UDOT's Dry Weather Screening Plan

1.0 Introduction

1.1 Objective of the Dry Weather Screening Plan

Dry weather screening at stormwater outfalls is part of UDOT's Illicit Discharge Detection and Elimination (IDDE) Plan to identify potential illicit discharges and locate illegal connections. The objective of this activity is to eliminate sources of non-stormwater discharges to the municipal separate storm sewer system (MS4) and Waters of the State. Dry weather screening involves identifying stormwater outfall locations, performing field investigations during periods of dry weather and assessing the potential for illicit discharges. Observations of non-stormwater flow at outfalls can reveal information about the pollutant type and possible source for locating the connection and eliminating the discharge. This plan describes procedures that will be implemented to perform this activity.

1.2 MS4 Permit Requirements

UPDES Permit No. UTS000003 (the MS4 Permit) section 5.2.4 requires that UDOT conduct dry weather screening efforts. The MS4 Permit requires that all stormwater outfalls be screened at least once during the Permit term. Screening methodology may be modified based on experience (MS4 Permit, 5.2.4.1), and this plan will be modified accordingly as changes are made.

1.3 Identifying Outfalls

Dry weather screening will be performed on all stormwater outfalls that are located within the Department's right of way (ROW) where the drainage system discharges to Waters of the State.

"Outfall" means a point source as defined by UAC R317-8-1.5(34) as the point where a municipal separate storm sewer system (MS4) discharges to Waters of the State and does not include open conveyances connecting two municipal separate storm sewers, or pipes, tunnels, or other conveyances which connect segments of the same stream or other Waters of the State and are used to convey Waters of the State.

"Waters of the State" means all streams, lakes, ponds, marshes, water-courses, waterways, wells, springs, irrigation systems, drainage systems, and all other bodies or accumulations of water, surface and underground, natural or artificial, public or private which are contained within, flow through, or border upon this state or any portion thereof, except bodies of water confined to and retained within the limits of private property, and which do not develop into or constitute a nuisance, or a public health hazard, or a menace to fish and wildlife which shall not be considered to be "Waters of the State" under this definition (UAC R317-1-1).

1.3.1 Exclusions

If an item does not satisfy the definition in Section 1.3, then the structure will not be counted as an outfall and will not be included in dry weather screening. Examples of items that should **NOT** be included in dry weather screening include:

- Drainage systems that discharge into detention and retention basins unless the basin discharges to Waters of the State
- Discharges from a bridge or collection systems serving a bridge (i.e. bridge deck drains)

1.3.2 Inaccessible Outfalls

If outfalls cannot be accessed from UDOT ROW, field screeners should indicate this on the Survey123 form (explained further below) in the notes section. Field personnel will not attempt to access the outfall by crossing or entering private property without permission. If possible, they should communicate with landowners to obtain proper permissions to access and screen outfalls that cannot be accessed directly from UDOT ROW.

In some cases, it may be possible to perform visual screening of outfalls without crossing fence lines or exiting UDOT ROW. If this is possible and field personnel can visually confirm that there is no flow or ponding present from behind a fence line or without exiting the ROW, they should perform screening from that location. Dry outfalls do not require water testing or sampling, and therefore screening may be able to be completed without direct access to the outfall.

1.4 Dry Weather Screening Training

All UDOT staff and contracted staff that will complete dry weather screening will be trained before start of work. Training will include proper roadside safety measures, utilizing the Survey123 form, field test kit protocols, and water sampling protocols. Ongoing training will occur through periodic check-in meetings with field staff. When contractors train their field staff, all training materials are based on information within this Dry Weather Screening Plan and approved by UDOT Stormwater Staff.

2.0 Preparing for Field Screening

2.1 Weather Conditions

Dry weather screening will be conducted during periods of dry weather. There should be no precipitation within the past 72 hours. The objective of dry weather screening is to detect non-stormwater discharges. Screening too soon after a storm event or snowmelt may confound efforts.

2.2 Schedule

UDOT will conduct screening on all UDOT outfalls once per permit term. Approximately 20% of outfalls will be screened each year. A complete list of these UDOT outfalls can be found on UPLAN in the map layer titled “Stormwater Drainage Features”.

2.3 Mobilization Procedures

If there has been no precipitation for the past 72 hours and the forecast indicates that precipitation is unlikely to occur, sampling teams shall prepare equipment for dry-weather screening and mobilize.

Preparation includes the following:

- Determine outfalls to be screened
- Collect field water quality test kit
- Ensure tablet or smartphone devices are fully charged, have the Survey123 app installed, and have the proper UDOT Dry Weather Screening Form downloaded
- Complete the mobilization checklist (Appendix A)
- Review Water Quality Sampling Procedures (Appendix B)
- Review field water quality test kit procedures (included with test kits)
- Review Field Safety Guidelines (3.1)

3.0 Field Screening Procedures

The Survey123 form for UDOT Dry Weather Screening will be utilized to document screening at all UDOT outfalls whether or not flow is observed. The form will direct screening personnel through the dry weather screening process, including what observations to make at each outfall and when to take photos. If flow is observed at an outfall, additional field testing is necessary (Section 4.0).

3.1 Field Safety Guidelines

All individuals working in UDOT ROW shall be cognizant of their personal safety as well as the safety of the travelling public. This includes the following safety protocols:

- Safely park vehicles on the roadway shoulder or slopes outside of travel lanes. Use vehicle warning lights (i.e. magnetic roof top beams or beacons) in conjunction with hazard lights (“flashers”).
- Avoid parking hot vehicles in tall vegetation that could ignite.
- Conduct all dry weather screening with at least two staff.
- Use proper personal protective equipment (PPE), including a high visibility safety vest at all times.
- Evaluate the area for potential hazards (poisonous plants/animals, hazardous or sharp objects, steep slopes, uneven footing, etc.) before attempting to locate the outfall for screening. Ensure the outfall location is accessible. Perform the inspection only if it is safe to do so.
- If there is fencing at an outfall (i.e. wildlife fencing, headwall fence, etc.) and there is not a feasible way to get around the fencing, use a ladder to climb the fence. Climbing fences directly can damage the fence or cause injury.
- Do not enter the drainage feature or outlet unless procedures are followed for permitted confined spaces.
- Follow proper water safety protocols and know the risks associated with working around water (flash floods, drowning)

- Be aware of the health concerns associated with hot weather (sunburn, heat stress, heat exhaustion, and heat stroke) and seek proper medical attention when necessary.
- Be aware of the health concerns associated with cold weather (frostbite, hypothermia) and seek proper medical attention when necessary.

3.2 Outfall Condition Parameters

Outfall condition can indicate an illicit discharge or illegal connection (ID/IC) at both flowing and non-flowing outfalls. Outfall conditions screened include the physical condition of the outfall, deposits or stains, and vegetation assessment. In addition to helping identify potential illicit discharges, noting outfall condition will be used to prioritize necessary maintenance at outfall structures.

3.2.1 *Physical Condition of the Outfall*. Cracking, deterioration, or peeling of paint at an outfall can be caused by severely contaminated discharges that are very acidic or basic in nature. Generally these discharges are associated with industrial sources. However, deterioration may also be the result of old age, poor construction, hydraulic scour, or other factors. Therefore, further investigation is necessary to determine whether an illicit discharge is present at an outfall in poor condition.

3.2.2 *Deposits or Stains*. Deposits or stains are defined as any type of coating which remains after a non-stormwater discharge has ceased. Stains within or on the outfall itself, as well as those in the area surrounding an outfall, can oftentimes indicate intermittent illicit discharges. The color as well as the presence of any fragments of floatable substances can be good clues to help determine the cause of the staining. Deposits include sediments, but also any powders or crystalline substances left behind after water has evaporated from outfalls or pools. The accumulation of sediment in outfalls may not always indicate an illicit discharge, but is still important to note for maintenance purposes.

