

DRAFT

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# ROYAL KUNIA PHASE II SEWER MASTER PLAN UPDATE



Ewa, Oahu, Hawaii

June 15, 2021

PREPARED FOR:

Haseko Royal Kunia LLC  
91-1001 Kaimalie Street, #205  
Ewa Beach, Hawaii 96706



R. M. TOWILL CORPORATION  
SINCE 1930

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EXHIBIT D

**ROYAL KUNIA PHASE II**

**SEWER MASTER PLAN UPDATE**

June 15, 2021

Prepared by:

R. M. Towill Corporation  
2024 North King Street, Suite 200  
Honolulu, Hawaii 96819  
(Ref. No. 1-23345-00)

Prepared for:

Haseko Royal Kunia LLC.  
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## **1. GENERAL**

### **1.1 Background**

Royal Kunia Phase II (RKII) is an approximately 346-acre proposed master planned development and includes the following TMK's: 9-4-002:001, 070, 071, 078 and 079. The proposed development includes commercial and industrial uses, single family and multi-family housing, school, parks, roadways, and utility infrastructure. RKII will include a new sewer system that is intended to be dedicated to the City and County of Honolulu (City).

A Revised Sewer Master Plan for Royal Kunia (revised RKSMP) was prepared by Park Engineering Inc. in May 1996 (See Appendix B). This report updates the previous sewer master plan for the Royal Kunia Development.

Sewer concepts, tributary areas and proposed improvements are based on the existing downstream conditions and current RKII development plan prepared by Haseko Royal Kunia LLC.

### **1.2 Objectives and Scope**

The Objective of this sewer master plan (SMP) is to describe the proposed wastewater improvements needed to support the RKII development.

The scope of this SMP includes RKII improvements within parcels 9-4-002:001, 070, 071, 078 and 079. Offsite developments include the Department of Agriculture (DOA) 24 single family residential units on DLNR agricultural land near the northeast corner of the development, and the Robinson Kunia Land LLC development located east of RKII. The proposed infrastructure shall serve the offsite developments.

### **1.3 Project Location**

RKII is located within the Ewa District on the island of Oahu and is approximately 1.3 miles north of the H-1 Freeway junction at Kunia Road. The project is located northeast of Kunia Road and north of Anoiki Street. The project site is bounded by agricultural land to the north, Waikele Gulch to the east, Anoiki Street and the Royal Kunia Phase I subdivision (RKI) and the Royal Kunia Country Club golf course to the south, and Kunia Road to the west. See **Figure 1-1 and 1-2** for the Regional and Location Map.

#### **1.4 Proposed Development**

The proposed RKII land uses include single family and multi-family residential, commercial, industrial, agricultural, school, and parks. The proposed development contains up to 1850 homes, 123.7 acres of commercial and industrial use, 12 acres of schoolgrounds and at least 9.2 acres of park. See **Figure 1-3** for the proposed conceptual development plan.

#### **1.5 Sustainable Communities Plan**

The project is located within the City's Central Oahu Sustainable Communities Plan (SCP) boundary. The Central Oahu SCP, dated March 2021 section 4.3.1, indicates wastewater treatment shall follow the following general policies:

- *“All new developments in Central Oahu to be connected to a regional or municipal sewer service system.”*
- *“Where feasible, use recycled water recovered from treated wastewater effluent as a source of non-potable water for irrigation and other uses where appropriate and approved by the Department of Health and Board of Water Supply.”*
- *“Locate wastewater treatment plants in areas shown as planned for industrial use and away from residential areas shown on the Urban Land Use Map in Appendix A of the SCP”*
- *Use a City review and approval process which provides adequate public notice and input for any major new private wastewater treatment plant. Do not require such comprehensive review and approval for other system elements, such as pump stations and mains.*

The proposed RKII sewer system supports the City's Central Oahu SCP General Policies indicated above.

