Unified Stream Assessment/Unified Subwatershed and Source Assessment
Quality Assurance Project Plan

In support of

Still River Watershed Action Plan for Non-point Source Pollution Reduction

(CTDEEP Contract #14-03f)

Including portions of the Connecticut municipalities of

Bethel, Brookfield, Danbury, New Fairfield, New Milford, Newtown, Redding and Ridgefield

Prepared by:
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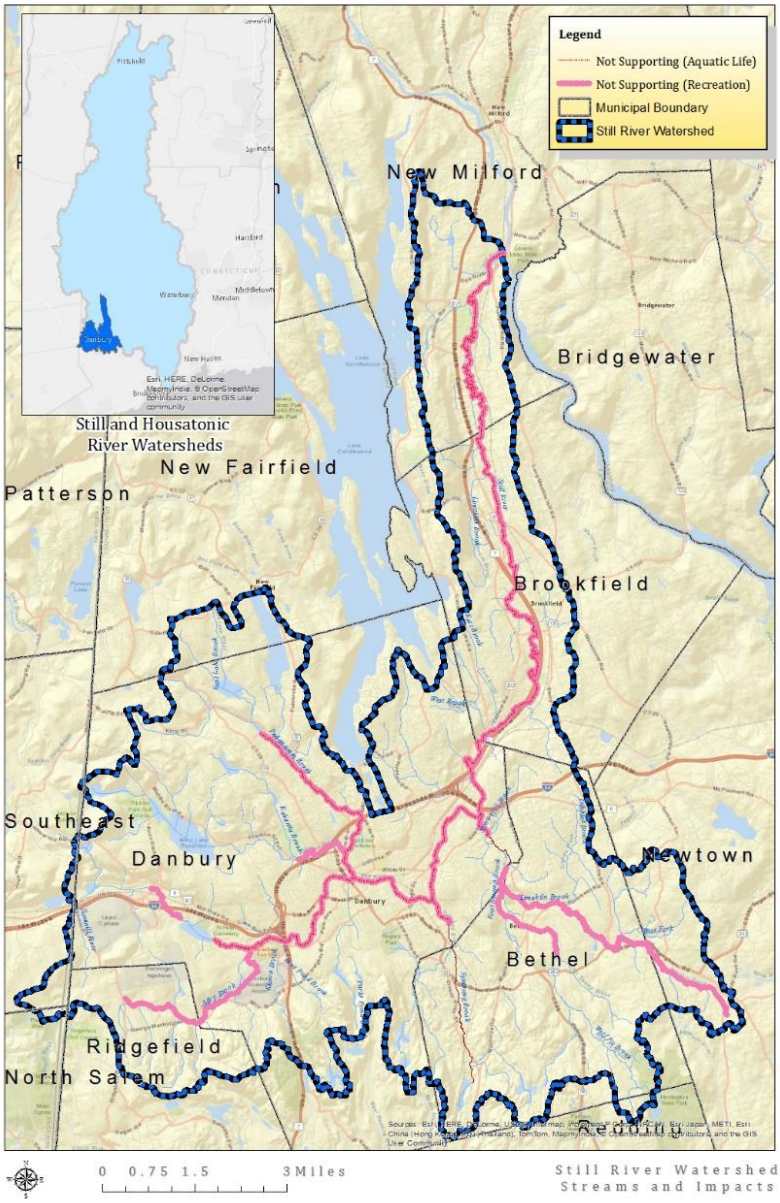

Title and Approval Sheet

CTDEEP Contract #14-03f

EPA Tracking # 15083

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Attachment A – Field Survey Forms
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Project Task/Organization

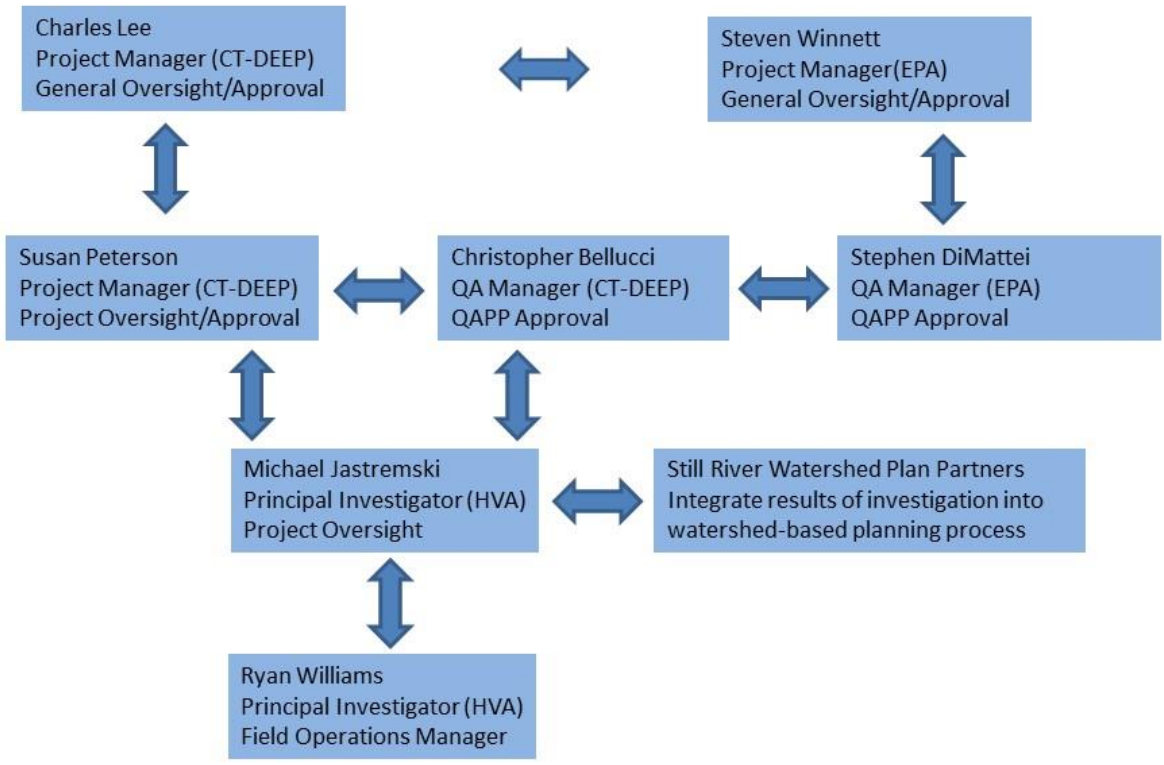

Figure 1: Project Task/Organization

Key personnel associated with the project are identified in Figure 1. Michael Jastremski will provide direct oversight of the project, including liaising with CT DEEP, management of field staff, dissemination of results to Still River Watershed Plan partners and integration of results with planning process.

Problem Definition/Background

The Danbury, CT metro area's Still River has made a dramatic comeback since the passage of the Clean Water Act in 1972. Much has been done since then to clean up point-source pollution that turned rivers like the Still into open industrial sewers; however the progress of the Still's recovery has plateaued as many of the point sources of pollution are being addressed. A significant portion of the Still River and its tributaries within the towns of Bethel, Brookfield, Danbury, Newtown, New Fairfield, New Milford, Redding and Ridgefield were listed as impaired in the most recent (2014) State of Connecticut Integrated Water Quality Report to Congress. Five of six main-stem segments, totaling 22.31 miles in length or 96.6% of the main-stem, were listed as impaired for aquatic life (the 6th segment was not assessed). Four of six main-stem segments were listed as impaired for recreational use (the remaining two segments were not assessed). Reaches along Miry Brook, Sympaug Brook, Padanaram and Limekiln Brook were listed as impaired for aquatic life. Reaches along all six major tributaries were listed as impaired for recreational use. Stormwater runoff and other non-point sources of pollution are the primary source of these impairments, regularly causing concentrations of pathogens to spike above levels considered safe for human contact. Stormwater runoff is also an important source of a number of other pollutants that impact Still River aquatic habitats including but not limited to excessive nutrients, sediment, road salt, hydrocarbons and other vehicle-related contaminants, and increased temperatures.

These periodic public health risks and impacts to aquatic life come at a time when the citizens of watershed communities are returning to the river in large numbers - a response to the relative improvement in water quality since 1972. What was once a stream clearly unsafe for recreation now appears natural along many reaches. Riverside trails have been built in some areas, and more projects to improve access for paddling, fishing and other kinds of river-based recreation are planned. People are coming back to the waters of the Still River after many years of avoidance and neglect. This is a positive trend and it should be encouraged, but it must be accompanied by a comprehensive effort to reduce polluted runoff and other non-point sources of pollution and complete the recovery of the Still River.

The Still River watershed is covered by a Total Maximum Daily Load (TMDL) for indicator bacteria. The TMDL was completed by CT-DEEP in 2010. This TMDL establishes the percentage reduction in bacteria colony density necessary to achieve consistency with the CT Water Quality Criteria to support recreational use at numerous locations on the river and its tributaries. The TMDL is based on monitoring of bacteria levels at fixed monitoring points representing periods when the river flow is dominated by stormwater runoff as well as during periods when runoff is minimal. To date, there has not been any coordinated effort to implement the TMDL. TMDLs are also in place for Lake Kenosia (developed in 2004 to address nutrients) and Limekiln Brook (developed in 2002 to address copper, zinc, ammonia and chlorine).

In this study, the Housatonic Valley Association (HVA) will use stream corridor and subwatershed assessment methods developed by the Center for Watershed Protection (CWP) to track down, categorize and rank pollution reduction projects that address pathogens and nutrients. This will support implementation of the 2010 TMDL and focus efforts to improve the water quality in the Still River and its tributaries. These "track down surveys" will feed into a watershed-based planning process currently underway for the Still River as part of this grant, involving appropriate divisions of municipal government (Planning, Public Works, Parks and Recreation, Inland Wetlands, Conservation, etc.) in all watershed communities (Bethel, Brookfield, Danbury, Newtown, New

Fairfield, New Milford, Redding and Ridgefield); local non-profit stakeholders including but not limited to the Still River Alliance, the Friends of Lake Lillinonah, and Candlewood Valley Trout Unlimited; regional agencies including but not limited to the Western Connecticut Council of Governments and the Northwest Conservation District; state agencies including but not limited to appropriate divisions of CT-DEEP; and federal agencies including but not limited to USDA Natural Resources Conservation Service and United States Geological Survey, US EPA. The work described in this QAPP falls under EPA Watershed-Based Planning Elements A (Identify causes and sources of pollution that need to be controlled) and C (Develop management measures to achieve goals).

Project/Task Description

Center for Watershed Protection's (CWP) Unified Stream Assessment method (USA) will be used to survey all stream reaches (approximately 40 stream miles) listed as impaired in the watershed (see Figure 1). The USA is a continuous stream walk that systematically evaluates conditions and identifies restoration opportunities within the urban stream corridor. The USA offers a means of assessing, documenting, and organizing stream corridor data to identify sources of impairment and potential pollution reduction projects[1]. Field assessment forms are used to document conditions, problems, and possible restoration/improvement actions. Potential stream impacts are noted on one of eight Impact Assessment Forms (Stormwater Outfalls, Severe Erosion, Impacted Buffers, Utility Impacts, Trash and Debris, Stream Crossings, Channel Modification, and Miscellaneous Agricultural Impacts); and overall conditions of the reach are summarized on a Reach Assessment Form. In order to maximize efficiency and facilitate data management in HVA's Geographic Information System (GIS), field assessment forms will be digitized into electronic forms to be used on a tablet computer. These digital forms will be used in conjunction with a GPS unit capable of collecting highly accurate spatial data about each feature. The information collected on the tablet and GPS for each feature will be combined into a single record using GIS mapping software and incorporated into a project database. This database will be used to facilitate further planning and analysis, including prioritization and development of pollution reduction projects.

If a stormwater outfall discharge showing signs of fecal contamination is encountered during the USA, a grab sample of the effluent will be collected and tested for ammonia nitrogen concentration. This test will serve as confirmation of a potential source of pathogens and will be added to the standard USA protocol for the purposes of this field investigation. To incorporate this additional data the Stormwater Outfall (OT) data form will be modified to include a field for ammonia nitrogen parts per million. If stream corridor surveys indicate the need for further investigations, possible upland sources will be assessed using CWP's Unified Subwatershed and Source Reconnaissance (USSR) method.[2]

If deemed significant, the USSR will be used to track impacts identified in the stream corridor back to their source. We will use the four components of the USSR - Neighborhood Source Assessment (NSA), Hotspot Site Investigation (HSI), Pervious Area Assessment (PAA) and the analysis of Streets and Storm Drains (SSD) - to examine pollution sources and potential NPS reduction projects within upland areas draining to problem areas identified by the USA. These rapid USSR surveys help identify upland stormwater BMP projects and source control to consider.

Taken together, these assessments will identify, categorize and rank pollution reduction projects in the watershed. The USA and USSR were designed for urbanized watersheds like the Still, and are ideal for this application. Standardized field forms promote consistency and help establish quality control for data collection. Prior to conducting surveys, aerial photos, topographic maps, and existing data about known problem areas will be reviewed, and survey reaches will be delineated. If it is determined that conducting a USSR is necessary; subwatersheds, neighborhoods, and hotspots will be identified and delineated.

