PENJAJAWOC STREAM – PRIORITIZED AREAS FOR RESTORATION

Restoration Site	Priority Level	Summary of Existing Concerns	Recommended Treatment
Mall Reach (Figure 1)	1	- A backwater effect dominates the reach, creating channel dimensions that are overly wide and a low gradient - Aggradation dominates the reach - Sedimentation of fines, low gradient and lack of coarse substrate have contributed to an overall lack of geomorphic diversity and aquatic habitat - Vegetated channel further slows flow and exacerbates deposition of fine materials - Lack of riparian cover and overwide dimensions contribute to warm water temperatures which can impact water quality and aquatic habitat - High organic content and warm water temperatures during the summer months may lead to anoxic conditions along the channel margins	- Need to determine cause of backwater effect (likely culvert associated with Interstate 95) - Redesign and realign channel (single-thread) - Minor reduction in length to increase overall gradient and facilitate sediment transport - Decrease cross-sectional area to increase velocities and promote sediment movement throughout reach - Improve geomorphological diversity through the formation of riffles - Turbulence in riffles will increase dissolved oxygen - Add plantings to moderate stream temperatures, create habitat and stabilize channel margins - Regular maintenance on storm water management ponds will ensure maximum storage capacity for the system - Investigate storm water Best Management Practices (BMPs)
Downstream of Interstate to Hogan Rd (Figure 2)	2	- Due to the aggradation that is happening upstream of Interstate 95, this site is sediment-starved and actively adjusting - In an attempt to supplement its sediment supply, the channel is actively eroding the bed (incision) and banks (widening) - As a result of this incision, the upstream culvert has become perched and the channel itself has	- Repair perched culvert crossing with an appropriately-sized structure - Re-connect channel to a functioning floodplain by lowering top of banks and terracing margins - Utilize plantings, live stakes and root wads to stabilize banks and improve riparian conditions - Depending on the severity of erosion, apply various bank treatment techniques (including

		become entrenched - The inability of high flow events to spill out onto a connected and functioning floodplain acts to confine high energy flows within the main channel - This energy is dissipated through further erosion	brush layering, wattles and vegetated rip rap) to stabilize banks, as required - Enact grade control along section through the utilization of step-pool morphology
Meadow Brook (Figure 3)	3	- Meadow Brook exhibits the geomorphic instabilities characteristic of a typical urban stream - The system is actively adjusting (degradation and widening) in response to the altered urban flow regime - As a result, the channel is incised and the system entrenched - The overall gradient is steep and bank erosion is prevalent - Due to the active erosion occurring within the system, fine materials are being transported downstream and being flushed into the main channel of Penjajawoc, holding major implications for aquatic habitat	- Redesign and realign channel - Modification of channel to a more sinuous planform will increase channel length and decrease the gradient - Reduction in gradient will moderate stream flow energy available for erosion - Increase in cross-sectional area reduce velocities within the bankfull channel and mitigate erosion - Re-grade banks to address channel entrenchment - Apply various techniques to stabilize channel margins - Investigate storm water Best Management Practices (BMPs)
Cemetery (Figure 4)	4	- Detention ponds at upstream extent affect water temperature and quality - Deposition of fine materials within pond has lead to a deficit downstream and subsequent moderate levels of erosion	- Monitor channel conditions downstream of detention ponds - Mitigate bank erosion issues as deemed necessary (spot-treatments)

Ad-Hoc Spot Treatments		
Rail Trestle And Route 2 Crossings (Figure 5)	- Existing stream crossing structures pose a barrier to fish passage	- Replace existing fish barriers with rocky ramp structures that maintain upstream grade control but enhance aquatic habitat
Beaver Dams (Figure 6)	- Beaver ponds can cause deposition of fine materials and increase water temperatures - Concerns exist regarding fish passage	- Do nothing - Dam removal is rarely effective since dam is often rebuilt immediately - Area is too large for exclusion fencing - Beaver ponds create over-wintering refugia - Most salmonid species can travel both upstream and downstream through dams under most flow conditions
Stillwater Ave (Figure 7)	- Aggradation dominates the reach	- Decrease cross-sectional area to increase velocities and promote sediment movement throughout reach - Add plantings to moderate stream temperatures, create habitat and stabilize channel margins

