Illicit Discharge Detection and Elimination (IDDE) Program

Prepared for:

City of Mercer Island, Washington

June 2009

R·W·BECK

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Illicit Discharge Detection and Elimination (IDDE) Program

Overview

An illicit discharge is generally any discharge, release, or pumping of a pollutant or polluted water into the stormwater system. The National Pollutant Discharge Elimination System (NPDES) regulates the discharge of stormwater under the authority of the Federal Clean Water Act. Washington State Department of Ecology (Ecology) has the designated authority to administer NPDES within the state of Washington. Under this authority, Ecology has issued NPDES permits regulating the discharge of stormwater. The City of Mercer Island is under the regulation of the Phase II Municipal Stormwater Permit issued on February 16, 2007. The current Phase II permit will remain in effect until February 15, 2012, after which a new Phase II permit will be issued.

The Phase II permit mandates permittees to prepare and implement an Illicit Discharge Detection and Elimination (IDDE) program. This plan and its implementation satisfies this requirement. The goal of this plan is to identify and then eliminate illicit discharges. Examples of illicit discharges include:

- Direct or indirect sanitary wastewater discharges that connect to the storm sewer or watercourse, such as a shop floor drain connected to a storm drain, a cross-connection between the municipal sewer and storm sewer systems, a damaged sanitary sewer line that is leaking sewage into a cracked storm sewer line, or a failing septic system that is leaking into a water course.
- Materials (e.g., used motor oil) that have been dumped illegally into a storm drain catch basin.
- Improper home or business owner activities such as washing paint brushes into a catch basin, washing new textured concrete driveways into a storm drain, draining swimming pools to the storm system (swimming pools have high pH and chlorine), excess use of fertilizers, or washing cars with chemicals that enter the storm drain system.

The NPDES Permit sets forth the minimum elements of the plan which are listed below. These minimum elements are described throughout the remainder of this document.

- Municipal Storm Sewer System Mapping
- Ordinances (that effectively prohibit illicit discharges)
- Detection and Elimination Program
- Public Education
- Staff Training

The City of Mercer Island has unique geologic characteristics that are reflected in the basic structure of its storm sewer system. The island is about 5 miles long and 1 to 2 miles wide with approximately 85 separate watercourses many of which are within ravines that outlet directly into Lake Washington. The piped portions of the storm drain system are relatively short since pipe runs are seldom far from a watercourse or Lake Washington. Typically, several drain systems daylight into each stream ravine such that there a very few pipe systems serving large drainage basins. Consequently, the City defined the watercourse discharges into the lake as “outfalls” for the purpose of this IDDE plan. This was discussed with the Department of Ecology who concurred with this approach.

Municipal Storm Sewer System Mapping

Current Program

The City currently has the following stormwater-related information in their GIS database:

- Storm sewers
- Catch basins and manholes
- Ditches
- Streams (watercourses)
- Outfalls

The current program is compliant with the NPDES permit requirements and is completed in advance of the established February 2011 deadline within the permit. Some of the more specific elements of the program as required by the permit are listed below:

1. A map of all structural BMPs owned, operated, or maintained by the City.
2. For pipe outfalls 24-inch-diameter pipes and watercourse outfalls, a map with the following attributes for each outfall:. tributary conveyances (type, material, and size where known), associated drainage areas, and land use. Although most of the watercourses and pipes have a cross-sectional area less than a 24-inch-diameter pipe, the City has elected to consider and map all of the known pipe outfalls/watercourses.
3. A program to develop and maintain a map of all connections (ditch or pipe) to the City’s storm system allowed or authorized after January 2007.
4. A map of areas of the City that do not discharge stormwater to surface waters. This would be any enclosed depression, isolated wetlands, or large areas relying on infiltration. The City does not have any such areas so this requirement is not applicable.

This data is preferred to be in electronic format with documented mapping standards. The City’s mapping is already in electronic format.

Ordinances

Current Ordinances

Section 15.09.020 of the City's current municipal code prohibits illicit discharges. The section references the fines and penalties that can be levied against violators in accordance with Section 15.09.060.

Recommendations

The City's current code adequately addresses the permit requirements related to the inspection, notification, and progressive enforcement of illicit discharges and connections. However, it is recommended that the code more specifically address prohibited, allowed, and conditional discharges to the City's storm sewer system. Draft language for these changes is currently being reviewed by the City and is anticipated to be adopted by August 2009.

Detection and Elimination Program

Current Resources

The City currently has three staffed programs that fulfill portions of a complete illicit discharge detection and elimination (IDDE) program: Customer Response Team, utility inspections performed by Development Services staff on private development projects, and the right-of-way maintenance program.

The Customer Response Team within the City's maintenance program maintains a hotline that citizens can call during business hours to report a potential illicit discharge. Reference the website and hotline number.

Hotline Phone Numbers:
(206) 275-7608 (daytime)
(425) 587-3400 after hours

Website with Hotline number and information:
http://www.mercergov.org/Page.asp?NavID=602
http://www.mercergov.org/Page.asp?NavID=2575

The hotline representative will then contact the appropriate city department/staff to visit the location of the complaint if appropriate. The Customer Response Team (CRT) will responds to all calls from citizens regarding spills and illicit discharges. If the emergency is a major spill or associated with a hazardous chemical, the Fire Department is notified.

The Development Services staff inspect the stormwater system of new construction to ensure that no cross-connections or illegal connections are installed during construction prior to issuing occupancy certificates.

The right-of-way maintenance program maintains and repairs the stormwater system as needed. By making timely repairs to the existing stormwater system, the likelihood of contaminants entering the stormwater system from the surrounding ground or nearby sanitary sewer pipes is greatly reduced.

Both the development services inspectors and maintenance staff are available to respond to complaints forwarded by the Customer Response Team.

Proactive Investigation

Prioritization Procedures

In addition to maintaining a hotline for citizen complaints, the City is required to pro-actively conduct field assessments to check for illicit discharges and illegal connections to the City's stormwater system and receiving waterbodies.

The first step of this proactive work is to prioritize those areas most likely to contain illicit discharges ("hot spots") based on an analysis of land use and other specific information. Based on previous work, the following types of areas are more likely to generate polluted discharges than others (Center for Watershed Protection & Pitt, 2004):

1. Locations where there have been repeated problems in the past. This could include areas with water quality data or where repeated complaints have been filed.
2. Older areas of a community typically have a higher percentage of illegal connections. Also, deteriorating sewer pipes can allow wastewater to exfiltrate out of the sanitary lines and into the surrounding environment.
3. Commercial and industrial areas tend to have a higher percentage of illicit discharges.
4. Areas with large and/or many storage vessels of hazardous solids or liquids.

Another consideration for the City of Mercer Island is the proximity of the higher risk land uses (commercial/industrial) to receiving waters. These areas will have a short flow path and greater chance of adversely affecting a larger aquatic system in the event of an illicit discharge or spill.

The City may also choose to conduct a qualitative assessment of City's surface waters by walking the streams to identify additional areas of concern. This activity can also be used to ground-truth the outfall map, determine the accessibility of the streams for future monitoring, and provide a photographic record of existing conditions.

By February 2011, the City will need to have conducted field assessments of at least three high priority water bodies (outfalls). Following these assessments, the City is required to annually inspect outfalls within a minimum of one stream system per year. During each "dry weather" inspection, it is expected that field personnel will collect data on the physical conditions at the outfall as well as water samples for lab analysis.

A GIS-based map can be developed of potential hot spots and prioritized water bodies. It is expected that due to internal training of staff and public outreach efforts required by the NPDES permit, the City will develop a better understanding of the causes and locations of illicit discharges. The GIS map (or other tracking tool) can be regularly updated to reflect reports from staff and the public as well as information learned by the on-going field assessment work as the City's IDDE program matures.

