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**Return Address:**

Skagit Surveyors & Planning PLLC

PO Box 1223

Burlington, WA 98233

**Document Title:**

Maintenance Manual

**Reference Number** (if applicable): _____

**Grantor(s):** [__] additional grantor names on page ___.

1) BS 80 LLC, a Washington limited liability company

2) _____

**Grantees(s):** [__] additional grantee names on page ___.

1) BS80 LLC, a Washington limited liability company

2) _____

**Abbreviated Legal Description:**

Ptn of NE ¼ and a Ptn of the W 1/3 of the SW ¼ Sec 23 Twp 36N R3E W.M.

**Assessor Parcel/Tax ID Number:** P48084, P48085, P48086,0P48087

# Plat of Samish Heights

Skagit County, Washington

## Stormwater and Drainage Facilities Maintenance Manual

Prepared For
Pat Stephens, Developer
PO Box 32330
Bellingham, WA 98225

June 11, 2018


Prepared By
Reichhardt & Ebe Engineering, Inc.
PO Box 978
Lynden, WA 98264

## 1.0 Purpose

The purpose of this Maintenance Manual is to provide guidance and responsibility for inspecting, operating and maintaining the drainage systems as designed and approved for the development of the Samish Heights and future Blanchard Knob Plats. The two developments are adjacent to one another, and share the same access road and drainage facilities.

## 2.0 Background

This maintenance manual is based upon a Stormwater Report for the development submitted by Skagit Surveyors and Engineers, dated October 24, 2012, and subsequent revisions and modifications. The original report included a detention pond, but an Addendum Memorandum dated April 20, 2015 modified the drainage and deleted the detention pond. Construction drawings were submitted and approved by Skagit County Public Works. During construction it was found that the design required modification, eliminating two culverts adjacent to Lots 1 through 6 of Samish Heights. This change eliminated roadway runoff across the lots, but increased runoff to the next downstream culvert. The increased runoff rate to the culvert was calculated by Reichhardt & Ebe Engineering Inc. and a dispersion system was designed and submitted to Skagit County on May 3, 2018. The system was conditionally approved, subject to "*Monitor dispersion from the spreader during significant rain events and through the next wet season for any concentrated flows within 100'. Additional measures can be performed as needed. Follow up inspection required.*" This monitoring requirement is included in the maintenance manual and Appendix.

## 3.0 Stormwater and Drainage Facilities

The drainage system consists of the following:

- Runoff from roofs, driveways and landscaped areas on individual lots will be infiltrated, either onsite or dispersed and infiltrated into adjacent native vegetated areas. Lots 1 through 6 may require Downspout Dispersion Trenches, per a letter report from Associated Earth Sciences, Inc. which is included in the Appendix.

- Road drainage consists of sheet flow off of the road surface onto native vegetated area and rock lined road ditches with check dams spaced approximately 50' apart and cross culverts at approximately 500' intervals which disperse overflow at natural locations during large storm events. The culvert discharge is dispersed to native vegetation.

## 4.0 Stormwater System Maintenance

The Stormwater Maintenance tables are copied from the 2012 Stormwater Management Manual for Western Washington, published by the Department of Ecology and are in the Appendix.

Table No. 1 - Detention Ponds does not apply to this project but is included for reference because Table No. 2 – Infiltration refers to it.

Table No. 2 – Infiltration will occur on lots and in natural dispersion areas adjacent to the lots. Some infiltration also will occur in road ditches and dispersion adjacent to roads and culvert discharge points.

Table No. 7 – Energy Dissipaters consist of rock check dams in road ditches and in dispersal pads at the discharge points of road culverts.

## 5.0 Maintenance Responsibilities

Drainage facilities require periodic inspection and maintenance in order to keep the systems operating as designed. All systems should be inspected at least twice annually, once in the fall before the winter rain season begins and once during the winter to be sure the systems are operating properly. The fall inspection should identify existing defects in accordance with the maintenance tables. The deficiencies should be corrected before winter storms occur. The winter inspection should identify any problems causing poor performance or failure. Depending upon the severity of the problem, temporary or permanent repairs should be made. Temporary repairs should be scheduled for permanent repair when conditions are favorable, and before the next winter storm season.

- Individual Lot Drainage
  Maintenance of infiltration systems and runoff dispersion from individual lots is the responsibility of the lot owner.

