the process was to develop three alternatives that explored various road networks, land use positioning, densities and openspace structures. The intent with this phase of the work was to identify a preferred scenario or composition of attributes from all the alternatives to create a preferred scenario.

- **Preferred Alternative Development:**
  During this phase of the process, a preferred solution was developed and elaborated upon including conceptual lotting and building massing.

- **Transportation Analysis**
  An analysis of the proposed land use types and densities was conducted to identify any potential future traffic issues, to establish a street hierarchy and to size the street rights-of-way.

- **Utility Master Plan:**
  After land uses and densities were set, a utility master plan was created locating primary trunk lines for sanitary sewer, water, gas and storm water lines.

- **Master Plan Illustrative:**
  An illustrative plan was created illustrating a conceptual composition of the program on the site.

- **Master Plan Document:**
  This Master Plan document was completed compiling all the work products and communicating the ideas in the master plan.

2.0 EXISTING CONDITIONS

The Existing Conditions section is organized under the following categories:

2.1 Existing Site Conditions

2.2 Existing Utility Conditions

2.3 Existing Transportation Conditions

2.1 Existing Site Conditions

Generally, the site is a very developable piece of property with few constraints. Land ownership is consolidated, the site is flat, very few structures are built on the property and other than the Murdock Canal corridor, no other easements exist.

The following is a more detailed description of existing conditions:

- **Slope:**
  The slope of the site is between 1.5 to 2% and will not pose challenges to any form of real estate development.

- **Views:**
  There is not a bad view on this property. Prevalent views exist east to Mount Timpanogos, northeast to American Fork Canyon, south to the LDS Temple, west to the Oquirrh Mountains and Utah Lake.

- **Hydrology:**
  The Murdock Canal has been piped and placed sub-grade. There are no other known major water courses in the vicinity. No known wetlands exist. Water table is not known at this time but due to the elevation of the site in relation to properties to the West, water table should not be an issue.

- **Municipal Boundaries:**
  The Highland City / American Fork City boundary is located generally in the middle of Developmental Center-owned land. No development is currently proposed south of that boundary in American Fork City. The Cedar Hills boundary exists along North County Boulevard on the north east portion of the site.

- **Roads:**
  No paved roads exist on the property. A road skirts the outside north western edge of the site connecting a small roundabout and Highland

Figure 10 : Opportunities and Constraints Diagram

2.1 Existing Site Conditions

Glen Park. 1500 North is a small dirt road running along the municipal boundary.

- **Murdock Pipeline:**
  The Murdock Canal Trail is a 17-mile addition to Utah County's existing trail system, which runs along the pipeline corridor going through this site. The trail will extend from 800 North in Orem to SR-92 in Lehi and will pass through seven Utah County cities, including American Fork, Cedar Hills, Highland, Lehi, Lindon, Orem and Pleasant Grove. Future expansions will eventually connect the trail to the Jordan River Parkway as well as the Provo River Trail. It will be available for year-round walking, jogging, equestrian use, cycling and skateboarding.

- **Additional Open Space Assets:**
  In addition to the Murdock Canal Trail, the Highland Trail runs adjacent to the site on the west edge. It leads to a trailhead on the western edge of the site as well as Highland Glen Park, which is located to the west and downhill from the site. Art Dye Trail leads from Highland Glen Park to Art Dye Park to the south.

- **Developmental Center Campus:**
  There are opportunities to link the campus with the real estate program on the site, specifically for potential recreational benefits and job opportunities. Care also needs to be taken to protect the privacy and security of the Developmental Center.

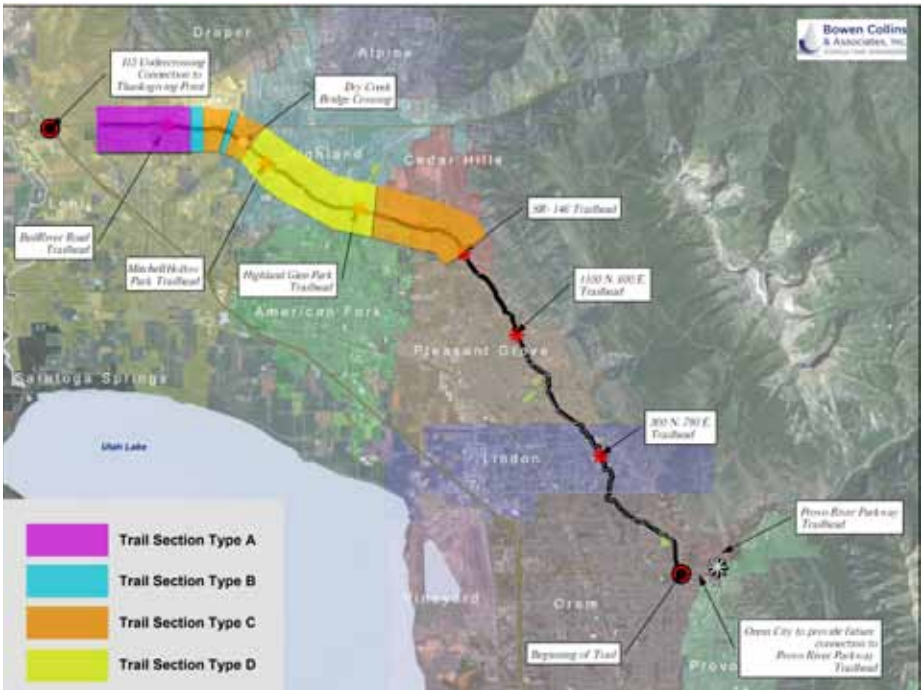


Figure 11 : Murdock Canal Trail (Bowen Collins)

Figure 12 : Murdock Canal Trail Section C (Bowen Collins)

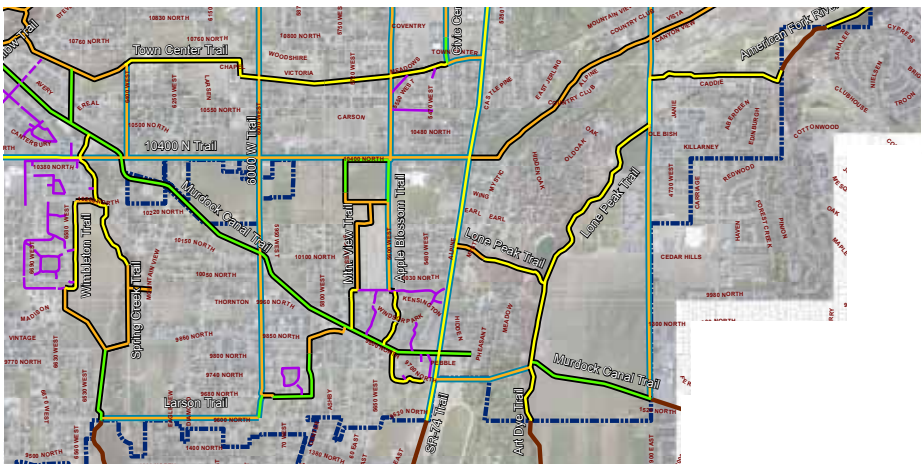


Figure 13 : Highland City Trails Map (Highland City

2.1 Existing Site Conditions

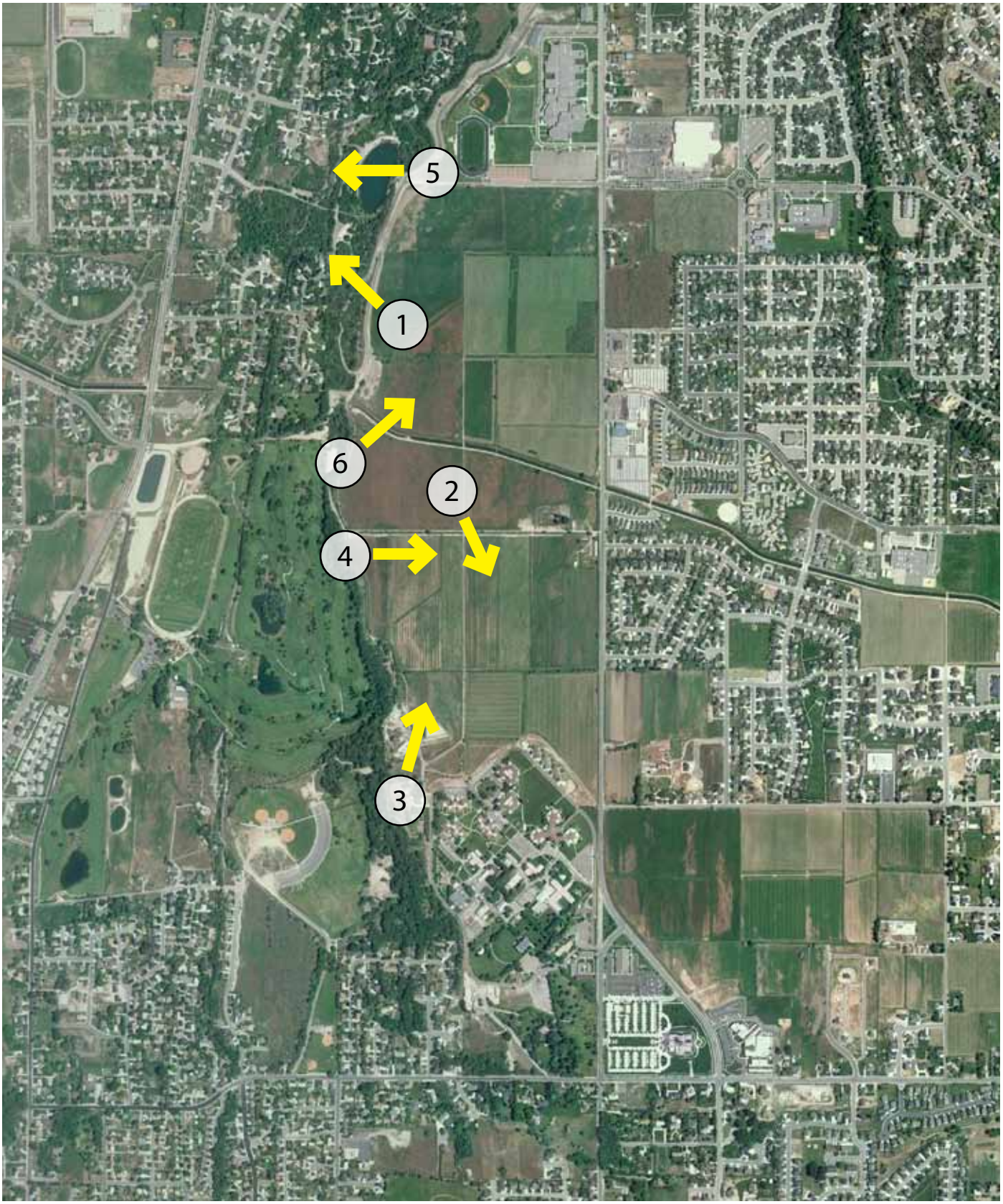


Figure 14 : Views Reference

2.1 Existing Site Conditions

1 *View northwest to Highland Glen Park - Note trail crossing*

2 *View south - Note LDS Temple in the background*

3 *View north towards the farm and mountains*

4 *View east to Mahogany Mountain (Note Mt. Timpanogos beyond)*

5 *View west over Highland Glen Park Pond*

6 *View northeast towards American Fork Canyon*

2.2 Existing Utility Conditions

2.2.1 INTRODUCTION

To support the USDC master plan project, Stantec completed a preliminary review of the existing utilities required to service the site. Meetings and teleconferences were held with utility providers to discuss the proximity of existing facilities as well as available capacities. The following includes a discussion of the existing utility systems and summarizes the current plan for connection to each utility and the next steps required for completion of the master plan. Figure 15 (pg. 19) provides a visual presentation of the existing utilities in the project area. The following is a summary of the utility conditions:

2.2.2 WATER

Contacts:
Utility Agency: Highland City
Key Contact: Lloyd Hansen
Telephone: (801) 756-5751

Utility Agency: American Fork City
Key Contact: Steve Parker
Telephone: (801) 763-3060

Utility Agency: Cedar Hills City
Key Contact: David Bunker
Telephone: (801) 785-9668

Utility Agency: Central Utah Water CD – Utah Co
Key Contact: Dave Pitcher
Telephone: (801) 226-7121

Existing System:
Highland City maintains a 12"-diameter water line on the north end of the soccer field, north of the site. There is also an 8"-diameter water line east of Lone Peak High School in the North County Boulevard. The line ends north of the project site. There is a 6"-diameter water line west of the site in the development along the north half of the site. Based on the City's master plan, a 12"-diameter loop will be required through the USDC site with connections to existing infrastructure north and southwest of the project area. This site is located within Highland City's main pressure zone. This equates to static pressures ranging from 116 – 135 psi across the USDC site.

2.2.3 SEWER

Contacts:
Utility Agency: Highland City
Key Contact: Lloyd Hansen
Telephone: (801) 756-5751

Utility Agency: American Fork City
Key Contact: Steve Parker
Telephone: (801) 763-3060

Utility Agency: Cedar Hills City
Key Contact: David Bunker
Telephone: (801) 785-9668

Existing System:
The existing sewer collection system in the area is operated and maintained by Highland City. Timpanogos Special Service District (TSSD) intercepts flows from Highland City and conveys them to a regional treatment plant servicing northern Utah County.

There is an 8"-diameter sewer line along the west side of the site that feeds to the City's American Fork River Wastewater Pump Station. The pump station force main delivers flows to an existing 8"-diameter sewer at 9860 North. The rated build out capacity of the lift station is 300 gpm. Based on the Highland City Wastewater Collection System Master Plan, there are current and future deficiencies between this point and the TSSD out-fall.

2.2.4 NATURAL GAS

Contacts:
Utility Agency: Questar
Key Contact: Danielle Wells
Telephone: (801) 324-3970

Existing System:
The Questar system is comprised of intermediate high pressure (IHP) distribution lines located along public streets on the east side of the North County Boulevard.

2.2.5 STORM WATER

Existing System:
In this area of Highland City, there is no downstream conveyance for storm water. There is potential for detention and discharge if off-site drainage conveyance is constructed to the USDC site. However, total on-site retention is most likely needed to handle the storm water flows for this site.

2.2.6 POWER

Contacts:
Utility Agency: Rocky Mountain Power - PacifiCorp
Key Contact: Joel Simmons
Telephone: (503) 813-6993

Existing System:
The existing Rocky Mountain Power (RMP) distribution system is comprised of overhead primary distribution on the east side of the North County Boulevard. Single phase distribution drops off the primary distribution through transformers serving existing homes east of the North County Boulevard.

2.2.7 IRRIGATION WATER

Contacts:
Utility Agency: Highland City
Key Contact: Lloyd Hansen
Telephone: (801) 756-5751
Utility Agency: Central Utah Water CD – Utah Co

2.2 Existing Utility Conditions

Key Contact: Dave Pitcher
Telephone: (801) 226-7121
Utility Agency: American Fork City
Key Contact: Steve Parker
Telephone: (801) 763-3060

2.2.8 FIBER OPTICS, CABLE, PHONE

Contacts:
Utility Agency: CentraCom Interactive
Key Contact: Alisa Faatz
Telephone: (435) 427-3331

Utility Agency: CenturyLink/Qwest
Key Contact: Arlene Comstock
Telephone: (801) 974-8130

Utility Agency: Comcast Cable
Key Contact: Gary Goldstein
Telephone: (801) 401-3041

Utility Agency: Integra Telecom
Key Contact: Shauna Jones
Telephone: (801) 708-6157

Existing System:
CentraCom Interactive provides cable television and phone fiber optic cable. The cable runs on both the power poles and in conduit on the east side of the project site, along the North County Boulevard. Fiber optic in conduit runs close to the south side of the project along 1100 North, east of the North County Boulevard.

Comcast Cable has aerial cables located on the Rocky Mountain Power poles on the east side of the North County Boulevard.

Integra Telecom has poles/fiber running north-south on the east side of the North County Boulevard.

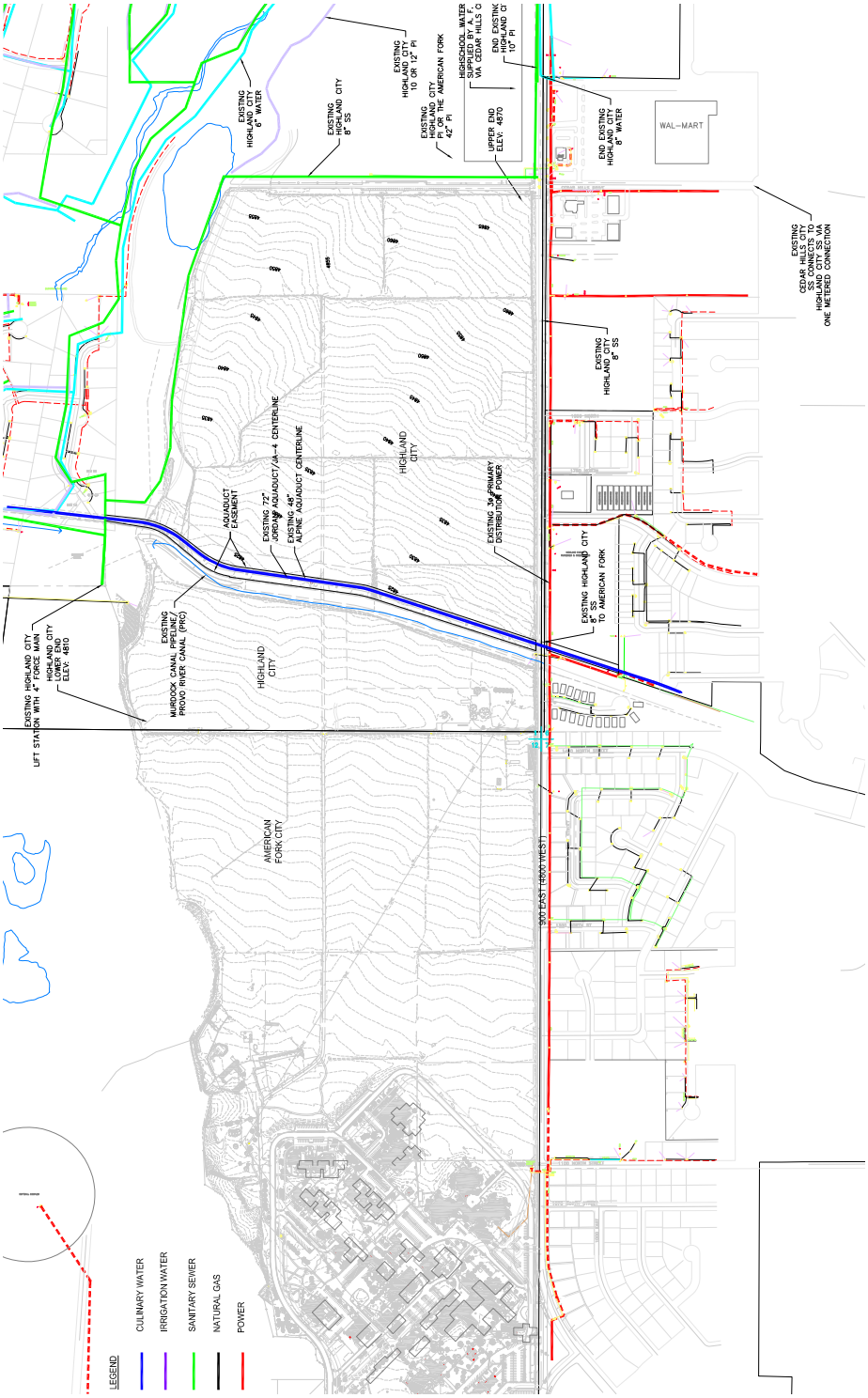


Figure 15 : Existing Utilities

2.2.9 OTHER UTILITIES

Contacts:
Utility Agency: Jordan Valley Water Conservancy District

Key Contact: Mark Winters
Telephone: (801) 254-7904

2.3 Existing Transportation Conditions

2.3.1 PURPOSE

The purpose of the existing conditions analysis is to study the pertinent intersections and roadways during peak travel periods of the day under existing traffic and geometric conditions. Through this analysis, existing traffic operational deficiencies can be identified and potential mitigation measures recommended.

2.3.2 INTRODUCTION

Conventional methods of analyzing mixed-use developments overstate the number of vehicle trips generated, and therefore understate transportation and air quality benefits. Fehr & Peers' MXD method accurately captures the trip-reducing benefits of mixed-use development projects, and is used throughout the United States to help developers, agencies, and the public to quantify these trip reductions. The MXD trip generation model is being promoted by the United States Environmental Protection Agency (EPA) and has been adopted by the San Diego Association of Governments (SANDAG), American Society of Civil Engineers (ASCE), and many others as a recommended resource for trip generation of smart-growth developments.

The MXD method was developed through a national study for the US EPA to more accurately predict vehicle trips by accounting for the Smart Growth (or "D") characteristics of the development site and its surrounding built environment.

- Density
- Diversity (mix) of land uses
- Design and connectivity of site circulation
- Destination accessibility
- Distance to transit
- Demographics
- Development scale

The MXD method is based on household travel surveys from 239 mixed-use developments throughout the country, and has been validated at 28 sites, including two sites in Utah. This extensive data set results in more accurate predictions. On an accuracy scale of 100, MXD has a rating of 90, compared to 65 for Institute of Transportation Engineers (ITE) estimates and 81 for ITE estimates plus adjustments per the Trip Generation Handbook. MXD adjusts ITE trip generation estimates downward to account for trips that remain within the development, trips that enter or leave via walk or bike modes, and trips that enter or leave via transit.

The MXD model has been validated and calibrated locally for Utah and has been implemented on several mixed-used sites in Salt Lake County with acceptance from local jurisdictions, including the Utah Department of Transportation (UDOT). More accurate trip generation forecasts result in:

- Reduced likelihood of overstating roadway impacts and mitigation measures
- Reduced air quality impacts and mitigation measures
- More efficient use of transportation infrastructure dollars and impact fees for all modes

Trip generation for the project was computed using trip data published in the Institute of Transportation Engineers (ITE) Trip Generation, 8th Edition, 2008 and MXD (mixed-use development) trip generation methodology. MXD was used due to its ability to more accurately predict trip generation for mixed-use developments. MXD also more accurately accounts for the internal capture (the trips that occur between land uses internal to the site.

The MXD model uses ITE trip generation rates and applies additional variables to those trip generation rates. Some of the additional variables include:

- Employment
- (Population + Employment) per square mile
- Land area
- Total jobs / population diversity
- Retail jobs / population diversity
- Number of intersections per square mile
- Employment within a mile
- Employment within a 30-minute trip by transit
- Average household size
- Vehicles owned per capita

2.3 Existing Transportation Conditions

2.3.3 BACKGROUND

The following is a summarization of the data review of the Highland City General Plan, the American Fork General Plan, the Mountainland Association of Governments (MAG) 2040 Long Range Plan, and Utah Transit Authority (UTA) service as they pertain to the Utah State Developmental Center project location.

HIGHLAND CITY GENERAL PLAN:
Planned improvements for the area include:

- North County Boulevard (5-Lane Arterial) is planned to be a four-lane facility with a center turn lane, planted median parkway detail, and 106' of right-of-way. (Portions are already complete or currently under construction).

- 11000 North (SR-92) (5-Lane Arterial) Highland City is planning for a five-lane cross-section the length of the corridor.

- 9600 North (Murdock Connector) (3-Lane Minor Collector) Highland City plans for this roadway through the project site to be a 3-lane residential collector.

- UTA bus route on SR-92 that links to the nearest planned commuter rail station.

Elements from the General Plan which apply to the Utah State Development Center site are:

- Traffic calming elements should be considered in all new street developments in order to minimize fast-moving vehicles.

- Culs-de-sac should be avoided.

- For maximum safety of pedestrians, sidewalks of adequate width (5 feet at a minimum) should be provided on both sides of all Highland City residential streets.

- Provide safe routes to school in all residential areas, utilizing a mix of sidewalks, trails and other design features as appropriate.

General Plan public scoping identified a few key issues:

- Traffic impacts of new developments
- Lack of sidewalks
- Lack of comprehensive traffic calming program Trails.

The Highland City General Plan specifies the Lone Peak Trail and the Art Dye Trail as existing trails. Together, they form the western border of the project site. They provide north-south trail access to the eastern portion of the City and connect to other City trails via an extension of the Lone Peak Trail.

The General Plan also indicates a future secured trail, the Murdock Canal trail, bisecting the property and running east-west just north of 1500 North. In addition, the North County Boulevard is identified as a future unsecured major roadside trail.

AMERICAN FORK GENERAL PLAN:
The American Fork City 2030 Master Plan indicates a road connection at approximately 1280 North. A major collector between 1500 North and the Developmental Center was removed from the Plan in a 2008 amendment.

- Trails:
  The American Fork City Park and Trails Master Plan specifies a neighborhood trail, the Art Dye Trail, on the western portion of the USDC property, as well as a trail following 800 East from Art Dye Park to 1100 North.

MOUNTAINLAND ASSOCIATION OF GOVERNMENTS 2040 LONG RANGE PLAN:
The MAG Long Range Plan plans the North County Boulevard as a 4-lane highway between SR-92 and State Street in American Fork. A significant portion of this road is complete, with the remainder currently under construction. It also calls for priority planned bike routes along the North County Boulevard. A priority planned paved trail is indicated along the city boundary between American Fork and Highland.

The MAG plan indicates a BRT line running along SR-92 to the North County Boulevard through American Fork. This line is projected for Phase 2 of the plan, 2021-2030.

UTAH TRANSIT AUTHORITY:
There is currently no transit service near the USDC. However, there is a FLEX route with intermittent services along the North County Boulevard in the vicinity of the project area.

UTA FLEX routes travel a fixed route and schedule but are permitted to deviate up to 3/4 mile to either pick up or let off passengers. The FLEX routes are designed to provide the convenience of a curb-to-curb drop off with a regular fixed route schedule and can make up to two route deviations per trip. Deviations can be scheduled up to two hours in advance and cost an additional dollar. FLEX route vehicles maintain the same accessibility as Paratransit service, making it a great option for Paratransit riders.

2.3 Existing Transportation Conditions

2.3.4 ANALYSIS METHODOLOGY

Level Of Service (LOS) is a term that describes the operating performance of an intersection or roadway. LOS is measured quantitatively and reported on a scale from A to F, with A representing the best performance and F the worst.

Table 1 provides a brief description of each LOS letter designation and an accompanying average delay per vehicle for both signalized and unsignalized intersections.

The Highway Capacity Manual 2000 (HCM 2000) methodology was used in this study to remain consistent with "state-of-the-practice" professional standards. This methodology has different quantitative evaluations for signalized and unsignalized intersections. For signalized intersections, the LOS is provided for the overall intersection (weighted average of all approach delays). Synchro, a traffic modeling software, was used to model the street network and estimate the vehicle delays. Synchro utilizes the methodology in the HCM 2000.

Fehr & Peers has also calculated overall delay values for unsignalized intersections, which provides additional information and represents the overall intersection conditions rather than just the worst approach. Both are reported in their respective tables throughout the report.

2.3.5 ROADWAY SYSTEM

The primary roadways that will provide access to the project site are described below:

- North County Boulevard – is classified as an arterial with a posted speed limit of 40 miles per hour (mph). The North County Boulevard consists of two lanes in each direction. Currently, there is construction on the North County Boulevard south of the project site.

- SR-92 – is classified as an arterial with a posted speed limit of 45 mph. It has one lane in each direction and a bike lane on both sides with large shoulders. A 10-foot raised center

LOS	Description of Traffic Conditions	Signalized Intersections	Unsignalized Intersections
		Avg. Delay[1] (sec/veh)	Delay[2] (sec/veh)
A	*Free Flow / Insignificant Delay* Extremely favorable progression. Individual users are virtually unaffected by others in the traffic stream.	0 to 10	0 to 10
B	*Stable Operations / Minimum Delays* Good progression. The presence of other users in the traffic stream becomes noticeable.	> 10 to 20	> 10 to 15
C	*Stable Operations / Acceptable Delays* Fair progression. The operation of individual users is affected by interactions with others in the traffic stream.	> 20 to 35	> 15 to 25
D	*Approaching Unstable Flows / Tolerable Delays* Marginal progression. Operating conditions are noticeably more constrained.	> 35 to 55	> 25 to 35
E	*Unstable Operations / Significant Delays Can Occur* Poor progression. Operating conditions are at or near capacity.	> 55 to 80	> 35 to 50
F	*Forced, Unpredictable Flows / Excessive Delays* Unacceptable progression with forced or breakdown of operating conditions.	> 80	> 50

1. Overall intersection LOS and average delay (seconds/vehicle) for all approaches.
2. Worst approach LOS and delay (seconds/vehicle) only.
3. Volume to capacity (v/c) ratio, average values.
Source: Fehr & Peers Descriptions, based on *Highway Capacity Manual,* 2000 Methodology (Transportation Research Board).

Table 1: Level Of Service Descriptions

median provides opportunities for left-turn pockets.

- Harvey Boulevard – is classified as a local road with a posted speed limit of 25 mph. Harvey Boulevard consists of one lane in each direction.

2.3.6 TRAFFIC VOLUMES

Fehr & Peers recorded AM and PM peak period traffic counts from 7:00 AM to 9:00 AM and 4:00 PM to 6:00 PM on Tuesday, April 17, 2012 at the following intersections:

- Cedar Hills Drive / North County Boulevard
- Harvey Boulevard / North County Boulevard
- 700 North / 1100 East
- 9910 North / SR-92

The traffic volumes counted in April represent an average day of the year. Therefore, no monthly or daily adjustment factors were applied to the April counts. The existing 2012 weekday AM and PM peak hour traffic volumes are shown in Figure 16.

