APPENDIX H

Preliminary Engineering and Drainage Report

PRELIMINARY ENGINEERING REPORT

FOR

WAIKAPU COUNTRY TOWN

Waikapu, Maui, Hawaii

**T.M.K.: (2) 3-6-002: 001 & 003, (2) 3-6-004: 003 & 006,
(2) 3-6-005: 007, and (2) 3-6-006: 036**

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1.0 INTRODUCTION

The purpose of this report is to provide information on the existing infrastructure, which will be servicing the proposed project and to also evaluate the adequacy of the existing infrastructure and anticipated improvements, which may be required for the development of the proposed project.

The subject parcels are identified as T.M.K.: (2) 3-6-002: 001 & 003, (2) 3-6-004: 003 and 006, (2) 3-6-005: 007, and (2) 3-6-006: 036, which encompasses a total area of approximately 1,576 acres. Of the total area, 1,562 acres is within the State Agricultural District and 14 acres is within the State Urban District. Waikapu Country Town (WCT) is situated south of Waikapu around the existing Maui Tropical Plantation and areas to the east of Honoapiilani Highway (See Exhibit 2).

WCT will be a master-planned community with a mixture of single- and multi-family residential, commercial, and civic uses. The Maui Island Plan's Directed Growth Plan designated approximately 485 acres of WCT's 1,562 acres into urban small town and rural growth boundaries. The remaining 1,077 acres will remain in the State's Agricultural District. Approximately 800 acres of the Project's agricultural lands will be preserved in perpetuity for agricultural use through a conservation easement, and the remaining area will be kept as large agricultural lots.

The proposed project will be built in two (2) five-year phases, both mauka and makai of Honoapiilani Highway (See Exhibit 5). The first phase will be from 2017 through 2021 and the second phase will be from 2022 through 2026. The development mauka of Honoapiilani Highway will create a "village center," incorporating the existing Maui Tropical Plantation (MTP) buildings and grounds. The mauka development is bound by Honoapiilani Highway to the south and east, Waikapu Town and Waikapu Stream to the north, and vacant land to the west. The development makai of Honoapiilani Highway will be mixed use, including residential units, commercial buildings, an elementary school, and parks. The makai development is bound by the planned Waiale Bypass to the south and east, Honoapiilani Highway to the west, and Waikapu Stream to the north.

Phase I of the project includes the development on the mauka side of Honoapiilani Highway and a portion of the makai side of the highway. The Phase I development schedule is 2017 through 2021 and includes the following:

- 332 single-family dwelling units;
- 15 rural residential units;
- 216 multi-family/town home units;
- 127 country town mixed-use dwelling units;
- 41 ohana units,
- Approximately 58,475 square feet of country town mixed-use commercial space;
- Approximately 140,372 square feet of new commercial and employment (it is assumed that the existing 29,250 square feet of commercial space will remain);
- Approximately 26.66 acres of parks and open space; and
- Approximately 12 acres for an elementary school.

Phase II of the development, scheduled for 2022 through 2026, will construct the remainder of the project, including the following:

- 638 single-family dwelling units;
- 65 rural residential units;
- 40 multi-family dwelling units;
- 105 ohana units; and
- Approximately 5.78 acres of parks and open space.

2.0 EXISTING INFRASTRUCTURE

2.1 ROADWAYS

The primary regional access to the Waikapu area is provided by Honoapiilani Highway, which traverses through the project site. It divides the project site into the mauka and makai sections. It is a two-lane undivided State Highway which runs in the north-south direction into Wailuku town. The speed limit is 30 miles per hour (mph) in the vicinity of the project site and Waiko Road. The Waiko Road intersection is signalized with existing left turn pockets into East and West Waiko Road. There is a left turn pocket on Honoapiilani Highway at its intersection with the driveway for the MTP.

Kuihelani Highway is located immediately east of the project site. It is a two-way, four-lane divided State arterial highway which also runs in a north-south direction. The posted speed limit on Kuihelani Highway at Waiko Road is 55 mph. There is an existing traffic signal at the Kuihelani Highway-Waiko Road intersection. The southern terminus of Kuihelani Highway is its intersection with Honoapiilani Highway. The northern terminus is at its intersection with Puunene Avenue, where it turns into Dairy Road.

Waiko Road is a two-lane County-owned collector roadway that runs in an east-west direction and connects Honoapiilani Highway and Kuihelani Highway. The posted speed limit on Waiko Road is 20 mph. Immediately east of Honoapiilani Highway, Waiko Road provides access to a residential community. Further east, Waiko Road provides access to industrial and livestock land uses. There is a weight limit of 10,000 pounds from vehicles entering and exiting Waiko Road from Honoapiilani Highway.

Waiale Road is a two-lane road with its southern terminus at Waiko Road. It turns into Lower Main Street near Kaahumanu Avenue. The section of Waiale Road from Waiko Road to Kuikahi Drive is privately owned. The segment from Kuikahi Drive to Lower Main Street is County owned and used as a collector road.

Kuikahi Drive is an east-west collector road. West of its intersection with Honoapiilani Highway, Kuikahi Drive passes through the Wailuku Heights Subdivision and terminates in a cul-de-sac at the top of the subdivision. Approximately 1,000 feet east of Honoapiilani Highway, it intersects with Waiale Road. The eastern terminus of Kuikahi Drive is at its intersection with Maui Lani Parkway.

Kamehameha Avenue is a County-owned north-south collector road. It is a two-lane roadway which begins at its intersection with Hana Highway and extends southward through the Maui Lani development with its terminus just south of Pomaikai Elementary School.

Maui Lani Parkway is a two-lane, east-west collector road with a raised median. It connects Kuihelani Highway with Kuikahi Drive. When completed, Maui Lani Parkway will extend to Kaahumanu Avenue near Baldwin High School. Upon completion of Maui Lani Parkway, it will connect Kuihelani Highway and Kaahumanu Avenue.

The MTP currently accesses the site from Honoapiilani Highway. There is a left turn lane into the MTP.

2.2 DRAINAGE

The elevation on the mauka development site ranges from approximately 350 feet above mean sea level at its southeasterly corner to approximately

710 feet above mean sea level at its northwesterly corner, with a slope averaging approximately 8%. The elevation on the makai development site ranges from approximately 256 feet above mean sea level at a low point along the southerly border to approximately 408 feet above mean sea level at the northwesterly corner, with a slope averaging approximately 4%. The land within the agriculture preserve areas will remain undeveloped.

According to Panel Numbers 15003 0389F, 15003 0393F, and 15003 0556F, revised November 4, 2015, of the Flood Insurance Rate Map, prepared by the United States Federal Emergency Management Agency, the project site is situated in Flood Zones X, XS, AE, and AEF (See Exhibits 4A to 4F). The vast majority of the site is situated in Flood Zone X. Flood Zone X represents areas that are outside of the 0.2% annual chance flood plain. Flood Zones AE, AEF, and XS are located along the eastern boundary of both the mauka and makai sites, where the Waikapu Stream is located. However, no development is proposed in these areas. The agricultural preserve and a park border the stream on the mauka and makai sites, respectively.

According to the "Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii" (August 1972), prepared by the United States Department of Agriculture Soil Conservation Service, the soils within the project site are classified as Ewa silty clay, 3 to 7 percent slopes (EsB), Iao clay, 3 to 7 percent slopes (IcB), Jaucas sand, 0 to 15 percent slopes (JaC), Rough broken land (rRR), Stony alluvial land (rSM), Pulehu silt loam (PpA and PpB), Pulehu cobbly silt loam (PrA and PrB), Pulehu clay loam, 0 to 3 percent slopes (PsA), Pulehu cobbly clay loam (PtA and PtB), Wailuku silty clay (WvB and WvC), Gravel pit (GPI), and Water (W) (See Exhibit 3). EsB is characterized as having moderate permeability, slow runoff, and slight erosion hazard. IcB is characterized as having moderately slow permeability, medium runoff and slight to moderate erosion hazard. JaC is characterized as having rapid permeability, very slow to slow runoff, slight erosion hazard. rRR consists of very steep land broken by intermittent drainage channels. rSM consists of stones, boulders, and soil deposited by streams along the bottoms of gulches and on alluvial fans. PpA, PpB, PrA, PrB, PsA, PtA, and PtB (Pulehu Series) are characterized as having moderate permeability, slow runoff, and slight erosion hazard. WrC is characterized as having moderate permeability, medium runoff, and severe erosion hazard. WvB and WvC are characterized as having moderate permeability, slow to medium runoff and slight to moderate erosion hazard.

Onsite runoff generally sheet flows in a west to east direction. There are seven (7) existing diversion berms along the upper most portion of the mauka site, which intercepts surface runoff and diverts it into Waikapu Stream (See Exhibit 7). The diversion berms were constructed when the lot was used for pineapple cultivation. It is part of the agricultural preserve that will not be developed and will remain in place and function as it is presently doing. The berms are protected by various grasses and weeds, which help to maintain a low runoff velocity as well filter sediments that are carried by the runoff.

Based on a 50-year, 1-hour storm, the existing diversion berms intercepts approximately 140,509 cubic feet of storm runoff and diverts it into Waikapu Stream. These diversion berms prevent runoff from sheet flowing into the proposed development areas.

Some of the existing runoff sheet flows into the Waihee Ditch, which traverses along the western boundary of T.M.K.: (2) 3-6-005: 007. The ditch flows in a southerly direction toward Maalaea and supplies water to existing agricultural reservoirs.

Runoff from the areas below the existing diversion berms generally sheet flows in a west to east direction toward Honoapiilani Highway. There are several small culverts that divert runoff across Honoapiilani Highway and discharges into the existing cane fields on the makai side of the highway

(See Exhibit 7). The following is a list of culvert crossings at Honoapiilani Highway adjacent to the project site.

Distance from Entrance to WCT Driveway	Culvert Size
4,200 feet south of driveway	24” w/ GICB
3,850 feet south of driveway	24” w/ GICB
2,050 feet south of driveway	24” w/ GICB
1,270 feet south of driveway	4’ x 2’ Box Culvert
1,000 feet south of driveway	72” Culvert
400 feet south of driveway	24” Culvert
1,600 feet north of driveway	Waikapu Stream

There is an existing grass swale traversing across the MTP site parallel to Honoapiilani Highway from the northeast corner of the project site to approximately 1,000 feet south of the MTP driveway. Runoff sheet flowing across the mauka side of the project site is captured by the grass swale and diverted in a southerly direction and across Honoapiilani Highway by the existing 72-inch culvert located 1,000 feet to the south of the MTP driveway. Runoff within the grass swale is conveyed across the MTP driveway by a 30-inch culvert.

It is estimated that the existing 100-year, 24-hour storm runoff from the Phase I project site mauka of Honoapiilani Highway is 452 cfs, corresponding to a runoff volume of 2,418,629 cubic feet and 373 cfs, corresponding to a runoff volume of 2,133,808 cubic feet from the Phase I project site makai of Honoapiilani Highway. Similarly, it is estimated that the existing 100-year, 24-hour storm runoff from the Phase II project site mauka of Honoapiilani Highway is 447 cfs, corresponding to a runoff volume of 2,916,206 cubic feet and 361cfs, corresponding to a runoff volume of 2,062,681 cubic feet from the Phase II project site makai of Honoapiilani Highway.

Presently, onsite runoff sheet flows across the project site in a west to east direction, across Honoapiilani Highway and into the existing sugar cane fields towards Kuihelani Highway and eventually discharges into Kealia Pond in North Kihei.

2.3 SEWER

There are County sewerlines on the north side of Waikapu Stream. The existing MTP is serviced by a private sewer system which connects to the County's sewer system on Waiko Road near Waikapu Town.

The existing MTP sewer system is a private system consisting of a 6-inch sewerline and manholes from the existing buildings, crossing Honoapiilani Highway to a sewer pump station located approximately 500 feet east of Honoapiilani Highway. A 4-inch forcemain conveys the wastewater from the sewer pump station through the cane fields, across Waikapu Stream, up on Waiko Road and connects to a sewer manhole on Waiko Road east of Waikapu town. There is an 8-inch gravity sewerline from the existing sewer manhole which connects to a County-owned sewer manhole east of Waikapu Town.

The sewer system from the MTP to the County-owned sewer manhole on Waiko Road is privately owned and maintained by the MTP. The County's sewer system traverses from the manhole on Waiko Road through the Waikapu Gardens Subdivision, through privately owned properties, onto Waiale Road, down Lower Main Street and discharges into the Wailuku Sewer Pump Station near the intersection of Kahului Beach Road, Lower Main Street and Waiehu Beach Road. Sewer collected at the Wailuku Sewer Pump Station is pumped to the Kahului Wastewater Reclamation Facility (KWRF) in Kanaha.

According to the Wastewater Reclamation Division, County of Maui, as of July 31, 2016, the KWRF has a capacity of 7.9 million gallons per day (mgd). The average flow into the KWRF is 5.2 mgd and the allocated capacity is

6.55 mgd. The remaining wastewater capacity at the KWRF is approximately 1.35 mgd.

2.4 WATER

Water service in the vicinity of the project site is provided by the County's water system consisting of a 12-inch waterline from the 300,000 gallon tank near the mauka terminus of Waiko Road. The storage tank is at an elevation of 764 feet.

The existing 12-inch waterline crosses Honoapiilani Highway and terminates to the east of Waikapu town in the vicinity of the industrial area. A 4-inch waterline connects to the 12-inch waterline on Honoapiilani Highway and traverses in a southerly direction and ends near the northerly boundary of the MTP. The MTP site is currently being serviced by two 5/8-inch water meters located at the northeast corner of the mauka property.

Fire protection for the MTP is presently provided by a private system consisting of a gravity fireline from the existing lagoon located immediately to the west of the MTP restaurant. Non-potable water from the lagoon is fed to fire pumps located on the exterior of the existing buildings which supplies water to the fire sprinkler systems in the buildings. There are also fire hydrants located on the grounds of the MTP. However, the fire hydrants may not have adequate pressure and capacity.

2.5 ELECTRIC, TELEPHONE, AND CABLE TV

Electric, telephone and cable TV service for the MTP is brought in underground from the overhead utilities along Honoapiilani Highway. There is an existing overhead 69 kv utility line which traverses through the property along the Waihee Ditch.

3.0 ANTICIPATED INFRASTRUCTURE IMPROVEMENTS

3.1 ROADWAYS

Access for the proposed project will be from the roadway connections on Honoapiilani Highway for both the mauka and makai development sites, as well as the future Waiale Road extension for the makai development.

The developers of Waikapu Country Town have subdivided an 80-feet wide right-of-way for the future Waiale Road extension from Waiko Road to Honoapiilani Highway. The right-of-way has been committed to the County for the development of the Waiale Road extension. The proposed improvements for the Waiale Road extension includes two (2) 12-foot travel lanes, 6-foot pave shoulders on both sides, 6-foot grassed swales on both sides, and a 10-feet wide bike/pedestrian path on one side.

The main onsite roadway from the Waiale Road Extension into the MTP will have a right-of-way of 80 feet (major arterial), the major collector road makai of and parallel to Honoapiilani Highway will have a right-of-way of 60 feet, all residential streets will have a right-of-way of 48 feet (minor urban street), and roadways serving rural areas will have a 40 feet right-of-way (minor rural street). All roadways will be improved to County standards. The cul-de-sacs will have an edge of pavement radius of 40 feet and a right-of-way radius of 50 feet to accommodate the larger fire trucks in the Central Maui district (see Exhibits 6 & 6A).

A Transportation Impact Analysis Report (TIAR) was completed for the project on December 2014 by Fehr & Peers, which provided the following summary:

"Future Conditions without Project. The future intersection operating conditions will be significantly affected by regional growth and development in the study area before project implementation. By 2022 and 2026 the

Project area will have experienced significant residential and commercial growth and due to the development of neighboring projects including Waiale, Maui Lani Development, Kehalani Development, Puunani residences, and other developments as outlined in Table 4. Future regional development will be accompanied by roadway network changes will improve mobility options for residents and visitors, as well as expand roadway capacities at various locations within the study area. Nevertheless, with this growth, five (5) of the 14 study intersections are projected to operate at an undesirable LOS E or F during one or both peak hours in each future year.

Project Traffic Impact. The traffic analysis addressed the completion of the first phase (2022) and the second phase (2026) with the Project. Following development of both the first phase and second phase of the Project, six (6) of the fourteen (14) intersections studied (Intersection 1-4 and 7-8) would operate at a LOS (E) or (F) in either the AM and/or PM peak hour. As noted above, all but one of these six intersections (Intersection 8) are projected to operate at undesirable levels without the addition of project traffic. Eight (8) of the study intersections (Intersections 5-6 and 9-14) are projected to operate at acceptable LOS with buildout of the project and will not require mitigation strategies. See Tables 6 and 7.

Mitigation Strategies. Mitigation strategies were developed to identify recommended improvements at the intersections with projected overall intersection levels of service, LOS (E) or LOS (F) in the years 2022 and 2026. Each of the identified project-related cumulative impacts would be fully mitigated (achieving LOS D or better for intersection operations) with recommended improvements as described Chapter 5 and Appendix F of the TIAR. In some cases, certain individual turning movements or approaches would continue to operate at LOS (E) or (F), even with overall intersection mitigation. However, further mitigation measures to address specific *turning movement or approach operations are not recommended because they do not meet typical traffic engineering guidelines or would result in atypical improvements (i.e., triple left turn lanes) that could have significant right-of-way impacts or change community character. The estimated share of traffic mitigation cost shown on Table 8 was calculated for proposed mitigations under Year 2026 with proper conditions*

As discussed, improvements are proposed at intersections identified as significantly impacted under Year 2026 with Project Conditions. In the past, development project development projects would make a fair share financial contribution for each mitigation measure to the appropriate governing agency (i.e., the County or HDOT). However, simply providing partial funds for a variety of different improvements does not ensure construction of any individual improvement.

More recently, HDOT has indicated a preference for development projects like WCT to fully design and build improvements at a select set of locations to ensure their implementation. Accordingly, a mitigation program for WCT was developed that would require construction of improvements at intersections closer to the project site where the project contributes to, but does not directly cause a significant impact. Note that the mitigation program is described below is a preliminary recommendation based on the proximity to intersections and without planning level cost estimates. As such, it is subject to change as the planning process continues.

The project proposes to fully fund mitigation measures that would return operations to pre-project levels at Intersection 1: Honoapiilani Highway & Kuikahi Drive and Intersection 8: Kuihelani Highway & Waiko Road. Additionally, although Intersection 13: Honoapiilani Highway & Waiale Road is not significantly impacted under Year 2026 with Project Conditions, the *project may also be responsible for funding intersection improvements necessary to provide access to the project 9i.e., a fourth/west leg).*

IMPROVEMENTS TO BE IMPLEMENTED BY OTHERS

For the remaining impacted intersections listed below, it is assumed that other development projects that are adjacent or closer in proximity to these impacted locations would be responsible for implementing the necessary intersection improvements:

- *Intersection 2: Waiale Road & Kuikahi Drive*
- *Intersection 3: S. Kamehameha Avenue & Maui Lani Parkway*
- *Intersection 4: Kuihelani Highway & Maui Lani Parkway*
- *Intersection 7: S. Kamehameha Avenue & Waiko Road"*

The TIAR recommended the following intersection mitigation measures for mid-term 2022: Intersection 1: Honoapiilani Highway & Kuikahi Drive – add separate left turn lane on south bound Honoapiilani Highway onto Kuikahi Drive and separate left turn and straight through lanes west bound on Kuikahi Drive. Intersection 8: Kuihelani Highway & Waiko Road – no improvements. Intersection 13: Honoapiilani Highway & Waiale Road – no improvements.

The recommended intersection mitigation measures for buildout 2026 are: Intersection 1: Honoapiilani Highway & Kuikahi Drive – no further improvements are necessary. Intersection 8: Kuihelani Highway & Waiko Road – create separate left and right turn lanes east bound on Waiko Road onto Kuihelani Highway. Intersection 13: Honoapiilani Highway & Waiale Road – no improvements.

The onsite roadway plan consists of streets classified as major arterial, major collector, minor urban street and minor rural street.

After coordination with local and state agencies during the early preparation stages of the TIAR, it was assumed that the Waiale Bypass would be completed and used in the study's future analysis scenarios. However, during the Draft EIS public circulation period, comments were raised about the impacts on the project design and the study area's transportation facilities if the Waiale Bypass was not funded and constructed in time for the project. In response, Fehr & Peers developed and analyzed forecast traffic volumes in Year 2026 without the Waiale Bypass in place, both before and after the addition of project traffic.

Fehr & Peers outlined the full range of improvements that address both project-related and/or cumulative traffic impacts in their October 17, 2016 Memorandum (Waikapu Country Town Project-Analysis of 2026 Conditions without the Waiale Bypass) as follows:

- *"<u>Intersection 1: Honoapiilani Highway & Kuikahi Drive</u> – Based on the May 2016 field observations, the eastbound and westbound approaches have been re-striped form one shared through/left-turn lane to one left-turn lane, one through lane, and one right-turn lane. Additionally, the eastbound and westbound left-turn phasing has been modified to protected/permitted. These modifications were used in the revised 2026 intersection operations analysis with and without the project in place.*
- *<u>Intersection 3: S. Kamehameha Avenue & Maui Lani Parkway</u> – A Roundabout will be replacing the all-way stop-controlled intersection and construction is likely to begin operation sometime in Summer 2017. This intersection control*

modification was used in the revised 2026 intersection operations analysis with and without the project in place.

- *<u>Intersection 6: Waiko Road & Waiale Road</u> – Signalization and construction of the fourth leg of this intersection are associated with the Waiale Bypass. Since this analysis evaluates no-bypass scenarios, the existing control and configuration were maintained in the revised 2026 intersection operations analysis with and without the project in place.*
- *<u>Intersection 9: Honoapiilani Highway & Main Street</u> – This future intersection will be constructed as part of this project. Due to the increase in volumes at this location without the Waiale Bypass in place, the intersection configuration has been revised from what was assumed in the TIAR in order to yield acceptable operating conditions (i.e., minimum level of service [LOS] D or better). Thus, this analysis assumes that the intersection is configured with one left-turn lane, one through lane, and one right-turn lane across all approaches. Signal phasing is assumed to be protected/permitted across all approaches, and there would be an overlap phase for the westbound right-turn. These modifications were used in the revised 2026 intersection operations analysis.*
- *<u>Intersection 10: Waiale Bypass & Main Street</u> – This future intersection will not exist without the Waiale Bypass in place.*
- *<u>Intersection 12: North-South Street Residential & Waiale Bypass</u> – This future intersection will be constructed as part of the project. Without the Waiale Bypass in place this intersection would be a 2-legged, side-street stop-controlled intersection. These modifications were used in the revised 2026 with project intersection operations analysis.*
- *<u>Intersection 13: Honoapiilani Highway & Waiale Bypass</u> – This future intersection will be constructed as part of the project.*

> *Without the Waiale Bypass in place, this intersection would be a 4-legged, side-street intersection with stop-control on the minor approach."*

The Memorandum also included the potential traffic improvements and stated:

"The full range of improvements that address both project-related and/or cumulative traffic impacts are discussed in detail below.

