

**PUD SKETCH PLAN
DRAINAGE REPORT**

FOR

**RESERVE AT
HOCKETT GULCH**

January 2018

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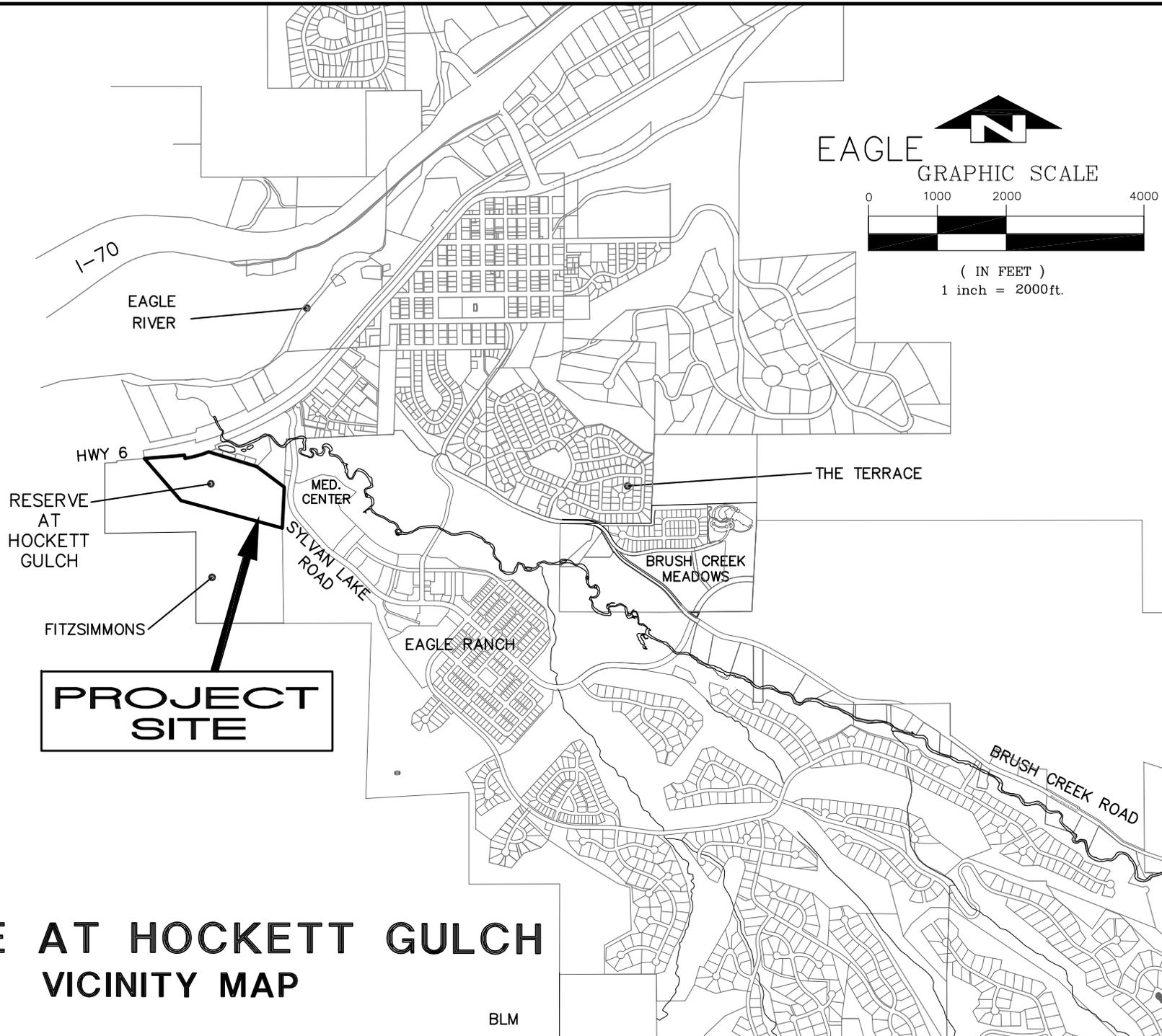
January 2018

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RESERVE AT HOCKETT GULCH VICINITY MAP

BLM

II. Introduction

The purpose of this Conceptual Drainage Report is to summarize the existing hydrologic conditions found at the Reserve at Hockett Gulch development site and to outline the guidelines that will be used to evaluate the historic and developed conditions for the proposed project. This report contains a general description of the planned low impact design for stormwater practices, historic drainage patterns, and methodology for calculating developed condition stormwater flow rates, a discussion of typical water quality measures and anticipated Colorado Department of Public Health and Environment permits that will be acquired for the project.

III. Site Description

The proposed Reserve at Hockett Gulch development is located south and west of the U.S. Highway 6 Sylvan Lake Roundabout and just south of the Green Acres Mobile Home Park in the Town of Eagle, Colorado. The site contains approximately 30 acres which is intended to be subdivided into development parcels, which include residential and residential/commercial mixed-use parcels as well as open space parcels. Approximately 21 acres are proposed to be developed into multi-family development parcels. The balance of the acreage will either be undeveloped, natural open space or more formal open space containing trails and park appurtenances.

The majority of the existing parcel is currently grasslands or natural hill country covered with sage and grasses.

IV. Low Impact Design (LID)

The proposed Reserve at Hockett Gulch development will implement the sustainable practice of Low Impact Design (LID) practices if feasible. To implement sustainable LID, the Denver Urban Drainage and Flood Control District (UDFCD) four-step process will be used as a guideline for the design of stormwater facilities. The four steps include: (1) employing runoff reduction practices, (2) providing water quality capture volume (WQCV), (3) stabilizing drainageways and (4) considering industrial and commercial BMPs.

