Residential Drop-Off Center (RDC) at Cinder Lake Landfill

PINES ENGINEERING INC.

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Problem Statement

To create a Residential Drop-Off Center to increase the safety of the residential customers at Cinder Lake Landfill.

Source: http://coastalenviron.blogspot.com/

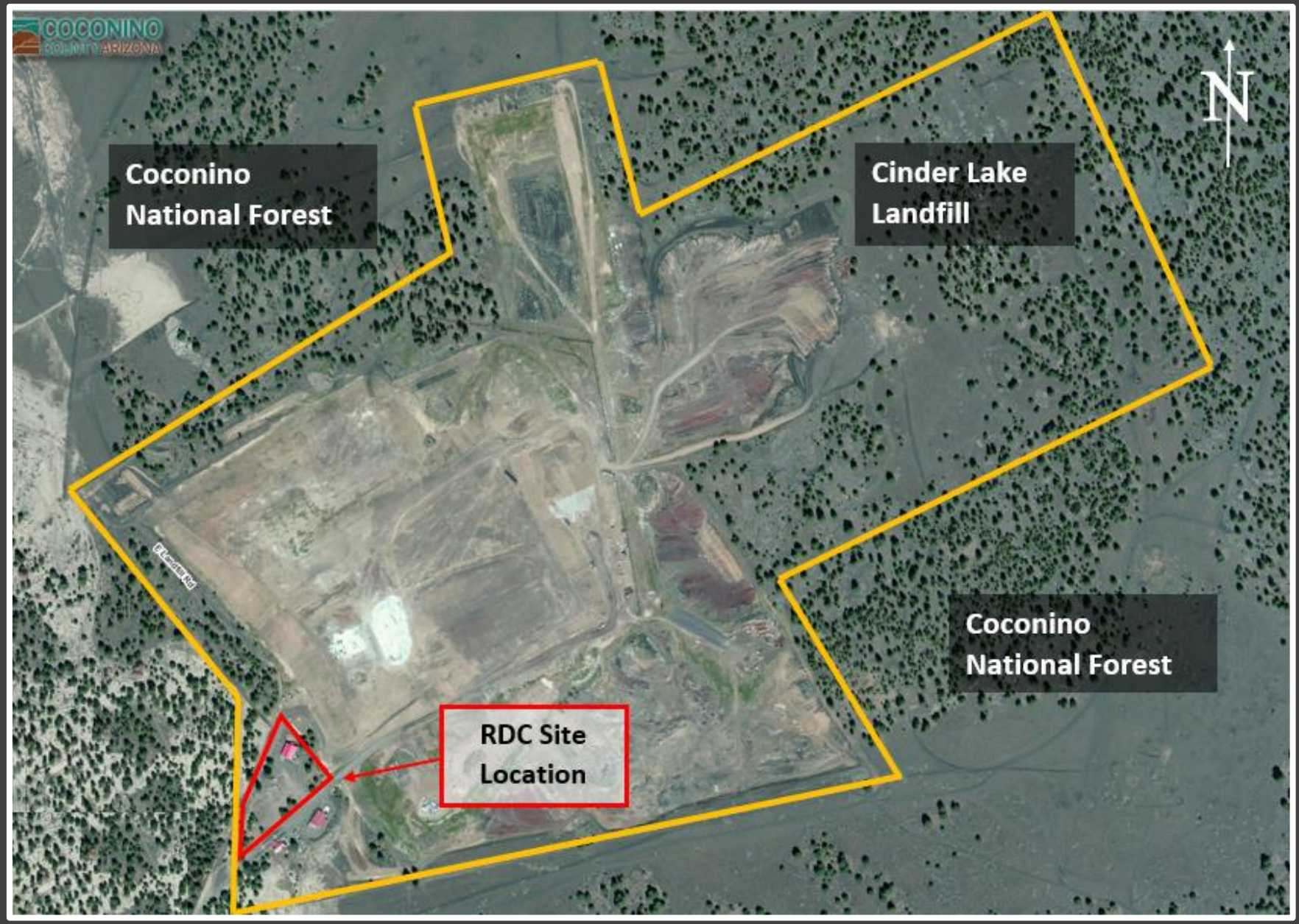
Background

Cinder Lake Landfill serves ~90,000 Flagstaff and Coconino County residents daily.

Existing conditions to consider:

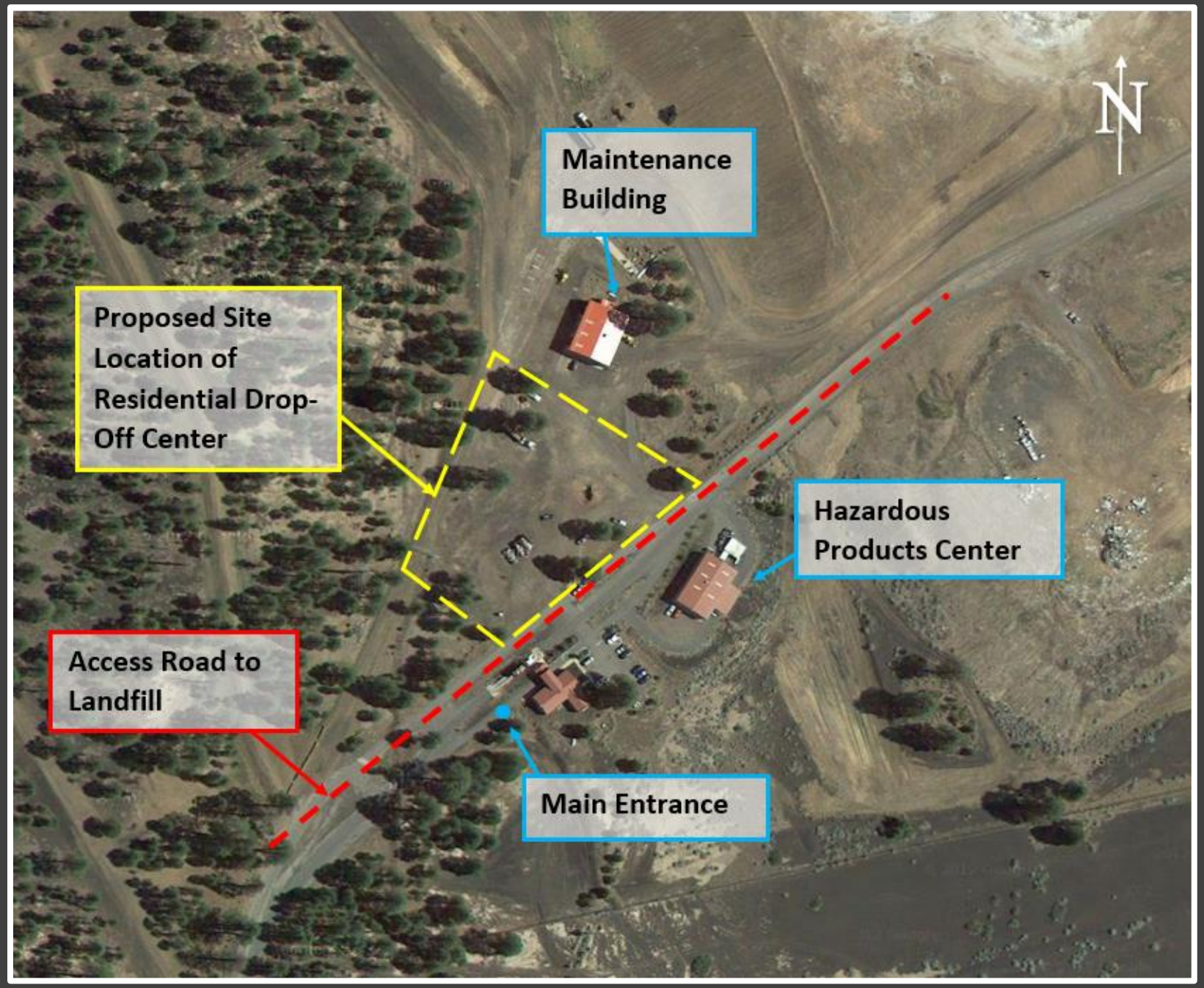
- Hydrology/Hydraulics
- Existing Vegetation
- Public Entrance
- Service Buildings

