View east from just west of the native outwash prairie boundary showing the dense Scot's broom interior in the foreground and native outwash prairie in the background. The homes in the background demarcate the eastern ownership boundary.

View west from native outwash prairie boundary showing the two highly invasive species on-site - Scot's broom and Douglas-fir.
View north from site interior showing dense Scot's broom and small native outwash prairie isolates. Prairie isolates west of the native outwash prairie boundary were flagged, as shown in the photo.

Close-up view of prairie isolate located west of the native outwash prairie boundary. The prairie isolates are small, generally 0.01 to 0.33 acres, and are surrounded by invasive species.
View west from native outwash prairie boundary showing a graded mound, which is visible as a lighter brown patch of predominantly non-native species. Disturbed areas, including areas graded, filled, or logged, were omitted from the native outwash prairie boundary.

View of small oak woodland near Finger 4 of Wetland A.
View east from native outwash prairie boundary showing the prairie interior with characteristic Mima mounds and prairie vegetation. Scot's broom and other invasive species are present within the prairie, and generally appear to colonize the tops of mounds first.

View west from the native outwash prairie interior showing the native outwash prairie boundary (indicated by arrows). Scot's broom forms a dense thicket west of the prairie boundary. Douglas-fir is present in patches throughout the site.
View east from native outwash prairie boundary showing the prairie interior, which has "islands" of Scot’s broom.

View north from area north of Tacoma Rail Mountain Division rail line showing logged area that is not dominated by native prairie species. Disturbed areas, including logged areas, were not included in the native outwash prairie boundary.
APPENDIX A

Washington Department of Fish and Wildlife Species Information
Date: APR 22 2002

Dear Habitats and Species Requester:

Enclosed are the habitats and species products you requested from the Washington Department of Fish and Wildlife (WDFW). This package may also contain documentation to help you understand and use these products.

These products only include information that WDFW maintains in a computer database. They are not an attempt to provide you with an official agency response as to the impacts of your project on fish and wildlife, nor are they designed to provide you with guidance on interpreting this information and determining how to proceed in consideration of fish and wildlife. These products only document the location of important fish and wildlife resources to the best of our knowledge. It is important to note that habitats or species may occur on the ground in areas not currently known to WDFW biologists, or in areas for which comprehensive surveys have not been conducted. Site-specific surveys are frequently necessary to rule out the presence of priority habitats or species.

Your project may require further field inspection or you may need to contact our field biologists or others in WDFW to assist you in interpreting and applying this information. Generally, for assistance on a specific project, you should contact the WDFW Habitat Program Manager for your county and ask for the area habitat biologist for your project area. Refer to the enclosed directory for those contacts.

Please note that sections potentially impacted by spotted owl management concerns are displayed on the 1:24,000 scale standard map products. If specific details on spotted owl site centers are required they must be requested separately.

These products are designed for users external to the forest practice permit process and as such does not reflect all the information pertinent to forest practice review. The Forest Practice Rules adopted August 22, 1997 by the Forest Practice Board and administered by the Washington Department of Natural Resources require forest practice applications to be screened against marbled murrelet detection areas and detection sections. Marbled murrelet detection locations are included in the standard priority habitats and species products, but the detection areas and detection sections are not included. If your project is affected by Forest Practice Regulations, you should specially request murrelet detection areas.

WDFW updates this information as additional data become available. Because fish and wildlife species are mobile and because habitats and species information changes, project reviews for fish and wildlife should not rest solely on mapped information. Instead, they should also consider new information gathered from current field investigations. Remember, habitats and species information can only show that a species or habitat type is present, they cannot show that a species or habitat type is not present. These products should not be used for future projects. Please obtain updates rather than use outdated information.
WASHINGTON DEPARTMENT OF FISH AND WILDLIFE
REGIONAL HABITAT PROGRAM MANAGER CONTACTS

For assistance with Priority Habitats and Species Information contact a regional habitat program manger and they will direct your questions to a biologist.

County project is in...

Asotin, Columbia, Ferry, Garfield Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman

Adams, Chelan, Douglas, Grant, Okanogan

Benton, Franklin, Kittitas, Yakima

Island, King, San Juan, Skagit, Snohomish, Whatcom

Clark, Cowlitz, Klickitat, Lewis, Skamania, Wahkiakum

Clallam, Grays Harbor, Jefferson, Kitsap, Mason, Pacific, Pierce, Thurston

Contact...

Kevin Robinette
8702 North Division Street
Spokane, WA 99218-1199
Phone: (509) 456-4082

Tracy Lloyd
1550 Alder Street NW
Ephrata, WA 98823-9699
Phone: (509) 754-4624

Ted Clausing
1701 24th Avenue
Yakima, WA 98902-5720
Phone: (509) 575-2740

Deborah Cornett
16018 Mill Creek Blvd.
Mill Creek, WA 98012-1296
Phone: (425) 775-1311

Steve Manlow
2108 Grand Blvd.
Vancouver, WA 98661
Phone: (360) 696-6211

Sue Patnude
48 Devonshire Road
Montesano, WA 98563-9618
Phone: (360) 249-4628

August 2000
Confidential information contained within the Washington Department of Fish and Wildlife, Habitats and Species Reports and accompanying maps. Please contact the Washington Department of Fish and Wildlife.
Oregon Silverspot Butterfly

*Speyeria zerene hippolyta*

This medium-sized, brown-and-orange butterfly has been extirpated from Washington. The coastal salt-spray meadows and open fields where the larval host plant once flourished have been overgrown with grasses, shrubs, and trees. The invading vegetation has crowded out stands of early blue violet, the essential food plant of silverspot larvae.

To help bring back the Oregon silverspot, critical habitat has been acquired and a Wildlife Diversity biologist has established a violet nursery. Plants from the nursery will, during the next few years, be transplanted to coastal sites. Butterflies may be reintroduced when suitable meadow habitat has been restored.

Meanwhile, potential habitat is being inventoried and monitored. Where violets persist, landowners are encouraged to adopt mowing schedules to keep grasses and woody vegetation at bay.
APPENDIX B

Washington Department of Natural Resources, Natural Heritage Program Species Information.
May 14, 2002

Andrea Aberle
Ecological Land Services Inc
1339 Commerce Ave – Ste 311
Longview WA 98632

SUBJECT: Environmental Classification Survey, Rocky Prairie, Thurston County
(T16N R02W S01,02,11,12)

We've searched the Natural Heritage Information System for information on rare plants, select rare animal species, and high quality wetland and terrestrial ecosystems in the vicinity of your project. A summary of this information, and corresponding materials, are enclosed. In your planning, please consider protection of these significant natural features. Please contact us for consultation on projects that may have an effect on these rare species or high quality ecosystems.

The information provided by the Washington Natural Heritage Program is based solely on existing information in the database. There may be significant natural features in your study area of which we are not aware. These data are being provided to you for informational and planning purposes only - the Natural Heritage Program has no regulatory authority. This information is for your use only for environmental assessment and is not to be redistributed. Others interested in this information should be directed to contact the Natural Heritage Program.

The Washington Natural Heritage Program is responsible for information on the state’s rare plant species as well as high quality ecosystems. We have begun to add to our database information on selected groups of animals of conservation concern, such as freshwater mussels, butterflies and bats. However, to ensure that you receive information on all animal species of concern, please contact Priority Habitats and Species, Washington Department of Fish and Wildlife, 600 Capitol Way N, Olympia, WA 98501-1091, or by phone (360) 902-2543.

If you have internet access, please visit our website for more information. Lists of rare plants and their status, as well as rare plant fact sheets, are available for download from the site. You will find us listed under Programs & Topics on the WA DNR homepage at www.wa.gov/dnr. Please call me at (360) 902-1667 if you have any questions, or by E-Mail: sandra.moody@wadnr.gov.

Sincerely,

Sandy Swope Moody, Environmental Review Coordinator
Washington Natural Heritage Program

Enclosures
WASHINGTON NATURAL HERITAGE INFORMATION SYSTEM
ENDANGERED, THREATENED AND SENSITIVE PLANTS,
SELECT RARE ANIMAL SPECIES,
HIGH QUALITY WETLAND ECOSYSTEMS AND HIGH QUALITY TERRESTRIAL ECOSYSTEMS
IN THE VICINITY OF ENVIRONMENTAL CLASSIFICATION SURVEY, ROCKY PRAIRIE
REQUESTED BY ECOLOGICAL LAND SERVICES INC

Data Current as of May 2002
Page 1 of 1

<table>
<thead>
<tr>
<th>TOWNSHIP, RANGE AND SECTION</th>
<th>ELEMENT NAME</th>
<th>STATE STATUS</th>
<th>FEDERAL STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>T16N R02W S02 SEcSW S11 NE S12</td>
<td>Aster curtus (white-top aster)</td>
<td>S</td>
<td>SC</td>
</tr>
<tr>
<td>T16N R02W S12 SWofNE</td>
<td>Howellia aquatilis (howellia)</td>
<td>T</td>
<td>LT</td>
</tr>
</tbody>
</table>
WASHINGTON NATURAL HERITAGE INFORMATION SYSTEM
Rare Animal and Plant Species - Definitions apply to vascular plants and animals unless otherwise stated.

FEDERAL STATUS DEFINITIONS: (Note: Federally listed plant species are subject to the US Endangered Species Act.)

LE = Listed Endangered: Any taxon that is in danger of extinction throughout all or a significant portion of its range and that has been formally listed as such in the Federal Register under the Federal Endangered Species Act.

LT = Listed Threatened: Any taxon that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range and that has been formally listed as such in the Federal Register under the Federal Endangered Species Act.

PE = Proposed Endangered: Any taxon that is in danger of extinction throughout all or a significant portion of its range and that has been proposed for listing as such in the Federal Register under the Federal Endangered Species Act.

PT = Proposed Threatened: Any taxon that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range and that has been proposed for listing as such in the Federal Register under the Federal Endangered Species Act.

C = Candidate species: Taxa for which current information indicates the probable appropriateness of listing as Endangered or Threatened and that has been published in the Federal Register as a candidate for listing under the Federal Endangered Species Act.

SC = Species of Concern: Species whose conservation standing is of concern but for which status information is still needed. Species of concern lists are not published in the Federal Register.

Animal:
NL = Not Listed: Used for populations or subspecies within a taxon that are not federally listed, when other populations or subspecies of that same taxon are listed.

STATE STATUS DEFINITIONS- (Note: The state ESA does not include provisions to list or protect rare plant species - the state rare plant list is advisory only.)

E = Endangered: Any taxon in danger of becoming extinct or extirpated from Washington within the foreseeable future if factors contributing to its decline continue. Populations of these taxa are at critically low levels or their habitats have been degraded or depleted to a significant degree.

T = Threatened: Any taxon likely to become Endangered in Washington within the foreseeable future if factors contributing to its population decline or habitat degradation or loss continue.

S = Sensitive: Any taxon that is vulnerable or declining and could become Endangered or Threatened in the state without active management or removal of threats.

Animal:
C = Candidate: Taxa under review for listing.

M = Monitor: Taxa of potential concern.

NL = Not Listed: Used for populations or subspecies within a taxon that have no state status, when other populations or subspecies within that same taxon are listed.

Vascular Plant:
X = Possibly Extinct or Extirpated from Washington: Based on recent field searches, a number of plant taxa are considered to be possibly extinct or extirpated from Washington. Taxa in this group are all high priorities for field investigations. If found, they will be assigned one of the above status categories.

