NOTICE TO
CLOCA BOARD OF DIRECTORS

Please find enclosed the Agenda and supporting documents for the CLOCA Board of Director’s meeting on Tuesday, October 17, 2017, 5:00 p.m., at 100 Whiting Avenue, Authority’s Office Boardroom.

The list below outlines upcoming meetings and events for your information.

UPCOMING MEETINGS & EVENTS

<table>
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<tr>
<th>Date</th>
<th>Time</th>
<th>Event</th>
<th>Location</th>
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<tr>
<td>Tuesday, October 17, 2017</td>
<td>5:00 p.m.</td>
<td>CLOCA Board of Director’s Meeting</td>
<td>100 Whiting Avenue Authority’s Office Boardroom</td>
</tr>
<tr>
<td>Tuesday, October 17, 2017</td>
<td>Immediately following CLOCA Board of Director’s Meeting</td>
<td>Central Lake Ontario Source Protection Authority Meeting</td>
<td>100 Whiting Avenue Authority’s Office Boardroom</td>
</tr>
<tr>
<td>Friday, November 3, 2017</td>
<td>7:00 p.m. to 9:00 p.m.</td>
<td>The Messenger (Film Night)</td>
<td>Darlington Energy Complex 1855 Energy Drive, Courtice</td>
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<tr>
<td>Tuesday, November 21, 2017</td>
<td>5:00 p.m.</td>
<td>CLOCA Board of Director’s Meeting</td>
<td>100 Whiting Avenue Authority’s Office Boardroom</td>
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<tr>
<td>Tuesday, December 19, 2017</td>
<td>5:00 p.m.</td>
<td>CLOCA Board of Director’s Meeting</td>
<td>100 Whiting Avenue Authority’s Office Boardroom</td>
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Check Out our Website! www.cloca.com
Discover your local Conservation Area.
Register as a Conservation Volunteer Programs & Services
Mobile access to online information with CLOCA’s new mobile website and Free Conservation Areas App

“What we do on the land is mirrored in the water.”
CENTRAL LAKE ONTARIO CONSERVATION AUTHORITY

AGENDA
AUTHORITY MEETING
Tuesday, October 17, 2017 - 5:00 P.M.

MEETING LOCATION: 100 WHITING AVENUE, OSHAWA
AUTHORITY’S ADMINISTRATIVE OFFICE, BOARDROOM

CIRCULATION LIST

Authority
Members: Don Mitchell, Chair
Bob Chapman, Vice Chair
John Aker
Shaun Collier
Joe Drumm
Adrian Foster
Derrick Gleed
Ron Hooper
Joe Neal
John Neal
Gerri Lynn O’Connor
David Pickles
Nester Pidwerbecki
Tom Rowett
Elizabeth Roy
Town of Ajax, Clerk
Municipalities: Municipality of Clarington, Clerk
City of Oshawa, Planning
City of Pickering, Clerk
Town of Whitby, Public Works
Town of Whitby, Planning
Township of Uxbridge, Clerk

Authority
Staff: C. Darling, Chief Administrative Officer
B. Boardman, Administrative Assistant/Recording Secretary
H. Brooks, Director, Watershed Planning & Natural Heritage
R. Catulli, Director, Corporate Services
G. Geissberger, Marketing & Communications Coordinator
D. Hope, Land Management & Operations Supervisor
C. Jones, Director, Planning & Regulations
P. Lowe, Director, Community Engagement
P. Sisson, Director, Engineering & Field Operations
Region: Region of Durham, Clerk
Region of Durham, Planning & Econ Dev.
Ajax Pickering News Advertiser
CHEX TV
CKDO
Compton Cable TV
94.9 The Rock
KX-96 Radio
Orono Times
Oshawa Express
Oshawa/Whitby/Clarington This Week
Rogers Cable TV
The Scugog Standard

AGENDA ITEM:

1. DECLARATIONS of interest by members on any matters herein contained

2. ADOPTION OF MINUTES of September 19, 2017

3. CORRESPONDENCE
   None

4. PRESENTATIONS
   None

5. DIRECTOR, DEVELOPMENT REVIEW & REGULATION
   (1) Staff Report #5540-17
       Re: Permits Issued for Development, Interference with Wetlands and Alteration to Shorelines and Watercourses – September 1 to 30, 2017

6. DIRECTOR, COMMUNITY ENGAGEMENT
   None

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<tr>
<th>AGENDA ITEM:</th>
<th>SUPPORTING DOCUMENTS</th>
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<tr>
<td>7. DIRECTOR, WATERSHED PLANNING &amp; NATURAL HERITAGE</td>
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<tr>
<td>(1) Staff Report #5541-17</td>
<td>pg. 3</td>
</tr>
<tr>
<td>(2) Staff Report #5542-17</td>
<td>pg. 19</td>
</tr>
<tr>
<td>Re: Ecological Services – Valuing natural areas within CLOCA</td>
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<td>8. DIRECTOR, ENGINEERING &amp; FIELD OPERATIONS</td>
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<tr>
<td>(1) Staff Report #5544-17</td>
<td>pg. 38</td>
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<tr>
<td>Re: LiDAR Mapping Acquisition – National Disaster Mitigation Program Application</td>
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<tr>
<td>9. DIRECTOR, CORPORATE SERVICES</td>
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<tr>
<td>(1) Staff Report #5543-17</td>
<td>pg. 48</td>
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<tr>
<td>Re: Open Information and Data Policy</td>
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<tr>
<td>10. CHIEF ADMINISTRATIVE OFFICER</td>
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<tr>
<td>None</td>
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<tr>
<td>11. CONFIDENTIAL MATTERS</td>
<td></td>
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<td>None</td>
<td></td>
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<tr>
<td>12. MUNICIPAL AND OTHER BUSINESS</td>
<td></td>
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<td>13. ADJOURNMENT</td>
<td></td>
</tr>
</tbody>
</table>
MEETING OF: Authority

DATE: Tuesday, October 1, 2017

TIME: 5:00 P.M.

LOCATION: 100 WHITING AVENUE, OSHAWA
AUTHORITY’S ADMINISTRATIVE OFFICE, BOARDROOM
REPORT

CENTRAL LAKE ONTARIO CONSERVATION AUTHORITY

DATE: October 17, 2017
FILE: RPRG3974
S.R.: 5540-17

TO: Chair and Members, CLOCA Board of Directors
FROM: Chris Jones, Director, Planning & Regulation

SUBJECT: Permits Issued for Development, Interference with Wetlands and Alteration to Shorelines and Watercourses – September 1 to 30, 2017

Attached are Development, Interference with Wetlands and Alterations to Shorelines and Watercourses applications, pursuant to Ontario Regulation 42/06, as approved by staff and presented for the members’ information.

RECOMMENDATION:

THAT Staff Report #5540-17 be received for information.
<table>
<thead>
<tr>
<th>Row #</th>
<th>Municipality</th>
<th>Owner / Applicant</th>
<th>Street / Lot / Con</th>
<th>Permit No.</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>CLARINGTON</td>
<td>DARLINGTON PROPERTY OWNER</td>
<td>3031 HOLT ROAD/LOT 20/CON 03</td>
<td>C17-197-G</td>
<td>DEVELOPMENT ACTIVITIES ASSOCIATED WITH THE MOVING AND PLACING OF FILL FOR THE CONSTRUCTION OF A DRIVEWAY AND PARKING AREA</td>
</tr>
<tr>
<td>2</td>
<td>CLARINGTON</td>
<td>PORT DARLINGTON LAND CORPORATION/D.G. BIDDLE &amp; ASSOCIATES LTD.</td>
<td>LOT 08/BFC</td>
<td>C17-200-GBHFA</td>
<td>DEVELOPMENT ACTIVITIES ASSOCIATED WITH THE INSTALLATION OF TWO BOX CULVERTS AT PORT DARLINGTON ROAD AT BENNETT CREEK AND FOR THE REMOVAL OF THE EXISTING ROAD AND CULVERT AND RESTORATION WORKS ON THE SOUTH SIDE OF PORT DARLINGTON ROAD</td>
</tr>
<tr>
<td>3</td>
<td>CLARINGTON</td>
<td>DARLINGTON PROPERTY OWNER</td>
<td>2160 CONCESSION 8/LOT 20/CON 08</td>
<td>C17-203-GBH</td>
<td>DEVELOPMENT ACTIVITIES ASSOCIATED WITH CONSTRUCTION OF A 28’ X 36’ GARAGE WITH A 10’ CARPORT</td>
</tr>
<tr>
<td>4</td>
<td>CLARINGTON</td>
<td>DARLINGTON PROPERTY OWNER</td>
<td>2185 REGIONAL ROAD 42/LOT 35/CON 05</td>
<td>C17-205-GBA</td>
<td>DEVELOPMENT ACTIVITIES ASSOCIATED WITH INGROUND POOL, POOL EQUIPMENT SHED AND CARANA</td>
</tr>
<tr>
<td>5</td>
<td>OSHAWA</td>
<td>PROPERTY OWNER</td>
<td>600 HOWDEN ROAD EAST/LOT 08/CON 08</td>
<td>C17-188-GBH</td>
<td>DEVELOPMENT ACTIVITIES ASSOCIATED WITH THE INSTALLATION OF A CULVERT AND CONSTRUCTION OF A DRIVEWAY</td>
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<tr>
<td>6</td>
<td>OSHAWA</td>
<td>PROPERTY OWNER</td>
<td>162 SUSSEX STREET/LOT 06/CON 02</td>
<td>C17-190-HBR</td>
<td>DEVELOPMENT ACTIVITIES ASSOCIATED WITH INTERIOR RENOVATIONS TO PERMIT BASEMENT APARTMENT</td>
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<td>7</td>
<td>OSHAWA</td>
<td>ROGERS COMMUNICATIONS</td>
<td>HARMONY RD N, SOUTH OF STORIE AVE/LOT 05/CON 03</td>
<td>C17-191-GBH</td>
<td>DEVELOPMENT ACTIVITIES ASSOCIATED WITH DIRECTIONAL BORE</td>
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<tr>
<td>8</td>
<td>OSHAWA</td>
<td>PROPERTY OWNER</td>
<td>2437 SECROTE DRIVE/LOT 10/CON 05</td>
<td>C17-194-GBH</td>
<td>DEVELOPMENT ACTIVITIES ASSOCIATED WITH THE INSTALLATION OF AN INGROUND POOL, RIVER ROCK AND WATERFALL</td>
</tr>
<tr>
<td>9</td>
<td>OSHAWA</td>
<td>PROPERTY OWNER</td>
<td>1037 PINE TREE COURT/LOT 03/CON 02</td>
<td>C17-195-GBH</td>
<td>DEVELOPMENT ACTIVITIES ASSOCIATED WITH THE REMOVAL OF OLD DECK AND CONSTRUCTION OF A NEW ONE</td>
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<tr>
<td>10</td>
<td>OSHAWA</td>
<td>PROPERTY OWNER</td>
<td>1025 BLUEFINCH COURT/LOT 03/CON 02</td>
<td>C17-198-GBH</td>
<td>DEVELOPMENT ACTIVITIES ASSOCIATED WITH CONSTRUCTION OF A BACKYARD DECK</td>
</tr>
<tr>
<td>11</td>
<td>OSHAWA</td>
<td>NORTH GRANDVIEW INC/GHD</td>
<td>1886 GRANDVIEW STREET NORTH/LOT 03/CON 04</td>
<td>C17-202-GBH</td>
<td>DEVELOPMENT ACTIVITIES ASSOCIATED WITH THE GRADING AND SERVICING OF THE SITE AS WELL AS THE CONSTRUCTION OF SINGLE FAMILY DWELLINGS</td>
</tr>
<tr>
<td>12</td>
<td>OSHAWA</td>
<td>PROPERTY OWNER</td>
<td>101 RAGLAN ROAD/LOT 13/CON 06</td>
<td>C17-207-GHL</td>
<td>DEVELOPMENT ACTIVITIES ASSOCIATED WITH THE REGRADING, RESTORATION/REVEGETATION OF SLOPE SOUTH OF RAGLAN ROAD AND THE REMOVAL OF FILL AND REVEGETATION IN OACCA REGULATED AREA (WEST LIMIT), INSTALLATION OF SILT FENCING</td>
</tr>
<tr>
<td>13</td>
<td>SCUGOG</td>
<td>ENBRIDGE GAS DISTRIBUTION INC</td>
<td>11171 LAKE RIDGE ROAD/LOT 01/CON 02</td>
<td>S17-209-GBH</td>
<td>DEVELOPMENT ACTIVITIES ASSOCIATED WITH PROPOSED SERVICE INTO 11171 LAKE RIDGE ROAD, APPROXIMATELY 170M SOUTH OF CHALK LAKE ROAD, SCUGOG</td>
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<td>14</td>
<td>WHITBY</td>
<td>PROPERTY OWNER</td>
<td>15 ANNIVITA COURT/LOT 28/CON 04</td>
<td>W17-192-GBH</td>
<td>DEVELOPMENT ACTIVITIES ASSOCIATED WITH A REAR YARD DECK, LANDSCAPING AND A FOUR SEASON ROOM</td>
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<td>15</td>
<td>WHITBY</td>
<td>MARMIKE FARMS/ASTRO EXCAVATING INC</td>
<td>1535 BRAWLEY ROAD/LOT 35/CON 07</td>
<td>W17-193-GFL</td>
<td>DEVELOPMENT ACTIVITIES ASSOCIATED WITH THE PLACEMENT OF 150M3 OF TOP SOIL/FILL FOR AGRICULTURAL PURPOSES</td>
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<td>16</td>
<td>WHITBY</td>
<td>WEST WHITBY HOLDINGS</td>
<td>960 ROSSLAND ROAD WEST/LOT 33/CON 02</td>
<td>W17-196-GCAW</td>
<td>DEVELOPMENT ACTIVITIES RELATING TO A NEW RESIDENTIAL PLAN OF SUBDIVISION INCLUDING TOPSOIL STRIPPING, SITE ALTERATION/GRADING, WATERCOURSE AND ON SITE POND WETLAND DECOMMISSIONING AND CONSTRUCTION OF STORMWATER/SEDIMENTATION CONTROL PONDS</td>
</tr>
<tr>
<td>17</td>
<td>WHITBY</td>
<td>LAZY DOLPHIN DEVELOPMENT INC/SCS CONSULTING GROUP LTD.</td>
<td>725 TAUNTON ROAD WEST/LOT 33/CON 03</td>
<td>W17-213-GCHA</td>
<td>DEVELOPMENT ACTIVITIES RELATING TO THE CONSTRUCTION OF TWO STREAMS OPEN BOTTOM BOX CULVERT AND ASSOCIATED STRUCTURAL APPURTENANCES OVERTOP OF THE FUTURE CHANNEL OF THE LG TRIBUTARY OF LYNDE CREEK</td>
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DATE: October 17, 2017
FILE: PGDP22
S.R.: 5541-17
TO: Chair and Members, CLOCA Board of Directors
FROM: Chris Jones, Director, Planning and Regulation
Heather Brooks, Director, Watershed Planning & Natural Heritage

