STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

JOHN ELIAS BALDACCI
GOVERNOR

DAVID P. LITTELL
COMMISSIONER

June 15, 2006

Mr. Jim Pellerin
Maine Department of Inland Fisheries and Wildlife
358 Shaker Road
Gray, Maine 04039

RE: Maine Permit Compliance System (PCS) Tracking #MEU508231
Maine Waste Discharge License (WDL) Application # W-008231-5U-A-N
**Final License**

Dear Mr. Pellerin:

Enclosed please find a copy of your **final** Maine WDL which was approved by the Department of Environmental Protection. Please read the license and its attached conditions carefully. You must follow the conditions in the Order to satisfy the requirements of law. Any discharge not receiving adequate treatment is in violation of State Law and is subject to enforcement action.

Any interested person aggrieved by a Department determination made pursuant to applicable regulations, may appeal the decision following the procedures described in the attached DEP FACT SHEET entitled "*Appealing a Commissioner's Licensing Decision.*"

The Department would like to make you aware that your monthly Discharge Monitoring Report (DMR) forms may not reflect the revisions in this permitting action for several months after permit issuance. However, you are required to report applicable test results for parameters required by this permitting action that do not appear on the DMR. Please see the attached April 2003 O&M Newsletter article regarding this matter.

If you have any questions regarding the matter, please feel free to call me at (207) 287-6114 or by email at Robert.D.Stratton@maine.gov.

Sincerely,

Robert D. Stratton
Division of Water Quality Management
Bureau of Land and Water Quality

Enc./cc: Stuart Rose (MEDEP); Sandy Lao (USEPA)

AUGUSTA
17 STATE HOUSE STATION
AUGUSTA, MAINE 04333-0017
(207) 287-7688 FAX: (207) 287-7826
RAY BLDG., HOSPITAL ST.

BANGOR
106 HOGAN ROAD
BANGOR, MAINE 04401
(207) 941-4570 FAX: (207) 941-4584

PORTLAND
312 CANCO ROAD
PORTLAND, MAINE 04103
(207) 822-6300 FAX: (207) 822-6303

PRESQUE ISLE
1235 CENTRAL DRIVE, SKYWAY PARK
PRESQUE ISLE, MAINE 04769-2094
(207) 764-0477 FAX: (207) 760-3143

web site: www.maine.gov/dep

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# DMR Lag

**(reprinted from April 2003 O&M Newsletter)**

When the Department renews discharge permits, the parameter limits may change or parameters may be added or deleted. In some cases, it is merely the replacement of the federally issued NPDES permit with a state-issued MEPDES permit that results in different limits. When the new permit is finalized, a copy of the permit is passed to our data entry staff for coding into EPA's Permits Compliance System (PCS) database. PCS was developed in the 1970's and is not user-friendly. Entering or changing parameters can take weeks or even months. This can create a lag between the time your new permit becomes effective and the new permit limits appearing on your DMRs. If you are faced with this, it can create three different situations that have to be dealt with in different ways.

1. If the parameter was included on previous DMRs, but only the limit was changed, there will be a space for the data. Please go ahead and enter it. When the changes are made to PCS, the program will have the data and compare it to the new limit.

2. When a parameter is eliminated from monitoring in your new permit, but there is a delay in changing the DMR, you will have a space on the DMR that needs to be filled. For a parameter that has been eliminated, please enter the space on the DMR for that parameter only with "NODI-9" (No Discharge Indicator Code #9). This code means monitoring is conditional or not required this monitoring period.

3. When your new permit includes parameters for which monitoring was not previously required, and coding has not caught up on the DMRs, there will not be any space on the DMR identified for those parameters. In that case, please fill out an extra sheet of paper with the facility name and permit number, along with all of the information normally required for each parameter (parameter code, data, frequency of analysis, sample type, and number of exceedances). Each data point should be identified as monthly average, weekly average, daily max, etc. and the units of measurement such as mg/L or lb/day. Staple the extra sheet to the DMR so that the extra data stays with the DMR form. Our data entry staff cannot enter the data for the new parameters until the PCS coding catches up. When the PCS coding does catch up, our data entry staff will have the data right at hand to do the entry without having to take the extra time to seek it from your inspector or from you.

   EPA is planning significant improvements for the PCS system that will be implemented in the next few years. These improvements should allow us to issue modified permits and DMRs concurrently. Until then we appreciate your assistance and patience in this effort.

STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION
STATE HOUSE STATION 17 AUGUSTA, MAINE 04333

DEPARTMENT ORDER

**IN THE MATTER OF**

| | | |
|---|---|---|
| ME. DEPT. INLAND FISHERIES & WILDLIFE | ) | PROTECTION AND IMPROVEMENT |
| BIG SPECK POND | ) | OF WATERS |
| NORWAY, OXFORD COUNTY, ME. | ) | MAINE |
| AQUATIC PESTICIDE TREATMENT | ) | WASTE DISCHARGE LICENSE |
| #MEU508231 | ) | |
| #W-008231-5U-A-N | ) | **NEW** |

Pursuant to the provisions of Maine Law 38 M.R.S.A., Section 414-A et seq., and applicable regulations the Department of Environmental Protection (Department) has considered the application of the MAINE DEPARTMENT OF INLAND FISHERIES AND WILDLIFE (MDIFW), with its supportive data, agency review comments, and other related materials on file and FINDS THE FOLLOWING FACTS:

## APPLICATION SUMMARY

The applicant has applied for a Maine Waste Discharge License (WDL) to enable eradication of invasive fish species, chain pickerel (Esox niger) and golden shiner (Notemigonus crysoleucas); and restocking with native brook trout (Salvelinus fontinalis) in Big Speck Pond, a Class GPA water in Norway, Maine. The MDIFW proposes to treat the pond with powdered and liquid formulations of rotenone (Prentox/Prenfish), an aquatic piscicide, in August 2006 and in subsequent years as necessary through the five year term of a WDL to insure program success. The primary target water of the treatment program is Big Speck Pond, however the treatment area also includes its outlet stream (Class AA), Little Speck Pond (Class GPA), and its outlet stream (Class AA). The applicant has designed the treatment program to minimize discharges to downstream waters within the treatment area and to prevent discharges to Hobbs Brook and other downstream waters outside of the treatment area. In addition to restoration of Big Speck Pond, the proposed treatment is part of a management plan to provide a quality trout fishery in Southern Maine, a rare resource due to illegal introductions of native and non-native fish species.

## PERMIT/LICENSE SUMMARY

January 12, 2001 – The Department received authorization from the U.S. Environmental Protection Agency (USEPA) to administer the National Pollutant Discharge Elimination System (NPDES) permit program in Maine, excluding areas of special interest to Maine Indian Tribes. On October 30, 2003, after consultation with the U.S. Department of Justice, USEPA extended Maine's NPDES program delegation to all but tribally owned lands. In those areas, the Department maintains the authority to issue WDLs pursuant to Maine law. The extent of Maine's delegated authority is under appeal at the time of this licensing action.

**PERMIT/LICENSE SUMMARY (cont'd)**

On February 1, 2005, USEPA published the *Proposed Rulemaking and Notice of Interpretive Statement for the Application of Pesticides to Waters of the United States in Compliance with* FIFRA (Federal Register Vol. 70, No. 20). In this notice, USEPA interpreted the Clean Water Act (33 U.S.C. 1251 et seq.) as not requiring NPDES permits for certain applications of pesticides if conducted in compliance with the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). USEPA guidance specifically discusses the application of pesticides directly to waters of the United States in order to control pests that are present in those waters, such as is the subject of this licensing action. The USEPA proposes to codify the interpretative statement at 40 CFR Part 122.3(h)(1). The Department is following the USEPA ruling on Clean Water Act applicability. However, the proposed activity is subject to Maine law; therefore the Department is issuing a Maine WDL.

Maine Law, 38 MRSA Section 465-A. Standards for Classification of Lakes and Ponds, specifies that such waters must be suitable for designated uses, which include "*...habitat for fish and other aquatic life. The habitat shall be characterized as natural.*" MDIFW reports that quality brook trout fisheries are relatively rare in southern Maine due largely to changes in fisheries composition from illegal introductions of both native and non-native fish species. Illegal introductions of fish have and continue to occur at an increased pace in southern Maine and are one of the most serious threats to Maine's brook trout populations and their habitat. The Big Speck Pond treatment program is designed to eradicate introduced and invasive species and reintroduce native brook trout in an attempt to restore and preserve the natural habitat and ecosystem of the pond.

**This licensing action establishes requirements for:**

1. an introduced/invasive fish eradication and native fish reclamation program which includes reduction of water levels in Big Speck Pond prior to treatment to provide for maximum natural rotenone degradation and to minimize or prevent impacts to downstream non-target organisms and resources;

2. rotenone concentration analysis within 24-hours of treatments;

3. residual rotenone toxicity bioassay testing using sentinel brook trout cages in Big Speck Pond prior to restoration of outlet flow, with a provision for repeat analyses as needed based on toxicity;

4. residual rotenone toxicity bioassay testing using sentinel brook trout cages at the confluences with downstream non-treatment area waters to determine potential effects on non-target organisms and resources, with provisions for repeat analyses as needed based on toxicity;

5. pre and post-treatment water quality monitoring;

6. post-restocking fish population census(es) and evaluation of brook trout survival and growth to determine treatment effectiveness and project success;

7. reporting requirements for all monitoring conducted.

## CONCLUSIONS

BASED on the findings in the attached Fact Sheet dated May 11, 2006 and revised June 12, 2006, and subject to the Conditions listed below, the Department makes the following conclusions:

1. The discharge, either by itself or in combination with other discharges, will not lower the quality of any classified body of water below such classification.

2. The discharge, either by itself or in combination with other discharges, will not lower the quality of any unclassified body of water below the classification which the Department expects to adopt in accordance with state law.

3. The provisions of the State's antidegradation policy, 38 MRSA Section 464(4)(F), will be met, in that:

   (a) Existing in-stream water uses and the level of water quality necessary to protect and maintain those existing uses will be maintained and protected;
   (b) Where high quality waters of the State constitute an outstanding national resource, that water quality will be maintained and protected;
   (c) The standards of classification of the receiving water body are met or, where the standards of classification of the receiving water body are not met, the discharge will not cause or contribute to the failure of the water body to meet the standards of classification;
   (d) Where the actual quality of any classified receiving water body exceeds the minimum standards of the next highest classification, that higher water quality will be maintained and protected; and
   (e) Where a discharge will result in lowering the existing quality of any water body, the Department has made the finding, following opportunity for public participation, that this action is necessary to achieve important economic or social benefits to the State.

4. The discharge will be subject to effluent limitations that require application of best practicable treatment.

5. The discharge is necessary and there are no other practical alternatives available.

6. The proposed treatment project will result in short-term adverse impacts to non-target aquatic organisms within the treatment area, but is necessary in order to eliminate the introduced species and ensure long-term maintenance of receiving water quality and uses.

## ACTION

THEREFORE, the Department APPROVES the above noted application of the MAINE DEPARTMENT OF INLAND FISHERIES AND WILDLIFE to conduct an aquatic pesticide treatment program and discharge rotenone to Big Speck Pond, Class GPA, SUBJECT TO THE ATTACHED CONDITIONS, and all applicable standards and regulations including:

1. "Maine Pollutant Discharge Elimination System Permit Standard Conditions applicable To All Permits," revised July 1, 2002, copy attached.

2. The attached Special Conditions, including any effluent limitations and monitoring requirements.

3. This license expires five (5) years from the date of signature below.

DONE AND DATED AT AUGUSTA, MAINE, THIS 15TH DAY OF June, 2006.

DEPARTMENT OF ENVIRONMENTAL PROTECTION

BY: _____ for
David P. Littell, Commissioner

PLEASE NOTE ATTACHED SHEET FOR GUIDANCE ON APPEAL PROCEDURES

Date of initial receipt of application: December 22, 2005
Date of application acceptance: December 23, 2005

FILED
JUN 21 2006
BOARD OF ENVIRONMENTAL PROT.
STATE OF MAINE

Date filed with Board of Environmental Protection _____.

This Order prepared by Robert D. Stratton, BUREAU OF LAND & WATER QUALITY
#MEU508231 / #W-008231-5U-A-N June 12, 2006

## SPECIAL CONDITIONS

## A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

The licensee is authorized to **conduct an introduced / invasive fish eradication program and discharge powdered and liquid formulations of rotenone (Prentox / Prenfish) to Big Speck Pond.** Such discharges related to **one initial treatment and subsequent booster treatments in each calendar year of the term of the license as necessary to insure program success,** shall be limited and monitored by the licensee as specified below.

1. All sampling and analysis must be conducted in accordance with: (a) methods approved by 40 Code of Federal Regulations (CFR) Part 136, (b) alternative methods approved by the Department in accordance with the procedures in 40 CFR Part 136, or (c) as otherwise specified by the Department. Samples that are sent out for analysis shall be analyzed by a laboratory certified by the State of Maine's Department of Health and Human Services except for proprietary techniques specifically approved by the Department.

2. The licensee shall utilize a pesticide applicator who is certified and licensed in aquatic pesticide control by the Maine Bureau of Pesticide Control and shall provide proof of certification/licensing to the Department upon request. All rotenone discharges shall be conducted pursuant to label instructions, information included in the licensee's application, and provisions of this licensing action.

