Sand Lake Restoration Project

Removal of an Invasive Northern Pike Population through the Application of Rotenone

Final Environmental Assessment

Alaska Department of Fish and Game
Division of Sport Fish

333 Raspberry Road
Anchorage, AK 99518

Principal Investigators:

Kristine Dunker	kristine.dunker@alaska.gov	267-2889
Dan Bosch	daniel.bosch@alaska.gov	267-2153
Chuck Brazil	charles.brazil@alaska.gov	267-2186
Matt Miller	matthew.miller@alaska.gov	267-2415
Robert Massengill	robert.massengill@alaska.gov	260-2928

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OFAPPENDICES

June 5, 2009

TO: United State Fish and Wildlife Service (USF&WS)

Sand Lake is an approximately 73.5 surface-acre natural lake located in South Anchorage. The Alaska Department of Fish and Game (ADF&G) has developed a draft Environmental Assessment (EA) that proposes applying rotenone to eradicate the illegally-introduced northern pike population in Sand Lake. The northern pike population threatens ADF&G's sport fish stocking program in the lake. In addition, Sand Lake is located within a half mile of Jewel and Sundi Lakes which currently do not contain northern pike. A primary goal of this project is to prevent the spread of northern pike to these and other water bodies in the Anchorage area.

In 2007, residents of Sand Lake contacted ADF&G to remove the northern pike population. They cited concerns for the rainbow trout population in the lake and declines in nesting success of resident waterfowl. With the local support and encouragement by Sand Lake residents for this endeavor, ADF&G is now moving ahead with plans to restore Sand Lake by removing the invasive northern pike. The objectives of this treatment are to completely remove the northern pike population and restock Sand Lake with rainbow trout and Arctic char. This will restore a popular angling opportunity for the public and help protect local fisheries in the Anchorage area. This EA is available online at:

http://www.sf.adfg.state.ak.us/Statewide/InvasiveSpecies/index.cfm/FA/rotenone.currentProjects

Please contact Kristine Dunker at (907) 267-2889 if you would like a copy or have questions. Please submit any comments related to this project to the address or email below by June 29, 2009.

Sand Lake Restoration Project: Environmental Assessment
Alaska Department of Fish and Game
333 Raspberry Road
Anchorage, AK 99518
or email at: kristine.dunker@alaska.gov

Sincerely,

Kristine Dunker - Fisheries Biologist

ALASKA DEPARTMENT OF FISH AND GAME
SPORT FISH DIVISION

Environmental assessment of the proposed rotenone treatment in Sand Lake

PART I: PROPOSED ACTION DESCRIPTION

A. Type of Proposed Action: Remove invasive northern pike that threaten the stocked rainbow trout and Arctic char fisheries in Sand Lake, Anchorage, Alaska. This effort will require the use of rotenone. Once all invasive northern pike have been eradicated, the lake will be restocked with rainbow trout and Arctic char. Removing the invasive pike will also reduce the threat that pike will be introduced into nearby Jewel and Sundi Lakes and other Anchorage water bodies (Appendix 1).

B**. Agency Authority for the Proposed Action**: By consent of the Board of Fisheries, the Alaska Department of Fish and Game is authorized to perform such acts per Alaska Statute (AS 16.35.200).

C. Estimated Commencement Date: October 2009

D. Name and Location of the Project: Sand Lake Restoration Project - Removal of an Invasive Northern Pike Population through the Application of Rotenone.

Sand Lake is located in T12N R4W Sec. 3 just west of Sand Lake Park and Jewel Lake Road in south Anchorage. It is a natural lake (Figures 1-3). The land ownership surrounding Sand Lake is primarily private with the exception of Sand Lake Park which is owned by the Municipality of Anchorage. Sand Lake is located within an urban setting, and several neighborhoods are located within the vicinity of the Lake. Sundi, Jewel, and Campbell lakes are located within a mile of Sand Lake.

E. Project Size (acres affected)

1. Developed/residential- 0 acres
2. Industrial - 0 acres
3. Open space/Woodlands/Recreation – 0 acres
4. Wetlands/Riparian – Sand Lake is approximately 73.5 surface acres in size, has a maximum depth of about 39 feet and an approximate volume of 1,138 acre-feet. There is no natural surface outlet from this lake, but there is a storm drain that connects Sand Lake to Campbell Lake approximately one mile to the south (Figure 4).
5. Floodplain - 0 acres
6. Irrigated Cropland - 0 acres
7. Dry Cropland - 0 acres
8. Forestry- 0 acres
9. Rangeland - 0 acres

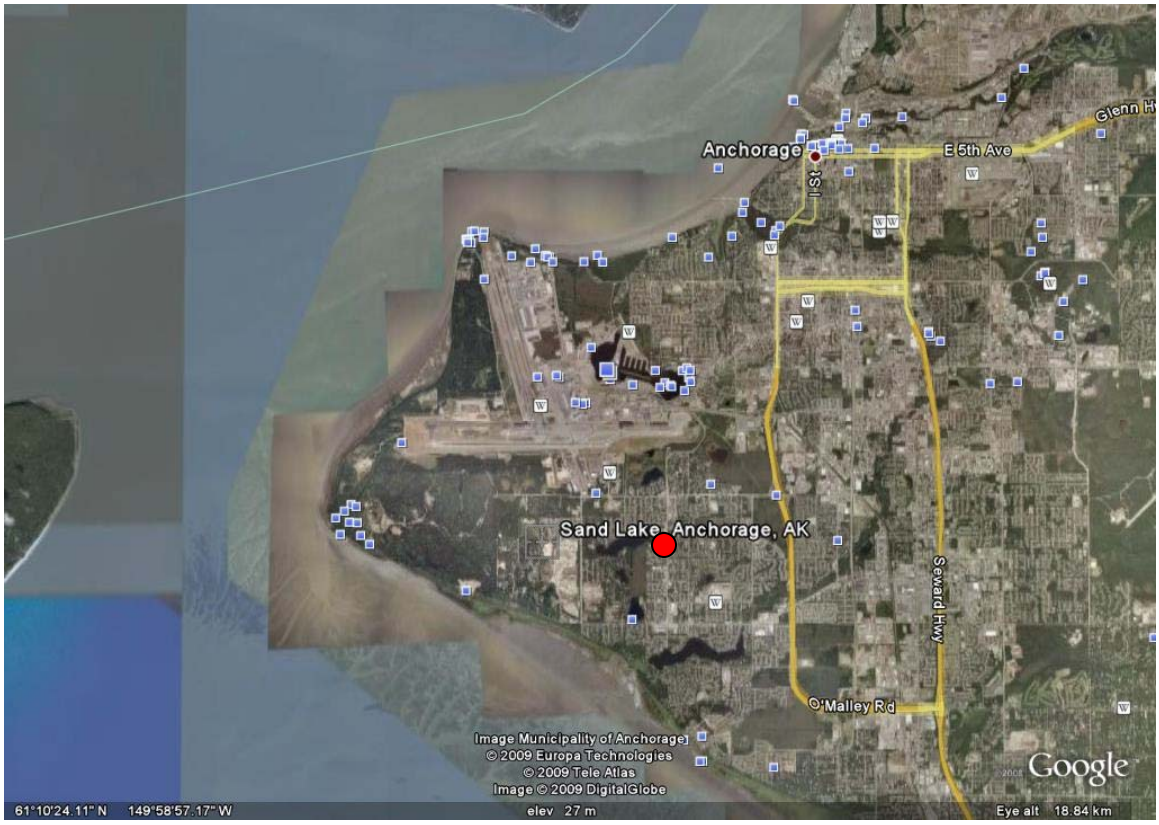
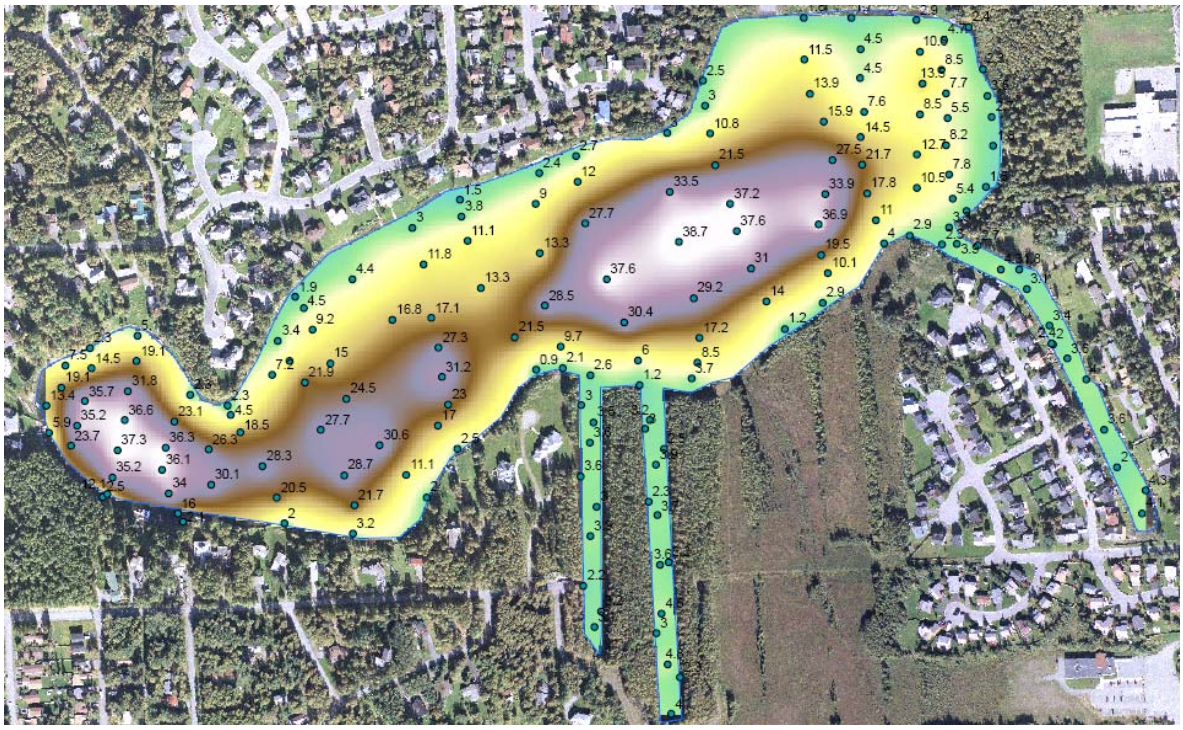


Figure 1. Location of Sand Lake in Anchorage, Alaska

Figure 2. Aerial photograph of Sand Lake



Elevation: 100'
Shoreline Length: 2.2 mi
Volume: 1,138 Acre Ft.
Mean Depth: 11.9'
Surface Acres: 73.5 Acres
Maximum Depth: 38.7'
ADF&G Management Area: Anchorage

Figure 3. Bathymetric map of Sand Lake

Figure 4a. Storm drain connecting Sand Lake to Campbell Creek.

Figure 4b. Outflow of the storm drain before in enters Campbell Lake.

F. Summary and Purpose of the Proposed Action

Background

Northern pike (*Esox lucius*) are native to most of Alaska, but they do not naturally occur in Southcentral (Morrow 1980; Figure 5). Where northern pike are native, they are a valuable sport and subsistence fish. However, outside of their native range, northern pike are an invasive species capable of causing tremendous ecological and economic damage (Management Plan for Invasive Northern Pike in Alaska available online at http://www.sf.adfg.state.ak.us/Static/invasive_species/PDFs/pike_management_plan.pdf). Pike are highly piscivorous and can deplete populations of rearing salmonids (Rutz 1996 and 1999). The presence of northern pike in Anchorage lakes is the result of illegal introductions, and the impacts from these introduced predators on local fisheries have, in some cases, been severe. Northern pike were illegally introduced into Sand Lake in Anchorage in the 1990s, and their presence currently threatens the status of the Alaska Department of Fish and Game's (ADF&G) stocking program in the lake.

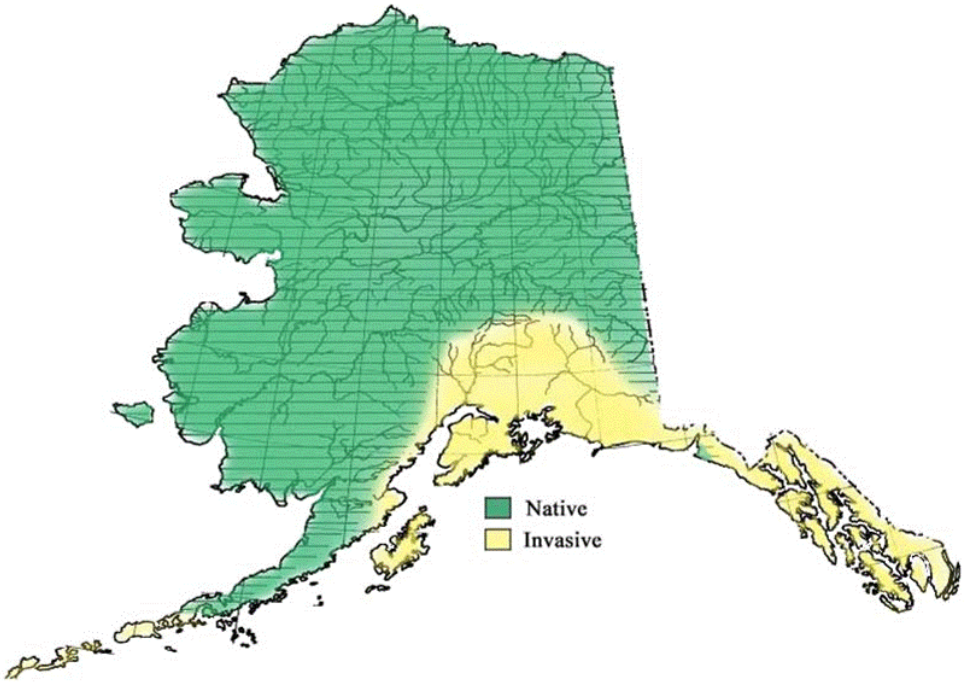


Figure 5. Map illustrating the native and invasive range of northern pike in Alaska.

