

TWO-WAY STOP CONTROL SUMMARY

Analyst: CL
 Agency/Co.: 10/13/2008
 Date Performed: 10/13/2008
 Analysis Time Period: AM Peak
 Intersection:
 Jurisdiction:
 Units: U. S. Customary Year 2018 w/out project
 Analysis Year: Year 2018 w/out project
 Project ID:
 East/West Street: Kuhio Hwy
 North/South Street: Anini Vista Rd
 Intersection Orientation: EW Study period (hrs): 1.00

Major Street: Approach Movement	Vehicle Volumes and Adjustments					
	Eastbound		Westbound			
	L	T	R	L	T	R
Volume	2	346		580	9	
Peak-Hour Factor, PHF	0.85	0.85		0.87	0.87	
Hourly Flow Rate, HFR	2	407		666	10	
Percent Heavy Vehicles	2	--	--	--	--	--
Median Type/Storage	Undivided /					
RT Channelized?						
Lanes	0	1		1	0	
Configuration	LT TR					
Upstream Signal?	No					

Minor Street: Approach Movement	Vehicle Volumes and Adjustments					
	Northbound		Southbound			
	L	T	R	L	T	R
Volume	7	8	9	10	11	12
Peak Hour Factor, PHF				0.75	0.75	
Hourly Flow Rate, HFR				4	0	
Percent Heavy Vehicles				2	2	
Percent Grade (%)				0	0	
Flared Approach: Exists?/Storage	/ 0 No /					
Lanes				0	0	
Configuration	LR					

Approach Movement	Delay, Queue Length, and Level of Service					
	Northbound		Southbound			
	L	T	R	L	T	R
Approach Movement	1	4	7	8	9	10
Lane Config	LT					LR
v (vph)	2					4
C(m) (vph)	915					539
v/c	0.00					0.01
95% queue length	0.01					0.02
Control Delay	8.9					11.7
LOS	A					B
Approach Delay						11.7
Approach LOS						B

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Major Street: Approach Movement	Vehicle Volumes and Adjustments					
	Eastbound		Westbound			
	L	T	R	L	T	R
Volume	1	731		484	4	
Peak-Hour Factor, PHF	0.87	0.87		0.82	0.82	
Hourly Flow Rate, HFR	1	840		590	4	
Percent Heavy Vehicles	2	--	--	--	--	--
Median Type/Storage	Undivided /					
RT Channelized?						
Lanes	0	1		1	0	
Configuration	LT TR					
Upstream Signal?	No					

Minor Street: Approach Movement	Vehicle Volumes and Adjustments					
	Northbound		Southbound			
	L	T	R	L	T	R
Volume	7	8	9	10	11	12
Peak Hour Factor, PHF				0.42	0.42	
Hourly Flow Rate, HFR				16	7	
Percent Heavy Vehicles				2	2	
Percent Grade (%)				0	0	
Flared Approach: Exists?/Storage	/ 0 No /					
Lanes				0	0	
Configuration	LR					

Approach Movement	Delay, Queue Length, and Level of Service					
	Northbound		Southbound			
	L	T	R	L	T	R
Approach Movement	1	4	7	8	9	10
Lane Config	LT					LR
v (vph)	1					23
C(m) (vph)	982					473
v/c	0.00					0.05
95% queue length	0.00					0.15
Control Delay	8.7					13.0
LOS	A					B
Approach Delay						13.0
Approach LOS						B

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 Project ID:
 East/West Street: Kuhio Hwy
 North/South Street: Ka Haku Rd
 Intersection Orientation: EW
 Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach Movement	Eastbound			Westbound		
	L	T	R	L	T	R
Volume	53	182		280	226	
Peak-Hour Factor, PHF	0.82	0.82		0.85	0.85	
Hourly Flow Rate, HFR	64	221		329	265	
Percent Heavy Vehicles	2	--	--	--	--	--
Median Type/Storage	Undivided /					
RT Channelized?						
Lanes	1	1		1	1	No
Configuration	L	T		T	R	
Upstream Signal?	No					

Minor Street: Approach Movement	Northbound			Southbound		
	L	T	R	L	T	R
Volume	7	8	9	10	11	12
Peak Hour Factor, PHF				0.84		0.84
Hourly Flow Rate, HFR				244		71
Percent Heavy Vehicles				2		2
Percent Grade (%)				0		0
Flared Approach: Exists?/Storage				/		Yes /2
Lanes				0		0
Configuration				LR		LR

Delay, Queue Length, and Level of Service

Approach Movement	Northbound			Southbound		
	L	T	R	L	T	R
v (vph)	64			315		
C(m) (vph)	982			942		
v/c	0.07			0.33		
95% queue length	0.21			1.50		
Control Delay	8.9			11.5		
LOS	A			B		
Approach Delay				11.5		
Approach LOS				B		

APPENDIX E
 CAPACITY ANALYSIS CALCULATIONS
 PROJECTED YEAR 2018 PEAK HOUR TRAFFIC
 ANALYSIS WITH PROJECT

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 Intersection Orientation: EW
 Study period (hrs): 1.00

Major Street: Approach Movement	Vehicle Volumes and Adjustments					
	Eastbound		Westbound			
	L	T	R	L	T	R
Volume	135	373		309	199	
Peak-Hour Factor, PHF	0.93	0.93		0.94	0.94	
Hourly Flow Rate, HFR	145	401		328	211	
Percent Heavy Vehicles	2	--	--	--	--	--
Median Type/Storage	Undivided /					
RT Channelized?						
Lanes	1	1		1	1	No
Configuration	L	T		T	R	
Upstream Signal?	No					

Minor Street: Approach Movement	Vehicle Volumes and Adjustments					
	Northbound		Southbound			
	L	T	R	L	T	R
Volume	7	8	9	10	11	12
Peak Hour Factor, PHF	0.94	0.94		0.94	0.94	
Hourly Flow Rate, HFR	326	91		326	91	
Percent Heavy Vehicles	2	2		2	2	
Percent Grade (%)	0	0		0	0	/2
Flared Approach: Exists?/Storage	/ 0 Yes /2					
Lanes	0	0		0	0	
Configuration	L/R					

Approach Movement	Delay, Queue Length, and Level of Service					
	Northbound		Southbound			
	L	T	R	L	T	R
EB	1	4	7	8	9	10
WB	4	7	8	9	10	11
Lane Config	L	L	L	L	L	L
v (vph)	145					417
C(m) (vph)	1029					606
v/c	0.14					0.69
95% queue length	0.49					6.21
Control Delay	9.1					23.8
LOS	A					C
Approach Delay						23.8
Approach LOS						C

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 Units: U. S. Customary
 Analysis Year: Year 2018 w/ project
 Project ID:
 East/West Street: Kuhio Hwy
 North/South Street: Kapaka St
 Intersection Orientation: EW
 Study period (hrs): 1.00

Major Street: Approach Movement	Vehicle Volumes and Adjustments					
	Eastbound		Westbound			
	L	T	R	L	T	R
Volume	3	357	27	26	474	8
Peak-Hour Factor, PHF	0.83	0.83	0.83	0.80	0.80	0.80
Hourly Flow Rate, HFR	3	430	32	32	592	9
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type/Storage	Undivided /					
RT Channelized?						
Lanes	0	1	0	0	1	0
Configuration	L	T		L	T	
Upstream Signal?	No					

Minor Street: Approach Movement	Vehicle Volumes and Adjustments					
	Northbound		Southbound			
	L	T	R	L	T	R
Volume	7	8	9	10	11	12
Peak Hour Factor, PHF	0.64	0.64	0.64	0.63	0.63	0.63
Hourly Flow Rate, HFR	23	0	32	9	1	4
Percent Heavy Vehicles	2	2	2	2	2	2
Percent Grade (%)	0	0		0	0	
Flared Approach: Exists?/Storage	0 1 0 0 / 0 1 0					
Lanes	0	1	0	0	1	0
Configuration	L/R					

Approach Movement	Delay, Queue Length, and Level of Service					
	Northbound		Southbound			
	L	T	R	L	T	R
EB	1	4	7	8	9	10
WB	4	7	8	9	10	11
Lane Config	L	L	L	L	L	L
v (vph)	3	32		55		14
C(m) (vph)	976	1099		631		469
v/c	0.00	0.03		0.09		0.03
95% queue length	0.01	0.09		0.29		0.09
Control Delay	8.7	8.4		11.2		12.9
LOS	A	A		B		B
Approach Delay				11.2		12.9
Approach LOS				B		B

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 Jurisdiction:
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 Analysis Year: Year 2018 w/ project
 Project ID:
 East/West Street: Kuhio Hwy
 North/South Street: Kapaka St
 Intersection Orientation: EW Study period (hrs): 1.00

Major Street: Approach Movement	Vehicle Volumes and Adjustments					
	Eastbound		Westbound			
	L	T	R	L	T	R
Volume	7	647	16	11	489	8
Peak-Hour Factor, PHF	0.94	0.94	0.94	0.90	0.90	0.90
Hourly Flow Rate, HFR	7	688	17	12	543	8
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type/Storage	Undivided /					
RT Channelized?						
Lanes	0	1	0	0	1	0
Configuration	LTR		LTR		No	
Upstream Signal?	No					

Minor Street: Approach Movement	Vehicle Volumes and Adjustments					
	Northbound		Southbound			
	L	T	R	L	T	R
Volume	17	0	25	12	0	12
Peak Hour Factor, PHF	0.70	0.70	0.70	0.43	0.43	0.43
Hourly Flow Rate, HFR	24	0	35	27	0	27
Percent Heavy Vehicles	2	2	2	2	2	2
Percent Grade (%)	0	0	0	0	0	0
Flared Approach: Exists?/Storage	0	1	0	No	/	No
Lanes	0	1	0	0	1	0
Configuration	LTR		LTR		LTR	

Approach Movement	Delay, Queue Length, and Level of Service					
	Northbound		Southbound			
	L	T	R	L	T	R
EB	1	4	7	10	11	12
WB	1	4	7	10	11	12
Lane Config	L	L	L	L	L	L
v (vph)	7	12	59	54	54	54
C(m) (vph)	1019	893	515	482	482	482
V/C	0.01	0.01	0.11	0.11	0.11	0.11
95% queue length	0.02	0.04	0.39	0.38	0.38	0.38
Control Delay	8.6	9.1	12.9	13.4	13.4	13.4
LOS	A	A	B	B	B	B
Approach Delay	12.9					
Approach LOS	B					

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 Project ID:
 East/West Street: Kuhio Hwy
 North/South Street: GC Dwy
 Intersection Orientation: EW Study period (hrs): 1.00

Major Street: Approach Movement	Vehicle Volumes and Adjustments					
	Eastbound		Westbound			
	L	T	R	L	T	R
Volume	36	336	3	2	513	47
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.84	0.84	0.84
Hourly Flow Rate, HFR	39	365	3	2	610	55
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type/Storage	Undivided /					
RT Channelized?						
Lanes	1	1	0	1	1	0
Configuration	LTR		LTR		L	
Upstream Signal?	No					

Minor Street: Approach Movement	Vehicle Volumes and Adjustments					
	Northbound		Southbound			
	L	T	R	L	T	R
Volume	2	0	3	34	1	22
Peak Hour Factor, PHF	0.42	0.42	0.42	0.58	0.58	0.58
Hourly Flow Rate, HFR	4	0	7	58	1	37
Percent Heavy Vehicles	2	2	2	2	2	2
Percent Grade (%)	0	0	0	0	0	0
Flared Approach: Exists?/Storage	0	1	0	No	/	Yes /2
Lanes	0	1	0	0	1	0
Configuration	LTR		LTR		LTR	

Approach Movement	Delay, Queue Length, and Level of Service					
	Northbound		Southbound			
	L	T	R	L	T	R
EB	1	4	7	8	9	10
WB	1	4	7	8	9	10
Lane Config	L	L	L	L	L	L
v (vph)	39	2	11	11	11	96
C(m) (vph)	924	1191	675	675	675	675
V/C	0.04	0.00	0.02	0.02	0.02	0.14
95% queue length	0.13	0.01	0.05	0.05	0.05	0.49
Control Delay	9.1	8.0	10.4	10.4	10.4	12.8
LOS	A	A	B	B	B	B
Approach Delay	10.4					
Approach LOS	B					

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 North/South Street: GC Dwy
 Intersection Orientation: EW
 Study period (hrs): 1.00

Major Street: Approach Movement	Vehicle Volumes and Adjustments					
	Eastbound		Westbound			
	L	T	R	L	T	R
Volume	44	646	0	1	436	51
Peak-Hour Factor, PHF	0.96	0.96	0.96	0.86	0.86	0.86
Hourly Flow Rate, HFR	45	672	0	1	506	59
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type/Storage	Undivided /					
RT Channelized?						
Lanes	1	1	0	1	1	0
Configuration	L	TR		L	TR	
Upstream Signal?	No					

Minor Street: Approach Movement	Vehicle Volumes and Adjustments					
	Northbound		Southbound			
	L	T	R	L	T	R
Volume	6	0	2	44	0	47
Peak Hour Factor, PHF	0.75	0.75	0.75	0.84	0.84	0.84
Hourly Flow Rate, HFR	8	0	2	52	0	55
Percent Heavy Vehicles	2	2	2	2	2	2
Percent Grade (%)	0					
Flared Approach: Exists?/Storage	No / Yes /2					
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		

Approach Movement	Delay, Queue Length, and Level of Service					
	Northbound		Southbound			
	L	L	L	L	L	L
v (vph)	45	1	10	107		
C(m) (vph)	1007	919	347	677		
v/c	0.04	0.00	0.03	0.16		
95% queue length	0.14	0.00	0.09	0.56		
Control Delay	8.7	8.9	15.7	13.3		
LOS	A	A	C	B		
Approach Delay	15.7					
Approach LOS	C					

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 Intersection Orientation: EW
 Study period (hrs): 1.00

Major Street: Approach Movement	Vehicle Volumes and Adjustments					
	Eastbound		Westbound			
	L	T	R	L	T	R
Volume	2	374		590	11	
Peak-Hour Factor, PHF	0.85	0.85		0.87	0.87	
Hourly Flow Rate, HFR	2	439		678	12	
Percent Heavy Vehicles	2	--	--	--	--	--
Median Type/Storage	Undivided /					
RT Channelized?						
Lanes	0	1		1	0	
Configuration	L	TR		L	TR	
Upstream Signal?	No					

Minor Street: Approach Movement	Vehicle Volumes and Adjustments					
	Northbound		Southbound			
	L	T	R	L	T	R
Volume	7	8	9	10	11	12
Peak Hour Factor, PHF				8	0.75	1
Hourly Flow Rate, HFR				10	10	1
Percent Heavy Vehicles				2	2	2
Percent Grade (%)	0					
Flared Approach: Exists?/Storage	/ 0 No /					
Lanes				0	0	0
Configuration				L	LR	

Approach Movement	Delay, Queue Length, and Level of Service					
	Northbound		Southbound			
	L	L	L	L	L	L
v (vph)	2	905		11		
C(m) (vph)	905	536		536		
v/c	0.00	0.00		0.02		
95% queue length	0.01	0.01		0.06		
Control Delay	9.0	11.9		11.9		
LOS	A	B		B		
Approach Delay	11.9					
Approach LOS	B					

HCS+: Unsignalized Intersections Release 5.3

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Vehicle Volumes and Adjustments

Major Street: Approach Movement	Eastbound			Westbound		
	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	4	750		508	8	
Peak-Hour Factor, PHF	0.87	0.87		0.82	0.82	
Hourly Flow Rate, HFR	4	862		619	9	
Percent Heavy Vehicles	2	--	--	--	--	--
Median Type/Storage	Undivided /					
RT Channelized?						
Lanes	0	1		1	0	
Configuration	LT					
Upstream Signal?	No					

Minor Street: Approach Movement

Approach Movement	Northbound			Southbound		
	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				10	4	
Peak Hour Factor, PHF				0.42	0.42	
Hourly Flow Rate, HFR				23	9	
Percent Heavy Vehicles				2	2	
Percent Grade (%)				0	0	
Flared Approach: Exists?/Storage				/	No	/
Lanes				0	0	
Configuration				LR		

Delay, Queue Length, and Level of Service

Approach Movement	EB	WB	Northbound			Southbound		
			7	8	9	10	11	12
	LT					LR		
v (vph)	4						32	
C(m) (vph)	954						440	
v/c	0.00						0.07	
95% queue length	0.01						0.24	
Control Delay	8.8						13.8	
LOS	A						B	
Approach Delay							13.8	
Approach LOS							B	

APPENDIX K. INFRASTRUCTURE

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PRINCEVILLE AGRICULTURAL SUBDIVISION

INFRASTRUCTURE STUDY

Hanalei, Kauai, Hawaii

AUGUST 2009

Prepared for:

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925 Bethel Street, Fifth Floor
Honolulu, Hawaii 96813

Prepared by:

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Honolulu, Hawaii 96819-3494

REFERENCES

- APPENDIX A - CONSTRUCTION DRAWINGS FOR LOT 2-A-1, PRINCEVILLE PHASE II
- APPENDIX B - DRAINAGE CALCULATIONS
- APPENDIX C - RETENTION BASIN SIZING FOR INDIVIDUAL HOUSE SITES
- APPENDIX D – ROADWAY DRAINAGE SYSTEM ANALYSIS

LIST OF FIGURES

- 1-1 Princeville Agricultural Subdivision Developed Conditions
- 3-1 Princeville Water System General System Map
- 3-2 Princeville Agricultural Subdivision Water System Map
- 4-1 Typical Septic System Layout
- 5-1 Princeville Agricultural Subdivision Drainage Tributaries

**SECTION 1
INTRODUCTION**

1.1 General

The Princeville Ranch Agricultural Subdivision project consists of a 21 lot subdivision on approximately 1,024 acres of land on the north shore of the island of Kauai (TMK: 5-3-06:014). Of the 21 proposed lots, 17 lots are intended for agricultural purposes, 2 lots include the existing Prince Golf Course and Makai Golf Course, 1 lot is defined for roadway purposes and 1 lot is comprised of land entirely within the Special Management Area (SMA). The subdivision is bounded by the existing Princeville development to the west, Anini Vista Subdivision on the east, Anini and Kalihi Kai Beaches to the north and the Kuhio Highway to the south. The land falls within both the Urban and Agricultural State Land Use Districts and has a mixture of Agricultural and Open county zoning designations.

Much of the land within the proposed 17 agricultural lots is comprised of steep forested gullies, with slopes as high as 50-percent, and plateaus of open pasture land. By conditions and restrictive covenants of the proposed Condominium Property Regime (CPR), the agricultural lots are limited to a cumulative maximum density of 75 farm dwelling (or ranch house) sites, each with an approximate minimum area of ¼ acre. The balance of the land is proposed to remain open and available to the Ranch for grazing of livestock

Related to the subdivision process, the owners are petitioning to re-designate the state land use for an approximate 120 acre portion of the property from Urban to Agriculture. The petition area is just north of the Princeville Airport and is bordered by the Prince Golf Course entry road to the west. The petition area affects 5 proposed agricultural lots and 17 potential farm dwelling sites.

Infrastructure planning and engineering for the on-site improvements required for the subdivision are summarized in this infrastructure study.

1.2 Purpose and Scope

This study provides an analysis and description of each of the proposed roadway, water, sewer and drainage systems for the project. The utility systems described in this study are designed and analyzed at a planning level since detailed plans for the farm dwelling sites and secondary access roadways are not yet developed. Construction plans for the backbone roadway infrastructure are presently being prepared by Esaki Surveying and Mapping, Inc. (Esaki) and much of the engineering calculations are provided by Esaki. The scope of this infrastructure study includes:

- Proposed roadway systems
- Proposed potable water demands.
- Proposed wastewater demands.
- Existing drainage conditions.
- Developed drainage conditions.

1.3 Related Studies

1.3.1 Princeville Ranch Preservation Plan

The plan, prepared by Group70 International, Inc. in August 2008, is designed to preserve the Princeville "Ranch" and its agricultural activities and resources. The plan identifies the parameters for development of the agricultural lands within the Princeville Ranch Agricultural Subdivision.

1.3.2 Traffic Impact Report for the Proposed Princeville Subdivision

The traffic impact report, prepared by Wilson Okamoto Corporation in November 2008, evaluates the traffic impacts resulting from the proposed 21-lot subdivision and recommends the proposed roadway improvements that may be necessary. The report concludes that the subdivision is not expected to have a significant impact on traffic operations in the vicinity.

1.3.3 Princeville Airport Master Plan

The *Princeville Airport Master Plan*, prepared by KFC Airport, Inc. in December 1996, discusses the regional infrastructure demands by the airport which is directly south of the Princeville Subdivision.

1.4 Existing Conditions

1.4.1 Climatology

The study area receives a moderate to high amount of rainfall with the prevailing northeasterly trade winds. The average annual rainfall is about 72-inches per year. Most of the rainfall occurs from October through April, during southerly "Kona" storms.

During the day and early evening hours, the site is relatively cool compared to other locations around Kauai and the state. Daily minimum and maximum temperatures in the project area run in the mid-60's (degrees Fahrenheit) in the winter months and mid-80's in the summer months. Average monthly temperatures at Princeville Ranch have been recorded to fall between 69°F and 77°F.

1.4.2 Topography

The proposed agricultural subdivision is located on the Princeville plateau which sits high above sea level. Numerous gullies and gulches slice up the plateaus due to stream erosion over the past centuries. Elevations within the subdivision vary from a high of 350-feet above mean sea level (MSL) to a low of 8-feet above MSL adjacent to the Anini Road. The land varies in slope from 1 percent to over 65 percent.

1.4.3 Soil Type and Ground Cover

The subdivision area generally contains two dominant soil types as classified by the Natural Resource Conservation Service, NRCS. The soil types include Makapili Series (MeB, MeC, MeD and MeE) and Rough Broken Land (rRR), with Makapili being the predominant type within the plateau areas. The Makapili Series soils are reddish-brown clay soils with a varying permeability and erosion hazard. The MeB soil (Makapili Silty Clay 0 to 8% slopes) on the lower end of the spectrum generally has a moderate to rapid permeability and slight erosion hazard. The severity increases along the Makapili series to where the MeE (Makapili Silty Clay 25% to 40% slopes) has a low permeability and the erosion hazard is severe. The Rough Broken Land (rRR) soil is intermixed with rock outcrops and weathered rock and makes up most of the

steep cliff and gully areas. Runoff is rapid and erosion is prevalent. Ground cover conditions within the subdivision's undeveloped areas are heavy forested area and brush and pasture grass.

1.5 Developed Conditions

Aside from the existing golf course, the proposed ultimate condition consists of a 17-lot agricultural subdivision with an asphalt paved roadway system, complete with underground potable water, drainage and electrical facilities, and not more than 75 farm/ranch dwellings on approximately 1,000 acres of land (See Figure 1-1).

Within the 120 acre petition area, the extent of the development will be minimal. Portions of only 5 subdivision lots and 17 potential ranch dwelling sites are located in the petition area.

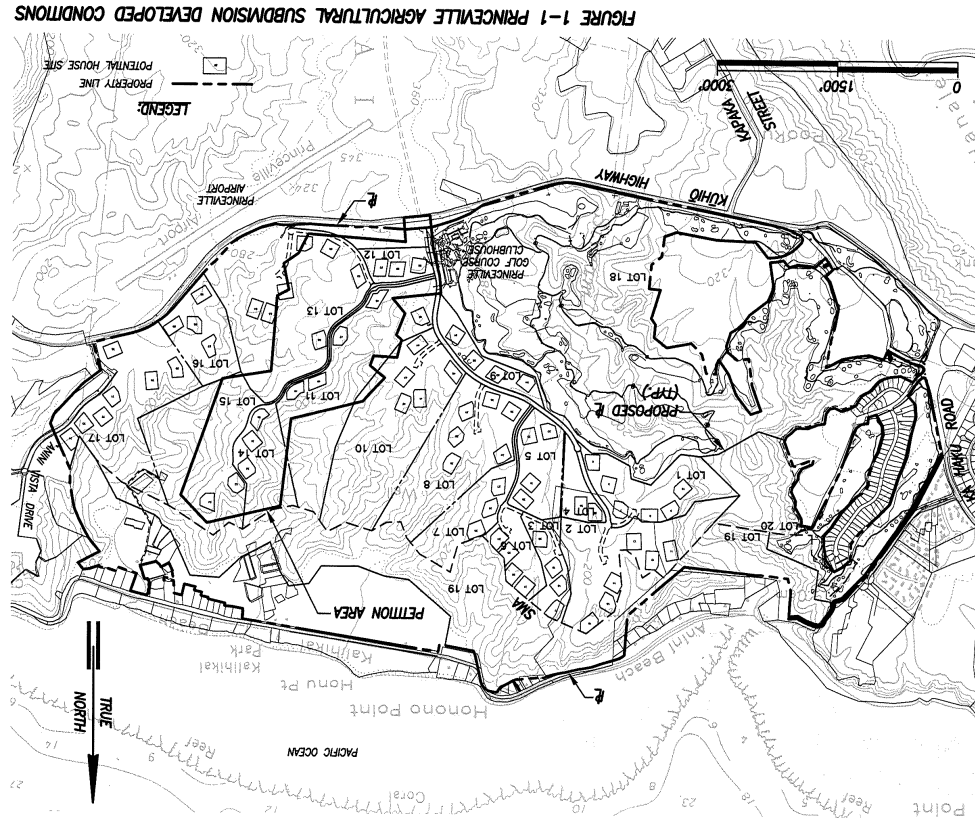


FIGURE 1-1 PRINCEVILLE AGRICULTURAL SUBDIVISION DEVELOPED CONDITIONS

**SECTION 2
ROADWAY SYSTEM**

2.1 Existing Conditions

The project area can be accessed from Kuhio Highway by the existing access road for the Prince Golf Course and Princeville Ranch as well as from Anini Vista Drive. The existing access roads consist of two lane (one lane in each direction) asphalt paved roadways. The intersections of each of these roads at Kuhio Highway are unsignalized. Within the project area, a limited amount of dirt roads are used for access and also to support the present agricultural activities.