In early July 2017 the Province released 2 policy proposal notices on the Environmental Bill of Rights Registry (EBR) to address the development of a: proposed Natural Heritage System (NHS) for the Greater Golden Horseshoe (GGH); and Agricultural system mapping and policies for the GGH. CLOCA staff have reviewed the documents and have prepared detailed responses (attachments 1 and 2). Key points are highlighted below:

Draft Criteria, Methods and Mapping of the Proposed Regional Natural Heritage System for The Growth Plan for the Greater Golden Horseshoe, 2017:
The Province’s proposed regional NHS was prepared at a very broad scale and the above document acknowledges that locally prepared NHS’s can further augment the regional NHS, in keeping with the policies of the recently approved Growth Plan (2017). Equally important is the development of a natural heritage system enhancement strategy which includes “priorities and resources to implement securement, stewardship, restoration and enhancement of natural heritage features, linkages and functions…”. The Province is called upon to fulfil this recommendation of the Coordinated Review Advisory Panel.

Draft Agricultural System Mapping and Proposed Implementation Procedures:
Policy 4.2.2.6 of the recently approved Growth Plan (2017) recognizes that local municipalities can protect other NHSs or identify new NHSs consistent with the PPS. However the Province’s proposed implementation of the agricultural system is inconsistent with this, compelling municipalities to identify the NHS as an overlay on prime agricultural lands, resulting in the removal of primary environmental protection designations implementing the local NHS. It is recommended that the draft agricultural land base map be revised to address local-scale natural heritage system designations or that such revisions be accommodated through the finalized implementation procedures.

The EBR posting closed on October 4th, 2017 and the attached comments have been submitted by staff noting that any additional comments made by the CLOCA Board of Directors will be provided to the Province after the October 17th, 2017 Board of Directors meeting.

RECOMMENDATIONS:
THAT Staff Report 5541-17 be received;
THAT Central Lake Ontario Conservation Authority Comments on Draft Criteria, Methods and Mapping of the Proposed Regional Natural Heritage System for The Growth Plan for the Greater Golden Horseshoe, 2017 Environmental Bill of Rights Posting No. 013-1014 dated October 3, 2017 be endorsed; and
THAT Central Lake Ontario Conservation Authority Comments on Draft Agricultural System Mapping and Proposed Implementation Procedures Environmental Bill of Rights Posting No. 013-0968 dated October 3, 2017 be endorsed

ATTACH.
October 3, 2017

Ms. Helma Geerts
Policy Advisor
Ministry of Agriculture, Food and Rural Affairs
1 Stone Road West, Floor 2
Guelph ON N1G 4Y2

Dear Ms. Geerts:

Subject: Central Lake Ontario Conservation Authority Comments on Draft Agricultural System Mapping and Proposed Implementation Procedures Environmental Bill of Rights Posting No. 013-0968
Our IMS #: PGDP22

Thank you for the opportunity to provide commentary on the proposed mapping and implementation procedures as part of your ministry’s support for the implementation of the Growth Plan for the Greater Golden Horseshoe, 2017. The Central Lake Ontario Conservation Authority (CLOCA) has taken an active role in the provincial Coordinated Review of the three provincial plans in effect for our watershed (the Growth Plan, Greenbelt Plan and Oak Ridges Moraine Conservation Plan). We have provided detailed comments at each stage of the Coordinated Review and are continuing to actively participate in the implementation process given the significance of the plans for managing land and resources within the geography we serve.

Staff-Level Comments to be Considered Further

Given the time-lines associated with the commenting deadline and our ability to report to our Board of Directors at their next meeting scheduled for October 17th, these comments are being submitted at a staff-level at this time. The staff comments will be presented to our Board of Directors for consideration and endorsement on October 17th. We intend to write to you as a follow-up should any modifications of these comments be made following Board of Directors consideration.

What we do on the land is mirrored in the water
Support for A Prosperous Agricultural Economy and a Protected Land Base

The CLOCA watershed is located in the central portion of Durham Region. Due to our geographic context, approximately half our watershed is planned for urbanization or intensification of existing urban areas. The other half of our watershed is planned for permanent protection of prime agriculture and environmental protection through the Oak Ridges Moraine Conservation Plan and the Protected Countryside of the Greenbelt Plan. We are experiencing both rapid urban growth consuming prime agriculture lands directly interfacing with an active agriculture system and the need to support and maintain that system on a working landscape that is permanently protected for agricultural uses. In this context, the approved Agricultural System policies in Section 4.2.6 of the Growth Plan, 2017 have great importance in our watershed and must be implemented to achieve the vision of a protected agricultural land base and the conditions under which the agri-food system can prosper without unintended consequences.

Significant Issues with Proposed Implementation Procedures and Proposed Agricultural Land Base Mapping

In our review of the proposed implementation procedures and proposed mapping, we have identified the following two significant issues that need to be addressed through revisions to the procedures and/or draft agricultural land base mapping:

1. Recognition of Locally Prepared, Identified and Designated Natural Heritage Systems

The proposed implementation procedures are written with the provincially-identified regional-scale natural heritage systems in mind and do not address areas in the Greater Golden Horseshoe, such as Durham Region, where significant effort and funds have been dedicated to create detailed local-scale natural heritage systems that have been established and implemented as primary land use designations in official plans consistent with the Provincial Policy Statement, 2014.

Specifically, Growth Plan, 2017, contains the following policy that needs to be clearly recognized and supported in the proposed implementation procedures:

“4.2.2.6
Beyond the Natural Heritage System, including within settlement areas, the municipality:
...
b) may continue to protect any other natural heritage system or identify new systems in a manner that is consistent with the PPS.”
This policy direction clearly provides for the continuation and future development/refinement of locally developed and designated natural heritage systems. The phrase “in a manner that is consistent with the PPS” ensures that these locally established systems may be designated as primary designations in Official Plans and zoning by-laws and not only as overlays. The Agricultural System Mapping will need to allow for refinements to be consistent with this policy and appropriate references should be added to the implementation guidance, specifically section 1.5.1; 1.6; 3.1.1.3; and 3.1.3 or any other appropriate section(s). See Attachment No. 1 to this letter for specific text changes requested in this regard.

2. Recognition of Environmental Planning in Draft Agricultural Land Base Mapping

Further to Comment No. 1 above, in our analysis, the proposed mapping of Prime Agricultural Areas and Candidate Areas creates an unacceptable overlap with significant natural heritage features, conservation areas and currently designated local-scale natural heritage systems. As an illustration, Attachment No. 2 to this letter provides a map which shows the draft Agricultural Land Base with the CLOCA-identified Natural Heritage Systems and CLOCA’s conservation area landholdings. Most of these areas have been designated as primary designations in local official plans for environmental protection and conservation purposes. For example, much of these lands are designated with the “Environmental Protection Area” designation in the Municipality of Clarington Official Plan or the “Open Space and Recreation” in the City of Oshawa Official Plan.

We do not support an implementation approach to Growth Plan, 2017 policy 4.2.6.2 which would oblige municipalities to remove primary environmental protection designations that implement a local-scale natural heritage system and replace as overlays on top of a new provincial agricultural land base map.

We ask that the draft agricultural land base map be revised at this time to address local-scale natural heritage system designations or that such revisions be accommodated through the finalized implementation procedures.

Finally, we wish to indicate that in certain instances, natural hazard lands are designated as a primary designation in official plans (i.e. the proposed Brooklin Secondary Plan in the Town of Whitby). Consideration for hazard land designations and associated policy direction in the Provincial Policy Statement, 2014 need to be addressed in both the mapping and implementation guidance.
Conclusion

Thank you for the opportunity to comment on the draft Agricultural System Mapping and Proposed Implementation Procedures. We would be pleased to discuss our comments, if desired.

