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DEPARTMENT OF
WATER RESOURCES

BEFORE THE
IDAHO DEPARTMENT OF WATER RESOURCES

IN THE MATTER OF DISTRIBUTION OF
WATER TO WATER RIGHT NOS. 36-
04103A, 36-04013B AND 36-7148 (Snake
River Farm)

(Water District Nos. 130 and 140)

DIRECT TESTIMONY OF
ANTHONIE M. SCHUUR

SUBMITTED ON BEHALF OF:

THE IDAHO GROUND WATER APPROPRIATOR'S INC.
NORTH SNAKE GROUND WATER DISTRICT
MAGIC VALLEY GROUND WATER DISTRICT

SEPTEMBER 11, 2009

1 Q STATE YOUR NAME, BUSINESS ADDRESS, AND POSITION.

2 A My name is Anthonie Michael Schuur. I am sole proprietor of my private consulting
3 practice, Aquaculture Management Services, since 1988. My business address is 11583
4 Valensin Road, Galt, California 95632. I was retained as an expert witness by Racine
5 Olson Nye Budge & Bailey on behalf of Idaho Ground Water Appropriators, Inc., North
6 Snake Ground Water District and Magic Valley Ground Water District.

7 Q WHAT IS YOUR AREA OF EXPERTISE?

8 A My training is in biology, economics, and engineering. My area of applied expertise is in
9 the planning and economic analysis; engineering, design, and operation of aquaculture
10 systems. I am a co-author of Bioeconomics of Aquaculture (Elsevier, 1982), a
11 monograph about the economics of aquaculture systems, and authored journal papers on
12 topics that are closely related to aquaculture system planning including hatchery logistics,
13 bio-energetics, biosecurity, and financial analysis. For the past seven years I have served
14 on the editorial board of the professional journal Aquacultural Engineering published by
15 Elsevier.

16 Q PLEASE DESCRIBE YOUR EDUCATIONAL AND PROFESSIONAL
17 BACKGROUND

18
19 A After attending UCLA for two years I served in the United States Marine Corps for three
20 years. After my discharge, I attended the University of California, Irvine where I
21 received a Bachelor of Science degree in Biological Science in 1969. I was then
22 employed by Brown and Caldwell, Consulting Engineers as a water quality biologist. In
23 1971, I was employed by the University of California, Davis as a Staff Research
24 Associate and program manager for the marine aquaculture program.

25 I also attended graduate school in Agricultural Economics at UC Davis without
26 completing a degree. In 1975, I was employed as a shrimp farm manager, constructing
27 and operating a 300 hectare farm in Costa Rica. After returning to the United States in
28 1978, I was employed by James M. Montgomery, Consulting Engineers as an Associate
29 and then Supervising Aquaculture Scientist. There I provided technical advisory services
30 and prepared numerous reports for domestic and international clients including state and
31 local government agencies, the World Bank, the Asian Development Bank, and USAID.
32 In 1984 I was employed by Agrifuture, Inc., an agriculture research and development
33 company, as Vice-President for aquaculture operations where I managed two highly
34 intensive fish farms and an oyster farm as well as providing consulting services to a
35 shrimp farming venture in Panama.

36 Since 1988, I have conducted a private practice in aquaculture consulting. I have
37 provided services to dozens of clients covering a wide variety of aquaculture planning
38 and management advisory assignments in many locations in the United States and around
39 the world. In five instances I have been retained as an expert witness in legal
40 proceedings concerned with aquaculture topics. My current biographical summary which
41 is attached hereto includes a description of the clients and projects that I have completed
42 in private practice.