3.2.3 *Vegetation Condition*. A general assessment of vegetation quantity and health can indicate potential illicit discharges. Excessive vegetation or algae growth could indicate nutrient enrichment from fertilizers or sewage inputs. The absence of vegetation may indicate illicit discharges that alter or inhibit plant growth, such as industrial discharges with a high or low pH. This vegetation measure is relative—some areas (wetlands, riparian areas, etc.) naturally have abundant vegetation while some have very little. Vegetation should only be considered an indicator of an illicit discharge when it is incongruous with the vegetation condition of the surrounding area.

3.3 Indicators of Illicit Discharges at Flowing Outfalls

There are a number of easily observable qualities of dry weather flows that may indicate the presence of ID/IC.

3.3.1 *Odor.* Odor of a discharge can vary widely and sometimes indicate the source of contamination. Industrial discharges may result in an odor that would suggest contamination from oil, gasoline, chemicals or solvents. Industries related to food production could discharge organic substances into drainage facilities. Sulfides are often a byproduct of these wastes and create a distinctive rotten egg smell. However, hydric wetland soils can also produce a rotten egg smell, so it is important to observe the area surrounding the outfall for contextual clues as to the source of the odor.

3.3.2 *Color.* Numerical field tests for color give more detailed color information, but a visual screening for color can also help indicate ID/IC source. The following colors may indicate particular sources:

- Brown, gray, or black water -- industrial sources.
- Reddish-brown -- meat processing industries.
- Yellow -- plating mill industries.

While color can oftentimes indicate contamination, natural conditions can also produce flows with abnormal appearance. Therefore, color can be a good first screen for ID/IC but it should also be supplemented by other parameters.

3.3.3 *Clarity.* Turbidity or clarity can be affected by ID/IC and is an indicator that can be quickly and easily assessed. Cloudy or opaque discharges may be the result of wastes from concrete mixing or stone related industries. Sanitary wastewater can also cause discharges with a cloudy appearance. High sediment loads also increase turbidity and may cause water to appear muddy or murky. High sediment loads could be from natural sources or from an illicit discharge if, for example, erosion is not controlled properly on a construction site.

3.3.4 *Floatable Matter.* A contaminated flow may also contain floatables (solids or liquids floating at the surface). These floatables can often help identify the ID/IC. Floatables from an industrial origin can include animal fats, spoiled food products, oils, plant parts, solvents, sawdust, foams, packing materials or fuel.

3.3.5 *Flow Rate.* Measuring the magnitude of the flow is an important measure of the severity of the discharge. With the combination of flow rate and pollutant concentrations, it is relatively easy to estimate the amount pollutants an ID/IC is introducing into receiving waters. While it may be possible to temporarily dam up low flows while investigating the source of a discharge, this may not be possible at higher flows. High flows with high concentrations of pollutants could pose a serious threat to receiving waters. Flow rate can be screened using one of two methods: the time to fill a container of a known volume or, for larger discharges, the flow velocity and an estimated cross-sectional area of the flow are measured.

3.4 Field Test Kit Procedures

During the outfall screening process, any outfalls with dry weather flows or ponded water should be screened for the following parameters using field test kits:

Table 1: Field Test Kit Parameters and Levels of Concern

Parameter	Types of Discharges it can detect	Levels of Concern and Type of Discharge Indicated
Ammonia	Sewage, Wash Water, Metal Plating	> 1 mg/L—sewage ≥ 50 mg/L—metal plating
Chlorine	Industrial or Commercial waste, swimming pool discharge	> 0.011 mg/L
Conductivity	Sewage, Wash water, Industrial or Commercial waste, deicing agents	Baseline conductivity levels vary regionally. See Appendix C.
pH	Wash water, Industrial or Commercial waste	< 6.5 or > 9.0
Temperature	Industrial or Commercial waste	> 28°C

Field test kits include specific instructions on the proper procedures for testing for each of the parameters in Table 1. Field test equipment will be properly calibrated and cleaned before and after testing according to manufacturer's instructions. Any wastes produced from testing (used reagents, etc.) or cleaning will be properly disposed of to avoid contaminating outfall sites.

3.4.1 Communication of Potential ID/ICs

When a survey with flowing, ponded, or indeterminate flow is submitted to the Survey123 database, an automated email notification is sent to the stormwater program manager, stormwater specialists, and the Region Stormwater Coordinator (RSC). In the event that contracted field screening personnel encounter flows that appear particularly hazardous to human health or the environment, they will contact UDOT as soon as possible. UDOT will coordinate with local health departments to limit human and/or environmental harm.

3.4.2 Presence of Deicing Agents

Conductivity field tests can be used to screen for the presence of deicing agents in dry weather flows. While conductivity naturally varies in ground and surface waters according to geology and other factors (Appendix C), levels higher than background could indicate the presence of deicing agents. Conductivity is used as a proxy for chloride testing because chloride field test kits include reagents that could pose potential health and environmental risks if not handled carefully.

In order to ensure that UDOT facilities are not responsible for any dry weather flows, any time there is flow or ponded water, any UDOT maintenance facilities "upstream" of the flow will be contacted and required to submit an inspection certifying proper salt storage practices at the facility. Connections between maintenance stations and outfalls are determined from desktop assessment of

the UDOT stormwater feature maps. Inspection findings will be documented in Survey123 using the "Dry Weather Screening Maintenance Station Follow up Inspection" form. Any deficiencies in salt storage at a site will be immediately remedied. If no deficiencies are identified at UDOT facilities or the local UDOT facilities are not the source of the discharge, normal stormwater network investigations will proceed as outlined in 4.2.

3.5 Laboratory Analysis

If the field measures indicate an ID/IC, but the potential source cannot be determined, UDOT may determine further lab testing of the water is necessary during follow-up inspections of outfalls. If lab analysis is deemed necessary, proper water quality sampling procedures will be followed, as outlined in Appendix B. Many analyses have relatively short hold times and require rapid delivery of samples to the lab facility. For this reason, any samples that require laboratory testing will be transported, on ice, to the closest lab facility for same day or next day delivery. If there is not a lab facility within a driving distance from the outfall site, proper steps will be taken to deliver samples by air mail. Laboratory Chain of Custody Forms will be completed for each sample and a copy will be sent to the RSC if the RSC is not on site for sampling. These forms will then be attached to the Survey123 form entry for the corresponding outfall. Lab analyses on samples will be performed according to Utah Public Health Laboratory's Environmental Chemistry standards. Any laboratory results will be attached to the corresponding Survey123 form entry.

Potential water quality parameters that may be laboratory tested and examples of when those tests should be used can be found in Table 2. Across the State of Utah, there are diverse land use types that are associated with assorted ID/IC risks. The "Land Uses/When to Perform Test" column in Table 2 indicates parameters that would be useful for assessing discharges commonly found within a particular land use type. The table also includes important laboratory information for each test.

