State of Hawaii
DEPARTMENT OF AGRICULTURE AND BIOSECURITY
1428 South King Street
Honolulu, Hawaii

ADDENDUM NO. 2

TO

JOB NO. DOAO-27
Wahiawā Dam Improvements
Wahiawā, Oʻahu, Hawaiʻi

April 2, 2026

The items listed hereinafter are hereby made a part of the contract for the above project and shall govern the work, taking precedence over previously issued plans and specifications governing the items mentioned.

QUESTIONS AND RESPONSES

QUESTION #1
Regarding the new 6 ft high chain link fence. Details on sheet C38 show post in standard concrete footings and a double swing gate. We cannot find this type of fence installation anywhere on the plans. The only fence we can find are mounted on the new spillway walls. Clarify where the standard concrete footing fence and gate are located

Response
The only fencing included in the project is along the training walls. Fencing with standard concrete footings and gates are not currently included in the project.

QUESTION #2
Regarding the new 6 ft high fence. There is no proposal item for the fence on the project. What proposal item should the new fence and gate be applied to?

Response
As noted in Specification Section 01200-1.04-KK, fencing is to be included under the Bid Item No. 36: Miscellaneous Items

QUESTION #3
Per sheet C38 surface mounted fence post. Provide how thick the new 8"x8" base plate is required. Do we assume that there are 4 each anchors per base plate or are there only 2 anchors per base plate? Note that no fence manufacturer will design post mounting.

Response
The base plate will be 8”x8”x3/8”. Assume 4 anchors per base plate.

QUESTION #4
Fence specifications 02821 paragraph 1.05C states that all fence material has to come from one manufacturer. There is no single manufacturer of all the fence components. Can this requirement be deleted to conform to material procurement in today's market?

Response
Typically fence components are from the same supplier/manufacturer and the intent of this requirement is for compatibility. However, if supply issues are encountered that can be evaluated during construction.

QUESTION #5
Fence specifications 02821 paragraph 2.01A states that the pipe has to meet ASTM F1083. Will Standard sch 40 weight pipe meeting ASTM A53 be acceptable. A53 and F1083 has the same structural qualities.

Response
ASTM F1083 is preferred.

QUESTION #6
Fence specification 02821 paragraph 2.03 states that we have to purchase material from these select manufacturers. These are not manufacturers these companies are suppliers who supply material from the manufacturers. Can this requirement be deleted as long as all material meets the required specifications?

Response
Fence Specification 02821, 2.03, C. says "Or approved equal". Contractors can use any manufacturer or supplier so long as the material meets required specifications.

QUESTION #7
Will the Contractor be responsible to obtain and pay for easements to access the construction site and create laydown space? If so, can contacts for the ADC and OHA properties be provided so Contractor can discuss use of properties before the bid?

Response
The contractor will be responsible for coordinating and paying for easement access through adjoining properties. Contacts will be provided to the selected contractor. Note that ADC will be the dam owner after construction of the project is complete. While not required, it would be advantageous for ADC to maintain permanent access to the dam and spillway from parcels currently owned by ADC. For bidding purposes, contractor should assume that access/staging easements will be guaranteed through adjoining parcels owned by the State of Hawai‘i (ADC and OHA). Access through privately owned parcels cannot be guaranteed at this time.

Given the uncertainties related to easements and in order to maintain a fair bidding process, a total lease allowance of $300,000 should be assumed for access/staging area easements as part of the added lump sum cost of Bid Item No. 3B – Easement Access.

QUESTION #8
The "Condition of Award" section of the Proposal states the state may award based on available funding. Please provide the Engineer's Estimate and confirm if the secured finding is equivalent to the estimate.

Response
The cost estimate is $60 million. Additional funding is not secured at this time.

QUESTION #9
Can the AutoCAD files be made available for reference?

Response
CAD will be provided to winning contractor.

QUESTION #10
Is there any topography related to the ADC and OHA properties that can be made available to Contractor to develop plan for access roads?

Response
Publicly available LiDAR terrain data is available for ADC and OHA properties. No additional topographic survey was obtained as part of the design for ADC and OHA properties.

QUESTION #11
Is there an Engineer's Estimate for this project? If so, what is the estimated contract amount?

Response
The cost estimate is $60 million. Additional funding is not secured at this time.

QUESTION #12
Please confirm the Aqua Dams on top of the existing dam will be removed, by others, prior to the start of this Contract.

Response
The Aqua Dam will be removed prior to construction. If high rainfall is expected, the Aqua Dam will be deployed to provide additional free board to the dam.

QUESTION #13
Specification Section I-9, Information and Instructions to Bidders, states that "Prior to construction, the Contractor will need to coordinate and obtain necessary clearances with appropriate landowning agencies based on preferred points of access. Both ADC and OHA have indicated a willingness to facilitate access through these parcels, though certain limitations may apply pending schedule of the project". Questions 1) Will the Department of Agriculture and Biosecurity guarantee the execution of these agreements for access, staging area, stockpile area, etc will be made for the project? 2) What are the costs (ie lease rate) to be anticipated for the utilization of these parcels for the duration of the project? 3) Will the Department of Agriculture and Biosecurity provide anticipated terms of the agreements?

Response
The contractor will be responsible for coordinating and paying for easement access through adjoining properties. Contacts will be provided to the selected contractor. Note that ADC will be the dam owner after construction of the project is complete. While not required, it would be advantageous for ADC to maintain permanent access to the dam and spillway from parcels currently owned by ADC. For bidding purposes, contractor should assume that access/staging easements will be guaranteed through adjoining parcels owned by the State of Hawai‘i (ADC and OHA). Access through privately owned parcels cannot be guaranteed at this time.

Given the uncertainties related to easements and in order to maintain a fair bidding process, a total lease allowance of $300,000 should be assumed for access/staging area easements as part of the added lump sum cost of Bid Item No. 3B – Easement Access.

QUESTION #14
Will the Department of Agriculture and Biosecurity guarantee the unlimited access to and from the work area, including staging area and stockpile area, for the duration of the project?

Response
For bidding purposes, contractor should assume that access/staging easements will be guaranteed through adjoining parcels owned by the State of Hawai‘i (ADC and OHA). Access through privately owned parcels cannot be guaranteed at this time.

QUESTION #15
Specification Section 1.04 A states "There may also be an opportunity to access the dam crest and spillway from the ADC parcel; however, it would require additional access through privately owned property (Lakeside Investors LLC, Tax Parcel TMK:73013004)." Questions 1) Will the Department of Agriculture and Biosecurity guarantee the execution of the agreement for access to the dam crest and spillway from the ADC parcel? 2) What are the costs (ie lease rate) to be anticipated for the utilization of this parcel for the duration of the project? 3) Will the Department of Agriculture and Biosecurity provide anticipated terms of the agreements?

Response
The contractor will be responsible for coordinating and paying for easement access through adjoining properties. Contacts will be provided to the selected contractor. Note that ADC will be the dam owner after construction of the project is complete. While not required, it would be advantageous for ADC to maintain permanent access to the dam and spillway from parcels currently owned by ADC. For bidding purposes, contractor should assume that access/staging easements will be guaranteed through adjoining parcels owned by the State of Hawai‘i (ADC and OHA). Access through privately owned parcels cannot be guaranteed at this time.

Given the uncertainties related to easements and in order to maintain a fair bidding process, a total lease allowance of $300,000 should be assumed for access/staging area easements as part of the added lump sum cost of Bid Item No. 3B – Easement Access.

QUESTION #16
What happens if the Contractor is unable to reach agreements with the listed property owners for access, staging area, stockpile area, etc for the duration of the project?

Response
For bidding purposes, contractor should assume that access/staging easements will be guaranteed through adjoining parcels owned by the State of Hawai‘i (ADC and OHA). Access through privately owned parcels cannot be guaranteed at this time.

QUESTION #17
There is a large risk of not being able to access or build the project without the agreements in place, not knowing what agreements will be made, or what the requirements/costs of each agreement will require. To maintain fair completion and provide the best value, for bidding purposes will the Department of Agriculture and Biosecurity consider an Allowance Item to address this item? This approach will allow offerors to submit fair and comparable pricing, minimize large contingencies and reduce the risk of unnecessary upfront costs to the Owner.

Response
Given the uncertainties related to easements and in order to maintain a fair bidding process, a total lease allowance of $300,000 should be assumed for access/staging area easements as part of the added lump sum cost of Bid Item No. 3B – Easement Access.

QUESTION #18
Will the Department of Agriculture and Biosecurity supply the contact information for ADC, OHA and Lakeside Investors, LLC parcel representatives that have indicated a willingness to facilitate agreements?

Response
The contractor will be responsible for coordinating and paying for easement access through adjoining properties. Contacts will be provided to the selected contractor. Note that ADC will be the dam owner after construction of the project is complete. While not required, it would be advantageous for ADC to maintain permanent access to the dam and spillway from parcels currently owned by ADC. For bidding purposes, contractor should assume that access/staging easements will be guaranteed through adjoining parcels owned by the State of Hawai‘i (ADC and OHA). Access through privately owned parcels cannot be guaranteed at this time.

Given the uncertainties related to easements and in order to maintain a fair bidding process, a total lease allowance of $300,000 should be assumed for access/staging area easements as part of the added lump sum cost of Bid Item No. 3B – Easement Access.

QUESTION #19
With Bid Question Responses due at 4:00 PM on April 2, 2026 it only allows for 2 weeks until the Bid is due. In an effort to provide the lowest price and the best value to the Department of Agriculture and Biosecurity please consider extending the proposal date by six weeks.

Response
An extension of the bid due date will not be possible.

QUESTION #20
With the complexity of this project we request a bid date extension of at least 2 weeks to adequately price a proposal. Please confirm that a bid date extension will be granted.

Response
An extension of the bid due date will not be possible.

QUESTION #21
Specification Section 02222-2 3.02C.1 states, "A quarantine period of 180 days is anticipated. The actual duration of the quarantine period will be determined by the Engineer based on surface survey monument monitoring results and may be greater than or less than 180 days." What is the maximum number of days the quarantine period could last? Will the Contractor be compensated calendar days and money if the quarantine period extends beyond 180 days?

Response
For bidding purposes, the Contractor should assume that the quarantine period will not exceed 180 days.

QUESTION #22
Specification Section 02322 3.03A states, "At least one supervisory person and one equipment operator shall be onsite at all times when the Contractor is working when open excavations are present on the site". Does this mean, if the contractor is only working on dayshift, a supervisor and operator have to be onsite 24 hours per day/ 7 days per week IF an open excavation is present anywhere on the site?

Response
No. This means that during working hours one supervisory person and one equipment operator are required to be on site while open excavations are present.

QUESTION #23
Specification Section 02322 3.03.e states, "Structure Foundation Surfaces shall be proof rolled with a loaded dump truck (72,000 gross vehicle weight) in presence of the Engineer". Please provide an acceptable alternative if a loaded dump truck is unable to access the structure foundation surface (ie narrow, deep or steep slopes).

Response
The intent of this requirement is to verify a firm subgrade prior to concrete placement. The Contractor shall coordinate with the Engineer during construction regarding vehicular access to locations to be proof rolled. Other types of pneumatic tire equipment may be considered.

QUESTION #24
Information and Instruction to Bidders Section N. Wages and Hours states, "No work shall be done on Saturdays, Sundays, legal state holidays, and/or in excess of eight (8) hours each day without the written consent of the Engineer". Will the Engineer approve work on Saturdays, Sundays, legal state holidays, and/or in excess of eight (8) hours per day?

Response
It is anticipated that the engineer will approve work on weekends, holidays, and/or in excess of eight (8) hours per day if warranted.

QUESTION #25
Information and Instruction to Bidders Section N. Wages and Hours states, "No work shall be done at night unless authorized by the Engineer". Will the Engineer approve night shift work?

Response
It is anticipated that the engineer may approve work at night if warranted with some exceptions to protect Hawaiian seabirds. All outdoor lights must be fully shielded so the bulb can only be seen from below and must include automatic switches and controls or lights being turned off when human activity is not occurring. Nighttime work should be avoided during September 15-December 15 for protection of Hawaiian seabirds.

Recent concurrence documentation received from the U.S. Fish and Wildlife Service regarding these and other conservation measures required to protect endangered species will be provided with this addendum. Of particular note is that woody plants greater than 15 feet tall will not be disturbed, removed, or trimmed during the birthing and pup rearing season of the Hawaiian hoary bat (June 1 through September 15).

QUESTION #26
Plan Sheet C25, Note 3 states, "THE SOIL/ROCK NAIL CONSTRUCTION DRAWINGS AND SPECIFICATIONS WILL BE PROVIDED IN A GEOTECHNICAL DESIGN ADDENDUM". Please supply this information to offerors.

Response
For bidding purposes, assume 20-foot long, #8 bars on 5’ x 5’ centers. Details for bidding purposes have been added to sheet C34. The bid tab has been revised to include bid items 13A Soil/Rock Nails and 13B Soil/Rock Nail Wall Facing.

QUESTION #27
What is the voltage rating of the overhead power lines associated with the power pole that is excavated near on Plan Sheet C6?

Response
Voltage rating is not known. Line appears to be owned by HAWAIIAN ELECTRIC CO INC.

QUESTION #28
Please confirm all excavation of material for Bid Item No. 13 - Permanent Support of Excavation Soil/Rock Nail Stabilization will be paid under Bid Item No. 10 - Common Excavation.

Response
All excavation on site will be common excavation, including the excavation of material under Bid Item No. 13.

QUESTION #29
Plan Sheet C31 illustrates a Spoil Pile Plan. Please confirm this is a permanent stockpile that will remain at the completion of the project.

Response
Confirmed. C31 shows a permanent spoil pile and will remain at completion of the project.

QUESTION #30
Plan Sheet C31 illustrates a Spoil Pile Plan. What is the maximum capacity (cubic yards) that can be placed in the spoil pile?

Response
Spoil pile volume was estimated from C3D quantities to be approximately 38,000 CY. Spoil pile volume can be greater as approved by engineer and remains within the limits of disturbance defined on the drawings.

QUESTION #31
Can the existing Plunge Pool be temporary filled with material to create access/laydown area? What are the restrictions/limitations on temporary filling the existing Plunge Pool with material?

Response
The plunge pool can be filled with temporary material without limitation as long as material is removed and the plunge pool is restored to its current condition. Note that if the spillway activates during high rainfall events, any material in that area will likely be washed out.

QUESTION #32
Is there a construction water source available onsite? If so, where is it located and what are the conditions of use?

Response
There is no known construction water source located on site.

QUESTION #33
Is there a construction power source available onsite? If so, where is it located and what are the conditions of use?

Response
There is no known construction power source available onsite.

QUESTION #34
Plan Sheet C2, Foundation Exploration Plan illustrates 7 Each Exploratory Borings and 9 Each Exploratory Test Pits. Please confirm these are the only borings and test pits the Engineer and Owner will required for Bid Item No. 34. If additional Exploratory Borings or Exploratory Test Pits are required by the Engineer or Owner, how will they be paid for?

Response
All exploratory borings and test pits are shown on Sheet C2. It is not anticipated that more will be required. As noted in Specification Section No. 01200, exploratory test pitting to locate the existing relief tunnel outlet, expose hand-placed rock of existing dam embankment, or observe other subsurface conditions is considered common excavation and will be paid for under Bid Item No. 10. Separate payments will not be made under specific Bid Items for exploratory test pitting performed by the Contractor or requested by the Engineer. Contractor Exploratory Borings as currently defined on the drawings will be paid for under Bid Item No. 34. If additional borings are required, a change order will be necessary.

QUESTION #35
SS 02210 Section 1.04 A.2, Site Conditions is requesting the Contractor to waive all rights for any subsurface conditions that differ from the information provided or indicated on the drawings. This is an unreasonable statement that will put unnecessary risk on the Offeror and not allow offerors to submit fair and comparable pricing. Please remove OR revise Specification Section 02210 1.04A.2 to properly handle Differing Site Conditions

Response
Contractors are required to call Hawai‘i 811 prior to commencement of construction. As noted in the Notice to Bidders, see DLNR Interim General Conditions 1994 Section 2.4 regarding how differing site conditions will be addressed for this project

QUESTION #36
Please confirm the Contractor can assume all export excavated material from site is not considered special waste

Response
For bidding purposed assume no special waste will be encountered. If special waste is encountered during construction that will be considered a changed condition at an additional cost. As noted in the Notice to Bidders, see DLNR Interim General Conditions 1994 Section 2.4 regarding how differing site conditions will be addressed for this project

QUESTION #37
Please confirm PVT is the only facility that can receive export soil material as an approved disposal facility.

Response
Contractor to determine which disposal facility is adequate.

QUESTION #38
Is there any hazardous and/or contaminated materials to be anticipated within the project limits? If so, how will the costs associated with it be handled?

Response
For bidding purposed assume no special waste will be encountered. If special waste is encountered during construction that will be considered a changed condition at an additional cost. As noted in the Notice to Bidders, see DLNR Interim General Conditions 1994 Section 2.4 regarding how differing site conditions will be addressed for this project.

QUESTION #39
Who will be required to submit the NOI-C for the project, the Owner or the Contractor?

Response
Owner will be required to submit the Notice of Intent (NOI-C).

QUESTION #40
Who will prepare and submit the SWPPP for the project, the Owner or the Contractor?

Response
Contractor will be responsible for SWPPP.

QUESTION #41
Will a NESHAP be required for demolition activities on the project?

Response
A NESHAP is not anticipated for this Project.

QUESTION #42
Is asbestos anticipated to be encountered on the project? If so, how will the costs associated with it be handled?

Response
Asbestos is not anticipated to be encountered. If asbestos is encountered during construction that will be considered a changed condition at an additional cost. As noted in the Notice to Bidders, see DLNR Interim General Conditions 1994 Section 2.4 regarding how differing site conditions will be addressed for this project

QUESTION #43
Has an asbestos survey been completed for the project? If so, please provide.

Response
No asbestos surveys have been completed. As noted in the Notice to Bidders, see DLNR Interim General Conditions 1994 Section 2.4 regarding how differing site conditions will be addressed for this project

QUESTION #44
Plan Sheet C8, Note 9 states, "AFTER EARTH DISTURBANCE BEGIN, ALL WATER WHICH COLLECTS WITHIN THE WORK AREA IS TO BE PUMPED TO A SEDIMENT FILTERING DEVICE BEFORE BEING DISCHARGED FROM SITE". What are the requirements for the level of treatment prior to discharge from site? Where are the approved locations that water can be discharged after it has been pumped to a sediment filtering device?

Response
Treatment to be in compliance with the State of Hawai‘i and Honolulu County regulations. Water to be discharged downstream of project site.

QUESTION #45
Section 01560-1 of Temporary Barriers & Enclosures, Subsection 1.02 – Temporary Fencing states, “Provide temporary fencing as required to fence off excavation, storage, and operating areas. Temporary fences are to be substantially constructed, neat in appearance, and unless otherwise indicated be six (6) feet high.” Please confirm whether a continuous 6-foot-high security fence installed around the perimeter of the project site will satisfy this requirement, given the fluid nature of excavation limits and operating areas throughout construction.

Response
Contractor is ultimately responsible for safety of the construction site and should provide means to maintain safety in excavation, storage, and operating areas.

QUESTION #46
Specification Section 02240 1.04 A.2 states, "Groundwater observations in historic borings and piezometers installed at the site by be provided at request to owner". Please provide all applicable data with regards to ground water.

Response
All boring and piezometer data has been provided in the Supplemental Data file provided as an attachment in the initial solicitation.

QUESTION #47
Plan Sheet G3, Note 4 states, "BY TIME OF CONSTRUCTION, PARCELS OWNED BY SUSTAINABLE HAWAII AND WAHIAWA WATER CO WILL HAVE BEEN ACQUIRED BY THE STATE OF HAWAII AGRIBUSINESS DEVELOPMENT COPORATION (ADC)". Questions 1) Will the Department of Agriculture and Biosecurity guarantee the execution of these agreements for access, staging area, stockpile area, etc will be made for the project? 2) What are the costs (ie lease rate) to be anticipated for the utilization of these parcels for the duration of the project? 3) Will the Department of Agriculture and Biosecurity provide anticipated terms of the agreements?

Response
The contractor will be responsible for coordinating and paying for easement access through adjoining properties. Contacts will be provided to the selected contractor. Note that ADC will be the dam owner after construction of the project is complete. While not required, it would be advantageous for ADC to maintain permanent access to the dam and spillway from parcels currently owned by ADC. For bidding purposes, contractor should assume that access/staging easements will be guaranteed through adjoining parcels owned by the State of Hawai‘i (ADC and OHA). Access through privately owned parcels cannot be guaranteed at this time.

Given the uncertainties related to easements and in order to maintain a fair bidding process, a total lease allowance of $300,000 should be assumed for access/staging area easements as part of the added lump sum cost of Bid Item No. 3A – Easement Access.

QUESTION #48
Based on the requirements for access agreements, Exploratory Drilling and Test Pits, Review Periods, Design and Review of Contractor Designed items, the potential 180+ Calendar Day Surcharge period, restrictions on work days/work hours, weather impacts, etc, please increase the contract duration from 730 consecutive calendar days to 1,095 consecutive calendar days.

Response
Any construction delays will be negotiated and compensated.

QUESTION #49
Specification Section 02680 1.04 D. states, "The Contractor shall have no claim for additional compensation resulting from flooding or flood damage during construction". There is a large risk of flooding or multiple floods during the duration of this project. To maintain fair competition and provide the best value, for bidding purposes will the Department of Agriculture and Biosecurity consider an Allowance Item to address this item? This approach will allow offerors to submit fair and comparable pricing, minimize large contingencies and reduce the risk of unnecessary upfront costs to the Owner.

Response
This line of Specification 02680 1.04 D has been deleted. Any construction delays will be negotiated and compensated.

QUESTION #50
Please confirm the Spillway Underdrain Tunnel Abandonment does not include placing any material inside of the tunnel. The abandonment is just bulkheaded at the opening. If material is required to be placed inside the limits of the tunnel, please state the material and requirements for placement.

Response
Confirmed. There will be no fill required to be placed inside the spillway underdrain tunnels, only a bulkhead.

QUESTION #51
Plan Sheet C25, Note 3 states, "THE SOIL/ROCK NAIL CONSTRUCTION DRAWINGS AND SPECIFICATIONS WILL BE PROVIDED IN A GEOTECHNICAL DESIGN ADDENDUM". If this information is not provided prior to bid, please provide a basis of design that the Offeror can utilize for pricing

Response
See response to Question #26.

QUESTION #52
What is the anticipated power source for the instrumentation data recorders (piezometers and weir monitors)? Please provide details

Response
Data recorders specified in Section 02495 Article 2.01 L are battery powered.

QUESTION #53
Section 7.16 appears to limit contractor in its ability to claim additional time/compensation for differing site conditions, which is a significant risk to Contractors. The Specs and Gen Conditions do not appear to include a Differing Site Conditions (DSC) process, however, the Interim General Conditions 1994 does in Section 2.4. Please confirm that if the Contractor encounters any site condition that is undisclosed in the plans, not observable or disclosed in the pre-bid site inspection and not known by Contractor when bidding the work, the Parties shall reasonably negotiate adjustment of the Contract Time, the Contract Price, or both, as reasonably necessary to address such differing site condition, or explain what is intended.

Response
As noted in the Notice to Bidders, see DLNR Interim General Conditions 1994 Section 2.4 regarding how differing site conditions will be addressed for this project.

QUESTION #54
The Contract Documents indicate that Contractor's remedy for delays caused by the Client/Owner shall allow for an extension of Contract Time but not an adjustment of Contract Price. Such a remedy is inadequate to compensate the Contractor for the direct cost impacts of such compensable changes. Please confirm that Client/Owner-responsible delays will be fairly negotiated as to impacts on time and cost or explain why not.

Response
Confirmed that Client/Owner-responsible delays will be fairly negotiated as to impacts on time and cost.

QUESTION #55
The specifications state that the Board may reject bids which contain omissions, alteration, not properly initialed, conditioned, or other irregularities. Please confirm if the Board will reject any bid that is conditioned or qualified.

Response
The Department of Agriculture and Biosecurity reserves the right to reject any and/or all bids and waive any defects when, in the Board's opinion, such rejection or waiver will be for the best interest of the State of Hawai‘i.

QUESTION #56
The bid period of validity (180 days) combined with Notice to Proceed delayed up to 1 year, requires contractors to hold pricing up to 1.5 years. Requiring contractors to lock in pricing for this duration creates risks for contractors which increases the price of bids for the State. Would the State consider reducing the bid period of validity to 3 months and NTP issuance within 3 months? This would reduce contractor risk of price escalation and reduce costs to the State.

Response
The contractor will be required to hold price for one year after bid opening.

QUESTION #57
Section 7.16 states "The Contractor agrees that it will not attempt to hold the State and its Departments and Agencies and their officers, representatives, employees or agents, liable or responsible for any losses or damages to third parties from the action of the elements, the nature of the work to be done under these specifications or from any unforeseen obstructions, acts of God, vandalism, fires or encumbrances which may be encountered in the prosecution of the work." Please confirm the contractor will not be responsible for downstream flooding damage if there is a failure of the dam not caused by the negligence of the contractor. If the contractor is liable for 3rd party damages due to acts of god or actions outside their control, the risk becomes too great for contractors to economically bid on the project.

Response
The Owner will not hold the Contractor responsible for downstream flooding damage if there is a failure of the dam not caused by the negligence of the contractor.

QUESTION #58
Note 1 of sheet 2 states plans are subject to change based on permit approval. If plans change, please confirm price will be negotiated for any additional work required to comply with permits.

Response
If plans change an amendment will be done and price will be negotiated for additional work.

QUESTION #59
Plan Sheet C25, Note 6 states, "IF STABILIZATION MEASURES ARE DEEMED REQUIRED BY THE ENGINEER, GEOTECHNICAL DESIGN PARAMETERS WILL BE PROVIDED TO THE CONTRACTOR TO DEVELOP A SLOPE STABILIZATION SYSTEM". Please confirm that if a slope stabilization system is required, the Contractor will be entitled to an equitable adjustment for both time and money.

Response
This note pertains to areas that have not already been identified as needing soil/rock nails as identified on Sheet C34. Compensation to stabilize additional slopes required by the Engineer will be made per the measurement and payment criterion for Bid Items 13A and 13B.

QUESTION #60
The Contractor is responsible for submitting and implementing a Hand Placed Rock Movement Monitoring plan. Please confirm that the Engineer has performed an stability analysis of the earthen dam with the reservoir full after the earthen dam has been excavated down to the existing hand placed stone.

Response
Revisions to the schematic Plan of Excavation and corresponding fill placement (e.g. Select Fill, Fine Drain Fill, etc.) are ongoing to reduce exposure of the Hand Placed Rock during Construction. For bidding purposes, the Contractor should assume that any revisions to the schematic Plan of Excavation and fill placement will be measured and paid for under existing bid items.

QUESTION #61
SS 02680 1.03 F.2 states, "The Contractor must coordinate with the Owner to maintain the pool elevation at Wahiawa Reservoir at acceptable levels throughout the work of this Contract". Section 1.04 E.4 states, "It shall be understood that the Owner assumes no responsibility, makes no commitments and is under no obligation to modify operations at the dam". Please clarify how the Offeror's are to base their bids if the Owner assumes no responsibility or commitments for dam operations that the Contractor has no authority over?

Response
The Owner is responsible for releases through the Gate House. That is the only location that the reservoir is able to be drained. The Owner will not make any modifications to outlet works to increase flows above what is already existing. Contractors will be required to coordinate with the owner for flow releases of the reservoir.

QUESTION #62
Please confirm Contract Calendar Days will be added to the project duration for any weather or flooding impacts on a day for day extension

Response
Construction calendar days will be added for any weather or flooding impacts to construction.

QUESTION #63
Please consider raising the allowable maximum temperature of concrete at the point of placement from 70F to 90F.

Response
Contractor is expected to make provisions to meet temperature requirements. See Specification 03300 3.03-B6. For any proposed placement exceeding 70°F, the Contractor shall submit a section-specific Hot Weather Concreting Plan / Thermal Control Plan for review and approval prior to placement. Approval, if granted, will apply only to the identified pour section and will not relieve the Contractor of responsibility for meeting all other concrete quality, curing, and crack-control requirements.

QUESTION #64
Bid Item No. 29 Concrete Repair includes a "Type 2 Repair for Concrete Crack Injection". How will the measurement of SF be made for repairs that utilize Crack Injection?

Response
The Bid Form amended to include separate line items for the various concrete repair types, including deep repair (SF), shallow repair (SF), weep holes (EA), and crack injection (LF). The Contract Documents will be coordinated accordingly between the drawings and specifications.

QUESTION #65
Specification Section 02222 3.03 C addresses "salvage" items. Please provide a list of which items will be included in the Owner's exercise of rights of salvage

Response
Demolished concrete may be used for riprap provided the requirements of Section 02373 are met. No other salvage items have been identified.

QUESTION #66
Please confirm that the contractor will not be liable for downstream flooding damage when contractor construction methods and water diversions are installed and operating as approved by the State

Response
The Owner will not hold the Contractor responsible for downstream flooding damage not caused by the negligence of the contractor.

QUESTION #67
Please consider allowing questions to be submitted for 1 week after the responses are posted to the first round of questions

Response
An extension of the bid due date will not be possible.

SPECIFICATIONS

Updated Invitation to Bids, Base Bid Table.

Updated Specification 01200, Price & Payment Procedures to include new bid items 3A, 3B, 13A, 13B, 29A, 29B, 29C, and 29D.

Updated Specifications 01330, Submittal Procedures.

Updated Specification 02270, Soil and Rock Nail Stabilization

Updated Specification 02680, Diversion of Water, Part 1.04-D.

Added Specification 02834, Shotcrete Facing.

Updated Specification 03300, Cast-In-Place Concrete, Part 3.02-A-1-C.

Updated Specification 03920, Repair of Existing Concrete, Entirety.

DRAWINGS

Sheet C34 Revised.

OTHER REFERENCES

Recent concurrence documentation received from the U.S. Fish and Wildlife Service regarding conservation measures required to protect endangered species are attached.

END OF ADDENDUM 2

DEPARTMENT OF AGRICULTURE AND BIOSECURITY

BRIAN KAU, P.E.
Administrator and Chief Engineer
Agricultural Resource Management Division

State of Hawai‘i
DEPARTMENT OF AGRICULTURE AND BIOSECURITY
AGRICULTURAL RESOURCE MANAGEMENT DIVISION
Honolulu, Hawai‘i

DEPARTMENT OF AGRICULTURE AND BIOSECURITY

Sharon Hurd
Chairperson

INVITATION FOR BIDS

Job No. DOA0-27
Wahiawā Dam Improvements
Wahiawā, O‘ahu, Hawai‘i

Ad Date:	March 10, 2026
Bids Due:	April 16, 2026; 02:00 PM
Bid Location:	HiePro - Electronic Procurement System
Contact:	Glenn Okamoto; email: glenn.m.okamoto@hawaii.gov

State of Hawai'i
DEPARTMENT OF AGRICULTURE AND BIOSECURITY
AGRICULTURAL RESOURCE MANAGEMENT DIVISION
Honolulu, Hawai'i

CONTRACT SPECIFICATIONS

Job No. DOAO-27
Wahiawā Dam Improvements
Wahiawā, O'ahu, Hawai'i

Approved: _____
for BRIAN KAU, P.E.
Administrator and Chief Engineer
Agricultural Resource Management Division
Department of Agriculture and Biosecurity

April 2026

CONTENTS

NOTICE TO BIDDERS
(Chapter 103D, HRS)

COMPETITIVE BIDS for Job No. DOAO-27, Wahiawā Dam Improvements, Wahiawā, Oʻahu, Hawaiʻi, shall be submitted to the Department of Agriculture and Biosecurity, Agricultural Resource Management Division (the Department), on the specified date and time through the Hawaiʻi State e-Procurement (HIePRO). HIePRO is accessible through the State Procurement Office website at www.spo.hawaii.gov.

The Department of Land and Natural Resources Interim General Condition, dated October 1994, as amended, and the General Conditions –AG008, latest revision, shall be made part of the specifications.

The project is located in Wahiawā, Oʻahu, Hawaiʻi.

The work shall generally consist of rehabilitation of Wahiawā Dam to bring the dam and its appurtenances into compliance with the State of Hawaiʻi Department of Land and Natural Resources (DLNR), Engineering Division, Dam Safety Program regulations. The dam rehabilitation involves: clearing and grubbing, topsoil stripping and stockpiling, excavation of portions of the existing dam embankment, dewatering and flow diversion, construction of a filter blanket, drain, and downstream embankment, spillway demolition and construction, topsoil placement and seeding, implementing erosion and sedimentation controls, selective wasting of excess materials, and selective demolition and disposal.

Due to the nature of work contemplated, bidders must possess a valid State Contractor's license Class "A".

A voluntary pre-bid conference will be held by video conference on March 17, 2026 at 10:00 am. If you are interested in joining the conference, please contact Glenn Okamoto at glenn.m.okamoto@hawaii.gov, by 4:30 pm on March 16, 2026.

The award of the contract, if it be awarded, will be subject to the availability of funds.

Since the estimated cost of construction is $250,000 or more, the apprenticeship agreement preference pursuant to Hawaiʻi Revised Statutes §103-55.6 (ACT 17, SLH 2009) shall apply.

Should there be any questions, please refer to the HIePRO solicitation.

INFORMATION AND INSTRUCTIONS TO BIDDERS

CONTENTS

INFORMATION AND INSTRUCTIONS TO BIDDERS

A. PROJECT LOCATION AND SCOPE OF WORK: The project location and scope of work shall be as generally described in the Notice to Bidders.

B. PROPOSALS**:** Bidders shall submit their bid, including the completed proposal form, bid bond, and any other documents required by the solicitation, as part of their bid through the State of Hawai‘i e-Procurement System (HIePRO). See Item D, PROPOSAL FORM.

C. GENERAL CONDITIONS: The Department of Land and Natural Resources Interim General Conditions dated October 1994, as amended, shall be made a part of these contract specifications and are referred to hereafter as the General Conditions.

D. PROPOSAL FORM: **The Bidders shall fill out and upload the electronic copy of the proposal form to the HIePRO website when submitting the bid. Bid Proposals shall not be mailed, faxed or delivered to the State, unless requested to do so after the designated closing date. The successful Bidder shall fill out and print a hard copy of the proposal form, sign and submit the form with the contract award package.**

E. OMISSIONS OR ERASURES: Any proposal which contains any omission or erasure or alteration not properly initialed, or conditional bid, or other irregularity may be rejected by the Board of Agriculture and Biosecurity (Board).

F. NOTICE OF INTENT TO BID AND QUESTIONNAIRE:
A Notice of Intent to Bid is not required for this project. In compliance with HRS Section 103D-310, the lowest responsive and responsible bidder may be required to complete a questionnaire. When requested by the State, the completed questionnaire shall be submitted to the Chief Engineer for evaluation. Failure to furnish the requested information within the time allowed may be grounds for a determination of non-responsibility, in accordance with HRS Section 103D-310 and HAR Section 3-122-108.

G. BID SECURITY: A bid security will be furnished by each bidder as provided in sub-section 2.7 of the General Conditions. The successful bidder's bid security will be retained until Contract execution and furnished a performance and payment bond in an amount equal to one hundred percent (100%) of the total Contract price, including an amount estimated to be required for extra work, is furnished.

The Department reserves the right to hold the bid securities of the four lowest bidders until the successful bidder has entered into a contract and has furnished the required performance bond. All bid securities will be returned in accordance with sub-section 3.5 of the General Conditions.

Should the successful bidder fail to enter into a contract and furnish a satisfactory performance bond within the time stated in the proposal, the bid security shall be forfeited as required by law.

H. CONTRACTOR'S LICENSE REQUIRED: The Department will reject all bids received from contractors who have not been licensed by the State Contractors License Board in accordance with Chapter 444, HRS; Title 16, Chapter 77, Hawai‘i Administrative Rules; and statutes amendatory thereto.

I. IRREGULAR BIDS: No irregular bids or propositions for doing the work will be considered by the Department.

J. WITHDRAWAL OF BIDS: No bidder may withdraw his bid between the time of the opening thereof and the award of contract.

K. SUCCESSFUL BIDDER TO FILE PERFORMANCE AND PAYMENT BONDS: The successful bidder will be required to file performance and payment bonds; each in the amount equal to the total contract price, including amounts estimated to be required for extra work, as provided in sub-section 3.6 of the General Conditions.

L. NUMBER OF EXECUTED ORIGINAL COUNTERPARTS OF CONTRACT DOCUMENTS: If requested by the Department, six copies of the Contract, performance and payment bonds shall be executed.

M. CHANGE ORDERS: No work of any kind in connection with the work covered by the plans and specifications shall be considered as change order work, or entitle the Contractor to extra compensation, except when the work has been ordered in writing by the Chief Engineer (Engineer) and in accordance with sub-section 4.2 of the General Conditions.

The Contractor shall clearly identify and inform the Engineer in writing of any deviations from the contract documents at the time of submission and shall obtain the Engineer's written approval to the specified deviation prior to proceeding with any work.

N. WAGES AND HOURS: In accordance with sub-sections 7.3 to 7.9 of the General Conditions relative to hours of labor, minimum wages and overtime pay, the current minimum wage rates promulgated by the Department of Labor and Industrial Relations (DLIR) shall be paid to the various classes of laborers and mechanics engaged in the performance of this contract on the job site. The minimum wages shall be increased during the performance of the contract in an amount equal to the increase in the prevailing wages for those kinds of work as periodically determined by the DLIR.

The Department will not recognize any claim for additional compensation because of the payment by the Contractor of any wage rate in excess of the said minimum wage rates. The possibility of wage increase is one of the elements to be considered by the Contractor in determining his bid, and will not, under any circumstances, be considered as the basis of a claim against the Department under this Contract.

No work shall be done on Saturdays, Sundays, legal State holidays, and/or in excess of eight (8) hours each day without the written consent of the Engineer. Should permission be granted to work at such times, the Contractor shall pay for all inspection administrative costs thereof. No work shall be done at night unless authorized by the Engineer.

O. PERMITS: The State will process permit applications whenever possible, and the Contractor shall procure the pre-processed permits and pay the required fees. If permit applications are not processed by the State, the Contractor shall process the permit applications, permits and licenses, and pay all charges and fees. In all cases, the Contractor shall give all notices necessary and incident to the due and lawful prosecution of the work.

P. PROPERTY DAMAGE: It shall be the responsibility of the contractor to respect State property and to prevent damage to existing improvements. The Contractor will be responsible for damages resulting from construction operations. Immediately upon discovery, the Contractor shall repair such damage to the satisfaction of the Engineer.

All trees and shrubbery outside the excavation, embankment or construction limits shall be fully protected from injury.

Q. TIME: The time of completion is specified in the Proposal. It is the Department's intention to insist the Contractor diligently prosecute the work to completion within the specified time.

Prospective bidders are reminded that the State has the option to proceed with or abandon a project depending on whether the project can be completed for occupancy in the specified time.

It is the bidder's responsibility to check the availability of all materials before bidding. The bidder shall select sub-contractors and suppliers who can warrant availability and delivery of all specified or qualified materials to assure project completion within the specified time.

The successful bidder must assume all risks for completing the project by the specified date. There shall be no extension of time for any reason except for delays caused by acts of God, labor disputes involving unions, or actions of the State. If for any reason the project falls behind schedule, the Contractor shall at its own cost, take necessary remedial measures to get the project back on schedule, i.e., working overtime, air freighting all materials, etc. In addition, if the Contractor fails to fully complete the project by the completion date, Contractor will be required to make the facility usable at its own cost.

R. BIDDER'S RESPONSIBILITY TO PROVIDE PROPER SUPERINTENDENCE: The successful low bidder shall designate in writing to the Engineer the name of its authorized superintendent (Superintendent), who will be present at the job site whenever any work is in progress. The Superintendent shall be responsible for all work, receiving and implementing instructions from the Engineer in a timely manner. The cost for superintendence shall be considered incidental to the project.

If the Superintendent is not present at the site of work, the Engineer shall have the right to suspend the work as described under sub-section 5.5 c. and 7.20 - Suspension of Work of the General Conditions.

S. LIQUIDATED DAMAGES: Liquidated damages in the amount specified in the Proposal will be assessed for each and every calendar day from and after the expiration of the time period stated in the Contract for the completion of the project.

T. HIRING OF HAWAI‘I RESIDENTS: The Contractor shall comply with Act 68, SLH 2010, in the performance and for the duration of this contract. The Contractor shall ensure that Hawai‘i residents compose not less than eighty percent of the workforce employed to perform the contract work on the project. The eighty percent requirement shall be determined by dividing the total number of hours worked on the contract by Hawai‘i residents, by the total number of hours worked on the contract by all employees of the Contractor in the performance of the contract. The hours worked by any Subcontractor of the Contractor shall count towards the calculation for this section. The hours worked by employees with shortage trades, as determined by the Department of Labor and Industrial Relations (DLIR), shall not be included in the calculation for this section.

The requirements shall apply to any subcontract of $50,000 or more in connection with the Contractor, that is, such Subcontractors must also ensure that Hawai‘i residents compose not less than eighty percent of the Subcontractor’s workforce used to perform the subcontract.

U. WATER AND ELECTRICITY: The Contractor shall make all necessary arrangements and pay all expenses for water and electricity used in the construction of this project.

V. PUBLIC CONVENIENCE AND SAFETY: The Contractor shall conduct construction operations with due regard to the convenience and safety of the public at all times. No materials or equipment shall be stored where it will interfere with the safe passage of public traffic. The Contractor shall provide, install, and maintain in satisfactory condition, all necessary signs, flares and other protective facilities and shall take all necessary precautions for the protection of the work and the convenience and safety of the public. The Engineer shall have the right to suspend the performance of the work in accordance with sub-section 7.20 - Suspension of Work of the General Conditions.

W. WORK TO BE DONE WITHOUT DIRECT PAYMENT: Whenever the contract states that the Contractor is to perform work or furnish materials of any kind for which no price is fixed in the contract, it shall be understood that the Contractor shall perform such work or furnish said materials without extra charge or allowance or direct payment of any sort. The cost of performing such work or furnishing said material is to be included by the Contractor in a unit price for the appropriate item unless it is expressly specified that such work or material is to be paid for as extra work.

X. AS-BUILT DRAWINGS: As-built drawings, the intent of which is to record the actual in-place construction so that any future renovations or tie-ins can be anticipated accurately, shall be required. All authorizations given by the Engineer to deviate from the plans shall be drawn on the job site plans. All deviations from alignments, elevations and dimensions which are stipulated on the plans shall be recorded on the as-built drawings. Final as-built drawings shall be submitted to the Engineer for review and approval. After the Engineer approves the as-built drawings, the contractor shall submit an electronic copy in Adobe PDF format on CD ROM.

Y. ASBESTOS CONTAINING MATERIALS: The use of asbestos containing materials or equipment is prohibited. The Contractor shall insure that all materials and equipment incorporated in the project are asbestos-free.

Z WORKER SAFETY: The Contractor shall provide, install and maintain in satisfactory condition all necessary protective facilities and shall take all necessary precautions for the protection and safety of its workers in accordance with the Occupational Safety and Health Standards for the State of Hawai‘i. The Engineer shall have the right to suspend the performance of the work in accordance with sub-section 7.20 - Suspension of Work of the General Conditions.

AA. TOILET FACILITIES: All toilet facilities constructed at the project site shall be in accordance with the Public Health Regulations of the State Department of Health (DOH). All necessary precautions shall be observed at the project site. The use of sanitary facilities shall be strictly enforced and workers violating these provisions shall be promptly discharged.

