Boundaries Unlimited Inc.

Civil Engineering
Surveying
& Beyond

Stormwater Quality Report

Minturn North Subdivision
Town of Minturn, CO
Project No. 22036.01

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Contents

A. Introduction

The purpose of this report is to provide a supplement to the Minturn North PUD: Drainage Report prepared by Wright Water Engineers (WWEDR), [Job No. 191-092.050 updated June 2023] and provide an outline and basis of design for the Stormwater Quality Improvements proposed at the Minturn North Subdivision in the Town of Minturn, County of Eagle, State of Colorado. The intent of the project is to construct thirty-nine (39) new single-family residences, along with roads, utilities, and storm water drainage.

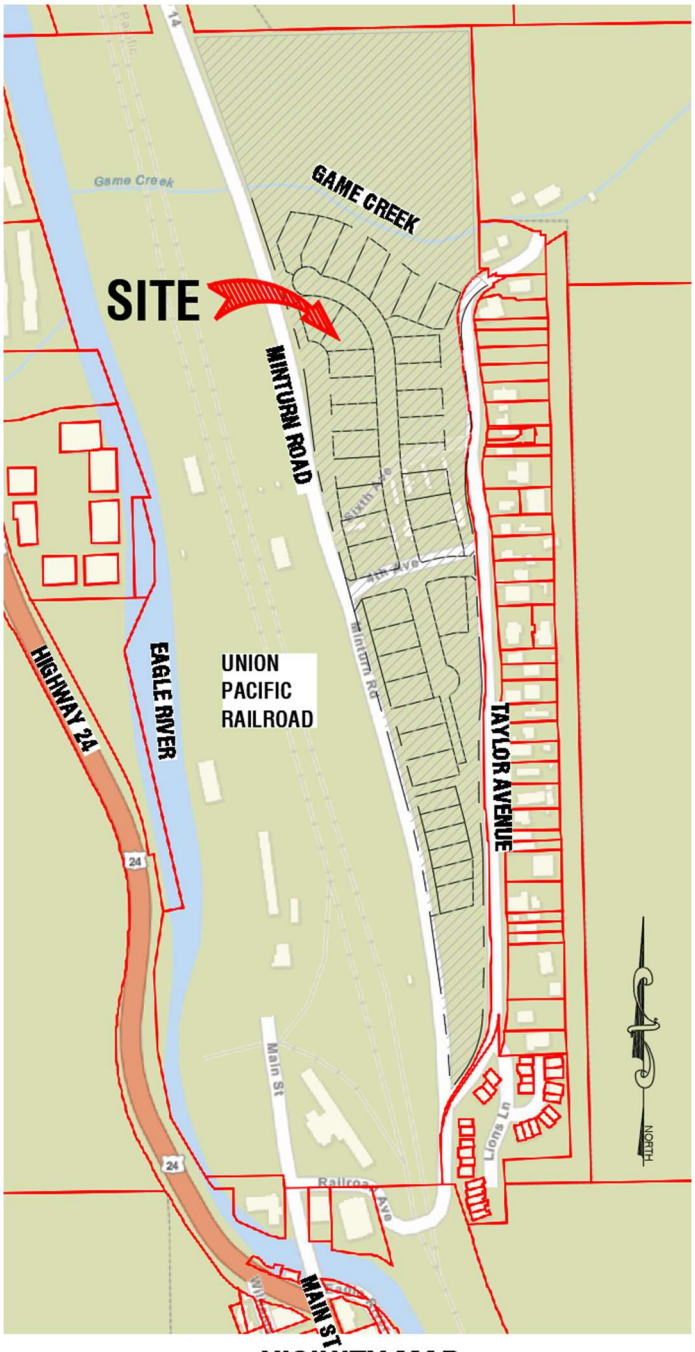

Figure 1: Location Map

B. Drainage

1. Historic/Existing Conditions

The majority of the property is currently vacant with the exception the 4th Street road connection between Minturn Road and Taylor Avenue, along with a few residential mobile home structures along 4th Street. In general, the building site slopes from the east to the west with historic site vegetation and soils described under Section 1.4 of the WWEDR. Uphill drainage from Taylor Avenue and above generally sheet flows across the roadway and onto the site. No existing stormwater management structures have been observed on the property.

2. Developed Conditions

As mentioned, the intent of the project is to construct thirty-nine (39) new single-family residences, along with roads, over- lot grading, utilities, and stormwater management structures across the property.

Drainage swales have been designed below Taylor Avenue to capture the existing offsite drainage and convey it safely through the site. The proposed roadways are designed with curb and gutter which flow to curb inlets/storm sewer at key locations for rapid removal from the roadways. The inlets/storm sewer discharge into roadside ditches and swales which in turn direct runoff to a series of existing culverts flowing under Minturn Road. In general, runoff will sheet flow in the upper reaches of the basins and shallow/channel flow thereafter.