Based on the considerations such as those above, the City had already implemented an ongoing monitoring program for several watercourses. Beginning in 1999, the City of Mercer Island contracted with King County Water and Land Resources Division to provide stormwater monitoring in select Mercer Island drainages and assess the effectiveness of drainage basin improvements, as well as in anticipation of the NPDES permitting requirements. The most recent work is documented in the *2006 Annual Report for the City of Mercer Island, Water Quality Monitoring in Five Drainage Basins* (published by King County in 2008).

Five basins were selected for this monitoring program and include Nos. 6, 10, 26, 32b, and 42, although not all basins are sampled each year. Measurements included conventional parameters, nutrients, biological parameters (bacteria and macroinvertebrates), dissolved metals, herbicides, pesticides, and sediment (metals and hydrocarbons). This information provides useful information in terms of evaluating stormwater quality relative to regional stream comparisons, assessing the efficacy of basin improvements, and looking for trends and/or localized water quality concerns.

The City plans to continue monitoring these basins for compliance with the NPDES permit. For future monitoring and assessment under this program the City plans to work with King County to ensure the monitoring procedures and documentation meets the requirements of the permit. The following paragraphs provide some guidance.

General Field Assessment Procedures

The following general recommendations apply to the dry weather field inspection and water sampling work (Cuyahoga County Board of Health, 2006):

1. Notify the public during field work campaigns. Public notices and informational mailers can improve the success of the program by educating the citizenry.
2. Develop training and protocols to keep workers safe during field work.
3. Make good use of the mapping information that has been developed by the City.
4. Fill out a standard field inspection form (see Appendix C)

Physical Parameters

During dry weather field inspections, a variety of physical parameters will be recorded at each site to assess conditions. At flowing outfalls this includes flow, odor, color, turbidity, and presence or absence of floatables. The information that is obtained from the physical characteristics observed are indicators and cannot be fully relied upon by themselves.

A qualitative observation of flow (none, trickle, moderate, or substantial) should be made. Flow rates can be estimated by one of the following simple methods:

a. Record the time required for the full flow to fill container of a known volume.

b. Multiply cross-sectional flow area by flow velocity. For most instances, flow area is based on an estimate of mean depth and width. Flow velocity is based on the time of travel for an object floating near the surface over a known length.

Odor is described by one of the following terms sewage, rancid/sour, petroleum/gas, sulfide, or other. The severity of the odor should also be recorded in the field.

Color can be a description of color type and intensity. It is also a quantitative measurement expressed in cobalt-platinum units (APHA, 1998).

Turbidity can be a qualitative descriptor (clear, slight cloudiness, cloudy, or opaque). Alternatively, it can be measured in the field or in the office with a hand held turbiditimeter. It is recommended that the City use a single make and model of meter to reduce the differences in readings associated solely with equipment readings.

Floatables are the best physical indicator. The most common floatables are sewage, suds, and oil sheens. Floatables do not include trash. The observation of sewage at an outfall location indicates that there is a severe problem with that MS4 and should be looked at as to where the source for the sewage is emanating from. Suds can indicate a variety of things. Some suds are naturally formed by the movement of the water. If the suds are located at a water drop off and break up quickly, this may only be water turbulence related. If the suds have a fragrant odor, this can indicate the presence of laundry water or wash water in the waterbody. Oil sheens need to be looked at to try and determine the source of the oil sheen. Some oil sheens are common and occur naturally by instream processes. This occurs when an iron bacteria forms a sheet-like film. This can be determined by looking at the sheen and seeing if it cracks when disturbed. Synthetic oil sheens, on the other hand, will swirl when disturbed. If this occurs, then the sheen is from an oil source.

The City may select a few water quality parameters that can be measured with inexpensive probes and test strips in the field. These include temperature, pH, ammonia, conductivity, chlorine, and hardness. Other than temperature these same parameters can be assessed during laboratory analyses so the field testing is usually unnecessary.

There may be physical indicators of illicit discharges even if no flow is present. These include: outfall damage, deposits/stains, abnormal vegetation, poor quality of pooled water, benthic growth in pipe.

During a dry weather inspection, observed flows are considered non-stormwater related. The flow may or may not be the result of an illicit discharge. Also, the absence of a flow does not indicate the absence of an illicit discharge since these discharges can be intermittent or transitory. It is important to observe carefully during the dry weather inspection to determine if an intermittent or transitory pollution problem has occurred.

Water Quality Sampling and Testing

During dry weather inspections physical clues indicating a pollution problem often are not observable. Therefore, water quality sampling and testing will be an essential part of the City's IDDE program. Some parameters can be directly measured in the field whereas others require laboratory analysis. The following table lists the parameters that must be sampled as well as suggested/optional parameters to be sampled to isolate an illicit discharge. The table also provides the analytical method and benchmark concentration that typically indicate when there is a problem. Note that these benchmark concentrations are based on samples collected from storm drains nationally. Therefore, benchmark concentrations would be lower for samples drawn from watercourses since the natural base flows would likely dilute any pollutants in water discharged from a contributing storm drainage system.

Water Quality Parameter	Use	Analytical Method	Benchmark Concentrations
Specific conductance	B, I	SM 2510B	>2,000 µs/cm
Hardness	B, I	EPA 130.1/SM 2340B	<10 mg/L or >2,000 mg/L as CaCO3
Turbidity	B, I	SM 2130B	>1,000 NTU
Color	B, I		>500 units
Bacterial counts	S		
Ammonia	R, I	EPA 350.2/SM4500-NH3 C	>50 mg/L
Surfactants (as MBAS)	R, I	EPA 425.1/SM5540C	>0.25 mg/L
pH	B, I	EPA 150.1/SM 4500H	< 5
Temperature	B		
Total chlorine	S		
Fluoride	R	EPA 300.0	0.25 mg/L
Potassium	R, I	EPA 200.7	>20 mg/L
Optical brighteners (florescence)	S		
Toxicity	S	EPA 600/4-90/027F (acute) for Daphnia pulex and Ceriodaphnia dubia	
Dissolved oxygen	S		
Industrial (metals, metalloids, cyanide, oils, grease)	S (for industrial basins)		
Other pollutants-nutrients, pesticides, automotive fluids	S		

Key:
- B = basic parameter to be analyzed at all sites
- R = key parameter to identify source of illicit discharge in a typical residential basin
- S = possible supplemental parameter
- I = key parameter to identify source of illicit discharge from an industrial/commercial area

Immediate Response Procedures

The field crew should be prepared to take immediate action in the event of encountering one of the following situations:

- Individuals actively in the process of introducing possible illegal substances or materials to the storm drain system
- Very strong chemical odor emanating from storm drain system
- Presence of fumes or smoke emanating from storm drain system
- Visible significant stream of a controlled chemical or petroleum product flowing in storm system or downstream waters
- Large chemical plume in stream or lake downstream of a City outfall
- Any condition that poses or could pose an immediate threat to property, human health or safety, or aquatic life.

The crew should take the following steps if one of the above situations is encountered:

1. Ensure crew safety and the public by instructing people to stay clear of the area.
2. Call 911 to report active illegal dumping or potential fire or significant chemical incident.
3. Call the City’s customer response team at 206-275-7608 to report a possible illegal discharge.
4. The following offices must all be called if an unauthorized discharge of oil or hazardous material such as a spill has occurred:
    a. The National Response Center at 1-800-424-8802;
    b. Washington Emergency Management Division at 1-800-OILS-911; and
    c. Washington State Department of Ecology—Northwest Office at 1-425-649-7000.
5. If a spill is encountered the following information should be recorded if possible:
    a. Where is the spill?
    b. What spilled?
    c. How much spilled?
    d. How concentrated is the spilled material?
    e. Who spilled the material?
    f. Is anyone cleaning up the spill?
    g. Are there resource damages (e.g. dead fish or oiled birds)?
    h. Who is reporting the spill?
    i. Your contact information?

