Sunset Strip Addition
Floodplain Enhancement Feasibility Analysis

Town of Payson, Arizona

Natural Channel Design, Inc.
2900 N. West Street #5
Flagstaff, AZ 86004

June, 2020

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Submitted to:
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EXECUTIVE SUMMARY

The American Gulch is an ephemeral wash that serves as a significant drainage with a contributing watershed that encompasses much of the town of Payson, Arizona. Over the past two decades, the town has implemented several enhancements of the wash in the areas west of Highway 87, including channelization to reduce the floodplain extent, construction of urban trails alongside the wash and development of parks and urban lakes along the corridor. The Sunset Strip Addition is the latest proposed enhancement, located approximately in the midway between prior upstream and downstream projects along the wash.

The site for this project currently exists as a relatively wide and shallow swale and floodplain extending approximately 1,250 lineal feet between Westerly Road and McLane Road and south of Main Street in the southwestern quadrant of Payson.

The Town of Payson, in cooperation with private land owners in the Sunset Strip Project area desires to develop areas within the current floodplain to create areas for public recreation and developable land, outside of the floodplain. This project explores the potential for the creation of such areas, presenting two options that provide a range of possible yield of space for development and recreation/greenbelt. One option provides for an urban lake while the other option leaves a significant portion of the floodplain intact for a greenbelt.

Both options would require significant earthwork (excavation and fill placement) to complete as well as potential adjustments to McLane Road, utility relocation and/or adjustments and revegetation. As presented herein, the project is estimated to require between $1.1M to $1.7M to complete, including design, permitting and construction costs. A variety of grant funding sources may be available to assist the town and property owner stake holders in implementing the project and are described within this report.

As part of this analysis, NCD performed two-dimensional hydraulic analysis of the existing floodplain and of the two conceptual layout options for the site. This effort was performed to verify the ability to encroach within the floodplain, yet minimize adverse flooding impact to properties adjacent to the site. While not yet detailed enough for permitting through FEMA, the analysis is a useful tool to better determine the extent and depth of flooding in the three different configurations. It also demonstrates the changes in the floodplain resulting from either of the two options explored can be completed with no adverse impact to the adjacent properties.

NCD recognizes that with a report of this type and the complexities of the potential project explored, that there may be further questions from the Town of Payson or the property owner stake holders. NCD is available to answer questions at the Town's convenience regarding the options and analysis presented herein.

PROJECT DESCRIPTION

American Gulch forms a major drainage through the town of Payson, Arizona. Portions of the ephemeral channel have been highly modified to serve as a stormwater conveyance while others have only experienced moderate modification along the edge of the wide valley that otherwise forms the channel. The entire reach of the channel within town and downstream of Highway 87 has been mapped by the Federal Emergency Management Agency (FEMA) for the estimated 100-year floodplain.

The subject reach of the American Gulch includes approximately 1250 lineal feet of the drainage and exists as a relatively wide and shallow swale and floodplain situated between two channelized reaches of the American Gulch. The upstream reach has recently received grant funding to naturalize the existing trapezoidal channel. The downstream reach exists as an incised channel with numerous headcuts that leads into three existing municipal lakes.

LOCATION

The project site is located south of Main Street and generally between Westerly Road and McLane Road in the southwestern quarter of the town of Payson, Gila County, Arizona (See Figure 1). More specifically, the site is located in the NE ¼ of Township 10N, Range 10E, Section 9 of the Gila-Salt River Base Line and Meridian. Elevations on the site range from approximately 4860 to 4900 feet above sea level.

The upstream watershed encompasses approximately 1,200 acres of primarily developed lands and a significant portion of the town of Payson. Existing vegetation across the floodplain primarily consists of grasses and other low lying vegetation.

PROJECT OBJECTIVES

The Town of Payson, in cooperation with private land owners in the Sunset Strip Project area desires to develop areas within the current floodplain that:

- Create several potential developable building pads, elevated above the floodplain;
- Provide for a significant area of greenspace and pedestrian corridor along the floodplain;
- Potential creation of a small municipal lake; and
- Provide for a channel or more confined floodway that is sized to contain flooding during high discharges while maintaining a geomorphically stable form.

This study serves to provide:

- Feasibility planning that can identify the potential for this type of development;
- Provide a conceptual level estimate of likely design and construction costs and;
- Provide an outline of what steps will be needed to design and successfully implement the project.

Figure 1 Location map.
The project is located south of Main Street, between McLane Road and Westerly Road in Payson, Arizona.

EXISTING CONDITIONS

The project site is bordered to the north and south by commercial properties along Main Street and Aero Drive, respectively. It is bordered to the east by Westerly Road and to the west by McLane Road. An existing 3 acre (+/-) apartment complex is located at the southwest corner of the site. Downstream of McLane Road, the channel extends through a relatively narrow corridor of town-owned property before transitioning back into a wider, privately held undeveloped floodplain.

The site itself encompasses approximately 11.8 acres of mixed public and private property and exists as a wide, undeveloped floodplain with only minor channel definition provided by disconnected headcuts extending from beneath the bridge under Westerly Road to the low water crossing at McLane Road. Vegetation consists primarily as low lying grasses with various species of trees scattered along the edges of the floodplain

The valley slopes down from east to west across the site at approximately 0.7% slope along the direction of flow with cross slopes on the floodplain generally less than 1%.

HYDROLOGY

Previous hydrologic studies relevant the site include the following studies:

1. Stantech Consulting Inc., 1997, *Drainage Design Report for American Gulch Channelization Plan for Kaibab Mill Site Property.*

2. Burgess & Niple, Inc. 1992, *Green Valley Park Joint-Use Facility Drainage Report, Technical Data Notebook Hydrology & Hydraulics*, Books 1-2 of 3, Revised March, 1993.

3. US Department of Housing and Urban Development, Federal Insurance Administration, Federal Emergency Management Agency (FEMA), 1979, *Flood Insurance Study, Town of Payson, Gila County, Arizona.*

These studies are not specific to the site itself, but rather are for the American Gulch drainage as a whole, of which the Sunset Strip project is a part. The original FEMA model (1979) provided the original basis of floodplain delineation for the American Gulch wash through the town limits of Payson. The Burgess and Niple study was specific to the development of the Green Valley Park (GVP) and lakes that now exist approximately 1,500 feet downstream of the Sunset Strip project. The Stantech report was specific to the Kaibab Channelization project, located immediately upstream of the Westerly Road bridge.

According to the effective FEMA model, the watershed area above Highway 87 is 1.76 mi^2 and increases to 2.76 mi^2 at McLane Road with the GVP and Stantech studies being approximately the same. The latter two studies modeled the 100-year flood event at the (then future) 2017 projected development of the watershed. As a result, the peak flows are significantly higher than the effective regulatory model. However, as our effort is to compare relative impact to the regulatory floodplain from potential construction and filling within it, for this concept-level analysis, the effective FEMA 100-year flood was used for that purpose. The effective regulatory 100-year flood event is quantified as 1,550 cfs at Highway 87 and increased to 2,000 cfs at McLane Road.

GEOMORPHOLOGY

The site currently exists as a broad, mildly sloping floodplain with minimal channel definition other than some discontinuous minor headcuts that have formed through it. Large flows enter the east side of the site from beneath the Westerly Road bridge and the upstream channelized portion of the American Gulch (Kaibab Mill Site) where it then disperses across the floodplain of the site before gathering again into a minor channel at McLane Road at the west side of the site.

HYDRAULICS

In the existing condition, depths of flow during the 100-year flood event vary across the floodplain from minimal to near 4 feet. Velocities are high where flows emerge from the upstream channelized portion of the American Gulch (as high at 10 fps) but soon drop to below 3 fps as the flows and energy disperse across the floodplain. Downstream, at McLane Road, where the flow gathers and passes through a low water crossing to a downstream channel, velocities increase and approach 8 fps.

As explained above, the FEMA 100-year flood is used to evaluate feasibility of and impact from potential development within the floodplain at this conceptual level. NCD performed an analysis of the existing

floodplain using the two dimensional (2D) capabilities within HEC-RAS. Though not appropriate at this time for formal permitting through FEMA, the 2D analysis tool provides a more detailed look at the areas of inundation from flooding and generally provides for better quality, more readable maps for planning purposes. Because of the difference between the HEC-RAS 2D model and the one dimensional (1D) model from which the effective regulatory floodplain was defined, there are some differences in what are shown as the flood limits and floodplain elevations. As a tool for comparative analysis between pre-project and post-project flooding extents, the 2D model is useful for this conceptual analysis.

Further details of the HEC-RAS 2D analysis are included later within this report.

RIPARIAN VEGETATION

Existing vegetation across the site is limited to riparian grasses across the floodplain with a limited number of trees along the fringes of the site. During early spring of 2020 some wetland species were noted amongst the bunch grasses, especially in areas of pooled water. The wetland species consisted mostly of *Carex* spp. and the specific species is not yet known. However, the presence of these facultative wetland type species indicates that other wetland species may be present for portions of the year when soil moisture conditions are appropriate.

ALTERNATIVES CONSIDERED

As a point of beginning, NCD was provided with a rough concept of a desired layout of the Sunset Strip project, showing a mix of use for the site that includes floodplain, recreational use and elevated pads reserved for development (Figure 2). Based upon that, NCD developed two potential options for enhancement of the site that provides for both flood and mixed commercial and recreational use. Option 1 includes the creation of a geomorphic channel through the site with elevated areas outside of the channel reserved for development and public recreation uses and includes a small lake. Option 2 involves leaving a significant portion of the floodplain intact and unchanged while elevating the remainder of the site to create areas above the floodplain that would be available for recreation and development.

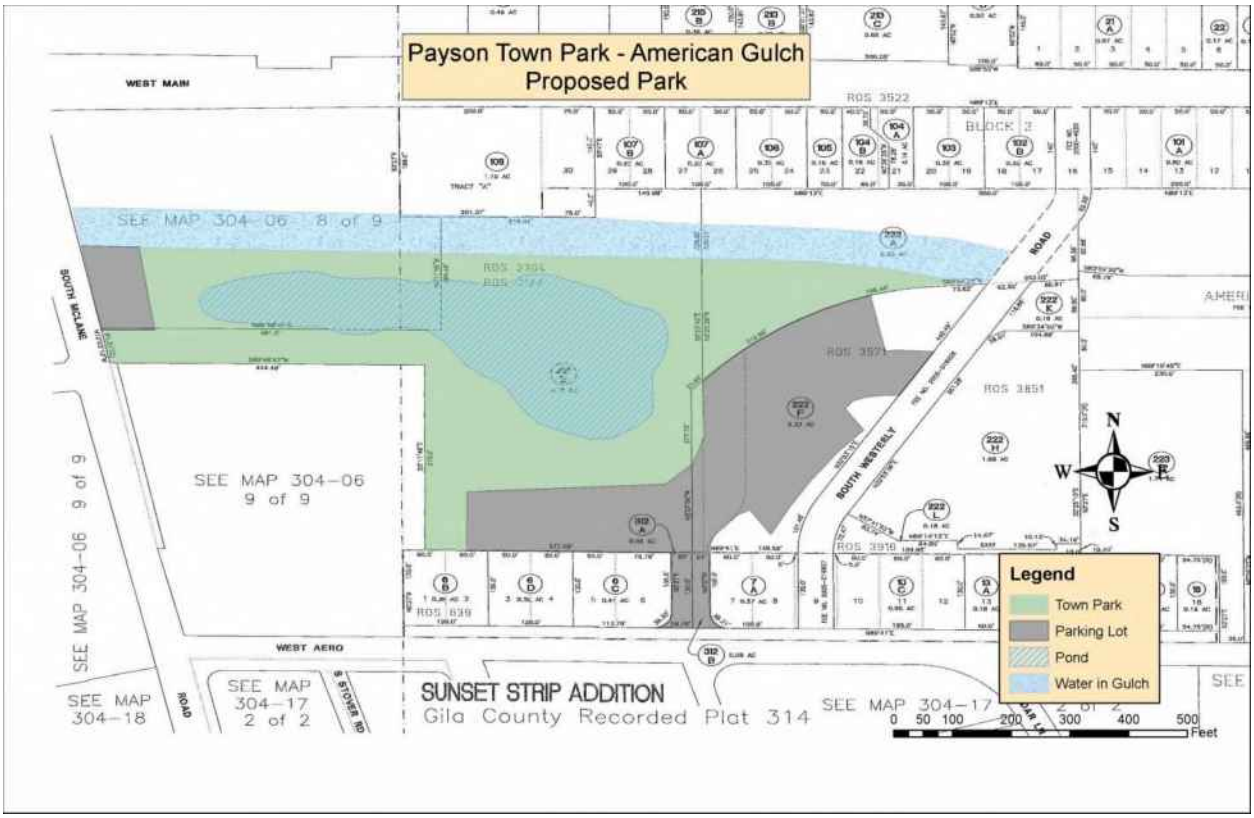


Figure 2 - Base Concept Provided to NCD by the Town of Payson

OPTION 1

For Option 1 (Figure 3), a bankfull channel is created, with similar shape and dimensions as the bankfull channel recently completed in the channel naturalization project located upstream of the Westerly Road bridge. On the fringes of the bankfull channel, a floodplain/floodway greenbelt would also be created with capacity to carry much of the 100year flood flows. Outside of the floodway, a one acre lake would be constructed, somewhat protected from the most frequently occurring flood events but still subject to backwater flooding during the 100-year event. Developable building pads, above the floodplain, would also be created around the southern edges of the project site.

The areas created as development pads are not equally distributed between the three private properties represented within the project. The intent of this option is to create an urban lake that would not be subject to frequent flooding yet still provide for developable areas on either side of it. To create equity in the areas of developable space for each of the property holders, it may be possible to perform combination/splits of the parcels, based upon the resulting areas that are elevated above the floodplain.

The lake as, shown within Figure 3 provides approximately 1.2 acre-feet of open water with approximately 7 feet of depth. Such a lake will require 4.3 acre feet of water to fill. Payson also experiences evaporation losses at a rate of approximately 60 inches/year. Therefore, not accounting for any additions to the lake directly from precipitation or from stormwater inflow, the lake will require an additional 6 acre-feet per year to maintain a full level. This requirement may be offset, depending on how much stormwater runoff can be routed into the lake, but for budgeting water needs during dry years, a source of 6 acre-feet/year would be advisable.

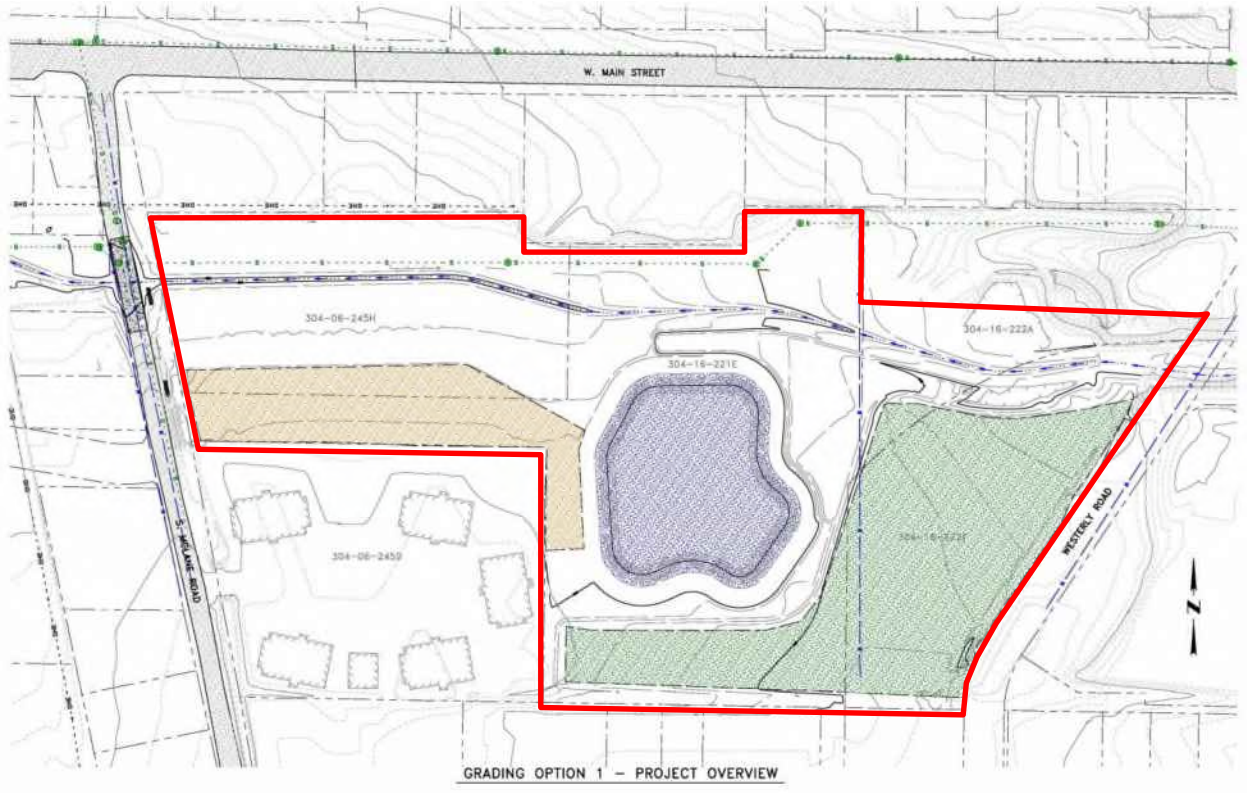


Figure 3 - Grading Option 1
Areas in green and orange indicate potential building pads. Area in blue represents a potential 1 acre lake. A graded channel exists across the northern portion of the site with associated floodplain and greenbelt areas.

OPTION 2

For the Option 2 (Figure 4), a significant portion of the site along the north half or the project area is left largely unchanged and allowed to continue to serve for floodplain/floodway conveyance while the southern half of the site are elevated to create area for building envelopes and recreational trails outside of the floodplain. The intent of this option is to allow a significant portion of the existing floodplain, with its

established vegetation to remain and to minimize disturbance to that area with the highest potential floodplain resource value.

The floodplain could be enhanced with additional riparian plantings such as willows and cottonwoods along its fringes to create a more aesthetic greenbelt but it would still primarily serve the purpose of flood conveyance. The floodplain will still have significant width to spread flows and dissipate energy. However, as this option relies upon a wide and level floodplain without specific channel definition, some reinforcing of the floodplain should be provided to protect against possible down cutting in high flow, high energy flood events. This could take the form of embedded rock sills and cross vane weirs to minimize the propagation of rilling or headcuts if they were to start in the floodplain during a large flood event.

The remainder of the site would be elevated above the floodplain to allow for recreation and development and creation of trails/park amenities. The elevated development pads would be stepped or tiered down in the downstream direction to correspond with the decreasing floodplain elevation and to minimize the amount of fill required.

