

**STATE OF NEW HAMPSHIRE
DEPARTMENT OF RESOURCES AND ECONOMIC DEVELOPMENT
DIVISION OF PARKS AND RECREATION
PLANNING AND DEVELOPMENT**

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PROJECT MANUAL

BEDROCK WELL INSTALLATION

THE FLUME
FRANCONIA NOTCH STATE PARK
FRANCONIA, NH

October 20, 2016

New Hampshire Department of Resources and Economic Development
The Flume – Bedrock Well Installation

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SECTION 00 11 16

INVITATION TO BID

BEDROCK WELL INSTALLATION
THE FLUME
FRANCONIA NOTCH STATE PARK

1. **Sealed Bids:** Proposals for a General Contract for the Construction of the above project will be received by the Owner until 2:00 P.M. prevailing time on Monday, November 7, 2016, at which time they will be publicly opened and read aloud. All Bids shall be made out only on the form included in the specifications package and delivered in sealed, labeled envelope marked: **Bid Proposal for The Flume-Bedrock Well Installation** and deposited in the bid box located at the reception desk of the Department of Resources and Economic Development (DRED) offices at 172 Pembroke Road in Concord, NH. Bidders are invited to attend the Bid opening. Bids received after the above stated time and date will not be accepted.
2. **Technical Questions:** Questions regarding the Bidding Documents shall be referred to: Department of Resources and Economic Development, 172 Pembroke Road, Concord New Hampshire, 03302, Telephone (603) 271-2606, attention Seth Prescott, Project Manager.
3. **Documents:** Bidding Documents are available at the Planning and Development Section of DRED, 172 Pembroke Road, Concord NH and at the following locations:

Construction Summary of New Hampshire Inc.: 734 Chestnut Street, Manchester, New Hampshire 03104, (603) 627-8856, www.constructionsummary.com

Infinite Imaging: 933 Islington Street, Portsmouth, NH 03801, (800) 581-2712 or (603) 436-3030, www.planroom.infiniteimaging.com

McGraw-Hill Construction: www.construction.com

Signature Digital Imaging: 45 Londonderry Turnpike, Hooksett, NH 03106, (603) 624-4025, www.signaturenh.com

Works in Progress: 20 Farrell Street, Suite 103, South Burlington, VT 05403. (800) 286 3633 or (802) 658-3797

New Hampshire Department of Administrative Services Bureau of Purchase and Property Website: <http://admin.state.nh.us/purchasing/vendorresources.asp>

New Hampshire State Parks Website: www.nhstateparks.org under the News & Events tab improvement projects sub tab

4. **Qualifications:** All companies, corporations, and trade names bidding must be registered and have a certificate of existence from the New Hampshire Secretary of State's Office, Corporate Division (telephone 603-271-3244) in order to do business with the State of New Hampshire

The Flume – Bedrock Well Installation

5. Bid Security: A Bid Bond in the amount of five (5%) percent of the total amount of the lump sum bid price shall accompany each Bid Proposal in accordance with the Instructions to Bidders.

6. Bonds: Bidders shall be required to provide the Owner with financial responsibility as security for the completion of the contract in accordance with the plans, specifications and contract documents, in the form of a Performance and Payment Bond in the amount of One Hundred (100%) Percent of the contract award, if the contract award is thirty-five thousand dollars (\$35,000) or more, the cost of which shall be a part of the Base Bid. The form of bond shall be that provided for by the Department, and the surety shall be acceptable to the Commissioner. No contract bond shall be required on contract awards of less than thirty-five thousand dollars (\$35,000).

7. Inspection of Site: Bidders are expected to thoroughly inspect existing building and site conditions prior to submission of Proposals.

8. Awards: In most cases the proposal submitted by the qualified bidder with the lowest base bid price shall be selected. However, the Department of Resources and Economic Development (DRED) reserves the right to reject any or all proposals, or advertise for new proposals as it judges to be in the best interest of the state.