43 **Q WHAT IS THE PURPOSE OF YOUR EVALUATION?**

44 **A** I have been asked by Idaho Groundwater Appropriators, Inc. and North Snake River and
45 Magic Valley Groundwater Districts to review the Over the Rim mitigation approach in
46 the context of its implications to fish culture especially as it relates to replacing a flow
47 deficit at Snake River Farm. More precisely, I refer to the approach as it is described by

48 the Order Approving Ground Water Districts' Replacement Plan for 2009 dated March
49 26, 2009 (Order). The Over the Rim plan specifies the provision of 1.99 to 3.0 cfs flow
50 on a continuous basis from several redundant wells located above the rim of the Snake
51 River Canyon and then conveyed by a pipeline over the canyon rim to a location adjacent
52 to the existing Snake River Farm spring so that it might be blended with existing water
53 supply or further conveyed without mixing to individual trout culture raceways. The
54 Order specifies several conditions including reliability, water temperature, and water
55 quality that characterize the acceptability of the Over the Rim supply. My function is to
56 determine that these conditions have been met and summarize the utility of the Over the
57 Rim water supply for fish culture.

58 **Q WHAT INFORMATION HAVE YOU REVIEWED TO FORM YOUR OPINION?**

59 Along with professional publications that I have referenced and relied on throughout my
60 years of experience, I specifically reviewed information relating to the Over the Rim
61 mitigation supply and plan. This includes the report prepared by SPF Water Engineering,
62 Testimony by Terry Scanlan, report and information prepared by Raymond Eldridge,
63 water quality data relating to the well field from which the mitigation water supply will
64 be pumped, water quality sampling data and information.

65 **Q WHAT IS YOUR GENERAL APPRAISAL OF THE OVER THE RIM**
66 **APPROACH WITH RESPECT TO FISH CULTURE?**

67
68 **A** The Over the Rim approach offers a mitigation flow that is a proportional response to the
69 mitigation need and that provides a water source that is likely to closely resemble the
70 existing spring supply. In theory, pumping water from existing wells that are the very
71 same ones that are identified as those depleting Snake River Farm spring flow is a direct
72 solution. One should view the Over the Rim delivery as a direct diversion of aquifer

73 water from existing agriculture to use at Snake River Farm that is suitable for fish
74 production and very similar to if not the very same water that emerges from the existing
75 springs that supply Snake River Farm.

76 The Over the Rim mitigation supply satisfies many of the objections to previous
77 proposals. From a fish culture perspective, the Over the Rim eliminates water quality
78 concerns raised by Clear Springs Foods, Inc. regarding other prior below the rim
79 solutions that have been proposed. The Over the Rim mitigation supply provides the full
80 quantity of replacement water which also provides a mitigation flow that from a practical
81 standpoint is nearly indistinguishable from Snake River Farm's existing spring supply for
82 purposes of raising fish. See Terry Scanlan Testimony, Raymond Eldridge Testimony
83 and related exhibits.

84 **Q WHAT OTHER ASPECTS OF THE OVER THE RIM MITIGATION SUPPLY**
85 **NEED TO BE ADDRESSED?**

86
87 **A** There are two aspects of the supply, constant water temperature and dissolved gas
88 equilibrium.

89 Temperature is a key variable for fish culture. Because the source of supply for Snake
90 River Farm and the Over the Rim mitigation supply is the same and has nearly the same
91 temperature, the initial investigation focused on whether or not the pipeline might warm
92 or cool water on its way to the Snake River Farm spring in a manner that might affect fish
93 production. An analysis of this was completed by Dr. Brendecke and is included in his
94 Direct Testimony. Dr. Brendecke's analysis indicates that there would not be a
95 significant change in water temperature by delivery through the pipeline to Snake River
96 Farm.

97

98 Q **DOES THE OVER THE RIM SYSTEM ADDRESS POTENTIAL GAS**
99 **EQUILIBRIUM ISSUES?**

100
101 A The proposed Over the Rim system design eliminates concerns relating to
102 supersaturation (ie, when the total dissolved gas pressure exceeds 100% of the
103 atmospheric pressure) by means described below and obviates the condition completely
104 with a degassing facility that is contained in the testimony of Mr. Eldridge and **Exhibits**
105 **2206, 2207 and 2208** that thoroughly aerates the water and ensures that TDG pressure is
106 in atmospheric equilibrium.