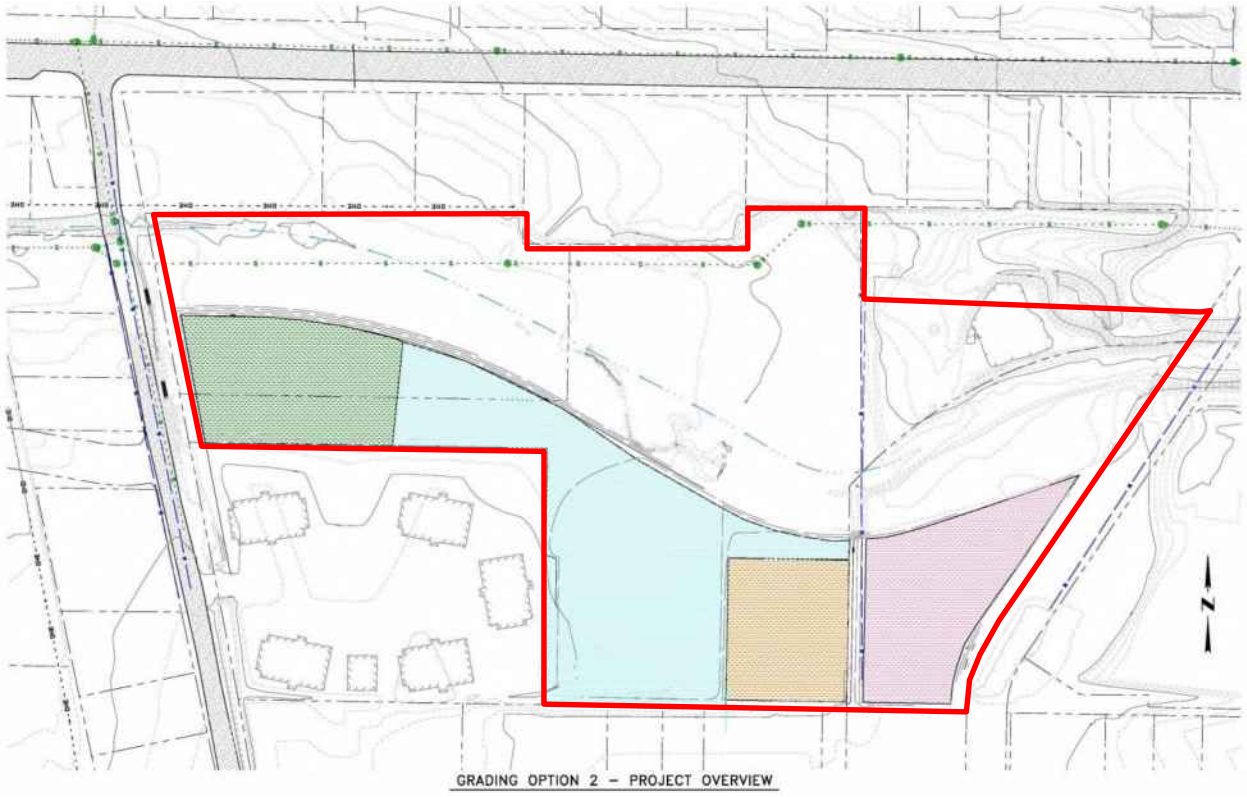


Figure 4 - Grading Option 2
Option 2 leaves the floodplain in the northern half of the project intact and largely undisturbed with pads reserved for development and recreational uses elevated above the floodplain constructed within the southern half of the project. The various colors depict separate development pads with differing elevations.

In Option 2, no significant channel construction of modification of the floodplain is proposed. However, depending upon the final design and floodplain modelling, if adverse impact and increases in floodplain elevations to neighboring properties results from the development from the south, some channel

modifications may be needed at McClane Road and downstream in order to increase conveyance and reduce both the depth and extent of flooding in the upstream areas.

Other options or combinations of options are possible that could be developed further in a formal design process. However, the options portrayed herein demonstrate a range of feasibility for elevating areas within the project to be above the existing floodplain while still providing a natural greenbelt to pass flood flows with minimal change in the floodplain elevations/extent.

HYDRAULIC ANALYSIS OF ALTERNATIVES CONSIDERED

The original floodplain through the project site was surveyed in the late 1970's with the first FEMA map going into effect in March of 1980 (FIRM Panel No. 0401070003A). The effective floodplain map is FIRM Panel No. 04007C0427D, 12/4/2007. Although significant changes in the topography have occurred upstream and downstream of this site in the 40 years since the original mapping, the floodplain map remains generally unchanged. The one exception is for that portion through the Sawmill Crossing project, upstream of the bridge at Westerly Road that was formally remapped prior to 2007.

Due to the numerous changes that have occurred in the floodplain, the one-dimensional hydraulic model that the maps are based upon may not accurately reflect the present day condition. For this reason, and in order to better compare existing to proposed conditions, NCD has chosen not to use the effective floodplain boundary as a base condition. Rather, we have chosen to model the floodplain using the two-dimensional capabilities within the USACE HEC-RAS software, based upon the present day topography and the proposed floodplain modifications as presented in Options 1 and 2.

If the project were to move forward, further refinement of the floodplain model would be required prior to seeking permitting approval through FEMA. Because the available topographic data used for this conceptual analysis is over a decade old and supplemental ground-based topographic data was limited, a full and detailed survey would also be required of the current floodplain, buildings, roads and infrastructure, extending upstream to the Sawmill Crossing and downstream to at least Country Club Drive. Additionally, it appears that the effective FEMA maps do not reflect the construction of the thee lakes downstream of this project and any map revisions may need to include to a point below the lowest lake.

The results of the hydraulic modelling as completed for this concept level analysis show that encroaching into the floodplain with elevated development pads and/or other amenities can be accomplished while minimizing adverse impact to adjacent properties. The following preliminary floodplain maps show the results of the modeling of the existing condition, and Options 1 and 2 presented herein. The modelling performed for this analysis uses the effective FEMA flood flows which are 1550 cfs at Hwy 87 increasing to 2000 cfs at McLane Road. Differences in extent of modelled flooding can be attributed to differences in the modelling techniques and more detailed topography with the present model as compared to that used for the effective FEMA model.

In Figure 6, the proposed urban lake can be seen near the center with the areas to the south and east of the lake removed from the floodplain. Additionally, the development pad near McLane Road (shown as orange in Figure 3) is shown within the floodplain, however, depth of flooding are minor, less than 1 foot such that any building could be constructed above the floodplain while the perimeter (such as parking areas) remained within the 100-year floodplain. By leaving this area within the 100-year floodplain, reduces the potential adverse impact to the properties along the north side of the channel, yet allows for a potential building to be elevated above the floodplain.

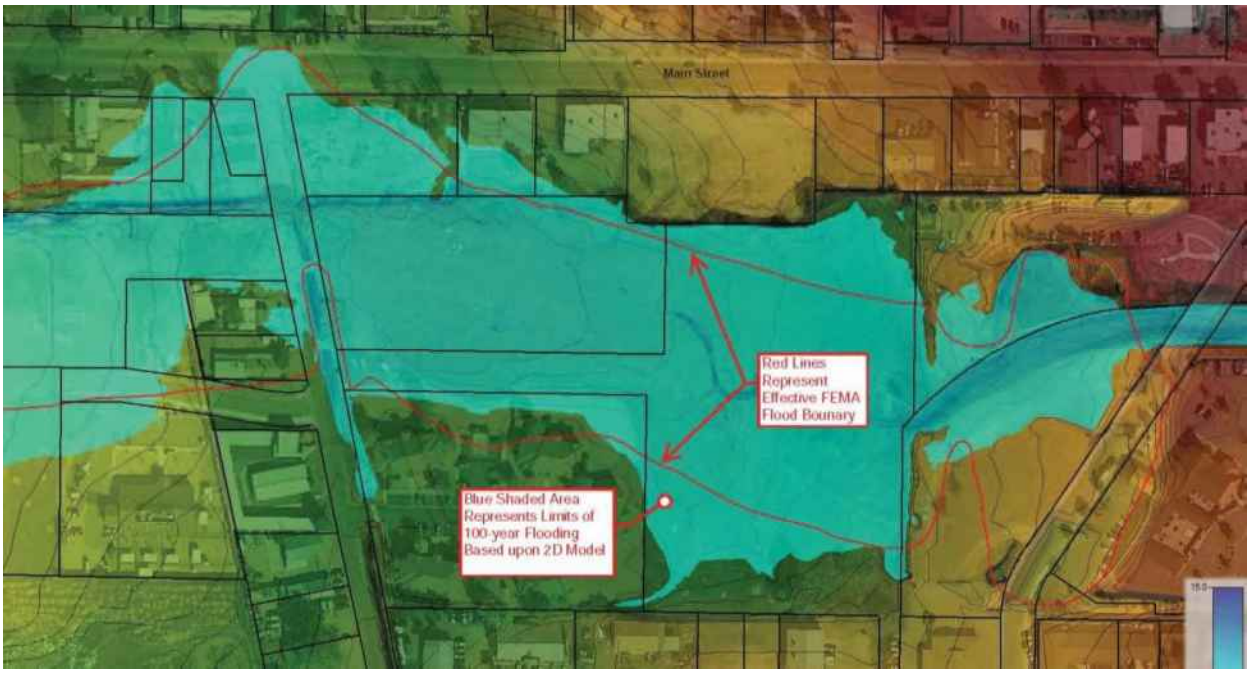


Figure 5 - Existing Condition, 100 year Flood Map
The red lines show the effective FEMA flood boundary. The blue shaded area depicts the 100 year flooding based upon the 2D model prepared for this analysis. The blue color represents the extent of flooding during the 100-year flood event.

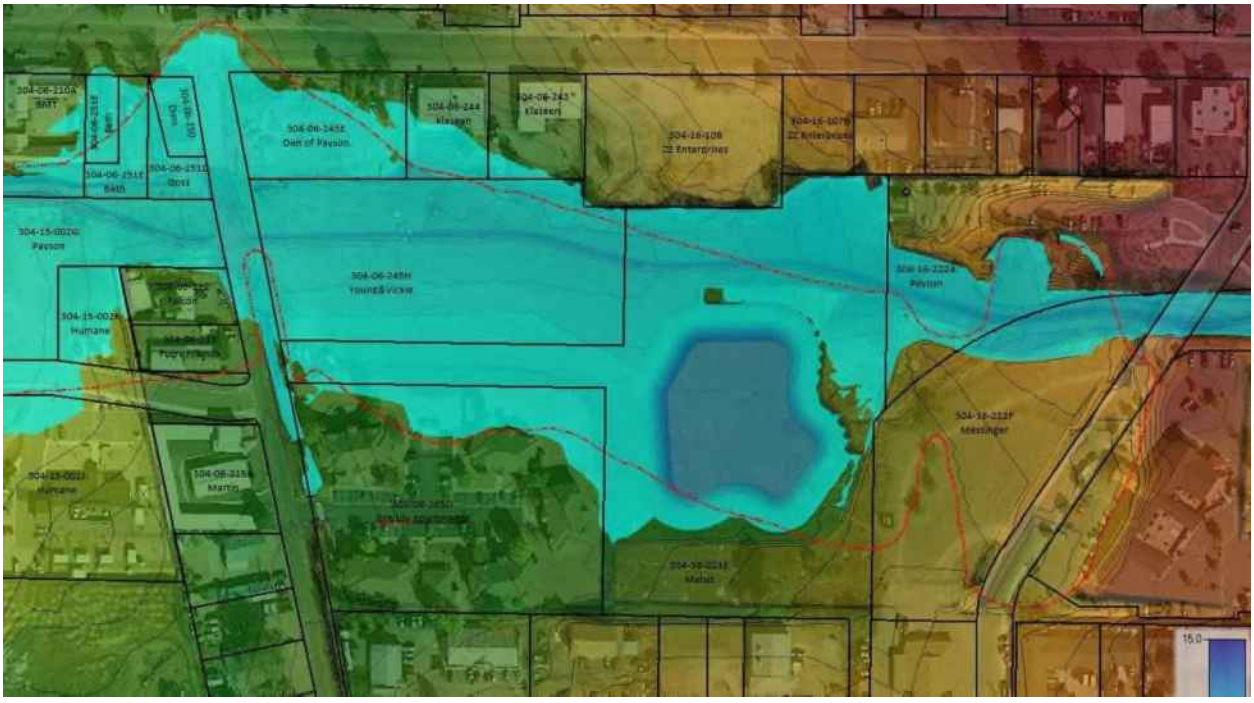


Figure 6 - Option 1, 100-year Flood Map
The red lines show the effective FEMA flood boundary. The blue shaded area depicts the 100 year flooding based upon the 2D model prepared for this analysis. Note the areas in the west and southern portions of the size have been removed from the flood zone.

In comparing the existing condition flood map (Figure 5) to the Option 1 flood map (Figure 6), one can see that the extent of flooding is very similar, with any additional flooding outside of the project property boundaries being minimal. Minor adjustments to the grading plan would be likely in a full design effort, however, on a conceptual level, this demonstrates that Option 1 is viable.

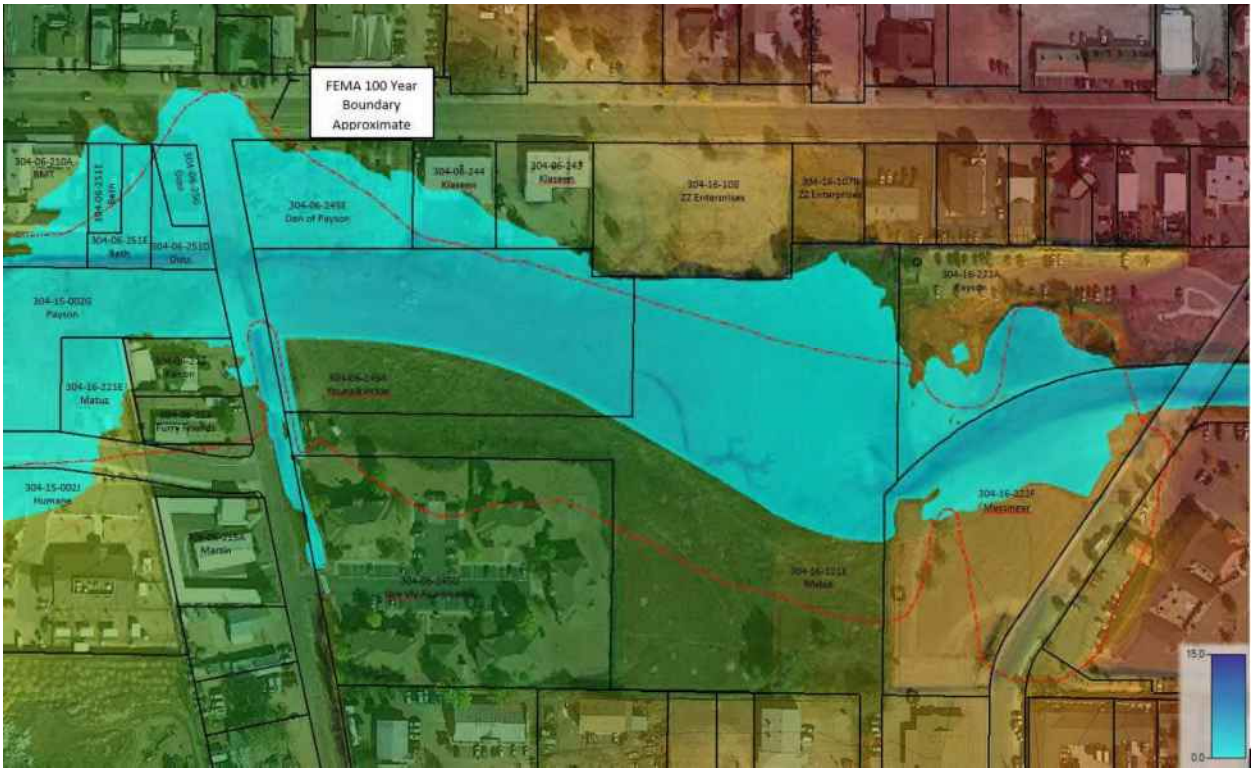


Figure 7 - Option 2, 100-year Flood Map
The red lines show the effective FEMA flood boundary. The blue shaded area depicts the 100 year flooding based upon the 2D model prepared for this analysis. Note that the areas in the southern half of the site have been removed from the floodplain. The legend/scale in the lower right indicates depths of flooding from 0 to 15 feet.

CONCEPT DESIGN OPTIONS

In both options explored, the intent of the design approach is to provide for a natural-like floodway to allow passage of the 100-year flood event through the site without adversely affecting adjacent properties. Additionally, the designs provide for areas of the project site, inclusive of several parcels, that are elevated above the floodplain to allow for recreational uses and future development.

Each option provides for differing areas of developable space and potential for recreation, but help provide and understand of the possibilities available for floodplain development that maintain a broader, natural-like floodway as compared to a minimized trapezoidal flood channel that was previously constructed upstream of the Westerly Road bridge.

Detailed descriptions of the two options explored are provided below.

OPTION 1:

- *Channel:* Excavation and shaping of 1,200 lineal feet of 'bankfull' channel with adjacent floodplain/floodway areas along the northern limits of the site. The channel and floodplain would require planting and irrigation to establish a recreational greenbelt approximately 2.8 acres in area.
- *Urban Lake:* Creation of a 1.2 acre urban lake located centrally within the project area. The pond would be protected from frequent flooding to prevent frequent filling with sediment but would be located within the 100-year floodplain. The lake would be built with a shallow fringe to allow establishment of wetland vegetation and would be >5 feet deep throughout most of the lake to prevent establishment of emergent vegetation. A synthetic liner for the lake bottom would be recommended in order to minimize seepage losses unless a geotechnical exploration can demonstrate suitable soils for a natural liner.
- *Developable Space:* Elevation with fill of approximately 2.7 acres to be above the 100 year floodplain and available for development and recreational uses. Also, the elevation of another 1.0 acre of land with less than 1 foot of depth of flooding. This would allow for a building to be constructed with a finished floor elevation above the floodplain elevation, but with any associated parking lot or exterior landscaping amenities to remain within the 100 year flood zone. This way, flood conveyance is maintained through the site (except for the building footprint), helping reduce increases in floodplain elevation to neighboring properties. Some additional refinements can likely be made to increase developable area where possible or decrease developable area where necessary to reduce negative flooding impacts to adjacent parcels.
- See Figure 3 and Conceptual Plans, Appendix A.

OPTION 2:

- *Floodplain:* Preservation of approximately 6 acres of the northern half of the project site to maintain the purpose of floodplain and floodway. The intent would be to minimize disturbance within that area, allow the established vegetation to remain and continue its floodplain function.
- *Developable Space:* Creation of approximately 4.5 acres of elevated land within the southern half of the site to be available for development and recreational purposes above the floodplain.
- *Urban Lake:* This option does not include a small lake as was proposed by the Town of Payson. Rather, this option preserves much of the area that may be an ephemeral wetland in the northeast quarter of the project site and otherwise maximizes the area that would be elevated above the 100-year floodplain. Creation of a lake, below existing grades within the floodplain would be possible without adversely affecting the floodplain boundary on the properties to the north. However, the lake would be subject to frequent inundation with ephemeral flows and the sediment that is carried with them.
- *Urban Trail:* Though not shown within the conceptual layout, an urban trail may be constructed within the floodplain, near to existing grades and meandering through the proposed cottonwood trees and other riparian vegetation at the edge of the elevated development pads. The trail would be subject to inundation during large flood events and would require cleaning and maintenance after such events but would leave a greater area for development within the elevated pads.
- See Figure 4 and Concept Plans, Appendix A.

Table 1 – Brief Comparison of Options

	Option 1	Option 2
Area Reserved for Development & Recreation (acres)	3.7	4.5
Area Reserved for Lake/Open Water (acres)	1.3	-
Area Reserved for Floodplain/Floodway & Other (acres)	6.8	7.3
Earthwork		
Clear/Grub (cy)	5,875	4,077
Excavation (cy)	24,125	101
Fill Placement (cy)	16,634	18,842
McLane Road Reprofile (Low Water Crossing) Required	Significant	Minor
Utility Relocations/Adjustments Required	Significant	Minor
Estimated Project Cost	$1.6M	$1.1M

OTHER COMPONENTS REQUIRED

DOWNSTREAM MODIFICATIONS

Both options require modifications to McLane Road and the downstream channel. McLane Road requires expansion of the existing low water crossing to provide for a lowered channel invert in order to maintain the approximate same floodplain elevation through the channel reach. Additionally, channel improvements to enhance flood -conveyance will be required for another 600 feet downstream of McLane Road in order to pass the 100-year flood and maintain the current regulatory floodplain elevations.