2.2 Proposed Conditions

The proposed subdivision creates 17 agricultural lots, a roadway lot and various roadway easements. The plan includes a new private 56 foot wide collector roadway system which provides the "backbone" access roads from Kuhio Highway to 15 of the proposed 17 agricultural lots (including the four agricultural lots that fall within the petition area). Two agricultural lots are proposed to have access to Kuhio Highway via the existing Anini Vista Drive. All of the lots that don't have direct contact with the backbone roadway system will have access via "local" 44 foot wide private roadway easements. It is anticipated that future lot owners will construct private roadways along these easements to provide access to their dwelling sites.

The plan also provides for a maximum of 75 residential dwelling "sites" spread amongst the 17 lots via conditions of a CPR. The proposed number of dwelling sites available within each lot varies between 2 and 7 depending on the size of the subdivided lot and the terrain. It will be a requirement to provide fire protection and emergency vehicle access to each of the dwelling sites. Therefore, sites that are not immediately accessible via the backbone roadway system, or local 44 foot wide roadway easements, are expected to construct individual roadways within the lots. Each of the proposed roadways will have a cul-de-sac or turnaround at its terminus to meet county requirements.

Proposed roadway improvements which are required for subdivision approval are shown in the construction plans, "Construction Drawings for Lot 2-A-1, Princeville Phase II", prepared by Esaki Surveying and Mapping, Inc. (Appendix A). The proposed collector road (Road A) is approximately 3,900 feet in total length, with 900 linear feet falling within the petition area. Collector road cross-sections consist of a 24 foot wide paved, normal crown travelway and 16' wide grassed shoulders/swales on each side of the travelway. In the ultimate developed condition, secondary or local roadways within easement areas could have a total length of over 13,200 linear feet, of which approximately 4,900 linear feet falls within the petition area. Local road cross-sections consist of a 20 foot wide paved, normal crown travelway and 12 foot wide grassed shoulders/swales on each side. Curbs, gutters and sidewalks are excluded from the plan in order to preserve the existing rural character and maximize the amount of vegetated open space.

The project roadways are expected to have a minimal impact to the environment and to the rural character of the area. The roadways within the petition area will have no significant impacts related to the petitioned land use change.

SECTION 3 WATER SYSTEM

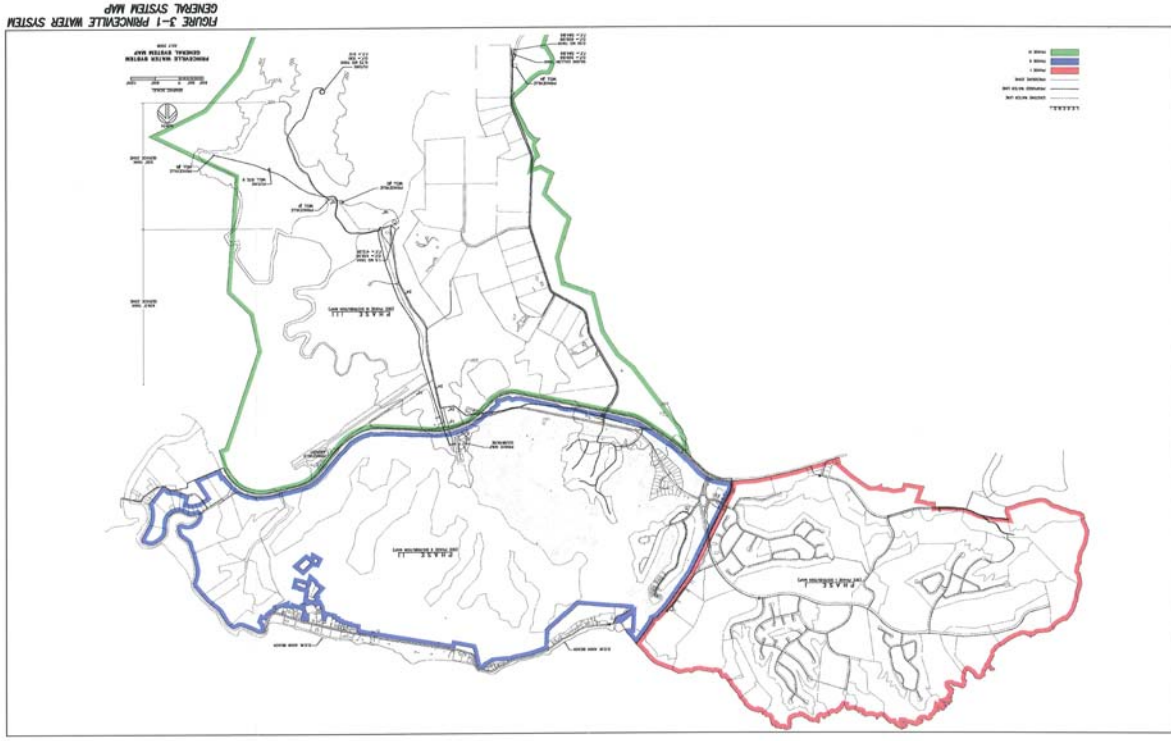
3.1 Existing Infrastructure

Presently, there are no water system improvements within the proposed agricultural subdivision, with the exception of the golf course. Potable water demands for the entire Princeville area, between the Hanalei River and the Kalihiwai River, are served by the Princeville Utilities Company, Inc. (PUCI). PUCI gets its water from three deep groundwater wells which have a total sustainable yield of 1.4 MGD (Million Gallons per Day). Presently, the water demands total 1.1 MGD and PUCI has just completed drilling well no. 5 which is estimated to have a yield of 0.8 MGD.

The groundwater is pumped into three reservoirs for distribution to approximately 1,700 customers of the Princeville Resort and surrounding areas. The primary storage reservoir consists of a 1.5 million gallon reservoir (overflow elevation of 439 feet MSL) constructed in the early 1970's. The reservoir is located approximately 3,600 feet south (mauka) of the Princeville Airport. The two other reservoirs include a 0.5 MG tank and a 0.05 MG tank which are both at 585 feet MSL. See Figures 3-1 and 3-2. PUCI is also planning to construct a 1.2 MG reservoir, which is currently in the design stage.

There is a 24-inch diameter water transmission line located approximately 200 feet southwest of the Princeville Airport's southwestern boundary line which carries water from the 1.5 MG reservoir to Kuhio Highway and then westward along the highway to the Princeville resort areas. Water is then brought to the existing Prince Golf Course clubhouse by a 12-inch branch water transmission line which crosses the highway near the golf course access road and terminates approximately 500 feet into the site. The capacity of the 12-inch line is estimated to be 35,000 gallons per minute with a pressure of 69 psi.

The quality and treatment of the water are under the control of the Princeville Utilities Company, which is regulated by the Hawaii Public Utilities Commission.



3.2 Design Criteria

The proposed water system is designed in conformance with the Department of Water's *Water System Standards, 2002*. Distribution pipes are required to deliver the peak hour flow with a minimum residual pressure of 40 psi, and the maximum daily flow plus fire flow with a minimum residual pressure of 20 psi at the critical fire hydrant. The maximum velocity in water mains, without fire flow, is 6 feet per second. The following design criteria were used:

Land Use	Average Daily Demand
Single Family Residential	500 GPD/Unit
Agricultural	2,500 GPD/acre

Demand Factors

Maximum Daily Demand = (1.5) x Average Daily Demand

Peak Hourly Demand = (3.0) x Average Daily Demand

3.3 Proposed Water Demands

The project includes 17 agricultural lots on approximately 400 acres, with most of the area intended for open grazing of livestock. For planning purposes, it's prudent to use the higher of the two demands listed above, 2,500 gallons per acre, per day, for agricultural uses. With a maximum of 75 (3/4 acre) dwelling sites, the calculated average potable water demand is 140,625 gallons per day (0.141 MGD). The private water system will be able to accommodate this demand.

The calculated potable water demands for the ultimate build-out of the agricultural lots are summarized as follows:

Study Area	Average (MGD)	Max. Day (MGD)	Peak (MGD)
Petition Area (17 dwelling sites)	0.032	0.048	0.096
Non-Petition Area (58 dwellings)	0.109	0.163	0.326
TOTAL	0.141	0.211	0.422

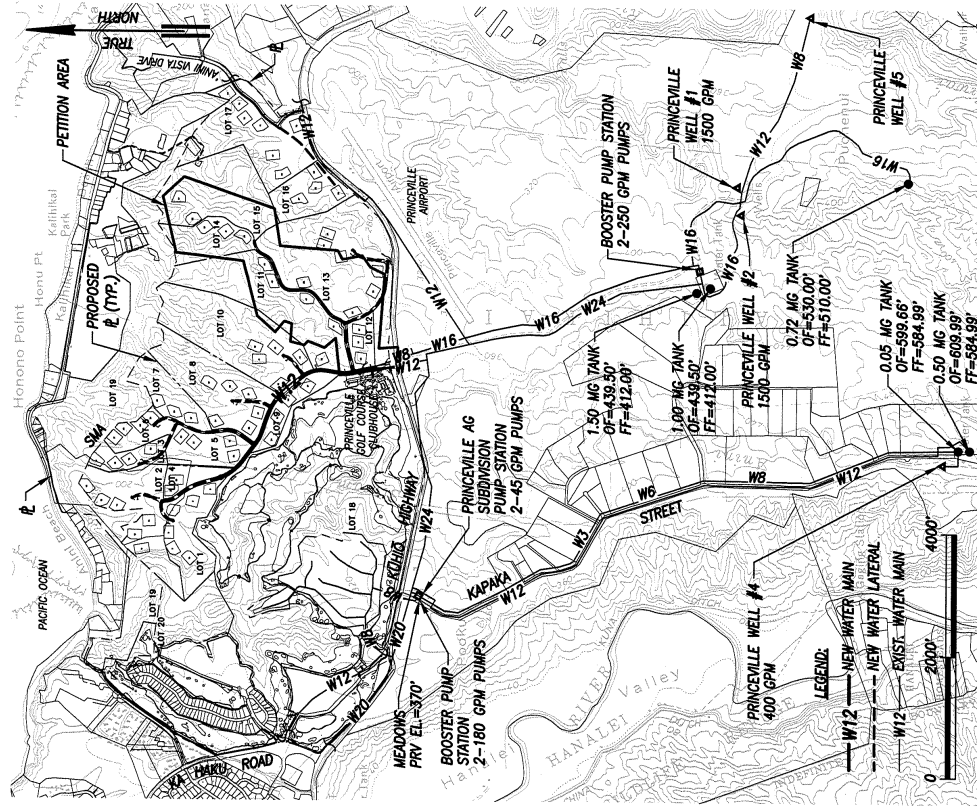


FIGURE 3-2 PRINCEVILLE AGRICULTURAL SUBDIVISION WATER SYSTEM

3.4 Proposed Water System

The proposed onsite (private) water system improvements include a 12-inch ductile iron water main along the collector roads, individual service laterals and water meters to service each subdivided lot. Proposed fire hydrants will be spaced at 500 feet in compliance county codes.

Typical Department of Water pressure (service) zones incorporate a minimum elevation difference of 100-feet between the elevation "head" of the reservoir and the service area. A portion of the proposed agricultural subdivision, including a portion of the petition area, falls above the 330-foot elevation (tank overflow elevation of 439 feet MSL) and must be served by the higher 585-foot system. This includes portions of Lot 9 and Lot 12.

SECTION 4

SEWER SYSTEM

4.1 Existing Infrastructure

There is no gravity sewer system servicing the proposed subdivision. The nearest wastewater treatment facility is located in the Princeville Resort area. The Prince Golf Course clubhouse is serviced by a pump station which pumps the sewage to Princeville's treatment plant. Originally the Club House used a leach field for disposal of the effluent but this system has been phased out and is no longer in use.

4.2 Design Criteria

The criteria for calculating sewage demand follow the design standards of the County of Kauai and the State of Hawaii. No groundwater is expected to be encountered at the depth that the sewer lines (or septic systems) will be installed for the proposed dwelling units. The design criteria are as follows:

SEWER DEMAND RATES¹

Average daily per capita flow = 100 gpd
Single-Family Residential = 4 persons/unit

Maximum Daily Flow = average daily flow x flow factor

Ground Water Infiltration = 1250 gal/acre/day

Design Peak Flow = design maximum flow + ground water infiltration

SEPTIC SYSTEM SIZING²

Up to 4 bedrooms = 1,000 gallon tank

5 bedrooms = 1,250 gallon tank*

Average daily per capita flow = 100 gpd

Occupancy = 2 persons/bedroom

Maximum Flow Rate = 1,000 gallons per day

Maximum no. of septic systems per subdivision = 50 (lots or dwelling units)

SOURCES:

1. *Sewer Design Standards*, Department of Public Works, County of Kauai, June 1973

2. Hawaii Administrative Rules, Title 11, Chapter 62 Wastewater Systems, Department of Health, State of Hawaii

4.3 Proposed Sewer System

4.3.1 County Standards for Wastewater Collection

The calculated sewer demands for the ultimate build-out of the agricultural lots utilizing the County design standards are summarized as follows:

Study Area	Average (MGD)	Max. Day (MGD)	Peak (MGD)
Petition Area (17 dwelling sites)	0.0068	0.034	0.082
Non-Petition Area (58 dwelling sites)	<u>0.0232</u>	<u>0.116</u>	<u>0.311</u>
TOTAL	0.0300	0.150	0.393

The Department of Health (DOH) will require that a development connect to an existing gravity sewer system or nearby wastewater treatment plant if available. However, since there is no gravity sewer system that serves the area, it is intended that each farm lot install an individual wastewater system (septic tank system), for a total of one individual wastewater system (IWS) per lot (17 total) as permitted by Chapter 62 (HAR 11-62). It may be possible that more than one IWS per lot could be constructed if an individual lot owner decides to create a CPR within his lot pursuant to the one acre exception in Chapter 62 (HAR 11-62-31.1).

4.3.2 Septic Tank Systems

Wastewater treatment and disposal is proposed to be done via an IWS for each dwelling, located within each individual lot. The IWS will consist of a septic tank system, which can be approved by the Hawaii State Department of Health, and a leach field or seepage pit for effluent disposal. Proposed dwellings are expected to vary in size and each dwelling site is assumed to utilize a maximum 1,250 gallon IWS (which can accommodate a 5 bedroom dwelling). See Figure 4-1 for a typical septic system layout. Specific percolation tests will be necessary to size each of the leach fields or design the size and depth of each seepage pit. A brief description of each IWS is provided below.

A septic tank system consists of the following:

- A watertight septic tank constructed of fiberglass. These tanks will be underground around 10 to 15 feet from the foundation of the house and typically 18 to 24 inches below the surface.
- Two chambers within the septic tank created by an internal wall with an opening for flow from one chamber to the next. The first chamber, which is under continuous addition of new wastewater is around two-thirds the size of the tank, while the second chamber makes up the remaining one-third of the tank. The second chamber allows re-suspended particles to settle and digestion to occur.
- An inlet and outlet device at either end of the tank. The inlet tee forces incoming wastewater down into the tank to prevent flow of wastewater directly across the top of the wastewater to the outlet, which allows for settling. The outlet tee draws effluent from the settled wastewater between the sludge and scum layers.
- An optional effluent filter may be installed to prevent solids from leaving the tank and entering the leach field.
- Gas-tight, cast iron manhole frames and covers with concrete risers (as needed).
- A leach field (or drain field) which receives the treated wastewater that is delivered from the outlet of the septic tank. The effluent is further treated before being absorbed into the soil. Each leach field will consist of a series of perforated PVC pipes and a subsurface gravel bed to provide further filtration of treated wastewater and facilitate absorption.
- A seepage pit, which may be allowed by the DOH if the terrain is not suitable or too steep for a leach field. Seepage pits could consist of subsurface 6 foot or 8 foot diameter precast concrete rings with a gravel bed to facilitate absorption, similar to the leach field.

**SECTION 5
DRAINAGE SYSTEM**

5.1 Existing Conditions

The project is situated on a sloping plateau with natural topographical elevations that provide positive slopes for storm water runoff to natural gulches. The majority of storm water from the project is surface drained in a northerly and easterly direction and eventually empties into the Pacific Ocean at Kaihi Kai Beach via small stream outlets. According to the Federal Emergency Management Agency's Flood Insurance Rate Map, the boundaries of the subdivision fall outside the defined flood plain boundaries.

The proposed subdivision can be described as affecting four main watersheds. A portion of the agricultural subdivision area and most of the golf course lots falls within the Anini Gulch watershed. The Anini Gulch watershed is approximately 1,300 acres and extends up into the hillside to over 1,000 feet above sea level. The majority of the subdivision falls within the smaller, more localized watersheds shown on Figure 5-1. Some of the tributary area extends above Kuhio Highway, below the Princeville Airport, and runoff from this area is conveyed across Kuhio Highway via underground culverts.

5.2 Design Criteria

The design criteria for the proposed drainage facilities are taken from the County of Kauai's *Storm Water Runoff System Manual*, July 2001. The *Erosion and Sediment Control Guide for Hawaii* is also used as references in determining existing as well as proposed runoff characteristics.

The criteria used in this study are summarized below:

- Hydrographs for Existing and Developed Conditions Peak Flows
 - Rainfall Depths = SCS TP-43
 - Runoff Curve Numbers = NRCS
 - Time of Concentration = NRCS
 - Runoff computation (greater than 100 acres) = TR-55
 - Peak Flow computation (less than 100 acres) = Rational Method (Q=CIA)

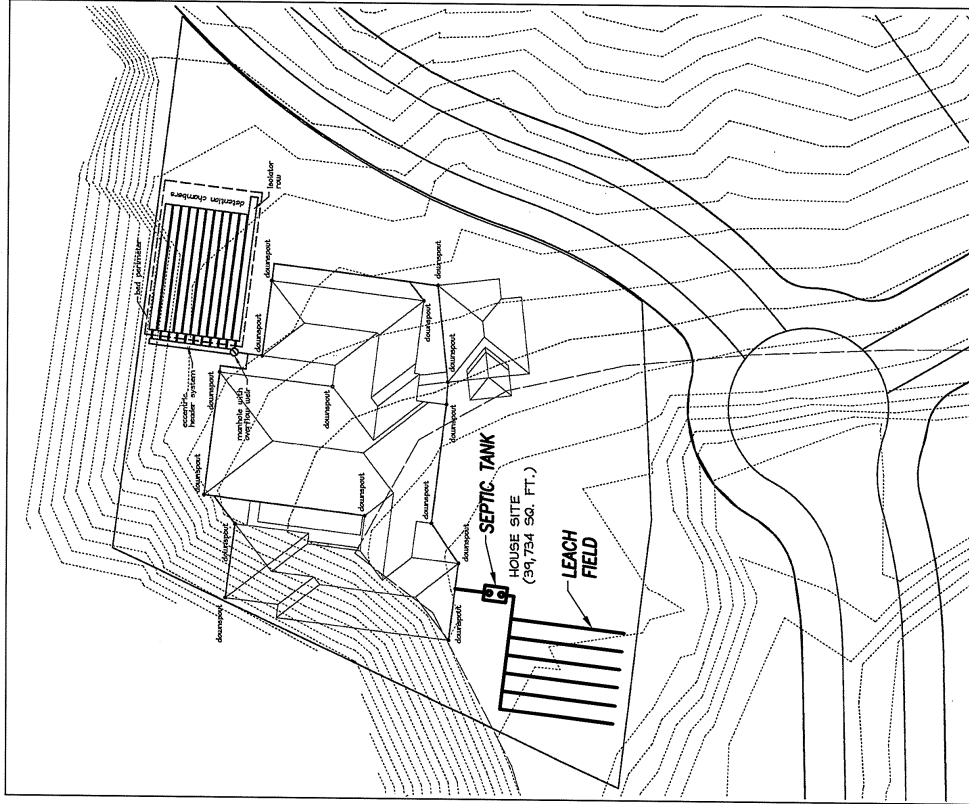


FIGURE 4-1 TYPICAL SEPTIC SYSTEM LAYOUT

- Recurrence Interval

- Areas greater than 100 acres: $T_m = 100$ years
- Areas less than 100 acres: $T_m = 2$ years

5.3 Increases in runoff

Increase in runoff volume is primarily due to the increase in impermeable ground surface from the development of roofs, sidewalks, courtyards and pavements. Analyses were done for the existing and developed conditions, including the proposed roadways and farm dwelling sites (see Appendix B). For the developed condition, the ultimate build-out of secondary roadways and all 75 farm dwelling sites was assumed.

Existing Condition

The calculated existing 100-year, 24-hour runoff volume from the entire agricultural subdivision area (approximately 490 acres) is 587 acre-feet. The calculated 100-year, 24-hour storm peak discharge rate is 3,190 cubic feet per second (cfs). Storm water discharges from the site are conveyed via the natural gullies and drainageways within the site toward the ocean.

Considering the petition area only, the calculated 100-year, 24-hour runoff volume and peak discharge rate is 121 acre-feet and 743 cfs, respectively.

Developed Condition

The calculated developed 100-year, 24-hour runoff volume for the entire agricultural subdivision area is 600 acre-feet. The increase in runoff volume due to the ultimate development is 13 acre-feet. The calculated 100-year, 24-hour storm peak discharge rate is 3,260 cubic feet per second (cfs), which is an increase of 70 cfs.

Considering the ultimate development of the petition area, the calculated 100-year, 24-hour runoff volume and peak discharge rate is 125 acre-feet and 766 cfs, respectively. This is an increase in runoff volume and peak flow of 4 acre-feet and 23 cfs respectively.

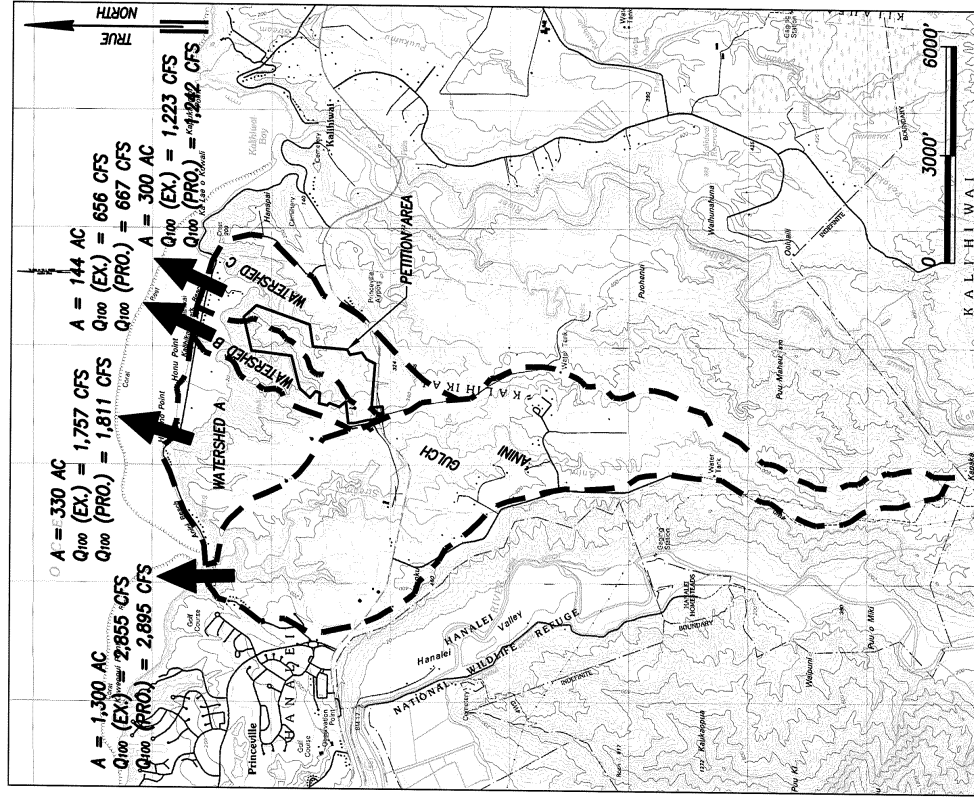


FIGURE 5-1 PRINCEVILLE AGRICULTURAL SUBDIVISION DRAINAGE TRIBUTARIES

The petition area spans two independent watersheds as shown on Figure 5-1. Increases in peak discharge rates are therefore calculated for both tributaries. It was determined that the increase in peak discharge rate due to the ultimate build-out is only 13 cfs for the eastern tributary and 8 cfs for the western tributary. These calculated increases are negligible compared to the 1,240 cfs and 670 cfs peak discharges for the eastern and western tributaries, respectively.

5.4 Proposed Drainage System

5.4.1 Drainage Plan Concept

The intent of the project is to maintain the existing runoff from the subdivision lands upon development in accordance with the County of Kauai's drainage standards. By incorporating retention and detention basins into the planned development, the increases in runoff volumes and peak discharge rates will be mitigated.

5.4.2 Farm Dwelling Sites

Within each of the farm dwelling sites, retention facilities are planned to provide an equivalent amount of retention as the calculated increase in runoff due to development. The average dwelling site is calculated to need an approximate storage of 2,400 cubic feet (0.056 acre-feet) due to development of the site. Storage could be provided by underground piping or storage chambers, or it can be provided above ground in shallow basins. See Appendix C for the retention calculations.

5.4.3 Roadway Systems

The subdivision roadways will be constructed such that storm water is diverted from the centerline of the roadways and off onto the grass shoulder areas. Increased storm water runoff due to development of the roadways (increased impervious surfaces) will be conveyed through the grassed swales and into underground drain collection systems via surface drain inlets. The underground drainage systems will discharge the roadway runoff into the natural drainageways throughout the site to maintain the natural drainage patterns.

The proposed underground drainage system is designed to convey the 2-year, 1 hour peak flow

and the roadway surface is designed to convey the 100-year, 1-hour peak flow within the roadway prism. See Appendix D for the roadway drainage system calculations.

It's possible to minimize the increased runoff due to the roadway pavements by utilizing pervious pavements. However, the increase in runoff due to the roadways is negligible when compared to the runoff generated by the regional tributary or watershed areas.

5.5 Drainage Impact Analysis

Increases in runoff volume and peak flows due to the proposed development are calculated to be negligible with respect to the regional runoff volumes and peak flows. The natural gullies and drainageways are significant enough to handle the peak flows which are generated by the regional watershed areas. Considering that the proposed individual developments will be responsible to capture and retain their increases in runoff, the local or immediate impacts due to development will also be negligible.

The calculated increases in runoff volume and peak flow from the petition area due to the ultimate build-out are not significant and would not significantly impact the downstream areas.

