Geomorphic Assessment Report and Watershed Plan

Black Brook

Laconia and Gilford, New Hampshire

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City of Laconia




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TABLE OF CONTENTS

1.0 INTRODUCTION

A stream geomorphic assessment was performed for Black Brook to evaluate the historic and existing stream channel conditions in order to understand the ongoing stream channel adjustment processes that are impacting water quality, aquatic and riparian habitats, and channel stability. This project grew out of general concerns about the health of Lake Winnipesaukee and recognition that the Lake is a product of its watershed and stream. The watershed and primary stream channels are shown in Figure 1.

Attention was drawn to Black Brook because of excessive sedimentation in Paugus Bay that has and continues to cause reduced depth and excessive milfoil growth, as well as observations of erosion on the Brook itself. The Laconia Conservation District secured funding from the NH Department of Environmental Services for this study.

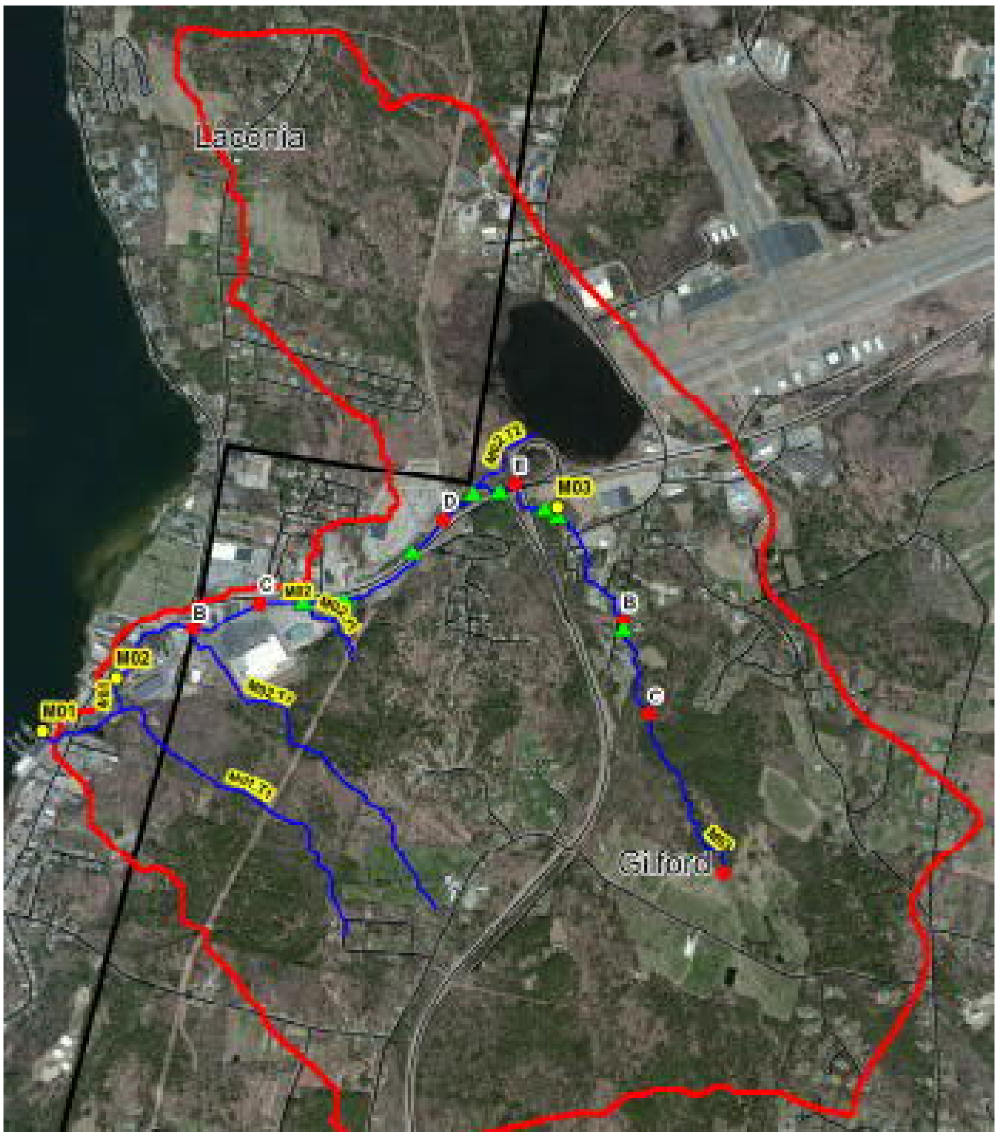

Figure 1. Black Brook Watershed and Primary Stream Channels

2.0 OVERVIEW OF STREAM MORPHOLOGY AS A MANAGEMENT TOOL

Stream geomorphology is the study of the form (or shape) and function of a stream channel as a result of the landscape through which it flows. Stream channels naturally adjust over time; they are not static. But the rate of change is typically slow, and new vegetation generally keeps up with slow pace of erosion on a natural channel. In modern history the changes to stream channels are often a result of indirect human activities such as watershed development or deforestation that change the rate and amount of water reaching stream channels, or the result of direct activities like the physical modifications to stream channels and floodplains. And the rate of stream channel change due to these human influences is increased.

While rivers change, there is a central tendency based on the characteristics of the landscape through which the river flows. That is, a channel in a given landscape (i.e., valley slope and width, drainage area, material size, etc) will tend toward a known shape, often called the reference condition. The reference condition is the shape or form a channel is expected to have considering the landscape through which it flows. Channels that meet the reference condition are stable and provide high quality aquatic habitat. Channels that have departed from reference conditions are unstable (i.e., erosion and deposition issues), provide poor aquatic habitat, and contribute to downstream water quality problems.