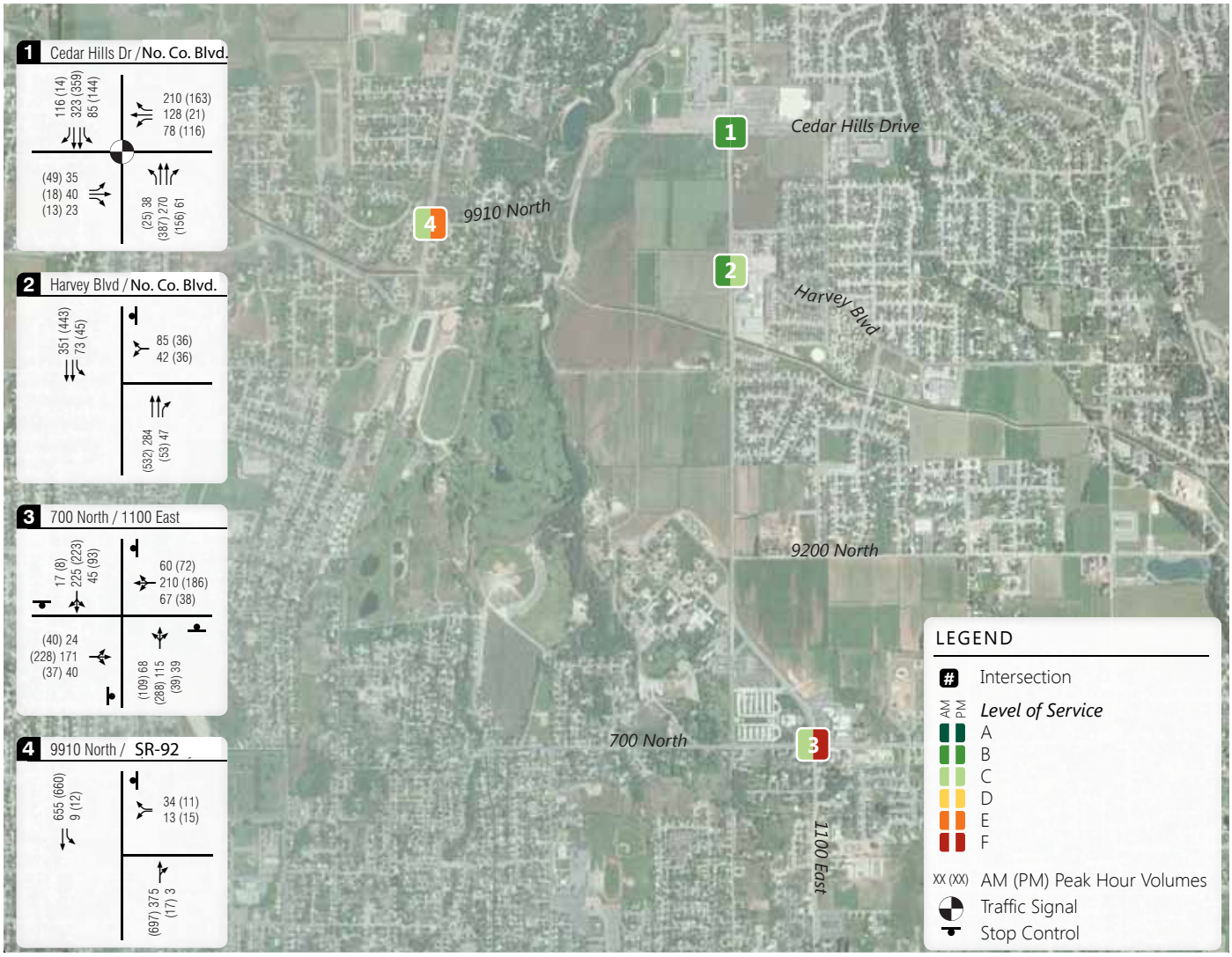


Figure 16 : Existing 2012 AM and PM Peak Hour Conditions

2.3 Existing Transportation Conditions

2.3.7 LEVEL OF SERVICE ANALYSIS

Using Synchro modeling software and the HCM 2000 delay thresholds, the existing background weekday AM and PM peak hour LOS was computed for each study intersection. The results of this analysis are reported in Tables 2A and 2B (see Appendix for the detailed LOS report). These results serve as a basis for the analysis of the impacts of the proposed development.

As shown in Table 2A, all study intersections operate at LOS C or better during the AM peak hour. As shown in Table 2B, all study intersections operate at LOS C or better during the PM peak hour with the exception of 700 North / 1100 East, which is under construction, and 9910 North / SR-92. The delay at 9910 North / SR-92 is due to unacceptable gaps in traffic for westbound left turns turning from 9910 North onto SR-92.

2.3.8 MITIGATION MEASURES

No mitigation measures are recommended for the existing 2012 conditions.

Intersection			Worst Movement[1]			Overall Intersection	
ID	Location	Control	Movement	Delay (Sec/Veh)	LOS	Avg. Delay (Sec/Veh)[2]	LOS
1	Cedar Hills Drive / No. Co. Blvd.	Signal	N/A	N/A	N/A	14.8	B
2	Harvey Boulevard / No. Co. Blvd.	WB Stop	WB LT	12.8	B	< 5.0	A
3	700 North / 1100 East[3]	4-Way Stop	WB	20.3	C	17.6	C
4	9910 North / SR-92	WB Stop	WB LT	22.5	C	< 5.0	A

1. This represents the worst approach LOS and delay (seconds/vehicle) and is only reported for unsignalized intersections.
2. This represents the overall intersection LOS and delay (seconds/vehicle).
3. Under construction conditions. Conditions are likely worse due to construction impacts.

Source: Fehr & Peers, April 2012.

Table 2A: Existing 2012 AM Peak Hour Level of Service

Intersection			Worst Movement[1]			Overall Intersection	
ID	Location	Control	Movement	Delay (Sec/Veh)	LOS	Avg. Delay (Sec/Veh)[2]	LOS
1	Cedar Hills Drive / No. Co. Blvd.	Signal	N/A	N/A	N/A	14.5	B
2	Harvey Boulevard / No. Co. Blvd.	WB Stop	WB LT	17	C	< 5.0	A
3	700 North / 1100 East[3]	4-Way Stop	NB	98.7	F	57.4	F
4	9910 North / SR-92	WB Stop	WB LT	36.5	E	< 5.0	A

1. This represents the worst approach LOS and delay (seconds/vehicle) and is only reported for unsignalized intersections.
2. This represents the overall intersection LOS and delay (seconds/vehicle).
3. Under construction conditions. Conditions are likely worse due to construction impacts.

Source: Fehr & Peers, April 2012.

Table 2B: Existing 2012 PM Peak Hour Level of Service

3.0 MARKET ASSESSMENT

The Market Assessment section is organized under the following categories:

3.1 SWOT Analysis
3.2 Demographics
3.3 Psychographics
3.4 Retail
3.5 Office
3.6 Residential
3.7 Demand Projections

3.0 Market Assessment

3.0.1 INTRODUCTION

Design Workshop was retained by USDC to complete a market investigation as part of a visioning and planning process for properties adjacent to the USDC campus in American Fork, Utah. This investigation analyzes the current and future prospects for residential, commercial, and office development for the subject property, given local and regional market information and lessons learned from other developments in Utah and around the country.

Study Objectives:
The following questions were identified as objectives established for the USDC market investigation:

- How has the local real estate market changed over the last few years, and how will recent trends both locally and nationally impact prospective development on the USDC property?
- What mix of real estate uses can be supported by the local market?

3.1 SWOT ANALYSIS

An evaluation of the strengths, weaknesses, opportunities and threats (SWOT) facing the USDC property from a market perspective was performed based upon information gathered during site visits conducted during Spring 2012, a review of aerial photography and local market data, and input from discussions with the client group and other individuals in the real estate community.

Strengths:

- Relatively favorable demographic factors in the Northern Utah County area and in the local vicinity surrounding the USDC property. The local market weathered the recent recession better than many parts of the country and appears poised for longer term growth.
- Proximity to the LDS temple, nearby schools, and local shopping areas.

Weaknesses:

- The subject property, and this portion of Northern Utah County in general, is relatively isolated from I-15 and the major transportation trunk lines that run through the valley, which connect to Salt Lake City to the north and Provo to the south. This limits the potential scale and intensity of new development on the USDC property and surrounding parcels.

Opportunities:

- There is opportunity in general to leverage proximity to Utah Valley University and to the LDS Temple to increase office and local-serving retail development.
- There is opportunity to leverage the access provided by the North County Boulevard to develop local serving office and retail uses as well as additional residential properties.

Threats:

- The real estate recovery is still relatively weak by historical standards, and therefore significant development of the USDC parcels may take many years to complete.
- Near-term developments along the SR-92(running east-west to the north of the subject property) may trump development at the USDC site given the more direct access provided by SR-92 to the I-15 corridor and to surrounding neighborhoods and communities.

3.2 DEMOGRAPHICS

Local Demographics:

The key demographic trends and projections concerning population, income, age, and other factors pertaining to the area around USDC were evaluated to reveal local market trends. These trends should be considered for their impact on planning efforts for the USDC property and potential real estate development activity in the general vicinity.

Design Workshop obtained historical and projected demographic information for the local market area from ESRI Business Solutions (ESRI). This organization helps users analyze regions and site locations, visualize and map demographic data and identify untapped market potential. Based primarily on U.S. Census data in concert with survey and other proprietary data sources, they provide historical and forecast data projections of population, median household income, age, and a variety of other key metrics.

Historical and Projected Trends:

As illustrated in the Table 3, the area located within three miles of the USDC property in northern Utah County has grown significantly over the last twenty years and the area in general represents one of the faster growing sectors in Utah and the American West. The population in the three mile radius nearly tripled from 1990 to 2010, from 25,000 people to nearly 70,000 residents. From 2010 to 2016, the area is expected to increase in population by an additional 9,000 residents. The median household income for the three mile radius, of $76,337 in 2010, reflects a significant base of affluence in the local area. This median household income is roughly $25,000 higher than the national average. Single-family homes and owning rather than renting a home tend to dominate the local area. The area within a three mile radius of the USDC campus reports home-ownership rates in excess of 80 percent, in contrast to national home-ownership rates that average around 60 percent historically.

In terms of age breakdown, adults in their prime earning and child-raising years, from the ages of 35 to 54, dominate the local study area within a three mile radius of USDC. Senior citizens age 65 or greater represented only 7 percent of the local population in 2010 will likely represent no

3-Mile Radius of USDC Site					
Source: ESRI, DW					
	1990	2000	2010	2016 (Projected)	Growth, 2010 - 2016
Population	25,220	44,501	68,611	77,156	8,545
Households	6,152	11,127	17,268	19,501	2,233
Median Household Income	$32,674	$59,434	$76,337	$85,494	
Homeownership Rate	80.8%	83.0%	82.3%	81.5%	

Table 3: Historical and Projected Demographic Trends, 3 Mile Radius Surrounding USDC Property

3-Mile Radius of USDC Site					
Age Breakdown					
	2010	2010 (Percent)	2016 (Projected)	2016 (Percent)	Growth, 2010 - 2016
0 - 14	24,074	35%	26,981	35%	2,907
15 - 24	10,219	15%	10,870	14%	651
25 - 34	8,328	12%	9,558	12%	1,230
35 - 54	16,737	24%	17,818	23%	1,081
55 - 64	4,616	7%	5,754	7%	1,138
Over 65	4,637	7%	6,175	8%	1,538

Table 4: Age Breakdown, 3 Mile Radius Surrounding USDC Property

greater than 8 percent of the population in 2016. Reflecting the significant presence of families in the area, people age 14 or less represent a total of 35 percent of the entire population within three miles of USDC, both in terms of data from 2010 and projections made for 2016. In general, relatively affluent families with multiple children dominate the neighborhood.

3.3 PSYCHOGRAPHICS

ESRI provides analyses of local populations based upon psychographic profiles that illustrate the stage of life, spending habits, and living patterns of various sub-sets of households in a given geographic area. These profiles provide clues regarding the preferences of population segments for various types of retail and residential development types. This section provides an analysis of the psychographic profiles for the area around USDC in order to help guide future development recommendations.

The primary psychographic market segments present in the vicinity of USDC today are described in the following sections. More extensive descriptions, based on characteristics collected at a national level, can be found in the appendix.

Current Psychographic Segments:

- Sophisticated Squires: This segment tends to include upscale married couple families with children, living on the fringe of development. As illustrated in the Figure 17, Sophisticated Squires currently tend to live in areas to the south of USDC, between the property and I-15, as well as right around USDC.

Figure 17 : Sophisticated Squires

- Boomburbs: Young families with dual incomes and the presence of multiple children dominate this segment. They tend to enjoy upscale suburban lifestyles and represent one of the top markets for purchases of various types of consumer goods. This group tends to locate in newer suburban housing developments around major cities. As illustrated

Top Psychographic Segments, 2011				
3 Mile Radius of USDC Site				
Segment	Households	Percent of Total	Population	Percent of Total
Sophisticated Squires	5,341	30.4%	21,986	31.6%
Boomburbs	5,084	29.0%	22,481	32.3%
Up and Coming Families	2,789	15.9%	10,963	15.7%
Main Street USA	1,948	11.1%	5,979	8.6%
Suburban Splendor	640	3.6%	2,530	3.6%

Table 5: Top Psychographic segments, 2011

in Figure 18, Boomburbs generally have located in more affluent areas around the USDC property.

Figure 18 : Boomburbs

- Up & Coming Families: This group is a mix of GenX and Baby Boomers, with a focus on growing families with higher than average incomes. Most of the wage earners in this segment are at the beginning of their careers, but they are on track to do well. Over two-thirds have college degrees and have good-paying professional jobs. They like to live in the Suburban outskirts, mostly in new housing developments. They own their homes – many for the first time as they put together the American Dream. As illustrated in Figure 19, these families tend to live to the south and west within American Fork, near downtown and near I-15.

Figure 19 : Up & Coming Families

- Main Street, USA: A mix of single-family homes and multiunit dwellings found in the suburbs of smaller metropolitan cities, mainly in the northeast, west, and midwest. This market is similar to the United States when comparing household type, age, educational attainment, housing type, occupation, industry, and household income type distributions. The median age of 36.8 years matches that of the U.S. median. The median household income is a comfortable $56,882. Homeownership is at 65 percent, and the median home value is $205,391. Active members of the community, residents participate in local civic issues and work as volunteers. They take care of their lawns and gardens, and work on small home projects. They enjoy going to the beach and visiting theme parks as well as playing chess, going bowling or ice skating, and participating in aerobic exercise.

Figure 20 : Main St. USA

- Suburban Splendor: These successful suburbanites are the epitome of upward mobility, just a couple of rungs below the top and situated recently in growing neighborhoods of affluent homes with a median home value over $377,000. Most are two-income families with children. The household population is younger, with a median age of 40 years, and is well educated and well employed. These households tend to congregate around the USDC area and within the southeastern suburbs of Salt Lake City, as illustrated in Figure 21.

Figure 21 : Suburban Splendor

Takeaways from Psychographic Segment Analysis:

In line with the general demographic factors outlined above, the area in the vicinity of the USDC property contains psychographic segments that tend to reflect middle to upper income tastes and preferences. Given the backgrounds of these psychographic groups, this means that larger format homes and somewhat higher level retail and restaurant offerings have greater potential in the area.

3.4 RETAIL

The retail offerings that exist in the vicinity of the USDC property orient around local-serving uses, including grocery, dry cleaning, banks, and other everyday uses. Larger, regional serving retail tends to cluster near Interstate 15 in the northern Utah County area, in keeping with patterns in most cities. An analysis of the existing retail spending patterns reveals that the area within a few miles of the USDC campus tends to lose retail business for electronics, home furnishings, and restaurant business to other parts of northern Utah County.

One of the key axioms of real estate is that "rooftops drive retail". In other words, adding more residents to the USDC property (through the development of townhomes, apartments, single family homes, etc.) creates demand for retail facilities to serve the needs of the additional population in the area. If the development of the USDC property were to result in several hundred new residents, this would create demand for additional grocery spending, as well as spending on everyday needs including florists, dry cleaners, pharmacies, and related uses.

The overall conclusion of the retail analysis is as follows:

- The USDC property is not positioned well enough to develop regional serving retail (including significant big box developments such as Lowe's, Target, etc.).
- Demand exists for a grocery store (mid-size, as opposed to a large warehouse grocery such as a Costco).
- Demand exists for a small program of restaurants, including one or two sit-down restaurants and three or four takeout or pad site restaurants.
- Demand exists for neighborhood retailers such as a dry cleaner, a bank branch, a coffee shop, and a few small gift stores.

3.5 OFFICE

The office market is already served fairly well in terms of higher quality, Class A office product in the Utah County area. Additionally, the local office market suffered significant setbacks during the recent real estate recession. Larger format office uses (for corporate campuses or for larger companies) tend to locate closer to I-15 and related highway facilities. The area around USDC is a more logical location for local serving office development. In particular, new office development on the USDC property may orient toward medical office uses or toward offices for smaller startup companies.

3.6 RESIDENTIAL

The residential market in the areas of northern Utah County near the USDC property have traditionally oriented around single-family detached homes, on fairly large lots and at low densities. This pattern of development is reflected in the preponderance of family oriented psychographic segments present in the study areas near the USDC property. Discussions with local developers has revealed that the local community has been somewhat less receptive to multi-family or higher density development in the past and has preferred the community continue with single-family detached development.

However, despite this historical development pattern, the residential analysis reveals that demand is likely to exist over the next twenty years for a more diversified program of residential products on the USDC property. A significant portion of the USDC property will likely develop as traditional detached housing, but demand will exist for more apartments and townhomes. In particular, townhomes and apartments may appeal to the growing senior citizen population in the northern Utah County area as well as young families who cannot yet afford to live in the larger single family detached properties present in the local area.

In general, the overall projected growth of the northern Utah County area over the next few decades, and the relatively central location of the USDC property relative to the rest of the developed area in the valley, bodes well for further residential development at the USDC property over the next twenty years.

3.7 DEMAND PROJECTIONS

Based upon an analysis of the existing inventory of built product in the northern Utah County area and projected growth rates for the community over the next two decades, the market investigation concludes that the USDC property has demand for a variety of product types, as outlined in table 6. This is a 25 year projection, based on long term rates of projected growth in population and employment. This program should be used as a planning tool and evaluated with site capacity, existing contextual land uses and a balance of land uses across all phases.

	Alternative 1 (SF or Units)			
	Total	10-15 Year	15 - 25 Year	10 Year - 25 Year
Grocery Retail	35,000	35,000	0	0
Restaurants	30,000	20,000	10,000	0
In-Line Retail	30,000	20,000	10,000	0
Pad Retail	25,000	15,000	10,000	0
Office	30,000	20,000	10,000	
Single-Family Development	100	100	80	0
Townhomes	120	80	40	
Apartments	400	200	200	0
Senior Housing (Apartments)	150	100	50	0
Senior Housing (Detached)	75	50	25	0

Table 6: Conceptual site Program

4.0 MASTER PLAN

The Master Plan section is organized under the following categories:

4.1 Plan Composition and Land Uses
4.2 Development Summary
4.3 Utility Framework Plan
4.4 Transportation
4.5 Phasing
4.6 Proforma

4.1 Plan Composition and Land Uses

4.1.1 ROAD FRAMEWORK

The road framework in the master plan is designed to integrate with existing intersections and also accommodate future road connections.

A main priority in the organization of the roads is to deliver a higher volume of traffic through a commercial center on the project site in order to create the highest potential for retail viability. The diagonal road illustrated in the plan captures a high percentage of vehicle trips in the project area and directs them through the commercial district in the north east corner of the project site. This also has benefits for the existing commercial areas built in that vicinity. Some minor access points for Lone Peak High School may need to be re-configured to allow for intersection stacking lengths and safety. It is also anticipated that traffic calming measures will be implemented along the north side of the site to enhance pedestrian safety in the vicinity of the school.

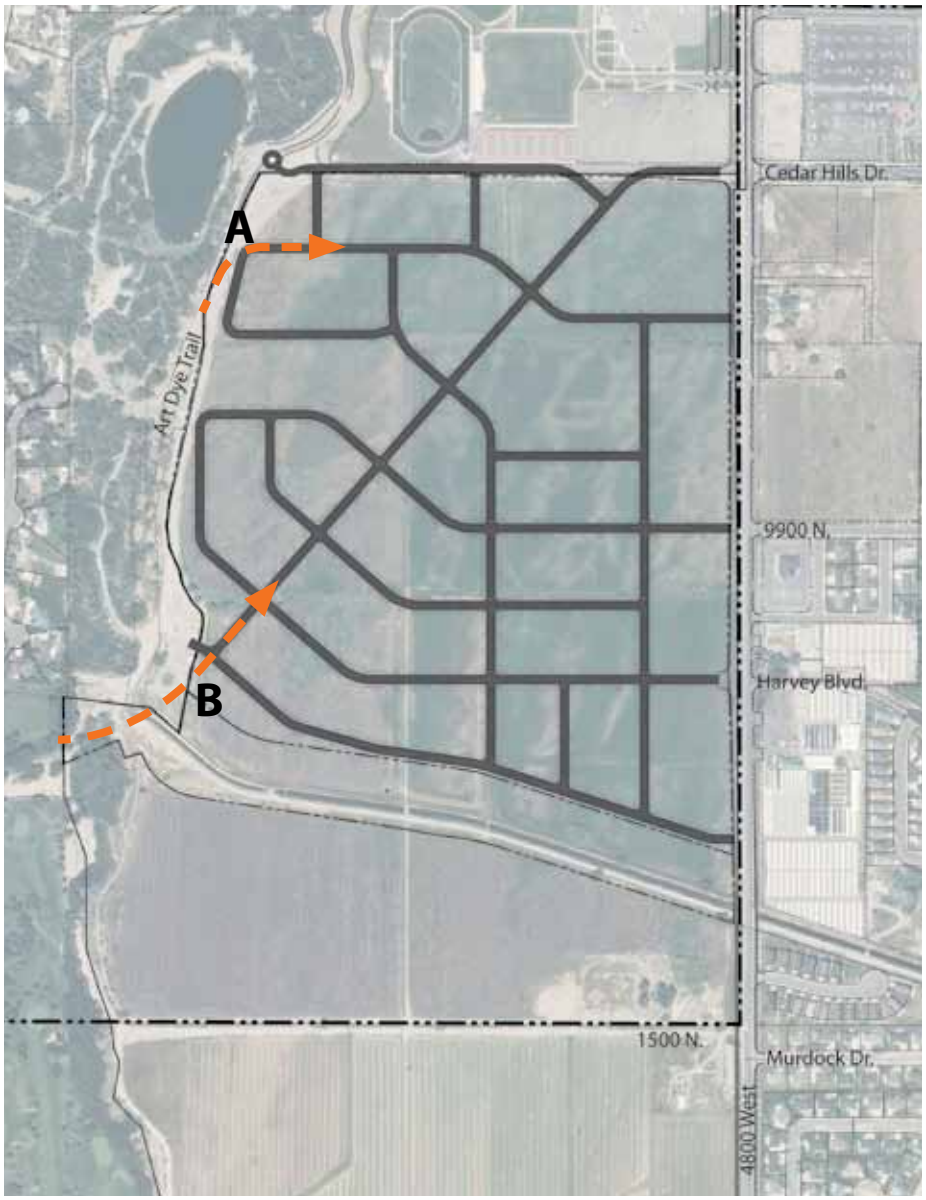


Figure 22 : Road Framework Diagram

- **Curb Cuts:**
  Four curb-cuts are proposed along the North County Boulevard. One of those connection points is proposed at Harvey Boulevard, where Highland City has proposed linking the Murdock Connector. Another curb-cut is proposed at 9900 North, and two more are located at undesignated street locations. It is anticipated that the road aligned with 9900 North would be used to access the Highland Trail trailhead.

  It is important to keep curb-cuts to a minimum and aligned with existing or proposed streets to ensure access points along the North County Boulevard can be managed effectively in the long-term and so that the flow and volume of the newly constructed corridor can be maintained.

- **Murdock Connector:**
  The Murdock Connector is a road being planned by Highland City to run through this project site from areas west to the North County Boulevard on the east side of the site. Multiple alignments are under consideration. The two alternative access points are identified at points **A** and **B** in the diagram to the right.

  It is anticipated that once the road reaches the project site, the alignment will follow the recommendations in this Master Plan.

4.1 Plan Composition and Land Uses

4.1.2 OPENSPACE

The openspace framework in the master plan is designed to be a significant asset for the community. Parks of varying sizes are incorporated to provide a range of uses within the community and openspace corridors were integrated to allow for trails, stormwater detention, connection to regional assets and to accommodate multiple uses.

- **Community Park:**
  A large Park that is 3.2 acres in size is centrally located in the northern portion of the site. This park is large enough to accommodate some smaller recreational fields or to be a programmed space for the community, which might include a plaza area and water feature, shade trees, jogging path, informal sports fields, stormwater detention, farmers market area or a pavilion. There could also be some overlap or dual use with Lone Peak High School and the surrounding neighborhood community.

- **Neighborhood Parks:**
  A series of smaller neighborhood parks around 1 acre in size are distributed around the community. These parks are intended to have small community garden plots, play structures, shade trees and seating areas.

- **Open Space Connectors:**
  Open space connectors are located along roads throughout the community to provide space for off-street trails and stormwater conveyance. These corridors link Lone Peak High School with the Murdock Trail corridor and link the North County Boulevard, north of the Murdock Pipeline Trail, to Highland Trail, Art Dye Trail and Highland Glen Park.

Figure 23 : Openspace Framework Diagram

- **Community Supported Agriculture (CSA):**
  A potential CSA could be integrated alongside the Murdock Pipeline Trail to serve this project and the larger community. For more information on what a CSA is, visit www.csautah.org/.

- **Remaining Open Space:**
  The remainder of the Developmental Center Properties are to be maintained as openspace with a continuation of the agricultural use operations.

4.1 Plan Composition and Land Uses

Example Community Park

Example Openspace Connector

Example Neighborhood Park

Example CSA

Example Community Garden

Trail Character

4.1 Plan Composition and Land Uses

4.1.3 SINGLE FAMILY RESIDENTIAL

The biggest market demand for this site is single-family residential. This location is also well suited to residential uses considering the high percentage of that use in the regional context and high value existing and future assets like the Murdock Pipeline trail, LDS Temple, local parks, trails golf and schools.

- **Single Family Residential:**
  This land use is primarily positioned away from arterial street frontages and a high percentage of the lots are positioned adjacent to open space conditions, which will increase potential values. The lots range in size from over a quarter acre, down to .13 acres. Most of these lots are alley-loaded to get garages in the rear and porches out front to foster a more traditional community interactions.

- **Senior Single Family Residential:**
  The differences in Senior single-Family from Single-Family are minor but notable:

  a. Senior Single-Family is usually a single-story home so that they are accessible for those with ambulatory challenges.

  b. There is often a home-owners association that residents fund, which takes care of grounds maintenance.

  c. The lots are typically smaller, accounting for smaller units that are generally preferred by seniors.

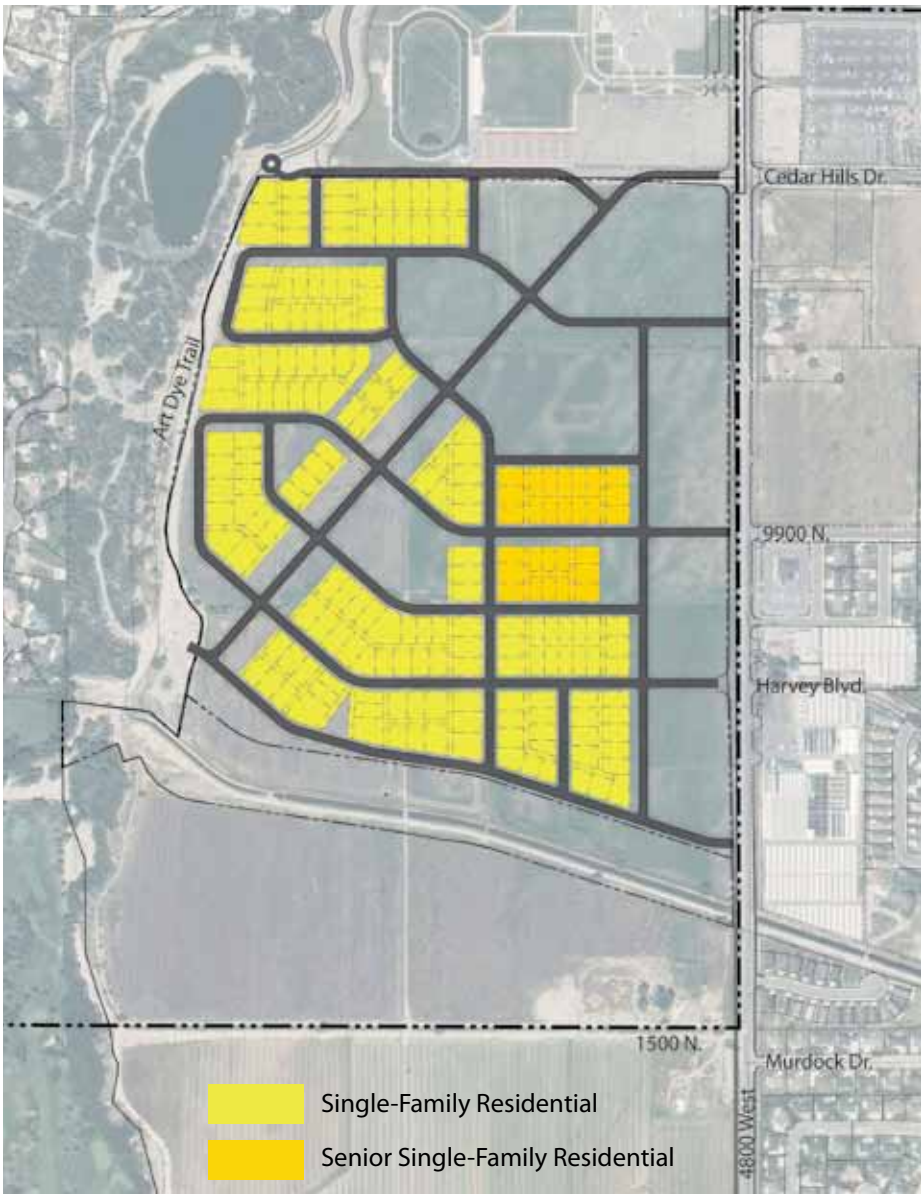


Figure 24 : Single-Family Residential Land Use Diagram

Single-Family Residential Character

Senior Single-Family Residential Character

4.1 Plan Composition and Land Uses

4.1.4 MULTI- FAMILY RESIDENTIAL

Multi-family residential uses in this plan are generally organized along higher volume arterial streets and have buildings fronting the streets and private courtyards in the center of the blocks.

- **Townhomes:**
  Townhomes are a type of medium-density housing, which is typically organized on a small footprint with multiple floors and units stacked side by side (row house). Townhomes are typically parked under the unit, and in the case of this plan, parking under the unit from the rear and accessed by an alley.

- **Apartments:**
  Apartments are a self-contained housing unit, where multiple units compose a building. These are often called flats or stacked flats. The apartments in this plan are envisioned at 2-3 stories and are a low enough density to surface park in the middle of the complex or park with one level below grade.

- **Senior Apartments / Assisted Living:**
  There is a small senior apartment component of this land use master plan adjacent to the senior single-family lots. This could be an assisted living complex or independent living units catered specifically for seniors.