REVEGETATION

Reestablishment of vegetation along and within the floodplain will be required where any disturbance and reshaping of the channel and floodplain is conducted. Revegetation will provide for resistance to erosion within the channel and floodplain and provide for an aesthetic greenbelt along what is an urban floodplain corridor.

FEATURE ROCKS AND CHANNEL ARMOR

As part of the channel creation of Option 1, large feature rocks, bank toe rock and channel riprap will be required along the lengths of the reach where shear stresses are high. Feature rocks and riprap placement would be similar in scale and magnitude to those in the channel work recently completed in the upstream section of American Gulch.

With Option 2, a wider swath of the floodplain is preserved and rockwork would be expected to be less. However, rock sills placed periodically along the floodplain may be appropriate to reduce the risk of channel incision during high flow events.

UTILITY ADJUSTMENTS

Underground utilities pass through the site and within McLane Road at the downstream end of the project. Depending upon the extent and depth of grading and floodplain modifications, vertical realignment may be necessary for water, sewer and dry utilities.

Sewer Lines

Based upon information provided by the sewer district, the existing sewer lines appear to be very deep through and/or across the site and would not require relocation. However, it is likely that some vertical adjustments to the manhole frames and lids will be required to match into the new finished grades.

Water Lines

Existing water lines will likely require vertical realignment based upon the finished grading. Option 1 would require the most significant amount of water line adjustment associated with the vertical realignment of McLane Road. There were also water line appurtenances noted running north to south across the approximate middle of the site that would require adjustment with either of the options presented.

Dry Utilities

Underground telephone, cable TV and electric lines were not located with this conceptual effort. Overhead utility lines are present along the north side of the project site and behind the properties that front McLane Road along the west side of the project. Existing overhead utilities are not likely to be in conflict with the proposed floodplain modifications. The presence of underground dry utilizes within the project boundaries will need to be verified during a full design effort with potential vertical and/or horizontal relocation necessary depending upon what is found.

DESIGN

Design of the project would be expected to include survey, civil engineering and landscape architecture services.

Survey:

- Topographic Survey: A full and detailed topographic survey, including the entire floodplain within and adjacent to the site and upstream and downstream of the project will be necessary. The topographic survey would be needed to support the proposed grading design as well as detailed hydraulic modelling that will be needed to remap the floodplain.
- Boundary Survey: A full property boundary survey, prepared by a registered land surveyor would be necessary to determine the exact parcel lines within and along the edges of the project site.
- Legal Descriptions: Services of a registered land surveyor would also be needed to prepare any legal descriptions for dedication of public easements, new rights-of-way and/or combination/splits of interior parcels of the site.

Civil Engineering:

- Plan Development: A full design and development of plan and specifications would be required for the mass grading and alteration of the floodplain/floodway, reconfiguration of the McLane Road and the low water crossing, utility adjustments, storm drain adjustments, development-ready fill pads and landscaping/revegetation.

- Hyrdologic and hydraulic analysis in support of the final grading design for permitting the project through FEMA for alteration of the regulatory floodplain limits.
- Permitting assistance (Clean Water Act 404) through the USACE.
- Geotechnical engineering services for subgrade exploration of existing site soils and earthwork recommendations for construction of fill pads to support future structures.

Landscape Architecture:

- Depending upon the level of design that is desired for the public recreational amenities within the greenbelt and floodplain, the town may also desire the services of a landscape architect to design the revegetation of the floodplain and floodplain fringe areas and design recreation amenities along the trail. It is recommended that the revegetation be limited to native species that are drought resistant and do not represent an invasive threat.

Total required time for Surveying and Engineer services would be estimated to require 6 to 9 months, depending upon the complexity of the design beyond that shown herein and the required permitting from outside agencies.

CONSTRUCTION

Following completion of design and permitting, the bidding and construction process of the project would be expected to last 6 to 12 months.

INSTITUTIONAL AND JURISDICTIONAL CONSIDERATIONS

PERMITTING

Permitting would be required through the Town of Payson, Federal Emergency Management Agency (FEMA) and potentially the US Army Corps of Engineers (USACE). Additional permitting may be required related to utility line adjustments such as Arizona Department of Environmental Quality (ADEQ) for water line and/or sewer line relocations, if necessary.

Federal Emergency Management Agency (FEMA) Obligations

Remapping the floodplain based upon the most current existing topography, the proposed and then completed construction would be required. The final design would require permitting with a Conditional Letter of Map Revision (CLOMR) through FEMA prior to the start of construction. Upon completion of construction, submittal to and approval by FEMA for a Letter of Map Revision (LOMR) would also be required to formally revise the regulatory flood maps within the limits of the project.

This work requires in-depth hydraulic modeling of the current condition, proposed design and as-built condition, detailed documentation of the model parameters and considerable dialog with FEMA personnel. Allowance for adequate time between submittal of the CLOMR and beginning of construction is advised. Review can require several months. The modeling, documentation and responding to FEMA inquiries is expected to require $40,000 to $50,000 contracted expense with an engineering consultant.

Federal Clean Water Act Section 404 Permitting

The Clean Water Act is design to protect water quality and is administrated by the Environmental Protection Agency and the US Army Corps of Engineers Regulatory Branch. Projects that result in dredge or fill of jurisdictional waters of the United States (WOUS) are required to obtain a permit for those activities through the Army Corps of Engineers. Under the current rules governing the definition of WOUS much of the low lying portions of the project area could be considered WOUS within the ill defined channel currently at the site. Work within the channel would require a 404 permit. Because of the channel work, greenspace development and ponding which could receive stormwater runoff and provide water quality enhancements, it is likely that permitting could occur under one of the various Nationwide 404 permits which allow specific actions such as habitat enhancement (Nationwide 27). These permits are relatively straightforward and easy to acquire. Project activities outside those permitted under the nationwide permit (wetland fill and underground piping of channels) will require an individual 404 permit, which is a more time consuming and costly process and may require mitigation for loss of aquatic resources.

Delineation of aquatic resources (WOUS) at the site were not part of the scope of this project and no formal investigation of their limits has been performed. However, the site has been visually surveyed for wetland plants and inundation frequency. This preliminary investigation indicates that although the site only has an ephemeral flood regime (no permanent flow) there is evidence of some wetland vegetation across much of the floodplain, and it appears that the jurisdictional channel at the site would be relatively wide.

Under the current rules for delineation of WOUS the ephemeral channel and potentially the ephemeral wetland would be jurisdictional. However, the rules are scheduled to change at the end of June 2020. The new rule would exempt this ephemeral system from WOUS and no 404 permit would be required for any portion of the project. The new rule change is controversial as most rule changes with the Clean Water Act have been. Currently, the Army Corps of Engineers regulators are still receiving regulatory guidance as to how to implement the new rules. Additionally, there is an expectation of a challenge to the new rules once they are implemented which may or may not lead to an injunction against implementing the rule. The timeline for settlement of these potential challenges is unknown.

This unsettled situation with permitting confounds how to approach the project. We have provided two alternatives, one based on development within the floodplain with green infrastructure and open space but requiring the narrowing of the potential jurisdictional limits and the other with minimal incursion into potential jurisdictional channel/wetland; basically avoiding work within jurisdictional limits. If the landowners and the Town of Payson wish to proceed with the larger impact design or some variant, there are two potential paths forward for permitting.

1) Wait until the new rule is in place and appears to be free from challenges. If the new rule is in place, there should be no need for permitting through the Clean Water Act because there would be no jurisdictional waters in the ephemeral wash. As stated before, this scenario may take some time to play out and there is no guarantee that any settlement would remove the floodplain from jurisdiction.

2) Proceed with a preliminary jurisdictional delineation of the potential jurisdictional channel and wetland area. This will require a detailed survey of plants, hydrology and soils. This information would be provided to the Army Corps of Engineers as a basis for determining the impacts from the project. The project should be designed with permitting through a Nationwide 27 permit in

mind. This permit would allow for impacts within the jurisdictional limits. However, much of the project would be focused on habitat and stream function improvements within the new channel. These functions can include, utilizing stable geomorphic dimensions and patterns, use of natural materials, inclusion of native riparian planting schemes, creation of some wetland fringe around portions of the pond and inclusion of methods for natural treatment of stormwater runoff. Inclusion of these functions into the design should satisfy criteria for the Nationwide 27 permit and greatly improve the outcome of the permit process.

This option would allow the project to proceed on its own schedule without waiting for outcome of challenges to the new rule and would meet the demands of the Clean Water Act either way the challenges were decided.

A jurisdictional delineation for the site would require further investigation of soils at multiple points throughout the site, investigation of the plant community for wetland vs dryland plants and some additional hydrologic modeling for low flows through the site. This information would be provided to the Army Corps of Engineers in report form with and opinion on the lack of or extent of wetlands at the site. These efforts would likely require $4,000 to $6,000 of effort including answering questions from the ACOE and providing additional data as needed. Additionally, application for Nationwide 27 would require a cultural resources survey (archaeology) and a biological evaluation of the site. This is the same process that the American Gulch project went through.

State of Arizona

Permitting through the Arizona Department of Environmental Quality (ADEQ) may be necessary, depending upon the required changes to sewer and water lines. Based upon this conceptual design, at a minimum, the existing water lines may require vertical adjustments and as such, permitting through ADEQ should be anticipated.

Town of Payson

It is anticipated that design review and permitting through the Town of Payson would be required, including a grading permits, right-of-way encroachment permit and local utility construction permitting. This permitting requirement and costs are anticipated to be minor at this time.

BUDGETARY ESTIMATES

At this conceptual level of analysis, developing an accurate cost estimate is not possible. However, an order of magnitude estimate of the expected budgetary costs for the options included within the report is provided in below. Actual costs may vary greatly and may be more or less than those estimated here, depending upon the final design, options included in the full design, utility relocations that are required and when the project actually unfolds.

Table 2 on the following page provides a concept level estimate of project costs in a side-by-side comparison between the two options. The final design option would be expected to vary from the two presented herein, but the range of costs between $1.1M and $1.7M is likely to create a project that provides for recreation, development and greenbelt/flood conveyance.

The budgetary estimates provided assume excavation and fill placement to create the finished grades within and above the floodplain elevations. The costs for design and construction of basic trails and a minor amount of public amenities are also captured by the estimates provided. However, the estimates do not include costs for the formal development of commercial or residential development within building pads. Buildings, parking lots, utility services, etc. should be considered above and beyond those costs captured herein.

Table 2 - Budgetary Estimate for Options Presented

	OPTION 1				OPTION 2			
ITEM	**UNIT**	**COST/UNIT**	**QTY**	**COST**	**UNIT**	**COST/UNIT**	**QTY**	**COST**
Mobilization/Demobilization	LS	$ 20,000	1	$ 20,000	LS	$ 20,000	1	$ 20,000
Clear & Grub	SY	$ 4	5875	$ 23,500	SY	$ 4	4077	$ 16,307
Excavation/Cut	CY	$ 10	21125	$ 212,522	CY	$ 10	101	$ 1,016
Fill Placement/Compaction	CY	$ 15	16634	$ 249,504	CY	$ 15	18842	$ 282,630
Fill Import (purchase/haul)	CY	$ 10	0	$ -	CY	$ 10	18741	$ 187,410
Spoils Haul-Off	CY	$ 5	10367	$ 51,834	CY	$ 5	4077	$ 20,384
Existing Utility Adjustment								
Water Line Adjustment	LF	$ 70	337	$ 23,590	LF	$ 70	0	$ -
Sewer Manhole Adjustment	EA	$ 500	5	$ 2,500	EA	$ 500	0	$ -
Dry Utility Adjustments	LF	$ 40	400	$ 16,000	LF	$ 40	150	$ 6,000
Storm Drain/Culvert	LF	$ 60	300	$ 18,000	LF	$ 60	300	$ 18,000
Channel Improvements								
Substrate	CY	$ 50	200	$ 10,000	CY	$ 50	0	$ -
Toe Rock	LF	$ 110	600	$ 66,000	LF	$ 110	800	$ 88,000
Cross Vane Weir	EA	$ 6,000	8	$ 48,000	EA	$ 6,000	0	$ -
Rock Vane Arm	EA	$ 2,000	8	$ 16,000	EA	$ 2,000	8	$ 16,000
Road Reprofile/Reconstruction	LF	$ 200	400	$ 80,000	LF	$ 200	0	$ -
Concrete Low Water Crossing	LS	$ 24,000	1	$ 24,000	LS	$ 24,000	0	$ -
Synthetic Lake Liner	SF	$ 3	65340	$ 196,020	SF	$ -	0	$ -
Rock Sill	LF	$ 110		$ -	LF	$ 110	0	$ -
Revegetation								
Erosion Control Blanket	ROLL	$ 150	34	$ 5,100	ROLL	$ 150	11	$ 1,650
Containerized Plants	EA	$ 68	200	$ 13,600	EA	$ 68	100	$ 6,800
Elk Fencing for Plants	LS	$ 7,500	1	$ 7,500	LS	$ 7,500	1	$ 7,500
Reseeding/Mulching	AC	$ 2,000	10	$ 20,000	AC	$ 2,000	6	$ 12,000
Irrigation System	LS	$ 5,000	1	$ 5,000	LS	$ 3,000	1	$ 3,000
Design								
Topographic & Boundary Survey	LS	$ 30,000	1	$ 30,000	LS	$ 30,000	1	$ 30,000
Engineering Design	LS	$ 166,301	1	$ 166,301	LS	$ 103,005	1	$ 103,005
Lanscape Architectural Services	LS	$ 20,000	1	$ 20,000	LS	$ 20,000	1	$ 20,000
Permiting								
USACE 404	LS	$ 6,000	1	$ 6,000	LS	$ 6,000	1	$ 6,000
FEMA LOMR/CLOMR	LS	$ 50,000	1	$ 50,000	LS	$ 50,000	1	$ 50,000
ADEQ	LS	$ 5,000	1	$ 5,000	LS	$ 5,000	1	$ 5,000
Construction Phase Services								
Construction Observation	LS	$ 20,000	1	$ 20,000	LS	$ 20,000	1	$ 20,000
Construction Materials Testing	LS	$ 17,500	1	$ 17,500	LS	$ 17,500	1	$ 17,500
Construction Suvey	LS	$ 7,500	1	$ 7,500	LS	$ 7,500	1	$ 7,500
Contingency								
Contingency at Concept Level	20%	$		267,227	20%	$		176,464
	Total Budgetary Estimate:			**$ 1,698,198**	**Total Budgetary Estimate:**			**$ 1,122,166**

The costs estimated for Option 1 assumes the use of a synthetic liner to create the urban lake. However, the costs for obtaining water to fill the urban lake, for extending water or reclaimed water mains to the lake and for installation of lake infrastructure (aeration equipment, shoreline amenities, etc.) should also be added when considering that option.

POTENTIAL FUNDING

Redevelopment of the area will require considerable funding. When summed total, the cost is likely to be daunting, even though tax base revenues and community amenity improvements may be highly beneficial. It is suggested that the project can be broken into various stages and tasks that are targeted towards specific funding resources. Below are several potential methods for funding based on our experience. Other sources may be available.

The design and major earthwork (building site fill) are likely the most difficult to find funding sources for. Federal Block Grants from Housing and Urban Development may provide a funding source for creation of building space, removal of property from flood plains and improvement of neighborhoods. Private investment is also a likely source of funding since returns for development rights, etc will provide a relatively easy and quick way to recover investment.

The green space and public amenity portions of the project may be much easier to fund through grants. Several sources that we are familiar with are:

Arizona Water Protection Fund - This funding source is best utilized for stream and wetland restoration efforts. It is easiest to access for projects that are improving ecological and physical function of streams and wetlands. This funding source could be utilized to improve stream capacity and habitat (including plantings). Development of wetland resources as well as development of the pond if it can be shown to be a water quality improvement for stormwater runoff will fit the mission of this program and stand a good chance of funding. Funds are usually available competitively for projects between $20,000 and $500,000 although funds availability changes from year to year. Contact: Reuben Teran Executive Director, rteran@azwater.gov. Website. https://www.azwpf.gov/.

US Fish and Wildlife Service Partners for Fish and Wildlife – This source is excellent for smaller projects or grants that are in addition to other grants. The Partners Program is most interested in improving habitat for anything from butterflies to fish. These funds are excellent to utilize for plantings or improvements to soil moisture conditions, removal of weeds, etc. Fund usually available up to $25,000. Website: https://www.fws.gov/southwest/es/arizona/partners.htm Contact: Jennifer Kaplan, Jennifer_kaplan@fws.gov

Arizona Game and Fish Department Heritage Grant Program - This is a competitive grant fund available for a wide variety of projects related to habitat improvement, education and outdoor recreation. Projects that are focused on trails, signage, habitat improvement, public access and public education are highly competitive. Contact: rbeck@azgfd.gov, https://www.azgfd.com/wildlife/heritagefund/grantsubprograms/

Several grant programs are specifically focused on creation and enhancement of open spaces. Examples are:

National Park Service Community Assistance in Conservation and Recreation Grants. Provides funding for community led conservation and outdoor recreation projects. Currently working with the Town of

Superior Waters and Trails Action Plan as well as the Flagstaff Trails Initiative. Website-https://www.nps.gov/orgs/rtca/apply.htm. Contact Ericka Pilcher, Program Manager, RTCA_Apps_IMR@nps.gov

Arizona State Parks and Trails– Provides funding to government and nonptofits for all kinds of motorize and non-motorized recreational trail uses. Likely a best fit for a trails or lake recreation portion of the project. The land and water conservation fund is a closely related grant program which is focused on providing matching funds for purchase of open space lands. Contact: jschmidt@azstateparks.gov, Website: https://azstateparks.com/apply-for-grants

Land and Water Conservation Fund – US Department of Interior – Utilizes revenue from oil and gas leases to provide matching grants for development of public parks and outdoor recreation sites. Funds can be utilized to work with private landowners in partnership for conservation practices. https://www.doi.gov/lwcf/about/. Contact: Joel Lynch (202) 354-6905. National Park Service, Washington, D.C.

RESULTS, CONCLUSIONS, RECOMMENDATIONS

The concept level design and analysis provided herein demonstrate that the existing floodplain of the American Gulch wash between Western Road and McLane Road can be modified to created developable areas above the floodplain while providing for a greenbelt to provide for public space, public recreations and floodplain/floodway. Of the approximate 11.8 acres land included within the site, the options presented herein provide for approximately 3.7 to 4.5 acres of developable land and reserves approximately 7 to 8 acres for floodplain/floodway and recreational uses (lake, trail, greenspace, etc.).

Our budgetary cost analysis indicates that the town should plan to seek funding for between $1.1M to $1.7M to construct the project, depending upon desired amenities and amount of land elevated for private development and recreation purposes. Funding sources may include private contributions and/or public grants, among others.