FIGURE 1

Flow Chart for Dry Weather Screening Activities

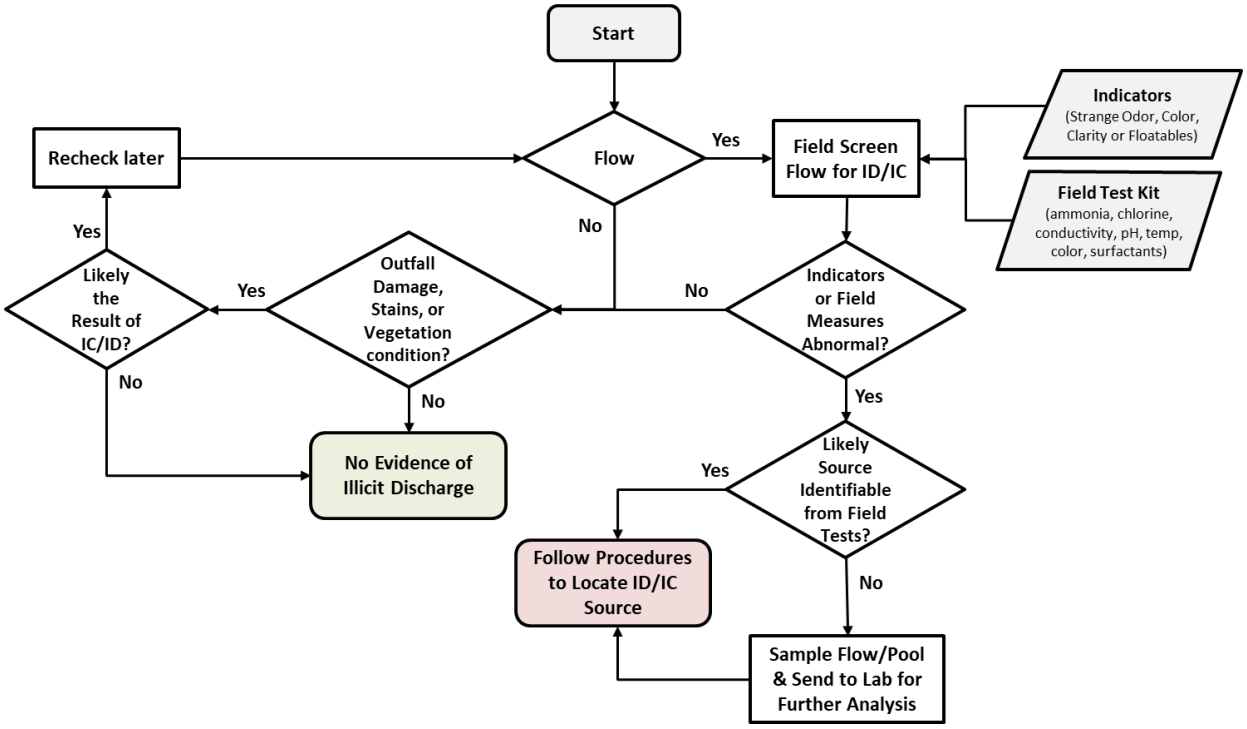


Table 2: Laboratory Test Parameters and When to Perform Tests				
Parameter and Label Abbreviation	**Levels of Concern and Types of Discharge Indicated**	**Land Uses/When to Perform Test**	**Bottle/ Preservative Info**	**Hold Times**
Conductivity (CON)	Sewage— ~ 1000 µS/cm; Washwater-- >200 ; Industrial/Commercial Wastes— >2000 µS/cm	Residential or Industrial Area	120 mL Plastic; on ice	Next day delivery, 28-day hold
Detergents/ Surfactants (SUR)	Sewage, Washwater, or Industrial/Commercial Wastes	Residential or Industrial Area	1 L glass amber; on ice	Same day delivery, 48-hr hold
E. coli (ECO)	Sewage Farm Waste	Residential Areas and Agricultural Areas	120 mL plastic; 10 mg $Na_2S_2O_3$, on ice	Same day, **8-hr hold***
Fluoride (FLO)	Municipal Tap— > 0.25 mg/L	Residential or Agricultural area— Perform with Surfactants to distinguish. Fluoride without surfactants indicates municipal tap water source or irrigation flows.	120 mL Plastic; on ice	Next day delivery, 28-day hold
Potassium (POT)	Sewage—Ammonia/ Potassium ratio > 1.0; Industrial /Commercial Wastes— > 20 mg/L	Mixed residential/Industrial Area—higher levels indicate industrial	250 mL plastic; HNO_3 to pH< 2, on ice	Next day delivery, 180-day hold
* Short hold time on E. coli samples. Other methods of determining sewage discharge may be more practical.				

4.0 Follow-Up Activities

The purpose of dry weather screening is to not only identify, but also to remove any illicit discharges or illegal connections into UDOT's stormwater system. Therefore, all flowing outfalls require follow-up. Because of UDOT's statewide jurisdiction, it is necessary for the stormwater team to perform desktop follow-up in order to coordinate efforts before performing in-field follow-up.

4.1 Desktop Follow-up

When a flowing or ponded outfall is found, an automated email notification kicks off desktop investigation. The RSC or other stormwater team member first investigates whether a UDOT maintenance station is connected to the outfall and could be responsible for the observed discharge. If there is a possible connection, maintenance staff at each connected station are contacted and asked to complete a "Dry Weather Screening Maintenance Station Follow-Up Inspection Form". This form includes pictures of all retention ponds, on-site catch basins, and salt storage areas.

Next, outfalls are prioritized for follow-up into “High Priority” and “Lower Priority” follow-up based on whether field test parameters and field observations indicate an obvious illicit discharge. Those high priority outfalls are visited as soon as possible to follow up with tracing and tracking activities. RSCs may perform high priority follow-up visits themselves or coordinate with their regional maintenance staff. RSCs keep a list of lower priority follow up sites so that stormwater staff can visit at a later date when other duties allow. Desktop follow-up procedures are explained in greater detail in Appendix D, “SOP for Desktop Follow Up on Ponded or Flowing Outfalls”.

4.2 Re-screening the Outfall for Flow

If outfall damage, stains, vegetation condition, or other factors indicate that there may be an intermittent flow at the outfall, the outfall should be re-screened. Because intermittent flows can be difficult to observe, there are a few techniques to help capture intermittent dry weather flows.

4.2.1 Sandbags or Dams

This technique involves either placing sandbags or creating a low dam at the outlet structure. The sandbags or dam collect intermittent flows so that anything pooled can be sampled or tested upon return to the site. These structures should be left in place for no more than 48 hours and should not be used when there is rain or snow in the forecast.

4.3 Stormwater Network Investigations

Used for flowing outfalls or outfalls where an intermittent flow has been confirmed, storm network investigation helps track an ID/IC to the source. Visual inspection at manholes, damming or sandbagging the trunk, dye testing, smoke testing, and video testing are all techniques used to help determine the source of a discharge. Additionally, there are three common systems used to track the source of the discharge:

4.3.1 Move Up the Trunk

Investigators start at the outlet and move up the storm drain network, sampling at up-network manholes as they go, in order to pinpoint the point of entry of the ID/IC. This generally works best for small drainage areas and networks.

4.3.2 Split the Network and Strategically Sample

Investigators select strategic manholes at the junctions of the storm drain network to isolate the discharge. This strategy works well in larger or more complex networks, as it limits the number of samples required.

4.3.3 Move Down the Network

Investigators start by sampling at manholes in the “headwaters” of the network and move progressively down-network. This technique works best in very large systems where there is the potential for multiple discharges into the system.

4.4 Drainage Area Investigations

Drainage area investigations are a parcel-by-parcel look at the area of the suspected source of the discharge to try and pinpoint the industry or parcel responsible for the discharge. This technique is particularly useful if Stormwater Network Investigations have narrowed down a target area and field or laboratory tests indicate the discharge is likely linked to a particular industry or land use. Using this previous information you can narrow down potential responsible parties for follow-up investigation. This follow-up investigation could include:

- Permit and Code Review
- As-built review (particular attention to drain connections)
- Aerial Photography Analysis
- Site visits (dye testing of plumbing systems)

5.0 Corrective Actions

When the source of a discharge is confirmed, quick remediation is essential to limiting harm. UDOT will collaborate with local health departments and municipalities in order to resolve ID/IC as efficiently as possible. The remediation steps will vary from case to case based on the nature of discharge or connection and the steps necessary for remediation. Responsibility for the correction will generally fall on the property owner, utility company or municipality (in case of sewage line leak), or UDOT itself.