SECTION 6

ELECTRICAL AND TELEPHONE SYSTEMS

Electrical power will be provided to the project by the Kauai Island Utility Cooperative (KIUC).

Primary electrical power is distributed from the main electrical generating facility located in Port Allen, throughout the Island of Kauai via a 57 kilovolt (KV) overhead power transmission system to various substations located throughout the island. KIUC provides a three-phase, 12 KV overhead primary distribution system in the area of the project.

Secondary electrical power is supplied to the site from three, pole-mounted, 25 KVA transformers located on the north (makai) side of the Kuhio Highway.

Hawaiian Telecom provides telephone service to the Island of Kauai. There are nine exchange areas on the island. A switching station serves each, exchange area, although an exchange may have peripheral or remote locations. The Princeville switching station is located next to the Princeville Fire and Police Stations. It services the area from Princeville to Haena.

Hawaiian Telecom has three aerial cables along Kuhio Highway fronting the project. One is a fiber optic trunking cable between Princeville and Kilauea. Another is a 100 pair trunking cable between Princeville and Kilauea. The third is a 100 pair cable that provides local service. Hawaiian Telecom has no short-term plans to increase the line capacity.

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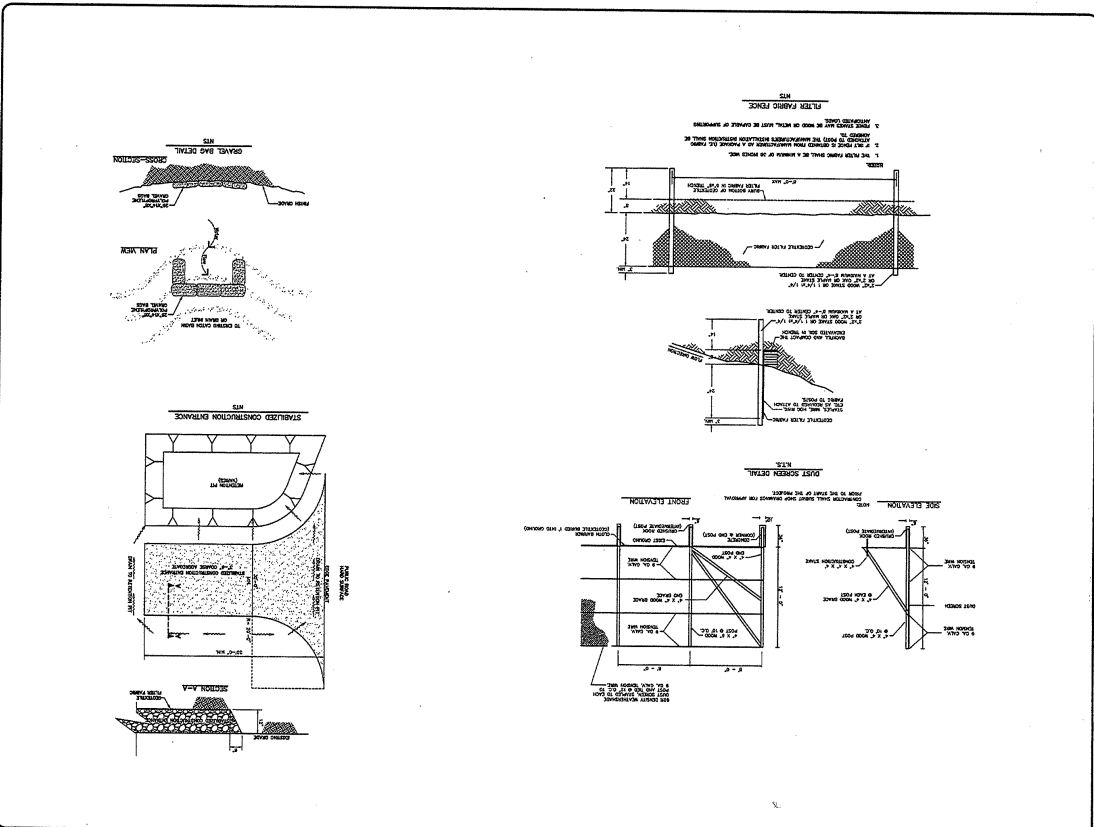
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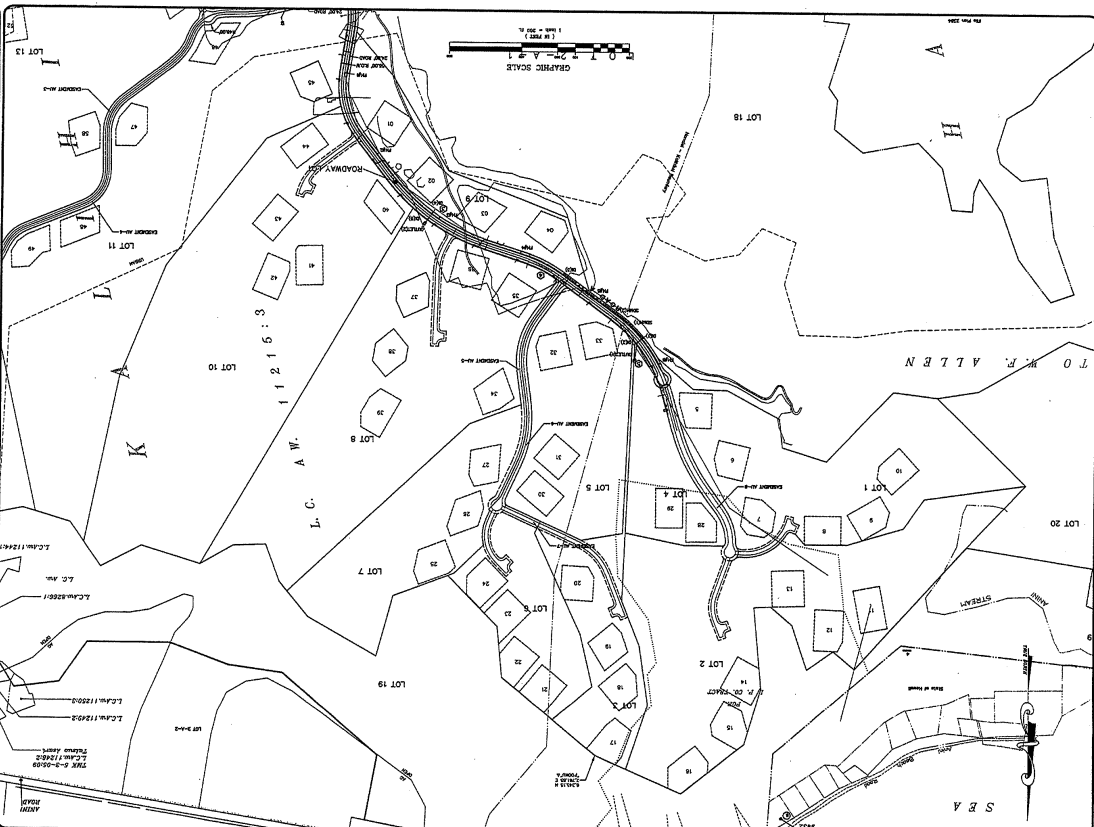
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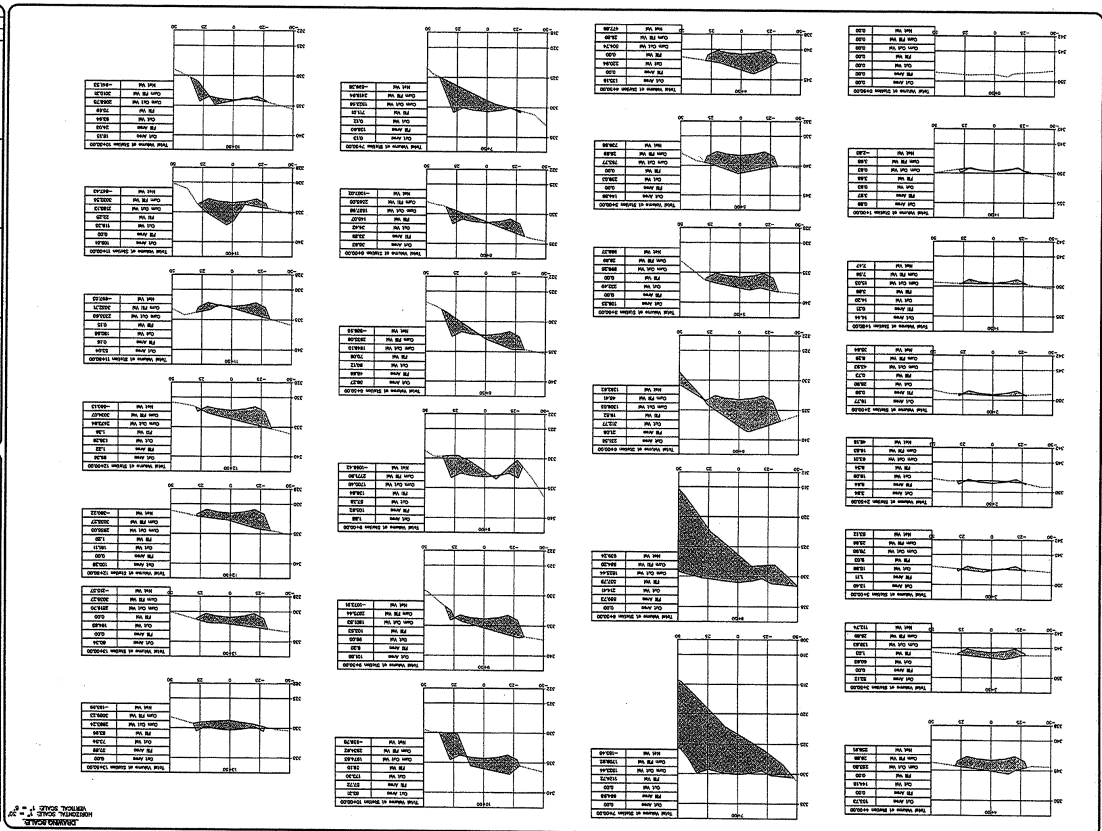
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 CLIENT: FRENCH TRAIL SUBDIVISION LLC
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UTAH PROFESSIONAL ENGINEERING SEAL
 JACOB A. CANNON
 LICENSE NO. 29854
 EXPIRES 12/31/2010



DATE: 02/07/2008
 DRAWN BY: JAC
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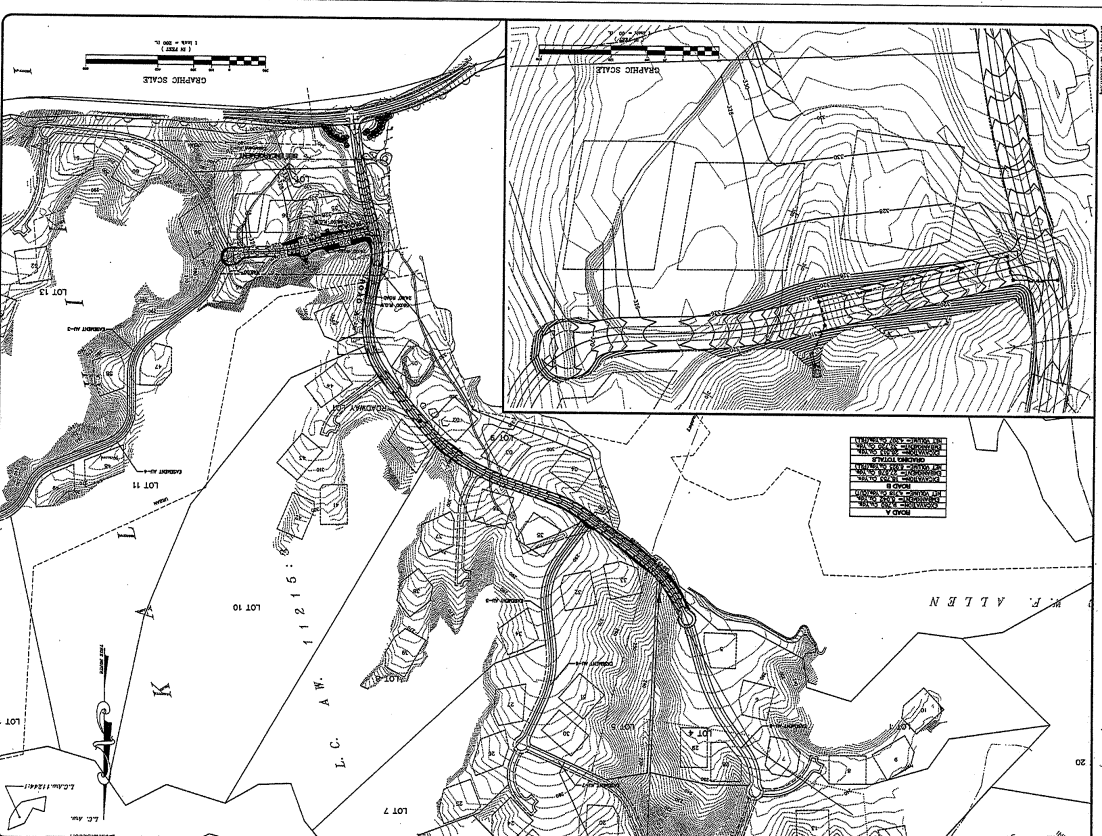
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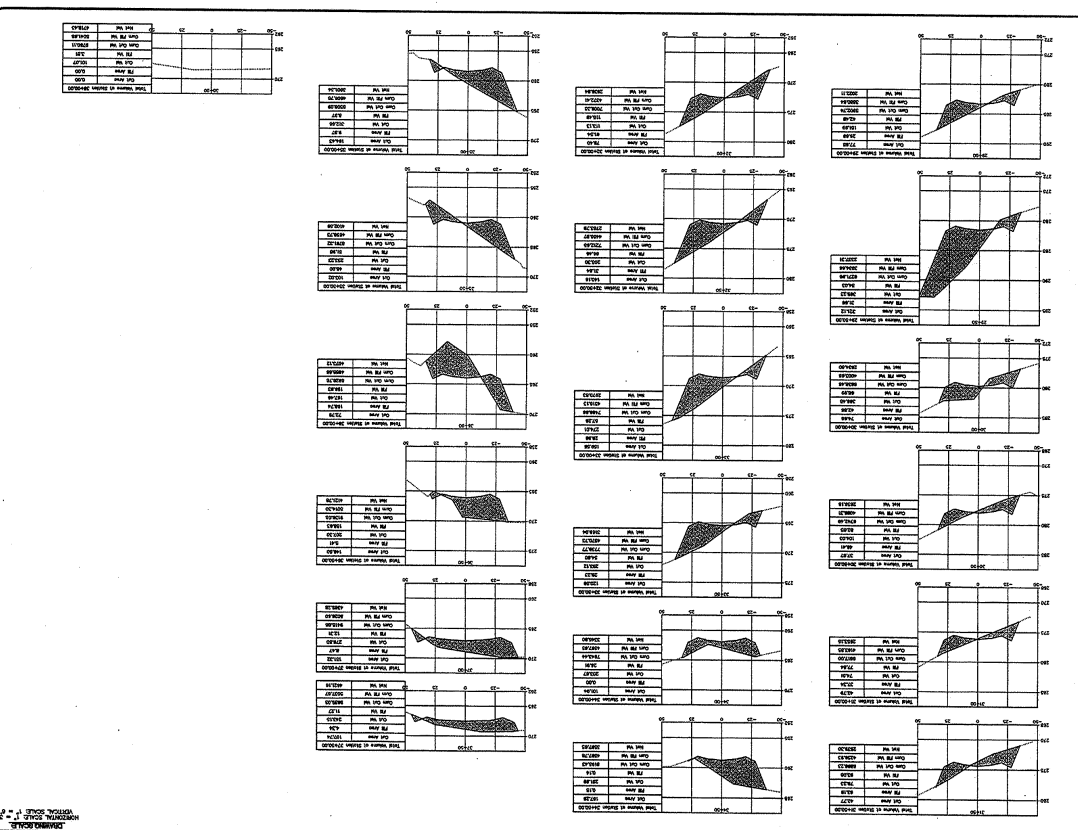
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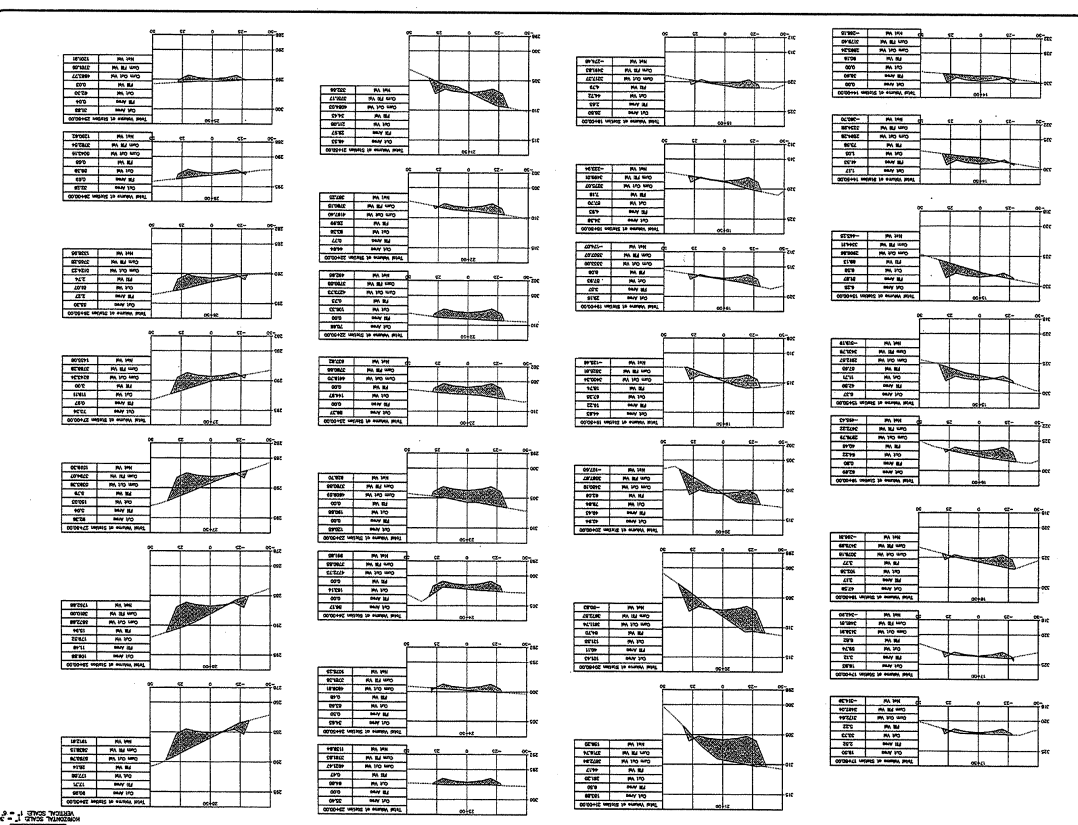
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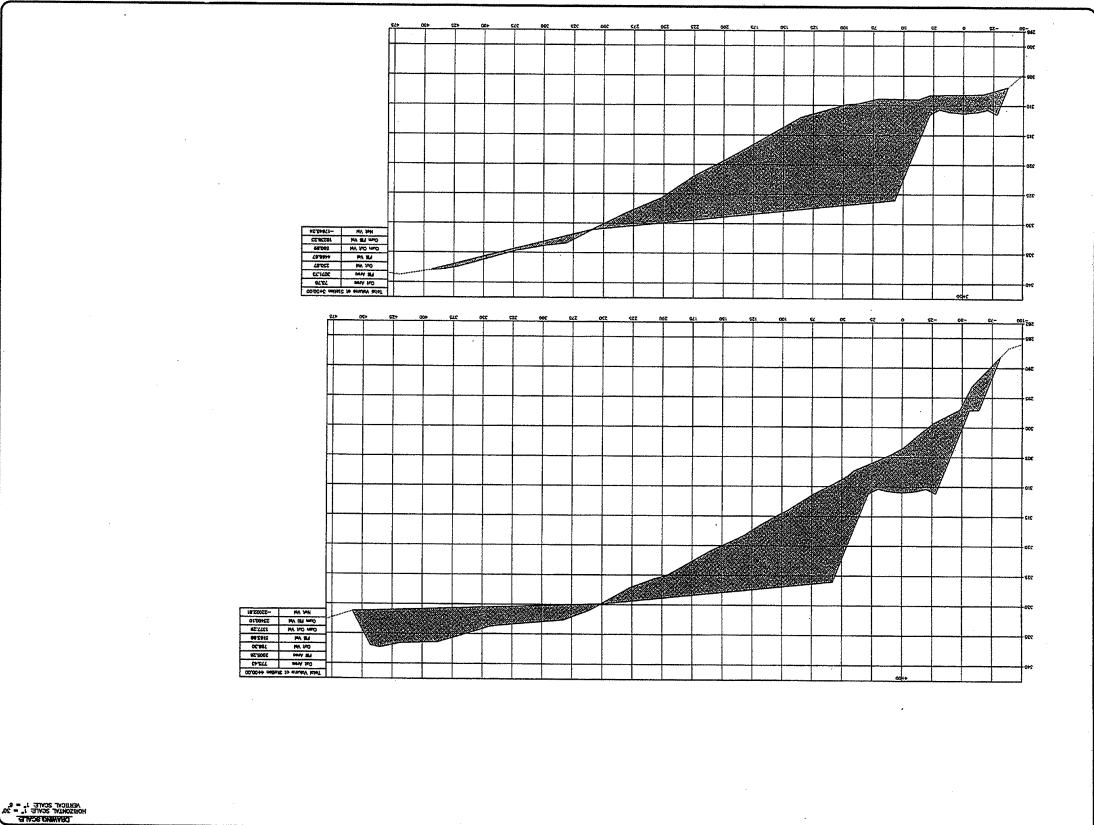
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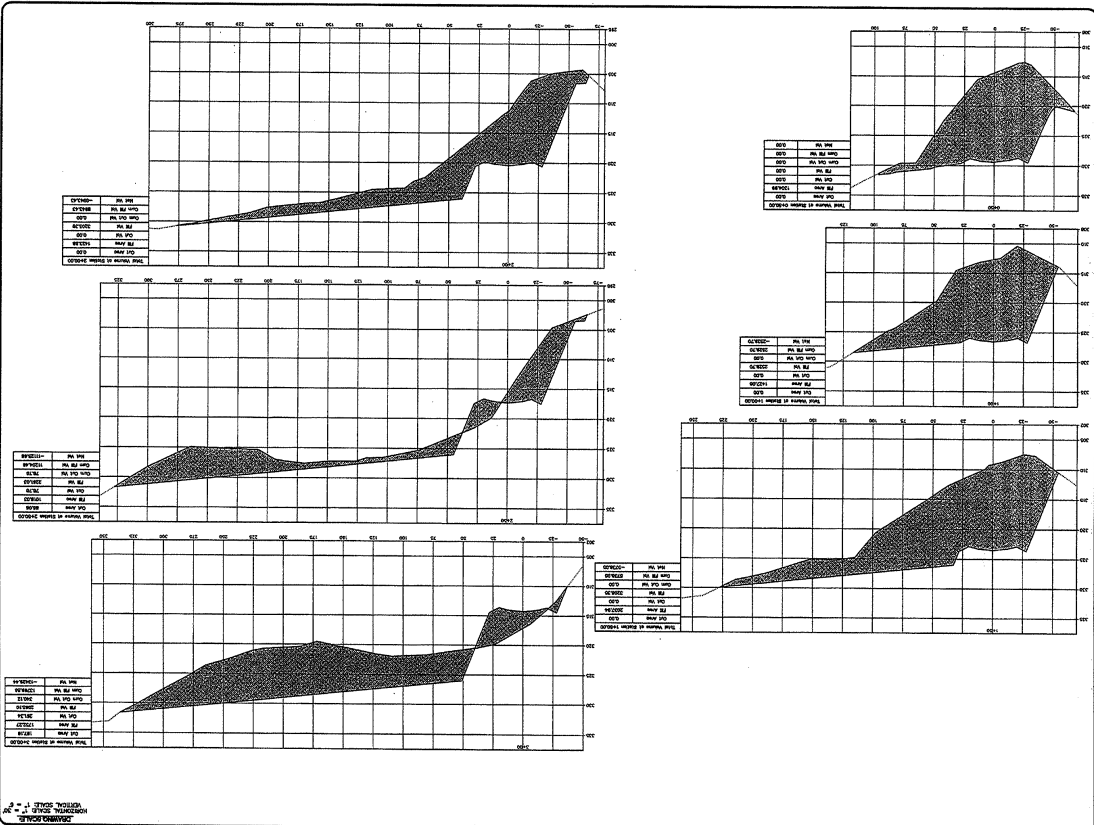
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 INC.

REVISIONS:

NO.	DATE	DESCRIPTION



02	02	02
02	02	02

PROJECT NO. 02002/03/06
SHEET NO. 02

DATE: 02/02/06

SCALE: 1" = 40'

PROJECT: ROAD B GRADING SECTIONS

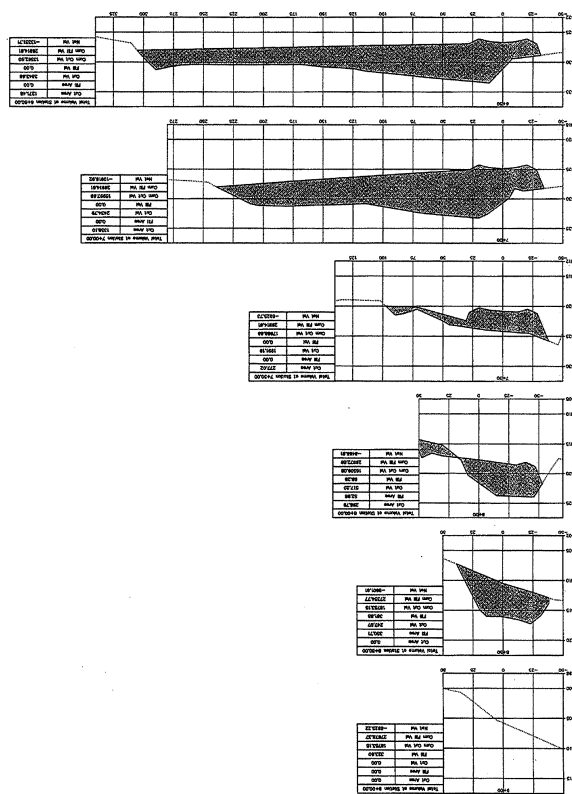
CLIENT: PHOENIX TRUSS CO. CORP. LLC

DESIGNED BY: JAMES E. WALKER, P.E.
CHECKED BY: JAMES E. WALKER, P.E.
DATE: 02/02/06

APPROVED BY: JAMES E. WALKER, P.E.