BB. SIGNS: Whenever the project involves closing or obstructing any public thoroughfare, the Contractor shall provide traffic signs conforming to the applicable provisions of the current edition of the "Manual on Uniform Traffic Control Devices for Streets and Highways", published by the Federal Highway Administration as directed by the Engineer for the purpose of diverting or warning traffic prior to the construction area. All traffic signs shall bear proper wording stating thereon the necessary information as to diverting or warning traffic.

The Contractor shall provide a project sign, size 4'-0" x 7'-0" to be placed as directed by the Engineer. The sign shall be constructed in accordance with Section 01580 - Project Identification of these specifications and approved by the Engineer. All wording, type and size of lettering and color selection shall be as specified in these specifications or as approved by the Engineer.

All signs shall be kept neat and clean, and properly erected at all times.

CC. FIELD OFFICE AREA FOR DEPARTMENT: When indicated in the Proposal, the Contractor shall provide a housed working area of at least 720 square feet adjacent to the Contractor's office for the Department's use. This area will be used by the Engineer to perform tests and to store equipment. As a minimum, the field office shall include the following: standard sized office desk and chair, lighting, ventilation, window-type air conditioning rated at 5,000 BTU, door and window with locking hardware, electrical outlets, and working communications facilities (a cellular telephone is acceptable). The Department will pay for all long distance toll charges made by the Engineer. See also Section 01520: Construction Facilities.

DD. QUANTITIES: All bids will be compared on the basis of quantities of work to be done as shown in the Proposal; the quantities shown in the Unit Price items are estimated, being given as a basis for comparison of bids. The Department reserves the right to increase or decrease the quantities given under the items or delete items entirely as may be required during the progress of the work.

EE. OTHER HEALTH MEASURES: Forms of work site exposure or conditions which may be detrimental to the health or welfare of workers or of the general public shall be eliminated or reduced to safe levels as required by the DOH codes, standards, and regulations. Suitable first aid kits and a person qualified to render first aid, as specified in the DOH regulations, shall be provided at all times when work is scheduled.

FF. HAWAI‘I BUSINESS OR COMPLIANT NON-HAWAI‘I BUSINESS REQUIREMENT: Bidders (Contractors) shall be incorporated or organized under the laws of the State or be registered to do business in the State as a separate branch or division that is capable of fully performing under the contract, as stipulated in §3-122-112 HAR.

GG. COMPLIANCE WITH §3-122-112 HAR:
As a condition for award of the contract and as proof of compliance with the requirements of 103D-310(c) HRS, the apparent low bidder shall furnish the required documents to the Department. If the valid required certificates are not submitted on a timely basis for award of a contract, a bidder otherwise responsive and responsible may not receive the award. Bidder is responsible to apply for and submit the following documents to the Department.

A. TAX CLEARANCE REQUIREMENTS (HRS Chapter 237): Bidder shall obtain a tax clearance certificate from the Hawai‘i State Department of Taxation (DOTAX) and the Internal Revenue Service (IRS). The certificate is valid for six months from the most recently approved stamp date on the certificate; the certificate must be valid on the date received by the Department.

B. Department of Labor (DLIR) “**Certificate of Compliance**”. (HRS Chapter 383 - Unemployment Insurance, Chapter 386 - Workers’ Compensation, Chapter 392 - Temporary Disability Insurance, and 393 – Prepaid Health Care): Bidder shall obtain a certificate of compliance from the Hawai‘i State Department of Labor and Industrial relations (DLIR). The certificate is valid for six months from the date of issue; certificates must be valid on the date received by the Department.

C. Department of Commerce and Consumer Affairs (DCCA), Business Registration Division (BREG) “**Certificate of Good Standing**”. Bidder shall obtain a certificate of good standing issued by the Department of Commerce and Consumer Affairs (DCCA), Business Registration Division (BREG). The certificate of good standing is valid for six months from the date of issue; certificates must be valid on the date received by the Department.

Alternately, instead of separately applying for these certificates at the various state agencies, bidder may choose to use the Hawai‘i Compliance Express (HCE), which allows businesses to register online through a simple wizard interface at http://vendors.ehawaii.gov to acquire a “Certificate of Vendor Compliance” indicating the bidder’s status is compliant with the requirements of §103D-310(c), HRS, and shall be accepted for contracting and final payment purposes. Bidders that elect to use the new HCE services will be required to pay an annual fee of $12.00 to the Hawai‘i Information Consortium, LLC (HIC). Bidders choosing not to participate in the HCE program will be required to provide the paper certificates as instructed in the previous paragraphs.

HH. NON-DISCRIMINATION NOTICE

The Department of Agriculture and Biosecurity (DAB) does not discriminate on the basis of race, color, sex, national origin, age, or disability, or any other class as protected under applicable federal or state law, in administration of its programs, or activities, and, the DAB does not intimidate or retaliate against any individual or group because they have exercised their rights to participate in actions protected, or oppose action prohibited, by 40 C.F.R. Parts 5 and 7, or for the purpose of interfering with such rights.

If you have any questions about this notice or any of DAB's non-discrimination programs, policies, or procedures, you may contact:

Rae Gee, Non-Discrimination Coordinator
Department of Agriculture and Biosecurity
1428 S. King Street, Honolulu, HI 96814,
(808) 973-9560
Dab.titlevi@hawaii.gov

If you believe that you have been discriminated against with respect to a DAB program or activity, please contact the DAB Non-Discrimination Coordinator identified above or visit our website at http://dab.hawaii.gov/blog/main/discriminationcomplaints/ to learn how and where to file a complaint of discrimination.

To request translation, interpretation, modifications, accommodations, or other auxiliary aids or services, contact the DAB Office of the Chairperson at (808) 973-9560 or email hdoa.info@hawaii.gov. Include a description of the accommodation you will need and tell us how to contact you if we need more information. Make your request as early as possible. Last-minute requests will be accepted but may be impossible to fill. Upon this request, this notice is available in alternate/accessible formats.

II. PROJECT LABOR AGREEMENTS (PLA)

The definitions of the terms 'Contractor' and "Subcontractor" for the purposes of this solicitation are those contained in the agency's General Terms and Conditions for Construction, not as defined in the PLA.

The required form of the Contractor's Agreement To Be Bound may be found in the Project Labor Agreement for the State of Hawai'i. Any Letter of Assent shall take the substantial form of the Agreement To Be Bound.

Any subcontractor performing only trade work not represented by PLA signatories shall not be required to submit a Letter of Assent. However, any such subcontractor shall be required to timely provide to the awarded Contractor a written statement attesting that the subcontractor will be performing only work not subject to the PLA, which Attestation of Exemption shall be executed by a person authorized to bind subcontractor. The awarded Contractor shall provide any such Attestation of Exemption to the Department upon demand.

The Contractor who is awarded the project must:

1. Obtain either a Letter of Assent or Attestation of Exemption, as appropriate, from each

subcontractor of any tier who may be employed on the project and make copies of such documents available to the Department upon demand.

2. Execute an Agreement To Be Bound.
3. Submit to the Department of Agriculture and Biosecurity a complete, fully executed Agreement To Be Bound within fourteen (14) calendar days of project award, or as soon thereafter as is practicable as determined by the Department. Failure to timely submit any required Agreement To Be Bound or to provide upon demand any required Letter of Assent or Attestation of Exemption shall be cause for the State in its sole discretion to rescind the subject award and to award the project to: the responsive and responsible offeror with the next lowest bid price for a solicitation made under HRS 103D-302; or the next highest ranked offeror satisfying all solicitation requirements for a solicitation made under HRS 103D-303.

By submitting an executed Agreement To Be Bound the Contractor shall be deemed to have certified that all required Letters of Assent and Attestations of Exemption have been gathered and will be made available to the Department upon demand.

JJ. SITE ACCESS

Currently, the site is accessed for maintenance purposes through an apartment building parking lot adjacent to the dam site. However, this access will not be acceptable for construction. Contractor access during construction is anticipated from Wilikina Drive through State of Hawai‘i Agribusiness Development Corporation (ADC) property (Tax Parcel TMK: 73013010) and/or from Kamananui Road through Office of Hawai’ian Affairs (OHA) property (Tax Parcel TMK: 71012015).

The ADC property could be used as a staging area, stockpiling area, spoil area, and to provide access to the downstream embankment and plunge pool with construction of a temporary access road. This access road would be designed and constructed by the contractor. There may also be opportunity to access the dam crest and spillway from the ADC parcel; however, it would require additional access through a privately owned property (Lakeside Investors LLC, Tax Parcel TMK: 73013004).

The OHA property could be used as a staging area, temporary stockpiling area, and temporary access to the dam crest and spillway. Access to these areas would be from the right side of the spillway. Ramps would need to be constructed to facilitate access through the spillway and up to the dam crest.

Prior to construction, the Contractor will need to coordinate and obtain necessary clearances with appropriate landowning agencies based on preferred points of access. Both ADC and OHA have indicated a willingness to facilitate access through these parcels, though certain limitations may apply pending the schedule of the project.

PROPOSAL

FOR

State of Hawai‘i
DEPARTMENT OF AGRICULTURE AND BIOSECURITY
AGRICULTURAL RESOURCE MANAGEMENT DIVISION

Job No. DOAO-27
Wahiawā Dam Improvements
Wahiawā, O‘ahu, Hawai‘i

Date:_____

Chief Engineer
Agricultural Resource Management Division
Department of Agriculture and Biosecurity
State of Hawai‘i
Honolulu, Hawai‘i

Dear Sir:

The undersigned, having carefully examined the local conditions and all available records and information covering conditions which may affect the cost of the work to be performed, and having carefully examined the Plans and Specifications, and other contract documents, hereby proposes to furnish and pay for all materials, tools, equipment, labor and other incidental work necessary to rehabilitate the dam, reconstruct the spillway, and perform related work as required or called for in this Proposal, all according to the true intent and meaning of the Notice to Bidders, Information and Instructions to Bidders, Proposal, Detailed Specifications, Interim General Conditions, Plans, and any and all addenda for:

Job No. DOAO-27
Wahiawā Dam Improvements
Wahiawā, O‘ahu, Hawai‘i

on file in the office of the Agricultural Resource Management Division for the TOTAL BASE BID (Items 1 to 37) of:

_____

_____Dollars ($_____)
and will fully complete all work under this contract within **730** consecutive calendar days from the date of written notice to proceed, including date of said order, said total sum being itemized on the following pages.

BASE BID

Item No.	Quantity	Unit	Description	Unit Price	Total
1.	1	LS	Mobilization and Demobilization	LS	$_____
2.	1	LS	Bonds and Insurance	LS	$_____
3A.	1	LS	Construction and Maintenance of Access Roads	LS	$_____
3B.	1	LS	Easement Access	LS	$300,000
4.	1	LS	Construction Stakeout, Quantity Verification, As-Builts, Etc.	LS	$_____
5.	1	LS	Erosion and Sediment Control	LS	$_____
6.	1	LS	Care and Diversion of Water	LS	$_____
7.	1	LS	Site Dewatering	LS	$_____
8.	2.9	Acre	Clearing and Grubbing	$_____	$_____
9.	4.3	Acre	Seeding and Mulching	$_____	$_____
10.	118,000	CY	Common Excavation	$_____	$_____
11.	1	LS	Hand-Placed Rock Monitoring	LS	$_____
12A.	1,715	LF	Anchor bars (Type A)	$_____	$_____
12B.	3,300	LF	Anchor bars (Type B)	$_____	$_____
13A.	539	EA	Soil/Rock Nails	$_____	$_____
13B.	1,600	SY	Soil/Rock Nail Wall Facing	$_____	$_____
14.	1	LS	Concrete Demolition	LS	$_____
15.	1	LS	Piezometer Abandonment	LS	$_____
16.	69,400	CY	Select Fill	$_____	$_____

Item No.	Quantity	Unit	Description	Unit Price	Total
17.	6,800	CY	Impervious Fill	$_____	$_____
18.	39,280	CY	Spoil Fill	$_____	$_____
20.	5,760	CY	Coarse Drain Fill	$_____	$_____
21.	1,230	CY	AASHTO No. 57 Drain Fill	$_____	$_____
22.	2,520	CY	Topsoil and Grading	$_____	$_____
23.	1,410	CY	Riprap	$_____	$_____
24.	1	LS	Spillway Underdrain Tunnel Abandonment	$_____	$_____
25.	8,700	CY	Slab and Ancillary Structure Concrete	$_____	$_____
26.	3,100	CY	Wall Concrete	$_____	$_____
27.	400	CY	Mass Concrete	$_____	$_____
28.	1,888,000	LB	Reinforcing Steel	$_____	$_____
29A.	100	SF	Deep Concrete Repair	$_____	$_____
29B.	100	SF	Shallow Concrete Repair	$_____	$_____
29C.	10	EA	Weep Hole Cleanout Repair	$_____	$_____
29D.	250	LF	Concrete Crack Repair	$_____	$_____
30.	1,100	LF	6-inch PVC Drain Pipe and Cleanouts	$_____	$_____
31.	350	LF	Toe Drain Pipe and Cleanouts	$_____	$_____
32.	1	LS	Prefabricated Junction Box and Toe Drain Weir Box	LS	$_____
33.	2,900	SY	Geotextile	$_____	$_____
34.	1	LS	Contractor Exploratory Borings	LS	$_____

Item No.	Quantity	Unit	Description	Unit Price	Total
35.	1	LS	Instrumentation	LS	$_____
36.	1	LS	Miscellaneous Items	LS	$_____
37.	1	LS	Project Closeout & Record Documents	LS	$_____
Total Base Bid (Items 1-37)					$_____

APPRENTICESHIP AGREEMENT PREFERENCE

1. If applicable to this project, any bidder seeking the preference must be a party to an apprenticeship agreement registered with the State Department of Labor and Industrial Relations (DLIR) at the time the bid is submitted for each apprenticeable trade the bidder will employ to construct the project. "Employ" means the employment of a person in an employer-employee relationship.

   a. The apprenticeship agreement shall be registered with the DLIR and confirm to the requirements of Hawai'i Revised Statutes Chapter 372.

   b. Subcontractors do not have to be a party to an apprenticeship agreement for the bidder to obtain preference.

   c. The bidder is not required to have apprentices in its employ at the time the bid is submitted to qualify for the preference.

2. A bidder seeking the preference must state the apprenticeable trade the bidder will employ for each trade to be employed to perform the work by submitting a completed signed original Certification Form 1 verifying participation in an apprenticeship program registered with DLIR. "Apprenticeable trade" shall have the same meaning as "apprenticeable occupation" pursuant to Hawai'i Administrative Rules (HAR) § 12-30-5.

   a. The Certification Form 1 shall be authorized by an apprenticeship sponsor listed on the DLIR list of registered apprenticeship programs. "Sponsor" means an operator of an apprenticeship program and in whose name the program is approved and registered with DLIR pursuance to HAR § 12-30-1.

   b. The authorization shall be an original signature by an authorized official of the apprenticeship sponsor.

   c. The completed signed original Certification Form 1 for each trade must be submitted with the bid. Previous certifications shall not apply.

   d. When filling out the Certification Form 1, the name of Apprenticeable Trade and

Apprenticeship Sponsor must be the same as recorded in the List of Construction Trades in Registered Apprenticeship Programs that is posted on the DLIR website. "Registered apprenticeship program" means a construction trade program approved by DLIR pursuant to HAR § 12-301 and § 12-30-4.

e. The Certification Form 1 and the List of Construction Trades in Registered Apprenticeship Programs is available on the DLIR website at: http://hawaii.gov/labor/wdd.

3. Upon receiving the Certification Form 1, the Procurement Officer will verify that the apprenticeship program is on the List of Construction Trades in Registered Apprenticeship Programs and that the form is signed by an authorized official of the Apprenticeship Program Sponsor. If the programs and signature are not confirmed by the DLIR, the bidder will not qualify for the preference.

4. If the bidder is certified to participate in an apprenticeship program for each trade which will be employed by the bidder for the project, a preference will be applied to decrease the bidder's bid amount by five percent (5%) for evaluation purposes.

5. Should the bidder qualify for other preferences (e.g. Hawai'i Products), all applicable preference shall be applied to the bid price.

CONTRIBUTIONS BY STATE AND COUNTY CONTRACTORS PROHIBITED

Contractors are hereby notified of the applicability of Section 11-355, HRS, which states that campaign contributions are prohibited from specified State of county government contractors during the term of the contract if the contractors are paid with funds appropriated by a legislative body.

CONDITION OF AWARD

It is understood that the award of the contract will be made on the basis of the lowest responsible Base Bid (Items 1 to 37). Write the total of bid items 1 to 37 on page P-1.

In the event the low bid is below the available funds certified by the appropriate fiscal officer, the head of the purchasing agency responsible for the procurement in question is authorized to award Additives to the lowest bidder. The award of Additives may be in any order or combination such that the Base Bid plus Additives do not exceed the available funds.

It is understood and agreed that the Department of Agriculture and Biosecurity reserves the right to reject any and/or all bids and waive any defects when, in the Board's opinion, such rejection or waiver will be for the best interest of the State of Hawai'i.

In the event all bids exceed available funds certified by the appropriate fiscal officer, the head of the purchasing agency responsible for the procurement in question is authorized in situations where time or economic considerations preclude resolicitation of work of a reduced scope to negotiate an adjustment of the bid price, including changes in the bid requirements, with the low responsible and responsive bidder, in order to bring the bid within the amount of available funds. It is understood

and agreed upon that the head of the purchasing agency may delete a portion or all of any item(s) in the proposal at the stated unit or lump sum price as necessary to stay within the available funding. The bidder is responsible to make an earnest effort to represent the actual cost of each item, including all materials, labor, equipment, overhead and profit in their bid proposal to preclude claims of anticipated profit or loss of profit because of an unbalanced bid proposal.

It is also understood that if a mutually agreeable cost for the reduced scope of work necessitated by a lack of available funds cannot be agreed upon between the bidder and the head of the purchasing agency within 14 calendar days after the bid opening, then the bid may be rejected in the best interest of the purchasing agency, and the head of the purchasing agency may negotiate in progressive order (lowest to highest) with the next lowest responsible and responsive bidder.

It is also understood and agreed that the award of the contract shall be conditioned upon funds being made available for this project and further upon the right of the Department of Agriculture and Biosecurity to hold all bids received for a period of sixty (60) days from the date of the opening thereof, unless otherwise required by law, during which time no bid may be withdrawn.

It is also understood that Notice to Proceed may be delayed up to one (1) year after the bid opening date, and that no additional compensation will be provided for any claim for escalation or delay for issuance of Notice to Proceed on or before that date.

It is also understood and agreed that the quantities given herewith are approximate only and are subject to increase or decrease, and that the undersigned will perform all quantities of work as either increased or decreased, in accordance with the provisions of the Contract Specifications.

It is also understood and agreed that the estimated quantities shown for the items for which a UNIT PRICE is asked in this Proposal are only for the purpose of comparing on a uniform basis, bids offered for the work under this contract, and the undersigned agrees that he is satisfied with and will at no time, dispute said estimated quantities as a means of claims for anticipated profit or loss of profit, because of a difference between the quantities of the various classes of work done or the materials and equipment installed, and the said estimated quantities. On UNIT PRICE bids, payment will be made only for the actual number of units incorporated into the finished project at the contract UNIT PRICE.

After the proposals are opened and read, the figures will be extended and/or totaled in accordance with the bid prices of the acceptable proposals and the totals will be compared. In the comparison of bids, words written in the proposal shall govern over figures and unit prices will govern over totals. Until the award of the contract, however, the right will be reserved to reject any and all proposals and to waive any defects or technicalities as may be deemed best for the interest of the State.

It is also understood and agreed that liquidated damages in the amount of ONE THOUSAND AND NO/100 ($1,000.00) for each and every calendar day in excess thereof prior to completion of the contract shall be withheld from payments due to the Contractor.

It is also understood and agreed that if this bid is accepted, the successful bidder must enter into and execute a contract with the Department of Agriculture and Biosecurity and furnish a Performance and Payment Bond, as required by law. These bonds shall conform to provisions of

Section 103D-324 and 325, Hawai‘i Revised Statutes and any law applicable hereto.

It is also understood and agreed that the successful bidder will provide all necessary labor, materials, tools, equipment, and other incidentals necessary to do all the work and furnish all the materials specified in the contract in the manner and time herein prescribed, and according to the requirements of the Engineer as therein set forth.

It is understood that by submitting this proposal, the undersigned is declaring that his firm has not been assisted or represented on this matter by an individual who has, in a State capacity, been involved in the subject matter of this contract in the past two years.

It is understood that by submitting this proposal in accordance with HAR 3-122-192, the undersigned is declaring that the price submitted is independently arrived without collusion.

It is also understood that by submitting this proposal, a Certification for Safety and Health Programs for bids in excess of $100,000 (in accordance with HRS 396-18), the undersigned certifies that his organization will have a written safety and health plan for this project that will be available and implemented by the Notice to Proceed date of this project. Details of the requirements of this plan may be obtained from the Department of Labor and Industrial Relations, Occupational, Safety and Health Division (HIOSH).

It is further understood and agreed that the successful bidder shall comply with paragraph 3.1.a "SUBCONTRACTING" of the General Provisions which requires that the contractor shall perform with his own organization and with the assistance of workmen under his immediate superintendence, work of a value not less than twenty percent (20%) of the value of all work embraced in the Contract, except that certain contract items of work, if specifically referred to in the special provisions, will be exempted from said twenty percent requirement.

Compliance with §103-310 HRS. As a condition of award all bidders shall comply with all laws governing entities doing business in the State, including Chapter 237 HRS (general excise tax); Chapter 383 HRS (employment security – unemployment insurance); Chapter 386 HRS (workers compensation); Chapter 392 HRS (temporary disability insurance); and Chapter 393 HRS (pre-paid health care), and shall produce all documents to the Department of Agriculture and Biosecurity, Agricultural Resource Management Division required to demonstrate compliance with these subsections. Any bidder making a false affirmation or certification under this subsection shall be suspended and may be debarred from further offerings or awards pursuant to §103D-702 HRS.

RECEIPT OF ADDENDA

The bidder also acknowledges receipt of any and all addenda issued by the Agricultural Resource Management Division, by recording the date of receipt of the respective addenda in the space provided below:

Addendum	Date Received
No. 1	_____
No. 2	_____
No. 3	_____
No. 4	_____
No. 5	_____
No. 6	_____
No. 7	_____

It is understood that failure to receive any such addendum shall not relieve the Contractor from any obligation under this Proposal as submitted.

It is also understood and agreed that if this Proposal is accepted and the undersigned should fail or neglect to contract as aforesaid, the State may determine that the bidder has abandoned the Contract, and thereupon, forfeiture of the security accompanying his proposal shall operate and the same shall become the property of the State.

JOINT CONTRACTORS OR SUBCONTRACTORS TO BE ENGAGED ON THIS PROJECT The Bidder agrees that the following is a complete listing of all joint contractors or subcontractors covered under Chapter 444, Hawai‘i Revised Statutes (HRS), who will be engaged by the Bidder on this project to perform the required work indicated pursuant to Section 103D-302, HRS. It is the sole responsibility of the contractor to review the requirements of this Project and determine the appropriate licenses that are required to complete the Project. The Bidder certifies that the completed listing of joint contractors or subcontractors fulfills the requirements for the project and the Bidder, together with the listed subcontractors or joint contractors have all the specialty contractor's licenses to complete the work, except as provided for in HRS §103D-302(b). Failure of the Bidder to comply with this requirement may be just cause for rejection of the bid.

"A" General Engineering Contractors and "B" General Building Contractors are reminded that due to the Hawai‘i Supreme Court's January 28, 2002 decision in Okada Trucking Co., Ltd.v. Board of Water Supply, et al., 97 Haw. 450 (2002), they are prohibited from undertaking any work, solely or as part of a larger project, which would require the general contractor to act as a specialty contractor in any area in which the general contractor has no license. Although the "A" and "B" contractor may still bid on and act as the "prime" contractor on an "A" or "B" project (See, HRS §444-7 for the definitions of an ‘‘A’’ and ‘‘B’’ project.), respectively, the "A" and "B" contractor may only perform work in the areas in which they have the appropriate contractor's license (An ‘‘A’’ or ‘‘B’’ contractor obtains "C" specialty contractor's licenses either on its own, or automatically under HAR § 16-77-32). The remaining work must be performed by appropriately licensed entities.

General Engineering "A" Contractors automatically have these "C" specialty contractor's licenses: C-3, C-9, C-10, C-17, C-24, C-31a, C-32, C-35, C-37a, C-37b, C-38, C-43, C-49, C-56, C-57a, C-57b and C-61.

General Building "B" Contractors automatically have these "C" specialty contractor's licenses: C-5, C-6, C-10, C-12, C-24, C-25, C-31a, C-32a, C-42a and C-42b.

In completing the Joint Contractors or Subcontractors List, describe the specialty contractor's nature and scope of work to be performed for this project and provide the complete firm name of the joint contractor or subcontractor in the respective columns. If the Bidder is a general contractor providing the work of a required specialty contractor, whose license is not automatically held pursuant to HAR 16-77-32, fill in the Bidder's (general contractor's) name and nature and scope of work to be performed on this project.

List only one joint contractor or subcontractor per required specialty contractor's classification, unless within the same specialty, the work of each joint contractor or subcontractor can be

described so that there is no overlap in work descriptions.

If a contractor's license is required by law for the performance of the work which is called for in this bid, the bidder and all subcontractors must have the required license before the submission of the bidder's proposal in the case of a non-federal aid project, and for federal-aid projects, the bidder must have the required license prior to the award of the project and all subcontractors prior to the start of the subcontracted work.

COMPLETE FIRM NAME OF JOINT CONTRACTOR OR SUBCONTRACTOR	NATURE AND SCOPE OF WORK TO BE PERFORMED

Enclosed herewith is a:

1.	Surety Bond (*1)	)	
2.	Legal Tender (*2)	)	
3.	Cashier's Check (*3)	)	
4.	Certificate of Deposit (*3)	)	in the
5.	Certified Check (*3)	)	amount
6.	Official Check (*3)	)	of
7.	Share Certificate (*3)	)	
8.	Teller's Check (*3)	)	
9.	Treasurer's Check (*3)	)	

(Cross Out Those Not Applicable)

_____

_____ Dollars ($_____)

as required by law.

Respectfully submitted,

_____

Name of Company, Joint Venture or Partnership

_____

Contractor's License No.

By: _____

Signature (*4)

Title _____

Print Name _____

Date

Address _____

_____

Telephone No. _____

E-Mail Address _____

NOTES:

1. Surety bond underwritten by a company licensed to issue bonds in this State;

2. Legal tender; or

3. A certificate of deposit; share certificate; or cashier's, treasurer's, teller's, or official check drawn by, or a certified check accepted by, and payable on demand to the State by a bank, a savings institution, or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration.

   A. These instruments may be utilized only to a maximum of $100,000.

   B. If the required security or bond amount totals over $100,000, more than one instrument not exceeding $100,000 each and issued by different financial institutions shall be accepted.

4. Please attach to this page evidence of the authority of this officer to submit bids on behalf of the Company and also the names and residence addresses of all officers of the Company.

5. Fill in all blank spaces with information asked for or bid may be invalidated. PROPOSAL MUST BE INTACT, MISSING PAGES MAY INVALIDATE YOUR BID.

End of Proposal

SPECIAL PROVISIONS

Amend INTERIM GENERAL CONDITIONS, dated October 1994, as follows:

Section 2 – Proposal Requirements and Conditions

1. **AMEND** Section 2.1 Qualification of Bidder with the following:

Written Notice of Intent to Bid or Offer: A written Notice of Intent to Bid is not required for the Solicitation.

Standard Qualification Questionnaire: Bidders may be required to complete a standard qualifications questionnaire. When requested, the information shall be furnished within two working days or longer at the discretion of the Engineer. Failure to furnish the requested information within the time allowed may be grounds for a determination of non-responsibility, in accordance with HRS Section 103D-310 and HAR Section 3-122-108.

Hawai‘i Business or Compliant Non-Hawai‘i Business Requirement: Bidders shall be incorporated or organized under the laws of the State or be registered to do business in the State as a separate branch or division that is capable of fully performing under the contract, as stipulated in §3-122-112 HAR. A certified letter is not required prior to bid opening.

Compliance with §3-122-112 HAR: As a condition for award of the contract and as proof of compliance with the requirements of 103D-310(c) HRS, the apparent low bidder shall furnish the required documents to the Department. If the valid required certificates are not submitted on a timely basis for award of a contract, a bidder otherwise responsive and responsible may not receive the award. Bidder is responsible to apply for and submit the following documents to the Department.

A. Tax Clearance (HRS Chapter 237): Bidder shall obtain a tax clearance certificate from the Hawai‘i State Department of Taxation (DOTAX) and the Internal Revenue Service (IRS). The certificate is valid for six months from the most recently approved stamp date on the certificate; the certificate must be valid on the date received by the Department.

B. Department of Labor (DLIR) “Certificate of Compliance”. (HRS Chapter 383 - Unemployment Insurance, Chapter 386 - Workers’ Compensation, Chapter 392 - Temporary Disability Insurance, and 393 – Prepaid Health Care): Bidder shall obtain a certificate of compliance from the Hawai‘i State Department of Labor and Industrial relations (DLIR). The certificate is valid for six months from the date of issue; certificates must be valid on the date received by the Department.

C. Department of Commerce and Consumer Affairs (DCCA), Business Registration Division (BREG) “Certificate of Good Standing”. Bidder shall obtain a certificate of good standing issued by the Department of Commerce and Consumer Affairs (DCCA), Business Registration Division (BREG). The certificate of good standing is valid for six months from the date of issue; certificates must be valid on the date received by the Department.

Hawai‘i Compliance Express. Alternately, instead of separately applying for these certificates at the various state agencies, bidder may choose to use the Hawai‘i Compliance Express (HCE), which allows businesses to register online through a simple wizard interface at http://vendors.ehawaii.gov to acquire a "Certificate of Vendor compliance" indicating that bidder's status is compliant with requirements of §103D-310(c), HRS, shall be accepted for contracting and final payment purposes.
Bidders that elect to use the new HCE services will be required to pay an annual fee of $15.00 to the Hawai‘i Information Consortium, LLC (HIC). Bidders choosing not to participate in the HCE program will be required to provide the paper certificates as instructed in the previous paragraphs.

2. **ADD** Section 2.4a, Pre-Bid Conferences

Required Pre-bid Conferences: For construction and design-build projects with an estimated value of $500,000 or more and solicited under the competitive sealed bid method (103D-302 HRS); and for construction and design-build projects with an estimated value of $100,000 or more and solicited under the competitive sealed proposal method (103D-303 HRS); a pre-bid conference is required.

Other Pre-Bid Conferences: The Department may require a pre-bid conference for construction or design-build projects that are below the dollar threshold listed in above or when projects have special or unusual requirements.

Other Conditions: The Department may require the prospective Bidders to make a physical inspection of the project site and make attendance at the pre-bid conference a condition for submitting an offer.

Nothing stated at the pre-bid conference shall change the solicitation unless a change is made by written addendum.

3. **DELETE** Section 2.5, Addenda and Interpretations, in its entirety and replace with the following:

"Discrepancies, omissions, or doubts as to the meaning of drawings and specifications should be communicated using the question and answer section on the HIePRO solicitation for interpretation and must be received in the time frame set in the HIePRO solicitation. Any interpretation, if made and any supplemental instructions will be in the form of written addenda to the plans and specifications and made available prior to the offer due date. It shall be the prospective bidder's sole responsibility to verify and obtain any said addenda. Failure of any bidder to receive any such addendum or interpretation shall not relieve such bidder from any obligation under his bid as submitted. All addenda so issued shall become part of the contract documents."

Section 3 – Award and Execution of Contract

1. **AMEND** Section 3.3, Award of Contract, by deleting "sixty (60)" and replacing with "ninety (90)" in the first paragraph.

2. **AMEND** Section 3.3, Award of Contract, by adding the following after the first paragraph:

"If the contract is not awarded within the ninety (90) days, the Department may request the successful Bidder to extend the time for the acceptance of its bid. The Bidder may reject such a request without penalty; and in such case, the Department may at its sole discretion make a similar offer to the next lowest responsive and responsible bidder and so on until a bid is duly accepted or until the Department elects to stop making such requests."

3. **AMEND** Section 3.9, Notice to Proceed, by deleting "180 days" and replacing with "one (1) year" in the last paragraph.

4. **ADD** Section 3.10, Protests:

"**3.10 PROTESTS**—Pursuant to Section 103D-701, Hawai'i Revised Statutes, an actual or prospective offeror who is aggrieved in connection with the solicitation or award may submit a protest. Any protest shall be submitting in writing to the Chairperson, Department of Agriculture, 1428 South King Street, Honolulu, Hawai'i 96814, or designee as specified in the solicitation.

A protest shall be submitted in writing within five (5) working days after the aggrieved person knows or should have known the facts giving rise thereto; provided that a protest based upon the content of the solicitation shall be submitted in writing prior to the date set for receipt of offers. Further provided that a protest of an award or proposed award shall be submitted within five (5) working days after the posting of the award of the contract.

Section 5 – Control of Work

AMEND Section 5.8 Value Engineering Incentive by deleting "$100,000" and replacing with "$250,000" in the first paragraph.

Section 6 – Substitution of Materials and Equipment

ADD the following to Section 6.3 Sub-paragraph b:

4. If the substitution meets all the requirements of the specifications and plans.

Section 7 – Prosecution and Progress

1. **DELETE** Section 7.2d in its entirety and replace with the following:

"d. Insurance Requirements

1. Obligation of Contractor

The Contractor shall not commence any work until it obtains, at its own expense, all required insurance. Such insurance must have the approval of the Department as to

limit, form and amount and must be maintained with a company authorized by law to issue such insurance in the State of Hawai‘i.

All insurance described herein will be maintained by the Contractor for the full period of the contract and in no event will be terminated or otherwise allowed to lapse prior to written certification of final acceptance of the work by the Department.

Certificate(s) of Insurance acceptable to the Department shall be filed with the Engineer prior to commencement of the work. These certificates shall contain a provision that coverages afforded under the policies will not be canceled or changed until at least thirty days written notice has been given to the Engineer by registered mail. The insurance policies shall name the State of Hawai‘i, its officers and employees as an additional insured and such coverage shall be noted on the Certificate. Should any policy be canceled before final acceptance of the work by the Department, and the Contractor fails to immediately procure replacement insurance as specified, the Department, in addition to all other remedies it may have for such breach, reserves the right to procure such insurance and deduct the cost thereof from any money due to the Contractor.

Nothing contained in these insurance requirements is to be construed as limiting the extent of Contractor’s responsibility for payment of damages resulting from its operations under this contract, including the Contractor’s obligation to pay liquidated damages, nor shall it affect the Contractor’s separate and independent duty to defend, indemnify and hold the Department harmless pursuant to other provisions of this contract. In no instance will the Department’s exercise of an option to occupy and use completed portions of the work relieve the Contractor of its obligation to maintain the required insurance until the date of final acceptance of the work.

All insurance described herein shall cover the insured for all work to be performed under the contract, all work performed incidental thereto or directly or indirectly connected therewith, including traffic detour work or other work performed outside the work area, and all change order work.

The Contractor shall, from time to time, furnish the Engineer, when requested, satisfactory proof of coverage of each type of insurance required or a copy of the actual policies covering the work. Failure to comply with the Engineer’s request may result in suspension of the work, and shall be sufficient grounds to withhold future payments due the Contractor and to terminate the contract for Contractor’s default.

2. Types of Insurance

The Contractor shall purchase and maintain insurance described below which shall provide coverage against claims arising out of the Contractor’s operations under the contract, whether such operations be by the Contractor itself or by the subcontractor or by anyone directly or indirectly employed by any of them or by anyone for whose acts any of them may be liable.

(a) Worker's Compensation. The Contractor and all subcontractors shall obtain full worker's compensation insurance coverage for all persons whom they employ or may employ in carrying out the work under this contact. This insurance shall be in strict conformity with the requirements of the most current and applicable State of Hawai'i Worker's Compensation Insurance laws in effect on the date of the execution of this contract and as modified during the duration of the contract.

(b) Commercial General Liability Insurance and Automobile Insurance. Contractor's commercial general liability insurance and automobile liability insurance shall both be obtained in a combined, single limit of not less than $1,000,000 per occurrence that shall include coverage for bodily injury, sickness, disease or death of any person, arising directly or indirectly out of, or in connection with, the performance of work under this contract.

The Contractor's property damage liability insurance shall provide for a single combined limit of not less than $1,000,000 for all damages arising out of injury to or destruction of property of others including the Department's, arising directly or indirectly out of or in connection with the performance of the work under this contract including explosion or collapse.

The Contractor shall either:

i. Require each of its subcontractors to procure and to maintain during the life of its subcontract, subcontractors' comprehensive general liability, automobile liability and property damage liability insurance of the type and in the same amounts specified herein; or

ii. Insure the activities of its subcontractors in its own policy.

The Contractor will be permitted, in cooperation with insurers, to maintain a self insured retention for up to 25% of the per occurrence combined single limits of the commercial general liability and the automobile liability policies. The existence of the self insured retention must be noted on the certificate of insurance coverage submitted to the Department or else it will be understood that the insurer is providing first dollar coverage for all claims. For all claims within the self-insured retention amount, the rights, duties and obligations between the Contractor and the Department shall be identical to that between a liability insurer and the Department, as an additional insured, as if there was no self-insured retention.

(c) Builder's Risk Insurance. Unless included in the Specifications of this project, the Contractor shall not be required to provide builder's risk insurance. If required as noted in the Specifications, builder's risk insurance shall be provided during the progress of work and until final acceptance by the Department upon completion of the contract. It shall be "All Risk" (including but not limited to earthquake, windstorm and flood damage) completed value insurance coverage on all

completed work and work in progress to the full replacement value thereof. Such insurance shall include the Department as additional name insured. The Contractor shall submit to the Engineer for its approval all items deemed to be uninsurable. The policy may provide for a deductible in an amount of up to 25% of the amount insured by the policy. With respect to all losses up to any deductible amount, the relationship between the Contractor and the Department shall be that of insurer and additional insured as if no deductible existed".

2. **DELETE** Section 7.16 in its entirety and replace with the following:

"RESPONSIBILITY FOR DAMAGE CLAIMS; INDEMNITY – The Contractor shall indemnify the State and the Department against all loss of or damage to the State's or the Department's existing property and facilities arising out of any act or omission committed in the performance of the work by the Contractor, any subcontractor or their employees and agents. Contractor shall defend, hold harmless and indemnify the Department and the State, their employees, officers and agents against all losses, claims, suits, liability and expense, including but not limited to attorneys' fees, arising out of injury to or death of persons (including employees of the State and the Department, the Contractor or any subcontractor) or damage to property resulting from or in connection with performance of the work and not caused solely by the negligence of the State or the Department, their agents, officers and employees. The State or the Department may participate in the defense of any claim or suit without relieving the Contractor of any obligation hereunder. The purchase of liability insurance shall not relieve the Contractor of the obligations described herein.

The Contractor agrees that it will not attempt to hold the State and its Departments and Agencies and their officers, representatives, employees or agents, liable or responsible for any losses or damages to third parties from the action of the elements, the nature of the work to be done under these specifications or from any unforeseen obstructions, acts of God, vandalism, fires or encumbrances which may be encountered in the prosecution of the work.

The Contractor shall pay all just claims for materials, supplies, tools, labor and other just claims against the Contractor or any subcontractor in connection with this contract and the surety bond will not be released by final acceptance and payment by the Department unless all such claims are paid or released. The Department may, but is not obligated to, withhold or retain as much of the monies due or to become due the Contractor under this contract considered necessary by the Engineer to cover such just claims until satisfactory proof of payment or the establishment of a payment plan is presented.

The Contractor shall defend, indemnify and hold harmless the State and its Departments and Agencies and their officers, representatives, employees or agents from all suits, actions or claims of any character brought on account of any claims or amounts arising or recovered under the Worker's Compensation Laws or any other law, by-law, ordinance, order or decree.

Section 8 – Measurement and Payment

1. **DELETE** Section 8.7a in its entirety and replace with the following:

a. Tax Clearances from the State of Hawai‘i Department of Taxation and Internal Revenue Service, subject to section 103D-328, HRS, current within two months of issuance date indicating that all delinquent taxes levied or accrued under State Statutes against the contractor have been paid.

2. **ADD** Section 8.7d, Certificate of Compliance:

d. A Certification from the Contractor affirming that the Contractor has, as applicable, remained in compliance with all laws as required by Section 103D-310, HRS, and Section 3-122-112, HAR. A contractor making a false affirmation shall be suspended and may be debarred pursuant to section 103D-702, HRS.

1. Certification of Compliance for Final Payment, State Procurement Office Form-22. Must be Signed Original.

3. **ADD** Section 8.7e, Hawai‘i Compliance Express:

e. In lieu of submitting the tax clearances from Taxation and IRS, and SPO Form -22, the Contractor may choose to use the Hawai‘i Compliance Express as described on page SP-1 of this Special Provisions

SECTION 01200

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 MEASUREMENT

A. Measurement will be made on basis of completion of work in accordance with Contract Documents and as stated hereinafter.

B. Item descriptions contained in this Section are not to be considered as all encompassing.

C. Contractor is entirely responsible for providing substantiation in support of payment applications, including but not limited to, surveying, daily logs, invoices, and computations. Several of the line items require computations, which shall be completed using computer applications.

1.02 PAYMENT

A. Incidental Costs:
   1. Include in appropriate pay items cost for:
      a. Labor.
      b. Equipment.
      c. Materials.
      d. Transportation.
      e. Plant.
      f. Tools.
      g. Bonds and Insurance.
      h. Worker's Compensation.
      i. Taxes.
      j. General Overhead.
      k. Profits.
      l. Tests: Incidental to the appropriate pay items.
      m. Laboratory, Shop and Factory Tests.
      n. Soil Tests.
      o. Painting Tests.
      p. Concrete Tests.
      q. Material and Equipment Tests.
      r. Temporary Excavation Support and Protection.
      s. Noise Restrictions.
      t. Compliance with the provisions of permits, project approvals, consent agreements and easements and all local, state and federal rules, regulations, and requirements.
      u. Obtaining permits and approvals where specified in the Contract Documents to be the responsibility of the Contractor.
      v. All other expenses necessary for prosecution of the Work.

1.03 VARIATIONS IN QUANTITIES

A. The quantity estimates for unit price items are approximate and are given solely to be used as a uniform basis for the comparison of bids. Contractor is specifically advised that the nature of portions of the Work included under this Contract is such that significant variations in actual quantities are possible for Bid Unit Price items. Regardless of the magnitude of any decrease or increase from the estimated quantities, there will be no grounds for changes in Contract Bid Unit Prices for the Work.

1.04 ITEM DESCRIPTIONS

A. General: Prices bid in Bidder's Proposal constitute complete payment for Work of the Contract, which Work is as specified in the Contract Documents, Drawings, and Specifications.
   1. Work and services of an administrative nature, and not referenced in Measurement and Payment statements or in Item Descriptions, is considered incidental to entire Work and no separate or additional payment will be paid for such.
   2. Bid Item Descriptions are not considered to be a comprehensive description of entire Work involved in the Items. The necessary appurtenance equipment, adjoining or attached structures and construction features, piping systems, and materials and construction operations not mentioned in the Bid Item Descriptions are considered incidental to the Items, and as such, must be included within the applicable Bid prices.
   3. Separate payments will not be made under specific Bid Items for removing, placing, or installing materials that are included elsewhere in a Lump Sum Bid Item.