Symptoms of a channel that has departed from reference conditions include the following:

- Degradation – “downcutting” or “incision” that results in an overly deep channel.
- Aggradation – deposition of sediment that leads to a shallowing of the channel
- Widening – almost always following an episode of degradation, the erosion of the channel banks resulting in an overly wide channel.
- Planform Adjustment – changes to the pattern of a river channel when viewed from above.

Factors that can cause a channel to depart from reference conditions can be either natural or human-induced, and sometimes a combination of both. Common natural causes include major flooding or clusters of atypically wet years). Common human-induced causes include forest clearing, channel straightening, bank armoring, removal of woody vegetation, filling floodplains, and loss of wetlands.

River channels tend to change in predictable ways known as the Channel Evolution Model (CEM). Figure 2 shows this predictable pattern. In short, changes such as straightening a channel or filling in the floodplain results in the stream having more erosive power, and it digs itself a deeper channel (Stage II). Over time, the stream banks collapse and the channel gets wider (Stage III). Flows in that wider channel are shallow, and they can’t transport sediment effectively, so the sediment starts to deposit as bars and benches (Stage IV). Eventually, those bars and benches become a new floodplain down at a lower elevation and the channel is again stable (Stage V).

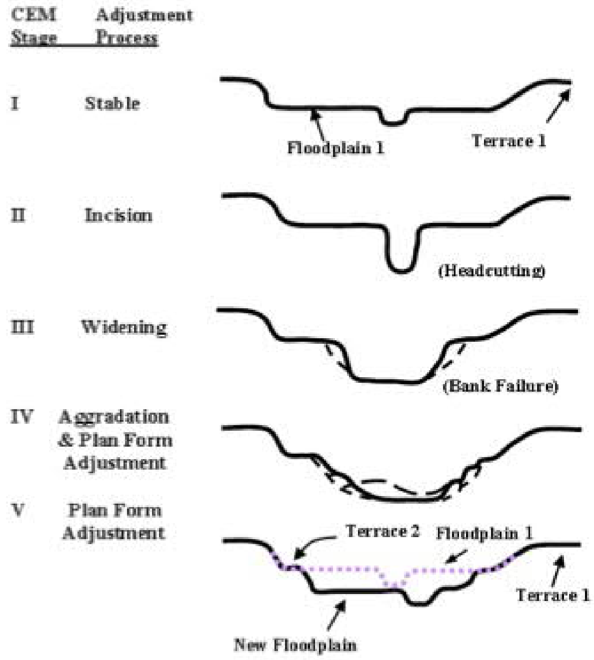

Figure 2. Stages of the Channel Evolution Model (CEM)

3.0 STREAM GEOMORPHIC ASSESSMENT METHODS

The assessment covered Black Brook from the mouth at Spinnaker Cove on Lake Winnipesaukee to the forested headwaters near Morrill Street in Gilford. See Figure 1 as well as Orthophoto Reference Maps in Attachment A. The assessment followed the "NH Implementation" of the Phase 1 and 2 Vermont Stream Geomorphic Assessment (SGA) Protocols. These protocols use mapping and field data to assess watershed, stream corridor, and channel conditions for use in developing management strategies intended to preserve and restore high-functioning stream channels and floodplains, protect and improve surface water quality (sediment and nutrients), and prevent property and infrastructure damage from erosion.