6. If possible isolate or contain visible chemical pollution in the effected waterbody with any materials that are accessible. For small discharges earth dams, absorbent pads, and containers may be useful to contain part of the illicit discharge.
7. Take detailed notes and photos/video for subsequent investigation by City or other agencies.

At a minimum, follow-up work includes contacting the Washington State Department of Ecology—Northwest Office (see phone number above) to determine if any additional reporting or investigative actions are necessary.

For incidents not determined to be emergencies, the City should investigate or refer to the appropriate agency any complaints, reports, or monitoring information that indicates a potential illicit discharge, spill, or illegal dumping.

Isolating Illicit Discharges (Source Tracing)

The City's current hotline will continue to be an effective tool for locating illicit discharges. However, in situations where outfall screening identifies an illicit discharge several methods can be used to trace to the source of the illicit discharge. Tracing techniques include visual inspections of drainage structures and lines, dye testing, damming lines to isolate areas, video inspection, indicator monitoring, smoke testing, and optical brightener monitoring traps. Other more elaborate approaches include using remote sensing tools to identify soil moisture, water temperature, and vegetation anomalies associated with failing septic systems and tracking illegal dumping activities. The most common approach for the City will likely rely upon visual inspections of the catch basins in the storm line above the outfall in which an illicit discharge is suspected.

Several resources exist to assist in evaluating the likely source of an illicit discharge. Generally, the sources are washwater, sanitary sewer or septage, potable water leak, animal contamination, illegal dumping, or industrial discharge.

Investigation and Response Procedures

Once an illicit discharge or illegal connection has been located, details about the discharge connection should be documented. Photographs and video may be helpful to record the location and nature of an illicit connection. The City should determine the name and contact information of property owner.

The response by the City will vary greatly depending on the type, location, frequency, severity, and source of illicit discharge. In general, the City will have several options available to address a specific discharge. In most cases where the violator is identified it is expected that they will voluntarily comply with any action required by the City to eliminate the potential for further illicit discharges. When the violation is the result on an illegal connection from a building, the property owner should respond once they are made aware of the connection, the environmental consequences, the applicable regulations, and the recommended remedy.

The City will prepare a letter to be sent to the property owner for any illicit discharge or illegal connection. Depending on the circumstances the letter will describe the findings of the investigation, the required remedy, the required deadline for compliance, technical resources, and the enforcement actions, fines, and legal actions that could ensue for non-compliance. The letter should also describe the relevant codes and laws. The letter should specify who the property owner should contact for additional information and to notify the City when the required remedy has been completed.

The City will conduct a follow-up inspection following notification that the required remedy has been completed.

Should the owner not remedy the discharge, the City may proceed to abate the violation as a public nuisance (following 30 days of certified notice as defined in Chapter 15.09.080 - Administration) as well as to seek equitable payment to make this remedy.

Public Education

Public Information

As part of the City's public outreach program, outreach material in print form will be made available to citizens. The education campaign will also rely upon the City's website (http://www.mercergov.org/), brochures, print ads, and/or fact sheets to make citizens aware of storm water, water pollution, and inform them of the City's hotline for reporting on possible illegal dumping, connections, or discharges. The best clearinghouse of sample outreach materials is found at the following website of the U.S. Environmental Protection Agency: http://www.epa.gov/owow/nps/toolbox/index.htm.

Hotline

The City has established a customer phone number for reporting of spills or illicit discharges. It is operated during the work week at 206-275-7608 and (425) 587-3400 after hours.

Reporting and Recordkeeping

Tracking (Spills, Inspections, and Public Comment/Feedback)

Tracking and documentation is a required part of the IDDE program (section S5C3e). Spills reported to the complaint hotline will be recorded on an "Illicit Discharge Hotline Incident Tracking Sheet" (Appendix D) Field personnel who discover or are involved in a spill will contact the complaint hotline to ensure that proper documentation of the incident is maintained. A work order will be created in WebWorks and utilized to track all IDDE activities.

IDDE inspections will be recorded on field forms (see Appendix C). Investigative, corrective, and enforcement actions will be recorded on forms provided in Appendix A.

Public comment/feedback will be conveyed to the IDDE program manager (Bill Sansbury) to ensure that the program is responsive to citizen complaints. The public will be directed to either the program manager directly or the hotline if they have general comments they would like to make on the City's IDDE program.

Staff Training

Training Lead

For those staff responsible for implementing the IDDE program, on the job training will be managed by the City's IDDE program manager, Bill Sansbury. He will manage and assign training as described below and shown in the Training Summary Table below.

Detailed Training

Detailed draining will be assigned to those individuals specifically involved in the immediate response procedures, source tracking of potential illicit discharges and sampling.

Note that the City may elect to retain consultants for source tracking of potential illicit discharges and sampling. In the years that consultants are used, the training may be waived.

General Training

General training will be via printed material distributed to staff at staff meetings. DVD, print or webcast material may be distributed if the need arises as the program develops.

Preliminary training activities, a schedule and identification of those to receive training are listed in the following table.

Training Topic	Attendees	Estimated Number of Staff	Training Type and Frequency	Description
Illicit Discharge Detection and Elimination—program field staff	Any staff responsible for assessing outfalls	2	In-field training	This training is for staff that will be responsible for field assessment of outfalls.
Illicit Discharge Detection and Elimination—general information	All field staff	20	Webcast or informational brochure	This training will explain the IDDE program. Included will be information on how to identify and report suspected illicit discharges.

References

The following references were used to prepare this plan and contain supplemental information that may be helpful to City staff.

1. ***IDDE Program Manuals:***

Center for Watershed Protection and Robert Pitt. Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments. October 2004. U.S Environmental Protection Agency. Washington, D.C.

Website for download:
http://www.cwp.org/Resource_Library/Controlling_Runoff_and_Discharges/idde.htm

Cuyahoga County Board of Health. Illicit Discharge Detection and Elimination Manual: A Guidance Manual for Municipalities in the State of Ohio. July 2006. Parma, Ohio.

Website for download:

http://www.ccbh.net/ccbh/export/sites/default/CCBH/pdf/stormwater/IDDE_Manual_July_2006_2.pdf

New England Interstate Water Pollution Control Commission. Illicit Discharge Detection and Elimination: A Handbook for Municipalities. January 2003. Lowell, Massachusetts

Website for download:
www.neiwpcc.org

San Diego Stormwater Copermittees Jurisdictional Urban Runoff Management Program (URMP). Illicit Connection / Illicit Discharge (IC/ID) Detection and Elimination Model Program Guidance. November 13, 2001.

Website for download (sponsored by Project Clean Water):
http://www.projectcleanwater.org/pdf/Model%20Program%20ICID.pdf

2. ***Websites for downloading outreach materials:***

Sponsored by North Central Texas Council of Goverments:
http://www.nctcog.org/envir/SEEclean/stormwater/pubs/brochures.asp

Sponsored by U.S. Environmental Protection Agency's Office of Water:
http://www.epa.gov/owow/nps/toolbox/