[1] Center for Watershed Protection. 2005. Unified Stream Assessment: A User's Manual.
[2] Center for Watershed Protection. 2005. Unified Subwatershed and Source Reconnaissance: A User's Manual.

Proposed Plan of Work

Item	Task	Anticipated Schedule[3]
1	QAPP approved for project	Month 1
2	Training – HVA will receive technical training from the Center for Watershed Protection in the USA and USSR procedures.	Complete
3	Plan USA surveys, including delineation of segments, and review of aerial photos and topo maps and gather information relevant to the survey area, including existing field/water quality data	Months 1-2
4	Conduct USA surveys	Months 2-12
5	Compile/evaluate USA data	Months 2-12
6	Plan USSR surveys, including delineation of subwatersheds, and review of aerial photos and topo maps and gather information relevant to the survey area, including existing field/water quality data	Months 9-14
7	Conduct USSR surveys	Months 9-16
8	Compile/evaluate USA data	Months 9-16

[3] Subject to revision based on field conditions during project period

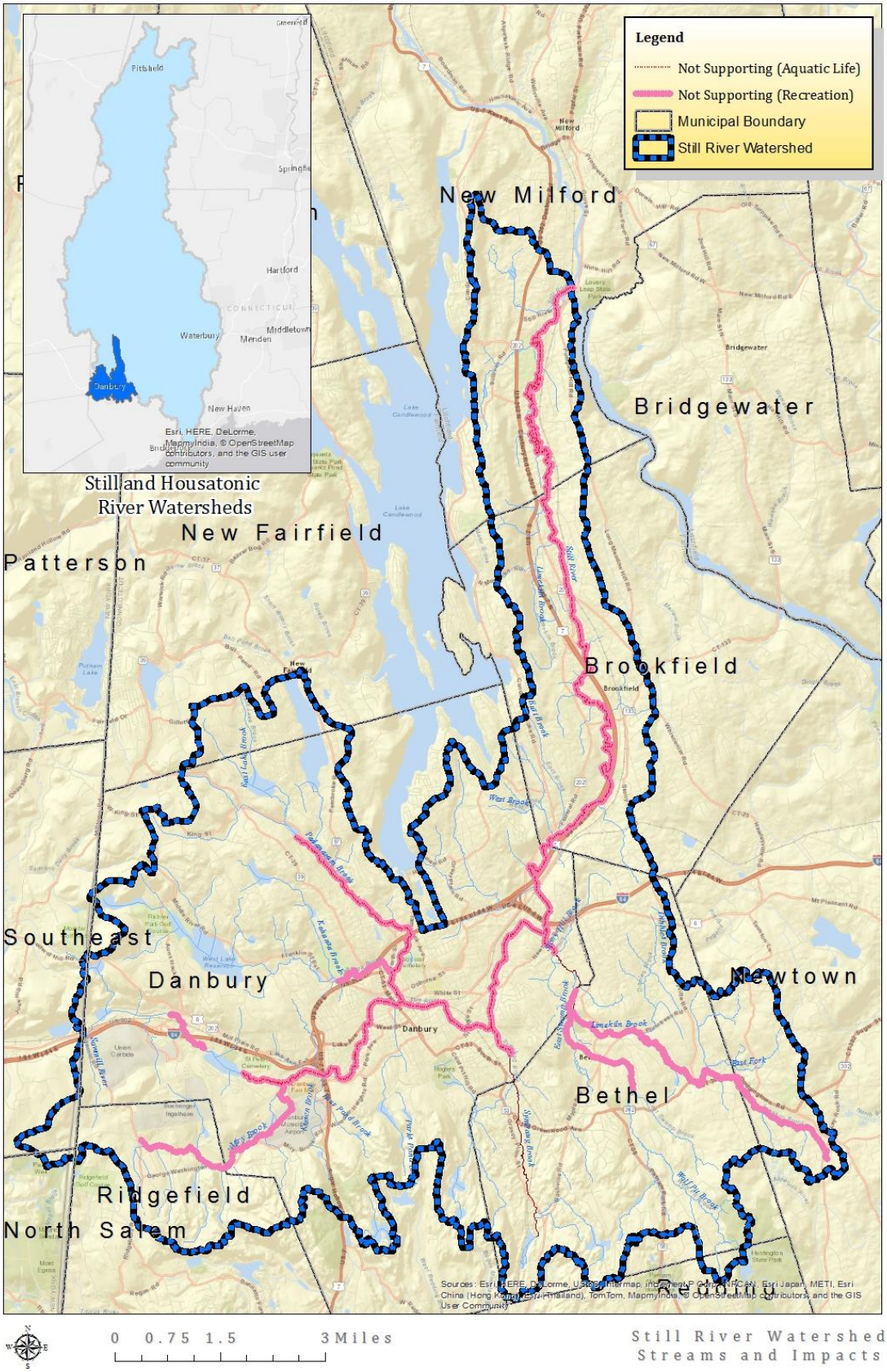

Figure 2: Project Area

Quality Objectives and Criteria

The track down survey effort consists of collecting observational data. Quality objectives require that observational survey data be collected in a manner that is consistent or comparable from one stream segment to the next and between field crews, and complete or thorough in that all applicable field forms are filled out. There are no quantitative quality objectives for track down survey data collection.

Special Training Requirements/Certification

Key HVA staff (Water Protection Director; Conservation Projects Manager; Conservation Technician) will be trained by Center for Watershed Protection staff in the Unified Stream Assessment and Unified Subwatershed and Site Reconnaissance methods. The training will be conducted primarily in the field. Initial field training for HVA staff and watershed plan partners was conducted in Bethel, CT on October 6th and 7th, 2015.

Assessments will generally be conducted by Field Crews of two trained HVA staff members. However, HVA may decide to combine trained staff with volunteers if there are suitable volunteers available. Volunteers will receive comprehensive training in the USA and USSR before being allowed to join a Field Crew. There will be one trained HVA staff member for each volunteer on a Field Crew at all times. The HVA Field Operations Manager will be responsible for maintaining a list of all trained individuals including date and location of training.

All Field Crew members will be required to review Manuals 10 and 11 of the Center for Watershed Protection's Subwatershed Restoration Manual Series: *Unified Stream Assessment: A User's Manual* and *Unified Subwatershed and Site Reconnaissance: A User's Manual.* These manuals provide detailed information about the methods and use of each field assessment form, as well as background information about the stream features and why they are included in the assessments.

HVA staff conducting field assessments will also be trained in the use of HVA's GPS unit (Trimble GeoXT, see attached specifications), which will be used to take photos using the onboard camera, in addition to recording the location of features important to the assessments.

Documents and Records

HVA Project/QA Manager Michael Jastremski will be responsible for distributing the most current approved QAPP to project staff. If any changes are made to the current QAPP they will be communicated by the HVA Project/QA Manager to project staff. Likewise, if these changes merit a revision that must be resubmitted and reapproved, this latest approved QAPP will be distributed among the project staff by the HVA Project/QA Manager.

Field Crews will be equipped with a tablet computer (see Attachment B for specifications) loaded with fillable PDF field forms for each impact assessment, reach level assessment forms, and photo inventory forms. The tablet will also be loaded with topographic maps and aerial photos of each survey area. Field forms will be uploaded to the HVA server at the end of each field day by the HVA Project/QA Manager. These digital copies will be organized by town, subwatershed, and stream reach.

Once a survey is completed, information from the field forms will be reviewed and forms will be filled out by field teams at the time of their field walk. Survey participants will record their names, the watershed/subwatershed name, the survey reach identification number, photo id number, site id number, the lat/long, and GPS unit id, and the time and date of the survey on each impact assessment form. The Reach Level Assessment Form will also include the beginning and ending lat/long, as well as a description of the location of entry and exit points. Survey reaches or segments will be delineated in advance by HVA.

If it is determined that a USSR must be conducted after the USA has been completed, teams will return to the field with fillable PDF field forms for each USSR field survey sheet. These forms are to be filled out by field teams at the time of the USSR assessment and then reviewed. Subwatersheds, neighborhoods, and potential hotspots will be identified and delineated in advance by HVA. Field forms will be uploaded to the HVA server at the end of each field day by the HVA HVA Project/QA Manager. These digital copies will be organized by town and subwatershed.

Once a survey is completed, GPS data will be downloaded and post-processed to improve accuracy, and information from the field forms will be reviewed.

Sampling Process Design

Unified Stream Assessment:

Stream corridor assessments will be completed along impaired reaches of the Still River and its tributaries as part of an effort to locate sources of impairments and identify potential pollution (i.e. pathogens and nutrients) reduction projects. These surveys will be conducted according to the Unified Stream Assessment (USA) method developed for small urban watersheds by the Center for Watershed Protection. The USA is a continuous stream walk that systematically evaluates conditions of the stream channel needed to identify restoration opportunities, including storm water retrofits, stream restoration, riparian management, and discharge prevention. Field assessment forms are used to document conditions, problems, and possible restoration/improvement actions. Eight Impact Assessment Forms collect specific information about the condition and restorability of individual problem sites identified along the stream corridor. They include Stormwater Outfalls, Severe Erosion, Impacted Buffers, Utility Impacts, Trash and Debris, Stream Crossings, Channel Modification, and Miscellaneous Issues. A Reach Assessment Form is used to summarize overall physical conditions of the entire survey reach.

If a stormwater outfall discharge showing signs of fecal contamination is encountered during the USA, a grab sample of the effluent will be collected and tested for ammonia nitrogen concentration using a LaMotte 1200 Colorimeter Ammonia Nitrogen test kit. This information is not a required element of the USA. To incorporate this additional data the Stormwater Outfall (OT) data form will be modified to include a field for ammonia nitrogen parts per million. 2 150-ml samples will be collected from every suspicious outfall and labelled with the appropriate site ID number. Samples will be filtered using a .45 µ syringe filter, stabilized with the addition of 2 mL of concentrated H_2SO_4 and taken back to the office for testing and proper disposal. If ammonia nitrogen is identified at a specific outfall, concentration in parts per million will be documented in the corresponding Stormwater Outfall data form.

Finally, photographs are documented on a Photo Inventory form. Forms are included in Attachment A. Standardized collection forms will promote consistency and help establish quality control for data collection.

The USA method was chosen due to its direct applicability to the goals of the track down survey effort. It thoroughly covers potential stream impacts and concerns that we expect to encounter. The USA is a proven method that has been used successfully by others; and its focus on identifying not only impacts but also restoration opportunities makes it ideal for the end goal of developing pollution reduction projects.

Table I

Why Use the USA?

- Cheap, fast
- Applies to all kinds of streams—rural and highly urban
- One of two basic tools used to initially assess restoration potential in the field
- Can and should be adapted to local needs
- Identifies problems in the stream corridor
- Collects basic feasibility factors on "restorability"
- Helps assemble initial inventory of stream corridor restoration sites, such as:

Discharge investigations
Stream daylighting projects
Storm water retrofits
Local stream repair/outfall stabilization
Bank stabilization or grade control
Buffer reforestation
Structural repairs to sewer lines
Stream cleanup sites
Fish barrier removal projects
Culvert repair/replacement sites
Natural channel design
De-channelization
Riparian wetland restoration
Enforcement actions

Source: *Unified Stream Assessment: A User's Manual*, February 2005, Center for Watershed Protection.

The USA consists of four steps: Pre-field Preparation; Stream Corridor Assessment; Quality Control; and Data Interpretation.

1. Pre-field Preparation

Prior to conducting the surveys, Field Crews will be established and trained (see Training Requirements/Certification, Element A8), supplies gathered and organized, survey reaches defined, field maps generated, assessment routes and schedules planned, and the public/ streamside landowners notified about the surveys. Aerial photos, topographic maps, and existing data about known problem areas will be reviewed to assist in defining survey reaches of uniform character and to familiarize field staff with the area to be surveyed. Each reach will be assigned an identification number. Reaches will be about 1 linear mile of stream, depending on access points.[4]

2. Stream Corridor Assessment

Field surveys will be conducted by trained staff and interns. Surveys will be conducted on foot or by boat, as necessary. Field Crews of two or three will conduct the surveys during July, August and September when water flows are lower, making it both possible and safe to walk in the stream along most reaches. At this time, potential concerns (e.g. excessive algal growth, increased deposition, bank scouring, open canopy) are also more visible. Initial surveys will be conducted during dry weather conditions to eliminate the possible effects that a rain event may have on normal conditions, such as washing away algae, or obscuring the presence of aquatic vegetation, or making it difficult to determine normal turbidity, water levels or water color. However, if further investigation is required to determine possible nonpoint sources, these may be conducted during or following rainstorms.

Field Crew responsibilities are divided as follows: one team member will focus on the reach assessment and impact assessments, and the other will focus on taking photos and recording GPS locations. Field Crews will walk up the stream corridor, but face downstream when determining

[4] *Unified Stream Assessment: A User's Manual*, March 2004, Center for Watershed Protection.

right/left bank problems. Individual impact sites are mapped and photographed as they are encountered, and impact assessment forms completed and ID numbers assigned. The location and ID are drawn on the reach diagram located on the reach assessment form.

