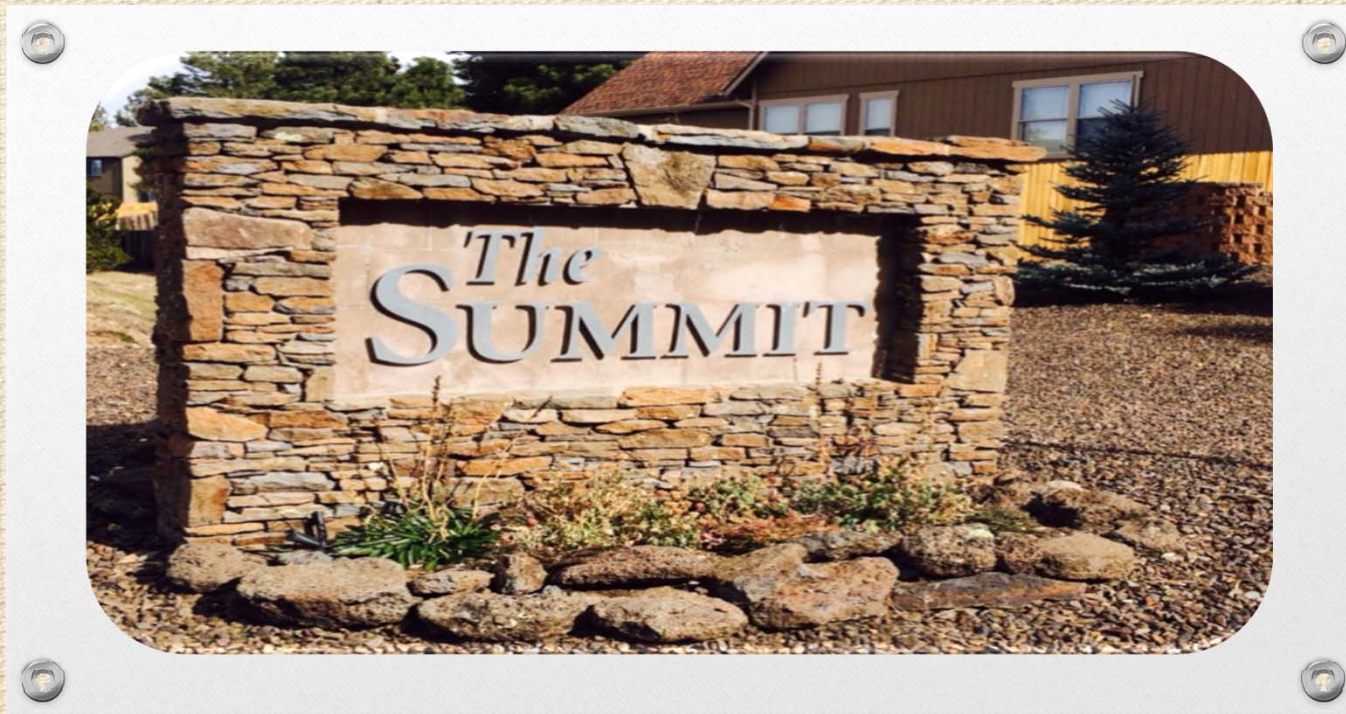


The Summit HOA Project



Team Members

Fatemah Husain, Hamad Alajmi, Eric Carrasco

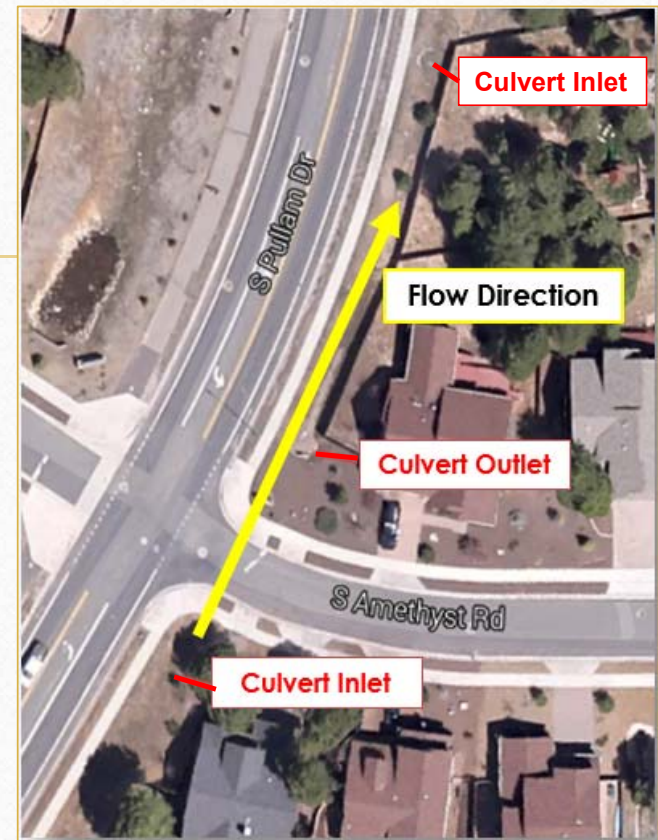
Introduction

- The purpose of the Summit Home Owner Association (HOA) project is to examine and redesign an unstable channel
- Backyard is sliding into the open channel
- Sediments is covering the outlet of the culvert