The Phase 1 assessment relied primarily on maps, orthophotos, and other remotely-sensed data. The primary intent of Phase 1 is break the channel into discrete reaches that share similar landscape settings (e.g., floodplain width and valley slope) and determine identify the general type of stream channel (using the Rosgen stream classification scheme) that would be expected in that setting in the absence of human or other disturbance.

The Phase 2 assessment relied on field data. Data were collected primarily in November 2014 and July 2015, with some minor additional data collection in April 2016. The reach breaks identified during Phase 1 were confirmed and some reaches were further subdivided into segments having similar characteristics (e.g., channel dimensions or sedimentation). Cross-sections were surveyed with a level and tape. Other features relevant to the assessment were located using GPS, and ArcGIS and the Stream Geomorphic Assessment Tool (SGAT) extension were used to compile and analyze some of the data.

The Phase 2 field data collected within each segment is relatively extensive. It includes obvious information beginning with the rational for making segment breaks, as well as more obscure information such as the presence of large woody material in the channel and the number of observed sediment deposits, which collectively provide insight into the condition of the channel. The information collected, much of which is recorded on Phase 2 Field Forms included in Attachment B, includes the following:

- Locations of stream corridor encroachments (e.g. berms, roads, development, etc.)
- Slope and texture of terraces/hillsides adjacent to the channel and/or valley bottom
- Presence, location, and height of any grade controls (e.g. bedrock, dam, etc.)
- Channel and floodplain dimensions measured at one representative, valley-wide cross-section
- Channel materials determined from a pebble count performed within a representative portion of the segment
- Representative riffle/step spacing
- Number of pieces of large woody material within the channel
- Average size of the largest particle on the streambed and depositional bar, if any
- Streambank characteristics (slope, texture, erosion, and vegetation)
- Location and length of any streambank revetments (e.g. riprap, retaining walls, etc.)
- Location, length, and height of any mass slope failures or gullies
- Buffer and riparian corridor characteristics (cover type, vegetation type, and buffer width)
- Presence and location of springs, seeps, tributaries, and adjacent wetlands
- Flow status at the time of the field work (low, moderate, or high)
- Number of debris jams
- Type and number of flow regulations and water withdrawals
- Type, number, and location of any stormwater outfalls
- Type, number, and location of any channel or valley constrictions (e.g. culverts, bridges, bedrock outcrops, etc.)
- Number and location of any beaver dams and the length of channel affected
- Type, number, and location of any depositional features (e.g. mid-channel bars, delta bars, etc.)
- Type and location of any significant planform changes (e.g. avulsions, flood chutes, braiding, etc.)
- Type, number, and location of any significant bedform changes indicative of aggradation or degradation (e.g. steep riffles, head cuts, or tributary rejuvenation)
- Number and location of any stream fords or animal crossings and
- Type and location of any channel alterations (e.g. dredging, straightening, windrowing, etc.) and the length of channel affected.

The cross-section and pebble count data collected in the field was used to compute several parameters including bankfull channel dimensions, width-to-depth ratio, entrenchment ratio, existing stream type, incision ratio, and particle size distributions. These parameters and the other data were used to complete Rapid Habitat and Rapid Geomorphic Assessments (RGA and RHA) for each segment that allowed grading of each segment as reference, good, fair, or poor. Also, the channel evolution stage, dominant geomorphic processes, and stream sensitivity were identified for each segment. The sensitivity ratings were used in conjunction with the measured bankfull channel widths and existing stream types to assign a recommended Fluvial Erosion Hazard (FEH) corridor width to each segment.

The field data and associated information was submitted to the New Hampshire Geological Survey for review and approval. Following several rounds of comments and responses, the assessment was deemed complete and in accordance with New Hampshire standards.

The approved assessment results were used to analyze departure from reference conditions, assign sensitivity ratings to each segment, and identify projects that would improve the local condition of Black Brook and reduce sediment and nutrient loading to Lake Winnipesaukee.