Sand Lake is an approximately 73.5-acre natural lake located in south Anchorage (Figures 1 and 2). ADF&G began stocking Sand Lake with rainbow trout (*Oncorhynchus mykiss)* in 1975. In 1986, ADF&G began stocking landlocked Chinook salmon (*Oncorhynchus tshawytscha*), and in 2002, began stocking Arctic char (*Salvelinus alpinus*). Lake trout (*Salvelinus namaycush*) were also stocked in 1999 and 2001 (Miller and Bosch 2004). In 1994, an introduced population of northern pike (*Esox lucius*) was discovered in the lake (Stratton and Cyr 1995). ADF&G continued to stock the lake believing the lake's depth would allow the stocked fish to coexist with the

pike. In the last few years, however, ADF&G has been forced to reduce its stocking effort in the lake because of the invasive pike population. Rainbow trout and Arctic char are currently the only species stocked, and the numbers stocked are lower to avoid wasting valuable hatchery fish as prey for pike. Residents around the lake have reported that they are unable to catch the rainbow trout ADF&G stocks, and they attribute this to predation by the northern pike. Residents have also observed a reduction in nesting success and waterfowl usage of the lake that coincides with the establishment of the northern pike population. The ADF&G Division of Sport Fish recognizes the threat that this invasive species poses to the recreational fisheries and habitat quality of Sand Lake and would like to increase the stocking program in the lake. For this to occur, the invasive northern pike population needs to be removed.

Aside from the detrimental effect the presence of pike have on the recreational fishing opportunities in Sand Lake, their presence raises other issues. Sand Lake is connected to Campbell Creek via a storm drain (Figure 4). Campbell Creek supports runs of wild salmon and resident species such as rainbow trout and Dolly Varden (*Salvelinus malma*). The presence of pike in Sand Lake increases the possibility that, through a variety of potential vectors, pike could move into Campbell Creek. Pike have recently been confirmed in Campbell Lake and may already be occupying the lower reaches of Campbell Creek. Assessment and renovation concepts are currently being considered for this system with the ultimate goal of removing the invasive pike population. The success of those future efforts would be jeopardized if pike from Sand Lake were to be transported into the Campbell Creek system after renovation efforts take place there. For this reason, it is essential to remove northern pike from Sand Lake before restoration efforts begin in Campbell Lake.

ADF&G has a legal responsibility to protect and improve Alaska's recreational fisheries resources. The Sport Fish Division Strategic Plan directs the Division to protect Alaska's aquatic habitats from aquatic nuisance species (ANS) (ADF&G 2003). The state has an aquatic nuisance species management plan (ADF&G 2002) which also directs the Division to eradiate ANS quickly with as few environmental impacts as possible. Finally, the Management Plan for Invasive Northern Pike in Alaska (ADF&G 2007) outlines the process for planning and implementing northern pike eradication efforts. Specifically, this process includes detecting populations of invasive pike, assessing habitat characteristics, proposing management alternatives, communicating with the public about control plans, implementing the chosen management action, and evaluating the success of the action.

Several actions have been implemented in an attempt to control the pike in local lakes. Outreach efforts including public service announcements, public presentations, publications, classroom education, educational DVDs, and an ADF&G pike webpage were all pursued means to educate the public on the threat of pike in Anchorage lakes. Management actions were taken to liberalize the bag limit and legal means and methods to encourage anglers to harvest more pike. There is currently no limit on the number of pike that can be harvested from Anchorage lakes, and multiple harvest methods are allowed. Liberalizing the regulations failed to eradicate pike because anglers typically harvest only a small portion of their catch (Jennings 2004).

In Cheney Lake in east Anchorage, Sport Fish Division biologists attempted to eliminate pike in the lake with gill nets and fyke nets. Over 170 pike were captured and removed,

but netting could not eradicate the entire population. Pike are ambush predators and are relatively inactive when not foraging (Mecklenburg 2002). Pike must be moving to encounter nets, and sedentary individuals are not captured. In addition, gillnetting for pike is labor intensive, and bycatch of waterfowl and other species is inevitable. While in some systems netting may be a tool for reducing the number of pike in a lake, netting is not an efficient method of pike eradication. To remove the entire northern pike population from Cheney Lake, ADF&G conducted a rotenone treatment in October of 2008. The success of that effort was evaluated during the spring of 2009. No northern pike were detected, and ADF&G restocked the lake with rainbow trout and threespine stickleback (*Gasterosteus aculeatus*). To continue removing invasive northern pike from Anchorage lakes and protect local fisheries, ADF&G is now proposing a treatment of rotenone to eradicate the pike from Sand Lake.

Purpose

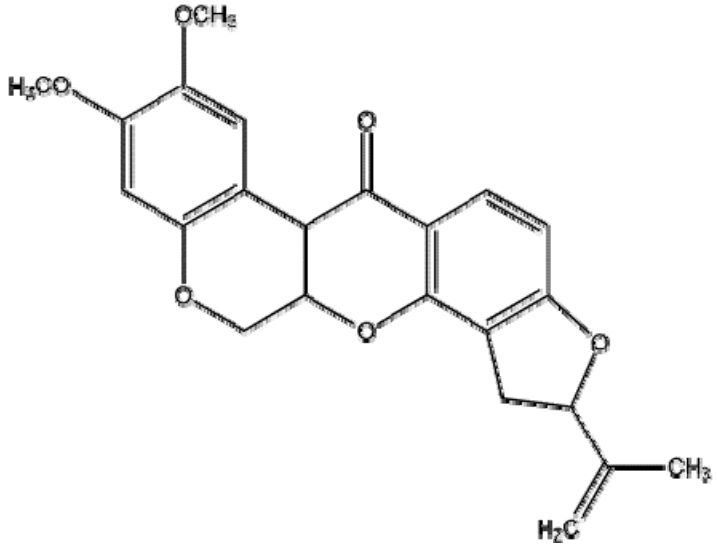
The purpose of this project is to eradicate an invasive, non-indigenous fish species (northern pike) from Sand Lake. This will alleviate the risk that these fish will be introduced into nearby water bodies and will allow ADF&G to restore and protect the sport fisheries in Sand Lake.

Objectives

- Remove all the invasive northern pike in Sand Lake using the piscicide CFT Legumine™ (5% liquid rotenone).

- Re-stock Sand Lake with hatchery-produced rainbow trout and Arctic char to provide recreational fishing opportunity.

Description of Rotenone



Molecular Structure of Rotenone

Rotenone is a naturally occurring chemical substance derived from the roots of tropical legumes such as jewel vine *(Derris* spp.) and lacepod *(Lonchocarpus* spp.) (Ling 2003). Native people throughout Australia, Oceania, Southern Asia and South America have utilized rotenone for centuries to capture fish for food in areas where these plants naturally occur (Quigley 1956, Bearez 1998, Robertson and Smith-Vaniz 2008). Rotenone has been used as a piscicide, a fish-killing agent, in the United States and elsewhere since the 1930s (Finlayson et al. 2000) and is currently registered by the EPA as a restricted-use pesticide for fish research and management activities (USEPA 2007).

Rotenone acts by inhibiting oxygen transfer at the cellular level. The biochemical process affected by rotenone takes place within the cell mitochondria and involves blocking electron transport by inhibiting NADH-ubiquinone reductase, resulting in the uncoupling of the metabolic pathway oxidative phosphorylation (Singer and Ramsay 1994, USEPA 2007). Fish mortality results from tissue anoxia caused by cardiac and neurological failure (Ling 2003). Rotenone is effective at low concentrations with fish because it is readily absorbed into the bloodstream through the thin cell layer of the gills. Mammals and other non-gill breathing animals do not have this rapid absorption route into the bloodstream and can tolerate exposure to concentrations much higher than those used to kill fish. Therefore, non-target organisms that do not have gills are not negatively affected at piscicidal concentrations (Finlayson 2000, Ling 2003, NPS 2006, USEPA 2007, MFW&P 2008).

Proposed Activities

The entire rotenone treatment for this project will occur within the boundaries of Sand Lake. The waters will be treated with CFT Legumine™ 5% liquid rotenone. CFT Legumine™ is a relatively new rotenone formulation. Although it has been used in

Europe for over a decade, CFT Legumine™ has recently been used successfully in the United States in large-scale rotenone treatments such as Lake Davis in California (CDF&G 2007). Here in Alaska, it was used successfully to remove populations of northern pike from Arc Lake in Soldotna and Cheney Lake in Anchorage in 2008.

For the Sand Lake treatment, it is anticipated that the label recommendations for "normal pond use" will be adequate to eradicate the northern pike. The estimated concentration of CFT Legumine™ formulation to be used in the Sand Lake treatment is approximately 1 ppm (0.05 ppm of active rotenone) or about 1 mg of CFT per liter of water. On-site assays using caged rainbow trout or coho salmon as sentinel fish will confirm that this concentration is sufficient to cause fish mortality in the lake. For invasive fish eradication projects, the target species is never used as the sentinel fish. This is a standard precaution to ensure that the invasive fish species is not accidentally re-introduced into the project area.

The preferred timing of the treatment will be during the first or second week of October 2009, just before the lake freezes. Rotenone naturally degrades with light and temperature (USEPA 2007). Therefore, cold water application of rotenone will enhance the active life of the chemical and ensure a longer exposure time during a period when dissolved oxygen levels naturally decrease, and freezing of the lake surface limits the accessibility of lake water to non-target species. The persistence of CFT Legumine™ under the ice in the lake will likely last through the winter as observed in Cheney and Arc Lakes during the winter of 2008-09. Standard protocol will be followed for rotenone treated waters, and signs will be posted to warn people not to drink or swim until the rotenone thoroughly mixes through the water column (at least 24 hours after treatment). These signs will remain in place until the rotenone naturally degrades and sentinel fish survive.

All materials and equipment necessary for this project will be transported by truck to the lake. ADF&G staff trained in rotenone application and certified as Alaska Department of Environmental Conservation (ADEC) pesticide applicators will supervise all aspects of the project and treatment. Project personnel will ensure that the rotenone and application equipment are secured. If the preferred project schedule is achieved, the rotenone will be dispersed in the lake with two motorboats via submerged venturi pumps and weighted hoses for applying rotenone to the deep areas of the lakes. The prop wash from the outboard motors will assist in mixing the rotenone through the water, and caged sentinel fish will be used to ensure the rotenone is thoroughly mixing through the water column. After the treatment, caged sentinel fish will be used to evaluate when the waters detoxify. The rotenone label specifies that once caged fish survive 24 hours in treated water, it is considered detoxified and is safe for restocking.

Dead fish that surface will be collected daily by ADF&G staff until the lake freezes. These fish will be disposed of at the Anchorage Landfill or used for Sport Fish Division education programs. Up to 70% of the pike killed during the rotenone treatment can be expected to immediately sink to the bottom of Sand Lake (Bradbury 1986). During ADF&G's 2008 rotenone treatments, all dead pike sank. Dead fish stimulate plankton growth and aid in the recovery of zooplankton and aquatic insect populations (UDWR 2007). Gill net and hook and line sampling will begin shortly after treatment to

determine the effectiveness of the rotenone treatment, and if no pike are found, the lake will be sampled again with gill nets in the spring of 2010 to confirm eradication. In order to ensure compliance with the Migratory Bird Treaty Act, gill nets will be monitored frequently to minimize the potential for the unauthorized "take" of loons and other birds that might become entangled in the nets. If any live northern pike are sampled, a second rotenone treatment will be required to achieve the desired project objectives. If necessary, this second rotenone treatment would be planned for the fall of 2010.

Monitoring will be a major component of this management activity. Baseline data on the water chemistry (temperature, dissolved oxygen, pH, specific conductance and nutrients) and dominant macro-invertebrate taxa will be collected during the summer prior to the rotenone treatment. Water chemistry parameters and dominant macro-invertebrate presence will also be monitored during the summer of 2010 to confirm that the lake has recovered to pre-treatment conditions. Water samples from Sand Lake will be collected monthly following the treatment until all rotenone has dissipated. These samples will be analyzed by the Washington Department of Agriculture for rotenone composition to measure the rate of degradation in the lake. Though rotenone is known to naturally break down in aquatic systems (Finlayson 2000), until recently, there were no data on the persistence of CFT Legumine™ components in Alaskan waters. The 2008 rotenone treatments for pike eradication provided useful insight for predicting the persistence of rotenone in Sand Lake. As previously mentioned, rotenone persisted under the ice through the majority of the winter in Cheney Lake in Anchorage, but was undetectable by mid-March. In Arc Lake near Soldotna, the rotenone persisted longer, and did not entirely detoxify until early June of 2009. If rotenone persists in Sand Lake throughout the winter as was observed in Arc Lake, it is anticipated that it will quickly break down by June 2010, after the lake thaws, and the water warms. Pending results from the chemical analysis of the lake water and confirmation that all northern pike have been eradicated, Sand Lake could be restocked with rainbow trout and Arctic char during the summer of 2010.

Funding

This proposed action would be partially federally funded through allocations to ADF&G from the U.S. Fish and Wildlife Service Aquatic Nuisance Species Program and a National Invasive Species Act grant from the National Oceanic and Atmospheric Administration. ADF&G Region II personnel will provide all manpower required to complete the project.

PART II. ENVIRONMENTAL REVIEW

A. NATURAL ENVIRONMENT

Table 1. Impacts to land resources.

1. Land Resources Will the proposed action result in:	Impact Unknown	None	Minor	Potentially significant	Can impact be mitigated
a. Soil instability or changes in geologic substructure?		**X**			
b. Disruption, displacement, erosion, compaction, moisture loss, or over-covering of soil which would reduce productivity or fertility?		**X**			
c. Destruction, covering or modification of any and unique geologic or physical features?		**X**			
d. Changes in siltation, deposition or erosion patterns that may modify the channel of a river or stream or the bed or shore of a lake?		**X**			
e. Exposure of people or property to earthquakes, landslides, ground failure, or other natural hazard?		**X**			

Table 2. Impacts to water.

2. Water Will the proposed action result in:	Impact Unknown	None	Minor	Potentially significant	Can impact be mitigated
a. Discharge into surface water or any alteration of surface water quality including but not limited to temperature, dissolved oxygen or turbidity?			**X**		**2a**
b. Changes in drainage patterns or rate and amount of surface runoff?		**X**			
c. Alteration of the course or magnitude of flood water or other flows?		**X**			
d. Changes in the amount of surface water in any water body or creation of a new water body?		**X**			
e. Exposure of people or property to water related hazards such as flooding?		**X**			
f. Changes in the quality of groundwater?		**X**			**2f**
g. Changes in the quantity of groundwater?		**X**			
h. Increase in risk of contamination of surface or groundwater?			**X**		**see 2a,f**
i. Effects on any existing water right or reservation?		**X**			
j. Effects on other water users as a result of any alteration in surface or groundwater quality?		**X**			
k. Effects on other users as a result of any alteration in surface or groundwater quality?		**X**			
l. Will the project affect a designated floodplain?		**X**			
m. Will the project result in any discharge that will affect federal or state water quality regulations? (Also see 2a)?			**X**		**2m**

Comment 2a. This project will introduce a pisicide to surface water to kill invasive, non-indigenous fish. It is anticipated the impacts will be short-term. CFT Legumine™ (5% liquid) is an EPA-registered restricted-use pesticide and is safe to use to eradicate invasive fish when applied according to label instructions. The proposed concentration of CFT Legumine™ is 1 ppm, but this may be adjusted within the product label's guidelines based upon the results of on-site bioassays. Under open-water conditions, CFT Legumine™ will be pumped into the lake from two boats, and backpack sprayers will be used to treat shallow areas with thick, emergent vegetation in the lake.

