Appendix I

Water Quality Plan
1064 Sediment Basins
1066 Construction Site Diversions
Operation & Maintenance Plan

I – 1 – Water Quality Plan Figures

I – 2 – Typical Erosion Control Measures

I – 3 – Calculations

Water Quality Plan

This Water Quality Plan was developed to outline the measures to be implemented at the DS Mine to manage water to meet State and Local regulations governing stormwater and industrial wastewater at non metallic mines in Wisconsin. The Water Quality Plan is a supplement to the DS Mine Reclamation Plan as required under ch NR 135 Wisconsin Administrative Code.

Description of Figures

The following description of figures is provided to assist in the interpretation of the Water Quality Plan. The narrative sections of the Water Quality Plan is intended to supplement the details of the plan as provided on the Figures.

Figure I-1.1 "Existing Drainage Basins"- This figure displays the proposed mining site with USGS 20 foot interval contours and the resulting Existing Drainage Basins X-1 through X-7. Also displayed are the Mining Areas A-0 through A-8. Arrows indicate direction of run-off. The arrow within the Drainage Basin at the property line represents the point of discharge for the corresponding Drainage Basin. Areas outside a drainage basin and within the property boundaries are primarily sheet flow runoff areas and bypass the points of discharge. Sections A-A' and B-B' are shown as insets to the sheet.

Figure I-1.2 "Composite Water Quality Control Plan" - This figure shows most of the major elements of the mine including stockpiles, and runoff management BMP's (sediment basins and conveyances). The drainage basin to each sediment basin is also displayed. Sediment Basin B-1.0 is omitted for clarity and is shown on a separate figure. Sections C-C' and D-D' are shown as insets to the sheet. Also displayed are the Mining Areas A-0 through A-8 and the USGS 20 foot interval contours. Area A-1 is the location of the site loadout area.

Figure I-1.3 "Process Water System" -This figure displays the process water storage area and maximum expected area of contribution. Also displayed are the Mining Areas A-0 through A-8 and the USGS 20 foot interval contours.

Figure I-1.4 "Sediment Basin B-1.0" - This figure displays Sediment Basin B-1.0 and the contributing area Drainage Basin X-7. Drainage Sub-Basin 1.0 is shaded to indicate the area in the bare soil condition used in the design of Sediment Basin B-1.0. Also displayed are the Mining Areas A-0 through A-8 and the USGS 20 foot interval contours.

Figure I-1.5 "Sediment Basin B-1.1, B-2.0, B-2.1, B-4.0". This figure displays the water quality BMP's that are constructed during the mine opening and the drainage basins contributing to each practice. Also displayed are the Mining Areas A-0 through A-8 and the USGS 20 foot interval contours.

General Water Quality Plan

Storm water discharges from non-metallic mines are regulated by the Wisconsin Department of Natural Resources (WDNR) through ch. NR 216 Wisconsin Administrative Code and fall under the General Permit No. WI-0046515-05. A request for coverage through a Notice of Intent will be provided separately.

The objective of the Water Quality Plan is to control and treat erosion and sediment through the life of the mine.

The basic Water Quality Plan strategy is to:

- Construct sediment basins to intercept runoff at the points of discharge from the site as indicated on Appendix I Figure I-1.1 and I-1.2 prior to major disturbance in the drainage basin;
- Divert runoff from areas undisturbed by mining to the extent possible; and
- Allow water within the mine to infiltrate or pump it to temporary storage for infiltration when necessary as indicated on Appendix I Figure I-1.3.

The design of each sediment basin has been developed sufficiently to demonstrate that the strategy is feasible and can be refined and implemented as mining progresses. The primary purpose of the sediment basins is to treat runoff from the area of contribution during the transition from existing grade to mine floor. In most cases, the floor of the mine will be lower than the entry point of the sediment basin. During this period the mine will be internally drained. Runoff accumulating in operating areas that cannot be managed in the floor of the mine will be pumped to the process water storage basin as shown on Appendix Figure I-1.3. As mining progresses the open area will be utilized for in-mine stockpiling of overburden. The sediment basins will treat stockpile runoff when conditions are such that gravity flow reaches the sediment basin.