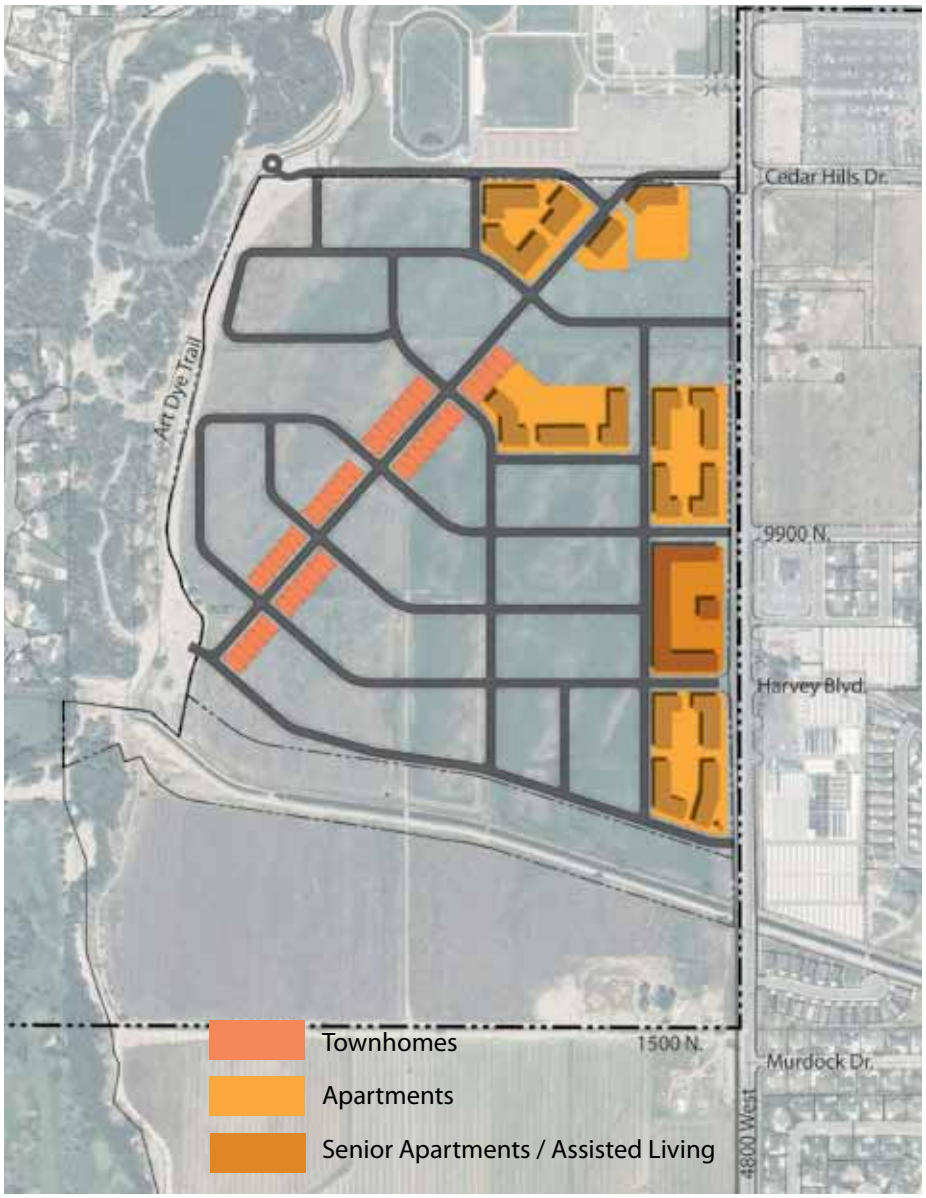


Figure 25 : Multi-Family Residential Land Use Diagram

Townhome Character

Apartments Character

Senior Apartments / Assisted Living Character

4.1 Plan Composition and Land Uses

4.1.5 COMMERCIAL

A commercial center is positioned near the north eastern portion of the site to take advantage of the existing commercial presence that is building there. The composition of the commercial center in this master plan is organized like a lifestyle center, where a small street is fronted with uses. Parking is on surface behind the buildings and the streetscape is well done with street trees, hardscape, a plaza where the open space corridor meets the commercial street and pedestrian scaled lighting.

- **Retail:**
  The composition of the retail in this master plan includes restaurants, some shopping and daily needs. Two restaurant or bank pads are located at the North County Blvd. / Cedar Hills Dr. intersection and the remainder of the street is primarily single-story retail with parapet walls to extend the building height. A 125,000 (+) square feet build-out should be targeted to create a critical mass and neighborhood context draw and tenant interest for this use.

- **Office:**
  There is demand for a small amount of professional office in this location. In this master plan, the office is linked to the commercial center, bookending the street and facing onto the community park. This office is 2-3 stories and is surface parked or with one level sub-grade under the building.

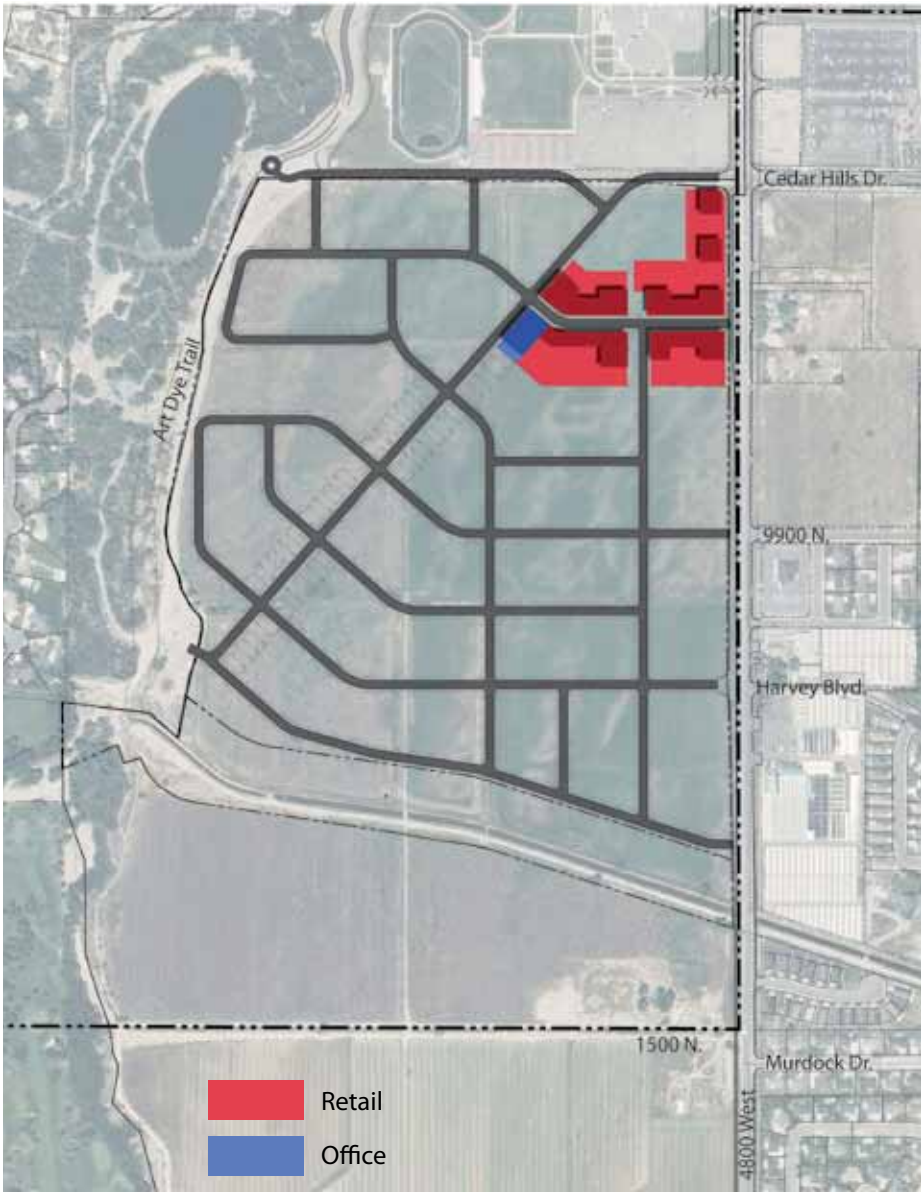


Figure 26 : Commercial Land Use Diagram

Retail Character

Office Character

4.1 Plan Composition and Land Uses

4.1.6 COMMUNITY BASED DEVELOPMENT

Most communities of this scale are large enough to support a community ammenity.

The site for the community based development parcel is located centrally in the community where it can be phased in once a critical mass of residents are living within the community.

The use for this site should be determined at a later date as the community develops and needs are determned. Potential uses could include a community center, senior center, gym or many other uses.

Figure 27 : Religious Institution

4.2 Development summary

Land Use	Acreage	Units / Lots	Square Feet	% of Land
Single Family Residential	34	165		24%
Apartments	15.76	630		11%
Townhomes	3.99	49		3%
Senior Apartments	3.34	200		2%
Senior Single Family	4.61	28		3%
Retail	6.15		133,991	4%
Office	1.54		40,197	1%
Community Based Development	2.84			2%
Open Space	22.35			16%
Roads (ROW)	48			34%
Total:	**143**			**100%**

Table 7: Development Summary

4.2 DEVELOPMENT SUMMARY

The information presented on this page is a projected calculation of units, lots and square footages based on density assumptions. For this study, the following density assumptions are embedded in these calculations:

Single Family: 5.1 units / acre

Apartments: 40 units / acre

Townhomes: 12.1 units / acre

Senior Apartments: 60 units / acre

Senior Single-Family: 6 units / acre

Retail: .5 Floor Area Ratio (FAR)

Office: .6 FAR

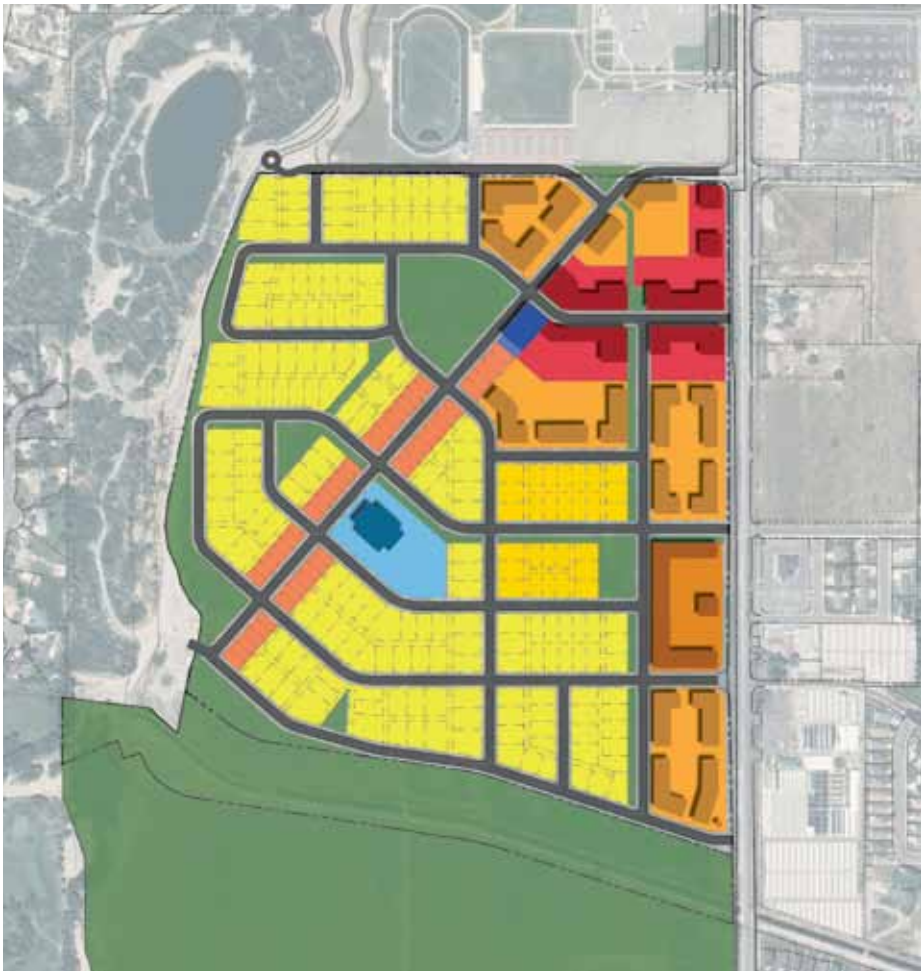


Figure 28 : Overall Land-Use Master Plan

4.3 Utility Framework Plan

4.3.1 INTRODUCTION

As part of the USDC Master Plan, the design team has completed a utility framework plan. The utility framework plan is intended to show connection locations and mainline sizes for key infrastructure including water, pressurized irrigation, sewer, and power. The framework plan also shows a conceptual drainage plan per Highland City requirements.

4.3.2 WATER SYSTEM FRAMEWORK

To develop the framework water system plan, Stantec evaluated the existing Highland City water system, calculated system demands for the proposed development, and evaluated connection points based on our review of available information. The water demands were calculated for the USDC development area based on the land use plan and State of Utah Division of Drinking Water (UDDW) Standards. The water demands were used to size water lines and identify source and storage demands for the project (See Figure 28) for the water system framework).

Water Demands:
The UDDW Standards require water system demand calculations for source, storage, line sizing, and water rights. The following describes the basis for the UDDW demands:

- ***Peak Day Demand*** – This is used to identify the required source capacity for a water system.
- ***Average Day Demand*** – This is used to identify the required storage demand for a water system. Storage must also be provided to supply fire flow.
- ***Peak Day + Fire Flow*** – This demand typically controls line sizing and is the sum of the project fire flow demand + the peak day demand.
- ***Peak Instantaneous Demand*** – This is considered the highest instantaneous use on a water system. This is also used to evaluate line sizing, but typically does not control it.
- ***Annual Water Right Demand*** – This is equal to the annualized average day demand for indoor demands and annual water demand for irrigation.

There are several land use types associated with the water system master plan including single family, townhomes, apartments, retail, office, and Community Based Development. The following two sections summarize the demands applied to this master plan for the potable water system. Refer to the appendix for detailed calculations.

Peak Day Demands:
UDDW standards are based on equivalent residential units (ERU's). Typical values for other standard uses are also provided in section R309-510 of the Rules Governing Public Drinking Water Systems. An ERU is a single family home representing an average of (4-4.5) residents per home and equates to a peak day demand of 800 gpd/unit. For this project the following unit peak day demands were derived from R309-510 and applied to the project:

- Single Family (1 ERU/unit): 800 gpd/unit
- Townhomes (0.75 ERU's/unit): 600 gpd/unit
- Apartments (0.625 ERU/Unit): 500 gpd/unit
- Retail (1 ERU/ 2000 sq.ft.): 800 gpd/ERU
- Office (1 ERU/ 2500 sq.ft.): 800 gpd/ERU
- Community Based Development (5 ERU/unit): 800 gpd/ERU
- The calculated peak day demand for the potable system is 465 gpm (see Appendix).

Average Day Demands:
Average day demands represent the amount of water that must be available in a storage facility. The UDDW standards for average day demands are equivalent to half of the peak day demand. For the USDC Utility Framework, this equates to the following:

- Single Family (1 ERU/unit): 400 gpd/unit
- Townhomes (0.75 ERU's/unit): 300 gpd/unit
- Apartments (0.625 ERU/Unit): 250 gpd/unit
- Retail (1 ERU/ 2000 sq.ft.): 400 gpd/ERU
- Office (1 ERU/ 2500 sq.ft.): 400 gpd/ERU
- Community Based Development (5 ERU/unit): 400 gpd/ERU
- The calculated average day demand for the master planned potable

4.3 Utility Framework Plan

system is 334,600 gallons (see Appendix).

Fire Flow Demands:
The State of Utah has adopted the International Fire Code (IFC) for fire safety regulations. As part of the IFC Standard, fire flow demands can be calculated for a water system area by evaluating the largest fire flow demand for the area. The Highland City Master Plan included 4,000 gpm for the fire flow demand in this area. This is a conservative number that will allow USDC great flexibility as they move forward with the development of this property. It should be noted that the IFC will allow for a reduction in fire flow based on equipping the interior of buildings with fire suppression sprinklers. Although it is anticipated that the non-residential uses will control fire flow for this area of the City, a typical residential fire flow is 1,500 gpm for (2) hours. It is recommended that USDC coordinate with Highland City during the platting process to finalize the fire flow for the development.

Peak Instantaneous Demands:
UDDW calculates peak instantaneous indoor demand based on an empirical equation that relates the number of ERU's to the peak day demand. This equation is expressed as follows:

Q=10.8*(n)0.64
Where:

Q = Peak Instantaneous Demand in gpm
n = Number of ERU's

The calculated peak instantaneous demand for the potable system is 801 gpm (see Appendix).

Figure 29 : Water Framework Plan

Average Annual Water Right Demands
The average annual water right demand represents the amount of water rights that are required to be held by the water system.

Based on the calculations, the USDC land use plan will require 374.8 ac-ft for potable uses (see Appendix).

Municipal System Expansion
As stated above, the City's Master plan shows a 12"-diameter loop through the USDC site. The remaining main water lines should be adequate at 12". The pressures at the site are relatively high. Coordination with Engineering staff should be conducted during development to evaluate the potential of a Pressure Regulating Valve (PRV) at the north end of the development.

4.3.3 SEWER SYSTEM FRAMEWORK

The sewer system master plan for the USDC development was developed in concert with the water system framework. Flow rates were derived from the appropriate water system demands with applicable peaking factors. The key objectives of the sewer framework are to identify points of connection, illustrate sewer collector alignments, and calculate sewer flows for the study area. Figure 29 illustrates the proposed sanitary sewer plan.

Sanitary Sewer Flows
The Sewer Framework Plan was designed to Utah Department of Environmental Quality (UDEQ) Standards. Title R317 of the Utah Administrative Code governs sanitary sewer design for the State. Section R317-3 details the requirements for sizing wastewater collection, treatment and disposal systems. Additionally, Highland City Design Standards and the Highland City Wastewater Collection System Master Plan were used as a reference. State and local requirements were used as a basis for the sewer flow calculation at the USDC development. The two key sewer flow calculations are as follows:

- Annual Average Daily Flow Rate (AADF): Highland City uses 80 gallons per capita day (gpcd) for the AADF calculation. This includes 55 gpcd per person and 25 gpcd for inflow and infiltration during wet weather. Based on the assumption that one ERU is 4.5 people, the AADF = 360 gpcd/ERU

- Maximum Design Flow Rate (MDF): Highland City applies a peaking factor of (4) to the AADF to determine the MDF. Alternatively, MDF can be calculated by applying a variable peaking factor per figure 4-1 of their master plan.

The total number of ERUs for the USDC project is 836.5. This equates to an AADF of 225 gpm (0.32 MGD) and a peak MDF of 898 gpm.

Based on Figure 4-1 of Highland City's master plan, a lower peaking factor can be used for the out-fall and lift station design. The peaking factor is based on the AADF in MGD. For an AADF of 0.32 MGD, the corresponding peaking factor is 2.7. This equates to a design MDF of 608 gpm for the out-fall and lift station (detailed calculations are available in the Appendix).

Municipal System Expansion
Highland City requires that sewer mains be sized for a d/D (depth of water over diameter) of 50%. The following lists pipe capacity at a 50% d/D for the City preferred slope of 0.60% (detailed calculations are available in the Appendix).

- 8" = 210 gpm
- 10" = 381 gpm
- 12" = 619 gpm
- 15" = 1124 gpm

Based on existing infrastructure, it is apparent that upgrades to the American Fork River Lift Station will be required. USDC will need to coordinate other system upgrades during the development process.

4.3 Utility Framework Plan

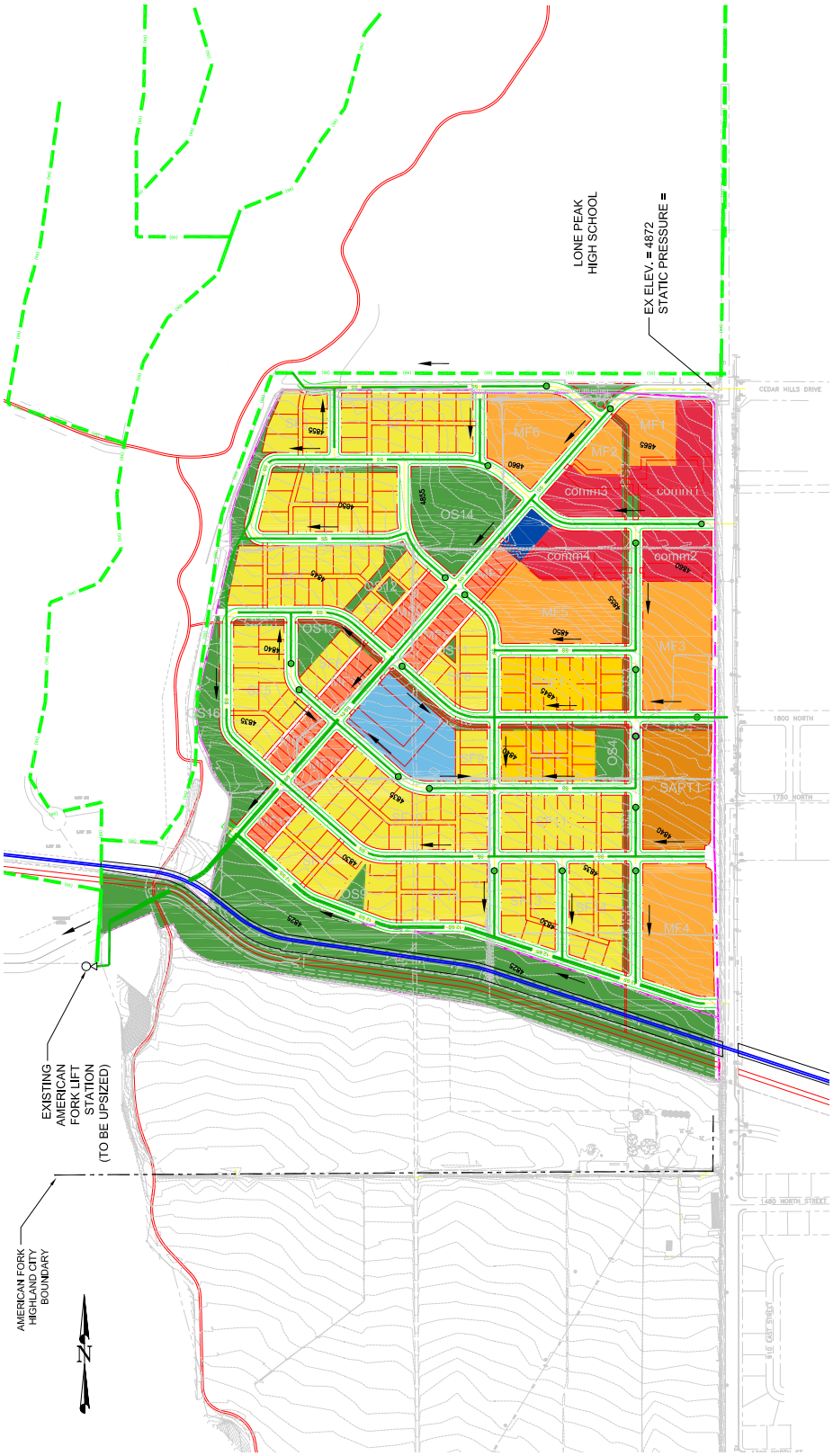


Figure 30 : Sewer Framework Plan

4.3.4 STORM WATER

The storm water framework strategy for the USDC development was completed to identify key constraints that must be addressed during design development and final design for the project. The goal was to provide a conceptual drainage plan that meets Highland City's requirements. To complete this portion of the utility framework, relevant hydrologic data was assembled for the project area including topography, precipitation data, and the proposed land use plan. Figure 30 illustrates the on-site storm water plan for the site.

Drainage Control Plan:
The USDC Development is located in Section 1, Township 5 South, Range 1 East, Salt Lake Base and Meridian. The proposed development area consists of residential, retail, office and open space land uses. The total area of the proposed development is 143 acres with the following land use breakdown:

- Single Family: Total Area = 50.6 acres
- Townhomes: Total Area = 4.0 acres
- Apartments: Total Area = 19.1 acres
- Retail: Total Area = 6.15 acres
- Office: Total Area = 1.54 acres
- Community Based Development: Total Area = 2.84 acres
- Open Space: Total Area = 22.35 acres
- Roadways: Total Area = 36.00 acres

Drainage Basin and Sub-basins:
The site is located on the east side of the American Fork River and drains from the northeast corner of the site to the southeast corner. The American Fork River enters a siphon off the northeast corner of the site. The current land use is agricultural.

4.3 Utility Framework Plan

Drainage Design Criteria:
The proposed drainage plan is based on an on-site retention concept. Precipitation data was obtained from the National Oceanic and Atmospheric Administration (NOAA) and is available in the Appendix. This information was used as part of the on-site retention basin sizing. See Appendix for retention basin sizing.

It should be noted that infiltration was not considered with this phase of planning. Geotechnical information should be obtained to include this with the final design. It is also anticipated that some non-residential areas will retain on site as part of the final design. This could reduce the size of the proposed basins. Final design should also consider use of dry wells as part of the overall management of storm water.

Storm water quality will be an important aspect of the final design for the system. The following recommendations are proposed to improve storm water quality:

- Oil/water separation from parking lots prior to retention/detention.
- Extended catch basins and/ or hydrodynamic separators for removal of suspended solids.
- Periodic maintenance will be required to remove sediment deposits from catch basins, pipelines, and ponds.
- Sediment storage shall be included in retention pond sizing

Figure 31 : Storm Water Framework Plan

4.3 Utility Framework Plan

Identification of Potential Improvements to Public Drainage Systems:
As stated above, a detention concept could be evaluated in the future. Given the current design, impacts to local drainage systems are not anticipated. Geotechnical information to evaluate groundwater and infiltration will be an important step in the design of the storm water system.

4.3.5 PRESSURIZED IRRIGATION

To develop the framework for the pressurized irrigation (PI) system, Stantec evaluated the existing Highland City pressurized irrigation system, calculated system demands for the proposed development, and evaluated connection points based on our review of available information. The pressurized irrigation demands were calculated for the USDC development based on the land use plan and State of Utah Division of Drinking Water (UDDW) standards. These secondary or irrigation water demands were used to size water lines and identify source and storage demands for the project (See Figure 31 for the water system framework).

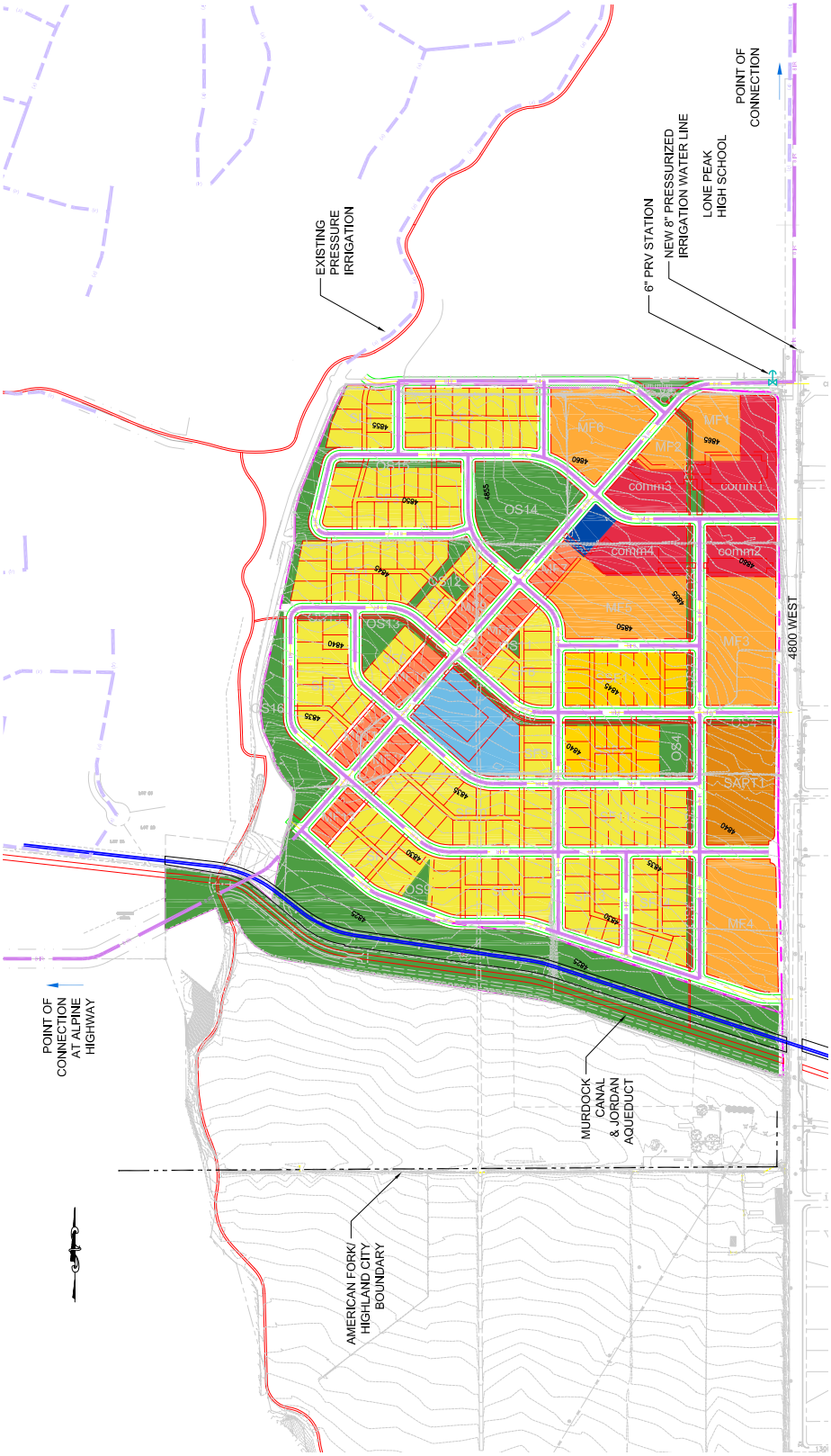


Figure 32 : Pressurized Irrigation Framework Plan

4.3 Utility Framework Plan

Outdoor Demands:
Outdoor demands were calculated for the project based on irrigated area assumptions and the estimated consumptive use for turf grass. Based on the land use plan, it is assumed that the majority of the open space will be native/non-irrigated. The following documents the irrigated area percentages incorporated into the PI framework:

- Single Family: Total Area = 38.5 acres, 40% irrigated
- Townhomes: Total Area = 4.0 acres, 20% irrigated
- Apartments: Total Area = 19.1 acres, 15% irrigated
- Retail: Total Area = 6.15 acres, 15% irrigated
- Office: Total Area = 1.54 acres, 15% irrigated
- Community Based Development: Total Area = 2.84 acres, 15% irrigated
- Open Space: Total Area = 22.35 acres, 40% irrigated
- Roadways: Total Area = 48.00 acres, 10% irrigated

The consumptive use was calculated based on the Utah Division of Water Rights Consumptive Use Tables. These tables were derived from a report completed by Utah State University (1998) and are based on climate for several weather stations across the state. The Pleasant Grove data was used for the USDC study.

Peak day demand is determined by applying the consumptive use values for turf grass in the Utah County area coupled with an application efficiency. Annual demands are also calculated based on the seasonal consumptive use in a drought year. The following irrigation unit demands were calculated for the Moab area and are applicable to this project:

- Peak Day Demand: 8,160 gpd/irrigated acre
- Average Day Demand: 4,080 gallons/irrigated acre
- Peak Instantaneous demand: 11.3 gpm/irrigated acre
- Average Annual demand: 2.73 ac-ft/irrigated acre

Please refer to the Appendix for detailed irrigation demands.

System Expansion:
As stated previously, a PRV will be required to connect to one of the PI lines located north of the USDC site. A second connection is also anticipated to the west of the site for looping. There is a network of 8"-diameter PI lines west of the site. Based on the site PI demands, 8" mains should adequately distribute irrigation water throughout the USDC development.

4.3 Utility Framework Plan

4.3.6 POWER

To develop the framework power system plan, Stantec obtained existing system information from Rocky Mountain Power. The key aspect of the power framework includes identification of connection points to the existing Power distribution grid. A preliminary distribution plan has also been prepared to illustrate a potential power delivery plan for site. (See Figure 32 for the power system framework).

Proposed System Expansion:
It is anticipated that three phase primary distribution will be preferred to serve the commercial area of the development. It is also anticipated that the power will be provided underground. In addition to the primary distribution, a grid of single phase distribution will be required to serve the single family housing areas of the USDC development as part of the final design.

