



March 20, 2018  
15045

Mr. Tim Beaucage  
Senior Planner  
Land Use Planning Commission  
22 State House Station  
Augusta, ME 04333-0022

**Third Party Review of the Rezoning Petition in Northern Aroostook County, Fish River Chain of Lakes Concept Plan**

Dear Mr. Beaucage:

Thank you for the opportunity to assist the Land Use Planning Commission (LUPC) with third party peer review services. Our review effort has focused on a slope and soil suitability analysis for the Fish River Chain of Lakes Concept Plan Rezoning Petition.

We offer the following comments for LUPC consideration.

**I. Information provided To Sebago Technics, Inc.:**

1. "The Fish River Chain of Lakes Concept Plan," Volume 1 with associated narratives, technical information, response to questions and supporting exhibits.
2. "The Fish River Chain of Lakes Concept Plan, "Volume 2, Concept Plan.
3. "The Fish River Chain of Lakes Concept Plan, "Volume 3, Maps.
4. "Soil Suitability Evaluation Update," dated March 2017.
5. Partial Lidar data provided by applicant in March of 2018 for slope assessment.

**II. Project Overview:**

1. Proposed Rezoning: Approximately 51,000 acres.
2. Project area includes approximately 425 camps, campsites, forest management roads and working forests.
3. Rezoning areas include proposed Commercial/Economic Development, Residential Development, Recreational Lodging, Forest Land, Public Reserve Land and Conservation Easements.

4. The rezoning covers multiple areas as follows:

- Long Lake development areas to include Long Lake A, B & C and CD-1, CD2.
- Cross Lake Development areas to include Cross Lake A, B, C, D & E and CD 3a, 3b, 3c and CD-4.
- Square Lake development areas to include Yerxa Block, Square Lake E and Square Lake W.
- Conservation areas, working woodlands, unique areas and Maine Public Land Reserve.

**III. General Review Comments:**

1. Application materials included a "Soil Suitability Evaluation," prepared by CES dated November, 2014 and updated through a "Soil Suitability Evaluation Update," prepared by ARC, dated, March 2017 and sealed by Roger R. St. Amend, a Certified Soils Scientist. The soils evaluation is principally based upon the USDA-NRCS "Soil Survey of Northeastern Aroostook County," published in 1964 and supplemented by field spot checking the soils.

Our review suggests the use of the USDA-NRCS soils survey is consistent with LUPC for Rezoning Application Requirements (Exhibit D) which states, "Submit on-site soils mapping conducted by a soil scientist for all areas proposed for development, including roads. Soils information should be at a minimum scale of 1:62,500 or 1" to the mile, with 40-acre minimum mapping units."

While Exhibit D of application states, "on-site" mapping is required, the USDA – NRCS soils survey provides mapping units of 1: 20,000 which is improved mapping as compared to the 1: 62,500 criteria that is required under the LUPC guidelines. The original CES report also states (page 2-3, December, 2014), that the CES soils scientist "visited most of the development areas and spot checked existing soil map units using soil augers and hand shovels."

We note that while this level of soils assessment is suitable for general planning purposes. However, the NRCS soil mapping scale is not sufficient to evaluate development specific constraints. Site specific soils mapping including wetland mapping will be needed as part of any site-specific development activity. As an example, the rezoning plan includes additional land area to be allocated to the camp lots with the intention of providing improved building windows including areas for subsurface wastewater disposal areas and establishing definitive lot boundaries. At the time any specific development plans are prepared, field delineation of the wetlands and lot test pits are recommended to confirm that the land areas are suitable for the intended purpose. This will also be needed to address any buffers or other controls to mitigate phosphorus export and surface runoff from the project areas. The submitted narratives included in the zoning partition acknowledged the limitations of the higher-level planning effort that is customary for the rezoning. Our lot by lot assessment suggest

some limitations exist that will require additional investigation as part of the rezoning to clarify the development suitability.

2. The application included an assessment of slopes, soil types, limitations and natural resources using published GIS database information to determine a "Development Unit," density for the area. Sebago Technics, Inc. obtained LIDAR data for each development area from Irving to conduct an independent slope assessment. Attached are slope assessment graphics (GIS generated) assessing slope in each development area. Slopes between 0 and 10%, 10 and 20% and over 20% were calculated. All slopes over 20% were considered not suitable for development due to constructability considerations, erosion and sedimentation control, controllability of drainage and due to the Maine State Wastewater Disposal Rules deeming slopes of 20% or greater unsuitable for septic systems.
3. We have reviewed and agree with the drainage classifications of the different soil series and how they were determined to be suitable or unsuitable for development. The soils are classified correctly based upon slope and drainage class. The poorly drained and very poorly drained soils had a suitability of "Unsuitable-Wet", the somewhat poorly drained soils had a suitability of "Limited Suitability". The moderately well drained soils with slopes less than 15% had a suitability of "Generally Suitable". Any soils with slopes 15% or greater had a suitability of "Generally Unsuitable-steep".
4. We did find a discrepancy on the maps/report that should be corrected. The March 2017 Soils Suitability report, page 2-1 includes a table specifying the soil suitability classes with color identification references keyed to the maps included in that report. The corresponding map includes a legend with soil types and suitability index. We note that the legend appears to have some incorrect references to suitability. For instance, the PgE Plaisted gravelly loam soil group specified in the legend (25 to 45 percent slopes), is shown as having an SP index of "Medium" and a Suitability of "Generally Suitable". However, the report indicates these soils would be considered unsuitable. We recommend the legend be reviewed and corrected to correlate better with the report and maps.
5. The application materials state, "The Concept Plan has been developed with input from the Maine Department of Environmental Protection on allowable phosphorus loading on each of the lakes included in the Plan area. Modeling demonstrates that levels of phosphorus discharged from maximum potential development would be below allowable limits." We were not able to locate any modeling information in the submittal documents we reviewed and suggest this information be provided to the LUPC if it has not already been provided. Since the development will be subject to a Maine DEP SLODA permit, we would defer to the MDEP for review the phosphorus modeling. If portions are not subject to MDEP permitting, LUPC should consider conducting an independent phosphorus export review.

6. Since the Development areas will generally be served by private well and septic (excluding the area Served by the Sinclair Sanitary District), we would suggest the development areas be reviewed (as part of any specific development plans) by a hydrogeologist retained by the applicant and reviewed by LUPC or MDEP to assess nitrate impacts. We recommend that a nitrate analysis be completed consistent with Section 17 – Wastewater Disposal of the Maine DEP Site Location of Development Act provisions.
  
7. Development activities will most likely require new roadway's and site development construction for the commercial development areas. The soils report includes provisions (rock sandwich construction) for construction of roadways within high water table areas. We also recommend that at the time of a definitive development plan, roadway plans be engineered and submitted to the LUPC addressing topography, soils, water tables, wetlands and the conveyance and treatment/handling of surface water runoff. The same would be required for site development activities.

Since the Maine DEP and LUPC have a Memorandum of Understanding (MOU), several technical provisions of the MDEP will be applicable to this project including but not limited to water supply, wastewater, lake water quality compliance, stormwater management and erosion control. We assume the rezoning partition does not alter this MOU between LUPC and MDEP. At the time of any specific development activities are brought forward, they will be subject to the applicable MDEP requirements.

#### **IV. Individual Development Area Review Comments:**

**General:** Attached to this review letter is a summary table that includes individual lot development assessments for slopes and soils with a calculated net development area per residential unit. Commercial development areas were calculated based upon total developable area with suitable slopes and soils. The slope analysis was derived from LIDAR data provided by Irving. We have also included computer generated slope assessments for each development area, which are appended to this report.

Section 10.26 Dimensional Standards in Chapter 10 of the LUPC regulations establishes minimum lot sizes for residential, commercial and other non-residential uses. The minimum lot size for residential uses is 40,000 square feet per dwelling unit or residential campsite except where each dwelling unit is to use a common or community sewer and not on-site subsurface waste water disposal, the minimum lot size shall be 20,000 square feet per dwelling unit. The minimum lot size for commercial, industrial, and other non-residential uses involving one or more buildings is 40,000 square feet, except as provided in Section 10.26, A,3. Determining the net density for each development area provides a general understanding of the development potential based upon slopes and soils.

**Square Lake West:** The Square Lake West development area is approximately 120 acres with a proposed development cap of 30 units.

1. **Slope Analysis:** The slope analysis indicates approximately 13 acres of the development area contains slopes greater than 20 percent that are considered unsuitable for development. The greater than 20% slopes are generally scattered throughout the westerly area of the development parcel with some continuous linear slope features. The area adjacent to Square Lake generally contains 0-10% slopes interspersed with limited development areas of 10 to 20% slopes. The slope assessments suggest the development area is suitable for the intended purposes noting that the few areas of slopes greater than 20% which are not considered suitable for development due to limitations for wastewater disposal systems, erosion and drainage control considerations and slope stability. Provided the areas of 20% slope features are avoided, the slope conditions are expected to be suitable for the intended use.
2. The soils in this development area (NRCS Mapping) include PvC (Plaisted Howland), HvB (Howland) and ThD (Thorndike channery silt loam) soil series. The ThD soils are considered unsuitable due to steep slopes, shallow to bedrock and expected susceptibility to erosion when disturbed. We would note that the soils mapping and the LIDAR data depict differences in the steep slope areas since the NRCS data is not based upon the more accurate LIDAR Data. As a result, we anticipate the areas of unsuitable soils due to steep grades will be dispersed throughout the development area as shown on the enclosed LIDAR mapping which consumes approximately 13 acres of the development area. Any development activities within the project area will need to be based upon actual field mapping of the slopes and soils to accurately integrate the physical slope restrictions in to the development. The PvC and HvB soils are both generally stony soils and located on slopes 8% to 15%. These soils are generally well drained with a water table over 2 feet and considered a hydrologic group "C/D" soil.

Considering the soil classifications, slopes and limitations for development along the shoreline of Square Lake, our assessment suggests that the project area and number of planned units (30) yields an effective net density of 2.7 acres/unit suggesting the proposed density and development area is reasonable and appropriate (Please refer to the development matrix analysis appended to this report). This assessment includes deductions for slopes over 20% and allowing for 25% of the 10% to 20% (limited suitability slopes) to be considered not suitable.

**Square Lake Yexas:** The Square Lake Yexas development area is approximately 51 acres with a proposed development cap of 67 units.

1. **Slope Analysis:** The slope analysis indicates approximately 4.4 acres of the development area contains slopes greater than 20 percent and generally considered unsuitable for development. The greater than 20% slopes are generally associated with linear slope features most likely contiguous slopes along hillsides. The area adjacent to Square Lake generally contains 0-10% slopes comprising 30.2 acres of land. Somewhat restrictive

slopes (10 to 20% slopes) encompass approximately 17.2 acres of the parcel area. The slope assessment suggests the development area is partially suitable for the intended purposes noting that the slopes greater than 20% are not considered suitable for development due to limitations for wastewater disposal systems, erosion and drainage control considerations and slope stability. Provided the development planning avoids the steeper slopes and recognizes the partial limitation of the 10% -20% slopes adequate land area exists to accommodate the 67-unit density.

2. The soils in this development area (NRCS Mapping) include PgB (Plaisted gravelly loam) and HoC (Howland gravelly loam) soil series. The PgB and HoC soils are both generally gravelly loams and located on slopes 3% to 8% and 8% to 15% respectively. These soils are generally moderately well drained to well drained with a water table over 16 inches and considered a hydrologic group "C" and "C/D" soils. These soil types do not suggest any significant limitations for development beyond localized limitations as a result of a higher-grade soil mapping.

We understand the Yexas Block project area is intended to be developed as either a less than 50-unit lodge type development or a less than 17 residential camp lots. Considering the soils, streams and associated development limitations, slopes over 20% and the development setback restrictions along the shoreline of Square Lake, our assessment suggests that the project area would provide for either of the development scenarios since approximately 32 acres of developable area is available. Should the 17-camp lot scenario be pursued, that would result in an effective net density of 1.9 acres/unit.