APPENDIX A:

MOBILIZATION CHECKLIST

Dry Weather Screening Mobilization Checklist

□ Dry Weather Screening Plan

Dry Weather Screening Form

□ Smart Phone or Tablet with camera and Survey123 App
□ Survey123 UDOT Dry Weather Screening Form downloaded
□ Battery pack/charger for smart phone or tablet

Field Observation and Safety Equipment

□ Warning beams or lights
□ Ladder
□ Tape Measure
□ Flashlight
□ Personal Protective Equipment (vest, boots, hard hat, etc.)
□ First Aid kit

Flow Field Testing

□ Container of known volume for flow rate test
□ Field Water Quality Test Kit and Testing Instructions
□ Container to dispose of any liquid wastes (reagents, etc.) from test kit
□ Garbage bag to dispose of any trash from test kit or grab sampling
□ Distilled Water

Grab Sampling for Lab Analysis

□ Sample Bottles and Labels
□ Grab Sample Equipment (decontaminated bucket, bailer or cup, rope, etc.)
□ Latex or Nitrile Sampling Gloves
□ Cooler (w/ ice if necessary)

APPENDIX B:

WATER QUALITY SAMPLING PROCEDURES

Water Quality Sampling Procedures

Sample bottles will be obtained from the laboratory; these bottles are prepared for specific analysis at the laboratory. Sample bottles will be labeled appropriately prior to sample collection.

Labeling Sample Bottles

Sample bottles will be labeled according to the following nomenclature:

- **[OUTFALL ID]_[TEST PARAMETER ABBREVIATION]_[REPLICATE #]/[TOTAL # OF REPLICATES]**
    - EXAMPLE: The label for the first of 2 water samples at outfall 14230711187 for Surfactants would read:
        - 14230711187_SUR_1/2

Test Parameter Abbreviations include:
Conductivity = CON; Detergents/Surfactants = SUR; *E. coli* = ECO; Fluoride = FLO; Potassium = POT

Sample Collection

The following guidelines will be employed when collecting grab samples:

- Grab samples will be collected directly into laboratory supplied containers for the specific analyte whenever possible.
- Sample containers will be properly labeled.
- Grab samples will be collected from the horizontal center channel, as much as possible.
- Samplers will avoid stirring the bottom sediment during sample collection, as much as possible.
- Sample containers will be held so the container opening faces upstream as applicable.
- Samplers will avoid the touching of the inside of sample containers to avoid contamination.
- Upon collection, sample containers will be placed into designated coolers and cooled with ice. Sample collection times will be recorded on the chain-of-custody forms.
- Samplers will take extreme care when filling sample containers to avoid spills, splatter or washout of container preservatives.
- All sample information will be recorded on the Grab Sample Data Sheet.

Sampling Equipment Decontamination

Sample collection containers will be decontaminated utilizing phosphorus-free detergent and deionized water. Sample collection containers will also be decontaminated with deionized water between sample collection at each site. Bottles obtained from the analytical laboratory do not require decontamination.

APPENDIX C:

CONDUCTIVITY BENCHMARK LEVELS OF CONCERN BY CITY/COUNTY

Region	Area	Baseline Groundwater TDS (mg/L)	Likely not Background Conductivity (µS/cm)	Source/Maps
R1	Ogden/Pineview Reservoir area	250 - 500	>800	PAGE 56 in https://indd.adobe.com/view/712cff95-3430-4459-9303-c369e5a3c767
R1	Box Elder County, North of Great Salt Lake (Brigham City, Corinne, Penrose Area, SR 83)	Varies widely (Fig. 6), average ~2500 - 5000	Wide variation and points of high conductivity make it hard to set a level of concern. Look at Fig 6 in attached paper.	https://indd.adobe.com/view/98fdea03-718d-4143-b399-eb4a56cc3510
R1	Davis Co/ South Weber Co	Average 369	>600	https://ugspub.nr.utah.gov/publications/open_file_reports/ofr-592.pdf
R1	Bothwell	1000 - 3000	> 4700, check map (Appendix: Plate 1)	https://ugspub.nr.utah.gov/publications/special_studies/ss-135.pdf
R1	Smithfield, Hyde Park, Logan, Mendon, Providence, Nibley, Hyrum, Wellsville, Paradise	250 - 500	> 800	https://ugspub.nr.utah.gov/publications/special_studies/ss-101.pdf
R1	Logan area-- UT 30 from N 5600 W to S 1000 W	0 - 250	> 400	https://ugspub.nr.utah.gov/publications/special_studies/ss-101.pdf
R1	Clarkston, Newton, Amalga	500 - 1000	> 1600	https://ugspub.nr.utah.gov/publications/special_studies/ss-101.pdf
R1	Lewiston	1000 - 1750	> 2750	https://ugspub.nr.utah.gov/publications/special_studies/ss-101.pdf
R2	I-80 Directly South of Great Salt Lake	Varies widely (Fig. 6), average ~2500 - 5000	Wide variation and points of high conductivity make it hard to set a level of concern. Look at Fig 6 in attached paper.	https://indd.adobe.com/view/98fdea03-718d-4143-b399-eb4a56cc3510
R2	I-80 exit 104 to I-215	> 10,000	TDS naturally high. Anything with a LOW conductivity could indicate illicit discharge. (See Plate 1)	https://ugspub.nr.utah.gov/publications/open_file_reports/ofr-560.pdf

R2	Directly East of Great Salt Lake (I-15)	500 - 1000	Wide variation and points of high conductivity make it hard to set a level of concern. Look at Fig 6 in attached paper.	https://indd.adobe.com/view/98fdea03-718d-4143-b399-eb4a56cc3510
R2	South Salt Lake to Midvale (I-15)	250 - 500	> 800	https://ugspub.nr.utah.gov/publications/open_file_reports/ofr-560.pdf
R2	East Salt Lake City, Canyon Rim, E. Millcreek, West Valley, Taylorsville, Oquirrh, West Jordan, South Jordan, Draper, Herriman	500 - 1000	> 1600	https://ugspub.nr.utah.gov/publications/open_file_reports/ofr-560.pdf
R2	Kennecott Mine Area	> 10,000 in plume surrounding Brigham Creek Reservoir	Variation. See plate 1 Map.	https://ugspub.nr.utah.gov/publications/open_file_reports/ofr-560.pdf
R2	Holladay, Cottonwood Heights, Cottonwood West, Midvale, Murray, Milcreek	0 - 500	> 800	https://ugspub.nr.utah.gov/publications/open_file_reports/ofr-560.pdf
R3	Uinta County (Bonanza, UT-45)	> 10,000	high TDS area. Anything with LOW conductivity could indicate illicit discharge. (Fig. 6)	https://ugspub.nr.utah.gov/publications/open_file_reports/ofr-595/ofr-595.pdf
R3	Provo City (Drinking water quality report)	100 - 200	> 400	https://www.provo.org/Home/ShowDocument?id=15681
R3	Utah Lake (Surface Water Measures)	600 - 1400 (Fig. 8)	> 1850	https://documents.deq.utah.gov/water-quality/locations/utah-lake/DWQ-2019-001841.pdf#page=39
R3	Duschene	150 - 550 (Table 5)	> 850	https://waterrights.utah.gov/technfo/wwwpub/GW2018.pdf
R3	Juab County (Nephi)	750 - 1100 (Table 5)	> 1750	https://waterrights.utah.gov/technfo/wwwpub/GW2018.pdf
R3	Heber	250 - 500 (Table 5)	> 800	https://waterrights.utah.gov/technfo/wwwpub/GW2018.pdf