- Road Drainage
  Maintenance of public road drainage is the responsibility of Skagit County. Maintenance of private access road and driveway drainage is the responsibility of the user or owner. Maintenance of the wellsite easement road drainage is the responsibility of the owner/operator of the water system.

## 6.0 Special Inspections and Maintenance

The re-designed culvert referred to in Section 2.0 is to be inspected jointly by the Developer and Skagit County Public Works during a major storm event in the winter of 2018/2019. Defects are to be noted and the developer is responsible for repairs or remediation.

## Appendix

- DOE Maintenance Tables, 1, 2 & 7
- AESI Letter dated June 14, 2013 re: dispersion of stormwater on lots.
- R&E Addendum to Blanchard Knob and Samish Heights Stormwater Design dated May 3, 2018. This includes the letter portion, maps, sketches and orifice calculation portions of the addendum. The full report is available at the Skagit County Public Works Dept.
- Skagit County response to the above mentioned R&E Addendum.

## 4.6 Maintenance Standards for Drainage Facilities

The facility-specific maintenance standards contained in this section are intended to be conditions for determining if maintenance actions are required as identified through inspection. They are not intended to be measures of the facility's required condition at all times between inspections. In other words, exceedence of these conditions at any time between inspections and/or maintenance does not automatically constitute a violation of these standards. However, based upon inspection observations, the inspection and maintenance schedules shall be adjusted to minimize the length of time that a facility is in a condition that requires a maintenance action.

**Table 4.5.2 Maintenance Standards**

**No. 1 – Detention Ponds**

| Maintenance Component | Defect | Conditions When Maintenance Is Needed | Results Expected When Maintenance Is Performed |
|---|---|---|---|
| General | Trash & Debris | Any trash and debris which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping.<br>If less than threshold all trash and debris will be removed as part of next scheduled maintenance. | Trash and debris cleared from site. |
| | Poisonous Vegetation and noxious weeds | Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public.<br>Any evidence of noxious weeds as defined by State or local regulations.<br>(Apply requirements of adopted IPM policies for the use of herbicides). | No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department)<br>Complete eradication of noxious weeds may not be possible. Compliance with State or local eradication policies required |
| | Contaminants and Pollution | Any evidence of oil, gasoline, contaminants or other pollutants<br>(Coordinate removal/cleanup with local water quality response agency). | ~~No contaminants or pollutants present.~~ |
| | Rodent Holes | Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes. | Rodents destroyed and dam or berm repaired. (Coordinate with local health department; coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.) |

## No. 2 – Infiltration

| Maintenance Component | Defect | Conditions When Maintenance Is Needed | Results Expected When Maintenance Is Performed |
|---|---|---|---|
| General | Trash & Debris | See "Detention Ponds" (No. 1). | See "Detention Ponds" (No. 1). |
| | Poisonous/Noxious Vegetation | See "Detention Ponds" (No. 1). | See "Detention Ponds" (No. 1). |
| | Contaminants and Pollution | See "Detention Ponds" (No. 1). | See "Detention Ponds" (No. 1). |
| | Rodent Holes | See "Detention Ponds" (No. 1). | See "Detention Ponds" (No. 1) |
| Storage Area | Sediment | Water ponding in infiltration pond after rainfall ceases and appropriate time allowed for infiltration. Treatment basins should infiltrate Water Quality Design Storm Volume within 48 hours, and empty within 24 hours after cessation of most rain events.<br>(A percolation test pit or test of facility indicates facility is only working at 90% of its designed capabilities. Test every 2 to 5 years. If two inches or more sediment is present, remove). | Sediment is removed and/or facility is cleaned so that infiltration system works according to design. |
| Filter Bags (if applicable) | Filled with Sediment and Debris | Sediment and debris fill bag more than 1/2 full. | Filter bag is replaced or system is redesigned. |
| Rock Filters | Sediment and Debris | By visual inspection, little or no water flows through filter during heavy rain storms. | Gravel in rock filter is replaced. |
| Side Slopes of Pond | Erosion | See "Detention Ponds" (No. 1). | See "Detention Ponds" (No. 1). |
| Emergency Overflow Spillway and Berms over 4 feet in height. | Tree Growth | See "Detention Ponds" (No. 1). | See "Detention Ponds" (No. 1). |
| | Piping | See "Detention Ponds" (No. 1). | See "Detention Ponds" (No. 1). |
| Emergency Overflow Spillway | Rock Missing | See "Detention Ponds" (No. 1). | See "Detention Ponds" (No. 1). |
| | Erosion | See "Detention Ponds" (No. 1). | See "Detention Ponds" (No. 1). |
| Pre-settling Ponds and Vaults | Facility or sump filled with Sediment and/or debris | 6" or designed sediment trap depth of sediment. | Sediment is removed. |