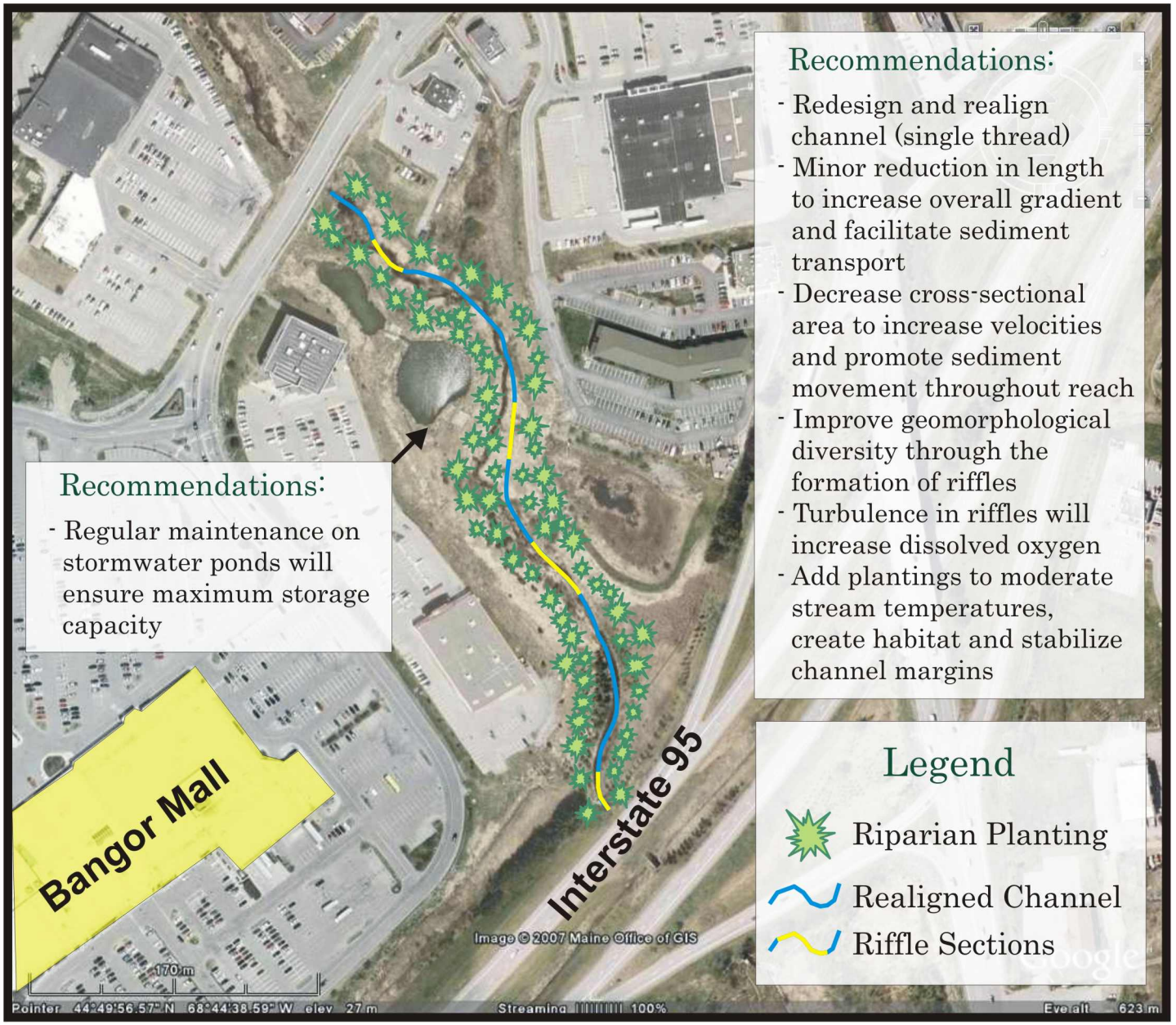
Recommendations:
- Redesign and realign channel (single thread)
- Minor reduction in length to increase overall gradient and facilitate sediment transport
- Decrease cross-sectional area to increase velocities and promote sediment movement throughout reach
- Improve geomorphological diversity through the formation of riffles
- Turbulence in riffles will increase dissolved oxygen
- Add plantings to moderate stream temperatures, create habitat and stabilize channel margins
Recommendations:
- Regular maintenance on stormwater ponds will ensure maximum storage capacity
Legend
Riparian Planting
Realigned Channel
Riffle Sections
Bangor Mall
Interstate 95
Image © 2007 Maine Office of GIS
170 m
Pointer 44°49'56.57" N 68°44'38.59" W elev 27 m
Streaming 100%
Eye alt 623 m