As each drainage basin is prepared for mining, the work will be preceded by verification of the sediment basin design and fit to the topography after a survey of the practice location. The design will be modified as necessary to adjust to changes in the mining plan and actual grades. The final engineering design of sediment basins and diversions shall include 1) fitting the design to site topography, 2) providing elevations of key components, and 3) outlet design for stability (e.g. rock lining).

Basis of Water Quality Plan

The runoff hydrology is modeled using HydroCAD 9.1 based upon the SCS TR-20 hydrologic methodology. HydroCAD output reports are attached herein under “Calculations”.

Sediment basins are included in the list of available controls in Sec. 3.1.2.2 of the Wisconsin Pollution Discharge Elimination System (WPDES) Permit No. WI-0046515-05. All proposed sediment basins will be designed in accordance with WDNR Conservation Practice Standard 1064 using Equation 1. Particle settling velocity is for Class II soils. See Standard 1064 attached to this section. Figure 1 of the standard shows the essential elements and construction of a sediment basin. See the “Standard 1064 Equation 1 Results Table” under “Calculations”.

All Sediment Basins were flood routed using HydroCAD 9.1. Output from the 1 Year, 24 Hour storm was used in Equation 1. All Sediment Basins safely route the 100 Year, 24 Hour storm event without overtopping.

Preliminary design of Channel Ch-1 and Storm Sewer SS-1 was performed in both FlowMaster V8i and HydroCAD. The Culvert C-4 system was verified with CulvertMaster v3.3. Output reports for each are attached herein under “Calculations”.

Diversions are shown in alignments consistent with gravity runoff using the USGS 20 foot contours as a guide. Experience has shown that the proposed route will require survey for final alignment. No diversion design was prepared for this report. The design will follow the Standard 1066 Construction Site Diversion. Channels liners will be designed for stability and cross sections will be designed for capacity.

Diversion channels, berms, and sediment basin slopes will have topsoil installed on the graded slopes, and the slopes will be seeded and mulched according to methods described in Section 6.4. Diversion channels will be lined with the appropriate erosion control. All outfalls will have erosion protection. Typical erosion control measures are shown in Appendix Figure I-2.1 and 2.2, “Typical Erosion Control Measures”.

Assumed Conditions

Grades are based upon the USGS 7.5 Minute Quadrangle 20 foot contour intervals.

The floor of the mine is at elevation 1105 feet above sea level.

During mining operations in a given existing drainage basin, runoff will continue to drain towards the original discharge point or the mine will be internally drained.

The existing condition Drainage Basins X-1 through X-7 are the contributing areas for each sediment basin and the contributing area through the life of the sediment basin will not exceed the existing condition.

Disturbed areas are assumed to have a CN = 94 in accordance with CCLC "Runoff Management within Non-metallic Mine Sites Chippewa County (Rev September 2009)".

Time of Concentration is assumed to be 10 minutes or in some cases less.

The table below shows the selected storm events used for the structural BMP's used on the project.

DESIGN EVENT TABLE

Best Management Practice	Issue	Event
Temporary Sediment Basins	TSS Stability	1-Year, 24 Hour Storm 100-Year, 24 Hour Storm
Long-Term Diversions, D-1, 2, 3, and 4 Series.	Capacity and Stability	25-Year, 24 Hour Storm
Other Diversions	Capacity and Stability	10-Year, 24 Hour Storm
Conveyance Channel 1	Capacity	25-Year, 24 Hour Storm
Process Water Storage	Volume	Two (2) 10-Year, 24 Hour Storms

Mine Development

Initial mine development occurs primarily in Areas A-0 through A-2 to create access and to construct a staging area pad for process equipment, stockpiles, and loadout. Storm water will be managed through the installation of several sediment basins and diversion channels. The table below indicates the initial sequence of construction and eventual mining.

