



Planning Commission Staff Report

General Plan Amendment

November 21, 2024

BASIC INFORMATION

Applicant:	None
Acreage:	30.6 acres
Location:	Approx. 540 West 4300 North
Parcels:	16-090-0020, 16-012-0015, 16-012-0016, 16-012-0017
Current Density Designation:	Rural Residential

SUMMARY

A City-proposed amendment is before the Planning Commission for consideration. The amendment is to modify the Future Land Use Map to include a density adjustment from Rural Residential 5 to Rural Residential 2 to accommodate the Master Street Plan portion of the General Plan for a planned 66-foot right-of-way and roadway, including providing capacity for city utility lines designated through the developable land.

ANALYSIS

November 7, 2024

The Planning Commission held a public hearing and received a staff presentation on this item. Public Comments were received by two individuals at this time:

- Sara Urry, who expressed challenges with modifying the Master Road Plan and exactions.
- A gentleman at the meeting asked about removing the roadway from City plans and what that would entail and whether a study would be required to adjust this plan.

No further public comments were received. The Planning Commission determined it wanted to complete review of the City's adopted Sensitive Lands Plan prior to making a recommendation on this item.

Additional Analysis

This proposed amendment to the General Plan modifies the current land use designation from five-acre minimum lot sizes to two-acre minimum lot sizes, with a retained option for clustered development. This proposal aims to facilitate the development necessary for constructing a new roadway in alignment with the City's Master Road Plan, which is a key component of the City's General Plan. The City's proposal seeks to support a balanced development approach by allowing for increased flexibility in lot sizes while also enabling vital infrastructure improvements. This clustering approach allows for preservation of open space within the development, which aligns with broader goals of sustainable and strategic land use.

The landowner had initially submitted a proposal for development at the five-acre lot standard; however, upon review, the City identified an opportunity to explore a configuration that would accommodate the planned roadway with connectivity of roadway infrastructure and utilities serving as a component of City long-range planning. The two-acre lot configuration with clustering ensures that the roadway project, as detailed in the Master Road Plan, can proceed in a manner consistent with the General Plan's long-term vision.

LEGAL EXACTIONS

The current roadway that intersects this land, north through south, can only be required as an exaction through meeting a rough proportionality test, as outlined in the Nollan/Dolan Supreme Court decision. In summary, an exaction must be compared against the impact created by the development and if there is an increased need for public services caused by this. The density can remain as is with completion of this roadway unlikely as the level of density required would make it difficult for the completion of a contiguous roadway without significant City investment.

It is important to note that any environmental impacts will be evaluated at the subdivision level, and final approval for lot configurations will be contingent upon these assessments. As such, the proposal does not guarantee a specific number of lots; actual lot numbers will be determined based on environmental and site-specific considerations.

In summary, this proposed amendment seeks to balance the need for infrastructure development with responsible land use.

CONSIDERATION

The Planning Commission will consider an amendment to the General Plan and provide a recommendation to the City Council. A recommendation of approval would be appropriate to also include direction for staff to provide updated language to the General Plan for Rural Residential 2 and the application of this designation. A recommendation of denial would be appropriate to include direction for staff to address modifications to the Master Street Map and transportation plan.

STAFF CONTACT

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ATTACHMENT(S)

- 1) Vicinity Map
- 2) Master Streets Plan
- 3) Sensitive Lands Study
- 4) Additional Land Information Provided By Property Owner

ATTACHMENT 1) Vicinity Map





PLEASANT VIEW CITY FOOTHILL AREA LAND PLANNING STUDY

March 2016

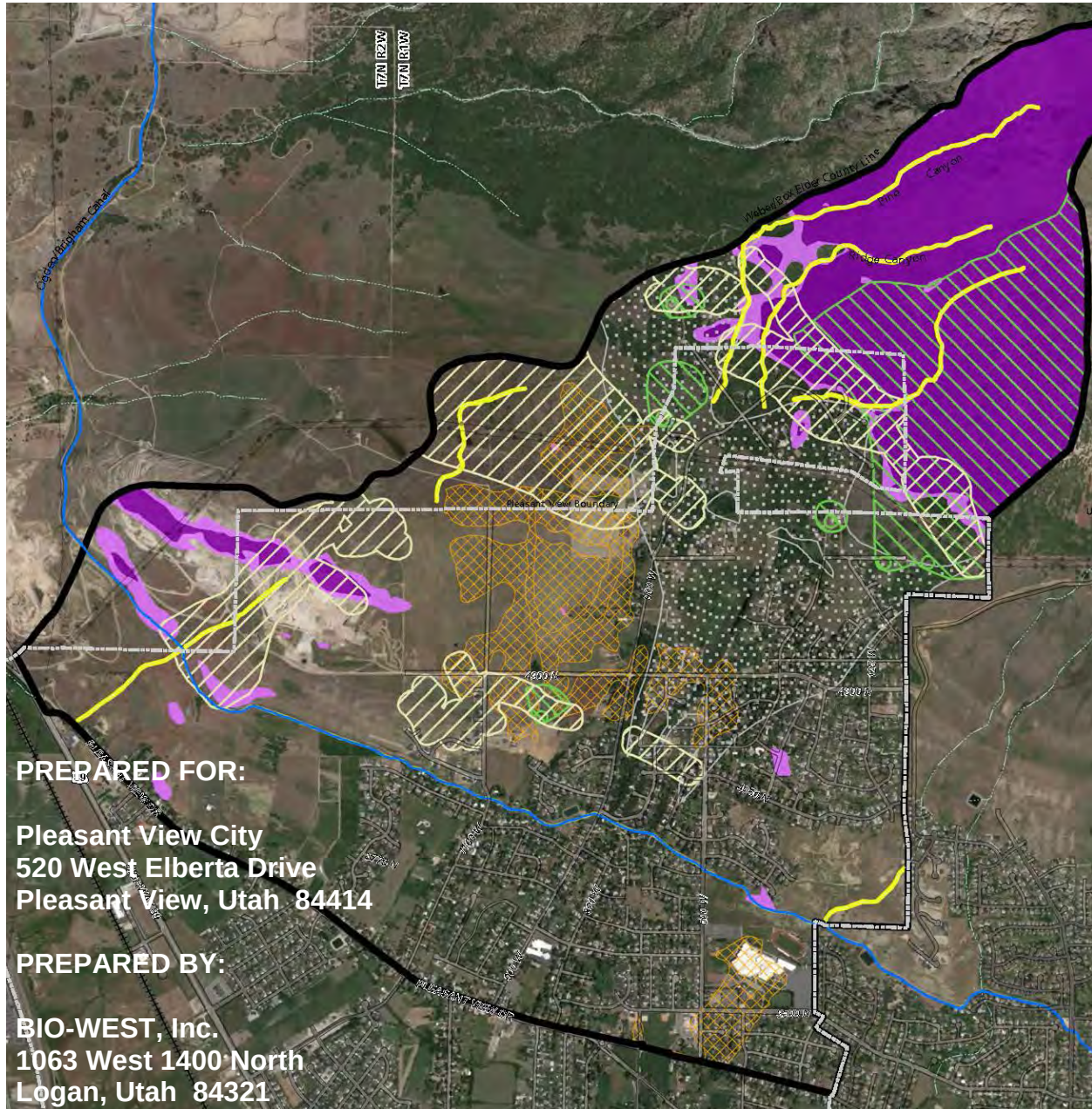


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1.0 PREFACE

Over the past ten years Pleasant View City (City) has experienced substantial residential development, and current development is beginning to encroach upon the City's sensitive foothill areas. Areas previously identified as sensitive have had an agricultural zoning (e.g., A-5, five-acre lot size minimum) since before the City managed its own land use development when planning functions were administered by Weber County. In the last year though, there have been pressures to consider general plan amendments and re-zonings that could potentially cause drastic changes in the foothill area vicinity. Continued development in this area is of particular concern because it may negatively affect important community resources, such as wildlife habitat and groundwater quality, and because naturally occurring hazards, such as landslides and earthquake faults, may make certain areas unsafe for future residents.

City officials hired BIO-WEST to conduct a comprehensive land planning study to obtain information that could be used in the proper management of future growth in the City's foothill study area, which includes a major portion of the City's undeveloped land. It is with this foresight and within this context that the Pleasant View City Foothill Area Land Planning Study (the Study) was initiated. A major objective of the Study is to provide the City with effective tools that can be used to guide future growth and development in the study area, ensuring that the health, safety, and welfare of Pleasant View residents is not compromised. The tools developed for this Study include:

- Natural Resource Inventory Maps
- Natural Resource Constraints Maps
- Potential Development Scenario Maps
- Recommended Development Master Plan Map
- Recommended Development Guidelines

The tools developed for this Study rely on the accuracy of data incorporated from previously completed studies, in particular the Natural Constraints to Urban Development in the North Ogden Area study (Ridd and Kaliser 1978), and additional limited fieldwork performed during the summer of 2015 to verify existing information. Any additional studies regarding resources within the study area that are currently being prepared, and other future studies that pertain to the study area, should also be considered when development proposals are presented to the City.

This Study provides information and recommendations for developers, residents, elected officials, and City staff to use, as the study area is developed over time. This Study is designed to guide development, not to constrain or restrict it. Visioning of future development must be assessed by the joint efforts of Pleasant View residents, the Pleasant View Planning Commission, and the Pleasant View City Council. Specific development proposals will be analyzed upon formal submittal to the City. Development proposals should incorporate the findings of this Study, the Pleasant View City General Plan, and any existing City ordinances that may apply.

2.0 PURPOSE

The purpose of this Study is to direct future development within the study area, in order to protect important natural resources, avoid natural or human-made hazards, and preserve lands for future public use. To this end, this Study is an initial step that identifies potential areas that should be protected, avoided, or preserved

based on information from the Resource Inventory Maps and Resource Constraints Maps (see Section 5). These maps were derived from published and unpublished information that was recorded for large geographical areas. As such, mapping components of this Study should not be taken literally without the benefit of more site-specific information when appropriate.

This Study is designed to assist developers, residents, elected officials and City staff in addressing the pending changes that may occur in the study area over the next 10 to 15 years and beyond. The focus of this Study is to provide information that will encourage innovative and creative residential developments within the study area. This Study is intended to identify those areas where developers may be required to conduct more site-specific studies prior to development approval.

This Study is also intended to produce definitive policy directions in the form of a recommended Development Master Plan and Development Guidelines for the study area. These plans and guidelines form the basis for making decisions about the importance of community resources within the study area. They also provide understanding about what issues are of critical concern to all interests of the community. The Development Master Plan and Development Guidelines prepared for this Study are discussed in detail in Sections 7 and 8.

3.0 BACKGROUND OF THE STUDY AREA

The City lies in the north-central part of Weber County in northern Utah, approximately 40 miles north of Salt Lake City (see Figure 1). Beyond the City limits, to the north and the east lie the Wasatch Mountains, part of the Wasatch-Cache National Forest. Ben Lomond, to the northeast, peers majestically over the City. In this part of the Salt Lake Valley, the Wasatch Mountains protrude sharply upward from the valley floor. The study area elevation ranges from 9,700 feet at Ben Lomond Peak to 4,400 feet near Pleasant View Drive. Because of its foothill location, surrounded by mountains to the north, the City commands a panoramic view of the Salt Lake Valley to the west and south (see Photo 1).

Currently, the City has a population of approximately 7,500 (Pleasant View City 2015) individuals and comprises approximately 6.7 square miles (4,300 acres) of land. The study area consists of approximately 3,421 acres of land with approximately 67 percent (2,285 acres) inside the City limits, approximately 14 percent (470 acres) within the U.S. Forest Service boundary, and the remaining 19 percent (666 acres) within unincorporated Weber County. Most of the existing development within the study area is primarily in residential, open space, and agriculture land uses. According to Pleasant View City Corporation Future Land Use Map adopted August 25 2009, most of the study area falls into the following three categories: Rural Residential (0 – 1 units/acre), Very Low Density Residential (1 – 2 units/acre), and Low Density Residential (2 – 4 units/acre).

Residential subdivisions currently exist in the southern and eastern portions of the study area and are rapidly developing towards the north and west (see Photo 2). There are approximately 1,631 acres, or 48 percent of the lands that are currently undeveloped within the study area. Approximately 965 acres lie within incorporated city limits and 666 acres that lie in the unincorporated county. Under current zoning, there is the potential for over 2,100 additional residential units that could be developed within the study area.



Photo 1. A characteristic view of the Salt Lake Valley toward the southeast of the study area.



Photo 2. Residential development is expanding northward through the study area.

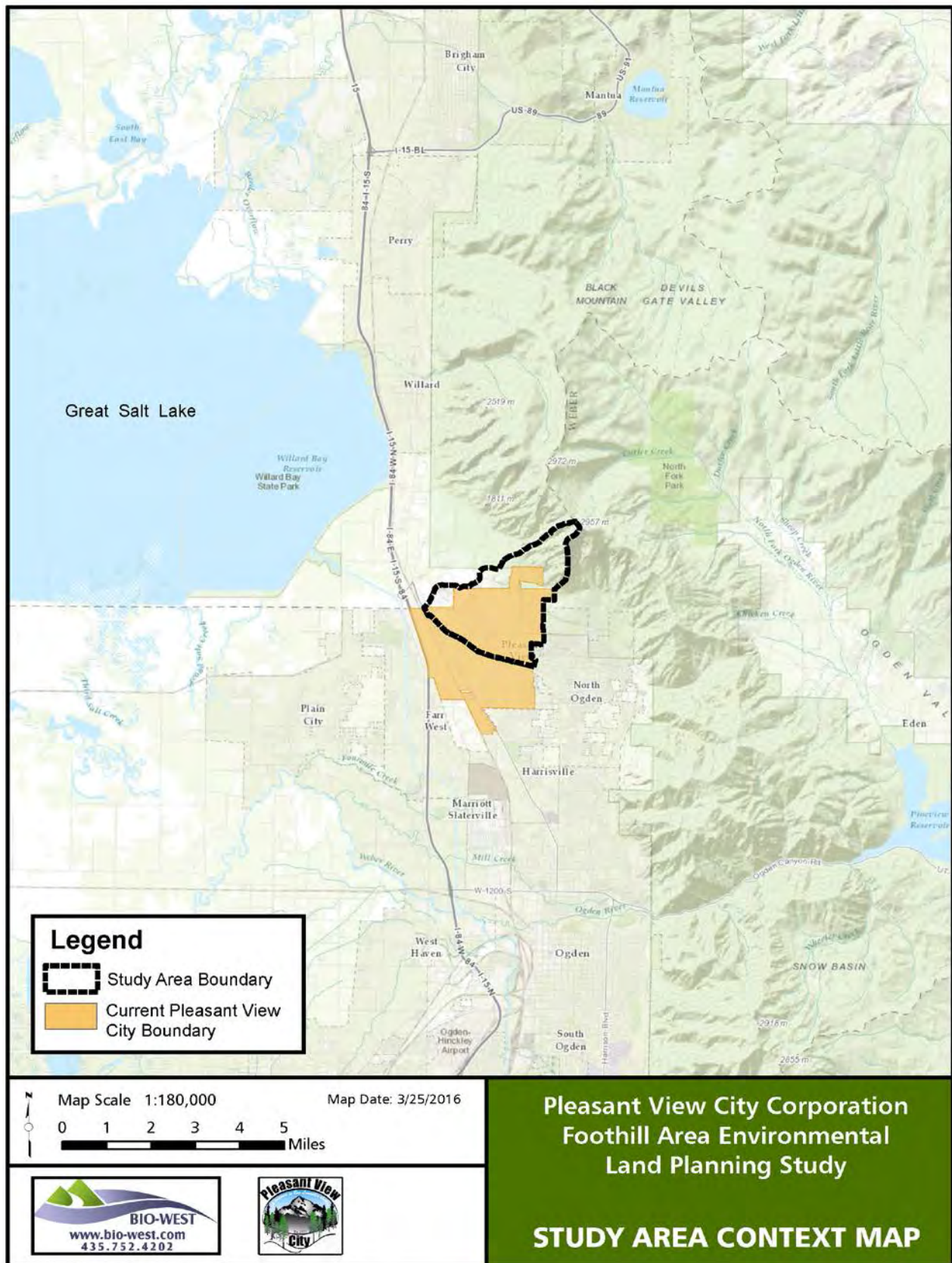


Figure 1. Study area context map for the Foothill Area Environmental Land Planning Study.

4.0 OVERVIEW OF THE PLANNING PROCESS

The implementation of this Study involved a five step planning process: (1) Creating Resource Inventory Maps; (2) Creating Resource Constraints Maps; (3) Creating Alternative Development Scenarios; (4) Creating a Development Master Plan; and (5) Creating Development Guidelines (see Figure 2). Each of these steps is described in detail later in this Study. In addition to implementing these five steps, a review of previous City planning documents and public input helped in identifying planning issues, prioritizing resource concerns, and recommending a preferred Development Master Plan.

Citizen participation was also incorporated into the planning process. A series of open house public workshops was held by the City to garner public participation for the 2014 General Plan Update. The open house attendees had an opportunity to fill out a survey. Those survey data (found in Appendix B of the General Plan) have been taken into consideration for this Pleasant View City Foothill Area Land Planning Study.

5.0 RESOURCE INVENTORY AND CONSTRAINTS MAPPING

Prior to initiating the resource mapping effort, a Base Map (see Figure A-1) was created that shows the boundaries of the study area. Also included on the Base Map is a watershed boundary that defines the furthest limits of lands surrounding the study area, which were mapped for each resource. The watershed boundary extends beyond the City limits in order to identify an extended “area of influence” that needs to be considered in future foothill area development decisions. Existing roads and residential development are also shown. The study area boundary, existing city boundary, and existing development are common elements on all of the Resource Inventory and Constraints Maps. Each resource that was incorporated into the Study is briefly described below. All maps are included in Appendix A.

Using existing data and information from field investigations conducted as part of this Study, a team of resource specialists mapped characteristics of different natural and human-made resources within the study area. The resulting Resource Inventory Maps characterize resource conditions such as Geomorphology, Geology, Earthquake Faults, Hydrology, Slope, Soils, Groundwater Recharge, and Water Source Protection Zones. In addition to recommendations from resource specialists, information from the Resource Inventory Maps was then used to generate Resource Constraints Maps.

Resource Constraints Maps delineate locations within the study area that pose “severe,” “moderate,” or “slight” constraints to residential development, based upon the specific characteristics of each resource. For example, the entire study area was mapped according to slope steepness. Areas with slopes between 15 and 20 percent steepness were considered to pose “slight” constraints to residential development. Steeper areas with 21 to 25 percent steepness were considered to pose “moderate” constraints to residential development while slopes 26 to 30 percent steepness were considered to pose “severe” constraints to residential development. While development would not be impossible in severe constraint areas, it could be unsafe and more expensive to implement and service. Resource Inventory Maps and Resource Constraints Maps were used in creating the Recommended Development Master Plan and Development Guidelines for the study area.

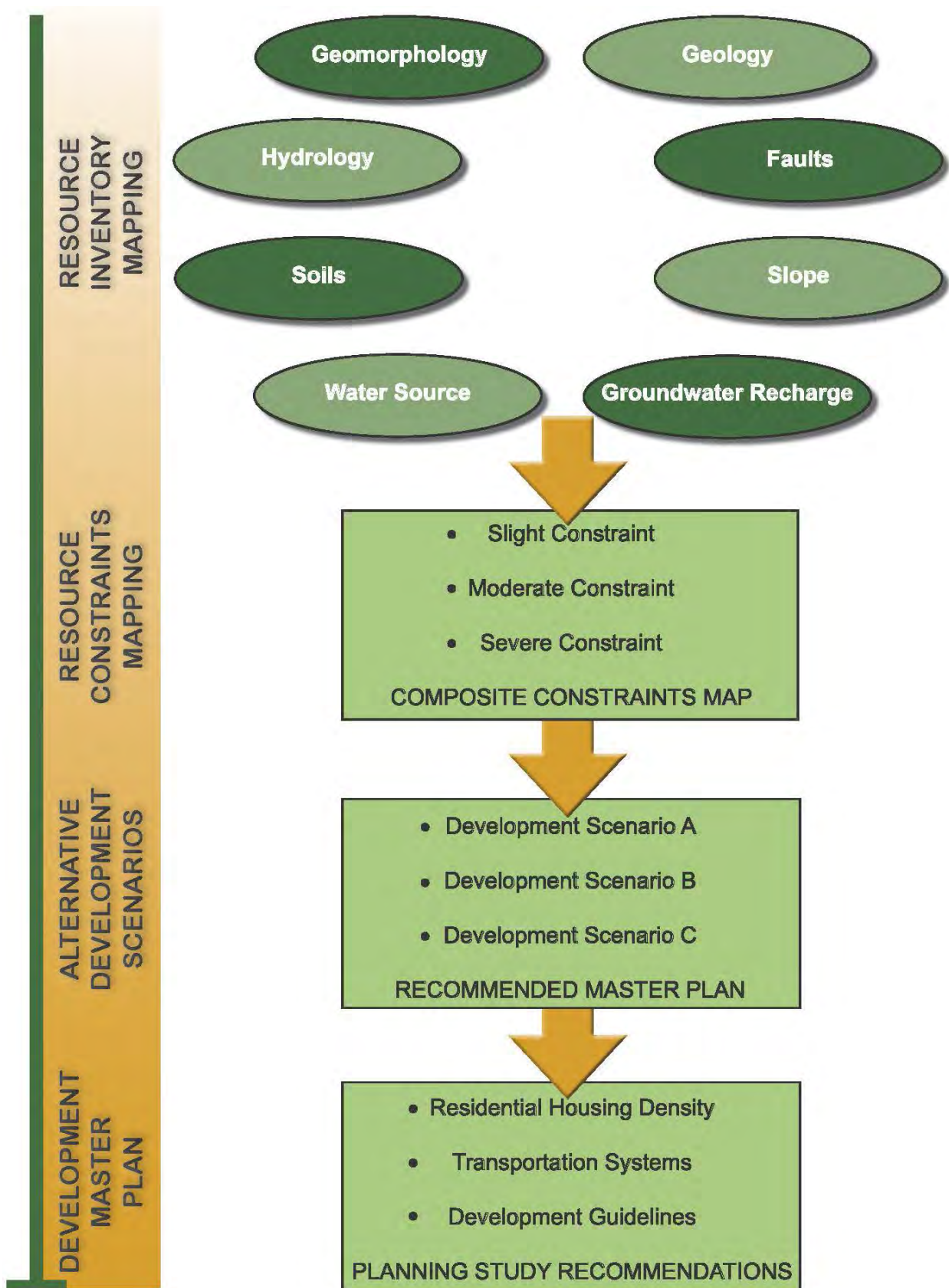


Figure 2. Overview of the Foothill Area Environmental Land Planning Study planning process.

5.1 Geomorphology

The Geomorphological Conditions Map (Figure A-2) shows the geologic processes that have influenced the topography of the study area. The study area is located within the Basin and Range province, at the base of the Wasatch Mountains. Historical Lake Bonneville deposits are present in the southern portion of the study area. The topography of the study area can be characterized as mountainous and alluvial terrain.

While no evidence exists that gravity-driven, slope-related processes including avalanches, landslides, and rock slides have occurred within the study area, areas southeast of the study area do show evidence of these processes. One large historical rock slide/landslide occurred in the North Ogden area and deposited material approximately 0.5 mile away from the mountain front (Pashley and Wiggins 1971). Another historical rock slide/landslide occurred near Beus Canyon in Ogden and deposited material approximately 1 mile away from the mountain front (Pashley and Wiggins 1971). These rock slides/landslides may have been induced by movement along the Wasatch fault, which is present in the study area. The bedrock units that are exposed on the mountainous terrain in the study area are susceptible to rock slides and landslides because they are highly fractured by faults that occur in the area.

The information from the Geomorphological Conditions Map was used to create the Landslide and Avalanche Constraints Map (Figure A-3). The Landslide and Avalanche Constraints Map shows zones around geomorphological features that could be hazardous to development. Historical rock slides and landslides in the area indicate that material may be deposited from 0.5 to 1 mile from the steep mountain front (Pashley and Wiggins 1971). A “severe constraints” classification was applied to areas within 0.5 mile of the mountain front. A “moderate constraints” classification was applied to areas between 0.5 and 1 mile of the mountain front. A “slight constraints” classification was applied to areas greater than 1 mile from the mountain front.

5.2 Geology

The Geological Conditions Map (Figure A-4) indicates the locations of bedrock types, historical Lake Bonneville deposits, and sediment formations such as alluvial fans. The geologic data was compiled from the U.S. Geological Survey Geologic Map of the North Ogden Quadrangle and part of the Ogden and Plain City Quadrangles (Crittenden and Sorensen 1985). The geologic deposits of an area indicate the types of geologic processes that occurred in the past, and are expected to occur in the future. Geologic deposits are sediments that are transported by debris flows, floods, and streams that occur over a long period of time (i.e., hundreds of years). For example, alluvial fans, which are sedimentary deposits that accumulate below the mouths of canyons, indicate potential hazardous conditions to development. Numerous buildings constructed on alluvial fans along the Wasatch front have been destroyed or damaged by debris flows and floods (Wieczorek et al. 1993; Kaliser 1983; Marsell 1971).

A debris flow or “flash flood” is a rapidly moving mix of sediment and water. Debris flows carry sediment ranging in size from clay particles to car-sized boulders. Debris flows occur during events of intense precipitation or rapid snow melt (Marsell 1971). Debris flows are one of the main geological processes that occur on alluvial fans. Debris flows do not occur every year, but can be very destructive when they do occur. The presence of alluvial fan deposits within the study area indicate that debris flows have occurred within the study area in the past and that the study area is susceptible to future debris flow events.

On September 7, 1991 a debris flow deposited snow approximately 1,300 feet from the mountain front causing damage to homes in the Cameron Cove Subdivision, which is located approximately 2.5 miles southeast of the study area in North Ogden City. This event indicates how far a debris flow could deposit material from the mountain front.

Information from the Geological Conditions Map was used to create a Geological Constraints Map (Figure A-5). The portion of alluvial fans closest to active stream channels, or closest to the mountain front, were mapped as having severe constraints to development because of the high potential for debris flows. Alluvial fan deposits located away from active stream channels or at some distance from the mountain front were mapped as having moderate constraints to development because of the moderate potential for debris flows. All other areas were mapped as having slight constraints to development because of the low probability for debris flow events.

5.3 Faults

The Geological Fault Conditions Map (Figure A-6) indicates the locations of active faults and possible fault zones located within the study area. Active faults are hazardous to development and knowledge of their location is important to minimize impacts to critical facilities, such as utility lines, hospitals, and schools during an earthquake event. Active faults typically do not occur along a single fault line but in a wider fault zone where a number of faults may cause surface rupture and ground deformation. The faults in the study area are primarily related to the Wasatch Fault Zone that is present along the mountain fronts of the Wasatch Front. The faults data was compiled from the Natural Constraints to Urban Development in the North Ogden Area, Utah Report (Ridd and Kaliser 1978) and the U.S. Geological Survey Faults Database (USGS 2015). The faults shown on the map are divided into three classifications. Class I faults are deep seated, tectonically induced major fault scarps (surface displacement) of definite location and origin. The Class I faults are clearly identifiable in the field and show evidence of relatively recent activity. Class II faults are clearly faults but more of a shallower nature. Class II fault scarps generally show less surface displacement than Class I faults. Class III faults are zones identified as having possible faults, these zones typically show little or no surface displacement.

The Geological Fault Constraints Map (Figure A-7) depicts buffer zones around the mapped active fault zones. Based on studies on the Wasatch Fault (McCalpin 1987) the fault zone is expected to be approximately 330 feet wide, with a maximum earthquake magnitude of 7.2 to 7.5 on the Richter Scale. Estimates for maximum fault scarp offset range from 10 to 16 feet. A fresh fault scarp is very unstable and will rapidly erode to a less steep angle. The mapped buffer zone includes an additional 20 feet to account for this eroding scarp face. Areas within 175 feet of an active fault zone were considered to pose severe constraints development, areas between 175 and 300 feet of an active fault zone were considered to pose moderate constraints, and areas greater than 300 feet from an active fault zone were considered to pose slight constraints to development.

5.4 Hydrology

Flooding is a natural and necessary part of the hydrologic regime for any stream. However, flooding can cause significant property damage resulting in major economic losses and potentially loss of life. Excluding development within streams and their floodplains, and other areas prone to flooding, would help to prevent such disasters. Floodplains and streams would also continue to provide many ecological services, such as

wildlife habitat and flood attenuation, if development is excluded from these areas. Therefore, accurately identifying flood zones along streams and areas prone to flooding from subsurface flow is key in defining flood hazard areas, and constraints to development. The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps FIRMs, which show the location of mapped floodplains, classify the majority of the study area as having minimal risk of flooding, with a small portion of the study area not mapped (Figure A-8).

The National Hydrography Dataset (NHD) shows three intermittent streams within the study area: Pine Canyon Creek, Ridge Canyon Creek, and an unnamed creek in the upper part of the study area (Figure A-9). The northwestern edge of the study area contains two additional unnamed intermittent creeks. The southeastern edge of the study area contains the downstream portion of an intermittent stream that flows mostly outside the study area. The USGS defines an intermittent stream as one that “contains water for part of the year, but more than just after rainstorms and at snowmelt” (<http://nhd.usgs.gov/FeatureDirectory.pdf>). These channels discharge onto an alluvial fan where flow disperses and infiltrates the soils and becomes subsurface flow. These streams may also branch into multiple channels on the alluvial fan surface (Ridd and Kaliser 1978).

The Ogden-Brigham Canal (Canal) cuts across the natural drainages, as it runs from North Ogden City across the alluvial fan in Pleasant View City, continuing north towards Brigham City, and represents a hydrologic barrier for surface water channels within the study area (Figure A-9). The Canal splits the study area into an area above the Canal that contains flow paths, and an area below the Canal. The area below the Canal may concentrate runoff into flow paths draining westward away from the Canal. However, the contributing area is small and would have little effect on the amount of water a given flow path would be carrying during a rainfall or storm water runoff event.

A study (Ridd and Kaliser 1978) completed for the North Ogden area, which has similar hydrology and topography, classified drainages within the study area as active or inactive, defining active channels as having an unvegetated channel bottom while inactive channels may have vegetation (Figure A-9). The location and activity of these drainages may have changed since that study was completed because of massive flood events that occurred in the 1980s, development in the study area since that time, and continued fluvial processes such as erosion and deposition over the ensuing decades.

Four watersheds were delineated to calculate the flood flow discharges for various return intervals for the six streams shown on the NHD. StreamStats (<http://water.usgs.gov/osw/streamstats/utah.html>) was used to delineate watersheds within the study area and estimate flood flows generated from each watershed (Figure A-9). StreamStats is a USGS online tool that delineates watersheds from a 10 meter accurate digital elevation model, in conjunction with regional regression equations generated for ungauged streams in Utah, to estimate flood flows (Wilkowske, C.D., Kenney, T.A., and Wright, S.J., 2008). The regional regression equations use StreamStats output, such as drainage area and other parameters, to estimate flows for return intervals from 2 to 100 years (Table 1), along with an estimate of error. These watersheds are indicative of contributing area for the streams. For areas not included in a watershed, but within the study area, the soils survey contains information about limitations to development based on flooding hazard (see Section 5.6).

Table 1. Summary of estimated peak flood flows for various return intervals and average annual flow generated from StreamStats.

PEAK FLOW RETURN INTERVAL (YEARS)	WATERSHED 1 FLOW (CUBIC FEET PER SECOND)	WATERSHED 2 FLOW (CUBIC FEET PER SECOND)	WATERSHED 3 (CUBIC FEET PER SECOND)	WATERSHED 4 (CUBIC FEET PER SECOND)
2	2.14	25.8	1.25	0.52
5	5.15	47.7	3.2	1.46
10	7.93	65.4	5.06	2.42
25	11.5	82.2	7.54	3.77
50	15.7	108	10.4	5.33
100	19.6	126	13.2	6.9
200	24.0	145	16.4	8.76
500	32.8	184	22.8	12.6
Average annual flow	0.35	3.67	0.21	0.0887

The watersheds are then defined as having potentially active channels, or inactive channels, using the active and inactive channel data from the Ridd and Kaliser (1978) report (Figure A-9). Not all of the study area is incorporated into a watershed. Some areas are alluvial surfaces with little topography that indicates the presence of a channel, or to accurately delineate a watershed. Again, these areas are alluvial, and may not have distinct or active channels. Instead, flow paths may vary and potentially include subsurface flow.

In comparing the locations of active and inactive channels, there are many active channels in the study area within and near Watershed 1. Assuming the conditions from 1978 are similar to today, it is likely that this drainage, and areas nearby, will have small streams that should be accounted for in development (see Section 8.0). Although the NHD shows no intermittent stream downstream of the upper watershed (Pine Creek, Ridge Creek, and an unknown drainage), this area likely has a significant swale or channel that flows at the very least during storms and snowmelt/runoff. Aerial imagery shows such a drainage in Watershed 2. According to Ridd and Kaliser (1978), the area near and within Watershed 2 includes a combination of active and inactive streams, with the active stream reaching to the Canal. Watershed 3 is in an area with channels characterized primarily as inactive, with no active channels present (Ridd and Kaliser 1978). Watershed 4 is within an area that has active channels (Ridd and Kaliser 1978) and includes an intermittent stream. Regardless of whether the channel is classified as active or inactive, any channel feature and depression has the capability of collecting surface runoff resulting in stream flow. The actual amount of flow depends on runoff generated that reaches the channel and if the stream bed intercepts subsurface flow.

