

# SITE DISTURBANCE PLAN YOMAN BLUFFS

A PORTION OF GOVERNMENT LOT 1, IN THE NORTHWEST 1/4  
OF SECTION 10, TOWNSHIP 59 NORTH, RANGE 4 WEST, B.M.  
BONNER COUNTY, IDAHO

**DEFINITION:** A TEMPORARY STONE-STABILIZED PAD LOCATED AT POINTS OF VEHICULAR INGRESS AND EGRESS ON A CONSTRUCTION SITE.

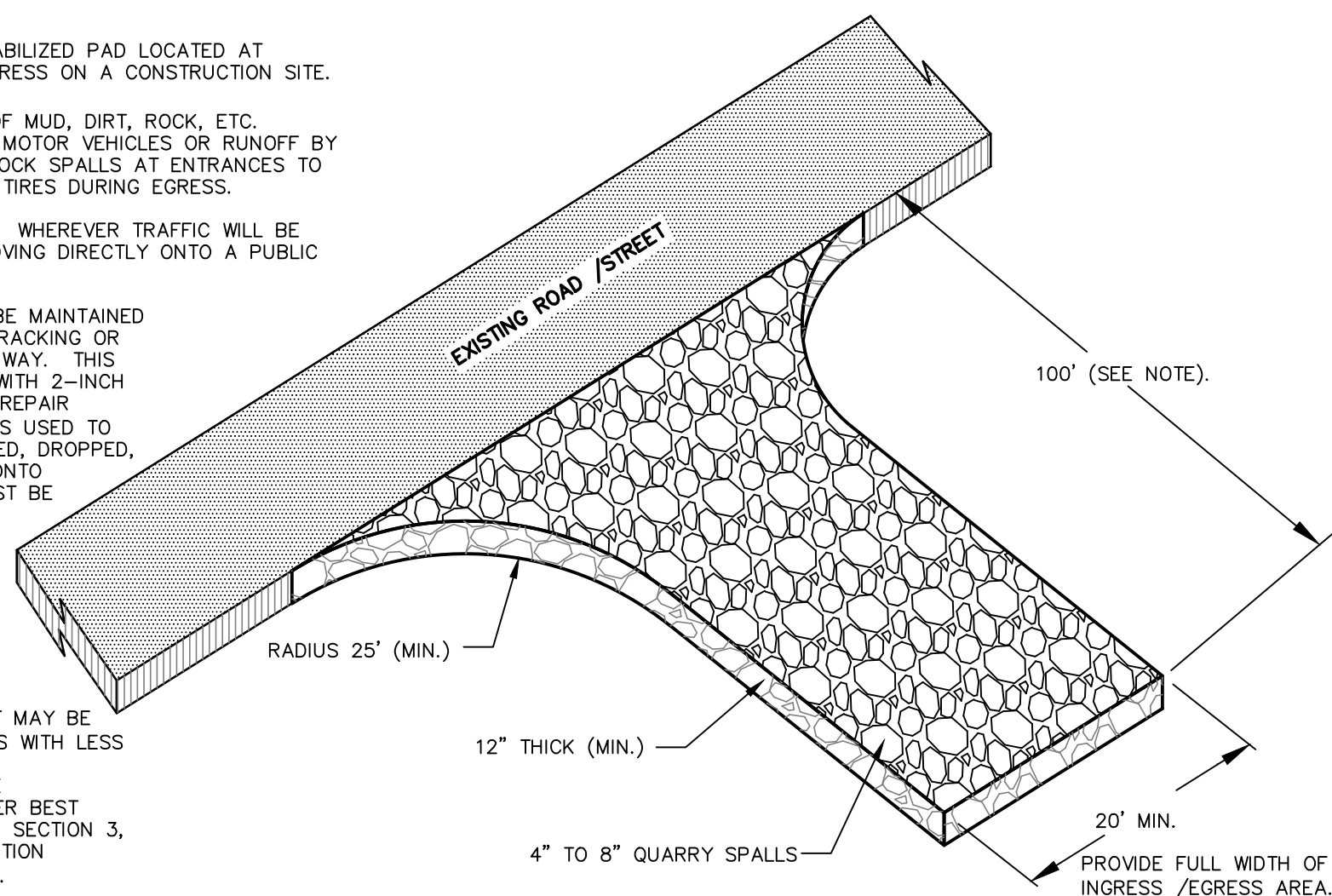
**PURPOSE:** TO REDUCE THE AMOUNT OF MUD, DIRT, ROCK, ETC. TRANSPORTED ONTO PUBLIC ROADS BY MOTOR VEHICLES OR RUNOFF BY CONSTRUCTING A STABILIZED PAD OF ROCK SPALLS AT ENTRANCES TO CONSTRUCTION SITES AND WASHING OF TIRES DURING EGRESS.

**CONDITIONS WHERE PRACTICE APPLIES:** WHEREVER TRAFFIC WILL BE LEAVING A CONSTRUCTION SITE AND MOVING DIRECTLY ONTO A PUBLIC ROAD OR OTHER PAVED AREAS.

**MAINTENANCE:** THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOW OF MUD ONTO PUBLIC RIGHT-OF-WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH 2-INCH STONES, AS CONDITIONS DEMAND, AND REPAIR AND/OR CLEANOUT OF ANY STRUCTURES USED TO TRAP SEDIMENT. ALL MATERIALS SPILLED, DROPPED, WASHED OR TRACKED FROM VEHICLES ONTO ROADWAYS OR INTO STORM DRAINS MUST BE REMOVED.

## NOTE

1. AS REQUIRED 100' MINIMUM, EXCEPT MAY BE REDUCED TO 50' MINIMUM FOR SITES WITH LESS THAN 1 ACRE OF EXPOSED SOIL.
2. CONSTRUCTION ENTRANCE SHALL BE CONSTRUCTED PER IDEQ STORMWATER BEST MANAGEMENT PRACTICES VOLUME 2, SECTION 3, BMP 5 STABILIZATION OF CONSTRUCTION ENTRANCE/EXIT STD. DRAWING SCE1.



## SEEDING SPECIFICATIONS

PROVIDE FRESH, CLEAN NEW CROP SEED COMPLYING WITH TOLERANCE FOR PURITY AND GERMINATION ESTABLISHED BY OFFICIAL SEED ANALYSTS OF NORTH AMERICA. PROVIDE SEED MIXTURE COMPOSED OF GRASS SPECIES AND PERCENTAGES AS FOLLOWS:

- 20 PERCENT ELKA PERENNIAL RYE
- 20 PERCENT DURAR HARD FESCUE
- 45 PERCENT COVAR SHEEP FESCUE
- 15 PERCENT REUBENS CANADIAN BLUEGRASS

PROVIDE MIXTURE COMPOSED OF GRASS SEED AND FERTILIZER IN PERCENTAGES AS FOLLOWS:

GRASS SEED MIXTURE: 90 LBS. PER ACRE  
FERTILIZER: 16:16:16 TIMED RELEASE COMPOSITION, 300 LBS. PER ACRE

ALL SEEDING OF SLOPES SHALL BE DONE IN ACCORDANCE WITH IDOT STANDARD SPECIFICATIONS.

CONTRACTOR SHALL IRRIGATE SEEDED AREAS UNTIL SEED HAS GERMINATED AND HAS BEEN ACCEPTED BY BONNER COUNTY.

## CONTACT PERSON

JON MANDERE, PRESIDENT  
MANDERE CONSTRUCTION, INC.  
13964 NORTH OHIO  
RATHDRUM, IDAHO 83858  
OFFICE: 208-687-3308  
MOBILE: 509-954-6215

## PROJECT NARRATIVE

THE PROPOSED PROJECT INCLUDES THE DEVELOPMENT OF NINE NEW SINGLE-FAMILY RESIDENCE PARCELS ALONG WITH THEIR DRIVEWAYS, GRADING, ACCESS ROAD AND ASSOCIATED DRAINAGE FACILITIES. THE SITE WILL BE RE-GRADED TO MEET THE REQUIREMENTS OF THE ACCESS ROAD. THE OVERALL PROJECT SITE IS APPROXIMATELY 37.6 ACRES. THE TERRAIN ON THE SITE IS FAIRLY SLEEP. IT IS ANTICIPATED THAT APPROXIMATELY 2.0 ACRES WILL BE DISTURBED DURING CONSTRUCTION. THE ACCESS ROAD IS 1,966 FEET LONG. CONSTRUCTION WILL BEGIN DURING THE FALL OF 2022, AND CONTINUE INTO SUMMER OF 2023. IT IS ANTICIPATED THAT CONSTRUCTION WILL TAKE 12 MONTHS OR LESS.

**SOIL TYPES:** THE SOILS IN THE REGION OF THE SUBJECT PROPERTY HAVE BEEN IDENTIFIED BY THE USDA NATURAL RESOURCES CONSERVATION SERVICE (NRCS) AS BELONGING TO BONNER SILT LOAM, COOL, 0 TO 4 PERCENT SLOPES. THE BONNER SILT LOAM, COOL, SOIL HAS A PUBLISHED HYDROLOGIC SOIL GROUP RATING OF "B" WITH A MODERATELY HIGH TO HIGH INFILTRATION RATE (0.57 TO 1.98 IN/HR).

**PROPOSED ACTION:** THE PROPOSED CONSTRUCTION WILL CONSIST OF GRADING TO ACCOMMODATE THE PROPOSED ACCESS ROAD. RUNOFF FROM THE PROPOSED IMPROVEMENTS WILL BE ROUTED TO DETENTION PONDS WHICH HAVE BEEN SIZED TO HANDLE THE PRE VS. POST 25 YEAR STORM. RUNOFF FROM THE PROPOSED ROAD AND DRIVEWAYS WILL BE CONVEYED VIA OVERLAND FLOW, DITCHES AND CULVERTS TO DRAINAGE DETENTION PONDS "A" AND "B". TEMPORARY EROSION AND SEDIMENT CONTROL WILL BE ACCOMPLISHED USING A FILTER FENCE AND A ROCK CONSTRUCTION ENTRANCE. STRAW BALES ARE TO BE KEPT ON THE SITE AND SPREAD OUT ON DISTURBED AREAS DURING LARGE PRECIPITATION EVENTS. ONCE CONSTRUCTION HAS BEEN COMPLETED, THE SITE SHALL BE SEEDED AND LANDSCAPED FOR PERMANENT EROSION AND SEDIMENT CONTROL. ALL EQUIPMENT IS TO CARRY OIL SPILL KITS DURING CONSTRUCTION.

## ELEVATION DATUM

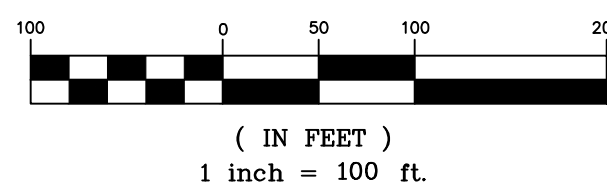
NAVD88 ESTABLISHED FROM OPUS SOLUTION OF STATIC GPS OBSERVATION ON A LOCAL CONTROL POINT.

## SITE TBM

FOUND 5/8 REBAR W/ PLASTIC, PLS 7156  
NORTHWESTER RIGHT-OF-WAY OF SHERWOOD BEACH ROAD AT THE SOUTHERLY RIGHT-OF-WAY OF PAUL JONES BEACH ROAD

ELEVATION: 2465.74

## GRAPHIC SCALE



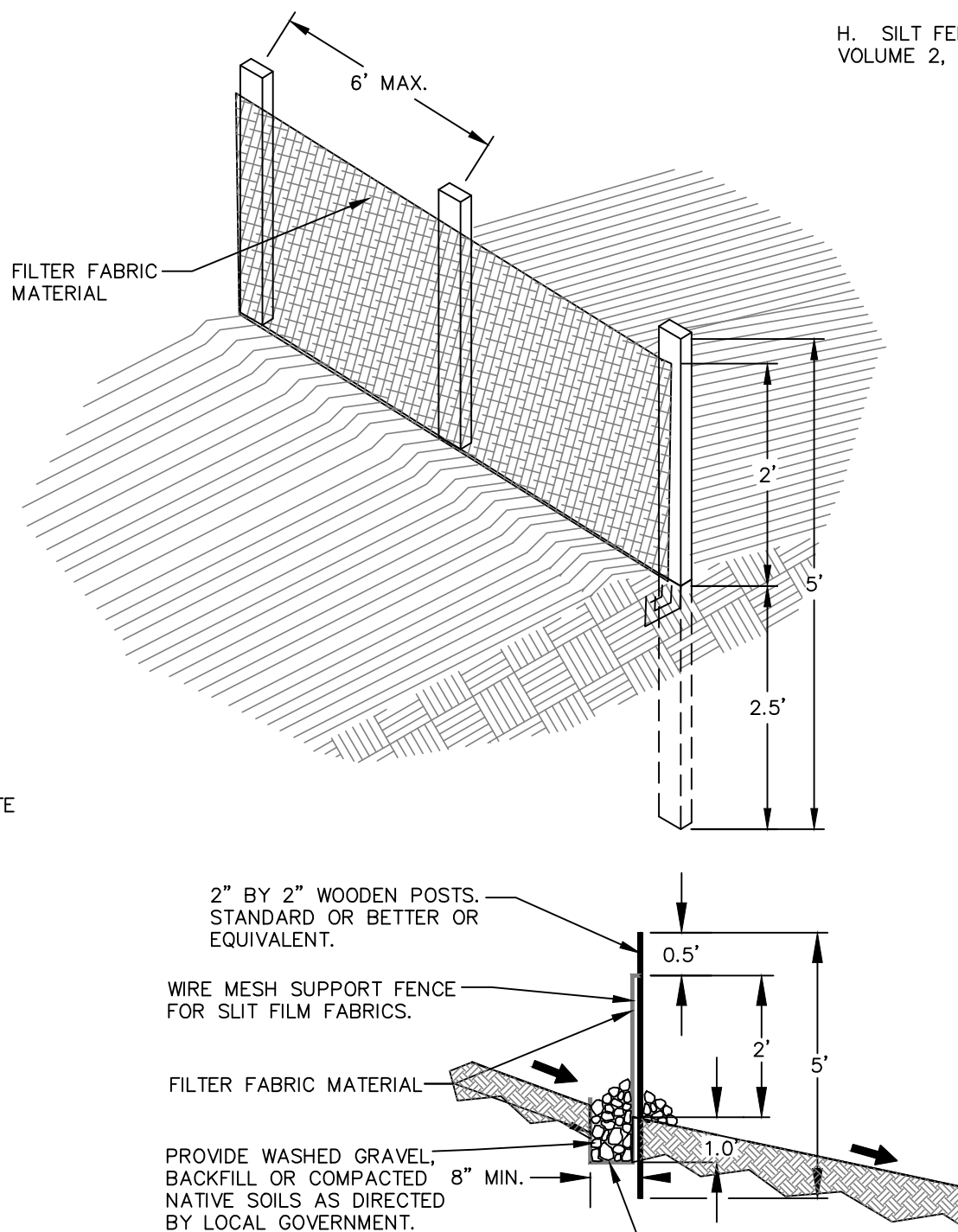
**DEFINITION:** A TEMPORARY SEDIMENT BARRIER CONSISTING OF A FILTER FABRIC STRETCHED ACROSS AND ATTACHED TO SUPPORTING POSTS AND ENTRENCHED. THE FILTER FENCE IS CONSTRUCTED OF STAKES AND SYNTHETIC FILTER FABRIC WITH A RIGID WIRE FENCE BACKING WHERE NECESSARY FOR SUPPORT.

**PURPOSE:** 1. TO INTERCEPT AND DETAIN SMALL AMOUNTS OF SEDIMENT UNDER SHEET FLOW CONDITIONS FROM DISTURBED AREAS DURING CONSTRUCTION OPERATIONS IN ORDER TO PREVENT SEDIMENT FROM LEAVING THE SITE.  
2. TO DECREASE THE VELOCITY OF SHEET FLOWS.

**CONDITIONS WHERE PRACTICE APPLIES:** FILTER FENCES MUST BE PROVIDED JUST UPSTREAM OF THE POINT(S) OF DISCHARGE OF RUNOFF FROM A SITE, BEFORE THE FLOW BECOMES CONCENTRATED. THEY MAY ALSO BE REQUIRED:

1. BELOW DISTURBED AREAS WHERE RUNOFF MAY OCCUR IN THE FORM OF SHEET AND RILL EROSION; WHEREVER RUNOFF HAS THE POTENTIAL TO IMPACT DOWNSTREAM RESOURCES.
2. PERPENDICULAR TO MINOR SWALES OR DITCH LINES FROM CONTRIBUTING DRAINAGE AREAS UP TO ONE ACRE IN SIZE.
3. CONTRACTOR SHALL COORDINATE WITH DESIGN ENGINEER FOR ACTUAL PLACEMENT LOCATIONS.
4. SILT FENCE TO BE PLACED AT LOCATIONS WHERE CONTRACTOR IS OF THE OPINION THAT IT IS NECESSARY TO MITIGATE THE POTENTIAL FOR EROSION ONTO ADJACENT PROPERTIES NOT OWNED BY OWNER. SILT FENCE IS NOT REQUIRED IF CONSTRUCTION IS DONE DURING THE DRY MONTHS OF JULY AND AUGUST.