9. Regulations: Bidders' attention is called to the fact that this Project is required to comply with, in addition to all other requirements of the Contract Documents, Equal Employment Opportunity and Affirmative Action Regulations

END OF INVITATION TO BID

SECTION 00 41 00

BID PROPOSAL FORM

Project No. **PR-**

PROJECT: **The Flume – Bedrock Well Installation**
The Flume Gorge
Franconia Notch State Park
Franconia, NH

DATE BID OPENING: **Monday, November 7, 2016** at 2:00 pm at DRED's office at 172 Pembroke Road, Concord, NH

START DATE: **November 21, 2016**

COMPLETION DATE: **No later than December 16, 2016**

Sealed bid proposals for the above project will be accepted until **2:00 p.m., November 7, 2016**. Bids may be deposited in the bid box at DRED's offices in Concord or mailed to the attention of Scott Coruth, Architect, Department of Resources and Economic Development (DRED), 172 Pembroke Road, Concord NH 03301. Please note on the outside of the sealed envelope: Bid Proposal for The Flume-Bedrock Well Installation.

DATE: _____

PROPOSAL OF: _____

GRAND TOTAL / LUMP SUM BASE BID: _____

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specifications and contract documents.

The undersigned acknowledges receipt of the following addenda, issued during the bidding time, and states that these have been incorporated in the proposal:

Addendum #1 dated _____

Addendum #2 dated _____

Addendum #3 dated _____

Dated _____

SCHEDULE OF VALUES: The Flume – Bedrock Well Installation

INDICATE DOLLAR AMOUNT OF CONTRACT SUM ALLOCATED TO EACH CATEGORY OF WORK AS DESIGNATED BELOW:

Dollar amount for 800 foot deep well:

Dollar amount for 160 feet of Casing:

Dollar amount for hydro-fracking at 500 foot well depth:

Mudding:

Grand Total: lump sum base bid

Contract will be awarded based on best price for the case of an: 800-foot deep well with 160-feet of casing and hydro-fracking at 500-foot well depth.

Cost per linear foot of drilling and casing to be added or deducted depending on final depth of well based on unit pricing below. Indicate dollar amount to be added or deducted.

Dollar amount per linear foot of casing:

Dollar amount per linear foot of drilling:

Note: Upon obtaining adequate volume or as instructed by the on-site Project Manager, drilling will stop and well construction price will be determined based on actual well depth and casing installed. Linear foot pricing will be used to determine actual cost.

NOTE: The Schedule of Values must be completely filled out in order for bid proposal to be considered responsive.

SIGNATURE PAGE

Company Name: _____

Address: _____

Phone: _____

E-mail Address: _____

Signature of Authorized Bidder:

Print: _____

Title: _____

Address of Bidder: _____
(If different than company)

Names and Addresses of Members of the Firm/Corporation

Name _____ address _____

Name _____ address _____

Name _____ address _____

SECTION 00 72 00

GENERAL CONDITIONS

GENERAL

This contract is to be governed by all the applicable provisions of these specifications.

This project consists of: construction of new bedrock well as indicated on the attached plan and in these specifications, at The Flume in Franconia Notch State Park, Franconia, NH.

BIDDING REQUIREMENTS

Bids shall only be accepted on the official Bid Proposal Forms, attached to these specifications. **Any bids submitted that are not on the official bid proposal forms will not be accepted.**

CONDITIONS AT SITE OR BUILDING

Bidders shall visit the site and be responsible for having ascertained pertinent local conditions such as: location, accessibility, general character of the site and the character and extent of existing work to remain, and any other work being performed thereon at the time of the submission of this bid.

PERFORMANCE AND PAYMENT BOND

In the event the bid is \$35,000 or more, the contractor shall furnish security by bond or otherwise in an amount equal to 100% of the contract guaranteeing performance and payment. The payment security shall meet the requirements of New Hampshire RSA 447:16.

The performance and payment bond must be returned with the signed contract within 15 days after the contract has been mailed or otherwise delivered to the bidder.

PROPOSAL GUARANTEE

The Contractor shall furnish a certified check or bid bond in the amount of 5% of the total amount of the Lump Sum Price made payable to the "Treasurer, State of New Hampshire" as a proposal guarantee. This proposal guarantee will be forfeited in the event that the contract is not executed. Personal checks will not be accepted.

DETERMINATION OF RIGHT TO DO BUSINESS WITH STATE OF N.H.

If selected as the low bidder, the bidder must be registered and have a certificate of existence from the Secretary of State, Corporate Division (telephone 603-271-3244) in order to do business with the State of New Hampshire.