To truly know what the flood hazard is for a specific property within the study area, the locations of streams and swales that have flow during rainfall and/or runoff events needs to be determined. The active and inactive flood hazard maps are likely somewhat inaccurate because they are based on data from the late 1970's. The watersheds that StreamStats generated also have limited accuracy because they are based on digital elevation models with 10-meter resolution. Because the flood flows generated from StreamStats are in part based on watershed area, flood flow estimates are somewhat inaccurate as well. Better topographic data and verifying the locations of active streams and potentially active swales would improve the determination of potential flood hazard areas. The state is planning to obtain statewide LIDAR data, and such an analysis would be feasible once data for the study area are available.

The Flood Potential Constraints Map (see Figure A-10) designates locations within the study area where development constraints associated with hydrological features may occur. Areas of “severe constraints” are located within 30 feet of a stream channel or within 16 feet of the Ogden-Brigham Canal. Development in these areas will likely cause adverse impacts to the quality, quantity, and timing of runoff. Areas of “moderate constraints” are located 30 to 100 feet from a stream channel. Areas of “slight constraints” are located more than 100 feet from stream channels and more than 17 feet from the Ogden-Brigham Canal.

5.5 Slope

The entire study area was mapped according to slope steepness. The Slope Conditions Map (see Figure A-11) indicates differences in the slope of the land within the study area. For this project, slope has been grouped into five categories: 0 to 15 percent, 15 to 20 percent, 20 to 25 percent, 25 to 30 percent, and over 30 + percent. A 10 percent slope means that for every 100 feet traveled horizontally, the elevation rises 10 feet.

Topography gradient or steepness of the land (i.e., the slope) is an important factor in assessing the suitability of developing houses, infrastructure, and other facilities. Most people recognize that building on a flat area is easier and less costly than building on steeper areas. This information is particularly important to community leaders since infrastructure, such as roads and sewers, become more difficult to construct and maintain in areas steeper than 10 percent. In general, as the slope increases, the development and service costs also increase. In addition, steeper slopes are more prone to hazards such as landslides, rock falls, and debris flows.

The Slope Constraints Map (see Figure A-12) depicts the slope-related constraints to development. Areas within the 0 to 15 percent slope category are considered to pose “no constraints” on development; areas within the 15 to 20 percent slope category are considered to pose “slight constraints” on development; areas within the 20 to 25 percent are considered to pose “moderate constraints” on development; areas within the 25 to 30 percent slope category are considered to pose “severe constraints” on development; and over 30 percent slope areas are considered to be “no build” since development may be unsafe, unsightly, or substantially more expensive to implement. In fact, existing City ordinances prohibit development on slopes steeper than 30 percent (Pleasant View City, 2012).

5.6 Soils

The Soil Conditions Map (see Figure A-13) identifies the different types of soils found within the study area, as defined by the U.S. Natural Resources Conservation Service (NRCS). Soil types were grouped together based on limiting factors (i.e. qualities that could limit development) to produce the Soil Constraints Map (see Figure A-14). Limiting factors include shallow depth to bedrock, shallow depth to water table, rock outcrops, and gravel pits. Soils were designated as posing “very slight constraints,” “slight constraints,” “low constraints,” “moderate constraints,” or “high constraints” to development, based on ratings by the NRCS (NRCS 1975). Table 2 provides a summary of soil types found within the study area and their limiting factors.

Knowledge of soil characteristics is important when planning land uses within a particular area. Whether the intended use is for agriculture, transportation, residential, commercial, or industrial purposes, certain soil types will be more suitable than others. Locating residential developments within soils that may pose a hazard to structural integrity can be a costly and dangerous endeavor.

Table 2. Information on limiting factors of soil types found within the study area.

SOIL SERIES AND MAP SYMBOL	ESTIMATED SOIL PROPERTIES SIGNIFICANT TO ENGINEERING				ENGINEERING INTERPRETATION OF SOILS
	Depth to Water Table (inches)	Depth to Restrictive Layer (inches)	Shrink-Swell Potential	Potential Slopes	Limitations for Use in Residential Development (Building Foundations)
Ackmen loam : AbC, AbD, AbE2	>80	>80	Low	3 to 20%	Moderate
Draper loam: DrC	36-60	>80	Moderate	3 to 6%	Severe
Francis loamy fine sand: FcC, FcD, FcE2	>80	>80	High	3 to 20%	Low
Hillfield-Timpanogos-Parleys complex: HTG2	>80	>80	High	30 to 60%	High
Ironton silt loam: IaC	24-36	>80	Low	3 to 6%	High
Kidman fine sandy loam: KaB	>80	>80	Low	1 to 3%	Slight
Kilburn-Francis association: KFE2,	>80	>80	Low	10 to 20%	Slight
Kilburn gravelly sandy loam: KgE2	>80	>80	Low	10 to 20%	Slight
Kilburn cobbly sandy loam: KIE2	>80	>80	Low	10 to 20%	Very Slight
Layton loamy fine sand: LcD	>80	>80	Low	6 to 10%	Low
Marriott gravelly sandy loam: MgD, MgE2	>80	>80	Low	6 to 20%	Moderate
Parleys loam: PaC, PaD, PaE2, PbA	>80	>80	Moderate	3 to 20%	Severe
Pleasant View loam: PvB, PvC, PvD, PvE, PvE2, PwD	>80	>80	Low	1 to 20%	Moderate
Ridd stony/rocky sandy loam: RdD, RkE2, RkG2, RrE	>80	20-40	Low	6 to 30%	Moderate
Sterling very rocky loam: ShF2	>80	>80	Low	6 to 50%	Moderate
Timpanogos loam: TbB, TbC, TbD2, TcD, TcE, TDD	>80	>80	Low to Moderate	1 to 20%	Moderate

Texture is one of the most important soil characteristics because it influences many other properties such as water retention, compaction ability, erosion potential, and fertility. Soil texture describes the proportionate distribution of different sizes of mineral particles in a soil. Generally, sandy soils are low in organic material and fertility; low in ability to retain moisture and nutrients; and well-drained and therefore well suited for road foundations and building sites. Finer textured soils are generally more fertile, containing more organic matter and are better able to retain moisture and nutrients. Soils that are so fine-textured as to be classified as clay, have characteristics that adversely affect their suitability as building sites and for road construction.

5.7 Groundwater Recharge

Many communities throughout the Intermountain West, including Pleasant View, rely on groundwater to provide domestic water supplies. Groundwater is typically supplied by water infiltrating into the ground in recharge areas. Groundwater recharge occurs when there is enough water present to move through the unsaturated zone of the soil into an aquifer. An aquifer is an underground layer of porous sediment or rock that contains water. Development in groundwater recharge areas, such as those that exist in the study area, creates impermeable surfaces that may result in less water infiltrating into the ground during spring flows and storm events. The reduced infiltration may lower the groundwater levels in the study area and reduce

the supply of groundwater available to community residents. The Groundwater Recharge Conditions Map (Figure A-15) shows where groundwater recharge and discharge areas are located within the study area (Anderson et al. 1994).

The Groundwater Recharge Constraints Map (Figure A-16) indicates where groundwater recharge and discharge areas occur in the study area. Groundwater recharge areas pose severe constraints to development due to the importance of maintaining an adequate and high quality water supply for Pleasant View City. Development in these areas will create impermeable surfaces which will cause reductions to infiltration and the groundwater supply. In addition, the quality of the groundwater may be impacted due to changes in land management within the recharge areas. Groundwater discharge areas pose moderate constraints to development due to the potential for encountering high groundwater levels and unstable building conditions.

5.8 Water Source Protection Zones

Several drinking water source protection zones have been established in the study area according to Utah State Administrative Code R309-600. Drinking water source protection zones are established to protect groundwater sources of drinking water, such as wells and springs from becoming contaminated from potential contamination sources. A potential contamination source is defined as any facility or site which employs an activity or procedure which may potentially contaminate groundwater. Development in drinking water source protection zones, such as those that exist in the study area, needs to be monitored to prevent potential contamination sources from impacting the public drinking water supply.

Drinking water source protection areas are divided into four separate zones for management purposes. Zone 1 is defined as an area 100 feet around a wellhead or collection area of a spring. Zone 2 is defined as the area within the 250 day groundwater travel time to the wellhead or collection area of a spring. Zone 3 is defined as the area within the 3 year groundwater travel time to the wellhead or collection area of a spring. Zone 4 is defined as the area within the 15 year groundwater travel time to the wellhead or collection area of a spring. The Water Source Protection Zones Map (Figure A-17) shows where drinking water protection zones are located within the study area.

Information from the Water Source Protection Zones Map was used to create a Water Source Constraints Map (Figure A-18). Areas designated on the map as Zone 1 or Zone 2 were mapped as having severe constraints to development because of the close proximity to a drinking water source and the high potential of drinking contamination from potential contamination sources. Areas designated on the map as Zone 3 or Zone 4 were mapped as having moderate constraints to development because of the further distance from a drinking water source and the moderate potential of drinking contamination from potential contamination sources.

6.0 ALTERNATIVE DEVELOPMENT SCENARIOS

One tool used commonly by planners to manage information across an area of land is called a Geographic Information System or GIS. This tool allows planners to “overlay” layers of information on top of each other to begin to understand how various opportunities or constraints exist across a landscape. Overlaying this information, or data, is a dynamic process allowing City staff, residents, and planners to make planning decisions based on prioritized concerns. Furthermore, development can be directed into the most suitable (i.e., least resource constraining) areas.

In the overlay process, as used for this project, data from a number of Resource Constraints Maps were combined and superimposed on the Base Map, resulting in the Composite Constraints Map (see Figure A-19). Areas of severe constraints for a number of important resources were allowed to “override” areas of moderate and slight constraints. The Composite Constraints Map indicates where the combination of selected resources (i.e., steep slopes, ground fault zones, active stream channels, alluvial fans, soils, and drinking water source locations) would pose severe constraints to development.

The information from the Composite Constraints Map was used to guide the creation of three conceptual alternative development scenarios for this Study. The conceptual nature of the alternative development scenarios is intended to represent a spectrum of possible futures for the hillside study area, given general guidelines regarding conservation goals. These scenarios are:

- Conceptual Development Scenario A: Full Build-Out
- Conceptual Development Scenario B: Focused Development
- Conceptual Development Scenario C: Maximum Open Space

Each Development Scenario Map includes a different combination of the following land use categories: Existing Development Area, Potential Development Area, Existing Public Parks and Open Space, Potential Public Parks and Open Space, Potential Private Open Space, and No-Build Area. The areas included in these Land Use Categories vary with each development scenario. Each development scenario is briefly described in the following section. A summary comparison of the Land Use Categories for each development scenario is provided in Table 3.

Table 3. Summary comparison of the land use categories for each development scenario.

LAND USE CATEGORIES	SCENARIO A: FULL BUILD-OUT CONCEPT	SCENARIO B: FOCUSED DEVELOPMENT CONCEPT	SCENARIO C: MAXIMUM OPEN SPACE CONCEPT
Existing Development Area	1,225 acres (36%)	1,225 acres (36%)	1,225 acres (36%)
Potential Development Area	1,346 acres (39%)	1,091 acres (32%)	650 acres (19%)
Existing Public Parks and Open Space	100 acres (3%)	100 acres (3%)	100 acres (3%)
Potential Public Parks and Open Space	275 acres (8%)	410 acres (12%)	306 acres (9%)
Potential Private Parks and Open Space	0 acre (0%)	120 acres (3%)	665 acres (19%)
Existing Forest Service Lands	475 acres (14%)	475 acres (14%)	475 acres (14%)
Totals	3,421 acres (100%)	3,421 acres (100%)	3,421 acres (100%)

6.1 Conceptual Development Scenario A: Full Build-Out

Scenario A represents maximum development of land within the study area, where all areas suitable for development under existing zoning ordinances would be available for development (see Figure A-20), except those areas classified as “non-developable” under current zoning ordinances. Lands classified as “non-developable” are currently protected under Pleasant View City zoning ordinances, which prohibit development on lands with slopes steeper than 30 percent. Scenario A would allow for residential uses to occupy nearly all lands within the study area, leaving little room for future parks and open space, and possibly putting community infrastructure and homes in harm’s way without significant financial expenditures to mitigate risks and protect health, safety, and welfare of residents.

6.2 Conceptual Development Scenario B: Focused Development

Scenario B represents a positive step towards locating development on the most suitable lands within the study area while avoiding the most sensitive lands with inherent risks (see Figure A-21). Areas with the most severe constraints on development, as determined using the overlay process, would be protected as both future public and private parks and open space lands. These future public and private parks and open space lands would include avoiding steep slopes, ground fault zones, active stream channels, and water source protection zones.

6.3 Conceptual Development Scenario C: Maximum Open Space

Scenario C represents a new paradigm for development within the study area that promotes the maximum conservation of sensitive lands within the study area (see Figure A-22) where development would be concentrated in those areas exhibiting the least constraints to development. Some of the important features of Scenario C include efficient infrastructure investments, minimization of impervious surfaces, and density bonuses for open-space subdivision designs. Scenario C includes avoiding steep slopes, ground fault zones, active stream channels, and water source protection zones while protecting groundwater recharge zones. It also promotes the integration of innovative subdivision design that retains more of the natural character of the study area.

7.0 RECOMMENDED DEVELOPMENT MASTER PLAN

The Preferred Development Master Plan represents a further refining of the Conceptual Development Scenario C: Maximum Open Space alternative development scenario described in Section 6.3. It is anticipated that development within “Potential Development Areas” as shown on Figure A-23 will be clustered to provide for meaningful open space and conservation lands between existing and new residential development areas. “Nodes” of development should be concentrated along major roadway intersections and away from sensitive lands where appropriate. Although specific lot sizes may vary, the overall density for a given parcel of land as shown on the City’s adopted “Future Land Use Map” would not be exceeded. Future private and public parks and open space lands are expected to be protected through donation to the City, inclusion in conservation easements, or maintained through a homeowner’s association in perpetuity. Some parks and open space lands may be suitable as future City parks. In addition, connections to existing and planned public trails should be evaluated for all parks and open space lands within the study area. Table 4 provides a summary of the area for each land use category shown on the Preferred Development Master Plan (see Figure A-23).

8.0 RECOMMENDED DEVELOPMENT GUIDELINES

Development guidelines are provisions that should be incorporated into each development proposal submitted to the City. They include specific actions, designs, or criteria to be followed when developments are proposed within the study area. Recommended development guidelines are presented below by resource category.

Table 4. Summary of the area for each land use category in the Preferred Development Master Plan.

LAND USE CATEGORIES	PREFERRED DEVELOPMENT MASTER PLAN
Existing Development Area	1,225 acres (36%)
Potential Development Area	650 acres (19%)
Existing Public Parks and Open Space	100 acres (3%)
Potential Public Parks and Open Space	356 acres (10%)
Potential Private Parks and Open Space	615 acres (18%)
Existing Forest Service Lands	475 acres (14%)
Totals	3,421 acres (100%)

8.1 Landslide and Avalanche

Guidelines for development in the landslide and avalanche hazard areas include the following:

- Avoid locating public buildings such as schools or auditoriums in the landslide and avalanche severe constraints areas (i.e., within 0.5 mile of the mountain front).
- Prevent construction of all habitable buildings within 100 feet of active stream channels.

8.2 Debris Flow

Guidelines for development on alluvial fans include the following:

- Preserve existing vegetation within drainage channels to act as a trap for debris flow sediments.
- Provide appropriate setbacks (minimum 100 feet) from drainage channels for new development.

8.3 Faults

Guidelines for development within fault zones include the following:

- Require that all utilities that traverse fault zones be designed to withstand earthquake induced ground movement.
- Prevent construction of habitable dwellings within 175 feet of known faults or landslide areas.

8.4 Hydrology

Guidelines for development in active hydrological areas include the following:

- No development should occur within the 100-year floodplain (where mapped or identified through new site-specific studies).

- No development should occur within 30 feet of the banks of a state-defined channel. The State of Utah Stream Alteration program defines a stream as:

A natural stream is any natural waterway that receives enough water to develop an ecosystem that differs from the surrounding upland environment. This is most easily determined by observing vegetation changes. Canals, ditches, or other man-made channels are not considered natural streams (<http://www.waterrights.utah.gov/strmalt/faq.asp>).

- No development should occur at the mouth of Ridge Canyon, Pine Canyon, and the unnamed canyons along the Forest Service property boundary at the top of the watershed because of risk of torrential flooding during high precipitation or runoff events and the potential for debris flows. Steep slopes would also severely limit development in these areas.
- No development should occur within 16 feet of the Ogden-Brigham Canal.
- No development should occur in areas identified as limited for dwellings with and without basements and/or commercial structures due to flooding based on site-specific soils data.
- Weber County Engineering may review proposed developments within unincorporated areas of Weber County and within Special Flood Hazard Areas (SFHA). “Any structures, fill, or other disturbance within a SFHA requires a floodplain development permit, and in some cases, an elevation certificate as well” (http://www.co.weber.ut.us/mediawiki/index.php/Flood_Maps). Special Floodplain Hazard Areas include areas identified as having a 0.1% probability of flooding (also known as the 100-year floodplain) as shown on FIRMs.

8.5 Slope

Guidelines for development on sloping terrain include the following:

- Limit building on slopes steeper than 15 percent to 20 percent. Slopes in this category are considered to pose slight constraints to development. Where construction occurs on these slopes, proper erosion and sediment controls should be required because the addition of impervious surfaces can cause excess surface runoff leading to erosion. Also the removal of the soil humus and vegetation can lead to stream pollution through increased sedimentation.
- Avoid building on slopes steeper than 20 percent. Steeper areas (20 percent slope or greater) are considered to pose moderate to severe constraints to development. Development would not be impossible in severe constraint areas. However, it would probably be unsafe and would definitely be more expensive to implement.
- Slopes steeper than 30 percent should remain naturally vegetated and non-developed.

8.6 Soils

- Ensure that new development proposals are properly evaluated for potential impacts from severely restrictive soils.

8.7 Groundwater Recharge

Guidelines for development within groundwater recharge areas include the following:

- Require open channel designs for stormwater management to slow water movement and allow for natural infiltration. This may include limiting development of curb and gutter in favor of a system of open channels that carry stormwater runoff to detention basins for proper infiltration.
- Maintain natural infiltration rates wherever possible. This is particularly important at the mouth of canyons where streamflow goes underground.
- Stormwater treatment and infiltration areas (i.e., detention basins) should be developed where impervious surfaces associated with developments (e.g., roads, driveways, rooftops, etc.) impact infiltration.

8.8 Water Source Protection Zones

Guidelines for development within water source protection zones include the following:

- Development within any area identified as a drinking water source protection (DWSP) zone should follow the development guidelines established in the Pleasant View City Drinking Water Source Protection Plan.
- No potential contamination sources shall be located, built, constructed or operated within a 100 foot radius (DWSP Zone 1) of any public water supply wellhead or margin of collection area. A potential contamination source is defined as any discernible, confined, and discrete source of pollutants or contaminants, including but not limited to any site, pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, animal feeding operation with more than ten animal units, landfill, or vessel or other floating craft, from which pollutants are or may be discharged.
- No pollution sources shall be located, built, constructed or operated within any area designated as DWSP Zone 2, unless the owner of the pollution source agrees to implement design or operating standards, as specified by Pleasant View City, which are intended to prevent discharges to public drinking water sources. A pollution source is defined as source discharges of contaminants to ground water or potential discharges of the liquid forms of "extremely hazardous substances" which are stored in containers in excess of "applicable threshold planning quantities" as specified in SARA Title III. Examples of possible pollution sources include, but are not limited to, the following: storage facilities that store the liquid forms of extremely hazardous substances, septic tanks, drain fields, class V underground injection wells, landfills, open dumps, landfilling of sludge and septage, manure piles, salt piles, pit privies, drain lines, and animal feeding operations with more than ten animal units.

- Any proposed development in DWSP Zones 3 and 4 must be reviewed by the Pleasant View City engineer to ensure compliance with State of Utah regulatory standards for public drinking water systems.

9.0 RECOMMENDATIONS

The following represent BIO-WEST's recommendations to the City as a result of the findings in this Study:

- In order to insure sustainable development of the foothill study area, City officials must require that all development proposals incorporate and address the findings of this Study. Information in this Study should be refined over time as new information becomes available. City officials should require that all development proposals within the study area address the constraints presented in this Study while allowing for innovative and creative responses to those constraints.
- Require site-specific studies by professional geologists to locate earthquake faults and recommend appropriate development setbacks for site-specific development proposals.
- Require site-specific studies by professional hydrologists to locate floodplain and flood-prone areas including active and inactive stream channels, and recommend appropriate development setbacks for site-specific development proposals.
- Adopt building codes sufficient to protect buildings from earthquake forces within the study area.
- Consider development of fertilizer and pesticide restrictions/guidelines to protect drinking water quality within the study area.
- Make modifications to existing zoning ordinances to provide for the following:
 - (1) Allow for future open space that is either dedicated to the City, donated to a land trust, or maintained through a homeowner's association, in perpetuity, where constraints prohibit development (i.e., conservation areas).
 - (2) Allow for flexible housing configurations that require closer grouping of homes on smaller lots resulting in more open space and conservation of sensitive land areas. The intent should be to increase open space within proposed developments and not to increase the overall density of development across the study area. This will result in less roads, utilities, and infrastructure, and therefore expenses to both the City and developers.
 - (3) Encourage landscaping with native plant species in residential neighborhoods to maintain visual quality and reduce water consumption. Provide literature to educate new residents on native plantings, including suggestions on plants that are undesirable to deer to minimize anticipated conflicts. Include the names of local nurseries that provide native plants.

- (4) Prevent commercial developments, feedlots, septic tanks, or underground/above ground storage tanks from being allowed in groundwater recharge zones to protect drinking water quality.
- (5) Develop a series of best management practices to promote low impact developments within the study area (e.g., bio-filters, green roofs, rain gardens, infiltration detention basins, permeable pavements) and to protect groundwater quality.
- (6) Create a series of development tools to protect open space and to promote conservation of sensitive lands (e.g., cluster development incentives, open-space subdivision designs, conservation easements, purchase of development rights, technical education and assistance programs).
- (7) Update the existing “Sensitive Area Overlay Zone” (Chapter 18.38) of the City’s ordinances to comply with the recommendations and information presented in this Study.

10.0 ACKNOWLEDGEMENTS

City Council

Toby Mileski, Mayor

Councilmembers:

Scott Boehme, Jerry Burns, Steve Gibson, Boyd Hansen and Sara Urry

Planning Commission

Danielle Jeppson, Chair

Planning Commissioners:

Neil Amaral, Kristi Hales, Richard Lewis, Andy Nef, Nathan Peterson, Keith Preece, Jim Cummings, Alternate and Jeff Hill, Alternate

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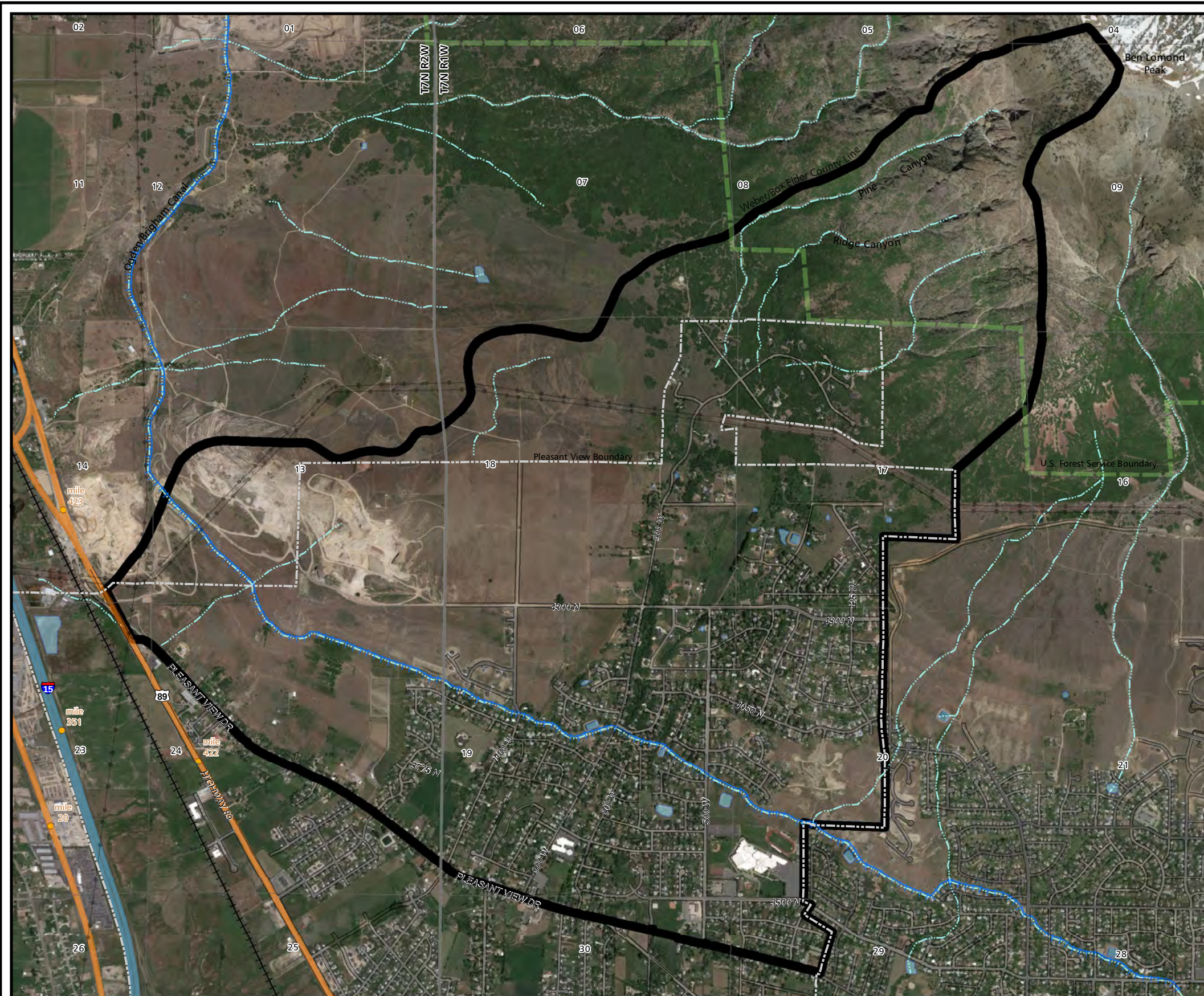
NAME	POSITION	EXPERIENCE	RESPONSIBILITIES
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Sandra Davenport	landscape architect	22	data collection, soils and slope text, mapping
Wes Thompson	senior geologist	27	data collection supervision
Dustin Lofthouse	geologist	10	data collection; geology, geomorphology, faults, groundwater recharge, and water source protection zones text
Shannon Herstein	hydrologist/water quality specialist	16	data collection, hydrology text
Glen Busch	GIS specialist	15	data collation and manipulation, mapping
Sandra Turner	senior writer/editor	25	document design and formatting
Aaron Crookston	cartographer	7	CAD and GIS mapping

12.0 REFERENCES

- Anderson P.B., Susong D.D., Wold S.R., Heilweil V.M., and R.L. Baskin. 1994. Hydrogeology of recharge areas and water quality of the principal aquifers along the Wasatch Front and adjacent areas, Salt Lake City (UT): USGS. Water-Resources Investigations Report 93-4221.
- BIO-WEST, Inc. 1997. North Ogden City North Hillside Development Study. BIO-WEST, Inc. Logan, Utah. 31 p. plus appendices.
- Crittenden, M.D., Jr. and Sorensen, M.L. 1985. Geologic map of the North Ogden Quadrangle and part of the Ogden and Plain City Quadrangles, Box Elder and Weber Counties, Utah. U.S. Geological Survey Miscellaneous Investigations Series, Map I-2199, Scale 1:24,000.
- Kaliser, B.N., 1983. Landslide, mouth of Cold Water Canyon, North Ogden, Utah. Memorandum to the file. Weber County Geologist Files. Weber County Planning Department, Ogden, Utah.
- Marsell, R.E. 1971. Cloudburst and snowmelt floods. Environmental geology of the Wasatch Front, 1971. Utah Geological Association Publication 1-N.
- McCalpin, J.P., 1987. Recommended setback distances from active normal faults. Proceedings of the Symposium on Engineering Geology and Soils Engineering 23 (1987): Pages 35-56.
- National Hydrography Dataset 2015. Available at <http://nhd.usgs.gov/FeatureDirectory.pdf>. Accessed August 26, 2015.
- Pashley, E.F., Jr., and Wiggins, R. A. 1971. Landslides of the Northern Wasatch Front. Environmental geology of the Wasatch front, 1971. Utah Geological Association Publication 1-K.
- Pleasant View City, Utah, Municipal Code (2012) Title 18 – Zoning, Chapter 18.38 Sensitive Area Overlay Zone.
- Ridd, M.K. and Kaliser, B.N., 1978. Natural constraints to urban development in the North Ogden Area, Utah. Center for Remote Sensing and Cartography, Department of Geography, University of Utah. Salt Lake City, Utah. May 1978.
- StreamStats version 3 2015. Available at <http://water.usgs.gov/osw/streamstats/utah.html>. Accessed August 26, 2015.
- [USGS] United States Geological Survey. 2015. Quaternary fault and fold database of the United States. Location: <http://earthquake.usgs.gov/hazards/qfaults>. Accessed: 8/20/2015.
- [NRCS] U.S. Soil Conservation Service, 1975. Soil Survey: Davis-Weber Area, Utah. United States Department of Agriculture, Soil Conservation Service. In Cooperation with Utah Agricultural Experiment Station. U.S. Government Printing Office. Washington, D.C. 1975

- Wieczorek, G.F., Ellen, S., Lips, E.W., and Cannon, S.H. 1993. Potential for debris flow and debris flood along the Wasatch Front between Salt Lake City and Willard, Utah, and measures for mitigation. U.S. Geological Survey Open-File Report 83-635.
- Wilkowske, C.D., Kenney, T.A., and Wright, S.J., 2008, Methods for estimating monthly and annual streamflow statistics at ungaged sites in Utah: U.S. Geological Survey Scientific Investigations Report 2008-5230, 63 p.