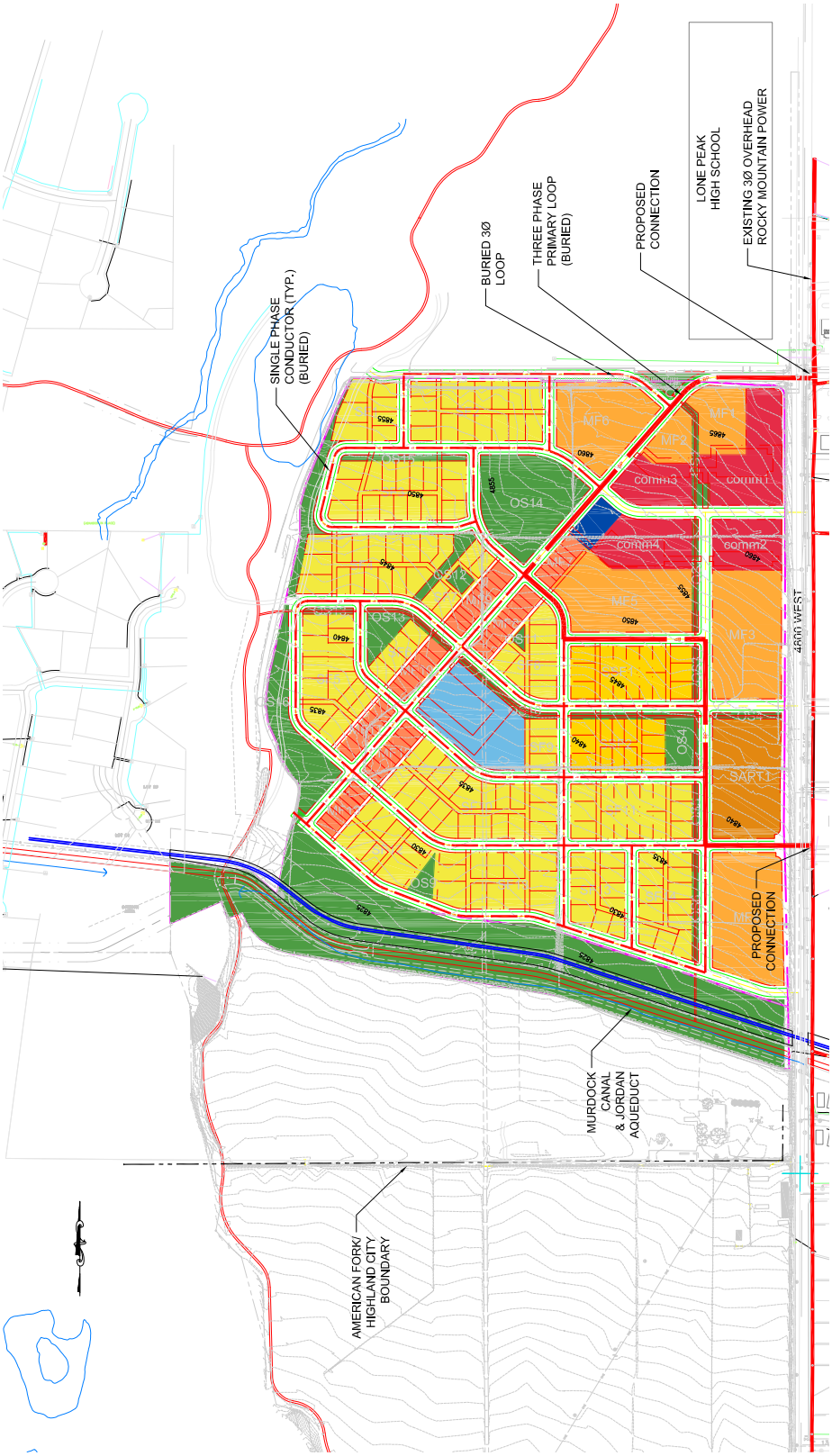


Figure 33 : Power Framework Plan

4.4 Transportation

4.4.1 INTRODUCTION

Traffic operations and impacts were analyzed at key intersections and roadways in the vicinity of the site for existing 2012 and future 2040 conditions. Both the AM and PM scenarios were performed for existing and 2040 time periods.

This section analyzes the traffic impacts of the site in conjunction with adjacent intersections. Where changes are needed to maintain acceptable level of service (LOS), improvements are proposed. Impacts are specifically addressed at the following study intersections and roadways:

- Cedar Hills Drive / North County Boulevard
- Harvey Boulevard / North County Boulevard
- 700 North / 1100 East
- 9910 North / SR-92

4.4.2 PROPOSED DEVELOPMENT

The proposed development includes (and is shown in Table 8.

- 255 Single-family homes
- 803 Multi-family homes
- 50 Townhomes
- 133,991 square feet of retail
- 40,00 square feet of office

Table 8 also shows the net external trips expected to be generated by USDC master plan and the percent reduction due to vehicle trip internalization.

Project traffic was assigned to the roadway network based on the proximity of project access points to major streets and freeways, high population densities, and regional trip attractions. Existing travel patterns observed during data collection also provided helpful guidance to establish these distribution percentages, especially in close proximity to the site. Figure 33 shows the resulting project-generated weekday AM and PM peak hour trips.

Time Period	Gross Trips	Net External Trips	Vehicle Trip Internalization
Daily	17,520	16,075	8%
AM Peak Hour	967	911	6%
PM Peak Hour	1,741	1,606	8%
Source: Fehr & Peers, March 2013			

Table 8: MXD Trip Generation and Internalization Estimate

4.4.3 2012 PLUS USDC PROJECT

Figure 34 : Project Generated Traffic

4.4 Transportation

The 2012 plus project conditions analysis evaluated the impact of the project traffic on the surrounding roadway network in the year 2012. In order to analyze this impact, the projected 2012 background traffic volumes were combined with those generated by the proposed project.

Intersection LOS analyses were then performed and compared to the results of the projected 2012 background traffic volumes. This comparison shows the impact of the proposed project.

Traffic Volumes:
Project-generated traffic (shown in Figure 33) was added to the 2012 background volumes to yield "2012 plus project" PM peak hour traffic volumes at the study intersections. The resulting PM peak hour traffic volumes are displayed in Figure 34.

Level of Service Analysis:
Using Synchro modeling software and the HCM 2000 delay thresholds, the AM and PM peak hour LOS was computed for each study intersection and project access. The results of this analysis are reported in Tables 5A and 5B (see Appendix for the detailed LOS report). The intersection of Harvey Boulevard / North County Boulevard is analyzed as a signal because the Highland City General Plan outlines this location as a future signal. As shown in Table 9A, all study intersections operate at LOS D or better during the AM peak hour. As shown in Table 9B, all study intersections operate at LOS C or better during the PM peak hour with the exception of the minor approach at Town Center / North County Boulevard. The delay at Town Center / North County Boulevard is due to unacceptable gaps in traffic for eastbound left turns turning from Town Center onto the North County Boulevard. It is expected that drivers will utilize signalized intersections or alternative routes if delay is unacceptable.

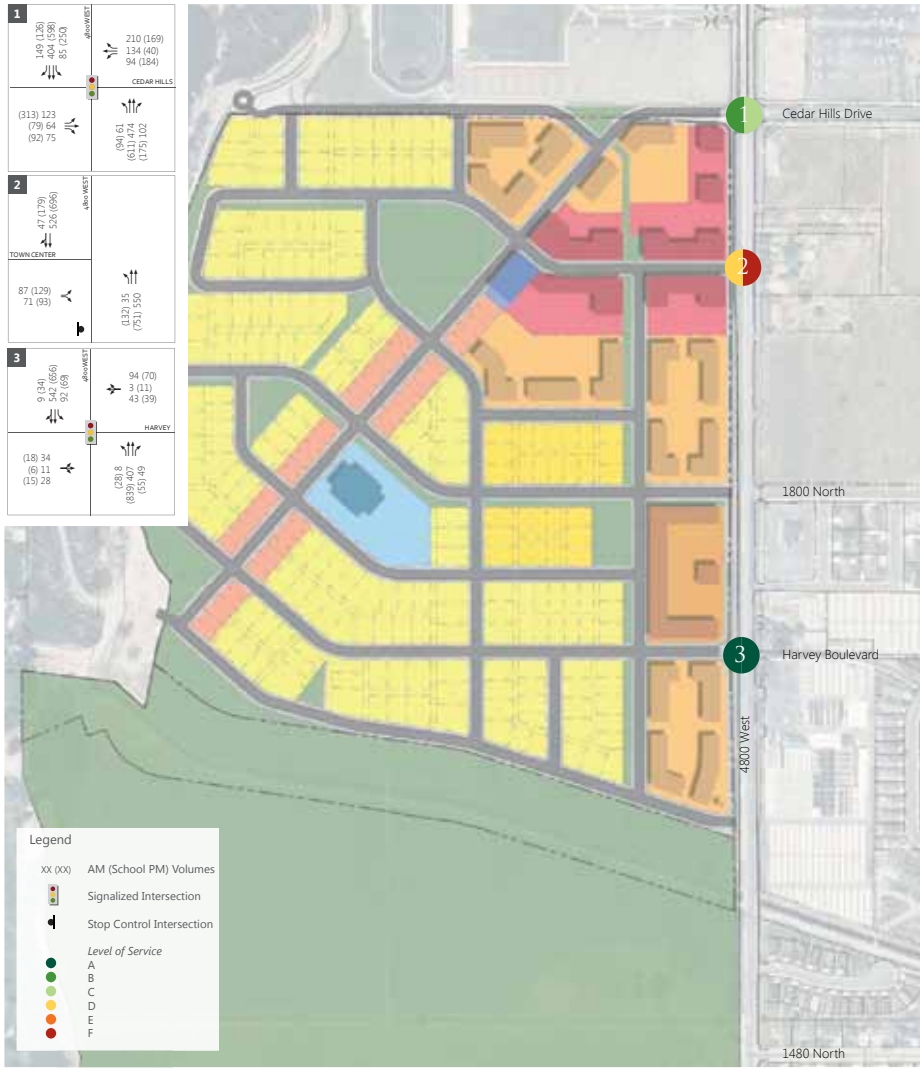


Figure 35 : Existing Plus Project Traffic

Intersection			Worst Movement[1]			Overall Intersection	
ID	Location	Control	Movement	Delay (Sec/Veh)	LOS	Avg. Delay (Sec/Veh)[2]	LOS
1	Cedar Hills Drive / No. Co. Blvd.	Signal	N/A	N/A	N/A	17.5	B
2	Town Center / No. Co. Blvd.	EB Stop	EBL	28.6	D	< 5.0	A
3	Harvey Boulevard /No. Co. Blvd.	Signal	N/A	N/A	N/A	< 5.0	A

1. This represents the worst approach LOS and delay (seconds/vehicle) and is only reported for unsignalized intersections.
2. This represents the overall intersection LOS and delay (seconds/vehicle).
Source: Fehr & Peers, March 2013.

Table 9A: Existing 2012 Plus Project AM Peak Hour Level Of Service

Intersection			Worst Movement[1]			Overall Intersection	
ID	Location	Control	Movement	Delay (Sec/Veh)	LOS	Avg. Delay (Sec/Veh)[2]	LOS
1	Cedar Hills Drive / No. Co. Blvd.	Signal	N/A	N/A	N/A	20.4	C
2	Town Center / No. Co. Blvd.	EB Stop	EBL	> 50.0	F	< 5.0	A
3	Harvey Boulevard /No. Co. Blvd.	Signal	N/A	N/A	N/A	< 5.0	A

1. This represents the worst approach LOS and delay (seconds/vehicle) and is only reported for unsignalized intersections.
2. This represents the overall intersection LOS and delay (seconds/vehicle).
Source: Fehr & Peers, March 2013.

Table 9B: Existing 2012 Plus Project PM (School) Peak Hour Level of Service

4.4 Transportation

4.4.4 FUTURE 2040 CONDITIONS

The future 2040 background conditions analysis evaluated the intersections under projected 2040 peak hour traffic volumes and roadway conditions. This analysis also provides a baseline condition for the year 2040, which can be used to determine project impacts in 2040.

Traffic Volumes:
Fehr & Peers projected 2040 volumes using the following growth rates based on MAG's 2040 travel demand model.

- 1.6% for the North County Boulevard, North of Cedar Hills
- 2.4% for the North County Boulevard, South of Cedar Hills
- 2.3% for Cedar Hills, East of the North County Boulevard
- 4.0% for Harvey Boulevard, East of the North County Boulevard

These volumes represent the 2040 background traffic conditions and are shown in Figure 35.

Level of Service Analysis:
Using Synchro modeling software and HCM 2000 delay thresholds, the existing background weekday AM and PM peak hour LOS was computed for each study intersection. The results of this analysis are reported in Tables 5A and 5B (see Appendix for the detailed LOS report). These results serve as a basis for the analysis of the impacts of the proposed development in 2040. The intersection of Harvey Boulevard / North County Boulevard is analyzed as a signal because the Highland City General Plan outlines this location as a future signal.

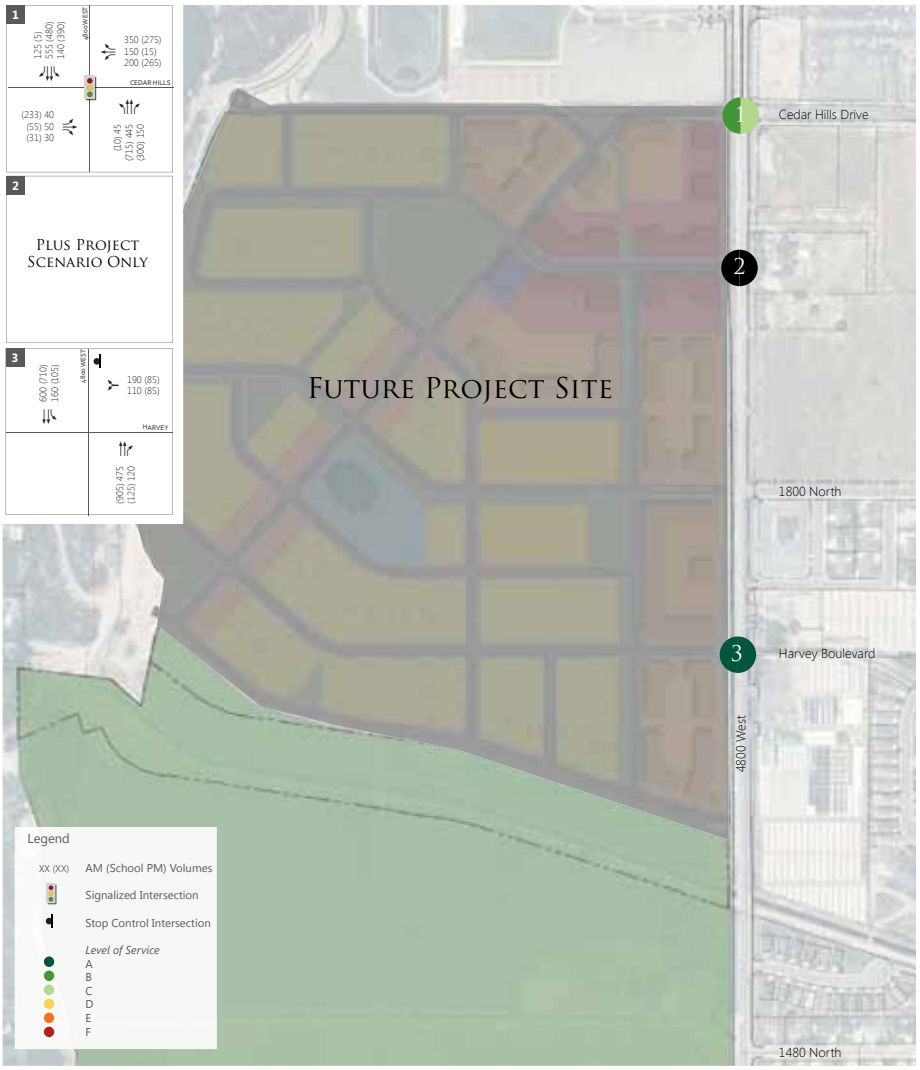


Figure 36 : Future 2040 Conditions

4.4 Transportation

4.4.5 2040 PLUS USDC PROJECT

The 2040 plus project conditions analysis evaluated the impact of the project traffic on the surrounding roadway network in the year 2040. In order to analyze this impact, the projected 2040 background traffic volumes were combined with those generated by the proposed project. Intersection LOS analyses were then performed and compared to the results of the projected 2040 background traffic volumes. This comparison shows the impact of the proposed project.

Traffic Volumes:
Project-generated traffic (shown in Figure 33) was added to the 2040 background volumes (shown in Figure 35) to yield "2040 plus project" PM peak hour traffic volumes at the study intersections. The resulting PM peak hour traffic volumes are displayed in Figure 36.

Level of Service Analysis:
Using Synchro modeling software and HCM 2000 delay thresholds, the AM and PM peak hour LOS was computed for each study intersection and project access. The results of this analysis are reported in Tables 10A and 10B (see Appendix for the detailed LOS report). The intersection of Harvey Boulevard / North County Boulevard is analyzed as a signal because the Highland City General Plan outlines this location as a future signal.

As shown in Table 10A, all study intersections operate at LOS B or better during the AM peak hour. As shown in Table 10B, all study intersections operate at LOS C or better during the PM peak hour with the exception of the minor approach at Town Center / North County Boulevard. The delay at Town Center / North County Boulevard is due to unacceptable gaps in traffic for eastbound left turns turning from Town Center onto the North County Boulevard. It is expected that drivers will utilize signalized intersections or alternative routes if delay is unacceptable.

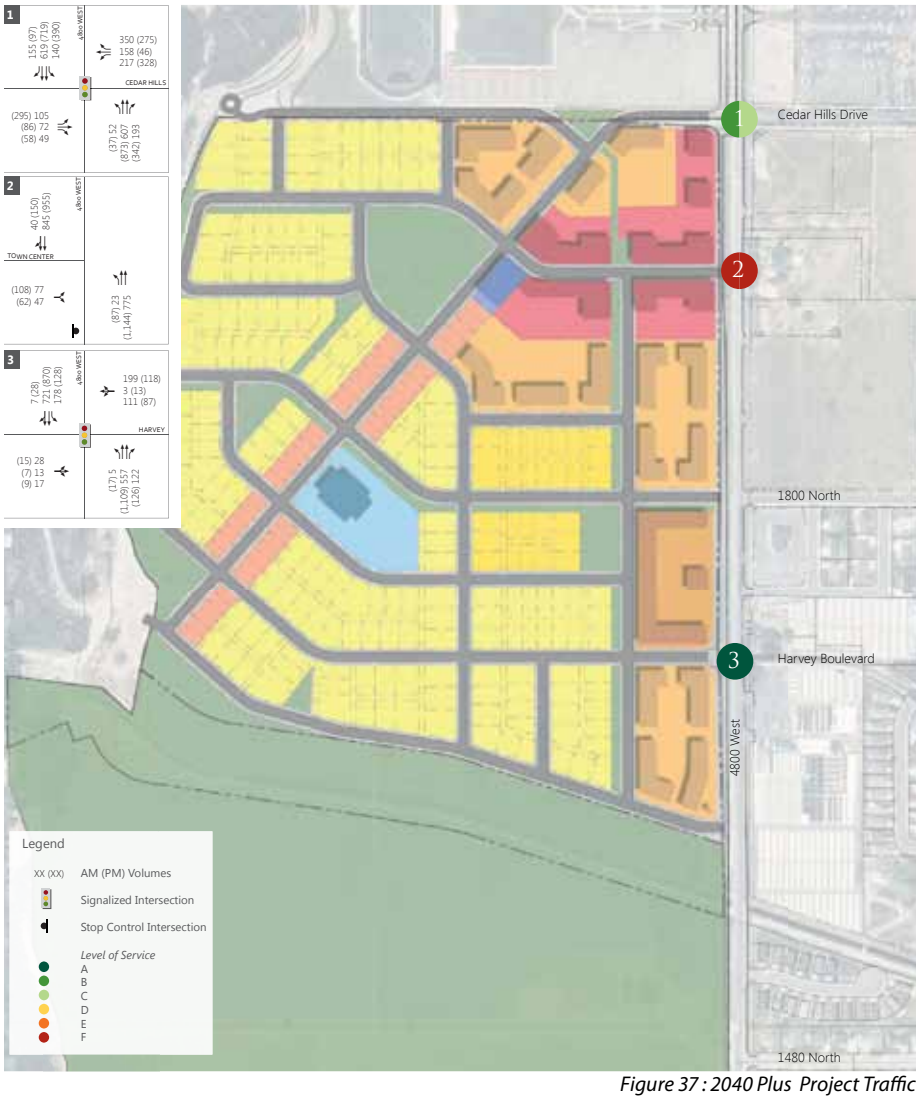


Figure 37 : 2040 Plus Project Traffic

Intersection			Worst Movement[1]			Overall Intersection	
ID	Location	Control	Movement	Delay (Sec/Veh)	LOS	Avg. Delay (Sec/Veh)[2]	LOS
1	Cedar Hills Drive / No. Co. Blvd.	Signal	N/A	N/A	N/A	18.2	B
2	Town Center / No. Co. Blvd.	EB Stop	EBL	>50.0	F	< 5.0	A
3	Harvey Boulevard /No. Co. Blvd.	Signal	N/A	N/A	N/A	6.9	A

1. This represents the worst approach LOS and delay (seconds/vehicle) and is only reported for unsignalized intersections.
2. This represents the overall intersection LOS and delay (seconds/vehicle).
Source: Fehr & Peers, March 2013.

Table 10A: Future 2040 Plus Project AM Peak Hour Level Of Service

Intersection			Worst Movement[1]			Overall Intersection	
ID	Location	Control	Movement	Delay (Sec/Veh)	LOS	Avg. Delay (Sec/Veh)[2]	LOS
1	Cedar Hills Drive / No. Co. Blvd.	Signal	N/A	N/A	N/A	31.6	C
2	Town Center / No. Co. Blvd.	EB Stop	EBL	> 50.0	F	< 5.0	A
3	Harvey Boulevard /No. Co. Blvd.	Signal	N/A	N/A	N/A	6.8	A

3. This represents the worst approach LOS and delay (seconds/vehicle) and is only reported for unsignalized intersections.
4. This represents the overall intersection LOS and delay (seconds/vehicle).
Source: Fehr & Peers, March 2013.

Table 10B: Future 2040 Plus Project PM (School) Peak Hour Level of Service

4.4.6 ROAD HIERARCHY

Daily project trips were assigned to the internal project roadway network. Based on capacities of a vehicular traffic lane, internal roadways were assigned a roadway type and language. These roadway types and language stem from the Highland City General Plan. The recommended cross-section for each roadway is shown in Figure 37.

Cedar Hills Drive through the development was classified as an arterial with four lanes and turn pockets. Right-of-way (ROW) width for this type of roadway in the Highland City General Plan is 106 feet with 82 feet of pavement.

Harvey Boulevard through the development was classified as a collector with two lanes and turn pockets. ROW width for this type of roadway in the Highland City General Plan is 74 feet with 54 feet of pavement.

All other roads in the development were classified as minor collector with one lane in each direction. ROW width for this type of roadway in the Highland City General Plan is 66 feet with 42 feet of pavement. The standard cross-sections from the Highland City General Plan are shown in the appendix. It is recommended that the cross sections be amended to include bicycle lanes.

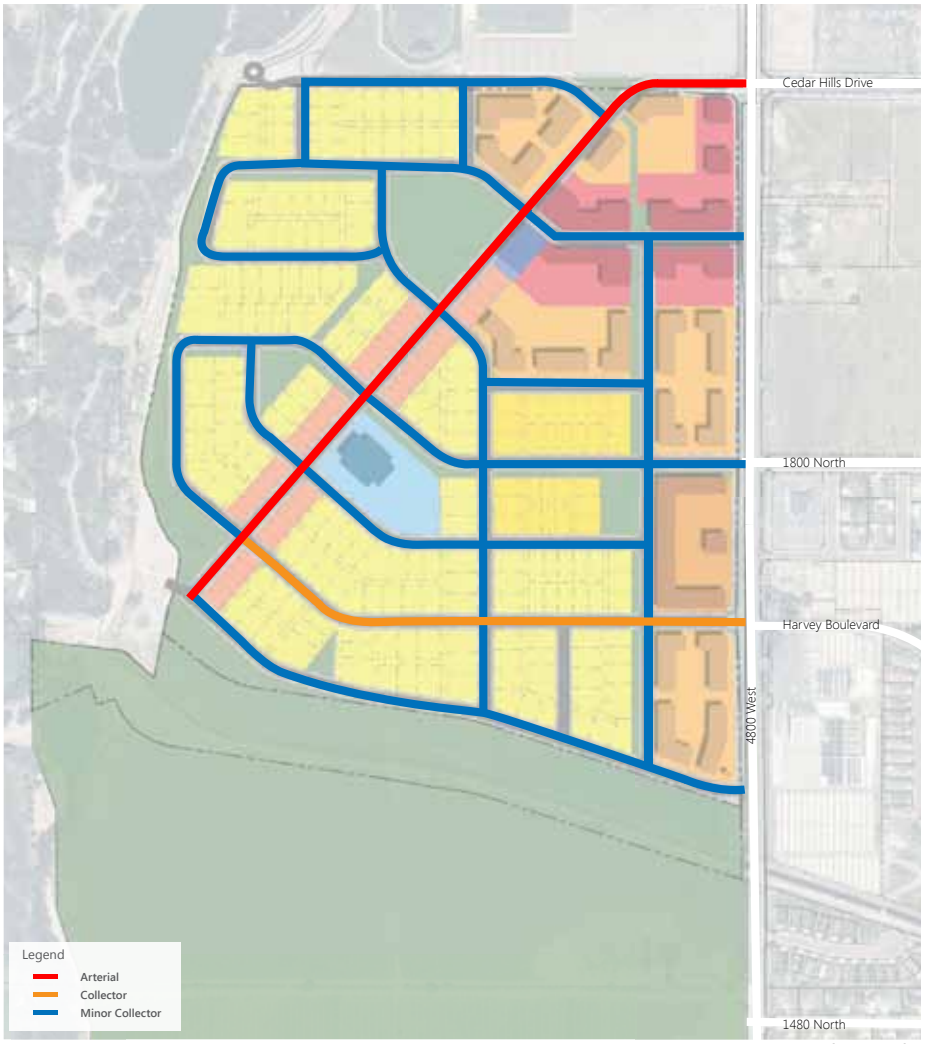


Figure 38 : Road Hierarchy

4.5 Streets

4.5.1 GENERAL

The street sections illustrated in this master plan document are variations of the Highland City standard street sections. Modifications have been made to introduce on-street parking in residential areas, bike lanes on busier streets and to propose some narrowing of the streets for cost savings, aesthetics and climatic reasons.

4.5.2 ARTERIAL STREET

The Arterial street will be the busiest street in the project area and will need the Arterial classification if the Murdock Connector links up to this diagonal street on the southwest side of the site.

The Arterial street includes two lanes in each direction and a center median, which would become a turn lane at intersections.

This plan proposes that bicycle lanes be included on busier streets to enhance safety and that bicyclists will ride in travel lanes on the slower collector streets.

A series of pedestrian safety devices are envisioned along this corridor to keep traffic speeds to posted limits and to aid safe pedestrian crossings. These could include Hawk Beacons, bump-outs and crosswalks.

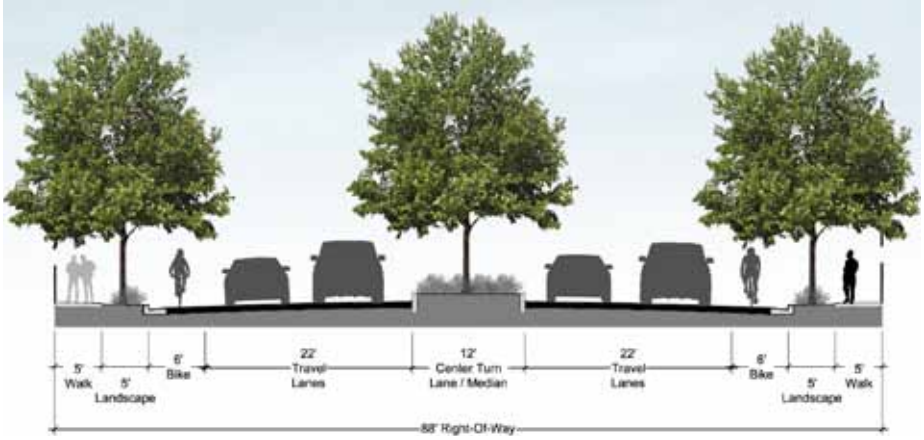


Figure 39 : Arterial Street Section

4.5.3 MAJOR COLLECTOR STREET

The Major Collector street is the secondary tier of street hierarchy. This street connects from the diagonal arterial street to the North County Boulevard aligned with Harvey Boulevard.

The Major Collector street includes one lane in each direction and a center turn lane.

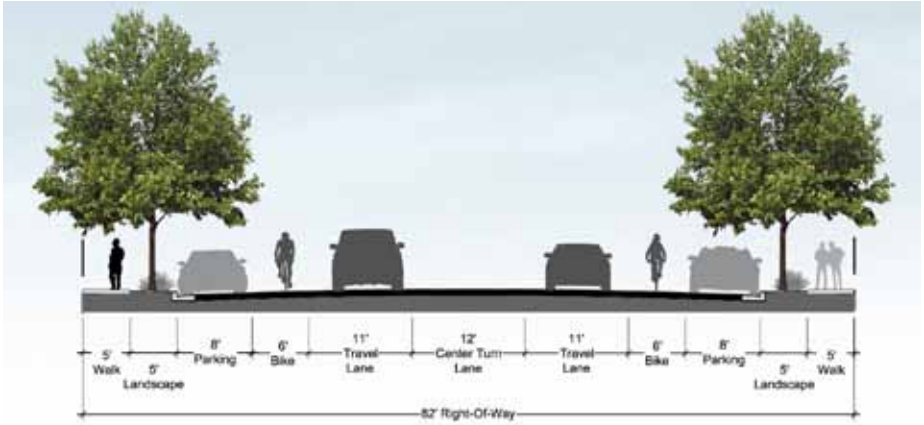


Figure 40 : Major Collector Street Section

4.5 Streets

This street has primarily single-family residential fronting onto it. It is proposed that the Major Collector have on-street parking to serve the residential uses. It is also proposed that bicycle lanes be implemented on this street to provide a bicycle-friendly loop within the development and connecting to contextual streets.

4.5.4 COLLECTOR STREET

The Collector street is the tertiary tier in the street hierarchy. This street is a slower residential street proposed with one lane in each direction and on-street parking for residential uses.

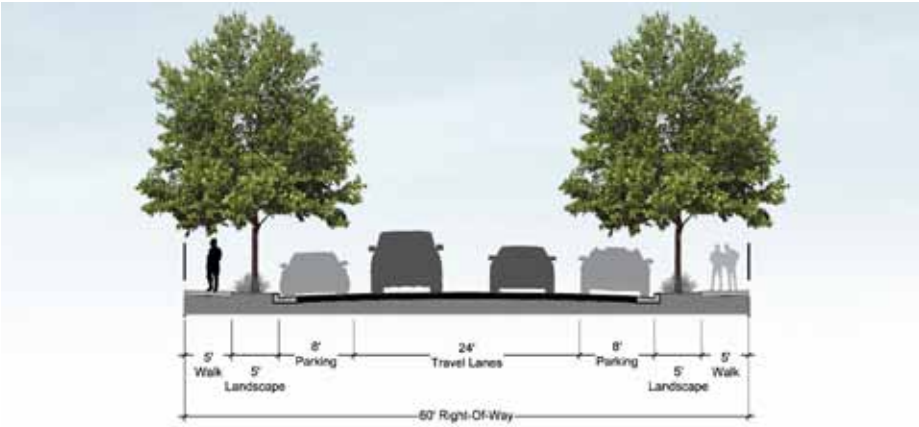


Figure 41 : Collector Street Section

4.5.5 ALLEY STREET

The Alley street is used to load residential uses from the back sides of the lot, keeping garages off the primary streets and to create a more pedestrian friendly street experience. This also helps to reduce curb-cuts on primary streets, improving the flow of traffic.