PROPOSAL SELECTION

In most cases the proposal submitted by the qualified bidder with the lowest base bid price shall be selected. However, the Department of Resources and Economic Development (DRED) reserves the right to reject any or all proposals, or advertise for new proposals as it judges to be in the best interest of the state.

CONTRACTORS QUALIFICATIONS

The Flume – Bedrock Well Installation

The successful bidder shall provide evidence upon request that they have been successfully performing this type, scale, and quality of work for a minimum of five years. Upon request, a comprehensive list of all similar projects worked on in the past two years by the general contractor shall be submitted along with contact information for 3 references of owner's representatives involved with three different projects completed by the contractor.

EXECUTION OF CONTRACT

The Contractor's attention is called to the following:

EXECUTION AND APPROVAL OF CONTRACT. The contract shall be signed by the successful Bidder and returned, together with the contract bond, if applicable, within 15 days after the contract has been mailed or otherwise delivered to the Bidder. No contract shall be considered as in effect until it has been fully executed by all the parties thereto and, when the contract amount is more than \$25,000, the award has been concurred in by the Governor and Council.

FAILURE TO EXECUTE CONTRACT. Failure to execute the contract within 15 days after the contract has been mailed or otherwise delivered to the successful Bidder shall be just cause for the cancellation of the award and the forfeiture of the proposal guaranty which shall become the property of the Department, not as a penalty, but in liquidation of damages sustained. Award may then be made to the next lowest Bidder, or the work may be re-advertised as the Commissioner of DRED may decide.

STARTING DATE

The Contractor shall start work after the Notice to Proceed is received. The Notice to Proceed shall be issued immediately upon contract approval by the Governor and Council, and shall establish the actual construction start date. Failure to start work within 15 calendar days after the start date shall be considered a default of the contract. If the actual start date is later than the advertised start date, the completion date shall be extended by an equivalent number of working days.

WORKERS COMPENSATION INSURANCE

Workers compensation insurance is required for all workers on the job site of this project. Per RSA 21-1:81-b At the onset of work on any NH state construction project, the general contractor or designated project construction manager, if any, shall provide to the Department Project Manager a current list of all subcontractors and independent contractors that the general contractor has agreed to use on the job site, with a record of the entity to whom that subcontractor is insured for workers compensation purposes. This list shall be posted on the jobsite and updated as needed to reflect any new subcontractors or independent contractors.

If it is determined that a subcontractor or independent contractor is present on a state construction site without the contractor's name and direct contracting relationship being posted in a visible location at the worksite, the general contractor or designated project manager shall require the subcontractor or independent contractor to provide the information within 36 hours and to post the information in a visible location at the worksite. If the information is not provided within 36 hours of its request, the general contractor shall suspend the contractor until the information is provided and posted.

PROTECTION OF EXISTING PROPERTY

It shall be the responsibility of the contractor to protect existing property from damage. Any damage caused by the contractor in the performance of the work shall be repaired or replaced at his expense to the satisfaction of the designated DRED Project Manager.

CODES

All work performed shall meet the provisions, if applicable, of the State of New Hampshire Department of Environmental Services statewide design criteria rules for bedrock (artesian) well construction and placement, We 100-900, and any local codes that may apply.

WORKMANSHIP

All work shall be performed in a neat workmanlike manner by skilled workmen who have been actively engaged in performing the type of work specified under this contract for the last two years.

CLEAN-UP

The site for this project is in a NH State Park and will be open to the public throughout the construction period. It is important to the Department of Resources and Economic Development that the site be maintained in a clean and presentable condition for the public. Therefore, all debris from the project shall be cleaned up daily and removed from the site at least on a weekly basis.

DEFAULT AND TERMINATION OF CONTRACT

If the Contractor...

- a) Fails to begin the work under the contract within the time specified in the contract, or
- b) Fails to perform the work with sufficient workmen and equipment or with sufficient materials to assure the prompt completion of said work, or
- c) Performs the work unsuitably or neglects or refuses to remove materials or to perform anew such work as may be rejected as unacceptable and unsuitable, or
- d) Discontinues the prosecution of work, or
- e) Fails to resume work which has been discontinued, within reasonable time after notice to do so, or
- f) Becomes insolvent or is declared bankrupt, or commits any act of bankruptcy or insolvency, or
- g) Makes an assignment for the benefit of creditors, or
- h) For any other cause whatsoever, fails to carry on the work in an acceptable manner...

