ILLICIT DISCHARGE DETECTION & ELIMINATION MANUAL

CITY OF CAÑON CITY

PREPARED BY CITY OF CAÑON CITY,
ENGINEERING DEPARTMENT
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CAÑON CITY
STORMWATER PROGRAM

City of Cañon City
Illicit Discharge and Detection (IDDE) Manual

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ACRONYMS

BMP	Best Management Practice
CDPHE	Colorado Department of Public Health and Environment
CDPS	Colorado Discharge Permit System
COC	Chain of Custody
CWA	Federal Clean Water Act
DESC	Drainage, Erosion & Sediment Control
DO	Dissolved Oxygen
EPA	U.S. Environmental Protection Agency
GESC	Grading, Erosion & Sediment Control
GIS	Geographic Information System
GPS	Global Positioning System
HDPE	High Density Poly-ethylene
IDDE	Illicit Discharge Detection and Elimination
IDP	Illicit Discharge Potential
MEP	Maximum Extent Practicable
MS4	Municipal Separate Storm Sewer System
NIOSH	National Institute for Occupational Safety and Health
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration
ORI	Outfall Reconnaissance Inventory
SOP	Standard Operating Procedure
TDS	Total Dissolved Solids
WQCD	Water Quality Control Division of the CDPHE

DEFINITIONS

Best Management Practices: Schedules of activities, prohibitions of practices, general good housekeeping pollution prevention and educational practices, maintenance procedures and other management practices to prevent or reduce the discharge of pollutants directly or indirectly to stormwater, receiving waters or stormwater conveyance systems. BMPs also include treatment practices, operating procedures and practices to control site runoff, spillage or leaks, sludge or waste disposal or drainage from raw materials storage.

Colorado Discharge Permit System (CDPS) Stormwater Discharge Permit: A permit issued pursuant to the Colorado Water Quality Control Act (25-8-101 et seq., CRS, 1973 as amended).

Control Measure: Any best management practice or other method used to prevent or reduce the discharge of pollutants to waters of the state. Control measures include, but are not limited to best management practices.

Drainageway: Any natural or artificial watercourse including but not limited to streams, rivers, creeks, ditches and channels. Drainageways include canals, waterways, gullies, ravines or washes in which water flows in a definite direction or course, either continuously or intermittently, including any area adjacent to it that is subject by reason of overflow or floodwater and meets any of the following conditions:

- Provides for conveyance of stormwater runoff from an upstream property or development
- Is defined as "Waters of the United States" by the Army Corps of Engineers or is defined as "Waters of the State" by the State of Colorado
- Supports riparian (riverbank) or sensitive habitat
- Its tributary area is equal to or greater than 20 acres
- Alteration or filling will change the manner in which runoff is discharged onto a downstream property and will potentially result in a negative impact to that downstream property.

Hazardous Material: Any material, including any substance, waste or combination thereof, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or significantly contribute to, a substantial present or potential hazard to human health, safety, property or to the environment when improperly treated, stored, transported, disposed of or otherwise managed.

Illicit Connection: Any drain or conveyance, whether on the surface or subsurface, which allows an illicit discharge to enter the storm sewer system, including, but not limited to: any conveyances which allow any non-stormwater discharge including sewage, process wastewater and wash water to enter the storm drainage system; and any connections to the storm drainage system from indoor drains, sump pumps and sinks, regardless of whether said drain or connection had been previously allowed, permitted or approved.

Illicit Discharge: Any direct or indirect release of pollutants to the storm drainage system that is not composed entirely of stormwater except discharges specifically authorized by a CDPS permit and discharges resulting from emergency firefighting activities.

Major Outfall: A municipal separate storm sewer outfall that discharges from a single pipe with an inside diameter of 36 inches or more or its equivalent (discharge from a single conveyance other than circular pipe which is associated with a drainage area of more than 50 acres); or, for municipal separate storm sewers that receive storm water from lands zoned for industrial activity (based on comprehensive zoning plans or the equivalent), an outfall that discharges from a single pipe with an inside diameter of 12 inches or more or from its equivalent (discharge from other than a circular pipe associated with a drainage area of two acres or more).

Minimize: Reduce and/or eliminate to the extent achievable using control measures that are technologically available and economically practicable and achievable in light of best industry practices.

Municipal Separate Storm Sewer System (MS4): Publicly-owned facilities by which stormwater is collected and conveyed, including, but not limited to, any roads with drainage systems, municipal streets, gutters, curbs, catch basins, inlets, piped storm drains, pumping facilities, retention and detention basins, and natural and human-made or altered drainage ditches, channels, lakes, reservoirs and other drainage structures.

National Pollutant Discharge Elimination System (NPDES) Stormwater Discharge Permit: A permit issued pursuant to Section 402 of the Clean Water Act.

Non-Stormwater Discharge: Any discharge to the storm drainage system that is not composed entirely of stormwater.

Outfall: The point where the storm sewer system discharges to State Waters. It does not include open conveyances connecting two municipal storm sewers, or pipes, tunnels or other conveyances which connect segments of the same stream or other State Waters and are used to convey State Waters.

Outlet: The discharge point of a stormwater facility such as a detention or retention basin, a grass swale or storm vault which does not directly discharge into a State Water or drainageway.

Pollutant: Any sewage, sewage biosolids, dirt, slurry, garbage, chemical waste, biological material, biological nutrient, solid waste, incinerator residue, ash, munitions, radioactive material, heat, rock, sand, cellar dirt, wrecked or discarded equipment and any municipal, industrial and agricultural wastes.

Pollution: The presence in waters of the state of any substances, contaminants or man-made or man-induced impairment of waters or alteration of the chemical, physical, biological or radiological integrity of water in quantities or at levels which are or may be potentially harmful or injurious to human health or welfare, animal or plant life, or property or which unreasonably interferes with the enjoyment of life or property, including outdoor recreation unless authorized by applicable law.

Receiving Water: Any water of the State of Colorado that receives a stormwater discharge from the MS4, including all watercourses, even if they are usually dry, and irrigation ditches that receive municipal stormwater. It also includes storm drainage systems owned by other entities.

Runoff: The part of snowfall, rainfall or other precipitation which is not absorbed, evapotranspirated, evaporated or left in surface depressions and which then flows controlled or uncontrolled into a watercourse or body of water.

Storm Sewer/Drainage System: A MS4

Stormwater: Any surface flow, runoff and drainage consisting entirely of water from any form of natural precipitation, and resulting from such precipitation.

Threatened Discharge: Conditions which create a substantial probability of harm to persons, property or natural resources therefore making it reasonably necessary to take immediate action to prevent, reduce or mitigate the probable damages.

Wastewater: Any water or other liquid, other than uncontaminated stormwater, discharged from a facility.

Waters of the State of Colorado (State Waters): Any and all surface and subsurface waters that are contained in or flow in or through the State of Colorado, but does not include waters in sewage systems, waters in treatment works of disposal systems, waters in potable water distribution systems, and all water withdrawn for use until use and treatment have been completed. The definition includes all watercourses, even if they are usually dry. (Ord. 14-2012 §§ 1, 2; Ord. 20-2005 § 1)

SECTION 1. INTRODUCTION

The Environmental Protection Agency (EPA) requires that discharges from regulated small municipal separate storm sewer systems (MS4s) such as the City of Cañon City must be covered under the National Pollutant Discharge Elimination System (NPDES) program. In Colorado, the Colorado Department of Public Health and Environment (CDPHE or Division) administers the NPDES program for the EPA through the Colorado Discharge Permit System (CDPS). The CDPS General Permit Stormwater Discharges Associated with Municipal Separate Storm Sewer Systems (MS4s) Section E.2. Illicit Discharge Detection and Elimination (IDDE) requires the permittee to implement a program to effectively prohibit illicit discharges.

1.1 Purpose/Intent

This manual constitutes the City of Cañon City's IDDE Plan and provides guidance for implementing the program.

This plan addresses the following five general components:

- ***Procedures for Locating Priority Areas Likely to have Illicit Discharges;***
- ***Procedures for Tracing the Source of an Illicit Discharge;***
- ***Procedures for Removing the Source of the Discharge;***
- ***Enforcement Responses; and***
- ***Training.***

1.2 Municipal Code Chapter 20.10 Stormwater Illicit Discharges and Permit Requirements

The municipal code gives the City of Cañon City the authority:

A. To regulate the introduction of pollutants to the MS4
B. To prohibit illicit connections and discharges to the MS4
C. To provide for inspection and monitoring procedures necessary to ensure compliance
D. To reduce pollutants in stormwater discharges from construction activity
E. To require permanent stormwater runoff controls to be constructed along with development to prevent the deterioration of water quality, and
F. To promote public awareness of the hazards involved in the improper discharge of pollutants into the storm drainage system.

SECTION 2. ILLICIT DISCHARGE DEFINED

An illicit discharge is defined by the CDPS General Permit as ***any discharge*** to an MS4 that is ***not composed entirely of stormwater*** except discharges specifically authorized by a CDPS or NPDES permit and discharges resulting from emergency firefighting activities.

Illicit discharges enter the system through either direct connections - wastewater piping mistakenly or deliberately connected to the storm drains, or indirect connections - infiltration into the MS4 from cracked sanitary systems, spills collected by inlets or materials such as paint or used oil dumped directly into an inlet. Illicit discharges may be either continuous or intermittent. Intermittent discharges tend to occur when carried by a storm event, while continuous illicit discharges often flow during dry weather. Illicit discharges may be most noticeable from outfalls but they may be found in any part of the storm sewer system (i.e. inlets, manholes, drainage channels/ditches or in the street).

Illicit discharges can result in untreated discharges with high concentrations of pollutants (heavy metals, toxics, oil and grease, solvents, nutrients, viruses, and bacteria) to receiving waterbodies. Pollutant levels from these illicit discharges have been shown to significantly degrade receiving water quality and threaten aquatic life, wildlife, and human health. Not all dry weather storm sewer system flow contains pollutants or pathogens. In some cases flow in these drains may be derived from springs, groundwater seepage, irrigation or leaks from water distribution pipes. Consequently, field testing and/or water quality sampling are needed to confirm whether pollutants are actually present to classify them as an illicit discharge.

Water quality testing is used to conclusively identify flows found in the storm sewer system and can distinguish illicit flow types (sewage/septage, washwater and liquid wastes) from cleaner discharges (tap water, irrigation and ground water). Each flow type has a distinct chemical fingerprint.

Not all illicit discharges (potential or actual) result in a flow. Investigations may also encompass incidents such as blocked flowlines, improper storage of sediment or material stockpiles, oil/automotive leaks on streets and illegal dumping of garbage or other materials in a drainageway. See Section 3.3.1 Illicit Discharge Field Investigation for a detailed list.

2.1 Sources of Illicit Discharges

The following are some examples of potential sources of illicit discharges.
Sanitary wastewater sources such as:

- Sanitary wastewater from improper sewerage connections, exfiltration or leakage
- Effluent from improperly operating and/or designed septic tank systems
- Overflows of sanitary sewerage systems

Automobile maintenance and operation sources such as:

- Commercial car wash wastewaters
- Radiator flushing wastewaters
- Engine degreasing wastes
- Leaks and spills from non-commercial auto care/repair
- Improper oil disposal
- Leaky underground storage tanks

Landscape irrigation sources such as:

- Direct spraying of fertilizers, pesticides or herbicides onto impervious surfaces
- Over-application of fertilizers, pesticides or herbicides onto landscaping

Other sources such as:

- Laundry wastes
- Non-contact cooling waters
- Metal plating baths
- Dewatering of construction sites
- Washing of concrete ready-mix trucks
- Power washing of buildings and parking lots
- Contaminated sump pump discharges
- Improper disposal of household toxic wastes
- Spills from roadway and other accidents
- Chemicals and other hazardous materials
- Illegal dumping of garbage and/or debris
- Sediment from construction sites or improperly stored material stockpiles
- Sanitary sludge landfills and disposal sites
- Improper disposal of pet/animal waste

2.2 Discharges Excluded from Enforcement Actions

Per the CDPS General MS4 permit the following discharges do not need to be effectively prohibited (i.e. the City is not required to address these discharges as illicit discharges):

- Landscape irrigation
- Lawn watering
- Diverted stream flows
- Irrigation return flow
- Rising ground waters
- Uncontaminated groundwater infiltration
- Uncontaminated pumped ground water – as long as it has not come into contact with construction activity
- Springs
- Flows from riparian habitats and wetlands
- Water line flushing in accordance with the Division's Low Risk Policy Discharge Guidance: Potable Water.
- Discharges from potable water sources in accordance with the Division's Low Risk Discharge Guidance: Potable Water
- Foundation drains
- Air conditioning condensation
- Water from crawl space pumps
- Footing drains
- Individual residential car washing
- Dechlorinated swimming pool discharges in accordance with the Division's Low Risk Discharge Guidance: Swimming Pools
- Water incidental to street sweeping (including associated sidewalks and medians) and that is not associated with construction
- Dye testing in accordance with the manufacturers' recommendations
- Stormwater runoff with incidental pollutants
- Discharges resulting from emergency firefighting activities
- Discharges authorized by a CDPS or NPDES permit
- Agricultural stormwater runoff
- Discharges that are in accordance with the Division's Low Risk Policy guidance documents or other Division policies and guidance documents where the Division has stated that it will not pursue permit coverage or enforcement for specified point source discharges.

The CDPS General Stormwater permit also allows the City to propose additional discharges to the Division for approval to exclude the discharges from being effectively prohibited. Upon approval by the Division, the City is not required to address the discharges as illicit discharges. The process to evaluate such discharges and submit them to the Division for approval follows.

In evaluating discharges, the City of Cañon City will review relevant information such as the chemical makeup, quantity, duration, location of the discharge and any previous historical information about the discharge or similar discharges to ensure that such discharge will not cause or contribute to a violation of a water quality standard. The permit also allows for submittal of discharges that are not eligible for coverage under a CDPS or NPDES general permit and prohibiting those discharges would result in changes to existing practices for the owner or operator of the discharges that are determined by the permittee to be impracticable.

If such a determination is made it will be documented, including any required controls or conditions placed on the discharge and submitted to the Division for approval. The discharge is not permitted until the City receives a response letter from the Division stating the discharge is approved. Once approved by the Division the City of Cañon City will follow its procedures for Public Notice of the approved discharge.

If, after Division approval, new information becomes available which shows the discharge does not meet the criteria to be excluded from being effectively prohibited the City must notify the Division within 30 days and revise its regulations and procedures with 180 days.

SECTION 3. GENERAL GUIDELINES

3.1 Procedures for Locating Priority Areas

The MS4 General Permit requires the permittee to locate priority areas with a higher likelihood of having illicit discharges, including areas with a higher likelihood of illicit connections. At a minimum, the priority areas must include areas with a history of past illicit discharges.

Illicit discharges typically are not uniformly distributed across a community, but tend to be clustered within certain land uses, subwatersheds, and sewage infrastructure areas. To establish priority areas land use, records or reports of previous illicit discharges, existing inspections and/or monitoring data, GIS mapping and other available data are used. The assessment can also be used to identify neighborhoods where stormwater education should be targeted to address illicit discharge problems. The primary purpose of the assessment however, is to guide field investigations.

The following procedures are used to assist in identifying priority areas.