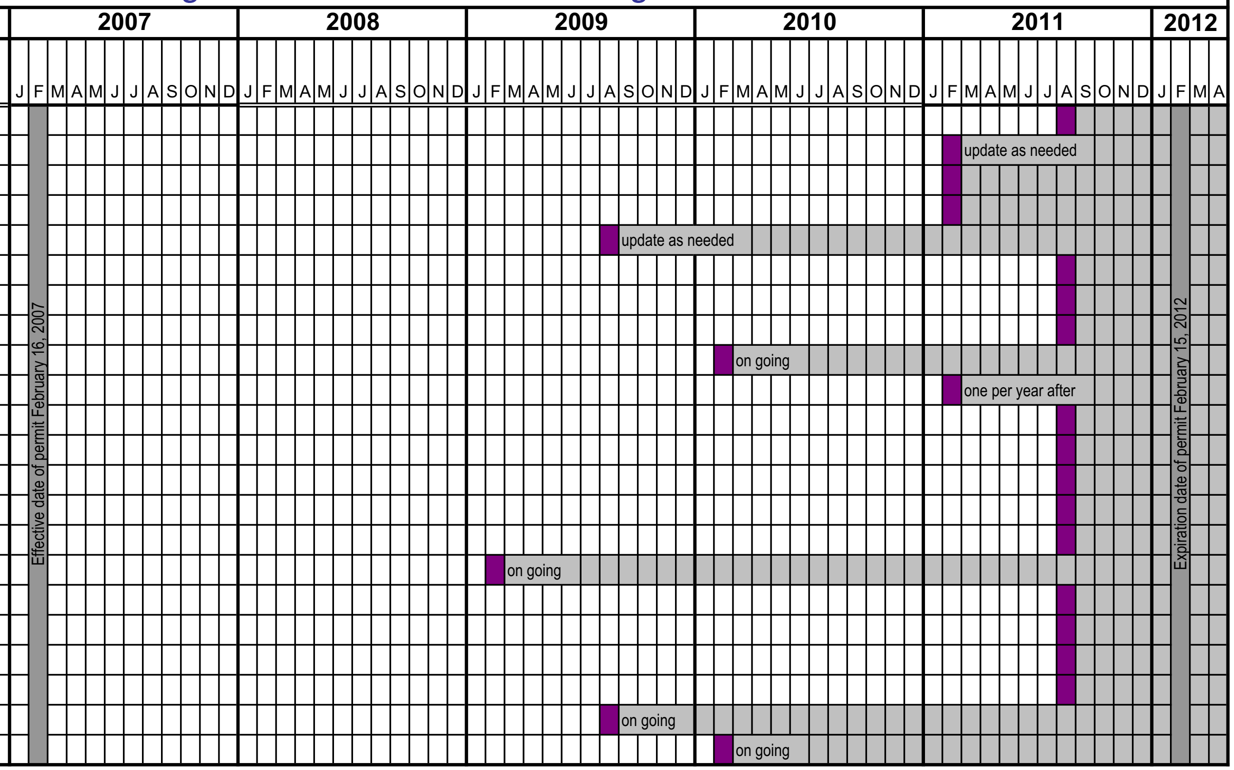
Appendix A
Permit Compliance Schedule

WESTERN WASHINGTON PHASE II MUNICIPAL STORMWATER PERMIT IMPLEMENTATION SCHEDULE

Illicit Discharge Detection and Elimination Program

as of January 2009

CHAPTER S5	SECTION C3	LINE	
			Illicit Discharge Detection and Elimination
		a.	Develop Stormwater Mapping System
		a.i	Map outfalls, receiving waters, & structural BMPs
		a.iii	Map systems that do not drain to surface water
		b.	Discharge Regulatory Mechanism / Ordinance
		c.	Non-stormwater Discharge Program
		c.ii	Identify possible discharge areas
		c.ii	Implement field assessment activities
		c.ii	Prioritize Receiving Waters for inspection
		c.ii	Assessment of 3 High Priority Receiving Waters
		c.iii	Procedures for characterizing nature of discharge
		c.iv	Procedures for tracing IDDE program
		c.v	Procedures for removing discharge source
		d	Inform public on hazards of illegal discharges
		d.i	Distribute info on Illegal Discharges to Public
		d.ii	Illicit Discharge Hotline / Public Reporting
		e.	track number & type of spills
		e.	track number & type of illicit discharges
		e.	track number of inspections for illicit connections
		e.	feedback form illicit discharge education efforts
		f.i	Field Staff Training (Illicit Discharge)
		f.ii	Ongoing Training Program / Documentation



Appendix B
Dry Weather Monitoring Sampling Manual

DRY WEATHER MONITORING SAMPLING MANUAL

1. *Dry Weather Monitoring Field Equipment Checklist*

The field equipment listed below is used to conduct dry weather monitoring.

- Clipboard, pens, pencils, Sharpie or other waterproof pens
- MS4 maps, Thomas Guide
- Digital camera
- Field notebook
- Latex gloves
- Protective eyeglasses or goggles
- Rubber boots
- Cooler and ice
- Paper towels
- Tape for securing cooler
- Sample bottles with preservatives
- Polypropylene bucket with rope, or sampling rod to collect samples from larger bodies of water
- Portable field test kits, colorimeters, or spectrophotometer and all reagents for these meters.
- Multi-parameter or individual probes to measure temperature, electrical conductivity, and pH
- Extra batteries for all meters
- Flow measurement equipment (required equipment will depend on method used)
    - Measuring tape for measuring stream width
    - Folding scale for measuring stream depth
    - Current meter or wristwatch
- De-ionized or ultra pure water in squeeze bottles for rinsing, dilutions, etc. (depending on methods used)
- Thermometer for measuring air temperature (optional)
- Waste disposal bottles
- Boat (for sampling lagoon sites)

2. *Sampling Procedures and Submission*

Dry weather monitoring typically involves the collection of *grab* samples only. The following procedures apply:

1. Use appropriate containers. See 40 CFR Part 136 for container types. Laboratories routinely provide pre-cleaned sample bottles with preservatives already added.

    a. Rinse the container with the sample at least twice. Do not rinse pre-cleaned, preserved containers, as the preservative will be lost.

    b. Use the proper preservatives. Use only analytical or higher grade reagents for preserving samples. Store samples in an ice chest at 4^{o} C until custody is transferred to the analytical laboratory directly or via contracted courier.

c. Avoid contaminating the sample. Wear latex gloves.

2. If practical, collect the sample at about 60% of the stream depth (from the surface) in an area of maximum turbulence (except when sampling for volatile organics). Avoid stagnant pools near the edge of flowing streams unless sampling stagnant pools. Enter the channel downstream of the sampling location and move upstream, disturbing as little of the bottom material as possible.

3. Record all qualitative observations and field testing results on the field data sheet. Estimate the flow rate as described on the back of the field data sheet. Also note any changes to standard procedures (for whatever reason), and describe any unusual or noteworthy conditions or results in detail on the bottom of the sheet.

4. Dispose of all spent reagents, reacted samples, and rinse solutions in the appropriate waste containers. Upon returning to the office or laboratory, decant these wastes into the sewer system of the office or laboratory unless otherwise instructed by the sewering agency. Be sure to clean all equipment (recheck calibration if any results were questionable), and restock reagents (if necessary).

5. If filtering samples in the field for dissolved trace metals analysis, do not preserve with HNO_3 until after the sample is filtered. If field personnel are submitting unfiltered samples for dissolved trace metals analysis those samples should not be preserved with HNO_3.

6. Samples collected for laboratory analysis should be submitted to the laboratory as soon as possible after collection. Complete the following tasks:

    1. Fill out the chain-of custody form making sure that all sample bottles are correctly labeled
    2. Carefully pack the sample bottles in the cooler
    3. Transport the samples to the laboratory
    4. Complete the chain-of-custody form

Automatic sampling methods may be useful during some source identification or enforcement investigations. Investigators should refer to the manufacturer's instructions for operating automatic sampling equipment.

3. Equipment Maintenance

In order to ensure the quality of field results, maintenance of equipment must be given a high priority. All equipment must be cleaned and serviced at the end of a field shift.

1. All water quality meters must be calibrated in the laboratory or office before field use. Calibration solutions should remain uncontaminated and not be used after their expiration dates.

2. Field meters and cameras must be in proper working order. Make sure that batteries have sufficient voltage to power the equipment for the entire field trip. Recharge or

replace them as necessary. Keep extra batteries in the instrument case. Probes should be inspected, cleaned and reconditioned regularly.

3. Clean and rinse all other sampling equipment after returning from the field. Store clean equipment in clear polyethylene bags or storage cases.