107 Q **WHAT IS YOUR OPINION OF THE DESIGN AND RELIABILITY OF THE**
108 **OVER THE RIM SYSTEM?**

109
110 A I have reviewed the Over the Rim system design and especially the degassing and
111 aeration system at the terminus of the pipeline. The well head and buried pipeline are
112 configured to robustly prevent any physical or security breach. The pipeline itself is
113 armored with a steel and concrete collar in the reach that descends, still buried, to the
114 canyon floor. The pipeline connection from the canyon entry to the spring terminus is
115 similarly protected. The pipe is regulated at a much lower pressure than would be the
116 case due to the elevation changes in the system. Hydraulically, the entire pipeline is
117 operated under positive pressure that precludes any possibility of air entrainment and is
118 designed such that it is always full, free of any air pockets that might interrupt a
119 continuous stream of water.

120 The pipeline discharges directly into the headwork of the degassing column and is sealed
121 from any possibility of contamination. Multiple columns provide ample aeration capacity
122 and scope for additional future flow. (See **Exhibits 2206, 2207 and 2208**) Water is
123 dispersed into the columns by splash plates that distribute water evenly over the entire

124 surface area of the columns. The column length and total volume provides more than
125 sufficient capacity for the degassing operation.

126 Having designed and reviewed numerous aquaculture facilities during my career, I have
127 never seen a higher level of reliability engineered into a fish culture system.

128 **Q IF THE OVER THE RIM SYSTEM IS IMPLEMENTED, HOW DO YOU**
129 **EXPECT IT TO PERFORM AND, MORE SPECIFICALLY, HOW WILL IT**
130 **AFFECT SNAKE RIVER FARM PRODUCTION AND OPERATIONS?**

131 **A** At the most fundamental level, an individual fish in the culture system should experience
132 no change as a result of the additional water supply added by the Over the Rim system.
133 The Over the Rim system will deliver incremental water at a high quality and at a
134 temperature indistinguishable from the Snake River Farm spring source. Quantitatively
135 and qualitatively, for culture purposes, the Over the Rim water source is for all practical
136 purposes an identical replacement of the deficit flow.
137

Anthony M. Schuur

BIOGRAPHICAL SUMMARY

Personal: Born Whittier, California August 12, 1945

Languages: English, Spanish

Education: B.S. Biological Science, University of California, Irvine, 1969;
Graduate Studies in Agricultural Economics, University of California,
Davis.

Employment Summary:

1988 to present, **Aquaculture Management Services**
Principal Aquaculture Consultant

1994 to 1997, **Altrix International/Jamaica Flour Mills Investments**
Project Development Manager
Project Manager, Altrix Panama shrimp farm expansion
Project Manager, Hellshire Hatchery design and construction

1984 to 1988, **Agrifuture Inc.**
Vice President, Director, Agrifuture, Inc.
Vice President, Tomales Shellfish Farms, Inc.
Vice President, Aquafuture, Inc.
Consultant to the World Bank (Indonesia)

1978 to 1984, **James M. Montgomery Consulting Engineers, Inc.**
Supervising Aquaculture Scientist
Senior Aquaculture Scientist

1976 to 1978, **Maricultura, S.A.**, Costa Rica
Production Manager
Assistant Operations Manager

1972 to 1976, **University of California, Davis**
Postgraduate Research Economist, Department of Agricultural Economics
Program Manager, Aquaculture Development Program
Staff Research Associate

1970 to 1972 **Brown and Caldwell, Consulting Engineers**
Water Quality Biologist

1965 to 1967 **United States Marine Corps**
Sergeant, communications specialist

Specific Experience Areas:

- Development, economic analysis, and design of aquaculture projects in public and private sectors. Preparation of commercial fish and shrimp farm studies for clients in Panama, Guatemala, Jamaica, Honduras, Nicaragua, Colombia, Venezuela, Ecuador, Mexico, Trinidad, India, Malaysia, Sri Lanka, Bangladesh, and Indonesia
- Operational management of commercial shrimp, shellfish, and finfish production programs.
- Preparation of business plans and financial projections for commercial aquaculture ventures.
- Preparation of bioengineering criteria and design studies and for commercial intensive and semi-intensive aquaculture production systems.
- Mathematical modeling of bioengineering systems.
- Preparation of rural development project plans in Africa, Asia, and Latin America.
- Instruction in bioenergetics and bioengineering (Associate Instructor, Aquaculture Department, Harbor Branch Oceanographic Institution)
- Project management including construction of water systems, supervision of civil works including pump stations, water control structures, and ponds.

