Gihon River Corridor Plan

Johnson, Hyde Park, & Eden, Vermont

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Prepared by:

Bear Creek Environmental, LLC
297 East Bear Swamp Road
Middlesex, Vermont 05602

and

The Lamoille County Planning Commission
632 LaPorte Road
Morrisville, VT 05661

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Bear Creek **Environmental**
297 East Bear Swamp Road, Middlesex, Vermont 05602
Phone: (802) 223-5140 / Fax: (802) 229-4410

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1.0 EXECUTIVE SUMMARY

The River Corridor Planning effort is sponsored by the Lamoille County Planning Commission (LCPC) with funding provided through a grant from the Agency of Natural Resources Clean and Clear Program and the Federal Emergency Management Agency (FEMA). The Vermont Department of Environmental Conservation River Management Program provided technical expertise and shared quality control/quality assurance responsibilities with Bear Creek Environmental. The River Corridor Plan (RCP) followed the Vermont Agency of Natural Resources River Corridor Planning Guide (Vermont Agency of Natural Resources, 2007a) and Draft 9 of Chapter 5 of the plan dated October 2, 2007. Information for the RCP came from the DEC, the Vermont Center for Geographic Information (VCGI), and field data collected by Bear Creek Environmental and LCPC.

The primary objective of the RCP is to use stream geomorphic assessment data to identify and prioritize river corridor protection and restoration projects within the Gihon River watershed in the Towns of Johnson, Hyde Park, and Eden. The stream geomorphic assessment data can be used by resource managers, community watershed groups, municipalities and others to identify how changes to land use alter the physical processes and habitat of rivers. The Vermont Stream Geomorphic Assessment Protocol includes three phases:

1. Phase 1- Remote sensing and cursory field assessment;
2. Phase 2 – Rapid habitat and rapid geomorphic assessment to provide field data to characterize the current physical condition of a river; and
3. Phase 3 – Detailed survey information for designing “active” channel management projects.

A Phase 1 Stream Geomorphic Assessment following Agency of Natural Resources Protocols was completed for the Gihon River by LCPC during spring 2005, and a Phase 2 Stream Geomorphic Assessment following Agency of Natural Resources Protocols was completed for the Gihon River by Bear Creek Environmental during summer 2006.

The main stem of the Gihon River varies between highly stable bedrock controlled channels and highly sensitive gravel dominated channels that are highly influenced by the presence and condition of the riparian vegetation as well as their ability to access a floodplain during high water events. The upper section of the Gihon River in Eden has undergone minor channel straightening, floodplain encroachment, and removal of riparian vegetation. Despite these impacts, there is little adjustment occurring in the upper reaches. Below the confluence of the White Branch there is an area of major channel adjustment before the river enters a well forested area and once again regains a sense of general stability. There are numerous floodplain

encroachments in North Hyde Park Village and below here the river is undergoing major and sometimes extreme adjustments in an undeveloped part of the watershed. There is an area of relative calm again where bedrock (first appears) and dominates the channel near the Whitcomb Island Bridge and then again the river begins to respond to frequent impacts of riparian vegetation removal and historic channel straightening in agricultural fields near the Rocky Road covered bridge and floodplain encroachment and streambank armoring within Johnson Village. These adjustments below Whitcomb Island Bridge are broken intermittently by bedrock controlled segments that are naturally less prone to adjustment.

As the river works toward a more stable equilibrium, the Johnson, Hyde Park, and Eden communities have the opportunity to provide long-term protection to the river corridor and encourage the reestablishment of floodplain vegetation and healthy instream habitat. At the reach and site level, potential restoration and protection projects that would be compatible with geomorphic adjustments and managing the stream toward equilibrium conditions were identified. A list of 32 potential restoration and conservation projects was developed during project identification. Types of projects include: river corridor protection through corridor easements and conservation efforts, replacing undersized structures causing channel instability, and improving riparian buffers.

2.0 LOCAL PLANNING PROGRAM OVERVIEW

2.1 RIVER CORRIDOR PLANNING TEAM

The river corridor planning team for the Gihon watershed is comprised of the Lamoille County Planning Commission, the Agency of Natural Resources, Bear Creek Environmental, local municipalities and landowners. This planning effort is sponsored by the Lamoille County Planning Commission. Funding for the project is provided through grants from the Clean and Clear Program and FEMA. Staci Pomeroy from the Vermont River Management Section of the Vermont Agency of Natural Resources (VANR) provided technical guidance for this project.

2.2 GOALS AND OBJECTIVES OF THE PROJECT

The primary objective of the River Corridor Management Plan is to use the Phase 1 and 2 Stream Geomorphic Assessment data to identify and prioritize river corridor protection and restoration projects within the Gihon River watershed. The State of Vermont's River Management Program has set out several goals and objectives that are supportive of the local initiative in the Gihon watershed. The state management goal is to, "manage toward, protect, and restore the fluvial geomorphic equilibrium condition of Vermont rivers by resolving conflicts between human investments and river dynamics in the most economically and ecologically sustainable manner" (Vermont Agency of Natural Resources, 2007a). The objectives of the Program are to include fluvial erosion hazard mitigation and sediment and nutrient load reduction as well as aquatic and riparian habitat protection and restoration. The Program seeks to conduct river corridor planning in an effort to remediate the geomorphic instability that is largely responsible for these problems in a majority of

Vermont's rivers. Additionally, the Vermont River Management Program has set out to provide funding and technical assistance to facilitate an understanding of river instability and the establishment of well developed and appropriately scaled strategies to protect and restore river equilibrium.

A community-based river corridor management plan provides many opportunities for enhancing and restoring the Gihon Watershed. These local goals support the objectives of the Vermont River Management Program and are listed below:

- Protect, manage, and restore stream corridors to accommodate river equilibrium conditions
- Promote sustainable community relationships with river systems
- Protect and restore the ecological potential and ecosystem services of rivers for future generations

3.0 BACKGROUND WATERSHED INFORMATION

3.1 Geographic Setting

3.1.1 Watershed Description

The Gihon River has a watershed size of 64.75 square miles just above the confluence of the Lamoille River in the Town of Johnson, Vermont (Figure 1). The Gihon River flows south and joins the Lamoille River which drains westerly into Lake Champlain. The Gihon River drains from its forested headwaters in Eden Notch and from the southern flanks of Belvedere and Hadley Mountains. It joins the Lamoille River at approximately 488 feet above sea level. The Phase 2 study focused on 18 stream reaches on the main stem of the Gihon River within the Towns of Johnson, Hyde Park and Eden. The combined length of the stream reaches assessed is approximately 14.2 miles.

3.1.2 Political Jurisdictions

Project reaches for the Gihon River are located in Lamoille County Vermont within the towns of Johnson, Hyde Park, and Eden. The Gihon watershed falls under the jurisdiction of the Lamoille County Planning Commission.

3.1.3 Land Use

The majority of the Gihon watershed is forested; however, agricultural land uses are also prevalent, particularly immediately adjacent to the river (Figure 2). Additionally, the lower end of the watershed includes Johnson Village and some concentrated areas of urban land use. The land use within the entire watershed includes approximately 73 percent forest, 13 percent agriculture, 6 percent water, 5 percent urban and 3 percent wetland.

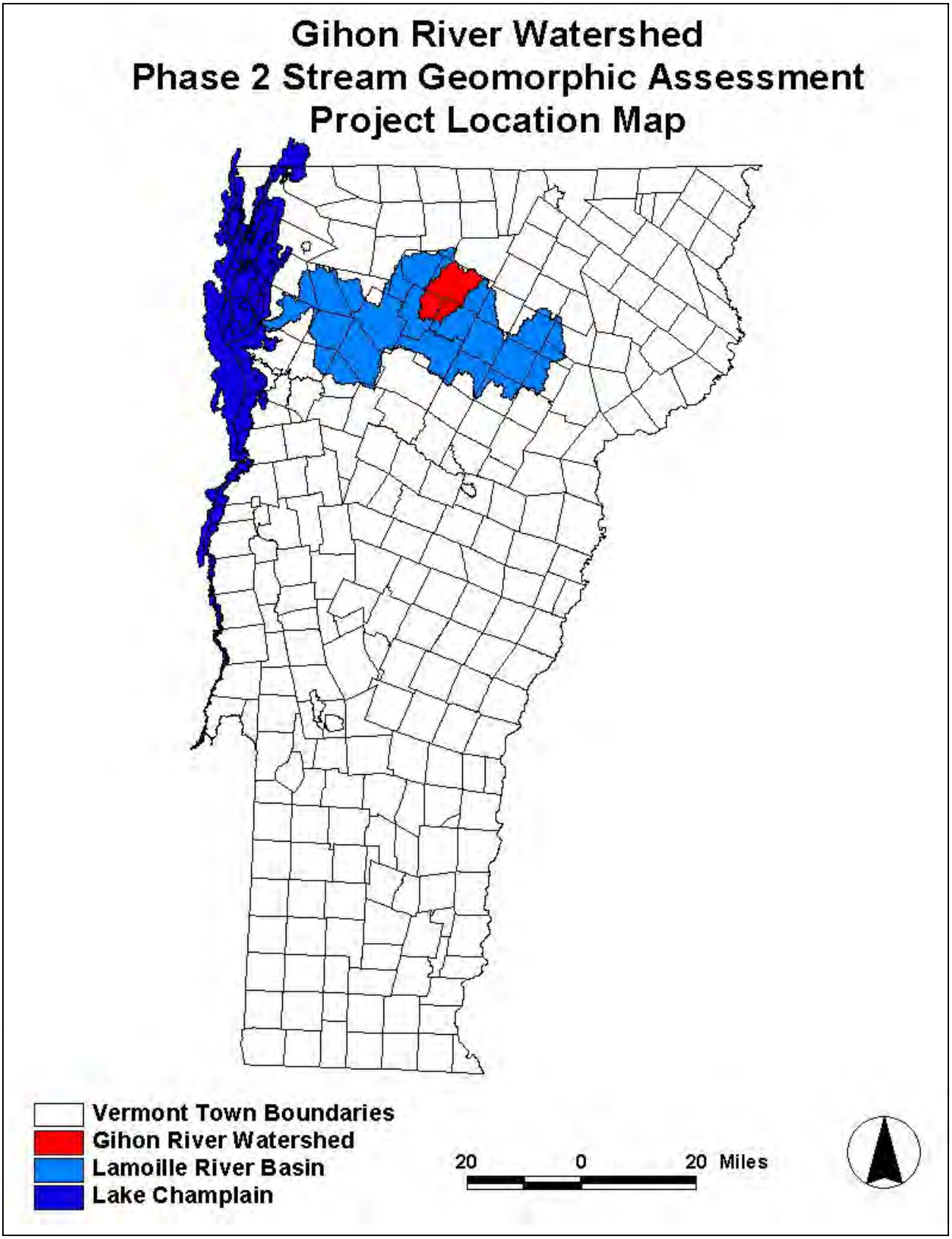

Figure 1: Project location map

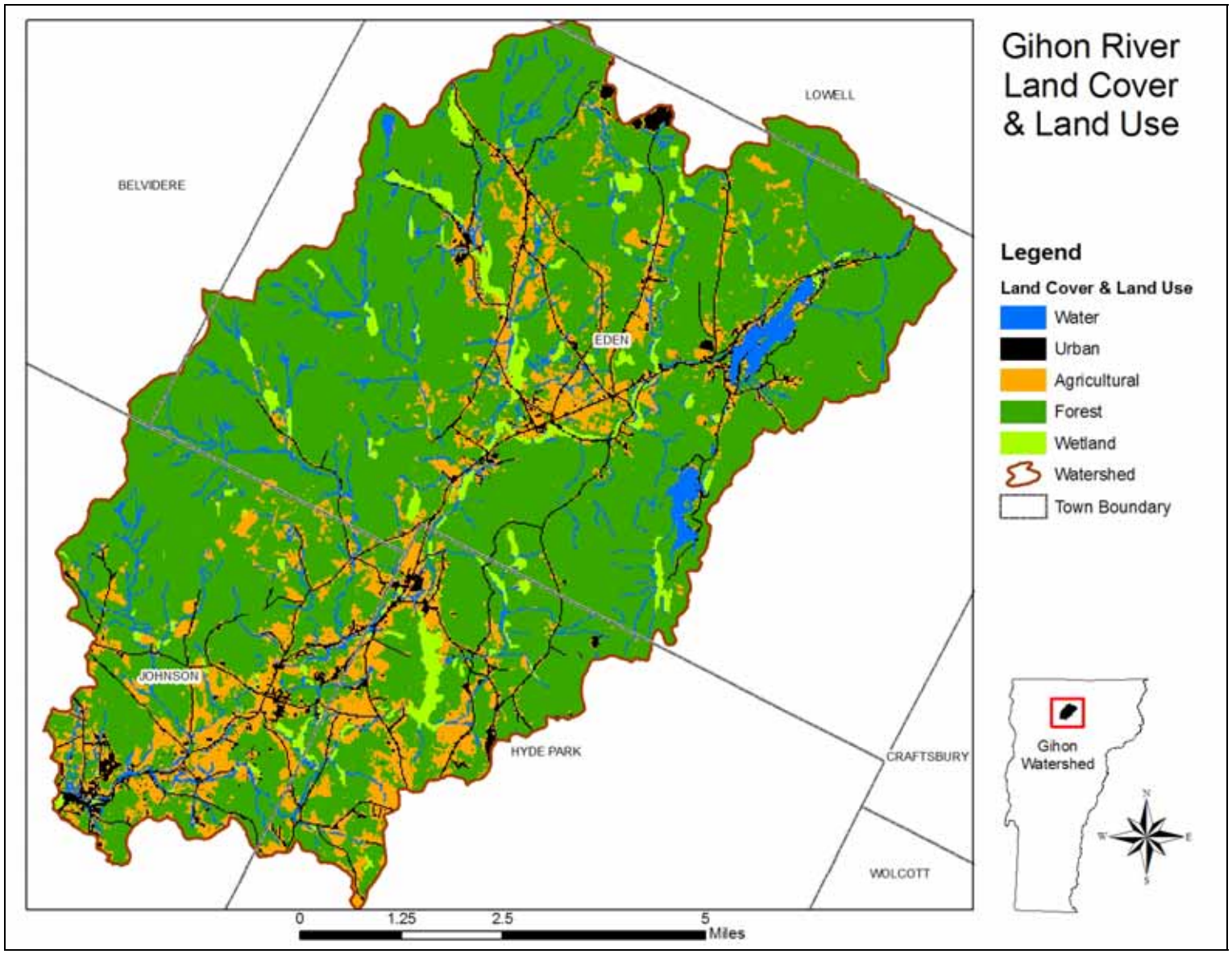

Figure 2. Land cover and land use for the Gihon watershed

3.2 Geologic Setting

The Gihon watershed is located within the Green Mountain Geo-physiographic Province. The Green Mountains were uplifted during the Taconic orogeny about 455 million years ago (Doolan, 1996). The bedrock beneath the Gihon watershed is that of the Hazens Notch Formation. This unit is comprised of carbonaceous and noncarbonaceous quartz schist that grades to quartzite and geniss (Doll, 1961). The Green Mountains and adjacent valleys have been covered with ice during historic glacial periods. The last large ice sheet, the Laurentide Ice Sheet, covered all of New England and advanced up the Lamoille River Valley. As the climate warmed, the glacier slowly retreated and glacial lakes were dammed in the Lamoille River valley. Following the retreat of the ice sheet, the Lamoille River and its tributaries began eroding the glacial and lake sediments that were left behind (Wright, 2003).

The dominant surficial geology of the Gihon River watershed consists of alluvium, glacial till, ice contact, and glacial lake deposits (Doll, 1970). The reaches studied in the Phase 2 geomorphic assessment have ice contact, alluvium, and glacial lake deposits as their dominant geology. Alluvial soils are frequently flooded, however are only slightly to moderately erodible from overland flow; but may be more susceptible to stream bank erosion processes. Ice contact soils are infrequently flooded, however have severe erodibility. Glacial lake deposits are rarely flooded and have very severe erodibility.

3.3 Geomorphic Setting

A Phase 1 Stream Geomorphic Assessment was conducted on 25 reaches. The Phase 2 study focused on 18 stream reaches on the main stem of the Gihon River within the towns of Johnson, Hyde Park, and Eden from the confluence with the Lamoille River upstream to Eden Mills. The combined length of the stream reaches assessed is approximately 14.2 miles (Figure 3). Each reach represents a similar section of the stream based on physical attributes such as valley confinement, slope, sinuosity, bed material, dominant bedform, land use, and other hydrologic characteristics. Each point represents the downstream end of the reach.

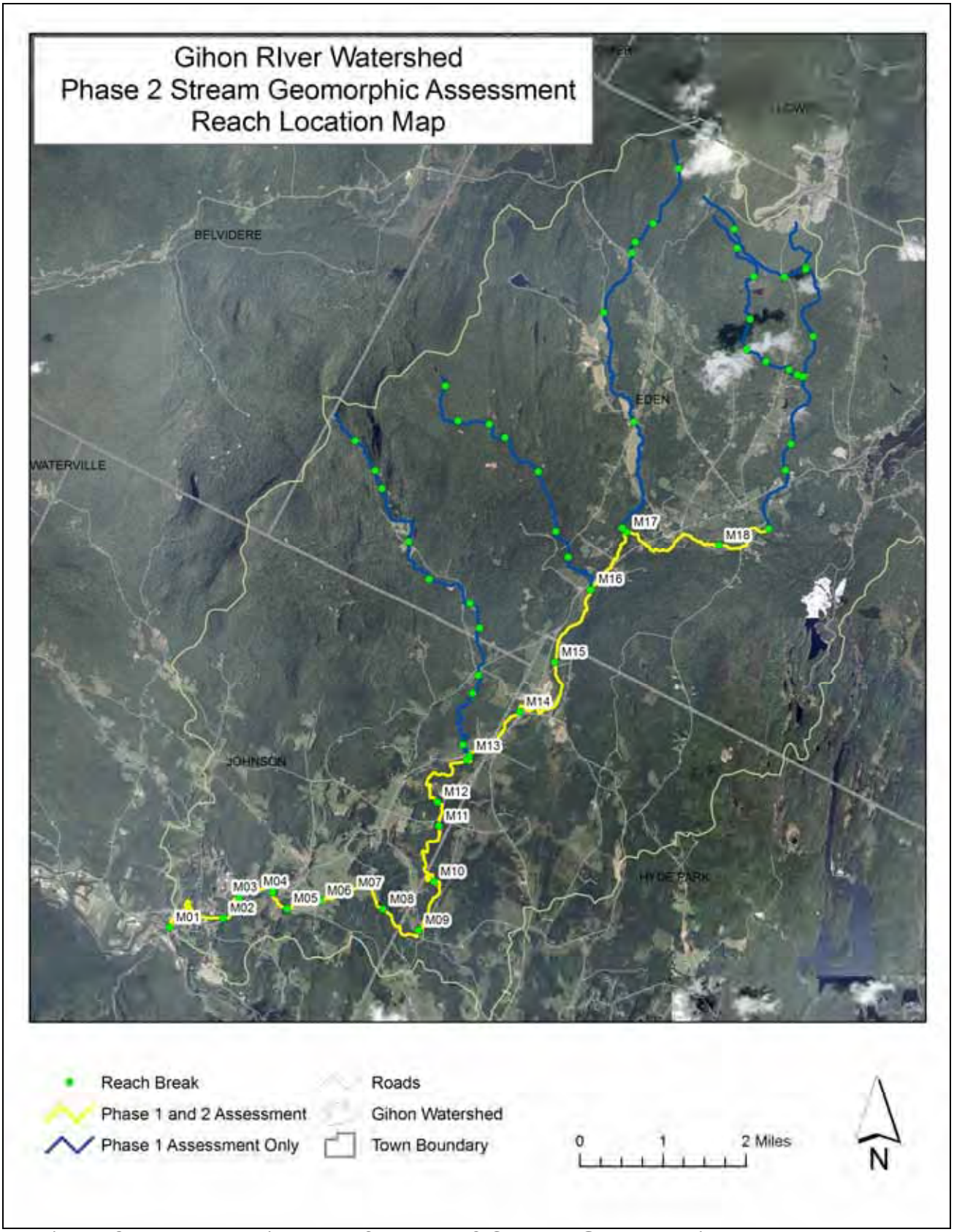

Figure 3. Reach location map for Phase 2 Stream Geomorphic Assessments

Reference stream types are based on the valley type, geology and climate of a region and describe what the channel would look like in the absence of human-related changes to the channel, floodplain, and/or watershed. Stream and valley characteristics including valley confinement, and slope determined from digital USGS topographic maps. The reference reach characteristics were refined during the windshield survey and Phase 2 Assessment. Reference reach typing was based on both the Rosgen (1996) and the Montgomery and Buffington (1997) classification systems. Table 1 shows the typical characteristics used to determine reference stream types (VANR, 2007b). Reference stream types for the assessed reaches are listed in Table 2. With the exception of reaches M03, M04, M09 and M11 which are more confined, all reaches are classified as "C" channels by reference. These reaches have a moderate width to depth ratio and flow through unconfined valleys.

Table 1: Reference Stream Type

Stream Type	Confinement	Valley Slope	Bed Form
A	Narrowly Confined	Very steep > 6.5 %	Cascade
A	Confined	Very steep 4.0 - 6.5 %	Step-Pool
B	Confined or Semi-confined	Steep 3.0 – 4.0 %	Step-Pool
B	Confined, Semi-confined or Narrow	Moderate to Steep 2.0 – 3.0 %	Plane Bed
C or E	Unconfined (Narrow, Broad or Very Broad)	Moderate to Gentle <2.0 %	Riffle-Pool or Dune-Ripple
D	Unconfined (Narrow, Broad or Very Broad)	Moderate to Gentle <4.0 %	Braided Channel

Table 2: Geomorphic Setting of Assessed Reaches

Reach ID	Reference Stream Type	Confinement	Valley Slope	Bedform
M01	C	Broad	0.73	Riffle-Pool
M02	B	Semi-confined	2.67	Bedrock
M03	Bc	Semi-confined	1.61	Plane Bed
M04	Bc	Semi-confined	0.21	Plane Bed
M05	C	Very Broad	0.31	Riffle-Pool
M06	C	Broad	0.20	Riffle-Pool
M07	C	Very Broad	0.32	Riffle-Pool

Table 2: Geomorphic Setting of Assessed Reaches

Reach ID	Reference Stream Type	Confinement	Valley Slope	Bedform
M08	B	Semi-confined	2.94	Bedrock
M09	Bc	Narrowly confined	0.64	Riffle-Pool
M10	C	Broad	0.45	Riffle-Pool
M11	B	Semi-confined	0.82	Plane Bed
M12	C	Broad	0.85	Riffle-Pool
M13	C	Narrow	0.75	Riffle-Pool
M14	C	Very Broad	0.14	Riffle-Pool
M15	C	Broad	0.56	Riffle-Pool
M16	C	Broad	0.38	Riffle-Pool
M17	C	Very Broad	0.64	Riffle-Pool
M18	C	Broad	1.46	Riffle-Pool

Natural bedrock grade controls were noted in seven of the assessed segments (M01-B, M02, M03, M04-A, M05, M09-B, and M11-B). The steepness of the valley side slopes was determined using a combination of USGS 1:24000 topographic maps and the Natural Resource Conservation Services soils layer. No alluvial fans were identified in the study area.

3.4 Hydrology

In order to better understand the flood history of Gihon River, long term data from the U.S. Department of the Interior, U.S. Geological Survey (USGS) gauge on the Lamoille River in Johnson, VT and data from a smaller brook, Stony Brook in Eden, VT, were obtained (USGS, 2007). Eighty-two years of record (1912-1913 and 1929-2008) are available for the Lamoille River gauge at Johnson, VT. A total of twenty-one years of record (1964-1974 and 1999-2008) are currently available for Stony Brook.

The near term record for Lamoille River and Stony Brook both show that 1973 was a high flow year. The long term record on the Lamoille gauge shows major flood events also occurred in the years 1912, 1936, 1984, 1995 and 1997. Figures 4 and 5 provide a flood frequency analysis for the Lamoille River gauge and the Stony Brook gauge respectively.

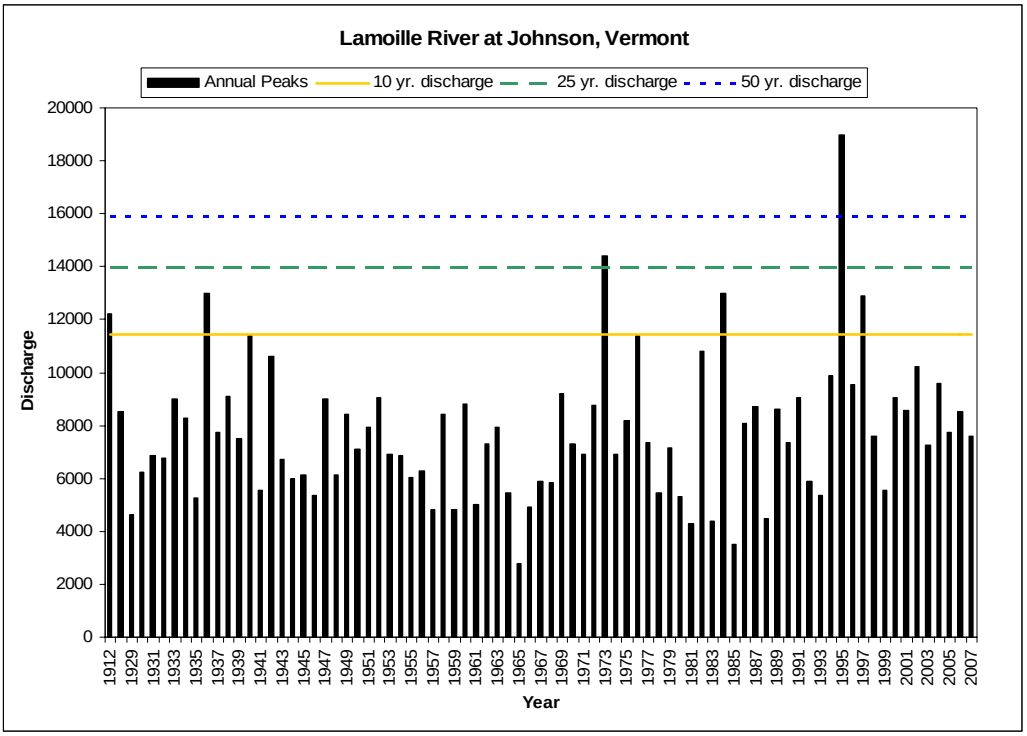

Figure 4. Flood frequency analysis for Lamoille River at Johnson, VT

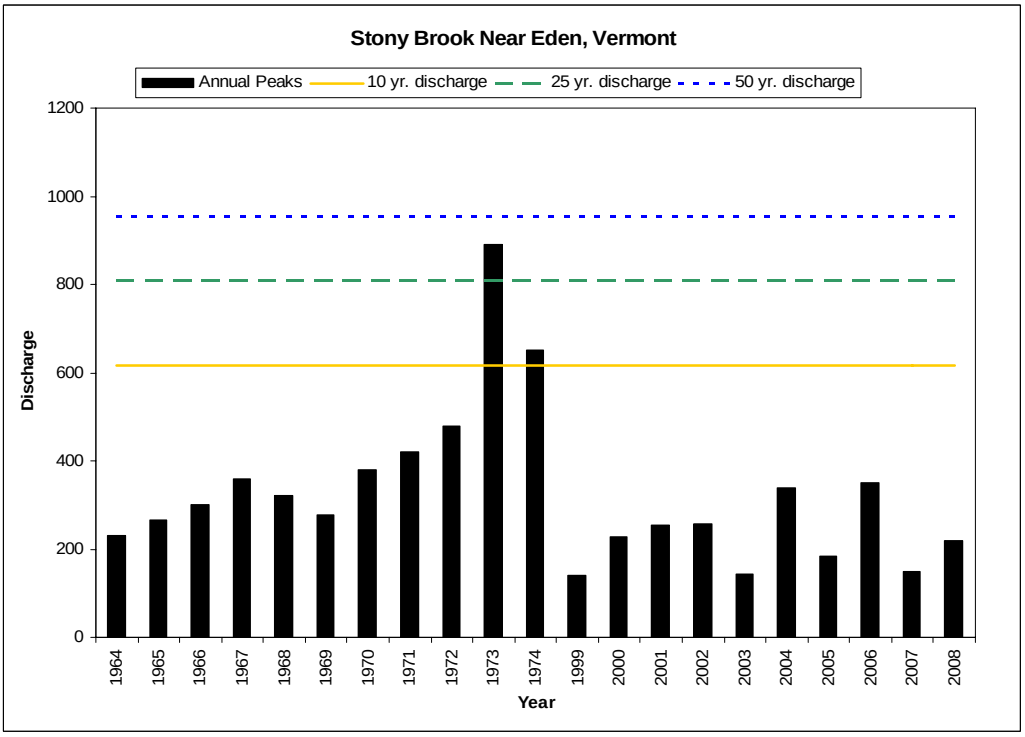

Figure 5. Flood frequency analysis for Stony Brook, Eden, VT

Of all the natural hazards experienced in Vermont, flooding is the most frequent, damaging, and costly. Over the last 50 years, flood recovery has cost Vermonters an average of 14 Million dollars a year. During the period of 1995-1998 alone, flood losses in Vermont totaled nearly $57 Million. While some flood losses are caused by inundation (i.e. waters rise, fill, and damage low-lying structures), most flood losses in Vermont are caused by "fluvial erosion". Fluvial erosion is erosion caused by rivers and streams, and can range from gradual bank erosion to catastrophic changes in river channel location and dimension during flood events (Vermont Agency of Natural Resources 2006).

Closer study of our rivers and streams reveals that Vermont's erosion hazard problems are largely due to pervasive, human-caused alteration during the past 150 to 200 years of our waterways and landscapes they drain. By end of the nineteenth century, forests had been cleared from many watersheds, resulting in major changes in watershed hydrology and sediment production. Towns and villages, the centers of commerce, grew on the banks of rivers, whose role in power generation and transportation at first outweighed flood risks. In addition, many watersheds were changed by development, agriculture, log drives, roads and railways. The legacy of this landscape manipulation is rivers, such as the Gihon, which are unstable and prone to fluvial erosion (Vermont Agency of Natural Resources 2006).

Through Vermont's history, flood waters on the Gihon River have destroyed property on numerous occasions. In 1995, Johnson Village, at the mouth of the Gihon, was the site of the of the most extensive flood damage in Lamoille County (Ryan 2001). Precipitation trend analysis suggests that intense, localized storms, which can cause flash flooding, are occurring with greater frequency.

Functioning floodplains play a crucial role to providing long term stability to a river system. Natural and anthropogenic impacts may alter the equilibrium of sediment and flow in natural stream systems and set in motion a series of morphological responses (aggradation, degradation, and widening and/or planform adjustment) as the channel tries to reestablish a dynamic equilibrium. Small to moderate changes in slope, discharge, and/or sediment supply can alter the size of transported sediment as well as the geometry of the channel; while large changes can transform reach level channel types (Ryan 2001). Human-induced practices that have contributed to stream instability within the Gihon River watershed include:

- Forest clearing
- Channelization and bank armoring
- Removal of woody riparian vegetation
- Floodplain encroachments
- Poor road maintenance and installation of infrastructure
- Loss of wetlands

These anthropogenic practices have altered the balance between water and sediment discharges within the Gihon River watershed. Channel morphologic responses to these practices contribute to channel adjustment that may further create unstable channels. The most common adjustment processes in the Gihon River are widening and planform migration as a result of historic degradation within the channel. Degradation is the term

used to describe the process whereby the stream bed lowers in elevation through erosion, or scour, of bed material. Aggradation is a term used to describe the raising of the bed elevation through an accumulation of sediment. The planform is the channel shape as seen from the air. Planform change can be the result of a straightened course imposed on the river through different channel management activities, or a channel response to other adjustment processes such as aggradation and widening. Channel widening occurs when stream flows are contained in a channel as a result of degradation or floodplain encroachment or when sediments overwhelm the stream channel and the erosive energy is concentrated into both banks.

3.5 Ecological Setting

The Gihon River watershed lies within the Northern Green Mountains biophysical region. This region is characterized by Thompson and Sorenson (2005) as having high elevations and cool summers. The Green Mountains have a strong influence on the weather resulting in an abundance of precipitation in the form of both rain and snow. Northern hardwood forest is the dominant community in this biophysical region. The Northern Green Mountains provide important habitat for both aquatic and terrestrial animals. According to Thompson and Sorenson (2005), the Green Mountains provide extensive habitat for black bear, white-tailed deer, bob cat, fisher, beaver and red squirrel. Birds such as blackpoll warbles, Swainson's thrush and the rare Bicknell's thrush nest in the high elevation forests.

4.0 METHODS

4.1 Phase 1 Methodology

A Stream Geomorphic Assessment process is divided into three phases, based on VANR protocols. Phase 1, the remote sensing phase, involves the collection of data from topographic maps and aerial photographs, from existing studies, and from very limited field studies, called "windshield surveys." The Phase 1 remote sensing techniques allow for large watersheds (100-150 square miles) to be assessed within a few months time. The Phase 1 assessment provides an overview of the general physical nature of the watershed, identifies which reaches are in particular need. A Phase 1 Assessment of the Gihon was completed by the Lamoille County Planning Commission in 2006.

