

COMBINED PRELIMINARY AND FINAL
DRAINAGE REPORT
for
OHANA SUBDIVISION
EL PASO COUNTY, COLORADO

Prepared for

Gary and Darlene Hammann 17825 Jones Road
Peyton, CO 80831

Prepared by

Allison Engineering 4245 Log Road
Peyton, CO 80831

Design Engineer's Statement: The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established the County for drainage reports and said report is in conformity with the applicable master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

James L. Allison, P.E. #27338



Owner/Developer's Statement: I, the owner/developer have read and will comply with all of the requirements specified in this drainage report and plan.

Gary and Darlene Hammann

El Paso County Certification: Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 and 2, El Paso County Engineering Criteria Manual & Land Development Code as amended.

Jennifer Irvine, P.E.
County Engineer / ECM Administrator

Conditions: Change to Joshua Palmer

Contents

| | | |
|----|---|----|
| 1 | Purpose | 4 |
| 2 | General Location and Description | 4 |
| 3 | Soils | 6 |
| 4 | Flood Plain Statement | 7 |
| 5 | Four Step Process | 7 |
| 6 | Existing Drainage Conditions | 8 |
| 7 | Proposed Drainage Conditions | 8 |
| 8 | Water Quality Provisions and Maintenance | 9 |
| 9 | Erosion Control | 9 |
| 10 | Construction Cost Opinion | 9 |
| 11 | Drainage Fees | 9 |
| 12 | Summary | 10 |
| 13 | Appedix | |
| | Rational Model Calculations | 11 |
| | 13.1 Culvert | 12 |
| | 13.2 Before and After Drainage Impact | 13 |
| 14 | References | 15 |

1 Purpose

This document is intended to serve as the Preliminary and Final Drainage Report for OHANA SUBDIVISION, a rural-residential subdivision of four lots of approximately 5 acres each. The purpose of this document is to identify and analyze the on- and off-site drainage patterns and to ensure that post development runoff is routed through the site safely and in a manner that satisfies the requirements set forth by the El Paso County Drainage Criteria Manual. The proposed principal use for the four lots is to be single-family residences and whatever ancillary structures are deemed useful such as detached garages, shops, barns, and other structures common with hobby-farm types of activities. The majority of each lot will remain low, sparse grasses typical of the present condition. This form of use is typical in all four directions from the proposed subdivision.

2 General Location and Description

OHANA Subdivision is located in the northwest quarter of Section 30, Township 13 South, Range 63 West of the 6th P.M., El Paso County, Colorado. Adjacent roads are Murr Road paralleling the west property line and Jones Road parallel to the north property line. The intersection of these two county roads is shown in the upper left-hand corner of Figure 14. There are no public roads within the boundary of the proposed subdivision. To the east is the eastern dominant drainage channel of the Haegler Ranch drainage basin within which the entirety of the proposed subdivision lies according to the Drainage Basins for El Paso County, Colorado, 2005 copyrighted by the Board of County Commissioners. However, the Haegler Ranch Basin Planning Study of May 2009 for the El Paso County Department of Transportation by URS Corporation indicates the proposed subdivision is in the Telephone Exchange drainage basin, CHMS0200 and CHWS0200, respectively. In the case that the eastern sides of three of the proposed four lots are in the Telephone Exchange basin, the drainage from those lots is to be contained within the proposed subdivision by proper grading of the Murr Road burrow area. The Haegler Ranch Basin Planning study indicates the delineation between the Haegler and Telephone Exchange basins occurs at the 6450-foot contour.

Existing site native grade slopes downward to the east towards the Haegler Ranch drainage way. The grade in its descent does not exceed 10% and is unbroken by erosion, cliffs, escarpments or any other feature which would indicate recent erosion or lack of conservation care.

The proportions of the various lots possibly residing in the Telephone Exchange basin are as shown in Table 1.