4.0 STREAM ASSESSMENT RESULTS

4.1 Overview

The assessed portion of Black Brook was broken into three reaches. The upstream limit of backwater from Paugus Bay marked the break between the first and second reach. A change in confinement indicated by reduced valley width was used to break the second and third reach. The reaches are labeled M01, M02, and M03 (M for mainstem as opposed to T for tributary) beginning at the mouth and moving upstream[1]. During Phase II, the reach break locations were confirmed in the field and were further subdivided into shorter segments that share similar characteristics. A total of 8 segments were identified – one in reach M01 (i.e., no further subdivision), five in reach M02, and two in reach M03. Figure 3 identifies the reaches and segments.

Figure 3. Black Brook Reaches and Segments

[1] The labeling in this study of Black Brook Mainstem Reach 3 (M03) and Tributary M02T2 is reversed from the labeling included in statewide stream channel mapping (NH Hydrography Dataset), which shows the mainstem extending into Lily Pond rather than turning to the south. The labeling used in this study is consistent with local convention and understanding of the watershed.

Table 1 summarizes the reference stream type, existing stream type, geomorphic and habitat condition, and dominant channel adjustment process for each segment.

Table 1. Phase 2 Assessment Results

Segment	Rosgen Stream Type		Geomorphic Condition	Channel Adjustment Process (Channel Evolution Stage)	Habitat Condition
	Reference	Existing			
M01A	Not fully assessed due to backwater from Lake and beaver dams				
M02A	“				
M02B	Not fully assessed because stream is in pipes				
M02C	E4	E4	Fair	Incising and widening (Stage II/III)	Fair
M02D	E4	E4	Good	Stable (Stage I)	Good
M02E	E4	B4 (departure)	Fair	Widening and aggrading (Stage III/IV)	Fair
M03A	B4	G4 (departure)	Fair	Widening and aggrading (Stage III/IV)	Fair
M03B	B4	B3	Good	Stable (Stage I)	Good

4.2 Segment-Specific Summaries

Brief descriptions of each assessed segment are provided below and photos of each segment are included in Attachment C.

Segment M01A

Segment M01A begins at the mouth of Black Brook at Lake Winnipesaukee and extends 1,500 feet to a point just upstream of the pedestrian bridge behind the McDonalds restaurant on Union Avenue. This is the only segment in Reach M01. The segment is backwatered in its entirety from the Lake and from beaver dams. Extensive wetlands are present along the margins of the channel for much of the segment. There is development in the river corridor for approximately half the segment length. There are four crossings of the brook in this segment including bridges at the Yacht Club (pedestrian), Railroad, Union Avenue, and behind McDonalds (pedestrian). All constrict the floodplain, but are wide enough to not constrict the channel. Because of the backwater, the channel itself was not fully assessed.

Segment M02A

Segment M02A begins just above the pedestrian bridge behind the McDonalds restaurant on Union Avenue and extends upstream approximately 1250 feet to just below Blaisdell Avenue (corresponding, coincidentally, to the Laconia-Gilford boundary). Much of this segment is impounded by a beaver dam. Unlike the downstream segment, however, the channel through this segment is a single continuous thread without significant adjacent wetlands. This is in part a product of more extensive filling of the floodplain for development on both sides of the channel. The one stream crossing in the segment is a relatively narrow private bridge (Laconia Ice Company) just downstream of Blaisdell Avenue. As with the previous segment, backwater conditions prevented a complete assessment of the channel itself.

Segment M02B

Segment M02B begins on the downstream side of Blaisdell Avenue and extends approximately 930 feet to just upstream of the Meredith Village Savings Bank. Almost 80% of this segment is in a series of three pipes including a 5' culvert under Blaisdell Avenue, a 6' culvert behind and under the Rite Aid property, and a 5' culvert under Meredith Village Savings Bank. Where not in pipes, development is extensive on both sides of the channel. Because of the extensive piping, detailed assessment of the channel characteristics in the segment was not possible.

Segment M02C

Segment M02C begins just upstream of the pipe at Meredith Village Savings Bank and extends approximately 2,100 feet to just upstream of entrance to Walmart. The channel closely parallels Lakeshore Road and crosses from one side to the other in the middle third of the segment. Throughout most of this segment, the floodplain on one side of the channel has been filled by the Lakeshore Road embankment and the floodplain on the other side filled for development, significantly reducing the natural floodplain width. There are a notable nine stream crossings in this segment: seven driveway culverts, a snow machine bridge, and one municipal culvert (Lakeshore Road). While the form of the channel is relatively uniform throughout the reach, vegetation patterns are not. Some areas, like that in front of Bank of New Hampshire have mowed grass down to water's edge while others have extensive shrub and small tree growth.