Background

- Location - channel is located in Flagstaff, Arizona on Pulliam Road
- Flow discharges north
- 2 existing culverts



Slide 3

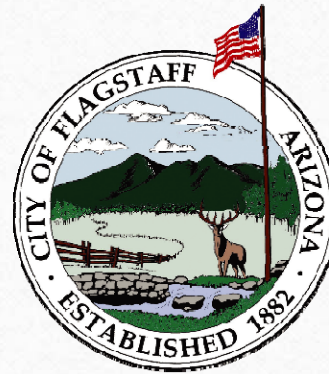
FH1

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Project Details

Stakeholders

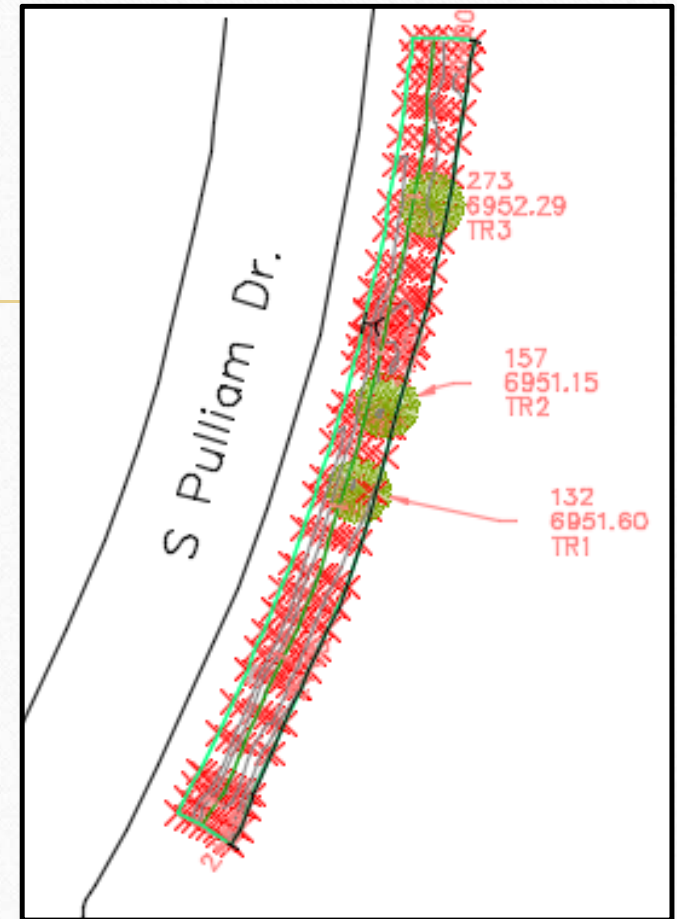
- The Summit HOA at Ponderosa Trails
- City of Flagstaff
- Client- Mark Lamer