Publications:

Co-author of Bioeconomics of Aquaculture, a monograph. Author or co-author of the following academic papers and more than 60 technical reports, system designs, and financial plans:

Schuur, A.M., Allen, P.G., and Botsford, L.W. 1974. An analysis of three facilities for the commercial production of *Homarus americanus*. American Society of Agricultural Engineers. Paper No. 74-5517.

Shleser, R.A., and Schuur, A.M. 1975. Utilization of power plant thermal effluent for mariculture. In: *Water Management by the Electrical Power Industry*. Water Resources Symposium. 8:307-312. Center for Research in Water Resources.

Botsford, L. W., Raush, H.E., Schuur, A.M. and Shleser, R.A. 1975. An economically optimum aquaculture facility. *Proceedings of the World Mariculture Society*, 6:407-420.

Schuur, A.M., Fisher, W.S., Van Olst, J., Carlberg, J., Shleser, R.A., and Ford, R. 1976. Hatchery Methods for the Production of Juvenile Lobsters (Homarus americanus). University of California Sea Grant Program. Publication 48.

Wickham, D.E., Shleser, R.A., and Schuur, A.M. 1976. Observations on the inshore population of Dungeness Crab, *Cancer magister*, in Bodega Bay. California Fish and Game, 62(1): 89-92.

Allen, P.G., L.W. Botsford, A.M. Schuur, and W.E. Johnston, 1984. Bioeconomics of Aquaculture, A Systems Approach. Elsevier, New York, 386 pp.

Schuur, A.M. 1991. A bioenergetic model for application to intensive fish culture system management. Fisheries Bioengineering Symposium, American Fisheries Society Symposium 10: 393-401.

Rolland Laramore, S. Allen, P.Hitchens, X. Romero, and A. Schuur. 2000. Artificial induction of active accommodation for white spot syndrome virus (WSSV) in *Penaeus vannamei* with tolerine products. Presented at 4th Congreso Centroamericano de Acuicultura, June 2000.

Schuur, A.M. 2003. Evaluation of biosecurity applications for intensive shrimp farming. Aquacultural Engineering 28 (1-2): 3-20.

Organizations:

California Aquaculture Association, President, 1988, Chairman of the Board, 1989; National Aquaculture Association, founding Director, 1990, Newsletter Editor, 1991; Editorial Board, Aquacultural Engineering, 1998-present; member World Aquaculture Society, Florida Aquaculture Association and Aquacultural Engineering Society.

Contact Information:

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NARRATIVE SUMMARY

Anthonie M. Schuur

Mr. Schuur is a professional aquaculture scientist with over 30 years of experience in aquaculture both as an operational manager and as a consultant. He has direct experience as the manager of commercial fin-fish, shrimp, and bivalve production facilities encompassing both intensive and extensive production methods. His consulting experience includes 7 years as a Supervising Environmental Scientist with James M. Montgomery Consulting Engineers and 15 years as an independent consultant specializing in services to commercial aquaculture clients. The scope of his consulting includes bioengineering studies, facility planning and design, operational advisory services, expert testimony, marketing development, and financial analysis.

He is a co-author of *Bioeconomics of Aquaculture*, a monograph describing the interrelationships between the biological, engineering, and economic aspects of aquaculture production. His scientific publications often emphasize the field of bioenergetics that underlies many of the criteria for aquaculture production facilities. He has conducted several seminars demonstrating the use of bioenergetics models for aquaculture systems management at national aquaculture technical meetings and at the University of California, Davis.

