

**Crystal Orr**

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**From:** Christine Moffitt [ChristineMoffitt@outlook.com]  
**Sent:** Monday, June 24, 2019 9:50 AM  
**To:** Planning Department  
**Subject:** REM-19-001  
**Attachments:** Moffitt Vitae 2019 Shortened.pdf; Moffitt Supplemental comments 24 June 2019.pdf

Dear Jill:

Attached is an electronic copy of my comments to supplement those submitted at the first hearing date 10 June. The hard copy will be provided as well via us mail.

Also submitted is a CV as requested by the hear officer regarding evidence of my qualifications as a fishery and aquatic biologist.

Thank you for your assistance.

Christine

Christine Moffitt  
700 Denise Place  
Coos Bay, OR 97420

Exhibit: 39  
Date: 6/24/19

**Christine M. Moffitt**  
**Leadership and Aquatic Resource Consulting**  
700 Denise Place  
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**EDUCATION:**

B.A., Biology, 1969, University of California, Santa Cruz, California  
M.A., Biological Sciences, 1973, Smith College, Northampton, Massachusetts  
Ph.D., Fisheries Biology, 1979, University of Massachusetts, Amherst

**Additional Formal Training Completed (past 15 years):**

Making the Connection Between Human Rights and Ecology  
Adaptive Management of Natural Resources  
Aquatic Invasive Species-Hazard Analysis and Critical Control Point Workshop.  
Decision Analysis  
Fish Nutrition  
Applying Risk Assessment Principles to Fish Health  
Emerging Animal Health Issues Identification and Analysis

**PROFESSIONAL EXPERIENCE:**

2017 – Present: Emerita Professor, Department of Fish and Wildlife Sciences, University of Idaho, Moscow Idaho 83844.  
2002-2017. Professor and Assistant Unit Leader, Idaho Cooperative Fish and Wildlife Research Unit, Department of Fish and Wildlife Sciences, University of Idaho, Moscow, Idaho 83844-1141.  
2011 (June- August) Professor and Acting Unit Leader, Idaho Cooperative Fish and Wildlife Research Unit, Department of Fish and Wildlife Resources, University of Idaho. I served, as unit leader while the position was vacant.  
2000-2003, Research Professor, Department of Fish and Wildlife Resources, University of Idaho. Moscow, Idaho 83844-1136.  
1999-2000. President, American Fisheries Society. 5410 Grosvenor Lane, Bethesda, MD 20814.  
1989-99, Adjunct Associate Professor, Department of Fish and Wildlife Resources, University of Idaho, Moscow, Idaho 83844-1136.  
1983-89, Adjunct Assistant Professor Department of Fish and Wildlife Resources, University of Idaho, Moscow, Idaho 83844-1136  
1981-83, Visiting Research Assistant Professor, Fishery Resources, University of Idaho  
1980-81, Postdoctoral Associate for Anadromous Fish Research, Connecticut River Fishways, Massachusetts Cooperative Fishery Research Unit, University of Massachusetts, Amherst, MA 01003  
1978-80, Instructor, Department of Biological Sciences, Smith College, Northampton, MA 01060.  
1977, Teaching Assistant, Department of Forestry and Wildlife Management, University of Massachusetts, Amherst, Massachusetts. 01003.  
1975-78, Graduate Research Assistant, Department of Forestry and Wildlife Management, University of Massachusetts

C. M. Moffitt, Detailed CV, revised 2019

1971-75, Research Associate, Amherst College  
 1969-71, Teaching Fellow in the Biological Sciences, Smith College, Northampton,  
 Massachusetts.

## **TEACHING AND EDUCATIONAL SERVICE**

### University of Idaho courses:

Studies of Tribal Fisheries Management.  
 Fish and Wildlife Sciences Seminar Series  
 Management issues in aquaculture and fish health.  
 Research and Issues in Aquatic Invasive Species  
 Contemporary Issues in Fisheries Management  
 Fish Physiology  
 Advanced Fisheries Management  
 Research in Environmental Science  
 Honors Project Research  
 Sustainable Aquaculture  
 Practicum in Environmental Science  
 Masters Research in Fisheries and Environmental Science  
 Dissertation Research in Fisheries and Environmental Science  
 Masters Research Geography  
 Aquaculture and Fish Health  
 Fish Diseases  
 Principles of Fish and Wildlife Biology  
 Fish Pathology and Fish Pharmacology

### Smith College:

Vertebrate Zoology  
 Animal Behavior  
 Introductory Biology

### University of Massachusetts

Techniques of Fisheries Management

## **HONORS AND AWARDS:**

Athena Women of the Year Award (Faculty Category). Academic Year 2016-2017.  
 University of Idaho.  
 Outstanding Faculty Award for 2015-2016 in Continuing Education and Outreach,  
 College of Natural Resources, April 2016.  
 Elected as Fellow of the American Fisheries Society. Recognition in Portland, Oregon.  
 2015. AFS members who are recognized by their peers as distinguished for their  
 outstanding and/or sustained contributions to the discipline and Society.  
 Idaho Chapter American Fisheries Society Excellence in Aquaculture. Boise, ID. March  
 2015. Continued leadership in aquaculture and fish health.  
 American Fisheries Society Equal Opportunity Section and Student Subsection. Honored  
 for Influential Career Contributions 2013. "Ladies Night," AFS annual meeting,  
 Little Rock, AR. September  
 American Fisheries Society Distinguished Service Award, 2013. For team leadership to  
 select a new Society Executive Director. May 2013.  
 University of Idaho Alumni Award for Excellence as a Mentor –2012 for Zachary L.  
 Penney, December

USGS Performance Award. 2012. For maintaining active research, teaching and outreach.

Lifetime Achievement Award, Idaho Chapter of the American Fisheries Society. March 2012.

Columbia River Intertribal Fish Commission. 2012. Recognition of outstanding partnership and collaboration with tribal entities. Presented to the University of Idaho in recognition of the Moffitt laboratory collaborations.

USGS Performance Award. 2011. For maintaining active research, teaching and outreach programs. November 2012

USGS Star Award for Outstanding Mentoring and Unit Support. September 2011

Outstanding Faculty Member in Environmental Science. University of Idaho. May 2011.

Outstanding Advisor 2010-2011. College of Natural Resources, April 2011

University of Idaho, Virginia Wolf Distinguished Service Award – Faculty. For continuous dedication to activism for gender justice. 2011.