4. Glassware used in the field (e.g. graduated cylinders for sample dilutions, test kit flasks and/ or beakers) should be cleaned immediately after usage. Use laboratory detergent, a brush, and hot tap water or 10% Analytical Grade HCl. Rinse three to four times with deionized water and wipe the outside of the glassware dry with a white paper towel. Dry in an inverted position. Store the dry glassware in the cabinets with stoppers intact (volumetric flasks) or in an inverted position (beakers).

4. Quality Control/ Quality Assurance

QA samples can be in the form of replicates, spikes, field blanks, method blanks, or synthetic samples. Dry weather monitoring programs can use these various types of QA/ QC samples to assess the accuracy and precision of the field and laboratory analyses performed for their dry weather monitoring programs.

1. Replicate samples can be collected periodically and submitted to the analytical laboratory to assess the accuracy of the field analyses for nitrate, ammonia, phosphate, electrical conductivity, pH, and turbidity.

2. Replicate samples are used to assess laboratory or field precision. They should be collected in the field in one container and split into two samples for analysis.

3. Spiked samples can be prepared in the field or the permittee's laboratory/ office. A field sample is spiked with known amounts of analytes and the total volume of this fraction is adjusted to a specific volume (usually 1 liter) using a portion of the original sample as makeup water. *Make sure that the volume of the added spike is small compared to the volume of the sample to which it is added.*

4. Blank samples must be prepared with deionized or ultrapure water (resistivity greater than 17 mega ohms). A trip blank is prepared by filling a sample container in the laboratory/ office and transporting it on a routine monitoring assignment, preserving it in the field (noting the station location), and submitting it with a normal batch of samples.

   Method or equipment blanks are prepared using the same methods used to collect, process, or contain samples before submittal to the laboratory. An example of an equipment blank would be pouring deionized water into a sample container to test the cleanliness of the container.

5. Synthetic samples can be prepared using aliquots of commercially prepared standards or from EPA quality assurance ampules. Deionized water should be used as makeup water and analytical grade NaCl should be used to adjust the electrical conductivity of the QA sample into the range of the environmental samples.

5. *Health and Safety*

Dry weather water sampling may occur when the sampling environment and discharges create hazardous conditions. Use safety precautions at all times when conducting dry weather monitoring.

Safety Guidelines

- Keep a first aid kit with field equipment.
- Watch out for traffic along the access road when sampling or making observations.
- Do NOT remain in open areas or stand under trees if lightning is occurring in the vicinity.
- Watch your step; the ground may be wet and slippery, steep, or unstable. Do not attempt to climb down unsafe slopes.
- Always wear clean latex rubber gloves when sampling.
- Protect eyes and skin against contact with acids and other preservatives.
- Use common sense when deciding whether to sample during adverse weather conditions. *This program is intended to assess dry weather conditions.* Do not sample during dangerous conditions such as high winds, lightning storms, or flooding conditions that might be unsafe.
- Do not enter channels during periods of high flow. The general rule of thumb is: If the product of the water depth in feet and the velocity in feet per second is greater than 10, or the level is above your waist, don't go in.
- Do not enter confined spaces
- Follow all analytical procedures as prescribed in the equipment manuals. Heed all warnings and precautionary statements.
- Be familiar with Material Safety Data Sheets for all chemicals used in the field and when calibrating instruments. Know the health hazards and emergency medical treatments, and follow proper disposal instructions.

Safety Equipment

The following safety equipment is recommended for use during dry weather sampling:

- First aid kit
- Safety glasses
- Latex gloves
- Rubber boots
- Safety rope

Table 1: Summary of Laboratory Sampling and Analysis Requirements

Physical and Inorganic Non-Metals	Analytical Method	Container	Volume (mL)	Preservative (Always @ 4o C)	Holding Time
TDS	SM 2540C	P	100		7 d
TSS	SM 2540D	P	100		7 d
Turbidity	SM 2130A	P	100		48 h
Alkalinity or Hardness	SM 2320B	P	100		14 d
pH	EPA 150.1	P	10		Field
Conductivity	SM2510B	P	20		28 d
Temperature		N/A			Field
Phosphorous, total	SM4500PE	P	100	H_2SO_4	28 d
Phosphorous, dissolved / reactive	SM4500PE	P	100	H_2SO_4	48 h
Nitrate	SM 4500 NO3 E	P	100		48 h
Nitrite	SM 4500 NO2 B	P	100		48 h
TKN	EPA 351.1	P	200		28 d
Ammonia	SM4500 NH3 D	P	500	H_2SO_4	28 d
BOD	EPA 405.1	P	1000		48 h
COD	EPA 410.4	P	10	H_2SO_4	28 d
Chlorine, Residual	SM4500 Cl G	N/A			Field
Organics					
*Petroleum Hydrocarbons, total (d + g)	EPA 8015	G + 2V	250 + 40 (2)	HCl	14 d
Oil and Grease	EPA 413.1	G	500	HCl	14 d
Diazinon	EPA 8140	G	1000		7 d
Chlorpyrifos	EPA 8140				
Methylene Blue Substances (MBAS)	SM 5540 C	P	250		48 h
Organochlorine Pesticides and PCBs	EPA 8081, 8082	G	1000		7 d
*Volatile Organic Compounds	EPA 8260	2V	40 (2)	HCl	14 d
Semivolatile Organic Compounds	EPA 8270	G	1000		7 d
Metals / Toxics					
Antimony	EPA 6010	P	500	HNO_3	6 m
Arsenic	EPA 6020	P			
Cadmium	EPA 6010	P			
Chromium	EPA 6010	P			
Copper	EPA 6010	P			
Lead	EPA 6010	P			
Nickel	EPA 6010	P			
Zinc	EPA 6010	P			
Thallium	EPA 7470	P			
Silver	EPA 6020	P			
Mercury	EPA 6010	P			28 d
Cyanide	SM 4500 CN C	P	500	NaOH	14 d
Phenols (from SVOC's)	EPA 8270	G	1000		7 d
Bacteriological (including dilutions)					
Coliform, total	SM 9221	P (sterile)	125	$Na_2S_2O_3$	6 h
Coliform, fecal	SM 9221	P (sterile)			
Coliform, *E Coli*		P (sterile)	125		
Enterococcus	SM 9230	P (sterile)	125		
Streptococcus	SM 9230	P (sterile)			

*ZHS (Zero Head Space Required)   V=VOA / G=Amber Glass / P=Plastic

Appendix C
Outfall Reconnaissance Inventory/ Sample Collection Field Sheet

OUTFALL RECONNAISSANCE INVENTORY/ SAMPLE COLLECTION FIELD SHEET

Section 1: Background Data

Subwatershed:		Outfall ID:	
Today's date:		Time (Military):	
Investigators:		Form completed by:	
Temperature (°F):	Rainfall (in.): Last 24 hours: Last 48 hours:		
Latitutde:	Longitude:	GPS Unit:	GPS LMK #:
Camera:		Photo #s:	

Land Use in Drainage Area (Check all that apply):

☐ Industrial
☐ Ultra-Urban Residential
☐ Suburban Residential
☐ Commercial
☐ Open Space
☐ Institutional
Other: ____
Known Industries: ____

Notes (e.g.., origin of outfall, if known):

Section 2: Outfall Description

LOCATION	MATERIAL	SHAPE		DIMENSIONS (IN.)	SUBMERGED
☐ **Closed Pipe**	☐ RCP ☐ CMP ☐ PVC ☐ HDPE ☐ Steel ☐ Other: __________	☐ Circular ☐ Eliptical ☐ Box ☐ Other: _____	☐ Single ☐ Double ☐ Triple ☐ Other: _____	Diameter/Dimensions: ______________________	In Water: ☐ No ☐ Partially ☐ Fully With Sediment: ☐ No ☐ Partially ☐ Fully
☐ **Open drainage**	☐ Concrete ☐ Earthen ☐ rip-rap ☐ Other: _____	☐ Trapezoid ☐ Parabolic ☐ Other: _____		Depth: _____ Top Width: _____ Bottom Width: _____	
☐ **In-Stream**	**(applicable when collecting samples)**				
Flow Present?	☐ Yes ☐ No ***If No, Skip to Section 5***				
Flow Description (If present)	☐ Trickle ☐ Moderate ☐ Substantial				