The Commissioner of DRED will give notice in writing to the Contractor of such delay, neglect, or default.

If the Contractor or Surety does not proceed in accordance with the Notice, then the Commissioner will, upon written notification from the Project Manager of the fact of such delay, neglect or default, and the Contractor's failure to comply with such notice, have full power and authority without violating the contract, to take the prosecution of the work out of the hands of the Contractor. The Commissioner may enter into an agreement for the completion of said contract according to the terms and conditions thereof, or use such other methods as in his opinion will be required for the completion of said contract in an acceptable manner.

All extra costs and charges incurred by the Department as a result of such delay, neglect or default, together with the cost of completion of the work under the contract will be deducted from any monies due or which may become due said Contractor. If such expenses exceed the sum which would have been payable under the contract, then the Contractor and the Surety shall be liable and shall pay to the Department, the amount of such excess.

FAILURE TO COMPLETE THE WORK ON TIME

If the Contractor fails to complete all of the work or sections of the Project, within the time specified in the Contract, the sum given in the schedule that follows will be deducted from any money due the Contractor. This deduction will be made, not as a penalty, but as fixed, agreed liquidation damages for inconvenience to the State and for reimbursing the Department the cost of the Administration of the Contract, including engineering and inspection. Should the amount of money otherwise due the Contractor be less than the amount of such liquidated damages, the Contractor and his Surety shall be liable to the State for such deficiency.

Permitting the Contractor to continue and finish the work after the time fixed for its completion, shall in no way obligate the State to waive any of its rights under the Contract.

When the final acceptance has been duly made by the Project Manager, any liquidated damage charges shall end.

The fixed, agreed, liquidated damages shall be assessed in accordance with the following schedule.

<u>ORIGINAL CONTRACT AMOUNT</u>		<u>AMOUNT OF LIQUIDATED DAMAGES PER WORKING DAY</u>
From more than:	to and including:	
\$0.00	\$25,000.00	\$ 300.00
\$25,000.00	\$50,000.00	\$ 400.00
\$50,000.00	\$100,000.00	\$ 500.00
\$100,000.00	\$500,000.00	\$ 600.00

SUBSTANTIAL COMPLETION & FINAL INSPECTION

When the work is substantially complete, the Contractor shall submit to the Project Manager, a list of items of work to be completed or corrected. The failure to include any items on such list does not alter the responsibility of the Contractor to complete all work in accordance with the Contract Documents. On the basis of an inspection by the Project Manager which determines that the work is substantially complete, a Certificate of Substantial Completion shall establish the date of substantial completion and state the responsibilities for any damage to the work and insurance, and fix the time limit within which the Contractor shall complete the items listed herein. Warranties required by the Contract documents shall commence on the date of Substantial Completion unless otherwise provided in the Certificate of Substantial Completion.

If the Contractor fails to proceed to complete the items on the “punch list”, then in addition to the corrective measures listed in the Certificate of Substantial Completion, the Commissioner may use the monies still due the Contractor to have such items completed and the Contractor shall lose any claim to the monies used.

Upon written notice that the Work is ready for final inspection and acceptance, the Project manager shall promptly make such inspection, and when he finds the Work acceptable under the Contract documents and the Contract fully performed, a Certificate of Final Payment will be issued.

Final inspection will be made by the Project Manager. Incomplete items necessary to complete the project shall be done prior to final payment. **The completion date for this project is December 16, 2016.**

GUARANTEE OF WORK

1. Except as otherwise specified, all work shall be guaranteed by the Contractor against defects resulting from the use of inferior materials, equipment or workmanship for **one year** from the date

of substantial completion of the work.