**MAINTENANCE:** THE FILTER FENCE AND INLET PROTECTIONS SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOW OF MUD AND SEDIMENT OFF THE CONSTRUCTION SITE. THIS MAY REQUIRE PERIODIC CLEANING WHEN SEDIMENT BUILD UP IS SIX INCHES OR ONE-THIRD OF THE FENCE OR INLET PROTECTION'S ORIGINAL HEIGHT.



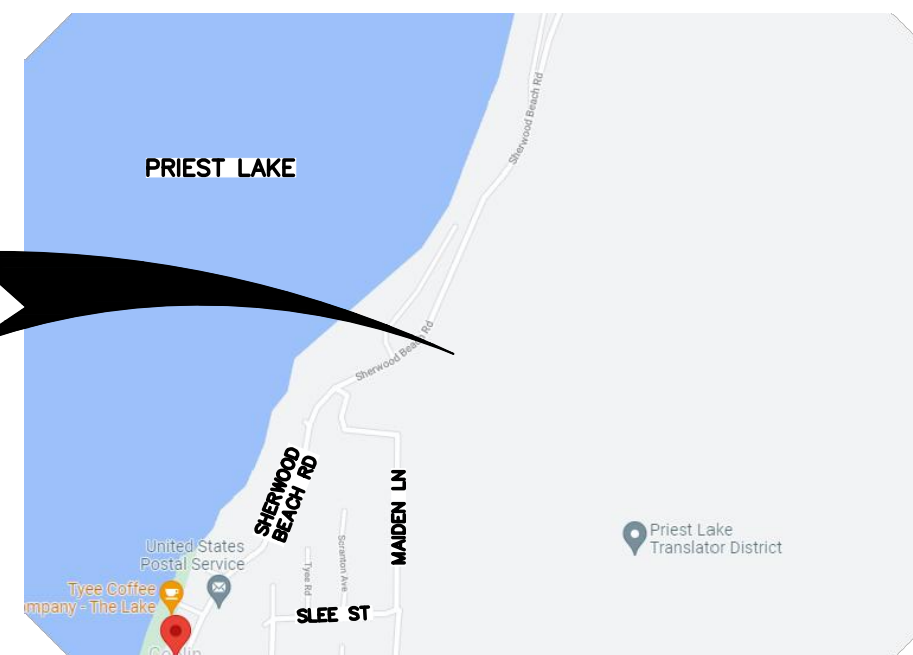
## TEMPORARY INLET PROTECTION

- NOTE:**
1. ALL DRYWELLS, INLETS, CATCH BASIN AND ANY OTHER STORMDRAIN FIXTURES WITH GRATED INLETS SHALL BE PROTECTED.
  2. PROTECTION SHALL REMAIN IN PLACE UNTIL VEGETATION IS ESTABLISHED.
  3. SEDIMENT MUST BE REMOVED WHEN IT REACHES 6" OR  $\frac{1}{3}$  OF THE HEIGHT OF THE FENCE.

**STANDARD NOTES:** IN ADDITION TO THE TECHNICAL INFORMATION REPORT (SEE CHAPTER 1-3) REQUIRED BY THE LOCAL GOVERNMENT WHEN PREPARING AN EROSION AND SEDIMENT CONTROL PLAN, ADD THE FOLLOWING NOTES TO THE FILTER FABRIC FENCE DETAIL (FIGURE II-5.1):

- A. THE FILTER FABRIC FENCE SHALL BE PURCHASED IN A CONTINUOUS ROLL CUT TO THE LENGTH OF THE BARRIER TO AVOID USE OF JOINTS. WHEN JOINTS ARE NECESSARY, OVERLAP FILTER CLOTH AND SECURELY FASTEN BOTH ENDS TO THE POST.
- B. POSTS SHALL BE SPACED A MAXIMUM OF 6 FEET APART AND DRIVEN SECURELY INTO THE GROUND A MINIMUM OF 30 INCHES (WHERE PHYSICALLY POSSIBLE).
- C. A TRENCH SHALL BE EXCAVATED APPROXIMATELY 8 INCHES WIDE AND 12 INCHES DEEP ALONG THE LINE OF POSTS AND UPSLOPE FROM THE BARRIER. THE TRENCH SHALL BE CONSTRUCTED TO FOLLOW THE CONTOURS.
- D. WHEN SILT FILM FILTER FABRIC IS USED, A WIRE MESH SUPPORT FENCE SHALL BE FASTENED SECURELY TO THE UPSLOPE SIDE OF THE POSTS USING HEAVY-DUTY WIRE STAPLES AT LEAST 1 INCH LONG, TIE WIRES OR HOG RINGS. THE WIRE SHALL EXTEND INTO THE TRENCH A MINIMUM OF 4 INCHES AND SHALL NOT EXTEND MORE THAN 36 INCHES ABOVE THE ORIGINAL GROUND SURFACE.
- E. SILT FILM FILTER FABRIC SHALL BE WIRED TO THE FENCE, AND 20 INCHES OF THE FABRIC SHALL EXTEND INTO THE TRENCH. THE FABRIC SHALL NOT EXTEND MORE THAN 36 INCHES ABOVE THE ORIGINAL GROUND SURFACE. FILTER FABRIC SHALL NOT BE STAPLED TO EXISTING TREES. OTHER TYPES OF FABRIC MAY BE STAPLED TO THE FENCE.
- F. WHEN EXTRA-STRENGTH OR MONOFILAMENT FABRIC AND CLOSER POST SPACING ARE USED, THE WIRE MESH SUPPORT FENCE MAY BE ELIMINATED. IN SUCH A CASE, THE FILTER FABRIC IS STAPLED OR WIRED DIRECTLY TO THE POSTS WITH ALL OTHER PROVISIONS OF STANDARD NOTE "E" APPLYING. EXTRA CARE SHOULD BE USED WHEN JOINING OR OVERLAPPING THESE STIFFER FABRICS.
- G. LOCAL GOVERNMENTS MAY SPECIFY THE USE OF PROPERLY COMPACTED NATIVE MATERIALS. IN MANY INSTANCES, THIS MAY BE THE PREFERRED ALTERNATIVE BECAUSE THE SOIL FORMS A MORE CONTINUOUS CONTACT WITH THE TRENCH BELOW.
- H. SILT FENCE SHALL BE INSTALLED PER IDEQ STORMWATER BEST MANAGEMENT PRACTICES VOLUME 2, SECTION 7, BMP 36 SILT FENCE STD. DRAWING SF-1.

PROJECT AREA



## VICINITY MAP

## LEGEND

### EXISTING FEATURES

- ASPHALT SURFACING
- CURB
- GRAVEL
- SIDEWALK OR CONCRETE
- FOUND POINT AS NOTED
- DRYWELL
- STORM MANHOLE
- CATCH BASIN
- GUY WIRE POLE
- POWER POLE/TELEPHONE POLE
- LIGHT POLE
- TELEPHONE ENCLOSURE
- WATER VALVE
- FIRE HYDRANT
- SANITARY SEWER MANHOLE
- TREE (DECIDUOUS OR CONIFEROUS)
- WATER LINE
- SANITARY SEWER LINE
- STORM DRAIN LINE / CULVERT
- POWER LINE (OHP OR BP)
- TELEPHONE LINE (OHT OR BT)
- GAS LINE
- CONTOURS
- FENCE
- FIBER OPTIC LINE

### PROPOSED IMPROVEMENTS

- ASPHALT SURFACING
- CURB
- CONCRETE OR SIDEWALK
- DRYWELL
- STORM MANHOLE
- CONCRETE INLET
- CURB INLET
- POWER POLE
- SIGN
- WATER VALVE
- WATER METER
- FIRE HYDRANT
- WATER SHUTOFF / WATER VAULT
- SANITARY SEWER MANHOLE
- CLEANOUT (CO)
- GAS METER
- WATER LINE (AS SIZED)
- SLEEVE FOR WATER / SEWER CROSSING
- SANITARY SEWER LINE
- STORM DRAIN LINE / CULVERT
- CONTOURS
- STORM WATER SWALE / POND
- DIRECTION OF SURFACE STORM WATER DRAINAGE
- TOP OF CURB ELEVATION
- FLOWLINE ELEVATION
- CURB INLET
- INLET ELEVATION AT FLOWLINE
- FINISHED GRADE ELEVATION

## SHEET INDEX

- C-00.0 - ESC PLAN
- C-01.0 - GRADING AND DRAINAGE PLAN
- C-02.0 - YOST COOLIN ACCESS ROAD PLAN & PROFILE STA: 0+00 TO 10+00
- C-02.1 - YOST COOLIN ACCESS ROAD PLAN & PROFILE STATION: 10+00 TO 19+66

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EROSION SEDIMENT CONTROL PLAN  
SITE DISTURBANCE PERMIT

YOMAN BLUFFS  
BONNER COUNTY, ID

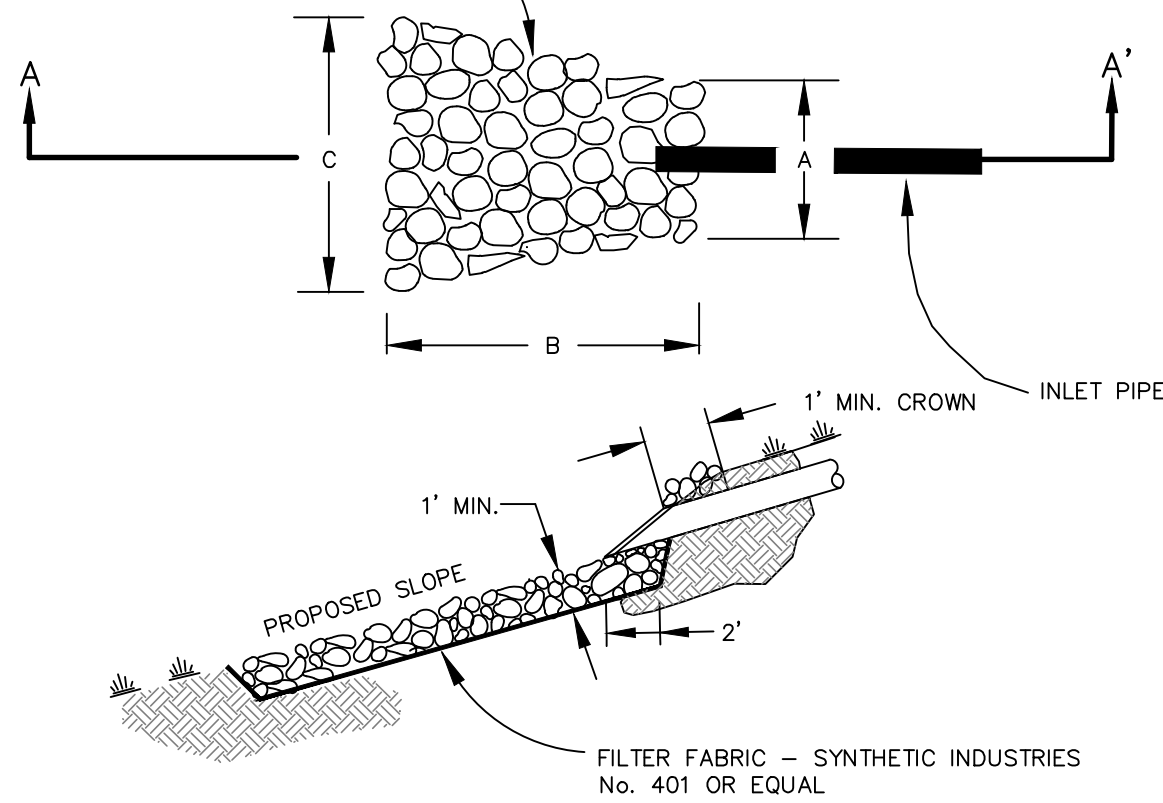


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CHECKED	AJS
PROJECT NUMBER	21-153
DRAWING NO.	C-00.0
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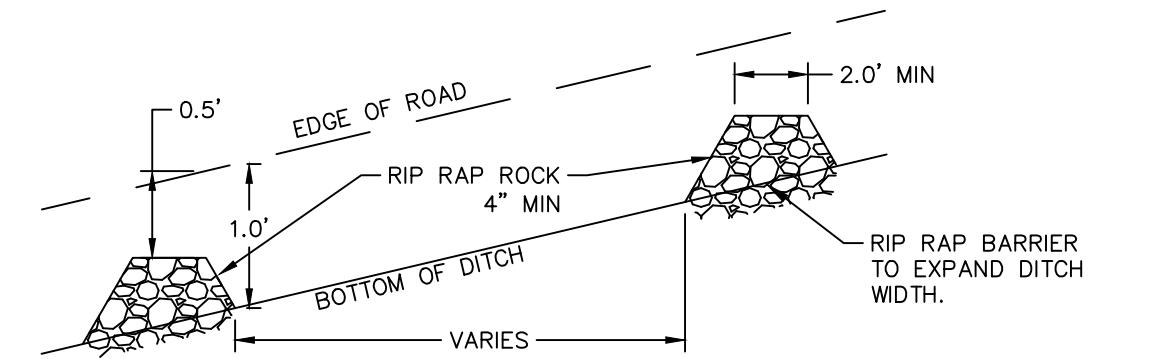
DRAINAGE PIPE OUTFALLS								
LOCATION	STATION	MIN.	AVG.	MAX.	THICKNESS	A	B	C
18" PIPE	MULTIPLE	1.0"	4"	6"	12.0"	3.0'	10.0'	10.0'

RIPRAP AT PIPE OUTLET WITH MINIMUM DIMENSIONS PER TABLE. RIPRAP TO CONSIST OF FIELD ROCK SIZED PER RIPRAP TABLE.



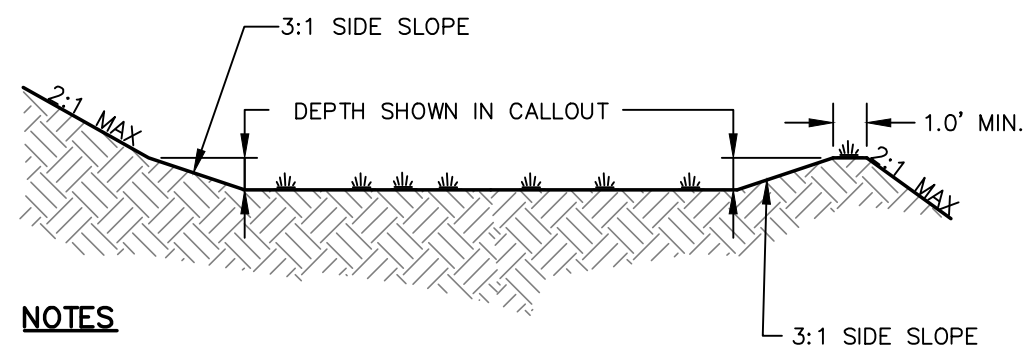
SECTION A-A'

RIP RAP DETAIL



ROCK DAM

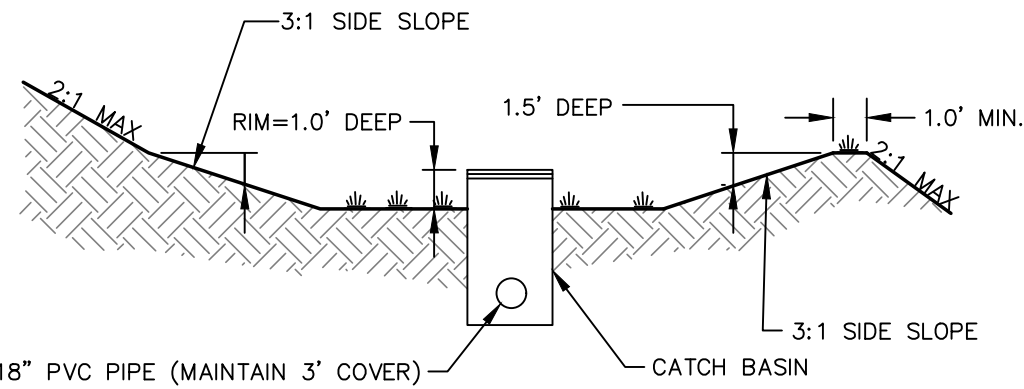
DETAIL



NOTES

- HYDROSEED OR SOD PER SEEDING SPECIFICATION.
- SWALE SIDE SLOPES TO BE 3:1 MAX (H:V).
- GRADE OF THE SWALE BOTTOM MAY NOT EXCEED 1.0%.