B. Bid Item No. 1 – Mobilization and Demobilization.
   1. Payment will be made at the Contract Lump Sum Price for Mobilization and Demobilization. Includes all labor, plant, materials, tools and equipment costs that are required to satisfactorily furnish, install, operate, maintain, and remove the Contractor's general plant and equipment, which includes but is not necessary limited to shops, storage and waste areas, sanitary facilities, primary power, back-up generators, temporary fencing, work associated with temporary access and haul roads, site access and maintenance of traffic, pre-construction inspections and video documentation, site restoration, traffic control plan, and preparation and delivery of project record documents, other charges incidental and necessary for the Work not specified elsewhere, and all Incidental Costs described in Article 1.02.
   2. Includes all labor, plant, materials, tools, and equipment costs that are required to satisfactorily furnish, install, operate, maintain, and remove the temporary field offices for the Contractor and Engineer, which includes but is not necessarily limited to furniture, equipment, and temporary utilities, as needed for the office operations, complete.
   3. Payment, complete. Bid Item will be paid to Contractor in equal monthly payments.

C. Bid Item No. 2 – Bonds and Insurance.
   1. Payment will be made at the Lump Sum Bid Price for this Bid Item.
   2. Includes costs for Performance and Payment Bonds and Contractor's Insurance required by Contract Documents.
   3. Bonds and insurance costs must be substantiated with invoices and included on the Contractor's first Application for Payment.

D. Bid Item No. 3A – Construction and Maintenance of Access Roads
   1. Payment will be made at the Lump Sum Bid Price for this Bid Item.
   2. Includes all labor, materials, plant, tools, and equipment costs related to temporary haul roads for site access including:
      a. Grading and construction of temporary haul roads or improvement of existing access roads as shown on the plans or otherwise approved by the Engineer.
      b. Restoration and seeding of areas disturbed for construction of temporary haul roads.
      c. Maintenance of haul roads.
      d. Electric tower protection.
      e. Temporary stream crossings.
      f. Any other Work that may be required for constructing, maintaining, removing, and restoring temporary haul roads that is not specifically included in another Bid Item.
   3. Payment, complete. Bid Item will be paid to Contractor in equal monthly payments.

E. Bid Item No. 3B – Easement Access
   1. Payment will be made at the Lump Sum Bid Price for this Bid Item.
   2. Includes labor and fees associated with temporary easements for access and staging areas.
   3. Payment, complete. Bid Item will be paid to Contractor in equal monthly payments.

~~E.~~F. Bid Item No. 4 – Construction Stakeout, Quantity Verification, As-Builts, Etc.
   1. Payment will be made at the Lump Sum Bid Price for this Bid Item.
   2. Includes all labor, materials, and equipment costs related to survey of the project.
   3. Payment, complete. Bid Item will be paid to Contractor in equal monthly payments.

~~F.~~G. Bid Item No. 5 – Erosion and Sediment Control.
   1. Payment will be made at the Lump Sum Bid Price for this Bid Item.
   2. Includes all labor, plant, materials, tools, and equipment costs that are required to satisfactorily perform the following Work, complete:
      a. Furnish, install, maintain and remove all Erosion and Sedimentation Control facilities that are not specifically measured for payment under a separate Bid Item.
      b. Perform all features and Work shown on the Erosion and Sedimentation Control Plan Drawings and as described elsewhere in the Contract Documents, including but not limited to Section 02370, and any other

temporary environmental controls that may be required by the Contract Documents.

c. Protective fencing, construction entrances, rock filters, erosion control blankets/soil stabilization matting, associated sediment removal equipment, temporary seeding of earthwork, stabilization and maintenance of seeded areas, stabilization and maintenance of access/haul roads and staging areas (including dressing roads with approved material), compost filter sock, and weighted filter tubes.

d. Prepare and submit an Erosion and Sediment Control Plan in accordance with Section 02370 for approval by the Owner and Regulatory Agencies if an offsite spoil area is used, or if the Contractor's Plan deviates from the Plan included in the Contract Drawings and Specifications.

e. Design, install, maintain, and remove offsite Erosion and Sedimentation Controls for off-site spoil areas, if required, or for modifications to the Erosion and Sedimentation Control Plan contained in the Contract Documents, if required.

f. Does not include costs to construct permanent post-construction stormwater management and storm drainage features.

3. Measurement for progress payments will be made based on the Schedule of Values accepted and the estimated percent of Work that is satisfactorily completed under this Bid Item at the partial payment estimate cutoff date.

~~G.~~H. Bid Item No. 6 – Care and Diversion of Water.

1. Payment will be made at the Lump Sum Bid Price for this Bid Item.
2. Includes all labor, plant, materials, tools, and equipment costs that are required to satisfactorily perform the following Work, complete:
   a. Design, submit, and amend the Diversion of Water Plan and design, furnish, install, maintain, and remove all components of the approved Diversion of Water features in accordance with the Contract Drawings, Specifications, and the approved Diversion of Water Plan.
   b. Care, maintenance and diversion of all stream flows, spring flows, discharges from the reservoir, and backwater from Kaukonahua Stream in the Work area not specifically measured for payment under a separate Bid Item.
   c. Temporary Cofferdams.
      1) Design, furnish, install, maintain, and remove all temporary cofferdams and related temporary features that are not specifically measured for payment under a separate Bid Item. Includes removal and onsite spoil or offsite disposal of fill and other materials that Contractor may elect to import from offsite for construction of temporary cofferdams.
      2) Perform all temporary cofferdam Work as shown on the Drawings and as described elsewhere in the Contract Documents, including but not limited to Section 02680.
      3) Includes but is not limited to the temporary cofferdams located in the reservoir or downstream of the Work area that are required to temporarily impound reservoir water or prevent backwater flooding

during the phased excavation and construction of the new spillway structure, temporary cofferdams required for dewatering and drilling and grouting operations, drilled drain operations, drill and grout anchors operations and temporary cofferdams necessary for diversion of surface water.

4) Excavation, installation, removal, and backfill of all temporary diversion piping culverts or channels and associated temporary supports that the Contractor may employ to control surface runoff, and temporary support, shoring, sheeting, and berms.

d. Any other Work that may be required to perform Work that is not specifically included in another Bid Item shall be included in Bid Item.

3. Separate payment will not be made for designing, furnishing, installing, monitoring, operating, maintaining, and removing any Contractor-proposed modifications or amendments to the schematic Diversion of Water Plan as shown on the Contract Drawings and as specified in Section 02680, all temporary culverts, pipes, bulkheads, cofferdams, diversion barriers, pumps, staged diversion of water from all areas of open excavation, removal of excavated material or other obstructions from diversion channels, or any associated temporary flow diversion works, the entire cost of which is considered incidental to and included in the Lump Sum Price for Work, complete.
4. Item does not include:
   a. Costs of erosion and sediment control features, which are paid for separately under Bid Item 5, Erosion and Sediment Control.
   b. Costs of excavation or stripping at the existing spillway associated with construction of the permanent works, which is paid for separately under Bid Item 22 Topsoil and Grading.
   c. Diversion of water specifically identified under any other Unit or Lump Sum Contract Price.
5. Payment of the Contract Lump Sum Price for Care and Diversion of Water will be prorated in approximately equal partial payments over the duration of the diversion of water performance periods commencing with acceptance of the Contractor's Diversion of Water Plan and ending with the Engineer's written recommendation of final payment in accordance with applicable provisions of the General Conditions.
6. Measurement for progress payments will be made based on the Schedule of Values accepted and the estimated percent of Work that is satisfactorily completed under this Bid Item at the partial payment estimate cutoff date.

~~H.~~I. Bid Item No. 7 – Site Dewatering

1. Payment will be made at the Lump Sum Bid Price for Dewatering.
2. Includes all labor, plant, materials, tools, equipment costs that are required to satisfactorily perform the following Work, complete:
   a. Design, furnish, drill, install, connect, operate, maintain, and abandon dewatering systems, including pumps, as shown on the Drawings and as described elsewhere in the Contract Documents, including but not limited to Section 02240 and the approved Dewatering Plan.

b. Preparation of an approved Dewatering Plan and Emergency Operations Plan to be implemented in the event uncontrolled seepage is experienced.
c. Performing supplementary subsurface explorations deemed necessary by the Contractor to define groundwater levels.
d. Directing pumped water to satisfactory outlet facilities.
e. Installation and maintenance of erosion and sediment control facilities and pollution prevention and control facilities as required to accommodate drilling water and cuttings not specifically included in another Bid Item.
f. Monitoring, recording, and reporting phreatic levels.
g. Dewatering sumps for controlling isolated seeps in the work area.
h. Any other Work that may be required to perform Site Dewatering that is not specifically included in another Bid Item.

3. Measurement for progress payments will be made based on the Schedule of Values accepted and the estimated percent of Work that is satisfactorily completed under this Bid Item at the partial payment estimate cutoff date.

~~I.~~J. Bid Item No. 8 – Clearing and Grubbing

1. Payment will be made at the Bid Unit Price per Acre for this Bid Item.
2. Includes all labor, plant, materials, tools, and equipment costs associated with clearing and grubbing the dam site, spillway site, designated spoil area, and all other Contract work areas as approved by the Engineer and shown on the Drawings. Includes felling trees, cutting brush, removing stumps and roots systems, backfilling holes and depressions, and removing and satisfactorily disposing of trees, stumps, roots, brush, undergrowth, and debris.
3. Does not include clearing and grubbing for areas disturbed for construction of temporary haul roads, which is paid separately under Bid Item No. 3 – Construction and Maintenance of Access Roads.
4. Does not include clearing and grubbing for areas disturbed by Contractor's temporary staging areas, which is paid separately under Bid Item No. 1 – Mobilization and Demobilization.
5. Measurement for payment will be determined based upon the surveyed area of clearing and grubbing. No measurement for payment will be made for excess clearing and grubbing for the convenience of the Contractor, or for clearing and grubbing beyond the limits shown on the Drawings unless approved in advance by the Engineer in writing.

~~J.~~K. Bid Item No. 9 – Seeding and Mulching

1. Payment will be made at the Bid Unit Price per Acre for this Bid Item.
2. Includes all labor, materials, plant, tools, and equipment costs for seeding and mulching areas disturbed by construction and areas designated as requiring topsoil and seeding on the Drawings.
3. Does not include seeding for areas disturbed for construction of temporary haul roads, which is paid separately under Bid Item No. 3 – Construction and Maintenance of Access Roads.
4. Does not include seeding for areas disturbed by Contractor's temporary staging areas, which is paid separately under Bid Item No. 1 – Mobilization and Demobilization.

5. Measurement for payment will be determined based upon the surveyed area of seeding and mulching. No measurement for payment will be made for excess seeding and mulching for the convenience of the Contractor, or for seeding and mulching beyond the limits shown on the Drawings unless approved in advance by the Engineer in writing.

~~K.~~L. Bid Item No. 10 – Common Excavation.

1. Payment will be made at the Bid Unit Price per Cubic Yard for this Bid Item.
2. Includes all labor, plant, materials, tools, equipment costs that are required to satisfactorily perform Common Excavation in areas of Work that are located within the limits of Excavation shown on the Drawings. Includes, but is not necessarily limited to:
   a. Excavate to the lines, grades, slopes and limits for excavation as shown on the Drawings and as described elsewhere in the Contract Documents, including but not limited to Section 02322.
   b. Excavate to such depths and dimensions required to produce a satisfactory Foundation Surface within the limits of excavation achievable by Common Excavation as described in Section 02322.
   c. Prepare an approved Plan of Excavation as specified in Section 02322.
   d. Bracing, sheeting, trenching, hauling, and maintaining stable slopes as specified in Section 02260.
   e. Loading and hauling excess materials resulting from Common Excavation and depositing at the designated onsite spoil area or other approved spoil location.
   f. Excavation and exploratory test pitting to locate the existing relief tunnel outlet, expose hand-placed rock of existing dam embankment, or observe other subsurface conditions is considered common excavation. Separate payments will not be made under specific Bid Items for exploratory test pitting performed by the Contractor or requested by the Engineer.
   g. Any other Work that may be required to perform Common Excavation within the limits of Excavation that is not specifically included in another Bid Item.
3. Payment lines shown on the Drawings for other than permanently exposed slopes are for measurement and payment only and may not represent the actual slope lines necessary to perform the Work.
4. Measurement for payment for Common Excavation that is performed outside of the limits of Excavation is not included in this Item .
5. Measurement for payment will be determined based upon the computed volume excavated between the existing grade surface as shown on the Drawings and the surveyed bottom surface of Common Excavation. No measurement for payment will be made for excess excavation for the convenience of the Contractor, or over-excavation beyond the excavation limits shown on the Drawings unless additional excavation was approved in advance by the Engineer in writing.

~~L.~~M. Bid Item No. 11 – Hand-Placed Rock Monitoring

1. Payment will be made at the Lump Sum Bid Price for this Bid Item.

2. Includes all labor, plant, materials, tools, equipment costs that are required to satisfactorily perform Hand-Placed Rock Monitoring as described in Section 02322 and on the Drawings. Includes, but is not necessarily limited to:
   a. Development of the Hand-Place Rock Movement Monitoring Plan.
   b. Displacement monitoring equipment.
   c. Development of monitoring and or survey reports
   d. Any other Work that may be required to perform Hand-Place Rock Monitoring that is not specifically included in another Bid Item.
3. Measurement for progress payments will be made based on the Schedule of Values accepted and the estimated percent of Work that is satisfactorily completed under this Bid Item at the partial payment estimate cutoff date.

~~M.~~N. Bid Item No. 12 – Anchor Bars

1. Bid Item No. 12a, Type A Anchors:
   a. Payment will be made at the Bid Unit Price per Linear Foot for each Type A Anchor.
   b. Includes all labor, plant materials, tools, and equipment costs that are required to satisfactorily furnish and install Type A Anchors within the plunge pool slab as shown on the Drawings and as described elsewhere in the Contract Documents, including but not limited to Section 02160. Includes, but is not necessarily limited to furnishing and installing anchor bars and heads, drilling, hole cleaning, pre-grouting and redrilling, grouting, proof testing, and cleanup. Includes submittals, mix designs, centralizers, hole inspection and cleaning, quality control testing, temporary platforms, and all other materials and Work required for installation in accordance with the Contract Documents.
   c. Measurement for payment will base on the length of Anchor Bars installed complete and as approved by the Engineer.
2. Bid Item No. 12b, Type B Anchors:
   a. Payment will be made at the Bid Unit Price per Linear Foot for each Type B Anchor.
   b. Includes all labor, plant materials, tools, and equipment costs that are required to satisfactorily furnish and install Type B Anchors within the spillway chute as shown on the Drawings and as described elsewhere in the Contract Documents, including but not limited to Section 02160. Includes, but is not necessarily limited to furnishing and installing anchor bars and heads, drilling, hole cleaning, pre-grouting and redrilling, grouting, proof testing, and cleanup. Includes submittals, mix designs, centralizers, hole inspection and cleaning, quality control testing, temporary platforms, and all other materials and Work required for installation in accordance with the Contract Documents.
   c. Measurement for payment will base on the length of Anchor Bars installed complete and as approved by the Engineer.

~~N.~~O. Bid Item No. 13 – Permanent Support of Excavation – Soil/Rock Nail Stabilization

1. Bid Item No. 13a, Soil/Rock Nails
   a. Payment will be made at the Contract Unit Price per Each Soil/Rock Nail.

b. Includes all labor, plant, materials, tools, and equipment costs that are required to satisfactorily furnish and install Soil/Rock Nails on the right spillway cut slope as shown on the Drawings and as described elsewhere in the Contract Documents, complete. Includes, but is not limited to, furnishing and installing Soil/Rock Nails, drilling, hole cleaning, pre-grouting and re-drilling, grouting, proof testing, and cleanup. Includes submittals, mix designs, centralizers, nail head assembly, hole inspection and cleaning, quality control testing, temporary platforms, repair of protective coatings, and all other materials and Work required for installation in accordance with the Contract Documents. Includes up to ten percent additional spot nails that are installed as needed based on conditions in the field.

c. Measurement for payment will be per each Soil/Rock Nail installation, as shown on the Drawings, complete and as approved by the Engineer Bid Item does not include shotcrete facing and drainage system which is paid for under Bid Item 13b.

2. Bid Item No. 13b, Soil/Rock Nail Wall Facing

a. Payment will be made at the Contract Unit Price per Square Yard of Soil/Rock Nail Wall Facing.

b. Includes all labor, plant materials, tools, and equipment costs that are required to satisfactorily furnish and install Soil/Rock Nail Wall Facing to the limits shown on the Drawings and as described in the Contract Documents, complete. Includes, but is not limited to, welded wire mesh, temporary and permanent drainage features, test panels, and patching mortar. Does not include shotcrete or other Soil/Rock Nail Wall Facing components placed beyond the limits shown on the Drawings unless placed at the direction of the Engineer in writing. Soil/Rock Nails and Soil/Rock Nail head assemblies are paid for under Bid Item 13a.

c. Measurement for payment will be made based on area of Soil/Rock Nail Wall Facing installed complete and as approved by the Engineer.

~~3. Payment will be made at the Lump Sum Bid Price for this Bid Item.~~

~~4. Includes all labor, plant, materials, including soil/rock nails, drainage, shotcrete with reinforcement, drilling, hardware, testing equipment, temporary work platforms, and all incidentals required to construct the soil/rock nails and complete shotcrete application.~~

~~5. Measurement for progress payments will be made based on the Schedule of Values accepted and the estimated percent of Work that is satisfactorily completed under this Bid Item at the partial payment estimate cutoff.~~

~~O.~~P. Bid Item No. 14 – Concrete Demolition

1. Payment will be made at the Lump Sum Bid Price for this Bid Item.
2. Includes all labor, materials, tools, and equipment costs associated with concrete demolition designated for removal on the Drawings including, but not necessarily limited to, the existing spillway control section slab and training walls, existing spillway chute and training walls, and existing fabridam gallery.
3. Item does not include backfill for spillway underdrain tunnels, which is paid separately under Bid Item No. 24 – Spillway Underdrain Tunnels Abandonment. Bid Item does not include demolition or removal of Piezometers, which is paid

separately under Bid Item No. 15 – Piezometer Abandonment. Bid Item does not include handling, stockpiling or processing of demolished concrete that is to be used for Riprap on the downstream embankment slope of the dam embankment as shown on the Drawings, which is paid under Bid Item No. 23 – Riprap.

4. Measurement for progress payments will be made based on the Schedule of Values accepted and the estimated percent of Work that is satisfactorily completed under this Bid Item at the partial payment estimate cutoff date.

~~P.~~Q. Bid Item No. 15 – Piezometer Abandonment

1. Payment will be made at the Lump Sum Bid Price for this Bid Item.
2. Includes all labor, materials, plant, tools, and equipment costs associated with the following work:
   a. Abandonment of piezometers designated to be abandoned on the Drawings and in accordance with the provisions of Section 02495.
3. Measurement for progress payments will be made based on the Schedule of Values accepted under the estimated percent of Work that is satisfactorily completed under this Bid Item at the partial payment estimate cutoff date.

~~Q.~~R. Bid Item No. 16 - Select Fill.

1. Payment will be made at the Bid Unit Price per Cubic Yard for this Bid Item.
2. Includes all labor, plant, materials, tools, equipment costs that are required to satisfactorily place Select Fill in areas of Work that are located within the limits of Select fill shown on Drawings. Includes, but is not necessarily limited to:
   a. Place Select Fill as shown on the Drawings and as described elsewhere in the Contract Documents, including but not limited to Section 02323.
   b. Performing all operations needed to stockpile, process, furnish, haul, place, compact, and maintain the Select Fill material.
   c. Performing preparation of foundations and partially completed fill surfaces for Select Fill material.
   d. Performing temporary surcharge loading, quarantine, monitoring, and removal as described elsewhere in the Contract Documents, including but not limited to Section 02212.
3. Measurement for payment for Select Fill that is performed outside of the limits of fill grade is not included in this Bid Item.
4. No measurement for payment will be made for placement of Select Fill due to over-excavation unless over-excavation was approved and documented in writing by the Engineer.
5. No measurement for payment will be made for Select Fill that is placed before the Foundation Surface is approved by the Engineer and surveyed, per Bid Item No. 10.
6. Measurement for payment of Select Fill will be based on the computed volume placed between the top of the Select Fill surface as shown on the drawings and the surveyed approved Foundation Surface.

~~R.~~S. Bid Item No. 17 - Impervious Fill.

1. Payment will be made at the Bid Unit Price per Cubic Yard for this Bid Item.

2. Includes all labor, plant, materials, tools, equipment costs that are required to satisfactorily place Impervious Fill in areas of Work that are located within the limits of Impervious Fill shown on Drawings . Includes, but is not necessarily limited to:
    a. Performing Impervious Fill as shown on the Drawings and as described elsewhere in the Contract Documents, including but not limited to Section 02323.
    b. Performing all operations needed to stockpile, process, furnish, haul, place, compact, and maintain the Impervious Fill material.
    c. Performing preparation of foundations and partially completed fill surfaces for Impervious Fill material.
3. Measurement for payment for Impervious Fill that is performed outside of the limits of fill grade is not included in this Bid Item.
4. No measurement for payment will be made for placement of Impervious Fill due to over-excavation unless over-excavation was approved and documented in writing by the Engineer.
5. No measurement for payment will be made for Impervious Fill that is placed before the Foundation Surface is approved by the Engineer and surveyed, per Bid Item No. 10.
6. Measurement for payment of Impervious Fill will be based on the computed volume placed between the top of the Impervious Fill surface as shown on the drawings and the surveyed approved Foundation Surface.

~~S.~~T. Bid Item No. 18 – Spoil Fill.

1. Payment will be made at the Bid Unit Price per Cubic Yard for this Bid Item.
2. Includes all labor, plant, materials, tools, equipment costs that are required to satisfactorily perform Spoil Fill in areas of Work. Includes, but is not necessarily limited to:
    a. Performing Spoil Fill as shown on the Drawings and as described elsewhere in the Contract Documents, including but not limited to Section 02323.
    b. Performing all operations needed to stockpile, process, furnish, haul, place, compact, and maintain the Spoil Fill material.
3. No measurement for payment will be made for placement of Spoil Fill due to over-excavation unless over-excavation was approved and documented in writing by the Engineer.
4. Measurement for payment of Spoil Fill will be based on the computed volume placed between the top of the Spoil Area foundation surface and the surveyed approved Spoil Fill stockpile surface.

~~T.~~U. Bid Item No. 19 - Fine Drain Fill.

1. Payment will be made at the Bid Unit Price per Cubic Yard for this Bid Item.
2. Includes all labor, materials, plant, tools, and equipment costs associated with placement of Fine Drain Fill including but not limited to:
    a. Performing Fine Drain Fill placement, as shown on the Drawings and as described elsewhere in the Contract Documents, including but not limited to Section 02323.

b. Performing all operations needed to stockpile, process, furnish, haul, place, compact, and maintain the Fine Drain Fill.
c. Performing preparation of foundations and partially completed fill surfaces for Fine Drain Fill.

3. No measurement for payment will be made for placement of Fine Drain Fill due to over-excavation unless over-excavation was approved and documented in writing by the Engineer.
4. No measurement for payment will be made for Fine Drain Fill placement that is placed before the Foundation Surface is approved by the Engineer and surveyed, per Bid Item No. 10.
5. Measurement for payment of Fine Drain Fill will be based on the lines and grades for placement of Fine Drain Fill as shown on the Contract Drawings.

~~U.~~V. Bid Item No. 20 - Coarse Drain Fill.

1. Payment will be made at the Bid Unit Price per Cubic Yard for this Bid Item.
2. Includes all labor, materials, plant, tools, and equipment costs associated with placement of Coarse Drain Fill including but not limited to:
   a. Performing Coarse Drain Fill placement, as shown on the Drawings and as described elsewhere in the Contract Documents, including but not limited to Section 02323.
   b. Performing all operations needed to stockpile, process, furnish, haul, place, compact, and maintain the Coarse Drain Fill.
   c. Performing preparation of foundations and partially completed fill surfaces for Coarse Drain Fill.
3. No measurement for payment will be made for placement of Coarse Drain Fill due to over-excavation unless over-excavation was approved and documented in writing by the Engineer.
4. No measurement for payment will be made for Coarse Drain Fill placement that is placed before the Foundation Surface is approved by the Engineer and surveyed, per Bid Item No. 10.
5. Measurement for payment of Coarse Drain Fill will be based on the lines and grades for placement of Coarse Drain Fill as shown on the Contract Drawings.

~~V.~~W. Bid Item No. 21 – AASHTO No. 57 Drain Fill.

1. Payment will be made at the Bid Unit Price per Cubic Yard for this Bid Item.
2. Includes all labor, materials, plant, tools, and equipment costs associated with placement of AASHTO No. 57 including but not limited to:
   a. Performing AASHTO No. 57 placement, as shown on the Drawings and as described elsewhere in the Contract Documents, including but not limited to Section 02323.
   b. Performing all operations needed to stockpile, process, furnish, haul, place, compact, and maintain the AASHTO No. 57.
   c. Performing preparation of foundations and partially completed fill surfaces for AASHTO No. 57.

3. No measurement for payment will be made for placement of AASHTO No. 57 due to over-excavation unless over-excavation was approved and documented in writing by the Engineer.
4. No measurement for payment will be made for AASHTO No. 57 placement that is placed before the Foundation Surface is approved by the Engineer and surveyed, per Bid Item No. 10.
5. Measurement for payment of AASHTO No. 57 will be based on the lines and grades for placement of AASHTO No. 57 as shown on the Contract Drawings.

~~W.~~X. Bid Item No. 22 – Topsoil and Grading.

1. Payment will be made at the Bid Unit Price per Cubic Yard for this Bid Item.
2. Includes all labor, plant, materials, tools, and equipment costs associated with topsoil stripping the dam site, designated spoil area, contractor staging, and laydown areas and all other Contract work areas as approved by the Engineer and shown on the Drawings. Also includes stockpiling, processing, and final grading and placement of topsoil.
3. Measurement will be made according to the lines and grades as shown on the Contract Drawings for the work. Progress payments will be made based on the estimated percent of Work that is satisfactorily completed under this Bid Item at the partial payment estimate cutoff date.

~~X.~~Y. Bid Item No. 23 – Riprap

1. Payment will be made at the Bid Unit Price per Cubic Yard for this Bid Item.
2. Includes all labor, materials, plant, tools, and equipment costs required for furnishing and placing Riprap to the neat lines shown on the Drawings. Includes all labor, materials, plant, tools, and equipment costs for installation of Riprap not limited to:
   a. Upstream embankment slope;
   b. Downstream embankment slope.
3. Includes all labor, materials, plant, tools, and equipment costs required for handling, stockpiling, processing of demolished concrete for use as Riprap on the downstream embankment slope of the dam embankment as shown on the Drawings and specified in Section 02373.
4. Payment will not be made for stockpiling or placement in excess of the thicknesses or limits shown on the Drawings.
5. Measurement will be made according to the lines and grades as shown on the Contract Drawings for the work. Progress payments will be made based on the estimated percent of Work that is satisfactorily completed under this Bid Item at the partial payment estimate cutoff date.

~~Y.~~Z. Bid Item No. 24 – Spillway Underdrain Tunnel Abandonment

1. Payment will be made at the Lump Sum Bid Price for this Bid Item .
2. Includes all labor, materials, plant, tools, and equipment costs required for Spillway Underdrain Tunnel Abandonment. Includes all labor, materials, plant, tools, and equipment costs for bulkheading the spillway underdrain tunnels. Also includes abandonment of the existing toe drain outlet.

3. Measurement for progress payments will be made based on the Schedule of Values accepted and the estimated percent of Work that is satisfactorily completed under this Bid Item at the partial payment estimate cutoff date.

~~Z.~~AA. Bid Item No. 25 – Slab and Ancillary Structure Concrete

1. Payment will be made at the Bid Price per Cubic Yard for this Bid Item.
2. Includes all labor, materials, plant, tools, and equipment costs for forming, placing, curing, and protecting structural cast-in-place concrete, including but not necessarily limited to the following structures:
   a. Spillway slab;
   b. Upper spillway chute slab;
   c. Lower spillway chute slab;
   d. Spillway wall footers;
   e. Cutoff walls;
   f. Parapet walls.
3. Includes any forming system components required to achieve satisfactory placement. Includes furnishing and installing all waterstops at concrete joints as indicated on the Drawings, complete.
4. Does not include any cost related to furnishing and installing reinforcing steel, which is paid separately under Bid Item No. 28 – Reinforcing Steel.
5. Measurement for payment of this Bid Item will be based on the actual volume of structural slab and ancillary structure concrete placed to lines and grades approved by the Engineer. Contractor assumes responsibility for all costs incidental to removal of structural concrete slabs placed prior to approval, if ordered by the Engineer.

~~AA.~~BB. Bid Item No. 26 – Wall Concrete

1. Payment will be made at the Bid Price per Cubic Yard for this Bid Item.
2. Includes all labor, materials, plant, tools, and equipment costs for forming, placing, curing, and protecting structural cast-in-place concrete, including but not necessarily limited to the following structures:
   a. Labyrinth weir walls;
   b. Spillway training walls;
   c. Upper Spillway chute training walls;
   d. Lower Spillway chute training walls other than mass concrete walls.
3. Includes any forming system components required to achieve satisfactory placement. Includes furnishing and installing all waterstops at concrete joints as indicated on the Drawings, complete.
4. Does not include Mass Concrete Walls in the lower spillway chute which are paid separately under Bid Item No. 27 - Mass Concrete.
5. Does not include any cost related to furnishing and installing reinforcing steel, which is paid separately under Bid Item No. 28 – Reinforcing Steel.
6. Measurement for payment of this Bid Item will be based on the actual volume of wall concrete placed to lines and grades approved by the Engineer. Contractor assumes responsibility for all costs incidental to removal of structural wall concrete placed prior to approval, if ordered by the Engineer.

~~BB.~~CC. Bid Item No. 27 – Mass Concrete

1. Payment will be made at the Contract Unit Price per Cubic Yard for this Bid Item.
2. Includes all labor, plant, materials, tools, and equipment costs that are required to satisfactorily furnish, place, finish, cure, and test cast-in-place, mass concrete, as shown on the Drawings, as approved by the Engineer, and as required by the Specifications, complete.
3. No measurement for payment will be made for mass concrete that is placed due to over excavation unless over-excavation was requested, approved and documented in writing by the Engineer.
4. No measurement for payment will be made for mass concrete that is placed before the foundation surface is approved by the Engineer and surveyed.
5. Measurement for payment of Mass Concrete will be based on the actual volume of mass concrete placed to lines and grades approved by the Engineer. Contractor assumes responsibility for all costs incidental to removal of mass concrete placed prior to approval, if ordered by the Engineer.

~~CC.~~DD. Bid Item No. 28 – Reinforcing Steel

1. Payment will be made at the Bid Unit Price per Pound for this Bid Item.
2. Includes all labor, materials, plant, tools, and equipment costs for furnishing and installing reinforcing steel for all cast-in-place structural concrete, including but not limited to those structures described under Bid Item No. 25 – Slab and Ancillary Structure Concrete and under Bid Item No. 26 – Wall Concrete.
3. Measurement for payment of Reinforcing Steel will be based on the actual weight of reinforcing steel placed and approved by the Engineer. Contractor assumes responsibility for all costs incidental to removal of reinforcing steel placed prior to approval, if ordered by the Engineer.

~~DD.~~EE. Bid Item No. 29 – Concrete Repair

1. Bid Item 29A~~C~~: Deep Concrete Repairs:
   Payment will be made at the Contract Unit Price per Square Foot of deep concrete repairs completed in accordance with the Plans and Specifications. Measurement will be based on the field-measured extent of the prepared concrete surface prior to placement of the repair material. Areas not shown for repair on the Drawings, or areas prepared without authorization of the Engineer, will not be measured for payment but shall be repaired at no additional cost to the Owner. Payment shall include all labor, plant, materials, tools, equipment, and incidental items required to complete deep concrete repairs, including all applicable pre-production repair work, initial cleaning, pre-repair inspections, surveys, mapping, trial sections, application verification, submittals, and as-built annotations attributable to the work, as well as localized diversion of water and dewatering, scaffolding, substrate preparation, reinforcing steel work, forms, repair materials, curing, cleanup, and specified finish. Diversion of Water and Erosion and Sediment Controls are excluded and will be paid under separate Contract prices.
2. Bid Item 29B: Shallow Concrete Repairs:
   Payment will be made at the Contract Unit Price per Square Foot of shallow concrete repairs completed in accordance with the Plans and Specifications. Measurement will be based on the field-measured extent of the prepared concrete

surface prior to placement of the repair material. Areas not shown for repair on the Drawings, or areas prepared without authorization of the Engineer, will not be measured for payment but shall be repaired at no additional cost to the Owner. Payment shall include all labor, plant, materials, tools, equipment, and incidental items required to complete shallow concrete repairs, including all applicable pre-production repair work, initial cleaning, pre-repair inspections, surveys, mapping, trial sections, application verification, submittals, and as-built annotations attributable to the work, as well as localized diversion of water and dewatering, scaffolding, substrate preparation, reinforcing steel work where required, forms where required, repair materials, curing, cleanup, and specified finish. Diversion of Water and Erosion and Sediment Controls are excluded and will be paid under separate Contract prices.

3. Bid Item 29C: Weep Hole Cleanout Repairs:
   Payment will be made at the Contract Unit Price per Each weep hole cleanout repair completed in accordance with the Plans and Specifications. Measurement will be based on the number of weep holes cleaned and repaired as accepted by the Engineer. Payment shall include all labor, plant, materials, tools, equipment, and incidental items required to complete the work, including all applicable pre-production repair work, initial cleaning, pre-repair inspections, surveys, mapping, trial sections, application verification, submittals, and as-built annotations attributable to the work, as well as removal of debris and vegetation from plugged weep holes to the full depth of the hole, localized dewatering, cleanup, and all appurtenant work necessary for a complete repair. Diversion of Water and Erosion and Sediment Controls are excluded and will be paid under separate Contract prices.
4. Bid Item 29D: Concrete Crack Repairs:
   Payment will be made at the Contract Unit Price per Linear Foot of concrete crack repairs completed in accordance with the Plans and Specifications. Measurement will be based on the field-measured extent along the alignment of the crack prior to injection, sealing, or other repair treatment. Cracks not shown for repair on the Drawings, or cracks prepared without authorization of the Engineer, will not be measured for payment but shall be repaired at no additional cost to the Owner. Payment shall include all labor, plant, materials, tools, equipment, and incidental items required to complete concrete crack repairs, including all applicable pre-production repair work, initial cleaning, pre-repair inspections, surveys, mapping, trial sections, application verification, submittals, and as-built annotations attributable to the work, as well as crack preparation, drilling, port installation, sealing, injection materials, curing where applicable, cleanup, and all appurtenant work necessary for a complete repair. Diversion of Water and Erosion and Sediment Controls are excluded and will be paid under separate Contract prices.

~~2. Payment will be made at the Bid Unit Price per Square Foot for this Bid Item.~~

~~3. Includes all labor, materials, plant, tools, and equipment costs required for repairing concrete as shown on the Drawings and as described in Section 03920. Includes all labor, materials, plant, tools, and equipment costs for repair of concrete not limited to the existing Plunge Pool walls, slab, and ogee crest as directed by Engineer.~~

~~4. Payment will not be made for repairs in excess of the limits directed by the Engineer.~~

~~5. Measurement for progress payments will be made based on computed area that is satisfactorily repaired under this Bid Item.~~

~~EE.~~FF. Bid Item No. 30 – 6-inch PVC Drain Pipe and Cleanouts

1. Payment will be made at the Bid Unit Price per Linear Feet for this Bid Item.
2. Includes all labor, materials, plant, tools, and equipment costs related to spillway drain pipes and cleanouts including:
   a. PVC perforated and solid drain piping and fittings.
   b. Weir plate.
   c. Animal guards.
   d. Check valves.
   e. Cleanouts.
   f. Any other Work that may be required for furnishing and installing PVC drain pipe and fittings that is not specifically included in another Bid Item.
3. Item does not include excavation for required spillway drains which are paid separately under Bid Item No. 10 – Common Excavation based on the classification of excavated material. Item does not include placement of fill including AASHTO No. 57 drain fill, coarse drain fill, fine drain fill, and approved fill, etc., which are paid separately under Bid Item No. 21 – AASHTO No. 57 Drain Fill, Bid Item No. 19 – Fine Drain Fill, Bid Item No. 20 – Coarse Drain Fill, and Bid Item 16 – Select Fill.
4. Measurement for payment will be based on length of PVC Drain Pipe installed in accordance with the Drawings and approved by Engineer. No measurement for payment will be made for excess PVC Drain Pipe installed for the convenience of the Contractor beyond the limits shown on the Drawings unless approved in advance by the Engineer in writing.

~~FF.~~GG. Bid Item No. 31 – Toe Drain Pipe and Cleanouts

1. Payment will be made at the Bid Unit Price per Linear Feet for this Bid Item.
2. Includes all labor, materials, plant, tools, and equipment costs related to drain pipes and cleanouts including:
   a. HDPE perforated and solid drain piping and fittings.
   b. Animal guards.
   c. Check valves.
   d. Cleanouts.
   e. Any other Work that may be required for furnishing and installing Toe Drain Pipe and fittings that is not specifically included in another Bid Item.
3. Item does not include excavation for required toe drains or weir boxes, which are paid separately under Bid Item No. 10 – Common Excavation based on the classification of excavated material. Item does not include placement of fill including AASHTO No. 57 drain fill, coarse drain fill, fine drain fill, and approved fill, etc., which are paid separately under Bid Item No. 21 – AASHTO No. 57 Drain Fill, Bid Item No. 19 – Fine Drain Fill, Bid Item No. 20 – Coarse Drain Fill, and Bid Item 16 – Select Fill.

4. Does not include reinforcing steel or structural concrete for Toe Drain Junction Box and Weir Box which is paid for separately under Bid Item No. 32 – Prefabricated Junction Box and Toe Drain Weir Box.
5. Measurement for payment will be based on length of Toe Drain Pipe installed in accordance with the Drawings and approved by Engineer. No measurement for payment will be made for excess Toe Drain Pipe installed for the convenience of the Contractor beyond the limits shown on the Drawings unless approved in advance by the Engineer in writing.

~~GG.~~HH. Bid Item No. 32 – Prefabricated Junction Box and Toe Drain Weir Box

1. Payment will be made at the Lump Sum Bid Price for this Bid Item.
2. Includes all labor, materials, plant, tools, and equipment costs that are required to satisfactorily furnish and install:
   a. Prefabricated Junction Box
   b. Toe Drain Weir Box.
3. Includes but is not necessarily limited to precast or cast-in-place concrete components and steel reinforcement, frames and covers, locking devices, wall pipe, pipe and connections, stainless steel weir and baffle plates, staff gages, adhesive anchors, manhole steps, drilling and cutting concrete, sealants, assembly, and installation. Excavation, Backfill, E&S Control measures, seeding, and electronic instrumentation for monitoring water levels in the weir box will be paid for under separate Bid Items.
4. Measurement for progress payments will be made based on the Schedule of Values accepted and the estimated percent of Work that is satisfactorily completed under this Bid Item at the partial payment estimate cutoff date.

~~HH.~~II. Bid Item No. 33 – Geotextile

1. Payment will be made at the Bid Unit Price per Square Yard for this Bid Item.
2. Includes all labor, materials, plant, tools, and equipment costs required for furnishing and placing Geotextile to the neat lines shown on the Drawings. Includes all labor, materials, plant, tools, and equipment costs for installation of geotextile not limited to:
   a. Upstream embankment slope;
   b. Downstream embankment slope.
3. Payment will not be made for placement in excess of the limits shown on the Drawings.
4. Measurement for progress payments will be made based on the Schedule of Values accepted and the estimated percent of Work that is satisfactorily completed under this Bid Item at the partial payment estimate cutoff date.

~~II.~~JJ. Bid Item No. 34 - Contractor Exploration Borings

1. Payment will be made at the Lump Sum Price for this Bid Item.
2. Includes all labor, plant, materials, tools, and equipment costs that are required to satisfactorily perform the Contractor Exploration Borings, complete, including:
   a. Drilling exploratory borings at locations shown on the Drawings and as described in Section 02210.

3. Measurement for progress payments will be made based on the Schedule of Values accepted and the estimated percent of Work that is satisfactorily completed under this Bid Item at the partial payment estimate cutoff date.

~~JJ.~~KK. Bid Item No. 35 – Instrumentation

1. Payment will be made at the Lump Sum Bid Price for this Bid Item.
2. Includes all labor, materials, plant, tools, and equipment costs for furnishing and installing instrumentation and control features shown on the Drawing and described in the Specifications, including:
   a. Permanent piezometer installations.
   b. Installation of buried PVC pipe and protective enclosures for weir box and/or piezometer data loggers.
   c. Installation of new vibrating wire instrumentation in piezometers and weir box per Section 02495 and as indicated on the Drawings.
   d. Any other Work that may be required for furnishing and installing instrumentation and control features that is not specifically included in another Bid Item.
3. Item does not include:
   a. Abandonment of existing piezometers which is paid for in Bid Item 15.
4. Measurement for progress payments will be made based on the Schedule of Values accepted and the estimated percent of Work that is satisfactorily completed under this Bid Item at the partial payment estimate cutoff date.

~~KK.~~LL. Bid Item No. 36 – Miscellaneous Items.

1. Payment will be made at the Lump Sum Bid Price for this Bid Item.
2. Includes all labor, plant, materials, tools, and equipment costs that are required to satisfactorily perform the following Work, complete:
   a. Furnish and install fencing and access gates as shown on the Drawings and as described elsewhere in the Contract Documents, including but not limited to Section 02821.
   b. Furnish and install debris boom and associated anchorage as shown on the Drawings and as described in Section 02390.
3. Measurement for progress payments will be made based on the Schedule of Values accepted and the estimated percent of Work that is satisfactorily completed under this Bid Item at the partial payment estimate cutoff date

~~LL.~~MM. Bid Item No. 37 – Project Closeout & Record Documents.

1. Payment will be made at the Lump Sum Bid Price for this Bid Item.
2. Includes all labor, materials, and cost related to the Bid Item.
3. Payment, Complete. Bid Item will be paid to Contractor at completion of project.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01330

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: General procedures and requirements for submittals.

B. Related Sections: 01320, 01330, 01410, 01450, 01455, 01550, 01722, 01730, 02222, 02240, 02260, 02270, 02322, 02323, 02370, 02373, 02390, 02495, 02625, 02680, 02821, 02834, 02921, 03100, 03200, 03300, 03600, 03920, 05500, 09900

1.02 DEFINITIONS

A. The term shop drawing used throughout this Section and the Contract Documents includes manufacturer's product data, shop drawings, samples and certificates.
   1. Product Data: Manufacturer's descriptive literature, product specifications, performance and capacity rating schedules, published details, and installation instructions.
   2. Shop Drawings: Contractor or manufacturer prepared, completely dimensioned and annotated detail drawings of the products presented.
      a. Shop drawings shall also include Contractor prepared layout and setting drawings as necessary to illustrate the assembly of various elements of the Work.
   3. Samples: Contractor or manufacturer prepared and delivered physical samples as requested in the various Specifications Sections.
   4. Certificates: Contractor or manufacturer prepared written documents certifying product compliance with the Contract Documents, Specifications and Drawings. The written documents shall include test records or reports, and such other types of certificates as required by the Specifications.

1.03 SUBMISSIONS REQUIRED

A. General: Descriptions under Submittals Article in each Specifications Section indicates type of submission required.

B. Submittals List: The submittals list on the following table is provided only as a convenience to the Contractor. Its accuracy is not guaranteed. The Contractor is responsible for carefully reading the Design Report, Specifications, and Drawings to determine complete submittal requirements.