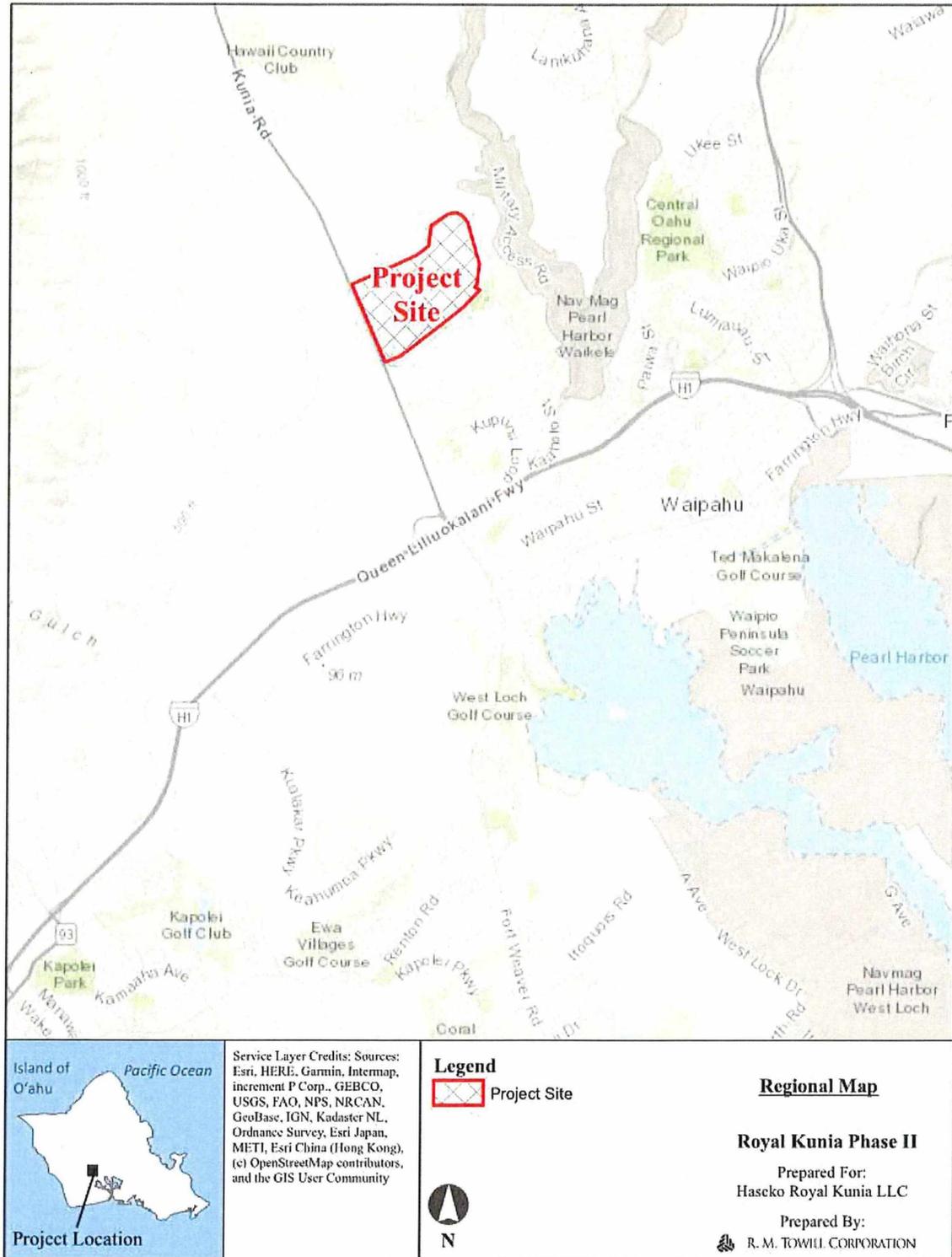


FIGURE 1-1 – Regional Map

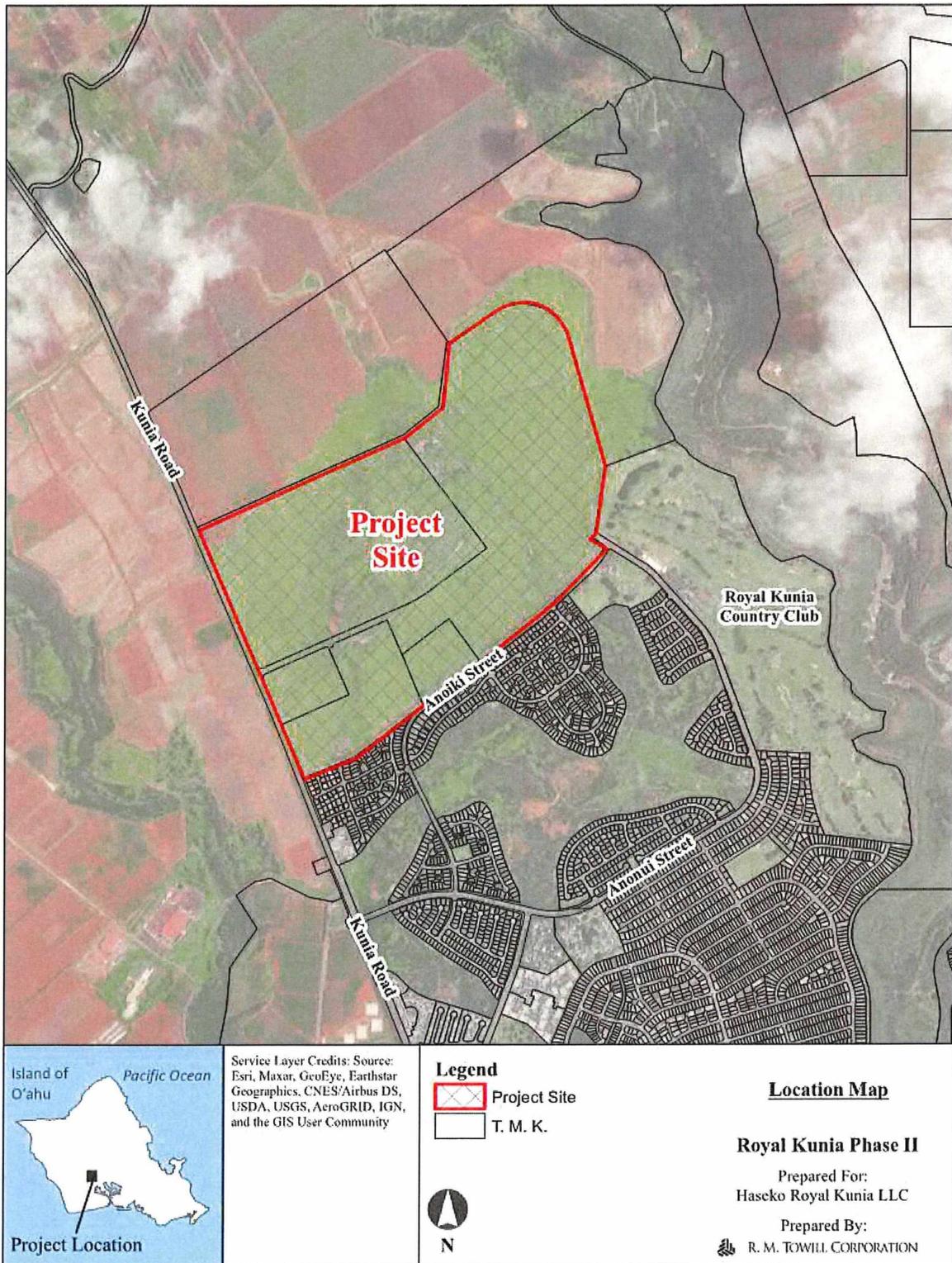
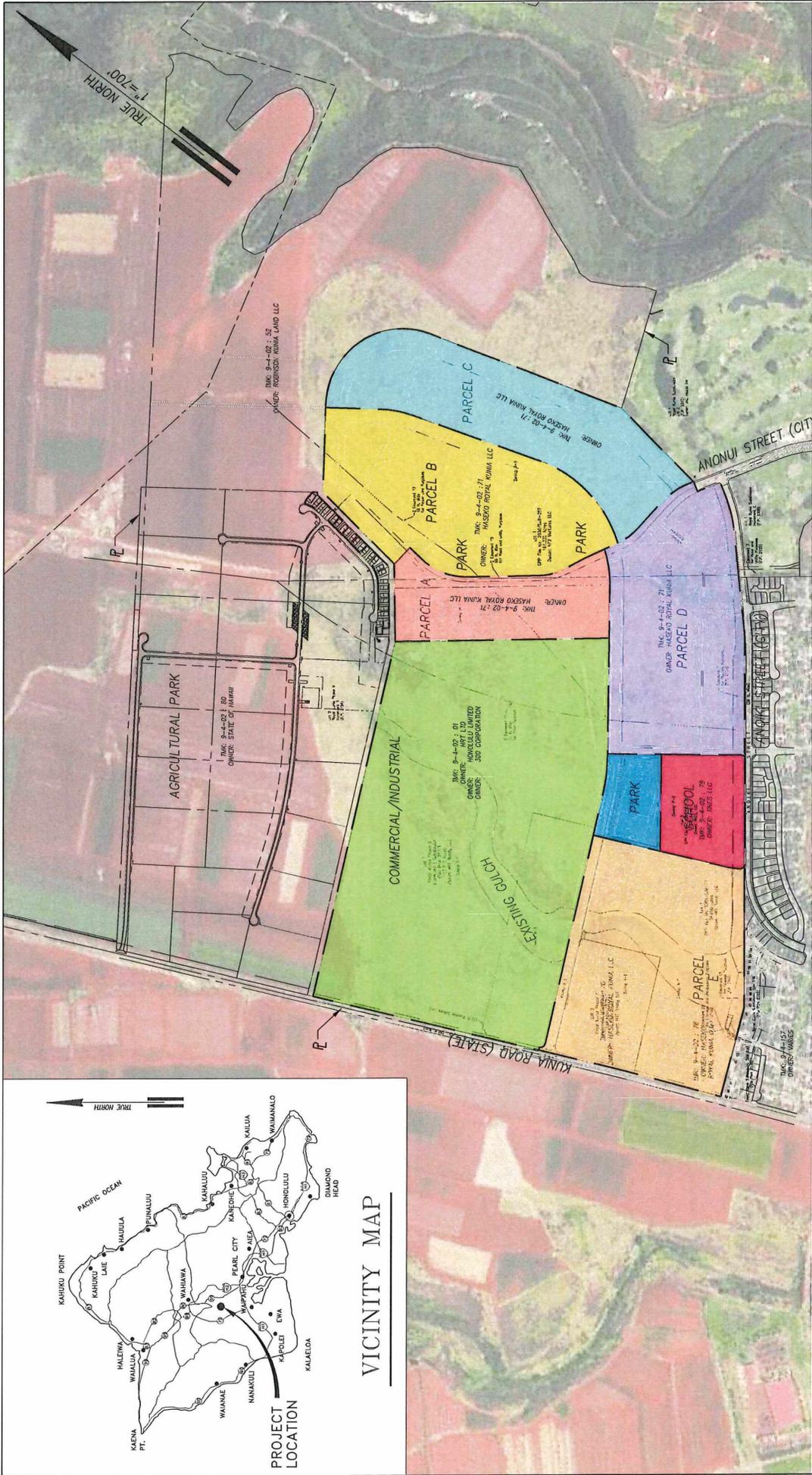


Figure 1-2 – Location Map



 <p><b>R. M. TOWILL CORPORATION</b>          808 842 1133 2024 North King Street, Suite 200 Honolulu Hawaii 96819-3484</p>	<p>ROYAL KUNIA PHASE II SEWER MASTER PLAN</p> <p><b>Proposed Conceptual Development Plan</b></p>	<p>Figure <b>1-3</b></p>
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## **2. EXISTING CONDITIONS**

### **2.1 Existing and Surrounding Uses**

The existing site is unimproved with ground cover generally consisting of prairie grass, cane grass, and thin stand trees. Existing Improvements adjacent to the site include Kunia Road and the existing RKI subdivision. There are no existing sewer system improvements in the RKII Parcels.

### **2.2 Existing Topography**

The overall terrain of the project site is sloping in the southward direction, with elevations varying from approximately 600 feet above mean sea level (MSL) at the north end of the site to 425 feet MSL at the south end of the site. Overall slopes generally vary between 3% to 5%, with steeper slopes of 30% or greater at the gulch found adjacent to Kunia road.

### **2.3 Existing Wastewater System**

The existing RKI wastewater infrastructure is designed to accommodate the proposed RKII wastewater flows in accordance with the approved master plans. Four existing points of connection are intended to receive wastewater flows from RKII. A 15-inch connection, an 18-inch, and an 8-inch connection are located along Anoiki Street. An 18-inch connection is located at the end of Anonui Street. The locations of the existing wastewater system connections are show in **Figure 4-1**.

The existing regional wastewater system consisting of 18-inch to 24-inch pipes is designed to convey wastewater flows from RKII, RKI, Village Park, and the west side of Waipahu South to the Waipahu Sewage Pump Station (Waipahu WWPS) located along Waipahu Depot Street. The Waipahu WWPS pumps collected wastewater southwest to the City's Honouliuli Wastewater Treatment Plant (HWWTP). The existing sewer system is shown on **Figure 2-1**.

**2.4 Existing Wastewater Treatment and Disposal**

The HWWTP, located at 91-1000 Geiger Rd, Ewa Beach, HI 96706, treats and disposes all of the wastewater generated by several communities in the Honouliuli sewer basin including Kunia. The locations of the HWWTP and surrounding WWPS are shown in **Figure 2-2**. Per the City and County of Honolulu’s “Central Oahu Sustainable Communities Plan”, dated March 2021, HWWTP has an existing capacity of 38 million gallons per day (mgd).

The “Development Plan Land Use Amendment Application and Final Environmental Assessment for Royal Kunia, Phase II Increment 3” prepared by William E. Wanket, Inc., dated May 1996, indicates that wastewater generated by the project “is expected to be accommodated at the treatment facility [HWWTP] after its expansion is completed in 1997. Thus, the project should not result in a significant impact to wastewater facilities serving the area.”