USGS, Performance Award. 2010. For maintaining active research and outreach programs. November 2010.

American Fisheries Society Emmeline Moore Prize for Lifetime Contributions to Diversity. 13 September. 2010. Pittsburgh, PA.

AFS Palouse Unit Distinguished Service Award. April 2010.

U of Idaho Alumni Award for Excellence as Mentor – 2009 for Lubia Cajas Cano Outstanding Graduate Student.

USGS Headquarters Diversity Award. 2009.

Idaho Chapter American Fisheries Society, Outstanding Mentor Award, 2008-09.

USGS Star Award. 2009. Maintaining active research and mentoring. College of Natural Resources, Outstanding Advisor. 2008.

University of Idaho, Candidate for U of Idaho Supervisor of the Year – Human Resources.

University of Idaho Alumni Award for Excellence as Mentor –2007 for Outstanding Graduate Student John Cassinelli

USGS, Star Award, 2006. For maintaining active research and outreach programs.

USGS, Star Award. 2004. For mentoring student that achieved awards and recognition for his studies and contributions.

University of Idaho Alumni Award for Excellence Mentor - for Outstanding Graduate student, Michael Colvin. 2004.

American Fisheries Society, Water Quality Section, Best Student Poster Award for Jeffrey Yanke (co-advised with Dr. Jim Congleton). 2004

Who's Who in Medicine and Healthcare, 2003 – present.

Who's Who in America 2003 –present.

Who's Who of American Women 2002-present.

University of Idaho Alumni Award for Excellence Mentor - for Outstanding Graduate Student, Darin Jones, 2001.

University of Massachusetts, Department of Natural Resource Conservation Distinguished Alumna Award, 1999

University of Idaho Alumni Award for Excellence - Mentor for Outstanding Graduate Student, Monica Hiner, 1999.

Certificate of Appreciation for Visionary Leadershi and Commitment to Advance Fisheries Science and Communications. AFS 2000 Strategic Planning Committee.

American Fisheries Society, Western Division, Special Recognition, 1999

American Fisheries Society, Meritorious Service Award, 1995  
 American Fisheries Society, Award of Merit, Western Division, 1995

## **OUTREACH AND ADVISORY ROLES:**

### **Current:**

2019 – present. Member Oregon Invasive Species Council. Meetings quarterly  
 2018 – present. Member, Oregon Sea Grant Advisory Council. Quarterly meetings.  
 2014- present. Member Academic, Western Regional Panel Aquatic Nuisance Species.  
 Quarterly Conference calls, Panel committee participation. Annual in Person  
 Meetings. <http://www.fws.gov/answest/>  
 2015- present, Member, USGS Emerging Wildlife Diseases work group  
 2012- present. Columbia River Basin Team of the 100<sup>th</sup> Meridian Initiative. Meetings  
 twice yearly. [http://www.100thmeridian.org/Columbia\\_RBT.asp](http://www.100thmeridian.org/Columbia_RBT.asp)

### **Panel and Advisory Boards: (completed)**

2015- 2018. Scientist Expert Panel for Delta Science Program- Review of feasibility of  
 use of shore-based ballast water reception and treatment facilities in California.  
 Delta Stewardship Council, and the California State Lands Commission.  
[http://deltacouncil.ca.gov/feasibility-study-shore-based-ballast-water-reception-  
 and-treatment-facilities-california-0](http://deltacouncil.ca.gov/feasibility-study-shore-based-ballast-water-reception-and-treatment-facilities-california-0)  
 2016. Member Lower Klamath Independent Scientific Review Team for review of  
 implementation criteria of long term plan for protection of late summer adult  
 salmon. US Bureau of Reclamation.  
[https://www.usbr.gov/main/qoi/docs/Independent\\_Scientific\\_Review\\_Protecting\\_A  
 dult\\_Salmon\\_Full.pdf](https://www.usbr.gov/main/qoi/docs/Independent_Scientific_Review_Protecting_Adult_Salmon_Full.pdf)  
 2015. Invited participant to establish Dreissenid mussel research priorities. Portland State  
 University. Organized by Pacific States, USGS, and USFWS. 4-5 November.  
 2012- 2017. Member Idaho Invasive Species Council Advisory Group. Meetings twice  
 yearly.  
 2006-07. Task Force Member “An Aquatic Nuisance Species Plan For Idaho: A  
 Supplement to Idaho’s Strategic Action Plan For Invasive Species,” April 2007.  
 2004 -2007. Chair, Technical Advisory Board for Silver Creek Watershed, The Nature  
 Conservancy, Hailey, Idaho.  
 2004-2005: FWS Strategic Plan Evaluation Committee, appointed by Sport Fishing and  
 Boating Partnership to Evaluate the USFWS Fisheries Program Progress toward  
 their draft Strategic Plan.  
 2003-2008. Potlatch Corporation Community Advisory Board. Acting Chair 2004-5.  
 2001-2003, Member, Fisheries Strategic Plan Steering Committee for USFWS, of the  
 Sport Fishing and Boating Partnership.

### **Extension Workshops and Intern Programs since 2000:**

*Actions to Increase the Engagement of Underrepresented Minorities in Fisheries and  
 Aquatic Sciences.* Organizer, Symposium special session organizer. American  
 Fisheries Society, Kansas City, MO, August 2016.  
 Wood River Land Trust Rock Creek Watershed restoration. Advising regarding  
 temperature profiles, fish species, and invertebrate sampling. June 2016.  
 University of Idaho Doris Duke Scholars Program, faculty mentor monthly meetings,  
 arranging for summer interns in aquatic resources 2014 – 2017  
*Understanding factors affecting the efficacy of KCl as a toxicant for adult and veliger*