SPECIFICATION SECTION OR DRAWING	ARTICLE OR OTHER REFERENCE	DESCRIPTION	NO. OF COPIES REQUIRED (MIN.)	SUBMISSION DUE
01320	1.03.A.	Construction Progress Schedule	6	Within 30 days after Notice to Proceed
01320	1.03C	Project Planner Generated Back-up File	1	Within 30 days after Notice to Proceed
01320	1.03.D.,E., and F.	Complete CPM Network Diagram	8	Within 60 days after issuance of the Notice to Proceed
01320	1.03H	Periodic Status Updates from CPM Schedule	6	Every 3 Months
01320	1.04	Look-Ahead Schedule Update	3	Every 3 Weeks
01320	1.05	Construction Progress Photos	Varies	Twice per Month
01330	1.04.A	Submittal Schedule	6	Within 30 Days after issuance of Notice to Proceed
01330	1.07.A	Manufacturer's Standard Specifications	6	Within 30 Days after Notice to Proceed
01410	1.03.B	Endangered Species Act Codes, Rules, Permits, and Fees	6	Prior to start of site work
01410	1.03.C.1	Start of Construction		14 Days Prior to Occurrence
01410	1.03.C.2	Notice for Inspection(s)		10 Days Prior to Occurrence
01410	1.03.C.3	Notice of Substantial Completion		14 Days Prior to Occurrence
01410	1.03.C.4	Notice of Final Inspection(s)		15 Days Prior to Occurrence
01410	1.03.C.5	Notice of Start of Filling of Reservoir		10 Days Prior to Occurrence
01410	1.09.A	Safety Program	6	Prior to start of site work
01450	1.03.A	Certified Test Reports	6	Prior to delivery of material
01450	1.03.B	Certificate of Compliance	6	Prior to delivery of material
01450	1.04	Contractor Quality Assurance Plan	6	Prior to structure completion
01455	1.03.D	Special Inspector Request for Approval	6	Prior to work

SPECIFICATION SECTION OR DRAWING	ARTICLE OR OTHER REFERENCE	DESCRIPTION	NO. OF COPIES REQUIRED (MIN.)	SUBMISSION DUE
01550	1.03.A	Pre-Construction Videotape Survey	6	Prior to work
01550	1.03.B	Site Management Organization Plan	6	Prior to work
01550	1.03.C	Roadway Stabilization Material Certifications	6	Prior to work
01550	1.03.D	$CaCl_2$ Surface Treatment Method (if applicable)	6	Prior to work
01722	1.04.A	Photo documentation of Preconstruction Condition	6	Prior to work
01730	1.02.A	Operation and Maintenance Manual	6	8 weeks Prior to Start of First Filling
02222	1.04.A	Demolition Plan	6	45 days prior to demolition work
02222	1.04B	Piezometer abandonment Contractor's qualifications	6	45 days prior to abandonment work
02222	1.04C	Closeout Submittals	6	Within 60 days after completion of demolition.
02240	1.03.A	Dewatering Plan	6	Within 30 calendar days prior to construction activity
02240	1.03.B	Emergency Operations Plan	6	Within 30 calendar days prior to construction activity
02240	1.03.C	Drilling and Well Construction Logs (if applicable)	6	Within 7 calendar days of completion of drilling
02260	1.03.A	Qualifications Data	6	Prior to work
02260	1.03.B	Design Data	4	Prior to work
02260	1.03.C	Certification Data	6	Prior to work
02270	1.03.A	Pre Construction Submittals	6	30 calendar prior to work
02270	1.03.B	Certified Mill Test Results for Soil Nail Bars and Couplers	6	Upon delivery of soils nails to project site
02270	1.03.C	Testing Submittals	6	3 working days after testing complete
02322	1.03A	Demonstration Documentation	6	Prior to work

SPECIFICATION SECTION OR DRAWING	ARTICLE OR OTHER REFERENCE	DESCRIPTION	NO. OF COPIES REQUIRED (MIN.)	SUBMISSION DUE
02322	1.03.B	Plan of Excavation	6	Draft prior to pre-con meeting. Final within 14 calendar days after Notice to Proceed
02322	1.03.C	Hand-Placed Rock Movement Monitoring Plan	6	Prior to large-scale excavation of embankment
02323	1.04.A	Plan of Operations	6	Prior to work
02323	1.04.B	Certificate of Compliance		Prior to work
02323	1.04.C	Independent Testing Lab Qualifications		Prior to work
02323	1.04.D	Quality Control Sampling and Testing Reports	6	Prior to work
02323	1.04.E	CLSM Manufacturer Certification	6	Prior to work
02370	1.03.A	Material Manufacturer's Certificates	6	Prior to work
02370	1.03.B	E&S Plan for Off-Site Spoil Area	6	Prior to work
02373	1.03.A	Source of Materials	6	Within 15 days of Notice to Proceed
02373	1.03B	Rock Samples	6	Prior to work
02373	1.03.C	Certificates of Compliance	6	Prior to work
02373	1.04.D	Geotextile Product Data	6	Prior to work
02390	1.04.A	Debris Boom Shop Drawings	6	Prior to fabrication
02390	1.04.A	Certificates of Compliance	6	Prior to fabrication
02495	1.03.A	Piezometer Driller Qualifications	6	With Bid
02495	1.03.B	Shop Drawings and Product Data	6	Prior to work
02495	1.03.C	Data Sheets	6	1 week after installation of Piezometer
02625	1.03.A	Shop Drawings and Product Data	6	Prior to work
02625	1.03.B	Certificates	6	Prior to work
02680	1.05.A	Diversion of Water Plan	6	45 days prior to start of work that requires diversion of water activities.
02680	1.05.B	Contractors Diversion of Water Plan Sealed by Hawai'i Professional Engineer	6	Prior to work

SPECIFICATION SECTION OR DRAWING	ARTICLE OR OTHER REFERENCE	DESCRIPTION	NO. OF COPIES REQUIRED (MIN.)	SUBMISSION DUE
02680	1.05.C	Plan Revisions if Necessary	6	Prior to work
02821	1.04.A	Shop Drawings and Product Data	6	Prior to work
02821	1.04.B	Certificates	6	Prior to work
02821	1.04.C	Samples	6	Prior to work
02834	1.03.A.1	Nozzle Operator Qualifications	6	14 Days Prior to work
02834	1.03.A.2	Compliance and Mill Test Reports	6	14 Days Prior to work
02834	1.03.A.3	Working Plan & Construction Sequence	6	14 Days Prior to work
02834	1.03.A.4	Final Shotcrete Mix Design	6	14 Days Prior to work
02921	1.03.A	Soil Analysis Test Reports	6	Prior to work
02921	1.03.B	Soil Supplement Product Certification	6	Prior to work
02921	1.03C	Seed Mixture	6	Prior to work
02921	1.03.D	Seed Certification	6	Prior to work
03100	1.03.A	Form Coating Product Data, Specification and Certification	6	Prior to work
03100	1.03 B	Form Ties Product Data, Specification and Two Samples	6	Prior to work
03200	1.03 A.1.	Shop Drawings for Concrete Reinforcement	6	Prior to work
03200	1.03 A.2	Drawings Showing All Fabrication Dimensions and Locations for Placing Reinforcement and Bar Supports	6	Prior to work
03200	1.03.B	Test Reports & Requirements	6	Prior to work
03300	1.03.A	Product Data for Cast-in-Place Concrete Accessories	6	Prior to work
03300	1.03.B	Samples of Materials	6	As requested
03300	1.03.C	Aggregate Testing Reports for AAR	6	Prior to production of concrete
03300	1.03.D	Design Mix for Concrete	6	Prior to production of concrete
03300	1.03.E	Test Reports for Concrete	6	Following testing
03300	1.03.F	Certificates for Concrete	6	Prior to delivery
03300	1.03.G	Delivery Tickets	6	Upon request

SPECIFICATION SECTION OR DRAWING	ARTICLE OR OTHER REFERENCE	DESCRIPTION	NO. OF COPIES REQUIRED (MIN.)	SUBMISSION DUE
03300	1.03.H	Schedule for Placing Concrete	6	A minimum of 25 days prior to placing concrete
03300	1.03.I	Testing Laboratory and Qualifications	6	Prior to testing
03300	1.03.J	Contractor's Personnel Qualifications	6	Prior to work
03300	1.03.K	Air Testing Equipment Certificate	6	Prior to work
03300	1.03.L	Approved ICC Evaluation Reports	6	Prior to work
03300	1.03.M.1	Employees' Names and Proposed Schedule for Waterstops	6	Prior to work
03300	1.03.M.2	Waterstop Manufacturer Shop Drawings	6	Prior to start of manufacturing
03300	1.03.M.3	Two 12-inch Long Samples for Each Waterstop Product and Hardware Samples	1	Prior to work
03300	1.03.M.4	Single Sample of Each Factory Fabrication	1	Prior to work
03300	1.03.M.5	Singe 12-inch Long Sample of Acceptable Field Butt Weld	1	Prior to work
03300	1.03.M.6	Waterstop Deficiency Remediation Plan	6	If required
03600	1.03.A	Product Data	6	Prior to work
03600	1.03.B.1	Quality Assurance and Control Submittals		Prior to production of grout
03600	1.03.B.2	Testing Agency		Prior to testing
03920	1.03.A	Product Data		Prior to material placement / approval by Engineer
03920	1.03.B	Samples		When requested by Engineer
03920	1.03.C.1	Manufacturer Qualifications		Prior to work
03920	1.03.C.2.a	Approved Equal Certification		With approved-equal request
03920	1.03.C.2.b	Approved Equal Product Data		With approved-equal request
03920	1.03.D.1	Contractor Qualifications		Within 2 weeks of Notice of Award
03920	1.03.D.2	Project References		Within 2 weeks of Notice of Award

SPECIFICATION SECTION OR DRAWING	ARTICLE OR OTHER REFERENCE	DESCRIPTION	NO. OF COPIES REQUIRED (MIN.)	SUBMISSION DUE
03920	1.03.E	Repair Work Schedule		Within 30 calendar days after Notice to Proceed
03920	1.03.F	Mapping of Repairs	1	Within 30 calendar days after completion of Advance Supplemental Field Survey
03920	1.03.G	Schedule of Repairs		Within 30 calendar days after completion of Advance Supplemental Field Survey
03920	1.03.H	Trial Section Report	1	Within 7 calendar days after completion of Trial Sections
03920	1.03.I	As-Built Repair Drawings	5	Two weeks after completion of work
03920	1.03.J	Manufacturer Certification		Two weeks after completion of work
03920	1.03.K	Installation Certification		Two weeks after completion of work
05500	1.04.A	Shop Drawings	6	Prior to work
05500	1.04.B	Product Data	6	Prior to work
05500	1.04.C	Mill Test Results	6	Prior to work
09900	1.05.B	Product Data	6	Prior to work
09900	1.05.C	Quality Assurance/Control	6	Prior to work
09900	1.05.D	Closeout Submittals		After completion of work

1.04 SCHEDULE OF SUBMITTALS AND MATERIALS LIST

A. Schedule of Submittals: Submit a progress schedule of submittals to the Engineer for approval Indicate in such schedule the proposed dates of submissions and the quantity for the various types of Work. Arrange submission dates in the proper sequence of the importance of the Work to the progress of construction.

1.05 CONSTRUCTION PROGRESS SCHEDULE

A. Provide Critical Path Method Construction Schedule in accordance with Section 01320.

1.06 SUBMITTAL PROCEDURES

A. Comply with the following or resubmission will be required:

1. Indicate contract number and specification section on each item submitted.
    a. Number each Shop Drawing using specification section numbers followed by 1.0, 2.0, 3.0, etc. for each submittal within a Section. Resubmittals must include .1, .2, .3, etc. in addition. For example, if the fifth item submitted in Section 03300 is returned for correction three times, the next resubmittal number will be 03300-5.3.
    b. Product identification.
    c. Shop Drawing title, product, drawing number, revision number, date of drawing and revision.
    d. Applicable Contract Drawings and specification section numbers.
    e. Subcontractor's, vendor's, and/or manufacturer's name, address and phone number.
    f. Contractor's certification statement.
2. Signify approval by stamp, initialing and dating each item prior to submission to the Engineer.
3. Catalog Data: Furnish each separate catalog, brochure, or single page submitted with identification required above.
    a. Catalogs or brochures submitted containing multiple items for approval need identification only on exterior. In this instance, identification to include page and catalog item numbers.
4. Space: Provide vacant space approximately 3 inches high by 4 inches wide adjacent to identification data to receive Engineer's status stamp.

B. Contractor's Responsibility:
1. Affix following signed Certification Statement to each Shop Drawing, working drawing, sample and catalog data submitted:
    a. Certification Statement: **By this submittal, I hereby represent that I have determined and verified field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with Contract Drawings, Specifications, other applicable approved Shop Drawings and Contract requirements.**
2. Review and approval of Shop Drawings, Samples, or Catalog Data by Engineer will not relieve responsibility with regard to fulfillment of terms of Contract. Assume risk of error and omission with no responsibility by Engineer.
3. No portion of work requiring a Shop Drawing, working drawing, sample, or catalog data allowed to be started nor materials be fabricated or installed prior to approval or qualified approval of item. Fabrication performed, materials purchased or on site construction accomplished that does not conform to approved Shop Drawings and data is at Contractor's risk. Owner will not be liable for expense or delay due to corrections or remedies required to accomplish conformity.
4. Project work, materials, fabrication, and installation to conform with approved Shop Drawings, working Drawings, applicable Samples, and Catalog Data.

C. Items requiring testing shall be forwarded directly to the approved laboratory. The Contractor shall pay all costs associated with testing.

D. Expedite critical materials, equipment and shop drawings, and other required submissions.

E. Incomplete submissions will be returned for resubmission.

F. Use of substitutions for materials or details shown on the contract drawings or called for in these specifications requires written approval from the Engineer.

G. After review by the Engineer, shop drawings will be returned marked either as Approved, Approved with Changes Noted, Returned for Correction or Not Approved.
   1. Approved: When shop drawings are returned "Approved", that means the shop drawings have been found to be in conformance with the Contract Documents. The Engineer's approval of the shop drawings does not relieve the Contractor from responsibility for errors or discrepancies in such shop drawings.
   2. Approved with Changes Noted: When shop drawings are returned "Approved With Changes Noted" that means the shop drawings have been found to be in conformance with the Contract Documents, provided the changes noted by the Engineer are incorporated in the shop drawings. Shop drawings returned "Approved With Changes Noted" will require resubmission with incorporated changes in accordance with Article 1.06, Paragraphs A. and B. Fabrication may proceed if the changes are incorporated.
   3. Returned For Correction: When shop drawings are returned noted "Returned For Correction" that means the Contractor shall make the required corrections and resubmit corrected shop drawings to the Engineer in accordance with Article 1.06, Paragraphs A. and B. No fabrication shall take place.
   4. Rejected: When shop drawings are returned "Rejected" that means the Contractor shall make completely new shop drawings and submit in accordance with Article 1.06, Paragraphs A. and B.

H. Substitutions or Contractor Design Items:
   1. Have working drawings and calculations certified by a Professional Engineer registered in the State of Hawai‘i accompanied by calculations or other sufficient information to completely explain proposed method of construction, including but not limited to type of machinery and method proposed. Submit design calculations with working drawings.
   2. Review and approval of working drawings by Engineer does not relieve Contractor’s responsibility with regard to fulfillment of terms of Contract. Contractor to assume risk of error, with no responsibility by Engineer.

1.07 PRODUCT DATA

A. Manufacturer's printed directions and manufacturer's standard specifications showing all dimensions, cuts, finishes, etc., as well as catalog cuts and ratings of all material will be required and shall be submitted in advance prior to application and/or installation.

1.08 TESTS

A. Submit required reports listing items tested, tests conducted and results obtained as specified.

1.09 CERTIFICATIONS

A. Submit required certifications in written form identifying authorized representative, manufacturer, systems designer and other required data as specified.

1.10 WARRANTIES

A. Refer to Specifications for required warranties. Copies of proposed warranties specified for products shall accompany the designated submittal of that product.

1.11 OPERATION AND MAINTENANCE MANUALS

A. Manual Format (Use 3-ring binder):
    1. Title page with the following information for each system covered:
        a. Project Title and Contract Number (in capital letters)
        b. Name of Company
        c. Name of the individual to be called
        d. Normal telephone numbers
        e. Contractor's account number for project
    2. Index listing all sections of the Manual.
    3. Warranties for equipment furnished in contract (Index tabbed).
    4. Complete system circuit diagrams, block diagrams, copies of all approved shop drawings, which shall clearly illustrate how all the components relate and how they are interconnected and a point wiring diagram.
    5. Reports, testing analysis.
    6. Operating instructions and maintenance instructions for all equipment and finish materials furnished.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SHOP DRAWING STAMP FORMAT

ABC Contractors, Inc.
Wahiawā, HI

Project: Contract No.
Project:
Job No.:

Owner: _____

Submittal No.:_____
Product:_____

Mfg. By:_____

Ref. Dwg/Spec:_____

"Certification Statement: By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with the Contract Drawings, Specifications, other applicable approved Shop Drawings and Contract requirements."

Contractors Review

[ ] Approved [ ] Approved with Changes Noted

By_____ Date

SECTION 02270

SOIL AND ROCK NAIL STABILIZATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Provisions for construction of a soil/rock nail temporary excavation support system as required for construction as shown in the Drawings.
   1. The Contractor shall furnish all labor, materials and equipment required to construct the soil/rock nail excavation support system in accordance with this specification and the Drawings.
   2. The soil/rock nails and shotcrete face shall be installed in stages, from the top down. Drilling equipment and machinery will not be permitted on or near the top of the soil nail support system during construction, unless approved by the Engineer.
   3. It is expected that most of the soil nails will be installed in highly weathered basalt (classified by USCS as CH or MH). However, it is possible that drill holes in the lower rows will penetrate less weathered rock based on the available subsurface information. Bedrock in the area of the soil nails was described as decomposed to moderately weathered basalt. Historic subsurface exploration information is available to the Contractor upon request to the Owner.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM).
   1. A36/A36M Standard Specification for Carbon Structural Steel
   2. A615/A615M Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
   3. C33 Standard Specification for Concrete Aggregates
   4. C109 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
   5. C150 Standard Specification for Portland Cement
   6. C494 Standard Specification for Chemical Admixtures for Concrete
   7. A1007 Standard Specification for Carbon Steel Wire for Wire Rope

B. American Association of State Highway and Transportation Officials (AASHTO)
   1. M291 Standard Specification for Carbon and Alloy Steel Nuts

C. Federal Highway Administration (FHWA)
   1. Soil Nail Walls Reference Manual (FHWA-NHI-14-007). February 2015.

D. State of Hawai‘i Department of Transportation
   1. Standard Specifications for Road and Bridge Constructions, 2005.

1.03 SUBMITTALS

A. Pre-Construction Submittals: Submit for approval the following documentation to the Engineer at least thirty (30) calendar days prior to the start of the soil nail installation:
   1. Shop drawings: Submit drawings indicating proposed layout and installation sequence of soil nails on this layout. Indicate dimensioned locations of soil nails, each soil nail identification, and its installation sequence number. Include verification test and proof test nail locations in accordance with the Drawings.
   2. Work Plan: Submit a detailed work plan describing the tools, methods of drilling and excavation to be performed, construction sequencing including proposed verification test locations, proof testing, and schedule. Work shall not begin until the work plan has been approved by the Engineer. Work Plan must also include the following:
      a. A list of equipment to be used and a plan describing the control/disposal of surface water, drill flush, and excess waste grout.
      b. Descriptions of methods of advancing drill holes.
      c. A step-by-step description of the proposed soil nail construction procedure, including personnel, testing, and equipment to assure quality control.
      d. Grouting methods, grouting equipment, and equipment for accurately monitoring and recording the grout depth, volume, and pressure as grout is placed.
      e. Procedure and equipment for Contractor monitoring of grout quality.
   3. Nail Grout Mix Design: The submittal shall include:
      a. Brand and type of Portland cement.
      b. Source, gradation, and quality of all aggregates, if used.
      c. Proportions of mix by weight and water-cement ratio.
      d. Manufacturer and brand name of all admixtures (where allowed).
      e. Name and AMRL certification of independent laboratory performing grout strength testing.
      f. Compressive strength results (per AASHTO T106/ASTM C109) verifying the required minimum 3-day and 28-day grout compressive strengths. Previous test results for an identical grout mix and materials completed within one year of the start of work may be submitted for verification of the required compressive strengths.
   4. Soil Nail Testing Methods and Equipment: The submittal shall include:
      a. Details of the jacking frame and appurtenant bracing
      b. Details showing methods of grouting the unbonded length of soil nails after completion of testing
      c. Equipment list
   5. Identification number and certified calibration records for each test jack and pressure gauge and load cell to be used to calibrate. Calibration records must include the date tested, device identification number and calibration test results, and must be certified for accuracy of at least two (2) percent of the applied certification loads by a qualified independent testing laboratory within ninety (90) days prior to submittal.

6. Manufacturer Certificates of Compliance for the soil nails test nails, bar couplers, wire mesh and geosynthetic facing materials, soil nail centralizers, bearing plates, and nuts.

B. Upon delivery of soil nails to the project site, provide certified mill test results for soil nail bars and couplers from each heat specifying the ultimate strength, yield strength, elongation, and composition.

C. Testing Submittals:
   1. Provide graphs of Verification and Proof test nails plotting deflection against load to the Engineer within three (3) working days after testing has been completed. Plots for each soil nail must include as a minimum for each load where deflection is to be measured:
      a. 80% of the theoretical elastic elongation of the unbonded length of the nail.
      b. Nail deflection as measured in the field.
      c. Creep test plots versus time for each load increment where creep testing is performed.

PART 2 PRODUCTS

2.01 MATERIALS

A. Furnish materials for construction of soil nails and wire mesh and geosynthetic facing that are new and without defects. Contractor is to remove defective materials from the job site at no additional cost to the Owner.
   1. Production Nails (Various Lengths): Threaded steel bar #8, 1.0-inch minimum diameter (1.125-inch minimum diameter with threads), grade 75 in accordance with ASTM A615, continuous without splices or welds, new, straight, and undamaged. If threads are cut into a reinforcing bar, use the next larger bar number designation at no additional expense to the Owner. The quantity and length of production nails are shown on the Contract Drawings.
   2. Test Nails: Threaded steel bar #8, 1.0-inch minimum diameter (1.125-inch minimum diameter with threads), grade 75 in accordance with ASTM A615, continuous without splices or welds, new, straight, and undamaged. If threads are cut into a reinforcing bar, use the next larger bar number designation at no additional expense to the Owner. Test nails must have a minimum 3-foot-long unbonded length below the bearing plate.
   3. Bar Couplers: Bar couplers must develop the full ultimate tensile strength of the bar (79 kips) as certified by the manufacturer.
   4. Wire Mesh and Shotcrete Facing: See Section 02834.
      a. High Tensile Steel Wire Mesh Facing consisting of Brugg TECCO® G65/3 Mesh or equivalent as determined by the Engineer.
   5. Geotextile Facing: HDOT Section 716.02 (Geotextiles for Permeable Separator Applications).
   6. Bearing/Spike Plates: Bearing/spikes consisting of Brugg P33 System Spike Plate or equivalent. Equivalent bearing/spike plates shall be compatible and produced

by the same manufacturer as the high tensile steel wire mesh facing approved by the Engineer.

7. Nuts and Washers: AASHTO M291, Grade B, galvanized or epoxy coated. For soil nails not perpendicular to the connection plate, provide heavy hex nuts with spherical seats or flat heavy hex nuts with spherical washers.
8. Connection Clips: Brugg T3 connections clips, 0.16-inch (4 mm) diameter, high tensile steel wire with a minimum ultimate tensile strength of 4,900 lbs. in accordance with ASTM A1007. Equivalent connection clips may be used as long as they are compatible with the approved high tensile steel wire mesh facing.
9. Boundary Ropes: Brugg boundary ropes, galvanized steel flexible wire rope, 0.5-inch diameter, 6x19 construction with a minimum breaking strength of 23,940 pounds, or equivalent that is compatible with approved high tensile steel wire mesh facing.
10. Spiral Wire Rope Anchors: Brugg galvanized double leg wire rope cable anchor with 0.75-inch diameter with 6x19 construction with a minimum breaking strength of 52,920 pounds. Equivalent material may be used as long as it is compatible with the approved high tensile steel wire mesh facing.
11. Centralizers: Schedule 40 PVC, steel or other material not detrimental to the nail steel (do not use wood); securely attached to the nail bar; sized to position the nail bar within 1 inch of the center of the drillhole; sized to allow grout tube insertion to the bottom of the drillhole, and sized to allow grout to freely flow up the drillhole during installation.
12. Nail Grout: Provide a neat or sand/cement mixture grout with a minimum 3-day compressive strength of 1,700 psi and a minimum 28-day compressive strength of 4,000 psi per AASHTO T106.
    a. Cement. AASHTO M85/ASTM C150, Type I/II.
    b. Fine Aggregate. Clean, natural sand meeting the requirements of Fine Aggregate per AASHTO M6/ASTM C33.
    c. Admixtures. AASHTO M194/ASTM C494. Provide admixtures which control bleed, improve flowability, reduce water content and retard set in the grout only when accepted by the Engineer. Do not use accelerators or expansive admixtures. Provide admixtures compatible with the grout and mixed in accordance with the manufacturer's recommendations.
13. Strip Drains: Use 12-inch wide TerraDrain® Strip 960 or approved equal.

B. Material Handling and Storage: Store all soil nails on supports to keep the steel from contact with the ground. Carefully handle soil nails during unloading and storing. Carry, do not drag, nails to the hole prior to installation. Do not ground welding leads to the nail steel. Nail steel must be protected from and free of dirt, rust, and other deleterious substances prior to installation. Damaged nails unsuitable for installation, as determined by the Engineer, must be replaced at the Contractor’s expense.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. Verification Testing. Perform a minimum of one successful verification test on a sacrificial test nail prior to initiating the installation of the production nails to demonstrate the adequacy of the Contractor's construction procedures and design. Install the verification nail with a bond length of ten feet (10') and unbonded length of eight feet (8'). Perform the verification testing in accordance with the provisions of Article 3.02.A. Equipment, materials, and procedures must mimic those for the production soil nails. Prior to beginning the temporary excavation slope, install one verification test nail at a location approved by the Engineer as described on the Drawings. The test nail must have a minimum unbonded length of three feet (3'). After testing, destress the soil nail and place grout to ground surface. Submit testing results to the Engineer for review and approval prior to proceeding with production nails. A verification test nail may not be incorporated as a production nail.

B. Nail Installation. Drill holes for soil nails at the angle, dimensions and locations shown on the Drawings. Provide the soil nail length necessary to develop adequate load capacity to satisfy testing acceptance criteria for the design load required based on the verification testing, but not less than the length indicated on the Drawings. The drilling method must be included in the approved Work Plan as specified in Article 1.03.
   1. The soil nails must not be installed greater than twelve inches (12") from the point of entry locations shown on the Drawings without prior written approval of the Engineer. At the point of entry, place the nail angle within plus or minus two (2) degrees of that shown on the Drawings. Subsidence or physical damage whether caused by the soil nail installation operations or by other operations shall be cause for immediate cessation of operations until directed to resume operations by the Engineer. Subsidence or physical damage caused by the soil nail operations must be repaired at the Contractor's expense.
   2. Place a soil nail, with attached tremie tube, in each drilled hole within fifteen (15) minutes of drilling. Place centralizers at three feet (3') feet from each end of the nail and along the nail at a maximum spacing of ten feet (10'), ensuring that no less than 1.5 inches of grout cover is achieved at all locations along the nail. Inject grout through the grout tube at the lowest point of the drill hole. Fill with grout progressively from the bottom to top. Provide grouting equipment capable of continuous mixing and producing a grout free of lumps.

C. Place facing system (wire mesh and shotcrete) in accordance with the details shown on the Drawings and the manufacturer recommendations. Remove any organic material from the slope/cut face prior to placing wire mesh facing. Provide full coverage of the limits of the soil nail installation area.

D. Install bearing plate and nut against the wire mesh facing and torque to provide 7 kips of tension on the nail after the grout has reached a compressive strength of at least 4,000 psi.

E. Proof test production nails in accordance with the provisions of Article 3.02.B.

F. Remove the temporary soil-nail system facing (wire mesh and geosynthetic) as backfilling of the excavation progresses upslope.

3.02 SOIL NAIL TESTING

A. Verification Testing. Perform a minimum of one (1) successful verification test on a sacrificial nail prior to installation of production nails, at the location directed by the Engineer. No bedrock is expected to be drilled at this location. Verification nails must have a bond length of ten feet (10') and unbonded length of eight feet (8'). The specified minimum verification test load (VTL) is 32 kips, as shown on the Contract Drawings, for an ultimate bond resistance between grout and soil of 2,016 psf. Do not perform nail testing until the nail grout has cured for at least 72 hours and attained at least the specified 3-day compressive strength. Testing in less than 72 hours will only be considered for approval if requested by the Contractor in writing and the approved grout mix test results show that the nail grout mix being used will provide the specified 3-day compressive strength in the lesser time.
   1. The alignment load (AL) necessary to maintain position of the stressing and testing equipment must not exceed 0.025 times the verification test load (VTL). Set dial gauges to "zero" after the alignment load has been applied. The maximum test load must not exceed 59 kips, which is 75 percent of the guaranteed ultimate tensile strength of the nail bar.
   2. Monitor the jack load with a load cell. Provide the Engineer with the calibration curve before start of testing.
   3. Equipment: Provide a dial gauge capable of measuring to 1/1000-inch movement. Use a hydraulic jack and gauge calibrated as a unit to apply the test load. Provide pressure gauge graduated in 10 ksf increments or less and use to measure the applied load. Apply test load incrementally. Use the load cell only in load hold situations to monitor that the load is being held at a constant value.
   4. Verification Testing Procedure: Incrementally load the proof test nail to a maximum test load of 1.0 times the Verification Test Load (VTL) in accordance with the following schedule. Record the soil nail movement at each load increment. Hold each load increment as specified below.

Load	Hold Time
AL (0.025 VTL)	Minimum of 1 minute
0.13 VTL	10 minutes
0.25 VTL	10 minutes
0.38 VTL	10 minutes
0.50 VTL	10 minutes
0.63 VTL	10 minutes
0.75 VTL (Creep Test)	60 minutes
0.88 VTL	10 minutes
1.00 VTL	10 minutes
AL	Minimum of 1 minute

5. All load increments must be maintained within five percent (5%) of the intended load. The 60-minute creep test period must start as soon as the 0.75 VTL is applied and the nail movement must be measured and recorded at 1 minute, 2, 3, 4, 5, 6, 10, 20, 30, 50, and 60 minutes.
6. The Engineer will review all verification tests to determine if the soil nail is acceptable. A nail will be accepted if the following three criteria are met:
    a. The total creep movement of less than 0.08 inches measured between the six- and sixty-minute readings and the creep rate is linear or decreasing throughout the creep test load hold period.
    b. The total measured movement at the maximum test load exceeds eighty percent (80%) of the theoretical elastic elongation of the test nail unbonded length.
    c. A pullout failure does not occur at VTL. Pullout failure is defined as the load at which attempts to further increase the test load result in continued pullout movement of the test nail. If pullout failure occurs during verification testing, the soil nails will not be accepted, and Contractor must record the pullout failure load.
7. Within three (3) working days of completing verification testing, submit to the Engineer for review and approval graphs of verification test nails, which plot deflection against load.
8. Unacceptable test results will result in modification to the Contractor's construction procedures. Any modifications of design or construction procedures will be at no change in the Contract prices. Modification plans must be submitted to the Engineer for review and approval prior to implementation additional verification testing. Continue with verification testing until verification test criteria are met.

B. Proof Testing. Soil nails for proof testing must have an unbonded length of eight feet (8') and a bonded length of ten feet (10'). Perform proof testing of soil nails at the locations shown on the Drawings. The specified proof test load (PTL) is 24 kips, as shown in the Drawings. Do not perform nail testing until the nail grout has cured for at least 72 hours and attained at least the specified 3-day compressive strength. Testing in less than 72 hours will only be allowed if requested by the Contractor in writing and the approved grout mix test results show that the nail grout mix being used will provide the specified 3-day compressive strength in the lesser time.
    1. The alignment load (AL) necessary to maintain position of the stressing and testing equipment must not exceed 0.025 times the proof test load (PTL). Set dial gauges to "zero" after the alignment load has been applied.
    2. Monitor the jack load with a load cell. Provide the Engineer with the calibration curve before start of testing.
    3. Equipment: Provide a dial gauge capable of measuring to 1/1000-inch movement. Use a hydraulic jack and gauge calibrated as a unit to apply the test load. Provide pressure gauge graduated in 10 ksf increments or less and use to measure the applied load. Apply test load incrementally. Use the load cell only in load hold situations to monitor that the load is being held at a constant value.
    4. Proof Testing Procedure: Upon completion of verification testing (as specified herein), perform proof testing at locations shown on Drawings. The Engineer

reserves the right to modify the location and number of proof tests. Incrementally load the proof test nail to the maximum proof test load (PTL) in accordance with the following schedule. Record the soil nail movement at each load increment. Hold each load increment until the deflection stabilizes, except for the 1.00 PTL load.

Load	Hold Time
AL (0.025 PTL)	Minimum of 1 minute
0.17 PTL	Minimum of 1 minute
0.33 PTL	Minimum of 1 minute
0.50 PTL	Minimum of 1 minute
0.67 PTL	Minimum of 1 minute
0.83 PTL	Minimum of 1 minute
1.00 PTL (Creep Test)	See Below
AL	Minimum of 1 minute

5. All load increments must be maintained within five percent (5%) of the intended load. Depending on the performance, either 10-minute or 60-minute creep tests must be performed at the maximum proof test load (1.00 PTL). The creep period must start as soon as the maximum proof test load is applied and the nail movement must be measured and recorded at 1 minute, 2, 3, 4, 5, 6 and 10 minutes. Where the nail movement between 1 minute and 10 minutes exceeds 0.04 inches, the maximum test load must be maintained an additional 50 minutes and movements must be recorded at 20 minutes, 30, 50 and 60 minutes.
6. The Engineer will review all proof tests to determine if the soil nail is acceptable. A nail will be accepted if the following three criteria are met:
    a. The total creep movement of less than 0.04 inches measured between the one- and ten-minute readings or a total creep movement of less than 0.08 inches is measured between the 6- and 60-minute readings, and the creep rate is linear or decreasing throughout the creep test load hold period.
    b. The total measured movement at the maximum test load exceeds eighty percent (80%) of the theoretical elastic elongation of the test nail unbonded length.
    c. A pullout failure does not occur at maximum PTL. Pullout failure is defined as the load at which attempts to further increase the test load result in continued pullout movement of the test nail.
7. Destress proof tested nails and place grout in the unbonded length to the ground surface. Successful proof tested nails meeting the test acceptance criteria in Article 3.02.B.6 may be incorporated as production nails.

END OF SECTION

SECTION 02680

CARE AND DIVERSION OF WATER

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Requirements for diverting water from all areas of the Project where work is to be performed. Construction of temporary diversion facilities is required for care and control of any and all surface runoff at active work areas during construction.

B. Specific construction features that will require care and temporary diversion of water are shown on the Drawings and include but are not necessarily limited to demolition of existing structures, construction of a new labyrinth spillway, and modifications to the earthen dam embankment. The construction phasing related to temporary diversion of water during the demolition, excavation, and construction is described by this Section and is shown on the Drawings.

1.02 REFERENCES

A. Federal Emergency Management Agency (FEMA)
   1. Flood Insurance Study: City and County of Honolulu Hawai‘i. No. 15003CV001C. Revised November 5, 2014.
      Available online:
      https://msc.fema.gov/portal/availabilitySearch?addcommunity=150001&communityName=HONOLULU%20,%20CITY%20AND%20COUNTY%20OF%20UNINCORPORATED%20AREAS#searchresultsanchor

B. Hawai‘i Department of Land and Natural Resources (DLNR)
   1. Instream Flow Standard: Hydrologic Unit of Ki‘iki‘i (3082)
      Available online:
      https://dlnr.hawaii.gov/cwrm/surfacewater/ifs/oahu/3082-kiikii/

C. National Oceanographic and Atmospheric Administration (NOAA):
   1. Point Precipitation Frequency Estimates, NOAA Atlas 14, Volume 4, Version 3.
      Available online:
      https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=pa

D. United States Geological Survey (USGS)
   1. Reservoir Level Gage, Wahiawā Reservoir at Spillway at Wahiawā, O‘ahu, HI - USGS-16210000.
      Available online:
      https://waterdata.usgs.gov/monitoring-location/USGS-16210000/#dataTypeId=continuous-00065-0&period=P7D&showFieldMeasurements=true

2. The National Streamflow Statistics Program, Flood Frequency Estimates for Streams on Kaua'i, O'ahu, Moloka'i, and Hawai'i, State of Hawai'i. Available online: https://pubs.er.usgs.gov/publication/sir20105035

E. US Army Corps of Engineers (COE)
1. Engineering Manual EM 1110-2-1902, Slope Stability, October 31, 2003. Available online: http://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-2-1902.pdf
2. Engineering Manual EM 1110-2-2300, General Design and Construction Considerations for Earth and Rock-Fill Dams, July 30, 2004. Available online: http://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-2-2300.pdf
3. Engineering Manual EM 1110-2-2503, Design of Sheet Pile Cellular Structures, September 29, 1989. Available online: http://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-2-2503.pdf
4. Engineering Manual EM 1110-2-1901, Seepage Analysis and Control for Dams, September 30, 1986. Available online: http://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-2-1901.pdf

1.03 PROJECT CONDITIONS

A. Data Representation: Data presented in the tables, figures, and attachments of this Section are approximate and provided solely for the convenience of the Contractor. The Contractor shall be fully responsible for assessment, interpretation, and verification of this information for its use in determining the extent and size of temporary diversion facilities. No guarantee of accuracy of the data or analyses is given or implied by the Engineer and/or the Owner.

B. Survey Control: Refer to Contract Drawings for horizontal and vertical survey control information. Vertical Datum is Mean Sea Level (MSL). All elevations cited herein are with respect to MSL datum unless noted otherwise. Horizontal Datum is Hawai'i State Plane, Zone 3.

C. Lake Description: Wahiawā Reservoir is an irrigation water supply impounded by Wahiawā Dam (21° 29' 51.56"N, 158° 2' 56.94" W) located on Kaukonahua Stream adjacent to the town of Wahiawā on the island of O'ahu in Hawai'i. The stage-storage curve for Wahiawā Reservoir can be found in Figure 02680-1.

D. Dam and Spillway: Wahiawā Dam (OA-0017) is primarily composed of an earth and rockfill embankment and a right abutment spillway. The Wahiawā Dam embankment is approximately 98 feet in maximum height and 660 feet long. The embankment consists of a 4H:1V upstream slope surfaced with riprap and a 2H:1V grass-covered downstream slope. Located at the dam's right abutment is the existing open channel spillway. The

spillway control section has a crest elevation of about 842.5 feet and is about 183 feet wide. The spillway chute is lined with concrete and bordered on each side with concrete training walls with a broad-crested concrete weir near the upstream end.

E. Existing Outlet Works: The existing outlet works facilities are located near Sta. 8+00 along the proposed dam baseline. A 6.5-foot diameter, 1,260-foot-long tunnel with inlet invert at approximately Elevation 773 feet begins upstream of the embankment on the left abutment of the dam and passes adjacent to the embankment to discharge directly into the channel downstream of the dam. Flow through the tunnel is regulated by a 20-foot diameter reinforced concrete intake tower. Four gate valves allow water to enter the tower, and a fifth gate valve (36"x48") is used to control flow from the tower into the tunnel.

   Operators for the existing outlet works gates are located on the upper deck of the intake tower and can be operated either manually or mechanically. The gate that separates the tower from the tunnel is typically used to regulate flow. While the gate and tunnel have significantly more capacity, the Contractor is alerted that the maximum discharge allowed through the tunnel is approximately 125 cfs. This corresponds to the maximum discharge that can pass through the downstream flume structure which diverts flow to the stream and irrigation canals. If flows in excess of 125 cfs are released, this structure will overtop resulting in scour damage to the flume and its foundation. It is estimated that the outlet can pass at least 125 cfs for all pool elevations in excess of 780 feet.

F. Temporary Reservoir Drawdown and Maintenance During Construction:
   1. To the extent practicable, Wahiawā Reservoir will be maintained at pool elevation of 822.5 feet for the duration of the Project to facilitate construction of the Project. This is equivalent to Gage Height of 60 feet per the USGS reservoir level gage (Wahiawā Reservoir at Spillway at Wahiawā, O'ahu, HI - USGS-16210000) and is 20 feet below the crest of the existing spillway. The Owner will drain the lake to this elevation to the extent possible prior to start of work. The Contractor is alerted that the maximum allowable rate of initial drawdown is one foot per day.
   2. The Contractor must coordinate with the Owner to maintain the pool level at Wahiawā Reservoir at acceptable levels throughout the work of this Contract. The reservoir fluctuates due to natural inflows and controlled releases for both irrigation demands and to maintain natural stream flow in the downstream Kaukonahua Stream. The Contractor shall routinely clear accumulated debris or sediment from the inlet areas of the existing outlet works as may be necessary, particularly following significant storm events that may carry floating debris from the watershed to the existing outlet works.
   3. During storm events within the watershed, a rapid increase in the pool level of Wahiawā Reservoir can occur. The Contractor is alerted that regulation of the reservoir level will be constrained by the discharge capacity of any temporary diversion works; the discharge capacity of the existing outlet works; and possibly other factors. The Contractor should consider in his bid the potential for weather-related delays and reservoir level-related delays to affect their work.

