As-Built Report for the Flat Lake, Highway 103, HADD Compensation Project: Shoreline and Slope Vegetation in 2005

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December 2005

Introduction

Flat Lake is part of the East River Watershed, a drainage basin located in the northeastern portion of St. Margarets Bay in the Halifax Regional Municipality (HRM). The twinning of Highway 103 required a partial in-filling of Flat Lake to accommodate new lanes and the westbound off-ramp at Exit 5. In order to protect lake water quality and restore habitat, native and indigenous (to the area) topsoils, woody material and herbaceous plants were used to vegetate the newly constructed slope. Photographs are provided in two accompanying *PowerPoint*® files (see also the large-format overview drawing provided with this report).

A dense cover of indigenous topsoils and native lakeshore trees, shrubs, ferns, bulrushes, rushes, sedges, grasses and wildflowers on the rocked slope will:

- Maintain the existing riparian biodiversity;
- Protect the slope from erosion;
- Function as a biological filter to remove pollutants and suspended sediments associated with highway runoff through settling, adsorption and biological uptake; and
- Create shelter and habitat for birds, small amphibians and invertebrates, including fish food.

(1) Vegetation Surveys and Salvage Prior to Construction

In June 2004 and during construction in 2005 (June-July), the common plant species and communities found along the shoreline of Flat Lake were noted. The shoreline of Flat Lake prior to construction was rocky, with trees and large shrub species bordering the lake and vegetation typical of highway back slopes occupying a thin soil layer. Vegetation largely consisted of native trees, shrubs, ferns, forest-floor species and wild flowers. Some introduced, naturalized, weedy species were also present, especially near the road shoulder. Table 1 lists the common native species with their preferred habitat type. Most of these species are expected to re-populate the new slope following transplanting of clumps of vegetation and soil from the lake's riparian zone, or top-dressing of the slope with surficial 'grubbings' containing topsoil, roots, spores and seed.

Stem cuttings of shrub species found around the lake were also taken for propagation during June and July of 2005. Since most native shrubs from this area spread through roots and form 'clones', root cuttings were taken from many different plants of the same species in different sites in order to diversify the genetic pool. These root plugs will be ready for transplanting in the spring of 2006.

Table 1. Common Native Plant Species Noted at Flat Lake, Highway 103, HRM.

Species	Site Conditions
Trees	
Birch (*Betula* spp.)	
Choke Cherry (*Prunus virginiana*)	
Pin Cherry (*Prunus pennsylvanica*)	Full sun. Roadside, cut-overs; soil tolerant.
Red Maple (*Acer rubrum*)	
Red Oak (*Quercus rubra*)	
Spruce (*Picea* spp.)	
White Pine (*Pinus strobus*)	Sun. Sandy or gravelly acidic soils, dry or moist
Shrubs	
Alder (*Alnus* spp.)	Sun, shade. Moist and poorly drained soils, pH tolerant, nitrogen fixing.
Alternate Leaf Dogwood (*Cornus alternifolia*)	Forest under-storey or edge. pH tolerant.
Bayberry (*Myrica pensylvanica*)	Sun. Dry soils, low fertility, pH tolerant, nitrogen fixing. Low growing.
Blackberry (*Rubus* spp.)	Sun. Infertile soil. Trailing or low growing.
Black Chokeberry (*Aronia melanocarpa*)	Sun to part shade. Adaptable to different soils, can grow in acidic soils. Low growing when in exposed situations.
Black Huckleberry (*Gaylussachia baccata*)	Sun or shade. Wet or dry acidic soils. Low growing to taller, depending on conditions.
Bristly Sarsaparilla (*Aralia hispida*)	Rocky, gravelly roadsides, low fertility soil. Pioneer in cut-over land. Low growing, individual plants.
Bush Honeysuckle (*Diervilla lonicera*)	Open, exposed, sun to shade. Edges of woods. Soil tolerant - well drained, infertile. Spreads and stabilizes soils. Low growing.
False Holly (*Neopanthus mucronata*)	Sun to shade. Moist soils. Lakesides, swamps. Tall shrub.
Labrador Tea (*Ledum groenlandicum*)	Sun to part shade. Acidic, moist soils. Low growing.
Lambkill (*Kalmia angustifolia*)	Full to partial sun. Dry to moist, acidic soils, organic to sandy. Low growing.