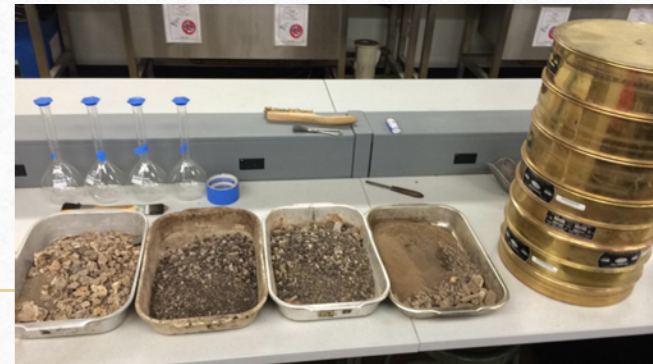
Client

Site Analysis: Surveying

- **Survey Data**
- **Topographic Map**
 - Channel length = 260 ft
 - Average Width = 16 ft



Site Analysis: Geotechnical



➤ Soil Testing

- Sieve Analysis, Plastic/Liquid Limit, Specific Gravity

➤ Soil Strength

- Assume values base on classification

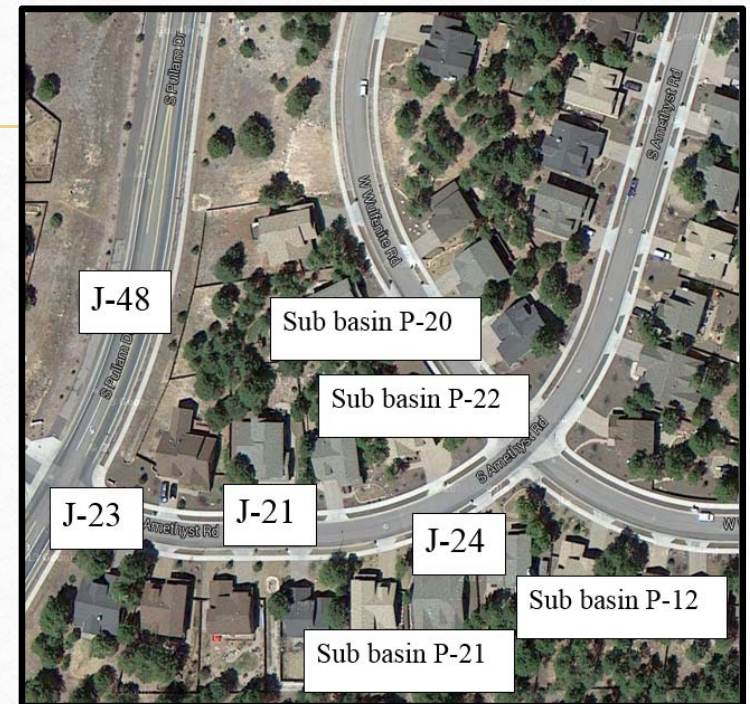
	AASHTO Classification	USCS Classification	Comments
Sample 1,2,3,4	A 2-4(0)	SP-SC Poorly-graded sand with clay and gravel	Excellent to good subgrade Good Drainage; pervious Good Compaction characteristics Reasonably stable for fill when dense

Site Analysis: Hydrology

➤ Rational Method for Flow design

- $Q = CIA$
 - Watershed Area: Amethyst = 19.8 acres
 - Watershed Area Pullium = 10.88 acres
 - Rainfall and Runoff analysis for 10yr, 25yr, and 100yr

Flow	10 year	25 year	100 year
Q design: Amethyst	25.27 cfs	31.73 cfs	42.75 cfs
Q design: Pullium	13.74 cfs	17.26 cfs	23.26 cfs



Design Alternatives

- Keep Existing Channel
- 3 Design Alternatives
 1. Culvert Design (Preferred)
 2. Engineered Channel
 3. Retaining Wall Design

Design Restrictions

➤ **Artificial Open Channels:**

- Drainage systems shall be designed for the 25-year design storm and checked with the 100-year design storm
- Channel side slopes shall not be steeper than 3H:1V
- Channel depth shall not exceed 3 feet in residential areas
- The minimum allowable channel slope is 0.5%
- Minimum freeboard is 1 foot