We would note that if a 50-unit lodge type development be pursued, it is likely this type of development scenario would require a non-transient community well and potentially an engineered subsurface wastewater disposal system requiring well-head protection and a mounding/nitrate assessment to protect lake water quality.

**Square Lake E:** The Square Lake E development area is approximately 281 acres with a proposed development cap of 85 units.

1. Slope Analysis: The slope analysis indicates approximately 31 acres of the development area contain slopes greater than 20 percent and generally considered unsuitable for development. The greater than 20% slopes are generally associated with linear features most likely contiguous slopes on hillsides. The area adjacent to Square Lake generally contains a shoreline section of slopes greater than 20% restricting the development in this area. Slopes 0-10% slopes encompass approximately 138 acres. Limited suitability slopes (10 to 20% slopes) encompass approximately 112 acres of the project area. The slope assessment suggests the development area is suitable for the intended purposes noting that the slopes greater than 20% are not considered suitable for development due to limitations for wastewater disposal systems, erosion and drainage control considerations and slope stability. Provided the development planning avoids the steeper slopes and recognizes the partial limitations of the 10% -20% slopes, adequate land area exists to accommodate the 85-unit density.

2. The soils in this development area (NRCS Mapping) include PgC (Plaisted gravelly loam), HoC (Howland gravelly loam), PvC (Plasited Howland association), HcV (Howland silt-loam) soil series. These soils range from a gravelly loam to a silt-loam and are moderately well drained to well drained soils with a water table over 16 inches and considered a hydrologic group "C" and "C/D" soils. These soil types do not suggest impractical limitations for development beyond localized limitations as a result of steep slopes (over 20%) and a higher-grade soil mapping. We would note that the HcV soils are considered a finer soil and may be more susceptible to erosion when disturbed but are generally suitable for development. Wetlands areas were also identified on the project site and generally located along the Square Lake Yexas and Square Lake E property division line and near the southerly end of the Square Lake E development area. The Wetlands are considered not suitable for development.

Considering the soils, streams, wetlands and associated development limitations, slopes over 20% and the development setback restrictions along the shoreline of Square Lake, our assessment suggests that the project area and number of planned units (85) yields an effective net density of 2.2 acres/unit. This represents a reasonable and appropriate net development density (Please refer to the development matrix analysis appended to this report). This assessment includes deductions for slopes over 20% and allowing for 25% of the 10% to 20% (limited suitability slopes) to be considered not suitable.

**Long Lake A:** The Long Lake A development area is approximately 127 acres with a proposed development cap of 50 units.

1. Slope Analysis: The slope analysis indicates approximately 24 acres of the development area contain slopes greater than 20 percent and are considered unsuitable for development. The greater than 20% slopes are generally associated with linear slope features. Slopes 0-10% slopes encompass approximately 31 acres. Limited suitability slopes (10 to 20% slopes) encompassing approximately 73 acres of the project area. The slope assessments suggest the development area is partially suitable for the intended purposes noting that the slopes greater than 20% are not considered suitable for development due to limitations for wastewater disposal systems, erosion and drainage control considerations and slope stability. Provided the development planning avoids the steeper slopes and recognizes the partial limitation of the 10% -20% slopes, adequate land area exists to accommodate the 50-unit density.
2. The soils in this development area (NRCS Mapping) include PvC (Plasited Howland association) and HcV (Howland silt-loam) soil series. These soils range from a gravelly loam to a silt-loam and are moderately well drained with a water table over 16 inches and considered a hydrologic group "C/D" soils. These soil types do not suggest appreciable limitations for development beyond localized limitations as a result of steep slopes (over 20%) and results of higher-grade soil mapping. We would note that the HcV soils are considered a finer soil and may be more susceptible to erosion when disturbed but are generally suitable for development.

Considering the soils, streams, wetlands and associated development limitations, slopes over 20%, our assessment suggests that the project area and number of planned units (50) yields an effective net density of 1.5 acres/unit. This represents a reasonable and appropriate net development density (Please refer to the development matrix analysis appended to this report). This assessment includes deductions for slopes over 20% and allowing for 25% of the 10% to 20% (limited suitability slopes) to be considered not suitable.

**Long Lake B:** The Long Lake B development area is approximately 55 acres with a proposed development cap of 15 units.

1. Slope Analysis: The slope analysis indicates approximately 11 acres of the development area contains slopes greater than 20 percent and are considered unsuitable for development. The greater than 20% slopes are generally associated with linear slope. Slopes 0-10% slopes encompass approximately 17 acres. Limited suitability slopes (10 to 20% slopes) encompass approximately 27 acres of the project area. The slope assessments suggest the development area is partially suitable for the intended purposes noting that the slopes greater than 20% are not considered suitable for development due to limitations for wastewater disposal systems, erosion and drainage control considerations and slope stability.

The Lidar terrain mapping suggest a linear feature of slopes in excess of 20% runs parallel to the primary access road between the existing camps and proposed development area. This will present a physical barrier impacting the ability to access the westerly portion of the property. As a result, access to the some of the developable land maybe difficult or not practicable due to physical constraints. Therefore, while the net developable area of 2.1 acres/unit appears reasonable, we recommend further evaluation and confirmation the westerly land area can be reasonably accessed.

2. The soils in this development area (NRCS Mapping) include HoB/HoC (Howland gravelly loam) and ThD (Thorndike channery silt loam) soil series. The ThD soils are considered unsuitable due to steep slopes and expected susceptibility to erosion when disturbed. ThD soils are also shallow to bedrock which serves as a restrictive layer at 11 to 23 inches. The soils in this project area range from a gravelly loam to a silt-loam and are moderately well to somewhat excessively drained with a water table over 16 inches and considered a hydrologic group "C/D" and "D" soils. Theses soils present some limitation depending on slope and location of the restrictive layer along with higher erosion potential and stormwater management considerations.

Our assessment suggests that the project area and number of planned units (15) yields an effective net density of 2.1 acres/unit (Please refer to the development matrix analysis appended to this report). This assessment includes deductions for slopes over 20% and allowing for 25% of the 10% to 20% (limited suitability slopes) to be considered not suitable.

While this net density appears reasonable, the physical location of the mapped feature represents potential restrictions in accessing the development land and will require special attention to the management stormwater to meet Maine DEP chapter 500 regulations. Additionally, the northerly area of the project site appears to be nearly all slopes in excess of 20% and therefore not suitable for development.

In conclusion, we recommend further consideration of this development parcel as it pertains to accessing the developable areas through the steep slope areas and the developability of the northerly portion of the site since this area appears to be generally consumed by slopes in excess of 20%.

**Long Lake C:** The Long Lake C development area is approximately 121 acres with a proposed development cap of 25 units.

1. **Slope Analysis:** The slope analysis indicates approximately 47 acres of the development area contain slopes greater than 20 percent and generally considered unsuitable for development. The greater than 20% slopes appreciable and likely associated liner slope features. Slopes 0-10% slopes encompass approximately 28 acres. Limited suitability slopes (10 to 20% slopes) encompass approximately 41 acres of the project area. The slope assessment suggests the development area is suitable for the intended purposes noting that extensive slopes greater than 20% that are not considered suitable for development due to limitations for wastewater disposal systems, erosion and drainage control considerations and slope stability. These areas are will restrict the locations for development, access and require careful planning to accommodate the slopes.
2. The soils in this development area (NRCS Mapping) include HcV (Howland silt-loam), ThC (Thorndike channery silt loam) and PgB/PgC/PgD (Plaisted gravelly loam) soil series. A small area of MoB is located in the westerly corner of the site. These soils range from a gravelly loam to a silt-loam and are well, moderately somewhat excessively drained with a water table over 17 inches and considered a hydrologic group "C" and "C/D" soils. The ThC soils are generally shallow to bedrock which serves as a restrictive layer at 11 to 23 inches. Theses soils present some limitations depending on slope and location of the restrictive layer along with higher erosion potential for the surficial soils and potential difficulties addressing stormwater management.

Considering the soil types and associated development limitations including slopes over 20%, our assessment suggests that the project area and number of planned units (25) yields an effective net density of 2.0 acres/unit. This represents a reasonable and appropriate net development density (Please refer to the development matrix analysis appended to this report) noting that the steep slopes will restrict development from several areas of the project area. This assessment includes deductions for slopes over 20% and allowing for 25% of the 10% to 20% (limited suitability slopes) to be considered not suitable.

**CD-2:** The CD-2 development area is approximately 165 acres and proposed as commercial development area.

1. Slope Analysis: The slope analysis indicates approximately .16 acres of the development area contains slopes greater than 20 percent and are generally considered unsuitable for development. The greater than 20% slopes are few and likely associated with a random slope features. Slopes 0-10% slopes encompass approximately 161 acres. Limited suitability slopes (10 to 20% slopes) encompass approximately 3.5 acres of the project area. The slope assessment suggests the development area is suitable for the intended purposes noting that the few slopes greater than 20% are not considered suitable for development due to limitations for wastewater disposal systems, erosion and drainage control considerations and slope stability. These areas are very few and will have little or no influence on development.
2. The soils in this development area (NRCS Mapping) is entirely mapped as MoA (Monarda-Burnham complex) soil series. These soils range are generally a silt-loam, poorly drained with a water table of 0" to 12" with hydrologic soil group "D" classification. These soils are indicative of wetlands and are severally limited for subsurface wastewater disposal systems due to the depth to groundwater. Any development on these soils will require substantive engineering considerations for dewatering, subsurface wastewater disposal, higher erosion potential and potential difficulties addressing stormwater management.

Due to the soil classification of this development area, we recommend field mapping of the wetlands and a site-specific soils survey to verify the soils, their limitation and the overall suitability of the parcel for development. We understand some limited site-specific evaluations were completed but believe additional more specific work is required to assess the suitability of this land for development.

**CD-1:** The CD-1 development area is approximately 282 acres and proposed as commercial development area.

1. Slope Analysis: The slope analysis indicates approximately 1.6 acres of the development area contains slopes greater than 20 percent and are generally considered unsuitable for development. The greater than 20% slopes are few and likely associated with a random slope features. Slopes 0-10% slopes encompass approximately 262 acres. The limited suitability slopes (10 to 20% slopes) encompass approximately 18 acres of the project area. The slope assessment suggests the development area is suitable for the intended purposes noting that the few slopes greater than 20% are not considered suitable for development due to limitations for wastewater disposal systems, erosion and drainage control considerations and slope stability. These areas are very few and will have little or no influence on development.
2. The soils in this development area (NRCS Mapping) mapped as MoA (Monarda-Burnham complex), CdB (Canandaigua silt loam, thin solum), PvB (Plaisted Howland association)

soil series. The MoA and CdB soils are generally a silt-loam, poorly drained with a water table of 0" to 18" and include a hydrologic soil group "D" classification. These soils are indicative of potential wetlands and can be severely limited for subsurface wastewater disposal systems due to the depth to groundwater. Any development on these soils will require substantive engineering considerations for dewatering, subsurface wastewater disposal, higher erosion potential and potential difficulties addressing stormwater management.

The PvB soils are well drained with a water table depth of 26" or more and considered a hydrological group "C". These soils are generally suitable for development.

Since the CdB and MoA to the soil are prominent and located between the probably point of access and developable soils, we recommend field mapping of the wetlands and a site-specific soils survey to verify the soils, their limitation and the overall suitability of the parcel for development including means of access to the developable area. We understand some limited site-specific evaluations were completed but believe additional more specific work is required to assess the suitability of this land for development.

**CD-3a, 3b, 3c and 4:** These commercial development areas are proximate to each other and share similar physical attributes. CD-3a is approximately 11 acres, CD-3b is approximately 6 acres, CD-3c approximately 11 acres and CD-4 approximately 73 acres.