Figure 1

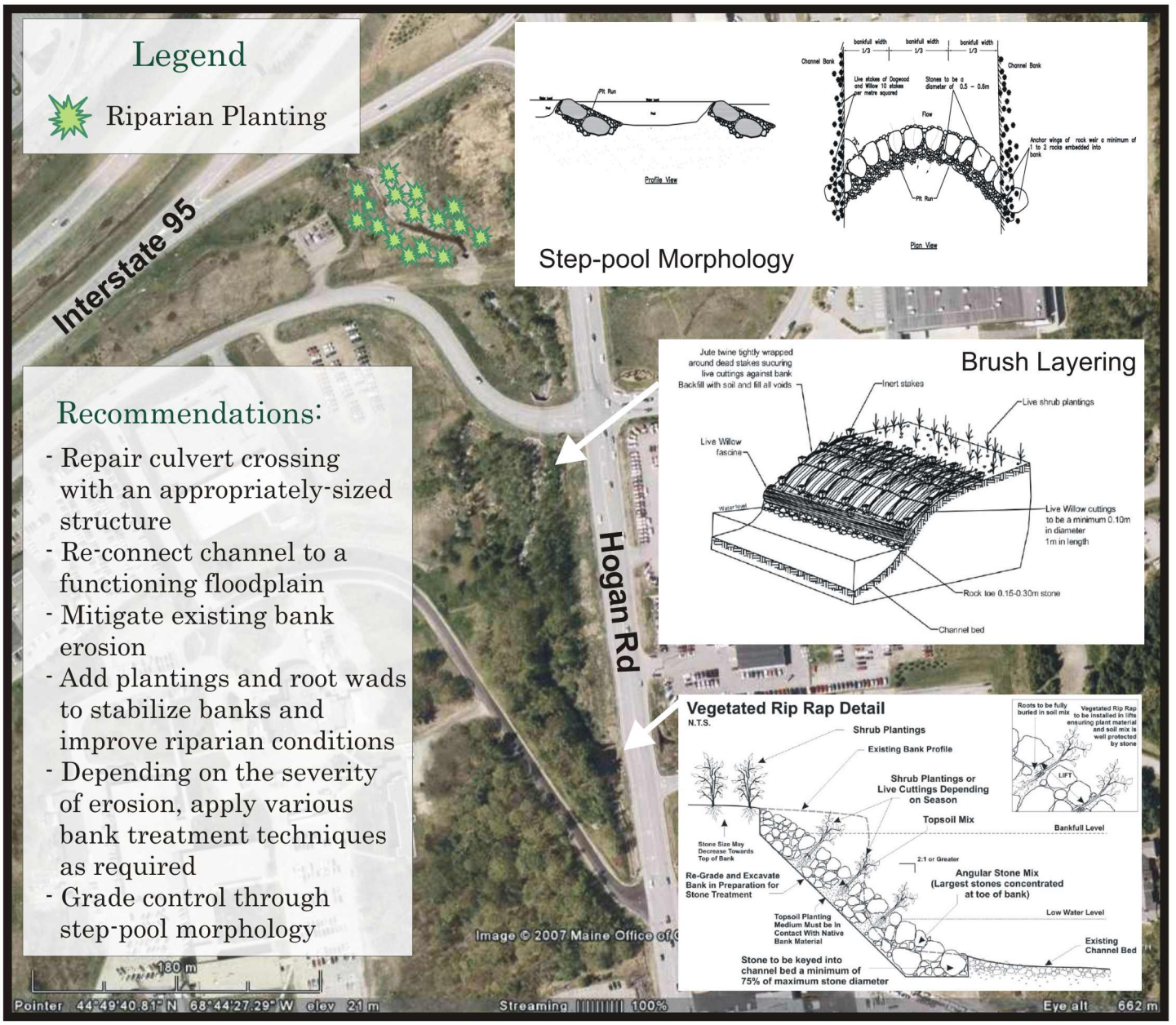
Legend
Riparian Planting
Interstate 95
Hogan Rd
Recommendations:
- Repair culvert crossing with an appropriately-sized structure
- Re-connect channel to a functioning floodplain
- Mitigate existing bank erosion
- Add plantings and root wads to stabilize banks and improve riparian conditions
- Depending on the severity of erosion, apply various bank treatment techniques as required
- Grade control through step-pool morphology
Step-pool Morphology
Profile View
Plan View
Brush Layering
Jute twine tightly wrapped around dead stakes sucuring live cuttings against bank
Backfill with soil and fill all voids
Inert stakes
Live shrub plantings
Live Willow fascine
Live Willow cuttings to be a minimum 0.10m in diameter 1m in length
Rock toe 0.15-0.30m stone
Channel bed
Vegetated Rip Rap Detail
N.T.S.
Shrub Plantings
Existing Bank Profile
Shrub Plantings or Live Cuttings Depending on Season
Topsoil Mix
Bankfull Level
Stone Size May Decrease Towards Top of Bank
2:1 or Greater
Re-Grade and Excavate Bank in Preparation for Stone Treatment
Angular Stone Mix (Largest stones concentrated at toe of bank)
Low Water Level
Topsoil Planting Medium Must be in Contact With Native Bank Material
Existing Channel Bed
Stone to be keyed into channel bed a minimum of 75% of maximum stone diameter
Roots to be fully buried in soil mix
Vegetated Rip Rap to be installed in lifts ensuring plant material and soil mix is well protected by stone
LIFT
Image © 2007 Maine Office of
180 m
Pointer 44°49'40.81" N 68°44'27.29" W elev 2.1 m
Streaming 100%
Eye alt 662 m