3. The licensee shall reduce water levels within Big Speck Pond by one meter prior to rotenone treatments to provide for maximum natural rotenone degradation and to minimize or prevent impacts to non-target organisms and resources;

4. The licensee shall conduct monitoring within Big Speck Pond once within 24-hours of each initial annual treatment to determine the concentration (mg/L) of rotenone and the necessity of additional (booster) treatments. A minimum of three grab samples shall be collected for water column profile analysis from the surface to the bottom. Analyses shall be conducted using bioassay methods described in Demong (1992) using a minimum of three 3-6-inch long live brook trout per profile depth, with trout responses used to calculate rotenone concentrations. Results shall be reported to the Department in writing pursuant to License Special Condition D. See Fact Sheet Attachment B for tabular representation.

5. The licensee shall conduct residual rotenone toxicity testing in Big Speck Pond immediately prior to restoration of the outlet flow. This analysis shall utilize 48-hour toxicity tests on five live brook trout placed in sentinel cages in Big Speck Pond near the outlet, timed so that completion of the test shall occur no less than 48-hours before outlet flow is restored. Analyses shall be repeated at one-week intervals until tests indicate 100% survival of the sentinel fish, regardless of the status of outlet flow. Results shall be reported to the Department in writing pursuant to License Special Condition D. See Fact Sheet Attachment B for tabular representation.

## SPECIAL CONDITIONS

### A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (cont'd)

6. The licensee shall conduct residual rotenone toxicity testing at the confluence of the Little Speck Pond outlet stream and Hobbs Brook beginning at the time of resumption of the Big Speck Pond outlet flow. This analysis shall utilize 48-hour toxicity tests on five live brook trout placed in sentinel cages in the area noted. Analyses shall be repeated at one-week intervals until tests conducted in Big Speck Pond indicate 100% survival of the sentinel fish. Results shall be reported to the Department in writing pursuant to License Special Condition D. See Fact Sheet Attachment B for tabular representation.

7. The licensee shall conduct residual rotenone toxicity testing at the confluence of Hobbs Brook and the Crooked River only in the event that Little Speck Pond outlet stream / Hobbs Brook sentinel trout bioassay tests indicate residual rotenone toxicity. This analysis shall utilize 48-hour toxicity tests on five live brook trout placed in sentinel cages in the area noted. Analyses shall be repeated at one-week intervals until tests conducted in Big Speck Pond indicate 100% survival of the sentinel fish. Results shall be reported to the Department in writing pursuant to License Special Condition D. See Fact Sheet Attachment B for tabular representation.

8. The licensee shall conduct water quality monitoring once prior to rotenone treatment during July-August 2006, once following treatment during July-August 2008, and once in July-August in each additional year in which rotenone treatments are conducted. Water quality monitoring shall consist of dissolved oxygen profile concentrations (mg/L), temperature profiles (degrees Celsius), pH (standard units) at the surface and within one meter of bottom, total alkalinity (mg/L CaCO3), at the surface and within one meter of bottom, and secchi disk transparency (m/ft), according to the Department's Standard Field Methods for Lake Water Quality Monitoring. Results shall be reported to the Department in writing pursuant to License Special Condition D. See Fact Sheet Attachment B for tabular representation.

9. Approximately two years following restocking of Big Speck Pond, the licensee shall conduct fish population census(es) and evaluate brook trout survival, growth, and project success. This shall be done by visual shoreline survey followed by seine, gill net, and/or minnow trap sampling. Results shall be reported to the Department in writing pursuant to License Special Condition D. See Fact Sheet Attachment B for tabular representation.

10. The licensee shall submit a report including and evaluating the results of all monitoring conducted in that year **by December 15 of each calendar year** *[PCS codes 90199, 90299, 90399, 90499, 90599]*. The annual report shall include evaluations of the treatment program success as well as recommendations for future treatment needs.

### B. UNAUTHORIZED DISCHARGES

The licensee is authorized to discharge only in accordance with the terms and conditions of this license. Discharges from any other point sources or by any other methods are not authorized under this license, and shall be reported in accordance with Standard Condition B.5 (Bypass) of this license.

## SPECIAL CONDITIONS
## C. NOTIFICATION REQUIREMENT

In accordance with Standard Condition D, the licensee shall notify the Department of the following:

1. Any substantial change in the volume or character of pollutants being introduced into the receiving water.

2. For the purposes of this section, adequate notice shall include information on:

   a. The quality or quantity of pollutants introduced to the receiving water; and

   b. Any anticipated impact of the change in the quantity or quality of the pollutants to be discharged to the receiving water.

## D. MONITORING AND REPORTING

The licensee shall conduct a monitoring program as described in License Special Condition A and Fact Sheet Section 2(g)(7), which will include testing for concentrations and toxicity of rotenone, water quality monitoring, and fish populations.

Monitoring results obtained during the previous month shall be summarized for each month and submitted to the Department in a report postmarked on or before the thirteenth ($13^{th}$) day of the month or hand-delivered to a Department regional office such that the reports are received by the Department on or before the fifteenth ($15^{th}$) day of the month following the completed reporting period. A signed copy of all reports required herein shall be submitted to the Department's assigned compliance inspector (unless otherwise specified) at the following address:

Department of Environmental Protection
Bureau of Land and Water Quality
Division of Water Quality Management
312 Canco Road
Portland, Maine 04103

## E. AQUATIC PESTICIDE TREATMENT PROGRAM

A fishery survey of Big Speck Pond conducted by MDIFW in 2000 indicated the presence of only two fish species: chain pickerel (*Esox niger*) and golden shiner (N*otemigonus crysoleucas*). Brook trout are native to the watershed and have been documented in downstream waters by MDIFW. MDIFW believes Big Speck Pond has the potential to produce a quality trout fishery and has attempted to stock the pond with brook trout on two occasions without success. MDIFW believes chain pickerel and golden shiners are not native to the pond or local drainage area and considers them "invasive" to this particular system, likely altering the aquatic communities and hindering efforts to re-establish a native brook trout fishery.

## SPECIAL CONDITIONS
## E. AQUATIC PESTICIDE TREATMENT PROGRAM (cont'd)

MDIFW reports that quality brook trout fisheries are relatively rare in southern Maine due largely to changes in fisheries composition from illegal introductions of both native and non-native fish species. Illegal introductions of fish has and continues to occur at an increased pace in southern Maine and is one of the most serious threats to Maine's brook trout populations and their habitat.

MDIFW's Big Speck Pond treatment program is designed to eradicate introduced and invasive species in Big Speck Pond through the discharge of powdered and liquid formulations of rotenone (Prentox / Prenfish) in one initial treatment and subsequent booster treatments in each calendar year of the term of the license, as necessary. These efforts will be followed by reintroduction of native brook trout in an attempt to restore and preserve the natural habitat and ecosystem of the pond as well as ensure the long-term maintenance of receiving water quality and uses. The primary target water of the treatment program is Big Speck Pond, however the treatment area also includes its outlet stream (Class AA), Little Speck Pond (Class GPA), and its outlet stream (Class AA). The applicant has designed the treatment program to minimize discharges to downstream waters within the treatment area and to prevent discharges to Hobbs Brook and other downstream waters outside of the treatment area.

## F. REOPENING OF PERMIT FOR MODIFICATIONS

Upon evaluation of the tests results or monitoring requirements specified in Special Conditions of this licensing action, new site specific information, new water quality monitoring data or modeling information, or any other pertinent test results or information obtained during the term of this license, the Department may, at anytime and with notice to the licensee, modify this license to; 1) include effluent limits necessary to control specific pollutants or whole effluent toxicity where there is a reasonable potential that the effluent may cause water quality criteria to be exceeded, (2) require additional monitoring if results on file are inconclusive; or (3) change monitoring requirements or limitations based on new information.

## G. SEVERABILITY

In the event that any provision, or part thereof, of this license is declared to be unlawful by a reviewing court, the remainder of the license shall remain in full force and effect, and shall be construed and enforced in all respects as if such unlawful provision, or part thereof, had been omitted, unless otherwise ordered by the court.

**MAINE WASTE DISCHARGE LICENSE**

FACT SHEET

Date: May 11, 2006
Revised: June 12, 2006

PERMIT COMPLIANCE SYSTEM TRACKING NO. #MEU508231
MAINE WASTE DISCHARGE LICENSE NO. #W-008231-5U-A-N

NAME AND ADDRESS OF APPLICANT:

**Maine Department of Inland Fisheries and Wildlife**
**358 Shaker Road**
**Gray, Maine 04039**

COUNTY: OXFORD

NAME AND ADDRESS WHERE DISCHARGE OCCURS: Big Speck Pond, Norway, Maine

RECEIVING WATER / CLASSIFICATION: Big Speck Pond, Class GPA;
(Outlet Stream, Class AA; Little Speck Pond, Class GPA; Outlet Stream, Class AA)

COGNIZANT OFFICIAL AND TELEPHONE NUMBER: Mr. James Pellerin
MDIFW Biologist
(207) 657-2345, ext 111

## 1. APPLICATION SUMMARY

Application: The applicant has applied for a Maine Waste Discharge License (WDL) to enable eradication of invasive fish species, chain pickerel (Esox niger) and golden shiner (Notemigonus crysoleucas), and restocking with native brook trout (Salvelinus fontinalis) in Big Speck Pond, a Class GPA water in Norway, Maine. The MDIFW proposes to treat the pond with powdered and liquid formulations of rotenone (Prentox/Prenfish), an aquatic piscicide, in August 2006 and in subsequent years as necessary through the five year term of a WDL to insure program success. The primary target water of the treatment program is Big Speck Pond, however the treatment area also includes its outlet stream (Class AA), Little Speck Pond (Class GPA), and its outlet stream (Class AA). The applicant has designed the treatment program to minimize discharges to downstream waters within the treatment area and to prevent discharges to Hobbs Brook and other downstream waters outside of the treatment area. In addition to restoration of Big Speck Pond, the proposed treatment is part of a management plan to provide a quality trout fishery in Southern Maine, a rare resource due to illegal introductions of native and non-native fish species.

## 2. LICENSE SUMMARY

a. Regulatory: January 12, 2001 – The Department received authorization from the U.S. Environmental Protection Agency (USEPA) to administer the National Pollutant Discharge Elimination System (NPDES) permit program in Maine, excluding areas of special interest to Maine Indian Tribes. On October 30, 2003, after consultation with the U.S. Department of Justice, USEPA extended Maine's NPDES program delegation to all but tribally owned lands. In those areas, the Department maintains the authority to issue WDLs pursuant to Maine law. The extent of Maine's delegated authority is under appeal at the time of this licensing action.

On February 1, 2005, USEPA published the *Proposed Rulemaking and Notice of Interpretive Statement for the Application of Pesticides to Waters of the United States in Compliance with* FIFRA (Federal Register Vol. 70, No. 20). In this notice, USEPA interpreted the Clean Water Act (33 U.S.C. 1251 et seq.) as not requiring NPDES permits for certain applications of pesticides if conducted in compliance with the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). USEPA guidance specifically discusses the application of pesticides directly to waters of the United States in order to control pests that are present in those waters, such as is the subject of this licensing action. The USEPA proposes to codify the interpretative statement at 40 CFR Part 122.3(h)(1). The Department is following the USEPA ruling on Clean Water Act applicability. However, the proposed activity is subject to Maine law; therefore the Department is issuing a Maine WDL. For the purpose of tracking data related to this licensing action within the Permit Compliance System, tracking # MEU508231 will be used as the reference number for the Norway project.

Maine Law, 38 MRSA Section 465-A. Standards for Classification of Lakes and Ponds, specifies that such waters must be suitable for designated uses, which include "*...habitat for fish and other aquatic life. The habitat shall be characterized as natural.*" MDIFW reports that quality brook trout fisheries are relatively rare in southern Maine due largely to changes in fisheries composition from illegal introductions of both native and non-native fish species. Illegal introductions of fish have and continue to occur at an increased pace in southern Maine and are one of the most serious threats to Maine's brook trout populations and their habitat. The Big Speck Pond treatment program is designed to eradicate introduced and invasive species and reintroduce native brook trout in an attempt to restore and preserve the natural habitat and ecosystem of the pond.

b. Terms and Conditions: This licensing action establishes requirements for:

1. an introduced/invasive fish eradication and native fish reclamation program which includes reduction of water levels in Big Speck Pond prior to treatment to provide for maximum natural rotenone degradation and to minimize or prevent impacts to downstream non-target organisms and resources;

2. rotenone concentration analysis within 24-hours of treatments;

3. residual rotenone toxicity bioassay testing using sentinel brook trout cages in Big Speck Pond prior to restoration of outlet flow, with a provision for repeat analyses as needed based on toxicity;

4. residual rotenone toxicity bioassay testing using sentinel brook trout cages at the confluences with downstream non-treatment area waters to determine potential effects on non-target organisms and resources, with provisions for repeat analyses as needed based on toxicity;

5. pre and post-treatment water quality monitoring;

6. post-restocking fish population census(es) and evaluation of brook trout survival and growth to determine treatment effectiveness and project success;

7. reporting requirements for all monitoring conducted.

c. History: The most recent licensing and regulatory actions include the following:

1997 – In anticipation of delegation from USEPA to administer the NPDES Program in Maine and upon the recommendation of MEDEP, the Maine Legislature repealed Maine Law, 38 M.R.S.A., Section 413.2-E, which stated, "*The following activities have been determined to have no significant adverse effect on the quality of the waters of the State and do not need to obtain an aquatic pesticide permit from the Department of Environmental Protection: A. The application of aquatic pesticides by the Department of Inland Fisheries and Wildlife to waters of the State for the purpose of restocking, including the elimination of undesirable species...*".