Reach Assessment Forms are completed after walking the entire survey reach. If conditions vary too much to assign an average, the survey reach will be divided into more uniform segments for the purposes of completing the Reach Assessment Form.[5]

Any observed sewage discharge or other significant pollution event will be reported immediately to municipal public health officials, HVA, CT-DEEP Project Managers, and the appropriate CT-DEEP inspection and enforcement staff (for industrial discharges, Edward Finger; T: 860-424-3817; E: edward.finger@ct.gov; for sewage and municipal wastewater related concerns, Craig Motasky T: 860 424-3815 E: craig.motasky@ct.gov). Field Crews will be provided with all necessary contact information.

3. Quality Control

Survey data will be compiled in a GIS database and mapped with input from DEEP staff. Data will be entered immediately after fieldwork is completed, and spot checked by the HVA QA manager. Field Crew members will review draft stream corridor maps with site impact assessment locations and survey reach scores to identify inaccuracies in data entry and any gaps in stream corridor coverage. [6]

4. Data Evaluation

USA data will be used to create detailed maps of the stream corridor showing degraded and non-impacted reaches, and location of problem areas and restoration candidates.

HVA staff will work with the Still River Watershed Plan Partners in planning and conducting the surveys; their local knowledge and experience will greatly benefit efforts to identify sources of impairments. In addition, HVA staff will ask each municipality participating in the project to publicize the survey project in advance through some form of public notice to be determined by municipal officials (e.g. letters to streamside landowners), and notify the local police department. Field Crews will carry several copies of an official municipal notice/authorization letter explaining the survey project and field activities, and providing a contact number for more information while conducting their field work. Copies of the letter can be provided to any private landowners. Should a private landowner request that field teams leave and not survey their property, the field team will comply with the request and leave the private landowner's property.

<u>Unified Subwatershed and Site Reconnaissance</u>:

If stream corridor surveys indicate the need for further investigations, possible upland sources will be assessed using CWP's Unified Subwatershed and Siteeconnaissance (USSR) method. The USSR is a rapid field survey to evaluate potential pollution sources and restoration opportunities within urban subwatersheds. As with the USA, the USSR method was chosen due to its direct applicability to the goals of the track down survey effort. The USA and USSR are complimentary survey systems

[5] Ibid.
[6] Ibid.

that address both stream corridors and their associated uplands.

The USSR is comprised of four major assessment components which are represented by four field forms. The Neighborhood Source Assessment (NSA) looks within individual neighborhoods for pollution source areas, stewardship behaviors, and residential restoration opportunities. The Hotspot Site Investigation (HSI) ranks the potential severity of hotspots within a subwatershed. Pervious Area Assessments (PAA) evaluate the potential to reforest turf areas or restore remnants of natural areas at all open parcels within the subwatershed. The Streets and Storm Drains (SSD) assessment measures the average pollutant accumulation in the streets, curbs, and catch basins of a subwatershed, and looks at potential for on-site retrofits for parking lots.

The USSR consists of three phases: Desktop Analysis; Field Survey; and Post-field Analysis. These three phases are broken into seven steps as detailed in Table 1.

Table 1

Seven Steps of the USSR		
Pre-Field	Step 1: Gather required information	NPDES permittees Existing neighborhood maps Municipal maintenance schedule for roads Census data List of HOA and contact information Current development projects Mapping data and aerial photographs
	Step 2: Generate field maps	Delineate subwatersheds Delineate residential neighborhoods Review environmental databases for regulated hotspots Perform business permit review for additional hotspots Put together emergency contact list
Field	Step 3: Conduct the USSR	Drive all roads Evaluate residential neighborhoods (NSA form) Survey all hotspot locations (HSI form) Complete PAA form for all pervious area sites Complete SSD form at select storm drains Take photos and GPS readings
Post-Field	Step 4: Verify data/maps	Rectify differences between pre-fieldwork maps and field notes Identify additional data to be collected
	Step 5: Data entry	Enter data from field forms into a spreadsheet or GIS. This involves downloading GPS unit and digital cameras (or getting film developed), and recording details on field maps
	Step 6: Produce list and map of candidate sites for each subwatershed	Screen retrofit, restoration, and pollution prevention projects to identify sites where further investigation is needed
	Step 7: Compile data for all subwatersheds into a single table	Develop subwatershed metrics to develop initial restoration strategy

Source: *Unified Subwatershed and Site Reconnaissance: A User's Manual*, February 2005, Center for Watershed Protection.

Sampling Methods

Unified Stream Assessment:

Table 2

Components of the USA
Impact assessments are site-specific and record data on condition and "restorability" at each problem site. Impact forms comprise an initial inventory of restoration opportunities. The eight impact assessment forms are as follows: • **Outfalls** (OT)—*all storm water and other discharge pipes* • **Severe erosion** (ER)—*bank sloughing, active widening or incision* • **Impacted buffer** (IB)—*lack of natural vegetation, width* • **Utilities in the Stream Corridor** (UT)—*leaking sewer, exposed pipes susceptible to damage* • **Trash and Debris in the Stream Corridor** (TR)—*trash and illegal dumping* • **Stream Crossing** (SC)—*culverts, dams, natural features, etc.* • **Channel Modification** (CM)—*straightening, channelization, dredging, etc.* • **Miscellaneous** (MI)—*unusual features or conditions* The reach level assessment (RCH) form characterizes the average physical conditions over the entire survey reach. The RCH tracks individual problem sites and provides information used to compare reach quality throughout the entire stream corridor. • **Reach Level Assessment** (RCH)—*average bank stability, in-stream habitat, riparian vegetation, flood plain connectivity, access, flow, and substrate over the entire reach.*

Source: *Unified Stream Assessment: A User's Manual*, February 2005, Center for Watershed Protection.

The USA method consists of nine stream corridor assessments: eight impact assessments and an overall reach assessment. They are summarized in Table 2, above. One impact assessment form is completed for each impacted site, and a reach assessment form is completed for each reach. Photographs are documented on a photo inventory form as they are taken in the field and cross referenced to impact assessment or reach assessment forms using the date, stream/reach, a location ID and photo number.

The information collected for each of the nine impact assessments and the reach assessment, as well as associated restoration practices, is summarized in Table 3 below.

Table 3

USA Impact and Reach Assessment Forms and Restoration Practices		
Assessment Form	**What It Assesses**	**Information Collected** *(In addition to photo & GPS)*
Outfalls **(OT)**	All discharge pipes or channels that discharge storm water or wastewater.	Basic type, source, and condition. If flowing, then flow conditions should be recorded and potentially reported to authorities.
Severe Bank Erosion **(ER)**	Slope failures, bank sloughing, head cuts, and incision or widening in areas noticeably worse than the average erosive condition of the survey reach. Also infrastructure or property threatened by erosion.	Location (meander or straight section), threat to property or infrastructure, accessibility; and basic bank measurements (height, angle, and bottom and top widths).
Impacted Buffer **(IB)**	Corridor lengths >100 feet long that lack at least a 25 feet wide, naturally-vegetated riparian buffer on one or both sides of stream.	Diversity and density of vegetation, flood plain conditions, adjacent land use, available area for reforestation
Utilities in Stream Corridor **(UT)**	Leaking or exposed sewer, water, or other utility lines causing water quality, habitat, or channel stability problems. Includes manhole stacks, pipes along bottom, in the bank, or above the stream susceptible to damage due to lack of maintenance or exposure.	Type, condition, and discharge characteristics associated with leaks (odors, color, etc). If leaking, report immediately to authorities. Record relevant information if potential fish barrier (see SC)
Stream Crossing **(SC)**	All man-made or natural structures that cross the stream, such as roadways, bridges, railroad crossings, or dams. Pipe crossings and other overhead utilities are assessed under UT.	Type of crossing, culvert dimensions, relative information if suspected fish barrier (6" water drop, or less than ½" water depth during normal flow conditions)
Channel Modification **(CM)**	Channelized, concrete-lined, or reinforced sections of stream >50 feet in length, regardless of construction material used. Locations of existing stream restoration or bank stabilization projects included. Enclosed sections are assessed under SC or OT.	Type of modification, length of stream impacted
Trash and Debris **(TR)**	Areas of significant trash and debris accumulation greater than average levels observed across the survey reach. Any areas where potentially hazardous or unknown chemicals have been dumped.	Mobility, dispersal, amount and type of trash; level of effort and type of equipment required for removal; location on public or private property
Misc. Impacts **(MI)**	High quality areas or unusual feature or activity impacting the stream corridor that doesn't fit into other seven impact assessments. This may include fish kills, cattle access, near stream construction, flood plain excavation, adjacent wetlands, grade controls, or other notable features.	
Reach Level **(RCH)**	Average characteristics for each survey reach. Tracks locations of impact assessments; used for screening restoration opportunities and for comparing reaches across the subwatershed.	

Source: *Unified Stream Assessment: A User's Manual*, February 2005, Center for Watershed Protection.

Unified Subwatershed and Site Reconnaissance:

The USSR method consists of four major assessments: Neighborhood Source Assessment, Hotspot Site Investigation, Pervious Area Assessment, and Streets and Storm Drains assessment. One field form is completed for each impacted site. Sites for USSR surveys will be identified based on a number of criteria as seen in Table 4.

Table 4

Selection Criteria for USSR Site Assessment		
USSR Field Form	**Land Use**	**Selection Criteria**
NSA	Residential	Visit all neighborhoods and sample a subset of individual homes
HSI	Commercial	Visit all regulated hotspots and priority non-regulated hotspots
	Industrial	
	Institutional	
	Municipal	
	Transport - Related	
PAA	Pervious Areas	Visit all publicly-owned pervious areas > 2 acres and all privately-owned pervious areas > 5 acres
SSD	Streets and Storm Water Conveyance	Evaluate road and storm drain conditions at random, pre-selected points Evaluate all parking lots > 2 acres

Source: *Unified Subwatershed and Site Reconnaissance: A User's Manual*, February 2005, Center for Watershed Protection.

A summary of how information from the four USSR assessments is applied to subwatershed restoration is detailed in Table 5.

Table 5

How the USSR Helps in Subwatershed Restoration

Neighborhoods

- Evaluates pollutant-producing behaviors in individual neighborhoods and assigns a pollution severity index for screening purposes
- Rates each neighborhood for overall restoration potential and identifies specific restoration projects
- Examines the feasibility of on-site storm water retrofits
- Indicates restoration projects that may require more direct municipal assistance for implementation (tree planting, storm drain stenciling, etc.)

Hotspots

- Creates an inventory of storm water hotspots, including regulated and non-regulated sites
- Rates the severity of each hotspot with regard to its potential to generate storm water runoff or illicit discharges
- Suggests appropriate follow-up actions for each hotspot, including referral for immediate enforcement
- Examines the feasibility of on-site storm water retrofits

Pervious Areas

- Evaluates the current condition of natural area remnants and their potential management needs
- Determines the reforestation potential of large pervious areas

Streets and Storm Drains

- Estimates the severity of pollutant accumulation on roads and within storm drain systems
- Assesses large parking areas for storm water retrofit potential
- Rates the feasibility of four municipal maintenance strategies

Sample Handling and Custody

Upon completion of field surveys, Field Crews will bring their tablet computer and GPS/digital camera to the HVA office. If suspect stormwater outfalls are encountered during field surveys, stabilized, labeled grab samples of discharge will be brought back to the office. Samples will be filtered using a .45 µ syringe filter, stabilized with the addition of 2 mL of concentrated H_2SO_4 and taken back to the office for testing and proper disposal. GPS data will-be post-processed to improve location accuracy. All electronic field forms will be uploaded and included with other digital data in a database on the HVA server. All data will be available upon request to CT-DEEP and US EPA, as well as Still River Watershed Plan partners.

Analytical Methods

The equipment associated with the track down survey project is a tablet computer to fill out electronic field forms, GPS unit w/onboard camera to record spatial data for identified impacts and take photographs, an ammonia nitrogen test kit to assess stormwater discharge, a 100' measuring tape and a stadia rod.

HVA will use an iPad Mini 2 tablet computer to record data in fillable PDF field forms. HVA will use a Trimble GeoXT Geoexplorer 6000 series GPS unit to record spatial data and take photographs using an onboard camera. HVA will use a LaMotte Ammonia Nitrogen Test Kit (Code 3304-01) for stormwater outfall testing. Specifications are included in Attachment B.

USA and USSR observational data gathering methods do not have quantitative performance standards associated with them. We will ensure consistency in making observations, evaluating impacts and recording information through thorough training of field staff, and overlap in staffing of field teams.

Quality Control Requirements

Quantitative measurement is not within the scope of the USA and USSR data collection processes. For observational data collection, "standardizing" evaluation and reporting techniques through field staff training, and overlap of field team staff will help establish consistency and objectivity and thus serve as a methods of quality control.

In addition, to enhance the effectiveness and efficiency of field data collection, field assessment forms will digitized and organized into folders kept on a tablet computer and backed up at the HVA office.

When a survey is completed, survey forms will be checked by the HVA Project/QA Manager for completeness, and to ensure that reach assessment sketches include all site impacts, and reach ID numbers and photo numbers are properly cross-referenced.[7]

The track down survey data does not require lab checks.

[7] Ibid.

Instrument/Equipment Testing, Inspection, and Maintenance Requirements (B6)
Instrument/Equipment Calibration and Frequency (B7)

The iPad Mini 2 tablet and Trimble GeoXT GPS unit will be charged at night before every field work day. Upon arrival at the office and before departure to a field site the iPad and GPS unit will be checked for a full battery. The iPad Mini 2 tablet can also be charged via a car adapter in the case of a drained battery in the field. There will be no spare battery as the power source for the GPS unit is internal.