Figure 2

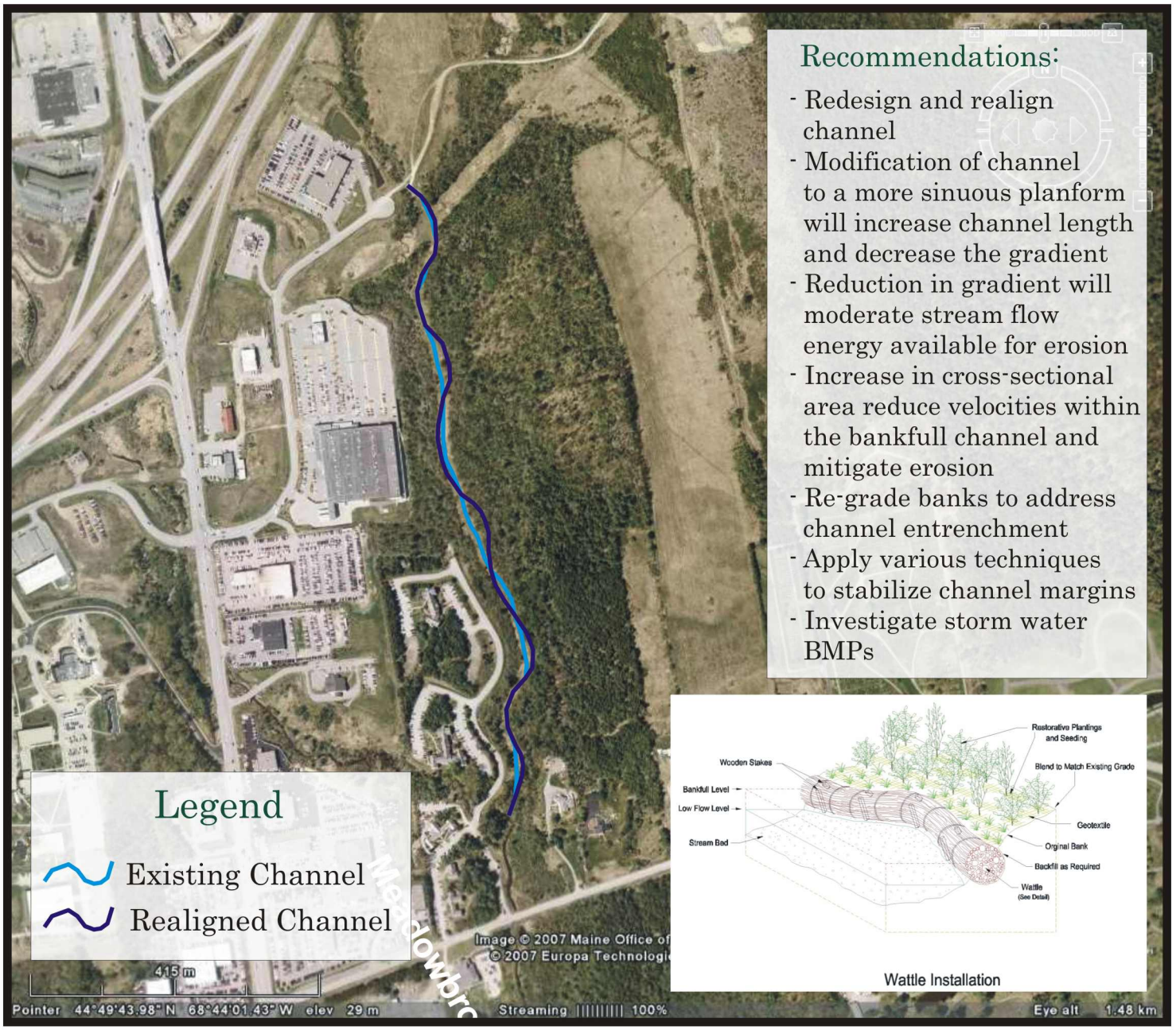
Recommendations:
- Redesign and realign channel
- Modification of channel to a more sinuous planform will increase channel length and decrease the gradient
- Reduction in gradient will moderate stream flow energy available for erosion
- Increase in cross-sectional area reduce velocities within the bankfull channel and mitigate erosion
- Re-grade banks to address channel entrenchment
- Apply various techniques to stabilize channel margins
- Investigate storm water BMPs
Legend
Existing Channel
Realigned Channel
415 m
Image © 2007 Maine Office of
© 2007 Europa Technologi
Pointer 44°49'43.98" N 68°44'01.43" W elev 29 m
Streaming 100%
Eye alt 1.48 km
Restorative Plantings and Seeding
Wooden Stakes
Blend to Match Existing Grade
Bankfull Level
Low Flow Level
Geotextile
Stream Bed
Orginal Bank
Backfill as Required
Wattle
(See Detail)
Wattle Installation

Figure 3


Geomorphic Concerns:
- Detention ponds at upstream extent affect water temperature and quality
- Deposition of fine materials within pond leads to a deficit and moderate erosion downstream
Recommendations:
- Monitor channel conditions downstream of detention ponds
- Mitigate bank erosion issues as deemed necessary (spot-treatments)
Image © 2007 Maine O
© 2007 Europa Tech
308 m
2005-13 - Maine DEP - Penjajawoc
Pointer 44°49'23.10" N 68°43'27.01" W elev 25 m
Streaming 100%
Eye alt 1.09 km

Figure 4


Geomorphic Concerns:
- Existing stream crossings pose a barrier to fish passage
Recommendations:
- Replace existing fish barriers with rocky ramp structures that maintain upstream grade control but enhance aquatic habitat
54 m
Google