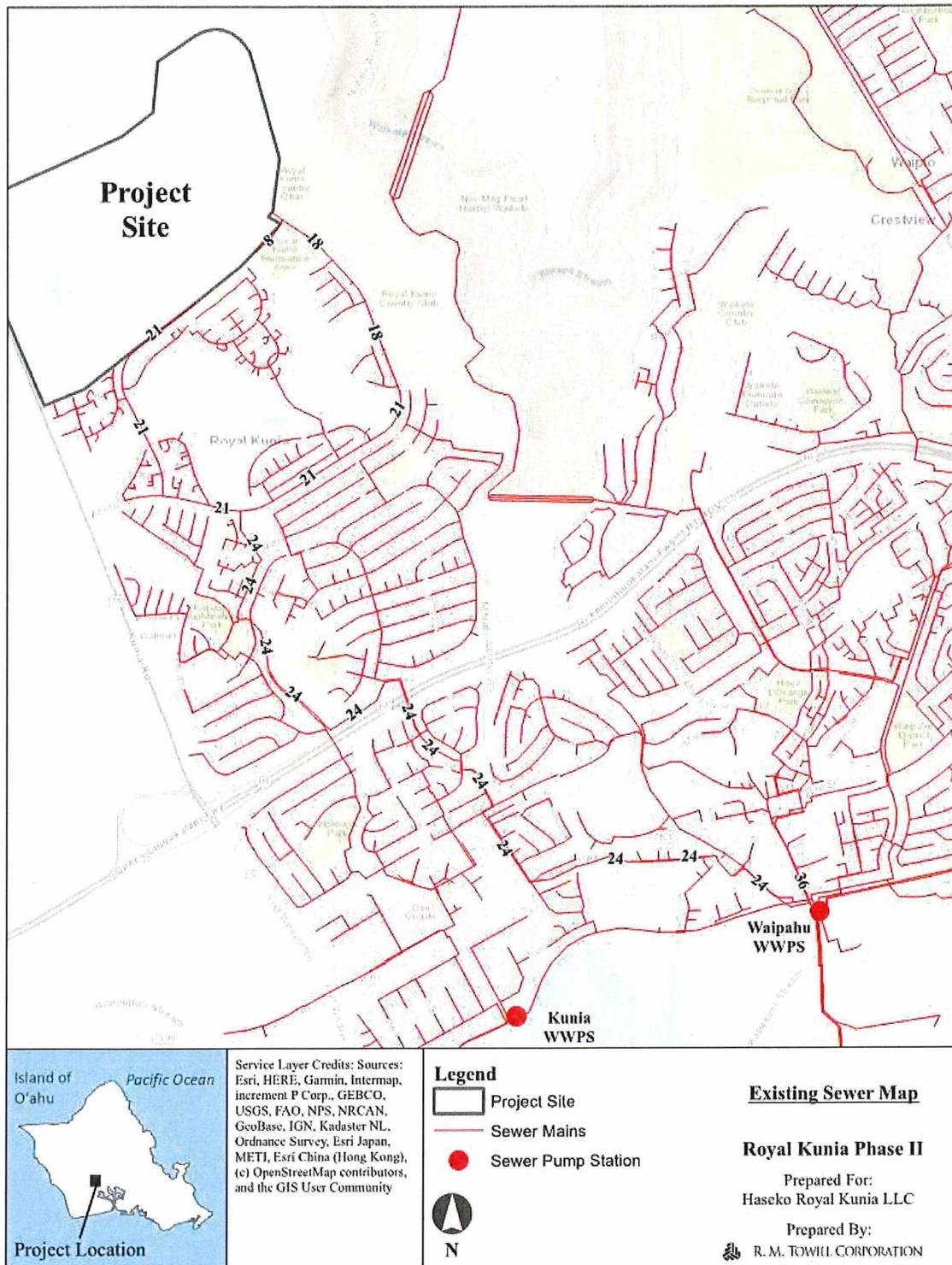


Figure 2-1 – Existing Sewer

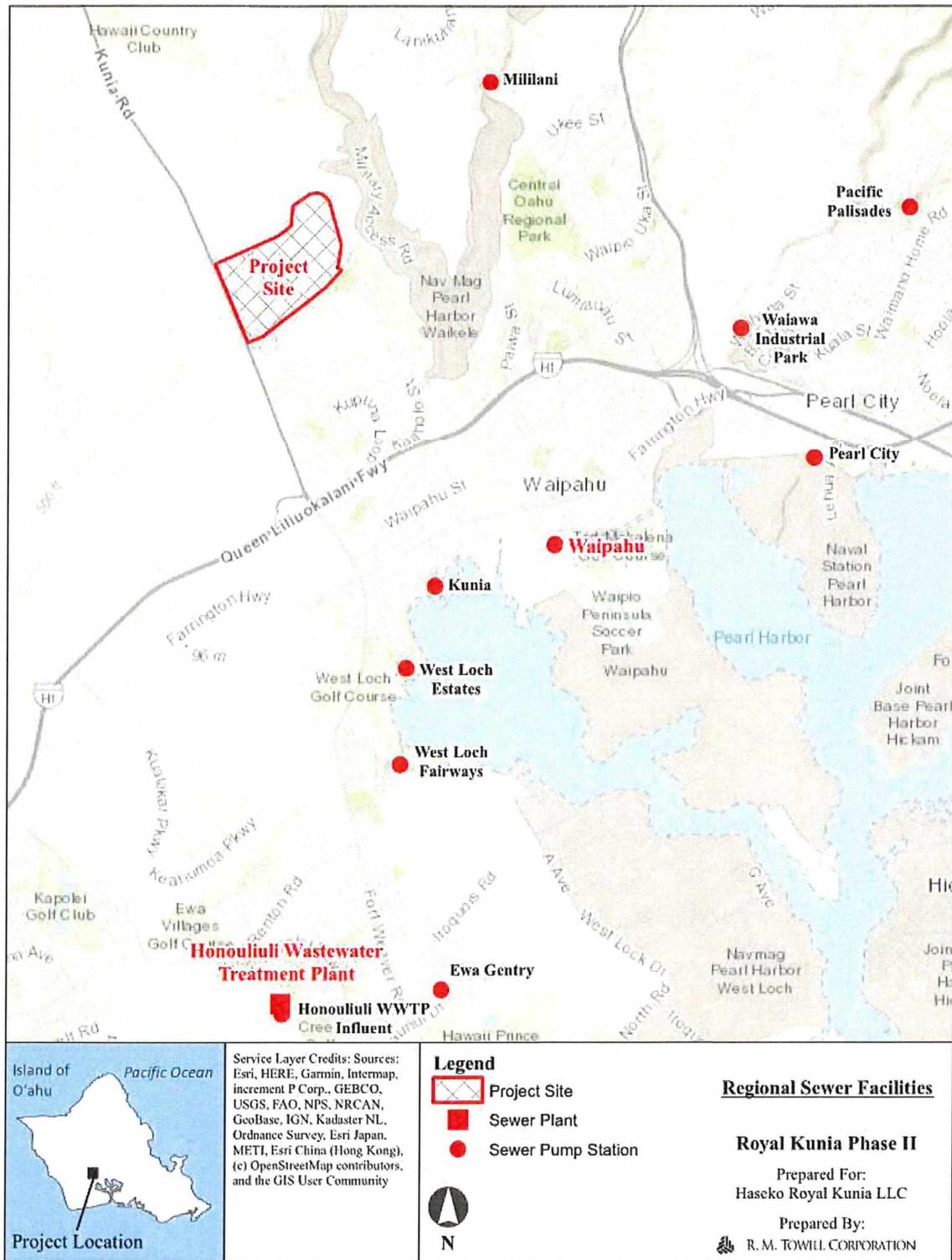


Figure 2-2 – Regional Sewer Facilities

**3. CRITERIA AND METHODOLOGY**

**3.1 Wastewater Demand Criteria**

The Royal Kunia Phase II wastewater demands, unit and area totals were prepared from the Royal Kunia Phase II Overall Site Plan provided by PBR Hawaii and Associates, Inc. dated May 3, 2021. Proposed wastewater demand estimates and sewer system design will conform with the City and County of Honolulu, Department of Environmental Services, Wastewater System Design Standards, July 2017.

**Table 3-1** summarizes the sewer demand rates utilized to compute the waste water design daily flows.

**Table 3-1: Wastewater System Demand Criteria**

**Sewer Demand Rates** (for computing average daily flow)

Single-Family Residential.....	4 persons/home @ 70 gpcd
Multi-Family Residential.....	2.8 persons/unit @ 70 gpcd
Parks (w/Comfort Station).....	5 cpa @ 70 gpcd *
Commercial/Industrial.....	100 cpa @ 70 gpcd
Schools.....	50 cpa @ 70 gpcd

\* Sewer Demand Rates per Royal Kunia Revised Sewer Master Plan dated May 1996

(cpa = capita per acre)

(gpcd = gallon per capita per day)

Base Sanitary Flow (BSF) = Average daily per capita wastewater flow multiplied by equivalent population.

Peak Base Sanitary Flow (PBSF) = average waste water flow x flow factor (Max Flow factor = 2.5)

Average Dry Weather Flow (ADWF) = BSF + Groundwater infiltration rate

Groundwater Infiltration (GWI) = 35 gallons per capita per day (gpcd)

Peak Dry Weather Flow (PDWF) = PBSF + GWI

Wet Weather Infiltration/Inflow (I/I) = 3,000 gallons per acre per day (gpac)

Design Flow (Q<sub>DES</sub>) = PDWF + I/I

**3.2. Wastewater System Design Criteria**

The sewer system design conforms with the City’s Wastewater System Design Standards and is proposed to be dedicated to the City. Sizes were determined for Polyvinyl Chloride (PVC) C900 or C905 pipes. The criteria used in this master plan are summarized in **Table 3-2**.

<b>Table 3-2 Sewer Pipe Design Criteria</b>	
<b>Minimum Pipe Slopes</b>	
<u>Pipe Diameter (inches)</u>	<u>Slope (ft/ft)</u>
8 (upstream terminal)	0.0100
8	0.0052
10	0.0039
12	0.0031
16	0.0021
18	0.0018
>18	0.0016
<b>Pipe Flow Velocities</b>	
Velocity (Manning’s Eq.)	$= \frac{(1.486)^*(r^{2/3})*(s^{1/2})}{n}$
Minimum	2.5 ft/sec at full flow
Maximum	10 ft/sec
<b>Minimum Size</b>	
Mains and branch mains: 8-inches	
Lateral sewers: 6-inches	
<b>Pipe Capacity</b>	
Maximum <sup>1</sup>	± 85% of full pipe
<b>Pipe Manning’s “n” Values</b>	
<u>Pipe Diameter</u>	<u>“n” Value</u>
All pipes	0.013

<sup>1</sup> Minimum excess pipe capacity of 15 percent of full flow capacity in consideration of potential future development.

**3.3. Impacts to Wastewater Facilities**

Wastewater flows for the proposed RKII project for full build-out conditions will be calculated to determine the sewer system sizing and to determine the impacts on the existing sewer system.

**4. PROPOSED CONDITIONS**

**4.1 Proposed Development**

The proposed RKII development contains up to 1850 single-family and multi-family residential homes, a minimum of 9.2 acres of park space, 123.7 acres of commercial and industrial use and 12 acres of school grounds within TMK:9-4-002: 001, 070, 071, 078 and 079

See **Figure 1-3** for the proposed conceptual development plan. A listing of the planned land uses for this development are provided in **Table 4-1**.

Arterial, collector, sub-collector, and local subdivision roads are intended to be dedicated to the City. All utility infrastructure, roadway prisms, and landscape planting will be designed to meet City standards and the requirements of utility companies.