Courtesy of Google Earth: @35.2404012,-111.5601341



Courtesy of Google Earth: @35.3097782,-111.517371

Proposed Site Location



Courtesy of Google Earth: @35.3056001,111.5209081

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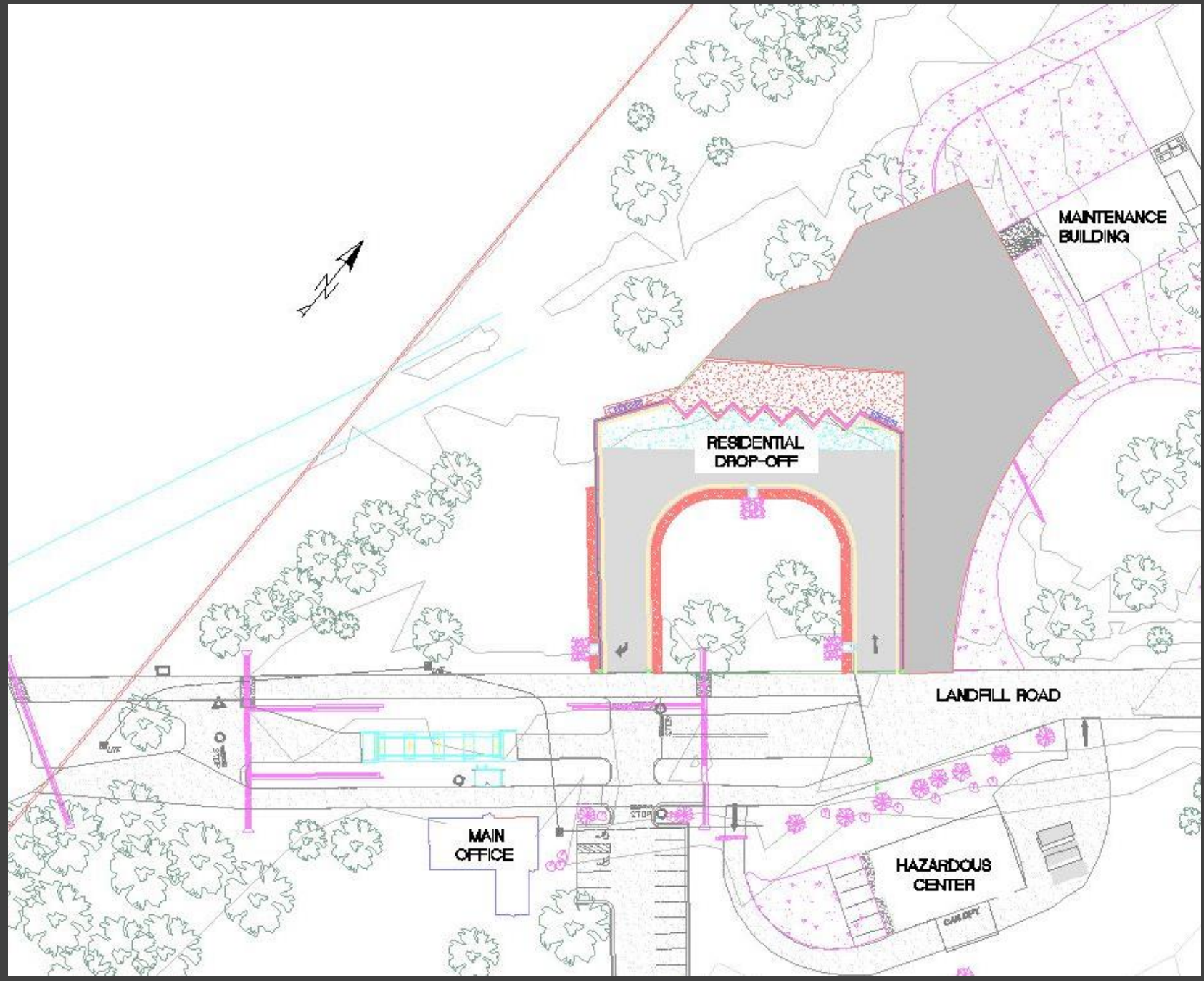
Proposed RDC

Drop-Off bins:

- MSW
- Recycling
- Green Waste



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Retaining Wall

PROPERTIES:

F’c (stem and footing) = 4000 psi

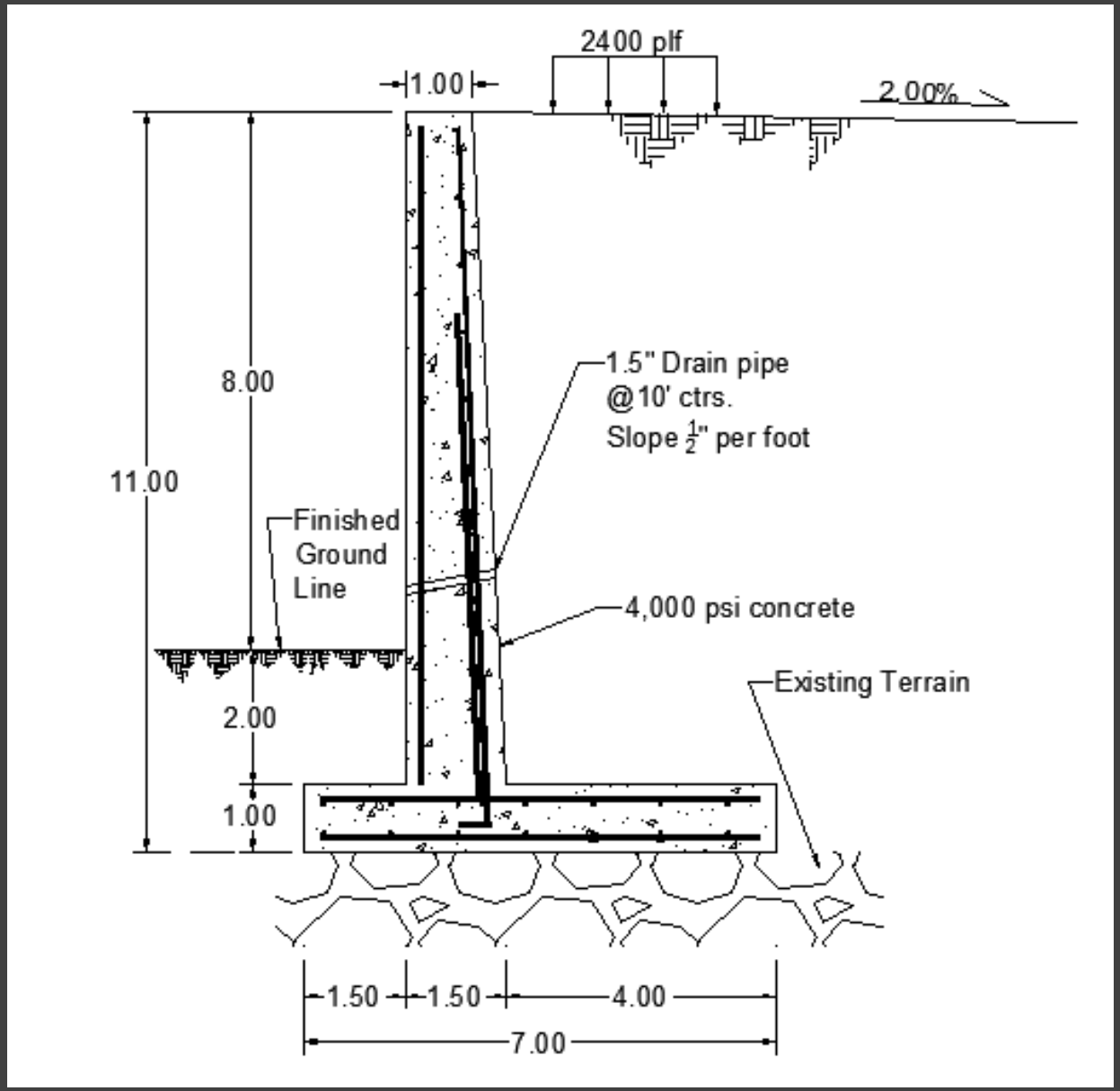
Friction Coefficient = 0.4

Dry Density = 103 pcf

Active Surcharge = 1800 plf

ASSUMPTIONS:

- Neglect Passive Surcharge



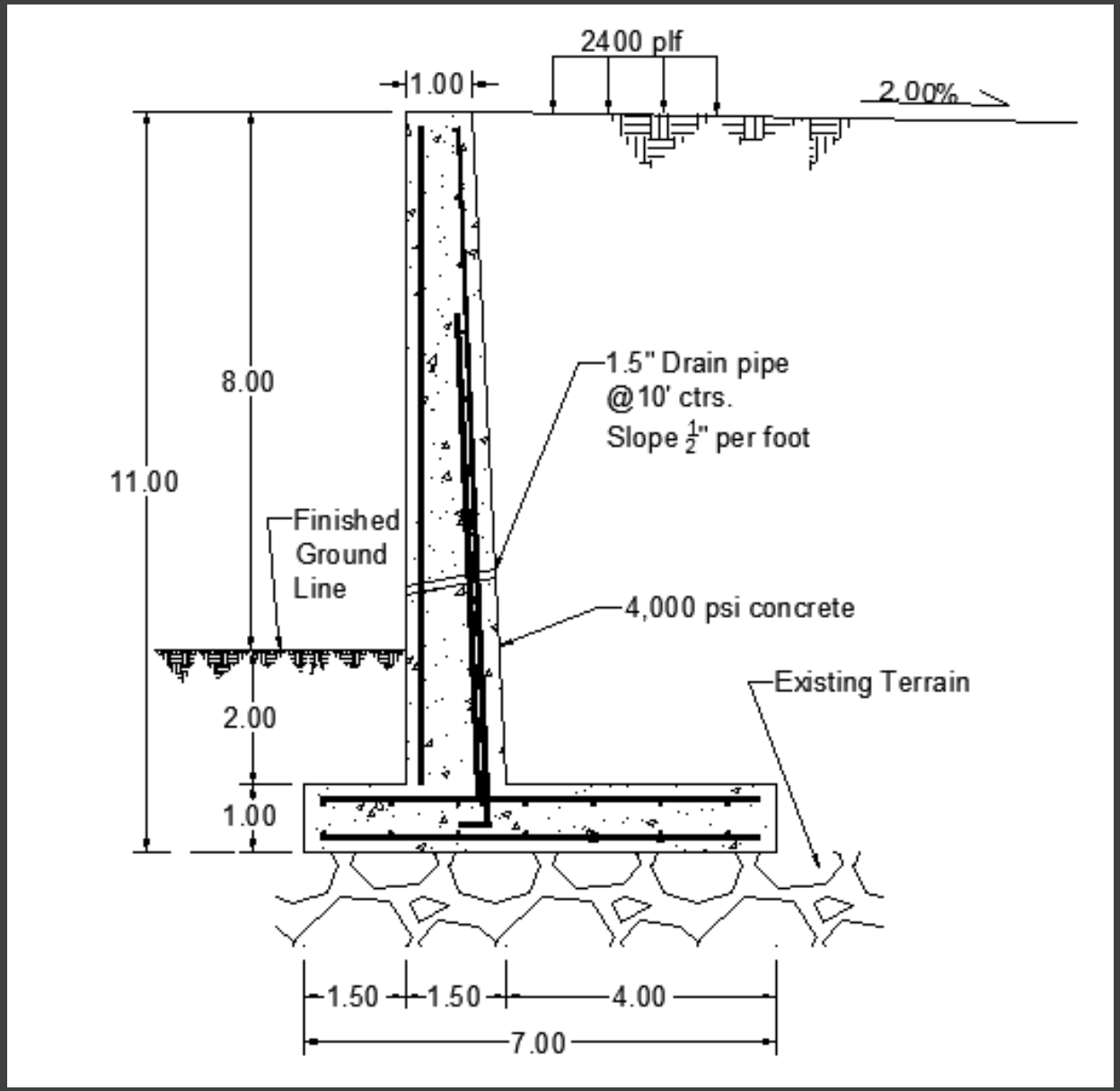
Retaining Wall

STABILITY CHECK:

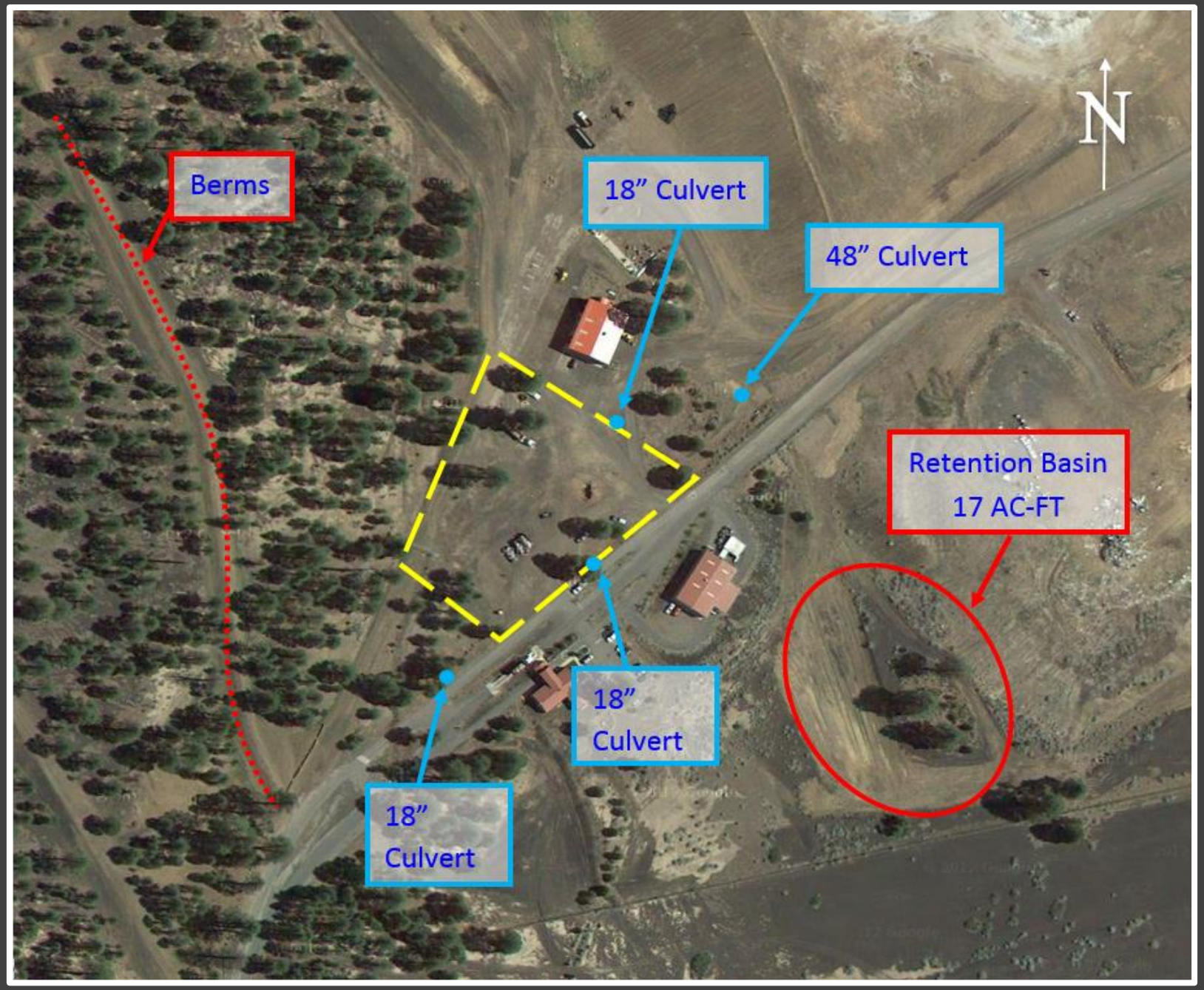
- Overturning Safety Factor…..3.50>1.50 ok!
- Sliding Safety Factor……2.21>1.50 ok!

SHEAR FORCE RATIO (Vu/ΦVc):

Stem:	0.23	ok!
Toe:	0.26	ok!
Heel:	0.79	ok!