4.2 Phase 2 Methodology

The Phase 2 assessment of the Gihon River was collaboratively conducted by BCE and LCPC following procedures specified in the Vermont Stream Geomorphic Assessment Handbook Phase 2 (Vermont Agency of Natural Resources, 2005). All assessment data were recorded on the Agency of Natural Resources Phase 2 data sheets, and were entered in to the ANR Stream Geomorphic Assessment data management system (DMS). The Phase 1 database was updated using the field data from the Phase 2 assessment in 2006.

The parameters and protocols used for undertaking each of the above steps are outlined in the Phase 2 Handbook (Vermont Agency of Natural Resources, 2005). The entire length of each Phase 2 reach was walked to determine segment breaks. Bank erosion, grade control structures, bank revetments, debris jams, depositional features, stormwater inputs, flood

chutes and other important features were mapped. Bear Creek Environmental used version 4.53 of the Stream Geomorphic Assessment Tool (SGAT), an ArcView Extension, to index features that were mapped during the Phase 2 assessment. BCE also indexed locations where riparian buffers are less than 25 feet on either side of the channel using SGAT version 4.56 based on National Agriculture Imagery Program (NAIP 2003) photos during winter 2008.

4.3 Bridge and Culvert

All structures within the Phase 2 study area were evaluated during Phase 2 field work for basic compatibility parameters. The Phase 2 structure notes and measured Phase 2 bankfull channel widths were used to determine structures causing major stresses on the system. A more detailed assessment of the stream crossings within the Gihon River Watershed using the Vermont River Management Bridge and Culvert Assessment protocol (Vermont Agency of Natural Resource, 2007c) has not yet been conducted.

4.4 River Corridor Plan

The Vermont Agency of Natural Resources River Corridor Planning Guide (2007a) and Draft 9 of Chapter 5 of the plan dated October 2, 2007 were followed to generate a series of stressor maps. These maps were created using indexed data from the Phase 1 and Phase 2 Stream Geomorphic Assessments along with existing data available from VCGI, including e911 roads, e911 buildings and e911 driveways. The stressor maps were then used to identify potential river corridor protection and restoration projects.

4.5 Quality Control/Quality Assurance Procedures

To assure a high level of confidence in the Phase 1 and 2 SGA data, strict quality assurance/quality control (QA/QC) procedures were followed by BCE. These procedures involved a thorough in-house review of all data as well as automated and manual QC checks with the DEC River Management Program.

In December 2006, BCE completed its own in-house QA review after all the Phase 2 data were entered into the DMS and the Phase 1 data were updated. The Phase 1 DMS and ArcView shapefiles were updated by Michael Blazewicz and Pamela DeAndrea based on the Phase 2 field assessment work. The DMS and the ArcView shapefiles for the Gihon River Phase 2 study were submitted to Staci Pomeroy of the ANR for a Quality Assurance review in December 2006. Some minor revisions were made by Bear Creek Environmental to the DMS following this review and the ANR QA review was completed in February 2007.

5.0 RESULTS

5.1 Phase 2 Results

Rapid Geomorphic Assessment

A summary of all Phase 2 results are provided in the Appendix. The reach condition ratings of Gihon River indicate that several of the reaches are actively, or have historically, undergone a process of minor or major geomorphic adjustment. The most common adjustment processes in the Gihon River are widening and planform migration as a result of historic degradation within the channel.

Several of the reaches studied in the Gihon River watershed are undergoing a channel evolution process in response to large scale changes in its sediment, slope, and/or discharge associated with the human influences on the watershed. Table 3 below summarizes the channel evolution of each study reach and the primary adjustment processes that are occurring. Once a stream begins to incise, it will typically erode its way through an evolution process until it has created a new floodplain at a lower elevation in the landscape. The common stages of channel evolution, as shown below in Figure 6, include:

- A pre-disturbance period
- Incision – channel degradation
- Aggradation and channel widening
- The gradual formation of a stable channel with access to its floodplain at a lower elevation

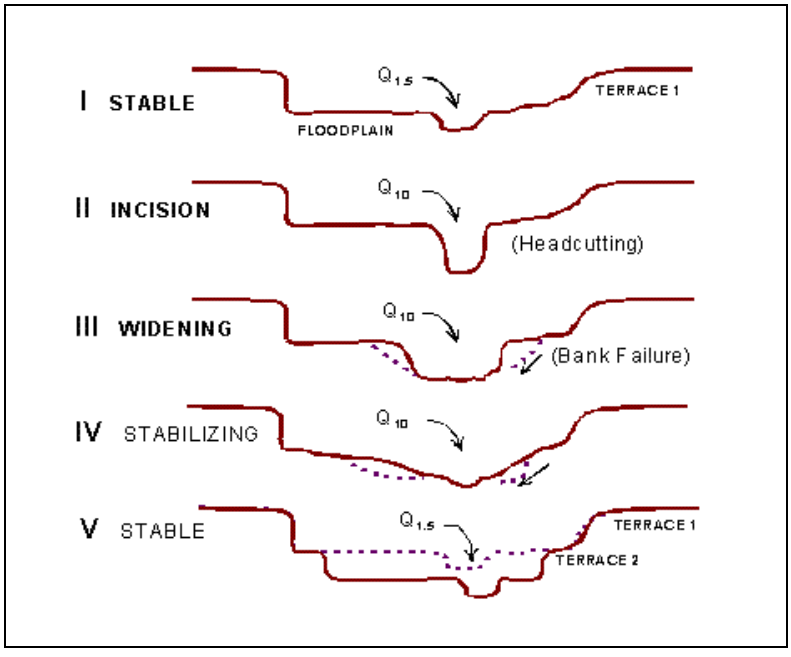

Figure 6. F-stage Channel Evolution Process (from Vermont Agency of Natural Resources, 2007a)

Table 3. Stream Type and Channel Evolution Stage

Segment Number	Entrenchment Ratio	Width to Depth Ratio	Reference Stream Type	Existing Stream Type	Channel Evolution Stage	Active Adjustment Process
M01-A	6.95	26.55	C4	C4	FIII	**Planform Aggradation** Widening
M01-B	4.26	19.26	C4	C4	FII	**Planform Widening** Aggradation
M02	Predominately bedrock controlled					
M03	1.63	28.83	B4c	B4c	FIII	**Widening** Planform Aggradation
M04-A	Predominately bedrock controlled					
M04-B	2.03	16.96	B4c	B4c	FIII	Widening Planform Aggradation
M05	19.62	18.33	C4	C4	FIII	**Planform Aggradation** Widening
M06	8.55	18.24	C4	C4	FIII	**Planform** Widening Aggradation
M07	14.66	18.11	C4	C4	FIII	**Planform** Widening Aggradation
M08	Predominately bedrock controlled					
M09-A	Impounded by dam					
M09-B	1.61	18.61	B4c	B4c	FI	Aggradation Widening Planform
M10	8.45	33.92	C4	C4	FIV	**Planform Aggradation Widening**
M11-A	1.13	30.36	B4	F4	FIII	**Widening** Aggradation Planform
M11-B	Predominately bedrock controlled					
M12	6.45	32.55	C4	C4	DIIc	**Planform Aggradation Planform**
M13-A	1.22	23.77	C4	F4	FIII	**Planform** Widening Aggradation
M13-B	2.90	25.00	C4	C4	FIII	**Planform** Widening Aggradation
M14-A	5.38	21.32	C4	C4	DIIc	Planform Widening Aggradation

Table 3. Stream Type and Channel Evolution Stage

Segment Number	Entrenchment Ratio	Width to Depth Ratio	Reference Stream Type	Existing Stream Type	Channel Evolution Stage	Active Adjustment Process
M14-B	7.19	19.33	C4	C4	FIII	Planform Widening Aggradation
M14-C	6.04	17.83	C4	C4	FIII	Aggradation Planform Widening
M15	8.30	24.51	C4	C4	FI	Aggradation Planform Widening
M16-A	7.36	13.25	C4	C4	FI	None
M16-B	2.27	26.43	C4	B3c	FII	Aggradation Planform Widening
M16-C	10.25	36.32	C4	C4	FIII	**Widening** **Planform** **Aggradation**
M17-A	16.82	15.28	C4	C4	FIII	Planform Widening Aggradation
M17-B	9.71	18.52	C4	C4	DIId	Planform Widening Aggradation
M18-A	5.32	20.90	C4	C4	FI	Aggradation Widening Planform
M18-B	4.61	15.86	C4	C4	FIII	Planform Widening Aggradation

Bold Red lettering - denotes extreme adjustment process
Bold Black lettering – denotes major adjustment process
Black lettering (no bold) – denotes minor adjustment process

In terms of the ANR channel evolution model, the Gihon River is predominately at stage III of the "F-stage" channel evolution model. In many reaches the channel has undergone historic degradation as evidenced by abandoned terraces and rejuvenating tributaries. Many of the cross sections on study reaches were found to be incised. The incision ratio ranged form 1.0 to 2.4. Along many of the main stem reaches and near the mouths of the tributaries, the system is actively adjusting to this lower bed elevation by moving laterally and widening in order to create a new floodplain at a lower elevation. This widening and planform adjustment is leading to another adjustment process, aggradation. Aggradation in the Gihon River study area seems to be a combination of endogenous sediment that is created as the stream widens and erodes its banks to reestablish a new floodplain as well as from exogenous sources such as gravel roads and land clearing.

Several segments within the Gihon River study area fell into another channel evolution model. The "D-stage" channel evolution model applies to reaches where there may have been some minor historic incision; however, the more dominant active adjustment process is aggradation, which then in turn leads to channel widening and planform adjustment. The D-stage adjustment process typically occurs in unconfined, low to moderate gradient valleys where the stream is not entrenched and has access to its floodplain or flood prone area at the 1-2 year flood stage.

This evolution is occurring in reaches M14-A and M12 where the stream channel has not incised. In the IIc stage, a steeper gradient may be imposed through activities such as channelization, but due to the resistance of the bed material, or a downstream grade control (such as in M12), the stream has not incised or lost access to its floodplain (remaining a "C" Stream Type). The channel is widening and migrating laterally through bank erosion caused by the increased stream power. The balance between stream power and boundary materials is re-established when the slope flattens after a process of channel lengthening and increased sinuosity. The stream bed in these channels may be a combination of poorly defined riffle-pool features and plane bed features.

In a similar but different process, reach M17-D most closely resembled IId of the D-stage model. In segment M17-D, the channel has become extremely depositional due to active beaver damming. Abundant sediment has built up in the system, causing the formation of many bars, shifting thalweg location, and braided flows. This process may continue here if the beavers remain, or the channel may eventually develop back into a single-thread channel.

Figure 7 is a map presenting the existing stream types found in the Gihon River watershed. Most of the reaches are Rosgen (1996) "C" channels by reference. C channels have wide valleys and moderate to gentle gradients. B channels have moderate to steep slopes and have narrower valleys than C channels. The existing geomorphic condition is depicted in Figure 8. All assessed segments and reaches in the Gihon River watershed were found to be in good or fair geomorphic condition. Geomorphic condition is determined based on the degree (if any) of channel degradation, aggradation, widening and planform adjustment. Four segments were not assessed because they were largely bedrock controlled segments. One segment (M09-A) was not assessed because it was impounded by a dam.

Figure 7. Phase 2 Existing Stream Types

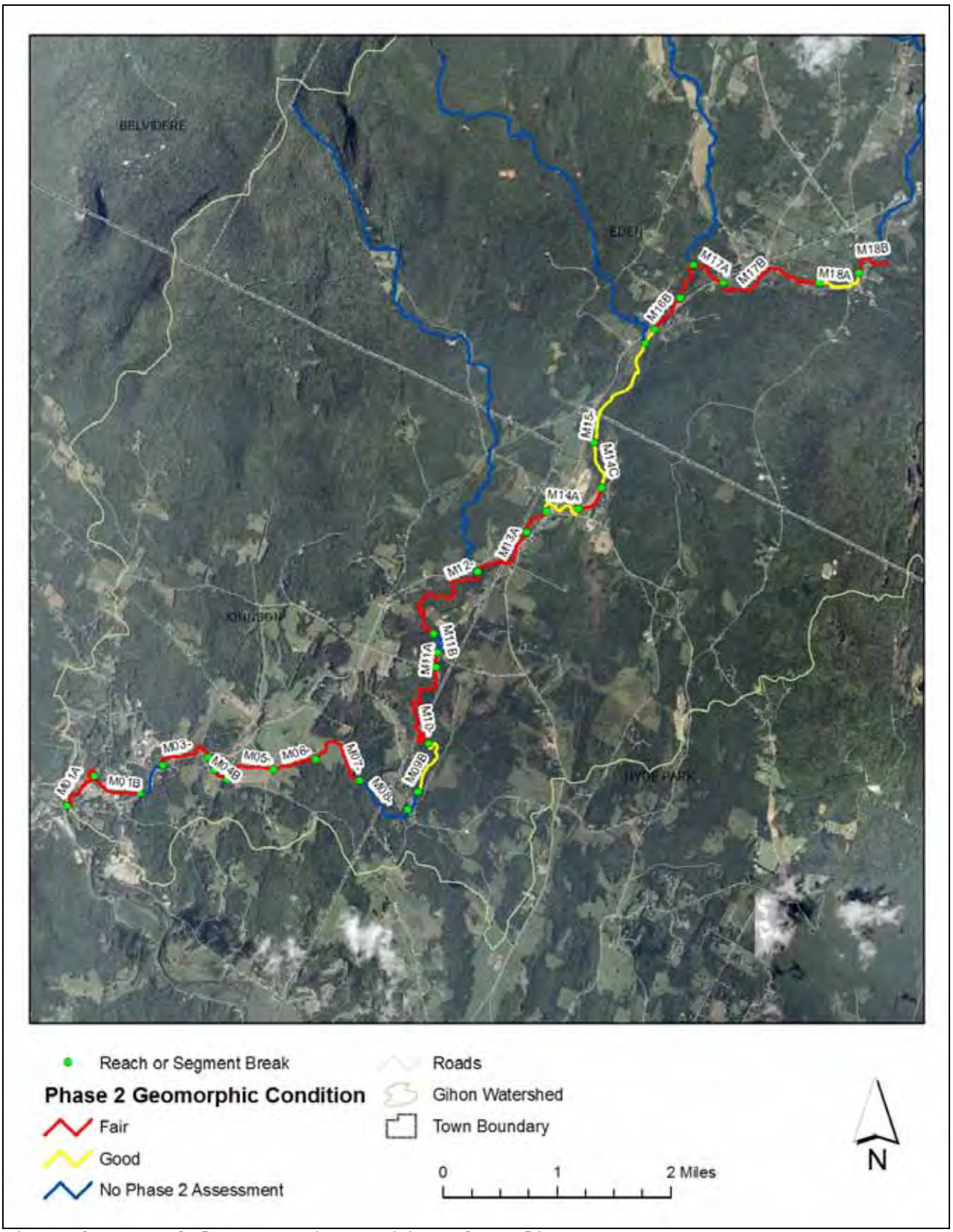

Figure 8. Phase 2 Geomorphic condition of the Gihon Watershed

HABITAT EVALUATION

Table 4 below shows a comparison of the habitat condition based on the Rapid Habitat Assessment (RHA) and and the geomorphic condition based on the Rapid Geomorphic Assessment (RGA). For twelve of the twenty-four assessed segments, both the RHA and the RGA resulted in a fair rating. Six segments had a rating of good for habitat, but a rating of fair for geomorphic condition. Reaches M09, M14-C, M15, M16-A, and M18 resulted in a rating of good for both geomorphic and habitat condition. Instream cover within many of the upstream reaches included large boulders, tree roots and depth cover in pools, many of which were well shaded by a healthy riparian corridor. Many of the reaches that had been straightened or had floodplain alterations lacked a strong riffle-pool bedform and the diversity of habitat features that this brings. Many reaches, especially near the villages had major intrusion into their river corridor from roads and many had inadequate riparian buffers due to historic and /or recent land clearing. Overall, the RHA score was similar to the RGA score, implying that the ecological health of the Gihon River is closely related to the geomorphic condition of the stream.

Table 4. Comparison of RHA and RGA for Phase 2 Reaches

Segment Number	Score RHA	Score RGA	Rating RHA	Rating RGA
M01-A	0.54	0.49	Fair	Fair
M01-B	0.39	0.49	Fair	Fair
M03	0.53	0.51	Fair	Fair
M04-B	0.47	0.56	Fair	Fair
M05	0.44	0.44	Fair	Fair
M06	0.51	0.56	Fair	Fair
M07	0.54	0.55	Fair	Fair
M09-B	0.74	0.71	Good	Good
M10	0.67	0.43	Good	Fair
M11-A	0.57	0.50	Fair	Fair
M12	0.65	0.51	Good	Fair
M13-A	0.56	0.46	Fair	Fair
M13-B	0.68	0.55	Good	Fair
M14-A	0.57	0.68	Fair	Good
M14-B	0.52	0.63	Fair	Fair
M14-C	0.75	0.65	Good	Good
M15	0.66	0.69	Good	Good
M16-A	0.66	0.78	Good	Good
M16-B	0.58	0.50	Fair	Fair
M16-C	0.70	0.45	Good	Fair
M17-A	0.57	0.59	Fair	Fair

Table 4. Comparison of RHA and RGA for Phase 2 Reaches				
Segment Number	**Score RHA**	**Score RGA**	**Rating RHA**	**Rating RGA**
M17-B	0.81	0.58	Good	Fair
M18-A	0.68	0.66	Good	Good
M18-B	0.67	0.55	Good	Fair

5.2 Bridge and Culvert Assessment

Seventeen bridges and one twin culvert are included in the reaches where Phase 2 field work was conducted in 2007. In order to assist local municipalities with priorities for replacement of the structures, priority lists were generated using the information and photographs taken during the assessment (see Table 5). The bridge span and culvert diameter was used as a first cut in prioritizing the structures for replacement. Geomorphic stability and aquatic organism passage was also considered when prioritizing bridges and culverts for replacement or retrofit.

The following general criteria were used to evaluate the structures.

High Priority: Structures with spans of approximately 50 percent of the bankfull width or less, which are significantly impeding natural sediment transport. Culverts that are impeding the passage of aquatic organisms are automatically placed in the high priority category (e.g. free fall outlet).

Moderate Priority: Structures with spans less than 50 percent that are not causing significant geomorphic instability and structures with spans greater than 50 percent that are causing instability. Culverts that are resulting in reduced aquatic organism passage (e.g. do not have material throughout the structure or have a cascade outfall) result in at least moderate priority)

Low Priority: Stream crossing structures that are not included in either of the two categories above.

Stream crossings identified as high priority for replacement/retrofit are included in the project identification table (Table 8) in Section 7. It is recommended that stream crossing within the Gihon watershed be assessed by the LCPC using the Bridge and Culvert Assessment protocol developed by the Agency of Natural Resources (Vermont Agency of Natural Resources, 2007c). This assessment will further refine the priority for replacement/retrofit of structures.

Table 5. Gihon River Stream Crossing Structures

Reach/ Segment No.	Structure Type	Road Name/ Location	Percent Channel Width	Aquatic Organism Passage	Problems Noted		Priority for Replacement
					Sediment Transport	Alignment	
M01-A	Bridge	Lower Main Street	86	NA	√		Moderate
M01-B	Bridge	Pearl Street	221	NA	√		Moderate; bridge has pier in center of channel
M02	Bridge	School Street	61[1]	NA			
M03	Bridge	Gillen Avenue	67	NA			
M03	Bridge	Route 100C W	37	NA	√		High
M03	Bridge	Route 100C E	53	NA	√		Moderate
M05	Bridge	Rocky Road	53	NA	√	√	High
M09-A	Bridge	Whitcomb Island Road	54[1]	NA	√	√	High
M11-B	Bridge	Wilson Road	61[1]	NA		√	Low
M13-A	Bridge	Route 100C	98	NA	√		Low
M14-A	Bridge	Route 100	98	NA		√	Low
M15	Bridge	Railroad	71	NA			
M16-B	Bridge	Route 100	47	NA	√	√	High
M16-B	Bridge	White Road	43	NA	√	√	High
M17-A	Bridge	Route 100	68	NA	√	√	Moderate
M17-B	Bridge	Blakeville Road	171	NA	√		Low
M18-A	Twin culverts	Mary Deuso Farm Road	35	Reduced	√	√	High
M18-B	Bridge	Blakeville Road	54	NA	√	√	High

NA – not applicable

Undersized bridges and culverts are not designed to accommodate both flow and sediment. During flood events large point bars can consequently deposit upstream of undersized bridges and culverts. During catastrophic flood events crossings can become outflanked, taking out large sections of roads and driveways. Significant sediment discharges to waterways can result. Sedimentation of the river poses water quality and aquatic habitat concerns.

6.0 Stressor, Departure and Sensitivity Analysis

Stressor, departure and sensitivity maps are presented here as a means of displaying the effects of all significant physical processes occurring within the Gihon River network that were observed during the Phase 1 and Phase 2 Stream Geomorphic Assessments. These maps also provide an indication of the degree to which the channel adjustment processes within the watershed have been altered, at both the watershed scale and the reach scale. The analysis of existing and historic departures from equilibrium conditions along a stream network allows for the prediction of future adjustments within the watershed. This is helpful in developing and prioritizing potential protection and restoration projects.

6.1 Departure Analysis and Stressor Identification

6.1.1 Hydrologic Regime Stressors

The hydrologic regime is the timing, volume, and duration of flow events throughout the year and over time and is characterized by the input and manipulation of water at the watershed scale. When the hydrologic regime has been significantly changed, stream channels will respond by undergoing a series of channel adjustments. The land use within the watershed plays a role in the hydrology of the receiving waters. The percentage of urban and cropland development within the watershed are factors which change a watershed's response to precipitation. The most common effects of urban and cropland development is increasing peak discharges and runoff by reducing infiltration and travel time (United States Department of Agriculture 1986).

The dominant watershed land cover/land use within the Gihon watershed is forest. None of the eighteen reaches resulted in a watershed land cover/land use impact rating of high (10% or more is crop and/or urban). Analysis of hydric soils located where current land uses are agricultural or urban indicates some minor loss of wetland attenuation in some subwatersheds. Historical deforestation in the Gihon watershed may also have contributed to historic incision.

The Gihon watershed has a modest network of roads as shown in Figure 9. Extensive road networks can contribute significantly to increased flows within a river resulting both from increased runoff and stormwater ditching. According to Foreman and Alexander (1998), increased peak flows in streams may be evident at road densities of 3.2 miles/ square mile. Subwatersheds with road densities of greater than 3.2 miles/ square mile account for approximately 7.0 percent of the Gihon watershed. Generally the subwatersheds of the Gihon River have road densities less than 3.0 miles/square mile.

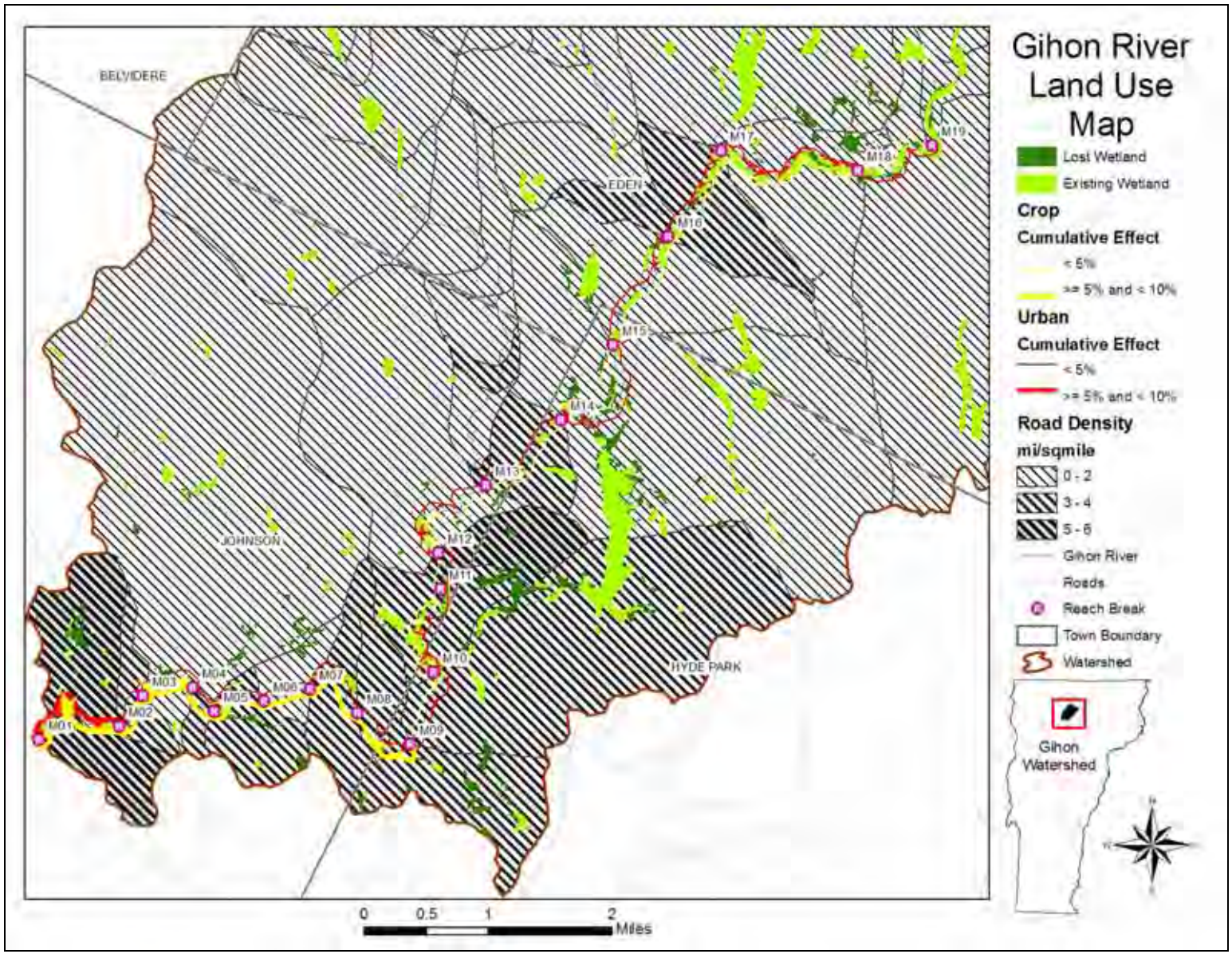

Figure 9. Land use map showing cumulative percent of urban land use, road density and lost wetlands.

6.1.2 Sediment Regime Stressors

The sediment regime is the quantity, size, transport, sorting and distribution of sediments. The sediment regime may be influenced by the proximity of sediment sources, the hydrologic regime, and the specific morphology of the valley, floodplain, and stream. The Sediment Load Indicators Map (Figure 10) shows the distribution of sediment load indicators in the Gihon watershed at the watershed scale. Isolated mass wasting sites were identified during the Stream Geomorphic Assessments in reaches M03 and M05, and multiple mass wasting sites were identified in reach M12. Localized areas of bank erosion and depositional features (steep riffles, mid channel bars, delta bars, flood chutes, and/or avulsions) are prevalent.

6.1.3 Reach Scale Sediment Regime Stressors

The previously discussed alterations to flow and sediment load at the watershed scale serve as a pretext for understanding the timing and degree to which reach scale modifications are contributing to field observed channel adjustment. When the valley, floodplain, channel and channel boundary conditions are modified, a stream may change the way sediment is transported, sorted, stored and distributed. The stressors that alter these conditions either increase or decrease stream power and or increase or decrease the resistance of its boundary conditions. This is helpful for determining why a reach is under adjustment and what types of management activities will be beneficial in returning the stream to equilibrium conditions. The primary stressors in each segment of the Gihon watershed are identified in Table 6.

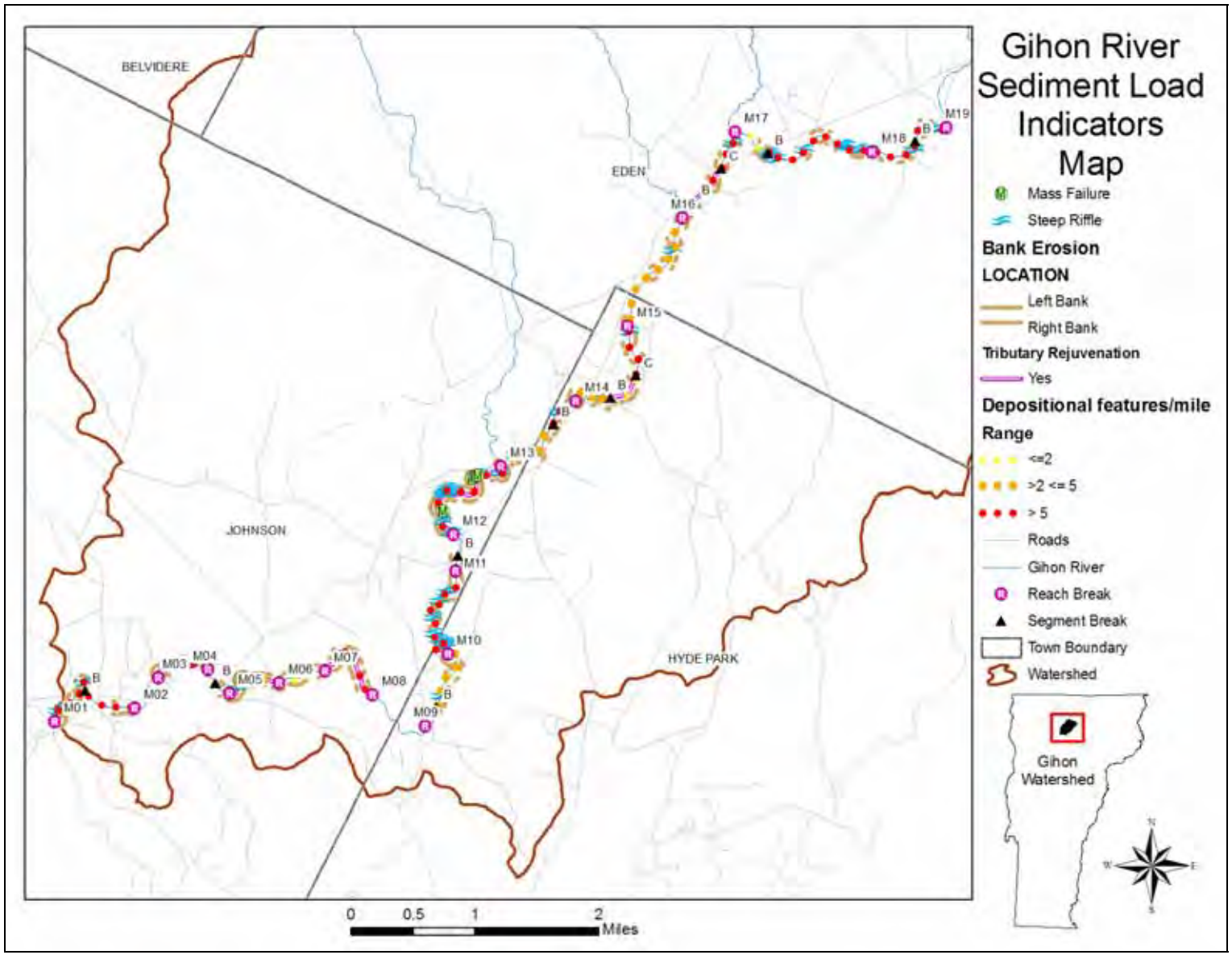

Figure 10. Sediment load indicators map showing deposition features per mile, bank erosion, steep riffles, mass failures and areas of tributary rejuvenation.