APPENDIX A: MAPS



Pleasant View City Corporation Foothill Area Environmental Land Planning Study

Legend

- Power Transmission Line
- Railroad
- Canal
- Intermittent Stream
- Current City Boundary
- Forest Service Boundary
- Reservoir or Pond
- Study Area Boundary

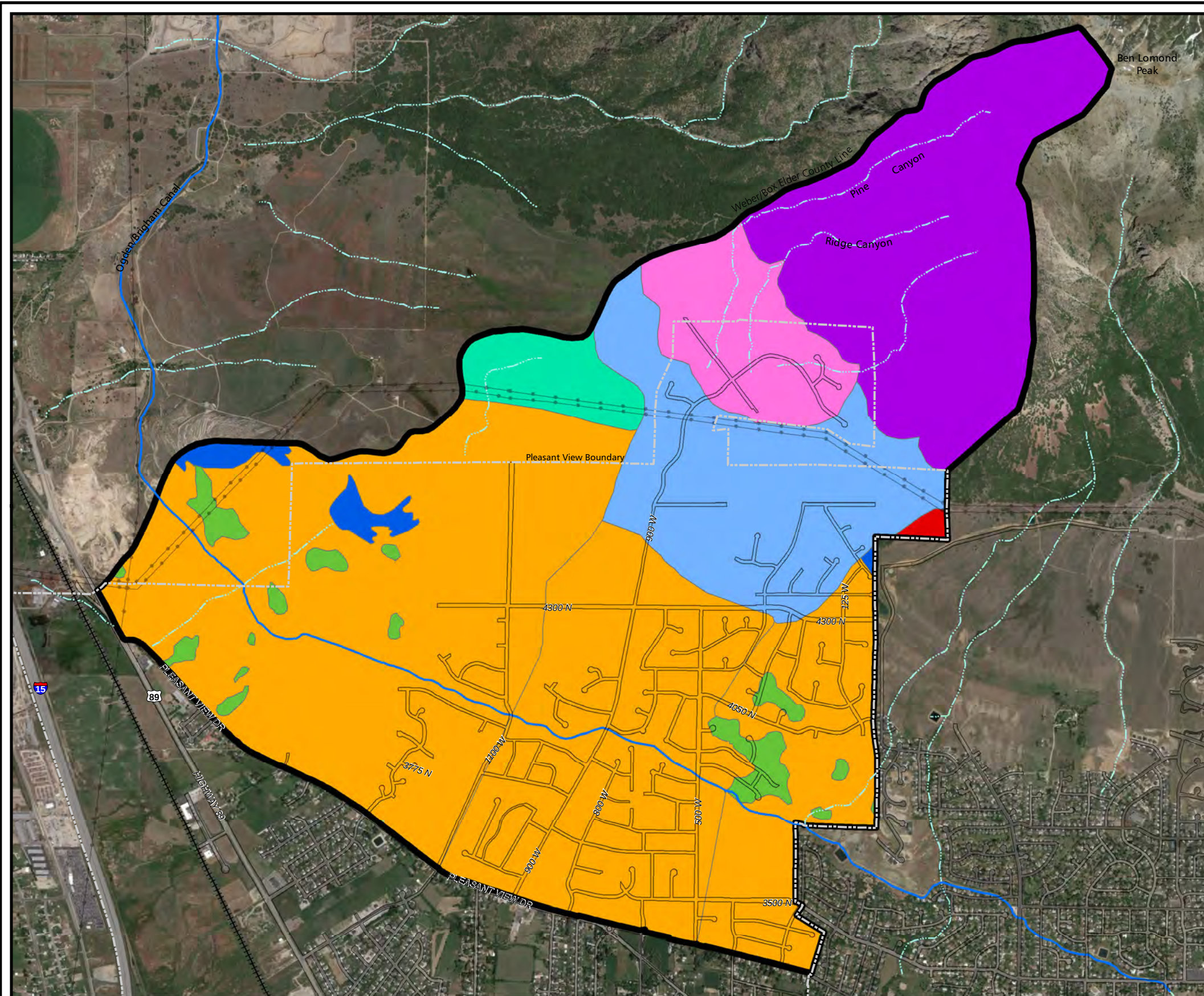
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Map Scale 1:24,000 1 inch = 2,000 feet

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BASE MAP

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Pleasant View City Corporation Foothill Area Environmental Land Planning Study

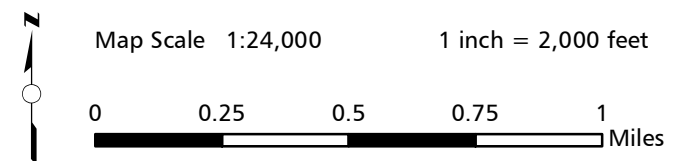
Legend

- Study Area Boundary
- Current City Boundary
- Canal
- Intermittent Stream

Geomorphological Conditions

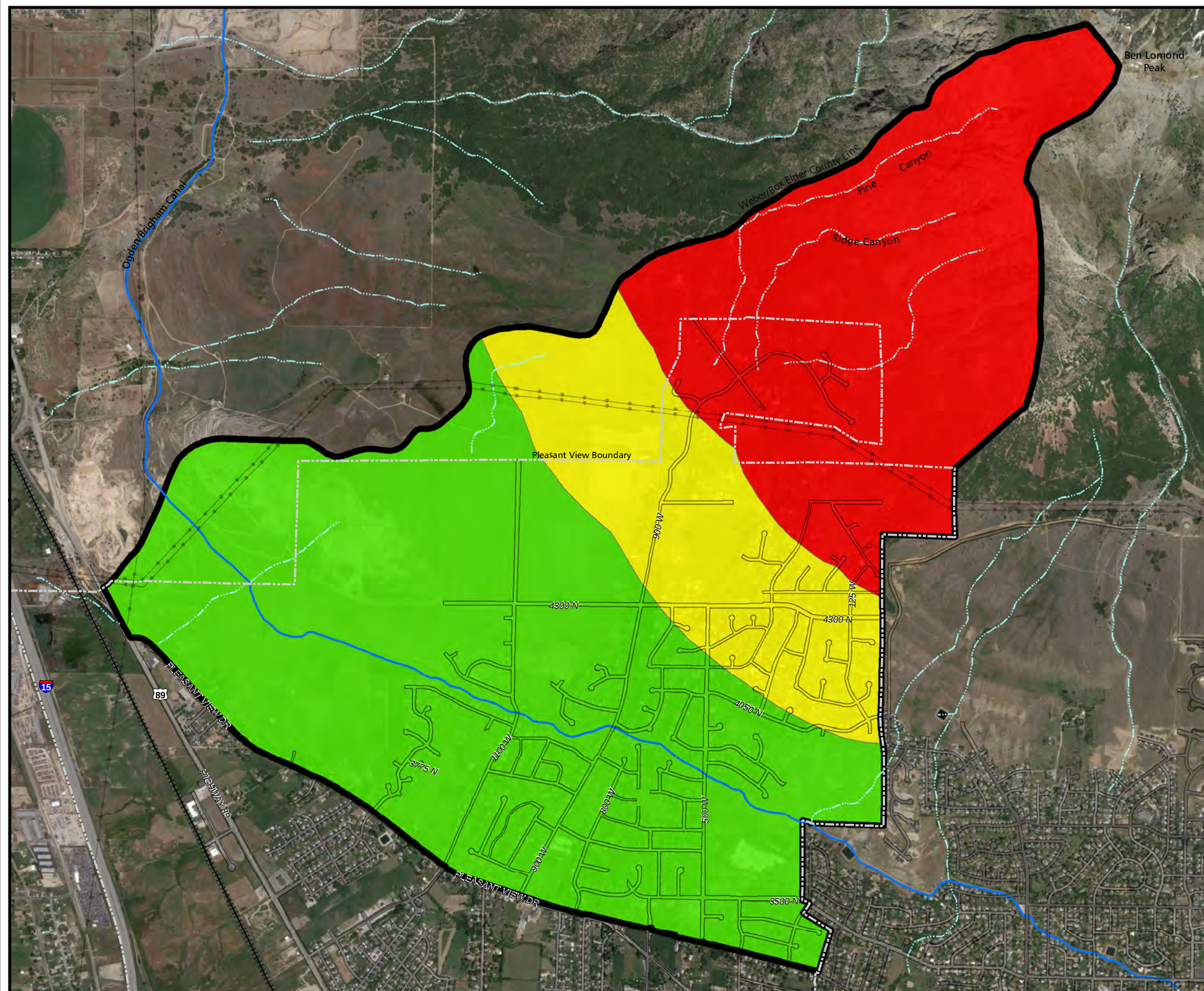
- Active Alluvial Terrain
- Bedrock Block Terrain
- Hummocky Bench Terrain
- Lake Deposit Beach Terrain
- Less Active Alluvial Terrain
- Mountain Block
- Older Alluvial Terrain
- Shoreface Bluff

Map Date: 11/16/2015



GEOMORPHOLOGICAL CONDITIONS

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Pleasant View City Corporation Foothill Area Environmental Land Planning Study

Legend

-  Study Area Boundary  Canal
 Current City Boundary  Intermittent Stream

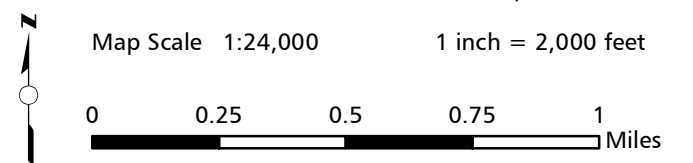
Landslide and Avalanche Constraints

-  Slight Constraints
-  Moderate Constraints
-  Severe Constraints

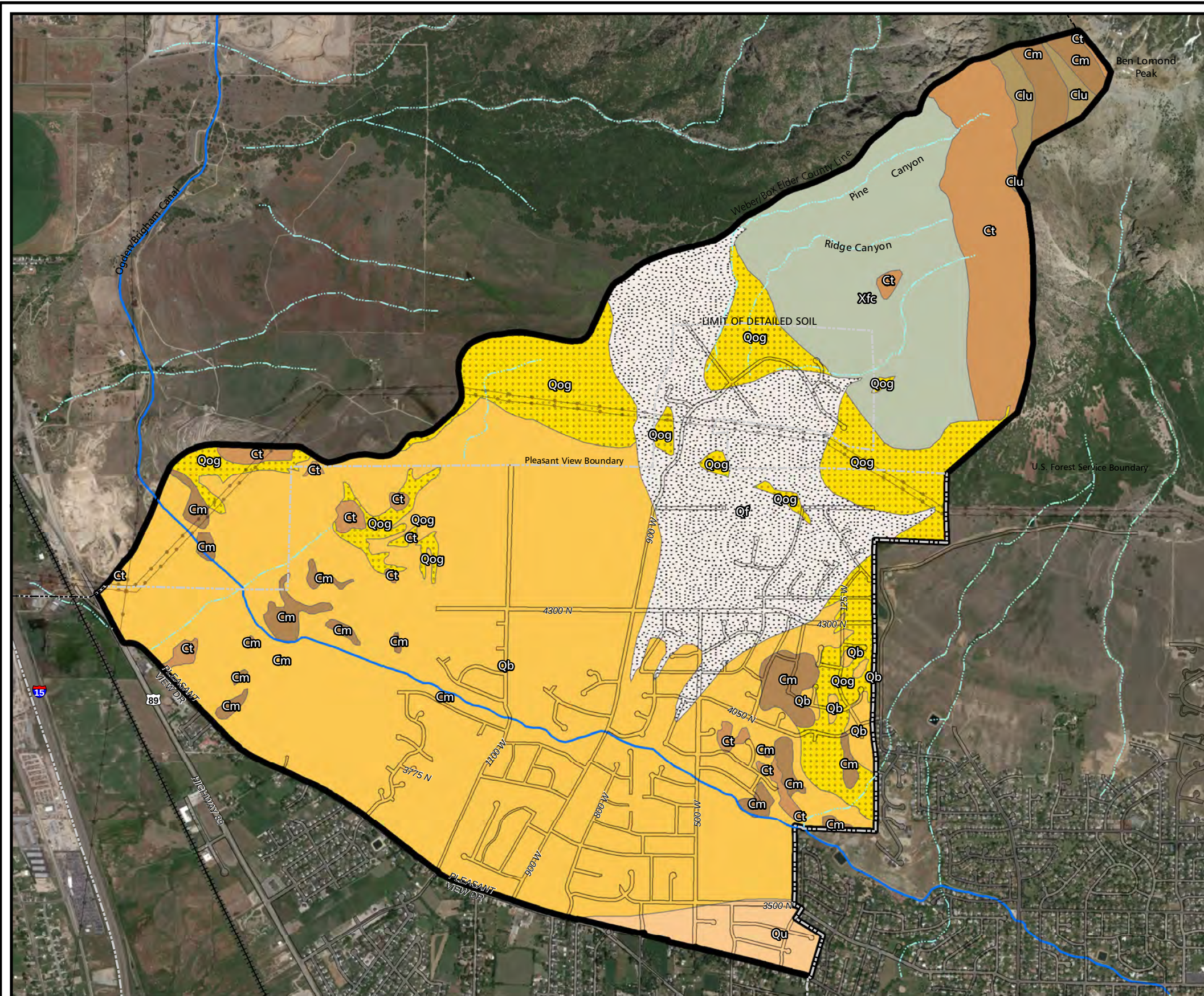
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Map Scale 1:24,000

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LANDSLIDE & AVALANCHE CONSTRAINTS



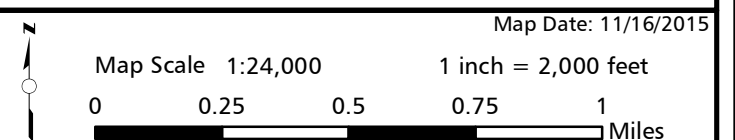
Pleasant View City Corporation Foothill Area Environmental Land Planning Study

Legend

- Study Area Boundary
- Canal
- Current City Boundary
- Intermittent Stream

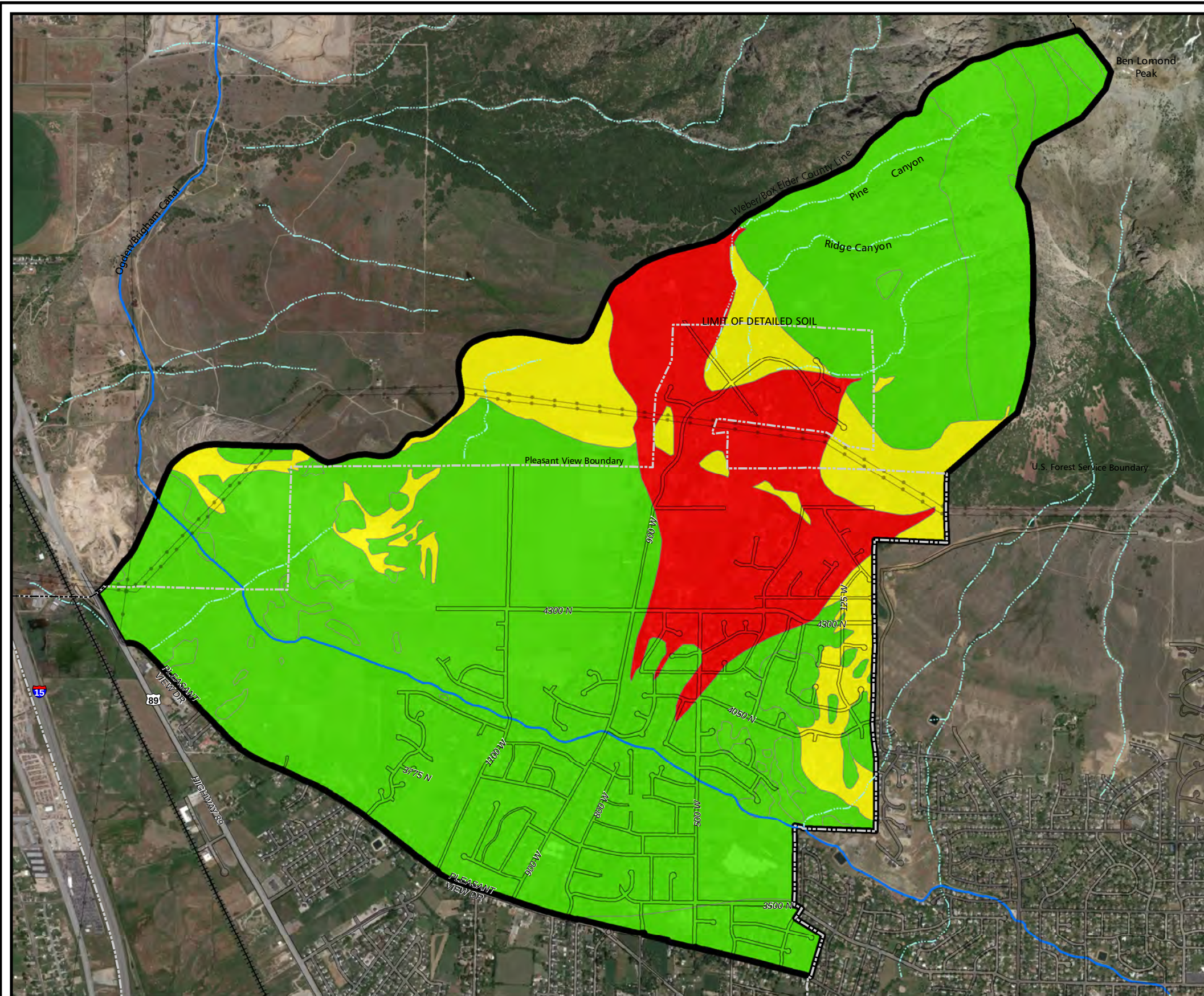
Geological Unit Conditions

- Clu - Limestone, Undivided (Middle Cambrian)
- Cm - Maxfield Limestone, Undivided (Middle Cambrian)
- Ct - Tintic Quartzite (Middle and Lower Cambrian)
- Qb - Lake Bonneville Deposits (Pleistocene)
- Qf - Alluvial Fan Deposits (Holocene)
- Qog - Older Gravel Deposits (Pleistocene)
- Qu - Special Deposits, Undivided (Holocene and Pleistocene)
- Xfc - Farmington Canyon Complex (Lower Proterozoic)



GEOLOGICAL CONDITIONS

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Pleasant View City Corporation Foothill Area Environmental Land Planning Study

- ## Legend
- Study Area Boundary
 - Current City Boundary
 - Canal
 - Intermittent Stream
- ## Geological Constraints
- Slight Constraints
 - Moderate Constraints
 - Severe Constraints

Map Date: 11/16/2015

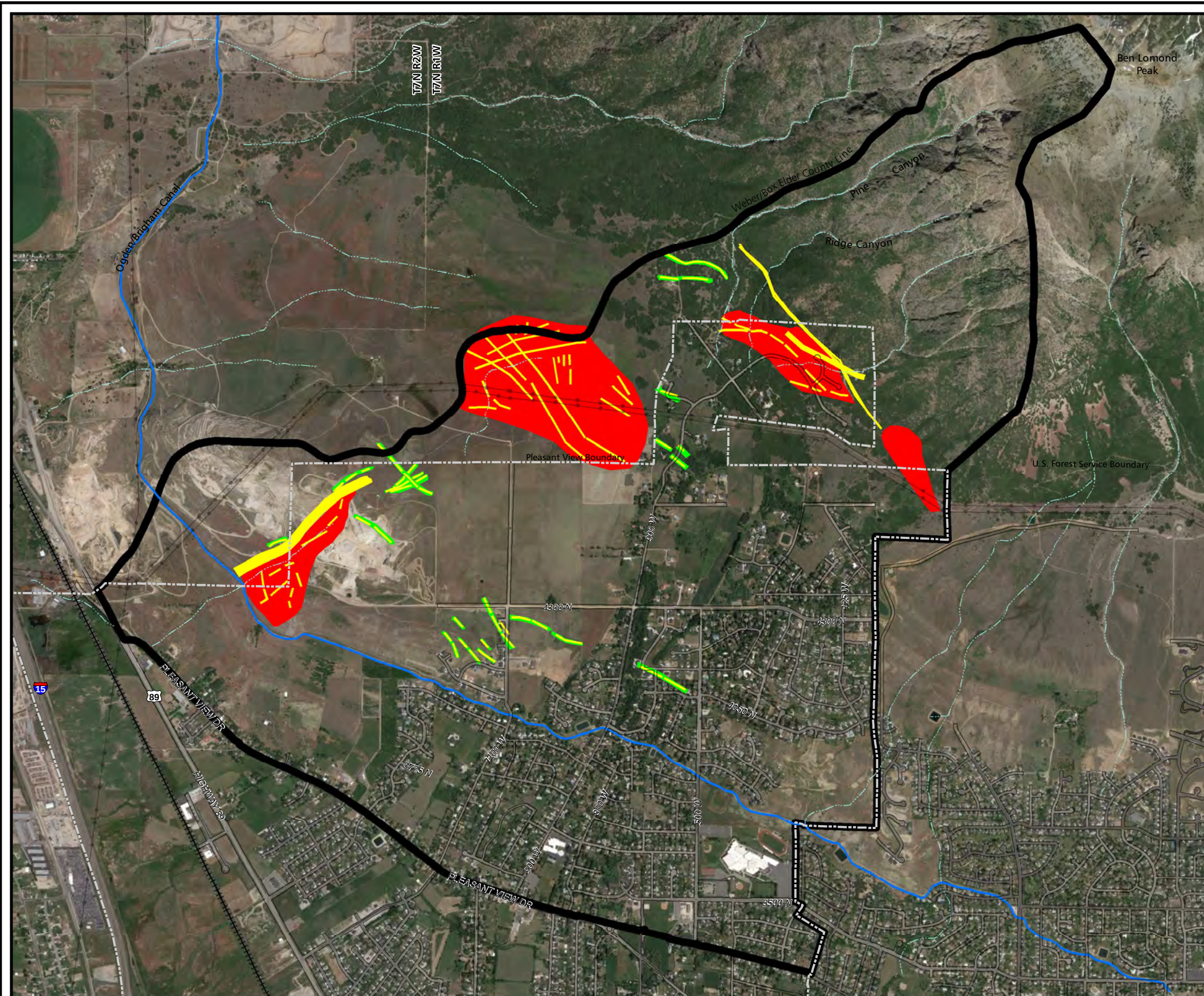
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GEOLOGICAL CONSTRAINTS

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Pleasant View City Corporation Foothill Area Environmental Land Planning Study

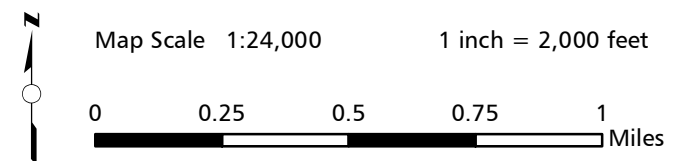
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- Study Area Boundary
- Current City Boundary
- Canal
- Intermittent Stream

Geological Fault Conditions

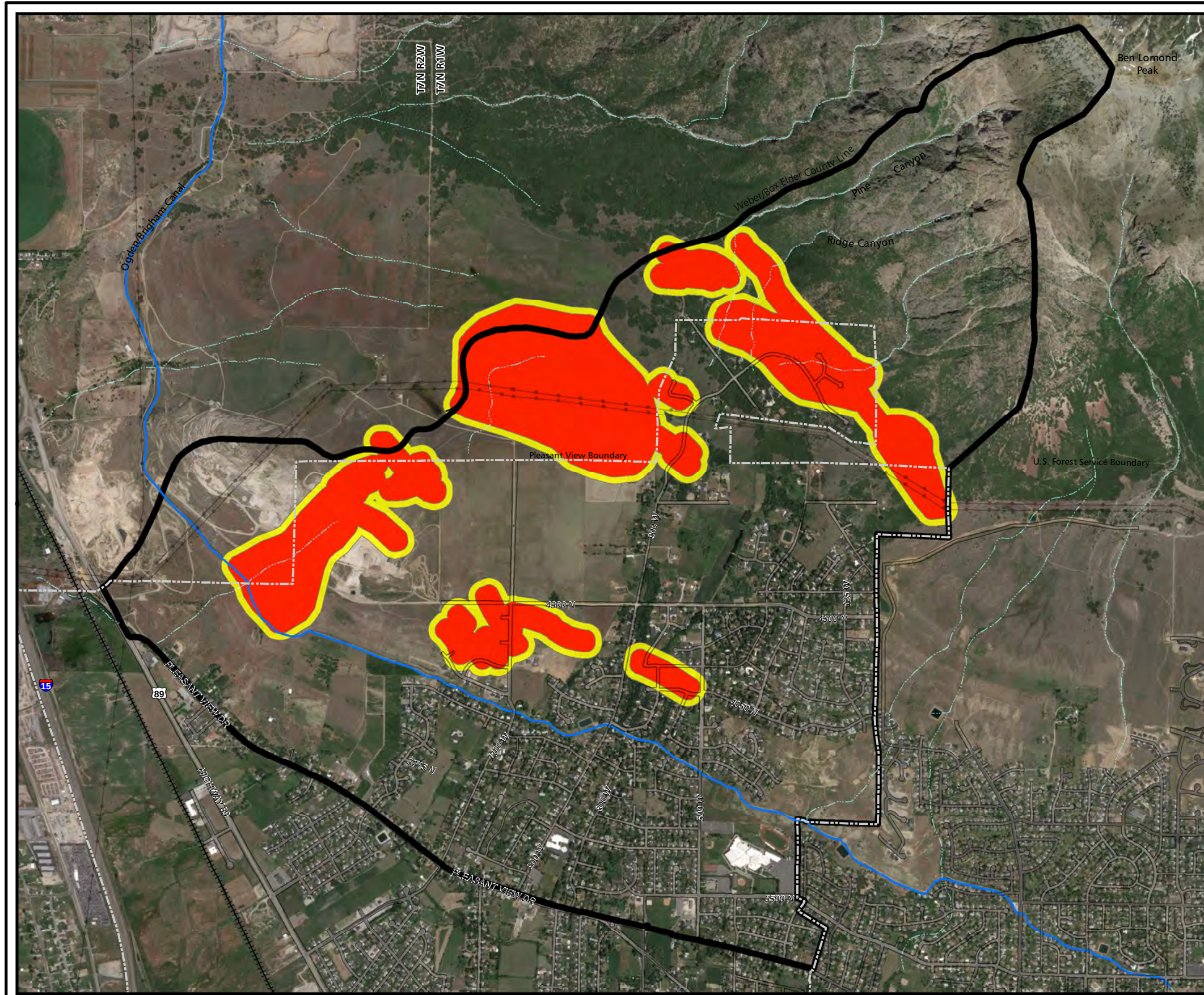
- CLASS I Deep Seated Faults with Well Defined Scarps
- CLASS II Probable Surface Fractures with Well Defined Scarps
- CLASS III Zone of Possible Faults with Little or No Surface Displacement

Map Date: 11/16/2015



GEOLOGICAL FAULT CONDITIONS

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Pleasant View City Corporation Foothill Area Environmental Land Planning Study

Legend

- Study Area Boundary
- Current City Boundary
- Canal
- Intermittent Stream

Geological Fault Constraints

- Ground Fault Zones - Moderate Constraints
- Ground Fault Zones - Severe Constraints
- All other Areas are Slight Constraints

Map Date: 11/16/2015

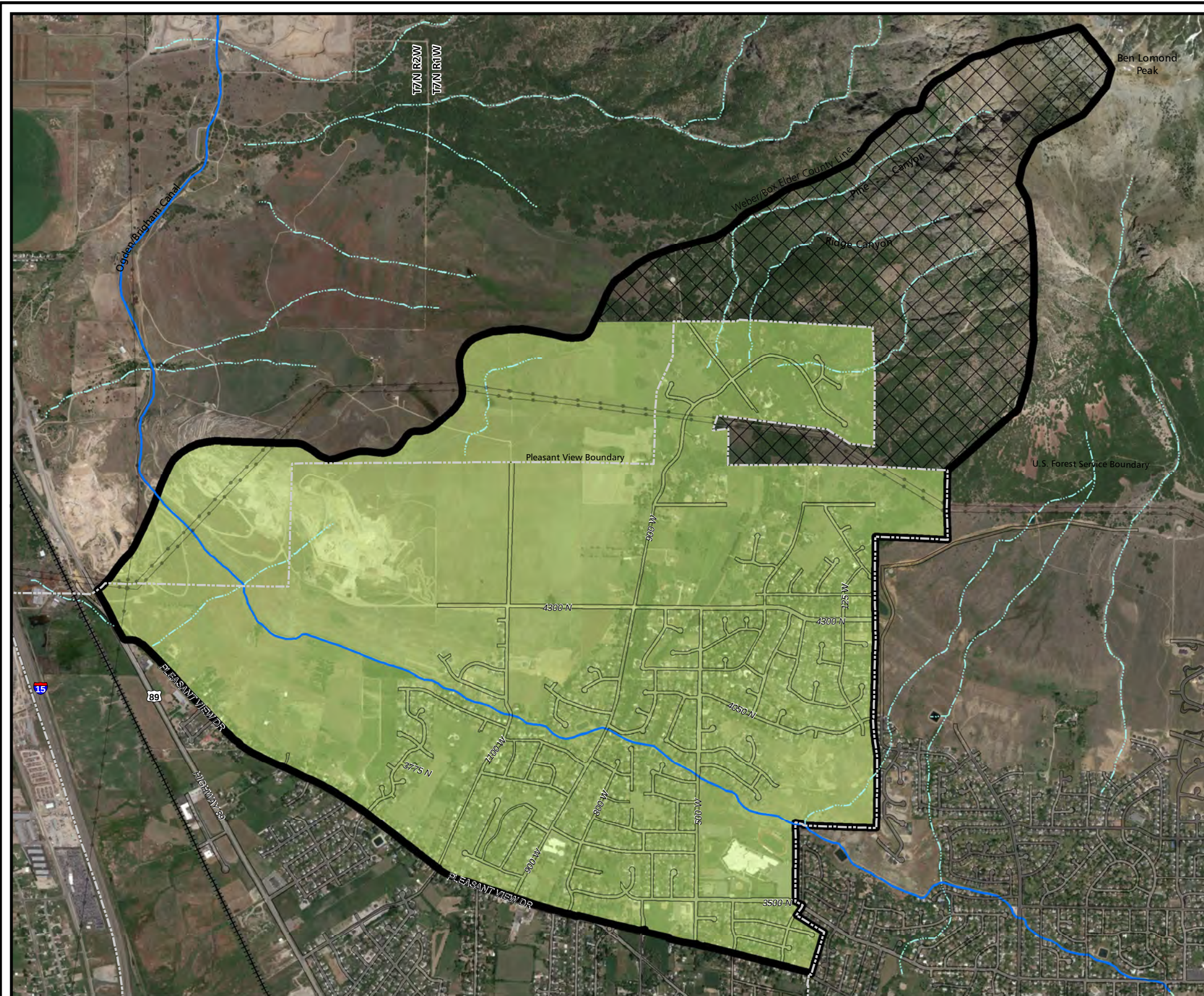
Map Scale 1:24,000 1 inch = 2,000 feet

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BIO-WEST
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435.752.4202

GEOLOGICAL FAULT CONSTRAINTS

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Pleasant View City Corporation Foothill Area Environmental Land Planning Study

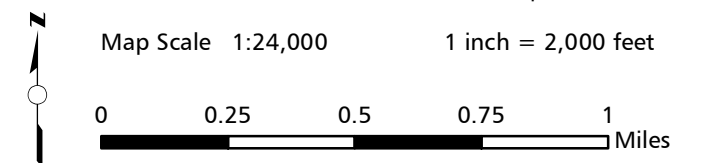
Legend

-  Study Area Boundary
-  Current City Boundary
-  Canal
-  Intermittent Stream

FEMA FIRM Map Zone Conditions

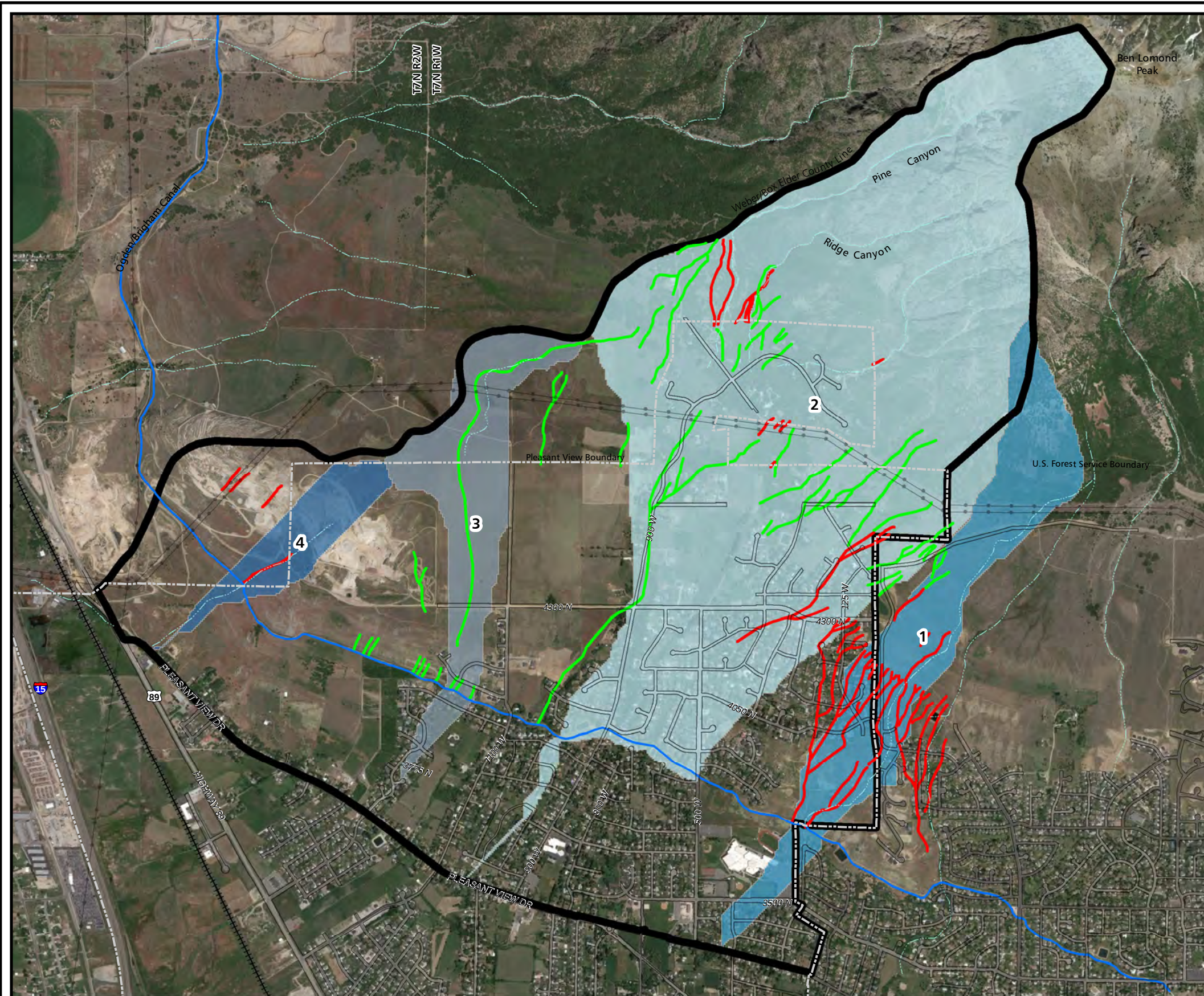
-  Zone X - Minimal Flood Hazard
(0.2 % annual chance of flood)
-  Zone D - Unmapped Flood Hazard