February 1, 2005 - EPA published *Proposed Rulemaking and Notice of Interpretive Statement for the Application of Pesticides to Waters of the United States in Compliance with FIFRA*. Pursuant to this notice, the Big Speck Pond treatment project does not require NPDES or Maine Pollutant Discharge Elimination System (MEPDES) permits if conducted in compliance with FIFRA. However, the project requires a waste discharge license pursuant to Maine law.

May 20, 2005 - Upon the recommendation of MEDEP, the Maine Legislature amended Maine Law, 38 M.R.S.A., Section 465-A.1.C to provide for licensing pollutant discharges to Class GPA waters for "*Aquatic pesticide or chemical discharges approved by the department and conducted by the department, the Department of Inland Fisheries and Wildlife or an agent of either agency for the purpose of restoring biological communities affected by an invasive species.*" The standards for Class AA waters (38 M.R.S.A., Section 465.1C) and other freshwater classifications were similarly amended.

December 22, 2005 - The MDIFW applied for a Maine WDL to enable eradication of invasive fish species and restocking with native brook trout (Salvelinus fontinalis) in Big Speck Pond, a Class GPA water in Norway, with the aquatic pesticide (piscicide) rotenone

(Prentox / Prenfish). The application was assigned Permit Compliance System Tracking number #MEU508231 and WDL #W-008231-5U-A-N.

d. Characterization of Treatment Area:

The treatment program's primary target water is Big Speck Pond. However, the potential treatment area includes Big Speck Pond (Class GPA), its outlet stream (Class AA), Little Speck Pond (Class GPA), and its outlet stream (Class AA). Big Speck Pond in Norway is a 14-acre, mesotrophic pond with a mean depth of 12-feet and a maximum depth of 40 feet. The narrow, southern end of the pond is characterized by relatively shallow water with moderate aquatic macrophyte growth, whereas the upper basin features deeper water with steeply sloped shorelines. The pond drains through an abandoned beaver dam and the outlet stream channel travels approximately 637 feet where it then enters Little Speck Pond. Over this distance the outlet stream drops a total of approximately 45 feet, with several areas of nearly vertical drops over ledge/boulders of up to 3-feet. These outlet features are expected to provide a natural fish barrier to prevent re-infestation of invasive/undesirable fish species from downstream sources. Little Speck Pond is a 4-acre, dystrophic pond with a maximum depth of 4 to 6-feet and a significant amount of organic deposition. The stream channel from Little Speck Pond travels a distance of approximately 1,300 feet before it enters Hobbs Brook (Class AA water), a tributary to the Crooked River (Class AA water). The Big Speck Pond watershed is approximately 66-acres and outlet flow is typically minimal. MDIFW suspects the Big Speck and Little Speck Pond outlets are intermittent in drier years. Given the physical characteristics of the natural outlets, the ability to control the water level or outflow is dependent on use of special mechanisms, such as pumping and sand bags.

A single landowner owns all of the surrounding property around both Big and Little Speck Ponds and there are no camps or homes in the vicinity. Big Speck Pond is potentially used for water contact recreation, fishing, and boating. However, as it is a remote water with limited access, public use is very limited. Access is obtained through permissive trespass, via a 4-wheel drive road that comes to within 300 feet of the southernmost tip of the pond.

e. Presence and History of Invasive Species:

An initial fishery survey of Big Speck Pond was conducted by MDIFW in 2000, with only two fish species observed: chain pickerel (*Esox niger*) and golden shiner (N*otemigonus crysoleucas*). Brook trout are native to the watershed and have been documented by MDIFW a short distance downstream of the pond and treatment area in Hobbs Brook. This same stream also supports other fish species including white suckers, blacknosed dace, and creek chub. The initial survey suggests the pond has the potential to produce a quality trout fishery, but competition and predation from pickerel and shiners would severely limit the fishery. MDIFW stocked two-hundred 8-10-inch long fall fingerling brook trout in 2001, but no trout were observed during subsequent winter and summer sampling events. MDIFW stocked larger spring yearling (10-12 inch long) trout in 2003 to address predation/competition issues, but fall sampling in the same year failed to indicate that any brook trout had survived. MDIFW discovered physical evidence of angler use following stocking, however MDIFW has not learned of trout being caught and has deemed the stocking program unsuccessful.

The MDIFW believes chain pickerel and golden shiners are not native to the pond or local drainage area and should be considered "invasive" to this particular system. These species have likely altered the aquatic communities and have hindered efforts to establish a brook trout fishery, a coldwater native to this watershed. Although chain pickerel and golden shiners are native to Maine, the outlet characteristics of Big Speck Pond and headwater stream habitats downstream of the pond suggest these species were historically introduced. The lack of white suckers in the pond, despite their presence in Hobbs Brook further supports the belief that the outlet channel is impassable and golden shiners and chain pickerel were introduced into the pond. As with most waters, historical information is lacking, so the actual date and origin of introduction remains unknown.

Brook trout populations have evolved in relatively simple aquatic communities and they are known to be very sensitive to introductions of, competition with, and predation by other fish species. Research suggests that brook trout waters in Maine are typically small, infertile lakes, which tend to be even more sensitive to new species introductions (Magnuson 1976, Li and Moyle 1981). In waters in Quebec, it was demonstrated (Magnan 1988) that the presence of one other fish species can effectively alter zooplankton and benthic invertebrate communities, resulting in declines of native brook trout populations. Research in Maine and other northern waters indicates that chemical reclamation with rotenone significantly improves coldwater fisheries, such as brook trout, by removal of invasive or undesirable fish species. In addition to restoring fish communities, reclamation projects are viewed as restoring the entire aquatic community to a more natural state.

f. Project Authority and Need:

MDIFW considers the proposed reclamation project to be consistent with and supported by its legislative mandate in Title 12 M.R.S.A. Ch. 702 §7011, Administrative Policy Regarding Fisheries Management, State of Maine Action Plan for Managing Invasive Species, and the Revised Strategic Management Plan for Fisheries, 2001-2016 as follows:

(1) The Maine Legislature established MDIFW "*to preserve, protect and enhance the inland fisheries and wildlife resources of the State*".
(2) MDIFW's Administrative Policy Regarding Fisheries Management states "*Management programs will focus on...protection and restoration of habitat...*" and Habitat Section-3 reads, "*Projects intended to enhance habitat, although very similar to restoration projects, are intended to improve the habitat value for certain fish species, but are not being done to restore a pre-existing, or historical condition*", as is the focus of the Big Speck Pond treatment program.
(3) The State of Maine Action Plan for Managing Invasive Species states that MDIFW will remove illegally introduced fish when feasible, and chemical reclamation is the most common and effective means of removing of accomplishing this goal.
(4) MDIFW's Revised Strategic Management Plan for Fisheries, 2001-2016 - under the Brook Trout Species Plan for Region A states,

"***Objective 4: Improve fishing quality in Region A lakes and ponds.***

A. *General Management Waters (84 waters): meet angler expectation of a catch rate of 5-6 brook trout/angler-day ranging from 10 to 15 inches long.*
B. *Size Quality Waters (9 waters): meet angler expectation of the presence of brook trout with a minimum size of 12 to 16 inches long.*
C. *Trophy Management Waters (none now in Region A): meet angler expectation of the presence of brook trout with a minimum size of 18 inches and/or 3 pounds in 1 new water.*"

MDIFW reports that quality brook trout fisheries are relatively rare in southern Maine due largely to changes in fisheries composition from illegal introductions of both native and non-native fish species. Illegal introductions of fish have and continue to occur at an increased pace in southern Maine and are one of the most serious threats to Maine's brook trout populations and their habitat. Water quality further limits the potential of many southern Maine waters to be suitable for brook trout and/or to provide quality fisheries. However, the region is blessed with an abundance of warm water lakes and ponds that currently support good populations of golden shiners and chain pickerel.

Remote fishing opportunities are even further limited in the region due to high population densities and heavy development. Big Speck Pond has the potential to not only provide a quality trout fishing experience, but also a remote fishing experience.

The Big Speck Pond treatment program addresses each of these mandates. Further, as stated in Fact Sheet Section 2c, "*upon the recommendation of MEDEP, the Maine Legislature amended Maine Law, 38 M.R.S.A., Section 465-A.1.C to provide for licensing pollutant discharges to Class GPA waters for 'Aquatic pesticide or chemical discharges approved by the department and conducted by the department, the Department of Inland Fisheries and Wildlife or an agent of either agency for the purpose of restoring biological communities affected by an invasive species.' The standards for Class AA waters (38 M.R.S.A., Section 465.1C) and other freshwater classifications were similarly amended.*"

g. Aquatic Pesticide Treatment Program:

**1. Project Goals:**

The treatment program's primary target water is Big Speck Pond. However, due to the physical characteristics of the receiving water and the nature of reclamation projects, the potential treatment area includes Big Speck Pond, its outlet stream, Little Speck Pond, and its outlet stream. The MDIFW proposes to treat Big Speck Pond with an aquatic piscicide (rotenone) in late August to early September of 2006. This is proposed as a one-time treatment event intended to eliminate the existing invasive and undesirable chain pickerel (*Esox niger*) and golden shiner (*Notemigonus crysoleucas*) populations, with a potential booster treatment (reapplication) within 72-hours in the event that unforeseen conditions reduce the effectiveness of the initial treatment. This licensing action also provides for annual retreatments through the life of the waste discharge license, as necessary to insure

program success. Partial reclamations are routinely used in other states and provide short-term improvements (3-8 years) to trout fisheries (Bradbury 1986, CDFG 1994). Although not always successful, Maine fishery biologists typically strive for complete kills to provide the best long-term results and benefits. After reclamation, the pond will be restocked with brook trout, which is a native species of the drainage. Initial stockings will likely occur in the spring or fall of 2007. The project is intended to restore the pond's biological communities to a more "natural" state, and to secondarily create a quality trout fishery. Special fishing regulations will also be adopted for Big Speck Pond to support this initiative.

**2. Pesticide Description:**

Common Name: Rotenone
Empirical Formula: $C_{23}H_{22}O_6$
Chemical Name: (2R, 6as, 12as)-1,2,6,6a,12,12a-hexahydro-2-isopropenyl-8,9-dimethoxychromeno[3,4-b]furo[2,3-h]chromen-6-one
Trade Name: Prentox Rotenone Fish Toxicant Powder & Prenfish Toxicant
EPA Registration Numbers: 655-422; 655-691
CAS Number: 83-79-4

Rotenone is a natural substance produced in the stems and roots of certain tropical plants in the bean family (*Leguminosea*). Rotenone has been used for centuries to capture food-fish in areas where these plants occur naturally. More recently, rotenone is routinely used as an agricultural insecticide to treat both crops and livestock and it is commonly used in household gardens. The widespread use of rotenone is largely due to several factors including its organic origin, its non-persistence in the environment, and its limited and/or short-term impacts to nontarget organisms and applicators. Rotenone works by inhibiting the biochemical process that allows the use of oxygen in the release of energy required for bodily processes (Sousa et al. 1991).

Rotenone formulations for fisheries management programs come in three general formulations: (1) a dry powder, (2) a liquid, and (3) a liquid with a synergist. The dry powder is the least expensive form and lacks the petroleum-based products present in the liquid formulations. The liquid formulation has several petroleum-based emulsifiers to assist with the horizontal and vertical dispersal of rotenone (5%) throughout the water column. The third is similar to the straight liquid formulation, except it contains a synergist with approximately half the amount of rotenone (2.5%). The synergist is added to increase the effectiveness of rotenone, which reduces the amount and costs associated with rotenone treatments. Historically, MDIFW has not used the synergist formulation for several reasons, including reports of variable results from other agencies, environmental persistence of synergist compounds, and public concerns regarding the synergist compounds.

### 3. History of Rotenone Use for Fisheries Management

Rotenone is a relatively selective piscicide. Although rotenone has some toxicity to all oxygen breathing organisms, fish are highly susceptible for 2 reasons: (1) rotenone is readily absorbed through the gill epithelium, which gives it direct access to the circulatory system, and (2) when applied to an aquatic environment fish cannot escape from it (Sousa et al. 1991). Initial effects on fish are often seen within one hour of treatment for more sensitive fish species, whereas more resistant species typically die within 24 hours. Rotenone has very low toxicity to terrestrial wildlife and humans for several reasons, including the low amount of active ingredient used in commercial rotenone products, its low solubility in water, its rapid degradation in the environment by light and heat, its vomit inducing properties, and inefficient absorption in the gastrointestinal tract, as well as, the presence of digestive enzymes that oxidize rotenone (Bradbury 1986).

Rotenone's ability to completely eradicate undesirable fish species, its limited persistence in the environment, and minimal/short-term impacts to nontarget wildlife has made it a very important fishery management tool. Its first recorded use in North America for fisheries management occurred in 1934, and its use spread rapidly throughout the United States and Canada. By 1970, 39 states and 2 provinces had reportedly used rotenone to reclaim waters (Lennon 1971). Today it is the most commonly used and preferred aquatic piscicide for fishery management projects, and only one of four (2 of which are lampricides) currently approved by the USEPA. Maine's first reported use of rotenone occurred in 1939 when the Maine Department of Inland Fisheries and Wildlife reclaimed two waters, Sabbathday Lake in New Gloucester and Lone Pond in Waterboro. To date, Maine biologists have conducted 198 reclamations statewide, and 45 waters have been reclaimed within the Sebago Lakes Region. No known significant, long-term impacts have been reported.