Predevelopment Hydrology/ Hydraulics



Courtesy of Google Earth: @35.3056001,111.5209081

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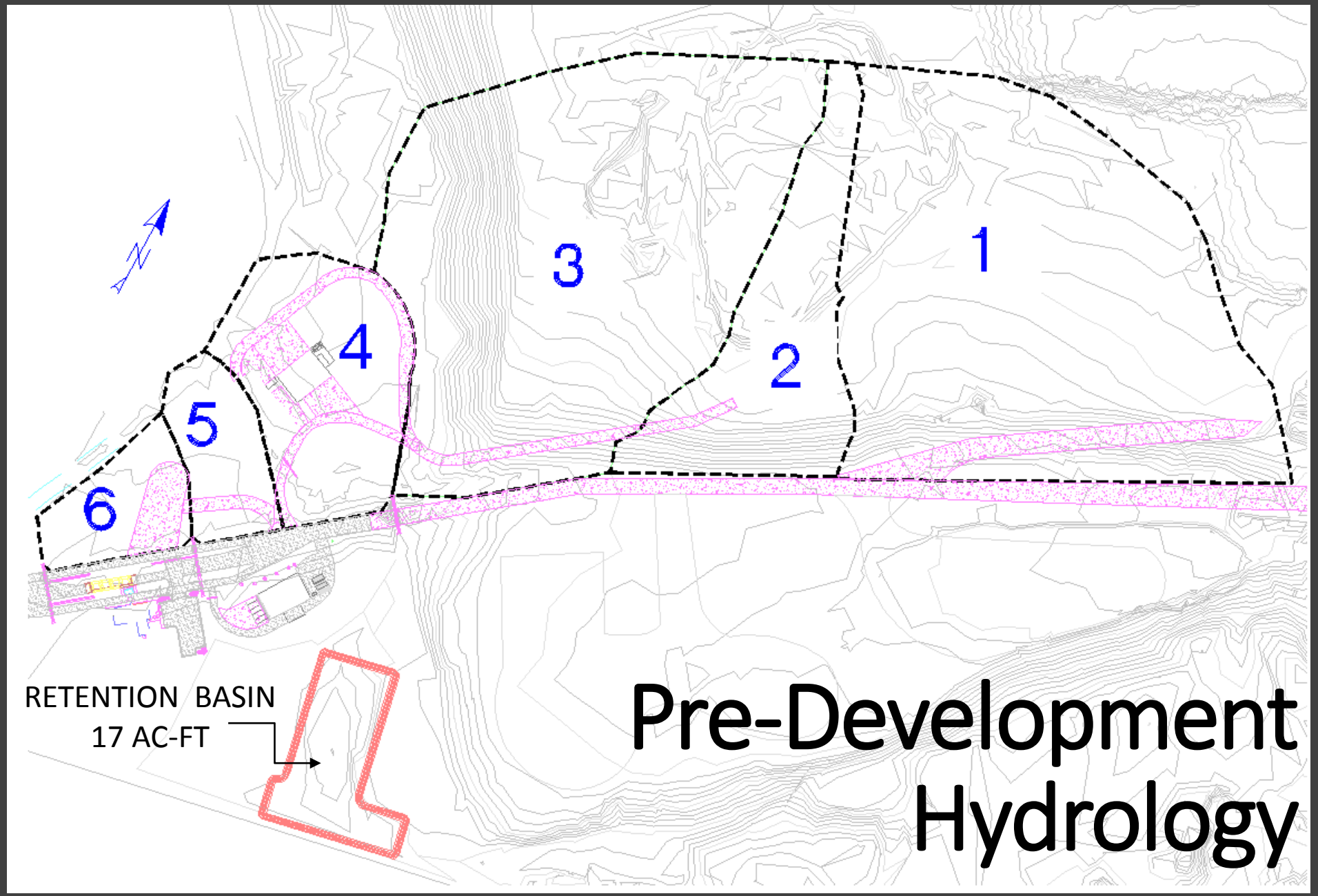