Figure 42 : Alley Street Section

4.6 Phasing Plan

4.6.1 GENERAL PHASING

The USDC project is anticipated to take approximately 20-25 years to build out. Phases in this project are anticipated to be between 5 and 7 years. The phasing of a mixed-use development needs to consider many variables including the following:

- **Mainline Infrastructure:**
  Water, sewer, gas and storm water infrastructures need to be front-loaded and may end up serving more than a single phase.

- **Absorption:**
  The number of units released on to the market should be able to be absorbed within the planned phase horizon. Multiple product types should also be released onto the market in each phase to take advantage of the spectrum of demand and to not flood the market with a particular product type.

- **Phasing with Assets:**
  Each phase should include an asset that creates value, adds excitement and energy and which can be a marketable and distinguishing attribute. These assets include units fronting the Murdock Pipeline Trail, the commercial center, the central park, the community based development site, etc.

- **Positioning and land value increase:**
  Some portions of the property should be incrementally reserved to allow for property value increases over time. That being said, an initial launch phase should capitalize on some of the more prominent and valuable existing assets to support a strong launch of the project.

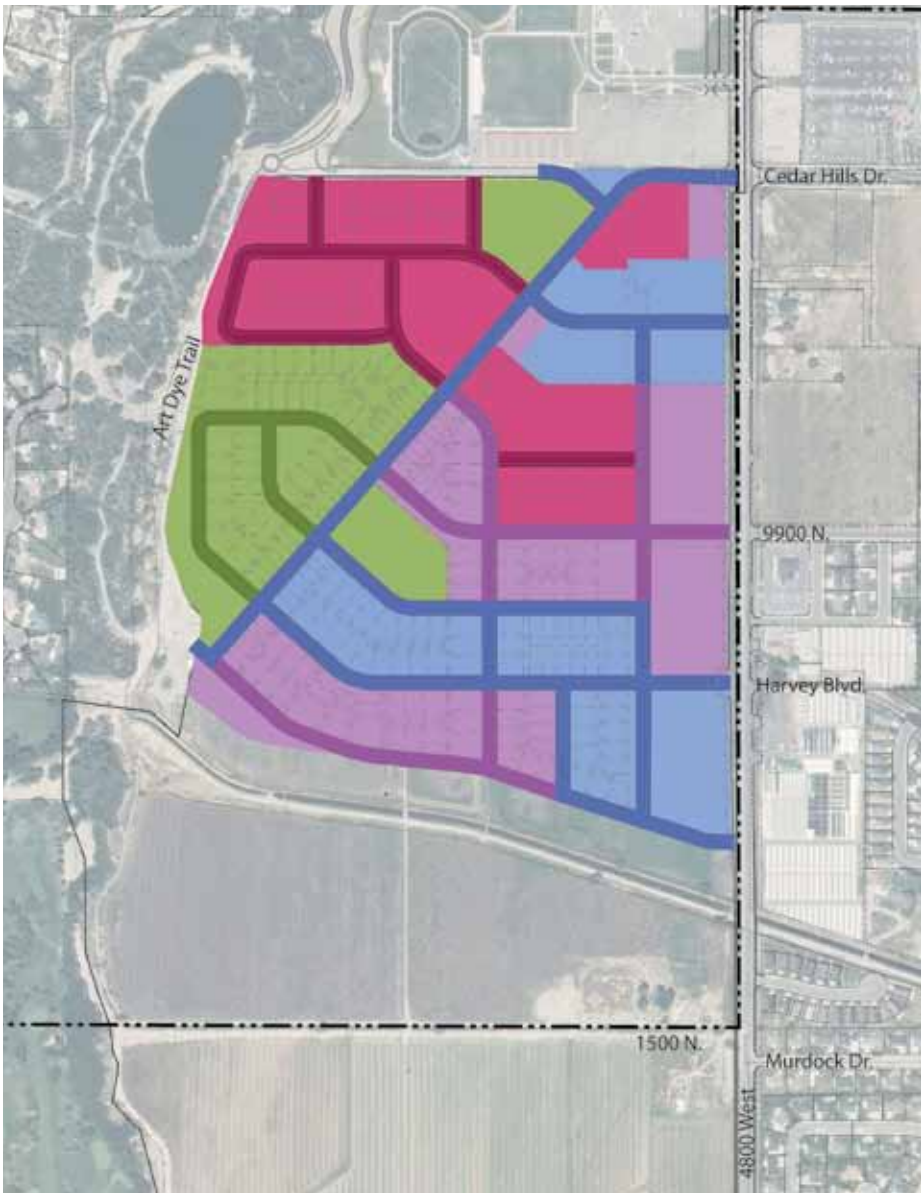


Figure 43 : Overall Phasing Diagram

- Phase 1 Real Estate
- Phase 1 Roads and Infrastructure
- Phase 2 Real Estate
- Phase 2 Roads and Infrastructure
- Phase 3 Real Estate
- Phase 3 Roads and Infrastructure
- Phase 4 Real Estate
- Phase 4 Roads and Infrastructure

- **Create a Place"**
  A place should be created in the first phase with the intent of establishing a real neighborhood with streetscapes, open space and a critical mass of residents.

4.6 Phasing

4.6.2 PHASE 1

Phase 1 includes main-line roads and infrastructure, single-family residential, apartments, town homes and the commercial center. The following are the major attributes of phase 1:

- **Mainline Infrastructure:**
  It is anticipated that the diagonal Murdock Connector road will be implemented by Highland City. USDC can take advantage of the road and infrastructure in phase 1 by connecting to it with the Harvey Boulevard extension and by linking the commercial center street to it.

- **Commercial Center:**
  The commercial center is a major launch and should be designed and leased out in the initial phase to develop a critical mass of retail, restaurants and daily needs.

- **Single-Family Residential:**
  48 units of single-family residential are included in phase 1, which equates to an average of 8 -10 lots absorbed per year. These lots are developed along the Harvey Boulevard connection to the Murdock Connector and fronting onto the Murdock Pipeline. The Murdock Pipeline Trail is a high value asset that can be marketed in phase 1. Proximity and frontage onto that open space asset will be desirable. The remainder of the lots fronting the Murdock Pipeline rail are reserved for the next phase and have a anticipated greater value.

- **Apartments:**
  Approximately 145 apartments are shown in phase 1 adjacent to the North County Boulevard. This is approximately one project with two apartment buildings that might have sub-phases spaced a couple years apart. Depending on market demand and density, this could go slightly up or down.

- **Townhomes:**
  A relatively conservative 7 townhome units are shown in phase 1 adjacent to the Murdock Connector to cautiously test the market as demand for that type of product starts to return.

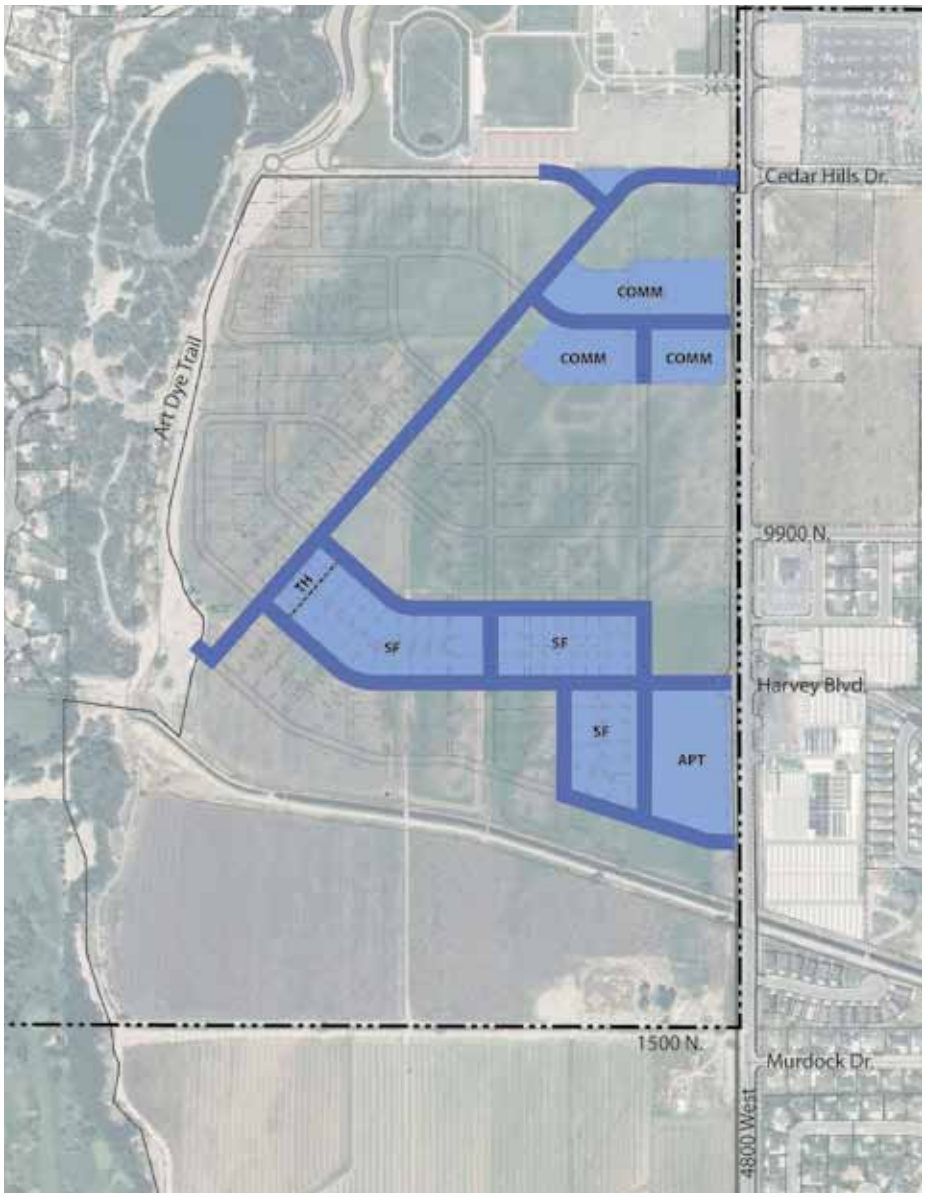


Figure 44 : Phase 1 Diagram

Phase 1 Real Estate

Phase 1 Roads and Infrastructure

4.6 Phasing

4.6.3 PHASE 2

Phase 2 includes primarily in-fill development on the east side of the Murdock Connector. Infrastructure costs will be high in phase 1 to launch the development and it may be challenging to turn a substantial profit. Phase 2 takes advantage of initial infrastructure costs, without adding too much more infrastructure to build, making the profit potential higher. This phase includes single-family residential, senior single-family residential, apartments and town homes. The following are the major attributes of phase 2:

- **Single-Family Residential:**
  39 units of single-family residential are included in phase 2, which equates to an average of 6 -8 lots absorbed per year. This is slightly lower than a target count of 10 but there are also senior-single family lots being released in this phase that may also compete with the traditional single-family. The lots fronting on the Murdock Pipeline Trail should command a premium by Phase 2.

- **Apartments:**
  Another project sized for145 apartments is shown in phase 2 adjacent to the North County Boulevard. Additionally, a senior apartment or assisted living complex is shown in phase 2, which could total 200 units or more. Either of these projects could also be built in phase 1 if demand is high enough following the initial apartment project.

- **Remaining Commercial:**
  An office building and a couple retail pads are added in phase 2, completing the build-out of the commercial center. The retail pads on the corner of Cedar Hills and the North County Boulevard are held out for property value increase as is the office pad.

- **Townhomes:**
  15 townhome units are added in phase 2 fronting on the Murdock Connector.

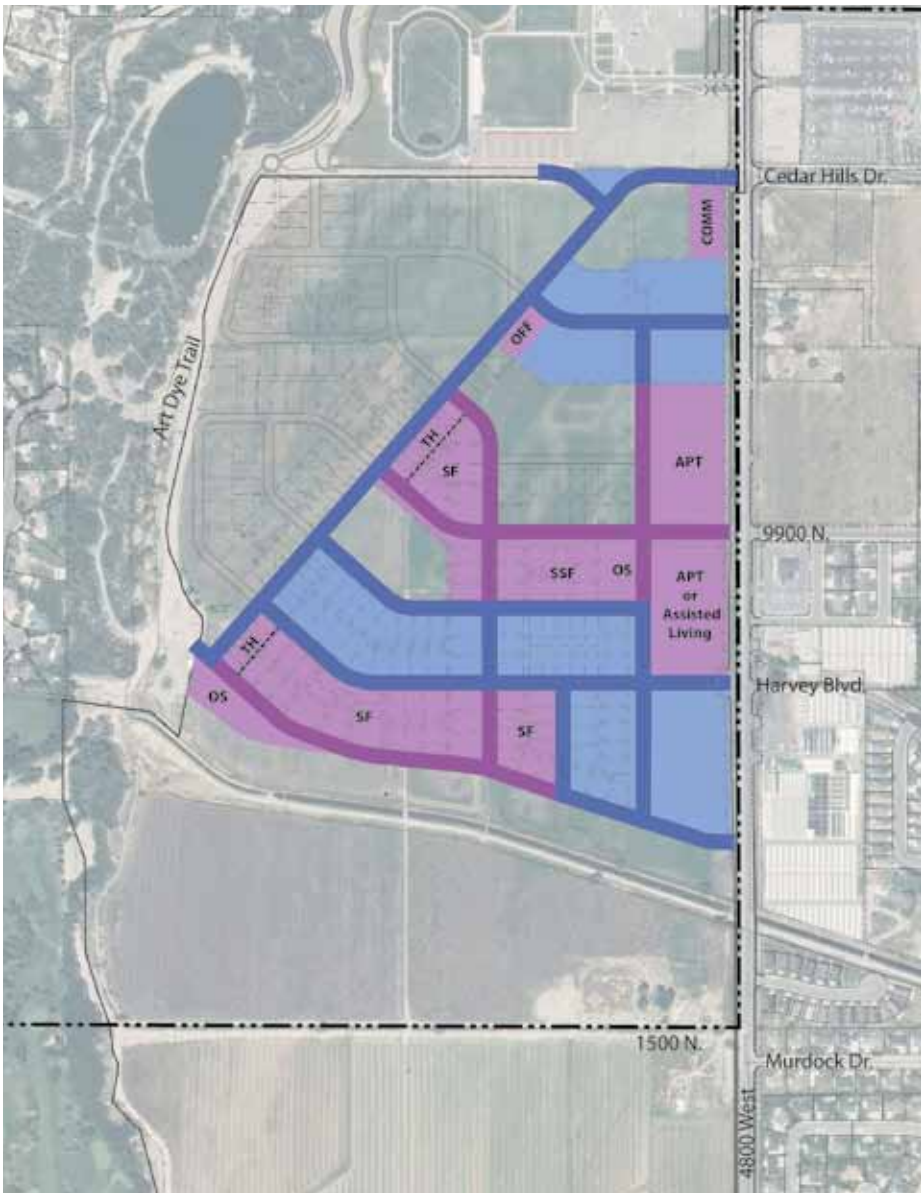


Figure 45 : Phase 2 Diagram

Phase 2 Real Estate

Phase 2 Roads and Infrastructure

4.6 Phasing

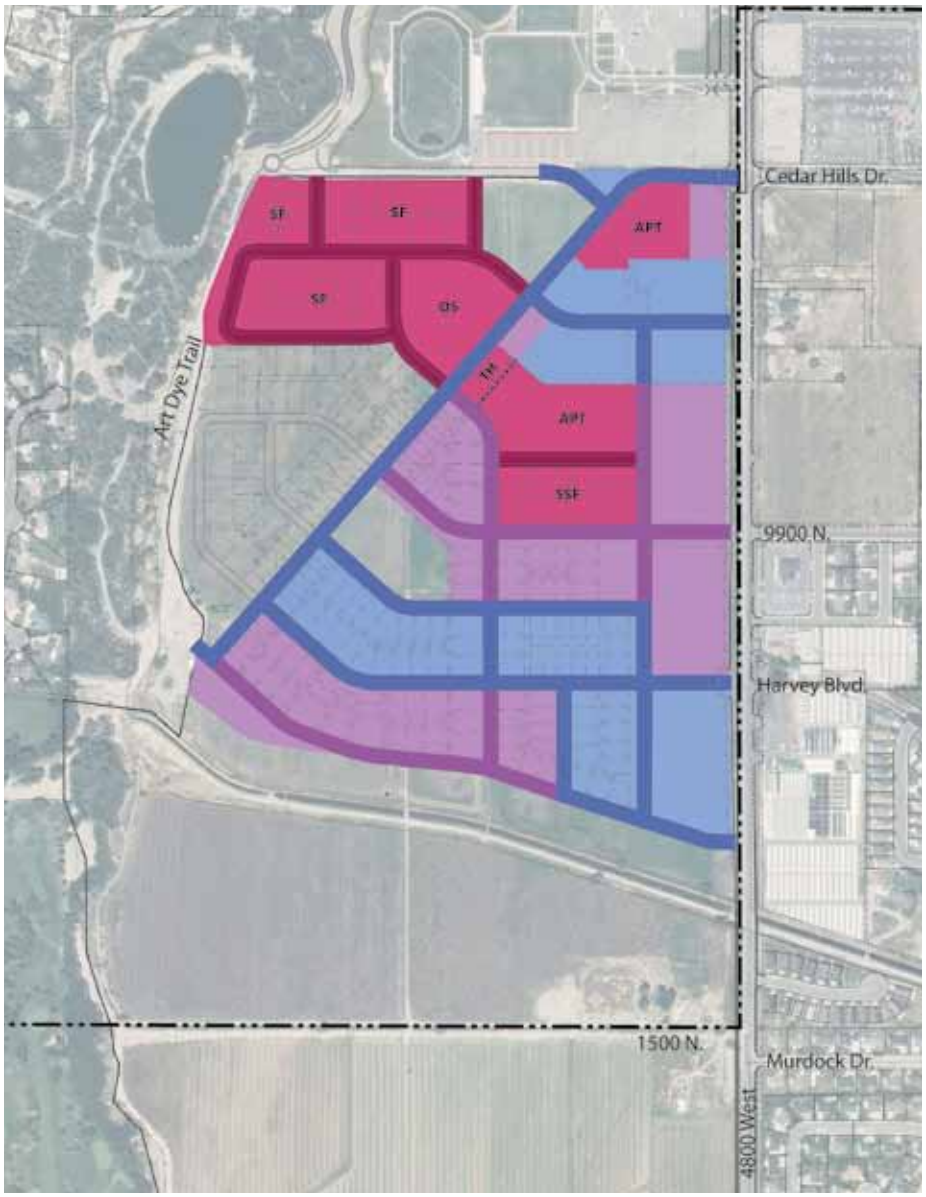
4.6.4 PHASE 3

Phase 3 jumps over to the west side of the Murdock Connector, while also in-filling additional locations on the east side. The following are the major attributes of phase 3:

- **Central Park:**
  The Central Park is a major community amenity being proposed for phase 3. This will add excitement, interest and demand for this next phase in the project, where road and utility infrastructure costs should be relatively low.

- **Single-Family Residential:**
  39 units of single-family residential are included in phase 3, which equates to an average of 6 -8 lots absorbed per year. This is slightly lower than a target count of 10 but it is anticipated that the price-point of these lots will be higher than phase 1 or 2 because most of the lots are facing on parks or openspace and are located in a quieter location on the west side of the site. These higher value lots may take slightly more time to absorb.

- **Apartments:**
  Approximately 228 apartments are shown in phase 3. This is approximately two projects with potential sub-phases spaced a couple years apart. Depending on market demand, these land uses could be converted to town home or condominium projects, which we are currently not showing in the plan due to lack of current market demand.



Phase 3 Real Estate

Phase 3 Roads and Infrastructure

Figure 46 : Phase 3 Diagram

4.6 Phasing

4.6.5 PHASE 4

Phase 4 concludes the build-out of the project with the remaining single-family residential, town homes apartments and community based development site. The following are the major attributes of phase 4:

- **Community Based Development:**
  With a critical mass of the community in place, the development of a community amenity site works well at this point in the project, if not slightly sooner in the latter half of phase 3.

- **Single-Family Residential:**
  39 units of single-family residential are included in phase 4. These lots are located in one of the most sought after locations of the site, adjacent to the community based development site, fronting on open space and with direct access to trails.

- **Apartments:**
  Approximately 111 apartments are shown in phase 4. This is approximately one project with the potential of sub-phases spaced a couple years apart.

- **Town Homes:**
  This is the largest town home release in a single phase with 25 units fronting the Murdock Connector. Some of the units adjacent to the central park could be released in phase 3 if demand is present.

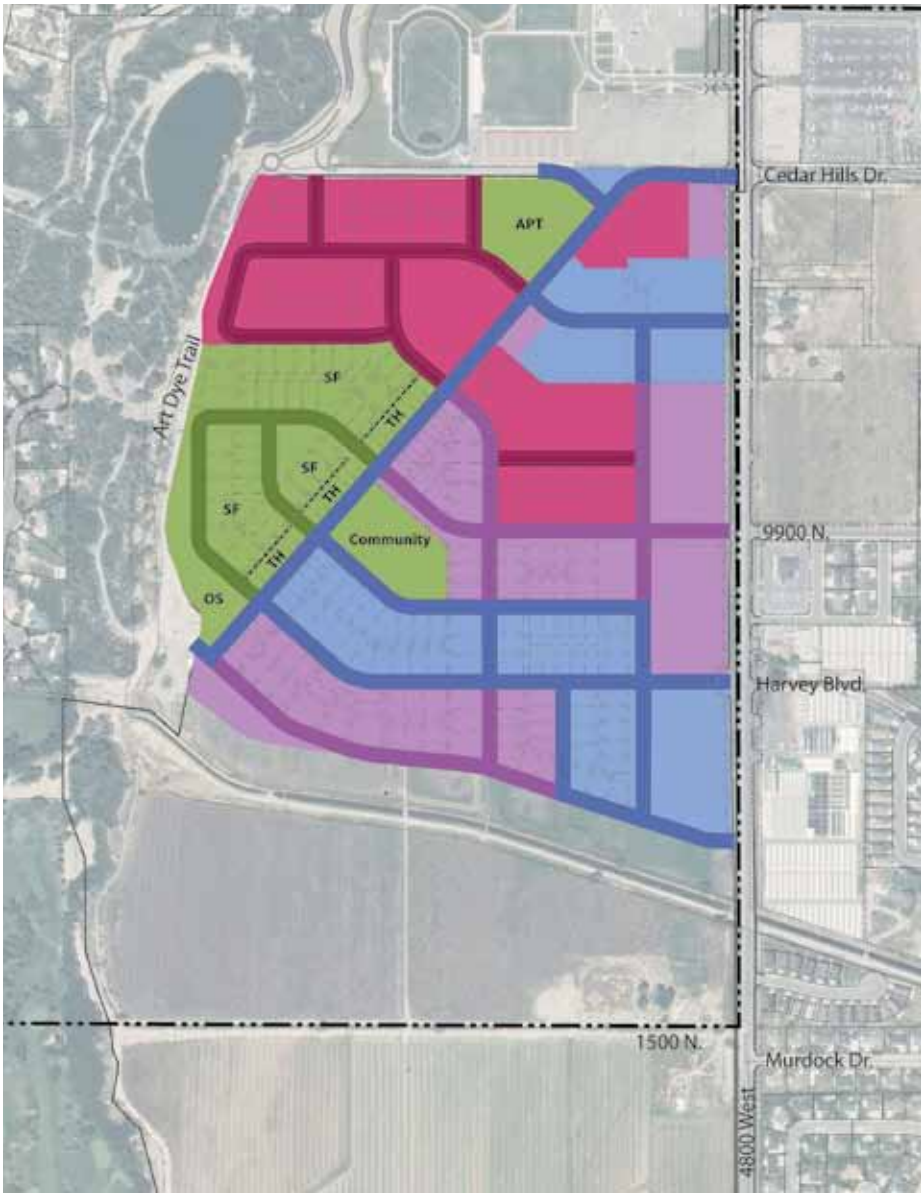


Figure 47 : Phase 4 Diagram

Phase 4 Real Estate

Phase 4 Roads and Infrastructure

4.7 Proforma

Profit and Loss Statement		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Revenues												
SFD Lots			$0	$285,600	$291,312	$519,992	$530,392	$541,000	$630,651	$643,264	$656,129	$752,908
Senior SFD Lots			$0	$102,000	$104,040	$159,181	$162,365	$165,612	$168,924	$57,434	$58,583	$119,509
MF Townhome Lots			$0	$581,400	$593,028	$604,889	$822,648	$839,101	$1,283,825	$436,501	$667,846	$908,270
MF Apartments (Operational CF)			$0	$2,311,896	$2,335,015	$2,358,365	$2,381,949	$2,405,768	$2,429,826	$4,132,374	$4,173,698	$4,215,435
MF Apartments (Sale of Asset)			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Senior Apartments (Operational CF)			$0	$1,934,352	$1,953,696	$1,973,232	$1,992,965	$2,012,894	$2,033,023	$2,053,354	$2,073,887	$2,094,626
Senior Apartments (Sale of Asset)			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Retail Space (Operational CF)			$0	$1,339,776	$1,353,174	$1,366,706	$1,380,373	$1,394,176	$1,408,118	$1,422,199	$1,436,421	$1,450,785
Retail Space (Sale of Asset)			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Office Space (Operational CF)			$0	$365,391	$369,045	$372,735	$376,462	$380,227	$384,029	$387,870	$391,748	$395,666
Office Space (Sale of Asset)			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Gross Revenue			**$0**	**$6,920,415**	**$6,999,309**	**$7,355,100**	**$7,647,154**	**$7,738,779**	**$8,338,397**	**$9,132,995**	**$9,458,313**	**$9,937,200**
Less Commissions & Mkting	5.0%	$0	$0	$346,021	$349,965	$367,755	$382,358	$386,939	$416,920	$456,650	$472,916	$496,860
Total Net Revenue		$0	$0	$6,574,394	$6,649,343	$6,987,345	$7,264,796	$7,351,840	$7,921,477	$8,676,346	$8,985,397	$9,440,340
Costs												
Hard Costs of Development												
Land		$ 1,120,000										
Roadways & Drainage			$1,283,885						$1,283,885			
Potable Water System			$207,388						$207,388			
Pressurized Irrigation System			$171,975						$171,975			
Sanitary Sewer System			$190,188						$190,188			
Dry Utilities			$357,500						$357,500			
Landscape / Open Space			$864,938						$864,938			
Amenities			$272,250									
Contingencies			$502,218.41	$0	$0	$0	$0	$0	$461,381	$0	$0	$0
Hard Costs of Building Construction												
Apartments			$0.00	$19,985,880	$0	$0	$0	$0	$0	$14,508,136	$0	$0
Senior Apartments			$0.00	$13,736,000	$0	$0	$0	$0	$0	$0	$0	$0
Retail			$0.00	$12,856,436	$0	$0	$0	$0	$0	$0	$0	$0
Office			$0.00	$3,856,902	$0	$0	$0	$0	$0	$0	$0	$0
Contingencies (5%)			$0.00	$2,521,761	$0	$0	$0	$0	$0	$725,407	$0	$0
Soft Costs												
Architects / Landscape Architects			$93,300						$93,300			
Engineers			$809,894						$809,894			
Legal		$	38,955					$	38,955			
Permits, Fees & Misc.		$	129,366						$129,366			
Contingencies			$53,576	$0	$0	$0	$0	$0	$53,576	$0	$0	$0
Total Gross Costs		**$1,120,000**	**$4,975,432**	**$52,956,980**	**$0**	**$0**	**$0**	**$0**	**$4,662,345**	**$15,233,542**	**$0**	**$0**
Total Projected Cash Flow		**($1,120,000)**	**($4,975,432)**	**($46,382,585)**	**$6,649,343**	**$6,987,345**	**$7,264,796**	**$7,351,840**	**$3,259,133**	**($6,557,197)**	**$8,985,397**	**$9,440,340**

Table 11: Proforma

Total Profit/Loss:	
NPV (10%) =	$18,210,335
NPV (15%) =	($5,003,368)
NPV (20%) =	($14,436,285)
Profit Potential*	$71,880,036

** Not discounted for time value of money*

PROFORMA SUMMARY

The financial analysis of the prospective development and re-purposing of the USDC holdings includes cash flows that the Developmental Center would receive from two sources. For apartments, retail development, and office development, USDC would receive ongoing cash flows tied to the rental and management of properties in these classifications. As square footage in these land use categories comes online, the model assumes that USDC would continue to obtain cash flows from the operations of these properties indefinitely. The financial model reflects units or square footage totals for apartments, retail properties, and office properties coming online in terms of four phases for the overall development. Phase 1 would begin in Year 2 of operations, phase 2 in Year 8 of operations, phase 3 in Year 15 of operations, and phase 4 in Year 20 of operations (based upon a total time horizon for the project of 25 years).

In contrast, the inventory of for-sale residential lots (including lots for condominiums or townhomes, for normal market-rate housing as well as housing geared to seniors) is absorbed as the development proceeds. The absorption schedule for the for-sale residential properties reflects a scenario where four different phases of the residential program would be sold (starting in years 2, 8, 15, and 20 of the project). The model assumes that within each phase, the project would sell residential lots on a fairly consistent basis from year to year. While in actuality the pattern of lot sales would vary based upon market conditions in a particular year, this methodology assumes a fairly consistent pattern of sales as a baseline for discussion.

4.7 Proforma

Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25
$767,966	$957,398	$1,154,100	$1,177,182	$554,181	$565,265	$768,760	$784,135	$899,795	$1,223,721	$1,248,196	$1,379,256	$1,515,060	$1,766,127	$1,801,450
$121,899	$124,337	$126,824	$129,361	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$926,436	$944,964	$963,864	$983,141	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$4,257,589	$4,300,165	$4,343,167	$4,386,598	$5,696,311	$5,753,275	$5,810,807	$5,868,915	$5,927,605	$5,986,881	$6,046,749	$6,107,217	$6,168,289	$6,229,972	$6,292,272
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$79,439,929
$2,115,572	$2,136,728	$2,158,095	$2,179,676	$2,201,473	$2,223,488	$2,245,723	$2,268,180	$2,290,862	$2,313,770	$2,336,908	$2,360,277	$2,383,880	$2,407,719	$2,431,796
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$30,701,422
$1,465,293	$1,479,946	$1,494,746	$1,509,693	$1,524,790	$1,540,038	$1,555,438	$1,570,993	$1,586,703	$1,602,570	$1,618,595	$1,634,781	$1,651,129	$1,667,640	$1,684,317
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$21,264,500
$399,622	$403,619	$407,655	$411,731	$415,849	$420,007	$424,207	$428,449	$432,734	$437,061	$441,432	$445,846	$450,305	$454,808	$459,356
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$5,799,366
10,054,379	**$10,347,158**	**$10,648,451**	**$10,777,383**	**$10,392,604**	**$10,502,072**	**$10,804,936**	**$10,920,672**	**$11,137,698**	**$11,564,003**	**$11,691,880**	**$11,927,378**	**$12,168,663**	**$12,526,266**	**$149,874,407**
$502,719	$517,358	$532,423	$538,869	$519,630	$525,104	$540,247	$546,034	$556,885	$578,200	$584,594	$596,369	$608,433	$626,313	$7,493,720
$9,551,660	$9,829,800	$10,116,028	$10,238,514	$9,872,974	$9,976,969	$10,264,689	$10,374,639	$10,580,813	$10,985,803	$11,107,286	$11,331,009	$11,560,230	$11,899,952	$142,380,687
			$1,283,885					$1,283,885						
			$207,388					$207,388						
			$171,975					$171,975						
			$190,188					$190,188						
			$357,500					$357,500						
			$864,938					$864,938						
$0	$0	$0	$461,381	$0	$0	$0	$0	$461,381	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$10,942,995	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$547,150	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
			$93,300					$93,300						
			$809,894					$809,894						
			$38,955					$ 38,955						
			$129,366					$129,366						
$0	$0	$0	$53,576	$0	$0	$0	$0	$53,576	$0	$0	$0	$0	$0	$0
$0	**$0**	**$0**	**$4,662,345**	**$11,490,144**	**$0**	**$0**	**$0**	**$4,662,345**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
9,551,660	**$9,829,800**	**$10,116,028**	**$5,576,169**	**($1,617,170)**	**$9,976,969**	**$10,264,689**	**$10,374,639**	**$5,918,468**	**$10,985,803**	**$11,107,286**	**$11,331,009**	**$11,560,230**	**$11,899,952**	**$142,380,687**

Table 11: Proforma (Continued)

In year 25, the sale of all leased property is illustrated in this proforma under the gross revenue cell for that year. There is no reason why the leased property could not continue to be leased in perpetuity but for the purposes of calculating the full value of the development, that revenue has been added onto the last year of this proforma.