CFT Legumine™ is a mixture of rotenone and other organic compounds that facilitate the emulsification and dispersion of rotenone in water. CFT Legumine™ was analyzed by the California Fish and Game Department in 2007 (Fisher 2007). This analysis showed that the primary ingredients are diethylene glycol ethyl ether (DGEE) (61.1%), Fennedefo 99™ (17.1%), N-methyl pyrrolidone (9.8%), rotenone (5.12%) and rotenolone (0.72%).

Fennedefo 99™ is primarily a fatty acid mixture and is used with rotenone as an emulsifying agent. DGEE and N-methyl pyrrolidone are solvents. Both solvents have low toxicity and are not known to persist in the aquatic environment because they degrade naturally via biodegradation within less than a month (TOXNET website http://toxnet.nlm.nih.gov/). Other compounds detected in CFT Legumine™ included benzene-based compounds, various ethylene glycol-based compounds, hexanol and naphthalene, but these trace compounds are measured in parts per trillions and are less than those allowed in drinking water standards. In piscidal concentrations, none of the constituents in CFT Legumine™ pose health risks for humans, other mammals, or birds. Gleason et al. 1969 estimated that a single lethal dose of liquid rotenone to humans is between 300-500 mg of rotenone per 2.2 pounds of body weight. Therefore, a 160-pound person would have to drink over 23,000 gallons of water at one time treated at the highest concentration of rotenone allowed under the product label instructions to receive a lethal dose (Finlayson et al. 2000).

The degradation of rotenone results in at least twenty different degradation products of which only one is toxic (rotenolone) (Cheng et al. 1972). Rotenolone is approximately an order of magnitude less toxic than rotenone (Finlayson 2000). The ultimate breakdown products of rotenone are carbon dioxide and water (http://www.prentiss.com/Products/fishman.htm.)

There are three ways in which rotenone can be detoxified once applied: by dilution, oxidation, or natural degradation. The first detoxification method involves basic dilution by freshwater. This may be accomplished by fresh groundwater or surface water flowing into the lake. The second method of detoxification involves the application of an oxidizing agent such as potassium permanganate. This dry crystalline substance is mixed with lake water to produce a concentration of liquid sufficient to detoxify the concentration of rotenone applied. Detoxification is typically accomplished after about 15-30 minutes of mixing between the two compounds (CWE Properties Ltd, 2004).

The third and most common method is to allow the rotenone to naturally breakdown.

Rotenone is a compound that is susceptible to natural detoxification through a variety of mechanisms such as water chemistry, water temperature, organic load, and exposure to oxygen and sunlight (Ware 2002; ODFW 2008; Loeb and Engstrom-Heg 1970; Engstrom-Heg 1972; Gilderhus et a1. 1986). Rotenone persistence studies have found that in cold water (32°- to 46° Fahrenheit), the half-life of rotenone ranges from 3.5- to 5.2 days (Gilderhus et al. 1986 and Dawson et al. 1991), although the EPA reports that rotenone has a half-life of 20 days in cold water (USEPA 2007). In 46°-water, it has been demonstrated that decreases in mortality rate corresponded with degrading concentrations of rotenone such that rotenone concentrations are no longer lethal to test fish within 18 days after treatment (Gilderhus et al. 1986). However, an under-the-ice application of rotenone conducted in Minnesota showed that target level concentrations of rotenone were sustained over a month until snowmelt allowed sunlight penetration to cause it to breakdown by ice-out (Bandow 1989). Under optimal conditions (low light, low temperature and low organic content) rotenone can persist for months under the ice at levels lethal to fish, as was observed in Arc Lake in Soldotna and Cheney Lake in Anchorage during the winter of 2008-09. Rotenone applied to Arc Lake in October of 2008 did not entirely degrade until early June 2009. The rotenone in Cheney Lake was undetectable by mid-March. Cheney Lake was more eutrophic than Arc Lake and had natural springs which increased the dilution of the rotenone and likely allowed it to degrade quicker. The water in Arc Lake also had lower alkalinity and pH which is known to slow the rate of rotenone degradation (Brian Finlayson, CDF&G, personal communication). The prolonged persistence of rotenone in both lakes allowed the rotenone to remain active throughout the winter and ensure entire eradication of the pike populations. If rotenone were to persist beneath the ice in Sand Lake as was observed during the 2008 rotenone treatments, this would, again, increase the likelihood of removing all of the pike in a single treatment. Once the lake thaws, is exposed to sunlight, and the water warms, any remaining rotenone will naturally detoxify. Sand Lake is more oligotrophic than Cheney Lake, so the rotenone won't bind as heavily with organics in the water. However, similar to Cheney Lake, there is groundwater upwelling into the lake along the north and west shorelines from a shallow underlying aquifer (Scott Wheaton, Municipal Hydrologist, personal communication). This constant freshwater input will also help dilute the rotenone beneath the ice. The preferred detoxification method for any rotenone treatment, including Sand Lake, is to allow the rotenone to degrade naturally over time. As suggested through various studies, degradation times vary under different conditions, but even if the rotenone persists during winter beneath the ice, all rotenone in Sand Lake should be detoxified shortly after ice out in 2010.

Another issue being considered is the storm drain that connects Sand Lake to Campbell Lake (Figure 4). Discharge rates from Sand Lake through the pipe that empties in the storm drain and eventually into Campbell Lake are weather-dependent. During dry periods, there is negligible discharge. However, following a rainstorm, the discharge rates will increase depending on the level of the lake. Rain events are common in Anchorage during the fall. Average October precipitation is 2.09 inches. The risk of rotenone-treated water entering Campbell Lake at a concentration detrimental to fish, however, is minimal. Rotenone is already diluted when applied to the lake. If a rain event occurred and rotenone-treated water entered the storm drain, the rotenone would further dilute from both the rain and the other storm water flushing through that system. Once this water reaches Campbell Lake, it would be further diluted by the lake water and

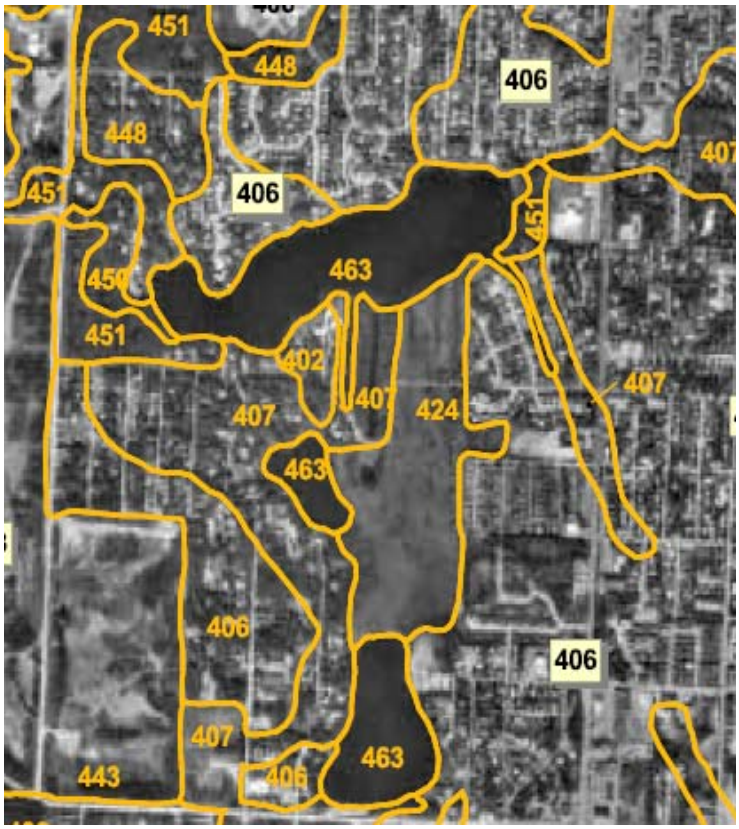
would no longer persist at a concentration dangerous to fish or aquatic invertebrates. As an added precaution during treatment, caged sentinel fish will be placed at the outflow of the storm drain pipe in Campbell Lake. This cage will be monitored by ADF&G personnel during treatment to ensure there is no rotenone- treated water entering the lake and affecting the sentinel fish. If sentinel fish do respond, project personnel will contact the Municipality of Anchorage to install an airbladder in the storm drain to temporarily block rotenone-treated water from passing through. Project personnel at the lake would then install a drip station containing potassium permanganate ($KMnO_4$) to neutralize the rotenone before it enters the storm drain so the air bladder can be removed. A similar plan was in place during the rotenone treatment of Cheney Lake (ADF&G 2008). Similar to the storm drain connection between Sand Lake and Campbell Creek, Cheney Lake was connected via a storm drain to Chester Creek. Emergency protocols were developed to alert the municipality to install the air bladder into the storm drain if needed, and neutralization plans were also formulated. Sentinel fish at the outlet of the storm drain in Chester Creek were monitored daily after the rotenone treatment for 1.5 months, and all test fish survived the entire monitoring period. Though the back-up protocols were in place, they were not needed because rotenone did not enter Chester Creek at a level detrimental to aquatic organisms. This will likely be the case again this year in Campbell Lake, but to be sure rotenone does not accidentally seep out of Sand Lake through the storm drain and into Campbell Lake, sentinel fish will again be monitored after treatment, and emergency response protocols will again be in place.

Following the rotenone treatment, there could be a substantial quantity of dead fish carcasses. Bradbury (1986) reported that approximately 70% of rotenone-killed fish in Washington lakes immediately sink. Parker (1970) reported that at water temperatures of 40° Fahrenheit and cooler, dead fish required 20-41 days to surface. The most important factors inhibiting fish from ever surfacing are cooler water (< 50 °Fahrenheit) and deep water (> 15 feet). Sand Lake has a maximum depth of 39 feet, and the desired treatment period (Oct-May) would likely result in water in the 32-45 °Fahrenheit range and potentially result in few recoverable fish. This was the result in Arc in Cheney Lakes, where all dead fish sank after the rotenone treatments.

Bradbury (1986) also reported that 9 of 11 water bodies in Washington treated with rotenone experienced an algae bloom shortly after treatment. This occurred from the input of phosphorus to the water as fish decayed. Bradbury further noted that approximately 70% of the phosphorus content in the dead fish would be released into the lake through bacterial decay. This stimulates phytoplankton production which in turn increases zooplankton production, providing prey for macro-invertebrates and fish. This change in water chemistry is viewed as a benefit to stimulate plankton growth (UDWR 2007). Nonetheless, ADF&G personnel will recover and dispose of all surfacing dead fish on regular intervals until ice-up, then again following ice-out until no dead fish are observed.

Comment 2f: No contamination of groundwater is anticipated to result from this rotenone treatment. Rotenone binds readily to sediments and is broken down in soil and in water through the processes of hydrolysis, photolysis, and biodegradation (Skaar 2001; Engstrom-Heg 1971, 1976; Ware 2002). The primary soil types in the Sand Lake area consists of cryorthents and urban land, Clam Gulch silt loam, Icknuun peat, and Smithfha loamy very fine sand (Figure 6; USDA Anchorage Soil Survey). An additional layer of organic muck and detritus overlies the soils within the lake. There are a series of shallow aquifers below the ground surface that provides water for the Sand-Sundi-Jewel Lake complex (Roy Ireland, DNR, personal communication). Movement of water in the shallow aquifers is primarily upward into the lake. General lateral groundwater movement within these aquifers in the Sand Lake area is from the northwest to the southeast (Scott Wheaton, Municipal Hydrologist, personal communication). A clay confining layer exists below the shallow aquifers to over 100 feet below the surface. There are several private wells in the Sand Lake area. According to DNR records, most known well depths are greater than 150-250 feet and well below the clay confining layer. This deep aquifer is not recharged by the lake complex. Rather, it is replenished by runoff in the Chugach Mountain Range with an estimated travel time of ten years.

Even though wells in the Sand Lake area are not dug into the unconfined shallow aquifers, research has documented that rotenone can only penetrate a maximum of three inches in sandy soils (Hisata 2002) and does not affect groundwater. Studies indicate that the other compounds in liquid rotenone formulations have not been detected at harmful levels in groundwater associated with rotenone application (Finlayson et al. 2000, Ridley et al. 2006, Fisher 2007), and case studies in Montana have concluded that rotenone movement through groundwater does not occur (MFWP, 2008). Generally, if there is sufficient sediment to support macrophyte growth, there is enough sediment to absorb rotenone and block any penetration into ground water. Because water leaving Sand Lake must travel through lake sediments, muck, and soil, and rotenone is known to bind readily with these substances, no exposure to ground or well water is anticipated.



#406 and 407 – Cryorthents and urban land

#402 – Clam Gulch silt loan

#423 – Icknuun peat

#450 – Smithfha loamy very fine sand

#451 – Smithfha-Anchorpark complex

#463 – Water

Figure 6. Soils map of the Sand Lake region (Anchorage Soil Survey).

Comment 2m: The treatment will occur within Sand Lake. ADF&G submitted a pesticide-use permit application to the Alaska Department of Environmental Conservation (ADEC). The application was approved, and the permit was issued on August 3, 2009.

Table 3. Impacts to air.

3. Air Will the proposed action result in:	Impact Unknown	None	Minor	Potentially significant	Can impact be mitigated
a. Emission of air pollutants or deterioration of ambient air quality? (Also see 13 c)			**X**		**3a**
b. Creation of objectionable odors?			**X**		**3b**
c. Alteration of air movement, moisture, or temperature patterns or any change in climate, either locally or regionally?		**X**			
d. Adverse effects on vegetation, including crops, due to increase emissions of pollutants?		**X**			
e. Will the project result in any discharge which will conflict with federal or sate air quality regulations?		**X**			

Comment 3a: Emissions from outboard motors could be produced but are expected to dissipate rapidly. Four-stroke motors will be used for the Sand Lake treatment, so any emissions or odors will be minor.