Lot Percentages and Areas in Telephone Exchange Basin

| Lot | Percentage | Area |
|-----|------------|--------|
| 1 | 28 | 0 |
| 2 | 18 | 4,967 |
| 3 | 2.4 | 37,250 |
| 4 | 0 | 57,970 |

Owing to the right-of-way drainage along Murr Road, convention in the county is to not accept drainage from rural properties into those areas. If this covention is followed, the historical drainage into Telephone Exchange Basin will be directed into the Haegler Ranch Basin. This assumes the Haegler Ranch Basin Drainage Basin Planning Study is accepted as correct.

The proposed subdivision encompasses 19.3101 acres of undeveloped land aside from the single homesite in the northwest corner closest to the intersection of Jones and Murr Roads. The homesite has been occupied for generations, dating at least to the start of the 20th century. Buildings on this, which is proposed as lot 1 in the plat plan, include a recently remodeled residence with a detached garage, two barns, and small greenhouse not suitable for commercial use but instead for hot-house fruits and vegetables.

The proposed Lot 1 has a current address of 17825 Jones Road, which since the entrance is from Murr Road will be reassigned within the process of subdividing.

Referring to Figure 14, on the north, east, and south sides, the land use is the same as that on this parcel, rural residential of 20 acres or more. Land

use to the west across Murr Road is the Blue Sage Subdivision consisting of 2.5-acre lots.

3 Soils

The single soil type of this subdivision is Blakeland loamy sand. The description provided in the El Paso County U. S. Department of Agriculture Soil Conservation Service Soil Survey is compatible with that observed in the course of the field work for the geological soil report for this subdivision performed by Allison Engineering.

Field examination of the area covered by Blakeland loamy sand finds consistent the slopes of "... 1 to 9 percent ... somewhat excessively drained soil ... extending to a depth 60 inches." From the field examination we found the depth of the soil as stated in the U. S. DoA Soil Survey to be shallower than that observed. This is likely owing to the limited depth the survey examined. The "excessively drained" characteristic of this soil is amplified with further Soil Survey comments such as "[p]ermeability of this Blakeland soil is rapid'." With further emphasis the "[a]vailable water capacity is low to moderate." Given the document provides such characterization it is apparent surface runoff will be very low. Noted in Figure 14 there are no surface markings on the eastern slope of the property where the land descends toward the main drainage of the Haegler Ranch defined drainage path. Such, if they existed, would indicate any recent erosion. In fact the Soil Survey gives credence by stating "[s]urface runoff is slow, the hazard of erosion is moderate."

For residential, light agriculture use such as are typical of hobby-farm activities, the Soil Survey warning that the "hazard of soil blowing is severe" is noteworthy. With the survey stating "[m]ost areas of this soil are used for range, homesites and wildlife habitat" it is an easy conclusion that overgrazing or initiated erosion could set in motion wind erosion. The survey substantiates the above by concluding: "Soil blowing is a hazard if protective vegetation is removed. Special erosion control practices must be provided to minimize soil losses." An assignment of capability subclass VIe is made in the survey.

Unresolved:
Please provide soils survey
map in appendix

4 Flood Plain Statement

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel No. 08041C0590 G with an effective date of December 7, 2018; encompassing the entirety of the proposed subdivision, Zone A only clips the northwest corner of proposed Lot 1. This is shown in Figure 14, which is a focus on that part of the FIRM encompassing the proposed subdivision. The spatial extent of this zone is a triangular area with dimensions of 170-feet along the north boundary and 256-feet along the east boundary. The total area of zone A in proposed Lot 1 is 21,760 square feet or slightly less than 1/2-acre. This area will be a “no-build area on the plat. No revisions are recorded for his FIRM.