Table 4-1: Proposed Land Use				
Land Use	RESIDENTIAL		OTHER	
	Total	Units	Total	Units
<b>Existing RKI Phase 1B (Per Sewer Master Plan)</b>				
Single Family	1200	units		
Multi-Family	648	units		
Private Rec Center/Park			12.1	acres
Public Park			9.5	acres
Commercial (Walmart)			9	acres
Golf Course (Domestic)				
<b>Proposed RKII</b>				
<b>PARCEL A</b>				
Multi-Family	380	units		
Parks, Open Space			1.0	acres
SUBTOTAL PARCEL A	380	units		
<b>PARCEL B</b>				
Single Family	300	units		
Parks, Open Space			2.1	acres
SUBTOTAL PARCEL B	300	units		
<b>PARCEL C</b>				
Single Family	325	units		
Parks, Open Space			2.0	acres
SUBTOTAL PARCEL C	325	units		
<b>PARCEL D</b>				
Single Family	300	units		
Parks, Open Space			2.4	acres
SUBTOTAL PARCEL D	300	units		
<b>PARCEL E</b>				
Single Family	0	units		
Multi-Family Low Rise (East)	343	units		
Multi-Family Low Rise (West)	202	units		
Parks, Open Space			5.6	acres
SUBTOTAL PARCEL E	545	units		
School			600	students
Commercial/Industrial			123.7	acres
TOTAL RKII	1850	units		
<b>OFFSITE</b>				
DOA Single Family	24	units		
Robinson Kunia Land LLC	1,200	units		
TOTAL OFFSITE	1224	units		

**4.2 Proposed Wastewater Demands and Pipe Sizing**

The total RKII project site will generate a wastewater design flow rate of approximately 6.52 MGD. The sewer pipe sizes shown on the proposed master plan are based on minimum design criteria slopes. Hydraulic calculations for sewer demand and pipe sizing are shown in Appendix A.

**4.3 Comparison to the Park Engineering Sewer Master Plan**

This Sewer Master Plan is an update to the Revised RKSMP prepared by Park Engineering Inc., dated August 1996 due to the changes to the RKII service demands. The initial RKII Sewer demand projections are shown in comparison to the current estimates per this master plan. The demand projections comparisons are summarized in **Table 4-2** below.

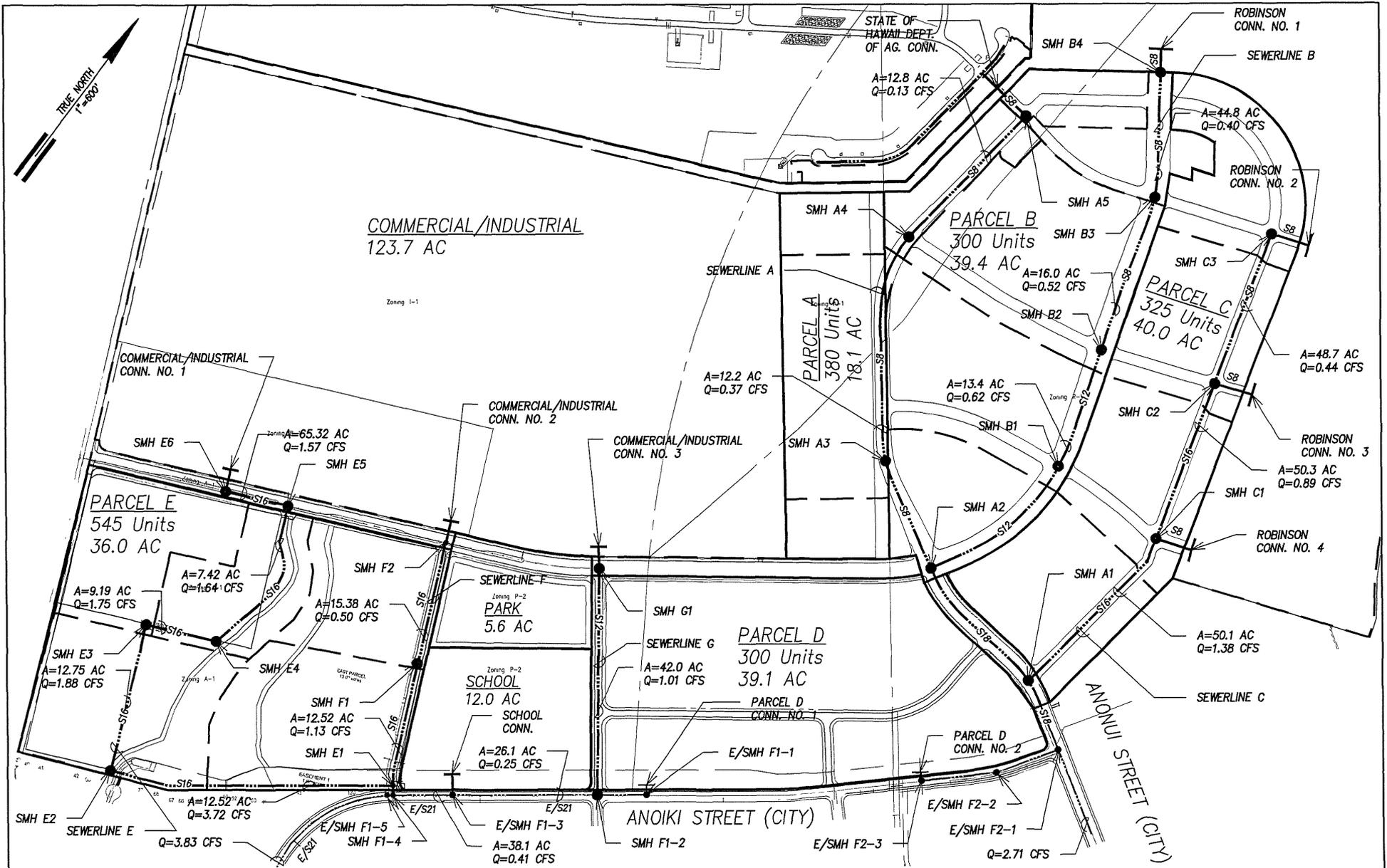
<b>Table 4-2: Sewer Master Plan Comparison</b>		
<b>Existing Sewer Manhole</b>	<b>Park Engineering Sewer Master Plan dated May 1996</b>	<b>R.M. Towill Corp. Sewer Master Plan dated June 2021</b>
SMH F1-4	4.16 MGD	3.81 MGD
SMH F2-1	2.71 MGD	2.71 MGD

#### **4.4 Proposed Wastewater System**

Wastewater generated from RKII will be collected by onsite gravity sewer pipes and conveyed generally south towards RKI. The RKII wastewater system will connect to 4 existing stubouts constructed as part of the RKI wastewater system. The RKII wastewater will be conveyed by the existing RKI regional wastewater system to the Waipahu WWPS and ultimately the HWWTP in conformance with the revised RKSMP and City wastewater standards. The new RKII sewerage system is intended to be dedicated to the City.

Per the revised RKSMP dated May 1996, *“The remaining sewage from both Royal Kunia Phase I and Phase II will be transported to the Waipahu Sewage Pump Station located on Waipahu Depot Street via a 24” off-site trunk sewer. The new sewer line will serve the proposed Royal Kunia Subdivision, Phases I and II. It will begin within the Royal Kunia Subdivision and terminate at the existing Waipahu Sewage Pump Station on Depot Road. The sewer line design was divided into approximately six separate segments, but all segments was constructed concurrently.”*

The alignment of the proposed sewer lines shall be located within the proposed City right-of-way. Where sewer lines cannot be located within the proposed City right-of-way, the sewer line shall be located in the center of easements with the following widths: 15 feet (8-inch to 16-inch diameter pipes, 25 feet (pipes larger than 16-inch diameter). An all-weather access road or gravel road (reviewed and approved by the City on a case-by-case basis) shall be provided along the sewer easement for maintenance of the sewer system. The maximum sewer manhole spacing shall be 350 feet for pipes up to 36-inch diameter in roadways, 250 feet for pipes up to 18-inches in diameter in non-roadway areas, 350 feet for pipes larger than 18-inches and up to 36-inches in diameter in non-roadway areas (Reference 6). Easements shall be designated for both sewer and access purposes. Groundwater is not anticipated to be encountered within the proposed sewer line trench.



Planning - Engineering - Environmental Services - Photogrammetry - Surveying - Construction Management  
**R. M. TOWILL CORPORATION**  
 808 842 1133 2024 North King Street Suite 200 Honolulu Hawaii 96819-3494

**ROYAL KUNIA PHASE II SEWER MASTER PLAN**



Figure 4-1

## 5. REFERENCES

1. *Wastewater System Design Standards, Volume 1*, Department of Environmental Services, City and County of Honolulu, July 2017
2. *Royal Kunia Revised Sewer Master Plan*, May 1996, Park Engineering Inc.
3. Central Oahu Sustainable Communities Plan, March 2021,  
Department of Planning and Permitting, City and county of Honolulu, Hawaii
4. Development Plan Land Use Amendment Application and Final Environmental Assessment for Royal Kunia, Phase II Increment 3

## APPENDICES

## APPENDIX A

### Wastewater Quantities and Hydraulic Computations





Wastewater Quantities and Hydraulic Computations  
(Minimum Slope for Pipe Sizing)





APPENDIX B

Royal Kunia Revised Sewer Master Plan Date May 1996

(Prepared by Park Engineering, Inc. dated May 1996)

**ROYAL KUNIA  
REVISED SEWER MASTER PLAN**

AT HOAEAE AND WAIKELE, EWA, OAHU, HAWAII

TAX MAP KEY: 9-4-02: POR 1, 46, 49, 50, 51, & 52

May 1996

PREPARED BY:

ParEn., Inc.

dba PARK ENGINEERING

ENGINEERS, SURVEYORS, PLANNERS

SUITE 300, KAWAIAHAO PLAZA

567 SOUTH KING STREET

HONOLULU, HAWAII 96813

**Royal Kunia**  
**Revised Sewer Master Plan**

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Bound together with this Report:

- Exhibit A - Project Location Map
- Exhibit B - Royal Kunia Sewer Master Plan Map
- Exhibit C - Royal Kunia Sewer Master Plan Sanitary Sewage Computations
- Exhibit D - Halekua Gardens I and 5.0 Acre Industrial Site Connections to Village Park Map
- Exhibit E - Halekua Gardens I and 5.0 Acre Industrial Site Connections to Village Park Sanitary Sewage Computations

**Royal Kunia**  
**Revised Sewer Master Plan**

**LOCATION:**

The property is located approximately 1 mile north of the Kunia Road - Waipahu Street Intersection. It is bounded by Kunia Road on the west, Waikele Stream on the east, and the existing Village Park subdivision on the south.

**TOPOGRAPHY:**

The property generally slopes toward the southeast at an average slope of 4%. Steeper gradients of 20% and greater can be found in the gully adjacent to Kunia Road.