Table 6. Gihon River Stressors Table

	Watershed Input Stressors [Moderate (M), High (H), Extreme (E)]		Reach Modification Stressors [Moderate (M), High (H), Extreme (E)]	
River Segment	Hydrologic	Sediment load	Stream Power **Bold**=increase Plain=decrease	Boundary Resistance **Bold**=increase Plain=decrease
M01 A	Wetland loss Road Density (H) % Urban (M)	Historic Degradation Depositional features (H) Erosion (H)	Constriction **Straightening (H)**	**Armoring (H)** Reduced riparian vegetation (H)
M01 B	Wetland loss Stormwater Inputs (H) Road Density (H)	Historic Degradation Depositional features (H) Erosion (H)	Grade Controls Constrictions **Straightening (H)** **Encroachment (H)**	**Armoring (H)** Reduced riparian vegetation (H)
M02	Road Density (M)		Grade Controls Constrictions	
M03	Wetland loss	Historic Degradation Depositional features (H) Erosion (M)	Grade Control Constrictions **Straightening (H)** **Encroachment (H)**	**Armoring (H)** Reduced riparian vegetation (H)
M04 A	Road Density (M)		Grade Controls Constriction	
M04 B	Stormwater Inputs (H) Road Density (M)	Historic Degradation Erosion (H)	**Straightening (H)** **Encroachment (H)**	**Armoring (H)** Reduced riparian vegetation (E)
M05	Wetland loss Stormwater Inputs (M) Road Density (M)	Historic Degradation Depositional features (M) Erosion (H)	Grade Control Constriction **Straightening (H)** **Encroachment (M)**	Reduced riparian vegetation (E)
M06	Wetland loss	Historic Degradation Erosion (H)	**Straightening (H)** **Encroachment (H)**	**Armoring (M)** Reduced riparian vegetation (E)
M07	Wetland loss Stormwater Inputs (M) Road Density (M)	Historic Degradation Depositional features (H) Erosion (H)	**Straightening (H)** **Encroachment (H)**	**Armoring (M)** Reduced riparian vegetation (E)
M08	Wetland loss Road Density (M)			
M09 A	Wetland loss Road Density (M)		Constriction	Reduced riparian vegetation (E)

Table 6. Gihon River Stressors Table

	Watershed Input Stressors [Moderate (M), High (H), Extreme (E)]		Reach Modification Stressors [Moderate (M), High (H), Extreme (E)]	
River Segment	Hydrologic	Sediment load	Stream Power **Bold**=increase Plain=decrease	Boundary Resistance **Bold**=increase Plain=decrease
M09 B	Wetland loss Road Density (M)	Depositional features (M) Erosion (M)	Grade Controls Constrictions	
M10	Wetland loss Road Density (M)	Historic Degradation Depositional features (H) Erosion (H)		Reduced riparian vegetation (M)
M11 A	Wetland loss Stormwater Inputs (H) Road Density (H)	Historic Degradation Erosion (H)	**Straightening (H)** **Encroachment (H)**	Reduced riparian vegetation (E)
M11 B	Wetland loss Road Density (H)		Grade Controls Constriction	Reduced riparian vegetation (E)
M12	Wetland loss Road Density (M)	Depositional Features (H) Erosion (H)		
M13 A	Wetland loss Stormwater Inputs (M) Road Density (M)	Historic Degradation Depositional features (M) Erosion (H)	Constriction **Straightening (H)** **Encroachment (H)**	**Armoring (H)** Reduced riparian vegetation (H)
M13 B	Wetland loss Road Density (M)	Historic Degradation Depositional features (H) Erosion (M)	**Encroachment (M)**	**Armoring (H)** Reduced riparian vegetation (E)
M14 A	Wetland loss	Depositional features (M) Erosion (H)	Constriction **Straightening (M)** **Encroachment (H)**	**Armoring (H)** Reduced riparian vegetation (E)
M14 B	Wetland loss	Historic Degradation Erosion (H)	**Straightening (H)**	**Armoring (M)** Reduced riparian vegetation (E)
M14 C	Wetland loss	Historic Degradation Depositional features (H) Erosion (H)	**Straightening (H)**	
M15	Wetland loss	Depositional Features (M) Erosion (M)	Constriction	

Table 6. Gihon River Stressors Table

	Watershed Input Stressors [Moderate (M), High (H), Extreme (E)]		Reach Modification Stressors [Moderate (M), High (H), Extreme (E)]	
River Segment	Hydrologic	Sediment load	Stream Power **Bold**=increase Plain=decrease	Boundary Resistance **Bold**=increase Plain=decrease
M16 A	Road Density (M)	Erosion (M)	**Straightening (H)** **Encroachment (H)**	**Armoring (M)** Reduced riparian vegetation (E)
M16 B	Wetland loss Road Density (M)	Historic Degradation Depositional features (H) Erosion (M)	Constrictions **Straightening (H)** **Encroachment (H)**	**Armoring (H)** Reduced riparian vegetation (E)
M16 C	Wetland loss Road Density (M)	Historic Degradation Depositional features (H) Erosion (H)	**Straightening (H)**	**Armoring (M)**
M17 A	Wetland loss	Historic Degradation Erosion (H)	Constriction **Straightening (H)**	**Armoring (H)**
M17 B	Wetland loss	Historic Degradation Depositional features (H) Erosion (M)	Constriction **Straightening (H)** **Encroachment (H)**	**Armoring (M)** Reduced riparian vegetation (M)
M18 A	Wetland loss	Depositional features (H) Erosion (M)	Constriction **Straightening (H)** **Encroachment (H)**	Reduced riparian vegetation (H)
M18 B	Wetland loss	Historic Degradation Depositional features (H) Erosion (M)	Constrictions **Straightening (H)** **Encroachment (M)**	**Armoring (H)**
Moderate	Stormwater Inputs and Depositional Features 2-5 mile; Road Density 3-4 mi/sq. mi. Straightening, Bank Armoring, Erosion, and Encroachments 5-20% Urban 5-10%; Reduced Riparian Buffer 5-20%			
High	Stormwater Inputs and Depositional Features >5 mile; Road Density 5-6 mi/sq. mi. Straightening, Bank Armoring, Erosion, and Encroachment >20% Urban 10-20%; Reduced Riparian Buffer 20-50%			
Extreme	Reduced Riparian Buffer>50%; % Urban>20%			

6.1.4 Channel Modifiers

Results from the Gihon watershed indicate that primary stressors include extensive straightening of the channel along with road crossings and encroachments (see Figure 11). The majority of the channel straightening within the Gihon watershed was associated with roads that run parallel to the stream and farm fields within the river corridor.

Dredging of the channel was observed or was reported by the Vermont ANR to have taken place in the following reaches: M01-A, M02, M04-B, M05, M08, M09-A M14-A, and M17-A. Additionally, where the channel showed that it had been straightened, it is likely that some dredging that may have occurred during the straightening process. These areas of historic dredging are indicated in the DMS, but other than segment M17-A are not in the Feature Indexing Tool (FIT) point locations. These areas could not be indexed because exact locations could not be identified and the version of SGAT used at the time of the project did not allow the option of "General Location". Updated versions of the tool now allow the general location to be recorded. It is recommended that the project be updated to better capture these data for future efforts.

6.1.5 Boundary Conditions and Riparian Modifiers

Riparian buffers provide many benefits. Some of these benefits are protecting and enhancing water quality, providing fish and wildlife habitat, providing streamside shading, and providing root structure to prevent bank erosion. Five stream segments, M04-B, M06, M07, M11-A, and M14-B had over 70 percent of the reach with little or no buffer on at least one bank. Seven other segments, M05, M09-A, M11-B, M13-B, M14-A, M16-A, and M16-B, had between 50 and 70 percent of the segment with riparian buffers less than 25 feet on at least one bank. The data for the locations indicated as having little to no buffer on the Boundary Conditions and Riparian Modifiers map (Figure 12) were indexed by Bear Creek Environmental based on NAIP photos. These stream reaches which lack a high quality riparian buffer are at a significantly higher risk of experiencing high rates of lateral erosion.

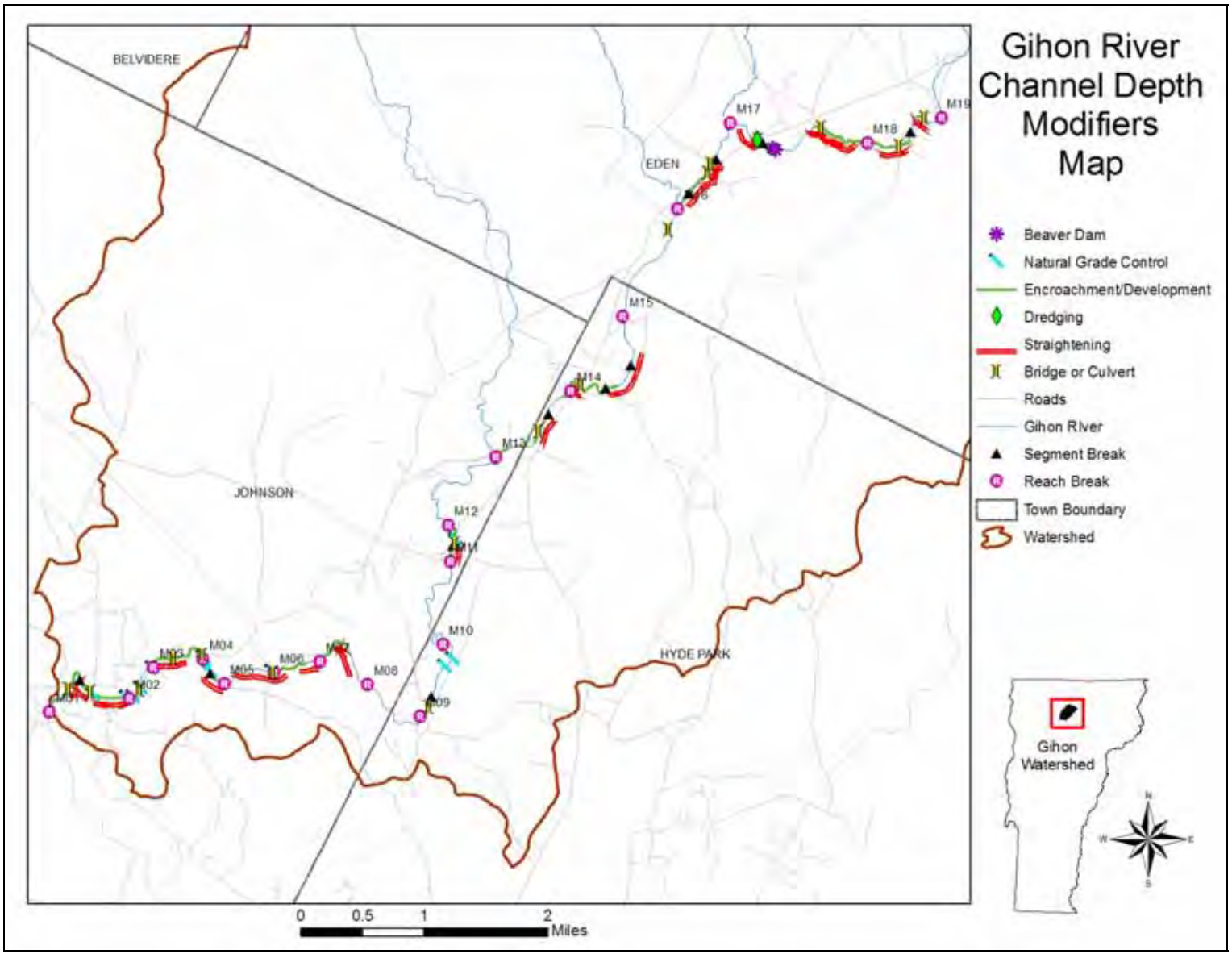

Figure 11. Channel depth modifiers map showing areas of straightening, dredging, grade controls, beaver dams and development.

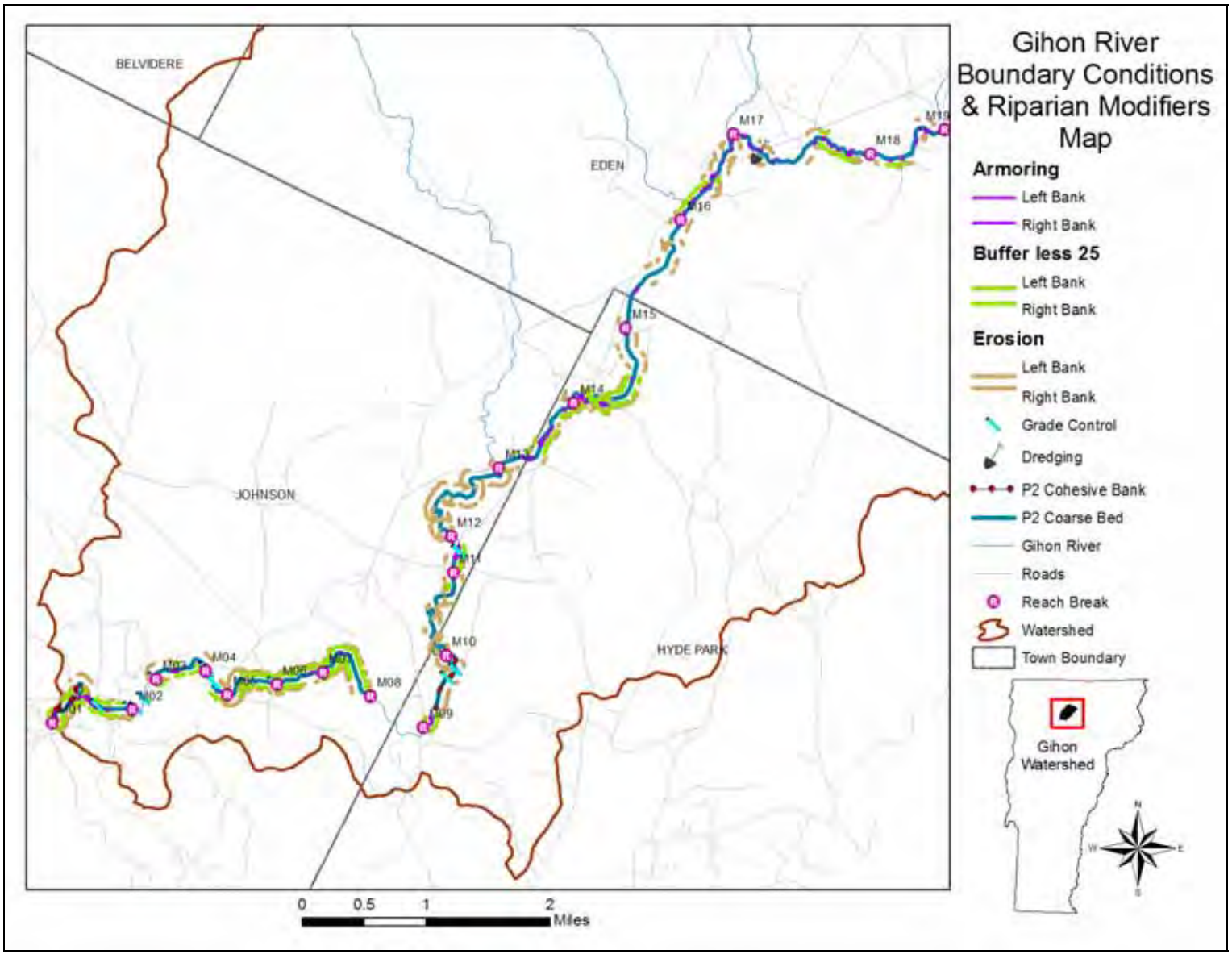

Figure 12. Boundary conditions and riparian modifications map showing areas of erosion, cohesive banks, grade controls and coarse bed materials.

6.1.6 Constraints to Sediment Transport and Attenuation

Successful river corridor restoration and protection projects depend on a thorough understanding of the sources, volumes, and attenuation of flood flows and sediment loads within the stream network. If increased loads are transported through the network to a sensitive reach, where conflicts with human investments are creating a management expectation, little success can be expected unless the restoration design accommodates the increased load or finds a way to attenuate the loads upstream (Vermont Agency of Natural Resources, 2007a).

Within a reach, the principles of stream equilibrium dictate that stream power and sediment will tend to distribute evenly over time (Leopold, 1994). Changes or modifications to watershed inputs and hydraulic geometry create disequilibrium and lead to an uneven distribution of power and sediment. Large channel adjustments observed as dramatic erosional and depositional features may be the result of this uneven distribution of power and sediment, and these adjustments may continue until a state of equilibrium is reached.

The sediment regime departure map (Figure 13) shows the Phase 1 reference stream sediment conditions for each reach within the stream network. These reference type streams use available floodplain access as a means to store sediment within the watershed. The majority of the stream network has a reference sediment regime of a *Coarse Equilibrium (in=out) & Fine Deposition*. The bedrock dominated reaches generally have a *Transport* sediment regime.

Changes in hydrology (such as development and agriculture within the riparian corridor) and sediment storage within the watershed have altered the reference sediment regime types for some reach segments. Some segments that were *Coarse Equilibrium (in=out) & Fine Deposition* type segments by reference have been converted to *Fine Source and Transport & Coarse Deposition* sediment regimes based on the Phase 2 Stream Geomorphic Assessment data. This means that most fine sediment entering the stream is being transported through without being deposited as a result of channel incision and reduced floodplain access. Additionally coarse sediment storage is increased due to increased load along with lower transport capacity. One segment (M01-B) that was *Coarse Equilibrium (in=out) & Fine Deposition* by reference has been converted to an *Unconfined Source and Transport* sediment regime due to increased transport capacity derived from bank armoring and channel straightening.

All departures were derived from the DMS according to the sediment regime criteria established by the Vermont Agency of Natural Resources (2007a). For bedrock dominated segments that were not assessed during the Phase 2 investigation (M02, M04-A, M08, and M11-B), Bear Creek Environmental used the protocols set forth in the VT ANR River Corridor Guide (2007a) to identify the proper existing sediment regime. Reach M09-A was not included in the existing sediment regime because it is impounded.

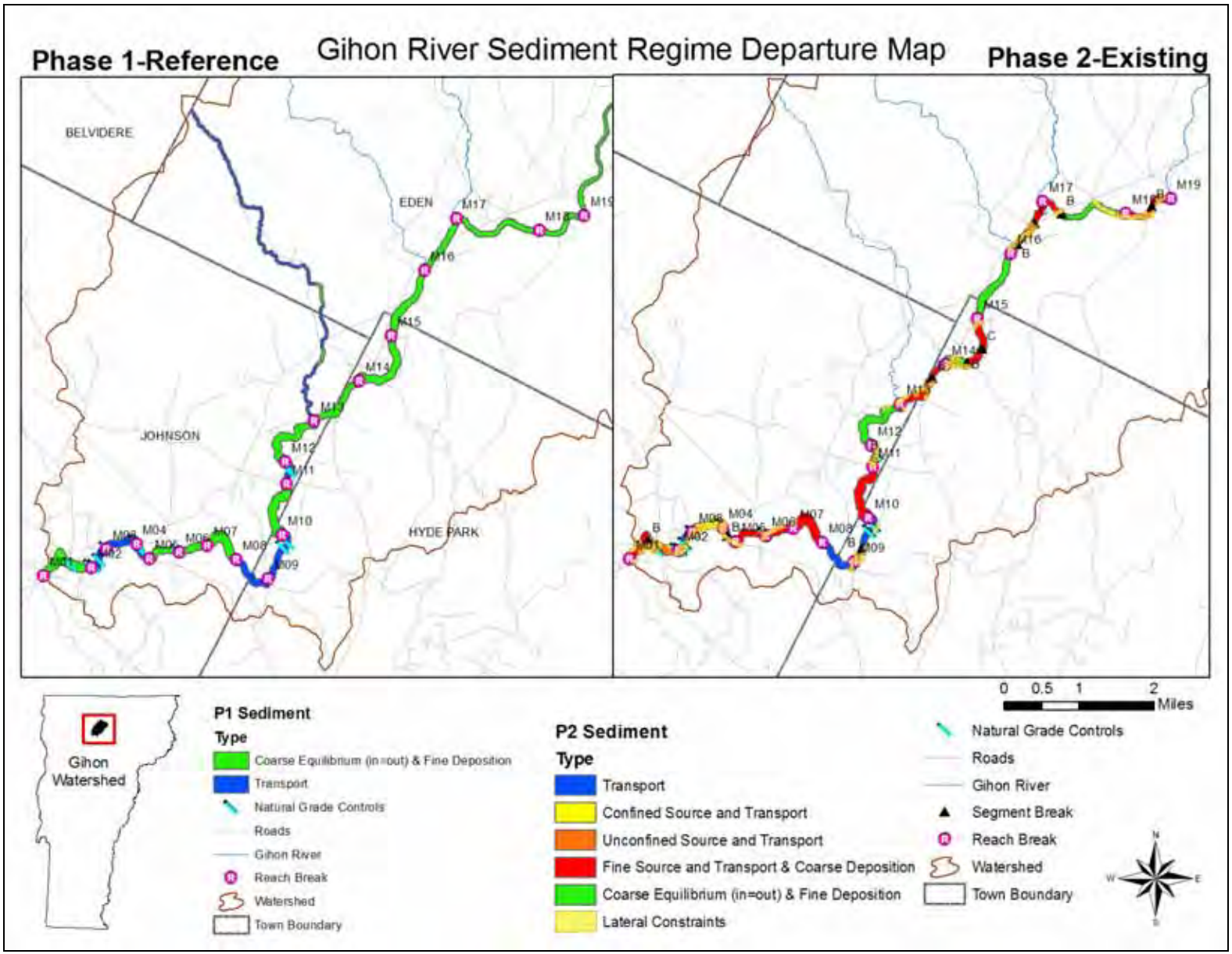

Figure 13. Sediment Regime Departure Map

The existing sediment regime for the Gihon watershed includes reduced floodplain access, increased stream power, reduced boundary resistance, and lateral constraints at various locations throughout the stream network. Watersheds which have lost attenuation or sediment storage areas, due to human related constraints, are generally more sensitive to erosion hazards, transport greater quantities of sediment and nutrients to receiving waters, and lack the sediment storage and distribution processes that create and maintain habitat (Vermont Agency of Natural Resources, 2007a). Segments and reaches of the Gihon watershed that can act as attenuation assets are identified below to help in designing stream corridor protection and restoration projects within the stream network. These segments include:

M01-A
M05
M10
M12
M14-A
M16-C
M17-B

6.2 Sensitivity Analysis

Stream sensitivity refers to the likelihood that a stream will respond to a watershed or local disturbance or stressor, such as; floodplain encroachment, channel straightening or armoring, changes in sediment or flow inputs, and/or disturbance of riparian vegetation (Vermont Agency of Natural Resources, 2007b).

Assigning a sensitivity rating to a stream is done with the assumption that some streams, due to their setting and location within the watershed, are more likely to be in an episodic, rapid, and/or measurable state of change or adjustment. A stream's inherent sensitivity may be heightened when human activities alter the setting characteristics that influence a stream's natural adjustment rate including: boundary conditions; sediment and flow regimes; and the degree of confinement within the valley. Streams that are currently in adjustment, especially those undergoing degradation or aggradation, may become acutely sensitive (Vermont Agency of Natural Resources, 2007b).

There are many variables that are contributing to the sensitivity of the reaches in the Gihon watershed. The existing geomorphic condition and stream sensitivity of the Phase 2 assessed reaches are presented in Table 7.

Table 7. Stream Sensitivity for Phase 2 Reaches

Segment Number	Reference Stream Type	Existing Stream Type	Stream Type Departure	Geomorphic Condition	Sensitivity
M01-A	C4	C4	None	Fair	Very High
M01-B	C4	C4	None	Fair	Very High
M03	B4c	B4c	None	Fair	High
M04-B	B4c	B4c	None	Fair	High
M05	C4	C4	None	Fair	Very High
M06	C4	C4	None	Fair	Very High
M07	C4	C4	None	Fair	Very High
M09-B	B4c	B4c	None	Good	Moderate
M10	C4	C4	None	Fair	Very High
M11-A	B4	F4	B to F	Fair	Extreme
M12	C4	C4	None	Fair	Very High
M13-A	C4	F4	C to F	Fair	Extreme
M13-B	C4	C4	None	Fair	Very High
M14-A	C4	C4	None	Good	High
M14-B	C4	C4	None	Fair	Very High
M14-C	C4	C4	None	Good	High
M15	C4	C4	None	Good	High
M16-A	C4	C4	None	Good	High
M16-B	C4	B3c	C to B	Fair	Very High
M16-C	C4	C4	None	Fair	Very High
M17-A	C4	C4	None	Fair	Very High
M17-B	C4	C4	None	Fair	Very High
M18-A	C4	C4	None	Good	High
M18-B	C4	C4	None	Fair	Very High

The location and slope of a stream also affects is morphology and sensitivity. Streams that are transporting sediment through the channel are less sensitive than streams that are storing and responding to sediment. Additionally, flow regime and floodplain constrictions may be affecting the sensitivity of the Gihon River. Changes in land use and land cover that increase impervious cover, peak discharges, and/or the frequency of high flows will heighten a stream's sensitivity to change and adjustment. Confinement becomes a significant sensitivity concern when structures such as roads, railroads, and berms significantly change the confinement ratio, reduce or restrict a stream's access to floodplain, and result in higher stream power during flood stage. Figure 14 is a map presenting the stream sensitivity, generalized according to stream type and condition as per the ANR protocol, and current adjustments for each reach segment in the Gihon watershed. Sensitivity ratings have not been assigned for bedrock dominated segments and impounded segments that were not assessed.

The stream sensitivity map also documents vertical channel adjustments currently going on within a reach segment. Major degradation or aggradation adjustment processes are displayed on the sensitivity corridors where they were found to be actively occurring and they were not evaluated as historic. This information is helpful in prioritizing the implementation of the projects identified in section 7 of this report, as certain management actions may be influenced by these active adjustment processes. Vertical channel adjustments exist in the following segments:

Segment ID	Current Major Adjustment Process
M01-A	Aggradation
M05	Aggradation
M10	Aggradation
M12	Aggradation
M16-C	Aggradation

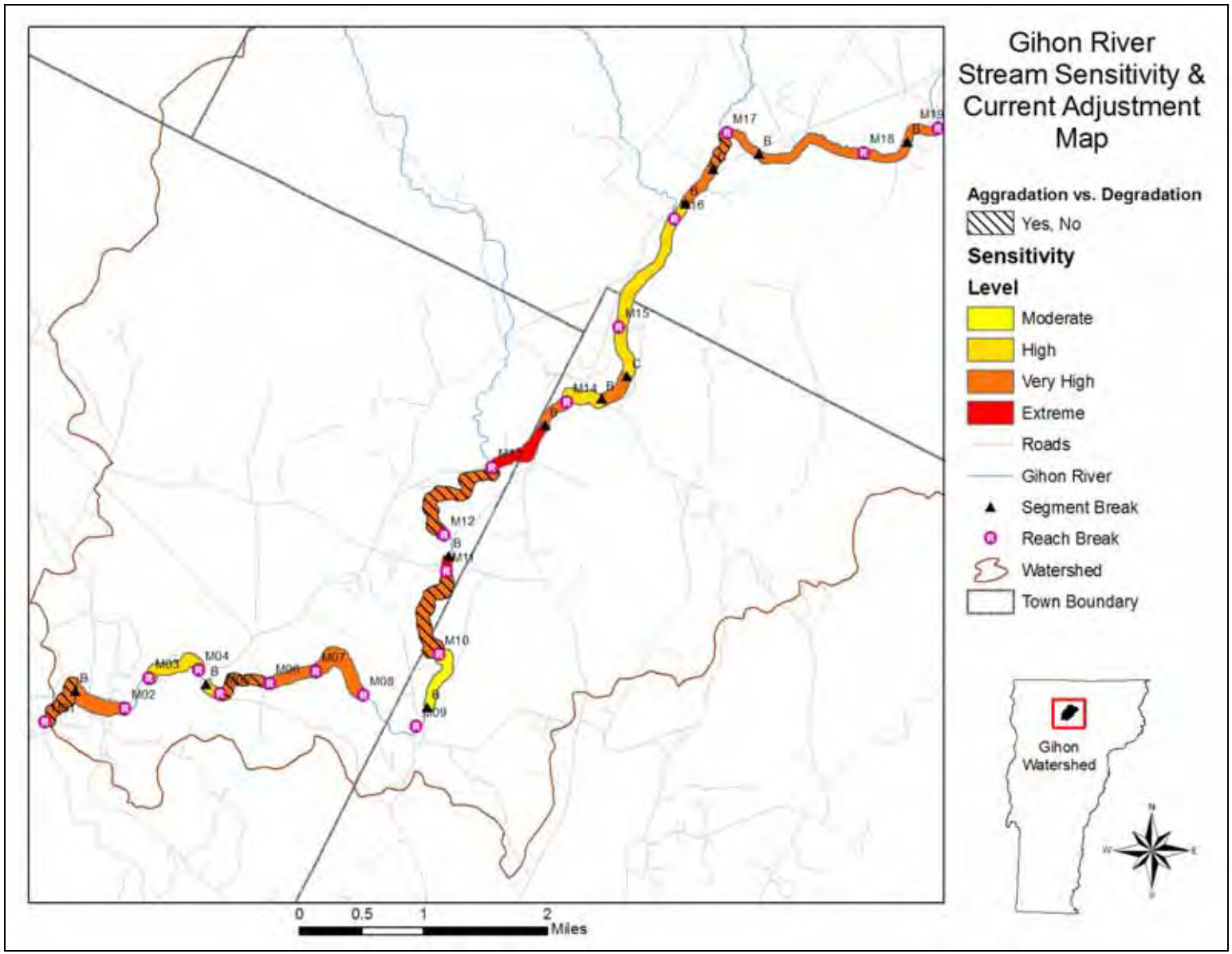

Figure 14. Gihon Watershed Stream Sensitivity and Current Adjustment

7.0 PRELIMINARY PROJECT IDENTIFICATION AND PRIORITIZATION

The departure and sensitivity analyses presented in Section 6.0 of this report provide beneficial background for selecting potential projects that will effectively help the channel return to equilibrium conditions by assessing limiting factors and by identifying underlying causes of channel instability. The stream reaches evaluated in this study present a variety of planning and management strategies which can be classified under one of the following categories: Active Geomorphic Restoration, Passive Geomorphic Restoration, and Conservation.

Active Geomorphic Restoration implies the management of rivers to a state of geomorphic equilibrium through active, physical alteration of the channel and/or floodplain. Often this approach involves the removal or reduction of human constructed constraints or the construction of meanders, floodplains or stable banks. Active riparian buffer revegetation and long-term protection of a river corridor is essential to this alternative.

Passive Geomorphic Restoration allows rivers to return to a state of geomorphic equilibrium by removing factors adversely impacting the river and subsequently using the river's own energy and watershed inputs to re-establish its meanders, floodplains and equilibrium conditions. In many cases, passive restoration projects may require varying degrees of active measures to achieve the ideal results. Active riparian buffer revegetation and long-term protection of a river corridor is also essential to this alternative.

Conservation is a passive restoration option to consider when stream conditions are generally good and nearing a state of dynamic equilibrium. Typically, conservation is applied to minimally disturbed stream reaches where river structure and function and vegetation associations are relatively intact. Similarly, corridor easement approaches to passive restoration provide protection for areas that are highly active in adjustment, allowing active processes to continue.

There are a number of voluntary programs available for river protection. Two of the primary programs are the Conservation Reserve Enhancement Program (CREP) and the River Corridor Easement (RCE). CREP is a program that helps protect environmentally sensitive land, decrease erosion, and restore wildlife habitat by taking land out of agricultural production. An overview of the Conservation Reserve Enhancement Program is found at http://www.fsa.usda.gov/FSA/webapp?area=home&subject=lown&topic=cep. The River Corridor Easement is designed to promote the long term physical stability of the river by allowing the river to achieve a state of equilibrium (where sediment and water loads are in balance). River corridor easements are vital for a passive geomorphic restoration approach and can also be used for conserving rivers that are in good condition (equilibrium). Rivers that are in equilibrium have access to their floodplains and therefore experience less erosion and negative impacts from flooding events. A description of each of the programs prepared by the Vermont River Management Program is provided below.

Conservation Reserve Enhancement Program

- CREP can be either a 15 or 30 year contract to plant trees.
- 90% of the practice costs are covered with the remaining 10% either resting with the participants or could be paid by the US Partners for Fish and Wildlife. Examples of the practice costs include fencing, watering facilities, and trees. There are some costs that are capped, but generally all the practice costs can be paid through the program.
- To provide additional incentives to enroll in CREP, the program offers upfront and annual rental payments for the land where agricultural production is lost during the contract period.

River Corridor Easement (RCE)

- Easements are in perpetuity, meaning the agreement stays with the land forever.
- A one time payment is received by the landowner for transferal of channel management rights to a second party (a land trust).
- Transferal of channel management rights means that the landowner would not longer be able to rock line river banks or remove gravel for personal use.
- A management plan accompanies the easement outlining the management and land use practices expected to occur within the corridor and describe any accommodations that must be made for existing structures (e.g. outbuildings, stream crossing, etc.).
- A RCE requires a minimum 50 foot buffer that floats with the river. No active land use is allowed within the buffer. The buffer can be actively planted or allowed to revegetate passively.
- The easement does not take away the agricultural land use rights, so the landowner could continue to crop or pasture the farm land mapped within the corridor that is outside the buffer, for as long as the river allows.

7.1 Watershed-Level Opportunities

Fluvial Erosion Hazard Zones

Of all types of natural hazards experienced in Vermont, flash flooding represents the most frequent disaster mode and has resulted in by far the greatest magnitude of damage suffered by private property and public infrastructure. While inundation-related flood loss is a significant component of flood disasters, the predominant mode of damage is associated with the dynamic, and oftentimes catastrophic, physical adjustment of stream channel dimensions and location during storm events due to bed and bank erosion, debris and ice jams, structural failures, flow diversion, or flow modification by man-made structures. These channel adjustments and their devastating consequences have frequently been documented wherein such adjustments are related to historic channel management activities, floodplain encroachments, adjacent land use practices and/or changes to watershed hydrology associated with land use and drainage.

The purpose of defining Fluvial Erosion Hazard Zones is to prevent increases in fluvial erosion resulting from uncontrolled development in identified fluvial erosion hazard areas;

minimize property loss and damage due to fluvial erosion; prohibit land uses and development in fluvial erosion hazard areas that pose a danger to health and safety; and discourage the acquisition of property that is unsuited for the intended purposes due to fluvial erosion hazards.