Rotenone has been used for a wide variety of fishery management applications including:

- eradication of exotic fish to restore native fisheries and aquatic communities;
- control and/or eradication of undesirable fish to improve sport fishing opportunities;
- elimination of fish to control disease(s);
- eradication of fish in rearing facilities to eliminate competing species;
- fish sampling and quantification of populations;
- treatment of drainages prior to impounding;
- and restoration of threatened and endangered species (McClay 2000).

Rotenone has also been used for wildlife habitat restoration, particularly the improvement of wetlands for waterfowl by controlling or eradicating carp populations that destroy aquatic macrophyte communities. Chemical reclamations are also being used successfully for biomanipulation projects to improve water quality. In Maine, reclamations with rotenone have primarily been used to control or eradicate undesirable fish species to improve sport-fishing opportunities and to eradicate non-native exotics to restore native fisheries.

**4. Alternative Treatments**

MDIFW reviewed alternative methods to rotenone for reducing or controlling fish communities provided by Finlayson et al. (2000) including:

(1) use of a piscicide other than rotenone (antimycin);
(2) angling regulations (i.e., modifications to promote or favor over-harvest);
(3) physical removal techniques (e.g., nets, traps, or electrofishing);
(4) biological control (i.e., predators, intraspecific manipulation, pathological reactions);
(5) dewatering or water fluctuation techniques;
(6) stream flow augmentation (e.g., create water temperatures or current conditions that negatively impact the species to be reduced);
(7) fish barriers (i.e., protect against entry by undesirable fish);
(8) and explosives for flowing waters and impoundments.

The advantages and limitations of each technique were reviewed however, the researcher (Schnick 1974 as cited by Finlayson et al. 2000) found that chemical reclamation or complete dewatering are the only two viable methods for completely eradicating invasive/undesirable fish populations, which is the typical objective of Maine reclamation projects. Complete dewatering on natural waters is generally not feasible due to the lack of outlet control structures or the lack of structures designed to allow complete dewatering. In addition, full dewatering may have more serious consequences for aquatic organisms and resources than rotenone treatments (Demong 2005). Antimycin is an alternative chemical treatment, but its environmental impacts have not been as thoroughly researched and reviewed by the scientific community. In addition, the use of antimycin has been determined to be too expensive of an alternative for lake and pond treatments by Washington state biologists (WDFW 1988).

Aquatic habitats are being threatened worldwide by the introduction of invasive aquatic organisms including plants, invertebrates, and fish. Illegal fish introductions are occurring at an alarming rate in Maine and elsewhere in the United States, and they pose one of the most significant threats to native fish and their habitats. The use of rotenone has been recognized as a viable and relatively innocuous method for restoring native fish communities. Harig and Bain (1995) have demonstrated chemical reclamations not only restore native fish communities, but top-down cascading trophic effects also re-establish phytoplankton and zooplankton communities that are more representative of "natural" lake ecosystems. In essence, rotenone is one of the few tools resource managers have to successfully "turn back the clock" and restore aquatic communities.

**5. Big Speck Pond Treatment Area Program:**

MDIFW will conduct the Big Speck Pond treatment area program through the use of powdered and liquid formulations of rotenone (Rotenone Fish Toxicant Powder & Prenfish Toxicant, product of Prentiss Inc.)

a. Concentrations: Use of concentrations of 0.2-8.0 parts per million (ppm) are consistent with label instructions of formulated rotenone products. Rotenone treatment recommendations vary depending on target fish species and organics in the system, which impacts effectiveness. For Big Speck Pond, MDIFW's target is an initial whole-lake treatment at 0.10 ppm active rotenone, which equates to 2.0 ppm rotenone product formulation based on the amount of active ingredient in the product. This level was selected due to the relatively high resistance of golden shiners (Demong 2005), heavy organics in the shallower portion of the basin, and a goal of complete eradication. MDIFW anticipates that this treatment will be a one-day, single treatment with concentration levels diminishing over time via natural degradation processes. As stated previously, the treatment program includes a potential booster treatment (reapplication) within 72-hours in the event that unforeseen conditions reduce the effectiveness of the initial treatment and provides for annual retreatments through the life of the waste discharge license, as necessary. The actual amount of rotenone applied depends on the formulation used and is based on the estimated water volume of the pond, which was calculated by MDIFW and is included in the Department's project file.

MDIFW found no $LC_{50}$ values (concentrations lethal to 50% of the test population) for rotenone reported for golden shiners or chain pickerel, the target species for this project, in any of the literature reviewed. However, the New York Department of Environmental Conservation (Demong 2005) suggests golden shiners appear to be fairly resistant to rotenone and literature is available for Northern Pike, which is in the same genus as pickerel and likely have similar sensitivities to rotenone.

Fishery managers typically recommend and use dosages of rotenone (i.e. 2.0 ppm for this project) that far exceed the $LC_{50}$ levels reported in the literature. According to Marking and Bills (1976) actual field dosages for rotenone treatments are higher for a variety of reasons including: (1) $LC_{50s}$ produce 50% mortality, whereas biologists are striving for 100% mortality; (2) environmental factors like sunlight, temperature, and organic matter quickly detoxify rotenone in the field, whereas these factors are controlled in laboratory type settings; (3) it is difficult to obtain uniform concentrations in a natural water, so larger doses are needed to insure target organisms are eliminated; and (4) some individuals in a population are more resistant.

Additionally, fish eggs are more resistant to rotenone than older life stages such as fry or fingerlings (Marking and Bills 1976, Bills et al. 1988). If fish eggs are likely to be present then a second follow-up treatment is often recommended or required to insure success of the project. A late summer treatment potentially eliminates the need for a 2$^{nd}$ follow-up treatment, which minimizes the use of rotenone required for the project. The planned draw down and extended time period available for natural detoxification incorporated into the Big Speck Pond treatment area program described below minimizes or eliminates potential downstream impacts to nontarget fishes in Hobbs Brook.

b. Timing: Rotenone treatments for fishery management projects are typically performed from late summer to late fall. Historically, rotenone treatments in Maine have primarily been conducted in the fall for a variety of reasons including: low water levels, low flow/discharge from treated waters, reduced aquatic vegetation to limit effectiveness, reduced recreational use, reduced costs, applicator comfort, fewer impacts to nontarget species, and to allow treatment after destratification. Uniform water temperatures promote complete dispersal of the chemical throughout the water column. Poor dispersal of rotenone through the thermocline has been known to cause treatment failures. Fall treatment also has some disadvantages, primarily related to toxicity time. In some cases, temperate climate ponds treated in late fall have remained toxic to fish into the following April (Woodward 2005, Demong 2005). These extended toxicity times may slow recovery of nontargets, delay restocking efforts, and create monitoring and downstream detoxification issues that are difficult to overcome.

Although much more difficult to perform, late summer treatment allows more flexibility in terms of monitoring requirements and would likely insure detoxification prior to ice-up conditions, thus minimizing or preventing effects on non-target organisms and resources. Typical disadvantages with late summer treatments are the need to use of liquid rotenone formulations, which are more expensive and have petroleum based emulsifiers for improved dispersal/mixing. Washington State reports (1988) predominantly using powdered formulations to avoid the inert ingredient issue, but other states routinely use liquid formulations and claim no additional adverse environmental impacts beyond those caused by rotenone (CDFG 1994, Demong 2005). Based on MDIFW's review, a late summer treatment appears to be the best, balanced option for minimizing nontarget impacts, while still addressing monitoring and downstream detoxification issues.

c. Methods: For fall treatments the bulk of the chemical is applied to the lake surface as a soluble powder containing approximately 5% rotenone via a specially equipped boat. A gas-powered pump located in a small, motorboat draws in pond water and mixes it with the powdered rotenone via a venturi system. The rotenone/pond water mixture is then piped overboard and dispersed over the entire surface area by motoring the boat around the pond. Liquid rotenone is commonly applied to small backwater areas, inlets, other shallow areas unreachable by motorized boat, and the outlet area downstream to the first impassable barrier via backpack tanks with manually operated hand pumps. This incidental use of liquid formulation involves very small quantities.

Conversely, late summer treatments typically involve the use of entirely liquid rotenone to aid with dispersal through and within stratified thermal layers. Although liquid based rotenone formulations contain petroleum-based emulsifiers, which may generate some environmental concerns, Finlayson et al. (2000) and CDFG (1994) provide evidence that the these products do not present environmental or human health risks when used for prescribed fisheries management projects.

For the Big Speck Pond treatment area program, MDIFW will use a modified late summer treatment plan to minimize the amount of liquid rotenone used for the treatment. Liquid rotenone will be applied in deeper stratified waters (> 3 meters) by means of a weighted distribution hose and manifold. Deeper waters will be treated in 3-meter strata starting from the bottom and working up towards the surface. The top 3-meter stratum will be treated with powdered rotenone as described above for fall treatments. Backwater areas, inlets, other shallow areas unreachable by motorized boat, and the outlet area downstream to the first impassable barrier will be treated with liquid rotenone dispensed via backpack tanks with manually operated hand pumps.

d. De-Watering Plan: MDIFW worked with MEDEP engineering staff to model and design the Big Speck Pond treatment area program to ensure the shortest possible period of rotenone activity and that there will be no discharge of rotenone to non-target waters beyond the treatment area. MDIFW's project involves drawing down the water level in Big Speck pond by 1-meter (115.68 acre-feet) in August prior to treatment, estimated as August 25. MEDEP calculations indicate that under average fall precipitation levels, utilizing the size of the watershed (66-acres) and data from a precipitation station located within 15-miles, Big Speck Pond will refill and begin discharging through its outlet in late November to early December or approximately 98 days.

MDIFW then calculated the length of time that rotenone will be active in Big Speck Pond following treatment and considering natural degradation. MDIFW's modeling indicated that it will take approximately 149 days for all of the water in Speck Pond to naturally detoxify to or below the threshold level of 0.03 ppm at which salmonids, among the most sensitive fish to rotenone, become impacted by the presence of rotenone. Thus, if treatment occurs on August 25, rotenone would be present in the Big Speck Pond discharge on December 1, the approximate time at which the outlet flow is restored. This estimate is conservative as it does not consider the expected reduction on available rotenone from contact with organic matter and sediments. As stated previously, the treatment program's primary target water is Big Speck Pond. However, the potential treatment area includes Big Speck Pond, its outlet stream, Little Speck Pond, and its outlet stream. Based on the additional dilution provided and the time of travel from Big Speck Pond to Hobbs Brook, MDIFW then calculated the length of time after rotenone treatment that Big Speck Pond would have to refill and overflow in order to result in a toxic discharge of rotenone to Hobbs Brook, which is outside of the treatment area. MDIFW's modeling indicated that if this condition occurred less than 16 days following treatment, a toxic discharge would occur (at or above the threshold level of 0.03 ppm). As stated earlier, MEDEP calculations predict a discharge from Big Speck Pond approximately 98 days after drawdown and treatment. Thus, the dewatering and timing of application provide an 82 day safety period for natural degradation prior to contact with Hobbs Brook (See Fact Sheet Attachment C).

Prior to application of rotenone to Big Speck Pond, MDIFW's treatment program and this licensing action require that MDIFW will reduce the water level in Big Speck Pond by a minimum of one meter through siphoning.

e. Neutralization: Residual rotenone concentration, bioassay, and water quality monitoring requirements are established in this licensing action to determine potential effects on non-target organisms and resources. Lakes and ponds treated with rotenone are generally left to detoxify naturally, but discharges of rotenone can be neutralized with oxidizing chemicals such as potassium permanganate ($KMnO_4$) or chlorine, particularly when there are significant downstream resources (i.e. potable water supplies, important tail-water fisheries). Historically, MDIFW has not neutralized outlet flows with oxidizing chemicals. Because of the physical properties of rotenone, concerns with aquatic toxicity of the neutralizing agents, and based on the methods designed into this project to avoid discharge to downstream resources, this licensing action does not require the use of neutralizing agents. Further information is available in the Department files and in Fact Sheet Section 2(g)(8), Rotenone Persistence in the Environment.

**6. Applicator:**

MDIFW regional fisheries staff will apply rotenone under the direct supervision of William Woodward, Assistant Regional Fisheries Biologist, MDIFW Sidney Office. Bill has decades of experience with rotenone applications, holds a Maine Master Pesticide Applicators License, and recently completed (2004) a rotenone course at the USFWS National Conservation Training Center. All project management, monitoring, and reporting responsibilities will be those of the licensee. Any contractors shall have direct experience in application of rotenone and will also be licensed to apply aquatic pesticides by the Maine Board of Pesticides Control.

**7. Monitoring Program:**

Reclamation projects are monitored in a variety of ways to evaluate the success of several objectives: effective eradication of the invasive species, containment of the rotenone discharge to the target water, and avoidance of impacts on non-target organisms and resources downstream. The final two objectives listed are also addressed through design of the treatment project by such means as lowering the water level in Big Speck Pond prior to treatment, modeling both the active period for rotenone and the length of time until outlet flow is restored to downstream waters, and the time of year the treatment program is conducted.

Based on MDIFW's past experiences with rotenone treatments and extensive literature review, which included communication with other state's fisheries agencies and review of their methodologies, the impacts of rotenone on nontarget organisms are either insignificant and/or of short-term duration with populations quickly recovering to pre-rotenone treatment levels. Consequently, this licensing action does not require monitoring of nontarget species within Big Speck Pond. However, monitoring of potential effects on non-target species in downstream waters is being required through use of live cages of sentinel fish, as outlined below.