R = Review: Taxa of potential concern, but for which no status has yet been assigned.
   Group 1 = Taxa in need of additional field work before a status can be assigned.
   Group 2 = Taxa with unresolved taxonomic questions.

W = Watch: Taxa more abundant and/or less threatened in Washington than previously assumed.

Non-Vascular Plant:
P = Priority: At this time, there is insufficient information to assign a statewide status to the non-vascular taxa. For now, the lichen and macrofungi lists have been divided into two priority groups based on criteria of occurrence pattern, vulnerability, threats, degree of protection, and taxonomy.
APPENDIX C

U.S. Fish and Wildlife Service Species Information
Dear Species List Requester:

We are providing the information you requested to assist your determination of possible impacts of a proposed project to species of Federal concern. Attachment A includes the listed threatened and endangered species, species proposed for listing, candidate species, and/or species of concern that may be within the area of your proposed project.

Any Federal agency, currently or in the future, that provides funding, permitting, licensing, or other authorization for this project must assure that its responsibilities section 7(a)(2) of the Endangered Species Act of 1973, as amended (Act), are met. Attachment B outlines the responsibilities of Federal agencies for consulting or conferencing with us (U.S. Fish and Wildlife Service).

If both listed and proposed species occur in the vicinity of a project that meets the requirements of a major Federal action (i.e., “major construction activity”), impacts to both listed and proposed species must be considered in a biological assessment (BA) (section 7(c); see Attachment B). Although the Federal agency is not required, under section 7(c), to address impacts to proposed species if listed species are not known to occur in the project area, it may be in the Federal agency’s best interest to address impacts to proposed species. The listing process may be completed within a year, and information gathered on a proposed species could be used to address consultation needs should the species be listed. However, if the proposed action is likely to jeopardize the continued existence of a proposed species, or result in the destruction or adverse modification of proposed critical habitat, a formal conference with us is required by the Act (section 7(a)(4)). The results of the BA will determine if conferencing is required.

The Federal agency is responsible for making a determination of the effects of the project on listed species and/or critical habitat. For a Federal agency determination that a listed species or critical habitat is likely to be affected (adversely or beneficially) by the project, you should request section 7 consultation through this office. For a "not likely to adversely affect" determination, you should request our concurrence through the informal consultation process. For a "no effect" determination, we would appreciate receiving a copy for our information.

Candidate species and species of concern are those species whose conservation status is of concern to us, but for which additional information is needed. Candidate species are included as an advance notice to Federal agencies of species that may be proposed and listed in the future. Conservation measures for candidate species and species of concern are voluntary but recommended. Protection provided to these species now may preclude possible listing in the future.
For other federally listed species that may occur in the vicinity of your project, contact the National Marine Fisheries Service at (360) 753-9530 to request a list of species under their jurisdiction. For wetland permit requirements, contact the Seattle District of the U.S. Army Corps of Engineers for Federal permit requirements and the Washington State Department of Ecology for State permit requirements.

Thank you for your assistance in protecting listed threatened and endangered species and other species of Federal concern. If you have additional questions, please contact Yvonne Dettlaff (360) 753-9582.

Sincerely,

[Signature]

Ken S. Berg, Manager
Western Washington Fish and Wildlife Office

Enclosure(s)

cc: COE
ATTACHMENT A

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES, CRITICAL HABITAT, CANDIDATE SPECIES, AND SPECIES OF CONCERN THAT MAY OCCUR IN THE VICINITY OF THE PROPOSED CITIFORE PROPERTY PROJECT IN THURSTON COUNTY, WASHINGTON

(T16N R2W S1-2,11-12)

FWS REF: 1-3-02-SP-1174

LISTED

Wintering bald eagles (*Haliaeetus leucocephalus*) may occur in the vicinity of the project. Wintering activities occur from October 31 through March 31.

Bull trout (*Salvelinus confluentus*) may occur in the vicinity of the project.

Oregon silverspot butterfly (*Speyeria zere ne hippolyta*) occurs in the vicinity of the project.

Major concerns that should be addressed in your biological assessment of the project impacts to listed species include:

1. Level of use of the project area by listed species,

2. Effect of the project on listed species’ primary food stocks, prey species, and foraging areas in all areas influenced by the project, and

3. Impacts from project construction (i.e., habitat loss, increased noise levels, increased human activity) that may result in disturbance to listed species and/or their avoidance of the project area.

*Castilleja levisecta* (golden paintbrush)

Major concerns that should be addressed in a biological assessment for a listed plant species include:

1. Distribution of the taxon in the project vicinity,

2. Disturbance (trampling, uprooting, collecting, etc.) of individual plants and loss of habitat, and

3. Changes in hydrology where the taxon is found.
PROPOSED

None

CANDIDATE

Mardon skipper (*Polites mardon*)
Oregon spotted frog (*Rana pretiosa*)
Whulge (Edith’s) checkerspot (*Euphydryas editha taylori*)

SPECIES OF CONCERN

The following species of concern have been documented in the county where the project is located. These species or their habitat could be located on or near the project site. Species in **bold** were specific occurrences located on the database within a 1 mile radius of the project site.

California wolverine (*Gulo gulo luteus*)
Cascades frog (*Rana cascadae*)
Long-eared myotis (*Myotis evotis*)
Long-legged myotis (*Myotis volans*)
Northern goshawk (*Accipiter gentilis*)
Northwestern pond turtle (*Clemmys marmorata marmorata*)
Oregon vesper sparrow (*Pooectetes gramineus affinis*)
Olive-sided flycatcher (*Contopus cooperi*)
Pacific fisher (*Martes pennanti pacifica*)
Pacific lamprey (*Lampetra tridentata*)
Pacific Townsend’s big-eared bat (*Corynorhinus townsendii townsendii*)
River lamprey (*Lampetra ayresi*)
Slender-billed, white breasted nuthatch (*Sitta carolinensis aculeata*)
Tailed frog (*Ascaphus truei*)
Valley silverspot (*Speyeria zerene bremeri*)
Van Dyke’s salamander (*Plethodon vandykei*)
Western gray squirrel (*Sciurus griseus griseus*)
*Aster curtus* (white-top aster)
APPENDIX D

National Marine Fisheries Service Species Information
There are Puget Sound Chinook (Oncorhynchus tshawytscha) in Thurston County.

Rachel Friedman

Andrea Aberle wrote:

> Rachel, I have not received a reply on the below species verification
> request sent to you back in April (it first went to DeeAnn). Please forward
> me your verification as soon as possible.
> Thank You,
> Andrea Aberle
> Ecological Land Services, Inc
> 1339 Commerce Ave. Suite 311
> Longview, WA 98632
> 360.578.1371
> 360.414.9305 fax
> andrea@eco-land.com
>
> -----Original Message-----
> From: DeeAnn Kirkpatrick [mailto:DeeAnn.Kirkpatrick@noaa.gov]
> Sent: Wednesday, April 10, 2002 10:12 AM
> To: Andrea Aberle
> Cc: Rachel Friedman
> Subject: Re: Listed spp. verification - Thurston County site
>
> Hi Andrea - Rachel also covers Thurston County, so you should correspond
> with
> her.
>
> Andrea Aberle wrote:
> 4/9/02
> Hello DeeAnn - I am assuming that you are the correct NW contact for this
> site.
> >
> > Re: Environmental Classification Survey - Thurston County, Citifore
> > property, Sections 1,2,11,12 - Township 16, Range 2 West, W.M.
> >
> > We are requesting that you verify that there are no listed species within
> > the project area. Any information regarding the presence of any listed
> > and
> > proposed species under ESA, Washington State listed priority habitats and
> > species, or high quality ecosystems that may occur within the project
> > area.
> > If you have any questions, please e-mail me at andrea@eco-land.com, or
> > call
> > me at (360) 578-1371.
> >
> > Thank You,
> > Andrea W. Aberle
> > Ecological Land Services, Inc
APPENDIX E

Native Outwash Prairie Data and Botanical Information
### Mean percent cover and frequency of non-prairie and prairie communities on paired vegetational plots at the Maytown Aggregates site in Thurston County, Washington

<table>
<thead>
<tr>
<th>Species</th>
<th>Scientific Name</th>
<th>Common Name</th>
<th>NON-PRAIRIE</th>
<th>Frequency</th>
<th>PRAIRIE</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cover</td>
<td></td>
<td>Cover</td>
<td></td>
</tr>
<tr>
<td><strong>Mosses</strong></td>
<td></td>
<td></td>
<td>27.0</td>
<td>67</td>
<td>36.5</td>
<td>92</td>
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<tr>
<td><em>Agrostis tenuis</em></td>
<td></td>
<td>Colonial bentgrass</td>
<td>27.8</td>
<td>67</td>
<td>17.0</td>
<td>67</td>
</tr>
<tr>
<td><em>Chrysanthemum leucanthemum</em></td>
<td></td>
<td>Oxeye daisy</td>
<td>1.6</td>
<td>25</td>
<td>16.1</td>
<td>42</td>
</tr>
<tr>
<td><em>Anthoxanthum odoratum</em></td>
<td></td>
<td>Sweet vernal grass</td>
<td>3.8</td>
<td>25</td>
<td>9.5</td>
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</tr>
<tr>
<td><em>Carex pensylvanica</em></td>
<td></td>
<td>Long-stolon sedge</td>
<td>7.2</td>
<td>42</td>
<td>9.3</td>
<td>75</td>
</tr>
<tr>
<td><em>Viola adunca</em></td>
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<td>Early blue violet</td>
<td>3.5</td>
<td>50</td>
<td>7.2</td>
<td>42</td>
</tr>
<tr>
<td><em>Plantago lanceolata</em></td>
<td></td>
<td>English plaintain</td>
<td>3.2</td>
<td>8</td>
<td>6.2</td>
<td>42</td>
</tr>
<tr>
<td><em>Veronica officinalis</em></td>
<td></td>
<td>Common speedwell</td>
<td>0</td>
<td>0</td>
<td>5.9</td>
<td>33</td>
</tr>
<tr>
<td><em>Fragaria vesca</em></td>
<td></td>
<td>Woodland strawberry</td>
<td>3.4</td>
<td>17</td>
<td>5.0</td>
<td>33</td>
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<tr>
<td><em>Eriophyllum lanatum</em></td>
<td></td>
<td>Woolly eriophyllum</td>
<td>2.5</td>
<td>17</td>
<td>4.4</td>
<td>17</td>
</tr>
<tr>
<td><em>Cytisus scoparius</em></td>
<td></td>
<td>Scot’s broom</td>
<td>42.3</td>
<td>75</td>
<td>2.5</td>
<td>17</td>
</tr>
<tr>
<td><em>Camassia quamash</em></td>
<td></td>
<td>Common camas</td>
<td>0</td>
<td>0</td>
<td>1.8</td>
<td>58</td>
</tr>
<tr>
<td><em>Lepidium sp.</em></td>
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<td>Peppergrass</td>
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<td>17</td>
<td>1.6</td>
<td>25</td>
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<tr>
<td><em>Vicia sativa</em></td>
<td></td>
<td>Common vetch</td>
<td>1.0</td>
<td>33</td>
<td>1.5</td>
<td>50</td>
</tr>
<tr>
<td><em>Dianthus californica</em></td>
<td></td>
<td>California oat-grass</td>
<td>0</td>
<td>0</td>
<td>1.5</td>
<td>17</td>
</tr>
<tr>
<td><em>Festuca idahoensis</em></td>
<td></td>
<td>Idaho fescue</td>
<td>0</td>
<td>0</td>
<td>1.3</td>
<td>8</td>
</tr>
<tr>
<td><em>Hypericum perforatum</em></td>
<td></td>
<td>Hairy cat’s-ear</td>
<td>0</td>
<td>0</td>
<td>1.3</td>
<td>8</td>
</tr>
<tr>
<td><em>Lomatium utriculatum</em></td>
<td></td>
<td>Spring-gold</td>
<td>0</td>
<td>0</td>
<td>1.3</td>
<td>8</td>
</tr>
<tr>
<td><em>Hypericum perforatum</em></td>
<td></td>
<td>Common St. John’s-wort</td>
<td>0.6</td>
<td>25</td>
<td>1.0</td>
<td>33</td>
</tr>
<tr>
<td><em>Solidago canadensis</em></td>
<td></td>
<td>Canada goldenrod</td>
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<td>17</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td><em>Achillea millefolium</em></td>
<td></td>
<td>Yarrow</td>
<td>1.5</td>
<td>17</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Arctostaphylos uva-ursi</em></td>
<td></td>
<td>Kintikinnick</td>
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<td>8</td>
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<td>0</td>
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<td><em>Symphoricarpos albus</em></td>
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<td>Common snowberry</td>
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<td>8</td>
<td>0</td>
<td>0</td>
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<tr>
<td><em>Taraxacum officinale</em></td>
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<td>Common dandelion</td>
<td>1.3</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Pseudotsuga menziesii</em></td>
<td></td>
<td>Douglas-fir</td>
<td>11.5</td>
<td>17</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