The basis of a Fluvial Erosion Hazard Zone is a defined river corridor which includes 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. River corridors, defined through VTANR Stream Geomorphic Assessment (2007b), are intended to provide landowners, land use planners, and river managers with a meander belt width which would accommodate the meanders and slope of a balanced or equilibrium channel, which when achieved, would serve to maximize channel stability and minimize fluvial erosion hazards. Information collected during the Phase 2 Assessment including reach sensitivity, reach condition, and stream type is used to develop these zones. Towns have the opportunity to work with the Vermont River Management Program to develop fluvial erosion hazard zones to reduce conflicts within the river corridor.

STORMWATER

Stormwater runoff rates are of particular concern in urbanized and agricultural watersheds because stormwater runs off from impervious surfaces rather than naturally infiltrating the soil. The cumulative effect of the increased frequency, volume, and rate of stormwater runoff results in increases in wash-off pollutant loading to streams and destabilization of stream channels. All potential restoration projects along the Gihon River should be evaluated in terms of their effects on stormwater.

7.2 Reach-Level Opportunities

A description of each reach/segment is provided in this section along with general recommendations for restoration and protection strategies. The reaches are listed from downstream to upstream.

Gihon River

Town of Johnson

Reach M01

Gihon River reach M01 was broken into two segments to account for historic channel management and a change in stream bedform that was observed as the river passes through Johnson Village.

Segment M01-A

Improve Riparian Buffer

Gihon River segment M01-A begins south of the Pearl St. Bridge where bank armoring ends and continues downstream, under the Route 15 Bridge to join the Lamoille River near the Johnson wastewater treatment facility. High levels of channel adjustment were observed in this reach. These adjustments are attributed to a combination of factors including: a historic lowering of the bed elevation of the Lamoille River, the increased sediment supply coming from upstream reaches of the Gihon River, and floodplain encroachment within the segment. Due to its location at the downstream end of a large watershed and at the confluence of an active and large river, this segment is naturally a place where the Gihon is more likely to undergo active adjustments.

The active adjustments recently observed include major aggradation and planform adjustment as well as minor widening. These adjustments are a result of the river working to create a new floodplain due to historic degradation which has caused the stream to incise.

Reach M01-A is undergoing major planform adjustment, aggradation, and minor widening.

Segment M01-B

Improve Riparian Buffer

Gihon segment M01-B begins below a bedrock waterfall upstream from downtown Johnson. The segment flows through a historically straightened section, past an old mill site (now housed by the Vermont Studio Center) under the Pearl Street Bridge and eventually ends 2453 feet downstream of a long section of rip rapped, channelized streambank. From above the first grade control (at the former mill), the reach has not incised significantly; however, downstream of the Pearl St. Bridge, the Gihon River has an incision ratio of 1.5. It is likely that without the significant investment in streambank armoring, the channel in this segment would be exhibiting much higher rates of channel widening and planform adjustment (which were still noted as major). Due to the anthropogenic disturbances observed in this reach, the Gihon River no longer has a riffle-pool bedform and is instead a plane bed system.

Reach M01-B is a plane bed stream due to historic channel straightening through the village of Johnson. Bank armoring has limited widening and planform adjustment

Reach M02

Gihon River reach M02 is a short, bedrock dominated channel 1922 feet long. The reach begins where the Gihon River takes a sharp "S" curve bend across from Lambert Lane, upstream of Johnson Village. The reach drops steeply through a series of bedrock ledges and waterfalls passing near an old powerhouse. It continues under the Powerhouse Covered Bridge ending several hundred feet downstream where the stream type changes. Although the reach was not fully assessed due to the bedrock influence in the channel, it was noted that route 100C has encroached on the east corridor reducing the quality of the riparian buffer.

M02 is a bedrock controlled channel and the site of a former dam

Reach M03
Improve Riparian Buffer
Replace Bridge

Gihon River reach M03 begins below a waterfall located above a bridge on Route 100C upstream from Johnson Village and ends at a sharp "S" turn bend across from Lambert Lane. The bridge at the western most Route 100C stream crossing has a narrow span (37percent of the bankfull channel width) and should be evaluated using the Vermont Agency of Natural Resources Bridge and Culvert Assessment protocol to determine the priority for replacement. The valley width of the reach appears to have been reduced by Route 100C. This floodplain encroachment, along with some historic straightening, seems to have changed the dominant bedform from a riffle-pool to a plane bed stream. The riparian buffer on this reach has been impacted by the residences that that line both sides of the river.

The reach appeared to be undergoing some major widening and is receiving sediment from upstream. Naturally occurring bedrock and large material in the stream channel have likely assisted in the overall stream stability of the reach.

M03 has large material and bedrock in the channel which has helped reduce instability

Reach M04

Gihon River reach M04 begins where the valley walls confine the stream south of the Schribner covered bridge. The 1500 foot reach was divided into two segments due to bedrock control on the bed and banks as well as a series of bedrock waterfalls that affect the morphology and channel dimensions of the lower 600 feet of the reach.

Reach M04-A

Gihon segment M04-A begins at a bedrock grade control several hundred feet upstream from the Route 100C bridge. From this point, bedrock dominates the bed and banks of the river as it drops steeply over several waterfalls and cascades. Due to the inherent stability of a bedrock gorge, this reach was not assessed for geomorphic condition.

M04-A is a bedrock controlled segment

Segment M04-B

Improve Riparian Buffer

Gihon River segment M04-B begins where Sinclair Road comes next to the river channel. This short segment extends downstream (850 feet) to the beginning of a bedrock controlled segment. The segment is a "B" type channel that marks the transition between a very broad valley upstream and a semi-confined bedrock channel in segment M04-A. This segment is predominately a transport channel, although a small amount of floodplain exists. It appears as if the stream or floodplain may have experienced minor straightening or filling during the construction of Sinclair Road. Currently only minor widening, aggradation, and planform adjustment were observed.

M04-B is a transitional segment between a very broad and semi-confined valley (B type channel)

Reach M05

Improve Riparian Buffer (Conservation Reserve Enhancement Program - CREP)
Replace undersized bridge

Gihon River reach M05 begins at the Schribner Covered Bridge (Rocky Road) and flows downstream for 2657 feet to where Sinclair Road and the valley walls of the Gihon River cause a change in stream type. The predominant land use of this reach is agricultural land, which has reduced the buffer to less than 5 feet in width along almost the entire reach. Historic channel straightening in this reach may be the cause of the channel incision (1.5 ratio) that was observed in this reach. As a result of this incision, the reach is currently undergoing major aggradation and planform adjustment as well as minor widening as the river works to build a new floodplain.

The bridge at the Rocky Road crossing was identified during the Phase 2 assessment as being both undersized and having a poor alignment. These two factors are causing localized geomorphic instability. It is recommended that this bridge be further evaluated using the Vermont Agency of Natural Resources Bridge and Culvert Assessment protocol to determine the priority for replacement

M05 has historically incised and is currently undergoing major planform adjustment and aggradation

Reach M06

Improve Riparian Buffer (CREP)

Gihon River reach M06 flows through predominately agricultural fields upstream of the Schribner Covered Bridge (Rocky Road). Agricultural impacts on this reach have reduced the buffer to less than 5 feet in width along almost the entire reach. Historic channel straightening may be the cause of the channel incision (1.3 ratio) that was observed in this reach. As a result of this incision, the reach is currently undergoing major planform adjustment and minor widening as the river attempts to redevelop a new floodplain.

M06 has historically degraded and is currently undergoing major planform and minor widening adjustment

Reach M07

Improve Riparian Buffer (CREP)

Gihon Reach M07 begins several thousand feet upstream from the Schribner covered bridge on Rocky Road where the valley walls of the Gihon River open up and the stream transitions from a bedrock controlled channel to a very broad alluvial valley. The dominant corridor land use within this reach is agriculture. Agricultural activities have impacted the riparian buffer which averages less than 5 feet in width on each side of the channel. Historic channel straightening may be the cause of the channel incision (1.4 ratio) that was observed in this reach. As a result of this incision, the reach is currently undergoing major planform adjustment and minor widening as the river attempts to redevelop a new floodplain.

M07 has historically incised, as depicted in this photograph

Reach M08

The lower end of Reach M08 is in Johnson, while the upper portion of the Reach is in Hyde Park. Reach M08 begins at the dam below Whitcomb Island Road and continues for 3611 feet. This reach was not included in the geomorphic assessment as it is a bedrock controlled channel with a well forested riparian corridor. A Phase 2 assessment of Reach M08 was not conducted due to its remote location; however, no significant channel adjustments are expected to be occurring within this reach.

Town of Hyde Park

Reach M09

Gihon River reach M09 was segmented due to impacts from a dam at its downstream end. The dam impounds the stream impacting sediment transport and water surface slope at the downstream end of the reach.

Segment M09-A (Impounded)
Improve Riparian Buffer
Replace undersized bridge

Gihon River segment M09-A begins upstream from Whitcomb Island Road. It continues for 1076 feet downstream to the M08 reach break. This segment has reduced water surface slope due to the run of the river dam on reach M08. Due to this change in hydrology, this reach was excluded from a full Phase 2 geomorphic assessment. It was observed, however, that the riparian buffer in this reach has been reduced to less than 5 feet in width through most of the segment due to residential development and clearing near Barnes Road on the east bank.

Segment M09-A is impacted by a dam at the downstream end of the reach. It was excluded from a full geomorphic assessment due to the backwater effect of the dam

Segment M09-B
Protect River Corridor

Segment M09-B begins about 2500 feet upstream from the Whitcomb Island Road Bridge where the valley width of the Gihon River changes from very broad to narrowly confined. The upstream end of this reach is a B channel dominated by gravel substrates. There are, however, large bedrock outcrops that run through portions of this reach and exposed slopes along the valley walls are consistently bedrock. Due to the very stable nature of the bed and banks, this reach has not incised. It remains a B channel with a healthy riparian buffer (>100 feet in width on both banks). There is some evidence of minor channel widening in this segment which appears to be a reaction to minor channel aggradation associated with streambank erosion upstream.

Segment M09-B is a naturally occurring B channel in a confined valley that has bedrock outcrops and a healthy riparian buffer on both banks.

Town of Johnson

Reach M10

Improve Riparian Buffer (minor)
Protect River Corridor

Gihon River reach M10 is located predominately within the Town of Johnson. A small portion of reach M10 is Hyde Park. Reach M10 is an actively adjusting channel that flows through predominately forested lands about half-way through the study area. The reach begins below a bedrock dominated section, and ends at a bedrock falls where it comes near Barnes Road. In between these two bedrock grade controls is Gihon reach M10, an incised channel (incision ratio of 1.4) that is undergoing extreme planform adjustment along with major aggradation and widening. The reason for these adjustments is not obvious, however numerous neck cut-offs, channel avulsions, flood chutes, and bars are evidence of a highly active channel. Fortunately, there is no significant infrastructure within the river corridor of this reach which remains well forested. The ability of the Gihon River to adjust through this reach and redevelop a floodplain, will likely contribute, overtime, to stability and flood reduction in downstream reaches.

M10 is undergoing extreme planform adjustment along with major widening and aggradation

Reach M11

Gihon River reach M11 begins upstream of Wilson Road. It was divided into two segments due to bedrock grade control (the most upstream grade control observed in this assessment) and bank material which dominated the upper portion of the reach and contributed to a change in stream type and channel stability between the upper and lower segments.

Segment M11-A

Improve Riparian Buffer

Segment M11-A is a short section of only 690 feet in length. The segment is a transition stretch between a bedrock dominated semi-confined channel of segment M11-B and the very broad valley of reach M10. Several residences on the east bank have made channel adjustments in this reach potentially dangerous. Field observations indicate a high level of historic incision (ratio of 2.4) through this segment. It is unknown whether this measured incision is a result of filling of the floodplain on the east bank in order to develop the houses that exist there. Due to its high width to depth ratio and high level of entrenchment, the stream was characterized as an F type stream channel, which likely represents a departure from its reference channel type, B.

Channel armoring on both banks was present and the riparian buffer on the east bank has been reduced to less than five feet in width. Major channel widening was recorded as the dominant current channel adjustment process within this segment.

M11-A is widening as a result of historic channel incision

Segment M11-B

Segment M11-B is a short (1107 feet) segment dominated by bedrock grade control and bedrock outcrops on the banks. Although the riparian buffer has been significantly disturbed on the east bank, due to Wilson Road, the highly stable nature of the bank and bed material has contributed to the overall stability of this stream. A partial assessment was conducted on this segment due to the bedrock influence.

M11-B is a bedrock dominated channel intersected by Wilson Road

Reach M12

Protect River Corridor

Gihon River reach M12 begins about 2500 feet downstream of the junction of Route 100 and 100C in North Hyde Park and continues downstream to where the valley walls of the Gihon confine the river just upstream from the Wilson Road Bridge. This reach exhibited no indication of recent channel incision. A bedrock grade controlled segment (M11-B) downstream is likely preventing incision within this reach. The river within this section, however, is undergoing a process of extreme planform adjustment as well as major aggradation and widening as it adjusts to alterations in sediment load and flow that have occurred upstream. With the exception of a few structures high on the west valley wall, the river in this reach is able to undergo extreme adjustments in a well forested corridor.

M12 is undergoing extreme planform adjustment

Town of Hyde Park

Reach M13

Gihon River reach M13 begins behind the furniture mill in North Hyde Park village and continues downstream for 4832 feet to the confluence with the Wild Brook. The reach was broken into two segments due to a change in channel confinement associated with historic degradation and floodplain encroachment.

Segment M13-A

Improve Riparian Buffer

Gihon River segment M13-A has undergone such extreme channel incision that it has become an F type stream (C by reference) that is highly entrenched between two high banks. Historic channel straightening through the Village of North Hyde Park as well as floodplain development and fill may have contributed to this condition. Major planform

adjustment and minor widening and aggradation were observed to be occurring as the stream works to redevelop a floodplain.

M13-A is undergoing major planform adjustment as a result of historic streambed incision

Segment M13-B

Improve Riparian Buffer
Protect River Corridor

Gihon segment M13-B begins just below the furniture mill in North Hyde Park and flows downstream through the village. Despite large encroachments into the river corridor on the east bank due to the village, the stream through this upper segment (1508 feet in length) has retained some floodplain access as a C type stream. Historic channel incision was recorded in this reach (incision ratio of 1.7) in addition to current major planform adjustment, minor widening and aggradation. Due to residential encroachment, the riparian buffer on the east bank has been reduced to less than 25 feet in width.

M13-B is adjusting its planform as a result of historic channel incision

Reach M14

Gihon River reach M14 begins upstream of North Hyde Park village. It was divided into three segments due to significant changes in levels of channel incision, historic channel alteration, and banks and buffers.

Segment M14-A

Improve Riparian Buffer

Gihon segment M14-A does not appear to have undergone recent incision. The reach has retained a riffle-pool bedform which may be a result of the moderate sinuosity and floodplain access which has been preserved in most of this segment. Surrounding land use in the corridor is dominated by residences. The riparian buffer along this reach has been impacted by residential development, which has reduced the buffer to between 0 and 25 feet in width through most of the reach. Despite these impacts, and some significant confinement of the channel and floodplain in the vicinity of the Route 100 Bridge, the river appears to only be undergoing minor planform adjustment and widening in this section.

M14-A has minor widening and planform adjustment

Segment M14-B

Improve Riparian Buffer

Gihon segment M14-B is also an incised channel that is thought to have been historically straightened for agricultural purposes. The major channel straightening has caused the bedform to be a weak riffle-pool system. The riparian buffer on both banks has been significantly disturbed. As a result of these anthropomorphic disturbances the river is exhibiting signs of minor channel widening and planform adjustment.

M14-B is widening in response to historic channel straightening and incision. The riparian buffer on both banks has been greatly impacted by agriculture and residential land use

Segment M14-C

Protect River Corridor

Segment M14-C flows through a forested corridor. The river through this reach is only slightly incised and numerous floodplain wetlands were found within the stream corridor. Evidence of minor channel widening, aggradation, and planform adjustment were observed to be occurring in this reach as a result of the incision. However, a very healthy riparian buffer is likely slowing these adjustment processes.

M14-C is somewhat incised with only minor channel widening, planform, and aggradation

Town of Eden

Reach M15

Protect River Corridor

Gihon River reach M15 begins at the confluence with the Stoney Brook in Eden and flows downstream through a broad valley for nearly a mile to where the valley walls widen north of North Hyde Park Village. Flowing through a dense, not recently disturbed forest, this reach appeared to be in good geomorphic condition. Minor widening, aggradation, and planform adjustments were observed in this reach which may be a result of instability upstream.

M15 flows through a heavily forested corridor and has good geomorphic stability

Reach M16

Gihon River reach M16 begins at the confluence with the White Branch and continues for 4816 feet downstream to the confluence with Stoney Brook. The reach was broken into three segments due to changes in planform and slope, depositional features, and corridor encroachments.

Segment M16-A

Protect River Corridor
Improve Riparian Buffer (West Bank)

Gihon River segment M16-A begins about 800 feet upstream of the Stoney Brook confluence. The stream through this area has excellent floodplain access along the east bank, which is dominated by alder and a mixed forested buffer. Although the stream is fairly straight through this short segment, it appears very stable, which may be a result of the very dense alder vegetation that is growing on the bank. No major stream channel adjustments were observed in this segment.

M16-A is a C channel with very densely vegetated banks that have likely assisted in keeping the channel stable

Segment M16-B

Improve Riparian Buffer

Replace undersized bridges

Gihon River segment M16-B begins upstream of White Road and continues for 2000 feet downstream to where the east valley wall opens up again and the channel becomes less confined. The river through this segment has been confined by Route 100. The loss of floodplain access has resulted in a change in stream type from a reference "C" riffle-pool channel to a "B" plane bed system. Much of the river has been rip-rapped along the road. Due to this larger material and the resistive boundary condition it creates, the river has exhibited only limited widening and planform adjustment. In addition to being a floodplain encroachment, the highway and nearby residences have reduced the buffer width to less than 5 feet in much of the segment. There are two undersized bridges in Segment M16-B (on Route 100 and White Road) that are recommended for further evaluation using the Bridge and Culvert Assessment protocol developed by the Vermont Agency of Natural Resources.

Route 100 has changed the planform and channel confinement of M16-B

Segment M16-C

Protect River Corridor and Riparian Buffer

Gihon River segment M16-C begins at the confluence with the White Branch and continues downstream to several hundred feet upstream of White Road where Route 100 changes the confinement of the river. The Gihon in this segment flows through undeveloped lands dominated by shrub-saplings and herbaceous vegetation. The river through this reach has undergone some historic degradation (incision ratio of 1.4). As a result of this incision, the channel is exhibiting major widening, aggradation, and planform adjustment.

M16-C is a C channel that is widening and adjusting planform

Reach M17

Gihon River reach M17 is a 7666 foot long reach that was broken into two segments due to historic alterations to the floodplain and channel in the lower part of the reach.

Segment M17-A

Segment M17-A begins just upstream from the Route 100 bridge and continues for 1876 feet downstream to the confluence of a tributary, the White Branch of the Gihon River. Evidence of extensive historic channel straightening was observed in this reach. The channelization that occurred has caused a loss of the riffle and pool bedform that would exist under reference conditions. Instead, a plane bed stream now exists. In addition to the loss of bedform, the stream channel has incised historically as a result of the channelization. The stream is only undergoing minor widening, planform, and aggradation adjustments, however, due to the very good near bank vegetation that exists as well as the large stone (old rip-rap) that lines much of the stream bank through this segment.

M17-A has been historically straightened and is now has a plane bed form

Segment M17-B

Gihon segment M17-B flows through a well forested riparian corridor beginning downstream of Mary Deuso Road and continues for 5790 feet to the beginning of major channel straightening upstream of Route 100 bridge. The channel has been heavily influenced by beavers. The beaver dams have caused a fair amount of aggradation in the channel. This aggradation has led to some instability as the channel widens and adjusts its planform in order to move around the dams. Despite the dynamic channel, there is excellent habitat through this segment as a result of increased woody debris in the channel and the deep pools that have been scoured.

Gihon segment M17-B is heavily influenced by beavers which have created excellent habitat, despite a geomorphically active channel

Reach M18

Gihon River reach M18 begins just off Blakeville Road in Eden and continues downstream for several thousand feet. The reach was broken into two segments due to a change in floodplain access caused by streambed incision.

Segment M18-A

Replace Twin Culverts

Gihon River segment M18-A begins downstream of an old mill site off Blakeville Road in Eden. This "C" type stream has excellent floodplain access along its entire reach. Some road encroachment has occurred along the south bank, and two undersized structures are causing localized instability to the channel. Despite these impacts, the stream through this reach is in good geomorphic condition exhibiting only minor evidence of aggradation, widening and planform adjustment. The riparian buffer on the north bank is excellent and is greater than 100 feet along the entire length of this segment. The riparian buffer on the south bank, although impacted by the road in some areas, is also dominated by a buffer over 100 feet in width.

Twin culverts in segment M18-A have combined diameters that are only 35 percent the bankfull channel width. The culverts do not have bed material throughout the inside of the structuring and are resulting in reduced aquatic organism passage. Both sediment transport and alignment were issues noted at this stream crossing. This structure has been identified as high priority for replacement.

M18-A is in very good geomorphic condition. In-stream woody vegetation in this segment offers good instream habitat

Twin culverts in M18-A high priority for replacement

Segment M18-B

Protect River Corridor

Replace undersized bridge

Gihon River segment M18-B flows through residential properties in Eden. Some evidence of past channel management was observed in this reach including channel straightening within the middle of the reach and an old mill site at the downstream end. It is likely that these past channel alterations account for the high level of historic degradation that was

observed at this site. The resistive boundary conditions, including a healthy riparian buffer along much of the reach and rip-rap along both banks, have reduced the amount of channel widening and planform adjustment observed in the field. A landowner along this reach indicated that in his lifetime the river had hardly ever flooded his lawn (adjacent to the river) further documenting the high level of incision through this segment.

A bridge with a narrow span on Blakesville Road is located within segment M18-B and was noted to be causing localized geomorphic instability due to deposition above the structure and poor alignment. This structure has been identified as a high priority for replacement.

Segment M18-B has been historically straightened. It is an incised channel that is currently undergoing minor channel widening, aggradation, and planform adjustment

Undersized bridge in M18-B identified as a priority for replacement

7.3 Site Level Opportunities

Site specific projects were identified using the criteria outlined by the ANR in Chapter 6 – Preliminary Identification and Prioritization (Vermont Agency of Natural Resources 2007a). This planning guide is intended to aid in the development of projects that project and restore river equilibrium. The site level projects that were developed for the Gihon River are provided below in Table 8. The project strategy, technical feasibility, and priority for each project are listed by project number and reach.

High priority projects include river corridor protection projects to provide attenuation of sediment and floodwaters through conservation and corridor easements, riparian buffer improvement areas, and the replacement or retrofitting of undersized stream crossing structures. According to Jim Ryan (2009), Lamoille River Basin Watershed Coordinator, in the time between Phase 2 data collection (field work) and the completion of this corridor plan, some proposed streambank stabilization and buffer planting projects have been implemented within the Gihon River watershed. Figure 15 displays the locations of these recently completed projects. Within the phase 2 study area, planting projects have been implemented in some reaches where buffer improvement projects are proposed in this report (M05, M06 and M14-A).

Information from the Phase 2 stream geomorphic assessment and ANR bridge and culvert assessment could be used to inform the Towns of Eden, Hyde Park and Johnson of which stream crossings are contributing to localized geomorphic instability.

Table 8. Gihon River Site Level Opportunities for Restoration and Protection

Town	Project # Segment	Condition and Channel Evolution Stage	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility and Priority	Other Social Benefits	Costs	Land Use Conversion	Potential Partners
Johnson	**#1 M01-A**	Fair F III	Downtown Johnson residential/commercial properties within corridor; high level of channel adjustment – not vertically stable	Improve Riparian Buffer	Low priority for plantings; establish no mow zone	Prevent erosion, improve habitat and reduce water temperature	Cost of plantings	Residential to forested	ANR, LCPC, landowners, land trust
Johnson	**#2 M01-B**	Fair F II	Runs through downtown Johnson; moderate incision ratio – not vertically stable	Improve Riparian Buffer	Low priority for plantings; establish no mow zone	Prevent erosion, improve habitat and reduce water temperature	Cost of plantings	Residential to forested	ANR, LCPC, landowners, land trust
Johnson	**#3 M03**	Fair F III	Residential properties limiting riparian buffer on both sides of the river; high incision ratio – not vertically stable	Improve Riparian Buffer	Low priority for plantings; establish no mow zone	Prevent erosion, improve habitat and reduce water temperature	Cost of plantings	Residential to forested	ANR, LCPC, landowners, land trust
Johnson	**#4 M03**	Fair F III	Bridge has narrow span;	Replace bridge	High priority for replacement (confirm priority using ANR Bridge & Culvert Assessment Protocol)	Improve sediment transport, reduce debris jam potential	High cost to replace structure	None	ANR, Town of Johnson, VTRANS
Johnson	**#5 M04-B**	Fair F III	Transport channel with limited floodplain access; high incision ratio – not vertically stable	Improve Riparian Buffer	Lowpriority for plantings; establish no mow zone	Prevent erosion, improve habitat and reduce water temperature	Cost of plantings	Residential to forested	ANR, LCPC, landowners, land trust
Johnson	**#6 M05**	Fair F III	Agricultural land uses within corridor; moderate incision ratio – not vertically stable	Improve Riparian Buffer	Moderate priority for plantings; establish no mow zone or plant back away from bank	Prevent erosion, improve habitat and reduce water temperature	Cost of plantings	Residential to forested	CREP, ANR, LCPC, landowners, land trust

Table 8. Gihon River Site Level Opportunities for Restoration and Protection

Town	Project # Segment	Condition and Channel Evolution Stage	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility and Priority	Other Social Benefits	Costs	Land Use Conversion	Potential Partners
Johnson	**#7 M05**	Fair F III	Undersized bridge with poor alignment at Rocky Road causing channel instability	Replace undersized bridge	High priority for replacement (confirm priority using ANR Bridge & Culvert Assessment Protocol)	Improve sediment transport, reduce debris jam potential	High cost to replace structure	None	ANR, Town of Johnson, VTRANS
Johnson	**#8 M06**	Fair F III	Agricultural land uses within corridor; minor vertical instability (incision ratio of 1.3)	Improve Riparian Buffer	Moderate priority for plantings	Prevent erosion, improve habitat and reduce water temperature	Cost of plantings	Residential to forested	CREP, ANR, LCPC, landowners, land trust
Johnson	**#9 M07**	Fair F III	Agricultural land uses within corridor; minor vertical instability (incision ratio of 1.4)	Improve Riparian Buffer	Moderate priority for plantings	Prevent erosion, improve habitat and reduce water temperature	Cost of plantings	Residential to forested	CREP, ANR, LCPC, landowners, land trust
Hyde Park	**#10 M09-A**	Not Assessed	Impounded segment lacking healthy riparian buffers	Improve Riparian Buffer	High priority for plantings	Prevent erosion, improve habitat and reduce water temperature	Cost of plantings	Residential to forested	ANR, LCPC, landowners, land trust
Hyde Park	**#11 M09-A**	Not Assessed	Undersized bridge causing instability	Replace undersized bridge	High priority for replacement (confirm priority using ANR Bridge & Culvert Assessment Protocol)	Improve sediment transport, reduce debris jam potential	High cost to replace structure	None	ANR, Town of Hyde Park, VTRANS
Hyde Park	**#12 M09-B**	Good F I	Stable bed and banks with healthy riparian buffers	Protect River Corridor	High priority for conservation easement	Flood and sediment attenuation	Cost of corridor easements	No new structures in corridor	ANR, LCPC, landowners, land trust

Table 8. Gihon River Site Level Opportunities for Restoration and Protection

Town	Project # Segment	Condition and Channel Evolution Stage	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility and Priority	Other Social Benefits	Costs	Land Use Conversion	Potential Partners
Johnson	**#13 M10**	Fair F IV	Well forested corridor with minor areas that could benefit from improved riparian vegetation	Improve Riparian Buffer (minor)	Low priority due to small area of benefit	Prevent erosion, improve habitat and reduce water temperature	Cost of plantings	Residential to forested	ANR, LCPC, landowners, land trust
Johnson	**#14 M10**	Fair F IV	Well forested corridor	Protect River Corridor	High priority for corridor easement	Flood and sediment attenuation	Cost of corridor easements	No new structures in corridor	ANR, LCPC, landowners, land trust
Johnson	**#15 M11-A**	Fair F III	Historically incised transition segment lacking healthy riparian buffer on east bank; high incision ratio – not vertically stable	Improve Riparian Buffer	Low priority for plantings	Prevent erosion, improve habitat and reduce water temperature	Cost of plantings	Residential to forested	ANR, LCPC, landowners, land trust
Johnson	**#16 M12**	Fair D IIc	Well forested corridor undergoing extreme corridor adjustment	Protect River Corridor	High priority for corridor easement	Flood and sediment attenuation	Cost of corridor easements	No new structures in corridor	ANR, LCPC, landowners, land trust
Hyde Park	**#17 M13-A**	Fair F III	Historically straightened, incised segment in village of North Hyde Park; high incision ratio – not vertically stable	Improve Riparian Buffer	Low priority for plantings	Prevent erosion, improve habitat and reduce water temperature	Cost of plantings	Residential to forested	ANR, LCPC, landowners, land trust
Hyde Park	**#18 M13-B**	Fair F III	Runs through village with encroachments; high incision ratio – not vertically stable	Improve Riparian Buffer	Low priority for plantings	Prevent erosion, improve habitat and reduce water temperature	Cost of plantings	Residential to forested	ANR, LCPC, landowners, land trust
Hyde Park	**#19 M13-B**	Fair F III	Runs through village with encroachments	Protect River Corridor	Low priority for corridor easement	Flood and sediment attenuation	Cost of corridor easements	No new structures in corridor	ANR, LCPC, landowners, land trust
Hyde Park	**#20 M14-A**	Good D IIc	Residential properties in corridor with good floodplain access	Improve Riparian Buffer	High priority for plantings	Prevent erosion, improve habitat and reduce water temperature	Cost of plantings	Residential to forested	ANR, LCPC, landowners, land trust

Table 8. Gihon River Site Level Opportunities for Restoration and Protection

Town	Project # Segment	Condition and Channel Evolution Stage	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility and Priority	Other Social Benefits	Costs	Land Use Conversion	Potential Partners
Hyde Park	**#21 M14-B**	Fair F III	Historically straightened channel lacking healthy riparian buffers; minor vertical instability (incision ratio of 1.3)	Improve Riparian Buffer	Moderate priority for plantings	Prevent erosion, improve habitat and reduce water temperature	Cost of plantings	Agriculture/residential to forested	ANR, LCPC, CREP, landowners, land trust
Hyde Park	**#22 M14-C**	Good F III	Forested corridor with healthy buffers and floodplain wetlands	Protect River Corridor	High priority for Conservation	Flood and sediment attenuation	Cost of conservation easements	No new structures in river corridor	ANR, LCPC, landowners, land trust
Eden	**#23 M15**	Good F I	Channel runs through dense, intact forest	Protect River Corridor	High priority for conservation	Flood and sediment attenuation	Cost of conservation easements	No new structures in river corridor	ANR, LCPC, landowners, land trust
Eden	**#24 M16-A**	Good F I	Excellent floodplain access and stable stream	Improve Riparian Buffer (West bank)	High priority for plantings	Prevent erosion, improve habitat and reduce water temperature	Cost of plantings	Residential to forested	CREP, ANR, USGWS, LCPC
Eden	**#25 M16-A**	Good F I	Excellent floodplain access and stable stream	Protect River Corridor	High priority for conservation	Flood and sediment attenuation	Cost of conservation easements	No new structures in river corridor	ANR, land trust, LCPC., landowners
Eden	**#26 M16-B**	Fair F II	Highway encroachment and residential properties limiting buffer width; high incision ratio – not vertically stable	Improve riparian buffer	Low priority for plantings	Prevent erosion, improve habitat and reduce water temperature	Cost of plantings	Residential to forested	ANR, land trust, LCPC
Eden	**#27 M16-B**	Fair F II	Undersized bridge on Route 100 causing channel instability	Replace undersized bridge	High priority for replacement (confirm priority using ANR Bridge & Culvert Assessment Protocol)	Improve sediment transport, reduce debris jam potential	High cost to replace structure	None	Town of Eden, ANR

Table 8. Gihon River Site Level Opportunities for Restoration and Protection

Town	Project # Segment	Condition and Channel Evolution Stage	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility and Priority	Other Social Benefits	Costs	Land Use Conversion	Potential Partners
Eden	**#28 M16-B**	Fair F II	Undersized bridge on White Road causing channel instability	Replace undersized bridge	High priority for replacement (confirm priority using ANR Bridge & Culvert Assessment Protocol)	Improve sediment transport, reduce debris jam potential	High cost to replace structure	None	Town of Eden, ANR
Eden	**#29 M16-C**	Fair F III	Incised channel through undeveloped land	Protect River Corridor	High priority for corridor easement	Flood and sediment attenuation	Cost of corridor easement	No new structures in river corridor	ANR, land trust, LCPC
Eden	**#30 M18-A**	Good F I	Two undersized culverts causing localized channel instability (poor alignment and undersized); these culverts are also potentially reducing aquatic organism passage.	Replace undersized culverts	High priority for replacement (confirm priority using ANR Bridge & Culvert Assessment Protocol)	Improve sediment transport, reduce debris jam potential, improve aquatic organism passage	High costs to replace structures	None	Town of Eden, VTRANS
Eden	**#31 M18-B**	Fair F III	Residential properties with healthy riparian buffers and bank armoring	Protect River Corridor	Moderate priority for Corridor Easement (multiple landowners)	Flood and sediment attenuation	Cost of corridor easements	No new structures in corridor	LCPC, ANR, land trust
Eden	**#32 M18-B**	Fair F III	Undersized bridge causing channel instability	Replace undersized bridge	High priority for replacement (confirm priority using ANR Bridge & Culvert Assessment Protocol)	Improve sediment transport, reduce debris jam potential	High cost to replace structure	None	Town of Eden, VTRANS

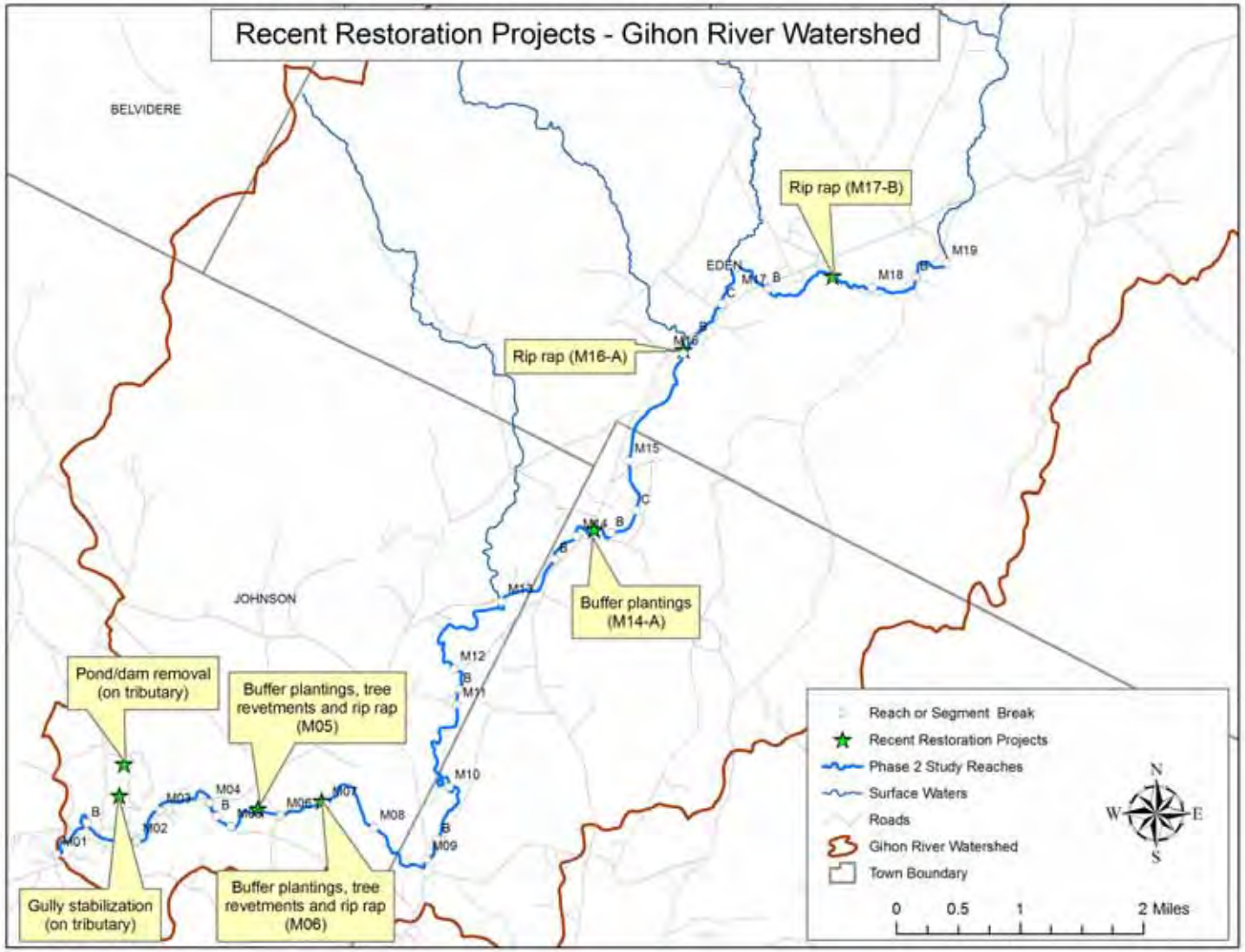

Figure 15: Map showing recent restoration projects within Gihon River watershed.