In addition, MDIFW will also utilize live cages with sentinel fish prior to re-stocking with native brook trout to ensure rotenone levels have dissipated. Pre-post treatment work often involves several years of follow-up sampling of fish populations with nets (i.e. trapnets, gillnets) to determine if nuisance species have been successfully eliminated, and to evaluate how trout populations have responded to the reduction in competition and predation. Pre/post fisheries work also includes basic water quality analysis.

MDIFW proposes and this licensing action requires monitoring for rotenone concentrations and residual toxicity within specified time periods following the initial and any booster treatments (reapplications) each year, designed to provide for adequate mixing within the water column, representative sampling, and, for later monitoring events, natural degradation and dilution (See License Special Condition A and Fact Sheet Section B (tabular representation)). Monitoring shall be conducted:

1. within Big Speck Pond once within 24-hours of each initial annual treatment to determine the concentration (mg/L) of rotenone and the necessity of additional (booster) treatments. A minimum of three grab samples shall be collected for water column profile analysis from the surface to the bottom. Analyses shall be conducted using bioassay methods described in Demong (1992) using a minimum of three 3-6-inch long live brook trout per profile depth, with trout responses used to calculate rotenone concentrations.

2. for residual rotenone toxicity testing in Big Speck Pond immediately prior to restoration of the outlet flow. This analysis shall utilize 48-hour toxicity tests on five live brook trout placed in sentinel cages in Big Speck Pond near the outlet, timed so that completion of the test shall occur no less than 48-hours before outlet flow is restored. Analyses shall be repeated at one-week intervals until tests indicate 100% survival of the sentinel fish, regardless of the status of outlet flow.

3. for residual rotenone toxicity testing at the confluence of the Little Speck Pond outlet stream and Hobbs Brook beginning at the time of resumption of the Big Speck Pond outlet flow. This analysis shall utilize 48-hour toxicity tests on five live brook trout placed in sentinel cages in the area noted. Analyses shall be repeated at one-week intervals until tests conducted in Big Speck Pond indicate 100% survival of the sentinel fish.

4. for residual rotenone toxicity testing at the confluence of Hobbs Brook and the Crooked River only in the event that Little Speck Pond outlet stream / Hobbs Brook sentinel trout bioassay tests indicate residual rotenone toxicity. This analysis shall utilize 48-hour toxicity tests on five live brook trout placed in sentinel cages in the area noted. Analyses shall be repeated at one-week intervals until tests conducted in Big Speck Pond indicate 100% survival of the sentinel fish.

5. for water quality once prior to rotenone treatment during July-August 2006, once following treatment during July-August 2008, and once in July-August in each additional year in which rotenone treatments are conducted. Water quality monitoring shall consist of dissolved oxygen profile concentrations (mg/L), temperature profiles (degrees Celsius), pH (standard units) at the surface and within one meter of bottom, total alkalinity (mg/L

CaCO3), at the surface and within one meter of bottom, and secchi disk transparency (m/ft), according to the Department's Standard Field Methods for Lake Water Quality Monitoring.

6. for post-restocking fish population census(es) and evaluation of brook trout survival and growth to determine treatment effectiveness and project success.

The licensee shall submit to the Department monthly reports of monitoring results pursuant to License Special Condition D, as well as a report including and evaluating the results of all monitoring conducted in that year by December 15 of each calendar year. The annual report shall include evaluations of the treatment program success as well as recommendations for future treatment needs.

MDIFW reviewed several potential methods of monitoring for residual rotenone levels within the Big Speck Pond treatment area to determine the potential for non-target effects and the timing for restocking with brook trout. Field testing of rotenone in water via colorimetric methods are described by Post (1955), however, based on the 0.2 ppm detection limit, which is still within the lethal range for many aquatic species, the usefulness of the test methods for anything other than qualitative (presence/absence) data is limited (Ling 2003). Dawson et al. (1983) describes a much more sensitive method of determining rotenone levels using high performance liquid chromatography. However, the availability of this type of equipment is limited in Maine, and the costs, manpower, and feasibility of monitoring rotenone from remote waters with this method make it inappropriate. Similar limitations exist for capillary gas chromatography and liquid chromatography / particle beam mass spectophotometry (Ling 2004). Sentinel fish provide a better level of detection, are commonly used during fishery reclamation projects, and are being established in this licensing action to determine residual rotenone toxicity. New York has successfully developed a field bioassay method, which is used to monitor rotenone levels as low as 0.05 ppm. New York biologists commonly use this method to insure they have reached their target treatment level and to re-boost rotenone concentrations as needed (Demong 1992). This method appears to have value for monitoring rotenone in Maine, particularly when treating more remote waters like Big Speck Pond. This method is being established in this licensing action to determine rotenone concentrations within 24-hours of each treatment event.

**8. Potential Non-Target Effects:**

The following section provides an in depth discussion and literature review of potential environmental impacts from use of rotenone as well as measures to minimize or prevent impacts. Rotenone is a naturally occurring organic compound that rapidly decomposes under typical environmental conditions and has a long history of safe and effective use as a fishery management tool. Although rotenone can also be toxic to nontarget species, particularly other aquatic invertebrates and juvenile amphibians, the scientific literature indicates that impacts are relatively short-term and natural communities typically recover to pre-treatment levels of abundance and diversity. In some cases, rotenone treatments have been credited

with improving water quality and restoring aquatic communities to more "natural" or "historical" situations.

MDIFW conducted and submitted the results of an extensive review of published research materials and drew on its own experience in using rotenone in Maine. MDIFW provided information on rotenone toxicity to numerous non-target fauna and flora, as well as humans. This information is summarized in this Fact Sheet and included in its entirety in the Department's project file.

a. Rotenone Persistence in the Environment: Rotenone degrades very rapidly in water with exposure to light, heat, and oxygen. Other factors that contribute to the break down of rotenone include alkalinity and pH (CDFG 1994), the presence of organics, turbidity, lake morphology, and dilution rate from surface runoff and inlets. Research concluded that temperature is the most significant factor leading to detoxification of rotenone. Empirical equations have been developed to predict toxicity time, which have been used by MDIFW in developing this project and methods for avoiding or minimizing impacts to non-target organisms and resources. Detoxification can also be expedited by neutralizing with oxidizing chemicals like potassium permanganate or chlorine. Toxicity time is somewhat variable depending on the factors mentioned above, but most lakes naturally detoxify within 5 weeks of treatment (Schnick 1974 as cited by Bradbury 1986). A review of 103 lakes treated with rotenone in Washington state showed that on average lakes remained toxic for 4-5 weeks. However, toxicity was highly variable from water to water with a range as short as 3 days to as long as 11 weeks (Bradbury 1986).

Rotenone is an unstable, organic chemical with a very short half-life. Gilderhus et al. (1986) determined the half-life of rotenone to be 13.9 hours in warm water (75 °F) and 83.9 hours in coldwater (32 °F). Similarly, another study reported a half-life of 10.3 days and 0.94 days at water temperatures of 32-41°F and 73-81°F, respectively. Rotenone residues decreased to below detection limits after 64 days in cold water versus 24 hours in the warm water treatment. (Gilderhus et al. 1988). Dawson et al. (1991) reports water sample half-lives of 1.3, 3.7, and 5.2 days for rotenone applications when water temperatures were 73°, 60 °, and 47°F, respectively. Four to five half-lives are typically required for a 2 ppm formulation to be reduced to undetectable limits of 2 ug/l (CDFG 1994). Rotenone degradation is even more rapid in river/stream environments. In flowing waters rotenone breaks down in less than 24 hours due to dilution, hydrolysis, and photolysis (CDFG 1994).

Rotenone has been detected in bottom sediments of treatment lakes, and although persistence is somewhat longer than in water, its degradation in sediments is still fairly rapid. Dawson et al. (1991) reported sediment rotenone levels decreased below detection limits by day 14 at 47°F, and by day 3 at water temperatures of 73°F. CDFG (1994) observed sediment rotenone levels similar to those found in water and natural detoxification lagged 1-2 weeks behind water levels. CDFG also reports that rotenone is rarely found in stream sediments following treatments.

b. Drift to Non-target Surface Waters: MDIFW proposes and this licensing action requires measures to prevent the discharge of rotenone to downstream areas during the treatment period, which could impact non-target organisms and resources. The Big Speck Pond watershed is small, outflow is limited, and the outlet channel is likely intermittent in dry years. MDIFW is proposing a late summer treatment plan, designed to reduce any potential downstream impacts. At this treatment time, surface water levels are typically quite low, rainfall is limited, and outlet discharge is expected to be minimal or nonexistent. In addition, MDIFW will draw the pond level down approximately 1 meter with siphons to eliminate the initial potential for downstream migration of rotenone and to provide time for the rotenone to degrade via natural processes before any discharge occurs. Modeling conducted by a MEDEP engineer anticipates no outlet discharge until late fall, when rotenone levels will have dissipated.

c. Non-target Animal Effects: Evaluations of non-target animal effects are as follow:

**Effects on Fish:** By design, aquatic piscicides like rotenone are toxic to fish species, however susceptibility varies among species. Not surprisingly, research conducted by Marking and Bills (1976) indicates that goldfish (*Carassius auratus*) were the most resistant of the 21 species tested, whereas Atlantic salmon (*Salmo salar*) were the most sensitive. MDIFW surveys indicated that only two fish species are present in Big Speck Pond. As the goal of this treatment project is eradication of those two invasive fish species and restocking with native brook trout, and in consideration of project methods incorporated to avoid impacts to downstream non-target organisms and resources, the Department anticipates no adverse impacts to non-target fish.

**Effects on Benthos:** Sensitivity to rotenone is highly variable among the benthic invertebrates, although most species studied are more tolerant than fish. Research indicates LC50 values range from as low as 0.1 ppm to as high as 47.2 ppm depending on the species tested, but are of limited value in examining impacts in natural systems, since most studies were conducted in bare aquarium systems devoid of sediments and organic matter that are present in natural systems and are shown to affect rotenone toxicity.

Although this treatment project is designed with methods and materials to avoid impacts to downstream non-target organisms and resources, short-term impacts will be realized within Big Speck Pond. Methods will be employed to reduce or prevent the downstream drift of rotenone to minimize the extent of impacts on local benthic communities. In addition, late summer and fall treatments are expected to reduce the effect on invertebrate communities. Based on the literature and past MDIFW experiences, benthic organisms are expected to naturally recolonize the available habitat.

**Effects on Zooplankton:** Research on rotenone effects on zooplankton indicate LC50 values range from 0.028 to 0.55 ppm depending on the species tested and suggests microscopic crustaceans would likely be quite vulnerable to rotenone at the levels used in typical fish control projects. (Bradbury 1986).

Research also indicates that zooplankton populations quickly repopulate a rotenone treated lake following a brief period of absence (2-12 weeks) from the pelagic zone. Despite heavy mortality, it appears zooplankton are able to survive rotenone treatments in several ways including: species specific tolerance to rotenone (Bradbury 1986), parthenogenic summer eggs and tough ephippial eggs that lie dormant in the sediments over the winter are unaffected by rotenone (Kiser et al. 1963, Anderson 1970), and adult zooplankton survive in shallow, littoral areas that quickly detoxify rotenone. Several studies indicate zooplankton associated with the pelagic zone are much more susceptible to rotenone than species or individuals associated with benthic and littoral areas (Kiser et al. 1963, Melaas et al. 2001, Harig and Bain 1995). Zooplankton in these habitats exhibit 30% survival and can quickly repopulate the treated water (Miller et al. 1995). A variety of changes in the zooplankton community structure have been observed following rotenone treatments. However, most are relatively minor and temporary changes that appear to be associated with a temporary dominance of species less affected by the rotenone treatment (Bradbury 1986).

Although this treatment project is designed with methods and materials to avoid impacts to downstream non-target organisms and resources, short-term impacts will be realized within Big Speck Pond. The reported results indicate microscopic crustaceans are very sensitive to rotenone and would be heavily impacted during the proposed treatment, and short-term impacts on the zooplankton communities are an unavoidable environmental impact. Methods will be employed to reduce or prevent the downstream drift of rotenone to minimize the extent of impacts on local zooplankton communities. In addition, late summer and fall treatments are expected to reduce the affects on zooplankton communities as suggested by Meelas (2001) and Kiser et al. (1963). Based on the literature and past MDIFW experiences, pre-existing zooplankton are expected to naturally recolonize the available habitat.

**Effects on Birds and Mammals:** Research indicates that wild birds and mammals as well as domestic animals are not affected by drinking water treated with rotenone or by eating fish killed from rotenone treatments related to fisheries management projects. However, birds and mammals that rely on fish or aquatic organisms as food may be indirectly affected by forcing these animals to temporarily search elsewhere for food resources.

The Big Speck Pond treatment is not expected to produce any significant impacts on birds or mammals. Indirect impacts from the loss of food resources are temporary and not likely a problem for adult birds and mammals, which are highly mobile and typically feed over extensive areas. MDIFW will mitigate the impacts on juvenile birds, waterfowl, and mammals by conducting a late summer to fall treatment. Project timing occurs after young, less mobile birds have fledged and mammals will have matured enough to have feeding patterns similar to adults.

**Effects on Amphibians and Reptiles:** Research indicates that adult amphibians are less sensitive to rotenone than fish, and should not be significantly affected at typical piscicidal concentrations (CDFG 1994, Farrington 1972 as cited by Ling 2003). Farrington reported that toxicity values for adult frogs, Rana pipiens, ranged from 5.8 ppm (LD50 96H) to 24.0 ppm ($LC_{50}$ 24H). On the other hand, rotenone is readily absorbed through gill epithelium, which makes larval amphibians and gill-breathing amphibian adults more susceptible to

rotenone. Chandler and Marking (1982) reported toxicity as low as 0.5 ppm ($LC_{50}$ 96 H) for frog tadpoles, *Rana sphenocephaly*. Similarly, Hamilton (1941 as cited by Ling 2003) conducted toxicity studies on larval frogs and salamanders and reported relatively low toxicity values. Actual toxicity is largely dependent on their stage of metamorphosis and how dependent they are on gill respiration.