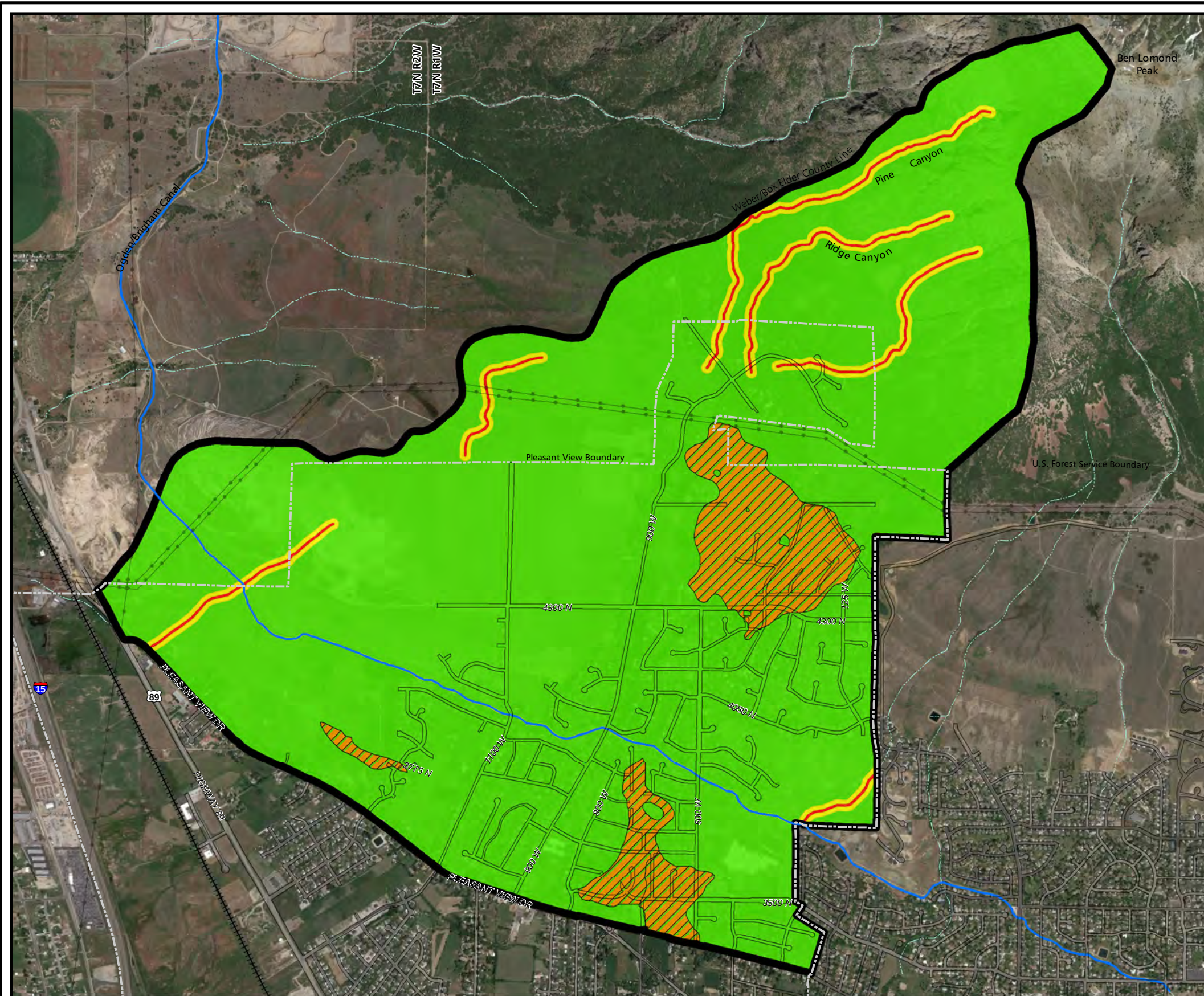
Map Date: 11/16/2015



FEMA FIRM MAP CONDITIONS

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Pleasant View City Corporation Foothill Area Environmental Land Planning Study

Legend

-  Study Area Boundary
-  Current City Boundary
-  Canal
-  Intermittent Stream

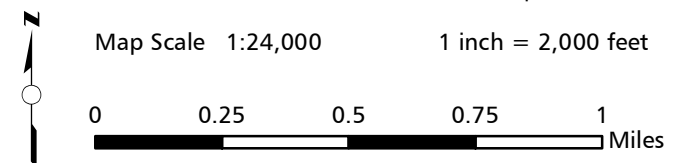
Flood Potential Constraints

-  Soil Types with Potential Flooding Limitations for Structures

Stream Channel Constraints

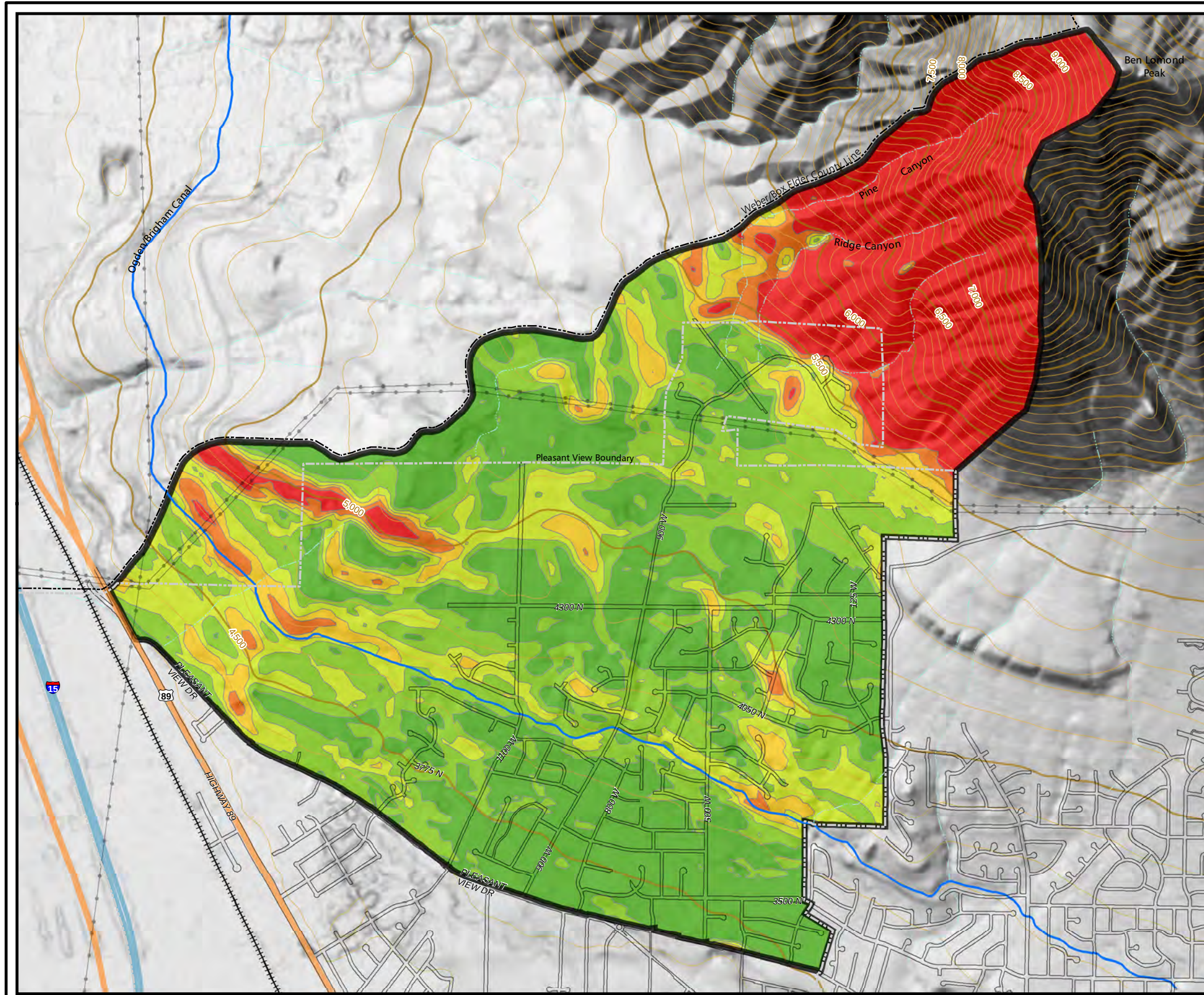
-  Slight Constraints (Outside 100 Feet)
-  Moderate Constraints (31 - 100 Feet)
-  Severe Constraints (0 - 30 Feet)

Map Date: 11/16/2015



FLOOD POTENTIAL CONSTRAINTS

Q:\projects\1876_PleasantView\Pleasant_FloodConstraints.mxd



Pleasant View City Corporation Foothill Area Environmental Land Planning Study

Legend

Study Area Boundary

Current City Boundary

Canal

Intermittent Stream

Slope Conditions

- 0 - 10 Percent
- 10 - 15 Percent
- 15 - 20 Percent
- 20 - 25 Percent
- 25 - 30 Percent
- Over 30 Percent

Map Date: 11/16/2015

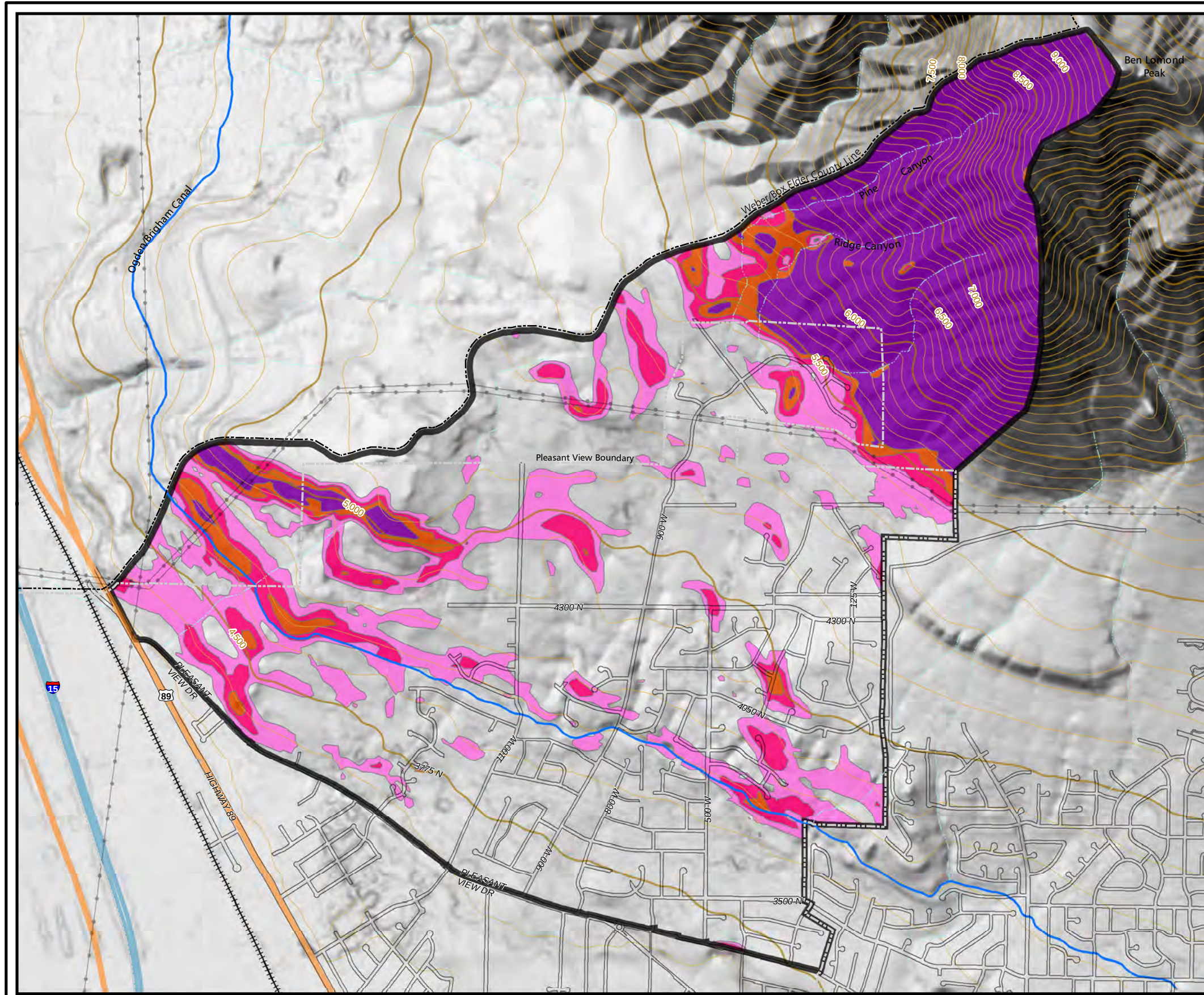
Map Scale 1:24,000

1 inch = 2,000 feet

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 435.752.4202

SLOPE CONDITIONS

Q:\projects\1876_PleasantView\Pleasant_Slope.mxd



Pleasant View City Corporation Foothill Area Environmental Land Planning Study

Legend

Study Area Boundary

Current City Boundary

Canal

Intermittent Stream

Slope Constraints

- 0 - 15 Percent - No Constraints
- 15- 20 Percent - Slight Constraints
- 20 - 25 Percent - Moderate Constraints
- 25 - 30 Percent - Severe Constraints
- Over 30 Percent - No Build

Map Date: 11/16/2015

Map Scale 1:24,000 1 inch = 2,000 feet

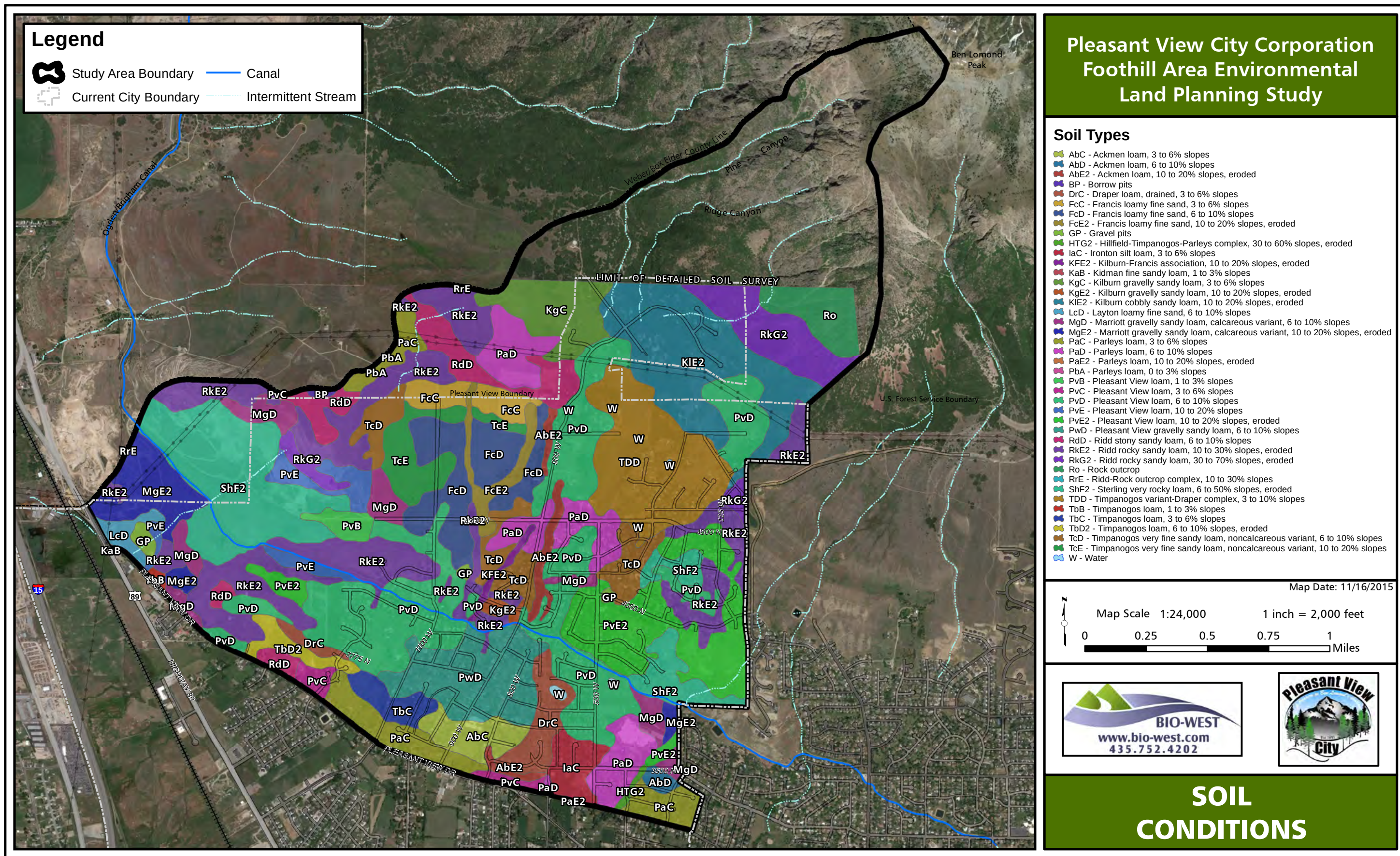
0 0.25 0.5 0.75 1

Miles

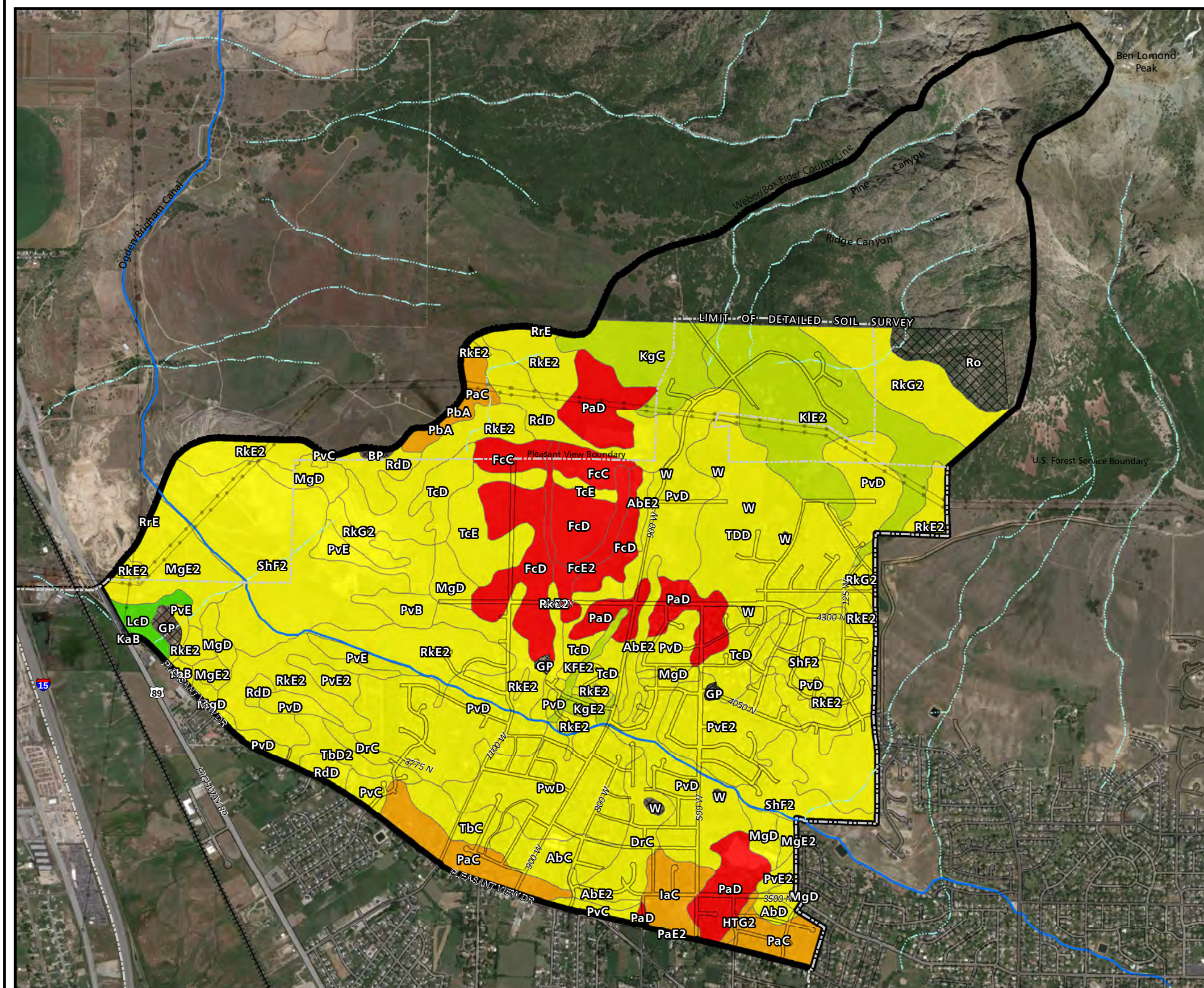
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SLOPE CONSTRAINTS

Q:\projects\1876_PleasantView\Pleasant_SlopeConstraints.mxd



Q:\projects\1876_PleasantView\Pleasant_Soils.mxd



Pleasant View City Corporation Foothill Area Environmental Land Planning Study

Legend



Study Area Boundary — Canal



Current City Boundary ——— Intermittent Stream

Geomorphology



- Very Slight Constraints



- Slight Constraints



- Moderate Constraints



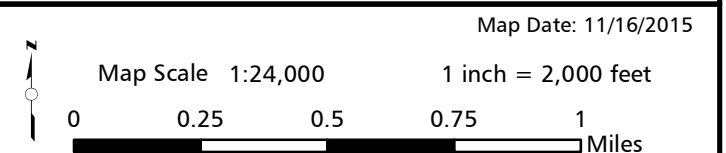
- High Constraints



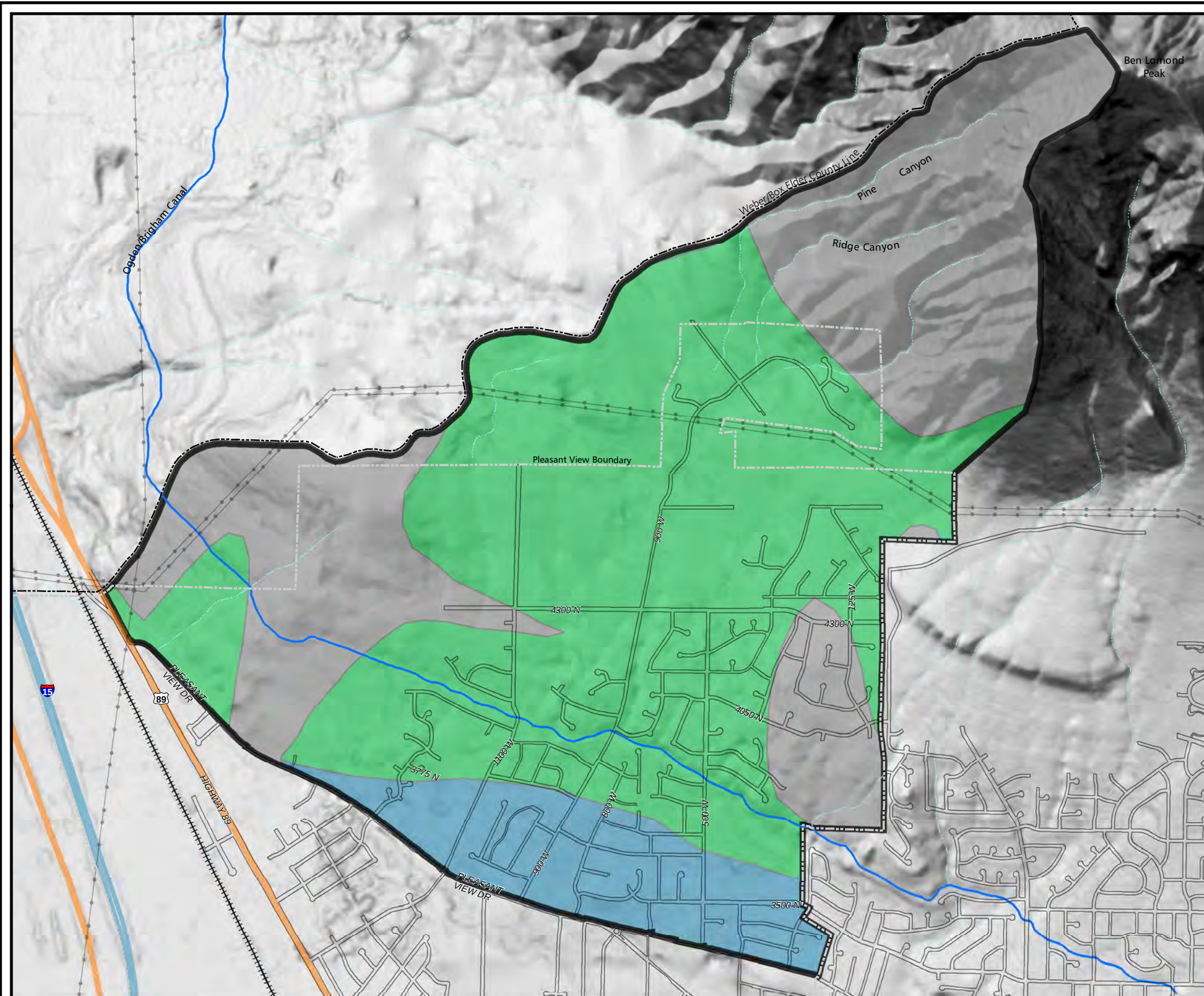
- Severe Constraints



➤ No Information Available



SOILS CONSTRAINTS



Pleasant View City Corporation Foothill Area Environmental Land Planning Study

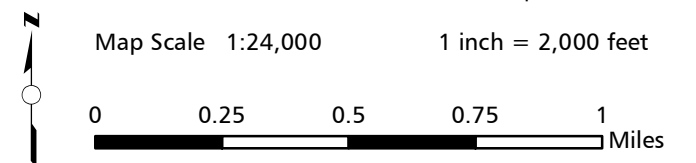
Legend

- Study Area Boundary
- Current City Boundary
- Canal
- Intermittent Stream

Groundwater Recharge Conditions

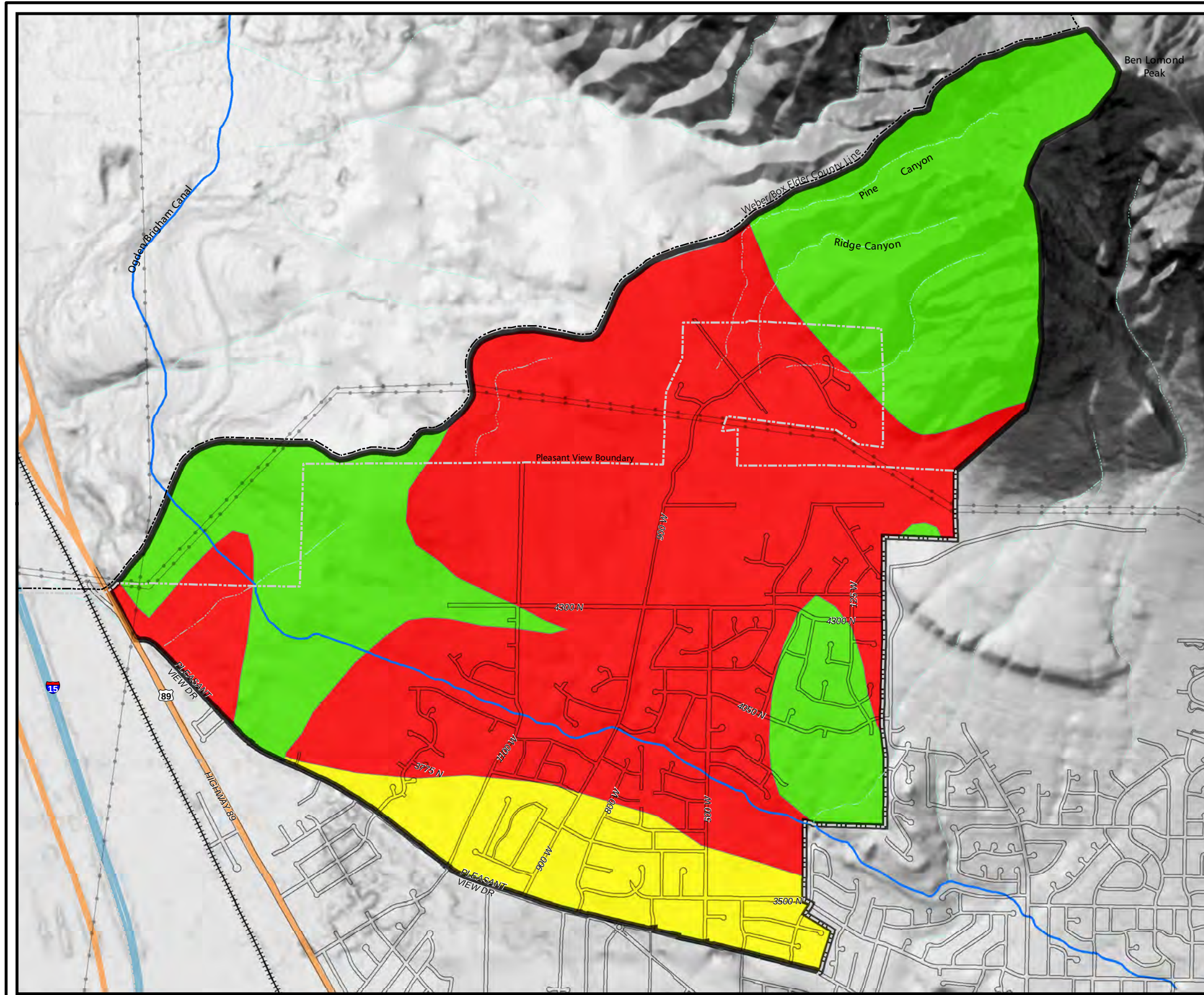
- Bedrock
- Discharge
- Primary Recharge

Map Date: 11/16/2015



GROUNDWATER RECHARGE CONDITIONS

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Pleasant View City Corporation Foothill Area Environmental Land Planning Study

Legend

Study Area Boundary

Current City Boundary

Canal

Intermittent Stream

Groundwater Recharge Constraints

Slight Constraints

Moderate Constraints

Severe Constraints

Map Scale 1:24,000

0 0.25 0.5 0.75 1 Miles

Map Date: 11/16/2015

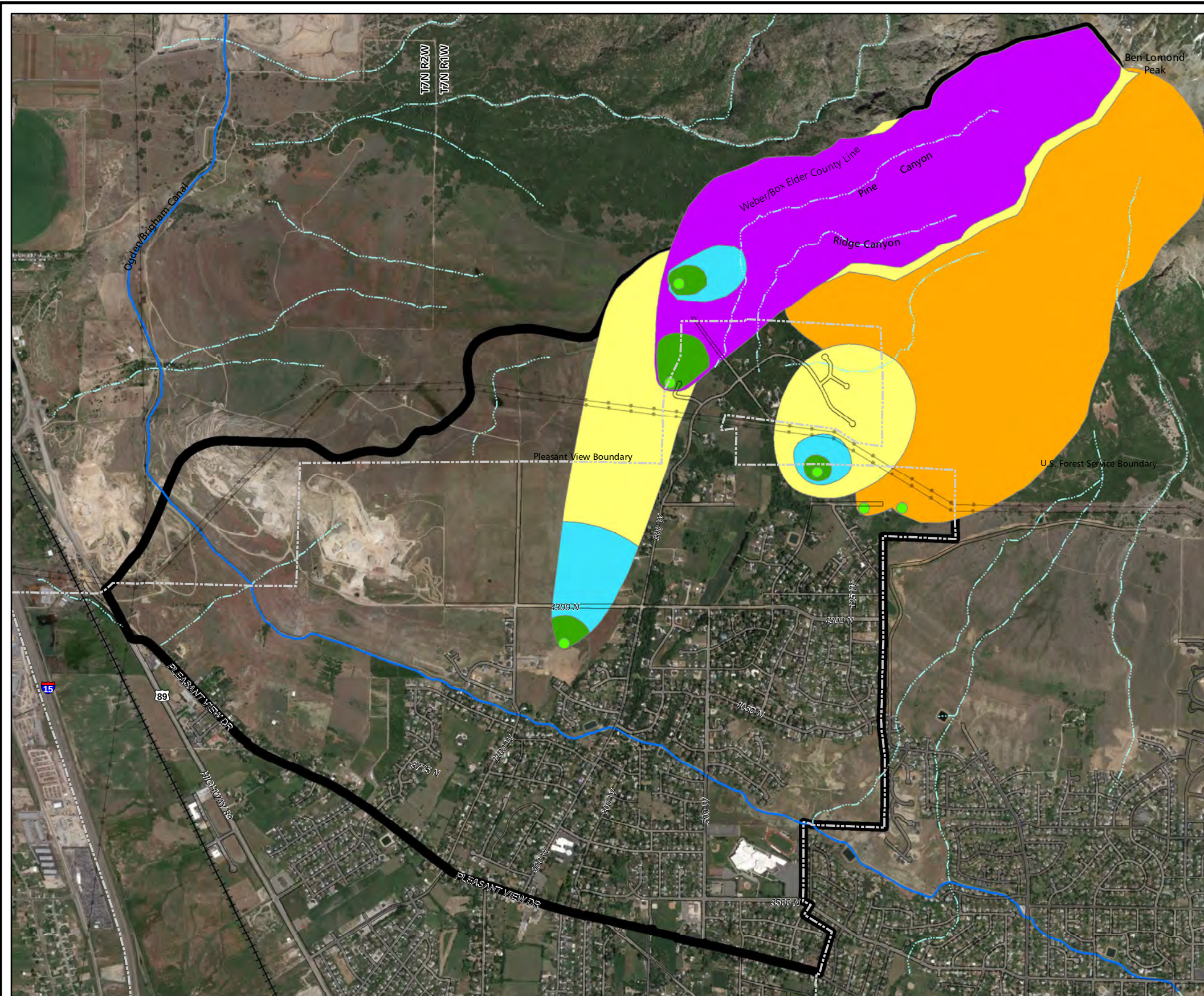
1 inch = 2,000 feet

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**Pleasant View
City**

GROUNDWATER RECHARGE CONSTRAINTS

Q:\projects\1876_PleasantView\Pleasant_GroundwaterConstraints.mxd



Pleasant View City Corporation Foothill Area Environmental Land Planning Study

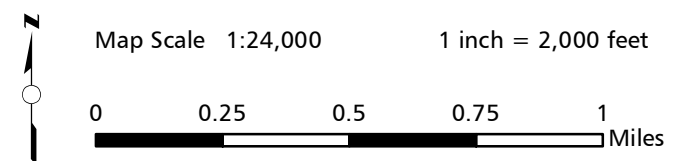
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-  Study Area Boundary
-  Current City Boundary
-  Canal
-  Intermittent Stream