- quagga mussels*. Webinar for Rapid Response Working Group, Columbia Basin Team. 18 February 2016.
- Tribal natural resources outreach: Organizer of team for outreach activities with regional tribes, visiting with tribes, travel to meet with tribal educators. 2015 - 2016
- Natural Resources Tribal Engagement Educational Summit. Organizing and planning team. September-October 2015. Panel moderator.
- Co-organizer: workshop and presentations on multi-cultural inclusion with Dr. Carolyn Finney author of *Black faces and White Spaces*. 27-30 September. Panel moderator.
- Actions and dialog to change perceptions and increase engagement of underrepresented minorities in fisheries and aquatic sciences*. Organizer, American Fisheries Society, special session. Portland, OR, August 2015.
- Western Region New Zealand mudsnail workshop. Planning team Seattle WA, June 16-17.
- Climate change and the potential effects on salmonid rearing in the future segment in continuing education workshop* "Inflow-Outflow, Responsible and Efficient Aquaculture" Idaho Chapter American Fisheries Society. 3 March 2015.
- Interactive workshop with Universidad Católica de Temuco, Presentation of program, tours of facilities and collaborative opportunities. August 2014.
- REU CRISP interns. Investigation of invasive species in the Snake/Columbia Rivers. June – August 2009 - 2014.
- Asian clam infestation in Lake Pend Oreille and Lake Tahoe*. Special citizens meeting. Panida Theater, Sandpoint, ID. June 2014.
- Aquatic Invasive Invertebrates Workshop*. Washington Department of Fish and Wildlife, Colville Tribe, Osoyoos Lake Managers, and Okanagon Nations. Oroville, WA, 4 March, 2014.
- Stream invertebrates of Paradise Creek*. HOIST (Helping Orient Indian Students and Teachers into STEM) Four-day workshop with 16 participants to introduce them to the function of freshwater streams.
- Mentor HOIST (Helping Orient Indian Students and Teachers into STEM). Summer 1994 – 2015.
- Mentor for REU EPSCoR summer and academic year programs. 2006-2007, 2009 - 2012.
- Mentor, Scholarships for Education and Economic Development (SEED) Program, USAID. 2012.
- Mentor, Environmental Science senior thesis students: Water quality and studies of invasive species 2010 - 2016.
- Review of oral and injectable applications of erythromycin to control bacterial kidney disease*. Continuing Education class "Practical tools for managing bacterial kidney disease." AFS Fish Health Section 52<sup>nd</sup> workshop. 14 June 2011. Nanaimo, BC.
- 6<sup>th</sup> National New Zealand mudsnail conference*. Co-organizer for Moscow, Idaho. March 15-16, 2011.
- New Zealand mudsnails and invasive mollusks*. Workshop for Idaho Department of Fish and Game and others. Nampa Research. January 2011.
- Mentor, Water of West REU. Salmonid physiology and migration. 2008 - 2011.
- Management of BKD and Erythromycin Drug Therapy*. Webinar for Alaska Hatchery Managers, Anchorage, AK. 16 January 2010.
- Workshop on invasive mollusks*. Idaho Department of Fish and Game. 2 day workshop on identification of invasive mollusks, HACCP process, and quality assurance. With

graduate student Kelly Stockton 2010.

*Minority Recruitment in the Cooperative Research Units.* Breakout session. National Meeting Hotel Monteleone, New Orleans, Louisiana, March 1 – 5,

*Ecology and Management of New Zealand Mud Snails:*USFWS, USGS & USFWS Webinar USA. June 18 2009.

[http://training.fws.gov/branchsites/CSP/WebSeminarSeries/june\\_09/information\\_page.html](http://training.fws.gov/branchsites/CSP/WebSeminarSeries/june_09/information_page.html).

Co- organizer. *Control of New Zealand Mudsnaills in Hatcheries.* 1.5 d workshop, Hagerman Fish Culture Experiment Station, and Hagerman National Fish Hatchery, 13-14 May 2008.

*Determining future location for AFS offices* Workshop leader. Governing Board Retreat, Annapolis, MD. March 2008.

*Control of NZMS in Hatcheries.* Workshop for Interested Partners. Sponsored by USFWS, and U of Idaho Coop Research Unit. 4-5 May 2006.

*Enhancement of Value Retreat.* American Fisheries Society Governing Board Retreat Leader. Lake Placid 8 September 2006.

Universidad de Concepcion – University of Idaho Academic Collaboration. Delegation visits Idaho. Patagonia ecosystems research center with University of Montana. Claudio Meier, Dr. Pedro Real, Hugo Romeo, Evelyn Habit, Oscar Parra. October 31-November 5, 2006.

#### **Journal Editorial Boards:**

2007-present. Associate Editor, *Transactions of the American Fisheries Society.*

1994-97. Associate Editors, *Journal of Aquatic Animal Health*

1991-94. Associate Editor, *North American Journal Fisheries Management*

2004 -2007. Journal Outreach Co-Editor, *Journal of Aquatic Animal Health.*

#### **Invited peer reviewer for manuscripts:**

PLOS; Fisheries Magazine; Nature Scientific Reports; Environmental Biology of Fishes; Aquaculture Research; Aquaculture; Canadian Journal of Fisheries and Aquatic Sciences, Ecology; Diseases of Aquatic Organisms; Journal of Fish Biology; Ecological Engineering; Water, Air and Soil Pollution; North American Journal of Fisheries Management; Freshwater Science; Aquatic Invasions; Aquatic Ecology; River Research and Applications; Environmental Engineering; Hydrobiology; Aquatic Toxicology; Aquatic Invasions; Environmental Toxicology and Chemistry; Northwest Science; North American Journal of Aquaculture; Environmental Management; Environmental Science and Pollution Research; Freshwater Biology, Environmental Toxicology; Chinese Journal of Oceanography and Limnology; Bulletin of Environmental Contamination and Toxicology; Environmental Management; Freshwater Biology; Functional Ecology; Veterinary Microbiology; Journal of Aquatic Animal Health; Journal of Fish Diseases; Transactions of the American Fisheries Society; International Journal of Environment and Pollution

#### **MEMBERSHIP, LEADERSHIP AND SERVICE IN PROFESSIONAL AND SCHOLARLY ORGANIZATIONS:**

American Association for the Advancement of Science since 1976

American Fisheries Society, fellow, past president, and life member

American Institute of Biological Sciences, member since 1978

Ecology Society of America, member since 1978

Society for Sigma Xi., member since 1972  
 American Institute for Fisheries Research Biologists, Fellow

