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COUNTY CLERK

TO: Honorable Alice Lee,
Council Chair
Maui County Council
County of Maui
200 South High Street
Wailuku, Hawai'i 96793

DATE: January 5, 2022

SUBJECT: Annual Compliance Report
(Change in Zoning Conditions
for Makena Resort Area)

Enclosed is/are:

Copies	Date	Description
1 (HC) + 1 (CD)	January 6, 2021	Annual Compliance Report

X	For your information For necessary action For your review For your files	For your use As requested For your signature Returning
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REMARKS: Aloha,

On behalf of Makena Golf & Beach Club Owners we are submitting the enclosed Annual Compliance Report for your review in accordance with Condition No. 22 of Ordinance 3613 (Change in Zoning for Makena Resort Area). Condition No. 22 states that:

*"The developer shall provide timely annual compliance reports to the Planning Director and the Council. The compliance reports shall include:
(a) the status of the developer's compliance with each of these conditions;
and (b) a reasonable estimate of the time needed for full compliance."*

Should you have any questions or require additional information, please feel free to call me at (808)983-1233.

Signed: 
Bryan Esmeralda, AICP
Senior Associate

BKE:yp
Copy to:

Kaimi Judd, Discovery Land Company (w/enclosure)
Josh Circle Woodburn, Discovery Land Company (w/enclosure)

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Annual Compliance Report

CHANGE IN ZONING CONDITIONS FOR MAKENA RESORT AREA

Prepared by
AREG AC Makena Propco LLC (doing business as Makena Golf & Beach Club Owners)
January 2022

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LIST OF EXHIBITS

Exhibit A	Transmittal and Water Quality Sampling Report Dated August 2021
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I. OVERVIEW

On August 27, 2010, ATC Makena N Golf LLC, ATC Makena S Golf LLC, ATC Makena Land SF1 LLC, ATC Makena Land MF1 LLC, ATC Makena Land MF2 LLC, ATC Makena Land MF3 LLC, ATC Makena Land C1 LLC, ATC Makena Land U1 LLC, ATC Makena Land B1 LLC, ATC Makena Land MF4 LLC, ATC Makena Land SF2 LLC, and ATC Makena Land AH1 LLC (collectively “ATC Makena Entities”), acquired through foreclosure most, but not all, of the lands that are covered by Ordinance No. 3613.

Lands so acquired by ATC Makena Entities and that are covered by Ordinance No. 3613 are identified by the following TMKs: 2-1-5: por 108, por 120, por 124, 2-1-6: 036, por 56, por 57, por 59, 2-1-7:004 por 068, 93, por 94, 2-1-8 por 078, por 79, por 81, por 90 (collectively the “Zoned Parcels”). In early 2020, there was a change in ownership configuration whereby AREG AC Makena Propco LLC (doing business as Makena Golf & Beach Club Owners) (“Makena Golf & Beach Club Owners”) acquired 100% of the membership interest of the entities that own the Zoned Parcels. This Annual Compliance Report is being submitted by Makena Golf & Beach Club Owners.

It is noted that Makena Golf & Beach Club Owners is currently in the process of planning the development of a resort residential project (the Makena Land Plan), involving lands subject to above-noted Ordinance. The proposed development will be subject to environmental review under Chapter 343, Hawaii Revised Statutes (HRS), and that process is expected to be initiated in 2022.

Ordinance No. 3613, entitled “A BILL FOR AN ORDINANCE TO AMEND PORTIONS OF LAND ZONING MAP NOS. 5 AND 514 TO ESTABLISH A-2 APARTMENT DISTRICT, B-2 COMMUNITY BUSINESS DISTRICT, B-R RESORT COMMERCIAL DISTRICT, H-M HOTEL DISTRICT, PK-1 NEIGHBORHOOD PARK DISTRICT, PK-4 GOLF COURSE PARK DISTRICT, R-1 AND R-3 RESIDENTIAL DISTRICT ZONING (CONDITIONAL ZONING) FOR LANDS SITUATED AT MAKENA, MAUI, HAWAII”, which authorized a change in County zoning districts, requires compliance with 44 conditions of zoning. Approximately 603.303 acres of land located in Makena, Maui, Hawaii, were subject to the Change in Zoning action.

The intent of this document is to provide an Annual Compliance Report as required by Condition No. 22 for the Zoned Parcels.

The developer shall provide timely annual compliance reports to the Planning Director and the Council. The compliance reports shall include: (a) the status of the developer's compliance with each of these conditions; and (b) a reasonable estimate of the time needed for full compliance.

II. STATUS OF COMPLIANCE WITH CONDITIONS

The following is a report on the current status of compliance with the 44 conditions imposed on the Zoned Parcels under Ordinance No. 3613.

1. *In the R-1, R-2, and R-3 Residential District zoned areas, the density shall not exceed 2.5 single-family dwelling units per acre.*

Status: Makena Golf & Beach Club Owners will comply with the provisions of said condition within the Zoned Parcels.

Estimate of Time for Compliance: This condition will continue during the life of the project.

2. *In the A-2 Apartment District zoned areas, the density shall not exceed eight units per acre, and the building height shall not exceed 45 feet. Height shall be measured from the natural or finish grade, whichever is lower.*

Status: Makena Golf & Beach Club Owners will comply with the provisions of said condition within the Zoned Parcels.

Estimate of Time for Compliance: This condition will continue during the life of the project.

3. *In the B-2 Community Business District zoned areas, the gross floor area of each building shall not exceed 60 percent of the total lot area.*

Status: Makena Golf & Beach Club Owners will comply with the provisions of said condition within the Zoned Parcels.

Estimate of Time for Compliance: This condition will continue during the life of the project.

4. *On Lot 19 (H-M Hotel District), the building height shall not exceed 45 feet and shall be consistent with the Urban Design Standards for Building Form in the Kihei-Makena Community Plan; no more than 89 units shall be developed; and no lockout units shall be allowed. Height shall be measured from the natural or finish grade, whichever is lower.*

Status: It is noted that Makena Golf & Beach Club Owners does not own Lot 19. H2R, LLC is the owner of Lot 19. H2R, LLC is responsible for compliance with the provisions of said condition.

5. *The developer shall preserve Makena's significant views of the Pacific Ocean and the broad vista to the Central Maui and Upcountry regions. The use of walls higher than four feet in front yard setbacks shall be prohibited.*

Status: Makena Golf & Beach Club Owners will comply with the provisions of said condition within the Zoned Parcels.

Estimate of Time for Compliance: This condition will continue during the life of the project.

6. *In the B-2 Community Business District zoned areas, the following permitted uses shall incorporate acoustical measures into the facility to mitigate potential noise impacts: amusement enterprises, including billiard and pool halls; auditoriums and theaters; baseball and football stadiums and other sport activities and amusements; bowling alleys; dancing and hula studios; gymnasiums; miniature golf courses; music conservatories and music studios; physical-culture studios; and printing, lithography, and publishing shops.*

Status: Makena Golf & Beach Club Owners will comply with the provisions of said condition within the Zoned Parcels.

Estimate of Time for Compliance: This condition will continue during the life of the project.

7. *All exterior lighting shall be shielded from adjacent residential properties and nearshore waters, and shall be fully shielded to prevent uplight. Lighting requirements in force at the time of building permit application shall be applied.*

Status: Makena Golf & Beach Club Owners will comply with the provisions of said condition within the Zoned Parcels.

Estimate of Time for Compliance: This condition will continue during the life of the project.