Section 3: Quantitative Characterization

FIELD DATA FOR FLOWING OUTFALLS				
PARAMETER		**RESULT**	**UNIT**	**EQUIPMENT**
☐Flow #1	Volume		Liter	Bottle
	Time to fill		Sec	
☐Flow #2	Flow depth		In	Tape measure
	Flow width	_____' _____"	Ft, In	Tape measure
	Measured length	_____' _____"	Ft, In	Tape measure
	Time of travel		S	Stop watch
Temperature			°F	Thermometer
pH			pH Units	Test strip/Probe
Ammonia			mg/L	Test strip

Outfall Reconnaissance Inventory Field Sheet

Section 4: Physical Indicators for Flowing Outfalls Only

Are Any Physical Indicators Present in the flow? ☐ Yes ☐ No *(If No, Skip to Section 5)*

INDICATOR	CHECK if Present	DESCRIPTION	RELATIVE SEVERITY INDEX (1-3)		
Odor	☐	☐ Sewage ☐ Rancid/sour ☐ Petroleum/gas ☐ Sulfide ☐ Other:	☐ 1 – Faint	☐ 2 – Easily detected	☐ 3 – Noticeable from a distance
Color	☐	☐ Clear ☐ Brown ☐ Gray ☐ Yellow ☐ Green ☐ Orange ☐ Red ☐Other:	☐ 1 – Faint colors in sample bottle	☐ 2 – Clearly visible in sample bottle	☐ 3 – Clearly visible in outfall flow
Turbidity	☐	See severity	☐ 1 – Slight cloudiness	☐ 2 – Cloudy	☐ 3 – Opaque
Floatables -Does Not Include Trash!!	☐	☐ Sewage (Toilet Paper, etc.) ☐ Suds ☐ Petroleum (oil sheen) ☐ Other:	☐ 1 – Few/slight; origin not obvious	☐ 2 – Some; indications of origin (e.g., possible suds or oil sheen)	☐ 3 - Some; origin clear (e.g., obvious oil sheen, suds, or floating sanitary materials)

Section 5: Physical Indicators for Both Flowing and Non-Flowing Outfalls

Are physical indicators that are not related to flow present? ☐ Yes ☐ No *(If No, Skip to Section 6)*

INDICATOR	CHECK if Present	DESCRIPTION	COMMENTS
Outfall Damage	☐	☐ Spalling, Cracking or Chipping ☐ Peeling Paint ☐ Corrosion	
Deposits/Stains	☐	☐ Oily ☐ Flow Line ☐ Paint ☐ Other:	
Abnormal Vegetation	☐	☐ Excessive ☐ Inhibited	
Poor pool quality	☐	☐ Odors ☐ Colors ☐ Floatables ☐ Oil Sheen ☐ Suds ☐ Excessive Algae ☐ Other:	
Pipe benthic growth	☐	☐ Brown ☐ Orange ☐ Green ☐ Other:	

Section 6: Overall Outfall Characterization

☐ Unlikely ☐ Potential (presence of two or more indicators) ☐ Suspect (one or more indicators with a severity of 3) ☐ Obvious

Section 7: Data Collection

1.	Sample for the lab?	☐ Yes	☐ No	
2.	If yes, collected from:	☐ Flow	☐ Pool	
3.	Intermittent flow trap set?	☐ Yes	☐ No	If Yes, type: ☐ OBM ☐ Caulk dam

Section 8: Any Non-Illicit Discharge Concerns (e.g., trash or needed infrastructure repairs)?

Calculating the Area (a) of the Cross Section of a Circular Pipe Flowing Partially Full

D = Depth of water a = area of water in partially filled pipe
d = diameter of the pipe Ta = Tabulated Value Then a = Ta*d2

D/d	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0013	0.0037	0.0069	0.0105	0.0147	0.0192	0.0242	0.0294	0.0350
0.1	0.0409	0.0470	0.0534	0.0600	0.0668	0.0739	0.0817	0.0885	0.0951	0.1039
0.2	0.1118	0.1199	0.1281	0.1365	0.1440	0.1535	0.1623	0.1711	0.1800	0.1890
0.3	0.1982	0.2074	0.2187	0.2280	0.2355	0.2450	0.2540	0.2642	0.2780	0.2836
0.4	0.2934	0.3032	0.3130	0.3220	0.3328	0.3428	0.3527	0.3627	0.3727	0.3827
0.5	0.3980	0.4030	0.4130	0.4230	0.4330	0.4430	0.4520	0.4620	0.4720	0.4820
0.6	0.4920	0.5020	0.5120	0.5210	0.5310	0.5400	0.5500	0.5590	0.5690	0.5780
0.7	0.5870	0.5960	0.6050	0.6140	0.6230	0.6320	0.6400	0.6490	0.6570	0.6660
0.8	0.6740	0.6810	0.6890	0.6970	0.7040	0.7120	0.7190	0.7250	0.7320	0.7360
0.9	0.7450	0.7500	0.7560	0.7610	0.7660	0.7710	0.7750	0.7790	0.7820	0.7840

AREA x VELOCITY

(CREEK/CHANNEL METHOD)

a. Measure the width, depth, and velocity of the water.

b. Convert each value to a common unit (i.e. all measurements converted to cm, ft, or in.).

c. Multiply the width * depth * velocity to determine flow.

d. Multiply the flow by 0.8 for creek measurements –or-- 0.9 for concrete channel measurements to account for channel roughness.

e. The results if measured in

- Ft = Ft^3/sec
- cm = cm^3/sec (mL/sec)
- in = in^3/sec

f. Convert to desired value.

TIME REQUIRED TO FILL A KNOWN VOLUME

(FILL A BOTTLE METHOD)

1. Determine volume/capacity of the sample bottle.
2. Measure time required to fill the bottle.
3. Flow will be determined by initial volume units:
   - mL/s
   - oz/s
4. Convert to desired value.

AREA x VELOCITY

(PARTIALLY FILLED PIPE)

a. All measurement must be converted to a common unit before calculation (ft, in, or cm).

b. Let D = water depth.

c. Let d = *inside* pipe diameter

d. Calculate D/d.

e. Find the tabulated (Ta) value on the partially filled pipe formula chart above using the D/d value. (i.e. if D/d = 0.263 then Ta =.1623).

f. Find the area using the formula $a = Ta*d^2$.

g. Multiply area (a) by the water velocity.

h. Convert to desired value.

Appendix D
Illicit Discharge Hotline Incident Tracking Sheet

Illicit Discharge Hotline Incident Tracking Sheet

Incident ID:

Responder Information *(for hotline incidents only)*	
Call taken by:	Call date:
Call time:	
Reporter Information	
Incident time:	Incident date:
	Precipitation (inches) in past 24-48 hrs:
Caller contact information (*optional*):	

Incident Location *(complete one or more below)*

Latitude and longitude:

Stream address or outfall #:

Closest street address:

Nearby landmark:

Primary Location Description	**Secondary Location Description:**		
☐ Stream corridor *(In or adjacent to stream)*	☐ Outfall	☐ In-stream flow	☐ Along banks
☐ Upland area *(Land not adjacent to stream)*	☐ Near storm drain	☐ Near other water source (storm water pond, wetland, etc.):	

Narrative description of location:

Upland Problem Indicator Description

☐ Dumping	☐ Oil/solvents/chemicals	☐ Sewage
☐ Wash water, suds, etc.	☐ Other: ______________________________	