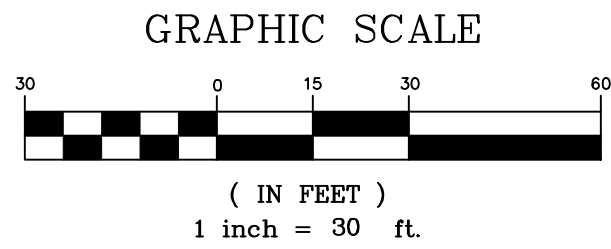
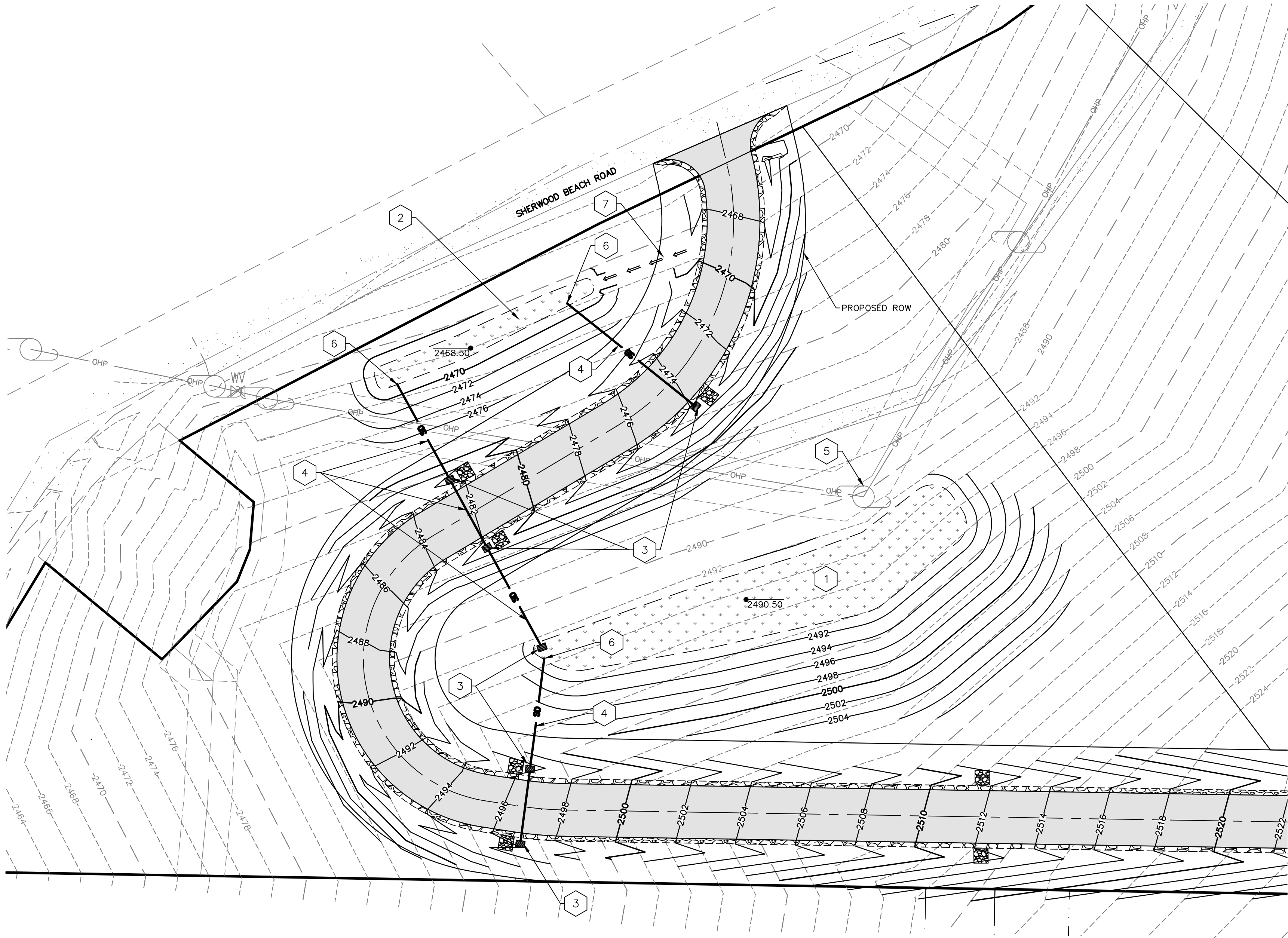
TYPICAL DETENTION POND SECTION



NOTES

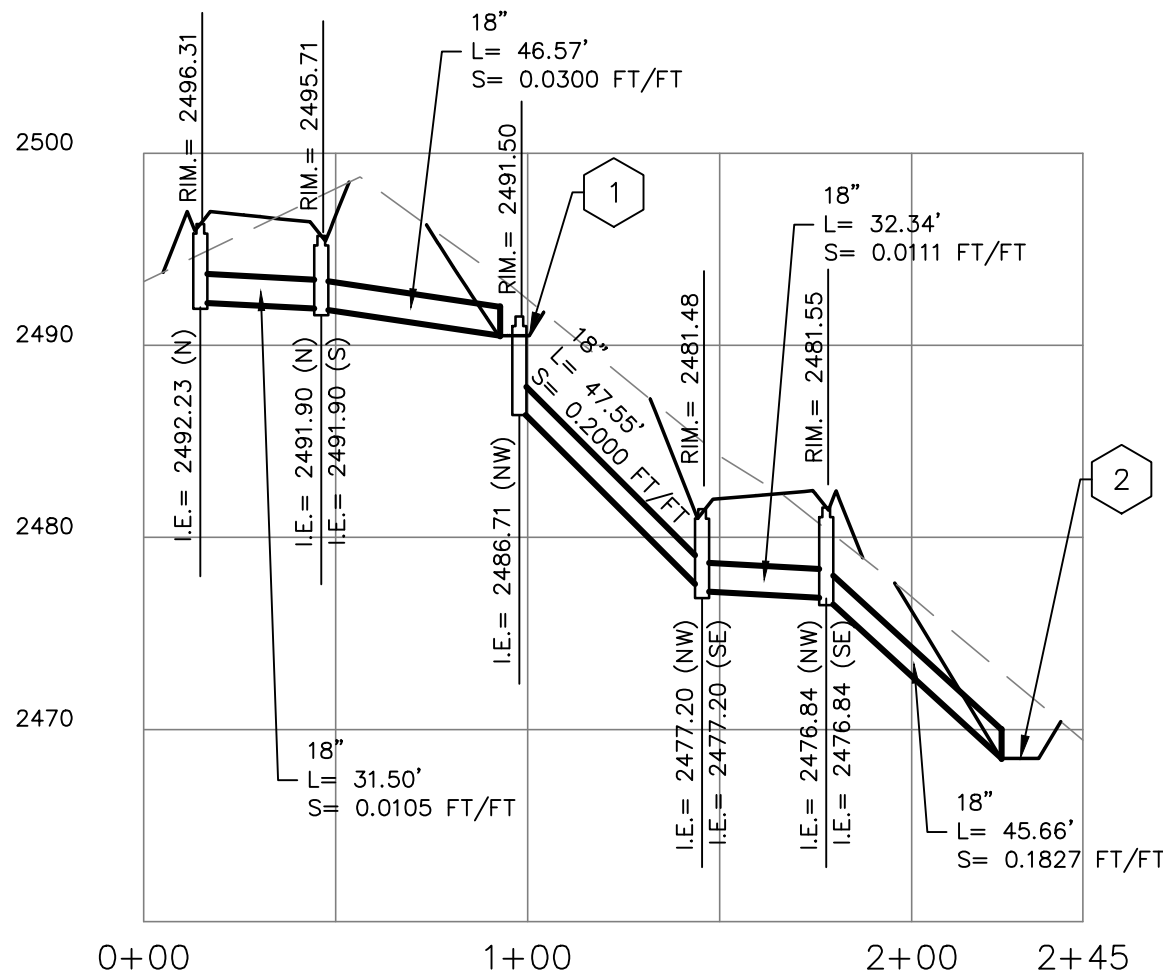
- HYDROSEED OR SOD PER SEEDING SPECIFICATION.
- SWALE SIDE SLOPES TO BE 3:1 MAX (H:V).
- GRADE OF THE SWALE BOTTOM MAY NOT EXCEED 1.0%.

TYPICAL DETENTION POND WITH CATCH BASIN



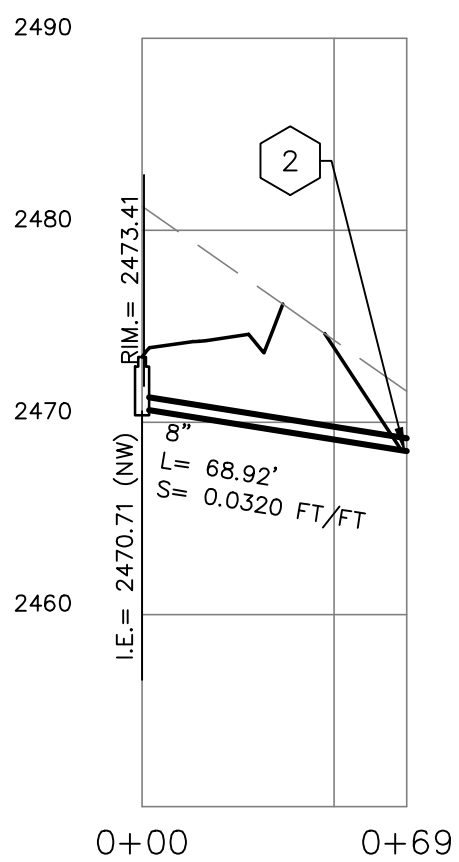
TABLE

- DETENTION POND "A"  
BOTTOM EL. =2490.50  
BOTTOM AREA = 4762 SF  
1.5' DEEP  
SEE TYPICAL DETENTION POND WITH CATCH BASIN SECTION FOR MORE INFORMATION.
- DETENTION POND "B"  
BOTTOM EL. =2468.50  
BOTTOM AREA = 912 SF  
1.0' DEEP  
SEE TYPICAL DETENTION POND SECTION FOR MORE INFORMATION.
- CATCH BASIN  
AT POND, SET 1 FT ABOVE POND  
BOTTOM W/ 18" PVC PIPE DAYLIGHTING  
DOWNHILL OF ROADWAY. MAINTAIN 3  
FT OF COVER OVER PVC PIPE. SEE  
PIPE PROFILES THIS PAGE FOR MORE  
DETAIL.
- 18" CULVERTS. MAINTAIN 1.0' (MIN.)  
OF COVER OVER LANDSCAPED  
AREAS AND 3.0' (MIN.) OF COVER  
OVER PAVED SURFACES. SEE  
WHERE APPLICABLE. DAYLIGHT PIPE  
TO POND BOTTOM.
- PROTECT POWER POLE.
- INSTALL RIP RAP AT THE END OF  
THE CULVERT PER DRAINAGE PIPE  
OUTFALL DETAIL, THIS SHEET.
- ROUTE STORMWATER FROM DITCH  
TO POND.



PIPES PROFILES

HORIZONTAL SCALE 1"=50'  
VERTICAL SCALE 1"=10'



COMPACTED NATIVE SUBGRADE OR STRUCTURAL  
FILL, TO REQUIRED SUBGRADE ELEVATION, IN  
ACCORDANCE WITH WSDOT SPECIFICATIONS.

ACCESS ROAD SECTION  
0+00 TO 19+66

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GRADING AND DRAINAGE PLAN  
SITE DISTURBANCE PERMIT

YOMAN BLUFFS  
BONNER COUNTY, ID

SHEET TITLE

PROJECT TITLE

SEAL



DATE 12/17/21

DRAWN EFZ

CHECKED AJS

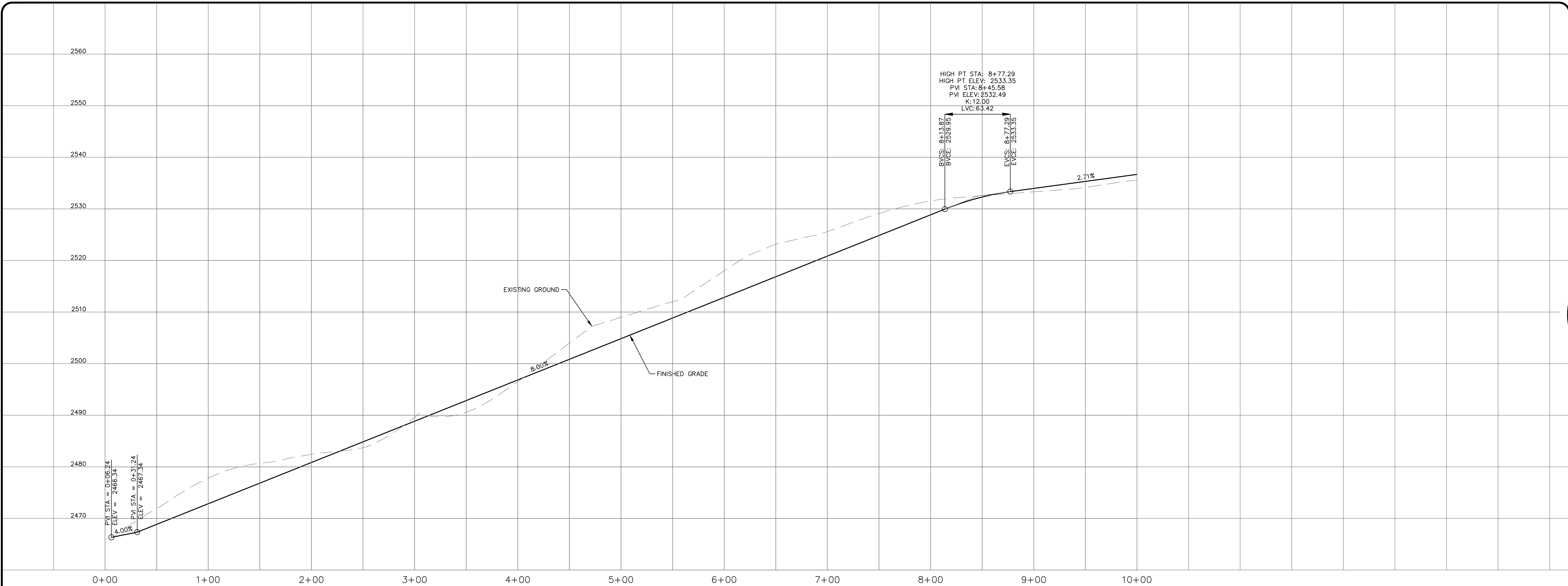
PROJECT NUMBER 21-153

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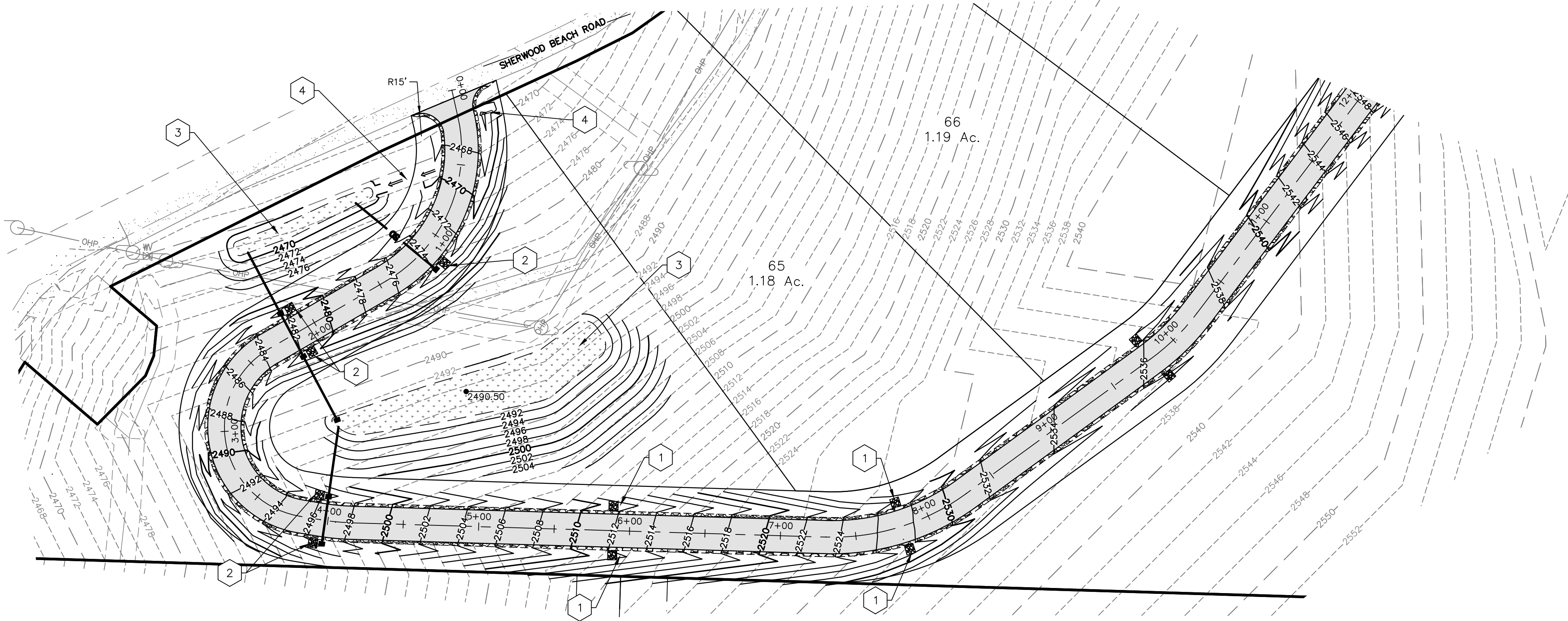
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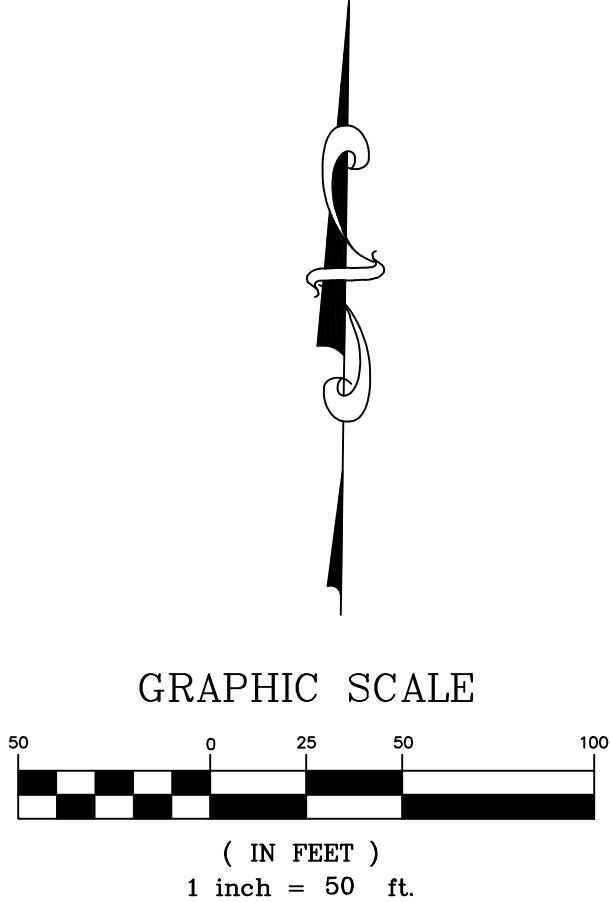


ACCESS ROAD PROFILE  
HORIZONTAL SCALE 1"=50'  
VERTICAL SCALE 1"=10'



ACCESS ROAD PLAN

TABLE	
1	ROCK DAM. SEE DETAIL ON SHEET C-01.0 FOR MORE INFORMATION.
2	UTILIZE ROCK DAM, AND SLOPE GRADING AS TO DIRECT STORMWATER TO CATCH BASINS.
3	SEE SHEET C-01.0 FOR ADDITIONAL DETAILS CONCERNING STORMWATER.
4	GRADE DITCH AS TO DAYLIGHT AT SWALE BOTTOM.
5	GRADE DEPRESSION NEAR APPROACH AS TO COLLECT MINOR FLOWS FROM ROADWAY.