## No. 7 – Energy Dissipaters

| Maintenance Components | Defect | Conditions When Maintenance is Needed | Results Expected When Maintenance is Performed |
|---|---|---|---|
| External: | | | |
| Rock Pad | Missing or Moved Rock | Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil. | Rock pad replaced to design standards. |
| | Erosion | Soil erosion in or adjacent to rock pad. | Rock pad replaced to design standards. |
| Dispersion Trench | Pipe Plugged with Sediment | Accumulated sediment that exceeds 20% of the design depth. | Pipe cleaned/flushed so that it matches design. |
| | Not Discharging Water Properly | Visual evidence of water discharging at concentrated points along trench (normal condition is a "sheet flow" of water along trench). Intent is to prevent erosion damage. | Trench redesigned or rebuilt to standards. |
| | Perforations Plugged. | Over 1/2 of perforations in pipe are plugged with debris and sediment. | Perforated pipe cleaned or replaced. |
| | Water Flows Out Top of "Distributor" Catch Basin. | Maintenance person observes or receives credible report of water flowing out during any storm less than the design storm or its causing or appears likely to cause damage. | Facility rebuilt or redesigned to standards. |
| | Receiving Area Over-Saturated | Water in receiving area is causing or has potential of causing landslide problems. | No danger of landslides. |
| Internal: | | | |
| Manhole/Chamber | Worn or Damaged Post, Baffles, Side of Chamber | Structure dissipating flow deteriorates to 1/2 of original size or any concentrated worn spot exceeding one square foot which would make structure unsound. | Structure replaced to design standards. |
| | Other Defects | See "Catch Basins" (No. 5). | See "Catch Basins" (No. 5). |

Associated Earth Sciences, Inc.

*Serving the Pacific Northwest Since 1981*

June 14, 2013
Project No. EE080636B

BS80, LLC
421 14th Street
Bellingham, Washington 98201

Attention: Mr. Jim Bell

Subject: Stormwater Discharge
BS80, LLC Property Lots 1 through 6
Blanchard Mountain
Skagit County, Washington

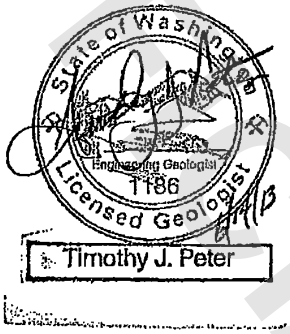
Dear Mr. Bell:

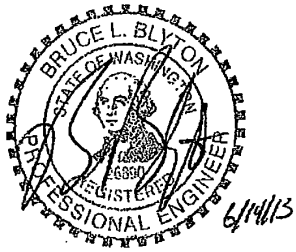
It is our understanding that current plans call for dispersion of stormwater on Lots 1 through 6 at the subject site. It is also our understanding that the stormwater to be dispersed on each lot will be limited to the runoff from the building roof and driveway on the lot on which the dispersion will occur. Given this condition, it is our opinion that dispersion on Lots 1 through 6 will not increase the risk of landslide activity on the subject site or adjoining areas provided that:

- All stormwater is dispersed using dispersion trenches in accordance with Figure 3.5 from the Washington Department of Ecology 2005 *Stormwater Manual for Western Washington* (see Appendix);
- A vegetated flowpath of at least 50 feet is maintained between the dispersion trench and any slope with an inclination of 40 percent or steeper; and,
- Associated Earth Sciences, Inc. (AESI) field verifies the suitability of the dispersion trench location at the time of construction to confirm that there aren't any topographic irregularities or other geomorphic features that deviate from the topographic survey.

Should you have any questions regarding this report, or other geotechnical aspects of this project, please do not hesitate to call.