1. Runoff Reduction Practices

Runoff peaks and volumes from developed areas may be reduced by utilizing a technique called minimizing directly connected impervious areas (MDCIA). Impervious areas may be reduced and runoff from impervious surfaces will likely be directed over grass areas to slow down runoff and encourage infiltration. This may be achieved by designing some of the following: building smaller parking lots, draining impervious areas over grass buffers and constructing grass swales. Benefits of

reducing imperviousness include increased infiltration, decreased flow rate and volume of site runoff, decreased WQCV and WQCV facilities, reduced size of channels and detention facilities, less curb and gutter, smaller storm sewer systems, smaller pavement areas and reduced runoff rates and volumes further downstream in the watershed. Best Management Practices (BMPs) that reduce runoff volume and peak runoff include grass buffers, grass swales, porous landscape detention and rain gardens, sand filter extended detention and constructed wetland channels.

2. Water Quality Capture Volume (WQCV)

The WQCV calculations allow the engineer to determine effective impervious area and more accurately quantify potential volume reduction benefits of BMPs. The purpose of designing BMPs based on the WQCV is to improve runoff water quality and reduce hydromodification and the associated impacts on receiving waters. Stormwater quality capture volume should be released slowly to achieve long-term settling of sediment and pollutants. Types of potential BMPs that provide treatment of the WQCV are porous landscape detention, extended detention basins and sand filter extended detention basins.

3. Stabilize Drainageways

Developed areas increase stormwater runoff. Natural drainageways are subject to bed and bank erosion where development occurs. Therefore, it is important to stabilize drainageways that receive flows from development.

4. Industrial and Commercial BMPs

Storage and handling areas should be covered. There should be a plan for spill containment and control provided by the contractor.

V. Conceptual Drainage Design

Historic and Developed drainage conditions will be analyzed in more detail during the Preliminary Plan review of this project within the Preliminary Drainage Report as required by the Town of Eagle's development submittal requirements.

a. Offsite Drainage Basins

Offsite drainage flows predominately south to north onto the site in ephemeral gullies. These existing drainageways are dry except during storm events. Offsite drainage basins will be diverted to the Sylvan Lake Road ditch or to Hockett

Gulch or U.S. Highway 6 wherever possible. If necessary drainage basins will be passed through the site.

b. Historic Drainage Basins

It appears, based upon existing topography that the majority of the Reserve at Hockett Gulch drains from south to north to Brush Creek and Hockett Gulch and eventually to the Eagle River. There is an existing concrete box culvert for Hockett Gulch that directs runoff from the western portion of the site under U.S. Highway 6. The eastern portion of the site outfalls to the Sylvan Lake Road ditch to Brush Creek.

c. Developed Drainage Basins

The Reserve at Hockett Gulch development is conceptually proposed to have stormwater water quality ponds in the drainage basins. These ponds will provide treatment of developed flows by treating the WQCV per the Design Methodology section of this report. The ponds will also function as Sediment Control traps during construction. By providing a pond in these drainage basins there will be stormwater and sediment controls for each phase of the project. Drainage basins in the western portion of the site may have underground storage that infiltrates or parking lot storage and infiltration practices to provide water quality treatment. These drainage basins may also have sediment control during construction.

It is anticipated that most of the existing irrigation ditches bisecting the parcel will be abandoned during development of the site and that the proposed drainage facilities will maintain historic drainage patterns. The irrigation pipe on the north side of the parcel will be kept intact and possibly piped in some ditch sections.

Debris flow quantities and mitigation will have to be reviewed by a debris flow consultant and be coordinated with the site and drainage plans. Debris flow/flood hazards out of the ephemeral draws draining onto the property will need to be evaluated.

d. Hillside Debris Flow

Per the Geotechnical Report (HP Geotech 115-296A, September 30, 2015) the potential for small hillside debris flows/floods are possible along the steep slope along the southern edge of the site. HP recommends further study of this potential issue and possible mitigation measures. Currently, AEI is showing a gravel recreation trail along the southern perimeter of the site which has a swale along the uphill side to capture and redirect small debris flows. Additional review by the Geotechnical Engineer will be required under Preliminary Plan and Final Plan for design of mitigation measures to protect the development site.

e. Design Methodology

Peak flows may be calculated using the WinTR-55 computer program “Small Watershed Hydrology”, as prepared by the Natural Resource Conservation Service (NRCS). WinTR-55 will be used to calculate Runoff Curve Numbers (RCN), Time of Concentration (Tc), and Flow Rates (Q) for each drainage basin. The 24-hour precipitation values were taken from NOAA Atlas 2, Volume III, Isopluvials and were found to be 1.6 and 2.4 inches for the 10 and 100-year storms respectively. Flows will be calculated using the actual soil types as obtained from the U.S. Soil Conservation Service, a soils summary from the USDA may be found in Appendix A. Runoff Curve Numbers (RCN) will be generated using pasture and sagebrush for historic conditions. The proposed culverts will be designed using the proposed land use for each tributary drainage area. The Time of Concentration (Tc) will be calculated using the NRCS WinTR-55 method.

Stormwater ponds for the Reserve at Hockett Gulch project will be fully analyzed and sized as a part of the Preliminary and Final Drainage Reports. It is anticipated that several ponds will be needed in order to provide treatment of the WQCV. These basins are anticipated to be located at the low end of the site. These have been conceptually drawn on the plans.