He has completed several comprehensive planning studies that include conceptual development, facility engineering, capital cost assessment, and analysis of projected financial performance. Under contract to the International Finance Corporation of the World Bank, he prepared an extensive shrimp farming feasibility study for a 6,000-acre site in Nicaragua. The study included an integrated plan for a shrimp farming industry complex including a hatchery, a shrimp farm capable of five million pounds of output per year, and a processing facility. In 1997, he completed an assignment as the project manager of a shrimp farm and hatchery complex in Panama and Jamaica. The Panama farm expansion involved construction of 300 hectares of new ponds, renovation of 100 hectares, construction of a 12 cum/sec pump station, and other ancillary structures. The Jamaica hatchery has the capacity to produce approximately 30 million shrimp post-larvae per month. In 1999, he prepared a comprehensive planning study for a shrimp-farming venture in Venezuela comprising more than 5,000 acres. Like many of the planning and design studies he has prepared, the project report served as the business plan for the venture, providing the vehicle for financing and implementing the project.

He has also prepared plans and system designs for several intensive fin-fish farming ventures including the facilities employed by The Fishery near Sacramento, California. The intensive facility, used for the production of sturgeon caviar, is the first dedicated caviar production venture; it produces several tons of select caviar annually. He has also prepared similar designs for intensive culture of several kinds of fish including catfish, tilapia, and striped bass.

Due to his specialization in aquaculture economics and the financial assessment of aquaculture ventures, Mr. Schuur has served several institutional clients requiring appraisals for aquaculture facilities. On five occasions, he prepared expert opinions for submission in court proceedings. His expert testimony was used to ascertain asset values and other financial issues. Mr. Schuur has also assisted lending institutions and development agencies in assessing loans for proposed aquaculture projects.

Mr. Schuur has served as a technical and management advisory resource to many commercial aquaculture production clients such as The Fishery, Shrimp Culture Inc., Sierra AquaFarms, SeaChick of Mississippi, Solar AquaFarms (Chiquita Brands), Grupo Granjas Marinas de San Bernardo, Altrix International, Jamaica Flour Mills (ADM) and Bluepoints Company, Inc. Services for these clients span a diversity of species and culture system approaches.

As an independent consultant, Mr. Schuur provides planning and bioengineering professional services to private, corporate, and public clients and serves on the editorial board of the journal, [Aquacultural Engineering](#).

ANTHONIE M. SCHUUR
Aquaculture Management Services
REPRESENTATIVE CLIENT LISTING (1989-2008)

client	scope of work
Shrimp Culture, Inc. Dr. William MacGrath	Farm feasibility studies in the Dominican Republic and Nicaragua (with IFC), shrimp hatchery facility engineering projects
The Fish Factory Dr. John Colt	Aquaculture Plan for the State of Minnesota, bioengineering studies
Economic Development Bank for Puerto Rico	Aquaculture project loan assessment
The Fishery Mr. Ken Beer	Intensive culture system design, pond system design, computer accounting systems
SDZ Land Co. Mr. Steven Zuckerman	Expert witness in legal case involving aquaculture feasibility issue
SeaChick (Mississippi) Mr. Don Robohm	Production management advisory service for intensive fish farming
JMM Consulting Engineers Mr. William Madden	Bioengineering consultant, international project development advisory services
Solar Aquafarms, Inc. Mr. Steven Serfling	Site selection studies, bioengineering studies
California Prison Industry Authority	Site feasibility studies and aquaculture project planning
California Sturgeon Growers Association	Executive Secretary, marketing, distribution, and product promotion
Seafood Industries Mr. Paul Jackson	Intensive fish culture system planning and design
Sierra Aquafarms Mr. Lennart Thornros	Technical advisory services, renovation of water recirculation system and oxygen injection system
Commonwealth Development Corp. Mr. Patrick Blow	Technical assessment and feasibility appraisal of multi-species aquaculture production complex in Belize
Bronson, Bronson, & McKinnon Mr. Robert N. Phillips	Expert testimony related to valuation of aquaculture facility in Hawaii