Species	Site Conditions
Meadowsweet (*Spirea alba*)	Sun. Soil tolerant, moist to dry; pH tolerant. Low growing.
Raspberry (*Rubus* spp.)	Sun. Soil tolerant. Pioneer species.
Red Elderberry (*Sambucus racemosa*)	Sun to partial shade. Soil tolerant, moist to dry, pH tolerant. Tall shrub. Pioneer, spreads readily.
Rhodora (*Rhododendron canadense*)	Sun. Acidic bogs, moist infertile soils. Low growing.
Sweetfern (*Comptonia peregrina*)	Sun. Well drained, acidic infertile soils. Nitrogen fixer. Pioneer colonizer of disturbed sites. Spreads and stabilizes soils. Low growing.
Wild Blueberry (*Vaccinium angustifolium*)	Sun. Sandy infertile acidic soils. Spreads and stabilizes soils from underground rhizomes.
Wild Raisin (*Viburnum nudum*)	Sun to part shade. Soil tolerant, likes acidic. Individual to stands. Medium height.
Wild Rose (*Rosa virginiana*)	Sun to part shade. Soil tolerant. Low growing.
Ground Covers Typical of the Forest Floor	
Bunchberry (*Cornus canadensis*)	Ground cover shrub. Creeping rhizomes, large colonies. Sometimes pioneer plant.
Clintonia-lily (*Clintonia borealis*)	Perennial herb. Deciduous to mixed woods.
Goldthread (*Coptis trifolia*)	Evergreen, basal leaves. Spreads by rhizomes.
Mayflower (*Epigaea repens*)	Prostrate evergreen shrub. Acidic well drained soils.
Starflower (*Trientalis borealis*)	Perennial. Pioneer. Spreads by rhizomes. Coniferous, deciduous, mixed woods.
Lily-of-the-valley (*Maianthemum canadense*)	Forms large colonies. Spreads by rhizomes.
Wild Sarsaparilla (*Aralia nudicaulis*)	Dry forest floor.
Wintergreen or Teaberry (*Gaultheria procumbens*)	Evergreen ground cover shrub. Creeping rhizomes, large colonies. Acidic soils.
Ferns	
Bracken Fern (*Pteridium aquilinum*)	Common, open, cut over areas, roadsides. Poor, infertile soils. pH tolerant.
Cinnamon Fern (*Osmunda cinnamomea*)	Sun. Poorly drained soils. pH tolerant.
Sensitive Fern (*Onoclea sensibilis*)	Sun to shade. Moist soils. pH tolerant.

(*2) Constructing and Vegetating the Slope*

A new slope along a portion of the south shore of Flat Lake was constructed by filling in the lake with large armour rock, then smaller rock mixed in with common fill (see the accompanying *Power-Point*® As-Built file). The infilling process started at the east end of the lake, Station 33+80, and continued westward to Station 33+215 (see the large-format overview drawing). The design called for a 1:1 slope face which in turn would affect ~1,600 m^2 of lake bed. However, as the in-filling continued, the toe began to drop into the lake between Stations 33+120 and 33+140. In order to achieve a stable slope capable of supporting the highway, more rock and fill were used from east of Station 33+140 westward which resulted in a slope that was more like a 2:1 slope. The resulting "area of compensation" is calculated as 2,576 m^2 (*i.e.*, the area between the old shoreline and the new toe-of-slope).

After the rock and common fill slope was complete in early July, grubbing material was top-dressed over the slope to a thickness of about 30 cm. After placement of the grubbings, clumps of native vegetation and attached soil were transplanted into the grubbings and firmed-in using the excavator bucket. Clumps were initially placed several metres apart, but they were transplanted at denser numbers as the construction moved westward (see photos in the accompanying *Power- Point*® As-Built file). During the in-filling, a 'mud wave' appeared between the new slope and the twin turbidity curtains. Riparian species were transplanted into the mud wave by slinging them over by hand and by hand-planting from a small a boat.

