APPENDIX J

Enviniti Prepared "Water Reclamation and Reuse Report"

Preliminary Wastewater Report

(Revised Final)

Preliminary Planning – Private Wastewater Treatment Works

at

Project Site:	Waikapu Country Town, Maui, Hawaii
Project Addresses:	0 Honoapiilani Hwy., Wailuku, HI, 96793
	1670 Honoapiilani Hwy., Wailuku, HI, 96793
	2000 Honoapiilani Hwy., Wailuku, HI, 96793
Project TMKs:	(2) 3-6-002:003
	(2) 3-6-004:003
	(2) 3-6-004:006
	(2) 3-6-005:007

for

Waikapu Properties, LLC
P.O. Box 1870, Manteca, CA, 95336

Revised Final Submittal Date: November 2015

Enviniti LLC

Table of Contents

Note: Updates, changes, and additions are written in blue.

1. Introduction

1.1. Authorization
- 1.1.1. This project was authorized by:
  - 1.1.1.1. Work Order & Agreement: 12-015
    - 1.1.1.1.1. Document dated: February 26, 2013
    - 1.1.1.1.2. Document signed and accepted: March 1, 2013
    - 1.1.1.1.3. Document approved by: Albert Boyce, Manager, Waikapu Properties, LLC
  - 1.1.1.2. Project Name: Preliminary Planning – Private Wastewater Treatment Works at Waikapu Country Town, Maui, Hawaii

1.2. Project Understanding
- 1.2.1. Property Owner and Client: Waikapu Properties, LLC
- 1.2.2. Project Management Companies and Prime Consultants:
  - 1.2.2.1. Planning Consultants Hawaii, LLC
  - 1.2.2.2. Hawaii Land Design LLC
- 1.2.3. Consultants:
  - 1.2.3.1. Civil Engineer: Otomo Engineering, Inc.
  - 1.2.3.2. Wastewater Engineer: Enviniti LLC
  - 1.2.3.3. Traffic Engineer: Fehr & Peers
  - 1.2.3.4. Market & Fiscal: The Hallstrom Group, Inc.
  - 1.2.3.5. Archaeology: Archaeological Services Hawaii, LLC
  - 1.2.3.6. Cultural: Hana Pono, LLC
  - 1.2.3.7. Flora & Fauna: Robert Hobdy
  - 1.2.3.8. Noise Quality: D.L. Adams & Associates, Ltd.
  - 1.2.3.9. Air Quality: B.D. Neal & Associates (dba Atmospheric Research &Technology, LLC)
  - 1.2.3.10. Surveying: Newcomer-Lee Land Surveying, Inc.
- 1.2.4. The project site is located at the following addresses and TMKs:
  - 1.2.4.1. Addresses:
    - 1.2.4.1.1. 0 Honoapiilani Hwy., Wailuku, HI, 96793
    - 1.2.4.1.2. 1670 Honoapiilani Hwy., Wailuku, HI, 96793
    - 1.2.4.1.3. 2000 Honoapiilani Hwy., Wailuku, HI, 96793
  - 1.2.4.2. TMKs:
    - 1.2.4.2.1. (2) 3-6-002:003
    - 1.2.4.2.2. (2) 3-6-004:003
    - 1.2.4.2.3. (2) 3-6-004:006
    - 1.2.4.2.4. (2) 3-6-005:007

2. Abbreviations & Definitions

2.1. 7-Day Average: The arithmetic mean of pollutant values of samples collected in a period of seven (7) consecutive days (EPA, 1984).
2.2. 30-Day Average: The arithmetic mean of pollutant values of samples collected in a period of thirty (30) consecutive days (EPA, 1984).
2.3. A_{BA}: Total horizontal area of all commercial buildings [SF]
2.4. ABS: Acrylonitrile Butadiene Styrene
2.5. ac: acres
2.6. A_{RA}: Total horizontal area of all commercial restaurants [SF]
2.7. A_{TAPA}: Total horizontal area of all active park-type lots [ac]
2.8. A_{TCA}: Total horizontal area of all commercial-type lots [SF], which includes Country Town Mixed-Use, Existing Commercial, and New Commercial/Emp.
2.9. A_{TESA}: Total horizontal area of all elementary school-type lot(s) [ac]
2.10. (Avg): Restaurant Customer Flow based on Average-type seating with NO bar-type seating
2.11. $(Avg + Bar)$: Restaurant Customer Flow based on Average-type seating with bar-type seating
2.12. BA: Building Area [SF]
    2.12.1. Total horizontal area of all commercial buildings (aka building footprint)
2.13. BOD: Biochemical Oxygen Demand [mg/L]
2.14. DOH-SDWB: State of Hawaii Department of Health Safe Drinking Water Branch
2.15. DOH-WWB: State of Hawaii Department of Health Wastewater Branch
2.16. Enviniti: Enviniti LLC
2.17. EPA: U.S. Environmental Protection Agency
2.18. (FF): Restaurant Customer Flow based on Fast Food-type seating with NO take-out meals
2.19. $(FF + TO)$: Restaurant Customer Flow based on Fast Food-type seating with take-out meals
2.20. Flow: Wastewater flow rate [gpd]
2.21. FOG: Fats, Oils, and Grease
2.22. ft^2: Square feet
2.23. GI: Grease Interceptor
2.24. gpd: Gallons per day
2.25. HAR: Hawaii Administrative Rule
2.26. $(H \times H)$: Permutation of "High Traffic" value and "High Vehicle Occupancy" value
2.27. $(H \times L)$: Permutation of "High Traffic" value and "Low Vehicle Occupancy" value
2.28. hr: Hour
2.29. IWS: Individual Wastewater System
2.30. L: Liter
2.31. LCC: Large-Capacity Cesspool
2.32. $(L \times H)$: Permutation of "Low Traffic" value and "High Vehicle Occupancy" value
2.33. $(L \times L)$: Permutation of "Low Traffic" value and "Low Vehicle Occupancy" value
2.34. Max.: Maximum
2.35. mg: milligrams
2.36. MGD: Million gallons per day
2.37. mg/L: Milligrams per liter
2.38. min: Minute
2.39. Min.: Minimum
2.40. NA: Not Applicable
2.41. NP: Not Provided
2.42. NPDES: National Pollutant Discharge Elimination System
2.43. O&M: Operation and Maintenance
2.44. OHA: Office of Hawaiian Affairs

2.45. Percent removal: A percentage expression of the removal efficiency across a treatment plant for a given pollutant parameter, as determined from the 30-day average values of the raw wastewater influent pollutant concentrations to the facility and the 30-day average values of the effluent pollutant concentrations for a given time period (EPA, 1984).
2.46. PL: Pre-Loader
2.47. POC: Point of Contact
2.48. PVC: Polyvinyl Chloride
2.49. Q: Wastewater flow rate [gpd]
2.50. RA: Restaurant Area [SF]
    2.50.1. Total horizontal area of all commercial restaurants
2.51. sec: Seconds
2.52. Secondary Treatment Standards: Quantifiable minimum level(s) of effluent quality attainable by secondary wastewater treatment.
2.53. SF: Square feet
2.54. SMH: Sewer Manhole
2.55. SS: Suspended Solids [mg/L]
    2.55.1. The pollutant parameter total suspended solids (EPA, 1984).
2.56. TAPA: Total Active Park Area [ac]
2.57. TCA: Total Commercial Area [SF]
    2.57.1. Total horizontal area of all commercial-type lots, which includes Country Town Mixed-Use, Existing Commercial, and New Commercial/Emp.
2.58. TESA: Total Elementary School Area [ac]
2.59. TSS: Total Suspended Solids (see SS)
2.60. $Meals_{(TO)}$: Take-Out Meals
2.61. UIC: Underground Injection Control
2.62. WCT: Waikapu Country Town
2.63. WFS: Wastewater Flow Standards
2.64. WP: Waikapu Properties, LLC
2.65. WRD: Wastewater Reclamation Division
2.66. WWTW: Wastewater Treatment Works (aka wastewater treatment plant)

3. WCT Document References

3.1. Documents provided by Client and/or Prime Consultants (see Table 1: Documents Provided by Client and Prime Consultants)

3.2. Drawings provided by Client and/or Prime Consultants (see Table 2: Drawing Provided by Client and Prime Consultants)

Table 1: Documents Provided by Client / Prime Consultants

#	Type of Document	Subject [Filename]	Dated	Qty. of Pages
1	Table	WCT Project Team	NP	1
2	Letter	WP LLC's response to objections of OHA to SWUPA-E no. 2356 [20090702Waikapu-OHA.pdf]	June 20, 2009	3
3	Spreadsheet	WCT – Conceptual Land Use Plan [WCT Land Use Plan_060513.pdf]	June 5, 2013	1
4	Letter	Waikapu – Tropical Plantation Development, Existing Sewer Availability [7-16-23 Wastewater Letter.pdf]	July 16, 2013	3
5	Spreadsheet	WCT Infrastructure Improvement Time and Cost [WCT Sewer.pdf]	August 22, 2013	1
6	Spreadsheet	WCT Phasing Plan [Incremental Phasing Program_102913.xlsx]	October 29, 2013	1
7	Spreadsheet	WCT, Conceptual Land Use Plan, Conceptual Plan with Maximum of 1433 Units per MIP WCT, Proposed Land Controls (Draft) [WCT Land Use Plan 1433 unit maximum_102913 _consultant draft.xlsx]	October 29, 2013	2
8	Narrative & Tables	Proposed Action Table 2: Phase I Conceptual Land Use Program for 2016 through 2026 Table 3: Phase II Conceptual Land Use Program for 2026 through 2036 Table 4: Conceptual Development Program for 2016 – 2036 [WCT Project Description_112613.docx]	November 26, 2013	4
9	Spreadsheet	Land Use Allocations [WCT Land Use Plan_092614_EISPN Insert.xlsx]	September 26, 2014	3
10	Spreadsheet	WCT Phasing Plan [Incremental Phasing Program_100114.xlsx]	October 1, 2014	1
11	Report	Preliminary Engineering Report for Waikapu Country Town, January 2015, Revised October 2015 [2013-06 Waikapu Country Town (10-15 Rev. Report).pdf]	October 7, 2015	74

Table 2: Drawing Provided by Client / Prime Consultants

#	Type of Document	Title [Filename]	Dated	Qty. of Pages
1	Plan	Waikapu, A Country Town, Waikapu, Maui, HI – Preliminary Draft Land Plan [12-027 Waikapu Preliminary Draft Land Plan 30X42 (02-06-13) (25%).jpg]	February 6, 2013	1
2	Plan	Waikapu, A Country Town, Waikapu, Maui, HI – Preliminary Draft Land Plan [12-027 Waikapu Preliminary Draft Land Plan 30X42 (02-06-13) (100%).jpg]	February 6, 2013	1
3	Plan	Waikapu, A Country Town, Waikapu, Maui, HI – Preliminary Draft Land Plan [12-027 Waikapu Preliminary Draft Land Plan 30X42 (02-06-13).pdf]	February 6, 2013	1
4	Plan	Concept Plan – Waikapu Country Town, Waikapu, Maui, HI [12-027 Waikapu Master Plan Overlay 11X17 (06-05-13).pdf]	June 5, 2013	1
5	Plan	Conceptual Phasing Plan (2016 – 2036) [Conceptual 20 year phasing plan_reduced_.pdf]	NP	1
6	Plan	Conceptual Phasing Plan (2016 – 2036) [Conceptual_phasing plan_102913.pdf]	NP	1
7	Plan	Hallstrom Absorption (Phase 1: 2017-2021, Phase 2: 2022-2026) [Absorption Diagram_100114__.pdf]	October 1, 2014	1
8	Plan	Waikapu Country Town – Illustrative Land Plan [12-027 Waikapu Illustrative Land Plan (2-23-2015).pdf]	February, 17, 2015	1
9	Plan	Waikapu Country Town – Illustrative Land Plan [Illustrative Inset 10-7-15.pdf]	October 7, 2015	1

4. Goal

4.1. The goal of this report is to assist the Client with future planning and development of a private WWTW for the subject project.

5. Purpose

5.1. The purpose of this report is to inform the Client of the general concepts and requirements for a private WWTW for the subject project.