Design Restrictions

➤ **Culvert Design:**

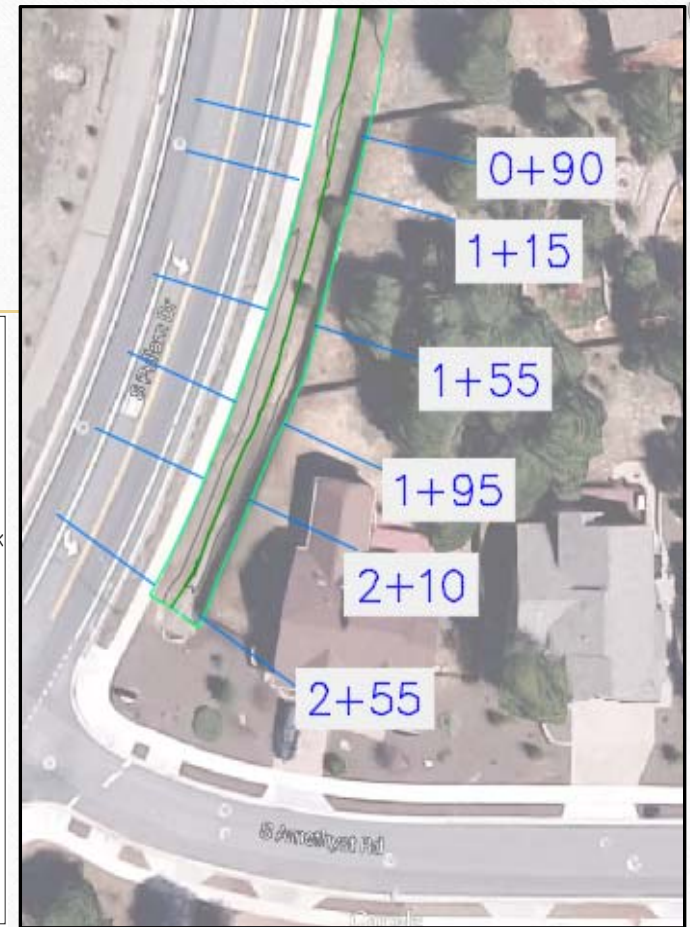
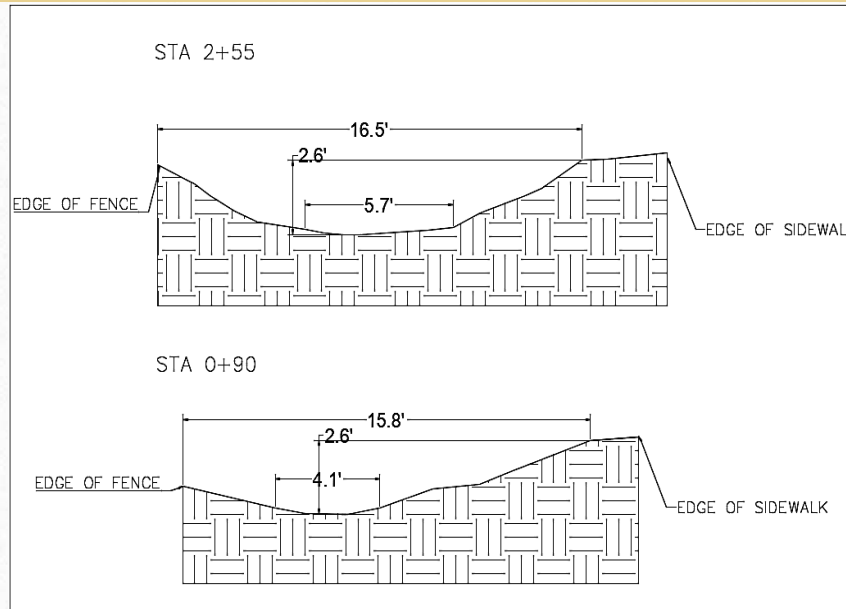
- All public storm drain shall be designed for the 10-year design storm and checked with 100-year design storm
- Minimum pipes diameter is 18 in
- Minimum pipes slope is 0.5%
- Minimum pipe radius is 486 feet