Because of the existing regulatory floodplain that extends through the site, significant additional analysis, design and permitting will be required in order to get to the point of construction and implementation of the project. The combined process of full design and permitting would likely require at least one year to complete. Additional time may be necessary, depending upon input from all of the stakeholders during the design process and the alternate design scenarios that may be desired to be explored by the group that will require additional consideration and analysis. Additionally, review and permitting times through FEMA for CLOMR approval of the floodplain revision can be lengthy. The town would be advised to plan for a two year design and implementation time frame in order

TECHNICAL APPENDICES

APPENDIX A: 11X17 SHEETS (HALF SCALE PRINTS) OF CONCEPT PLANS

APPENDIX B: HEC-RAS 2D MODEL RESULTS

Floodplain Depths

- Existing Condition
- Option 1
- Option 2

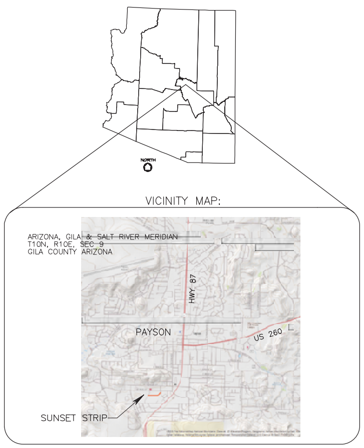
Floodplain Velocities

- Existing Condition
- Option 1
- Option 2

APPENDIX A:
11X17 SHEETS (HALF SCALE PRINTS) OF CONCEPT PLANS

AMERICAN GULCH "SUNSET STRIP"
CHANNEL AND RIPARIAN ENHANCEMENT
WESTERLY ROAD TO MCLANE ROAD
GILA COUNTY, ARIZONA

VICINITY MAP:



CALL ARIZONA BLUE STAKE TWO WORKING DAYS BEFORE YOU DIG DIAL 8-1-1

ANY UNDERGROUND UTILITIES LOCATIONS DEPICTED ON THE PLANS ARE TO BE CONSIDERED APPROXIMATE ONLY. THE UTILITY LOCATIONS (IF SHOWN) WERE PLOTTED FROM A COMBINATION OF FIELD DATA, RECORD DATA, LANDOWNER INFORMATION, AND UTILITY MAPS PROVIDED BY OTHERS, AND MAY NOT REFLECT ALL EXISTING UTILITIES OR THE EXACT LOCATION. LOCATION OF ALL EXISTING UTILITIES SHALL BE CONFIRMED BY THE CONTRACTOR PRIOR TO CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR THE PROTECTION OF AND ANY DAMAGE TO EXISTING UTILITIES. CALL BEFORE YOU DIG (DIAL '811' OR '1-800-STAKE-IT').

PREPARED FOR:

TOWN OF PAYSON
ENGINEERING DEPARTMENT
303 N. BEELINE HIGHWAY
PAYSON, AZ 85541

PREPARED BY:

NATURAL CHANNEL DESIGN, INC.
2900 N. WEST STREET #5
FLAGSTAFF, AZ 86004
PHONE: (928) 774-2336

SHEET INDEX:

SUNSET STRIP CHANNEL & RIPARIAN ENHANCEMENT

APPROX. IMAGE SCALE 1"=100'

UNAUTHORIZED CHANGES & USES

THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.

CALL ARIZONA BLUE STAKE TWO WORKING DAYS BEFORE YOU DIG DIAL 8-1-1

DATE: **19 MAY 2020**

DRAWING NUMBER: **CVR01**

NCD PROJECT NUMBER: **SUNSET**

SHEET NUMBER: **1** OF **11**

PRELIMINARY CONCEPT NOT FOR CONSTRUCTION

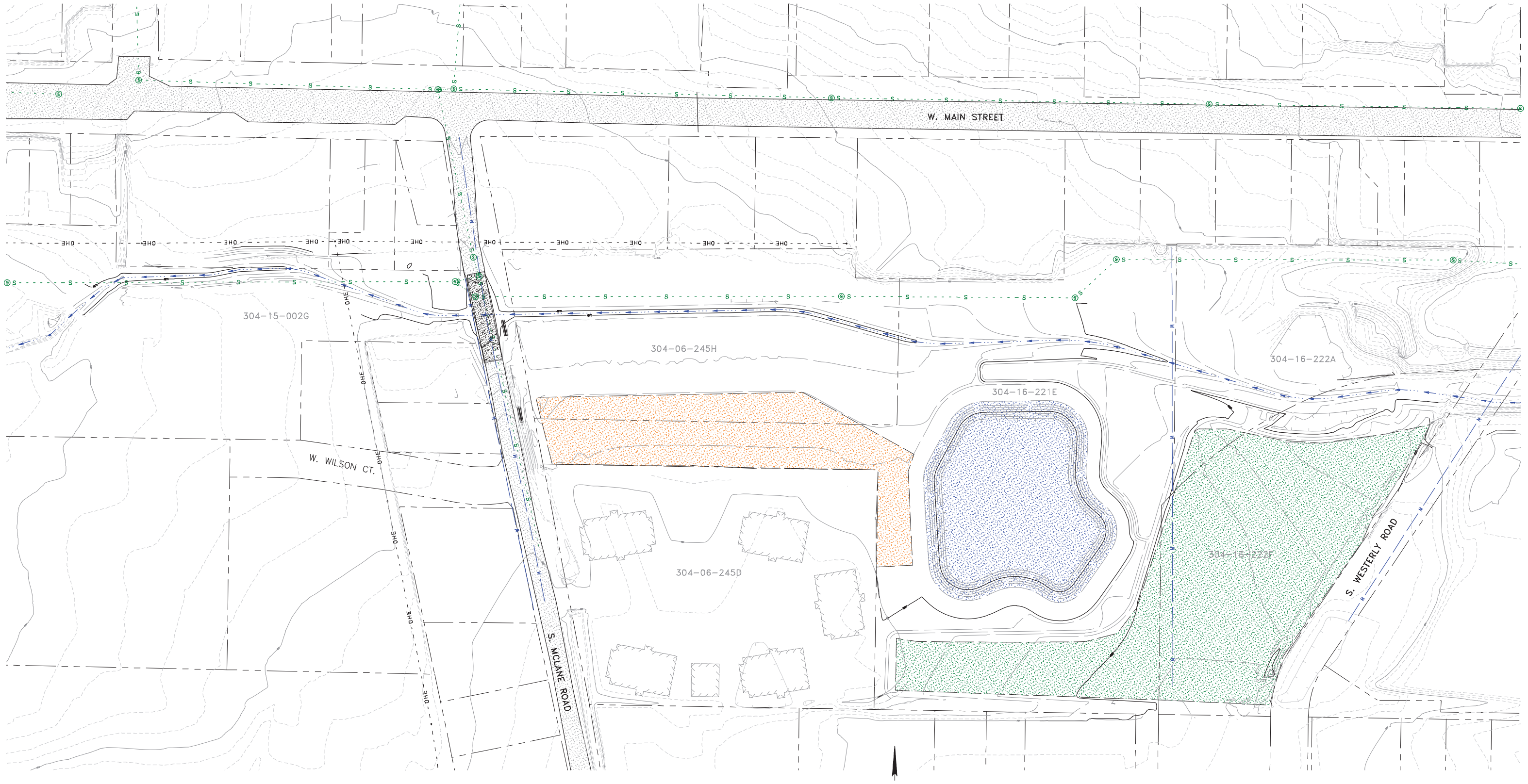
COVER, LOCATION MAP AND LEGEND

AMERICAN GULCH – "SUNSET STRIP" CONCEPT DEVELOPEMENT
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

NO.	DATE	BY	REVISION

DRAWN BY: JF, MK
DESIGNED BY:
CHECKED BY:

Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336



GRADING OPTION 1 – PROJECT OVERVIEW

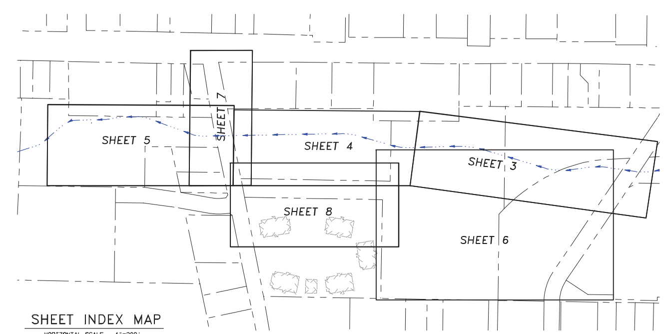
HORIZONTAL SCALE 1"=80'

0 40 80

	BOX WITH ORANGE HATCH: Building Pad 1: 1.08 acres above floodplain APN: 304-06-245H 0.32 Acres APN: 304-16-221E 0.77 Acres
	BOX WITH GREEN HATCH: Building Pad 2: 2.56 acres above floodplain APN: 304-16-222F 1.84 Acres APN: 304-16-221E 0.66 Acres APN: 304-16-222A 0.06 Acres
	BOX WITH BLUE HATCH: Lake: 1.26 acres of open water APN: 304-16-221E 1.26 Acres

NOTES:

1. Parcel lines shown are approximate and based upon GIS data provided by the Town of Payson
2. Locations of existing utilities shown are approximate only and based upon information found in the field or in maps provided to NCD by the utility companies
3. Existing contours shown should be considered approximate. The topography is a composite of aerial topography from prior to 2010, supplemented with a limited ground-based topographic survey performed by NCD in 2020.



SHEET INDEX MAP

HORIZONTAL SCALE 1"=200'

0 100 200

GRADING OPTION 1– PROJECT OVERVIEW

AMERICAN GULCH – "SUNSET STRIP" CONCEPT DEVELOPEMENT
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

PRELIMINARY CONCEPT NOT FOR CONSTRUCTION

DATE: 19 MAY 2020

NCD PROJECT NUMBER: SUNSET

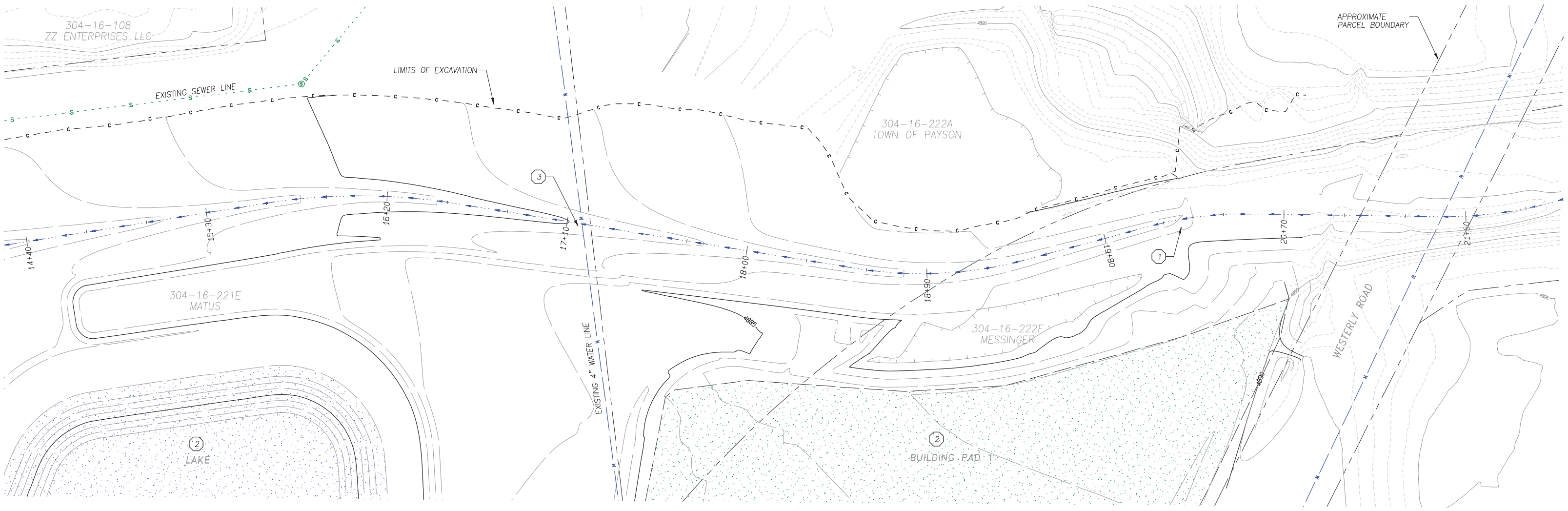
SHEET NAME: OVR01

SHEET NUMBER: 2 of 11

DRAWN BY: JF, MK
DESIGNED BY:
CHECKED BY:

NO.	DATE	BY	REVISION

Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336

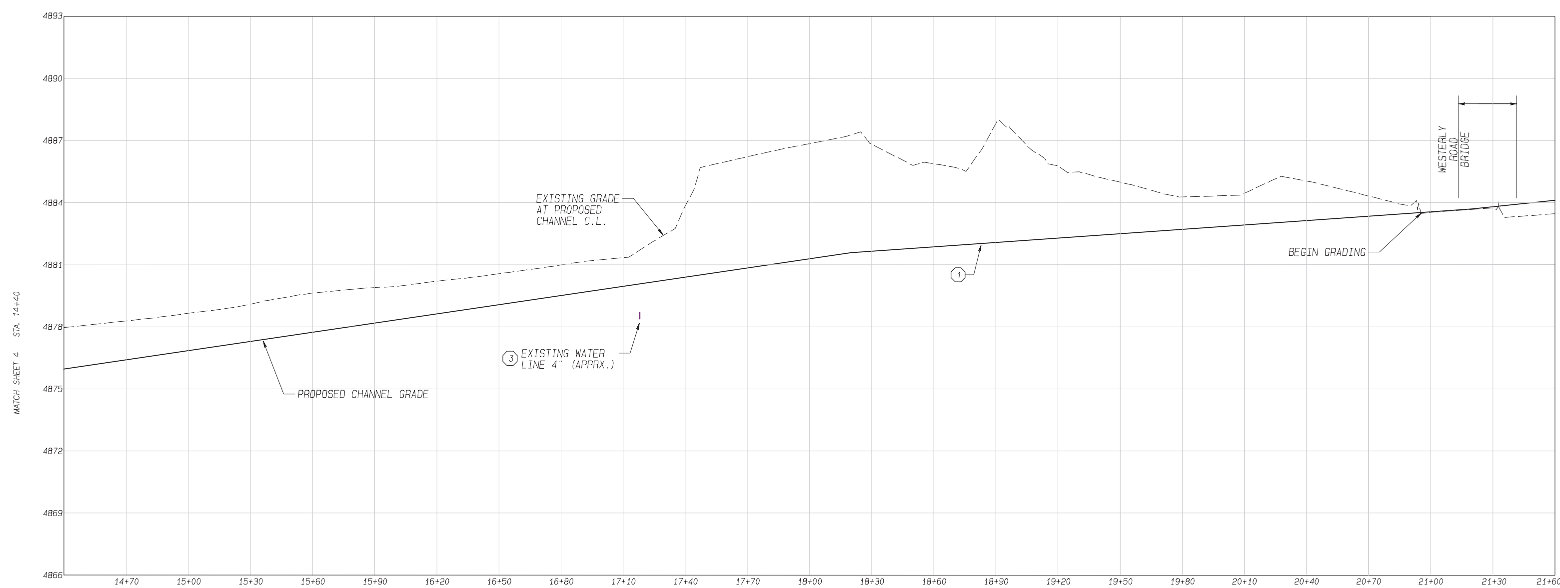


NOTES

1. NEW CHANNEL GRADING. SEE SHEET 8 FOR TYPICAL CHANNEL DETAILS.
2. EXCAVATION AND FILL PLACEMENT AND FEATURE CONSTRUCTION
3. LOWER EXISTING WATERLINE UNDER PROPOSED CHANNEL ALIGNMENT.

CHANNEL GRADING PLAN & PROFILE
STA. 21+00 TO STA. 14+40

HORIZONTAL SCALE 1"=30'
VERTICAL SCALE 1"=3'



GENERAL NOTES

LOCATION OF SEWER, WATER AND OVERHEAD ELECTRICL LINES ARE APPROXIMATE AND WILL BE CONFIRMED AT A LATER STAGE OF DESIGN.

PARCEL LINES ARE APPROXIMATE AND BASED UPON THE GILA COUNTY GIS LAYER.

SHEET NAME: PLN01
SHEET NUMBER: 3 OF 11
DATE: 19 MAY 2020
NCD PROJECT NUMBER: SUNSET

PRELIMINARY CONCEPT NOT FOR CONSTRUCTION

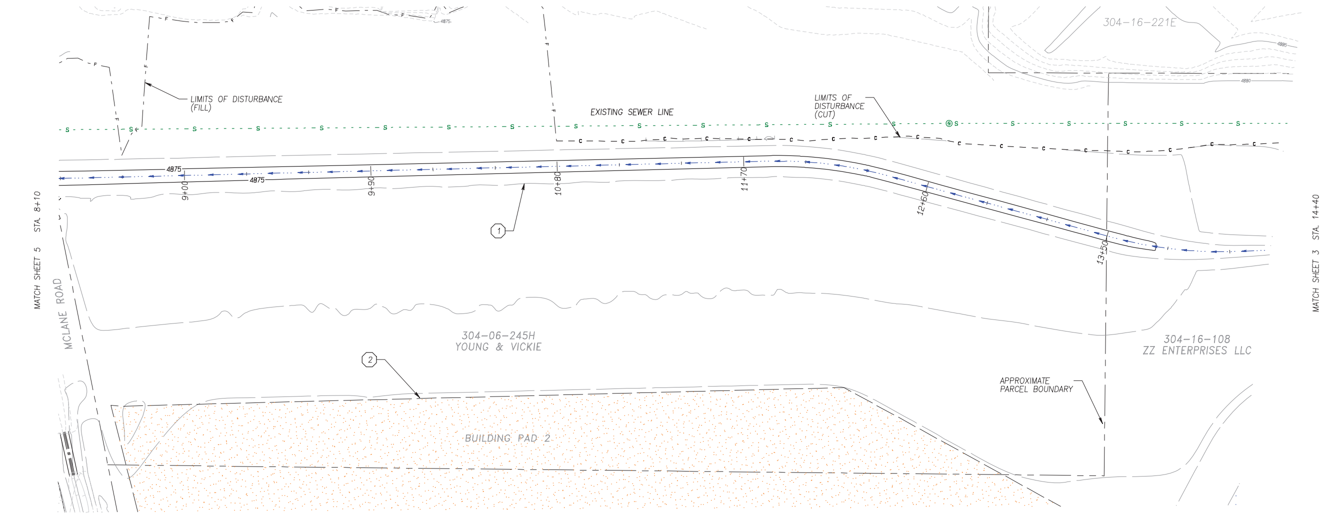
GRADING OPTION 1
PLAN & PROFILE VIEW STA 14+40 TO 21+00

AMERICAN GULCH - "SUNSET STRIP" CONCEPT DEVELOPEMENT
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

DRAWN BY: JF, MK
DESIGNED BY:
CHECKED BY:

NO.	DATE	BY	REVISION

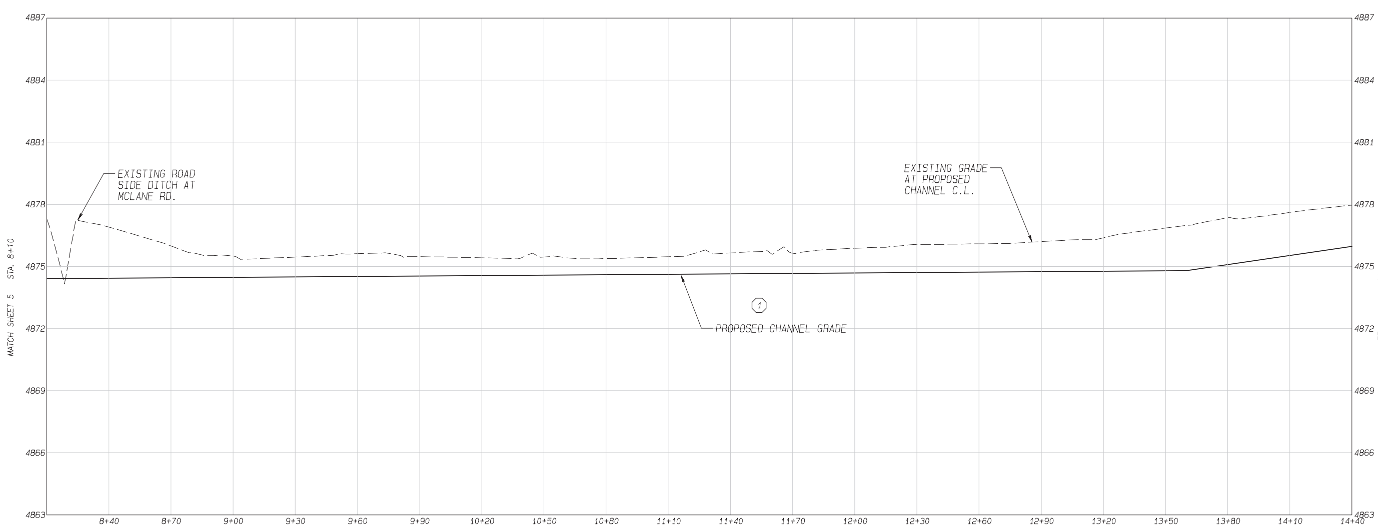
Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336


LIMITS OF DISTURBANCE (FILL)
EXISTING SEWER LINE
LIMITS OF DISTURBANCE (CUT)
304-16-221E
4875
9+00
9+90
10+80
11+70
12+60
13+50
MATCH SHEET 5 STA. 8+10
MCLANE ROAD
MATCH SHEET 3 STA. 14+40
304-06-245H
YOUNG & VICKIE
304-16-108
ZZ ENTERPRISES LLC
APPROXIMATE PARCEL BOUNDARY
BUILDING PAD 2

CHANNEL GRADING PLAN & PROFILE
STA. 14+40 TO STA. 8+10

HORIZONTAL SCALE 1"=30'
0 15 30

VERTICAL SCALE 1"=3'
0 1.5 3


4887
4884
4881
4878
4875
4872
4869
4866
4863
EXISTING ROAD SIDE DITCH AT MCLANE RD.
EXISTING GRADE AT PROPOSED CHANNEL C.L.
PROPOSED CHANNEL GRADE
MATCH SHEET 5 STA. 8+10
MATCH SHEET 3 STA. 14+40
8+40
8+70
9+00
9+30
9+60
9+90
10+20
10+50
10+80
11+10
11+40
11+70
12+00
12+30
12+60
12+90
13+20
13+50
13+80
14+10
14+40

NOTES

1. NEW CHANNEL GRADING. SEE SHEET 8 FOR TYPICAL CHANNEL DETAILS.
2. EXCAVATION AND FILL PLACEMENT AND FEATURE CONSTRUCTION.