5 Four Step Process

Step 1: Employ Runoff Reduction Practices - Approximately an additional 0.5 acres of the proposed 19.3101-acre subdivision will be impermeable surface once the three proposed and yet-to-be developed lots are fully developed with homes and outbuildings. This additional 0.5 acres of impermeable surface will be distributed across the three undeveloped lots. Among those structures, roof drains will likely only be placed on the homes. Drains therefrom are to be directed away from the home and onto level and stabilized grade a minimum of 10-feet from the residence.

Per ECM I.7.1.b.5, all low density (rural) housing of 2.5 acre or larger lots need not consider Water Quality Capture Volume (WQCV), as discussed in DCM2. However, other permanent BMPs may be required as appropriate. Each lot within the proposed subdivision is larger than 2.5 acres.

Step 2: Stabilize Drainage ways - Hay bales and silt fences placed prior to, and maintained during construction are anticipated to lead to stabilized drainage paths adjacent to impervious surfaces.

Step 3: Provide Water Quality Capture Volume - Water capture will not be required as explained in Step 1.

Step 4: Consider Need for Industrial and Commercial BMP's - This site is not being developed for industrial or commercial use and BMP's on that basis are not necessary.

6 Existing Drainage Conditions

Surficial markings do not indicate defined erosion. As explained with reference to the El Paso County Soil Survey in the section of this report titled "Soils," the soil is sufficiently porous, runoff is unlikely. If a surface flow were to develop, the majority of the drainage would be to the east and into the main drainage path of the Haegler drainage basin. A lesser surface area would drain to the west and into the drainage parallel to Murr Road which drains north toward Jones Road where any flow in this road barrow ditch makes a right-turn to the east, then downhill to the east channel of the Haegler Drainage channel.

The only potential drainage into the area of the proposed subdivision would be along the south boundary line which would be sheet flow and of limited extent owing to the porous nature of the soil.

The only existing culvert is that beneath the driveway entrance into the presently developed Lot 1 from Murr Road on the west. That culvert is an 16-inch circular, corrugated metal cuvert. The Rational Method was used in the appendix to calculate the flow into this culvert. The flow was found to be well below the capacity of the 16-inch culvert though the owners are aware of the county requirement for an 18-inch culvert.

There are no previous reports and therefore, none that need to be adhered to.

Include discussion & analysis of existing roadside ditch. Size, velocity of flows, etc. If it appears to be stable or any erosion occuring, especially near existing culvert.

7 Proposed Drainage Conditions

No alteration of the existing drainage conditions will result from the placement of residences on the three yet undeveloped lots. Each of those lots will have driveways entering from Murr Road with minimum 18-inch culverts. The residential structures and ancillary buildings during construction and

until re-establishment of native grasses and any landscaping could lead to erosion without erosion fences and hay bales; these are required as part of the erosion control plan.

8 Water Quality Provisions and Maintenance

The principal form of water quality runoff enhancement is the use of erosion fences and hay bales to slow or stop water from construction areas developing sufficient volume and speed to result in erosion. The effect of these measures will be to slow runoff, promote infiltration, thus reducing peak volumes. As described above in the 'Soils' section of this document, the soil is very permeable.

9 Erosion Control

Erosion control measures are to be implemented prior to grading or construction and shall be maintained during all subsequent phases of construction. Erosion control measures will consist of silt fencing those portions of the property being developed, tracking control measures at the access points to the site, installation of hay bales at grass swales and re-vegetation with appropriate plant species.

10 Construction Cost Opinion

It is the opinion of the above signed engineer that silt fencing and hay bale placement and maintenance will not exceed \$800.00 for each of the three lots yet to be developed within this proposed subdivision.

11 Drainage Fees

To be assessed and specified by the county.

2023 drainage basin fees are \$12,985 per impervious acre and bridge fees are \$1,916 per impervious acres. Per ECM Appendix I.7.1.B.5, assume a 10% imperviousness per lot, unless show that it is less. Determine fees based on impervious acres.