1 Only species with ≥ 1% cover are listed. Data were collected on 15 June 2002.
2 Species lacked mature flowers and therefore, positive identification was not possible.
3 Species marked with an asterisk are identified as prairie invaders by Del Moral and Deardorff (1976).
Mean percent cover of non-prairie and prairie communities for Scot's broom and Douglas-fir on line-strip transects at the Maytown Aggregates site in Thurston County, Washington

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>NON-PR ARIE $^2$</th>
<th>PRAIRIE $^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cytisus scoparius</strong></td>
<td>Scot's broom</td>
<td>46.6</td>
<td>10.1</td>
</tr>
<tr>
<td><strong>Pseudotsuga menziesii</strong></td>
<td>Douglas-fir</td>
<td>8.3</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>54.9</strong></td>
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$^1$ Data were collected on 15 June 2002.

$^2$ Non prairie cover data collected from 101 to 200 feet along a line transect.

$^3$ Prairie cover data collected from 0 to 100 feet along a line transect.
<table>
<thead>
<tr>
<th>Scientific Name</th>
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<td><em>Achillea millefolium</em></td>
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<tr>
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<td><em>Anaphalis margaritacea</em></td>
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<td><em>Antennaria neglecta</em></td>
<td>Field pussytoes</td>
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<td><em>Anthoxanthum odoratum</em></td>
<td>Sweet vernalgrass</td>
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<td><em>Apocynum sp.</em></td>
<td>Dogbane</td>
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<tr>
<td><em>Camassia quamash</em></td>
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<td><em>Carex pensylvanica</em></td>
<td>Long-stolonized sedge</td>
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<tr>
<td><em>Chrysantherum leucanthemum</em></td>
<td>Oxeye daisy</td>
</tr>
<tr>
<td><em>Cladonia sp.</em>, <em>Cladina sp.</em></td>
<td>Lichens</td>
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<td><em>Claytonia perfoliata</em></td>
<td>Miner’s lettuce</td>
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<td><em>Cytisus scoparius</em></td>
<td>Scot’s broom</td>
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<tr>
<td><em>Danthonia californica</em></td>
<td>California oat-grass</td>
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<td><em>Delphinium sp.</em></td>
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<td><em>Dodecatheon hendersonii</em></td>
<td>Broad-leaved shooting star</td>
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<tr>
<td><em>Eriophyllum lanatum</em></td>
<td>Woolly eriophyllum or Oregon sunshine</td>
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<td><em>Festuca idahoensis var. idahoensis</em></td>
<td>Idaho fescue</td>
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<td><em>Fragaria vesca</em></td>
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<td>Common St. John’s-wort</td>
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<td>Spring gold or Fine-leaved desert parsley</td>
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<td>Bracken fern</td>
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<td><em>Quercus garryana</em></td>
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<td><em>Ramunculus occidentalis</em></td>
<td>Western buttercup</td>
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<td><em>Rumex acetosella</em></td>
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<td><em>Solidago canadensis</em></td>
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<td><em>Symphoricarpos albus</em></td>
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<td><em>Veronica officinalis</em></td>
<td>Common speedwell</td>
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<td><em>Vicia sativa</em></td>
<td>Common vetch</td>
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<tr>
<td><em>Viola adunca</em></td>
<td>Early blue violet</td>
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<tr>
<td><em>Zygodenus venenosus</em></td>
<td>Death camas</td>
</tr>
</tbody>
</table>

1 Botanical surveys conducted 11 April, 28 May, 4 June, and 15 June 2002.

2 Species lacked mature flowers and therefore, positive identification was not possible.

* Species marked with an asterisk are identified as prairie invaders by Del Moral and Daurderff (1976).
LEGEND:
- **Douglas Fir**
- **Scot's Broom**

NOTES:
1. Native Outwash Prairie boundary delineated by ELS, Inc. on May 28 and June 4, 2002.
MAYTOWN AGGREGATES
SUPPLEMENT REPORT TO THE HABITAT MANAGEMENT PLAN
Clarification and Response To Thurston County MDNS

for
Maytown Aggregates
Thurston County, Washington

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April 23, 2004
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Introduction

This report provides clarification to related comments received by Thurston County in response to its MDNS for Maytown Aggregates. The County published the MDNS in early April 2004 and received comments from agencies, environmental groups, and citizens. The County then requested clarification or more information to address some of those comments, in a letter dated April 15, 2004. Ecological Land Services, Inc. (ELS) has provided responses and clarifications to the County’s request in this report.

Additional Field Work

To assist us in preparing these responses, on April 16 and 18, 2004, ELS staff surveyed most of the on-site portion of Allen Creek and the entire on-site portion of Beaver Creek. We followed the eastern-most channel of Allen Creek, which runs north-south, starting from south of the main access road to the site and extending approximately 2,300 feet upstream to the southern property boundary (Figure 1). On Beaver Creek, we generally followed the main channel of the stream from near the southern property boundary to the eastern property boundary, a distance of approximately 11,650 feet or roughly 2 miles. In many areas along Beaver Creek, the floodplain was flat and wide and we could not discern a defined channel.

We located every observable beaver dam along the surveyed sections of Allen and Beaver Creeks. Data were collected from three dams along Allen Creek, although at least four other small dams were observed. Data were also collected from nine dams along Beaver Creek; at least four other small dams were observed. We likely missed some of the beaver dams because of the dense vegetation and deteriorating quality of some of the older dams. The following information was collected to address the items raised in the County’s April 15, 2004 letter, including a characterization of the habitat within the drainages, an evaluation of the potential for this habitat to support the Olympic mudminnow, and an assessment of potential impacts from mining and any mining-related water level fluctuations on the habitat for the Olympic mudminnow, Oregon spotted frog, and howellia should they exist in these drainage systems, and to help determine the effect of beavers on the stream systems and Wetland A.

Methodology

The scope and methods for the field survey are as follows:

- Map and describe aquatic habitat features and types within the drainages such as streams, wetlands, beaver dams, relic ditches, and plant communities. Observation and/or data points were mapped by collecting latitude and longitude coordinates with a Garmin™ IV GPS (global positioning system) and/or corroborating field locations with a recent air photo (2002). Conditions were also photo-documented with a digital camera.
- Determine the extent of natural and human-caused influences on these aquatic systems including past drainage activities, beaver activity, land use practices, natural and human-caused erosion and sedimentation.
- Describe the topography and general landscape within and adjacent to the stream drainages, and how they may have been shaped by natural and human-caused influences.
- Describe the bathymetry of the drainages.
- Obtain water elevation data above and below individual beaver dams. Water elevations were measured using a telescoping graduated rod in tenths of feet and a clinometer.
- Collect surface water temperatures in degrees Celsius using a thermometer.
- Observe water sources for both drainages.
- Document stream flow characteristics, including riffle-pool transitions.
- Document stream substrate.
- Observe dominant vegetation and describe any apparent changes or trends in plant communities due to natural or human-caused influences.
- Document habitat supporting the distribution of “Important Species in Thurston County” within the drainages and associated wetlands.
- Consider appropriate locations for hydrologic monitoring stations.

Summary of Hydrogeologic Analysis

Pacific Groundwater Group (PGG), in its July 2002 Hydrogeologic Analysis, determined that the proposed mining will have no material impact on hydrology for gravel washing, wheel washing, and dust suppression and domestic wash use. Furthermore, PGG concluded that there will be no substantial changes to water temperatures or water turbidity, and no adverse impacts to groundwater from potential hydrocarbon contamination. ELS understands that mining results in two primary groundwater effects—“lake effect” that results in a drawdown of upgradient groundwater and a mounding of downgradient groundwater, and increases in evaporation from the creation of a open body of water. Lake effect can be mitigated by the placement of lower permeable material such as topsoil or fine sediments on the sides and bottom of the pit as it is reclaimed. Evaporation cannot be mitigated directly; however, it can be mitigated indirectly by reducing lake effect.

In its July, 2002 analysis, PGG examined the lake effect with all eight pits open and with no mitigation (reduction of lake bed conductance). However, as explained in PGG's April, 2004 analysis, this scenario is very unlikely. More recent and expanded analysis by PGG, in its April 2004 Response to Comments on Thurston County MDNS for Maytown Aggregates, evaluated more realistic scenarios in which only two gravel pits are open at one time while the other pits are either unopened or reclaimed with a low-permeable surface on the pit lake bed. Two ends of the spectrum were analyzed and compared, and accounted for both lake effect and evaporation. The eight-pit open model without mitigation (analyzed in July, 2002) would result in a maximum 1.3 foot drop in the summer water level in Wetland A Finger 4. The numbers presented, however, represent the maximum lake effect if all eight lakes were created at the same time without mitigation, which will not occur. The proposed mine will sequence the excavation of aggregate and creation of lakes over a 20-year period, so that each mining area is reclaimed before proceeding to the next. Consequently, the mining effects will grow slowly as the open water expands over the 20-year life of the mine. In addition, monitoring will be undertaken to determine if additional mitigation of reclaimed lakes is warranted. As indicated above the eight-
pit open model assumes no additional mitigation has been undertaken. At the opposite end of the spectrum, with the two-pit open model and with intensive mitigation, the maximum summer water level change would result in an actual increase of 0.6 feet in Wetland A Finger 4. This assumes that all pits would have a four-foot thickness of low permeable “skin” on their sideslopes and bottoms. Therefore, water level change is quite sensitive to decreasing the lakebed conductance. Obviously, the goal of the mitigation is to have little or no change in water levels in the wetlands as a result of mining; therefore, some level of mitigation between these two scenarios that were analyzed would be appropriate.