8. *In the B-2 Community Business District zoned areas, merchandise, equipment, and supplies shall be stored within enclosed buildings or enclosed areas that are appropriately screened with fencing and landscape planting for the following permitted uses: equipment rental and sales yards; hardware and garden supply stores; parcel delivery stations; and printing, lithography, and publishing shops.*

Status: Makena Golf & Beach Club Owners will comply with the provisions of said condition within the Zoned Parcels.

Estimate of Time for Compliance: This condition will continue during the life of the project.

9. *The developer, its successors and permitted assigns shall pay the Department of Education, \$3,000 per dwelling unit upon issuance of each building permit to be used, to the extent possible, for schools serving the Kihei-Makena Community Plan area; provided that, should the State pass legislation imposing school impact fees that apply to the Makena Resort Area, the developer, its successors and permitted assigns, shall from that point forward comply with the State requirements, or contribute \$3,000 per dwelling unit, whichever is greater. Should a previous agreement exist between the Department of Education and the landowner, this condition shall prevail.*

Status: Makena Golf & Beach Club Owners will comply with the provisions of said condition within the Zoned Parcels.

Estimate of Time for Compliance: Upon issuance of each building permit for a new dwelling unit during the life of the project.

10. *The developer shall provide pedestrian and bicycle access ways within the roadways throughout and fronting the Makena Resort Area. A schematic plan for pedestrian and bicycle access ways throughout and fronting the Makena Resort Area shall be submitted to the Department of Planning for consideration by the Maui Planning Commission in conjunction with SMA permit applications.*

Status: The schematic plan for pedestrian, bicycle, and cart access ways throughout Makena Resort area prepared by Miyabara & Associates was transmitted with the 2010 Annual Report.

Estimate of Time for Compliance:

A schematic plan was submitted with the 2010 Annual Report. Refinements of the plan, if necessary, will be submitted as the Makena Land Plan further develops and application(s) for SMA Use Permits are submitted.

11. *The developer shall make a contribution to the County for traffic improvements in an amount equal to \$5,000 per unit. The contribution shall be paid to the County prior to issuance of the initial building permit. Upon adoption of a traffic impact fee ordinance, the developer shall comply with the ordinance in lieu of this voluntary contribution. Should a traffic impact fee ordinance be adopted prior to the collection of this contribution, the applicable amount shall be the greater of the two. Such contributions or fees shall not be counted towards Condition No. 12 below.*

Status:

Makena Golf & Beach Club Owners will comply with the provisions of said condition within the Zoned Parcels.

Estimate of Time for Compliance:

Prior to issuance of the initial building permit and continuing with the issuance of additional initial building permits as the project is developed.

12. *Upon commencement of the first phase of construction, the developer shall pay its pro-rata share to upgrade Pi'ilani Highway from Kilohana Drive to Wailea Ike Drive to four lanes of traffic, and shall cooperate with the State Department of Transportation and other area developers to implement such improvements concurrent with development.*

Status:

Makena Golf & Beach Club Owners will comply with the provisions of said condition. Makena Golf & Beach Club Owners is pursuing an agreement with the State Department of Transportation (SDOT) that will address Makena Golf & Beach Club Owners' fair share/pro-rata share contribution and means of implementing traffic improvements related to the development of the Zoned Parcels.

Estimate of Time for Compliance:

It is anticipated that Makena Golf & Beach Club Owners will have an agreement with SDOT in place prior to the start of its first phase of construction on the Zoned Parcels.

13. *The developer shall provide construction access roads from Pi'ilani Highway to the construction sites. Construction traffic shall be prohibited on Kilohana Drive, Wailea Ike Drive, Wailea Alanui Drive, and Makena Alanui Drive to the extent practicable.*

Status: Makena Golf & Beach Club Owners does not own the rights-of-way for a construction access road, but has initiated discussions with adjacent landowners to identify a possible location of a construction access road route for future construction within the Zoned Parcels should construction access be warranted and practicable. These discussions are ongoing.

Further, it is noted that the Construction Transportation Management Plan, as required by Condition No. 14, includes measures that are intended to reduce construction traffic. For further information see Condition No. 14.

Estimate of Time for Compliance: At the time of construction on the Zoned Parcels if warranted and available.

14. *The developer shall develop and submit a Transportation Management Plan ("TMP"), to be reviewed and approved by the State Department of Transportation, the County Department of Public Works, and the County Department of Transportation. The purpose of the TMP shall be to reduce traffic generated by construction activity related to the Makena Resort Area. The TMP shall provide for programs such as park and ride, shuttles, and/or restrictions on worker access to ongoing construction activity during peak hour traffic. Upon approval, project contractors shall implement the TMP during construction activities. The developer shall submit an annual report to the State Department of Transportation, the County Department of Public Works, the County Department of Transportation, and the Maui County Council to document the success of the TMP in meeting its benchmarks of reducing traffic during project construction.*

The TMP shall be reviewed and approved by the State Department of Transportation, the County Department of Public Works, and the County Department of Transportation prior to issuance of each SMA permit within the Makena Resort Area.

Status: A Construction Transportation Management Plan (CTMP) for the Makena Resort area was submitted to the SDOT, the County Department of Public Works (DPW), and the County Department of Transportation (CDOT) on July 13, 2009, and included in the 2010 Annual Report. Makena Golf & Beach Club Owners will work with applicable reviewing agencies to obtain

approval of the CTMP. As appropriate, an updated CTMP will be prepared for the Zoned Parcels in connection with the development of the Makena Land Plan.

Makena Golf & Beach Club Owners will comply with the provisions of said condition.

Estimate of Time for Compliance:

An approved CTMP will be in place prior to issuance of the first SMA Use Permit for development within the Zoned Parcels.

15. *As part of the first SMA application, the developer shall submit a TMP to reduce the dependency on individual vehicular transportation modes. The TMP shall be reviewed and approved by the State Department of Transportation, the County Department of Public Works, and the County Department of Transportation to address post-construction traffic issues.*

Status:

A TMP for post-construction operations for the Makena Resort area was submitted to the SDOT, DPW, and the CDOT on July 13, 2009, and included in the 2010 Annual Report. By letter dated, August 19, 2009, the SDOT approved the TMP for post-construction operations. As noted above, as appropriate, an updated TMP will be prepared for the Zoned Parcels in connection with the development of the Makena Land Plan.

Estimate of Time for Compliance:

An approved TMP for post-construction operations will be included in the first SMA Use Permit application for development within the Zoned Lands.

16. *The developer shall participate in the pro rata funding and construction of adequate civil defense measures as determined by the State and County civil defense agencies.*

Status:

Satisfied. As previously reported, the ATC Makena Entities agreed to two (2) locations for emergency sirens - one at the Makena Resort Wastewater Treatment Plant (WWTP), and one near Makena State Park (as reported in the 2010 Annual Report). Final Right-Of-Entry and Non-Exclusive License Agreements dated May 25, 2012 with the State of Hawaii, Department of Defense (DOD) were submitted with the 2012 Annual Report. However, in December 2016, DOD informed the ATC Makena Entities that it intended

for one of the two sirens to instead be located at Makena State Park and for the second siren to be located on Makena Golf & Beach Club Owners' WWTP property. The siren at Makena Golf & Beach Club Owners' WWTP property was completed in 2017.

Estimate of Time for Compliance:

Makena Golf & Beach Club Owners has complied with the provisions of this condition. DOD installed the siren at Makena Golf & Beach Club Owners' WWTP property in 2017.

17. *Should any human burials or any historic sites such as artifacts, charcoal deposits, stone platforms, pavings, or walls be found, the developer shall stop construction work in the immediate vicinity and notify the State Historic Preservation Division (SHPD), the Maui/Lanai Island Burial Council (MLIBC), and the Maui County Cultural Resources Commission (CRC).*

Status:

Makena Golf & Beach Club Owners will comply with the provisions of said condition within the Zoned Parcels.