Pre-Development Hydrology

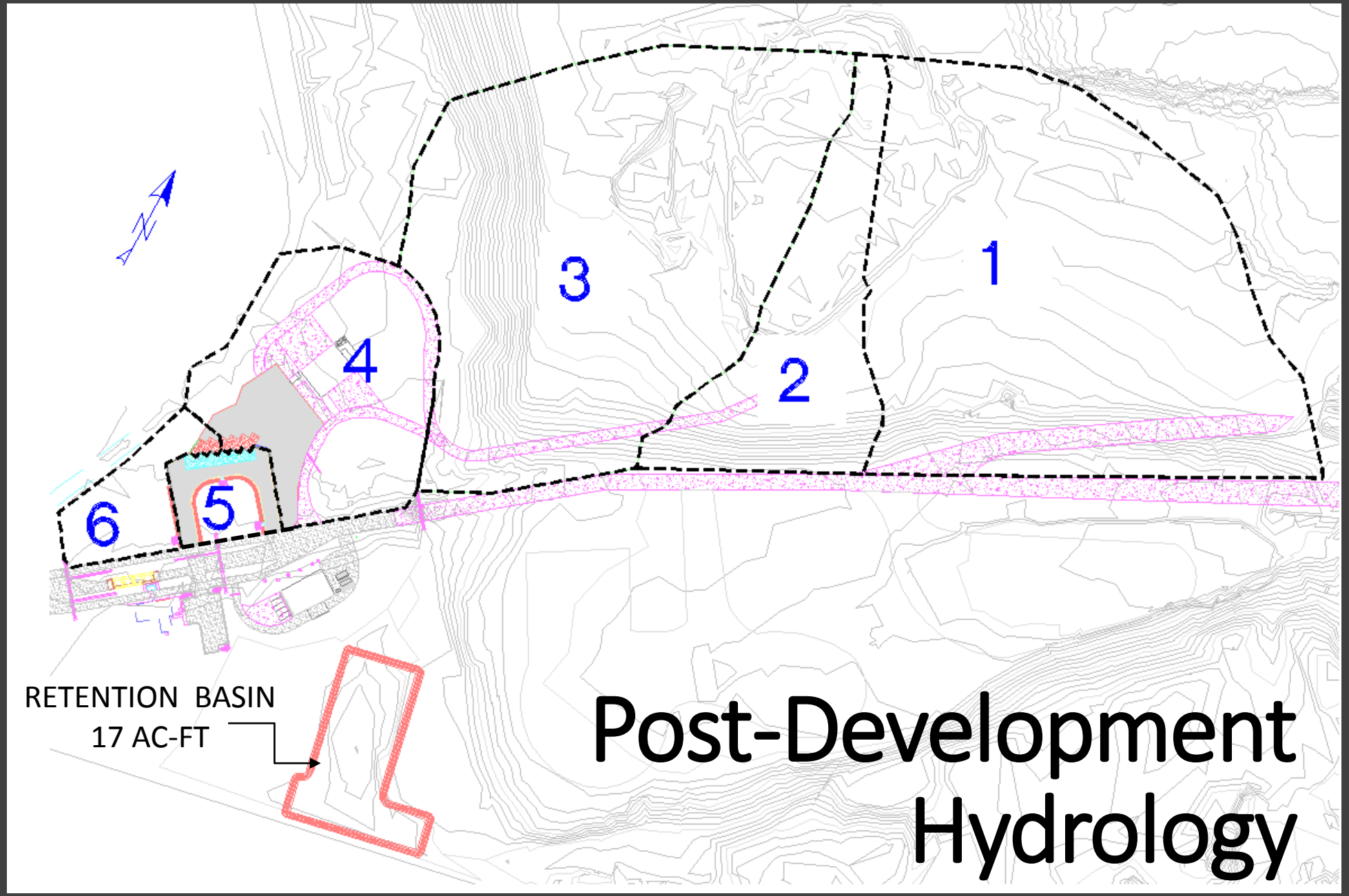
Pre-Development Data

Pre-Development	
Year event	Q (cfs)
2	8.65
5	14.24
10	25.19
25	11.72
50	19.71

Rational Method
Q=CiA*(Cf)

Cf: For less frequent, high intensity event

100 year event					
Sub-basin	Cf	C	i (in/hr.)	A (Acres)	Q (cfs)
1	1.25	0.21	3.96	9.46	9.83
2	1.25	0.21	3.96	3.06	3.18
3	1.25	0.21	3.96	9.92	10.31
4	1.25	0.33	3.96	2.77	4.56
5	1.25	0.23	3.96	1.04	1.20
6	1.25	0.26	3.96	1.01	1.30
				∑=	**30.38**



Post-Development Hydrology

Post-Development Data

Post-Development	
Year event	Q (cfs)
2	9.12
5	15.01
10	26.55
25	12.36
50	20.78

Rational Method

Q=CiA*(Cf)

Cf: For less frequent, high intensity event

100 year event					
Sub-basin	Cf	C	i (in/hr.)	A (Acres)	Q (cfs)
1	1.25	0.21	3.96	9.46	9.83
2	1.25	0.21	3.96	3.06	3.18
3	1.25	0.21	3.96	9.92	10.31
4	1.25	0.35	3.96	3.39	5.87
5	1.25	0.66	3.96	0.62	2.03
6	1.25	0.2	3.96	0.82	0.81
				∑=	**32.03**