The channel in segment M02C is incised (Stage II of the Channel Evolution Model, CEM) and in some locations is widening (Stage III)[2]. Significant fresh sediment deposits were noted in some channel locations as well as on the adjacent floodplain. The channel earns ratings of Fair (on the Poor-Fair-Good-Reference continuum) for both geomorphic and habitat condition. The changes in channel form (primarily incision) do not yet represent a change is stream type. As the channel responds to incision with eventual bank erosion and channel widening (as is predicted by the CEM), the changes will very likely be significant enough to represent a change in stream type throughout this reach.

Segment M02D

Segment M02D begins just upstream of the easterly entrance to Walmart and extends approximately 1,200 feet upstream to a culvert under Lakeshore Road near the Bypass (Rte 3). Outflow from Lily Pond joins Black Brook midway through the segment. Notable in this segment is the broad forested floodplain generally present on one or both sides of the channel. There are no culverts or bridges in the segment.

The channel in Segment M02D is generally stable and representative of Stage 1 of the CEM. Fresh sand and gravel deposits were observed in the channel and on the floodplain. The channel earns ratings of Good (on the Poor-Fair-Good-Reference continuum) for both geomorphic and habitat condition.

Segment M02E

Segment M02E begins at the outlet of a culvert under Lakeshore Road near the bypass (Rte 3) and extends upstream approximately 730 feet to a location roughly opposite the cloverleaf off-ramp of the Bypass. The downstream half of this segment is comprised of culverts under

[2] Field assessment data for this segment reports an incision ratio of 1.0, which would indicate no incision. However, we contend that it is indeed incised, and the field measurements are the result of the observed recent and highly mobile sediment deposits in the channel that mask the true channel depth as well as the lack of any natural vegetation that would normally be used to confirm the bankfull elevation in an incised channel (and would in this case have placed that elevation further down the bank below the elevation of incipient flooding).

Lakeshore Road and under the Bypass and a length of open channel between the two. The upstream half is open channel with forested floodplain on the left (south) bank and mowed meadow on the right (north) bank.

The mowed meadow on the right overbank slopes away from the channel. While that is not unheard of in a natural setting, it is certainly uncommon, and it may indicate that the channel was relocated when the Bypass was constructed. Specifically, the channel may have historically flowed in the more northwesterly direction across what's now the mowed meadow but was pushed into the existing east-west alignment when the Bypass was constructed. A review of historical aerial photographs suggests this is indeed the case. That manual relocation of the channel would explain the instability of the existing channel.

The channel (as assessed in the upstream half of the segment above the culverts) previously incised and is now undergoing major widening, aggradation, and planform adjustment (CEM Stage III/IV). While some sediment generated from within this segment is depositing as part of the planform adjustment, much is being transported to downstream reaches. The channel earns ratings of Fair (on the Poor-Fair-Good-Reference continuum) for both geomorphic and habitat condition. The existing channel is more entrenched and has a larger width-to-depth ratio than the reference channel for this location, and the existing B4 stream type is a departure from the reference E4 stream type.

Segment M03A

Segment M03A begins at the upstream end of a mowed meadow roughly opposite the Bypass cloverleaf off-ramp and extends upstream approximately 1,800 feet to just above Breton Road. There are four stream crossings in this segment including three municipal culverts and one long private culvert under the parking lot between the two branches of Annis Drive.

The channel (as assessed in the downstream portion of the segment below the culverts) previously incised and is now undergoing major widening, aggradation, and planform adjustment (CEM Stage III/IV). The segment has been and continues to be a significant source of sediment that is transported to downstream reaches. The channel earns ratings of Fair (on the Poor-Fair-Good-Reference continuum) for both geomorphic and habitat condition. The existing channel is more entrenched than the reference channel for this location, and the existing G4 stream type is a departure from the reference B4 stream type.

Segment M03B

Segment M03B begins just upstream of Breton Road and extends approximately 1,350 feet upstream. There is one private bridge on the segment.

The channel in Segment M03B is generally stable and representative of Stage 1 of the CEM. Fresh sand and gravel deposits were observed in the channel and on the floodplain. The channel earns ratings of Good (on the Poor-Fair-Good-Reference continuum) for both geomorphic and habitat condition.