7.4 Next Steps

There are many opportunities to restore the Gihon River to a stable condition. Addressing these issues can reduce flood hazards, avoid conflicts regarding land use, and save money spent on flood damage and river maintenance. The Towns of Eden, Hyde Park and Johnson can pursue the opportunity to work the Vermont River Management Program to develop fluvial erosion hazard zones for the land surrounding the Gihon River. Additionally, a formal bridge and culvert survey using the Bridge and Culvert Assessment protocol developed by the Agency of Natural Resources (Vermont Agency of Natural Resources, 2007c) of all stream crossings within the Phase 2 study area is recommended to properly identify those structures that are causing the most channel instability. This assessment will further refine the priority for replacement/retrofit of structures identified for replacement.

8.0 Glossary of Terms

Adapted from:
Restoration Terms, by Craig Fischenich, February, 2000, USAE Research and Development Center, Environmental Laboratory, 3909 Halls Ferry Rd., Vicksburg, MS 39180
And
Vermont Stream Geomorphic Assessment Handbook, Appendix Q, 2004, VT Agency of Natural Resources, Waterbury, VT. http://www.vtwaterquality.org/rivers/docs/assessmenthandbooks/rv_apxqglossary.pdf

Adjustment process – type of change that is underway due to natural causes or human activity that has or will result in a change to the valley, floodplain, and/or channel condition (e.g., vertical, lateral, or channel plan form adjustment processes).

Aggradation - A progressive buildup or raising of the channel bed and floodplain due to sediment deposition. The geologic process by which streambeds are raised in elevation and floodplains are formed. Aggradation indicates that the stream discharge and/or bed load characteristics are changing. Opposite of degradation.

Alluvial fan – A fan-shaped accumulation of alluvium (alluvial soils) deposited at the mouth of a ravine or at the juncture of a tributary stream with the main stem where there is an abrupt change in slope.

Alluvial soils – Soil deposits from rivers.

Alluvium – A general term for detrital deposits made by streams on riverbeds, floodplains, and alluvial fans.

Avulsion – A change in channel course that occurs when a stream suddenly breaks through its banks, typically bisecting an overextended meander arc.

Bank Stability – The ability of a streambank to counteract erosion or gravity forces.

Bankfull channel depth - The maximum depth of a channel within a riffle segment when flowing at a bankfull discharge.

Bankfull channel width - The top surface width of a stream channel when flowing at a bankfull discharge.

Bankfull discharge - The stream discharge corresponding to the water stage that overtops the natural banks. This flow occurs, on average, about once every 1 to 2 years and given its frequency and magnitude is responsible for the shaping of most stream or river channels.

Bar – An accumulation of alluvium (usually gravel or sand) caused by a decrease in sediment transport capacity on the inside of meander bends or in the center of an overwide channel.

Berms – Mounds of dirt, earth, gravel or other fill built parallel to the stream banks designed to keep flood flows from entering the adjacent floodplain.

Cascade – River bed form where the channel is very steep with narrow confinement. There are often large boulders and bedrock with waterfalls.

Channelization – The process of changing (usually straightening) the natural path of a waterway.

Culvert – A buried pipe that allows flows to pass under a road.

Degradation – (1) A progressive lowering of the channel bed due to scour. Degradation is an indicator that the stream's discharge and/or sediment load is changing. The opposite of aggradation. (2) A decrease in value for a designated use.

Delta bar – A deposit of sediment where a tributary enters the mainstem of a river.

Depositional features – Types of sediment deposition and storage areas in a channel (e.g. mid-channel bars, point bars, side bars, diagonal bars, delta bars, and islands).

Drainage Basin – The total area of land from which water drains into a specific river.

Dredging – Removing material (usually sediments) from wetlands or waterways, usually to make them deeper or wider.

Erosion – Wearing away of rock or soil by the gradual detachment of soil or rock fragments by water, wind, ice, and other mechanical, chemical, or biological forces.

Floodplain – Land built of sediment that is regularly covered with water as a result of the flooding of a nearby stream.

Gaging Station – A particular site in a stream, lake, reservoir, etc., where hydrologic data are obtained.

Grade control - A fixed feature on the streambed that controls the bed elevation at that point, effectively fixing the bed elevation from potential incision; typically bedrock, dams or culverts.

Gradient – Vertical drop per unit of horizontal distance.

Habitat – The local environment in which organisms normally grow and live.

Headwater – Referring to the source of a stream or river.

Incised River – A river that erodes its channel by the process of degradation to a lower base level than existed previously or is consistent with the current hydrology.

Islands – Mid-channel bars that are above the average water level and have established woody vegetation.

Lacustrine soils- Soil deposits from lakes.

Meander - The winding of a stream channel, usually in an erodible alluvial valley. A series of sine-generated curves characterized by curved flow and alternating banks and shoals.

Meander migration – The change of course or movement of a channel. The movement of a channel over time is natural in most alluvial systems. The rate of movement may be increased if the stream is out of balance with its watershed inputs.

Meander belt width – The horizontal distance between the opposite outside banks of fully developed meanders determined by extending two lines (one on each side of the channel) parallel to the valley from the lateral extent of each meander bend along both sides of the channel.

Meander wavelength - The lineal distance downvalley between two corresponding points of successive meanders of the same phase.

Meander wavelength ratio – The meander wavelength divided by the bankfull channel width.

Meander width ratio – The meander belt width divided by the bankfull channel width.

Mid-channel bar – Sediment deposits (bar) located in the channel away from the banks, generally found in areas where the channel runs straight. Mid-channel bars caused by recent channel instability are unvegetated.

Planform - The channel shape as if observed from the air. Changes in planform often involve shifts in large amount of sediment, bank erosion, or the migration of the channel.

Plane bed – Channel lacks discrete bed features (such as pools, riffles, and point bars) and may have long stretches of featureless bed.

Point bar –The convex side of a meander bend that is built up due to sediment deposition.

Pool -- A habitat feature (section of stream) that is characterized by deep, low-velocity water and a smooth surface.

Reach - Section of river with similar characteristics such as slope, confinement (valley width), and tributary influence.

Restoration – The return of an ecosystem to a close approximation of its condition prior to disturbance.

Riffle - A habitat feature (section of stream) that is characterized by shallow, fast-moving water broken by the presence of rocks and boulders.

Riffle-pool - Channel has undulating bed that defines a sequence of riffles, runs, pools, and point bars. Occurs in moderate to low gradient and moderately sinuous channels, generally in unconfined valleys with well-established floodplains.

Riparian Buffer – The width of naturally vegetated land adjacent to the stream between the top of the bank and the edge of other land uses. A buffer is largely undisturbed and consists of the trees, shrubs, groundcover plants, duff layer, and naturally uneven ground surface.

Riparian Corridor – Lands defined by the lateral extent of a stream's meanders necessary to maintain a stable stream dimension, pattern, profile and sediment regime.

Segment – A relatively homogeneous section of stream contained within a reach that has the same reference stream characteristics but is distinct from other segments in the reach.

Sensitivity – The valley, floodplain and/or channel condition's likelihood to change due to natural causes and/or anticipated human activity.

Side bar – Unvegetated sediment deposits located along the margins or the channel in locations other than the inside of channel meander bends.

Step-pool – Characterized by longitudinal steps formed by large particles (boulder/cobbles) organized into discrete channel-spanning accumulations that separate pools, which contain smaller sized materials. Often associated with steep channels in confined valleys.

Surficial sediment/geology – Sediment that lies on top of bedrock.

Tributary – A stream that flows into another stream, river, or lake.

Urban runoff – Storm water from city streets and gutters that usually carries a great deal of litter and organic and bacterial wastes into the receiving waters.

9.0 REFERENCES

Doll, C. G. 1961. Centennial Geologic Map of Vermont. http://www.anr.state.vt.us/DEC/GEO/centmap.htm. Accessed April 2009.

Doll, C. G. 1970. Surficial Geologic Map of Vermont. http://www.anr.state.vt.us/DEC/GEO/SurfMap.htm. Accessed April 2009.

Doolan, Barry L. 1996. The Geology of Vermont. Rocks and Minerals, Vol. 71, No.4. Washington, D.C.

Foreman, R.T.T. and L.E. Alexander. 1998. Roads and Their Ecological Effects: Annual. Review of Ecological Systematics. Vol. 29: 207-231.

Leopold, L.B. 1994. A View of the River. Cambridge, Massachusetts.

Montgomery, David and Buffington, John. 1997. Channel Reach Morphology in Mountain Basins. GSA Bulletin. Boulder, Colorado.

Rosgen, Dave. 1996. Applied River Morphology. Pagosa Springs, Colorado.

Ryan, J. 2001. Stream stability assessment of Lamoille County, Vermont. Washington, Vermont.

Ryan, J. 2009. Email Communication. April 24, 2009.

Thompson and Sorenson. 2005. Wetland, Woodland, Wildland: A guide to the natural communities of Vermont. Capital City Press, Montpelier, Vermont.

United States Department of Agriculture. 1986. Urban Hydrology for Small Watersheds. Soil Conservation Service, Engineering Division, Technical Release 55. Washington, D.C.

USGS. 2007. United States Geologic Survey website. http://waterdata.usgs.gov/vt/nwis/rt

Vermont Agency of Natural Resources. 2005. Vermont Stream Geomorphic Assessment Phase 2 Handbook.: Rapid Stream Assessment, Field Protocols. Waterbury, Vermont.

Vermont Agency of Natural Resources. 2006. Fluvial Erosion Municipal Guide. Waterbury, Vermont.

Vermont Agency of Natural Resources. 2007a. Vermont Agency of Natural Resources River Corridor Planning Guide to Identify and Develop River Corridor Protection and Restoration Projects. (Partially Drafted July 2007). Vermont Agency of Natural Resources, Department of Environmental Conservation, River Management Program, Waterbury, Vermont.

Vermont Agency of Natural Resources. 2007b. Vermont Agency of Natural Resources Phase 2 Handbook, Rapid Stream Assessment Field Protocols. Vermont Agency of Natural Resources, Department of Environmental Conservation, River Management Program, Waterbury, Vermont.

Vermont Agency of Natural Resources. 2007c. Vermont Geomorphic Assessment, Appendix G, Bridge and Culvert Assessment.. Vermont Agency of Natural Resources, Department of Environmental Conservation, River Management Program, Waterbury, Vermont.

Wright, Stephen. 2003. Glacial Geology of the Burlington and Colchester 7.5' Quads, VT. University of Vermont Burlington, Vermont. http://www.anr.state.vt.us/DEC/GEO/pdfdocs/GlacGeoBurlwright.pdf

Appendix
Phase 2 Results
Gihon River

Stream: **Gihon River** Reach # **M01** Segment: **A** Completion Date: **August 16, 2006**

Organization: **Bear Creek Environmental** Observers: **Mike Blazewicz and Mike** Why Not assessed: Rain: **No**

Segment Length (ft): **3,045** Segment Location: **This segment begins at the confluence of the Gihon River and the Lamoille River. The**

QC Status - Staff: Passed **Cons**

Step 1. Valley and Floodplain

1.1 Segmentation **Grade Controls**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	**0**	**0**
height	**0**	**0**
Roads	**82**	**0**
height	**0**	**0**
Railroads	**0**	**0**
height	**0**	**0**
Improved Paths	**0**	**0**
height	**0**	**0**
Development	**1,716**	**355**

1.4 Adjacent Side	Left	Right
Hillside Slope	**Hilly**	**Hilly**
Continuous w/	**Sometimes**	**Sometimes**
W/in 1 Bankfill	**Sometimes**	**Sometimes**
Texture	**Not Evalua**	**Not Evalua**

1.5 Valley Features

Valley Width (ft) **535**

Width Determination **Estimated**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **77**

2.2 Max Depth (ft) **5.00**

2.3 Mean Depth (ft) **2.90**

2.4 Floodprone Width (ft) **535**

Notes:

Passed *Step 2. (Contued)*

2.5 Aband. Floodpln **9.50** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **26.55**

2.7 Entrenchment Ratio **6.95**

2.8 Incision Ratio **1.90**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **350**

2.12 Substrate Composition

Bedrock	**0** %
Boulder	**0** %
Cobble	**2** %
Coarse Gravel	**53** %
Fine Gravel	**30** %
Sand	**15** %
Silt and smaller	**0** %

Silt/Clay Present? **Yes**

Detritus **5** %

Large Woody **19**

2.13 Average Largest Particle on

Bed **6.0** **inches**

Bar **4.0** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	**None**	**0.00**
Gullies	**None**	**0.00**

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	**Sand**	**Sand**
Consistency	**Non-cohesive**	**Non-cohesive**
Lower		
Material Type	**Clay**	**Gravel**
Consistency	**Cohesive**	**Non-cohesive**

Bank Erosion	Left	Right
Erosion Length (ft)	**1,124**	**610**
Erosion Height (ft)	**4.00**	**4.00**
Revetmt. Type	**Rip-Rap**	**Rip-Rap**
Revetmt. Length (ft)	**453**	**722**

Near Bank Veg. Type	Left	Right
Dominant	**Herbaceous**	**Herbaceous**
Sub-dominant	**Shrubs/Saplin**	**Shrubs/Saplin**

Bank Canopy	Left	Right
Canopy %	**1-25**	**1-25**

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**0-25**	**>100**
Sub-dominant	**51-100**	**0-25**
W less than 25	**0**	**0**

Buffer Veg. Type	Left	Right
Dominant	**Deciduous**	**Deciduous**
Sub-dominant	**Shrubs/Saplin**	**Shrubs/Saplin**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Residential**	**Residential**
Sub-dominant	**Commercial**	**Commercial**
Mass Failures	**0**	**0**
Height	**0**	**0**
Gullies	**0**	**0**
Height	**0**	**0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **None**

4.2 Adjacent Wetlands **Minimal**

4.3 Flow Status **Low**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	**0**	Road Ditch	**0**
Other	**0**	Tile Drain	**0**
Overland Flow	**0**	Urb Strm Wtr Pipe	**0**

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	**7**	**3**

Diagonal	Delta	Island
1	**0**	**0**

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
2	**0**	**0**	**0**

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
3	**0**	**No**

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **644**

5.5 Dredging **Gravel Mining**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M01 | Segment: A | Completion Date: August 16, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz and Mike Adams | Rain: No

Segment Length (ft): 3,045 | Segment Location: This segment begins at the confluence of the Gihon River and the Lamoille River. The

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	66.0	Yes	No	Yes	Yes
Problem	Deposition Above,Scour Above				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type Unconfined

	Score	STD	Historic
7.1 Channel Degradation	**10**	**None**	**Yes**
7.2 Channel Aggradation	**9**	**None**	**No**
7.3 Widening Channel	**11**		**No**
7.4 Change in Planform	**9**		**No**
Total Score	**39**		
Geomorphic Rating	**0.4875**		

Channel Evolution Model	F
Channel Evolution Stage	III
Geomorphic Condition	Fair
Stream Sensitivity	Very High

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type High

	Score
6.1 Epifaunal Substrate - Available Cover	9
6.2 Embeddedness	8
6.3 Velocity/Depth Patterns	15
6.4 Sediment Deposition	9
6.5 Channel Flow Status	8
6.6 Channel Alteration	11
6.7 Frequency of Riffles/Steps	18
6.8 Bank Stability	Left: 5 Right: 7
6.9 Bank Vegetation Protection	Left: 5 Right: 5
6.10 Riparian Vegetation Zone Width	Left: 3 Right: 4
Total Score	107
Habitat Rating	0.535
Habitat Stream Condition	Fair

Narrative:

Historic degradation. Active planform and aggradation as new floodplain is created.

Project: **Gihon**

Phase 2 Segment Summary

May 11, 2009 SGAT Version: 3

Stream: **Gihon River** Reach # **M01** Segment: **B** Completion Date: **August 11, 2006**

Organization: **Bear Creek Environmental** Observers: **Mike Blazewicz and Mike** Why Not assessed: Rain: **Yes**

Segment Length (ft): **2,453** Segment Location: **Segment begins approximately 1500 feet upstream of Route 15 bridge and continues to just**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Grade Controls**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	1,157	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	896	1,478

1.4 Adjacent Side	Left	Right
Hillside Slope	Hilly	Hilly
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **600**

Width Determination **Estimated**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **68**

2.2 Max Depth (ft) **4.80**

2.3 Mean Depth (ft) **3.53**

2.4 Floodprone Width (ft) **290**

Notes:

Channelized reach through village.

Step 2. (Contued)

2.5 Aband. Floodpln **7.30** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **19.26**

2.7 Entrenchment Ratio **4.26**

2.8 Incision Ratio **1.52**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Eroded**

2.11 Riffle/Step Spacing (ft) **N/A**

2.12 Substrate Composition

Bedrock	0%
Boulder	6%
Cobble	23%
Coarse Gravel	40%
Fine Gravel	18%
Sand	13%
Silt and smaller	0%

Silt/Clay Present? **Yes**

Detritus **2** %

Large Woody **10**

2.13 Average Largest Particle on

Bed **8.0** **inches**

Bar **4.0** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Plane Bed**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Mix	Mix
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	576	101
Erosion Height (ft)	5.43	4.00
Revetmt. Type	Multiple	Multiple
Revetmt. Length (ft)	933	616
Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Herbaceous
Bank Canopy	Left	Right
Canopy %	1-25	1-25

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	0-25
Sub-dominant	>100	>100
W less than 25	0	0
Buffer Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Herbaceous
Sub-dominant	Deciduous	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Residential	Residential
Sub-dominant	Commercial	Commercial
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Minimal**

4.3 Flow Status **Low**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	4	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
4	0	2
Diagonal	**Delta**	**Island**
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
1	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **2,025**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M01 | Segment: B | Completion Date: August 11, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz and Mike Adams | Rain: Yes

Segment Length (ft): 2,453 | Segment Location: Segment begins approximately 1500 feet upstream of Route 15 bridge and continues

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken
Ledge	Mid-Segment	6.00	4.00		
Waterfall	Upstream	10.00	6.00		

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	150.	Yes	No	No	Yes
	Problem	Deposition Above,Deposition Below,Scour			
Bedrock	50.0	Yes	No	Yes	Yes
	Problem	Deposition Above,Scour Above,Scour			

Step 7. Rapid Geomorphic Assessment Data

Confinement Type: Unconfined

	Score	STD	Historic
7.1 Channel Degradation	**8**	**None**	**Yes**
7.2 Channel Aggradation	**12**	**None**	**No**
7.3 Widening Channel	**9**		**No**
7.4 Change in Planform	**10**		**No**
Total Score	**39**		
Geomorphic Rating	**0.4875**		

Channel Evolution Model	F
Channel Evolution Stage	II
Geomorphic Condition	Fair
Stream Sensitivity	Very High

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type: High

	Score
6.1 Epifaunal Substrate - Available Cover	8
6.2 Embeddedness	8
6.3 Velocity/Depth Patterns	8
6.4 Sediment Deposition	6
6.5 Channel Flow Status	8
6.6 Channel Alteration	3
6.7 Frequency of Riffles/Steps	8
6.8 Bank Stability	Left: 6 Right: 9
6.9 Bank Vegetation Protection	Left: 3 Right: 7
6.10 Riparian Vegetation Zone Width	Left: 2 Right: 2
Total Score	78
Habitat Rating	0.39

Habitat Stream Condition: Fair

Narrative:

Historic degradation. Widening and planform limited by channelization and armoring therefore locked in stage II of CEM.

Project: **Gihon**

Phase 2 Segment Summary

May 11, 2009 SGAT Version: 3

Stream: **Gihon River** Reach # **M02** Segment: **0** Completion Date: **August 11, 2006**

Organization: **Bear Creek Environmental** Observers: **Mike Blazewicz and Pam** Why Not assessed: **bedrock gorge** Rain: **Yes**

Segment Length (ft): **1,955** Segment Location: **This segment begins just upstream from bedrock falls and continues to about 1200 feet**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **None**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	1,446	475
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	401	114

1.4 Adjacent Side	Left	Right
Hillside Slope	Steep	Very Steep
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Bedrock	Bedrock

1.5 Valley Features

Valley Width (ft) **258**

Width Determination **Estimated**

Confinement Type **Semi-confined**

Rock Gorge? **Yes**

Human-caused Change? **no**

Step 2. Stream Channel

2.1 Bankfull Width **0**

2.2 Max Depth (ft) **0.00**

2.3 Mean Depth (ft) **0.00**

2.4 Floodprone Width (ft) **0**

Notes:

Reach is heavily influenced by bedrock on the banks and bed and was not assessable. The reach, however, was not a bedrock gorge as defined by the Phase 2 protocol ("continuous bedrock banks at least 10 feet high").

Step 2. (Contued)

2.5 Aband. Floodpln **0.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **0.00**

2.7 Entrenchment Ratio **0.00**

2.8 Incision Ratio **0.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity

2.10 Riffles Type

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	0%
Coarse Gravel	0%
Fine Gravel	0%
Sand	0%
Silt and smaller	0%

Silt/Clay Present?

Detritus **0** %

Large Woody **0**

2.13 Average Largest Particle on

Bed **0.0**

Bar **0.0**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Bedrock**

Subclass Slope: **None**

Bed Form: **Bedrock**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Bedrock	Bedrock
Consistency	Cohesive	Cohesive
Lower		
Material Type	Bedrock	Bedrock
Consistency	Cohesive	Cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	0	0
Erosion Height (ft)	0.00	0.00
Revetmt. Type	Rip-Rap	None
Revetmt. Length (ft)	23	0

Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Coniferous
Sub-dominant	Lawn	Deciduous

Bank Canopy	Left	Right
Canopy %	26-50	51-75

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	26-50	>100
Sub-dominant	51-100	None
W less than 25	0	0

Buffer Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Mixed Trees
Sub-dominant	Herbaceous	None

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Residential	Forest
Sub-dominant	Forest	None
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **None**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	0	0

Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,021**

5.5 Dredging **Gravel Mining**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M02 | Segment: 0 | Completion Date: August 11, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz and Pam DeAndrea | Rain: Yes

Segment Length (ft): 1,955 | Segment Location: This segment begins just upstream from bedrock falls and continues to about 1200

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	Upstream	0.00	0.00		
Ledge	Mid-Segment	0.00	0.00		
Ledge	Downstream	0.00	0.00		

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bedrock	50.0	Yes	No	Yes	Yes
Problem	Deposition Above,Scour Above,Scour				
Bridge	50.0	Yes	No	Yes	Yes
Problem	Scour Above,Scour Below				

Narrative:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model

Channel Evolution Stage

Geomorphic Condition Good

Stream Sensitivity

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Project: **Gihon** | **Phase 2 Segment Summary** | May 11, 2009 SGAT Version: 3

Stream: **Gihon River** Reach # **M03** Segment: **0** Completion Date: **August 11, 2006**

Organization: **Bear Creek Environmental** Observers: **Mike Blazewicz & Mike Adams** Why Not assessed: Rain: **Yes**

Segment Length (ft): **3,089** Segment Location: **Segment begins where the bedrock ledge segment ends. It continues until about 180 feet**

QC Status - Staff: Passed **Cons**

Step 1. Valley and Floodplain

1.1 Segmentation **None**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	2,808	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	2,052	77

1.4 Adjacent Side	Left	Right
Hillside Slope	Hilly	Steep
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **300**

Width Determination **Estimated**

Confinement Type **Semi-confined**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **94**

2.2 Max Depth (ft) **4.10**

2.3 Mean Depth (ft) **3.26**

2.4 Floodprone Width (ft) **153**

Notes:

Passed *Step 2. (Contued)*

2.5 Aband. Floodpln **7.60** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **28.83**

2.7 Entrenchment Ratio **1.63**

2.8 Incision Ratio **1.85**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Not Applicable**

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Bedrock	13%
Boulder	17%
Cobble	20%
Coarse Gravel	18%
Fine Gravel	20%
Sand	12%
Silt and smaller	0%

Silt/Clay Present? **Yes**

Detritus **2** %

Large Woody **25**

2.13 Average Largest Particle on

Bed **36.0** **inches**

Bar **6.0** **inches**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Gravel**

Subclass Slope: **c**

Bed Form: **Plane Bed**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	One	30.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Boulder/Cobbl	Boulder/Cobbl
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	238	393
Erosion Height (ft)	4.00	4.00
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	747	295
Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Herbaceous
Bank Canopy	Left	Right
Canopy %	1-25	1-25
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	>100
Sub-dominant	0-25	51-100
W less than 25	0	0
Buffer Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Mixed Trees	Mixed Trees

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Residential	Residential
Sub-dominant	None	Hay
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	1	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	3	0

Diagonal	Delta	Island
0	0	2

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
2	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	Yes

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,385**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M03 | Segment: 0 | Completion Date: August 11, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz & Mike Adams | Rain: Yes

Segment Length (ft): 3,089 | Segment Location: Segment begins where the bedrock ledge segment ends. It continues until about 180

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Waterfall	Upstream	10.00	10.00		

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	50.0	Yes	No	Yes	Yes
Problem	Deposition Below,Scour Above,Scour				
Bridge	34.5	Yes	No	Yes	Yes
Problem	Deposition Above,Scour Below				
Bridge	63.0	Yes	No	Yes	Yes
Problem	Scour Above,Scour Below				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type: Plane Bed

	Score	STD	Historic
7.1 Channel Degradation	**7**	**None**	**Yes**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**9**		**No**
7.4 Change in Planform	**12**		**No**
Total Score	**41**		
Geomorphic Rating	**0.5125**		

Channel Evolution Model	F
Channel Evolution Stage	III
Geomorphic Condition	Fair
Stream Sensitivity	High

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type: High

	Score
6.1 Epifaunal Substrate - Available Cover	12
6.2 Embeddedness	9
6.3 Velocity/Depth Patterns	15
6.4 Sediment Deposition	9
6.5 Channel Flow Status	12
6.6 Channel Alteration	8
6.7 Frequency of Riffles/Steps	13
6.8 Bank Stability	Left: 7 Right: 7
6.9 Bank Vegetation Protection	Left: 5 Right: 5
6.10 Riparian Vegetation Zone Width	Left: 1 Right: 2
Total Score	105
Habitat Rating	0.525
Habitat Stream Condition	Fair

Narrative:

Historic degradation, current major widening, some planform adjustment, aggradation due to upstream erosion.

Project: **Gihon** **Phase 2 Segment Summary** May 11, 2009 SGAT Version: 3

Stream: **Gihon River** Reach # **M04** Segment: **A** Completion Date: **August 8, 2006**

Organization: **Bear Creek Environmental** Observers: **Mike Blazewicz and Pam** Why Not assessed: **bedrock gorge** Rain: **Yes**

Segment Length (ft): **708** Segment Location: **Segment begins about 170 feet upstream of Route 100C bridge and continues another 708**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Grade Controls**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	496	191
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	90	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Very Steep	Very Steep
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Bedrock	Bedrock

1.5 Valley Features

Valley Width (ft) **250**

Width Determination **Estimated**

Confinement Type **Semi-confined**

Rock Gorge? **Yes**

Human-caused Change? **no**

Step 2. Stream Channel

2.1 Bankfull Width **0**

2.2 Max Depth (ft) **0.00**

2.3 Mean Depth (ft) **0.00**

2.4 Floodprone Width (ft) **0**

Notes:

Series of bedrock waterfalls. Reach is heavily influenced by bedrock on the banks and bed and was not assessable. The reach, however, was not a bedrock gorge as defined by the Phase 2 protocol ("continuous bedrock banks at least 10 feet high").

Step 2. (Contued)

2.5 Aband. Floodpln **0.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **0.00**

2.7 Entrenchment Ratio **0.00**

2.8 Incision Ratio **0.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity

2.10 Riffles Type

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	0%
Coarse Gravel	0%
Fine Gravel	0%
Sand	0%
Silt and smaller	0%

Silt/Clay Present?