GENERAL NOTES

LOCATION OF SEWER, WATER AND OVERHEAD ELECTRICL LINES ARE APPROXIMATE AND WILL BE CONFIRMED AT A LATER STAGE OF DESIGN.

PARCEL LINES ARE APPROXIMATE AND BASED UPON THE GILA COUNTY GIS LAYER.

SHEET NAME: PLN02

SHEET NUMBER: 4 OF 11

DATE: 19 MAY 2020

NCD PROJECT NUMBER: SUNSET

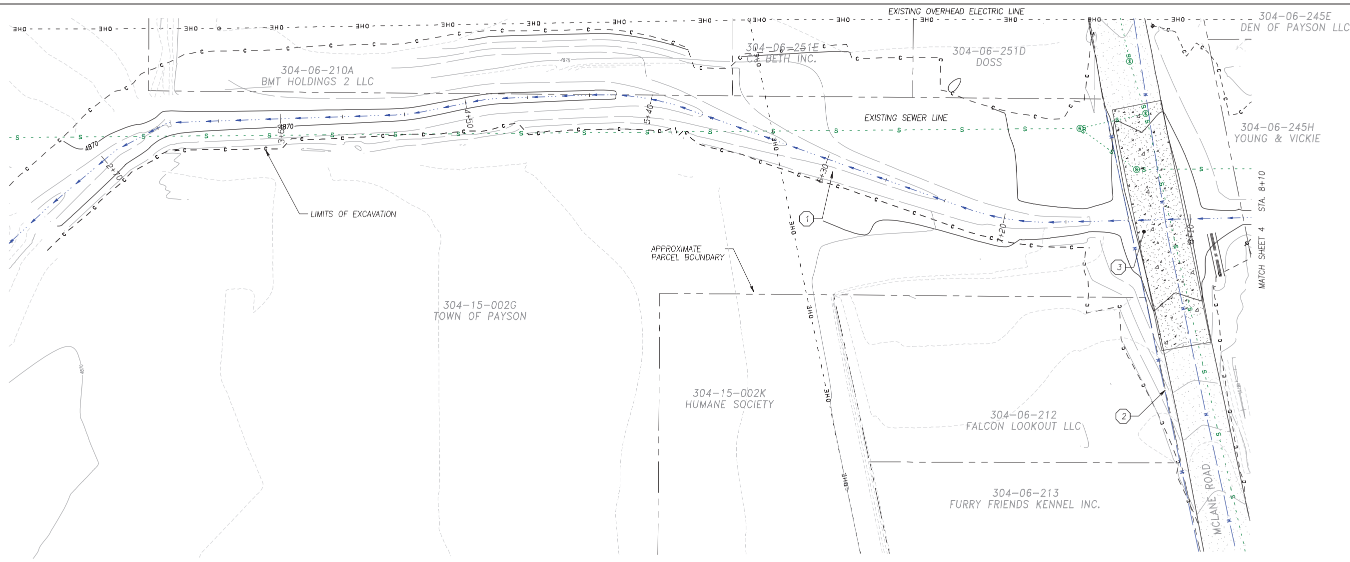
PRELIMINARY CONCEPT NOT FOR CONSTRUCTION

GRADING OPTION 1
PLAN & PROFILE VIEW STATION 14+40 TO 8+10

AMERICAN GULCH - "SUNSET STRIP" CONCEPT DEVELOPEMENT
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

DRAWN BY: JF, MK			
DESIGNED BY:			
CHECKED BY:			
NO.	DATE	BY	REVISION

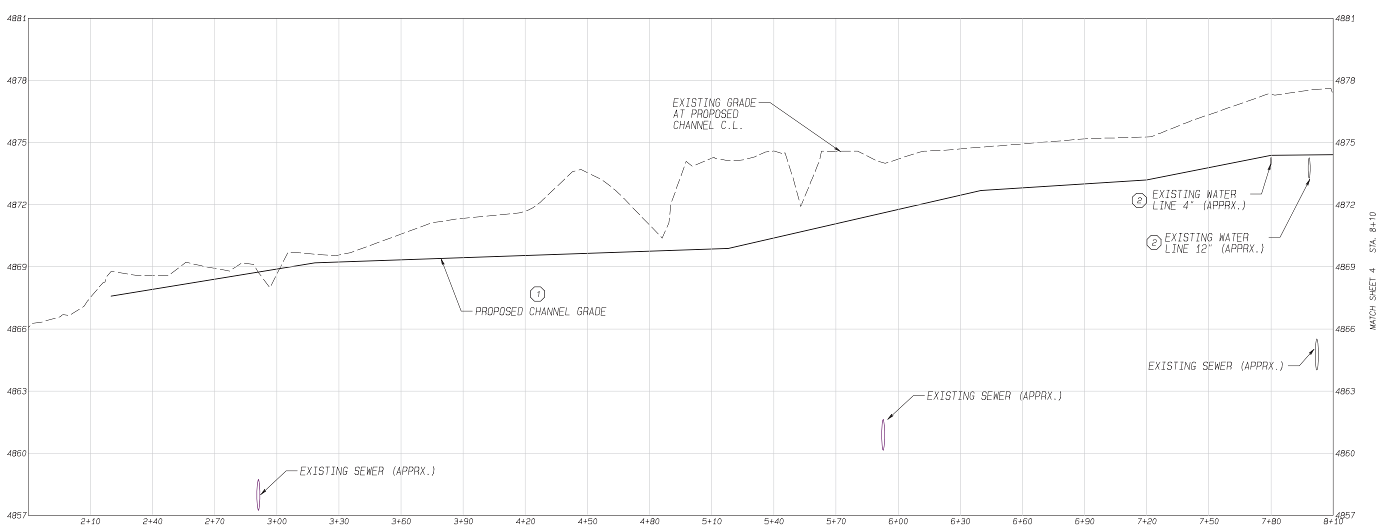
Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336



EXISTING OVERHEAD ELECTRIC LINE
304-06-245E
DEN OF PAYSON LLC
304-06-251E
C. BETH INC.
304-06-251D
DOSS
304-06-210A
BMT HOLDINGS 2 LLC
EXISTING SEWER LINE
304-06-245H
YOUNG & VICKIE
LIMITS OF EXCAVATION
APPROXIMATE PARCEL BOUNDARY
STA. 8+10
MATCH SHEET 4
304-15-002G
TOWN OF PAYSON
304-15-002K
HUMANE SOCIETY
304-06-212
FALCON LOOKOUT LLC
304-06-213
FURRY FRIENDS KENNEL INC.
MCLANE ROAD

CHANNEL GRADING PLAN & PROFILE
STA. 8+10 TO STA. 1+00

HORIZONTAL SCALE 1"=30'
VERTICAL SCALE 1"=3'



EXISTING GRADE AT PROPOSED CHANNEL C.L.
EXISTING WATER LINE 4" (APPRX.)
EXISTING WATER LINE 12" (APPRX.)
PROPOSED CHANNEL GRADE
EXISTING SEWER (APPRX.)
EXISTING SEWER (APPRX.)
EXISTING SEWER (APPRX.)
MATCH SHEET 4 STA. 8+10
4881
4878
4875
4872
4869
4866
4863
4860
4857
2+10
2+40
2+70
3+00
3+30
3+60
3+90
4+20
4+50
4+80
5+10
5+40
5+70
6+00
6+30
6+60
6+90
7+20
7+50
7+80
8+10

NOTES

1. 1 LS — NEW CHANNEL GRADING, SEE SHEET 8 FOR CHANNEL DETAILS.
2. 1 LS — LOWER EXISTING WATERLINE UNDER PROPOSED CHANNEL ALIGNMENT.
3. 1 LS — REINFORCED CONCRETE LOW WATER CROSSING AT MCLANE ROAD. SEE SHEET 7 FOR LOW WATER CROSSING DETAILS.

GENERAL NOTES

LOCATION OF SEWER, WATER AND OVERHEAD ELECTRICL LINES ARE APPROXIMATE AND WILL BE CONFIRMED AT A LATER STAGE OF DESIGN.

PARCEL LINES ARE APPROXIMATE AND BASED UPON THE GILA COUNTY GIS LAYER.

SHEET NAME: PLN03
SHEET NUMBER: 5 OF 11

DATE: 19 MAY 2020
NCD PROJECT NUMBER: SUNSET

PRELIMINARY CONCEPT NOT FOR CONSTRUCTION

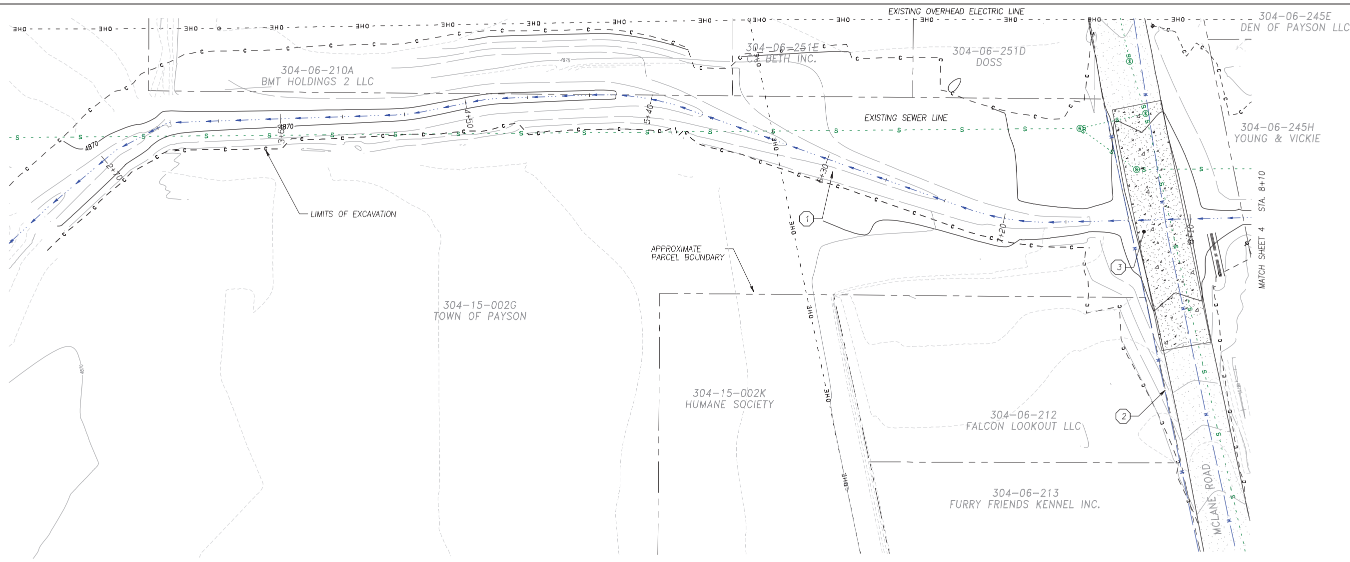
GRADING OPTION 1
PLAN & PROFILE VIEW STATION 8+10 TO 1+00

AMERICAN GULCH – "SUNSET STRIP" CONCEPT DEVELOPEMENT
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

DRAWN BY: JF, MK
DESIGNED BY:
CHECKED BY:

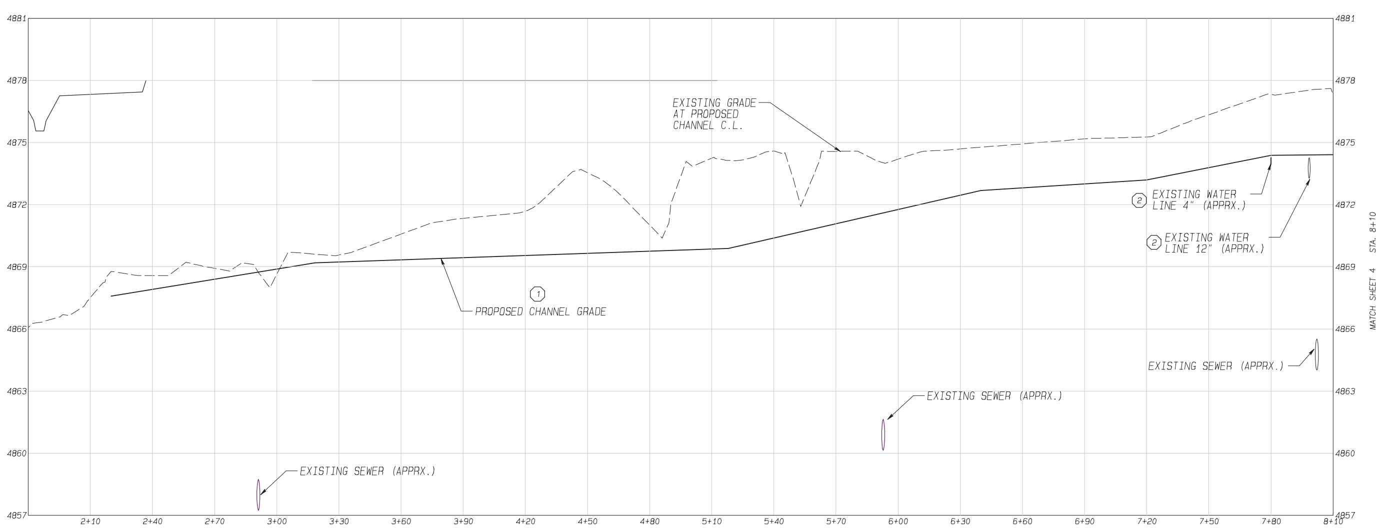
NO.	DATE	BY	REVISION

Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336



CHANNEL GRADING PLAN & PROFILE
STA. 8+10 TO STA. 1+00

HORIZONTAL SCALE 1"=30'
VERTICAL SCALE 1"=3'



NOTES

1. 1 LS NEW CHANNEL GRADING, SEE SHEET 8 FOR CHANNEL DETAILS.
2. 1 LS LOWER EXISTING WATERLINE UNDER PROPOSED CHANNEL ALIGNMENT.
3. 1 LS REINFORCED CONCRETE LOW WATER CROSSING AT MCLANE ROAD. SEE SHEET 7 FOR LOW WATER CROSSING DETAILS.

GENERAL NOTES

LOCATION OF SEWER, WATER AND OVERHEAD ELECTRICL LINES ARE APPROXIMATE AND WILL BE CONFIRMED AT A LATER STAGE OF DESIGN.

PARCEL LINES ARE APPROXIMATE AND BASED UPON THE GILA COUNTY GIS LAYER.

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DRAWN BY: JF, MK
DESIGNED BY:
CHECKED BY:

NO.	DATE	BY	REVISION

GRADING OPTION 1
PLAN & PROFILE VIEW STATION 8+10 TO 1+00

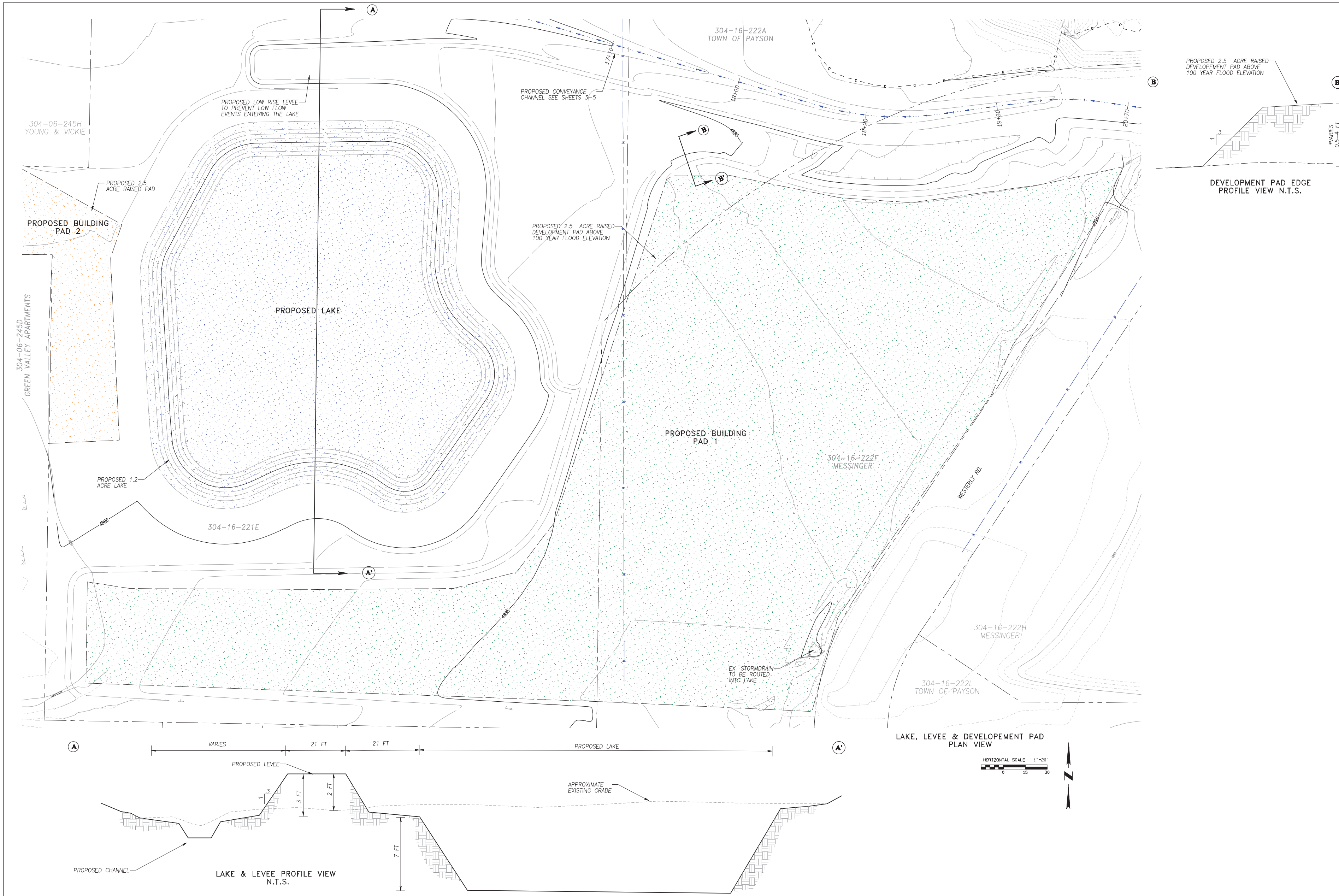
AMERICAN GULCH – "SUNSET STRIP" CONCEPT DEVELOPEMENT
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

PRELIMINARY CONCEPT NOT FOR CONSTRUCTION

UNAUTHORIZED CHANGES & USES
THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.