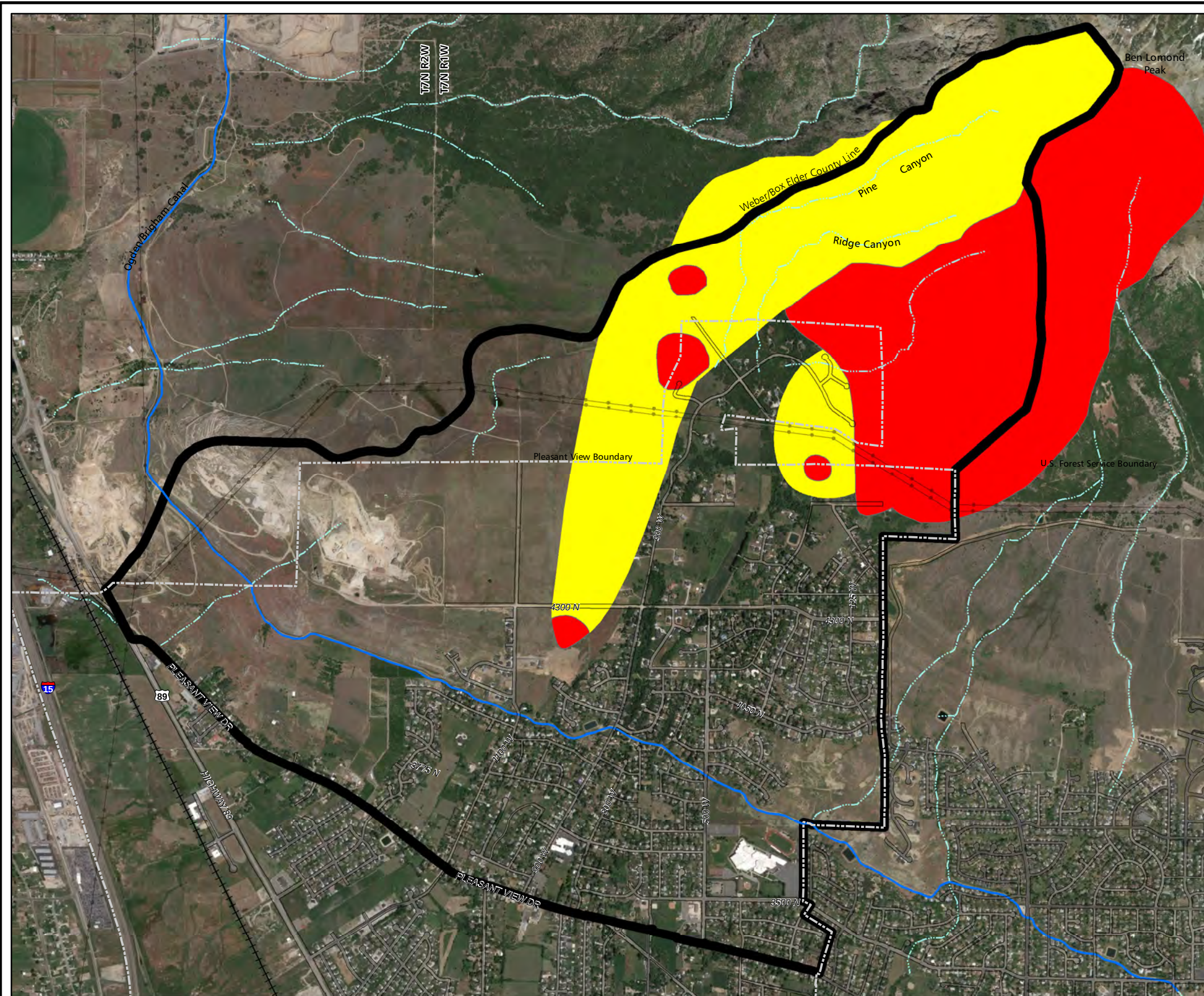
Drinking Water Source Protection Zones

-  Zone 1: 100 Feet From Wellhead or Spring
-  Zone 2: 250 Day Groundwater Travel Time
-  Zone 2-3-4: 0.5 to 15 Year Groundwater Travel Time
-  Zone 3: 3 Year Groundwater Travel Time
-  Zone 3-4: 3 to 15 Year Groundwater Travel Time
-  Zone 4: 15 Year Groundwater Travel Time

Map Date: 11/16/2015



WATER SOURCE PROTECTION ZONES



Pleasant View City Corporation Foothill Area Environmental Land Planning Study

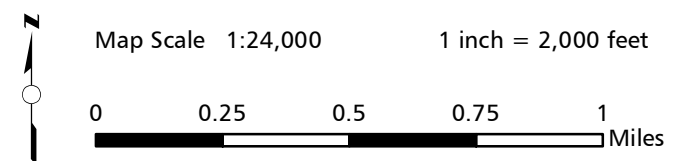
Legend

-  Study Area Boundary
-  Current City Boundary
-  Canal
-  Intermittent Stream

Water Source Constraints

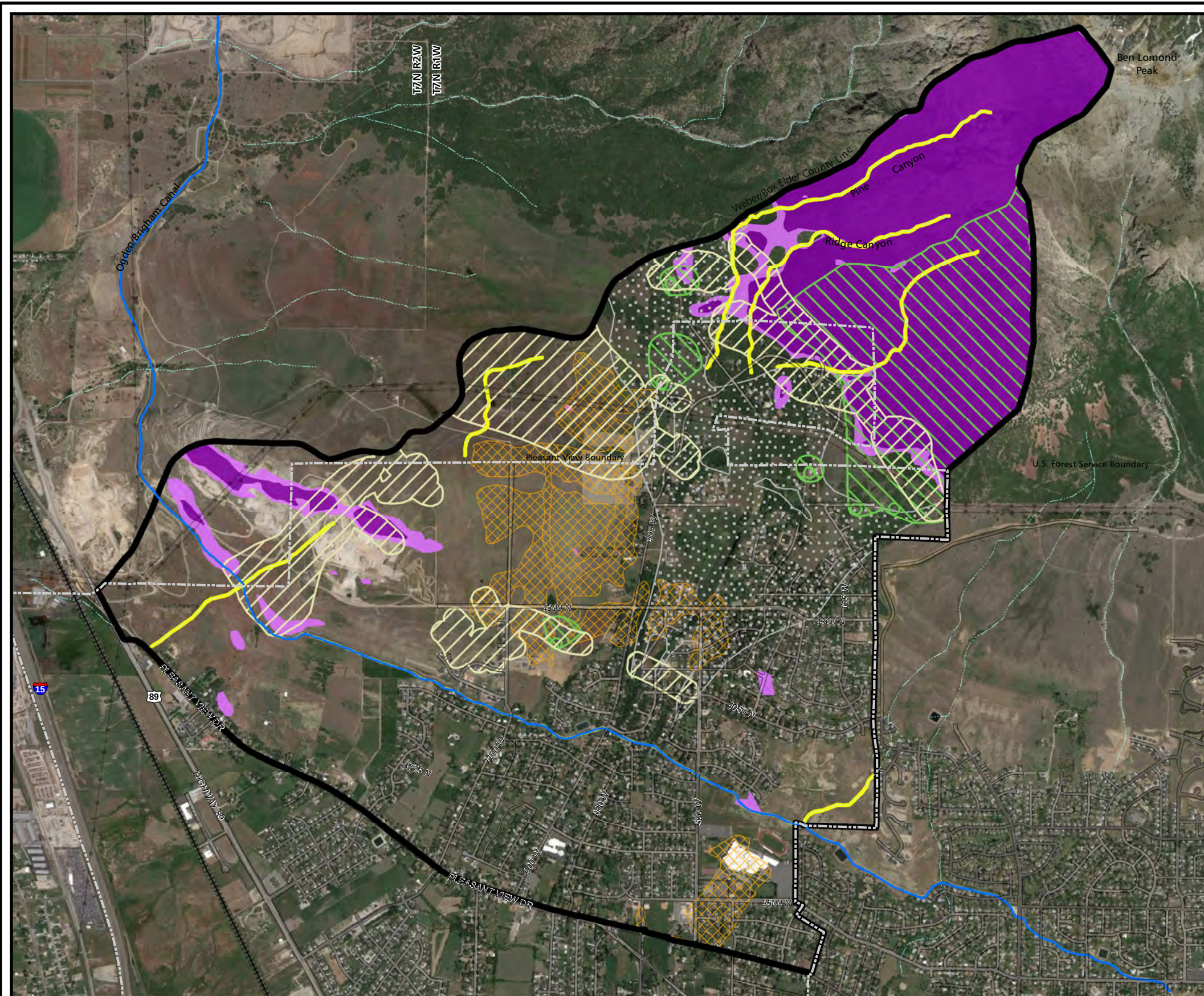
-  Moderate Constraints
-  Severe Constraints

Map Date: 11/16/2015



WATER SOURCE CONSTRAINTS

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Pleasant View City Corporation Foothill Area Environmental Land Planning Study

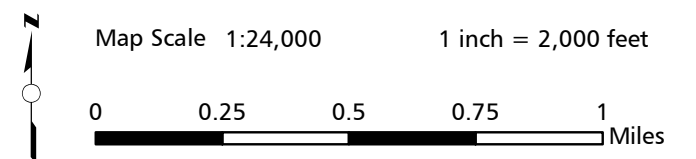
Legend

- Study Area Boundary
- Current City Boundary
- Canal
- Intermittent Stream

Composite Constraints

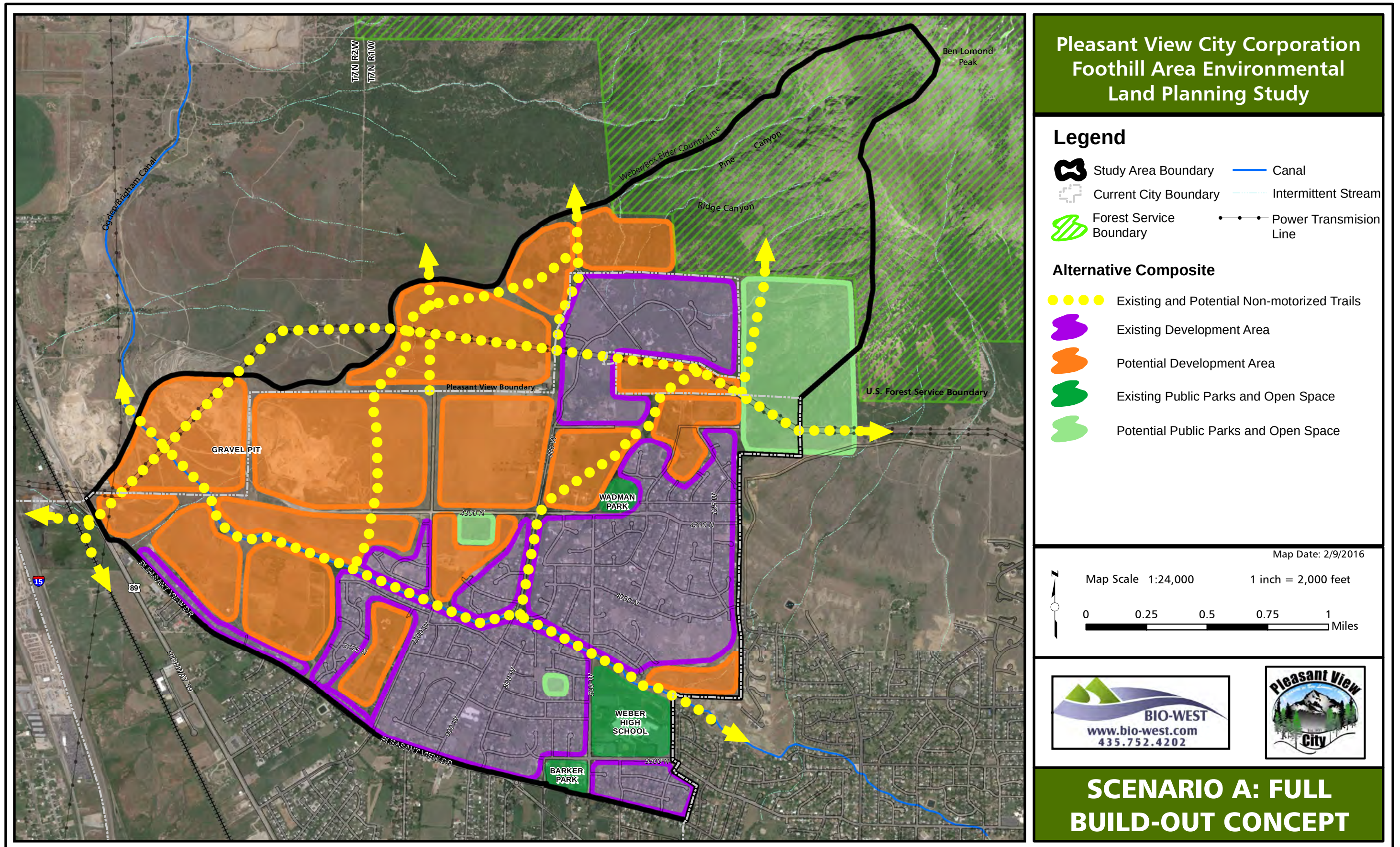
- Slope Over 30 Percent - No Build
- Slope 25 - 30 Percent - Severe Constraints
- Ground Fault Zones - Severe Constraints
- Stream Channel (0 - 30 Feet) - Severe Constraints
- Geological - Severe Constraints
- Soils - Severe Constraints
- Water Source - Severe Constraints

Map Date: 4/5/2016

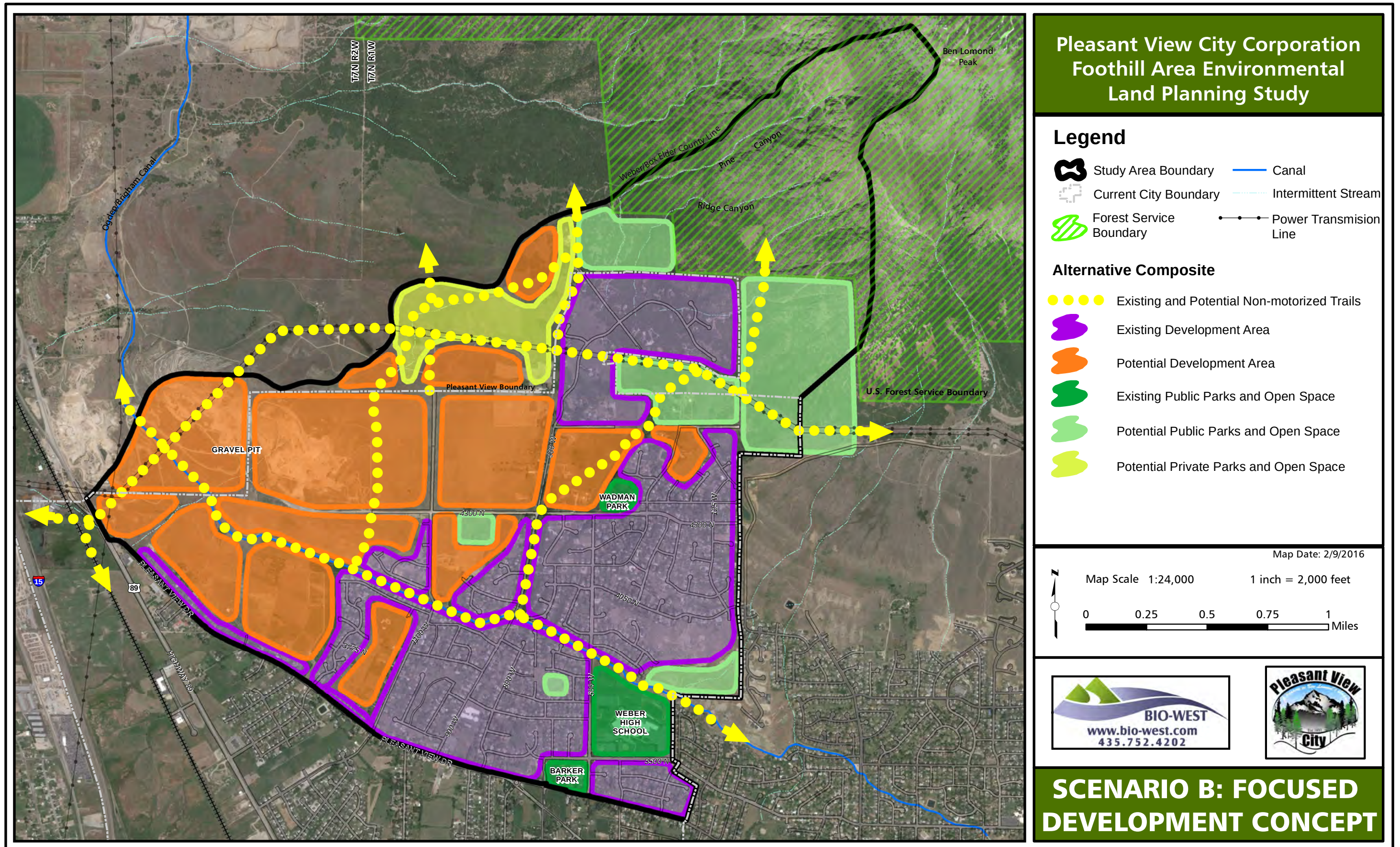


COMPOSITE CONSTRAINTS

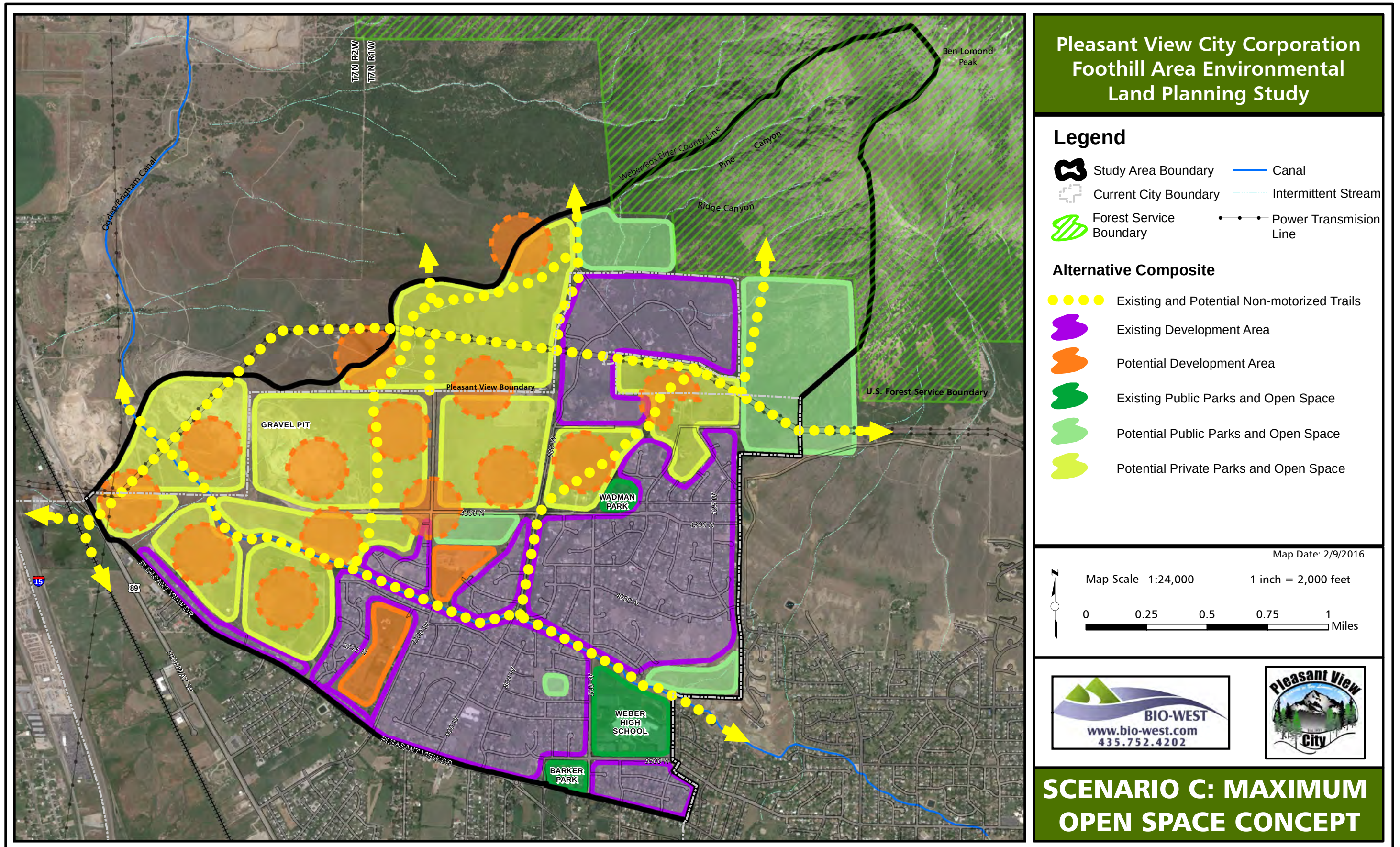
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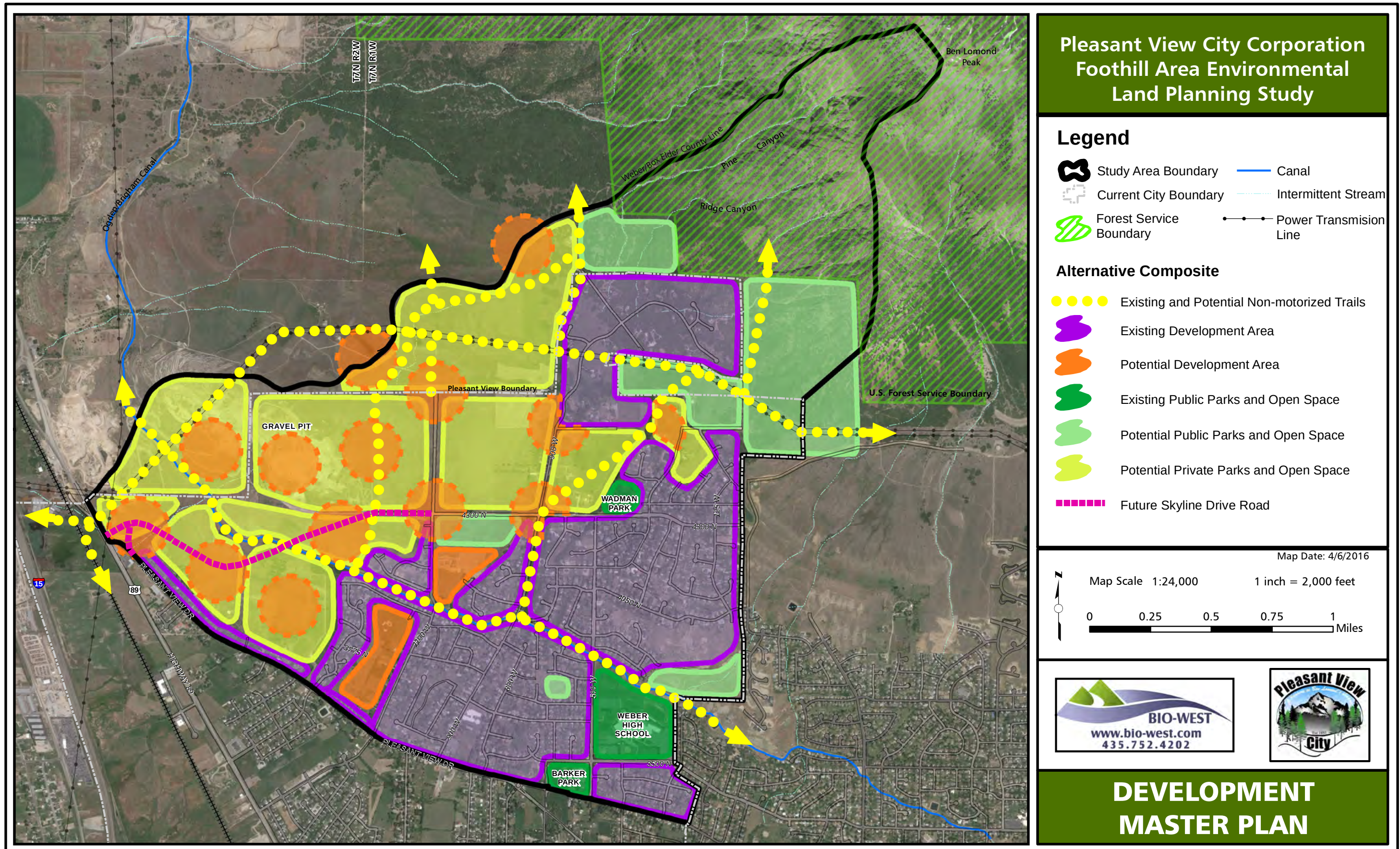
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Aquatic Resources Delineation

Christofferson Farm

Pleasant View, Utah



May 2022
Wetland Resources



Aquatic Resources Delineation

Christofferson Farm

Pleasant View, Utah

Prepared for:

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Val Poll, Project Manager
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May 2022

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A. INTRODUCTION

An aquatics resources delineation was conducted in May 2022 for the Christofferson Farm property in Pleasant View, Utah (Appendix A: Map 1). The delineation was prepared for Canyon Ledge, LLC who are developing the property as a residential subdivision. To get to the project area from Interstate 15 north of Ogden, take the 2700 North exit and head east to 1000 West. Turn left (north) on 1000 West and continue to Pleasant View Avenue. Turn right on Pleasant View Avenue, then take a left on 900 West. Continue north on 900 West to 4300 North. Turn right on 4300 North and continue to 500 West. The project area is on the north side of 4300 North at 500 West.

B. METHODOLOGY

Wetland Resources surveyed the project area for wetlands and other aquatic resources on May 4, 2022. There had been some recent precipitation, temperatures were normal, and the project area was experiencing Severe Drought conditions according to the U.S. Drought Monitor Map (USDA 2022).

Wetlands

The wetland delineation was completed in accordance with the U.S. Army Corps of Engineers' (USACE) 1987 Wetland Delineation Manual (USACE 1987) and the Arid West Supplement (USACE 2008). All potential wetland areas were checked for wetland indicators. The following procedure was implemented at each sample point:

1. The herbaceous and shrub plant species within a five foot radius of the sample point were recorded, as directed in the 1987 Manual (USACE 1987). A 30 foot radius was used for tree species (USACE 1987). The percent of relative cover for each species was determined by estimating areal cover. The indicator status of each species was determined by using the National Wetland Plant List: Arid West (USACOE 2020). If a plant species comprised at least 20 percent of the total relative cover in its stratum, it was considered to be a dominant plant species. If more than 50 percent of the dominant plant species had an indicator status of obligate (OBL), facultative wetland (FACW), or facultative (FAC), the sample point met the wetland vegetation parameter. If an area does not pass the dominance test but meets the hydric soil and wetland hydrology criteria, the prevalence index is considered. A prevalence index of 3.0 or less indicates that hydrophytic vegetation is present. The prevalence index is a weighted-average wetland indicator status of all plant species in the sampling plot, where each indicator status category is given a numeric code (OBL = 1, FACW = 2, FAC = 3, FACU = 4, and UPL = 5) and weighting is by abundance (absolute percent cover).
2. A 20 inch-deep soil pit was dug at each sample point to assess soil characteristics. Soil color, texture, and moisture at different depths within the soil profile were recorded. Color was determined by comparing a moistened soil sample with the Munsell Soil Color Charts. If the soil characteristics met the hydric soil criteria provided in the Arid West Supplement and the Field Indicators of Hydric Soils (NRCS 2006) manuals, the sample point met the wetland soils parameter.
3. Each soil pit was examined to determine correlation with the wetland hydrology criteria. Field indicators of periodic saturation and/or inundation include redox features, drainage patterns in the wetland, sulfur odor, gleyed soils, soils with low chroma,

sediment deposits, salt crust, surface soil cracks, or water stained leaves. If at least one primary indicator or two secondary indicators were present, the sample point met the wetland hydrology parameter.

If a sample point met all three parameters, it was classified as occurring in a wetland. Wetland boundaries were surveyed using a sub-meter accuracy GPS unit.

Other Aquatic Resources

Other aquatic resources include open water, unvegetated areas within wetlands with less than 5% vegetative cover, natural stream channels, ditches, and canals. The aquatic resources survey was conducted in accordance with the Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States (Lichvar and McColley 2008), and the Updated Datasheet for the Identification of the Ordinary High Water Mark in the Arid West Region of the Western United States (Curtis and Lichvar 2010). The aquatic resources were surveyed using a sub-meter GPS unit. OHWM data sheets were completed for intermittent and ephemeral stream channels.

C. RESULTS AND DISCUSSION

Wetlands

The 20.9-acre project area contains a total of 0.096 acres of wetland. Table 1 provides the wetland acreages, and Table 2 lists all of the wetland plant species identified within the project area. Maps showing the project area and the surveyed wetland and Waters of the U.S. boundaries are provided in Appendix A. Photos of the project area are provided in Appendix B, and data sheets supporting the wetland boundaries are provided in Appendix C.

W-1 - This palustrine emergent (PEM) wetland occurs on a small flat area on a slope, at an apparent groundwater discharge zone. The wetland is dominated by Nebraska sedge, clustered field sedge, Baltic rush, and strawberry clover. The soils have a matrix color of 10YR4/2 with 2% redox, meeting the criteria for Depleted Matrix, and are classified as Timpanogos variant-Draper complex. The soils were saturated at the surface in the wetland area, and the water table was very close to the surface, meeting the wetland hydrology criteria. The hydrology for this wetland appears to be provided by a small groundwater discharge zone. There is no flow of water, but this small area has a high water table, while the immediately surrounding areas are dry at 20 inches. This wetland is completely surrounded by uplands, with no surface connection to other waters of the U.S. or any ditches. Sample Points 1 and 2, Photos 1 and 2.

W-2 - This palustrine emergent (PEM) wetland occurs below a small manmade irrigation pond, and is supported by the overflow from the pond. The wetland is dominated by tall wheatgrass, Nebraska sedge, and meadow foxtail. The soils have a matrix color of 10YR2/2 with no redox, which does not meet any of the hydric soil indicators. They are classified as Timpanogos variant-Draper complex soils. The soils were saturated at the surface in the wetland area due to water flowing from the pond outlet, but the soils were not saturated below 10 inches, an indicator that the hydrology is provided solely by the pond overflow. The pond is supported by a buried irrigation pipe that inputs water into the pond. There is a valve that can potentially turn off all of the water flowing into the pond. If the water can be completely turned off, this wetland will likely dry out and not be jurisdictional. The water enters a pipe at the bottom end of this wetland, enters the lower irrigation pond, then into a small ditch with no OHWM, and completely dries out before reaching a raised pipe inlet into a storm sewer pipe. Sample Points 3 and 4, Photos 3 and 4.

No examples of interstate or foreign commerce were observed or documented in the wetlands within the project area. There is no recreation occurring in the wetlands by interstate or foreign travelers.

The uplands in the project area are dominated by meadow fescue, bulbous bluegrass, alfalfa, and cheatgrass. A complete list of upland species identified in the project area can be found in Table 3. The soils in the upland areas were dry and did not exhibit any indicators of hydric soil or wetland hydrology.

Other Aquatic Resources

There are no other aquatic resources within the project area other than the wetlands. There are two small man-made irrigation ponds that have a valve to shut off the input of water from the irrigation pipe. The upper pond is open water (Photos 5 and 6), and the lower pond has filled in with common reed (Photos 7 and 8). These man-made ponds are not jurisdictional because they are excavated in uplands and do not have a natural hydrology source.

Table 1. Wetland Acreages

Wetland Number	PEM (acres)	Latitude	Longitude
W-1	0.050	41.338749°	-111.987320°
W-2	0.046	41.340623°	-111.984492°
Total	0.096		

Table 2. Wetland plant species identified in the project area.

Botanical Name	Common Name	2020 Arid West Indicator Status
<i>Carex nebrascensis</i>	Nebraska sedge	OBL
<i>Carex praegracilis</i>	clustered field sedge	FACW
<i>Crataegus douglasii</i>	black hawthorn	FAC
<i>Dipsacus fullonum</i>	Fuller's teasel	FAC
<i>Hordeum jubatum</i>	foxtail barley	FAC
<i>Juncus balticus</i>	Baltic rush	FACW
<i>Maianthemum stellatum</i>	starry false lily of the valley	FAC
<i>Phalaris arundinacea</i>	reed canary grass	FACW
<i>Phragmites australis</i>	common reed	FACW
<i>Poa pratensis</i>	Kentucky bluegrass	FAC
<i>Ranunculus sceleratus</i>	cursed buttercup	OBL
<i>Ribes aureum</i>	golden currant	FAC
<i>Rumex crispus</i>	curly dock	FAC

Table 2. Wetland plant species identified in the project area.