There is no other equipment used that requires testing, inspection or maintenance records.

There is no equipment that requires calibration.

Inspection/Acceptance of Supplies and Consumables (B8)

This element is not applicable to the track down survey project.

Non-direct Measurements

A number of data sources will be used in planning for the track down surveys. These will include but not be limited to:

1. High resolution aerial photography of the area obtained from CT Environmental Conditions Online (CTECOS).

2. Natural Resource Inventory Maps published to create Town Plans of Conservation and Development.

3. USGS Topographical Maps

CTECOS and other data will be used to create maps for reference in the field. The track down survey database will also be linked to a GIS to display results graphically.

Data Management

When a survey is completed, field data forms will be uploaded to the HVA server at the office and checked by the HVA Project/QA Manager (see Quality Control Requirements – Element B5). When field forms are determined to be complete, data will be entered into the watershed map. The survey data and photos will be compiled into a document, and will be easily referenced to their corresponding points on the map. This document will also display photos of typical conditions in many of the watersheds reaches.

Reach Survey Data Forms will be coded for overall habitat score (as computed on the Reach Assessment form) which will be used as a second check on field data entry.[8] In addition, all field data will be entered into an Access® database modeled after CWP's USA Field Sheet Database, which provides data entry forms that look like the field data sheets. 10% of all entries into Access database will be QA checked with original Reach Survey Data Forms to ensure accuracy. [9] Electronic data will be backed up on CDs and updated when additions or other changes are made.

The Microsoft Office 2010 version of Access® will be used for the database and ESRI's® ArcGIS 10.1 will be used for all GIS mapping work. These programs are already installed and running on existing HVA desktop computers under the Microsoft Windows 7® operating system.

Field data will be analyzed in a number of ways, as suggested in the USA and USSR manuals that are all useful in planning restoration strategies. *Stream Corridor Project Counts* will be done as an initial screening tool. Counts will focus on impact sites that have the greatest potential for stream corridor restoration. They can be expressed as simple numbers, e.g. the number of severe bank erosion sites or potential outfall retrofit sites, or as a fraction of stream or survey reach length, e.g. the length of inadequate buffers relative to total stream length. A GIS base map of the watershed will be used to gain a better understanding of the spatial distribution of stream impacts, potential restoration projects and overall reach quality; the types of information chosen to display graphically will depend on initial findings and restoration goals. *Stream Corridor Metrics* are a way to summarize relative conditions of survey reaches and stream corridors to prioritize and target further investigation or restoration activities. For example, stream corridors with a relatively high density of outfalls that have signs of polluted stormwater contamination would be a high priority for the installation of a stormwater quality retrofit measure. These metrics can also be used to compare subwatersheds as part of larger watershed-based restoration strategies.[10]

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[8] Ibid.

[9] *Unified Stream Assessment: A User's Manual*, March 2004, Center for Watershed Protection

[10] Ibid.

Assessments and Response Actions

After an initial track down survey is completed in a sub-watershed, the results and method will be evaluated for effectiveness by the HVA Project/QA Manager, field staff, and other data users (e.g. DEEP). If the surveys are not effectively and efficiently meeting the goals of the track down survey project, components of the method will be revised as necessary, including field data forms, training requirements, field assessment methods, quality control, data management and analysis. Any revisions to HVA's approach will trigger a modification of this document and will require subsequent approval by signatories listed on Title and Approval Sheet. As future surveys are completed, methods will continue to be evaluated and changed if needed.

Reports to Management

As track down surveys are completed, information will be integrated into the development of an EPA 9-Element Watershed-based Plan for the Still River. Reports for this element of the planning process will be delivered to CTDEEP and US EPA as a Field Assessment Report containing the following elements:

- Map of assessment reaches/subwatersheds
- Field assessment preparation documentation (ie. - Copies of: landowner mailing materials and address lists; volunteer training agenda(s), assessment guidance handouts and training attendance sheets)
- Completed stream corridor assessment forms
- Completed upland areas/subwatershed assessment forms
- Results of Stream Corridor Project Counts and Stream Corridor Metrics
- DRAFT Field Assessment Report
- FINAL DRAFT Field Assessment Report incorporating DEEP comments
- FINAL Field Assessment Report, incorporating Still River Partners and public comment

Data Review, Verification and Validation

All completed survey forms will be reviewed by the HVA Project/QA Manager to ensure that quality objectives are being met (forms are thoroughly completed, observations are being made and recorded in a consistent manner, impacts are being measured and evaluated in the same way).

Verification and Validation Methods

If inconsistencies are found in survey data collection, surveys will be re-done to ensure that data are comparable and of use. Once the data has been entered in the database, any problems associated with transcribing data will be corrected as they are found while spot-checking the forms against data entry forms and printed maps.

All data will be stored at the HVA office. Copies of the electronic database will be provided to the DEEP. Results will also be summarized and graphically displayed for distribution to other users.

Reconciliation with User Requirements

Track down survey results are expected to be used in locating sources of impairments and planning for restoration projects. If after completion of the pilot track down survey projects, including field data collection and analysis, the data cannot be used as required, the survey methods will be re-evaluated and changes will be made where needed. Project leaders at HVA will work with DEEP staff and other data users to gather input and plan for and address needed changes.

Attachment A
Track Down Survey (USA and USSR) Field Forms

Storm Water Outfalls **OT**

WATERSHED/SUBSHED:		**DATE:** ___/___/___	**ASSESSED BY:**
SURVEY REACH ID:	**TIME:** ___:___AM/PM	**PHOTO ID:** (*Camera-Pic #*)	/#
SITE ID (*Condition-#*): **OT-**_____	**LAT** ___°___'___" **LONG** ___°___'___"	**LMK**_____	**GPS:** (*Unit ID*)

BANK: ☐LT ☐RT ☐ Head

FLOW: ☐ None ☐ Trickle ☐ Moderate ☐ Substantial ☐ Other:

TYPE: ☐ Closed pipe — **MATERIAL:** ☐ Concrete ☐ Metal ☐ PVC/Plastic ☐ Brick ☐ Other: — **SHAPE:** ☐ Single ☐ Circular ☐ Double ☐ Elliptical ☐ Triple ☐ Other: — **DIMENSIONS:** Diameter:_____(in)

☐ Open channel — ☐ Concrete ☐ Earthen ☐ Other: — ☐ Trapezoid ☐ Parabolic ☐ Other: — Depth: _____(in) Width (Top):_____(in) " (Bottom):_____(in)

SUBMERGED: ☐ No ☐ Partially ☐ Fully

NOT APPLICABLE

CONDITION: ☐ None ☐ Chip/Cracked ☐ Peeling Paint ☐ Corrosion ☐ Other:

ODOR: ☐ No ☐ Gas ☐ Sewage ☐ Rancid/Sour ☐ Sulfide ☐ Other:

DEPOSITS/STAINS: ☐ None ☐ Oily ☐ Flow Line ☐ Paint ☐ Other:

VEGGIE DENSITY: ☐ None ☐ Normal ☐ Inhibited ☐ Excessive ☐ Other:

PIPE BENTHIC GROWTH: ☐ None ☐ Brown ☐ Orange ☐ Green ☐ Other:

POOL QUALITY: ☐ No pool ☐ Good ☐ Odors ☐ Colors ☐ Oils ☐ Suds ☐ Algae ☐ Floatables ☐ Other:

FOR FLOWING ONLY	**COLOR:**	☐ Clear ☐ Brown ☐ Grey ☐ Yellow ☐ Green ☐ Orange ☐ Red ☐ Other:
	TURBIDITY:	☐ None ☐ Slight Cloudiness ☐ Cloudy ☐ Opaque
	FLOATABLES:	☐ None ☐ Sewage (toilet paper, etc.) ☐ Petroleum (oil sheen) ☐ Other:
OTHER CONCERNS:	☐ Excess Trash (paper/plastic bags) ☐ Needs Regular Maintenance	☐ Dumping (bulk) ☐ Bank Erosion ☐ Excessive Sedimentation ☐ Other:

POTENTIAL RESTORATION CANDIDATE ☐ Discharge investigation ☐ Stream daylighting ☐ Local stream repair/outfall stabilization ☐ no ☐ Storm water retrofit ☐ Other:

If yes for daylighting:
Length of vegetative cover from outfall: _____ft Type of existing vegetation:_____ Slope: _____°

If yes for stormwater:
Is stormwater currently controlled? ☐ Yes ☐ No ☐ Not investigated
Land Use description:_____
Area available:

OUTFALL SEVERITY: (*circle #*)	Heavy discharge with a distinct color and/or a strong smell. The amount of discharge is significant compared to the amount of normal flow in receiving stream; discharge appears to be having a significant impact downstream.	Small discharge; flow mostly clear and odorless. If the discharge has a color and/or odor, the amount of discharge is very small compared to the stream's base flow and any impact appears to be minor / localized.	Outfall does not have dry weather discharge; staining; or appearance of causing any erosion problems.
	5	4 3	2 1

SKETCH/NOTES:

REPORTED TO AUTHORITIES: ☐ YES ☐ NO

Severe Bank Erosion **ER**

WATERSHED/SUBSHED:		**DATE:** ___/____/___	**ASSESSED BY:**
SURVEY REACH:	**TIME:**___:___AM/PM	**PHOTO ID** (CAMERA-PIC #):	/#
SITE ID: (*Condition-#*) ER-_____	*START* **LAT** ___°___'___" **LONG** ___°___'___" **LMK** ____		**GPS:** (*Unit ID*)
	END **LAT** ___°___'___" **LONG** ___°___'___" **LMK** ____		

PROCESS: ☐ Currently unknown

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

BANK OF CONCERN: ☐ LT ☐ RT ☐ Both (*looking downstream*)
LOCATION: ☐ Meander bend ☐ Straight section ☐ Steep slope/valley wall ☐ Other:

DIMENSIONS:

Length (*if no GPS*)	LT_____ft	and/or RT_____ft	Bottom width _____ft
Bank Ht	LT_____ft	and/or RT_____ft	Top width _____ft
Bank Angle	LT_____°	and/or RT_____°	Wetted Width _____ft

LAND OWNERSHIP: ☐ Private ☐ Public ☐ Unknown **LAND COVER:** ☐ Forest ☐ Field/Ag ☐ Developed:

POTENTIAL RESTORATION CANDIDATE: ☐ No ☐ Grade control ☐ Bank stabilization ☐ Other:

THREAT TO PROPERTY/INFRASTRUCTURE: ☐ No ☐ Yes (Describe):

EXISTING RIPARIAN WIDTH: ☐ ≤25 ft ☐ 25 - 50 ft ☐ 50-75ft ☐ 75-100ft ☐ >100ft

EROSION SEVERITY(*circle#*) Channelized= ☐ 1	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.	Pst downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.
	5	4 3	2 1
ACCESS:	**Good access:** Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair access:** Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult access.** Must cross wetland, steep slope or other sensitive areas to access stream. Minimal stockpile areas available and/or located a great distance from stream section. Specialized heavy equipment required.
	5	4 3	2 1

NOTES/CROSS SECTION SKETCH:

REPORTED TO AUTHORITIES ☐ YES ☐ NO

Impacted Buffer **IB**

WATERSHED/SUBSHED:		**DATE:** ___/___/___	**ASSESSED BY:**
SURVEY REACH:	**TIME:** ___:___AM/PM	**PHOTO ID:** (*Camera-Pic #*)	/#
SITE ID: (*Condition-#*) IB-____	*START* **LAT** ___° ___' ___" **LONG** ___° ___' ___" **LMK** ____		**GPS:** (*Unit ID*)
	END **LAT** ___° ___' ___" **LONG** ___° ___' ___" **LMK** ____		

IMPACTED BANK: ☐ LT ☐ RT ☐ Both

REASON INADEQUATE: ☐ Lack of vegetation ☐ Too narrow ☐ Widespread invasive plants ☐ Recently planted ☐ Other:

LAND USE: (*Facing downstream*)	Private	Institutional	Golf Course	Park	Other Public
LT Bank	☐	☐	☐	☐	☐:
RT Bank	☐	☐	☐	☐	☐:

DOMINANT LAND COVER:	Paved	Bare ground	Turf/lawn	Tall grass	Shrub/scrub	Trees	Other
LT Bank	☐	☐	☐	☐	☐	☐	☐:
RT Bank	☐	☐	☐	☐	☐	☐	☐:

INVASIVE PLANTS: ☐ None ☐ Rare ☐ Partial coverage ☐ Extensive coverage ☐ unknown

STREAM SHADE PROVIDED? ☐ None ☐ Partial ☐ Full

WETLANDS PRESENT? ☐ No ☐ Yes ☐ Unknown

POTENTIAL RESTORATION CANDIDATE ☐ Active reforestation ☐ Greenway design ☐ Natural regeneration ☐ Invasives removal ☐ no ☐ Other:

RESTORABLE AREA

	LT BANK	RT
Length (ft):	_____	_____
Width (ft):	_____	_____

REFORESTATION POTENTIAL: (*Circle #*)

Impacted area on public land where the riparian area does not appear to be used for any specific purpose; plenty of area available for planting	Impacted area on either public or private land that is presently used for a specific purpose; available area for planting adequate	Impacted area on private land where road; building encroachment or other feature significantly limits available area for planting
5 4	3	2 1