Yours truly

Chris Jones, M.C.I.P., R.P.P.,
Director,
Planning and Regulation

Heather Brooks, M.C.I.P., R.P.P.,
Director,
Watershed Planning and Natural Heritage

Attachment: Draft Provincial Agricultural Land Base Mapping within CLOCA Watershed

cc: Watershed Municipal Planning Staff
    Neighboring Conservation Authority Staff

g:\planning\planning\comments\2017\proposed provincial ag system.doc
## CLOCA Detailed Review Comments
### Implementation Procedures for the Agricultural System in Ontario’s Greater Golden Horseshoe

<table>
<thead>
<tr>
<th>Section</th>
<th>CLOCA Comments</th>
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<tbody>
<tr>
<td><strong>Summary</strong></td>
<td>Throughout the document the term “natural heritage system” is placed in context as one system as defined by the province in the provincial plans. Instead, the phrase “regional-scale natural heritage system” (as defined by the province) should be used so as to recognize the different scales of planning and natural heritage systems in the Greater Golden Horseshoe.</td>
</tr>
<tr>
<td><strong>1.5 Effects of the Implementation Procedures and Provincial Planning Context</strong></td>
<td>Suggest that the implementation procedures go beyond the “be consistent with” standard to the “conform to” standard for the purpose of implementing the plans.</td>
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</tbody>
</table>
| **1.5.1 Growth Plan and Greenbelt Plan**                                | The following reference to the Greenbelt and Growth Plan Natural Heritage Systems needs greater precision for accuracy and to properly understand the concept for implementation (suggested revisions shown): “Both the Greenbelt and Growth Plan contain broad regional-scale natural heritage systems identified by the province. The Greenbelt Plan states that the Greenbelt natural heritage system is an overlay on top of the prime agricultural area and rural lands designations, not a designation in or of itself. The Growth Plan states that the Growth Plan natural heritage system is an overlay outside of settlement areas. 

In addition, Growth Plan policies allow the full range of agricultural, agriculture-related and on-farm diversified uses in the Growth Plan natural heritage systems outside of natural heritage features (e.g. provincially significant wetlands) and key hydrologic features. In natural heritage features and key hydrologic features, expansions or alterations to existing buildings or structures for agricultural uses, agriculture-related uses and on-farm diversified uses may be permitted subject to conditions. The Greenbelt Plan contains similar provisions for the Greenbelt Natural Heritage System.” |
Local-scale natural heritage systems have been designated and zoned in single-tier or lower tier Official Plans consistent with the Provincial Policy Statement, 2014 and watershed planning, with greater precision than the provincial-scale systems. These systems may be nested within the broader regional-scale systems in the Growth Plan and Greenbelt Plans and contain specific land use policy directions at a local-scale and may be designated as primary designations pursuant to Policy 4.2.2.6 of the Growth Plan.

| 1.5.2 Oak Ridges Moraine Conservation Plan | This section of the document is not clear as to how prime agricultural areas and rural lands are to be identified, as lands within this plan are already subject to provincial land use designations that each contain agriculture as permitted uses. How would adding further land use designations as an additional layer to the Oak Ridges Moraine Conservation Plan mapping conform to the Plan? The guideline must speak with precision on this matter. |
| 1.6 Innovations in the Agricultural System Approach | Figure 2, page 14, compares the Existing Approach and the Agricultural System Approach. Identification of the NHS as a hatch on the Agricultural System Approach is not appropriate for local-scale NHS by indicating that all NHS will be an overlay. This figure and respective policies need to be revised to recognize the differences in regional, local and feature-based designations of systems and areas. At a minimum, natural features and their vegetation protection zones along with associated natural hazards (i.e., riverine valley systems with flood and erosion hazards) should not contain an agricultural designation. The regional-scale NHS can be an overlay or a designation as outlined in Section 3.1.1.3. Finally, the figure should also be revised to illustrate water resource systems, which are to be within their own designation pursuant to Growth Plan policy. In addition, the guidance should specifically indicate in this section that the provincial agricultural land base mapping will be refined with local natural heritage systems and identified natural hazards. Revised text is proposed as follows: |
OMAFRA’s agricultural land base map will be refined during municipal comprehensive reviews based on additional information and important local context including local-scale natural heritage systems, water resource systems and natural hazards (Section 3.1). The province will support these refinement efforts by sharing data and providing guidance.

Linking prime agricultural areas is mentioned with limited and very general discussion on what constitutes a linkage. Clarification as to when, where, why, and how a linkage area can be identified is requested.

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<tr>
<th>2.1.2.4 Interactions Between the Natural Heritage System, Water Resource System and the Agricultural Land Base</th>
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<tr>
<td>This section states: “When OMAFRA undertook the GGH LEAR and prepared the agricultural land base map, lands with natural heritage and hydrologic features and functions were included in the evaluation. This recognized that some lands within natural heritage and water resource systems are and will continue to be used for agriculture. It is important to identify large, contiguous prime agricultural areas, even where lands are crossed by wetlands or other significant features.” The statement above understood, and accepted, for the purpose of the initial production of the land base map, however, significant refinements to the draft mapping and implementation guidance are required to ensure that finalized agricultural land base mapping clearly illustrates the intent of planning authorities to maintain a balance of both broad contiguous areas for agricultural uses and a protected, linked and restored natural heritage system that avoids competing and conflicting land uses on a working landscape. The current mapping and implementation guidance does not achieve this objective.</td>
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<tr>
<th>3.1.1.1 Prime Agricultural Areas</th>
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<tr>
<td>The way this section is constructed means that significant refinements are required to the provincial agricultural land base map. Local and single-tier land use mapping of local-scale natural heritage systems, water resource systems and natural hazards, for example, must be either recognized in the provincial agricultural land base map or the implementation provisions must be broadened to allow planning authorities to refine</td>
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the mapping for both of these systems. Significant public and private landholdings for environmental protection, such as conservation areas, must be removed from the agricultural land base map following local consultation.

Respectfully request that the sentence...
“Refinements that would present significant discrepancies with provincial mapping or inconsistencies across municipal boundaries, unless the result is a higher degree of agricultural land protection than would have been achieved through consistency” be revised for further clarity of intent. Keeping this sentence as worded could have a significant negative impact on the mapping and ultimate protection of both local and regional-scale NHS and natural hazard areas.

Notation 12 states that the mapping used property boundaries to map prime agricultural areas and that prime agricultural areas should not divide individual parcels. Why should mapping of agricultural areas be treated differently than other land uses and environmental features? Many criticisms in the mapping of NH features and functions revolve around whether the mapped feature/function is present. Projecting the mapping of the feature/function or land use to the property limit generates significant confusion for the property owner, administrator and implementer. With today’s digital mapping capabilities mapping of the prime agricultural areas should reflect land use and the actual landscape. With the clarification that mapping may be refined upon conducting site visit to ground truth limits.

Support the provision that allows municipalities to determine whether they wish to include candidate areas into the agricultural land base.

3.1.1.3 Agricultural Land Base Refinements Related to Natural Heritage Features and Areas

Proposed revisions to the text in this section are included, as follows: “In Growth Plan and Greenbelt Plan areas, plan policies require the regional-scale natural heritage system to be mapped as an overlay outside of settlement areas. Regional-scale natural heritage system and Agricultural System policies would both apply where they overlap. Within settlement areas of
the Growth Plan, the *regional-scale* natural heritage system is required to be a separate designation rather than an overlay. Outside of settlement areas, natural heritage features and areas (e.g. provincially significant wetlands, not linkage areas) may be shown in official plans as an overlay or as separate natural heritage features and areas designation. *If a separate designation is used for natural heritage features and areas, it is important to ensure that the natural heritage features and areas designation includes policies to prohibit non-agricultural uses, prevent lot creation and fragmentation and allow agricultural uses to continue. This will ensure that agriculture receives equivalent policy protection as in prime agricultural areas and that the natural heritage features and areas benefit from this protection."

Again, the difference between regional-scale and local-scale system has been lost in this guidance. Direction to promote permitted agricultural uses within local-scale systems is often not-appropriate, especially within natural features. Features and associated vegetation protection zones should only allow conservation and restoration as permitted uses.

Finally, a recognition of natural hazards should be included in this guidance.

<table>
<thead>
<tr>
<th>3.1.2.4 Connection to Water Resources System</th>
<th>This section does not speak to the requirement under Growth Plan, 2017 for planning authorities to identify and designate these systems in official plans and how those designations relate to the agricultural land base mapping. Water Resource systems should not be an overlay but should be a primary designation. This section might also be expanded to speak to water related natural hazards and designations in that regard.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1.3 Official Plan Policies</td>
<td>This section should be revised in relation to Natural Heritage Systems, as follows: &quot;-- The <em>regional-scale</em> natural heritage system and mapping using the overlay approach over the agricultural land base with primary designations for local-scale systems, features, vegetation protections zones and natural hazards, as appropriate.&quot;</td>
</tr>
</tbody>
</table>
It is not acceptable that all natural heritage systems in the GGH would become subordinate overlays to agricultural uses. Separate designations play an important role in illustrating intended land use and avoiding land use conflicts. Mapping that would signal an intention that all/most lands outside of settlement areas are designated for agricultural uses could promote significant misunderstandings and challenges for natural heritage protection in the GGH and would override or undermine decades of resource management planning and watershed planning efforts. A balance is required, as envisioned in the PPS, 2014, the provincial plans and local planning priorities, which is not reflected in this guidance. Further, for this guidance to conform with the Growth Plan, the following policy needs to be recognized:

"4.2.2.6

Beyond the Natural Heritage System, including within settlement areas, the municipality:

...b) may continue to protect any other natural heritage system or identify new systems in a manner that is consistent with the PPS."
October 3, 2017

Ms. Ala Boyd  
Manager, Natural Heritage Section  
Ministry of Natural Resources and Forestry  
2nd Floor S, 300 Water Street  
Peterborough ON K9J 8M5

Dear Ms. Boyd:

Subject: Central Lake Ontario Conservation Authority Comments on Draft Criteria, Methods and Mapping of the Proposed Regional Natural Heritage System for The Growth Plan for the Greater Golden Horseshoe, 2017 Environmental Bill of Rights Posting No. 013-1014  
Our IMS #: PGDP22

Thank you for the opportunity to provide commentary on the proposed methods and mapping of the proposed regional-scale Natural Heritage System as part of your ministry’s support for the implementation of the Growth Plan for the Greater Golden Horseshoe, 2017. The Central Lake Ontario Conservation Authority (CLOCA) has taken an active role in the provincial Coordinated Review of the three provincial plans in effect for our watershed (the Growth Plan, Greenbelt Plan and Oak Ridges Moraine Conservation Plan). We have provided detailed comments at each stage of the Coordinated Review and are continuing to actively participate in the implementation process given the significance of the plans for managing land and resources within the geography we serve.

Staff-Level Comments to be Considered Further
Given the time-lines associated with the commenting deadline and our ability to report to our Board of Directors at their next meeting scheduled for October 17th, these comments are being submitted at a staff-level at this time. The staff comments will be presented to our Board of Directors for consideration and endorsement on October 17th. We intend to write to you as a follow-up should any modifications of these comments be made following Board of Directors consideration.

What we do on the land is mirrored in the water
Support for A Regional-Scale Provincially-Identified Natural Heritage System Where Such Systems Do Not Yet Exist in the Greater Golden Horseshoe

The CLOCA watershed is located in the central portion of Durham Region within the “inner-ring” of the Greater Golden Horseshoe. Due to our geographic context, the CLOCA watershed is already well supported through existing provincial plan designations: approximately half our watershed is planned for urbanization or intensification of existing urban areas. The other half of our watershed is planned for permanent protection of prime agriculture and environmental protection through the Oak Ridges Moraine Conservation Plan and the Protected Countryside and Natural Heritage System policy overlay of the Greenbelt Plan. As you know, both of these plans contain regional-scale provincially-identified natural heritage systems, which define the urban structure of our geography and ensure that land use planning for the regional-scale core areas and linkages on the landscape continue to sustain ecological and hydrological integrity by protecting key natural heritage and key hydrologic features and areas, biodiversity and the movement of plants and animals along with adjacent agricultural lands.