Initial Storm Water BMP Installation Sequence Table

No.	Description	Reference Figure
1	Sediment Basin B-1.0, Diversion D-1, and pioneer access road	I-1.4
2	Sediment Basin B-4.0 and Diversions D-5 Series	I-1.4 & 5
3	Strip Area A-1 and Stockpile S-2 West A-horizon & B-horizon	I-1.5
4	Primary access roads and Channel Ch-1 for Diversions D-3 thru D-5	I-1.5
5	Area A-1 overburden to Stockpile S-1 with Diversion D-1	I-1.5
6	Sediment Basins B-2.0 and 2.1 with Diversion D-2	I-1.5
7	Area A-2 stripping and overburden removal	I-1.5
8	Sediment Basin B-3.0 and Diversions D-6 thru 8	I-1.2
9	Area A-3 stripping and overburden removal to Stockpile S-2 East	I-1.2
10	Sediment Basin B-6.0 in Area A-6	I-1.2
11	Sediment Basin B- 8.0 in Area A-6 for process water storage	I-1.2 & 1.3
12	Sediment Basin construction and mining operations by drainage basin	I-1.2

Sediment Basin B-1.0 as shown on Appendix Figure I-1.4 will serve the entire X-7 Drainage Basin as shown on Appendix Figure I-1.1. As stripping operations in A-1 proceed and overburden is placed in Stockpile S-1,

the stockpile size increases and begins to encroach on the storage capacity of Sediment Basin B-1.0. Sediment Basins B-2.0 and B-2.1 will be constructed in the southerly portion of Area A-1. Sediment Basin B-1.0 will be replaced by Sediment Basin B-1.1 as shown on Appendix Figure I-1.5.

Sediment Basin B-2.0 and B-2.1 treat runoff have a combined drainage basin capacity of 39 acres of mine or bare soil runoff in addition to the off-site contribution and part of Stockpile S-1.The bare soil contributing area as shown on Appendix Figure I-1.5 is less than 39 acres. Diversion D-2 routes runoff from the west to join runoff from the northeast portion of Stockpile S-1and into Sediment Basin 2.1. Diversions on the east side route runoff to Channel Ch-1. Diversion D-4.3 is an alternative to Diversion D-4.2 if it is determined that the existing grades will not allow this diversion to provide positive drainage.

The final layout of the site loading area as shown on Figure 2 will be modified as plans are completed by the mining contractor. The revised layout may require adjustments to the sediment basin design to accommodate any significant reconfiguration. The two sediment basins outlet to a common storm sewer that drains to an outfall downstream of Sediment Basin 1.1 as shown on Appendix Figure I-1.5. The two sediment basins are connected by the storm sewer. Modeling does not account for the hydraulic connection, but both sediment basins have the capacity for the 100 Year, 24 Hour Event without overtopping. In the event that one or both are overtopped the overland connection between them allows flooding to utilize the additional storage volume across the connecting area before flowing into the Sediment Basin 1.1.

Runoff from the east in Drainage Basin Ch-1 is routed to the east side of the primary access road into Channel Ch-1 as shown on Appendix Figure I-1.5. This runoff does not require treatment until mining occurs in the drainage basin.

Sediment Basin 4.0 will be constructed in preparation for stockpiling topsoil and B-horizon at Stockpile S-2 as shown on Appendix Figure I-1.5. The treated water from Sediment Basin 4.0 is routed to Channel Ch-1.

Channel Ch-1 passes through Culverts C-4 and C-5. Both culvert inlets are in a sumped conditions although some bypass may occur at Culvert C-5 which will continue downstream in the ditch of 20th Street.

Mine Operating Period

Process Water

The mine floor is expected to be well below the site loading area elevation. Area A-2 and succeeding mining areas will be mined to an elevation that will prevent runoff from flowing by gravity to the sediment basins. The mine area becomes internally drained. Precipitation and perched water will have no surface outlet. The intent is to manage this water thru the extent practicable by grading the mine floor to inactive areas and allowed to infiltrate.

When major events occur that exceed the capacity of in-mine storage and infiltration, then excess water must be removed. Under the WPDES rules the act of pumping the water reclassifies it as process water. This is the only source of process water at the mine. Basin 8.0, “Process Water Storage Basin” as shown on Appendix Figure I-1.3 will be constructed to accept process water. There will be no surface outlet. The infiltration rates of rock are highly speculative. Lateral rates vary from vertical. The rate is unknown and actual rates may vary from regulatory rates by orders of magnitude. This plan proposes to handle the uncertainty by creating excess storage in lieu of routing rainfall, runoff, pumping and infiltration. The process water storage basin has capacity for the volume of two (2) 10 Year, 24 Hour Storm Events back to back from the largest expected area. This area is defined by the combined active mine and in-mine stockpile condition (63 acres) and is shown as the shaded area on Appendix Figure I-1.3. Infiltration will occur in the floor and walls of the basin between events and in the mine.