**SEWER MASTER PLAN:**

This master plan accounts for the ultimate grading and drainage plans for the Royal Kunia Development. The plan, attached as Exhibit B, was developed according to the latest Land Use Map for the Royal Kunia Development. It involves connecting two sites, Halekua Gardens I and 5.0 Acres of an Industrial Site both located at the southwest corner of Royal Kunia Phase I, to the existing sewer system within the Village Park Subdivision. The accompanying plan and computations within Village Park are included as Exhibits D and E respectively. The remaining sewage from both Royal Kunia Phase I and Phase II will be transported to the Waipahu Sewage Pump Station located on Waipahu Depot Road via a 24" off-site trunk sewer. The new sewer line will serve the proposed Royal Kunia Subdivision, Phases I and II. It will begin within the Royal Kunia Subdivision and terminate at the existing Waipahu Sewage Pump Station on Depot Road. The sewer line design was divided into approximately six separate segments, but all segments was constructed concurrently. (See Exhibit A : Project Location Map.)

The design criteria for the project was extracted from the Design Standards of the Division of Wastewater Management, Volume 1, July, 1993. The criteria are as follows:

1. Approximate unit projections and developable acreages were obtained from a preliminary Land Use Map (Exhibit B) and used to determine flows in the sewer main.
2. Average daily per capita flow = 80 gal/capita/day.

**Royal Kunia**  
**Revised Sewer Master Plan**

3. Density:
  - a. Single Family Dwelling (SFD) - 4 persons/unit
  - b. Low Density Apartment Occupancy (LDA)
    - 85 capita/acre for areas where the number of units are unknown.
    - 2.8 capita/unit for areas where the number of units are known.
  - c. Industrial - 100 capita/acre
  - d. School - 1200 students
  - e. Park/Ride - negligible
  - f. Parks - 5 capita/acre
  - g. Golf Course Club House - 1.0 Acre Club House @ 250 capita/acre
4. Factor for maximum rate of dry weather sewage flow is extracted from Babbitt's curve:

$$\text{Maximum Factor} = \frac{5}{P^{0.2}}$$

where P = population in thousands

5. Normal Infiltration = 5 gal/capita/day  
Wet Infiltration = 1,250 gal/acre/day
6. Peak Flow = summation of Maximum flow plus Infiltration.
7. Manning's formula was used as the basis for the hydraulic design of the sewer:

$$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

where n = roughness coefficient  
R = hydraulic radius  
A = area of pipe flow  
S = slope in ft/ft

8. Minimum Velocity = 2.0 ft/sec  
Maximum Velocity = 10.0 ft/sec

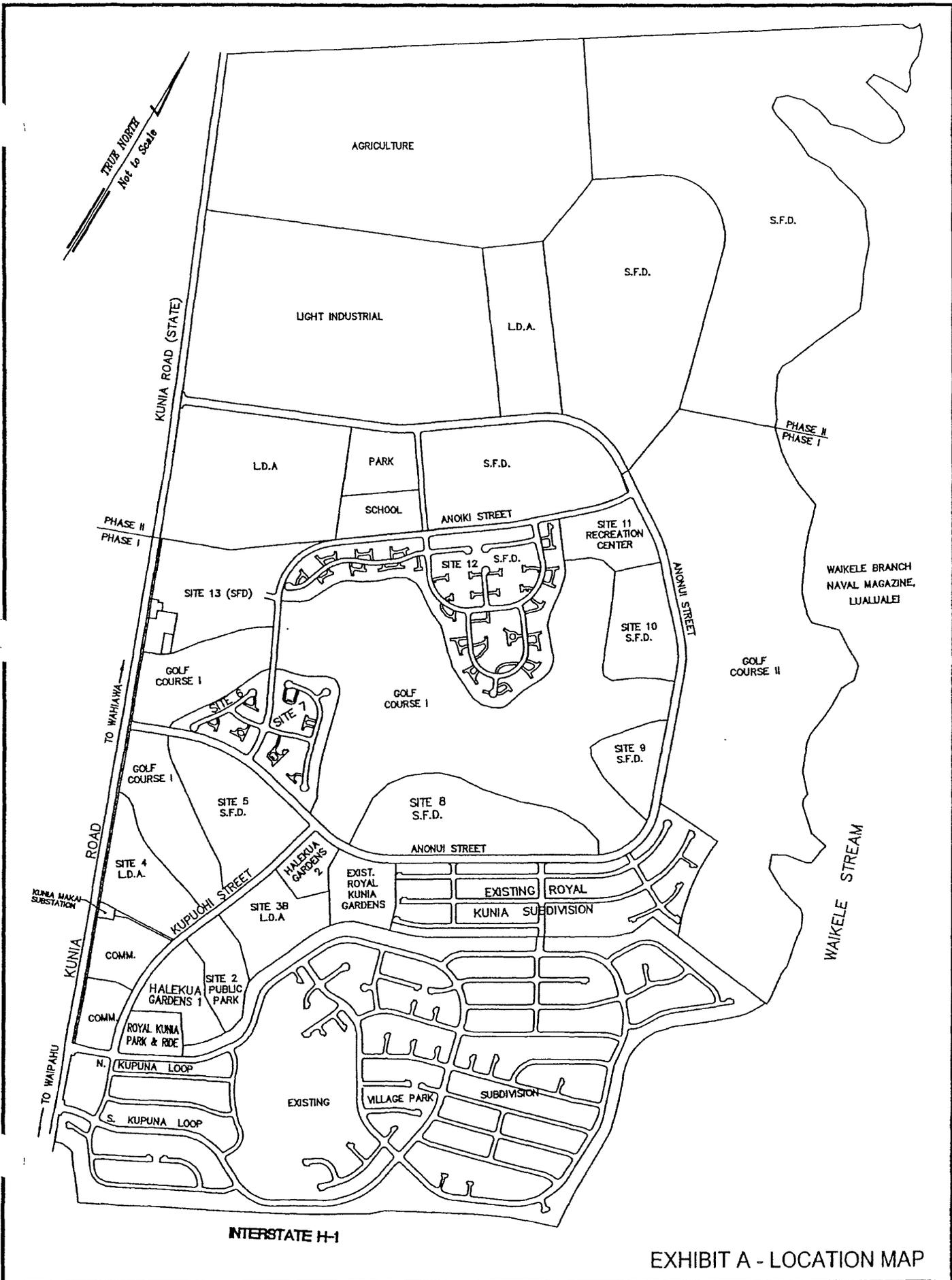
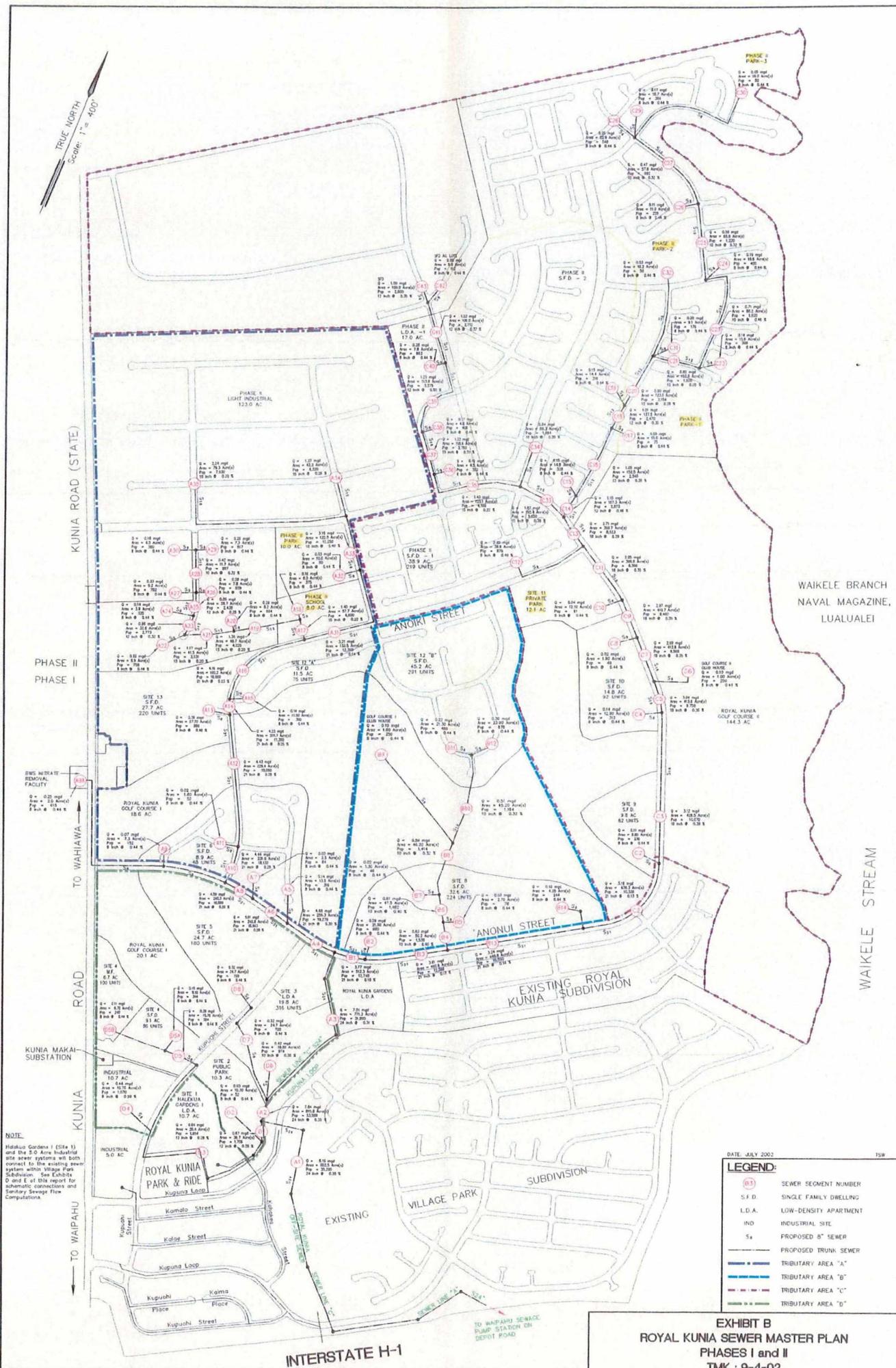


EXHIBIT A - LOCATION MAP

TRUE NORTH  
Scale: 1" = 400'



NOTE:  
Hialeah Gardens I (Site 1) and the O O Area Industrial site sewer systems will both connect to the existing sewer system within Village Park Subdivision. See Exhibit D and E of this report for submittal connections and Sanitary Sewer flow Computations.