- Training of employees on recognition and reporting of suspected illicit discharges and priority areas
- A public complaint hotline (276-5265 or 240-5325) and internet reporting form/cell phone application
- Mapping of reported illicit discharges and investigations in the CarteGraph OMS database. Reports of illicit discharges and investigations, including locations, are entered into the database by the investigator. Maps can then be generated to locate areas with multiple illicit discharge reports.
- Evaluate land use or zoning and potential discharges associated with the land use
- Evaluate history of septic systems and conversion to the sanitary sewer system
- Performing periodic or regular visual screening of storm system components during dry weather (no less than 72 hours after the last rain fall of 0.10 inches or more) to evaluate physical indicators
- Inspection reports of storm system components indicating areas of illegal dumping and/or excessive trash
- Evaluation of historic water quality data which shows standards have been chronically exceeded
- Sampling of suspect flows/discharges for parameters of concern (chemical testing)
- Evaluating samples for discharges from leaking sanitary sewer/septic systems (E. coli tests)
- Performing follow-up inspections of suspect outfalls

Priority area designations rely on active and on-going visual observation, reporting and mapping activities and are subject to periodic adjustment. Trained staff will be notified of changes in priority areas as they occur.

The above guidelines were considered to identify priority areas within the City permit boundaries. Priority areas identified include:

- Areas with multiple illicit discharges
- Areas with multiple reported illicit discharges
- Commercial/Industrial areas with adjacent drainage channels or waterbodies
- Drainages where dumping or excess trash has been reported

The actual physical location(s) of priority areas are listed in the yearly program documentation spreadsheet and included in the annual training.

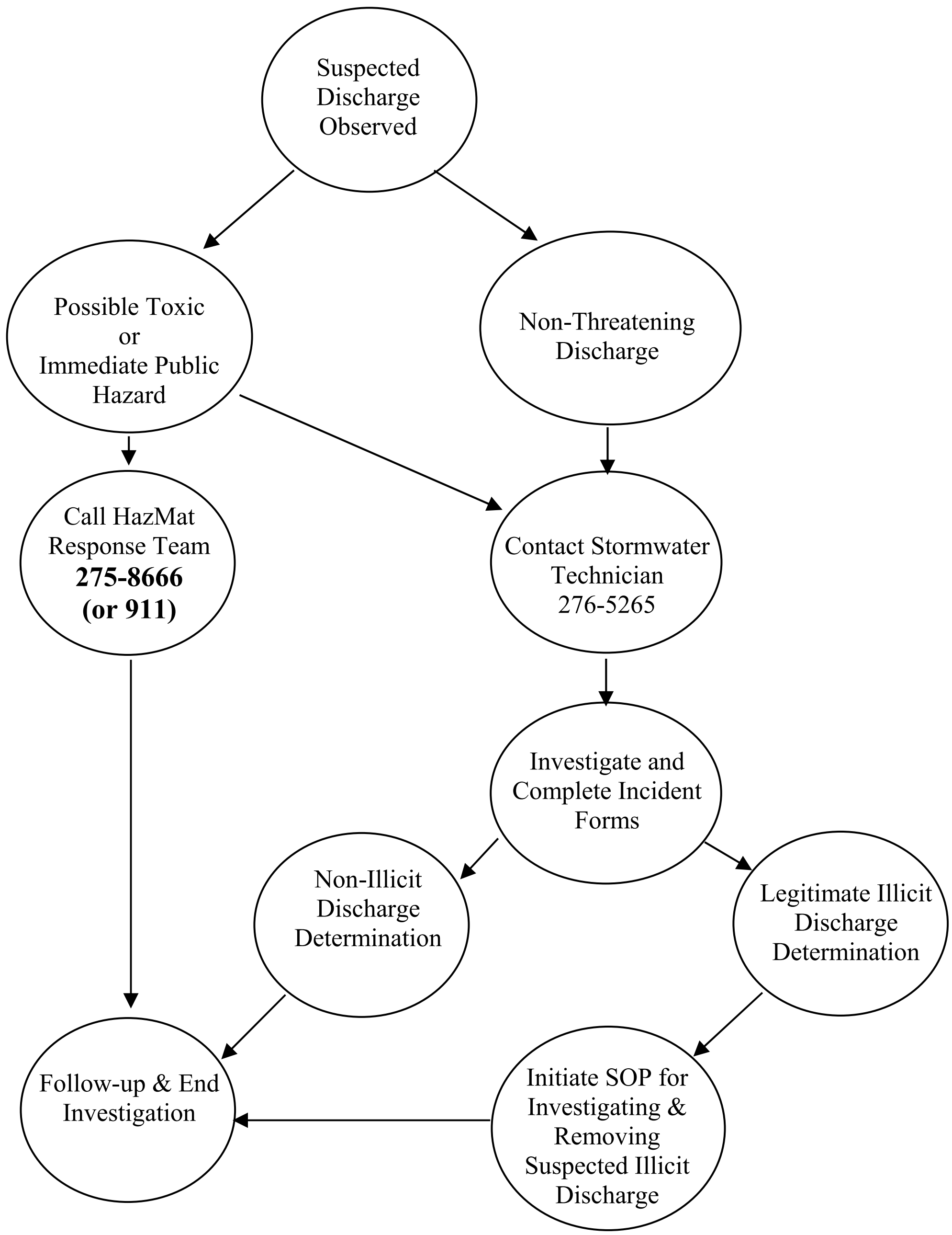
3.2 Procedures for Tracing the Source of an Illicit Discharge

1. Field staff shall be observant in their daily routines, watching for evidence of illicit discharges or unusual flows from the storm drain systems. Should a suspected discharge be discovered, it **must** be reported to the City of Cañon City Stormwater Technician at 276-5265 (office) or 240-5325 (cell), following one of the two decision

trees listed below:

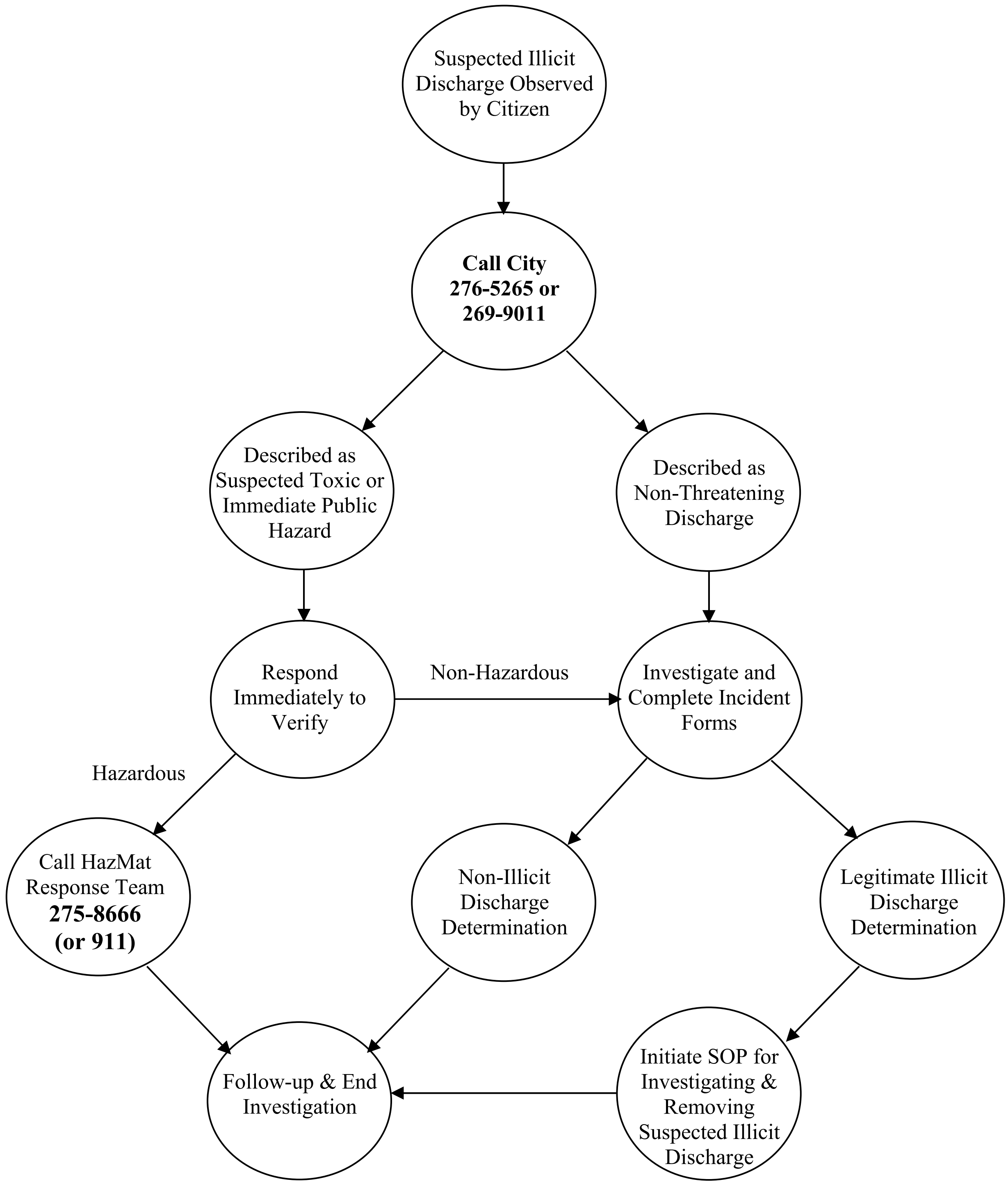
ILLICIT DISCHARGE REPORTING & RESPONSE By City Staff

Illustration #1 – IDDE Reporting and Response – City Staff



ILLICIT DISCHARGE REPORTING & RESPONSE
Citizen Generated

Illustration #2 – IDDE Reporting and Response - Citizen



The minimum information to be reported to the Stormwater Technician should include:

- Location
- Date
- Time
- Description of the discharge
- License plate number (if applicable)
- Photos should be taken if possible

The employee initially observing the suspect discharge **need NOT** approach the potential violator (if present) at the time of the incident. However, if the violator does not appear threatening, collection of personal information to be relayed to the Stormwater Technician would be beneficial.

SAFETY CONSIDERATIONS:
Keep safety considerations at the forefront of observation procedures at all times. Hazards should be anticipated and avoided.

- Never approach, contact, or sample a substance if the toxicity is at all suspect.
- The observation should be investigated in groups of two or more whenever possible.
- Never open a sealed container to check the contents.

2. Once the information has been received by the Stormwater Technician, a field investigation of the discharge shall occur utilizing the following techniques and tools, as applicable.

A. A comprehensive Storm Sewer System Map via ArcMap and the CarteGraph OMS database will be used for tracing the source of an illicit discharge. Information kept in the database to improve its usability includes:

- Locations of all inlets, manholes, channels, pipes, conduits and outfalls/outlets, including GPS coordinates where applicable. See Appendix A for examples of typical outfalls.
- Basic information on each component, as applicable, including an assigned ID, classification, jurisdiction, physical parameters, and source of the primary flow. (The specifics of mapping and gathering data on infrastructure are contained in the Stormwater Technician's Manual).
- Identification of the drainage area for each outfall
- Identification of the land use for each drainage area
- Identification of the receiving waters for each component
- Significant contributors such as agricultural operations using irrigation and known industries

The use of the CarteGraph OMS database, in conjunction with GIS, not only allows a map of the storm sewer system to be produced; it also allows important attributes and historical information to be associated to the outfalls, inlets, junctions and other infrastructure within that area. Information can then be easily accessed when an illicit discharge is discovered or reported. This capability greatly enhances the ability of field personnel to quickly isolate, verify, and eliminate the source of illicit discharges.

B. Field analyses of the discharge using the multi-parameter probe, chlorine field analysis equipment, nitrate and phosphate field kit and/or test strips to characterize the discharge. See Appendix B IDDE Sampling and Water Quality Monitoring for specific procedures.

C. Collection of samples of the discharge and of potential sources of the discharge (if possible) for chemical analyses to characterize the discharge. See Appendix B IDDE Sampling and Water Quality Monitoring for specific procedures.

D. Check infrastructure (e.g. manholes and inlets) upstream of discharge to isolate the source. Sampling may occur at upstream locations. Repeat until a junction is found with no evidence of discharge; the source is likely to be located between the junction with no evidence of a discharge and the next downstream junction.

E. Be observant of surrounding areas; look for water in gutters and streets. A drainage area investigation may be conducted to locate the source of the discharge. The simplest approach is a rapid "windshield" survey of the drainage area to find the potential discharger or generating site. A drive-by survey works well in small drainage areas, particularly if field crews are already familiar with its business operations. Often discharges with a unique color, smell, or off-the-chart indicator sample reading may point to a specific industrial or commercial source. Field crews try to match the characteristics of the discharge to the most likely type of generating site and then inspect all of the sites of the same type within the drainage area until the culprit is found. For example, if fuel is observed at an outfall, crews might quickly check every business operation in the catchment that stores or dispenses fuel. Drainage area investigations are only effective if the discharge observed at an outfall has distinct or unique characteristics that allow crews to quickly ascertain the probable operation or business that is generating it. It should be noted that drainage area investigations are not usually helpful in tracing sewage discharges, since they often are not related to specific land uses or generating sites.

3.2.1 Access and Inspection of Facilities and Properties

The City of Cañon City's Municipal Code allows for the access and inspection of a property if an illicit discharge is suspected of originating on the property. Chapter 20.10.090 of the code reads:

A. Whenever the Director has reasonable cause to believe that there exists, or potentially exists, in or upon any premises any condition which constitutes a violation of this chapter, the Director shall have the right to enter the premises at any reasonable time to determine if the owner or operator is complying with all requirements of this chapter. In the event that the owner or occupant refuses entry after a request to enter has been made, the City is hereby empowered to seek assistance from a court of competent jurisdiction in obtaining such entry.

B. The Director shall have the right to set up on the property of any discharger to the MS4 such devices that are necessary to conduct an investigation of such discharges. The investigation may include, but is not limited to, the following: sampling of any discharge or process waters, the taking of photographs, interviewing staff on alleged violations, and access to any and all facilities or areas within the premises that may have any effect on the discharge.

C. If the violation constitutes an immediate danger to public health or public safety, the Director is authorized to enter upon the subject private property, without giving prior notice, to take any and all measures necessary to abate the violation and/or restore the property. (Ord. 12-2019 § 11)

3.2.2 Additional Tracing Options

The following techniques may be considered for tracing illicit discharges. The City will use these methods if they are deemed feasible and beneficial to tracing the source of an illicit discharge.

1. Using video cameras to inspect storm sewers: The City may request assistance from the Fremont Sanitation District to video inspect storm sewer lines to detect possible illicit connections or breaks in the line which would allow infiltration.

2. Conducting dye-testing to delineate potential source areas: The non-toxic dye is introduced into toilets, sinks, or floor drains. If it appears in the storm sewer system or at an outfall, rather than in the sanitary sewer, an illicit connection can be determined to exist. Dye testing may also be used to determine a direct

connection to an outfall (e.g. a business owner does not realize the floor drains are piped directly to a water body).

Dye testing should be planned in advance as several agencies and personnel may need to be involved. Property and/or business owners need to be notified of the testing; the Fremont Sanitation District should be notified as they may wish to participate since the dye may go into their system; and the Cañon City Fire Department should be notified to avoid a possible response should someone call in the dye as a spill or possible hazardous material. At least two staff members equipped with cell phones or 2-way radios, flashlights and cameras, are needed to conduct the dye test – one to introduce the dye to the system and one to look for its appearance at a downstream manhole or outfall. Existing storm and sewer system maps for the area in question should be reviewed before testing to identify lateral sewer connections and how they can be accessed. If building plans are available they should be reviewed also.

The type and color of dye to use should be determined beforehand. Some discharges may already be colored, in which case a contrasting color of dye would need to be used. The following table lists the choices available for dye types.