Estimate of Time for Compliance:

This condition will continue during the life of the project.

18. *The developer, its successors and permitted assigns, shall provide a comprehensive preservation/mitigation plan pursuant to Chapter 6E, Hawaii Revised Statutes, that has been approved by the State Historic Preservation Division, Department of Land and Natural Resources, and the Office of Hawaiian Affairs prior to any grading within the project area.*

Status:

Preservation plans and related plans will be prepared in compliance with the requirements Chapter 6E, HRS, and consistent with the findings of the Department of Land and Natural Resources, State Historic Preservation Division (SHPD)-approved archaeological studies. All such plans will be presented to SHPD for approval, and, as appropriate, the Office of Hawaiian Affairs.

Estimate of Time for Compliance:

Makena Golf & Beach Club Owners will comply with Chapter 6E, HRS, prior to any grading within the Zoned Parcels. In

accordance with Chapter 6E, HRS, Makena Golf & Beach Club Owners will prepare preservation/mitigation plans for each Zoned Parcel in compliance with SHPD requirements, and subject to the review and approval of SHPD, and the Office of Hawaiian Affairs, as appropriate.

19. *Marine monitoring programs shall be conducted which include monitoring and assessment of coastal water resources (groundwater and surface water) that receive surface water or groundwater discharges from the hydrologic unit where the project is located. Monitoring programs shall include both water quality and ecological monitoring.*

Water Quality Monitoring shall provide water quality data adequate to assess compliance with applicable State water quality standards at Hawaii Administrative Rules Chapter 11-54. Assessment procedures shall be in accordance with the current Hawaii Department of Health ("HIDOH") methodology for Clean Water Act Section 305(b) water quality assessment, including use of approved analytical methods and quality control/quality assurance measures. The water quality data shall be submitted biannually, or every six months, to HIDOH for use in the State's Integrated Report of Assessed Waters prepared under Clean Water Act Sections 303(d) and 305(b). If this report lists the receiving waters as impaired and requiring a Total Maximum Daily Load ("TMDL") study, then the monitoring program shall be amended to evaluate land-based pollutants, including: (1) monitoring of surface water and groundwater quality for the pollutants identified as the source of the impairment; and (2) providing estimates of total mass discharge of those pollutants on a daily and annual basis from all sources, including infiltration, injection, and runoff. The results of the land-based pollution water quality monitoring and loading estimate shall be submitted to the HIDOH Environmental Planning Office, TMDL Program.

The ecological monitoring shall include ecological assessment in accordance with the Coral Reef Assessment and Monitoring Program protocols used by the Department of Land and Natural Resources. The initial assessment shall use the full protocol. Subsequent biannual assessments can use the Rapid Assessment Techniques. Results shall be reported biannually to the Aquatic Resources Division, Department of Land and Natural Resources.

The monitoring and assessments shall be conducted by degreed scientists experienced with Clean Water Act programs, water quality monitoring, water quality assessment, water quality-based permitting, water quality modeling, watershed planning, and TMDL. Study

design should be made available for both public review and peer review by the State Department of Health, Department of Aquatic Resources, and the University of Hawaii researchers. Results of monitoring shall be published and publicly available online.

Status: Makena Golf & Beach Club Owners retained the services of AECOS, Inc. for assistance with compliance with this condition. Included with this Annual Report is the latest quarterly monitoring report dated August 2021 (see Exhibit A). This report has been transmitted to the State DOH.

Allen Cattell, Ph.D. of AECOS, Inc. has confirmed that the AECOS' reports have been prepared to comply with this condition. The reports: (1) assess the degree that fertilizers, as well as other nutrient sources, used on land to enhance golf course turf growth and resort landscaping, leach to groundwater and subsequently discharge into nearshore waters; (2) establish whether there is delivery of these nutrients into the nearshore zone; and (3) determine if subsequent water quality has any measurable impacts on biological community structure in the nearshore marine environment. The nutrients that are monitored each quarter determine water quality, as well as the nature of the benthic and pelagic biologic communities.

Estimate of Time for Compliance: Water quality monitoring and assessment will continue to be conducted in compliance with the provisions of said condition.

20. *The developer shall implement efficient soil-erosion and dust-control measures during and after development to the satisfaction of DOH and the County.*

Status: Makena Golf & Beach Club Owners will comply with the provisions of said condition within the Zoned Parcels.

Estimate of Time for Compliance: This condition will continue during the life of the project.

21. *The developer shall give notice to the Department of Planning and the Council of any intent to sell, lease, assign, place in trust, or otherwise voluntarily alter the ownership interests in the Makena Resort Area, prior to any development.*

Status: As documented in this Annual Report, Makena Golf & Beach Club Owners acquired 100% of the membership interest of the entities that own the Zoned

Parcels subject to Ordinance 3613. However, title to the real estate holdings has not changed since the Zoned Parcels were acquired by the ATC Makena Entities in August 27, 2010. Makena Golf & Beach Club Owners will continue to comply with the provisions of said condition within the Zoned Parcels.

Estimate of Time for Compliance:

This condition will continue during the period prior to any development within the Zoned Parcels.

22. *The developer shall provide timely annual compliance reports to the Planning Director and the Council. The compliance reports shall include: (a) the status of the developer's compliance with each of these conditions; and (b) a reasonable estimate of the time needed for full compliance.*

Status:

This Annual Compliance Report is being submitted in compliance with said condition.

Estimate of Time for Compliance:

This condition will continue annually in January through to the build out of the project.

23. *Failure to fulfill any condition may result in a reversion to former or more appropriate zoning or community plan designations or other remedies.*

Status:

Makena Golf & Beach Club Owners acknowledges the provisions of said condition.

Estimate of Time for Compliance:

This condition will continue during the life of the project.

24. *If any of the property subject to this Change in Zoning is consolidated with other property for purposes of an SMA permit application, these conditions shall apply to the entirety of the consolidated property.*

Status:

Makena Golf & Beach Club Owners acknowledges the provisions of said condition.

Estimate of Time for Compliance:

This condition will continue during the life of the project.

25. *The developer shall comply with the County's Residential Workforce Housing Policy as provided in Chapter 2.96, Maui County Code.*

Status:

Makena Golf & Beach Club Owners will comply with the provisions of said condition within the Zoned Parcels.

Estimate of Time for Compliance:

This condition will continue during the life of the project.

26. *The developer shall comply with all applicable County water ordinances. The water rates for the residential workforce housing units shall be no higher than the general water consumer rates set by the County in its annual budget, for as long as the units are subject to Chapter 2.96, Maui County Code.*

Status:

Makena Golf & Beach Club Owners will comply with the provisions of said condition within the Zoned Parcels.

Estimate of Time for Compliance:

This condition will continue during the life of the project.

27. *The developer shall provide a water conservation plan for the Makena Resort Area, approved by the Department of Water Supply, prior to the issuance of any SMA permits. For each project, the developer shall construct a dual waterline system to accommodate the use of non-potable water for landscaping and irrigation purposes prior to the issuance of any building permits.*

Status:

A Water Conservation Plan (WCP) for the Makena Resort area was approved by the County Department of Water Supply on July 27, 2009 and submitted with the 2010 Annual Report.

Estimate of Time for Compliance:

Makena Golf & Beach Club Owners has complied with the requirement to provide a WCP. Makena Golf & Beach Club Owners will comply with water conservation requirements prior to the issuance of any building permits for any development within

the Zoned Parcels requiring a SMA Use Permit.