1. Slope Analysis: The slope analysis indicates the majority of the parcels contain slopes in the 0 to 10 percent range with only a very small component with slopes greater than 20%. Therefore, all four development areas are considered to have suitable slopes for development.
2. The soils in this development area (NRCS Mapping) are mapped as RaA (Red Hook and Atherton silt loams), and an area of MaB (Machias gravelly loam) soil series. The RaA soils are generally poorly drained and include a water table of 6" to 18" with hydrologic group B/D classification. These soils are indicative of potential wetlands and can be moderately limited for subsurface wastewater disposal systems due to the depth to groundwater. Any development on these soils will require substantive engineering considerations for dewatering, subsurface wastewater disposal, higher erosion potential and potential difficulties addressing stormwater management.

The MaB soils are moderately well drained with a water table depth of 18" or more and considered a hydrological group "B". These soils are generally suitable for development.

Since the RaA soil are prominent we recommend field mapping of the wetlands and a site-specific soils survey to verify the soils, their limitations and the overall suitability of the parcels for development. Given the peculiar shape of CD-3a and the narrow linear configuration of CD-3b these lots maybe overly restrictive for development. We understand some limited site-specific evaluations were completed but believe additional more specific work is required to assess the suitability of this land for development.

**Cross Lake A:** The Cross Lake A development area is approximately 112 acres with a proposed development cap of 30 units.

1. **Slope Analysis:** The slope analysis indicates approximately 1.5 acres of the development area contains slopes greater than 20 percent and are considered unsuitable for development. The greater than 20% slopes are few and likely associated with a high points or continuous slope features. Slopes 0-10% slopes encompass approximately 95.7 acres. Limited suitability slopes (10 to 20% slopes) encompass approximately 14.6 acres of the project area. The slope assessment suggests the development area is suitable for the intended purposes noting that the few slopes greater than 20% are not considered suitable for development due to limitations for wastewater disposal systems, erosion and drainage control considerations and slope stability. These areas are very few and will have little or no influence on development.
2. The soils in this development area (NRCS Mapping) include and HvB (Howland loam) and MoA (Monarda-Burnham complex). These soils range from a stony loam to a silt-loam and are poorly drained (MoA moderately) and moderately well drained (HvB) with a water table of 0-12 inches (MoA) and 17-26" (HvB) and considered a hydrologic group "D" and "C/D" soils. The MoA soils are indicative of potential wetlands and can be severely limited for subsurface wastewater disposal systems due to the depth to groundwater. Any development on these soils will require substantive engineering considerations for dewatering, subsurface wastewater disposal, higher erosion potential and potential difficulties addressing stormwater management.

Our assessment suggests that the project area and number of planned units (30) yields an effective net density of 1.9 acres/unit (Please refer to the development matrix analysis appended to this report). This assessment includes deductions for slopes over 20% and allowing for 25% of the 10% to 20% (limited suitability slopes) to be considered not suitable.

While this net density appears reasonable, the physical location of the mapped feature represents potential restrictions in accessing the development land and will require special attention the development planning and for the management of stormwater/erosion to meet Maine DEP chapter 500 regulations.

Further investigation of the MoA soils is recommended to assess both the presence of wetlands and for the identification of access to the suitable soil development area.

**Cross Lake B:** The Cross Lake B development area is approximately 99 acres with a proposed development cap of 30 units.

1. **Slope Analysis:** The slope analysis indicates approximately 1.8 acres of the development area contains slopes greater than 20 percent and are considered unsuitable for development. The greater than 20% slopes are few and likely associated with high points or continuous slope features. Slopes 0-10% slopes encompass approximately

88.3 acres. Limited suitability slopes (10 to 20% slopes) encompass approximately 9 acres of the project area. The slope assessment suggests the development area is suitable for the intended purposes noting that the few slopes greater than 20% are not considered suitable for development due to limitations for wastewater disposal systems, erosion and drainage control considerations and slope stability. These areas are very few and will have little or no influence on development.

2. The soils in this development area (NRCS Mapping) are mapped as RaA (Red Hook and Atherton silt loams), SgB (Stetson gravelly loam) and MaB (Machias gravelly loam) soil series. The RaA soils are generally poorly drained and include a water table of 6" to 18" with hydrologic group B/D classification. The MaB soils are moderately well drained and include a water table of 18 to 36 inches and carry a hydrologic group B classification. SgB soils are well drained with a water table greater than 80 inches and carry a hydrologic group A classification. The RaA soils are indicative of potential wetlands and can be moderately limited for subsurface wastewater disposal systems due to the depth to groundwater. Mapping indicates these soils areas are relatively few and should not pose any appreciable concerns. We do note that any development on the RaA soils would require substantive engineering considerations for dewatering, subsurface wastewater disposal, higher erosion potential and potential difficulties addressing stormwater management.

The MaB and SgB soils are moderately well to well drained with a water table depth of 18" or more. These soils are generally suitable for development.

Considering the soil types and associated development limitations including slopes over 20%, our assessment suggests that the project area and number of planned units (30) yields an effective net density of 2.5 acres/unit. This represents a reasonable and appropriate net development density (Please refer to the development matrix analysis appended to this report). This assessment includes deductions for slopes over 20% and allowing for 25% of the 10% to 20% (limited suitability slopes) to be considered not suitable.

**Cross Lake C:** The Cross Lake C development area is approximately 58 acres with a proposed development cap of 30 units.

1. Slope Analysis: The slope analysis indicates approximately .44 acres of the development area contains slopes greater than 20 percent and are considered unsuitable for development. The greater than 20% slopes are few and likely associated with random slope features. Slopes 0-10% slopes encompass approximately 54.8 acres. Limited suitability slopes (10 to 20% slopes) encompass approximately 3.2 acres of the project area. The slope assessment suggests the development area is suitable for the intended purposes noting that the few slopes greater than 20% are not considered suitable for development due to limitations for wastewater disposal systems, erosion and drainage control considerations and slope stability. These areas are very few and will have little or no influence on development.

2. The soils in this development area (NRCS Mapping) include PgB (Plaisted gravelly loam) and MoB (Monarda-Burnham complex) soil series. The PgB soils generally gravelly loams and located on slopes 3% to 8%. These soils are generally well drained with a water table over 26 inches and considered a hydrologic group "C" soils. These soils types do not suggest any significant limitations for development beyond localized limitations as a result of a higher-grade soil mapping. The MoB soils are silt-loams, poorly drained and generally have a water table of 0 to 12." The MoB soils present severe limitation for septic systems and would require substantive engineering for dewatering and addressing erosion and stormwater management.

Considering the soils and associated development limitations our assessment suggests that the project area and number of planned units (30) yields an effective net density of .6 acres/unit. While the total land area would accommodate the LUPC dimensional requirements of 40,000 square feet per lot, the soil and slope restrictions allow for lessor net density of approximately 20,000 square feet of net developable area per lot. This represents a fairly compact development density (Please refer to the development matrix analysis appended to this report). This assessment includes deductions for slopes over 20% and allowing for 25% of the 10% to 20% (limited suitability slopes) to be considered not suitable.

The constraints of this site will require special attention to development planning, layout and the management of stormwater/erosion to meet Maine DEP chapter 500 regulations and may include nitrate studies with potential nitrate mitigation to protect both the lake and private drinking water wells.

In conclusion, we recommend further investigation of MoB mapped soil area to verify the available development area and for the presence of restrictive soils impacting the planning, layout and configuration of development.

**Cross Lake D:** The Cross Lake D development area is approximately 185 acres with a proposed development cap of 35 units.

1. Slope Analysis: The slope analysis indicates approximately 49.2 acres of the development area contains slopes greater than 20 percent and are considered unsuitable for development. Slopes 0-10% slopes encompass approximately 54.7 acres. Limited suitability slopes (10 to 20% slopes) encompass approximately 75.8 acres of the project area. The slope assessment suggests the overall parcel is constrained due to slopes with the over 20% slopes consisting of linear features throughout the development area. The slopes of 0-10% are predominately located in the north westerly and south easterly region of the parcel. Given the orientation and locations of the steep and moderately steep slopes, it is expected the development areas will predominantly occur in the identified 0-10% slope area. As a result, the effective development area due to slopes is significantly less than the 185 acres of the overall parcel area. This suggests the relatively low density of 35 units is reasonable for this parcel.

2. The soils in this development area (NRCS Mapping) include PgB/PgC/PgD/PgE (Plaisted gravelly loam), MoB (Monarda-Burnham complex) and HoB/HoC (Howland gravelly loam) soil series. The Pg soils generally gravelly loams and located on slopes 3% to 60% (B-E slope designation). These soils are generally well drained with a water table over 26 inches and considered a hydrologic group "C" soils. These soil types do not suggest any significant limitations for development beyond localized limitations as a result of a higher-grade soil mapping and steep slopes. The MoB soils are silt-loams, poorly drained and generally have a water table of 0 to 12." The MoB soils are considered not suitable for development due to the depth to groundwater, potential presence of wetlands and erosion potential. The HoB and HoC soils are generally gravelly loams and located on slopes 3% to 8% and 8% to 15% respectively. These soils are generally moderately well drained to well drained with a water table over 16 inches and considered a hydrologic group "C/D" soils.

Considering the soil types and associated development limitations including slopes over 20%, our assessment suggests that the project area and number of planned units (35) yields an effective net density of 1.9 acres/unit. This represents a reasonable and appropriate net development density (Please refer to the development matrix analysis appended to this report) recognizing that significant areas of the 187 acres will be constrained and not suitable for development. This suggests the development units will most likely be located in the north westerly and south easterly portions of the site. This assessment includes deductions for slopes over 20% and allowing for 25% of the 10% to 20% (limited suitability slopes) to be considered not suitable.

**Cross Lake E:** The Cross Lake E development area is approximately 164 acres with a proposed development cap of 60 units.

1. Slope Analysis: The slope analysis indicates approximately 32.4 acres of the development area contains slopes greater than 20 percent and are considered unsuitable for development. Slopes 0-10% slopes encompass approximately 66.4 acres. Limited suitability slopes (10 to 20% slopes) encompass approximately 64.3 acres of the project area. The slope assessment suggests the over 20 percent slopes are primarily located in north-south orientation running parallel to the lake just easterly of the center of the parcel. As a result, development areas are expected to either side of this steep slope feature. The slopes of 0-10% and 10-20% comprise the majority of the parcel and represent slope areas suitable for the intended unit density.
2. The soils in this development area (NRCS Mapping) include PgB/PgD (Plaisted gravelly loam), MoB (Monarda-Burnham complex) and HvB/HvC (Howland loam) soil series. The Pg soils generally gravelly loams and located on slopes 3% to 8% and 15% to 30% (B and D slope designation). These soils are generally well drained with a water table over 26 inches and considered a hydrologic group "C" soils. These soil types do not suggest any significant limitations for development beyond the steep slope areas and localized limitations as a result of a higher-grade soil mapping.

The MoB soils are silt-loams, poorly drained and generally have a water table of 0 to 12.” The MoB soils are considered not suitable for development due to the depth to groundwater, potential presence of wetlands, erosion potential and development limitations. The HvB and HvC soils are generally very stony loams and located on slopes 3% to 8% and 8% to 15% respectively. These soils are generally moderately well drained to well drained with a water table of 17 to 26 inches and considered a hydrologic group “C/D” soils.

Considering the soil types and associated development limitations including slopes over 20%, our assessment suggests that the project area and number of planned units (60) yields an effective net density of 1.4 acres/unit. This represents a reasonable and appropriate net development density (Please refer to the development matrix analysis appended to this report). This assessment includes deductions for slopes over 20% and allowing for 25% of the 10% to 20% (limited suitability slopes) to be considered not suitable.

**Closure**

This review is intended to assist the LUPC with assessing the appropriateness of the individual development areas as they relate to soil types and slopes. Thank you for the opportunity to work with LUPC on this project. Please feel free to contact me with any questions or if we can be further assistance.