Detritus **0** %

Large Woody **0**

2.13 Average Largest Particle on

Bed **0.0**

Bar **0.0**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Bedrock**

Subclass Slope: **c**

Bed Form: **Bedrock**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Bedrock	Bedrock
Consistency	Cohesive	Cohesive
Lower		
Material Type	Bedrock	Bedrock
Consistency	Cohesive	Cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	0	0
Erosion Height (ft)	0.00	0.00
Revetmt. Type	None	None
Revetmt. Length (ft)	0	0

Near Bank Veg. Type	Left	Right
Dominant	Deciduous	Deciduous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

Bank Canopy	Left	Right
Canopy %	51-75	51-75

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	51-100	>100
Sub-dominant	>100	None
W less than 25	0	0

Buffer Veg. Type	Left	Right
Dominant	Mixed Trees	Mixed Trees
Sub-dominant	None	None

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Forest
Sub-dominant	Residential	Residential
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **None**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	0	0

Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	

5.4 Stream Ford or Animal **No**

5.5 Straightening **None**

Straightening Length: **0**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M04 | Segment: A | Completion Date: August 8, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz and Pam DeAndrea | Rain: Yes

Segment Length (ft): 708 | Segment Location: Segment begins about 170 feet upstream of Route 100C bridge and continues another

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	Upstream	0.00	0.00		
Ledge	Mid-Segment	0.00	0.00		
Ledge	Downstream	0.00	0.00		

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bedrock	50.0	Yes	No	Yes	Yes

Problem: Deposition Above,Scour Above,Scour

Narrative:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model

Channel Evolution Stage

Geomorphic Condition: Good

Stream Sensitivity

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Project: **Gihon** | **Phase 2 Segment Summary** | May 11, 2009 | SGAT Version: 3

Stream: **Gihon River** | Reach # **M04** | Segment: **B** | Completion Date: **August 8, 2006**

Organization: **Bear Creek Environmental** | Observers: **Mike Blazewicz & Pam** | Why Not assessed: | Rain: **Yes**

Segment Length (ft): **775** | Segment Location: **Segment begins where series of bedrock waterfalls ends and continues another 775 feet**

QC Status - Staff: Passed **Cons**

Step 1. Valley and Floodplain

1.1 Segmentation **Grade Controls**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	770	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	144	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Very Steep	Very Steep
Continuous w/	Never	Never
W/in 1 Bankfill	Always	Always
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **175**

Width Determination **Estimated**

Confinement Type **Semi-confined**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **67**

2.2 Max Depth (ft) **4.70**

2.3 Mean Depth (ft) **3.95**

2.4 Floodprone Width (ft) **136**

Notes:

Passed *Step 2. (Contued)*

2.5 Aband. Floodpln **8.70** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **16.96**

2.7 Entrenchment Ratio **2.03**

2.8 Incision Ratio **1.85**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Not Applicable**

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Bedrock	0%
Boulder	8%
Cobble	27%
Coarse Gravel	29%
Fine Gravel	26%
Sand	10%
Silt and smaller	0%

Silt/Clay Present? **Yes**

Detritus **2** %

Large Woody **3**

2.13 Average Largest Particle on

Bed	48.0	inches
Bar	N/A	inches

2.14 Stream Type

Stream Type: **B**

Bed Material: **Gravel**

Subclass Slope: **c**

Bed Form: **Plane Bed**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	87	399
Erosion Height (ft)	4.00	4.00
Revetmt. Type	Rip-Rap	None
Revetmt. Length (ft)	173	0

Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Herbaceous

Bank Canopy	Left	Right
Canopy %	26-50	26-50

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	>100
Sub-dominant	None	None
W less than 25	0	0

Buffer Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Mixed Trees
Sub-dominant	None	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Pasture	Forest
Sub-dominant	None	None
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **None**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	1	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	0	0

Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **186**

5.5 Dredging **Gravel Mining**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M04 | Segment: B | Completion Date: August 8, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz & Pam DeAndrea | Rain: Yes

Segment Length (ft): 775 | Segment Location: Segment begins where series of bedrock waterfalls ends and continues another 775

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken

4.8 Channel Constrictions **None**

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

Step 7. Rapid Geomorphic Assessment Data

Confinement Type Plane Bed

	Score	STD	Historic
7.1 Channel Degradation	**10**	**None**	**Yes**
7.2 Channel Aggradation	**12**	**None**	**No**
7.3 Widening Channel	**11**		**No**
7.4 Change in Planform	**12**		**No**
Total Score	**45**		
Geomorphic Rating	**0.5625**		

Channel Evolution Model	F
Channel Evolution Stage	III
Geomorphic Condition	Fair
Stream Sensitivity	High

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type High

	Score
6.1 Epifaunal Substrate - Available Cover	8
6.2 Embeddedness	7
6.3 Velocity/Depth Patterns	8
6.4 Sediment Deposition	7
6.5 Channel Flow Status	13
6.6 Channel Alteration	8
6.7 Frequency of Riffles/Steps	12
6.8 Bank Stability	Left: 7 Right: 4
6.9 Bank Vegetation Protection	Left: 4 Right: 7
6.10 Riparian Vegetation Zone Width	Left: 1 Right: 7
Total Score	93
Habitat Rating	0.465
Habitat Stream Condition	Fair

Narrative:

Historic degradation, some minor widening and planform. Minor aggradation associated w/upstream erosion.

Project: **Gihon**

Phase 2 Segment Summary

May 11, 2009 SGAT Version: 3

Stream: **Gihon River** Reach # **M05** Segment: **0** Completion Date: **July 31, 2006**

Organization: **Bear Creek Environmental** Observers: **Mike Blazewicz & Stacey** Why Not assessed: Rain: **No**

Segment Length (ft): **2,657** Segment Location: **Segment begins just upstream of where stream flows through an agricultural area although**

QC Status - Staff: Passed **Cons**

Step 1. Valley and Floodplain

1.1 Segmentation **None**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	**284**	**0**
height	**0**	**0**
Roads	**492**	**0**
height	**0**	**0**
Railroads	**0**	**0**
height	**0**	**0**
Improved Paths	**0**	**0**
height	**0**	**0**
Development	**0**	**31**

1.4 Adjacent Side	Left	Right
Hillside Slope	**Hilly**	**Steep**
Continuous w/	**Never**	**Sometimes**
W/in 1 Bankfill	**Never**	**Sometimes**
Texture	**Not Evalua**	**Silt/Clay**

1.5 Valley Features

Valley Width (ft) **1,295**

Width Determination **Estimated**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **no**

Step 2. Stream Channel

2.1 Bankfull Width **66**

2.2 Max Depth (ft) **4.90**

2.3 Mean Depth (ft) **3.60**

2.4 Floodprone Width (ft) **1,295**

Notes:

Landowner (former at top of reach) working w/NRCS to restore buffer and remove a berm on the left bank that will hopefully allow the river to flood and ease pressure against the mass failure..

Passed *Step 2. (Contued)*

2.5 Aband. Floodpln **7.40** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **18.33**

2.7 Entrenchment Ratio **19.62**

2.8 Incision Ratio **1.51**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **800**

2.12 Substrate Composition

Bedrock	**0** %
Boulder	**2** %
Cobble	**9** %
Coarse Gravel	**56** %
Fine Gravel	**23** %
Sand	**10** %
Silt and smaller	**0** %

Silt/Clay Present? **Yes**

Detritus **2** %

Large Woody **27**

2.13 Average Largest Particle on

Bed **10.0** **inches**

Bar **5.0** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	**One**	**100.00**
Gullies	**None**	**0.00**

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	**Sand**	**Sand**
Consistency	**Non-cohesive**	**Non-cohesive**
Lower		
Material Type	**Gravel**	**Gravel**
Consistency	**Non-cohesive**	**Non-cohesive**

Bank Erosion	Left	Right
Erosion Length (ft)	**1,787**	**1,247**
Erosion Height (ft)	**5.52**	**4.84**
Revetmt. Type	**None**	**Rip-Rap**
Revetmt. Length (ft)	**0**	**104**

Near Bank Veg. Type	Left	Right
Dominant	**Herbaceous**	**Herbaceous**
Sub-dominant	**Shrubs/Saplin**	**Shrubs/Saplin**

Bank Canopy	Left	Right
Canopy %	**1-25**	**1-25**

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**0-25**	**0-25**
Sub-dominant	**None**	**>100**
W less than 25	**0**	**0**

Buffer Veg. Type	Left	Right
Dominant	**Herbaceous**	**Herbaceous**
Sub-dominant	**Shrubs/Saplin**	**Shrubs/Saplin**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Hay**	**Hay**
Sub-dominant	**None**	**Forest**
Mass Failures	**0**	**0**
Height	**0**	**0**
Gullies	**0**	**0**
Height	**0**	**0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	**0**	Road Ditch	**0**
Other	**2**	Tile Drain	**0**
Overland Flow	**0**	Urb Strm Wtr Pipe	**0**

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
2	**4**	**1**
Diagonal	**Delta**	**Island**
0	**0**	**0**

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	**0**	**0**	**0**

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
1	**0**	**Yes**

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,564**

5.5 Dredging **Gravel Mining**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M05 | Segment: 0 | Completion Date: July 31, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz & Stacey Ambler | Rain: No

Segment Length (ft): 2,657 | Segment Location: Segment begins just upstream of where stream flows through an agricultural area

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	Upstream	5.00	2.00		

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	35.0	Yes	No	Yes	Yes

Problem: Deposition Above, Deposition Below, Scour

Step 7. Rapid Geomorphic Assessment Data

Confinement Type: Unconfined

	Score	STD	Historic
7.1 Channel Degradation	**9**	**None**	**Yes**
7.2 Channel Aggradation	**8**	**None**	**No**
7.3 Widening Channel	**11**		**No**
7.4 Change in Planform	**7**		**No**
Total Score	**35**		
Geomorphic Rating	**0.4375**		

Channel Evolution Model	F
Channel Evolution Stage	III
Geomorphic Condition	Fair
Stream Sensitivity	Very High

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type: High

	Score
6.1 Epifaunal Substrate - Available Cover	8
6.2 Embeddedness	9
6.3 Velocity/Depth Patterns	13
6.4 Sediment Deposition	8
6.5 Channel Flow Status	12
6.6 Channel Alteration	8
6.7 Frequency of Riffles/Steps	14
6.8 Bank Stability	Left: 1 Right: 3
6.9 Bank Vegetation Protection	Left: 4 Right: 5
6.10 Riparian Vegetation Zone Width	Left: 1 Right: 1
Total Score	87
Habitat Rating	0.435

Habitat Stream Condition: Fair

Narrative:

Historic degradation, current major planform adjustment; some aggradation and widening.

Project: **Gihon**

Phase 2 Segment Summary

May 11, 2009 SGAT Version: 3

Stream: **Gihon River** Reach # **M06** Segment: **0** Completion Date: **July 31, 2006**

Organization: **Bear Creek Environmental** Observers: **Mike Blazewicz and Stacey** Why Not assessed: Rain: **No**

Segment Length (ft): **2,126** Segment Location: **Segment begins approximately 50 feet upstream of bridge at top of M05. It continues along**

QC Status - Staff: Passed **Cons** **Passed**

Step 1. Valley and Floodplain

1.1 Segmentation **None**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	1,632	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	260	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Very Steep	Very Steep
Continuous w/	Sometimes	Never
W/in 1 Bankfill	Sometimes	Never
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **530**

Width Determination **Estimated**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **no**

Step 2. Stream Channel

2.1 Bankfull Width **62**

2.2 Max Depth (ft) **5.00**

2.3 Mean Depth (ft) **3.40**

2.4 Floodprone Width (ft) **530**

Notes:

Step 2. (Contued)

2.5 Aband. Floodpln **6.60** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **18.24**

2.7 Entrenchment Ratio **8.55**

2.8 Incision Ratio **1.32**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **450**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	8%
Coarse Gravel	44%
Fine Gravel	35%
Sand	14%
Silt and smaller	0%

Silt/Clay Present? **Yes**

Detritus **2** %

Large Woody **19**

2.13 Average Largest Particle on

Bed **6.0** **inches**

Bar **3.0** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	861	1,116
Erosion Height (ft)	5.40	4.97
Revetmt. Type	None	Other
Revetmt. Length (ft)	0	169

Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Herbaceous

Bank Canopy	Left	Right
Canopy %	1-25	1-25
Mid-Channel Canopy		Open

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	0-25
Sub-dominant	>100	None
W less than 25	0	0

Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Hay	Hay
Sub-dominant	Forest	None
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	1	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
1	0	4

Diagonal	Delta	Island
1	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,315**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M06 | Segment: 0 | Completion Date: July 31, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz and Stacey Ambler | Rain: No

Segment Length (ft): 2,126 | Segment Location: Segment begins approximately 50 feet upstream of bridge at top of M05. It continues

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken

4.8 Channel Constrictions **None**

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

Step 7. Rapid Geomorphic Assessment Data

Confinement Type: Unconfined

	Score	STD	Historic
7.1 Channel Degradation	**11**	**None**	**Yes**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**11**		**No**
7.4 Change in Planform	**10**		**No**
Total Score	**45**		
Geomorphic Rating	**0.5625**		

Channel Evolution Model	F
Channel Evolution Stage	III
Geomorphic Condition	Fair
Stream Sensitivity	Very High

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type: High

	Score
6.1 Epifaunal Substrate - Available Cover	11
6.2 Embeddedness	11
6.3 Velocity/Depth Patterns	15
6.4 Sediment Deposition	8
6.5 Channel Flow Status	15
6.6 Channel Alteration	9
6.7 Frequency of Riffles/Steps	15
6.8 Bank Stability	Left: 4 Right: 3
6.9 Bank Vegetation Protection	Left: 4 Right: 4
6.10 Riparian Vegetation Zone Width	Left: 1 Right: 1
Total Score	101
Habitat Rating	0.505

Habitat Stream Condition: Fair

Narrative:

Historic incision; minor widening & major planform adjustment.

Project: **Gihon**

Phase 2 Segment Summary

May 11, 2009 SGAT Version: 3

Stream: **Gihon River** Reach # **M07** Segment: **0** Completion Date: **July 31, 2006**

Organization: **Bear Creek Environmental** Observers: **Mike Blazewicz and Stacey** Why Not assessed: Rain: **No**

Segment Length (ft): **3,748** Segment Location: **Segment begins just upstream of the end of Hunter Road and continues untill about 1300**

QC Status - Staff: Passed **Cons**

Step 1. Valley and Floodplain

1.1 Segmentation **None**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	1,549	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Very Steep	Steep
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **794**

Width Determination **Estimated**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **no**

Step 2. Stream Channel

2.1 Bankfull Width **67**

2.2 Max Depth (ft) **4.50**

2.3 Mean Depth (ft) **3.70**

2.4 Floodprone Width (ft) **982**

Notes:

Passed *Step 2. (Contued)*

2.5 Aband. Floodpln **6.40** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **18.11**

2.7 Entrenchment Ratio **14.66**

2.8 Incision Ratio **1.42**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **500**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	11%
Coarse Gravel	50%
Fine Gravel	23%
Sand	16%
Silt and smaller	0%

Silt/Clay Present? **Yes**

Detritus **2** %

Large Woody **30**

2.13 Average Largest Particle on

Bed **7.0** **inches**

Bar **3.0** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	1,345	1,224
Erosion Height (ft)	4.46	5.07
Revetmt. Type	None	Rip-Rap
Revetmt. Length (ft)	0	379
Near Bank Veg. Type	Left	Right
Dominant	Invasives	Invasives
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin
Bank Canopy	Left	Right
Canopy %	1-25	1-25
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	0-25
Sub-dominant	None	None
W less than 25	0	0
Buffer Veg. Type	Left	Right
Dominant	Invasives	Invasives
Sub-dominant	Herbaceous	Herbaceous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Hay	Hay
Sub-dominant	Forest	Forest
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Minimal**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	3	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	1	6

Diagonal	Delta	Island
0	1	1

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
4	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	Yes

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **2,396**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M07 | Segment: 0 | Completion Date: July 31, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz and Stacey Ambler | Rain: No

Segment Length (ft): 3,748 | Segment Location: Segment begins just upstream of the end of Hunter Road and continues untill about

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions **None**

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

Step 7. Rapid Geomorphic Assessment Data

Confinement Type Unconfined

	Score	STD	Historic
7.1 Channel Degradation	**9**	**None**	**Yes**
7.2 Channel Aggradation	**14**	**None**	**No**
7.3 Widening Channel	**12**		**No**
7.4 Change in Planform	**9**		**No**
Total Score	**44**		
Geomorphic Rating	**0.55**		

Channel Evolution Model	F
Channel Evolution Stage	III
Geomorphic Condition	Fair
Stream Sensitivity	Very High

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type High

	Score
6.1 Epifaunal Substrate - Available Cover	11
6.2 Embeddedness	11
6.3 Velocity/Depth Patterns	16
6.4 Sediment Deposition	10
6.5 Channel Flow Status	15
6.6 Channel Alteration	10
6.7 Frequency of Riffles/Steps	15
6.8 Bank Stability	Left: 5 Right: 5
6.9 Bank Vegetation Protection	Left: 4 Right: 4
6.10 Riparian Vegetation Zone Width	Left: 1 Right: 1
Total Score	108
Habitat Rating	0.54
Habitat Stream Condition	Fair

Narrative:

Historic incision. Current minor widening & major planform adjustment.

Project: **Gihon**

Phase 2 Segment Summary

May 11, 2009 SGAT Version: 3

Stream: **Gihon River** Reach # **M08** Segment: **0** Completion Date: **November 13, 2006**

Organization: **Bear Creek Environmental** Observers: **MB** Why Not assessed: **bedrock gorge** Rain: **No**

Segment Length (ft): **3,611** Segment Location: **Gorge downstream of hydroelectric dam.**

QC Status - Staff: Provisional Cons

Step 1. Valley and Floodplain

1.1 Segmentation **None**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	0	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope		
Continuous w/		
W/in 1 Bankfill		
Texture		

1.5 Valley Features

Valley Width (ft) **0**

Width Determination

Confinement Type

Rock Gorge? **Yes**

Human-caused Change?

Step 2. Stream Channel

2.1 Bankfull Width **0**

2.2 Max Depth (ft) **0.00**

2.3 Mean Depth (ft) **0.00**

2.4 Floodprone Width (ft) **0**

Notes:

Passed *Step 2. (Contued)*

2.5 Aband. Floodpln **0.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **0.00**

2.7 Entrenchment Ratio **0.00**

2.8 Incision Ratio **0.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity

2.10 Riffles Type

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	0%
Coarse Gravel	0%
Fine Gravel	0%
Sand	0%
Silt and smaller	0%

Silt/Clay Present?

Detritus **0** %

Large Woody **0**

2.13 Average Largest Particle on

Bed **0.0**

Bar **0.0**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Bedrock**

Subclass Slope: **None**

Bed Form: **Bedrock**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	**None**	**0.00**
Gullies	**None**	**0.00**

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope

Bank Texture	Left	Right
Upper		
Material Type		
Consistency		
Lower		
Material Type		
Consistency		

Bank Erosion	Left	Right
Erosion Length (ft)	0	0
Erosion Height (ft)	0.00	0.00
Revetmt. Type	None	None
Revetmt. Length (ft)	0	0

Near Bank Veg. Type	Left	Right
Dominant		
Sub-dominant		

Bank Canopy	Left	Right
Canopy %		
Mid-Channel Canopy		

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant		
Sub-dominant		
W less than 25	0	0

Buffer Veg. Type	Left	Right
Dominant		
Sub-dominant		

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant		
Sub-dominant		
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps

4.2 Adjacent Wetlands

4.3 Flow Status

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **Large**

Impoundmt. Location **Upstream**

4.6 Up/Down strm flow reg **Up Stream**

(old) Upstrm Flow Reg **Run-of-river**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	0	0

Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	

5.4 Stream Ford or Animal **No**

5.5 Straightening **None**

Straightening Length: **0**

5.5 Dredging **Gravel Mining**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River Reach # M08 Segment: 0 Completion Date: November 13,
Organization: Bear Creek Environmental Observers: MB Rain: No
Segment Length (ft): 3,611 Segment Location: Gorge downstream of hydroelectric dam.

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Dam	Upstream	35.00	35.00		

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

Narrative:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model
Channel Evolution Stage
Geomorphic Condition Good
Stream Sensitivity

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Project: **Gihon**

Phase 2 Segment Summary

May 11, 2009 SGAT Version: 3

Stream: **Gihon River** Reach # **M09** Segment: **A** Completion Date: **July 19, 2006**

Organization: **Bear Creek Environmental** Observers: **Mike Blazewicz and Pam** Why Not assessed: **impounded** Rain: **No**

Segment Length (ft): **1,071** Segment Location: **Segment begins about 500 feet upstream of dam and continues another 1071 feet. The dam**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Flow Status**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	742	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	320

1.4 Adjacent Side	Left	Right
Hillside Slope	Very Steep	Very Steep
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **109**

Width Determination **Estimated**

Confinement Type **Semi-confined**

Rock Gorge? **No**

Human-caused Change? **no**

Step 2. Stream Channel

2.1 Bankfull Width **0**

2.2 Max Depth (ft) **0.00**

2.3 Mean Depth (ft) **0.00**

2.4 Floodprone Width (ft) **0**

Notes:

Step 2. (Contued)

2.5 Aband. Floodpln **0.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **0.00**

2.7 Entrenchment Ratio **0.00**

2.8 Incision Ratio **0.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity

2.10 Riffles Type

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	0%
Coarse Gravel	0%
Fine Gravel	0%
Sand	0%
Silt and smaller	0%

Silt/Clay Present?

Detritus **0** %

Large Woody **0**

2.13 Average Largest Particle on

Bed **0.0**

Bar **0.0**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	127	0
Erosion Height (ft)	4.00	0.00
Revetmt. Type	Multiple	Rip-Rap
Revetmt. Length (ft)	247	86

Near Bank Veg. Type	Left	Right
Dominant	Lawn	Shrubs/Saplin
Sub-dominant	Shrubs/Saplin	Invasives

Bank Canopy	Left	Right
Canopy %	1-25	1-25

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	0-25
Sub-dominant	>100	>100
W less than 25	0	0

Buffer Veg. Type	Left	Right
Dominant	Deciduous	Herbaceous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Residential
Sub-dominant	None	Forest
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Minimal**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **Large**

Impoundmt. Location **In Reach**

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	1	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	0	0

Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
1	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	

5.4 Stream Ford or Animal **No**

5.5 Straightening **None**

Straightening Length: **0**

5.5 Dredging **Gravel Mining**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M09 | Segment: A | Completion Date: July 19, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz and Pam DeAndrea | Rain: No

Segment Length (ft): 1,071 | Segment Location: Segment begins about 500 feet upstream of dam and continues another 1071 feet. The

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	41.0	Yes	No	Yes	Yes
Problem	Deposition Above,Deposition Below,Scour				

Narrative:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model

Channel Evolution Stage

Geomorphic Condition Fair

Stream Sensitivity

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Project: **Gihon**

Phase 2 Segment Summary

May 11, 2009 SGAT Version: 3

Stream: **Gihon River** Reach # **M09** Segment: **B** Completion Date: **July 19, 2006**

Organization: **Bear Creek Environmental** Observers: **Mike Blazewicz and Pam** Why Not assessed: Rain: **No**

Segment Length (ft): **3,224** Segment Location: **Segment begins approximately 450 feet upstream of the Whitcomb Island Pond bridge and**

QC Status - Staff: Passed **Cons** **Passed**

Step 1. Valley and Floodplain

1.1 Segmentation **Flow Status**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	0	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope	**Very Steep**	**Very Steep**
Continuous w/	**Sometimes**	**Sometimes**
W/in 1 Bankfill	**Sometimes**	**Sometimes**
Texture	**Not Evalua**	**Not Evalua**

1.5 Valley Features

Valley Width (ft) **109**

Width Determination **Measured**

Confinement Type **Narrowly**

Rock Gorge? **No**

Human-caused Change? **no**

Step 2. Stream Channel

2.1 Bankfull Width **67**

2.2 Max Depth (ft) **4.50**

2.3 Mean Depth (ft) **3.60**

2.4 Floodprone Width (ft) **108**

Notes:

Step 2. (Contued)

2.5 Aband. Floodpln **4.50** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **18.61**

2.7 Entrenchment Ratio **1.61**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **350**

2.12 Substrate Composition

Bedrock	2%
Boulder	1%
Cobble	7%
Coarse Gravel	58%
Fine Gravel	20%
Sand	12%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **3** %

Large Woody **52**

2.13 Average Largest Particle on

Bed **18.0** **inches**

Bar **5.0** **inches**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Gravel**

Subclass Slope: **c**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	**None**	**0.00**
Gullies	**None**	**0.00**

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	**Sand**	**Sand**
Consistency	**Non-cohesive**	**Non-cohesive**
Lower		
Material Type	**Bedrock**	**Bedrock**
Consistency	**Cohesive**	**Cohesive**

Bank Erosion	Left	Right
Erosion Length (ft)	**610**	**322**
Erosion Height (ft)	**4.29**	**3.83**
Revetmt. Type	**None**	**None**
Revetmt. Length (ft)	**0**	**0**

Near Bank Veg. Type	Left	Right
Dominant	**Coniferous**	**Coniferous**
Sub-dominant	**Invasives**	**Invasives**

Bank Canopy	Left	Right
Canopy %	**51-75**	**51-75**

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-dominant	**None**	**None**
W less than 25	**0**	**0**

Buffer Veg. Type	Left	Right
Dominant	**Mixed Trees**	**Mixed Trees**
Sub-dominant	**Shrubs/Saplin**	**Shrubs/Saplin**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Forest**
Sub-dominant	**None**	**None**
Mass Failures	**0**	**0**
Height	**0**	**0**
Gullies	**0**	**0**
Height	**0**	**0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	**0**	Road Ditch	**0**
Other	**0**	Tile Drain	**0**
Overland Flow	**0**	Urb Strm Wtr Pipe	**0**

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	3	4

Diagonal	Delta	Island
1	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
2	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
1	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **None**

Straightening Length: **0**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M09 | Segment: B | Completion Date: July 19, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz and Pam DeAndrea | Rain: No

Segment Length (ft): 3,224 | Segment Location: Segment begins approximately 450 feet upstream of the Whitcomb Island Pond bridge

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	Mid-Segment	6.00	4.00		
Ledge	Upstream	0.00	0.00		

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bedrock	61.5	Yes	No	Yes	No
Problem	Deposition Above,Deposition Below				
Bedrock	60.0	Yes	No	Yes	Yes
Problem	Deposition Below,Scour Above,Scour				
Bedrock	55.0	Yes	No	Yes	No
Problem	Deposition Above,Deposition Below,Scour				

Narrative:
Minor aggradation and widening.

Step 7. Rapid Geomorphic Assessment Data

Confinement Type: Confined

	Score	STD	Historic
7.1 Channel Degradation	**17**	**None**	**No**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**13**		**No**
7.4 Change in Planform	**14**		**No**
Total Score	**57**		
Geomorphic Rating	**0.7125**		

Channel Evolution Model	D
Channel Evolution Stage	I
Geomorphic Condition	Good
Stream Sensitivity	Moderate

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type: High

	Score
6.1 Epifaunal Substrate - Available Cover	15
6.2 Embeddedness	14
6.3 Velocity/Depth Patterns	18
6.4 Sediment Deposition	8
6.5 Channel Flow Status	10
6.6 Channel Alteration	18
6.7 Frequency of Riffles/Steps	18
6.8 Bank Stability	Left: 7 Right: 8
6.9 Bank Vegetation Protection	Left: 6 Right: 6
6.10 Riparian Vegetation Zone Width	Left: 10 Right: 10
Total Score	148
Habitat Rating	0.74

Habitat Stream Condition: Good

Project: **Gihon** | **Phase 2 Segment Summary** | May 11, 2009 | SGAT Version: 3

Stream: **Gihon River** | Reach # **M10** | Segment: **0** | Completion Date: **July 19, 2006**

Organization: **Bear Creek Environmental** | Observers: **Mike Blazewicz & Pam** | Why Not assessed: | Rain: **Yes**

Segment Length (ft): **5,886** | Segment Location: **Segment begins where stream becomes much more sinuous through a forested section and**

QC Status - Staff: Passed **Cons** **Passed**

Step 1. Valley and Floodplain

1.1 Segmentation **None**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	0	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Hilly	Steep
Continuous w/	Never	Never
W/in 1 Bankfill	Never	Never
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **601**

Width Determination **Estimated**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **no**

Step 2. Stream Channel

2.1 Bankfull Width **97**

2.2 Max Depth (ft) **4.40**

2.3 Mean Depth (ft) **2.86**

2.4 Floodprone Width (ft) **820**

Notes:

Channel has changed course in a couple of locations. Extensive knotweed on both banks.

Step 2. (Contued)

2.5 Aband. Floodpln **6.40** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **33.92**

2.7 Entrenchment Ratio **8.45**

2.8 Incision Ratio **1.45**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **400**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	10%
Coarse Gravel	60%
Fine Gravel	23%
Sand	7%
Silt and smaller	0%

Silt/Clay Present? **Yes**

Detritus **3** %

Large Woody **18**

2.13 Average Largest Particle on

Bed	6.0	inches
Bar	6.0	inches

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Boulder/Cobbl	Boulder/Cobbl
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	1,695	2,632
Erosion Height (ft)	3.78	3.76
Revetmt. Type	Rip-Rap	None
Revetmt. Length (ft)	47	0
Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Invasives	Invasives
Bank Canopy	Left	Right
Canopy %	1-25	1-25
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	None	None
W less than 25	0	0
Buffer Veg. Type	Left	Right
Dominant	Mixed Trees	Mixed Trees
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Forest
Sub-dominant	None	None
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Abundant**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
2	6	4
Diagonal	**Delta**	**Island**
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
7	0	2	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
7	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **None**

Straightening Length: **0**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M10 | Segment: 0 | Completion Date: July 19, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz & Pam DeAndrea | Rain: Yes

Segment Length (ft): 5,886 | Segment Location: Segment begins where stream becomes much more sinuous through a forested section

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken

4.8 Channel Constrictions **None**

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

Step 7. Rapid Geomorphic Assessment Data

Confinement Type Unconfined

	Score	STD	Historic
7.1 Channel Degradation	**14**	**None**	**Yes**
7.2 Channel Aggradation	**9**	**None**	**No**
7.3 Widening Channel	**8**		**No**
7.4 Change in Planform	**3**		**No**
Total Score	**34**		
Geomorphic Rating	**0.425**		

Channel Evolution Model	F
Channel Evolution Stage	IV
Geomorphic Condition	Fair
Stream Sensitivity	Very High

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type High

	Score
6.1 Epifaunal Substrate - Available Cover	14
6.2 Embeddedness	14
6.3 Velocity/Depth Patterns	18
6.4 Sediment Deposition	8
6.5 Channel Flow Status	8
6.6 Channel Alteration	18
6.7 Frequency of Riffles/Steps	18
6.8 Bank Stability	Left: 6 Right: 3
6.9 Bank Vegetation Protection	Left: 4 Right: 4
6.10 Riparian Vegetation Zone Width	Left: 9 Right: 10
Total Score	134
Habitat Rating	0.67

Habitat Stream Condition Good

Narrative:

Some historic degradation. Extreme planform adjustment, major widening and aggradation as river is in late stages of floodplain redevelopment.

Project: **Gihon** **Phase 2 Segment Summary** May 11, 2009 SGAT Version: 3

Stream: **Gihon River** Reach # **M11** Segment: **A** Completion Date: **July 18, 2006**

Organization: **Bear Creek Environmental** Observers: **Mike Blazewicz & Pam** Why Not assessed: Rain: **Yes**

Segment Length (ft): **690** Segment Location: **Segment begins about 900 feet upstream from where sinuosity in M10 decreases and**

QC Status - Staff: Passed **Cons**

Step 1. Valley and Floodplain

1.1 Segmentation **Grade Controls**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	672	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	572	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Steep	Very Steep
Continuous w/	Never	Always
W/in 1 Bankfill	Sometimes	Always
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **211**

Width Determination **Estimated**

Confinement Type **Semi-confined**

Rock Gorge? **No**

Human-caused Change? **no**

Step 2. Stream Channel

2.1 Bankfull Width **85**

2.2 Max Depth (ft) **4.10**

2.3 Mean Depth (ft) **2.80**

2.4 Floodprone Width (ft) **96**

Notes:

Possible straightening with bridge and road.

Passed *Step 2. (Contued)*

2.5 Aband. Floodpln **9.90** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **30.36**

2.7 Entrenchment Ratio **1.13**

2.8 Incision Ratio **2.41**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Not Applicable**

2.11 Riffle/Step Spacing (ft) **N/A**

2.12 Substrate Composition

Bedrock	0%
Boulder	18%
Cobble	32%
Coarse Gravel	29%
Fine Gravel	15%
Sand	6%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **7**

2.13 Average Largest Particle on

Bed	48.0	inches
Bar	12.0	inches

2.14 Stream Type

Stream Type: **F**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Plane Bed**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

B 4 Non Plane Bed

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Boulder/Cobbl	Boulder/Cobbl
Consistency	Non-cohesive	Non-cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	120	192
Erosion Height (ft)	4.00	4.00
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	31	30

Near Bank Veg. Type	Left	Right
Dominant	Deciduous	Deciduous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

Bank Canopy	Left	Right
Canopy %	26-50	26-50

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	>100
Sub-dominant	None	None
W less than 25	0	0

Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Mixed Trees
Sub-dominant	Deciduous	None

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Residential	Forest
Sub-dominant	None	None
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **None**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	1	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	0	1
Diagonal	**Delta**	**Island**
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **597**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M11 | Segment: A | Completion Date: July 18, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz & Pam DeAndrea | Rain: Yes

Segment Length (ft): 690 | Segment Location: Segment begins about 900 feet upstream from where sinuosity in M10 decreases and

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions **None**

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

Step 7. Rapid Geomorphic Assessment Data

Confinement Type Plane Bed

	Score	STD	Historic
7.1 Channel Degradation	**4**	**B to F**	**Yes**
7.2 Channel Aggradation	**14**	**None**	**No**
7.3 Widening Channel	**9**		**No**
7.4 Change in Planform	**13**		**No**
Total Score	**40**		
Geomorphic Rating	**0.5**		

Channel Evolution Model	F
Channel Evolution Stage	III
Geomorphic Condition	Fair
Stream Sensitivity	Extreme

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type High

	Score
6.1 Epifaunal Substrate - Available Cover	12
6.2 Embeddedness	10
6.3 Velocity/Depth Patterns	8
6.4 Sediment Deposition	14
6.5 Channel Flow Status	12
6.6 Channel Alteration	10
6.7 Frequency of Riffles/Steps	13
6.8 Bank Stability	Left: 7 Right: 6
6.9 Bank Vegetation Protection	Left: 4 Right: 7
6.10 Riparian Vegetation Zone Width	Left: 1 Right: 9
Total Score	113
Habitat Rating	0.565
Habitat Stream Condition	Fair

Narrative:

Historic degradation and current widening.