6. Objectives

6.1. The objectives of this report are to discuss the following topics in order for the Client to identify the requirements and future tasks necessary for the Client to plan, design, construct, operate, and maintain a private WWTW for the subject project:

6.1.1. General Private WWTW Description
6.1.2. Project Specific Private WWTW Description
6.1.3. Assumptions for Wastewater Flow Estimation
6.1.4. Preliminary Private WWTW Flow Estimates
6.1.5. Preliminary Private WWTW Cost Estimates
6.1.6. Future Tasks for Private WWTW

7. Stakeholders / Points of Contact

7.1. Property Owner / Client
 7.1.1. Waikapu Properties, LLC
  7.1.1.1. P.O. Box 1870, Manteca, CA, 95336
  7.1.1.2. Michael Atherton, LLC Manager, Land Owner
   7.1.1.2.1. (209) 601-4187 (work)
   7.1.1.2.2. AthertonIsland@aol.com
  7.1.1.3. Albert Boyce, LLC Manager, Land Owner
   7.1.1.3.1. (209) 239-4014 (work)
   7.1.1.3.2. (209) 239-7886 (work fax)
   7.1.1.3.3. (209) 479-2896 (mobile)
   7.1.1.3.4. AlbertBoyce@gmail.com
  7.1.1.4. Larry Anderson, LLC Manager, Land Owner
  7.1.1.5. William Filios, LLC Manager

7.2. Project Management Companies / Prime Consultants
 7.2.1. Planning Consultants Hawaii, LLC
  7.2.1.1. 2331 W. Main Street, Wailuku, HI, 96793
  7.2.1.2. Land Use Planning, Sustainability Plan, Incremental Development Plan, Agricultural Impact Assessment
  7.2.1.3. Michael Summers, LLC Manager
   7.2.1.3.1. (808) 244-6231 (work)
   7.2.1.3.2. (808) 269-6220 (mobile)
   7.2.1.3.3. MSummers@PlanningConsultantsHawaii.com
 7.2.2. Hawaii Land Design LLC
  7.2.2.1. P.O. Box 880479, Pukalani, HI, 96788
  7.2.2.2. Landscape Architecture
  7.2.2.3. William ("Bill") Mitchell, LLC Manager
   7.2.2.3.1. (808) 385-2859 (work)
   7.2.2.3.2. BMitchell@HawaiiLandDesign.com

7.3. Subconsultant / Report Author
 7.3.1. Enviniti LLC
  7.3.1.1. P.O. Box 256659, Honolulu, HI, 96825
  7.3.1.2. Wastewater Engineering
  7.3.1.3. Jonathan Nagato, PE, LLC Member, Principal
   7.3.1.3.1. (808) 368-8649 (mobile)
   7.3.1.3.2. Jon@enviniti.com
  7.3.1.4. Ross Tanimoto, PE, Chief Engineer
   7.3.1.4.1. Ross@enviniti.com

7.4. Other Subconsultants
 7.4.1. Otomo Engineering, Inc.
  7.4.1.1. 305 South High Street, Suite 102, Wailuku, HI, 96793
  7.4.1.2. Civil Engineering
  7.4.1.3. Stacy Otomo, PE, President
   7.4.1.3.1. (808) 242-0032 (office)
   7.4.1.3.2. stacy@OtomoEngineering.com
 7.4.2. Fehr & Peers
  7.4.2.1. 100 Pringle Avenue, Suite 600, Walnut Creek, CA, 94596
  7.4.2.2. Traffic Engineering
  7.4.2.3. Sohrab Rashid
   7.4.2.3.1. (619) 758-3002 (work)
   7.4.2.3.2. S.Rashid@FehrAndPeers.com

7.4.3. The Hallstrom Group, Inc.
- 7.4.3.1. 1003 Bishop Street, Suite 1350, Honolulu, HI, 96813
- 7.4.3.2. Market & Fiscal
- 7.4.3.3. Thomas Holiday
  - 7.4.3.3.1. (808) 526-0444 (work)
  - 7.4.3.3.2. tws@HallstromGroup.com

7.4.4. Archaeological Services Hawaii LLC
- 7.4.4.1. 1930 E. Vineyard Street, Wailuku, HI, 96793
- 7.4.4.2. Archaeology
- 7.4.4.3. Lisa Rotunno-Hazuka, LLC Member
  - 7.4.4.3.1. (808) 244-2012 (work)
  - 7.4.4.3.2. lisa@ashMaui.com

7.4.5. Hana Pono, LLC
- 7.4.5.1. P.O. Box 2039, Wailuku, HI, 96793
- 7.4.5.2. Cultural
- 7.4.5.3. Kainoa Horcajo
  - 7.4.5.3.1. (808) 283-9419 (work)
  - 7.4.5.3.2. KHorcajo@gmail.com

7.4.6. Robert Hobdy
- 7.4.6.1. 2560-B Pololei Place, Haiku, HI, 96708
- 7.4.6.2. Flora & Fauna
- 7.4.6.3. Robert Hobdy
  - 7.4.6.3.1. (808) 573-8029 (work)
  - 7.4.6.3.2. HobdyR001@hawaii.rr.com

7.4.7. D.L. Adams & Associates, Ltd.
- 7.4.7.1. 970 N. Kalaheo Avenue, Suite A-311, Kailua, HI, 96734
- 7.4.7.2. Noise Quality
- 7.4.7.3. Dana Dorsch
  - 7.4.7.3.1. (808) 254-3318 (office)
  - 7.4.7.3.2. ddorsch@dlaa.com

7.4.8. B.D. Neal & Associates (dba Atmospheric Research &Technology, LLC)
- 7.4.8.1. P.O. Box 1808, Kailua Kona, HI, 96745
- 7.4.8.2. Air Quality
- 7.4.8.3. Barry Neal, LLC Member
  - 7.4.8.3.1. (808) 329-1627 (office)
  - 7.4.8.3.2. BDNeal@BDneal.com

7.4.9. Newcomer-Lee Land Surveying, Inc.
- 7.4.9.1. 1498 Lower Main Street, Suite D, Wailuku, HI, 96793
- 7.4.9.2. Surveying
- 7.4.9.3. Bruce Lee, LPLS
  - 7.4.9.3.1. (808) 244-8889 (office)

8. Introduction of Project

8.1. The following is the project description from the Project Management Company and Lead Consultant, Planning Consultants Hawaii, LLC, per the document titled "WCT Project Description_112613.docx" and dated November 26, 2013. Updates, changes, and additions to the following project description are based on information from Otomo Engineering, Inc. per the document titled "Preliminary Engineering Report for Waikapu Country Town" and dated October 2015.

The WCT is situated in Central Maui, just south of the small plantation community of Waikapu, at the Maui Tropical Plantation (MTP). The property is identified as TMK Nos. (2) 3-6-5:007; 3-6-002:001 and 003; 3-6-004:003 and 006; and 3-6-006:036. The project area encompasses approximately 14 acres of State Urban District land and 1,562 acres of State Agricultural District land.

The existing MTP retail shops, restaurant, convention hall, tropical gardens and lagoon are on a portion of the State Land Use Urban designated land (TMK No. (2) 3-6-005:007). Approximately 488 acres of State Agricultural District land is proposed to be re-designated to the State Urban and Rural Districts. Approximately 1,074 acres will remain within the State Agricultural District. Much of this land, approximately 800 acres, will be protected in perpetuity through an agricultural easement, or similar mechanism.

WCT will be a "complete community," encompassing a mixture of single- and multi-family residential units, commercial, and civic uses. In accordance with the MIP's Directed Growth Area Guidelines, WCT includes [1,579] residential units together with neighborhood retail, commercial, a school, parks and open space. The town will be bound by agricultural land that will be preserved in perpetuity through a conservation easement. The utilization of conservation subdivision design (CSD) practices will preserve additional rural land for farming, open space, and open land recreation.

WCT will be built in two [five] year phases both mauka and makai of Honoapiilani Highway. Development mauka of the highway will focus inward onto a "village center," incorporating the existing buildings and grounds of the MTP. The Master Plan calls for a diverse mixture of affordable and market priced housing, along with commercial, entertainment, and civic uses within and around the village center.

Development makai of the highway will focus onto a pedestrian-oriented "main street," a nearby elementary school, and parks. The makai development is bound to the east by the planned extension of the Waiale Road, which will intersect with Honoapiilani Highway. A primary objective of the project is to develop a community where walking and biking are the preferred modes of transportation and recreation for short commutes. Therefore, in addition to proposing mixed-use and more compact development patterns, approximately eight miles of hiking, biking and walking trails will be incorporated into the project. Public transit will also be accommodated in strategic locations to facilitate the use of transit to job-rich areas in Wailuku/Kahului and South and West Maui. For the purpose of assessing the project's development impacts, the conceptual master plan and development program is consistent with the MIP's allocation of [1,579] units to the project. The MIP has an allowance for affordable housing and Ohana units. Affordable housing and Ohana units are not counted towards the total number of units allocated in the MIP.

The Applicant understands that local market conditions will ultimately determine the types of units sold and density of development within the project. It is intended that at full build-out the overall character of development, mix of uses and development pattern will be *consistent with the master plan vision, design guidelines, and zoning ordinances. However, should future market demand warrant additional residential units, and/or a higher density of development within the WCT Planned Growth Area, then a future amendment to the MIP may be required together with an analysis of the impact of the additional units upon infrastructure and public facility systems. The project will be implemented in two (2) [five-year] phases through [2026].*

Figure 1: Hallstrom Absorption (Phase 1: 2017-2021 and Phase 2: 2022-2026)

[Enviniti was not provided with an updated Conceptual Phasing Plan (2016 – 2026). However, the Hallstrom Absorption diagram shows the two (2) five-year phases.]

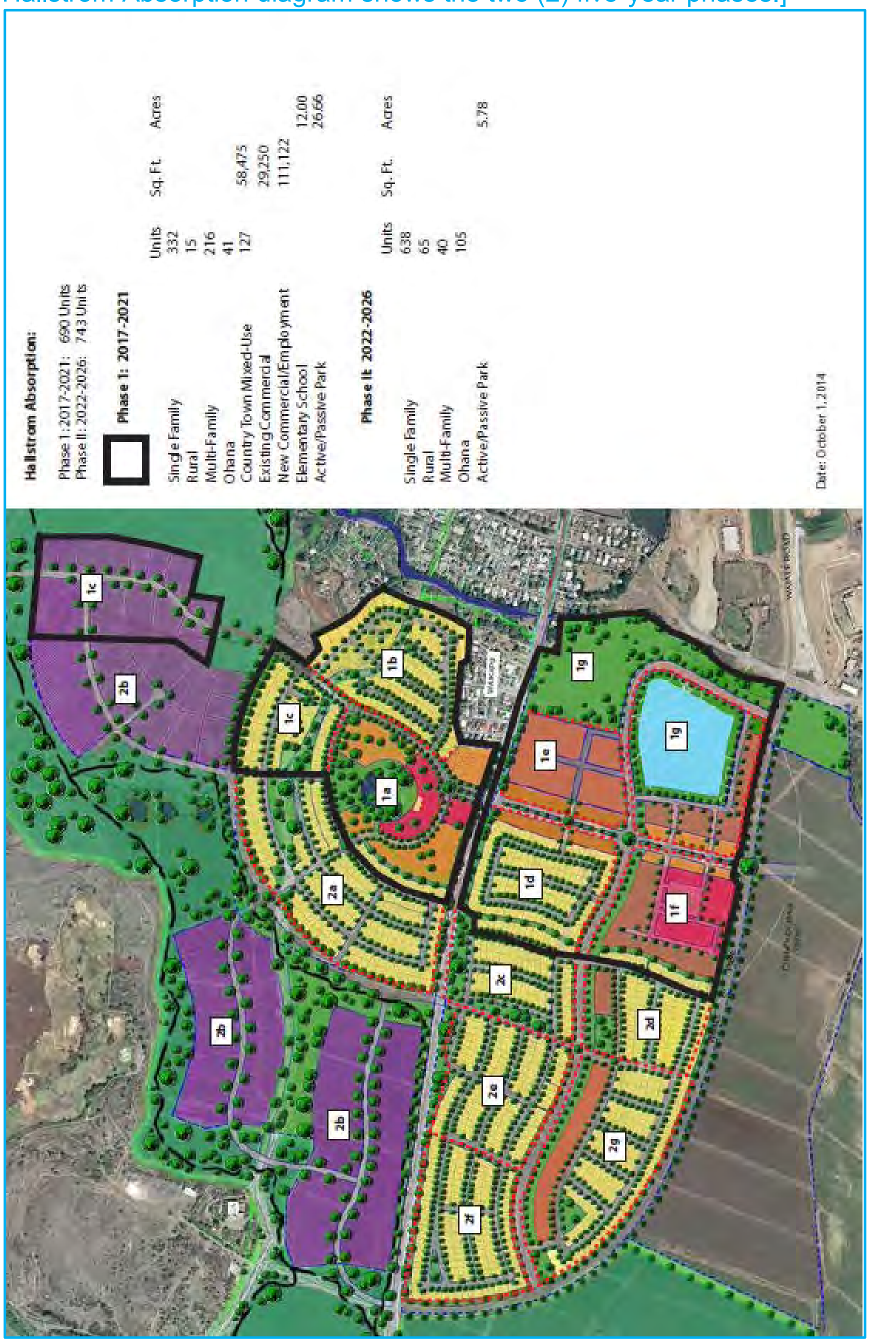
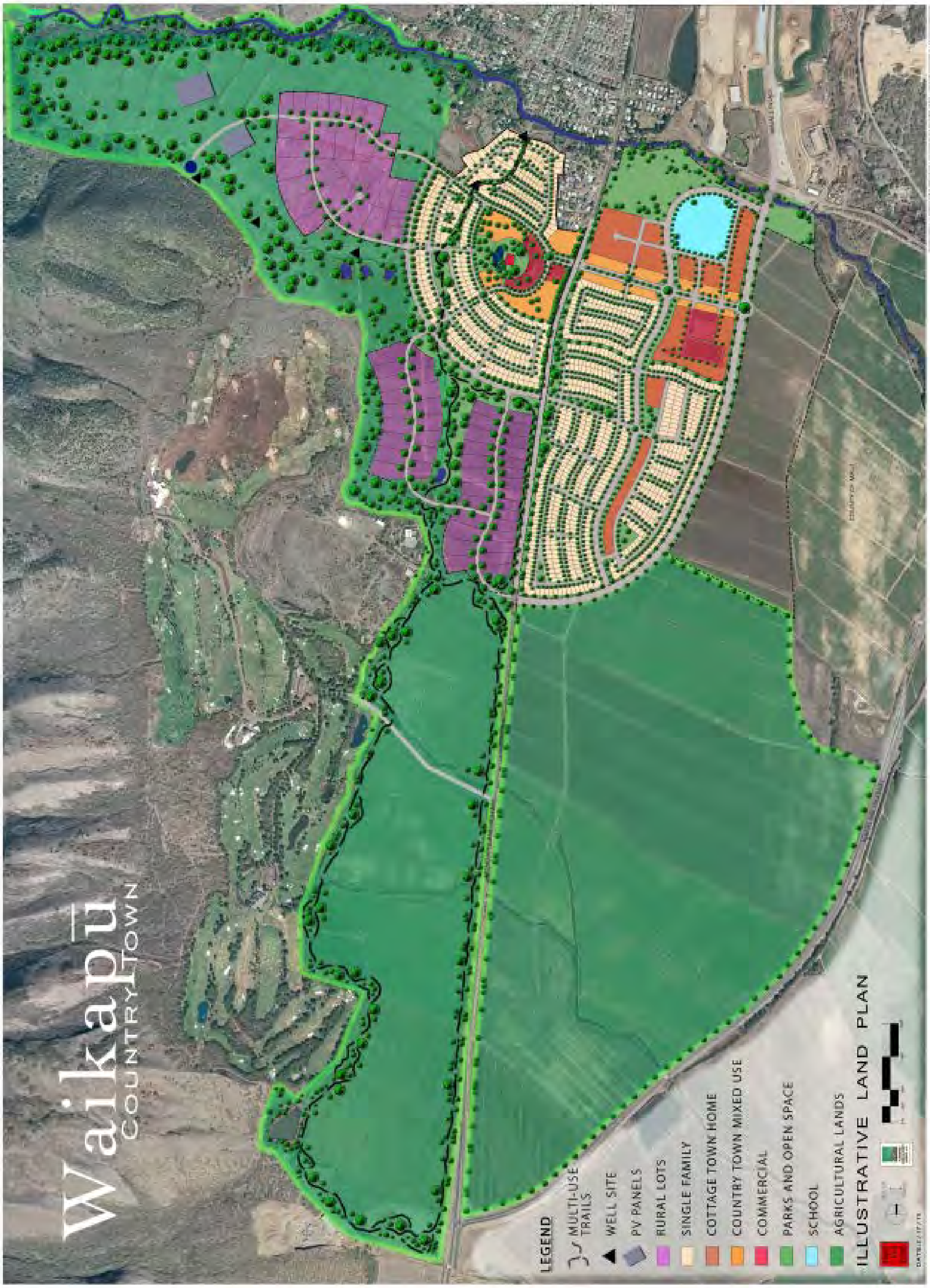