5.0 BRIDGE AND CULVERT ASSESSMENT

Each stream crossings within the study area was inspected and the size, material, and surrounding stream channel condition documented. A simple inventory is presented in Table 2. Field data sheets and photos are included in Attachments D and E.

There are 23 crossings in the study area. Black Brook is confined to culverts for nearly four tenths of a mile, which is approximately 20% of the channel length. All the crossings eliminate the natural floodplain. That's typical for stream crossings anywhere, but given the sheer number and length of crossings, the cumulative impact becomes particularly significant on Black Brook. Put another way, floodplain functions including attenuation of peak flows and trapping of sediment – two functions that would reduce nutrient and sediment loading to Paugus Bay – have been eliminated on 20% of Black Brook due to culverts.

In general, the most downstream five culverts (up to and including the Laconia Ice bridge) are wide enough to span the channel bankfull width and thus have limited impact on the channel itself. From Blaisdell Avenue to the upstream end of the brook, however, the culverts are consistently too narrow to span the natural channel and are thus likely to contribute to local erosion and channel instability, contribute to flood risks by catching debris and backing up water during major storm events, and reduce the effective movement of fish and other aquatic organisms.

Table 2. Inventory of Stream Crossings

#	Reach	Road/Drive	Type	Span (ft)	Length (ft)	Notes
1	M01A	Private Pedestrian Walkway	Bridge	55	9	Timber with center pier on concrete
2	M01A	Railroad (abandoned)	Bridge	30	15	Old wood pilings piles
3	M01A	Union Avenue	Bridge	20	44	Modern concrete
4	M01A	Ped/Bike Path	Bridge	32	15	Old timber
5	M02A	Laconia Ice	Bridge	9	20	Old concrete slab
6	M02B	Blaisdell Avenue	Culvert	5	100	Concrete box
7	M02B	CVS Parking Lot	Culvert	6	200	Concrete box
8	M02B	Meredith Savings Bank Lot	Culvert Culvert	4 (x2) 5	385	Double corrugated steel outlet Concrete box culvert inlet
9	M02C	Hannaford Entrance Drive	Culvert	7	81	Elliptical corrugated steel
10	M02C	Wild Bird Depot Entrance	Culvert	4.2	64	Old smooth steel
11	M02C	Bank of NH Entrance Drive	Culvert	4.4	62	Old smooth steel
12	M02C	Electrical Substation	Culvert	5.3 (x2)	41	Double elliptical corrugated steel
13	M02C	Country Cooking Entrance	Culvert	5.6	52	Corrugated steel
14	M02C	Kelso Motors	Culvert	6.1 5.75	188	Corrugated steel vert ellipse outlet Corrugated steel arch at inlet
15	M02C	Lakeshore Road	Culvert	7	59	Corrugated steel ellipse

16	M02C	Walmart Entrance Drive	Culvert	6.9	95	Corrugated steel ellipse
17	M02E	Lakeshore Road	Culvert	3.3 (x2)	102	Double barrel concrete pipes
18	M02E	Rte 3	Culvert	6	190	Corrugated steel
19	M03A	Annis Drive	Culvert	4	33	Concrete box
20	M03A	Parking Lot and Upper Annis Drive	Culvert	4 4.9	200	Concrete box outlet Corrugated steel inlet
21	M03A	Mulberry Road	Culvert	4.9	81	Corrugated plastic
22	M03A	Bretton Road	Culvert	3.9	49	Corrugated plastic
23	M03B	Priv drive off Bretton	Bridge	8	12	Concrete slab on blocks

6.0 PROJECT IDENTIFICATION

In recognition that instability of the Black Brook channel is a primary cause of excess sediment and nutrient loading to Paugus Bay, potential projects have been identified that have clear benefits for geomorphic channel stability. Projects may also have secondary water quality benefits and habitat benefits, but it is those that most directly meet the objective of restoring geomorphic channel stability that are presented here. Six potential projects and five additional general management measures have been identified.

6.1 Potential Projects

Six potential projects, some with sub projects, have been identified. Each is described briefly below. Project Concept Sheets are included in Attachment F.

- Project #1. Replace Culverts with Larger Structures that Span the Channel. (Reaches M02, and M03) There are twenty-three stream crossings within the three reaches of the study area. Eighteen of those, from Blaisdell Avenue upstream, are undersized relative to the stream channel and thus contribute to channel instability.