An attempt was made to transplant the clumps to the appropriate area on the new slope to meet roadside as well as ecological vegetation goals. Species that prefer moister soil and/or taller growing species (*e.g.* Red Maple, Willows, and Alders) were placed, whenever possible, towards the bottom of the slope (however, at the end of the process, clumps of tall-growing species were placed at all levels of the slope). Lower growing species, or those that inhabit dryer soil and would spread rapidly to stabilize the slope, were also preferentially place towards the top (*e.g.* Wild Rose, Sweetfern, Bush Honeysuckle, and Blueberry).

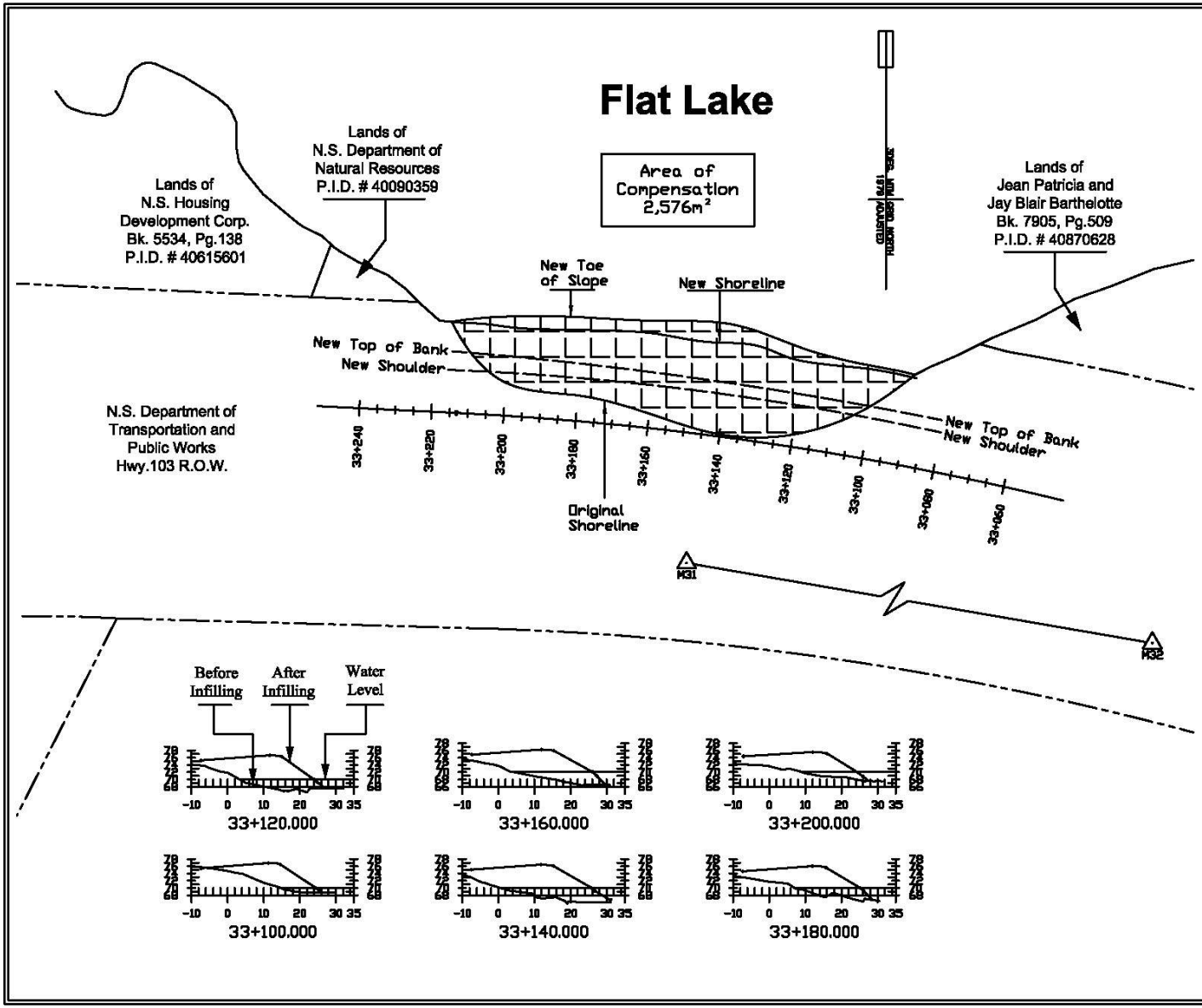
Transplanting of clump vegetation took several weeks during July. The slope was periodically watered using pumped lake water both during and after planting. After planting, some *Nova Scotia Highway Seed Mix* was also hand spread on the steeper, eastern end of the slope (1:1 slope). Finally, hay mulch was hand-spread over bare soils on the entire slope. In total, 1,594 m^2 of slope and shoreline were vegetated. As noted earlier, additional shrub plugs will be transplanted within this area next spring.