NO.	REVISIONS	DATE

SCALE ENGINEERS - SURVEYORS - PLANNERS
1818 Madison Blvd.
Tampa, Florida 33604
TEL: (813) 888-2222 FAX: (813) 888-2222
WWW.PFLANNINGANDSURVEYING.COM
PFLANNING AND SURVEYING, INC.



02	02	02
02	02	02

PROJECT NO. 02002/03/06
SHEET NO. 02

DATE: 02/02/06

SCALE: 1" = 40'

PROJECT: ROAD B GRADING SECTIONS

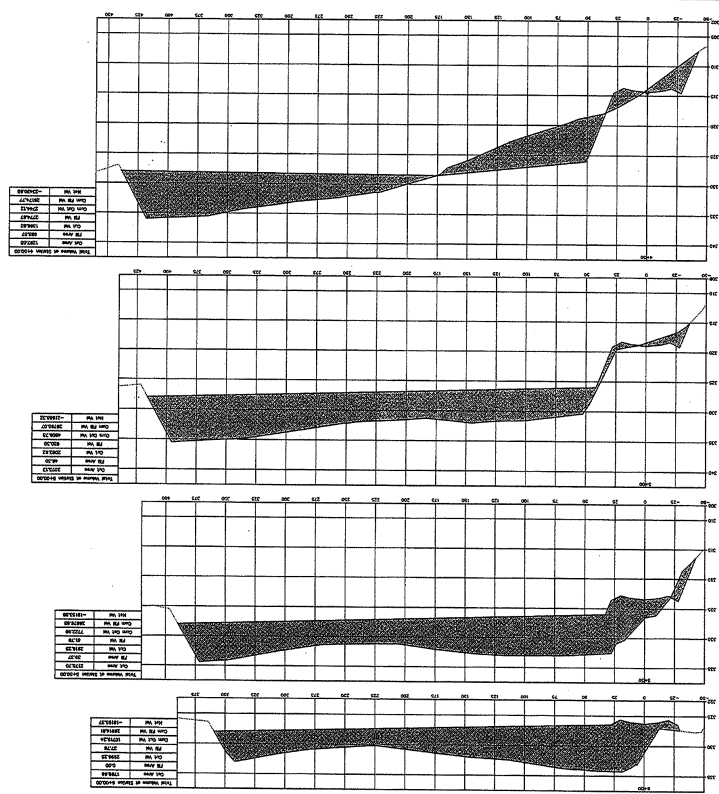
CLIENT: PHOENIX TRUSS CO. CORP. LLC

DESIGNED BY: JAMES E. WALKER, P.E.
CHECKED BY: JAMES E. WALKER, P.E.
DATE: 02/02/06

APPROVED BY: JAMES E. WALKER, P.E.

NO.	REVISIONS	DATE

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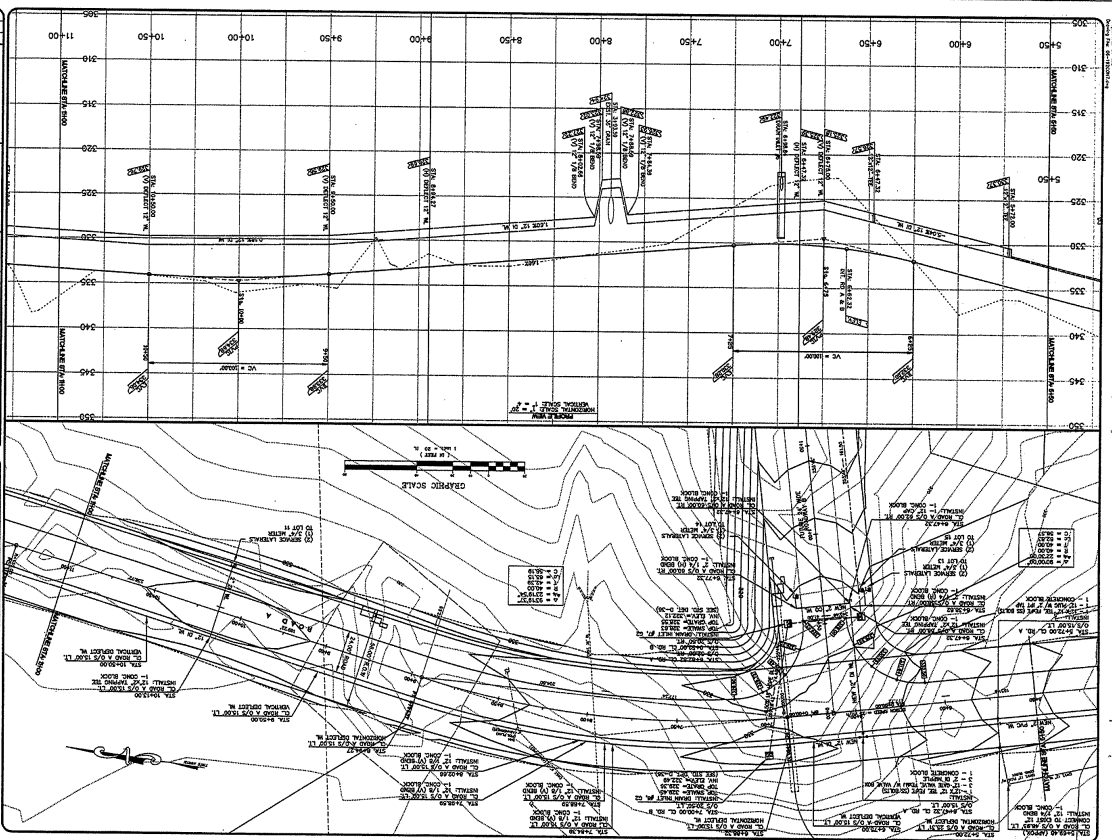
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 DRAWN BY: [Signature]
 CHECKED BY: [Signature]
 PROJECT: [Project Name]

PLAN & PROFILE
 ROAD A
 PROJECT: [Project Name]
 CONTRACTOR: [Contractor Name]
 DESIGNER: [Designer Name]

[Professional Seal]
 [Professional Title]

REVISIONS
 NO. DATE DESCRIPTION
 1 06/19/08 [Description]

[Company Logo]
 [Company Name]



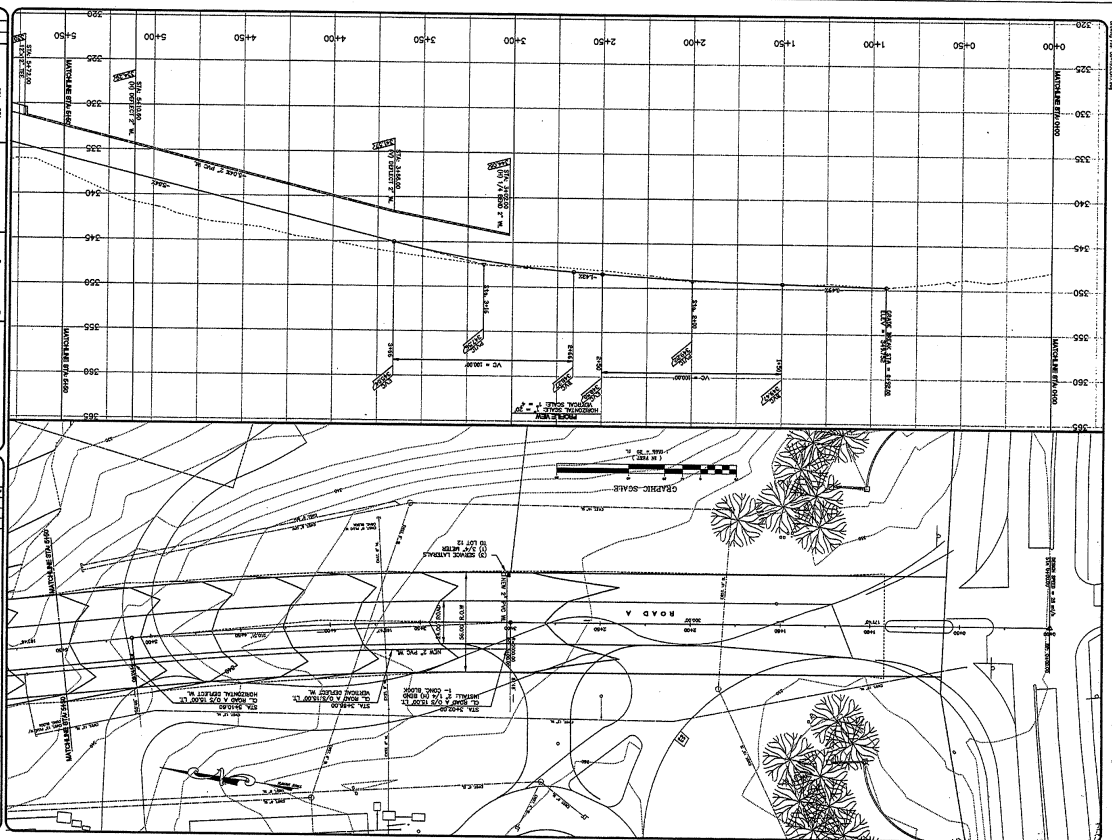
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 DRAWN BY: [Signature]
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 PROJECT: [Project Name]

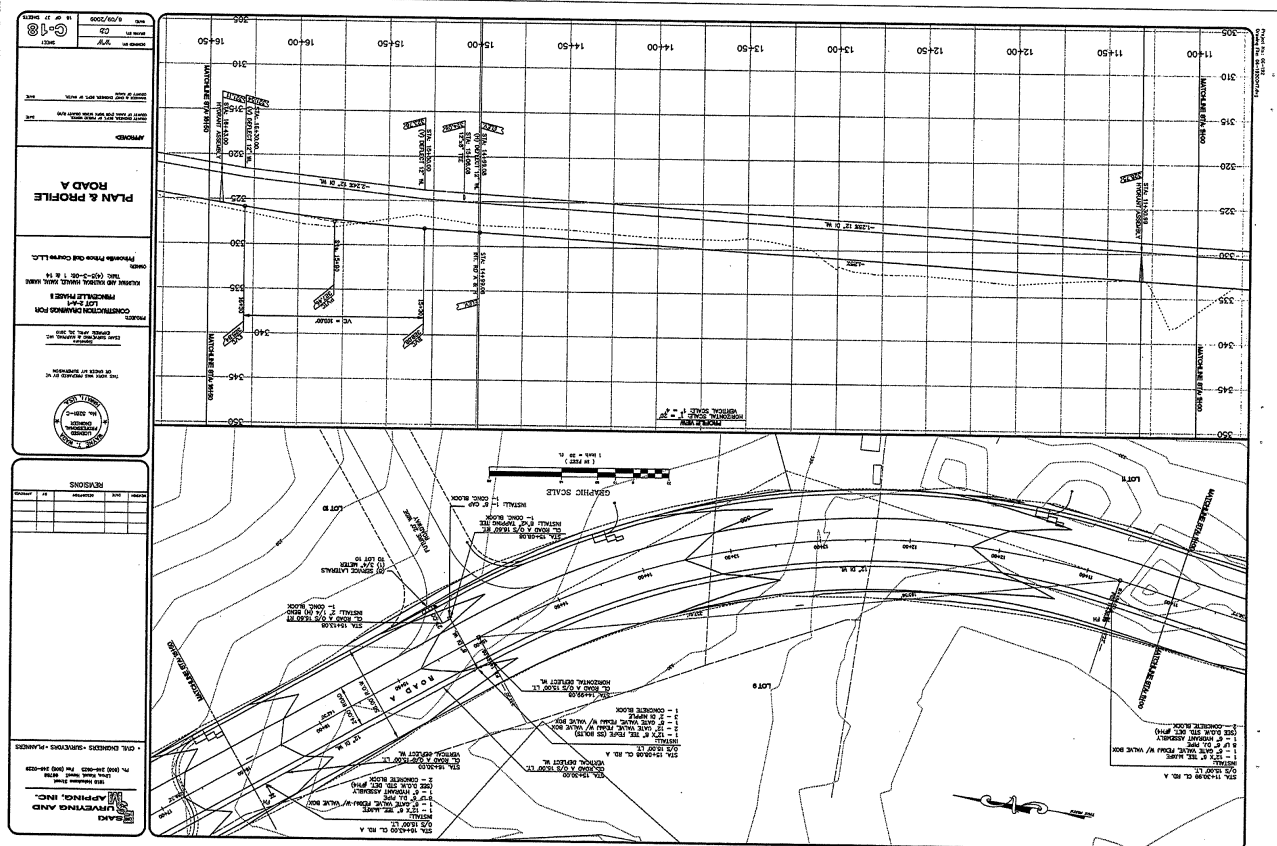
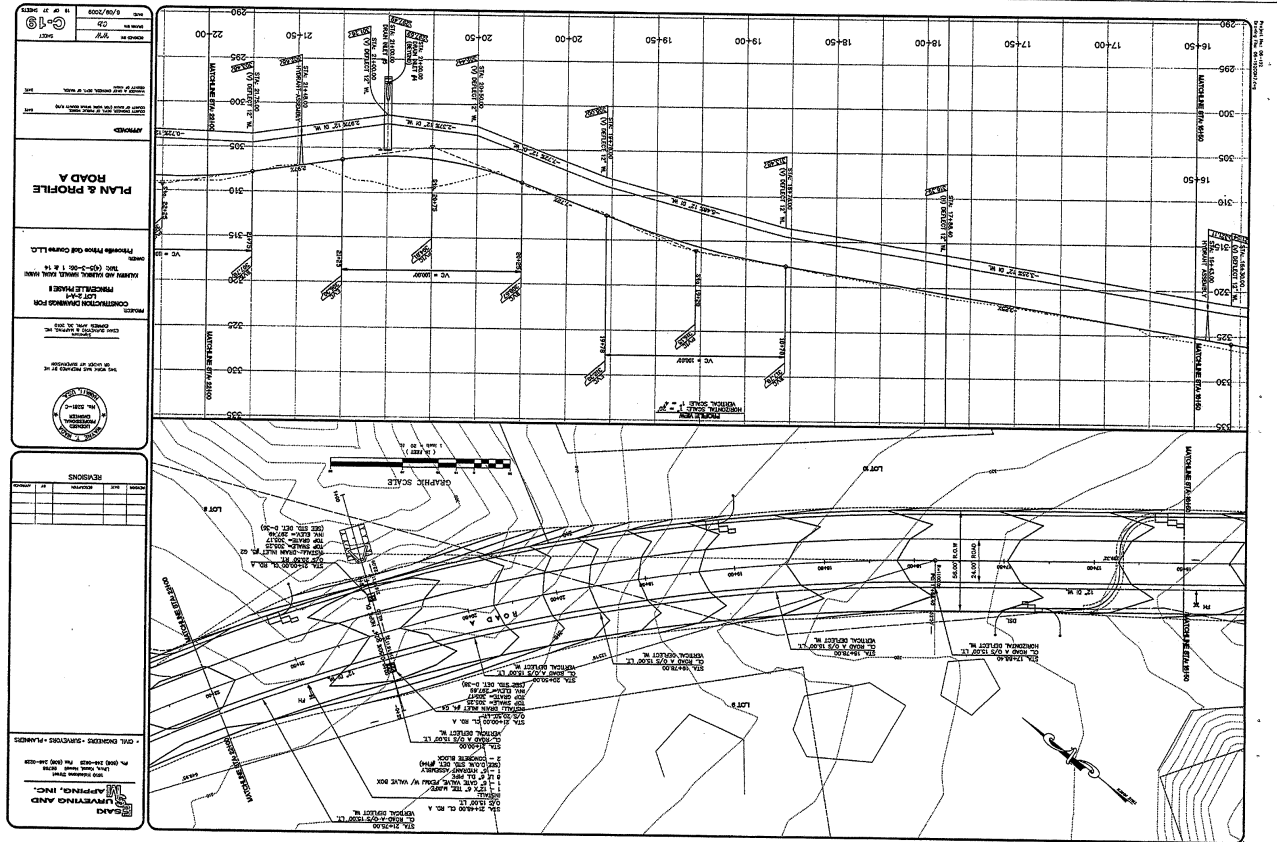
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 ROAD A
 PROJECT: [Project Name]
 CONTRACTOR: [Contractor Name]
 DESIGNER: [Designer Name]

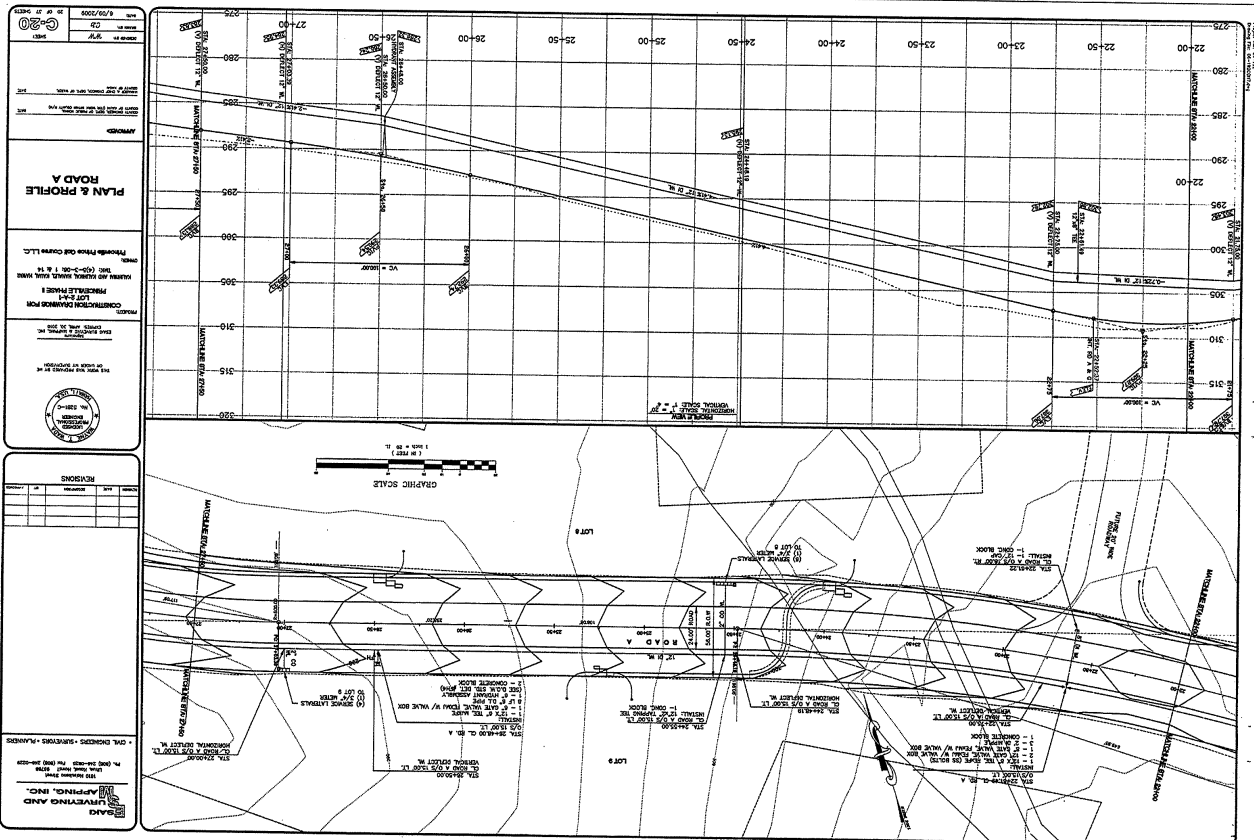
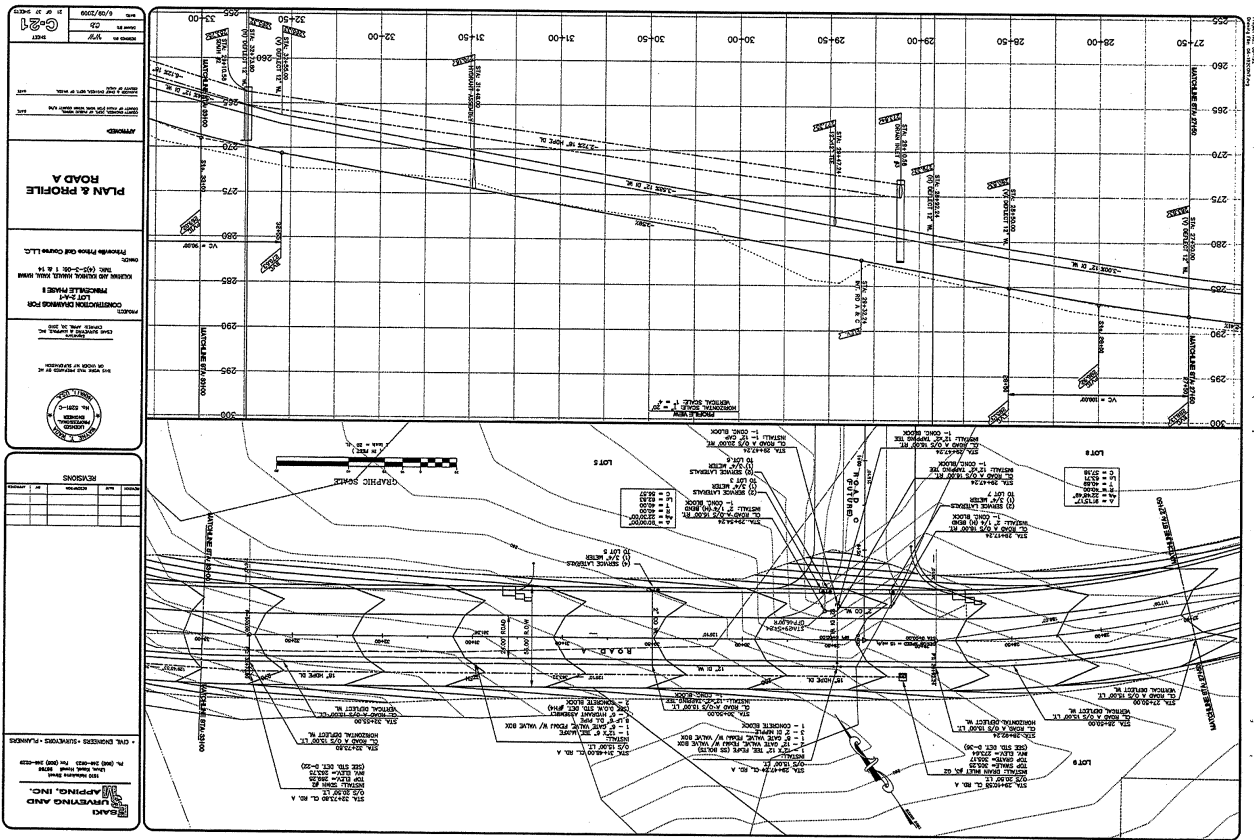
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 [Professional Title]

REVISIONS
 NO. DATE DESCRIPTION
 1 06/19/08 [Description]

[Company Logo]
 [Company Name]