Imperative to Implement the Coordinated Review Advisory Panel Recommendations to Strengthen Protection of Natural Heritage Systems by Funding a Locally-Delivered Natural Heritage System Enhancement Strategy

The proposed natural heritage system responds to both the approved policy in the Growth Plan as well as Recommendation No. 43 of the Coordinated Review Advisory Panel. At this time, we wish to draw your attention to an equally critical portion of Recommendation No. 44 of the Panel (emphasis added):

“Recommendation 44

Strengthen protection of natural heritage systems by:

- Developing a natural heritage system enhancement strategy for the area of the four plans, including priorities and resources to implement securement, stewardship, restoration and enhancement of natural heritage features, linkages and functions...”

We understand that the government has committed to implement all of the recommendations of the Advisory Panel. We believe that policy approaches, including regional-scale natural heritage system mapping, are not enough to secure and restore our natural heritage. Sustained, provincial operational and program funding for securement, stewardship, restoration and enhancement are required at this time in order to properly implement the vision of the provincial plans and in this context, specifically, the Growth Plan.

Proposed Natural Heritage System Additions in the Draft Mapping for the CLOCA Watershed are Negligible and Do Not Meaningfully Improve Natural Heritage Protection or Connectivity

In the proposed draft mapping within the CLOCA watershed, there are some areas of land that have been mapped as within the natural heritage system. These areas are small in size and are
mapped along the southern margins of the Greenbelt Plan Area adjacent to land already within the Greenbelt Natural Heritage System. According to our data and analysis, in some instances there are no existing natural heritage features in these areas and these areas do not connect to other features outside of the Greenbelt Plan Area. We understand that the draft mapping utilized an automated process that re-modelled the natural heritage features, core areas and linkage areas within the existing Greenbelt. We speculate that in some instances the mapping is due to a mapping error or failure to ‘clip’ these lands at the Greenbelt Plan boundary.

Given that these additional areas are marginal, small in scale, do not provide linkages to other features or areas, do not meaningfully add to features already within the Greenbelt Plan Natural Heritage System and are already designated in local-scale natural heritage systems which connect these areas to a more fulsome network, and given the limited utility the addition of these areas would provide for natural heritage protection in our watershed, we request that these areas be removed from the final mapping. Attachment No. 1 to this letter provides our detailed mapping and analysis of these areas for your consideration.

Responses to Specific Consultation Questions
Please see Attachment No. 2 to this letter, which contains our responses to the specific consultation questions.

Conclusion
Thank you for the opportunity to comment on the draft Criteria, Methods and Mapping of the Proposed Regional Natural Heritage System for The Growth Plan for the Greater Golden Horseshoe, 2017. We would be pleased to discuss our comments, if desired.

Yours truly

Chris Jones, M.C.I.P., R.P.P., Director, Planning and Regulation
Heather Brooks, M.C.I.P., R.P.P., Director, Watershed Planning and Natural Heritage

Attachment No. 1 Detailed Mapping and Analysis of NHS Areas
Attachment No. 2 Responses to Consultation Questions

cc: Watershed Municipal Planning Staff
    Neighboring Conservation Authority Staff

g:\planning\planning\comments\2017\proposed provincial nhshb revisions.doc
Proposed Growth Plan
Natural Heritage System

- Existing Provincial Natural Heritage System (Oak Ridges Moraine Conservation Plan and Greenbelt Plan)
- Urban Area Boundary
- CLOCA Scientific Boundary
- Watershed Boundary
- Lake
- Drainage

<table>
<thead>
<tr>
<th>Area</th>
<th>Area in ha</th>
<th>% of CLOCA Watershed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.02</td>
<td>0.009%</td>
</tr>
<tr>
<td>2</td>
<td>10.57</td>
<td>0.017%</td>
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<td>3</td>
<td>5.94</td>
<td>0.009%</td>
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<tr>
<td>4</td>
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<td>0.017%</td>
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<tr>
<td>5</td>
<td>14.96</td>
<td>0.023%</td>
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<tr>
<td>6</td>
<td>1.89</td>
<td>0.003%</td>
</tr>
<tr>
<td>7</td>
<td>6.24</td>
<td>0.010%</td>
</tr>
<tr>
<td>8</td>
<td>1.27</td>
<td>0.002%</td>
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<td>9</td>
<td>4.81</td>
<td>0.008%</td>
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<td>10</td>
<td>4.22</td>
<td>0.007%</td>
</tr>
<tr>
<td>11</td>
<td>4.28</td>
<td>0.007%</td>
</tr>
<tr>
<td>12</td>
<td>4.27</td>
<td>0.007%</td>
</tr>
<tr>
<td>Total</td>
<td>75.34</td>
<td>0.118%</td>
</tr>
</tbody>
</table>

CLOCA Watershed Area: 63,933.28 ha


Proprietor: CENTRAL LAKE ONTARIO NATURAL HERITAGE SYSTEM
PROPERTIES MANAGEMENT GROUP, INC. 
ZONE 17, CENTRAL MERIDIAN (81 DEGREES WEST)

Date Printed: October 5, 2017

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Map Compiled by the Central Lake Ontario Conservation Authority, 100 Whiting Ave., Oshawa, Ontario, L1H 3T3

Lake Ontario
The development of an Ecological Services Report was a directive of both the Watershed Management Plans and the CLOCA Strategic Plan. The purpose of this Report (attached) is to illustrate the economic contribution that natural areas make to their watershed communities, particularly with respect to protecting property and infrastructure, maintaining comfortable and healthy living spaces, and promoting healthy lifestyles.

Prepared in-house by CLOCA staff, this action plan adopts the methodology used by the David Suzuki Foundation for the 2005 Greenbelt Report. With a focus on valuing the services that CLOCA’s ecosystems provide to its residents. It is estimated that CLOCA’s forests, wetlands, successional habitats, and rivers contribute almost $130M annually to the local economy, largely in avoided costs.

Illustrating the economic and social contributions of our natural areas to our quality of life provides us with a new perspective, one that can further encourage CLOCA’s watershed stakeholders to protect existing natural heritage features and promote additional support for stewardship and restoration activities throughout the jurisdiction. To help convey this information, it is proposed that a communication campaign; the primary audience for which will be residents and municipal partners be developed in 2018. The proposed CLOCA 2018 Preliminary Budget will include an allocation for a communication campaign which will include a mix of traditional print format, social media promotion, and web-based products at a cost of approximately $8000.00

**RECOMMENDATIONS:**

*That Staff Report 5542-17 be received for information; and,*

*That Ecological Services Action Plan attached to this report be approved*

Attach.

JS/BB/bb
s:\reports\2017\sr5542_17.docx
Ecological Services: Valuing Natural Areas within CLOCA

Action Plan #14

Central Lake Ontario Conservation

October 2017
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1. INTRODUCTION

Through the watershed management and planning process, Central Lake Ontario Conservation (CLOCA) has revealed the wealth of natural resources that exist within its jurisdiction and demonstrated the need to preserve these features long-term to maintain healthy watersheds. Protecting and enhancing natural features not only provides habitat for wildlife, it sustains human health and prosperity - an aspect that is often undervalued when land-use decisions are being made in our watersheds.

1.1 PURPOSE

The development of an Ecological Services Action Plan was a recommendation from the Watershed Management Plans. The purpose of this action plan is to look more closely at some of the goods and services that the natural features in CLOCA’s watersheds provide to its residents and attempt to frame these services in an economic context.

CLOCA’s Strategic Plan also supports the development of this action plan as it will facilitate a better understanding of the importance of our watershed’s natural resources and enable CLOCA to build awareness within our watershed community about the social and economic value of our watershed features through an effective and targeted marketing and communication campaign.

1.2 CONTEXT

Through its Watershed Management Plans CLOCA has established minimum forest and wetland cover targets for each of its watersheds based on recommendations from Environment and Climate Change Canada’s (ECCC) 2004 publication *How Much Habitat Is Enough?*. Currently, 29% of CLOCA’s land cover can be classified as natural, with 11% being forest and 10% being wetland. While the CLOCA jurisdiction is fortunate to have enough wetland cover to meet ECCC’s minimum 10% wetland cover target, the watersheds fall short of meeting the recommended 30% minimum forest cover. Although the Watershed Management Plans provide a lengthy rationale for why it is important to meet these land cover targets from an ecosystem health point of view, an economic rationale has not yet been presented. It is hoped that this action plan and its associated communication products will provide additional motivation for policy makers, municipalities and watershed residents to protect and improve natural cover within the CLOCA jurisdiction.

---

2. DISCUSSION

2.1 WHAT ARE ECOLOGICAL GOODS AND SERVICES?

“Ecological goods and services” are the physical benefits that people derive from nature; generally food, building materials, and fuel. An example of a “good” is the timber that people extract from a forest that is then turned into market goods like lumber. An example of a “service” is the oxygen that forests produce and that people breathe in. Together these goods and services are called “natural capital”, and this capital provides benefits over time.

Natural Capital = Ecological Goods + Ecological Services

Unless a market exists for an ecological good or service it is generally difficult to account for its monetary value when land use changes are being considered. As a result, many of the ecological goods and services that sustain human populations, and which would be costly to replace with built infrastructure, are left out of the economic equation when a natural feature is removed. This process is often referred to as revealing the “hidden” economic value of ecosystem goods and services.

Although ecosystems are complex and the relationships between ecosystem components are often not well-understood, efforts have been made to quantify the economic value of the goods and services that natural features provide to people in order to develop more realistic cost-benefit equations and generate additional economic rationale that can be used by land use planners to justify the preservation of local natural resources when faced with competing interests.

2.2 METHODOLOGY

CLOCA has reviewed several natural capital valuations prepared for other jurisdictions and has determined that Ontario’s Wealth, Canada’s Future: Appreciating the Value of the Greenbelt’s Eco-Services, prepared by the David Suzuki Foundation in 2008 (referred to henceforth as the Greenbelt report), is the most relevant and replicable example to the CLOCA jurisdiction.

Adopting the structure laid out in the Greenbelt report, monetary values were calculated for the ecological services provided by forests, wetlands, successional habitats, and rivers in each of CLOCA’s watersheds. These ecosystem types are defined in Section 8 and the cover for each ecosystem type was determined using the 2017 ELC layer. River calculations utilized the 2016 CLOCA drainage layer.
This report focuses on estimating the monetary value of the services provided by ecosystems rather than the goods, and an overview of the findings for the CLOCA jurisdiction can be found in Section 8. The economic value of each ecosystem type, along with a discussion of the services included in the calculation for that ecosystem type, is presented in Sections 3-6.

2.3 LIMITATIONS

The intent of this valuation exercise is to offer some insight into the economic advantage that protecting these features may provide to Durham Region and CLOCA’s municipal partners. In some cases the values developed by the David Suzuki Foundation for the Greenbelt may vary somewhat for CLOCA’s jurisdiction and many services may have increased in value as a result of inflation, which has not been accounted for in this exercise. Nevertheless, utilizing their values within our watershed provides a clear illustration of the significance of the value that ecological services provide to our community.