CALL BEFORE YOU DIG 811

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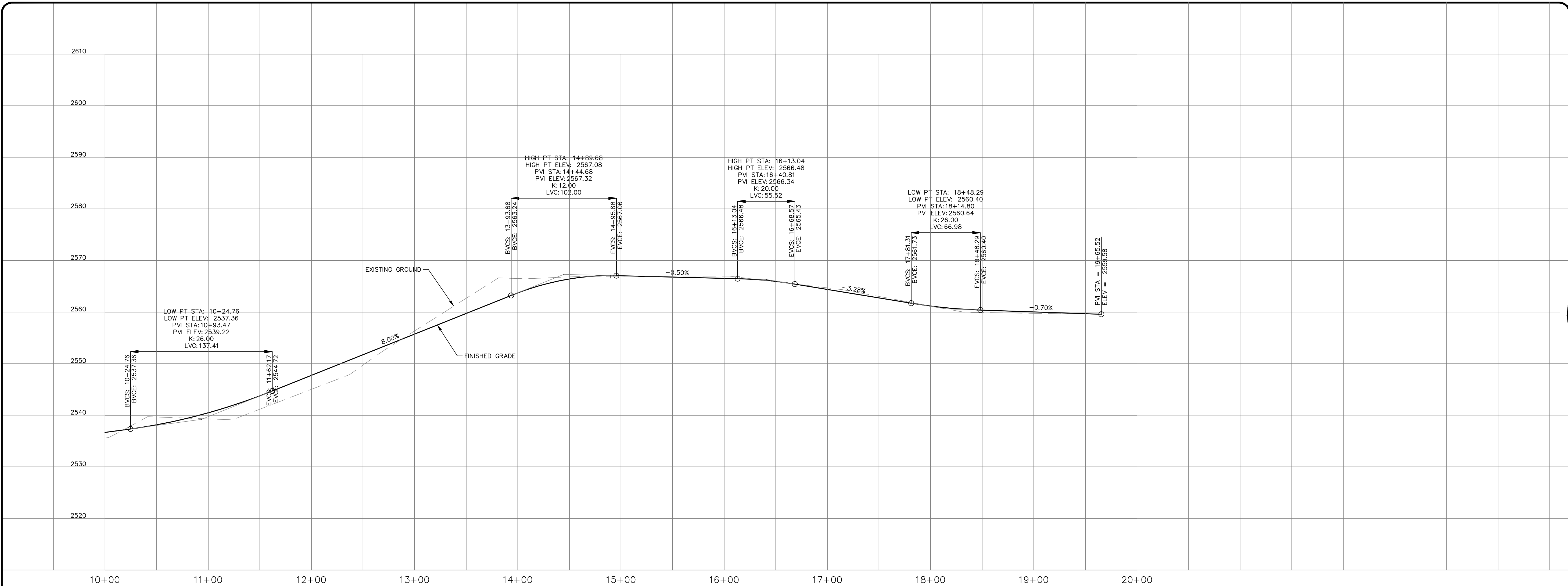
SHEET TITLE  
YOST COOLIN ACCESS ROAD PLAN & PROFILE  
STA: 0+00 TO 10+00

PROJECT TITLE  
YOMAN BLUFFS  
BONNER COUNTY, IDAHO

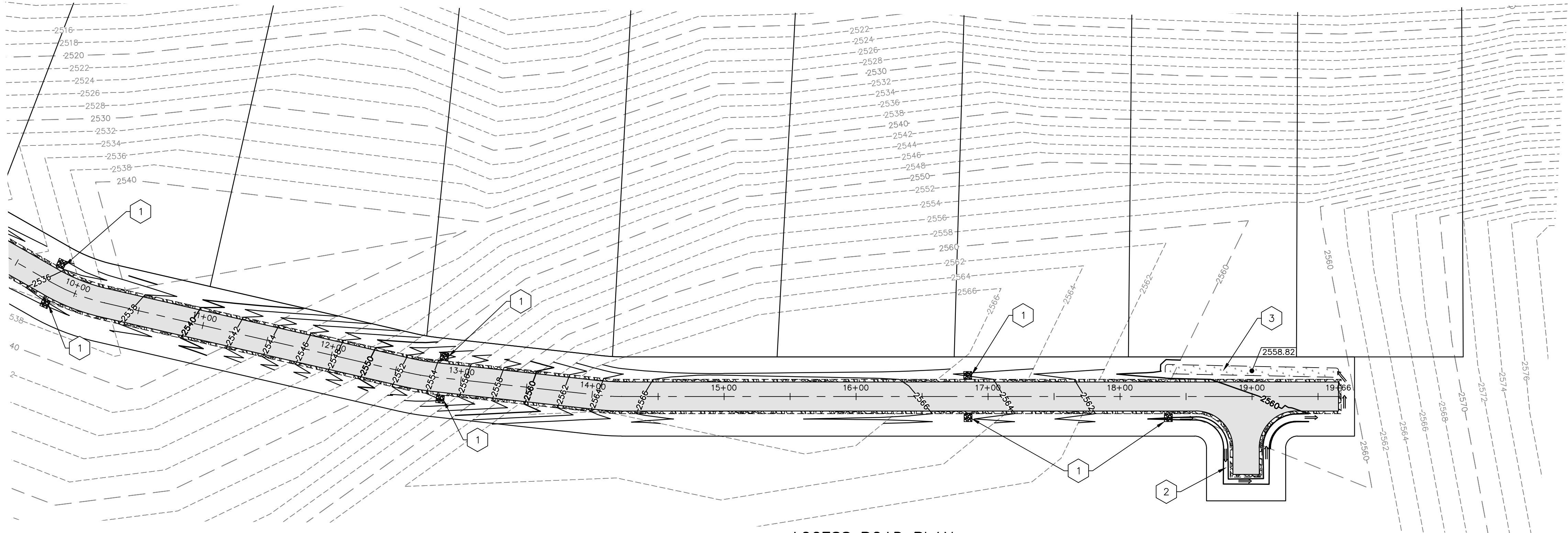
PROFESSIONAL ENGINEER  
REGISTERED  
7028  
12/17/21  
STATE OF IDAHO  
JERRY DEAN STORHÅNG

DATE 12/17/21  
DRAWN EFZ  
CHECKED AJS  
PROJECT NUMBER 21-153  
DRAWING NO. C-02.0  
SITE DISTURBANCE



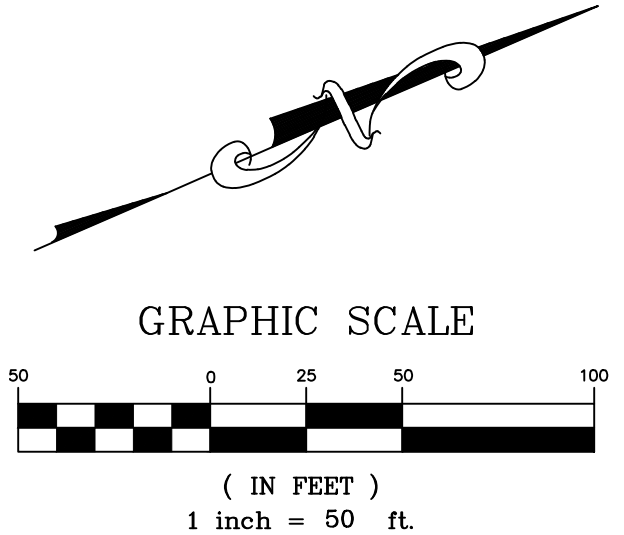


ACCESS ROAD PROFILE  
HORIZONTAL SCALE 1"=50'  
VERTICAL SCALE 1"=10'



ACCESS ROAD PLAN

TABLE	
1	ROCK DAM. SEE DETAIL ON SHEET C-01.0 FOR MORE INFORMATION.
2	GRADE DITCH AROUND HAMMERHEAD AS TO ALLOW STORMWATER TO CONTINUE EASTWARD.
3	DETENTION POND "D" BOTTOM EL. =2558.52 BOTTOM AREA = 917 SF 0.5' DEEP SEE TYPICAL DETENTION POND SECTION FOR MORE INFORMATION.



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SHEET TITLE  
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STA: 10+00 TO 19+66

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BONNER COUNTY, IDAHO

PROFESSIONAL ENGINEER  
REGISTERED  
7028  
12/17/21  
STATE OF IDAHO  
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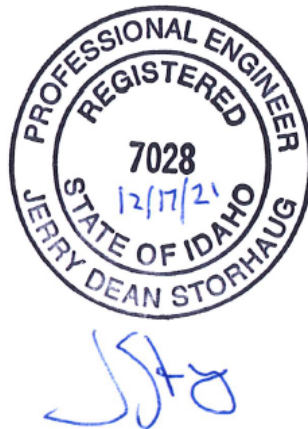
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# YOMAN BLUFFS SITE DISTURBANCE PERMIT

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## DRAINAGE REPORT

December, 2021



Storhaug Engineering  
Project No. 21-153



**STORHAUG ENGINEERING**

510 East Third, Spokane, Washington  
Phone 509-242-1000    [www.Storhaug.com](http://www.Storhaug.com)

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CHAPTER 2 – SOIL & RAINFALL INFORMATION

CHAPTER 3 – RUNOFF CALCULATIONS

CHAPTER 4 – BASIN MAP

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# Chapter 1

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## DRAINAGE SUMMARY



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# **Yoman Bluffs – Site Disturbance Permit Drainage Summary**

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## **PROJECT LOCATION AND DESCRIPTION**

The proposed project includes the development of a plat with nine single-family residence parcels along with the necessary driveways, grading access road and drainage infrastructure. The site is approximately 37.6 acres with the proposed construction to disturb approximately 1.97 acres.

## **SITE CHARACTERISTICS**

The project is situated in Coolin City, Bonner County, Idaho. The site gains access by connecting into Sherwood Beach Road. Currently, the site slopes to the west at 2-25% and is covered with native grasses and trees.

## **SUBSURFACE CHARACTERISTICS**

The soils in the region of the subject property have been identified by the USDA Natural Resources Conservation Service (NRCS) as belonging to Bonner Silt Loam, Cool, 0 to 4 percent slopes. The Bonner Silt Loam, Cool, soil has a published Hydrologic soil group rating of “B” with a moderately high to high infiltration rate (0.57 to 1.98 in/hr).

Due to the size and nature of the grading proposed on this plan, a geotechnical report may not be needed for this drainage investigation. Bonner County may require a geotechnical report if deemed necessary.

## **WATER QUALITY TREATMENT**

Post-development basins are analyzed using the 0.5” first flush method. All future driving surfaces are considered PGIS. The proposed swales have been adequately sized to provide treatment for all contributing PGIS within each respective basin. See calculations, Chapter 3.

## **POST-DEVELOPMENT BASINS**

Refer to Chapter 4 for the Basin Map.

On-Site stormwater runoff has been analyzed using the SCS method for the 25-year design storm event. The swales in Basins “A”, “B” and “D” are sized to store the net increase in stormwater runoff generated by the proposed improvements. For runoff detention and storage, we are using the conservative assumption that no infiltration exists.

Swales “A” and “B” are hydraulically connected as Swale “A” overflows to Swale “B” once full. Swales “A” and “B” are designed to store the increased runoff generated from the Access Road up to its high point, the driveways and half of the roofs. The remaining part of the Access Road which is part of Basin “D” drains towards Swale “D”. Lastly, the other halves of the roofs, which are part of Basin “C” are expected to drain following the existing pattern. This is possible given that Basin “C” has no PGIS and given that the generated volume from Basin “C” combined with the volume generated from Basins “X”, “A”, “B” and “D” – after deducting the swales’ volumes – remains lower than the overall pre-development volume.

The runoff in Basin “X” is routed via overland flow to the access road’s upstream ditch. The downstream ditch collects the access road’s runoff along with the driveways and the roofs’ halves. These two are combined via a culvert discharging to Swale “A”. Swale “A” overflows via another culvert – connected to a 1’ raised catch basin – towards Swale “B”.



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Swales “A” and “B” have been sized to treat and store the increased runoff generated from the asphalt access road and asphalt driveways. Runoff from the driveways will sheet flow to the Access Road’s ditch.

Given the infiltration rate in the area, the swales water volumes can fully infiltrate the ground in less than 72 hours.

## METHODOLOGY

The provided SCS method calculations show the total 25-year storm volume in both pre-development and post-development conditions. The storage volume required equals the calculated post-development volume minus the pre-development volume. All areas of post-development increased flow are fully stored in detention ponds, and therefore a net decrease for the sites volume and release rate will occur.

Within the calculation spreadsheet, required and provided treatment volumes have also been provided. Treatment volume has been provided for the first 0.5” of runoff for PGIS. PGIS on this site include the proposed asphalt access road and the asphalt driveways, as they are new ‘connected’ impervious surfaces. Driveways are assumed to be 25’ long and 20’ wide. As for roofs, they are assumed to be 50’x 50’.

## PIPE AND DITCH FLOW CALCULATIONS

Pipe and ditch flow calculations were also performed to ensure the storm drainage system is sized appropriately to accommodate and convey all runoff to their respective swales. In order to do so, the largest basin flowing into a single leg of storm drainage piping was analyzed for the max flow in the event of a 25-year storm and compared to the full flow capacity of the pipe at the point in which the largest volume of water will be flowing through the pipe. The following table summarizes the inputs and results using the Manning’s equation at the most extreme point of each pipe network. When more than one pipe are proposed for the same flow, the smaller slope is shown in the table.

Basin	Cross Section	Pipe Slope	Manning’s n	Sub-Basin Peak Discharge (CFS)	Provided Max Discharge (CFS)
Basin X	Ditch Depth: 1’ Side Slopes: 4:1 & 2:1	2.71%	0.018	6.04	24.71
Basin A		2.71%	0.018	3.52	24.71
Basin B		4.00%	0.018	1.38	30.02
Basin D		0.70%	0.018	1.84	12.56
Basins A + X	18” pipe	1.05%	0.013	9.56	10.76
Basins A + B + X	18” pipe	1.11%	0.013	10.94	11.07

Some pipe/ditch sizes were upsized for conservancy and more flexibility in construction. Therefore, since the most severe case on each network is able to handle the flow seen during a 25-year storm, each network is sized adequately for its respective basin.

## SUMMARY

The following report shows that the proposed improvement will have a positive or negligible impact on the sites storm water conditions. The proposed site will release storm water with a smaller rate and volume for the 25-year storm than it did in pre-development conditions. Additionally, all surfaces requiring treatment have been provided adequate treatment volumes. The following tables provide a summary of the stormwater design.