➤ **Retaining Wall**

- Height cannot exceed 5 feet
- Frost line depth is 2.5 feet

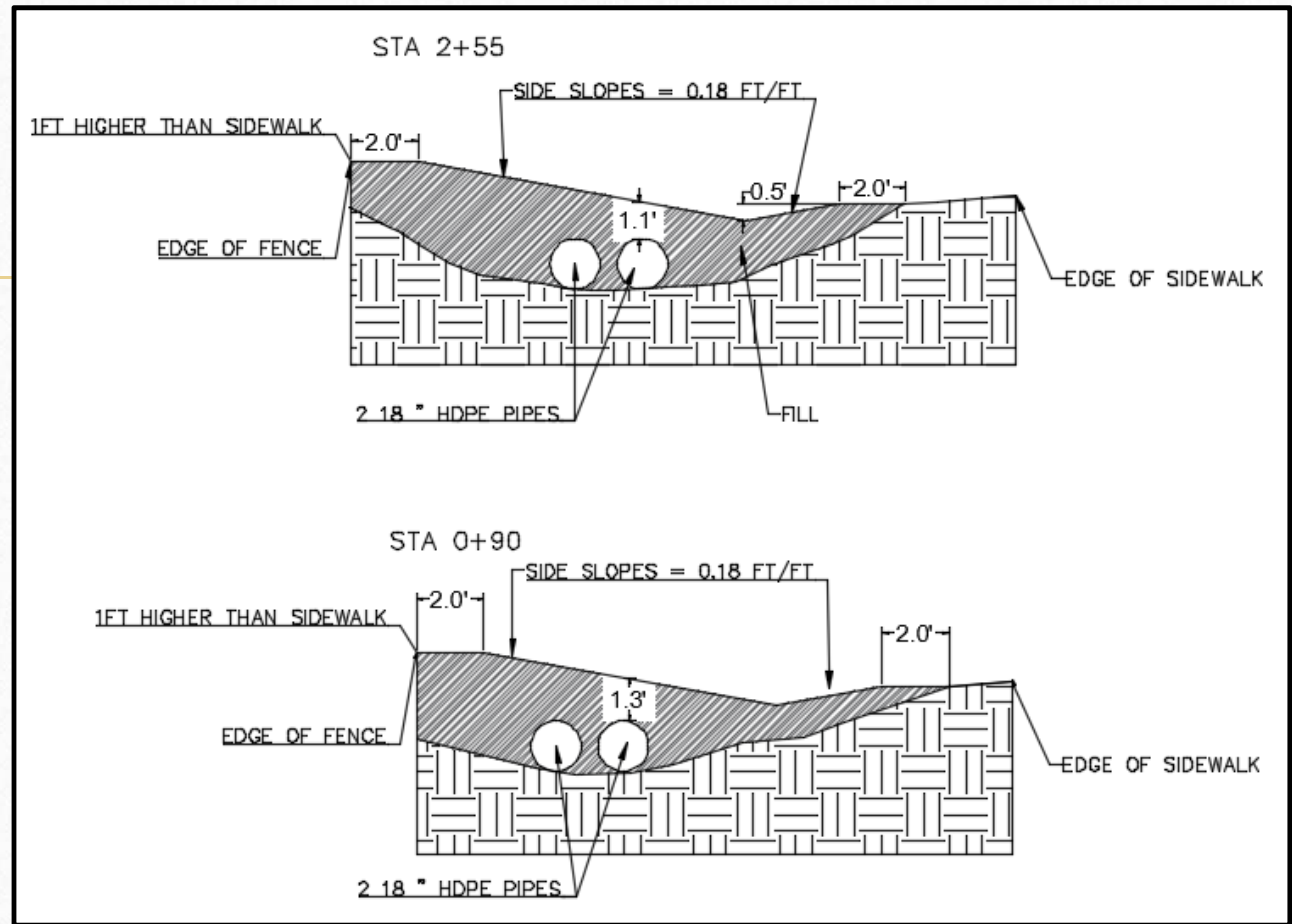
Existing Channel

- Channel length
- Channel slope
- Side slopes
- Channel depth
- Channel width

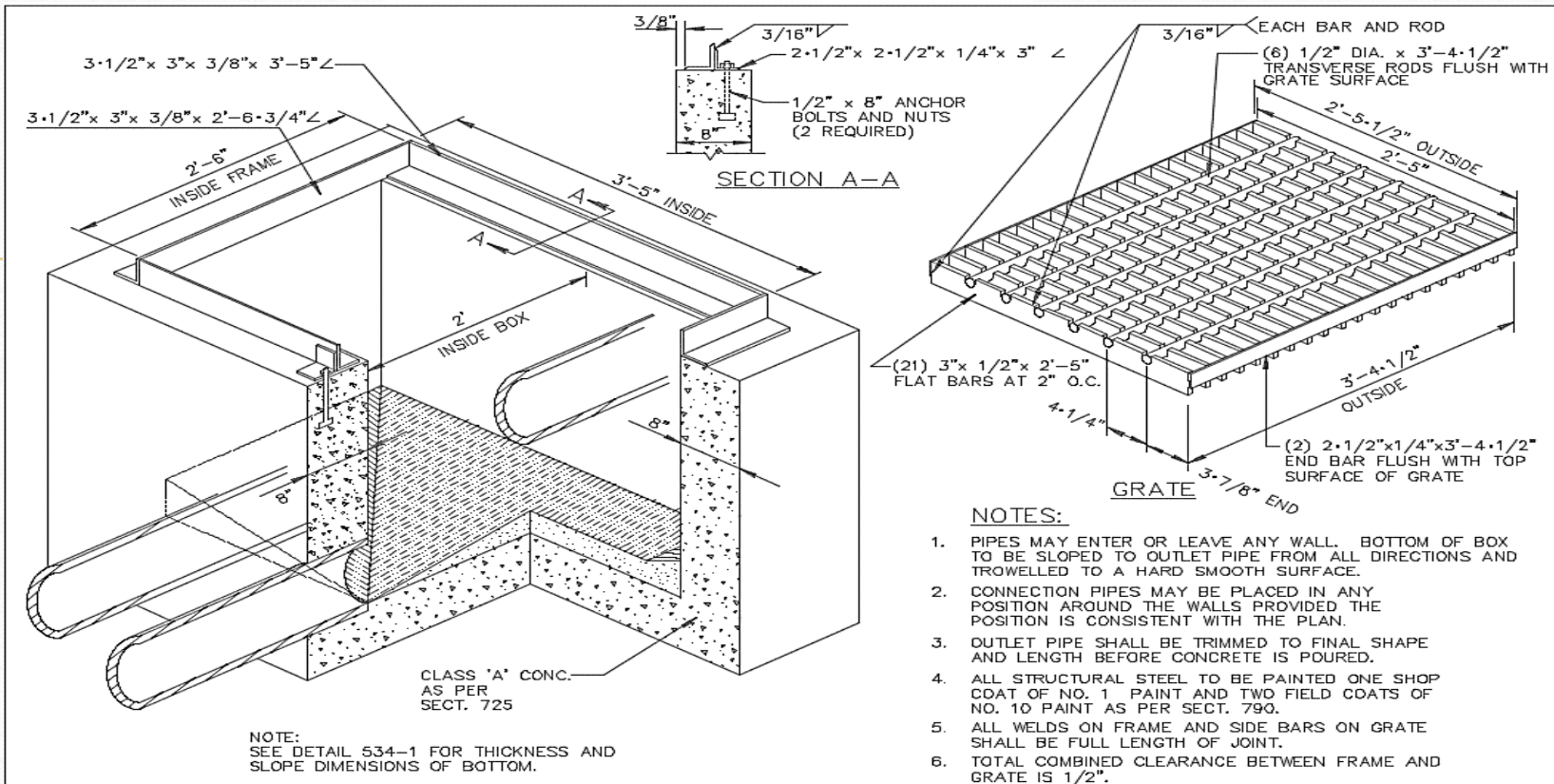