Figure 2: Illustrative Land Plan

Figure 3: Illustrative Land Plan



9. General Private WWTW Description

9.1. Wastewater Sources and Characteristics

9.1.1. Flow

9.1.1.1. The unit of measurement for the volumetric rate of movement of wastewater.

9.1.1.2. Most commonly expressed in gallons per day (“gpd”) or million gpd (“MGD”).

9.1.1.3. Domestic wastewater from the following types of establishments:

9.1.1.3.1. Residential:

9.1.1.3.1.1. Water closets (i.e. toilets)

9.1.1.3.1.2. Showers

9.1.1.3.1.3. Lavatories, sinks, and basins

9.1.1.3.2. Commercial:

9.1.1.3.2.1. Non-FOG Sources:

9.1.1.3.2.1.1 Water closets

9.1.1.3.2.1.2 Urinals

9.1.1.3.2.1.3 Lavatories, sinks, and basins

9.1.1.3.2.1.4 Floor drains

9.1.1.3.2.2. FOG Sources:

9.1.1.3.2.2.5 Dishwashers

9.1.1.3.2.2.6 Kitchen sinks (1-, 2-, and 3-compartment sinks)

9.1.1.3.2.2.7 Floor drains

9.1.1.3.2.2.8 Floor sinks

9.1.1.3.3. Civic:

9.1.1.3.3.1. Water closets

9.1.1.3.3.2. Urinals

9.1.1.3.3.3. Showers

9.1.1.3.3.4. Lavatories, sinks, and basins

9.1.1.3.3.5. Floor drains

9.1.2. BOD: Biochemical Oxygen Demand

9.1.2.1. A measure of the amount of dissolved oxygen required by aerobic biological bacteria and other microorganisms in water or wastewater to stabilize decomposable organic matter present in a given water sample at a specific temperature over a specific time period.

9.1.2.2. Most commonly expressed in milligrams per liter (“mg/L”)

9.1.2.3. BOD is not a measure of some specific pollutant (Vesilind and Morgan, 2004).

9.1.2.4. A very low rate of use would indicate:

9.1.2.4.1. The absence of contamination,

9.1.2.4.2. The available microorganisms are uninterested in consuming the available organics, or

9.1.2.4.3. The microorganisms are dead or dying (Vesilind and Morgan, 2004).

9.1.2.5. BOD_5: Five-day BOD. The standard BOD test is run in the dark at 20°C for five (5) days.

9.1.2.6. “BOD_5” means five (5) days BOD as measured by a standard test indicating the quantity of oxygen utilized by wastewater under controlled conditions of temperature and time (DOH-WWB, 2004).

9.1.2.7. The BOD_5 in the effluent from a treatment works shall not exceed 30 mg/L based on the arithmetic average of the results of the analyses of composite samples (DOH-WWB, 2004).
9.1.2.7.1. For wastewater treatment works with design flows greater than or equal to 100,000 gpd, the owner or operator shall perform composite sampling at least weekly (DOH-WWB, 2004).
9.1.2.8. The BOD_5 in the effluent from a treatment works shall not exceed 60 mg/L based on a grab sample (DOH-WWB, 2004).
9.1.2.8.1. For wastewater treatment works with design flows less than 100,000 gpd, the owner or operator shall perform grab sampling at least monthly (DOH-WWB, 2004).
9.1.2.9. Secondary Treatment Standards:
9.1.2.9.1. 7-Day Average $BOD_5 \leq 45$ mg/L (EPA, 1984)
9.1.2.9.2. 30-Day Average $BOD_5 \leq 30$ mg/L (EPA, 1984)
9.1.2.9.3. 30-Day Average BOD_5 Percent Removal ≥ 85% (EPA, 1984)

9.1.3. TSS: Total Suspended Solids (aka "SS")
9.1.3.1. A measure of the amount material other than water or gas that is not dissolved into the water, but is able to be suspended in the water and does not settle to the bottom, which would be settleable solids.
9.1.3.2. Most commonly expressed in milligrams per liter ("mg/L")
9.1.3.3. "SS" means suspended solids and indicates the characteristic state of solids in wastewater (DOH-WWB, 2004).
9.1.3.4. The SS in the effluent from a treatment works shall not exceed 30 mg/L based on the arithmetic average of the results of the analyses of composite samples (DOH-WWB, 2004).
9.1.3.4.1. For wastewater treatment works with design flows greater than or equal to 100,000 gpd, the owner or operator shall perform composite sampling at least weekly (DOH-WWB, 2004).
9.1.3.5. The SS in the effluent from a treatment works shall not exceed 60 mg/L based on a grab sample (DOH-WWB, 2004).
9.1.3.5.1. For wastewater treatment works with design flows less than 100,000 gpd, the owner or operator shall perform grab sampling at least monthly (DOH-WWB, 2004)
9.1.3.6. The pollutant parameter total suspended solids (EPA, 1984).
9.1.3.7. Secondary Treatment Standards:
9.1.3.7.1. 7-Day Average SS ≤ 45 mg/L (EPA, 1984)
9.1.3.7.2. 30-Day Average SS ≤ 30 mg/L (EPA, 1984)
9.1.3.7.3. 30-Day Average SS Percent Removal ≥ 85% (EPA, 1984)

9.1.4. pH
9.1.4.1. A measure of acidity or basicity of an aqueous solution.
9.1.4.2. "pH" means the logarithm of the reciprocal of the hydrogen ion concentration measured at 25°C or measured at another temperature and then converted to a n equivalent value at 25°C (DOH-WWB, 2004).
9.1.4.3. Secondary Treatment Standards:
9.1.4.3.1. $6.0 \leq pH \leq 9.0$ (EPA, 1984)

9.1.5. Priority Pollutants

9.1.5.1. A set of organic and inorganic pollutants identified and regulated by the EPA based on their known or suspected carcinogenicity, mutagenicity, teratogenicity, or high acute toxicity, and for which analytical test methods have been developed (Tchobanoglous, Burton, and M&E, 1991).

9.1.5.2. The current list of Priority Pollutants can be found in Appendix A – Priority Pollutants.

9.1.6. O&G: Oils & Grease (aka FOG)

9.1.6.1. O&G consists of a group of related constituents that are of special concern in wastewater treatment due to their unique physical properties and highly concentrated energy content (Kiepper, 2013).

9.1.6.2. O&G constituents in wastewater can come from plants and animals (e.g. lard, butter, vegetable oils, and fats) as well as petroleum sources (e.g. kerosene, lubricating oils) (Kiepper, 2013).

9.1.6.3. O&G are generally hydrophobic (i.e. “water-hating”) and thus have low solubility in wastewater, resulting in relatively low biodegradability by microorganisms (Kiepper, 2013).

9.1.6.4. O&G becomes more soluble (i.e. more easily dissolved) in wastewater at high temperatures and will form emulsions (i.e. oil-water mixtures) that will often separate back out of wastewater as temperatures become cooler; thus, O&G are notorious for causing sewer collection system problems (e.g. blockages, pump failures) (Kiepper, 2013).

9.1.6.5. Pre-treatment equipment and systems installed as close to the wastewater source as possible and prior to entering the wastewater collection system is the best management practice to prevent long-term wastewater collection system and WWTW system problems.

9.1.6.6. Pre-treatment equipment and systems are typically utilized after commercial and civic establishment types (i.e. restaurants, public restrooms).

9.1.6.7. Examples of pre-treatment equipment and systems may include:

9.1.6.7.1. Grease interceptors (“GI”)

9.1.6.7.2. Pre-Loaders (“PL”, aka “trash tanks”)

9.1.6.7.3. Solids and FOG collection, handling, and disposal management plans and systems

9.2. Collection System: A system or network of underground pipes and sewer manholes (“SMH”) and underground and/or aboveground pump stations installed to convey wastewater (i.e. liquid and solids) from the wastewater sources to the WWTW.

9.2.1. Gravity Lines: The portion of the collection system, which typically includes underground pipes and fittings installed at specific downstream slopes, which conveys the wastewater by means of gravity.

9.2.1.1. Pipes and Fittings

9.2.1.1.1. Sizes and materials to be determined during the design phase of the project.

9.2.1.1.2. Typical diameters range from 4-inch to 48-inch.

9.2.1.1.3. Typical materials include:

9.2.1.1.3.1. ABS

9.2.1.1.3.2. PVC

9.2.1.2. Sewer Manholes ("SMH"): The access point from the existing grade to the gravity pipe, which is typically installed at the location of a change in direction of the pipe path, at the location of a junction of pipes, and/or after a specific horizontal length of pipe run according to applicable codes, standards, and regulations.

9.2.1.2.1. Sizes, types, and quantities to be determined during the design phase of the project.

9.2.1.2.2. Typical materials:

9.2.1.2.2.1. Reinforced concrete (for base, walls or riser-sections, and cone-section)

9.2.1.2.2.2. Cast-iron (for covers and frames)

9.2.1.2.2.3. Wrought iron or stainless steel (for rungs)

9.2.1.3. O&M:

9.2.1.3.1. Periodic and continuous inspection, unclogging, cleaning, pumping, and repair shall be performed by WWTW Operator Service Provider.

9.2.1.3.2. Responsible party (i.e. WWTW Operator Service Provider) shall be identified by others.

9.2.1.3.3. WWTW Operator Service Provider shall have properly trained, certified, and managed personnel.

9.2.1.4. Odor

9.2.1.4.1. Odor from collection system is typical and inevitable.

9.2.1.4.2. Responsible party (i.e. WWTW Operator Service Provider) shall be capable of addressing.

9.2.1.5. Spill Prevention and Response

9.2.1.5.1. Responsible party (i.e. WWTW Operator Service Provider) shall be capable of preventing and responding to spills.

9.2.1.5.2. Responsible party (i.e. WWTW Operator Service Provider) shall be well aware and updated of current and applicable Federal, State, and local laws, regulations, protocols, and procedures.

9.2.1.6. Contingencies

9.2.1.6.1. Responsible party (i.e. WWTW Operator Service Provider) shall prepare and implement proper safety, O&M, odor, and emergency response plans.

9.2.1.6.2. Responsible party (i.e. WWTW Operator Service Provider) shall have proper equipment (e.g. tools, vehicles, pump trucks), systems (e.g. 24-7 call-center), and personnel in order to operate and maintain collection system in a timely manner.

9.2.1.6.3. Responsible party (i.e. WWTW Operator Service Provider) shall have in-stock necessary surplus materials (e.g. pipes, covers, fittings, SMHs, etc.) in order to repair collection system in a timely manner.

9.2.2. Pump Station (aka "force main" or "lift station"): A facility, which typically includes a secured building, storage well, and system of pipes, valves, pumps, and other equipment, to convey raw wastewater from a low-point of an upstream gravity line to a higher-point of a downstream gravity line.

9.2.2.1. O&M

9.2.2.1.1. Periodic and continuous inspection, unclogging, cleaning, pumping, and repair shall be performed by WWTW Operator Service Provider.

9.2.2.1.2. Responsible party (i.e. WWTW Operator Service Provider) shall be identified by others.

9.2.2.1.3. WWTW Operator Service Provider shall have properly trained, certified, and managed personnel.

9.2.2.2. Odor

9.2.2.2.1. Odor from pump station is typical and inevitable.

9.2.2.2.2. Responsible party (i.e. WWTW Operator Service Provider) shall be capable of addressing.

9.2.2.3. Spill Prevention and Response

9.2.2.3.1. Responsible party (i.e. WWTW Operator Service Provider) shall be capable of preventing and responding to spills.

9.2.2.3.2. Responsible party (i.e. WWTW Operator Service Provider) shall be well aware and updated of current and applicable Federal, State, and local laws, regulations, protocols, and procedures.

9.2.2.4. Contingencies

9.2.2.4.1. Responsible party (i.e. WWTW Operator Service Provider) shall prepare and implement proper safety, O&M, odor, and emergency response plans.

9.2.2.4.2. Responsible party (i.e. WWTW Operator Service Provider) shall have proper equipment (e.g. tools, vehicles, pump trucks), systems (e.g. 24-7 call-center), and personnel in order to operate and maintain pump station in a timely manner.

9.2.2.4.3. Responsible party (i.e. WWTW Operator Service Provider) shall have in-stock necessary surplus materials (e.g. pipes, covers, fittings, SMHs, etc.) in order to repair pump station in a timely manner.

9.2.2.5. Instrumentation

9.2.2.5.1. Sizes, types, and quantities to be determined during the design phase of the project.

9.2.2.6. Valving

9.2.2.6.1. Sizes, types, and quantities to be determined during the design phase of the project.

9.2.2.7. Backup Power

9.2.2.7.1. Sizes, types, and quantities to be determined during the design phase of the project.

9.2.2.7.2. 100% backup power will be required for all pump stations.

9.3. Treatment (liquids and solids): A facility, which typically includes a secured and fenced lot or property, buildings, aboveground and underground tanks, and systems of pipes, valves, pumps, and other equipment, to physically and biologically treat the raw wastewater to acceptable effluent according to the project goals and/or current and applicable Federal, State, and/or local laws, regulations, and standards.