  Replacement culvert sizes should reflect what is known about the stage of channel evolution evident in the surrounding channel. For instance, the channel width in Reach M02C is approximately 7 feet, but we know the channel is incised, and thus some future widening can be expected. An appropriately sized culvert would be designed to span the future anticipated channel width.

  An aluminum pipe arch culvert (i.e., squashed pipe shape) would provide the most cost-effective means of spanning the channel. A structure on the order of 12 – 14 feet wide would be suitable for use anywhere in Reaches M02 and M03, taking into account likely future channel adjustments. The culvert would be recessed and the stream channel constructed through it, with dimensions approximating the natural surrounding channel, so that the finished product resembles the natural stream with a cover over it.

- Project #2. Eliminate Culverts by Sharing Drives. (Reach M02C) Sharing a drive to eliminate a typical culvert would restore on the order of 40 feet of stream channel and floodplain thereby providing additional area for floodwater and sediment to spill out and deposit rather than being transported downstream. Reducing the length of excessively long culverts would provide the same general benefits.

Many adjacent properties could share driveways, though the amount of site work (i.e., grading, curbing, pavement, etc) needed to provide lateral connections between properties varies widely. In Reach M02, an electrical substation and neighboring restaurant (Country Cookin' at the Lakeside) is a particularly feasible location for a shared driveway. The substation crossing consists of two parallel 5' corrugated steel pipes. The restaurant's crossing consists of a single pipe of similar size. Both are relatively old and rusted. It appears the substation could be readily accessed via the restaurant property and the exiting culverts to the substation removed thereby restoring 40 feet of channel and floodplain. Alternately, a new single shared crossing could be installed and both existing ones eliminated.

- Project #3. "Daylight" the Brook. (Reaches M02 and M03) Daylighting refers to the practice of eliminated piped lengths of stream and restoring a natural channel and floodplain. This allows for some reduction in peak streamflows and provides floodplain on which sediment can be deposited rather than transported downstream. There are five candidate locations:

  - Under Annis Drive Loop (Project #3A). 130' length of pipe under parking lot at U-Haul Dealer. Expanded floodplain on left bank could be restored. Owner would lose 0.5 acres of paved parking.
  - Under Kelso Motors Frontage (Project #3B). 180' length could be reduced to 40'. Owner would lose 0.2 acres of land on which cars are currently displayed. The existing culvert is actively failing, with subsistence of the land above it requiring maintenance by the owner.
  - Under Meredith Village Savings Bank. 160' length of pipe under parking lot. Access to the bank and parking would need to be significantly reconfigured and expanded on the neighboring Lowes lot, making this location extremely logistically difficult and expensive to implement. Thus, it is not explored further in this report.
  - Under Lowes Overflow Parking (Project #3C). 120' pipe length under the overflow parking area just downstream of the Lowes entrance drive. Extensive floodplain or 0.25 acre restored wetland could be created on the right overbank if the entire parking area (26 spots) were eliminated.
  - Behind CVS Pharmacy. 230' pipe length under the parking lot. The channel with a narrow floodplain could be restored. Space is limited, and daylighting would require eliminating the ability to drive behind the CVS building (likely unacceptable) or shrinking and redesigning the adjacent Lowes parking lot. Because of these logistical and cost obstacles, this location is not further explored in this report.

- Project #4. Revegetate to Improve Floodplain Function. (Reach M02) Candidate locations have floodplain but due to lack of robust vegetation the floodplain does not function well to reduce flood flows, trap sediment, and resist erosion. Candidate locations for restoration of floodplain vegetation:
  - Bank of New Hampshire (Project #4A). Currently neatly mowed.
  - Upstream of Bypass (Project #4B). Currently mowed seasonally to top of right bank. Gravel bar deposits on channel margins could also be planted.

- Project #5. Remove Pockets of Fill to Restore Floodplain. (Reaches M01 and M02) Fill in the floodplain is very common throughout Reaches M01 and M02. Much of the fill now has development on it, but there are locations of excess fill pockets that it appears could be removed without impacting use of the land. Removal would restore a small piece of floodplain. A sample candidate location is the right bank of the Brook just downstream of the Lakeshore Road Crossing.

- Project #6. Actively Stabilize Channel. (Reach M03A) The channel below Annis Drive in Reach M03A is incised and unstable and will be a persistent source of sediment until it has widened enough (sending more sediment downstream) that it has adequate floodplain width at the new lower elevation. Rather than wait for that to happen, material can be manually excavated to create the desired floodplain.