2. If, within any guarantee period, repairs or changes are required in connection with guaranteed work, which in the opinion of the Project Manager, is rendered necessary as a result of the use of materials, equipment or workmanship which are inferior, defective, or not in accordance with the terms of the Contract, the Contractor shall, promptly upon receipt of notice from the Commissioner, and at his own expense:
 - a. Place in satisfactory condition in every particular, all of such guaranteed work; correct all defects therein, and...
 - b. Make good all damage to the building or site, or equipment or contents thereof, which in the opinion of the Project Manager, is the result of the use of materials, equipment or workmanship which are inferior, defective, or not in accordance with the terms of the Contract, and...
 - c. Make good any work or material, or the equipment and contents of said building or site disturbed in fulfilling any such guarantee.
3. In any case, wherein fulfilling the requirements of the Contract or of any guarantee, embraced in or required thereby, the Contractor disturbs any work guaranteed under another contract, he shall restore such disturbed work to a condition satisfactory to the Project Manager and guarantee such restored work to the same extent as it was guaranteed under such other contracts.
4. If the Contractor, after notice, fails to proceed promptly to comply with the terms of the guarantee, the Commissioner may have the defects corrected and the Contractor and his Surety shall be liable for all expense incurred.
5. All special guarantees applicable to definite parts of the work that may be stipulated in the specifications or other papers forming a part of the Contract shall be subject to the terms of this paragraph during the first year of the life of such special guarantee.

PROSECUTION OF WORK

Upon starting the work within the 15 days set forth by this contract, the Contractor shall prosecute the work a minimum of 8 hours daily per working day until completion, excluding breakdowns or inclement weather. If the Contractor finds it impossible to start the work as stated above, he may make a written request to the Project Manager for an extension of time. Any such request shall be made prior to expiration of the allowable 15 days, and shall contain reasons which the Contractor believes will justify the granting of his request. In his request, the Contractor shall submit his proposed starting date.

CHANGES IN THE WORK

The Project Manager may at any time, by a written order, and without notice to the Sureties, make changes in the Drawings and Specifications and completion date of this contract and within the general scope thereof.

In making any change, the additional cost or credit for the change shall be determined as follows:

- The order shall stipulate the mutually agreed upon lump sum price which shall be added to or deducted from the contract price. The contractor shall furnish an itemized breakdown of the prices used in computing the value of any change that might be ordered.
- If the price change is an addition to the contract price and the work is performed by the general contractor and not a subcontractor, it shall include the contractor's indirect costs as follows:

Workmen's Compensation and Employee Liability, Unemployment and Social Security Taxes.

- In addition to the above indirect costs, the general contractor shall be allowed a markup not to exceed ten percent (10%). Said ten percent (10%) shall be all inclusive for overhead, supervision, and profit. In addition to this, an allowance shall be made for performance and payment bond additional premiums.
- If the price change is an addition to the contract price and involves the work of the general contractor and subcontractor, the general contractor would be allowed ten percent (10%) on that part of the work performed by him and five percent (5%) on that part of the work performed by the subcontractor. The same percentages shall apply to subcontractors.
- On any change which involves a net credit to the Owner, no allowance for overhead and profit shall be figured.

INSURANCE REQUIREMENTS

No operations under this contract shall commence unless and until certification of insurance attesting to the below listed requirements have been filed with the Commissioner, approved by the Attorney General, and the Contract approved by the Governor and Council and a Notice to Proceed is issued.

Insurance requirements by paragraphs 1-4 below shall be the responsibility of the Prime Contractor. The Prime Contractor, at his discretion, may make similar requests of any subcontractor.

Following is the summary of minimum insurance requirements:

- 1.) Workmen's Compensation Insurance (In accordance with RSA 281-A.)
 - a. Employers' Liability
 - 1.) \$100,000 each accident
 - 2.) \$500,000 Disease-policy limit
 - 3.) \$100,000 Disease-each employee
- 2.) Commercial General Liability Insurance: Occurrence Form Policy: Include full Contractual Liability (see Indemnification Clause 9), Explosion, Collapse, and Underground coverage's:
 - a. Limits of Liability:
 - 1.) \$1,000,000 Each Occurrence Bodily injury & Property Damage
 - 2.) \$2,000,000 General Aggregate-Include per Project Aggregate Endorsement
 - 3.) \$2,000,000 Products/Completed Operations Aggregate
 - 4.) State shall be named as an additional named insured.
- 3.) If blasting and/or demolition are required by the Contract, the Contractor or subcontractor shall obtain the respective coverage for those activities, and shall furnish to the Commissioner a certificate of Insurance evidencing the required coverage's prior to commencement of any operations involving blasting and/or demolition.
- 4.) Owner's Protective Liability coverage for the benefit of the State of New Hampshire Department of Resources and Economic Development.
 - a. Limits of Liability:
 - 1.) \$2,000,000 Each Occurrence
 - 2.) \$3,000,000 Aggregate