Botanical Name	Common Name	2020 Arid West Indicator Status
<i>Salix fragilis</i>	crack willow	FAC
<i>Trifolium fragiferum</i>	strawberry clover	FAC
<i>Typha latifolia</i>	cattail	OBL

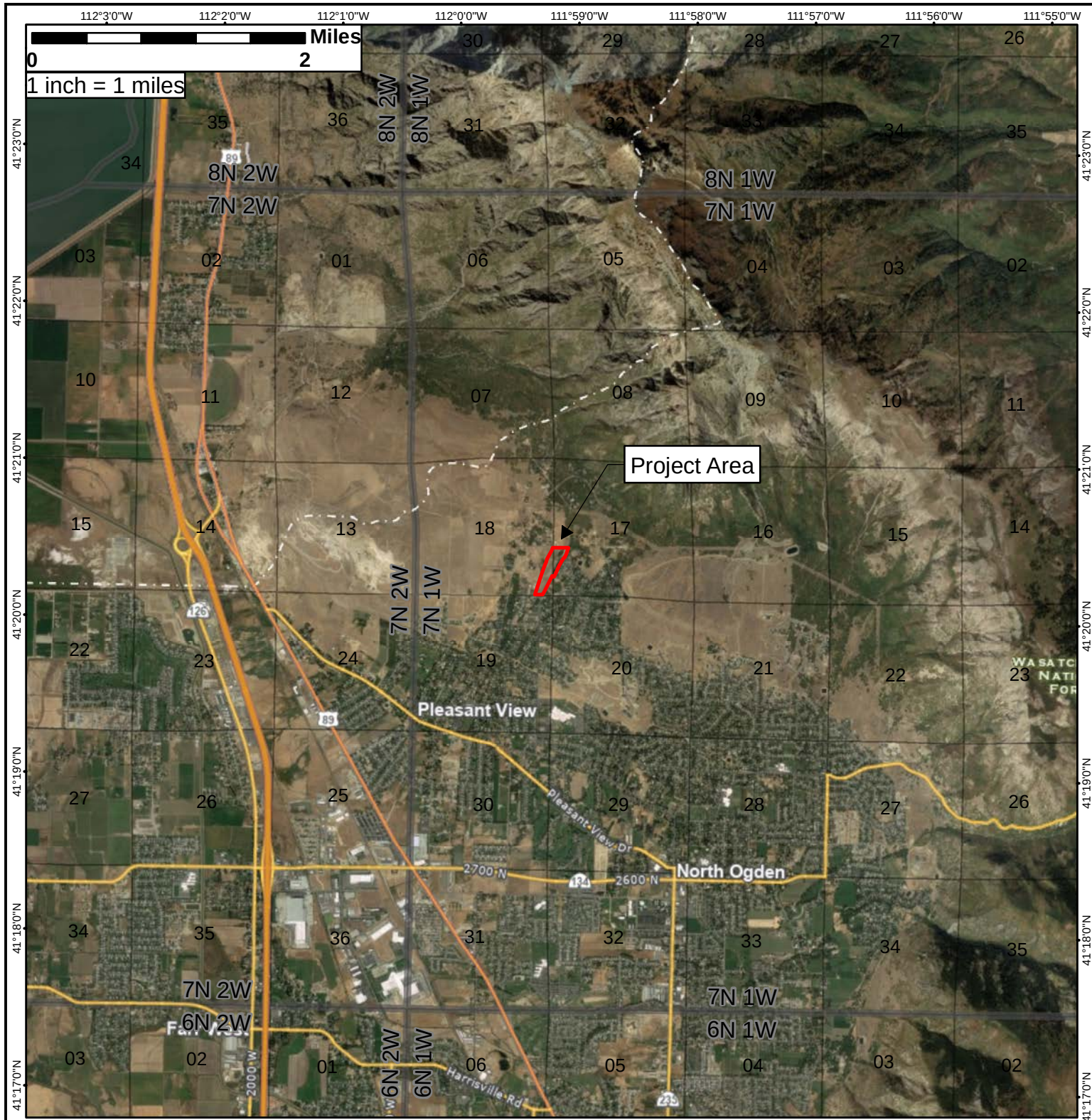
Table 3. Upland plant species identified in the project area.

Botanical Name	Common Name	2020 Arid West Indicator Status
<i>Achillea millefolium</i>	common yarrow	FACU
<i>Agropyron elongatum</i>	tall wheatgrass	UPL
<i>Bromus inermis</i>	smooth brome	UPL
<i>Bromus tectorum</i>	cheatgrass	UPL
<i>Cardaria draba</i>	whitetop	UPL
<i>Cirsium arvense</i>	Canada thistle	FACU
<i>Convolvulus arvensis</i>	field bindweed	UPL
<i>Cynoglossum officinale</i>	houndstongue	FACU
<i>Dactylis glomeratus</i>	orchardgrass	FACU
<i>Descurainia sophia</i>	flixseed tansy mustard	UPL
<i>Festuca pratensis</i>	meadow fescue	FACU
<i>Grindelia squarrosa</i>	curly cup gumweed	FACU
<i>Isatis tinctoria</i>	dyer's woad	UPL
<i>Maianthemum stellatum</i>	starry false lily of the valley	FACU
<i>Medicago sativa</i>	alfalfa	UPL
<i>Melilotus officinalis</i>	sweetclover	FACU
<i>Phleum pretense</i>	timothy	FACU
<i>Poa bulbosa</i>	bulbous bluegrass	FACU
<i>Taraxacum officinale</i>	dandelion	FACU
<i>Thlaspi arvense</i>	field pennycress	UPL
<i>Trifolium repens</i>	white clover	FACU

REFERENCES

- Cowardin, Lewis M., Carter, Virginia, Golet, Francis C., and LaRoe, Edward T. 1979. Classification of Wetlands and Deepwater Habitats of the United States. FWS/OBS-79/31. U.S. Fish and Wildlife Service, Washington, D.C.
- Curtis, Katherine E., and Lichvar, Robert W. 2010. Updated Datasheet for the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States. ERDC/CRREL TN-10-1. U.S. Army Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory.
- Lichvar, Robert W., and McColley, Shawn M. 2008. A Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States. ERDC/CRREL TR-08-12. U.S. Army Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory.
- Munsell Color Services. 2000. Munsell Soil Color Charts. Gretag Macbeth, New Windsor, New York.
- Natural Resources Conservation Service (NRCS). 2006. Field Indicators of Hydric Soils in the United States. Version 6.0.
- Natural Resources Conservation Service (NRCS). 2022. Web Soil Survey. Website: <http://websoilsurvey.nrcs.usda.gov>.
- U.S. Army Corps of Engineers - Engineering Laboratory (USACOE). 1987. Corps of Engineers Wetlands Delineation Manual (Online Edition). Technical Report Y-87-1. U.S. Army Engineers Waterways Experiment Station. Vicksburg, Mississippi.
- U.S. Army Corps of Engineers – Environmental Laboratory (USACOE). 2008. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region. Version 2.0. Report ERDC/EL TR-08-28. Vicksburg, Mississippi.
- U.S. Army Corps of Engineers 2020. National Wetland Plant List, version 3.5. U.S. Army Corps of Engineers. Engineer Research and Development Center. Cold Regions Research and Engineering Laboratory, Hanover, NH
- U.S. Department of Agriculture (USDA). 2022. The PLANTS Database, National Plant Data Center, Baton Rouge, LA 70874-4490 USA PLANTS. <https://plants.usda.gov/java/>
- U.S. Department of Agriculture (USDA). 2022. U.S. Drought Monitor. <http://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?UT>
- U.S. Environmental Protection Agency. 2008. Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in *Rapanos v. United States* & *Carabell v. United States*

APPENDIX A: MAPS



Project Location

Christofferson Farm

Sections 17 & 18
in T.7N, R.1W, S.L.B.&M.

Legend

Project Area

Projection:

NAD 83 UTM Zone 12N

Source:

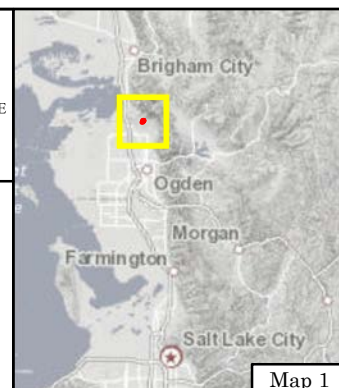
9/11/2018 Google Imagery

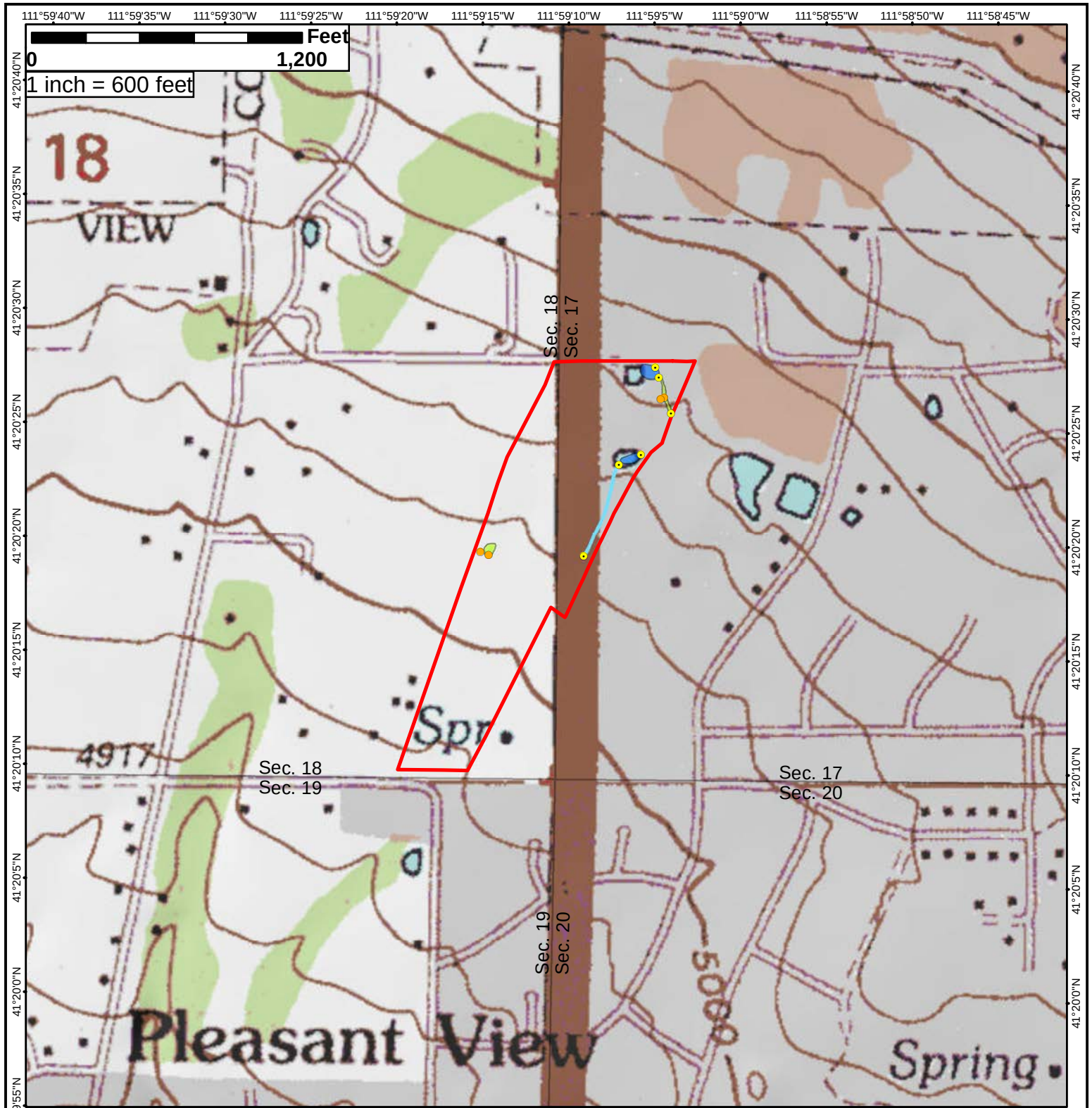
Survey Performed by
Todd Sherman



Wetland Resources, Inc.

Created: 5/12/2022
Author: CMM





Topographic Overview Christofferson Farm

Sections 17 & 18
in T.7N, R.1W, S.L.B.&M.

Legend

- Project Area
- Culverts
- Sample Points (SP)
- Palustrine Emergent Wetlands
- Irrigation Ponds
- Ditch

Projection:

NAD 83 UTM Zone 12N

Source:

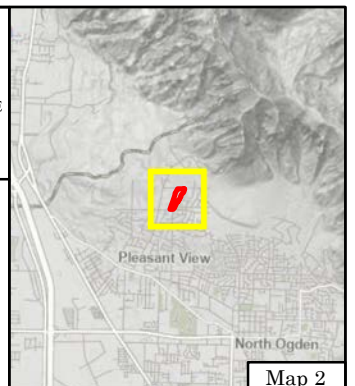
USGS 7.5' TopoQuad
North Ogden

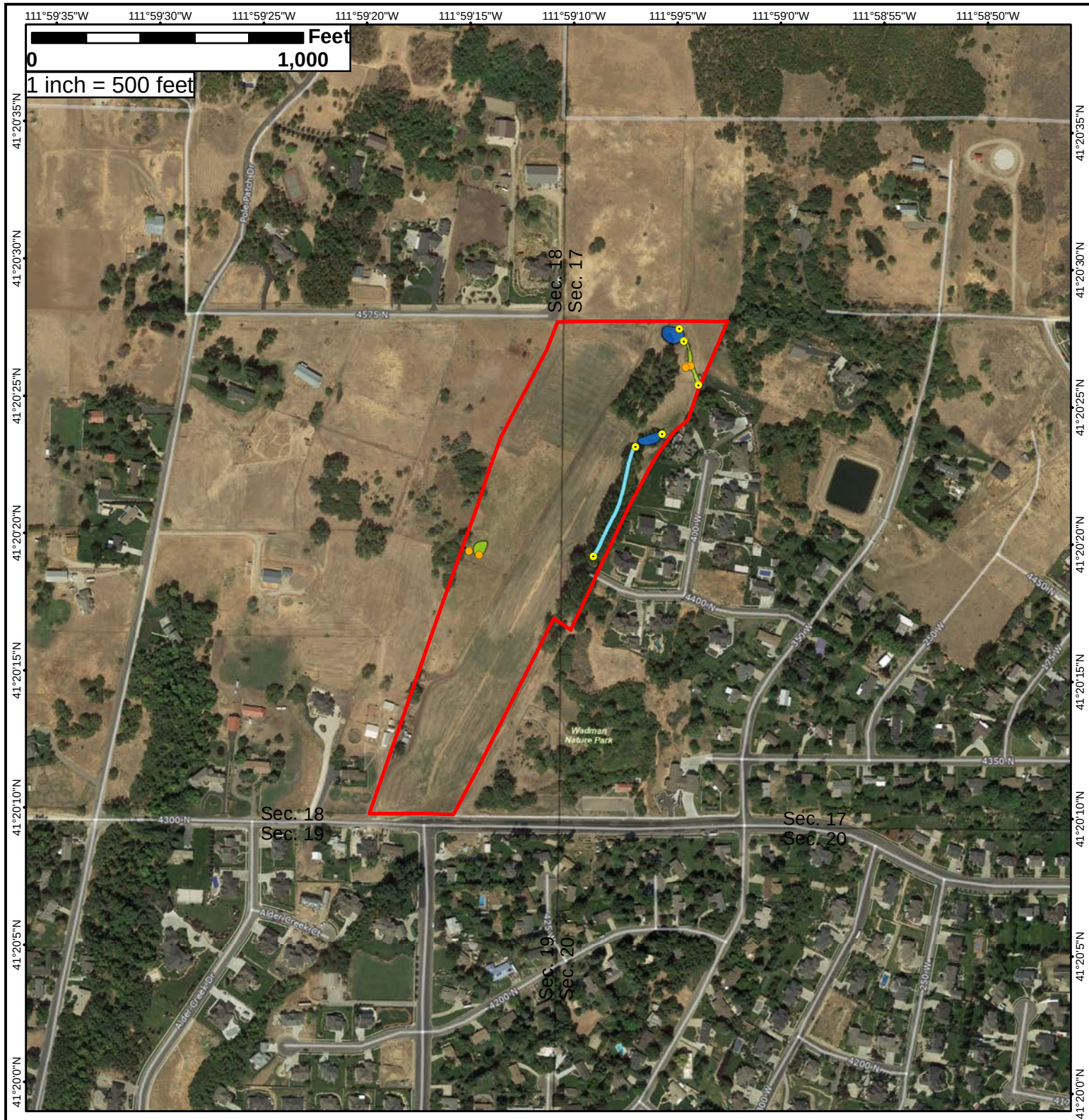
Survey Performed by
Todd Sherman



Wetland Resources, Inc.

Created: 5/12/2022
Author: CMM





Aerial Overview Christofferson Farm

Sections 17 & 18
in T.7N, R.1W, S.L.B.&M.

Legend

- Project Area
- Culverts
- Sample Points (SP)
- Palustrine Emergent Wetlands
- Irrigation Ponds
- Ditch

Projection:

NAD 83 UTM Zone 12N

Source:

9/11/2018 Google Imagery

Survey Performed by
Todd Sherman

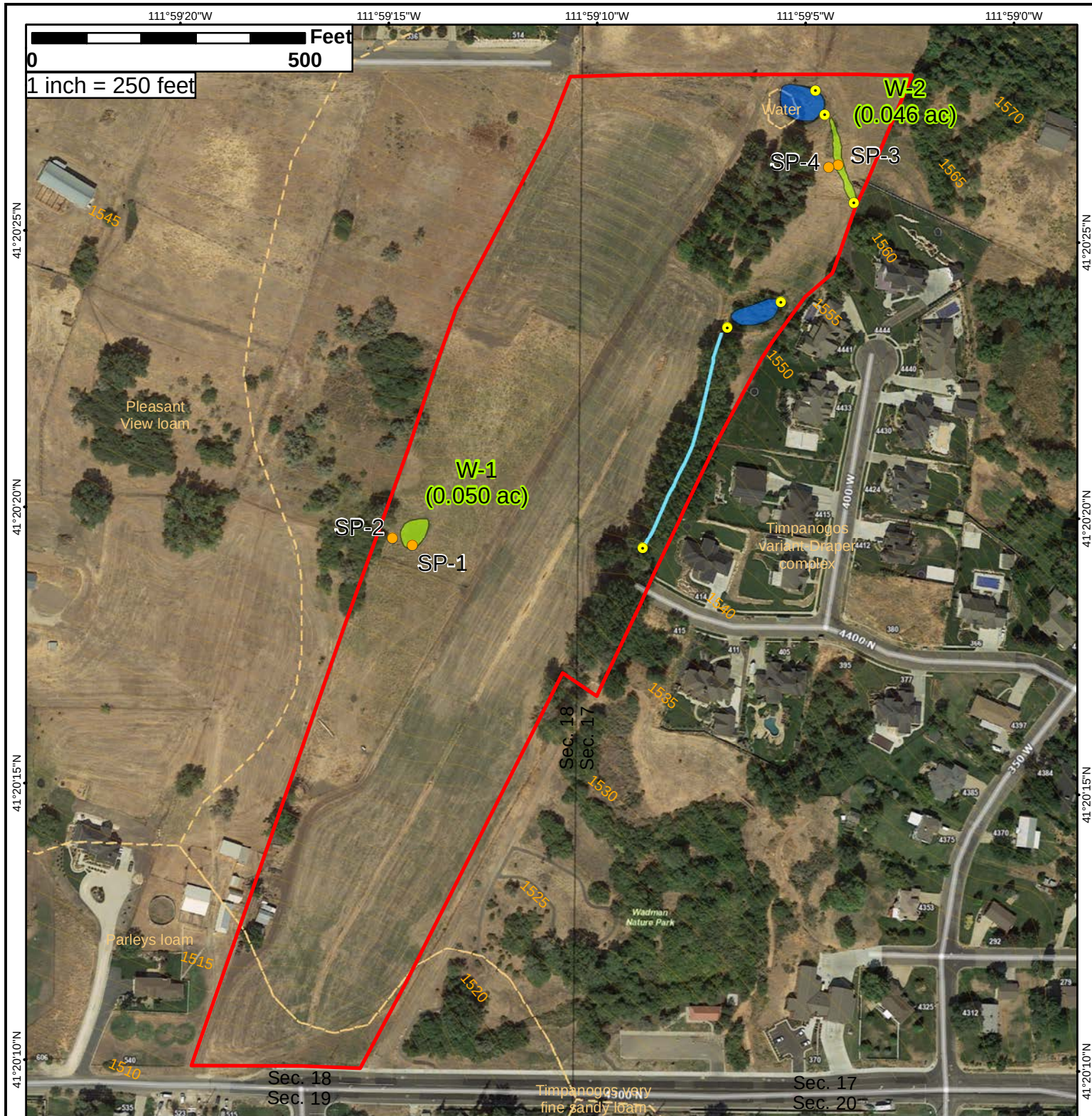


Wetland Resources, Inc.

Created: 5/12/2022
Author: CMM



Map 3



Delineation Detail Christofferson Farm

Project Dimensions:

Note: dimensions include entire project area

Project Area = 20.905 ac
Wetlands = 0.096 ac

Legend

- Project Area
- Culverts
- Sample Points (SP)
- Palustrine Emergent Wetlands
- Irrigation Ponds
- Ditch
- Soils
- Contours (1m height interval)

Projection:

NAD 83 UTM Zone 12N

Source:

9/11/2018 Google Imagery

Survey Performed by
Todd Sherman



Wetland Resources, Inc.

Created: 5/12/2022
Author: CMM



Map 4

APPENDIX B: PHOTOS



Photo 1.
Wetland W1,
view SE.



Photo 2.
Shallow
inundation in
Wetland W1,
while the
immediately
surrounding
areas are dry.



Photo 3.
Wetland W2 with
pond outlet pipe.
View SE.



Photo 4.
Wetland W2,
View North.



Photo 5.
Upper irrigation
pond.



Photo 6.
Upper irrigation
pond inlet pipe.



Photo 7.
Lower irrigation
pond, overtaken
by Phragmites.



Photo 8.
Small ditch with
no OHWM below
lower pond.

APPENDIX C: WETLAND DATA SHEETS

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Christofferson Farm **City/County:** Weber County **Sampling Date:** 04-May-22
Applicant/Owner: Canyon Ledge LLC **State:** UT **Sampling Point:** 01
Investigator(s): Todd Sherman **Section, Township, Range:** S 18 T 7N R 1W
Landform (hillslope, terrace, etc.): Footslope **Local relief (concave, convex, none):** flat **Slope:** 2.0 % / 1.1 °
Subregion (LRR): LRR D **Lat.:** 41.339349° **Long.:** -111.986302° **Datum:** WGS84
Soil Map Unit Name: Timpanogos variant-Draper complex, 3 to 10 percent slopes **NWI classification:** PEM

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐ , **Soil** ☐ , **or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ☒ No ☐
Are Vegetation ☐ , **Soil** ☐ , **or Hydrology** ☐ **naturally problematic?** (If needed, explain any answers in Remarks.)

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ☒ No ☐ Hydric Soil Present? Yes ☒ No ☐ Wetland Hydrology Present? Yes ☒ No ☐	Is the Sampled Area within a Wetland? Yes ☒ No ☐
Remarks: Small isolated patch of wetland vegetation at an apparent groundwater discharge zone.	

VEGETATION - Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species? Rel.Strat. Cover	Indicator Status	Dominance Test worksheet:
1. _____	0	☐ 0.0%	_____	Number of Dominant Species That are OBL, FACW, or FAC: <u>3</u> (A) Total Number of Dominant Species Across All Strata: <u>3</u> (B) Percent of dominant Species That Are OBL, FACW, or FAC: <u>100.0%</u> (A/B)
2. _____	0	☐ 0.0%	_____	
3. _____	0	☐ 0.0%	_____	
4. _____	0	☐ 0.0%	_____	
		0 = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)				Prevalence Index worksheet: Total % Cover of: Multiply by: OBL species <u>50</u> x 1 = <u>50</u> FACW species <u>30</u> x 2 = <u>60</u> FAC species <u>20</u> x 3 = <u>60</u> FACU species <u>0</u> x 4 = <u>0</u> UPL species <u>0</u> x 5 = <u>0</u> Column Totals: <u>100</u> (A) <u>170</u> (B) Prevalence Index = B/A = <u>1.700</u>
1. _____	0	☐ 0.0%	_____	
2. _____	0	☐ 0.0%	_____	
3. _____	0	☐ 0.0%	_____	
4. _____	0	☐ 0.0%	_____	
5. _____	0	☐ 0.0%	_____	
		0 = Total Cover		
Herb Stratum (Plot size: _____)				Hydrophytic Vegetation Indicators: ☒ Dominance Test is > 50% ☒ Prevalence Index is ≤ 3.0 ¹ ☐ Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) ☐ Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
1. <u>Carex nebrascensis</u>	50	☒ 50.0%	OBL	
2. <u>Trifolium fragiferum</u>	20	☒ 20.0%	FAC	
3. <u>Carex praegracilis</u>	20	☒ 20.0%	FACW	
4. <u>Juncus balticus</u>	10	☐ 10.0%	FACW	
5. _____	0	☐ 0.0%	_____	
6. _____	0	☐ 0.0%	_____	
7. _____	0	☐ 0.0%	_____	
8. _____	0	☐ 0.0%	_____	
9. _____	0	☐ 0.0%	_____	
10. _____	0	☐ 0.0%	_____	
11. _____	0	☐ 0.0%	_____	
		100 = Total Cover		
Woody Vine Stratum (Plot size: _____)				Hydrophytic Vegetation Present? Yes ☒ No ☐
1. _____	0	☐ 0.0%	_____	
2. _____	0	☐ 0.0%	_____	
		0 = Total Cover		
% Bare Ground in Herb Stratum: <u>0</u>		% Cover of Biotic Crust: <u>0</u>		

Remarks:
 The area meets the wetland vegetation criteria.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 01

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features						Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²				
0-6	10YR	2/1	100%						Loam	
6-20	10YR	2/1	40%	2.5YR	4/6	2%	C	M	Loam	
6-20	10YR	4/2	60%	2.5YR	4/6	2%	C	M	Loam	

¹ Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- | | |
|--|--|
| ☐ Histosol (A1) | ☐ Sandy Redox (S5) |
| ☐ Histic Epipedon (A2) | ☐ Stripped Matrix (S6) |
| ☐ Black Histic (A3) | ☐ Loamy Mucky Mineral (F1) |
| ☐ Hydrogen Sulfide (A4) | ☐ Loamy Gleyed Matrix (F2) |
| ☐ Stratified Layers (A5) (LRR C) | ☒ Depleted Matrix (F3) |
| ☐ 1 cm Muck (A9) (LRR D) | ☐ Redox Dark Surface (F6) |
| ☐ Depleted Below Dark Surface (A11) | ☐ Depleted Dark Surface (F7) |
| ☐ Thick Dark Surface (A12) | ☐ Redox depressions (F8) |
| ☐ Sandy Muck Mineral (S1) | ☐ Vernal Pools (F9) |
| ☐ Sandy Gleyed Matrix (S4) | |

Indicators for Problematic Hydric Soils:³

- ☐ 1 cm Muck (A9) (LRR C)
- ☐ 2 cm Muck (A10) (LRR B)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

³ Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ☒ No ☐

Remarks:

Soils meet the criteria for depleted matrix.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- | | |
|--|--|
| ☐ Surface Water (A1) | ☐ Salt Crust (B11) |
| ☒ High Water Table (A2) | ☐ Biotic Crust (B12) |
| ☒ Saturation (A3) | ☐ Aquatic Invertebrates (B13) |
| ☐ Water Marks (B1) (Nonriverine) | ☐ Hydrogen Sulfide Odor (C1) |
| ☐ Sediment Deposits (B2) (Nonriverine) | ☐ Oxidized Rhizospheres along Living Roots (C3) |
| ☐ Drift deposits (B3) (Nonriverine) | ☐ Presence of Reduced Iron (C4) |
| ☐ Surface Soil Cracks (B6) | ☐ Recent Iron Reduction in Plowed Soils (C6) |
| ☐ Inundation Visible on Aerial Imagery (B7) | ☐ Thin Muck Surface (C7) |
| ☐ Water-Stained Leaves (B9) | ☐ Other (Explain in Remarks) |

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (Riverine)
- ☐ Sediment Deposits (B2) (Riverine)
- ☐ Drift Deposits (B3) (Riverine)
- ☐ Drainage Patterns (B10)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☒ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (inches): _____

Water Table Present? Yes ☒ No ☐ Depth (inches): 2

Saturation Present? (includes capillary fringe) Yes ☒ No ☐ Depth (inches): 0

Wetland Hydrology Present? Yes ☒ No ☐

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

Soils are saturated at the surface, with a water table depth of 2 inches.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Christofferson Farm City/County: Weber County Sampling Date: 04-May-22
 Applicant/Owner: Canyon Ledge LLC State: UT Sampling Point: 02
 Investigator(s): Todd Sherman Section, Township, Range: S 18 T 7N R 1W
 Landform (hillslope, terrace, etc.): Footslope Local relief (concave, convex, none): convex Slope: 6.0 % / 3.4 °
 Subregion (LRR): LRR D Lat.: 41.339349° Long.: -111.986302° Datum: WGS84
 Soil Map Unit Name: Timpanogos variant-Draper complex, 3 to 10 percent slopes NWI classification: Upland

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)
 Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐
 Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ☐ No ☒	Is the Sampled Area within a Wetland? Yes ☐ No ☒
Hydric Soil Present? Yes ☐ No ☒	
Wetland Hydrology Present? Yes ☐ No ☒	
Remarks: <u>Upland adjacent to SP-1.</u>	

VEGETATION - Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species? Rel.Strat. Cover	Indicator Status	Dominance Test worksheet: Number of Dominant Species That are OBL, FACW, or FAC: <u>0</u> (A) Total Number of Dominant Species Across All Strata: <u>1</u> (B) Percent of dominant Species That Are OBL, FACW, or FAC: <u>0.0%</u> (A/B)
1. _____	0	☐ 0.0%	_____	
2. _____	0	☐ 0.0%	_____	
3. _____	0	☐ 0.0%	_____	
4. _____	0	☐ 0.0%	_____	
	0	= Total Cover		
Sapling/Shrub Stratum (Plot size: _____)				
1. _____	0	☐ 0.0%	_____	Prevalence Index worksheet: Total % Cover of: _____ Multiply by: OBL species <u>0</u> x 1 = <u>0</u> FACW species <u>0</u> x 2 = <u>0</u> FAC species <u>15</u> x 3 = <u>45</u> FACU species <u>85</u> x 4 = <u>340</u> UPL species <u>0</u> x 5 = <u>0</u> Column Totals: <u>100</u> (A) <u>385</u> (B) Prevalence Index = B/A = <u>3.850</u>
2. _____	0	☐ 0.0%	_____	
3. _____	0	☐ 0.0%	_____	
4. _____	0	☐ 0.0%	_____	
5. _____	0	☐ 0.0%	_____	
	0	= Total Cover		
Herb Stratum (Plot size: _____)				
1. <u>Festuca pratensis</u>	75	☒ 75.0%	FACU	Hydrophytic Vegetation Indicators: ☐ Dominance Test is > 50% ☐ Prevalence Index is ≤ 3.0 ¹ ☐ Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) ☐ Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
2. <u>Trifolium fragiferum</u>	10	☐ 10.0%	FAC	
3. <u>Taraxacum officinale</u>	5	☐ 5.0%	FACU	
4. <u>Phleum pratense</u>	5	☐ 5.0%	FACU	
5. <u>Dipsacus fullonum</u>	5	☐ 5.0%	FAC	
6. _____	0	☐ 0.0%	_____	
7. _____	0	☐ 0.0%	_____	
8. _____	0	☐ 0.0%	_____	
9. _____	0	☐ 0.0%	_____	
10. _____	0	☐ 0.0%	_____	
11. _____	0	☐ 0.0%	_____	
	100	= Total Cover		
Woody Vine Stratum (Plot size: _____)				
1. _____	0	☐ 0.0%	_____	Hydrophytic Vegetation Present? Yes ☐ No ☒
2. _____	0	☐ 0.0%	_____	
	0	= Total Cover		
% Bare Ground in Herb Stratum: <u>0</u> % Cover of Biotic Crust: <u>0</u>				

Remarks:

The area does not meet the wetland vegetation criteria.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 02[illegible]

Hydrology

Wetland Hydrology Indicators:		
Primary Indicators (minimum of one required; check all that apply)		Secondary Indicators (2 or more required)
☐ Surface Water (A1)	☐ Salt Crust (B11)	☐ Water Marks (B1) (Riverine)
☐ High Water Table (A2)	☐ Biotic Crust (B12)	☐ Sediment Deposits (B2) (Riverine)
☐ Saturation (A3)	☐ Aquatic Invertebrates (B13)	☐ Drift Deposits (B3) (Riverine)
☐ Water Marks (B1) (Nonriverine)	☐ Hydrogen Sulfide Odor (C1)	☐ Drainage Patterns (B10)
☐ Sediment Deposits (B2) (Nonriverine)	☐ Oxidized Rhizospheres along Living Roots (C3)	☐ Dry Season Water Table (C2)
☐ Drift deposits (B3) (Nonriverine)	☐ Presence of Reduced Iron (C4)	☐ Crayfish Burrows (C8)
☐ Surface Soil Cracks (B6)	☐ Recent Iron Reduction in Plowed Soils (C6)	☐ Saturation Visible on Aerial Imagery (C9)
☐ Inundation Visible on Aerial Imagery (B7)	☐ Thin Muck Surface (C7)	☐ Shallow Aquitard (D3)
☐ Water-Stained Leaves (B9)	☐ Other (Explain in Remarks)	☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☐	No ☒	Depth (inches): _____
Water Table Present?	Yes ☐	No ☒	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes ☐	No ☒	Depth (inches): _____

Wetland Hydrology Present? Yes ☐ No ☒

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available: _____

Remarks:

 No indicators of wetland hydrology.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Christofferson Farm **City/County:** Weber County **Sampling Date:** 04-May-22
Applicant/Owner: Canyon Ledge LLC **State:** UT **Sampling Point:** 03
Investigator(s): Todd Sherman **Section, Township, Range:** S 17 T 7N R 1W
Landform (hillslope, terrace, etc.): Footslope **Local relief (concave, convex, none):** convex **Slope:** 10.0 % / 5.7 °
Subregion (LRR): LRR D **Lat.:** 41.339349° **Long.:** -111.986302° **Datum:** WGS84
Soil Map Unit Name: Timpanogos variant-Draper complex, 3 to 10 percent slopes **NWI classification:** PEM

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)
 Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐
 Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ☒ No ☐ Hydric Soil Present? Yes ☒ No ☐ Wetland Hydrology Present? Yes ☒ No ☐	Is the Sampled Area within a Wetland? Yes ☒ No ☐
Remarks: Drainage slope below a man-made irrigation pond	

VEGETATION - Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species? Rel.Strat. Cover	Indicator Status	Dominance Test worksheet:
1. _____	0	☐ 0.0%	_____	Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)
2. _____	0	☐ 0.0%	_____	Total Number of Dominant Species Across All Strata: 3 (B)
3. _____	0	☐ 0.0%	_____	Percent of dominant Species That Are OBL, FACW, or FAC: 66.7% (A/B)
4. _____	0	☐ 0.0%	_____	
	0	= Total Cover		
Sapling/Shrub Stratum (Plot size: _____)				Prevalence Index worksheet: Total % Cover of: Multiply by: OBL species 30 x 1 = 30 FACW species 5 x 2 = 10 FAC species 35 x 3 = 105 FACU species 0 x 4 = 0 UPL species 30 x 5 = 150 Column Totals: 100 (A) 295 (B) Prevalence Index = B/A = 2.950
1. _____	0	☐ 0.0%	_____	Hydrophytic Vegetation Indicators: ☒ Dominance Test is > 50% ☒ Prevalence Index is ≤ 3.0 ¹ ☐ Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) ☐ Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
2. _____	0	☐ 0.0%	_____	
3. _____	0	☐ 0.0%	_____	
4. _____	0	☐ 0.0%	_____	
5. _____	0	☐ 0.0%	_____	
	0	= Total Cover		
Herb Stratum (Plot size: _____)				
1. Agropyron elongatum	30	☒ 30.0%	UPL	
2. Hordeum jubatum	30	☒ 30.0%	FAC	
3. Carex nebrascensis	20	☒ 20.0%	OBL	
4. Ranunculus sceleratus	10	☐ 10.0%	OBL	
5. Juncus balticus	5	☐ 5.0%	FACW	
6. Rumex crispus	5	☐ 5.0%	FAC	
7. _____	0	☐ 0.0%	_____	
8. _____	0	☐ 0.0%	_____	
9. _____	0	☐ 0.0%	_____	
10. _____	0	☐ 0.0%	_____	
11. _____	0	☐ 0.0%	_____	
	100	= Total Cover		
Woody Vine Stratum (Plot size: _____)				
1. _____	0	☐ 0.0%	_____	Hydrophytic Vegetation Present? Yes ☒ No ☐
2. _____	0	☐ 0.0%	_____	
	0	= Total Cover		
% Bare Ground in Herb Stratum: 0 % Cover of Biotic Crust: 0				

Remarks:
 The area meets the wetland vegetation criteria.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 03[illegible]

Hydrology

Wetland Hydrology Indicators:			
Primary Indicators (minimum of one required; check all that apply)		Secondary Indicators (2 or more required)	
☒ Surface Water (A1)	☐ Salt Crust (B11)	☐ Water Marks (B1) (Riverine)	
☐ High Water Table (A2)	☐ Biotic Crust (B12)	☐ Sediment Deposits (B2) (Riverine)	
☐ Saturation (A3)	☐ Aquatic Invertebrates (B13)	☐ Drift Deposits (B3) (Riverine)	
☐ Water Marks (B1) (Nonriverine)	☐ Hydrogen Sulfide Odor (C1)	☐ Drainage Patterns (B10)	
☐ Sediment Deposits (B2) (Nonriverine)	☐ Oxidized Rhizospheres along Living Roots (C3)	☐ Dry Season Water Table (C2)	
☐ Drift deposits (B3) (Nonriverine)	☐ Presence of Reduced Iron (C4)	☐ Crayfish Burrows (C8)	
☐ Surface Soil Cracks (B6)	☐ Recent Iron Reduction in Plowed Soils (C6)	☐ Saturation Visible on Aerial Imagery (C9)	
☐ Inundation Visible on Aerial Imagery (B7)	☐ Thin Muck Surface (C7)	☐ Shallow Aquitard (D3)	
☐ Water-Stained Leaves (B9)	☐ Other (Explain in Remarks)	☐ FAC-neutral Test (D5)	
Field Observations: Surface Water Present? Yes ☒ No ☐ Depth (inches): 1 Water Table Present? Yes ☐ No ☒ Depth (inches): Saturation Present? (includes capillary fringe) Yes ☐ No ☒ Depth (inches): Wetland Hydrology Present? Yes ☒ No ☐			
Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:			
Remarks: The soils are inundated, but are only saturated in the upper 10 inches. Soils are only moist below that depth.			