Representative Client Listing (continued)

client	scope of work
Pesca Nova S.A. Mr. Roberto Ehrens	Intensive aquaculture system planning for site in Colima, Mexico
JMM Consulting Engineers Mr. William Madden	International Group, project development and proposal preparation, Pakistan
Southern California Edison Co. Mr. Joe Kelly	Aquaculture project development and financial assessment connected with power plant effluent.
KAD Partners Mr. Phillip Wilson	Technical advisory services, financial analysis, and masterplan preparation connected with Kona Ocean Center
WESCO Mr. Scott Cressi	Development of aquaculture options for reclamation of open pit mining operation.
Southern California Edison Co. Ms. Barbara Oldaker	Bioengineering and design consultant for marine biology laboratory and aquarium exhibit
Ponce Marine Farm Mr. Gil Kendrick	Technical consulting services and financial analysis for Puerto Rico shrimp farm venture
Law Offices of Reinwald O'Connor Mr. Jerry Guben	Court appointed expert for appraisal of aquaculture facility value in bankruptcy proceeding
Agro Productos S.A. Mr. Roberto Ehrens	Planning and engineering design of commercial fish culture facility in central Mexico
Montgomery Watson Engineers Mr. John Knoll	Development of computerized database for tracking of documents related to litigation for the City of Los Angeles
Jamaica Flour Mills Mr. John Ruland	Appraisal level design and feasibility of Jamaica hatchery project in association with Shrimp Culture Inc.
Pine Mountain Club Mr. Lee Benevides	Preparation of lake management plan recommendations for aquatic weed control and fishery enhancement
Pacific Sea Farms, Inc. Mr. Amund Utne	Assessment of groundwater resources for aquaculture facilities; Oahu, Hawaii
Altrix International Mr. Joe Thaggard	Preparation of appraisal level design and feasibility study of integrated shrimp farming complex; Aguadulce, Panama
Altrix Seafoods/Hellshire Hatcheries Mr. John Ruland	Design and construction management of a 500 hectare shrimp farm expansion in Panama and a 400 metric ton shrimp hatchery in Jamaica.

Representative Client Listing (continued)

client	scope of work
Granjas Marinas de San Bernardo Mr. James Heerin	Development of environmental criteria for a sustainable shrimp farming industry in Honduras.
S&S Industries, Ltd.	Engineering design review of pipeline and pumping station for shrimp farm seawater supply system; Madras, India
ShrimpCulture, Inc. (2) Mr. Ralph Parkman	Preparation of engineering design and feasibility studies for shrimp farm ventures in Mexico and Venezuela
Shrimp Culture Technologies, Inc. Mr. Jim Norris	Preparation of design studies for shrimp breeding facilities in Florida
West Bay Law Inc. Mr. Paul Wartelle	Expert testimony regarding animal rights issues involved in the sale of live finfish
First Republic Corporation of America Mr. Jonathan Rosen	On-going technical advisory services connected with operation of two shrimp farms in Ecuador
The Fishery (2) Mr. Ken Beer	Design studies and facility planning for a commercial sturgeon caviar production facility
Mr. John Harvin	Design study and financial analysis for intensive shrimp farming ventures in Central Florida.
Sturgeon AquaFarms Mr. Mark Zaslovsky	Appraisal design study and financial analysis of a venture to produce Russian sturgeon and caviar in Florida.
Central American Bank for Economic Integration (CABEL)	Loan monitoring and supervision for aquaculture projects in Central America.
Harbor Branch Oceanographic Institution Mr. Joe Mountain	Preparation of appraisal level design study for intensive environmentally controlled shrimp production in Florida.
Aquanetics, Inc. Mr. Sam Courtland	Design of biofiltration and other treatment equipment, technical assistance to clients.
Sweetwater Shrimp Company Mr Steve Geigy	Design of inland shrimp farm in Florida, including a recirculating pond system.
Indian River Aquaculture, LLC Mr. Don Schumman	Design of biofiltration and other treatment equipment, technical assistance to clients.
SeaArk International Mr. Dick Monroe	Design and implantation of high intensity shrimp rearing systems and shrimp hatchery in commercial pilot facility in South Africa
The Fishery Mr. Ken Beer	Planning and design of commercial intensive fish farming facilities for catfish, sturgeon, and other species