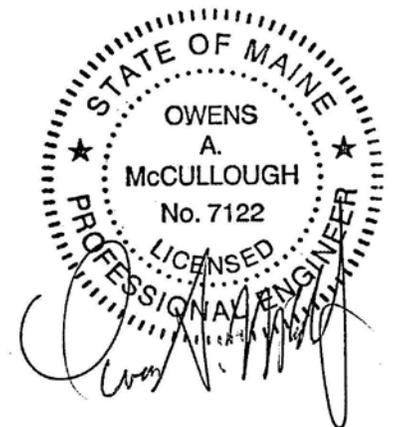
Sincerely,

SEBAGO TECHNICS, INC.



Owens A. McCullough, P.E., LEED-AP  
Sr. Vice President

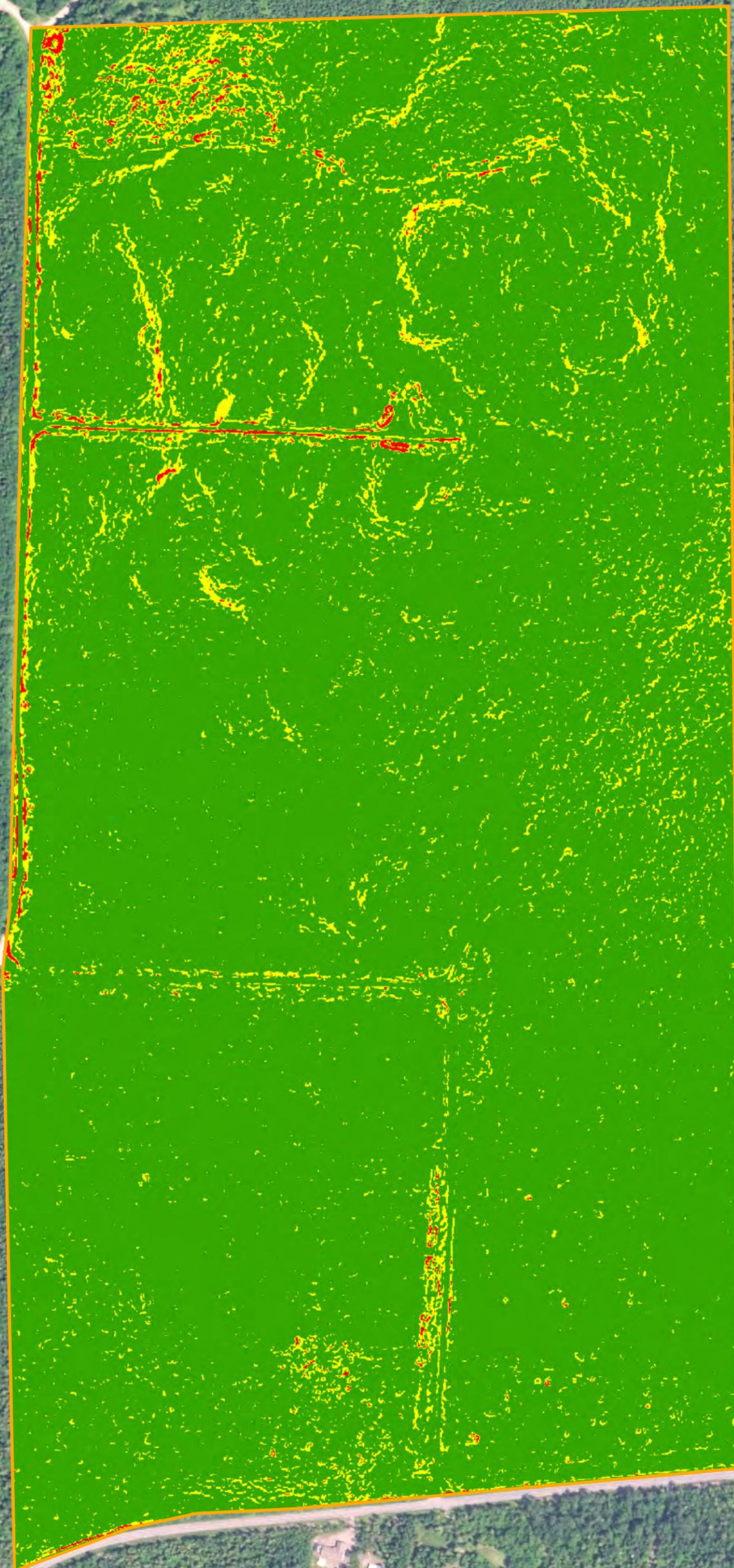
OAM: oam



Development Area Identification	Area Ac.	Proposed No. of Units	Slopes 0 - 10% Suitable Ac.	Slopes 10 - 20% Limited Suitability 25% Considered Unsuitable for Lot Density Ac.	Slopes Over 20% Unsuitable Ac.	Wetland Areas & Soils - Unsuitable Excludes Soils w/ Steep Slopes Ac.	Roads and Access Drainage Improvements 10% of Land Area Non-Commercial Ac.	Waterfront Setbacks & Riverine Area Ac.	Developable Area Ac.	Proposed Net Dev. Density Non-Commercial Ac.
Square Lake W	121	30	55.3	52.6	13.1	0	12.1	3	79.7	2.7
Yexas Block*	51.8	50	30.2	17.2	4.4	0	5.18	6.1	31.8	
	51.8	17	30.2	17.2	4.4	0	5.18	6.1	31.8	1.9
Square Lake E	281.1	85	137.6	112.4	31.1	0	28.11	10.5	183.3	2.2
Long Lake A	127.4	50	30.7	72.9	23.8	0	12.74	0.1	72.5	1.5
Long Lake B	54.85	15	16.8	26.7	11.4	0	5.485	0	31.3	2.1
Long Lake C	121.21	25	27.8	40.8	47	0	12.121	3	48.9	2.0
CD -2	165	**	161	3.5	0.16	161.3	**	0	0.0	**
CD-1	281.5	**	262.1	17.8	1.6	185	**	0	90.5	**
CD-3b, 3c, & CD-4	94.9	**	92.6	2	0.33	82	**	0	12.1	**
CD-3a	12	**	10.9	0.81	0.11	11.9	**	0	0.0	**
Cross Lake B	99	30	88.3	9	1.8	9.6	9.9	0	75.5	2.5
Cross Lake A	111.7	30	95.7	14.6	1.5	38	11.17	0.9	56.5	1.9
Cross Lake C	58.5	30	54.8	3.2	0.44	32	5.85	0	19.4	0.6
Cross Lake D	185	35	54.7	75.8	49.2	32	18.5	0	66.4	1.9
Cross Lake E	164	60	66.4	64.3	32.4	12.8	16.4	1.1	85.2	1.4

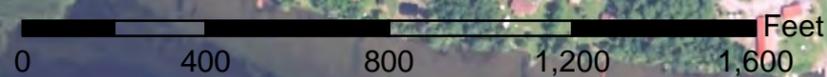
\* Yexas Block includes two development scenarios - less than 50 commercial lodging type units or less than 17 traditional residential subdivision lots

\*\* Commercial Development unit density undetermined and assumed to be dependent upon type of development.



CD-1 Development Area  
0-10% Slope = 262.132 Acres  
10-20% Slope = 17.828 Acres  
>20% Slope = 1.581 Acres  
Total Area = 281.542 Acres

CD-1 Slope VALUE	
	0 - 10
	10.00000001 - 20
	20.00000001 - 62

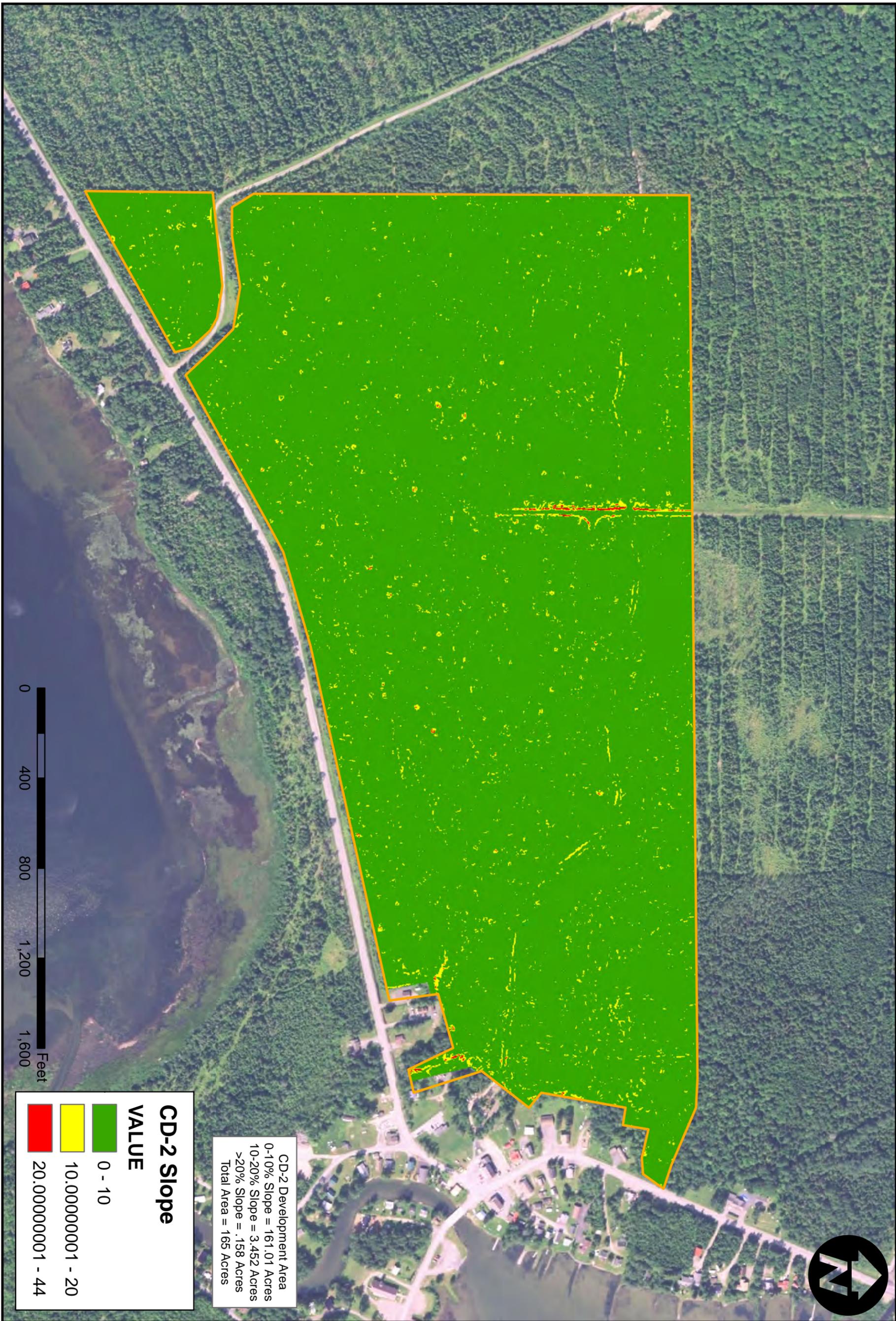


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### SLOPE EVALUATION OF FISH RIVER CHAIN OF LAKES DEVELOPMENT AREAS

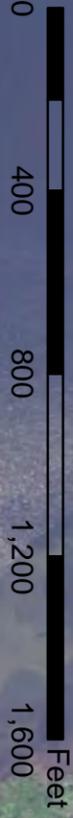
SCALE: 1" = 400'  
DATE: 03/07/18

LOCATION: CD-1	FOR: J.D. IRVING LIMITED	INFORMATION: 2011 LIDAR DERIVED DATA PROVIDED BY J.D. IRVING, LIMITED
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CD-2 Development Area  
 0-10% Slope = 161.01 Acres  
 10-20% Slope = 3,452 Acres  
 >20% Slope = .158 Acres  
 Total Area = 165 Acres