**PUBLICATIONS: Recent 20 year listed. Refereed Journals, Peer Reviewed Symposia, Books and Chapters**

- Barenberg, A. and C. M. Moffitt. 2017. Toxicity of aqueous alkaline solutions to New Zealand mudsnails, Asian clams, and quagga mussels. *Journal of Fish and Wildlife Management on line early*. <http://fwspubs.org/doi/pdf/10.3996/022017-JFWM-013>
- Stockton-Fiti, K. A., and C. M. Moffitt. 2017. Safety and Efficacy of Virkon® Aquatic as a control tool for invasive mollusks in aquaculture. *Aquaculture*. 480:71-76.
- Penaluna, B. E., I. Arismendi, C. M. Moffitt, and Z. L. Penney. 2017. Nine suggestions to actively enhance diversity and inclusion in the American Fisheries Society. *Fisheries* 42:399-402.
- Moffitt, C. M. K. A. Stockton-Fiti, and R. Caudi. 2016. Toxicity of potassium chloride to veliger and byssal stage dreissenid mussels related to water quality. *Management of Biological Invasions* 7:257–268
- Stockton, K.A., C. M. Moffitt, B. J. Watten, and B. Vinci. 2016. Hydraulics and particle removal efficiency of mixed cell raceway and Burrow’s pond rearing systems. *Aquacultural Engineering* 74:52-61. [doi:10.1016/j.aquaeng.2016.04.005](https://doi.org/10.1016/j.aquaeng.2016.04.005)
- Penney, Z. L., C. M. Moffitt, B. Jones, and B. Marston. 2016. Physiological comparisons of plasma and tissue metrics of selected inland and coastal steelhead kelts. *Environmental Biology of Fishes* 99:487-498. Doi:10.1007/s10641-016-0493-x
- Moffitt, C. M., B. J. Watten, A. Barenberg, and J. Henquinet. 2015. Hydroxide stabilization as a new tool for ballast disinfection: efficacy of treatment on zooplankton. *Management of Biological Invasions* 6:263-275.
- Trushenski, J. T., H. L. Blankenship, J. D. Bowker, T. A. Flagg, J. A. Hesse, K. M. Leber, D. D. MacKinlay, D. J. Maynard, C. M. Moffitt, V. A. Mudrak, K.T. Scribner, S. F. Stuewe, J. A. Sweka, G. E. Whelan, and C. Young-Dubovsky 2015. Introduction to a special section: Hatcheries and management of aquatic resources (HaMAR)—Considerations for use of hatcheries and hatchery-origin fish. *North American Journal of Aquaculture* 77:327-342.
- Plumb, J. M., and C. M. Moffitt 2015. Re-estimating temperature-dependent consumption parameters in bioenergetics models for juvenile Chinook salmon. *Transactions of the American Fisheries Society* 144:323–330.
- Buelow, J., and C. M. Moffitt. 2015. Physiological indices of seawater readiness in postspawning steelhead kelts. *Ecology of Freshwater Fish*. 24: 112-122.
- Penney, Z. L., and C. M. Moffitt. 2014. Fatty acid consumption in white muscle and liver tissue of stream maturing steelhead during early migration and kelt emigration. *Journal of Fish Biology* 86: 105-120
- Penney, Z. L. and C. M. Moffitt. 2014. Proximate composition and energy density of stream maturing adult steelhead during upstream migration, sexual maturity, and kelt emigration. *Transactions of the American Fisheries Society* 143:399-413
- Penney, Z. L., and C. M. Moffitt. 2014. Histological assessment of organs in sexually mature and post-spawning steelhead trout and insights into iteroparity. *Reviews in Fish Biology and Fisheries* 24:781–801.



- Connor, W. P., K. F. Tiffan, J. M. Plumb, and C. M. Moffitt. 2013. Evidence for density-dependent growth opportunity as a factor for changes in downstream movement timing and body size of subyearling Chinook salmon. *Transactions of the American Fisheries Society* 142:1453-1468.
- White, G., J. Claussen, C. Moffitt, B. Norcross, and D. Parrish. 2013. Dr. J. Frances Allen: pioneer of women in fisheries. *Fisheries* 38:103-111.
- Stockton, K. and C. M. Moffitt. 2013. Disinfection of three wading boot surfaces infested with New Zealand mudsnails. *North American Journal of Fisheries Management* 33:529-538.
- Plumb, J. M., W. P. Connor, K. F. Tiffan, C. M. Moffitt, R. W. Perry, and N.S. Adams. 2012. Estimating and predicting collection probability of fish at dams using multistate modeling. *Transactions of the American Fisheries Society* 141:1364-1373.
- Moffitt, C. M., and C. A. James. 2012. Response of New Zealand mudsnails *Potamopyrgus antipodarum* to freezing and near freezing fluctuating water temperatures. *Freshwater Science* 31:1035-1041. 2012
- Nielson, R. J., C. M. Moffitt and B. J. Watten. 2012. Toxicity of elevated partial pressures of carbon dioxide to invasive New Zealand mudsnails. *Environmental Toxicology and Chemistry*, 31:1838–1842.
- Stockton, K.A., C. M. Moffitt, D. L. Blew, and C. N. Farmer. 2012. Acute toxicity of sodium fluorescein to ashy pebblesnails *Fluminicola fuscus*. *Northwest Science* 86:190-197.
- Nielson, J., C. M. Moffitt, and B. J. Watten. 2012. Hydrocyclonic separation of invasive New Zealand mudsnails from an aquaculture water source. *Aquaculture*. 326–329:156–162
- Moffitt, C. M. and C. A. James. 2012. Seasonal dynamics of *Potamopyrgus antipodarum* infestations in a heavily used recreational watershed in intermountain North America. *Aquatic Invasions* 7:193–202.
- Williams, C. J., and C. M. Moffitt. 2010. Estimation of fish and wildlife disease prevalence from imperfect diagnostic tests on pooled samples with varying pool sizes. *Ecological Informatics* 5: 273-280.
- Anlauf, K. A., and C. M. Moffitt. 2010. Modelling of landscape variables at multiple extents to predict fine sediments and suitable habitat for *Tubifex tubifex* in a stream system. *Freshwater Biology* 55: 794–805.
- Cassinelli, J. and C. M. Moffitt. 2010. Growth and physiology of selected desert and montane adapted populations of redband trout (*Oncorhynchus mykiss gairdneri*). *Transactions of the American Fisheries Society* 139:339–352.
- Bruce, R. L., and C. M. Moffitt. 2010. Quantifying risks of volitional consumption of New Zealand mudsnails by steelhead and rainbow trout. *Aquaculture Research*. *Aquaculture Research* 41:552-558.
- Moffitt, C. M. 2009. Climate change and anthropogenic Influences – Pages 151–153 in A. J. Haro, K. L. Smith, R. A. Rulifson, C. M. Moffitt, R. J. Klauda, M. J. Dadswell, R. A. Cunjak, J. E. Cooper, K. L. Beal, and T. S. Avery, editors. *Challenges for diadromous fishes in a dynamic global environment*. American Fisheries Society, Symposium 69, Bethesda, Maryland.
- Bruce, R. L., C. M. Moffitt, and B. Dennis. 2009. Survival and passage of ingested New Zealand mudsnails through the intestinal tract of rainbow trout. *North American Journal of Aquaculture* 71:287–301.