Figure 5

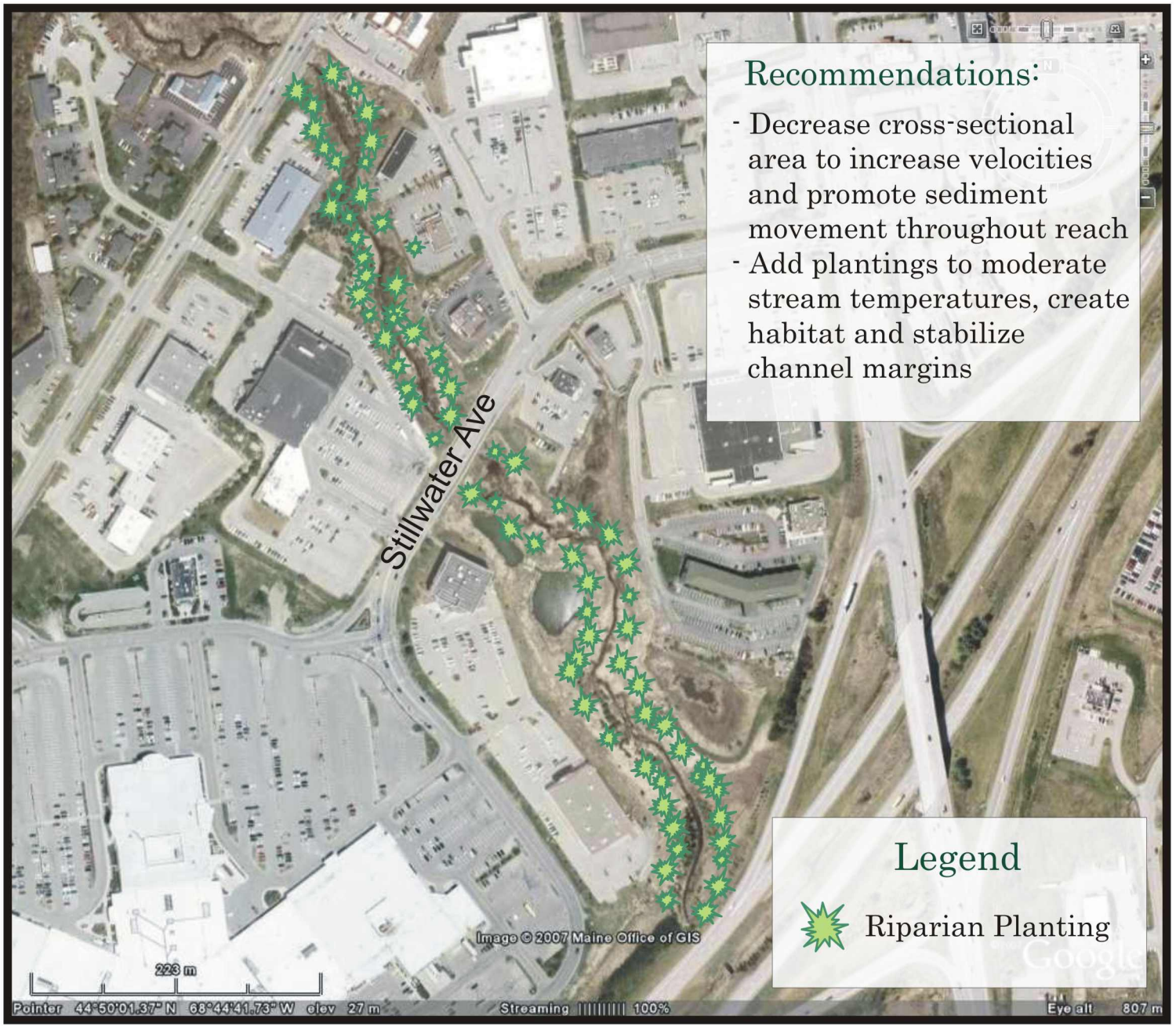
Recommendations:
- Decrease cross-sectional area to increase velocities and promote sediment movement throughout reach
- Add plantings to moderate stream temperatures, create habitat and stabilize channel margins
Stillwater Ave
Legend
Riparian Planting
Image © 2007 Maine Office of GIS
223 m
Pointer 44°50'01.37" N 68°44'41.73" W elev 27 m
Streaming 100%
Eye alt 807 m

Figure 6


Recommendations:
- Do nothing
- Dam removal is rarely effective since dam is often rebuilt immediately
- Area is too large for exclusion fencing
- Beaver ponds create over-wintering refugia
- Most salmonid species can travel both upstream and downstream through dams under most flow conditions
127 m
Pointer 44°49'10.26" N 68°43'50.61" W elev 9 m
Streaming 100%
Eye alt 466 m

Figure 7