Additional options for excess water volumes include circulating the process water through the blast rock in-mine stockpiles and pumping water that meets the WPDES effluent limits to a convenient discharge point.

Typical Mining Area Storm Water Treatment

The mine areas, drainage basins, sediment basins, storm sewer, culverts, channel, and diversion structures are shown on Appendix Figure I-1.2. As mining progresses in Areas A-3 through A-8, the following typical methods will be used when initiating disturbance in each of the drainage basins within the proposed project site.

1. Construction of the on-site access/haul roads will include erosion control BMP's as shown on Appendix Figure I-2.1 and I-2.2.

2. The area along the outer perimeter of the mine boundary at the point of discharge from the drainage will be cleared of the remaining trees and stumps in the footprint of the sediment basin construction.

3. Construction of the sediment basin and adjoining diversion to capture mining area runoff and or prevent off-site runoff from entering the sediment basin.

4. Most mining areas will have the topsoil and B-horizons stripped and stockpiled in Stockpile S-2. Some material may be used to create a seedbed for seed and mulch on diversions, sediment basin embankments, and channel liners where appropriate. Topsoil and B-horizon stockpiles will be relocated when mining occurs in the area of Stockpile S-2.

5. All exposed topsoil and B-horizon soils at the perimeter of the property will be seeded and mulched according to Section 6.4.

6. Diversion channels will be lined with the appropriate erosion control measures.

After the necessary storm water control structures are in place for each area, mining activities will commence, including overburden removal, mining of the sand resource and internal stockpiling where possible.

Diversion Management

Two potential runoff management conditions may exist at the perimeter:

- Condition1- the area flanking the drainage basin may bypass the sediment basin and
- Condition 2- off-property drainage may enter the sediment basin drainage.

Illustrations of these conditions are shown on Appendix Figure I-1.1.

Condition 1 will be handled by diverting flank area runoff into the sediment basin. Section A-A' on Appendix Figure I-1.1 shows this condition. The act of stripping the overlying topsoil and B-horizon may create a diversion channel of sufficient capacity. If the resulting cross section is too small it can be supplemented with a berm. The condition of the exposed channel is likely to be erosion resistant bedrock. The appropriate erosion control measures will be installed based upon channel stability requirements.

Condition 2 will be handled by diverting off-property runoff to the downstream side of the sediment basin in order to bypass the sediment basin. Section B-B' on Appendix Figure I-1.1 shows this condition. This prevents runoff from unmined areas and beyond the control of the operator from entering the treatment system. The appropriate erosion control measures will be installed based upon channel stability requirements.

As mining progresses into Areas A-4 and A-5 within Drainage Basin Ch-1, Diversion D-15 will be constructed to route runoff into the mine floor in Area A-3 and that portion of Diversion D-4.2 uphill of Diversion D-15 will be removed.

When mining operations in Area A-8 disturbs Drainage Basin Ch-1 a new diversion and sediment basin will be necessary to prevent runoff from entering Channel Ch-1. The remaining area of Drainage Basin Ch-1 truncated by Diversion D-15 and uphill of Diversion D-3 is relatively small. The area of contribution to Sediment Basin 2.0 that exists at that future time can be evaluated to see if it is small enough that the future Drainage Basin Ch-1 may possibly be treated in Sediment Basin 2.0. Drainage Basin 2.1 may also be connected to Sediment Basin 2.0 with a culvert to provide additional treatment capacity.

Stockpile Storm Water Management and Erosion Control

The typical methods of storm water management described above will be used when stockpiling within each of the drainage basins within the proposed project site.