6.2 Additional General Management Measures

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A. Fluvial Erosion Hazard Zones

The development of Fluvial Erosion Hazard (FEH) Zones is recommended to prevent increases in man-made conflicts that can result from development in identified fluvial erosion hazard areas; minimize property loss and damage due to fluvial erosion; and prohibit land uses and development in fluvial erosion hazard areas that pose a danger to health and safety. The basis of a Fluvial Erosion Hazard Zone is a defined river corridor, including the course of a river and its adjacent lands. The width of the corridor is defined by the lateral extent of the river meanders, called the meander belt width, which is governed by valley landforms, surficial geology, and the length and slope requirements of the river channel. The width of the corridor is also governed by the stream type and sensitivity of the stream. Information collected during the Phase 2 Assessment including reach sensitivity, reach condition, and stream type can be used to develop these zones.

FEH Zones are intended to delineate for landowners, land use planners, and river managers the area needed to accommodate the natural movement of a balanced or equilibrium stream channel and, if protected from unlimited development, would serve to maximize channel stability and minimize fluvial erosion hazards.

The formal use of FEH Zone maps varies. They can be developed to serve solely as a source of information for landowners and local regulators about possible risks associated with proposed development. They can also be used in a more formal capacity if a community chooses to do so, by incorporating them into local zoning regulations much as is done with FEMA floodplain maps.

Towns have the opportunity to work with the New Hampshire Department of Environmental Services (NHDES) to develop fluvial erosion hazard zones to reduce conflicts within the river corridor. Additional information regarding Fluvial Erosion Hazard Zones is available on the NHDES website http://des.nh.gov/organization/commissioner/pip/factsheets/geo/documents/geo-10.pdf, in the Environmental Fact Sheet (New Hampshire Department of Environmental Services, 2010a); and in Chapter 2.9 of the Innovative Land Use Planning and Techniques Handbook: New Hampshire Department of Environmental Services, 2010b.

B. Changes in Parking Lot Size Requirements

Based even on a cursory review of orthophotos of the Black Brook watershed, it is clear that the channel and floodplain are pinched in many locations to make room for expansive parking lots. It's also readily apparent that the parking lots are sized for uncommonly busy times and are otherwise typically less than half full.

Laconia regulations prescribe the number of parking spaces for various land uses. Gilford does not. In practice, even with prescriptive parking requirements, review boards often use the numbers as guidelines and make a final determination about the number of spaces.

Given that more parking has contributed to filling of the floodplain that has resulted in an unstable channel and excessive sediment and nutrient loading to the Lake, both municipalities should make efforts to require less parking or to require alternate parking arrangements (e.g., formal sharing arrangement with adjacent businesses) when more parking would contribute to additional fill in the Black Brook floodplain.

C. Community volunteer efforts

Community volunteer efforts are recommended as means to accomplish Land Use guidelines emphasizing clean-up efforts. Trash is common in the stream channel in Reach 2. The City of Laconia, the Town of Gilford, and community groups have the opportunity to sponsor stream cleanup days to remove trash from Black Brook and tributaries. This cleanup effort would improve water quality and would offer a connection between local citizens and the stream that runs through their communities.

D. Landowner education and outreach

Landowner education and outreach is recommended to improve the public's understanding of fluvial processes, stressors to stream health, and opportunities for restoration through voluntary streamside plantings and protection of stream channels.

E. Conservation easements

Conservation easements are recommended in areas currently free of existing development and stream stressors, in order to protect the integrity of the stream corridors from future encroachments. In the Black Brook Watershed, the land surrounding Reach M02D (largely between Lily Pond and Walmart) is an example of an area that would benefit from conservation easements to the extent it is not already conserved. This area currently provides significant flood and sediment load attenuation that has direct positive benefits to the more developed portions of the watershed downstream where sedimentation and flooding is a problem. The presence of conservation easements would ensure that this land continues to provide these benefits into the future.

A second location for which there is no current conservation easement or similar protection is the left (looking downstream) overbank of the channel between Union Avenue and Blaisdell Avenue. While there is development in this area, there is significantly more undeveloped floodplain than the opposite side of the brook. Indeed, much of the left overbank is currently flooded by backwater from the lake and from beaver dams. The area is acting as a natural sediment detention area. Were it to be filled and developed as has occurred on the opposite bank, the benefits of the intact and functioning floodplain would be lost and the sediment and nutrient issues in Paugus Bay exacerbated.