- Lindstrom, N. M. D. R. Call, M. L. House, C. M. Moffitt, and K. D. Cain. 2009. A quantitative enzyme-linked immunosorbent assay (ELISA) and filtration-based fluorescent antibody test (FAT) as potential tools to screen broodstock for *Flavobacterium psychrophilum* infection. *Journal of Aquatic Animal Health*.21:43-56.
- Colvin, M. E., and C. M. Moffitt. 2009. Evaluation of irrigation canal networks to assess stream connectivity in a watershed. *River Research and Applications*.25: 486-496.
- Cajas Cano, L., and C. M. Moffitt. 2008. Comparing footprints of trout and beef production. *World Aquaculture* 39(3): 10-13; 70-72.
- Anlauf, K. and C. Moffitt. 2008. Models of stream habitat characteristics associated with tubificid populations in an intermountain watershed. *Hydrobiologia*. 603:147–158.
- Jones, D. T., C. M. Moffitt, and K. Kenneth Peters. 2007. Temperature-mediated differences in bacterial kidney disease expression and survival in *Renibacterium salmoninarum* challenged bull trout and other salmonids. *North American Journal of Fisheries Management*, 27:695–706.
- Moffitt, C. M., and S. M. A. Mobin. 2006. Profile of microflora of the posterior intestine of Chinook salmon before, during and following administration of rations with and without erythromycin. *North American Journal of Aquaculture*. 68:176-185.
- Williams, C. J., and C. M. Moffitt. 2006. *Erratum* Estimation of pathogen prevalence in pooled samples using maximum likelihood methods and open source software. *Journal of Aquatic Animal Health* 18:149-155.
- Moffitt, C. M. 2005. Environmental, economic and social aspects of animal protein production and opportunities for aquaculture. *Fisheries* 30(9):36-38.
- Williams, C. J., and C. M. Moffitt. 2005. Estimation of prevalence of pathogens in pooled samples using maximum likelihood methods and open source software. *Journal of Aquatic Animal Health*. 17:386-391.
- Moffitt, C. M., A. H. Haukenes, and C. J. Williams. 2004. Evaluating and understanding fish health risks and their consequences in propagated and free-ranging fish populations. *American Fisheries Society Symposium* 44:529-537.
- Moffitt, C. M. 2004. The implications of aquaculture production and development on sustainable fisheries. *American Fisheries Society Symposium* 43:91-108
- Moffitt, C. M. 2004. The implications of aquaculture production and development on sustainable fisheries. Pp.91-108 in *Fish in our future: perspectives on fisheries sustainability*. *American Fisheries Society Symposium* 43.
- Jones, D. and C. M. Moffitt. 2004. Swimming endurance of bull trout, lake trout, arctic char, and rainbow trout following challenge with *Renibacterium salmoninarum*. *Journal of Aquatic Animal Health* 16: 10-22.
- Williams, C. J., and C. M. Moffitt 2003. Bayesian estimation of fish disease prevalence from pooled samples incorporating sensitivity and specificity. pp 39-51 in C. J. Williams, editor, *Bayesian Inference and Maximum Entropy Methods in Science and Engineering: 22<sup>nd</sup> International Workshop*. American Institute of Physics.
- Kiryu, Y. and C.M. Moffitt.2002. Models of comparative toxicity of injectable erythromycin in four salmonid species. *Aquaculture* 211:29-41.
- Haukenes, A. and C.M. Moffitt. 2002. Hatchery evaluation of erythromycin phosphate injections in pre-spawning spring chinook salmon. *North American Journal of Aquaculture*.64:167-174.

- Hiner, M. and C.M. Moffitt. 2002. Modeling *Myxobolus cerebralis* infections in trout: associations with habitat variables. Whirling Disease: Reviews and Current Topics. American Fisheries Society Symposium 29:167-179.
- Williams, C. J., and C. M. Moffitt. 2002. A brief critique of the methods of sampling and reporting of pathogens in populations of fish (brief review of status) Whirling Disease: Reviews and Current Topics. American Fisheries Society Symposium 29:213-214.
- Williams, C.J. and C.M. Moffitt. 2001. A critique of methods of sampling and reporting of pathogens in populations of fish. *Journal of Aquatic Animal Health* 13:300-309.
- Kiryu, Y. and C.M. Moffitt. 2001. Acute LD50 and kidney histopathology following injection of erythromycin (Erythro-200) and its carrier in spring chinook salmon *Journal of Fish Diseases*. 24: 409-416.
- Moffitt, C.M. and Y. Kiryu. 2001. Acute and chronic toxicity following parenteral application of erythromycin (Erythro-200) to maturing spring chinook salmon held at two water temperatures. *Journal of Aquatic Animal Health*. 13:8-19.
- Hiner, M. and C.M. Moffitt. 2001. Variation in *Myxobolus cerebralis* infections in field exposed cutthroat and rainbow trout in Idaho. *Journal of Aquatic Animal Health*. 13:124-132.
- Haukenes, A.H. and C.M. Moffitt. 1999. Concentrations of erythromycin in maturing chinook salmon following intraperitoneal injection of one of two drug formulations. *Journal of Aquatic Animal Health* 11:61-67.
- Moffitt, C.M. and Y. Kiryu. 1999. Toxicity, teratogenesis, and efficacy of injectable erythromycin (Erythro-200) administered repeatedly to adult spring chinook salmon. *Journal of Aquatic Animal Health* 11:1-9.
- Assaf, N.A., J.V. Pothuluri, R-F. Wang, C.E. Cerniglia, and C.M. Moffitt. 1999. Bioassay procedure for the evaluation of erythromycin activity in aquaculture environments. *Journal of World Aquaculture Society* 30:137-146.
- Books and Book Chapters:**
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24 June 2019

Coos County Planning Department  
c/o Planning Director Jill Rolfe  
Coos County Courthouse  
250 N. Baxter  
Coquille, Oregon 97423

Re: County Remand File No. REM-19-001/LUBA Case No. 2016-095

These comments are provided in addition to those provided at the initial hearing date before the extension to 24 June.