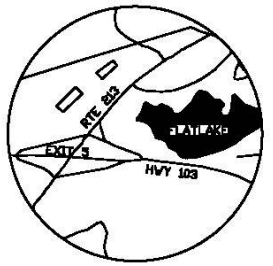
(3) Post-Construction Monitoring

Observations on the success of the vegetation were made during the remainder of July and from August into November. Although the leaves turned brown on most of the woody growth, by mid-August there was new leaf growth appearing on many clumps. By late fall, new sprouts were evident

coming up from the ground from many shrubs and Bracken Fern indicating excellent plant survival and root regeneration.

In the future, monitoring will be conducted at regular construction stations, set at 20 m intervals. Photos of the monitoring stations are provided in an accompanying *Power-Point*® monitoring file. A permanent stake will be placed at the bottom of the slope as well as the top, and the species present and percent cover will be recorded in a two metre plot width between the top and bottom of the slope. Monitoring will begin in early summer of 2006 and continue annually for a five year period (2010).





Key Plan - 1:10,000

Legend

Control Point
Centreline of New Westbound Lane
Area of Compensation

ALL MEASUREMENTS TAKEN AND COORDINATES USED ARE BASED ON THE NOVA SCOTIA COORDINATE SYSTEM AND ARE REFERENCED TO ZONE 5 CENTRAL MERIDIAN 64 DEGREES 30 MINUTES WEST LONGITUDE.

COORDINATE POINTS SHOWN ARE SURVEY NAILS DRIVEN INTO THE EDGE OF THE EXISTING ASPHALT OF HIGHWAY 103 IN THE LOCATIONS INDICATED ON THE PLAN, WITH THE COORDINATE VALUES LISTED BELOW.

	N	E	elev.
M31	4951413.955	5551341.273	75.312
M32	4951381.329	5551531.181	77.362

DATE OF SURVEY: AUGUST 29, 2005

SCALE 1:500

10 0 10 20 30 40 50

PROVINCE OF NOVA SCOTIA DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS

Flat Lake Infilling Highway 103 Exit 5

COUNTY HALIFAX ROUTE 103

SURVEYED BY P.F.
DRAWN BY P.F.
DATE OF PLAN Nov. 16 2005
CHECKED
Approved
A.F.R. No.

Approved
Approved
NSDOT File No.
NSDOT Plan No.
Sheet 1 of 1

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December 2005

June 2004: One Year Before Construction (ROW cleared in 2003)


Shoreline in June 2004

Common Plant Species

Alders
Red Maple
Willows
Birches
Pin Cherry
Chokecherry
Oak
Red Elderberry

Wild Raisin
Huckleberry
Sweetfern
Bayberry
Wild Rose
Bush Honeysuckle
Blueberry
Rhodora
Lambkill
Labrador Tea
Black Chokeberry
Blackberry

False Holly
Meadowsweet
Bristly
Sarsaparilla

Forest Floor:
Goldthread,
Clintonia,
Lily of Valley,
Bunchberry,
Wintergreen,
Mayflower.
Bracken Fern,
Cinnamon Fern

Flat Lake

Lands of
N.S. Housing
Development Corp.
Bk. 5534, Pg.138
P.I.D. # 40615601

Lands of
N.S. Department of
Natural Resources
P.I.D. # 40090359

Area of
Compensation
2,576m²

Lands of
Jean Patricia and
Jay Blair Barthelotte
Bk. 7905, Pg.509
P.I.D. # 40870628

New Toe
of Slope

New Shoreline

New Top of Bank
New Shoulder

N.S. Department of
Transportation and
Public Works
Hwy.103 R.O.W.