9.3.1. If a private WWTW is utilized, then:
9.3.1.1. A WWTW design must be completed by a Civil Engineer
9.3.1.2. The WWTW design must be in compliance with the DOH-WWB HAR 11-62
9.3.1.3. A WWTW Application must be completed by the Owners or their Engineer
9.3.1.4. The WWTW Application and related document and procedural requirements must be in compliance with the DOH-WWB HAR 11-62
9.3.2. Sizes, types, and materials to be determined during the design phase of the project.
9.3.3. The following are a general overview of typical, but not all, types of treatment systems.

9.3.4. Liquids Treatment

9.3.4.1. Preliminary Treatment
9.3.4.1.1. Bar screens and/or grit channels remove materials that are able to be easily collected from the influent raw wastewater entering the WWTW in order to prevent damaging or clogging the pumps and lines of the primary clarifier(s).
9.3.4.1.2. Typical material removed may include trash, leaves, branches, cans, rages, plastic, etc.

9.3.4.2. Flow Equalization
9.3.4.2.1. Equalization basins temporarily store the influent raw wastewater after preliminary treatment in order to efficiently and uniformly discharge the influent raw wastewater into the primary clarifiers.
9.3.4.2.2. Equalization basins temporarily store the influent raw wastewater after preliminary treatment in order to allow for maintenance of downstream equipment.
9.3.4.2.3. Equalization basins serve as a dilution, distribution, and/or discharge point for high-strength wastewater (e.g. from portable toilet or septic tank pump trucks), which may disrupt the biological processes downstream.

9.3.4.3. Primary Sedimentation Treatment (aka “Primary Sedimentation” or “Primary Treatment”)
9.3.4.3.1. Primary clarifiers or settling tanks allow the influent raw wastewater after flow equalization to physically settle as sludge to the bottom or float as scum to the top.
9.3.4.3.2. The objective of primary treatment is to remove solids.

9.3.4.4. Secondary Biological Treatment (Step 1 of 2)

9.3.4.4.1. The process in which the primary treated wastewater is allowed to biologically degrade.

9.3.4.4.2. The primary treatment has removed much of the suspended organic matter, but the primary treated wastewater still contains a high demand form oxygen due to the dissolved biodegradable organics (i.e. BOD).

9.3.4.4.3. The objective of secondary treatment is to remove BOD by allowing the microorganisms to be brought into contact with oxygen and the dissolved biodegradable organics (i.e. “food”) in order to digest the wastewater.

9.3.4.4.4. Typical methods of secondary treatment achieved using aerobic biological processes may include, but are not limited to:

9.3.4.4.4.1. Suspended-growth (e.g. activated sludge)

9.3.4.4.4.2. Fixed-film or attached growth (e.g. trickling filters, rotating biological contactors, or bio-towers)

9.3.4.5. Secondary Sedimentation Treatment (Step 2 of 2)

9.3.4.5.1. After the microorganisms have aerobically digested the wastewater, the microorganisms are separated from the liquid in a second clarifier or settling tank.

9.3.4.6. Disinfection

9.3.4.6.1. If required per the project goals and/or current and applicable Federal, State, and local laws, regulations, and standards, then disinfection may be performed.

9.3.4.6.2. Disinfection destroys and/or sterilizes pathogenic organisms in order to reduce or eliminate the possibility of disease transmission.

9.3.4.6.3. Typical methods of disinfection may include, but are not limited to:

9.3.4.6.3.1. Chlorine

9.3.4.6.3.2. Ultraviolet (“UV”) light

9.3.4.6.3.3. Ozone

9.3.4.6.3.4. Sodium hydrochloride

9.3.5. Solids Treatment

9.3.5.1. Stabilization

9.3.5.1.1. The objective of solids (or sludge) stabilization is to reduce the following problems:

9.3.5.1.1.1. Solids (or sludge) odor and putrescence (i.e. aesthetically displeasing).

9.3.5.1.1.2. Presences of pathogenic organisms (i.e. potentially harmful to humans and environment).

9.3.5.1.2. Typical methods of solids (or sludge) stabilization may include, but are not limited to:

9.3.5.1.2.1. Lime stabilization

9.3.5.1.2.2. Aerobic digestion

9.3.5.1.2.3. Anaerobic digestion, which may include the following methods, but is not limited to:
9.3.5.1.2.3.9 Primary and secondary anaerobic digesters (e.g. two-stage anaerobic digestion)
9.3.5.1.2.3.10 Egg-shaped anaerobic digester(s)

9.3.5.2. Dewatering
9.3.5.2.1. The objective of solids (or sludge) dewatering is to reduce the quantity of water contained in the solids (or sludge).
9.3.5.2.2. Typical methods of solids (or sludge) dewatering may include, but are not limited to:
9.3.5.2.2.1. Sand drying bed
9.3.5.2.2.2. Belt filter
9.3.5.2.2.3. Solid bowl decanter centrifuge

9.3.6. Backup power
9.3.6.1. Sizes, types, and quantities to be determined during the design phase of the project.
9.3.6.2. 100% backup power will be required for all WWTW equipment and systems.

9.3.7. Reuse (or Recycled) Water
9.3.7.1. In Hawaii, reuse (or recycled) water is governed by the document titled "Guidelines for the Treatment and Use of Recycled Water" (DOH-WWB, 2002).
9.3.7.2. The classifications of recycled water (from least to most treated) is as follows:
9.3.7.2.1. R-3
9.3.7.2.2. R-2
9.3.7.2.3. R-1
9.3.7.3. A summary of suitable uses for recycled water is enclosed in Appendix B – Summary of Suitable Uses for Recycled Water.

9.4. Disposal (liquids and solids): Treated wastewater liquids and solids may be disposed on-site or off-site.
9.4.1. Sizes, types, and materials to be determined during the design phase of the project.
9.4.2. The following are a general overview of typical, but not all, types of disposal systems.

9.4.3. Liquids (i.e. Treated Effluent)

9.4.3.1. Injection Well (aka “Seepage Pit”)

9.4.3.1.1. “Injection well” has the same meaning as defined in chapter 11-23 (DOH-WWB, 2004).

9.4.3.1.2. “Injection well” means a will into which subsurface disposal of fluid or fluids occurs or is intended to occur by means of injection (DOH-SDWB, 2000).

9.4.3.1.3. “Seepage pit” means an excavation in the ground whose depth is greater than its widest surface dimension and which receives the discharge from treatment units and permits the effluent to seep through its bottom or sides to gain access to the underground formation (DOH-WWB, 2004).

9.4.3.1.4. Typical materials:

9.4.3.1.4.1. Pre-cast reinforced concrete (for base, walls or riser-sections, and cone-section)

9.4.3.1.4.1.11 Injection sections are perforated to allow injection, seepage, or discharge into the underground soil and lined with geotextile fabric material to reduce clogging of the perforation by soil.

9.4.3.1.4.1.12 Non-injection sections are not perforated.

9.4.3.1.4.2. Cast-iron (for covers and frames)

9.4.3.1.4.3. Wrought iron or stainless steel (for rungs)

9.4.3.1.5. The utilization and allowed use of injection wells or seepage pits are determined by the DOH-SDWB in accordance with HAR 11-23.

9.4.3.1.6. Typically, any injection well, defined by class V subclass A in HAR 11-23 section 11-23-06, above the Underground Injection Control (“UIC”) boundary line is prohibited.

9.4.3.1.7. Typically, any injection well, defined by class V subclass A in HAR 11-23 section 11-23-06, below the UIC boundary line is allowed per the requirements of HAR 11-23.

9.4.3.1.8. If injection well(s) are allowed to be utilized, then a the design and construction of the injection well(s) must be in compliance with DOH-SDWB HAR 11-23 and a UIC Permit Application must be:

9.4.3.1.8.1. In compliance with DOH-SDWB HAR 11-23

9.4.3.1.8.2. Completed by the Owners or their Engineer

9.4.3.1.8.3. Submitted to the DOH-SDWB

9.4.3.1.8.4. Approved by the DOH-SDWB prior to construction and installation

9.4.3.1.8.5. Maintained via annual monitoring and reporting

9.4.3.2. Absorption Beds
9.4.3.2.1. Absorption beds are another method of treated effluent disposal. However, due to their horizontal configuration, the wastewater capacity of this project, and the available land area, absorption beds would most likely take-up too much land area to be efficient and/or effective.

9.4.3.3. Percolation
9.4.3.3.1. Percolation Rate:
9.4.3.3.1.1. The unit of measurement for the time duration per vertical length of the movement of liquid through porous material.
9.4.3.3.1.2. Most commonly expressed in minutes per inch ("mpi").
9.4.3.3.1.3. In Hawaii, the percolation rate is cross-referenced to Table 3 in the DOH-WWB HAR 11-62 Appendix F to obtain the corresponding required absorption area per 200 gpd.
9.4.3.3.2. Percolation Test:
9.4.3.3.2.1. A procedural test to determine the percolation rate.

9.4.3.4. Reuse (or Recycled) Water
9.4.3.4.1. See Section 9.3.7.

9.4.4. Solids

9.4.4.1. Biosolids Reuse
9.4.4.1.1. See Section 9.3.7.

9.4.4.2. Off-Site Transport and Disposal of Treated and Dewatered Sludge
9.4.4.2.1. If the local County accepts treated and dewatered sludge, then the treated and dewatered sludge, testing of the sludge, and transport equipment, methods, and procedures must meet the current and applicable Federal, State, and/or local laws, regulations, and standards.
9.4.4.2.2. Feasibility, applicability, and all other components of off-site transport and disposal of treated and dewatered sludge to be determined during the design phase of the project.

9.5. Associated issues
9.5.1. Odor:
9.5.1.1. Odors in domestic wastewater usually are caused by gases produced by the decomposition of organic matter or by substances added to the wastewater (Tchobanoglous, Burton, and M&E, 1991).
9.5.1.2. The importance of odors at low concentrations in human terms is related primarily to the psychological stress they produce rather than to the harm they do to the body. In extreme situations, offensive odors can lead to the deterioration of person and community pride, interfere with human relations, discourage capital investment, lower socio-

economic status, and deter growth (Tchobanoglous, Burton, and M&E, 1991).

9.5.1.3. Odors can be measured by sensory methods (i.e. often a panel of human subjects are exposed to odors) or instrumental methods (i.e. specific odorant concentrations are measured) (Tchobanoglous, Burton, and M&E, 1991).

9.5.1.4. Proximity of residential areas and direction of prevailing winds shall be considered by during the design phase of the project.

9.5.2. Supervisory Control and Data Acquisition (“SCADA”): At type of computer-based industrial control system with coded signals to provide 24-hour monitoring, remote control, and process control for wastewater pump stations, WWTW facilities, and reuse systems.

9.5.3. Reporting: Monitoring, testing and reporting shall be based on all current and applicable Federal, State, and local laws, regulations, and standards.

9.5.4. Training: All WWTW Operator Service Provider staff shall be properly trained and certified. Continuous and updated training shall be provided to all staff of the WWTW. Training certification shall include, but is not limited to the following:

9.5.4.1. Hazardous Waste Operations and Emergency Response

9.5.4.2. OSHA Hazard Recognition Training for the Construction Industry

9.5.4.3. First Aid, CPR, Adult AED

9.5.5. Safety: All WWTW Operator Service Provider staff shall understand that safety and health of the public and themselves is priority. Safety plans and practices may include, but are not limited to the following:

9.5.5.1. OSHA 29 Code of Federal Regulation 1910

9.5.5.2. OSHA 29 Code of Federal Regulation 1926

10. Project Specific Private WWTW Description

10.1. Information and Description Provided By Client

10.1.1. WCT intends to be a “complete community”, encompassing a mixture of single- and multi-family residential units, commercial, and civic uses.

10.1.2. WCT intends to be built in two (2) phases of five (5) years each both mauka and makai of Honoapiilani Highway.

10.1.3. WCT intends to be a low-volume commercial community, which encourages more pedestrian and bicycle traffic.

Updates, changes, and additions into the following tables are shown in pink cells.

Table 3: Phase 1 – Development Unit Type vs. Incremental Phasing Program

	Type	Subtype	Phase 1									
			1 A	1 B	1 C	1 D	1 E	1 F	1 G	1 H	Subtotal	Unit
1	Residential	Single Family	15.00	113.00	60.00	125.00	0.00	19.00	0.00	0.00	332.00	units
		Rural	0.00	0.00	15.00	0.00	0.00	0.00	0.00	0.00	15.00	
		Multi-Family	0.00	0.00	0.00	0.00	90.00	54.00	72.00	0.00	216.00	
		Ohana	2.00	11.00	21.00	6.00	0.00	1.00	0.00	0.00	41.00	
		Country Town Mixed-Use (MF Residential)	86.00	0.00	0.00	11.00	14.00	8.00	7.00	0.00	126.00	
2	Commercial	Country Town Mixed-Use (Commerical)	29,621.00	0.00	0.00	7,806.00	10,106.00	4,251.00	6,691.00	0.00	58,475.00	SF
		Existing Commercial	29,250.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29,250.00	
		New Commercial/Emp.	24,438.00	0.00	0.00	0.00	0.00	86,684.00	0.00	0.00	111,122.00	
3	Civic	Elementary School	0.00	0.00	0.00	0.00	0.00	0.00	15.76	0.00	15.76	ac
		"Active" Park	2.28	0.00	0.00	0.00	0.00	2.70	0.43	18.16	23.57	

Table 4: Phase 2 – Development Unit Type vs. Incremental Phasing Program

	Type	Subtype	Phase 2								
			2 A	2 B	2 C	2 D	2 E	2 F	2 G	Subtotal	Unit
1	Residential	Single Family	156.00	0.00	64.00	60.00	117.00	125.00	116.00	638.00	units
		Rural	0.00	65.00	0.00	0.00	0.00	0.00	0.00	65.00	
		Multi-Family	0.00	0.00	0.00	13.00	0.00	0.00	27.00	40.00	
		Ohana	16.00	65.00	3.00	3.00	6.00	6.00	6.00	105.00	
		Country Town Mixed-Use (MF Residential)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2	Commercial	Country Town Mixed-Use (Commerical)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	SF
		Existing Commercial	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
		New Commercial/Emp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3	Civic	Elementary School	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ac
		"Active" Park	0.00	0.00	0.00	2.22	0.00	0.00	5.56	7.78	

Table 5: Project (Phases 1 & 2) – Development Unit Type vs. Conceptual Land Use Plan

	Type	Subtype	Project		
			Subtotal	Total	Unit
1	Residential	Single Family	970.00	1,578.0	units
		Rural	80.00		
		Multi-Family	256.00		
		Ohana	146.00		
		Country Town Mixed-Use (MF Residential)	126.00		
2	Commercial	Country Town Mixed-Use (Commerical)	58,475.00	198,847.0	SF
		Existing Commercial	29,250.00		
		New Commercial/Emp.	111,122.00		
3	Civic	Elementary School	15.76	47.1	ac
		"Active" Park	31.35		

11. Assumptions for Wastewater Flow Estimation

11.1. Beyond the development unit types and quantities provided in Table 3, Table 4, and Table 5 limited information was provided regarding the description, types and subtypes, mix, quantities, sizes, etc. of the various residential, commercial, and civic establishments.