The ecological services valued in this report follow those outlined in the Greenbelt report and include air quality, climate regulation, water runoff and flood control, water filtration and waste treatment, soil formation, biological activities such as pollination, and recreation. However, there are numerous other benefits that humans derive from our natural areas that have not been accounted for or which may not have been incorporated into the valuation of an included service. For example, the value of recreation for various ecosystem types was calculated based on a 1996 national survey that estimated the economic impact of outdoor recreation and asked participants to assess their willingness to pay for such activities. While there is certainly an economic benefit to communities from increased tourism in a natural area, the calculated value does not include any of the human health benefits that people derive from undertaking outdoor activities. Studies suggest that these benefits include decreased stress, improved mental well-being, increased attention span and focus, improved physical fitness, shortened recovery times, and greater social capital, and that these benefits increase the closer natural areas are to people. The decreased load on the Health Care system as a result of fewer people needing medical attention due to increased physical activity likely represents significant sums of saved money, but quantifying those savings is extremely difficult and is not represented in the values presented in this report. As a result, it is safe to say that the economic value of the ecological services outlined in this report are conservative in nature.

---

Although it is recognized that the suite of ecosystem services and human benefits included in this report may not be exhaustive, this valuation exercise is still worthwhile as it begins to reveal the otherwise hidden economic value of CLOCA’s ecosystems to its residents and planning partners.

2.4 FINDINGS

The annual economic value of forests, wetlands, successional habitats, and rivers to the local and regional economy is almost $130 M. Some of the economic considerations included in this calculation are the estimated cost of replacing an ecosystem service with built infrastructure or with human labour, and/or the health care costs (air pollution only) that are avoided by maintaining natural areas. These considerations are explained in more detail in Sections 3-6.

Per ecosystem type, wetlands are the most economically valuable followed by forests, successional habitats and rivers.

Table 1 – Summary of annual non-market ecosystem service values by ecosystem type for the CLOCA jurisdiction

<table>
<thead>
<tr>
<th>ECO SYSTEM TYPE</th>
<th>AREA (HA)</th>
<th>$/HA/YR</th>
<th>TOTAL ($M/YR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest</td>
<td>6,683</td>
<td>5,414</td>
<td>36.2</td>
</tr>
<tr>
<td>Wetland</td>
<td>6,024</td>
<td>14,153</td>
<td>85.3</td>
</tr>
<tr>
<td>Successional</td>
<td>4,502</td>
<td>1,667</td>
<td>7.5</td>
</tr>
<tr>
<td>River</td>
<td>966</td>
<td>335</td>
<td>0.3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>18,176</td>
<td></td>
<td>128.9</td>
</tr>
</tbody>
</table>

Per watershed, the Bowmanville/Soper Creek watershed contributes the most towards CLOCA’s overall natural capital. This is attributable to its overall size and natural cover, and this trend is consistent across the watersheds with the exception of the Black/Harmony/Farewell Creek watershed, which has slightly less natural cover than the Oshawa Creek watershed but economically contributes more. This is a result of the high proportion of wetlands in this watershed, particularly along the Lake Iroquois Beach.
Table 2 – Summary of annual non-market ecosystem service values by ecosystem type for each of CLOCA’s watersheds.

<table>
<thead>
<tr>
<th>Ecosystem Type</th>
<th>Lynde</th>
<th>Oshawa</th>
<th>Black/Harmony/Farewell</th>
<th>Bowmanville/Soper</th>
<th>Small Watersheds (West)</th>
<th>Small Watersheds (East)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area (ha)</td>
<td>1406</td>
<td>1093</td>
<td>669</td>
<td>3008</td>
<td>213</td>
<td>291</td>
</tr>
<tr>
<td>$/Year</td>
<td>7.6</td>
<td>5.9</td>
<td>3.6</td>
<td>16.2</td>
<td>1.2</td>
<td>1.5</td>
</tr>
<tr>
<td>Wetland</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area (ha)</td>
<td>1295</td>
<td>833</td>
<td>1333</td>
<td>1798</td>
<td>400</td>
<td>362</td>
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<tr>
<td>$/Year</td>
<td>18.3</td>
<td>11.8</td>
<td>18.9</td>
<td>25.4</td>
<td>5.7</td>
<td>5.1</td>
</tr>
<tr>
<td>Successional</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area (ha)</td>
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<td>768</td>
<td>465</td>
<td>1374</td>
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<td>$/Year</td>
<td>1.6</td>
<td>1.3</td>
<td>0.8</td>
<td>2.3</td>
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<td>0.9</td>
</tr>
<tr>
<td>River</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area (ha)</td>
<td>193</td>
<td>221</td>
<td>138</td>
<td>311</td>
<td>61</td>
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<td>$/Year</td>
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<td>74,271</td>
<td>46,161</td>
<td>104,252</td>
<td>20,588</td>
<td>13,755</td>
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<tr>
<td><strong>Total ($/yr)</strong></td>
<td><strong>27.6</strong></td>
<td><strong>19.1</strong></td>
<td><strong>23.3</strong></td>
<td><strong>44.1</strong></td>
<td><strong>7.5</strong></td>
<td><strong>7.6</strong></td>
</tr>
</tbody>
</table>
3. **FORESTS**

CLOCA has 6,683 ha of forest cover in its jurisdiction. Table 3 represents a conservative list of the services that forests provide which benefit human health and contribute to the economy.

*Table 3 – Summary table of annual forest ecosystem values (including air pollution removal) in CLOCA*

<table>
<thead>
<tr>
<th>Ecosystem Service Function</th>
<th>KG per Hectare</th>
<th>Total KG Removed per Year</th>
<th>Value per Kg</th>
<th>$/HA/YR</th>
<th>Total (SM/yr)</th>
</tr>
</thead>
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<tr>
<td><strong>Air Quality (total)</strong></td>
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<tr>
<td>CO</td>
<td>1.2</td>
<td>8020</td>
<td>1.04</td>
<td>1.25</td>
<td>0.008</td>
</tr>
<tr>
<td>O³</td>
<td>30.3</td>
<td>202495</td>
<td>7.51</td>
<td>227.59</td>
<td>1.52</td>
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<td><strong>Air Quality components</strong></td>
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<tr>
<td>NO²</td>
<td>7.5</td>
<td>50123</td>
<td>7.51</td>
<td>56.34</td>
<td>0.38</td>
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<tr>
<td>PM</td>
<td>16.8</td>
<td>112274</td>
<td>5.01</td>
<td>84.25</td>
<td>0.56</td>
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<tr>
<td>SO²</td>
<td>4.2</td>
<td>28069</td>
<td>1.83</td>
<td>7.71</td>
<td>0.05</td>
</tr>
<tr>
<td><strong>Climate regulation (carbon stored)</strong></td>
<td></td>
<td></td>
<td>919.00</td>
<td>6.14</td>
<td></td>
</tr>
<tr>
<td><strong>Climate regulation (carbon uptake)</strong></td>
<td></td>
<td></td>
<td>39.11</td>
<td>0.26</td>
<td></td>
</tr>
<tr>
<td><strong>Water runoff control</strong></td>
<td></td>
<td></td>
<td>1,523.00</td>
<td>10.18</td>
<td></td>
</tr>
<tr>
<td>Water filtration</td>
<td></td>
<td></td>
<td>473.98</td>
<td>3.17</td>
<td></td>
</tr>
<tr>
<td><strong>Soil formation</strong></td>
<td></td>
<td></td>
<td>17.00</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td>Waste treatment</td>
<td></td>
<td></td>
<td>58.00</td>
<td>0.39</td>
<td></td>
</tr>
<tr>
<td><strong>Pollination (agriculture)</strong></td>
<td></td>
<td></td>
<td>1,109.00</td>
<td>7.41</td>
<td></td>
</tr>
<tr>
<td>Seed dispersal</td>
<td></td>
<td></td>
<td>537.00</td>
<td>3.59</td>
<td></td>
</tr>
<tr>
<td>Biological control</td>
<td></td>
<td></td>
<td>25.97</td>
<td>0.17</td>
<td></td>
</tr>
<tr>
<td>Recreation &amp; Aesthetics</td>
<td></td>
<td></td>
<td>334.73</td>
<td>2.24</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>5,414.00</strong></td>
<td><strong>36.18</strong></td>
<td></td>
</tr>
</tbody>
</table>

Generally, the most significant services that forests provide for human health are water supply, carbon storage, and air quality maintenance.
3.1 CLIMATE CHANGE

Predicting the impacts of climate change and mitigating for these effects has become an increasingly important task at all levels of government in Ontario. Of primary interest is minimizing atmospheric carbon, the main contributor to climate change, and forests can play a central role in this respect.

There are two distinct ways in which forests can aid in minimizing atmospheric carbon levels:

1. Intact forests are carbon stores. They contain more than half of all terrestrial carbon and when they are removed to make room for agriculture or development this carbon is released, contributing to climate change over time. In the CLOCA jurisdiction forests currently store an estimated 1.5 million tonnes of carbon (220 tonnes/ha), which can be prevented from entering into the atmosphere by simply preserving CLOCA’s forest ecosystems.

2. Forests reduce atmospheric carbon levels by removing CO\textsubscript{2} from the atmosphere through respiration (uptake). Based on numbers provided in the Greenbelt report, CLOCA’s forests remove an additional 5000 tonnes of carbon each year (0.75 tonnes/ha).

As Table 3 shows, CLOCA’s forests provide $6.3M in carbon storage and sequestration services each year, with the primary service being carbon storage.

The economic value of forests as carbon storage banks was calculated using an avoided damages cost. This calculation was developed by the David Suzuki Foundation based on a 2005 estimate of the average cost of global damages due to CO\textsubscript{2} levels in the atmosphere from the Intergovernmental Panel on Climate Change.

The economic value of carbon uptake by forests was calculated using CITYgreen software, a model that quantifies the removal of CO\textsubscript{2} by trees based on their age class. Each age class is associated with a set number of tonnes of CO\textsubscript{2} uptake per year. On average, a hectare of forest removes 0.75 tonnes of carbon annually, and the monetary value of the carbon removed is calculated using the global average cost of carbon emissions. In 2008 it was C$52 per tonne of Carbon.

3.2 AIR QUALITY

Air pollution, in particular carbon monoxide (CO), ozone (O\textsubscript{3}), nitrogen oxide (NO\textsubscript{2}), particulate matter (PM), and sulphur dioxide (SO\textsubscript{2}), is detrimental to human health and has damaging environmental effects, including agricultural crop damage, poor visibility and soil damage. The economic impacts of air pollution are significant, with 70% of associated costs being related to humans and health care needs.
Forests play a significant role in reducing the impacts of air pollution by removing many of them via leaf absorption. Studies have shown that 1 m² of tree canopy can remove 8 – 12 grams of pollutants. In terms of mitigating human health impacts, urban forests are most valuable as they remove pollutants from areas where people are concentrated. In addition, trees provide us with oxygen – an essential service.

Table 3 shows that in the CLOCA jurisdiction forests remove an estimated 400 tonnes of pollutants from the air each year, which amounts to an annual economic savings of $2.5M.

### 3.3 WATER

Forests play a significant role in maintaining water quality and regulating flows, and these services are valuable to human health and well-being.

**Water Filtration**

As water travels overland through forests they filter, store, and transform pollutants into non-harmful forms. Riparian forests are particularly valuable in this respect. This filtration service helps to ensure that the water entering into our aquifers and into the Great Lakes system is clean, and for municipalities it represents a cost savings: studies show that for every 10% loss in forest cover there is an associated 20% increase in water treatment costs.

In practical terms, the Greenbelt report estimated that water treatment costs would increase from $0.60 per cubic metre to $0.94 per cubic metre in the City of Toronto if a 10% loss of forest cover occurred. By comparison, if residential water had to be replaced by bottled water, the 2008 Greenbelt report estimated that it would cost residents $825 billion per year ($1.50/L).

In the CLOCA jurisdiction it is estimated that forests provide a water filtration value of $3.1M each year.