12 Summary

Development of the OHANA SUBDIVISION FILING NO. 1 (Lots 1, 2, 3, and 4) will not adversely affect the surrounding developments per this the combined preliminary and final drainage report with no negative impact on the existing developments on any side of this project. The proposed drainage facilities will adequately convey, detain and route runoff from the to-be-developed structures within this proposed subdivision. The Haegler Drainage Basin will not be further burdened by the development and erosion to its banks will not occur with reasonable compliance to the drainage plan of this report.

13 Appedix

Rational Model Calculations

13.1 Culvert

Along the perimeter of the proposed Ohana subdivision, the only existing culvert within the drainage ways of either Jones Road or Murr Road is the one beneath the driveway leading into the developed Lot 1. Being only a 16-inch corrugated metal culvert it does not strictly meet the requirements noted in the El Paso County ECM and DCM as the requirement is for an 18-inch culvert.

For the single existing culvert, the drainage area is shown in Figure 14. Murr Road crests 145 feet south of the culvert opening, and drainage is to the north, the drainage area is relatively small. Considering Figure 14 the area serviced by the culvert is the road surface and shoulder. For the Rational Method, the runoff coefficient is to be an area weighted average.

Appendix only goes to Figure 7. Please update reference.

Using Table 5-1 from the Drainage Criteria manual and a recognition the hydrologic soil type within the proposed subdivision is A/B, the Murr Road gravel roadway has a C_i of 0.80 and 0.85 for the 10- and 100-year events respectively. The Murr Road burrow area is characterized as pasture/meadow and is assigned 0.25 and 0.35, respectively, for the two event types.

Murr Road right-of-way is a standard 50 ft. county profile conforming to Figure 14, the graveled roadway area serviced by the currently installed culvert is 145 ft. by 16 ft. With a 17' maximum burrow pit width claimable by the county, the runoff coefficient, C , used in the Rational Method equation, Equation (2), is calculated per Equation (2).

$$Q = CiA \tag{1}$$

$$C = \sum_{i=1}^{n+1} C_i A_i / A \tag{2}$$

$$C_{10} = (0.80 \times 0.057ac + 0.25 \times 0.057) / 0.114ac C_{10} = 0.53 \tag{3}$$

and

$$C_{100} = (0.85X0.057ac + 0.35X0.057)/0.114acC_{100} = 0.60 \quad (4)$$

Time of concentration is determined using Equation 5 with lengths, L, determined as a rectilinear measurement from the southern-most crest point to the culvert inlet and the slope being generally 2%.

$$T_c = 1.87(1.1 - C_1)0L^{0.5}S - 0.33 \quad (5)$$

$$T_{cRoad} = 1.87(1.1 - 0.80)12^{0.5}(2 - 0.33)T_{cRoad} = 3.2sec \quad (6)$$

$$T_{cBurrow} = 1.87(1.1 - 0.80)145^{0.5}(2 - 0.33)T_{cBurrow} = 11.2sec \quad (7)$$

$$T_c = T_{cBurrow} + T_{cRoad}T_c = 3.2 + 11.2T_c = 14.4sec \quad (8)$$

Equation 5 finds a T_c of only 14.4 seconds for the roadway area for which the intensity is determined from DCM Figure 5-1 as 6 inches and 9 inches for the 10- and 100-year events, respectively.

The aggregated Rational Method calculation is:

$$Q_{10} = 0.53X6X0.114Q_{10} = 0.36cfs \quad (9)$$

and

$$Q_{100} = 0.60X9X0.114Q_{100} = 0.62cfs \quad (10)$$

The volumes of water for C_{10} and C_{100} are so small the current 16-in diameter culvert is sufficient though the subdivision owners are not opposed to installing an 18-in culvert. Indicate if existing culvert has riprap outlet protection.

13.2 Before and After Drainage Impact

As in the previous section, the Rational Method is used.