11.2. Therefore, the following rationales were used for the wastewater flow estimation of the various residential, commercial, and civic establishments.

11.3. Residential (i.e. Single Family, Rural, Multi-Family, and Ohana)

11.3.1. *This value is for information only.* Min. Flow per Apartment or Condo = 255 gpd/unit (County of Maui, WRD, WFS, 02-Feb-2000)

11.3.2. *This value is for information only.* Max. Occupancy per Apartment or Condo = 2.5 persons/unit

11.3.3. *This value is for information only.* Max. Occupancy per Residence = 4 persons/unit (County of Maui, WRD, WFS, 02-Feb-2000)

11.3.4. *This value is for information only.* Min. Dwelling Flow per Person = 100 gpd/person (DOH-WWB, HAR 11-62, Appendix F, Table 1, 15-Apr-1997)

11.3.5. *This value is for information only.* Min. Dwelling Occupancy per Bedroom = 2 persons/bedroom (DOH-WWB, HAR 11-62, Appendix F, Table 1, 15-Apr-1997)

11.3.6. Min. Flow per Residence = 350 gpd/unit (County of Maui, WRD, WFS, 02-Feb-2000)

11.3.7. Residential Scenario A: Min. Flow per Residence = 350 gpd/unit

11.4. Commercial (i.e. Country Town Mixed-Use, Existing Commercial, and New Commercial/Emp.)

11.4.1. For all Commercial type lots, only horizontal areas in square feet were provided. It was assumed that these horizontal areas were total area, NOT building area. Therefore, the following assumptions were used in order to calculate estimated flow scenarios, but need to be verified by the Owner, their Architect, or other Consultants or project specific data needs to be provided by the Owner and/or other Consultants:

11.4.1.1. Max. Percentage of Commercial Building Coverage = 25%

$$A_{BA} = A_{TCA} \times (Max.\ \%\ Commercial\ Building\ \ Coverage) = A_{TCA} \times 25\% = 0.25A_{TCA}$$

11.4.2. Building Area (“BA”): Total horizontal area of all commercial buildings.

11.4.3. Total Commercial Area (“TCA”): Total horizontal area of all commercial-type lots, which includes:

11.4.3.1. Country Town Mixed-Use

11.4.3.2. Existing Commercial

11.4.3.3. New Commercial/Emp.

11.4.4. For Commercial Employee Flow per TCA:

11.4.4.1. Min. Retail Flow per Employee = 15 gpd/person (County of Maui, WRD, WFS, 02-Feb-2000)

11.4.4.2. Min. Office Flow per Employee = 20 gpd/person (County of Maui, WRD, WFS, 02-Feb-2000)

11.4.4.3. Min. Industrial Flow per Employee = 25 gpd/person (County of Maui, WRD, WFS, 02-Feb-2000)

11.4.4.4. Min. Factory Flow per Employee = 30 gpd/person (County of Maui, WRD, WFS, 02-Feb-2000)

11.4.4.5. Max. Occupancy per Office = 200 SF/person (County of Maui, WRD, WFS, 02-Feb-2000)

11.4.4.6. Max. Occupancy per Retail Warehouse = 350 SF/person (County of Maui, WRD, WFS, 02-Feb-2000)

11.4.4.7. Max. Occupancy per Storage or Industrial = 500 SF/person (County of Maui, WRD, WFS, 02-Feb-2000)

$$\frac{Q_{Min.\ Retail\ Warehouse}}{A_{BA}} = \frac{1\ person}{350\ ft^2} \times \frac{15\ gpd}{person} = 0.043\frac{gpd}{ft^2} = \frac{Q_{Min.\ Retail\ Warehouse}}{0.25A_{TCA}}$$

$$\frac{Q_{Min.\ Retail\ Warehouse}}{A_{TCA}} = 0.043\frac{gpd}{ft^2} \times 0.25 = 0.011\frac{gpd}{ft^2}$$

$$\frac{Q_{Min.\ Industrial}}{A_{BA}} = \frac{1\ person}{500\ ft^2} \times \frac{25\ gpd}{person} = 0.050\frac{gpd}{ft^2} = \frac{Q_{Min.\ Industrial}}{0.25A_{TCA}}$$

$$\frac{Q_{Min.\ Industrial}}{A_{TCA}} = 0.050\frac{gpd}{ft^2} \times 0.25 = 0.013\frac{gpd}{ft^2}$$

$$\frac{Q_{Min.\ Factory}}{A_{BA}} = \frac{1\ person}{500\ ft^2} \times \frac{30\ gpd}{person} = 0.060\frac{gpd}{ft^2} = \frac{Q_{Min.\ Factory}}{0.25A_{TCA}}$$

$$\frac{Q_{Min.\ Storage}}{A_{TCA}} = 0.060\frac{gpd}{ft^2} \times 0.25 = 0.015\frac{gpd}{ft^2}$$

$$\frac{Q_{Min.\ Office}}{A_{BA}} = \frac{1\ person}{200\ ft^2} \times \frac{20\ gpd}{person} = 0.100\frac{gpd}{ft^2} = \frac{Q_{Min.\ Office}}{0.25A_{TCA}}$$

$$\frac{Q_{Min.\ Office}}{A_{TCA}} = 0.100\frac{gpd}{ft^2} \times 0.25 = 0.025\frac{gpd}{ft^2}$$

11.4.4.8. Commercial Employee Scenario B: Min. Retail Employee Flow per TCA = 0.011 gpd/SF

11.4.4.9. Commercial Employee Scenario C: Min. Industrial Employee Flow per TCA = 0.013 gpd/SF

11.4.4.10. Commercial Employee Scenario D: Min. Factory Employee Flow per TCA = 0.015 gpd/SF

11.4.4.11. Commercial Employee Scenario E: Min. Office Employee Flow per TCA = 0.025 gpd/SF

11.4.5. For Commercial Non-Restaurant Customer Flow per TCA:

11.4.5.1. Min. Retail Flow per Customer = 5 gpd/person (County of Maui, WRD, WFS, 02-Feb-2000)

11.4.5.2. The following traffic data was assumed in order to calculate estimated flow scenarios, but need to be verified by the Owner or Traffic Engineer or project specific data needs to be provided by the Owner and/or other Consultants:

11.4.5.2.1. Low Traffic = 5% vehicles/SF

11.4.5.2.2. High Traffic = 15% vehicles/SF

11.4.5.2.3. Low Vehicle Occupancy = 2 persons/vehicle

11.4.5.2.4. High Vehicle Occupancy = 4 persons/vehicle

$$\frac{Q_{Min.\ Retail\ Customer\ (L\times L)}}{A_{BA}} = \frac{5\ gpd}{person} \times \frac{5\%\ vehicles}{ft^2} \times \frac{2\ persons}{vehicle} = 0.50\frac{gpd}{ft^2} = \frac{Q_{Retail\ Customer\ (L\times L)}}{0.25A_{TCA}}$$

$$\frac{Q_{Min.\ Retail\ Customer\ (L\times L)}}{A_{TCA}} = 0.50\frac{gpd}{ft^2} \times 0.25 = 0.13\frac{gpd}{ft^2}$$

$$\frac{Q_{Min.\ Retail\ Customer\ (L\times H)}}{A_{BA}} = \frac{5\ gpd}{person} \times \frac{5\%\ vehicles}{ft^2} \times \frac{4\ persons}{vehicle} = 1.00\frac{gpd}{ft^2} = \frac{Q_{Retail\ Customer\ (L\times H)}}{0.25A_{TCA}}$$

$$\frac{Q_{Min.\ Retail\ Customer\ (L\times H)}}{A_{TCA}} = 1.00\frac{gpd}{ft^2} \times 0.25 = 0.25\frac{gpd}{ft^2}$$

$$\frac{Q_{Min.\ Retail\ Customer\ (H\times L)}}{A_{BA}} = \frac{5\ gpd}{person} \times \frac{15\%\ vehicles}{ft^2} \times \frac{2\ persons}{vehicle} = 1.50\frac{gpd}{ft^2} = \frac{Q_{Retail\ Customer\ (H\times L)}}{0.25A_{TCA}}$$

$$\frac{Q_{Min.\ Retail\ Customer\ (H\times L)}}{A_{TCA}} = 1.50\frac{gpd}{ft^2} \times 0.25 = 0.38\frac{gpd}{ft^2}$$

$$\frac{Q_{Min.\ Retail\ Customer\ (H\times H)}}{A_{BA}} = \frac{5\ gpd}{person} \times \frac{15\%\ vehicles}{ft^2} \times \frac{4\ persons}{vehicle} = 3.00\frac{gpd}{ft^2} = \frac{Q_{Retail\ Customer\ (H\times H)}}{0.25A_{TCA}}$$

$$\frac{Q_{Min.\ Retail\ Customer\ (H\times H)}}{A_{TCA}} = 3.00\frac{gpd}{ft^2} \times 0.25 = 0.75\frac{gpd}{ft^2}$$

11.4.5.3. Commercial Non-Restaurant Customer Scenario B: Min. Retail Customer Flow (Low x Low) per TCA = 0.13 gpd/SF

11.4.5.4. Commercial Non-Restaurant Customer Scenario C: Min. Retail Customer Flow (Low x High) per TCA = 0.25 gpd/SF

11.4.5.5. Commercial Non-Restaurant Customer Scenario D: Min. Retail Customer Flow (High x Low) per TCA = 0.38 gpd/SF

11.4.5.6. Commercial Non-Restaurant Customer Scenario E: Min. Retail Customer Flow (High x High) per TCA = 0.75 gpd/SF

11.4.6. For Commercial Restaurant Customer Flow per TCA:

11.4.6.1. For Restaurants, NO information was provided. Therefore, the following assumptions were used in order to calculate estimated flow scenarios, but need to be verified by the Owner, their Architect, or other Consultants or project specific data needs to be provided by the Owner and/or other Consultants:

11.4.6.1.1. Restaurant Area (“RA”): Total horizontal area of all commercial restaurants

11.4.6.1.2. Min. RA per Seat = 15 SF/seat

11.4.6.1.3. Percentage of RA of BA = 15%

$$A_{RA} = A_{BA} \times (\%\ RA\ of\ BA) = A_{BA} \times 15\% = 0.25A_{TCA} \times 0.15 = 0.0375A_{TCA}$$

11.4.6.2. Min. Flow per Take-Out Meal = 3 gpd/meal (DOH-WWB, HAR 11-62, Appendix F, Table 1, 15-Apr-1997). The following assumptions were made, but need to be verified by the Owner, other Consultants, or the site specific restaurant:

11.4.6.2.1. BA of Take-Out Restaurant = 3,000 SF

11.4.6.2.2. Time Duration per Take-Out Meal = 60 sec/meal

11.4.6.2.3. Quantity of Take-Out Meals per Minute = 1 meals/min

11.4.6.2.4. Quantity of Take-Out Meals per Hour = 60 meals/hr

11.4.6.2.5. Time Duration of Take-Out Operations = 12 hours

11.4.6.3. Min. Flow per Bar Seat = 15 gpd/seat (DOH-WWB, HAR 11-62, Appendix F, Table 1, 15-Apr-1997)

11.4.6.4. Min. Flow per Average Seat = 80 gpd/seat (DOH-WWB, HAR 11-62, Appendix F, Table 1, 15-Apr-1997 and County of Maui, WRD, WFS, 02-Feb-2000)

11.4.6.5. Min. Flow per Fast Food Seat = 100 gpd/seat (DOH-WWB, HAR 11-62, Appendix F, Table 1, 15-Apr-1997 and County of Maui, WRD, WFS, 02-Feb-2000)

$$\frac{Q_{Min.\ Restaurant\ Customer(Avg)}}{A_{RA}} = \frac{80\ gpd}{seat} \times \frac{seat}{15\ ft^2} = \frac{16\ gpd}{3\ ft^2} = \frac{Q_{Min.\ Restaurant\ Customer(Avg)}}{0.0375 A_{TCA}}$$

$$\frac{Q_{Min.\ Restaurant\ Customer\ Flow\ (Avg)}}{A_{TCA}} = \frac{16\ gpd}{3\ ft^2} \times 0.0375 = 0.2 \frac{gpd}{ft^2}$$

$$\frac{Q_{Min.\ Restaurant\ Customer(Avg+Bar)}}{A_{RA}} = \frac{(15+80) gpd}{seat} \times \frac{seat}{15\ ft^2} = \frac{19\ gpd}{3\ ft^2} = \frac{Q_{Min.\ Restaurant\ Customer(Avg+Bar)}}{0.0375 A_{TCA}}$$

$$\frac{Q_{Min.\ Restaurant\ Customer(Avg+Bar)}}{A_{TCA}} = \frac{19\ gpd}{3\ ft^2} \times 0.0375 = 0.238 \frac{gpd}{ft^2}$$

$$\frac{Q_{Min.\ Restaurant\ Customer(FF)}}{A_{RA}} = \frac{100\ gpd}{seat} \times \frac{seat}{15\ ft^2} = \frac{20\ gpd}{3\ ft^2} = \frac{Q_{Min.\ Restaurant\ Customer(FF)}}{0.0375 A_{TCA}}$$

$$\frac{Q_{Min.\ Restaurant\ Customer(FF)}}{A_{TCA}} = \frac{20\ gpd}{3\ ft^2} \times 0.0375 = 0.250 \frac{gpd}{ft^2}$$

$$\frac{Meals_{TO}}{A_{RA}} = \frac{60\ meals}{hour} \times \frac{12\ hours}{3{,}000 ft^2} = 0.24 \frac{meals}{ft^2}$$

$$\frac{Q_{Min.\ Restaurant\ Customer(FF+TO)}}{A_{RA}} = \left(\frac{100\ gpd}{seat} \times \frac{seat}{15\ ft^2}\right) + \left(\frac{3\ gpd}{meal} \times \frac{0.24\ meals}{ft^2}\right) = \frac{554\ gpd}{75\ ft^2}$$

$$\frac{Q_{Min.\ Restaurant\ Customer(FF+TO)}}{A_{RA}} = \frac{Q_{Min.\ Restaurant\ Customer(FF+TO)}}{0.0375 A_{TCA}}$$

$$\frac{Q_{Min.\ Restaurant\ Customer(FF+TO)}}{A_{TCA}} = \frac{554\ gpd}{75\ ft^2} \times 0.0375 = 0.227 \frac{gpd}{ft^2}$$