**Run-off Control**

Forests protect against flooding and erosion by regulating overland flows. Loss of forest cover leads to changes in the drainage system resulting in lowered water levels in dry seasons, higher water levels in wet years or during rain events, increased sediment in the creek system, and increased water temperatures.

In the CLOCA jurisdiction it is estimated that forests provide run-off control services of over $10M annually.
3.4 OTHER SERVICES

As Table 3 demonstrates, forests provide people with recreational opportunities, contribute to waste treatment and soil formation, and serve a role in agricultural processes. Together these services amount to almost $14M annually.

Recreation

In the Greenbelt report, the value of recreation services provided by forests was based on the economic benefit of tourism and the price that people would pay to participate in nature-based recreation. As was previously discussed under ‘limitations’ there are likely numerous other human benefits from recreation that have not been accounted for in this valuation.

Pollination and Seed Dispersal

Pollinators are essential for the production of many fruits and vegetables in Ontario and their activities represent an enormous economic value. Natural cover is key to maintaining wild pollinator populations and forests provide important nesting habitat, food and nectar which supports pollinator biodiversity.

Forests provide habitat for birds and mammals, who in turn contribute to the regeneration of natural areas by dispersing seeds. In some instances planting is a paid service and birds and mammals do it free of charge, so there is an economic value to the activity.

Soil Formation, Waste Treatment, Biological Control

Studies suggest that forests also provide humans with services in the form of soil formation, waste treatment, i.e., trapping phosphorus and nitrogen, and natural pest control (providing habitat for birds). They contribute almost $700,000 worth of services each year, based on the estimated cost of replacing them with built infrastructure or human labour.
4. WETLANDS

CLOCA has approximately 6,024 ha of wetland in its jurisdiction. As Table 4 indicates, there are different types of wetlands, each providing a slightly different set of services: as such, the economic value of each wetland type varies slightly.

The most abundant wetland type in the CLOCA jurisdiction is swamp and these wetlands are estimated to contribute almost $7M worth of economic services.

Table 4 – Summary table of annual wetland ecosystem values in CLOCA

<table>
<thead>
<tr>
<th>Ecosystem Services</th>
<th>Open Water $/HA/YR</th>
<th>Bog $/HA/YR</th>
<th>Marsh $/HA/YR</th>
<th>Swamp $/HA/YR</th>
<th>Fen $/HA/YR</th>
<th>Total $/HA/YR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate regulation (carbon stored)</td>
<td>676.59</td>
<td>486.09</td>
<td>539.61</td>
<td>429.41</td>
<td>1,360.35</td>
<td>2.7</td>
</tr>
<tr>
<td>Climate regulation (carbon uptake)</td>
<td>13.02</td>
<td>13.02</td>
<td>13.02</td>
<td>13.02</td>
<td>13.02</td>
<td>0.8</td>
</tr>
<tr>
<td>Flood Control</td>
<td>4,038.51</td>
<td>4,038.51</td>
<td>4,038.51</td>
<td>4,038.51</td>
<td>4,038.51</td>
<td>24.3</td>
</tr>
<tr>
<td>Water filtration</td>
<td>473.98</td>
<td>473.98</td>
<td>473.98</td>
<td>473.98</td>
<td>473.98</td>
<td>28.5</td>
</tr>
<tr>
<td>Waste treatment (removal of excess P and N runoff)</td>
<td>3,017.00</td>
<td>3,017.00</td>
<td>3,017.00</td>
<td>3,017.00</td>
<td>3,017.00</td>
<td>18.1</td>
</tr>
<tr>
<td>Habitat/Refugia</td>
<td>5,830.88</td>
<td>5,830.88</td>
<td>5,830.88</td>
<td>5,830.88</td>
<td>5,830.88</td>
<td>35.1</td>
</tr>
<tr>
<td>Recreation &amp; Aesthetics</td>
<td>335.00</td>
<td>335.00</td>
<td>335.00</td>
<td>335.00</td>
<td>335.00</td>
<td>2.0</td>
</tr>
<tr>
<td>Total ($ / ha / year)</td>
<td>14,385.00</td>
<td>14,194.00</td>
<td>14,248.00</td>
<td>14,138.00</td>
<td>15,069.00</td>
<td>6024</td>
</tr>
<tr>
<td>Area (ha)</td>
<td>166</td>
<td>1</td>
<td>904</td>
<td>4949</td>
<td>3</td>
<td>6024</td>
</tr>
<tr>
<td>TOTAL ($M/Year)</td>
<td>2.4</td>
<td>0.14</td>
<td>12.9</td>
<td>69.9</td>
<td>0.48</td>
<td>85.3</td>
</tr>
</tbody>
</table>

4.1 CLIMATE CHANGE

Wetlands, like forests, store and sequester carbon. The estimated value of stored carbon and carbon uptake is based on the soils and peat found within wetlands; however, the calculations presented in the Greenbelt report do not consider the carbon uptake that occurs by plants within the
wetlands. It is likely, therefore, that the overall economic value of wetlands, in terms of climate change prevention and mitigation, is underestimated.

4.2 WATER

Water Treatment
The real economic value of wetlands on the landscape is their role in water management. Like forests, they filter contaminants and sediment from point sources and improve the quality of drinking water, and in this respect the Greenbelt report values both forests and wetlands at the same annual rate.

Where wetlands differ from forests is in their ability to treat waste water. They effectively absorb nutrient waste, such as nitrogen and phosphorus, which runs off from farmlands. Studies show that one hectare of wetland can remove 80 – 770 kg of phosphorus and 350 – 32,000 kg of nitrogen each year. If CLOCA’s wetlands were subjected to these minimum and maximum nutrient loadings on an annual basis (Table 5) they would have the potential to remove millions of kg of nitrogen and phosphorus from the waste treatment system. At an estimated treatment cost of $22 - $61/kg of phosphorus and $3 - $8.50/kg of nitrogen (2008 values), the potential nutrient removal cost savings from wetlands is significant.

Table 5 – Low-end and high-end estimates of nutrient removal capacity in CLOCA wetlands.

<table>
<thead>
<tr>
<th>NUTRIENT</th>
<th>ESTIMATED REMOVAL RATE (KG/HA)</th>
<th>REMOVAL CAPACITY OF CLOCA WETLANDS (KG/YR)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW</td>
<td>HIGH</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>80</td>
<td>770</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>350</td>
<td>32,000</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Water Storage
Another important service that wetlands provide is water storage. While both forest and wetland ecosystems help to regulate water flows, thereby providing protection against flooding and erosion, wetlands retain large quantities of water and release it slowly over time. The benefit of this is that there are more stable stream water levels in both dry and wet seasons, reduced sedimentation in streams and cooler water
temperatures. In particular, stream level moderation reduces flooding incidents and provides an important economic benefit for private landowners (protection of property) and government (protection of infrastructure). The estimated value of this service is over $24M/year.

4.3 OTHER SERVICES
The Greenbelt report also assigned economic value to wetlands for their contribution to wildlife habitat and human recreation. In terms of habitat, the service value relates to the cost savings that a community/agency incurs as a result of preserving an existing wetland; in other words, there is value in the fact that money will not have to be spent in the future to restore the lost/degraded wetland. The recreational values, are similar to those for forests and were derived from a 1996 survey. Together, the estimated value of these services is $37 M per year.

5. SUCCESSIONAL HABITATS
The Greenbelt report includes grassland ecosystems in its overall service valuation; however, the CLOCA jurisdiction does not have many, if any, true grassland ecosystems. CLOCA does have numerous idle and regenerating ecosystems that certainly provide benefits and should be accounted for. As such, CLOCA has adopted the term “successional” habitat to describe the 4500 ha of idle fields and regenerating areas within the jurisdiction and has used the ecosystem services and values assigned to the “idle land” category in the Greenbelt report to estimate their economic value.

Table 6 – Summary table of annual successional habitat ecosystem values in CLOCA

<table>
<thead>
<tr>
<th>Ecosystem Services</th>
<th>$/HA/YR</th>
<th>Annual Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate regulation (carbon stored)</td>
<td>317.00</td>
<td>$ 1,427,134</td>
</tr>
<tr>
<td>Climate regulation (carbon uptake)</td>
<td>29.00</td>
<td>$ 130,558</td>
</tr>
<tr>
<td>Erosion control and sediment retention</td>
<td>6.00</td>
<td>$ 27,012</td>
</tr>
<tr>
<td>Soil Formation</td>
<td>6.00</td>
<td>$ 27,012</td>
</tr>
<tr>
<td>Nutrient cycling</td>
<td>24.00</td>
<td>$ 108,048</td>
</tr>
<tr>
<td>Habitat for Pollination for Crop Production</td>
<td>1,109.00</td>
<td>$4,992,718</td>
</tr>
<tr>
<td>Biological control</td>
<td>40.00</td>
<td>$ 180,080</td>
</tr>
<tr>
<td>Cultural Value</td>
<td>138.00</td>
<td>$ 621,276</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1,667.00</td>
<td>$7,504,834</td>
</tr>
</tbody>
</table>
Although successional habitats do not provide the same level of service as forests and wetlands, their contribution can’t be overlooked.

- Successional habitats help prevent climate change by containing the carbon stored in the soil and preventing it from entering into the atmosphere.
- Because the land is in permanent vegetative cover, carbon is sequestered from the atmosphere as the vegetation grows thereby helping to slow climate change.
- They contribute to maintaining water quality in the creek system by slowing the flow of overland water, which reduces erosion and retains sediment.
- Successional habitats provide food, nectar and habitat for pollinators, which is an important service for food production and agriculture.
- Habitats in permanent vegetative cover help promote soil formation, cycle nutrients through the food web and contribute to biological control of pests by providing habitat for birds and other wildlife.
- Cultural values have been included for accuracy but the Greenbelt report associates this service more with cultivated agricultural lands and as such it may not be relevant to the successional habitat ecosystem that CLOCA has included in this report.

6. **RIVERS**

The Greenbelt report doesn’t include a discussion about rivers but does assign an economic service value to the ecosystem type of $335 per ha and associates that value with recreation and aesthetics, with the cost derived, presumably, from the same recreation survey that was used to assess value for all of the other ecosystem types. It is unclear from the Greenbelt report if the ‘river’ category is meant to describe only certain systems or if it applies to all creek systems. CLOCA generally does not have large rivers; rather, we tend to have creeks and streams. As the definition is unknown, CLOCA has included all of its creeks in the calculation and estimates that the recreational value is $323,610 per year.
7. CONCLUSIONS

CLOCA’s natural areas play an important role in maintaining ecological integrity and watershed health, but they also contribute to the local and larger economies by preventing flooding, attracting tourism, cycling nutrients, filtering our breathing air and drinking water, and providing habitat for wildlife whose activities directly benefit us. In this report those services have been quantified to paint a clearer picture of how much we benefit from our local ecosystems.

Conservatively, it is estimated that CLOCA’s natural areas contribute almost $130 million annually to the economy. In some cases this sum represents actual income generated, but in most cases this sum represents savings to land-owners and government agencies through the avoidance of damage to crops, property or infrastructure, or the avoided cost of replacing a natural service with built infrastructure.

For some benefits, such as human health, it is difficult to account for the role that local ecosystems play in contributing to overall well-being and happiness. Certainly the evidence is mounting that exposure to nature has a positive impact on people’s mental and physical health, and it is likely that there is economic value for citizens who require less medical attention or are more productive members of the community.

The purpose of this report was to demonstrate the potential economic value of CLOCA’s forests, wetlands, successional habitats and rivers, and it is hoped that the figures provided will further motivate residents, land-owners, and planning agencies to protect existing natural features and continue to invest in enhancing and restoring degraded or lost features across the jurisdiction.