- 5.) Commercial Automobile Liability covering all motor vehicles including owned, hired, borrowed, and non-owned vehicles.
a. Limits of Liability:
1.) \$1,000,000 Combined Single Limit for Bodily injury & Property Damage

- 6.) Commercial Umbrella Liability
a. Limits of Liability:
1.) \$1,000,000 Each Occurrence
2.) \$1,000,000 Aggregate

- 7.) Builder's Risk Insurance (Fire and Extended Coverage):

The Contractor shall insure the work included in the Contract, including extras and change orders, on an "All Risk" basis, on a one hundred percent (100%) completed value basis of the Contract, as modified. Builder's Risk coverage shall include materials located at the Contractor's premises, on-site, in-transit, and at any temporary site. The policy by its own terms or by endorsement shall specifically permit partial or beneficiary occupancy prior to completion or acceptance of the entire work. The policies shall be in the names of the State of New Hampshire Department of Resources and Economic Development and the Contractor. The policies shall provide for the inclusion of the names of all other Contractors, Subcontractors, and others employed on the premises as insured's. The policies shall stipulate that the insurance companies shall have no right of subrogation against any Contractors, Subcontractors or other parties employed on the premises.

- 8.) General Insurance Conditions
Each policy shall contain a clause prohibiting cancellation or modifications of the policy earlier than thirty (30) days or ten (10) in cases of non-payment of premium after written notice thereof has been received by the State.

- 9.) Indemnification:
The Contractor shall indemnify, defend, and hold harmless the State of New Hampshire, its Agencies, and its agents and employees from and against any and all claims, liabilities, suits or penalties arising out of (or which may be claimed to arise out of) acts of omissions of the Contractor or subcontractors in the performance of work covered by the Contract. This covenant shall survive the termination of the Contract. Notwithstanding the foregoing, nothing herein contained shall be deemed to constitute a waiver of the sovereign immunity of the State, which immunity is hereby reserved by the State.

END OF GENERAL CONDITIONS

SECTION 33 21 00

WATER SUPPLY WELLS

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Provide all labor, materials, equipment, services, etc. required to furnish and install all Water Supply Wells as indicated on the Drawings, Specified herein, or otherwise required for a complete and proper job.
1. The Work shall include, but shall not necessarily be limited to:
 - a. Drilling and placing of well and casing
 - b. Development of the well
 - c. Testing of well

1.02 REFERENCES

- A. American National Standards Institute (ANSI)
- B. American Society for Testing and Materials International (ASTM)

1.03 SYSTEM DESCRIPTION

- A. Work under this section includes construction of one production water well with a minimum desired yield of 5 to 10-gallons per minute, extending to a depth of approximately 800-feet in accordance with ANSI/AWWA A100

1.04 SUBMITTALS

- A. Within 90 days of the completion of the well installation, submit a copy of the State of New Hampshire's "Well Completion Report", and additional reporting as required, containing:
1. Log of well drilling
 2. Geophysical logs
 3. Record drawings of well, indicating well construction details, location of well on site, and locations of all monitoring wells
 4. Records of static water level measurements, times at which they were taken and any observable changes in static water level with well depth.
 5. Results of interim and final pumping tests.
 6. Well development data.
 7. Results of testing of water samples for suspended solids, chemical and bacteriological content.
 8. Recommendations on water treatment.
 9. Type and size of permanent well pump recommended.
 10. Well maintenance instructions.

1.05 QUALITY ASSURANCE

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- A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- B. Hire services of hydrogeologist to advise on well construction and materials.
- C. Pilot and Test Holes: Provide drilling of pilot holes and wells and sealing of test holes as required.
- D. Well Development: Certified laboratory testing and disinfection.

1.06 DELIVERY, STORAGE AND HANDLING

- A. All materials and related accessories shall be delivered and stored in strict compliance with the manufacturer's instructions.