R3	Goshen Valley (Southwestern shore of Utah Lake)	900 - 1700 (Table 5)	> 2600	https://waterrights.utah.gov/technfo/wwwpub/GW2018.pdf
R4	Milford Area	2000 - 3000	> 4700	https://geology.utah.gov/wp-content/uploads/snt50-1_tds-plume-forge-map-1.gif
R4	Pahvant Valley (Delta, Fillmore)	500 - 1200	> 1800	https://waterrights.utah.gov/technfo/wwwpub/GW2018.pdf
R4	Beaver County	400 - 900	> 900	https://waterrights.utah.gov/technfo/wwwpub/GW2018.pdf
R4	Beryl Junction	250 - 550	> 550	https://waterrights.utah.gov/technfo/wwwpub/GW2018.pdf
R4	San Pitch Mountains (Hwy 89, Gunnison to Sterling)	Wide variation 150 - 9000 (surface water concentrations)	Wide Variation, but high TDS from Springs not unusual for the area. (See Fig 9a and 9b for maps)	https://indd.adobe.com/view/020b6d40-76cd-4340-8c57-9857f82e7630
R4	Cedar City	500 - 1000	> 1600, however look at map (plate 1, appendix). Some select areas with higher TDS	https://ugspub.nr.utah.gov/publications/special_studies/ss-134.pdf
R4	Cedar Valley (N of Enoch and S of Hamiltons Fort)	300 - 500	> 800, however look at map (plate 1, appendix). Some select areas with higher TDS	https://ugspub.nr.utah.gov/publications/special_studies/ss-134.pdf
R4	Centerfield/Axtell (SR-89)	1000 - 3000	> 4700	https://ugspub.nr.utah.gov/publications/special_studies/ss-132.pdf
R4	Gunnision and Fayette	500 - 1000	> 1600, however look at map (plate 4, appendix). Some select areas with higher TDS	https://ugspub.nr.utah.gov/publications/special_studies/ss-132.pdf
R4	Sanpete County-- Fairview, Mount Pleasant, Spring City, Fountain Green, Manti, South Ephraim	0 - 500	> 800	https://ugspub.nr.utah.gov/publications/special_studies/ss-102.pdf
R4	Sanpete County-- North Eprhaim and Chester	500 - 1500	Varies, but > 1600 flag. Some small pockets of high TDS in Chester (see map plate 7)	https://ugspub.nr.utah.gov/publications/special_studies/ss-102.pdf

R4	St. George Area (Virgin River from the Utah/Arizona border to Pah Tempe Springs)	surface water 2360	> 3700	https://rules.utah.gov/publicat/code/r317/r317-002.htm
R4	Spanish Valley (Moab)	169-1820, majority of area under 1000	>2850- page 18 Summary section- basis for groundwater	https://ugspub.nr.utah.gov/publications/circular/c-99.pdf
R4	Castle Valley	230-1250	>1960- page 18 Summary section-basis for groundwater	https://ugspub.nr.utah.gov/publications/circular/c-99.pdf
R4	Moab Wash/Crescent Junction Area	surface up to 10,000; deeper groundwater >35,000	> 16,000 (Section 3.1.6.3; pg 3-21)	https://books.google.com/books?id=kQ4xAQAAMAAJ&pg=SA3-PA88&lpg=SA3-PA88&dq=TDS+cisco+utah+groundwater&source=bl&ots=yjgBWImyHt&sig=ACfU3U2IXRCGtRBJ5gQktZwJu2qTJ7iRcg&hl=en&sa=X&ved=2ahUKEwiejZjk_uLnAhWSHzQIHVTcCw0Q6AEwA3oECAsQAQ#v=onepage&q=tds&f=false

APPENDIX D:

SOP FOR DESKTOP FOLLOW UP ON PONDED OR FLOWING OUTFALLS

UDOT Dry Weather Screening-- SOP for Following up on Ponded or Flowing Outfalls

Purpose

This SOP outlines the necessary steps for RSCs or complex staff in Dry Weather Screening follow-up. These procedures are set into motion when the contractor that is field screening outfalls finds an outfall that has either flowing or ponded water. Due to UDOT's statewide jurisdiction, it is necessary that we prioritize follow-up inspections, tracking, and tracing activities at flowing and ponded outfalls. In a single day of outfall screening, our contracted field screening teams may be working in multiple regions of the state and may locate dozens of flowing outfalls. This SOP will walk Stormwater Staff through the desktop analysis needed to prioritize outfalls and determine further necessary follow-up procedures.

SOP Outline

This SOP will cover the following topics:

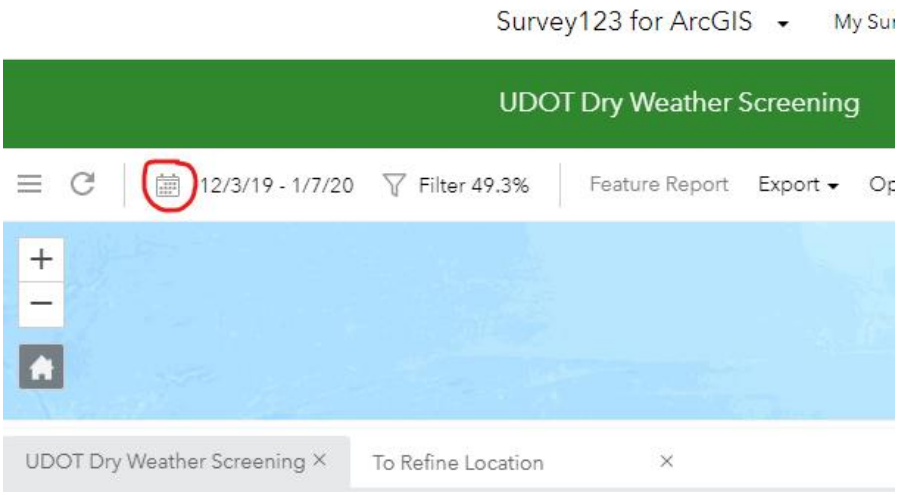
1. Contents and Purpose of Automated Flow Notifications
2. Determining When to Send a Dry Weather Screening Follow-Up Inspection Form
3. Identifying Potential Illicit Discharges

Automated Flow Notifications

The RSC in the respective region, stormwater specialists, and stormwater program manager should all receive automated email notifications when a flowing or ponded outfall is found. This email notification will include the following information:

- Outfall ID
- Whether the Outfall is ponded or flowing
- Observations: Odor, Water Color, Water Clarity, Floatables, Stains or Deposits, Vegetation Condition
- Field Tests: flow rate, ammonia, chlorine, conductivity, pH

For more detailed information and the inspection report, go to the Survey123 data page: https://survey123.arcgis.com/surveys/a8373b21b7664d22a17853c0b1fd4318/data
In order to more easily locate a record, you can select only reports that were submitted on a particular date. Click on the calendar icon in the top left of the white toolbar (circled in red, below) in order to narrow the results by date submitted.