Sincerely,
**ASSOCIATED EARTH SCIENCES, INC.**
**Kirkland, Washington**




Timothy J. Peter, L.E.G., L.Hg.
Senior Project Geologist

Bruce L. Blyton, P.E.
Senior Principal Engineer

Attachment: Appendix: Figure 3.5 from the 2005 Washington Department of Ecology Stormwater Management Manual for Western Washington

cc: Ms. Marianne Manville-Ailles
Skagit Surveyors and Engineers

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# APPENDIX

## Figure 3.5

## 2005 Washington Department of Ecology Stormwater Management Manual for Western Washington

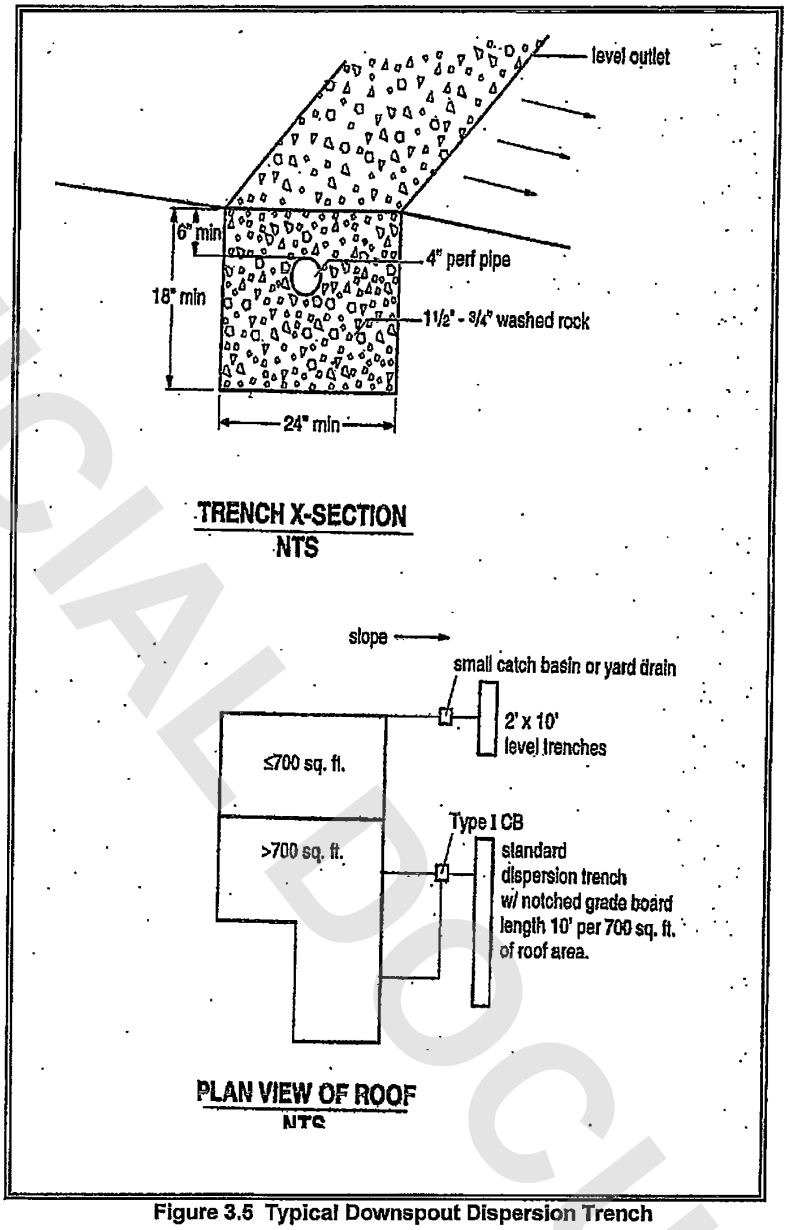


**Figure 3.5 Typical Downspout Dispersion Trench**

Source: King County

Reichhardt & Ebe
ENGINEERING INC

May 3, 2018

Skagit County
1800 Continental Place
Mount Vernon, WA 98273

**RE: Addendum to Blanchard Knob and Samish heights stormwater design**

To: Paul Erickson

This letter is intended to addend the April 20, 2015 Memorandum prepared by John Abenroth Jr. of Skagit Surveyors & Engineers, titled "Addendum to Blanchard Knob and Samish Heights stormwater design."