"<u>Intersection 1: Honoapiilani Highway & Kuikahi Drive</u> – The mitigation presented in the TIAR is not sufficient to mitigate the impact under the no-bypass scenario. Thus, the impact at this intersection could be reduced by widening the northbound approach from a left-turn lane, a through lane, and a right-turn to a left-turn lane, a through lane, and two right-turn lanes, widening the southbound approach from a left-turn lane, a through lane, and a right-turn lane to two left-turn lanes, a through lane, a right-turn lane, and widening the westbound approach from a left-turn lane, a through lane, and a right-turn lane to two left-turn lanes, a through lane, and two right-turn lanes. Additionally, to complement the addition of a second southbound left-turn lane and a second westbound left-turn lane, the east and south legs of the intersection would each need to be widened to provide a second departure lane. Signal modifications at this intersection would include protected phasing on all approaches and right-turn overlap phasing on the westbound and northbound approaches. Additional right-of-way would be needed on both Honoapiilani Highway and Kuikahi Drive to fully implement this improvement, which would result in LOS D operations at an overall intersection level.

<u>Intersection 2: Waiale Road & Kuikahi Drive</u> – The impact at this intersection could be mitigated using a reduced version of the improvements proposed

in the TIAR for this location. The improvements need to mitigate the impacts identified under the no by-pass scenario include widening the eastbound and westbound approaches to provide a left-turn lane, two through lanes, and a right-turn lane. To complement the widening of the eastbound and westbound approaches, both the eastbound and westbound departures would also need to be widened to each provide a second receiving lane. This improvement would result in LOS D operations at an overall intersection level.

<u>Intersection 3: Kamehameha Avenue & Maui Lani Parkway</u> – The impact at this intersection could be mitigated by implementing the improvements presented in the TIAR, which is signalization of the intersection and maintaining the existing lane configuration (i.e., a shared left/through/right lane on the eastbound and westbound approached and a left-turn lane and a shared through/right-turn lane on the northbound and southbound approaches). It should be noted, however, that the updated 2026 No Project Condition now assumes that the intersection would be configured as a single-lane roundabout.

As discussed in the TIAR, the pre-project improvement is install a traffic control signal with permitted phasing at all approaches. For LOS D or better operations at an overall intersection level, not only would a traffic signal need to be installed, but the eastbound and northbound approaches would need to provide a left-turn lane and a shared through/right-turn lane and the westbound and southbound approaches to provide a left-turn lane, a through lane, and a right-turn lane.

<u>Intersection 4: Kuihelani Highway & Maui Lani Parkway</u> – The impact at this intersection could be mitigated by implementing the improvements presented in the TIAR, which is to widen the eastbound approach to provide a left-turn lane, a shared through/left turn lane, and a right-turn lane. In

addition to the change in configuration, the eastbound and westbound left-turn phasing would need to be modified to split phasing. This improvement would result in LOS D operations at an overall intersection level.

<u>Intersection 5: Honoapiilani Highway & Waiko Road</u> – This intersection is a new impact not previously identified in the TIAR. Thus, the impact at this intersection could be reduced by widening the northbound approach from a left-turn lane and a shared through/right-turn lane to provide a left-turn lane, a through lane, and a shared through/right-turn lane, and widening the eastbound and westbound approaches to provide a left-turn lane and a shared through/right-turn lane. The northbound departure of the highway would require widening for a minimum of approximately 250 feet to provide a second receiving lane, which would transition back into the existing single northbound lane. Additional right-of-way may be needed on both Honoapiilani Highway and Waiko Road for fully implement this improvement, which would result in LOS D operations at an overall intersection level.

<u>Intersection 6: Waiale Road & Waiko Road</u> – The impact at this intersection is a new impact not previously identified in the TIAR. It could be mitigated with the installation of a traffic signal, which was assumed to be in place in the Cumulative, pre-project condition in the TIAR due to its key location on the Waiale Bypass. This improvement would result in LOS D operations at an overall intersection level and the turning movement level.

<u>Intersection 7: S. Kamehameha Avenue & Waiko Road</u> – The impact at this intersection could be mitigated using the improvement presented in the TIAR, which is installing a traffic signal with permitted phasing at all approaches. This improvement would result in LOS D or better operations at both the overall intersection level and the turning movement level.

<u>Intersection 8: Honoapiilani Highway & Waiale Road</u> – The impact at this intersection could be mitigated using the improvement presented in the TIAR, which is widening and restriping the eastbound approach to provide a left-turn lane and a right-turn lane. This improvement would result in LOS D or better operations at an overall intersection level.

<u>Intersection 13: Honoapiilani Highway & Waiale Road</u> – The impact at this intersection is a new impact not previously identified in the TIAR. It could be mitigated with the installation of a traffic signal, which was assumed to be in place in the Cumulative, pre-project condition in the TIAR due to its key location on the planned Waiale Bypass. This improvement would result in LOS D or better operations at an overall intersection level and turning movement level."

The Memorandum concluded: *"This memorandum documents analysis conducted to assess project-related and cumulative impacts upon full build-out of the proposed Waikapu Country town project if the planned Waiale Bypass were not constructed by 2026. While three more study intersections would be significantly impacted under this scenario than in the "with Bypass" scenario analyzed in the TIAR, LOS D can be achieved at the locations with an expanded program of roadway improvements as mitigation."*

The State Department of Transportation's (SDOT) 2035 Transportation Plans for the Maui District includes the widening of Honoapiilani Highway fronting the project site. Two additional travel lanes are planned. In anticipation of the future widening of Honoapiilani Highway, the planned development on the mauka and makai side of Honoapiilani will include a landscape buffer between the highway and the proposed development. The width of the landscape buffer will be coordinated with the SDOT to accommodate the future additional two lanes.

3.2 DRAINAGE

The proposed project will require both excavation and embankment for the construction of the roadways, building pads, infrastructure installation and drainage improvements. In general, the drainage design criteria are to minimize any alteration to the existing drainage patterns and volumes.

Since the project area is greater than 100 acres, the NRCS Method will be used to compute and design the storm water detention facilities. The Rational Method will be used to design the onsite drainage systems with drainage areas less than 100 acres. For these onsite drainage systems, the 50-year, 1-hour storm frequency will be used.

It is estimated that the pre-development 100-year, 24-hour storm runoff from the Phase I project site mauka of Honoapiilani Highway is 452 cfs, corresponding to a runoff volume of 2,418,629 cubic feet and 373 cfs, corresponding to a runoff volume of 2,133,808 cubic feet from the Phase I project site makai of Honoapiilani Highway. Similarly, it is estimated that the pre-development 100-year, 24-hour storm runoff from the Phase II project site mauka of Honoapiilani Highway is 447 cfs, corresponding to a runoff volume of 2,916,206 cubic feet and 361 cfs, corresponding to a runoff volume of 2,062,681 cubic feet from the Phase II project site makai of Honoapiilani Highway.

It is estimated that the post-development 100-year, 24-hour storm runoff from the Phase I project site mauka of Honoapiilani Highway is 497 cfs, corresponding to a runoff volume of 2,567,545 cubic feet and 639 cfs, corresponding to a runoff volume of 2,905,771 cubic feet from the Phase I project site makai of Honoapiilani Highway. Similarly, it is estimated that the post-development 100-year, 24-hour storm runoff from the Phase II project site mauka of Honoapiilani Highway is 507 cfs, corresponding to a runoff volume of 3,131,436 cubic feet and 506 cfs, corresponding to a runoff volume of 2,454,805 cubic feet from the Phase II project site makai of Honoapiilani Highway (See Appendix A for Hydrologic Calculations).

In accordance with the County's *"Rules for the Design of Storm Drainage Facilities",* the design of the drainage systems with retention basins shall be based on the following design conditions:

> *"In areas where the existing drainage systems are inadequate, the existing system shall be upgraded to handle runoff from the new project area or a new system shall be provided to connect to an adequate outlet. When there is no existing drainage system or adequate outlet to connect to, the additional runoff generated by the development may be retained on-site in a temporary retention basin with the following design conditions:*
>
> *A. Storage volume of an infiltration basin, infiltration trench piping, or retention basin shall equal at least the total additional runoff volume for the appropriate storm intensity.*
> *B. Soil percolation shall not be used in satisfying required storage volumes.*
> *C. Fifty percent (50%) of voids within the rock envelope for subsurface drains may be used in satisfying required storage volume provided that filter fabric is installed around the pipe and at the interface of the rock envelope and soil.*
> *D. Sumps, detention and retention facilities will remain private.*
> *E. Detention or retention ponds with embankment heights equal to or in excess of 50 acre-feet shall conform to all state and federal requirements relative to dams".*

The project will also be required to comply with Ordinance 3902, which requires subdivisions to comply with Section 18.20.130 Post Construction Storm Water Quality Best Management Practices of the Maui County Code. The criteria for sizing of storm water quality facilities are:

"(a) The criteria can be met by:

(1) Either detaining storm water for a length of time that allows storm water pollutants to settle (detention treatment from such methods as

extended detention wet and dry ponds, created wetlands, vaults/tanks, etc.);

(2) By use of filtration or infiltration methods (flow-through based treatment from such methods as sand filters, grass swales, other media filters, and infiltration);

(3) Short-term detention can be utilized with a flow-through based treatment system (e.g., a detention pond designed to meter flows through a swale of filter) to meet the criteria; or

(4) Upstream flow-through treatment and detention treatment can be utilized.

(b) Other proposals to satisfy the water quality criteria may be approved by the director if the proposal is accompanied by a certification and appropriate supporting material from a civil engineer, licensed in the State of Hawaii, that verifies compliance with one of the following (by performance or design):

(1) After construction has been completed and the site is permanently stabilized, reduce the average annual total suspended solid ("TSS") loadings by eighty percent. For the purposes of this measure, an eighty percent TSS is to be determined on an average annual basis for the two-year/twenty-four hour storm.

(2) Reduce the post development loadings of TSS so that the average annual TSS loadings are no greater than predevelopment loadings."

Based on the above drainage design and water quality criteria, the Phase I development mauka of Honoapiilani Highway will be required to mitigate an increase in runoff of 45 cfs and provide a minimum storage volume of 148,916 cubic feet and mitigate 266 cfs and provide a minimum storage volume of 771,963 cubic feet makai of Honoapiilani Highway. In addition, the Phase I development mauka of Honoapiilani Highway will be required to provide approximately 196,020 feet of storage to meet the post construction water quality standards and 217,800 cubic feet of storage for the Phase I development makai of the highway.

The Phase II development mauka of Honoapiilani Highway will be required to mitigate an increase in runoff of 60 cfs and provide a minimum storage volume of 215,230 cubic feet and mitigate 145 cfs and provide a minimum storage volume of 392,124 cubic feet makai of Honoapiilani Highway. In addition, the Phase II development mauka of Honoapiilani Highway will be required to provide approximately 297,660 feet of storage to meet the post construction water quality standards and 210,540 cubic feet of storage for the Phase I development makai of the highway.

The proposed project contains a mix of residential, apartment, commercial, school and open space. Runoff will be collected by drainage systems within the roadways and grassed swales within the landscaped areas and routed to one of several detention basins. A description of the detention basins are as follows (See Exhibit 8):

Detention Basins No. 1 to 4: These basins will be constructed outside of the development area and within a natural swale area to reduce the runoff volume reaching Honoapiilani Highway.

Detention Basin No. 5: Runoff from the most westerly rural lots in Phase II will be diverted into this detention basin.

Detention Basin No. 6: Runoff from the most westerly lots in Phase I will be diverted into this detention basin.

Detention Basin No. 7: The majority of the Phase I and II development makai of Honoapiilani Highway will be diverted into this detention basin.

Detention Basin No. 8: The majority of the Phase I and II development mauka of Honoapiilani Highway between the Waihee Ditch and the highway will be diverted into this detention basin.

The drainage system will be designed to accommodate the increase in surface runoff volume from a 100-year, 24-hour storm created by the project and the volume required to meet the post construction water quality standards. In addition to the detention basins, large grassed swales will be constructed within the open space areas to divert runoff to designated outlets.

The design of the detention basins will include an overflow pipe which will allow a minimal discharge during a storm event and fully drain the basin within 48 hours after each storm event.

After the development of the proposed project, there will be no change in the volume of runoff diverted to Waikapu Stream from the upper agricultural preservation area. The existing diversion berms will continue to divert runoff from the areas mauka of the project site into Waikapu Stream.

In accordance with the County's *"Rules for the Design of Storm Water Treatment Best Management Practices",* the design of the stormwater system will include water quality treatment to reduce the discharge of pollutants to the maximum extent practicable. Some examples of stormwater best management practices (BMP) are:

> **Grassed Swales** will be implemented within the landscaped areas where practical. Grass and groundcover provides natural filtration and allows for percolation into the underlying soils.
>
> **Open Space and Parks** will be maintained with grass or other landscape materials, thereby reducing the amount of impervious surfaces and promotes infiltration.
>
> **Stormwater Detention** serves to collect and store stormwater allowing some of the suspended solids to settle out. The stored runoff will infiltrate into the underlying soils and recharge groundwater.

A maintenance plan will be developed for the stormwater BMPs. The plan will include the requirements for removal of the accumulated debris and sediment, maintaining vegetation, and performing inspections to insure the BMPs are functioning properly.

Temporary erosion control measures will be incorporated during the construction period to minimize dust and soil erosion. Additional controls will be implemented to protect Waikapu Stream. Temporary BMPs include the construction of diversion berms and swales, dust fences, silt fences, stabilized construction entrances, truck wash down areas, inlet protection, temporary grassing of graded areas, and slope protection. Water trucks and temporary sprinkler systems will be used to minimize dust generated from the graded areas. A National Pollution Discharge Elimination System (NPDES) permit will be required by the Department of Health prior to approval of the grading permit.

The drainage design criteria will be to minimize any alterations to the drainage pattern of the existing onsite surface runoff. No additional runoff will be allowed to sheet flow toward Kealia Pond.

3.3 SEWER

The County Department of Environmental Management (DEM) has projected that wastewater flows from the Waikapu Growth Area may reach two million gallons per day. They have stated that the preferred method of wastewater treatment from this area would be by a wastewater treatment facility located in the Waikapu area. This would eliminate the excessive energy consumption for pumping, reduce the use of shoreline injection wells for disposal and allow the reuse of treated water at the proposed regional park and other nearby sites.

In July 2013 the DEM reviewed the capacity situation of their wastewater system in the Wailuku area. Included in their review were the existing gravity sewer lines, pump station and the treatment facility. The following assumptions were made:

- *“The Kehalani, Waiolani Mauka, Waikapu Gardens multi-family and Maui Lani projects completed their build out (approximately 2,100 units).*
- *Waikapu Sewer Extension on project is completed per the County’s 6 year CIP project list.*
- *The upgrade of sewer on Waiale Road fronting Kehalani is completed by the County of Maui.*
- *Any flows accepted from the projects in the Waikapu area (not in the current service area) are introduced to the system on Waiko Road where the existing force main connection is located.*
- *The Kahului Wastewater Reclamation Facility has capacity allocation remaining for approximately 1.11 mgd (3,000 dwelling units) and 0.54 mgd for other supportive uses to issue building permits (as of 6/30/2013).*
- *Wet weather flows have the ability to double the volume within the wastewater system and adequate capacity need to be maintained for these infrequent events.*

After several rounds of hydraulic modeling were conducted to determine the effects of adding flows from outside the service area to the existing County wastewater system the following results were obtained:

1) *The Kahului Wastewater Reclamation Facility does not have the capacity to accept flows from outside the current service area in perpetuity without a project to increase capacity. Plant capacity would need to be expanded by approximately two million gallons per day for the buildout of all projects.*
2) *The Wailuku Wastewater Pump Station would have adequate capacity to accommodate about 2,000 homes above that currently expected for the area, however, additional studies would be needed to determine if any modifications at the Kahului WWRF headworks would be required.*

3) In order for the collection system to accept any flows from the Tropical Plantation/Waiale area of Waikapu an upgrade of the existing gravity sewer in Lower Main Street from 12" to 15" would be required. This segment stretches from Ainahou Place to Hala Place (Manholes KA20GE0100 to KA20GB0510) and is approximately 1,950 l.f.

4) A second upgrade would be required prior to the number of equivalent housing units exceeding two hundred (200). This would require upsizing current lines at two locations: (a) the 8" main trunk line from the force main daylight manhole in Waiko Road through Waikapu Gardens would need to be upgraded to 12" (approximately 2,750 l.f.); (b) upsize the final two pipe segments prior to the Wailuku Pump Station from 24" to 36" (approximately 150 l.f. with a major bypass operation). Upgrade 4(a) would accommodate approximately 450 additional homes.

5) Further analysis is required to determine the exact extent of Lower Main Street improvements required for additional units over 650.

6) While not modeled we would expect that the existing pump station owned, operated and maintained by the tropical plantation would need to be upgraded in order to handle the flows generated by the new housing development.

Thus there exists a possibility of allowing a temporary connection for these out of service area projects so that they can proceed with the development and sales while designing and constructing a wastewater reclamation facility for the area. An agreement would be need to be completed between the County and the developer(s) with defined milestones in regards to required upgrades, building permits allowed, possible reimbursements (if any) for improvement work on the existing collection system, provisions for the treatment facility etc".

The policy of the DEM is that wastewater capacity cannot be reserved until the project is ready to receive building permits. If capacity at the KWRF is available at the time building permits are ready to be issued for the project, the project may consider a temporary connection to the County's sewer system and complete the required upgrades for the connection in the Phase I development.

The Waikapu Country Town development will need to construct a stand-alone private wastewater treatment facility or partner with other projects in the Waikapu area, such as A&B's Waiale project or the County of Maui to construct a regional wastewater treatment facility. The planning and design of a stand-alone or combined wastewater treatment facility will be coordinated with the availability of capacity within the County system. If required, a private wastewater treatment facility will be designed, constructed and in operation upon completion of the first home.

In addition to any capacity that may be available in the County's sewer system, the developers are looking into several private wastewater treatment facility alternatives. The first is a conventional wastewater treatment facility. This alternative generally involves liquids treatment consisting of preliminary treatment, flow equalization, primary sedimentation treatment, secondary biological treatment, secondary sedimentation treatment, disinfection, and disposal. The treatment of solids includes stabilization, dewatering, and disposal.

The second and preferred wastewater treatment alternative is to utilize a Food Chain Reactor (FCR) configuration, consisting of biological treatment in successive reactor zones utilizing fixed biomass on a combination of natural plant roots and engineered biofiber media, along with a limited amount of suspended biomass. This alternative generally involves pretreatment, secondary biological treatment through a FCR zone, process aeration, chemical phosphorus removal/coagulation, flocculation, disinfection and disposal.
Brown and Caldwell Consultants were retained by the Department of Environmental Management to prepare the *"Central Maui Recycled Water Study".* The report dated April 2015, concluded the following:

“A conceptual Central Maui service area wastewater system was developed. The major elements required for the Central Maui service area include:

- *Three new WWPSs.*
- *A wastewater conveyance system that includes gravity sewers and forcemains.*
- *A new Central Maui WWRF to produce R-1 recycled water.*
- *A soil aquifer treatment system for excess recycled water disposal.*
- *A brackish groundwater well to provide supplemental water to the recycled water system.*
- *A recycled water pump station and storage tank.*
- *Recycled water transmission pipelines to the Tier 1 areas.*

The total cost for the system is estimated to be $91.4 million, or $20,300 per market-rate EDU.

The County may consider increasing the size of the service area to include areas outside the defined Central Maui growth area. Future MIP updates could include projects that have been proposed but were excluded from the current Urban Growth Boundaries. Examples include the Department of Hawaiian Homelands project in Puunene, and Maalaea Mauka subdivision. The County could also consider providing capacity for the existing Maalaea development area to eliminate the use of near-shore injection wells there. These additional areas would contribute to wastewater flows, and would have to be considered in the conveyance, treatment, reuse, supplemental water, and disposal systems. Capital costs, O&M costs, and WWRF land area requirements would increase to accommodate projects that are outside of the defined service area boundaries. Assessment of the additional costs and land area requirements was outside the scope of this study.

Approximately 80 percent of the recycled water that is produced by the WWRF throughout a typical year would be beneficially used for irrigation purposes. Supplemental groundwater would be needed to meet the irrigation needs of the recycled water users during the hot season. The system will have no injection wells for effluent disposal. Excess recycled water during the wet season would be disposed in a soil aquifer treatment system. The soil aquifer treatment system will provide additional natural treatment as the applied water percolates through the soil to groundwater. The soil aquifer treatment system will provide an additional layer of environmental protection compared to the status-quo injection well systems used for effluent disposal at the County's existing WWRF's.

If the County decides to proceed with a public wastewater system for the Central Maui growth area it should consider preparing a master plan for the wastewater and recycled water systems."

The Waikapu Country Town development could construct a stand-alone private wastewater treatment plant near the northeast corner of the project site after the maximum units is serviced by the County's wastewater system. However, the treatment plant will be needed in about 2017 and the developers will continue to work with the County and other projects within the Waikapu area on a collaborative wastewater treatment facility. At the time the wastewater treatment plant is constructed, any units which temporarily connected to the County's wastewater system will be connected to the new wastewater treatment plant.

3.4 WATER

Water and fire protection for the project will be provided from a private onsite water system. Five (5) wells have been drilled on the site (See Exhibit 12). Three (3) wells have been designated for potable use and two (2) for non-potable purposes. All of the wells are located within the Waikapu Aquifer.

According to the Commission on Water Resource Management, the sustainable yield of the Waikapu aquifer is 3.0 million gallons per day. The three potable water wells have been approved by the State of Hawaii, Commission on Water Resource Management for a total pumping capacity of 2,300 gallons per minute (gpm).

Waikapu Country Town Well No. 1 (State Well No. 5030-01) was drilled at a ground elevation of approximately 654 feet above mean sea level (MSL) and will be used as a potable water source. It has a rated capacity of 500 gpm. Waikapu Country Town Well No. 2 (State Well No. 5131-02) was drilled at a ground elevation of approximately 778 feet above MSL and will be used as a potable water source. It has a rated capacity of 700 gpm. Waikapu Country Town Well No. 3 (State Well No. 5131-04) was drilled at a ground elevation of approximately 523 feet above MSL and will be used as a potable water source. It has a rated capacity of 1,000 gpm.

A 10-day pump test was conducted from April 26, 2016 to May 6, 2016 for Potable Wells 1, 2 and 3 by Water Resource Associates (WRA). The results of the pump test at each well were:

Well 1 was pumped at a constant rate of 972 gpm (1.39 mgd) for 10 days for a total pumpage of 13,600,000 gallons. The chloride content varied from 41 mg/L to 47 mg/L (potable water limit is 250 mg/l). WRA suggested that Well 1 is capable of yielding 1.4 mgd with a static water level of 8.5 feet above mean sea level.

Well 2 was pumped at a constant rate of 720 gpm (1.03 mgd) for 10 days for a total pumpage of 10,238,400 gallons. The chloride content decreased from 132 mg/L to 100 mg/L. WRA suggested that Well 2 is capable of yielding 1.0 mgd with a static water level of 15.0 feet above mean sea level.

Well 3 was pumped at a constant rate of 747 gpm (1.07 mgd) for 10 days for a total pumpage of 10,487,8800 gallons. The chloride content varied from 25 mg/L to 109 mg/L. WRA suggested that the sustainable capacity of Well 3 is less than 700 gpd, despite a static water level of 8.5 feet above mean sea level. They recommended further testing at lower pumping rates and drawdowns to assess Well 3's sustainable pumping capacity with regard to chlorides.

The WRA report stated the following regarding water quality:

"The water quality parameter which is of most concern during a pumping test is chloride because it is an easily determined indicator of salt water intrusion. The potable water limit for chloride content is 250 mg/L, which indicates that Well 1 produces the freshest water at approximately 40 mg/L, followed close behind by basalt Well 2 at approximately 100 mg/L and alluvial Well 3 varying between 25 and 109 gm/L.