28. *All energy systems for all residential, commercial, and hotel units shall be designed and constructed to meet all applicable Energy Star® requirements established by the Climate Protection Division of the United States Environmental Protection Agency in effect at the time of construction. For purposes of this condition, energy systems shall include all hot-water systems, roof and attic areas, outside walls, windows, air-cooling systems, and heating systems.*

Status: Makena Golf & Beach Club Owners will comply with the provisions of said condition within the Zoned Parcels.

Estimate of Time for Compliance: This condition will continue during the life of the project.

29. *All residential, commercial, and hotel units shall comply with Chapter 16.16, Maui County Code.*

Status: Makena Golf & Beach Club Owners will comply with the provisions of said condition within the Zoned Parcels.

Estimate of Time for Compliance: This condition will continue during the life of the project.

30. *All air-cooling systems and all heating systems for laundry facilities, swimming pools, and spa areas shall make maximum use of energy-efficient construction and technology.*

Status: Makena Golf & Beach Club Owners will comply with the provisions of said condition within the Zoned Parcels.

Estimate of Time for Compliance: This condition will continue during the life of the project.

31. *The developer shall construct a minimum of 60 new parking stalls at Maluaka Beach, including at least 10 at the north end, within one year of the issuance to the developer of any SMA permit by the Maui Planning Commission relating to a parcel or a portion thereof that is a subject of this Change in Zoning. Unless necessary to protect public safety or to*

comply with State or Federal law, the required parking stalls need not be asphalt surfaced. Development costs and land shall not satisfy park dedication requirements.

Status: Makena Golf & Beach Club Owners will comply with the provisions of said condition. It should be noted that H2R, LLC owns Lot 19 where the southern Maluaka beach parking is planned to be located.

Estimate of Time for Compliance: Within one year of issuance of any SMA permit relating to a Zoned Parcel. If H2R, LLC proceeds with development first, Makena Golf & Beach Club Owners will cooperate towards satisfying this requirement.

32. *The developer shall develop an expansion of the beach park at the south end of Maluaka Beach, such that the beach park shall comprise at least 1.5 acres of land area for public use and beach access. The developer shall submit the necessary applications required for the expansion within six months of the approval of this Change in Zoning. The land area of the expansion of the existing park shall be applied as credit toward satisfying a portion of any applicable park dedication requirements.*

Status: Satisfied. As previously reported, the ATC Makena Entities, in coordination with Discovery Land Company, the Makena Cultural Focus Group, the Makena Community Advisory Group, and the Department of Parks and Recreation (DPR) implemented an expansion location acceptable to all parties to the south end of the existing Maluaka Beach Park. The expansion area is approximately 0.66 acres in size bringing the combined existing and proposed park up to 1.5 acres. This expansion was formalized and documented in compliance with all County, State and Federal rules and regulations through the recordation of a Declaration of Restrictive Covenants for Park Purposes with the Bureau of Conveyances. A copy of the declaration and agreement was submitted as part of the 2018 Annual Report.

Estimate of Time for Compliance: Makena Golf & Beach Club Owners has complied with the provisions of this condition.

33. *To the extent practicable, the developer shall provide, in perpetuity, traversable lateral shoreline access in the area between the shoreward boundary and the mauka boundary of the Makena Resort Area. Costs associated with this condition shall not satisfy park dedication requirements.*

Status: Miyabara & Associates prepared a schematic plan for pedestrian and bicycle access ways throughout the Makena Resort area. A copy of this schematic plan was submitted as part of the 2010 Annual Report. In November 2015, the ATC Makena Entities restored approximately 1,600 lineal feet of the Maluaka Shoreline trail between the Maluaka Beach Park and the Southern boundary of their oceanfront parcel near the 15th Green of the South Golf Course. The trail will be maintained in perpetuity.

Estimate of Time for Compliance: Lateral shoreline access has been available and will continue through the life of the project.

34. *Within one year of the approval of this Change in Zoning, the developer shall initiate and fund a plan for the development of the State Park at Makena for the State Department of Land and Natural Resources and the Department of Parks and Recreation, soliciting and taking into consideration the comments of various user groups, including Surfrider Foundation, Savemakena.org, Maui Tomorrow, the Kihei Community Association, and the Makena Homeowner's Association. The plan shall incorporate recreational, landscaping, parking, and facility concepts as a guide for future development of the park. Costs associated with this condition shall not satisfy park dedication requirements.*

Status: Satisfied. The final Makena State Park Plan dated February 2013 was submitted to the State Department of Land and Natural Resources, the County DPR and the Oneloa Coalition in March 2013. The final plan document and associated transmittals were submitted to the County Department of Planning in March, 2013 in compliance with this condition. The Department of Planning issued a letter of condition fulfillment dated June 3, 2013. These documents were provided with the 2014 Annual Report.

Estimate of Time for Compliance: Makena Golf & Beach Club Owners has complied with the provisions of this condition.

35. *The developer shall renovate and beautify Makena Landing (TMK: 2-1-007:094), see attached map, in coordination with the Department of Parks and Recreation and the State Department of Land and Natural Resources. Costs associated with this condition shall not satisfy park dedication requirements.*

Status: Makena Golf & Beach Club Owners will comply with the provisions of said condition. Following submittal and processing of the necessary applications, a Shoreline Setback Determination (SSD) for the Makena Landing beach park property was issued by the Department of Planning on May 20, 2013 (see 2014 Annual Report). A Special Management Area Minor Permit and Shoreline Setback Approval (SSA) for the proposed renovation and beautification work at the park were issued by the Department of Planning on October 1, 2013. Copies of these approvals were provided with the 2014 Annual Report.

Various adjustments to the 2013 site plan to reflect input received from the Makena Community Advisory Group and the Makena Cultural Focus Group were made consistent with this input and authorized by the Department of Planning.

Estimate of Time for Compliance:

Some of the renovation and beautification work has begun, such as landscape improvements, and tree maintenance. In addition, the restroom fixtures have all been updated and replaced, all damaged doors, trim, and stalls have been replaced, and the restroom structure interior and exterior repainting was completed in 2021. Makena Golf & Beach Club Owners has engaged with an ADA consultant for recommendations on accessibility. The work plan for additional measures is in the process of being clarified with the County DPR.

36. *The developer shall maintain Makena Landing (TMK: 2-1-007:094), North Maluaka (TMK: 2-1-007:068), and South Maluaka (TMK: 2-1-005:124), see attached map, and all future parklands within the Makena Resort Area.*

Status: A Unilateral Agreement was submitted to County DPR for their approval on June 26, 2009. After working with the DPR to revise the agreement and update the obligations for maintenance to reflect the expansion to Maluaka Beach Park, discussed above in Condition No. 32, the Unilateral Maintenance Agreement was finalized and recorded with the Bureau of Conveyances. A copy of the agreement was submitted as part of the 2018 Annual Report.

Makena Golf & Beach Club Owners will continue to maintain Makena Landing, North Maluaka, and South Maluaka in compliance with said condition and Unilateral Maintenance Agreement.

Estimate of Time for Compliance: As noted above, the formal agreement relating to maintenance was finalized and recorded with the Bureau of Conveyances in conjunction with work related to compliance with Condition 32; however, maintenance has been and will continue to be undertaken for the life of the project.

37. *To exhibit respect for the Hawaiian culture and a Hawaiian sense of place, structures within the Makena Resort Area shall be based on or inspired by principles of Hawaiian island architecture in design and construction.*

Status: Makena Golf & Beach Club Owners will comply with the provisions of said condition within the Zoned Parcels.

Estimate of Time for Compliance: This condition will continue during the life of the project.