I urge the County carefully consider the specific remand issues, and to also put this project into the context that it should be that of consideration of the cumulative effects this massive project proposed in a series of separate applications for various areas. The impact of each and all these applications must be evaluated considering the cumulative effects they will have on the condition of the Coos Bay estuary, the public trust uses, and future potential of these resources.

Besides **not providing a true public benefit** as this is a Canadian Company, using the facilities and lands of Oregon to transport process and export a product from outside of Oregon to markets in Asia. There is no public benefit to this project of Oregonians nor is there a public need for this development given the beneficiaries. Moreover, the Greenhouse gasses that will be emitted to process and prepare the natural gas product for shipping will cumulatively make the facility the largest emitter of Greenhouse gas in the state.

**The project will unreasonably interfere with the public trust rights.**

The CBEMP Policy #5 provides the local government shall support dredge and fill activities in the estuary only if the use or alteration does not unreasonably interfere with public trust rights.

Public trust rights with respect to submerged lands and navigable waters is rooted in the principle that “navigable waterways are a valuable and essential resource and as such all people have an interest in maintaining them for commerce, fishing, and recreation.” The proposed activities of dredging and outcome of operation of the facility will encroach upon the public’s rights to use the navigable waters in Coos Bay and Jordan Cove.

Fishing activity in the bay occurs throughout the year for various targets. Among the those is the recreational crab fishery. All boat-based crab fishing takes place around the slack high tide water events. The fishers deploy rings and set them with bait and then the retrieval occurs during the 2 h around high tide. The fishers retrieve each of these and harvest and sort the crabs. Many boats use up to a dozen rings, and all activity takes place in the 2 h slack high tide period. This same time is when the LNG ships will be moving fully loaded out of the bay. This will disrupt and totally interfere with the recreational access to what is a highly important and economically important component of the functional use of the estuary.

Other ship traffic will be unreasonably affected by this high density of ship traffic in and out of the bay. Commercial fishing fleets that come into and out of the bay depend on weather conditions for access. In the winter, often the access into and out of the bay can be limited by weather conditions and having these large ships with exclusion zones surrounding them will affect all other associated fish fleet traffic.

Other resource uses will be affected by the ship traffic of LNG carriers. Clam harvest by scuba fishers that work at slack low and high tides.

**The effects of this project on the habitat for the public trust of fish and wildlife is of highest concern.**

Work is proposed by the Applicant within wetlands and waters of the State of Oregon associated with the project components in the section below. Dredging and filling and associated activities in benthic systems of estuaries leads to direct mortality of organisms and plants in the treatment area, but also alters the exchange of waters and nutrients, horizontal salinity gradients, tidal current amplitude, and resulting sediment transport. According to many scientific studies, dredging can trigger ecological succession such that more opportunistic invertebrate species are likely to dominate shortly following a dredging event and other effects can be observed on feeding, and mobility and reproduction.

Coos Bay is considered part of the critical habitat for the threatened distinct population of Green Sturgeon *Acipenser medirostris* and provides important summer habitat for subadults and adults. According to the NOAA plan for recovery of sturgeon, “Road building (resulting in sedimentation), a proposed liquefied natural gas (LNG) project, dredging, urbanization (resulting in pollution and increased peak flows), commercial shipping, stream channelization, wetland filling and draining, and development and silviculture (resulting in the loss of large woody debris and forested land cover) . . . ” are threats to recovery.<sup>1</sup>

Access channel dredging would result in the permanent conversion of approximately 12.9 acres of unvegetated shallow subtidal habitat to deep subtidal habitat and the Applicant notes that the activities would permanently impact approximately 1.91 acres of vegetated shallows (eelgrass habitat). They imply that these impacts are necessary because the LNG Terminal facility requires a safe harbor to load LNG carriers and the size and safety requirements of the LNG carriers necessitate a marine slip and berth of the proposed size and set off from Coos Bay at the proposed location. No alternative is suggested to support a smaller sized design. The proposed dredging of the Access Channel to a 45-foot depth would result in removal of tidal and subtidal habitat including a large area with beds of eelgrass. The removal of 1.9 million CY of substrates from the existing tidal and subtidal habitat would occur.

The efficacy of this removal is discussed below under the Eelgrass, but there is no mention of the loss of access for recreation from removal of the tidal areas in the Access Channel region. Recreational boating, and clam and crabbing access would not be possible from the nearby Bureau of Land Management (BLM) boat launch during some of the dredging operations, and if

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<sup>1</sup> NOAA National Marine Fisheries Service, *Final Green Sturgeon Critical Habitat Biological Report*, September 2009, p. 32.

access is possible, noise and interference from the activities would hamper most activities. The public access for hunting and access to open water areas is focused out of the BLM launch. Many recreationalists walk with their family and pets along the tidal areas. The access to the important clamming areas upstream and downstream is secured from the BLM boat launch. The proposed Access Channel dredging is just upstream from this important area with proposed channel alterations affecting 22 acres of tidal and subtidal habitat, 15 of which are deep subtidal habitat.

The freshwater emergent wetlands identified within the Access and Utility Corridor are characterized in summary tables, and these wetlands in the spit are connected to the sand aquifer. The Energy Terminal is near the Coos Bay-North Bend water wells. These water rights are part of the infrastructure of the region for industrial water and even drinking water sources and represent an extensive shallow aquifer that is highly interconnected.

Moreover, industrial wastewater contaminants from prior activities at the site should be carefully considered as the drainage and porosity of the aquifer and surface is altered. In our review of this application, JCEP apparently fails to address issues relating to the extent and risk that previous industrial contamination at the proposed site and neighboring areas would be released in water as a result of major dredging, soil compression, and filling. The potential exists for the project's proposed dredging and excavation to expose the surface and groundwater to several subsurface chemical contaminants directly or by altering the hydrology around the site, mobilizing sequestered contamination to move into the aquifer. The proposed deep soil mixing and sand-compaction sitework to be conducted in the access and utility corridor is likely to alter the horizontal groundwater patterns and affect existing wetlands and their associated functions and wildlife values components.