The Drainage Study prepared by Wright Water Engineering sized the channels, inlets and culverts. The Civil Engineering plans addressed erosion protection with the implementation and location of erosion mats, fabrics and riprap.

The swales will be enhanced with Reinforced Permeant Check Dams (RPCD) installed at regularly spaced intervals, permanent turf reinforcement and native grasses. The RPCDs will be 6” to 12” high and constructed of wire and rock gabions stretching across the swales. The RPCDs will reduce flow velocities with the secondary benefit of trapping sediment and waters behind each structure. The reduced velocity will help protect the permanent turf reinforcement and native grasses while the native grasses will naturally skim hydrocarbon pollutants and promote additional sediment fallout. The proposed system will provide an extensive stormwater quality enhancement with scour protection, sediment removal, pollutant reduction and infiltration of minor runoff.

Curb drainage inlets will be located at the low points of all the streets and at intersections. These inlets will each contain a BMP SNOUT® stormwater quality structure. Additionally, Bio-Skirt oil booms will be installed with each Snout to soak up floating oils and enhance hydrocarbon removal.

A BMP Snout is a vented fiberglass stormwater structure and catch basin hood that improves water quality by converting the drainage inlet into a baffle with an oil and debris trap. They are installed over the outlet pipe in a storm water structure with a sump, then acts to skim oils, floatables and trash off of the surface water while letting settleable solids sink to the bottom. The cleaner water exits from beneath the SNOUT, which is lower than the bottom of the pipe, but above the bottom of the structure, allowing both floatable material and solids that sink to stay in the structure.

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BMP recommends a depth of 2.5 times the outlet pipe ID or a minimum of 3' for pipes 12" ID or less, whichever is greater. The deeper the sump, the more effective the stormwater structure and catch basin filters will be both in terms of pollutant removals and reducing frequency of maintenance. More depth in a structure means more quiescence, thus allowing the pollutants a better chance to separate out and the basin drain filter to be more effective. Also, a deeper sump results in less scouring, thus the captured solids are more likely to be retained in the structure with the help of the catch basin trap (sump). Finally, more depth provides more volume, which means fewer cycles between maintenance, which reduces the service cost over the lifetime of the facility.

A Bio-Skirt is a skirted boom that increases the capture and retention of hydrocarbons caught in the structure. Bio-Skirts are treated with a surface-bonded anti-microbial to preserve the booms service life. A Bio-Skirt can adsorb and retain about 1 gallon of oil. The Bio-Skirt not only captures more oil, including emulsified oils and PAHs, it keeps the hydrocarbons locked in the structure which otherwise can be easily mobilized in a high flow storm event.

The Civil Engineering Plans show the location of the swales, RPCDs and inlets/storm sewer and roadside ditches needed to convey drainage to the culverts flowing under Minturn Road. Disturbed areas will be revegetated with landscaping, turf reinforcement, hydro-mulch and a County approved non-irrigated seed mix.

3. *Low Impact Site Design*

The grading strategy is to maintain the character of the existing topography and revegetate disturbed area with turf reinforcement, landscape plants, hydro-mulch, and a County approved non-irrigated seed mix. The estimated extent of disturbance and vegetative replacement is represented on the Plans. Low Impact Site Design (LID) principals have been considered for implementation as follows:

Principle 1: Consider stormwater quality needs early in the design process

Boundaries Unlimited Inc. was brought onto the design early in the process to discuss treatment options and incorporate feasible Best Management Practices (BMP(s)).

Principle 2: Use the entire site when planning for stormwater quality treatment

The design implements swales, RPCDs, and inlets/storm sewer with BMP Snouts/Bio-Skirts to convey and manage runoff at multiple locations. Much of the site was designed to reduce flow velocities and disturbed areas are planned to be revegetated with turf reinforcement and hydro-mulch along with landscape plants and grasses.

Principle 3: Avoid unnecessary impervious area

The design limits the amount of impervious area required for roads and driveways. The development will include open space and parks. Each individual lot will be limited to 50% impervious area.

Principle 4: Reduce runoff rates and volumes to more closely match natural conditions

Due to the open nature of the site, the runoff downstream, which is slightly increased from historic, will serve to water the existing vegetation without adverse effects to downstream properties.

Principle 5: Integrate stormwater quality management and flood control

The permanent turf reinforcement, vegetated swales and RPCD will provide treatment of the

runoff through sediment fallout, reduce flow velocities and increase vegetative watering. The BMP Snouts and Bio-Skirts will aid in reducing solids and oils from the roadways.

Principle 6: Develop stormwater quality facilities that enhance the site, the community and the environment

The design contains long permanent turf reinforcement, vegetated swales which will enhance the character of the site and environment and increase vegetative watering of the grasses.

Principle 7: Use a treatment train approach

A train approach has been incorporated through the use of grass lined swales, RPCDs and BMP Snouts/Bio-Skirts.

Principle 8: Design sustainable facilities that can be safely maintained

Swales have been kept shallow to enable grass trimming and landscape maintenance. The drainage pipes are shallow and can be easily rooted or jetted, if necessary.