What cannot be mitigated directly by reducing lakebed conductance is the change in the seasonality of the maximum groundwater level change. Analysis indicates that there is an existing 4-foot seasonal fluctuation in water levels at Wetland A Finger 4. The lowest groundwater levels typically occur in the fall. Due to the maximum mining effect in the summer as a result of evaporation, the water levels may decline earlier in the summer than under present conditions (July-August instead of October). However, with the two open pit model and with mitigation, the predicted increase in water level change at Wetland A Finger 4 would indirectly mitigate this seasonal shift in low water. In other words, one effect can be reduced by the mitigation of another effect. Monitoring of groundwater levels upgradient and downgradient of the open pits will be essential to determine the appropriate mitigation for pit reclamation, in order that little to no effect to surface water levels in the wetlands and stream drainages occur as a result of mining. PGG also provides further details and recommendations for continued hydrologic monitoring, many of which have been incorporated in this report under the section titled Proposed Hydrologic Monitoring.

Response to Comments from Thurston County Development Services

The following sections are preceded by each question or comment, in italics, provided by Thurston County Development Services in a letter dated April 15, 2004. Following each question or comment is our response.

COMMENT 1. *The State Department of Fish and Wildlife commented that the Olympic Mudminnow, a State Sensitive species, could inhabit portions of the overall ownership and was not included in the Habitat Management Plan. Please provide an analysis of this finding in relation to the subject property and the proposed mining activity.*

ELS solicited information regarding presence of Priority Habitat and Species in the project area from the Washington Department of Fish and Wildlife (WDFW) when it prepared the Habitat Management Plan contained in the project application. See Appendix A to the August 2002 Habitat Management Plan. WDFW’s response, dated April 22, 2002, did not identify the Olympic mudminnow (*Novumbra hubbsi*) within the project boundary. Therefore, it was not addressed in the August 2002 Habitat Management Plan. To evaluate whether this State Sensitive species could potentially inhabit portions of the site, ELS performed an extensive field survey of Beaver and Allen Creek drainages and their associated wetland on April 16 and 18, 2004.
Background

ELS utilized existing studies, research articles and previous experience evaluating preferred Olympic mudminnow habitat in the local region to compare with the conditions and characteristics of the drainage system within the project area. The following is a summary of the preferred habitat characteristics for this species of concern.

The Olympic mudminnow is found only in Washington State\(^1\). Current distribution of the Olympic mudminnow includes the southern and western lowlands of the Olympic Peninsula, the Chehalis and lower Deschutes River drainages, and south Puget Sound lowlands west of Nisqually River. The distribution was dictated by the glacial history of Western Washington during the Pleistocene Era. The WDFW has over 100 elevation measurements of Olympic mudminnow collection sites\(^1\). Only one site was located above 357 feet elevation.

Habitat requirements for the Olympic mudminnows are usually found in slow-moving streams, wetlands and ponds. Three habitat characteristics appear to be required for this species: 1) several centimeters of soft mud bottom substrate, 2) little to no water flow, and 3) abundant aquatic vegetation. If any of these characteristics were missing, no mudminnows were found\(^1,2\). A site near Lake Ozette was dredged several days before being sampled by Mongillo and Hallock in 1995 and all vegetation was removed in and around the site with increased water flow. There were still mudminnows present when sampled in 1995; however, in 1996 no mudminnows were present and the site still lacked vegetation. As vegetation slowly returned over the years, the number of mudminnows increased to pre-dredging levels. Mongillo and Hallock concluded mudminnows could recover from dredging if the site is allowed to re-vegetate and the minnows still have suitable access to the site.

Even where suitable habitat is present, competition with other fish is one of the major limitations affecting the Olympic mudminnow, primarily when exotic and/or native fish are present. A comparison of catch-per-unit-effort (CPUE) of Olympic mudminnows versus number of other fish species present indicates that Olympic mudminnows do not compete well and/or are preyed upon by other fish species. WDFW's 1993-1998 survey indicates that the presence of two or more native fish species may also inhibit Olympic mudminnow populations. Olympic mudminnows appear to be quite sensitive to competition/predation from exotic and native fish species\(^1\).

The Mongillo and Hallock report investigated other habitat variables influencing the Olympic mudminnow. A restricted tolerance range of water current and salinity was exhibited. In habitats with suitable current and salinity, the amount of light was the most important factor, followed by substrate type (mud), plants and temperature. These variables are important all year, but Mongillo and Hallock observed that an interaction among them during the summer was even more important. Low tolerance to water current has restricted Olympic mudminnows to lowlands. Generally, as elevation increases so do slope and water current. Over 60 percent of the mudminnow collection sites are under 162 feet elevation\(^1\).
Methodology

Methodologies summarized in this section are related to the mudminnow and additional methodology is referenced in other sections to address specific questions and concerns. ELS documented vegetative cover, including that within aquatic areas, stream flow characteristics, riffle to pool transitions, stream channel substrate, geomorphic features and bathymetry of the stream/wetland and water temperature by a pedestrian survey of Beaver Creek and Allen Creek within the property boundary on April 16 and 18, 2004. Data was collected over 2 linear miles of stream and ponded areas associated with the wetland and drainage patterns between the western and eastern boundaries of the project site (Figure 1).

Findings

The majority of habitat observed in the stream corridor was typical of a relatively flat to low gradient stream with significant damming and pooling created by historic and recent beaver activity (Photoplates 1-1 through 1-4). The eastern most portion of the drainage system (outside of the project boundary) where Beaver Creek bisects the native outwash prairie was not affected or altered by beaver activity. During the April 2004 field surveys, we observed no surface water in Beaver Creek for approximately 2,100 feet in the eastern portion of Wetland A and through the outwash prairie. Upstream of the stream's submergence, small amounts of the flow spill from its defined channel and infiltrate into the prairie substrate. Downstream of this dry segment, surface water gradually reappears, first by ponding in small pockets then gradually deepening as one approaches the expansive inundated area at the confluence of Finger 4 (Figure 1). Throughout the submerged section of the stream we observed historic surface water flow indicators from the previous winter. Sediment deposits and obligate wetland plant species provided the evidence of previous surface water flow. The upper section of the channel bisecting the prairie appears to have been historically excavated and straightened, based on its well-defined banks.

Beaver damming appears to have significantly changed the composition of vegetation throughout the surveyed area, with most recent activities noted in the upper reaches of Wetland A, Wetland Boundary Survey and Rating Report. Refer to Photoplates 1-1 and 1-4. Much of the stream canopy once dominated by coniferous and hardwood forest species has died and reseeded to an open water, emergent and scrub-shrub community. The stream channel substrate is nearly all comprised of muddy bottoms except for small exposures of gravels and cobbles where beavers have excavated the mud for their dams. Several temperature readings were taken in the stream and pond areas, with a range of 10-13 degrees Celsius. Channel width was relatively broad, meandering and inconsistent as was depth of water due to the beaver damming. Depth of water varied 1-5 feet in the system based on elevation change and effects of damming. Very few riffles were observed other than flows cresting beaver dams and water moving around the dams. Some small riffles were observed in the upper reaches of Beaver Creek immediately below the dams and before downstream pooling. The average slope of the drainage evaluated was 0.21 percent. Refer to the attached cross section for a profile of Beaver Creek (Figure 2) and further information regarding findings in the discussion of Question 2.
Conclusions

Olympic mudminnow prefer very similar environmental conditions and habitat to those required by the Oregon spotted frog. Since the frog has been documented to inhabit the areas within the subject drainages, it is likely that the Olympic mudminnow is also present. Based on the information gathered from the literature search for these species and a field evaluation of the existing habitat and environmental conditions, it is determined there is abundant preferred habitat for both the Oregon spotted frog and the Olympic mudminnow. Observed beaver activity within the drainages of Beaver and Allen Creeks and their associated wetlands has revealed significant alteration in water elevations over the last 60 years. Refer to aerial photos discussion in the Comment 2 response. It is obvious beaver are physically controlling water levels in these drainage systems, increasing ponding and water depths, as well as expanding the wetland boundaries into adjacent areas by their continued damming activity.

As explained in response to Question 2, without mitigation, we expect the low water point of the year to move to July-August instead of October. The July-August period is well beyond the period to potentially strand Oregon spotted frog eggs or tadpole. The tadpole metamorphose and become small frogs by mid May to early June at which time they are mobile and able to move to deeper water. Similar responses are assumed for the Olympic mudminnow due to their similar habitat requirements as the Oregon spotted frog.

Due to the conditions discussed above and in conjunction with the data and conclusions presented in the Comment 2 response, it is our professional opinion that sufficient preferred habitat for the Olympic mudminnow and Oregon spotted frog will remain despite potential mining effects. This is in consideration of the extent of habitat already available and the natural fluctuations in water level occurring from normal evaporation within the wetland. This opinion is based on the scenario of eight pits open all at once with no mitigation, potentially 1 foot drop in wetland A Finger 4, described by the PGG Hydrogeologic Analysis. This scenario will not occur because all eight pits can not be opened at one time. It is anticipated that pit mitigation measures will reduce or eliminate potential impacts. Refer to the monitoring plan at the end of this report, which addresses habitat characteristics to be monitored prior to and during mining to determine any potential changes in the wetland system. In any event, it can be expected that Beaver damming will continue to largely control water elevations in the aforementioned drainage systems thereby minimizing potential affects of mining by increasing the amount of water and the duration of ponding that occurs in the system. Beaver damming has increased the minnow’s potential habitat and decreased the potential for stranding of the minnow. As history has shown, beaver activity within these drainages is actually increasing preferred habitat for the Olympic mudminnow and Oregon spotted frog.

COMMENT 2. Please provide additional clarification and analysis of possible impacts and mitigation measures in the hydrology of wetland "A" and the surface water systems in relation to Howellia and the Oregon Spotted Frog and the proposed mining operation. The details of the analysis shall include a monitoring plan in partnership with the State of
Washington Department of Fish and Wildlife (WDFW) that includes monitoring of the water levels and water temperatures as recommended by WDFW.

To analyze possible impacts and mitigation measures in the hydrology of Wetland A and the surface water systems (Allen and Beaver Creeks) in relation to howellia (Howellia aquatilis) and the Oregon spotted frog (Rana pretiosa) and the proposed mining operation, ELS in consultation with the project applicant and consulting hydrogeologist, PGG, conducted a more in-depth baseline survey of the Beaver Creek and Allen Creek drainages, and associated Wetland A. Therefore, a stream and wetland survey was conducted on April 16 and 18, 2004 on a portion of the Allen Creek drainage and approximately 2.0 miles of the Beaver Creek drainage.

This additional survey was necessary because the original Wetland Boundary Survey and Rating Report for Maytown Aggregates prepared by ELS in August 2002 focused on the wetland boundary delineation, wetland plant community descriptions, wetland categorization, wetland buffer description and determination, and general descriptions of wetland hydrology and analysis of potential wetland and buffer impacts. As the principal purpose of this work was to define the geographical extent of critical areas and their buffers in order to establish the mine boundary, an in-depth survey of the hydrological and habitat features was not conducted at that time. In 2002 the focus of the field work relating to wetlands and the on-site streams was concentrated primarily at the upland-wetland boundary. This recent survey concentrated on the interior of Wetland A and its association with Beaver and Allen Creeks. This survey and analysis also documented historical information to determine past conditions of the wetlands and streams, along with the natural and human-caused forces that have influenced these conditions over time. ELS believes it is necessary to fully understand the baseline hydrological and habitat conditions of these on-site aquatic systems before it is possible to predict the potential effects of the proposed mining activity on the hydrology of Wetland A, the on-site surface water systems (Beaver and Allen Creeks), and “Important Species of Thurston County” and to analyze whether any effects observed in the future are a result of mining activity. The potential effects on groundwater and surface water hydrology as a result of the proposed mining activity are provided by PGG, in a companion document of the same date.