It is expected that overburden stockpiles will be blast rock with significant voids interrupting surface flow runoff and allowing infiltration. Stockpile construction will generally follow Section 6.0 of the Reclamation Plan. The upper layer of the overburden stockpiles will be limited to the Tunnel City blast rock. This will serve to armor the stockpile and control erosion. If the Tunnel City material fails to adequately prevent erosion, other armoring materials will be employed. In the event of any sediment transport from the stockpile, channels and ditch checks at the sides of the stockpiles lead into the sediment basin. The appropriate erosion control measures will be installed where necessary on the stockpile slopes. All perimeter slopes with the potential for erosion will be seeded and mulched according to methods discussed in Section 6.4 of the Reclamation Plan.

Two potential storm water management conditions may exist within the drainage basins during stockpiling activities:

- Condition 3 - construction of stockpiles on the floor of the mine and
- Condition 4 - construction of stockpiles on the existing surface.

The stockpile areas with illustrations of these conditions are shown on Appendix Figure I-1.2.

Condition 3 exists in the event that the stockpile does shed water as surface flow to the perimeter of the mine, a channel will be constructed as shown in Section C-C' to capture runoff and direct it to the sediment basins. As noted above, most rainfall is expected to move vertically through the stockpile to the mine floor which is in an internally drained condition..

Condition 4 shows how stockpile faces will be protected from runoff from undisturbed areas adjacent to the stockpile by a diversion channel. Potential stockpile runoff from the face of the stockpile will be captured in a diversion/channel and directed to a sediment basin. This is shown on Section D-D' and by Diversions D-5 and D-6 on Appendix Figure I-1.2.

Definitions

Watershed - the area of landscape shaped such that precipitation runoff is directed towards a surface water body such as a stream or lake.

Drainage Basin - the area of landscape shaped such that precipitation runoff is focused to a chosen discharge point.

Best Management Practice (BMP) – a structural or management practice intended to treat storm water runoff such as a sediment basin or diversion.

Sediment Basin - a storm water runoff best management practice as defined by Wisconsin Department of Natural Resource Construction Site Erosion & Sediment Control Standard 1064 "Sediment Basin".

Diversion - a berm or channel constructed across a slope to collect and divert runoff.

Berm - an embankment of earth that may be used to dam or impound water, divert runoff, or obstruct view.

Channel - a constructed conveyance of storm water within a cross-section having a bottom width, sloping sides and a specific depth. Channels characteristically have slope to direct water in the downhill direction.

Conveyance - a means of moving water across distance- typically a channel or conduit.

Storm Sewer - a closed conduit for conveying water by gravity (typically a circular pipe).

Sediment Basin
(1064)

Wisconsin Department of Natural Resources
Conservation Practice Standard

I. Definition

A sediment control device constructed with an engineered outlet, formed by excavation or embankment to intercept sediment-laden runoff and retain the sediment.

II. Purposes

Detain sediment-laden runoff from disturbed areas for sufficient time to allow the majority of the sediment to settle out.

III. Conditions Where Practice Applies

Sediment basins are utilized in areas of concentrated flow or points of discharge during construction activities. Sediment basins shall be constructed at locations accessible for clean out. Site conditions must allow for runoff to be directed into the basin.

Sediment basins are designed to be in place until the contributory drainage area has been *stabilized*[1]. Sediment basins are temporary and serve drainage areas up to 100 acres however other conservation practices are often more economical for smaller drainage areas. For drainage areas smaller than 5 acres sediment traps or ditch checks may be applicable; for design criteria refer to WDNR conservation Practice Standard Sediment Trap (1063) or Ditch Check (1062).

Design to WDNR Conservation Practice Standard Wet Detention Basin (1001) when a permanent stormwater basin is required.

IV. Federal, State, and Local Laws

Users of this standard shall be aware of applicable federal, state, and local laws, rules, regulations, or permit requirements governing the use and placement of sediment basins. This standard does not contain the text of federal, state, or local laws.

V. Criteria

This section establishes the minimum standards for design, installation and performance requirements. Sediment basins meeting these design criteria are deemed 80% effective by design in trapping sediment.

A. **Timing** – Sediment basins shall be constructed prior to disturbance of up-slope areas and placed so they function during all phases of construction. Sediment basins shall be placed in locations where runoff from disturbed areas can be diverted into the basin.