1.07 PROJECT CONDITIONS

- A. Before commencing drilling, determine if area in which well is to be drilled has history of flowing wells or natural gas formations.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Well Screens:
 - 1. Well screen diameter, length, materials type and openings as recommended.
 - 2. Couplings to connect screen sections, when required, to be of same material as screen.
 - 3. Provide screen with bail plug, self-closing valve, threaded plate or quick setting concrete plug to close bottom.
 - 4. Provide screen with neoprene seal at top.
 - 5. Join screen to casing by welding.
- B. Permanent Well Casing: ASTM A53; Schedule 40
 - 1. Use pipe fittings of same standard as pipe casing
 - 2. Joints: Welded
- C. Cement Grout: ANSI/ASTM C 150 for cement, 2500 psi grout, type as suited for project conditions.

PART 3 – EXECUTION

3.01 DRILLING

- A. Use drilling equipment, methods, fluids and additives approved for uses indicated.
- B. Drill in locations and to depths to achieve desired flow rate.

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- C. Drill holes plumb and straight.
- D. Ensure drilling methods do not impair production from aquifers encountered.
- E. Prevent foreign matter from entering bore hole and prevent contaminated water or other objectionable fluids from reaching aquifer through bore hole.
- F. Cover top of bore hole to prevent tampering and eliminate dangerous conditions for persons or animals in area.
- G. Maintain log of bore holes including following information:
 - 1. Depth of changes in formation
 - 2. Description of formations encountered
 - 3. Elevations at which aquifers are encountered, sudden changes in water level, loss of drilling fluid or other indications of permeable strata
 - 4. Electric logging test results
- H. Conduct well development and pumping tests, and obtain clear water samples.
- I. Be prepared to control, shut off and seal hole should flowing artesian water or gas be encountered.
- J. Equip arterial wells with variable flow control device to control rate of flow after completion. Stop flow of water for period of not less than 48 hours by closing control device, and determine if well is effectively sealed to prevent escape of water from annular space of well and its immediate vicinity. Seal off water by grouting as necessary.
- K. Seal abandoned holes by approved methods with concrete, cement bentonite grout, or other material approved by Owner.
- L. Re-drill holes lost due to caving or abandoned due to loss of drilling equipment at no cost to Owner.

3.02 WELL DEVELOPMENT

- A. Develop the well within 7 days of completion, but no sooner than 48-hours after cement grouting is complete.
- B. Develop the well by approved methods until the water pumped from the well is substantially free from sand, and until turbidity is less than 5 on the Jackson Turbidity Scale specified in AWWA 10084.
- C. Developing equipment must be an approved type and of sufficient capacity to remove all cutting fluids, sand, rock cuttings, and any other foreign materials.
- D. Perform development using only mechanical surging, over pumping, or jetting, or a combination thereof in accordance with ASTM D5521/D5521M

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- E. Furnish, install, or construct the necessary discharge line and troughs to conduct and dispose of the discharge a sufficient distance from the work area to prevent damage and not interfere with the public use of the Park.
- F. Conduct development to achieve a stable well of maximum efficiency and continue until a satisfactory sand test is obtained.
- G. Provide an open tube or other approved means for accurately determining the water level in the well under all conditions.
- H. Remove all materials pulled into the well by the development process prior to performing the pumping test.
- I. Well Development Criteria: Development is complete when all of the following criteria are met:
 - 1. Well water is clear to the unaided eye, and turbidity less than or equal to 5 Nephelometric Turbidity Units (NTUs)
 - 2. Sediment thickness in the well is less than 1 percent of the screen length
 - 3. A minimum of three times the standing water volume in the well is removed plus three times the volume of all added water and drilling fluid lost during drilling and installation of the well is removed
 - 4. Determine Oxygen-reduction potential in accordance with AWWA 10084. Conduct temperature, specific conductance, dissolved oxygen, turbidity, and pH readings in accordance with EPA 600/4-79/020.

3.03 SCREEN INSTALLATION

- A. When aquifer material has been sampled and analyzed, Owner to be advised on type and size of screen required.
- B. Install screen to manufacturer's recommendations.

3.04 PERMANENT CASING INSTALLATION

- A. Clean casing pipe and fittings prior to installation.
- B. Install permanent well casing to sizes and depths as directed by hydrogeologist.
- C. Seal annular space between casing and borehole wall by grouting, to prevent entrance of surface water or other deleterious matter into aquifer, and to prevent intermixing of water.
- D. After grouting is completed, cut off casing squarely and neatly, maximum 18-inches above ground level and minimum 12-inches above final finish grade. Cover casing with flanged cap.
- E. Maintain accurate records of casing lengths and sizes installed.