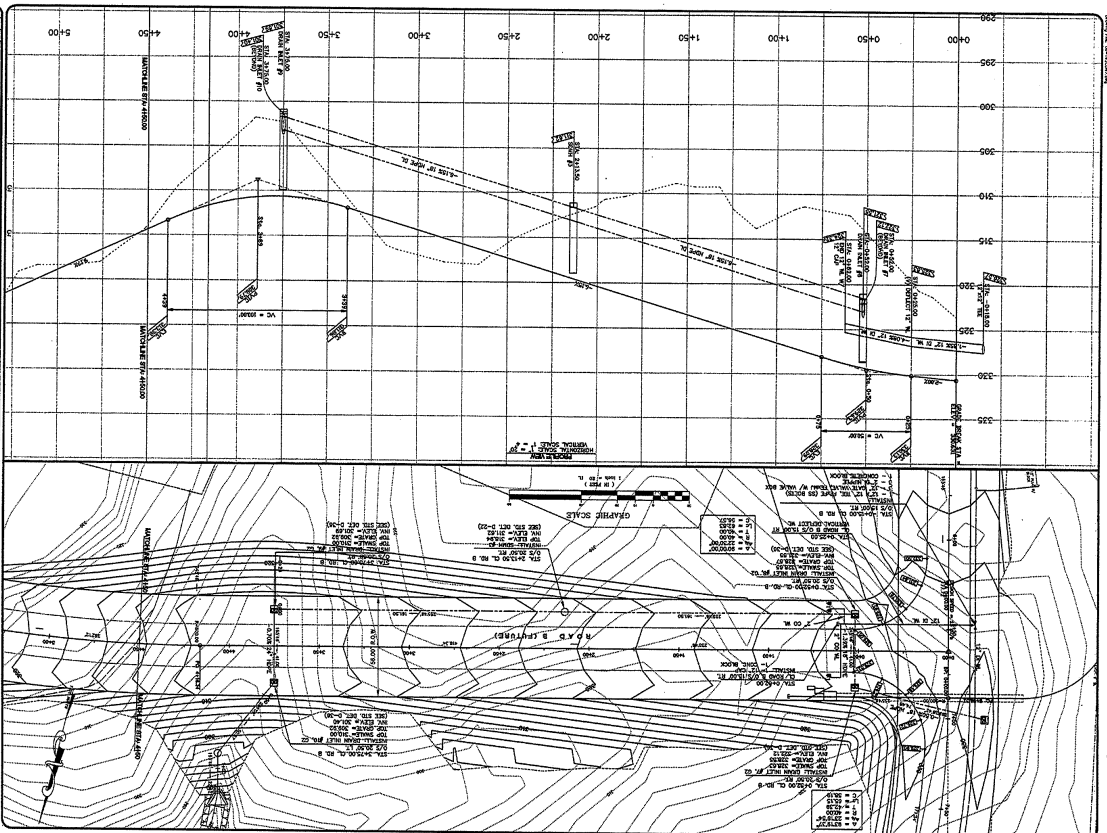






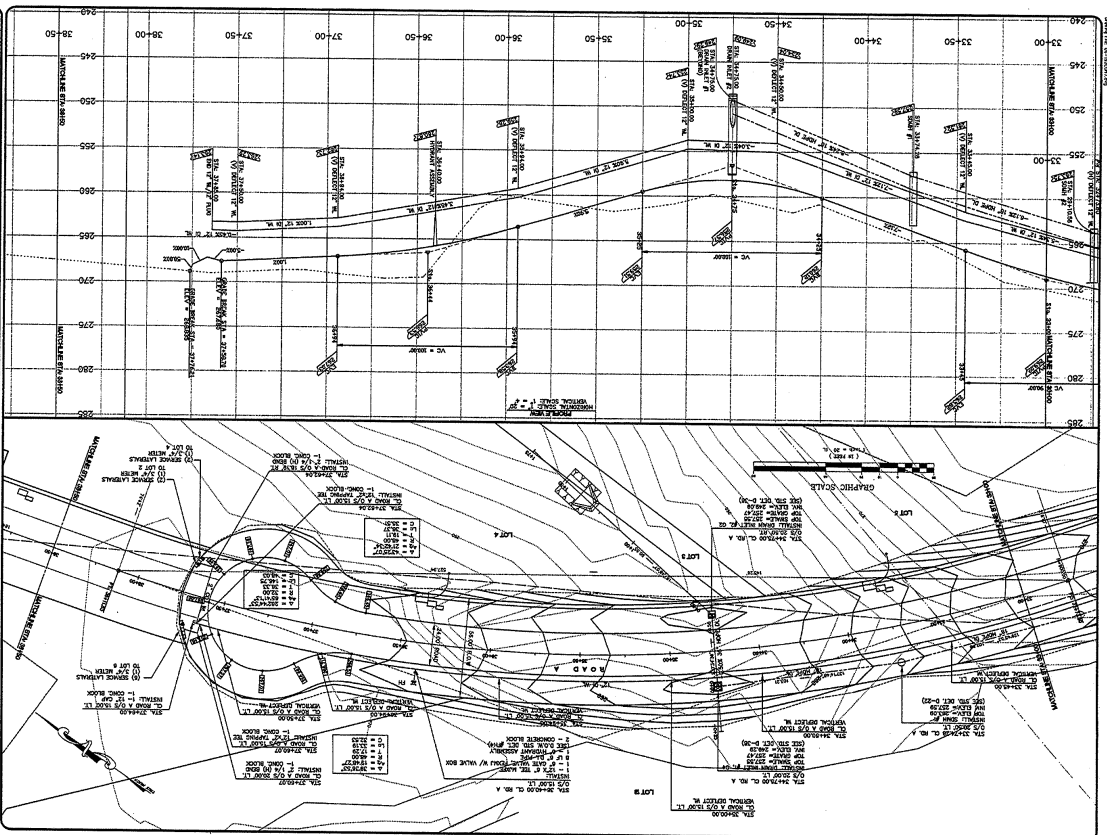
6/27/2009
 2021
 ROAD B
 PLAN & PROFILE
 CONSTRUCTION DRAWINGS FOR
 ROAD B (SHEET 1 OF 1)
 PREPARED BY: [Signature]
 CHECKED BY: [Signature]
 DATE: 6/27/2009
 PROJECT NO.: [Number]
 SHEET NO.: [Number]

CIVIL ENGINEERS - SURVEYORS - PLANNERS
 [Logo]
 [Address]
 [Phone Number]



6/27/2009
 2021
 ROAD A
 PLAN & PROFILE
 CONSTRUCTION DRAWINGS FOR
 ROAD A (SHEET 1 OF 1)
 PREPARED BY: [Signature]
 CHECKED BY: [Signature]
 DATE: 6/27/2009
 PROJECT NO.: [Number]
 SHEET NO.: [Number]

CIVIL ENGINEERS - SURVEYORS - PLANNERS
 [Logo]
 [Address]
 [Phone Number]

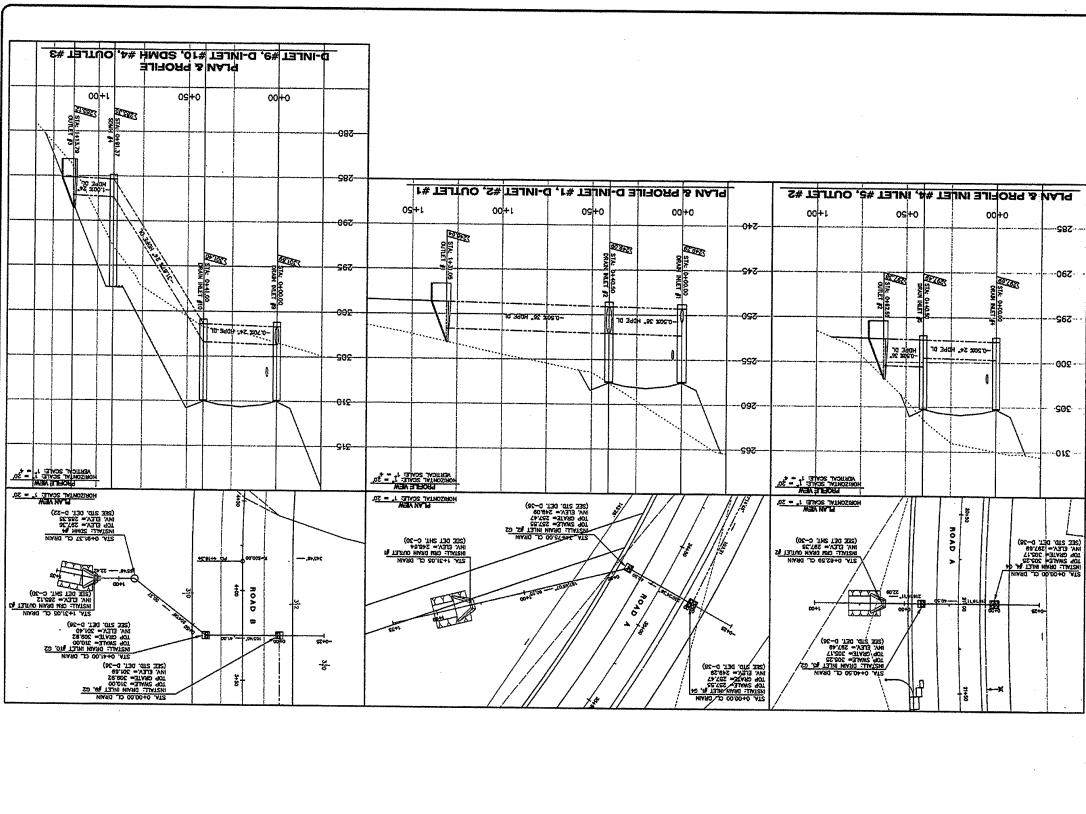


DATE: 5/19/2009
 DRAWING NO.: 23
 PROJECT: ROAD B

PLAN & PROFILE DRAINLINE
 THROUGH TRUSS CO. CORP. LLC.
 EXISTING AND PROPOSED DRAINAGE SYSTEMS
 FOR ROAD B
 PHASE I
 CONSTRUCTION DRAWING FOR PERMIT

THE STATE OF MISSISSIPPI
 DEPARTMENT OF TRANSPORTATION
 MISSISSIPPI DEPARTMENT OF TRANSPORTATION
 PROJECT NO. 44-12-0000-01
 CONTRACT NO. 44-12-0000-01-01
 SHEET NO. 23 OF 23

DESIGNER: LIVING AND LEARNING, INC.
 PROJECT MANAGER: [Name]
 CHECKED: [Name]
 DATE: 5/19/2009

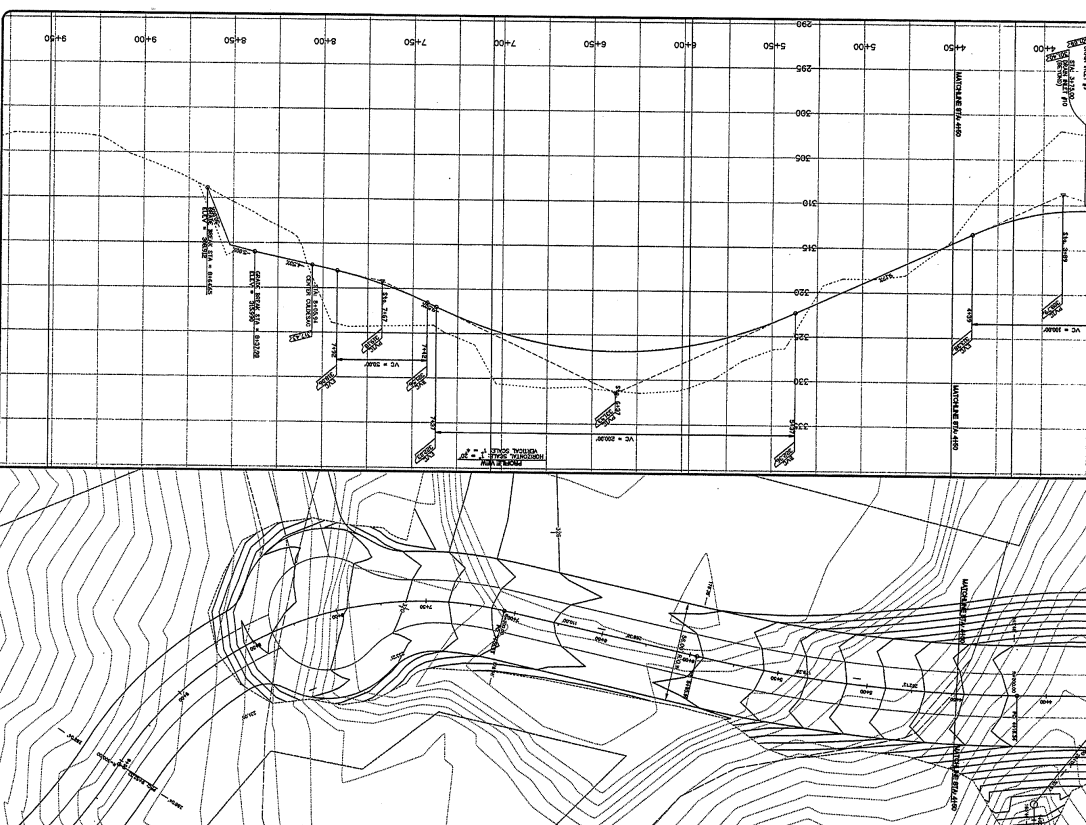


DATE: 5/19/2009
 DRAWING NO.: 23
 PROJECT: ROAD B

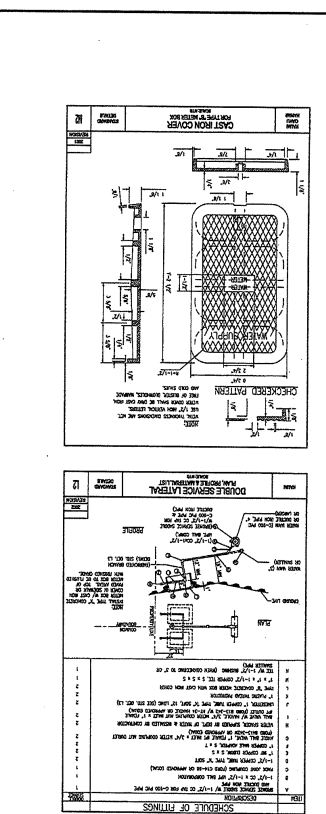
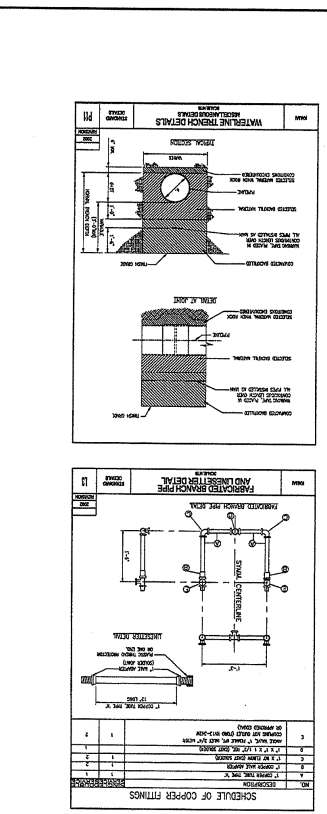
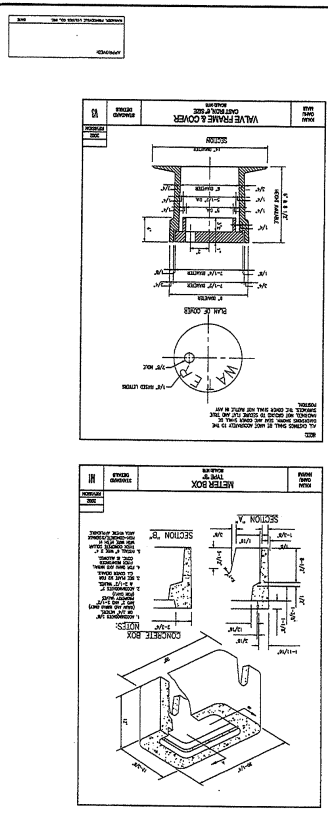
PLAN & PROFILE ROAD B
 THROUGH TRUSS CO. CORP. LLC.
 EXISTING AND PROPOSED DRAINAGE SYSTEMS
 FOR ROAD B
 PHASE I
 CONSTRUCTION DRAWING FOR PERMIT

THE STATE OF MISSISSIPPI
 DEPARTMENT OF TRANSPORTATION
 MISSISSIPPI DEPARTMENT OF TRANSPORTATION
 PROJECT NO. 44-12-0000-01
 CONTRACT NO. 44-12-0000-01-01
 SHEET NO. 24 OF 23

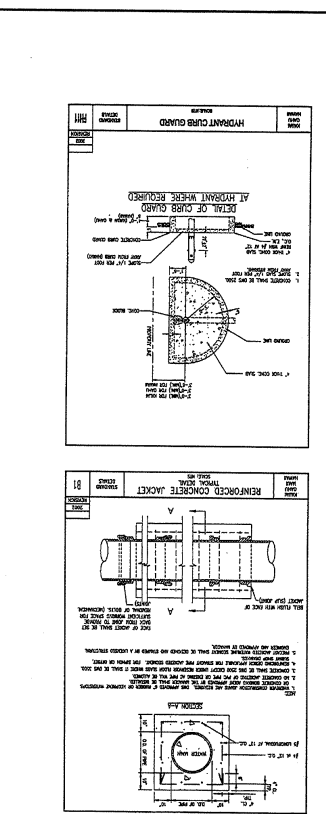
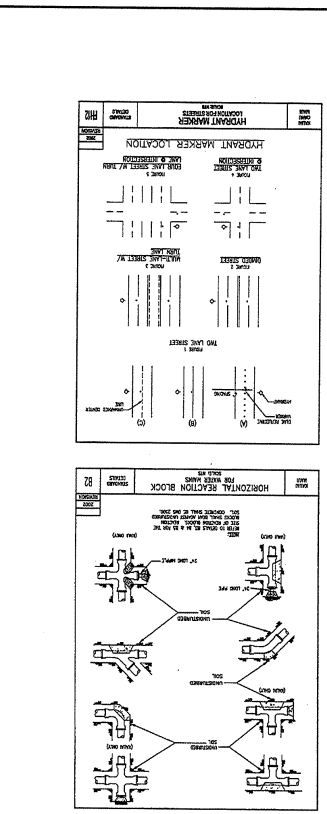
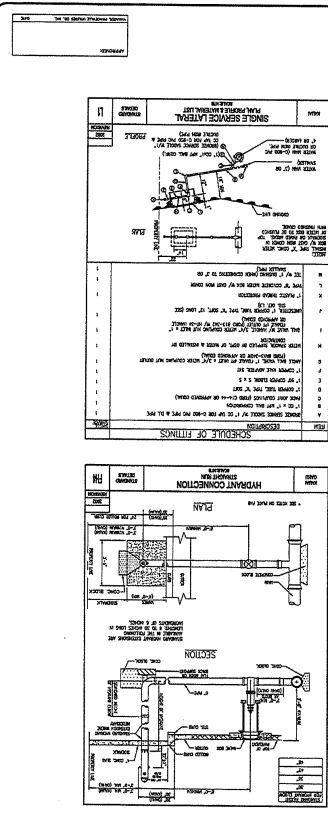
DESIGNER: LIVING AND LEARNING, INC.
 PROJECT MANAGER: [Name]
 CHECKED: [Name]
 DATE: 5/19/2009



27
 0000/2000
 WATER DETAILS
 CONCRETE FINISHES FOR
 INTERIORS
 CONCRETE FINISHES FOR
 EXTERIORS
 CONCRETE FINISHES FOR
 INTERIORS
 CONCRETE FINISHES FOR
 EXTERIORS
 CONCRETE FINISHES FOR
 INTERIORS
 CONCRETE FINISHES FOR
 EXTERIORS



28
 0000/2000
 WATER DETAILS
 CONCRETE FINISHES FOR
 INTERIORS
 CONCRETE FINISHES FOR
 EXTERIORS
 CONCRETE FINISHES FOR
 INTERIORS
 CONCRETE FINISHES FOR
 EXTERIORS
 CONCRETE FINISHES FOR
 INTERIORS
 CONCRETE FINISHES FOR
 EXTERIORS



DATE: 6/25/2025
 DRAWN BY: JAV
 CHECKED BY: JAV

MISCELLANEOUS DETAILS

THROUGH THESE OLD COUNTY LLC
 2025 (25)-08-1 & 24
 EXISTING AND NEW ROAD MARKINGS SHALL BE MAINTAINED THROUGHOUT THE PROJECT PER THE CONTRACT DOCUMENTS FOR LOT 24-25.

AT THE OPTION OF THE CONTRACTOR, THE ROAD MARKINGS SHALL BE MAINTAINED THROUGHOUT THE PROJECT PER THE CONTRACT DOCUMENTS FOR LOT 24-25.

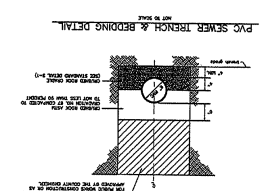
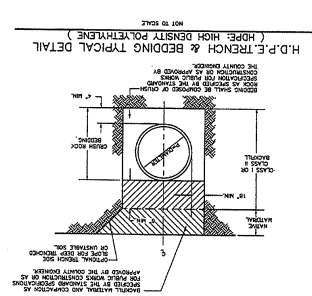
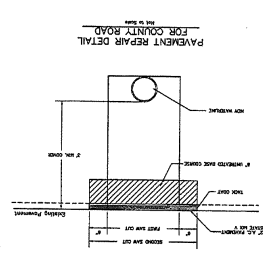
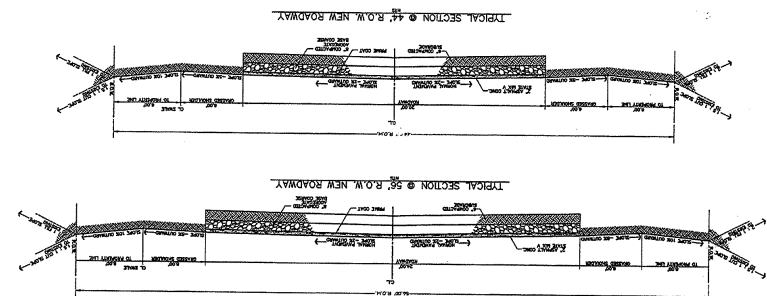
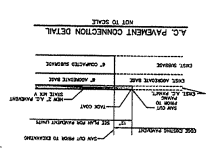
APPROVED: [Signature]

SCALE: AS SHOWN

REVISIONS:

NO.	DESCRIPTION	DATE

CONTRACTOR: [Name]
 PROJECT: [Name]



DATE: 6/25/2025
 DRAWN BY: JAV
 CHECKED BY: JAV

WATER DETAILS

THROUGH THESE OLD COUNTY LLC
 2025 (25)-08-1 & 24
 EXISTING AND NEW ROAD MARKINGS SHALL BE MAINTAINED THROUGHOUT THE PROJECT PER THE CONTRACT DOCUMENTS FOR LOT 24-25.

AT THE OPTION OF THE CONTRACTOR, THE ROAD MARKINGS SHALL BE MAINTAINED THROUGHOUT THE PROJECT PER THE CONTRACT DOCUMENTS FOR LOT 24-25.

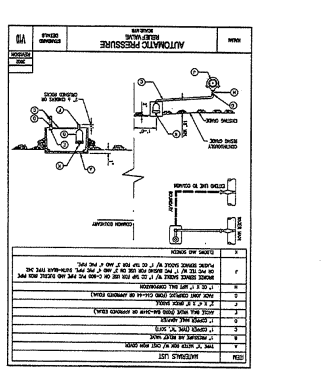
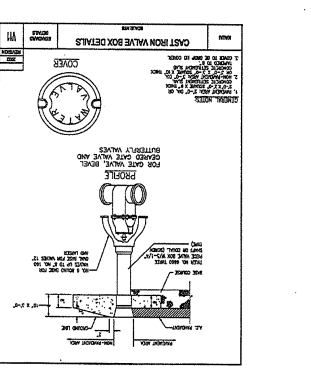
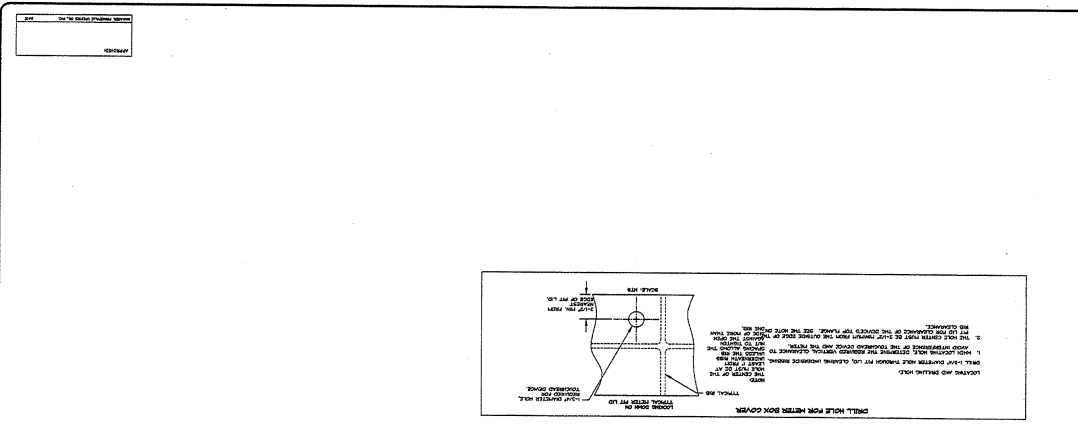
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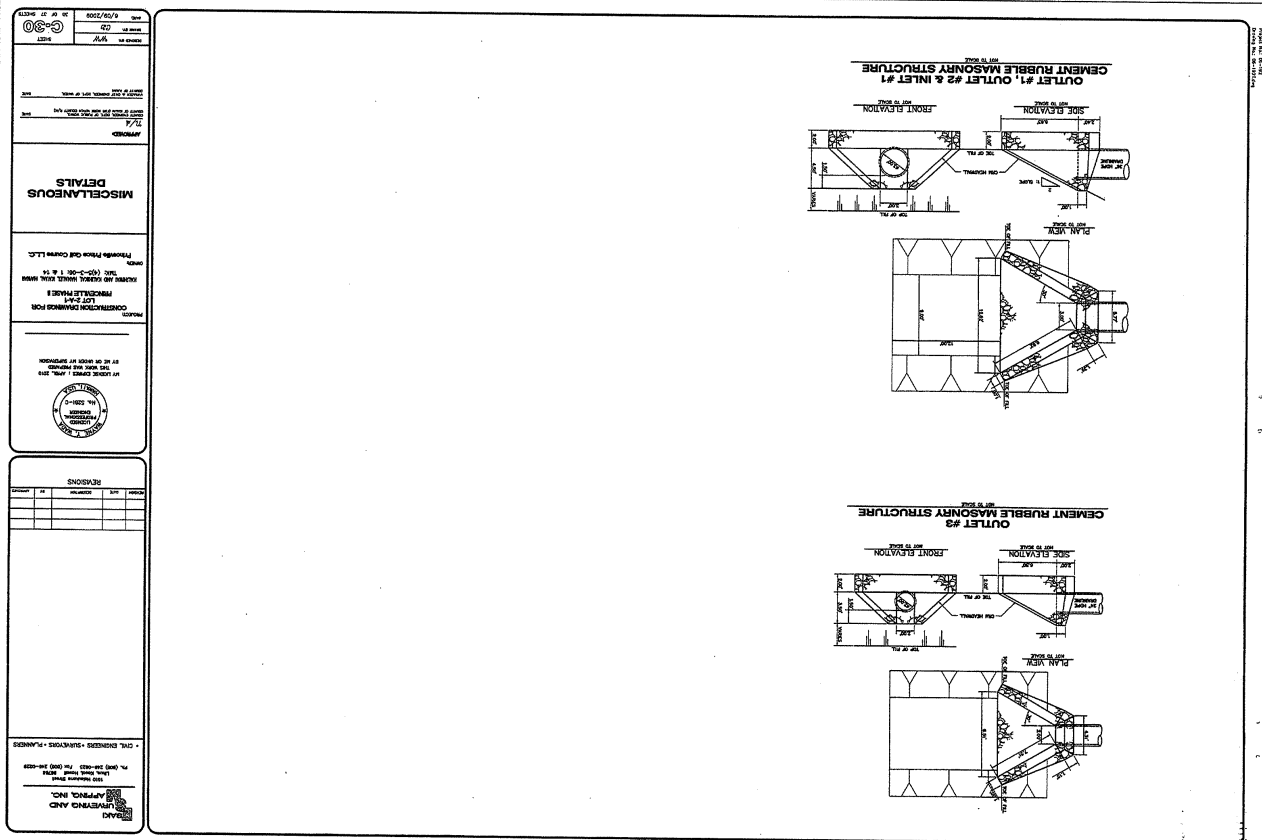
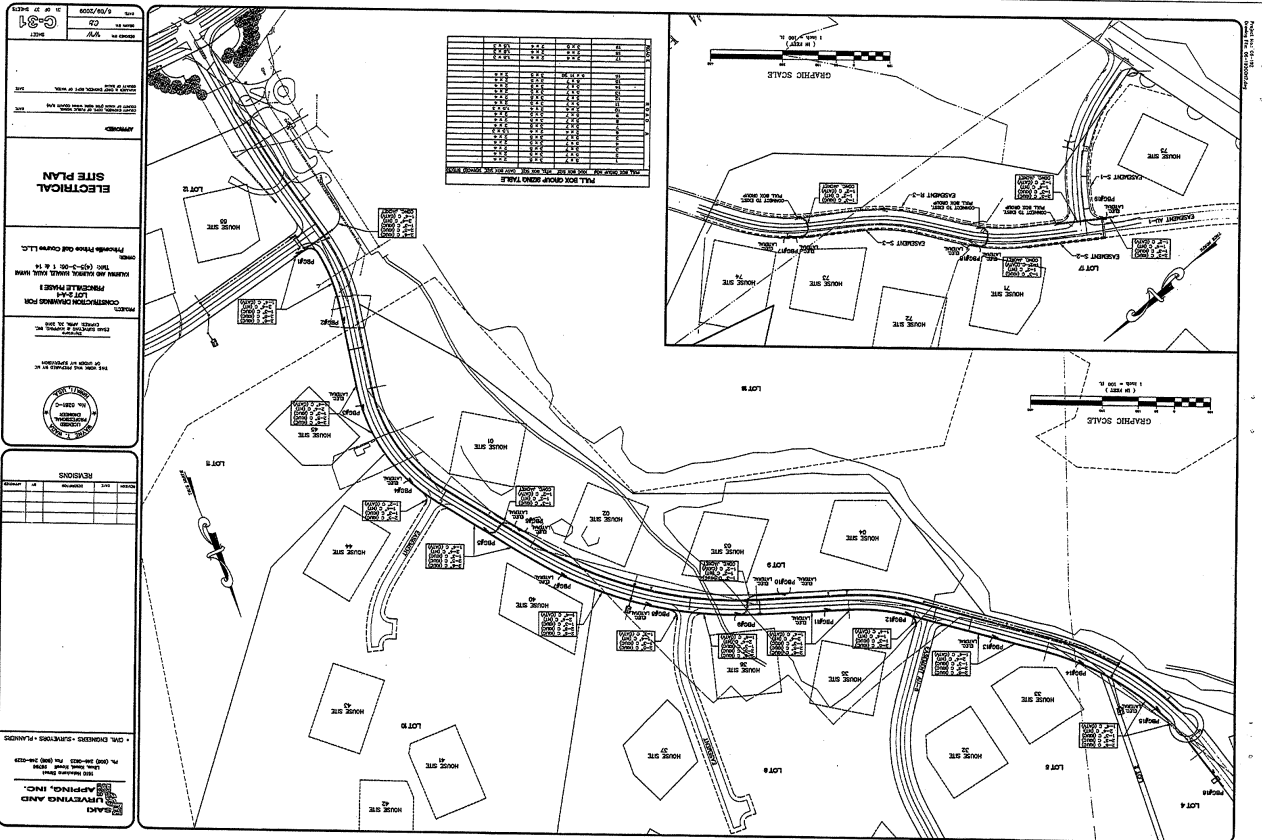
SCALE: AS SHOWN