Survey Results

Based on information collected in the field surveys of April 16 and 18, 2004, an aerial flight and photos collected on April 19, review of topographical data on the 2002 site plan, and review of recent (2002) and historical aerial photos (1941, 1977, 1983, 1986, 1997, 1999, and 2002), the following sections provide general and specific observations of the Allen and Beaver Creek drainages and associated Wetland A. The sections are organized relative to the source of information. The first section provides observations obtained from the field survey conducted on April 16 and 18 as well as current conditions provided by review of topographical data and the April 19 aerial flight. The second section provides results of the interpretation of a time-series of available aerial photos, dating back to 1941. These help corroborate or correct observations made on the ground that suggest previous hydrological and habitat conditions.
Field Survey, Topographical Interpretation, and Aerial Flight Results

1. From east to west, beginning where Beaver Creek crosses the eastern property line and ending where Beaver Creek intersects the section line between Sections 10 and 11, Beaver Creek experiences a 24-foot vertical drop in elevation over a horizontal distance of ~11,650 feet, or an average 2.1-foot vertical drop every 1,000 feet (0.21 percent), which characterizes a relatively low gradient stream. During the April 16 and 18 field surveys, surface water flow was observed throughout this stretch of Beaver Creek except for a 2,100 horizontal foot section located in the eastern portion of the stream (outside of the project boundary) where the flow goes subterrain (Figure 2).

2. There are segments within the overall surveyed length of Beaver Creek that have somewhat higher average gradients (0.29-0.43 percent), which can be seen in the stream profile (Figure 2). These areas coincide with the greatest occurrences of beaver dams. During the April 16 and 18, 2004 field surveys, we observed no surface water in Beaver Creek for approximately 2,100 feet, in the eastern portion of Wetland A and through the outwash prairie. Upstream of the stream’s submergence, water flows out of its defined channel and infiltrates into the prairie substrate. Downstream of this dry segment, surface water gradually reappears, first by ponding in small pockets then gradually deepening as one approaches the expansive inundated area at the confluence of the stream with Wetland A Finger 4 (Figure 2). Throughout the submerged section of the stream we observed historic surface water flow indicators from the previous winter. Sediment deposits and obligate wetland plant species provided the evidence of previous surface water flow.

3. Observations of on-going beaver activity were made throughout the survey of Beaver and Allen Creeks, except for the eastern-most 3,500 feet of Beaver Creek where there is little suitable habitat and much of the flow is subterranean and, therefore, the stream has no surface water flow. Evidence of beaver activity was seen as dams of varying breadth and height consisting of both woody material and mud, recent chewed and gnawed branches, excavated meandering channels, fallen trees, and beaver trails and slides. Proceeding upstream on Beaver Creek, west to east, nine major beaver dams were observed between the Section 10/11 line and the convergence with Finger 4 of Wetland A. Difference in water height elevations as a result of the dams ranged from 0.30 feet to 1.3 feet. Several other major and minor beaver dams are present along Beaver Creek that were not observed from the ground due to the dense vegetation and deteriorating quality of older dams but were observed during the fly over. Of the recorded beaver dams shown on Figure 2, the dams account for water elevation changes ranging from 0.30 feet to 1.30 feet, measured from immediately above and below each dam. The cumulative impact of the beaver dams is to increase water height by 5.65 feet.

4. Beginning at the western limit of the survey and moving upstream, the surface topography within the Beaver Creek/wetland system can be described as uneven, rough, and undulating, and cut by numerous meandering channels with intervening hummocks of emergent and scrub-shrub vegetation. This is particularly the case on the upstream side of the dams, where
beaver have excavated channels and utilized borrowed silt and rooted vegetation to build onto the dam. Once forested areas on the north and south sides of the wetlands are gradually, but markedly, declining due to the raised water levels from damming. This has the effect of creating numerous standing dead trees and downed woody debris. See Photoplates 1-1 and 1-4.

5. Evidence of stressed trees due to gradually rising water elevations can be seen throughout the forested areas on the north side of Beaver Creek. This effect is less pronounced on the south side of Beaver Creek because the upland slope adjacent to the wetland is steeper and, therefore, flooding impacts are not as pronounced. On the north side of Beaver Creek, the topography is considerably more gradual; therefore, any raised water level due to beaver damming effect can impact many acres of adjacent forested area that were previously dominated by vigorous growing, native trees. Affected tree species recorded in these areas include mainly Douglas-fir, red alder, western reedcedar, and black cottonwood. Observed effects of raised water levels on these trees are exhibited by shallow rooting and/or root rot that cause blowdown, broken and stressed top branches, and reduced growth rates. As upland species die, the vegetation community transitions to species more tolerant of flooding such as Oregon ash and willow. Of the area surveyed along Beaver Creek, virtually all of the adjacent uplands on the north side of the drainage between the Section 10/11 line and the confluence with Finger 4 of Wetland A, a distance of more than 5,000 feet, exhibit evidence of forest die-out due to raised water levels. The width of this affected zone range from 100 to 175 feet based on our field observations. Therefore, it is estimated that 17 to 20 acres of forested uplands are in the process of being converted to wetlands as a result of raised water levels from beaver activity.

6. The field survey confirmed that surface water in wetlands within the upper reaches of the Allen Creek drainage is connected to surface water elevations of the wetlands along Beaver Creek. It is thought that water flow between these two drainages is mostly influenced by beaver activity. As dams are built higher on Beaver Creek, flow is likely forced toward Allen Creek, and conversely, if dams are built higher on Allen Creek, the opposite effect occurs.

7. Both topographical interpretation and on-site observations confirm that the four “fingers” of Wetland A have different elevation ranges. Although they are delineated as part of one large wetland, the fingers are part of different watersheds depending upon their location. Moving from west to east, Finger 1 ranges from elevation 209 feet at its mouth to 214 feet at its eastern tip. Finger 2 ranges from elevation 212 feet at its mouth to 217 feet at its eastern tip. Both Fingers 1 and 2 drain primarily to Allen Creek. Finger 3 ranges from elevation 212 feet at its mouth to 216 feet at its eastern tip, and may drain to both Allen and Beaver Creeks, depending upon the influence of beaver dams within these two drainages (see #6 above). Finger 4 is virtually level throughout at elevation 215 feet, and is distinct among the four fingers in this regard. Finger 4 drains completely to Beaver Creek. In Fingers 1-3, the outer (eastern) limits of the fingers likely receive groundwater discharge during periods of high groundwater elevations, which becomes surface water flow in a down-gradient westerly
direction. Proceeding west, these fingers then flatten relatively quickly around consistent elevations of 212 to 214 feet elevation.

8. In the middle reach of Beaver Creek, upstream of the eastern-most beaver dam, the wetland can be characterized as an expansive and semi-open emergent and scrub-shrub wetland. The majority of the wetland substrate is relatively level and the water level is consistently about 2.5 feet. This water height appears to be determined by the height of the large beaver dam located just downstream. The dam is effective due to the narrow width of the Beaver Creek drainage immediately downstream as well as the steeper slopes of the uplands on both sides of this constricted drainage area. Vegetation within the flooded area within Finger 4 consists of moderately sparse clumps of willow and highly stressed reed canarygrass. The presence of reed canarygrass throughout this area suggests water levels have been lower in the recent past. Numerous floating and submerged woody debris along with a few scattered standing snags, made up exclusively of western redecedar, suggest that historically water depths were low enough to support a forested wetland community.

9. During the field survey, human-caused influences on Beaver and Allen Creeks, and their associated wetlands were observed. Generally, there appear to be no present or on-going human-caused influences that can be readily observed; however, there are remnants of past activities. Two relatively deep (3.0 vertical feet), straight, and uniformly shaped drainages ditches run parallel to each other and constitute the upstream portion of Allen Creek where an apparent farm field with hay, pasture or crop land was located. The western ditch contains a 36-inch culvert under a single-lane road crossing, providing access to lands west of the relic field. Several fence lines are present along Allen Creek and in Finger 1 of Wetland A, suggesting that farming or ranching has occurred in these areas in the past. Two parallel fences were also observed crossing Beaver Creek, approximately where the property line intersects it. One fence is older with cedar fence posts and rusted barbed wire and another, more recently installed fence consists of metal posts with barbed wire. Both fences are in areas with standing water and dense growths of reed canarygrass. The presence of reed canarygrass stands in Allen and Beaver Creek drainages may indicate past land clearing or agricultural activities, however, these activities can only be corroborated by historic aerial photo interpretation. Some areas along Beaver Creek have straight, inundated channels that likely indicate past drainage activities, likely relating to agricultural activities. Refer to the 1941 aerial photo (Figure 4), and a map of the farmed areas depicted on the 1941 photo (Figure 3).

10. Observed sources of hydrology for Beaver and Allen Creeks within the site include the following: Beaver Creek where it enters the eastern property line, groundwater and surface water flow from the four fingers of Wetland A, and at least three seasonal tributaries from the south extending from beyond 143rd Avenue SE. There are also several minor seasonal tributaries, shorter in distance, that convey surface water to the south side of the Beaver Creek drainage.
11. The aerial flight on April 19, 2004 provides photos of present day conditions of Beaver and Allen Creeks (Photoplates 1-1, 2-7). In general, the aerial flight corroborates what was observed on the ground on April 16 and 18, 2004. It also confirmed that Finger 4 of Wetland A was uniformly inundated by water depths that were similar to those documented in #8 above.

12. Howellia and Oregon spotted frog were not documented during the field survey; however, it is assumed that, among the range of habitats found within the Beaver and Allen Creek drainages, there are specific and preferred habitat suited for both of these species.

**Historical Aerial Photo Interpretation**

Historical aerial photo interpretation provides the ability to determine how conditions have changed over time within the Allen and Beaver Creek drainages. Air photos were analyzed from circa 1941, 1977, 1983, 1986, 1997, 1999 and 2002. Analysis of this 60-year time-period provides the ability to corroborate or correct observations made in the field survey.

To best represent changes over time to the hydrology and habitat within the Allen and Beaver Creek drainages, three specific areas were compared among all the aerial photos, including the farmed area within Allen Creek and two areas within the Beaver Creek drainage. These three areas were selected because they best illustrate contrasting hydrologic conditions between 1941 and the present day. One area, which was farmed in 1941, is located approximately 2,000 to 4,000 feet east of Tilley Road; the other area is located at the intersection of Beaver Creek and Finger 4 of Wetland A. The comparisons are provided as follows.

**Allen Creek Farm Site**

This area was included in the field survey conducted in April 2004, reviewed for topographical data on the 2002 aerial photo and site plan, and observed during the April 19 aerial flight. This area is rectangular-shaped, approximately 2,000 feet long north-south and 500 feet wide east-west. This area encompasses the two parallel ditches described in the field survey on April 16 and documented in #9 above.

**1941** The 1941 (July) aerial photo suggests that this area was farmed except for one centrally-located oval area that is forested (Figures 3 and 4). No ditches can be observed in this photo; however, the photo was taken in the summer and it is possible that water features can not be readily observed. Different colorations among the farmed areas suggest areas of distinct cropping, harvesting, or livestock grazing activities. No standing water can be observed.