CALL ARIZONA BLUE STAKE TWO WORKING DAYS BEFORE YOU DIG 8-1-1

DATE: 19 MAY 2020
SHEET NAME: PLN03
NCD PROJECT NUMBER: SUNSET
SHEET NUMBER: 5 OF 11


PROPOSED BUILDING PAD 2
PROPOSED 2.5 ACRE RAISED PAD
304-06-245H YOUNG & VICKIE
304-06-245D GREEN VALLEY APARTMENTS
PROPOSED LOW RISE LEVEE TO PREVENT LOW FLOW EVENTS ENTERING THE LAKE
PROPOSED LAKE
PROPOSED 1.2 ACRE LAKE
304-16-221E
PROPOSED CONVEYANCE CHANNEL SEE SHEETS 3-5
304-16-222A TOWN OF PAYSON
PROPOSED 2.5 ACRE RAISED DEVELOPMENT PAD ABOVE 100 YEAR FLOOD ELEVATION
PROPOSED BUILDING PAD 1
304-16-222F MESSINGER
WESTERLY RD.
EX. STORMDRAIN TO BE ROUTED INTO LAKE
304-16-222H MESSINGER
304-16-222L TOWN OF PAYSON
17+10
18+00
18+90
19+80
20+70
LAKE, LEVEE & DEVELOPEMENT PAD PLAN VIEW
HORIZONTAL SCALE 1"=20'
0 15 30
N
VARIES
21 FT
21 FT
PROPOSED LAKE
PROPOSED LEVEE
3 FT
2 FT
7 FT
APPROXIMATE EXISTING GRADE
PROPOSED CHANNEL
LAKE & LEVEE PROFILE VIEW N.T.S.
PROPOSED 2.5 ACRE RAISED DEVELOPEMENT PAD ABOVE 100 YEAR FLOOD ELEVATION
*VARIES 0.5-4 FT
DEVELOPMENT PAD EDGE PROFILE VIEW N.T.S.

Natural Channel Design, Inc.
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Flagstaff, Arizona 86004
(928) 774-2336

DRAWN BY: JF, MK
DESIGNED BY:
CHECKED BY:

NO.	DATE	BY	REVISION

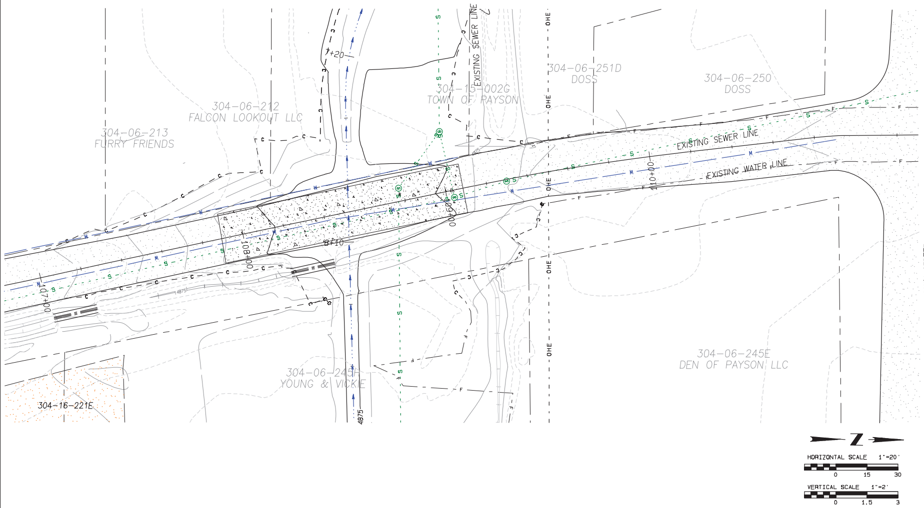
AMERICAN GULCH – "SUNSET STRIP" CONCEPT DEVELOPEMENT
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

GRADING OPTION 1
BUILDING & LAKE GRADING PLAN

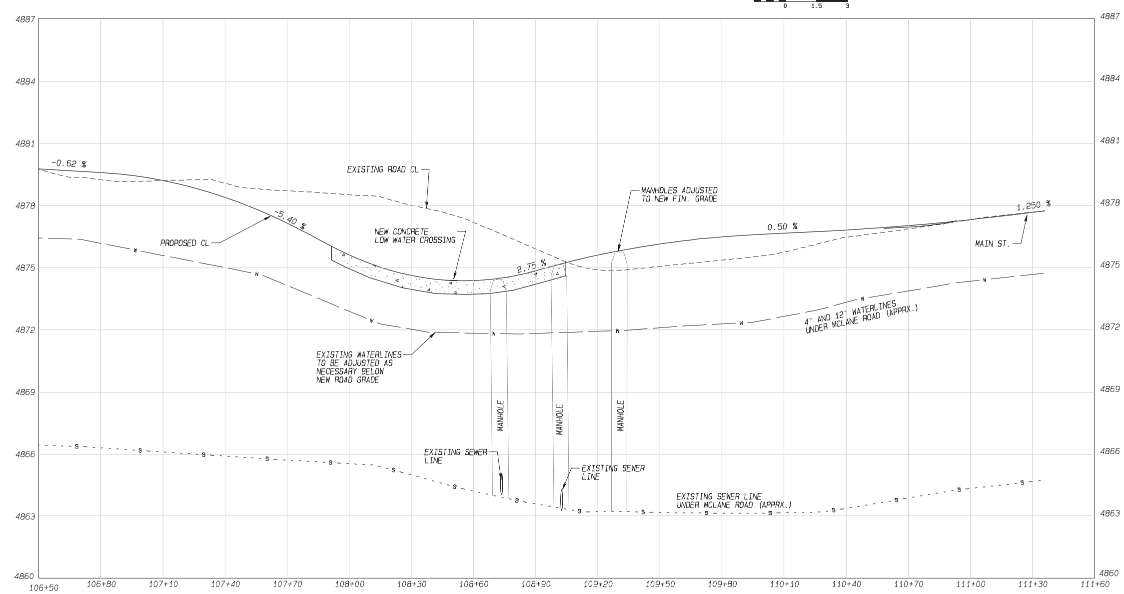
PRELIMINARY CONCEPT NOT FOR CONSTRUCTION

UNAUTHORIZED CHANGES & USES: THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.

DATE: 19 MAY 2020
NCD PROJECT NUMBER: SUNSET
SHEET NAME: PLN04
SHEET NUMBER: 6 of 11



304-06-213
FURRY FRIENDS
304-06-212
FALCON LOOKOUT LLC
304-10-002G
TOWN OF PAYSON
304-06-251D
DOSS
304-06-250
DOSS
EXISTING SEWER LINE
EXISTING WATER LINE
304-06-245E
DEN OF PAYSON LLC
304-06-24
YOUNG & VICKIE
304-16-221E
MAIN STREET
HORIZONTAL SCALE 1"=20'
VERTICAL SCALE 1"=2'

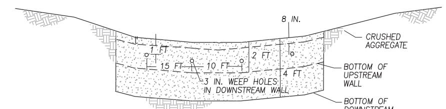


-0.62 %
-5.40 %
2.75 %
0.50 %
1.250 %
EXISTING ROAD CL
PROPOSED CL
NEW CONCRETE LOW WATER CROSSING
MANHOLES ADJUSTED TO NEW FIN. GRADE
MAIN ST.
4" AND 12" WATERLINES UNDER MCLANE ROAD (APPRX.)
EXISTING WATERLINES TO BE ADJUSTED AS NECESSARY BELOW NEW ROAD GRADE
MANHOLE
MANHOLE
MANHOLE
EXISTING SEWER LINE
EXISTING SEWER LINE
EXISTING SEWER LINE UNDER MCLANE ROAD (APPRX.)
4887
4884
4881
4878
4875
4872
4869
4866
4863
4860
106+50
106+80
107+10
107+40
107+70
108+00
108+30
108+60
108+90
109+20
109+50
109+80
110+10
110+40
110+70
111+00
111+30
111+60

TYPICAL LOW WATER CROSSING

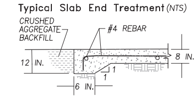
*Actual dimensions will vary

*Length and slope dimensions will vary

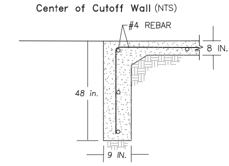


Elevation Looking Upstream
(Not to Scale)

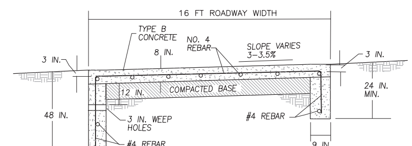
Typical Slab End Treatment (NTS)



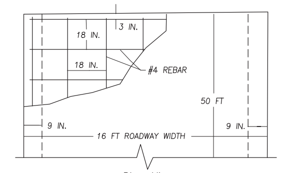
Center of Cutoff Wall (NTS)



Concrete Surface Road with Concrete Walls

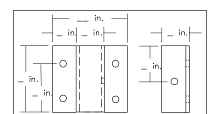


Section View
(Not to Scale)

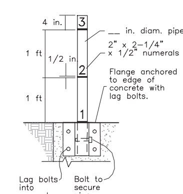


Plan View
(Not to Scale)

DETAIL ADAPTED FROM ADOT STANDARD DRAWING C-19_10_1 CONCRETE SURFACE ROAD WITH CONCRETE WALLS. DEPTH GAGES ARE NOT TO BE INCLUDED. ALL OTHER ASPECTS OF CONSTRUCTION NOT SHOWN HEREIN SHALL BE PER THE CURRENT EDITION OF ADOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION.

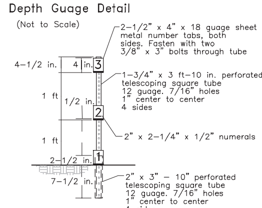


Depth Guage Flange
(Not to Scale)



Depth Guage Detail
(Not to Scale)

Depth Guage Detail
(Not to Scale)



4-1/2 in.
4 in.
1 ft
1/2 in.
1 ft
2-1/2 in.
7-1/2 in.
3
2
1
2-1/2" x 4" x 18 guage sheet metal number tabs, both sides. Fasten with two 3/8" x 3" bolts through tube
1-3/4" x 3 ft-10 in. perforated telescoping square tube 12 guage. 7/16" holes 1" center to center 4 sides
2" x 2-1/4" x 1/2" numerals
2" x 3" - 10" perforated telescoping square tube 12 guage. 7/16" holes 1" center to center 4 sides

MCLANE ROAD LOW WATER CROSSING
PLAN, PROFILE & TYPICAL DETAILS

AMERICAN GULCH - "SUNSET STRIP" CONCEPT DEVELOPEMENT
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

PRELIMINARY CONCEPT NOT FOR CONSTRUCTION

SHEET NAME: LWC01
SHEET NUMBER: 7 of 11
DATE: 19 MAY 2020
NCD PROJECT NUMBER: SUNSET

DRAWN BY: JF, MK
DESIGNED BY:
CHECKED BY:

NO.	DATE	BY	REVISION

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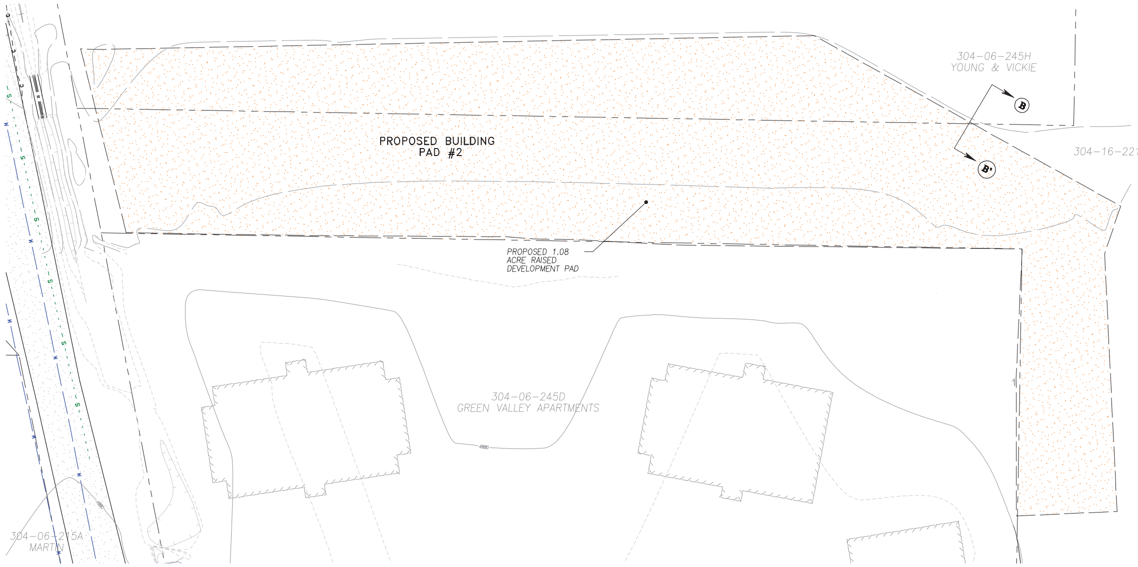
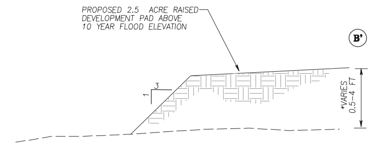
2900 N. West St. #5
Flagstaff, Arizona 86004
(928) 774-2336

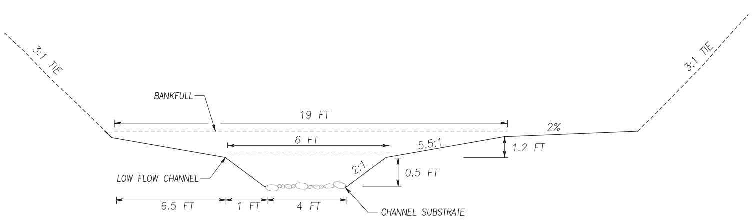




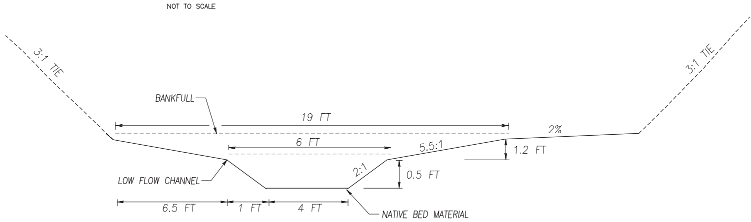
DEVELOPMENT PAD EDGE PROFILE VIEW N.T.S.

HORIZONTAL SCALE 1"=30'
0 15 30

DEVELOPMENT PAD EDGE PROFILE VIEW N.T.S.

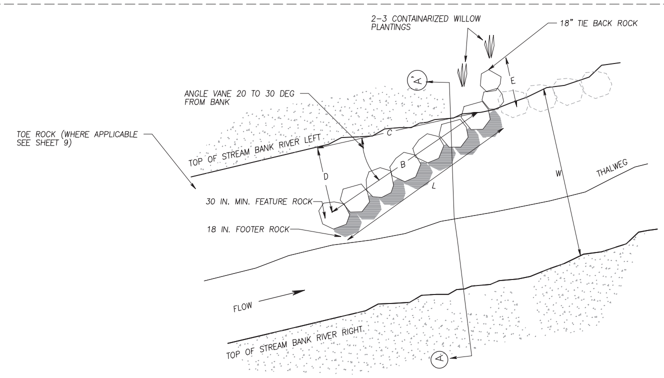


TYPICAL RIFFLE CROSS SECTION WITH SUBSTRATE ROCK
NOT TO SCALE



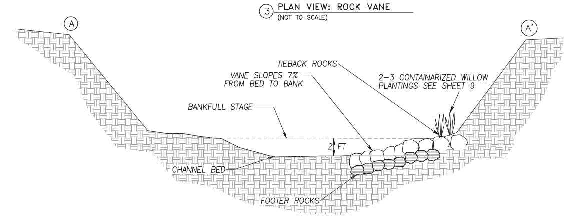
TYPICAL CROSS SECTION
NOT TO SCALE

NOTE:
THESE CROSS SECTIONS AND DETAILS PROVIDE AN INDICATION OF WHAT THE TYPICAL CHANNEL AND ADJACENT FLOODPLAIN AREAS MAY LOOK LIKE IN CROSS SECTION. FULL DESIGN WOULD LIKELY REQUIRE SOME REFINEMENT OF THESE DETAILS.