B. **Sizing Criteria** – Properly sized sediment basins are more effective at trapping fine-grained particles than sediment traps. Specific trapping efficiency varies based on the surface area and the particle size distribution of the sediment entering the device. See Figure 1 for clarification of terms. Attachment 1 includes a sample design problem.

1. *Treatment Surface Area* – The surface area of the sediment basin measured at the invert of the lowest outlet. The treatment surface area shall be sized based on the texture of the soil entering the device and the peak outflow during the 1-year, 24-hour design storm using Equation 1:

$$S_a = 1.2 * (q_{out} / v_s)$$

Where:

S_a = Treatment surface area measured at the invert of the lowest outlet of sediment basin (square feet)

q_{out} = Peak outflow (cubic feet / second) during the 1-year, 24-hour design storm for the principal outlet

v_s = Particle settling velocity (feet/second)

1.2 = EPA recommended safety factor.

[1] Words in the standard that are shown in italics are described in X. Definitions. The words are italicized the first time they are used in the text.

Particle settling velocities (*Vs*) shall be based on representative soil class as follows:

a. Soil Class 1: $v_s = 1.2*10^{-3}$ ft/sec
b. Soil Class 2: $v_s = 7.3*10^{-5}$ ft/sec
c. Soil Class 3: $v_s = 1.2*10^{-5}$ ft/sec

Note: Particle settling velocities calculated assuming a specific gravity of 2.65 and a water temperature of 68 degrees Fahrenheit.

Soil Class 1 includes particles greater than 20 microns generally corresponding to sand, loamy sand, and sandy loam.

Soil Class 2 includes particles between 5 and 20 microns generally corresponding to loam, silt, and silt loam aggregates as transported in runoff.

Soil Class 3 includes particles between 2 and 5 microns generally corresponding to clay loam, silty clay, and clay aggregates as transported in runoff.

The representative soil class shall be selected based on the dominant textural class of the soil entering the device.

The treatment surface area of sediment basins can be reduced when used in conjunction with water applied polymers. When employing polymers, size the treatment surface area for controlling fine soils (Class 3) using the settling velocity for medium soils (Class 2). When designing for medium sized soils (Class 2) use the settling velocity for coarse soils (Class 1). See WDNR Conservation Practice Standard Sediment Control Water Application of Polymers (1051) for criteria governing the proper use and selection of polymers.

2. Depth below Treatment Surface Area – The depth below the treatment surface area as measured from the invert of the lowest outlet of the sediment basin shall be a minimum of 5 feet deep (2 feet for sediment storage plus 3 feet to protect against scour/ resuspension) and a maximum of 10 feet deep to limit the potential for thermal stratification.

Due to side slope requirements and safety shelf considerations it maybe difficult to maintain 5 feet of depth for the entire treatment surface area. Therefore, 50% of the total treatment surface area shall be a minimum of 5 feet deep. For basins less than 5,000 square feet, maximize the area of 5 feet depth.

Interior side slopes below the lowest invert shall be 2:1 (horizontal: vertical) or flatter to maintain soil stability.

While a permanent pool of water below the lowest invert may form, it is not required to be maintained through irrigation or installation of a liner system.

3. *Active Storage Volume* – The volume above the treatment surface area shall be calculated using one of the following methods:

   a. The method outlined in TR-55 for determining the storage volume for detention basins. This can be accomplished by using Figure 2 where:

      $\mathbf{q_o}$ = Peak outflow (cubic feet / second) during the 1-year, 24-hour design storm for the principal outlet calculated using Equation 1 (see section V.B.1).

      $\mathbf{q_i}$ = Calculated peak inflow or runoff rate (cubic feet / second) during the 1-year, 24-hour design storm.

      Vr = Calculated volume of runoff from the 1-year 24-hour design storm for the entire contributory area with the maximum area of disturbance characterized as bare soil.

      Vs = Is the required active storage volume determined using Figure 2.

b. The active storage volume may be calculated based on routing the 1-year, 24-hour storm provided the principal outlet requirements stipulated in section V.D.2 are maintained. This method will require the use of a model.

Note: Both these methods require iterative calculations.