### **South Dunes Site**

The 136-acre South Dunes site and the corridor contains numerous wetlands of various sizes interspersed in the landscape and estimated at 22 acres. This site would receive the fill and spoils from multiple activities to elevate it to 63 to 70 feet. The proposal to stack and dewater dredged sediments above the water table at the South Dunes Terminal areas would most certainly affect infiltration and seasonal groundwater recharge dynamics that support wetlands in the vicinity of the project. The hydraulic dredge pipeline (HDP) would extend from the Access Channel to South Dunes. Portions of the 2-foot diameter pipe would be installed below highest measured tide (HMT). An approximately 1-mile-long permanent access and utility corridor would be constructed between Ingram Yard and the South Dunes site to provide a conduit for the underground feed gas supply to the LNG Terminal. The temporary housing site associated with the project is slated for the area, as well as multiple underground utilities. The elevation of the areas against tsunami for the permanent facilities, including fire and water, would change drainage patterns for all nearby wetlands. Finally, this site would be the area that receives the hydraulic directional drilling (HDD) infrastructure under-bay pipeline to the Jordan Cove Meter Station at Mile Post (MP) 0.00. At the Jordan Cove Meter Station, the pipeline is approximately 0.2 mile south of the Weyerhaeuser North Spit Landfill leaking underground storage tank (LUST) site. This is the same site as the Weyerhaeuser Containerboard/Mill property. The pipeline proceeds for a short distance to the west then utilizes an approximate 5,200-foot HDD to



cross the Coos Bay estuary from the North Spit from about MP 0.12 to MP 1.11 south of North Point on the west side of Highway 101.

### **Kentuck Project Site**

The 100-acre site is proposed to serve mitigation sites for the loss of wetlands from the entire project of PCGP pipeline and LNG terminal. The PCGP component of the Kentuck project would enhance degraded emergent wetlands within the golf course to forested wetlands at a ratio of 3:1.

The compensatory mitigation plan is designed to conform with USACE and DSL compensatory wetland mitigation requirements, but the 100-acre proposed Kentuck mitigation project already contains substantial wetland values that would be affected or destroyed by the project. Why this approach is being considered. The mitigation project at Kentuck is also proposed to receive a 300,000 CY of unconsolidated sand and silty sand sediments from dredging operations at the time of removal of the berm from the marine slip area. The mitigation project goals are to restore habitat for Coho Salmon (*Oncorhynchus kisutch*) and mitigate for the loss of all wetlands throughout the disruption of wetland, riparian and associated areas as a result of the 229-mile pipeline project across the state. The mitigation put forth contains no discussions of alternatives to this approach for the project or any other potential mitigation along the pipeline swath. Moreover, the Kentuck site has freshwater wetland values as palustrine wetland/forest and its vegetative cover is used by migratory and resident wildlife and game and associated hydrological values. Where is the actual accounting of wetland loss and gain with this proposal?

The concept of reconnecting Kentuck Creek and slough within the Kentuck watershed to provide a wider wetland area rather than the narrow corridor that exists is a reasonable proposal, but the methods and design of the project fail to capture the full potential of this mitigation opportunity to further upstream mitigation. The fill of 4.3 acres proposed through construction of a high elevation dike or permanent levee around the area is not clear. The Applicant should provide the rationale for the need to reconstruct the dike and impact these wetlands to accomplish a re-connection of this area with the waterway. The Applicant indicates that the area would be re-graded to allow for re-connection of water flow and distribution, but no details are provided as to how this activity would be done. If this change in slopes were to be accomplished using dredge materials, there are significant differences between the sediments from the dredge material and those of the existing wetlands they are altering and reconnecting. There are other confusing components of the proposal such as the new levee approximately 50-foot wide and 1,100-foot long across the northwest portion of the Kentuck Project site. This proposed action appears to be coupled with a plan to remove an approximately 1,500-foot long segment of the existing Kentuck levee upstream from the proposed new levee. The Applicant application materials do not provide any rationale for this proposed action.

Moreover, the entire project poses a large risk from transporting the dredge material across the bay and navigation channel via scow, then through the temporary dredge transfer line, and then hydraulically pumped to the Kentuck mitigation site. There are no details for the protection of water resources during this activity and a total absence of consideration of alternative sites or methods. The application states that sediments destined for the Kentuck Project site would be transported using scows that would be moved to a location east of the Coos Bay Channel. The

sediments on the scows would then be hydraulically pumped to the Kentucky mitigation site via a 1.3-plus mile-long pipeline. The pipeline route would traverse intertidal and shallow subtidal portions of the estuary between the Coos Bay Channel and the Kentucky Project Site. The lack of details and inherent risks of water movement and pipelines poses threats to any of the resource values in the region of the transfer. There are mariculture operations in the bay area nearby the Kentucky Inlet, and other fish and shellfish habitats and other wildlife habitats that can be affected by disruptions associated with transfer and logistics of sediment movement and dewatering, not to mention the proposed HDD pipeline crossing.

## **Eelgrass**

Eelgrass beds have an important role in the life cycles of fish, invertebrates and wildlife species. Because eelgrass is a rooted plant, it performs a vital function of stabilizing coastal sediments, preventing erosion. The eelgrass community provides direct and indirect food and cover for many marine species. Because the proposed Access Channel development permanently destroys 1.9 acres of eelgrass, the Applicant proposes to mitigate this through development of a larger eelgrass habitat across from the project that is currently an estuarine tide flat area south of the western tip of the North Bend Airport runway.

The biology and habitat requirements and constituents of eelgrass communities are complex and the biologists in the bay have been working to restore and reestablish these communities throughout the bay and estuary. The project needs to consider carefully the cumulative effects of destruction of eelgrass and how restoration practices should be accomplished using a careful scientific approach.

The Eelgrass Mitigation site chosen already has eelgrass associated with it and there are wetland values associated with the mud flats area proposed to be altered from its existing slope draining toward the north east. What will the Applicant do about the losses of existing productive habitat that is destroyed to create this new eelgrass area? The existing zoning of the Coos Bay Estuary Management Plan prohibits the proposed dredging activity as this is a Natural Aquatic zone. Moreover, the eelgrass communities are all along the banks of the habitat near to the proposed navigation reliability improvement project. However, at this important site in the bay by the airport, the proposed removal of sediments to change slope to provide a more tidal exposed area for eelgrass would destroy any biota and infauna in that habitat. The shape of the structure proposed appears to be more of a pond environment with sharp slopes to a depth of -2 feet below mean tide. Likely that feature would provide a trap for invertebrates or vertebrates with tidal receding. Where would the sediments removed from this be placed? What procedures would be used to change the slope and develop this site? What basis is there for this design? Furthermore, what source of eelgrass would be used to seed this area to provide transplant shoots and plugs? Are they going to recover the eelgrass removed from the North Spit area and place it at this location? The biology and habitat requirements and constituents of eelgrass communities are complex and the biologists in the bay have been working to restore and reestablish these communities throughout the bay and estuary. The project needs to consider carefully the cumulative effects of destruction of eelgrass and how restoration practices should be accomplished using a careful scientific approach.