This letter is specific only to the portion of the previous stormwater in the vicinity of Blanchard Knob lots 1 – 10. The approximate roadway stations 50+50 to 58+00. The April 20, 2015 design included having the subject area disperse through numerous culverts, some of which were to lots 1 – 6. Due to varying site constraints, and the preference not to discharge water on residential lots, the development was not constructed in this manner. Therefore, we are presenting this letter to show how this modification is still compliant with, or exceeds, the overall design approach and stormwater regulations which apply.

Upon construction completion R&E staff observed the achieved drainage patterns. This is documented in the attached "Revised Road Drainage Plan" exhibit. Drainage Area 1 is the portion of lots 7 – 10 and Drainage Area 2 is the portion of the roadway which drain to a rock lined infiltration ditch. The overflow from the infiltration ditch is to a culvert at approximate station 50+50.

R&E created drainage basins based on the "Revised Road Drainage Plan". In this we conservatively estimated that the impervious surface on lots 7 – 10, as assumed by Mr. Abenroth, was completely included within the portions of lots 7 – 10 which drain to the culvert at station 50+50. We further utilized the same infiltration rates and infiltration ditch cross section as modeled by Mr. Abenroth in the subject section along lots 7 – 10 frontages. We did update the soils utilized by Mr. Abenroth. During construction it was observed that in the subject area the soils appeared to be more conducive to infiltration than appeared in the Geotechnical reports. Upon inspection of the attached USGS soil survey it was found that the soils were listed as #4, Andic Xerochrepts, Hydrologic Soil Group B, which would be more representative of what was observed. The WWHM model is attached. This model was utilized to calculate the 100-year stormwater events discharge at the station 50+50 culvert, utilizing a 15-minute timestep. That being 0.71 cubic feet per second (cfs).

Being that the culvert at station 50+50 does not discharge to proposed lots, it was felt best to determine if BMP T5.30 "Full Dispersion" could be utilized into the native vegetation. Full Dispersion exceeds the original


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intent of Mr. Abenroth's approved analysis. Mr. Abenroth had proven that bypassing the discharged water over lots complied with the appropriate stormwater regulations. The revised proposal to Fully Dispersion would allow those areas draining to it to be considered "Ineffective" surfaces, thereby increasing the projects ability to meet the stormwater regulations.

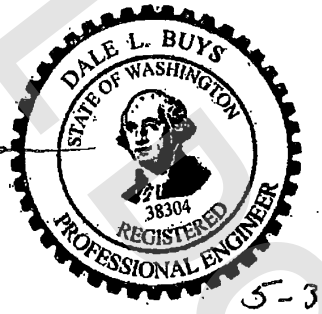
Full Dispersion, BMP T5.30, under "Roadway Dispersion BMP's states that a single 50-foot long dispersion trench is allowed to discharge up to 0.5 cfs. Being that our project is slightly above 0.5 cfs, at 0.71 cfs it was calculated that 0.5 cfs / 50 feet = 0.01 cfs per foot of trench. Therefore, we would need to disperse over 0.01 / 0.71 = 71 linear feet. We propose to do so with the attached Dispersion Proposal and details. This includes 80 linear feet of CPSP pipe, exceeding the 71 linear feet. This pipe will be laid along the contour to promote an even distribution of the water along its length, and a catch basin that will act as an emergency overflow. The orifice equation was utilized to determine the number and size of orifice required to disperse the flow along the length of pipe required to not exceed the dispersion flow. This calculation also allowed us to calculate the head of water within the pipe required to create that flow through the orifice. This orifice calculation is attached. Various other details of the proposal include the use of ecology blocks and straps to secure the pipe which is laid along a flat bench created for which the pipe is installed on, and the installation of open graded rock material covering the pipe to protect it from vandalism and ultraviolet degradation, as well as reduce the energy of the discharged water and further facility dispersion.

In summary, by Fully Dispersing the water which was previously stated to bypass over adjacent lots, the ability of this project to comply with the previously approved stormwater approach is increased.

Sincerely,

Dale Buys

Dale Buys, P.E.
Reichhardt & Ebe Engineering, Inc.