DATE: JULY 2002 TSW

**LEGEND:**

- (S-1) SEWER SEGMENT NUMBER
- S.F.D. SINGLE FAMILY DWELLING
- L.D.A. LOW-DENSITY APARTMENT
- IND INDUSTRIAL SITE
- S<sub>8</sub> PROPOSED 8" SEWER
- PROPOSED TRUNK SEWER
- TRIBUTARY AREA "A"
- TRIBUTARY AREA "B"
- TRIBUTARY AREA "C"
- TRIBUTARY AREA "D"

**EXHIBIT B**  
**ROYAL KUNIA SEWER MASTER PLAN**  
**PHASES I and II**  
**TMK : 9-4-02**

SEWER: ROYAL KUNIA SEWER MASTER PLAN (SITE 8PDH SUBDIVISION)  
 DISTRICT: WAIPAHI  
 REFERENCE MAPS: TMK - 9-4-02

EXHIBIT "C"

BY: TSS  
 Sheet: RKIIACT-SMP(SITE8)

Normal Infiltr. 5 (gpcd) [USE 5 OR 35]  
 Wet Infiltr: 1250 (gpad) [USE 1250 OR 2750]

DIST, ZONE, OR ST	POINT OR SEGMENT	TRIB. AREA		TRIB. POP.		FLOW gpcd	AVE. FLOW (mgd)	MAX FLOW FACT	MAX FLOW (mgd)	NORM DESIGN AVE		DESIGN HRLY FLOW (mgd)	WET INFILT. (mgd)	DESIGN PEAK FLOW (mgd)	Pipe Size (IN)	Slope (%)	Capacity (mgd)	Vel. (fps)	Qreq /Qall (%)
		Increment	Total	Increment	Total					INFIL (mgd)	FLOW (mgd)								
POR SITE 12 "A"	A15	11.5	11.5	300	300	80	0.0240	5.00	0.1200	0.0015	0.0255	0.1215	0.0144	0.1359	8	0.44	0.45	1.99	0.30
A15 + A16	A14	201.7	201.7	17,200	17,200	80	1.3760	2.83	3.8948	0.0860	1.4620	3.9808	0.2521	4.2330	21	0.25	5.11	3.29	0.83
SITE 13	A13	27.7	27.7	880	880	80	0.0704	5.00	0.3520	0.0044	0.0748	0.3564	0.0346	0.3910	8	0.46	0.46	2.04	0.85
A13 + A14 =	A12	229.4	229.4	18,080	18,080	80	1.4464	2.80	4.0535	0.0904	1.5368	4.1439	0.2867	4.4306	21	0.28	5.41	3.48	0.82
POR SITE 6	A11	1.6	1.6	52	52	80	0.0042	5.00	0.0208	0.0003	0.0044	0.0211	0.0020	0.0231	8	0.44	0.45	1.99	0.05
A11 + A12 =	A10	231.0	231.0	18,132	18,132	80	1.4506	2.80	4.0628	0.0907	1.5412	4.1534	0.2887	4.4422	21	0.28	5.41	3.48	0.82
BWS NITRATE REMOVAL	A9A	2.0	2.0	615	615	80	0.0492	5.00	0.2460	0.0031	0.0523	0.2491	0.0025	0.2516	8	0.44	0.45	1.99	0.56
POR SITE 6	A9	7.3	7.3	152	152	80	0.0122	5.00	0.0608	0.0008	0.0129	0.0616	0.0091	0.0707	8	0.44	0.45	1.99	0.16
A9A + A9 + A10 =	A8	240.3	240.3	18,899	18,899	80	1.5119	2.78	4.1997	0.0945	1.6064	4.2942	0.3004	4.5946	21	0.28	5.41	3.48	0.85

SEWER: ROYAL KUNIA SEWER MASTER PLAN (SITE 8PDH SUBDIVISION)  
 DISTRICT: WAIPAHAU  
 REFERENCE MAPS: TMK : 9-4-02

EXHIBIT "C"

BY TSS

Sheet RKIIACT-SMP(SITE8)

Normal Infiltration: 5 (gpcd) [USE 5 OR 35]  
 Wet Infiltration: 1250 (gpad) [USE 1250 OR 2750]

DIST, ZONE, OR ST	POINT OR SEGMENT	TRIB. AREA		TRIB. POP		FLOW gpcd	AVE FLOW (mgd)	MAX FLOW FACT.	MAX FLOW (mgd)	NORM DESIGN AVE		DESIGN HRLY FLOW (mgd)	WET INFILT (mgd)	DESIGN PEAK FLOW (mgd)	Pipe Size (IN)	Slope (%)	Capacity (mgd)	Vel (fps)	Qreq /Gall (%)
		Increment	Total	Increment	Total					INFIL (mgd)	FLOW (mgd)								
POR SITE 7	A7	2.5	2.5	64	64	80	0.0051	5.00	0.0256	0.0003	0.0054	0.0259	0.0031	0.0290	8	0.44	0.45	1.99	0.06
A7 + A8 =	A6		242.8		18,963	80	1.5171	2.78	4.2111	0.0948	1.6119	4.3059	0.3035	4.6094	21	0.28	5.41	3.48	0.85
POR SITE 7	A5	13.5	13.5	316	316	80	0.0253	5.00	0.1264	0.0016	0.0269	0.1280	0.0169	0.1449	8	0.44	0.45	1.99	0.32
A5 + A6 =	A4		256.3		19,279	80	1.5423	2.77	4.2671	0.0964	1.6387	4.3635	0.3204	4.6839	21	0.30	5.60	3.60	0.84
A4 + B1 =	A3		771.3		31,895	80	2.5516	2.50	6.3832	0.1595	2.7111	6.5426	0.9642	7.5068	24	0.31	8.12	4.00	0.92
A3 + D6 + D7 =	A2		815.8		33,589	80	2.6871	2.48	6.6530	0.1679	2.8551	6.8210	1.0198	7.8408	24	0.35	8.63	4.25	0.91
A2 + D1 =	A1		852.5		35,295	80	2.8236	2.45	6.9220	0.1765	3.0001	7.0985	1.0657	8.1641	24	0.35	8.65	4.26	0.94

SEWER: ROYAL KUNIA SEWER MASTER PLAN (SITE 8PDH SUBDIVISION)  
 DISTRICT: WAIPAHU  
 REFERENCE MAPS: TMK . 9-4-02

EXHIBIT "C"

BY TSS

Sheet: RKIIACT-SMP(SITE8)

Normal Infiltr: 5 (gpcd) [USE 5 OR 35]  
 Wet Infiltr: 1250 (gpcd) [USE 1250 OR 2750]

DIST, ZONE, OR ST	POINT OR SEGMENT	TRIB. AREA		TRIB POP		FLOW gpcd	AVE. FLOW (mgd)	MAX FLOW FACT.	MAX FLOW (mgd)	NORM DESIGN AVE		DESIGN HRLY FLOW (mgd)	WET INFILT. (mgd)	DESIGN PEAK FLOW (mgd)	Pipe Size (IN)	Slope (%)	Capacity (mgd)	Vel. (fps)	Qreq /Qall (%)
		Increment	Total	Increment	Total					INFIL (mgd)	FLOW (mgd)								
TRIBUTARY AREA "B"																			
POR SITE 12 "B"	B12	23.9	23.9	676	676	80	0.0541	5.00	0.2704	0.0034	0.0575	0.2738	0.0299	0.3037	8	0.44	0.45	1.99	0.67
POR SITE 12 "B"	B11	21.3	21.3	488	488	80	0.0390	5.00	0.1952	0.0024	0.0415	0.1976	0.0267	0.2243	8	0.44	0.45	1.99	0.50
B11 + B12 =	B10	45.2	45.2	1,164	1,164	80	0.0931	4.85	0.4517	0.0058	0.0989	0.4575	0.0565	0.5140	10	0.32	0.70	1.97	0.74
GC I CLUB HOUSE	B9	1.0	1.0	250	250	80	0.0200	5.00	0.1000	0.0013	0.0213	0.1013	0.0013	0.1025	8	0.44	0.45	1.99	0.23
B9 + B10 =	B8	46.2	46.2	1,414	1,414	80	0.1131	4.67	0.5277	0.0071	0.1202	0.5348	0.0578	0.5926	10	0.32	0.70	1.97	0.85
POR SITE 8 (MIDDLE - 1)	B7	1.9	1.9	60	60	80	0.0048	5.00	0.0240	0.0003	0.0051	0.0243	0.0023	0.0266	8	0.44	0.45	1.99	0.06
B7+B8	B6	48.1	48.1	1,474	1,474	80	0.1179	4.63	0.5456	0.0074	0.1253	0.5529	0.0601	0.6130	10	0.40	0.78	2.21	0.79
POR SITE 8 (MIDDLE - 2)	B5	2.8	2.8	68	68	80	0.0054	5.00	0.0272	0.0003	0.0058	0.0275	0.0035	0.0310	8	0.44	0.45	1.99	0.07
B5+B6	B4	50.9	50.9	1,542	1,542	80	0.1234	4.59	0.5656	0.0077	0.1311	0.5733	0.0636	0.6369	10	0.40	0.78	2.21	0.82
POR SITE 8 (RIGHT)	B14	4.5	4.5	112	112	80	0.0090	5.00	0.0448	0.0006	0.0095	0.0454	0.0056	0.0509	8	0.44	0.45	1.99	0.11
TRIBUTARY AREA "C"	C1	436.3	436.3	10,306	10,306	80	0.8244	3.14	2.5853	0.0515	0.8760	2.6369	0.5454	3.1823	21	0.13	3.68	2.37	0.86
B14 + C1 =	B13	440.8	440.8	10,418	10,418	80	0.8334	3.13	2.6078	0.0521	0.8855	2.6599	0.5510	3.2108	21	0.14	3.82	2.46	0.84
B4 + B13 =	B3	491.6	491.6	11,960	11,960	80	0.9568	3.04	2.9123	0.0598	1.0166	2.9721	0.6145	3.5866	21	0.17	4.21	2.71	0.85
POR SITE 8 (LEFT)	B2	23.4	23.4	656	656	80	0.0525	5.00	0.2624	0.0033	0.0558	0.2657	0.0293	0.2949	8	0.44	0.45	1.99	0.66
B2 + B3 =	B1	515.0	515.0	12,616	12,616	80	1.0092	3.01	3.0394	0.0631	1.0723	3.1024	0.6438	3.7462	21	0.18	4.33	2.79	0.86