REVISIONS:

NO.	DESCRIPTION	DATE

CONTRACTOR: [Name]
 PROJECT: [Name]





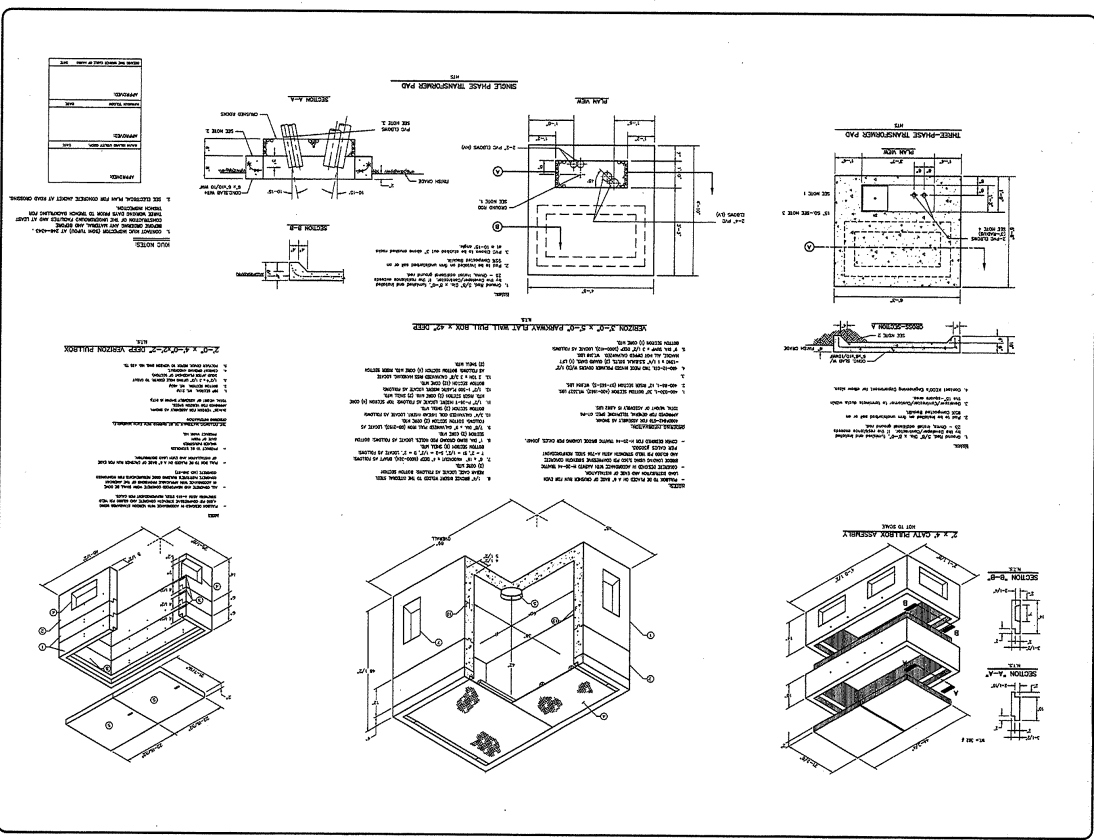
SHEET NO. 2 OF 2
 PROJECT NO. 100-00-000
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 CONTRACTOR: [Blank]
 DESIGNER: [Blank]
 APPROVED: [Blank]
 DATE: [Blank]

ELECTRICAL NOTES
 1. REFER TO ALL NOTES ON SHEETS 100-00-000 THROUGH 100-00-004.
 2. ALL WORK TO BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC) AND THE NATIONAL FIRE ALARMA CODE (NFPA) AS APPLIED TO THIS PROJECT.
 3. ALL WORK TO BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
 4. ALL WORK TO BE INSTALLED IN ACCORDANCE WITH THE LOCAL ELECTRICAL CODES.
 5. ALL WORK TO BE INSTALLED IN ACCORDANCE WITH THE LOCAL FIRE CODES.
 6. ALL WORK TO BE INSTALLED IN ACCORDANCE WITH THE LOCAL BUILDING CODES.
 7. ALL WORK TO BE INSTALLED IN ACCORDANCE WITH THE LOCAL PLUMBING CODES.
 8. ALL WORK TO BE INSTALLED IN ACCORDANCE WITH THE LOCAL MECHANICAL CODES.
 9. ALL WORK TO BE INSTALLED IN ACCORDANCE WITH THE LOCAL HEALTH AND SAFETY CODES.
 10. ALL WORK TO BE INSTALLED IN ACCORDANCE WITH THE LOCAL ENVIRONMENTAL CODES.

REVISIONS

NO.	DATE	DESCRIPTION

100-00-000-0000-0000
 APPROVED AND
 [Signature]
 [Title]



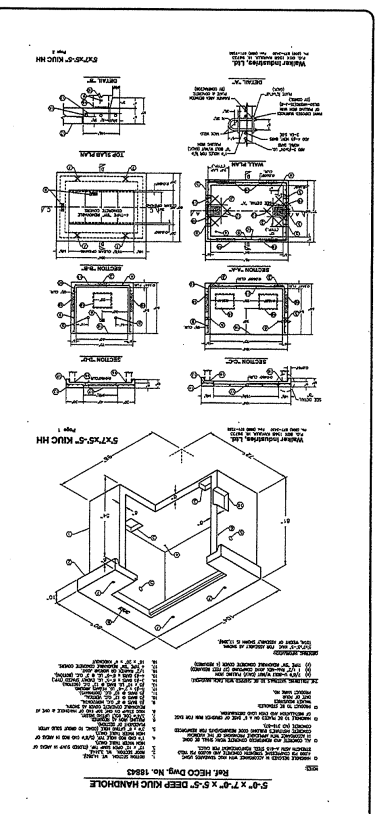
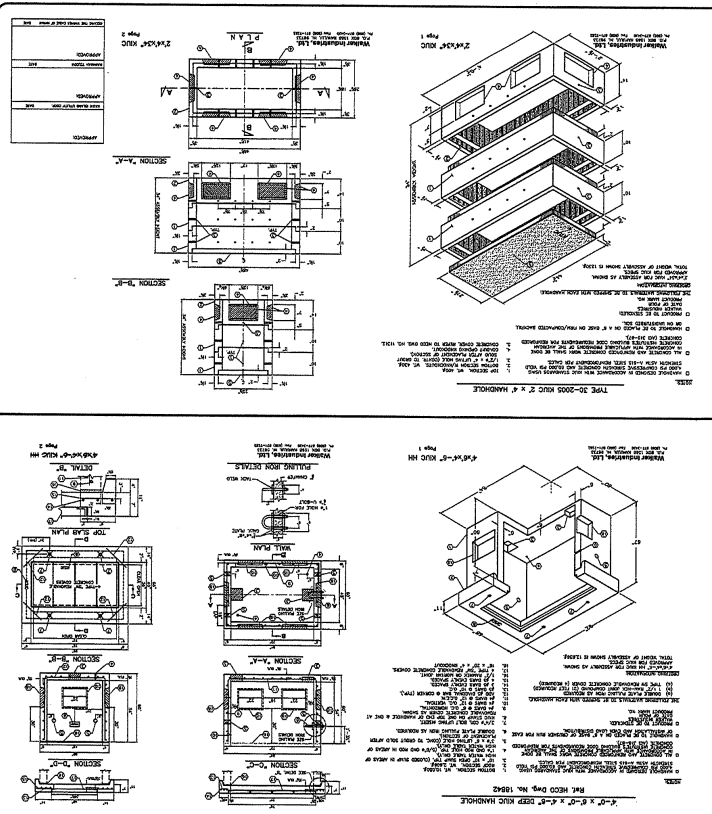
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 PROJECT NO. 100-00-000
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 DATE: [Blank]

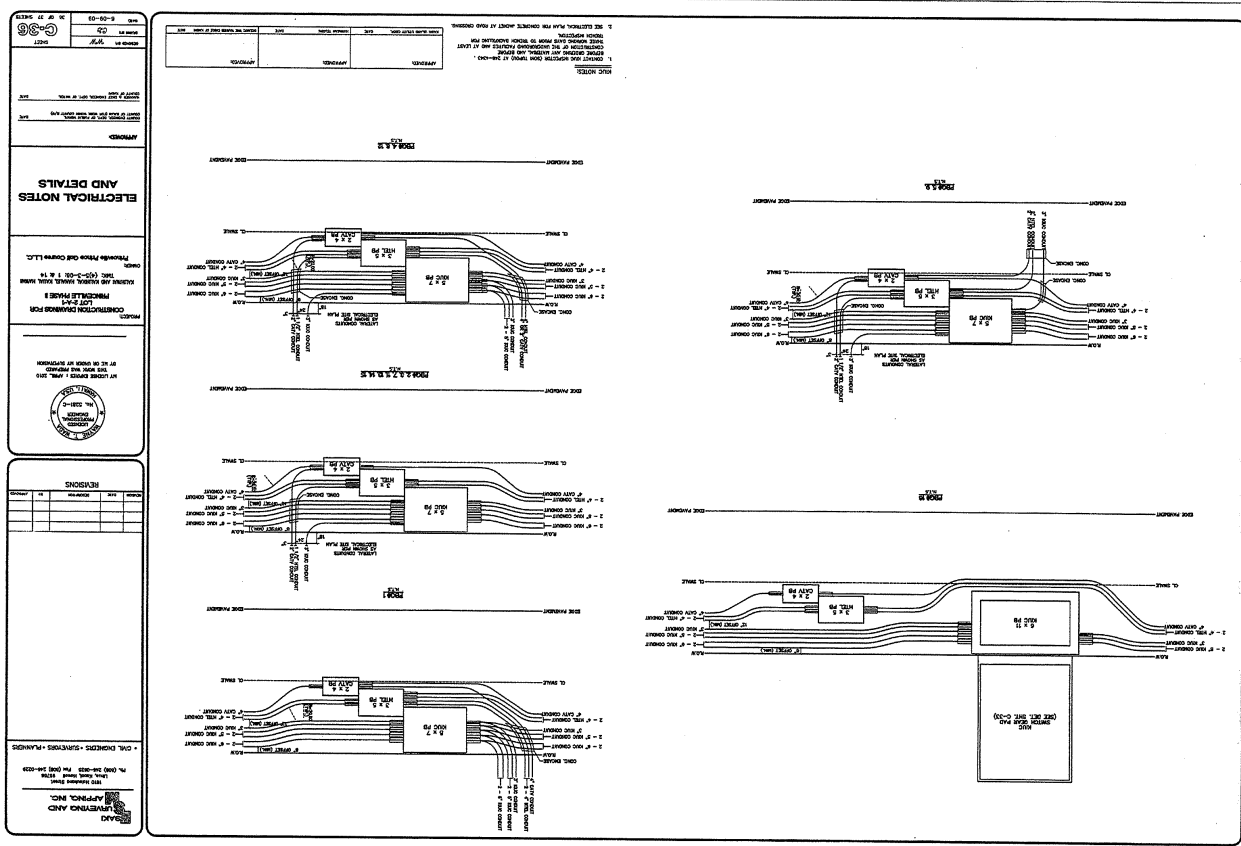
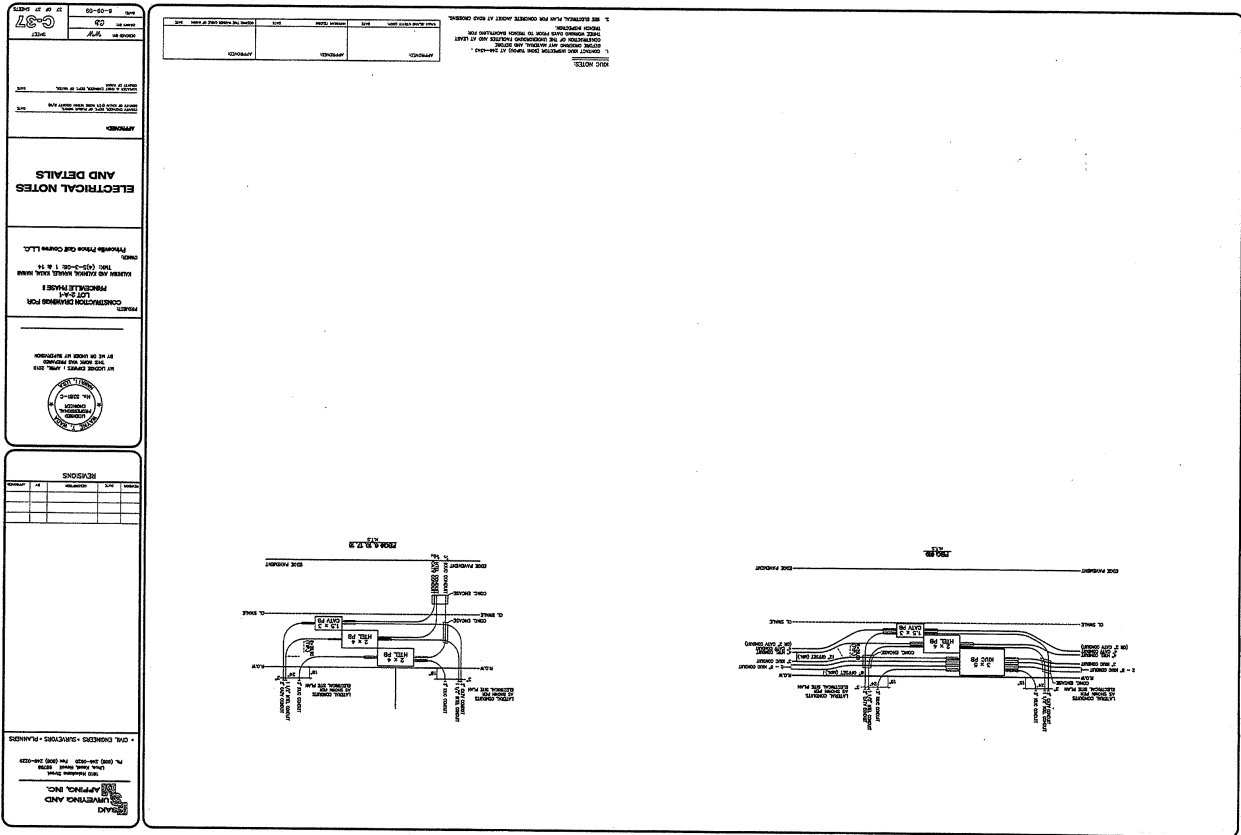
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 10. ALL WORK TO BE INSTALLED IN ACCORDANCE WITH THE LOCAL ENVIRONMENTAL CODES.

REVISIONS

NO.	DATE	DESCRIPTION

100-00-000-0000-0000
 APPROVED AND
 [Signature]
 [Title]





APPENDIX B
DRAINAGE CALCULATIONS

Princeville Subdivision Runoff Calculations Summary 7/30/2009												
Description	Tributary Area (ac)	Existing		Proposed		Increase		Existing		Proposed		Increase
		Runoff Volume (ac-ft)	Peak Runoff (cfs)	Runoff Volume (ac-ft)	Peak Runoff (cfs)	Runoff Volume (ac-ft)	Peak Runoff (cfs)	Runoff Volume (ac-ft)	Peak Runoff (cfs)	Runoff Volume (ac-ft)	Peak Runoff (cfs)	
Ultimate Buildout	490	587.2	600.3	13.1	3,186	3,256	70					
Typical House Site	0.75	0.9	1.0	0.1	8	9	1					
Petition Area	120	121.0	124.7	3.7	743	766	23					
Petition Area (Western Drain Area)	53	53.5	55.1	1.6	392	404	12					
Petition Area (Eastern Drain Area)	67	67.6	69.7	2.1	415	428	13					
Regional Drainage - Anini Gulch	1,300	---	---	---	2,855	2,895	40					
Regional Drainage - Watershed A	330	---	---	---	1,757	1,811	54					
Regional Drainage - Watershed B	144	---	---	---	656	667	11					
Regional Drainage - Watershed C	300	---	---	---	1,223	1,242	19					

Princeville Subdivision Runoff Calculations Ultimate Buildout 7/30/2009									
Ultimate Buildout Area 100-Year, 24-Hour Rain Fall			490 ac 18 in						
Soil Type Rough Broken Land (RR)				Hydrologic Group C					
Existing Curve Number									
Land Use				Hydrologic Group CN	CN				
Pasture or Range Land - Good Condition				C	74				
Proposed Curve Number									
Land Use				Hydrologic Group	CN	Area (ac)			
Residential (25% Impervious)				C	80	57 (75 house sites @ 0.75 ac ea)			
Impervious (Paved Road)				C	95	10			
Pasture or Range Land - Good Condition				C	74	423			
Composite				say	75.1	76			
<u>Existing Time of Concentration</u>									
Length (ft)	Slope	Velocity (fps)	Tc (min)						
5,000	6.2%	3.0 (Pasture)	28						
<u>Proposed Time of Concentration</u>									
Length (ft)	Slope	Velocity (fps)	Tc (min)						
5,000	6.2%	3.0 (Pasture)	28						

Princeville Subdivision Runoff Calculations Ultimate Buildout 7/30/2009									
Existing Runoff Volume									
Runoff Depth (From TR-55)			14.38 in						
Area			490 ac						
Runoff Volume			587.2 ac-ft						
Proposed Runoff Volume									
Runoff Depth (From TR-55)			14.7 in						
Area			490 ac						
Runoff Volume			600.3 ac-ft						
Increase in Runoff Volume			13.1 ac-ft						
24-Hour Peak Runoff									
Existing 24-hour Peak Runoff			3,186						
Proposed 24-hour Peak Runoff			3,256						
Increase in 24-Hour Peak Runoff			70						

Project : Princeville subdivision
 County : Kauai
 Subtitle: Ultimate Buildout - Existing Condition

Date: 07-30-2009

Date: _____

User: MN

State: HI

Checked: _____

Data: Drainage Area : 490 Acres
 Runoff Curve Number : 74
 Time of Concentration: 0.47 Hours
 Rainfall Type : I
 Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	18
Ia/P Ratio	0.04
Used	0.10
Runoff (in)	14.38
Unit Peak Discharge (cfs/acre/in)	0.452
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	3186

0

Project : Princeville subdivision
 County : Kauai
 Subtitle: Ultimate Buildout - Proposed Condition

Date: 07-30-2009

Date: _____

User: MN

State: HI

Checked: _____

Data: Drainage Area : 490 Acres
 Runoff Curve Number : 76
 Time of Concentration: 0.47 Hours
 Rainfall Type : I
 Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	18
Ia/P Ratio	0.04
Used	0.10
Runoff (in)	14.70
Unit Peak Discharge (cfs/acre/in)	0.452
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	3256

0

Princeville Subdivision Runoff Calculations Typical House Site 7/30/2009					
<u>Existing Runoff Volume</u>					
Runoff Depth (From TR-55)	14.38 in				
Area	0.75 ac				
Runoff Volume	0.9 ac-ft				
<u>Proposed Runoff Volume</u>					
Runoff Depth (From TR-55)	15.31 in				
Area	0.75 ac				
Runoff Volume	1.0 ac-ft				
<u>Increase in Runoff Volume</u>					
	0.1 ac-ft				
	2,532 cu-ft				
	1,286 sq basin area (8" deep)				
<u>24-Hour Peak Runoff</u>					
Existing 24-hour Peak Runoff	8				
Proposed 24-Hour Peak Runoff	9				
Increase in 24-Hour Peak Runoff	1				

Princeville Subdivision Runoff Calculations Typical House Site 7/30/2009					
House Site Area	0.75 ac				
100-Year, 24-Hour Rain Fall	18 in				
<u>Soil Type</u>					
Rough Broken Land (rRR)	Hydrologic Group	C			
<u>Existing Curve Number</u>					
Land use	Hydrologic Group	CN			
Pasture or Range Land - Good Condition	C				74
<u>Proposed Curve Number</u>					
Land use	Hydrologic Group	CN			
Residential (25% Impervious)	C				80
<u>Existing Time of Concentration</u>					
Length (ft)	Velocity (fps)	Tc (min)			
250	3.0 (Pasture)	1			
<u>Proposed Time of Concentration</u>					
Length (ft)	Velocity (fps)	Tc (min)			
250	3.0 (Pasture)	1			

Project : Princeville Subdivision
 County : Kauai
 Subtitle: House Site - Existing Condition
 State: HI
 User: MN
 Checked: _____
 Date: 07-30-2009
 Date: _____

Data: Drainage Area : .75 Acres
 Runoff Curve Number : 74
 Time of Concentration: 0.10 Hours
 Rainfall Type : I
 Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	18
Ia/P Ratio	0.04
	Used
Runoff (in)	14.38
Unit Peak Discharge (cfs/acre/in)	0.787
Pond and Swamp Factor	1.00
0.0% Ponds Used	
Peak Discharge (cfs)	8

0

Project : Princeville Subdivision
 County : Kauai
 Subtitle: House Site - Proposed Condition
 State: HI
 User: MN
 Checked: _____
 Date: 07-30-2009
 Date: _____

Data: Drainage Area : .75 Acres
 Runoff Curve Number : 80
 Time of Concentration: 0.10 Hours
 Rainfall Type : I
 Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	18
Ia/P Ratio	0.03
	Used
Runoff (in)	15.31
Unit Peak Discharge (cfs/acre/in)	0.787
Pond and Swamp Factor	1.00
0.0% Ponds Used	
Peak Discharge (cfs)	9

0

Princetonville Subdivision									
Runoff Calculations									
Petition Area									
7/30/2009									
	Petition Area		120 ac						
	100-Year, 24-Hour Rain Fall		18 in						
	Soil Type			Hydrologic Group	B				
	MaKapili (MeB, MeC, MeD, MeE)								
	Existing Curve Number			Hydrologic Group	CN				
	Land Use								
	Pasture or Range Land - Good Condition				B	61			
	Proposed Curve Number			Hydrologic Group					
	Land Use								
	Residential (25% Impervious)				B	70	12 (16 house sites @ 0.75 ac ea)		
	Impervious (Paved Road)				B	95	3		
	Pasture or Range Land - Good Condition				B	61	105		
	Composite				say	62.8			
						63			
	Existing Time of Concentration								
	Length (ft)			Velocity (fps)	Tc (min)				
	Slope								
	3,750		4.6%	3.0 (Pasture)	21				
	Proposed Time of Concentration								
	Length (ft)			Velocity (fps)	Tc (min)				
	Slope								
	3,750		4.6%	3.0 (Pasture)	21				

Princetonville Subdivision									
Runoff Calculations									
Petition Area									
7/30/2009									
	Existing Runoff Volume								
	Runoff Depth (From TR-55)		12.1 in						
	Area		120 ac						
	Runoff Volume		121.0 ac-ft						
	Proposed Runoff Volume								
	Runoff Depth (From TR-55)		12.47 in						
	Area		120 ac						
	Runoff Volume		124.7 ac-ft						
	Increase in Runoff Volume		3.7 ac-ft						
	24-Hour Peak Runoff								
	Existing 24-hour Peak Runoff		743						
	Proposed 24-Hour Peak Runoff		766						
	Increase in 24-Hour Peak Runoff		23						