11.4.6.6. Commercial Restaurant Customer Scenario B: Min. Restaurant Customer Flow (average seating with NO bar) per TCA = 0.200 gpd/SF

11.4.6.7. Commercial Restaurant Customer Scenario C: Min. Restaurant Customer Flow (average seating with bar) per TCA = 0.238 gpd/SF

11.4.6.8. Commercial Restaurant Customer Scenario D: Min. Restaurant Customer Flow (fast food seating with NO take-out meals) per TCA = 0.250 gpd/SF

11.4.6.9. Commercial Restaurant Customer Scenario E: Min. Restaurant Customer Flow (fast food seating with take-out meals) per TCA = 0.227 gpd/SF

11.5. Civic (i.e. Elementary School and "Active" Park)

11.5.1. For all Elementary School type lots, only horizontal area in acres was provided. It was assumed that the horizontal area for Elementary School was total area, NOT building area. No further information for Elementary School type lots was provided; therefore, the above assumption and following data were used in order to calculate estimated flow scenarios, but these assumptions and data need to be verified by the Owner and/or other Consultants or project specific data needs to be provided by the Owner and/or other Consultants:

11.5.1.1. Lihikai Elementary School:

11.5.1.1.1. Land Area = 16.9618 acres

11.5.1.1.2. Quantity of Students = 1,011 students

11.5.1.1.3. Quantity of Employees = 72 employees

11.5.1.1.3.1. Quantity of Teachers = 46 persons

11.5.1.1.3.2. Quantity of Staff = 26 persons

11.5.1.2. Pomaikai Elementary School:

11.5.1.2.1. Land Area = 13.494 acres

11.5.1.2.2. Quantity of Students = 593 students

11.5.1.2.3. Quantity of Employees = 78 employees

11.5.1.2.3.1. Quantity of Teachers = 31 persons

11.5.1.2.3.2. Quantity of Staff = 47 persons

11.5.1.3. Wailuku Elementary School:

11.5.1.3.1. Land Area = 4.15103 acres

11.5.1.3.2. Quantity of Students = 881 students

11.5.1.3.3. Quantity of Employees = 58 employees

11.5.1.3.3.1. Quantity of Teachers = 41 persons

11.5.1.3.3.2. Quantity of Staff = 17 persons

11.5.1.4. Kihei Elementary School:

11.5.1.4.1. Land Area = 24.778 acres

11.5.1.4.2. Quantity of Students = 876 students

11.5.1.4.3. Quantity of Employees = 79 employees

11.5.1.4.3.1. Quantity of Teachers = 61 persons

11.5.1.4.3.2. Quantity of Staff = 18 persons

11.5.1.5. For Elementary School Flow per TCA:

11.5.1.5.1. Min. Flow per Elementary Student = 15 gpd/student (County of Maui, WRD, WFS, 02-Feb-2000)

11.5.1.5.2. *This value is for information only.* Min. Flow per High-School Student = 25 gpd/student (County of Maui, WRD, WFS, 02-Feb-2000)

$$\frac{Q_{Min.\ Student}}{A_{TESA}} = \frac{15\ gpd}{student} \times \frac{876\ students}{24.778\ acres} = 530\,\frac{gpd}{acre}$$
$$\frac{Q_{Min.\ Student}}{A_{TESA}} = \frac{15\ gpd}{student} \times \frac{593\ students}{13.494\ acres} = 659\,\frac{gpd}{acre}$$
$$\frac{Q_{Min.\ Student}}{A_{TESA}} = \frac{15\ gpd}{student} \times \frac{1{,}011\ students}{16.9618\ acres} = 894\,\frac{gpd}{acre}$$
$$\frac{Q_{Min.\ Student}}{A_{TESA}} = \frac{15\ gpd}{student} \times \frac{881\ students}{4.15103\ acres} = 3{,}184\,\frac{gpd}{acre}$$

11.5.1.6. Civic Elementary School Scenario F: Min. Elementary School Student Flow per TESA = 530 gpd/ac
11.5.1.7. Civic Elementary School Scenario G: Min. Elementary School Student Flow per TESA = 659 gpd/ac
11.5.1.8. Civic Elementary School Scenario H: Min. Elementary School Student Flow per TESA = 894 gpd/ac
11.5.1.9. Civic Elementary School Scenario I: Min. Elementary School Student Flow per TESA = 3,184 gpd/ac

$$\frac{Q_{Min.\ Employee}}{A_{TESA}} = \frac{20\ gpd}{employee} \times \frac{61\ employees}{24.778\ acres} = 64\frac{gpd}{acre}$$
$$\frac{Q_{Min.\ Employee}}{A_{TESA}} = \frac{20\ gpd}{employee} \times \frac{72\ employees}{16.9618\ acres} = 85\frac{gpd}{acre}$$
$$\frac{Q_{Min.\ Employee}}{A_{TESA}} = \frac{20\ gpd}{employee} \times \frac{78\ employees}{13.494\ acres} = 116\frac{gpd}{acre}$$
$$\frac{Q_{Min.\ Employee}}{A_{TESA}} = \frac{20\ gpd}{employee} \times \frac{58\ employees}{4.15103\ acres} = 279\frac{gpd}{acre}$$

11.5.1.10. Civic Elementary School Scenario F: Min. Elementary School Employee Flow per TESA = 64 gpd/ac
11.5.1.11. Civic Elementary School Scenario G: Min. Elementary School Employee Flow per TESA = 85 gpd/ac
11.5.1.12. Civic Elementary School Scenario H: Min. Elementary School Employee Flow per TESA = 116 gpd/ac
11.5.1.13. Civic Elementary School Scenario I: Min. Elementary School Employee Flow per TESA = 279 gpd/ac

11.6. For all Active Park type lots, only horizontal areas in acres were provided. It was assumed that restroom facilities will be provided. It was assumed that the horizontal areas for Active Parks were total areas, NOT building areas. No further information for Active Park type lots was provided; therefore, the above assumptions and following data were used in order to calculate estimated flow scenarios, but these assumptions and data need to be verified by the Owner and/or other Consultants or project specific data needs to be provided by the Owner and/or other Consultants:

- 11.6.1. Makapuu Beach North Comfort Station
  - 11.6.1.1. Approximate Wastewater Flow = 3,000 gpd
  - 11.6.1.2. Land Area = 20.59 acres
- 11.6.2. Barbers Point Beach Park Comfort Station
  - 11.6.2.1. Approximate Wastewater Flow = 2,000 gpd
  - 11.6.2.2. Land Area = 7.39 acres
- 11.6.3. Kahana Valley State Park Comfort Station
  - 11.6.3.1. Approximate Wastewater Flow = 3,000 gpd
  - 11.6.3.2. Land Area = 8.364 acres
- 11.6.4. Wailua River State Park Comfort Station
  - 11.6.4.1. Approximate Wastewater Flow = 5,000 gpd
  - 11.6.4.2. Land Area = 3.446 acres

$$\frac{Q_{Min.\ Park}}{A_{TAPA}} = \frac{3{,}000\ gpd}{20.59\ acres} = 146\frac{gpd}{acre}$$
$$\frac{Q_{Min.\ Park}}{A_{TAPA}} = \frac{2{,}000\ gpd}{7.39\ acres} = 271\frac{gpd}{acre}$$
$$\frac{Q_{Min.\ Park}}{A_{TAPA}} = \frac{3{,}000\ gpd}{8.364\ acres} = 359\frac{gpd}{acre}$$
$$\frac{Q_{Min.\ Park}}{A_{TAPA}} = \frac{5{,}000\ gpd}{3.446\ acres} = 1{,}415\frac{gpd}{acre}$$

- 11.6.5. <u>Civic Active Park Scenario F:</u> Min. Active Park Flow per TAPA = 146 gpd/ac
- 11.6.6. <u>Civic Active Park Scenario G:</u> Min. Active Park Flow per TAPA = 271 gpd/ac
- 11.6.7. <u>Civic Active Park Scenario H:</u> Min. Active Park Flow per TAPA = 359 gpd/ac
- 11.6.8. <u>Civic Active Park Scenario I:</u> Min. Active Park Flow per TAPA = 1,415 gpd/ac

12. Preliminary Private WWTW Flow Estimates

Updates, changes, and additions into the following tables are shown in pink cells.

Table 6: Summary of Development Unit Type vs. Incremental Phasing Program

	Type	Subtype	Unit	Phase 1 Subtype Total	Phase 2 Subtype Total	Project Subtype Total	Phase 1 Type Total	Phase 2 Type Total	Project Type Total
1	Residential	Single Family	units	332	638	970	730	848	1,578
		Rural		15	65	80			
		Multi-Family		216	40	256			
		Ohana		41	105	146			
		Country Town Mixed-Use (MF Residential)		126	0	126			
2	Commerical	Country Town Mixed-Use (Commerical)	SF	58,475	0	58,475	198,847	0	198,847
		Existing Commercial		29,250	0	29,250			
		New Commercial/Emp.		111,122	0	111,122			
3	Civic	Elementary School	ac	15.76	0.00	15.76	39.33	7.78	47.11
		"Active" Park		23.57	7.78	31.35			

Table 7: Summary of Residential Scenario vs. Flows Estimates

	Type	Scenario	Dwelling Flow/Unit	Phase 1 Flow	Phase 2 Flow	Project Flow	Unit
1	Residential	A	350 gpd/unit	255,500	296,800	552,300	gpd

Table 8: Summary of Commercial Scenarios & Sub-Categories vs. Flow Estimates

	Type	Scenario	Employee Flow/Unit	Phase 1 Flow	Phase 2 Flow	Project Flow	Unit
2	Commerical	B	0.011 gpd/SF	2,200	0	2,200	gpd
		C	0.013 gpd/SF	2,600	0	2,600	
		D	0.015 gpd/SF	3,000	0	3,000	
		E	0.025 gpd/SF	5,000	0	5,000	
		Scenario	**Non-Restaurant Customer Flow/Unit**	**Phase 1 Flow**	**Phase 2 Flow**	**Project Flow**	
		B	0.130 gpd/SF	25,900	0	25,900	
		C	0.250 gpd/SF	49,700	0	49,700	
		D	0.380 gpd/SF	75,600	0	75,600	
		E	0.750 gpd/SF	149,100	0	149,100	
		Scenario	**Restaurant Customer Flow/Unit**	**Phase 1 Flow**	**Phase 2 Flow**	**Project Flow**	
		B	0.200 gpd/SF	39,800	0	39,800	
		C	0.238 gpd/SF	47,300	0	47,300	
		D	0.250 gpd/SF	49,700	0	49,700	
		E	0.227 gpd/SF	45,100	0	45,100	

Table 9: Summary of Civic Scenarios & Sub-Categories vs. Flow Estimates

Type		Scenario	Elementary School Student Flow/Unit	Phase 1 Flow	Phase 2 Flow	Project Flow	Unit
3	Civic	F	530 gpd/ac	8,400	0	8,400	gpd
		G	659 gpd/ac	10,400	0	10,400	
		H	894 gpd/ac	14,100	0	14,100	
		I	3,184 gpd/ac	50,200	0	50,200	
		Scenario	**lementary School Employe Flow/Unit**	**Phase 1 Flow**	**Phase 2 Flow**	**Project Flow**	
		F	64 gpd/ac	1,000	0	1,000	
		G	85 gpd/ac	1,300	0	1,300	
		H	116 gpd/ac	1,800	0	1,800	
		I	279 gpd/ac	4,400	0	4,400	
		Scenario	**Active Park Flow/Unit**	**Phase 1 Flow**	**Phase 2 Flow**	**Project Flow**	
		F	146 gpd/ac	3,400	1,100	4,600	
		G	271 gpd/ac	6,400	2,100	8,500	
		H	359 gpd/ac	8,500	2,800	11,300	
		I	1,415 gpd/ac	33,400	11,000	44,400	

Table 10: Summary of All Scenarios vs. Flow Estimates

Type		Scenario	Phase 1 Flow	Phase 2 Flow	Project Flow	Unit
1	Residential	A	255,500	296,800	552,300	gpd
2	Commerical	B	67,900	0	67,900	
		C	99,600	0	99,600	
		D	128,300	0	128,300	
		E	199,200	0	199,200	
3	Civic	F	12,800	1,100	14,000	
		G	18,100	2,100	20,200	
		H	24,400	2,800	27,200	
		I	88,000	11,000	99,000	

Table 11: Summary of Estimate Types vs. Average Flow Estimates

Estimate Type	Phase 1	Phase 2	Project	Unit
	Q(avg)			
Aggressive	336,000	298,000	634,000	gpd
Average	415,000	301,000	716,000	
Conservative	543,000	308,000	851,000	

Table 12: Population Estimates

Population		Qty/unit	Phase 1	Phase 2	Project	Unit
			Qty (persons)			
1	Residential	4	2,920.0	3,392.0	6,312.0	capita
2	Commercial	40	183.0	0.0	183.0	
3	Civic	NA	NA	NA	NA	
Totals			3,103.0	3,392.0	6,495.0	