Stream Corridor Problem Indicator Description

Odor	☐ None	☐ Sewage	☐ Rancid/Sour	☐ Petroleum (gas)
	☐ Sulfide (rotten eggs); natural gas	☐ Other: Describe in "Narrative" section		
Appearance	☐ "Normal"	☐ Oil sheen	☐ Cloudy	☐ Suds
	☐ Other: Describe in "Narrative" section			
Floatables	☐ None:	☐ Sewage (toilet paper, etc)	☐ Algae	☐ Dead fish
	☐ Other: Describe in "Narrative" section			

Narrative description of problem indicators:

Suspected Violator (name, personal or vehicle description, license plate #, etc.):

Investigation Notes	
Initial investigation date:	Investigators:
☐ No investigation made	Reason:
☐ Referred to different department/agency:	Department/Agency:
☐ Investigated: No action necessary	
☐ Investigated: Requires action	Description of actions:
Hours between call and investigation:	
Notification and Enforcement Actions (if any):	
Date case closed:	
Notes:	

Appendix E
City Stormwater System Map

R·W·BECK

0 275 550 1,100 1,650 2,200
Feet

N

Lambert Conformal Conic Projection

Washington Stateplane NAD 1983 Coordinate System

Legend

Storm Control Structures

- Detention Control Structure
- High Flow Control Structure
- Private Outfall

Major Roads

- Arterial
- Freeway

Discharge Point

- DryWell
- Infiltration
- LevelSpreader
- Outfall
- Unknown

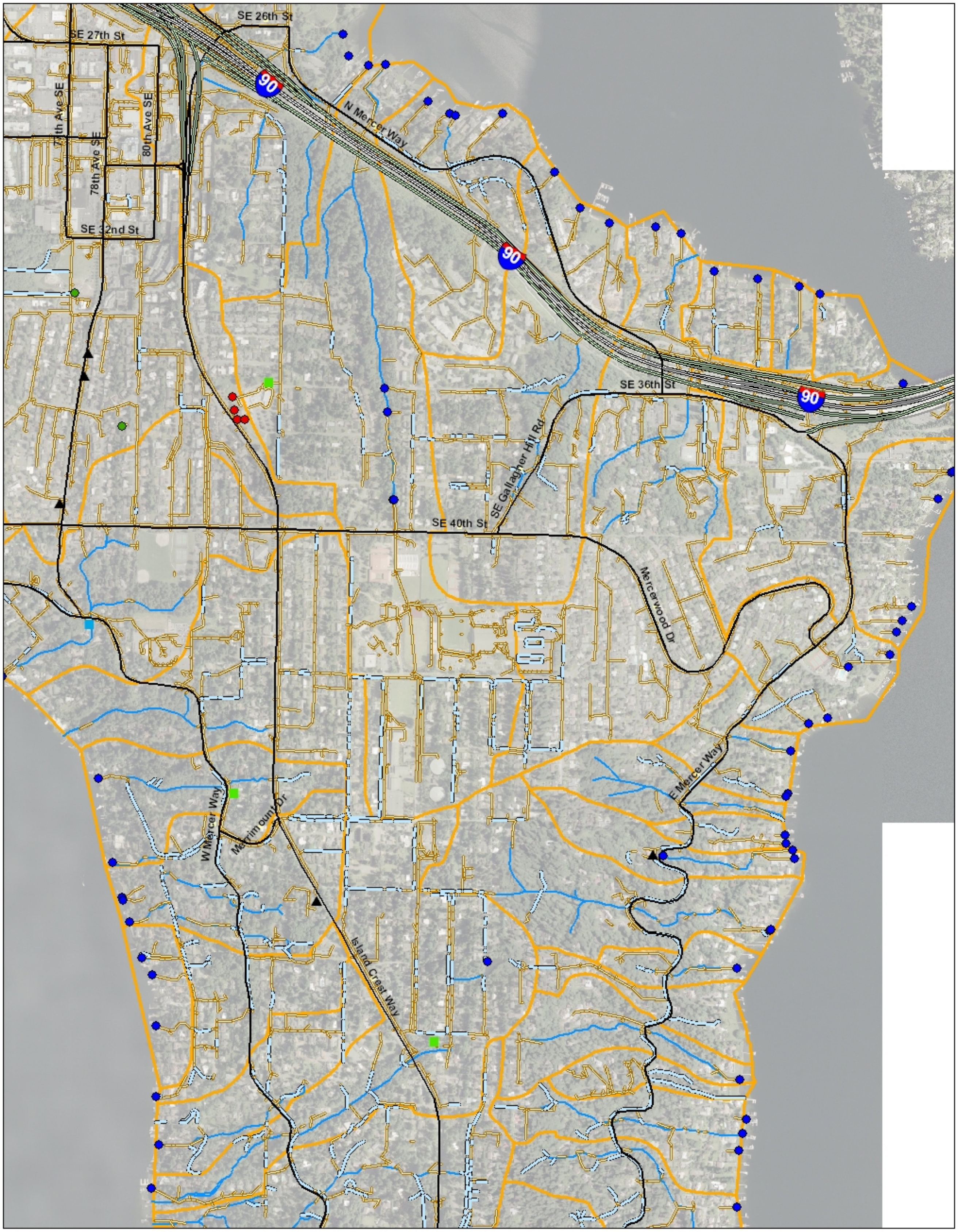
- Ditch
- StormPipe
- Streams
- Stream Basin Boundary

Mercer Island, WA
Northwest Map

Project **NPDES (Phase II) Implementation Assistance**

Client **City of Mercer Island**

R·W·BECK



0 275 550 1,100 1,650 2,200 Feet

N

Lambert Conformal Conic Projection

Washington Stateplane NAD 1983 Coordinate System

Legend

Storm Control Structures

- Detention Control Structure
- High Flow Control Structure
- Private Outfall

Major Roads

- Arterial
- Freeway

Discharge Point

- DryWell
- Infiltration
- LevelSpreader
- Outfall
- Unknown

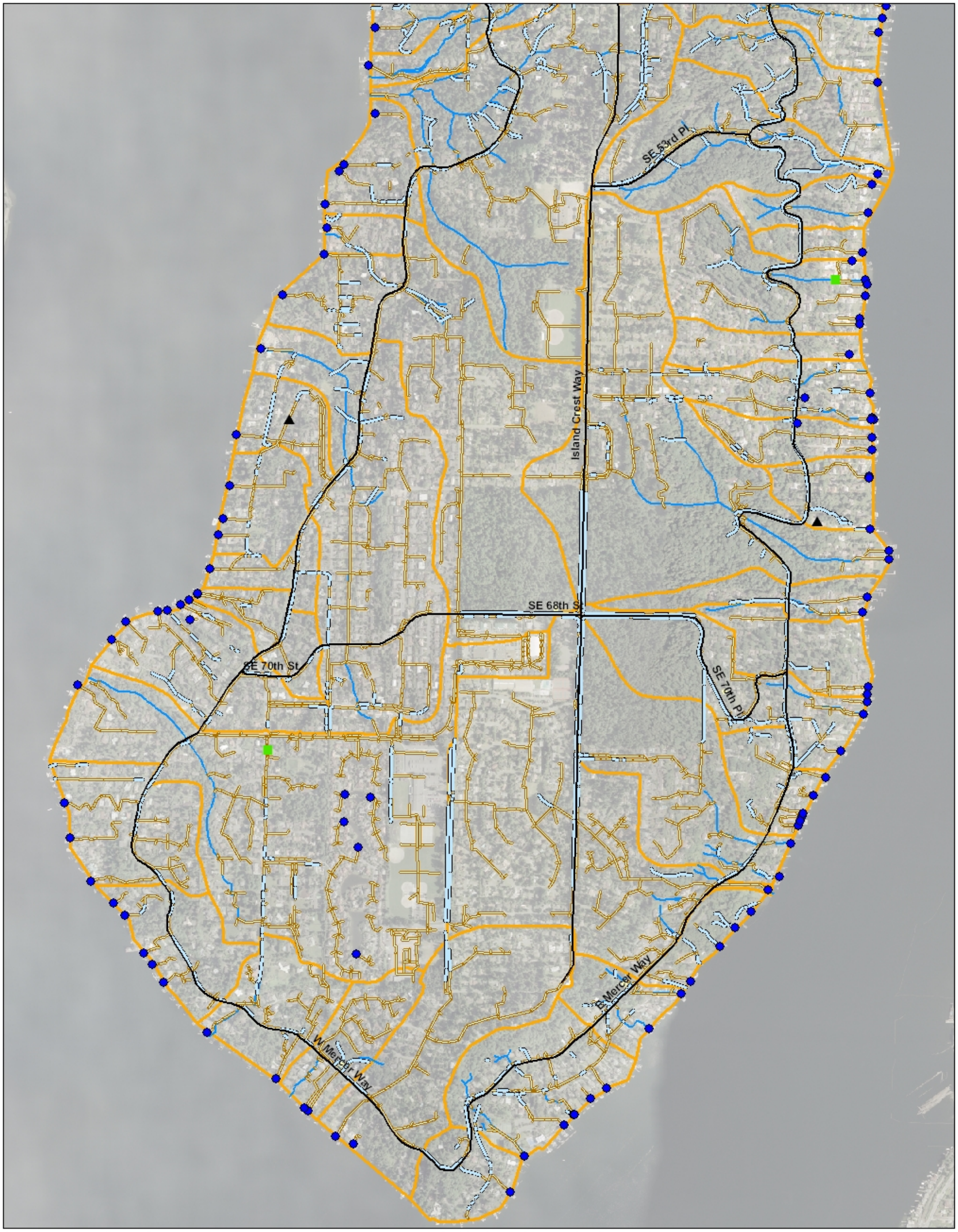
- Ditch
- StormPipe
- Streams
- Stream Basin Boundary