Comment 3b: Other powder and liquid rotenone formulations are known to cause odors during treatment. However, CFT Legumine™ was formulated to remove the hydrocarbon solvents that are present and responsible for these odors in other rotenone formulations. Prentiss Corporation, which manufactures CFT Legumine™, lists it as "virtually odor-free". Therefore, any odors associated with the rotenone treatment in Sand Lake should be short term and minor.

The dead northern pike carcasses that will result from this project may cause objectionable odors. Collecting and/or sinking of dead fish in the lake will help mitigate this, making the impacts from these odors short-term and minor as well.

Table 4. Impacts to vegetation.

4. Vegetation Will the proposed action result in:	Impact Unknown	None	Minor	Potentially significant	Can impact be mitigated
a. Changes in the diversity, productivity or abundance of plant species (including trees, shrubs, grass, crops and aquatic plants)?		**X**			**4a**
b. Alteration of a plant community?		**X**			
c. Adverse effects on any unique, rare, threatened, or endangered species?		**X**			
d. Reduction in acreage or productivity of any agricultural land?		**X**			
e. Establishment of spread of noxious weeds?		**X**			
f. Will the project affect wetlands, or prime and unique farmland?		**X**			

Comment 4a: The application boats will be launched from a private, concrete boat launch. The treatment, itself, will be staged from the public access area off 80th avenue which is primarily a dirt access point without grass or other vegetation. There will be no impact to vegetation from staging the application in this area. However, treating littoral areas of the lake with emergent vegetation with back pack sprayers will require project personnel to walk through and temporarily flatten some plants. However, no direct, immediate, or long-term impacts to vegetation are anticipated from the treatment, itself, because rotenone does not negatively affect plants.

Table 5. Impacts to fish and wildlife.

5. Fish/Wildlife Will the proposed action result in:	Impact Unknown	None	Minor	Potentially significant	Can impact be mitigated
a. Deterioration of critical fish or wildlife habitat?		**X**			
b. Changes in the diversity or abundance of game animals or bird species?			**X**		**5b**
c. Changes in diversity or abundance of nongame species?			**X**		**5c**
d. Introduction of new species into an area?		**X**			
e. Creation of a barrier to the migration or movement of animals?		**X**			
f. Adverse effects on any unique, rare, threatened, or endangered species?		**X**			
g. Increase in conditions that stress wildlife populations or limit abundance (including harassment, legal or illegal harvest or other human activity)?			**X**		**See 5b,c**
h. Will the project be performed in any area in which T & E species are present, and will the project affect any T & E species on their habitat? (Also 5f)		**X**			
i. Will the project introduce or export any species not presently or historically occurring in the receiving location? (Also see 5d)		**X**			

Comment 5b:

Fish: This project is designed to kill non-indigenous invasive fish. Other than northern pike, the only other fish species in Sand Lake are the three-spine stickleback, introduced Alaska blackfish *(Dallia pectoralis),* and ADF&G-stocked game fish (i.e. rainbow trout, Arctic char, and potentially lake trout). Sticklebacks tend to be more resilient to rotenone and often survived treatments in Alaska during the 1960s and 1970s. However, sticklebacks were entirely removed from Cheney Lake in Anchorage following the 2008 rotenone treatment. In the spring of 2009, ADF&G personnel in cooperation with graduate students and faculty from the University of Alaska Anchorage and Stoneybrook University in New York reintroduced sticklebacks into Cheney Lake. Following the Sand Lake rotenone treatment, if sticklebacks are entirely

removed, ADF&G will apply for a fish transport permit to reintroduce them from another nearby lake or Campbell Creek. This would assist in providing a food source for waterfowl when they return to the lake in the spring of 2010. Alaska blackfish are not native to Anchorage lakes. Their eradication in Sand Lake is not a concern, although some may survive as they did in Cheney Lake. Currently, ADF&G has an emergency order out liberalizing the bag limits of sport fish in Sand Lake (EO#2-R-2-29-08; issued on November 24, 2008). ADF&G encourages anglers to harvest the game fish out of the lake before the rotenone treatment so these fish can be used for food or donated to a local food bank. Before the rotenone application takes place, ADF&G personnel will extensively gillnet the lake in September to remove fish for donation to Beans Café in Anchorage.

Game Mammals: Sand Lake is located within an urban setting. Bears occasionally move into greenbelts and stream corridors in Anchorage, but they are a rare occurrence in the vicinity of Sand Lake. During the fall, when the Sand Lake treatment is planned, bears will be preparing for hibernation and are not expected to be in the vicinity. Following the rotenone treatment, daily monitoring of the lake to collect dead fish should limit fish carcasses from becoming an attractant to bears. This project should have no impact on bears in Anchorage.

Moose are frequently found throughout Anchorage. During the fall, they could be present near the lake. It is possible that these moose may stand in or ingest water from the lake during the period from application until the lake surfaces freezes over. EPA approved bioassays indicate that, at the proposed concentrations, rotenone will have no effect on mammals that are exposed to or drink the rotenone-treated water (Schnick 1974a, 1974b).

Migratory waterfowl: During the proposed treatment period, most waterfowl will have already migrated from the area. The remaining waterfowl that could be present during the proposed treatment may be disturbed by the treatment activities and temporarily leave the Sand Lake area, but the availability of other waters in close proximity to the project area should minimize any impacts. It is possible that birds may feed on rotenone-killed fish carcasses shortly after treatment. However, research has indicated it is not physiologically possible for birds to consume sufficient quantities of rotenone-killed fish to result in a lethal dose (Finlayson 2000 and USEPA 2007).

Other Birds: Birds common to the area that also could potentially consume dead fish include the bald eagle, common loon, red-necked grebe, mallard duck, American widgeon, red-breasted merganser, raven, and magpie. It is possible that some of these bird species could be present during treatment, come in contact with rotenone-treated water, drink rotenone-treated water, and/ or consume rotenone-killed fish. Efforts to remove rotenone-killed fish that surface would minimize any potential risks to these birds. However, at the concentrations necessary to kill fish, birds are not harmed even if they do consume rotenone-killed fish (Finlayson et al. 2000, Ling 2003, NPS 2006, USEPA 2007). During their re-registration process for rotenone, the EPA acknowledged that birds would have to eat tens of thousands of rotenone-killed fish to receive a lethal dose (Jarvin and Ankley 1999 cited in USEPA 2007). According to Finlayson et al (2000), the hazard associated with drinking water containing rotenone is very small for birds and mammals because of the low concentration of rotenone used during treatments and the natural degradation of rotenone in the environment. Long-term impacts from removing Sand Lake's northern pike population would not have significant impact on birds. Conversely, because northern pike have been known to opportunistically prey on waterfowl and their young, the eradication of these fish from the lake may actually benefit nesting success and avian populations in the area.

Comment 5c: Other non-game organisms that might be present during this project include zooplankton, aquatic insects, wood frogs, and small mammals such as muskrats.

Invertebrates: In general, studies report that with the exception of zooplankton, most aquatic invertebrates are less sensitive to rotenone treatment than fish (Schnick 1974b). However, Anderson (1970) reported that comparisons between samples of zooplankton taken before and after a rotenone treatment did not substantially change. One study reported that no long-term significant reduction in aquatic invertebrates was observed after a rotenone treatment which was applied at concentrations twice as high as those proposed for Sand Lake (Houf and Campbell 1977). In most cases, the reduction in aquatic invertebrate density is temporary (Schnick 1974b). In a study on the relative tolerance of aquatic invertebrates to rotenone, Engstrom-Heg et al. (1978) reported that the long-term impacts of rotenone are mitigated because those insects that were most sensitive to rotenone also tended to have the highest rate of re-colonization. Chandler and Marking (1982) found that clams and snails were between 50 and 150 times more tolerant than fish to rotenone.

Because of their short life cycles, good dispersal ability, and generally high reproductive potential (Anderson and Wallace 1984), aquatic invertebrates are capable of rapid recovery from disturbance (Jacobi and Deegan 1977; Boulton et al. 1992; Matthaei et al. 1996). Recolonization will include aerial dispersal of adult invertebrates (e.g. mayflies, caddisflies, dragonfly naiads) from nearby wetlands as well as Sundi and Jewel lakes. In the spring of 2009, dense populations of amphipods, dytsicid beetles and dragonfly naiads were observed in Cheney Lake after it had been treated with rotenone in the fall of 2008. Additionally, several live clams were also observed.

Amphibians: Wood Frogs are the only amphibians in the Anchorage area and are likely present in Sand Lake and nearby wetlands. Wood frogs mate in the spring, and their offspring develop rapidly during early summer. This northern adaptation helps ensure complete metamorphosis before fall freeze-up (ADF&G Wildlife Notebook Series: Frogs and Toads). Because adult frogs do not have gills, they are more resistant to the effects of rotenone than fish. Grisak et al. (2007) conducted laboratory studies on long-toed salamanders, Rocky Mountain tailed frogs, and Columbia spotted frogs and concluded that the adults of these species would not respond negatively to rotenone, but the larval and tadpole life stages could be affected by rotenone at piscicidal concentrations. These authors recommended implementing rotenone treatments at times when tadpoles were not present, such as in the early spring or later in the fall which aligns well with the timing of the proposed fall Sand Lake treatment.

Non-game mammals: Various mammals ranging in size from shrews to moose could be in the vicinity of Sand Lake and could scavenge on rotenone killed fish or drink treated lake water. The effects of rotenone on non-target organisms have been studied extensively. Mammals, in general, are not affected because enzymes in their stomachs neutralize rotenone (Finlayson 2000, AFS 2002, and USEPA 2007). Laboratory tests have been conducted in which rats and dogs have been fed forms of rotenone as part of their diet for periods of six months to two years (Marking 1988). Observed effects included diarrhea, decreased food consumption, and weight loss. Researchers reported that despite the unusually high treatment concentrations of rotenone fed to rats and dogs, the chemical did not cause tumors or reproductive problems in these mammals. CDFG (1994) studies on potential risks to terrestrial animals found that a 22-pound

dog would have to drink 7,915 gallons of lake water within 24 hours, or eat 660,000 pounds of rotenone-killed fish to receive a lethal dose. A half-pound mammal would need to consume 12.5 mg of pure rotenone to receive a lethal dose (Bradbury 1986) or drink an unlikely 66 gallons of water treated at 1 ppm, the planned concentration for Sand Lake.

It is important to note that nearly all of these examples involved subjecting laboratory specimens to unusually high concentrations of rotenone, or conducting tests on animals that would not be exposed to rotenone during normal use in fisheries management. Based on this information we would expect the impacts to non-target, non-gill breathing organisms to be non-existent.

B. HUMAN ENVIRONMENT

Table 6. Noise and electrical effects.

6. Noise/Electrical Effects Will the proposed action result in:	Impact Unknown	None	Minor	Potentially significant	Can impact be mitigated
a. Increase in existing noise levels?			**X**		**6a**
b. Exposure of people to severe or nuisance noise levels?		**X**			
c. Creation of electrostatic or electromagnetic effects that could be detrimental to human health or property		**X**			
d. Interference with radio or television reception and operation?		**X**			

Comment 6a: The only noise generated from this project would result from the use of outboard motors during application of the rotenone and collection of dead fish afterwards. The noise generated from these activities would be short-term and minor.

Table 7. Land use impacts.

7. Land Use Will the proposed action result in:	Impact Unknown	None	Minor	Potentially significant	Can impact be mitigated
a. Alteration or interference with the productivity or profitability of the existing land use area?		**X**			
b. Conflicted with a designated natural area or area of unusual scientific or educational importance?		**X**			
c. Conflict with any existing land use whose presence would constrain or potentially prohibit the proposed action?		**X**			
d. Adverse effects on the relocation of residences?		**X**			

Table 8. Risk and health hazards.

8. Risk/Health Hazards Will the proposed action result in:	Impact Unknown	None	Minor	Potentially significant	Can impact be mitigated
a. Risk of an explosion or release of hazardous substances (including, but not limited to oil, pesticides, chemicals, or radiation) in the event of an accident or other forms of disruption?			**X**		**8a**
b. Affect an existing emergency response or emergency evacuation plan or create a need for a new plan?		**X**			**8b**
c. Creation of any human health hazard or potential hazard?		**X**			**see 8a,c**
d. Will any chemical toxicants be used?		**X**			**see 8a**

Comment 8a: The principal risk of human exposure to hazardous materials from this project would be limited to the rotenone applicators. All applicators would follow protocol and wear safety equipment listed on the CFT Legumine label such as a fitted respirator (when mixing), goggles, rubber boots and gloves, and protective clothing. All applicators have been trained on the safe handling and application of the piscicide at a formal course taught at the U.S. Fish and Wildlife Service Natural Conservation Training Center in Shepherdstown, West Virginia. Four sport fish division biologists have been certified by the ADEC to apply pesticides in Alaska.

Rotenone will be mixed, transported, handled, applied and stored according to the label specifications to reduce the probability of human exposure or spill, and all operations will be conducted or supervised by state-certified applicators. In the event of an accidental rotenone spill at Sand Lake, project personnel will contain the spill, immediately contact the ADEC for assistance, and ensure that non-project personnel do not enter the spill area.

Comment 8b: ADF&G has a treatment plan for this rotenone application. This plan addresses all aspects of safety for project personnel. Elements of the plan include establishing a clear chain of command, training, delegation and assignment of responsibility, clear lines of communication between members, spill contingency, first aid, emergency responder information, personal protective equipment, monitoring and quality control, and other details. Emergency response protocols are addressed in detail in the treatment plan. The risk of emergency response for this project would be minimal, and any impacts to potential emergency responders would be short-term and minor.

Comment 8c: Although pesticides are widely used to control unwanted species, legitimate public concerns have been raised regarding health and human safety. As with any pesticide, direct exposure to, or consumption of piscicides at **full strength**, can have harmful or sometimes fatal effects on humans. Rotenone is an EPA-registered restricted use pesticide under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA; USEPA 2007). Further, CFT Legumine™ is registered by the ADEC for use in Alaska.