Assuming no development within the entirety of the proposed Ohana Subdivision, inputs to the Rational Method are as follows:

Area = 20 acres
 L = 660 ft
 S = 6
 $C_{10} = 0.25$
 $C_{100} = 0.35$

For hydrology, EPC has adopted Chapter 6 of the City of Colorado Springs Drainage Criteria Manual. Per Section 3.2.1, overland flow in non-urban areas should not exceed 300 ft. Also, see Equation 6-8 for overland flow calculation.

The T_c is calculated using equation Equation 5 as

$$T_c = 1.87(1.1 - 0.25)660^{0.5}(6 - 0.33)T_c = 231seconds \quad (11)$$

A time of concentration of 231 seconds corresponds to 6 and 9 minutes for the 10- and 100-year events, respectively.

$$Q_{10} = CiAQ_{10} = 0.25 \times 6 \times 20Q_{10} = 30cfs \quad Q_{100} = 0.35 \times 9 \times 20Q_{100} = 63cfs \quad (12)$$

As evidenced by the lack of defined drainage ways from within the subdivision to the east into the Haeger drainage path and the contour map for the proposed subdivision, it is apparent the 30 and 63 cfs values corresponding to the 10- and 100-year events are not confined to channels but are surface flows.

Post development, it is assumed each lot will contribute 6000 square feet of impermeable surface for a total of 24,000 square-feet or 0.55 acres. Considering for the Rational Method for this added volume:

$$Q_{10} = CiAQ_{10} = 1.0 \times 6 \times 0.55Q_{10} = 3.3cfs \quad (13)$$

$$Q_{100} = 1.0 \times 9 \times 0.55Q_{100} = 5.0cfs \quad (14)$$

As in the pre-developed case, the flows would remain as sheet flow provided adequate erosion control and inclusion of swells to prevent concentrated flows are included in the development.

It appears that there is a ridge through the development site, which splits flows to east and west. Please provide separate drainage basins and determine if flows exiting site increase. If there is an increase in flows, detention may be needed. Lots larger than 2.5 acres are excluded from water quality requirement but not detention.

Per ECM Section 3.2.4 suitable outfall locations need to be defined. Provide description of these for each basin where flows exit site and label on map.

Provide an analysis for "worst-case" scenario for new driveway culvert crossing sizing. Indicate if outlet protection will be needed. If so, please provide calculations for riprap size and dimension

14 References

1. "Drainage Basins, El Paso County, Colorado 2005", Copyrighted by Board of County Commissioners
2. "haegler Ranch Basin Drainage Basin Planning Study", May 2009 for County Department of Transportation by URS Corporation, 9960 Federal Drive, Suite 300
3. FEMA FIRM Panel No. 08041C0590 G
4. "El Paso County and City of Colorado Springs Drainage Criteria Manual".
5. "SCS Soils Map for El Paso County"
6. Flood Insurance Rate Map (FIRM), Federal Emergency Management Agency, Effective date March 17, 1097.