***** IMPORTANT:** Before performing follow-up on any outfall, check the **QA/QC Status** Column. Make sure that this column says **"Reviewed"**. This means that the contractor has checked the field team's work and corrected any issues. ***

Determining When to Send out a DWS Followup Inspection Form to a Maintenance Station

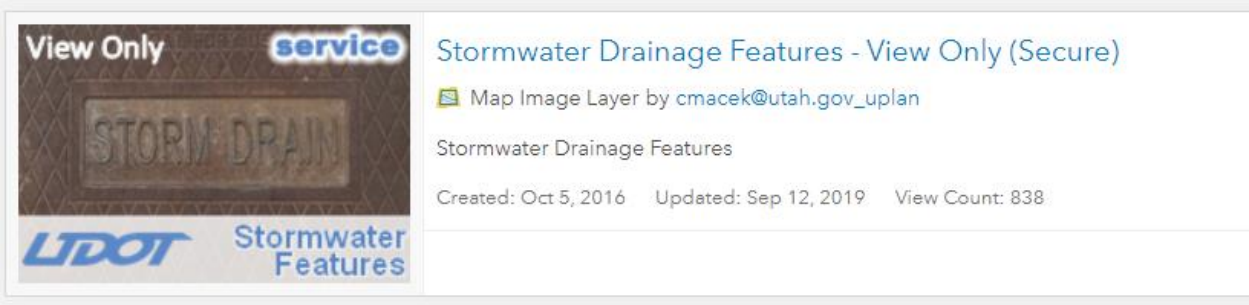
Purpose: In order to meet requirements of the Consent Decree, UDOT needs to verify that any flowing outfalls are not the result of illicit discharges occurring at UDOT facilities. This short followup inspection is to document that all UDOT facilities connected to outfalls where there was a hit were investigated. At each outfall where flow is detected, UDOT uses the following procedures to determine if it is necessary to distribute this form to any UDOT maintenance stations. There are 2 steps to this procedure:

1. Find the outfall using the Outfall ID
2. Compare outfall location to maintenance station locations

Finding the Outfall by Outfall ID

Accessing the Stormwater Drainage Features Database

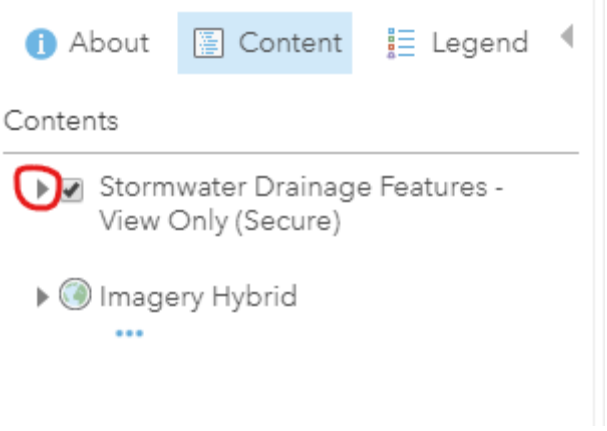
1. In order to access the database with all of our mapped stormwater infrastructure, go to Uplan, **type "stormwater" in the search bar**, and hit enter. Click on the icon below. It should be the first entry to come up.



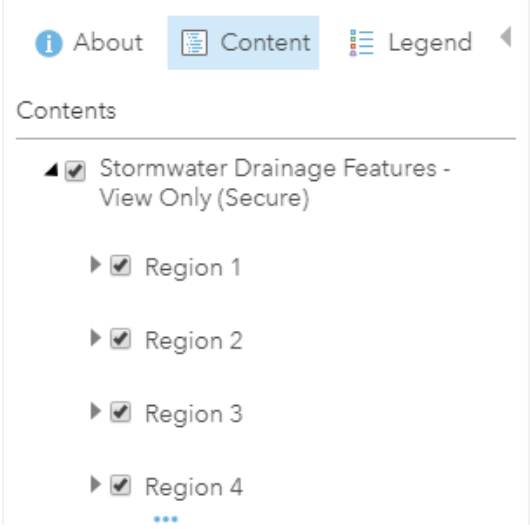
2. This is a secure layer so it will ask for your **login** information (even if you are already logged into Uplan, it will ask again).

Searching for an Outfall by Outfall ID

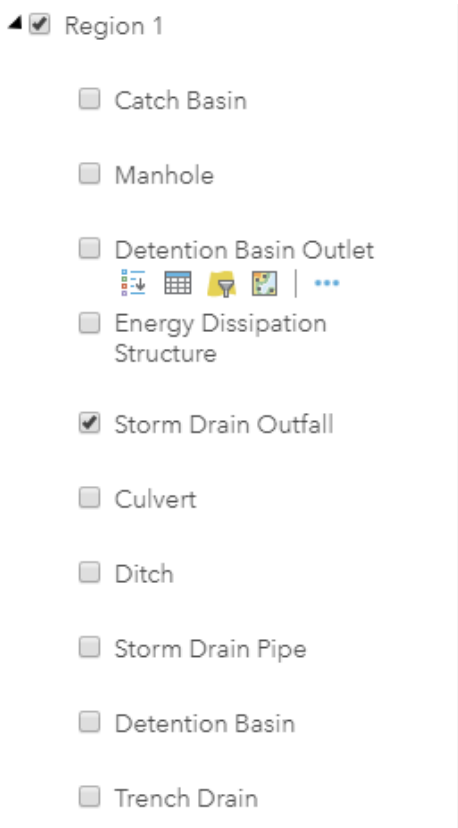
1. This is the stormwater feature database. In order to see all of the mapped features, toggle features on and off, and search the database, you need to expand the feature set. Make sure you are in the **"Content" tab** (highlighted in blue) and **click on the triangle circled in red** next to the "Stormwater Drainage Features" item.



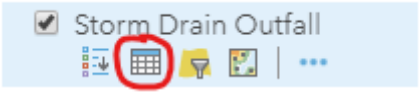
2. This will give you an expanded view that will show a category for each region. Click the triangle next to the region of interest to expand that region and look at individual types of features. **Make sure there is a check in the box next to the region.**



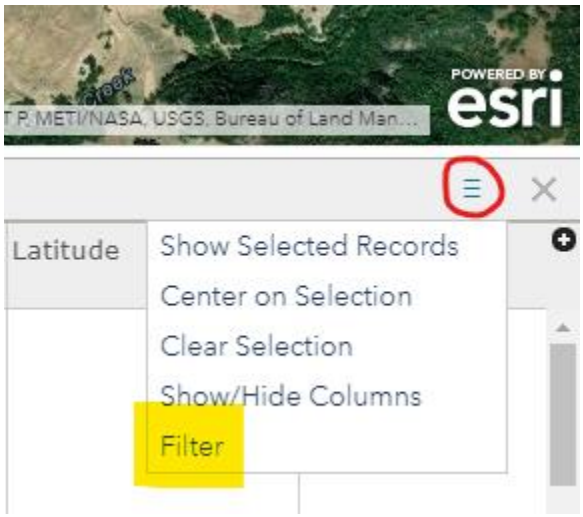
3. Make sure that there is a **check in the boxes next to any types of features that you want to view**. For example, only Outfalls would show up on the map in the screenshot shown below.



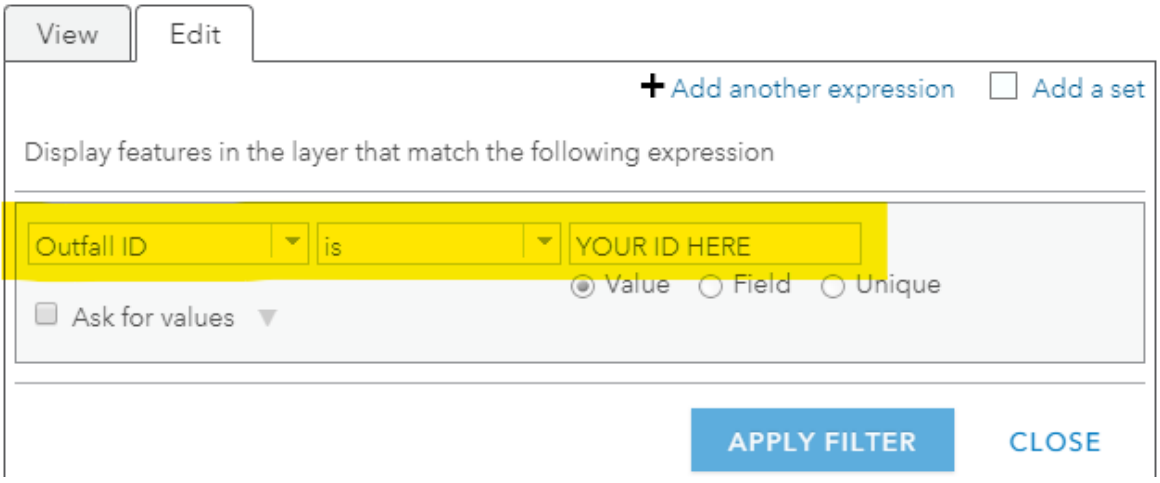
4. Hover your mouse over the “Storm Drain Outfall” item, and 5 icons should appear below the label. Click the **“Show Table” icon**. This will bring up the attribute table. The attribute table contains all of the data that is associated with the points and lines on the map, including the Outfall ID.