38. *The developer shall provide a baseline study survey of flora and fauna as part of each SMA permit application within the Makena Resort Area; the study shall be conducted by recognized independent experts on Hawaiian flora and fauna and list all endemic, indigenous, and endangered species, their distribution in the Makena Resort Area and adjacent shorelines. This study shall also include a preservation/mitigation plan and comments from the State Department of Land and Natural Resources, the U.S. Fish and Wildlife Service, and the U.S. Corps of Engineers, and the Maui representative of the Hawaii Wildlife Fund and The Nature Conservancy.*

Status: Robert Hobdy prepared a baseline coastal flora and fauna study of Makena's coastal lands. The study was circulated to the State Department of Land and Natural Resources, the U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, the Maui representative of the Hawaii Wildlife Fund and The Nature Conservancy for review and comment. A copy of the flora and fauna study was submitted as part of the 2010 Annual Report. We note that Robert Hobdy has been retained in connection with the preparation of the Makena Land Plan project.

Estimate of Time for Compliance: Makena Golf & Beach Club Owners will continue to comply with this condition within the Zoned Parcels.

39. *No transient vacation rentals or time shares shall be allowed within this Makena Resort rezoning application area; and further, no special use permit or conditional permit for such accommodations shall be accepted by the Department of Planning.*

Status: Makena Golf & Beach Club Owners acknowledges the provisions of said condition.

Estimate of Time for Compliance: This condition will continue during the life of the project.

40. *A second hotel shall not be constructed within the Makena Resort Area.*

Status: Makena Golf & Beach Club Owners acknowledges the provisions of said condition as it applies to hotel zoned lands subject to Ordinance 3613, which is limited to Parcel 19 that is owned by H2R, LLC.

41. *All buildings constructed within the Makena Resort Area shall be LEED (Leadership in Energy and Environmental Design) certified if they are 500 square feet or larger.*

Status: Makena Golf & Beach Club Owners will comply with the provisions of said condition within the Zoned Parcels.

Estimate of Time for Compliance: This condition will continue during the life of the project.

42. *New dwelling units shall not exceed 800, excluding residential workforce housing.*

Status: Makena Golf & Beach Club Owners acknowledges the provisions of said condition. New dwelling units within the Zoned Parcels shall not exceed 800, excluding residential workforce housing.

Estimate of Time for Compliance: This condition will continue during the life of the project.

43. *The developer, its successors and permitted assigns, shall contribute \$1,000 per market-priced unit, collected at issuance of building permit, to the County, for the development and maintenance of a police station in South Maui.*

Status: Makena Golf & Beach Club Owners will comply with the provisions of said condition within the Zoned Parcels.

Estimate of Time for Compliance: Upon issuance of each initial building permit for market-priced units within the Zoned Parcels.

44. *The developer shall provide Driveway “D” from Makena Alanui Road to Makena Resort Sewage Treatment Plant and beyond as an emergency evacuation route for the area.*

Status: Makena Golf & Beach Club Owners will comply with the provisions of said condition.

Estimate of Time for Compliance: This condition will continue during the life of the project.

EXHIBIT A.

Mākena Golf & Beach Club quarterly water quality monitoring report

April 2021

August 18, 2021

Final

AECOS No. 1535M

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Introduction

The State Land Use Commission requires that Mākena Golf and Beach Club (MG&BC; “Project”) submit water quality monitoring reports to the Hawaiʻi Department of Health (HDOH) in compliance with Condition No. 10 in the “Declaration of Conditions”, a document that pertains to the Amendment of the MG&BC District Boundary, dated April 17, 1998. The monitoring report must also ensure compliance with Condition 19 of the County of Maui, Zoning Ordinance 3613. The goals of the monitoring program established to comply with Condition No. 10 and Ordinance 3613 are: (1) assess degree to which fertilizers, as well as other nutrient sources used on land to enhance golf course turf growth and resort landscaping, leach to groundwater and subsequently reach nearshore waters; (2) establish evidence of delivery of these nutrients into the nearshore environment; and (3) determine if subsequent water quality has any measurable impacts on biological community structure in the nearshore marine environment (see AECOS, 2019a, b).

Water quality parameters of particular interest for the purposes of our monitoring are termed nutrients¹. Nutrient enrichment can enhance nuisance algae production in aquatic environments (HDLNR, 2014). Nutrient enrichment can also negatively impact corals and other biological components in Hawaiʻi coastal waters (Laws et al., 2004; MRC, 2011; AECOS, 2016). A separate program monitors nearshore biological assemblages off the MG&BC properties

¹ “Nutrients” are nitrogen and phosphorus compounds that promote plant growth, including algal growth in the marine environment. These chemicals are the main ingredients in applied fertilizers.

to determine if marine water quality is impacting the biota extant there (see AECOS, 2020).

Tables and figures throughout this quarterly report compare the most recent (April 15, 2021) water quality monitoring results with means calculated from twelve previous monitoring events undertaken quarterly between June 2018 and February 2021.

Background

Waters south from Nahuna Point—including Mākena Bay and Maluaka Bay (Figure 1)—to Pu‘u Ola‘i are designated as “Class A, open coastal waters” in State of Hawai‘i, water quality standards (HDOH, 2014). These waters are included on the HDOH 2020 list of impaired waters in Hawai‘i prepared under Clean Water Act §303(d) as impaired for nitrate+nitrite, ammonium, total nitrogen, turbidity, and chlorophyll α (HDOH, 2020). These waters are listed as “Category 2” (meaning that some designated uses are attained), “Category 3” (meaning that insufficient data and/or information exist to make use-support determinations), and “Category 5” (meaning that available data and/or information indicate that at least one designated use is not supported or is threatened); a Total Maximum Daily Load² study may be needed.

Marine waters from Pu‘u Ola‘i south are designated as Class AA “open coastal waters” in State of Hawai‘i, water quality standards (HDOH, 2014) and included on the HDOH 2020 list of impaired waters in Hawai‘i for nitrate+nitrite, ammonium, and turbidity (HDOH, 2020). These waters are also listed under Categories 2, 3, and 5.

Methods

The April 15, 2021 quarterly monitoring event was conducted along three monitoring transects in nearshore waters adjacent to MG&BC (Transects M-1, M-2, and M-3) and at a control site located well south of Pu‘u Ola‘i (Transect M-4). Sampling stations were set at 2-m, 10-m, 50-m, and 100-m distance from shore along each transect and water samples collected from near the surface at each station. Water quality samples were also obtained from two irrigation source water wells: Seibu Well 6 and Seibu Well 4 (see Fig. 1).

² Total Maximum Daily Load (TMDL) studies are done to establish limits on point-source discharges of substances causing impairments to water quality in aquatic environments. The term “needed” in the HDOH document actually means “has not been done”. A TMDL for any particular location is undertaken by HDOH and is unrelated to this monitoring effort as no point-source discharge is existing or contemplated at Mākena.