Culvert Design: Cross Sections

- Shoulders
- Pipe cover
- Side slopes
- Pipe type



Grate Inlet Dimension



DETAIL NO.
535



STANDARD DETAIL
ENGLISH

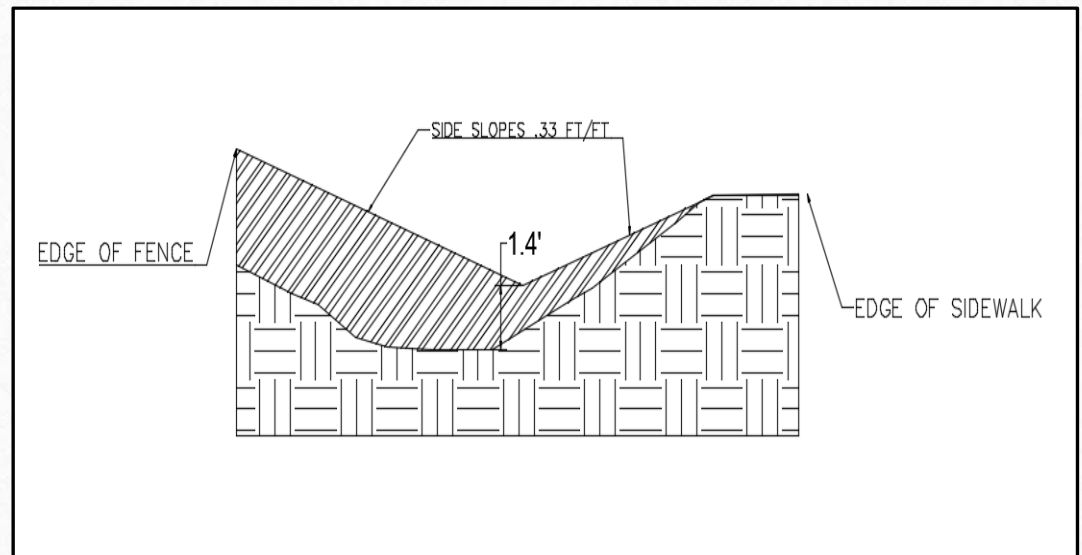
CATCH BASIN TYPE 'F'
(FOR USE WITHOUT CURB)

REVISED
01-01-2009

DETAIL NO.