2-3 CONTAINARIZED WILLOW PLANTINGS
18" TIE BACK ROCK
ANGLE VANE 20 TO 30 DEG FROM BANK
TOE ROCK (WHERE APPLICABLE SEE SHEET 9)
TOP OF STREAM BANK RIVER LEFT
30 IN. MIN. FEATURE ROCK
18 IN. FOOTER ROCK
THALWEG
FLOW
TOP OF STREAM BANK RIVER RIGHT
A
A'
B
C
D
E
L
W

3 PLAN VIEW: ROCK VANE
(NOT TO SCALE)



3 SECTION VIEW: ROCK VANE
(NOT TO SCALE)

NEW CHANNEL
TYPICAL CROSS SECTIONS AND GRADE CONTROL DETAILS

LOW DEVELOPMENT PAD PLAN VIEW, TYPICAL CHANNEL DIMENSIONS & ROCK VANE DETAIL

AMERICAN GULCH – "SUNSET STRIP" CONCEPT DEVELOPEMENT
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

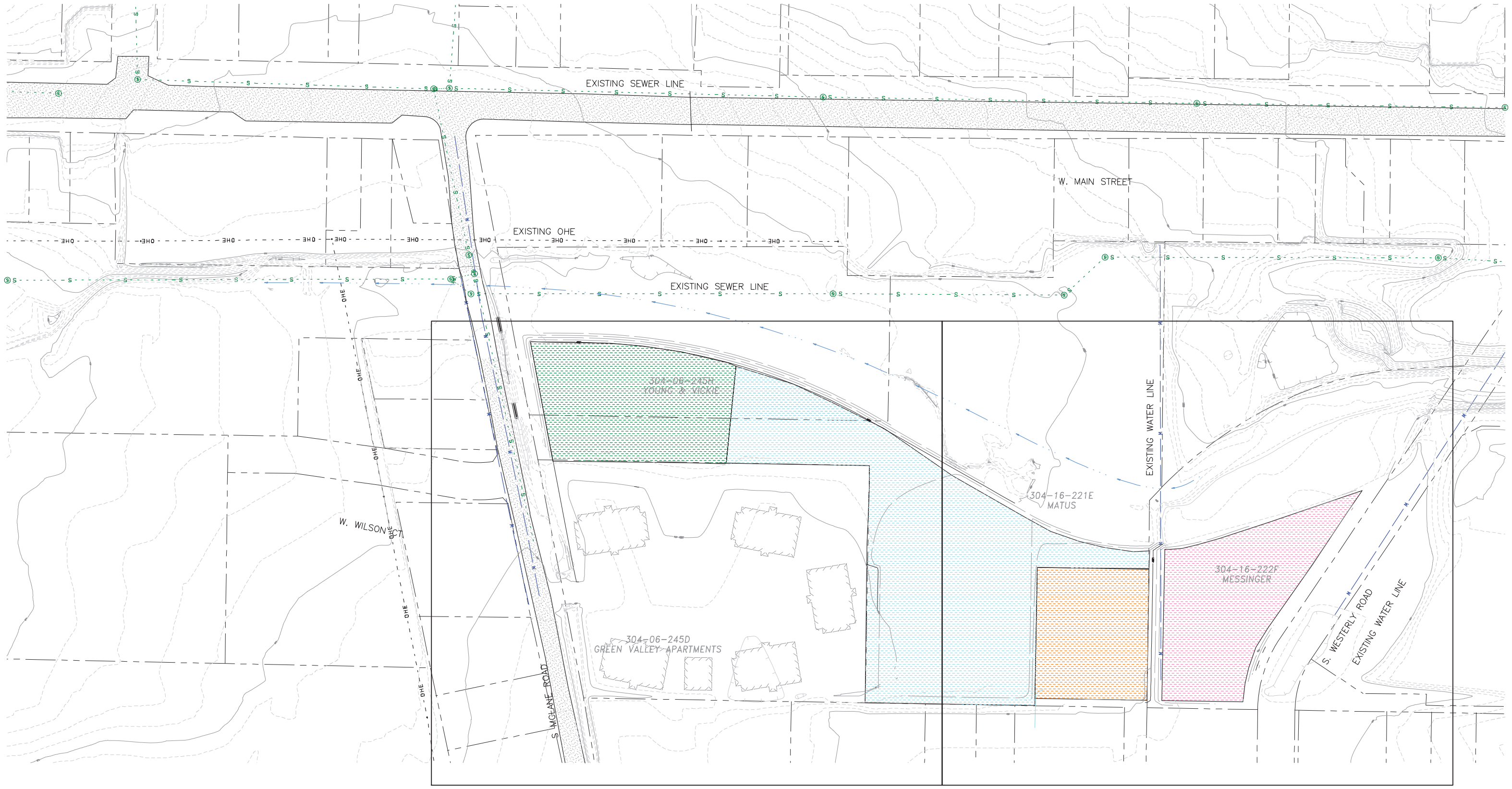
PRELIMINARY CONCEPT NOT FOR CONSTRUCTION

DATE: 19 MAY 2020
NCD PROJECT NUMBER: SUNSET
SHEET NAME: DTL01
SHEET NUMBER: 8 of 11

DRAWN BY: JF, MK
DESIGNED BY:
CHECKED BY:

NO.	DATE	BY	REVISION

Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336



GRADING OPTION 2 – PROJECT OVERVIEW

N

HORIZONTAL SCALE 1"=80'
0 40 80

BOX WITH GREEN HATCH:
Building Pad 1: 0.88 acres above floodplain
APN: 304-06-245H 0.55 Acres
APN: 304-16-221E 0.33 Acres

BOX WITH LIGHT BLUE HATCH:
Building Pad 2: 2.15 acres above floodplain
APN: 304-16-221E 1.99 Acres
APN: 304-06-245H 0.16 Acres

BOX WITH ORANGE HATCH:
Building Pad 3: 0.60 acres above floodplain
APN: 304-16-221E 0.60 Acres

BOX WITH PINK HATCH:
Building Pad 4: 0.86 acres above floodplain
APN: 304-16-222F 0.86 Acres

NOTES:
1. Parcel lines shown are approximate and based upon GIS data provided by the Town of Payson
2. Locations of existing utilities shown are approximate only and based upon information found in the field or in maps provided to NCD by the utility companies

Natural Channel Design, Inc.
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DRAWN BY: JF, MK
DESIGNED BY:
CHECKED BY:

NO.	DATE	BY	REVISION

GRADING OPTION 2
PROJECT OVERVIEW

AMERICAN GULCH – "SUNSET STRIP" CONCEPT DEVELOPEMENT
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

PRELIMINARY CONCEPT NOT FOR CONSTRUCTION

UNAUTHORIZED CHANGES & USES
THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.

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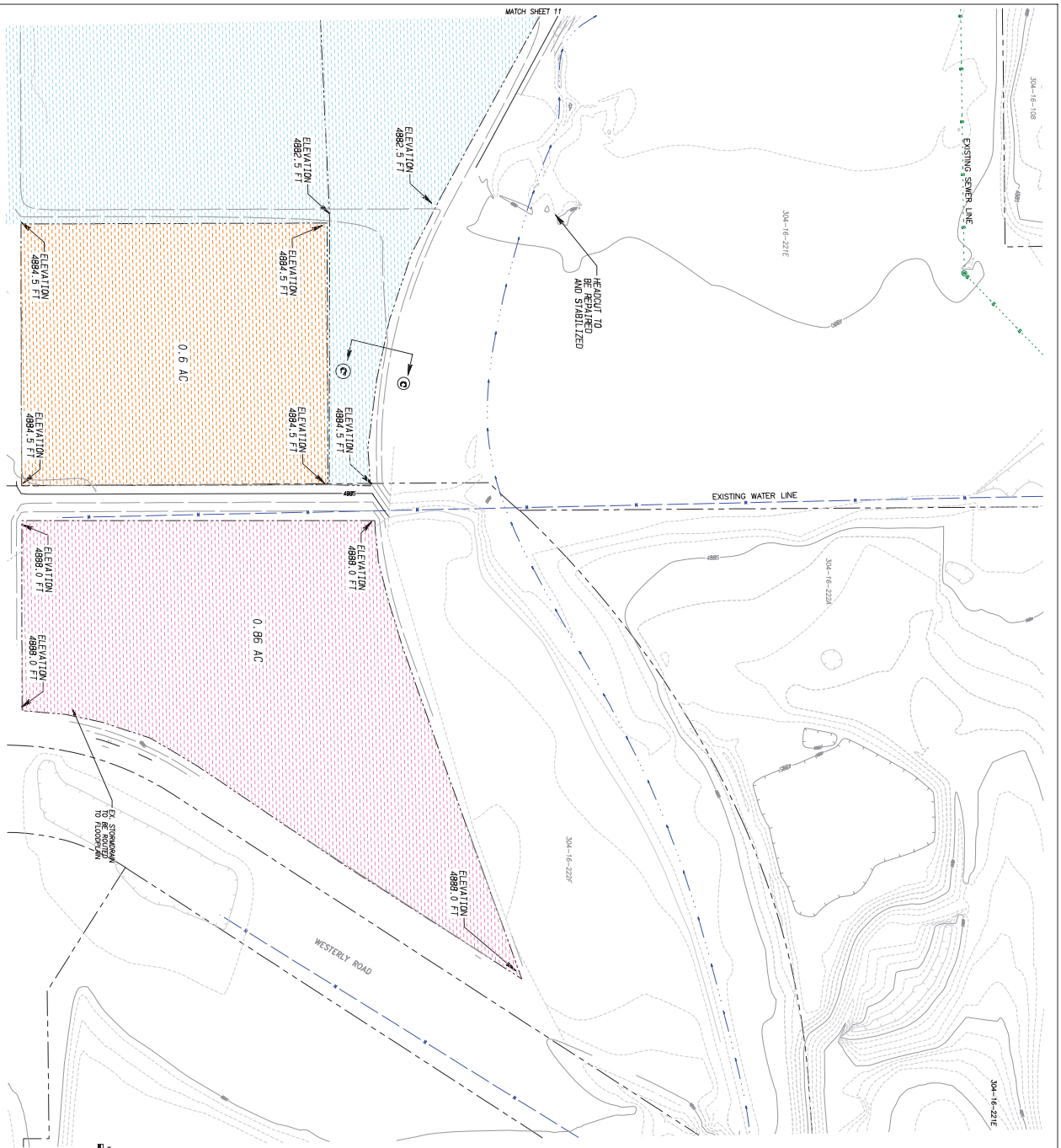
DIAL 8-1-1

DATE: 19 MAY 2020
NCD PROJECT NUMBER: SUNSET
SHEET NAME: OVR01
SHEET NUMBER: 9 OF 11

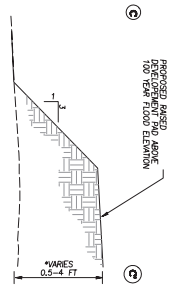


GENERAL NOTES

LOCATION OF SEWER, WATER AND OVERHEAD ELECTRICAL LINES ARE APPROXIMATE AND WILL BE CONFIRMED AT A LATER STAGE OF DESIGN.

PARCEL LINES ARE APPROXIMATE AND BASED UPON THE GILA COUNTY GIS LAYER.

HORIZONTAL SCALE 1"=30'



DEVELOPEMENT PAD EDGE PROFILE VIEW N.T.S.

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Flagstaff, Arizona 86004
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DRAWN BY: JF, MK			
DESIGNED BY:			
CHECKED BY:			
NO.	DATE	BY	REVISION

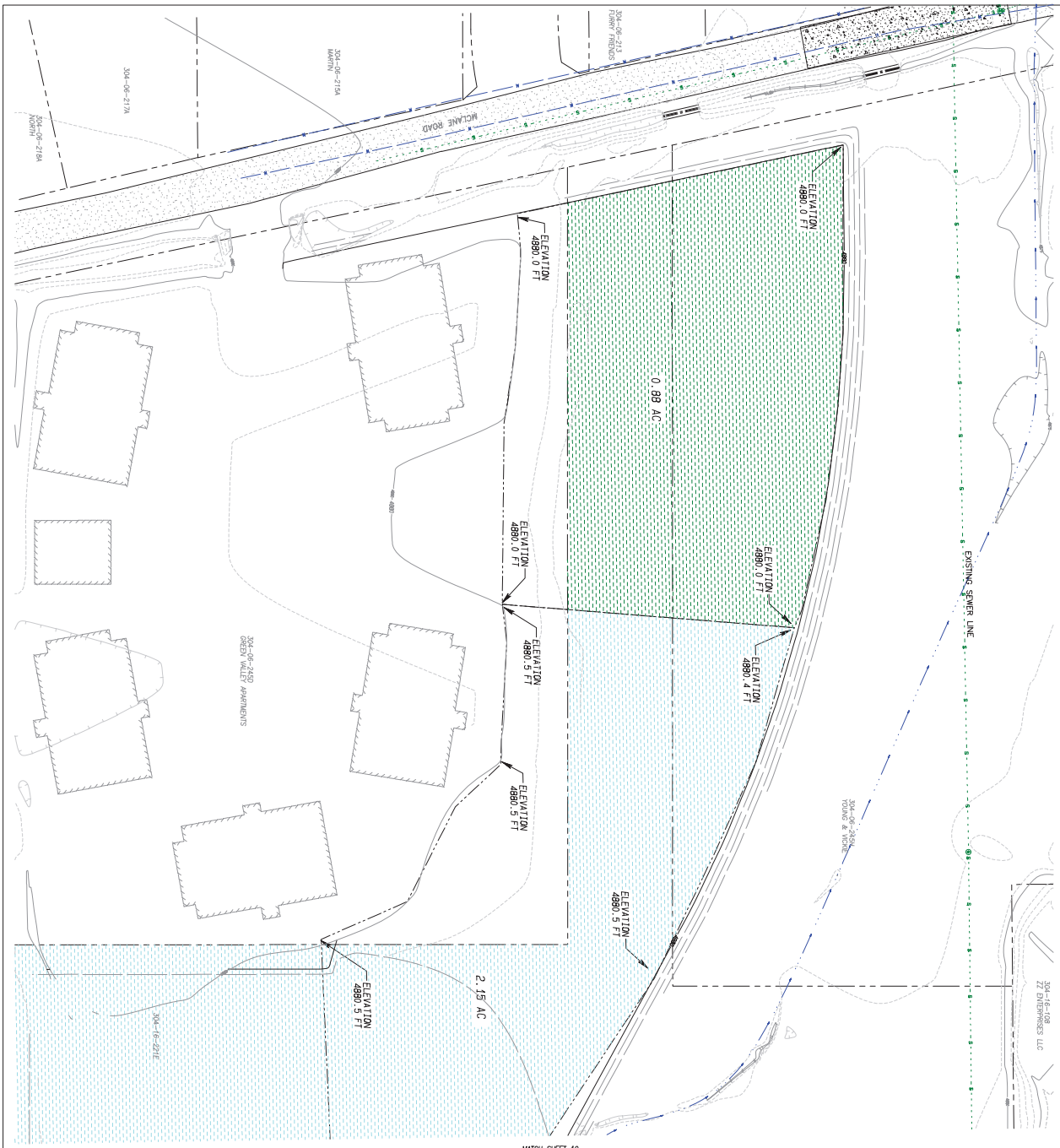
GRADING OPTION 2 – BUILDING PAD PLAN VIEW EAST

AMERICAN GULCH – "SUNSET STRIP" CONCEPT DEVELOPEMENT
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

PRELIMINARY CONCEPT NOT FOR CONSTRUCTION

UNAUTHORIZED CHANGES & USES
THE ENGINEER PREPARING THESE PLANS FOR AN OWNER IS RESPONSIBLE ONLY FOR THE CONCEPTS INCORPORATED IN THESE PLANS AND HE SHALL NOT BE RESPONSIBLE FOR THE UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES MUST BE RECORDED AND DATED BY THE ENGINEER PREPARING THE PLANS.

DATE: 10 MAY 2020
NCD PROJECT NUMBER: SUNSET
SHEET NAME: PLN08
SHEET NUMBER: 10 OF 11



GENERAL NOTES

LOCATION OF SEWER, WATER AND OVERHEAD ELECTRICAL LINES ARE APPROXIMATE AND WILL BE CONFIRMED AT A LATER STAGE OF DESIGN.

PARCEL LINES ARE APPROXIMATE AND BASED UPON THE GILA COUNTY GIS LAYER.

HORIZONTAL SCALE 1"=30'

N

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Flagstaff, Arizona 86004
(928) 774-2336

NO.	DATE	BY	REVISION

DRAWN BY: JF, MK
DESIGNED BY:
CHECKED BY:

GRADING OPTION 2 – BUILDING PAD PLAN VIEW WEST

AMERICAN GULCH – "SUNSET STRIP" CONCEPT DEVELOPEMENT
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

PRELIMINARY CONCEPT NOT FOR CONSTRUCTION

UNAUTHORIZED CHANGES & USES
THE ENGINEER PREPARING THESE PLANS FOR AN AUTHORIZED JURISDICTION IS LIABLE ONLY FOR WORK PERFORMED BY HIM OR UNDER HIS DIRECT SUPERVISION. ANY UNAUTHORIZED CHANGES OR USES OF THESE PLANS WILL RELIEVE THE ENGINEER OF RESPONSIBILITY FOR THESE PLANS.

DATE: 10 MAY 2020
NCD PROJECT NUMBER: SUNSET

SHEET NAME: PLN06
SHEET NUMBER: 11 OF 11

Appendix B:
HEC-RAS 2D Model Results

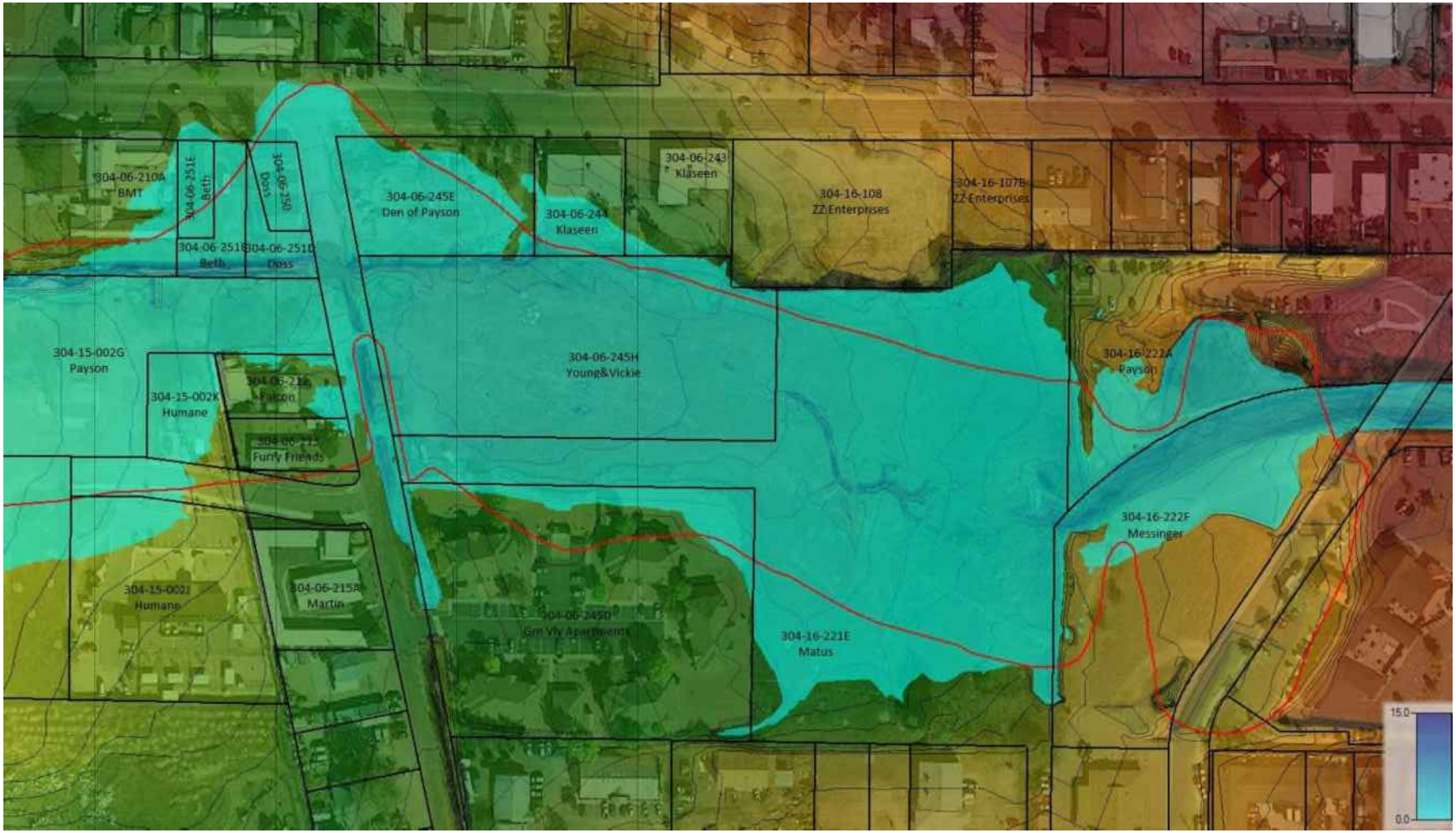

Figure A1 - Existing Condition, Floodplain Mapping
Red lines indicate effective FEMA floodplain boundary. Blue shaded area indicates results of HEC-RAS 2D floodplain modelling.