Table 1. Dye Availability

Tablets	• Compressed powder, useful for releasing dye over time • Easy to handle, little mess, dissolves quickly • Flow mapping and tracing in storm and sanitary sewer drains • Plumbing system tracing, septic system analysis, leak detection
Liquid Concentrate	• Very concentrated, disperses quickly • Works well in all volumes of flow • Recommended if metering of input is required • Flow mapping and tracing in storm and sanitary sewer drains • Plumbing system tracing, septic system analysis, leak detection
Strips	• Similar to liquid but less mess
Powder	• May be messy, must be dissolved in liquid to work right • Recommended for very small or very large applications where liquid is undesirable • Leak detection
Wax Cakes	• Recommended for moderate-sized waterbodies • Flow mapping and tracing in storm and sanitary sewer drains
Wax Donuts	• Recommended for large bodies of water (lakes, rivers, ponds) • Flow mapping and tracing in storm and sanitary sewer drains • Leak detection

Tips for successful dye testing:

- **Dye Selection**
  - Green and liquid dyes are the easiest to see.
  - Dye test strips can be a good alternative for residential or some commercial applications. (Liquid can leave a permanent stain).
  - Check the sanitary sewer before using dyes to get a “base color.” In some cases the sewage may have an existing color that would mask a dye (e.g., a print shop with a permitted discharge to the sanitary sewer).
  - Choose two dye colors, and alternate between them when testing multiple fixtures.

- **Selecting Fixtures to Test**
  - Check the plumbing plan for the site to isolate fixtures that are separately connected.
  - For industrial facilities, check most floor drains (these are often misdirected).
  - For plumbing fixtures, test a representative fixture (e.g., a bathroom sink).
  - Test some locations separately (e.g., washing machines and floor drains), which may be misdirected.
  - If conducting dye investigations on multiple floors, start from the basement and work your way up.
  - At all fixtures, make sure to flush with plenty of water to ensure that the dye moves through the system.

- **Selecting a Sewer Manhole for Observations**
  - Pick the closest manhole possible to make observations (typically a sewer lateral).
  - If this is not possible, choose the nearest downstream manhole.

- **Communications Between Crew Members**
  - The individual conducting the dye testing calls in to the field person to report the color dye used, and when it is dropped into the system.
  - The field person then calls back when dye is observed in the manhole.
  - If dye is not observed (e.g., after two separate flushes have occurred), dye testing is halted until the dye appears.

- **Locating Missing Dye -** The investigation is not complete until the dye is found. Some reasons for dye not appearing include:
  - The building is actually hooked up to a septic system.
  - The sewer line is clogged.
  - There is a leak in the sewer line or lateral pipe.

3. Conducting smoke tests to delineate potential source areas: A non-toxic smoke is introduced into the storm sewer system and where the smoke appears is observed. Smoke testing can help locate illicit connections and damage to the storm sewer system. As with dye testing, advanced planning is a must. The public should be informed in advance and local fire, police and 911 dispatch should be informed on the day of testing. Information provided to the public should include the date testing will occur, reason for the testing, precautions they may take to prevent smoke from entering into their residence or business and what they should do if it does and a contact number for the public to call for information or to relay concerns.

   The basic equipment needed for smoke testing includes manhole safety equipment, sewer plugs, a smoke source and blower. There a two types of smoke sources: a smoke bomb or candle or liquid smoke. The smoke bomb or candle burns at a controlled rate, releasing a very visible white smoke. Liquid smoke is a petroleum-based product that is injected into the hot exhaust of the blower. The smoke produced is generally not as consistently visible as that produced by a smoke bomb and it does not travel as far.

   Smoke testing follows three basic steps: first, the section being tested is sealed off by plugging storm inlets; second, the smoke is released and forced by the blower through the system; and third, crews watch for any smoke escaping above ground. Storm inlets can be sealed with sandbags, beach balls or expandable plugs. As with dye testing crews should be equipped with cell phones or 2-way radios and cameras.

4. Septic System Investigation - Low-density residential watersheds may require special investigation methods if they are not served by sanitary sewers and/ or storm water is conveyed in ditches or swales. The major illicit discharges found in low-density development are failing septic systems and illegal dumping. Homeowner surveys, surface inspections and infrared photography have all been effectively used to find failing septic systems in low-density watersheds.

3.2.3 Special Monitoring Techniques for Intermittent Discharges

The hardest discharges to detect and test are intermittent or transitory discharges to the storm sewer system which often have an indirect mode of entry. With some specialized sampling techniques, however, it may be possible to catch these discharges. Transitory discharges, such as spills and illegal dumping, are primarily sampled to assign legal responsibility for enforcement actions or to reinforce ongoing pollution prevention education efforts. In most cases, crews attempt to trace transitory discharges back up the pipe or drainage area using visual techniques. However, field crews should always collect a sample to document the event.

This section lists some specific monitoring techniques used to track down intermittent discharges. Intermittent discharges cannot be reliably detected using conventional outfall monitoring techniques, and are normally found as a result of hotline complaints or spill events. Nevertheless, when these discharges are encountered, they should be sampled if possible.

An outfall may be suspected of having intermittent discharges based on physical indicators (e.g., staining), poor in-stream dry weather water quality, or the density of generating sites in the contributing subwatershed. The only sure way to detect an intermittent discharge is to monitor the outfall for a long period of time, which is neither cost-effective nor feasible. As an alternative, these four monitoring techniques can be used to help track these problems:

- **Sandbags** - This technique involves placement of sandbags or similar barriers within strategic manholes in the storm sewer system to form a temporary dam that will collect any intermittent flows that may occur. Any discharge collected behind the sandbag is then assessed using visual observations or by indicator sampling. Sandbags are lowered on a rope through the manhole to form a dam along the bottom of the storm pipe, taking care not to completely block it. Sandbags are typically installed at junctions in the network to eliminate contributing branches from further consideration. They should be left in place for no more than 48 hours, and should only be installed when dry weather is forecast. The biggest downside to sandbagging is that it requires at least two trips to each manhole.

- **Odd Hours Monitoring:** Many intermittent discharges actually occur on a regular schedule, but unfortunately not the same one used by field crews during the week. For example, some generating sites discharge over the weekend or during the evening hours. If an outfall is deemed suspicious, program managers may want to consider scheduling “odd hours” sampling at different times of the day or week. Key times to visit suspicious outfalls include mornings and afternoons, weekday evenings or weekend mornings and evenings.

- **Caulk Dams:** This technique uses caulk, plumber’s putty, or a similar substance to make a dam about two inches high within the bottom of the storm drain pipe to capture any dry weather flow that occurs between field observations. Any water that has pooled behind the dam is then sampled using a hand-pump sampler, and analyzed in the lab for appropriate indicator parameters.

- **Pool Sampling:** In this technique, field crews collect indicator samples directly from the “plunge pool” below an outfall, if one is present. An upstream sample is also collected to characterize background stream or ditch water quality that is not influenced by the outfall. The pool water and stream sample are then analyzed for indicator parameters, and compared against each other. Pool sampling results can be constrained by stream dilution, deposition, storm water flows, and chemical reactions that occur within the pool.

3.2.4 Additional Monitoring Methods

- **Ambient In-Stream Water Quality Monitoring:** In-stream water quality monitoring can help detect sewage and other discharges in a community or larger watershed. Stream monitoring can identify the drainages with the greatest illicit or sewage discharge potential which is then used to target outfall indicator monitoring. At the smaller reach scale, stream monitoring may sometimes detect major individual discharges to the stream.

- **Stream Monitoring to Identify Problem Reaches or Subwatersheds**: Stream monitoring data can be used to locate areas where human or aquatic health risks are higher. To obtain this information, stream monitoring should be conducted regularly during dry weather conditions to track water quality (at least monthly) and to document changes in water quality over a period of time. Stream monitoring data are particularly effective when combined with other data. For example, a subwatershed with many physical indicators of illicit discharges (e.g., a high number of flowing outfalls) that also has poor stream water quality would be an obvious target for intensive outfall monitoring.

  Stream monitoring parameters should reflect local water quality goals and objectives, and frequently include bacteria, ammonia, nitrogen and phosphorus. Bacteria are useful since sewage discharges can contribute to violations of water contact standards set for recreation during dry weather conditions. An important caveat when interpreting stream monitoring data is that a violation of bacteria standards during dry weather flow does not always mean that an illicit discharge or sewage overflow is present. While raw sewage has bacteria concentrations that greatly exceed bacteria standards (approximately 12,000 MPN/100 mL) other bacteria sources, such as urban wildlife and waterfowl, can also cause a stream to violate standards. Consequently, stream monitoring data need to be interpreted in the context of other information, such as upstream land use, past complaints, age of infrastructure, and available historical water quality data.

  Ideally, stream monitoring stations should be strategically located with a minimum of one station per subwatershed or drainage, with additional stations at stream confluences and downstream of reaches with a high outfall density.

- **Stream Monitoring to Identify Specific Discharges:** Stream monitoring data can help field personnel locate individual discharges within a specific stream reach. Immediate results are needed for this kind of monitoring. It is important to know what factors can influence each sample parameter. Therefore, data should always be interpreted in the context of surrounding land use. Stream monitoring benchmarks should be continuously refined as communities develop a better understanding of what dry weather baseline concentrations to expect.

  If stream monitoring indicates that a potential problem level benchmark has been exceeded, field personnel continue stream sampling to locate the discharge through a process of elimination. Walk upstream taking regular samples above and below stream confluences until the benchmark concentration declines. Then take chemistry samples at strategic points to narrow down the location of the discharge, using the in-pipe monitoring strategy.

- **Macroinvertebrate Sampling and Characterization:** Biological data has been obtained from macroinvertebrate community structure analysis from two monitoring locations. One above the jurisdiction of the City and one below the furthest downstream discharge point from the City. Because macroinvertebrates reside in the stream year-round, they are susceptible to pollutant "pulses" that could be missed by other monitoring means. Aquatic macroinvertebrates include species which will be present in either good or poor water quality, but not both. The presence and quantity of certain species provide important information as to the types of discharges the aquatic community has been exposed to over time. Macroinvertebrate sampling and analysis will be done when feasible and appropriate.

3.2.5 Unique Field Situations

- **Irrigation Ditches** - Field personnel will have to address unique issues given the extensive network of open irrigation conveyance channels throughout the City. The irrigation ditches and channels also function as stormwater conveyance systems. Open channels and ditches are often very long with only a few obvious outfalls draining to them. The irrigation network can have illicit discharges at any point. Maps of irrigation return, groundwater and stormwater outfalls assist in narrowing points of potential illicit discharges.

- **Winter and Ice** - Ice can be used as a discharge indicator when it forms in streams and pipes during the winter months. Because ice lasts for many weeks and most illicit discharges are warm, field personnel can interpret outfall history from ice melting patterns along pipes and streams. For example, exaggerated melting at a frozen or flowing outfall may indicate warm water from a sewage or industrial discharge. Also, ice acts like an intermittent flow trap and literally freezes discharges. Crews should also look for these traps to find any discolored ice within the pipe or below the outfall. A final winter indicator is "rime ice," which forms when steam freezes. This beautiful ice formation is actually a good indicator of sewage or other relatively hot discharges that cause steam to form.

3.3 Illicit Discharge Incident Recordkeeping

When a suspected illicit discharge is observed and reported by City Staff or a citizen the incident will be investigated promptly. Information from the report and subsequent investigations will be entered into the CarteGraph OMS SW Violations database. Once the incident is resolved, the date closed will be recorded and a report will be generated. Reports are stored digitally in ..\..\Field Investigation & Monitoring\CarteGraph IDDE Reports. If the illicit discharge report is invalid, the IDDE incident report still needs to be completed and a closure date assigned. In the situation where an illicit discharge is untraceable due to the discharge no longer occurring or evidence of a discharge cannot be found, the IDDE incident report still needs to be completed, documenting all steps taken, and a closure date assigned.

Tracking through CarteGraph OMS will provide valuable data including:

- ***Number and types of incidents reported each year***
- ***Identification of recurring problems and chronic offenders***
- ***Most common problems reported by the public and City staff***
- ***Areas in which to focus information and education efforts***
- ***The types of outreach efforts which appear to be most effective***
- ***Provide a measure of program success.***

3.3.1 SW Violations (Illicit Discharges) Asset Database in CarteGraph OMS

The following information is obtained in order to create the asset record and document the report of an illicit discharge in the CarteGraph OMS database:

- Address/Location of the reported discharge

- Incident date and time
- Description of discharge
- Name & contact information of person reporting the discharge, if applicable
- Date and time the incident was reported and how the contact was made, if applicable
- Information on the suspected violator if obtainable

CarteGraph automatically assigns an ID when a new record is created. A unique Incident Number is also assigned based on the date of the investigation and the number of events investigated that day. For example if two potential illicit discharge events were investigated on March 1, 2012, the ID numbers would be 2012_03_01_001 and 2012_03_01_002.

Illicit discharges have been grouped into categories for ease of generating reports to track the types reported. The categories are:

Accident	Illicit Connection
Automotive Discharge	Leaking Dumpster
Blocked Flowlines	Non-hazardous Spill
Construction-Concrete Washout	Other
Construction-No BMPs	Pesticide/Herbicide/Fertilizer
Construction-Other	Pet Waste
Construction-Sediment Release	Power Washing
Hazardous Spill	Prohibited Discharge-Other
Illegal Dumping-Drainage	Restaurant Oil/Grease
Illegal Dumping-Flowline	Sediment
Illegal Dumping-Inlet	Sewage
Illegal Dumping-Other Area	Yard Waste
Illegal Dumping-Waterbody	

For tracking and reporting purposes the illicit discharge report should also be categorized as to Discharge Type.

- Excluded Discharge
- Illicit Connection
- Potential Discharge
- Prohibited Discharge

3.3.2 Illicit Discharge Field Investigation

Not all illicit discharges (potential or actual) result in a flow. Investigations may also encompass incidents such as blocked flowlines, improper storage of sediment or material stockpiles, oil/automotive leaks on streets and illegal dumping of garbage or other materials in a drainageway. The following information is obtained in order to document any investigation and the steps or actions taken to eliminate the discharge or prevent a potential discharge. Investigations are performed as an Inspection Task to the asset record.

Investigation Information:

- Date and time of investigation
- Weather conditions
- Investigation location details
- Indicators observed
- Additional findings and notes
- Rationale for the investigation and response to the report
- If any enforcement action is taken, including a verbal warning or instruction, it is recorded as a separate task with the following information, as applicable.
  - Violation date
  - Notice Type
  - Notice ID
  - Notice Reason
  - Delivery Type
  - Issued Date
  - Fine Amount
  - Issued By
  - Notes
  - Water Quality testing performed (See Appendix B for data to record on water quality testing)

3.3.3 Request Database

All contacts will be entered into the CarteGraph OMS database system, including non-illicit discharge contacts. Information recorded in the database includes: time and type of initial contact, issue and issue category, location of issue, contact information and details. Any work requested as a result of the contact can be assigned to the request as a task, or cross-referenced through the asset database by assigning the request number to a task for an asset.

3.4 Procedures for Removing the Source of an Illicit Discharge

There are various proven methods that can be used to remove/correct illicit discharges. Securing the voluntary cooperation of the responsible party to resolve the problem is the most beneficial method in correcting existing illicit discharges and eliminating future discharges. Should the responsible party not be willing to resolve the problem, legal remedies also exist to secure their cooperation.