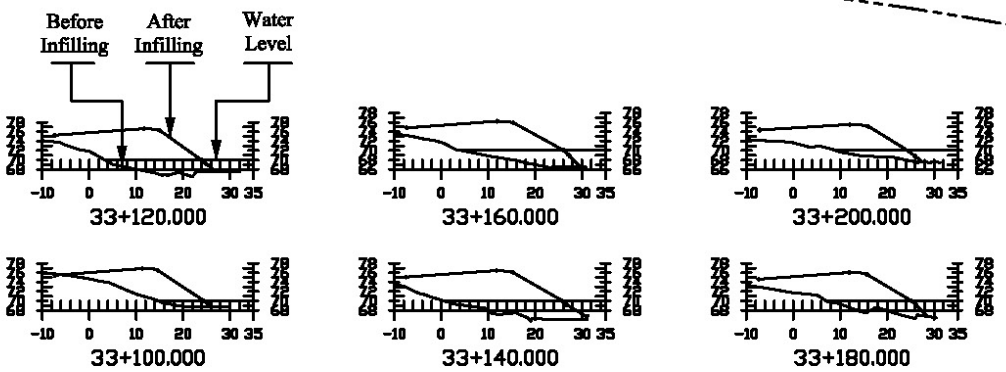
33+240
33+220
33+200
33+180
33+160
33+140
33+120
33+100
33+080
33+060

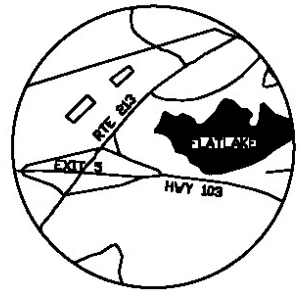
Original
Shoreline

New Top of Bank
New Shoulder

M31

M32





Key Plan - 1:10,000

Legend

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Centreline of New Westbound Lane
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	N	E	elev.
M31	4951413.955	5551341.273	75.312
M32	4951381.328	5551531.181	77.362

DATE OF SURVEY: AUGUST 29, 2005

SCALE 1:500

10 0 10 20 30 40 50

PROVINCE OF NOVA SCOTIA DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS

Flat Lake Infilling
Highway 103 Exit 5

COUNTY ANNAPOLIS ROUTE 103

SURVEYED BY P.F.
DRAWN BY P.F.
DATE OF PLAN Nov. 25 2005
CHECKED
Approved
A.F.S. No.

Approved
Approved
NSDOT File No.
NSDOT Plan No.
Sheet 1 of 1

June 27, 2005
In-Filling Has Started

In-Filling With Clean Rock; Common Fill and Rock Used in Upper Section of Slope

Building Slope and Rock Sill


Mud Wave Beginning to Emerge

Grubbings Top-Dressed Onto Slope (East End)

Clumps of Native Plant Communities Being Placed in Grubbings (East End)

Species Selected For Transplanting

Trees and Large Shrubs:

- Red Maple
- Willows
- Alder
- Birches
- White Pine

Low Growing Shrubs:

- Sweetfern
- Bayberry
- Black Huckleberry
- Lambkill
- Rhodora
- Blueberry
- Bush Honeysuckle
- Wild Rose