In addition to the frequent tests for chlorides, representative water samples were carefully collected from Wells 1, 2 and 3 for testing by Eurofins Analytical, an approved lab, in accordance with the requirements of the Hawaii Department of Health for new potable water sources. The results indicate that all three wells are capable of producing potable water of excellent quality. The chlorides are low and the tested inorganic constituents are well within the Federal maximum contaminant levels (MCL) of public water systems. Further, all volatile and non-volatile organic contaminants and pesticides analyzed were non-detectable."

Two non-potable water wells were drilled as designated as Waikapu Country Town Wells No. 4 (State Well No. 5130-03) and No. 5 (State Well No. 5130-04). Well No. 4 was drilled at a ground elevation of approximately 459 feet above MSL and Well No. 5 was drilled at a ground elevation of approximately 482 feet above MSL. The capacity of Well No. 4 is 500 gpm and 650 gpm for Well No. 5. Both wells have preliminarily shown low salinity levels, and testing is being conducted to determine the viability of those wells for domestic use. If not viable for domestic use, it will be used for non-potable agricultural use.

Water pumped from the non-potable wells will be discharged into the Waihee Ditch or lined onsite reservoirs and used for irrigation purposes for the residential lots, agricultural farming, parks and open areas (See Exhibit 14).

The following Non-Potable Irrigation Calculations table was prepared by Planning Consultants Hawaii, LLC and Hawaii Land Design, LLC. The State Department of Agriculture irrigation rate of 3,400 gallons per acre was used.

Land Use	**Acres**	**Factor**	**Irrigated Acres**	**Irrigation Rate @ 3400/acre**
Single Family	131.05	0.25	32.76	111392.50
MF/Town Home	21.203	0.25	5.30	18022.55
Rural	124.82	0.5	62.41	212194.00
CT Mixed Use	16.168	0.25	4.04	13742.80
Commercial	12.89	0.25	3.22	10956.50
Town Center/Lagoon	4.28	1	4.28	14552.00
School	12	0.25	3.00	10200.00
Active/Passive Park	32.44	1	32.44	110296.00
Greenways/Open Space	49.66	1	49.66	168844.00
TOTAL	404.511		197.1178	670,200.35
Agriculture	1077	0.75	807.75	2,746,350.00
TOTAL				**3,416,550.35**

The estimated potable water demand for the project was determined from the Department of Water Supply's Water System Standards (DWSWSS), dated 2002, as follows:

- Single-Family: 600 gallons per day (gpd) per unit
- Rural Residential: 1,000 gpd/unit*
- Multi-Family: 560 gpd/unit
- Country Town Mix-Use: (Dwelling) 560 gpd/unit
- Country Town Mix-Use: (Commercial) 140 gallons/1,000 s.f.
- Commercial/Employment: 140 gallons/1,000 s.f.
- Parks and Open Space: 1,700 gallons/acre
- School: 1,700 gallons/acre

*Note-the DWSWSS does not have a value for the potable demand for a Rural Residential designation. The 1,000 gpd/unit used is based on discussion with the Department of Water Supply engineers as an acceptable demand for this designation.

The Department of Water Supply (DWS) does not have water demand standards for a dual water system (both potable and non-potable). However, in discussions with the DWS, it was determined that the DWSWSS standards could be conservatively reduced by one-third if a dual water system was used for a project. Based on this criteria, the estimated water demand for the project would be reduced to:

- Single-Family: 400 gallons per day (gpd) per unit
- Rural Residential: 667 gpd/unit
- Multi-Family: 373 gpd/unit
- Country Town Mix-Use: (Dwelling) 373 gpd/unit
- Country Town Mix-Use: (Commercial) 93 gallons/1,000 s.f.
- Commercial/Employment: 93 gallons/1,000 s.f.

- Parks and Open Space: 0 gallons/acre (irrigation will be from the non-potable water source)
- School: 1,133 gallons/acre

Based on the water usage, the projected water projected average daily water demand for Phase I is 311,033 gallons per day (gpd). In accordance with the DWSWSS, the maximum daily water demand is calculated as being 1.5 times the average daily demand, or 466,550 gpd. Based on the commercial uses, the maximum fire demand is 2,000 gpm (See Appendix B for Water Demand Calculations). The projected average daily water demand for Phase II is 334,475 gpd and the maximum daily water demand 501,713 gpd. Irrigation of parks and open spaces will be provided by the non-potable water system.

Water conservation measures such as low-flow toilets and shower heads will be considered for use in the project, which will decrease the water demand. Irrigation of the parks and open space will be from the non-potable water source, which will also decrease the water demand.

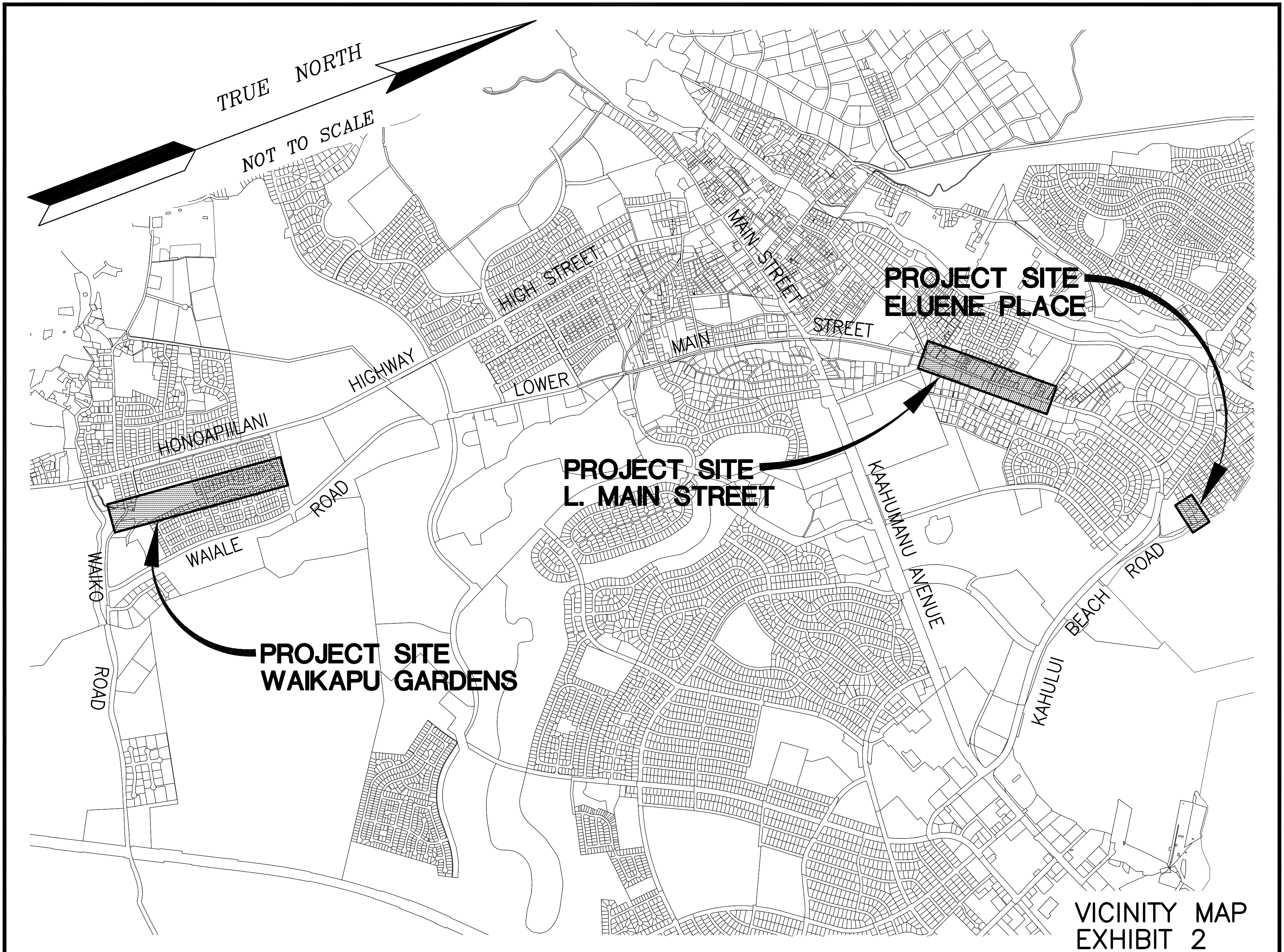
The reservoir capacity is based on the DWSWSS Criterion 1 for Reservoir Capacity, which is to meet the maximum daily consumption with the reservoir full at the beginning of the 24-hour period with no source input into the reservoir. Based on this criterion, the required storage volume for the two phases is 968,263 gallons. It is recommended that a 1.0 million gallon reservoir be constructed to accommodate the two phases of the project. As an alternative, the developer can also construct two storage reservoirs, each with a storage volume of 0.50 million gallons. Each 0.50 million gallon reservoir can be constructed at the beginning of each phase. The two reservoir option can allow the second reservoir to be constructed as the demand increases and allow for more flexibility during maintenance and repair should one of the reservoirs have to be taken out of service.

The 1.0 million gallons of water storage will be constructed mauka of Well No. 5 at an elevation of approximately 800 feet MSL.   This will allow for the entire project to be serviced by gravity flow from the reservoir(s).

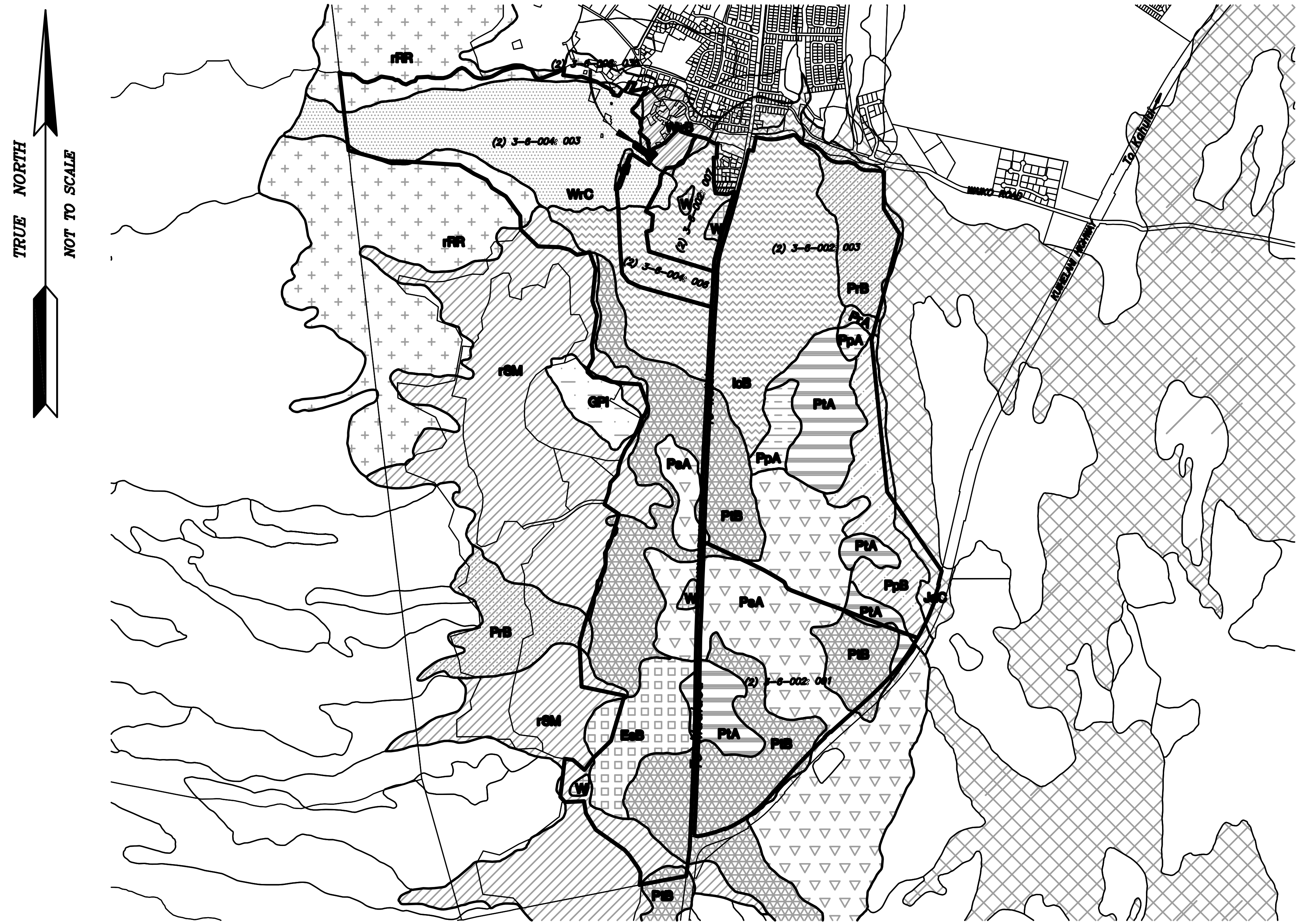
3.5 ELECTRIC, TELEPHONE, AND CABLE TV

Electric, telephone and cable TV service will be provided by the existing facilities in the area. The project's electrical engineering consultant will coordinate the required improvements with the utility companies to determine the required onsite and offsite improvements to support the project.

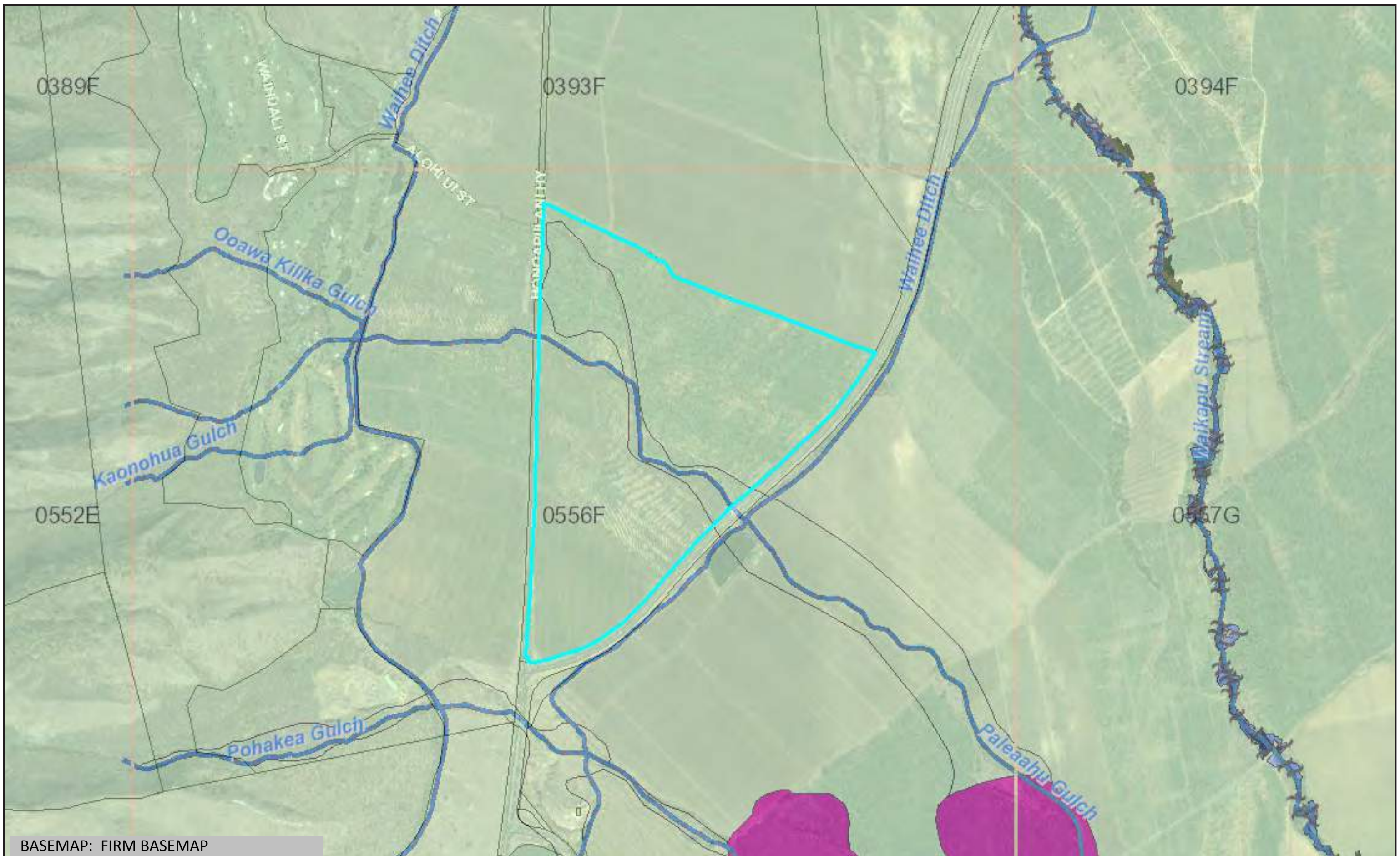
EXHIBITS



VICINITY MAP
EXHIBIT 2



SOIL SURVEY MAP
EXHIBIT 3



Flood Hazard Assessment Report

www.hawaiinfip.org

Waikapu Country Town

Property Information

COUNTY:	MAUI
TMK NO:	(2) 3-6-002:001
WATERSHED:	POHAKEA; WAIKAPU
PARCEL ADDRESS:	0 HONOAPIILANI HWY WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 04, 2015
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL:	1500030556F
PANEL EFFECTIVE DATE:	SEPTEMBER 25, 2009

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: NO
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 0.30 0.60 mi

Disclaimer: The Hawaii Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use, accuracy, completeness, and timeliness of any information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR, its officers, and employees from any liability which may arise from its use of its data or information.

If this map has been identified as 'PRELIMINARY', please note that it is being provided for informational purposes and is not to be used for flood insurance rating. Contact your county floodplain manager for flood zone determinations to be used for compliance with local floodplain management regulations.

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(*Note: legend does not correspond with NFHL)*

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

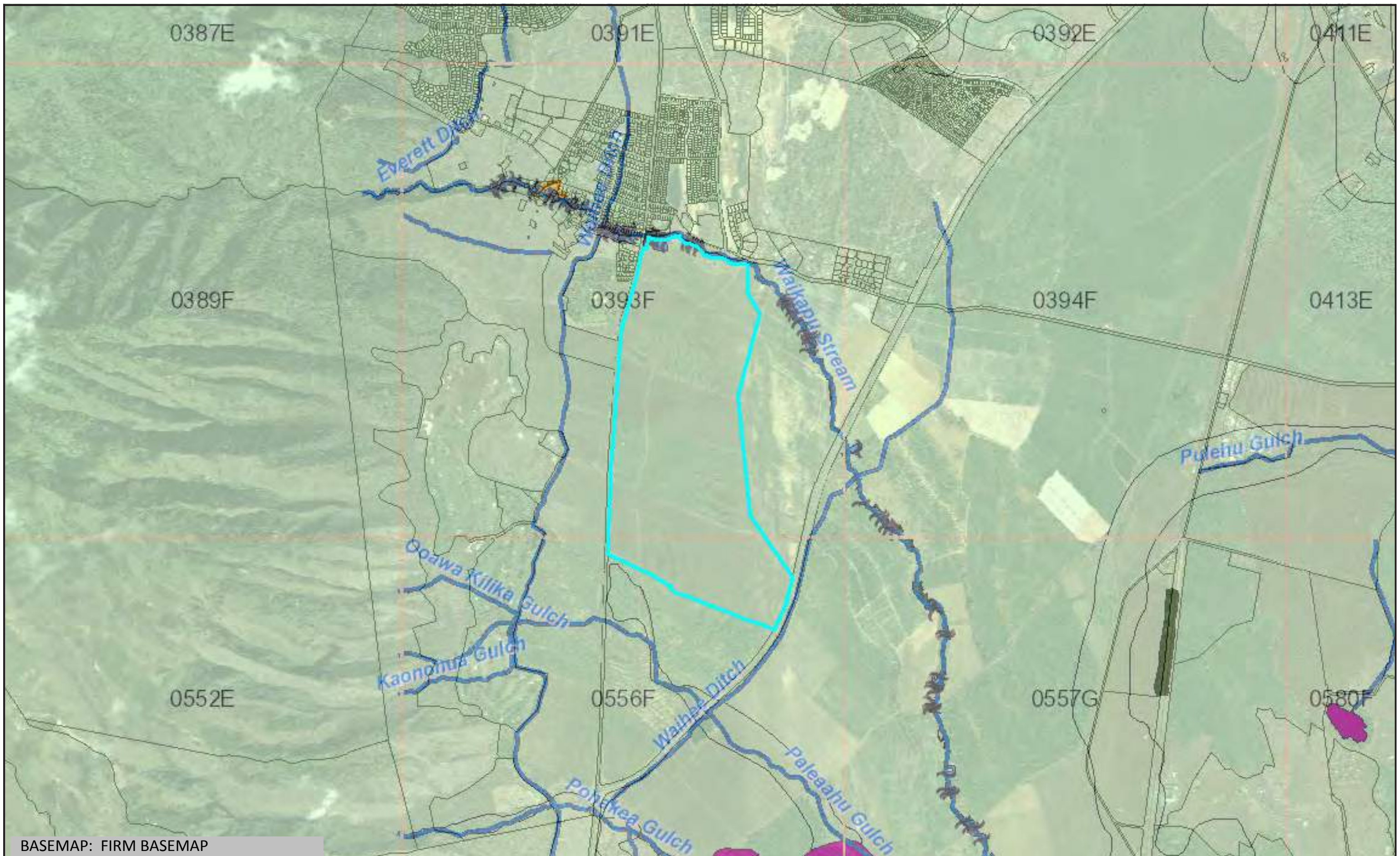
- **Zone A**: No BFE determined.
- **Zone AE**: BFE determined.
- **Zone AH**: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
- **Zone AO**: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
- **Zone V**: Coastal flood zone with velocity hazard (wave action); no BFE determined.
- **Zone VE**: Coastal flood zone with velocity hazard (wave action); BFE determined.
- **Zone AEF**: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

- **Zone XS (X shaded)**: Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
- **Zone X**: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

- **Zone D**: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.