## Water table and estuarine hydrology

The removal of benthic material to depths greater than the existing navigation channel would affect the hydrology in the area, particularly with tidal seawater flows, creating a low spot. As stated earlier, although each activity and project detail are discussed separately, the cumulative effects of multiple dredge and fill activities are extensive and represent long-term disruption in the hydrology and biological function. The 47-foot-deep excavation into the highly permeable sand substrate of the spit would provide new pathways for groundwater from the wetlands within the spit to move toward that excavation. Though sheet piles would be placed on both sides and the end of the slip, use of sheet piles as proposed is not watertight and the hydraulic gradient created by the 47-foot-deep excavation (covering more than 20 acres), in combination with a very shallow water table, would draw water toward and into the slip during construction. This disruption of groundwater hydrology would likely have a harmful impact on wetlands immediately adjoining the JCEP terminal site. This potential outcome is not described, or the extent of the likely impact determined and accounted for in the application for a removal-fill permit.

These proposed dredging and removal activities have the potential to affect wells and aquifers. The wells on the sand spit range in depth from 90 to 120 feet below ground surface, from which non-potable water is withdrawn from the Dune-Sand Aquifer. From our examination of information about the Aquifer, there is a high potential that the land filling, road building, and excavating activities of the site would affect these wells. The report and modeling by U.S. Geological Survey (USGS) <sup>2</sup> of water levels in wells across this aquifer (see Jones's Fig. 21 as Figure 1 below) show the contours of the water table and the shallow water tables surrounding the location of the marine slip and laydown areas. The general flow of the water table is toward the north and west; the aquifer is highly permeable. The substrate permeability and slopes appear to support that runoff from the site, and changes in water flow would likely influence and infiltrate the groundwater and groundwater related surface water resources of the spit.

To allow for the marine slip excavation via land-based operations, the Applicant states that a berm would be retained between the excavation for the slip and the Access Channel, thereby implying there would only be freshwater effects to address, not disruption of the estuarine environment during construction. This is likely inaccurate. The logistics of this design are such that effects to the Coos Bay estuary would result from a change in hydrology when removing substrates from the bay and the sand spit and then connecting these two areas. The hydrology of the sand spit may be so altered as to allow directional sub surface water flows in the aquifer, providing the opportunity for saltwater intrusion at some periods during the year.

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<sup>2</sup> Jones, M. A. 1992. Ground-water availability from a dune-sand aquifer near Coos Bay and North Bend, Oregon. U.S.G.S. Open-File Report 90-563

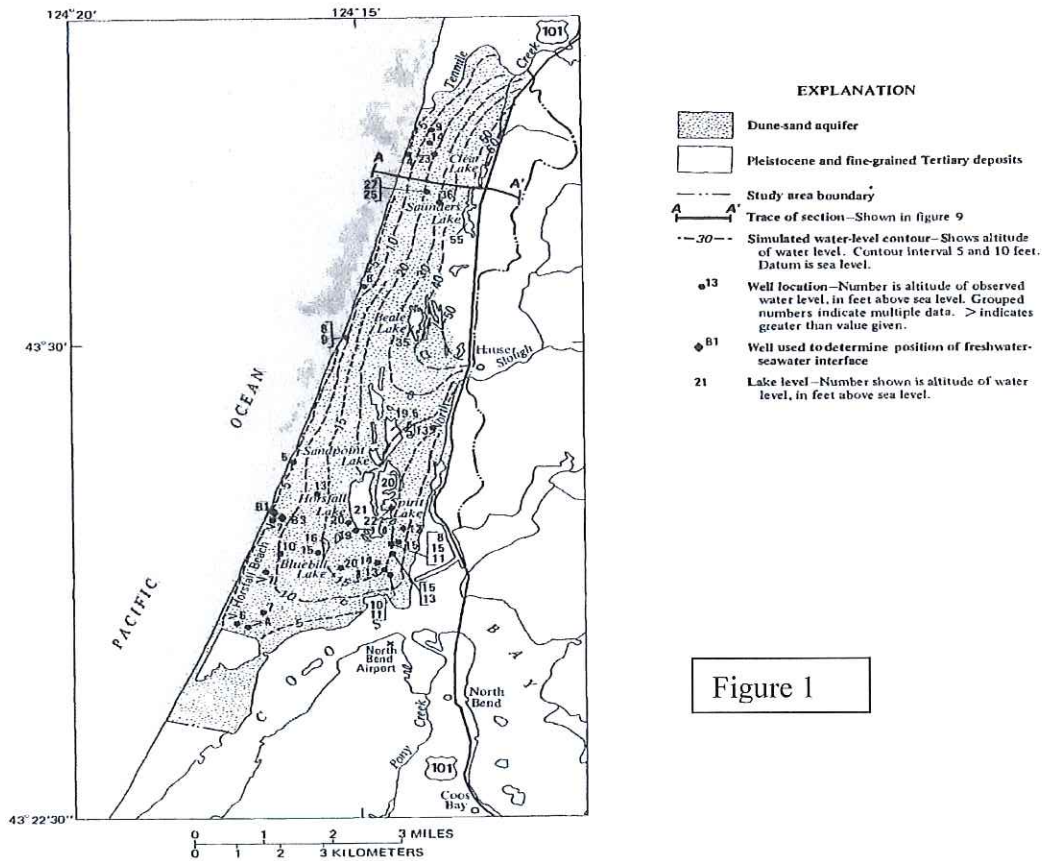


Figure 21.--Average observed water levels in wells and lakes, and contours of the simulated water levels in the upper layer of the model in the dune aquifer for the 1984 water year.

For these and other reasons articulated by various parties familiar with the issues, I urge the County to deny these applications.

Sincerely,

*Christine M. Moffitt*

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