

SUBMISSION OF WATER DEVELOPMENT PROJECTS

		FOR AGENCY USE ONLY
Through the development of scientific studies defining the aquifer within the Cedar Basin it has been documented that additional water resources will be necessary to sustain the growth and further development of the area. Without water the future economic development will be impacted by the availability and cost of existing water supplies to accommodate only the growth capable within our current water budget. This form is being circulated to document additional water supply sources that could be utilized to further alleviate the water deficit in the aquifer, as well as provide water for the future residents of the valley. This form will be evaluated for completeness of content. Please ensure that the proposed project is fully defined and information to substantiate the claim is submitted for a complete evaluation.		Application Number
		Date Filed
Name and address of applicant (<i>include zip code</i>) Gary F. Player 1671 W 546 S Cedar City, Utah 84720 gfplayer@kennylakeventures.us	Name, title, and address of authorized agent if different from item 1 (<i>include zip code</i>) H. Roice Nelson, Jr. 2155 W 700 S #31 Cedar City, Utah 84720 rnelson@walden3d.com	Telephone (area code)
		Applicant
		Authorized Agent

A. Provide names, addresses, phone numbers and email addresses of those who filled out this form.

Gary F. Player 1671 W 546 S Cedar City, Utah 84720 gfplayer@kennylakeventures.us	H. Roice Nelson, Jr. 2155 W 700 S, No. 31 Cedar City, Utah 84720 rnelson@walden3d.com
---	--

B. Project Description (Details are Vital)

- Scope of Work and Project Description
- Type of System or Facility
- Quantity of Water Anticipated
- Scientific Analysis of Water Resource
- Uses (irrigation, culinary, industrial etc.)
- Years Resource is Available
- Constructability
- Additional information to describe resource and availability (utilize additional sheets as necessary)

ARCo Three Peaks Well Re-Entry

B.1. This project is an opportunity to develop ground water from the fractured quartz monzonite bedrock aquifer within the western portion of the Cedar Valley basin as defined by the Utah Division of Water Rights (UDWR). The availability of water would be proven initially with the recompletion of one abandoned exploratory oil well along Iron Springs Road. That ARCo well was drilled on private lands. The well would be re-entered and tested with perforations through existing casing at depths ranging from 2,490 to 2,610 feet below ground level, with projected sustainable productivity of more than 2,000 gallons per minute. Produced water could be pumped into a reservoir constructed in Iron Springs Creek, and allowed to percolate into the Cedar Valley alluvial basin. Water could eventually be conducted approximately 6 miles to the southeast via pipeline to industrial and residential consumers along Utah Highway 56.

B.2. This well would be one of an eventual larger set of wells utilized to reduce over drafting of the Cedar Valley Basin alluvial aquifer system. Water could be utilized for both industrial and culinary purposes. The well location is near to existing power lines and roads so that only minimal new development would be necessary to test the concept.

B.3. A well capable of 2,000 gallons per minute would produce 4.456 cubic feet per second, or 8.836 acre-feet per day. Therefore, one well pumped for 365 days each year would provide more than 3,200 acre-feet. Recharge estimates for the bedrock aquifers under Harmony Mountains and Three Peaks prepared by Player in 2010 range from 12,800 to 16,000 acre-feet per year, showing that continuous production of 12,000 acre-feet per year would not draw down the bedrock aquifer. THE AREA UNDERLAIN BY THE FRACTURED QUARTZ MONZONITE AQUIFER WEST OF CEDAR VALLEY IS APPROXIMATELY 200 SQUARE MILES. THE FOLLOWING ESTIMATE OF RECHARGE IS BASED ON 15 INCHES OF PRECIPITATION PER YEAR AND 10% INFILTRATION:

Precipitation = 1.25 feet per year
 Infiltration at 10% = .125 feet per year
 Area = 200*640 = 128,000 acres
 Annual infiltration = .125*128,000 = 16,000 acre-feet per year

Alternatively, recharge would not be less than 12,800 acre-feet with one foot (12 inches) of precipitation and 0.1 foot of infiltration per year.

B.4. The likelihood of a sustainable bedrock aquifer resource in the Harmony Hills west of Cedar Valley was shown by Player in geohydrologic reports prepared for the Cedar City Water Utility. Scientific studies included estimation of bedrock thickness, and review of published and unpublished chemical analyses of spring waters issuing from the bedrock aquifers. Summaries of those studies are attached to a cover letter for the Player-Nelson submissions. One water sample was obtained from the Quichapa Creek No. 1 well, drilled in 2012. Water from the quartz monzonite aquifer (encountered below 500 feet) was mixed with water from a thin sandstone layer in the Quichapa Volcanics at about 225 feet below ground level. Total dissolved solids (TDS) in the mixed sample were 205 mg/L (milligrams per liter of water). Water from the Quichapa Creek Left-hand Canyon spring was sampled on the same day. That water had a lower TDS of 165 mg/L. It is interesting to note that water from the test well was found to be significantly younger (approximately 510 years before present) than water issuing from the surface spring in Quichapa Left-hand Canyon (approximately 1,660 years before present). The age difference suggests that recharge water occurring in the fractured quartz monzonite aquifer is younger than water that is the source of the springs in the shallower but less permeable Quichapa Volcanic rocks.