CD-2 Slope	
VALUE	
	0 - 10
	10.000000001 - 20
	20.000000001 - 44



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SLOPE EVALUATION  
 OF:  
 FISH RIVER CHAIN OF LAKES DEVELOPMENT AREAS  
 FOR:  
 J.D. IRVING LIMITED

DATE: 03/07/18  
 SCALE: 1" = 400'  
 PROJ. NO.: 15045  
 SHEET 1 OF 1



CD-3a Development Area  
0-10% Slope = 10.881 Acres  
10-20% Slope = .806 Acres  
>20% Slope = .106 Acres  
Total Area = 11.992 Acres

**CD-3a Slope**  
**VALUE**

	0 - 10
	10.00000001 - 20
	20.00000001 - 30

0 300 600 900 1,200 Feet



CD-3b/CD-3c/CD-4 Development Area  
 0-10% Slope = 92.56 Acres  
 10-20% Slope = 2.03 Acres  
 >20% Slope = .33 Acres  
 Total Area = 94.92 Acres

**CD-3b/CD-3c/CD-4 Slope VALUE**

	0 - 10
	10.00000001 - 20
	20.00000001 - 43

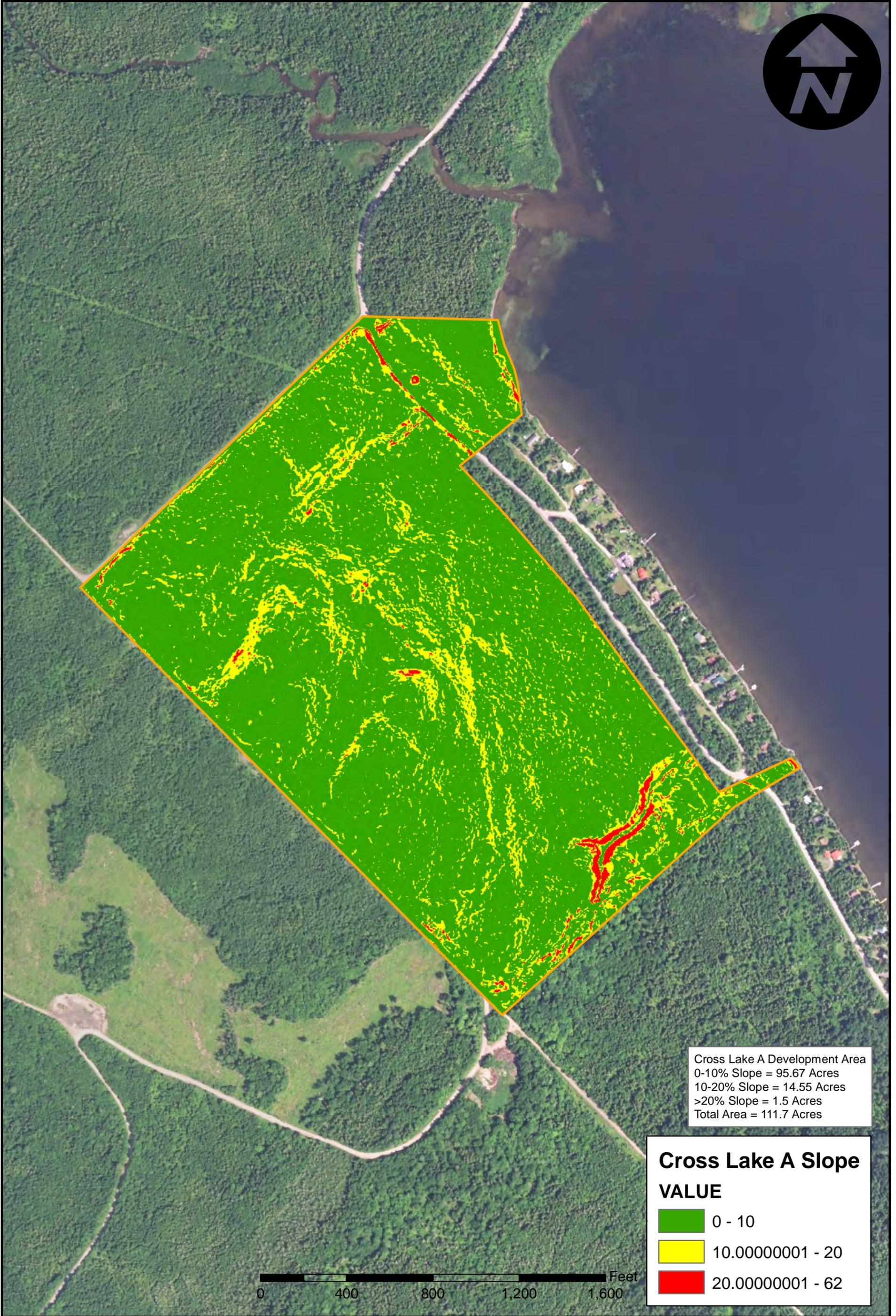


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**SLOPE EVALUATION OF FISH RIVER CHAIN OF LAKES DEVELOPMENT AREAS**

SCALE: 1" = 300'  
 DATE: 03/07/18

LOCATION: CD-3b/CD-3c/CD-4	FOR: J.D. IRVING LIMITED	INFORMATION: 2011 LIDAR DERIVED DATA PROVIDED BY J.D. IRVING, LIMITED
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Cross Lake A Development Area  
 0-10% Slope = 95.67 Acres  
 10-20% Slope = 14.55 Acres  
 >20% Slope = 1.5 Acres  
 Total Area = 111.7 Acres

**Cross Lake A Slope VALUE**

	0 - 10
	10.00000001 - 20
	20.00000001 - 62



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**SLOPE EVALUATION OF FISH RIVER CHAIN OF LAKES DEVELOPMENT AREAS**

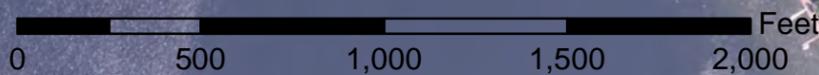
LOCATION: CROSS LAKE A	FOR: J.D. IRVING LIMITED	INFORMATION: 2011 LIDAR DERIVED DATA PROVIDED BY J.D. IRVING, LIMITED	SCALE: 1" = 400'
			DATE: 03/07/18



Cross Lake B Development Area  
 0-10% Slope = 88.25 Acres  
 10-20% Slope = 8.97 Acres  
 >20% Slope = 1.84 Acres  
 Total Area = 99.06 Acres

**Cross Lake B Slope  
 VALUE**

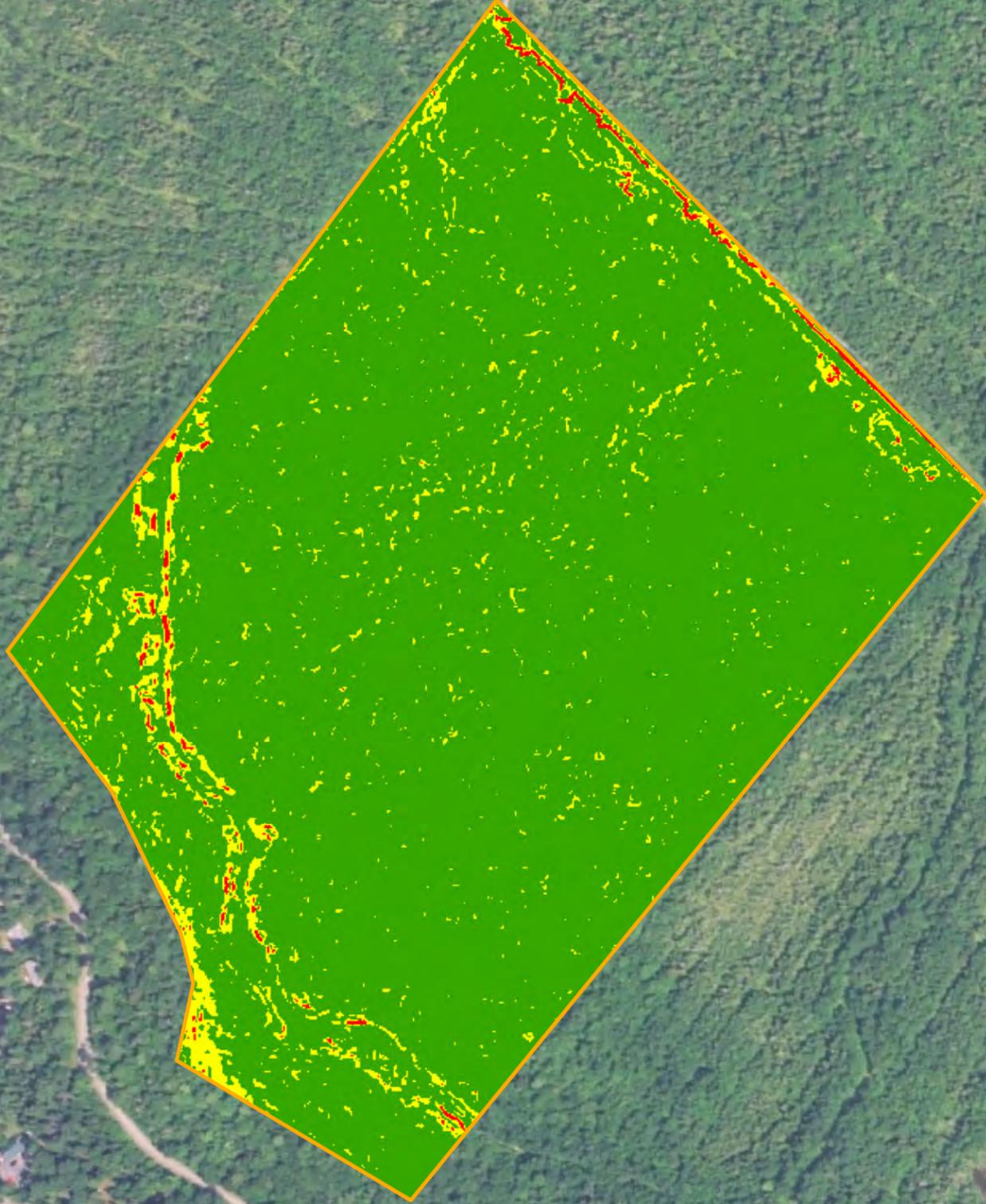
- 0 - 10
- 10.00000001 - 20
- 20.00000001 - 69



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**SLOPE EVALUATION  
 OF FISH RIVER CHAIN OF LAKES DEVELOPMENT AREAS**

LOCATION: CROSS LAKE B	FOR: J.D. IRVING LIMITED	INFORMATION: 2011 LIDAR DERIVED DATA PROVIDED BY J.D. IRVING, LIMITED	SCALE: 1" = 500'
			DATE: 03/07/18



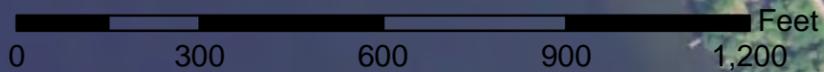
Cross Lake C Development Area  
 0-10% Slope = 54.82 Acres  
 10-20% Slope = 3.2 Acres  
 >20% Slope = .44 Acres  
 Total Area = 58.45 Acres