Flood Hazard Assessment Report

www.hawaiinfip.org

Waikapu Country Town

Property Information

COUNTY: MAUI

TMK NO: (2) 3-6-002:003

WATERSHED: IAO; WAIKAPU

PARCEL ADDRESS: 0 HONOAPIILANI HWY
WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 04, 2015
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL - EFFECTIVE DATE:	1500030393F - NOVEMBER 04, 2015 1500030556F - SEPTEMBER 25, 2009

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: NO
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 0.60 1.20 mi

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FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(*Note: legend does not correspond with NFHL)*

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

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	Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
	Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
	Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

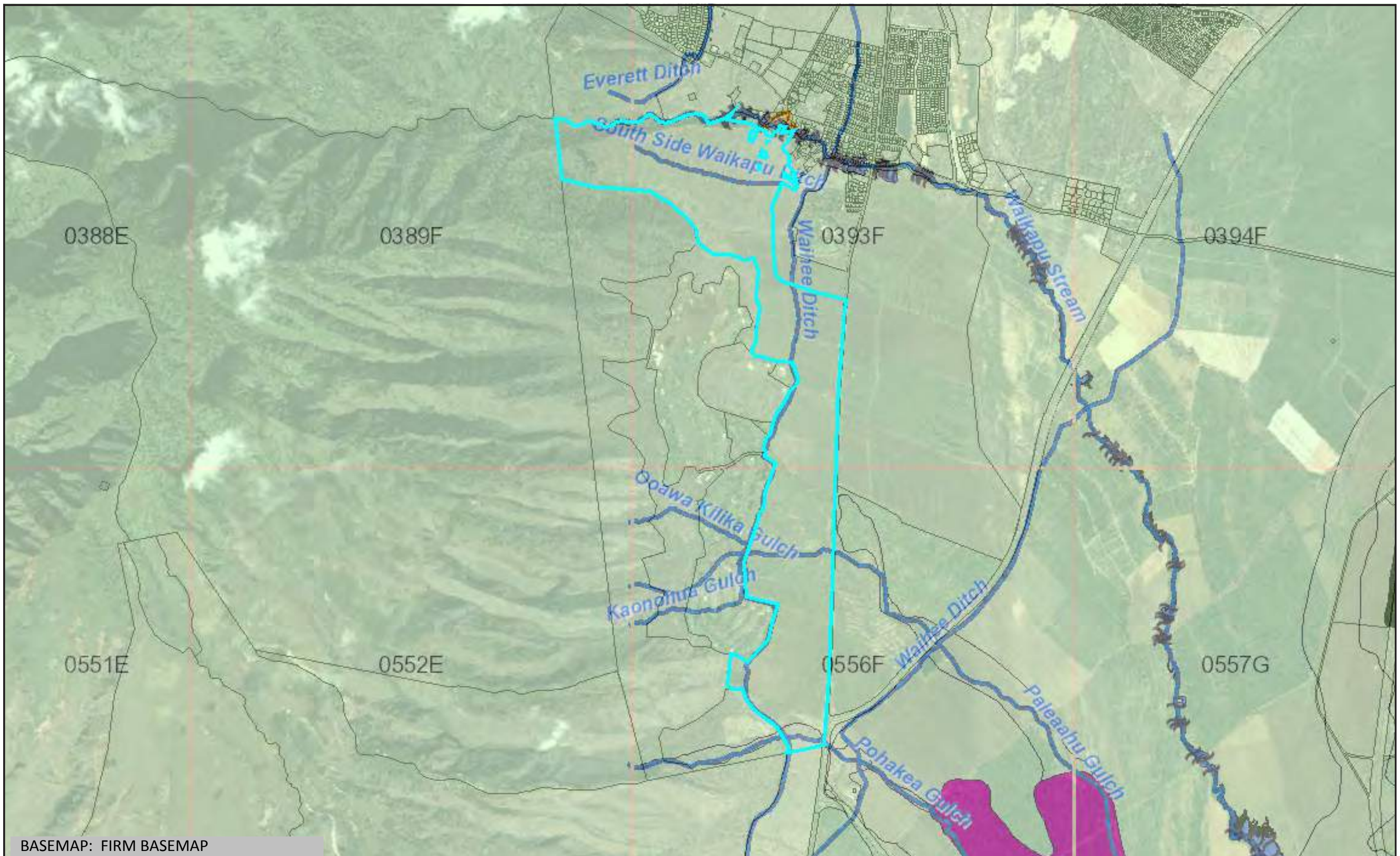
NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

	Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
	Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.

EXHIBIT 4B - FLOOD INSURANCE RATE MAP



Flood Hazard Assessment Report

www.hawaiinfip.org

WAIKAPU COUNTRY TOWN

Property Information

COUNTY: MAUI

TMK NO: (2) 3-6-004:003

WATERSHED: POHAKEA; WAIKAPU

PARCEL ADDRESS: 0 HONOAPIILANI HWY
WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE: NOVEMBER 04, 2015

LETTER OF MAP CHANGE(S): NONE

FEMA FIRM PANEL - EFFECTIVE DATE:
1500030389F - NOVEMBER 04, 2015
1500030393F - NOVEMBER 04, 2015
1500030556F - SEPTEMBER 25, 2009

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THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 0.60 1.20 mi

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OTHER FLOOD AREAS

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Flood Hazard Assessment Report

www.hawaiinfip.org

WAIKAPU COUNTRY TOWN

Property Information

COUNTY:	MAUI
TMK NO:	(2) 3-6-004:006
WATERSHED:	WAIKAPU
PARCEL ADDRESS:	2000 HONOAPIILANI HWY WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 04, 2015
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL:	1500030393F
PANEL EFFECTIVE DATE:	NOVEMBER 04, 2015

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0 600 1,200 ft

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OTHER FLOOD AREAS

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Flood Hazard Assessment Report

www.hawaiinfip.org

WAIKAPU COUNTRY TOWN

Property Information

COUNTY:	MAUI
TMK NO:	(2) 3-6-005:007
WATERSHED:	WAIKAPU
PARCEL ADDRESS:	1670 HONOAPIILANI HWY WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 04, 2015
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL:	1500030393F
PANEL EFFECTIVE DATE:	NOVEMBER 04, 2015

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0 600 1,200 ft

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Flood Hazard Assessment Report

www.hawaiinfip.org

WAIKAPU COUNTRY TOWN

Property Information

COUNTY: MAUI

TMK NO: (2) 3-6-006:036

WATERSHED: WAIKAPU

PARCEL ADDRESS: 0 WAIKAPU
WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE: NOVEMBER 04, 2015

LETTER OF MAP CHANGE(S): NONE

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PANEL EFFECTIVE DATE: NOVEMBER 04, 2015

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0 100 200 ft

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EHXIBIT 4F - FLOOD INSURANCE RATE MAP

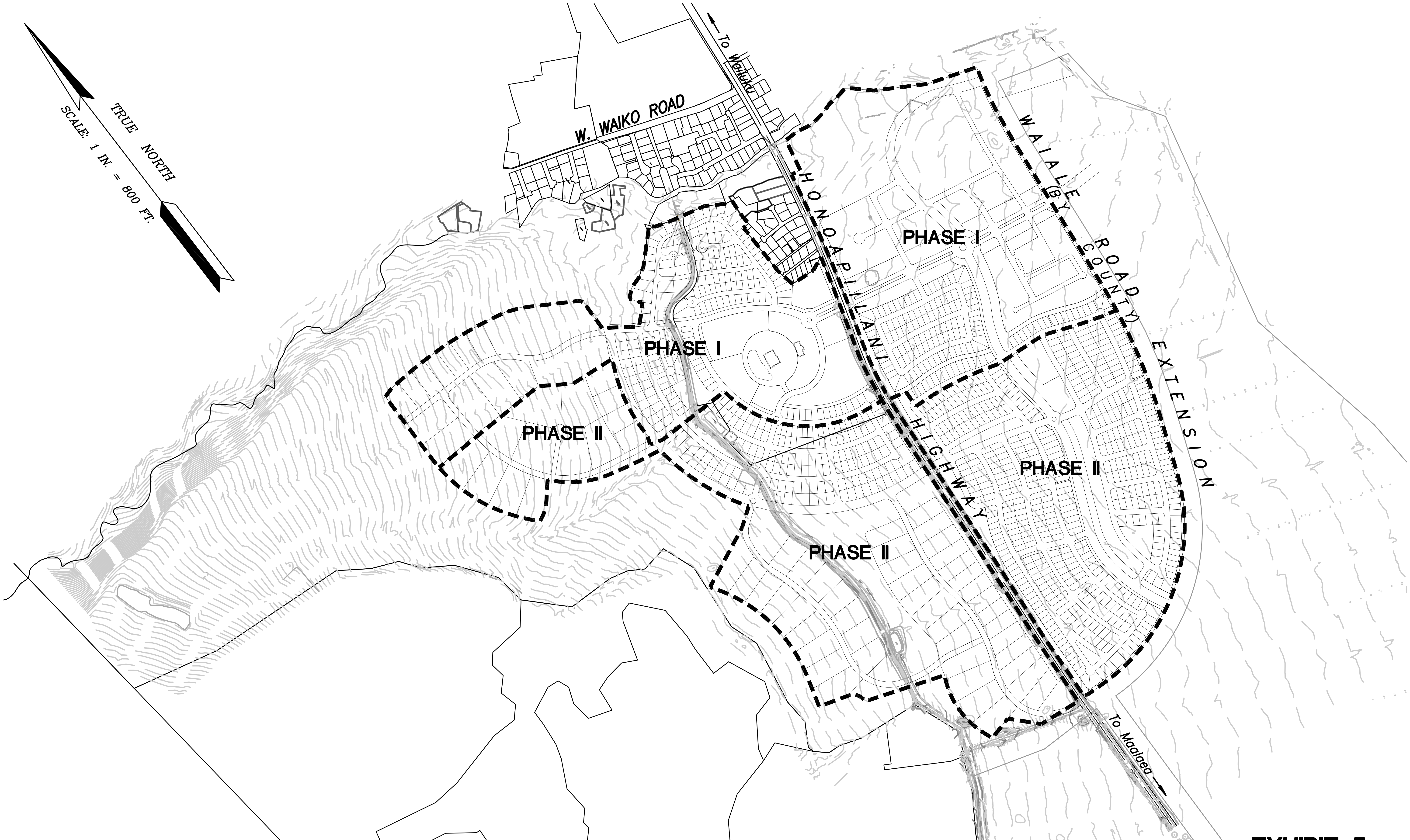


EXHIBIT 5
PHASING MAP

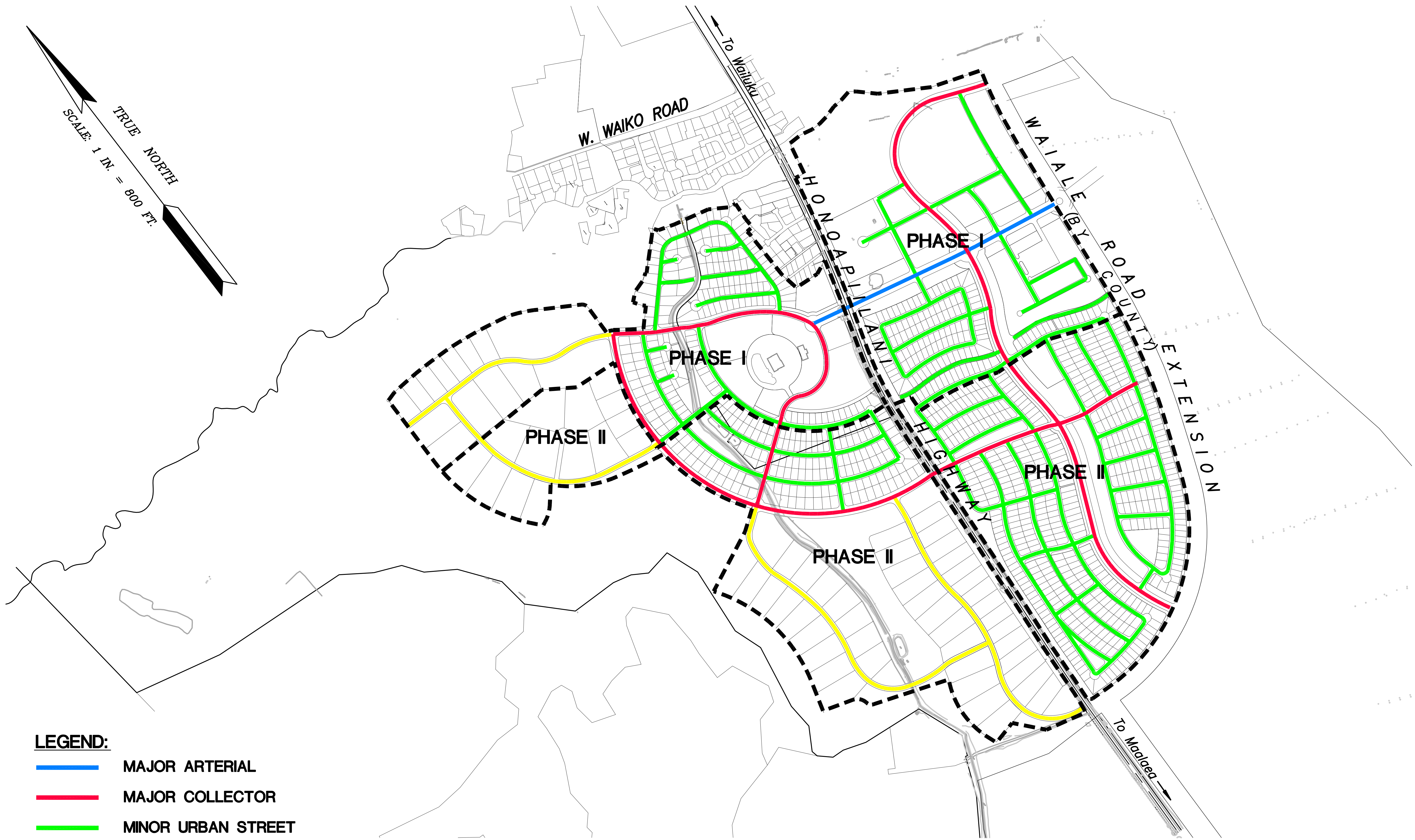


EXHIBIT 6
PROPOSED ROADWAY SYSTEM

ROADWAY CLASSIFICATION TABLE

ROADWAY CLASSIFICATION	RIGHT-OF-WAY WIDTH (MIN.)	PAVEMENT WIDTH (MIN.)	PAVEMENT STRUCTURE*
Major Arterial	80 Ft.	56 Ft.	Class “A”
Major Collector	60 Ft.	44 Ft.	Class “A”
Minor Urban Street	48 Ft.	28 Ft.	Class “B”
Minor Rural Street	40 Ft.	22 Ft.	Class “C”

* The pavement structures listed below are the minimum. Modified pavement structures submitted by a licensed Soils Engineer will be considered.

Class “A”
2-1/2” asphalt concrete
5” asphalt treated base
8” subbase
Curbed median island
Concrete curb & gutters
Concrete sidewalks on both sides of street

Class “B”
2-1/2” asphalt concrete
4” asphalt treated base
6” subbase
Concrete curb & gutters
Concrete sidewalks on both sides of street