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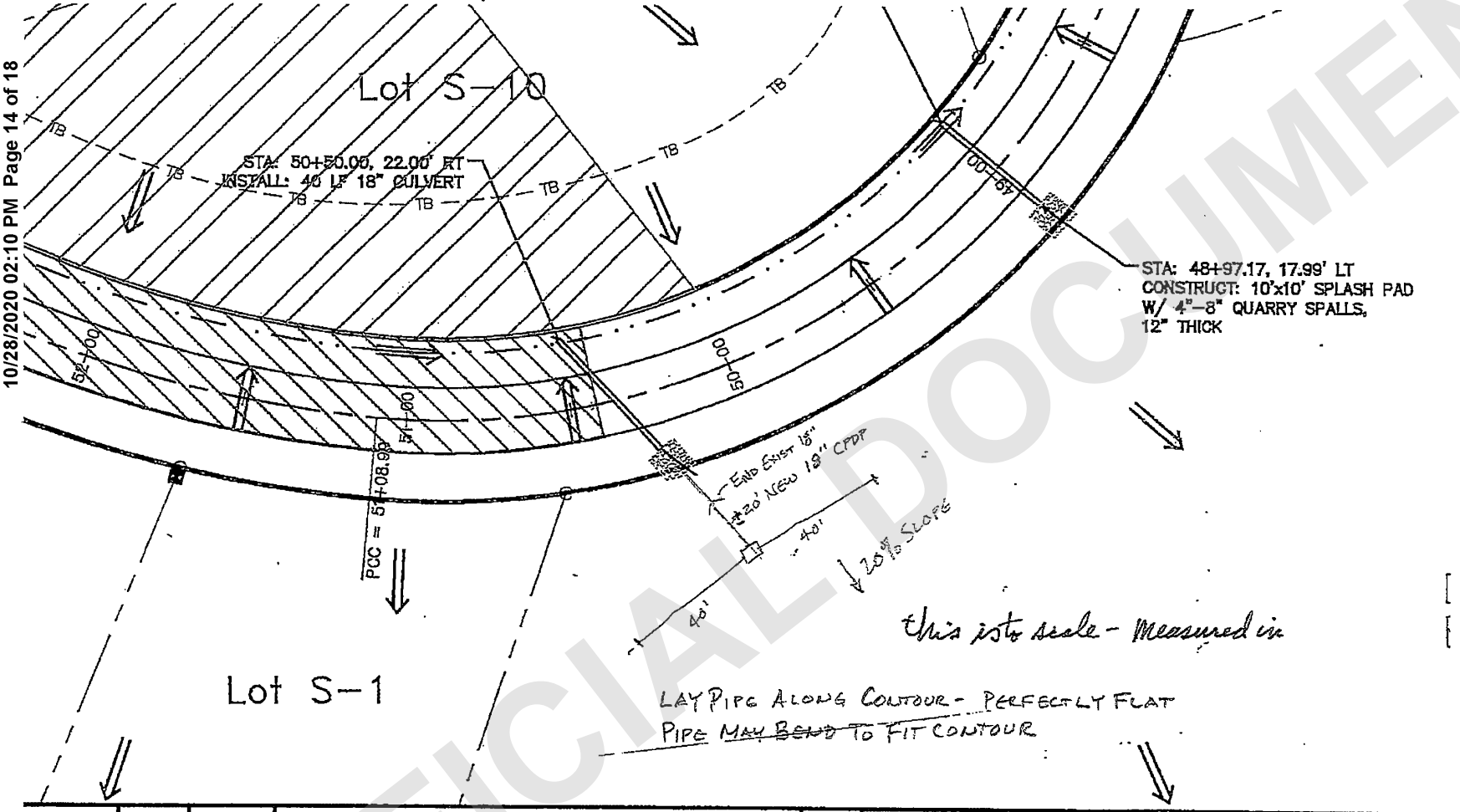