3.05 GRAVEL PACKING

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The Flume – Bedrock Well Installation

- A. Gravel used for gravel packing to be clean, rounded, water washed quartz or granitic gravel free of silt, clay and other deleterious materials.
 - 1. Gradation to be specified after analysis of aquifer samples.
 - 2. Relative density (formally specific gravity): minimum 2.5
 - 3. Thin, flat and elongated particles: maximum 2% by mass
- B. Place gravel packing as indicated by approved methods
- C. Store gravel packing in manner which avoids contamination

3.06 GROUTING AND SEALING

- A. Seal casing of well extending into consolidated formation into upper 5-feet of formation by grouting with neat cement grout.
- B. Drive steel casing into consolidated formation until seal is obtained.
- C. Fill annular space below 10-foot depth as indicated.
- D. Grout annular space from ground surface to 10-foot depth using neat cement grout, sand cement grout or bentonite.
- E. Place grout from bottom up by approved methods. Place grout in one continuous operation.
- F. Use retainer, packer or plug at bottom as necessary to ensure grout does not leak into well.
- G. When further drilling is required after grouting, do not drill until 72 hours after complete placement of grout.

3.07 TESTS

- A. After the well has been developed make arrangements for conducting capacity tests. If the capacity test indicates the required capacity can be obtained, perform the tests for water quality. If the capacity and quality tests indicate that the required capacity and quality can be obtained, complete the permanent well, as specified, at that depth. Submit test reports within 24 hours following the conclusion of each test. Prior to making quality tests, clean drilling equipment, tools and pumps contacting well water with live steam.
- B. Capacity Pump Test: Provide an approved temporary test pump, with discharge piping of sufficient size and length to conduct the water being pumped to point of discharge, and equipment necessary for measuring the rate of flow and water level in the well. Run an 8 hour constant rate or step-drawdown capacity test with the pumping rate and drawdown at the pump well recorded every 30 minutes. Begin the test at the rate of the expected capacity of the well and at least that rate maintained throughout the duration of the test. If this capacity cannot be maintained for the test period, terminate the capacity test and drill the test hole deeper or relocate as directed.

- C. Test for Plumbness and Alignment: Upon completion of the permanent well, test for plumbness and alignment by lowering into the well, to the total depth of the well, a plumb 40 feet long or a dummy of the same length. The outer diameter of the plumb must not be more than 1/2-inch smaller than the diameter of that part of the hole tested. If the plumb or dummy fail to move freely throughout the length of the casing or well screen for the depth of the well or should well vary from vertical in excess of two-thirds the inside diameter of that part of the well being tested for each 100-feet of depth, correct the plumbness and alignment of the well. If the faulty alignment and plumbness is not correctable, abandon the well and drill a new well at no additional cost to the Owner.
- D. Test for Quality of Water: When capacity test in the test hole has been completed, and again after the yield in the permanent well and drawdown test or capacity test have been completed, secure samples of the water in suitable containers, and of sufficient quantity, to have bacterial, physical, and chemical analyses made by a recognized testing laboratory. Perform all sampling and analyses using EPA and State approved methods, procedures, and holding times.
- E. Sand Test: As part of the capacity test, or at the end of each intermittent pumping, perform a determination of the amount of sand (filter pack and foundation material) a well is producing. Remove all material from the bottom of the tailpipe prior to starting the sand test. Divert the flow from the discharge into a container that will collect all the sand being carried by the water, or through a Rossum Sand tester. Development of the well is satisfactory if the amount of sand collected is less than 1-pint per 25,000 gallons of water pumped. Upon completion of the test, determine the amount of sand in the tailpipe to verify that no material is being deposited in the bottom of the well.

3.08 DRILLING WASTE DISPOSAL

- A. Dispose of slurry, drill cuttings, rock core; other solid or liquid material bailed, pumped, or otherwise removed from the borehole during drilling, installation, completion, and well development procedures; and fluids from material/equipment decontamination activities by removal off-site and by procedures within all appropriate regulatory requirements.

END OF WATER SUPPLY WELLS