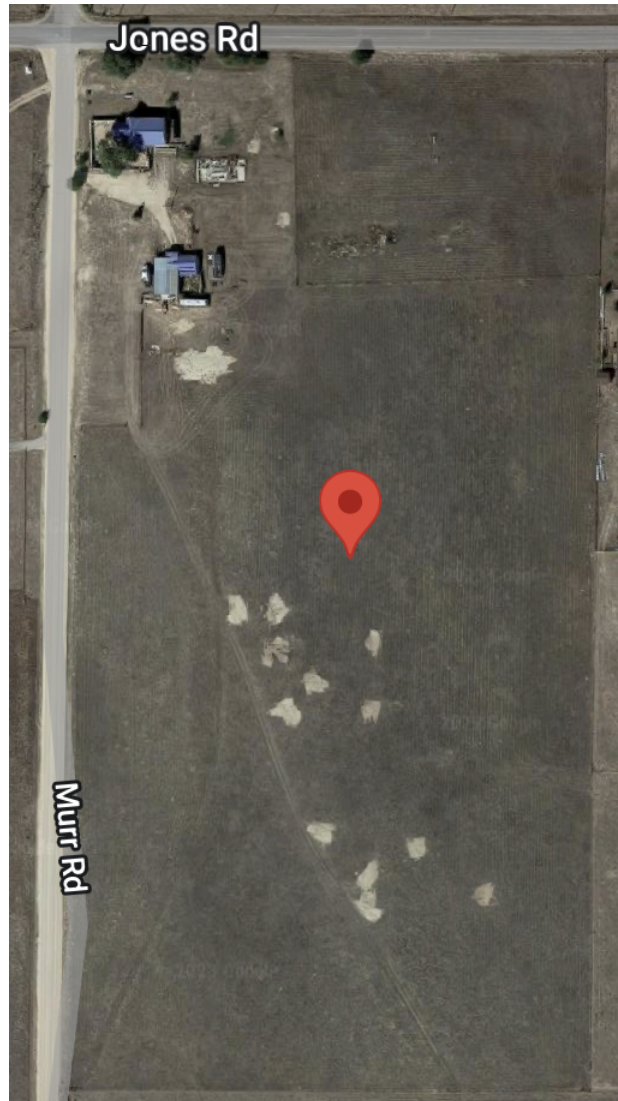


Figure 1: Satellite view of the proposed subdivision, the outlines of which are apparent from mowing and land uses differing from those to the south and east.



Figure 2: Context map showing land uses on the four sides of the proposed subdivision.



Figure 3: Photo of the east side of the proposed subdivision showing the absence of any erosion or defined drainage path.



Figure 4: Closeup of the FIRM map which includes the area of the proposed subdivision.