**1977** The 1977 (June 30) aerial photo clearly shows the drainage ditches which can still be observed in the present day (Photoplate 2-1). This aerial photo suggests that the entire area was uniformly cropped for hay or pasture. Water can be observed in the two ditches but the field appears to be dry.
1983-1986 The 1983 (April 13) aerial photo indicates that the cropped area was reduced on the north and south ends (Photoplate 2-2). On the north end, it appears that flooding of the field caused the reduction as ponded water is clearly visible in the photo. This photo also shows a farm road and culvert crossing over the western ditch that is described in #9 previously. The 1986 photo (June 9) shows similar conditions to the 1983 photo; however, the inundation in the north portion of the field is apparent in the summer month of June, whereas the 1983 photo showed this inundation in April (Photoplate 2-3). Portions of the field still appear to be actively farmed in 1986.

1997 to present The 1997, 1999 and 2002 photos similarly show that farming activity has been completely abandoned in this area and vegetation is slowly transitioning from farmed or pastured species to native and non-native species (Photoplates 2-4 to 2-6). The forested area in the center of the area was also harvested at some time between 1986 and 1997. The extent of surface water inundation in the north portion of the field does not appear to have substantially changed between 1997 and 2002; however, it is more extensive than is shown in the 1983 and 1986 photos and is dramatically more extensive than that shown in the 1977 and 1941 photos.

This time-series comparison suggests that controlling water levels within the Allen Creek drainage has been necessary to successfully farm in this area, and that gradual water level increases are a natural result of the abandonment of drainage maintenance activities and beaver damming downstream of these areas.

**Beaver Creek Farm Site**

This area was included in the field survey conducted in April 2004, reviewed for topographical data on the 2002 aerial photo and site plan, and observed during the April 19 aerial flight. This area is irregularly shaped and approximately 2,000 feet long east-west and 500 feet wide north-south. This area currently encompasses two or three major beaver dams, and several minor ones as observed from the air, documented in #3 previously.

1941 The 1941 aerial photo indicates that this area was farmed or used for ranching in two distinct fields, the largest to the west and a much smaller field to the east (Figures 3 and 4). The larger field shows three different colored areas running east-west that suggests different crops or pastures. The smaller field is separated from the larger field by forest, and forested area borders the small field to the east or upstream. It is clear that both of these fields are located within what is presently the Beaver Creek drainage. No stream flow or ponded water is apparent in the photo; however, the photo was taken in the summer and it is possible that water features can not be readily observed. Moderately dense forested areas also border the larger field, north and south of the field.

1977 The 1977 (June 30) aerial photo shows that the northern half of the larger field has been abandoned but the south half is still used for pasture or hay (Photoplate 2-1). A meandering channel or drainage course can be observed within the abandoned portion of the field, oriented east-west and another area upstream has multiple meandering channels. The forested areas both downstream and upstream of the small field have been harvested. In fact, the harvested area
upstream is nearly 1,500 feet long. There are what appear to be five beaver dams within or in the vicinity of these once-farmed areas along Beaver Creek.

1983-1986 The 1983 (April 13) aerial photo shows that the remaining portion of the field from 1941 has been abandoned (Photoplate 2-2). The beaver dams are more prominent. In addition, the meandering channels appear to have widened since 1977. The 1986 (June 9) photo shows a further retreat of the abandoned farm field, as the area is overtaken with native scrub-shrub wetland vegetation (Photoplate 2-3). A uniform stand of deciduous trees (red alder) can be seen growing along the north side of the drainage, in a band between the beaver pond area to the south and forested uplands dominated by conifers to the north.

1997 to present The 1997 (January 13) aerial photo shows beaver ponds in the same locations as in 1986; however, the width of the deeper channels appears to have increased (Photoplate 2-4). This could be the effect of having a winter time photo during high water. The band of red alder has continued to mature along the north side of the drainage. The original farmed fields of 1941 have completely been overtaken by scrub-shrub and emergent wetlands. The 1999 aerial photo (May 22) shows three distinct beaver ponds within this area. The band of red alder trees appears to have substantially thinned (Photoplate 2-5). The 2002 photo shows that the band of red alder trees has virtually disappeared (Photoplate 2-6). This is corroborated by our field survey in April 2004. The beaver ponds and channels are still clearly defined and visible in the 2002 photo.

Based on this time-series comparison of aerial photos, the water elevation of the Beaver Creek drainage has been raised approximately 3 to 4 feet within this area over a period of about 60 years, primarily due to the combined effect of abandonment of drainage facilities and the natural damming activity of beavers. This estimated water height difference is illustrated on Figure 2.

Intersection of Beaver Creek and Finger 4 of Wetland A

This area was included in the field survey conducted in April 2004, reviewed for topographical data on the 2002 aerial photo and site plan, and observed during the April 19 aerial flight. This area is the mouth of Finger 4 of Wetland A, where it intersects with Beaver Creek.

1941 The 1941 aerial photo shows this area as moderately forested, with little or no scrub-shrub, emergent, or open water wetland (Figures 3 and 4).

1977 By the 1977 aerial photo, the trees had mostly died or had been harvested; however, many were still present as snags (Photoplate 2-1). An area of open water appears at the extreme southwestern end of Finger 4, which coincides with the present area of open water upstream of a documented beaver dam.

1983-1986 The 1983 photo shows similar conditions; however, numerous floating and submerged small logs can be seen in the south portion of Finger 4, suggesting that many of the trees from the forest in 1941 had fallen over and become large woody debris (Photoplate 2-2).
The 1986 photo shows that the open water area upstream of the beaver dam has nearly tripled in size (Photoplate 2-3).

1977 to present  The 1997 photo, taken in January during winter high water, shows that the entire area of Finger 4 is inundated, although the patches of scrub-shrub vegetation are still intact (Photoplate 2-4). The 1999 and 2002 photos show similar conditions and a gradually expanding size of the open water area upstream of the beaver dam (Photoplates 2-5 and 2-6).

Based on this time-series comparison of historical aerial photos, it is estimated that the water level of this portion of Beaver Creek and Finger 4 has increased 3 to 4 feet over the past 60 years. The forested area observed in the 1941 photograph could not be sustained after it was flooded by beaver activity. The activity of beavers over the past six decades has resulted in a gradual and continuous rise in surface water elevations of Beaver Creek and Finger 4 of Wetland A.

Discussion

The Allen Creek drainage, and the western two-thirds of the Beaver Creek drainage, and their associated wetlands (Wetland A and Fingers 1-4) are aquatic systems highly influenced by beaver activity. The field survey, aerial flight, and historical aerial photo review provides evidence that the surface water elevation of Beaver Creek has risen gradually but steadily over the past 60 years. This has been the likely combined result of abandonment of agricultural drainage facilities and the natural dam-building activities of beaver. The presence of drained farmland and coniferous forest in 1941, within the area that is currently inundated significantly (3 to 4 feet depth) behind multiple beaver dams provides solid evidence to support the past and present water level profile comparison shown on Figure 2. As beaver continue dam-building activities, the Beaver and Allen Creek drainages will continue to experience rises in surface water elevations. The evidence of forest decline and vegetation community change in areas adjacent to the drainages demonstrates that this effect is on-going.

Beaver-influenced wetland systems are in a constant state of hydrological and habitat change and transition. The constant and repetitive action of beaver to block the drainage and raise water levels to create their own preferred habitat acts as a dynamic and constant perturbation to the wetland/stream system. Shifting hydrologic patterns result in shifting vegetation patterns, which in turn shifts the preferred habitats for native flora and fauna. The currently expansive and diverse aquatic system found throughout Beaver and Allen Creeks and their associated wetlands is due largely to the significant perturbation caused by beaver activity over the last 60 years.

PGG has analyzed current groundwater conditions and potential effects on groundwater of mining at the proposed Maytown Aggregates site. PGG and ELS have shared their baseline information, respective models and surveys, and discussed the relationship of groundwater and the surface waters of Beaver and Allen Creeks and associated wetlands. Our understanding is that the nature of the local geology and landforms support a virtually seamless connection between groundwater and surface waters at the site. We also understand that there is an annual
fluctuation between low water conditions (early fall) and high water conditions (spring). The observations conducted by PGG indicate that baseline water levels fluctuate four feet under natural conditions in Finger 4 of Wetland A. This is consistent with the historical aerial photo interpretation conducted by ELS that shows that water levels in the wetlands drop quickly through the months of June and July. The retreat in water levels relate to the vertical dropping of groundwater elevations, which in turn are caused by the annual summer drought cycle of the Pacific Northwest. Despite this drop in water level during the summer and fall, there is still stream outflow from Beaver Creek at Tilley Road during this time. Beaver activity dampens this fluctuation effect by detaining larger bodies of water which then meter-out water slowly downstream. Despite the annual drop in water level, the beavers have made sufficiently deep areas upstream of their dams so that forage and safe habitat is available to them throughout the year. These deeper areas are, therefore, likely to support surface hydrology even during the lowest period of groundwater, which occurs in the fall. This is further corroborated by the areas of open water, visible in the aerial photos and in the photoplates, which are sufficiently deep year-round to prevent the establishment of emergent and scrub-shrub vegetation that would otherwise normally grow where wetlands seasonally go dry.

**Howellia**

Howellia (*Howellia aquatilis*) is an aquatic winter annual with submerged and floating stems that grows in wetlands with firmly consolidated bottoms. These wetlands typically flood in the spring from rains and snowmelt and exhibit some drying during the growing season². The seasonal drying is important because howellia reproduces only from seed and the seeds must be exposed to air to germinate. Consequently, the size of a howellia population can vary annually depending on the extent its habitat dried out the previous growing season. Howellia favors areas with shallow water and the edges of lower elevation ponds that are deep and are partially surrounded by deciduous trees and shrubs. Portions of the fingers of Wetland A flood in the spring (Photoplate 2-7) and may dry out in the late summer near their outer limits³. Fingers 1, 2, and 3 are likely too densely forested to provide howellia habitat. Finger 4 may provide more suitable habitat. As indicated in our August 2002 Habitat Management Plan, some areas of Wetland A likely provide suitable habitat for howellia, especially near the outer limits of Finger 4.

The Washington Department of Natural Resources (WDNR) commented that any permanent change in water level, or in the seasonal pattern of recharge and drying of wetlands providing howellia habitat would likely result in a change in plant species composition in the zone between high and low water. ELS has considered both of the potential mining impacts to howellia and its habitat—the annual drawdown and the seasonality changes. Howellia occupies the emergent aquatic zone within wetlands. However, to propagate successfully, the species requires an annual drawdown of surface water so that substrate is exposed for seed germination in the late growing season. It is our observation that beaver activity, in combination with the natural annual drawdown of surface water levels, has largely contributed to the creation of this favorable habitat for howellia. Reed canarygrass, a highly invasive species, is currently present within the wetland and stream systems and may compete with howellia because of its tolerance to fluctuating water
levels. Despite the presence of reed canarygrass, beaver activity has likely maintained howellia habitat by creating deeper areas of open water that does not favor reed canarygrass.