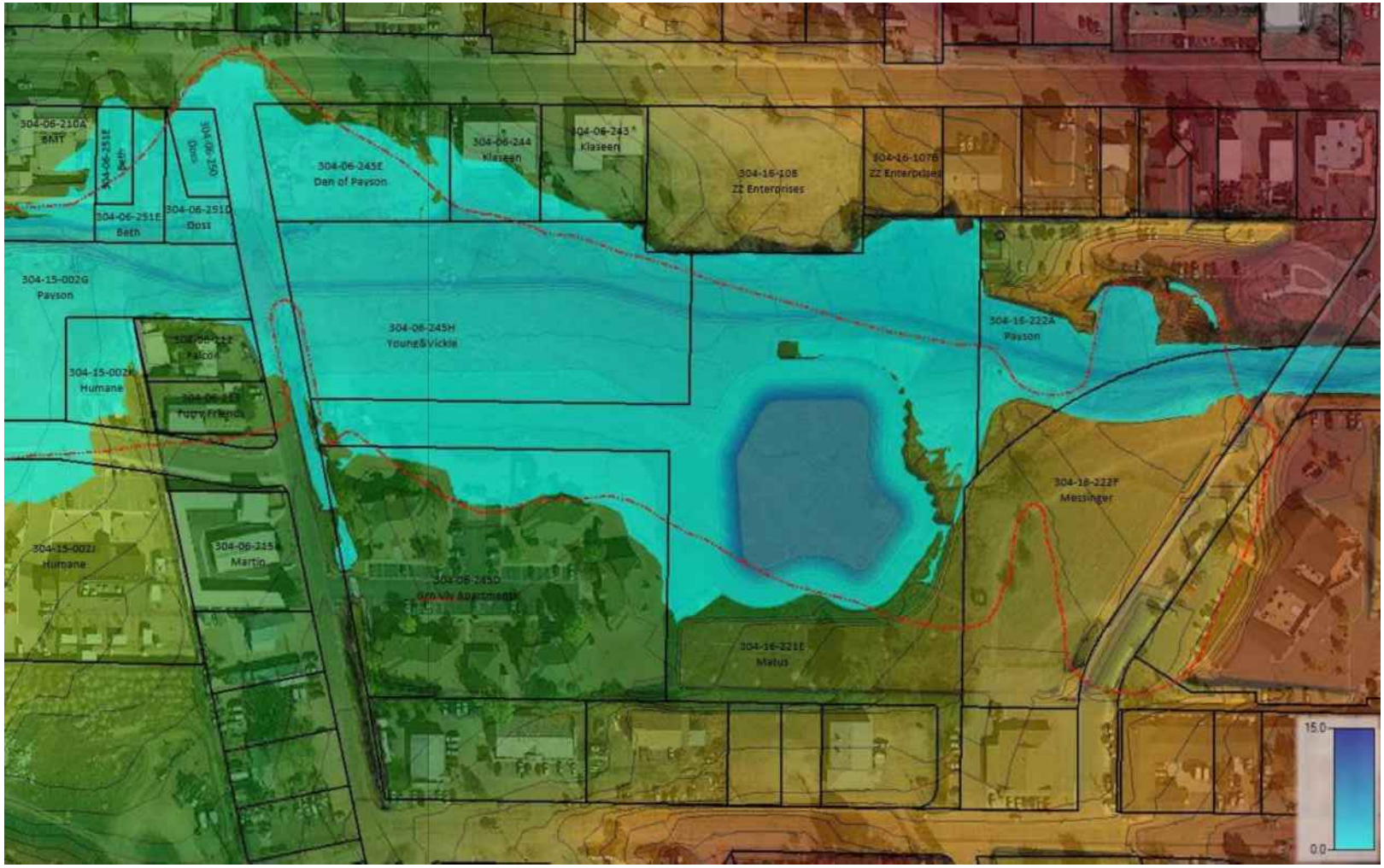

Figure A2- Option 1, Floodplain Mapping
Red lines indicate effective FEMA floodplain boundary. Blue shaded area indicates results of HEC-RAS 2D floodplain modelling.

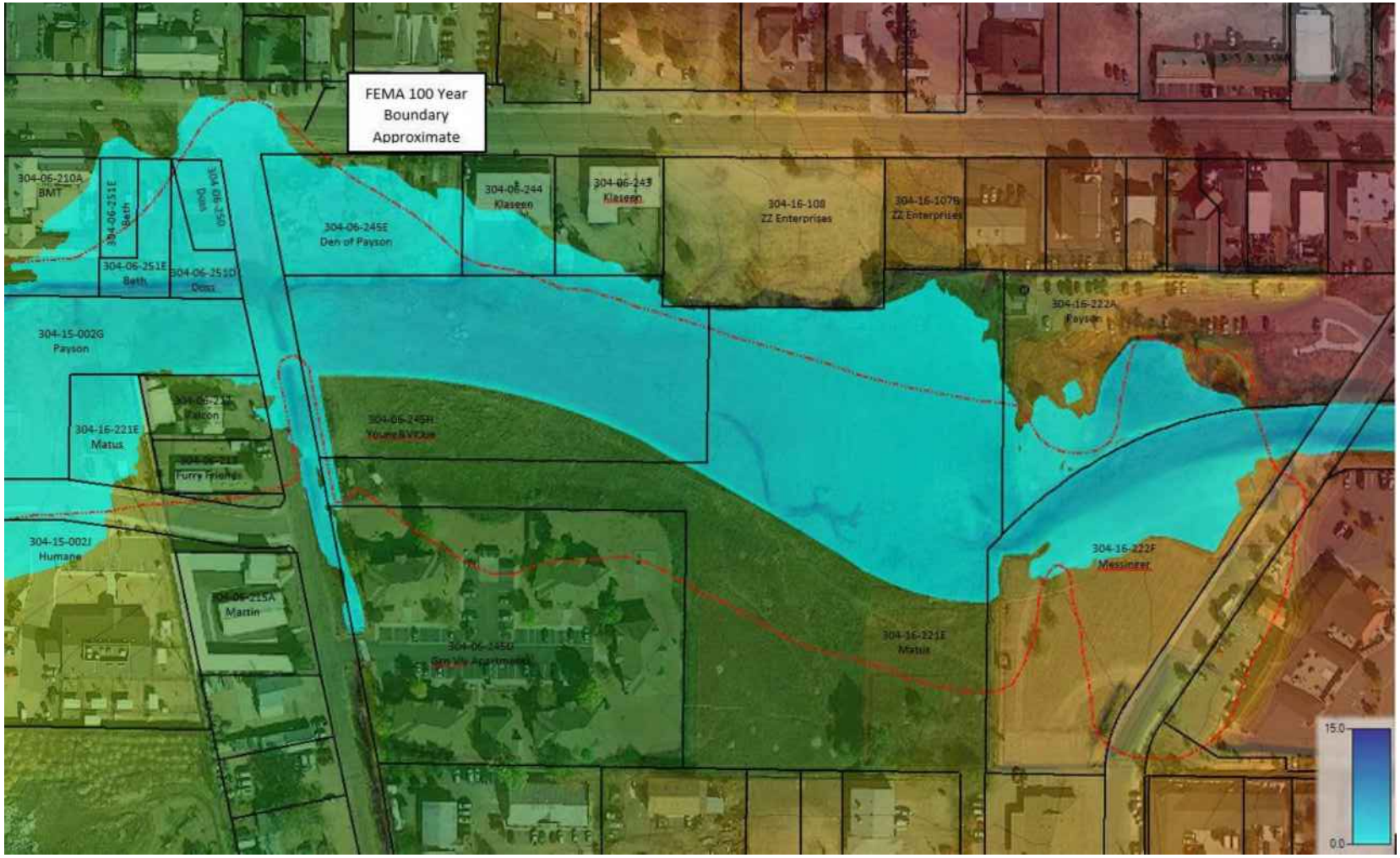

Figure 3 - Option 2, Floodplain Mapping
Red lines indicate effective FEMA floodplain boundary. Blue shaded area indicates results of HEC-RAS 2D floodplain modelling.

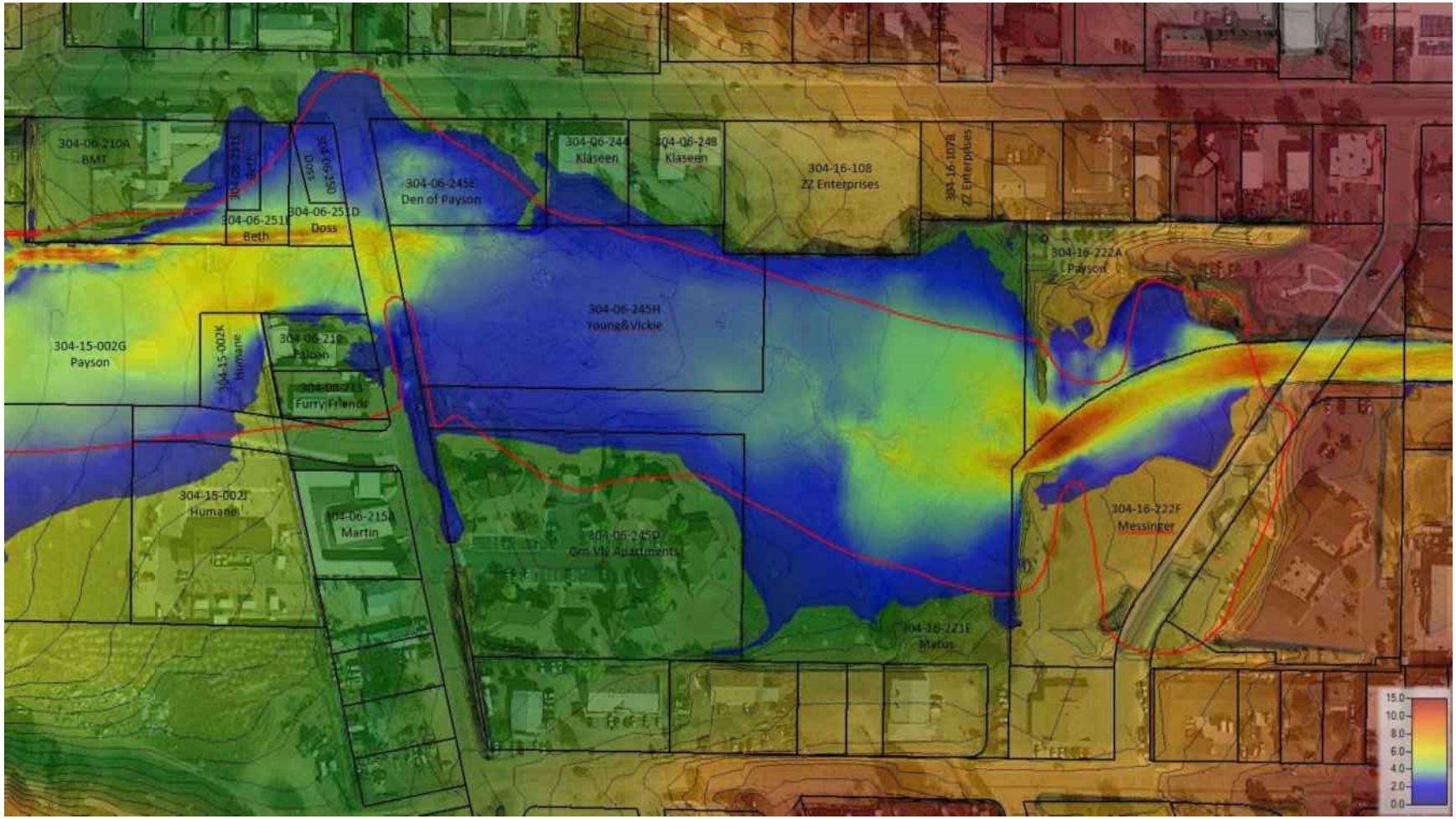

Figure 4 - Existing Condition, Floodplain Velocities
Red lines indicate effective FEMA floodplain boundary. Dark blue shaded areas indicate lowest velocities. Red areas within the floodplain indicate higher velocities.

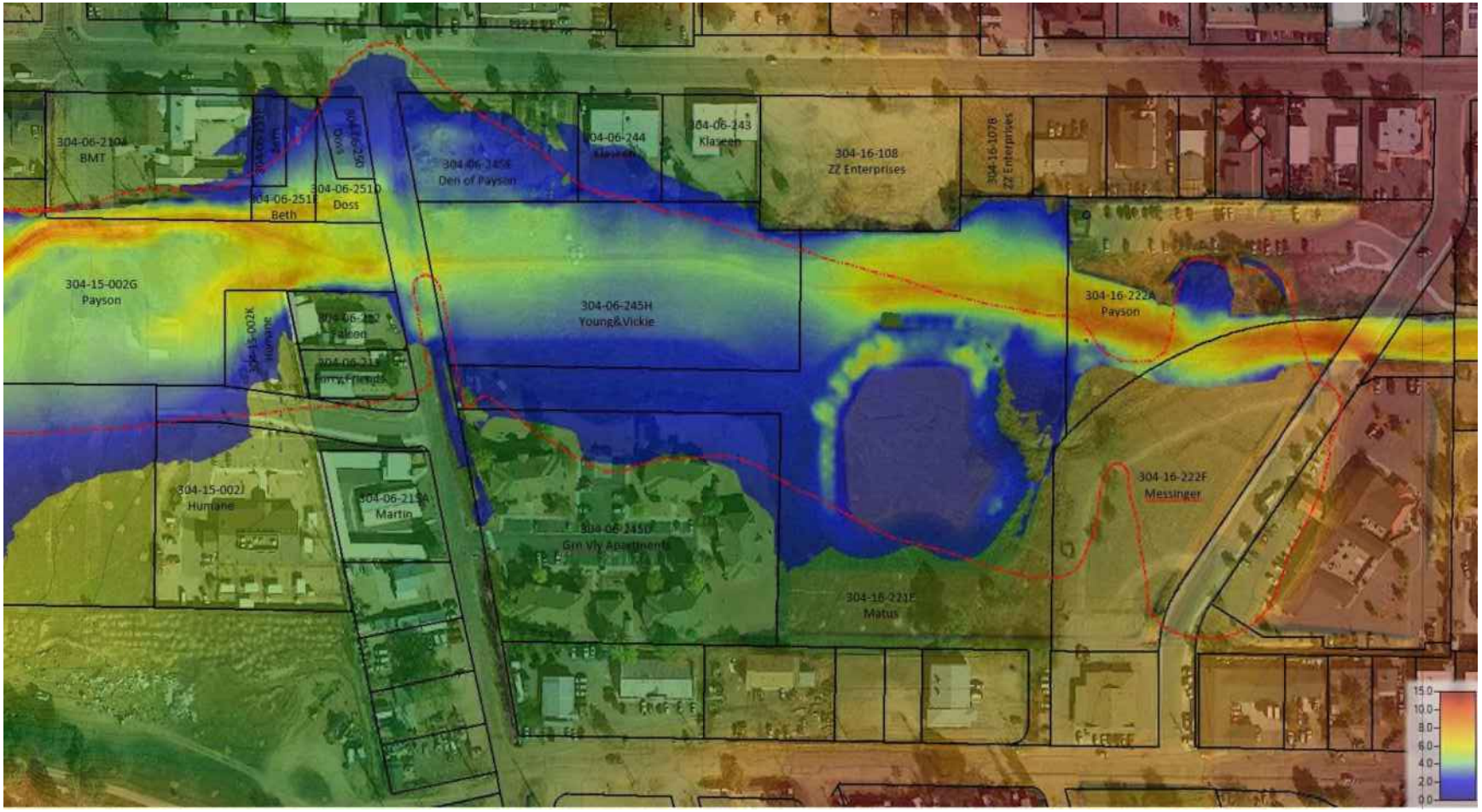

Figure 5 - Option 1, Floodplain Velocities
Red lines indicate effective FEMA floodplain boundary. Dark blue shaded areas indicate lowest velocities. Red areas within the floodplain indicate higher velocities.

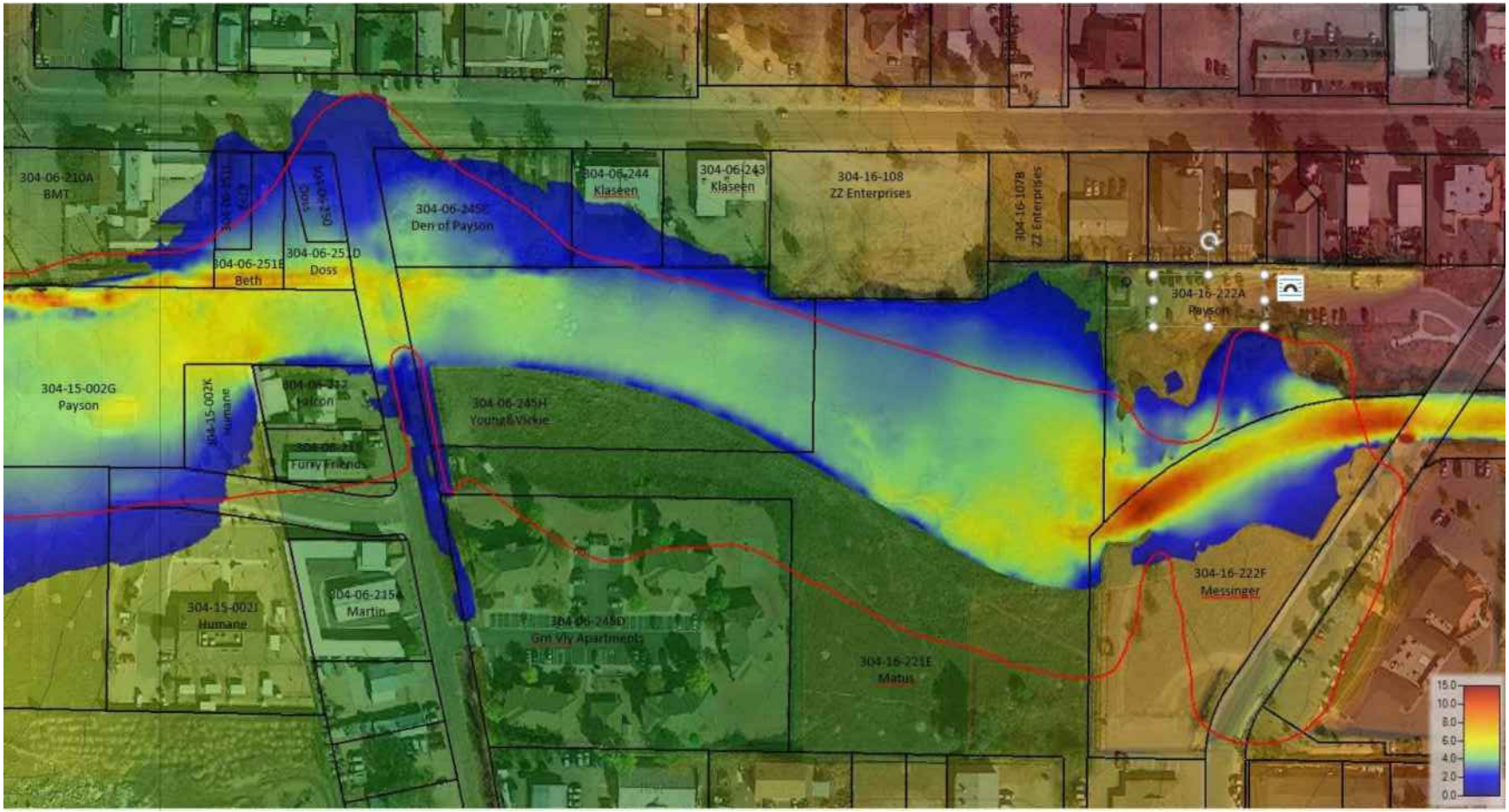

Figure 6 - Option 2, Floodplain Velocities

Red lines indicate effective FEMA floodplain boundary. Dark blue shaded areas indicate lowest velocities. Red areas within the floodplain indicate higher velocities.