7.1 COMMUNICATING ECOSYSTEM SERVICE VALUES

It is particularly important for watershed residents to understand how valuable local natural areas are for maintaining personal and community health and well-being. As such, CLOCA will follow up this action plan with a series of communication products aimed at raising awareness about how natural areas benefit people. Products may include brochures or fact sheets, interactive online tools such as storyboards, partnering with local agencies to streamline messaging, and working with municipal partners to incorporate the economic value of natural areas into their own budgets.
8. DEFINITIONS

Forest
This ecosystem was defined using the following ELC categories from CLOCA’s 2017 ELC layer: CUP, CUW, FOD, FOM, and FOC.

River
This ecosystem type is not defined in the 2008 Greenbelt Report. For this report all creeks were included in the calculation and area (ha) was determined by sorting the streams into smaller and larger segments and applying a 3m average width to smaller creeks and a 10 m average width to larger ones.

Successional
This ecosystem is comprised of regenerating habitats and includes the CUM, CUT, and CUS ELC categories. These habitats are more closely related to the 2008 report’s definition of ‘idle land’, but in practice in the CLOCA jurisdiction it is more fitting to call these lands ‘successional’. The values used the by the 2008 report for calculating the services from idle land have been used in this valuation to calculate the service costs for successional ecosystems.

Wetland
This ecosystem was defined using the following ELC categories from CLOCA’s 2017 ELC layer: BOS, BOT, FEO, FES, FET, MAM, MAS, SAM, SAS, SAF, SWD, SWM, SWC, SWT, OAO.
MEMO TO: Chair and Members, CLOCA Board of Directors
FROM: R. Perry Sisson, Director, Engineering and Field Operations
Rod Wilmot, GIS Systems Supervisor
SUBJECT: LiDAR Mapping Acquisition - National Disaster Mitigation Program Application

**Purpose:**
The purpose of this report is to inform the CLOCA Board of Directors of the proposed funding application under the National Disaster Mitigation Program for acquisition of base mapping for the west half of the CLOCA watershed. The base mapping will provide multiple uses and will benefit CLOCA floodplain mapping programs. Similar mapping has been recently produced for the eastern portion of CLOCA’s watershed by the Ontario Ministry of Agriculture and Rural Affairs, and an opportunity exists to acquire the remaining portions of CLOCA.

**Background:**
Light Detection and Ranging (LiDAR), is a surveying method that uses pulses of laser light to produce an image of the ground surface. Aircraft mounted with LiDAR scanners fly over the area to be mapped, and as the pulses of light reflect from objects on the ground, the image of the earth surface is created. The topographic image is more accurate (ground points accurate to within 0.1m) than the current topographic mapping in the CLOCA watershed, and will enable more detailed floodplain mapping studies, and will also be utilized in planning and regulation and natural heritage programs for multiple uses. The attached proposal provides more explanation of uses of LiDAR mapping.

In 2017, the Ontario Ministry of Agriculture and Rural Affairs produced LiDAR mapping to support soil mapping work, and included the Municipality of Clarington within the study area. The OMAFRA program does not have plans to provide mapping for the Oshawa and Whitby areas.

**The Study:**
CLOCA GIS staff have inquired with the vendor of LiDAR products and has determined the cost to complete mapping for the western portion of the CLOCA watershed to be $70,000 for the acquisition of the LiDAR data, and a further $20,000 to process the data and create the topographic base mapping. The acquisition would be completed in spring of 2018 during the period before trees leaf-out, to enable better penetration and collection of ground elevation in forested areas.

CLOCA also met with municipal partners to discuss the project and attain an early determination of the level of interest from Region of Durham, City of Oshawa, and Town of Whitby staff. With participation from municipal partners, and with a grant for 50% of the project cost from the National Disaster mitigation Program, the costs to each agency are very reasonable, as shown on the following table.
CLOCA staff propose to submit an application under the 4th intake of National Disaster Mitigation Program (NDMP), and if successful, will be able to recover 50% of the project cost through the federal grant. The NDMP is a Public Safety Canada investment of $200 million to address rising flood risks and costs, and build the foundation for informed mitigation investments that could reduce, or even negate, the effects of flood events in the future. The announcement of successful applications is scheduled for early 2018, and projects in the NDMP must be completed within two years.

CLOCA will continue to work with our partner municipalities to secure funding for the project in 2018. CLOCA’s portion of funding will be provided through budgeting portions of our base funding for natural hazard mapping and GIS services. If the NDMP application is not successful, the project will not proceed.

**RECOMMENDATIONS:**

*THAT Staff Report #5544-17 be received for information; and,*

*THAT the Board of Directors endorse the submission of a funding proposal to the National Disaster Mitigation Program for LiDAR topographic mapping for the western portion of the Central Lake Ontario Conservation Authority watershed, in partnership with our local and regional municipalities.*

---

**Federal Government Funding: Cash**

<table>
<thead>
<tr>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>National Disaster Mitigation Program (NDMP)</strong></td>
</tr>
<tr>
<td><strong>Other Federal Funding:</strong></td>
</tr>
<tr>
<td><strong>Other Federal Funding:</strong></td>
</tr>
<tr>
<td><strong>Total Federal Government Funding</strong></td>
</tr>
</tbody>
</table>

**Non-Federal Government Funding and Other: Cash**

<table>
<thead>
<tr>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Regional Municipality of Durham</strong></td>
</tr>
<tr>
<td><strong>City of Oshawa</strong></td>
</tr>
<tr>
<td><strong>Town of Whitby</strong></td>
</tr>
<tr>
<td><strong>Central Lake Ontario Conservation Authority</strong></td>
</tr>
</tbody>
</table>

**Subtotal – Cash** $40,000.00

**Non-Federal Government Funding and Other: In-Kind**

<table>
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<tr>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td><strong>Central Lake Ontario Conservation Authority</strong></td>
</tr>
</tbody>
</table>

**Subtotal – In-Kind** $5,000.00

**Total Non-Federal Government Funding and other** $45,000.00

**TOTAEL FUNDING** $90,000.00

---

Attach.

RPS/RW/bb

s:\reports\2017\sr5544_17.docx
Nation Disaster Mitigation Program LiDAR Acquisition Partnership Proposal between the Town of Whitby, City of Oshawa, Regional Municipality of Durham and the Central Lake Ontario Conservation Authority

Engineering Services
Central Lake Ontario Conservation Authority
100 Whiting Ave, Oshawa, ON L1H3T3

Central Lake Ontario Conservation Authority Website: www.cloca.com
Objectives

The Central Lake Ontario Conservation Authority (CLOCA) wishes to enter into a Partnership with the Town of Whitby, City of Oshawa and the Regional Municipality of Durham in order to acquire classified LiDAR digital elevation data and derivative products for geographic areas encompassing the Town of Whitby, City of Oshawa and portions of the Central Lake Ontario Conservation Authority Jurisdictional Boundary not covered by the OMAFRA LiDAR acquisition project of 2016 – 2017.

The proposed LiDAR acquisition area is approximately 400 square kilometres and includes parts of the City of Pickering, Town of Ajax, Township of Uxbridge and Township of Scugog. (Figure 1)
Through funding previously secured from Public Safety Canada as part of the National Disaster Mitigation Program (NDMP), CLOCA is currently in the process of conducting 2D (Two-Zone) floodplain mapping studies for damage centres. However, in order to accomplish the 2D mapping, higher accuracy elevation data is required than what is currently available through the First Base Solutions DEM mapping product provided by the Region of Durham. Through the NDMP, we are applying for funding for the acquisition of LiDAR for the entire municipalities of Oshawa and Whitby. The specification would be similar to that of the OMAFRA project previously completed by Airborne Sensing, with incorporation of the draft Federal Airborne LiDAR Data Acquisition Guideline Version 1.0, where applicable.

Uses of LiDAR Information

LiDAR provides a raw point cloud, or a file of points representing everything from trees, to valleys to hydro lines and buildings, from which many applications can be derived. Specifically for urban areas, applications include the mapping of building features (i.e. footprints), urban forestry, defining floodplain areas, utility feature extraction, land cover classification and corridor assessment to name a few. The following list outlines some of the more common ones:

1. Digital Elevation Model (DEM): a DEM is a 3D representation of a terrain. Provided as a raster/grid product, each cell/pixel within the grid has an x/y/z-coordinate value. Cell/pixel size can determine overall quality of the product (i.e. the smaller the cell, the greater the number of elevation readings, the potential for greater accuracy). An extremely valuable product as elevation values provide the starting point required for many applications including road and bridge decks and floodplain modelling.

2. Impervious Surface Modeling: LiDAR collects x/y/z-coordinate, RGB (colour), and intensity values. Intensity is the amount of light energy reflected back from the surface. Impervious surfaces (asphalt, concrete, buildings) are perceived darker than pervious surfaces.

3. Planning and Development: a stripped point cloud provides the ability to visualize the terrain and detail beneath forest cover. With this ability it is possible to measure slope and see trends over a site. Show terrain in 3D and add development plans. Hill shade product for planning, presentations with council and citizens.

4. Emergency Management: provides the ability to use elevations for determining at what flood stage a potentially vulnerable building will become inundated by flood waters. Useful to Emergency Services personnel.

5. Agriculture: LiDAR helps the farmer to find the area that uses costly fertilizer. LiDAR can be used to create elevation map of the farmland that can be converted to create slope and sunlight exposure area map. Both the layer information can be used to create high, medium and low crop production area. Extracted information will help farmers to save on the costly fertilizer.

6. Forest Planning and Management: LiDAR is widely used in the forest industry for planning and management. It is used to measure the vertical structure of a forest canopy, as well as the canopy bulk density and canopy base height. Other uses include the measurement of peak height to estimate root expansion.

7. Tourism and Parks Management: LiDAR DEM can be used to plan park and tourism areas. A highly accurate land surface model can help determine the best areas for the placement of playgrounds, trees and walking trails. LiDAR can be used to determine accessibility issues for trails.

8. Environmental Assessment: Micro topography data generated from the LiDAR data can be used in an environment assessment. Environment assessments are done to protect the plants and environment. LiDAR can be used to find areas that are affected by human activities.
Sample Products Courtesy of TRCA:

**Figure 2 - Hill Shade**

**Figure 3 - Intensity Mapping**
Figure 4 - Terrain Detail

Figure 5 - Slope Grid
Data Accuracy Guidelines

Floodplains can have a variety of land cover types from open to low vegetation, brush land, forested or urban. Acquisition of LiDAR data within the floodplain is therefore subject to a variety of conditions and should ultimately be guided by the need to collect sufficient ground returns for all cover types present in the floodplain. For example, if a portion of the data collection area is covered in dense riparian vegetation, higher overall data collection density may be required in order to achieve sufficient ground point density in the riparian area.