The City of Cañon City's Municipal Code, Chapter 20.10.100 states in part: *"Notwithstanding other requirements of law, as soon as any person responsible for any premises, facility or operation, or responsible for emergency response for a facility or operation has information of any known or suspected release of materials which are resulting or may result in illegal discharges or pollutants discharging into stormwater, the MS4, or waters of the state, that person shall take all necessary steps to ensure the discovery, containment, and cleanup of such release."* In practice, the party responsible for the illicit discharge (if known) is required to stop the illicit discharge and clean up the discharge and all surface residue left from the discharge as much as practicable. In some cases it is not possible to clean up all of the residue. An example is dried paint or paint washwater in the curb and gutter. It may be possible to trace the source of the discharge and find the person responsible for the discharge, but removing dried paint is nearly impossible. In this example, the responsible party may be required to clean up any paint that has not fully dried and to sweep the area to remove as much residue as possible.

If the person(s) responsible for the illicit discharge cannot be identified or located or if the discharge is too large for the responsible party to handle alone, the City Public Works Streets Department may assist in the clean-up. The Streets Superintendent is contacted to dispatch a crew to the site. Sand absorbents, socks, pillows or pads are used to capture spilled liquid and street sweeping is used to remove as much residue as possible. Inlets may be cleaned using the vac truck. All clean-up materials are properly disposed of. Illicit discharges are only washed down when the washwater can be captured and disposed of properly. Cost of the clean-up may be charged to the responsible party if identified.

In areas prone to illegal dumping, such as drainageways, the dumped items are removed by either the Streets Department or the City's contracted vegetation management crew. To prevent further dumping, access may be restricted to an area or signage installed where feasible and appropriate.

In the event of a hazardous materials release, the Cañon City Fire Department will be contacted for cleanup.

In the event of an illicit connection, the City will require removal of the connection. Often home or business owners are not aware of the existence of the illicit connection. In these cases, providing the responsible party with information about the connection, the environmental consequences of the connection, City regulations prohibiting the connection and how to remedy the situation may be enough to secure voluntary compliance. If not, escalating enforcement may be required. The illicit connection should be plugged, if possible, until compliance is achieved.

3.5 Enforcement and Penalties

When stormwater non-compliance is identified by the City of Cañon City, enforcement actions are taken promptly. An action the City takes against the person(s) in non-compliance is based on the nature and severity of the situation and in accordance with the City's Municipal Code. The City uses professional judgement and enforcement discretion to determine the appropriate level of compliance assistance and enforcement actions in a given situation.

Illicit discharges and stormwater non-compliances are considered to be either minor or major violations. Minor violations are generally instances of non-compliance that do not directly result in a discharge or may be considered an incidental discharge and are addressed by the responsible party immediately upon notification. Major violations are generally those acts or omissions that lead to a discharge of pollutants to stormwater. They often include chronic violators and/or intentional acts or discharges that are not removed or resolved in a timely manner. Serious discharges may require an immediate escalation to a higher level of enforcement. The level of enforcement response depends on several factors:

- Severity of the violation: the duration, quality and quantity of pollutants, and the effect on public safety and the environment.
- The violator's knowledge of the regulations being violated (either negligent or intentional)
- A history of violations and/or enforcement actions, and/or
- The potential deterrent value of the enforcement action.

The City typically enforces on illicit discharges and non-compliance in a graduated manner, beginning with verbal warnings, letters or emails and education to obtain voluntary compliance then escalating to increasingly severe enforcement actions if compliance is not achieved. Each of the items listed below may be used in any order and can be used concurrently.

3.5.1 Informal Enforcement Response

For illicit discharges that do not constitute an immediate danger to public health or public safety, the following enforcement procedure(s) may result:

- Once City Stormwater personnel verifies that the reported incident is a potential or actual illicit discharge, the responsible party will be notified immediately of the requirement to cease the discharge and clean up the area affected by that discharge. Notification may be verbal, by certified letter or by email; each should have educational material also presented.

3.5.2 Formal Enforcement Response

While active civil and criminal enforcement is the least desirable outcome of the IDDE program, it may sometimes be necessary in the following situations:

- Recurring illicit discharge incidents
- Failure of person knowingly responsible for an illicit discharge to notify the City per municipal code within 24 hours of the incident
- Refusal to voluntarily take remedial action on the illicit discharge

In these situations, or in the event of a major violation, a Notice of Non-Compliance may be issued on-site by City Stormwater personnel or delivered by certified mail to the person responsible for the discharge stating that:

- Remediation of the illicit discharge will begin immediately. A time period of ten (10) days may be allowed (by City municipal code) if remediation will entail structural repairs or changes which require more time to complete. The party responsible for the discharge must be informed that they are still in non-compliance until remediation is complete;
- The area affected by the illicit discharge must be inspected by a City Inspector within the time period designated for remediation;
- Final remediation must receive approval from the City Inspector within the time period designated.
- The City Engineer receives a copy of the Notice of Non-Compliance and a hard copy of the notice is kept on file in the Enforcement binder.
- A scanned copy will be attached to the SW Violations asset record in the CarteGraph OMS database.

If remediation is not performed in the time frame prescribed by the Notice of Non-Compliance a Notice of Violation & Enforcement Action and/or a Stop Work Order will be issued by the City Engineer, at which time:

- The owner and/or operator shall immediately stop all activity and correct the violation(s). Any operations related to the violation(s) shall not recommence until authorized in writing by the City to proceed.
- The responsible party will be charged a penalty, which may be assessed from the first day of the violation.
- A hard copy of the notice is kept on file in the Enforcement binder.
- A scanned copy will be attached to the SW Violations asset record in the CarteGraph OMS database.

Stop Work Order - Whenever the City Engineer determines that any activity is occurring which is not in compliance with the requirements of City code, the City can order the activity stopped upon service of written notice to the responsible owner and/or operator. The owner and/or operator shall immediately stop all activity until authorized in writing by the City to proceed. If the owner and/or operator cannot be located, the notice to stop shall be posted in a conspicuous place upon the area where the activity is occurring and shall state the nature of the violation. It shall be unlawful for any owner and/or operator to fail to comply with the order.

See Appendix C for enforcement forms.

It should be noted that a discharge may also be subject to enforcement and penalties by the State and Federal Government.

3.5.3 Judicial Enforcement Response

It is unlawful for any person to violate any provision or fail to comply with any of the requirements of City of Cañon City Municipal Code Chapter 20.10 Stormwater Illicit Discharges and Permit Requirements. Any person who violates any of the provisions of the code may be subject to one or more of the enforcement actions outlined in this section.

- **Civil Penalties -** The City Engineer is authorized to impose and collect civil penalties not to exceed $250 **per violation per day, from the day the violation is identified or reported until it is eliminated**, if an alleged violator who is served a written notice of violation fails to take the remedial action set forth in the notice of violation or otherwise fails to cure the violations set forth therein within ten (10) days after the notice of violation is served upon the owner or operator (or such longer period as is authorized in writing, if a cure cannot reasonably be accomplished in ten (10) days). The amount of the penalty shall depend upon the severity of the violation.

- **Criminal Penalties -** Violators may be subject to a criminal penalty not to exceed $2,650 **per day, per violation. Each day or part of a day any violation occurs or continues is a separate offense**.

- **Enforcement Costs -** Any condition caused or permitted to exist in violation of any of the provisions of the code is a threat to public health, safety, and welfare, and is declared and deemed a public nuisance. The City is authorized to enter upon the subject private property, without giving prior notice, to take any and all measures necessary to abate the violation and/or restore the property. Any costs incurred as a result of this action may be assessed to the person or persons responsible for the discharge.

3.6 Training

Illicit Discharge Detection and Elimination Training is held annually for all applicable City employees. The training is conducted by the City Stormwater Technician or may be conducted by an outside entity. Applicable employees include, but are not limited to, Public Works Streets, Equipment Repair, Water Distribution and Water Treatment; Engineering Department, Parks Department, Code Enforcement Officers and City Facilities. Annual trainings may be held for newly hired employees only, with trainings for all applicable employees being conducted at least once every permit term or as information and/or procedures change. Additional trainings may be held when/if deemed necessary. Staff is given basic training on the types of illicit discharges that may occur and the procedures to follow if a possible illicit discharge is observed. Training materials may include videos, power-point presentations, the "IDDE – A Grate Concern" pocket reference booklet and other relevant materials.

Training also includes the following information for response to hazardous materials.

3.6.1 Guidelines for Hazardous Materials Response

If the suspected discharge is potentially toxic or represents an impending hazard to the public, the Fremont County Hazardous Materials Response Team 275-8666 (or 911) must be contacted immediately.

1. Stay upwind and uphill from the material.
2. Isolate the area and keep people out.
3. Call 275-8666 (or 911) for a Hazmat / Fire / EMS response from the Canon City Fire Protection District. Inform dispatch of what you see.
4. Convey any information regarding the following:
   - If there are any injuries or exposures
   - Size and type of vehicle or containers
   - Placards

- Labels
- MSDS sheets
- Shipping Papers
- Size of spill
- Color of material
- If any smoke or vapors seem to be coming from the material
- If there is any threat of the material spilled to people or the environment.

Remain in a safe area and await response from the Canon City Fire Protection District.

3.6.2. Training Recordkeeping
Records will be kept of each training session. Information to be recorded will include the following:

- Date of training
- Type of training
- Name and department of each individual attending the training
- List of topics covered
- List of materials used in training

The hard copy of the training sign-in sheet will be kept in the binder for the Annual Report supporting documentation. The sign-in sheet will also be scanned and digitally located in ..\..\IDDE Training for City Staff.

SECTION 4. PUBLIC EDUCATION AND OUTREACH

Public education and outreach about illicit discharges is an important component of any IDDE program. Information and outreach about illicit discharges is integrated into existing public education and outreach programs such as the quarterly newsletters, EnviroScape demonstrations at local schools and festivals, Public Service Announcements and targeted flyers to businesses. Education and outreach is also done on an individual basis when the need arises. The Stormwater webpage contains guidance on what constitutes an illicit discharge and how to report potential illicit discharges.

SECTION 5. PROGRAM EVALUATION

Evaluation of the City of Cañon City's Illicit Discharge Detection and Elimination Program is accomplished through frequent analysis of the SW Violations asset database in CarteGraph OMS. The database contains geospatial data, sampling data, results of on-site investigations, enforcement activities, dumping and spill sites, and hotline calls. The tracking system is important from both an enforcement and program evaluation standpoint. Each of the program components are continually reviewed and modified, if needed, using data compiled from the database.

Regular analysis of the database by all staff involved in the various components of the program (managers, field personnel and GIS staff) sheds light on program strengths and deficiencies, and improves targeting of limited program resources. For example, if hotline complaints are found to uncover the most severe illicit discharge problems, more resources may be allocated to increase public awareness about the hotline, shifting resources from outfall screening and indicator monitoring.

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IDDE MANUAL APPENDIX A

OUTFALL EXAMPLES

TYPICAL OUTFALLS

Ductile Iron Round Pipe

Circular CMP

Circular PVC

Elliptical RCP
Measure both Horizontal and vertical diameters

Circular HDPE

Circular RCP

TYPICAL OUTFALLS

Box Outfall

Roof Drain; Once marked doesn't need inspected unless a problem is noted.

Concrete pan

Riprap Channel

Field connection to inside of bridge or culvert. Always mark and record.

Double Outfall; Mark as separate outfalls unless known to have the same origin.

IDDE MANUAL APPENDIX B

IDDE SAMPLING
AND
WATER QUALITY
MONITORING

City of Cañon City
Illicit Discharge and Detection (IDDE) Manual

TABLE OF CONTENTS – APPENDIX B

SECTION B.1. INTRODUCTION:

This standard sampling procedure is applicable to the collection of representative liquid samples from outfalls, inlets, manholes and from surface water sampling locations.

B.1.1. Sampling Objectives

Sampling is conducted to identify discharges with the significant reasonable potential to contribute to exceedance of stream water quality standards, and to identify potential cross-connections discharging to the storm sewer system and/or surface waters within the City of Cañon City's jurisdiction.

The following sections discuss the strategies that will be utilized to detect illicit discharges using in-field sampling and screening techniques designed to gather basic information. The sections also discuss the chemical indicator parameters that can identify illicit discharges; ***provide general guidance on how to collect, analyze and interpret each parameter***; and provide a basic framework for utilizing the screening data to:

- Address obvious discharges
- Develop a water chemistry monitoring program
- Make future program decisions

B.1.2. Indicator Parameters to Identify Illicit Discharges

Indicator monitoring is used to confirm illicit discharges and to provide clues about their source or origin. In addition, indicator monitoring can measure improvements in water quality during dry weather flows found as a result of the IDDE program.

Indicator parameters that can be used to help confirm the presence or origin of an illicit discharge include:

- Ammonia
- Boron
- Chlorine
- Color
- Conductivity
- Detergents
- E. coli, Enterococci,
- Total coliform
- Nitrate/Nitrite/Total Nitrogen
- Fluorescence
- Fluoride
- Hardness
- pH
- Potassium
- Surface Tension
- Surfactants
- Turbidity
- Phosphorous (Ortho or Total)

In most cases, though, only a small subset of indicator parameters (e.g., three to five) is required to adequately characterize an illicit discharge. An ideal indicator parameter should reliably distinguish illicit discharges from clean water and provide clues about its sources.

In addition, they should possess the following characteristics:

- Have a significantly different concentration for major flow or discharge types
- Exhibit relatively small variations in concentrations within the same flow or discharge type
- Be conservative (i.e., concentration will not change over time due to physical, chemical or biological processes)
- Be easily measured with acceptable detection limits, accuracy, safety and repeatability.

The table below summarizes the parameters that meet most of the indicator criteria, compares their ability to detect different flow types, and reviews some of the challenges that may be encountered when measuring them.

Table B-1 – Illicit Discharge Chemical Indicators

Indicator Parameters Used to Detect Illicit Discharges					
	Types of Discharge Detected				
Parameter	Sewage	Wash Water	Tap Water	Industrial/ Commercial	Lab/Analytical Issues
Ammonia	+	±	—	±	Can change into Nitrogen variants while flowing to the outfall; may be generated from non-human sources such as pets and wildlife.
Boron	±	±	—	**NA**	May be found in elevated levels in groundwater.
Chlorine	—	—	—	±	High volatility in water limits usefulness to flows with very high chlorine concentrations
Color	±	±	—	±	Clean water may yield a false positive
Conductivity	—	—	—	±	Ineffective in saline waters or where deicing agents are used.
Detergents/Surfactants	+	+	—	+	Reagent is a hazardous waste
E. coli	+	—	—	—	< 5-hour holding time and a 24-hour incubation time. Does not go to species level so may indicate a wildlife source.
Fluoride	—	—	+	±	Only applicable if MS4 fluoridates. High concentrations present in groundwater from North Cañon.
Hardness	—	—	±	±	May be elevated in groundwater. Limited usefulness except for extreme high/low values.
pH	—	±	—	±	
Potassium	+	±	—	+	May need to use two analytical techniques depending upon concentration found
Turbidity	±	±	—	±	
Nitrate-N/Total Nitrogen	±	±	—	±	May be from natural or agricultural sources.
Phosphorus	±	±	—	±	May be from natural or agricultural sources.

KEY

\+ Can almost always (>80% of samples) distinguish this discharge from clean flow types (e.g. tap water or natural water).

± Can sometimes (>50%) distinguish this discharge from clean flow types depending on regional characteristics, or can be helpful in combination with other parameters.

— Poor indicator. Cannot reliably detect illicit discharges, or cannot detect tap water.

NA: Data not available to assess the utility of parameter for this purpose.

SECTION B.2. DISCHARGE STANDARD SAMPLE COLLECTION PROCEDURES:

Program personnel need to be knowledgeable about the key fundamentals of sampling such as proper procedures and Quality Assurance / Quality Control. The objective is to identify illicit discharges within the storm sewer system or from outfalls in order to trace the source and eliminate the discharge and to identify potential cross connections.