With appropriate mine pit reclamation and mitigation to reduce the lake effect, which will indirectly reduce the impact of seasonality related to evaporation, it is not anticipated that howellia distribution will be negatively impacted by the effects of mining because the species requires an annual drawdown in the late growing season to expose substrate for seed germination. The habitat in which this species is likely to occur has been under the influence of continual hydrological manipulation by beaver for the past 60 years. This, in combination with natural seasonal and periodic shifts in water level fluctuation, has not eliminated its preferred habitat at the site. On the basis of analysis provided by PGG, a gradual shift in the annual low water period for the wetlands (July-August instead of October) can be mitigated indirectly through measures to reduce lake effect. For example, mitigation for lake effect, assuming a 4-foot thick low permeable skin is left in the appropriate reclaimed pits, is expected to increase water levels in Finger 4 of Wetland A. This could partially or fully off-set the effect of low groundwater levels occurring earlier in the season due to evaporation from the created lakes. Another mitigating factor is the current conditions created by beaver damming. It is our opinion that the on-going trend of increasing water levels due to beaver activity, in combination with the seasonal water level fluctuation, will continue to be the over-riding factors influencing the distribution of howellia.

Oregon Spotted Frog
Based on the aforementioned field survey on April 16 2004, there appears to be an abundance of preferred Oregon spotted frog habitat throughout the entire Beaver and Allen Creek drainages. As described in the previous sections, beaver have significantly increased water levels and altered the composition of vegetation within these drainages. It is our opinion that the damming effect created by the beaver has created a greater diversity of suitable frog habitat and increased the area which they would typically occupy. Ponding created by the beaver activity has increased extensive contiguous and shallow emergent Palustrine wetland habitat that is essential breeding area. This habitat is positioned adjacent to deeper low gradient channels or ponds where the frog will seek summer residence as water levels temporarily recede. Based on PGG's projected drop in groundwater levels and timing in which this will occur, it our opinion that there is sufficient preferred habitat for the frog to sustain these fluctuations during and after mining operations, provided current conditions remain relatively consistent. ELS recommends that water levels, preferred habitat and temperature be part of an ongoing monitoring plan in order to identify any significant changes within this section of Beaver and Allen Creeks. Additionally, monitoring should be started immediately in order to gather as much background information prior to potential influences of mining. It is conceivable to gather up to six years of background data before any potential mining impacts, based on PGG's report and the proposed mining sequence.

PGG analyzed and compared two ends of the possible spectrum relating to mining. They accounted for both lake effect and evaporation. The eight-pit open model without mitigation would result in a maximum 1.3 foot drop in the summer water level in Wetland A Finger 4. The
numbers presented, however, represent the maximum lake effect if all eight lakes were created at 
the same time without mitigation, which will not occur. The proposed mine will sequence the 
evacuation of aggregate and creation of lakes over a 20-year period, so that each mining area is 
reclaimed before proceeding to the next. Consequently, the mining effects will grow slowly as 
the open water expands over the 20-year life of the mine. In addition, monitoring will be 
undertaken to determine if additional mitigation of reclaimed lakes is warranted.

As indicated above, the eight-pit open model assumes no additional mitigation has been 
undertaken. At the opposite end of the spectrum, with the two-pit open model and with intensive 
mitigation, the maximum summer water level change would result in an actual increase of 0.6 
feet in Wetland A Finger 4. This assumes that all pits would have a four-foot thickness of low 
permeable “skin” on their sideslopes and bottoms. Therefore, water level change is quite 
sensitive to decreasing the lakebed conductance. Obviously, the goal of the mitigation is to have 
little or no change in water levels in the wetlands as a result of mining, therefore some level of 
mitigation between these two scenarios that were analyzed would be appropriate. What cannot 
be mitigated directly by reducing lakebed conductance is the change in the seasonality of the 
maximum groundwater level change. Analysis indicates that there is an existing 4-foot seasonal 
fluctuation in water levels at Wetland A Finger 4. The lowest groundwater levels typically occur 
in the fall. Due to the maximum mining effect in the summer as a result of evaporation, the 
water levels may decline earlier in the summer than under present conditions (July-August 
instead of October). However, with the two open pit model and with mitigation, the predicted 
increase in water level change at Wetland A Finger 4 would indirectly mitigate this seasonal shift 
in low water. As stated previously, on-going beaver damming activity is another mitigating 
factor.

Monitoring of groundwater levels upgradient and downgradient of the open pits will be essential 
to determine the appropriate mitigation for pit reclamation, in order that little to no effect to 
surface water levels in the wetlands and stream drainages occur as a result of mining. A 
hydrological monitoring plan is included at the end of this supplemental report.

Conclusions

- Beaver activity has significantly altered and influenced the Beaver Creek and Allen Creek 
  drainages over the past 60 years. The influence has been so great as to raise the water 
elevations of a large portion of the Beaver Creek drainage three or four vertical feet.
- Beaver activity is currently altering and increasing wetland habitat by flooding adjacent 
  wetland and upland forest areas. Open water areas and channels are also gradually 
  increasing in size. The varied habitat influenced by the beaver is favorable to the distribution 
  of the Oregon spotted frog.
- It is our observation that the combination of beaver damming activity and the natural annual 
  surface water fluctuation within the wetlands and stream drainages is favorable to the 
  distribution of howellia.
- Mining two pits at a time, even without mitigation to reduce lakebed conductance, will only 
  result in minor changes in the surface water level in Wetland A. Mitigation to reduce
lakbed conductance can reduce or eliminate this minor change and also indirectly reduce seasonality effects of low water. In combination with the mitigating factor of increasing water levels due to beaver activity, wetland habitat for howellia is not expected to be negatively impacted as a result of mining.

- Mining may cause groundwater levels to decline earlier in the year than under present conditions (July-August instead of October). This impact could be mitigated indirectly by reducing lakebed conductance.

- Without mitigation, we expect the low water point of the year to move to July-August instead of October. The July-August period is well beyond the period to potentially strand Oregon spotted frog eggs or tadpole. The tadpole metamorphose and become small frogs by mid May to early June at which time they are mobile and able to move to deeper water. Similar responses are assumed for the Olympic mudminnow due to their similar habitat requirements as the Oregon spotted frog.

- On-going beaver activity will dampen effects of fluctuating water levels and may even offset it. Beaver damming has significantly raised the surface water level (3-4 feet) over the majority of the system over the past 60 years.

- Monitoring is necessary to observe the potential lake effect and seasonal effects on the wetlands and the species that currently inhabit them. Obviously, the goal of the mitigation is to have little or no change in water levels in the wetlands as a result of mining, therefore some level of mitigation between the two scenarios analyzed by PGG in April, 2004 would be appropriate. Monitoring will be necessary to determine the appropriate mitigation. A Hydrologic Monitoring Plan is included at the end of this supplemental report.

**COMMENT 3.** Page 7 of the Habitat Management plan states that there are three, small isolated, non-regulated areas of oak within the overall ownership and then later states that there are other smaller oak areas that are less than 5 acres that do not meet the minimum acreage requirement for an important habitat designation by Thurston County (Chapter 17.15 TCC, Table 8). Please elaborate on this finding by providing a site plan illustrating all three oak stands, their size, and why they are not regulated and not considered associated to one another.

**Three Oak Areas**

Three, small areas of Oregon white oak (*Quercus garryana*) were identified and are shown on Figure 1 as well as the figures included in the August 2002 Habitat Management Plan. These oaks are growing in small associations that are dominated by grass and shrub understories. Oak Area 1 is 4.02 acres; Oak Area 2 is 3.06 acres; and Oak Area 3 is 0.72 acres. These areas do not meet Thurston County’s minimum acreage requirement of 5 acres and, therefore, are not regulated (Chapter 17.15 TCC, Table 8). Although they are not regulated, the mine boundary was intentionally drawn to exclude Oak Areas 1, 2, and 3. In addition, Oak Areas 1, 2, and portions of 3 also lie within Wetland A’s 300-foot buffer. The project boundary, which is a permit boundary and does not represent (i.e. is larger than) a disturbance boundary, was originally drawn through Oak Area 3, but has been adjusted north to avoid these oak areas entirely (Figure 1).
In its comment letter, WDFW explains that the goals of it Management Recommendations for oak woodlands include:

(1) To maintain or enhance the structural and functional integrity of Oregon white oak woodlands needed to support diverse wildlife populations across the landscape (emphasis in WDFW letter).

These oak areas will be preserved and connected to the large, protected wetland and stream system to the south and west and to the large, protected native outwash prairie to the east, fulfilling the intent of the WDFW Management Recommendations.

Lack of Association

The TCC defines oak woodlands as “areas where Oregon white oak (Quercus garryana) comprises more than 20 percent of the trees in pure or mixed stands of oak or oak savannah greater than five acres in size.” The TCC does not define what constitutes a “stand” of oaks and, consequently, we rely on the WDFW Management Recommendations for further guidance. The WDFW Management Recommendations describe Oregon white oak woodlands as “stands of pure oak or oak/conifer associations where the canopy coverage of the oak component is ≥ 25%; or where total canopy coverage of the stand is < 25%, but oak accounts for at least 50% of the canopy coverage present. The latter is referred to as an oak savanna.” Using this description, the boundary of a “stand” occurs at the point where neither of these criteria is met.

The three clusters of Oregon white oak trees on the property are generally comprised purely of oak, which occupy > 20 percent canopy cover of the oak area (Photoplate 3-1). The oak areas are distinct from their surroundings, which lack an oak canopy coverage of > 20 percent and do not meet the WDFW definition of oak savannas. Oak Areas 1 and 2, which are north and northeast of Finger 4 of Wetland A, respectively, are not associated with each other because they are separated by a minimum of 80 feet of non-forested habitat. This non-forested area is dominated by Scot’s broom, grasses, and other understory species and lacks the minimum oak component of > 20 percent to trigger important habitat status as specified in Chapter 17.15 TCC, Table 8 (Photoplate 3-2). We estimated the canopy coverage of oak in the gap between Oak Areas 1 and 2 to be less than 5 percent, not the ≥ 25 percent advised by the WDFW, or the > 20 percent as defined by the TCC. Thus, these two oak areas are not associated because they are separated by a gap that does not contain the minimum threshold cover of oak to be considered important habitat. Likewise, Oak Areas 1 and 2 and Oak Area 3 are not associated because they are separated by a minimum of 4,400 feet or over 0.75 miles of non-forested, non-regulated habitat that is dominated by Scot’s broom.

Although Oak Areas 1, 2, and 3 are not associated and not regulated under the TCC definition of oak woodland (Chapter 17.15, Table 8), the oak areas and most of the areas between them will be undisturbed by mining activities. These three oak areas will be preserved and connected to
the large, protected wetland and stream system to the south and west and to the large, protected native outwash prairie to the east.

Other Oaks

The WDFW commented that the statements about the mapped and other small oak areas in the August 2002 Habitat Management Plan was confusing. To clarify, ELS mapped three, small oak areas, ranging from 0.72- to 4.02-acres, in the southern part of the overall ownership. The three oak areas are below the TCC threshold size of 5 acres and are not regulated (Chapter 17.15, Table 8). Nevertheless, these three oak areas were identified and included the August 2002 Habitat Management Plan because of their proximity to the wetland/stream system and the native outwash prairie, both significant environmental features that will be protected.