### CROSS LAKE C

#### SLOPE

#### VALUE

- 0 - 10
- 10.00000001 - 20
- 20.00000001 - 60

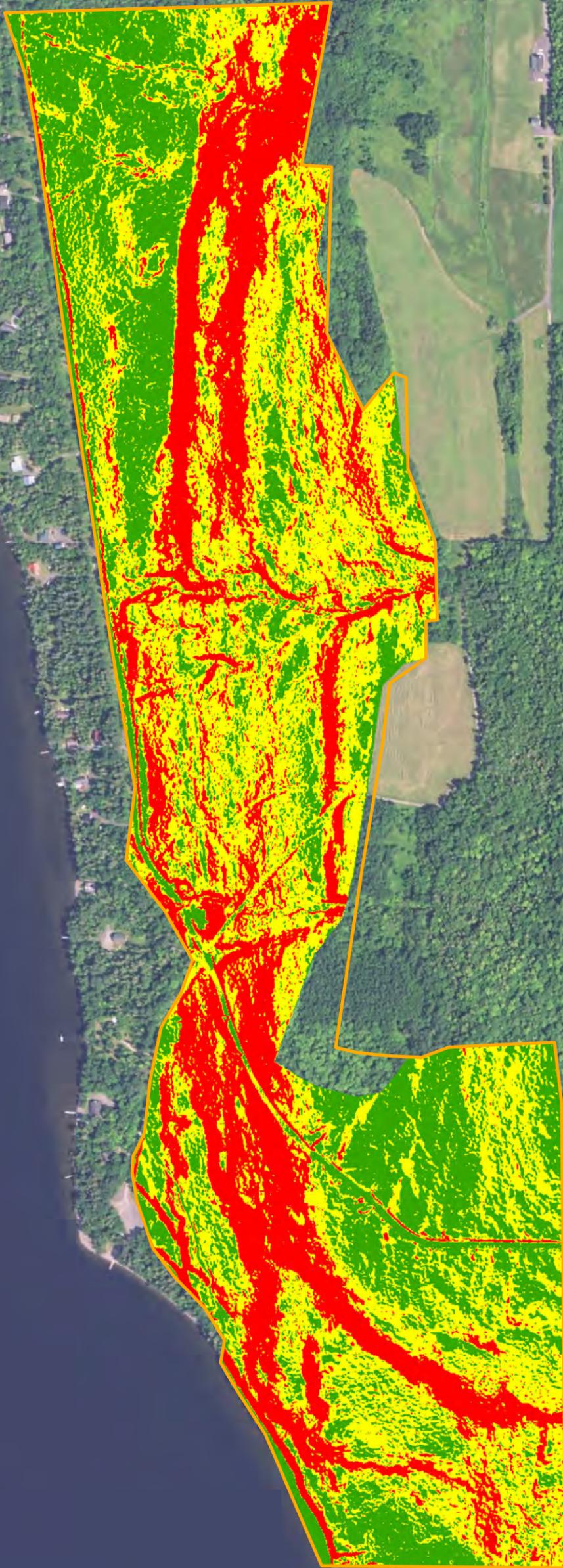


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#### SLOPE EVALUATION OF FISH RIVER CHAIN OF LAKES DEVELOPMENT AREAS

SCALE: 1" = 300'  
 DATE: 03/07/18

LOCATION: CROSS LAKE C	FOR: J.D. IRVING LIMITED	INFORMATION: 2011 LIDAR DERIVED DATA PROVIDED BY J.D. IRVING, LIMITED
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Cross Lake D Development Area  
 0-10% Slope = 54.74 Acres  
 10-20% Slope = 75.78 Acres  
 >20% Slope = 49.24 Acres  
 Total Area = 184.91 Acres

**Cross Lake D Slope VALUE**

- 0 - 10
- 10.00000001 - 20
- 20.00000001 - 118

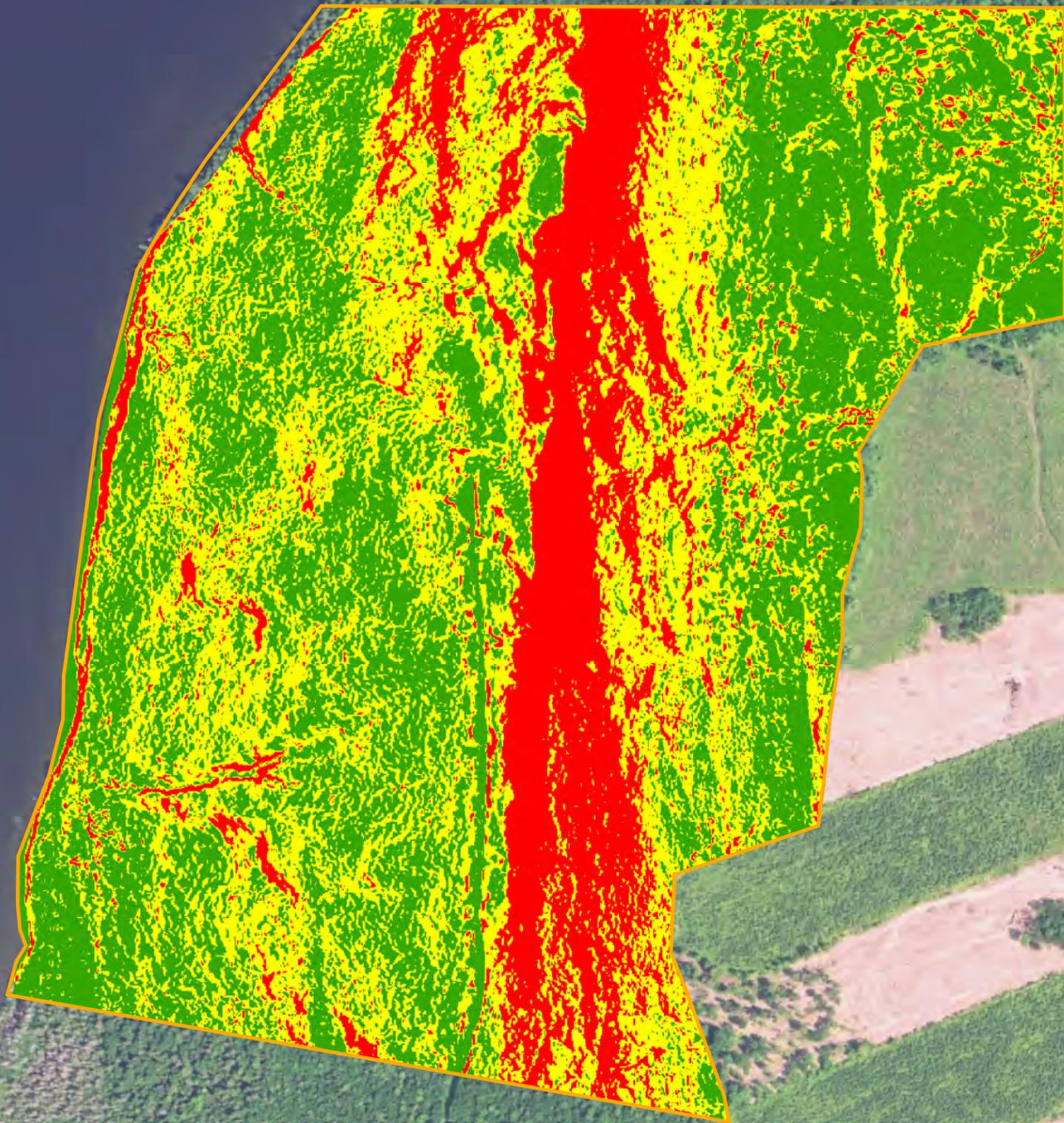


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**SLOPE EVALUATION OF FISH RIVER CHAIN OF LAKES DEVELOPMENT AREAS**

LOCATION: CROSS LAKE D		FOR: J.D. IRVING LIMITED	INFORMATION: 2011 LIDAR DERIVED DATA PROVIDED BY J.D. IRVING, LIMITED
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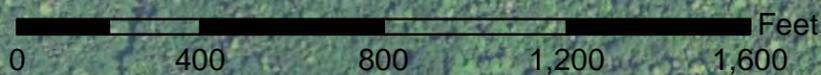
SCALE: 1" = 500'  
 DATE: 03/07/18



Cross Lake E Development Area  
 0-10% Slope = 66.37 Acres  
 10-20% Slope = 64.34 Acres  
 >20% Slope = 32.42 Acres  
 Total Area = 164 Acres

**Cross Lake E Slope  
 VALUE**

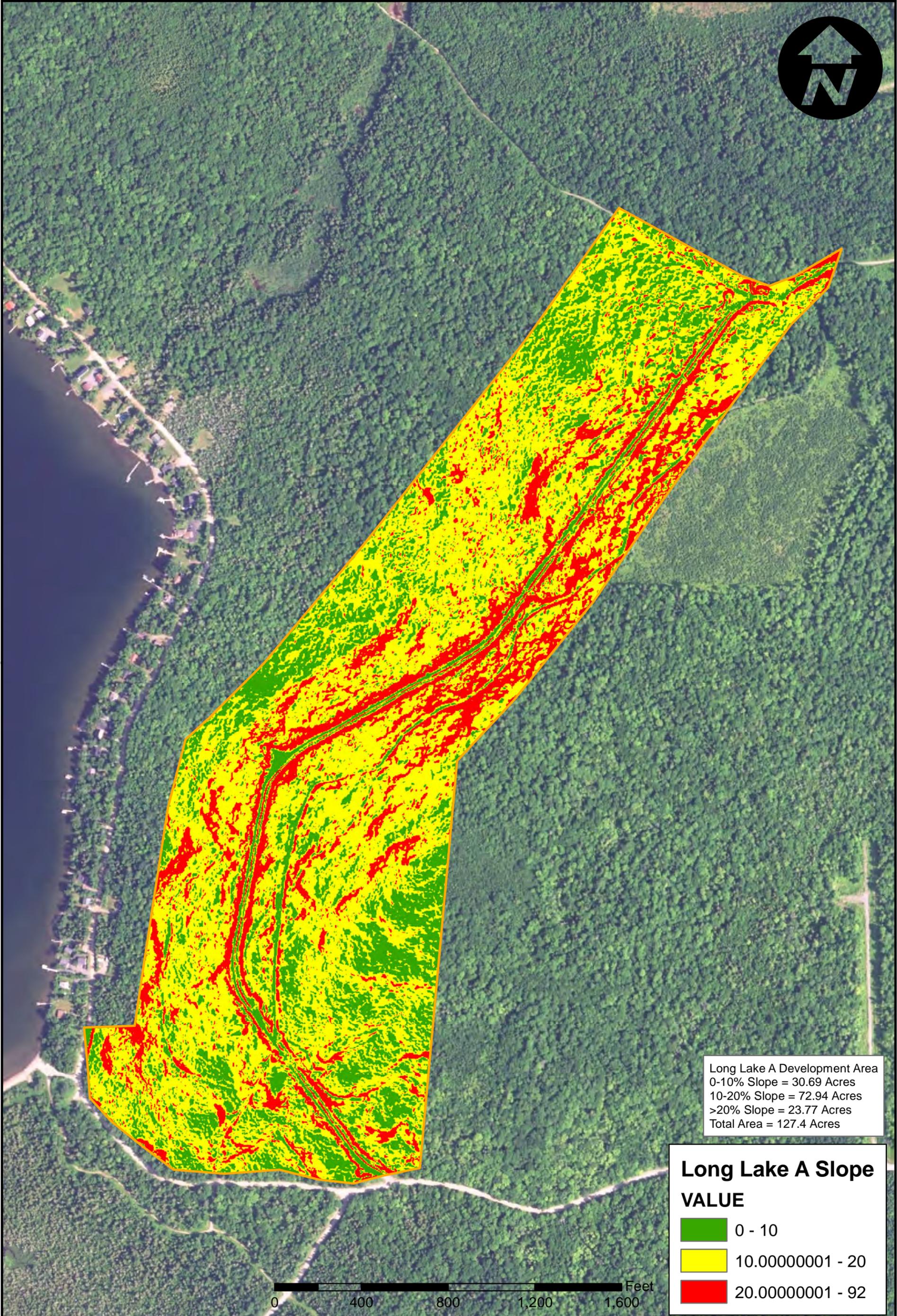
-  0 - 10
-  10.00000001 - 20
-  20.00000001 - 76