POTENTIAL CONFLICTS WITH REFORESTATION ☐ Widespread invasive plants ☐ Potential contamination ☐ Lack of sun ☐ Poor/unsafe access to site ☐ Existing impervious cover ☐ Severe animal impacts (deer, beaver) ☐ Other:

NOTES:

Stream Crossing **SC**

WATERSHED/SUBSHED:		**DATE:** ___/___/___	**ASSESSED BY:**
SURVEY REACH ID:	**TIME:** ___:___ AM/PM	**PHOTO ID:** (*Camera-Pic #*)	/#
SITE ID: (*Condition-#*) SC-_____	**LAT** ___°___'___" **LONG** ___°___'___" **LMK**____		**GPS** (*Unit ID*)

TYPE: ☐ Road Crossing ☐ Railroad Crossing ☐ Manmade Dam ☐ Beaver Dam ☐ Geological Formation ☐ Other:

FOR ROAD/ RAILROAD CROSSINGS ONLY

SHAPE:
☐ Arch ☐ Bottomless
☐ Box ☐ Elliptical
☐ Circular
☐ Other:

 # BARRELS:
☐ Single
☐ Double
☐ Triple
☐ Other:

MATERIAL:
☐ Concrete
☐ Metal
☐ Other:

ALIGNMENT:
☐ Flow-aligned
☐ Not flow-aligned
☐ Do not know

DIMENSIONS: (*if variable, sketch*)
Barrel diameter: _____(ft)
Height: _____(ft)
Culvert length: _____(ft)
Width: _____(ft)
Roadway elevation: _____(ft)

CONDITION: (*Evidence of…*)
☐ Cracking/chipping/corrosion ☐ Downstream scour hole
☐ Sediment deposition ☐ Failing embankment
☐ Other (*describe*):

CULVERT SLOPE:
☐ Flat
☐ Slight (2° – 5°)
☐ Obvious (>5°)

POTENTIAL RESTORATION CANDIDATE ☐ no
☐ Fish barrier removal ☐ Culvert repair/replacement ☐ Upstream storage retrofit
☐ Local stream repair ☐ Other:

IS SC ACTING AS GRADE CONTROL ☐ No ☐ Yes ☐ Unknown

If yes for fish barrier

EXTENT OF PHYSICAL BLOCKAGE:
☐ Total ☐ Partial
☐ Temporary ☐ Unknown

CAUSE:
☐ Drop too high Water Drop: _____ (in)
☐ Flow too shallow Water Depth: _____ (in)
☐ Other:

BLOCKAGE SEVERITY: (*circle #*)

5	4	3	2	1
A structure such as a dam or road culvert on a 3rd order or greater stream blocking the upstream movement of anadromous fish; no fish passage device present.		A total fish blockage on a tributary that would isolate a significant reach of stream, or partial blockage that may interfere with the migration of anadromous fish.		A temporary barrier such as a beaver dam or a blockage at the very head of a stream with very little viable fish habitat above it; natural barriers such as waterfalls.

NOTES/SKETCH:

REPORTED TO AUTHORITIES ☐ YES ☐ NO

Channel Modification **CM**

WATERSHED/SUBSHED:	**DATE:** ___/___/___	**ASSESSED BY:**
SURVEY REACH ID:	**TIME:** ___:___AM/PM	**PHOTO ID:** *(Camera-Pic #)* /#
SITE ID: *(Condition-#)* **CM-**____	*START* **LAT** ___° ___' ___" **LONG** ___° ___' ___" **LMK** ____	**GPS:** *(Unit ID)*
	END **LAT** ___° ___' ___" **LONG** ___° ___' ___" **LMK** ____	

TYPE: ☐ Channelization ☐ Bank armoring ☐ concrete channel ☐ Floodplain encroachment ☐ Other:

MATERIAL:
☐ Concrete ☐ Gabion
☐ Rip Rap ☐ Earthen
☐ Metal
☐ Other:

Does channel have perennial flow?	☐ Yes ☐ No
Is there evidence of sediment deposition?	☐ Yes ☐ No
Is vegetation growing in channel?	☐ Yes ☐ No
Is channel connected to floodplain?	☐ Yes ☐ No

DIMENSIONS:
Height _____(ft)
Bottom Width _____(ft)
Top Width: _____(ft)
Length: _____(ft)

BASE FLOW CHANNEL
Depth of flow _____(in)
Defined low flow channel? ☐ Yes ☐ No
% of channel bottom _____%

ADJACENT STREAM CORRIDOR
Available width LT_____(ft) RT_____(ft)
Utilities Present? ☐ Yes ☐ No
Fill in floodplain? ☐ Yes ☐ No

POTENTIAL RESTORATION CANDIDATE ☐ Structural repair ☐ Base flow channel creation ☐ Natural channel design ☐ Can't tell
☐ no ☐ De-channelization ☐ Fish barrier removal ☐ Bioengineering

CHANNELIZATION SEVERITY: *(Circle #)*	A long section of concrete stream (>500') channel where water is very shallow (<1" deep) with no natural sediments present in the channel.		A moderate length (> 200') ,but channel stabilized and beginning to function as a natural stream channel. Vegetated bars may have formed in channel.		An earthen channel less than 100 ft with good water depth, a natural sediment bottom, and size and shape similar to the unchannelized stream reaches above and below impacted area.
	5	4	3	2	1

NOTES:

Trash and Debris **TR**

WATERSHED/SUBSHED:		**DATE:** ___/___/___	**ASSESSED BY:**
SURVEY REACH ID:	**TIME:** ___:___AM/PM	**PHOTO ID:** (*Camera-Pic #*)	/#
SITE ID: (*Condition-#*) **TR-**____	**LAT** ___°____'____" **LONG** ___°____'____" **LMK** ____		**GPS:** (*Unit ID*)

TYPE: ☐ Industrial ☐ Commercial ☐ Residential	**MATERIAL:** ☐ Plastic ☐ Paper ☐ Metal ☐ Tires ☐ Construction ☐ Medical ☐ Appliances ☐ Yard Waste ☐ Automotive ☐ Other:	**SOURCE:** ☐ Unknown ☐ Flooding ☐ Illegal dump ☐ Local outfall	**LOCATION:** ☐ Stream ☐ Riparian Area ☐ Lt bank ☐ Rt bank	**LAND OWNERSHIP:** ☐ Public ☐ Unknown ☐ Private **AMOUNT** (*# Pickup truck loads*):

POTENTIAL RESTORATION CANDIDATE ☐ Stream cleanup ☐ Stream adoption segment ☐ Removal/prevention of dumping
☐ no ☐ Other:

If yes for trash or debris removal	**EQUIPMENT NEEDED :** ☐ Heavy equipment ☐ Trash bags ☐ Unknown **WHO CAN DO IT:** ☐ Volunteers ☐ Local Gov ☐ Hazmat Team ☐ Other	**DUMPSTER WITHIN 100 FT:** ☐ Yes ☐ No ☐ Unknown

CLEAN-UP POTENTIAL: (*Circle #*)	A small amount of trash (i.e., less than two pickup truck loads) located inside a park with easy access	A large amount of trash, or bulk items, in a small area with easy access. Trash may have been dumped over a long period of time but it could be cleaned up in a few days, possibly with a small backhoe.	A large amount of trash or debris scattered over a large area, where access is very difficult. Or presence of drums or indications of hazardous materials	
	5	4	3	2 1

NOTES:

REPORTED TO AUTHORITIES ☐ YES ☐ NO

Utility Impacts **UT**

WATERSHED/SUBSHED:	**DATE:** ___/____/___	**ASSESSED BY:**
SURVEY REACH ID:	**TIME:**___:___AM/PM	**PHOTO ID:** (*Camera-Pic #*) /#
SITE ID: (*Condition-#*) **UT-**____	**LAT**___° ____' ____" **LONG**___° ____' ____" **LMK:** ____	**GPS:** (*Unit ID*)

TYPE:	**MATERIAL:**	**LOCATION:**	**POTENTIAL FISH BARRIER:**	**PIPE DIMENSIONS:**
☐ Leaking sewer ☐ Exposed pipe ☐ Exposed manhole ☐ Other:	☐ Concrete ☐ Corrugated metal ☐ Smooth metal ☐ PVC ☐ Other:	☐ Floodplain ☐ Stream bank ☐ Above stream ☐ Stream bottom ☐ Other:	☐ Yes ☐ No	Diameter: ____in Length exposed: ____ft

CONDITION: ☐ Joint failure ☐ Pipe corrosion/cracking ☐ Protective covering broken ☐ Manhole cover absent ☐ Other:

EVIDENCE OF DISCHARGE:		
	COLOR	☐ None ☐ Clear ☐ Dark Brown ☐ Lt Brown ☐ Yellowish ☐ Greenish ☐ Other:
	ODOR	☐ None ☐ Sewage ☐ Oily ☐ Sulfide ☐ Chlorine ☐ Other:
	DEPOSITS	☐ None ☐ Tampons/Toilet Paper ☐ Lime ☐ Surface oils ☐ Stains ☐ Other:

POTENTIAL RESTORATION CANDIDATE ☐ Structural repairs ☐ Pipe testing ☐ Citizen hotlines ☐ Dry weather sampling ☐ no ☐ Fish barrier removal ☐ Other:

If yes to fish barrier, Water Drop: _____ (in)

UTILITY IMPACT SEVERITY: (*Circle #*)				
Leaking= ☐ 5	Section of pipe undermined by erosion and could collapse in the near future; a pipe running across the bed or suspended above the stream; a long section along the edge of the stream where nearly the entire side of the pipe is exposed; or a manhole stack that is located in the center of the stream channel and there is evidence of stack failure.	A moderately long section of pipe is partially exposed but there is no immediate threat that the pipe will be undermined and break in the immediate future. The primary concern is that the pipe may be punctured by large debris during a large storm event.	Small section of exposed pipe, stream bank near the pipe is stable; the pipe is across the bottom of the stream but only a small portion of the top of the pipe exposed; the pipe is exposed but is reinforced with concrete and it is not causing a blockage to upstream fish movement; a manhole stack that is at the edge of the stream and does not extend very far out into the active stream channel.	
	5	4	3	2 1

NOTES:

REPORTED TO LOCAL AUTHORITIES ☐ Yes ☐ No

Watershed/Subshed:	**Date:** ___/____/___	**Assessed by:**
Survey Reach ID:	**Time:**___:___AM/PM	**Photo ID:** (*Camera-Pic #*) /#
Site ID: (*Condition-#*) **MI-**_____	**Lat**___°_____'_____" **Long**___°_____'_____" **LMK:** _____	**GPS:** (*Unit ID*)

Potential Restoration Candidate ☐ Storm water retrofit ☐ Stream restoration ☐ Riparian Management
☐ no ☐ Discharge Prevention ☐ Other:

Describe:

Reported to local authorities ☐ Yes ☐ No

Watershed/Subshed:	**Date:** ___/____/___	**Assessed by:**
Survey Reach ID:	**Time:**___:___AM/PM	**Photo ID:** (*Camera-Pic #*) /#
Site ID: (*Condition-#*) **MI-**_____	**Lat**___°_____'_____" **Long**___°_____'_____" **LMK:** _____	**GPS:** (*Unit ID*)

Potential Restoration Candidate ☐ Storm water retrofit ☐ Stream restoration ☐ Riparian Management
☐ no ☐ Discharge Prevention ☐ Other:

Describe:

Reported to local authorities ☐ Yes ☐ No

Watershed/Subshed:	**Date:** ___/____/___	**Assessed by:**
Survey Reach ID:	**Time:**___:___AM/PM	**Photo ID:** (*Camera-Pic #*) /#
Site ID: (*Condition-#*) **MI-**_____	**Lat**___°_____'_____" **Long**___°_____'_____" **LMK:** _____	**GPS:** (*Unit ID*)

Potential Restoration Candidate ☐ Storm water retrofit ☐ Stream restoration ☐ Riparian Management
☐ no ☐ Discharge Prevention ☐ Other:

Describe:

Reported to local authorities ☐ Yes ☐ No

Reach Level Assessment **RCH**

SURVEY REACH ID: _____	WTRSHD/SUBSHD:	DATE: __/__/__	ASSESSED BY:

START TIME:___:___AM/PM LMK: _____ LAT___°____'____" LONG___°____'____" DESCRIPTION:	*END* TIME:___:___AM/PM LMK: _____ LAT___°____'____" LONG___°____'____" DESCRIPTION:	GPS ID:

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☐ 50%-75% ☐ 25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM *(Evidence of)*
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING *(water surface)*
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

☐ Unknown

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank _____(ft)
RT bank _____(ft)
Width: Bottom _____(ft)
Top _____(ft)

REACH ACCESSIBILITY

5	4	3	2	1
Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.		**Fair:** Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.		**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

REPORTED TO AUTHORITIES ☐ YES ☐ NO

OVERALL STREAM CONDITION				
	Optimal	**Suboptimal**	**Marginal**	**Poor**
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) not able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) not able to enter floodplain. Stream deeply entrenched.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
OVERALL BUFFER AND FLOODPLAIN CONDITION				
	Optimal	**Suboptimal**	**Marginal**	**Poor**
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: _____/80 + Buffer/Floodplain: _____/80 = **Total** Survey Reach _____/160

Photo Inventory

(By Camera)

Project: _____

Group: _____

Camera: _____

This field sheet is to be completed AS photos are taken in the field. The intent is to force us to organize pictures taken on a camera basis. Fill out one sheet per camera (add sheets as needed). Only fill in Date/Reach/Location ID when you start in a new spatial or temporal location.