Class “C”
2” asphalt concrete
6” base course
Grassed swales in shoulders

EXHIBIT 6A
ROADWAY CLASSIFICATION TABLE

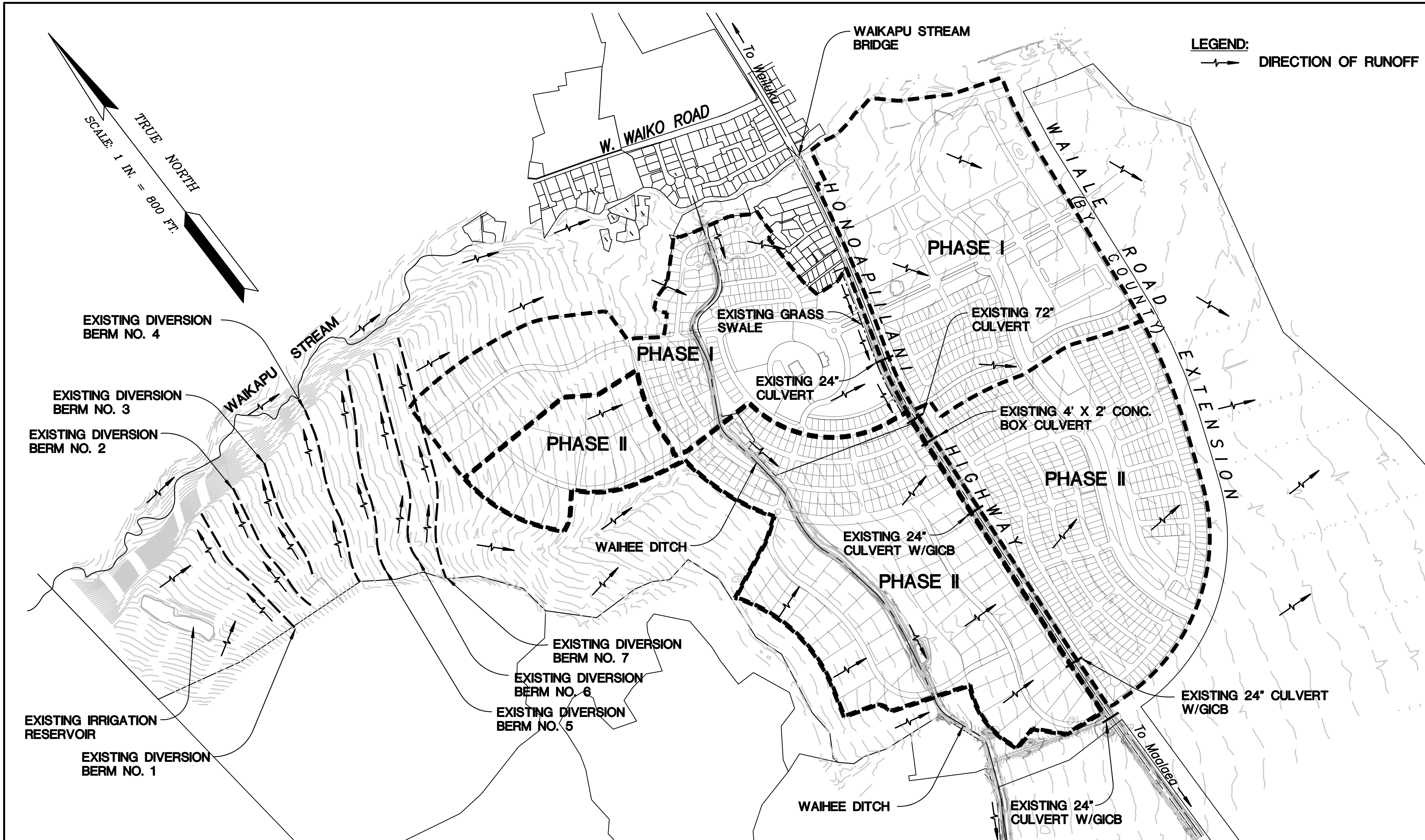


EXHIBIT 7
EXISTING DRAINAGE PATTERN

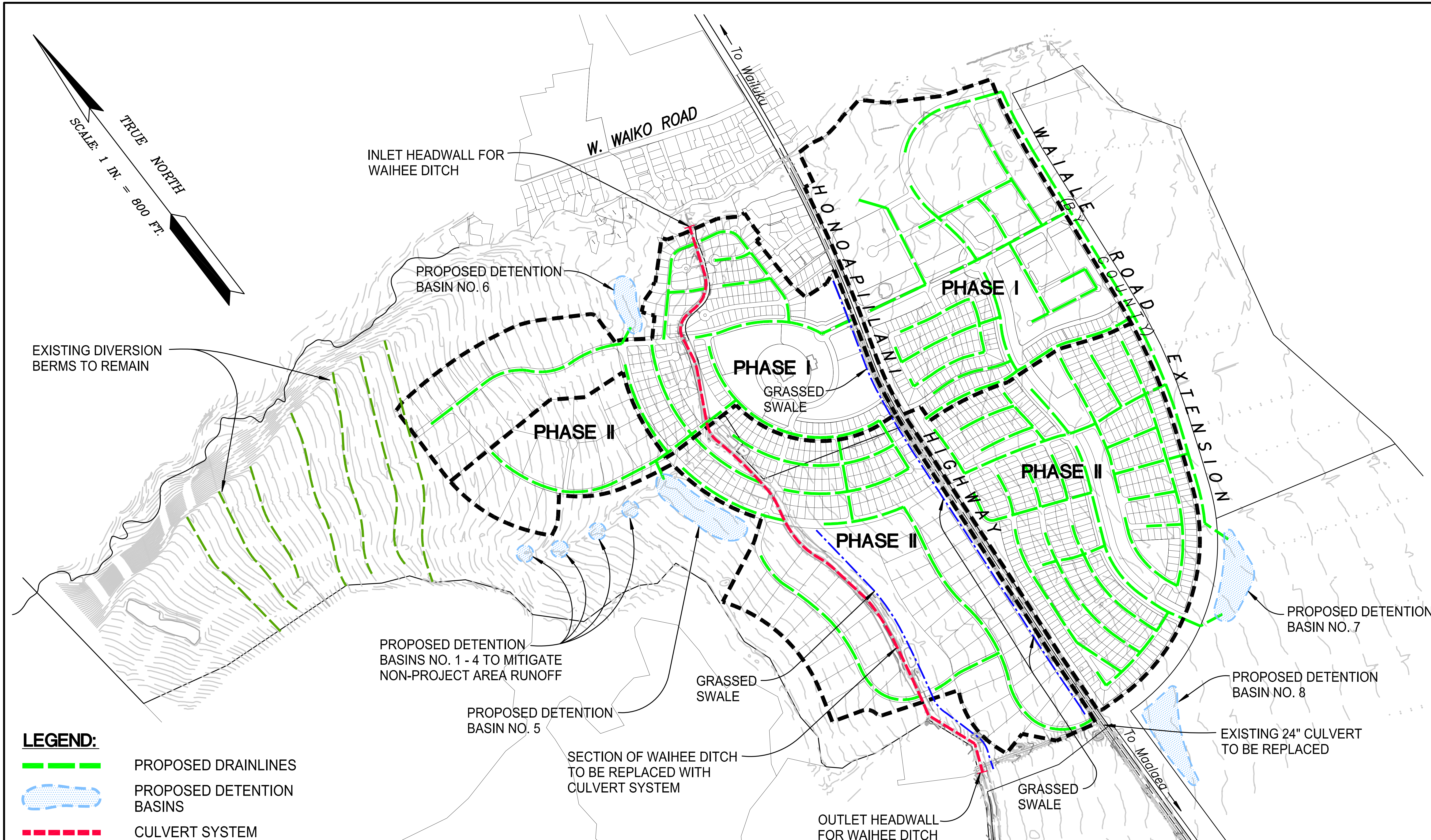


EXHIBIT 8
PROPOSED DRAINAGE SYSTEM

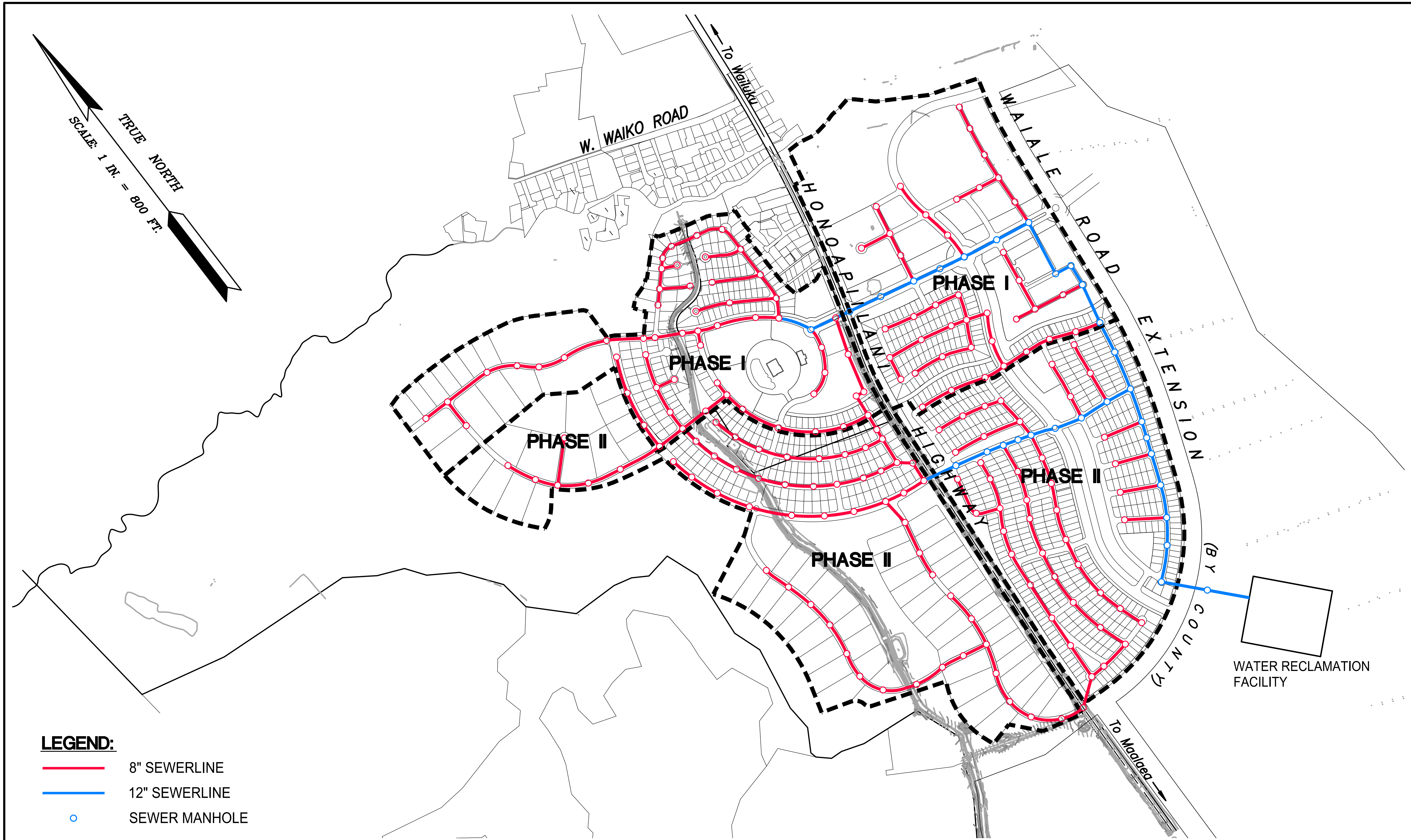


EXHIBIT 9
PROPOSED ONSITE SEWER SYSTEM

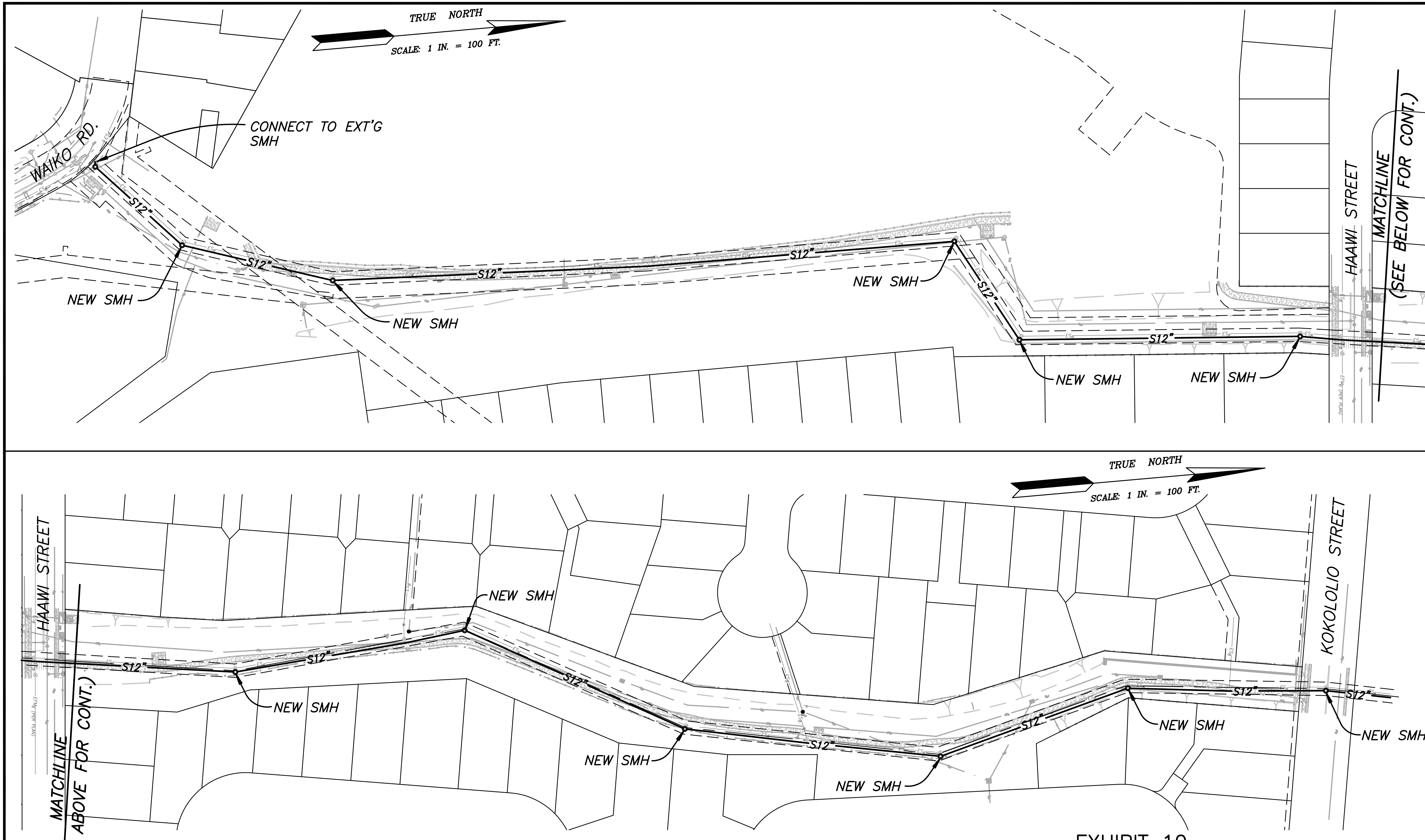


EXHIBIT 10
OFFSET SEWERLINE IMPROVEMENTS
(WAIKAPU GARDENS)

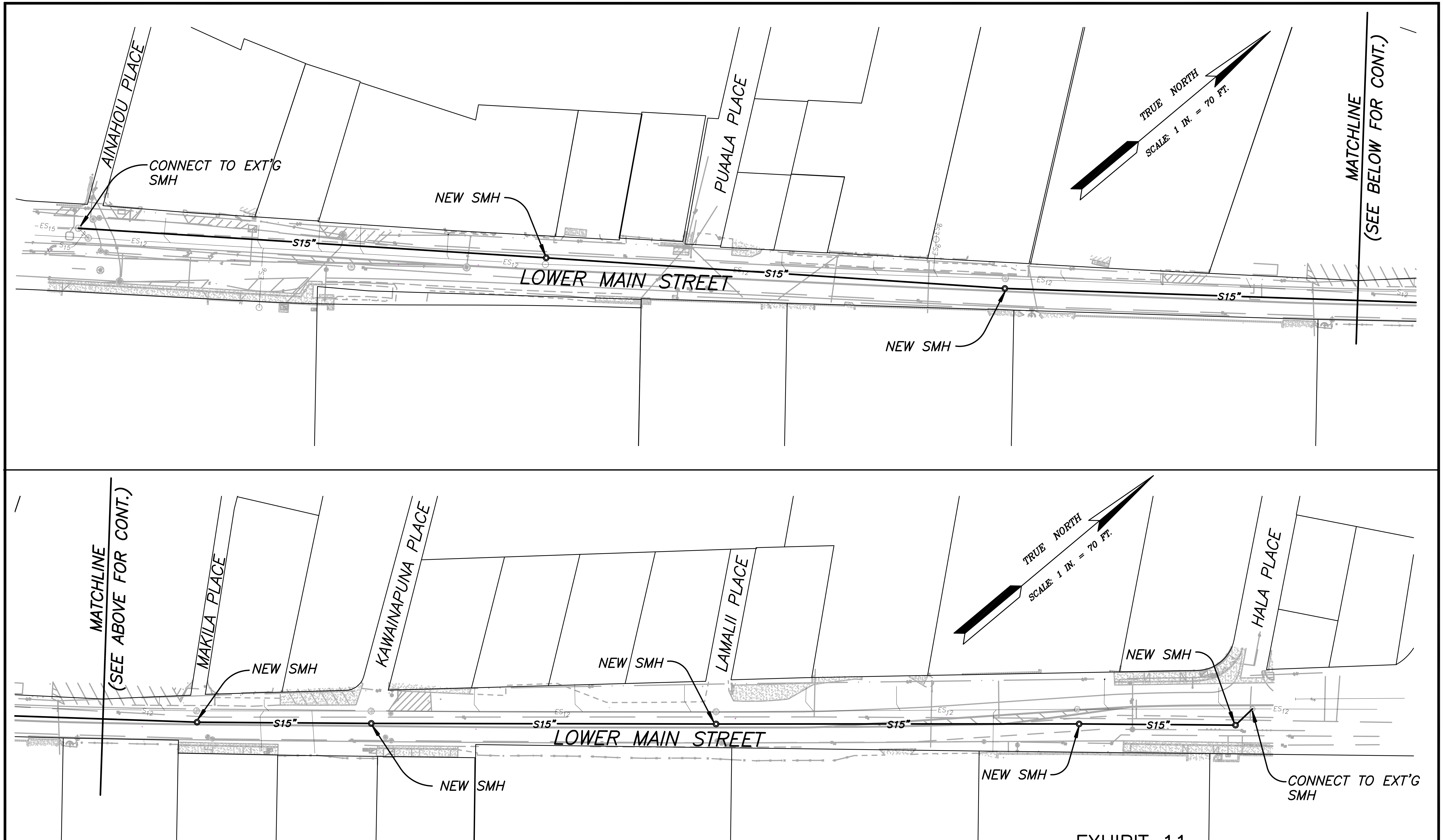


EXHIBIT 11
OFFSET SEWERLINE IMPROVEMENTS
(LOWER MAIN STREET)

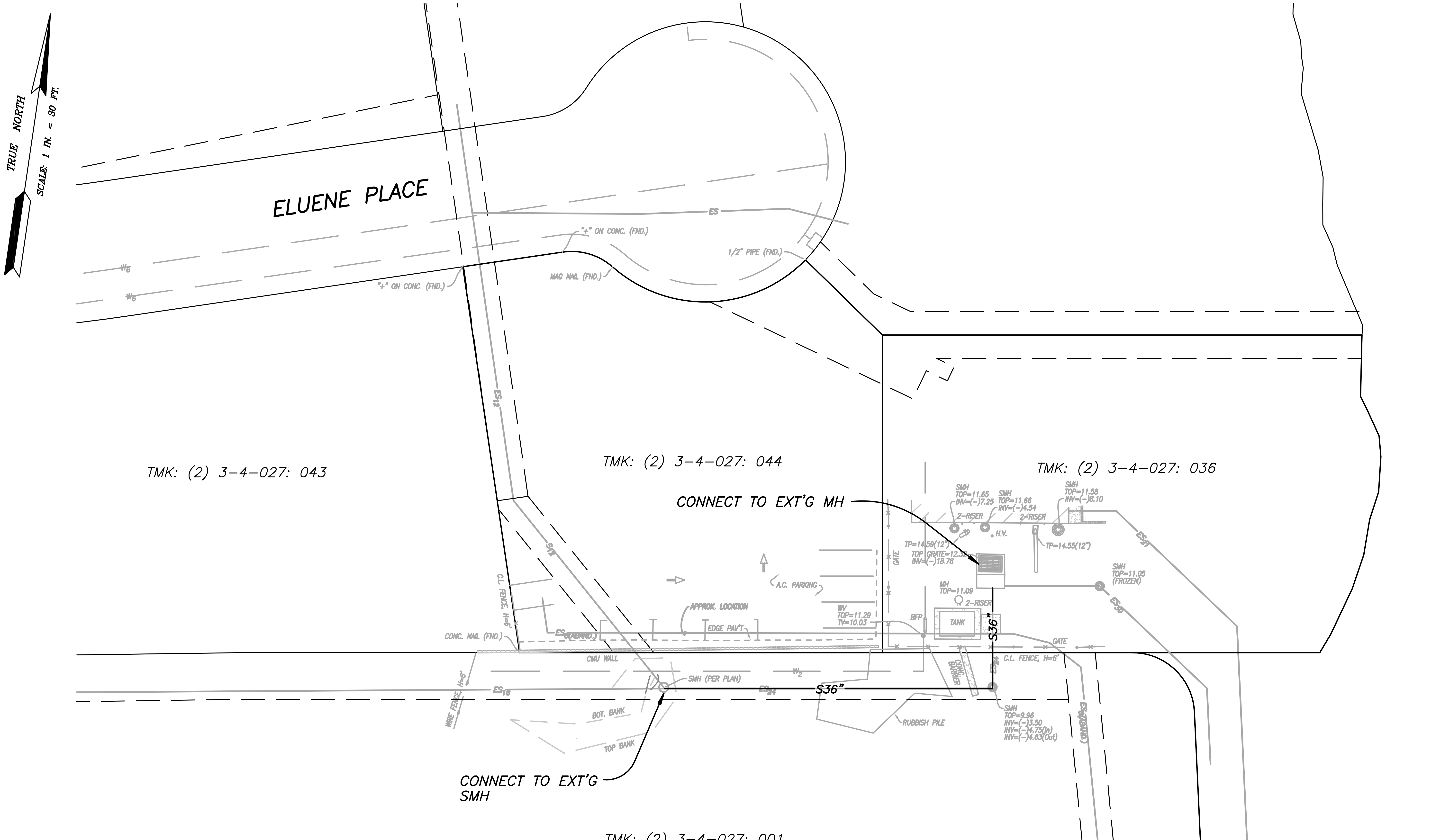


EXHIBIT 12
OFFSET SEWERLINE IMPROVEMENTS
(ELUENE STREET)

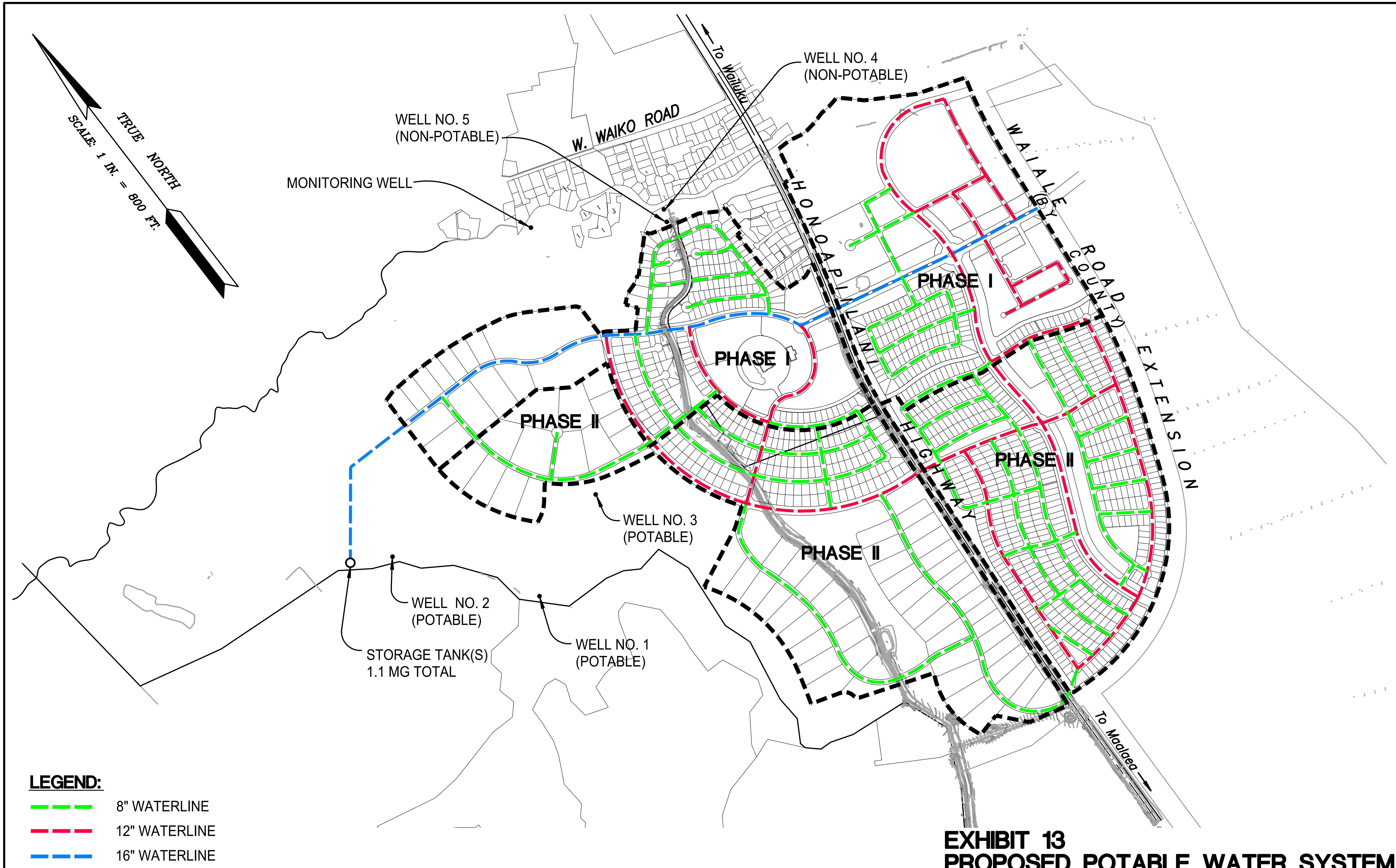
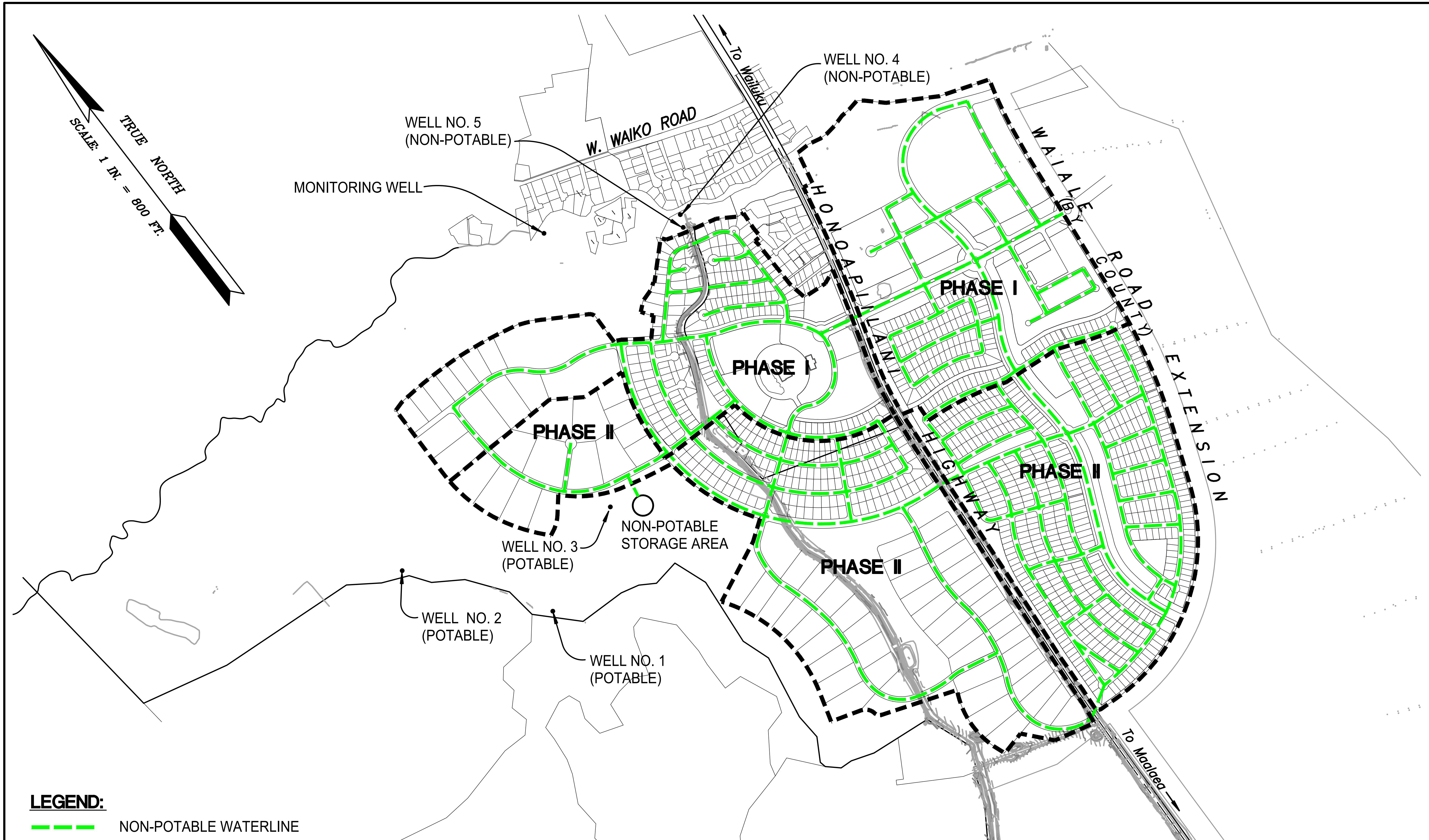


EXHIBIT 13
PROPOSED POTABLE WATER SYSTEM



LEGEND:

NON-POTABLE WATERLINE

EXHIBIT 14
PROPOSED NON-POTABLE WATER SYSTEM

APPENDIX A

HYDROLOGIC CALCULATIONS

Hydrologic Calculations – Diversion Berms

Purpose: Determine the volume of water upstream of the development being diverted into Waikapu Stream.