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Christofferson Farm **City/County:** Weber County **Sampling Date:** 04-May-22
Applicant/Owner: Canyon Ledge LLC **State:** UT **Sampling Point:** 04
Investigator(s): Todd Sherman **Section, Township, Range:** S 17 T 7N R 1W
Landform (hillslope, terrace, etc.): Footslope **Local relief (concave, convex, none):** convex **Slope:** 10.0 % / 5.7 °
Subregion (LRR): LRR D **Lat.:** 41.339349° **Long.:** -111.986302° **Datum:** WGS84
Soil Map Unit Name: Parleys Loam, 6-10% slopes **NWI classification:** Upland

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)
 Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐
 Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ☐ No ☒ Hydric Soil Present? Yes ☐ No ☒ Wetland Hydrology Present? Yes ☐ No ☒	Is the Sampled Area within a Wetland? Yes ☐ No ☒
Remarks: Upland adjacent to SP-3.	

VEGETATION - Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species? Rel.Strat. Cover	Indicator Status
1. _____	0	☐ 0.0%	_____
2. _____	0	☐ 0.0%	_____
3. _____	0	☐ 0.0%	_____
4. _____	0	☐ 0.0%	_____
0 = Total Cover			
Sapling/Shrub Stratum (Plot size: _____)			
1. _____	0	☐ 0.0%	_____
2. _____	0	☐ 0.0%	_____
3. _____	0	☐ 0.0%	_____
4. _____	0	☐ 0.0%	_____
5. _____	0	☐ 0.0%	_____
0 = Total Cover			
Herb Stratum (Plot size: _____)			
1. Poa bulbosa	80	☒ 80.0%	FACU
2. Festuca pratensis	20	☒ 20.0%	FACU
3. _____	0	☐ 0.0%	_____
4. _____	0	☐ 0.0%	_____
5. _____	0	☐ 0.0%	_____
6. _____	0	☐ 0.0%	_____
7. _____	0	☐ 0.0%	_____
8. _____	0	☐ 0.0%	_____
9. _____	0	☐ 0.0%	_____
10. _____	0	☐ 0.0%	_____
11. _____	0	☐ 0.0%	_____
100 = Total Cover			
Woody Vine Stratum (Plot size: _____)			
1. _____	0	☐ 0.0%	_____
2. _____	0	☐ 0.0%	_____
0 = Total Cover			
% Bare Ground in Herb Stratum: 0	% Cover of Biotic Crust: 0		

Dominance Test worksheet:
 Number of Dominant Species That are OBL, FACW, or FAC: 0 (A)
 Total Number of Dominant Species Across All Strata: 2 (B)
 Percent of dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:
 Total % Cover of: Multiply by:
 OBL species 0 x 1 = 0
 FACW species 0 x 2 = 0
 FAC species 0 x 3 = 0
 FACU species 100 x 4 = 400
 UPL species 0 x 5 = 0
Column Totals: 100 (A) 400 (B)
 Prevalence Index = B/A = 4.000

Hydrophytic Vegetation Indicators:
☐ Dominance Test is > 50%
☐ Prevalence Index is ≤3.0¹
☐ Morphological Adaptations¹ (Provide supporting data in Remarks or on a separate sheet)
☐ Problematic Hydrophytic Vegetation¹ (Explain)

¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ☐ No ☒

Remarks:

The area does not meet the wetland vegetation criteria.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 04

[illegible]

Hydrology

Wetland Hydrology Indicators:		
Primary Indicators (minimum of one required; check all that apply) ☐ Surface Water (A1) ☐ High Water Table (A2) ☐ Saturation (A3) ☐ Water Marks (B1) (Nonriverine) ☐ Sediment Deposits (B2) (Nonriverine) ☐ Drift deposits (B3) (Nonriverine) ☐ Surface Soil Cracks (B6) ☐ Inundation Visible on Aerial Imagery (B7) ☐ Water-Stained Leaves (B9) ☐ Salt Crust (B11) ☐ Biotic Crust (B12) ☐ Aquatic Invertebrates (B13) ☐ Hydrogen Sulfide Odor (C1) ☐ Oxidized Rhizospheres along Living Roots (C3) ☐ Presence of Reduced Iron (C4) ☐ Recent Iron Reduction in Plowed Soils (C6) ☐ Thin Muck Surface (C7) ☐ Other (Explain in Remarks) Secondary Indicators (2 or more required) ☐ Water Marks (B1) (Riverine) ☐ Sediment Deposits (B2) (Riverine) ☐ Drift Deposits (B3) (Riverine) ☐ Drainage Patterns (B10) ☐ Dry Season Water Table (C2) ☐ Crayfish Burrows (C8) ☐ Saturation Visible on Aerial Imagery (C9) ☐ Shallow Aquitard (D3) ☐ FAC-neutral Test (D5)		
Field Observations: Surface Water Present? Yes ☐ No ☒ Water Table Present? Yes ☐ No ☒ Saturation Present? (includes capillary fringe) Yes ☐ No ☒ Depth (inches): _____ Depth (inches): _____ Depth (inches): _____ Wetland Hydrology Present? Yes ☐ No ☒		
<u>Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:</u> _____		
Remarks: No indicators of wetland hydrology.		



ENGINEERING • GEOTECHNICAL • ENVIRONMENTAL (ESA I & II) •
MATERIALS TESTING • SPECIAL INSPECTIONS •
ORGANIC CHEMISTRY • PAVEMENT
DESIGN • GEOLOGY

GEOTECHNICAL ENGINEERING STUDY

Christofferson Farm Development

About 500 West 4300 North
Pleasant View, Utah

CMT PROJECT NO. 18803

FOR:

Canyon Ledge, LLC
6841 S 1300 E
Salt Lake City, Utah 84121

August 18, 2022

CMT TECHNICAL SERVICES

August 18, 2022

Mr. Jaiden Olsen
Canyon Ledge, LLC
6841 S 1300 E
Salt Lake City, Utah 84121

Subject: Geotechnical Engineering Study
Christofferson Farm Development
About 500 West 4300 North
Pleasant View, Utah
CMT Project No. 18813

Mr. Olsen:

Submitted herewith is the report of our geotechnical engineering study for the subject site. This report contains the results of our findings and an engineering interpretation of the results with respect to the available project characteristics. It also contains recommendations to aid in the design and construction of the earth related phases of this project.

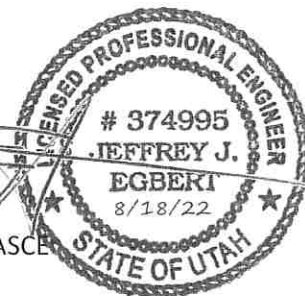
On July 19, 2022, a CMT Technical Services (CMT) staff professional was on-site and supervised the excavation of 10 test pits extending to depths of about 6 to 8 feet below the existing ground surface. Samples of the subsurface soils were collected from the test pits during the field operations that were subsequently transported to our laboratory for further testing and observation.

Conventional spread and/or continuous footings may be utilized to support the proposed residences, provided the recommendations in this report are followed. This report presents detailed discussions of design and construction criteria for this site.

We appreciate the opportunity to work with you at this stage of the project. CMT offers a full range of Geotechnical Engineering, Geological, Material Testing, Special Inspection services, and Phase I and II Environmental Site Assessments. With offices throughout Utah, Idaho, Arizona, Colorado and Texas, our staff is capable of efficiently serving your project needs. If we can be of further assistance or if you have any questions regarding this project, please do not hesitate to contact us at 801-590-0394.

Sincerely,
CMT Technical Services

Jeffrey J. Egbert, P.E., LEED A.P., M. ASCE
Senior Geotechnical Engineer



Reviewed by:

Andrew M. Harris, P.E.
Geotechnical Division Manager

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1.0 INTRODUCTION

1.1 General

CMT Technical Services (CMT) was retained to conduct a geotechnical subsurface study for the proposed development of approximately 26.7 acres as a single-family residential subdivision. The parcel is situated on the north side of 4300 North Street at about 500 West in Pleasant View, Utah, as shown in the **Vicinity Map** below.



VICINITY MAP

1.2 Objectives, Scope and Authorization

The objectives and scope of our study were planned in discussions among Dr. Val Poll, Mr. Jaiden Olsen of Canyon Ledge, LLC, and Mr. Andrew Harris of CMT. In general, the objectives of this study were to define and evaluate the subsurface soil and groundwater conditions at the site, and provide appropriate foundation, earthwork, pavement and seismic recommendations to be utilized in the design and construction of the proposed development.

In accomplishing these objectives, our scope of work included performing field exploration, which consisted of the excavating/logging/sampling of 10 test pits, performing laboratory testing on representative samples of the

subsurface soils collected in the test pits, and conducting an office program, which consisted of correlating available data, performing engineering analyses, and preparing this summary report. This scope of work was authorized by returning a signed copy of our proposal dated June 24, 2022 and executed on June 29, 2022.

1.3 Description of Proposed Construction

We understand that single family residential subdivision and associated infrastructure is planned for approximately 26.7-acre site. The site may be subdivided into 5-acre lots, or rezoned to allow 0.5-acre lots. The residences will likely be 1 to 2 levels above grade, constructed using conventional wood framing, founded on spread footings, with basements (groundwater conditions permitting). Maximum continuous wall and column loads are anticipated to be 1,000 to 3,000 pounds per lineal foot and 10,000 to 50,000 pounds, respectively. Uniform floor loads are expected to not exceed 100 pounds per square foot. If the structural loading conditions are different than we have projected, please notify us so that any appropriate modifications to our conclusions and recommendations contained herein can be made.

We understand that pavements at the site will include internal residential streets, which we anticipate will be surfaced with asphalt concrete. Traffic is projected to consist of mostly automobiles and light trucks, a few daily medium-weight delivery trucks, a weekly garbage truck, and an occasional fire truck.

Site development will require some earthwork in the form of minor cutting and filling. A site grading plan was not available at the time of this report, but we project that maximum cuts and fills may be on the order of 2 to 3 feet. If deeper cuts or fills are planned, CMT should be notified to provide additional recommendations, if needed.

1.4 Executive Summary

Proposed residences can be supported upon conventional spread and continuous wall foundations. The most significant geotechnical aspects regarding site development include the following:

1. Vegetation, and topsoil 6 to 18 inches in thickness across the site to be removed;
2. Subsurface natural soils consist predominately of SAND (SM), with some layers of SILT (ML) and CLAY (CL-ML), extending to the maximum depth explored of approximately 8 feet below the existing site grades;
3. Groundwater was encountered in test pits TP-4 and TP-6 at depths of between 6.0 and 6.5 feet below the existing site grades, and later measured at 7 feet in TP-4. Groundwater was not encountered in the other test pits; and
4. Foundations and floor slabs may be placed on suitable, undisturbed natural soils or on properly placed and compacted structural fill extending to suitable, undisturbed natural soils.

CMT must assess that topsoil, undocumented fills (if encountered), debris, disturbed or unsuitable soils have been removed and that suitable soils have been encountered prior to placing site grading fills, footings, slabs, and pavements.

In the following sections, detailed discussions pertaining to the site are provided, including subsurface descriptions, geologic/seismic setting, earthwork, foundations, lateral resistance, lateral pressure, floor slabs, and pavements.

2.0 FIELD EXPLORATION

2.1 General

In order to define and evaluate the subsurface soil and groundwater conditions, 10 test pits were excavated with a backhoe at the site to depths of approximately 6 to 8 feet below the existing ground surface. Locations of the test pits are shown on **Figure 1, Site Plan**, included in the Appendix. The field exploration was performed under the supervision of an experienced member of our geotechnical staff.

Representative samples of the subsurface soils encountered were collected by obtaining disturbed "grab" samples, utilizing a 2.5-inch outside diameter thin-wall drive sampler, and cutting relatively undisturbed "block" samples from within the test pits. The samples were sealed in plastic bags and containers prior to transport to the laboratory.

The subsurface soils encountered in the test pits were classified in the field based upon visual and textural examination, logged and described in general accordance with ASTM¹ D-2488. These field classifications were supplemented by subsequent examination and testing of select samples in our laboratory. Graphical representations of the subsurface conditions encountered are presented on each individual Test Pit Log, **Figures 2 through 11**, included in the Appendix. A Key to Symbols defining the terms and symbols used on the logs, is provided as **Figure 12** in the Appendix.

Following completion of excavating operations, 1.25-inch diameter slotted PVC pipe was installed in test pit TP-4 to allow subsequent water level measurements.

Upon completion of logging and sampling, the test pits were backfilled with the excavated soils. When backfilling, minimal to no effort was made to compact the backfill and no compaction testing was performed. Thus, the test pit backfill is considered undocumented fill and settlement of the backfill in the test pits over time should be anticipated.

2.2 Infiltration Testing

We also performed infiltration testing as part of our field exploration. The testing consisted of creating and filling a small hole at the test depth with water, and measuring the rate of water drop within the small hole over a certain time period (i.e. 15 minutes). We repeated this process multiple times until subsequent readings were the same. Test locations are noted on **Figure 1**. The south test was conducted at a depth of approximately 4 feet below the existing ground surface in natural silty sand soils. The final measured infiltration rate was approximately 11.5 minutes per inch. The northern test was conducted at a similar depth in similar natural soils.

¹American Society for Testing and Materials

The measured rate was 15 minutes per inch. These rates could increase (become slower) over time due to siltation, thus we recommend an appropriate factor of safety be applied for design.

3.0 LABORATORY TESTING

Selected samples of the subsurface soils were subjected to various laboratory tests to assess pertinent engineering properties, as follows:

1. Moisture Content, ASTM D-2216, Percent moisture representative of field conditions
2. Dry Density, ASTM D-2937, Dry unit weight representing field conditions
3. Atterberg Limits, ASTM D-4318, Plasticity and workability
4. Gradation Analysis, ASTM D-1140/C-117, Grain Size Analysis
5. One Dimension Consolidation, ASTM D-2435, Consolidation properties

To provide data necessary for an assessment of potential settlement from structural loads a consolidation test was performed on each of 2 representative samples of the natural soils encountered across the site. Based upon data obtained from the consolidation testing, the soils at this site are moderately over-consolidated and have slightly high compressibility under additional loading. Detailed results of the consolidation tests are maintained within our files and can be transmitted to you, if so desired.

Laboratory test results are presented on the test pit logs (**Figures 2 through 11**) and in the following **Lab Summary Table**:

LAB SUMMARY TABLE

TEST PIT	DEPTH (feet)	SOIL CLASS	SAMPLE TYPE	MOISTURE CONTENT(%)	DRY DENSITY (pcf)	GRADATION			ATTERBERG LIMITS			COLLAPSE (-)/ EXPANSION(+)
						GRAV.	SAND	FINES	LL	PL	PI	
TP-1	2.5	CL-ML	Rings	4	96			58				
TP-1	5	CL-ML	Bag	9				54	24	18	6	
TP-2	3	SM	Bag	5		1	58	41				
TP-3	3	SM	Bag	6		25	49	26				
TP-4	2.5	SM/ML	Bag	15				49		NP	NP	
TP-4	5	ML	Bag	20				53				
TP-5	2	SM	Bag	3				43		NP	NP	
TP-5	5	SM	Rings	6	100							
TP-5	7.5	SM	Bag	11				40				
TP-6	2.5	SM	Bag	15				48				
TP-6	5	SM	Bag	18				20		NP	NP	
TP-6	7.5	SM	Bag	15		7	71	22				
TP-7	5	ML	Bag	2		3	37	60				
TP-7	7.5	SM	Bag	5				47				
TP-8	3	SM	Bag	5		12	70	18				
TP-10	2	SM	Bag	3		8	70	22				

4.0 GEOLOGIC & SEISMIC CONDITIONS

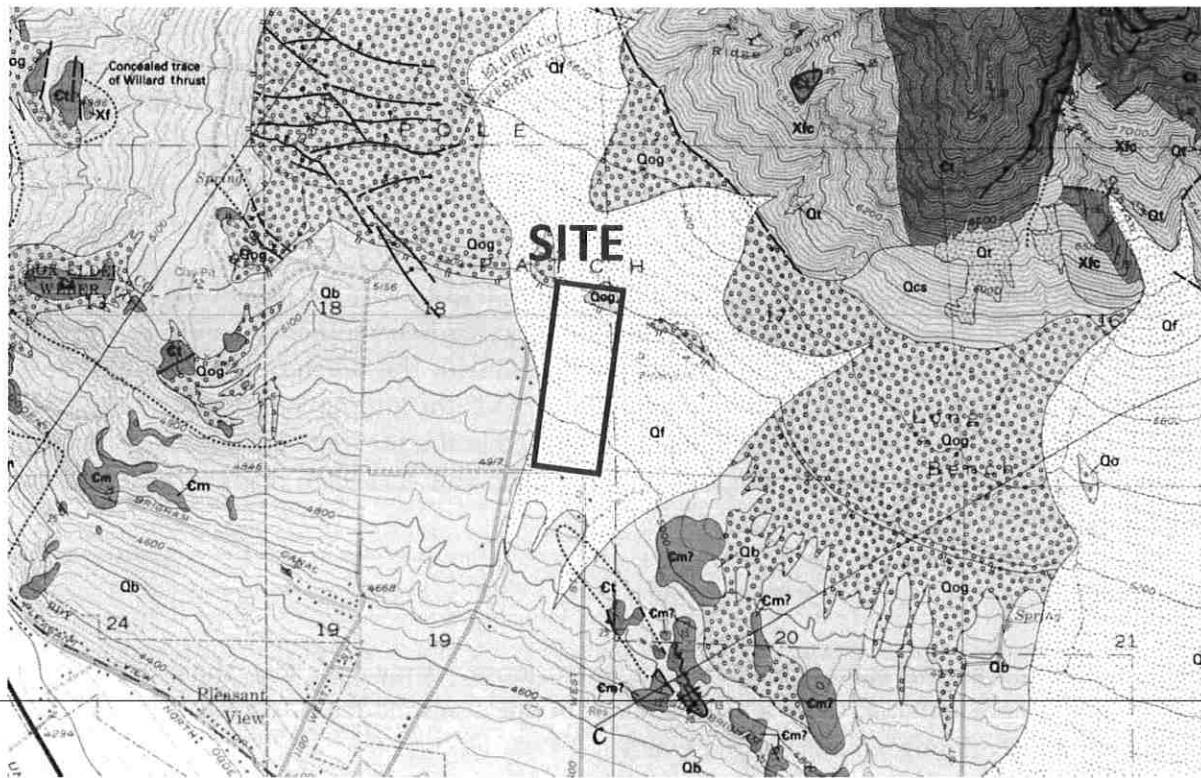
4.1 Geologic Setting

The subject site is located in the north-central portion of Weber County in north-central Utah. The site sits at an elevation of between approximately 4,965 and 5,133 feet above sea level. The site is located in the northeast portion of a valley bound by the Wasatch Mountains on the east and Antelope Island (Great Salt Lake) and the Promontory Mountains to the west. The valley is a deep, sediment-filled basin that is part of the Basin and Range Physiographic Province. The valley was formed by extensional tectonic processes during the Tertiary and Quaternary geologic time periods. The valley is located within the Intermountain Seismic Belt, a zone of ongoing tectonism and seismic activity extending from southwestern Montana to southwestern Utah. The active (evidence of movement in the last 10,000 years) Wasatch Fault Zone is part of the Intermountain Seismic Belt and extends from southeastern Idaho to central Utah along the western base of the Wasatch Mountain Range.

Much of northwestern Utah, including the valley in which the subject site is located, was also previously covered by the Pleistocene age Lake Bonneville. The Great Salt Lake, located along the western margin of the valley and beyond, is a remnant of this ancient fresh water lake. Lake Bonneville reached a high-stand elevation of between approximately 5,160 and 5,200 feet above sea level at between 18,500 and 17,400 years ago. Approximately 17,400 years ago, the lake breached its basin in southeastern Idaho and dropped by almost 300 feet relatively fast as water drained into the Snake River. Following this catastrophic release, the lake level continued to drop slowly over time, primarily driven by drier climatic conditions, until reaching the current level of the Great Salt Lake. Shoreline terraces formed at the high-stand elevation of the lake and several subsequent lower lake levels are visible in places on the mountain slopes surrounding the valley. Much of the sediment within the Valley was deposited as lacustrine sediments during both the transgressive (rise) and regressive (fall) phases of Lake Bonneville and in older, pre-Bonneville lakes that previously occupied the basin.

The geology of the North Ogden 7.5' Quadrangle has been mapped by Crittenden and others². The surficial geology at the site and surrounding areas is mapped as "Alluvial Fan Deposits" (Map Unit Qf) dated Holocene and "Older Gravel Deposit" (Map Unit Qog) dated Pleistocene. Unit Qf is described in the referenced map as "Boulder- to pebble-size gravel, sand, and silt in alluvial fans along Wasatch front and along west edge of Ogden Valley. Deposited after high stand of Lake Bonneville; thickness 0-60 m." Unit Qog is described as "Deposits of boulders, cobbles and sand in low-angle alluvial cones along the Wasatch front and locally in stream canyons. Mostly older than high stand of Lake Bonneville; thickness 0-100? M." No fill has been mapped at the subject site. Refer to the **Geologic Map**, shown on the following page.

² Crittenden, M.D. Jr., Sorensen, M.L., 1985, Geologic Map of the North Ogden Quadrangle and Part of the Ogden and Plain City Quadrangles, Box Elder and Weber Counties, Utah, USGS miscellaneous investigations series, Map I-1606, 1:24,000 scale



GEOLOGIC MAP

4.2 Faulting

No active surface fault rupture traces are mapped crossing, adjacent to, or projecting toward the site on the referenced geologic map. The nearest mapped active fault is the Brigham City segment of the Wasatch Fault Zone approximately 0.4 miles to the northwest of the northern portion of the site. Should this segment of the fault rupture causing an earthquake, ground shaking at this site could be intense.

4.3 Seismicity

4.3.1 Site Class

Utah has adopted the International Building Code (IBC) 2018, which determines the seismic hazard for a site based upon 2014 mapping of bedrock accelerations prepared by the United States Geologic Survey (USGS) and the soil site class. The USGS values are presented on maps incorporated into the IBC code and are also available based on latitude and longitude coordinates (grid points). For site class definitions, IBC 2018 Section 1613.2.2 refers to Chapter 20, Site Classification Procedure for Seismic Design, of ASCE³ 7-16, which stipulates that the average values of shear wave velocity, blow count and/or shear strength within the upper 100 feet (30 meters) be utilized to determine seismic site class.

³American Society of Civil Engineers

Based on average shear wave velocity data within the upper 30 meters ($V_{s,30}$) published by McDonald and Ashland⁴, the subject site is located within unit description Q03W, which has a log-mean $V_{s,30}$ of 349 meters per second (1145 feet per second). Thus, it is our opinion the site best fits Site Class D – Stiff Soil Profile (with data), which we recommend for seismic structural design.

4.3.2 Seismic Design Category

The 2014 USGS mapping utilized by the IBC provides values of peak ground, short period and long period spectral accelerations for the Site Class B/C boundary and the Risk-Targeted Maximum Considered Earthquake (MCE_R). This Site Class B/C boundary represents average bedrock values for the Western United States and must be corrected for local soil conditions. The Seismic Design Categories in the International Residential Code (IRC 2018 Table R301.2.2.1.1) are based upon the Site Class as addressed in the previous section. For Site Class D (with data) at site grid coordinates of 41.3382 degrees north latitude and -111.9870 degrees west longitude, S_{DS} is 1.019 and the **Seismic Design Category** is D_2 .

4.3.3 Liquefaction

Liquefaction is defined as the condition when saturated, loose, sandy soils lose their support capabilities because of excessive pore water pressure which develops during a seismic event. Clayey soils, even if saturated, will generally not liquefy during a major seismic event.

The site is located within an area designated by the Utah Geologic Survey⁵ as having “Very Low” liquefaction potential. A special liquefaction study was not performed for this site. We predominately encountered unsaturated, medium dense to dense (estimated) sand and medium stiff to stiff (estimated) silt soils within the depths we explored which, support the mapped liquefaction susceptibility designation. Groundwater was encountered in test pits TP-4 and TP-6 at depths of 6.0 to 6.5 feet, and the soils below these depths consisted of silt and sand. Further investigation would be required to quantify the liquefaction risk.

4.4 Other Geologic Hazards

No landslide deposits or features, including lateral spread deposits, are mapped on or adjacent to the site. The site is not located within a currently known or mapped potential debris flow, stream flooding, or rock fall hazard area.

⁴ McDonald, G.N. and Ashland, F.X., 2008, “Earthquake Site-Conditions Map for the Wasatch Front Urban Corridor, Utah,” Utah Geological Survey Special Study 125, 41 pp.

⁵ Utah Geological Survey, “Liquefaction-Potential Map for a Part of Weber County, Utah,” Utah Geological Survey Public Information Series 27, August 1994. https://ugspub.nr.utah.gov/publications/public_information/pi-27.pdf

5.0 SITE CONDITIONS

5.1 Surface Conditions

At the time the test pits were excavated the site consisted of a field vegetated with alfalfa, trees, and some grasses and weeds. There were two small outbuildings on the west side of the site. Overall, the site is relatively flat, with a slight slope downward to the south. Based upon aerial photos dating back to 1993 that are readily available on the internet, the site has remained relatively unchanged since that time. The site is bordered on the north by an open field and residential homes, on the east by an existing residential subdivision, on the south by 4300 North Street, and on the west by residential homes and fields (see **Vicinity Map** in **Section 1.1** above).

5.2 Subsurface Soils

At the locations of the test pits we encountered approximately 6 to 18 inches of topsoil at the surface.

Below the topsoil in test pit TP-1 we encountered natural Sandy Silty CLAY (CL-ML) extending to the bottom of the test pit at approximately 8 feet. In test pit TP-7 we encountered Sandy SILT (ML) extending to a depth of about 7 feet below the surface, underlain by Silty SAND (SM) extending to the bottom of the test pit at approximately 8 feet.

In test pit TP-4 we encountered Silty SAND (SM) extending to a depth of about 5 feet below the surface, underlain by Sandy SILT (ML) extending to the bottom of the test pit at approximately 8 feet.

In test pits TP-2, TP-3, TP-5, TP-6, TP-8, TP-9, and TP-10 we encountered natural Silty SAND (SM) soils, with varying amounts of gravel and cobble, extending to the bottom of the test pits at approximately 6 (where refusal occurred) to 8 feet.

The silt/clay soils were slightly moist to wet, dark brown to light brown in color, and estimated to be medium stiff to stiff in consistency.

The natural sand soils were slightly moist to wet, dark brown to red-brown in color, and estimated to be medium dense to dense. The sand soils are projected to exhibit moderately high strength and low compressibility characteristics.

For a more descriptive interpretation of subsurface conditions, please refer to the test pit logs, **Figures 2 through 11**, which graphically represent the subsurface conditions encountered. The lines designating the interface between soil types on the logs generally represent approximate boundaries - in situ, the transition between soil types may be gradual.

5.3 Groundwater

We encountered groundwater in only two test pits, TP-4 and TP-6, at depths of about 6.0 to 6.5 feet below existing grade at the time of our field exploration. On August 17, 2022, CMT personnel returned to the site and

measured groundwater at a depth of 7 feet in the slotted PVC pipe installed in test pit TP-4. This depth to groundwater could affect deeper excavations and allowable floor slab depths.

Groundwater levels can fluctuate seasonally. Numerous other factors such as heavy precipitation, irrigation of neighboring land, and other unforeseen factors, may also influence ground water elevations at the site. The detailed evaluation of these and other factors, which may be responsible for ground water fluctuations, is beyond the scope of this study.

5.4 Site Subsurface Variations

Based on the results of the subsurface explorations and our experience, variations in the continuity and nature of subsurface conditions should be anticipated. Due to the heterogeneous characteristics of natural soils, care should be taken in interpolating or extrapolating subsurface conditions between or beyond the exploratory locations.

Also, after completing the logging and sampling, the test pits were backfilled with the excavated soils but minimal to no effort was made to compact these soils. Thus, the test pit backfill is considered undocumented fill and settlement of the backfill in the test pits over time should be anticipated.

6.0 SITE PREPARATION AND GRADING

6.1 General

All deleterious materials should be stripped from the site prior to commencement of construction activities. This includes vegetation, topsoil, loose and disturbed soils, etc. Based upon the conditions observed in the test pits there is topsoil on the surface of the site which we estimated to be about 6 to 18 inches in thickness. When stripping and grubbing, topsoil should be distinguished by the apparent organic content and not solely by color; thus we estimate that topsoil stripping will need to include the upper 4 to 12 inches. However, given the past agricultural uses of the site, the upper 12 to 15 inches may have been disturbed during farming.