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**SLOPE EVALUATION  
 OF FISH RIVER CHAIN OF LAKES DEVELOPMENT AREAS**

LOCATION: CROSS LAKE E	FOR: J.D. IRVING LIMITED	INFORMATION: 2011 LIDAR DERIVED DATA PROVIDED BY J.D. IRVING, LIMITED	SCALE: 1" = 400'
			DATE: 03/08/18



Long Lake A Development Area  
0-10% Slope = 30.69 Acres  
10-20% Slope = 72.94 Acres  
>20% Slope = 23.77 Acres  
Total Area = 127.4 Acres

**Long Lake A Slope VALUE**

	0 - 10
	10.00000001 - 20
	20.00000001 - 92

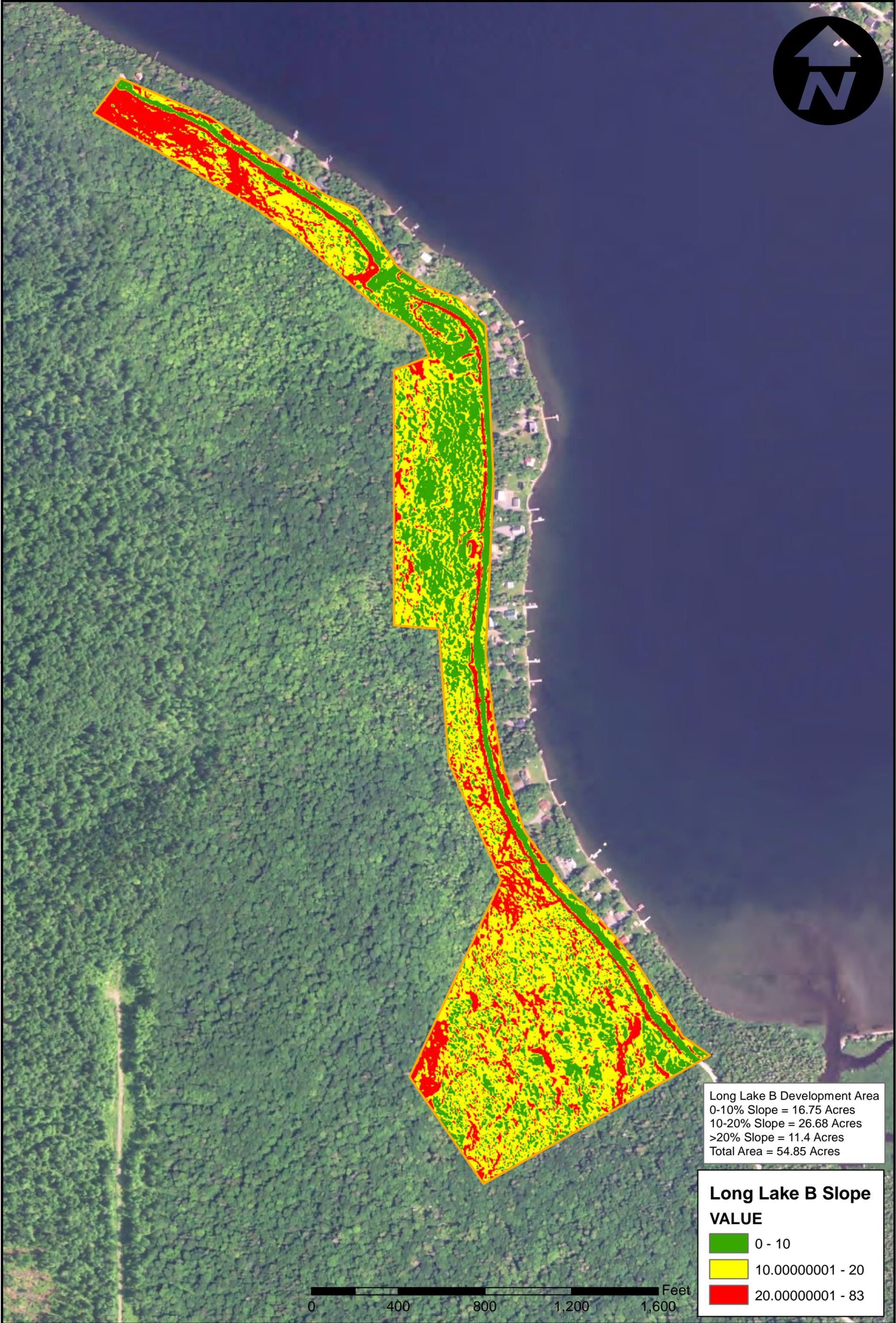
0 400 800 1,200 1,600 Feet



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**SLOPE EVALUATION  
OF FISH RIVER CHAIN OF LAKES DEVELOPMENT AREAS**

LOCATION: LONG LAKE A	FOR: J.D. IRVING LIMITED	INFORMATION: 2011 LIDAR DERIVED DATA PROVIDED BY J.D. IRVING, LIMITED	SCALE: 1" = 400'
			DATE: 03/07/18



Long Lake B Development Area  
0-10% Slope = 16.75 Acres  
10-20% Slope = 26.68 Acres  
>20% Slope = 11.4 Acres  
Total Area = 54.85 Acres

Long Lake B Slope VALUE	
	0 - 10
	10.00000001 - 20
	20.00000001 - 83

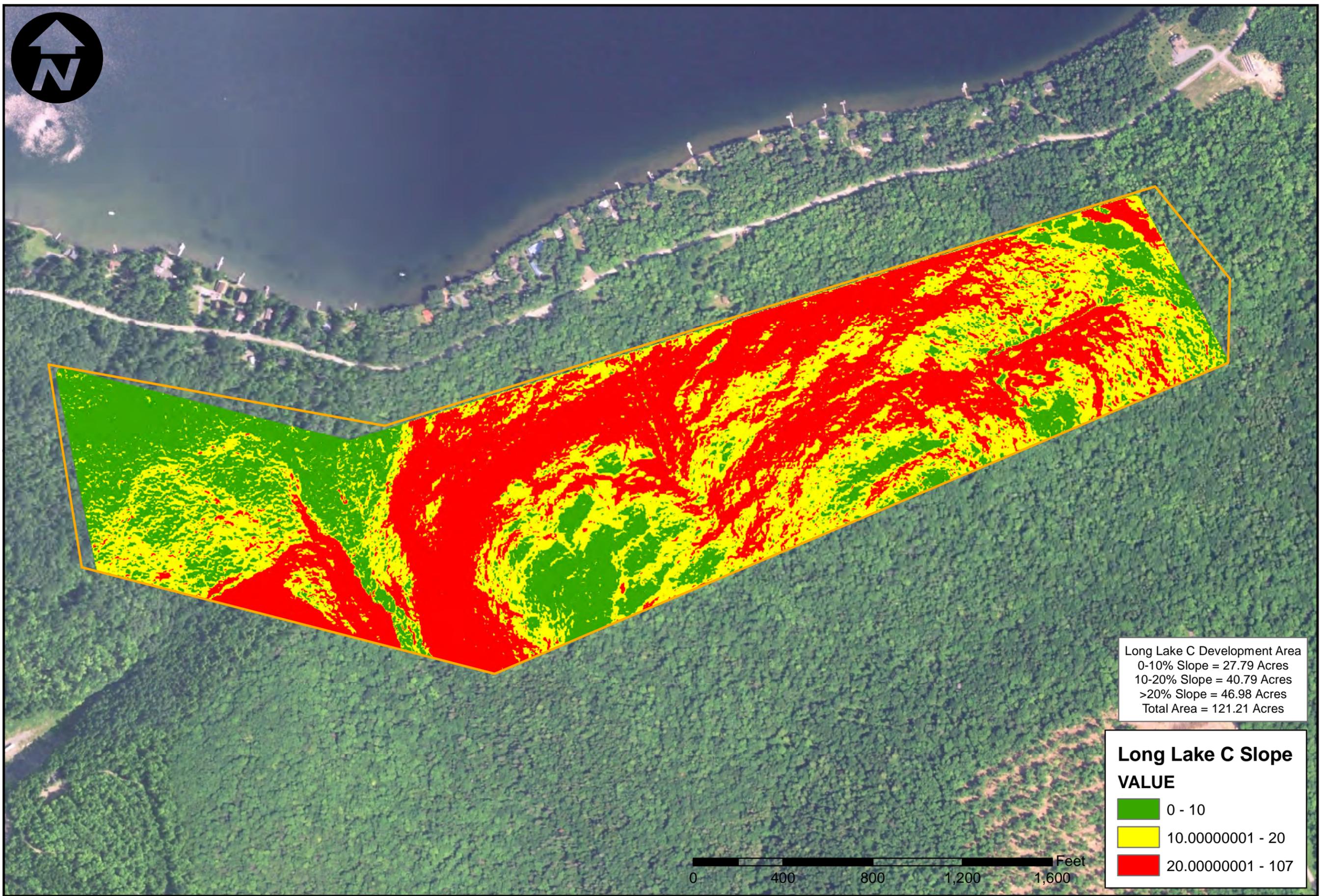


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**SLOPE EVALUATION  
OF FISH RIVER CHAIN OF LAKES DEVELOPMENT AREAS**

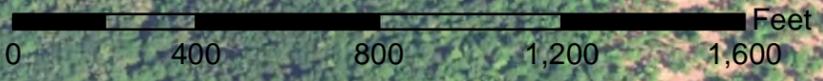
SCALE: 1" = 400'  
DATE: 03/07/18

LOCATION: LONG LAKE B	FOR: J.D. IRVING LIMITED	INFORMATION: 2011 LIDAR DERIVED DATA PROVIDED BY J.D. IRVING, LIMITED
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Long Lake C Development Area  
 0-10% Slope = 27.79 Acres  
 10-20% Slope = 40.79 Acres  
 >20% Slope = 46.98 Acres  
 Total Area = 121.21 Acres

Long Lake C Slope VALUE	
	0 - 10
	10.00000001 - 20
	20.00000001 - 107



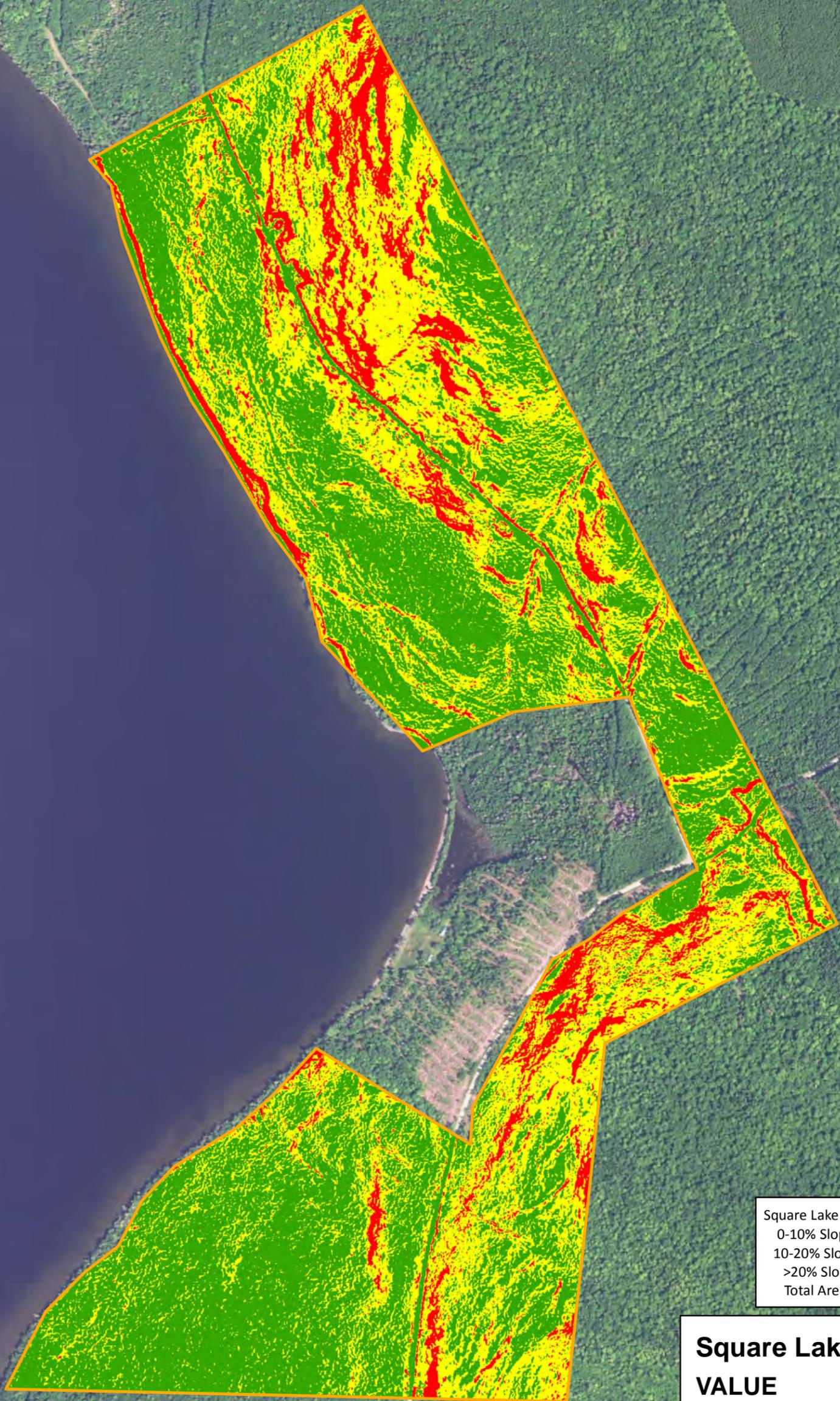
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SLOPE EVALUATION  
 OF: FISH RIVER CHAIN OF LAKES DEVELOPMENT AREAS  
 FOR: J.D. IRVING LIMITED