Table 13: Summary of Estimate Types vs. Maximum Flow Estimates

Babbit Peaking Factor	Phase 1	Phase 2	Project	
	3.99	3.92	3.44	
Estimate Type	**Phase 1**	**Phase 2**	**Project**	**Unit**
	Q(max)			
Aggressive	1,339,531	1,167,065	2,180,436	gpd
Average	1,654,481	1,178,814	2,462,449	
Conservative	2,164,779	1,206,228	2,926,737	

Table 14: Dry Weather Infiltration/Inflow Flow Estimates

Q(dry i/i)/capita	5.00	gpd/capita		
Estimate Type	**Phase 1**	**Phase 2**	**Project**	**Unit**
	Q(dry i/i)			
Average	15,515	16,960	32,475	gpd

Table 15: Summary of Estimate Types vs. Design Average Flow Estimates

Estimate Type	Phase 1	Phase 2	Project	Unit
	Q(des avg)			
Aggressive	351,515	314,960	666,475	gpd
Average	430,515	317,960	748,475	
Conservative	558,515	324,960	883,475	

Table 16: Summary of Estimate Types vs. Design Maximum Flow Estimates

Estimate Type	Phase 1	Phase 2	Project	Unit
	Q(des max)			
Aggressive	1,355,046	1,184,025	2,212,911	gpd
Average	1,669,996	1,195,774	2,494,924	
Conservative	2,180,294	1,223,188	2,959,212	

Table 17: Wet Weather Infiltration/Inflow Flow Estimates

Pre-Development Land Type	Acres	
State Urban	14	
State Agricultural	1562	1576

Post-Development Land Type	Acres	
State Urban & Rural	488	
State Agricultural	1074	
Unaccounted	14	1576

Q(wet i/i)/A	1,250.00	gpd/acre
Estimate Type	Project Q(wet i/i)	Unit
Average	627,500	gpd

Table 18: Summary of Estimate Types vs. Design Peak Flow Estimates

Estimate Type	Phase 1	Phase 2	Project	Unit
	Q(des peak)			
Aggressive	1,982,546	1,811,525	2,840,411	gpd
Average	2,297,496	1,823,274	3,122,424	
Conservative	2,807,794	1,850,688	3,586,712	

13. Preliminary Private WWTW Cost Estimates

13.1. Based on the historical data provided August 23, 2013, the following information was used for preliminary cost estimate purposes:

13.1.1. Engineering Cost Estimate Range per Flow
8% – 12% of Construction Costs

13.1.2. Construction Cost Estimate Range for Secondary Treatment per Flow
$23.00/gpd – $35.00/gpd

13.1.3. Construction Cost Estimate Range for R-1 Recycle Treatment per Flow
$17.00/gpd – $26.00/gpd

13.1.4. Construction Cost Estimate Range for Sludge Off-Site Disposal per Flow
$8.00/gpd – $12.00/gpd

Table 19: Summary of Cost Estimate Range vs. WWTW Component

Phase 1															
Estimate Type	Engineering			Secondary			R-1 Recycled			Sludge Off-Site Disp.			Total Cost Estimate Range		
	8%	-	12%	$ 23/gpd	-	$ 35/gpd	$ 17/gpd	-	$ 26/gpd	$ 8/gpd	-	$ 12/gpd			
Aggressive	$ 1.29 M	-	$ 2.94 M	$ 7.73 M	-	$ 11.76 M	$ 5.71 M	-	$ 8.74 M	$ 2.69 M	-	$ 4.03 M	$ 17.42 M	-	$ 27.47 M
Average	$ 1.59 M	-	$ 3.64 M	$ 9.55 M	-	$ 14.53 M	$ 7.06 M	-	$ 10.79 M	$ 3.32 M	-	$ 4.98 M	$ 21.52 M	-	$ 33.94 M
Conservative	$ 2.08 M	-	$ 4.76 M	$ 12.49 M	-	$ 19.01 M	$ 9.23 M	-	$ 14.12 M	$ 4.34 M	-	$ 6.52 M	$ 28.14 M	-	$ 44.41 M

Phase 2															
Estimate Type	Engineering			Secondary			R-1 Recycled			Sludge Off-Site Disp.			Total Cost Estimate Range		
	8%	-	12%	$ 23/gpd	-	$ 35/gpd	$ 17/gpd	-	$ 26/gpd	$ 8/gpd	-	$ 12/gpd			
Aggressive	$ 1.14 M	-	$ 2.61 M	$ 6.85 M	-	$ 10.43 M	$ 5.07 M	-	$ 7.75 M	$ 2.38 M	-	$ 3.58 M	$ 15.44 M	-	$ 24.37 M
Average	$ 1.16 M	-	$ 2.64 M	$ 6.92 M	-	$ 10.54 M	$ 5.12 M	-	$ 7.83 M	$ 2.41 M	-	$ 3.61 M	$ 15.61 M	-	$ 24.62 M
Conservative	$ 1.18 M	-	$ 2.70 M	$ 7.08 M	-	$ 10.78 M	$ 5.24 M	-	$ 8.01 M	$ 2.46 M	-	$ 3.70 M	$ 15.96 M	-	$ 25.19 M

Project															
Estimate Type	Engineering			Secondary			R-1 Recycled			Sludge Off-Site Disp.			Total Cost Estimate Range		
	8%	-	12%	$ 23/gpd	-	$ 35/gpd	$ 17/gpd	-	$ 26/gpd	$ 8/gpd	-	$ 12/gpd			
Aggressive	$ 2.43 M	-	$ 5.55 M	$ 14.58 M	-	$ 22.19 M	$ 10.78 M	-	$ 16.48 M	$ 5.07 M	-	$ 7.61 M	$ 32.86 M	-	$ 51.83 M
Average	$ 2.75 M	-	$ 6.27 M	$ 16.47 M	-	$ 25.06 M	$ 12.17 M	-	$ 18.62 M	$ 5.73 M	-	$ 8.59 M	$ 37.12 M	-	$ 58.54 M
Conservative	$ 3.27 M	-	$ 7.46 M	$ 19.57 M	-	$ 29.79 M	$ 14.47 M	-	$ 22.13 M	$ 6.81 M	-	$ 10.21 M	$ 44.12 M	-	$ 69.59 M

Table 20: Summary of Total Cost Estimate Range

Estimate Type	Phase 1			Phase 2			Project		
	Total Cost Estimate Range								
Aggressive	$ 17.42 M	-	$ 27.47 M	$ 15.44 M	-	$ 24.37 M	$ 32.86 M	-	$ 51.83 M
Average	$ 21.52 M	-	$ 33.94 M	$ 15.61 M	-	$ 24.62 M	$ 37.12 M	-	$ 58.54 M
Conservative	$ 28.14 M	-	$ 44.41 M	$ 15.96 M	-	$ 25.19 M	$ 44.12 M	-	$ 69.59 M

13.2. These preliminary cost estimates do NOT include the following:
- 13.2.1. Construction Cost Estimates for:
  - 13.2.1.1. Treated Effluent On-Site Disposal System
  - 13.2.1.2. Collection System
  - 13.2.1.3. Sludge On-Site Treatment & Disposal System
  - 13.2.1.4. Reuse/Recycled Water Distribution System
- 13.2.2. O&M Cost Estimates for:
  - 13.2.2.1. WWTWs
  - 13.2.2.2. Effluent On-Site Disposal
  - 13.2.2.3. Sludge Off-Site Disposal
  - 13.2.2.4. Collection System
  - 13.2.2.5. Sludge On-Site Treatment & Disposal System
  - 13.2.2.6. Reuse/Recycled Water Distribution System

14. Future Tasks for Private WWTW

14.1. Identification of Alternative Private WWTW Site

14.1.1. From a preliminary review of the preferred site for the private WWTW (see Table 21), an alternative site may need to be considered. Considering the Average Wastewater Flows for Phase 1 and Phase 2, the approximate available area of 6.33 acres may NOT be feasible.

14.1.2. An alternative site with a larger area for the private WWTW must be considered.

14.1.3. The approximate area needed for the private WWTW for the entire Project may range from 10.40 acres to 13.96 acres.

Table 21: Estimate of WWTW Land Area Requirement

Approx. WWTW Area per Q(avg)		0.0000164 acres/gpd		
Estimate Type	Phase 1	Phase 2	Project	Unit
	WWTW Area			
Aggressive	5.52	4.89	10.40	acres
Average	6.81	4.94	11.75	
Conservative	8.91	5.06	13.96	
Preferred Site for WWTW per Owners	Area	275,570 SF		
		6.33 acres		
	Perimeter	2,152 ft		

14.2. Identification of Allowed and Feasible Treated Effluent Disposal System

14.2.1. From a preliminary review of the UIC map and boundary line for the island of Maui, it appears that the portion of the WCT subdivision property that is east of (or makai of) Honoapiilani Hwy. is below the UIC boundary line. Therefore, injection wells may be considered in this portion of the subdivision property. Further review and analysis must be performed prior to and during the design phase of the project. See the following figures:

14.2.1.1. Figure 4: DOH-SDWB UIC Areas

14.2.1.2. Figure 5: UIC Boundary Line for County of Maui

14.2.1.3. Figure 6: UIC Boundary Line for Island of Maui

14.2.1.4. Figure 7: UIC Boundary Line for Waikapu

14.2.1.5. Figure 8: UIC Boundary Line for WCT

14.2.2. If on-site disposal of treated effluent by means of injection well is not allowed, then horizontal absorption beds may not be feasible due to the available land area. On-site disposal may be allowed by means of reuse/recycled water. Further review and analysis must be performed prior to and during the design phase of the project.

14.2.3. If on-site disposal of treated effluent is not allowed and/or on-site disposal by means of reuse/recycled water is not allowed, not feasible, and/or it is not feasible to dispose all reuse/recycled water on-site, then off-site disposal may be required. Off-site disposal may be reuse/recycled water distribution to user(s) of reuse/recycled water.

14.2.3.1. Owner must determine the user(s) of reuse/recycled water and all associated and applicable agreements, contracts, responsibilities, fees, etc.

14.2.3.2. Further review and analysis must be performed prior to and during the design phase of the project.

14.3. Identification of Approved Disposal Site Treated and Dewatered Sludge

14.3.1. Further discussion with the County of Maui must be conducted to determine the allowed quantity of treated and dewatered sludge to be accepted at their facility(ies).

14.3.2. If the County of Maui does not allow or accept any or all of the treated and dewatered sludge from the WCT private WWTW, then further sludge treatment and processing equipment and facilities must be considered.

14.3.3. Further review and analysis must be performed prior to and during the design phase of the project.

14.4. Identification of the Private Collection System

14.4.1. Whether the WCT project decides to utilize a private WWTW or connection to the County of Maui collection system, the following items will need to be developed:

14.4.1.1. The internal collection system within the boundaries of the WCT project.

14.4.1.2. The quantity, types, and sizes of pump stations within the boundaries of the WCT project.

14.4.2. Development of the internal collection system for the WCT project was not in the Scope of Work for this Preliminary Planning Report by Enviniti and, therefore, was not discussed.

14.4.3. Further review and analysis must be performed during the design phase of the project.

14.5. Detailed Information Required for Design

14.5.1. Client shall provide further subdivision and development use information to the wastewater engineer to calculate more accurate wastewater flows, particularly for the Commercial and Civic uses.