Date	Stream/ Reach	Location ID	Photo #	Description

Neighborhood Source Assessment **NSA**

WATERSHED:	SUBWATERSHED:	UNIQUE SITE ID:	
DATE: ___/___/_____	ASSESSED BY:	CAMERA ID:	PIC#:

A. NEIGHBORHOOD CHARACTERIZATION

Neighborhood/Subdivision Name: _____ Neighborhood Area (acres) _____

If unknown, address (or streets) surveyed:

_____

Homeowners Association? ☐ Y ☐ N ☐ Unknown If yes, name and contact information: _____

Residential *(circle average single family lot size):* _____

☐ Single Family Attached (Duplexes, Row Homes) <1/8 1/8 ¼ 1/3 1/3 acre ☐ Multifamily (Apts, Townhomes, Condos)

☐ Single Family Detached <¼ ¼ ½ 1 >1 acre ☐ Mobile Home Park

Estimated Age of Neighborhood: _____ years	Percent of Homes with Garages: _____% With Basements ____%	INDEX*
Sewer Service? ☐ Y ☐ N		○
Index of Infill, Redevelopment, and Remodeling ☐ No Evidence ☐ <5% of units ☐ 5-10% ☐ >10%		○

Record percent observed for each of the following indicators, depending on applicability and/or site complexity	Percentage	Comments/Notes	
B. YARD AND LAWN CONDITIONS			
B1. % of lot with impervious cover			
B2. % of lot with grass cover			○
B3. % of lot with landscaping (e.g., mulched bed areas)			◇
B4. % of lot with bare soil			○
**Note: B1 through B4 must total 100%*			
B5. % of lot with forest canopy			◇
B6. Evidence of permanent irrigation or "non-target" irrigation			○
B7. Proportion of *total neighborhood* turf lawns with following management status:	High: ____		○
	Med: ____		
	Low: ____		
B8. Outdoor swimming pools? ☐Y ☐N ☐ Can't Tell Estimated # ____			○
B9. Junk or trash in yards? ☐ Y ☐ N ☐ Can't Tell			○
C. DRIVEWAYS, SIDEWALKS, AND CURBS			
C1. % of driveways that are impervious ☐ N/A			
C2. Driveway Condition ☐ Clean ☐ Stained ☐ Dirty ☐ Breaking up			○
C3. Are sidewalks present? ☐ Y ☐ N If yes, are they on one side of street ☐ or along both sides ☐			
☐ Spotless ☐ Covered with lawn clippings/leaves ☐ Receiving 'non-target' irrigation			○
What is the distance between the sidewalk and street? _____ ft.			◇
Is pet waste present in this area? ☐ Y ☐ N ☐ N/A			○
C4. Is curb and gutter present? ☐ Y ☐ N If yes, check all that apply:			
☐ Clean and Dry ☐ Flowing or standing water ☐ Long-term car parking ☐ Sediment			○
☐ Organic matter, leaves, lawn clippings ☐ Trash, litter, or debris ☐ Overhead tree canopy			◇

* INDEX: ○ denotes potential pollution source; ◇ denotes a neighborhood restoration opportunity

D. ROOFTOPS			
D1. Downspouts are directly connected to storm drains or sanitary sewer			◇ ○
D2. Downspouts are directed to impervious surface			
D3. Downspouts discharge to pervious area			
D4. Downspouts discharge to a cistern, rain barrel, etc.			
**Note: C1 through C4 should total 100%*			
D5. Lawn area present downgradient of leader for rain garden? ☐ Y ☐ N			◇
E. COMMON AREAS			
E1. Storm drain inlets? ☐ Y ☐ N If yes, are they stenciled? ☐ Y ☐ N Condition: ☐ Clean ☐ Dirty			◇
Catch basins inspected? ☐ Y ☐ N If yes, include Unique Site ID from SSD sheet: _____			○
E2. Storm water pond? ☐ Y ☐ N Is it a ☐ wet pond or ☐ dry pond? Is it overgrown? ☐ Y ☐ N What is the estimated pond area? ☐ <1 acre ☐ about 1 acre ☐ > 1 acre			◇
E3. Open Space? ☐ Y ☐ N If yes, is pet waste present? ☐ Y ☐ N dumping? ☐ Y ☐ N			○
Buffers/floodplain present: ☐ Y ☐ N If yes, is encroachment evident? ☐ Y ☐ N			
F. INITIAL NEIGHBORHOOD ASSESSMENT AND RECOMMENDATIONS			
Based on field observations, this neighborhood has significant indicators for the following: *(check all that apply)* ☐ Nutrients ☐ Oil and Grease ☐ Trash/Litter ☐ Bacteria ☐ Sediment ☐ Other _____			○

Recommended Actions

Specific Action

- ☐ Onsite retrofit potential?
- ☐ Better lawn/landscaping practice?
- ☐ Better management of common space?
- ☐ Pond retrofit?
- ☐ Multi-family Parking Lot Retrofit?
- ☐ Other action(s) _____

Describe Recommended Actions:

Initial Assessment

NSA Pollution Severity Index

- ☐ Severe (More than 10 circles checked)
- ☐ High (5 to 10 circles checked)
- ☐ Moderate (Fewer than 5 circles checked)
- ☐ None (No circles checked)

Neighborhood Restoration Opportunity Index

- ☐ High (More than 5 diamonds checked)
- ☐ Moderate (3-5 diamonds checked)
- ☐ Low (Fewer than 3 diamonds checked)

NOTES:

Hotspot Site Investigation **HSI**

WATERSHED:	SUBWATERSHED:		UNIQUE SITE ID:
DATE: ___/___/_____	ASSESSED BY:	CAMERA ID:	PIC#:
MAP GRID:	LAT ___°_____'_____" LONG ___°_____'_____"		LMK #

A. SITE DATA AND BASIC CLASSIFICATION

Name and Address: _____

_____

_____

SIC code (if available): _____

NPDES Status: ☐ Regulated ☐ Unregulated ☐ Unknown

Category: ☐ Commercial ☐ Industrial ☐ Institutional ☐ Municipal ☐ Transport-Related

Miscellaneous ☐ Golf Course ☐ Marina ☐ Animal Facility

Basic Description of Operation: _____

	INDEX*
B. VEHICLE OPERATIONS ☐ **N/A** *(Skip to part C)*	**Observed Pollution Source?**
B1. Types of vehicles: ☐ Fleet vehicles ☐ School buses ☐ Other: _____	
B2. Approximate number of vehicles: _____	
B3. Vehicle activities *(circle all that apply)*: Maintained Repaired Recycled Fueled Washed Stored	○
B4. Are vehicles stored and/or repaired outside? ☐ Y ☐ N ☐ Can't Tell Are these vehicles lacking runoff diversion methods? ☐ Y ☐ N ☐ Can't Tell	○
B5. Is there evidence of spills/leakage from vehicles? ☐ Y ☐ N ☐ Can't Tell	○
B6. Are uncovered outdoor fueling areas present? ☐ Y ☐ N ☐ Can't Tell	○
B7. Are fueling areas directly connected to storm drains? ☐ Y ☐ N ☐ Can't Tell	○
B8. Are vehicles washed outdoors? ☐ Y ☐ N ☐ Can't Tell Does the area where vehicles are washed discharge to the storm drain? ☐ Y ☐ N ☐ Can't Tell	○
C. OUTDOOR MATERIALS ☐ **N/A** *(Skip to part D)*	**Observed Pollution Source?**
C1. Are loading/unloading operations present? ☐ Y ☐ N ☐ Can't Tell If yes, are they uncovered *and* draining towards a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell	○
C2. Are materials stored outside? ☐ Y ☐ N ☐ Can't Tell If yes, are they ☐ Liquid ☐ Solid Description: _____ Where are they stored? ☐ grass/dirt area ☐ concrete/asphalt ☐ bermed area	○
C3. Is the storage area directly or indirectly connected to storm drain (circle one)? ☐ Y ☐ N ☐ Can't Tell	○
C4. Is staining or discoloration around the area visible? ☐ Y ☐ N ☐ Can't Tell	○
C5. Does outdoor storage area lack a cover? ☐ Y ☐ N ☐ Can't Tell	○
C6. Are liquid materials stored *without* secondary containment? ☐ Y ☐ N ☐ Can't Tell	○
C7. Are storage containers missing labels or in poor condition (rusting)? ☐ Y ☐ N ☐ Can't Tell	○
D. WASTE MANAGEMENT ☐ **N/A** *(Skip to part E)*	**Observed Pollution Source?**
D1. Type of waste *(check all that apply)*: ☐ Garbage ☐ Construction materials ☐ Hazardous materials	○
D2. Dumpster condition *(check all that apply)*: ☐ No cover/Lid is open ☐ Damaged/poor condition ☐ Leaking or evidence of leakage (stains on ground) ☐ Overflowing	○
D3. Is the dumpster located near a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell If yes, are runoff diversion methods (berms, curbs) lacking? ☐ Y ☐ N ☐ Can't Tell	○
E. PHYSICAL PLANT ☐ **N/A** *(Skip to part F)*	**Observed Pollution Source?**
E1. Building: Approximate age: _____ yrs. Condition of surfaces: ☐ Clean ☐ Stained ☐ Dirty ☐ Damaged Evidence that maintenance results in discharge to storm drains (staining/discoloration)? ☐ Y ☐ N ☐ Don't know	○ ○

*Index: ○ denotes potential pollution source; ☐ denotes confirmed polluter (evidence was seen)

E2. Parking Lot: Approximate age _____ yrs. Condition: ☐ Clean ☐ Stained ☐ Dirty ☐ Breaking up Surface material ☐ Paved/Concrete ☐ Gravel ☐ Permeable ☐ Don't know	○
E3. Do downspouts discharge to impervious surface? ☐ Y ☐ N ☐ Don't know ☐ None visible Are downspouts directly connected to storm drains? ☐ Y ☐ N ☐ Don't know	○
E4. Evidence of poor cleaning practices for construction activities (stains leading to storm drain)? ☐ Y ☐ N ☐ Can't Tell	○
F. TURF/LANDSCAPING AREAS ☐ N/A *(skip to part G)* **Observed Pollution Source?**	
F1. % of site with: Forest canopy ____% Turf grass _____% Landscaping ____% Bare Soil ____%	○
F2. Rate the turf management status: ☐ High ☐ Medium ☐ Low	○
F3. Evidence of permanent irrigation or "non-target" irrigation ☐ Y ☐ N ☐ Can't Tell	○
F4. Do landscaped areas drain to the storm drain system? ☐ Y ☐ N ☐ Can't Tell	○
F5. Do landscape plants accumulate organic matter (leaves, grass clippings) on adjacent impervious surface? ☐ Y ☐ N ☐ Can't Tell	○
G. STORM WATER INFRASTRUCTURE ☐ N/A *(skip to part H)* **Observed Pollution Source?**	
G1. Are storm water treatment practices present? ☐ Y ☐ N ☐ Unknown If yes, please describe: _____	○
G2. Are private storm drains located at the facility? ☐ Y ☐ N ☐ Unknown Is trash present in gutters leading to storm drains? If so, complete the index below.	○

Index Rating for Accumulation in Gutters

	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organic material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

G3. Catch basin inspection – Record SSD Unique Site ID here: _____ Condition: ☐ Dirty ☐ Clean

H. INITIAL HOTSPOT STATUS - INDEX RESULTS

☐ Not a hotspot (fewer than 5 circles and no boxes checked) ☐ Potential hotspot (5 to 10 circles but no boxes checked)
☐ Confirmed hotspot (10 to 15 circles and/or 1 box checked) ☐ Severe hotspot (>15 circles and/or 2 or more boxes checked)

Follow-up Action:
- ☐ Refer for immediate enforcement
- ☐ Suggest follow-up on-site inspection
- ☐ Test for illicit discharge
- ☐ Include in future education effort
- ☐ Check to see if hotspot is an NPDES non-filer
- ☐ Onsite non-residential retrofit
- ☐ Pervious area restoration; complete PAA sheet and record Unique Site ID here: _____
- ☐ Schedule a review of storm water pollution prevention plan

Notes:

Pervious Area Assessment **PAA**

WATERSHED:	SUBWATERSHED:	UNIQUE SITE ID:	
DATE: ___/___/_____	ASSESSED BY:	CAMERA ID:	PIC #:
MAP GRID:	LAT___°____'____"LONG___°____'____"		LMK #

A. PARCEL DESCRIPTION

Size: ___acre(s) Access to site (*check all that apply*): ☐ Foot access ☐ Vehicle access ☐ Heavy equipment access
Ownership: ☐ Private ☐ Public Current Management: ☐ School ☐ Park ☐ Right-of-way ☐ Vacant land
☐ Other (please describe) _____
Contact Information: _____
Connected to other pervious area? ☐ Y ☐ N If yes, what type? ☐ Forest ☐ Wetland ☐ Other _____
Estimated size of connected pervious area: ____ acre(s) Record Unique Site ID of connected fragment: _____