SEWER ROYAL KUNIA SEWER MASTER PLAN (SITE 8PDH SUBDIVISION)  
 DISTRICT: WAIPAHU  
 REFERENCE MAPS: TMK : 9-4-02

EXHIBIT "C"

BY TSS

Sheet RKIIACT-SMP(SITE8)

Normal Infil: 5 (gpcd) [USE 5 OR 35]  
 Wet Infil: 1250 (gpad) [USE 1250 OR 2750]

DIST, ZONE, OR ST	POINT OR SEGMENT	TRIB. AREA		TRIB. POP.		FLOW gpcd	AVE. FLOW (mgd)	MAX FLOW FACT.	MAX FLOW (mgd)	NORM DESIGN AVE		DESIGN HRLY FLOW (mgd)	WET INFILT. (mgd)	DESIGN PEAK FLOW (mgd)	Pipe Size (IN)	Slope (%)	Capacity (mgd)	Vel. (fps)	Qreq /Gall (%)
		Increment	Total	Increment	Total					INFIL (mgd)	FLOW (mgd)								
TRIBUTARY AREA "C"																			
SFD C, PH II AG. LOTS C42 + C43	C43	100.0	100.0	2,600	2,600	80	0.2080	4.13	0.8591	0.0130	0.2210	0.8721	0.1250	0.9971	12	0.35	1.18	2.33	0.84
	C42	6.0	6.0	112	112	80	0.0090	5.00	0.0448	0.0006	0.0095	0.0454	0.0075	0.0529	8	0.44	0.45	1.99	0.12
	C41	106.0	106.0	2,712	2,712	80	0.2170	4.10	0.8886	0.0136	0.2305	0.9021	0.1325	1.0346	12	0.37	1.22	2.40	0.85
LDA - 2 (C) C40 + C41	C40	7.8	7.8	663	663	80	0.0530	5.00	0.2652	0.0033	0.0564	0.2685	0.0098	0.2783	8	0.44	0.45	1.99	0.62
	C39	113.8	113.8	3,375	3,375	80	0.2700	3.92	1.0585	0.0169	0.2869	1.0753	0.1423	1.2176	12	0.50	1.41	2.79	0.86
LDA - 2 (B) C38 + C39	C38	4.8	4.8	408	408	80	0.0326	5.00	0.1632	0.0020	0.0347	0.1652	0.0060	0.1712	8	0.44	0.45	1.99	0.38
	C37	118.6	118.6	3,783	3,783	80	0.3026	3.83	1.1597	0.0189	0.3216	1.1766	0.1483	1.3268	15	0.20	1.62	2.04	0.82
LDA - 2 (A) C36 + C37	C36	4.5	4.5	383	383	80	0.0306	5.00	0.1530	0.0019	0.0325	0.1549	0.0056	0.1605	8	0.44	0.45	1.99	0.36
	C35	123.1	123.1	4,166	4,166	80	0.3332	3.76	1.2525	0.0208	0.3541	1.2734	0.1539	1.4272	15	0.22	1.70	2.14	0.84
SFD - 2 (I) C34 + C35	C34	69.3	69.3	1,484	1,484	80	0.1187	4.62	0.5485	0.0074	0.1261	0.5560	0.0866	0.6426	10	0.38	0.76	2.15	0.85
	C33	192.4	192.4	5,650	5,650	80	0.4520	3.54	1.5983	0.0282	0.4802	1.6266	0.2405	1.8671	15	0.38	2.24	2.82	0.84
PARK - 3 SFD - 2(H) SFD - 2(G) C28 + C29 + C30	C30	16.0	16.0	80	80	80	0.0064	5.00	0.0320	0.0004	0.0068	0.0324	0.0200	0.0524	8	0.44	0.45	1.99	0.12
	C29	18.7	18.7	364	364	80	0.0291	5.00	0.1456	0.0018	0.0309	0.1474	0.0234	0.1708	8	0.44	0.45	1.99	0.38
	C28	22.9	22.9	548	548	80	0.0438	5.00	0.2192	0.0027	0.0466	0.2219	0.0286	0.2506	8	0.44	0.45	1.99	0.56
	C27	57.6	57.6	992	992	80	0.0794	5.00	0.3968	0.0050	0.0843	0.4018	0.0720	0.4738	10	0.32	0.70	1.97	0.68
SFD - 2(F) C26 + C27	C26	11.0	11.0	228	228	80	0.0182	5.00	0.0912	0.0011	0.0194	0.0923	0.0138	0.1061	8	0.44	0.45	1.99	0.24
	C25	68.6	68.6	1,220	1,220	80	0.0976	4.81	0.4690	0.0061	0.1037	0.4751	0.0858	0.5608	10	0.32	0.70	1.97	0.81
SFD - 2(E) C24 + C25	C24	19.6	19.6	400	400	80	0.0320	5.00	0.1600	0.0020	0.0340	0.1620	0.0245	0.1865	8	0.44	0.45	1.99	0.41
	C23	88.2	88.2	1,620	1,620	80	0.1296	4.54	0.5884	0.0081	0.1377	0.5965	0.1103	0.7067	10	0.46	0.83	2.37	0.85
SFD - 2(D) C22 + C23	C22	15.6	15.6	308	308	80	0.0246	5.00	0.1232	0.0015	0.0262	0.1247	0.0195	0.1442	8	0.44	0.45	1.99	0.32
	C21	103.8	103.8	1,928	1,928	80	0.1542	4.38	0.6763	0.0096	0.1639	0.6859	0.1298	0.8157	12	0.28	1.06	2.08	0.77
PARK - 2 SFD - 2(C) C21 + C31 + C32	C32	10.2	10.2	50	50	80	0.0040	5.00	0.0200	0.0003	0.0043	0.0203	0.0128	0.0330	8	0.44	0.45	1.99	0.07
	C31	9.1	9.1	176	176	80	0.0141	5.00	0.0704	0.0009	0.0150	0.0713	0.0114	0.0827	8	0.44	0.45	1.99	0.18
	C20	123.1	123.1	2,154	2,154	80	0.1723	4.29	0.7390	0.0108	0.1831	0.7498	0.1539	0.9037	12	0.28	1.06	2.08	0.85
SFD - 2(B) C19 + C20	C19	14.4	14.4	316	316	80	0.0253	5.00	0.1264	0.0016	0.0269	0.1280	0.0180	0.1460	8	0.44	0.45	1.99	0.32
	C18	137.5	137.5	2,470	2,470	80	0.1976	4.17	0.8246	0.0124	0.2100	0.8369	0.1719	1.0088	12	0.35	1.18	2.33	0.85
PARK - 1 C17 + C18	C17	15.0	15.0	75	75	80	0.0060	5.00	0.0300	0.0004	0.0064	0.0304	0.0188	0.0491	8	0.44	0.45	1.99	0.11
	C16	152.5	152.5	2,545	2,545	80	0.2036	4.15	0.8445	0.0127	0.2163	0.8572	0.1907	1.0479	12	0.38	1.23	2.43	0.85

SEWER: ROYAL KUNIA SEWER MASTER PLAN (SITE 8PDH SUBDIVISION)  
 DISTRICT: WAIPAHU  
 REFERENCE MAPS: TMK : 9-4-02

EXHIBIT "C"

BY: TSS

Sheet: RKIIACT-SMP(SITE8)

Normal Infil: 5 (gpcd) [USE 5 OR 35]  
 Wet Infil: 1250 (gpcd) [USE 1250 OR 2750]

DIST, ZONE, OR ST	POINT OR SEGMENT	TRIB. AREA		TRIB POP		FLOW gpcd	AVE. FLOW (mgd)	MAX FLOW FACT.	MAX FLOW (mgd)	NORM INFIL (mgd)	DESIGN AVE FLOW (mgd)	DESIGN HRLY FLOW (mgd)	WET INFILT. (mgd)	DESIGN PEAK FLOW (mgd)	Pipe Size (IN)	Slope (%)	Capacity (mgd)	Vel (fps)	Qreq /Qall (%)
		Increment	Total	Increment	Total														
SFD - 2 (A)	C15	14.8	14.8	328	328	80	0.0262	5.00	0.1312	0.0016	0.0279	0.1328	0.0185	0.1513	8	0.44	0.45	1.99	0.34
	C15 + C16		167.3		2,873	80	0.2298	4.05	0.9305	0.0144	0.2442	0.9449	0.2092	1.1540	12	0.46	1.36	2.67	0.85
	C14																		
	C13	359.7		8,523		80	0.6818	3.26	2.2208	0.0426	0.7244	2.2634	0.4497	2.7131	18	0.29	3.18	2.78	0.85
SFD - 1	C12	38.9	38.9	876	876	80	0.0701	5.00	0.3504	0.0044	0.0745	0.3548	0.0486	0.4034	8	0.49	0.47	2.10	0.85
	C12 + C13 =		398.6		9,399	80	0.7519	3.19	2.4016	0.0470	0.7989	2.4486	0.4983	2.9469	18	0.35	3.49	3.05	0.84
PRIVATE PARK	C10	12.1	12.1	61	61	80	0.0049	5.00	0.0244	0.0003	0.0052	0.0247	0.0151	0.0398	8	0.44	0.45	1.99	0.09
	C10 + C11 =		410.7		9,460	80	0.7568	3.19	2.4141	0.0473	0.8041	2.4614	0.5134	2.9748	18	0.35	3.49	3.05	0.85
SITE 10 (NORTH)	C8	1.9	1.9	48	48	80	0.0038	5.00	0.0192	0.0002	0.0041	0.0194	0.0024	0.0218	8	0.44	0.45	1.99	0.05
	C8 + C9 =		412.6		9,508	80	0.7606	3.19	2.4239	0.0475	0.8081	2.4714	0.5158	2.9872	18	0.35	3.49	3.05	0.86
GC II CLUB HOUSE	C6	1.0	1.0	250	250	80	0.0200	5.00	0.1000	0.0013	0.0213	0.1013	0.0013	0.1025	8	0.44	0.45	1.99	0.23
	C6 + C7 =		413.6		9,758	80	0.7806	3.17	2.4747	0.0488	0.8294	2.5235	0.5170	3.0406	18	0.36	3.54	3.10	0.86
SITE 10 (SOUTH)	C4	12.9	12.9	312	312	80	0.0250	5.00	0.1248	0.0016	0.0265	0.1264	0.0161	0.1425	8	0.44	0.45	1.99	0.32
	C4 + C5 =		426.5		10,070	80	0.8056	3.15	2.5379	0.0503	0.8559	2.5882	0.5332	3.1213	18	0.38	3.64	3.18	0.86
SITE 9	C2	9.8	9.8	236	236	80	0.0189	5.00	0.0944	0.0012	0.0201	0.0956	0.0123	0.1078	8	0.44	0.45	1.99	0.24
	C2 + C3 =		436.3		10,306	80	0.8244	3.14	2.5853	0.0515	0.8760	2.6369	0.5454	3.1823	21	0.13	3.68	2.37	0.86