The Urban Drainage and Flood Control District (UDFCD) manual may be used to calculate the WQCV based upon impervious area percentages of each developed drainage basin.

Hydraflow Hydrographs 2007 computer program using the U.S. Soil Conservation Service (SCS) method may be used in pond design to calculate developed flow rates and to provide flood routing through the proposed pond structures. The ponds will be sized to treat the WQCV and route the developed 100-year storms through the ponds. Detention is not anticipated for this development since the drainage outfalls are into much larger basins and the development is at the bottom of the watershed. If detention is required, the stormwater management ponds may need to increase in size and impact the development plan.

Hydraflow Hydrographs input parameters include drainage area, runoff curve number, time of concentration, pond elevation and storage volume. The available storage volume in each proposed pond is calculated by taking the area at each pond contour and then computing the cumulative volume. The flow rate out of the pond is then calculated at different elevations based upon the size of the outlet pipe. Hydraflow Hydrographs uses the inflow, storage volume, and outflow rate at different elevations to generate the peak outflow and a maximum water surface elevation in the pond. It is an iterative process based upon storage volume, but once the outflow rate is less than or equal to the historic flow rate and the water

surface elevation within the pond is acceptable, the pond size and the pond outfall pipe size are acceptable.

f. Water Quality

Each pond will provide water quality treatment of stormwater. The pond riser structure will be modified to filter out sediments during construction. After the site is stabilized, the pond riser will have the modifications for sediment control removed and a permanent water quality appurtenance will be constructed. This could consist of a water quality plate on the riser. There will be water quality controls implemented both during and after construction for each drainage basin. Implementing LID will reduce disturbed and impervious areas, thereby reducing detention facility sizes.

VI. Storm Sewer Design

Storm sewer will outfall to the ditch on Sylvan Lake Road for the eastern portion of the Reserve at Hockett Gulch. The western portion of the site will drain towards Hockett Gulch and outfall to the US Highway 6 right-of-way. Historic runoff from the Reserve at Hockett Gulch to the Green Acres Mobile Home Park (GAMHP) will be cut off by a berm that will be constructed along the GAMHP that will serve as the embankment for the water quality ponds and contain runoff coming from the Reserve at Hockett Gulch. Storm sewer could outfall to the wetlands ponds earlier on the west end of the GAMHP if an easement could be obtained.

VII. Floodplain Determination

There are no Federal Emergency Management Agency (FEMA) floodplains affecting this site. Brush Creek has a FEMA floodplain but it does not to impact the proposed Reserve at Hockett Gulch development.

VIII. Hockett Gulch

The hydrology for Hockett Gulch was calculated by AMEC in a report prepared for the CDOT U.S. Highway 6 Box Culvert replacement entitled “Final Hydraulic Report, US 6 over the Brush Creek, US 6 over Hockett Gulch, Eagle, Colorado” prepared in September 2014. The 100-year flow for Hockett Gulch was calculated to be 145 cfs. Preliminary calculations show that two (2) 10-foot x 4-foot box culverts would pass the estimated bulked flow of 290 cfs in anticipation of debris flow. The bulked flow was estimated as two times the 100-year clearwater flow but will need evaluation by a debris flow engineer. Channel calculations show that a trapezoidal ditch 10 feet wide with 3:1 side slopes and an ‘n’ factor of 0.35 would have a depth of flow of 1.83’. Therefore, a 3 foot deep ditch would allow over 1 foot of freeboard above the assumed bulked flow.

Velocities indicate that armoring of the channel would be necessary. Calculations may be found in Appendix C.

IX. CDPHE Permits

It is anticipated that sediment control for the Reserve at Hockett Gulch will be addressed through the Colorado Discharge Permit System (CDPS), Stormwater Discharges Associated with Construction Activity permit depending upon the final disturbed area. This permit is obtained from the Colorado Department of Public Health and Environment (CDPHE) and requires the preparation of a Stormwater Management/Best Management Practices (SWM/BMP) plan. A SWM/BMP plan will be prepared for the site to ensure that sediment control measures will be installed to control sediment from leaving the site.

It is also anticipated that a groundwater discharge permit will be obtained for this site should any dewatering of groundwater be required during construction. This permit is also obtained from the CDPHE as part of the CDPS permit system.