Figure 4: DOH-SDWB UIC Areas

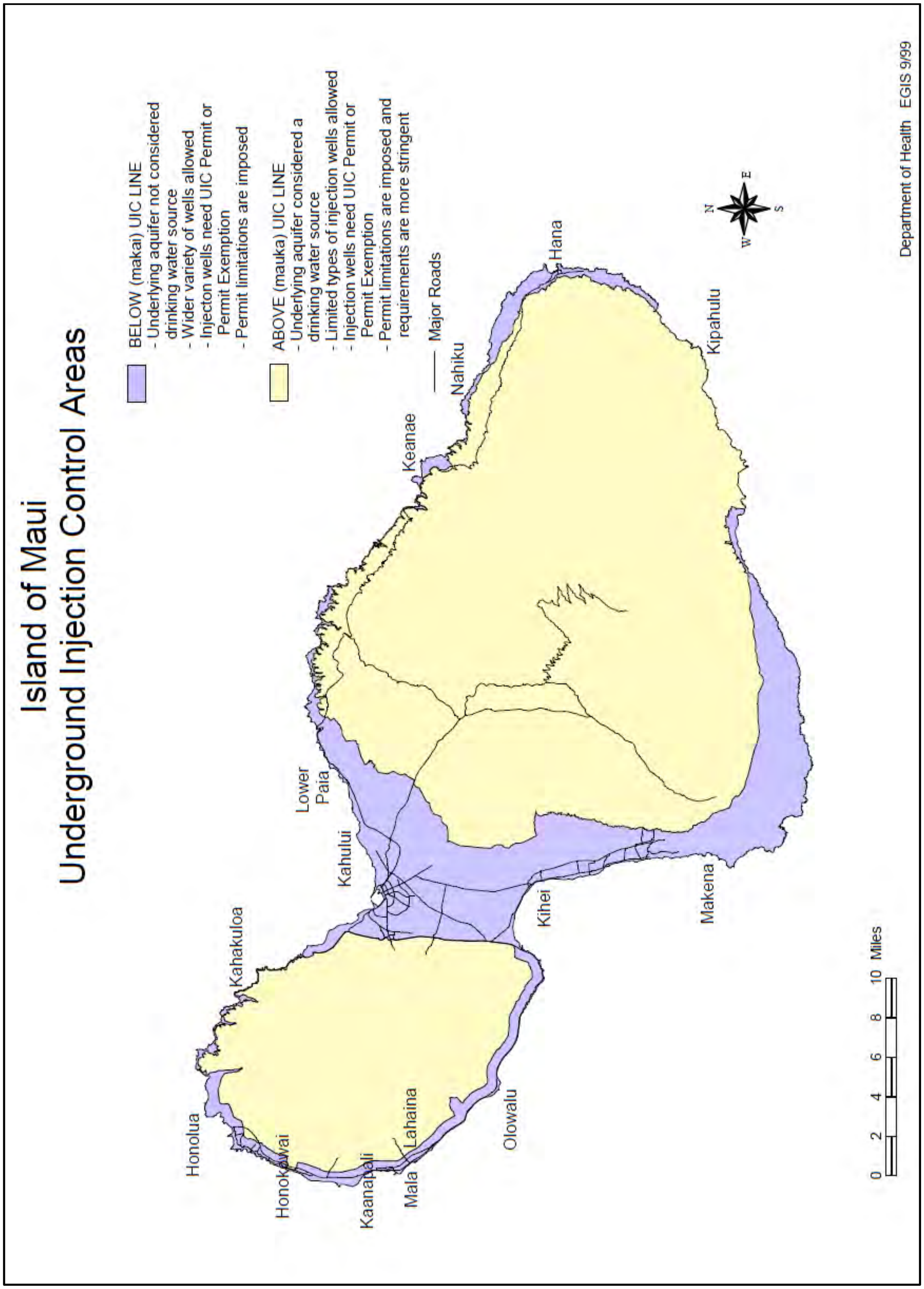


Figure 5: UIC Boundary Line for County of Maui

Figure 6: UIC Boundary Line for Island of Maui

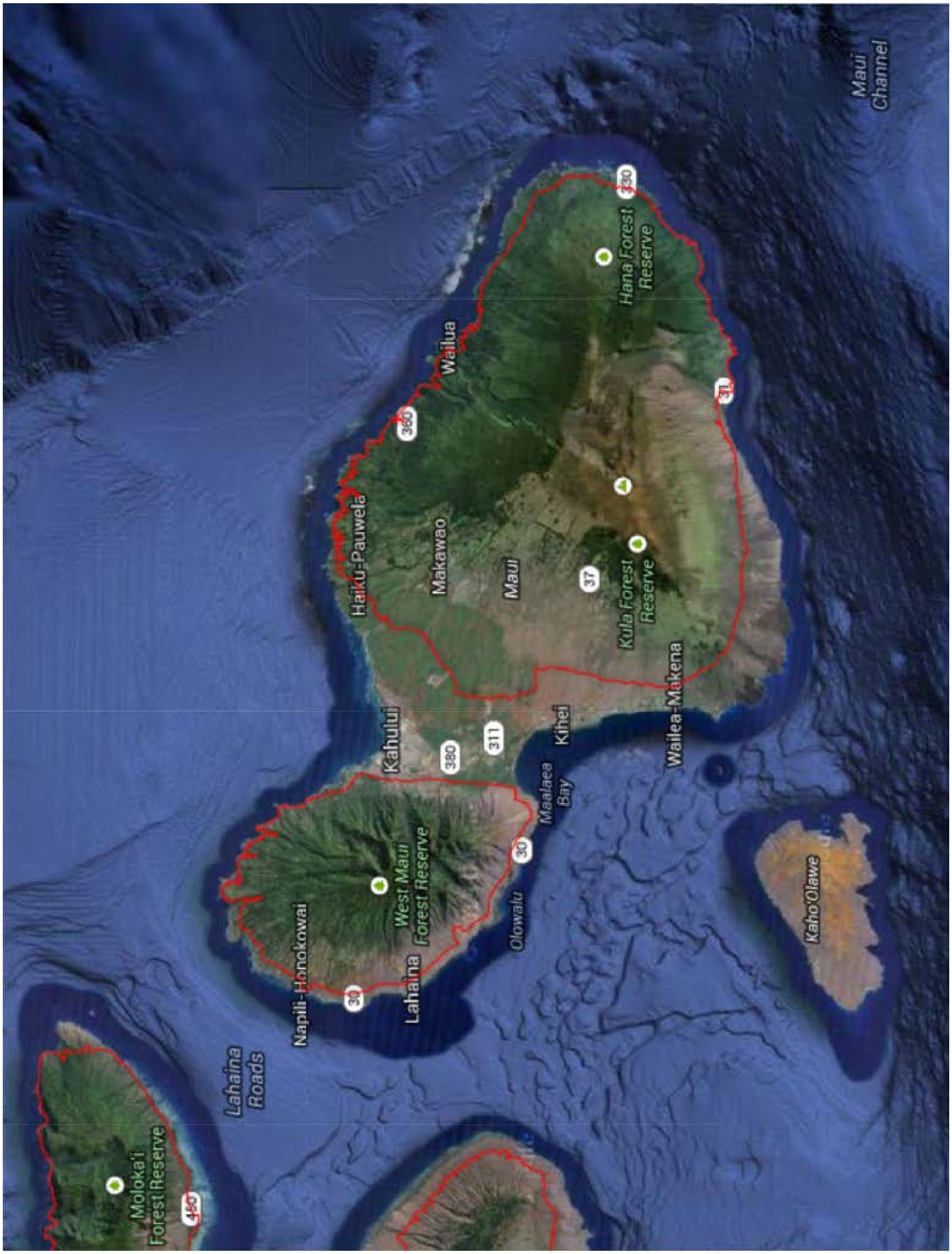


Figure 7: UIC Boundary Line for Waikapu

Figure 8: UIC Boundary Line for WCT

15. References

City and County of Honolulu Department of Wastewater Management (1993). *Design Standards Volume 1*. Available from the City and County of Honolulu website: http://www1.honolulu.gov/csd/mrc/onlinesources.htm.

City and County of Honolulu Department of Wastewater Management (1984). *Design Standards Volume 2*. Available from the City and County of Honolulu website: http://www1.honolulu.gov/csd/mrc/onlinesources.htm.

Kiepper, B. H. (2013). *Understanding Laboratory Wastewater Tests: I. Organics (BOD, COD, TOC, O&G)*. Available from The University of Georgia College of Agricultural & Environmental Sciences website: http://www.caes.uga.edu/publications/pubDetail.cfm?pk_id=7895#OG

State of Hawaii Department of Health Safe Drinking Water Branch (2000). *Hawaii Administrative Rules Title 11 Department of Health Chapter 23 Underground Injection Control* (revised October 11, 2000). Available from DOH-WWB website: http://health.hawaii.gov/sdwb/uicprogram/

State of Hawaii Department of Health Wastewater Branch (2002). *Guidelines for the Treatment and Use of Recycled Water* (revised May 15, 2002). Available from DOH-WWB website: http://health.hawaii.gov/wastewater/home/forms/

State of Hawaii Department of Health Wastewater Branch (2004). *Hawaii Administrative Rules Title 11 Department of Health Chapter 62 Wastewater Systems* (revised January 14, 2004). Available from DOH-WWB website: http://health.hawaii.gov/wastewater/home/forms/

Tchobanoglous, G., Burton, F. L., and Metcalf & Eddy, Inc. (1991). *Wastewater Engineering Treatment, Disposal, and Reuse* (3rd ed.). New York, NY,: Irwin/McGraw-Hill.

United States of America Environmental Protection Agency (1984). *National Pollutant Discharge Elimination System, Electronic Code of Federal Regulations, Title 40: Protection of Environment, Part 133 – Secondary Treatment Regulation* (current as of March 14, 2014). Available from U.S. Government Printing Office website: http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=c056d33340b3f9d88e6f07af7b86446e&rgn=div5&view=text&node=40:23.0.1.1.20&idno=40

Vesilind, P. A., and Morgan, S. M. (2004). *Introduction to Environmental Engineering* (2nd ed.). Belmont, CA: Brooks/Cole-Thomson Learning.

Appendix A – Priority Pollutants

1. Acenaphthene
2. Acrolein
3. Acrylonitrile
4. Benzene
5. Benzidine
6. Carbon tetrachloride
7. Chlorobenzene
8. 1,2,4-trichlorobenzene
9. Hexachlorobenzene
10. 1,2-dichloroethane
11. 1,1,1-trichloreothane
12. Hexachloroethane
13. 1,1-dichloroethane
14. 1,1,2-trichloroethane
15. 1,1,2,2-tetrachloroethane
16. Chloroethane
17. REMOVED
18. Bis(2-chloroethyl) ether
19. 2-chloroethyl vinyl ethers
20. 2-chloronaphthalene
21. 2,4,6-trichlorophenol
22. Parachlorometa cresol
23. Chloroform
24. 2-chlorophenol
25. 1,2-dichlorobenzene
26. 1,3-dichlorobenzene
27. 1,4-dichlorobenzene
28. 3,3-dichlorobenzidine
29. 1,1-dichloroethylene
30. 1,2-trans-dichloroethylene
31. 2,4-dichlorophenol
32. 1,2-dichloropropane
33. 1,3-dichloropropylene
34. 2,4-dimethylphenol
35. 2,4-dinitrotoluene
36. 2,6-dinitrotoluene
37. 1,2-diphenylhydrazine
38. Ethylbenzene
39. Fluoranthene
40. 4-chlorophenyl phenyl ether
41. 4-bromophenyl phenyl ether
42. Bis(2-chloroisopropyl) ether
43. Bis(2-chloroethoxy) methane
44. Methylene chloride
45. Methyl chloride
46. Methyl bromide
47. Bromoform
48. Dichlorobromomethane
49. REMOVED
50. REMOVED
51. Chlorodibromomethane
52. Hexachlorobutadiene
53. Hexachlorocyclopentadiene
54. Isophorone
55. Naphthalene
56. Nitrobenzene
57. 2-nitrophenol
58. 4-nitrophenol
59. 2,4-dinitrophenol
60. 4,6-dinitro-o-cresol
61. N-nitrosodimethylamine
62. N-nitrosodiphenylamine
63. N-nitrosodi-n-propylamine
64. Pentachlorophenol
65. Phenol
66. Bis(2-ethylhexyl) phthalate
67. Butyl benzyl phthalate
68. Di-N-Butyl Phthalate
69. Di-n-octyl phthalate
70. Diethyl Phthalate
71. Dimethyl phthalate
72. benzo(a) anthracene
73. Benzo(a)pyrene
74. Benzo(b) fluoranthene
75. Benzo(k) fluoranthene
76. Chrysene
77. Acenaphthylene
78. Anthracene
79. Benzo(ghi) perylene
80. Fluorene
81. Phenanthrene
82. Dibenzo(,h) anthracene
83. Indeno (1,2,3-cd) pyrene
84. Pyrene
85. Tetrachloroethylene
86. Toluene
87. Trichloroethylene
88. Vinyl chloride
89. Aldrin
90. Dieldrin
91. Chlordane
92. 4,4-DDT
93. 4,4-DDE
94. 4,4-DDD
95. Alpha-endosulfan
96. Beta-endosulfan
97. Endosulfan sulfate
98. Endrin
99. Endrin aldehyde
100. Heptachlor
101. Heptachlor epoxide
102. Alpha-BHC
103. Beta-BHC
104. Gamma-BHC
105. Delta-BHC
106. PCB–1242 (Arochlor 1242)
107. PCB–1254 (Arochlor 1254)
108. PCB–1221 (Arochlor 1221)
109. PCB–1232 (Arochlor 1232)
110. PCB–1248 (Arochlor 1248)
111. PCB–1260 (Arochlor 1260)
112. PCB–1016 (Arochlor 1016)
113. Toxaphene
114. Antimony
115. Arsenic
116. Asbestos
117. Beryllium
118. Cadmium
119. Chromium
120. Copper
121. Cyanide, Total
122. Lead
123. Mercury
124. Nickel
125. Selenium
126. Silver
127. Thallium
128. Zinc
129. 2,3,7,8-TCDD

Appendix B – Summary of Suitable Uses for Recycled Water

Table 22: Summary of Suitable Uses for Recycled Water

SUITABLE USES OF RECYCLED WATER	R1	R2	R3
IRRIGATION: (S)pray, (D)rip & Surface, S(U)bsurface, (A)LL=S D & U, Spray with (B)uffer, (N)ot allowed, /=or			
Golf course landscapes	A	U/B	N
Freeway and cemetery landscapes	A	A	N
Food crops where recycled water contacts the edible portion of the crop, including all root crops	A*	N	N
Parks, elementary schoolyards, athletic fields and landscapes around some residential property	A	U	N
Roadside and median landscapes	A	U/B	N
Non-edible vegetation in areas with limited public exposure	A	AB	U
Sod farms	A	AB	N
Ornamental plants for commercial use	A	AB	N
Food crops above ground & not contacted by irrigation	A	U	N
Pastures for milking and other animals	A	U	N
Fodder, fiber, and seed crops not eaten by humans	A	AB	DU
Orchards and vineyards bearing food crops	A	D/U	DU
Orchards and vineyards not bearing food crops during irrigation	A	AB	DU
Timber and trees not bearing food crops	A	AB	DU
Food crops undergoing commercial pathogen destroying process before consumption	A	AB	DU
SUPPLY TO IMPOUNDMENTS: (A)llowed (N)ot allowed			
Restricted recreational impoundments	A	N	N
Basins at fish hatcheries	A	N	N
Landscape impoundments without decorative fountain	A	A	N
Landscape impoundments with decorative fountain	A	N	N
SUPPLY TO OTHER USES: (A)llowed (N)ot allowed			

Table 23: Summary of Suitable Uses for Recycled Water (continued)

SUITABLE USES OF RECYCLED WATER	R1	R2	R3
Flushing toilets and urinals	A	N	N
Structural fire fighting	A	A	N
Nonstructural fire fighting	A	A	N
Commercial and public laundries	A	N	N
Cooling saws while cutting pavement	A	N	N
Decorative fountains	A	N	N
Washing yards, lots and sidewalks	A	N	N
Flushing sanitary sewers	A	A	N
High pressure water blasting to clean surfaces	A	N	N
Industrial Process without exposure of workers	A	A	N
Industrial Process with exposure of workers	A	N	N
Cooling or air conditioning system without tower, evaporative condenser, spraying, or other features that emit vapor or droplets	A	A	N
Cooling or air conditioning system with tower, evaporative condenser, spraying, or other features that emit vapor or droplets	A	N	N
Industrial boiler feed	A	A	N
Water jetting for consolidation of backfill material around potable water piping during water shortages	A	N	N
Water jetting for consolidation of backfill material around piping for recycled water, sewage, storm drainage, and gas; and electrical conduits	A	A	N
Washing aggregate and making concrete	A	A	N
Dampening roads and other surfaces for dust control	A	A	N
Dampening brushes and street surfaces in street sweeping	A	A	N