G. The approximate stage-storage curve is provided in Figure 02680-1.

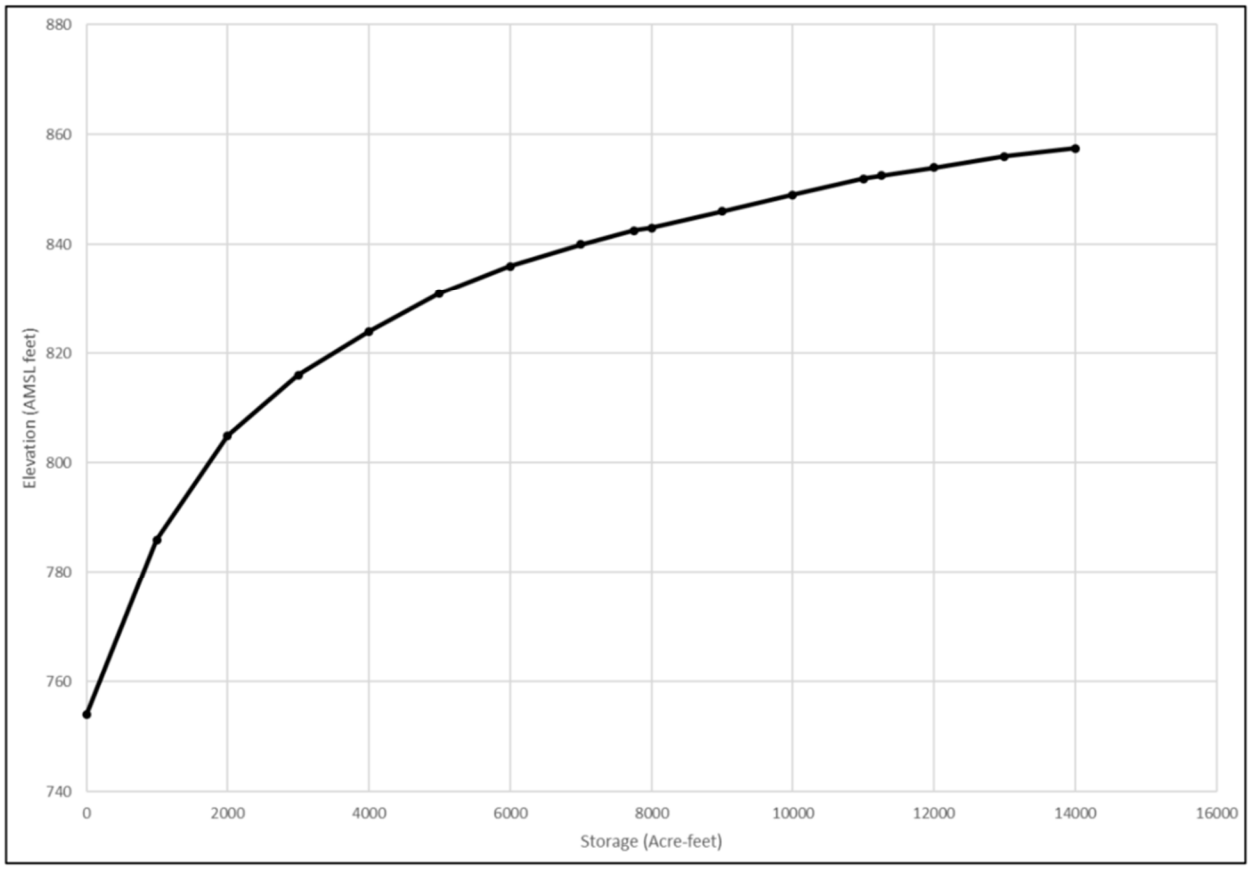

FIGURE 02680-1
Approximate Stage-Storage Curve for Wahiawā Reservoir

H. Conservation Release: The Hawai‘i DLNR Commission on Water Resource Management currently requires an instream flow standard of 3.5 cfs (2.26 mgd) below Wahiawā Reservoir in Kaukonahua Stream. This is released to the stream via a sluice gate on the flume just downstream of the outlet works tunnel. The Owner will maintain responsibility for regulating outflows from the reservoir during construction.

I. Wahiawā Reservoir is a FEMA Zone D Flood Hazard Area (i.e., Area of Undetermined Flood Hazard) as defined in the 2014 FEMA-issued Flood Insurance Study (FIS) (FIS No. 15003CV001C and 15003CV003C, and 2011 FIRM No. 15003C0210F). The project site must be cleared of all construction debris upon Contract completion to prevent unintended impacts to the hydraulics of the Kaukonahua Stream floodplain.

J. The following factors shall be considered by the Contractor when planning the diversion of water during construction of the Project:
   1. Reservoir level at the project site will vary depending on the flows from Kaukonahua Stream into the Wahiawā Reservoir, groundwater conditions, weather conditions, and other factors.

2. Precipitation is expected to cause temporary rises in groundwater and reservoir levels and increased potential for inflow into, and inundation of, active work areas.
3. The existing outlet works will be the primary means of maintaining Wahiawā Reservoir at the target drawdown pool level (Elev. 822.5 feet) during pre-construction activities and during construction activities. The Contractor may also utilize pumps, siphons, diversion channels, or other methods approved by the Engineer to supplement the capacity of the outlet works. The existing outlet works will not have adequate capacity to convey all storm events through the work area without impounding water in the reservoir. Thus, storm events may cause the reservoir to partially or fully fill. The Contractor shall make provisions in his bid to accommodate wet weather flows and provide adequate dewatering and filtering measures should it become necessary to dewater the work area during the construction period.
4. Contractor shall perform diversion of water activities in accordance with the Drawings and as described in this Section. Diversion of Water Phase sequencing is described in Article 3.01.C. Incorporate the diversion of water work Phases into the overall sequence of construction Stages described in Section 01310 and as described in Article 1.04.C.
5. The Contractor shall execute all stages of work in conformance with the Erosion and Sedimentation Pollution Control Plan for the Project.
6. Contractor shall be responsible for paying and arranging for use of commercially available electrical power or providing on-site generating capacity, as required, for temporary diversion measures such as pumping.

K. The approximate stage-discharge rating curve for the existing spillway is shown in Figure 02680-2.

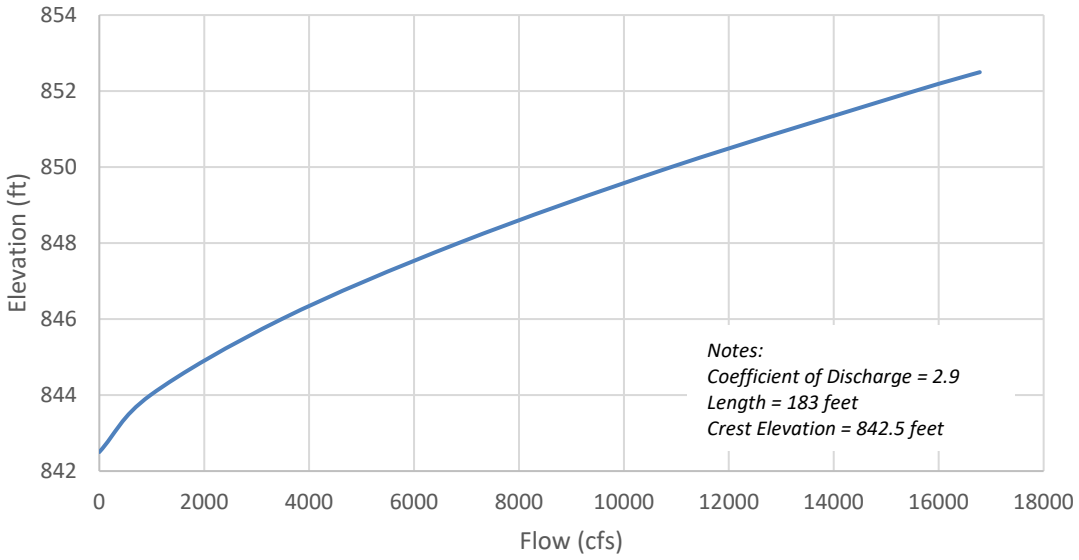

FIGURE 02680-2
Approximate Discharge Rating Curve for Existing Spillway

L. Estimated peak inflows into Wahiawā Reservoir for the 2-, 5-, 10-, 25-, 50-, and 100-year flood events are summarized in Table 02680-1. These peak inflow estimates are presented for informational purposes only and were obtained from a detailed HEC-HMS hydrologic model of the Wahiawā watershed and reservoir. The hydrologic modeling was based on National Oceanic and Atmospheric Administration (NOAA) Atlas 14 precipitation data and applied to the watershed using a 3-day storm duration with a frequency distribution.

TABLE 02680-1
Estimated Peak Inflow to Wahiawā Reservoir

Event Return Period	Annual Exceedance Probability	Estimated Peak Inflow (cfs)
2-Year Flood	50%	6,470
5-Year Flood	20%	9,280
10-Year Flood	10%	11,490
25-Year Flood	4%	14,710
50-Year Flood	2%	17,330
100-Year Flood	1%	20,090

M. The anticipated peak lake level and peak outflow resulting from an inflow storm event are dependent on discharge capability and the available storage within the lake at the start of the inflow storm event, among numerous other factors. Outflow characteristics and available lake storage will vary as construction progresses and will be constantly varying during certain diversion of water phases. Therefore, definitive estimates of peak lake levels and corresponding outflows cannot be provided for all diversion of water phases. Estimated peak pool levels provided below and any estimated levels of protection afforded by particular diversion of water configurations as may be depicted on the Drawings were prepared based, in part, on engineering judgment and limited by the available information that supports the hydrologic and hydraulic computer modeling, which is inherently uncertain. These data are provided for informational purposes only.

N. To protect work areas within the spillway and plunge pool, the contractor may construct a cofferdam within the approach of the spillway or other means of supplemental diversion capacity either through or around the work area. In no case should the temporary condition reduce the spillway capacity at the top of dam elevation to less than the existing condition as shown in Figure 02680-2.

O. To protect the dam embankment from overtopping during construction, any cofferdam system proposed as part of the Diversion of Water Plan must be designed and constructed as an erodible fuse plug. This will maintain the existing spillway capacity should a major flood occur during construction. Cofferdam height is to be designed by the contractor based on desired level of protection for work area. The maximum allowable crest elevation of a fuse plug cofferdam is 848.5 feet.

P. Anticipated peak lake levels for the 2-, 5-, 10-, 25-, and 50-, and 100-year flood events for the existing condition and Diversion of Water Plan conditions are summarized in Table 02680-2.

TABLE 02680-2
Estimated Peak Reservoir Levels for Various Conditions

Event Return Period	Annual Probability of Exceedance	Peak Reservoir Level (feet, MSL)			
		Reservoir Starting Level 822.5 feet	Reservoir Starting Level 827.5 feet	Reservoir Starting Level 832.5 feet	Reservoir Starting Level 837.5 feet
2-Year Flood	50%	834.9	836.3	840.2	843.5
5-Year Flood	20%	838.7	839.9	842.9	846.1
10-Year Flood	10%	841.4	842.4	845	848.3
25-Year Flood	4%	844.5	845.5	848.3	***
50-Year Flood	2%	847.3	848.3	***	***
100-Year Flood	1%	***	***	***	***

1. *Peak Reservoir Levels in this table were estimated based on hydrologic routing of flood hydrographs through the reservoir. These values assume that the spillway is fully blocked by a cofferdam system and that the only means of bypassing flow around the dam is the existing outlet works which is operating at its maximum discharge capacity of 125 cfs for the full duration of the flood. See Article 1.03.E regarding limitations on discharge capacity.*
2. *Key Elevations include:*
   - *Dam embankment crest elevation at dam centerline for Existing Conditions = 852.5 feet +/-.*
   - *Spillway crest elevation for the Existing Conditions = 842.5 feet +/-.*
   - *Target Drawdown Elevation = 822.5 feet +/- for diversion of water phases. If drawdown is not adequately maintained or if multiple flood events occur within a short period of time, an elevated drawdown condition is possible.*
3. *Values noted with asterisks (***) indicate that without supplemental diversion capacity, the maximum allowable cofferdam crest elevation would overtop resulting in flooding of the spillway and plunge pool work areas. These values do not account for additional means to bypass or divert water around work areas that can be adopted in the Contractor's Diversion of Water Plan should additional protection of work areas be desired.*
4. *During any given construction phase, the estimated discharge capacity and commensurate reservoir levels will be highly dependent on the actual operation of the existing outlet works, inverts of the temporary bypass piping, excavation levels achieved, and placement of temporary diversion barriers*

Q. Estimated rainfall depths for the Wahiawā Reservoir watershed for the, 2-, 5-, 10-, 25-, 50-, 100-year return periods are presented in Table 02680-3 for 6-hour, 24-hour, and 72-hour duration storm events, reproduced from NOAA Atlas 14, Volume 4, Version 3. This data is available online at:

https://hdsc.nws.noaa.gov/pfds/pfds_map_hi.html

TABLE 02680-3
Approximate Precipitation Frequency Data for Wahiawā Dam Watershed

Event Return Period	Annual Exceedance Probability	6-Hour Rainfall Depth (inches)	24-Hour Rainfall Depth (inches)	72-Hour Rainfall Depth (inches)
2-Year Rainfall	50%	3.9	5.8	8.2
5-Year Rainfall	20%	5.0	7.8	10.8
10-Year Rainfall	10%	6.0	9.3	12.7
25-Year Rainfall	4%	7.2	11.5	15.4
50-Year Rainfall	2%	8.2	13.2	17.6
100-Year Rainfall	1%	9.2	15.0	19.7

1.04 DIVERSION REQUIREMENTS

A. General: Divert water away from all areas of the Project where work is to be performed. Install or construct diversion facilities, channels, culverts, sumps, and pumping facilities as required so that all construction activities can be performed in the dry. Provide all plant, equipment, labor, and materials in connection with furnishing, installing, operating, and maintaining all necessary diversion works. Work includes planning for and implementing methods for responding to flooding conditions.

B. Responsibility: With the exception of the existing outlet works, the Contractor is wholly responsible for designing, installing, maintaining, and operating all diversion facilities, and for protecting the work area from flooding. At all times, Contractor shall protect any exposed embankment soils from erosion. The Contractor shall coordinate with the Owner to ensure that the outlet works is operated in a way that meets downstream release requirements while maintaining an appropriate pool elevation.

C. As described in Article 1.03.J.4., Section 01310 contains a suggested overall sequence of construction for consideration by the Contractor. The suggested sequence of construction is intended to include work activities that will form the completed work. The Contractor may submit to the Engineer for approval an alternate construction sequence provided that such proposals retain all permanent features of the work as required by the Drawings and Specifications, and are acceptable to the Engineer and Owner, and observe all permitting requirements. The suggested construction sequence is not intended to restrict Contractor creativity in approaching the work, nor is it intended to define for the Contractor the extent of maximum flood protection to be provided.

~~D. The Contractor shall have no claim for additional compensation resulting from flooding or flood damage during construction. Should such conditions occur, the Contractor shall, at their expense, repair or replace any damaged work.~~

~~E.~~D. Specific Requirements:

1. Portions of the Work are located upstream of, within, and downstream of the spillway (existing and proposed), embankment, and abutments of Wahiawā Dam, and it is imperative that diversion of water be accomplished so as not to compromise the safety of Wahiawā Dam or its appurtenant structures.
2. The Contractor shall develop a Diversion of Water Plan in accordance with Article 1.05 and other provisions of this Section and submit the Plan to the Engineer for review.
    a. The Plan shall include schedule constraints specified in this Section, Section 01310, other Sections, the Erosion and Sedimentation Control Narrative shown on the Drawings, in the Diversion of Water Plan shown on the Drawings, and as indicated elsewhere on the Drawings.
    b. The Plan shall clearly depict all related features and works.
3. The Contractor shall be solely responsible for damage to partially or fully completed work, including pumping of water and subsequent cleanup of all flood damage to public or private property, upstream or downstream of the Project site, resulting from an inadequate diversion scheme constructed by the Contractor. Any and all damages to partially or fully completed work and public or private property resulting from the Contactor's activities shall be repaired or replaced to the satisfaction of the Engineer at the Contractor's expense.
4. It shall be understood that the Owner assumes no responsibility, makes no commitment and is under no obligation to modify operations at the dam. Contractor is advised that hydraulic release facilities at the dam (i.e., outlet works) have limited discharge capacities.
5. Care shall be exercised by the Contractor at all times when installing or operating diversion of water facilities to prevent any unnecessary disturbance of and deposition of construction materials, debris, and/or sediment into Kaukonahua Stream or the lakebed area of Wahiawā Reservoir. At no time will fuel, cement-laden runoff, or other contaminants be allowed to enter the lakebed area or the streams or tributary areas.

~~F.~~E. Diversion of Water Methods and Criteria:

1. Suggested methods and sequencing requirements for flow diversion are presented on the Drawings and as specified herein. If the Contractor elects to propose flow diversion methods and sequencing that differ from methods and sequencing requirements shown on the Drawings and specified herein, hydrologic and hydraulic documentation shall be provided by the Contractor to conclusively demonstrate the adequacy and risks attendant to the flow diversion schemes proposed to be implemented by the Contractor and shall be designed by an experienced professional engineer registered in the State of Hawai‘i.
2. Contractor shall be responsible for establishing culvert sizes, temporary energy dissipation structures, and design of temporary cofferdams (including crest elevations), to minimize the potential for flood damage to the existing dam and its appurtenances and ongoing work activities. Contractor designs shall be reviewed by the Engineer prior to implementation. Contractor shall design and install diversion facilities for each stage of construction, as required.

3. If the Contractor elects to import soil or borrow material from an off-site source to construct a temporary cofferdam or for any other use on the Project, then the Contractor must obtain the material from a source that is permitted in compliance with the provisions of the Contract Documents and that maintains a site-specific Erosion and Sediment Pollution Control Plan, and the Contractor must submit documentation that demonstrates that the proposed off-site source is in compliance with the above.
4. Contractor may, at his discretion, propose to modify or amend the schematic Diversion of Water Plan as shown on the Contract Drawings and as specified herein. Any such modifications shall be documented in writing within the Diversion of Water Plan submission, as applicable, which includes explanations of the benefits for the changes and full documentation demonstrating adequacy of the amended scheme. The Contractor's work related to proposing the above, whether the proposal is ultimately approved or not, will be performed at no cost to the Owner and will not be a basis for a contract time extension or contract milestone extension. Additionally, the Diversion of Water Plan will need to conform to what is stated in the NPDES dewatering permit, Form G: (https://health.hawaii.gov/cwb/clean-water-branch-home-page/forms/)
    a. Approval by the Engineer of Contractor-proposed changes to the Project phasing defined in this Section, or to the sequence of construction activities outlined in the Erosion and Sediment Control Notes on the Contract Drawings, and in Section 01310, is not guaranteed. Proposed changes shall provide equal or improved mitigation of flood-related risk as compared to the sequencing provided by the Contract Documents. Contractor should anticipate that proposed alterations which potentially increase the magnitude of flooding or risk of dam failure, or which potentially increase other damages associated with flooding, will be rejected.
    b. Any required permit alterations or approvals consequent to such proposals shall be the responsibility of the Contractor.
    c. The work associated with the development, submission, approval, and construction of any modified or amended Plans will be performed by the Contractor at no additional cost to the Owner, including any temporary features, rework, or extended duration of required temporary work activities that may need to be performed in order to obtain approval or complete the work.
5. Contractor's Diversion of Water Plan shall include measures to protect partially completed Work that could be damaged from localized runoff sources in the event of storm events occurring at critical stages in the construction, as well as detailed plans for site restoration prior to any stoppages of work in active diversion of water work zones for extended periods of time including, but not necessarily limited to, any weather related shutdowns.

1.05 SUBMITTALS

A. Diversion of Water (DOW) Plan: The Contractor shall submit the proposed initial DOW Plan to the Engineer for approval at least forty-five (45) days prior to the work. At Contractor's discretion, a sequential series of Plans may be provided to address

particular diversion of water phases, with the initial submittal addressing at least Phase 1 of the Work. Subsequent DOW Plan updates shall be submitted no less than forty-five (45) days prior to the start of work that requires diversion of water activities addressed by each DOW Plan update. At a minimum, the following data shall be submitted as part of any DOW Plan:

1. Method(s) of care and diversion of water, including general and detailed drawings of plan features in adequate detail to demonstrate compliance of design objectives for plan operation.
2. Design computations documenting the adequacy of structural and hydraulic capacity of proposed features, such as temporary cofferdams, work platforms, and diversion walls.
    a. If a temporary cofferdam fuse plug is proposed, the cofferdam, foundation, and abutments must be stable under all loading conditions (static and dynamic) prior to overtopping. Design earth embankment cofferdams/work platforms in accordance with EM 1110-2-1902 and EM 1110-2-2300. Seepage through the cofferdam, foundation and abutments must be controlled and collected to provide safe operation. The design should include seepage control measures such as foundation cutoffs, impervious zones, transition zones, drainage materials and blankets and dewatering system, as necessary. Design seepage control measures in accordance with EM 1110-2-1901. The cofferdam must be designed and constructed such that it will erode and fully wash away should it overtop. The downstream slope and main section of the fuse plug cofferdam should consist of cohesionless or low-cohesion materials (e.g., sand, gravel) that will easily mobilize if the cofferdam is overtopped. The cofferdam must be designed for operation over at least a two (2) year period and suitable for fluctuating lake levels. Cofferdam height is to be designed by the contractor based on desired level of protection for work area. The maximum allowable elevation of a fuse plug cofferdam is 848.5 feet.
    b. Penetrations into the embankment such as piles, shafts or other engineering materials shall not be allowed.
    c. Earthen cofferdams must be designed to safely accommodate a drawdown rate of at least one foot (1') per day.
3. Hydraulic capacity calculations for all culverts, pipes, and temporary pumping facilities.
4. Sedimentation control features that differ from the Contract Drawings.
5. Clearances provided between the permanent work and the temporary water diversion features.
6. Schedule showing the proposed timing, sequence and duration of each operation requiring diversion of water.
7. Contractor's criteria for triggering evacuation from work area(s), and the anticipated temporary demobilization actions for equipment and materials that would be undertaken.
8. Names and titles of supervisory personnel, and associated telephone numbers at which the Contractor may be contacted at all times during the construction period.
9. All other data necessary to portray a clear understanding of the proposed DOW Plan.

10. The Contractor's DOW Plan is required to be approved by the Engineer. The Contractor's schedule should be prepared to anticipate at least fourteen (14) calendar days for review by the Engineer, with the understanding that the above durations do not include additional review time associated with resubmittals by the Contractor, if needed.

B. The Contractor's DOW Plan shall be prepared and sealed by a Hawai‘i-registered professional engineer with a minimum of five (5) years of experience in the design of temporary diversion of water systems for dams that meet the minimum jurisdictional requirements for dams regulated in Hawai‘i. Engineer's approval of the Contractor's Plan submittals will not relieve the Contractor from full responsibility for the adequacy of the diversion and protective works, or for furnishing all equipment, labor, and materials, and performing all operations in connection with the diversion of water during construction; nor shall such approval be construed as obligating the Owner for any loss or damage resulting from the diversion operations.

C. DOW Plan Revisions: Revisions to the Contractor's DOW Plan shall be made as conditions warrant and as required by the Engineer to protect all existing facilities, and/or partially completed work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONSTRUCTION SEQUENCING

A. Construction Activities: Schedule all work when weather and Project conditions permit satisfactory diversion of water. Allow sufficient time in the work schedule for drying of wet materials, inspection of the foundation by the Engineer, and removal of unsuitable materials that may be encountered within the work area.

B. There are two existing facilities normally available for discharge from the dam; the existing spillway structure and the existing outlet works. Since the work requires replacement of the existing spillway, the DOW sequence of work is suggested to be as described in Article 3.01.C. As described in Article 1.04.C., overall construction activities are intended to occur as noted in Section 01310; however, the Contractor may submit alternate task sequencing for Engineer's review and approval along with justification that the Contractor's proposal is more beneficial to the Project than the sequence described herein.

C. DOW Work Sequence
1. Surface Runoff / Baseflow Diversion:
   a. All baseflow and streamflow in excess of baseflow will be routed through the existing outlet works as described in Articles 1.03.E. and F. unless or until an adequate approved bypass configuration proposed by the Contractor has been constructed.
2. The following construction sequence is developed to first provide the ability to pass the PMF safely by installing the new spillway, and secondly to provide a

rehabilitated and filtered downstream embankment capable of safely collecting seepage. Work following these activities can be carried out with lesser risk to the project. Perform DOW-specific construction activities in the DOW phasing sequence described below. The specific DOW Phases described below are referenced in the overall sequence of construction described in Section 01310. Prior to beginning DOW Phase 1, Temporary Reservoir Drawdown will be performed as described in Article 1.03.F to the extent possible. Temporary Reservoir Maintenance will be performed as described in Article 1.03.F to the extent possible throughout the DOW Phases described below.

a. Phase 1 DOW: Perform Phase 1 DOW activities in accordance with the applicable provisions of this Section, and in the sequence listed below.
    1) Install, and maintain throughout Phase 1 DOW, the temporary cofferdam shown on the diversion of water Drawing(s) plus any other approved Phase 1 DOW features that may be proposed by the Contractor.
    2) Perform work activities in the Phase 1 DOW Work Area shown on the Drawing.
    3) Remove Phase 1 DOW features when work is complete to the satisfaction of the Engineer in the Phase 1 DOW work area.
b. Phase 2 DOW
    1) Perform work activities in the Phase 2 DOW Work Area shown on the Drawings.

D. Construction activities that have not been stipulated or referenced in the DOW Phases described in this Section may be completed at the Contractor's convenience.

E. Coordination of multiple trades and/or subcontractors will be required to accomplish work that will, in many cases, need to occur within multiple diversion of water phases. The Contractor should not anticipate that the entire dam will be available for work, at any one point in time, without interference with temporary facilities needed for diversion of water and potential risk of flooding.

F. Additional information regarding staging of earthmoving activities is shown on the Erosion and Sediment Control Plan Narrative on the ES-series Drawings.

3.02 PERFORMANCE

A. Maintenance of Diversion Capacity: Maintain adequate flow diversion capability at all times until all construction work is completed.

B. Diversion Channels, Culverts, Cofferdams, Systems: Construct all diversion facilities with sufficient clearances to perform the required work. Implement erosion control measures as specified in Section 02370, Erosion and Sediment Control, during placement, operation, and removal of these items.

C. Water diverted through any pipe or channel which is discharged into any existing natural lake or stream channel shall not be allowed to cause erosion.

D. Removal: Remove all temporary DOW features after they have served their purpose and construction is completed. Exercise care during the removal of all DOW features to minimize turbidity in the lake and the adjacent stream channels; exercise care during removal of DOW features to prevent injury to the permanent work; and repair or replace to the satisfaction of the Engineer. Any damage will all be repaired at no additional cost to the Owner.

3.03 PROTECTION OF WORK

A. Flood Protection:
   1. Contractor shall regularly monitor weather forecasts for the potential for precipitation. In the event of severe weather conditions that could reasonably be anticipated to result in flooding that could endanger the Work, implement, in a timely fashion, all possible precautions to protect partially or fully completed work or the dam from damage as may be ordered by the Owner in anticipation of an impending flood event.
   2. Any and all precautionary measures that may be required in anticipation of a flood event and any work necessary to reestablish the construction activities subsequent thereto shall be the Contractor's responsibility, and therefore, no additional payment will be made.
   3. Prior to halting work in any active work zone for an extended period, including but not necessarily limited to flood events, all open excavations shall be backfilled to the satisfaction of the Engineer.

END OF SECTION

SECTION 02834

SHOTCRETE FACING

PART 1 GENERAL

1.01 DESCRIPTION

A. Section Includes: Furnishing all labor, materials, tools, supervision, transportation, installation equipment, testing, and incidentals necessary to complete the work specified herein and shown on the Drawings. The work consists of the construction of shotcrete facing over the excavated cut slope above the right spillway training wall to the limits shown on the Drawings. The shotcrete facing will be attached to the soil/rock slope with soil/rock nails that are grouted in place.

1.02 QUALITY ASSURANCE

A. Reference Standards:
   1. American Society for Testing and Materials (ASTM):
      a. A563 – Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric)
      b. A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
      c. A884 – Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement
      d. A1064 - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
      e. C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
      f. C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)
      g. C150; Standard Specification for Portland Cement
      h. C171; Standard Specification for Sheet Materials for Curing Concrete
      i. C494; Standard Specification for Chemical Admixtures for Concrete
      j. C618; Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
      k. C928; Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs
      l. C989; Standard Specification for Cement for Use in Concrete and Mortars
      m. C1116; Standard Specification for Fiber-Reinforced Concrete
      n. C1141; Standard Specification for Admixtures for Shotcrete
      o. C1240; Standard Specification for Silica Fume Used in Cementitious Mixtures
      p. C1436; Standard Specification for Materials for Shotcrete
      q. D1785; Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
      r. D3963; Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars

2. American Concrete Institute Standards (ACI)
   a. 308R; Recommended Practice for Curing Concrete
   b. 506.2; Specifications for Shotcrete
3. American Association of State Highway & Transportation Officials (AASHTO)
   a. M157 Specification for Ready-Mixed Concrete
4. State of Hawai‘i Department of Transportation
   a. Standard Specifications for Road and Bridge Constructions, 2005.

B. Qualifications:
   1. Provide shotcreting nozzle operators with at least one year of experience in the application of shotcrete on projects of comparable nature. Shotcreting nozzle operators who have worked under the immediate supervision of a foreman or instructor for at least two years are also qualified.

1.03 SUBMITTALS

A. At least calendar 14 days before starting shotcrete work:
   1. Contractor nozzle operator qualifications meeting the requirements of Article 1.02.B.
   2. Submit a Certificate of Compliance and mill test reports, as applicable, for all materials used.
   3. Submit Working Plan showing the methods, materials, and equipment to be used in the assembly and installation of the shotcrete and the Contractor's proposed construction sequence. Include methods for control and disposal of waste materials.
   4. Submit final shotcrete mix design with proportions of all materials, water-cement ratio, and the results of all tests made on sample mixtures of the shotcrete. The final mix design shall conform to the requirements in this Section.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site at such times and intervals to ensure continuity of installation and uninterrupted progress of work.

B. Store cement to prevent moisture degradation and partial hydration. Do not use cement that has become caked or lumpy. Store aggregates so that segregation and inclusion of foreign materials are prevented.

1.04 JOB CONDITIONS

A. Do not begin any soil/rock nail construction work until written approval is made by the Engineer.

B. The reservoir is a potential source for raw water supply, and care must be exercised to avoid contamination of the reservoir.

C. Handle and store epoxy coated bars in a way that will prevent them from being damaged beyond what is permitted by ASTM D3963. Repair damaged epoxy coating

in accordance with ASTM A775 and the coater's recommendations using an epoxy field repair kit approved by the epoxy manufacturer. Repaired areas shall have a minimum 0.3 mm coating thickness.

PART 2 PRODUCTS

2.01 MATERIALS

A. Nails and Nail Head Assemblies: See Section 02270.

B. Steel Welded Wire Mesh: ASTM A1064, Grade 60 ksi, epoxy coated (Type 1, Class A). Welded Wire Mesh shall have 6x6 spacing and minimum wire size W8.5xW8.5.

C. Strip Drains: See Section 02270.

D. Shotcrete Facing:
   1. Cement: ASTM C150 Type I, II, III, or V unless otherwise indicated in the Drawings.
   2. Water: Conform to the requirements per Section 03600.
   3. Aggregate:
      a. Normal Weight Aggregate: Shall meet the requirements of ASTM C33.
      b. Light Weight Aggregate: Shall meet the requirements of ASTM C330.
   4. Admixtures:
      a. See Section 03300 Article 2.01 F.
      b. The use of admixtures is subject to the approval of the Engineer.
      c. The use of expansive admixtures or admixtures containing calcium chloride is prohibited.

E. Patching Mortar: Conform to the requirements for Non-Shrink, Non-Metallic Grout per Section 03600 or approved equal.

2.02 MIXES

A. Shotcrete:
   1. Compressive strength of 3,000 psi within 7 days and 4,500 psi within twenty-eight days.
   2. Maximum water cement ratio: 0.40.
   3. Air content: 6.5± 1.5.
   4. Slump: 1.5 to 3 inches.
   5. For mixture acceptance purposes, the average core compressive strength shall be equal to at least 1.2 times the required compressive strength specified herein.

2.03 DELIVERY EQUIPMENT

A. For dry mix process, provide equipment capable of discharging the aggregate-cement mixture into the delivery hose and delivering a continuous, smooth stream of uniformly mixed material to the discharge nozzle. Equip the discharge nozzle with a manually operated water injection system (water ring) for directing an even

distribution of water through the aggregate-cement mixture. The water valve shall be capable of ready adjustment to vary the quantity of water and shall be convenient to the nozzleman. Provide water pressure at the discharge nozzle sufficiently greater than the operating air pressure to ensure that the water is intimately mixed with the other materials. If the line water pressure is inadequate, introduce a water pump into the line. Ensure that the water pressure is steady (nonpulsating). Clean delivery equipment thoroughly at the end of each shift. Inspect equipment parts, especially the nozzle lines and water ring, at regular intervals and replace as required.

B. For wet mix process, provide equipment capable of delivering the premixed materials accurately, uniformly, and continuously through the delivery hose. Follow recommendations of the equipment manufacturer on the type and size of nozzle to be used, and on cleaning, inspection, and maintenance of the equipment. Ready mixed shotcrete is to be delivered in transit mixers complying with AASHTO M157

C. Provide a supply of clean, dry air adequate for maintaining sufficient nozzle velocity for all parts of the work and, if required, for simultaneous operation of a suitable blow pipe for clearing away rebound.

PART 3 EXECUTION

3.01 BATCHING, MIXING, AND EQUIPMENT

A. Shotcrete installation shall be in general conformance with the requirements of ACI 506.2 except as otherwise specified herein

B. Batching and Mixing: Aggregate and cement may be batched by weight or volume. Provide mixing equipment capable of thoroughly mixing the materials in sufficient quantity to maintain placing continuity. For dry mix process, provide capability to discharge all mixed materials without any carry-over from one batch to the next. Provide ready mix shotcrete complying with AASHTO M 157 for wet mix process.

3.02 QUALITY CONTROL

A. Preconstruction Testing
   1. Test specimens to be made by each application crew using the equipment, materials, mixture proportions, and procedures proposed for the job, prior to the commencement of the work.
   2. A test panel at least 30 x 30 inches shall be made for each mixture being considered and for each shooting position to be encountered in the job. The test panels are to be fabricated to the same thickness as the structure, but not less than 4 inches. Take at least five 4-inch diameter cores from each panel for testing in accordance with ASTM C42.
   3. Samples for testing shall be obtained by the Contractor in the presence of the Engineer and tested by the Contractor's Independent Testing Laboratory.

B. Construction Testing

1. Cut cores from the structure and test in accordance with ASTM C42. A minimum of three cores shall be taken from each 1,000 square feet of completed facing or per shift.
2. Alternately, make one test panel with minimum dimensions of 18 x 18 x 4 inches, gunned in the same position as the work represented for each 1,000 square feet of completed facing. Panels shall be gunned during the course of the work by the Contractor's regular nozzlemen. Field cure panels in the same manner as the work, except that the test specimens shall be soaked in water for a minimum of 40 hours prior to testing. The Contractor shall cut a minimum of three cores from each panel for testing in accordance with ASTM C42.
3. The average compressive strength of a set of three cores must equal or exceed 85 percent of the compressive strength specified in these specifications.

3.03 SHOTCRETE APPLICATION AND FINISHING

A. Perform excavation as required by the Contract Documents and the approved Plan of Excavation as described in Section 02322.

B. Scale loose rock blocks to the limits indicated prior to installing Soil/Rock Nails in any particular area. Follow closely the construction sequence in accordance with the Drawings and the approved Work Plan as described under Article 1.03.A.

C. Install Soil/Rock Nails per the Drawings and in accordance with Section 02270.

D. Install Welded Wire Mesh as necessary to support the weight of each lift of shotcrete prior to setting. Set plane of outermost Welded Wire Mesh mat to be a minimum of 2" behind finished face of shotcrete. Support Welded Wire Mesh by attaching to soil/rock nails using wire fasteners and attach to edges of Welded Wire Mesh to wall surface using concrete anchors as necessary to prevent movement during shotcrete application.

E. Maintain safety in all areas where shotcrete is to be applied, including dust protection. Causticity of cement and accelerating hardening admixtures may cause skin and respiratory irritation unless safety measures are taken in addition to providing required ventilation. During the application of shotcrete, provide nozzlemen and helpers with gloves and adequate protective clothing.

F. In anticipation of shotcreting, clean surfaces of all loose material, mud, rebound from previously placed shotcrete, and other foreign matter that will prevent bond of shotcrete. Dampen surface before shotcreting. Install strip drains per the Drawings.

G. Shotcrete shall emerge from the nozzle in a uniform and continuous flow. When for any reason, the flow becomes intermittent, divert the nozzle for the work until uniform and continuous flow resumes. A nozzleman's helper equipped with an air blowout jet, shall attend the nozzelman at all times during the placement of shotcrete to keep the working area free from rebound.

H. Use weep holes, drain pipes, or other methods to control seepage. Where used, provide a weep hole, 2 foot long, 2 inch diameter, slotted drain pipe (Schedule 40 PVC) placed in pre-drilled holes sloped 5 percent to drain. Protect against contamination during shotcreting to ensure proper functioning. Dampen surface before shotcreting. Install permanent drainage as specified herein.

I. Apply shotcrete with the same equipment and the same technique as those used in the approved test panels. Nozzle operators performing the test panels are to be the same operators used to place shotcrete in the work. Measuring pins shall be installed on 5 foot centers in each direction. The pins shall be non-corrosive and designed to prevent infiltration of water through the shotcrete. Other methods may be approved to establish whether the required minimum thickness of shotcrete is being applied if the Contractor can satisfactorily demonstrate the reliability of these other methods. When a layer of shotcrete is to be covered by a succeeding layer at a later time, it shall first be allowed to develop its initial set. Then remove all laitance and loose material, and rebound by brooming or scraping. Remove laitance that has been allowed to take final set by sandblasting, and thoroughly clean surface.

J. Do not shotcrete if ambient temperature is less than 40° F.

K. Firmly position the wire fabric to prevent vibration while the shotcrete is being applied. Lap mesh 1 ½ squares in both directions. Bend tie wires flat in the plane of the mesh and do not form large knots. Provide a minimum cover of 2 inches of shotcrete.

L. Control thickness, method of support, air pressure, and water content of shotcrete to preclude sagging or sloughing off.

M. Fill first horizontal and vertical corners and any area where rebound cannot escape or be blown free.

N. Hold nozzle at a distance and angle that will place the material behind the reinforcement before any material is allowed to accumulate on its face. In the dry mix process, additional water may be added to the mix when encasing reinforcement, to facilitate a smooth flow of material behind the bars. Do not place shotcrete through more than one layer of reinforcing steel rods or mesh in one application unless preconstruction tests have demonstrated that steel is properly encased.

O. Provide undisturbed final layer of shotcrete as applied from nozzle without hand finishing, unless otherwise specified.

P. Taper construction joints over a minimum distance of 12 inches to a thin edge, and thoroughly wet before placing any adjacent section. Repair surface defects as soon as possible after initial placement of the shotcrete. All shotcrete that lacks uniformity, that exhibits segregation, honeycombing, or lamination, or that contains any dry patches, slugs, voids, or sand pockets shall be removed and replaced with fresh shotcrete.

Q. Do not repair core holes with shotcrete. Instead, fill solid with patching mortar after cleaning and thoroughly dampening.

R. Use the following precautions during shotcreting:
1. Do not place shotcrete if drying or stiffening of the mix takes place at any time prior to delivery to the nozzle.
2. Do not use rebound or previously expended material in the shotcrete mix.
3. The area to which shotcrete is to be applied shall be clean and free of rebound or overspray.
4. Discontinue shotcreting when temperature drops below 40°F or when shotcrete cannot be protected.
5. Protect any existing structures and facilities from shotcrete rebound as appropriate.

3.04 CURING

A. Immediately after finishing, keep shotcrete continuously moist for at least 24 hours. Use one of the following materials or methods:
1. Ponding or continuous sprinkling.
2. Absorptive mat or fabric, sand, or other covering kept continuously wet.
3. Curing compounds in accordance with ASTM C309. On natural gun or flash finishes, use the application rate of one gallon per 100 square feet. Do not use curing compounds on any surfaces against which additional shotcrete or other cementitious finishing materials are to be bonded unless positive measures, such as sandblasting, are taken to completely remove curing compounds prior to the application of such additional materials.

B. Provide additional final curing immediately following the initial curing and before the shotcrete has dried. Use one of the following materials or methods:
1. Continue the method used in initial curing.
2. Application of impervious sheet material conforming to ASTM C171.

C. Continue curing for the first seven days after shotcreting or until the required strength is obtained. During the curing period, maintain shotcrete above 40° F and in a moist condition as specified.

END OF SECTION

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SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work specified in this Section consists of designing mix, furnishing, placing, and curing Portland cement concrete, reinforced and unreinforced, and mass concrete, as indicated. Underwater concreting will not be permitted.

B. Related Sections
   1. Work Specified Under Other Sections: Items to be embedded in concrete are as specified in the various Sections of this Specification. The responsibility for coordinating concrete placements with embedded items rests solely with the Contractor.

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials, AASHTO M 182 Burlap cloth made from Jute or Kenaf.

B. American Concrete Institute (ACI):
   1. ACI 117; Specifications for Tolerances for Concrete Construction and Materials and Commentary.
   2. ACI 207.1R; Guide to Mass Concrete.
   3. ACI 211.1; Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
   4. ACI 221; Guide for Use of Normal Weight and Heavy Weight Aggregates in Concrete.
   5. ACI 237R; Self-Consolidating Concrete.
   6. ACI 301; Specifications for Structural Concrete.
   7. ACI 304R; Guide for Measuring; Mixing, Transporting and Placing Concrete.
   8. ACI 305R; Hot Weather Concreting.
   9. ACI 306R; Cold Weather Concreting.
   10. ACI 308R; Guide to Curing Concrete.
   11. ACI 309R; Guide for Consolidation of Concrete.
   12. ACI 318; Building Code Requirements for Structural Concrete and Commentary.
   13. ACI 350; Code Requirements for Environmental Engineering Concrete Structures and Commentary.

C. American Society for Testing and Materials (ASTM):
   1. ASTM C 31; Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   2. ASTM C 33; Standard Specification for Concrete Aggregates.
   3. ASTM C 39; Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

4. ASTM C 42; Standard Test Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
5. ASTM C 78; Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
6. ASTM C 88; Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
7. ASTM C 94; Standard Specification for Ready-Mixed Concrete.
8. ASTM C 114; Standard Test Methods for Chemical Analysis of Hydraulic Cement.
9. ASTM C 143; Standard Test Method for Slump of Hydraulic-Cement Concrete.
10. ASTM C 150; Standard Specification for Portland Cement.
11. ASTM C 171; Standard Specification for Sheet Materials for Curing Concrete.
12. ASTM C 172; Standard Practice for Sampling Freshly Mixed Concrete.
13. ASTM C 173; Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
14. ASTM C 192; Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
15. ASTM C 227; Standard Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations.
16. ASTM C 231; Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
17. ASTM C 260; Standard Specification for Air-Entraining Admixtures for Concrete.
18. ASTM C 295, Standard Guide for Petrographic Examination of Aggregates for Concrete.
19. ASTM C 309; Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
20. ASTM C 330; Standard Specification for Lightweight Aggregate for Structural Concrete.
21. ASTM C 494; Standard Specification for Chemical Admixtures for Concrete.
22. ASTM C 618; Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
23. ASTM C 856; Standard Practice for Petrographic Examination of Hardened Concrete.
24. ASTM C 881; Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
25. ASTM C 882; Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.
26. ASTM C 989; Standard Specification for Slag Cement for Use in Concrete and Mortars.
27. ASTM C 1260; Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).
28. ASTM D 638; Standard Test Method for Tensile Properties of Plastics.
29. ASTM D 695; Test Method for Compressive Properties of Rigid Plastics.
30. ASTM C 1260; Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).

31. ASTM C 1567; Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method).
32. ASTM C 1602; Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
33. ASTM C 1610; Standard Test Method for Static Segregation of Self-Consolidating Concrete Using Column Technique.
34. ASTM C 1611; Standard Test Method for Slump Flow of Self-Consolidating Concrete.
35. ASTM C 1621; Standard Test Method for Passing Ability of Self-Consolidating Concrete by J-Ring.
36. ASTM C 1712; Standard Test Method for Rapid Assessment of Static Segregation Resistance of Self-Consolidating Concrete Using Penetration Test.
37. ASTM D 1751; Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
38. ASTM D 1752; Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
39. ASTM E 329; Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

D. U.S. Army Corps of Engineers Specifications:
   1. U.S. Corps of Engineers CRD-C 572 Specification for Waterstop.
   2. U.S. Corps of Engineers CRD-C 94 Specification for Surface Retarder.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's descriptive product data and current specifications for the concrete accessories specified herein (admixtures, joint fillers, joint sealants, curing materials, floor hardeners, waterstops, etc.). Include installation instructions.

B. Samples: Submit samples of materials being used when requested by the Engineer including names, sources, and descriptions.