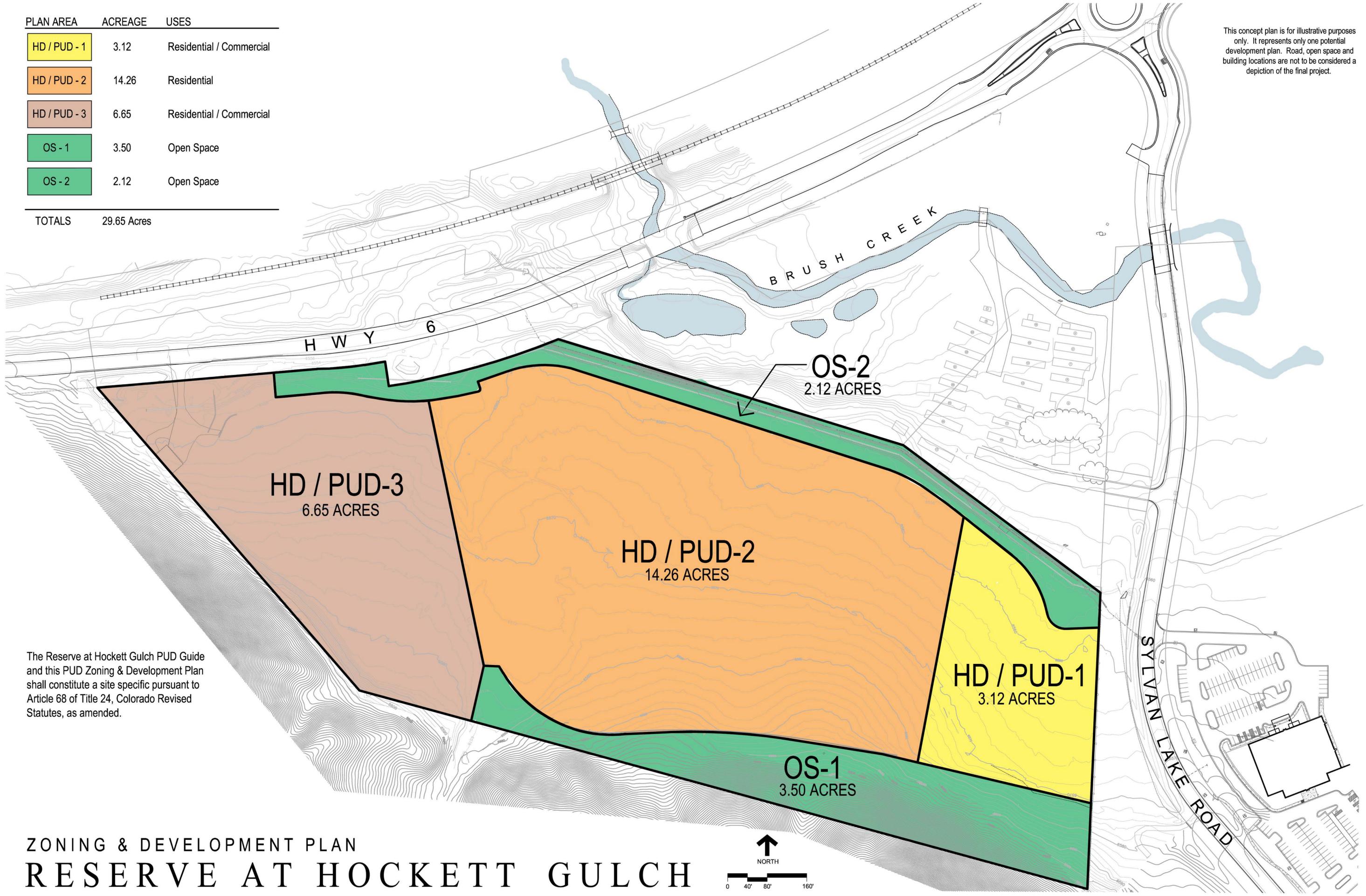
The State of Colorado (CDPHE) Air Pollution Control Division also requires an Air Pollution Emissions Notice (APEN) Fugitive Dust for Land Development Construction permit be obtained for construction sites disturbing more than 25 acres or lasting more than 6 months in duration. This permit will be applied for and obtained as required.

X. Summary

As the site planning is refined for the mixed use areas, potential low impact design practices that could be used to treat stormwater flows will be analyzed. Water quality treatment of stormwater will be provided by various methods including treating runoff in water quality ponds. The appropriate permits will be obtained from local, state and federal agencies.

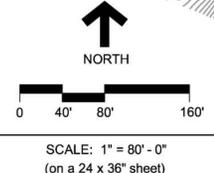
PLAN AREA	ACREAGE	USES
HD / PUD - 1	3.12	Residential / Commercial
HD / PUD - 2	14.26	Residential
HD / PUD - 3	6.65	Residential / Commercial
OS - 1	3.50	Open Space
OS - 2	2.12	Open Space
TOTALS	29.65 Acres	

This concept plan is for illustrative purposes only. It represents only one potential development plan. Road, open space and building locations are not to be considered a depiction of the final project.



The Reserve at Hockett Gulch PUD Guide and this PUD Zoning & Development Plan shall constitute a site specific pursuant to Article 68 of Title 24, Colorado Revised Statutes, as amended.

ZONING & DEVELOPMENT PLAN
RESERVE AT HOCKETT GULCH
 EAGLE, COLORADO



APPENDIX A

**PRELIMINARY HOCKETT GULCH
BOX CULVERT
CALCULATIONS**

01-05-2015

Pre. Box Culvert

JH4

$$\Phi = 290 \text{ cfs}$$

100 Barrel

$$\text{Try } 10' \text{ wide} = \frac{\Phi}{B} = \frac{290}{10} = 29 \text{ cfs} ; D = 4.7'$$