Principle 9: Design and maintain facilities with public safety in mind

The property is located within rural and mountainous terrain and will require homeowners and Homeowners Association personnel to exercise reasonable precautions to access the swales and drainage pipes as he or she would to access other portions of the property.

4. Hydrologic Criteria & Structures

The stormwater management system has been designed to convey the 100-year runoff from the upper basins within the roadway corridors/swales and convey it to the historic locations along Minturn Road. See the Drainage Study for all relative stormwater calculations.

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5. Operation and Maintenance

Erosion control measures and Best Management Practices (BMPS) should be followed during construction to ensure that the property and the adjacent sites are not impacted from sedimentation. This plan utilizes a combination of sediment control fencing, permanent turf reinforced grass lined swales, and RCPMs to minimize erosion, reduced flow velocities and improve water quality.

During construction activities and until vegetation can be established, sediment control fencing should be installed along the lower limits of all excavations. Certified weed free hay bales, check dams, silt dikes or erosion control logs should be installed across swales/ditches in accordance with Colorado Department of Transportation M-Standards. During construction, the Contractor shall be responsible for removing debris from the structures, repairing any damaged erosion controls, and removing accumulated sediment from behind hay bales, check dams, silt dikes, erosion control logs and sediment control fences after each storm event. After construction, the Homeowners Association shall be responsible for removing debris and sediment after each storm event and dredging sediment on an as-needed basis.

The grass lined swales must be inspected and maintained routinely to remove debris and ensure that the systems are operating effectively. The Mile High Flood District (aka Urban Drainage Flood Control District) recommends the following minimum maintenance procedures for grass swales:

Table 8.6 Maintenance Recommendations for Grassed Swales (UDFCD 1999)

Required Action	Maintenance Objective	Frequency of Action
Inspections	Check the grass for uniformity of cover, sediment accumulation in the swale, and near culverts.	Routine – Annual inspection is suggested.
Lawn mowing and Lawn care	Maintain irrigated grass at 2 to 4 inches tall and non-irrigated native grass at 6 to 8 inches tall. Collect cuttings and dispose of them offsite or use a mulching mower.	Routine – As needed.
Debris and Litter removal	Keep the area clean for aesthetic reasons, which also reduces floatables being flushed downstream.	Routine – As needed by inspection, but no less than two times per year. Check each spring after snowmelt.
Sediment removal	Remove accumulated sediment near culverts and in channels to maintain flow capacity. Replace the grass areas damaged in the process.	Routine – As needed by inspection. Check each spring after snowmelt.
Grass reseeding and mulching	Maintain a healthy dense grass in channel and side slope.	Non-routine – As needed by annual inspection.

RPCDs must be inspected and maintained routinely to removed debris and excess vegetation which may grow behind or on the dam lip. Vegetation within and immediately below the RPCD should also be mowed regularly during the summer and fall to help control vegetative growth and promote even flow.

Curb Drainage Inlet structures with BMP Snouts should be cleaned with a vacuum truck when the sump is half full with sediment. The Snout itself requires no real maintenance other than routine inspection and rinsing with a hose or pressure washer during the cleaning sequence of the catch basin and flushing the anti-siphon vent with water or air to verify that it is clear. When the Bio-Skirt becomes saturated with oil, it can be wrung out and re-deployed. It can also be

washed in a washing machine and redeployed. The Anti-microbial properties that protect the fabric will stay intact, even after washing. At a minimum, Bio-Skirts should be serviced or replaced annually.

The design plans more specifically locate many of the erosion control features. These plans are a good representation of the site requirements, but may not be all inclusive. The Contractor shall be responsible for complying with all local and state guidelines and permitting issues.

Sediment and mud should be prevented from leaving the construction site by immediate placement of a stabilized construction entrance at the construction entrance. The Contractor should be responsible for cleaning and general upkeep of the site and adjacent roadways. As an effective dust control measure, water may be utilized to minimize uprising of dust.

Good housekeeping BMPs should be followed throughout the entire life of the project. These include but are not limited to:

- refuge receptacles should be regularly emptied and equipped with lids;
- keeping machinery in good operating condition to prevent leakage;
- apply appropriate (not excessive) amounts of fertilizer to the landscaping;
- scheduled maintenance cleaning of any downstream swales, ditches, downstream curb and gutter, storm sewer inlets and culverts;
- general site cleanliness and proper training of employees;
- Grading must be performed (but not in excess) to ensure that drainage is directed away from all structures in all directions.

Once construction activities are completed, final stabilization of the disturbed areas should begin. Within one growing season of the project completion, uniform vegetative site coverage should be equal to or greater than 70% of the pre-disturbance levels, or equivalent permanent, physical erosion reduction methods should be employed. When the site is determined to have reached the final stabilization stage, erosion control structures can be removed.

C. Works Cited

Urban Drainage Flood Control District. (Updated 2019). Urban Storm Drianage Criterial Manual, Volumes 1-3. Denver, CO.