Several recent documents have addressed a range of questions concerning rotenone and human health and safety issues especially in relationship to the use of rotenone for fisheries management (Finlayson et al. 2000, NPS 2006, CDF&G 2006, Fisher 2007 and USEPA 2007). Additional information on rotenone and human health and safety concerns is available online at:

The Rotenone Stewardship Program (http://www.fisheries.org/units/rotenone/index.htm)

The Extension Toxicology Network (http://extoxnet.orst.edu/pips/rotenone.htm)

The World Health Organization (http://www.who.int/ipcs/publications/pesticides_hazard_rev_3.pdf)

Millions of dollars have been spent in the U.S. on research to evaluate the safety of rotenone, and the majority of this work has focused on human health questions (Finlayson et al. 2000). Results of these studies summarized in Finlayson et al. 2000 confirm that rotenone does not cause birth defects (HRI 1982), reproductive dysfunction (Spencer and Sing 1982), gene mutations (Van Geothem et al. 1981; BRL 1982), or cancer (Marking 1988). No fatalities in humans have been reported in response to proper use of rotenone products (Ling 2003). When used according to label instructions for fish management, hazards to human health are minimal. Non-lethal symptoms such as headaches and skin rashes were reported for humans exposed to powdered rotenone continuously for three weeks (Pintler and Johnson 1958), but this is not typical exposure, and this current project proposes the use of liquid rotenone instead of powder. In their re-registration of rotenone, the USEPA (2007) concluded that using rotenone to control fish “does not present a risk of unreasonable adverse effects to humans or the environment”.

Regarding exposure to trace constituents in CFT Legumine™ liquid rotenone, trichloroethylene

(TCE), a known carcinogen, is present, but the concentration of this substance in water immediately following treatment (0.0000073 mg TCE per liter of water) (Fisher 2007) is within the level permissible in drinking water (Finlayson 2000). Finlayson et al. (2000) also stated that other substances including xylenes and naphthalene found in CFT Legumine™ are the same as those found in fuel oil and are present in recreational waters everywhere because of outboard motors.

As discussed earlier, drinking rotenone poses little risk to humans because of the low concentration used and rapid degradation in the aquatic environment. Again, a 160-pound adult would have to drink 23,000 gallons, and a 22-pound child would need to drink over 1,400 gallons of rotenone-treated water at one sitting to receive a lethal dose at pisicidal concentrations (Gleason et al 1969, Finlayson et al. 2000).

There have been previous concerns that rotenone exposure could be linked to Parkinson's disease, but this linkage has since been refuted. In a study in which rats were injected with rotenone for a period of several weeks, researchers reported finding symptoms characteristic of Parkinson's disease (Betarbet et al. 2000). However, these results have been challenged on the basis of methodology: (1) that the continuous intravenous injection method used leads to "continuously high levels of the compound in the blood," and (2), that dimethyl sulfoxide (DMSO) was used to enhance tissue penetration whereas normal routes of exposure actually slow introduction of chemicals into the bloodstream (Rotenone Stewardship program, http://www.fisheries.org/units/rotenone/parkinsonsstudy.shtml). Finally, injecting rotenone into the body is not a normal way of assimilating the compound. Similar studies (Marking 1988) have found no Parkinson-like results.

The major risks to human health from rotenone come from accidental exposure during mixing and application. This is the only time when humans are exposed to concentrations that are greater than those needed to eradicate fish. To prevent accidental exposure to liquid formulated rotenone, the ADEC requires applicators to be:

- Working under the direct supervision of a trained and certified pesticide applicator
- Equipped with the proper safety gear, which, in this case, includes fitted respirator, eye protection, rubberized gloves, and protective clothing.
- In possession of product labels during use
- Storing materials only in approved containers that are properly labeled
- Adhering to the product label requirements for storage, handling, and application

Any threats to human health during application will be greatly reduced with proper use of safety equipment. Public notification through news releases, signage, lake access closure, and administrative personnel in the project area should be adequate to keep unintended park users from being exposed to any treated waters.

There could be an inhalation risk to ground applicators spraying rotenone in the littoral vegetation. To guard against this, ground applicators will be equipped with protective clothing, eye protection, and proper breathing equipment (i.e. organic vapor respirators with pesticide filters).

Table 9. Impacts to the community.

9. Community Impact Will the proposed action result in:	Impact Unknown	None	Minor	Potentially significant	Can impact be mitigated
a. Alteration of the location, distribution, density, or growth rate of the human population of the area?		**X**			
b. Alteration of the social structure of a community?		**X**			
c. Alteration of the level of distribution of employment or community or personal income?		**X**			
d. Changes in the industrial or commercial activity?		**X**			
e. Increased traffic hazards or effects on existing transportation facilities or patterns of movement of people and goods?		**X**			

Table 10. Impacts to public services, taxes and utilities.

10. Public Services/Taxes/Utilities	Impact Unknown	None	Minor	Potentially significant	Can impact be mitigated
a. Will the proposed action have an effect upon or result in the need for new or altered governmental services in any of the following areas: fire or police protection, schools, parks/recreational facilities, roads or other public maintenance, water supply, sewer or septic systems, solid water disposal, health, or other governmental services? If any, specify:			**X**		**10a**
b. Will the proposed action have an effect upon the local or state tax base and revenues?		**X**			
c. Will the proposed action result in need for new facilities or substantial alterations of any of the following utilities: electric power, natural gas, other fuel supply or distribution systems, or communications?		**X**			
d. Will the proposed action result in increase use of any energy source?		**X**			
e. Define projected revenue sources		**X**			
f. Define projected maintenance costs		**X**			

Comment 10a. This project will occur within Sand Lake. During the day of treatment, residents around the lake will be asked to stay out of the water until the rotenone thoroughly mixes. Once mixed, there will be no lake access restrictions. Despite having to close the lake to recreational use for one day, restoring the fisheries in Sand Lake will provide long-lasting recreational fishing opportunities. Though access to the lake will be limited during treatment, there will be no long-term closures or impacts to recreational users.

Table 11. Impacts to aesthetics and recreation.

11. Aesthetics/Recreation	Impact Unknown	None	Minor	Potentially significant	Can impact be mitigated
a. Alteration of any scenic vista or creation of an aesthetically offensive site or effect that is open to public view?			**X**		**11a**
b. Alteration of the aesthetic character of a community or neighborhood?			**X**		**11c**
c. Alteration of the quality or quantity of recreational/tourism opportunities and settings?			**X**		**11a,c**
d. Will any designated or proposed wild and scenic rivers, trails or wilderness areas be impacted? (Also see 11a, 11c)		**X**			

Comment 11a. As previously mentioned, public access will be discouraged at Sand Lake immediately before, during and immediately after treatment using appropriate signage and public notices. It is also possible offending odors could arise from decomposing fish shortly after treatment or from the CFT Legumine™ formulation itself, although the Prentiss Corporation describes CFT Legumine™ as odorless. The odors from CFT Legumine™ would be expected to dissipate rapidly. This was the experience with Cheney Lake and Arc Lake in 2008. Also, planned routine removal of fish carcasses post-treatment would be expected to minimize offensive odors.

Comment 11c: The primary goals of this project are to (1) reduce the threat of northern pike being illegally introduced into other nearby water bodies and (2) to improve habitat and fishing quality at Sand Lake which would result in increased use by recreational anglers. Anglers that enjoy fishing for pike in Sand Lake may be impacted because these pike will be eradicated. However, restoring the rainbow trout and Arctic char fisheries will provide more favorable and abundant recreational fishing opportunities in the lake. Removing the northern pike will likely result in more residents, families, and kids fishing in the lake. This is one of the major objectives of this project, but it is also recognized that there may be minor aesthetic impacts to lake residents as a result. However, any aesthetic impacts directly associated with the rotenone treatment and dead fish in the treatment area would be minor.

Table 12. Impacts to cultural and historical resources.

12. Cultural/Historical Resources	Impact Unknown	None	Minor	Potentially significant	Can impact be mitigated
a. Destruction or alteration of any site, structure or object of prehistoric, or paleontological importance?		**X**			
b. Physical change that would affect unique cultural views?		**X**			
c. Effects on existing religious or sacred uses of a site or area?		**X**			
d. Will the project affect historic or cultural resources?		**X**			

5.**Table 12. Impacts to cultural and historical resources.**
Table 13. Summary evaluation of significance.

13. Summary Evaluation of Significance Will the proposed action, considered as a whole:	Impact Unknown	None	Minor	Potentially significant	Can impact be mitigated
a. Have impacts that are individually limited, but cumulatively considerable? (A project or program may result in impacts on two or more separate resources which creates a significant effect when considered together or in total).		**X**			
b. Involve potential risks or adverse effects which are uncertain but extremely hazardous if they were to occur?		**X**			
c. Potentially conflict with the substantive requirements of any local, state, or federal law, regulation, standard or formal plan?		**X**			
d. Establish a precedent or likelihood that future actions with significant environmental impacts will be proposed?		**X**			
e. Generate substantial debate or controversy about the nature of the impacts that would be created?	**X**				**13e**
f. Is the project expected to have organized opposition or generate substantial public controversy?	**X**				**13f**
g. List any federal or state permits required.					**13g**

Comment 13e and 13f: In general**,** the use of any pesticide can generate controversy from some people. Outreach efforts by the Department will help to educate the public on the safe and effective use of rotenone. It is not known if this project will have organized opposition. One reason that ADF&G is considering this course of action is that invasive northern pike have already impacted fisheries in Anchorage and have resulted in lost fishing opportunities in lakes that were previously stocked with rainbow trout or salmon.

Comment 13g: The following permits and approvals are required:

ADEC (Alaska Department of Environmental Conservation): Alaska Pesticide Use Permit (Appendix 2)

Alaska Board of Fisheries: Written consent of approval to use rotenone must be requested of and granted by the Alaska Board of Fisheries (Appendix 3).

PART III. ALTERNATIVES

Alternative 1 - Rotenone treatment and rainbow trout stocking (Proposed Action)

The proposed action involves removing invasive northern pike from Sand Lake using CFT Legumine™ 5% liquid rotenone. Following treatment and natural detoxification, the lake would be restocked with rainbow trout and Arctic char.

This alternative offers the highest probability of achieving the goals of improving the recreational fishery in Sand Lake for public use and reducing the threat of invasive pike in Sand Lake being transported illegally to other areas.

Alternative 2 - Draining

Completely draining a lake or chemical treatment are the only methods proven to completely eradicate invasive, non-indigenous fish. Sand Lake is not small enough to easily drain, and several lake residents house float planes on the lake. Draining the lake would be a detriment to this use. Further, water would have to be actively pumped overland into Campbell Creek over one mile away to avoid flooding neighboring residences. Routing the pumped water would be logistically difficult. Even if it were logistically possible, it would take months to pump the water low enough to allow the lake to completely freeze and winterkill the pike. In addition to the time, the pumps would likely be a nuisance to area residents because they would have to run 24 hours and would be loud enough for neighbors to hear. Draining the lake and allowing it to winterkill would not be a feasible option. This method would be far less efficient and cost prohibitive than chemical treatment. Residents around Sand Lake have already expressed that draining the lake is not a preferred alternative.

Alternative 3 - Mechanical Removal

This alternative would involve using gill nets and/or traps to selectively remove northern pike. Once all northern pike were removed, Sand Lake would be restocked with rainbow trout and Arcic char.

Under specific conditions, gill nets have been successfully used to remove unwanted fish from lakes. Bighorn Lake, a 5.2- surface acre lake located in Banff National Park in Alberta, Canada, was gillnetted from 1997 to 2000 to remove an invasive population of brook trout (Parker et al. 2001). Over 10,000 net nights (1 net night = 1 net set overnight for at least 12 hours) were conducted over a four-year period to remove the population that totaled 261 fish. The researchers concluded that the removal of non-native trout using gill nets was impractical for larger lakes (> 5 acres). In clear lakes, fish have the ability to acclimate to the presence of gill nets and avoid them. These researchers reported observing brook trout avoiding gill nets within about two hours of being set.

Knapp and Matthews (1998) reported that Maul Lake, a 3.9-acre lake in the Inyo National Forest in California, was gill netted from 1992 to 1994 to remove another population of brook trout. The population consisting of 97 fish was successfully removed after 108 net days of effort. Following the removal of brook trout, Maul Lake was mistakenly restocked with rainbow trout. Efforts to remove them using gill nets were implemented immediately. From 1994 through 1997, 4,562 net days were required to remove the 477 rainbow trout from the

lake. Knapp and Matthews (1998) reported that gill nets could be used as a viable alternative to chemical treatment, but they acknowledged that the small size and shallow depth of Maul Lake leant itself to a successful fish eradication using gill nets. Their criteria for successful fish removal using gill nets include lakes less than 3.9 surface acres, less than 19 feet deep, little or no inflow or outflow to perpetuate reinvasion, and no natural reproduction of the fish population. Sand Lake exceeds the surface area and depth criteria described by these researchers, and the pike population is reproducing.

Deploying gill nets and traps requires frequent on-site inspections to check and re-set nets. This method of fish removal at Sand Lake would require an unreasonable time and manpower commitment and would be cost-prohibitive. Gill netting, the more efficient of the two mechanical methods listed, could expose birds and aquatic mammals to the risk of net entanglement in water. Although attempts can be made to visually discourage birds from approaching nets by using owl decoys or similar, prolonged and unattended netting will likely result in significant bird bycatch. Setting gill nets under the ice may be an option for removing some northern pike in small lakes, but Sand Lake is too large to cost-effectively net the lake with adequate coverage. Nets tend to encrust in the ice and are often destroyed. In addition, pike must be moving to encounter the nets, and northern pike tend to be the least active during the winter. Finally, Sand Lake is a popular ice fishing location in Anchorage, and under-ice gillnets would have the potential to damage ice augers and other gear belonging to anglers. Gillnetting is not an efficient eradication technique, and though it can successfully reduce pike populations, it will not completely eradicate them.

Alternative 4- No Action

The no action alternative would allow the *status quo* to continue which would maintain or reduce the present angling opportunity and habitat quality of Sand Lake. As long as invasive northern pike remain in Sand Lake, ADF&G will not have the ability to increase stocking levels of rainbow trout and Arctic char or enhance habitat quality to benefit nesting success of waterfowl, and angling opportunities for the local public will be continue to be limited. Further, there will be continued risk that northern pike could be transported from Sand Lake to nearby water bodies where they could threaten other wild and stocked fisheries.

PART IV. ENVIRONMENTAL ASSESSMENT CONCLUSION SECTION

A) Is an EIS required? *(Section A-D: for EA reviewer to address)*

Section 102(2)(C) of NEPA establishes the threshold "trigger" that starts the NEPA process. Since this project is being funded in part with federal dollars, the Federal decision-maker has to answer this key question – Might this proposed action be "a major Federal action significantly affecting the quality of the human environment"? If the Federal agency does not find significance, e.g. the project proposal analyzed in the EA would not significantly affect the environment, a Finding of No Significant Impact (FONSI) can be prepared.

After reviewing the information provided by the applicant, the assessment of environmental impact contained in Part II of this document, and the responses to the public comments that were received, the U.S. Fish and Wildlife Service has accepted the EA and has prepared and signed a FONSI for the project as described above.