$$15' \text{ wide} = \frac{290}{15} = 19.3 \text{ cfs}$$

$$D = 3.5'$$

Top Road @ 6560

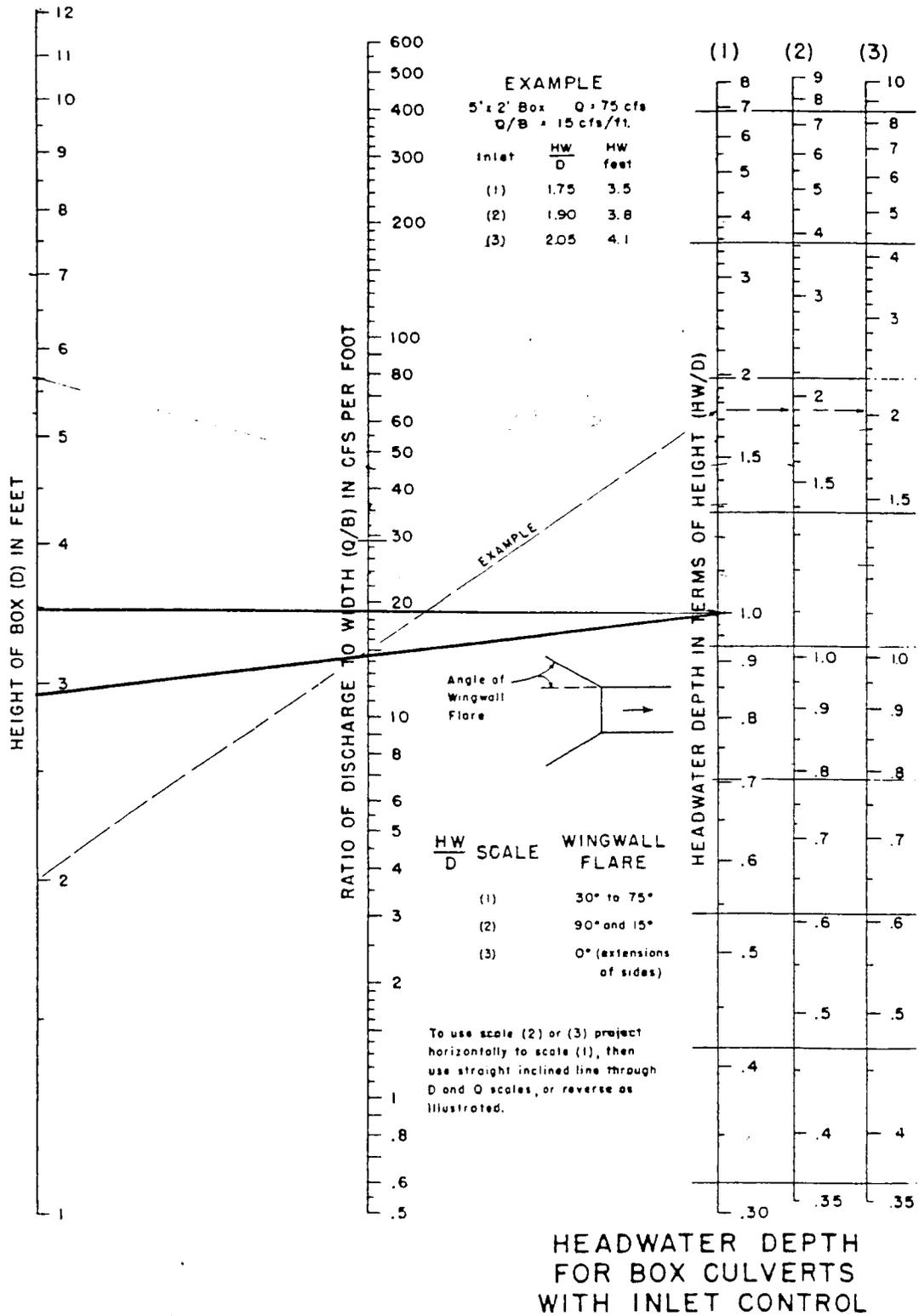
$$\begin{array}{r} - 2 \text{ Cover} \\ \hline 6558 \end{array}$$

$$20' \text{ wide} = \frac{290}{20} = 14.5$$

$$D = 2.9'$$

$$\begin{array}{r} - 4' \text{ Box} \\ \hline 6554 \text{ I.M.U} \end{array}$$

CHART I



Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name:

Comment: Hockett Gulch

Solve For Depth

Given Input Data:

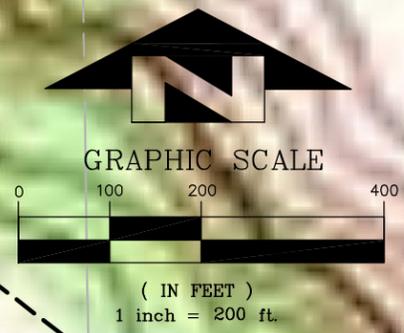
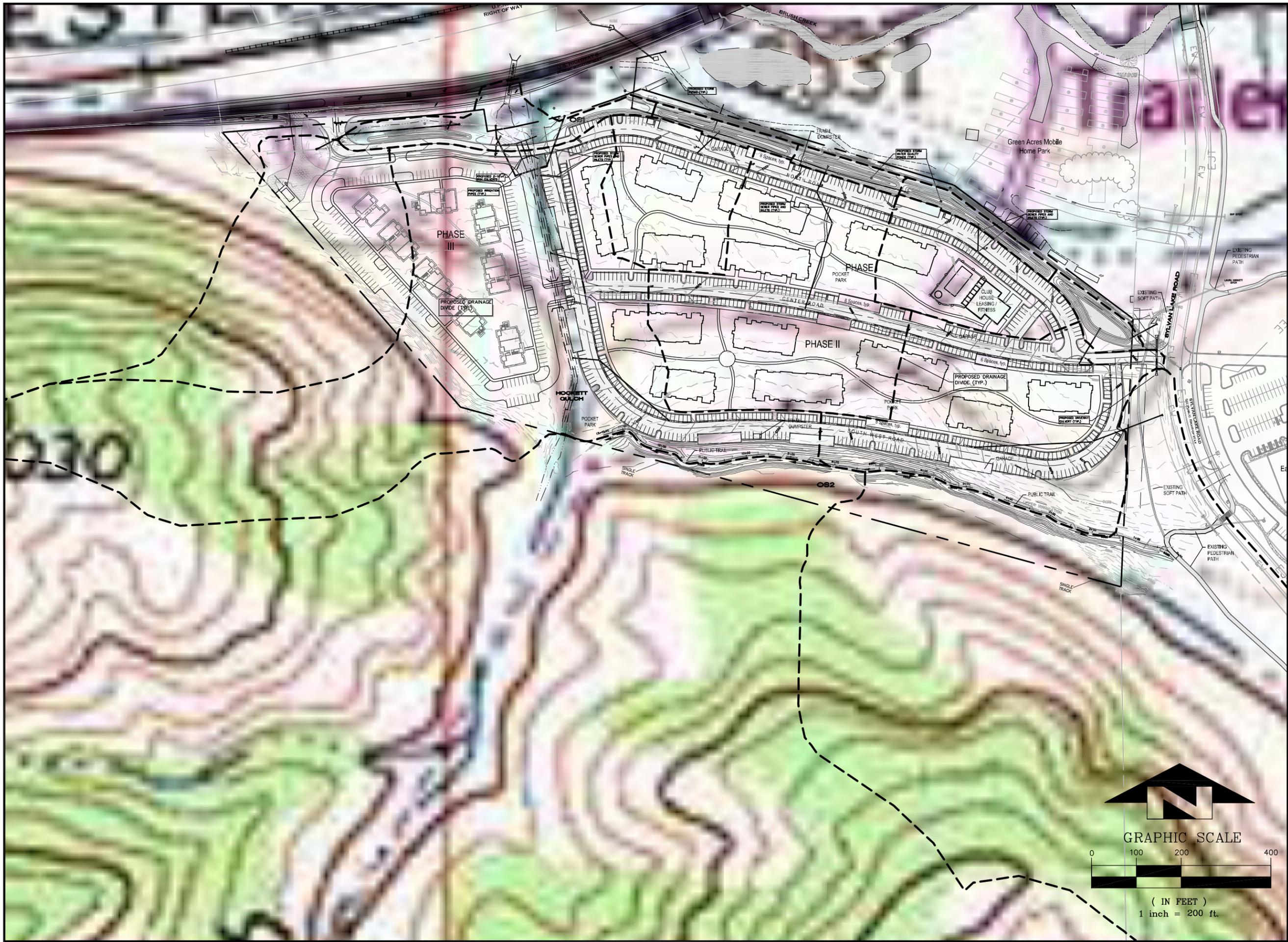
Bottom Width.....	10.00 ft
Left Side Slope..	3.00:1 (H:V)
Right Side Slope.	3.00:1 (H:V)
Manning's n.....	0.035
Channel Slope....	0.0400 ft/ft
Discharge.....	290.00 cfs

Computed Results:

Depth.....	1.83 ft
Velocity.....	10.20 fps
Flow Area.....	28.43 sf
Flow Top Width...	21.00 ft
Wetted Perimeter.	21.60 ft
Critical Depth...	2.34 ft
Critical Slope...	0.0157 ft/ft
Froude Number....	1.54 (flow is Supercritical)

MAPS

O:\Eagle\JHY Parcel-44021-2015\DWG\Drainage\DAW-JHY.dwg, SHT-1, 11x17-200 QUAD, 1/30/2018 7:09:11 AM, Miles