C. Concrete Aggregates:
   1. Submit source of all aggregates.
   2. For each source of aggregate, submit the following as required by Article 2.01 D:
      a. Results of one petrographic analysis prepared in accordance with ASTM C 295.
      b. Results of testing in accordance with ASTM C 1260.
      c. Results of testing in accordance with ASTM C 1567.
   3. For each source of aggregate for mass concrete, submit the following as required by Article 3.08.C:
      a. Results of testing in accordance with ASTM C 227.
      b. Results of testing in accordance with ASTM C 1260.

c. Results of additional testing in accordance with ASTM C 295, ASTM C 856, ASTM C 1567, additional tests in accordance with ASTM C 1260, and other tests as requested by the Engineer.

D. Design Mix: Prior to production of concrete, submit for approval, on form attached at the end of this Section, all mix designs proposed for the Project. Include with each proposed design mix a standard deviation analysis in accordance with ACI 301 Section 4.2 or trial mixture test data proposed in ACI 301 Section 4.2. Use materials in such proposed design mix as specified in this Section.

E. Test Reports:
   1. Submit concrete test reports specified in Part 3, Field Quality Control in this Section.

F. Certificates:
   1. Furnish the Engineer, and local authorities requiring same, certificates originated by the batch mixing plant certifying ready mixed concrete, as manufactured and delivered, to be in conformance with ASTM C 94.

G. Delivery Tickets: A delivery ticket shall accompany each load of concrete from the batch plant.
   1. Tickets must be signed by the Contractor's representative, noted as to time and place of pour and kept in a record at the site. Make such records available for inspection upon request by the Engineer.
   2. Information presented on the ticket to include the tabulation covered by ASTM C 94, Section 16, as well as any additional information the local codes may require.

H. Schedule: Submit schedule showing curing and placement methods, construction joint locations, and sequence of pouring a minimum of twenty-five (25) days prior to placing concrete.

I. Independent Testing Laboratory: Prior to proceeding with testing, submit name and experience qualifications of the proposed Independent Testing Laboratory for approval. Include certificate documenting compliance with ASTM E 329 for laboratory, laboratory personnel, and field testing and inspection personnel.

J. Qualification of the Contractor’s Personnel: Submit experience qualifications of the person or persons designated to be responsible for Quality Control Sampling and Testing.

K. Air Testing Equipment: Submit certificate of current calibration for air testing equipment to be used on Project.

L. Submit current Approved ICC Evaluation Reports for all epoxy adhesive products to be used for grouting dowels.

M. Waterstops:

1. Submit name(s) of employee(s) designated to perform field splices and proposed schedule for waterstop manufacturer's field splice training as required in Article 1.04 D.3 in this Section.
2. Submit manufacturer shop drawings showing fabrication details for all factory-formed corners, directional changes, intersections, transitions, and any other special factory-formed items for approval prior to start of manufacturing. Shop drawings shall also include method of securing and supporting waterstop in forms to maintain proper orientation and location during concrete placement.
3. Submit two (2) twelve-inch (12") long (minimum) samples of each waterstop product that is used in the work. Submit companion samples of hardware (i.e., bolts, nuts, washers, batten bars, adhesive, gaskets, etc.) as applicable to the specified item.
4. Submit a single sample of each factory fabrication that is used in the work. After approval, samples may be incorporated into the finished work.
5. Provide to the Engineer a single twelve-inch (12") long sample of an acceptable field butt weld as required in Article 1.04 D.3 in this Section.
6. If requested by the Engineer, submit a Waterstop Deficiency Remediation Plan.

1.04 QUALITY

A. Quality Control Testing Responsibilities:
   1. The Contractor shall perform Quality Control Testing for each stage of work. This includes testing as required in Article 3.05. Engineer may, at any time, inspect any of the Contractor's Quality Control operations and perform such independent or supplemental tests as he believes necessary to corroborate or check results reported by the Contractor. Furnish equipment and personnel as necessary to secure samples for Quality Assurance Testing by Engineer. Quality Assurance Testing performed by Engineer does not relieve the Contractor of his responsibility for performing all of the quality control tests and inspections.
   2. Independent Testing Laboratory: Quality control testing assigned as the responsibility of the Contractor shall be performed by a qualified approved independent testing laboratory. The independent testing laboratory shall be regularly engaged in performing work conforming to The American Society for Testing and Materials ASTM E 329, Recommended Practice for Inspection and Testing Agencies for Concrete and Steel in Construction. The Contractor shall submit detailed documentation adequately demonstrating that the laboratory meets these criteria. Engineer reserves the right to perform on-site inspections of the independent testing laboratory in advance of approval and at any time during the duration of this Contract to verify compliance with testing standards. Additionally, the independent laboratory testing must be performed under the general supervision of a Registered Professional Engineer.

B. Qualifications of Contractor's Personnel Responsible for Quality Control Sampling and Testing: The Contractor shall submit for approval the qualifications of the person or persons designated to be responsible for the Quality Control Sampling and Testing. Submittals shall include resumes and other documentation adequately demonstrating their experience in performing similar work. Approval of personnel will be based on

documentation adequately demonstrating that minimum qualification requirements are met. The Engineer reserves the right to reject any personnel not deemed to be fully qualified for the work. Minimum qualifications for personnel responsible for the sampling and testing are as follows:

1. Experience shall include testing and construction observation performed in connection with reinforced concrete construction. Field technicians responsible for testing shall have current certification as ACI Concrete Field Testing Technician – Grade I.
2. A minimum of one (1) full-time quality control person shall be supplied by the Contractor for each concrete placement activity. This person shall have prior experience in the work task for which he is responsible and shall be approved by the Engineer. Work within that activity shall not be carried out without his presence on the site.

C. Source Quality Control:
   1. Laboratory Tests: Materials stated herein require advance examination or testing according to methods referenced, or as required by the Engineer.
   2. Compression Test Cylinders: For laboratory trial batches, make in accordance with American Concrete Institute ACI 301. Test to consist of six (6) compression test cylinders for each class of concrete with two (2) broken at seven (7) days, two (2) broken at twenty-eight (28) days and two (2) spares (if testing at 56 days is required). Perform in accordance with ASTM C 192 and ASTM C 39.

D. Vinyl Waterstop Field Splices:
   1. Both field and factory-formed splicing shall be done in accordance with the waterstop manufacturer's specifications and recommendations.
   2. Only straight butt joint splices will be allowed in the field. No other types of field splices are permitted. See Article 3.02 B.1. in this Section.
   3. Prior to installing any waterstops in the permanent work, the Contractor shall provide to the Owner in writing the name(s) of employee(s) designated to perform field splices. The designated Contractor's employee(s) shall be trained at the jobsite by a qualified representative in the proper method of performing field splices. Upon completion of the training, each designated Contractor employee(s) shall demonstrate in the presence of the Engineer and waterstop qualified representative the ability to complete at least two (2) straight butt joint field splices of each size and type of finished waterstop in accordance with the manufacturer's specifications and recommendations.
   4. This training shall be provided at no additional cost to the Owner.
   5. Only designated Contractor employee(s) trained by the waterstop qualified representative, and which have successfully demonstrated ability in accordance with all provisions of Article 1.04.D.3, are permitted to perform field splicing in the permanent work.
   6. Waterstop splicing defects that are unacceptable include, but are not limited to the following:
      a. Tensile strength less than eighty percent (80%) of parent section.
      b. Free lap joints.

c. Misalignment of center bulb, ribs, and end bulbs greater than one-sixteenth inch (1/16”).
d. Misalignment that reduces waterstop cross section more than fifteen percent (15%).
e. Bond failure at joint deeper than one-sixteenth inch (1/16”) or fifteen percent (15%) of material thickness.
f. Misalignment of waterstop splice resulting in misalignment of waterstop in excess of one-half inch (½”) in ten feet (10’).
g. Visible porosity in the weld area, including pin holes.
h. Charred or burnt material.
i. Bubbles or inadequate bonding.
j. Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.

1.05 PROJECT CONDITIONS

A. ACI Compliance:
1. Cast-in-place concrete work shall conform to ACI 301 except as modified by these Specifications or the Drawings.
2. Mass concrete proportioning, placement, consolidation and curing shall be in accordance with Article 3.08 in this Section. Consideration shall be given to temperature rise caused by the hydration of the cement. Large differences in temperature within the concrete shall be avoided.

B. Pre-Concrete Conference:
1. At least thirty-five (35) days prior to the start of the concrete construction schedule, the Contractor shall conduct a meeting to review the proposed mix designs and to discuss the required methods and procedures to achieve the required concrete construction. The contractor shall send a pre-concrete conference agenda to all attendees, including the Owner’s representative, twenty (20) days prior to the scheduled date of the conference.
2. The Contractor shall require responsible representatives of every part who is concerned with the concrete work to attend the conference, including but not limited to the following:
a. Contractor's superintendent;
b. Laboratory responsible for the concrete design mix;
c. Laboratory responsible for field quality control;
d. Concrete subcontractor / placement subcontractor;
e. Ready-mix concrete producer; and
f. Engineer / Owner’s representative.
3. Minutes of the meeting shall be recorded, typed, and printed by the Contractor and distributed to all parties attending within five (5) days of the meeting.
4. At a minimum, the meeting shall address the following:
a. Mix design(s);
b. Admixture(s);
c. Forming systems;
d. Placing methods;

e. Special considerations for pumping (if applicable);
f. Shifts of work;
g. Curing;
h. Hot weather concreting procedures; and
i. Concrete Quality Assurance / Quality Control checklists.

1.06 SEQUENCING

A. Where other construction work is relative to concrete pours, or must be supported by or embedded in concrete, those performing such related work must be given five (5) days' notice to introduce or furnish embedded items before concrete is placed.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cement:
   1. Portland Cement: ASTM C 150 of the following Type:
      a. Type II, Moderate Sulfate Resistance. If Type II is not available, contractor shall submit substitution for review and approval.
   2. Only one brand and manufacturer of approved cement shall be used for exposed concrete.
   3. Cementitious material is a mixture of cement and either ground granulated blast – furnace slag (GGBFS) or Pozzolan.

B. Ground Granulated Blast – Furnace Slag (GGBFS): Conform to ASTM C 989, Grade 120, NSF approved for contact with potable water.
   1. Use GGBFS at the rate of twenty-five percent (25%) (min.) to fifty percent (50%) (max.), by weight, of the total cementitious material.

C. Pozzolan: Conform to ASTM C 618 Class F fly ash, NSF approved for contact with potable water.
   1. Minimum rate of thirty percent (30%) of total cementitious material.
   2. Loss on ignition shall not exceed four percent (4%).
   3. Sulfur trioxide content shall not exceed eight percent (8%).
   4. Available alkalis expressed as equivalent Na2O shall not exceed one and one-half percent (1.5%).
      Calcium oxide content shall not exceed eight percent (8%) as determined by ASTM C 114.

D. Crystalline Waterproofing Additive: Add Crystalline waterproofing to all concrete used in water retaining structure walls.
   1. Water retaining structures include, but are not necessarily limited to, labyrinth weir walls and slab and spillway training walls.
   2. Concrete waterproofing system shall be of the crystalline type that chemically controls and permanently fixes a non-soluble crystalline structure throughout the capillary voids of the concrete. The system shall cause the concrete to become

sealed against the penetration of liquids from any direction and shall protect the concrete from deterioration due to harsh environmental conditions.

3. Dosage rate to be 2% (Xypex, Sika WT-215 P) or 1% (ICS Penetron) of the total cementitious material content. If the waterproofing admixture manufacturer recommends other dosage rates than specified above, submit the recommendation to the Engineer for approval. Add crystalline waterproofing additive at the batch plant.
4. Acceptable Manufacturers:
    a. XYPEX.
    b. ICS Penetron.
    c. Sika WT-215 P.

E. Normal Weight Concrete Aggregates: Provide aggregate meeting requirements of ASTM C 33 and subject to the following limitations.

1. Coarse Aggregate Size: Maximum size of coarse aggregate shall not exceed the following requirements but in no case larger than one and one-half inches (1½").
    a. One-fifth (1/5) narrowest dimension between sides of forms within which concrete is to be cast.
    b. Three-fourths (¾) of the minimum clear spacing between reinforcing bars.
    c. One-third (1/3) the slab thickness for unreinforced slabs.
    d. Reduced aggregate concrete containing aggregate with particle size not less than one-eighth inch (1/8") nor more than one-half inch (1/2") in any dimension and a maximum of five percent (5%) of particles passing a No. 8 sieve (for use in metal pan stairs only).
    e. Three-fourths (¾) of the minimum clear spacing between waterstop and reinforcing steel. See Article 3.02.B.1 this Section.
2. Testing for Alkali-Aggregate Reactivity: Aggregates from each source proposed for use in concrete shall be tested for susceptibility to alkali-aggregate reaction in accordance with the following procedures. Concrete supplier may provide testing already conducted on representative aggregate samples to establish results of Alkali-Aggregate Reactivity Testing.
    a. Perform a petrographic analysis in accordance with ASTM C 295. The analysis shall be performed by a Petrographer experienced in identifying reactive constituents in aggregates. The analysis shall indicate rock type, mineralogical constituents, physical and chemical characteristics of the materials that have a bearing on the performance of the aggregate when it is used as concrete aggregate; particularly the identification of any potentially alkali-aggregate reactive constituents. Not more than one (1) analysis is required for each aggregate source provided the parent rock type is the same, and the material is being mined from the same geologic formation and from the same approximate location within a single quarry.
    b. Test the aggregate source(s) in accordance with ASTM C 1260. Aggregates tested in accordance with ASTM C 1260 shall be considered potentially reactive if expansion exceeds 0.10% at sixteen (16) days after casting.
    c. Aggregates that are shown to be potentially reactive based on testing in accordance with ASTM C 1260 shall not be used without additional testing in accordance with procedures in ASTM C 1567 using the proposed

cementitious material(s). If expansion exceeds 0.10% at sixteen (16) days after casting when the aggregate(s) are tested in accordance with ASTM C 1567 using the proposed blend of cementitious materials, the aggregates shall not be used.

d. Aggregate sources that are shown to be susceptible to alkali-carbonate reactivity (ACR) based on testing performed for this project, based on prior field performance, or based on prior testing, shall not be used in any concrete mixes.

F. Water: Conforming to the requirements of ASTM C 1602. Clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances that may be deleterious to concrete or reinforcement.

G. Concrete Admixtures:
   1. Use only non-corrosive, non-chloride admixtures.
   2. Provide admixtures produced and serviced by established, reputable manufacturers and use in compliance with manufacturer's recommendations.
      a. Only one (1) manufacturer per approved admixture shall be used.
   3. Admixtures used for all cast-in-place concrete shall conform to the requirements of ANSI/NSF 61.
   4. Air-Entraining Admixture: Use a product conforming to requirements of ASTM C 260.
      a. Acceptable Manufacturers:
         1) AEA-92; The Euclid Chemical Company.
         2) Sika Air; Sika Corporation.
         3) Micro Air; BASF.
         4) Or approved equal.
   5. Water-Reducing Admixture: Use a product conforming to requirements of ASTM C 494 Type A. (Use this for all concrete except where an admixture listed below is used).
      a. Acceptable Manufacturers:
         1) Eucon WR-91; The Euclid Chemical Company.
         2) PolyHeed 997; BASF.
         3) Or approved equal.
   6. Water-Reducing and Retarding Admixture: Use a product conforming to requirements of ASTM C 494, Type D.
      a. Acceptable Manufacturers:
         1) Eucon Retarder-75; The Euclid Chemical Company.
         2) Plastiment; Sika Corporation.
         3) Pozzolith 200N; BASF.
         4) Or approved equal.
   7. High-Range Water Reducing Admixture: Use a product conforming to requirements of ASTM C 494, Types A and F.
      a. Acceptable Manufacturers:
         1) Eucon 37; The Euclid Chemical Company.
         2) Sika ViscoCrete 2100; Sika Corporation.
         3) Glenium 7700; BASF.

4) Or approved equal.

8. Water-Reducing, and Acceleration Admixture: Use a product conforming to requirements of ASTM C 494, Types C or E. Not permitted for use in concrete for water retaining structures.
   a. Acceptable Manufacturers:
      1) Accelguard 80; The Euclid Chemical Company.
      2) Pozzutec 20; BASF.
      3) Plastocrete 161 FL, Sika Rapid-1, or Sikaset series; Sika Corporation.
      4) Or Approved Equal.
9. Store admixtures in a manner to prevent contamination, evaporation, moisture penetration, or damage. Do not use products that have been stored longer than six (6) months.
10. Prior to the mix design review by the Engineer, provide written conformance to the specified requirements of all admixtures.

H. Preformed Expansion Joint Fillers:
   1. Non-extruding and Resilient Bituminous Types (for exterior use in pavements and sidewalks only): ASTM D 1751.
   2. Sponge Rubber and Cork Type: ASTM D 1752.
   3. Self-Expanding Cork Type: ASTM D 1752.
   4. Acceptable Manufacturers:
      a. A. C. Horn.
      b. Greenstreak.
      c. Or approved equal.

I. Vinyl Waterstops: Ribbed type manufactured from virgin polyvinyl chloride plastic compound conforming to U.S. Corps of Engineers CRD-C 572.
   1. 6-inch Waterstop: 6 x 3/8-inch, such as Sika Greenstreak; Cat. No. 679.
   2. 9-inch Waterstop: 9 x 3/8-inch with center bulb of 1-inch outside diameter, such as Sika Greenstreak; Cat. No. 696.
   3. Acceptable Manufacturers:
      a. Sika Greenstreak (Catalog Nos. as specified above).
      b. Vinylex Corporation
      c. W. R. Meadows, Inc.
      d. Or approved equal.

J. Surface Applied Waterstop: A specially formulated joint sealant that swells upon contact with water. Provide waterstop packaged in continuous length coils. Material composition as follows:
   1. Chloroprene rubber and chloroprene rubber modified to impart hydrophilic properties.
   2. Waterstop shall have a coating formulated to inhibit initial expansion due to moisture presence in the fresh concrete.
   3. Size: Dual extrusion design; 10 mm by 20 mm.
   4. Waterstop shall be secured to hardened concrete with the waterstop manufacturer’s standard adhesive binder.

5. Joints and seams in the waterstop shall be sealed with the waterstop manufacturer's standard sealant. Sealant must be compatible with vinyl waterstops and all materials against which the surface applied waterstops will be located.
6. Acceptable Manufacturers:
    a. Sika Greenstreak; Hydrotite CJ.
    b. ADEKA; Ultraseal.
    c. Or approved equal.

K. Curing Materials. Use curing materials that will not stain or affect concrete finish or lessen the concrete strength and comply with the following requirements:
1. Burlap: Materials conforming to AASHTO M 182.
2. Sheet Materials: Material conforming to ASTM C 171.
3. Water: Meet the standard chemical requirements for ready mix concrete as established in ASTM C 94, "Standard Specification for Ready-Mixed Concrete." The Contractor will be permitted to use water from the reservoir or stream provided it meets these requirements or is treated, as necessary. Submit water test results for the selected source (reservoir or alternative source) meeting the requirements of ASTM C 94 to the Engineer. Additional testing of site water quality by the Contractor may be required by the Engineer if there is a suspected change in the quality of the site water. The Engineer reserves the right to suspend the use of site water pending additional testing results of water quality. Water quality improvements shall be the responsibility of the Contractor and considered incidental to the work.
4. Liquid Curing Compound: Liquid curing compound shall only be used to prevent bond between control joints as indicated on the drawings.
    a. Water-Based Curing Compound for Concrete Surfaces: Sika Antisol -250 W.

L. Epoxy Bonding Compound: A high-modulus, low-viscosity, moisture-insensitive epoxy adhesive having the following properties:
1. Compressive Properties, ASTM D 695 at twenty-eight (28) days;
    a. Compressive Strength: 8,000 psi. min.
2. Tensile Properties, ASTM D 638 at fourteen (14) days.
    a. Tensile Strength: 4,000 psi. min.
    b. Elongation at Break: One to three percent (1% to 3%).
3. Bond Strength, ASTM C 882:
    a. Plastic concrete to hardened concrete at fourteen (14) days (moist cure): 1,700 psi. min.
4. Mixed epoxy resin adhesive shall conform to ASTM C 881, Type II, Grade 2, Class C.
5. Acceptable Manufacturers:
    a. Sika Corporation; Sikadur 32 Hi-Mod.
    b. Euclid Chemical Company; Euco Epoxy #452 MV or #620.
    c. Or approved equal.

M. Epoxy Adhesive (for grouting dowels): Two-component, high strength, moisture tolerant epoxy adhesive:

1. Mixed epoxy resin adhesive shall conform to ASTM C 881.
2. Acceptable Manufacturers:
   a. Powers Fasteners PE1000+, www.powers.com.
   b. Simpson XP, www.simpsonanchors.com.
3. Installation:
   a. Follow Manufacturer's recommendations.

2.02 MIXES

A. Selection of Proportions of Normal weight Concrete: ACI 211.1.

B. Proportions of Ingredients: Establish proportions, including water-cementitious material ratio on the basis of either laboratory trial mixture tests or standard deviation analysis, with the materials specified herein.
   1. Laboratory Trial Mixture Test: ACI 301, Section 4 and ACI 318, Section 5.3.
   2. Standard Deviation Analysis: ACI 301, Section 4 and ACI 318, Section 5.3.

C. Water-Cementitious Material Ratio:
   1. Class A Concrete shall have a maximum water-cementitious material ratio of 0.42.
   2. Class B Concrete shall have a maximum water-cementitious material ratio of 0.55.
   3. High Early Strength concrete shall have a maximum water-cementitious material ratio of 0.40.

D. Slump: Proportion and produce concrete to a slump as indicated below. The slump ranges apply when vibration is used to consolidate the concrete.

	Slump, inches	
Types of Construction	Maximum*	Minimum
Reinforced foundation walls and footings	3	1
Plain footings, caissons, and substructure walls	3	1
Slabs, beams, and reinforced walls	4	1
Building columns	4	1
Pavements and slabs-on-grade	3	1

*May be increased one inch (1") for methods of consolidation other than vibration.

   1. Pumped concrete shall have a 5-inch maximum slump, measured prior to pumping.
   2. Concrete containing high-range water-reducing admixture shall have an 8-inch maximum slump after admixture is added to concrete with a 2- to 4-inch slump.
   3. Slump Flow for Self-Consolidating Concrete: Proportion and produce concrete with a slump flow range between 22 inches (minimum) to 28 inches (maximum).

2.03 ADMIXTURES

A. Air Entraining: Provide air-entrained concrete for each concrete pour except where indicated otherwise on the Drawings or specified herein. Total air content required as follows:

1. Maximum-size coarse aggregate, inches:	Air content percent by volume:
1½	5 ± 1
3/4 or 1	6 ± 1
3/8 or 1/2	7½ ± 1

B. Water-Reducing Admixture: Unless high temperatures occur or placing conditions dictate a change, use concrete containing a water-reducing admixture.

C. Water-Reducing and Retarding Admixture: When high temperatures occur or placing conditions dictate, the water-reducing admixture (Type A) may be replaced with a water-reducing and retarding admixture (Type D). Notify the Engineer of such change and submit product data prior to placement of concrete.

D. Water-Reducing and Accelerating Admixture: When low temperatures occur or placing conditions dictate, the water-reducing admixture (Type A) can be replaced with a water-reducing and accelerating admixture. Notify the Engineer of such change and submit product data prior to placement of concrete. Water-reducing and accelerating admixture (Type C and E) will not be permitted in concrete for water retaining structures.

2.04 SOURCE QUALITY CONTROL

A. Classes of Concrete:
   1. Class A: 4,500 psi minimum compressive strength at twenty-eight (28) days; 564 pounds per cubic yard minimum cementitious material content.
   2. Class B: 3,000 psi minimum compressive strength at twenty-eight (28) days; 517 pounds per cubic yard minimum cementitious material content.
   3. High Early Strength: 3,000 psi minimum compressive strength at three (3) days; minimum 3,750 psi compressive strength at twenty-eight (28) days; 752 pounds per cubic yard minimum cementitious material content.

B. General Requirement: All Backfill Concrete and Dental Concrete, as shown on the Drawings, shall be Class B concrete. All other concrete shall be Class A concrete unless other requirements are specifically referenced in the Drawings.

C. Specified Flexural Strength at Twenty-eight (28) Days:
   1. Class A: 603 psi.

D. SCC (Self-Consolidating Concrete) shall be placed where designated on the Drawings (not used). The provided concrete mix shall meet the following criteria:
   1. Slump Flow Test, ASTM C1611: Acceptable horizontal flow range between 22 inches and 28 inches.

2. T50 Test: Results between 2 to 7 seconds.
3. J-Ring Test, ASTM C1621: The tested difference between the Slump Flow Test and the J-Ring Test shall be less than 1 inch.
4. Penetration Test, ASTM C1712: Penetration depth shall be less than ½ inch.
5. Column Segregation Test, ASTM C1610: Segregation limit shall be less than 10%.

PART 3 EXECUTION

3.01 INSPECTION

A. Inspect work to receive cast-in-place concrete for deficiencies that would prevent proper execution of the finished work. Do not proceed with placing concrete until such deficiencies are corrected to the satisfaction of the Engineer.

B. Contractor shall provide the Engineer sufficient notice prior to each cast-in-place concrete placement to allow the Engineer to perform an inspection of the work to receive cast-in-place concrete.

C. Should the Engineer's inspections identify quality control issues or other quality control issues arise during construction of the cast-in-place concrete, the Engineer may require the Contractor to develop a quality control checklist to be submitted to the Engineer for review and approval prior to each cast-in-place concrete placement.

3.02 PREPARATION

A. Joints:
   1. Construction Joints: Only the location of critical joints throughout the structures are indicated on the Drawings. Select additional joint locations, if needed, in walls, slabs, and beams subject to the Engineer's approval and meeting the following conditions:
      a. Locate such joints to least impair the strength of the structure and near the middle of the span of structural slabs or beams.
      b. The horizontal length between wall joints shall not exceed thirty feet (30') in a continuous wall. At corners or other intersections of two (2) or more walls, provide a joint in each wall at a distance less than fifteen to twenty feet (15' to 20') from the intersection point in all directions.
      c. Space construction joints in structural slabs not greater than thirty feet (30') in each direction unless noted otherwise based on the spillway slab joint plan drawing, although some adjustments, as approved by the Engineer, may be permitted due to column spacing and details.
      d. If a beam intersects another beam at a proposed construction joint, offset the joint in the beam a distance equal to twice the width of the beam and provide adequate shear reinforcement as determined by the Engineer.
      e. Maximum joint spacing for slabs-on-grade shall not be greater than twenty feet (20').
      f. Provide waterstops in construction joints where such joints are exposed to liquids, in contact with earth, or subject to weather exposure.

g. Place walls and slabs in alternate sections allowing at least two (2) days elapsed time for slabs and five (5) days elapsed time for walls before concrete is placed against an adjacent horizontal or vertical joint.
h. Submit requests for approval of joint locations ten (10) days prior to scheduled concrete pours. Do not make concrete pours unless joint locations have been approved in writing by the Engineer.
i. As a lift is completed, the top surface shall be immediately and carefully protected from any condition that will damage the concrete.
j. Cleaning: Concrete surfaces to which other concrete is to be bonded shall be prepared for receiving the next lift or adjacent concrete by cleaning with either high pressure water jet, or air-water cutting. If the concrete surface is formed, is congested with reinforcing steel, is relatively inaccessible, or, if for any other reason it is considered undesirable to disturb the surface of a lift before it has hardened, surface cutting by means of air-water jets will not be permitted and the use of high pressure water jet will be required.
k. Air-Water Cutting: Air-water cutting of a construction joint shall be performed at the proper time and only on horizontal construction joints. The surface shall be cut with an air-water jet to remove all laitance and to expose clean, sound aggregate, but not so as to undercut the edges of the larger particles of aggregate. The air pressure used in the jet shall be 100 psi plus or minus 10 psi and the water pressure shall be just sufficient to bring the water into effective influence of the air pressure. When approved by Engineer, a retarder complying with the requirements of CRD-C 94 may be applied to the surface of the lift to prolong the period of time during which air-water cutting is effective. Prior to receiving approval, the Contractor shall furnish manufacturer's data for the material to be used and shall demonstrate the method to be used in its application. After cutting, the surface shall be washed and rinsed as long as there is any trace of cloudiness of the wash water. The surface shall again be washed just prior to placing the succeeding lift.
l. High Pressure Water Jet: A stream of water under a pressure of not less than 3,000 psi may be used for cleaning. Its use shall be delayed until the concrete is sufficiently hard so that only the surface skin or mortar is removed and there is no undercutting of coarse aggregate particles. Where the cleaning occurs more than two (2) days prior to placing the next lift, or where the work in the area subsequent to the cleaning causes dirt or debris to be deposited on the surface, the surface shall be cleaned again as the last operation prior to placing the next lift.
m. Waste Disposal: The method used in disposing of wastewater employed in cutting, washing, and rinsing of concrete surfaces shall be such that the wastewater does not stain, discolor, or affect exposed surfaces of the structures.
n. No exceptions permitted to the above requirements unless written approval is given by the Engineer.

2. Expansion Joints and Contraction Joints:
   a. Install where indicated on the Drawings.

b. Do not extend reinforcing or other embedded metal items through expansion and contraction joints except where indicated otherwise on Drawings.
c. Sawcutting contraction joints will not be permitted.
d. Provide waterstops in joints exposed to liquids, in contact with earth, or subject to weather exposure.

3. Bonding to New Concrete: Bond fresh concrete with hardened previously poured new concrete in accordance with the following:
   a. Remove all dirt, oil, grease, and other bond-inhibiting materials by mechanical means.
   b. Roughen and prepare concrete surface following ICRI Technical Guideline Number 310.2R. Roughened concrete surface shall have a benchmark profile CSP-6 (per IRCI Technical Guideline No. 310.2R) unless noted otherwise on the drawings.
   c. Dampen with water or pre-soak the substrate for no less than twenty-four (24) hours to achieve a saturated surface dry concrete condition.
   d. Cover the hardened concrete with a heavy coating of grout to approximately one-half inch (½") thickness. Use grout of same material composition and proportions of concrete being poured except coarse aggregate omitted. Use grout with a slump of six inches (6") minimum.
   e. Place new concrete on grout before it has attained its initial set.
   f. Other bonding methods must be approved by Engineer prior to use.
4. Bonding to Existing Concrete: Bond fresh concrete with existing concrete in accordance with the following:
   a. Remove all dirt, oil, grease, and other bond-inhibiting materials by mechanical means.
   b. Roughen and prepare concrete surface following ICRI Technical Guideline Number 310.2R. Roughened concrete surface shall have a benchmark profile CSP-6 (per IRCI Technical Guideline No. 310.2R) unless noted otherwise on the drawings.
   c. Thoroughly clean repair area.
   d. Apply Epoxy Bonding Compound over existing prepared concrete in accordance with manufacturer's instructions.
5. When concreting is to be discontinued for more than forty-five (45) minutes and if the construction plane is to be horizontal, install waterstops and embed dowels in the concrete before initial hardening. Use keyways and dowels in vertical concrete construction only when indicated or directed by the Engineer. Use waterstops for water retaining structures or structures below grade. Horizontal joints are not permitted in slabs or footings.
   a. Extend dowels placed in joint one (1) splice length into wall and one (1) splice length into next concrete pour.

B. Embedded Items:
   1. Vinyl Waterstops:
      a. Install in all joints where watertightness is required, and at locations indicated in the Contract Documents, to form a continuous watertight diaphragm in each joint or series of interconnected joints.
         1) Vinyl Waterstops:

a) Use ribbed type waterstops of the following dimensions except as otherwise indicated on the Drawings.
   (1) Expansion and contraction joints in new construction: Nine inches (9") wide by three-eighths inch (3/8") thick, with center bulb.
   (2) Construction joints: Six inches (6") wide by three-eighths inch (3/8") thick; no center bulb.

b. Use continuous lengths without splices to the extent possible to minimize the number of field splices.

c. Provide factory-formed and tested waterstop at all corners, directional changes, and intersections leaving only a straight butt joint splice in the field.

d. Connect all adjoining waterstops including vertical and horizontal runs to provide a continuous water barrier. Except for square-cut, straight butt joint field splices, all adjoining waterstop connections shall be factory-formed and tested.

e. Splices:
   1) Strength: Not less than eighty percent (80%) of the mechanical strength of the parent section.
   2) Watertightness: Make equal to that of continuous material.
   3) Heat seal adjacent surfaces in accordance with manufacturer's recommendations using a thermostatically controlled electric source of heat that provides sufficient heat to melt but not to char the material.
   4) The continuity of the characteristic features of the cross section of the waterstop shall be maintained across the splice. The spliced area, when cooled and bent by hand in as sharp an angle as possible, shall show no sign of separation.

f. Adequately support waterstops in accordance with manufacturer's recommendations to prevent displacement and deformity of the waterstops during concrete pours. Maintain two inches (2") minimum clearance between waterstop and reinforcing steel.

g. Maximum tolerances for positioning of the waterstop shall be as follows:
   1) Longitudinal alignment: not more than one-inch (1") variation within any ten-foot (10') length of the waterstop, and not more than two-inch (2") deviation from the planned waterstop location, measured at the concrete joint location on a centered waterstop or along mounting surface for retrofit waterstop.
   2) Longitudinal alignment of exposed edge (i.e., "tilt"): Plus or minus one-quarter inch (±¼") per one inch (1") of waterstop width (i.e., 1:4), to be measured relative to waterstop alignment at concrete joint or point of waterstop fixity. For example, a nine-inch (9") wide waterstop shall not tilt more than one and one-eighth inches (1-1/8") from its point of fixity at the concrete joint.
   3) Centering of center-bulbed waterstops on concrete joints: Joint line between concrete placements shall be within middle one-half (½) of center bulb thickness.
   4) Flat/ribbed waterstops centered on joints: Joint line between concrete placements shall be within middle one-fourth (¼) of waterstop width,

"W" (i.e., +/-"W"/8). For example, for a six-inch (6") wide waterstop, which should be centered on the joint with three inches (3") of waterstop on each side, no more than three and three-quarter inches (3¾") and no less than two and one-quarter inches (2¼") of waterstop shall be exposed after the first concrete placement. Further, upon stripping the first placement forms, there shall be no waterstop ribs from the embedded side of the waterstop visibly showing, and no waterstop ribs from the free side of the waterstop embedded in fresh concrete.

5) The above tolerances shall only be relaxed with specific written approval of the Engineer.

6) If the above tolerances are not achieved, the Contractor shall perform joint sealing remediation within the non-compliant area. At a minimum, joint sealing remediation within the non-compliant area shall consist of embedding, grouting, and water testing an Injected Vinylester-Based Resin Waterstop, strictly following the manufacturer's procedures to allow re-injection. The Contractor shall submit a Waterstop Deficiency Remediation Plan for approval that details the affected area(s) and specific method(s) to be utilized. Any non-compliance in the waterstop installation must be corrected to the Engineer's satisfaction, at no additional cost, before the concrete work will be accepted.

h. A sufficient number of ties shall be placed, as directed, to ensure that water stops will remain in the required position during concrete placement. Waterstop shall not be punctured in any manner except as specifically shown on the Drawings.

i. Where waterstops terminate at structural foundations, embed the bottom of each waterstop a minimum of six inches (6") into firm rock or seal to other cut-off systems.

j. Use slotted forms or split formwork to accommodate the waterstop. The use of split or butterfly waterstop is prohibited.

k. During concrete placement, concrete splatter that accumulates on the waterstop and that becomes dry shall be manually removed during placement activities, and prior to fresh concrete being brought to grade on the waterstop.

l. Pressure wash exposed surface of embedded waterstop to provide a clean waterstop surface prior to erection of forms for adjacent concrete panel or structure.

m. At top of wall locations, terminate waterstop 6" below top of wall, unless noted otherwise.

2. In substructures and other structures required to be watertight, install waterstops if concreting is discontinued for a sufficient length of time which, in the opinion of the Engineer, may result in seepage cracks in concrete. Injected Vinylester-Based Resin Waterstops:

a. Install injection hoses and inject vinylester-based resin in strict accordance with the specifications and technical information provided by the manufacturer and as indicated herein.

b. Installation of injection hoses:

1) Install in lengths not to exceed forty feet (40').

2) Install in center of walls and slabs as shown on the Drawings. Encase the injection hose and vent ends in not less than three inches (3") of concrete.
3) Attach to the substrate with plastic anchor clips spaced in accordance with the manufacturer's recommendations.
4) Do not fasten injection hoses to reinforcing steel.
5) Do not criss-cross any injection hoses. Use reinforced PVC vent ends for crossing over the injection hoses.
6) Encase reinforced PVC vent ends in a junction box covered with a matching face plate and mounted firmly against the formwork.
7) Inspect and obtain approval by the Engineer of all installations prior to pouring concrete.

c. Injection Application:
1) Prepare injection material in strict accordance with the manufacturer's printed instructions and specifications regarding mixing, injection procedures, application life, and equipment requirements.
2) Inject the sealing material only when ambient temperatures are between 45ºF and 100ºF.
3) Injection operations should not begin prior to the normal twenty-eight (28) day concrete curing time period, in order to allow for shrinkage.
4) Inject vinylester-based resin in accordance with manufacturer's recommendations.
5) If the injection material penetrates the wall or slab surfaces, wipe clean with water and patch with rapid-setting cement.
6) After injection is complete, evacuate injection hose with water following the manufacturer's recommended procedure.
7) After injection and in strict accordance with manufacturer's directions, test for watertightness and re-inject, if necessary, until satisfactory seal is achieved.

d. Field support by manufacturer: A manufacturer's representative shall be present for the first installation operation and first injection operation and at any other times deemed necessary by the Engineer to ensure proper installation and injection of vinylester-basin resin injection system.

e. If joints are determined to be leaking after water is placed inside structure, drain water from structure and reinject vinylester-based resin in injection hoses within the limits of the leak in accordance with the injection procedures previously described herein.

3. Surface Applied Waterstop Installation: Install surface applied waterstop at such location where indicated on the Drawings.
a. Install the waterstop in strict accordance with the manufacturer's installation instructions and with respect to the environmental requirements specified therein and substrate preparation.

4. Embedded Pipes and Conduits: Material not harmful to concrete may be permitted to be embedded in concrete upon approval by the Engineer. Items embedded shall satisfy the following:
a. Maximum outside dimension not greater than one-third (1/3) the overall thickness of the member in which it is embedded.

b. Minimum spacing between items not less than three (3) item widths on center nor less than three inches (3") clear between items, whichever is greater.
c. Item shall not impair strength of concrete member.
d. Provide two inches (2") minimum clearance to surface of concrete member.

C. Anchoring Reinforcement Dowels into Existing Concrete:
1. Drill holes for each dowel to the size and depth indicated on the Drawings with carbide tip bit or star bit. Core drilling will not be permitted. Do not drill into or cut or otherwise damage existing reinforcement bars. If existing reinforcement bars are encountered during the drilling operation, relocate the hole to clear the existing reinforcement as directed by the Engineer.
2. Blow clean each finished hole with an oil-free air jet and then flush with a jet of clean water.
3. Immediately prior to the grouting operation, remove all water from the hole and from the walls of the hole.
4. Pump dispensing gun for proper mixture. Insert nozzle and pump epoxy adhesive into the hole and insert reinforcement dowels. Do not retemper grout that has begun to stiffen; discard such grout. Comply with manufacturer's specified time limit within which the material must be placed after mixing.

3.03 CONSTRUCTION

A. Production of Concrete
1. Ready-Mixed Concrete:
a. Batched, mixed, and transported in accordance with ASTM C 94.
b. Add admixtures to the mix in accordance with ACI 301.
c. Plant equipment and facilities conforming to the "Check List for Certification of Ready Mixed Concrete Production Facilities" of the National Ready Mixed Concrete Association.

B. Placing
1. General: Conduct placement work in accordance with ACI 304R and such additional requirements as specified herein.
a. Complete discharge of the concrete within one and one-half (1½) hours or before the mixing drum has revolved 300 revolutions, whichever comes first, after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregates.
2. Preparation:
a. Prepare formwork in advance and remove snow, ice, water, and debris from within forms.
b. Pre-position reinforcement in advance of concrete pours.
c. Pre-position waterstops, expansion joint materials, anchors, and embedded items in advance of concrete pours.
d. Sprinkle subgrades with clean water sufficiently to eliminate water loss from concrete in accordance with ACI 301 Chapter 11.
e. Do not place concrete on frozen surfaces.
3. Conveying:

a. Handle concrete from mixer to final deposit rapidly by methods that will prevent segregation or loss of ingredients to maintain required quality of concrete.
b. Do not convey concrete through aluminum or aluminum alloy.
c. Do not place concrete by pumps or other similar devices without prior written approval of the Engineer.
d. Placing concrete by pumping methods shall conform to the applicable requirements of ACI 304R, Chapter 9, and ACI 304.2R.

4. Depositing:
   a. Do not drop concrete freely where reinforcing will cause segregation, nor more than four (4) feet.
   b. Deposit and consolidate concrete in approximately horizontal layers not exceeding 12 to 18 inches.
   c. Do not allow concrete to flow laterally more than three feet.
   d. Place concrete at such a rate that concrete being integrated with fresh concrete is still plastic.
   e. Do not deposit concrete on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within sections.
   f. Do not use concrete that has partially hardened or has been contaminated by foreign materials.
   g. Do not subject concrete to procedures that will cause segregation.
   h. Do not place concrete in forms containing standing water.
   i. Make placement within sections continuously to produce monolithic unit.
   j. Do not begin placement of concrete in beams or slabs until concrete previously placed in adjoining walls or columns has attained initial set.
   k. Do not bend reinforcement out of position when placing concrete.
   l. For Self-Consolidating Concrete, the following placement requirements shall be followed:
      1. Concrete shall be deposited continuously and in layers of such thickness that no fresh SCC is placed on concrete that has hardened enough to cause a seam or plane of weakness.
      2. Concrete placement rate shall allow entrapped air to escape.
      3. Concrete placement rate shall be appropriate for the form system.
      4. Lateral flow of concrete shall be limited to sixteen (16) feet.
      5. When placing with a pump truck, the pump hose shall be placed under the concrete surface whenever possible to reduce the possibility of entrapping additional air.

5. Consolidation:
    a. Consolidate concrete by vibration, spading, rodding, or other manual methods. Work concrete around reinforcement, embedded items and into corners; eliminate all air or stone pockets and other causes of honeycombing, pitting or planes of weakness.
    b. Use vibration equipment of internal type and not the type attached to forms and reinforcement.
    c. Use vibrators capable of transmitting vibration to concrete in frequencies sufficient to provide satisfactory consolidation.
    d. Do not leave vibrators in one spot long enough to cause segregation. Remove concrete segregated by vibrator operation.
    e. Do not use vibrators to spread concrete.
    f. Have sufficient reserve vibration equipment to guard against shutdown of work occasioned by failure of equipment in operation.
    g. For Self-Consolidating Concrete, internal and external vibration to achieve consolidation is prohibited.
6. Hot Weather Concreting: Perform hot weather concrete work in accordance with ACI 305R and the following additional requirements.
    a. Temperature of concrete delivered at the jobsite shall not exceed ninety degrees Fahrenheit (90˚F).
    b. Cool ingredients before mixing to prevent temperature in excess of ninety degrees Fahrenheit (90˚F).
    c. Make provisions for windbreaks, shading, fog spraying, sprinkling, or wet cover when necessary.