B) Public involvement:

This final EA/ FONSI is posted on the following website: http://www.sf.adfg.state.ak.us/Statewide/InvasiveSpecies/index.cfm/FA/rotenone.currentProjects. In addition, a news release will be issued by June 28, 2009 that outlines the proposed project, announces the public comment period, provides a link to an ADF&G website about rotenone, and provides a link to the draft EA. All interested citizens will be encouraged to contact the preparer of this EA to discuss the project. After federal approval, and prior to the rotenone treatment, all lake residents will receive an informational letter, and a news release will be issued in early October.

Public scoping/ notifications:

1) The local ADF&G Anchorage advisory committee, the Sand Lake Community Council, ADEC, USFWS, Anchorage Department of Parks and Recreation, and the Municipality of Anchorage Watershed Task Force were sent a project synopsis (Appendix 1) and an e-mail link to this EA.

2) Fact sheets describing the project were distributed to approximately 400 households around the lake. These flyers also announced the public meeting date (July 8, 2009) and included the web address to ADF&G's rotenone website.

3) ADF&G created websites to provide information about rotenone to the public. These included links to this EA. As previously mentioned, these links were made available in the news release and meeting flyers.

4) Written public notices of the Sand Lake restoration proposal were announced in the Anchorage Daily News and an ADF&G news release as required by ADEC during the pesticide use permitting process.

5) An informational public meeting was held at 7:00 pm on July 8, 2009 at Calvary Church.

C) Duration of the comment period:

The comment period was held for 30 days. Public comments were accepted from June 29 – July 29, 2009**.**

D) Consideration of comments:

Written Public Comments and Responses:

The Sand Lake Restoration project was initiated back in 2007 when residents living around the lake approached ADF&G about removing the northern pike population in the lake. A resident of Sand Lake and member of the Sand Lake Home Owners Association polled other members of the association to determine if there was local support for ADF&G to conduct a rotenone application in the lake for the purpose of removing the pike. Appendix #4 lists the written responses he collected in 2007. Overall, these comments were overwhelmingly in support of the rotenone treatment with the exception of two comments that addressed concerns (#22 and 25):

1) *The first concern (comment #22), in summary, was that there will be more people fishing in Sand Lake when the northern pike are removed.*

   It is likely that restoring the sport fishery in Sand Lake will increase the number of people who fish there. That is one of the main goals of this project. ADF&G is trying to rehabilitate the lake so that it remains a popular fishing location for families. ADF&G has a legal authority to stock fish to enhance recreational fishing opportunities (AS 16.10.44). ADF&G stocks many water bodies in Alaska for the purpose of providing recreational angling opportunities. However, with pike remaining in the Sand Lake, many hatchery fish are currently wasted as prey for pike rather than supplying the sport fishery. Hatchery-produced fish are a public resource, and Sand Lake has public access so Anchorage residents can utilize the lake and the fish that are stocked into it.

2) *The second concern (comment #25) was whether or not rotenone is linked with Parkinson's disease.*

   In 2000, researchers at Emory University published a study where they claimed rotenone caused Parkinson's disease-like symptoms in rats (Beterbet et al. 2000). The results of that study have been refuted because of the methods used. Rats were intravenously injected with pure, undiluted rotenone, into their jugular veins for a period of several weeks. This exposure is completely unrealistic with regards to fisheries management where rotenone products are diluted to very small concentrations. Other substances such as table salt (NaCl) and penicillin

injected into laboratory animals using the same methods can produce similar results. A significant amount of human health and safety research was initiated after the Emory study to ensure rotenone was safe. Rotenone was not found to have any human-health concerns. Rotenone was re-registered by the Environmental Protection Agency in 2007, and the EPA concluded that there are no adverse human or environmental health risks with using rotenone for fisheries management. A more in depth discussion on this topic can be found on p. 32, comment 8c.

A 30-day public comment period on the draft environmental assessment was conducted from June 30 through July 30, 2009. No opposing verbal or written comments were received during this period. Two people e-mailed comments in support of the project. Those comments are listed in Appendix #5.

Verbal Public Comments and Responses:

An informational public meeting was held on July 8, 2009 during the 30-day public comment period. ADF&G posted signs at the lake and sent out announcements to approximately 430 residents around Sand Lake. The meeting was held at Calvary Church and was attended by 23 members of the public.

The meeting included a 45-minute presentation describing the project and an approximately 45-minute question and answer session. The topics discussed during the question and answer session are detailed in Appendix 6. None of the meeting attendees opposed the project, and the questions were primarily informational.

E) Name, title, address, and telephone number of the Person Responsible for Preparing the EA Document:

Kristine Dunker, Fishery Biologist
Alaska Department of Fish and Game
333 Raspberry Road
Anchorage, AK 99518
Ph (907) 267-2889
email: Kristine.dunker@alaska.gov

LITERATURE CITED

AFS (American Fisheries Society). 2002. Rotenone stewardship program, fish management chemicals subcommittee. www.fisheries.org/rotenone/.

Alaska Department of Fish and Game 2008. Final environmental assessment and finding of no significant impact for northern pike eradication from Cheney Lake, Anchorage, AK.

Alaska Department of Fish and Game 2007. Management Plan for Invasive Northern Pike in Alaska. Alaska Department of Fish and Game, Anchorage, Alaska. http://www.sf.adfg.state.ak.us/Static/invasive_species/PDFs/pike_management_plan.pdf .

Alaska Department of Fish and Game. 2002. Aquatic Nuisance Species Management Plan. Alaska Department of Fish and Game. 55 pp.

Alaska Department of Fish and Game. 2003. Division of Sport Fish Strategic Plan. Alaska Department of Fish and Game, Division of Sport Fish, Anchorage. 25 pp.

Anderson, N.H., and J.B. Wallace. 1984. Habitat, life history, and behavioral adaptations of aquatic insects. Pages 38-58 in R.W. Merrit and K.W. Cummins (eds.), An Introduction to the Aquatic Insects of North America. 2nd ed. Kendall/Hunt Publishing, Dubuque, Iowa.

Anderson, R.S. 1970. Effects of rotenone on zooplankton communities and a study of their recovery patterns in two mountain lakes in Alberta. Journal of the Fisheries Research Board of Canada. Vol 27, no. 8, 1335-1355.

Bandow, F. 1989. Under-ice distribution of rotenone with lake aeration equipment. Minesota Department of Natural Resources, Investigational Report 397.

Bearez, P. 1998. First archaeological indication of fishing by poison in a sea environment by the Engoroy population at Salango (Manabi, Equador). Journal of Archaeological Science 25: 943-948.

Betarbet, R., T.E. Sherer, G. MacKenzie, M. Garcia-Osuna, A.V. Panov, and T. Greenamyre. 2000. Chronic systemic pesticide exposure reproduces features of Parkinson's disease. *Nature Neuroscience* 3 (12): 1301-1306.

Boulton, A.J., C.G Peterson, N.B. Grimm, and S.G. Fisher. 1992. Stability of an Aquatic Macroinvertebrate Community in a Multiyear Hydrologic Disturbance Regime. Ecology 73(6):2192-2207.

Bradbury, A. 1986. Rotenone and trout stocking: a literature review with special reference to Washington Department of Game's lake rehabilitation program. Fisheries management report 86-2. Washington Department of Game.

BRL (Biotech Research Laboratories). 1982. Analytical studies for detection of chromosomal aberrations in fruit flies, rats, mice, and horse bean. Report to U.S. Fish and Wildlife Service (USFWS Study 14-16-0009-80-54). National fishery research Laboratory, La Crosse, Wisconsin.

California Department of Fish and Game and U.S. Forest Service. 2007. Lake Davis pike eradication project. Final environmental impact statement. EIR/EIS. Portola, CA.

California Department of Fish and Game. 2006. Results of a monitoring study of the littoral and planktonic assemblages of aquatic invertebreates in Lake Davis, Plumas County, California, following a rotenone treatment. California Department of Fish and Game, Rancho Cordova, California (Available: http://www.dfg.ca.gov/lakedavis/docs/1997AquaticInvertRpt.pdf).

California Department of Fish and Game. 1994. Rotenone use for fisheries management – final programmatic environmental impact report 9SCH 92073015). CDFG, Environmental Services Division, Sacramento.

Chandler, J.H. and L.L. Marking. 1982. Toxicity of rotenone to selected aquatic invertebrates and frog larvae. The progressive fish culturist 44(2) 78-80.

Cheng, H.M., I. Yamamuto, and J.E. Casida. 1972. Journal of Agricultural Food Chemistry. 4: 850-856.

CWE Properties Ltd., 2004 CFT Legumine™ product label. Greely, Colorado.

Dawson, V.K., W.H. Gingerich, R.A. Davis, and P.A. Gilderhus. 1991. Rotenone persistence in freshwater ponds: effects of temperature and sediment adsorption. North American Journal of Fisheries Management 11: 226-231. Department of Fish and Game. ENVIRON International Corporation, Seattle,

Engstrom-Heg, R 1976. Potassium permanganate demand of a stream bottom. New York Fish and Game Journal vol. 23 no. 2:155-159.

Engstrom-Heg, R. 1971. Direct measure of potassium permanganate demand and residual potassium permanganate. New York Fish and Game Journal vol. 18 no. 2:117-122.

Engstrom-Heg, R. 1972. Kinetics of rotenone-potassium permanganate reactions as applied to the protection of trout streams. New York Fish and Game Journal vol. 19 no. 1:47-58.

Engstrom-Heg, R., R.T. Colesante, and E. Silco. 1978. Rotenone tolerances of stream-bottom insects. New York Fish and Game Journal, 25(1):31-41
Equipment. Minnesota Department of Natural Resources, Investigational Report

Finlayson, BJ., RA. Schnick, R.L. Caiteux, L. DeMong, W.D. Horton, W. McClay, C.W. Thompson, and GJ. Tichacek. 2000. Rotenone use in fisheries management: administrative and technical guidelines manual. American Fisheries Society, Bethesda, Maryland.

Fisher, J. P. 2007. Screening level risk analysis of previously unidentified rotenone formulation constituents associated with treatment of Lake Davis. Report prepared for California Department of Fish and Game. ENVIRON International Corporation, Seattle, Washington.

Gilderhus, P.A., J.L. Allen, and V.K. Dawson. 1986. Persistence of rotenone in ponds at different temperatures. North American Journal of Fisheries Management. 6: 129-130.

Gleason, M., R. Gosselin, H. Hodge, and P. Smith. 1969. Clinical toxicology of commercial products. The WWilliam and Wilkins Company, Baltimore, Maryland.

Grisak, G.G., D. R. Skaar, G. L. Michael, M.E. Schnee, and B.L. Marotz. 2007 Toxicity of Fintrol (antimycin) and Prenfish (rotenone) to three amphibian species. Intermountain Journal of Sciences, vol. 13, No.1, 1-8.

Hisata, J.S. 2002. Lake and stream rehabilitation: rotenone use and health risks. Final supplemental environmental impact statement. Washington Department of Fish and Wildlife, Olympia.

Houf L.J and R.S. Campbell. 1977. Effects of antimycin A and rotenone on macrobenthos in ponds. . investigations in fish control. Department of the Interior, Fish and Wildlife Service, 80:1-29. (Three appendices).

HRI (Hazelton Raltech Laboratories). 1982. Teratology studies with rotenone in rats. Report to U.S. Geological Survey. Upper Midwest Environmental Sciences Center (USFWS Study 81-178). La Crosse, Wisconsin.

Jacobi, G.Z. and D.J. Deegan. 1977. Aquatic macroinvertebrates in a small Wisconsin trout stream Before, During, and Two Years after Treatment with the Fish Toxicant Antimycin. Investigations in Fish Control. Department of the Interior, Fish and Wildlife Service, 80:24 p. 19 ref. 8 fig., 9 tab.

Jarvinen, A.W., and G.T. ANkley. 1999. Linkage of effects to tissue residues: Develoment of a comprehensive database for aquatic organisms exposed to inorganic and organic chemicals. SETAC Press, Pensacola, Florida (CITED by USEPA 2007).

Jennings, G.B.,K. Sundet, A.E. Bingham and H.K. Sigurdsson. 2004. Participation, catch, and harvest in Alaska sport fisheries during 2001. Alaska Department of Fish and Game, Fishery Data Series No. 04-11, Anchorage.

Knapp, R.A. and K.R Matthews. 1998. Eradication of nonnative fish by gill netting from a small mountain lake in California. Restoration Ecology, vol. 6,2:207-213.

Ling, N. 2003. Rotenone- a review of its toxicity and use for fisheries management. Science for Conservation 211. 40 p. ISBN 0-478-22345-5.

Loeb, H.A. and R. Engstrom-Heg. 1970. Time-dependant changes in toxicity of rotenone dispersions to trout. Toxicology and applied pharmacology 17, 605-614.

Marking, L.L. 1988. Oral toxicity of rotenone to mammals. Investigations in fish control, technical report 94. U.S, Fish and Wildlife Service, National Fisheries Research Center, La Crosse, Wisconsin.

Matthaei, C.D., Uehlinger, U., Meyer, E.I., Frutiger, A. 1996. Recolonization by benthic invertebrates after experimental disturbance in a Swiss pre-alpine river. Freshwater Biology 35 (2):233-248.

Mecklenburg, C. W., T. A. Mecklenburg, and L. M. Thorsteinson. 2002. Fishes of Alaska. American Fisheries Society. Bethesda Maryland. 1037 pp.

MFWP. 2008. (Montana Fish, Wildlife and Parks): Tunnel lake environmental assessment. Choteau, Montana. Available online at: http://fwp.mt.gov/publicnotices/default.aspx.

Miller, M.G. and D. Bosch. 2004. Area management report for the recreational fisheries of Anchorage, 2003. Alaska Department of Fish and Game, Fisher Management Series No. 04-07, Anchorage.

Morrow, J. E. 1980. The freshwater fishes of Alaska. Alaska Northwest Publishing Company, Anchorage, Alaska. 248 pp.

NPS. 2006. Restoration of westslope cutthroat trout in the East Fork Specimen Creek watershed: Environmental Assessment. National Park Service, U.S. Department of Interior, Yellowstone National Park, Wyoming. (Available: http://www.nps.gov/yell/parkmgmt/uplad/wctrestoration_ea.pdf),

ODFW(Oregon Department of Fish and Wildlife), 2008. Rotenone: frequently asked questions. Oregon Department of Fish and Wildlife web page, Diamond Lake Home Page, http://www.dfw.state.or.us/fish/diamond_lake/FAQs.asp.