A. Determine the Runoff Coefficient (C):

DRAINAGE AREA CHARACTERISTICS:

LANDSCAPE AREAS:

Infiltration (Medium)	=	0.07
Relief (Hilly)	=	0.06
Vegetal Cover (Good)	=	0.03
Development Type (Landscape)	=	<u>0.15</u>
C	=	0.31

B. Determine the 50-year 1-hour rainfall:

i_{50} = 3.0 inches

Adjust for time of concentration to compute Rainfall Intensity (I):

Diversion Berm	1	2	3	4	5	6	7
Tc [min]	25	14	14	15	14	13	13
I [in]	4.56	5.77	5.77	5.62	5.77	5.93	5.93

C. Drainage Area (A):

Diversion Berm	1	2	3	4	5	6	7
Area [acres]	19.90	8.60	7.30	16.30	13.10	12.90	13.70

D. Compute the 50-year storm runoff (Q):

$$Q = CIA$$

Q1 = (0.31)(4.56)(19.90)
= 28.12 cfs

Q2 = (0.31)(5.77)(8.60)
= 15.38 cfs

Q3 = (0.31)(5.77)(7.30)
= 13.15 cfs

Q4 = (0.31)(5.62)(16.30)
= 28.32 cfs

Q5 = (0.31)(5.77)(13.10)
= 23.52 cfs

Q6 = (0.31)(5.93)(12.90)
= 23.71 cfs

Q7 = (0.31)(5.93)(13.70)
= 25.18 cfs

E. 50-year, 1-hour storm Volume (V):

Diversion Berm	1	2	3	4	5	6	7	**Total**
Volume [cu. ft.]	42,177	12,920	11,042	25,488	19,755	18,490	19,637	**148,509**

HYDROLOGIC CALCULATIONS BY PHASING

Phase	Pre-Development Flow (cfs)	Post-Development Flow (cfs)	Increase in Flow (cfs)
I Mauka	452	497	45
I Makai	373	639	266
II Mauka	447	507	60
II Makai	361	506	145

RUNOFF VOLUME CALCULATIONS BY PHASING

Phase	Pre-Development Flow (C.F.)	Post-Development Flow (C.F.)	Storage Required (C.F.)
I Mauka	2,418,629	2,567,545	148,916
I Makai	2,133,808	2,905,771	771,963
II Mauka	2,916,206	3,131,436	215,230
II Makai	2,062,681	2,454,805	392,124

Hydrograph Plot

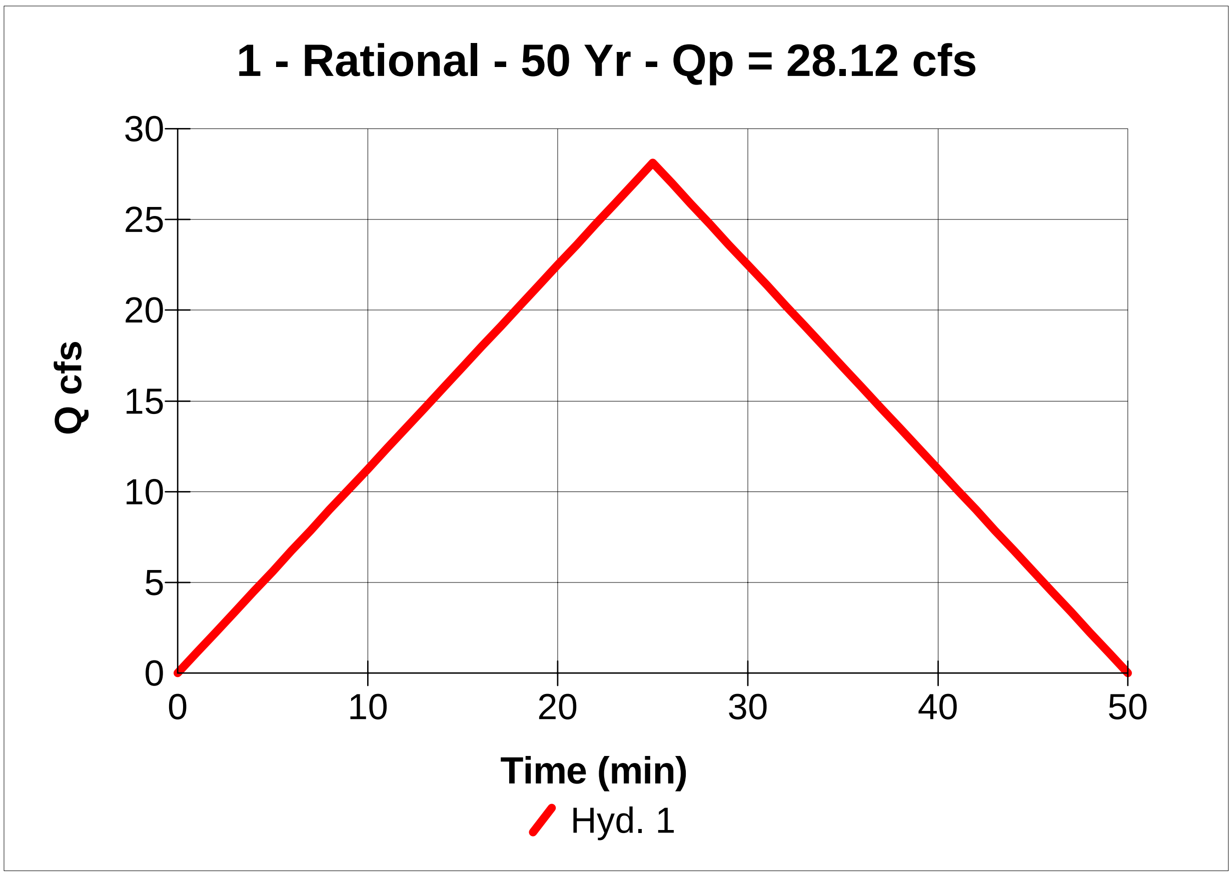
English

Hyd. No. 1

Diversion Berm 1

Hydrograph type	= Rational	Peak discharge	= 28.12 cfs
Storm frequency	= 50 yrs	Time interval	= 1 min
Drainage area	= 19.9 ac	Runoff coeff.	= 0.31
Intensity	= 4.56 in	Time of conc. (Tc)	= 25 min
I-D-F Curve	= 3-0.IDF	Reced. limb factor	= 1

Total Volume = 42,177 cuft



Hydrograph Plot

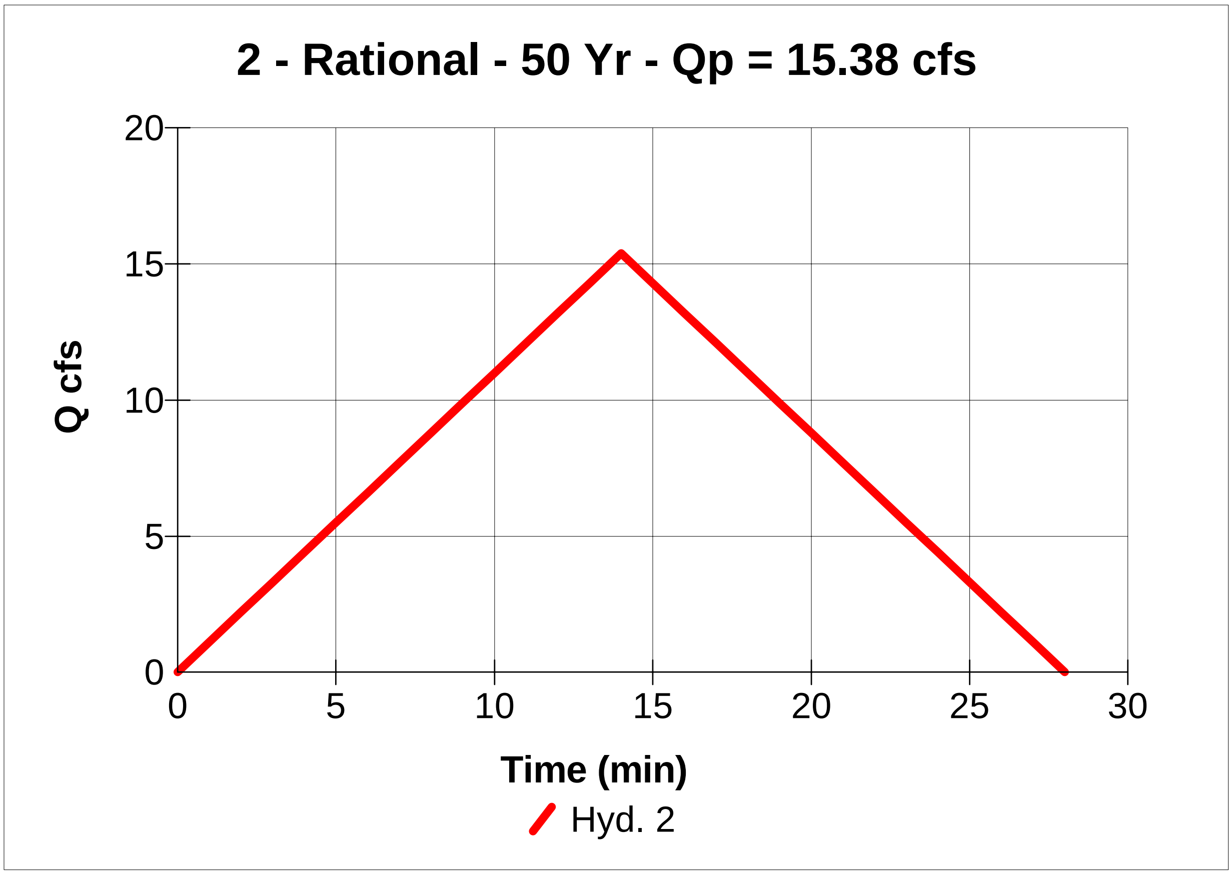
English

Hyd. No. 2

Diversion Berm 2

Hydrograph type	= Rational	Peak discharge	= 15.38 cfs
Storm frequency	= 50 yrs	Time interval	= 1 min
Drainage area	= 8.6 ac	Runoff coeff.	= 0.31
Intensity	= 5.77 in	Time of conc. (Tc)	= 14 min
I-D-F Curve	= 3-0.IDF	Reced. limb factor	= 1

Total Volume = 12,920 cuft



Hydrograph Plot

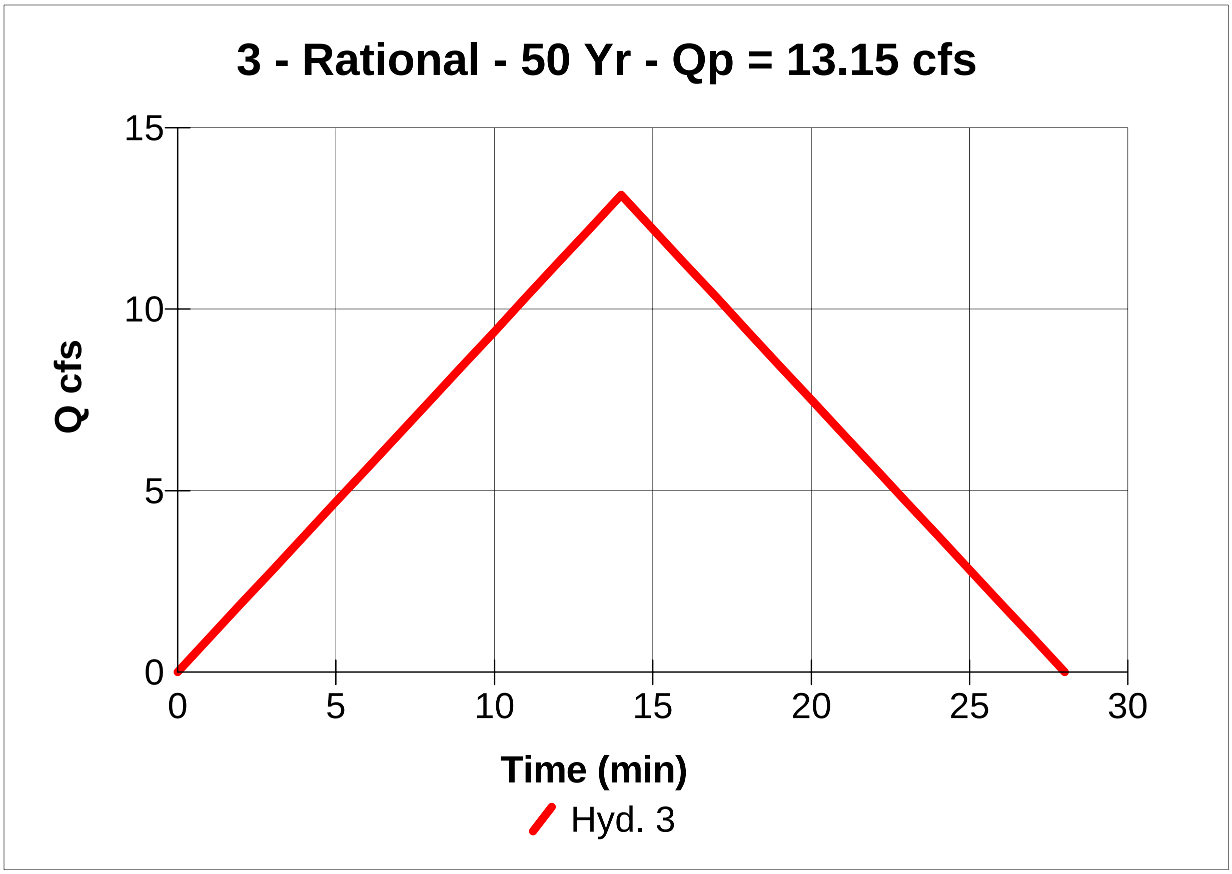
English

Hyd. No. 3

Diversion Berm 3

Hydrograph type	= Rational	Peak discharge	= 13.15 cfs
Storm frequency	= 50 yrs	Time interval	= 1 min
Drainage area	= 7.3 ac	Runoff coeff.	= 0.31
Intensity	= 5.77 in	Time of conc. (Tc)	= 14 min
I-D-F Curve	= 3-0.IDF	Reced. limb factor	= 1

Total Volume = 11,042 cuft



Hydrograph Plot

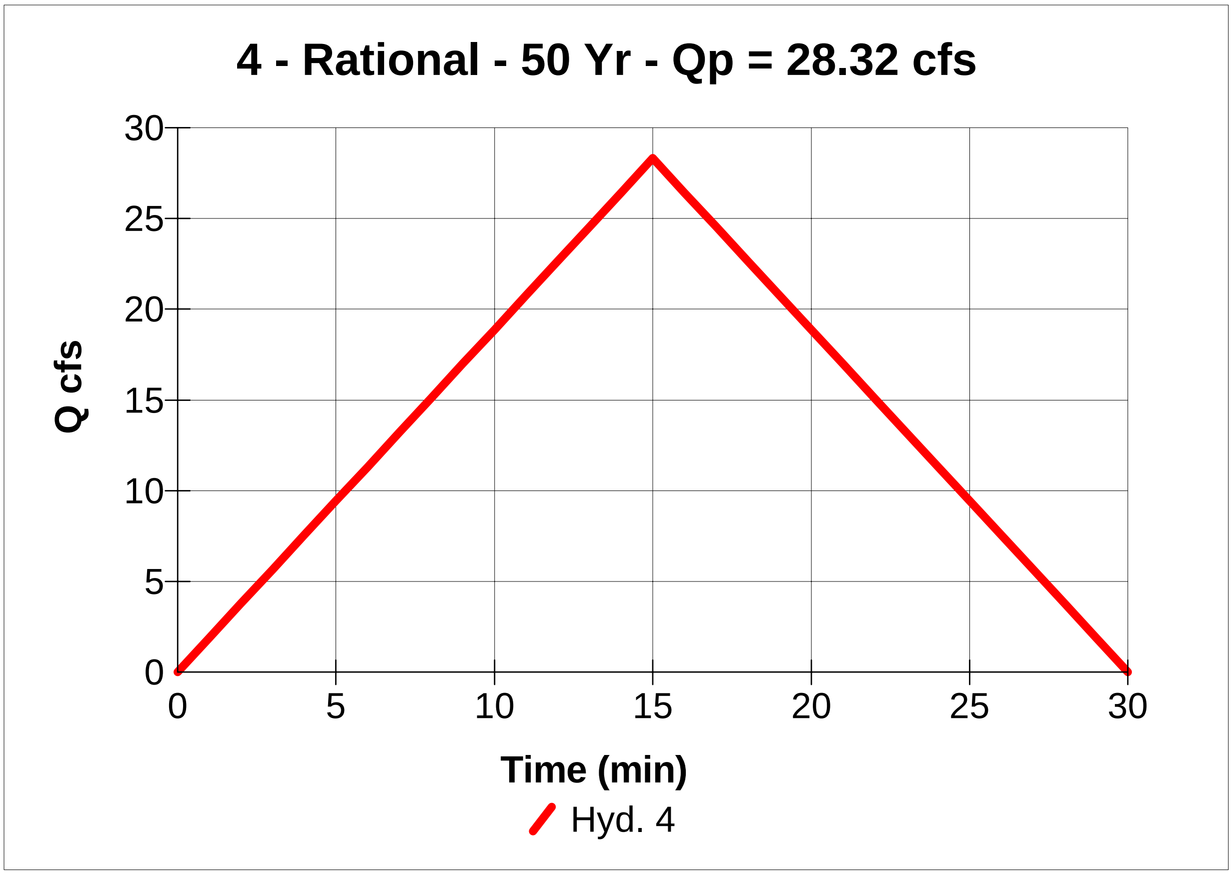
English

Hyd. No. 4

Diversion Berm 4

Hydrograph type	= Rational	Peak discharge	= 28.32 cfs
Storm frequency	= 50 yrs	Time interval	= 1 min
Drainage area	= 16.3 ac	Runoff coeff.	= 0.31
Intensity	= 5.62 in	Time of conc. (Tc)	= 15 min
I-D-F Curve	= 3-0.IDF	Reced. limb factor	= 1

Total Volume = 25,488 cuft



Hydrograph Plot

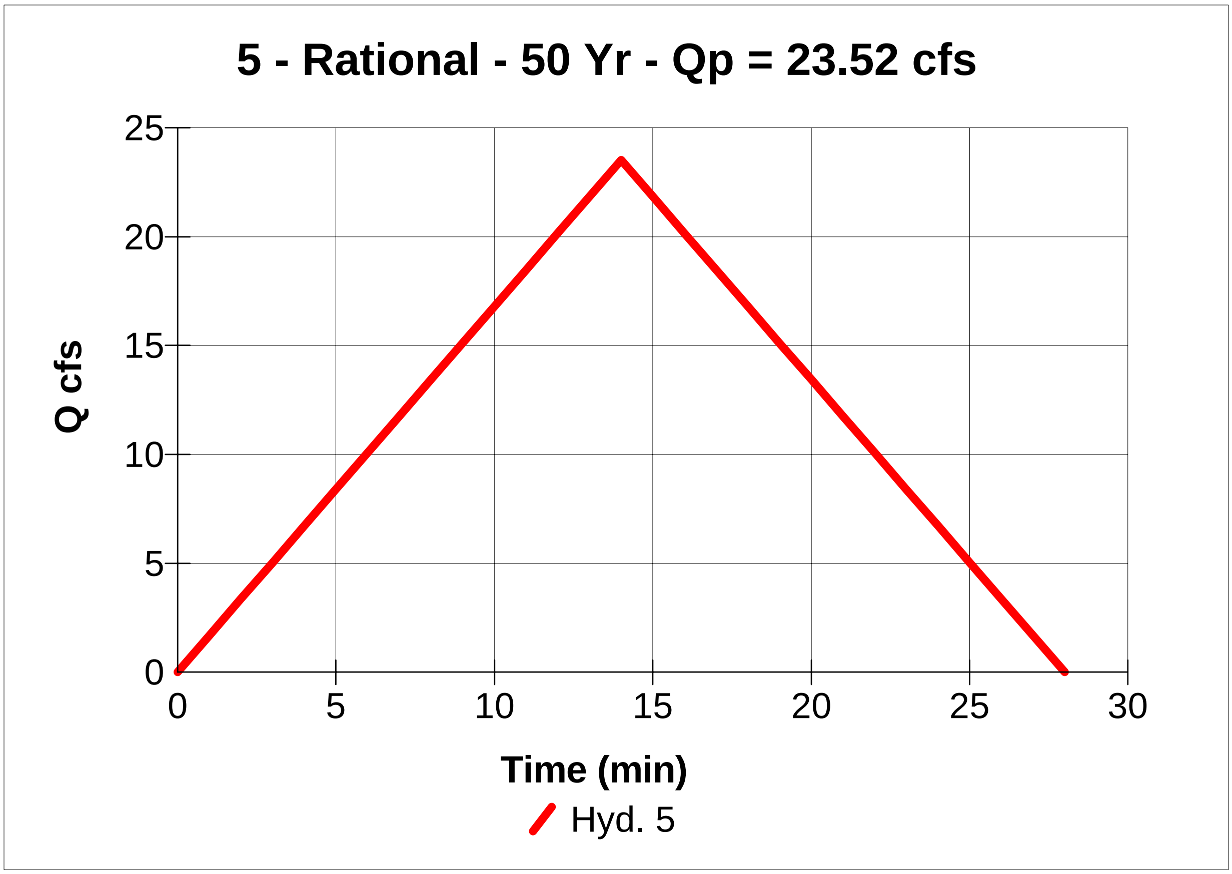
English

Hyd. No. 5

Diversion Berm 5

Hydrograph type	= Rational	Peak discharge	= 23.52 cfs
Storm frequency	= 50 yrs	Time interval	= 1 min
Drainage area	= 13.1 ac	Runoff coeff.	= 0.31
Intensity	= 5.77 in	Time of conc. (Tc)	= 14 min
I-D-F Curve	= 3-0.IDF	Reced. limb factor	= 1

Total Volume = 19,755 cuft



Hydrograph Plot

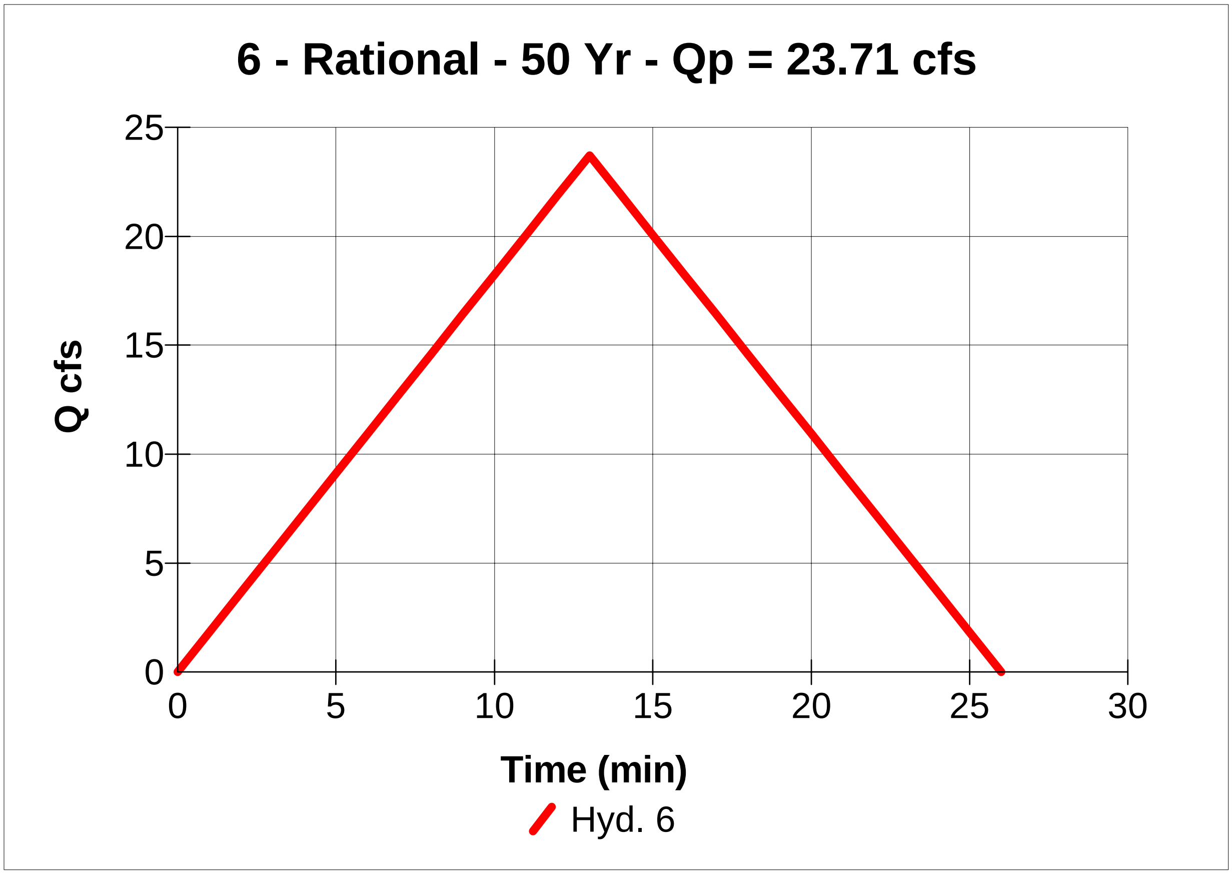
English

Hyd. No. 6

Diversion Berm 6

Hydrograph type	= Rational	Peak discharge	= 23.71 cfs
Storm frequency	= 50 yrs	Time interval	= 1 min
Drainage area	= 12.9 ac	Runoff coeff.	= 0.31
Intensity	= 5.93 in	Time of conc. (Tc)	= 13 min
I-D-F Curve	= 3-0.IDF	Reced. limb factor	= 1