5.0 NEXT STEPS

The Next Steps section is organized under the following categories:

5.1.1 Planning and Entitlement
5.1.2 Transportation
5.1.3 Utilities and Engineering

5.1 Next Steps Summary

5.1.1 PLANNING AND ENTITLEMENT

- **Municipal review:**
  This planning process did not include any municipal review other than with the Highland City Transportation Planner. The plan composition, mix of uses and densities should be reviewed and coordinated with appropriate municipal agencies.

- **Entitlement:**
  This is a process for entitling the property with the uses and densities shown. This process is different for a State entity compared to a third party developer but the steps may include a re-zone or establishment of a development agreement. U.C.A. 63A-5-220 4 (a), (b), (c), (d), (e) must be followed by the Division of Services for People with Disabilities in order to proceed with next steps or phases.

- **Concept Plan, Preliminary Plan and Final Plan applications:**
  These are formal steps in the Highland City Development Code, which all subdivisions typically navigate. Depending on how the project is developed and who the master developer is, some of this work could be completed by a third party.

- **Development Strategy:**
  A development strategy should be laid out determining who the master developer will be, who will negotiate deals, manage on-going operations, facilitate the Design Review Process, how maintenance will be taken care of, how infrastructure will be financed, if any districts or owners associations will be established, etc.

- **Design Guidelines:**
  Design Guidelines should be established to protect the structure of the master plan, to set quality standards and design parameters for buildings and public open space, to set design review and submission requirements, and to establish a design review committee.

- **Codes Covenants and Restrictions (CC&R's):**
  A set of CC&R's should be developed in conjunction with the Design Guidelines. CC&R's are typically prepared by a land use attorney or governance specialist and will set legally binding parameters for the community including its governance.

5.1.2 TRANSPORTATION

- **Coordination with Highland City on proposed street sections:**
  The proposed street sections should be coordinated and negotiated with Highland City to seek the objectives identified in this Master Plan.

- **Comprehensive Traffic Impact Study (TIS):**
  I TIS needs to be prepared for the entire development. This will be submitted to Highland City and potentially the Utah Department of Transportation (UDOT) and Utah County. The TIS will include items such as:

  a. Years of analysis for study,
  b. Data collection,
  c. Trip generation,
  d. Trip distribution and assignment,
  e. Capacity analysis,
  f. Traffic signal impacts,
  g. Right-of-way access,
  H. Accident and safety analysis,
  I. Design and mitigation

  Some of these items have already been completed in the current planning analysis and can be used in the formal TIS.

- **Access Permits:**
  With North County Boulevard being a State road, USDC will be required to obtain an access permit for the new roads/accesses intersecting with the North County Boulevard.

5.1.3 UTILITIES AND ENGINEERING

- **Geotechnical Report**:
  A geotechnical report will need to be completed to survey soil conditions and subgrade composition such as the permeability of site soils, depths to groundwater, depths to bedrock etc. Currently, the storm water plan for this project does not account for any on-site percolation because subgrade conditions are not known. The result of that variable is to over-engineer (oversize) retention basins for the development, which can consume several acres of land.

- **Water and Sewer models:**
  These models will progress the master plan work associated with project and provide more detail for on-site and off-site improvements. Municipal engineering staff coordination is anticipated prior to submittal of a rezone application.

- **Road Design**:
  Part of the Concept Plan through Final Plan process includes road design including profiles and vertical curves.

- **Grading and Drainage:**
  Part of the Concept Plan through Final Plan process includes the development of an overall grading and drainage plan. This will include the stormwater strategy for the site.

- **Water and Sewer system design**:
  Part of the Concept Plan through Final Plan process includes water and sewer system design. This will build upon the master plan for the property and approved models for the system.

6.0 APPENDIX

The Appendix section is organized under the following categories:

6.1 Traffic Counts
6.2 Detailed Level of Service Reports
6.3 Highland City Street Sections
6.4 Psychographics Details
6.5 Civil Engineering Calculations and Background Data

FEHR & PEERS
TRANSPORTATION CONSULTANTS

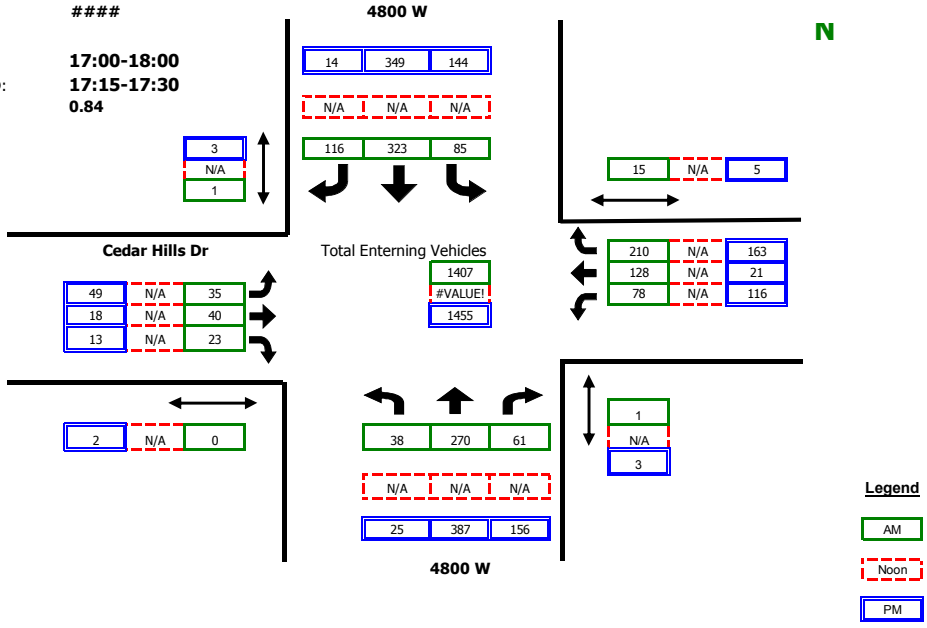
Intersection Turning Movement Summary

Intersection:	**4800 W and Cedar Hills Dr**	**Date:**	**Tuesday, April 17, 2012**
	North/South: 4800 W	**Day of Week Adjustment:**	**100.0%**
	East/West: Cedar Hills Dr	**Month of Year Adjustment:**	**100.0%**
Jurisdiction:		**Adjustment Station #:**	
Project Title:	**Utah Developmental Center**	**Growth Rate:**	**0.0%**
Project No:	**UT12-930**	**Number of Years:**	**0**
Weather:			

AM PEAK HOUR PERIOD: **7:15-8:15**
AM PEAK 15 MINUTE PERIOD: **7:30-7:45**
AM PHF: **0.72**

NOON PEAK HOUR PERIOD:
NOON PEAK 15 MINUTE PERIOD:
NOON PHF: **####**

PM PEAK HOUR PERIOD: **17:00-18:00**
PM PEAK 15 MINUTE PERIOD: **17:15-17:30**
PM PHF: **0.84**



RAW COUNT SUMMARIES	4800 W Northbound				4800 W Southbound				Cedar Hills Dr Eastbound				Cedar Hills Dr Westbound				
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	
AM PERIOD COUNTS																	
Period	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**	**N**	**O**	**P**	**TOTAL**
7:00-7:15	1	70	12	0	11	39	2	0	5	1	2	0	15	3	30	1	191
7:15-7:30	5	52	15	0	15	43	26	0	14	8	6	0	13	28	46	1	271
7:30-7:45	26	61	7	1	21	62	82	1	15	28	13	0	23	89	62	11	489
7:45-8:00	4	73	27	0	29	115	4	0	5	3	2	0	23	10	63	3	358
8:00-8:15	3	84	12	0	20	103	4	0	1	1	2	0	19	1	39	0	289
8:15-8:30	1	51	9	0	20	89	2	1	1	0	0	0	25	2	28	0	228
8:30-8:45	0	59	17	0	13	67	1	0	1	0	1	0	15	1	26	0	201
8:45-9:00	2	48	20	0	13	71	2	0	1	0	0	0	21	4	38	1	220
NOON PERIOD COUNTS																	
Period	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**	**N**	**O**	**P**	**TOTAL**
14:00-14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:15-14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:30-14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:45-15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00-15:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15-15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30-15:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:45-16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PM PERIOD COUNTS																	
Period	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**	**N**	**O**	**P**	**TOTAL**
16:00-16:15	7	77	40	2	38	78	2	0	31	4	2	0	28	6	37	9	350
16:15-16:30	7	87	36	1	34	78	3	1	25	4	3	1	28	4	40	5	349
16:30-16:45	5	97	32	0	44	81	1	1	2	2	0	0	32	4	38	1	338
16:45-17:00	5	90	38	1	25	81	1	0	4	1	2	0	30	5	30	1	312
17:00-17:15	3	96	32	0	29	98	2	0	14	8	0	0	33	4	45	1	364
17:15-17:30	13	107	54	1	47	89	10	0	16	6	5	0	31	6	47	1	431
17:30-17:45	6	86	42	2	32	91	2	0	9	1	4	2	23	4	35	1	335
17:45-18:00	3	98	28	0	36	71	0	3	10	3	4	0	29	7	36	2	325

FEHR & PEERS
TRANSPORTATION CONSULTANTS

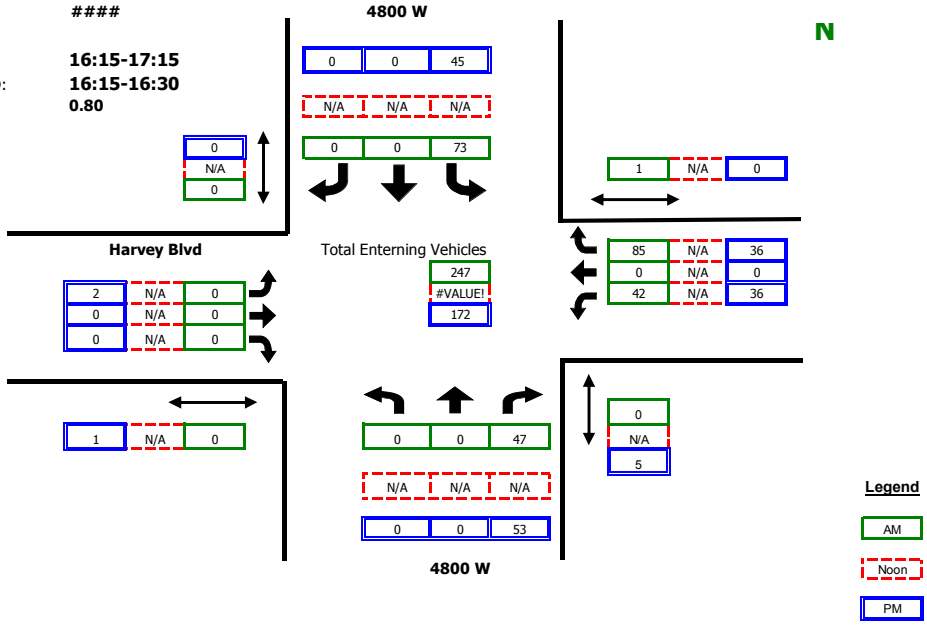
Intersection Turning Movement Summary

Intersection:	**4800 W & Harvey Blvd**	**Date:**	**Tuesday, April 17, 2012**
	North/South: 4800 W	**Day of Week Adjustment:**	**100.9%**
	East/West: Harvey Blvd	**Month of Year Adjustment:**	**101.4%**
Jurisdiction:		**Adjustment Station #:**	
Project Title:	**Utah Developmental Center**	**Growth Rate:**	**0.0%**
Project No:	**UT12-930**	**Number of Years:**	**0**
Weather:			

AM PEAK HOUR PERIOD: **7:30-8:30**
AM PEAK 15 MINUTE PERIOD: **7:45-8:00**
AM PHF: **0.66**

NOON PEAK HOUR PERIOD:
NOON PEAK 15 MINUTE PERIOD:
NOON PHF: **####**

PM PEAK HOUR PERIOD: **16:15-17:15**
PM PEAK 15 MINUTE PERIOD: **16:15-16:30**
PM PHF: **0.80**



RAW COUNT SUMMARIES	4800 W Northbound				4800 W Southbound				Harvey Blvd Eastbound				Harvey Blvd Westbound				
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	
AM PERIOD COUNTS																	
Period	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**	**N**	**O**	**P**	**TOTAL**
7:00-7:15	0	0	6	0	0	0	0	0	0	0	0	0	7	0	11	0	24
7:15-7:30	0	0	7	0	10	0	0	0	0	0	0	0	12	0	11	0	40
7:30-7:45	0	0	7	0	9	0	0	0	0	0	0	0	12	0	27	0	55
7:45-8:00	0	0	21	0	37	0	0	0	0	0	0	0	11	0	25	0	94
8:00-8:15	0	0	8	0	13	0	0	0	0	0	0	0	10	0	24	1	55
8:15-8:30	0	0	11	0	14	0	0	0	0	0	0	0	9	0	9	0	43
8:30-8:45	0	0	4	0	5	0	0	0	0	0	0	0	9	0	5	0	23
8:45-9:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NOON PERIOD COUNTS																	
Period	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**	**N**	**O**	**P**	**TOTAL**
14:00-14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:15-14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:30-14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:45-15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00-15:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15-15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30-15:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:45-16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PM PERIOD COUNTS																	
Period	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**	**N**	**O**	**P**	**TOTAL**
16:00-16:15	0	0	13	0	5	0	0	0	0	0	0	0	13	0	6	0	37
16:15-16:30	0	0	21	4	10	0	0	0	0	0	0	0	9	0	14	0	54
16:30-16:45	0	0	11	0	14	0	0	0	2	0	0	1	8	0	5	0	40
16:45-17:00	0	0	10	0	4	0	0	0	0	0	0	0	10	0	8	0	32
17:00-17:15	0	0	11	1	17	0	0	0	0	0	0	0	9	0	9	0	46
17:15-17:30	0	0	5	0	10	0	0	0	0	0	0	0	5	0	9	0	29
17:30-17:45	0	0	15	0	17	0	0	0	0	0	0	0	5	0	7	0	44
17:45-18:00	0	0	6	0	10	0	0	0	0	0	0	0	4	0	9	0	29

6.2 Detailed Level of Service Reports

HCM Signalized Intersection Capacity Analysis
3: Cedar Hills Dr & 4800 W — 4/26/2012

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.67	1.00	1.00	0.61	1.00	1.00	0.54	1.00	1.00	0.54	1.00	1.00
Satd. Flow (perm)	1245	1863	1583	1141	1863	1583	1009	3539	1583	997	3539	1583
Volume (vph)	35	40	23	78	128	210	38	270	61	85	323	116
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	43	25	85	139	228	41	293	66	92	351	126
RTOR Reduction (vph)	0	0	21	0	0	186	0	0	38	0	0	69
Lane Group Flow (vph)	38	43	4	85	139	42	41	293	28	92	351	57
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	11.6	9.0	9.0	15.4	10.9	10.9	28.7	26.2	26.2	32.5	28.1	28.1
Effective Green, g (s)	13.6	10.0	10.0	17.4	11.9	11.9	30.7	27.2	27.2	34.5	29.1	29.1
Actuated g/C Ratio	0.21	0.16	0.16	0.27	0.19	0.19	0.48	0.42	0.42	0.54	0.45	0.45
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	294	291	247	364	346	294	525	1502	672	602	1607	719
v/s Ratio Prot	0.01	0.02		c0.02	c0.07		0.00	0.08		c0.01	c0.10	
v/s Ratio Perm	0.02		0.00	0.04		0.03	0.03		0.02	0.07		0.04
v/c Ratio	0.13	0.15	0.02	0.23	0.40	0.14	0.08	0.20	0.04	0.15	0.22	0.08
Uniform Delay, d1	20.3	23.4	22.9	17.9	23.0	21.8	8.9	11.6	10.8	7.2	10.6	9.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.0	0.3	0.8	0.2	0.1	0.3	0.1	0.1	0.3	0.2
Delay (s)	20.5	23.6	22.9	18.2	23.7	22.1	9.0	11.9	10.9	7.4	10.9	10.1
Level of Service	C	C	C	B	C	C	A	B	B	A	B	B
Approach Delay (s)		22.3			21.9			11.4			10.2	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	14.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.28		
Actuated Cycle Length (s)	64.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	35.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Baseline — Synchro 6 Report
Fehr & Peers Associates. Inc. — Page 1

HCM Unsignalized Intersection Capacity Analysis
17: Harvey Blvd & 4800 W — 4/26/2012

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	42	85	284	47	73	351
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	46	92	309	51	79	382
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	658	154			360	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	658	154			360	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	88	89			93	
cM capacity (veh/h)	371	864			1195	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	138	154	154	51	79	191	191
Volume Left	46	0	0	0	79	0	0
Volume Right	92	0	0	51	0	0	0
cSH	600	1700	1700	1700	1195	1700	1700
Volume to Capacity	0.23	0.09	0.09	0.03	0.07	0.11	0.11
Queue Length 95th (ft)	22	0	0	0	5	0	0
Control Delay (s)	12.8	0.0	0.0	0.0	8.2	0.0	0.0
Lane LOS	B				A		
Approach Delay (s)	12.8	0.0			1.4		
Approach LOS	B						

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	29.4%	ICU Level of Service	A
Analysis Period (min)	15		

Baseline — Synchro 6 Report
Fehr & Peers Associates. Inc. — Page 3

HCM Signalized Intersection Capacity Analysis — Existing PM School
3: Cedar Hills Dr & 4800 W — 3/12/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.75	1.00	1.00	0.71	1.00	1.00	0.56	1.00	1.00	0.38	1.00	1.00
Satd. Flow (perm)	1398	1863	1583	1321	1863	1583	1038	3539	1583	711	3539	1583
Volume (vph)	233	55	31	125	10	169	25	387	156	250	295	3
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	253	60	34	136	11	184	27	421	170	272	321	3
RTOR Reduction (vph)	0	0	30	0	0	161	0	0	115	0	0	2
Lane Group Flow (vph)	253	60	4	136	11	23	27	421	55	272	321	1
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	15.6	6.9	6.9	15.8	7.0	7.0	22.0	19.6	19.6	33.0	25.6	25.6
Effective Green, g (s)	17.6	7.9	7.9	17.8	8.0	8.0	24.0	20.6	20.6	34.0	26.6	26.6
Actuated g/C Ratio	0.28	0.12	0.12	0.28	0.13	0.13	0.38	0.32	0.32	0.53	0.42	0.42
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	443	231	196	438	234	199	430	1144	512	536	1478	661
v/s Ratio Prot	c0.09	0.03		0.05	0.01		0.00	0.12		c0.07	0.09	
v/s Ratio Perm	c0.07		0.00	0.04		0.01	0.02		0.03	c0.20		0.00
v/c Ratio	0.57	0.26	0.02	0.31	0.05	0.12	0.06	0.37	0.11	0.51	0.22	0.00
Uniform Delay, d1	19.5	25.3	24.5	17.9	24.5	24.7	12.6	16.6	15.1	8.6	11.9	10.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.8	0.6	0.0	0.4	0.1	0.3	0.1	0.9	0.4	0.8	0.3	0.0
Delay (s)	21.2	25.9	24.5	18.3	24.6	25.0	12.6	17.5	15.5	9.3	12.2	10.8
Level of Service	C	C	C	B	C	C	B	B	B	A	B	B
Approach Delay (s)		22.4			22.2			16.7			10.9	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	16.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	63.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	54.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Existing PM School — Synchro 6 Report
Fehr & Peers Associates, Inc. — Page 1

HCM Unsignalized Intersection Capacity Analysis
17: Harvey Blvd & 4800 W — 3/12/2013

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	36	36	517	53	45	406
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	39	39	562	58	49	441
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	880	281			620	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	880	281			620	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	86	95			95	
cM capacity (veh/h)	272	716			957	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	78	281	281	58	49	221	221
Volume Left	39	0	0	0	49	0	0
Volume Right	39	0	0	58	0	0	0
cSH	394	1700	1700	1700	957	1700	1700
Volume to Capacity	0.20	0.17	0.17	0.03	0.05	0.13	0.13
Queue Length 95th (ft)	18	0	0	0	4	0	0
Control Delay (s)	16.4	0.0	0.0	0.0	9.0	0.0	0.0
Lane LOS	C				A		
Approach Delay (s)	16.4	0.0			0.9		
Approach LOS	C						

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	31.8%	ICU Level of Service	A
Analysis Period (min)	15		

Baseline — Synchro 6 Report
Fehr & Peers Associates, Inc. — Page 1

6.2 Detailed Level of Service Reports

HCM Signalized Intersection Capacity Analysis — AM Existing Plus Project
3: Cedar Hills Dr & 4800 W — 3/12/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.57	1.00	1.00	0.71	1.00	1.00	0.49	1.00	1.00	0.38	1.00	1.00
Satd. Flow (perm)	1054	1863	1583	1325	1863	1583	920	3539	1583	710	3539	1583
Volume (vph)	123	64	75	94	134	210	61	474	102	85	404	149
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	134	70	82	102	146	228	66	515	111	92	439	162
RTOR Reduction (vph)	0	0	69	0	0	194	0	0	67	0	0	94
Lane Group Flow (vph)	134	70	13	102	146	34	66	515	44	92	439	68
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	16.7	9.7	9.7	15.9	9.3	9.3	31.0	26.4	26.4	34.4	28.1	28.1
Effective Green, g (s)	18.7	10.7	10.7	17.9	10.3	10.3	33.0	27.4	27.4	36.4	29.1	29.1
Actuated g/C Ratio	0.27	0.16	0.16	0.26	0.15	0.15	0.48	0.40	0.40	0.53	0.42	0.42
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	369	289	245	393	278	236	509	1405	629	487	1493	668
v/s Ratio Prot	c0.04	0.04		0.03	c0.08		0.01	c0.15		c0.02	0.12	
v/s Ratio Perm	0.06		0.01	0.04		0.02	0.05		0.03	0.08		0.04
v/c Ratio	0.36	0.24	0.05	0.26	0.53	0.14	0.13	0.37	0.07	0.19	0.29	0.10
Uniform Delay, d1	19.9	25.6	24.8	20.1	27.1	25.5	9.8	14.7	12.9	8.3	13.2	12.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.4	0.1	0.4	1.8	0.3	0.1	0.7	0.2	0.2	0.5	0.3
Delay (s)	20.5	26.0	24.9	20.4	28.9	25.8	9.9	15.4	13.1	8.5	13.7	12.4
Level of Service	C	C	C	C	C	C	A	B	B	A	B	B
Approach Delay (s)		23.1			25.6			14.5			12.7	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	17.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	69.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	45.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Baseline — Synchro 6 Report
Fehr & Peers Associates, Inc. — Page 1

HCM Unsignalized Intersection Capacity Analysis — AM Existing Plus Project
30: 4800 W & — 3/12/2013

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	87	71	35	550	526	47
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	95	77	38	598	572	51
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)					772	
pX, platoon unblocked	0.96	0.96	0.96			
vC, conflicting volume	972	311	623			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	929	241	565			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	61	89	96			
cM capacity (veh/h)	246	730	962			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	95	77	38	299	299	381	242
Volume Left	95	0	38	0	0	0	0
Volume Right	0	77	0	0	0	0	51
cSH	246	730	962	1700	1700	1700	1700
Volume to Capacity	0.39	0.11	0.04	0.18	0.18	0.22	0.14
Queue Length 95th (ft)	43	9	3	0	0	0	0
Control Delay (s)	28.6	10.5	8.9	0.0	0.0	0.0	0.0
Lane LOS	D	B	A				
Approach Delay (s)	20.5		0.5			0.0	
Approach LOS	C						

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	34.2%	ICU Level of Service	A
Analysis Period (min)	15		

Baseline — Synchro 6 Report
Fehr & Peers Associates, Inc. — Page 1

HCM Signalized Intersection Capacity Analysis — AM Existing Plus Project
17: Harvey Blvd & 4800 W — 3/12/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	0.95	1.00	1.00	0.95	
Frt		0.95			0.91		1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.98			0.98		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1727			1668		1770	3539	1583	1770	3530	
Flt Permitted		0.85			0.87		0.43	1.00	1.00	0.50	1.00	
Satd. Flow (perm)		1503			1469		793	3539	1583	924	3530	
Volume (vph)	34	11	28	43	3	94	8	407	49	92	542	9
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	37	12	30	47	3	102	9	442	53	100	589	10
RTOR Reduction (vph)	0	26	0	0	89	0	0	0	17	0	2	0
Lane Group Flow (vph)	0	53	0	0	63	0	9	442	36	100	597	0
Turn Type	Perm			Perm			Perm		Perm	Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		5.0			5.0		27.0	27.0	27.0	27.0	27.0	
Effective Green, g (s)		5.0			5.0		27.0	27.0	27.0	27.0	27.0	
Actuated g/C Ratio		0.12			0.12		0.68	0.68	0.68	0.68	0.68	
Clearance Time (s)		4.0			4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		188			184		535	2389	1069	624	2383	
v/s Ratio Prot								0.12			c0.17	
v/s Ratio Perm		0.04			c0.04		0.01		0.02	0.11		
v/c Ratio		0.28			0.34		0.02	0.19	0.03	0.16	0.25	
Uniform Delay, d1		15.9			16.0		2.1	2.4	2.2	2.4	2.5	
Progression Factor		1.00			1.00		0.76	0.76	0.57	1.00	1.00	
Incremental Delay, d2		0.8			1.1		0.1	0.2	0.1	0.5	0.3	
Delay (s)		16.7			17.1		1.7	2.0	1.3	2.9	2.8	
Level of Service		B			B		A	A	A	A	A	
Approach Delay (s)		16.7			17.1			1.9			2.8	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	4.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.26		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	38.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Baseline — Synchro 6 Report
Fehr & Peers Associates, Inc. — Page 1

HCM Signalized Intersection Capacity Analysis — PM Plus Project
3: Cedar Hills Dr & 4800 W — 3/12/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.62	1.00	1.00	0.70	1.00	1.00	0.33	1.00	1.00	0.21	1.00	1.00
Satd. Flow (perm)	1146	1863	1583	1306	1863	1583	608	3539	1583	391	3539	1583
Volume (vph)	313	79	92	184	40	169	94	611	175	250	598	126
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	340	86	100	200	43	184	102	664	190	272	650	137
RTOR Reduction (vph)	0	0	81	0	0	154	0	0	137	0	0	93
Lane Group Flow (vph)	340	86	19	200	43	30	102	664	53	272	650	44
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	20.2	11.2	11.2	16.4	9.3	9.3	23.1	17.0	17.0	28.5	19.7	19.7
Effective Green, g (s)	22.2	12.2	12.2	18.4	10.3	10.3	25.1	18.0	18.0	30.5	20.7	20.7
Actuated g/C Ratio	0.35	0.19	0.19	0.29	0.16	0.16	0.39	0.28	0.28	0.48	0.32	0.32
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	494	355	301	434	299	254	367	994	445	397	1143	511
v/s Ratio Prot	c0.11	0.05		0.06	0.02		0.03	0.19		c0.10	0.18	
v/s Ratio Perm	c0.13		0.01	0.07		0.02	0.08		0.03	c0.22		0.03
v/c Ratio	0.69	0.24	0.06	0.46	0.14	0.12	0.28	0.67	0.12	0.69	0.57	0.09
Uniform Delay, d1	17.0	22.0	21.3	18.4	23.1	23.0	12.7	20.4	17.2	11.6	18.0	15.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.0	0.4	0.1	0.8	0.2	0.2	0.4	3.6	0.6	4.8	2.1	0.3
Delay (s)	21.0	22.4	21.4	19.1	23.3	23.2	13.1	24.0	17.7	16.4	20.1	15.4
Level of Service	C	C	C	B	C	C	B	C	B	B	C	B
Approach Delay (s)		21.3			21.3			21.6			18.5	
Approach LOS		C			C			C			B	

Intersection Summary			
HCM Average Control Delay	20.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	64.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	64.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Baseline — Synchro 6 Report
Fehr & Peers Associates, Inc. — Page 1

6.2 Detailed Level of Service Reports

HCM Unsignalized Intersection Capacity Analysis — PM Plus Project
30: 4800 W & — 3/12/2013

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	129	93	132	751	696	179
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	140	101	143	816	757	195
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)					682	
pX, platoon unblocked	0.86	0.86	0.86			
vC, conflicting volume	1549	476	951			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1477	231	783			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	85	80			
cM capacity (veh/h)	81	664	716			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	140	101	143	408	408	504	447
Volume Left	140	0	143	0	0	0	0
Volume Right	0	101	0	0	0	0	195
cSH	81	664	716	1700	1700	1700	1700
Volume to Capacity	1.74	0.15	0.20	0.24	0.24	0.30	0.26
Queue Length 95th (ft)	297	13	19	0	0	0	0
Control Delay (s)	466.9	11.4	11.3	0.0	0.0	0.0	0.0
Lane LOS	F	B	B				
Approach Delay (s)	276.1		1.7			0.0	
Approach LOS	F						

Intersection Summary			
Average Delay	31.7		
Intersection Capacity Utilization	49.4%	ICU Level of Service	A
Analysis Period (min)	15		