Parker, R.O. 1970. Surfacing of dead fish following application of rotenone. Transactions of the American Fisheries Society. 994:805-807.

Pintler, H.E., and W.C. Johnson. 1958. Chemical control of rough fish in the Russian River drainage, California. California Fish and Game 44: 91-124.

Quigley, C. 1956. Aboriginal fish poisons and the diffusion problem. American Anthropologist, New Series 58: 508-525.

Ridley, M., B. Bainer, R. Goodrich, and T. Carlsen. 2006. Review and assessment of Plumas County's groundwater quality monitoring at Lake Davis. Lawrence Livermore National Laboratory. (Available: http://www.countyofplumas.com/publichealth/envhealth/LakeDavisReportFinal081606.pf)

Robertson, Ross D. and W.F. Smith-Vaniz. 2008. Rotenone: An essential but demonized tool forassessing marine fish diversity. Bioscience 58: 165-169.

Rutz, D. S. 1996. Seasonal movements, age and size statistics, and food habits of northern pike in upper Cook Inlet during 1994 and 1995. Alaska Department of Fish and Game, Fishery Data Series Report No. 96-29. Anchorage.

Rutz, D. S. 1999. Movements, food, availability and stomach contents of northern pike in selected river drainages, 1996-1997. Division of Sport Fish, Alaska Department of Fish and Game. Fishery Data Series Report No. 99-5. Anchorage.

Schnick, R. A. 1974a. A review of the literature on the use of antimycin in fisheries. U.S. Fish and Wildlife Service, National Fishery Research Laboratory. La Crosse, Wisconsin.

Schnick, R. A. 1974b. A review of the literature on the use of rotenone in fisheries. U.S. Fish and Wildlife Service, National Fishery Research Laboratory. La Crosse, Wisconsin

Singer, T. P., and R. R. Ramsay. 1994. The reaction site of rotenone and ubiquinone with mitochondrial NADH dehydrogenase. Biochimica et Biophysica Acta 1187:198-202.

Skaar, D. 2001. A brief summary of the persistence and toxic effects of rotenone. Montana Fish, Wildlife & Parks, Helena.

Spencer, F. and L.T. Sing. 1982. Reproductive responses to rotenone during decidualized pseudogestation and gestation in rats. *Bulletin of Environmental Contamination and Toxicology*. 228: 360-368.

Stratton, B. and P. Cyr. 1995. Annual management report for the recreational fisheries in the Anchorage area, 1994. Alaska Department of Fish and Game, Fishery Management Report No. 95-5, Anchorage, AK.

UDWR (Utah Division of Wildlife Resources). 2007. Final environmental assessment and finding of no significant impact for native trout restoration and enhancement projects in southwest Utah. Southern Region Office, Utah Division of Wildlife Resources, Cedar City, Utah. Available: http://www.fws.gov/mountain-prairie/federalassistance/native_trout/UTAH_FINAL_CUTT_EA_807.pdf.

USDA. Soil Survey of Anchorage, Alaska. http://soildatamart.nrcs.usda.gov/Manuscripts/AK605/0/Anchorage.pdf.

USEPA (United States Environmental Protection Agency). 2007. Reregistration eligibility decision for rotenone. Document EPA 738-R-07-007(March 2007). United States Environmental Protection Agency, Washington, D.C.

Van Goethem, D, B. Barnhart, and S. Fotopoulos. 1981. Mutagenicity studies on rotenone.

Ware, G.W. 2002. An introduction to insecticides 3rd edition. University of Arizona, Department of Entomology, Tuscon. *on* EXTOXNET. Extension Toxicology Network. Oregon State University web page.

Appendix 1. Sand Lake Project Synopsis to be distributed to interested members of the public and organizations.

Alaska Department of Fish and Game
Sport Fish Division
Anchorage, Alaska

Contact: Dan Bosch (267-2153), Chuck Brazil (267-2186), Kristine Dunker (267-2889)

Sand Lake Restoration Project Synopsis

Northern pike (*Esox lucius*) are native to most of Alaska, but they do not naturally occur in Southcentral. Where northern pike are native, they are a valuable sport and subsistence fish. However, outside of their native range, northern pike are an invasive species capable of causing tremendous ecological and economic damage. This is because pike are highly piscivorous and can deplete populations of rearing salmonids. The presence of northern pike in Anchorage lakes is the result of illegal introductions, and the impacts from these introduced predators on local fisheries have been severe.

Northern pike were illegally introduced into Sand Lake in Anchorage, and their presence currently threatens the status of the Alaska Department of Fish and Game's (ADF&G) stocking program in the lake. Sand Lake is an approximately 73.5-acre natural lake located in south Anchorage that has been traditionally stocked with rainbow trout, Chinook salmon and Arctic char. In the late 1990s, northern pike were discovered in the lake. ADF&G reduced stocking levels and continued to stock the lake believing the lake's depth would allow the stocked fish to coexist with the pike. In the last few years, however, ADF&G has been forced to further reduce the stocking effort in the lake to avoid wasting valuable hatchery fish as prey for pike. Residents around the lake have reported a decline is fishing success for rainbow trout, and they attribute this to the northern pike. Residents have also observed a reduction in waterfowl usage of the lake that coincides with the establishment of the pike population. The ADF&G Division of Sport Fish recognizes the threat that this invasive species poses to the fisheries and habitat quality of Sand Lake and would like to increase the stocking program in the lake. For this to occur, the northern pike need to be removed.

Aside from the detrimental effect the presence of pike have on the recreational fishing opportunities in Sand Lake, their presence raises other issues. Sand Lake is located less than a half mile from Jewel and Sundi lakes and, currently, northern pike are not known to exist in either lake. Jewel Lake is also a stocked lake and provides popular recreational fishing opportunities for Anchorage residents. If northern pike were to become established in Jewel Lake, stocking programs there could also be threatened. Taking measures to prevent the future spread of invasive pike to theses lakes will be much more efficient than trying to eradicate them once they have become established.

ADF&G is currently proposing to remove the northern pike population in Sand Lake. The most practical method to accomplish this will involve using a chemical called rotenone. Rotenone is a naturally-occurring substance derived from the roots of tropical plants and is a common tool employed by fish managers to eradicate invasive fish. Rotenone works to kill fish by disrupting a biochemical process that allows fish to use oxygen in their blood. In the concentrations necessary to kill fish, rotenone is not dangerous for birds or mammals. No public health effects from the use of rotenone in fish management have been reported. ADF&G has recently used rotenone to successfully remove northern pike from Cheney Lake in Anchorage and Arc Lake near Soldotna.

ADF&G is preparing an environmental assessment document that will initiate the local public participation process for this project. The rotenone treatment in Sand Lake is being planned for late fall 2009. Sand Lake will be monitored throughout winter and spring to assure the pike have been eradicated. If all pike have been successfully removed, rainbow trout and Arctic char will be re-stocked in the lake by the summer of 2010.

Appendix 2. Department of Environmental Conservation Pesticide Use Permit

STATE OF ALASKA / SEAN PARNELL, GOVERNOR

DEPT. OF ENVIRONMENTAL CONSERVATION
DIVISION OF ENVIRONMENTAL HEALTH
PESTICIDES PROGRAM

555 Cordova Street
Anchorage, Alaska 99501
PHONE: (907) 269-7690
FAX: (907) 269-7600
http://www.dec.state.ak.us/

Certified Mail # 7007 2560 0001 6559 4584
Return Receipt Requested

August 3, 2009

Kristine Dunker
Alaska Department of Fish and Game
333 Raspberry Road
Anchorage, Alaska 99518

Subject: Permit to Apply Pesticides, **# 09-AQU-02**

Dear Ms. Dunker:

The Department of Environmental Conservation (DEC) has completed its evaluation of your request for a permit for the application of the pesticide **CFT Legumine Fish Toxicant,** EPA Registration Number **75338-2** and **Prentox Rotenone Fish Toxicant Powder**, EPA Registration Number **655-691** to waters of the state to eradicate invasive Northern Pike in Sand Lake, Anchorage, Alaska. DEC is issuing the enclosed permit in accordance with Alaska Statute 46.03.330 and Title 18, Chapter 90.525 of the Alaska Administrative Code (18 AAC 90.525) for a period not to exceed two years.

Any person who disagrees with this decision may request an adjudicatory hearing in accordance with 18 AAC 15.195 - 18 AAC 15.340, or an informal review by the Division Director in accordance with 18 AAC 15.185. Informal review requests must be delivered to the Division Director, Alaska Department of Environmental Conservation, 555 Cordova Street, Anchorage, AK 99501 within 15 days of the permit decision. Adjudicatory hearing requests must be delivered to the Commissioner of the Department of Environmental Conservation, 410 Willoughby Avenue, Suite 303, Juneau, Alaska 99801, within 30 days of the permit decision. In addition, please send a copy of the request to ADEC Pesticide Program, 1700 E. Bogard Road, Building B Suite 103, Wasilla, AK 99654. If a hearing is not requested within 30 days, the right to appeal is waived.

Sincerely,

Robert J. Blankenburg, P.E.
Solid Waste & Pesticides Program Manager

Enclosure

STATE OF ALASKA
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
555 CORDOVA STREET
ANCHORAGE, ALASKA 99501

PERMIT TO APPLY PESTICIDES

Permit No.: 09-AQU-02
Date Issued: August 3, 2009
Date Effective: September 12, 2009
Date Expires: December 31, 2010

The Alaska Department of Environmental Conservation (ADEC), under authority of Alaska Statute 46.03.330 and Title 18, Chapter 90.525 of the Alaska Administrative Code (18 AAC 90.525), hereby grants a Permit to Apply Pesticides to:

Kristine Dunker
Alaska Department of Fish and Game
333 Raspberry Road
Anchorage, Alaska 99518

for the purpose of applying the pesticide **CFT Legumine Fish Toxicant**, EPA Registration Number **75338-2** and **Prentox Rotenone Fish Toxicant Powder**, EPA Registration Number **655-691** to waters of the state to eradicate invasive Northern Pike in Sand Lake, Anchorage, Alaska.

The permit holder shall manage and apply the pesticide in accordance with 18 AAC 90 and the permit application materials submitted June 8, 2009. In addition, the following permit conditions and stipulations are required:

1. Apply pesticides prior to freeze up or ice formation on the lake.

2. Use pesticides only in the manner specified by the label instructions. Adhere to all the requirements specified by the pesticide product label.

3. Ensure that pesticides are applied only by a person properly certified by DEC to apply such pesticides, or a person under the direct supervision of a person so certified.

4. Apply pesticides using properly calibrated equipment, and in strict compliance with safety precautions.

5. Public notification signs must be posted prior to pesticide application at each point of access to the lake, as specified in 18 AAC 90.630(a). Signs shall remain posted at the treatment site until application is complete.

6. If rotenone-treated water is discharged through the storm drain and sentinel fish at Campbell Lake exhibit any signs or symptoms of rotenone poisoning, apply potassium permanganate immediately to neutralize the rotenone.

7. Notify the DEC Pesticide Program immediately if potassium permanganate is applied to neutralize rotenone-treated water.

8. Maintain the following records for each pesticide used. Records must be available to DEC upon request:
   - Product name
   - EPA registration number
   - Target pest
   - Date and time of application
   - Method of application
   - Weather conditions during application
   - Amount of pesticide used
   - Location and size of treatment area
   - Names of applicators
   - Purchase, storage, and disposal information

9. Dispose of empty pesticide containers in accordance with label directions and 18 AAC 90.615(a). Any burning of pesticide containers must be done in compliance with 18 AAC 50.

10. Immediately report any spill or accident, alleged accident, or complaint to the DEC Pesticide Program at 1-800-478-2577.

11. Ensure that decontamination, safety, and spill clean-up supplies are available at the treatment site at all times during application.

12. Store all pesticide containers securely, as required by 18 AAC 90.615(d). Post a warning notice on the outside of each storage area in compliance with 18 AAC 90.615(e)-(h).

13. No later than **March 31, 2011**, submit a written Summary of Treatment Results in accordance with 18 AAC 90.535. This summary must include the following information for **each** pesticide used:
   - Product name
   - EPA registration number
   - Target pest
   - Dates and times of application
   - Method of application
   - Weather conditions during applications
   - Total amount of pesticide used
   - Location and size of treatment area
   - Names of applicators

- Purchase, storage, and disposal information
- Assessment of success or failure of the treatments
- Any observed effect on human health, safety or welfare, animals, or the environment

In addition to the above stipulations, the ADEC Pesticide Program may monitor treatments to ensure compliance with 18 AAC 90 and the Permit Conditions and Stipulations.

This permit expires on **December 31, 2010**, or upon completion of the above described project, whichever comes first, and may be revoked in accordance with 18 AAC 90.540.

Robert J. Blankenburg, P.E.
Solid Waste & Pesticides Program Manager

Appendix 3. Board of Fish letter approving the use of rotenone.

STATE OF ALASKA

SEAN PARNELL, GOVERNOR

DEPARTMENT OF FISH AND GAME
BOARD OF FISHERIES

ADF&G
P.O . BOX 115526
JUNEAU, AK 998011-5526
PHONE: (907) 465-4110
FAX: (907) 465-6094

Charles O. Swanton
Division Director
ADF&G, Sport Fish
PO Box 115526
Juneau, AK 99811-5526

August 18, 2009

Dear Charles,

The Board of Fisheries received your August 11, 2009 letter asking for consent to use Rotenone to eradicate a non-indigenous Northern Pike population from Sand Lake in Anchorage and Scout Lake near Sterling as per Alaska Statute 16.35.200. The Board of Fisheries supports its use in this project. The board members were polled and there was no opposition.

Please contact Jim Marcotte, the board's Executive Director (465-6095) if you have any questions on this.

Regards,

John E. Jensen

John Jensen
Chairman, Alaska Board of Fisheries

cc: Board of Fisheries members
Kristine Dunker, ADF&G
Rob Massengill, ADF&G
James Hasbrouck, ADF&G
Rob Bentz, ADF&G

Note: Charlie Swanton, the Director of the Division of Sport Fish for the Alaska Department of Fish and Game gave his approval through e-mail correspondence dated August 12, 2009.

Appendix #4. Comments received during project scoping in 2007.

Note to the USFWS: All comments were received with names and e-mail addresses associated with them. Names, addresses, and e-mail addresses were removed to maintain anonymity of responders because this draft EA will be posted online for public review.