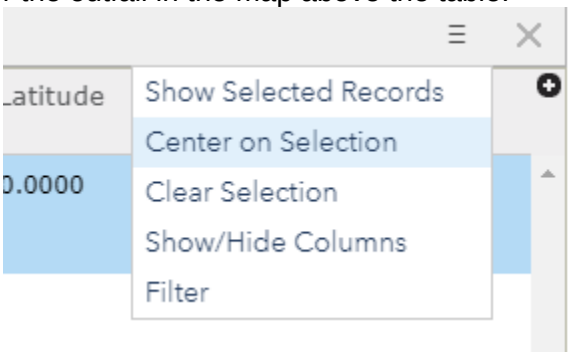
5. To search by Outfall ID, you will need to use the **“filter”** function. Click on the three horizontal lines at the top right of the table (circled in red) and then click “Filter” (highlighted in yellow).



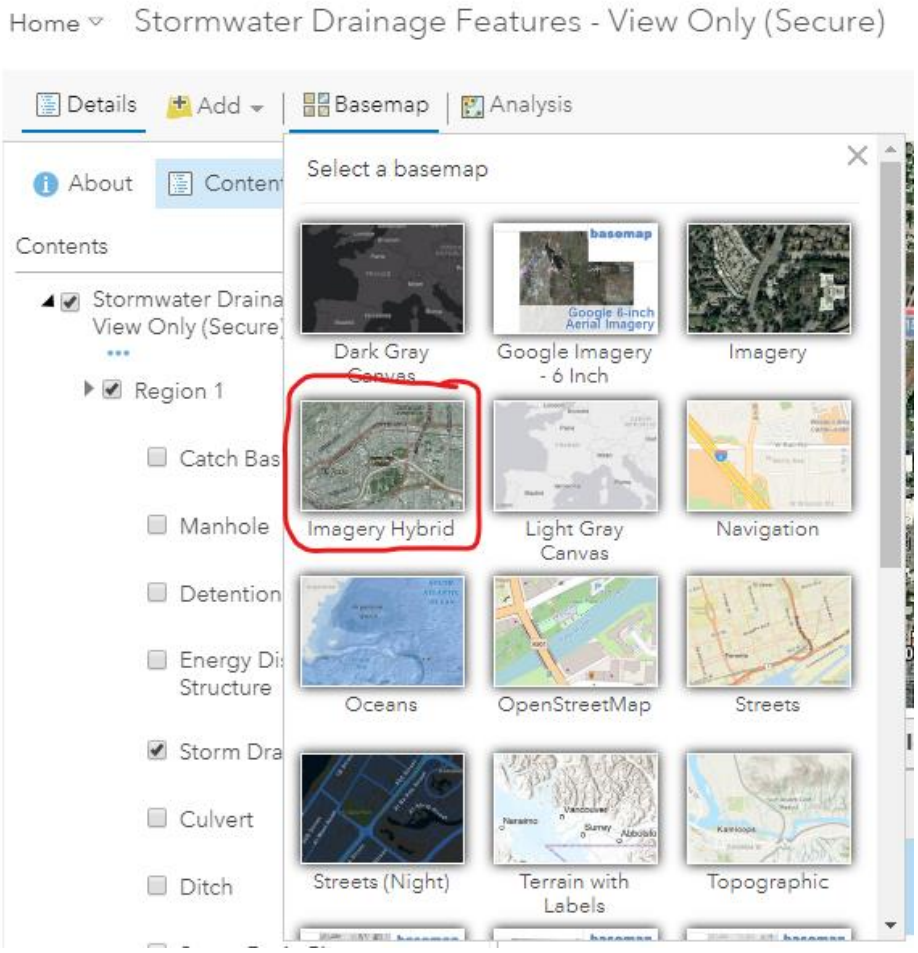
6. In the “Edit” tab of the window that appears, change the expression to match that highlighted below. Use the first drop-down menu to select “Outfall ID”. The next should be “is”. **In the final box, type the outfall ID that you are trying to find**. Then click **“APPLY FILTER”.**



7. To zoom to an outfall on the map, click on that row with the outfall ID of interest. It will highlight the row in blue. Then click the icon with the three horizontal bars to bring up the menu, and click on **“Center on Selection”**. This will highlight the outfall of interest on the map and will center the outfall in the map above the table.

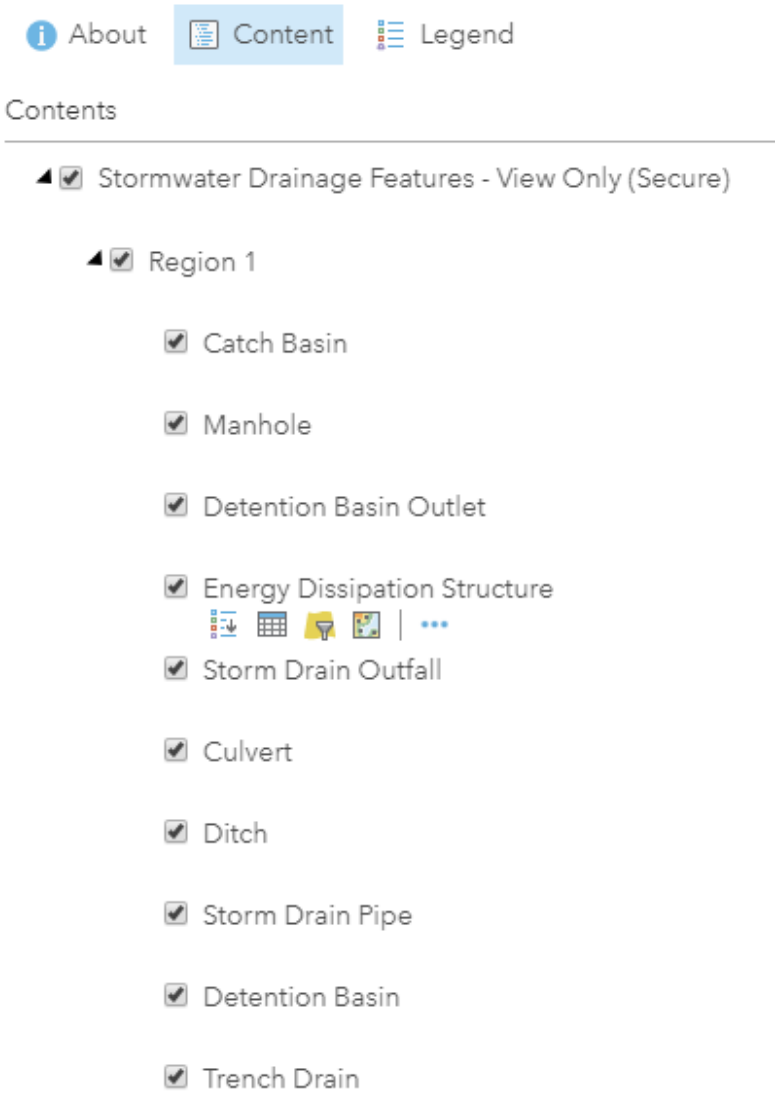


8. **If the map does not have any streets labeled**, go to “Basemap” in the top right of the page, above the contents bar. Select **Imagery Hybrid** (circled in red) for a map with labeled streets and points of interest. This can be helpful if trying to locate an outfall for followup investigation.