PET-EX-PRN
GRAPHICAL PEAK DISCHARGE METHOD

Version 2.10

Project : Princeville subdivision
 County : Kauai
 Subtitle: Petition Area - Existing Condition

User: MN
 Checked: _____

Date: 07-30-2009
 Date: _____

Data: Drainage Area : 120 Acres
 Runoff Curve Number : 61
 Time of Concentration: 0.35 Hours
 Rainfall Type : I
 Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	18
Ia/P Ratio	0.07
	Used
Runoff (in)	12.10
Unit Peak Discharge (cfs/acre/in)	0.512
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	743

0

PET-PRO-PRN
GRAPHICAL PEAK DISCHARGE METHOD

Version 2.10

Project : Princeville subdivision
 County : Kauai
 Subtitle: Petition Area - Proposed Condition

User: MN
 Checked: _____

Date: 07-30-2009
 Date: _____

Data: Drainage Area : 120 Acres
 Runoff Curve Number : 63
 Time of Concentration: 0.35 Hours
 Rainfall Type : I
 Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	18
Ia/P Ratio	0.07
	Used
Runoff (in)	12.47
Unit Peak Discharge (cfs/acre/in)	0.512
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	766

0

Princeville Subdivision Runoff Calculations Petition Area (Western Drain Area) 7/30/2009									
Petition Area (Western Drain Area) 100-Year, 24-Hour Rain Fall				53 ac 18 in					
Soil Type Makapiti (MeB, MeC, MeD, MeE)				Hydrologic Group	B				
Existing Curve Number									
Land Use Pasture or Range Land - Good Condition					Hydrologic Group	CN	61		
Proposed Curve Number									
Land Use Residential (25% Impervious) Impervious (Paved Road) Pasture or Range Land - Good Condition					Hydrologic Group	CN	Area (ac)	6 0.75 ac ea	
Composite						say	63		
Existing Time of Concentration									
Length (ft)				Slope (fps)	Velocity (fps)	Tc (min)			
3,000	7.9%	4.0 (Pasture)			13				
Proposed Time of Concentration									
Length (ft)				Slope (fps)	Velocity (fps)	Tc (min)			
3,000	7.9%	4.0 (Pasture)			13				

Princeville Subdivision Runoff Calculations Petition Area (Western Drain Area) 7/30/2009									
Existing Runoff Volume									
Runoff Depth (From TR-55) Area				12.1 in 53 ac					
Runoff Volume					53.5 ac-ft				
Proposed Runoff Volume									
Runoff Depth (From TR-55) Area				12.47 in 53 ac					
Runoff Volume					55.1 ac-ft				
Increase in Runoff Volume									
Increase in Runoff Volume					1.6 ac-ft				
24-Hour Peak Runoff									
Existing 24-hour Peak Runoff					392				
Proposed 24-Hour Peak Runoff					404				
Increase in 24-Hour Peak Runoff					12				

Project : Princeville Subdivision
 County : Kauai
 Subtitle: Petition Area (West) Existing Condition

Date: 07-30-2009
 Date: _____

State: HI
 User: MN
 Checked: _____

Data: Drainage Area : 53 Acres
 Runoff Curve Number : 61
 Time of Concentration: 0.22 Hours
 Rainfall Type : I
 Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	18
Ia/P Ratio	0.07
	Used
Runoff (in)	12.10
Unit Peak Discharge (cfs/acre/in)	0.612
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	392

0

Project : Princeville Subdivision
 County : Kauai
 Subtitle: Petition Area (West) Proposed Condition

Date: 07-30-2009
 Date: _____

State: HI
 User: MN
 Checked: _____

Data: Drainage Area : 53 Acres
 Runoff Curve Number : 63
 Time of Concentration: 0.22 Hours
 Rainfall Type : I
 Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	18
Ia/P Ratio	0.07
	Used
Runoff (in)	12.47
Unit Peak Discharge (cfs/acre/in)	0.612
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	404

0

Princeville Subdivision Runoff Calculations Petition Area (Eastern Drain Area) 7/30/2009									
Petition Area (Eastern Drain Area) 100-Year, 24-Hour Rain Fall			67 ac 18 in						
Soil Type Makapili (MeB, MeC, MeD, MeE)		Hydrologic Group B							
Existing Curve Number		Hydrologic Group CN							
Land Use Pasture or Range Land - Good Condition		B		CN		61			
Proposed Curve Number		Hydrologic Group		CN		Area (ac)			
Residential (25% Impervious) Impervious (Paved Road)		B		70		6 (8 house sites @ 0.75 ac ea)			
Pasture or Range Land - Good Condition		B		95		2			
Composite		say		61		59			
Composite		say		62.8		63			
Existing Time of Concentration									
Length (ft)		Slope		Velocity (fps)		Tc (min)			
3,750		4.6%		3.0 (Pasture)		21			
Proposed Time of Concentration									
Length (ft)		Slope		Velocity (fps)		Tc (min)			
3,750		4.6%		3.0 (Pasture)		21			

Princeville Subdivision Runoff Calculations Petition Area (Eastern Drain Area) 7/30/2009									
Existing Runoff Volume			12.1 in						
Runoff Depth (From TR-55) Area			67 ac						
Runoff Volume			67.6 ac-ft						
Proposed Runoff Volume			12.47 in						
Runoff Depth (From TR-55) Area			67 ac						
Runoff Volume			69.7 ac-ft						
Increase in Runoff Volume			2.1 ac-ft						
24-Hour Peak Runoff									
Existing 24-hour Peak Runoff			415						
Proposed 24-Hour Peak Runoff			428						
Increase in 24-Hour Peak Runoff			13						

Project : Princeville Subdivision
 County : Kauai
 Subtitle : Petition Area (East) Existing Condition

State: HI
 User: MN
 Checked: _____

Date: 07-30-2009
 Date: _____

Data: Drainage Area : 67 Acres
 Runoff Curve Number : 61
 Time of Concentration: 0.35 Hours
 Rainfall Type : I
 Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	18
Ia/P Ratio	0.07
Used	0.10
Runoff (in)	12.10
Unit Peak Discharge (cfs/acre/in)	0.512
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	415

0

Project : Princeville Subdivision
 County : Kauai
 Subtitle : Petition Area (East) Proposed Condition

State: HI
 User: MN
 Checked: _____

Date: 07-30-2009
 Date: _____

Data: Drainage Area : 67 Acres
 Runoff Curve Number : 63
 Time of Concentration: 0.35 Hours
 Rainfall Type : I
 Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	18
Ia/P Ratio	0.07
Used	0.10
Runoff (in)	12.47
Unit Peak Discharge (cfs/acre/in)	0.512
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	428

0

Project : Princeville Subdivision
 County : Kauai
 Subtitle: Regional Drainage - Anini Gulch - Existing Condition
 State: HI
 User: MN
 Checked: _____
 Date: 07-30-2009
 Date: _____

Data: Drainage Area : 1300 Acres
 Runoff Curve Number : 61
 Time of Concentration: 3.35 Hours
 Rainfall Type : I
 Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	20
Ia/P Ratio	0.06
	Used
Runoff (in)	13.96
Unit Peak Discharge (cfs/acre/in)	0.157
Pond and Swamp Factor	1.00
0.0% Ponds Used	
Peak Discharge (cfs)	2855

Princeville Subdivision Runoff Calculations Regional Drainage - Anini Gulch 7/30/2009	1,300 ac 20 in	Hydrologic Group B	Area (ac)	61	6 (7 house sites @ 0.75 ac ea)
Anini Gulch Tributary Area 100-Year, 24-Hour Rain Fall					
Soil Type Pooku (pmB,PmC,PmD,PmE) Makapili (MeB,MeC,MeD,MeE)		Hydrologic Group B			
Existing Curve Number					
Land use		Hydrologic Group CN			
Pasture or Range Land - Good Condition				61	
Proposed Curve Number					
Land use		Hydrologic Group CN			
Residential (25% Impervious)				70	
Impervious (Paved Road)				95	1
Pasture or Range Land - Good Condition				61	1,293
Composite				61.1	
				62	
Existing Time of Concentration					
Length (ft)	Velocity (fps)	Tc (min)			
36,250	3.1%	3.0 (Pasture)	201		
Proposed Time of Concentration					
Length (ft)	Velocity (fps)	Tc (min)			
36,250	3.1%	3.0 (Pasture)	201		
24-Hour Peak Runoff					
Existing 24-hour Peak Runoff					2,855
Proposed 24-Hour Peak Runoff					2,895
Increase in 24-Hour Peak Runoff					40

Project : Princeville subdivision
 County : Kauai
 State: HI
 Subtitle: Regional Drainage - Anini Gulch - Proposed Condition

User: MN
 Checked: _____
 Date: _____

Data: Drainage Area : 1300 Acres
 Runoff Curve Number : 62
 Time of Concentration: 3.35 Hours
 Rainfall Type : I
 Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	20
Ia/P Ratio	0.06
Used	0.10
Runoff (in)	14.15
Unit Peak Discharge (cfs/acre/in)	0.157
Pond and Swamp Factor	1.00
0.0% Ponds Used	
Peak Discharge (cfs)	2895

Princeville Subdivision Runoff Calculations Regional Drainage - Watershed A 7/30/2009	Watershed A Tributary Area 100-Year, 24-Hour Rain Fall 330 ac 18 in	Soil Type Makapili (MeB, MeC, MeD, MeE)	Hydrologic Group B	Area (ac)	Hydrologic Group	Area (ac)
Existing Curve Number						
Land Use				CN		
Pasture or Range Land - Good Condition			B	61		
Proposed Curve Number						
Land Use				CN		
Residential (25% Impervious)			B	70		26 (34 house sites @ 0.75 ac ea)
Impervious (Paved Road)			B	95		5
Pasture or Range Land - Good Condition			B	61		299
Composite			say	62.2		
Existing Time of Concentration						
Length (ft)	Velocity (fps)		Tc (min)			
5,430	6.1%	3.0 (Pasture)	30			
Proposed Time of Concentration						
Length (ft)	Velocity (fps)		Tc (min)			
5,430	6.1%	3.0 (Pasture)	30			
24-Hour Peak Runoff						
Existing 24-hour Peak Runoff					1,757	
Proposed 24-Hour Peak Runoff					1,811	
Increase in 24-Hour Peak Runoff					54	

Project : Princeville subdivision
 County : Kauai
 Subtitle: Regional Drainage - watershed A - Existing Condition

State: HI
 User: MN
 Checked: _____

Date: 07-30-2009
 Date: _____

Data: Drainage Area : 330 Acres
 Runoff Curve Number : 61
 Time of Concentration: 0.50 Hours
 Rainfall Type : I
 Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	18
Ia/P Ratio	0.07
Used	0.10
Runoff (in)	12.10
Unit Peak Discharge (cfs/acre/in)	0.440
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	1757

0

Project : Princeville subdivision
 County : Kauai
 Subtitle: Regional Drainage - watershed A - Proposed Condition

State: HI
 User: MN
 Checked: _____

Date: 07-30-2009
 Date: _____

Data: Drainage Area : 330 Acres
 Runoff Curve Number : 63
 Time of Concentration: 0.50 Hours
 Rainfall Type : I
 Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	18
Ia/P Ratio	0.07
Used	0.10
Runoff (in)	12.47
Unit Peak Discharge (cfs/acre/in)	0.440
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	1811

0

Project : Princeville Subdivision
 County : Kauai
 Subtitle: Regional Drainage - Watershed B - Proposed Condition

Data: Drainage Area : 144 Acres
 Runoff Curve Number : 62
 Time of Concentration: 0.70 Hours
 Rainfall Type : I
 Pond and Swamp Area : NONE

State: HI User: MN
 Checked: _____
 Date: _____

```

=====
Storm Number      : 1
-----
Frequency (yrs)   : 100
-----
24-Hr Rainfall (in) : 18
-----
Ia/P Ratio        : 0.07
-----
Used              : 0.10
-----
Runoff (in)       : 12.29
-----
Unit Peak Discharge (cfs/acre/in) : 0.377
-----
Pond and Swamp Factor : 1.00
0.0% Ponds Used
-----
Peak Discharge (cfs) : 667
=====
    
```

Princeville Subdivision Runoff Calculations Regional Drainage - Watershed C 7/30/2009	Watershed B Tributary Area 100-Year, 24-Hour Rain Fall 300 ac 18 in	Soil Type Makapili (MeB, MeC, MeD, MeE)	Hydrologic Group B	Existing Curve Number	Land Use Pasture or Range Land - Good Condition	Hydrologic Group B	Area (ac)	61
Proposed Curve Number								
Land Use								
Proposed Curve Number								
Land Use								
Residential (25% Impervious)								
Impervious (Paved Road)								
Pasture or Range Land - Good Condition								
Composite								
								61.8
								62
Existing Time of Concentration								
Length (ft)								
Slope								
Velocity (fps)								
Tc (min)								
9,570								4.0%
3.0 (Pasture)								53
Proposed Time of Concentration								
Length (ft)								
Slope								
Velocity (fps)								
Tc (min)								
9,570								4.0%
3.0 (Pasture)								53
24-Hour Peak Runoff								
Existing 24-hour Peak Runoff								1,223
Proposed 24-Hour Peak Runoff								1,242
Increase in 24-Hour Peak Runoff								19

Project : Princeville Subdivision
 County : Kauai
 Subtitle : regional Drainage - Watershed C - Existing Condition

Date: 07-30-2009
 Date: _____

User: MN
 Checked: _____

Data: Drainage Area : 300 Acres
 Runoff Curve Number : 61
 Time of Concentration: 0.88 Hours
 Rainfall Type : I
 Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	18
Ia/P Ratio	0.07
	Used
Runoff (in)	12.10
Unit Peak Discharge (cfs/acre/in)	0.337
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	1223

0

Project : Princeville Subdivision
 County : Kauai
 Subtitle : regional Drainage - Watershed C - Proposed Condition

Date: 07-30-2009
 Date: _____

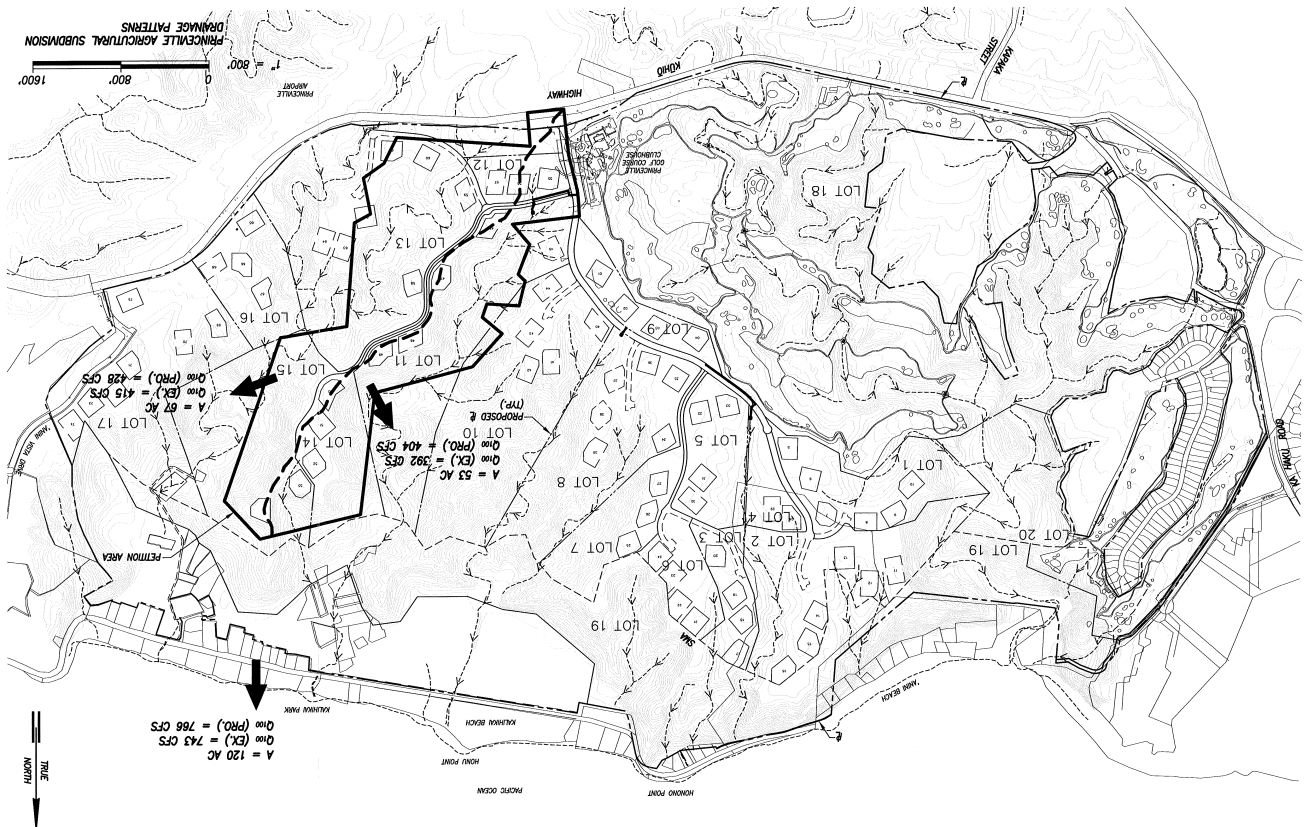
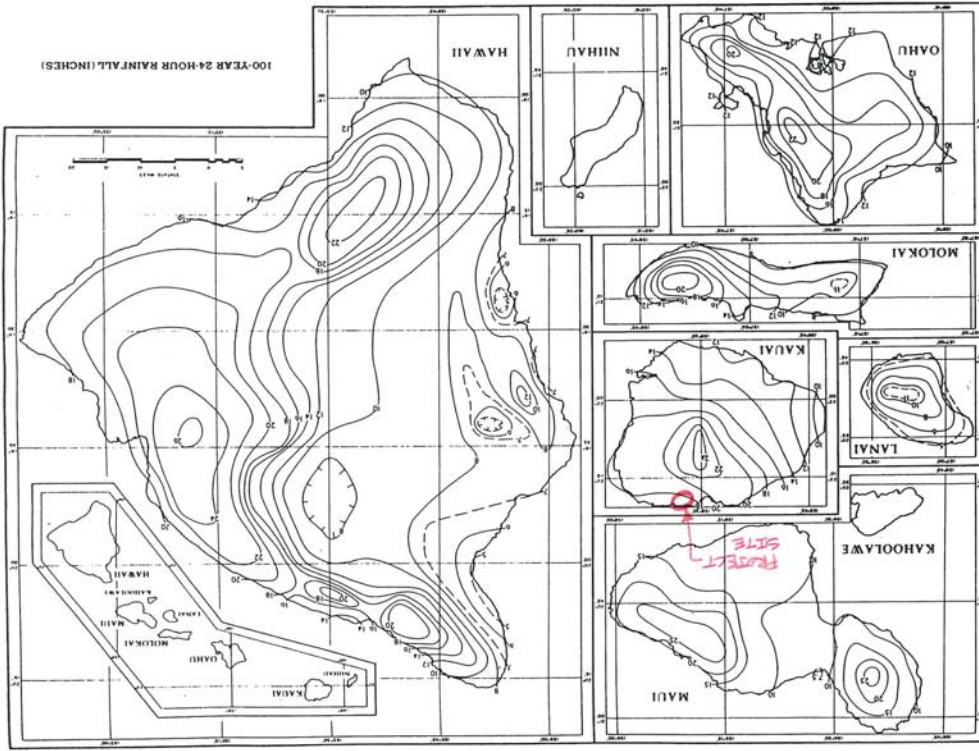
User: MN
 Checked: _____

Data: Drainage Area : 300 Acres
 Runoff Curve Number : 62
 Time of Concentration: 0.88 Hours
 Rainfall Type : I
 Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	18
Ia/P Ratio	0.07
	Used
Runoff (in)	12.29
Unit Peak Discharge (cfs/acre/in)	0.337
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	1242

0

Figure 56—100-yr. 24-hr. rainfall (in.)



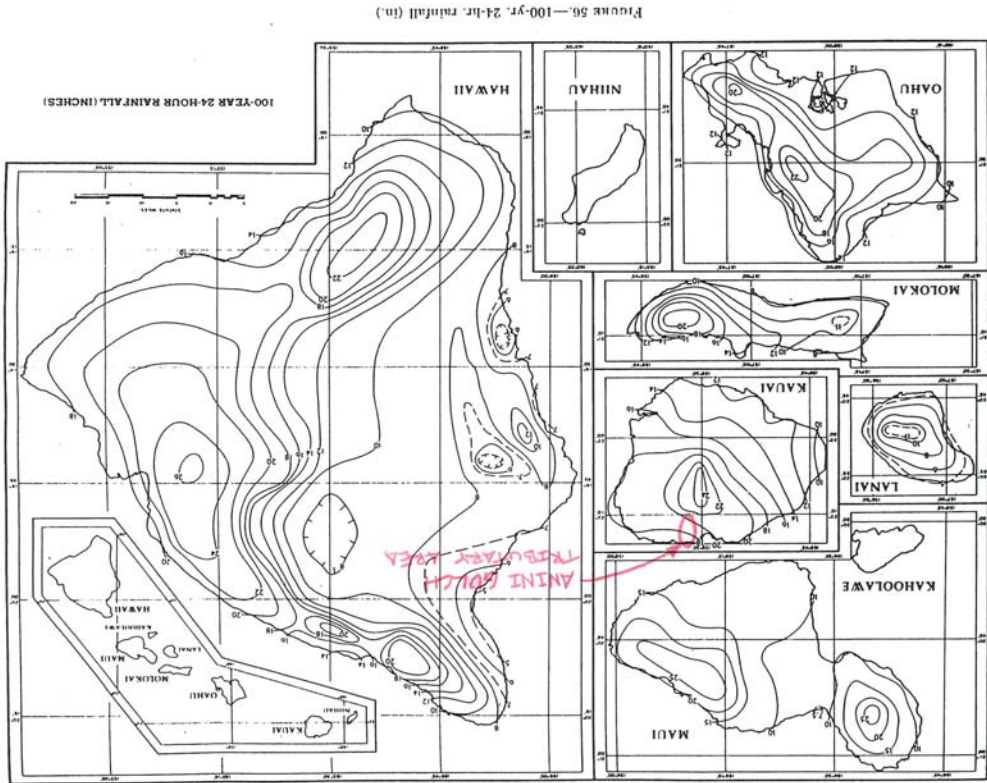


Figure 5b.—100-yr. 24-hr. rainfall (in.)

Princeville Subdivision Soil Classification 7/30/2009	
Existing Soil	Hydrologic Group
rRR	C
MeB	B
MeC	B
MeD	B
MeE	B
PmB	B
PmC	B
PmD	B
PmE	B
Ultimate Buildout	
Primary Soil Type: rRR	
Use Hydrologic Group C	
Petition Area	
Primary Soil Type: MeB, MeC, MeD, MeE	
Use Hydrologic Group B	
Anini Gulch	
Primary Soil Type: MeB, MeC, MeD, MeE, PmB, PmC, PmD, PmE	
Use Hydrologic Group B	
Watershed A, B, C	
Primary Soil Type: MeB, MeC, MeD, MeE	
Use Hydrologic Group B	

TABLE 15. Runoff curve numbers for selected agricultural, suburban, and urban land use

Land use description	Hydrologic soil group			
	A	B	C	D
Cultivated land ¹				
without conservation treatment	72	81	88	91
with conservation treatment	62	71	78	81
Pasture or range land				
poor condition	68	79	86	89
good condition	39	61	74	80
Meadow				
good condition	30	58	71	78
Wood or Forest land				
thin stand, poor cover, no mulch	45	66	77	83
good cover	25	55	70	77
Open Spaces, lawns, parks, golf courses, cemeteries, etc.				
grass cover on 75% or more of the area	39	61	74	80
grass cover on 50% to 75% of the area	49	69	79	84
Commercial and business areas (85% impervious)	89	92	94	95
Industrial districts (72% impervious).	81	88	91	93
Residential ¹				
Average lot size				
% acre or less	65	77	85	90
% acre	38	61	75	83
% acre	30	57	72	81
% acre	25	54	70	80
1 acre	20	51	68	79
Average % Impervious ²				
Paved parking lots, roofs, driveways ² etc.	95	95	95	95
Streets and roads	95	95	95	95
paved with curbs and storm sewers	95	95	95	95
gravel	76	85	89	91
dirt	72	82	87	89

1. For a more detailed description of agricultural land use curve numbers refer to National Engineering Handbook, Section 4, Hydrology, Chapter 9, Aug. 1972.
2. Good cover is protected from grazing and litter and brush cover soil.
3. Curve numbers are computed assuming the runoff from the house and driveway is directed to the street with a minimum of roof water directed to lawns where additional infiltration could occur.
4. The remaining pervious areas (lawn) are considered to be in good pasture condition for these curve numbers.