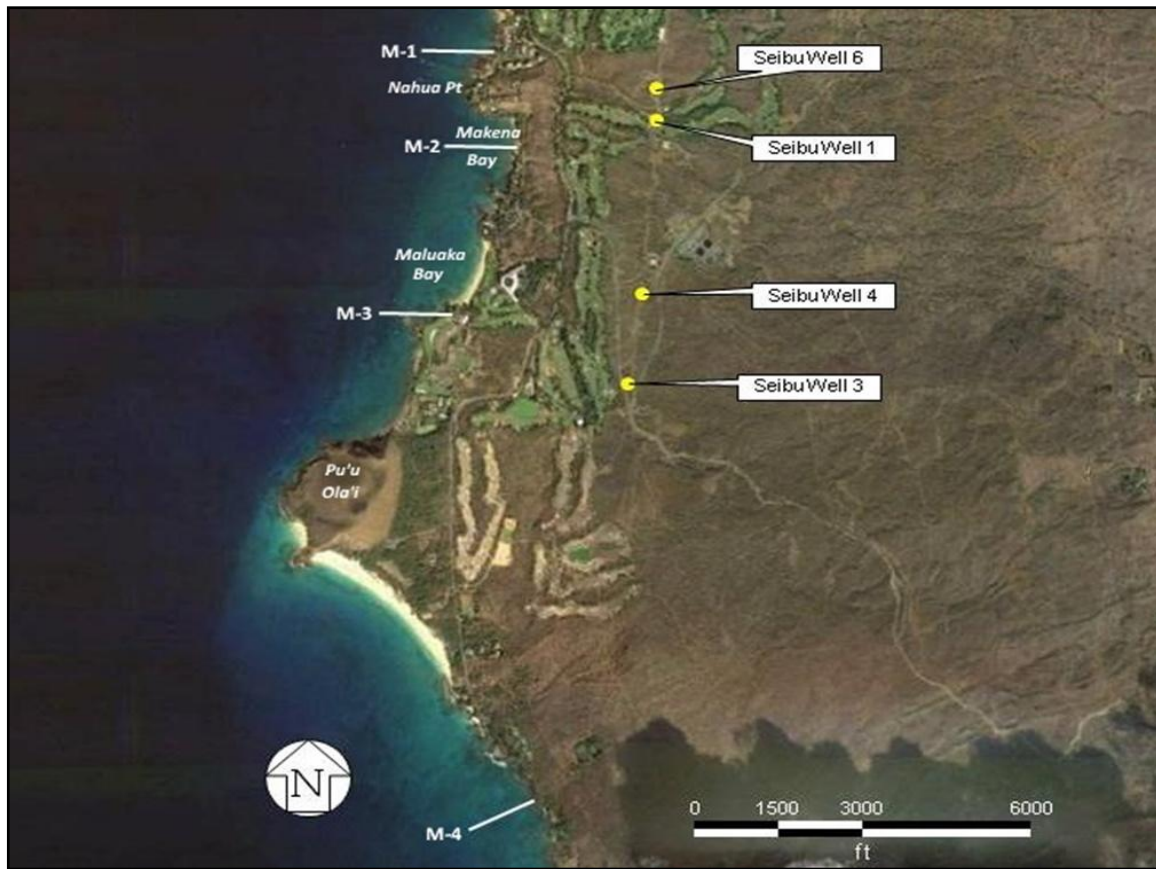


Figure 1. Location of water quality monitoring transects (M-1 through M-4) and irrigation supply wells at MG&BC.

Temperature, salinity, pH, and dissolved oxygen (DO) were measured *in situ* at each station. Collected water samples were immediately chilled and returned to the AECOS laboratory (AECOS Log No. 42365) for laboratory analyses. The following parameters were measured from these samples: salinity, turbidity, ammonium, nitrate+nitrite, total nitrogen (total N), ortho-phosphate, total phosphorus (total P), and chlorophyll *a*. Table 1 lists the instruments and analytical methods used for these field measurements and laboratory analyses.

The predicted tide on the April 15, 2021 event was high at 0427 hours (+0.96 ft), falling to a low of -0.12 ft at 1044 hours (Station 1615202, Mākena; NOAA, 2021). Winds were mild (2 to 3 kts) from the south to west and nearshore surf was mostly choppy (2 to 3 ft). Water quality samples were collected at all stations along each of the four transects between 0945 and 1100 hours, followed by sampling at the MG&BC wells.

Table 1. Analytical methods and instruments used for water quality analyses reported herein.

Analysis	Method	Reference	Instrument
Temperature	SM 2550B	SM (2017)	YSI Model 550 DO meter thermistor
Salinity	SM 120.1	SM (2017)	Accument AB200
pH	SM 4500H+	SM (2017)	pH pHep HANNA meter
Dissolved Oxygen	SM 4500-O G	SM (2017)	YSI Model 550 DO meter
Turbidity	EPA 180.1	USEPA (1993b)	Hach 2100Q Turbidimeter
Ammonium	EPA 349	USEPA (1997a)	Lachat Quickchem 8500
Nitrate + Nitrite	EPA 353.2	USEPA (1993a)	Lachat Quickchem 8500
Total Nitrogen	EPA 353.4	USEPA (1993a)	Shimadzu TNM-1
Ortho-Phosphate	EPA 365.5	USEPA (1997b)	Lachat Quickchem 8500
Total Phosphorus	EPA 365.5	USEPA (1997b)	Lachat Quickchem 8500
Chlorophyll α	SM10200H(M)	SM (1998)	Turner Fluorometer

Results

Water quality results, displayed in Tables 2 and 3, are compared with long-term mean values. On April 15, 2021, salinities were similar to long-term means, increasing somewhat from Transect M-1 to Transect M-4 and, with distance from shore. Temperatures along all transects were low compared with long-term means, reflecting a seasonal pattern. Temperature values changed little with distance from shore or between transects. pH values along all four transects were slightly elevated compared with long-term means. DO saturation values were generally similar to the long-term means. Turbidity and chlorophyll α levels were elevated along Transects M-1 and M-2 compared with long-term means. Turbidity was also elevated along Transect M-3.

Nitrate+nitrite concentrations on April 15, 2021 (Table 3) were elevated at all stations, especially on Transect M-1 through Transect M-3, and to a lesser degree at Transect M-4, decreasing with distance from shore. Ammonium concentrations were also somewhat elevated along all four transects, but did not show the trend of decreasing values with distance from shore.. Total

nitrogen concentrations were similar to long-term means except at Transect M-3 where concentrations were elevated compared with the long-term means. Total-P concentrations were elevated on all transects except M-2.

Table 2. Physical/chemical water quality and chlorophyll α means for June 2018 through January 2021 ($n = 12$) compared to April 15, 2021 results.

Transect	DFS [†] (m)	Salinity (ppt)		Temperature (° C)		pH		DO (% Sat.)		Turbidity [‡] (NTU)		Chl. α (μg/L)	
		Means	April 2021	Means	April 2021	Means	April 2021	Means	April 2021	Means	April 2021	Means [‡]	April 2021
M-1	2	33.74	33.03	27.0	24.3	8.12	8.18	103	95	1.49	2.09	0.76	1.03
	10	33.82	34.07	26.6	24.4	8.18	8.27	107	96	0.78	1.83	0.47	1.10
	50	34.05	33.81	26.6	24.4	8.18	8.30	102	97	0.67	1.51	0.38	1.00
	100	34.31	34.34	26.6	24.5	8.16	8.13	99	94	0.45	0.85	0.25	0.40
	Means	33.98	33.81	26.7	24.4	8.16	8.22	103	96	0.85	1.57	0.47	0.88
M-2	2	33.98	33.49	26.8	24.5	8.13	8.25	99	93	2.02	2.46	0.42	0.64
	10	33.99	33.72	26.7	24.4	8.16	8.26	95	93	1.46	1.55	0.35	0.52
	50	34.05	33.99	26.7	24.5	8.16	8.28	97	92	0.86	1.11	0.28	0.34
	100	34.27	34.14	26.7	24.5	8.15	8.27	96	98	0.57	0.98	0.22	0.30
	Means	34.07	33.84	26.7	24.5	8.15	8.27	97	94	1.23	1.53	0.32	0.45
M-3	2	33.67	33.61	26.8	24.5	8.15	8.26	108	104	0.69	1.37	0.59	0.64
	10	34.08	34.37	26.7	24.3	8.15	8.24	104	100	0.56	0.53	0.42	0.31
	50	34.32	34.42	26.7	24.4	8.15	8.24	101	99	0.43	0.50	0.27	0.27
	100	34.41	34.45	26.7	24.4	8.15	8.25	99	95	0.41	0.46	0.22	0.22
	Means	34.12	34.21	26.7	24.4	8.15	8.25	103	100	0.52	0.72	0.38	0.36
M-4	2	34.13	33.83	26.3	24.1	8.10	8.26	101	99	1.32	1.02	0.64	0.24
	10	34.13	34.02	26.3	24.1	8.11	8.22	101	102	1.00	0.92	0.47	0.45
	50	34.47	34.27	26.3	24.1	8.12	8.19	99	100	0.63	0.74	0.30	0.42
	100	34.57	34.63	26.4	24.0	8.11	8.15	97	100	0.45	0.56	0.21	0.28
	Means	34.33	34.19	26.3	24.1	8.11	8.21	100	100	0.85	0.81	0.41	0.35
Hawai'i Dry Criteria		+/- 10%		+/- 1C°		7.6-8.6		≥75%		≤0.20 NTU		≤0.15 μg/L	
† distance from shore ‡ geometric mean red: exceeds standard													