C. Finishing:
1. General: Finish concrete in the various specified manners either to remain as natural concrete or to receive an additional applied finish or material.
2. Formed Surfaces: Provide one or more of the following finishes to the surfaces of the concrete after removal of forms. The locations where these finishes are required are listed herein or specified on the Drawings. Allowable surface irregularities are designed as either "abrupt" or "gradual." Check gradual irregularities using ten-foot (10') straightedges.
    a. "Rough Form" finish: Surface may include roughness and irregularities not to exceed one-half inch (½"), but tie holes and defects shall be patched.
    b. "Ordinary Wall" finish: Surface that is true and uniform without any conspicuous offsets or bulges. Gradual irregularities not to exceed one-half inch (½") and abrupt irregularities not to exceed one-quarter inch (¼").
    c. "Plywood" finish: Similar to the "ordinary wall" finish. Construct the surface of the forms using five-eighth inch (5/8") plywood or boards lined with tempered hardboard not less than three-sixteenth (3/16") thick. Place the plywood or liner sheets in an orderly and symmetrical arrangement using sheets as large as practicable. Do not use sheets showing torn grain, worn edges, patches of holes from previous use, or other defects that will impair the texture of the concrete surfaces. Remove gradual irregularities exceeding one-half inch (½") and abrupt irregularities exceeding one-eighth inch (1/8").

Completely remove all fins on the surface. Rub all surfaces that cannot meet these requirements.

d. "Rubbed" finish: Apply to a freshly hardened "plywood" finish. Complete rubbing within one (1) day of removal of forms. Wet surfaces and rub with a carborundum brick or other abrasive until all form marks, projections, and irregularities have been removed and a smooth uniform surface, texture, and color are produced. Wash the surface clean after rubbing.

3. Unformed Surfaces: In concrete having unformed surfaces, use just sufficient mortar to avoid the necessity for excessive floating. Slope exposed unformed surfaces to provide quick, positive drainage and to avoid puddles in low spots. Unless otherwise noted, set floor drains one-half inch (½") below the normal floor elevation and slope floor toward the drain. Slope all surfaces exposed to weather one-quarter inch (¼") per foot for drainage unless noted otherwise on Drawings.
   a. "Floated" Finish: After concrete has been placed, consolidated, struck off, and leveled, do not work further until ready for floating. Begin floating when water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation. During or after first floating, check planeness of surface with a ten-foot (10') straightedge applied at not less than two (2) different angles. Cut down high spots and fill low spots during this procedure to produce a surface with true planes within one-quarter inch (¼") in ten feet (10') as determined by a ten-foot (10') straightedge placed anywhere on the slab in any direction. Following straightedge checking, refloat slab immediately to a uniform sandy texture.
   b. "Steel Trowel" Finish: Obtained by working a floated finish with a steel trowel. First troweling shall produce a smooth surface that is relatively free of defects, but that may still show some trowel marks. Perform additional troweling by hand after the surface has hardened sufficiently. Perform final troweling when a ringing sound is produced as the trowel is moved over the surface. Thoroughly consolidate surface by hand trowel operations. Produce finished surface essentially free of trowel marks, uniform in texture and appearance, with true planes within one-quarter inch (¼") in ten feet (10'), as determined by a ten-foot (10') straightedge placed anywhere on the slab in any direction.
   c. "Broom or Belt" Finish: Immediately after concrete has received a floated finish, give surface a coarse transverse scored texture by drawing a broom or burlap across the surface.
   d. "Nonslip" Finish: The surfaces shall be given a "dry shake" application of non-slip aggregate surfacer. The rate of application of such material not to be less than twenty-five pounds per one hundred square feet (25 lbs/100 sf). Apply in accordance with manufacturer's recommendations.
4. Special Finishes:
   a. Weirs and Overflow Surfaces: Provide "hard steel trowel" finish to surfaces to produce a hard, dense, smooth surface free of irregularities. Obtain finish by troweling a regular steel trowel finish after the surface has nearly hardened. The hard surface will have a somewhat glossy appearance. The elevation of the weir crest shall be constant along its entire length.

b. Flumes and Troughs: Provide a "hard steel trowel" finish to the top of bottom slab. Use "plywood" formed finish on side walls, and an "ordinary wall" finish on overhead surfaces. Provide a "rubbed" finish on all surfaces that will not be in contact with water.
c. Deck Finish: Power or single-hand troweling of slab surface followed by a light hair broom drawn across the slab to produce fine shallow scored texture.
d. Architectural Finishes. Special finishes such as Vinyl Composition Tile, Quarry Tile, Ceramic Tile, or other, when used, shall be as specified herein or on the Drawings.

5. Application for Finishes: Except where the type of finish is indicated on the Drawings or under "Special Finish", all concrete surfaces shall be finished as indicated below:

Feature	Surface Finishes Applied
Wall Footings	
- Formed Vertical Faces	Rough Form
- Top Surfaces	Floated
Cutoff Walls	Rough Form
Training/Retaining/Building Walls	
- Exposed Vertical Face	Rubbed
- Concealed Back Face	Rough Form
- Top Surface	Floated
Spillway Slabs	
- Horizontal	Floated
- Sloped	Floated
Chute/Baffle Blocks	
- Formed Vertical Faces	Rough Form
- Top Surfaces	Floated
End Sills & Baffle Wall	
- Formed Vertical Faces	Rough Form
- Top & Sloping Surfaces	Floated
Hydraulic Control Weirs	
- Spillway Crest	Weirs and Overflow Surfaces
Concrete Slabs/Paving (non-hydraulic)	Broom or Belt
Culvert/Vault/Weir/Cleanout	
- Exposed Vertical Face	Rubbed
- Concealed Back Face	Rough Form
- Top Surface	Floated
- Slabs	Broom or Belt
Pipe Cradles & Encasements	
- Formed Vertical Faces	Rough Form
- Top Surfaces	Floated

3.04 CURING AND PROTECTION

A. General: Immediately after placement and finishing, protect concrete from premature drying, excessive hot or cold temperatures, and mechanical injury. Perform curing by water curing for all slabs, and by either water curing or sheet form curing methods for other concrete. The concrete curing shall be in accordance with ACI 308. Cure concrete continuously for a minimum of seven (7) days at ambient temperatures above forty degrees Fahrenheit (40˚F).

B. Hot Weather Curing: See Hot Weather Concreting in Article 3.03.B.7.

C. Water Curing: All concrete slabs shall be treated immediately after placing and finishing is completed to provide continuous moist water curing above fifty degrees Fahrenheit (50˚F) for at least the first seven (7) days, regardless of ambient air temperature. Water for curing shall comply with requirements of Article 2.01 of this Section. If water is used that stains or discolors concrete surfaces that are to be permanently exposed, they shall be cleaned as directed by the Engineer. Where forms of tongue-and-groove or shiplap sheathing are left in place during curing, the sheathing shall be kept wet at all times. Horizontal surfaces shall be cured by ponding, by covering with a minimum uniform thickness of two inches (2”) continuously saturated sand, or by covering with saturated non-staining burlap or cotton maps.

D. Finished surfaces and slabs shall be protected from the direct rays of the sun and from wind to prevent checking and crazing.

E. Vinyl waterstops embedded in concrete but left exposed for more than thirty (30) days shall be protected from the direct rays of the sun, from wind, from water flow, and from debris damage for the entire duration of exposure. Modifications to the suggested means of waterstop protection as shown in the Drawings are subject to the Engineer’s approval.

3.05 FIELD QUALITY CONTROL

A. Testing and Inspection:
   1. During the entire period when concrete is being placed, provide testing services by an independent testing laboratory at no cost to the Owner.
   2. The Engineer reserves the right to make any and all tests as he deems necessary during the progress of the Work.
   3. Failure of the independent testing laboratory or the Engineer to detect defective work will not prevent rejection when defect is later discovered, nor will it obligate the Engineer for final acceptance.
   4. The Independent Testing Laboratory shall:
      a. Obtain composite samples at random during the progress of the Work in conformity with ASTM C 172.
      b. Mold and standard-cure six (6) test specimens for each strength test in accordance with ASTM C 31 and as follows:
         1) Concrete compression test: Use standard six-inch by twelve-inch (6”x12”) cylinders.

2) Concrete flexural strength: Use six-inch by six-inch by twelve-inch (6”x6”x12”) beams.
3) Identify each test by number, mix, amount of admixture, origin of sample in the structure, the date the test specimen was made, the date the test specimen was tested, the amount of slump determined, and the compressive and flexural strength test results.
4) Test Methods:
   a) Compressive strength test: ASTM C 39.
   b) Flexural strength test: ASTM C 78
   c) Test two (2) specimens at seven (7) days for information. Test two (2) specimens at twenty-eight (28) days for acceptance. A strength test is the average of the strengths of the two (2) cylinder specimens cast at the same time from a concrete sample taken from a single truckload tested at twenty-eight (28) days.
   d) Hold two (2) field control cylinder specimens of each set for testing (56-day) if low breaks are encountered.
   e) At a minimum, perform one (1) strength test for each fifty cubic yards (50 cy) of concrete poured, but not less than one (1) strength test for each structure. Not less than one (1) set of cylinder specimens shall be taken on any one day.

c. Make slump tests for each truckload upon truck arrival at the jobsite and whenever consistency of concrete appears to vary in accordance with ASTM C 143.
   1) If slump exceeds the maximum values specified in this Section and the batched water-cement ratio exceeds the approved mix design water-cement ratio, the concrete shall be rejected.
   2) If slump is less than the desired value at first discharge from the mixing drum, water may be added, but only up to the maximum water specified or approved water-cement ratio, to increase the slump to within the specified limits; water shall be incorporated into the mixture by further mixing equal to at least one-half (½) the number of mix revolutions for normal mixing. Further addition of water is prohibited.
d. Make air content tests for each truckload upon truck arrival at the jobsite in accordance with ASTM C 231 or ASTM C 173.
   1) If the air content falls outside of the limits specified in this Section, the concrete shall be rejected.
e. Determine temperature of concrete sample for every truckload.
f. Upon delivery to the independent testing laboratory, moist-cure cylinder specimens in accordance with ASTM C 31.
g. Prepare and submit all reports required in the various standards and specifications referenced herein.
   1) Distribution of reports shall be:
      a) Two (2) copies to the Engineer.
      b) One (1) or more copies, as required, to the Contractor.
h. The Contractor shall require that the Independent Testing Laboratory immediately notify the Contractor and the Engineer of any test results that do not conform to the Specification requirements.

5. Additional testing for Self-Consolidating Concrete:
    a. Concrete strength test, air content test, and temperature determination of truckload shall follow requirements noted above.
    b. Perform slump flow test, with an acceptable horizontal flow range between 22 inches and 28 inches, for each truckload upon truck arrival at the project site in accordance with ASTM C1611.
        1) Perform a T50 test for same truckload; results shall be between 2 seconds and 7 seconds.
        2) If listed values for slump test and/or T50 test are not obtained, the Engineer shall be notified. Field adjustment, such as the addition of water, is not allowed.
    c. Perform J-Ring test, ASTM C1621, for each truckload upon arrival at the project site.
        1) Difference between the slump flow test and the J-Ring Test shall be less than 1 inch.
    d. Perform penetration test, ASTM C1712, for each truckload upon arrival at the project site.
        1) Penetration depth shall be less than ½ inch.
6. All cylinder specimen strength tests and any additional cylinder tests due to defective concrete shall be performed at the Contractor's expense.

B. Evaluation of Concrete Compressive Strength:
1. Test results for standard molded and standard cured test cylinder specimens shall be evaluated separately for each specified concrete mix design.
2. Concrete strength will be considered satisfactory if every arithmetic average of any three (3) consecutive strength tests equals or exceeds the specified twenty-eight (28) day strength and no individual strength test falls below specified twenty-eight (28) day strength by more than 500 psi.
3. If the concrete fails to meet the specified strength requirements submit a remediation plan to the Engineer for approval that shall include, at a minimum, one (1) or more of the following:
    a. Submit a revised mix design to increase the strength of the remaining project concrete to be placed.
    b. Perform tests on the in-place concrete. Such testing shall be performed by the Contractor at no increase in Contract price.
        1) Testing shall be performed in accordance with ACI 301.
        2) Testing by impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer to determine relative strengths at various locations in the structure as an aid in reevaluating concrete strength in place or for selecting areas to be cored. Such tests shall not be used as a basis for acceptance or rejections.
        3) Core Tests:
            a) Where required, cores shall be obtained and tested in accordance with ASTM C 42. If the concrete in the structure will be dry under service conditions, the cores shall be air dried (temperature 60˚F to 80˚F, relative humidity less than 60%) for seven (7) days before test and shall be tested dry. If the concrete in the structure will be more

than superficially wet under service conditions, the cores shall be tested after moisture conditioning in accordance with ASTM C 42.

b) At least three (3) representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores shall be subject to approval by the Engineer. If, before testing, one (1) or more of the cores shows evidence of having been damaged subsequent to or during removal from the structure, it shall be replaced.

c) Concrete in the area represented by a core test will be considered adequate if the average strength of the cores is equal to at least eighty-five percent (85%) of, and if no single core is less than seventy-five percent (75%) of, the specified strength, f'c.

d) Core holes shall be filled in accordance with the approved remediation plan.

4. The Engineer may require removal and replacement of any and all concrete not meeting the compressive strength acceptance criteria. Any removal and replacement due to low compressive strength test results shall be performed by the Contractor at no increase in Contract price

3.06 ACCEPTANCE OF STRUCTURE

A. General
   1. Completed concrete work that meets all applicable requirements will be accepted without qualification.
   2. Completed concrete work that fails to meet one (1) or more requirements, but that has been repaired to bring it into compliance, in the Engineer's opinion, will be accepted without qualification.
   3. Completed concrete work that fails to meet one (1) or more requirements, and that cannot be brought into compliance, in the Engineer's opinion, may be accepted or rejected as provided in this Section.

B. Concrete Compressive Strength: The twenty-eight (28) day compressive strength test results will be used as basis of acceptance of concrete with respect to strength requirements and as a minimum criteria for measuring concrete for payment. If the concrete fails to meet the compressive strength requirements, additional curing as specified by Engineer may be required and modifications, including removal and replacement of low-strength concrete and change in the concrete mix design, may be required for the remaining concrete work, all at the expense of the Contractor.

C. Dimensional Tolerances:
   1. Dimensional tolerances shall be in accordance with the requirements in ACI 117-10. Dimensional tolerance requirements shall be applied to the work of this contract in accordance with Table A. Tolerances on surface finishes shall be as indicated in Article 3.03.
   2. Formed surfaces resulting in concrete outlines smaller than required by an amount exceeding the requirements stated above shall be considered deficient in strength and subject to the provisions of Article 3.06.E and Article 3.06.F.

3. Formed surfaces resulting in concrete outlined larger than required, by an amount exceeding the requirements stated above may be rejected and the excess material shall be subject to removal. If removal of the excess material is permitted, it shall be accomplished in such a manner as to maintain the strength of the section and to meet all other applicable requirements of function and appearance.
4. Concrete members cast in the wrong location may be rejected if the strength, appearance, or function of the structure is adversely affected or the misplaced items interfere with other construction.
5. Inaccurately formed concrete surfaces exceeding the requirements stated above and that are exposed to view may be rejected and shall be repaired or removed and replaced if required.
6. Finished flatwork exceeding the allowable tolerances may be repaired provided that strength or appearance is not adversely affected. High spots may be removed with a terrazzo grinder, low spots filled in with an approved patching compound, or other remedial measure performed as permitted.

TABLE A: APPLICATION OF STRUCTURAL TOLERANCES

Feature	ACI 117-10 Reference Section
Wall Footings	3.2.1, 3.3.1, 3.5.1, 3.5.2, 3.5.3
Cutoff Walls	3.2.1, 3.3.1, 3.4.1, 3.5.2, 4.5.2
Training/Retaining Walls	4.1.1, 4.1.3, 4.2.1, 4.2.2, 4.4.2, 4.4.3, 4.4.4, 4.5.1, 4.5.2, 4.5.3, 4.5.4, 4.6.1, 4.8.3
Spillway Slabs	4.2.1, 4.4.1, 4.4.3, 4.4.5, 4.5.3, 4.5.4, 4.6.1, 10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.2.3, 10.3.1, 10.4.1.1, 10.4.1.2
Chute/Baffle Blocks	4.1.1, 4.1.3, 4.2.1, 4.4.2, 4.5.1
Hydraulic Control Weirs - End Sill - Spillway Crest - Measuring Weirs - Stepped Spillway Treads	4.2.1, 4.7.1, 4.8.1, 8.3.2, 10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.2.3, 10.3.1, 10.4.1.1, 10.4.1.2
Concrete Paving (non-hydraulic)	4.2.1, 4.4.1, 4.4.3, 4.4.5, 4.5.3, 4.5.4, 4.6.1, 12.2.3
Culvert/Vault/Weir/Cleanout	10.1.2, 10.2.1, 10.2.2, 10.2.3, 10.3.1, 10.4.1.1, 10.4.1.2
Pipe Cradles & Encasements	3.2.1, 3.3.1, 3.4.1, 3.5.1, 3.5.2, 3.5.3, 4.1.1, 4.1.3, 4.2.1, 4.2.2, 4.4.2, 4.5.1

D. Appearances:
   1. Concrete exposed to view with defects that adversely affect the appearance of the specified finish may be repaired, if possible. If, in the opinion of the Owner, the defect cannot be repaired, the concrete may be accepted or rejected as provided in these specifications.

E. Strength of Structure – Potential Deficiency:
   1. The strength of the structure in place will be considered potentially deficient if it fails to comply with any requirements that control the strength of the structure, including but not necessarily limited to the following conditions:
      a. Low concrete strength.
      b. Reinforcing steel size, quantity, strength, position, or arrangement at variance with the requirements of the contract documents.
      c. Concrete that differs from the required dimensions or location in such a manner as to reduce the strength.
      d. Curing less than that specified.
      e. Inadequate protection of concrete from extremes of temperature during early stages of hardening and strength development.
      f. Mechanical injury, construction fires, accidents, or premature removal of formwork likely to result in deficient strength.
      g. Poor workmanship likely to result in deficient strength. Structural analysis and/or additional testing may be required when the strength of the structure is considered potentially deficient.
   2. Core tests may be required when the strength of the concrete in place is considered potentially deficient.

F. Failure to Meet Requirements:

1. The Owner and Engineer reserve the right to reject any or all items that do not meet the requirements of the Contract Documents. The Contractor will replace these items covering all expenses in connection with such replacements.
2. If strength tests of concrete fail to meet the minimum requirements as specified herein, the concrete represented by such tests shall be considered questionable and shall be subject to further testing at the expense of the Contractor.
3. Additional tests of the hardened concrete may be required by the Owner and/or Engineer if in their opinion there is cause for concern over the adequacy of the structure regardless of the results of Contractor Quality Control Testing. If the Contractor's quality control testing meets all other requirements of this specification, the Contractor shall not be required to bear the costs of such additional tests unless results confirm the concrete in place is deficient.
4. If core tests fail to demonstrate strengths adequate for the intended purpose of the member or members in question, as determined by the Owner and/or Engineer, or are inconclusive or impractical to obtain, or if structural analysis does not confirm the safety of the structure, load tests may be required and their results evaluated in accordance with Chapter 20 of "Building Code Requirements for Structural Concrete" (ACI 318).
5. If the structural members are accepted on the basis of tests other than the original cylinder tests, the Contractor shall compensate the Owner for the Contractor's failure to meet specified strength requirements by deducting from the Contract price an amount equal to one hundred dollars ($100) per cubic yard for each one hundred pounds per square inch (100 psi) below the specified strength. The original laboratory-cured twenty-eight (28) day test cylinder results shall be used to determine the difference between specified and furnished strengths.
6. Concrete work judged inadequate by Engineer and/or the Owner based on structural analysis, or by results of a load test, shall be reinforced with additional construction if so directed by Engineer and the Owner or shall be replaced, at the Contractor's expense.
7. Unless indicated otherwise in this Article, the Contractor shall pay all costs incurred in providing the additional testing and/or analysis required by this Section.

3.07 REPAIR OF DEFECTIVE CONCRETE

A. Defective Concrete:
   1. Porous areas, open or porous construction joints, and honeycombed concrete will be considered to indicate that the requirements for mixing, placing, and handling have not been complied with, and will be sufficient cause for rejection of the members of the structure thus affected.
   2. Defective work exposed upon removal of forms shall be entirely removed or repaired within forty-eight (48) hours after forms have been removed.
   3. Repaired areas will not be accepted if:
      a. The structural requirements have been impaired by reducing the net section of compression members.
      b. The bond between the steel and concrete has been reduced.

c. The area is not finished to conform in every respect to the texture, contour, and color of the surrounding concrete.

4. If the above requirements are not satisfied, or if there are excessive honeycombs or other defects, the Engineer may require that the members of unit involved be entirely removed and satisfactorily replaced at no additional expense to the Owner.
5. The Engineer will determine the extent and manner of action to be taken for the correction of defective concrete as may be revealed by surface defects or otherwise.
   a. Prior to repair of structural defects or defects that impair watertightness, including but not limited to shrinkage cracks, use of improper form ties, etc., submit proposed material and repair methods to the Engineer for approval.
6. As soon as the forms have been stripped and the concrete surfaces exposed, remove fins and other projections, fill recesses left by the removal of form ties, and repair surface defects that do not impair structural strength. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete to the satisfaction of the Engineer.
7. Hammer pack tie holes and other small cavities with a stiff mortar of the same material, but somewhat leaner than that in the concrete. Clean the cavity and the area wetted before mortar is placed.
8. Repair and patch defective areas with cement mortar of mix proportions and materials identical to those used in the surrounding concrete. Produce a finish on the patch that is indistinguishable from the surrounding concrete.
9. Where the honeycomb or voids are not excessive, and repairs are authorized by the Engineer, chip out the defective areas in a square shape to sound solid concrete with a depth not less than two inches (2”). Make edges of cuts perpendicular to concrete surface or slightly undercut to provide a key at the edge of the patch. Before placing cement mortar, thoroughly clean, dampen, and brush coat area to be patched with neat cement grout. Other patching materials may be used if accepted by Engineer in writing prior to start of repair work. The patch should be kept damp for seven (7) days at a temperature above fifty degrees Fahrenheit (50°F).

3.08 MASS CONCRETE

A. Concrete sections 4 feet or more in the least dimension and any concrete so listed in Article 2.04 are termed mass concrete and shall conform to the special provisions of this article in addition to all applicable provisions of other articles in this specification section. Mass concrete proportioning, placement, consolidation and curing shall be in accordance with this specification section and ACI 304R, 309R, 211.1, and 207.1R.

B. Additional requirements for heating, cooling, curing and protecting mass concrete sections shall be as specified in this Section.

C. Materials, Testing, Proportioning, Mix Design:
   1. Materials and mix proportioning for mass concrete shall be in accordance with this specification section and ACI 207.1R, Mass Concrete, latest edition.

2. Type III Portland cement and accelerating type admixtures shall not be used.
3. Aggregates shall conform to the requirements of ASTM C 88 and C 227, and C 1260. Aggregate size shall be in accordance with ASTM C33 and Article 2.01.D.
4. Testing
    a. Test the coarse and fine aggregate sources in accordance with ASTM C 227. Aggregates tested in accordance with ASTM C 227 shall be considered potentially reactive if expansion exceeds 0.10% at 6 months or 0.05% at 3 months if 6-month test results are not available.
    b. Test the coarse and fine aggregate sources in accordance with ASTM C 1260. Aggregates tested in accordance with ASTM C 1260 shall be considered potentially reactive if expansion exceeds 0.10% at 16 days.
    c. Aggregates that are shown to be potentially reactive based on testing in accordance with ASTM C 227 or ASTM C 1260 shall not be used without additional testing and written approval by the Engineer. Additional testing shall include testing in accordance with procedures in ASTM C 295, ASTM C 856, ASTM C 1567, additional tests in accordance with ASTM C 1260, and other tests as requested by the Engineer. Approval of any aggregate source that is shown to be potentially reactive based on testing in accordance with ASTM C 227 or ASTM C 1260 is at the sole discretion of the Engineer and is not guaranteed regardless of the results of any additional tests performed.
5. The selection of the mix design shall recognize that serious volume change stresses can be avoided by controlling the temperature drop of the concrete from the maximum to ambient. Avoidance of thermal shock is important in preventing surface cracks due to temperature gradients. The maximum internal temperature will depend upon the initial concrete temperature and the type and quantity of cementitious materials used.
6. Mixes shall be designed using types and amounts of cement and cementitious materials which will reflect lower internal temperatures, while achieving the compressive strength specified for mass concrete. Optimum cement is only obtainable by aggregate proportioning that reduces the volume of the void spaces and depends upon aggregate gradation. Minimum cement factors with maximum size aggregate, air entrainment and low water cement ratios should be used, to produce workable concrete and the specified strength.
7. Bonding Agent and Anti-Corrosion (Reinforcing Steel) Coating
    a. Required for use at cold joints with mass concrete placements.
    b. A three-component, polymer-modified, cementitious coating formulated to inhibit reinforcing steel corrosion and improve bond strength.
    c. Bonding agent shall be Sika Armatec 110 EpoCem, or approved equal.

D. Placement:
1. Place within the slump limits as specified in Article 2.02.D.
2. Placing Temperatures: The temperature of the concrete when deposited at the point of placement shall not exceed 70°F, nor be less than 35°F. When the temperature of the surrounding air is expected to be below 35ºF during placing or within 24 hours thereafter, or conditions classify as “cold weather” as defined in

ACI 306R.1, then the temperature of the concrete when deposited at the point of placement shall be in accordance with temperature requirements for cold weather concreting listed in ACI 306R.1.

3. Concrete shall not be placed until the installation of the temperature monitoring system has been inspected and approved by the Engineer and adequate materials for the curing and thermal protection of the concrete are on the site.
4. Sequencing: Construct mass concrete in alternating placements that are separated by a minimum time delay as follows.
    a. For vertically adjacent placements (i.e., horizontal joints), limit depth (vertical thickness) of placements to no more than 6 feet and delay 5 full calendar days before placing overlying concrete.
    b. Where the following two conditions are both met, CM may relax the above limits to delay only 3 full calendar days between adjacent placements at horizontal construction joints:
        1) Placement depths are limited to 3 feet vertically, and
        2) Average daily temperature is 55 degrees or less for a period of at least two (2) consecutive days after the placement occurs.

E. Curing and Protection: The curing requirements previously specified in this Section shall apply to mass concrete as modified in this article:
    1. The curing period shall be a minimum of 14 days or until concrete is covered with subsequent placements. Curing shall be performed by continuous fogging or sprinkling, or by application of mats or fabric kept continuously wet. If used, mats or fabric shall not be covered with any other materials that would prevent easy visual confirmation of the wet curing unless insulation is required during cold weather protection. Forms shall be stripped from the concrete as soon as allowable by these specifications and wet curing shall be initiated.
    2. Temperature Monitoring:
        a. Thermocouples or thermistors shall be installed in mass concrete placements in sets of two located on a grid at locations as shown on the Contract Drawings. One logger shall be placed at mid-depth and mid-width of the concrete placement and the second logger shall be located directly adjacent (horizontally) from the first and 2 inches inside the surface.
        b. Each wire lead shall extend a minimum of 6 feet out of the concrete and shall be securely labeled with the location of the corresponding logger and a tracking number.
        c. Placement plans showing all thermocouples and manufacturer's installation instructions and operating manuals for all related equipment shall be submitted for approval prior to concrete placement.
        d. Temperature monitoring shall continue for the duration of the curing period and until the internal temperature is within 25 degrees F of the average ambient air temperature following the end of the curing period. The average ambient air temperature shall be based on a 5-day running average of average daily air temperature (average of daily high and low temperatures). Temperature monitoring shall be performed once daily at each thermocouple consistently between the hours of 6:00 a.m. and 8:00 a.m.

e. Temperature monitoring equipment shall be *intelli*Rock TMP-02 loggers with an *intelli*Rock II reader, or approved equal.

3. Thermal Control:
   a. At mass concrete placements, the curing water added shall not be colder than 30 degrees F below the interior temperature of the concrete. If necessary, curing water shall be heated.
   b. For mass concrete, the maximum temperature differential between the interior of the concrete (core thermocouple) and the exterior of the concrete (near-surface thermocouple) shall not be more than 35 degrees Fahrenheit. When the difference in temperature between the core and the surface (horizontally) exceeds 30 degrees Fahrenheit, insulation blankets shall be added in 1/2 inch layers as needed to prevent the difference from increasing. Joints in insulation blankets shall be staggered a minimum of 12 inches at adjacent layers. Insulation blankets shall be placed over curing mats and moisture retaining cover. If the addition of layers of insulation are not sufficient to limit the temperature gradient to 35 degrees Fahrenheit, the concrete placement shall be tented and heat shall be applied as needed to control the temperature gradient.
   c. Thermal controls and protection shall be maintained until the interior concrete temperature is within 25 degrees F of the average ambient air temperature following the end of the curing period. The average ambient air temperature shall be based on a 5-day running average of average daily air temperature (average of daily high and low temperatures).
   d. The rate of cooling within the interior of the concrete shall be regulated to control the temperature drop to not more than 2 degrees Fahrenheit in any one hour and 10 degrees Fahrenheit in any 24-hour period.
   e. Where insulation blankets are provided over mass concrete, at the end of the Thermal Control period they shall be removed one layer at a time at such a rate that the temperature differential between the core and the near-surface thermocouple never exceeds 35 degrees Fahrenheit and the cooling rate specified above is not exceeded. In no case shall more than one layer of blankets be removed in an 8-hour period.

END OF SECTION

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FINAL CONCRETE MIX DESIGN SUBMITTAL FORM
(One for each required mix design)

PROJECT:_____ Location:_____
General Contractor:_____
Mix design no.:_____ Design strength:_____

USE (Describe *):_____
Mix Design Preparation: Based on Standard Deviation Analysis:_____
(check one) or Based on Trial Mixture Test Data:_____

MATERIALS:

Aggregates: (Provide size, type, source, specification)
Coarse:_____
Fine:_____

Cement Type/Source:_____

Admixtures: (Provide product, manufacturer)
Water Reducer:_____
Air Entraining:_____
Accelerator:_____
Other:_____

CONCRETE PROPERTIES

Water/Cementitious Material Ratio:_____
Slump:_____ inches
Entrained Air:_____ %
Density:_____ pcf

SPECIFIC GRAVITIES

Fine Aggregate:_____
Coarse Aggregate:_____

ADMIXTURES

Accelerator:_____ oz. per 100# cement
W. R.:_____ oz. per 100# cement
A. E.:_____ oz. per 100# cement
Other:_____ oz. per 100# cement

MIX PROPORTIONS

	Weight (lbs)	Absolute Volume (cubic feet)
Cementitious Material:		
Fine ** Aggregate:		
Coarse ** Aggregate:		
Water:		
Entrained Air:		
Other:		
TOTAL:		

TEST RESULTS SUBMITTAL FORM

METHOD 1 - STANDARD DEVIATION ANALYSIS (ACI 318 Chapter 5):

Number of Test Cylinders Evaluated:_____ Standard Deviation:_____
(Attach Copy of All Test Results)

Mix Designs Proportioned to Achieve Both of the Following:

$f'_{cr} = f'_c + 1.34s =$ _____ psi
$f'_{cr} = f'_c + 2.33s - 500 =$ _____ psi

Actual $f'_c =$ _____ psi ($\leq f'_{cr}$)

Slump = _____ in. Air Content = _____ %

METHOD 2 - TRIAL MIXTURE TEST DATA (ACI 318, Chapter 5):

Age (days)	Mix 1 (comp. str.)	Mix 2 (comp. str.)	Mix 3 (comp. str.)
7			
28			
28			
28 day avg.			

Mix Design Proportioned to Achieve the Following:

$f'_{cr} = f'_c + 1200$ psi (for $f'c \leq 5000$ psi)
or $f'_{cr} = 1.1f'_c + 700$ psi (for $f'c > 5000$ psi)

Slump = _____ in. Air Content = _____ %

REMARKS:

Note: Fill in all blank spaces. Use -0- (zero) or N.A. (not applicable). See Design and Control of Concrete Mixtures, Portland Cement Association, for assistance in filling out this form.

SUBMITTED BY:
Ready-Mix Supplier:
Name:_____
Address: _____
_____
Phone Number: _____

SECTION 03920

REPAIR OF EXISTING CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Scope: This section covers the materials, techniques, and workmanship requirements for deep concrete repairs, shallow concrete repairs, weep hole cleanout repairs, and concrete crack repairs on exposed deteriorated concrete surfaces.

B. Related Work Specified Elsewhere:
   1. Section 02222: Demolition
   2. Section 03100: Concrete Formwork
   3. Section 03200: Concrete Reinforcement
   4. Section 03300: Concrete

1.02 REFERENCES

A. ASTM C 33, Specification for Concrete Aggregates.

B. ASTM C 39, Test Method for Compressive Strength of Cylindrical Concrete Specimens.

C. ASTM C 109, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens).

D. ASTM C 496, Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.

E. ASTM C 882, Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's published product data, catalog cuts, specifications, installation/application instructions and such other data as required to provide complete descriptive information for each material. No materials shall be placed without prior approval from the Engineer.

B. Submit samples of proposed materials when requested by the Engineer. If more than one color is available, submit color options in which materials are available.

C. Concrete Repair Product Manufacturer Qualifications:
   1. Submit a notarized statement and supporting documentation from the proposed Concrete Repair Product Manufacturer demonstrating that the Concrete Repair Product Manufacturer meets the specific qualification requirements described in Article 1.04.A of this Section.
   2. The proposed use of "approved equal" concrete repair products manufactured by a Concrete Repair Product Manufacturer other than Sika will be considered for approval provided that submits the following:
      a. The required notarized "Approved Contractor" Certification.
      b. Satisfactory published product data, catalog cuts, specifications, installation/application instructions and complete descriptive information for each material, which demonstrates that the proposed "approved equal" products meet the requirements of the Contract Documents.

D. Concrete Repair Contractor/Subcontractor Qualifications (to be submitted within two weeks of Notice of Award):
   1. Submit a notarized Certification from the proposed Concrete Repair Contractor/Subcontractor attesting that the proposed Concrete Repair Contractor / Subcontractor meets the specific qualification requirements described in Article 1.04.B of this Section.
   2. Submit references, including brief project description, contact persons' name and telephone number, of at least three similar projects that have been in service for three years. Projects shall have been completed within the last five (5) years by the proposed Concrete Repair Contractor/Subcontractor using the specified products of the approved Concrete Repair Products Manufacturer.

E. Advance Supplemental Repair Work Schedule: Submit in accordance with the requirements of Article 3.01.A in this Section within thirty (30) calendar days following Notice-to-Proceed.

F. Advance Supplemental Mapping of Repairs:
   1. Submit in accordance with the requirements of Article 3.01.A of this Section (including review of Advance Supplemental Submissions by the approved Concrete Repair Product Manufacturer) within thirty (30) calendar days following completion of Advance Supplemental Field Survey. Upon request, Engineer will provide AutoCAD files of Contract Drawings to the Contractor for his use in repairs mapping
   2. In addition to submitting the number of required hardcopies per the requirements of Section 01330: Submittal Procedures, the Contractor shall submit three (3) duplicate copies of electronic AutoCAD files of the submitted Mapping of Repairs drawings on CD or DVD, including the necessary reference files, color tables, shapefiles, fonts and other pertinent information that is needed to properly view and print the electronic format of the drawings.
   3. The Contractor shall include the approved Concrete Repair Product Manufacturer on the distribution of all Mapping of Repairs submittals and re-submittals made to the Owner, including all enclosures.

G. Advance Supplemental Schedule of Repairs:
   1. Submit in accordance with the requirements of Article 3.01.A of this Section (including review of Advance Supplemental Submissions by the approved Concrete Repair Product Manufacturer) within thirty (30) calendar days following completion of Advance Supplemental Field Survey.
   2. In addition to submitting the number of required hardcopies per the requirements of Section 01330: Submittal Procedures, the Contractor shall submit an electronic file of the submitted Schedule of Repairs in either MS Word or Excel format.
   3. The Contractor shall include the approved Concrete Repair Product Manufacturer on the distribution of all Schedule of Repairs submittals and re-submittals made to the Owner, including all enclosures.

H. Trial Section Observations and Recommendations Report: Submit the approved Concrete Repair Product Manufacturer's Trial Section Observations and Recommendations Report in accordance with the requirements of Article 3.01.B of this Section within seven (7) calendar days following completion of the Trial Sections.

I. As-Built Repair Drawings. The As-Built Repair Drawings shall be submitted concurrent with the Record Documents submission (see Section 01798). The As-Built Repair Drawings shall be prepared using the Advance Supplemental Mapping of Repairs as a base document. The As-Built Repair Drawings shall depict any approved field changes to the locations, dimensions, and types of concrete repairs made during the performance of the repair Work. Submit five (5) hardcopies and three (3) duplicate copies of electronic AutoCAD files of the As-Built Drawings on CD or DVD, including the necessary reference files, color tables, shapefiles, fonts and other pertinent information that is needed to properly view and print the electronic format of the drawings, and the survey files.

J. Certification from the Contractor that all repair materials installed for each applicable repair category were supplied by the same approved Concrete Repair Product Manufacturer.

K. Certification from the Contractor that all surfaces were properly prepared and that specified repair materials were installed in accordance with manufacturer's recommendations, the Contract Documents, the approved Mapping of Repairs, the approved Schedule of Repairs and in accordance with the recommendations contained in the Concrete Repair Product Manufacturer's written Trial Section Observations and Recommendations Report.

1.04 QUALITY ASSURANCE

A. Concrete Repair Product Manufacturer Qualifications: The manufacturer of the products specified in this Section shall have in existence, for a minimum of 10 years, a program of training, certifying, and technically supporting a nationally organized Approved Contractor Program with annual recertification of its participants.

B. Concrete Repair Contractor/Subcontractor Qualifications:
   1. Concrete Repair Contractor/Subcontractor supervisory and labor personnel assigned and actively participating in the Concrete Repair portions of the Rehabilitation of Wahiawā Dam shall have completed, prior to commencing production work, the Concrete Repair Manufacturer's program of instruction in the use of specified products and materials including:
      a. Cementitious repair mortars for deep concrete repairs and shallow concrete repairs.
      b. Crack repair materials.
      c. Anti-corrosion and bonding agents.

C. Concrete Repair Product Manufacturer's Services: The Contractor shall arrange for, and provide, the services of the Concrete Repair Product Manufacturer's Technical Representative for:
   1. Pre-Repair Inspection in accordance with the provisions of Article 3.01.A of this Section.
   2. Review of Advance Supplemental Submissions in accordance with the provisions of Article 3.01.A of this Section.
   3. Trial Sections in accordance with the provisions of Article 3.01. B of this Section.
   4. Application Verification in accordance with the provisions of Article 3.01.H of this Section.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver repair materials to job site in their original unopened containers with labels intact and legible at time of use.
   1. Store liquid components protected from freezing and within the environmental temperature limits as recommended by the product manufacturer.
   2. Store dry components protected from the weather and under the conditions acceptable to the product manufacturer.

1.06 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Do not apply repair products when the ambient and surface temperatures are lower than 45 degrees Fahrenheit or such manufacturer's limitations which may be more restrictive.
   2. Do not attempt to apply repair products when rain, flowing water over or through the spillway, or groundwater are present.

B. Traffic Limitations: Do not expose finished cementitious repair work to traffic of any kind until four hours or as recommended by the repair product manufacturer following finished applications of the repair products, whichever is longer.

C. Existing Conditions: During the preliminary investigations of the concrete structures, the full extent and depth of deterioration could not be accurately observed and determined. As a result, the exact quantity, and extent, of each repair could not be

accurately ascertained. To provide a precise quantification of the work to be performed, the Contractor shall, after contract award, perform Advance Supplemental Repair Work as described in Article 3.01.A of this Section.

D. Reinforcement may be encountered within the repair region.

1.07 REPAIR EVALUATION AND SELECTION

A. Prior to final selection of repair methods and materials, evaluate with the Engineer each repair area in sequence by determining the cause of damage, evaluating the extent of damage, evaluating the need to repair, selecting the repair method and material, preparing the existing concrete for repair, applying the repair, and curing the repair.

B. Do not finalize repair material selection until the cause, extent, and need for repair have been evaluated by the Engineer.

C. Select, in conjunction with the Engineer, repair methods and materials for compatibility with the existing concrete, reinforcing steel, exposure conditions, service environment, and expected performance of the repaired section.

D. Do not use repair materials or methods that may accelerate damage to the existing concrete or reinforcing steel, as approved by the Engineer.

E. Where the cause of damage is active or recurring, include measures to mitigate, isolate, or accommodate the underlying cause of deterioration as part of the repair work.

PART 2 PRODUCTS

2.01 MATERIALS

A. All repair and restoration materials used shall conform to ANSI 61 standard for potable water.

B. Repair system materials for a particular application shall be produced by a single approved Concrete Repair Product Manufacturer. Select repair materials for compatibility with the existing concrete, reinforcing steel, exposure conditions, service environment, and expected performance of the repaired section. Do not use materials or methods that may accelerate damage to the existing concrete or reinforcing steel.

C. Deep Concrete Repair Materials:
   1. Vertical form-and-pour repair mortar: A polymer-modified, Portland cement, two-component, fast-setting, easy-tooling patching mortar, concrete gray in color, mixed with aggregate. Material shall be SikaTop 111 Plus, or approved equal.
   2. Horizontal trowel-grade repair mortar: A polymer-modified, Portland cement, two-component, fast-setting, easy-tooling patching mortar suitable for horizontal surfaces and concrete gray in color. Material shall be SikaTop 122 Plus, or approved equal.

D. Shallow Concrete Repair Materials: A silica-fume-enhanced, fiber-reinforced, fast-setting, easy-tooling cementitious sprayable mortar for structural repairs, concrete gray in color. Material shall be SikaRepair 224, or approved equal.

E. Concrete Crack Repair Materials:
1. Non-structural crack repairs: Use a high-solids, hydrophobic, non-toxic, expanding polyurethane liquid chemical grout. The grout shall remain permanently flexible and adhere to wet or dry surfaces. Material shall be SikaFix HH, or approved equal.
2. Structural crack repairs: Provide an epoxy resin adhesive for sealing cracks and porting devices, concrete gray in color, and an epoxy resin adhesive for pressure injection grouting, clear amber in color. Materials shall be Sikadur 35 Hi-Mod LV (injection resin) and Sikadur 31 Hi-Mod Gel (cap seal and porting adhesive), or approved equal.

F. Weep Hole Cleanout Repairs: No proprietary repair material is specified. Provide equipment and incidental materials suitable for cleaning weep holes and approved by the Engineer.

G. Anti-Corrosion Coating and Bonding Agents:
1. Provide anti-corrosion coating on reinforcing steel where specified and where recommended for the repair system.
2. Bonding agents shall be used only where specifically required by the approved repair material manufacturer or specifically indicated for the repair category.
3. Bonding agents shall not be used as a substitute for proper concrete removal, cleaning, substrate conditioning, placement, consolidation, and curing.
4. For cast-in-place concrete replacement repairs, do not use bonding compounds unless specifically accepted for the repair condition.

PART 3 EXECUTION

3.01 GENERAL PREPARATION

A. Advance Supplemental Repair Work: To provide a precise quantification of the work to be performed, the Contractor shall, after contract award and prior to beginning Trial Section work, perform Advance Supplemental Repair Work that is needed to further define the repair and rehabilitation work shown on the Concrete Repair Details Drawing(s). The Contractor's performance of the Advance Supplemental Repair Work shall generally be in accordance with the activities and sequence outlined below
1. Schedule: The Contractor shall prepare an Advance Supplemental Repair Work Schedule containing a description, sequence and proposed calendar schedule for performance of each activity included in the Advance Supplemental Repair Work.
2. Control of Water: Install a cofferdam upstream of the principal spillway structure as specified in Section 02680 prior to the Initial Cleaning.
3. Initial Cleaning: After the temporary cofferdam has been installed upstream of the principal spillway, the Contractor shall pressure wash and clean all of the above-grade principal spillway concrete surfaces. The Contractor's cleaning operations shall be sufficient to remove algae, efflorescence, calcite leaching, and other

deposits that may be obscuring concrete surfaces, and shall be performed to the satisfaction of the Engineer.