Compare Outfall Location to Maintenance Station Locations

1. Use the following map to locate any maintenance stations near the outfall. http://uplan.maps.arcgis.com/apps/webappviewer/index.html?id=b7eed9a2f56b43b98b5af5ff59359e5b
2. In the Stormwater Drainage Features Database (same map used to originally find the outfall) **add all of the features to the map by clicking the check marks** next to all of the different feature types.



This will make it so that you can follow a complete drainage path from the maintenance stations nearby to see if any of them link to the outfall of interest.

Sending the Notification

If there is a maintenance station that could potentially be connected to an outfall where there was flow, an email with the link to the survey form will need to be sent to that station. They will need to complete this using the Survey123 app on their mobile device.

Dry Weather Screening Maintenance Station Follow Up Inspection: https://arcg.is/1OqmmD0

If they have questions on how to download Survey123 or how to submit inspections, they should follow this SOP: https://docs.google.com/document/d/1Vv1no_RSSs-CqVXBaLLvVtSbqnSs_6SxFY8ohVrjLKg/edit

Identifying Potential Illicit Discharges and Illegal Connections

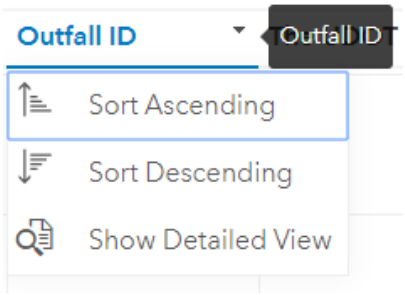
Purpose:
After determining whether a maintenance station must complete a follow-up inspection form, stormwater staff must determine what in-field follow-up is necessary at a flowing or ponded outfall. Using the field test kit parameters and field observations Stormwater Staff will prioritize field visits to flowing outfalls.

Documenting Dry Weather Screening Follow-Up

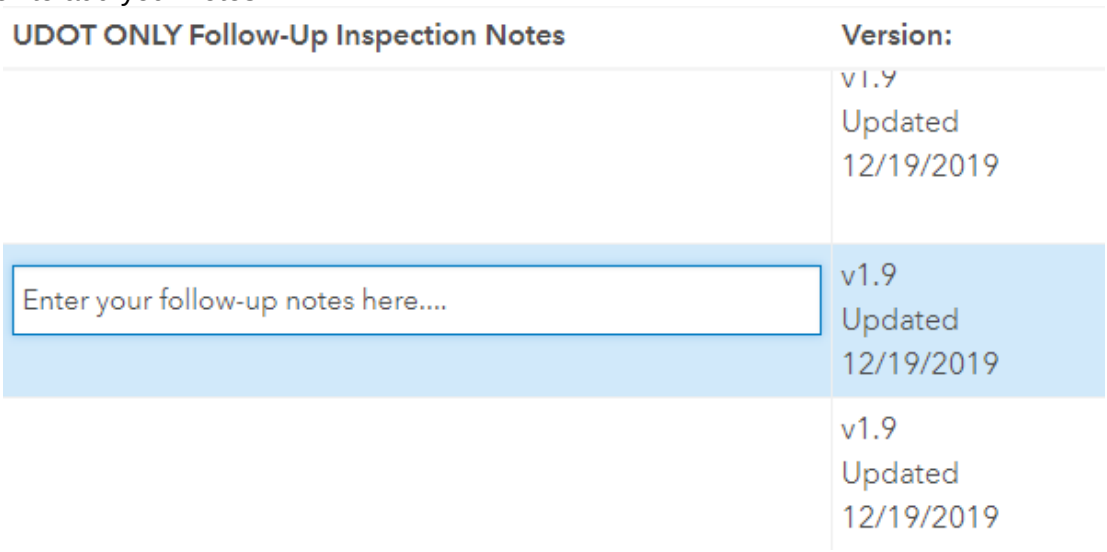
RSCs are responsible for tracking all dry weather screening follow-up done at flowing or ponded outfalls. All follow-up documentation should be filed in the respective region subfolder in the Dry Weather Screening Follow-Up Investigations folder in the team Google drive. Follow-up can be documented in either a narrative or spreadsheet format (see examples in Follow-Up Investigations folder). Any pictures from follow-up investigations should be filed into folders that include the outfall ID of the investigated outfall in the name. RSCs need to keep a list of all lower priority outfalls that need follow-up screening so that these outfalls can be visited when in the area.

In addition to documentation in Google Drive folders, there is a field in the Survey123 UDOT Dry Weather Screening form called “UDOT ONLY Follow-Up Inspection Notes” where a short narrative summary of follow-up actions can be added. Writing notes in this section ensures that follow-up actions are tied directly to the original field inspection instead of having to compare between survey123 and Google Drive.

In order to add Follow-Up notes to the original form, go to the UDOT Dry Weather Screening Data page in Uplan. Click on the “Outfall ID” heading and Sort (either ascending or descending) to make it easier to find the Outfall that you performed follow-up on. Click anywhere on that row to highlight it.



Scroll all the way to the right to find the UDOT ONLY Follow-Up Notes Column. Double click in the cell to add your notes.



***** IMPORTANT: DO NOT EDIT VALUES IN ANY COLUMNS OTHER THAN THE FOLLOW-UP INSPECTION NOTES *****

Outfall Prioritization

High Priority Flowing or Ponded Discharges

High priority outfalls are those flowing or ponded outfalls where field observations or field test parameters indicate discharges that are obvious or severe illicit discharges, illegal connections, or dumping. These outfalls warrant follow-up investigations as soon as is practicable. Below are some field test parameter levels that would indicate a high priority flowing outfall.

Field Test Kit Parameters and Levels of Concern		
Parameter	**Types of Discharges it can Detect**	**Levels of Concern and Type of Discharge Indicated**
Ammonia	Sewage, Washwater, Metal Plating	> 1 mg/L—sewage > 50 mg/L—metal plating
Chlorine	Industrial or Commercial waste, swimming pool discharge	> 0.011 mg/L
Conductivity	Sewage, Washwater, Industrial or Commercial waste, deicing agents	Refer to this spreadsheet. Varies by location as to what exceeds background levels in groundwater.
pH	Washwater, Industrial or Commercial waste	< 6.5 or > 9.0
Temperature	Industrial or Commercial waste	> 28°C

In addition to this table, any outfalls with field observations that indicate severe or obvious illicit discharges should be high priority for investigation. This includes any flow or ponded water with an abnormal color, odor, oil sheen or floatables.

Lower Priority Flowing or Ponded Outfalls

While follow-up is important at all flowing outfalls, lower priority outfalls are those that do not have field tests or observations that indicate an illicit discharge. These lower priority outfalls are those that, based on field observations, are likely flowing or ponded due to surfacing groundwater or a similar source. Follow-up screening should still be performed at these lower priority outfalls, when possible, to trace upstream and confirm the suspected source is not an illicit discharge or illegal connection. RSCs will plan to visit low priority outfalls when passing through or visiting an area for other job duties or when their schedules allow for the necessary travel time.