To get reliable, accurate and defensible data, it is important to develop a consistent field sampling protocol to collect each indicator sample. Good field sampling incorporates six basic elements:

- *Where and When to Collect Samples*
- *Sample Collection Protocol*
- *Preservation and Storage of Samples*
- *Sample Labeling and Chain of Custody*
- *Quality Assurance / Quality Control Samples*

B.2.1 Where and When to Collect Samples

Indicator sampling occurs at three principle locations in the storm sewer system to detect illicit discharges.

- At the outfall
- Within the storm sewer network (e.g. inlets, manholes, channels)
- In the stream

Sampling dry weather flows from outfalls is the most common monitoring procedure in most IDDE programs. In-pipe sampling is often needed to track down and isolate individual discharges once a potential discharge problem is encountered at an outfall. Many of the sample collection protocols can be applied to in-pipe sampling. In-stream monitoring involves sample collection at perennial stream channels during dry weather flow conditions. Stream monitoring is less precise than outfall monitoring at detecting individual discharges. It can, however, screen stream reaches for those with the greatest illicit discharge potential and measure progress over time in terms of changes in stream water quality.

Indicator samples should be collected during dry weather periods to avoid flows caused by storm water or groundwater infiltration. While the preferred criteria for dry weather sampling is 72 hours without rainfall, 48 hours is considered sufficient to make sampling more practical. An exception to this rule is sampling in response to hotline complaints, which should be conducted immediately. The time of day sampling is conducted is particularly important when the suspected source is residential sewage. Peak water usage occurs in the morning and evening, therefore sampling in the early morning (i.e., beginning of the work day) is recommended in these situations.

All monitoring should occur during periods when irrigation flows are not expected to be a significant contributor to dry weather flows.

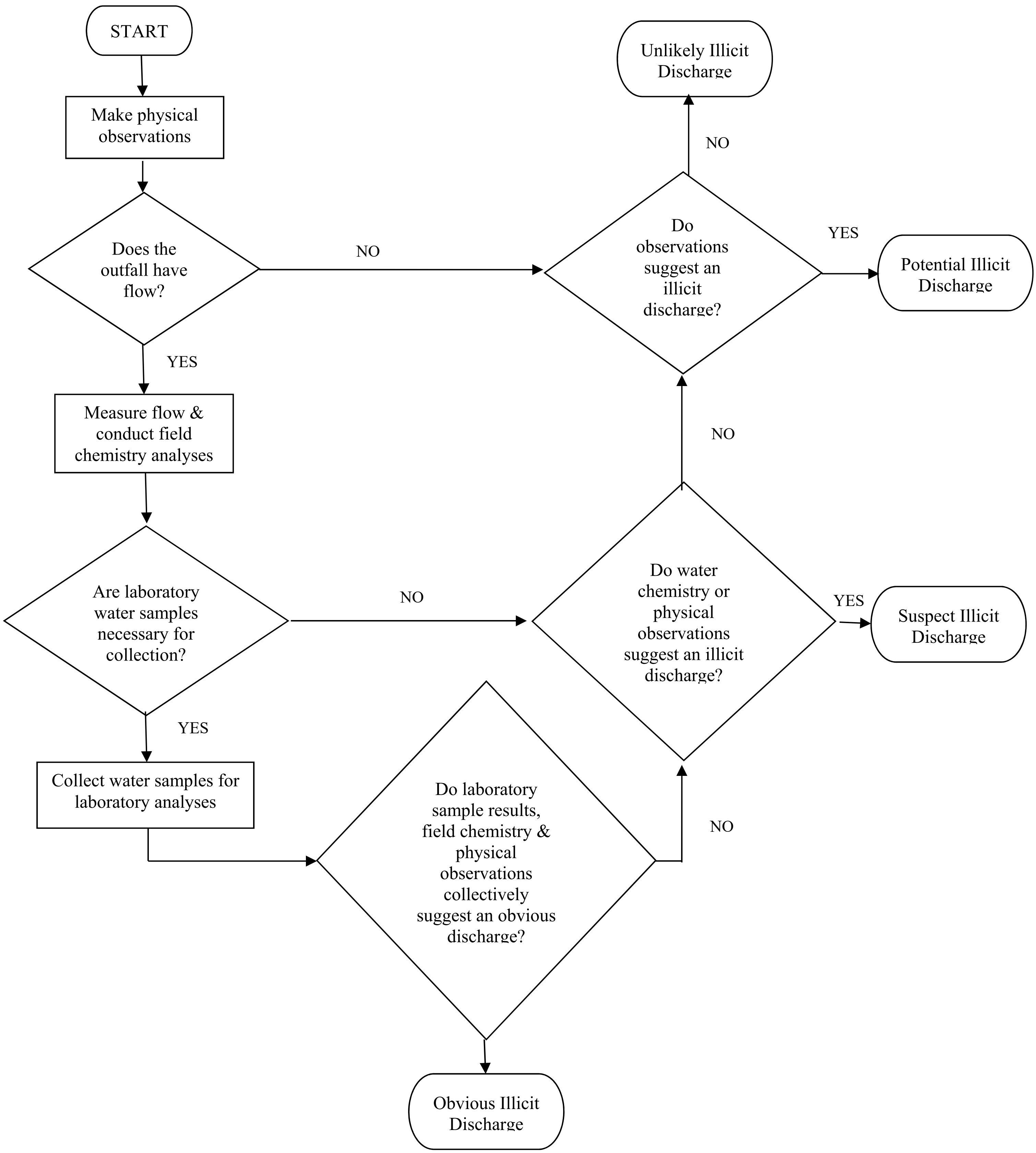
NOTE: All screening/sampling must occur at a frequency of more than one week from the previous screening/sampling occurrence.

B.2.2. Outfall Screening

If a measurable dry-weather flow of unknown origin is observed, a sample must be taken and documented. The occurrence of any significant physical indictors shall be observed and documented including odor, color, significant turbidity, floatables, deposition or excessive algae or vegetation growth. Illustration B-1 provides a decision tree for outfall sampling.

Illustration B-1. Outfall Decision Tree

Rectangles represent actions while diamonds represent decisions.



B.2.3. Illicit Discharge Sampling
If a suspected illicit discharge flow is reported, sampling will be done to confirm the source of the discharge. All procedures for documenting the illicit discharge incident and investigation will be followed.

B.2.4. Secondary Sampling
Secondary sampling may be required if the initial sampling results indicate:

- *E Coli* concentration exceeding 126 cfu/100 mL
- Boron and/or surfactants values exceed 0.35 mg/L and 0.25 mg/L, respectively which indicates that the discharge is contaminated by sewage or washwater
- If the discharge contains detergents, determine whether they are derived from sewage or washwater, using the ammonia to potassium ratios. A ratio of greater than one suggests sewage contamination, whereas ratios less than one indicate washwater contamination
- Fluoride and free chlorine levels between 0.9 and 1.1 may indicate a potable water source
- Industrial benchmark concentrations
    - Ammonia ≥ 50 mg/L
    - Conductivity ≥ 2000 µS/cm (adjust for background values)
    - pH ≤ 5.0
    - Potassium ≥ 20 mg/L

B.2.5. Water Chemistry Sampling Procedures

Table B-2. Sampling Prep List

Hanna Multi-Parameter Probe		Hach Pocket Colorimeter		LaMotte Nitrate/Phosphate Field Test Kit		Notebook Computer
Sterilized[1] Sample Containers		Small Cooler w/Ice		Neoprene Gloves		Paper Towels
Flow Measurement Container		Extended Reach Sampler		Sampling Log Book/Field Notebook		Container for Used Chemicals
Steel Toe Boots or Waders		Stopwatch		Distilled Water		
WTP Lab Chain of Custody		Pueblo Lab Chain of Custody		Sample Labels		

1) Field meters shall be calibrated.

2) Contact both the City of Cañon City Water Treatment Plant (240-5281) and the Pueblo City-County Health Department (719-583-4318) to determine if the lab is ready to accept samples. The following GENERAL guidelines should be followed to determine the best times to sample. When responding to an emergency however not all of the guidelines may be applicable.

    - Obtain samples before 11 AM to accommodate delivery and sample processing times

    - It is preferable to sample earlier in the week. Unless necessary, no samples should be taken on Friday due to incubation time for bacteria.

3) The use of good field practices helps to eliminate the potential for contamination and prevent the field crew from being exposed to harmful pollutants. To insure consistent samples the following practices should be followed:

[1] With the exception of bacteria sample bottles, for non-regulatory events sample bottles can be sterilized by running them through the dishwasher with NO SOAP and hi-temp dry cycle.

- Fill out and put the label on the bottle prior to filling. The labeling and collection integrity of each sample are critical components of the sampling protocol. Sample Labels must be filled out using a permanent marker such as a “Sharpie”. Information on the label must include the name of the MS4 and sampler, a unique sample ID, date and time the sample was collected, source of the sample (e.g. outfall, inlet), sample type (e.g. grab), any preservative added to the sample and any comments pertaining to the sample or sampling site which may affect the sample (e.g. unusual weather conditions). The unique sample ID is comprised of the sample location ID_date_time. For example if a sample was taken from outfall N9SB-15 on April 12, 2007 at 10:00 am its sample ID would be “N9SB-15_2007/04/12_1000”.

  An example of the information to include on the label is shown here.

N9SB-15_2007/04/12_1000	4/12/2007 1000
City of Cañon City	G.R.DeBekker
Outfall	Grab Sample
Overcast and windy	Preservative Type

- Gloves and safety glasses should always be worn to prevent accidental contact with skin and eyes and to prevent contamination of the sample. Do not touch the inside of the lid or bottle. Clean hands with sanitary wipes (anti-bacterial) after the sample(s) are collected.
- Approach the sampling location from downstream
- If the depth of the flow allows, rinse the bottle used to collect samples for the Water Treatment Plant lab analyses three times in the water to be sampled (ambient water) prior to collecting the sample. Do NOT rinse the bottle for the *E. coli* sample as it contains preservatives. Collect samples upstream from where you are standing if sampling from a stream or channel.
- Keep bottles and test tubes capped at all times to prevent accidental contamination of the sample and to prevent spills of chemicals.
- Properly fill test tubes and titration pipettes. No air bubbles should be present.
- Keep all trash picked up and dispose of used samples into a container which can be sealed; dispose of the samples properly.
- Fill the sample collection bottle so that 90% of the volume is filled to facilitate the addition of preservatives and to allow titration/mixing.
- Add any needed preservative at the time of sample collection
- Put samples in an ice-filled cooler immediately to cool samples to 4ºC (40ºF)

4) Dry weather flows can be shallow, have low flow volumes and be hard to reach. In some cases, alternative methods of sample collection may be used.
   - A “dipper,” consisting of a HDPE bottle at the end of a long pole, can be used to catch flows from the outfall.
   - A pre-measured, clean, cut-off plastic milk jug can be used in shallow flows from the pipe.
   - In either case, make sure not to disturb any sediments or benthic growth in the pipe as a sample is taken. Also, be sure to rinse the sample collection vessel three times in ambient water before collecting the sample.

5) The following parameters can be obtained in the field:
   - Temperature
   - Dissolved Oxygen
   - pH
   - Conductivity
   - Total Dissolved Solids
   - Salinity
   - Chlorine
   - Nitrate-Nitrogen
   - Orthophosphate
   - Flow

If possible use a 1-Liter container and a stopwatch to determine the discharge volume. Record the discharge volume on the field sample sheet and/or the field logbook and note on how it was determined. (Illustration B-2. Field Sample Sheet.) The sample sheet is located at ..\..\Field Investigation & Monitoring\WQ Data\Forms.

Place the water chemistry probe directly into the effluent from the outfall or into the pool/stream of the sampling location. Wait for the field readings to stabilize. After the field readings have stabilized record the readings on the field sample sheet and/or the field logbook. For field chlorine, follow the instructions for the colorimeter. For Nitrate/Phosphate follow the directions in the test kit.

6) While waiting for the field meter readings to stabilize, begin discharge sample collection. When sampling a discharge from an outfall try to obtain the sample directly from the outfall using the sample container. If this is not possible due to location or safety, attach the bottle to the remote sampler and attempt to fill the bottle.

   - Fecal coliform / *E. coli* – Remove cap from sample bottle taking care not to touch the inside of the lid. Fill bottle directly from discharge if possible

   - Potassium – One 1 liter plastic bottle, fill to shoulder and add approximately 2 ml of Nitric Acid (rinse each bottle with ambient water three times before filling) to adjust to pH of 2 – 3.

   - Remaining Analytes – Two 1 liter plastic bottles filled to shoulder. No preservative (rinse each bottle with ambient water three times before filling)

Each indicator parameter has a unique sample preservation technique and a maximum holding time for laboratory analysis. If samples are being analyzed immediately at the Water Treatment Plant or at the Pueblo Health Department Lab the only preservatives required are for potassium and E. coli. See table below. A separate sample should be taken for the potassium analysis.

Table B-3 – Sample Parameters Requiring Preservatives

Parameter	Preservative	Procedures
E. coli	Sodium Thiosulfate	Preservative pre-measured in bottle
Potassium	Nitric Acid	Add 2ml/Liter to adjust pH to 2 -3

7) Store samples in the cooler (ice the bacteria samples) and complete the appropriate chain of custody form. See Illustrations B-3 and B-4 for chain of custody forms. The forms are located at ..\..\Field Investigation & Monitoring\Labs\Forms.

8) Deliver water chemistry samples to the City of Cañon City Water Treatment Plant lab immediately then take bacteria sample bottle(s) to the Pueblo City-County Health Dept. lab, located at 101 W. 9th St in Pueblo.

Illustration B-2. Field Sample Sheet

Parameter	Date	Date	Date	Date	Date	Date	Date	Date	Date
	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID
Field									
Flow (L/sec)									
Temp C°									
DO (mg/L)									
Cond (µS/cm)									
pH (field)									
Salinity									
TDS (ppm)									
Free Cl_2 (field mg/L)									
Total Cl_2 (field mg/L)									
Nitrate-N (ppm)									
Nitrate (Nitrate-N x 4.4) (ppm)									
Orthophosphate (ppm)									
Odor									
Color									
Turbidity									
Floatables									
Deposition									
Vegetation									
Algae Growth									
Time									
Air Temp F									
12 hr Precipitation									
24 hr Precipitation									
48 hr Precipitation									
72 hr Precipitation									

Additional Notes:

Results Interpretation:

Illustration B-3 Water Treatment Plant Lab Chain of Custody Form

City of Cañon City Chain of Custody and Analytical Request Record

CAÑON CITY STORMWATER PROGRAM

Program: ☐-Illicit Discharge Detection Monitoring
Circle One ☐-Surface Water Monitoring

Receipt Temp

Contact Name: **Glenda DeBekker**

Phone/Fax: **276-5265/269-9017 Fax**

Email: **grdebekker@canoncity.org**

ANALYSIS REQUESTED

EPA/State Compliance:

Yes ☐ No ☐

A2LA ☐ Level IV ☐

Sampler: (Please Print)

Comments:

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	Total Chlorine	pH	Turbidity	Total Hardness	Ammonia	Detergents	Potassium	Boron	Fluoride	Total Nitrogen	Total Phosphorus		
1															
2															
3															
4															
5															
6															
7															

Custody Record MUST be Signed			
	Relinquished by (print):	Date/Time:	Signature:
	Received by (print):	Date/Time:	Signature:
	Sample Disposal:	Return:	Lab Disposal:

Drinking Water Bacteriological Analysis Request Form

Pueblo City-County Health Department
Laboratory
101 W. 9th St.
Pueblo CO 81003
(719) 583-4318
pueblohealthdept.org

Lab Use Only

ECOData entry ______ initial _____ results

****Samples over 30 hours old and not in approved container are unsuitable for testing****

Samples can be dropped off for analysis between 8 AM and 4 PM Monday through Thursday.
Please do not send or bring samples that will be received the day before a holiday or on Friday.