4. Pre-Repair Inspection:
   a. The Contractor shall schedule a Pre-Repair Inspection to occur at a time that is mutually agreeable to the Engineer. The Contractor shall arrange for and provide the services (physically onsite) of the approved Concrete Repair Product Manufacturer's Technical Representative and of the "Approved Contractor" supervisory personnel for the entire duration of the Pre-Repair Inspection.
   b. The Contractor shall provide ladders and other equipment as may be required to perform the Pre-Repair Inspection.
   c. During the Pre-Repair Inspection, the Contractor shall locate, inspect, classify and demarcate all repair categories shown on the Concrete Repair Details Drawing(s) at all of the above-grade principal spillway concrete surfaces that are shown on the drawings. The Contractor's demarcation work shall include physically painting identification markings on the concrete surface to the limits of all repairs located during the Pre-Repair Inspection. The demarcation shall use a suitable paint color code keyed to each repair category. The demarcation shall be as agreed upon by the participants of the Pre-Repair Inspection, and shall be approved by the Engineer prior to the Contractor beginning Pre-Repair Inspection.
5. Advance Supplemental Field Survey (Field Survey): The Contractor shall perform Field Survey to obtain sufficient measurements and details to fully document the locations, dimensions, limits and color coding of all repair categories that were identified and demarcated during the Pre-Repair Inspection. The Contractor's Field Survey shall be tied in to project horizontal and vertical control.
6. Advance Supplemental Mapping of Repairs (Mapping of Repairs):
   a. Mapping of Repairs shall be prepared by the Contractor in AutoCAD format and shall utilize the electronic files of the Drawings for mapping concrete deficiencies
   b. The Contractor shall prepare Mapping of Repairs based upon measurements and details obtained during the Field Survey. The Mapping of Repairs shall contain sufficient detail to fully and completely show the locations, dimensions, limits and color coding of all repair categories that were identified and demarcated during the Pre-Repair Inspection. Information shown on the Mapping of Repairs shall be horizontally and vertically correct.
   c. Each individual repair location shall be shown on the Mapping of Repairs in the view (plan / elevation / section) that best shows the dimensions, limits, color coding and details applicable to that individual repair location. The Contractor shall include on each drawing a legend that depicts color coding and other pertinent information necessary to fully document the repair categories.
   d. Following Award, and upon receipt of the Contractor's written request, the Owner will furnish to the Contractor the electronic files of the Drawings needed to prepare the mapping.
7. Advance Supplemental Schedule of Repairs (Schedule of Repairs): The Contractor shall prepare a Schedule of Repairs that provides details of pertinent information associated with each repair category shown on the Mapping of Repairs. The

information to be provided in the Contractor's Schedule of Repairs shall include but not necessarily be limited to the following:

a. Information needed to measure each repair category for payment in accordance with the provisions of Specification Section 01200: Price and Payment Procedures, including but not limited to updated quantity estimates (areas, linear feet of repair, etc.) and projected cost of the repairs based upon the applicable Unit Prices or Lump Sum prices contained in the Bid Schedule.

b. Individual steps proposed to be followed by the Contractor in performing each repair category, and, where applicable, the Contractor's proposed sequencing of each repair category relative to the other repair categories. Include specific information regarding surface preparation, installation and curing methods and durations for each repair category.

c. Proposed locations and schedule for performing Trial Sections for each applicable repair category.

d. Proposed calendar schedule for performing permanent repairs.

8. Review of Advance Supplemental Submissions by Concrete Repair Product Manufacturer:
   a. Prior to the Contractor's submission of the Mapping of Repairs and the Schedule of Repairs to the Owner, the Contractor shall obtain the approved Concrete Repair Product Manufacturer's Technical Representative's review and concurrence with the information shown in the Contractor's Mapping of Repairs and the Schedule of Repairs submittals.
   b. The Contractor's submittals for the Mapping of Repairs and Schedule of Repairs to the Owner shall be transmitted in one package, and shall contain a signed and dated statement from the approved Concrete Repair Product Manufacturer's Technical Representative indicating review of and concurrence of the information contained on each of the submittals. The Contractor shall include the approved Concrete Repair Product Manufacturer on the distribution of all Mapping of Repairs and Schedule of Repairs submittals and re-submittals made to the Owner, including all enclosures.

B. Trial Sections:
   1. The Trial Sections shall be performed following approval of the Contractor's Schedule of Repairs and approved Mapping of Repairs and prior to beginning performance of permanent repairs that will be measured for payment under Unit Price items in the Bid Schedule.
   2. The Contractor shall arrange for and provide the services (physically onsite) of the approved Concrete Repair Product Manufacturer's Technical Representative and the "Approved Contractor" supervisory and installation personnel for the entire duration of the Trial Sections.
   3. The Trial Sections will provide the approved Concrete Repair Product Manufacturer's Technical Representative and the Engineer the opportunity to witness the Contractor's / Subcontractor's first performance of each applicable repair category. The Trial Sections will also establish visual examples of the acceptable finished appearance of each applicable repair category.
   4. The Trial Sections shall be performed at locations within the permanent work area. The Contractor shall perform Trial Sections at the locations described in the

Contractor's approved Schedule of Repairs. The Trial Sections are intended to provide the Contractor the opportunity to demonstrate the techniques and materials that will be used in the performance of each applicable repair category described in the Contractor's approved Schedule of Repairs and approved Mapping of Repairs.

5. The Contractor shall arrange for and provide the services (physically onsite) of the approved Concrete Repair Product Manufacturer's Technical Representative during performance of the Trial Sections to verify that the Contractor's personnel are properly performing the following for each applicable repair category:
   a. Mixing and handling the materials.
   b. Surface preparation.
   c. Installation of the repair materials and accessories.
   d. Finishing.
   e. Curing.
   f. Cleanup.
6. The approved Concrete Repair Product Manufacturer's Technical Representative shall be on site for the entire duration of the Trial Sections. Following the completion of the Trial Sections, the approved Concrete Repair Product Manufacturer's Technical Representative shall prepare a concise written Trial Section Observations and Recommendations Report. At a minimum, the Trial Section Observations and Recommendations Report shall document observations at the Trial Sections, shall contain an objective critique of the Contractor's Trial Sections work and shall provide recommendations for any changes or improvements to personnel or procedures. The recommendations contained in the Concrete Repair Product Manufacturer's Trial Section Observations and Recommendations Report shall be incorporated into the Contractor's repair work.
7. Contractor personnel performing the Trial Sections shall be "Approved Contractor" personnel as described in Article 1.04 of this Section, and shall be the same personnel that will be utilized by the Contractor to perform the repair work unless changes in personnel are recommended in the Trial Section Observations and Recommendations Report. The Contractor shall not substitute personnel without prior approval of the Engineer.
8. The Contractor shall receive the Engineer's approval of the Trial Section prior to initiating concrete repairs.

C. Repair Area Verification: Contractor shall meet with the Engineer before commencing removal work to verify areas to be repaired.

D. Protective Measures: Prior to performance of surface preparation work, provide in-place protection to properly protect existing structures from debris that results from concrete removal and materials being used to restore concrete structures.
   1. Provide temporary measures to prevent the spillage of concrete debris and repair product debris.
   2. Metal fabrications that are now anchored to or embedded in the existing concrete structures shall be removed at certain locations. These fabrications shall be salvaged, unless otherwise noted, and reinstalled on restored concrete surfaces. Contractor has the option of replacing metal fabrications now embedded instead of salvaging them but to do so at no increase in Contract Price.

E. Where concrete repairs require the removal of bituminous material, it shall be removed by abrasive blast cleaning (or other equally effective mechanical cleaning method) to bare concrete prior to performing the concrete repairs.

F. Repair Area Surface Preparation: It shall be the Contractor's responsibility to ensure that all repair surfaces are properly prepared in accordance with the approved Concrete Repair Product Manufacturer's recommendations and these Specifications.
   1. Final acceptance of concrete removal and cleaning procedures will be based on actual field results.
   2. Demonstrate proposed preparation methods at representative locations, when requested by the Engineer, to verify compliance with specified surface roughness and bond requirements before production work proceeds.
   3. Remove all unsound or deteriorated concrete before placement of repair materials.
   4. After concrete removal and reinforcing steel preparation, perform primary cleaning to remove dust, debris, and weakened or microfractured surface material.
   5. Protect prepared surfaces from contamination and damage before repair placement.
   6. Within 48 hours before placement, perform secondary cleaning to remove bond-breaking contaminants. Vacuum or hydro wash surfaces, as appropriate, immediately prior to application of repair products.
   7. For cementitious repair materials, condition substrate to a saturated-surface-dry condition immediately prior to placement, with no standing or free water. For noncementitious materials, comply with the manufacturer's surface-moisture requirements.

G. Repair procedures are defined in this Section with additional guidelines given on the Contract Drawings.

H. Application Verification:
   1. The Contractor shall arrange for and provide the services (physically onsite) of the approved Concrete Repair Product Manufacturer's Technical Representative for Application Verification, which shall include, but not necessarily be limited to a review and assessment of the progress and quality of the repair work being performed by the "Approved Contractor" for each applicable repair category and to confirm that the "Approved Contractor" personnel are properly performing each applicable repair category.
   2. The Application Verification will be performed at the request of the Engineer. The Contractor shall schedule the Application Verification to occur not more than three (3) calendar days following the Engineers' request.

I. GENERAL CURING AND PROTECTION:
   1. Begin curing immediately after finishing.
   2. Maintain repair materials continuously protected from rapid drying, precipitation, flowing water, freezing, and other harmful exposures during the curing period.
   3. For cementitious mortar and concrete repairs, maintain moist curing for not less than 7 days unless more restrictive requirements are recommended by the manufacturer or specified elsewhere.

4. Use wet burlap, polyethylene sheeting, misting, curing compound, forms left in place, or other accepted methods appropriate to the repair material and exposure.
5. Protect repairs from direct sun, wind, rain, and freezing during curing.

3.02 PREPARATION REQUIREMENTS FOR SPECIFIC CONCRETE REPAIRS

A. In addition to the general preparation requirements specified in Article 3.01 in this Section, the following preparation requirements shall be performed for the repair category specified at the area receiving the repairs as indicated on the Drawings.

B. General Requirements for Deep Concrete Repairs and Shallow Concrete Repairs:
1. Sawcut the perimeter of repair areas to a minimum depth of 1 inch unless otherwise approved by the Engineer.
2. Provide square or slightly inward-tilted edges. Do not bevel repair edges outward.
3. Feather edges are not permitted.
4. Avoid acute corners and intersecting saw kerfs. Round repair corners where practical.
5. Use removal methods that avoid damage to sound concrete and reinforcing steel. High-pressure hydroblasting or hydrodemolition is preferred where practical for larger removals.
6. Where impact tools are used near reinforcing steel, limit chipping hammers to 15-pound or 30-pound class tools, as appropriate for the repair geometry and as accepted by the Engineer.
7. Do not use scabblers or bush hammers unless specifically approved for a limited, non-bond-critical purpose.
8. If reinforcing steel is exposed during removal, remove additional concrete as required to properly clean and encapsulate the bar.
9. Where corrosion is present, determine the apparent cause of reinforcement corrosion. Where chloride-related corrosion is present, extend removal beyond visibly distressed concrete as required by the Engineer to address contaminated substrate and reduce the risk of perimeter corrosion adjacent to the repair.

C. Surface Preparation for Deep Concrete Repairs - Vertical and Overhead Surfaces: Exercise reasonable care in removing the unsound concrete to the limits which were determined prior to removal operations. Make a one inch deep saw cut around the perimeter of the repair area. Remove spalled, scaled, loose and deteriorated concrete to sound concrete; additional requirements as follows:
1. Areas to be repaired must be clean, sound, and free of contaminants. Remove unsound concrete material in a manner to facilitate uniform placement of mortar; slope upper area of excavated voids evenly to within one inch of the surface, the upper outline shall be essentially normal (perpendicular) to the surface.
2. Render surfaces of exposed concrete and reinforcing steel free of oil, solvent grease, dirt, dust, rust, coatings, loose particles and foreign matter.
3. Mechanically prepare the concrete substrate to obtain a surface profile of +/- 1/16" (CSP 5 or greater as per ICRI Guidelines) with a new exposed aggregate surface. Area to be patched shall not be less than 1/2" in depth.

4. Use caution where reinforcing steel is uncovered so as not to damage the steel or its bond in the surrounding concrete. Do not use pneumatic tools in direct contact with reinforcing steel. Use maximum 30-pound size hammer for chipping behind reinforcing steel. Exposed reinforcing shall remain in place except where otherwise indicated for removal by direction of the Engineer.
    a. The depth of concrete removal shall be such as to include deteriorated concrete but not less than 2 inch behind uncovered reinforcing steel.
    b. Where the existing reinforcing steel is severely corroded or damaged, cut out reinforcing steel and replace with new reinforcing steel of the same size and spacing. Where existing steel is determined by the Engineer to have insufficient cover, either replace reinforcing or adjust as directed. Attach new steel behind existing steel with a minimum lap as determined by the Engineer. Remove concrete to a minimum depth of 2 inch behind new steel.
    c. Where reinforcing steel with active corrosion is encountered, determine the apparent cause of the corrosion, blast clean in accordance with SSPC-SP-6, Commercial Blast Cleaning, and remove surface contaminants, rust, and rust scale. Where corrosion has occurred due to the presence of chlorides, high-pressure wash the steel after mechanical cleaning and extend removal beyond visibly distressed concrete where required by the Engineer. Apply anti-corrosion coating where specified and where recommended for the repair system.
5. Form excavated areas on vertical surfaces of concrete members in accordance with Section 03100.

D. Surface Preparation for Deep Concrete Repairs - Horizontal Surfaces: Exercise reasonable care in removing the unsound concrete to the limits which were determined prior to removal operations. Make a one inch deep saw cut around the perimeter of the repair area. Remove spalled, scaled, loose and deteriorated concrete to sound concrete; additional requirements as follows:
    1. Areas to be repaired must be clean, sound, and free of contaminants. Remove unsound concrete material in a manner to facilitate uniform placement of plasticized concrete; slope upper area of excavated voids evenly to within one inch of the surface, the upper outline shall be essentially normal (perpendicular) to the surface.
    2. Render surfaces of exposed concrete and reinforcing steel free of oil, solvent grease, dirt, dust, rust, coatings, loose particles and foreign matter.
    3. Mechanically prepare the concrete substrate to obtain a surface profile of +/- 1/16" (CSP 5 or greater as per ICRI Guidelines) with a new exposed aggregate surface. Area to be patched shall not be less than 1/2" in depth.
    4. Use caution where reinforcing steel is uncovered so as not to damage the steel or its bond in the surrounding concrete. Do not use pneumatic tools in direct contact with reinforcing steel. Use maximum 30-pound size hammer for chipping behind reinforcing steel. Exposed reinforcing shall remain in place except where otherwise indicated for removal by direction of the Engineer.
        a. The depth of concrete removal shall be such as to include deteriorated concrete but not less than 1 inch below uncovered reinforcing steel.

b. Where the existing reinforcing steel is severely corroded or damaged, cut out reinforcing steel and replace with new reinforcing steel of the same size and spacing. Where existing steel is determined by the Engineer to have insufficient cover, either replace reinforcing or adjust as directed. Attach new steel behind existing steel with a minimum lap as determined by the Engineer. Remove concrete to a minimum depth of 1 inch behind new steel.
c. Where reinforcing steel with active corrosion is encountered, determine the apparent cause of the corrosion, blast clean in accordance with SSPC-SP-6, Commercial Blast Cleaning, and remove surface contaminants, rust, and rust scale. Where corrosion has occurred due to the presence of chlorides, high-pressure wash the steel after mechanical cleaning and extend removal beyond visibly distressed concrete where required by the Engineer. Apply anti-corrosion coating where specified and where recommended for the repair system.

E. Surface Preparation for Shallow Concrete Repairs: Prepare surfaces receiving sprayable mortar as follows:
1. Areas to be repaired must be clean, sound, and free of contaminants. All loose and deteriorated concrete shall be removed by mechanical means. Clean surfaces of dirt, oil, grease, or other bond-inhibiting substances.
2. Mechanically prepare concrete substrate to obtain a minimum surface profile of +/-3/8 inch (CSP 6 or greater as per ICRI Guidelines) with a new exposed aggregate surface. Area to be patched shall not be less than 3/8 inch in depth.
3. Provide bonding agent on excavated surfaces only where specifically required by the approved repair material manufacturer or specifically accepted by the Engineer for the repair condition.

F. Surface Preparation for Concrete Crack Repairs - Non-Structural Cracks: Prepare surfaces receiving chemical grout as follows:
1. Clean cracks to be sealed using oil free compressed air or water under pressure to remove all dirt and/or loose material from inside the crack.

G. Surface Preparation for Concrete Crack Repairs - Structural Cracks: Prepare surfaces receiving epoxy injection as follows:
1. Areas to be repaired must be clean, sound, and free of contaminants. Clean cracks to be sealed using oil free compressed air or water under pressure to remove all dirt and/or loose material from inside the crack.

H. Surface Preparation for Weep Hole Cleanout Repairs:
1. Remove surface debris, vegetation, and other loose obstructions at and around the weep hole openings before cleaning the holes to full depth.

3.03 MATERIAL APPLICATION

A. General: Mix, prepare and apply materials in accordance with manufacturer's directions.

B. Anti-Corrosion Coating and Bonding Agent Application: Prior to application of anti-corrosion coating, mechanically clean reinforcing steel to remove rust and bond-breaking or inhibiting matter. Use blast cleaning methods or other mechanical means, exclusive of vibratory or impact methods, to prepare reinforcing steel and adjacent concrete surfaces in accordance with coating manufacturer's requirements. Where bonding agents are specifically required, apply them only in accordance with the approved repair material manufacturer's current printed literature. Bonding agents shall not be used as a substitute for proper concrete removal, cleaning, substrate conditioning, placement, consolidation, and curing.

C. Deep Concrete Repairs - Vertical and Overhead Surfaces: Repair as follows:
   1. At time of placement, surfaces shall be water saturated but surface dry with no glistening water. Immediately upon completion of mixing operation, place repair mortar in strict accordance with manufacturer's recommended procedures.
   2. Curing: On open repair areas, cure with wet burlap and polyethylene, a fine mist of water. Moist curing should commence immediately after finishing and continue for 7 days. If necessary, protect newly applied material from rain. To prevent from freezing, cover with insulating material.
   3. Adhere to all limitations and cautions for the Portland cement mortar in the manufacturer's current printed literature.

D. Deep Concrete Repairs - Horizontal Surfaces: Repair as follows:
   1. At the time of placement, the substrate should be saturated surface dry with no standing water. Immediately upon completion of mixing operation, place repair mortar in strict accordance with manufacturer's recommended procedures.
   2. Curing: On open repair areas, cure with wet burlap and polyethylene, a fine mist of water. Moist curing should commence immediately after finishing and continue for 7 days. Protect newly applied material from rain, sun, and wind until compressive strength is 70% of the 28-day compressive strength. To prevent from freezing, cover with insulating material. Setting time is dependent on temperature and humidity.
   3. Adhere to all limitations and cautions for the Portland cement mortar in the manufacturer's current printed literature.

E. Shallow Concrete Repairs: Repair as follows:
   1. At the time of placement, the substrate should be saturated surface dry with no standing water. Place repair mortar in strict accordance with manufacturer's recommended procedures.
   2. Curing: On open repair areas, cure with wet burlap and polyethylene, a fine mist of water. Moist curing should commence immediately after finishing and continue for 7 days. Protect newly applied material from rain, sun, and wind, and frost until compressive strength is 70% of the 28-day compressive strength. To prevent from freezing, cover with insulating material. Setting time is dependent on temperature and humidity.
   3. Adhere to all procedures, limitations and cautions for the silica fume, polymer-modified Portland cement mortar in the manufacturer's current printed technical data sheet and literature.

F. Concrete Crack Repairs - Non-Structural Cracks: Repair as follows:
   1. Placement procedure: set packers as required by the manufacturer
      a. Begin by drilling 5/8" diameter holes along the side of the crack at a 45 degree angle. Drill the hole to intersect the crack midway through the substrate. Spacing of the devices shall be accomplished as required to achieve the travel of the Polyurethane chemical grout for the pressure injection grouting between packers and to fill the crack to the maximum. It is anticipated that maximum spacing will be approximately 12 inches. Closer spacing will be required to fill narrow cracks. On structures open on both sides, provide packers on opposite sides at staggered elevations. Install the injection packers in the holes.
      b. If the crack to be injected is 1/2" or greater at surface, pack an open cell polyurethane foam saturated with the mixed Polyurethane chemical grout into the crack. Spray the saturated foam with a small amount of water to activate the grout and create a surface seal.
      c. Pump polyurethane chemical grout at a pressure less than 250 psi into or behind fissure or into voids which are allowing water to infiltrate into unwanted areas. If concrete being injected contains insufficient moisture to activate the grout, inject the crack with a small amount of water prior to injecting the polyurethane chemical grout.
      d. Pump polyurethane chemical grout for 45 seconds and then pause to allow the material to flow into all of the cracks and crevices. Watch for material flow and water movement to appear on the surface. When movement stops, begin injection into the next packer. When sealing vertical cracks, begin injecting at the bottom of the crack and work vertically. If faster reaction time is needed, or if grout is being pumped at cold temperature, additional Accelerator can only be added to component B. Consult manufacturer’s technical service before adding Accelerator. Re-inject to assure that all voids are properly sealed off.
      e. Minimum installation temperature
         1) Minimum substrate temperature: 40 degrees Fahrenheit
         2) Minimum material temperature: 60 degrees Fahrenheit
      f. Adhere to all limitations and cautions for the polyurethane chemical grout as stated in the manufacturers current printed literature.

G. Concrete Crack Repairs - Structural Cracks: Repair as follows:
   1. Placement procedure:
      a. The epoxy resin adhesive for sealing the cracks and porting devices: Set porting devices as required by the manufacturer. Spacing of the porting devices should not exceed the thickness of the substrate. Spacing of the porting devices shall be accomplished as required to achieve the travel of the epoxy resin adhesive for the pressure injection grouting between ports and fill the cracks to the maximum. On structures open on both sides, provide porting devices on opposite sides at staggered elevations. Apply the mixed epoxy resin adhesive for sealing over the cracks and around each porting device to provide an adequate seal to prevent the escape of the epoxy resin adhesive for the injection grouting. Where required by the Engineer, apply the epoxy resin

adhesive for sealing in such a manner that minimal defacing or discoloration of the substrate shall result.

b. The epoxy resin adhesive for the pressure injection grouting:
   1) Manual: Load the mixed epoxy resin adhesive for grouting into a disposable caulking cartridge or bulk-loading caulking gun. Inject the prepared cracks with a constant pressure in order to achieve maximum filling and penetration without the inclusion of air pockets or voids in the epoxy resin adhesive. Begin the pressure injection at the lowest port and continue until there is the appearance of the epoxy resin adhesive at an adjacent port, thus indicating travel. When travel is indicated, to discontinue or continue the pressure injection from that port should be made by the contractor, based on his experience, with the approval of the Engineer. Continue the procedure until all pressure injectable cracks have been filled.
   2) Automated: Dispense the epoxy resin adhesive for grouting under constant pressure in accordance with procedures recommended by the equipment manufacturer or as required to achieve maximum filling and penetration of the prepared cracks without the inclusion of air pockets or voids in the epoxy resin adhesive. The pressure injection of single or multiple ports, by the use of a manifold system, is possible. This decision should be made by the contractor, based upon his experience, with the approval of the Engineer. Continue the approved procedure until all pressure injectable cracks have been filled.

2. If penetration of any cracks is impossible, consult the Engineer before discontinuing the injection procedure. If modification of the proposed procedure is required to fill the cracks, submit said modification in writing to the Engineer for acceptance prior to proceeding.
3. Adhere to all limitations and cautions for the epoxy resin adhesives in the manufacturer's current printed literature.

H. Weep Hole Cleanout Repairs:
   1. Remove all debris and vegetation from plugged weep holes to the full depth of the hole using mechanical means or air pressure, as approved by the Engineer.

3.04 CONCRETE REPAIR FINISHES

A. All deep concrete repairs and shallow concrete repairs shall be finished to produce a surface which is true and uniform without any conspicuous offsets or bulges. Forms shall be sanded to meet required tolerance in surface irregularities. Gradual irregularities shall not exceed 1/8-inch and abrupt irregularities shall not exceed 1/16-inch. This finish shall be achieved without excessive rubbing. Gradual irregularities shall be checked by use of 5 foot straight edges.

B. Rubbed finish shall be applied to freshly-hardened deep concrete repairs and shallow concrete repairs. The rubbing shall be completed no later than one day after forms are removed. Surfaces shall be wetted and rubbed with a carborundum brick, or other abrasive, and plenty of water until all form marks, projections and irregularities have

been removed and a smooth surface, texture, and color are produced. The surface shall be washed clean.

C. Where deep concrete repairs or shallow concrete repairs are performed without the use of forms, the finish shall be obtained by working a float finish with a steel trowel. The finish troweling shall not start until the surface has hardened sufficiently to prevent an excess of fine material from being drawn to the surface. Steel troweling shall be performed with firm pressure to produce a dense, smooth, uniform surface.

D. Exposed edges of deep concrete repairs and shallow concrete repairs shall match the exposed edges of the existing concrete structures. Where existing exposed edges are chamfered or rounded, exposed edges of repairs shall be chamfered or rounded to match existing concrete. If existing exposed edges are square, exposed edges of repairs shall be square.

END OF SECTION

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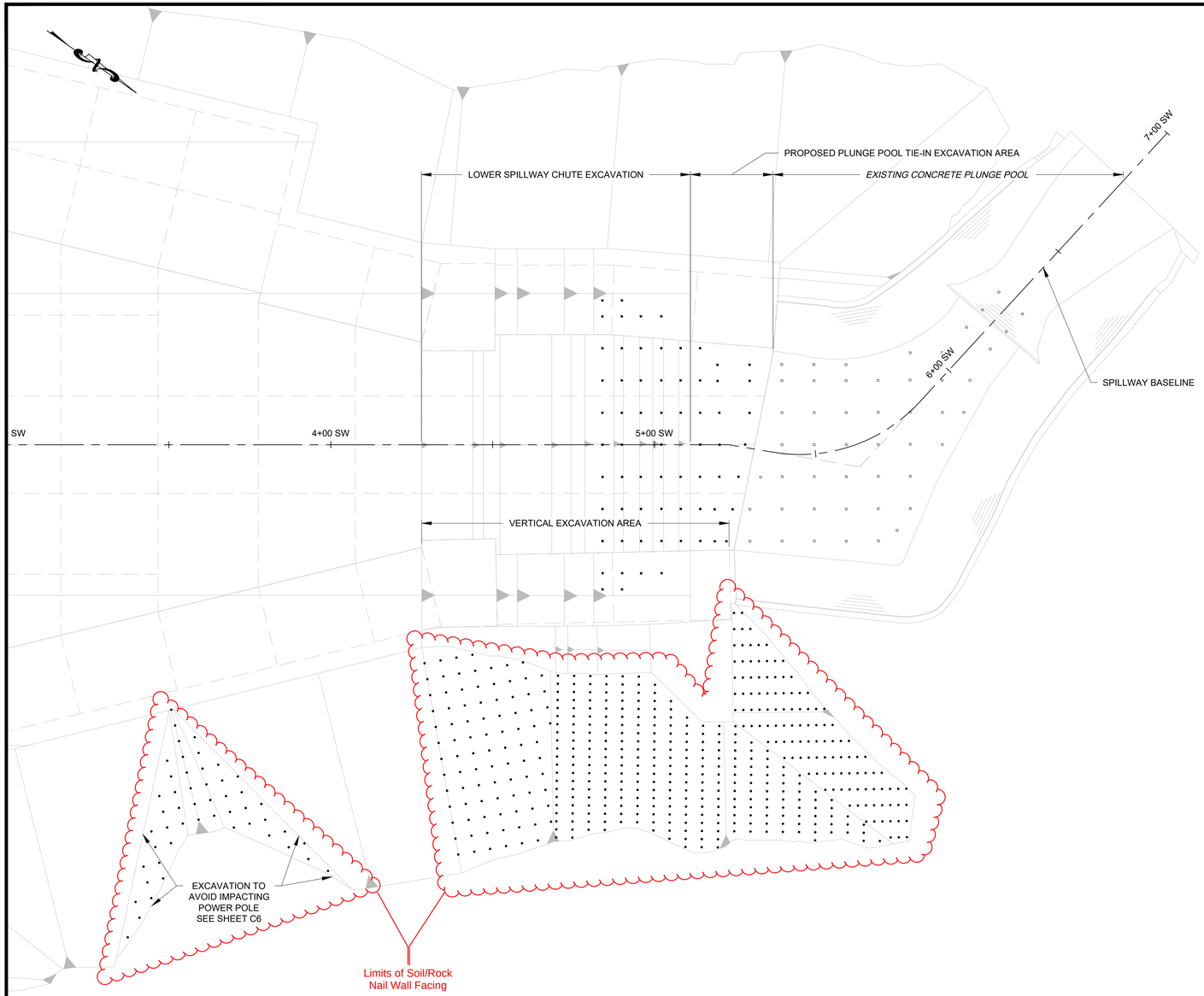


LEGEND:

- ✹ S1 SOIL/ROCK NAIL IDENTIFIER
- ☐ A1 TYPE A ANCHOR BAR IDENTIFIER
- ◙ B1 TYPE B ANCHOR BAR IDENTIFIER

ANCHOR PLAN VIEW

20 -0- 20 40

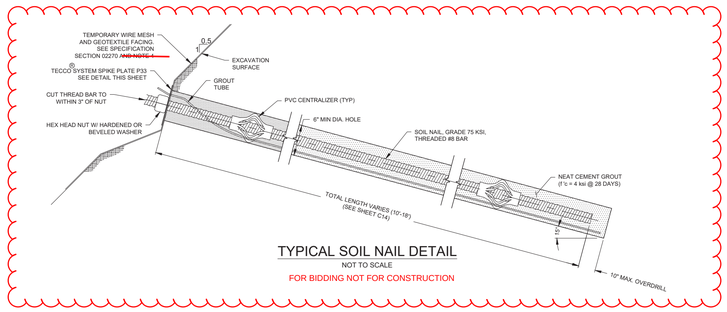
SCALE IN FEET

ANCHOR BAR TABLE		
POINT ID	NORTHING (FT)	EASTING (FT)

SOIL NAIL TABLE		
POINT ID	NORTHING (FT)	EASTING (FT)

NOTES:

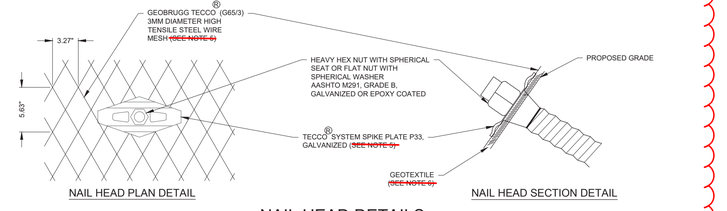
1. TEMPORARY SUPPORT OF EXCAVATION CONSISTING OF SOIL/ROCK NAILS WILL BE REQUIRED TO CONSTRUCT THE RIGHT SPILLWAY WALL FROM STA. 4+28 SW TO 5+30 SW.
2. SOIL/ROCK NAILS ARE TO BE DESIGNED BY THE ENGINEER, UPON COMPLETION OF A FUTURE GEOTECHNICAL SUBSURFACE INVESTIGATION BY THE ENGINEER OR CONTRACTOR.
3. THE SOIL/ROCK NAIL CONSTRUCTION DRAWINGS AND SPECIFICATIONS WILL BE PROVIDED IN A GEOTECHNICAL DESIGN ADDENDUM.
4. THE NUMBER AND LENGTH OF SOIL NAILS SHOWN IN THE PLAN ARE FOR BIDDING PURPOSES ONLY. ACTUAL NUMBER AND LENGTH REQUIRED TO BE PROVIDED IN FUTURE GEOTECHNICAL DESIGN ADDENDUM.
5. BASED ON THE RESULTS OF THE GEOTECHNICAL SUBSURFACE INVESTIGATION, A REINFORCED SOIL/ROCK NAIL SLOPE WITH ANCHORED WIRE MESH MAY BE REQUIRED TO PROVIDE SAFE WORKING CONDITIONS DURING SPILLWAY WALL CONSTRUCTION.
6. IF STABILIZATION MEASURES ARE DEEMED REQUIRED BY THE ENGINEER, GEOTECHNICAL DESIGN PARAMETERS WILL BE PROVIDED TO THE CONTRACTOR TO DEVELOP A SLOPE STABILIZATION SYSTEM.
7. SOIL/ROCK NAIL SPACING AS SHOWN IS 5'X'5. STRIP DRAINS SHALL BE LOCATED BETWEEN EACH COLUMN OF ANCHORS ALONG THE SLOPE.



TYPICAL SOIL NAIL DETAIL

NOT TO SCALE

FOR BIDDING NOT FOR CONSTRUCTION



NAIL HEAD PLAN DETAIL

NAIL HEAD SECTION DETAIL

NAIL HEAD DETAILS

NOT TO SCALE

FOR BIDDING NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	BY
	Addendum No. 2		

REVISIONS

DESIGNED	CADD	SCALE
JBP	JBP	AS SHOWN
DRAWN	CHECKED	APPROVED
JBP	TWJ	GLR

GFT

HAWAII DEPT. OF AGRICULTURE & BIOSECURITY
HONOLULU, OAHU, HAWAI'I

WAHIAWĀ DAM
REHABILITATION

CIVIL

ANCHOR PLAN AND DETAILS

JOB NO.	SHEET NO.
083109	C34
DATE	DRAWING NO.
03/2026	38 OF 63

C:\Users\jbenthyman\DCA\CDocs\GANNETT FLEMING INC\083109_Hawaii_DOA_Wahiawa_Dam_Rehabilitation\Project Files\Design\Esk\GDH\DWG\Design_Set\ANCHOR_PLAN_AND_DETAILS.dwg
Plot Date = 1/30/2026 3:10 PM, Plotted By: Jason Benthyman

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawai‘i 96850

In Reply Refer To:
2026-00036373-S7-001

March 25, 2026

Ms. Emily R. Hegedus
GFT Infrastructure Inc.
300 Sterling Parkway, Suite 200
Mechanicsburg, Pennsylvania 17050

Subject: Informal Consultation for the Proposed Wahiawā Dam Rehabilitation Project, O‘ahu

Dear Ms. Hegedus:

The U.S. Fish and Wildlife Service (Service) Pacific Island Fish and Wildlife Office received your letter dated February 12, 2026, requesting our concurrence with your determination that the proposed Wahiawā Dam Rehabilitation Project, on the island of O‘ahu, may affect but is not likely to adversely affect the following federally listed species: endangered ‘ōpe‘ape‘a (Hawaiian hoary bat, *Lasiurus cinereus semotus*); endangered ae‘o (Hawaiian stilt, *Himantopus mexicanus knudseni*), endangered ‘alae ke‘oke‘o (Hawaiian coot, *Fulica alai*), endangered ‘alae ‘ula (Hawaiian gallinule, *Gallinula galeata sandvicensis*), threatened koloa (Hawaiian duck, *Anas wyvilliana*) (hereafter collectively referred to as Hawaiian waterbirds); endangered ‘ua‘u (Hawaiian petrel, *Pterodroma sandwichensis*), endangered Hawai‘i distinct population segment (DPS) of the ‘akē‘akē (band-rumped storm-petrel, *Hydrobates castro*), and threatened ‘a‘o (Newell’s shearwater, *Puffinus newelli*) (hereafter collectively referred to as Hawaiian seabirds).

The findings and recommendations in this consultation are based on the following: 1) your informal consultation request dated February 12, 2026; and 2) other information available to us. This response is in accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq*.).

Project Description
The Wahiawā Dam Rehabilitation Project is a critical initiative aimed at enhancing flood safety and structural stability for one of O‘ahu’s water resources. Currently owned by Sustainable Hawai‘i, Inc. and Dole Food Company Hawai‘i (Dole), the dam is in the process of being transferred to the State of Hawai‘i. Located in Wahiawā, adjacent to Wilikina Drive (Route 99) and west of Wahiawā Homesteads, the earthen dam impounds the Kaukonahua Stream to form

Wahiawā Reservoir, commonly known as Lake Wilson. This reservoir serves as a vital irrigation source and recreational area and is managed as a designated fishery by the Division of Aquatic Resources. The dam stands 88 feet (ft) high and spans 66 ft, with a maximum storage capacity of 9,200 acre-feet (ac-ft), and its concrete-lined spillway discharges into a plunge pool that drains into the steep ravine of Kaukonahua Stream.

The project encompasses approximately 60.5 acres (ac), including the dam embankment and appurtenances, Wahiawā Reservoir, Kaukonahua Stream, Wahiawā Reservoir Ditch, access roads, and staging areas. The reservoir captures the confluence of the North and South Forks of Kaukonahua Stream, while the Wahiawā Reservoir Ditch originates at the dam's low-level outlet tower and flows northwest beyond the project area. Portions of the project area include former agricultural lands owned by Dole and the Office of Hawaiian Affairs, now fallow and overgrown with invasive *Megathyrsus maximus* (guinea grass). Access to the site is provided by three gated unpaved roads from the northwest, northeast, and southwest, with surrounding land uses including Route 99, U.S. Army's Schofield Barracks, and agricultural fields. The culturally significant Kukaniloko Birthstones State Monument lies east of the project area.

As a high-hazard potential structure, Wahiawā Dam requires upgrades to meet Hawai‘i Administrative Rules Chapter 13-190.1-4, which mandate spillway capacity sufficient to pass the Probably Maximum Flood (PMF). Planned improvements include lowering the spillway crest from elevation 842.5 ft to 840 ft to increase discharge capacity and reduce flood risk while maintaining reservoir levels necessary for agriculture, aquatic health, and recreation, A new stepped labyrinth weir will replace the aging, undersized spillway to safely convey PMF flows, with Stage 1 at elevation 840 ft and Stage 2 at 846 ft. The existing plunge pool will remain in Service following structural assessment. Additional modifications will address embankment stability through removal of the downstream buttress using material excavated from the spillway expansion. The dam crest will be raised to elevation 852.5 ft with a 2-ft parapet for freeboard and a new access ramp will be added.

Outlet works and tunnels will remain unchanged, though abandoned diversion tunnels will be inspected and secured with a filter diaphragm tied to the new embankment features. Reservoir levels will remain at the minimum allowable pool during construction to preserve fishery health, with a temporary cofferdam providing access.

<u>Conservation Measures</u>
To avoid and minimize potential project impacts to ‘ōpe‘ape‘a, Hawaiian waterbirds, and Hawaiian seabirds, the following measures will be implemented:

‘Ōpe‘ape‘a

- Woody plants greater than 15 ft tall will not be disturbed, removed, or trimmed during the birthing and pup rearing season, June 1 through September 15.

Hawaiian Waterbirds

- In areas where Hawaiian waterbirds are known to be present, reduced speed limits will be posted and enforced, and project personnel and contractors will be informed about the presence of endangered species on-site.

- A biological monitor that is familiar with the species' biology will conduct Hawaiian waterbird nest surveys at the area of concern prior to project initiation. Surveys will be repeated within 3 days of project initiation and after any subsequent delay of work of three or more days (during which time the birds may attempt to nest).
    - If a nest or active brood is found:
        - The Service will be contacted within 48 hours for further guidance.
        - A 100-ft buffer will be established and maintained around all active nests and/or broods until the chicks/ducklings have fledged. Potentially disruptive activities or habitat alteration will not be conducted within this buffer.
        - A biological monitor that is familiar with the species' biology will be present on the project site during all construction or earth moving activities until the chicks/ducklings fledge.

Hawaiian Seabirds

- All outdoor lights will be fully shielded so the bulb can only be seen from below.
- Automatic motion sensor switches and controls will be installed on all outdoor lights or lights will be turned off when human activity is not occurring in the lighted area.
- Nighttime construction will not occur during the seabird fledging period, September 15 through December 15.

Analysis of Effects

Consequences of the Proposed Action on the ʻŌpeʻapeʻa

ʻŌpeʻapeʻa roost in woody vegetation across all islands and will leave their young unattended in trees and shrubs when they forage. If trees or shrubs 15 ft or taller are cleared during pupping season, June 1 through September 15, there is a risk that young ʻōpeʻapeʻa could inadvertently be injured or killed, since they are too young to fly or move away from disturbance.

Because woody plants taller than 15 ft will not be disturbed, removed, or trimmed between June 1 and September 15, it is unlikely that ʻōpeʻapeʻa roosting in trees will become injured or killed as a result of project activities; therefore, the effects are discountable.

Consequences of the Proposed Action on Hawaiian Waterbirds

Waterbirds are currently found in a variety of wetland habitats including freshwater marshes and ponds, coastal estuaries and ponds, artificial reservoirs, loʻi kalo or taro (*Colocasia esculenta*) patches, irrigation ditches, sewage treatment ponds, and in the case of the Hawaiian duck, montane streams, and marshlands. Hawaiian stilts may also be attracted to project staging areas even in sub-optimal locations if ephemeral or persistent standing water is present. Threats to Hawaiian waterbird species from the proposed project include injury or mortality from vehicle strike, crushing of nests by stockpiled construction materials, and trampling by project personnel where nests may occur.

Because surveys will be conducted to confirm species presence, buffers will be established around nests, and speed limits will be reduced in areas where waterbirds are known to be present, it is not probable that adults, chicks, or eggs will be run over by vehicles, that nests be crushed

by stockpiled construction materials, or that nests be trampled by project personnel; therefore, the effects are discountable.

Consequences of the Proposed Action on Hawaiian Seabirds
Hawaiian seabirds may traverse the project area at night during the breeding, nesting, and fledging seasons, March 1 through December 15. Outdoor lighting could result in seabird disorientation, fall out, and injury or mortality. Seabirds are attracted to lights and after circling the lights they may become exhausted and collide with nearby wires, buildings, or other structures or they may land on the ground. Downed seabirds are subject to increased mortality due to collision with automobiles, starvation, and predation by dogs, cats, and other predators. Young birds (fledglings) traversing the project area between September 15 and December 15, in their first flights from their mountain nests to the sea, are particularly vulnerable to light attractions.

Nighttime work is not currently proposed; however, if nighttime work becomes necessary, because outdoor lights will be fully shielded so that bulbs are only visible from below, motion sensors and lighting controls will be used to reduce illumination, and nighttime work during the seabird fledging season (September 15–December 15) will be avoided, it is unlikely that Hawaiian seabirds would result in disorientation, fallout, and injury or mortality. Therefore, the effects of the action are considered discountable.

Summary
Based on our review of your proposed project, effects are discountable. Because effects are discountable, we concur with your determination that the proposed project may affect, but is not likely to adversely affect ʻōpeʻapeʻa, Hawaiian waterbirds, and Hawaiian seabirds.

We appreciate your efforts to conserve protected species. If you have questions regarding this response, please contact Joy Hiromasa Browning, Fish and Wildlife Biologist, at joy_browning@fws.gov. When referring to this project please include this reference number: 2026-0003673-S7-001.

Sincerely,

JINY KIM
Digitally signed by JINY KIM
Date: 2026.03.25 11:01:01 -10'00'

Island Team Manager
Oʻahu, Kauaʻi, Northwest Hawaiian Islands and American Samoa