PART I. NATURAL AREA REMNANT

FOREST	WETLAND
B. CURRENT VEGETATIVE COVER	**B. CURRENT VEGETATIVE COVER**
B1. Percent of forest with the following canopy coverage: Open _____% Partly shaded _____% Shaded _____% **Note – these should total 100%* **B2.** Dominant tree species: _____ _____ **B3.** Understory species: _____ _____ **B4.** Are invasive species present? ☐ Y ☐ N ☐ Unknown If yes, % of forest with invasives: _____ Species: _____	**B1.** % of wetland with following vegetative zones: Aquatic: _____ Emergent: _____ Forested: _____ **Note – these should total 100%* **B2.** Dominant species: _____ _____ **B3.** Are invasive species present? ☐ Y ☐ N ☐ Unknown If yes, % of wetland with invasives: _____ Species: _____
C. FOREST IMPACTS	**C. WETLAND IMPACTS**
C1. Observed Impacts (*check all that apply*): ☐ Animals ☐ Clearing/encroachment ☐ Trash and dumping ☐ Storm water runoff ☐ Other	**C1.** Observed Impacts (*check all that apply*): ☐ Animals ☐ Clearing/encroachment ☐ Trash and dumping ☐ Storm water runoff ☐ Hydrologic impacts ☐ Other
D. NOTES	**D. NOTES**

E. INITIAL RECOMMENDATION

☐ Good candidate for conservation/protection
☐ Potential restoration candidate
☐ Poor restoration or conservation candidate

Pervious Area Assessment **PAA**

PART II. OPEN PERVIOUS AREAS

A. CURRENT VEGETATIVE COVER

A1. Percent of assessed surface with:
Turf _____% Other Herbaceous _____% None (bare soil) _____% Trees _____% Shrubs _____% Other _____%
(please describe): _____ **Note – these should total 100%*

A2. Turf: Height: _____ inches Apparent Mowing Frequency: ☐ Frequent ☐ Infrequent ☐ No-Mow ☐ Unknown
Condition (*check all that apply*): ☐ Thick/Dense ☐ Thin/Sparse ☐ Clumpy/Bunchy ☐ Continuous Cover

A3. Thickness of organic matter at surface: _____ inches

A4. Are invasive species present? ☐ Y ☐ N ☐ Unknown If yes, % of site with invasives: _____
Species: _____

B. IMPACTS

B1. Observed Impacts (*check all that apply*): ☐ Soil Compaction ☐ Erosion ☐ Trash and Dumping
☐ Poor Vegetative Health ☐ Other (describe): _____

C. REFORESTATION CONSTRAINTS

C1. Sun exposure: ☐ Full sun ☐ Partial sun ☐ Shade ☐ Unknown

C2. Nearby water source? ☐ Y ☐ N ☐ Unknown

C3. Other constraints: ☐ Overhead wires ☐ Underground Utilities ☐ Pavement ☐ Buildings
☐ Other (please describe): _____

D. NOTES

E. INITIAL RECOMMENDATION

☐ Good candidate for natural regeneration
☐ May be reforested with minimal site preparation
☐ May be reforested with extensive site preparation
☐ Poor reforestation or regeneration site

PART III. SKETCH

Streets and Storm Drains **SSD**

WATERSHED:	SUBWATERSHED:	UNIQUE SITE ID:
DATE: ___/___/_____	ASSESSED BY:	CAMERA ID:
MAP GRID	RAIN IN LAST 24 HOURS ☐ Y ☐ N	PIC #

A. LOCATION

A1. Street names or neighborhood surveyed:
_____

A2. Adjacent land use: ☐ Residential ☐ Commercial ☐ Industrial ☐ Institutional ☐ Municipal ☐ Transport-Related

A3. Corresponding HSI or NSA field sheet? If so, circle HSI or NSA and record its Unique Site ID here _____

B. STREET CONDITIONS

B1. Road Type: ☐ Arterial ☐ Collector ☐ Local ☐ Alley ☐ Other: _____

B2. Condition of Pavement: ☐ New ☐ Good ☐ Cracked ☐ Broken

B3. Is on-street parking permitted ☐ Y ☐ N If yes, approximate number of cars per block: _____

B4. Are large cul-de-sacs present? ☐ Y ☐ N

B5. Is trash present in curb and gutter? If so, use the index to the right to record amount.	Index Rating for Accumulation in Gutters				
	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organic Material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

C. STORM DRAIN INLETS AND CATCH BASINS

C1. Type of storm drain conveyance: ☐ open ☐ enclosed ☐ mixed

C2. Percentage of inlets with catch basin storage: _____ ☐ N/A

Sample 1-2 catch basins per NSA/HSI	**C3.** Catch basin #1	**C4.** Catch basin #2
Latitude	___° ___' ___"	___° ___' ___"
Longitude	___° ___' ___"	___° ___' ___"
LMK #		
Picture #		
Current Condition	☐ Wet ☐ Dry	☐ Wet ☐ Dry
Condition of Inlet	☐ Clear ☐ Obstructed	☐ Clear ☐ Obstructed
Litter Accumulation	☐ Y ☐ N	☐ Y ☐ N
Organics Accumulation	☐ Y ☐ N	☐ Y ☐ N
Sediment Accumulation	☐ Y ☐ N	☐ Y ☐ N
Sediment Depth (in feet)	_____ ft.	_____ ft.
Water Depth	_____ ft.	_____ ft.
Evidence of oil and grease	☐ Y ☐ N	☐ Y ☐ N
Sulfur smell	☐ Y ☐ N	☐ Y ☐ N
Accessible to vacuum truck	☐ Y ☐ N	☐ Y ☐ N

D. NON-RESIDENTIAL PARKING LOT (>2 acres)

D1. Approximate size: _____ acres

D2. Lot Utilization: ☐ Full ☐ About half full ☐ Empty

D3. Overall condition of Pavement: ☐ Smooth (no cracks) ☐ Medium (few cracks) ☐ Rough (many cracks) ☐ Very Rough (numerous cracks and depressions)

D4. Is lot served by a storm water treatment practice? ☐ Y ☐ N If yes, describe: _____

D5. On-site retrofit potential: ☐ Excellent ☐ Good ☐ Poor

Attachment B
Equipment Specifications

Apple iPad mini with Retina Display MF575LL/A (64GB, Wi-Fi + T-Mobile, Black with Space Gray) OLD VERSION

Available from these sellers.

Product Description

Size:**64 GB** | Item Shape:**Wi-Fi + T-Mobile** | Color:**Space Gray**

iPad mini with Retina display is amazing to hold. And behold. Every photo is incredibly detailed and vibrant, and every line of text is remarkably crisp and clear. With higher resolution than an HDTV, it's stunning. iPad mini is powered by the new A7 chip with 64-bit architecture. A7 delivers killer performance. It is up to four times faster CPU and up to eight times faster graphics performance than the previous generation.

Product Information

Size: **64 GB** | Shape: **Wi-Fi + T-Mobile** | Color: **Space Gray**

Technical Details — Collapse all

Summary

Screen Size	7.9 inches
Screen Resolution	2048 x 1536
Max Screen Resolution	1536 pixels
Processor	1.3 GHz Cortex A7
RAM	1 GB DDR2
Hard Drive	64 GB
Wireless Type	802.11abg
Number of USB 2.0 Ports	1
Number of USB 3.0 Ports	1
Average Battery Life (in hours)	10 hours

Other Technical Details

Brand Name	Apple
Series	Apple iPad mini with Retina Display
Item model number	MF575LL/A
Hardware Platform	PC
Operating System	Apple IOS 7
Item Weight	12 ounces
Item Dimensions L x W x H	7.87 x 5.30 x 0.29 inches
Color	Space Gray
Rear Webcam Resolution	5 MP
Processor Brand	Apple
Processor Count	2
Computer Memory Type	SIMM
Flash Memory Size	64
Hard Drive Interface	Serial ATA
Battery Type	Lithium Polymer (LiPo)
Batteries:	1 Lithium ion batteries required. (included)

DATASHEET

GEOEXPLORER 6000 SERIES
GEOXT HANDHELD

KEY FEATURES

220 channel GNSS receiver
Submeter real-time and 50 cm postprocessed accuracy

Floodlight satellite shadow reduction technology option
More positions and increased accuracy in tough environments

Sunlight readable display
4.2" polarized screen for unmatched clarity in bright sunlight

3.5G modem option
Integrated cellular for Internet connectivity in the field

5 megapixel autofocus camera
Capture high quality photographs and link directly to features

Field swappable battery
More than 8 hours operation on a single charge and swap-and-go battery replacement in the field

A NEW STANDARD FOR PRODUCTIVE GNSS DATA COLLECTION

The Trimble® GeoExplorer® 6000 series takes GNSS productivity to a whole new level. Combining submeter accuracy GNSS, high quality photo capture, wireless Internet, and connectivity options in a single product, the GeoXT™ handheld is the ideal field device for organizations mapping critical assets and infrastructure, or for anyone needing dependable submeter accuracy GNSS data, simple operation, and repeatable results.

Together with the latest field software enhancements and GNSS innovations—including Trimble Floodlight™ satellite shadow reduction technology—the GeoXT handheld is the ideal submeter field solution for any industry, including utility companies, local government organizations, and federal agencies.

Reliable submeter performance

Integrating the latest in Trimble GNSS receiver technology, with the optional ability to track both GPS and GLONASS satellites, the GeoXT handheld delivers consistent submeter accuracy in real time and 50 cm accuracy after postprocessing.

For submeter accuracy, the GeoXT handheld's integrated SBAS receiver can be used to obtain real time corrections such as WAAS, EGNOS, or MSAS, or the GeoXT handheld's built-in Bluetooth® wireless technology can be used to seamlessly connect to a Trimble GeoBeacon™ receiver.

For 50 cm accuracy, data collected with Trimble field software can be postprocessed using the Trimble GPS Pathfinder® Office software or GPS Analyst™ extension for Esri ArcGIS Desktop software. These office processing suites use Trimble DeltaPhase™ technology to achieve 50 cm accuracy for GNSS code measurements after postprocessing, and even higher levels of postprocessed accuracy are possible if GNSS carrier data is logged for extended periods.

Floodlight satellite shadow reduction

Trees and buildings create shadows, limiting the environments where reliable high-accuracy GNSS data collection can be performed. Using the innovative Trimble Floodlight satellite shadow reduction technology, the GeoXT handheld continues to deliver productive, usable positioning data in areas where legacy GNSS receiver systems cannot.

With the optional Floodlight technology option installed, the GeoXT receiver can compute positions even with very weak satellite signals. Floodlight technology increases the number of positions that are gathered in difficult locations, and boosts accuracy in those places where normally only low accuracy data is available. With the GeoXT handheld, field crew can now work with fewer disruptions, meaning better data, faster, at less cost.

Never-seen-before display performance

The GeoXT handheld includes a sunlight-optimized, display designed specifically for outdoor operation. It maintains exceptional clarity in all outdoor conditions, including direct sunlight. Text is crisp and easy to read. Background maps and photos are rich and vibrant. At 4.2" (10.7 cm), the display is also big, so the touch panel is spacious and easy to control.

Work online, anywhere

Internet access in the field gives workers live access to the information they need to make better decisions, faster. Once connected, field workers can collaborate with their office and with each other, even from remote locations.

The GeoXT handheld offers a choice of wireless technology to enable Internet connections directly on the device—including an optional 3.5G cellular modem built into the handheld itself, integrated Wi-Fi, or Bluetooth wireless technology.

Whether connecting to corporate networks, or accessing web-based services such as real-time map data or VRS™ corrections, accessing and updating live information in the field is simple and fast.

Bluetooth technology also enables wireless connection to other external devices such as Bluetooth-enabled laser range finders, barcode scanners or RFID readers.

High quality photo capture

A photograph is often the best way to capture information about an asset, event, or site. The GeoXT handheld includes a 5 megapixel autofocus camera with geo-tagging capability. The camera can be controlled by the TerraSync™ software and other third party applications, so photo capture and linking of images to GIS features is seamless and simple to integrate with existing data capture workflows.

Designed for work

The GeoExplorer 6000 series was designed with a single goal in mind—delivering a high-accuracy handheld GNSS system that works faster, longer, and in more places than any other.

The Lithium-Ion battery provides up to 8 hours of GNSS operation on a single charge, and can be swapped on-the-go without shutting down the device—enabling near-continuous operation and minimizing field worker downtime.

The GeoXT handheld is powered by a super-fast OMAP 3503 series processor and 256 MB RAM. With 2 GB of internal storage and the capacity to add an additional 32 GB via SDHC card, the GeoXT handheld has the capacity and power you need to work with high resolution maps and complex datasets.

The fully ruggedized IP65 construction is designed to withstand the harshest environments. Wherever field workers go, they can take the GeoXT handheld with the confidence that the equipment can handle the toughest conditions.

These smart design features combine with unprecedented accuracy and productivity to deliver the ultimate high performance handheld field solution.

The GeoXT handheld. Designed for work.