DATE:	03/07/2018
SCALE:	1" = 400'
PROJ. NO:	15045

SHEET 1 OF 1



Square Lake E Development Area  
 0-10% Slope = 137.568 Acres  
 10-20% Slope = 112.429 Acres  
 >20% Slope = 31.085 Acres  
 Total Area = 281.084 Acres

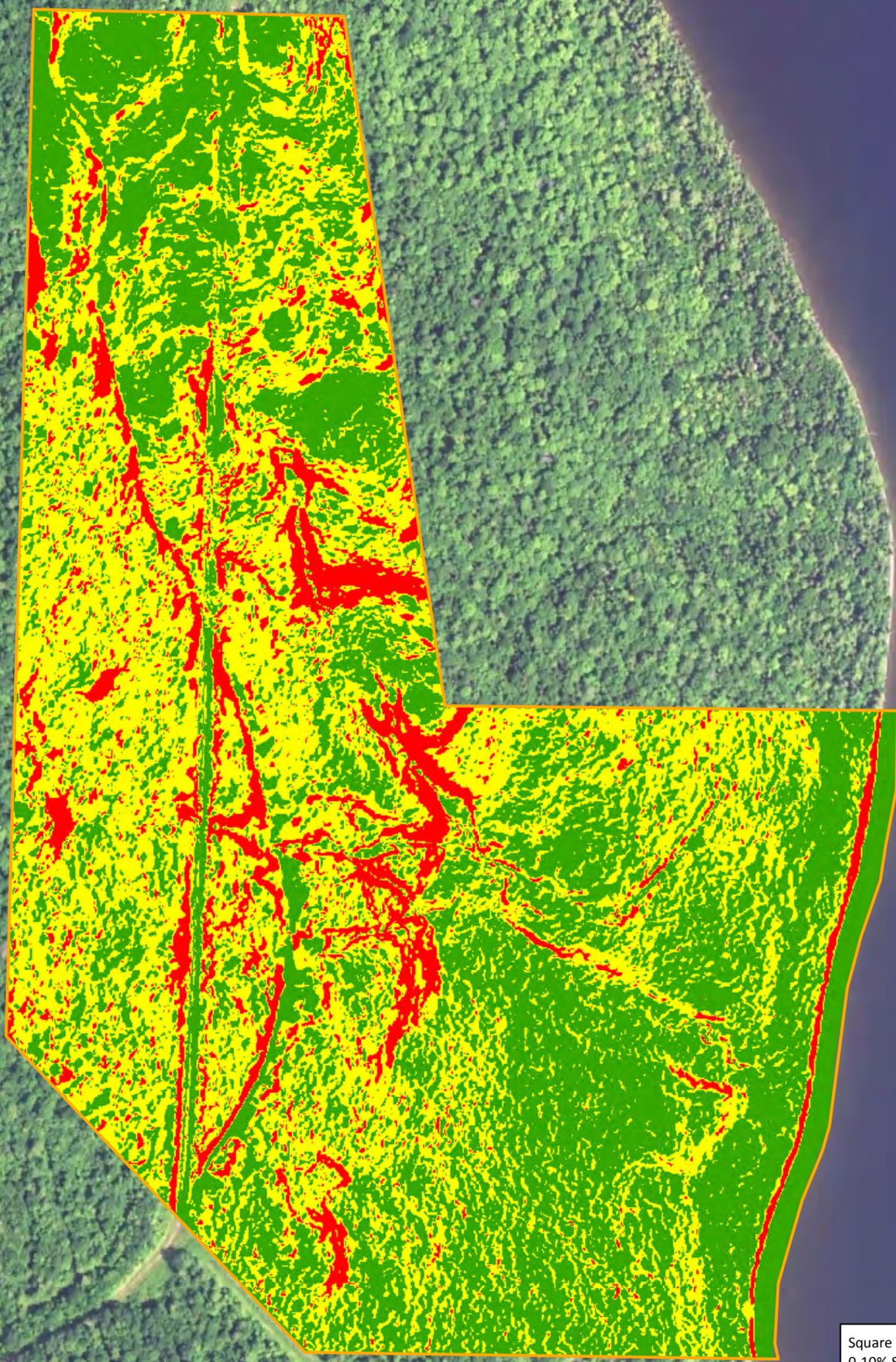
Square Lake E Slope VALUE	
	0 - 10
	10.00000001 - 20
	20.00000001 - 99



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**SLOPE EVALUATION OF FISH RIVER CHAIN OF LAKES DEVELOPMENT AREAS**

LOCATION: SQUARE LAKE E	FOR: J.D. IRVING LIMITED	INFORMATION: 2011 LIDAR DERIVED DATA PROVIDED BY J.D. IRVING, LIMITED	SCALE: 1" = 600'
			DATE: 03/07/18



Square Lake W Development Area  
0-10% Slope = 55.291 Acres  
10-20% Slope = 52.605 Acres  
>20% Slope = 13.125 Acres  
Total Area = 121.021 Acres

**Square Lake W Slope VALUE**

	0 - 10
	10.00000001 - 20
	20.00000001 - 78

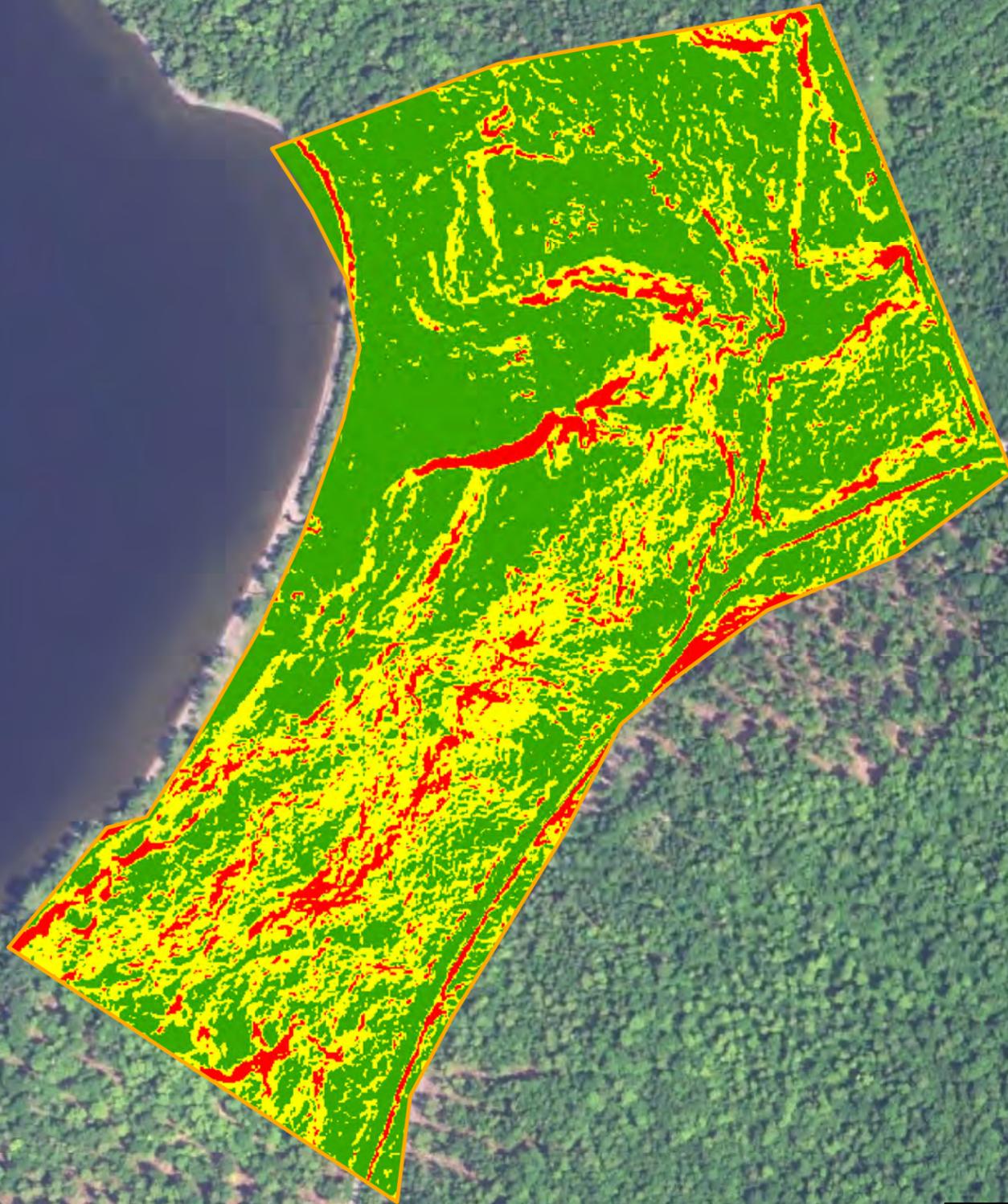


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**SLOPE EVALUATION OF FISH RIVER CHAIN OF LAKES DEVELOPMENT AREAS**

LOCATION: SQUARE LAKE W	FOR: J.D. IRVING LIMITED	INFORMATION: 2011 LIDAR DERIVED DATA PROVIDED BY J.D. IRVING, LIMITED
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SCALE: 1" = 300'  
DATE: 03/08/18



Yerxa Block Development Area  
 0-10% Slope = 30.183 Acres  
 10-20% Slope = 17.191 Acres  
 >20% Slope = 4.411 Acres  
 Total Area = 51.801 Acres

**Yerxa Block Slope VALUE**

	0 - 10
	10.00000001 - 20
	20.00000001 - 100



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**SLOPE EVALUATION OF FISH RIVER CHAIN OF LAKES DEVELOPMENT AREAS**

LOCATION: YERXA BLOCK	FOR: J.D. IRVING LIMITED	INFORMATION: 2011 LIDAR DERIVED DATA PROVIDED BY J.D. IRVING, LIMITED	SCALE: 1" = 300'
			DATE: 03/07/18