535

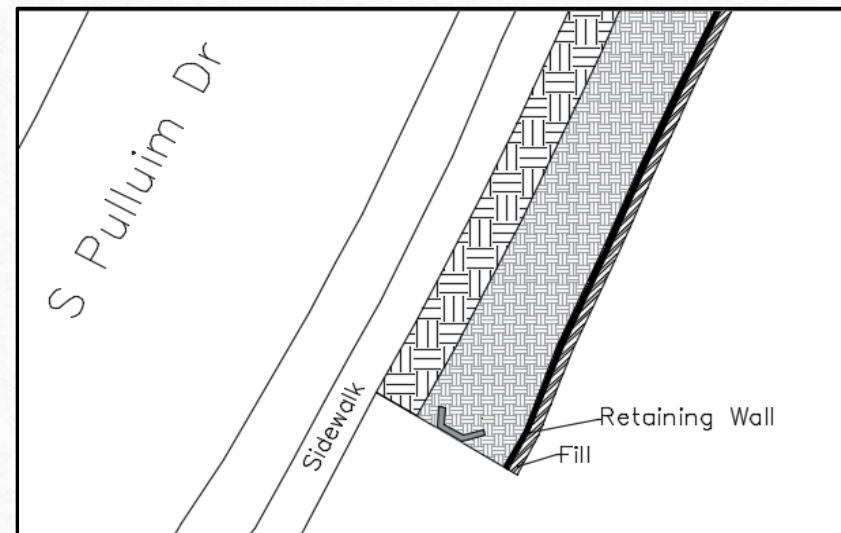
Design Alternative 2: Engineered Channel

- Design does not meet standards
- Side slopes shall not be steeper than 3H:1V
- Slope revision could be designed if the channel is extended beyond homeowners properties