Baseline — Synchro 6 Report
Fehr & Peers Associates, Inc. — Page 1

HCM Signalized Intersection Capacity Analysis — PM Plus Project
17: Harvey Blvd & 4800 W — 3/12/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	0.95	1.00	1.00	0.95	
Frt		0.95			0.92		1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.98			0.98		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1729			1688		1770	3539	1583	1770	3513	
Flt Permitted		0.88			0.88		0.37	1.00	1.00	0.30	1.00	
Satd. Flow (perm)		1555			1502		684	3539	1583	565	3513	
Volume (vph)	18	6	15	39	11	70	28	839	55	69	656	34
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	20	7	16	42	12	76	30	912	60	75	713	37
RTOR Reduction (vph)	0	14	0	0	44	0	0	0	20	0	5	0
Lane Group Flow (vph)	0	29	0	0	86	0	30	912	40	75	745	0
Turn Type	Perm			Perm			Perm		Perm	Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		5.2			5.2		26.8	26.8	26.8	26.8	26.8	
Effective Green, g (s)		5.2			5.2		26.8	26.8	26.8	26.8	26.8	
Actuated g/C Ratio		0.13			0.13		0.67	0.67	0.67	0.67	0.67	
Clearance Time (s)		4.0			4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		202			195		458	2371	1061	379	2354	
v/s Ratio Prot								c0.26			0.21	
v/s Ratio Perm		0.02			c0.06		0.04		0.03	0.13		
v/c Ratio		0.14			0.44		0.07	0.38	0.04	0.20	0.32	
Uniform Delay, d1		15.4			16.1		2.3	2.9	2.2	2.5	2.8	
Progression Factor		1.00			1.00		0.79	0.88	0.57	1.00	1.00	
Incremental Delay, d2		0.3			1.6		0.3	0.5	0.1	1.2	0.4	
Delay (s)		15.8			17.6		2.1	3.1	1.3	3.7	3.1	
Level of Service		B			B		A	A	A	A	A	
Approach Delay (s)		15.8			17.6			2.9			3.2	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	4.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	45.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Baseline — Synchro 6 Report
Fehr & Peers Associates, Inc. — Page 1

HCM Signalized Intersection Capacity Analysis — 2040 AM
3: Cedar Hills Dr & 4800 W — 3/12/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.65	1.00	1.00	0.51	1.00	1.00	0.39	1.00	1.00	0.37	1.00	1.00
Satd. Flow (perm)	1218	1863	1583	946	1863	1583	723	3539	1583	686	3539	1583
Volume (vph)	40	50	30	200	150	350	45	445	150	140	555	125
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	54	33	217	163	380	49	484	163	152	603	136
RTOR Reduction (vph)	0	0	28	0	0	294	0	0	109	0	0	86
Lane Group Flow (vph)	43	54	5	217	163	86	49	484	54	152	603	50
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		1	3		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	11.0	8.5	8.5	19.2	12.6	12.6	22.3	18.7	18.7	27.1	21.1	21.1
Effective Green, g (s)	13.0	9.5	9.5	21.1	13.6	13.6	24.3	19.7	19.7	29.1	22.1	22.1
Actuated g/C Ratio	0.22	0.16	0.16	0.35	0.23	0.23	0.41	0.33	0.33	0.49	0.37	0.37
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	297	296	251	439	424	360	374	1166	521	461	1308	585
v/s Ratio Prot	0.01	0.03		c0.06	0.09		0.01	0.14		c0.04	c0.17	
v/s Ratio Perm	0.02		0.00	c0.11		0.05	0.04		0.03	0.12		0.03
v/c Ratio	0.14	0.18	0.02	0.49	0.38	0.24	0.13	0.42	0.10	0.33	0.46	0.09
Uniform Delay, d1	18.8	21.8	21.2	14.4	19.6	18.9	10.9	15.6	13.9	8.9	14.3	12.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.3	0.0	0.9	0.6	0.3	0.2	1.1	0.4	0.4	1.2	0.3
Delay (s)	19.0	22.1	21.3	15.3	20.1	19.2	11.0	16.7	14.3	9.3	15.5	12.6
Level of Service	B	C	C	B	C	B	B	B	B	A	B	B
Approach Delay (s)		20.9			18.3			15.7			14.0	
Approach LOS		C			B			B			B	

Intersection Summary			
HCM Average Control Delay	16.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	59.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	47.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Baseline — Synchro 6 Report
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HCM Signalized Intersection Capacity Analysis — 2040 AM
17: Harvey Blvd & 4800 W — 3/12/2013

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00		0.95	1.00	1.00	0.95
Frt	0.91		1.00	0.85	1.00	1.00
Flt Protected	0.98		1.00	1.00	0.95	1.00
Satd. Flow (prot)	1673		3539	1583	1770	3539
Flt Permitted	0.98		1.00	1.00	0.46	1.00
Satd. Flow (perm)	1673		3539	1583	859	3539
Volume (vph)	110	190	475	120	160	600
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	120	207	516	130	174	652
RTOR Reduction (vph)	158	0	0	55	0	0
Lane Group Flow (vph)	169	0	516	75	174	652
Turn Type				Perm	Perm	
Protected Phases	8		2			6
Permitted Phases				2	6	
Actuated Green, G (s)	8.8		23.2	23.2	23.2	23.2
Effective Green, g (s)	8.8		23.2	23.2	23.2	23.2
Actuated g/C Ratio	0.22		0.58	0.58	0.58	0.58
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	368		2053	918	498	2053
v/s Ratio Prot	c0.10		0.15			0.18
v/s Ratio Perm				0.05	c0.20	
v/c Ratio	0.46		0.25	0.08	0.35	0.32
Uniform Delay, d1	13.5		4.1	3.7	4.4	4.3
Progression Factor	1.00		0.65	0.72	1.00	1.00
Incremental Delay, d2	0.9		0.3	0.2	1.9	0.4
Delay (s)	14.5		3.0	2.8	6.4	4.7
Level of Service	B		A	A	A	A
Approach Delay (s)	14.5		2.9			5.1
Approach LOS	B		A			A

Intersection Summary			
HCM Average Control Delay	6.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	49.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Baseline — Synchro 6 Report
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6.2 Detailed Level of Service Reports

HCM Signalized Intersection Capacity Analysis — 2040 PM
3: Cedar Hills Dr & 4800 W — 3/12/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.75	1.00	1.00	0.56	1.00	1.00	0.46	1.00	1.00	0.16	1.00	1.00
Satd. Flow (perm)	1392	1863	1583	1044	1863	1583	854	3539	1583	299	3539	1583
Volume (vph)	233	55	31	275	15	265	10	715	300	390	480	5
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	253	60	34	299	16	288	11	777	326	424	522	5
RTOR Reduction (vph)	0	0	30	0	0	249	0	0	224	0	0	3
Lane Group Flow (vph)	253	60	4	299	16	39	11	777	102	424	522	2
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	16.2	7.2	7.2	20.8	9.5	9.5	24.4	23.2	23.2	43.5	37.3	37.3
Effective Green, g (s)	18.2	8.2	8.2	22.8	10.5	10.5	26.4	24.2	24.2	44.5	38.3	38.3
Actuated g/C Ratio	0.24	0.11	0.11	0.30	0.14	0.14	0.34	0.31	0.31	0.58	0.50	0.50
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	378	198	169	425	254	216	319	1112	498	484	1760	787
v/s Ratio Prot	0.09	0.03		c0.11	0.01		0.00	0.22		c0.19	0.15	
v/s Ratio Perm	0.07		0.00	c0.10		0.02	0.01		0.06	c0.32		0.00
v/c Ratio	0.67	0.30	0.02	0.70	0.06	0.18	0.03	0.70	0.21	0.88	0.30	0.00
Uniform Delay, d1	26.2	31.8	30.8	23.0	29.0	29.4	16.7	23.2	19.4	17.3	11.4	9.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.5	0.9	0.1	5.2	0.1	0.4	0.0	3.7	0.9	16.1	0.4	0.0
Delay (s)	30.7	32.6	30.9	28.2	29.1	29.9	16.8	26.9	20.3	33.4	11.8	9.7
Level of Service	C	C	C	C	C	C	B	C	C	C	B	A
Approach Delay (s)		31.0			29.0			24.8			21.5	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	25.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	77.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	73.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Baseline — Synchro 6 Report
Fehr & Peers Associates, Inc. — Page 1

HCM Signalized Intersection Capacity Analysis — 2040 PM
17: Harvey Blvd & 4800 W — 3/12/2013

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00		0.95	1.00	1.00	0.95
Frt	0.94		1.00	0.85	1.00	1.00
Flt Protected	0.97		1.00	1.00	0.95	1.00
Satd. Flow (prot)	1705		3539	1583	1770	3539
Flt Permitted	0.97		1.00	1.00	0.27	1.00
Satd. Flow (perm)	1705		3539	1583	504	3539
Volume (vph)	110	85	905	125	105	710
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	120	92	984	136	114	772
RTOR Reduction (vph)	60	0	0	41	0	0
Lane Group Flow (vph)	152	0	984	95	114	772
Turn Type				Perm	Perm	
Protected Phases	8		2			6
Permitted Phases				2	6	
Actuated Green, G (s)	8.7		38.3	38.3	38.3	38.3
Effective Green, g (s)	8.7		38.3	38.3	38.3	38.3
Actuated g/C Ratio	0.16		0.70	0.70	0.70	0.70
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	270		2464	1102	351	2464
v/s Ratio Prot	c0.09		c0.28			0.22
v/s Ratio Perm				0.06	0.23	
v/c Ratio	0.56		0.40	0.09	0.32	0.31
Uniform Delay, d1	21.4		3.5	2.7	3.3	3.2
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	2.7		0.5	0.2	2.4	0.3
Delay (s)	24.1		4.0	2.9	5.7	3.6
Level of Service	C		A	A	A	A
Approach Delay (s)	24.1		3.9			3.9
Approach LOS	C		A			A

Intersection Summary			
HCM Average Control Delay	5.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	52.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Baseline — Synchro 6 Report
Fehr & Peers Associates, Inc. — Page 1

HCM Signalized Intersection Capacity Analysis — 2040 AM Proj
3: Cedar Hills Dr & 4800 W — 3/12/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.61	1.00	1.00	0.68	1.00	1.00	0.32	1.00	1.00	0.25	1.00	1.00
Satd. Flow (perm)	1130	1863	1583	1261	1863	1583	602	3539	1583	462	3539	1583
Volume (vph)	105	72	49	217	158	350	52	607	193	140	619	155
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	78	53	236	172	380	57	660	210	152	673	168
RTOR Reduction (vph)	0	0	43	0	0	306	0	0	144	0	0	109
Lane Group Flow (vph)	114	78	10	236	172	74	57	660	66	152	673	59
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	16.5	10.5	10.5	17.5	11.0	11.0	22.4	18.5	18.5	26.8	20.7	20.7
Effective Green, g (s)	18.5	11.5	11.5	19.5	12.0	12.0	24.4	19.5	19.5	28.8	21.7	21.7
Actuated g/C Ratio	0.30	0.19	0.19	0.32	0.19	0.19	0.40	0.32	0.32	0.47	0.35	0.35
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	412	348	296	461	363	308	331	1120	501	367	1247	558
v/s Ratio Prot	0.03	0.04		c0.06	0.09		0.01	0.19		c0.05	c0.19	
v/s Ratio Perm	0.05		0.01	c0.10		0.05	0.05		0.04	0.15		0.04
v/c Ratio	0.28	0.22	0.03	0.51	0.47	0.24	0.17	0.59	0.13	0.41	0.54	0.11
Uniform Delay, d1	16.1	21.3	20.5	16.6	22.0	20.9	11.7	17.7	15.0	10.2	16.0	13.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.3	0.0	1.0	1.0	0.4	0.2	2.3	0.5	0.8	1.7	0.4
Delay (s)	16.5	21.6	20.5	17.6	23.0	21.4	12.0	20.0	15.6	11.0	17.6	13.8
Level of Service	B	C	C	B	C	C	B	B	B	B	B	B
Approach Delay (s)		19.0			20.6			18.5			16.0	
Approach LOS		B			C			B			B	

Intersection Summary			
HCM Average Control Delay	18.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	61.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	54.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Baseline — Synchro 6 Report
Fehr & Peers Associates, Inc. — Page 1

HCM Unsignalized Intersection Capacity Analysis — 2040 AM Proj
30: 4800 W & — 3/12/2013

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	77	47	23	775	845	40
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	84	51	25	842	918	43
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)					702	
pX, platoon unblocked	0.86	0.86	0.86			
vC, conflicting volume	1411	481	962			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1319	243	800			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	32	92	96			
cM capacity (veh/h)	124	655	708			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	84	51	25	421	421	612	350
Volume Left	84	0	25	0	0	0	0
Volume Right	0	51	0	0	0	0	43
cSH	124	655	708	1700	1700	1700	1700
Volume to Capacity	0.68	0.08	0.04	0.25	0.25	0.36	0.21
Queue Length 95th (ft)	91	6	3	0	0	0	0
Control Delay (s)	80.2	11.0	10.3	0.0	0.0	0.0	0.0
Lane LOS	F	B	B				
Approach Delay (s)	53.9		0.3			0.0	
Approach LOS	F						

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	35.6%	ICU Level of Service	A
Analysis Period (min)	15		

Baseline — Synchro 6 Report
Fehr & Peers Associates, Inc. — Page 1

6.2 Detailed Level of Service Reports

HCM Signalized Intersection Capacity Analysis — 2040 AM Proj
17: Harvey Blvd & 4800 W — 3/12/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	0.95	1.00	1.00	0.95	
Frt		0.96			0.91		1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.98			0.98		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1747			1673		1770	3539	1583	1770	3534	
Flt Permitted		0.83			0.86		0.33	1.00	1.00	0.42	1.00	
Satd. Flow (perm)		1480			1459		606	3539	1583	788	3534	
Volume (vph)	28	13	17	111	3	199	5	557	122	178	721	7
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	30	14	18	121	3	216	5	605	133	193	784	8
RTOR Reduction (vph)	0	13	0	0	138	0	0	0	66	0	1	0
Lane Group Flow (vph)	0	49	0	0	202	0	5	605	67	193	791	0
Turn Type	Perm			Perm			Perm		Perm	Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		9.8			9.8		18.0	18.0	18.0	18.0	18.0	
Effective Green, g (s)		9.8			9.8		18.0	18.0	18.0	18.0	18.0	
Actuated g/C Ratio		0.27			0.27		0.50	0.50	0.50	0.50	0.50	
Clearance Time (s)		4.0			4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		405			399		305	1779	796	396	1777	
v/s Ratio Prot								0.17			0.22	
v/s Ratio Perm		0.03			c0.14		0.01		0.04	c0.24		
v/c Ratio		0.12			0.51		0.02	0.34	0.08	0.49	0.44	
Uniform Delay, d1		9.8			11.0		4.5	5.3	4.6	5.9	5.7	
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.1			1.0		0.0	0.1	0.0	0.9	0.2	
Delay (s)		9.9			12.0		4.5	5.5	4.7	6.8	5.9	
Level of Service		A			B		A	A	A	A	A	
Approach Delay (s)		9.9			12.0			5.3			6.1	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM Average Control Delay	6.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	35.8	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Baseline — Synchro 6 Report
Fehr & Peers Associates, Inc. — Page 1

HCM Signalized Intersection Capacity Analysis — 2040 PM Proj
3: Cedar Hills Dr & 4800 W — 3/12/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.72	1.00	1.00	0.55	1.00	1.00	0.36	1.00	1.00	0.12	1.00	1.00
Satd. Flow (perm)	1349	1863	1583	1017	1863	1583	662	3539	1583	224	3539	1583
Volume (vph)	295	86	58	328	46	275	37	873	342	390	719	97
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	321	93	63	357	50	299	40	949	372	424	782	105
RTOR Reduction (vph)	0	0	56	0	0	258	0	0	207	0	0	52
Lane Group Flow (vph)	321	93	7	357	50	41	40	949	165	424	782	53
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	17.4	8.4	8.4	22.2	10.8	10.8	32.2	28.3	28.3	50.8	41.9	41.9
Effective Green, g (s)	19.4	9.4	9.4	24.2	11.8	11.8	34.2	29.3	29.3	51.8	42.9	42.9
Actuated g/C Ratio	0.23	0.11	0.11	0.28	0.14	0.14	0.40	0.34	0.34	0.61	0.50	0.50
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	355	205	174	397	257	218	328	1211	542	470	1774	793
v/s Ratio Prot	0.11	0.05		c0.13	0.03		0.01	0.27		c0.20	0.22	
v/s Ratio Perm	0.10		0.00	c0.12		0.03	0.04		0.10	c0.35		0.03
v/c Ratio	0.90	0.45	0.04	0.90	0.19	0.19	0.12	0.78	0.30	0.90	0.44	0.07
Uniform Delay, d1	31.5	35.7	34.1	28.3	32.7	32.7	15.8	25.3	20.7	22.7	13.7	11.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	25.3	1.6	0.1	22.3	0.4	0.4	0.2	5.1	1.4	20.3	0.8	0.2
Delay (s)	56.8	37.3	34.2	50.6	33.1	33.1	16.0	30.4	22.1	43.0	14.5	11.2
Level of Service	E	D	C	D	C	C	B	C	C	D	B	B
Approach Delay (s)		50.0			41.9			27.7			23.4	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM Average Control Delay	31.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	85.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	80.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Baseline — Synchro 6 Report
Fehr & Peers Associates, Inc. — Page 1

HCM Unsignalized Intersection Capacity Analysis — 2040 PM Proj
30: 4800 W & — 3/12/2013

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	108	62	87	1144	955	150
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	117	67	95	1243	1038	163
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)				1310	712	
pX, platoon unblocked	0.91	0.86	0.86			
vC, conflicting volume	1930	601	1201			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1644	381	1076			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	87	83			
cM capacity (veh/h)	68	533	557			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	185	95	622	622	692	509
Volume Left	117	95	0	0	0	0
Volume Right	67	0	0	0	0	163
cSH	100	557	1700	1700	1700	1700
Volume to Capacity	1.85	0.17	0.37	0.37	0.41	0.30
Queue Length 95th (ft)	380	15	0	0	0	0
Control Delay (s)	491.2	12.8	0.0	0.0	0.0	0.0
Lane LOS	F	B				
Approach Delay (s)	491.2	0.9			0.0	
Approach LOS	F					

Intersection Summary			
Average Delay	33.8		
Intersection Capacity Utilization	55.8%	ICU Level of Service	B
Analysis Period (min)	15		

Baseline — Synchro 6 Report
Fehr & Peers Associates, Inc. — Page 1

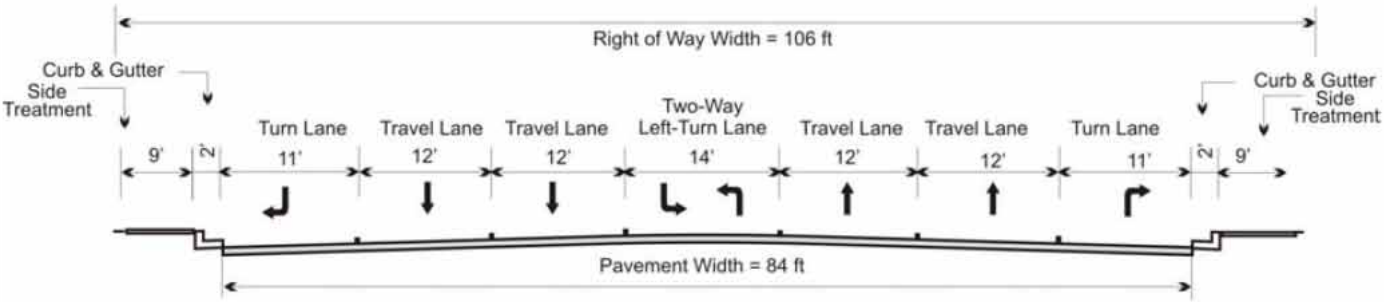
HCM Signalized Intersection Capacity Analysis — 2040 PM Proj
17: Harvey Blvd & 4800 W — 3/12/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	0.95	1.00	1.00	0.95	
Frt		0.96			0.93		1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.98			0.98		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1748			1693		1770	3539	1583	1770	3523	
Flt Permitted		0.87			0.85		0.26	1.00	1.00	0.19	1.00	
Satd. Flow (perm)		1560			1475		489	3539	1583	353	3523	
Volume (vph)	15	7	9	87	13	118	17	1109	126	128	870	28
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	8	10	95	14	128	18	1205	137	139	946	30
RTOR Reduction (vph)	0	8	0	0	59	0	0	0	50	0	3	0
Lane Group Flow (vph)	0	26	0	0	178	0	18	1205	87	139	973	0
Turn Type	Perm			Perm			Perm		Perm	Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		10.6			10.6		32.6	32.6	32.6	32.6	32.6	
Effective Green, g (s)		10.6			10.6		32.6	32.6	32.6	32.6	32.6	
Actuated g/C Ratio		0.21			0.21		0.64	0.64	0.64	0.64	0.64	
Clearance Time (s)		4.0			4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		323			305		311	2253	1008	225	2243	
v/s Ratio Prot								0.34			0.28	
v/s Ratio Perm		0.02			c0.12		0.04		0.06	c0.39		
v/c Ratio		0.08			0.58		0.06	0.53	0.09	0.62	0.43	
Uniform Delay, d1		16.4			18.3		3.5	5.1	3.6	5.6	4.7	
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.1			2.8		0.1	0.2	0.0	5.0	0.1	
Delay (s)		16.5			21.1		3.6	5.4	3.6	10.5	4.8	
Level of Service		B			C		A	A	A	B	A	
Approach Delay (s)		16.5			21.1			5.2			5.5	
Approach LOS		B			C			A			A	

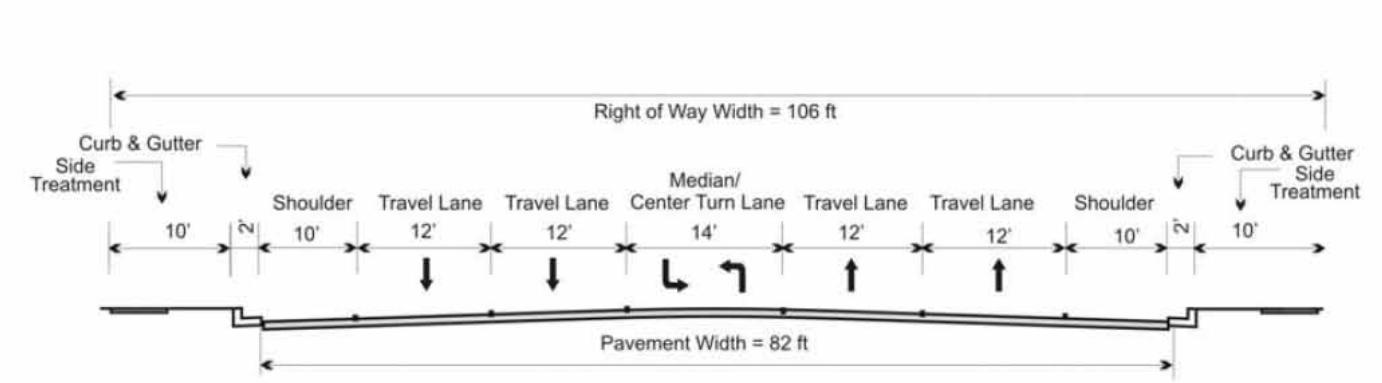
Intersection Summary			
HCM Average Control Delay	6.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	51.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Baseline — Synchro 6 Report
Fehr & Peers Associates, Inc. — Page 1

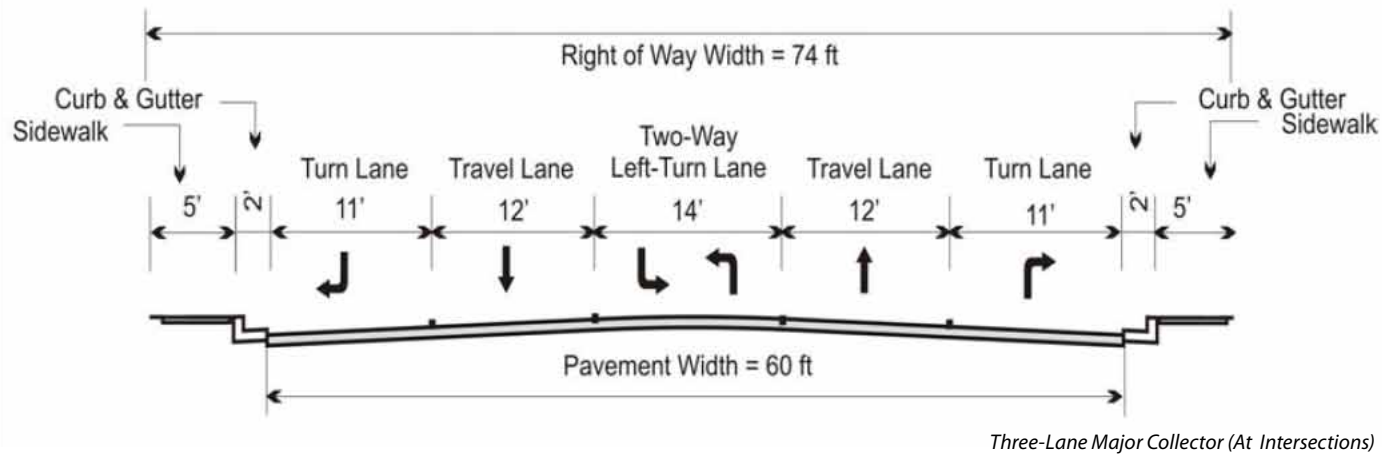
6.3 Highland City Street Sections



Five-Lane Arterial (At Intersections)

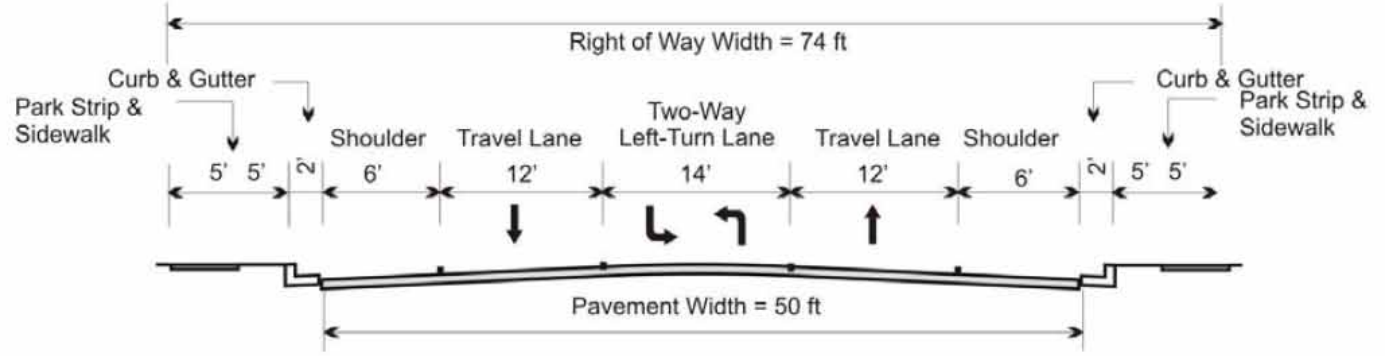


Five-Lane Arterial (Between Intersections)

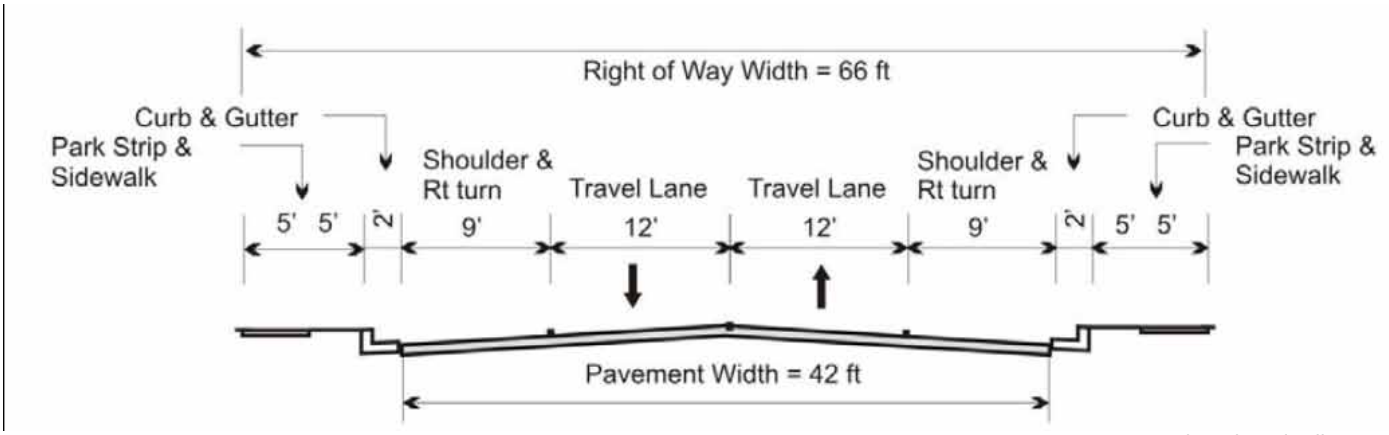


Three-Lane Major Collector (At Intersections)

6.3 Highland City Street Sections



Three-Lane Major Collector (Between Intersections)



Two-Land Residential Collector

6.4 Psychographics Details

6.4.1 BOOMBURBS

Demographic:
The newest additions to the suburbs, these communities are home to younger families with a busy, upscale lifestyle. Both the neighborhoods and the families are growing. Boomburbs is the fastest growing market in the U.S., almost 6 percent annually since 2000. It is also home to one of the highest concentrations of young families with children. Their median age is less than 34 years; most Boomburbs residents are between 35 and 44 years of age. There is also little ethnic diversity in this population; white is the predominant race.

Socioeconomic:
Two incomes support most of these households. Boomburbs include one of the highest concentrations of dual income households, complemented by one of the highest rates of labor force participation, over 73 percent. The labor force is college-educated and employed primarily in professional or management occupations. Their median household income is over $100,000, more than double the U.S. median. Median net worth here is over $145,000. Net worth is not as high as their household income implies, but most residents have recently upgraded their homes. More than half of these households do receive additional income from interest, dividends, or rental properties.

Residential:
Most of the homes in Boomburbs were built after 1990. These are the newest developments in growing areas. Most homes are single-family structures, and home value is high, over $275,000. Houses have a high median home value of nearly $250,000, more than $100,000 higher than the U.S. average. The rate of home ownership rate is 92 percent, compared to 67 percent across the U.S. Commuting links the dual career households with their suburban lifestyle. Many work outside their resident county; 36 percent cross county lines to work (compared to 24 percent for the U.S.). Boomburbs neighborhoods are concentrated in the South Atlantic and Mountain states.

Preferences:
Boomburbs' represent the top market for home built-ins and recent purchases of everything from household furnishings, baby furniture and equipment to cars (including motorcycles) and camcorders. Their product preferences reflect their suburban lifestyle. They are one of the top markets for sport utility vehicles, lawn care, new trees, and casual apparel. They're active and favor golf, tennis and swimming. Boomburbs are likely to do their food shopping at upscale grocery stores such as Harris-Teeter.

Boomburbs are also technically savvy. The adults own PDAs, computers, MP3 players, and cellular phones, and their children represent the top markets for game boys and PC use among the under 18 crowd. These consumers also stay in touch through newspapers, a variety of magazines including business and finance, travel, airline and sports magazines, radio and television. They listen to talk radio and favor cable channels like CNN, The Discovery Channel and The Learning Channel.

6.4.2 MAIN STREET USA

Demographic:
Main Street, USA is comprised of a mix of household types, similar to the U.S. distribution, with a median age of 35.8 years, also similar to the U.S. Almost half of the households are married couple families (with and without children); 27 percent, single-person households; and the remainder, shared or other families. Most residents are white (80 percent).

Socioeconomic:
Residents of Main Street, USA earn a comfortable median household income of $50,400 (on a national basis), with income mainly derived from wages (80 percent of households). A fourth of the households receive Social Security benefits. Median net worth is $114,500 (on a national basis). Main Street, USA residents primarily work in services and manufacturing industries, with another 30 percent employed in professional and management occupations. Almost a fifth of Main Street, USA residents have earned a bachelor's or graduate degree, while 30 percent have some college credits.