Additionally, other individual and groups of oaks that are less than 5 acres are scattered in the northern portion of the overall ownership. These oaks are not immediately adjacent to significant environmental habitats as are the three oak areas in the southern part of the ownership. Like the three oak areas, however, the oaks in the north are not regulated because they do not meet the minimum acreage threshold under the TCC and are not associated because the area between them is not occupied by > 20 percent oak canopy cover. Furthermore, most of the oaks in the north are located in disturbed areas along the access road and railroad right-of-way. One medium-size oak group, identified as Oak Area 4, is less disturbed and, therefore, has been included in the areas to be protected, even though it is only 2.3 acres and is not regulated under Chapter 17.15 TCC, Table 8. Nevertheless, the applicant has elected to avoid Oak Area 4 and, consequently, the mine boundary has been adjusted to avoid Oak Area 4 (Figure 1).

COMMENT 4. The WDFW have stated that a thirty- (30) foot buffer along the native outwash prairie boundary is insufficient to protect the prairie habitat from disturbance from daily activities (e.g. equipment, stockpiling of materials, etc.) The WDFW have recommended a 100-foot buffer rather than the 30-foot buffer. Thurston County Development Services Department is prepared to require a 100-foot buffer along the prairie on the final MDNS unless you can demonstrate that the proposed 30-foot buffer would provide more benefit to the prairie than the WDFW recommended 100-foot buffer.

The project application proposed a minimum 30-foot buffer. Due to the irregular boundary of the prairie, the proposed buffer actually ranged from 30- to ~450-feet.

WDFW expressed concern that a buffer of 30 feet would be insufficient to protect the prairie habitat from daily activities (equipment and stockpiles) and recommended a 100-foot buffer. We note that it did not cite any scientific reference for this comment and that it has not promulgated any Management Recommendations for prairies. Nevertheless, based on WDFW's recommendation, the buffer has been expanded to 100 feet and ranges from 100- to ~470-feet and includes 19.4 acres (Figure 5). Both the project and mine boundaries have been reduced to avoid the native outwash prairie and its 100-foot buffer.
Even though we have increased the buffer as requested, we address the comments about mining equipment and stockpiles. Mining methods described by Appendix G to the environmental checklist (Mining & Reclamation Plan) propose that extraction will take place in three separate cuts or benches (one above the water table and two below). Therefore, mining equipment will be working along the eastern edge of Mine Areas 3 and 4 for relative short durations (in the range of three to four years, based on mining at 1,000,000 cy/year). At the completion of mining of each individual area, the topsoil berm will be placed on the slope above the water line with a dozer, which is considered low impact equipment.

It is not clear to which stockpiles WDFW referred. Mine Areas 3 and 4 are located adjacent to the prairie buffer. As indicated above, a berm of topsoil will be stockpiled within the 30-foot setback for reclaiming the shoreline at the completion of each of these mine areas. The stockpiled topsoil around the ponds will have very little impact because it will not take up very much area and will be temporarily revegetated to minimize the potential for erosion. The closest aggregate stockpile is approximately 3,200 feet from the prairie.

COMMENT 5. Please explicate why the native outwash prairie isolates are considered isolated and not associated with the larger delineated native outwash prairie boundary.

According to Chapter 17.15 TCC, Table 8, native outwash prairies are “open areas of excessively drained soils greater than 5 acres in size which are covered by native drought-resistant species of grasses, forbs, lichens, and mosses.” The TCC identifies the dominant grasses and herbaceous plants that are typically present in native outwash prairies, and then states that “[n]on-native plant species may be present but do not dominate the community.” ELS identified 18, isolated, remnants of prairie west of the delineated native outwash prairie boundary using the prairie species listed in Table 8 (Chapter 17.15 TCC) to distinguish the areas from non-prairie habitat. We termed these prairie remnants “isolates,” and labeled the isolates “A” through “R”. The isolates total 1.58 acres and are not regulated under the TCC because they do not meet the minimum threshold size of 5 acres for important habitat status. The native outwash prairie isolates are essentially islands of non-regulated prairie in a sea of Scot’s broom, Douglas-fir, and other prairie invasive species (Table 1, Photoplate 5-1). We delineated these isolates from the surrounding non-prairie because the native, prairie species listed in Table 8 (Chapter 17.15 TCC) dominated the community, which we interpreted to mean occupying greater than 50 percent aerial cover as estimated ocularly.

Based on our field analysis in 2002 and again in 2004, invading, non-prairie species occupy a greater percent cover of the areas between the isolates and the native outwash prairie than do the prairie species listed in Table 8 (Chapter 17.15 TCC). These non-prairie areas, consequently, do not meet the criteria for important habitat as defined under the TCC and were separated from the native outwash prairie boundary and from the isolates because they are dominated by invading, non-prairie species. Scot’s broom and Douglas-fir are two non-prairie species that are invading easterly across the site, influencing the microclimate and altering species composition to favor non-prairie species. The Scot’s broom forms extremely dense thickets outside of the isolates (Photoplate 5-2). We estimate that the Scot’s broom occupies >90 percent cover in many areas
outside of the isolates. Portions of Isolates A, B, J, and K also are separated from the native outwash prairie and from each other by forested areas dominated by Douglas-fir, which is also an invading, non-prairie species like Scot’s broom. The Scot’s broom- and Douglas-fir-dominated areas separate the isolates closest to the native outwash prairie boundary (Isolates J and K) by about 50 feet and at least 90 feet for the remaining isolates. A list of invading, non-prairie species is presented in Table 1.

We re-examined the prairie boundary and isolates on April 18, 2004. The isolates occupy about the same areas today as they did in 2002, but the Scot’s broom and other non-prairie invasives are continuing to encroach upon these remnants of native outwash prairie. Based on our field observations and aerial photo review, the invading species will eventually out-compete the prairie species in the isolates and move the native outwash prairie boundary eastward. The non-prairie species clearly are progressing east and we anticipate that the isolates will be dominated by non-prairie species, and will no longer have the prairie species identified in Table 8 (Chapter 17.15 TCC), in the next half-decade.

Table 1. List of invading, non-prairie species identified in the areas between the isolates and the delineated native outwash prairie boundary.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SCOT’S BROOM-DOMINATED AREAS</strong></td>
<td></td>
</tr>
<tr>
<td>Scot’s broom*</td>
<td><em>Cytisus scoparius</em></td>
</tr>
<tr>
<td>Bracken fern*</td>
<td><em>Pteridium aquilinum var. pubescens</em></td>
</tr>
<tr>
<td>Common snowberry</td>
<td><em>Symporicarpus albus</em></td>
</tr>
<tr>
<td>Hairy cat’s-ear*</td>
<td><em>Hypochaeris radicata</em></td>
</tr>
<tr>
<td>Oxeye daisy*</td>
<td><em>Cysanthenum leucanthemum</em></td>
</tr>
<tr>
<td>Common dandelion</td>
<td><em>Taraxacum officinale</em></td>
</tr>
<tr>
<td>Common St. John’s Wort*</td>
<td><em>Hypericum perforatum</em></td>
</tr>
<tr>
<td>Himalayan blackberry</td>
<td><em>Rubus discolor</em></td>
</tr>
<tr>
<td>Ornamental hawthorn</td>
<td><em>Crataegus sp.</em></td>
</tr>
<tr>
<td><strong>DOUGLAS-FIR DOMINATED AREAS</strong></td>
<td></td>
</tr>
<tr>
<td>Douglas-fir*</td>
<td><em>Pseudotsuga menziesii</em></td>
</tr>
<tr>
<td>Miner’s-lettuce</td>
<td><em>Claytonia perfoliata</em></td>
</tr>
<tr>
<td>Bedstraw</td>
<td><em>Galium sp.</em></td>
</tr>
<tr>
<td>Cascara seedling</td>
<td><em>Rhamnus purshiana</em></td>
</tr>
<tr>
<td>Common dandelion</td>
<td><em>Taraxacum officinale</em></td>
</tr>
<tr>
<td>Bracken fern*</td>
<td><em>Pteridium aquilinum var. pubescens</em></td>
</tr>
</tbody>
</table>

* Species marked with an asterisk are identified as non-prairie plants by Del Moral and Deardorff (1976).
1 Species lacked mature flowers and, therefore, positive identification was not possible.
Hydrological Monitoring Plan

This section discusses additional data collection, which is one element of a hydrologic monitoring program. A Groundwater Monitoring Plan has already been submitted as Appendix F, of PGG’s 2002 report. The existing Groundwater Monitoring Plan stipulates that water levels be measured six times a year starting with issuance of the mining permit, and to be continued throughout the operational period of the mine. One recommended modification to that schedule is that collecting data in accordance with the Groundwater Monitoring Plan and Habitat Management Plan begin at this time. Secondly, one groundwater monitoring well should be installed upgradient and one downgradient of each pit boundary. If possible, these monitoring wells should be installed one year prior to excavation and as close as possible to each pit. Data gathered from these wells prior to and after mining will provide a representative picture of what effects mining may have on fluctuating groundwater. We currently have five or six measurements of water level and flow at the key locations over a period of almost two years. Additional data in this “background” period will strengthen the monitoring plan by documenting hydrologic variations prior to mining. It will, therefore, also allow us to more easily identify changes to the hydrology during mining, as explained further below.

A “background” data set should be identified, which would consist of all the hydrologic measurements collected during the period before mining effects are expected. There are no established rules about how many measurements should be in the background data set; however the more data that are included in the background data set, the better will be our ability to identify mining effects in the “foreground” (period of mining below the water table). To include as much data as possible in the background data set, we recommend that the background period include all data prior to mining south of the railroad tracks and below the water table. This would allow the background period to include the time that pits 1 and 2 are being mined north of the railroad tracks. Pits 1 and 2 are far enough from the critical hydrologic resources (mostly Wetland A) to preclude significant hydrologic impacts there.

Identification of potential mining effects should consist of comparing the background and foreground data sets, with careful consideration of the statistical distribution of hydrologic data, antecedent conditions (rainfall, temperature etc), and possibly statistical significance. The hydrology of the site will be influenced by hydrologic variables acting on local (mining, beavers, groundwater use), regional, and global scales (including global warming) that will not be the same during the background and foreground periods. Thus, to identify mining effects, the comparison must include corrections for all variables except mining. Even then, the identification of small effects will always be subject to substantial uncertainty. Larger changes are more easily ascribed to a particular variable.

Methods of interpreting the foreground data were broadly outlined in the Groundwater Monitoring Plan. The details of the analytical method should be left to the discretion of the hydrogeologist. Such methods may include trend analysis, statistical hypothesis testing, reference to existing long-term data sets in Thurston County, and use of antecedent precipitation.
indices. The Washington State Department of Ecology hydrologic basin plans and solid waste monitoring regulations provide examples of some of these processes.

As part of the Habitat Management Plan, the following monitoring is recommended to collect background and ongoing data to determine if mining effects are significant for biota in the wetland systems associated with Beaver and Allen Creeks.

- Establish monitoring points that are representative of the aquatic habitat features and types within the drainages such as streams, wetlands, beaver dams, relic ditches, and plant communities.
- Install staff gages in pools and channels to monitor changes in water levels throughout the year.
- Obtain water elevation data above and below individual beaver dams.
- Collect surface water temperatures.
- Document stream flow characteristics.
- Document dominant vegetation and describe any apparent changes or trends in plant communities due to natural or human-caused influences.
- Document habitat supporting the distribution of "Important Species" within the drainages and associated wetlands.
- Document seasonal variations relating to water level fluctuations.

The monitoring plan will be in consultation with WDFW and will consider its recommendations and suggestions related specifically to species of concern.

NOTE:
Beaver dams shown on this profile were documented on April 16, 2004. It is likely that other beaver dams are present that were not located in the field.