SEWER: ROYAL KUNIA SEWER MASTER PLAN (SITE 8PDH SUBDIVISION)  
 DISTRICT: WAIPAHU  
 REFERENCE MAPS: TMK : 9-4-02

EXHIBIT "C"

BY: TSS

Sheet: RKIIACT-SMP(SITE8)

Normal Infiltr: 5 (gpcd) [USE 5 OR 35]  
 Wet Infiltr: 1250 (gpcd) [USE 1250 OR 2750]

DIST, ZONE, OR ST	POINT OR SEGMENT	TRIB. AREA		TRIB. POP.		FLOW gpcd	AVE. FLOW (mgd)	MAX FLOW FACT.	MAX FLOW (mgd)	NORM DESIGN AVE		DESIGN HRLY FLOW (mgd)	WET INFILT. (mgd)	DESIGN PEAK FLOW (mgd)	Pipe Size (IN)	Slope (%)	Capacity (mgd)	Vel (fps)	Qreq /Qall (%)
		Increment	Total	Increment	Total					INFIL (mgd)	FLOW (mgd)								

TRIBUTARY AREA "D"																			
SITE 5	D8	24.7	24.7	720	720	80	0.0576	5.00	0.2880	0.0036	0.0612	0.2916	0.0309	0.3225	8	0.44	0.45	1.99	0.72
	D7		24.7		720	80	0.0576	5.00	0.2880	0.0036	0.0612	0.2916	0.0309	0.3225	8	0.44	0.45	1.99	0.72
HALEKUA GDNS II	D6	19.8	19.8	974	974	80	0.0780	5.00	0.3898	0.0049	0.0828	0.3946	0.0248	0.4194	8	0.53	0.49	2.19	0.85
SITE 4A (CPR)	D5A	9.1	9.1	344	344	80	0.0275	5.00	0.1376	0.0017	0.0292	0.1393	0.0113	0.1506	8	0.44	0.45	1.99	0.33
	D5B	6.7	6.7	240	240	80	0.0192	5.00	0.0960	0.0012	0.0204	0.0972	0.0083	0.1055	8	0.44	0.45	1.99	0.23
SITE 4B (CPR)	D5A + D5B		15.7		584	80	0.0467	5.00	0.2336	0.0029	0.0496	0.2365	0.0196	0.2561	8	0.44	0.45	1.99	0.57
INDUSTRIAL	D4	10.7	10.7	1,070	1,070	80	0.0856	4.93	0.4222	0.0054	0.0910	0.4276	0.0134	0.4410	8	0.59	0.52	2.31	0.85
	D4 + D5 =	D3	26.4		1,654	80	0.1323	4.52	0.5983	0.0083	0.1406	0.6065	0.0330	0.6395	12	0.28	1.06	2.08	0.60
PUBLIC PARK	D2	10.3	10.3	52	52	80	0.0042	5.00	0.0208	0.0003	0.0044	0.0211	0.0129	0.0339	8	0.44	0.45	1.99	0.08
	D2 + D3 =	D1	36.7		1,706	80	0.1365	4.49	0.6133	0.0085	0.1450	0.6218	0.0459	0.6677	12	0.28	1.06	2.08	0.63



SEWER. HALEKUA GARDENS I & 5.0 AC INDUSTRIAL CONNECTIONS TO VILLAGE PARK  
 DISTRICT. WAIPAHAU  
 REFERENCE MAPS TMK : 9-4-02

EXHIBIT "E"

BY TSS  
 FILE VPIISMP.XLS

Normal Infiltr. 5 (gpcd) [USE 5 OR 35]  
 Wet Infiltr 1250 (gpad) [USE 1250 OR 2750]

DIST, ZONE, OR ST	POINT OR SEGMENT	TRIB. AREA		TRIB. POP.		FLOW gpcd	AVE. FLOW (mgd)	MAX FLOW FACT	MAX FLOW (mgd)	NORM DESIGN AVE		DESIGN HRLY FLOW (mgd)	WET INFILT (mgd)	DESIGN PEAK FLOW (mgd)	Pipe Size (IN)	Slope (%)	Capacity (mgd)	Vel. (fps)	Qreq /Qall (%)
		Increment	Total	Increment	Total					INFILT (mgd)	FLOW (mgd)								
HALEKUA I TO SMH #1		10.7	10.7	426	426	80	0.0341	5.00	0.1704	0.0021	0.0362	0.1725	0.0134	0.1859	8	1.00	0.68	3.01	0.27
SMH #1 to SMH #2			10.7		426	80	0.0341	5.00	0.1704	0.0021	0.0362	0.1725	0.0134	0.1859	8	40.00	4.29	19.01	0.04
SMH #2 to SMH #3			10.7		426	80	0.0341	5.00	0.1704	0.0021	0.0362	0.1725	0.0134	0.1859	8	2.00	0.96	4.25	0.19
SMH #3 to SMH #4			2.1		44	80	0.0035	5.00	0.0176	0.0002	0.0037	0.0178	0.0026	0.0204	8	1.60	0.86	3.80	0.02
SMH #3 to SMH #5			8.8		256	80	0.0205	5.00	0.1024	0.0013	0.0218	0.1037	0.0110	0.1147	8	1.00	0.68	3.01	0.17
SMH #3 to SMH #6			21.6		726	80	0.0581	5.00	0.2904	0.0036	0.0617	0.2940	0.0270	0.3210	8	1.00	0.68	3.01	0.47
SMH #6 to SMH #7			21.6		726	80	0.0581	5.00	0.2904	0.0036	0.0617	0.2940	0.0270	0.3210	8	3.00	1.18	5.21	0.27
SMH #7 to SMH #8			21.6		726	80	0.0581	5.00	0.2904	0.0036	0.0617	0.2940	0.0270	0.3210	8	3.80	1.32	5.86	0.24
SMH #8 to SMH #19			15.3		732	80	0.0586	5.00	0.2928	0.0037	0.0622	0.2965	0.0191	0.3156	8	2.90	1.16	5.12	0.27
SMH #8 to SMH #9			36.9		1,458	80	0.1166	4.64	0.5408	0.0073	0.1239	0.5481	0.0461	0.5943	8	6.30	1.70	7.55	0.35
SMH #9 to SMH #10			36.9		1,458	80	0.1166	4.64	0.5408	0.0073	0.1239	0.5481	0.0461	0.5943	8	5.26	1.56	6.90	0.38
SMH #10 to SMH #11			36.9		1,458	80	0.1166	4.64	0.5408	0.0073	0.1239	0.5481	0.0461	0.5943	8	8.47	1.97	8.75	0.30
SMH #11 to SMH #20			12.2		610	80	0.0488	5.00	0.2440	0.0031	0.0519	0.2471	0.0153	0.2623	8	2.90	1.16	5.12	0.23
SMH #11 to SMH #12			49.1		2,068	80	0.1654	4.32	0.7153	0.0103	0.1758	0.7257	0.0614	0.7870	8	7.04	1.80	7.98	0.44
SMH #12 to SMH #13			49.1		2,068	80	0.1654	4.32	0.7153	0.0103	0.1758	0.7257	0.0614	0.7870	8	4.26	1.40	6.21	0.56
SMH #13 to SMH #14			49.1		2,068	80	0.1654	4.32	0.7153	0.0103	0.1758	0.7257	0.0614	0.7870	8	4.52	1.44	6.39	0.55
SMH #14 to SMH #15			49.1		2,068	80	0.1654	4.32	0.7153	0.0103	0.1758	0.7257	0.0614	0.7870	8	7.14	1.81	8.03	0.43
SMH #15 to SMH #22			13.7		410	80	0.0328	5.00	0.1640	0.0021	0.0349	0.1661	0.0171	0.1832	8	7.08	1.81	8.00	0.10
SMH #15 to SMH #16			62.8		2,478	80	0.1982	4.17	0.8267	0.0124	0.2106	0.8391	0.0785	0.9176	8	4.00	1.36	6.01	0.68
SMH #16 to SMH #21			23.9		500	80	0.0400	5.00	0.2000	0.0025	0.0425	0.2025	0.0299	0.2324	8	0.44	0.45	1.99	0.52
SMH #16 to SMH #17			86.7		2,978	80	0.2382	4.02	0.9576	0.0149	0.2531	0.9725	0.1084	1.0809	12	0.50	1.41	2.79	0.76
SMH #17 to SMH #18			86.7		2,978	80	0.2382	4.02	0.9576	0.0149	0.2531	0.9725	0.1084	1.0809	12	0.50	1.41	2.79	0.76
VP 14-15 to SMH #18			21.1		336	80	0.0269	5.00	0.1344	0.0017	0.0286	0.1361	0.0264	0.1625	8	0.50	0.48	2.13	0.34
SMH #18 to OUTLET			107.8		3,314	80	0.2651	3.93	1.0431	0.0166	0.2817	1.0597	0.1348	1.1945	12	0.50	1.41	2.79	0.84