ALPINE ENGINEERING INC.
 2410 W. 6TH UNIT A8 / PO BOX 97
 EDWARDS CO 81632 / 970.866.3373
 WWW.ALPECIVIL.COM

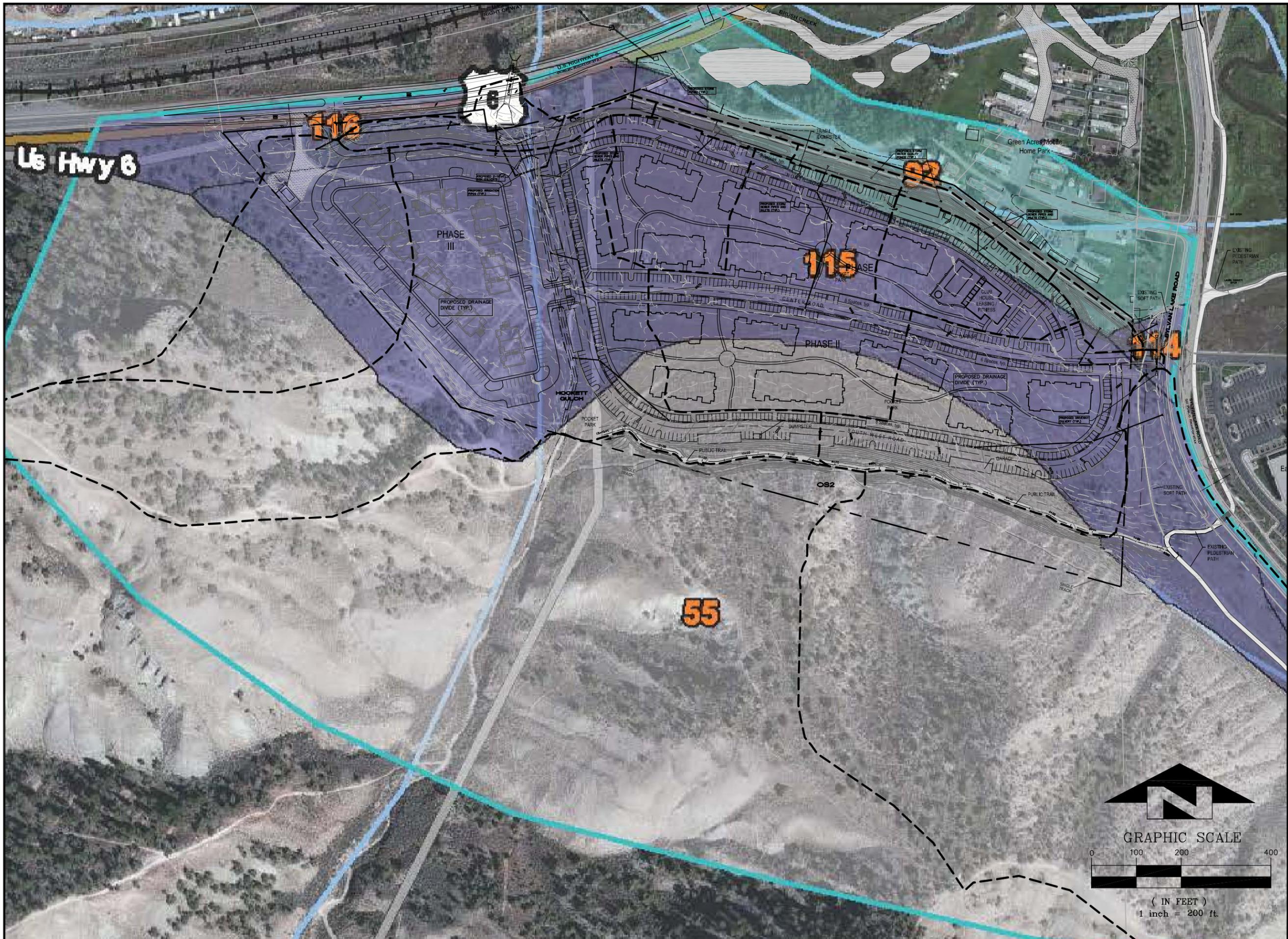
RESERVE AT HOCKETT GULCH
 PUD SKETCH PLAN
 OFFSITE DRAINAGE AREA MAP

DESIGNED	HM	NO.	DATE	REVISIONS	BY
DRAWN	HM				
CHECKED	GLB/KAK				
JOB NO.	44021				
DATE	01/29/2018				

SHEET
1

(SEAL)

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RESERVE AT HOCKETT GULCH
PUD SKETCH PLAN
SOILS DRAINAGE AREA MAP

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JOB NO.	44021				
DATE	01/29/2018				

(SEAL)