Total Volume = 18,490 cuft



Hydrograph Plot

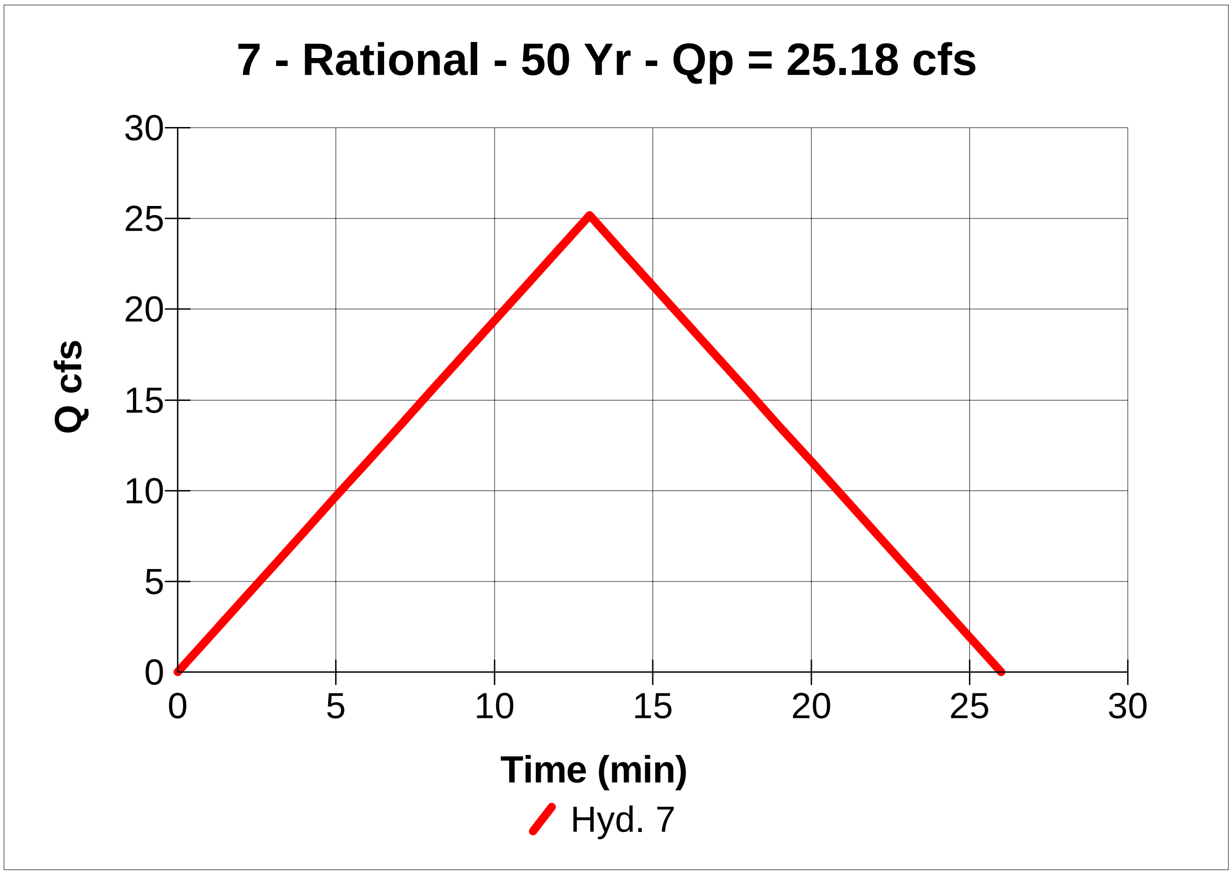
English

Hyd. No. 7

Diversion Berm 7

Hydrograph type	= Rational	Peak discharge	= 25.18 cfs
Storm frequency	= 50 yrs	Time interval	= 1 min
Drainage area	= 13.7 ac	Runoff coeff.	= 0.31
Intensity	= 5.93 in	Time of conc. (Tc)	= 13 min
I-D-F Curve	= 3-0.IDF	Reced. limb factor	= 1

Total Volume = 19,637 cuft

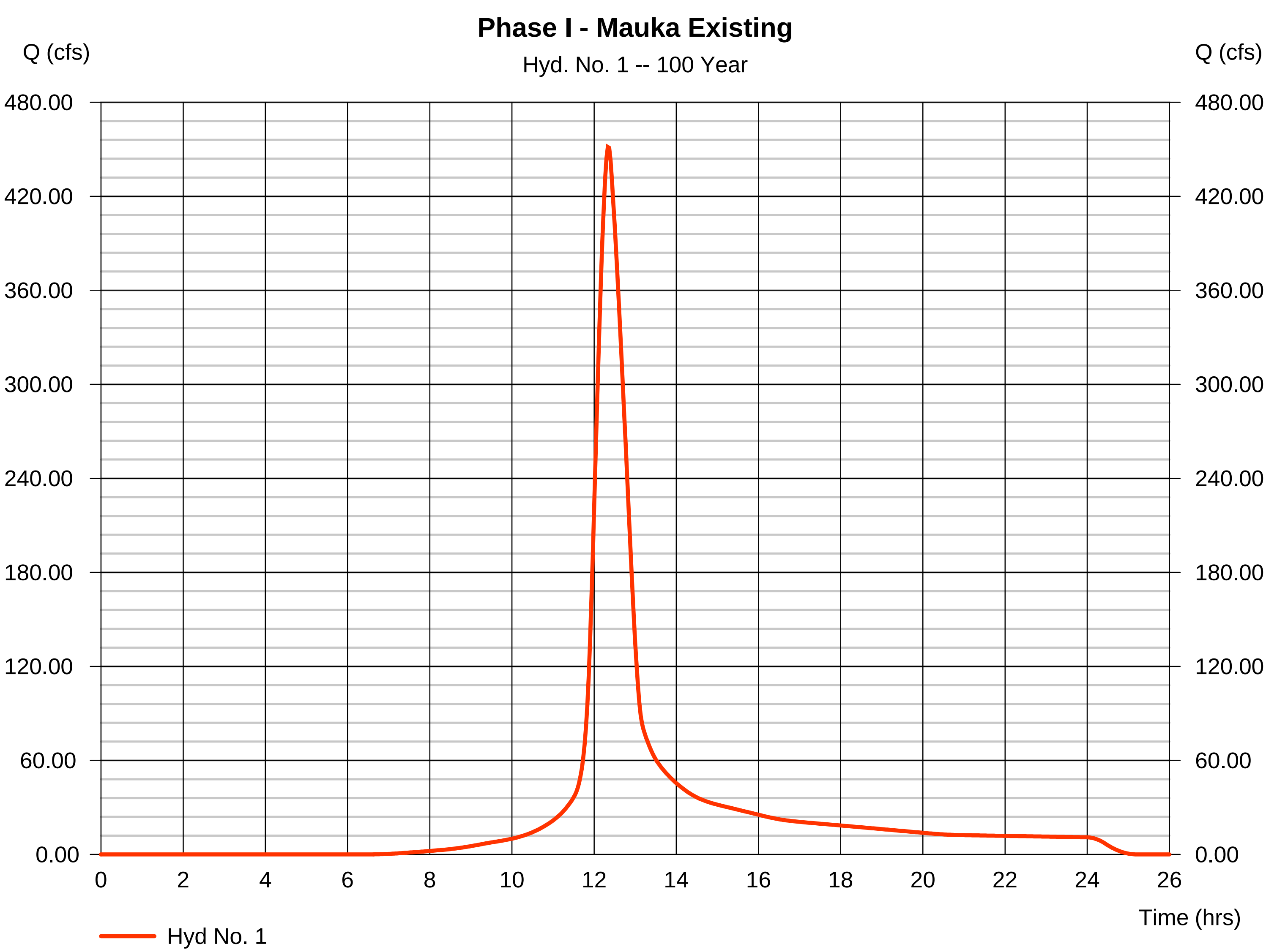


Hydrograph Report

Hyd. No. 1

Phase I - Mauka Existing

Hydrograph type	= SCS Runoff	Peak discharge	= 451.50 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.33 hrs
Time interval	= 2 min	Hyd. volume	= 2,418,629 cuft
Drainage area	= 108.000 ac	Curve number	= 70
Basin Slope	= 8.0 %	Hydraulic length	= 4000 ft
Tc method	= LAG	Time of conc. (Tc)	= 45.54 min
Total precip.	= 10.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

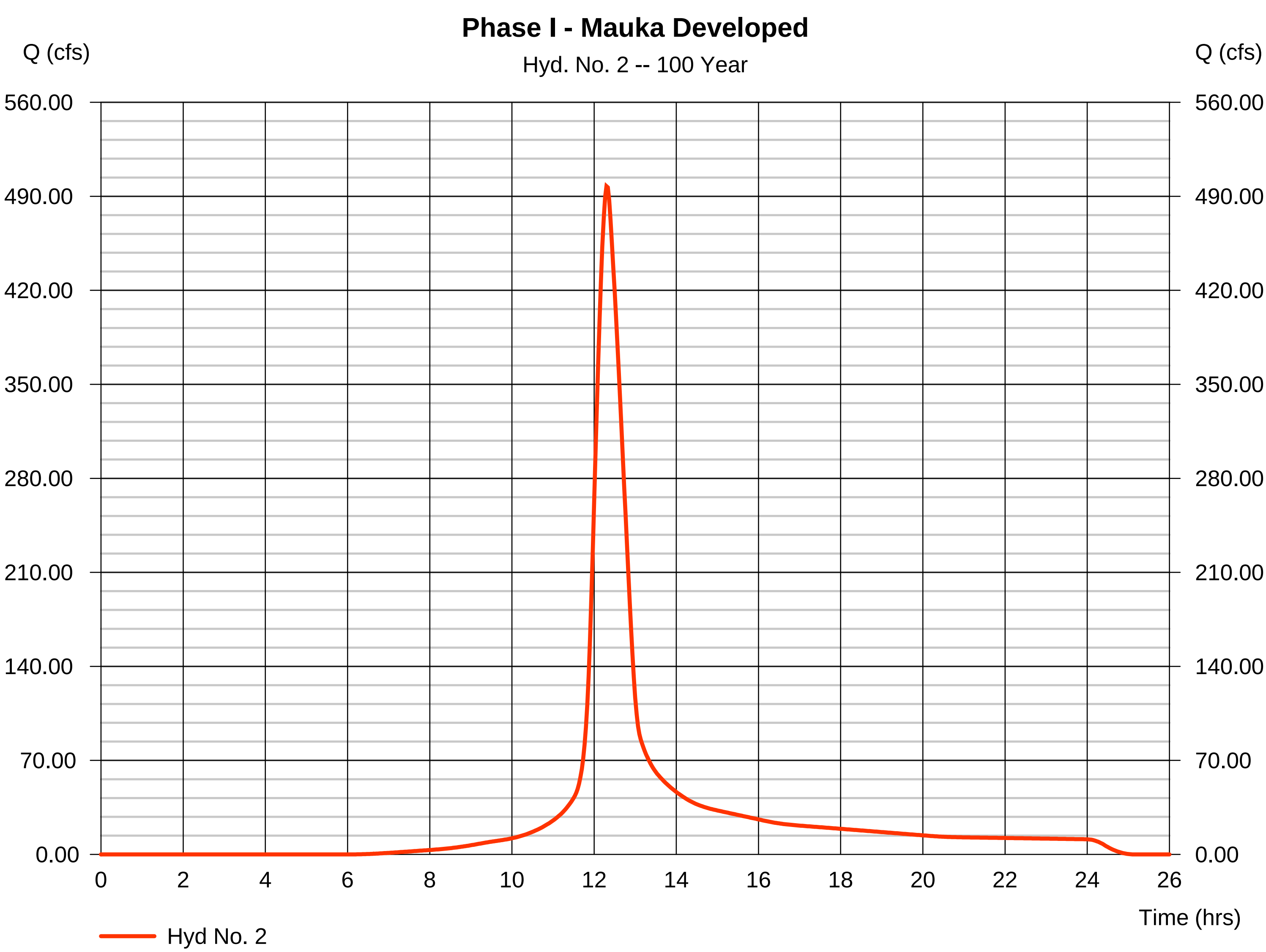


Hydrograph Report

Hyd. No. 2

Phase I - Mauka Developed

Hydrograph type	= SCS Runoff	Peak discharge	= 497.48 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 2,567,545 cuft
Drainage area	= 108.000 ac	Curve number	= 72
Basin Slope	= 8.0 %	Hydraulic length	= 4000 ft
Tc method	= LAG	Time of conc. (Tc)	= 43.12 min
Total precip.	= 10.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

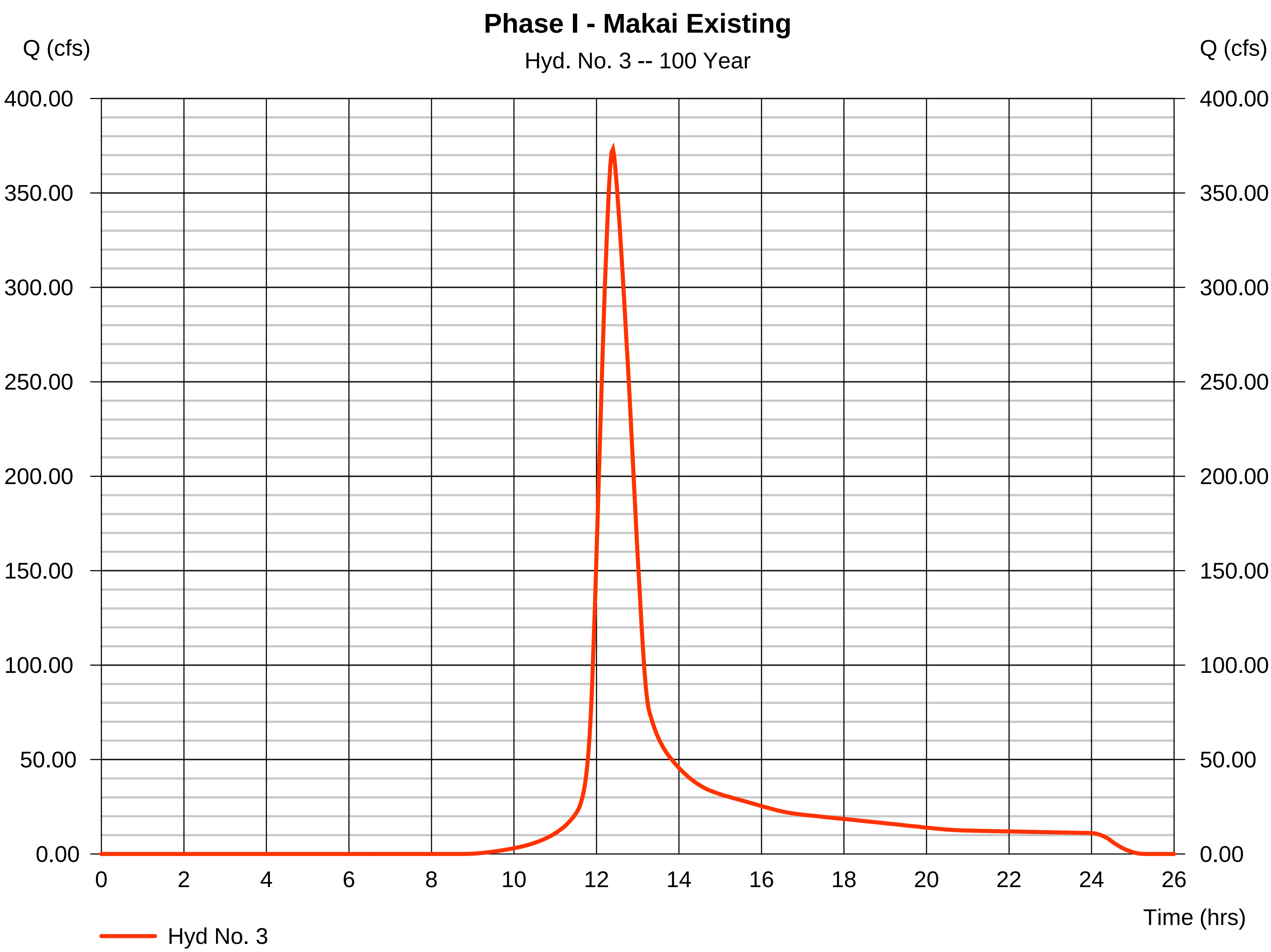


Hydrograph Report

Hyd. No. 3

Phase I - Makai Existing

Hydrograph type	= SCS Runoff	Peak discharge	= 373.19 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 2,133,808 cuft
Drainage area	= 120.000 ac	Curve number	= 60
Basin Slope	= 4.0 %	Hydraulic length	= 2050 ft
Tc method	= LAG	Time of conc. (Tc)	= 48.95 min
Total precip.	= 10.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



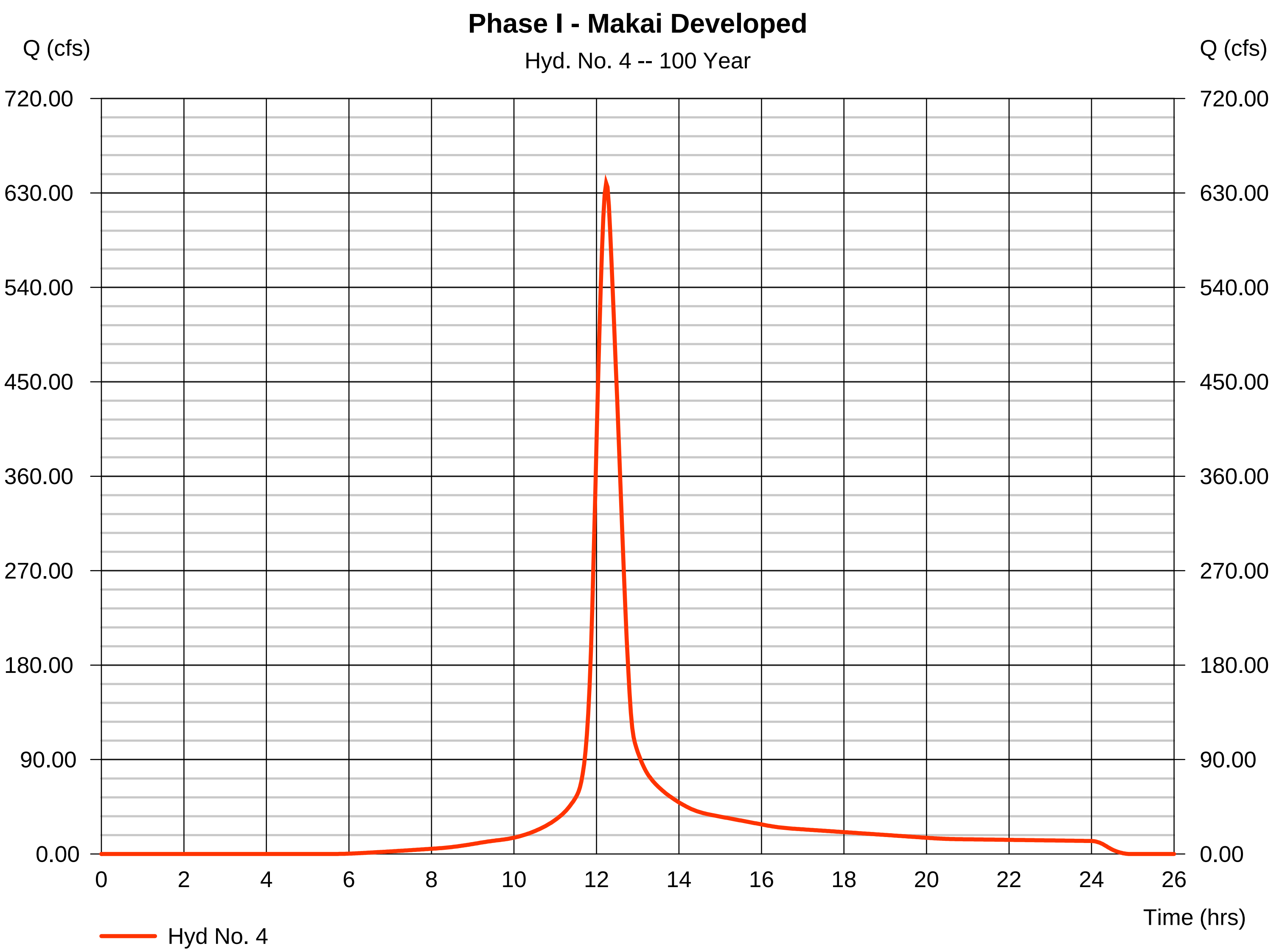
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Monday, 01 / 5 / 2015

Hyd. No. 4

Phase I - Makai Developed

Hydrograph type	= SCS Runoff	Peak discharge	= 639.39 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 2,905,771 cuft
Drainage area	= 120.000 ac	Curve number	= 74
Basin Slope	= 4.0 %	Hydraulic length	= 2050 ft
Tc method	= LAG	Time of conc. (Tc)	= 33.78 min
Total precip.	= 10.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



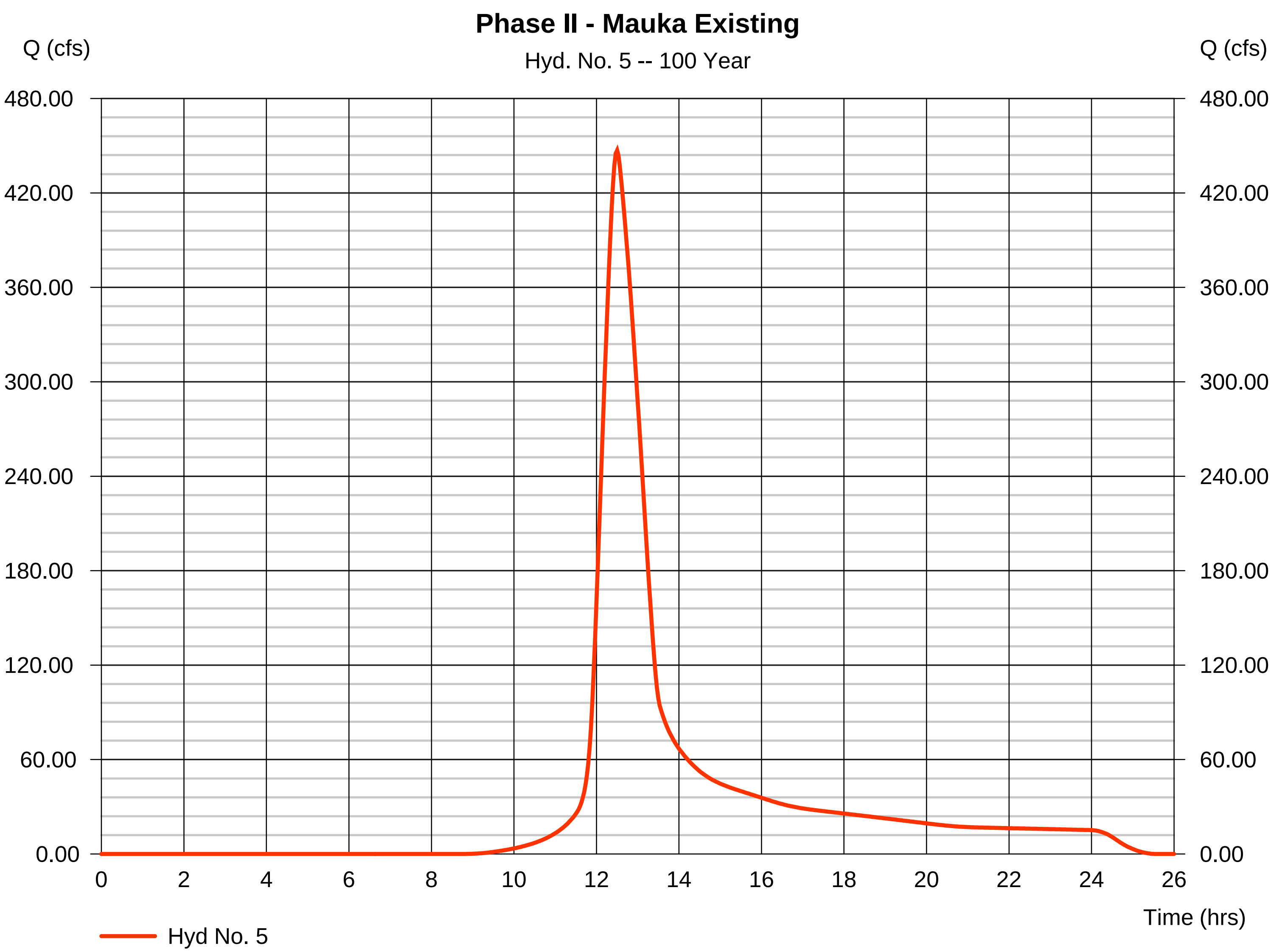
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Tuesday, 12 / 30 / 2014