B.5. Water pumped into a reservoir along Iron Springs Creek would be usable by for irrigation in the western portion of Cedar Valley, allowing farmers and ranchers to switch from expensive pumped wells to virtually free canal water.

B.6. The bedrock aquifer resource is sustainable due to annual infiltration from precipitation. In the unlikely event of long term drought, the production of 3,200 acre-feet per year could be sustained for almost 3,600 years without recharge into the fractured quartz monzonite bedrock aquifer system within the Cedar Valley Basin. That aquifer is estimated to contain more than 11,500,000 acre-feet of water in place.

B.7. This well could be drilled by local drilling contractors. Power lines are in place along Highway 14 for easy access to the drill site.

B.8. Summaries of bedrock aquifer studies completed in 2010 are attached to the cover letter for the Player-Nelson submissions. More detailed reports can be provided when requested.

C. Attach a map covering the area of development and location of proposed project.

1. Identify Property Ownership

2. Identify Potential Conflicts

3. Provide Details of the Area and Necessary Changes to the Area

C. A map showing the proposed location for the ARCo test and that portion across the sonic log across the most likely interval to test are attached.

C.1. The well site is on private property.

C.2. There are no potential conflicts. Re-entry of the well will require a permit from the Utah Division of Oil, Gas, and Mining.

C.3. The area is flat and will not require grading.

D. Identify any Federal, State or Local Government Issues

1. Federal

- a. Army Corp of Engineers
- b. Bureau of Land Management
- c. Fish and Wildlife
- d. Forest Service
- e. Other

Federal issues are minimal on developed private property. Iron Springs Creek dried up as the Cedar Basin aquifer was over drawn, and no fishery is present. The proposed area is outside of managed Sage Grouse habitat.

2. State

- a. Department of Environmental Quality
- b. Division of Water Rights
- c. Other

There are no known State issues. Cedar Basin water rights will be transferred by the Utah Division of Water Rights into the old ARCo well prior to beginning full scale production. The sources of those water rights would be farmers, ranchers, Cedar City Municipal Water Utility, and Southern Utah University. It is at least possible that the well would discover "new water" that could be appropriated to the District.

3. Local

- a. County
- b. Municipal
- c. Other

No local issues are known exist.

E. Provide cost estimates of project

Each exploratory well will cost on the order of \$200,000 to complete and equip with pumps and short pipelines to streams. Full development of 15 wells (described in a separate Submission) would cost approximately \$3,000,000 to develop 12,000 acre-feet per year. The CAPEX for full development of the aquifer would be on the order of \$250 per acre-foot.

F. Describe additional evaluated alternatives, if any

Separate Submissions of Water Development Projects from Player and Nelson include the following: (1) Deepening of the Cedar City Quichapa Creek Number 1 well into the fractured quartz monzonite aquifer; and (2) Construction of a Cretaceous aquifer test well at the Shepherders Cabin Road, about one mile west of Woods Ranch,

G. Describe any environmental effects the proposed project would have on wildlife and/or plant species

Full scale production of water from the fractured quartz monzonite aquifer west of Cedar Valley could lead to the elimination of over drafting from the Cedar Valley aquifer system.

H. Provide cultural resource evaluations of proposed area

Iron Springs Gap has provided access to several industrial and mining operations, and has been "disturbed" for 100 years. No cultural or archeological resources are present at the site. For your information, Player served as an environmental inspector during construction of the Kern River Pipeline, and supervised SUU archeologist Barbara Frank as she prepared clearances across a 100-mile segment of the line from Milford to eastern Nevada.

I. Provide any additional information deemed necessary in the evaluation of this project to provide future sustainable water resources to the Cedar Basin

Player reviewed the Harmony Hills bedrock aquifer system for Cedar City in 2010. All of his work will be available for review with the permission of City Engineer's office. For example, additional data includes meteorological studies, summaries of geology, water analyses, aquifer rock properties, old well records, etc. Summaries of the aquifer study are attached to the cover letter provided with the Player-Nelson Submissions.

Respectfully Submitted,



Gary Farnsworth Player
Utah Professional Geologist No. 5280804-2250
Idaho Professional Geologist No. 1050
Certified Petroleum Geologist No. 3097



H. Roice Nelson, Jr.
Texas Professional Geoscientist No. 5120
Louisiana Professional Geoscientist No. 879

Utah Oil and Gas Map 2.0.0 (ChangeLog.html)



LOCATION MAP:
PROPOSED ARCo THREE PEAKS EXPLORATORY WELL RE-ENTRY, Iron County
Map provided by Utah Division of Oil, Gas, and Mining, Salt Lake City, Utah

Submitted by G.F. Player and H. Roice Nelson, Jr.