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<b>Basins</b>	<b>Required Treatment Volume (0.5" first flush)</b>	<b>Provided Treatment Volume</b>
<b>Basin A</b>	1,113 CF	2,536 CF
<b>Basin B</b>	367 CF	537 CF
<b>Basin D</b>	560 CF	563 CF

<b>Basins</b>	<b>Pre-Development Volume (CF)</b>		<b>Post-Development Volumes (CF)</b>
<b>Combined</b>	31,186		-
<b>Basin A + B+ X</b>	-		27,968
<b>Pond A</b>	-		-5,388
<b>Pond B</b>	-		-1,241
<b>Basin C</b>	-		6,433
<b>Basin D</b>	-		2,549
<b>Pond D</b>	-		-563
<b>Total</b>	<b>31,186</b>	<b>&gt;</b>	<b>29,758</b>

*Calculations and documentation supporting this design concept follow.*



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# Chapter 2

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## Soils and Rainfall Information

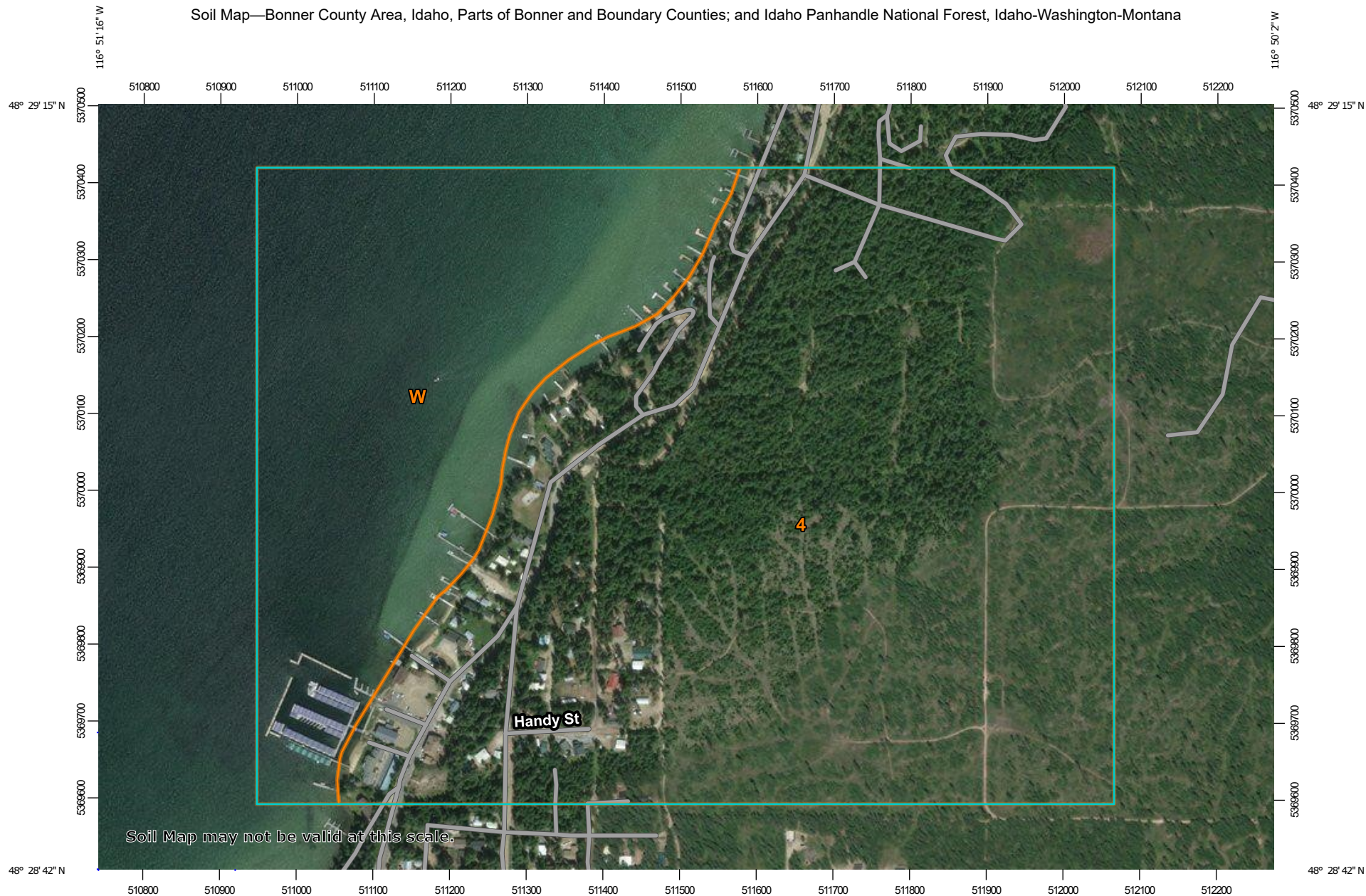


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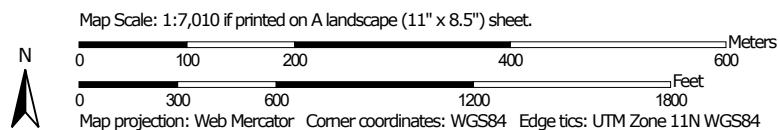
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# Soil Map—Bonner County Area, Idaho, Parts of Bonner and Boundary Counties; and Idaho Panhandle National Forest, Idaho-Washington-Montana



Soil Map may not be valid at this scale.



**Natural Resources  
Conservation Service**

Web Soil Survey  
National Cooperative Soil Survey

12/15/2021  
Page 1 of 4




## MAP LEGEND

### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

### Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

### Water Features



Streams and Canals

### Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

### Background



Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Bonner County Area, Idaho, Parts of Bonner and Boundary Counties

Survey Area Data: Version 17, Sep 9, 2021

Soil Survey Area: Idaho Panhandle National Forest, Idaho-Washington-Montana

Survey Area Data: Version 8, Sep 9, 2021

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 24, 2010—Nov 4, 2016

## MAP LEGEND

## MAP INFORMATION

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.



## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
4	Bonner silt loam, cool, 0 to 4 percent slopes	160.5	69.9%
<b>Subtotals for Soil Survey Area</b>		<b>160.5</b>	<b>69.9%</b>
<b>Totals for Area of Interest</b>		<b>229.6</b>	<b>100.0%</b>

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
W	Water	69.2	30.1%
<b>Subtotals for Soil Survey Area</b>		<b>69.2</b>	<b>30.1%</b>
<b>Totals for Area of Interest</b>		<b>229.6</b>	<b>100.0%</b>

## Bonner County Area, Idaho, Parts of Bonner and Boundary Counties

### 4—Bonner silt loam, cool, 0 to 4 percent slopes

#### Map Unit Setting

*National map unit symbol:* 546c

*Elevation:* 2,000 to 4,200 feet

*Mean annual precipitation:* 25 to 45 inches

*Mean annual air temperature:* 41 to 46 degrees F

*Frost-free period:* 60 to 120 days

*Farmland classification:* All areas are prime farmland

#### Map Unit Composition

*Bonner, cool, and similar soils:* 80 percent

*Minor components:* 20 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Bonner, Cool

##### Setting

*Landform:* Outwash terraces

*Landform position (three-dimensional):* Tread

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Volcanic ash and loess over outwash derived from granite and/or schist and/or gneiss

##### Typical profile

*Oi - 0 to 1 inches:* slightly decomposed plant material

*A - 1 to 6 inches:* ashy silt loam

*Bw - 6 to 22 inches:* gravelly silt loam

*2BC - 22 to 30 inches:* gravelly loam

*3C - 30 to 60 inches:* very gravelly loamy sand

##### Properties and qualities

*Slope:* 0 to 4 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately high to high (0.57 to 1.98 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water supply, 0 to 60 inches:* Low (about 5.9 inches)

##### Interpretive groups

*Land capability classification (irrigated):* 4e

*Land capability classification (nonirrigated):* 4e

*Hydrologic Soil Group:* B



*Ecological site:* F043AY524WA - Frigid, Udic, Loamy, Foothills/  
Mountainsides, ashy surface (Western Hemlock/Moist Forbes)  
Tsuga heterophylla / Clintonia uniflora , Tsuga heterophylla /  
Asarum caudatum  
*Other vegetative classification:* western hemlock/queencup beadlily  
(CN570)  
*Hydric soil rating:* No

### **Minor Components**

#### **Selle**

*Percent of map unit:* 5 percent  
*Landform:* Outwash terraces  
*Landform position (three-dimensional):* Tread  
*Down-slope shape:* Convex  
*Across-slope shape:* Linear  
*Other vegetative classification:* western redcedar/queencup beadlily  
(CN530)  
*Hydric soil rating:* No

#### **Colburn**

*Percent of map unit:* 5 percent  
*Landform:* Stream terraces  
*Landform position (three-dimensional):* Tread  
*Down-slope shape:* Concave  
*Across-slope shape:* Linear  
*Other vegetative classification:* western redcedar/queencup beadlily  
(CN530)  
*Hydric soil rating:* No

#### **Capehorn**

*Percent of map unit:* 5 percent  
*Landform:* Flood plains  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Other vegetative classification:* western redcedar/ladyfern (CN540)  
*Hydric soil rating:* Yes

#### **Rathdrum**

*Percent of map unit:* 5 percent  
*Landform:* Outwash terraces  
*Landform position (three-dimensional):* Tread  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave  
*Other vegetative classification:* western redcedar/queencup beadlily  
(CN530)

*Hydric soil rating:* No

## Data Source Information

Soil Survey Area: Bonner County Area, Idaho, Parts of Bonner and Boundary Counties

Survey Area Data: Version 17, Sep 9, 2021

Soil Survey Area: Idaho Panhandle National Forest, Idaho-Washington-Montana

Survey Area Data: Version 8, Sep 9, 2021



Note: The CN values used for the SCS calculations are below.

**TABLE 5-1**  
**RUNOFF CURVE NUMBERS**  
**ANTECEDENT RUNOFF CONDITION (ARC) II**

Cover type and hydrologic condition	Group A Soils	Group B Soils	Group C Soils	Group D Soils
<b>Open Space (lawns, parks, golf courses, cemeteries, landscaping, etc.):<sup>1</sup></b>				
Poor condition (grass cover <50% of the area)	68	79	86	89
Fair condition (grass cover on 50% to 75% of the area)	49	69	79	84
Good condition (grass cover on >75% of the area)	39	61	74	80
<b>Impervious Areas:</b>				
Open water bodies: lakes, wetlands, ponds etc.	100	100	100	100
Paved parking lots, roofs, driveways, etc. (excluding right of way)	98	98	98	98
Porous pavers and permeable interlocking concrete (assumed as 85% impervious and 15% lawn):				
Fair lawn condition (weighted average CNs)	91	94	96	97
Gravel	76	85	89	91
Dirt	72	82	87	89
<b>Pasture, Grassland, or Range-Continuous Forage for Grazing:</b>				
Poor condition (ground cover <50% or heavily grazed with no mulch).	68	79	86	89
Fair condition (ground cover 50% to 75% and not heavily grazed)	49	69	79	84
Good condition (ground cover >75% and lightly or only occasionally grazed)	39	61	74	80
<b>Cultivated Agricultural Lands:</b>				
Row Crops (good) e.g. corn, sugar beets, soy beans	64	75	82	85
Small Grain (good) e.g. wheat, barley, flax	60	72	80	84
Meadow (continuous grass, protected from grazing and generally mowed for hay)	30	58	71	78
<b>Brush (brush-weed-grass mixture with brush the major element):</b>				
Poor (<50% ground cover)	48	67	77	83
Fair (50% to 75% ground cover)	35	56	70	77
Good (>75% ground cover) <sup>2</sup>	30	48	65	73
<b>Woods - grass combination (orchard or tree farm)<sup>3</sup>:</b>				
Poor	57	73	82	86
Fair	43	65	76	82
Good	32	58	72	79
<b>Woods:</b>				
Poor (Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning)	45	66	77	83
Fair (Woods are grazed but not burned, and some forest litter covers the soil)	36	60	73	79
Good (Woods are protected from grazing, and litter and brush adequately cover the soil)	30	55	70	77
<b>Herbaceous (mixture of grass, weeds, and low-growing brush, with brush the minor element)<sup>4</sup>:</b>				
Poor (<30% ground cover)		80	87	93
Fair (30% to 70% ground cover)		71	81	89
Good (>70% ground cover)		62	74	85
<b>Sagebrush with Grass Understory<sup>4</sup>:</b>				
Poor (<30% ground cover)		67	80	85
Fair (30% to 70% ground cover)		51	63	70
Good (>70% ground cover)		35	47	55

<sup>1</sup> Composite CNs may be computed for other combinations of open space cover type.

<sup>2</sup> Actual curve number is less than 30; use CN = 30 for runoff computations.

<sup>3</sup> CNs shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CNs for woods and pasture.

<sup>4</sup> Curve numbers have not been developed for group A soils.

For a more detailed and complete description of land use curve numbers refer to Chapter 2 of the Soil Conservation Service's Technical Release No. 55 (Publication 210-VI-TR-55, Second Ed., June 1986).

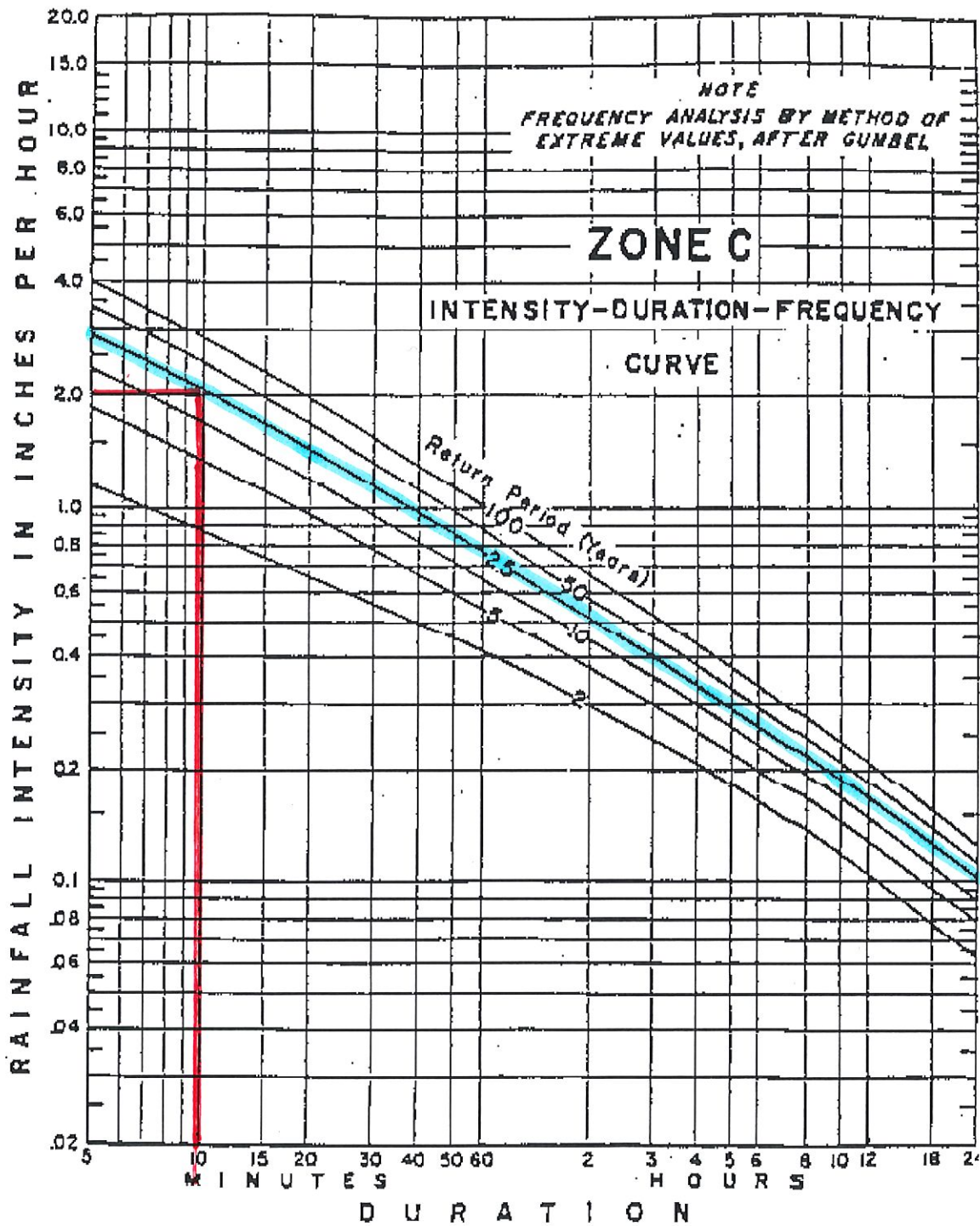
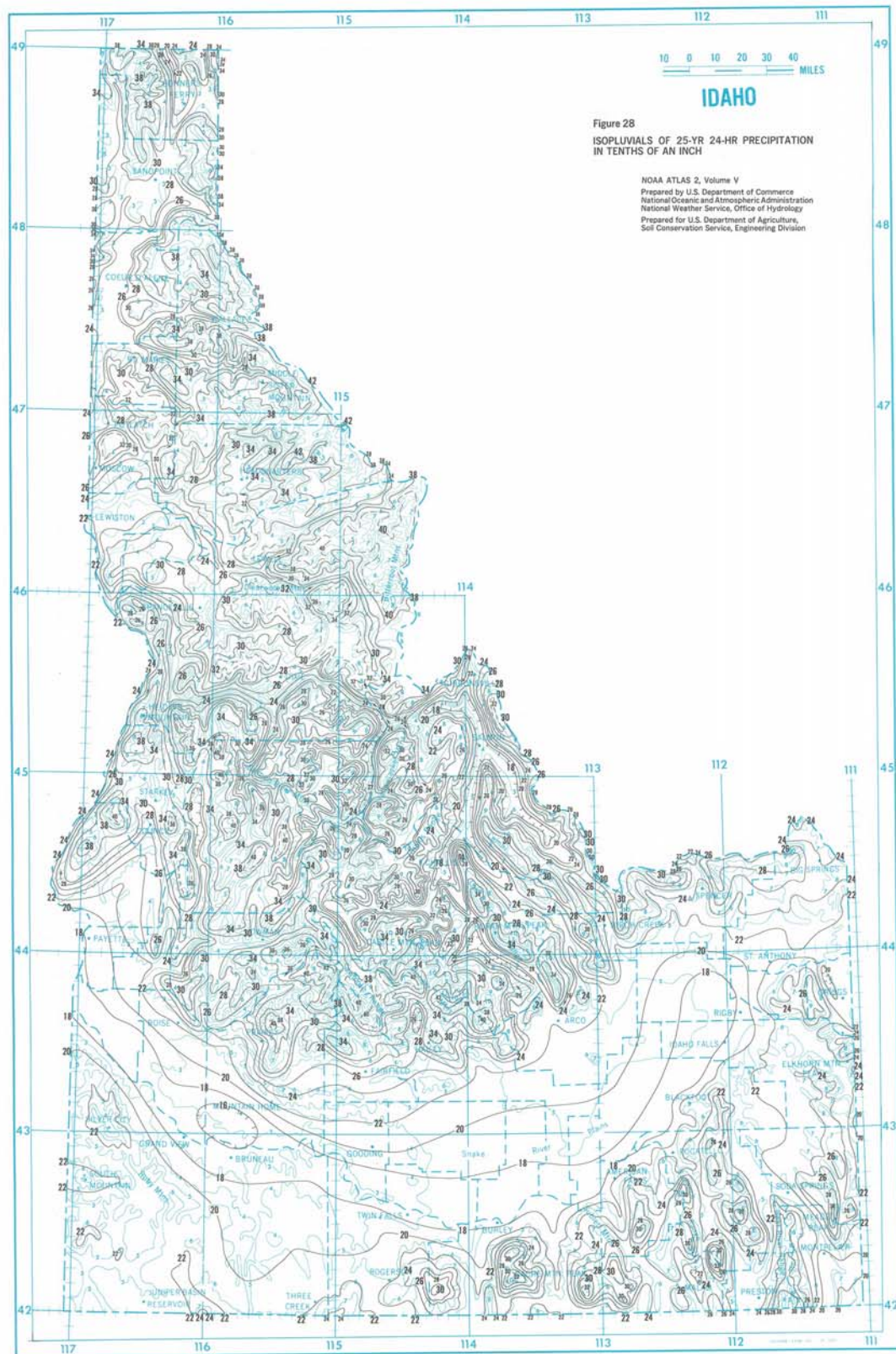