Hyd. No. 5

Phase II - Mauka Existing

Hydrograph type	= SCS Runoff	Peak discharge	= 447.09 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.50 hrs
Time interval	= 2 min	Hyd. volume	= 2,916,206 cuft
Drainage area	= 164.000 ac	Curve number	= 60
Basin Slope	= 8.0 %	Hydraulic length	= 4000 ft
Tc method	= LAG	Time of conc. (Tc)	= 59.08 min
Total precip.	= 10.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

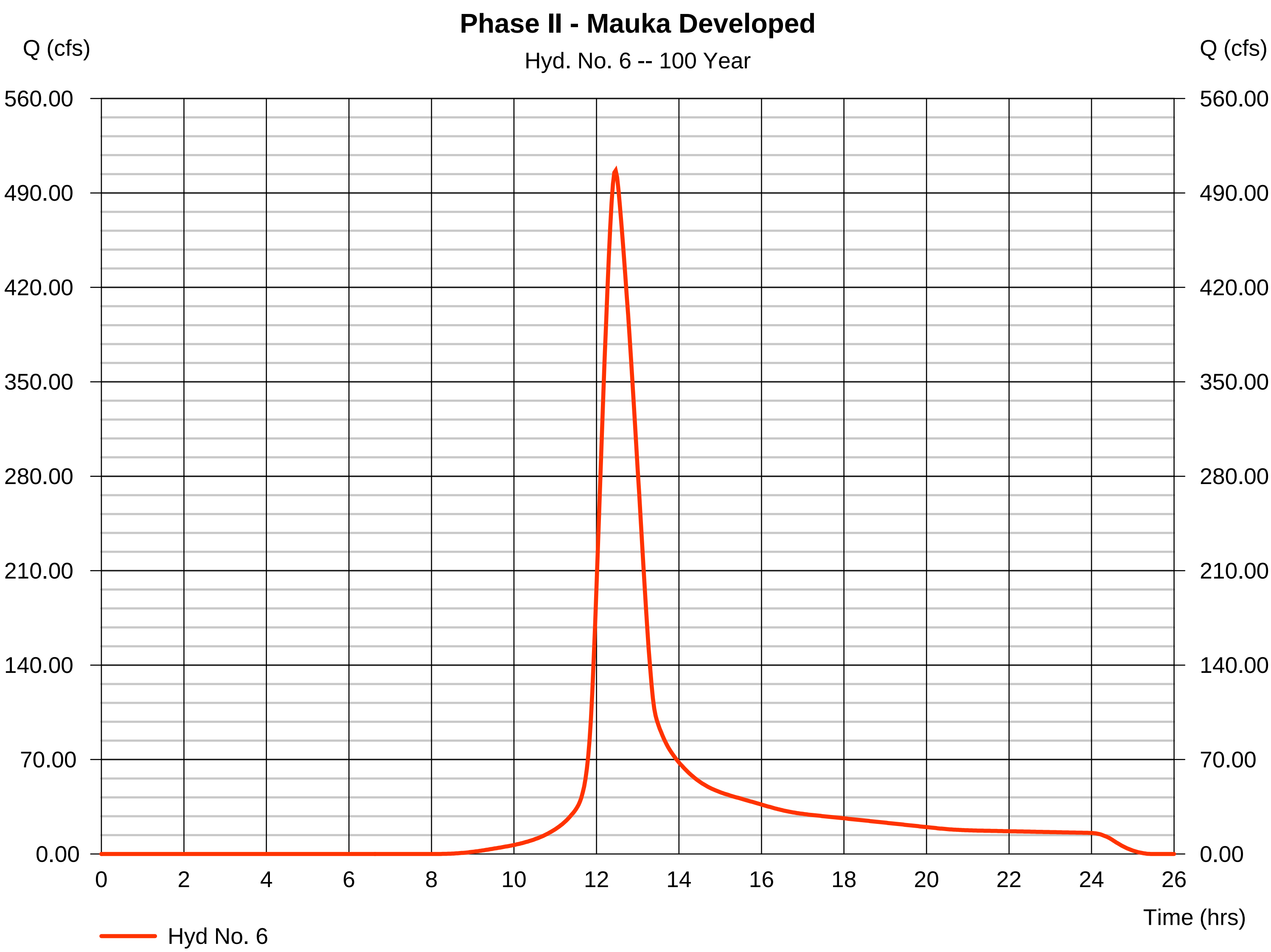


Hydrograph Report

Hyd. No. 6

Phase II - Mauka Developed

Hydrograph type	= SCS Runoff	Peak discharge	= 506.56 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.47 hrs
Time interval	= 2 min	Hyd. volume	= 3,131,436 cuft
Drainage area	= 164.000 ac	Curve number	= 63
Basin Slope	= 8.0 %	Hydraulic length	= 4000 ft
Tc method	= LAG	Time of conc. (Tc)	= 54.73 min
Total precip.	= 10.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

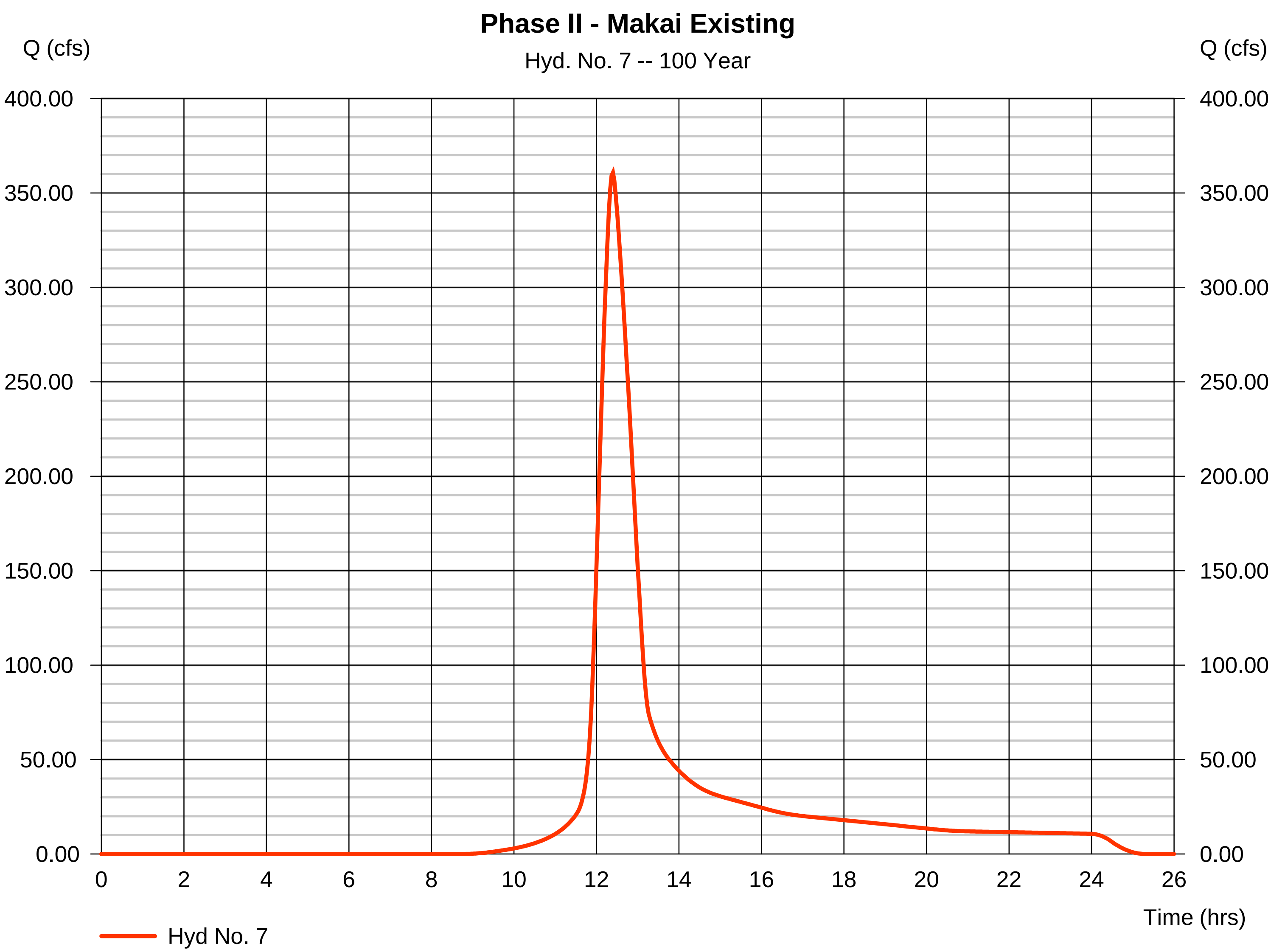


Hydrograph Report

Hyd. No. 7

Phase II - Makai Existing

Hydrograph type	= SCS Runoff	Peak discharge	= 360.75 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 2,062,681 cuft
Drainage area	= 116.000 ac	Curve number	= 60
Basin Slope	= 4.0 %	Hydraulic length	= 2000 ft
Tc method	= LAG	Time of conc. (Tc)	= 47.99 min
Total precip.	= 10.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

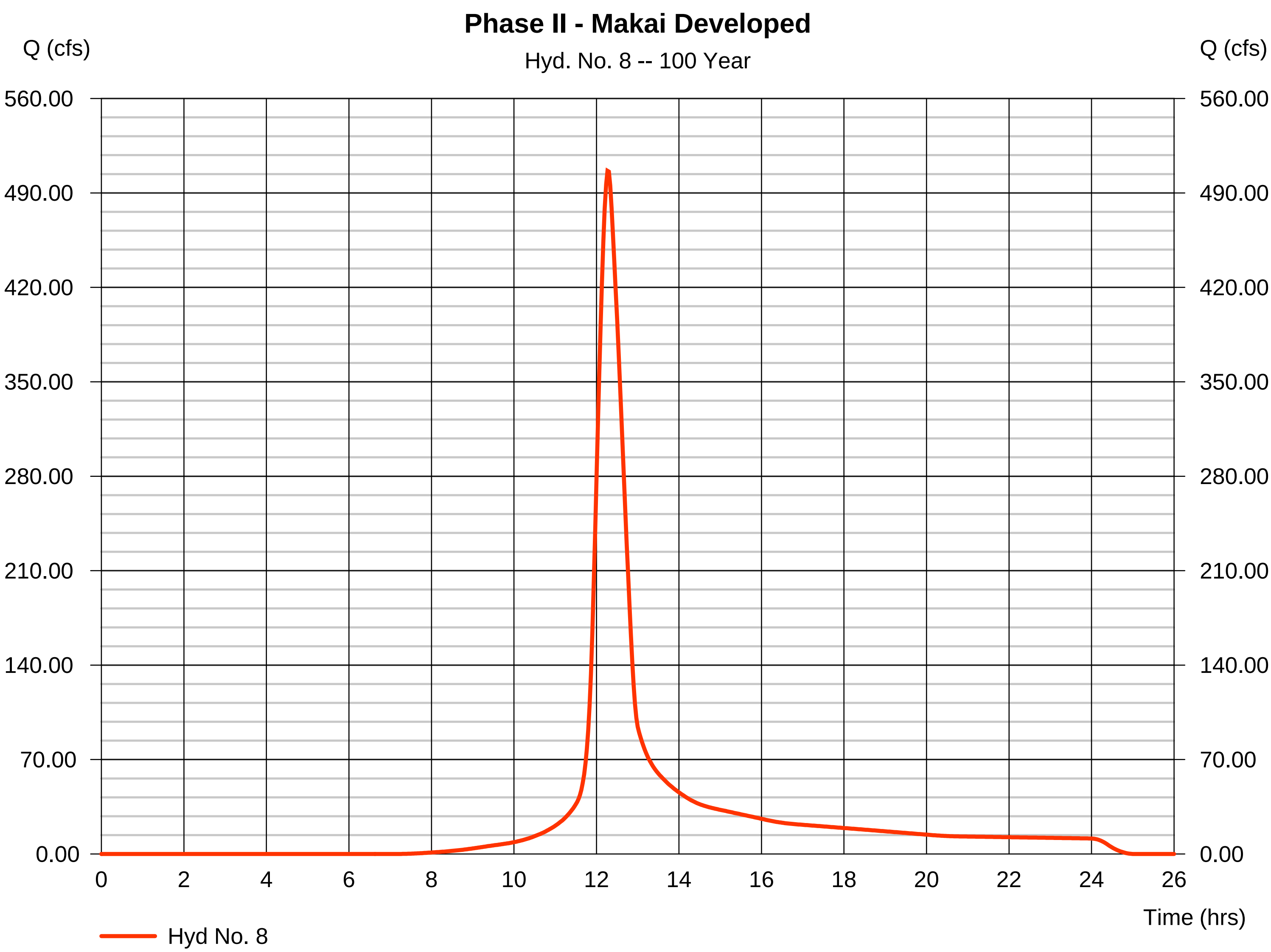


Hydrograph Report

Hyd. No. 8

Phase II - Makai Developed

Hydrograph type	= SCS Runoff	Peak discharge	= 506.32 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 2,454,805 cuft
Drainage area	= 116.000 ac	Curve number	= 67
Basin Slope	= 4.0 %	Hydraulic length	= 2000 ft
Tc method	= LAG	Time of conc. (Tc)	= 40.07 min
Total precip.	= 10.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



APPENDIX B

STORM WATER QUALITY CALCULATIONS

Storm Water Quality Calculations:

For the purpose of this preliminary study, it is assumed that 50% of the drainage area will be impervious.

Phase I Mauka Development

A. Determine the Runoff Coefficient (C):

$$C = 0.05 + (0.009 \times IMP)$$

$$IMP = \text{Impervious Area (\%)} = 50.0\%$$

$$C = 0.05 + (0.009 \times 50.0) = 0.50$$

B. Drainage Area (A) = 108Acres

C. Compute the Water Quality Design Volume (WQDV):

$$WQDV = C \times 1'' \times A \times 3630$$

$$= (0.50)(1.0)(108)(3630)$$

$$= \mathbf{196{,}020\ cubic\ feet}$$

Phase I Makai Development

A. Determine the Runoff Coefficient (C):

$$C = 0.05 + (0.009 \times IMP)$$

$$IMP = \text{Impervious Area (\%)} = 50.0\%$$

$$C = 0.05 + (0.009 \times 50.0) = 0.50$$

B. Drainage Area (A) = 120 Acres

C. Compute the Water Quality Design Volume (WQDV):

$$WQDV = C \times 1'' \times A \times 3630$$

$$= (0.50)(1.0)(120)(3630)$$

$$= \mathbf{217{,}800\ cubic\ feet}$$

Phase II Mauka Development

A. Determine the Runoff Coefficient (C):

$$C = 0.05 + (0.009 \times IMP)$$

$$IMP = \text{Impervious Area (\%)} = 50.0\%$$

$$C = 0.05 + (0.009 \times 50.0) = 0.50$$

B. Drainage Area (A) = 164 Acres

C. Compute the Water Quality Design Volume (WQDV):

$$WQDV = C \times 1'' \times A \times 3630$$
$$= (0.50)(1.0)(164)(3630)$$
$$= \mathbf{297{,}660\ cubic\ feet}$$

Phase II Makai Development

A. Determine the Runoff Coefficient (C):

$$C = 0.05 + (0.009 \times IMP)$$

$$IMP = \text{Impervious Area (\%)} = 50.0\%$$

$$C = 0.05 + (0.009 \times 50.0) = 0.50$$

B. Drainage Area (A) = 116 Acres

C. Compute the Water Quality Design Volume (WQDV):

$$WQDV = C \times 1'' \times A \times 3630$$
$$= (0.50)(1.0)(116)(3630)$$
$$= \mathbf{210{,}540\ cubic\ feet}$$

APPENDIX C

WATER DEMAND CALCULATIONS

PHASE I WATER DEMAND CALCULATIONS

Land Use	Area (Ac.) or Units	Average Unit Demand	Average Total Demand (gpd)
Single-Family	332 Units	400 gpd/unit	132,800
Rural Residential	15 Units	667 gpd/unit	10,005
Multi-Family	216 Units	373 gpd/unit	80,568
Country Town Mix-Use (Dwelling)	127 Units	373 gpd/unit	47,371
Ohanas	41 Units	200 gpd/unit	8,200
Country Town Mix-Use (Commercial)	58,475 s.f.	93 gpd/1,000 s.f.	5,438
Commercial/Employment	140,372 s.f.	93 gpd/1,000 s.f.	13,055
Parks & Open Space	26.66 ac.	0 gpd/ac.	0*
School	12 ac.	1,133 gpd/ac	51,000**
Total Average Day Demand			**348,437 gpd**
Maximum Daily Demand			**522,656 gpd**

**Per the DWSWSS, the average demand for a school is 13,596 gpd. However, the DOE is requiring an allocation based on 60 gallons per 850 person per day, so an average daily demand of 51,000 gpd will be used.

PHASE II WATER DEMAND CALCULATIONS

Land Use	Area (Ac.) or Units	Average Unit Demand	Average Total Demand (gpd)
Single-Family	638 Units	400 gpd/unit	255,200
Rural Residential	65 Units	667 gpd/unit	43,355
Multi-Family	40 Units	373 gpd/unit	14,920
Ohanas	105 Units	200 gpd/unit	21,000
Parks & Open Space	5.78 ac.	0 gpd/ac.	0*
Total Average Day Demand			**334,475 gpd**
Maximum Daily Demand			**501,713 gpd**

*Irrigation of parks and open space will be provided from the non-potable wells (Wells No. 4 and 5), therefore will have an average demand of 0.

Reservoir Capacity:

1. Meet the maximum day consumption. Reservoir full at the beginning of the 24-hour period with no source input into the reservoir.

   Maximum Daily Demand = 522,656 + 501,713 = 1,024,369 gallons

   Reservoir Capacity = 1,024,369 gallons (Use one 1.1 MG Reservoir or two 0.55 MG Reservoirs)

2. Meet the maximum day rate plus fire flow for duration of fire. Reservoir ¾ full at start of fire, with credit for incoming flow from pumps, one maximum size pump out of service.

   Maximum Daily Demand = 968,263 gpd = 672 gpm

   Fire Flow = 2,000 gpm

   Total Required Demand = 2,672 gpm

   Fire Duration = 2 hours

   Incoming flow from pumps = 800 + 500 = 1,300 gpm (assume largest pump (1,000 gpm) is out of service)

   Required Reservoir Volume = 2,672 – 1,300 = 1,372 gpm

   Reservoir Volume = [(1,372 gpm) x (60 min/hr) x (2 hr)] / 0.75

   = 219,520 gallons

USE CRITERION 1, ONE 1.1 MILLION GALLON RESERVOIR OR TWO 0.55 MILLION GALLON RESERVOIRS.

APPENDIX D

WASTEWATER CALCULATIONS

WASTEWATER CALCULATIONS

Based on the *"Preliminary Wastewater Report",* prepared by Enviniti LLC, dated March 2013, the following were the determined average wastewater and design maximum flow rates for the project:

AVERAGE FLOW ESTIMATES*:

Phase I – 395,000 gpd
Phase II – 303,000 gpd
Total Project – 698,000 gpd

DESIGN MAXIMUM FLOW ESTIMATES*:

Phase I – 1,548,652 gpd
Phase II – 1,257,125 gpd
Total Project – 2,449,819 gpd

*Note-the estimated flow rates were calculated using the conceptual phasing plan. Assumptions were made on the use and development of land classifications. The flow rates will be refined as a more detailed development plan becomes available.

PHASE I WASTEWATER FLOW CALCULATIONS

Land Use	Area (Ac.) or Units	Average Unit Demand	Average Total Demand (gpd)
Single-Family	332 Units	350 gpd/unit	116,200
Rural Residential	15 Units	350 gpd/unit	5,250
Multi-Family	216 Units	255 gpd/unit	55,080
Country Town Mix-Use (Dwelling)	127 Units	350 gpd/unit	44,450
Ohanas	41 Units	180 gpd/unit	7,380
Country Town Mix-Use (Commercial)	58,475 s.f.	1 per 200 s.f. @ 20 gpd/unit	5,848
Commercial/Employment	140,372 s.f.	1 per 350 s.f. @ 20 gpd/unit	8,021
School (Elementary)	12 ac. (850 total students and staff)	25 gpd/unit	21,250
Average Daily Flow Rate			**263,479 gpd**

PHASE II WASTEWATER FLOW CALCULATIONS

Land Use	Area (Ac.) or Units	Average Unit Demand	Average Total Demand (gpd)
Single-Family	638 Units	350 gpd/unit	223,300
Rural Residential	65 Units	350 gpd/unit	22,750
Multi-Family	40 Units	255 gpd/unit	10,200
Ohanas	105 Units	180 gpd/unit	18,900
Total Average Day Demand			**275,150 gpd**

APPENDIX E

ORDER OF MAGNITUDE COST ESTIMATES

WAIKAPU COUNTRY TOWN
ORDER OF MAGNITUDE COST ESTIMATES

	PHASE I (MAUKA)	PHASE I (MAKAI)	PHASE II (MAUKA)	PHASE II (MAKAI)
GENERAL WORK	$ 4,200,000	$ 4,400,000	$ 3,075,000	$ 4,995,000
ROADWAY	$ 6,678,400	$ 8,129,000	$ 3,104,000	$ 9,200,000
OFFISTE ROADWAY	$ 1,900,000	-----	$ 400,000	-----
SEWER SYSTEM	$23,880,000**	$ 5,610,000	$12,409,000	$ 7,717,500**
POTABLE WATER SYSTEM	$14,228,000	$ 4,687,000	$10,785,000	$ 8,890,000
NON-POTABLE WATER SYSTEM	$ 3,345,000	$ 2,497,000	$ 2,140,000	$ 3,588,000
DRAINAGE SYSTEM	$11,980,000	$11,700,000	$10,832,000	$12,480,000
TOTAL COST	**$66,211,400***	**$37,023,000***	**$42,745,000***	**$46,870,500***

Total Estimated Cost-Phase I: $103,234,400*

Total Estimated Cost-Phase II: $89,615,500*

*Note-Cost estimate does not include underground electrical, telephone and cable TV

**Note-Cost estimate includes a private wastewater treatment plant servicing the Waikapu Country Town project only