Generally, groundwater seepage into nearshore coastal waters will result in a lowering of salinity and an increase in nitrate+nitrite concentrations. Water

Table 3. Nutrient water quality geometric means for June 2018 through January 2021 ($n = 12$) compared to April 15, 2021 results.

Transect	DFS† (m)	NO ₃ +NO ₂ (μgN/L)		NH ₄ (μgN/L)		Total N (μgN/L)		PO ₄ (μgP/L)		Total P (μgP/L)	
		Means	April 2021	Means	April 2021	Means	April 2021	Means	April 2021	Means	April 2021
M-1	2	55	99	17	38	203	181	2	1	10	20
	10	46	80	20	35	171	170	1	1	6	62
	50	35	88	17	41	163	154	2	2	9	14
	100	26	41	21	38	144	145	1	1	7	25
	Means	41	77	19	38	170	163	2	1	8	30
M-2	2	29	80	10	29	127	126	3	2	30	24
	10	29	69	14	14	130	152	3	2	11	14
	50	26	59	12	40	127	114	3	1	9	9
	100	17	27	14	26	114	83	2	1	10	13
	Means	25	59	13	27	125	119	3	1	15	15
M-3	2	48	156	14	29	186	228	3	3	8	21
	10	37	75	11	20	149	148	3	1	7	7
	50	23	72	22	20	126	164	2	1	8	11
	100	15	69	14	26	115	138	2	1	2	17
	Means	31	93	15	24	144	170	2	1	6	14
M-4	2	14	27	12	32	104	99	2	5	8	15
	10	13	19	16	38	101	99	3	1	8	24
	50	8	16	18	24	98	91	2	1	8	12
	100	6	8	16	26	88	101	2	1	6	6
	Means	10	18	15	30	98	98	2	2	8	14
Hawai'i Dry Criteria		≥3.5 μgN/L		≥2μgN/L		≥110 μgN/L		ns		≥16μgP/L	
† distance from shore											
Red: exceeds standard						ns - no standard					

quality further offshore typically reflects water moving into the MG&BC vicinity from points to the north or south, i.e., not being much influenced by local groundwater influx. Using the PacIOOS Regional Ocean Modeling System (ROMS), we can display approximated water current movements off the southwestern coast of East Maui that occurred just prior to and during our April

15, 2021 sampling event (PacIOOS, 2021). The direction of flow on April 15, 2021 was from the northwest towards shore in the early morning hours and then offshore to the southwest (Figure 2). This pattern is somewhat unusual and not consistent with observed winds.



Figure 2. Approximated current flow off Mākena coast during morning hours (0200 to 1100 hours) of April 15, 2021 (PacIOOS, 2021).

Discussion

Elevated nearshore nitrate+nitrite concentrations along all transects, decreasing with distance from shore, implicate groundwater influx as a source of this form of soluble nitrogen. Ammonium concentrations were also elevated along all transects. Ammonium is not typically related to low salinity levels near shore, being generated within the nearshore waters from natural biological processes. Elevated turbidities were likely due to choppy sea conditions in the Project area during sampling.

Nutrient Subsidies

Tables 4 and 5 present groundwater nitrate+nitrite and ortho-phosphate subsidies in nearshore marine waters calculated for the April 15 event. Estimated nitrate+nitrite concentrations (based on salinity values) were elevated at the 2-m stations at Transect M-1, M-2, and M-3. Ortho-phosphate concentrations (based on salinity values) were only very slightly elevated at the 2-m stations at Transects M-2, M-3, and M-4.

Table 4. Estimated nitrate+nitrite subsidies at nearshore (2-m) stations on April 15, 2021.

Location	Measured		Estimated	Subsidy
	NO ₃ +NO ₂	Salinity	NO ₃ +NO ₂	NO ₃ +NO ₂
	(µgN/L)	(PSU)	(µgN/L)	(µgN/L)
Seibu Wells	1830	1.36	---	---
M-1	99	33.03	63	36
M-2	80	33.49	62	18
M-3	156	33.61	62	94
M-4	27	33.83	61	0

Irrigation and Fertilizer Tracking

We track turf and landscape fertilization/irrigation data provided by Jonathan Galicinao (MG&BC) on a monthly basis. Nutrient concentrations are measured in irrigation supply wells on each sampling event. Figure 3 presents our comparison of estimated fertilizer “residual” (blue bars) with actual sampling event nitrate+nitrite concentrations (red circles) at the 2 m stations on

Table 5. Estimated ortho-phosphate subsidies at nearshore (2-m) stations on April 15, 2021.

Location	Measured		Estimated	Subsidy
	PO ₄	Salinity	PO ₄	PO ₄
	(μgP/L)	(PSU)	(μgP/L)	(μgP/L)
Seibu Wells	66	1.36	---	---
M-1	0.5	33.03	2	0
M-2	2.0	33.49	1	1
M-3	3.0	33.61	1	2
M-4	5.0	33.83	1	4

Transects M-1, M-2, and M-3. By residual is meant the 20% of an application that was not absorbed by plant material or otherwise lost; not reaching the groundwater. The 80% loss of applied fertilizer nitrogen is an average for Maui golf courses detailed in a U. S. Geologic Survey report (USGS, 2018).

Note in Fig. 3 that the greatest applications of nitrate+nitrite residual occurred in March, June, and December 2018, February and June 2019, and January, June and September 2020. At Transect M-1, excess nitrate+nitrite concentrations appeared to peak in March and again in August of 2019, and February of 2020, about one to two months after elevated fertilizer application. However, in December 2018, Transect M-1 peaked as high as the August 2019 value, but without an elevated fertilizer application in the months before.

At Transect M-2, nitrate-nitrite response peaks were recorded following February 2019 and January 2020 application peaks, but not closely following the June 2019 peak or the greater September 2020 peak. The situation at M-3 was a single peak in February 2020 following the irrigation peak in January 2020.

Additional measurements over a longer period could establish if any valid relationship exists between MG&BC fertilizer application and our salinity-based method for detecting excess nitrate+nitrite in the waters directly offshore³. The apparent lack of response after application spikes in June and September 2020 would seem to indicate that the noise in the data sets may well be too great to reveal any connection between them. As additional data accumulates, we might

³ Explained in detail in AECOS, 2018, p. 10-11.