Federal Airborne LiDAR Data Acquisition Guideline Version 1.0

The level of data collection effort (point density, vertical and horizontal accuracy) should generally reflect the requirements of the intended flood mapping application, which typically depend on the level of flood risk and the regulatory framework in place. Table 1.0 lists the recommended approximate LiDAR data accuracy and density specifications for floodplain mapping applications as a function of flood risk category, based on the review of existing provincial and territorial guidelines. The flood risk categories are defined following the MMM report, and are similar to the vertical accuracy classes adopted in the Ontario guidelines:

- High Flood Risk Category: All urban areas and rural areas that are protected by diking;
- Medium Flood Risk Category: All other rural areas that include settlements and agricultural lands;
- Low Flood Risk Category: Sparsely populated areas.
Table 1 - Recommended approximate LiDAR data accuracy and density for floodplain mapping applications

<table>
<thead>
<tr>
<th>Vertical Accuracy (open, level, hard surfaces)</th>
<th>Flood Risk Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-vegetated Vertical Accuracy (NVA) – Vertical Root Mean Square Error (RMSE)</td>
<td>High</td>
</tr>
<tr>
<td>≤ 5.0-7.5 cm</td>
<td>7.5-10.0 cm</td>
</tr>
<tr>
<td>Non-vegetated Vertical Accuracy (NVA) – 95% confidence level (± 1.96 * RMSE)</td>
<td>≤ ±10-15 cm</td>
</tr>
<tr>
<td>Horizontal Accuracy (open, level, hard surfaces)</td>
<td></td>
</tr>
<tr>
<td>Horizontal Root Mean Square Error (RMSE)</td>
<td>≤ ±11-15 cm</td>
</tr>
<tr>
<td>Horizontal Accuracy – 95% confidence level (± 1.7309 * RMSE)</td>
<td>≤ ±20-25 cm</td>
</tr>
<tr>
<td>Data Density</td>
<td>Aggregate nominal point density (ANPD) for DSM (first return) and DEM (last return)</td>
</tr>
</tbody>
</table>

Current State of Digital Elevation Data
Currently through a joint partnership with the Regional Municipality of Durham, the Town of Whitby, City of Oshawa and CLOCA have access to the First Base Solutions (FBS) DEM Mapping Project of 2010 and soon 2016. The First Base Solutions mapping of 2010 included breaklines and mass points (spot heights) with a 10m spacing. This elevation information was recycled from the initial 2002 GTA Orthophotography Project using a change detection process to update areas where required. The vendor stated accuracy for CMAS/LMAS is +/- 0.50m. This accuracy level would place this product into Level 3 accuracy according to the MapCon Mapping Ltd., 2009, Guidelines for Risk Assessment. Level 3 accuracy use is for moderately to sparsely populated areas that are primarily surrounded by agricultural and/or forested lands when conducting floodplain mapping. CLOCA has previously conducted an accuracy assessment of the FBS digital elevation model for non-vegetated hard surfaces, and was able to obtain a root mean square error (RMSE) of 0.32m at 95% Confidence Interval. (Digital Elevation Model Verification, CLOCA, 2011(Appendix C)). The RMSE when converted equals an LMAS of 0.49m at 90% Confidence Interval verifying the stated accuracy level provided by First Base Solutions on non-vegetated surfaces. The RMSE of 0.32m at 95% meets the old Flood Damage Reduction Program Guidelines of 1/3 the contour interval, with the contour interval being 1m in this case.

Budget
The funding provided by the NDMP will cover half the cost. I have an estimate from the vendor (Airborne) for the cost to complete the project. The estimate is $70,000 for Oshawa and Whitby and additional small areas along CLOCA’s boundary that were not covered by the OMAFRA product. This estimate is based on the classifications codes requested in Table 2 below.

Data Accuracy Guidelines
Floodplains can have a variety of land cover types from open to low vegetation, brush land, forested or urban. Acquisition of LiDAR data within the floodplain is therefore subject to a variety of conditions and should ultimately be guided by the need to collect sufficient ground returns for all cover types present in the floodplain. For example, if a portion of the data collection area is covered in dense riparian vegetation, higher overall data collection density may be required in order to achieve sufficient ground point density in the riparian area.
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<th>Flood Risk Category</th>
<th>Vertical Accuracy (open, level, hard surfaces)</th>
<th>Horizontal Accuracy (open, level, hard surfaces)</th>
<th>Aggregate nominal point density (ANPD) for DSM (first return) and DEM (last return)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Non-vegetated Vertical Accuracy (NVA) – Vertical Root Mean Square Error (RMSE) ≤ 5.0-7.5 cm</td>
<td>Horizontal Root Mean Square Error (RMSE) ≤ 11-15 cm</td>
<td>≥ 4-10 pts/m²</td>
</tr>
<tr>
<td></td>
<td>Non-vegetated Vertical Accuracy (NVA) – 95% confidence level (± 1.96 * RMSE) ≤ ±10-15 cm</td>
<td>Horizontal Accuracy – 95% confidence level (± 1.7308 * RMSE) ≤ ±20-25 cm</td>
<td>2-4 pts/m²</td>
</tr>
<tr>
<td>Medium</td>
<td>7.5-10.0 cm</td>
<td>30-45 cm</td>
<td>1-2 pts/m²</td>
</tr>
<tr>
<td>Low</td>
<td>15 cm</td>
<td>60 cm</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 - Recommended approximate LiDAR data Accuracy and density for floodplain mapping applications

Deliverables
The acquisition requirements are to be completed in conformance with USGS LiDAR Base Specification (Version 1.2). The Deliverables must be consistent with those identified in the USGS LiDAR Base Specifications (V 1.2) – Deliverables Section Download link:


Required Deliverables
- Metadata – as per USGS LiDAR Metadata Template (Appendix 4 in Base Specifications document)
- Raw Point Cloud
- Classified Point Cloud (outlined in Table 2)
- Bare-earth Surface (Raster Digital Elevation Model)

Note: All required Deliverables are described in full detail in the ‘Deliverables’ section of USGS Base LiDAR Specification (Version 1.2)

Next Steps
- CLOCA to Draft Request for Bids
- Partners to review Draft Request for Bids
- Obtain formal quotes from Vendors
  - Data received by CLOCA and QA/QC to ensure it meets accuracy specifications.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Processed, unclassified</td>
</tr>
<tr>
<td>2</td>
<td>Bare Earth</td>
</tr>
<tr>
<td>6</td>
<td>Building</td>
</tr>
<tr>
<td>7</td>
<td>Low Point (noise)</td>
</tr>
<tr>
<td>9</td>
<td>Water</td>
</tr>
<tr>
<td>10</td>
<td>Ignored Ground (Near a breakline)</td>
</tr>
<tr>
<td>17</td>
<td>Bridge decks</td>
</tr>
<tr>
<td>18</td>
<td>High Noise</td>
</tr>
</tbody>
</table>

Table 3 - Codes for Classified Point Cloud
REPORT

CENTRAL LAKE ONTARIO CONSERVATION AUTHORITY

DATE: October 17, 2017
FILE: APOA11
S.R.: 5543-17
TO: Chair and Members, CLOCA Board of Directors
FROM: Rod Wilmot, GIS/Systems Supervisor
Rose Catulli, Director of Corporate Services
SUBJECT: Open Information and Data Policy

The Open Information and Data Policy outlines the principles, roles and responsibilities related to the Central Lake Ontario Conservation Authority’s (CLOCA’s) efforts to make information, documents and data, routinely available in a machine readable format for any public use. The Policy supports CLOCA’s Strategic Plan through the creation of opportunities to openly share data and knowledge for public use, and is consistent with the “open government” approach being taken by many federal and provincial agencies, regional municipalities and some conservation authorities.

The purpose of the Policy is to provide guidance and direction to CLOCA staff on the creation of an open information and data system for CLOCA as a whole. The Policy removes barriers and set the rules by which CLOCA information and data are made available to the public as valuable, machine readable data sets.

Many of CLOCA’s information assets are currently publically available on the CLOCA website cloca.ca, however many data sets collected and maintained by CLOCA are only available by request. The intent is to make more (select) data sets readily available for the public for increased transparency and to increase efficiency by making regularly requested data available online for immediate access and use. Examples of data sets to be made available include watershed boundaries, drainage, conservation areas and climate monitoring stations.

Corporate Services staff will work with the data custodians to develop procedures relating to the implementation of the Policy, and will be responsible for the review and screening of the information and data to be made available through the system.

Currently a page on the corporate website has been created to consolidate information that is presently available (e.g. year in review documents, e-newsletters, watershed plans and monitoring reports). Once approved the GIS/IS Team will be implementing a more robust online portal for sharing geospatial data and information more broadly, along with a corporate open data license that has been reviewed by CLOCA solicitors and insurance provider.

CLOCA staff will continue to work with its partners regarding its corporate open data/information process and have been contributing metadata (information about CLOCA’s data sets) to facilitate awareness and sharing of the information among our partners. Similar work will be undertaken with other partners and stakeholders as the CLOCA system evolves.

RECOMMENDATIONS:

THAT Staff Report #5543-17 be received for information;
THAT the Open Information and Data Policy be endorsed; and,
THAT this policy be reviewed by management on an annual basis.
Preface

The Open Information and Data Policy outlines the principles, roles and responsibilities related to Central Lake Ontario Conservation Authority’s (CLOCA’s) efforts to make information, and data readily available in machine readable format for any use. The Open Information and Data Policy supports Goal 5 of CLOCA’s Strategic Plan: Advance Watershed Science and Knowledge.

Share The Knowledge:
- Identify and share knowledge, data, science and practices for community partners to use in their efforts to protect and enhance the watershed, inspiring positive actions and outcomes;
- Increase knowledge of the CLOCA data warehouse, tools and capacity and broaden access to these resources;
- Make information available to the general public in a format that is easy to access and understand;
- Identify additional opportunities to share knowledge and information with partner organizations and adjacent Conservation Authorities, (including the use of citizen science and application of new technologies);

CLOCA routinely gathers information in the research it has done; this gathering is funded publically so CLOCA feels an obligation to make it publically available. CLOCA wants to expedite and facilitate making this collected information readily accessible so that it may be put to use.

1. Purpose
The purpose of this policy is to provide guidance and direction to staff on making information available using an open information and data system for CLOCA as a whole. The Open Information and Data Policy sets the protocols by which CLOCA information and data are made available to the public.

CLOCA may publish information and data online to improve transparency and public participation, enhance access to CLOCA services, and ultimately strengthen transparency and accountability.

2. Authority
This policy may be updated, revised or rescinded by the Authority.
3. Policy Statements / Action Items

3.1. Guiding Principles

3.1.1. CLOCA will share information and data while adhering to rights of privacy, security and confidentiality and CLOCA’s commercial interest, as identified in the Conservation Authorities Act, the Municipal Freedom of Information and Protection of Privacy Act and other legislation, as applicable.

3.1.2. CLOCA will identify existing and potential information and data for release as part of the policy which includes new and existing data sets, publication of information and data, and maintain legacy data and information as per CLOCA’s Draft Records Management Policy.

3.1.3. CLOCA will endeavor to make information and data available in a timely manner.

3.1.4. Use of data by external parties is subject to the conditions of use outlined in a Data Sharing Agreement. Corporate Services is responsible for management of records for open information and data release, awareness, training and issue resolution, and for maintaining the Open Data License.

4. Audit Compliance

Procedures and guidelines pursuant to the Open Information and Data Policy shall be developed to ensure audit implementation compliance. Supervisors are accountable for ensuring compliance with this policy.

Where supervisors determine they cannot comply with their roles and responsibilities outlined in the Open Information and Data Policy they shall bring their non-compliance issues to the Director of Corporate Services for review. The Director of Corporate Services will recommend a course of action.

5. Definitions

*Data* - facts and statistics collected together for reference or analysis.

*Data set* - a collection of raw, non-manipulated data usually presented in tabular form with associated metadata, and which is machine readable.

*Data Sharing Agreement* – a document that identifies the terms and conditions upon which CLOCA data may be used and distributed – including an appropriate disclaimer and requirement for acknowledgement of the source of the shared data.

*Information* - Information is data that has been converted into a meaningful and useful context, usually in the form of a document, web application, video or some other media file.

*Open Data* - data that can be freely used, reused and redistributed by anyone - subject only, at most, to the requirement to attribute and share alike.

*Open Information* – documents and other information not considered data that can be freely used, reused and redistributed by anyone - subject only, at most, to the requirement to attribute and share alike.