| NO. | DATE | DESCRIPTION | BY |
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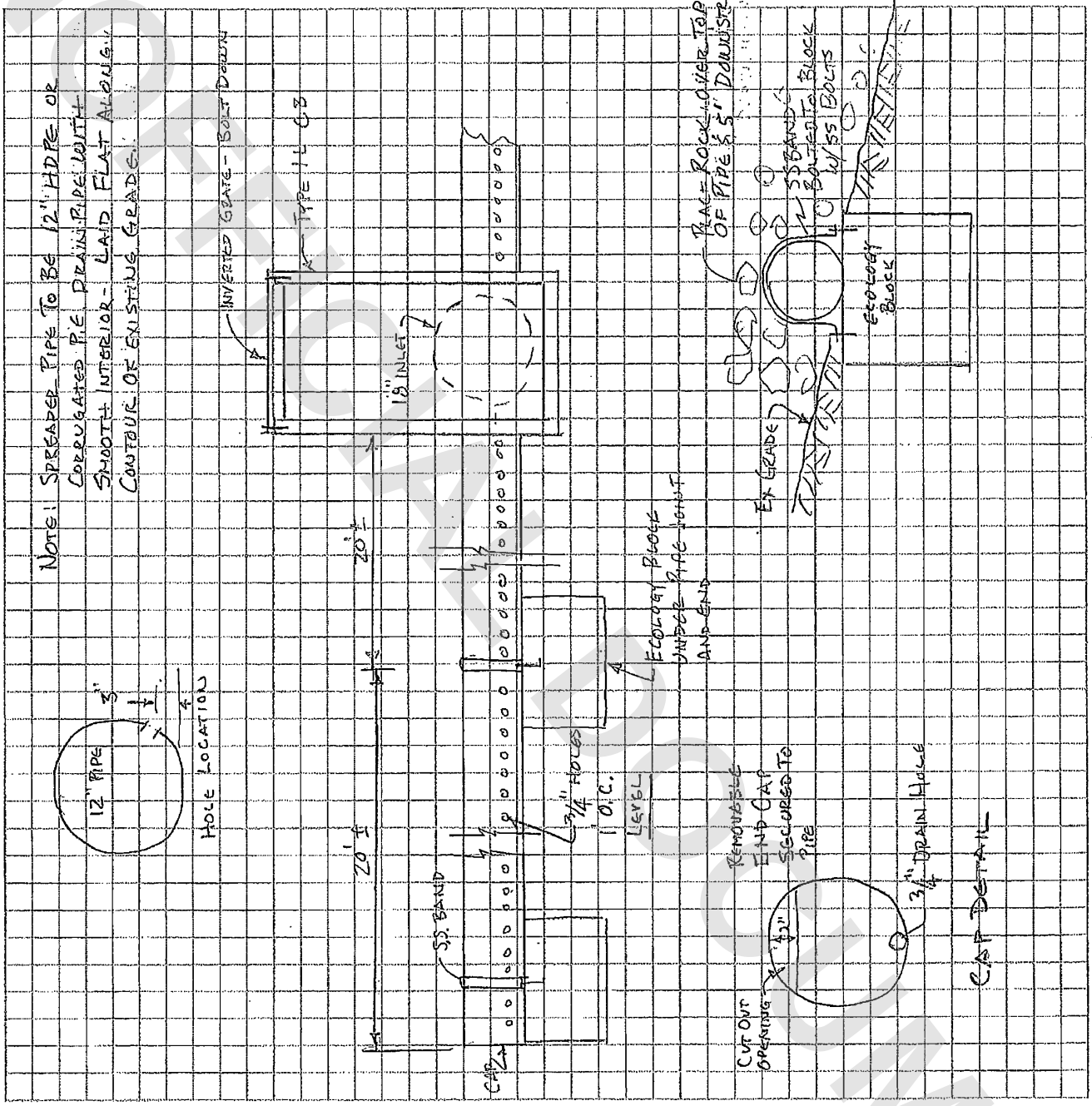
Dispersion Proposal

3687

R&E Reichhardt & Ebe ENGINEERING INC

Job No. _____
Ref. _____
Date _____
Prepared By _____

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# Orifice Calculation


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| | | |
|---|---|---|
| $Q_{target}$(cfs)= | 0.71 | WWHM Calc. |
| Orifice(in)= | 0.75 | Chosen Value |
| dh(ft)= | 0.37 | Variable |
| Cd= | 0.62 | Chosen Value |
| A(ft)= | 0.003 | =3.14*(K6/24)^2 |
| g= | 32.2 | Given |
| Flow per orifice $Q_{calc}$(cfs)= | 0.009 | =K9*K10*(2*K11*K7)^0.5 |
| Number of Orifices to get flow | 76.89101 | =K4/K13 |

SITE COPY

Monitor dispersion from this spreader during significant rain events & through the next wet season for any re-concentrated flows within 100'. Additional measures can be performed as needed.
Follow up inspection req'd
5/15/18

Reichhardt & Ebe
ENGINEERING INC

May 3, 2018

Skagit County
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