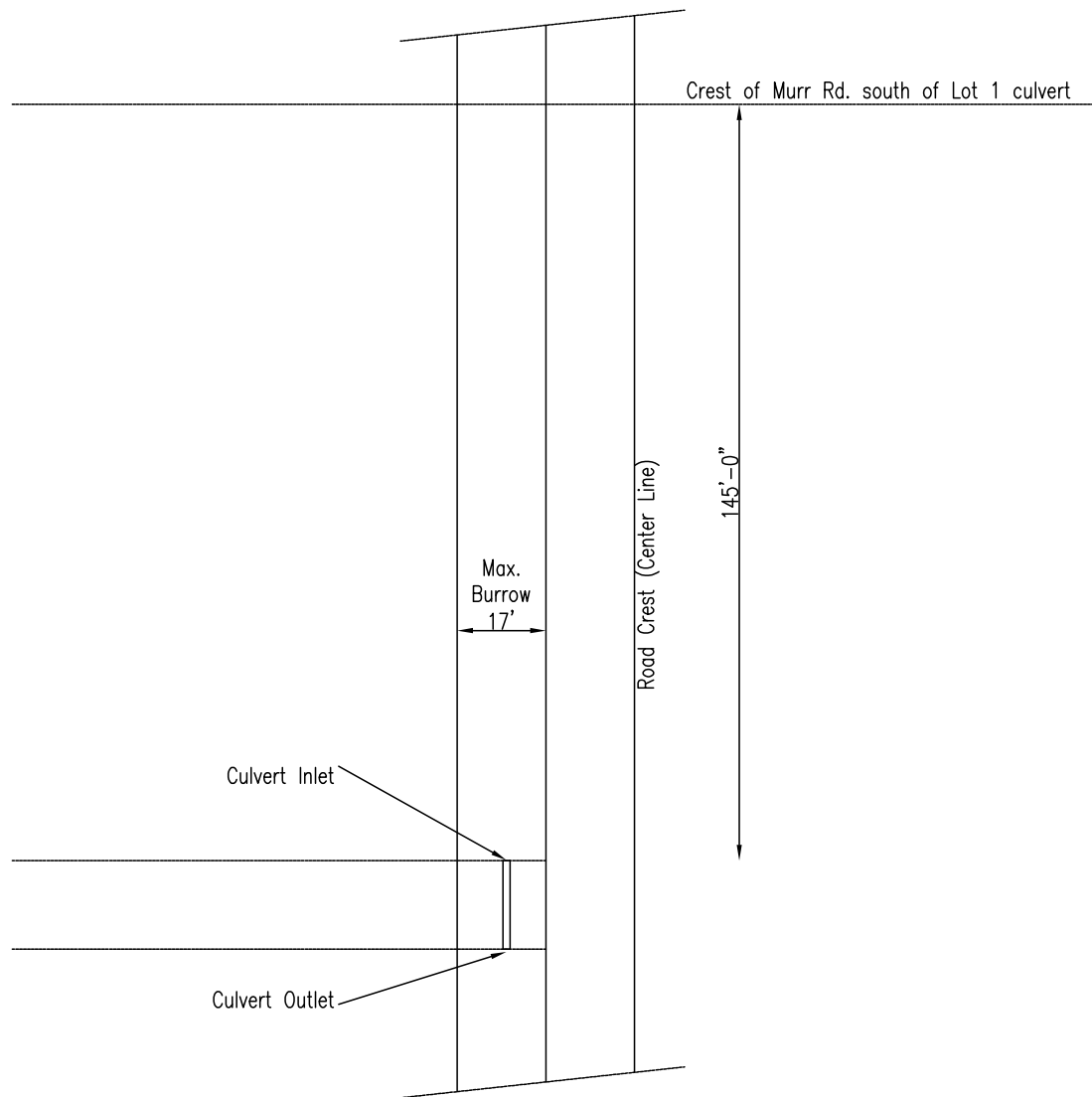


Figure 5: Diagram of the area drained at the existing 16-inch culvert.