Figure D-2. Zone C Intensity-Duration-Frequency (IDF) Curve





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# Chapter 3

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## RUNOFF CALCULATIONS



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**DETENTION BASIN DESIGN**

**PROJECT: 21-153 YOMAN BLUFFS**  
**BASIN: Combined Basin (PRE-DEV)**  
 REVIEWER: AJS  
 DESIGNER: EFZ  
 DATE: 12/20/2021

**RUNOFF STORAGE**

-Single (Type-A)	0	-Double (Type-B)	0
Exfiltration (cfs)	0.3		1.0
Time of Conc. (min)		32.33	
Area (Acres)		49.44	
Composite "C"		0.15	
208 Treated Area (acres)		0.00	
Volume Provided	208:	0	Storm: 0
Outflow (cfs)		0.37	
Area * C" Factor		7.42	

#1 Time Inc. (min.)	#2 Time Inc. (sec.) (#1*60)	#3 Intensity (in./hr.)	#4 Q-dev. (cfs) (A*C*#3)	#5 V-in (cu.-ft.)	#6 V-out (cu.-ft.) (Outf.*#2)	#7 Storage (cu.-ft.) (#5-#6)
32.33	1930.75	1.08	7.98	20753	211.24	20041
5	300	2.90	21.51	8646	110.00	8536
10	600	2.00	14.83	11926	220.00	11706
15	900	1.70	12.61	15205	330.00	14875
20	1200	1.50	11.12	17888	440.00	17448
25	1500	1.26	9.31	18715	550.00	18165
30	1800	1.20	8.90	21466	660.00	20806
35	2100	1.03	7.61	21011	770.00	20241
40	2400	0.98	7.27	22237	880.00	21357
45	2700	0.88	6.55	22010	990.00	21020
50	3000	0.85	6.30	23060	1100.00	21960
55	3300	0.78	5.81	23007	1210.00	21797
60	3600	0.78	5.78	24640	1320.00	23320
100	6000	0.55	4.06	27065	2200.00	24865
110	6600	0.52	3.84	27868	2420.00	25448
120	7200	0.51	3.78	29727	2640.00	27087
140	8400	0.45	3.32	30108	3080.00	27028
160	9600	0.41	3.07	31479	3520.00	27959
200	12000	0.36	2.68	33991	4400.00	29591
4000	240000	0.06	0.45	107728	88000.00	19728
5000	300000	0.05	0.39	117774	110000.00	7774
4320	259200	0.00	0.00	0	95040.00	-95040

**208 SWALE POND CALCULATIONS**

*Volume Required [cf] = 1133*A	0 cu.-ft.	Inadequate
Volume Required [cf] = 1815*A	0 cu.-ft.	Inadequate
*Must meet SRSM soil requirements	0 cu.-ft.	Inadequate

**STORAGE REQUIREMENTS - 2-YEAR DESIGN STORM**

Maximum storage required by Bowstring =	29591 cu.-ft.
Number and type of Drywells Required =	0 Single (Type-A) 0 Double (Type-B)

**TIME OF CONCENTRATION (minutes)**

Tc (overland)	Tc (ditch)
L(A) = 1415	L(C) = 893
K(A) = 150	K(C) = 1100
S(A) = 0.119	S(C) = 0.027
Tc (A) = 27.38	Tc (C) = 4.95
L(B) = 0	
K(B) = 0	Tc (C) = 4.95
S(B) = 0	Tc(A+B) = 27.38
Tc (B) = 0.00	Tc(tot.) = 32.33
	Intensity = 0.00

Tc (total) = Tc (overland) + Tc (gutter)

Tc = L / [K\*(S)]

L = length of segment (ft)

S = slope of segment (feet/foot)

K = ground cover coefficient (ft/min)

-See Table 5-6 of SRSM for "K" values

**UNDERGROUND PERCOLATION GALLERIES**

Soil Infiltration Rate	1.98 in/hr	Minimum Infiltration Area Required (based on Peak Runoff Volume and Soil Infiltration Rate) =	7875 sf
	4.583E-05 ft/sec	Infiltration Area Provided =	8000 sf
0	0.4		
Gallery Disposal Rate	0.37 cfs		

Trench Number	Gallery Width (ft)	Bottom Length (ft)	Gallery Depth (ft)	Trench Bottom Area (sf)	Trench Side Area (sf)	Total Infiltration Area (Bottom + Sides) (sf)	Pipe Length (ft)	Pipe Diameter (ft)	Pipe Volume (cf)	Drainrock Volume (cf)	Total Gallery Volume (cf)
XXX	8000.0	0.0	0.0	8000.0	0.0	8000.0	0.0	0.0	0.0	0.0	0.0
XXX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
						8000					0

**CONTRIBUTING AREAS**

Site	49.44 Acres			2153717 s.f.	
	Areas (Ac.)	"C"	A°C	Areas (s.f.)	Treat?
Asphalt	0.00	0.900	0.0000	0	Y
Driveways	0.00	0.900	0.0000	0	Y
Detached Sidewalks	0.00	0.900	0.0000	0	N
Building/Roof	0.00	0.900	0.0000	0	N
Grass / Landscaping	49.44	0.150	7.4164	2153717	N
Gravel	0.00	0.500	0.0000	0	N
Offsite Pavement	0.00	0.900	0.0000	0	Y
	Total A	Comp "C"	Qpeak		
Total Site	49.44	0.15	7.98		
Connected Impervious	0.00	N/A	0.00		

**POND VOLUMES**

Swale Number	Bottom Elevation Area (sf)	Depth to 208 Elevation (ft)	208 Elevation Area (sf)	Depth to Top Elevation (ft)	Top Elevation Area (sf)	208 Volume (cf)	Storage Volume (cf)
208 SWALE		0.50		1.0		0	0
XXX	0	0.50	0	1.0	0	0	0
						0	0

**PEAK RUNOFF VOLUME (25-YR STORM, SCS METHOD)**

Areas (Ac.)	CN	A"C	P <sub>25</sub> =
Asphalt	98	0.000	2.5 in
Attached Sidewalks	98	0.000	S = 6.67
Detached Sidewalks	98	0.000	Total Runoff Depth (Q <sub>25</sub> ) = 0.17 in
Building/Roof	98	0.000	Total Storm Volume (V) = 31186 cf
Grass / Landscaping	49.44	60	*Class C Soils w/ >75% Grass Cover
Unimproved	0.00	85	
Offsite Pavement	0.00	90	
Total A	49.44	Comp "C"	60.00

**DETENTION BASIN DESIGN**

**PROJECT: 21-153 YOMAN BLUFFS**  
**BASIN: BASIN A**  
 REVIEWER: AJS  
 DESIGNER: EFZ  
 DATE: 12/20/2021

**RUNOFF STORAGE**

-Single (Type A)	0	-Double (Type B)	0
Exfiltration (cfs)	0.3		1.0
Time of Conc. (min)			6.06
Area (Acres)			2.42
Composite "C"			0.50
208 Treated Area (acres)			0.64
Volume Provided	208	2535.74	Storm
Outflow (cfs)		0.37	
Area "C" Factor		1.20	

#1 Time Inc. (min.)	#2 Time Inc. (sec.) (#1*60)	#3 Intensity (in./hr.)	#4 Q dev. (cfs) (A"C*#3)	#5 V-in (cu.-ft.)	#6 V-out (cu.-ft.) (Outf.*#2)	#7 Storage (cu.-ft.) (#5*#6)
6.06	363.32	2.93	3.52	1714	133.22	1581
5	300	2.90	3.48	1400	110.00	1290
10	600	2.90	3.48	1738	220.00	1618
15	900	1.70	2.04	2090	330.00	1760
20	1200	1.50	1.80	2385	440.00	1945
25	1500	1.26	1.51	2449	550.00	1899
30	1800	1.20	1.44	2773	660.00	2113
35	2100	1.03	1.23	2742	770.00	1972
40	2400	0.98	1.18	2971	880.00	2091
45	2700	0.88	1.06	2906	990.00	2006
50	3000	0.85	1.02	3189	1100.00	2089
55	3300	0.78	0.94	3222	1210.00	2012
60	3600	0.78	0.94	3489	1320.00	2169
100	6000	0.55	0.66	4031	2200.00	1831
110	6600	0.52	0.62	4181	2420.00	1761
120	7200	0.51	0.61	4487	2640.00	1847
140	8400	0.45	0.54	4588	3080.00	1508
160	9600	0.41	0.50	4833	3520.00	1313
200	12000	0.36	0.43	5273	4400.00	873
4000	240000	0.06	0.07	17411	88000.00	70589
5000	300000	0.05	0.06	19043	110000.00	90957
4320	259200	0.00	0.00	0	95040.00	95040

**208 SWALE POND CALCULATIONS**

Volume Required [c] = 0.5" * A	1113 cu. ft.	Adequate
*Must meet SRSM soil requirements	Provided: 2536 cu. ft.	

**STORAGE REQUIREMENTS - 2-YEAR DESIGN STORM**  
 Maximum storage required by Bowstring =

Provided:	2169 cu.-ft.
	5388 cu.-ft.
	<b>Adequate</b>
Number and type of Drywells Required =	0 - Single (Type A)
	0 - Double (Type B)

**TIME OF CONCENTRATION (minutes)**

Tc (overland)	Tc (ditch)
L(A) = 0	L(C) = 1100
K(A) = 420	K(C) = 1100
S(A) = 0.000	S(C) = 0.027
Tc (A) = 0.00	Tc (C) = 6.06
L(B) = 0	
K(B) = 0	Tc (C) = 6.06
S(B) = 0	Tc(A+B) = 0.00
Tc (B) = 0.00	Tc(tot.) = 6.06
	Intensity = 2.93

Tc (total) = Tc (overland) + Tc (gutter)

Tc = L / [K\*(S)]

L = length of segment (ft)

S = slope of segment (feet/foot)

K = ground cover coefficient (ft/min)

-See Table 5-6 of SRSM for "K" values

**CONTRIBUTING AREAS**

Site	2.42 Acres		105595 s.f.		
	Areas (Ac.)	"C"	A"C	Areas (s.f.)	Treat?
Asphalt	0.56	0.900	0.5000	24200	Y
Driveways	0.06	0.900	0.0517	2500	Y
Detached Sidewalks	0.00	0.900	0.0000	0	N
Building/Roof	0.14	0.900	0.1291	6250	N
Grass / Landscaping	1.57	0.300	0.4700	68245	N
Gravel	0.10	0.500	0.0505	4400	N
Offsite Pavement	0.00	0.900	0.0000	0	Y
	Total A	Comp "C"	Qpeak		
Total Site	2.42	0.50	3.52		
Connected Impervious	0.61	0.90	1.60		

**POND VOLUMES**

Swale Number	Bottom Elevation Area (sf)	Depth to 208 Elevation (ft)	208 Elevation Area (sf)	Depth to Top Elevation (ft)	Top Elevation Area (sf)	208 Volume (cf)	Storage Volume (cf)
208 SWALE	4762	0.50	5381	1.0	6013	2535.74	5388
XXX	0	0.50	0	1.0	0	0	0
						2535.74	5388
Exfiltration Rate	0.57 in/hr	0.063 cfs					
Time to percolate	24 hr						

**PEAK RUNOFF VOLUME (25-YR STORM, SCS METHOD)**

Areas (Ac.)	CN	A"C	P <sub>25</sub>
Asphalt	0.56	98	64.444
Attached Sidewalks	0.06	98	5.624
Detached Sidewalks	0.00	98	0.000
Building/Roof	0.14	98	14.061
Grass / Landscaping	1.57	60	94.001
Unimproved	0.10	60	6.061
Offsite Pavement	0.00	85	0.000
Total A	2.42	Comp "C"	71.86
			P <sub>25</sub> = 2.5 in
			S = 3.92
			Total Runoff Depth (Q <sub>25</sub> ) = 0.52 in
			Total Storm Volume (V) = 4604 cf
			*Class C Soils w./ >75% Grass Cover

**UNDERGROUND PERCOLATION GALLERIES**

Soil Infiltration Rate	1.98 in/hr	Minimum Infiltration Area Required (based on Peak Runoff Volume and Soil Infiltration Rate) =	1163 sf
2225	4.583E-05 ft/sec	Infiltration Area Provided =	8090 sf
Voids in Drains	0.4		
Gallery Disposal Rate	0.37 cfs		

Trench Number	Gallery Width (ft)	Bottom Length (ft)	Gallery Depth (ft)	Trench Bottom Area (sf)	Trench Side Area (sf)	Total Infiltration Area (Bottom + Sides) (sf)	Pipe Length (ft)	Pipe Diameter (ft)	Pipe Volume (cf)	Drainrock Volume (cf)	Total Gallery Volume (cf)
XXX	8000.0	0.0	0.0	8000.0	0.0	8000.0	0.0	0.0	0.0	0.0	0.0
XXX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
						8000					0

**DETENTION BASIN DESIGN**

**PROJECT: 21-153 YOMAN BLUFFS**  
**BASIN: BASIN B**  
 REVIEWER: AJS  
 DESIGNER: EFZ  
 DATE: 12/20/2021

**RUNOFF STORAGE**

-Single (Type-A)	0	-Double (Type-B)	0
Exfiltration (cfs)	0.3		1.0
Time of Conc. (min)			5.00
Area (Acres)			1.15
Composite "C"			0.41
208 Treated Area (acres)			0.20
Volume Provided	208:	536.5975	Storm: 1241
Outflow (cfs)			0.37
Area * C" Factor			0.47