Based on the scientific literature the Big Speck Pond treatment will likely have no impact on reptiles. However, there may be short-term impacts on amphibians, particularly juveniles. Methods will be employed to reduce or prevent the downstream drift of rotenone to minimize the extent of impacts on local communities. In addition, late summer and fall treatments are expected to reduce the affects on amphibian populations, which are expected to fully recover within a relatively short period of time.

d. Non-target Plant Effects: Evaluations of non-target plant effects are as follow:

**Effects on Phytoplankton:** Rotenone treatments for fishery management projects are not known to create any direct toxic impacts on phytoplankton. However, research indicates that some indirect effects on the phytoplankton community may occur due to changes in phosphorus levels from decaying fish and reduced grazing pressures from zooplankton (Bradbury 1986). Short-term increases in algal production are not uncommon, and are often followed by a longer-term reduction. Changes in phytoplankton communities are often restored shortly after fish are re-introduced into the system. Post-rotenone nutrient pulses appear to be a relatively short-term phase with little potential for recurrence in subsequent years. It should also be noted, these nutrient inputs are not additional loads, but simply a temporary, sudden availability of nutrients already present in the existing system (Bradbury 1986). On the other hand, rotenone treatments have reportedly resulted in longer-term improvements in water clarity and lower phytoplankton levels, which have been attributed to the removal of benthivorous fish and/or increases in zooplankton grazing levels due to reduced fish predation.

Fall rotenone treatments are expected to be the best option for minimizing the potential of temporary algal blooms, because they occur near or after fall turnover when dissolved oxygen levels adjacent to bottom sediments would not likely become anoxic. In addition, decreasing temperatures and day-length would likely reduce algal production at the time of any nutrient pulse. Although a late summer treatment is proposed to address other environmental issues, an algal bloom at Big Speck Pond following summer treatment is not anticipated due to a lack of benthivorous fish species and relatively small fish populations. Indirect effects on the phytoplankton community from the treatment are likely to be short-term impacts related to temporary changes in grazing levels. However, recent research from the Adirondacks indicates that restoration of native brook trout waters has resulted in mild top-down cascading facts that also creates a more historical or natural community of zooplankton and phytoplankton (Harig and Bain 1995).

**Effects on Terrestrial Plants/Aquatic Macrophytes:** According to the USEPA (1989 as cited by CDFG 1994) rotenone formulations are not toxic to plants. In addition, nitrogen fixation in soil, sediment, and water is neither greatly reduced or enhanced by rotenone at levels associated with fish management projects. Research indicates that rotenone residues do not persist in sediments for more than ten days.

e. Threatened and Endangered Species: MDIFW Wildlife Division maps (Fact Sheet Attachment A) indicate that there are no known occurrences of threatened or endangered species in the vicinity of the reclamation project. Big Speck Pond was noted as providing inland waterfowl bird wading habitat. As stated above, the Big Speck Pond treatment is not expected to produce any significant impacts on birds or mammals. MDIFW also reports that there are no rare plants or rare/exemplary natural communities as identified through the Maine Natural Areas Program occur in the vicinity of the project site.

f. Water Quality within the Treatment Area: Evaluations of effects on water quality within the treatment area are as follow:

**Surface Water:** MDIFW researched and reported that any effects from the treatment project on odors, tastes, or increased bacteria levels in Big Speck Pond water will be short term, if present. The Department does not anticipate this potential to be of concern to the public due to the pond's current limited recreational use, distance from any residences, and that it is not used for consumptive purposes. MDIFW has incorporated use of powdered rotenone to further reduce odor and taste issues.

**Groundwater:** The Department does not anticipate adverse impacts to groundwater from the proposed treatment project due to the physical properties of rotenone. Rotenone's propensity for rapid detoxification under natural conditions, strong affinity for organics, and low permeability in soils suggest a very low potential for impacts to either groundwater or surface water resources. Extensive testing in 26 wells adjacent to 9 treatments of rotenone in California since 1987 with no detectable formulation components confirms this to be the case. Dawson et al. (1991) found rotenone sediment residues decreased below detection within 14 days at 47°F and 3 days at 73°F, which suggests limited opportunity for rotenone to occur in groundwater. In addition, he also discovered rotenone leached vertically less than 1 inch in most soils, but just over 3 inches in sandy soils, and readily bound to sediments. Based on these results, it is highly unlikely that rotenone would enter groundwater. These conclusions have been verified in discussions between the Department and the Maine Board of Pesticide Control.

g. Human Heath: The safety of rotenone has been extensively studied as part of the USEPA approval process, and much of this research has been geared towards human health issues. As discussed earlier, rotenone has very low toxicity to humans for several reasons including: the low amount of active ingredient used in commercial rotenone products, its low solubility in water, its rapid degradation in the environment by light and heat, its vomit inducing properties, and inefficient absorption in the gastrointestinal tract, as well as the presence of digestive enzymes that oxidize rotenone. The USEPA has determined rotenone use for fishery management projects does not present a risk of unreasonable adverse effects to

humans and the environment (USEPA 1981, 1989 as cited by Finlayson et al. 2000). Rotenone is not known to be teratogenic, fetotoxic, mutagenetic, or carcinogenic.

There has been significant discussion in recent years regarding a possible link between rotenone and Parkinson's disease, which was the result of an Emerson University study. The American Fisheries Society Fish Management Chemicals Subcommittee (2001) has reviewed the study and concluded that the method of exposure was highly unnatural and has little resemblance to exposures and levels pertinent to fisheries management projects.

In regards to fishery management projects, there are several pathways that non-applicators might possibly come into contact with rotenone including: consumption of fish or water treated with rotenone; physical contact with rotenone treated water; and direct contact with rotenone dust or liquid formulations during its application.

**Acute and Chronic Oral Toxicity:** No direct tests for rotenone toxicity have been conducted on humans. Thus, oral toxicity must be inferred from other mammalian-based studies. Using a 300 mg/kg estimate of acute oral toxicity for humans and the highest rotenone residue levels found in dead fish (< 0.10 ug/g @ a typical 2.0 ppm treatment level), a 132-pound person would need to consume about 396 pounds of fish at one-time to receive a lethal dose (CDFG 1994). Although risks associated with eating dead fish from rotenone treated waters are extremely low, MDIFW does not support and/or recommend the practice. The USEPA has not established any consumption guidelines, and there are risks of bacterial contamination from eating fish that have been dead for some period of time. In addition, there is no risk from eating fish that have been stocked after the reclamation procedures, because fish are not stocked until rotenone drops below detectable levels.

Similarly, any risks associated with drinking rotenone treated water are very unlikely due to the low concentration levels for fishery management applications, as well as, the rapid degradation of rotenone. At a treatment level of 0.25 mg/l and using the 300 mg/kg oral lethal dose estimate, a 132-pound person would have to drink 19,022 gallons of rotenone treated water at a single sitting to receive a lethal dose. Rotenone has been used extensively on drinking water supplies without any known impacts (Bradbury 1986). The USEPA has not established guidelines for rotenone in potable water (CDFG 1994).

None of these scenarios are even remotely likely to occur as limited treatment events are planned, rotenone breaks down rapidly in the environment, people would not likely consume dead or dying fish, and new fish would not be restocked until rotenone levels have dissipated.

**Direct Public Contact with Treated Water:** Bodily contact with rotenone treated water may potentially occur via recreational activities such as boating, fishing, and swimming. Product labels for rotenone generally state people should not be allowed to swim in rotenone treated waters until the application is complete and all of the rotenone has been thoroughly mixed into the water. According to the USEPA, there is no reason to restrict the use of rotenone in waters intended for swimming use, and based on toxicology data and exposure levels a waiting interval was not necessary for swimming in waters treated with rotenone.

**Direct Public Contact with Chemical:** Direct contact with dust and/or liquid formulations is not a significant issue with the general public. The general public is prohibited from handling any of the chemicals involved, and/or from being in the local vicinity of the chemical (i.e. loading and dispensing areas). In addition, application methods significantly reduce dust and liquid exposure potential to very localized areas directly around the applicators.

**Applicator Exposure and Risk:** Applicators have a much greater risk exposure to rotenone due the direct handling and application of the products. Rotenone formulations used in fisheries management are classified as Category 1 materials by the USEPA, which means they are in the "extremely toxic" range for acute toxicity

The public will not be allowed in the vicinity of the treatment areas while the chemical is being applied. In addition, the area will be posted at likely access points with information about the treatment including advisories against swimming, drinking, and eating dead fish. Rotenone exposure to applicators can be significantly reduced by the use of proper handling procedures and protective equipment. Staff members involved in application will be required to wear full rain gear, rubber gloves, and air-purifying respirators with full-face shields.

**Environmental Impacts from Inert Ingredients in Liquid Formulations:** Liquid based rotenone formulations contain petroleum-based products to aid with vertical and horizontal dispersion of rotenone throughout the water column. Several of these products (trichloroethylene TCE, naphthalene, and xylene) are also found in fuel oil and are typically present in surface waters due to the use of outboard motors (Finlayson et al. 2000). The persistence of the VOCs and semi-VOCs is relatively short in both water and sediments, and these compounds have not been detected in wells used to monitor groundwater (Finlayson et al. 2001). Initial concentration levels of xylenes, naphthalene, and methylnaphthalenes did not exceed water quality criteria or guidelines (based on lifetime exposure) set by the USEPA. Although TCE is a carcinogen, its initial concentration was also well below USEPA levels (5 ppb) allowed for drinking water (Finlayson et al. 2000). Fall treatments typically minimize the use of liquid formulations to small treatment areas (i.e. shallow water, backwaters, inlets) and mitigate the issues associated with VOCs and semi-VOCs by utilizing mostly powdered formulations. However, MDIFW is proposing a more expensive late summer treatment to address more significant environmental issues including downstream migration, longer toxicity times, and monitoring problems. Although not commonly done by other agencies, MDIFW is proposing a combination of powdered and liquid formulations to treat above and below the thermocline, which is intended to minimize the use of liquid formulations while maintaining a reasonable possibility of a successful treatment.

## 9. Public Information and Involvement:

MDIFW has contacted the landowner, Mike Cullinan, on several occasions and he has expressed a willingness to work with the MDIFW on this project. MDIFW has discussed its intentions to pursue this project at several speaking engagements and in its regional newsletters, which are distributed to several thousand Sportsman's Alliance of Maine members located in southern Maine and posted on MDIFW's website. In September of 2002,

MDIFW advertised a public meeting on the project in the Norway Advertiser Democrat and the Bethel Citizen for two consecutive weeks, which was held at the Oxford Hills High School on September 23, 2002. There was no opposition to the proposed project from the public. MDIFW will continue to provide public notifications as this project moves forward through the regional newsletter, weekly fishing reports, public speaking engagements, and other means of communication.

In addition to the above measures, MDIFW staff will insure public notice about the proposal by:

(1) Mailing, by registered mail to the single riparian landowner, not more than 21 days prior to treatment, of a notice regarding the specifics of the treatment and a copy of the American Fisheries Society Brochure on rotenone use.
(2) Informational Posters about the treatment at likely access points to the pond and other places in Town likely to receive attention. Information will include: treatment purpose, treatment materials, treatment date and duration, who to contact for more information, and any cautionary notes (i.e. drinking/swimming).
(3) Complete all other notifications as required through MEDEP's Wastewater Discharge Permitting Process.

## 3. CONDITIONS OF LICENSES

Maine law, 38 M.R.S.A. Section 414-A, requires that the effluent limitations prescribed for discharges, including, but not limited to, effluent toxicity, require application of best practicable treatment (BPT), be consistent with the U.S. Clean Water Act, and ensure that the receiving waters attain the State water quality standards as described in Maine's Surface Water Classification System. In addition, 38 M.R.S.A., Section 420 and Department rule 06-096 CMR Chapter 530, *Surface Water Toxics Control Program,* require the regulation of toxic substances not to exceed levels set forth in Department rule 06-096 CMR Chapter 584, *Surface Water Quality Criteria for Toxic Pollutants*, and that ensure safe levels for the discharge of toxic pollutants such that existing and designated uses of surface waters are maintained and protected.

## 4. REGULATIONS CONCERNING THE USE OF AQUATIC PESTICIDES

Department Rules, Chapter 514, REGULATIONS CONCERNING THE USE OF AQUATIC PESTICIDES. Section 1, *Definition.* states, "an aquatic pesticide is any substance (including biological agents) applied in, on or over the waters of the State or in such a way as to enter those waters for the purpose of inhibiting the growth or controlling the existence of any plant or animal in those waters". In accordance with Chapter 514, Section 2, *Criteria for Approving a License to Use Aquatic Pesticides,*

Subsection A, "Except as provided in 38 M.R.S.A. Section 362-A, no permit for aquatic pesticide use will be issued for a pesticide which is not registered for the intended use by the United States Environmental Protection Agency and the Maine Department of Agriculture".

Subsection B, "No permit for aquatic pesticide use will be issued unless the applicant or agent for the applicant is certified and licensed in aquatic pest control by the Maine Board of Pesticides Control".

Subsection C, "A permit for aquatic pesticide use will be issued only if the applicant provides adequate protection for non-target species".