In-filling Continues to West

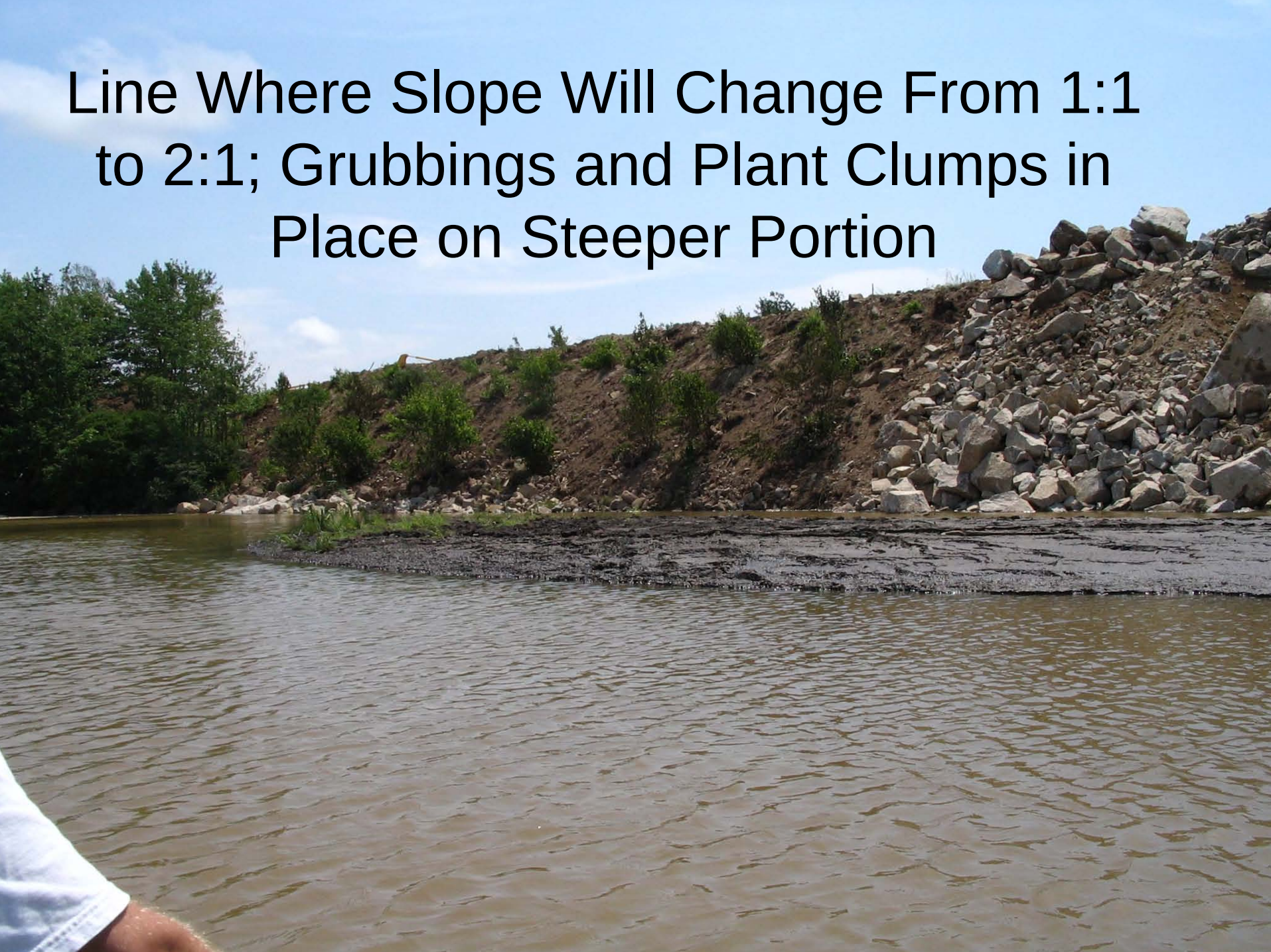
Mud Wave Continues to Emerge as In-filling Progresses

Clumps of Riparian Species Brought By Excavator to Top-of-Slope; Ready for Division and Placement on the Slope, Edge of Sill, and the Mud Wave


Slinging Small Clumps of
Riparian Species Onto
the Mud Wave

Bottom Rocks Disappear; More Rock/Infilling Required


Mud Wave Planted By
Hand From Boat


Line Where Slope Will Change From 1:1 to 2:1; Grubbings and Plant Clumps in Place on Steeper Portion