Mercer Island, WA
Central Map

Project **NPDES (Phase II) Implementation Assistance**

Client **City of Mercer Island**

R·W·BECK



0 345 690 1,380 2,070 2,760
Feet

N

Lambert Conformal Conic Projection

Washington Stateplane NAD 1983 Coordinate System

Legend

Storm Control Structures

- Detention Control Structure
- High Flow Control Structure
- Private Outfall

Major Roads

- Arterial
- Freeway

Discharge Point

- DryWell
- Infiltration
- LevelSpreader
- Outfall
- Unknown

- Ditch
- StormPipe
- Streams
- Stream Basin Boundary

Mercer Island, WA
South Map

Project **NPDES (Phase II) Implementation Assistance**

Client **City of Mercer Island**

Appendix F
City Land Use/Land Cover Map

R·W·BECK

Legend

0 275 550 1,100 1,650 2,200 Feet

N

Streams

Major Roads

Arterial

Freeway

Buildings 2007

Care Center

Church

Club

Commercial

Government

Mixed Use

Multi Family

School

Single Family

Storage

Lambert Conformal Conic Projection

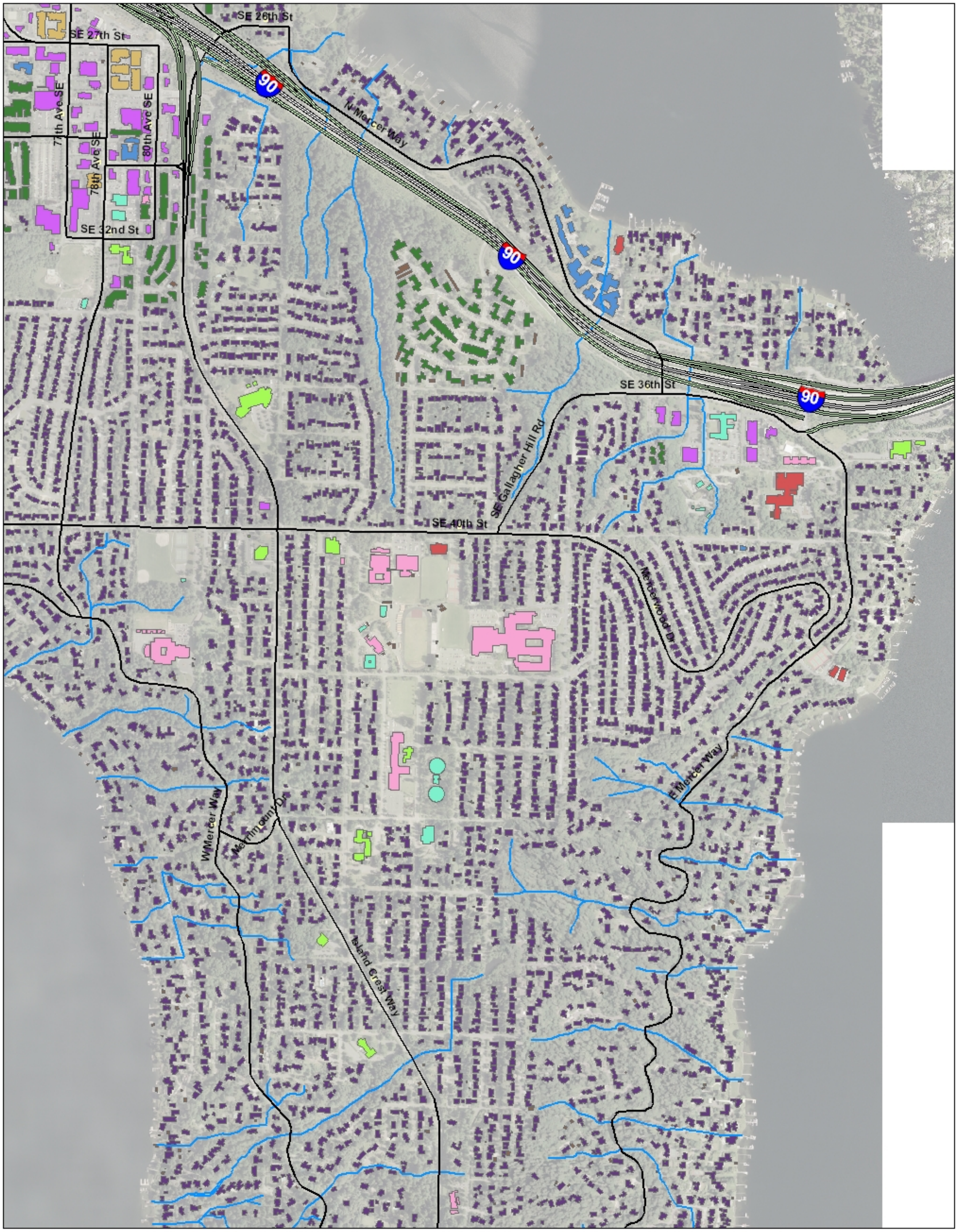
Washington Stateplane NAD 1983 Coordinate System

Mercer Island, WA
Northwest Land Use Map

Project: **NPDES (Phase II) Implementation Assistance**

Client: **City of Mercer Island**

R·W·BECK



Legend

0 305 610 1,220 1,830 2,440 Feet

Streams

Major Roads
- Arterial
- Freeway

Buildings 2007
- Care Center
- Church
- Club
- Commercial
- Government
- Mixed Use
- Multi Family
- School
- Single Family
- Storage

N

Lambert Conformal Conic Projection

Washington Stateplane NAD 1983 Coordinate System

Mercer Island, WA
Central Land Use Map

Project **NPDES (Phase II) Implementation Assistance**

Client **City of Mercer Island**

R·W·BECK

0 355 710 1,420 2,130 2,840
Feet

N

Lambert Conformal Conic Projection

Washington Stateplane NAD 1983 Coordinate System

Legend

Streams

Major Roads

Arterial

Freeway

Buildings 2007

Care Center

Church

Club

Commercial

Government

Mixed Use

Multi Family

School

Single Family

Storage

Mercer Island, WA
South Land Use Map

Project **NPDES (Phase II) Implementation Assistance**

Client **City of Mercer Island**

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