Sampling instructions (For TCR) Samples must be representative of the water distribution system. Water taps used for sampling should be free of aerators, strainers, hose attachments, mixing type faucets, and purification devices. Cold water taps should be used. The service line must be cleared before sampling by maintaining a steady water flow for at least two minutes (until a steady water temperature is achieved). At least 100 ml of sample must be collected, allowing at least a 1-inch air space to facilitate mixing of the sample by shaking. Immediately after collection, complete this form.

Customer Information:
City of Canon City
Stormwater Program
P.O. Box 1460
Canon City, CO 81215
Tel: 719-276-5265
Fax: 719-269-9017

Billing Information:
Same

Email Results:
grdebekker@canoncity.org

Sample Information:

Collection Date: _________________ Collection Time: ______________ AM/PM

Name of collector: _____________________________

Sample site address: _______________________________________ County: _______________

Sample site location: ____

Purpose: □ **Special Purpose**

Laboratory Use Only Billing Information: 1486 $22/Sample

Received By: _______________ Date:________________ Time: ___________________ □ Courier □ Person

Tested: Date: ________________ Time:____________________

Method: □ Quanti-tray

Results per 100 ml sample: Total coliform: □ Presence □ Absence Fecal coliform/E. coli: □ Presence □ Absence

Analyst: ______________________ Date: __________________ Time: _________________
Comments:

B.2.6. Quality Assurance and Quality Control
The labeling and integrity of each sample are important parts of the sampling protocol. Program managers must also track the "chain of custody" from the time the sample is initially collected until it is analyzed and reported as data to limit errors resulting from mislabeling, lost samples, and improper laboratory analysis.

To ensure sampling results are accurate, it is important to institute quality assurance measures as part of the sampling protocol. Quality assurance samples serve as a check against biases introduced during sample collection, or within the laboratory. Quality assurance samples also assess the accuracy of the analysis method and its consistency for samples collected at the same site.

Examples of quality assurance samples include field blanks and duplicate samples which are described below:

- *Field Blanks* – Field blanks are deionized water samples prepared in the field at the time of sample collection. If the lab results for field blanks have non-zero values, it indicates that impurities were introduced to the sample during collection or lab analysis. The distilled deionized water should be placed in the dipper or whatever is used to collect samples and then poured in the sample bottle, just as a real sample.

- *Duplicate (Replicate) Samples* – This quality assurance technique relies on the collection of two or more samples from the same location and flow source during the same field visit. A discrepancy between the two sample measurements indicates a lack of precision or repeatability introduced during sample collection or lab analysis.

Quality Assurance and Quality Control are also ensured by regular maintenance and calibration of equipment. The multi-parameter probe will be cleaned and calibrated after each use. When not in use, it will be calibrated at least every three months.

SECTION B.3. SAFETY:
Whenever sampling is done there are safety considerations that require planning. This is even more important when sampling is being conducted in urban stream environments where there is potential for contact with contaminated water, sharp debris and objects, and threatening individuals (both animals and humans). Field crews should be comprised of at least two individuals, each equipped with proper foot (e.g., sturdy boots or waders) and hand wear (latex, neoprene or rubber gloves).

Private properties should not be accessed unless proper notification has been provided, preferably in advance, or if the discharge constitutes an immediate danger to public health or safety. It is recommended that field crews to be vaccinated against Hepatitis B, particularly if the crews will be accessing waters known to be contaminated with illicit sewage discharges.

When working in or near a street where traffic is a concern, traffic cones and/or appropriate signage must be in place and reflective vests must be worn.

Field Personnel must be familiar with and always adhere to the ***City of Cañon City Confined Space Entry Policy*** below:

1) Scope

a. A confined space refers to a space that has limited openings for entry and exit, unfavorable natural ventilation that could contain or produce hazardous atmospheres, and is not intended for continuous employee occupancy. Examples of such City of Cañon City confined spaces include but are not limited to storage tanks, metering vaults, valve vaults, filter beds, and other utility vaults, manholes and tunnels.

b. This Directive applies to any employee having authorization to enter and work in facilities determined to be a confined space.

c. This Directive references the City's Confined Space Entry Program which is based on current criteria developed by the National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA).

2) Policy

a. Confined spaces shall be considered dangerous and may not be entered until all required safeguards have been accomplished, entry permits completed and authorization granted as outlined within the City's Confined Space Entry Program.

b. Any extenuating circumstances, conditions or operating procedures not covered within the City's Confined Space Entry Program shall be investigated or conducted in accordance with a common sense approach, using accepted industry and safety standards.

c. There shall be no horseplay or shortcutting of safety procedures.

SECTION B.4. ANALYTICAL AND FIELD TESTING PARAMETERS

- **Ammonia:** Ammonia can be found naturally in water as a result of decomposition of algae, dead plants and animals and from the metabolic wastes of animals. In high concentrations it can be highly toxic to aquatic life. It is a good indicator of sewage since its concentration is much higher in sewage than in tap water or groundwater. Ammonia is relatively simple to analyze for in the lab, although it does have a tendency to volatize. Ammonia concentrations can also be affected by increased pH or temperature. Ammonia is analyzed at the Water Treatment Plant lab.

- **Boron:** Boron, which is an element present in borax, is often found in detergents and soaps. As such, it is a good potential indicator for both washwater and sewage, especially when combined with results from detergent/surfactant and potassium tests. It may be found in groundwater and is a common ingredient in water softeners. Boron is analyzed at the Water Treatment Plant lab.

- **Chlorine:** Chlorine is added to our drinking water as a disinfectant and as such its concentrations tend to be significantly higher than in most other water sources. Unfortunately, it is also extremely volatile – even moderate levels of organic material can cause the level of chlorine to drop below detection level. If high levels are detected, chlorine may indicate a water line break, swimming pool discharge or an industrial discharge. Total chlorine is analyzed at the Water Treatment Plant lab while both free and total chlorine are tested for in the field.

- **Conductivity/Salinity/Total Dissolved Solids:** Conductivity is the measure of how well the water will conduct electricity. Salinity is the measure of salts in the water. Total Dissolved Solids (TDS) is the amount of dissolved material in the water. Conductivity is often strongly correlated with salinity and TDS. Conductivity by itself is not a strong indicator of an illicit discharge, especially since natural waters may have a high conductivity. Salts and TDS in fresh water can be from industrial sources, wastewater or from surrounding soils. Conductivity can also be affected by the water temperature; it may vary as much as 3% for every 1^{o} in temperature change. All of these parameters are tested for in the field with the multi-parameter probe.

- **Detergents/Surfactants:** Detergents are a good indicator of sewage and washwater discharges. They are almost universally present in these discharges as well as discharges from industrial or commercial cleansers, while being absent from natural or tap water. Surfactants are the active ingredient in most commercial detergents and are not found in nature. Surfactants present in cleansers, emulsifiers and lubricants make them an excellent indicator of industrial or commercial liquid wastes. Detergents are analyzed at the Water Treatment Plant lab.

- **Dissolved Oxygen (DO):** Dissolved Oxygen is the measure of the amount of oxygen (as a gas) in the water. By itself dissolved oxygen cannot be used to differentiate illicit discharge flow types, but it can be used as an additional screening factor for potential sewage and industrial discharges, septic tank failures and agricultural runoff. DO is affected by many factors such as temperature (cold water holds more than warm water); time of day (oxygen is produced by plants during the day and used by animals at night); water depth and flow; turbidity of the water and the amount of splashing, wind and wave action. Dissolved oxygen is measured in the field with the multi-parameter probe.

- ***E. coli*:** This is a bacteria found in human and animal intestinal tracts. High readings of *E. coli* can indicate contamination from a sanitary sewer source. High concentrations may also be found if there is wildlife or livestock around the water source. The Pueblo lab does not differentiate between human and animal *E. coli*, so land use around the discharge source or along its path needs to be looked at carefully before a sewage source is assumed.

- **Fluoride:** Fluoride is added to the drinking water provided by the City of Cañon City's Water Department, but not to drinking water in North Cañon which is provided by the Park Center Water District. This is due to the naturally high levels of fluoride already present in their water source (1.8 – 3.1 mg/l). If fluoride levels of 0.9 – 1.1 mg/l are found in a sample it may indicate a water line break or leak. Lower levels of fluoride or extremely high levels are more indicative of a natural water source such as river water (used for irrigation) or ground water. Fluoride analysis is done at the Water treatment Plant lab.

- **Hardness (Total as $CaCO_3$):** Hardness measures the positive calcium ions in the water. Hardness has limited value for detecting illicit discharges except when values are extremely high or low which may indicate the presence of a type of liquid waste. It is most useful in distinguishing between natural groundwater flow and tap water in areas where the level is elevated due to karst or limestone terrain. Hardness is measured at the Water Treatment Plant lab.

- **Nitrate-Nitrogen:** Nitrate-Nitrogen is generally found only in trace amounts in surface water. It can be found in sewage effluent and agriculture runoff (from fertilizers and animal waste), and as such may be used as a screening indicator for those types of flows. Nitrate is an end product of the biological oxidation of ammonia. Nitrates may also be found naturally in soils from decomposition of organic matter and animal waste. Currently nitrate is only tested for in the field, but may be added at a later date to the analytical parameters tested for at the Water Treatment Plant lab.

- **pH:** pH measures how acidic or basic the water is. Most discharges are neutral (pH around 7), but liquid wastes from industries may have a very high or very low pH. pH can be affected by the type of soil or bedrock the water flows through, by acid rain and can vary during the day. Water that is too acidic or basic can affect biological processes such as reproduction in fish and the formation of the outer shell in crayfish. pH is measured both in the field and at the Water Treatment Plant lab.

- **Phosphate:** Phosphorus is needed for plant growth, but too much can cause excessive plant and algae growth. It is usually found in nature as phosphate (PO_4^{-3}). It can be found in sewage effluent (from detergents) and agriculture runoff (from fertilizers and animal waste), and as such may be used as a screening indicator for those types of flows. Phosphate may also be found naturally in soils. Currently phosphate (as orthophosphate) is only tested for in the field, but may be added at a later date to the analytical parameters tested for at the Water Treatment Plant lab.

- **Potassium:** Potassium concentrations are usually relatively high in sewage and are very high in many industrial process waters. It can act as an indicator of both. Used in combination with ammonia, it can help to distinguish between washwaters and sanitary wastes. Potassium analysis is done at the Water Treatment Plant lab.

- **Temperature:** Temperature can be used as an indicator for some industrial process flows and potential sewage flows as these may be much warmer than the ambient water. In natural waters such as the river and creek temperature is influenced by flow, depth, stream cover, water color, time of day and the season. The Arkansas River and Four Mile Creek are cold-water streams with optimal temperatures for aquatic organisms of 17ºC from June to September and 9ºC from October to May. Temperature readings are taken in the field with the multi-parameter probe.

- **Turbidity:** Turbidity, which is a quantitative measure of the cloudiness of the sample, is measured in the field. The cloudiness is caused by suspended particles present in the sample. The particles may be clay, silt, organic, inorganic or microscopic organisms. It cannot distinguish between contaminated flow types, but is used as a screening indicator for contaminated flow versus groundwater or tap water. Increased turbidity may indicate runoff from construction, erosion or agriculture or may be due to natural conditions. It is considered a good indicator, in natural waters, of the quality and productivity of an aquatic system and is often used to monitor stream health. Turbidity is measured at the Water Treatment Plant lab.

Table B-4.

Analytical Methods used by the Water Treatment Plant Lab		
Indicator Parameter	**Analytical Method**	**Detection Limits**
Ammonia	Salicyate Method #8155	0.10 – 0.50 mg/l as NH_3
Boron	Azomethine – H Method 10061 L.R.	0.020 – 1.50 mg/l as B
Detergents &/or surfactants	Crystal Violet Method #8028	0.002 – 0.275 mg/l as LAS
Fluoride	SPADNS Method #8029	0.02 – 2.00 mg/l as F-
pH	Bench Top pH Analyzer	1 – 14
Potassium	Tetraphenylborate Method #8049	0.1 – 7.0 mg/l
Total Chlorine	DPD Method #8167	0.02 – 2.00 mg/l
Total Hardness	EDTA Method #8213	10 – 4000 mg/l as $CaCO_3$
Turbidity	Bench Top Nephelometric Method	0.0 – 4000 NTU

SECTION B.5. TECHNIQUES IN INTERPRETING INDICATOR DATA

The best combination of indicator parameters will be used to confirm discharges and identify flow types. The two techniques that will be used to interpret indicator parameter data are the Flow Chart Method and Single Parameter Screening. A third technique, the Chemical Fingerprint Library may be developed over time.

- **The Flow Chart Method** is preferred because it can distinguish four major discharge types found in residential watersheds, including sewage and washwater flows which are usually the most common illicit discharges. This method is a relatively simple technique that analyzes four or five indicator parameters that are safe, reliable and inexpensive to measure.

  Step 1: Distinguish clean flows from contaminated flows using detergents

  The first step evaluates whether the discharge is derived from sewage or washwater sources, based on the presence of detergents. Boron and/or surfactants are used as the primary detergent indicator(s); values of boron or surfactants that exceed 0.35 mg/L and 0.25 mg/L, respectively, signal that the discharge is contaminated by sewage or washwater.

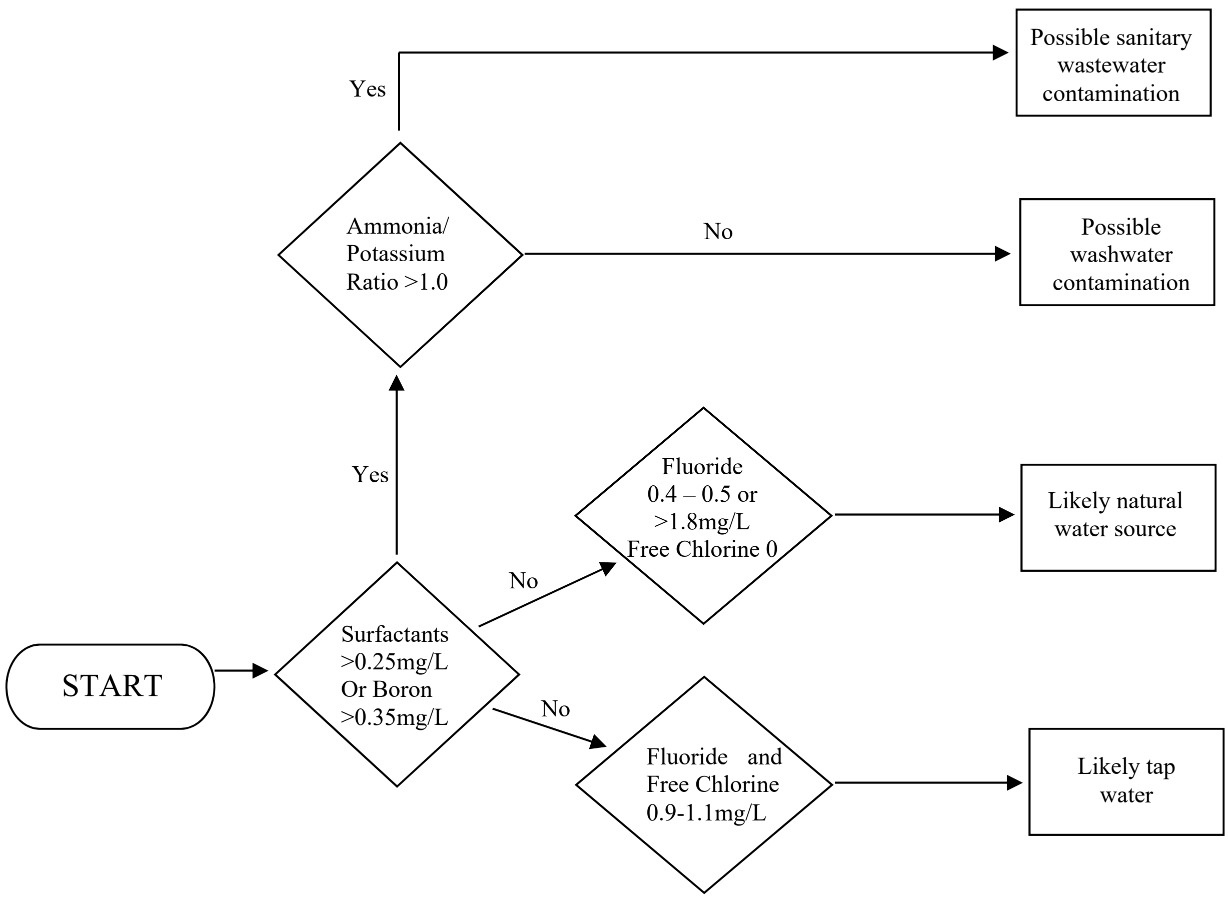
  Step 2: Separate washwater from wastewater using the Ammonia/Potassium ratio

  If the discharge contains detergents, the next step is to determine whether they are derived from sewage or washwater using the ammonia to potassium ratio. In general, a ratio greater than one suggests sewage contamination, whereas a ratio of less than one indicates washwater contamination.