Project: **Gihon** **Phase 2 Segment Summary** May 11, 2009 SGAT Version: 3

Stream: **Gihon River** Reach # **M11** Segment: **B** Completion Date: **July 18, 2006**

Organization: **Bear Creek Environmental** Observers: **Mike Blazewicz & Pam** Why Not assessed: **bedrock gorge** Rain: **Yes**

Segment Length (ft): **1,107** Segment Location: **Segment begins where bedrock grade controls are and continues another 1107 feet.**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Grade Controls**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	865	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Very Steep	Very Steep
Continuous w/	Always	Always
W/in 1 Bankfill	Always	Always
Texture	Bedrock	Bedrock

1.5 Valley Features

Valley Width (ft) **211**

Width Determination **Estimated**

Confinement Type **Semi-confined**

Rock Gorge? **Yes**

Human-caused Change? **no**

Step 2. Stream Channel

2.1 Bankfull Width **0**

2.2 Max Depth (ft) **0.00**

2.3 Mean Depth (ft) **0.00**

2.4 Floodprone Width (ft) **0**

Notes:

Reach is heavily influenced by bedrock on the banks and bed and was not assessable. The reach, however, was not a bedrock gorge as defined by the Phase 2 protocol ("continuous bedrock banks at least 10 feet high").

Step 2. (Contued)

2.5 Aband. Floodpln **0.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **0.00**

2.7 Entrenchment Ratio **0.00**

2.8 Incision Ratio **0.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity

2.10 Riffles Type

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	0%
Coarse Gravel	0%
Fine Gravel	0%
Sand	0%
Silt and smaller	0%

Silt/Clay Present?

Detritus **0** %

Large Woody **0**

2.13 Average Largest Particle on

Bed **0.0**

Bar **0.0**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Bedrock**

Subclass Slope: **None**

Bed Form: **Bedrock**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Cohesive
Lower		
Material Type	Bedrock	Bedrock
Consistency	Cohesive	Cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	0	0
Erosion Height (ft)	0.00	0.00
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	587	254
Near Bank Veg. Type	Left	Right
Dominant	Deciduous	Deciduous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin
Bank Canopy	Left	Right
Canopy %	26-50	26-50
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	>100
Sub-dominant	None	None
W less than 25	0	0
Buffer Veg. Type	Left	Right
Dominant	Mixed Trees	Mixed Trees
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Forest
Sub-dominant	None	None
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **None**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **1**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	1	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	0	0

Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
2	0	1	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **267**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M11 | Segment: B | Completion Date: July 18, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz & Pam DeAndrea | Rain: Yes

Segment Length (ft): 1,107 | Segment Location: Segment begins where bedrock grade controls are and continues another 1107 feet.

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	Downstream	4.00	1.00		
Ledge	Downstream	5.00	2.00		

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	45.0	Yes	No	Yes	Yes

Problem: Scour Above,Scour Below,Alignment

Narrative:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model

Channel Evolution Stage

Geomorphic Condition: Good

Stream Sensitivity

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Stream: **Gihon River** Reach # **M12** Segment: **0** Completion Date: **July 18, 2006**

Organization: **Bear Creek Environmental** Observers: **Mike Blazewicz & Pam** Why Not assessed: Rain: **Yes**

Segment Length (ft): **6,345** Segment Location: **Reach begins where stream becomes more sinuous and then straightens out where it**

QC Status - Staff: Passed **Cons**

Step 1. Valley and Floodplain

1.1 Segmentation **None**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	0	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Extremely	Extremely
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Cobble	Cobble

1.5 Valley Features

Valley Width (ft) **500**

Width Determination **Estimated**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **no**

Step 2. Stream Channel

2.1 Bankfull Width **83**

2.2 Max Depth (ft) **3.80**

2.3 Mean Depth (ft) **2.55**

2.4 Floodprone Width (ft) **535**

Notes:

Trib rejuvenating related to straightening of trib. Top of reach was slightly incised.

Passed *Step 2. (Contued)*

2.5 Aband. Floodpln **3.80** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **32.55**

2.7 Entrenchment Ratio **6.45**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **300**

2.12 Substrate Composition

Bedrock	0%
Boulder	5%
Cobble	28%
Coarse Gravel	44%
Fine Gravel	15%
Sand	8%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **97**

2.13 Average Largest Particle on

Bed **48.0** **inches**

Bar **16.0** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	Multiple	50.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Boulder/Cobbl	Boulder/Cobbl
Consistency	Non-cohesive	Non-cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	2,106	2,393
Erosion Height (ft)	4.10	3.27
Revetmt. Type	None	None
Revetmt. Length (ft)	0	0

Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Coniferous
Sub-dominant	Invasives	Invasives

Bank Canopy	Left	Right
Canopy %	26-50	1-25

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	None	None
W less than 25	0	0

Buffer Veg. Type	Left	Right
Dominant	Mixed Trees	Deciduous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Forest
Sub-dominant	None	None
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Minimal**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
2	11	4
Diagonal	**Delta**	**Island**
0	1	1

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
10	0	2	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
10	0	Yes

5.4 Stream Ford or Animal **Yes**

5.5 Straightening **None**

Straightening Length: **0**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M12 | Segment: 0 | Completion Date: July 18, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz & Pam DeAndrea | Rain: Yes

Segment Length (ft): 6,345 | Segment Location: Reach begins where stream becomes more sinuous and then straightens out where it

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions **None**

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

Step 7. Rapid Geomorphic Assessment Data

Confinement Type Unconfined

	Score	STD	Historic
7.1 Channel Degradation	**18**	**None**	**No**
7.2 Channel Aggradation	**9**	**None**	**No**
7.3 Widening Channel	**10**		**Yes**
7.4 Change in Planform	**4**		**No**
Total Score	**41**		
Geomorphic Rating	**0.5125**		

Channel Evolution Model	D
Channel Evolution Stage	IIc
Geomorphic Condition	Fair
Stream Sensitivity	Very High

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type High

	Score
6.1 Epifaunal Substrate - Available Cover	15
6.2 Embeddedness	10
6.3 Velocity/Depth Patterns	16
6.4 Sediment Deposition	8
6.5 Channel Flow Status	8
6.6 Channel Alteration	18
6.7 Frequency of Riffles/Steps	18
6.8 Bank Stability	Left: 5 Right: 4
6.9 Bank Vegetation Protection	Left: 5 Right: 5
6.10 Riparian Vegetation Zone Width	Left: 10 Right: 8
Total Score	130
Habitat Rating	0.65

Habitat Stream Condition Good

Narrative:

Major aggradation and planform adjustment.

Project: **Gihon**

Phase 2 Segment Summary

May 11, 2009 SGAT Version: 3

Stream: **Gihon River** Reach # **M13** Segment: **A** Completion Date: **July 11, 2006**

Organization: **Bear Creek Environmental** Observers: **Mike Blazewicz & Pam** Why Not assessed: Rain: **No**

Segment Length (ft): **3,324** Segment Location: **Segment begins approximately 0.5 miles dwonstream of bridge near general store.**

QC Status - Staff: Passed **Cons**

Step 1. Valley and Floodplain

1.1 Segmentation **Channel Dimensions**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	**0**	**0**
height	**0**	**0**
Roads	**1,125**	**665**
height	**0**	**0**
Railroads	**0**	**0**
height	**0**	**0**
Improved Paths	**0**	**0**
height	**0**	**0**
Development	**1,142**	**241**

1.4 Adjacent Side	Left	Right
Hillside Slope	**Extremely**	**Extremely**
Continuous w/	**Sometimes**	**Sometimes**
W/in 1 Bankfill	**Sometimes**	**Sometimes**
Texture	**Not Evalua**	**Not Evalua**

1.5 Valley Features

Valley Width (ft) **300**

Width Determination **Estimated**

Confinement Type **Narrow**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **63**

2.2 Max Depth (ft) **3.70**

2.3 Mean Depth (ft) **2.65**

2.4 Floodprone Width (ft) **77**

Notes:

Passed *Step 2. (Contued)*

2.5 Aband. Floodpln **7.60** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **23.77**

2.7 Entrenchment Ratio **1.22**

2.8 Incision Ratio **2.05**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **550**

2.12 Substrate Composition

Bedrock	**0** %
Boulder	**13** %
Cobble	**25** %
Coarse Gravel	**37** %
Fine Gravel	**15** %
Sand	**10** %
Silt and smaller	**0** %

Silt/Clay Present? **Yes**

Detritus **3** %

Large Woody **26**

2.13 Average Largest Particle on

Bed **36.0** **inches**

Bar **12.0** **inches**

2.14 Stream Type

Stream Type: **F**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	**None**	**0.00**
Gullies	**None**	**0.00**

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	**Sand**	**Sand**
Consistency	**Non-cohesive**	**Non-cohesive**
Lower		
Material Type	**Boulder/Cobbl**	**Boulder/Cobbl**
Consistency	**Non-cohesive**	**Non-cohesive**

Bank Erosion	Left	Right
Erosion Length (ft)	**851**	**153**
Erosion Height (ft)	**7.01**	**7.24**
Revetmt. Type	**Rip-Rap**	**Multiple**
Revetmt. Length (ft)	**1,289**	**297**

Near Bank Veg. Type	Left	Right
Dominant	**Shrubs/Saplin**	**Shrubs/Saplin**
Sub-dominant	**Invasives**	**Invasives**

Bank Canopy	Left	Right
Canopy %	**26-50**	**26-50**

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**0-25**	**51-100**
Sub-dominant	**>100**	**>100**
W less than 25	**0**	**0**

Buffer Veg. Type	Left	Right
Dominant	**Mixed Trees**	**Mixed Trees**
Sub-dominant	**Shrubs/Saplin**	**Shrubs/Saplin**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Shrubs/Saplin**	**Shrubs/Saplin**
Sub-dominant	**Forest**	**Residential**
Mass Failures	**0**	**0**
Height	**0**	**0**
Gullies	**0**	**0**
Height	**0**	**0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Minimal**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	**0**	Road Ditch	**0**
Other	**3**	Tile Drain	**0**
Overland Flow	**0**	Urb Strm Wtr Pipe	**0**

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	**1**	**1**

Diagonal	Delta	Island
0	**0**	**0**

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	**0**	**0**	**0**

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
3	**0**	**No**

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,207**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M13 | Segment: A | Completion Date: July 11, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz & Pam DeAndrea | Rain: No

Segment Length (ft): 3,324 | Segment Location: Segment begins approximately 0.5 miles dwonstream of bridge near general store.

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	62.0	Yes	No	No	No
Problem	Deposition Above,Deposition Below,Scour				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type Unconfined

	Score	STD	Historic
7.1 Channel Degradation	**4**	**C to F**	**Yes**
7.2 Channel Aggradation	**11**	**None**	**No**
7.3 Widening Channel	**12**		**No**
7.4 Change in Planform	**10**		**No**
Total Score	**37**		
Geomorphic Rating	**0.4625**		

Channel Evolution Model	F
Channel Evolution Stage	III
Geomorphic Condition	Fair
Stream Sensitivity	Extreme

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type High

	Score
6.1 Epifaunal Substrate - Available Cover	11
6.2 Embeddedness	11
6.3 Velocity/Depth Patterns	10
6.4 Sediment Deposition	13
6.5 Channel Flow Status	13
6.6 Channel Alteration	8
6.7 Frequency of Riffles/Steps	9
6.8 Bank Stability	Left: 6 Right: 9
6.9 Bank Vegetation Protection	Left: 3 Right: 7
6.10 Riparian Vegetation Zone Width	Left: 3 Right: 8
Total Score	111
Habitat Rating	0.555
Habitat Stream Condition	Fair

Narrative:

Historic incision, current minor widening, major planform adjustment, some aggradation.

Project: **Gihon** **Phase 2 Segment Summary** May 11, 2009 SGAT Version: 3

Stream: **Gihon River** Reach # **M13** Segment: **B** Completion Date: **July 11, 2006**

Organization: **Bear Creek Environmental** Observers: **Mike Blazewicz & Pam** Why Not assessed: Rain: **No**

Segment Length (ft): **1,508** Segment Location: **Segment begins approximately 830 feet upstream of bridge near general store.**

QC Status - Staff: Passed **Cons**

Step 1. Valley and Floodplain

1.1 Segmentation **Channel Dimensions**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	198	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	407	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Extremely	Extremely
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **300**

Width Determination **Estimated**

Confinement Type **Narrow**

Rock Gorge? **No**

Human-caused Change? **no**

Step 2. Stream Channel

2.1 Bankfull Width **60**

2.2 Max Depth (ft) **3.70**

2.3 Mean Depth (ft) **2.40**

2.4 Floodprone Width (ft) **174**

Notes:

Apperas to be naturally in a narrow valley.
Lots of metal/scrap trash in channel.

Passed *Step 2. (Contued)*

2.5 Aband. Floodpln **6.20** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **25.00**

2.7 Entrenchment Ratio **2.90**

2.8 Incision Ratio **1.68**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **300**

2.12 Substrate Composition

Bedrock	0%
Boulder	5%
Cobble	24%
Coarse Gravel	41%
Fine Gravel	19%
Sand	11%
Silt and smaller	0%

Silt/Clay Present? **Yes**

Detritus **3** %

Large Woody **11**

2.13 Average Largest Particle on

Bed **30.0** **inches**

Bar **8.0** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Gravel
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Boulder/Cobbl	Boulder/Cobbl
Consistency	Non-cohesive	Non-cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	296	182
Erosion Height (ft)	10.18	5.00
Revetmt. Type	Rip-Rap	None
Revetmt. Length (ft)	340	0

Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Invasives	Deciduous

Bank Canopy	Left	Right
Canopy %	26-50	51-75

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	>100
Sub-dominant	0-25	None
W less than 25	0	0

Buffer Veg. Type	Left	Right
Dominant	Mixed Trees	Mixed Trees
Sub-dominant	Invasives	None

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Shrubs/Saplin	Forest
Sub-dominant	Residential	None
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Minimal**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
1	1	1

Diagonal	Delta	Island
1	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
1	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
1	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **None**

Straightening Length: **0**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M13 | Segment: B | Completion Date: July 11, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz & Pam DeAndrea | Rain: No

Segment Length (ft): 1,508 | Segment Location: Segment begins approximately 830 feet upstream of bridge near general store.

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken

4.8 Channel Constrictions **None**

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

Step 7. Rapid Geomorphic Assessment Data

Confinement Type: Unconfined

	Score	STD	Historic
7.1 Channel Degradation	**12**	**None**	**Yes**
7.2 Channel Aggradation	**11**	**None**	**No**
7.3 Widening Channel	**11**		**No**
7.4 Change in Planform	**10**		**No**
Total Score	**44**		
Geomorphic Rating	**0.55**		

Channel Evolution Model	F
Channel Evolution Stage	III
Geomorphic Condition	Fair
Stream Sensitivity	Very High

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type: High

	Score
6.1 Epifaunal Substrate - Available Cover	11
6.2 Embeddedness	11
6.3 Velocity/Depth Patterns	14
6.4 Sediment Deposition	11
6.5 Channel Flow Status	13
6.6 Channel Alteration	15
6.7 Frequency of Riffles/Steps	18
6.8 Bank Stability	Left: 7 Right: 8
6.9 Bank Vegetation Protection	Left: 6 Right: 9
6.10 Riparian Vegetation Zone Width	Left: 4 Right: 9
Total Score	136
Habitat Rating	0.68

Habitat Stream Condition: Good

Narrative:

Historic degradation, currently widening and planform adjustment as it works to create new floodplain.

Project: **Gihon**

Phase 2 Segment Summary

May 11, 2009 SGAT Version: 3

Stream: **Gihon River** Reach # **M14** Segment: **A** Completion Date: **July 14, 2006**

Organization: **Bear Creek Environmental** Observers: **Mary Nealon & Mike Blazewicz** Why Not assessed: Rain: **Yes**

Segment Length (ft): **2,512** Segment Location: **Segment begins approximately 0.5 miles upstream of the 100C bridge in North Hyde Park.**

QC Status - Staff: Passed **Cons**

Step 1. Valley and Floodplain

1.1 Segmentation **Planform and Scope**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	**0**	**0**
height	**0**	**0**
Roads	**978**	**519**
height	**0**	**0**
Railroads	**0**	**0**
height	**0**	**0**
Improved Paths	**0**	**0**
height	**0**	**0**
Development	**1,230**	**1,235**

1.4 Adjacent Side	Left	Right
Hillside Slope	**Hilly**	**Hilly**
Continuous w/	**Never**	**Sometimes**
W/in 1 Bankfill	**Never**	**Sometimes**
Texture	**Not Evalua**	**Not Evalua**

1.5 Valley Features

Valley Width (ft) **500**

Width Determination **Estimated**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **58**

2.2 Max Depth (ft) **3.80**

2.3 Mean Depth (ft) **2.72**

2.4 Floodprone Width (ft) **312**

Notes:

Rip rap both sides, associated with section by bridge.

Passed *Step 2. (Contued)*

2.5 Aband. Floodpln **3.80** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **21.32**

2.7 Entrenchment Ratio **5.38**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **500**

2.12 Substrate Composition

Bedrock	**0**%
Boulder	**1**%
Cobble	**21**%
Coarse Gravel	**54**%
Fine Gravel	**21**%
Sand	**3**%
Silt and smaller	**0**%

Silt/Clay Present? **Yes**

Detritus **1** %

Large Woody **16**

2.13 Average Largest Particle on

Bed **12.0** **inches**

Bar **5.0** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	**None**	**0.00**
Gullies	**None**	**0.00**

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	**Sand**	**Sand**
Consistency	**Non-cohesive**	**Non-cohesive**
Lower		
Material Type	**Gravel**	**Gravel**
Consistency	**Non-cohesive**	**Non-cohesive**

Bank Erosion	Left	Right
Erosion Length (ft)	**519**	**562**
Erosion Height (ft)	**7.89**	**4.05**
Revetmt. Type	**Rip-Rap**	**Rip-Rap**
Revetmt. Length (ft)	**801**	**230**

Near Bank Veg. Type	Left	Right
Dominant	**Herbaceous**	**Herbaceous**
Sub-dominant	**Shrubs/Saplin**	**Shrubs/Saplin**

Bank Canopy	Left	Right
Canopy %	**26-50**	**1-25**

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**0-25**	**0-25**
Sub-dominant	**0-25**	**>100**
W less than 25	**0**	**0**

Buffer Veg. Type	Left	Right
Dominant	**Herbaceous**	**Herbaceous**
Sub-dominant	**Shrubs/Saplin**	**Shrubs/Saplin**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Residential**	**Residential**
Sub-dominant	**None**	**Forest**
Mass Failures	**0**	**0**
Height	**0**	**0**
Gullies	**0**	**0**
Height	**0**	**0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Minimal**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	**0**	Road Ditch	**0**
Other	**0**	Tile Drain	**0**
Overland Flow	**0**	Urb Strm Wtr Pipe	**0**

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
1	**3**	**0**

Diagonal	Delta	Island
0	**0**	**0**

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	**0**	**0**	**0**

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
1	**0**	**No**

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **506**

5.5 Dredging **Gravel Mining**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M14 | Segment: A | Completion Date: July 14, 2006

Organization: Bear Creek Environmental | Observers: Mary Nealon & Mike Blazewicz | Rain: Yes

Segment Length (ft): 2,512 | Segment Location: Segment begins approximately 0.5 miles upstream of the 100C bridge in North Hyde

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	57.0	Yes	No	No	Yes
Problem	Scour Above,Scour Below,Alignment				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type Unconfined

	Score	STD	Historic
7.1 Channel Degradation	**13**	**None**	**No**
7.2 Channel Aggradation	**15**	**None**	**No**
7.3 Widening Channel	**13**		**No**
7.4 Change in Planform	**13**		**No**
Total Score	**54**		
Geomorphic Rating	**0.675**		

Channel Evolution Model	D
Channel Evolution Stage	IIc
Geomorphic Condition	Good
Stream Sensitivity	High

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type High

	Score
6.1 Epifaunal Substrate - Available Cover	12
6.2 Embeddedness	12
6.3 Velocity/Depth Patterns	16
6.4 Sediment Deposition	13
6.5 Channel Flow Status	13
6.6 Channel Alteration	9
6.7 Frequency of Riffles/Steps	13
6.8 Bank Stability	Left: 7 Right: 7
6.9 Bank Vegetation Protection	Left: 4 Right: 4
6.10 Riparian Vegetation Zone Width	Left: 2 Right: 1
Total Score	113
Habitat Rating	0.565
Habitat Stream Condition	Fair

Narrative:

Steeper gradient steeped by channelization, but due to the resistance of the bed material, the stream has not incised or lost access to its floodplain (remaining a “C” Stream Type). Bedform is weak RP.

Project: **Gihon**

Phase 2 Segment Summary

May 11, 2009 SGAT Version: 3

Stream: **Gihon River** Reach # **M14** Segment: **B** Completion Date: **July 14, 2006**

Organization: **Bear Creek Environmental** Observers: **Mary Nealon and Mike** Why Not assessed: Rain: **Yes**

Segment Length (ft): **1,603** Segment Location: **Segment begins where channel straightens out. Approximately 2500 feet upstream of the**

QC Status - Staff: Passed **Cons** **Passed**

Step 1. Valley and Floodplain

1.1 Segmentation **Channel Dimensions**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	0	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	559	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Hilly	Hilly
Continuous w/	Never	Never
W/in 1 Bankfill	Never	Never
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **800**

Width Determination **Estimated**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **no**

Step 2. Stream Channel

2.1 Bankfull Width **52**

2.2 Max Depth (ft) **3.50**

2.3 Mean Depth (ft) **2.69**

2.4 Floodprone Width (ft) **374**

Notes:

Step 2. (Contued)

2.5 Aband. Floodpln **4.60** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **19.33**

2.7 Entrenchment Ratio **7.19**

2.8 Incision Ratio **1.31**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **600**

2.12 Substrate Composition

Bedrock	0%
Boulder	1%
Cobble	32%
Coarse Gravel	35%
Fine Gravel	22%
Sand	10%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **1** %

Large Woody **2**

2.13 Average Largest Particle on

Bed **12.0** **inches**

Bar **N/A** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	401	472
Erosion Height (ft)	6.05	4.55
Revetmt. Type	None	Rip-Rap
Revetmt. Length (ft)	0	122
Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin
Bank Canopy	Left	Right
Canopy %	1-25	1-25
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	26-50	0-25
Sub-dominant	0-25	None
W less than 25	0	0
Buffer Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Herbaceous
Sub-dominant	Herbaceous	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Residential	Crop
Sub-dominant	None	None
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Minimal**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	0	0
Diagonal	**Delta**	**Island**
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	Yes

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,603**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M14 | Segment: B | Completion Date: July 14, 2006

Organization: Bear Creek Environmental | Observers: Mary Nealon and Mike Blazewicz | Rain: Yes

Segment Length (ft): 1,603 | Segment Location: Segment begins where channel straightens out. Approximately 2500 feet upstream of

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken

4.8 Channel Constrictions **None**

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

Step 7. Rapid Geomorphic Assessment Data

Confinement Type: Unconfined

	Score	STD	Historic
7.1 Channel Degradation	**11**	**None**	**Yes**
7.2 Channel Aggradation	**15**	**None**	**No**
7.3 Widening Channel	**12**		**No**
7.4 Change in Planform	**12**		**No**
Total Score	**50**		
Geomorphic Rating	**0.625**		

Channel Evolution Model	F
Channel Evolution Stage	III
Geomorphic Condition	Fair
Stream Sensitivity	Very High

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type: High

	Score
6.1 Epifaunal Substrate - Available Cover	7
6.2 Embeddedness	14
6.3 Velocity/Depth Patterns	8
6.4 Sediment Deposition	13
6.5 Channel Flow Status	16
6.6 Channel Alteration	8
6.7 Frequency of Riffles/Steps	13
6.8 Bank Stability	Left: 5 Right: 5
6.9 Bank Vegetation Protection	Left: 4 Right: 5
6.10 Riparian Vegetation Zone Width	Left: 4 Right: 1
Total Score	103
Habitat Rating	0.515
Habitat Stream Condition	Fair

Narrative:

Historic degradation associated with straightening, minor widening and planform adjustment. Floodplain access upstream probably helping. limit adjustment.

Stream: **Gihon River** Reach # **M14** Segment: **C** Completion Date: **July 14, 2006**

Organization: **Bear Creek Environmental** Observers: **Mary Nealon and Mike** Why Not assessed: Rain: **Yes**

Segment Length (ft): **2,240** Segment Location: **Segment begins where buffer becomes more forested approximately 1600 feet upstream**

QC Status - Staff: Passed **Cons**

Step 1. Valley and Floodplain

1.1 Segmentation **Banks and Buffers**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	0	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Hilly	Hilly
Continuous w/	Never	Never
W/in 1 Bankfill	Never	Never
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **940**

Width Determination **Estimated**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **no**

Step 2. Stream Channel

2.1 Bankfull Width **51**

2.2 Max Depth (ft) **3.80**

2.3 Mean Depth (ft) **2.86**

2.4 Floodprone Width (ft) **308**

Notes:

Passed *Step 2. (Contued)*

2.5 Aband. Floodpln **5.30** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **17.83**

2.7 Entrenchment Ratio **6.04**

2.8 Incision Ratio **1.39**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **750**

2.12 Substrate Composition

Bedrock	0%
Boulder	1%
Cobble	29%
Coarse Gravel	49%
Fine Gravel	17%
Sand	4%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **8** %

Large Woody **33**

2.13 Average Largest Particle on

Bed **10.0** **inches**

Bar **4.0** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	541	403
Erosion Height (ft)	3.46	2.45
Revetmt. Type	None	None
Revetmt. Length (ft)	0	0
Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Coniferous	Coniferous
Bank Canopy	Left	Right
Canopy %	1-25	26-50
Mid-Channel Canopy		Open

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	None	None
W less than 25	0	0
Buffer Veg. Type	Left	Right
Dominant	Coniferous	Coniferous
Sub-dominant	Herbaceous	Herbaceous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Forest
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Abundant**

4.2 Adjacent Wetlands **Abundant**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
1	0	2
Diagonal	**Delta**	**Island**
0	0	1

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
1	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **616**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M14 | Segment: C | Completion Date: July 14, 2006

Organization: Bear Creek Environmental | Observers: Mary Nealon and Mike Blazewicz | Rain: Yes

Segment Length (ft): 2,240 | Segment Location: Segment begins where buffer becomes more forested approximately 1600 feet

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions **None**

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

Step 7. Rapid Geomorphic Assessment Data

Confinement Type Unconfined

	Score	STD	Historic
7.1 Channel Degradation	**13**	**None**	**Yes**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**13**		**No**
7.4 Change in Planform	**13**		**No**
Total Score	**52**		
Geomorphic Rating	**0.65**		

Channel Evolution Model	F
Channel Evolution Stage	III
Geomorphic Condition	Good
Stream Sensitivity	High

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type High

	Score
6.1 Epifaunal Substrate - Available Cover	14
6.2 Embeddedness	14
6.3 Velocity/Depth Patterns	13
6.4 Sediment Deposition	14
6.5 Channel Flow Status	14
6.6 Channel Alteration	18
6.7 Frequency of Riffles/Steps	11
6.8 Bank Stability	Left: 7 Right: 7
6.9 Bank Vegetation Protection	Left: 9 Right: 9
6.10 Riparian Vegetation Zone Width	Left: 10 Right: 10
Total Score	150
Habitat Rating	0.75

Habitat Stream Condition Good

Narrative:

Historic degradation, minor planform, aggradation and widening.

Project: **Gihon**

Phase 2 Segment Summary

May 11, 2009 SGAT Version: 3

Stream: **Gihon River** Reach # **M15** Segment: **0** Completion Date: **July 12, 2006**

Organization: **Bear Creek Environmental** Observers: **Mike Blazewicz & Stacey** Why Not assessed: Rain: **No**

Segment Length (ft): **5,636** Segment Location: **Reach begins in forested section where stream becomes relatively straight and runs**

QC Status - Staff: Passed **Cons** **Passed**

Step 1. Valley and Floodplain

1.1 Segmentation **None**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	0	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Hilly	Steep
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **480**

Width Determination **Estimated**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **no**

Step 2. Stream Channel

2.1 Bankfull Width **63**

2.2 Max Depth (ft) **3.40**

2.3 Mean Depth (ft) **2.57**

2.4 Floodprone Width (ft) **523**

Notes:

Step 2. (Contued)

2.5 Aband. Floodpln **3.40** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **24.51**

2.7 Entrenchment Ratio **8.30**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **1,200**

2.12 Substrate Composition

Bedrock	0%
Boulder	10%
Cobble	35%
Coarse Gravel	26%
Fine Gravel	22%
Sand	7%
Silt and smaller	0%

Silt/Clay Present? **Yes**

Detritus **5** %

Large Woody **116**

2.13 Average Largest Particle on

Bed **36.0** **inches**

Bar **6.0** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Boulder/Cobbl	Boulder/Cobbl
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	935	688
Erosion Height (ft)	2.46	3.39
Revetmt. Type	None	Rip-Rap
Revetmt. Length (ft)	0	254
Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Coniferous	Coniferous
Bank Canopy	Left	Right
Canopy %	51-75	51-75
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	None	None
W less than 25	0	0
Buffer Veg. Type	Left	Right
Dominant	Mixed Trees	Mixed Trees
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Forest
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Abundant**

4.2 Adjacent Wetlands **Abundant**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	0	3

Diagonal	Delta	Island
0	1	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
3	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
1	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **None**

Straightening Length: **0**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M15 | Segment: 0 | Completion Date: July 12, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz & Stacey Ambler | Rain: No

Segment Length (ft): 5,636 | Segment Location: Reach begins in forested section where stream becomes relatively straight and runs

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	45.0	Yes	No	Yes	Yes

Problem: Scour Below

Step 7. Rapid Geomorphic Assessment Data

Confinement Type: Unconfined

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**No**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**12**		**No**
7.4 Change in Planform	**14**		**No**
Total Score	**55**		
Geomorphic Rating	**0.6875**		

Channel Evolution Model	F
Channel Evolution Stage	I
Geomorphic Condition	Good
Stream Sensitivity	High

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type: High

	Score
6.1 Epifaunal Substrate - Available Cover	11
6.2 Embeddedness	12
6.3 Velocity/Depth Patterns	6
6.4 Sediment Deposition	11
6.5 Channel Flow Status	13
6.6 Channel Alteration	18
6.7 Frequency of Riffles/Steps	8
6.8 Bank Stability	Left: 7 Right: 9
6.9 Bank Vegetation Protection	Left: 9 Right: 9
6.10 Riparian Vegetation Zone Width	Left: 9 Right: 9
Total Score	131
Habitat Rating	0.655
Habitat Stream Condition	Good

Narrative:

Minor widening, aggradation & planform adjustment but no incision due to resistance of boundary conditions.

Project: **Gihon** **Phase 2 Segment Summary** May 11, 2009 SGAT Version: 3

Stream: **Gihon River** Reach # **M16** Segment: **A** Completion Date: **July 7, 2006**

Organization: **Bear Creek Environmental** Observers: **Mike Blazewicz & Stacey** Why Not assessed: Rain: **No**

Segment Length (ft): **832** Segment Location: **Segment begins just upstream of confluence with M15.01 and continues for 832 feet until a**

QC Status - Staff: Passed **Cons** **Passed**

Step 1. Valley and Floodplain

1.1 Segmentation **Corridor Encroachment**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	420	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	589	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Steep	Steep
Continuous w/	Never	Sometimes
W/in 1 Bankfill	Never	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **324**

Width Determination **Estimated**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **no**

Step 2. Stream Channel

2.1 Bankfull Width **44**

2.2 Max Depth (ft) **4.30**

2.3 Mean Depth (ft) **3.32**

2.4 Floodprone Width (ft) **324**

Notes:

Looks very straight, but stable. Trib widening and planform adjustment process seems associated with an undersized culvert on route 100 that is causing incision on the trib rather than incision on the mainstem.