Residential:
Main Street, USA has a mix of single-family homes and multi-unit dwellings, similar to the U.S. These neighborhoods are found in the suburbs of smaller metropolitan cities, primarily in the Northeast and Midwest. Almost two-thirds of the housing was built before 1970. About 64 percent of the householders are homeowners, with a median home value of $165,000 (on a national basis).

Preferences:
Residents of Main Street, USA are active members of their communities, taking part in fund-raisers and volunteer programs. They take day trips to the

beach, theme park or the zoo and occasionally go on domestic vacations. For evening leisure time, they enjoy dinner and a movie or play billiards at their favorite bar. Applebees, Outback Steakhouse and Red Lobster are their favorite family restaurants. Many residents prefer to cook at home and play board games or rent a movie.

They use the Internet to play games or search for employment, but shopping online is growing in popularity. If they do not have access at home, they may access the Internet at work, school or the public library. They rely extensively on the Yellow Pages for restaurants, stores, contractors and more.

Because Main Street, USA Homes are older, householders invest in small home remodeling and improvement projects. Residents are more likely to complete work by themselves than hire an outside contractor. To complete the job, they purchase tools and supplies from Home Depot or Lowe's.

Residents keep up their gardens by planting new bulbs, fertilizing their lawns and using insecticide regularly. They treat their pets with dog biscuits, but prefer the convenience of dry cat or dog food to canned foods.

6.4.3 SOPHISTICATED SQUIRES

Demographics:
Sophisticated Squires enjoy cultured country living in newer home developments on the fringe of urbanized areas. They have traded longer commutes for fewer neighbors. These urban escapees are mostly married couple families. About 40 percent have children; ranging from toddlers to over 18 years. The median age of the population in Sophisticated Squires is 37 years; the majority of householders are between 35 and 54 years of age—mostly Baby Boomers. This segment is not ethnically diverse; most of the residents are white.

Socioeconomic:
Sophisticated Squires are college educated. About one-third of the labor force has a Bachelor's or graduate degree; another third has some college to their credit. Labor force participation rates are high for males and females, although most of the women, over 60 percent, are part-time workers. The range of occupations varies from blue collar to management, but the most common occupations are professionals. Their median income is just above $79,000. Wage or salary income, earned by 90 percent of the households, is supplemented with interest, dividend, or rental income among almost half of the households. Their median net worth is $168,000.

Residential:
Sophisticated Squires reside in less densely populated areas. Concentrated in the Atlantic coast states, over 90 percent of the homes are single-family structures and owner occupied. Median home value is $214,000. About 75 percent of the homes in the area were built before 1989, and 55 percent were built between 1970 and 1989. Over 80 percent of these households own at least two vehicles.

Preferences:
The vehicles of choice among the Squires are SUVs and minivans. Cargo space is vital to families, suburban DIY projects, and golfers. Golf is very important to Sophisticated Squires. They play golf, attend golfing events, purchase golf clothing, and watch golf tournaments and The Golf Channel. They also enjoy tennis and mountain biking. To stay fit, many own a treadmill, join Weight Watchers for diet control and take vitamins and dietary supplements. To keep up with their lawn maintenance, Sophisticated Squires own mowers, trimmers and leaf shredders and purchase lawn fertilizer and insecticides. To tackle home improvement projects such as painting or installing hardwood floors, they own most of the power tools stocking the shelves of Home Depot. Many have a second mortgage.

Sophisticated Squires shop suburban classics like L.L. Bean, Land's End and Eddie Bauer. Mail order is common, as is shopping online. To reach Sophisticated Squires, their preferred media include all-talk, sports and classic hits radio (drive times), newspapers and magazines, especially business/finance and home/garden features. They are light television viewers, but prefer news, weather and home improvement programs, in addition to golf.

6.4 Psychographics Details

6.4.4 SUBURBAN SPLENDOR

Demographic:
Residents of Suburban Splendor live with maturing families in growing neighborhoods. They are slightly older, with a median age of 40 years, and married, with growing children. Their neighborhoods are a bit younger, with most homes built after 1980, and still increasing. Household growth in these suburbs is over two percent annually. Diversity is low with a predominantly white population.

Socioeconomic:
These successful suburbanites are the epitome of upward mobility, just a couple rungs below Top Rung in affluence. With a median household income of almost $114,000 and median net worth of $246,000 (nationally), their wealth is more than double the U.S. medians. Labor force participation rates are high for both men and women in this market, indicating dual incomes for many households. Most of the labor force works in management and professional positions; more than half hold Bachelor's or graduate degrees. Their salaries are supplemented by other income from interest, dividends, and rentals at a rate almost two times that of the national average.

Residential:
Families in the Suburban Splendor segment rank first among Tapestry's segments for home ownership; 92 percent own their homes. Homes are large, luxurious, with a median home value of $378,000 (on a national basis), and newer. Located in growing neighborhoods, most homes, more than 60 percent, are relatively new, built after 1980. Since dual incomes commonly require multiple vehicles, over 85 percent of these households own two or more vehicles. Suburban Splendor neighborhoods are located mostly in the metropolitan areas of California and the Northeast.

Preferences:
The homes in Suburban Splendor feature the latest amenities, from spas to espresso machines, and reflect the latest in home design, like hardwood flooring. Spending on home improvements also focuses on upgrades and all the newest gadgets, from snow blowers to lawn edgers, although these residents are more likely to hire home services than undertake DIY projects.

Their free time is devoted to family, travel, and self-improvement pursuits like physical fitness, reading, and visits to museums or the theatre. Fitness includes regular exercise on high-ticket equipment at home or at the gym, plus sports like racquetball, skiing, tennis and golf. Reading materials range from multiple newspapers to books and magazines, especially airline, travel, business and finance. As expected, they rack up the miles in frequent flyer programs as they frequently travel in the U.S. and overseas for business and pleasure.

Suburban Splendor residents are very active investors, using the Internet to check their holdings and make stock trades. They hold home equity credit lines, consult with financial planners, and own life insurance policies exceeding $500,000. They are also shoppers, favoring upscale retailers like Nordstrom, Lord & Taylor, Ann Taylor, and Barnes & Noble. They use the Internet frequently to purchase books and apparel. Use of the Internet, however, favors convenience, not entertainment. Media preferences include all-news, talk, sports, and classical music radio.

6.4 Psychographics Details

6.4.5 UP & COMING FAMILIES

Demographic:
With an annual growth rate of 4.2 percent, Up and Coming Families represents the second highest household growth market and the youngest affluent family market (with a median age of 32.0 years) of Community Tapestry. Residents are a mix of Generation Xers and baby boomers. The profile for this market is young, affluent families with younger children. Eighty percent of households are composed of families. Approximately two-fifths of households consist of married couples with children. Most of the residents in this segment are white; however, the diversity of the population is increasing with its size.

Socioeconomic:
At the beginning of their careers, Up and Coming Families residents are earning above-average income but have not had time to accumulate much wealth. The median household income is $77,444, well above the national median. The median net worth is $162,486. Nearly two-thirds of residents aged 25 years and older have a degree or some college credits. Labor force participation is well above average at 73 percent, and unemployment is low. Understandably, 91 percent of households derive income from wage and salary compensation. Although half of the households have children, they also have working parents.

Residential:
Nearly half of Up and Coming Families segments are concentrated in the South, the other half in the West and Midwest. These neighborhoods are located in suburban outskirts of mid-sized metropolitan areas with populations higher than 250,000. Households are mainly new single-family dwellings. Home-ownership is at 85 percent. More than half of the housing units were built in the last 10 years. Houses in these neighborhoods are valued at $221,956, slightly above the U.S. median.

Preferences:
Consumer choices for Up and Coming Families are dictated by family and home. Many are beginning or expanding their families, so maternity clothes and baby equipment are essential purchases in addition to children's clothing and toys. Because many are first-time homeowners, purchases such as basic household furniture and lawn fertilizer, weed control, and insecticide are important. Vying for attention in the family budget are car loans, student loans, and mortgage payments. Up and Coming Families residents most likely own or lease an SUV or minivan. They enjoy eating out at family restaurants such as Red Robin, Chili's Grill & Bar, and Olive Garden and fast-food restaurants such as Chick-fil-A, Chuck E. Cheese's, and Papa John's.

Leisure activities include playing softball, going to the zoo, and visiting theme parks (generally Sea World or Disney World), where they make good use of their digital camera or camcorder. They enjoy renting science fiction, comedy, and family type DVDs. A favorite TV show is 24. Favorite cable stations are Oxygen, E!, and the Discovery Health Channel. Residents prefer to listen to soft adult contemporary, sports, and classic hits radio.

USDC UTILITY FRAMEWORK PLAN
PRELIMINARY WATER SYSTEM DEMANDS

ITEM NO.	TYPE OF USE	Total AREA	TOTAL	UNIT	PEAK DAY SOURCE DEMAND: UNIT DEMAND WINTER	PEAK DAY SOURCE DEMAND: UNIT DEMAND SUMMER	PEAK DAY SOURCE DEMAND: TOTAL DAILY DEMAND WINTER	PEAK DAY SOURCE DEMAND: TOTAL DAILY DEMAND WINTER	PEAK DAY SOURCE DEMAND: TOTAL DAILY DEMAND SUMMER	PEAK DAY SOURCE DEMAND: TOTAL DAILY DEMAND SUMMER	MINIMUM TANK STORAGE REQ'D: UNIT DEMAND WINTER	MINIMUM TANK STORAGE REQ'D: UNIT DEMAND SUMMER	MINIMUM TANK STORAGE REQ'D: TOTAL DEMAND WINTER	MINIMUM TANK STORAGE REQ'D: TOTAL DEMAND SUMMER	PEAK INSTANTANEOUS DEMAND WINTER	PEAK INSTANTANEOUS DEMAND SUMMER	ANNUAL WATER RIGHT DEMANDS: UNIT DEMAND	ANNUAL WATER RIGHT DEMANDS: TOTAL DEMAND
AREA A																		
I. POTABLE					(GPD)	(GPD)	(GPM)	(GPD)	(GPM)	(GPD)	(GAL)	(GAL)	(GAL)	(GAL)	(GPM)	(GPM)	(AC-FT)	(AC-FT)
			(b)		(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)
(FORMULAS)							(b)*(c)/1440	(b)*(c)	(b)*(d)/1440	(b)*(d)	(c)/2	(d)/2	(b)*(i)	(b)*(j)	10.8*((peak day/800)^0.64)		(calc.)	(b)*(o)
1. RESIDENTIAL																		
SINGLE FAMILY		165	UNITS		800	800	92	132,000	92	132,000	400	400	66,000	66,000			0.448	73.9
SENIOR SINGLE FAMILY		28	UNITS		800	800	16	22,400	16	22,400	400	400	11,200	11,200			0.448	12.5
TOWNHOMES		49	UNITS		600	600	20	29,400	20	29,400	300	300	14,700	14,700			0.336	16.5
APARTMENTS		630	UNITS		500	500	219	315,000	219	315,000	250	250	157,500	157,500			0.280	176.4
SENIOR APARTMENTS		200	UNITS		500	500	69	100,000	69	100,000	250	250	50,000	50,000			0.280	56.0
2. RETAIL																		
RETAIL (134,000 SQFT 1 ERU/2000)		67	ERU		800	800	37	53,600	37	53,600	400	400	26,800	26,800			0.448	30.0
3. OFFICE																		
OFFICE (40,000 SQFT 1 ERU/2500)		16	ERU		800	800	9	12,800	9	12,800	400	400	6,400	6,400			0.448	7.2
4. CHURCH																		
CHURCH		5	ERU		800	800	3	4,000	3	4,000	400	400	2,000	2,000			0.448	2.2
SUBTOTAL POTABLE							**465**	**669,200**	**465**	**669,200**			**334,600**	**334,600**	**801**	**801**		**374.8**
II. IRRIGATION	(ACRES/UNIT)				(GPD/AC)	(GPD/AC)	(GPM)	(GPD)	(GPM)	(GPD)	(GAL)	(GAL)	(GAL)	(GAL)	(GPM)	(GPM)	(AC-FT)	(AC-FT)
(FORMULAS)	(a)					UDDW	(a)*(b)*(c)/1440	(a)*(b)*(c)	(b)*(d)/1440	(g)*1440	(c)/2	(d)/2	(a)*(b)*(i)	(a)*(b)*(j)	(e)*2	(g)*2	2.73 ac-ft/ac	(b)*(o)
1. RESIDENTIAL																		
SINGLE AMILY (40% Irrigated)	33.9	13.6	ACRES			8,160			77	110,748		4,080		55,374		154	2.730	37.0
SENIOR SINGLE FAMILY (40% Irrigated	4.6	1.8	ACRES			8,160			10	15,047		4,080		7,524		21	2.730	5.0
TOWNHOMES (20% Irrigated)	4.0	0.8	ACRES			8,160			5	6,512		4,080		3,256		9	2.730	2.2
APARTMENTS (15% Irrigated)	15.8	2.4	ACRES			8,160			13	19,290		4,080		9,645		27	2.730	6.5
SENIOR APARTMENTS (15% Irrigated)	3.3	0.5	ACRES			8,160			3	4,088		4,080		2,044		6	2.730	1.4
2. RETAIL																		
RETAIL (15% IRRIGATED)	6.15	0.9	ACRES			8,160			5	7,528		4,080		3,764		10	2.730	2.5
3. OFFICE																		
OFFICE (15% IRRIGATED)	1.54	0.2	ACRES			8,160			1	1,885		4,080		942		3	2.730	0.6
4. CHURCH																		
CHURCH (25% IRRIGATED)	2.84	0.7	ACRES			8,160			4	5,794		4,080		2,897		8	2.730	1.9
5. OPEN SPACE																		
OPEN SPACE (40% IRRIGATED)	22.35	8.9	ACRES			8,160			51	72,950		4,080		36,475		101	2.730	24.4
6. ROAD PARK STRIPS																		
ROW (10% IRRIGATED)	48.000	4.8	ACRES			8,160			27	39,168		4,080		19,584		54	2.730	13.1
SUBTOTAL IRRIGATION		**34.68**							**197**	**283,009**				**141,505**		**393**		**94.7**
TOTAL POTABLE AND IRRIGATION							**465**	**669,200**	**661**	**952,209**			**334,600**	**476,105**	**801**	**1,194**		**469.5**
III. FIRE FLOW / STORAGE RESERVES		(GPM)	(HOURS)										(GAL)	(GAL)				
1. FIRE FLOW (Assume 3500 gpm; 3 hrs)		**3,500**	**3**										**630,000**	**630,000**				
				TOTAL			**465**	**669,200**	**661**	**952,209**			**964,600**	**1,106,105**	**801**	**1,194**		**469.5**
							(GPM)	(GPD)	(GPM)	(GPD)			(GAL)	(GAL)	(GPM)	(GPM)		(AC-FT)

NOTES:
1. PEAK DAY DOMESTIC DEMANDS WERE BASED ON STATE DRINKING WATER REGULATIONS AND THE 1994 PARK CITY WATER SUPPLY/DEMAND STUDY.
2. PEAK DAY IRRIGATION DEMAND = 6,900 GPD/ACRE PER UTAH DIVISION OF WATER RIGHTS CONSUMPTIVE USE TABLES FOR THE NWS STATION AT KAMAS, ELEVATION 6470'.
3. ANNUAL WATER SUPPLY REQUIREMENTS:
   DOMESTIC = 0.5 TIMES THE PEAK DAY DEMAND, ANNUALIZED.
   IRRIGATION = 1.96 A.F./ ACRE PER UTAH DIVISION OF WATER RIGHTS CONSUMPTIVE USE TABLES FOR THE NWS STATION AT KAMAS, ELEVATION 6470' AND AMES IRRIGATION HANDBOOK.

USDC UTILITY FRAMEWORK PLAN
PRELIMINARY SANITARY SEWER FLOW

TYPE OF USE	NO. OF UNITS	UNIT	AVE. DAY DEMAND/UNIT	AVERAGE ANNUAL DAILY FLOW RATE: FLOW/ UNIT	AVERAGE ANNUAL DAILY FLOW RATE: TOTAL FLOW	AVERAGE ANNUAL DAILY FLOW RATE: TOTAL FLOW	MAXIMUM DAILY DESIGN FLOW RATE (PEAKING FACTOR = 4): FLOW/ UNIT	MAXIMUM DAILY DESIGN FLOW RATE: TOTAL FLOW	MAXIMUM DAILY DESIGN FLOW RATE: TOTAL FLOW
AREA A			(GPD)	(GPD)	(GPM)	(GPD)	(GPD)	(GPM)	(GPD)
	(a)		(b)	(c)	(d)	(e)	(i)	(j)	(k)
(FORMULAS)				(b)*0.9	(a)*(c)/1440	(d)*1440	(c)*4	(a)*(i)/1440	(j)*1440
1. RESIDENTIAL									
SINGLE FAMILY	165	UNITS	360	360	41	59,400	1,440	165	237,600
SENIOR SINGLE FAMILY	28	UNITS	360	360	7	10,080	1,440	28	40,320
TOWNHOMES	49	UNITS	300	300	10	14,700	1,200	41	58,800
APARTMENTS	630	UNITS	250	250	109	157,500	1,000	438	630,000
SENIOR APARTMENTS	200	UNITS	250	250	35	50,000	1,000	139	200,000
2. RETAIL									
RETAIL (134,000 SQFT 1 ERU/2000)	67	ERU	360	360	17	24,120	1,440	67	96,480
3. OFFICE									
OFFICE (40,000 SQFT 1 ERU/2500)	16	ERU	360	360	4	5,760	1,440	16	23,040
4. CHURCH									
CHURCH	5	ERU	360	360	1	1,800	1,440	5	7,200
TOTAL					**225**	**323,360**		**898**	**1,293,440**

NOTES:

1). Highland City uses a peaking factor of 4 for small flows. For larger flows, a peaking factor curve can be applied per figure 4.1 of the Highland City Master Plan.

USDC UTILITY FRAMEWORK PLAN - IRRIGATION DEMANDS

IRRIGATION DEMANDS FOR AVERAGE ELEVATIONS OF 4760'

AVERAGE GROWING SEASON: Apr 15 to Oct 15		180	Days (Conservative)
PEAK DAY CONSUMPTIVE USE (C.U.)[1]			
Peak Consumptive Use (Turf Grass)	=	5.22	in/month
	=	0.17	in/day
x 1.25 Peaking Factor	=	0.21	in/day
SEASONAL CONSUMPTIVE USE (C.U.)[1]			
24.7 inches/year * 1.0	=	24.68	in/yr
SEASONAL GROSS REQUIREMENTS			
SEASONAL CONSUMPTIVE USE (C.U.) =		24.68	in/yr
Less soil moisture	-	1.75	in/yr
(silt loam 1.75 in/ft*1ft effective root zone)[2]			
Less rainfall average (during irrigation season)	-	7.2	in/yr
NET SEASONAL CONSUMPTIVE USE (C.U.)	=	15.73	in/yr
GROSS IRRIGATION REQUIREMENTS			
Assumed Efficiency : 70%			
Seasonal:			
Net C.U./Efficiency			
15.73 in/yr / 70%	=	22.47	in/yr
IF NO RAIN OCCURS			
(net seasonal + rainfall avg) / 70%	=	32.76	in/yr
32.76 in/yr/ 12	=	**2.73**	**ac-ft/acre**
Peak Day			
Peak C.U. / Efficiency			
#### inches/day / 70%	=	0.30	in/day
gpm/ac Conversion			
0.30 43560 ft2/ac*7.48 gal/ft3)/(12 in/ft*1440 min/day)	=	5.67	gpm/ac
gpd/ac Conversion			
5.67 gpm / ac * 1440 min / day	=	**8160**	gpd/ac (Peak Day Demand)

[1] Data taken from the *Utah Division of Water Rights Consumptive Use Tables* for the NWS Station at PLEASANT GROVE http://www.waterrights.utah.gov/techinfo/consumpt/i6919.htm).
[2] Ref: Ames Irrigation Handbook - Third Edition 1967

6.5 Civil Engineering Calculations and Background Data

USDC UTILITY FRAMEWORK DRAINAGE SUMMARY			
BASIN ID	BASIN SIZE (AC)	POND SIZE[1] (AC-FT)	POND FOOTPRINT (FT^2)[2]
USDC - HIGHLAND CITY			
1	22.66	2.84	50,000
2	8.34	1.05	18,000
3	100.39	14.00	244,000

NOTES:
1. Pond sized based on total retention. No infiltration rate has been assumed.
It is anticipated that pond sizes could be altered based on measured infiltration rates.
2. Foot print based on a max depth of water of 3' feet.

UTAH STATE DEVELOPMENTAL CENTER UTILITY FRAMEWORK
BASIN 1

Total Area	Area sq. ft.	C	CA	Weighted "C"	0.60
Roof Area				Total Acres	22.66
Paved Area				Allowable Q cfs/acre	0
Landscaped Area				Allowed Release Rate Q cfs	0.00
Totals	987,182	N/A	0	Total Release Rate cfs	0.00

100 Year Storm Information

(4) Interval (min.)	Precipitation (inches/hr)	(1) Precipitation (inches)	(2) CA/12 (cu.ft./inch)	(3) (1)X(2) Accum. Sto. (cu.ft.)	(5) Maximum Release Rate (cu.ft./min.)	(6) (4)X(5) Accum. Rel. (cu.ft.)	(7) (3)-(6) Req'd. Sto. (cu.ft.)
15	4.08	1.02	49,359	50,346	0.0	0	50,346
30	2.76	1.38	49,359	68,116	0.0	0	68,116
60	1.70	1.70	49,359	83,910	0.0	0	83,910
360	0.35	2.07	49,359	102,173	0.0	0	102,173
720	0.20	2.45	49,359	120,930	0.0	0	120,930
1440	0.10	2.51	49,359	123,891	0.0	0	123,891

UTAH STATE DEVELOPMENTAL CENTER UTILITY FRAMEWORK
BASIN 2

Total Area	Area sq. ft.	C	CA	Weighted "C"	0.50
Roof Area				Total Acres	8.34
Paved Area				Allowable Q cfs/acre	0
Landscaped Area				Allowed Release Rate Q cfs	0.00
Totals	363,256	N/A	0	Total Release Rate cfs	0.00

100 Year Storm Information

(4) Interval (min.)	Precipitation (inches/hr)	(1) Precipitation (inches)	(2) CA/12 (cu.ft./inch)	(3) (1)X(2) Accum. Sto. (cu.ft.)	(5) Maximum Release Rate (cu.ft./min.)	(6) (4)X(5) Accum. Rel. (cu.ft.)	(7) (3)-(6) Req'd. Sto. (cu.ft.)
15	4.08	1.02	18,163	18,526	0.0	0	18,526
30	2.76	1.38	18,163	25,065	0.0	0	25,065
60	1.70	1.70	18,163	30,877	0.0	0	30,877
360	0.35	2.07	18,163	37,597	0.0	0	37,597
720	0.20	2.45	18,163	44,499	0.0	0	44,499
1440	0.10	2.51	18,163	45,589	0.0	0	45,589

UTAH STATE DEVELOPMENTAL CENTER UTILITY FRAMEWORK
BASIN 3

Total Area	Area sq. ft.	C	CA		
				Weighted "C"	0.50
Roof Area				Total Acres	100.39
Paved Area				Allowable Q cfs/acre	0
Landscaped Area				Allowed Release Rate Q cfs	0.00
Totals	4,373,125	N/A	0	Total Release Rate cfs	0.00

100 Year Storm Information

(4) Interval (min.)	Precipitation (inches/hr)	(1) Precipitation (inches)	(2) CA/12 (cu.ft./inch)	(3) (1)X(2) Accum. Sto. (cu.ft.)	(5) Maximum Release Rate (cu.ft./min.)	(6) (4)X(5) Accum. Rel. (cu.ft.)	(7) (3)-(6) Req'd. Sto. (cu.ft.)
15	3.36	0.84	218,656	183,671	0.0	0	183,671
30	2.26	1.13	218,656	247,082	0.0	0	247,082
60	1.40	1.40	218,656	306,119	0.0	0	306,119
360	0.32	1.92	218,656	419,820	0.0	0	419,820
720	0.18	2.16	218,656	472,298	0.0	0	472,298
1440	0.12	2.79	218,656	609,789	0.0	0	609,789

Precipitation Frequency Data Server

NOAA Atlas 14, Volume 1, Version 5
Location name: American Fork, Utah, US*
Coordinates: 40.4074, -111.7761
Elevation: 4826ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval(years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.128 (0.112•0.149)	0.162 (0.143•0.189)	0.223 (0.195•0.259)	0.279 (0.241•0.325)	0.367 (0.309•0.430)	0.448 (0.368•0.529)	0.542 (0.432•0.647)	0.653 (0.500•0.792)	0.830 (0.604•1.03)	0.992 (0.691•1.26)
10-min	0.195 (0.171•0.226)	0.247 (0.217•0.287)	0.340 (0.298•0.394)	0.425 (0.367•0.494)	0.558 (0.470•0.653)	0.682 (0.559•0.804)	0.825 (0.657•0.984)	0.994 (0.761•1.21)	1.26 (0.920•1.57)	1.51 (1.05•1.92)
15-min	0.242 (0.212•0.280)	0.307 (0.269•0.356)	0.421 (0.369•0.489)	0.527 (0.455•0.612)	0.691 (0.583•0.810)	0.845 (0.693•0.997)	1.02 (0.814•1.22)	1.23 (0.944•1.49)	1.57 (1.14•1.95)	1.87 (1.30•2.38)
30-min	0.326 (0.285•0.377)	0.413 (0.363•0.479)	0.568 (0.497•0.658)	0.709 (0.613•0.825)	0.931 (0.785•1.09)	1.14 (0.933•1.34)	1.38 (1.10•1.64)	1.66 (1.27•2.01)	2.11 (1.54•2.62)	2.52 (1.76•3.20)
60-min	0.403 (0.353•0.467)	0.511 (0.449•0.593)	0.702 (0.614•0.814)	0.878 (0.759•1.02)	1.15 (0.971•1.35)	1.41 (1.16•1.66)	1.70 (1.36•2.03)	2.05 (1.57•2.49)	2.61 (1.90•3.24)	3.12 (2.17•3.96)
2-hr	0.503 (0.455•0.571)	0.630 (0.566•0.712)	0.824 (0.736•0.932)	1.00 (0.889•1.14)	1.30 (1.12•1.48)	1.56 (1.31•1.80)	1.87 (1.53•2.18)	2.24 (1.76•2.66)	2.83 (2.11•3.45)	3.37 (2.40•4.21)
3-hr	0.583 (0.531•0.650)	0.721 (0.658•0.802)	0.914 (0.829•1.02)	1.09 (0.981•1.22)	1.37 (1.21•1.54)	1.62 (1.39•1.83)	1.91 (1.61•2.19)	2.26 (1.84•2.69)	2.85 (2.21•3.49)	3.37 (2.52•4.25)
6-hr	0.759 (0.704•0.827)	0.934 (0.863•1.02)	1.14 (1.05•1.24)	1.32 (1.21•1.44)	1.59 (1.44•1.75)	1.82 (1.61•2.01)	2.07 (1.81•2.32)	2.38 (2.03•2.70)	2.94 (2.43•3.52)	3.43 (2.76•4.29)
12-hr	0.963 (0.890•1.05)	1.18 (1.09•1.29)	1.43 (1.32•1.56)	1.64 (1.50•1.79)	1.94 (1.76•2.13)	2.19 (1.95•2.42)	2.45 (2.16•2.75)	2.75 (2.37•3.12)	3.21 (2.69•3.72)	3.59 (2.94•4.33)

http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_printpage.html?lat=40.4074&lon=-111.7761&data=depth&units=english&series=pds (1 of 6) [3/26/2013 3:55:16 PM]

Precipitation Frequency Data Server

24-hr	**1.08** (1.00•1.16)	**1.31** (1.22•1.42)	**1.57** (1.46•1.69)	**1.78** (1.66•1.92)	**2.06** (1.92•2.22)	**2.28** (2.12•2.45)	**2.51** (2.32•2.77)	**2.77** (2.51•3.15)	**3.24** (2.76•3.76)	**3.62** (2.97•4.38)
2-day	**1.28** (1.19•1.37)	**1.56** (1.46•1.68)	**1.86** (1.74•1.99)	**2.10** (1.96•2.25)	**2.43** (2.26•2.59)	**2.67** (2.49•2.86)	**2.92** (2.71•3.13)	**3.17** (2.92•3.40)	**3.50** (3.19•3.80)	**3.74** (3.40•4.42)
3-day	**1.38** (1.28•1.49)	**1.69** (1.57•1.82)	**2.01** (1.87•2.17)	**2.28** (2.12•2.45)	**2.64** (2.45•2.83)	**2.92** (2.69•3.13)	**3.20** (2.94•3.44)	**3.48** (3.19•3.75)	**3.85** (3.50•4.19)	**4.13** (3.73•4.69)
4-day	**1.49** (1.37•1.61)	**1.82** (1.68•1.97)	**2.17** (2.01•2.34)	**2.46** (2.27•2.65)	**2.85** (2.63•3.08)	**3.16** (2.90•3.41)	**3.47** (3.18•3.76)	**3.79** (3.45•4.11)	**4.21** (3.80•4.58)	**4.53** (4.07•4.96)
7-day	**1.75** (1.61•1.91)	**2.13** (1.97•2.33)	**2.53** (2.33•2.75)	**2.85** (2.63•3.09)	**3.29** (3.03•3.56)	**3.61** (3.32•3.91)	**3.94** (3.62•4.27)	**4.27** (3.90•4.63)	**4.69** (4.26•5.10)	**4.99** (4.52•5.45)
10-day	**1.95** (1.80•2.12)	**2.39** (2.21•2.59)	**2.82** (2.61•3.05)	**3.17** (2.93•3.41)	**3.61** (3.34•3.89)	**3.94** (3.64•4.24)	**4.26** (3.93•4.58)	**4.57** (4.20•4.92)	**4.94** (4.52•5.34)	**5.21** (4.75•5.64)
20-day	**2.56** (2.36•2.77)	**3.13** (2.89•3.39)	**3.69** (3.41•3.98)	**4.12** (3.81•4.44)	**4.65** (4.30•5.01)	**5.04** (4.66•5.42)	**5.40** (4.99•5.80)	**5.73** (5.29•6.17)	**6.13** (5.65•6.61)	**6.39** (5.89•6.91)
30-day	**3.09** (2.85•3.33)	**3.77** (3.49•4.06)	**4.42** (4.10•4.76)	**4.92** (4.56•5.29)	**5.56** (5.15•5.96)	**6.01** (5.56•6.45)	**6.45** (5.96•6.93)	**6.85** (6.32•7.38)	**7.33** (6.75•7.93)	**7.67** (7.04•8.30)
45-day	**3.81** (3.54•4.11)	**4.65** (4.33•5.01)	**5.43** (5.06•5.83)	**6.03** (5.62•6.46)	**6.78** (6.32•7.25)	**7.30** (6.81•7.80)	**7.79** (7.26•8.31)	**8.22** (7.67•8.78)	**8.71** (8.13•9.30)	**9.02** (8.42•9.63)
60-day	**4.52** (4.19•4.86)	**5.51** (5.11•5.93)	**6.42** (5.97•6.89)	**7.12** (6.62•7.63)	**8.00** (7.42•8.55)	**8.60** (7.99•9.20)	**9.16** (8.51•9.80)	**9.67** (8.97•10.3)	**10.2** (9.49•11.0)	**10.6** (9.83•11.4)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical

http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_printpage.html?lat=40.4074&lon=-111.7761&data=depth&units=english&series=pds (2 of 6) [3/26/2013 3:55:16 PM]