Step 3: Separate tap water from natural water

If the sample is free of detergents, the next step is to determine if the flow is derived from spring/groundwater or comes from tap water. Two benchmark indicators are used in this step – fluoride and free chlorine. Both naturally occur in the Arkansas River and in area groundwater, but both are also added to drinking water by the Cañon City Water Treatment Plant. Fluoride and residual free chlorine levels in drinking water are about 0.9 mg/L. River water has a natural level of about 0.4 – 0.5 mg/L of fluoride and no free chlorine. The groundwater from north Cañon City has an extremely high natural level of fluoride, ranging from 1.8 to 3.1 mg/L. Park Center Water District does not treat their drinking water with fluoride for this reason. Free chlorine residual levels in their drinking water are about 1.1 mg/L. The purpose of determining the source of a relatively "clean discharge" is that it can point to water line breaks, outdoor washing, non-target irrigation and other uses of municipal water that generate flows with pollutants.

Illustration B-5. Flow Chart Method of Interpreting Indicator Data



• **Single Parameter Screening:** Research suggests that detergents are the best single parameter to detect the presence or absence of the most common illicit discharges (sewage and washwater). Ammonia is another single parameter indicator that may be used to detect possible sewage contamination. An ammonia concentration of greater than 1 mg/L is generally considered to be a positive indicator of sewage contamination. As a single parameter, ammonia has some limitations. First, ammonia by itself may not always be capable of identifying sewage discharges, particularly if they are diluted by "clean" flows. Second, while some washwaters and industrial discharges have relatively high ammonia concentrations, not all do, which increases the prospects of false negatives. Other dry weather discharges, such as non-target irrigation, can also have high ammonia concentrations (>1 mg/L). Analyzing for both ammonia and potassium, and looking at the ammonia/potassium ratio, is a simple adjustment to the single parameter approach that helps to more accurately characterize the discharge. Ratios greater than one indicate a sewage source, while ratios less than or equal to one indicate a washwater source.

- **The Chemical Fingerprint Library:** The chemical library is a compilation of the chemical composition of the range of discharge types found in a community. The primary purpose of the library is to characterize distinct flow types that may be observed at outfalls, including both clean and contaminated discharges. A good library will include data on the composition of tap water, groundwater, sewage, septage, non-targeted irrigation water, irrigation return flows, industrial process waters and washwaters (e.g. laundry, car wash, etc.). The chemical library helps customize the flow chart method and benchmarks which will assist in distinguishing between "clean" flows and contaminated flows.

  To develop the library, samples are collected directly from the discharge source (e.g. tap water, wastewater treatment influent, shallow wells, septic tanks, irrigation return, groundwater, etc.). **As a general rule, about 10 samples are typically needed to characterize each flow type, although more samples may be needed if the flow type has a high coefficient of variation.** The measure of error can be statistically defined by evaluating the coefficient of variation of the sample data (variability relative to the mean value), and the statistical distribution for the data (the probable spread in the data beyond the mean).

  Chemical libraries should also be compared to databases that summarize indicator monitoring of dry weather flows at suspect outfalls. Outfall samples may not always be representative of individual flow types because of mixing of flows and dilution, but they can serve as a valuable check if the discharge source is actually confirmed. The chemical library and indicator database can be used to refine the flow chart method for interpreting indicator data. Over time, other flow types may be added to the chemical library, such as transitory discharges that generate small volume flows (e.g. "dumpster juice", power washing and residential car washing). Transitory discharges are hard to detect with outfall monitoring, but may cumulatively contribute significant dry weather loads. Existing water quality data from various sources for the area can accessed at www.waterqualitydata.us.

The following table lists the possible sources associated with the indicator parameters used by the City of Cañon City's IDDE program.

Table B-5. Parameter Analysis Quick Reference Table

Indicator Parameter	Analytical Results	Standard Limits	Possible Sources	Comments
E. coli	>126 cfu/100 ml	126 cfu/100 ml	Sewage	May be influenced by wildlife or livestock sources. If high concentrations are found, test for ammonia/potassium ratio to distinguish between sewage and washwater.
Detergents/Surfactants	>0.25 mg/L <0.25 mg/L		Sewage/washwater Natural or potable water	Test for ammonia/potassium ratio to distinguish between sewage and washwater and fluoride/chlorine for natural/potable water.
Boron	>0.35 mg/L <0.25 mg/L	0.75 mg/L (agriculture)	Sewage/washwater Natural or potable water	Test for ammonia/potassium ratio to distinguish between sewage and washwater and fluoride/chlorine for natural/potable water.
Ammonia	>0.1 mg/L	0.6-0.1 mg/L	Sewage Industrial waste	Check ammonia/potassium ratio
Potassium	Presence		Sewage Industrial waste	Check ammonia/potassium ratio
Ammonia/Potassium Ratio	>1.0 <1.0		Sanitary wastewater Washwater	If discharge contains surfactants
Fluoride	0.9-1.1 mg/L 0.4-0.5	2 mg/L (drinking water)	Tap water Natural source	Canon City DW ~0.9 mg/L North Canon (Park Center Water) 1.8-3.1 mg/L
Chlorine	0.9-1.1 mg/L	0.019 mg/L	Potable water	Not a good indicator since chlorine does not exist in a "free state" for long
Nitrate-Nitrogen (Nutrients)	Benchmark yet to be determined	10 mg/L (drinking water) 1,250 ug/L [1.25 mg/L] (Total Nitrogen interim value)	Sewage Sanitary wastewater Agriculture	Also occurs naturally
Phosphorus (as orthophosphate) (Nutrients)	Benchmark yet to be determined	110 ug/L [0.11 mg/L] (Total Phosphorus interim value)	Sewage Sanitary wastewater Agriculture	Also occurs naturally
Total Hardness (as $CaCO_3$)				Additional parameter to distinguish between natural and potable water sources.
Turbidity	High levels		Industrial Sanitary wastewater Construction runoff	
Conductivity/TDS/Salinity				Usefulness depends on whether concentrations are elevated in natural waters
pH	<3 or >12	6.0-9.0	Industrial source	
Temperature	High	17.0°C June-Sept 9.0°C Oct-May	Sanitary wastewater Industrial processes	Useful when sampling is done during cold weather
Dissolved Oxygen	Very Low	6.0 mg/L 7.0mg/L (spawning)	Sewage/septic tanks Industrial Agriculture	Not useful by itself

SECTION B.6. RECORDKEEPING

The following records will be kept in the CarteGraph OMS databases:

- Water Quality forms will be filled out when sampling is done. If sampling is done as a result of a reported illicit discharge, the report is entered into the Request database and a SW Violation asset is created in CarteGraph OMS.
- Water Quality sampling is recorded as a task associated with the SW Violation asset record in the CarteGraph OMS database. As not all sampling is done for illicit discharge detection verification, the task can also be recorded as a task associated with another asset or as a stand-alone task in the database.

Additional recordkeeping:

- Maintenance and calibration records of the multi-parameter probe and the chlorine analysis meter is kept in the spreadsheet located at ..\..\Field Investigation & Monitoring\Equipment\MultiparameterProbeMaintenanceLog.xls

B.6.1. Water Quality Form in CarteGraph OMS:

Section 1. Sample Basic Information

This section is used to record basic information about the sample. A unique ID is assigned to the sample which is comprised of the sample location ID_date_time. For example if a sample was taken from outfall N9SB-15 on April 12, 2007 at 10:00 am its sample ID would be "N9SB-15_2007/04/12_1000". The sample date and time, person sampling, sample source and collection point are recorded here. The reason and rationale for sampling is also recorded in this section.

Section 2. Field Conditions

Air temperature and weather conditions at the time of the sampling are recorded in this section. Precipitation in the previous 24 and 48 hours are also noted.

Sections 3 and 4. Flow Data Methods

Flow – Field personnel can determine the rate of flow using one of two techniques. The first technique (Flow #1) records the time it takes to fill a container of known volume, such as a one liter sample bottle. It may be necessary to use a "homemade" container to capture flow, such as a cut out plastic milk container that is marked to show a one liter volume. The shape and flexibility of plastic containers allow crews to capture relatively flat and shallow flow. The flow volume is determined as the volume of flow captured in the container per unit of time.

The Flow #2 method can be used to determine flow velocity in locations where larger discharges occur (if a mechanical flow meter is not available). Field personnel measure off a fixed flow length, usually about five or ten feet. A small bobber is dropped into the flow at the starting point. The time it takes the bobber to travel the measured length is recorded. The velocity of flow is then computed as the length of the flow path (in feet) divided by the travel time (in seconds). The cross-sectional flow area is also recorded. It is calculated by measuring the depth of the flow at the deepest point and the width of flow, then multiplying the two. Finally, the cross-sectional area (in square feet) is multiplied by the flow velocity (feet/second) to calculate the flow rate in cubic feet/second.

Section 5. Physical Indicators

This section is used to record sensory indicator data (odor, color, turbidity, floatables, deposition, vegetation and algae growth). Sensory indicators are detected by smell or sight, and require no measurement equipment. Sensory indicators are important in detecting the most severe or obvious discharges. Section 5 of the form focuses on whether sensory indicators are present, and if so, what are their severity, on a scale of one to three. Descriptions of the indicators follow. Examples are shown in Illustration B-6.

- **Odor:** Description of any odors emanating from the outfall. A severity score of one means that the odor is faint; a score of two indicates a moderate odor is detectable; and a score of three is assigned if the odor is so strong that it is noticeable from a considerable distance.

- **Color:** A visual assessment of the discharge color and its intensity. The best way to measure color is to collect the discharge in a clear sample bottle and hold it up to the light. The color of the discharge can be clear, slightly tinted, or intense. If the sample is from an outfall field personnel should also look for downstream plumes of color. A severity score of one means there is faint color present in the sample bottle; a score of two means color is clearly visible in the sample bottle; and a score of three is assigned if color is clearly visible in the flow.

- **Turbidity:** A measure of the cloudiness of the water. Like color, turbidity is best observed in a clear sample bottle, but can also be quantitatively measured using field probes. There can be some confusion of turbidity with color. Turbidity is a measure of how easily light can penetrate through the sample bottle, whereas color is defined by the tint or intensity of the color observed. If the sample is clear it is assigned a severity index of zero; slight cloudiness is assigned a one; cloudy is assigned an index of two; and opaque rates a three.

- **Floatables:** The presence of any floatable materials in the discharge or the plunge pool below an outfall. Sewage, oil sheen and suds/foam are all examples of floatable indicators. Trash and debris are generally not considered an indicator. The presence of floatable materials is determined visually. A severity index of one is assigned if there are few/slight floatables present and their origin is not obvious; if some are present with indications of origin an index of two is assigned; and if some are present with an obvious origin an index of three is assigned. If it appears that the floatable is sewage, a severity score of three should be automatically assigned. Surface oil sheens are ranked based on their thickness and coverage. In some cases, surface sheens may not be related to oil discharges, but instead are created by in-stream processes. A thick or swirling sheen associated with a petroleum-like odor may be diagnostic of an oil discharge. Suds are rated based on their foaminess and staying power. A severity score of three is designated for thick foam that travels many feet before breaking up. Suds that break up quickly may simply reflect water turbulence, and do not necessarily have an illicit origin. Indeed, some streams have naturally occurring foams due to the decay of organic matter. On the other hand, suds that are accompanied by a strong organic or sewage-like odor may indicate a sanitary sewer leak or connection. If the suds have a fragrant odor, they may indicate the presence of laundry water or similar wash waters.

- **Deposition:** The degree of any deposited earthen materials in or near the outfall. A severity index of one is assigned if there is slight deposition and its origin is not obvious; for moderate deposition in areas of lower flow an index of two is assigned; and for excessive deposition which inhibits function an index of three is used.

- **Vegetation:** The growth of vegetation present can be an indicator of the presence of nutrients or an illicit discharge. If growth appears normal or none is present due to lack of area/soil for growth a severity index of zero is assigned; for apparent excessive or inhibited growth an index of one is assigned.

Algae Growth: Like vegetation, growth or absence of algae can be an indicator of the presence of nutrients or an illicit discharge. If growth appears normal or none is present a severity index of zero is assigned; for apparent excessive or inhibited growth an index of one is assigned. Toxic algae may resemble thick pea soup, spilled paint on the water's surface, and/or create a thick mat of foam along the shoreline. Toxic algae is generally green, red, gold, or turquoise. You may also see small specks or blobs floating at or just below the water surface. Toxic algae is typically not stringy or mustard yellow in color (the latter is probably pollen). See Section B.7. for more detailed information on algae blooms and testing methods.