#1 Time Inc. (min.)	#2 Time Inc. (sec.) (#1*60)	#3 Intensity (in./hr.)	#4 Q dev. (cfs) (A"C*#3)	#5 V in (cu. ft.)	#6 V out (cu. ft.) (Outf. *#2)	#7 Storage (cu. ft.) (#5-#6)
5.00	300.00	2.90	1.38	553	110.00	443
5	300	2.90	1.38	553	110.00	443
10	600	2.00	0.95	666	220.00	446
15	900	1.70	0.81	808	330.00	478
20	1200	1.50	0.71	926	440.00	486
25	1500	1.26	0.60	954	550.00	404
30	1800	1.20	0.57	1082	660.00	422
35	2100	1.03	0.49	1072	770.00	302
40	2400	0.98	0.46	1163	880.00	283
45	2700	0.88	0.42	1174	990.00	184
50	3000	0.85	0.40	1250	1100.00	150
55	3300	0.78	0.37	1264	1210.00	54
60	3600	0.78	0.37	1369	1320.00	49
100	6000	0.55	0.26	1586	2200.00	-614
110	6600	0.52	0.25	1645	2420.00	-775
120	7200	0.51	0.24	1766	2640.00	-874
140	8400	0.45	0.21	1807	3080.00	-1273
160	9600	0.41	0.20	1904	3520.00	-1616
200	12000	0.36	0.17	2078	4400.00	-2322
4000	240000	0.06	0.03	6873	88000.00	-81127
5000	300000	0.05	0.03	7517	110000.00	-102483
4320	259200	0.00	0.00	0	95040.00	-95040

**208 SWALE POND CALCULATIONS**

Volume Required [cf] = 0.5" * A	367 cu. ft.	Adequate
*Must meet SRSM soil requirements	537 cu. ft.	Provided:

**STORAGE REQUIREMENTS - 2-YEAR DESIGN STORM**  
 Maximum storage required by Bowstring =

486 cu. ft.	Provided:
1241 cu. ft.	Adequate
0 - Single (Type-A)	
0 - Double (Type-B)	

**TIME OF CONCENTRATION (minutes)**

Tc (overland)	Tc (ditch)
L(A) = 0	L(C) = 600
K(A) = 420	K(C) = 1100
S(A) = 0.000	S(C) = 0.078
Tc (A) = 0.00	Tc (C) = 1.95
L(B) = 0	
K(B) = 0	Tc (C) = 1.95
S(B) = 0	Tc(A+B) = 0.00
Tc (B) = 0.00	Tc(tot.) = 5.00
	Intensity = 2.90

Tc (total) = Tc (overland) + Tc (gutter)

Tc = L / [K\sqrt{S}]

L = length of segment (ft)

S = slope of segment (feet/foot)

K = ground cover coefficient (ft/min)

-See Table 5-6 of SRSM for "K" values

**CONTRIBUTING AREAS**

Site	1.15 Acres		50197 s.f.		
	Areas (Ac.)	"C"	A°C	Areas (s.f.)	Treat?
Asphalt	0.20	0.900	0.1818	8800	Y
Driveways	0.00	0.900	0.0000	0	Y
Detached Sidewalks	0.00	0.900	0.0000	0	N
Building/Roof	0.00	0.900	0.0000	0	N
Grass / Landscaping	0.91	0.300	0.2741	39797	N
Gravel	0.04	0.500	0.0184	1600	N
Offsite Pavement	0.00	0.900	0.0000	0	Y
	Total A	Comp "C"	Qpeak		
Total Site	1.15	0.41	1.38		
Connected Impervious	0.20	0.90	0.53		

**POND VOLUMES**

Swale Number	Bottom Elevation Area (sf)	Depth to 208 Elevation (ft)	208 Elevation Area (sf)	Depth to Top Elevation (ft)	Top Elevation Area (sf)	208 Volume (cf)	Storage Volume (cf)
208 SWALE	912	1	1234	1	1571	537	1241
XXX	0	1	0	1	0	0	0
						537	1241
Exfiltration Rate	0.57 in/hr	0.012 cfs					
Time to percolate	29 hr						

**PEAK RUNOFF VOLUME (25-YR STORM, SCS METHOD)**

Areas (Ac.)	CN	A"C	
Asphalt	0.20	98	19.708
Attached Sidewalks	0.00	98	0.000
Detached Sidewalks	0.00	98	0.000
Building/Roof	0.00	98	0.000
Grass / Landscaping	0.91	60	54.816
Unimproved	0.04	60	2.204
Offsite Pavement	0.00	85	0.000
Total A	1.15	Comp "C"	66.66
			P <sub>25</sub> = 2.5 in
			S = 6.00
			Total Runoff Depth (Q <sub>25</sub> ) = 0.35 in
			Total Storm Volume (V) = 1447 cf
			*Class C Soils w/ >75% Grass Cover

**UNDERGROUND PERCOLATION GALLERIES**

Soil Infiltration Rate	1.98 in/hr	Minimum Infiltration Area Required (based on Peak Runoff Volume and Soil Infiltration Rate) =	365 sf
733.33333	4.583E-05 ft/sec	Infiltration Area Provided =	8000 sf
Voids in Drainrock	0.4		
Gallery Disposal Rate	0.37 cfs		

Trench Number	Gallery Width (ft)	Bottom Length (ft)	Gallery Depth (ft)	Trench Bottom Area (sf)	Trench Side Area (sf)	Total Infiltration Area (Bottom + Sides) (sf)	Pipe Length (ft)	Pipe Diameter (ft)	Pipe Volume (cf)	Drainrock Volume (cf)	Total Gallery Volume (cf)
XXX	8000.0	0.0	0.0	8000.0	0.0	8000.0	0.0	0.0	0.0	0.0	0.0
XXX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
						8000					0



<p><b>DETENTION BASIN DESIGN</b></p>	<p><b>PROJECT: 21-153 YOMAN BLUFFS</b>  <b>BASIN: BASIN C</b>  REVIEWER: AJS  DESIGNER: EFZ  DATE: 12/20/2021</p>
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Single (Type-A) Exfiltration (cfs)	0 0.3	Double (Type-B) 0 4.0		
Time of Conc. (min)			11.22	
Area (Acres)			8.95	
Composite "C"			0.32	
208 Treated Area (acres)			0.00	
Volume Provided	208:	3508:		Storm: 3508
Outflow (cfs)			0.37	
Area * C" Factor			2.84	

#1 Time inc. (min.)	#2 Time inc. (sec.) (#1*60)	#3 Intensity (in./hr.)	#4 Q-dev. (cfe) (A°C*#3)	#5 V-in (cu.-ft.)	#6 V-out (cu.-ft.) (Out#-#2)	#7 Storage (cu.-ft.) (#5-#6)
11.22	673.30	2.03	6.75	5192	248.91	4945
5	300	2.90	8.23	3310	110.00	3200
10	600	2.90	5.68	4565	229.00	4345
15	900	1.70	4.83	5449	330.00	5119
20	1200	1.50	4.26	6085	440.00	5645
25	1500	1.26	3.56	6162	550.00	5612
30	1800	1.20	3.44	6912	660.00	6252
35	2100	1.03	2.91	6788	770.00	6018
40	2400	0.98	2.78	7314	880.00	6434
45	2700	0.88	2.64	7345	990.00	6255
50	3000	0.85	2.44	7792	1100.00	6692
55	3300	0.78	2.22	7849	1210.00	6639
60	3600	0.78	2.21	8479	1320.00	7159
100	6000	0.55	1.56	9690	2200.00	7290
110	6600	0.52	1.47	10035	2420.00	7615
120	7200	0.61	1.45	10756	2640.00	8116
140	8400	0.45	1.27	10977	3080.00	7897
160	9600	0.41	1.17	11544	3520.00	8024
200	12000	0.36	1.03	12569	4400.00	8169
4000	240000	0.06	0.17	41164	88000.00	-46836
5000	300000	0.05	0.15	45018	110000.00	-64982
4320	259200	0.00	0.00	0	05040.00	-05040

*Volume Required [cf] = 1133*A	0 cu. ft.	Adequate
*Volume Required [cf] = 1815*A	0 cu. ft.	Adequate
*Must meet SPSM soil requirements	3508 cu. ft.	

Maximum storage required by Bowstring =	8160 cu.-ft.
Provided:	3508 cu.-ft.
	<b>Inadequate</b>
Number and type of Drywells Required =	0 - Single (Type A) 0 - Double (Type B)

Tc (overland) =		Tc (ditch) =	
L(A) =	317	L(C) =	1119
K(A) =	150	K(C) =	1100
S(A) =	0.255	S(C) =	0.021
Tc (A) =	4.19	Tc (C) =	7.03
L(B) =	0		
K(B) =	0	Tc (C) =	7.03
S(B) =	0	Tc(A+B) =	4.19
Tc (B) =	0.00	Tc(tol.) =	11.22
		Intensiv =	2.03

	Soil Infiltration Rate	1.98 in/hr	Minimum Infiltration Area Required (based on Peak Runoff Volume and Soil Infiltration Rate) =	1625 sf
		4.58E-05 ft/sec		
0	Voide in Drainrook	0.4	Infiltration Area Provided =	9090 sf
	Gallery Disposal Rate	0.37 cfs		

Trench Number	Gallery	Bottom	Gallery	Trench	Trench	Total Infiltration Area (Bottom + Sides)	Pipe Length	Pipe Diameter	Pipe Volume	Drainrock Volume	Total Gallery Volume
	Width	Length	Depth	Bottom	Side						
	(ft)	(ft)	(ft)	(sq ft)	(sq ft)						
XXX	8000.0	1.0	0.0	8000.0	0.0	8000.0	0.0	0.0	0.0	0.0	0.0
XXX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
						8000					0

Site	8.95 Acres			389714 s.f.				
	Areas (Ac.)	"C"	A"C	Areas (s.f.)	Treat?			
Asphalt	0.00	0.900	0.0000	0	Y			
Driveways	0.00	0.900	0.0000	0	Y			
Detached Sidewalks	0.00	0.900	0.0000	0	N			
Building/Roof	0.26	0.900	0.2324	11250	N			
Grass / Landscaping	8.69	0.900	2.6065	376464	N			
Gravel	0.00	0.500	0.0000	0	N			
Offsite Pavement	0.00	0.900	0.0000	0	Y			
	Total A	Comp "C"	Openk					
Total Site	8.95	0.32	5.75					
Connected Impervious	0.00	N/A	0.00					

	Bottom Elevation	Depth to 208 Elevation	208 Elevation	Depth to Top Elevation	Top Elevation	208 Volume	Storage Volume
Swaile Number	Area (sf)	Elevation (ft)	Area (sf)	Elevation (ft)	Area (sf)	Volume (cf)	Volume (cf)
208 SWALE	7016	0.50	7016	0.5	7016	3508	3508
XXX	0	0.50	0	1.0	0	0	0
						<u>3508</u>	<u>3508</u>

Areas (Ac.)	CN	A/C	
Asphalt	0.00	98	0.000
Attached Sidewalks	0.00	98	0.000
Detached Sidewalks	0.00	98	0.000
Building/Roof	0.26	98	25.310
Grass / Landscaping	8.69	60	521.300
Unimproved	0.00	60	0.000
Offsite Pavement	0.00	85	0.000
<b>Total A</b>	<b>8.95</b>	<b>Comp "C"</b>	<b>61.10</b>

**DETENTION BASIN DESIGN**

**PROJECT: 21-153 YOMAN BLUFFS**  
**BASIN: BASIN D**  
 REVIEWER: AJS  
 DESIGNER: EFZ  
 DATE: 12/20/2021

**RUNOFF STORAGE**

-Single (Type-A)	0	-Double (Type-B)	0
Exfiltration (cfs)	0.3		1.0
Time of Conc. (min)		5.00	
Area (Acres)		1.23	
Composite "C"		0.51	
208 Treated Area (acres)		0.31	
Volume Provided	208:	562.75	Storm: 563
Outflow (cfs)		0.37	
Area * C" Factor		0.63	

#1 Time Inc. (min.)	#2 Time Inc. (sec.) (#1*60)	#3 Intensity (in./hr.)	#4 Q dev. (cfs) (A*C*#3)	#5 V-in (cu.-ft.)	#6 V-out (cu.-ft.) (Outf.*#2)	#7 Storage (cu.-ft.) (#5-#6)
5.00	300.00	2.90	1.84	738	110.00	628
5	300	2.90	1.84	738	110.00	628
10	600	2.00	1.27	880	220.00	660
15	900	1.70	1.08	1079	330.00	749
20	1200	1.50	0.95	1237	440.00	797
25	1500	1.26	0.80	1274	550.00	724
30	1800	1.20	0.76	1446	660.00	786
35	2100	1.03	0.65	1432	770.00	662
40	2400	0.98	0.62	1553	880.00	673
45	2700	0.88	0.56	1568	990.00	578
50	3000	0.85	0.54	1670	1100.00	570
55	3300	0.78	0.50	1688	1210.00	478
60	3600	0.78	0.49	1829	1320.00	509
100	6000	0.55	0.35	2118	2200.00	-82
110	6600	0.52	0.33	2197	2420.00	-223
120	7200	0.51	0.32	2359	2640.00	-281
140	8400	0.45	0.28	2413	3080.00	-667
160	9600	0.41	0.26	2542	3520.00	-978
200	12000	0.36	0.23	2775	4400.00	-1625
4000	240000	0.06	0.04	9179	88000.00	-78821
5000	300000	0.05	0.03	10040	110000.00	-99960
4320	259200	0.00	0.00	0	95040.00	-95040

**208 SWALE POND CALCULATIONS**

Volume Required [cf] = 0.5" \* A  
 \*Must meet SRSM soil requirements  
 Provided: 560 cu. ft.  
 Adequate  
 Adequate

**STORAGE REQUIREMENTS - 2-YEAR-DESIGN-STORM**

Maximum storage required by Bowstring =

Number and type of Drywells Required =

Provided: 797 cu.-ft.  
 563 cu.-ft.  
 Inadequate  
 0 -Single (Type-A)  
 0 -Double (Type-B)

**TIME OF CONCENTRATION (minutes)**

Tc (overland)		Tc (ditch)	
L(A) =	0	L(C) =	500
K(A) =	420	K(C) =	1100
S(A) =	0.000	S(C) =	0.015
Tc (A) =	0.00	Tc (C) =	3.71
L(B) =	0		
K(B) =	0	Tc (C) =	3.71
S(B) =	0	Tc(A+B) =	0.00
Tc (B) =	0.00	Tc(tot.) =	5.00
		Intensity =	0.00

Tc (total) = Tc (overland) + Tc (gutter)

Tc = L / [K\*(S)]

L = length of segment (ft)

S = slope of segment (feet/foot)

K = ground cover coefficient (ft/min)

-See Table 5-6 of SRSM for "K" values

**CONTRIBUTING AREAS**

Site	1.23 Acres	53701 s.f.		
	Areas (Ac.)	"C"	A"C	Areas (s.f.) Treat?
Asphalt	0.26	0.900	0.2364	11440 Y
Driveways	0.05	0.900	0.0413	2000 Y
Detached Sidewalks	0.00	0.900	0.0000	0 N
Building/Roof	0.11	0.900	0.1033	5000 N
Grass / Landscaping	0.76	0.300	0.2285	33181 N
Gravel	0.05	0.500	0.0239	2080 N
Offsite Pavement	0.00	0.900	0.0000	0 Y
Total A	1.23	Comp "C"	0.51	Qpeak
Total Site	1.23		0.51	1.84
Connected Impervious	0.31	0.90	0.81	

**POND VOLUMES**

Swale Number	Bottom Elevation (sf)	Depth to 208 Elevation (ft)	208 Elevation (sf)	Depth to Top Elevation (ft)	Top Elevation (sf)	208 Volume (cf)	Storage Volume (cf)
208 SWALE	917	0.50	1334	0.5	1334	563	563
XXX	0	0.50	0	1.0	0	0	0
Exfiltration Rate	0.57 in/hr	0.012 cfs				563	563
Time to percolate	13 hr						

**PEAK RUNOFF VOLUME (25-YR STORM, SCS METHOD)**

Areas (Ac.)	CN	A"C	
Asphalt	98	25.737	P <sub>25</sub> = 2.5 in
Attached Sidewalks	98	4.500	S = 3.69
Detached Sidewalks	98	0.000	Total Runoff Depth(Q <sub>25</sub> ) = 0.57 in
Building/Roof	98	11.249	Total Storm Volume (V) = 2549 cf
Grass / Landscaping	60	45.704	*Class C Soils w/ >75% Grass Cover
Unimproved	60	2.865	
Offsite Pavement	85	0.000	
Total A	1.23	Comp "C"	73.05

**UNDERGROUND PERCOLATION GALLERIES**

Soil Infiltration Rate	1.98 in/hr	Minimum Infiltration Area Required (based on Peak Runoff Volume and Soil Infiltration Rate) =	644 sf
4120	4.583E-05 ft/sec	Infiltration Area Provided =	8000 sf
Voids in Drainrock	0.4		
Gallery Disposal Rate	0.37 cfs		

Trench Number	Gallery Width (ft)	Bottom Length (ft)	Gallery Depth (ft)	Trench Bottom Area (sf)	Trench Side Area (sf)	Total Infiltration Area (Bottom + Sides) (sf)	Pipe Length (ft)	Pipe Diameter (ft)	Pipe Volume (cf)	Drainrock Volume (cf)	Total Gallery Volume (cf)
XXX	8000.0	1.0	0.0	8000.0	0.0	8000.0	0.0	0.0	0.0	0.0	0.0
XXX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
						8000					0