Soil Properties Related to Erosion and Sedimentation
For the Islands of
Kauai, Oahu, Maui, Molokai, and Lanai 1/
July 1993

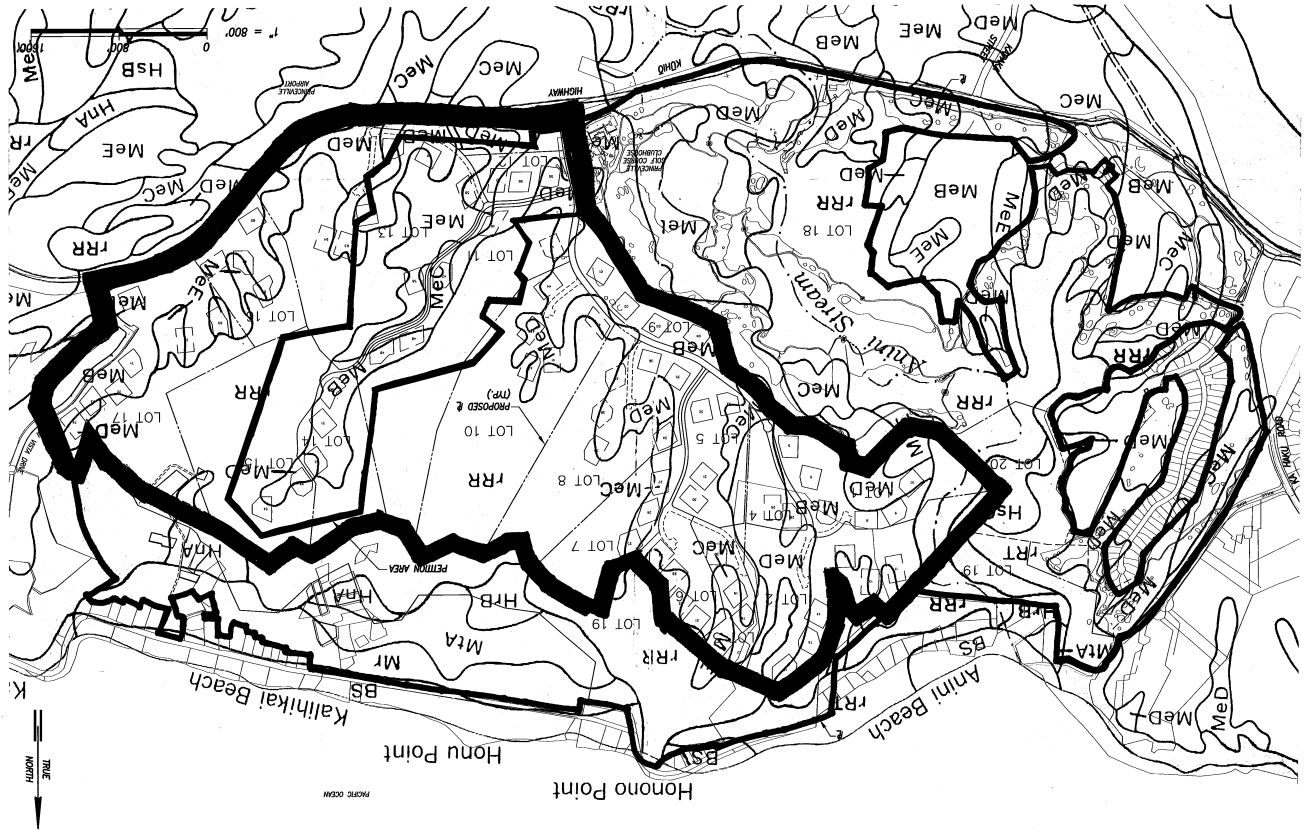
Soil Symbol	Soil Series or Miscellaneous Land Type	Erosion Factors		Hydrologic Group	Erosion Resistance Group
		K	T (t/a/yr)		
UXB	WAIHEE	0.10	5	B	II
UXC	WAIHEE	0.10	5	B	II
UYB	WAIHEE	0.10	5	B	II
UYC	WAIHEE	0.10	5	B	II
UZA	WAIPIHU	0.28	5	C	II
UZB	WAIPIHU	0.28	5	C	II
UZC	WAIPIHU	0.28	5	C	II
UZE	WAIPIHU	0.28	5	C	II
UAE	ALAKAI	0.05	5	D	I
UAD	AHALU	0.05	2	D	I
UAC	AHALU	0.05	2	D	I
UAD	AHALU	0.05	2	D	I
UAD	AHALU	0.05	2	D	I
UAC	OLOKU	0.05	2	D	I
UAC	OLOKU	0.05	2	D	I
F01	CHIDER LAND	0.02	5	A	I
F02	HONOHARU	0.05	5	A	I
F03	HONOHARU	0.05	5	A	I
F04	HONOHARU	0.05	5	A	I
F05	HONOHARU	0.05	5	A	I
F06	HONOHARU	0.05	5	A	I
F07	HONOHARU	0.05	5	A	I
F08	HONOHARU	0.05	5	A	I
F09	HONOHARU	0.05	5	A	I
F10	HONOHARU	0.05	5	A	I
F11	HONOHARU	0.05	5	A	I
F12	HONOHARU	0.05	5	A	I
F13	HONOHARU	0.05	5	A	I
F14	HONOHARU	0.05	5	A	I
F15	HONOHARU	0.05	5	A	I
F16	HONOHARU	0.05	5	A	I
F17	HONOHARU	0.05	5	A	I
F18	HONOHARU	0.05	5	A	I
F19	HONOHARU	0.05	5	A	I
F20	HONOHARU	0.05	5	A	I
F21	HONOHARU	0.05	5	A	I
F22	HONOHARU	0.05	5	A	I
F23	HONOHARU	0.05	5	A	I
F24	HONOHARU	0.05	5	A	I
F25	HONOHARU	0.05	5	A	I
F26	HONOHARU	0.05	5	A	I
F27	HONOHARU	0.05	5	A	I
F28	HONOHARU	0.05	5	A	I
F29	HONOHARU	0.05	5	A	I
F30	HONOHARU	0.05	5	A	I
F31	HONOHARU	0.05	5	A	I
F32	HONOHARU	0.05	5	A	I
F33	HONOHARU	0.05	5	A	I
F34	HONOHARU	0.05	5	A	I
F35	HONOHARU	0.05	5	A	I
F36	HONOHARU	0.05	5	A	I
F37	HONOHARU	0.05	5	A	I
F38	HONOHARU	0.05	5	A	I
F39	HONOHARU	0.05	5	A	I
F40	HONOHARU	0.05	5	A	I
F41	HONOHARU	0.05	5	A	I
F42	HONOHARU	0.05	5	A	I
F43	HONOHARU	0.05	5	A	I
F44	HONOHARU	0.05	5	A	I
F45	HONOHARU	0.05	5	A	I
F46	HONOHARU	0.05	5	A	I
F47	HONOHARU	0.05	5	A	I
F48	HONOHARU	0.05	5	A	I
F49	HONOHARU	0.05	5	A	I
F50	HONOHARU	0.05	5	A	I
F51	HONOHARU	0.05	5	A	I
F52	HONOHARU	0.05	5	A	I
F53	HONOHARU	0.05	5	A	I
F54	HONOHARU	0.05	5	A	I
F55	HONOHARU	0.05	5	A	I
F56	HONOHARU	0.05	5	A	I
F57	HONOHARU	0.05	5	A	I
F58	HONOHARU	0.05	5	A	I
F59	HONOHARU	0.05	5	A	I
F60	HONOHARU	0.05	5	A	I
F61	HONOHARU	0.05	5	A	I
F62	HONOHARU	0.05	5	A	I
F63	HONOHARU	0.05	5	A	I
F64	HONOHARU	0.05	5	A	I
F65	HONOHARU	0.05	5	A	I
F66	HONOHARU	0.05	5	A	I
F67	HONOHARU	0.05	5	A	I
F68	HONOHARU	0.05	5	A	I
F69	HONOHARU	0.05	5	A	I
F70	HONOHARU	0.05	5	A	I
F71	HONOHARU	0.05	5	A	I
F72	HONOHARU	0.05	5	A	I
F73	HONOHARU	0.05	5	A	I
F74	HONOHARU	0.05	5	A	I
F75	HONOHARU	0.05	5	A	I
F76	HONOHARU	0.05	5	A	I
F77	HONOHARU	0.05	5	A	I
F78	HONOHARU	0.05	5	A	I
F79	HONOHARU	0.05	5	A	I
F80	HONOHARU	0.05	5	A	I
F81	HONOHARU	0.05	5	A	I
F82	HONOHARU	0.05	5	A	I
F83	HONOHARU	0.05	5	A	I
F84	HONOHARU	0.05	5	A	I
F85	HONOHARU	0.05	5	A	I
F86	HONOHARU	0.05	5	A	I
F87	HONOHARU	0.05	5	A	I
F88	HONOHARU	0.05	5	A	I
F89	HONOHARU	0.05	5	A	I
F90	HONOHARU	0.05	5	A	I
F91	HONOHARU	0.05	5	A	I
F92	HONOHARU	0.05	5	A	I
F93	HONOHARU	0.05	5	A	I
F94	HONOHARU	0.05	5	A	I
F95	HONOHARU	0.05	5	A	I
F96	HONOHARU	0.05	5	A	I
F97	HONOHARU	0.05	5	A	I
F98	HONOHARU	0.05	5	A	I
F99	HONOHARU	0.05	5	A	I
F00	HONOHARU	0.05	5	A	I

- 1/ Replaces Table 14 in Erosion and Sediment Control Guide for Hawaii (1981).
- 2/ A soil symbol that is repeated indicates the soil map unit has two or more components. See the soil survey to obtain percentage of each component, or make on-site determination.

TABLE 35. Runoff curve numbers for selected agricultural, suburban, and urban land use

Land use description	Hydrologic soil group			
	A	B	C	D
Cultivated land ¹				
without conservation treatment	72	81	88	91
with conservation treatment	62	71	78	81
Pasture or range land				
poor condition	68	79	86	89
good condition	39	61	74	80
Meadow				
good condition	30	58	71	78
thin stand, poor cover, no mulch	45	66	77	83
good cover ²	25	55	70	77
Open Spaces, lawns, parks, golf courses, cemeteries, etc.				
grass cover on 75% or more of the area	39	61	74	80
fair condition	49	69	79	84
grass cover on 50% to 75% of the area	89	92	94	95
Commercial and business areas (85% impervious)				
Industrial districts (72% impervious).	81	88	91	93
Residential ³				
Average lot size				
1/2 acre or less	77	85	90	92
1/4 acre	61	75	83	87
3/8 acre	57	72	81	86
1/2 acre	54	70	80	85
1 acre	51	68	79	84
Paved parking lots, roofs, driveways ⁴ etc.	95	95	95	95
Streets and roads				
paved with curbs and storm sewers	95	95	95	95
gravel	76	85	89	91
dirt	72	82	87	89

1. For a more detailed description of agricultural land use curve numbers refer to National Engineering Handbook, Section 4, Hydrology, Chapter 9, Aug. 1972.
 2. Curve numbers are computed assuming the runoff from the house and driveway is directed towards the street with a minimum of roof water directed to lawns where additional infiltration could occur.
 3. The remaining pervious areas (lawn) are considered to be in good pasture condition for these curve numbers.
 4. The remaining pervious areas (lawn) are considered to be in good pasture condition for these curve numbers.



APPENDIX C

RETENTION BASIN SIZING FOR INDIVIDUAL HOUSE SITES

By

Esaki Surveying and Mapping, Inc.

RETENTION BASIN SIZING FOR INDIVIDUAL HOUSE SITES
LOT 2-A-1, PRINCEVILLE PHASE II

Owner: Princeville Prince Golf Course LLC
Tax Map Key: (4) 5-3-06: 01, 14
Date: May 2009



Brandon K. Fujishige

This work was prepared by
me or under my supervision
Expires: April 30, 2010

ESAKI SURVEYING & MAPPING, INC.
1610 Haleukana Street
Lihue, Kauai, Hawaii 96766

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III. Retention Basin Sizing	9 - 21
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I. FACTS SHEET

FACTS SHEET

General Location and Description

1. Name of town: Hanalei
2. Tax Map Key: (4) 5-3-06: 01, 14
3. Names of local streets within and adjacent to the proposed project: Kuhio Highway and Anini Road
4. Identification of major and local drainageways, facilities, and/or easements within and adjacent to the proposed project: see Location Map (sheet 7)
5. Names of surrounding developments: Princeville Subdivision to the west
6. Flood information: See this report
7. Property Boundaries: see Location Map (sheet 7)
8. Area of property in acres: 872.29 acres
9. Ground cover (type of trees, shrubs, vegetation, general soil conditions, topography and average slope); typical pasture; see Site Map (sheet 8) for topography and slope
10. General project description: the project involves the construction of subdivision infrastructure – roads, drainage system, water lines, underground electric/telephone/cable, etc.
11. Proposed land use: agricultural

Hydrologic map and data for the existing drainage condition

N/A

Hydrologic map and data for the proposed onsite and offsite drainage improvements

See Appendix B for proposed drainage improvements

Drainage Report Items

1. Plan and profile of proposed onsite and offsite drainage improvements: N/A
2. Drainage sub-areas and discharges: N/A
3. Catch basin/drain inlet interception and bypass rates: N/A
4. Street flooding or dry pavement widths: N/A
5. Design flows between manholes and catch basin inlets: N/A
6. Hydraulic grade lines in culverts, manholes and catch basin inlets: N/A

7. Hydraulic grade lines and velocities at outlet structures: N/A
8. Detention basin hydrology and hydraulics: N/A
9. Drainageway and building setback lines and/or floodway, flood fringe and flood elevation lines: N/A
10. Description of changes to existing drainage patterns on adjacent and downstream properties and "unreasonable risk": None

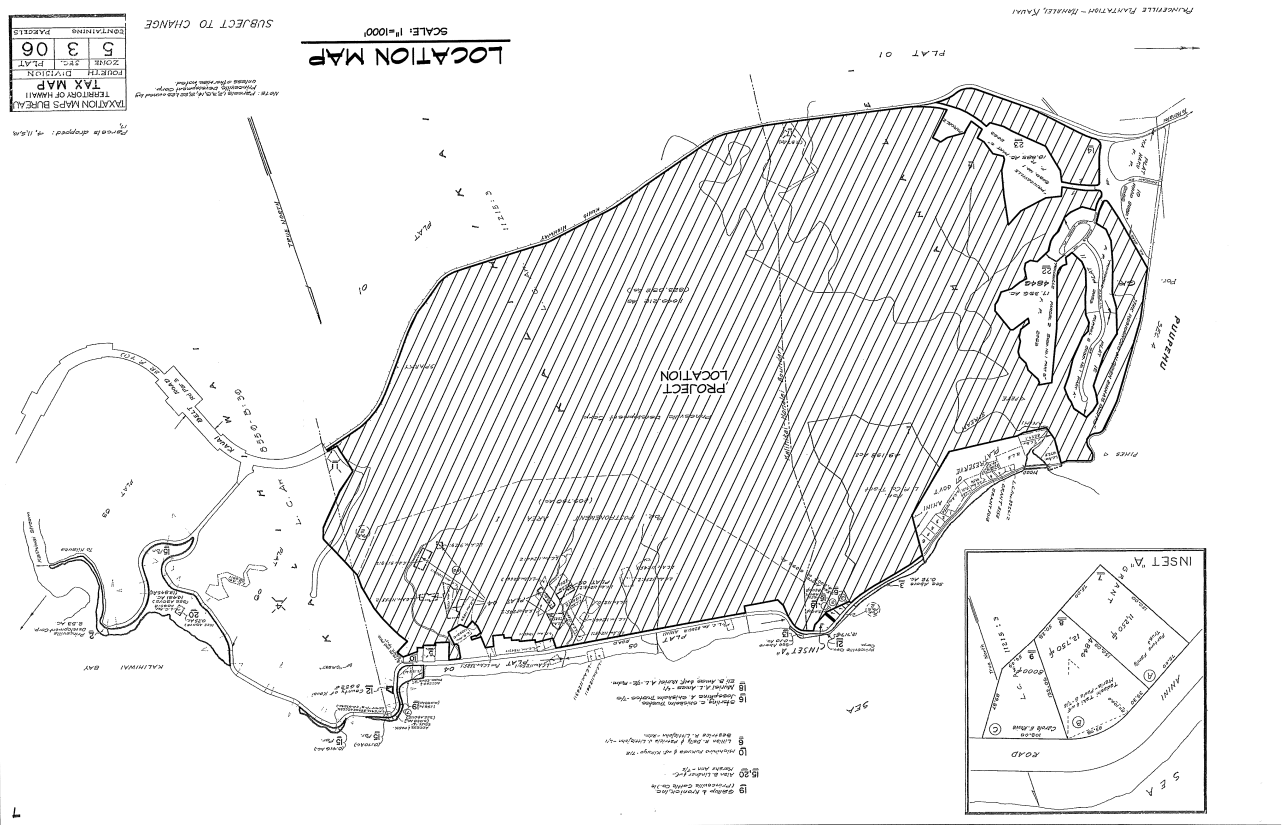
Conclusions

1. Compliance with the MANUAL: Yes
2. The Drainage Concept will not adversely affect adjacent and downstream properties: Yes

II. PURPOSE

PURPOSE

The purpose of this report is to size and analyze a generic retention basin system for the individual house sites. House site 46 was used for sizing purposes because it is the largest site and would require the largest retention basin system.



III. RETENTION BASIN SIZING

RETENTION BASIN SIZING

$$CN_p = [(39.516)(61) + (218)(74)] / 39,734 = 61$$

$$CN_b = [(39.516)(65) + (218)(77)] / 39,734 = 65$$

use min. $T_c = 0.1$ hr.

$$i_{100} = 17.5 \text{ inches}$$

$$Q_p = 11.64 \text{ inches}$$

$$Q_b = 12.37 \text{ inches}$$

$$\Delta Q = Q_b - Q_p = 12.37 - 11.64 = 0.73 \text{ inch} = 0.0608 \text{ feet}$$

$$A = 39,734 \text{ ft}^2$$

$$\text{Storage} = (\Delta Q)(A) = (0.0608)(39,734) = 2,416 \text{ ft}^3$$

The Site Calculator on StormTech's website was used to calculate the required bed size and number of chambers. A 61 ft. by 39 ft. bed with 78 chambers will be required for house site 46.

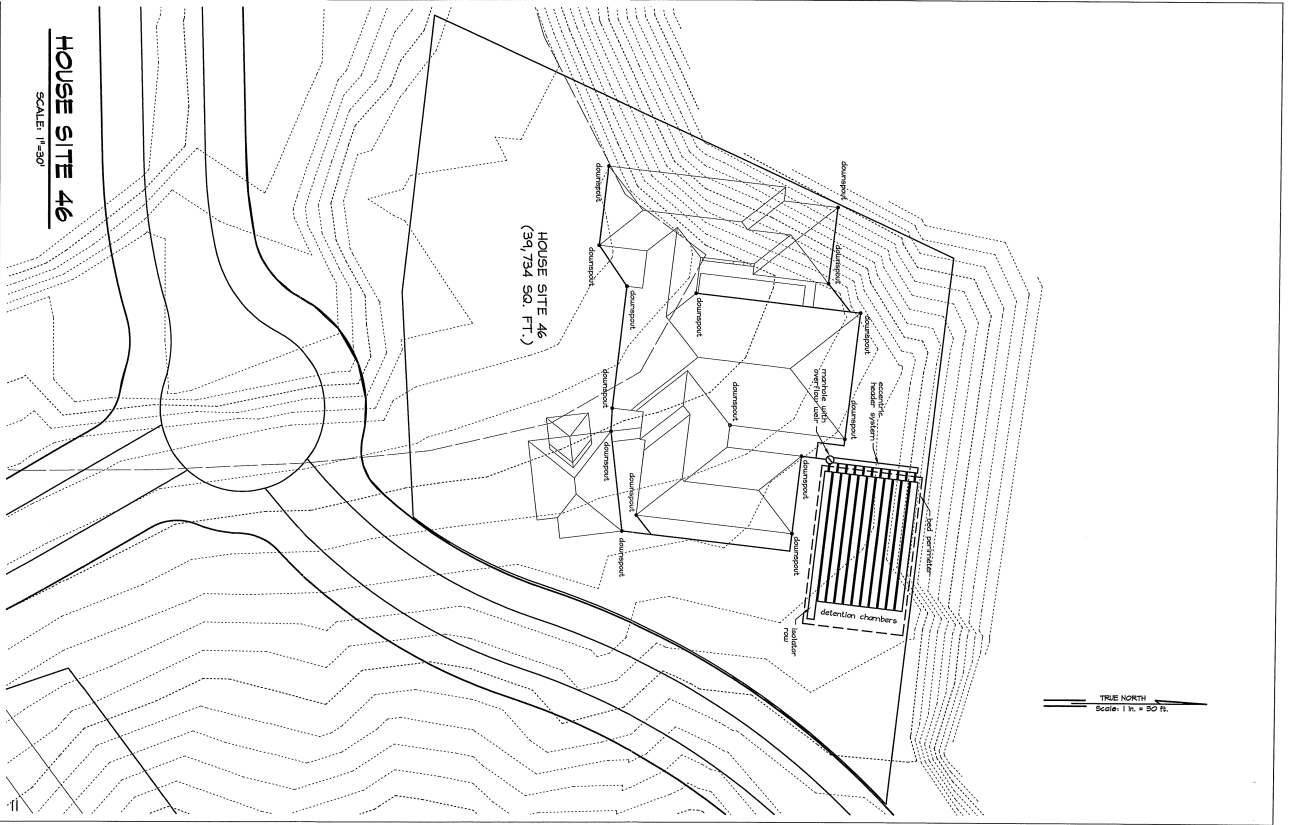
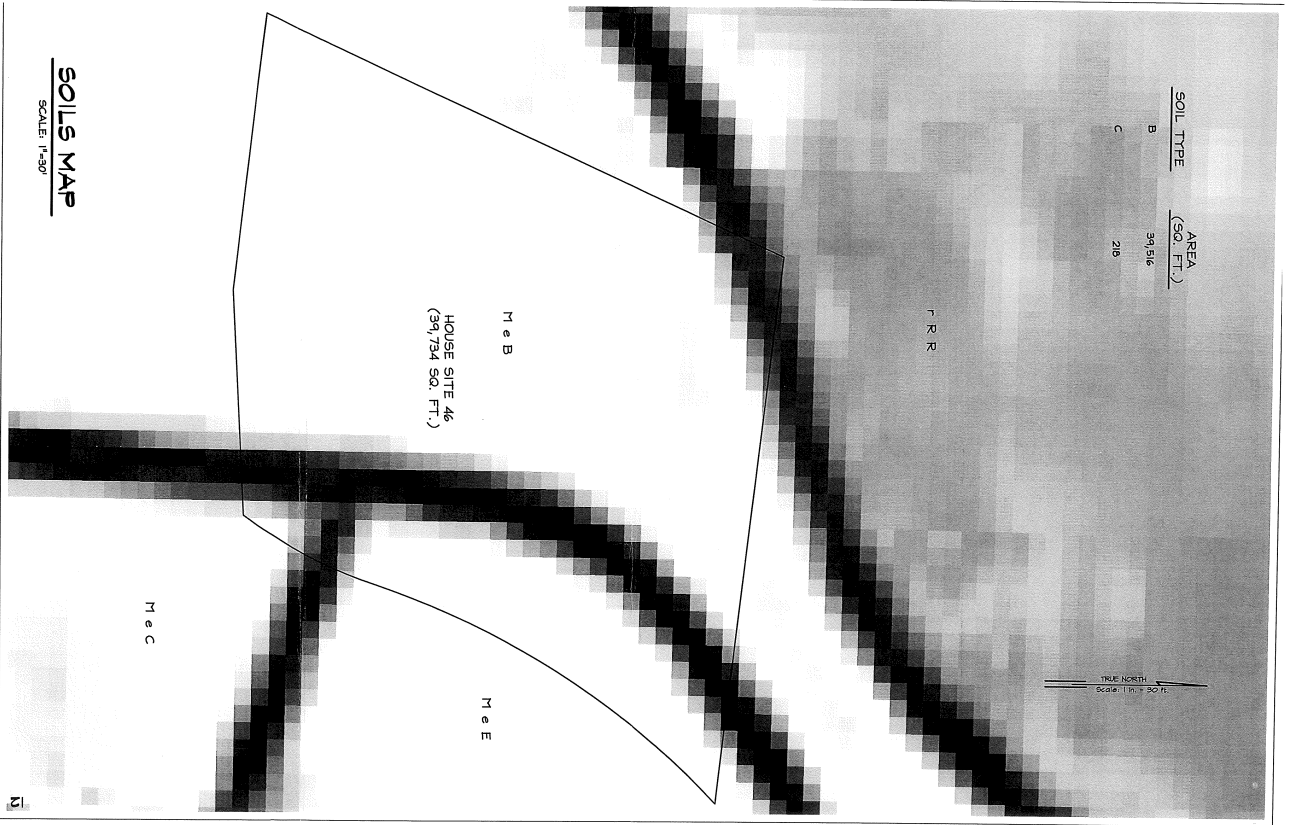


Table 2-2a.—Runoff curve numbers for urban areas¹

Cover description	Average percent impervious area ²	Curve numbers for hydrologic soil group—			
		A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) ³		68	79	86	89
Poor condition (grass cover < 50%)		49	69	79	84
Fair condition (grass cover 50% to 75%)		39	61	74	80
Good condition (grass cover > 75%)					
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) ⁴		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85				
Industrial	72				
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/2 acre	30	57	72	81	86
1 acre	25	54	70	80	85
2 acres	20	51	68	79	84
	12	46	65	77	82

¹Average runoff condition, and $I_p = 0.25$.
²The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open ground hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.
³CN's shown are for urban areas. Landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.
⁴Composite CN's to use for the best temporary measures during grading and construction should be computed using figure 2-3 or 2-4, based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2c.—Runoff curve numbers for other agricultural lands¹

Cover description	Hydrologic condition	Curve numbers for hydrologic soil group—			
		A	B	C	D
Pasture, grassland, or range—continuous forage for grazing²					
Poor	Poor	68	79	86	89
Fair	Fair	49	69	79	84
Good	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay					
Poor	Poor	30	58	71	78
Fair	Fair				
Good	Good				
Brush—brush-weed-grass mixture with brush the major element³					
Poor	Poor	48	67	77	83
Fair	Fair	35	56	70	77
Good	Good	20	48	65	73
Woods—grass combination (orchard or tree farm)⁵					
Poor	Poor	57	73	82	86
Fair	Fair	43	65	76	82
Good	Good	32	53	72	79
Woods⁶					
Poor	Poor	45	66	77	83
Fair	Fair	36	60	73	79
Good	Good	20	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots					
Poor	Poor	59	74	82	86
Fair	Fair				
Good	Good				

¹Average runoff condition, and $I_p = 0.25$.
²Poor: < 50% ground cover or heavily grazed with no mulch.
 Fair: 50 to 75% ground cover and not heavily grazed.
 Good: > 75% ground cover and lightly or only occasionally grazed.
³Poor: < 50% ground cover.
 Fair: 50 to 75% ground cover.
 Good: > 75% ground cover.
⁴Actual curve number is less than 30; use CN = 30 for runoff computations.
⁵CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.
⁶Poor: Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
 Fair: Woods are grazed but not burned, and some forest litter covers the soil.
 Good: Woods are protected from grazing, and litter and brush adequately cover the soil.