Illustration B-6. Physical Indicator Examples

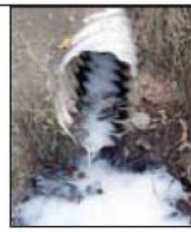
PHYSICAL INDICATOR EXAMPLES

Color: Brown; Severity: 2
Turbidity Severity: 2

Color: Blue-green; Severity: 3
Turbidity Severity: 2

Highly Turbid Discharge
Color: Brown; Severity: 3
Turbidity Severity: 3

Sewage Discharge
Color: 3
Turbidity: 3



Paint
Color: White; Severity: 3
Turbidity: 3

Industrial Discharge
Color: Green; Severity: 3
Turbidity Severity: 3

Blood
Color: Red; Severity: 3
Turbidity Severity: None

Failing Septic System:
Turbidity Severity: 3

Turbidity in Downstream Plume
Turbidity Severity: 2
(also confirm with sample bottle)

High Turbidity in Pool
Turbidity Severity: 2
(Confirm with sample bottle)

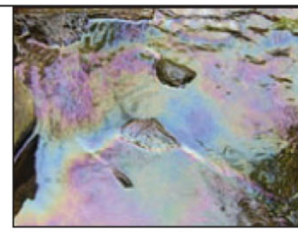
Iron Floc
Color: Reddish Orange; Severity: 3
(Often associated with a natural source)

Slight Turbidity
Turbidity: 1
(Difficult to interpret this observation; May be natural or an illicit discharge)

Construction Site Discharge
Turbidity Severity: 3

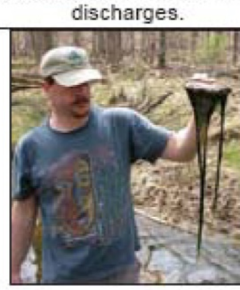
Discharge of Rinse from Floor Sanding (Found during wet weather)
Turbidity Severity: 3

PHYSICAL INDICATOR EXAMPLES

SUDS		
		
Natural Foam Note: Suds only associated with high flows at the “drop off” Do not record.	Low Severity Suds Rating: 1 Note: Suds do not appear to travel; very thin foam layer	High severity suds Rating: 3 Sewage
OIL SHEENS		
		
Low Severity Oil Sheen Rating: 1	Moderate Severity Oil Sheen Rating: 2	High Severity Oil Film Rating: 3

	
Turbidity is Evaluated as the Amount of Light that can Pass Through the Sample.	**Natural sheen from bacteria such as iron floc forms a sheet-like film that cracks if disturbed**

PHYSICAL INDICATOR EXAMPLES

		
Bacterial growth at this outfall indicates nutrient enrichment and a likely sewage source.	This bright red bacterial growth often indicates high manganese and iron concentrations. Surprisingly, it is not typically associated with illicit discharges.	Sporalitis filamentous bacteria, also known as "sewage fungus" can be used to track down sanitary sewer leaks.
		
Algal mats on lakes indicate eutrophication. Several sources can cause this problem. Investigate potential illicit sources.	Illicit discharges or excessive nutrient application can lead to extreme algal growth on stream beds.	The drainage to this outfall most likely has a high nutrient concentration. The cause may be an illicit discharge, but may be excessive use of lawn chemicals.

Rime Ice

Icicles

Sections 6-9. Field and Lab Data
This section is used to record the readings from the multi-parameter probe, results of chemical tests done in the field and lab, and the results of the E. coli sample (if one was taken).

- **Multi-Parameter Probe –** The probe is placed either in the flow itself or, if an outfall is being sampled, in the splash pool below the outfall. If there is not enough flow to cover the probe or a splash pool is not present, a liter sample bottle can be filled and the probe inserted. Once the readings have stabilized the values for each parameter are noted. The readings should also be logged on the meter itself then downloaded in the office.

- **Field Chemical Tests –** Readings from any tests (chlorine, nitrate-nitrogen and orthophosphate) done in the field are entered here.

- **Lab Chemical** Tests **–** If a sample is taken for analysis by the lab at the Water Treatment Plant, the date and time the sample was delivered to the lab is noted. Results of the analysis are recorded in this section.

- **Bacteria Sample –** If a sample was taken for E. coli testing the date and time the sample was delivered to the lab is noted. The results of the test are entered into this section

Section 10. Final Determination
The final determination of the source of the discharge is recorded in this section.

Section 11. Remediation
Any remediation actions taken to remove the discharge are recorded here.

SECTION B.7. HARMFUL ALGAE BLOOMS (HABs)

B.7.1. Introduction

Algae are microscopic plants that live in water, forming the base of the aquatic food chain. They can be green, blue, red or brown and often form slick, slimy layers of scum on the surface of water or coat the surface of submerged rocks and vegetation. While algae blooms do occur naturally, human activities are contributing to an increase in their frequency and severity. Algae blooms consume large amounts of oxygen that fish, shellfish and other aquatic organisms need to survive. They cloud the water blocking sunlight which is needed by the plants in the water to grow and to produce oxygen. Algae can also clog fish gills, reducing the amount of oxygen they are able to extract from the water.

Certain types of algae can emit poisons which can cause health problems for humans, pets and wildlife. Coming into contact with these poisons can cause stomach aches, rashes or more severe problems for humans and can severely sicken or kill pets and wildlife. Humans can also become sick after eating fish or shellfish which have absorbed these toxins. Harmful algae blooms can also release airborne toxins which can cause sore throats, headaches and serious respiratory problems. Excess nitrogen in drinking water can have impacts to human health, particularly for infants under 6 months of age.

Algae blooms do happen in Colorado, often during hot sunny weather in slow-moving bodies of water such as lakes. Harmful algae blooms also occur in Colorado; they can occur anywhere but are less likely to occur in high mountain lakes and reservoirs. The only way to know if an algae bloom is harmful is to have it tested. The best way to avoid becoming sick from an algae bloom is to stay out of the water, keep pets and livestock out of the water and don't drink the water.

B.7.2. Field Testing

Field tests include jar tests, stick tests, microscopic identification, or use of a field identification guide. Field tests can be effective to *qualitatively* screen for the presence of blue-green algae. The only way to tell positively that toxins are being produced, though, is through laboratory testing.

- Jar Test:

  Fill a glass jar ¾ full with the sample water (collected just under the surface of the algae layer). Place it in the refrigerator without being disturbed overnight. Carefully remove the jar the next day and observe where the algae settled. If the algae collected at the top of the water, this indicates that blue-green algae (and thus, possibly toxic algae) are present.

- Stick Test:

  Dip a sturdy stick into the algae scum layer. If the stick pulls out algae that looks stringy or hair-like, the algae is likely harmless filamentous green algae. If the stick comes out looking coated in paint, it may be blue-green algae which can produce toxins.

- Test strips are available for use in acquiring semi-quantitative test results in the field for microcystins, cylindrospermopsin, and anatoxin. Be aware that the upper end of some test strip ranges are below the toxin advisory levels (e.g., 1-5 means the highest quantitative value is 5 µg/L for microcystins). Therefore, those test strips with testing ranges below the toxin advisory levels are informative to indicate the presence or absence of toxins but will not identify if toxin advisory levels are exceeded. CDPHE recommends purchasing test strips with an upper range that exceeds the toxin advisory level. Note that if one test result is negative (for example, the microcystins test strip) testing for other toxins should be considered. Presence or absence of one category of toxin does not determine if others will or won't be present. Further lab testing is not necessary if test strips do not indicate toxins are present.

B.7.3. Laboratory Testing

CDPHE's Laboratory Services Division tests water for microcystins, cylindrospermopsin, and anatoxin by both enzyme-linked immunosorbent assay (ELISA) and liquid chromatography and tandem mass spectrometry (LC/MS/MS) detection. Each of these two laboratory tests provide the most accurate quantification but each test will provide slightly different results. Turnaround times may vary throughout the season and by laboratory so check before sending a sample. CDPHE's sampling and shipping instructions for laboratory testing are available here: https://bit.ly/CDPHELabHAB

For water chemistry testing information, please call or email the CDPHE Chemistry Laboratory at 303-692-3048 or cdphe_chemistry@state.co.us.

B.7.4. Sampling Safety Considerations
Field testing and/or sample collection should only be done by trained personnel. Personal protective equipment should be worn during the testing or sample collection, including gloves, protective eyewear and waders if applicable. Gloves should be disposed of properly after each sampling event. Wash hands, any exposed skin and waders with potable water after each sampling event to prevent possible side effects and to prevent contamination if multiple samples are taken.

B.7.5. Risk Management in the event a HAB or potential HAB is determined
If field testing determines that a potential HAB is present or if lab samples confirm one is present the CDPHE should be notified immediately at https://bit.ly/3g110Ab. The Fremont County Public Health and Environment should also be contacted. The following signage should be installed in the area of the algae bloom:

- "Caution Toxic Algae May Be Present: Use when potentially toxic algae are visible and no routine field or laboratory monitoring is occurring, when laboratory test results are pending, or when quantitative tests (test strips or laboratory analysis) demonstrate toxins are present but below the toxin advisory level.

- "Danger: Area is Closed to Full-Body Contact, Toxic Algae is Present": Use when any of the following are true:

    - Microcystin or saxitoxin levels are greater than 8 μg/L.
    - Cylindrospermopsin or anatoxin levels are greater than 15 μg/L.
    - A confirmed report by a medical provider of a human illness or animal death associated with a visible algal bloom has been reported for a specific water body.

Signage will be maintained until the algae bloom is gone or testing shows no more toxin in the water. Signage may be available from the CDPHE. Refer to the CDPHE Toxic Algae Risk Management Toolkit.

B.7.6. Remediation
Toxic algae will naturally dissipate with cooler temperatures, after wind events or storms that mix the water, cloudy days, and other natural factors. Do NOT use algaecide to remove the algae. Algaecides can result in more toxins in the short-term because the toxin is released from the dying algae cells into the surrounding water.

B.7.7. Reference Guides
- Toxic Algae Risk Management Toolkit for Recreational Waters Colorado Department of Public Health and Environment 6/2020 9pp.
- Toxic Algae Frequently Asked Questions Colorado Department of Public Health and Environment 4pp.
- Reference Field Identification Guide US Geological Society https://pubs.usgs.gov/of/2015/1164/ofr20151164.pdf.

IDDE MANUAL APPENDIX C

ENFORCEMENT FORMS

City of Cañon City

P.O. Box 1460 – 128 Main Street – Cañon City, CO 81215-1460
(719) 269-9011 – Fax: (719) 269-9017

Engineering Department

NOTICE OF NON-COMPLIANCE

Issued for Violation of Chapter 20.10 of the Cañon City Municipal Code
STORMWATER ILLICIT DISCHARGES AND PERMIT REQUIREMENTS

Date and Time of Violation:____
Location of Violation(s):____
Responsible Party Cited:____
Mailing Address:____
(Street, City, State, Zip)

Violation(s) CCMC Section	Description of Violation

You are hereby directed to take corrective action to remove or remedy each violation listed above within ten (10) calendar days. Failure to correct the violation(s) of this notice within ten (10) calendar days of the date of the notice may result in the City of Cañon City pursuing any or all remedies available under Section 20.10.160 of the Municipal Code, including but not limited to civil penalties. Civil penalties for a violation may be up to $250.00 per day per violation for each day the violation(s) exists.

CORRECTIVE ACTIONS REQUIRED WITH 10 CALENDAR DAYS OF THIS NOTICE:
____
____
____
____
____
____
____

Terms of Issuance

This order does not constitute a waiver of any provisions of the City of Cañon City Municipal Code, or any plan or permit issued pursuant thereto, which remain in full force and effect.

☐ Mailed ☐ Personally Served

Served By: Name____________________________ Signature:________________________________
Date:____________________________________
Phone: (719) 269-9011

City of Cañon City

P.O. Box 1460 – 128 Main Street – Cañon City, CO 81215-1460

(719) 269-9011 – Fax: (719) 269-9017

Engineering Department

NOTICE OF VIOLATION & PENALTY ASSESSMENT

Issued for Violation of Chapter 20.10 of the Cañon City Municipal Code
STORMWATER ILLICIT DISCHARGES AND PERMIT REQUIREMENTS

Date and Time of Violation:____
Location of Violation(s):____
Responsible Party Cited:____
Mailing Address:____
(Street, City, State, Zip)

Cañon City Municipal Code ("CCMC") § 20.10.160 authorizes the assessment of civil penalties for violation of Chapter 20.10 of the CCMC, upon failure to comply with a Notice of Non-Compliance or a Stop Work Order. You were served with a Notice on _____________ and have failed to comply with that Notice by correcting the stated violation(s). As a result, the following civil penalties are being assessed.

Violation(s) CCMC Section	**Description of Violation**	**Penalty Amount**

<u>ORDER</u>

UPON RECEIPT OF THIS ORDER, PARTY SHALL IMMEDIATELY CORRECT THE VIOLATION(S) AND PAY THE PENALTY, IF INDICATED, AND THE OPERATIONS RELATED THERETO SHALL NOT RECOMMENCE UNTIL SUCH TIME AS PARTY IS ABLE TO DEMONSTRATE THAT IT WILL COMPLY WITH THE CITY'S STORMWATER ILLICIT DISCHARGE CODE AND ANY PLAN OR PERMIT ISSUED PURSUANT THERETO AND THE CITY PROVIDES WRITTEN AUTHORIZATION TO ALLOW RESUMPTION OF ACTIVITIES.

The TOTAL PENALTY ASSESSMENT is due within ten (10) calendar days of the date of service of this notice. If the penalty assessment is not timely paid, the City may take further legal action.

<u>CORRECTIVE ACTIONS REQUIRED WITH 10 CALENDAR DAYS OF THIS NOTICE:</u>
____
____
____
____

<u>Terms of Issuance</u>

This order does not constitute a waiver of any provisions of the City of Cañon City Municipal Code, or any plan or permit issued pursuant thereto, which remain in full force and effect.

☐ Mailed ☐ Personally Served

Served By: Name___________________________ Signature:________________________________
Date:____________________________________
Phone: (719) 269-9011

<u>RIGHT OF PROTEST</u>

You have the right to protest the amount of the penalty imposed herein. You do not have the right to protest the notice of violation. The protest must be made in writing to the City Administrator and must be postmarked or received in person within ten (10) days from the effective date of this notice and must include the following information: Your name, address and telephone number, and the signature of the responsible party cited, Notice of Non-Compliance number and the reason you believe the penalty is incorrect. If you will be represented by an attorney, your appeal must include the name, address, telephone number and signature of your legal representative. Corporate agents must sign for corporations.

If the protest contains all of the required information, a hearing will be scheduled before the City Administrator and you will be notified of such hearing date by mail. Incomplete protests will not be scheduled for a hearing. If you fail to submit a timely protest, you will waive any right to protest the penalty imposed herein.

City of Cañon City

P.O. Box 1460 – 128 Main Street – Cañon City, CO 81215-1460
(719) 269-9011 – Fax: (719) 269-9017

Engineering Department

STOP WORK ORDER

Issued for Violation of Chapter 20.10 of the Cañon City Municipal Code
STORMWATER ILLICIT DISCHARGES AND PERMIT REQUIREMENTS

Date and Time of Violation:____
Location of Violation(s):____
Responsible Party Cited:____
Mailing Address:____
(Street, City, State, Zip)

The following findings are made and order issued pursuant to the authority vested in the undersigned, per Chapter 20.10 of the Cañon City Municipal Code.

Violation(s) CCMC Section	Description of Violation

ORDER

UPON RECEIPT OF THIS ORDER, PARTY SHALL IMMEDIATELY CEASE ALL ACTIVITIES RELATED TO CONSTRUCTION OR GRADING OPERATIONS AND THE OPERATIONS RELATED THERETO SHALL NOT RECOMMENCE UNTIL SUCH TIME AS PARTY IS ABLE TO DEMONSTRATE THAT IT WILL COMPLY WITH THE CITY'S CODE RELATED TO STORMWATER DISCHARGES AND ANY PLAN OR PERMIT ISSUED PURSUANT THERETO AND THE CITY PROVIDES WRITTEN AUTHORIZATION TO ALLOW RESUMPTION OF ACTIVITIES.

You are hereby directed to take corrective action to remove or remedy each violation listed above within ten (10) calendar days. Failure to correct the violation(s) of this notice within ten (10) calendar days of the date of the notice may result in the City pursuing any or all remedies available under Section 20.10.160 of the Municipal Code, including but not limited to civil penalties. Civil penalties for a violation may be up to $250.00 per day per violation for each day the violation(s) exists.

CORRECTIVE ACTIONS REQUIRED WITH 10 CALENDAR DAYS OF THIS NOTICE:
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Terms of Issuance

This order does not constitute a waiver of any provisions of the City of Cañon City Municipal Code, or any plan or permit issued pursuant thereto, which remain in full force and effect.

☐ Mailed ☐ Personally Served

Served By: Name____________________________ Signature:_________________________________
Date:_______________________________________
Phone: (719) 269-9011