Trimble

GEOEXPLORER 6000 SERIES GEOXT HANDHELD

SYSTEM SUMMARY
- Single-frequency GNSS receiver and antenna with Everest™ multipath rejection technology and optional Trimble Floodlight satellite shadow reduction technology
- Sunlight readable 4.2" polarized screen
- Optional integrated 3.5G cellular modem
- Integrated Wi-Fi and Bluetooth wireless technology
- 5 megapixel autofocus camera
- Windows Mobile® 6.5 (Professional edition)
- Rugged and water-resistant design

SIZE AND WEIGHT
Height	234 mm (9.2 in)
Width	99 mm (3.9 in)
Depth	56 mm (2.2 in)
Weight (inc. battery)	925 g (2.0 lb)

GNSS
Receiver	Trimble Maxwell™ 6 GNSS chipset
Channels	220 channels
Systems	GPS, GLONASS[1], SBAS
GPS	L1C/A
GLONASS[1]	L1C/A, L1P
SBAS[2]	WAAS/EGNOS/MSAS
Update rate	1 Hz
Time to first fix	45 s (typical)
NMEA-0183 support	Optional
RTCM support	RTCM2.x/RTCM3.x
CMR support	CMR/CMR+/CMRx

GNSS ACCURACY (HRMS) AFTER CORRECTION[3]
Real-time code corrected	
VRS or local base	75 cm + 1 ppm
SBAS (WAAS/MSAS/EGNOS)	< 1 m
Code postprocessed	50 cm + 1 ppm
Carrier postprocessed[4]	
After 10 minutes	20 cm + 2 ppm
After 20 minutes	10 cm + 2 ppm
After 45 minutes	1 cm + 2 ppm

TEMPERATURE
Operation	–20 °C to +50 °C (–4 °F to 122 °F)
Storage	–30 °C to +70 °C (–22 °F to 158 °F)
Charging	0 °C to +45 °C (32 °F to 113 °F)

MECHANICAL SHOCK
Drop	1.2 m (4 ft) concrete under plywood
Vibration	Method 514.5

ALTITUDE & HUMIDITY RATINGS
Relative humidity	95% non-condensing
Maximum operating altitude	3,658 m (12,000 ft)
Maximum storage altitude	5,000 m (16,400 ft)

INGRESS PROTECTION
Water/Dust	IP65

BATTERY
Type	Rechargeable, removable Li-Ion
Capacity	11.1V 2.5 AH
Charge time	4 hours (typical)

BATTERY RUN TIME[4]
GNSS only	11.5 hours
GNSS & VRS over BT	11 hours
GNSS & VRS over Wi-Fi	10 hours
GNSS & VRS over Cellular modem	8.5 hours
Standby time	50 days

BUTTONS & CONTROLS
- Power key
- Left & right application keys
- Camera key

CONNECTORS & INPUTS
- Internal microphone and speaker
- Mini USB connector
- DE-9 serial via optional USB to serial converter
- External power connector
- SIM socket
- SDHC socket

CAMERA
Still mode	Autofocus 5 MP
Still image format	JPG
Video mode	Up to VGA resolution
Video file format	WMV with audio

CELLULAR[5] & WIRELESS[6]
UMTS/HSDPA	850/900/2100 MHz
GPRS/EDGE	850/900/1800/1900 MHz
Wi-Fi	802.11 b/g
Bluetooth	Version 2.1 + EDR

DISPLAY
Type	Transflective LED-backlit LCD
Size	4.2" (diagonal)
Resolution	480x640
Luminance	280 cd/m²

HARDWARE
Processor	TI OMAP 3503
RAM	256 MB
Flash	2 GB
External storage	SD/SDHC up to 32 GB

LANGUAGES
- English (US), Spanish, French, German, Italian, Portuguese (Brazilian), Chinese (Simplified), Korean, Japanese, Russian

IN THE BOX
- GeoExplorer 6000 series handheld
- Pouch
- Hand strap
- USB data cable
- Rechargeable battery pack
- AC Power adaptor
- Screen protector kit
- Spare stylus & tether
- Documentation

OPTIONAL ACCESSORIES
- Tempest™ external GNSS antenna
- 1.5 m & 5 m external antenna cable
- Range pole kit for external antenna
- Backpack kit for external antenna
- Vehicle mount
- Hard carry case
- TDL 3G cellular modem
- GeoBeacon receiver
- Null modem cable
- USB to serial converter cable

SOFTWARE COMPATIBILITY
- TerraSync™ software
- Trimble GPScorrect™ extension for Esri ArcPad software
- Trimble GPS Controller software
- GNSS Connector software
- GPS Pathfinder® Office software
- Trimble GPS Analyst™ extension for Esri ArcGIS Desktop software
- Third party NMEA-based applications[7]

1 GLONASS tracking is available only if the Trimble Floodlight satellite shadow reduction option is activated.
2 SBAS (Satellite Based Augmentation System). Includes WAAS available in North America only, EGNOS available in Europe only, and MSAS available in Japan only.
3 HRMS refers to Horizontal Root Mean Squared accuracy 1-sigma (68%). Except in conditions where most GNSS signals are affected by trees, or buildings, or other objects. 45 minute carrier postprocessed accuracy is limited to data collected within 10 km of the base station. Except when using VRS corrections, accuracy varies with proximity to base station by +1 ppm for code postprocessing and real-time. Carrier postprocessed accuracy varies with proximity to base station by +2 ppm.
4 Tested by Trimble with default system settings at 21°C ambient. Actual run time will vary with conditions of use
5 3.5G edition handhelds only. The GeoXT 3.5G edition handheld is PTCRB certified and can operate on supported networks that do not require carrier certification. Consult with your local reseller for more information.
6 Bluetooth and Wi-Fi type approvals are country specific. GeoExplorer 6000 series handhelds have Bluetooth and Wi-Fi approval in the U.S. and in most European countries. For further information please consult your local reseller.
7 NMEA output is an optional upgrade.

Specifications subject to change without notice.

bg WI FI CERTIFIED™ Bluetooth®

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Trimble

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store.trimble.com

1200 COLORIMETER
AMMONIA-NITROGEN
CODE 3680-01

QUANTITY	CONTENTS	CODE
30 mL	Ammonia Nitrogen Reagent #1	V-4797-G
3 x 30 mL	*Ammonia Nitrogen Reagent #2	*V-4798-G
1	Pipet, 1 mL, plastic	0354
1	Colorimeter Tubes, with caps	0290-6
1	Water Sample Collecting Bottle	0688
1	1200 Colorimeter for Ammonia Nitrogen	26737

***WARNING:** Reagents marked with an * are considered to be potential health hazards. To view or print a Material Safety Data Sheet (MSDS) for these reagents go to lamotte.com. To obtain a printed copy, contact LaMotte by e-mail, phone or fax.

To order individual reagents or test kit components, use the specified code number.

INTRODUCTION

Ammonia nitrogen is present in various concentrations in many surface and ground water supplies. Any sudden change in the concentration of ammonia nitrogen in a water supply is cause for suspicion. A product of microbiological activity, ammonia nitrogen is sometimes accepted as chemical evidence of pollution when encountered in natural waters.

Ammonia is rapidly oxidized in natural water systems by special bacterial groups that produce nitrite and nitrate. This oxidation requires that dissolved oxygen be available in the water. Ammonia is an additional source of nitrogen as a nutrient which may contribute to the expanded growth of undesirable algae and other forms of plant growth that overload the natural system and cause pollution.

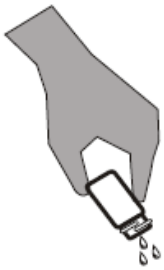
AMMONIA NITROGEN TEST PROCEDURE: NESSLER METHOD

Read the 1200 Colorimeter Manual before proceeding. Carefully wipe tubes dry before inserting into the colorimeter chamber.

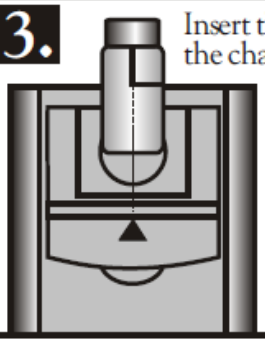
AMMONIA NITROGEN

1. 

Fill the Water Sample Collecting Bottle (0688) with sample water. This will be used to dispense sample water for the tests.

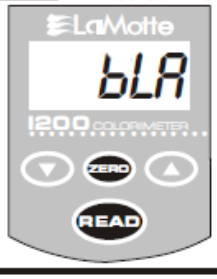
2. 

Rinse and fill a colorimeter tube (0290) to the 10 mL line with sample water. Cap and wipe dry.

3. 

Insert the tube into the chamber, being sure to align the index line with the arrow on the meter. Close the lid. This tube is the blank or zero.

4. Push the **READ** button to turn the meter on. Press the **ZERO** button and hold it for 2 seconds until *BLA* is displayed. Release the buton to take a blank reading (0.0 ppm).



5. 

Remove tube from colorimeter. Add 8 drops of Ammonia Nitrogen Reagent #1 (V-4797). Cap and mix.

6. 

Use 1.0 mL pipet (0354) to add 1.0 mL of *Ammonia Nitrogen Reagent #2 (V-4798).

7. 

Cap and invert to mix. Wait 5 minutes for full color development. Wipe tube dry.

8. Align the index line with the arrow on the meter, insert tube into chamber. Close the lid. Push the **READ** button. Record results as ppm Ammonia Nitrogen (NH_3-N).

NOTE: For the best possible results, carry a reagent blank through the procedure. After scanning the blank in Step 4, perform the test procedure on clear, colorless, distilled or deioized water. Subtract results of regent blank from all subsequent test results.

NOTE: If the reading displays ER2, repeat procedure on diluted sample, and multiply the result by the appropriate dilution factor. See 1200 Colorimeter Instruction Manual for procedure.

CALCULATIONS

To express results as Unionized Ammonia (NH_3):

Unionized Ammonia (NH_3) = ppm Ammonia Nitrogen (NH_3-N) x 1.2

To express results as Ionized Ammonia (NH_4^+):

Ionized Ammonia (NH_4^+) = ppm Ammonia Nitrogen (NH_3-N) x 1.3

Ammonia in water occurs in two forms: toxic unionized ammonia (NH_3) and the relatively non-toxic ionized form, ammonium ion (NH_4^+). This test method measures both forms as ammonia-nitrogen (NH_4-N) to give the total ammonia-nitrogen concentration in water. The actual proportion of each compound depends on temperature, salinity, and pH. A greater concentration of unionized ammonia is present when the pH value and salinity increase.

1. Consult the table below to find the percentage that corresponds to the temperature, pH and salinity of the sample.
2. To express the test result as ppm Unionized Ammonia Nitrogen (NH_3-N), multiply the total ammonia-nitrogen test result by the percentage from the table.
3. To express the test result as ppm Ionized Ammonia Nitrogen (NH_4^+-N), subtract the unionized ammonia-nitrogen determined in Step 2 from the total ammonia nitrogen.

	10°C		15°C		20°C		25°C	
pH	FW[1]	SW[2]	FW	SW	FW	SW	FW	SW
7.0	0.19		0.27		0.40		0.55	
7.1	0.23		0.34		0.50		0.70	
7.2	0.29		0.43		0.63		0.88	
7.3	0.37		0.54		0.79		1.10	
7.4	0.47		0.68		0.99		1.38	
7.5	0.59	0.459	0.85	0.665	1.24	0.963	1.73	1.39
7.6	0.74	0.577	1.07	0.836	1.56	1.21	2.17	1.75
7.7	0.92	0.726	1.35	1.05	1.96	1.52	2.72	2.19
7.8	1.16	0.912	1.69	1.32	2.45	1.90	3.39	2.74
7.9	1.46	1.15	2.12	1.66	3.06	2.39	4.24	3.43
8.0	1.83	1.44	2.65	2.07	3.83	2.98	5.28	4.28
8.1	2.29	1.80	3.32	2.60	4.77	3.73	6.55	5.32
8.2	2.86	2.26	4.14	3.25	5.94	4.65	8.11	6.61
8.3	3.58	2.83	5.16	4.06	7.36	5.78	10.00	8.18
8.4	4.46	3.54	6.41	5.05	9.09	7.17	12.27	10.10
8.5	5.55	4.41	7.98	6.28	11.18	8.87	14.97	12.40

[1]Freshwater data from Trussel (1972).

[2]Seawater values from Bower and Bidwell (1978). Salinity for the Seawater values = 34% at an ionic strength of 0.701 m.

FOR EXAMPLE:

A fresh water sample at 20°C has a pH of 8.5 and the test result is 1.0 ppm as total Ammonia-Nitrogen.

1. The percentage from the table is 11.18% (or 0.1118).
2. 1 ppm total Ammonia-Nitrogen x 0.1118 = 0.1118 ppm Unionized Ammonia-Nitrogen
3.

Total Ammonia-Nitrogen		1.0000 ppm
Unionized Ammonia-Nitrogen	–	0.1118 ppm
Ionized Ammonia-Nitrogen	=	0.8882 ppm

AMMONIA NITROGEN TEST METHOD SPECIFICATIONS

APPLICATION

Drinking , surface, and saline waters; domestic and industrial wastes.

RANGE

0 to 5.0 ppm Ammonia Nitrogen

METHOD

Ammonia forms a colored complex with Nessler's Reagent in proportion to the amount of ammonia present in the sample. Rochelle salt is added to prevent precipitation of calcium or magnesium in undistilled samples.

HANDLING & PRESERVATION

Preservation is accomplished by the addition of 2 mL of concentrated H_2SO_4 at 4°C.

INTERFERENCES

Sample turbidity and color may interfere. Turbidity may be removed by a filtration procedure. Color interference may be eliminated by adjusting the instrument to 100%T with a sample blank.

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