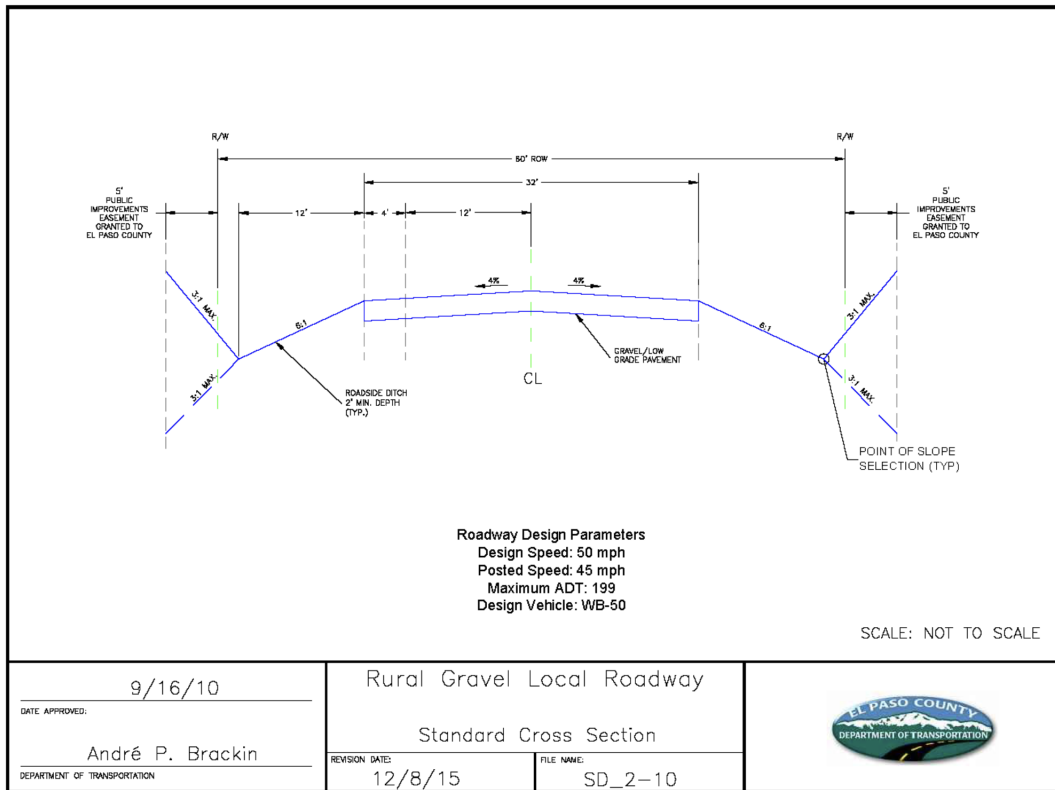


Figure 6: Road profile from the ECM showing assumptions used in the calculation of surface area fed to 16-inch existing culvert.

Need to clearly show what is existing vs. what is proposed.

Rotate map so text is upright and north points to top of page.

Provide map that is to scale & provide legend

Label all adjacent property owners

Show drainage arrows

Show and label existing culvert mentioned in report

Missing easement lines for this note.

It appears that there is a ridge running through the project site. A drainage basin with flows for each will need to be shown and calculated.

Fix overlapping text

Label no-build area for floodplain

Not sure of the intent of this statement as there are higher elevations along the roadway.

Per EPC GIS information an existing culvert crosses Jones Rd at intersection. Please show and label.

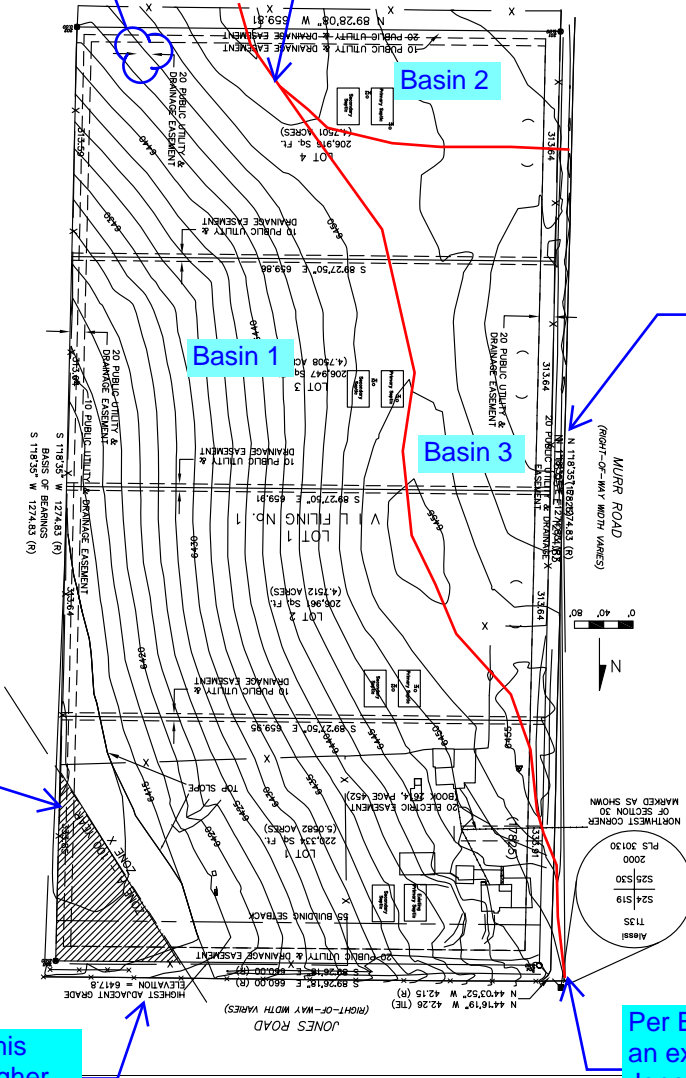


Figure 7: Small plat plan of proposed subdivision. Larger print accompanies this report.