1) Thank you for expressing my feelings about the Pike situation in Sand Lake. They have ruined not only the Trout fishery but have severely hurt the survival of the baby ducks. Yes, poison the fish and start over with new trout. I love flyfishing too, and enjoy watching them. It saddens me to see the pike and how they have taken over. I'll bet I have at least 8 pike living in the weeds in front of my house! When the trout are released in the lake and they are around my dock, my dog spends hours watching them. Sometimes I have to give him treats to get him to come off the dock and in at night! Quite a few years ago, I bought " Fish Chow" to feed the trout.....I wouldn't consider that now. My original feelings when the pike were discovered, was to poison the lake immediately, so yes, let's help it happen!

2) Amen, brother. Kill the pike. Long live rainbows.
Thanks for taking the time to look into it for all of us.

3) I think the trout restoration project would be a great improvement for Sand Lake!

4) We have seen the same result that you cite as a consequence of the pike introduction. We live on the main canal and see many pike, but few trout anymore. When we moved herein 1978, we saw many trout and no pike. We'd support a reasonable solution to this situation either through Ak Fish & Game or another appropriate agency.

5) (Personal name) asked me to respond for him. He would totally support the plan for the control and eradication of the pike in Sand Lake. He feels the sooner the better. Please let us know if there is a need for any financial support for the project.

6) Thanks for your effort on this. We support a plan to eradicate pike in Sand Lake under the supervision of Fish and Game.

7) I am in favor of getting rid of the pike with Rotenone. You have my support.

8) I agree with you that something needs to be done with the lake as the lack of waterfowl (with the exception of the geese) this year is alarming. My only concern is putting something toxic into the lake as everyone on this side of the lake has a well and the water has so much arsenic in it anyway it is toxic enough!

If the ADF&G feels that it would be safe to proceed as outlined in your memo and the rest of the residents on this side are ok with it, then we would have no objections.

9) Since I don't fish, I don't care what they do to relieve the problem. I have also noticed the drastic decline in trout, but the other day a guy came by in a canoe and told me they were catching dollies like mad in the center of the cove on my end of the lake. I did not know there were dollies in here, and he says they were not pike. So I would vote to remove the pike by whatever means short of draining the lake.

10) Sounds like a good time to get rid of the pike. They can't flourish without a good food source and it looks like they've eaten that up. Bring back the rainbows!

11) I am in favor of killing the pike and restocking with rainbows, as are all of my neighbors.

12) We are all for a solution.

13) I support your plan and need as outlined.

14) We are both in agreement on your proposal.

15) We are in total support of eliminating the pike from our lake. Rotenone seems to be the best way to accomplish this.

16) I am in favor of getting rid of the pike.

17) Kill the lake and start over. Good Idea. I agree.

18) I'm with you 110%. I've noted the same drastic trout decline & pike buildup as you.

19) We live on Sand Lake (address.) and support the idea of getting rid of the Northern Pike in Sand Lake ASAP.

20) Great idea.

21) Are there are any concerns for human users of the water (swimmers, wake boarders, etc)? If not then you have my support for removing the unwanted, destructive species.

22) First - I do not believe that someone is dumping pike into our lake. I believe that the eggs come in on weeds brought by the planes (ie. tail rudders and such). Why do I believe this because I do not believe that "someone" is catching large pike "alive" knowing which are female or male etc., keeping them alive and then dumping them into lakes including ours. They would have to be a very bright Biologist.

Anyway the second reason, and to me more important is that we started with very small pike to begin with (I never saw or caught a pike of any size whenever I was fishing for trout for many years before this). Probably 8-10 years ago, I was out by

our shoreline and I thought I saw a very small 2 - 3" pike minnow in the weeds (I grow up back in NY and I know what pike look like) I mentioned it to (personal name). The next year I saw slightly larger ones and each year they have gotten bigger and yes less and less trout as a result of them but also because of the "huge" increase in winter ice fisherman.

The lake is full of pike now - I can catch 20-40 in two hours about 8-20" long. (Personal name) caught a 31" one and I have seen them up to 36".

The eagles and Ospreys catch pike now by the shoreline.

So I am not quite sure which is better or worse for that matter. More trout to attract more non-resident fisherman that seem to leave behind lots of trash especially cans (look in the water around the canals and other favorite spots) or let the lake go to the pike which the fisherman don't seem to catch (especially in winter) or like. Maybe less "visiting"fisherman and trash?

So as you can see I can go either way on this. I would like to hear other resident's thoughts.

23) (Personal name), I share you views about trout numbers being greatly diminished or absent from Sand Lake. I am seeing a few pike in the lake around our dock and there is almost no surface activity on the calm days which is a big change. We still see eagles and loons and the occasional osprey. I also think the number of grebes is down. I have read what you describe, about it being necessary "kill" the lake and start over. If that is the appropriate and necessary step, then I support it. If it matters this is my 33rd summer on Sand Lake and I too miss evenings with fly rod, canoe and a #18 mosquito catching and releasing feisty little Rainbows. Thanks for your efforts.

24) Thank you for emailing us your ideas on the northern pike and your plans for their elimination from Sand Lake. Though we are definitely interested in eliminating the pike from the lake, we would like to study the process you outlined in a little more detail. In particular we want to study the use of rotenone, its long term effectiveness related to the biodiversity of the lake, and potential hazards associated with this chemical.

Please expect a more definitive reply next week after we have had sufficient time to consider the proposal.

25) Dear (personal name), we just read your email yesterday and have looked up rotenone online. It has some potential poor side effects noted in the report on the website we have attached and we wondered if you and the fish and game were aware of it, seeing as the website you gave us on your email didn't mention Parkinson's. It isn't that we are against it, not at all. We just wonder how much research into the side effects has been put into the study for Sand Lake. Thanks for your work on this very irritating problem!

Appendix #5. Comments received during the public comment period between June 30 and July 30, 2009.

1) I would like to provide comments on the Sand and Scout Lake Environmental Assessments. The website lists you as the contact so I assume you should receive this, if not please forward.

I am in favor of the use of Rotenone or any other means in all Alaskan waters to eliminate pike. They are an invasive species and should be completely eradicated. Please do not stop with these two lakes there are several lakes in the Willow area that have been overrun with pike. We used to see lots of baby loons and ducks now there are none. And forget about catching a trout or salmon they are an endangered species because the 38" pike have them for a snack.

Thanks for allowing me to comment.

2) Hi, I totally agree with eradicating the pike in all the lakes and streams in Alaska. I have lived here for a long time and fishing is not the same in the lakes where pike have been placed. Please do something or fishing will never be the same here.

Appendix #6. Questions asked and responses given during the public meeting discussion on July 8, 2009.

1) *How large were the stunted pike in Cheney Lake?*
   The Cheney Lake pike were all in the range of 15-16 inches in length.

2) *Are the pike in Sand Lake stunted?*
   The pike in Sand Lake are not stunted to the extent they were in Cheney Lake because the lake is deeper, there is more habitat variation, and, because we have continued stocking Sand Lake at low levels, the pike have always had prey.

3) *Do the dead fish sink? What was the experience with Cheney and Arc Lakes?*
   Most of the fish will sink. That was our experience with last year's treatments where all of the pike sank to the bottom of the lakes. However, back in 2000 when ADF&G used rotenone in a lake on the Kenai Peninsula to remove illegally-introduced yellow perch, many of those perch surfaced. That treatment occurred in early September when water temperatures were still a little warmer. It is likely that the fish in Sand Lake will sink, but we will collect any that surface following treatment.

4) *Are pike moved around by sticking to floatplane floats?*
   This is not likely because of the desiccation of eggs that adhere to floatplane floats. If floatplanes were a vector, lakes like Lake Hood would have populations of northern pike, and it doesn't. Pike have been illegally introduced by people flying them and releasing them into lakes, but eggs that accidentally adhere to floats would not survive to recolonize other lakes with floatplane access.

5) *Didn't ADF&G plant pike in Bulchitna Lake in the 1960s?*
   No, ADF&G did not stock these pike.

6) *Will fish netted before the rotenone treatment be donated?*
   Yes, before we treat Sand Lake, we will gillnet as many fish in the lake as we can and donate these to Beans Café downtown.

7) *What is the natural species in Sand Lake?*
   Three-spine sticklebacks are likely the only naturally-occurring fish in Sand Lake.

8) *How much does this project cost?*
   The rotenone and shipping costs approximately $25K. If personal time is factored in, total project costs exceed $100K.

9) *Will the rotenone get into the wetlands?*
   The littoral areas of Sand Lake will be treated with backpack sprayers., but the rotenone binds with organic materials, and will not persist. Wetland 37A to the south of Sand Lake is separated from the lake because of a high ridge along the

southern shore of the lake. The ridge will block any rotenone-treated water from moving into that area.

10) *Can the rotenone-killed fish be eaten?*
It would not hurt anyone to eat the fish, but ADF&G cannot endorse this. The EPA and FDA do not have permissible tolerance limits for consuming rotenone-killed fish.

11) *Is there anything anyone can do to assist?*
You can participate in the public process by submitting comments on the draft EA during the comment period. You can also help get your neighbors involved.

12) *Is this project going forward regardless?*
The timing and ability of this project to move forward will depend on the outcome of the public process and obtaining approvals from both the Alaska Department of Environmental Conservation and the U.S Fish and Wildlife Service.

13) *When can people fish in Sand Lake again?*
If the treatment is successful, the lake will be stocked with rainbow trout and Arctic char in the early summer of 2010.

14) *Is there anything we can do to help move along the process because we hear people saying they are against this?*
If you hear people saying they don't want to see the pike removed, encourage them to call us. We want to discuss the project with these folks. If anybody really opposes this project, we need to hear from those people during this comment period.

15) *Will signs be posted about the rotenone?*
Yes, we will post signs at all public access points before the treatment. We will also send a letter of all the residents around the lake and issue a news release prior to treatment.

16) *What is the length of time it takes to kill the fish with rotenone?*
Most of the fish will die within the first 48 hours. We will be testing this with caged, sentinel fish during the treatment. Last year, when we treated Cheney Lake, all the caged fish died within 12 hours.

Appendix #7. Finding of No Significant Impact.

U.S. Department of the Interior
Fish and Wildlife Service
Region 7, Alaska

FINDING OF NO SIGNIFICANT IMPACT

Proposed Removal of Invasive Northern Pike *Esox lucius* from Sand Lake, Anchorage, Alaska

The Alaska Department of Fish and Game (ADF&G), Sport Fish Division, proposes using the piscicide rotenone to remove an illegally introduced population of northern pike in Sand Lake, Anchorage, Alaska. Planned activities include the complete eradication of northern pike from the lake and subsequent restocking with rainbow trout and Arctic char. It is anticipated the removal of northern pike from Sand Lake will reduce the threat of northern pike being illegally introduced into other nearby water bodies, including the Campbell Creek watershed. The proposed action will also restore a quality angling opportunity for the public in the area. The eradication project will be funded primarily through allocations to ADF&G from the U.S. Fish and Wildlife Service Aquatic Nuisance Species Program.

Alternatives Considered

Four alternatives were evaluated: draining the lake, using gill nets and/or trap nets to remove northern pike, the proposed project, and a "no action" alternative. Draining the lake was dismissed as an alternative due to the difficulty of efficiently draining the lake to a level that would freeze completely, which is necessary to eradicate the pike. This alternative would take months, would be very noisy involving large pumps operating around the clock, and is opposed by local residents. Also, the lake is used by several residents who have float planes, and draining the lake would have been detrimental to them. Mechanical removal was also dismissed as an alternative, as deployment of nets and traps has primarily been successful in very small lakes and Sand Lake exceeds the surface area criteria necessary for success. Also, gill netting, one of the two mechanical methods evaluated, could expose birds and aquatic mammals to the risk of net entanglement in water. The "no action" alternative was also rejected because there would be continued risk that northern pike could be transported from Sand Lake to nearby wild fisheries.

Public Review

The local ADF&G advisory committee in Anchorage, the Sand Lake Community Council, ADEC, USFWS, Anchorage Department of Parks and Recreation, and the Municipality of Anchorage Watershed Task Force were sent a project synopsis and an e-mail link to this EA on May 14, 2009. Fact sheets describing the project were distributed to approximately 400 households around the lake. These flyers also announced the public meeting date (July 8, 2009) and included the web address to ADF&G's rotenone website. ADF&G created websites to provide information about rotenone to the public. These included links to this EA. Written public notices of the Sand Lake restoration proposal were announced in the Anchorage Daily

News and an ADF&G news release, as required by ADEC during the pesticide use permitting process. An informational public meeting was held at 7:00 pm on July 8, 2009, at Calvary Church.

The public comments that were received were overwhelmingly in support of the project. However, one comment raised concerns about the potential for more people using the area for recreation. ADF&G responded that one of the goals of the project is to increase fishing opportunities. While it is possible that more people could use the area for fishing than do currently, ADF&G has the legal authority to stock fish in this waterbody. Another comment raised concerns regarding potential adverse effects of rotenone on humans relative to Parkinson's disease. ADF&G responded that one study initially indicated a link between rotenone and Parkinson's disease, however, that study was later refuted by several other studies. Also, in 2007, the EPA concluded that there were no adverse human or environmental health risks associated with using rotenone for fisheries management. A third respondent raised potential concern over using rotenone in the lake, as some of the residents have drinking water wells. The EA specifically addresses this issue. No contamination of groundwater is anticipated to result from this rotenone treatment. Rotenone binds readily to sediments and is broken down in soil and in water through the processes of hydrolysis, photolysis, and biodegradation. Also, known drinking water wells are located at a depth greater than 150-250 feet, are well below a clay confining layer, and that aquifer is replenished by runoff from the Chugach Mountain Range.

Conclusions

Evaluation of the ecologic and socio-economic effects of the proposal has shown this project will not negatively impact the quality of the human environment. No wetlands or other sensitive habitats will be affected by the work as proposed. Furthermore, the proposed techniques were previously used by ADF&G in the fall of 2008 to successfully remove the entire northern pike population from Cheney Lake, in Anchorage. Accordingly, I find that all reasonable alternatives were considered in the evaluation of this project. I also find that this project complies with the meaning of Executive Order 11990 and 11988. Therefore, based on a review and evaluation of the enclosed, environmental assessment, I have determined the proposed removal of invasive northern pike as described in the project entitled, "Sand Lake Restoration Project" is not a major federal action which would significantly affect the quality of the human environment within the meaning of Section 102 (2) (c) of the National Environmental Policy Act of 1969.

The environmental assessment, prepared by the Alaska Department of Fish and Game has been adopted by the U.S. Fish and Wildlife Service according to rules contained in 40 CFR 1506.3. Accordingly, preparation of an environmental impact statement on the proposed action is not required.

for Geoffrey L. Haskett
Regional Director

30 Sept 09
Date