Step 2. (Contued)

2.5 Aband. Floodpln **4.30** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **13.25**

2.7 Entrenchment Ratio **7.36**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **500**

2.12 Substrate Composition

Bedrock	0%
Boulder	14%
Cobble	16%
Coarse Gravel	38%
Fine Gravel	20%
Sand	12%
Silt and smaller	0%

Silt/Clay Present? **Yes**

Detritus **2** %

Large Woody **15**

2.13 Average Largest Particle on

Bed **24.0** **inches**

Bar **N/A** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Boulder/Cobbl	Boulder/Cobbl
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	141	146
Erosion Height (ft)	3.00	3.00
Revetmt. Type	None	Rip-Rap
Revetmt. Length (ft)	0	60
Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	None	Herbaceous
Bank Canopy	Left	Right
Canopy %	1-25	1-25
Mid-Channel Canopy		Open

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	0-25
Sub-dominant	None	>100
W less than 25	0	0
Buffer Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Mixed Trees	Herbaceous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Shrubs/Saplin	Residential
Sub-dominant	Forest	Forest
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Minimal**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	0	0
Diagonal	**Delta**	**Island**
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **539**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M16 | Segment: A | Completion Date: July 7, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz & Stacey Ambler | Rain: No

Segment Length (ft): 832 | Segment Location: Segment begins just upstream of confluence with M15.01 and continues for 832 feet

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken

4.8 Channel Constrictions **None**

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

Narrative:

No significant adjustment observed.

Step 7. Rapid Geomorphic Assessment Data

Confinement Type: Unconfined

	Score	STD	Historic
7.1 Channel Degradation	**15**	**None**	**No**
7.2 Channel Aggradation	**16**	**None**	**No**
7.3 Widening Channel	**16**		**No**
7.4 Change in Planform	**15**		**No**
Total Score	**62**		
Geomorphic Rating	**0.775**		

Channel Evolution Model	F
Channel Evolution Stage	I
Geomorphic Condition	Good
Stream Sensitivity	High

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type: High

	Score
6.1 Epifaunal Substrate - Available Cover	13
6.2 Embeddedness	13
6.3 Velocity/Depth Patterns	8
6.4 Sediment Deposition	14
6.5 Channel Flow Status	16
6.6 Channel Alteration	8
6.7 Frequency of Riffles/Steps	13
6.8 Bank Stability	Left: 9 Right: 9
6.9 Bank Vegetation Protection	Left: 9 Right: 6
6.10 Riparian Vegetation Zone Width	Left: 9 Right: 4
Total Score	131
Habitat Rating	0.655

Habitat Stream Condition: Good

Project: **Gihon** **Phase 2 Segment Summary** May 11, 2009 SGAT Version: 3

Stream: **Gihon River** Reach # **M16** Segment: **B** Completion Date: **July 7, 2006**

Organization: **Bear Creek Environmental** Observers: **Mike Blazewicz & Stacey** Why Not assessed: Rain: **No**

Segment Length (ft): **2,024** Segment Location: **Segment begins just upstream of rejuvenating tributary on left bank and where Route 100**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Planform and Scope**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	1,906	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	658	163

1.4 Adjacent Side	Left	Right
Hillside Slope	Steep	Steep
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **150**

Width Determination **Measured**

Confinement Type **Semi-confined**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **60**

2.2 Max Depth (ft) **3.10**

2.3 Mean Depth (ft) **2.27**

2.4 Floodprone Width (ft) **136**

Notes:

Step 2. (Contued)

2.5 Aband. Floodpln **4.70** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **26.43**

2.7 Entrenchment Ratio **2.27**

2.8 Incision Ratio **1.52**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Not Applicable**

2.11 Riffle/Step Spacing (ft) **N/A**

2.12 Substrate Composition

Bedrock	0%
Boulder	19%
Cobble	43%
Coarse Gravel	22%
Fine Gravel	10%
Sand	6%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **1** %

Large Woody **27**

2.13 Average Largest Particle on

Bed **24.0** **inches**

Bar **N/A** **inches**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Cobble**

Subclass Slope: **c**

Bed Form: **Plane Bed**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Boulder/Cobbl	Boulder/Cobbl
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	230	81
Erosion Height (ft)	3.00	3.00
Revetmt. Type	Rip-Rap	Multiple
Revetmt. Length (ft)	133	731
Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Herbaceous
Sub-dominant	Herbaceous	Shrubs/Saplin
Bank Canopy	Left	Right
Canopy %	1-25	1-25
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	0-25
Sub-dominant	0-25	>100
W less than 25	0	0
Buffer Veg. Type	Left	Right
Dominant	Mixed Trees	Herbaceous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Forest
Sub-dominant	Residential	Residential
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Minimal**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
2	0	0
Diagonal	**Delta**	**Island**
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
1	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	Yes

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,908**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M16 | Segment: B | Completion Date: July 7, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz & Stacey Ambler | Rain: No

Segment Length (ft): 2,024 | Segment Location: Segment begins just upstream of rejuvenating tributary on left bank and where Route

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	26.0	Yes	No	Yes	Yes
Problem	Deposition Above,Scour Above,Scour				
Bridge	28.0	Yes	No	Yes	Yes
Problem	Deposition Above,Scour Above,Scour				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type Unconfined

	Score	STD	Historic
7.1 Channel Degradation	**7**	**C to B**	**Yes**
7.2 Channel Aggradation	**11**	**None**	**No**
7.3 Widening Channel	**11**		**No**
7.4 Change in Planform	**11**		**No**
Total Score	**40**		
Geomorphic Rating	**0.5**		

Channel Evolution Model	F
Channel Evolution Stage	II
Geomorphic Condition	Fair
Stream Sensitivity	Very High

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type High

	Score
6.1 Epifaunal Substrate - Available Cover	13
6.2 Embeddedness	13
6.3 Velocity/Depth Patterns	11
6.4 Sediment Deposition	14
6.5 Channel Flow Status	16
6.6 Channel Alteration	5
6.7 Frequency of Riffles/Steps	5
6.8 Bank Stability	Left: 7 Right: 9
6.9 Bank Vegetation Protection	Left: 6 Right: 6
6.10 Riparian Vegetation Zone Width	Left: 8 Right: 3
Total Score	116
Habitat Rating	0.58

Habitat Stream Condition Fair

Narrative:

Historic degradation, widening limited by boundary conditions.

Project: **Gihon** | **Phase 2 Segment Summary** | May 11, 2009 SGAT Version: 3

Stream: **Gihon River** Reach # **M16** Segment: **C** Completion Date: **July 7, 2006**

Organization: **Bear Creek Environmental** Observers: **Mike Blazewicz & Stacey** Why Not assessed: Rain: **No**

Segment Length (ft): **1,960** Segment Location: **Segment begins 345 feet upstream of White Road bridge and continues 1960 feet until just**

QC Status - Staff: Passed **Cons**

Step 1. Valley and Floodplain

1.1 Segmentation **Planform and Scope**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	0	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Steep	Steep
Continuous w/	Never	Sometimes
W/in 1 Bankfill	Never	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **800**

Width Determination **Estimated**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **no**

Step 2. Stream Channel

2.1 Bankfull Width **73**

2.2 Max Depth (ft) **3.50**

2.3 Mean Depth (ft) **2.01**

2.4 Floodprone Width (ft) **748**

Notes:

Passed *Step 2. (Contued)*

2.5 Aband. Floodpln **4.90** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **36.32**

2.7 Entrenchment Ratio **10.25**

2.8 Incision Ratio **1.40**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **300**

2.12 Substrate Composition

Bedrock	0%
Boulder	13%
Cobble	22%
Coarse Gravel	43%
Fine Gravel	15%
Sand	7%
Silt and smaller	0%

Silt/Clay Present? **Yes**

Detritus **5** %

Large Woody **45**

2.13 Average Largest Particle on

Bed **18.0** **inches**

Bar **5.0** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Undercut**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	944	335
Erosion Height (ft)	3.16	3.00
Revetmt. Type	Rip-Rap	None
Revetmt. Length (ft)	410	0
Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin
Bank Canopy	Left	Right
Canopy %	1-25	1-25
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	None	None
W less than 25	0	0
Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	None	None
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Abundant**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
2	1	1
Diagonal	**Delta**	**Island**
1	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
1	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
1	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **742**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M16 | Segment: C | Completion Date: July 7, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz & Stacey Ambler | Rain: No

Segment Length (ft): 1,960 | Segment Location: Segment begins 345 feet upstream of White Road bridge and continues 1960 feet until

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken

4.8 Channel Constrictions **None**

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

Step 7. Rapid Geomorphic Assessment Data

Confinement Type: Unconfined

	Score	STD	Historic
7.1 Channel Degradation	**8**	**None**	**Yes**
7.2 Channel Aggradation	**10**	**None**	**No**
7.3 Widening Channel	**8**		**No**
7.4 Change in Planform	**10**		**No**
Total Score	**36**		
Geomorphic Rating	**0.45**		

Channel Evolution Model	F
Channel Evolution Stage	III
Geomorphic Condition	Fair
Stream Sensitivity	Very High

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type: High

	Score
6.1 Epifaunal Substrate - Available Cover	13
6.2 Embeddedness	11
6.3 Velocity/Depth Patterns	18
6.4 Sediment Deposition	8
6.5 Channel Flow Status	9
6.6 Channel Alteration	15
6.7 Frequency of Riffles/Steps	18
6.8 Bank Stability	Left: 4 Right: 8
6.9 Bank Vegetation Protection	Left: 9 Right: 9
6.10 Riparian Vegetation Zone Width	Left: 9 Right: 9
Total Score	140
Habitat Rating	0.7
Habitat Stream Condition	Good

Narrative:

Historic degradation, active widening, planform adjustment, minor aggradation.

Project: **Gihon** | **Phase 2 Segment Summary** | May 11, 2009 | SGAT Version: 3

Stream: **Gihon River** | Reach # **M17** | Segment: **A** | Completion Date: **June 19, 2006**

Organization: **Bear Creek Environmental** | Observers: **Mike Blazewicz & Stacey** | Why Not assessed: | Rain: **Yes**

Segment Length (ft): **1,876** | Segment Location: **Segment begins about 1500 feet downstream of bridge and continues to about 250 feet**

QC Status - Staff: Provisional Cons

Step 1. Valley and Floodplain

1.1 Segmentation **Substrate Size**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	0	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	120	58

1.4 Adjacent Side	Left	Right
Hillside Slope	Steep	Steep
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **450**

Width Determination **Estimated**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **no**

Step 2. Stream Channel

2.1 Bankfull Width **33**

2.2 Max Depth (ft) **2.90**

2.3 Mean Depth (ft) **2.16**

2.4 Floodprone Width (ft) **555**

Notes:

Evidence of historical straightening.

Passed *Step 2. (Contued)*

2.5 Aband. Floodpln **3.80** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **15.28**

2.7 Entrenchment Ratio **16.82**

2.8 Incision Ratio **1.31**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Not Applicable**

2.11 Riffle/Step Spacing (ft) **N/A**

2.12 Substrate Composition

Bedrock	0%
Boulder	13%
Cobble	28%
Coarse Gravel	18%
Fine Gravel	21%
Sand	20%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **10** %

Large Woody **25**

2.13 Average Largest Particle on

Bed **10.0** **inches**

Bar **4.0** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Plane Bed**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Boulder/Cobbl	Boulder/Cobbl
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	405	309
Erosion Height (ft)	5.00	4.00
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	358	417
Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Herbaceous
Bank Canopy	Left	Right
Canopy %	26-50	26-50
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	None	None
W less than 25	0	0
Buffer Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Herbaceous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Forest	Forest
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Abundant**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **1**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	1	0

Diagonal	Delta	Island
0	0	1

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **860**

5.5 Dredging **Dredging**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M17 | Segment: A | Completion Date: June 19, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz & Stacey Ambler | Rain: Yes

Segment Length (ft): 1,876 | Segment Location: Segment begins about 1500 feet downstream of bridge and continues to about 250

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	22.5	Yes	No	Yes	Yes

Problem: Deposition Above,Scour Below,Alignment

Step 7. Rapid Geomorphic Assessment Data

Confinement Type: Unconfined

	Score	STD	Historic
7.1 Channel Degradation	**10**	**None**	**Yes**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**13**		**No**
7.4 Change in Planform	**11**		**No**
Total Score	**47**		
Geomorphic Rating	**0.5875**		

Channel Evolution Model: F

Channel Evolution Stage: III

Geomorphic Condition: Fair

Stream Sensitivity: Very High

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type: High

	Score
6.1 Epifaunal Substrate - Available Cover	13
6.2 Embeddedness	14
6.3 Velocity/Depth Patterns	8
6.4 Sediment Deposition	13
6.5 Channel Flow Status	15
6.6 Channel Alteration	3
6.7 Frequency of Riffles/Steps	8
6.8 Bank Stability	Left: 5 Right: 9
6.9 Bank Vegetation Protection	Left: 4 Right: 4
6.10 Riparian Vegetation Zone Width	Left: 9 Right: 9
Total Score	114
Habitat Rating	0.57

Habitat Stream Condition: Fair

Narrative:

Historic channel straightening incision, currently minor windening, planform adjustment, widening limited by good vegetation on lower end and large stone wall (could be removed to improve floodplain access).

Project: **Gihon** **Phase 2 Segment Summary** May 11, 2009 SGAT Version: 3

Stream: **Gihon River** Reach # **M17** Segment: **B** Completion Date: **June 19, 2006**

Organization: **Bear Creek Environmental** Observers: **Mike Blazewicz & Stacey** Why Not assessed: Rain: **No**

Segment Length (ft): **5,790** Segment Location: **Segment begins approximately 250 feet upstream from bridge and continues 5,790 feet.**

QC Status - Staff: Passed **Cons**

Step 1. Valley and Floodplain

1.1 Segmentation **Substrate Size**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	2,673	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	228	56

1.4 Adjacent Side	Left	Right
Hillside Slope	Hilly	Steep
Continuous w/	Never	Never
W/in 1 Bankfill	Sometimes	Never
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **450**

Width Determination **Estimated**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **35**

2.2 Max Depth (ft) **2.80**

2.3 Mean Depth (ft) **1.89**

2.4 Floodprone Width (ft) **340**

Notes:

Reach heavily influenced by beavers.

Passed *Step 2. (Contued)*

2.5 Aband. Floodpln **3.60** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **18.52**

2.7 Entrenchment Ratio **9.71**

2.8 Incision Ratio **1.29**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **200**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	10%
Coarse Gravel	55%
Fine Gravel	20%
Sand	15%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **30** %

Large Woody **84**

2.13 Average Largest Particle on

Bed **6.0** **inches**

Bar **3.0** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Undercut**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	753	212
Erosion Height (ft)	3.17	3.00
Revetmt. Type	Rip-Rap	Multiple
Revetmt. Length (ft)	454	399
Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Herbaceous
Bank Canopy	Left	Right
Canopy %	26-50	26-50

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	None	None
W less than 25	0	0
Buffer Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Herbaceous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Forest	Forest
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Abundant**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **1**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **2**

Affected Length (ft) **1,200**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
2	3	8
Diagonal	**Delta**	**Island**
1	0	1

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
9	0	1	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
8	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,874**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M17 | Segment: B | Completion Date: June 19, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz & Stacey Ambler | Rain: No

Segment Length (ft): 5,790 | Segment Location: Segment begins approximately 250 feet upstream from bridge and continues 5,790

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	60.0	Yes	No	No	Yes
Problem	Deposition Above,Deposition Below,Scour				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type Unconfined

	Score	STD	Historic
7.1 Channel Degradation	**11**	**None**	**Yes**
7.2 Channel Aggradation	**11**	**None**	**No**
7.3 Widening Channel	**11**		**No**
7.4 Change in Planform	**13**		**No**
Total Score	**46**		
Geomorphic Rating	**0.575**		

Channel Evolution Model	D
Channel Evolution Stage	IId
Geomorphic Condition	Fair
Stream Sensitivity	Very High

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type High

	Score
6.1 Epifaunal Substrate - Available Cover	16
6.2 Embeddedness	13
6.3 Velocity/Depth Patterns	18
6.4 Sediment Deposition	13
6.5 Channel Flow Status	16
6.6 Channel Alteration	15
6.7 Frequency of Riffles/Steps	19
6.8 Bank Stability	Left: 7 Right: 8
6.9 Bank Vegetation Protection	Left: 8 Right: 10
6.10 Riparian Vegetation Zone Width	Left: 8 Right: 10
Total Score	161
Habitat Rating	0.805
Habitat Stream Condition	Good

Narrative:

Some evidence of incision likely attributed to cutting back through beaver dammed deposits.. Area affected by beavers causing extensive aggradational features, planform adjustment and widening. Overall stream looks very healthy.

Project: **Gihon** **Phase 2 Segment Summary** May 11, 2009 SGAT Version: 3

Stream: **Gihon River** Reach # **M18** Segment: **A** Completion Date: **June 17, 2006**

Organization: **Bear Creek Environmental** Observers: **Mike Blazewicz & Pam** Why Not assessed: Rain: **Yes**

Segment Length (ft): **2,365** Segment Location: **Segment begins approximately 0.5 miles upstream of the bridge in reach M-17. It continues**

QC Status - Staff: Passed **Cons**

Step 1. Valley and Floodplain

1.1 Segmentation **Channel Dimensions**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	2,041	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	77	168

1.4 Adjacent Side	Left	Right
Hillside Slope	Very Steep	Very Steep
Continuous w/	Never	Never
W/in 1 Bankfill	Never	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **260**

Width Determination **Estimated**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **37**

2.2 Max Depth (ft) **2.30**

2.3 Mean Depth (ft) **1.77**

2.4 Floodprone Width (ft) **197**

Notes:

Segment impacted historically by beavers.
Double culvert should be removed.

Passed *Step 2. (Contued)*

2.5 Aband. Floodpln **2.30** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **20.90**

2.7 Entrenchment Ratio **5.32**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **350**

2.12 Substrate Composition

Bedrock	0%
Boulder	3%
Cobble	20%
Coarse Gravel	46%
Fine Gravel	13%
Sand	18%
Silt and smaller	0%

Silt/Clay Present? **Yes**

Detritus **10** %

Large Woody **11**

2.13 Average Largest Particle on

Bed **12.0** **inches**

Bar **6.0** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Undercut**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	404	0
Erosion Height (ft)	2.28	0.00
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	138	24
Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin
Bank Canopy	Left	Right
Canopy %	1-25	1-25
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	0-25	None
W less than 25	0	0
Buffer Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Herbaceous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Residential	Forest
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Abundant**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **1**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
2	3	0
Diagonal	**Delta**	**Island**
0	0	1

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
6	0	1	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
2	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **950**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M18 | Segment: A | Completion Date: June 17, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz & Pam DeAndrea | Rain: Yes

Segment Length (ft): 2,365 | Segment Location: Segment begins approximately 0.5 miles upstream of the bridge in reach M-17. It

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Culvert	6.50	Yes	No	Yes	Yes
Problem	Deposition Above,Deposition Below,Scour				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type Unconfined

	Score	STD	Historic
7.1 Channel Degradation	**15**	**None**	**No**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**14**		**No**
7.4 Change in Planform	**11**		**No**
Total Score	**53**		
Geomorphic Rating	**0.6625**		

Channel Evolution Model	F
Channel Evolution Stage	I
Geomorphic Condition	Good
Stream Sensitivity	High

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type High

	Score
6.1 Epifaunal Substrate - Available Cover	13
6.2 Embeddedness	15
6.3 Velocity/Depth Patterns	16
6.4 Sediment Deposition	8
6.5 Channel Flow Status	16
6.6 Channel Alteration	10
6.7 Frequency of Riffles/Steps	14
6.8 Bank Stability	Left: 7 Right: 9
6.9 Bank Vegetation Protection	Left: 7 Right: 8
6.10 Riparian Vegetation Zone Width	Left: 3 Right: 10
Total Score	136
Habitat Rating	0.68
Habitat Stream Condition	Good

Narrative:

Minor aggradation and planform adjustment.

Project: **Gihon** | **Phase 2 Segment Summary** | May 11, 2009 | SGAT Version: 3

Stream: **Gihon River** | Reach # **M18** | Segment: **B** | Completion Date: **June 17, 2006**

Organization: **Bear Creek Environmental** | Observers: **Mike Blazewicz & Pam** | Why Not assessed: | Rain: **Yes**

Segment Length (ft): **2,001** | Segment Location: **Segment begins approximately 0.2 moels downstream of bridge in upper part of reach M18.**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Channel Dimensions**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	310	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	319	268

1.4 Adjacent Side	Left	Right
Hillside Slope	Very Steep	Very Steep
Continuous w/	Never	Never
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft)	350
Width Determination	Estimated
Confinement Type	Broad
Rock Gorge?	No
Human-caused Change?	yes

Step 2. Stream Channel

2.1 Bankfull Width	36
2.2 Max Depth (ft)	3.10
2.3 Mean Depth (ft)	2.27
2.4 Floodprone Width (ft)	166

Notes:

Historic channel straightening though middle of reach. Lower end of reach is boulder/bedrock step-pool section and probably previous dam site. This section is only 100 to 200 feet long and therefore not segmented out.

Step 2. (Contued)

2.5 Aband. Floodpln	4.60 ft.
Human Elev Floodpln	0.00 ft.
2.6 Width/Depth Ratio	15.86
2.7 Entrenchment Ratio	4.61
2.8 Incision Ratio	1.48
Human Elevated Inc Rat	0.00
2.9 Sinuosity	Low
2.10 Riffles Type	Not Applicable
2.11 Riffle/Step Spacing (ft)	N/A

2.12 Substrate Composition

Bedrock	0%
Boulder	4%
Cobble	35%
Coarse Gravel	41%
Fine Gravel	11%
Sand	9%
Silt and smaller	0%

Silt/Clay Present?	Yes
Detritus	5 %
# Large Woody	47

2.13 Average Largest Particle on

Bed	40.0	inches
Bar	N/A	inches

2.14 Stream Type

Stream Type:	C
Bed Material:	Gravel
Subclass Slope:	None
Bed Form:	Plane Bed
Field Measured Slope:	

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Boulder/Cobbl	Boulder/Cobbl
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	284	176
Erosion Height (ft)	3.47	3.00
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	441	352
Near Bank Veg. Type	Left	Right
Dominant	Deciduous	Deciduous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin
Bank Canopy	Left	Right
Canopy %	76-100	76-100
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	0-25	None
W less than 25	0	0
Buffer Veg. Type	Left	Right
Dominant	Mixed Trees	Mixed Trees
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Forest
Sub-dominant	Residential	None
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps	Abundant
4.2 Adjacent Wetlands	None
4.3 Flow Status	Moderate
4.4 # of Debris Jams	3
4.5 Flow Regulation Type	None
Flow Regulation Use	
Impoundments	None
Impoundmt. Location	
4.6 Up/Down strm flow reg	
(old) Upstrm Flow Reg	None

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	1	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams	0
Affected Length (ft)	0

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
1	0	0

Diagonal	Delta	Island
1	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
2	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
1	0	No

5.4 Stream Ford or Animal	No
5.5 Straightening	Straightening
Straightening Length:	723
5.5 Dredging	None

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: Gihon River | Reach # M18 | Segment: B | Completion Date: June 17, 2006

Organization: Bear Creek Environmental | Observers: Mike Blazewicz & Pam DeAndrea | Rain: Yes

Segment Length (ft): 2,001 | Segment Location: Segment begins approximately 0.2 moels downstream of bridge in upper part of reach

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	19.5	Yes	No	Yes	Yes
Problem	Deposition Above,Scour Above,Scour				
Bedrock	30.0	Yes	No	Yes	No
Problem	None				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type Unconfined

	Score	STD	Historic
7.1 Channel Degradation	**8**	**None**	**Yes**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**11**		**No**
7.4 Change in Planform	**12**		**No**
Total Score	**44**		
Geomorphic Rating	**0.55**		

Channel Evolution Model	F
Channel Evolution Stage	III
Geomorphic Condition	Fair
Stream Sensitivity	Very High

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type High

	Score
6.1 Epifaunal Substrate - Available Cover	13
6.2 Embeddedness	15
6.3 Velocity/Depth Patterns	15
6.4 Sediment Deposition	14
6.5 Channel Flow Status	15
6.6 Channel Alteration	7
6.7 Frequency of Riffles/Steps	13
6.8 Bank Stability	Left: 7 Right: 9
6.9 Bank Vegetation Protection	Left: 5 Right: 5
6.10 Riparian Vegetation Zone Width	Left: 8 Right: 8
Total Score	134
Habitat Rating	0.67
Habitat Stream Condition	Good

Narrative:

Historic degradation. Acting as a transfer reach. Minor widening and planform slowed by boundary conditions and rip-rap.

Stream Geometry Data

Gihon

		Phase 2 Stream Type					Phase 1 Data			Phase 2 Channel Data												
Reach	Seg-ment	Stream Type	Bed Material	Bedform	Subcl. Slope	Sub Rch?	Channel Slope	Channel width	Bankfull width	Max. depth	Mean depth	Floodpr. width	Abandn FldPln	W/D Ratio	Entrench-ment	Incision Ratio	Stage Evol.	Evol. Model	RGA Cond.	RHA Cond.	QC Stf	QC Aut
M01	A	C	Gravel	Riffle-Pool	None	No	0.53	82.08	77.0	5.0	2.9	535.0	9.5	26.55	6.95	1.90	III	F	Fair	Fair	P	P
M01	B	C	Gravel	Plane Bed	None	No	0.53	82.08	68.0	4.8	3.53	290.0	7.3	19.26	4.26	1.52	II	F	Fair	Fair	P	P
M02	0	B	Bedrock	Bedrock	None	No	2.40	81.36											Good		P	F
M03	0	B	Gravel	Plane Bed	c	No	1.29	81.21	94.0	4.1	3.26	153.0	7.6	28.83	1.63	1.85	III	F	Fair	Fair	P	P
M04	A	B	Bedrock	Bedrock	c	No	0.20	77.51											Good		P	F
M04	B	B	Gravel	Plane Bed	c	No	0.20	77.51	67.0	4.7	3.95	136.0	8.7	16.96	2.03	1.85	III	F	Fair	Fair	P	P
M05	0	C	Gravel	Riffle-Pool	None	No	0.26	77.46	66.0	4.9	3.6	1295.0	7.4	18.33	19.62	1.51	III	F	Fair	Fair	P	P
M06	0	C	Gravel	Riffle-Pool	None	No	0.19	77.16	62.0	5.0	3.4	530.0	6.6	18.24	8.55	1.32	III	F	Fair	Fair	P	P
M07	0	C	Gravel	Riffle-Pool	None	No	0.24	76.99	67.0	4.5	3.7	982.0	6.4	18.11	14.66	1.42	III	F	Fair	Fair	P	P
M08	0	B	Bedrock	Bedrock	None	No	2.63	76.64											Good		P	F
M09	A	C	Gravel	Riffle-Pool	None	No	0.54	75.88											Fair		P	F
M09	B	B	Gravel	Riffle-Pool	c	No	0.54	75.88	67.0	4.5	3.6	108.0	4.5	18.61	1.61	1.00	I	D	Good	Good	P	P
M10	0	C	Gravel	Riffle-Pool	None	No	0.32	73.79	97.0	4.4	2.86	820.0	6.4	33.92	8.45	1.45	IV	F	Fair	Good	P	P
M11	A	F	Gravel	Plane Bed	None	Yes	0.78	73.38	85.0	4.1	2.8	96.0	9.9	30.36	1.13	2.41	III	F	Fair	Fair	P	P
M11	B	B	Bedrock	Bedrock	None	No	0.78	73.38											Good		P	F
M12	0	C	Gravel	Riffle-Pool	None	No	0.66	73.04	83.0	3.8	2.55	535.0	3.8	32.55	6.45	1.00	IIc	D	Fair	Good	P	P
M13	A	F	Gravel	Riffle-Pool	None	No	0.68	67.20	63.0	3.7	2.65	77.0	7.6	23.77	1.22	2.05	III	F	Fair	Fair	P	P
M13	B	C	Gravel	Riffle-Pool	None	No	0.68	67.20	60.0	3.7	2.4	174.0	6.2	25.00	2.90	1.68	III	F	Fair	Good	P	P
M14	A	C	Gravel	Riffle-Pool	None	No	0.11	66.83	58.0	3.8	2.72	312.0	3.8	21.32	5.38	1.00	IIc	D	Good	Fair	P	P
M14	B	C	Gravel	Riffle-Pool	None	No	0.11	66.83	52.0	3.5	2.69	374.0	4.6	19.33	7.19	1.31	III	F	Fair	Fair	P	P
M14	C	C	Gravel	Riffle-Pool	None	No	0.11	66.83	51.0	3.8	2.86	308.0	5.3	17.83	6.04	1.39	III	F	Good	Good	P	P
M15	0	C	Gravel	Riffle-Pool	None	No	0.51	63.09	63.0	3.4	2.57	523.0	3.4	24.51	8.30	1.00	I	F	Good	Good	P	P
M16	A	C	Gravel	Riffle-Pool	None	No	0.33	58.42	44.0	4.3	3.32	324.0	4.3	13.25	7.36	1.00	I	F	Good	Good	P	P
M16	B	B	Cobble	Plane Bed	c	No	0.33	58.42	60.0	3.1	2.27	136.0	4.7	26.43	2.27	1.52	II	F	Fair	Fair	P	P
M16	C	C	Gravel	Riffle-Pool	None	No	0.33	58.42	73.0	3.5	2.01	748.0	4.9	36.32	10.25	1.40	III	F	Fair	Good	P	P
M17	A	C	Gravel	Plane Bed	None	No	0.52	47.79	33.0	2.9	2.16	555.0	3.8	15.28	16.82	1.31	III	F	Fair	Fair	P	P
M17	B	C	Gravel	Riffle-Pool	None	No	0.52	47.79	35.0	2.8	1.89	340.0	3.6	18.52	9.71	1.29	IId	D	Fair	Good	P	P
M18	A	C	Gravel	Riffle-Pool	None	No	1.19	46.29	37.0	2.3	1.77	197.0	2.3	20.90	5.32	1.00	I	F	Good	Good	P	P
M18	B	C	Gravel	Plane Bed	None	No	1.19	46.29	36.0	3.1	2.27	166.0	4.6	15.86	4.61	1.48	III	F	Fair	Good	P	P

Rapid Geomorphic Assessment

Gihon

Reach	Segment	Sub-Rch?	Degradation			Aggradation			Widening		Planform		Geo. Score	Geo. Condition	Evol. Stage	Confinement Type	Sensitivity	QC Stf	QC Aut
			Score	STD	Historic	Score	STD	Historic	Score	Historic	Score	Historic							
M01	A	No	10	None	Yes	9	None	No	11	No	9	No	0.49	Fair	III	BD	Very	P	P
M01	B	No	8	None	Yes	12	None	No	9	No	10	No	0.49	Fair	II	BD	Very	P	P
M02	0	No											0.00	Good		SC		P	F
M03	0	No	7	None	Yes	13	None	No	9	No	12	No	0.51	Fair	III	SC	High	P	P
M04	A	No											0.00	Good		SC		P	F
M04	B	No	10	None	Yes	12	None	No	11	No	12	No	0.56	Fair	III	SC	High	P	P
M05	0	No	9	None	Yes	8	None	No	11	No	7	No	0.44	Fair	III	VB	Very	P	P
M06	0	No	11	None	Yes	13	None	No	11	No	10	No	0.56	Fair	III	BD	Very	P	P
M07	0	No	9	None	Yes	14	None	No	12	No	9	No	0.55	Fair	III	VB	Very	P	P
M08	0	No											0.00	Good				P	F
M09	A	No											0.00	Fair		SC		P	F
M09	B	No	17	None	No	13	None	No	13	No	14	No	0.71	Good	I	NC	Moderat	P	P
M10	0	No	14	None	Yes	9	None	No	8	No	3	No	0.43	Fair	IV	BD	Very	P	P
M11	A	Yes	4	B to F	Yes	14	None	No	9	No	13	No	0.50	Fair	III	SC	Extreme	P	P
M11	B	No											0.00	Good		SC		P	F
M12	0	No	18	None	No	9	None	No	10	Yes	4	No	0.51	Fair	IIc	BD	Very	P	P
M13	A	No	4	C to F	Yes	11	None	No	12	No	10	No	0.46	Fair	III	NW	Extreme	P	P
M13	B	No	12	None	Yes	11	None	No	11	No	10	No	0.55	Fair	III	NW	Very	P	P
M14	A	No	13	None	No	15	None	No	13	No	13	No	0.68	Good	IIc	BD	High	P	P
M14	B	No	11	None	Yes	15	None	No	12	No	12	No	0.63	Fair	III	VB	Very	P	P
M14	C	No	13	None	Yes	13	None	No	13	No	13	No	0.65	Good	III	VB	High	P	P
M15	0	No	16	None	No	13	None	No	12	No	14	No	0.69	Good	I	BD	High	P	P
M16	A	No	15	None	No	16	None	No	16	No	15	No	0.78	Good	I	BD	High	P	P
M16	B	No	7	C to B	Yes	11	None	No	11	No	11	No	0.50	Fair	II	SC	Very	P	P
M16	C	No	8	None	Yes	10	None	No	8	No	10	No	0.45	Fair	III	VB	Very	P	P
M17	A	No	10	None	Yes	13	None	No	13	No	11	No	0.59	Fair	III	VB	Very	P	P
M17	B	No	11	None	Yes	11	None	No	11	No	13	No	0.58	Fair	IId	VB	Very	P	P
M18	A	No	15	None	No	13	None	No	14	No	11	No	0.66	Good	I	BD	High	P	P
M18	B	No	8	None	Yes	13	None	No	11	No	12	No	0.55	Fair	III	BD	Very	P	P