Subsection D, "A permit for aquatic pesticide use will be issued only if the applicant can demonstrate a significant need to control the target species and that pesticide control offers the only reasonable and effective means to achieve control of the target species. Demonstration of significant need may included, but not be limited to, health risk, economic hardship, or loss of use."

Subsection E, "In addition to paragraphs (A) through (D), any discharge of aquatic pesticides, alone or in combination with all other discharges, shall meet all other applicable requirements of Maine's waste discharge laws including, but not limited to, the provisions of 38 M.R.S.A. Sections 464 and 465".

In response to the citations above: rotenone (Prentox/Prenfish) is registered for the use proposed in this licensing action by the USEPA and the Maine Department of Agriculture. The licensee shall utilize a pesticide applicator who is certified and licensed in aquatic pesticide control by the Maine Bureau of Pesticide Control and has provided proof of certification/licensing to the Department. The licensee has disclosed that effects on some non-target species are anticipated due to the scope of the project, but that such effects shall be minimized to the extent possible through design of the program itself such as lowering the water level in Big Speck Pond prior to treatment, modeling both the active period for rotenone and the length of time until outlet flow is restored to downstream waters, and the time of year the treatment program is conducted. The licensee has demonstrated a significant need to control the target species, has explored potential alternate methods to treatment, and has designed an effective treatment program. The Department anticipates that the proposed treatment project will result in short-term adverse impacts to non-target organisms within Big Speck Pond, but is necessary in order to eradicate introduced and invasive species, reintroduce native brook trout, restore and preserve the natural habitat and ecosystem, and ensure long-term maintenance of receiving water quality and uses. The Department finds that the aquatic pesticide treatment program for the Big Speck Pond treatment area complies with Chapter 514.

## 5. RECEIVING WATER QUALITY STANDARDS:

Big Speck and Little Speck Ponds are classified as Class GPA waters pursuant to Maine Law, 38 M.R.S.A., Section 465-A, which also describes the standards for GPA waters. The Big Speck Pond and Little Speck Pond outlet streams are classified as Class AA waters pursuant to Maine Law, 38 M.R.S.A., Section 467.9.B(2), with standards for Class AA waters described in Section 465.1.

Maine Law, 38 M.R.S.A., Section 465-A.1.C states, "*There may be no new direct discharge of pollutants into Class GPA waters. The following are exempt from this provision...Aquatic pesticide or chemical discharges approved by the department and conducted by the department, the Department of Inland Fisheries and Wildlife or an agent of either agency for the purpose of restoring biological communities affected by an invasive species...*". The standards for Class AA waters (38 M.R.S.A., Section 465.1C) and other freshwater classifications contain similar provisions. Maine Law, 38 M.R.S.A., Section 466.8-A states, "*Invasive species means an invasive animal as determined by the Department of Inland Fisheries and Wildlife... . A species may be determined to be invasive for all waters or for specific waters.*"

## 6. RECEIVING WATER QUALITY CONDITIONS:

The treatment program's primary target water is Big Speck Pond. However, the potential treatment area includes Big Speck Pond, its outlet stream, Little Speck Pond, and its outlet stream. Big Speck Pond in Norway is a 14-acre, mesotrophic pond with a mean depth of 12-feet and a maximum depth of 40 feet. The narrow, southern end of the pond is characterized by relatively shallow water with moderate aquatic macrophyte growth, whereas the upper basin features deeper water with steeply sloped shorelines. The pond drains through an abandoned beaver dam and the outlet stream channel travels approximately 637 feet where it then enters Little Speck Pond. Over this distance the outlet stream drops a total of approximately 45 feet, with several areas of nearly vertical drops over ledge/boulders of up to 3-feet. These outlet features are expected to provide a natural fish barrier to prevent re-infestation of invasive/undesirable fish species from downstream sources. Little Speck Pond is a 4-acre, dystrophic pond with a maximum depth of 4 to 6 feet and a significant amount of organic deposition. The stream channel from Little Speck Pond travels a distance of approximately 1,300 feet before it enters Hobbs Brook, a tributary to the Crooked River. The Big Speck Pond watershed is approximately 66-acres and outlet flow is typically minimal. MDIFW suspects the Big Speck and Little Speck Pond outlets are intermittent in drier years.

A fishery survey of Big Speck Pond conducted by MDIFW in 2000 indicated the presence of only two fish species: chain pickerel (*Esox niger*) and golden shiner (N*otemigonus crysoleucas*). Brook trout are native to the watershed and have been documented in downstream waters by MDIFW. MDIFW believes Big Speck Pond has the potential to produce a quality trout fishery and has attempted to stock the pond with brook trout on two occasions without success. MDIFW believes chain pickerel and golden shiners are not native to the pond or local drainage area and considers them "invasive" to this particular system, likely altering the aquatic communities and hindering efforts to re-establish a native brook trout fishery.

MDIFW reports that quality brook trout fisheries are relatively rare in southern Maine due largely to changes in fisheries composition from illegal introductions of both native and non-native fish species. Illegal introductions of fish has and continues to occur at an increased pace in southern Maine and is one of the most serious threats to Maine's brook trout populations and their habitat.

A single landowner owns all of the surrounding property around both Big and Little Speck Ponds and there are no camps or homes in the vicinity. Big Speck Pond is potentially used for water contact recreation, fishing, and boating. However, as it is a remote water with limited access, public use is very limited. Access is obtained through permissive trespass, via a 4-wheel drive road that comes to within 300 feet of the southernmost tip of the pond.

## 7. EFFLUENT LIMITATIONS & MONITORING REQUIREMENTS:

Pursuant to Maine Law (38 M.R.S.A., §414-A.1), the Department shall only authorize discharges to Maine waters when those discharges, either by themselves or in combination with other discharges, "*will not lower the quality of any classified body of water below such classification*". Further, "*the discharge will be subject to effluent limitations that require application of the best practicable treatment*". "*Best practicable treatment means the methods of reduction, treatment, control and handling of pollutants, including process methods, and the application of best conventional pollutant control technology or best available technology economically available, for a category or class of discharge sources that the department determines are best calculated to protect and improve the quality of the receiving water and that are consistent with the requirements of the Federal Water Pollution Control Act*" (40 CFR). "*If no applicable standards exist for a specific activity or discharge, the department must establish limits on a case-by-case basis using best professional judgement...*" considering "*...the existing state of technology, the effectiveness of the available alternatives for control of the type of discharge and the economic feasibility of such alternatives...*".

MDIFW's Big Speck Pond treatment program is designed to eradicate introduced and invasive species in Big Speck Pond through the discharge of powdered and liquid formulations of rotenone (Prentox / Prenfish) in one initial treatment and subsequent booster treatments in each calendar year of the term of the license, as necessary. These efforts will be followed by reintroduction of native brook trout in an attempt to restore and preserve the natural habitat and ecosystem of the pond as well as ensure the long-term maintenance of receiving water quality and uses.

MDIFW's Big Speck Pond treatment program has been designed to minimize or prevent impacts to downstream non-target organisms and resources through such means as reduction of water levels in Big Speck Pond prior to treatment to provide for maximum natural rotenone degradation and to minimize or prevent impacts to non-target organisms and resources, timing of rotenone applications, the formulation to be used, etc. Additionally, the Big Speck Pond treatment program includes requirements to conduct rotenone concentration monitoring within 24-hours of treatments; residual rotenone toxicity bioassay testing using sentinel brook trout cages in Big Speck Pond prior to restoration of outlet flow, with a

provision for repeat analyses as needed based on toxicity; residual rotenone toxicity bioassay testing using sentinel brook trout cages at the confluences with downstream non-treatment waters to determine potential effects on non-target organisms and resources, with provisions for repeat analyses as needed based on toxicity; pre and post-treatment water quality monitoring; post-restocking fish population census(es) and evaluation of brook trout survival and growth to determine treatment effectiveness and project success; and includes reporting requirements for all monitoring conducted.

## 8. DISCHARGE IMPACT ON RECEIVING WATER QUALITY:

MDIFW reports that quality brook trout fisheries are relatively rare in southern Maine due largely to changes in fisheries composition from illegal introductions of both native and non-native fish species. Illegal introductions of fish has and continues to occur at an increased pace in southern Maine and is one of the most serious threats to Maine's brook trout populations and their habitat. The Big Speck Pond treatment program is designed to eradicate introduced and invasive species and reintroduce native brook trout in an attempt to restore and preserve the natural habitat and ecosystem. The Department anticipates that the proposed treatment project will result in short-term adverse impacts to some non-target aquatic organisms, but is necessary in order to eliminate the introduced species and ensure long-term maintenance of receiving water quality and uses.

As licensed, the Department has determined in the long-term that the existing water uses will be maintained and protected and the discharge will not cause or contribute to the failure of Big Speck Pond or other waters within the treatment area to meet the standards of their classifications.

## 9. PUBLIC COMMENTS:

Public notice of this application was made in the Advertiser Democrat newspaper on or about December 22, 2005. The Department receives public comments on an application until the date a final agency action is taken on that application. Those persons receiving copies of draft licenses shall have at least 30 days in which to submit comments on the draft or to request a public hearing, pursuant to Chapter 522 of the Department's rules.

## 10. DEPARTMENT CONTACTS:

Additional information concerning this licensing action may be obtained from and written comments should be sent to:

Robert D. Stratton
Division of Water Quality Management
Bureau of Land and Water Quality
Department of Environmental Protection
17 State House Station
Augusta, Maine 04333-0017

Telephone: (207) 287-6114
Fax: (207) 287-7826
email: Robert.D.Stratton@maine.gov

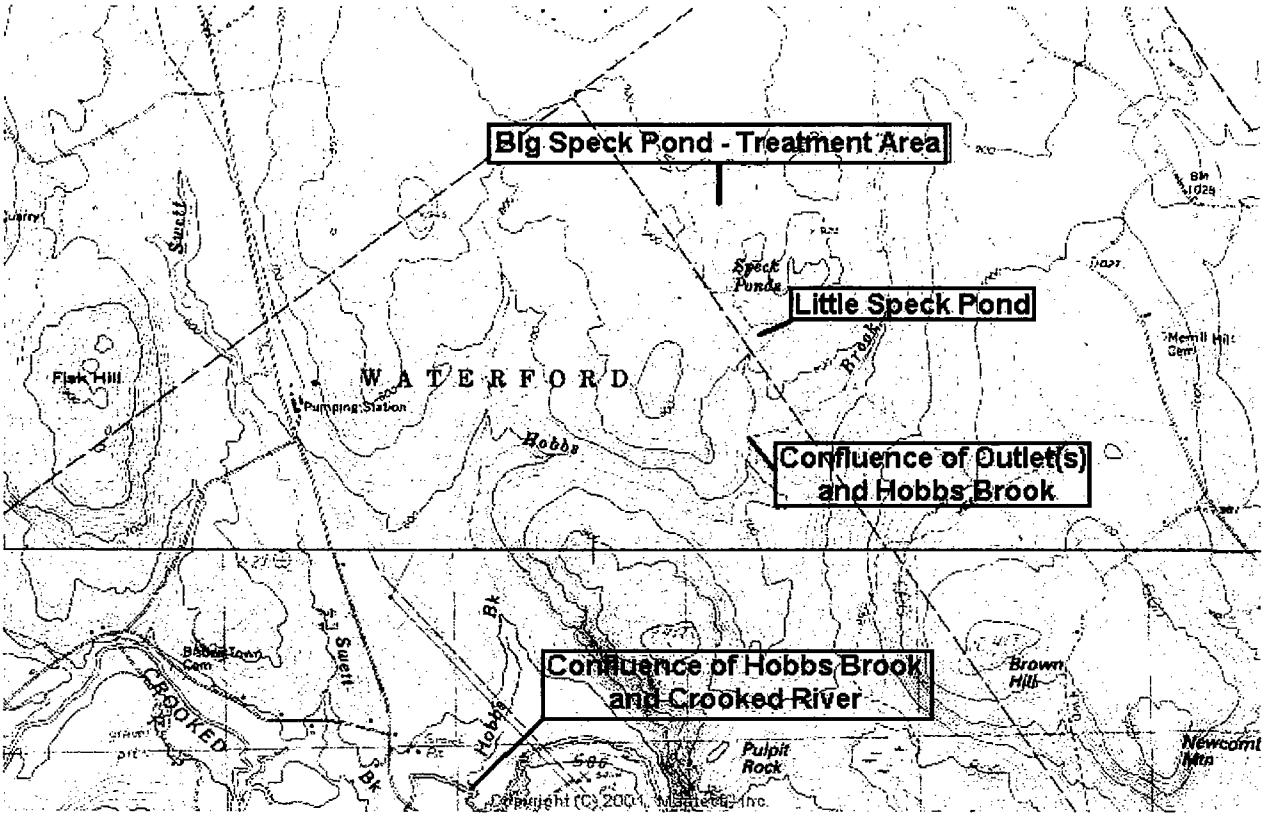
## 11. RESPONSE TO COMMENTS:

During the period of May 11, 2006 through June 12, 2006, the Department solicited comments on the proposed draft Maine Waste Discharge License to be issued to the Maine Department of Inland Fisheries and Wildlife for the proposed discharge. The Department did not receive any comments that resulted in significant revisions to the license. Therefore, no response to comments has been prepared.