**DETENTION BASIN DESIGN**

PROJECT: 21-153 YOMAN BLUFFS  
 BASIN: BASIN X  
 REVIEWER: AJS  
 DESIGNER: EFZ  
 DATE: 12/20/2021

**RUNOFF STORAGE**

-Single (Type-A)	0	-Double (Type-B)	0
Exfiltration (cfs)	0.3		1.0
Time of Conc. (min)		29.87	
Area (Acres)		35.69	
Composite "C"		0.15	
208 Treated Area (acres)		0.00	
Volume Provided	208:	0	Storm:
Outflow (cfs)		0.37	0
Area * C" Factor		5.35	

#1 Time Inc. (min.)	#2 Time Inc. (sec.) (#1*60)	#3 Intensity (in./hr.)	#4 Q-dev. (cfs) (A*C*#3)	#5 V-in (cu.-ft.) (Outf.*#2)	#6 V-out (cu.-ft.) (Outf.*#2)	#7 Storage (cu.-ft.) (#5-#6)
29.87	1792.05	1.13	6.04	14508	657.08	13852
5	300	2.90	15.52	6241	110.00	6131
10	600	2.00	10.74	8608	220.00	8388
15	900	1.70	9.10	10975	330.00	10645
20	1200	1.50	8.03	12911	440.00	12471
25	1500	1.26	6.72	13508	550.00	12958
30	1800	1.20	6.42	15476	660.00	14816
35	2100	1.03	5.50	14889	770.00	14119
40	2400	0.98	5.25	15787	880.00	14907
45	2700	0.88	4.73	15649	990.00	14659
50	3000	0.85	4.55	16422	1100.00	15322
55	3300	0.78	4.19	16396	1210.00	16186
60	3600	0.78	4.18	17575	1320.00	16255
100	6000	0.55	2.93	19387	2200.00	17187
110	6600	0.52	2.77	19976	2420.00	17556
120	7200	0.51	2.73	21320	2640.00	18680
140	8400	0.45	2.40	21611	3080.00	19531
160	9600	0.41	2.21	22610	3520.00	19090
200	12000	0.36	1.94	24436	4400.00	20036
4000	240000	0.06	0.32	77740	88000.00	-10260
5000	300000	0.05	0.28	84993	110000.00	-25007
4320	259200	0.00	0.00	0	95040.00	-95040

**208 SWALE POND CALCULATIONS**

Volume Required [cf] = 1133*A.	0 cu.-ft.	Inadequate
Volume Required [cf] = 1815*A.	0 cu.-ft.	Inadequate
*Must meet SRSM soil requirements	0 cu.-ft.	Provided:

**STORAGE REQUIREMENTS - 2-YEAR DESIGN STORM**

Maximum storage required by Bowstring =	20036 cu.-ft.	Provided:
	0 cu.-ft.	Inadequate
Number and type of Drywells Required =	0 Single (Type A)	
	0 Double (Type B)	

**TIME OF CONCENTRATION (minutes)**

Tc (overland)		Tc (ditch)	
L(A) =	845	L(C) =	1366
K(A) =	150	K(C) =	1100
S(A) =	0.059	S(C) =	0.034
Tc (A) =	23.16	Tc (C) =	6.71
L(B) =	0		
K(B) =	0	Tc (C) =	6.71
S(B) =	0	Tc(A+B) =	23.16
Tc (B) =	0.00	Tc(tot.) =	29.87
		Intensity =	1.13

Tc (total) = Tc (overland) + Tc (gutter)

Tc = L / [K\*(S)]

L = length of segment (ft)

S = slope of segment (feet/foot)

K = ground cover coefficient (ft/min)

-See Table 5-6 of SRSM for "K" values

**UNDERGROUND PERCOLATION GALLERIES**

Soil Infiltration Rate =	1.98 in/hr	
	4.583E-05 ft/sec	
0		
Voids in Drainrock =	0.4	
Gallery Disposal Rate =	0.37 cfs	

Trench Number	Gallery Width (ft)	Bottom Length (ft)	Gallery Depth (ft)	Trench Bottom Area (sf)	Trench Side Area (sf)	Total Infiltration Area (Bottom + Sides) (sf)	Pipe Length (ft)	Pipe Diameter (ft)	Pipe Volume (cf)	Drainrock Volume (cf)	Total Gallery Volume (cf)
XXX	8000.0	1.0	0.0	8000.0	0.0	8000.0	0.0	0.0	0.0	0.0	0.0
XXX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
						8000					0

**CONTRIBUTING AREAS**

Site	35.69 Acres	1554511 s.f.		
Areas (Ac.)	"C"	A"C	Areas (s.f.)	Treat?
Asphalt	0.00	0.900	0	Y
Driveways	0.00	0.900	0	Y
Detached Sidewalks	0.00	0.900	0	N
Building/Roof	0.00	0.900	0	N
Grass / Landscaping	35.69	0.150	1554511	N
Unimproved	0.00	0.000	0	N
Offsite Pavement	0.00	0.900	0	Y
Total A		Comp "C"	Qpeak	
Total Site	35.69	0.15	6.04	
Connected Impervious	0.00	N/A	0.00	

**POND VOLUMES**

Swale Number	Bottom Elevation (sf)	Depth to-208 Elevation (ft)	208 Elevation (sf)	Depth to-Top Elevation (ft)	Top Elevation (sf)	208 Volume (cf)	Storage Volume (cf)
208 SWALE		0.50		1.0		0	0
XXX	0	0.50	0	1.0	0	0	0
						0	0

**PEAK RUNOFF VOLUME (25-YR STORM, SCS METHOD)**

Areas (Ac.)	CN	A"C	
Asphalt	98	0.000	P25= 2.5 in
Attached Sidewalks	98	0.000	S= 6.67
Detached Sidewalks	98	0.000	Total Runoff Depth (Q25)= 0.17 in
Building/Roof	98	0.000	Total Storm Volume (V)= 22509 cf
Grass / Landscaping	60	2144	*Class C Soils w/ >75% Grass Cover
Unimproved	60	0.000	
Offsite Pavement	85	0.000	
Total A	35.69	Comp "C"	60.00

Minimum Infiltration Area Required (based on Peak Runoff Volume and Soil Infiltration Rate) = 5684 sf  
 Infiltration Area Provided = 8000 sf



DETENTION BASIN DESIGN

PROJECT: 21-153 YOMAN BLUFFS  
BASIN: OFFSITE BASIN A + B + X  
REVIEWER: AJS  
DESIGNER: EFZ  
DATE: 12/20/2021

RUNOFF STORAGE

Single (Type A)	0	Double (Type B)	0
Exfiltration (cfs)	0.3		1.0
Time of Conc. (min)			6.71
Area (Acres)			39.26
Composite "C"			0.32
208 Treated Area (acres)			0.81
Volume Provided		208:	0
Outflow (cfs)			0.37
Area "C" Factor			12.38

#1 Time Ine. (min.)	#2 Time Ine. (sec.) (#1*60)	#3 Intensity (in./hr.)	#4 Q dev. (cfs) (A"C*#3)	#5 V in (cu. ft.)	#6 V out (cu. ft.) (Outf.*#2)	#7 Storage (cu. ft.) (#5-#6)
6.71	402.54	2.76	34.13	18413	147.60	18265
5	300	2.90	35.91	14434	110.00	14324
10	600	2.00	24.76	18247	220.00	18027
15	900	1.70	21.06	21825	330.00	21495
20	1200	1.50	18.57	24829	440.00	24389
25	1500	1.26	15.54	25444	550.00	24894
30	1800	1.20	14.86	28778	660.00	28118
35	2100	1.03	12.71	28433	770.00	27663
40	2400	0.98	12.13	30782	880.00	29902
45	2700	0.88	10.94	31028	990.00	30038
50	3000	0.85	10.52	33013	1100.00	31913
55	3300	0.78	9.70	33340	1210.00	32130
60	3600	0.78	9.66	36089	1320.00	34769
100	6000	0.55	6.78	41638	2200.00	39438
110	6600	0.52	6.41	43176	2420.00	40756
120	7200	0.51	6.31	46329	2640.00	43689
140	8400	0.45	5.55	47365	3080.00	44285
160	9600	0.41	5.12	49877	3520.00	46357
200	12000	0.36	4.48	54404	4400.00	60004
4000	240000	0.06	0.75	179460	88000.00	91460
5000	300000	0.05	0.65	196280	110000.00	86280
4320	259200	0.00	0.00	0	95040.00	-95040

208 SWALE POND CALCULATIONS

\*Volume Required (cf) = 1133\*A  
Volume Required (cf) = 1816\*A  
First flush (0.5")

\*Must meet SRSM soil requirements

Provided: 0 cu. ft.

Inadequate  
Inadequate

STORAGE REQUIREMENTS - 2-YEAR DESIGN STORM

Maximum storage required by Bowstring =

Provided: 91460 cu. ft.

Inadequate  
0 Single (Type A)  
0 Double (Type B)

Number and type of Drywells Required =

TIME OF CONCENTRATION (minutes)

Te (overland)		Te (ditch)	
L(A) =	0	L(C) =	1366
K(A) =	429	K(C) =	1109
S(A) =	0.000	S(C) =	0.034
Te (A) =	0.99	Te (C) =	6.71
L(B) =	0		
K(B) =	0	Te (C) =	6.71
S(B) =	0	Te (A+B) =	0.00
Te (B) =	0.00	Te (tot.) =	6.71
		Intensity =	0.00

Te (total) = Te (overland) + Te (gutter)

Te = L / [K \* (S)]

L = length of segment (ft)

S = slope of segment (feet/foot)

K = ground cover coefficient (ft/min)

\*See Table 5-6 of SRSM for "K" values

CONTRIBUTING AREAS

Site	39.26 Acres		1710303 s.f.	
	Areas (Ac.)	"C"	A"C	Areas (s.f.) Treat?
Asphalt	0.76	0.900	0.6818	33000 Y
Driveways	0.06	0.900	0.0517	2500 Y
Detached Sidewalks	0.00	0.900	0.0000	0 N
Building/Roof	0.14	0.900	0.1291	6250 N
Grass / Landscaping	38.17	0.300	11.4501	1662553 N
Gravel	0.14	0.500	0.0689	6000 N
Offsite Pavement	0.00	0.900	0.0000	0 Y
Total A	39.26	Comp "C"	0.32	Qpeak
Total Site	39.26	0.32	34.13	
Connected Impervious	0.81	0.90	2.13	

POND VOLUMES

Swale Number	Bottom Elevation Area (sf)	Depth to 208 Elevation (ft)	208 Elevation Area (sf)	Depth to Top Elevation (ft)	Top Elevation Area (sf)	208 Volume (cf)	Storage Volume (cf)
208 SWALE							
XXX	0	0.50	0	1.0	0	0	0
						0	0

PEAK RUNOFF VOLUME (25-YR STORM, SCS METHOD)

Areas (Ac.)	CN	A"C	
Asphalt	98	74	P <sub>25</sub> = 2.5 in
Attached Sidewalks	0.06	98	S = 6.39
Detached Sidewalks	0.00	98	0
Building/Roof	0.14	98	14
Grass / Landscaping	38.17	60	2290
Gravel	0.14	85	12
Offsite Pavement	0.00	90	0
Total A	39.26	Comp "C"	61.02

Total Runoff Depth (Q<sub>25</sub>) = 0.20 in  
Total Storm Volume (V) = 27968 cf  
\*Class C Soils w/ >75% Grass Cover

UNDERGROUND PERCOLATION GALLERIES

Soil Infiltration Rate	1.98 in/hr	Minimum Infiltration Area Required (based on Peak Runoff Volume and Soil Infiltration Rate) =	7063 sf
208-3333	4.583E-05 ft/sec	Infiltration Area Provided =	8000 sf
Voids in Drainrock	0.4		
Gallery Disposal Rate	0.37 cfs		

Trench Number	Gallery Width (ft)	Bottom Length (ft)	Gallery Depth (ft)	Trench Bottom Area (sf)	Trench Side Area (sf)	Total Infiltration Area (Bottom + Sides) (sf)	Pipe Length (ft)	Pipe Diameter (ft)	Pipe Volume (cf)	Drainrock Volume (cf)	Total Gallery Volume (cf)
XXX	8000.0	1.0	0.0	8000.0	0.0	8000.0	0.0	0.0	0.0	0.0	0.0
XXX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
						8000					0

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# Chapter 4

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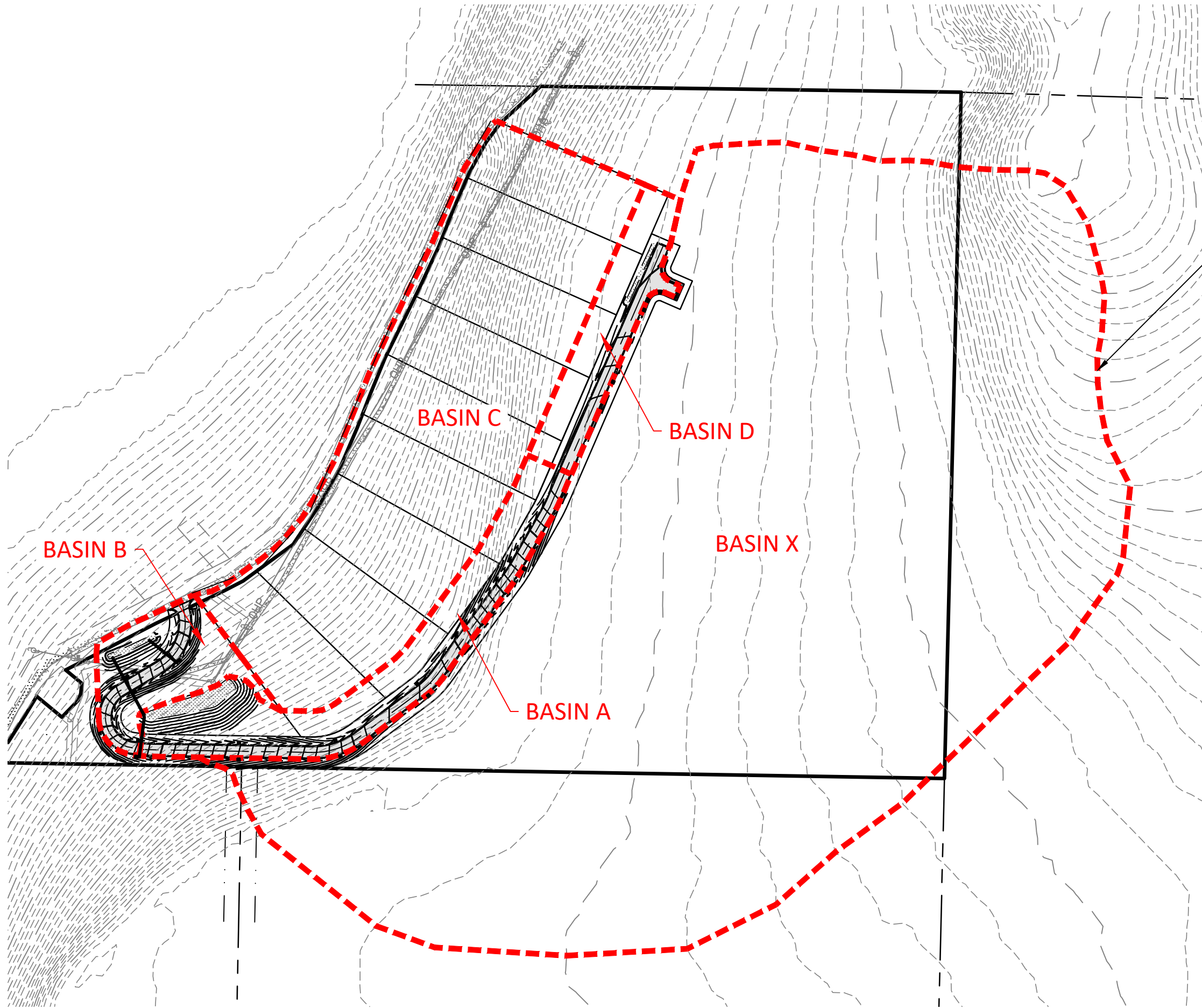
## BASIN MAP



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**STORHAUG ENGINEERING**

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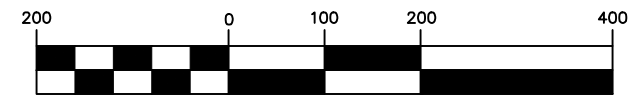


NOTE: CONTOURS AS SHOWN ARE GENERATED FROM AUTODESK INFRAWORKS' MODEL BUILDER AND REPRESENT 2' INTERVALS.

THE EXTERIOR OF THE PRE-DEVELOPMENT BASIN IS THE SAME AS THE CUMULATIVE POST-DEVELOPMENT BASINS.



GRAPHIC SCALE



( IN FEET )  
1 inch = 200 ft.

CALL BEFORE YOU DIG 811

DRAWN	EFZ	DATE	12/17/2021
CHECKED	AJS	SCALE	1" = 200'
1	OF	1	
PROJECT NUMBER	21-153		

YOMAN BLUFFS - BASIN MAP  
CITY OF COOLIN  
BONNER COUNTY, IDAHO