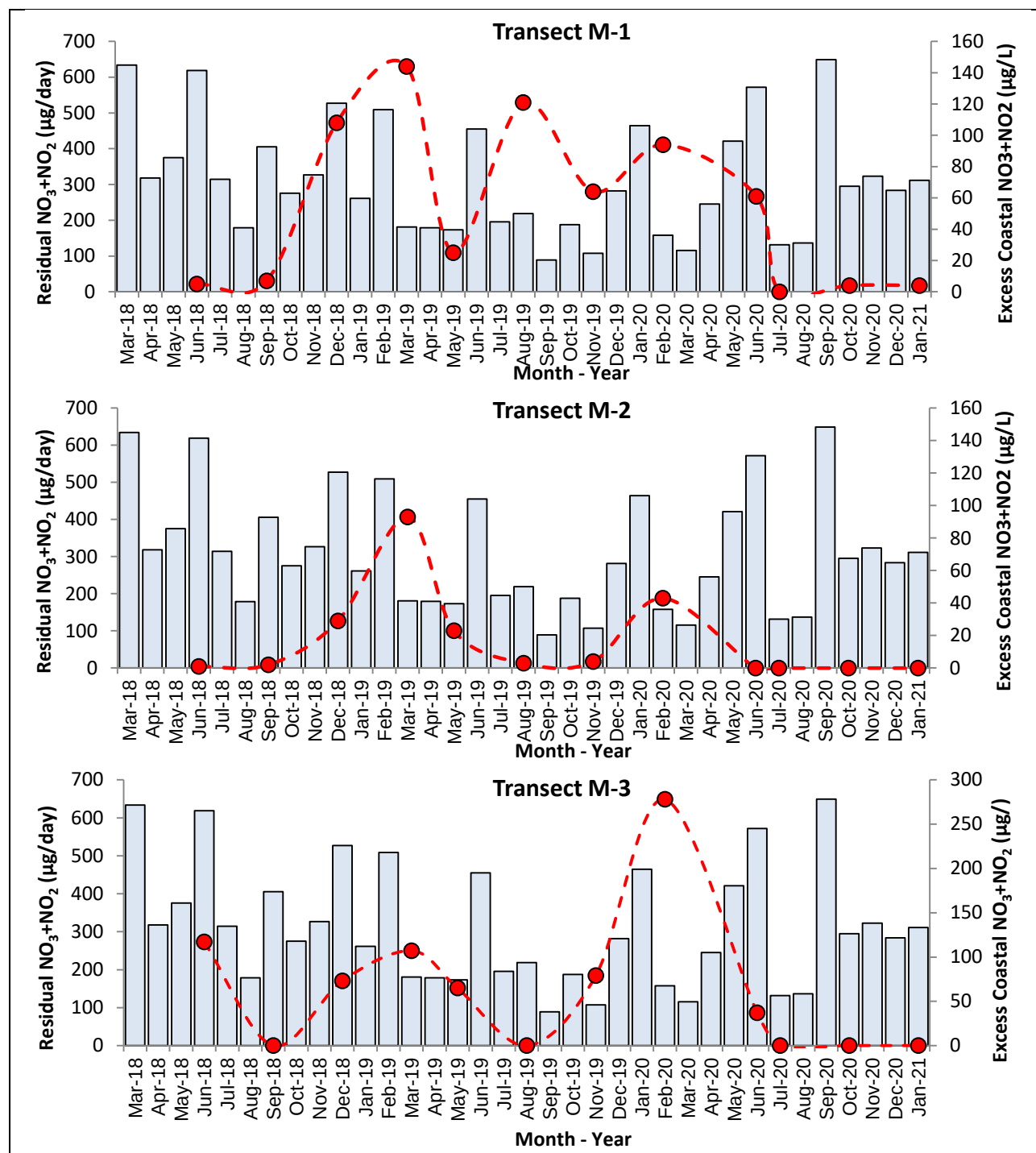


Figure 3. Mean estimated nitrate+nitrite residuals to golf course turf and landscaping (blue columns; g/day) and measured nitrate+nitrite (red circles $\mu\text{g/L}$) levels at 2-m stations of Transect M-1 to M-3.

be able to recommend changes to fertilizer application methods that will meet golf course and landscape requirements, while minimizing measurable effects on nearshore water quality.

Nutrient Limitation

Inorganic nitrogen and phosphorus compounds are typically identified as potentially “limiting” nutrients in Hawaiian marine waters. Increases in a limiting nutrient concentration can result in enhanced growth of phytoplankton and macroalgae. Excessive algal growth has happened in the coastal waters off Kīhei due to discharge of both nitrogen and phosphorus compounds from the Kīhei Wastewater Treatment Plant (Laws et al., 2004; Dailer et al., 2010). Maintaining low limiting nutrient concentrations is essential to maintaining a more pristine and diverse biological community in marine waters.

We can estimate the limiting nutrient (nitrogen or phosphorus) by comparing molar ratios (N:P ratios) of dissolved inorganic nitrogen (DIN: nitrate, nitrite, and ammonium) to dissolved inorganic phosphate (DIP: ortho-phosphate). N:P ratios for 20 Hawaiian algal species range from 15:1 to 44.1 with an average of about 29:1 (Atkinson and Smith, 1983). High N:P ratios (>29.1) are potentially related to DIP limitation, whereas low N:P ratios (<29.1) are related to DIN limitation.

Analyses using accumulating data averages can be useful to decipher trends. Because we’re still gathering data, sufficient nutrient and chlorophyll α data are not presently available to make statistical inferences regarding actual limiting nutrient determinations in Mākena waters. Data presented herein are based on the twelve previous sample sets and P vs. N limitation will vary from place to place along the coast and over time as additional monitoring results are added to the data set (see Table 6). For example, during the present sampling event, N:P values for monitoring stations along all transects were DIP limited, due to the fact that DIN concentrations were relatively high along these transects compared with DIP concentrations. N/P limitation can also vary between stations along individual transects, as shown in Transect M-4 for long-term means.

Since different algal species present a wide range of N:P requirements (Atkinson & Smith, 1983), constantly changing nutrients in these waters tend to prevent excessive algal growth by preventing extensive growth of just one or a few species.

Table 6. A summary of average DIN and DIP values for twelve monitoring events (June, 2018 – January, 2021) and April, 2021.

Transect	DFS† (m)	DIP (μM/L)		DIN (μM/L)		DIN:DIP ratio		N/P Limited potential	
		Means	April 2021	Means	April 2021	Means	April 2021	Means	April 2021
M-1	2	0.07	0.02	5	10	69	607	P	P
	10	0.02	0.02	5	8	292	509	P	P
	50	0.06	0.06	4	9	61	143	P	P
	100	0.04	0.02	3	6	80	350	P	P
M-2	2	0.11	0.06	3	8	25	121	P	P
	10	0.09	0.06	3	6	33	92	P	P
	50	0.10	0.02	3	7	28	438	P	P
	100	0.07	0.02	2	4	33	235	P	P
M-3	2	0.09	0.10	4	13	49	137	P	P
	10	0.09	0.02	3	7	36	421	P	P
	50	0.07	0.03	3	7	45	204	P	P
	100	0.06	0.02	2	7	34	421	P	P
M-4	2	0.07	0.16	2	4	26	26	N	P
	10	0.09	0.02	2	4	23	252	P	P
	50	0.05	0.02	2	3	36	177	P	P
	100	0.06	0.02	2	2	27	151	P	P

Conclusions

The April 15, 2021 monitoring event provided a somewhat different picture of water quality off MG&BC compared with most past monitoring events. This difference is perhaps attributable to the low tide pertaining during sampling, which revealed groundwater seepage at the 2-m stations along transects M-1, M-2, and M-3 for nitrate+nitrite and extending further offshore. DIN to DIP ratios indicate that DIP was the presumptive limiting nutrient for algal growth at all stations along all four transects during this sampling event, as is being revealed as the norm for all stations.

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