Following clearing and grubbing the site should be observed by a CMT geotechnical engineer to assess that suitable natural soils have been exposed and any deleterious materials, loose and/or disturbed soils have been removed, prior to placing site grading fills, footings, slabs, and pavements.

Fill placed over large areas to raise overall site grades can induce settlements in the underlying natural soils. If more than 3 feet of site grading fill is anticipated over the natural ground surface, we should be notified to assess potential settlements and provide additional recommendations as needed. These recommendations may include placement of the site grading fill far in advance to allow potential settlements to occur prior to construction.

6.2 Temporary Excavations

Excavations deeper than 8 feet are not anticipated at the site. Groundwater was encountered shallower than this depth in test pits TP-4 and TP-6 at the time the test pits were excavated. Groundwater was later measured at 7 feet below the existing ground surface in TP-4. We anticipate that excavations extending below a depth of about 5 feet will likely encounter groundwater, and dewatering of such excavations will likely be required.

The natural soils encountered at this site predominantly consisted of sand. For sandy/gravelly (cohesionless) soils, temporary construction excavations not exceeding 4 feet in depth should be no steeper than one-half horizontal to one vertical (0.5H:1V). For excavations up to 8 feet and above groundwater, side slopes should be no steeper than one horizontal to one vertical (1H:1V). Excavations encountering saturated cohesionless soils will be very difficult to maintain, and will require very flat side slopes and/or shoring, bracing and dewatering.

In clayey (cohesive) soils, temporary construction excavations not exceeding 4 feet in depth may be constructed with near-vertical side slopes. Temporary excavations up to 8 feet deep, above or below groundwater, may be constructed with side slopes no steeper than one-half horizontal to one vertical (0.5H:1V).

To reduce disturbance of the natural soils during excavation, we recommend that smooth edge buckets/blades be utilized.

All excavations must be inspected periodically by qualified personnel. If any signs of instability or excessive sloughing are noted, immediate remedial action must be initiated. All excavations should be made following OSHA safety guidelines.

6.3 Fill Material

Following are our recommendations for the various fill types we anticipate will be used at this site:

FILL MATERIAL TYPE	DESCRIPTION RECOMMENDED SPECIFICATION
Structural Fill	Placed below structures, flatwork and pavement. Well-graded sand/gravel mixture, with maximum particle size of 4 inches, a minimum 70% passing 3/4-inch sieve, a maximum 20% passing the No. 200 sieve, and a maximum Plasticity Index of 10.
Site Grading Fill	Placed over larger areas to raise the site grade. Sandy to gravelly soil, with a maximum particle size of 6 inches, a minimum 70% passing 3/4-inch sieve, a maximum 50% passing No. 200 sieve, and a maximum Plasticity Index of 15.
Non-Structural Fill	Placed below non-structural areas, such as landscaping. On-site soils or imported soils, with a maximum particle size of 8 inches, including silt/clay soils not containing excessive amounts of degradable/organic material (see discussion below).
Stabilization Fill	Placed to stabilize soft areas prior to placing structural fill and/or site grading fill. Coarse angular gravels and cobbles 1 inch to 8 inches in size. May also use 1.5-inch to 2.0-inch gravel placed on stabilization fabric, such as Mirafi RS280i, or equivalent (see Section 6.6).

On-site soils are not suitable for use as structural fill, but may be used as site grading fill and non-structural fill. Note that these soils are moisture-sensitive, which means they are inherently more difficult to work with in proper moisture conditioning (they are very sensitive to changes in moisture content), requiring very close moisture control during placement and compaction. This will be very difficult, if not impossible, during wet and cold periods of the year. We also recommend the site grading fill thickness using on-site soils not exceed a maximum of 3 feet below structures, to minimize potential settlements.

All fill material should be approved by a CMT geotechnical engineer prior to placement.

6.4 Fill Placement and Compaction

The various types of compaction equipment available have their limitations as to the maximum lift thickness that can be compacted. For example, hand operated equipment is limited to lifts of about 4 inches and most "trench compactors" have a maximum, consistent compaction depth of about 6 inches. Large rollers, depending on soil and moisture conditions, can achieve compaction at 8 to 12 inches. The full thickness of each lift should be compacted to at least the following percentages of the maximum dry density as determined by ASTM D-1557 (or AASHTO⁶ T-180) in accordance with the following recommendations:

⁶ American Association of State Highway and Transportation Officials

LOCATION	TOTAL FILL THICKNESS (FEET)	MINIMUM PERCENTAGE OF MAXIMUM DRY DENSITY
Beneath an area extending at least 4 feet beyond the perimeter of structures, and below flatwork and pavement (applies to structural fill and site grading fill) extending at least 2 feet beyond the perimeter	0 to 5	95
Site grading fill outside area defined above	0 to 5	92
Utility trenches within structural areas	--	96
Roadbase and subbase	-	96
Non-structural fill	0 to 5	90

Structural fills greater than 5 feet thick are not anticipated at the site. For best compaction results, we recommend that the moisture content for structural fill/backfill be within 2% of optimum. Field density tests should be performed on each lift as necessary to verify that proper compaction is being achieved.

6.5 Utility Trenches

For the bedding zone around the utility, we recommend utilizing sand bedding fill material that meets current APWA⁷ requirements.

All utility trench backfill material below structurally loaded facilities (foundations, floor slabs, flatwork, parking lots/drive areas, etc.) should be placed at the same density requirements established for structural fill in the previous section.

Most utility companies and local governments are requiring Type A-1a or A-1b (AASHTO Designation) soils (sand/gravel soils with limited fines) be used as backfill over utilities within public rights of way, and the backfill be compacted over the full depth above the bedding zone to at least 96% of the maximum dry density as determined by AASHTO T-180 (ASTM D-1557). The natural sand soils at this site will likely not meet these specifications.

Where the utility does not underlie structurally loaded facilities and public rights of way, natural soils may be utilized as trench backfill above the bedding layer, provided they are properly moisture conditioned and compacted to the minimum requirements stated above in **Section 6.4**.

6.6 Stabilization

The natural silt/clay soils at this site will likely be susceptible to rutting and pumping. The likelihood of disturbance or rutting and/or pumping of the existing natural soils is a function of the load applied to the surface, as well as the frequency of the load. Consequently, rutting and pumping can be minimized by avoiding concentrated traffic, minimizing the load applied to the surface by using lighter equipment and/or partial loads,

⁷ American Public Works Association

by working in drier times of the year, or by providing a working surface for the equipment. Rubber-tired equipment particularly, because of high pressures, promotes instability in moist/wet, soft soils.

If rutting or pumping occurs, traffic should be stopped and the disturbed soils should be removed and replaced with stabilization material. Typically, a minimum of 18 inches of the disturbed soils must be removed to be effective. However, deeper removal is sometimes required.

To stabilize soft subgrade conditions (if encountered), a mixture of coarse, clean, angular gravels and cobbles and/or 1.5- to 2.0-inch clean gravel should be utilized, as indicated above in **Section 6.3**. Often the amount of gravelly material can be reduced with the use of a geotextile fabric such as Mirafi RS280i or equivalent. Its use will also help avoid mixing of the subgrade soils with the gravelly material. After excavating the soft/disturbed soils, the fabric should be spread across the bottom of the excavation and up the sides a minimum of 18 inches. Otherwise, it should be placed in accordance with the manufacturer's recommendation, including proper overlaps. The gravel material can then be placed over the fabric in compacted lifts as described above.

7.0 FOUNDATION RECOMMENDATIONS

The following recommendations have been developed on the basis of the previously described project characteristics, including the maximum structural loads discussed in **Section 1.3**, the subsurface conditions observed in the field and the laboratory test data, and standard geotechnical engineering practice.

7.1 Foundation Recommendations

Based on our geotechnical engineering analyses, the proposed residences may be supported upon conventional spread and/or continuous wall foundations placed on suitable, undisturbed natural soils and/or on structural fill extending to suitable natural soils. Footings may be designed using a net bearing pressure of 1,500 psf if placed on suitable, undisturbed, natural soils or 2,000 psf if placed on a minimum 18 inches of structural fill.

The term "net bearing pressure" refers to the pressure imposed by the portion of the structure located above lowest adjacent final grade, thus the weight of the footing and backfill to lowest adjacent final grade need not be considered. The allowable bearing pressure may be increased by 1/3 for temporary loads such as wind and seismic forces.

We also recommend the following:

1. Exterior footings subject to frost should be placed at least 30 inches below final grade.
2. Interior footings not subject to frost should be placed at least 16 inches below grade.
3. Continuous footing widths should be maintained at a minimum of 18 inches.
4. Spot footings should be a minimum of 24 inches wide.

7.2 Installation

Under no circumstances shall foundations be placed on undocumented fill, topsoil with organics, sod, rubbish, construction debris, other deleterious materials, frozen soils, or within ponded water. If other unsuitable soils are encountered, they must be completely removed and replaced with properly compacted structural fill.

Deep, large roots may be encountered where trees and larger bushes are located or were previously located at the site; such large roots should be removed. The base of footing excavations should be observed by a CMT geotechnical engineer to assess if suitable bearing soils have been exposed.

All structural fill should meet the requirements for such, and should be placed and compacted in accordance with **Section 6** above. The width of structural replacement fill below footings should be equal to the width of the footing plus 1 foot for each foot of fill thickness. For instance, if the footing width is 2 feet and the structural fill depth beneath the footing is 2 feet, the fill replacement width should be 4 feet, centered beneath the footing.

The minimum thickness of structural fill below footings should be equivalent to one-third the thickness of structural fill below any other portion of the foundations. For example, if the maximum depth of structural fill is 6 feet, all footings for the new structure should be underlain by a minimum 2 feet of structural fill.

7.3 Estimated Settlement

Foundations designed and constructed in accordance with our recommendations could experience some settlement, but we anticipate that total settlements of footings founded as recommended above will not exceed 1 inch, with differential settlements on the order of 0.5 inches over a distance of 25 feet. We expect approximately 50% of the total settlement to initially take place during construction.

7.4 Lateral Resistance

Lateral loads imposed upon foundations due to wind or seismic forces may be resisted by the development of passive earth pressures and friction between the base of the footings and the supporting soils. In determining frictional resistance, a coefficient of 0.30 for natural silt/clay soils or 0.40 for natural sand soils and structural fill, may be utilized for design. Passive resistance provided by properly placed and compacted natural sand soils above the water table may be considered equivalent to a fluid with a density of 400 pcf. A combination of passive earth resistance and friction may be utilized if the passive pressure component of the total is divided by 1.5.

8.0 LATERAL EARTH PRESSURES

We project that, groundwater level permitting, basement walls up to 8 feet tall will be constructed at this site. The lateral earth pressure values given below anticipate that existing sand soils will be used as backfill material, placed and compacted in accordance with the recommendations presented herein. If other soil types will be

used as backfill, we should be notified so that appropriate modifications to these values can be provided, as needed.

The lateral pressures imposed upon subgrade facilities will depend upon the relative rigidity and movement of the backfilled structure. Following are the recommended lateral pressure values, which also assume that the soil surface behind the wall is horizontal and that the backfill within 3 feet of the wall will be compacted with hand-operated compacting equipment.

CONDITION	STATIC (psf/ft)*	SEISMIC (psf)*
Active Pressure (wall is allowed to yield, i.e. move away from the soil, with a minimum 0.001H movement/rotation at the top of the wall, where "H" is the total height of the wall)	38	39
At-Rest Pressure (wall is not allowed to yield)	59	N/A
Passive Pressure (wall moves into the soil)	400	215

*Equivalent Fluid Pressure (applied at 1/3 Height of Wall)

*Equivalent Fluid Pressure (added to static and applied at 1/3 Height of Wall)

9.0 FLOOR SLABS

Floor slabs may be established upon suitable, undisturbed, natural soils and/or on structural fill extending to suitable natural soils (same as for foundations). Under no circumstances shall floor slabs be established directly on any topsoil, undocumented fills, loose or disturbed soils, sod, rubbish, construction debris, other deleterious materials, frozen soils, or within ponded water. Floor slabs should be kept at least 3 feet above measured groundwater levels at this site or a minimum of 18 inches above the elevation controlled by a land drain system.

In order to facilitate curing of the concrete, we recommend that floor slabs be directly underlain by at least 4 inches of "free-draining" fill, such as "pea" gravel or 3/4-inch to 1-inch minus, clean, gap-graded gravel. To help control normal shrinkage and stress cracking, the floor slabs should have the following features:

1. Adequate reinforcement for the anticipated floor loads with the reinforcement continuous through interior floor joints;
2. Frequent crack control joints; and
3. Non-rigid attachment of the slabs to foundation walls and bearing slabs.

10.0 DRAINAGE RECOMMENDATIONS

10.1 Surface Drainage

It is important to the long-term performance of foundations and floor slabs that water not be allowed to collect near the foundation walls and infiltrate into the underlying soils. We recommend the following:

1. All areas around each residence should be sloped to provide drainage away from the foundations. We recommend a minimum slope of 4 inches in the first 10 feet away from the structure. This slope should be maintained throughout the lifetime of the structure.
2. All roof drainage should be collected in rain gutters with downspouts designed to discharge at least 10 feet from the foundation walls or well beyond the backfill limits, whichever is greater.
3. Adequate compaction of the foundation backfill should be provided. We suggest a minimum of 90% of the maximum laboratory density as determined by ASTM D-1557. Water consolidation methods should not be used under any circumstances.
4. Landscape sprinklers should be aimed away from the foundation walls. The sprinkling systems should be designed with proper drainage and be well-maintained. Over watering should be avoided.
5. Other precautions that may become evident during construction.

10.2 Foundation Subdrains

Groundwater at this site is relatively shallow in the vicinity of test pits TP-4 and TP-6 (west side of site); however fluctuations in the groundwater elevations and perched groundwater conditions are possible throughout the development. Therefore, we recommend that perimeter foundation subdrains be installed within the development.

Foundation subdrains should consist of a 4-inch diameter perforated or slotted plastic or PVC pipe surrounded by clean gravel. The invert of the subdrain should be at least 2 feet below the top of the lowest adjacent floor slab. The gravel portion of the drain should extend a minimum 2 inches laterally and below the perforated pipe and at least 1 foot above the top of the lowest adjacent floor slab. The gravel zone must be installed immediately adjacent to the perimeter footings and the foundation walls. To reduce the possibility of plugging, the gravel must be wrapped with a geotextile, such as Mirafi 140N or equivalent. Prior to the installation of the footing subdrain, the below-grade walls should be dampproofed. The slope of the subdrain should be at least 0.5%. The gravel placed around the drain pipe should be clean 3/4-inch to 1-inch minus gap-graded gravel and/or "pea" gravel. The foundation subdrains can be discharged into the area subdrains, storm drains, or other suitable down-gradient location.

11.0 PAVEMENTS

All pavement areas must be prepared as discussed above in **Section 6.1**. Under no circumstances shall pavements be established over topsoil, undocumented fills (if encountered), loose or disturbed soils, sod, rubbish, construction debris, other deleterious materials, frozen soils, or within ponded water.

In roadway areas, subsequent to stripping and prior to the placement of pavement materials, the exposed subgrade must be proof rolled by passing moderate-weight rubber tire-mounted construction equipment over

the surface at least twice. If excessively soft or otherwise unsuitable soils are encountered, we recommend they be removed to a minimum of 18 inches below the subgrade level and replaced with structural fill.

We anticipate the natural silt/clay soils will exhibit poor pavement support characteristics when saturated or nearly saturated. Based on our laboratory testing experience with similar soils, our pavement design utilized a California Bearing Ratio (CBR) of 3 for the natural silt/clay soils.

Given the projected traffic as discussed above in **Section 1.3**, the following pavement sections are recommended for approximately 4 ESAL's (18-kip equivalent single-axle loads) per day:

MATERIAL	PAVEMENT SECTION THICKNESS (inches)	
Asphalt	3	3
Road-Base	10	6
Subbase	0	6
Total Thickness	13	15

Untreated base course (UTBC) should conform to city specifications, or to 1-inch-minus UDOT specifications for A-1-a/NP, and have a minimum CBR value of 70%. Material meeting our specification for structural fill can be used for subbase, as long as the fines content (percent passing No. 200 sieve) does not exceed 15%. Roadbase and subbase material should be compacted as recommended above in **Section 6.4**. Asphalt material generally should conform to APWA requirements, having a ½-inch maximum aggregate size, a 75-gradation Superpave mix containing no more than 15% of recycled asphalt (RAP) and a PG58-28 binder.

12.0 QUALITY CONTROL

We recommend that CMT be retained as part of a comprehensive quality control testing and observation program. With CMT on-site we can help facilitate implementation of our recommendations and address, in a timely manner, any subsurface conditions encountered which vary from those described in this report. Without such a program CMT cannot be responsible for application of our recommendations to subsurface conditions which may vary from those described herein. This program may include, but not necessarily be limited to, the following:

12.1 Field Observations

Observations should be completed during all phases of construction such as site preparation, foundation excavation, structural fill placement and concrete placement.

12.2 Fill Compaction

Compaction testing by CMT is required for all structural supporting fill materials. Maximum Dry Density (Modified Proctor, ASTM D-1557) tests should be requested by the contractor immediately after delivery of any

fill materials. The maximum density information should then be used for field density tests on each lift as necessary to ensure that the required compaction is being achieved.

12.3 Excavations

All excavation procedures and processes should be observed by a geotechnical engineer from CMT or their representative. In addition, for the recommendations in this report to be valid, all backfill and structural fill placed in trenches and all pavements should be density tested by CMT. We recommend that freshly mixed concrete be tested by CMT in accordance with ASTM designations.

13.0 LIMITATIONS

The recommendations provided herein were developed by evaluating the information obtained from the subsurface explorations and soils encountered therein. The exploration logs reflect the subsurface conditions only at the specific location at the particular time designated on the logs. Soil and ground water conditions may differ from conditions encountered at the actual exploration locations. The nature and extent of any variation in the explorations may not become evident until during the course of construction. If variations do appear, it may become necessary to re-evaluate the recommendations of this report after we have observed the variation.

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties, either expressed or implied.

We appreciate the opportunity to be of service to you on this project. If we can be of further assistance or if you have any questions regarding this project, please do not hesitate to contact us at (801) 590-0394. To schedule materials testing, please call (801) 381-5141.

APPENDIX

SUPPORTING DOCUMENTATION

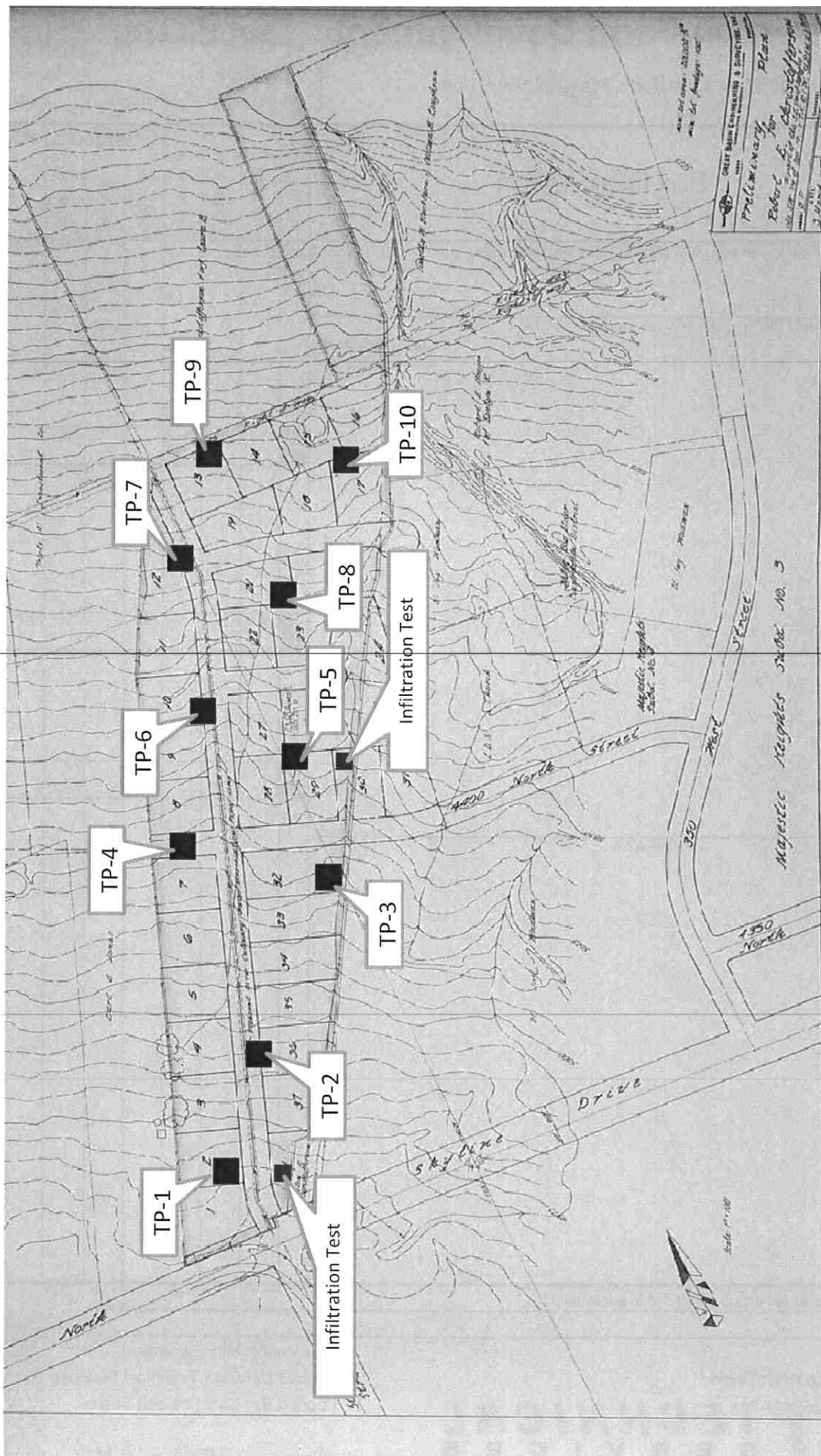


Figure:

Christofferson Farm Development

Test Pit Log

TP-1

About 500 West 4300 North, Pleasant View, Utah

Total Depth: 8'

Date: 7/19/22

Water Depth: (see Remarks)

Job #: 18813

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gradation			Atterberg		
							Gravel %	Sand %	Fines %	LL	PL	PI
0		Topsoil: Dark brown silty sand with organics and deep roots										
1		Brown Sandy SILTY-CLAY (CL-ML), moist										
2		stiff (estimated)										
3			▲	1	4	96			58			
4												
5			▲	2	9				54	24	18	6
6												
7			▲	3								
8		END AT 8'										
9												
10												
11												
12												
13												
14												

Remarks: Groundwater not encountered during excavation.

Coordinates: °, °

Surface Elev. (approx): Not Given

CMT TECHNICAL SERVICES

Equipment: Mini Excavator

Excavated By: CMT Technical Services

Logged By: Christine and Steve

Figure:

2

Christofferson Farm Development

Test Pit Log

TP-2

About 500 West 4300 North, Pleasant View, Utah

Total Depth: 8'

Date: 7/19/22

Water Depth: (see Remarks)

Job #: 18813

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density (pcf)	Gradation			Atterberg		
							Gravel %	Sand %	Fines %	LL	PL	PI
0		Topsoil: Dark brown silty sand with organics and deep roots										
1		Brown Silty SAND (SM) with cobble, moist										
2		very dense (estimated)										
3		grades with cobbles up to 12"		4	5		1	58	41			
4												
5				5								
6												
7				8								
8		END AT 8'										
9												
10												
11												
12												
13												
14												

Remarks: Groundwater not encountered during excavation.

Coordinates: °, °

Surface Elev. (approx): Not Given

Equipment: Mini Excavator

Excavated By: CMT Technical Services

Logged By: Christine and Steve

Figure:

3

CMT TECHNICAL SERVICES

Christofferson Farm Development

Test Pit Log

TP-3

About 500 West 4300 North, Pleasant View, Utah

Total Depth: 8'

Date: 7/19/22

Water Depth: (see Remarks)

Job #: 18813

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gradation			Atterberg		
							Gravel %	Sand %	Fines %	LL	PL	PI
0		Topsoil: Dark brown silty to clayey sand with deep roots										
1		Brown Silty SAND (SM) with gravel, slightly moist										
2		dense (estimated)										
3				7	6		25	49	26			
4												
5				8								
6												
7				9								
8		END AT 8'										
9												
10												
11												
12												
13												
14												

Remarks: Groundwater not encountered during excavation.

Coordinates: °, °

Surface Elev. (approx): Not Given

Equipment: Mini Excavator

Excavated By: CMT Technical Services

Logged By: Christine and Steve

CMT TECHNICAL
SERVICES

Figure:

4

Christofferson Farm Development

Test Pit Log

TP-4

About 500 West 4300 North, Pleasant View, Utah

Total Depth: 8'
Water Depth: 6.5'

Date: 7/19/22
Job #: 18813

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density (pcf)	Gradation			Atterberg		
							Gravel %	Sand %	Fines %	LL	PL	PI
0		Topsoil: Dark brown silt with organics and roots										
1												
2		Dark Brown Silty SAND (SM)/Sandy SILT (ML), moist medium dense/stiff (estimated)										
3				10	15				49		NP	NP
4												
5		Dark Brown Sandy SILT (ML), moist medium stiff (estimated)		11	20				33			
6												
7		grades gray, coarse sand wet										
8		END AT 8'		12								
9												
10												
11												
12												
13												
14												

Remarks: Groundwater encountered during excavation at depth of 6.5 feet.

Slotted PVC pipe installed to depth of 8.0 feet to facilitate water level measurements.

Coordinates: °, °

Surface Elev. (approx): Not Given

Equipment: Mini Excavator

Excavated By: CMT Technical Services

Logged By: Christine and Steve

Figure:

5

CMT TECHNICAL SERVICES

Christofferson Farm Development

Test Pit Log

TP-5

About 500 West 4300 North, Pleasant View, Utah

Total Depth: 8'

Date: 7/19/22

Water Depth: (see Remarks)

Job #: 18813

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density (pcf)	Gradation			Atterberg		
							Gravel %	Sand %	Fines %	LL	PL	PI
0		Topsoil: Brown silt with organics and roots										
1												
2		Light Brown Silty SAND (SM), slightly moist medium dense (estimated)		13	3				43		NP	NP
3												
4												
5				14	6	100						
6												
7												
8				15	11				40			
8		END AT 8'										
9												
10												
11												
12												
13												
14												

Remarks: Groundwater not encountered during excavation.

Coordinates: °, °

Surface Elev. (approx): Not Given

Equipment: Mini Excavator

Excavated By: CMT Technical Services

Logged By: Christine and Steve

CMT TECHNICAL
SERVICES

Figure:

6

Christofferson Farm Development

Test Pit Log

TP-6

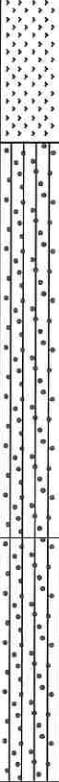
About 500 West 4300 North, Pleasant View, Utah

Total Depth: 8'

Date: 7/19/22

Water Depth: 6'

Job #: 18813

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gradation			Atterberg		
							Gravel %	Sand %	Fines %	LL	PL	PI
0		Topsoil: Dark brown silt with organics and roots										
1												
2		Orange Brown Silty SAND (SM), slightly moist medium dense (estimated)										
3				16	15				48			
4		grades less silt, gray, moist										
5				17	18				20		NP	NP
6		wet										
7		grades some gravel										
8		END AT 8'		18	15		7	71	22			
9												
10												
11												
12												
13												
14												

Remarks: Groundwater encountered during excavation at depth of 6 feet.

Coordinates: °, °

Surface Elev. (approx): Not Given

Equipment: Mini Excavator

Excavated By: CMT Technical Services

Logged By: Christine and Steve

Figure:

7

CMT TECHNICAL SERVICES

Christofferson Farm Development

Test Pit Log

TP-7

About 500 West 4300 North, Pleasant View, Utah

Total Depth: 8'

Date: 7/19/22

Water Depth: (see Remarks)

Job #: 18813

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density (pcf)	Gradation			Atterberg		
							Gravel %	Sand %	Fines %	LL	PL	PI
0		Topsoil: Dark brown silt with organics and roots										
1												
2		Brown Sandy SILT (ML), slightly moist medium stiff (estimated)										
3				19								
4												
5		grades light brown										
6				20	2		3	37	60			
7												
8		Light Brown Silty SAND (SM), slightly moist medium dense (estimated)										
9				21	5				47			
10		END AT 8'										
11												
12												
13												
14												

Remarks: Groundwater not encountered during excavation.

Coordinates: °, °

Surface Elev. (approx): Not Given

Equipment: Mini Excavator

Excavated By: CMT Technical Services

Logged By: Christine and Steve

CMT TECHNICAL SERVICES

Page: 1 of 1

Figure:

8

Christofferson Farm Development

Test Pit Log

TP-8

About 500 West 4300 North, Pleasant View, Utah

Total Depth: 8'

Date: 7/19/22

Water Depth: (see Remarks)

Job #: 18813

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density (pcf)	Gradation			Atterberg		
							Gravel %	Sand %	Fines %	LL	PL	PI
0		Topsoil: Dark brown silty sand with organics and deep roots										
1		Dark Brown to Gray Silty SAND (SM), moist										
2		dense (estimated)										
3				22	5		12	70	18			
4												
5		grades moist to very moist		23								
6												
7		medium dense (estimated)		24								
8		END AT 8'										
9												
10												
11												
12												
13												
14												

Remarks: Groundwater not encountered during excavation.

Coordinates: °, °

Surface Elev. (approx): Not Given

Equipment: Mini Excavator

Excavated By: CMT Technical Services

Logged By: Christine and Steve

Figure:

9

CMT TECHNICAL SERVICES

Christofferson Farm Development

Test Pit Log

TP-9

About 500 West 4300 North, Pleasant View, Utah

Total Depth: 6'

Date: 7/19/22

Water Depth: (see Remarks)

Job #: 18813

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gradation			Atterberg		
							Gravel %	Sand %	Fines %	LL	PL	PI
0		Topsoil: Dark brown silty sand with organics and deep roots										
1		Brown Silty SAND (SM) with gravel and cobbles up to 8", slightly moist dense (estimated)										
2												
3												
4												
5												
6		REFUSAL AT 6'										
7												
8												
9												
10												
11												
12												
13												

Remarks: Groundwater not encountered during excavation.

Coordinates: °, °

Surface Elev. (approx): Not Given

Equipment: Mini Excavator

Excavated By: CMT Technical Services

Logged By: Christine and Steve

Figure:

10

CMT TECHNICAL SERVICES

Christofferson Farm Development Test Pit Log TP-10

About 500 West 4300 North, Pleasant View, Utah

Total Depth: 7'

Date: 7/19/22

Water Depth: (see Remarks)

Job #: 18813

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density (pcf)	Gradation			Atterberg		
							Gravel %	Sand %	Fines %	LL	PL	PI
0		Topsoil: Dark brown silty sand with organics and deep roots										
1		Brown Silty SAND (SM), slightly moist										
2		medium dense (estimated)										
3												
4												
5		grades red brown										
6												
7		END AT 7'										
8												
9												
10												
11												
12												
13												
14												

Remarks: Groundwater not encountered during excavation.

Coordinates: °, °

Surface Elev. (approx): Not Given

Equipment: Mini Excavator

Excavated By: CMT Technical Services

Logged By: Christine and Steve

Figure:

11

CMT TECHNICAL
SERVICES

Christofferson Farm Development

About 500 West 4300 North, Pleasant View, Utah

Key to Symbols

Date: 7/19/22

Job #: 18813

① Depth (ft)	② GRAPHIC LOG	③ Soil Description	④ Sample Type	⑤ Sample #	⑥ Moisture (%)	⑦ Dry Density(pcf)	⑧ Gradation	⑨ Atterberg																																																																	
							Gravel % Sand % Fines %	LL PL PI																																																																	
COLUMN DESCRIPTIONS																																																																									
① Depth (ft.): Depth (feet) below the ground surface (including groundwater depth - see below right).	② Graphic Log: Graphic depicting type of soil encountered (see ② below).	③ Soil Description: Description of soils, including Unified Soil Classification Symbol (see below).	④ Sample Type: Type of soil sample collected; sampler symbols are explained below-right.	⑤ Sample #: Consecutive numbering of soil samples collected during field exploration.	⑥ Moisture (%): Water content of soil sample measured in laboratory (percentage of dry weight).	⑦ Dry Density (pcf): The dry density of a soil measured in laboratory (pounds per cubic foot).	⑧ Gradation: Percentages of Gravel, Sand and Fines (Silt/Clay), obtained from lab test results of soil passing the No. 4 and No. 200 sieves.	⑨ Atterberg: Individual descriptions of Atterberg Tests are as follows: LL = Liquid Limit (%): Water content at which a soil changes from plastic to liquid behavior. PL = Plastic Limit (%): Water content at which a soil changes from liquid to plastic behavior. PI = Plasticity Index (%): Range of water content at which a soil exhibits plastic properties (= Liquid Limit - Plastic Limit).																																																																	
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Note: Dual Symbols are used to indicate borderline soil classifications (i.e. GP-GM, SC-SM, etc.).

- The results of laboratory tests on the samples collected are shown on the logs at the respective sample depths.
- The subsurface conditions represented on the logs are for the locations specified. Caution should be exercised if interpolating between or extrapolating beyond the exploration locations.
- The information presented on each log is subject to the limitations, conclusions, and recommendations presented in this report.