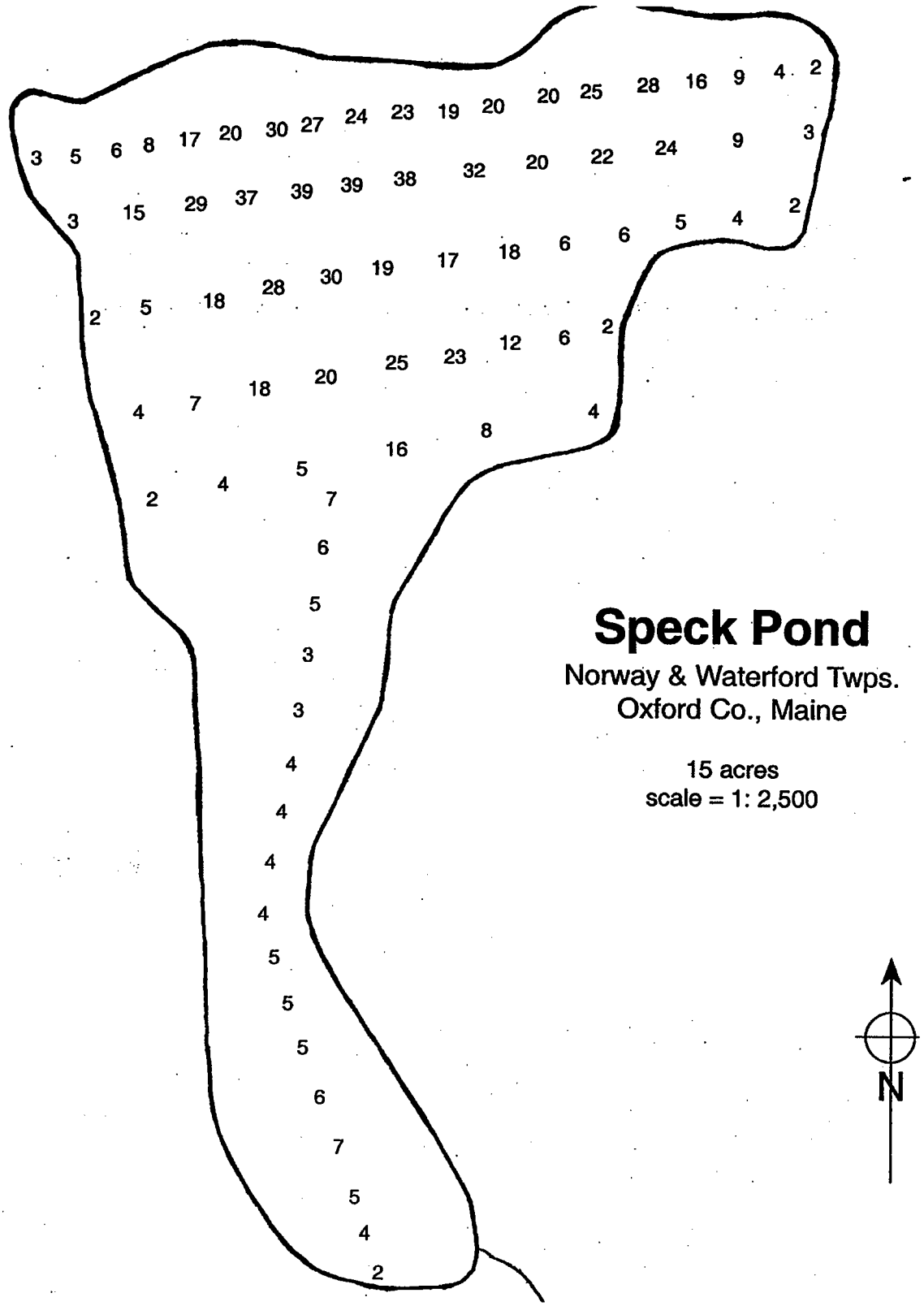
# ATTACHMENT A

**(Location and Resource Maps)**

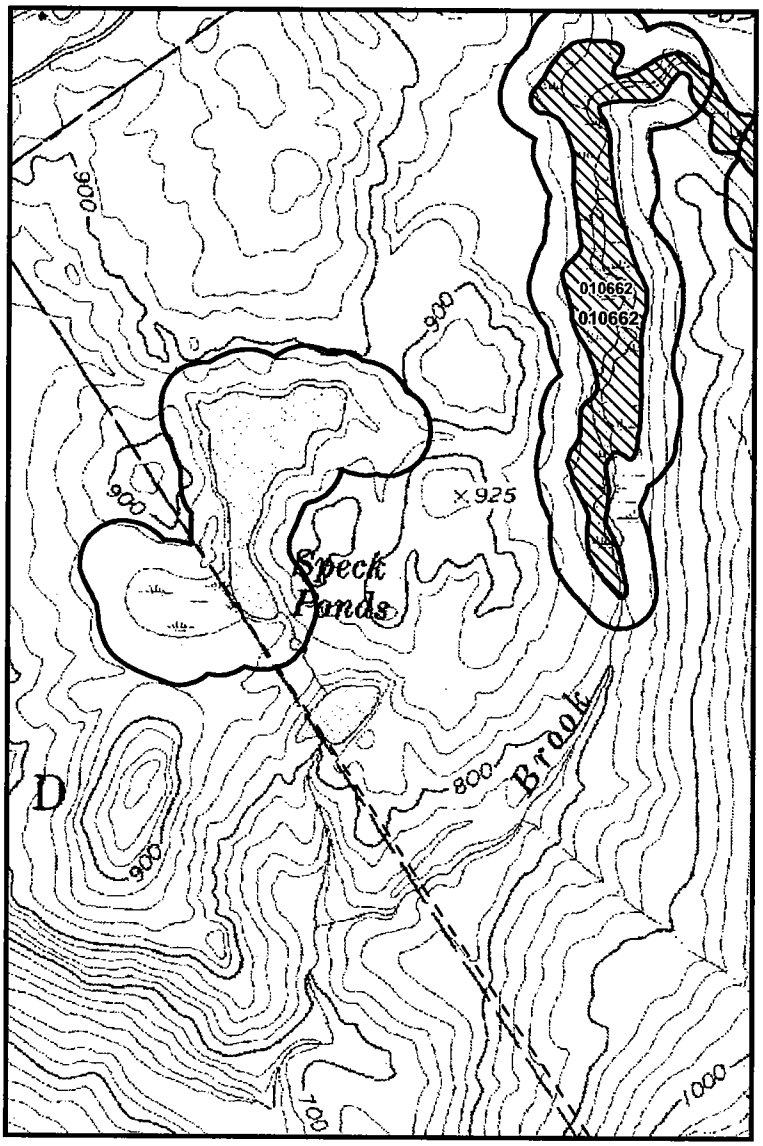
Topographic Map of Speck Pond Area.



Depth Map of Big Speck Pond.



# Search for Wildlife Observations & Habitat - Norway / Speck Ponds




- Bald Eagle Nest Site
- Piping Plover / Least Tern Nesting, Feeding, & Brood-rearing Area
- Roseate Tern Nesting Area
- Deer Winter Area
- Inland Waterfowl / Wading Bird Habitat
- Coastal Waterfowl / Wading Bird Habitat
- Seabird Nesting Island
- Shorebird Area
- Biological Conservation Database Rare Species or Habitat Observation
- Rare Plant
- Rare / Exemplary Natural Community
- Township Boundary
- County

0 0.1 0.2 0.3 0.4 Miles

1:11,784

*UTM Projection, Zone 19N, NAD83*

RR1, 358 Shaker Road
Gray, ME 04039
Voice: (207) 657-2345
Fax: (207) 657-2980
February 16, 2005

# ATTACHMENT B

**(Tabular Representation of Monitoring Requirements)**

| Speck Pond | | | |
|---|---|---|---|
| **Parameters** | **Units** | **Minimum Sampling Frequency** | **Sample Type** |
| Rotenone [1] | mg/L | Once 24 hours following treatment | Grab – surface and bottom |
| Rotenone Toxicity – Bioassay: 48-hr live box test (5 fish), 100% survival | # of days until 100% survival | Once post-treatment, approximately 3-12 weeks after treatment (just prior to outlet discharge) | Observation |
| D.O. Profile | mg/l | Once pretreatment & 2 yr post-treatment | Grab |
| Temperature Profile | °C | Once pretreatment & 2 yr post-treatment | Grab |
| pH | standard | Once pretreatment & 2 yr post-treatment | Grab – surface and bottom |
| Total Alkalinity | mg/L CaCO3 | Once pretreatment & 2 yr post-treatment | Grab – surface and bottom |
| Secchi | m/ft | Once pretreatment & 2 yr post-treatment | Grab |
| Fish Populations | NA | 2 yr post-treatment | Gillnet |

| Downstream Receiving Waters Below Neutralization Zone | | | |
|---|---|---|---|
| Rotenone Toxicity – Bioassay: 48-hr live box test (5 fish)<br>Site 1 – @ confluence of Speck Ponds' outlet and Hobbs B | % survival | 1. Begin test at time of outlet discharge, and<br>2. Repeat at one-week intervals until upstream treated water is detoxified per upstream bioassay. | Observation |
| Rotenone Toxicity – Bioassay: 48-hr live box test (5 fish)<br>Site 2 - @ confluence of Hobbs B and Crooked R | % survival | 1. Begin test if Site 1 becomes toxic, and<br>2. Repeat at one-week intervals until upstream treated water is detoxified per upstream bioassay. | Observation |

[1] Analyze using bioassay methods described in Demong (1992).

# ATTACHMENT C

**(Rotenone Degradation and Discharge Calculations)**

Appendix I. Modeling of Rotenone Degradation to Predict How Many Days of Natural Detoxification are Needed to Adequately Protect Organisms in Hobbs Brook – Based on Equations Developed by Engstrom-Heg and Colesante (1979).

Question #1: Is Speck Pond likely to discharge toxic water by the estimated refill date determined by MDEP (late November/early December)?

$\text{Log}_e T = \text{loge}\ (194.4*\log_e R_1/DR_2)-0.1298t$
$D=Vt/Vh$
$R_d= R_1(Vd/Vt)$ - substitute $R_1$ with $R_d$ if drawdown is used

T = time in days to detoxify
$R_1$=initial rotenone concentration=2.0 ppm
$R_2$=threshold rotenone concentration safe for fish = 0.03 ppm
$R_d$=initial rotenone concentration w/ dilution created by drawdown= 1.49 ppm
t= temperature (hypolimnion/fall overturn) = 50°C
Vt= total lake volume= 154.76 acre-ft
Vh=hypolimnetic volume (=>4m)= 54.50 acre-ft
Vd=drawndown volume= 115.68 acre-ft
D=2.84

$R_1/DR_2 = 1.49/0.09=16.5$
$\log_e R_1/DR_2=2.81$
$\text{Log}_e T = \text{loge}\ (194.4*2.81)-0.1298(10)$
$= 6.303-1.298$
$= 5.005$
= 149 days

Conclusion, it will take approximately 149 days for all of the water in Speck Pond to naturally detoxify to or below the threshold level of 0.03 ppm. Assuming treatment takes place on 8/25 and discharge occurs 98 days later on 12/1 (see Appendix H) some slightly toxic water could discharge from Big Speck Pond.

Question #2: Little Speck Pond and its outlet are included in the transition zone where an impact may occur. Thus, the more appropriate question to ask is, "Will Hobbs Brook receive a toxic discharge?"

$\text{Log}_e T = \text{loge}\ (194.4*\log_e R_1/DR_2)-0.1298t$
$D=Vt/Vh*Q_2/Q_1$
$R_d= R_1(Vd/Vt)$ - substitute $R_1$ with $R_d$ if drawdown is used

T = time in days to detoxify
$R_1$=initial rotenone concentration=2.0 ppm
$R_2$=threshold rotenone concentration safe for fish = 0.03 ppm
$R_d$=initial rotenone concentration w/ dilution created by drawdown= 1.49 ppm
t= temperature (hypolimnion/fall overturn) = 50°C

Vt= total lake volume= 154.76 acre-ft
Vh=hypolimnetic volume (=>4m)= 54.50 acre-ft
Vd=drawndown volume= 115.68 acre-ft
$Q_2$= estimated total discharge = 1.96 cfs
$Q_1$= estimated outlet discharge = 0.15 cfs
D=37.12

Note: Stream discharge was estimated by using standard ABF calculations (below). Although actual flows may vary and differ from the estimate, we are assuming the dilution ratio will be closely related to watershed size and be similar under various flow conditions.

Estimated discharge of Hobbs Brook before confluence w/ Speck Pond Outlet:
0.5 cfs/sqmile*3.616sqmi=1.81 cfs
Estimated discharge of Speck Pond Outlet before confluence w/ Hobbs Brook:
0.5cfs/sqmile*0.306sqmi = 0.15 cfs

$R_1/DR_2$ = 1.49/1.11=1.34
$\log_e R_1/DR_2$=0.29
$\text{Log}_e$ T = loge (194.4*0.29)-0.1298(10)
= 4.047-1.298
= 2.75
= 16 days

Conclusion, no toxic discharge to Hobbs Brook is anticipated if Big Speck Pond is treated 16 days before a discharge from Big Speck Pond could reach Hobbs Brook. Since the drawdown should prevent any discharge for up to 98 days, there is an 82-day (98-16) "safety period" for the rotenone to detoxify under natural conditions. In addition, these calculations are conservative (-Heg and Colesante 1979) and they do not include additional dilution and loss of rotenone to organics from the outlet channel and Little Speck Pond.

**Based on the current proposal, it is highly unlikely nontarget organisms in Hobbs Brook would be impacted from this treatment, and the use of a neutralizing agent like potassium permanganate is not warranted.**

# ATTACHMENT D

**(References Cited)**

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