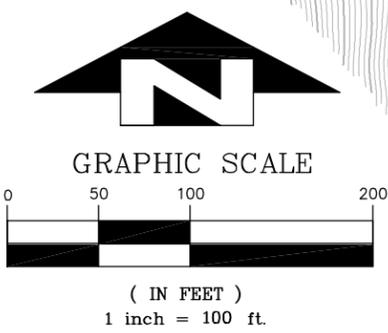
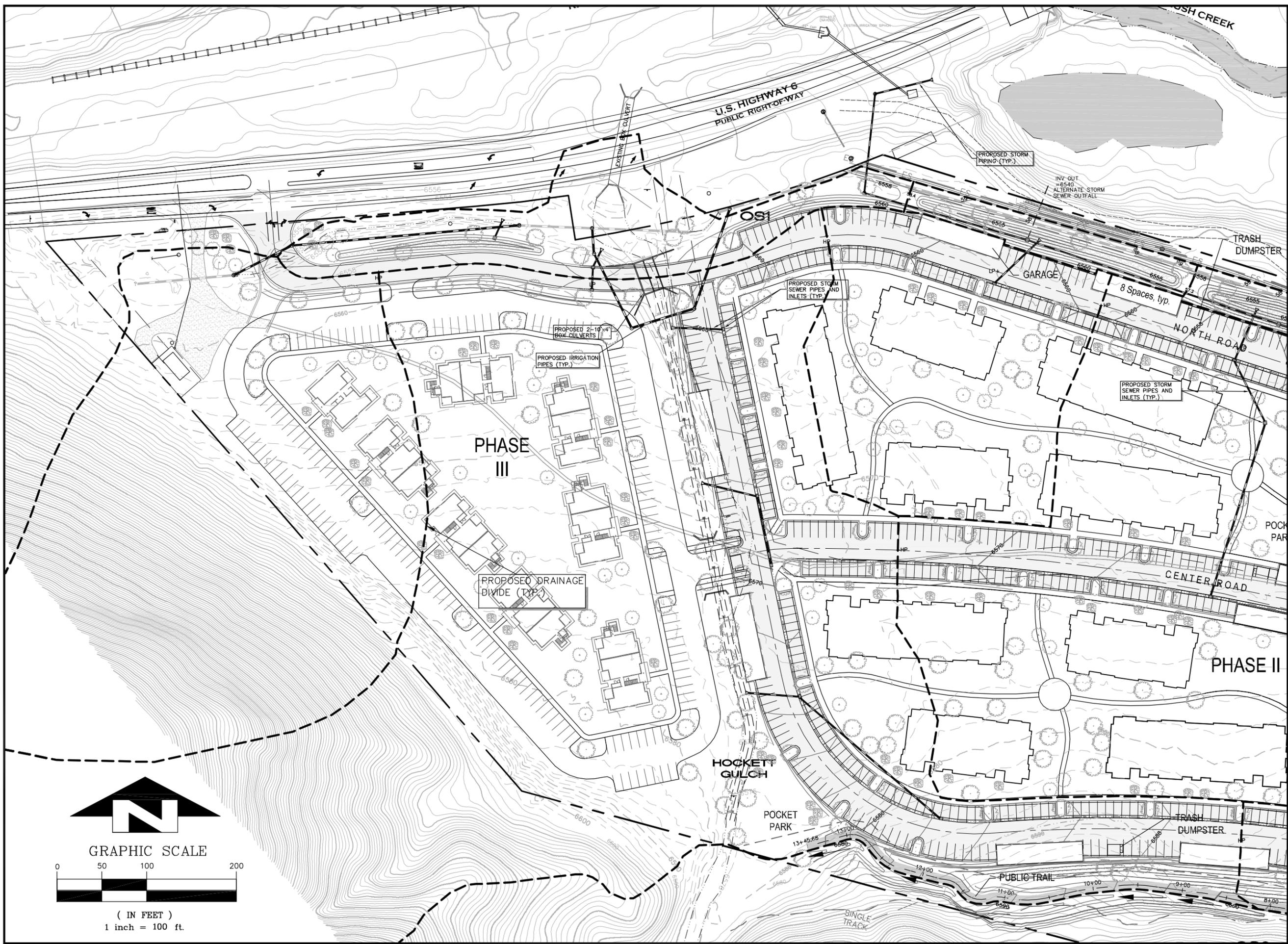
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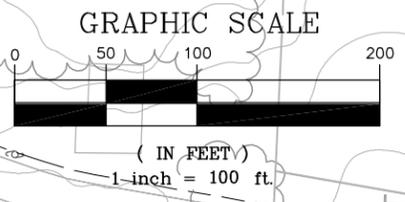
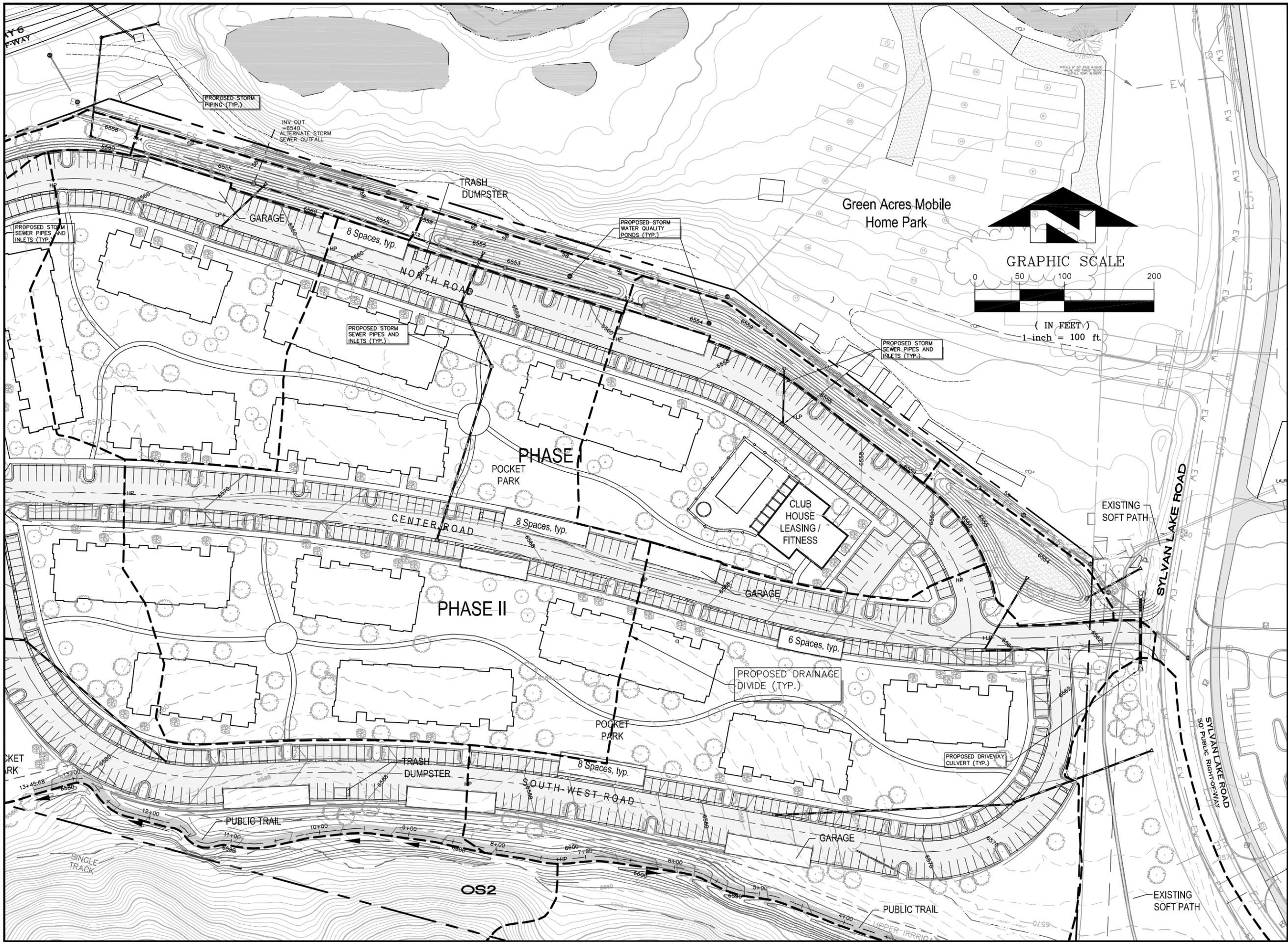
RESERVE AT HOCKETT GULCH
 PUD SKETCH PLAN
 DEVELOPED DRAINAGE AREA MAP

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DATE	01/29/2018			

SHEET 3



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RESERVE AT HOCKETT GULCH
 PUD SKETCH PLAN
 DEVELOPED DRAINAGE AREA MAP

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JOB NO.				
DATE				