Design Alternative 3: Retaining Wall

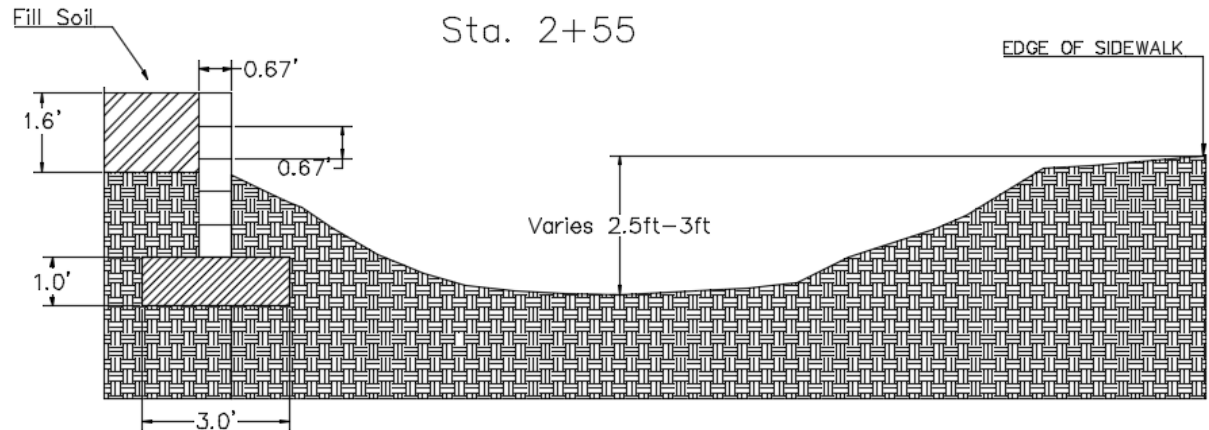
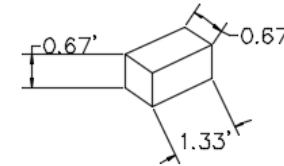
- Material Type: 8”*8”*16” Cinder Block
- Required Depth: 2.5ft
- GeoStructural Analysis: Masonry Wall
- Longitudinal Reinforcement: no. 4 rebar
- Soil Strength: Cohesionless soil
- Friction Angle 30 degrees
- Dry Unit Weight 105pcf
- Sat. Unit Weight 127pcf



Retaining Wall: Cross Section

- Retaining wall type and dimension
- Fill value
- Channel depth

Notes:
CMU Retaining Wall
Cast in Place Foundation
Concrete Blocks
Reinforcement Type: No. 4 Rebar
Compressive Strength: 1700ps
Fill Soil varies along channel



Cut/Fill Area: 10.2ft^2
Length of Retaining Wall: 264ft
Volume: 2692.8ft^3

Cost and Staffing

- Design Cost

Classification	Hours	Pay Rate \$/hr	Cost \$
S.ENG	90	90	8,100
ENG	200	60	12,000
LAB.T	70	35	2,450
A.A	15	30	450
		Total	23,000

- Material Cost

- 160 ft HDPE pipe 18" Diameter = \$4,800
- Pipe connections = \$80
- 190 cubic yards fill = \$1520
- 2357 lb concrete cast = \$2,236

Total Design Cost = \$31,600

Broader Impacts

- No more property damages
- Satisfied homeowner
- Good experience for entry level engineers
- Economics
- Safer environment

Acknowledgements

➤ Instructors at NAU

- *Bridget N. Bero, Ph.D., P.E., Professor*
- *Charles Schlinger, Ph.D., P.E, Assoc. professor*
- *Mark Lamer, PE, MEng, Lecturer*
- *Gerjen “Gary” Slim E.I.T (Lab Manager at Northern Arizona University)*
- *Chun-Hsing (Jun) Ho, PhD, PE*
- *Thomas Nelson*

➤ City of Flagstaff

- *Jim Janecek, P.E, C.F.M. (City of Flagstaff)*
- *Rita Severson (Administrative Specialist)*

References

- [1] Spinar, R. (2001, Apr 19). *City of Flagstaff Stormwater Management Design Manual*. Retrieved Nov 06, 2014, from <http://www.flagstaffstormwater.com/DocumentCenter/Home/View/16>
- [2] adopts, T. S. (2013, April 1). *Master Rules and Policies* . Retrieved nov 5, 2014, from www.thesummitatpthoa.com:
http://www.thesummitatpthoa.com/uploads/SUM_Master_Rules_and_Policies_adopted_040113.pdf
- [3] Committee, T. P. (2013, May 15). *Residential Development Standards*. Retrieved Nov 02, 2014, from www.ponderosatrailshoa.com:
http://www.ponderosatrailshoa.com/uploaded_files/224/files/RDS%20Final%202005-15-13%20rev%202005_28_13_2.pdf
- [4] HOA, T. S. (2013, April 1). *Master Rules and Policies*. Retrieved Oct 7, 2014, from [thesummitatpthoa.com](http://www.thesummitatpthoa.com):
http://www.thesummitatpthoa.com/uploads/SUM_Master_Rules_and_Policies_adopted_040113.pdf

Questions?