In-Filling Continues

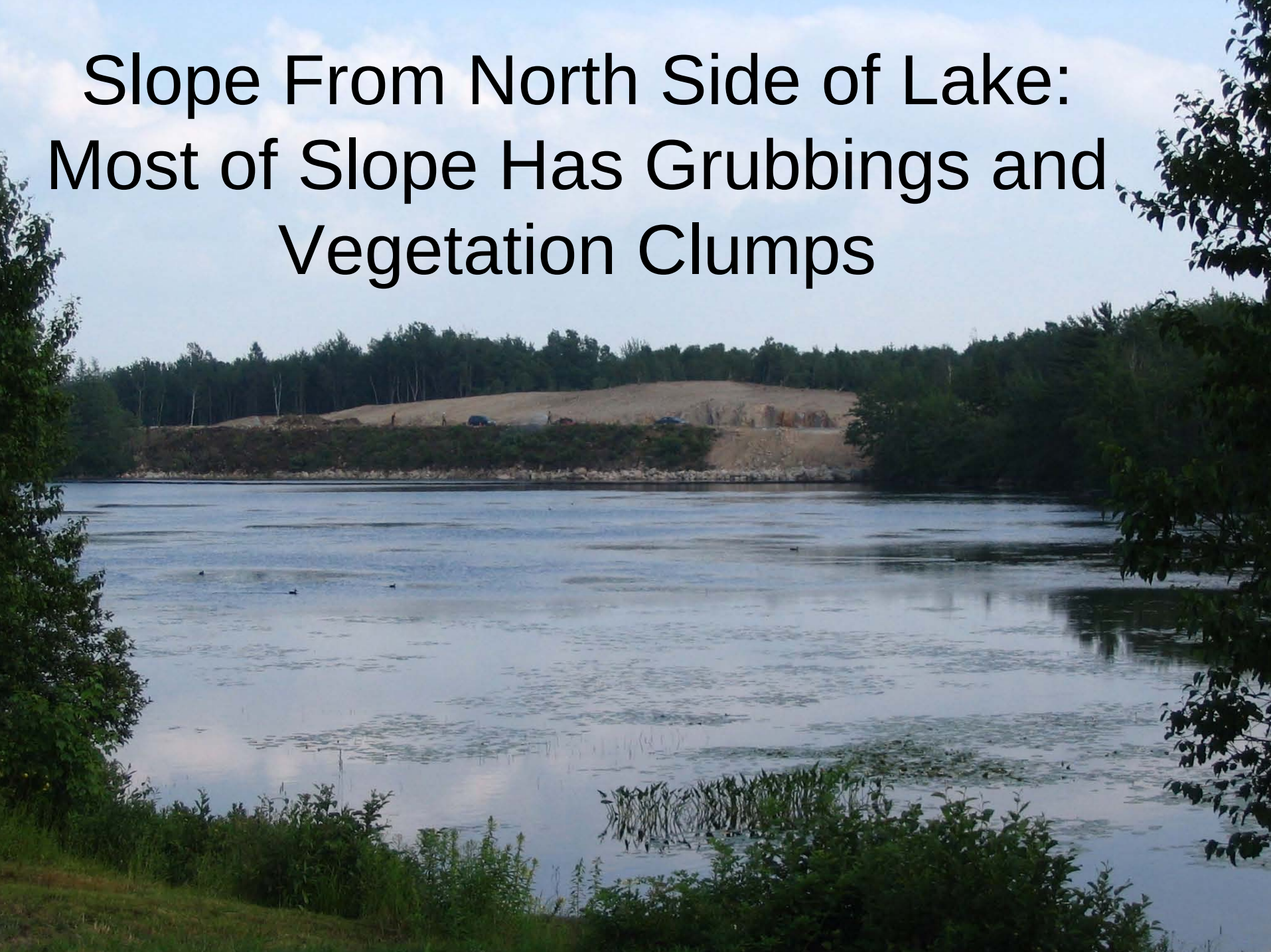
Application of Grubbings Continues Westward on Slope


KOMATSU


KOMATSU

Vegetation Clumps Selected From Construction Area to West of Lake

Planting Continues After Grubbings Placed


Slope From North Side of Lake:
Most of Slope Has Grubbings and
Vegetation Clumps

Vegetation Clumps Dug From Area to be Filled

Watering as Transplanting Completed to Top-of-Slope


August 23, 2005


Slope With Hay Mulch

September 2, 2005

September 2, 2005

September 2, 2005


October 17, 2005
1,594 m²

Flat Lake, Highway 103, HADD Compensation Project: August 2005 Station Photos

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Environmental Services, TPW
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Station 33+80

Station 33+100

Station 33+120

Station 33+140

Station 33+160

Station 33+180


Station 33+200


Station 33+220

West To East

Towards West, From Bottom of Slope