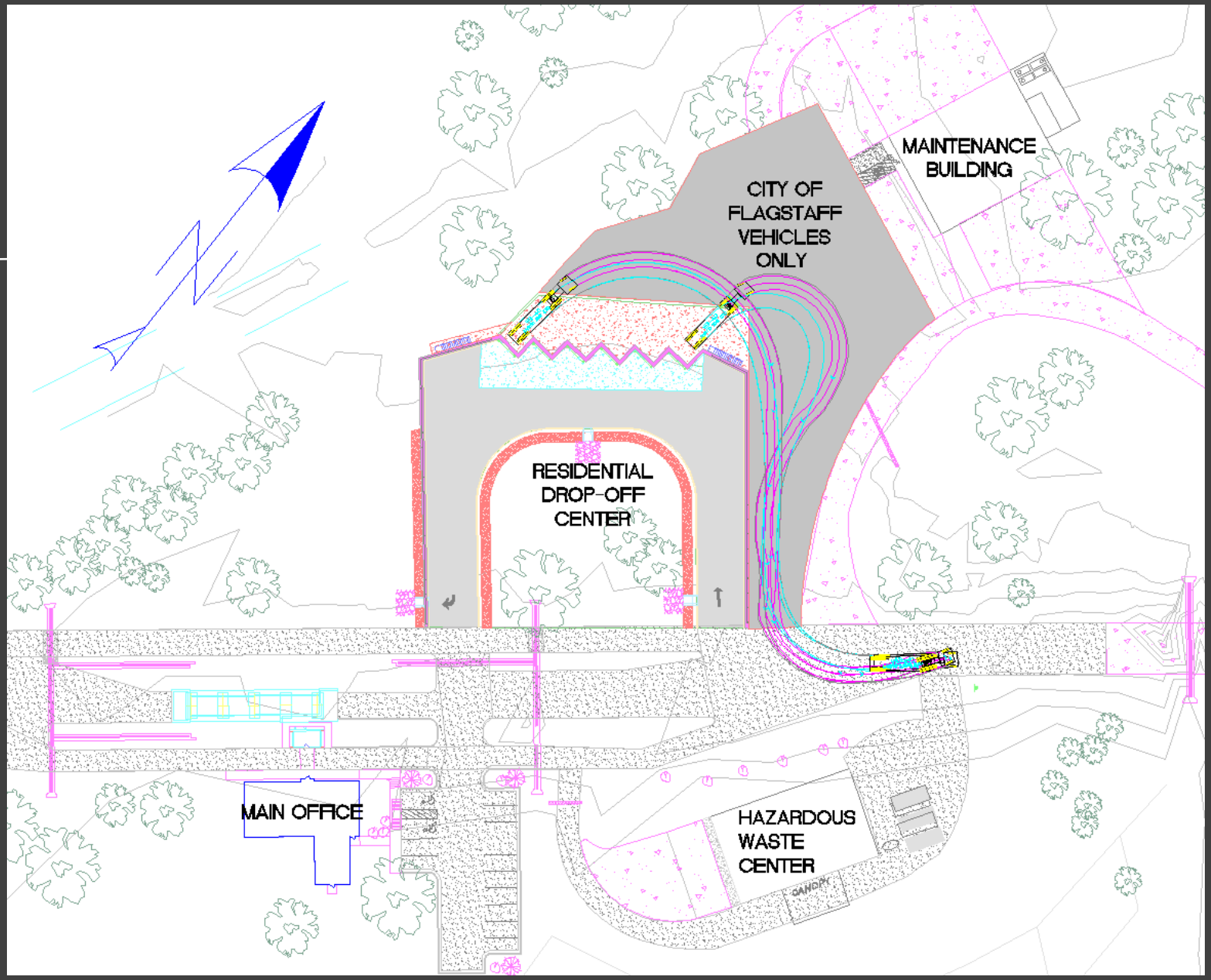
Operations

Entrance on east side of RDC

Waste is dropped off on concrete pad

Waste pushed into bin by Skid Steer Loader--Daily

Hauling of bins to working face approximately once every 2 days



Costs

Design Costs: $ 53,352

- Total Hours: 468 hours

Construction Costs: $465,616

Budget: $1,000,000

Task	Hours	Billable Rate	Total Cost
Meetings	68	$114.00	$7,752.00
Survey	14	$114.00	$1,596.00
Traffic Count	4.5	$114.00	$513.00
Hydrology/Hydraulics	37.5	$114.00	$4,275.00
Retention Wall	47.5	$114.00	$5,415.00
Layout Design	86.5	$114.00	$9,861.00
Construction Plans	40	$114.00	$4,560.00
Cost Analysis	4.5	$114.00	$513.00
Reports/presentations	101	$114.00	$11,514.00
Other	64.5	$114.00	$7,353.00
TOTAL	**468**		**$53,352.00**

Construction Cost Breakdown

Project	Total per Unit		QTY	TOTAL
Cut/Fill	$1.91	CY	23422	$12,178
Asphalt Pavement	$2.45	SF	31510	$77,294
Concrete Pavement	$1,969.00	CY	150	$12,337
Retaining Wall	$267.00	LF	402	$214,668
Waste Collection	$5,000.00	EA	6	$30,000
Barrier	$200.00	EA	12	$2,400
Railing	$58.50	LF	402	$23,517
Pavement Marking	$30.00	EA	3	$90
Signage	$78.00	EA	5	$390
Water protection	$1.29	SF	960	$1,239
Regulatory Rqmts.	$2,000.00	TOT	1	$2,000
Chains	$6.50	EA	8	$52
Rip Rap	$30.50	TON	100	$3,050
Bollards	$200.00	EA	14	$2,800
Mechanical Ledge	$1,000.00	EA	6	$6,000
Contingency			20%	$77,603
			TOTAL	**$465,616**

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Benefit Cost Analysis

EXISTING OPERATIONS

40% of operations dedicated to burying residential waste

Operation Costs: +$5.8 Million

B/C Ratio: 0.43

PROPOSED OPERATIONS

10% of operations dedicated to burying residential waste

Decreased buried recyclables by 10%

Operation Costs: +$150,000

B/C Ratio: 1.43

Impacts

Environmental

- Increases recycling

Social

- Increases safety
- Promotes use of a RDC
- Connects individuals to their impact

Economical

- Increases lifespan of landfill
- Decreases operation time

Source: http://kpcw.org/post/more-recycling-results-more-space-saved-three-mile-landfill

Acknowledgements

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Questions?