4. Shape – The length to width ratio of the flow path shall be maximized with a goal of 3:1 or greater. The flow path is considered the general direction of water flow within the basin including the treatment surface area and any forebay.

C. **Embankments** – Earthen embankments shall be designed to address potential risk and structural integrity issues such as seepage and saturation. All constructed earthen embankments shall meet the following criteria.

1. The base of the embankment shall be stripped of all vegetation, stumps, topsoil and other organic matter.

2. Side slopes shall be 3:1 or flatter. The minimum embankment top width shall be adequate to provide structural stability. Where applicable the top width shall be wide enough to provide maintenance access.

3. There shall be a core trench or key-way along the embankment.

4. Any pipes extending through the embankment shall be bedded and backfilled with equivalent soils used to construct the embankment. The bedding and backfill shall be compacted in lifts and to the same standard as the original embankment. Excavation through a completed embankment shall have a minimum side slope of 1:1 or flatter.

5. Measures shall be taken to minimize seepage along any conduit buried in the embankment.

D. **Outlet** – Sediment basins shall have both a principal outlet and an overflow spillway.

1. Timing – Outlets must be constructed in conjunction with the remainder of the basin and must be constructed prior to the basin receiving runoff. Sediment basins are ineffective until the outlet is constructed.

2. Principal Water Quality Outlet – The principal water quality outlet shall be designed to pass the 1-year 24-hour storm without use of the overflow spillway or other outlet structures. The maximum outflow (q_o) from the principal water quality outlet shall be less than or equal to the q_o used in Equation 1 (V.B.1). If the sediment basin is to serve as a permanent stormwater basin, the principal outlet structure can be modified (i.e. removable plates) to meet flow requirements encountered during and after construction; separate outlet structures do not need to be constructed.

Note: Local ordinances may require control of larger storm events such as the 2-year 24 hour storms. In these cases, additional or compound outlets maybe required.

3. Overflow (Emergency) Spillway – An overflow spillway shall be provided consisting of an open channel constructed adjacent to the embankment and built over a stabilized area. The spillway shall be designed to carry the peak rate of runoff expected from a 10-year, 24-hour design storm or one commensurate with the degree of hazard, less any reduction due to flow in the principal outlet. The top of the embankment shall be at least one foot above the design high water level and a minimum of 1 foot above the invert of the overflow spillway. The overflow spillway shall be protected from erosion. Flow from the overflow spillway shall be directed away from the embankment.

4. Outlet Protection – All outlet designs shall incorporate preventive measures for ice damage, trash accumulation, and erosion at the outfall. For orifices less

than 8-inches in diameter, or equivalent, additional measures to prevent clogging are required.

E. **Inlet Protection** – Inlets shall be designed to prevent scour and reduce velocities during peak flows. Possible design options include flow diffusion, plunge pools, directional berms, baffles, or other energy dissipation structures.

F. **Location** – Temporary sediment basins should be located to provide access for cleanout and disposal of trapped sediment.

G. **Removal** – Temporary sediment basins shall be removed after the contributing drainage area has been stabilized. Complete final grading and restoration according to the site plans. If standing water needs to be removed it shall be done in accordance with WDNR Conservation Practice Standard Dewatering (1061).

VI. Considerations

A. When constructing a sediment basin that will also serve as the long-term stormwater detention pond, build the sediment basin to the larger of the two sizes required either for stormwater control or erosion control. In addition, when sizing the outlet structure first design the outlet for the long-term stormwater management requirements then check to satisfy the flow requirements for sediment control during construction. If additional flow restriction is needed consider use of a temporary restriction plates or other measures to avoid having to construct separate outlet structures for the sediment basin and stormwater basin.

B. Over-excavation beyond the required depth in the sediment storage area of the sediment basin may allow for less frequent maintenance. Addition of other measures in the contributing drainage area may reduce sediment accumulation and associated maintenance requirements.

C. The use of a sediment forebay can extend the useful life of the main sediment storage area by trapping the majority of sediment in the forebay area. Separation of the forebay from the rest of the basin requires construction of a submerged shelf (if wet) or a stone or stabilized earthen embankment. The forebay should have a surface area equal to at least 12% of the total basin area.

D. In addition to soil stability issues, interior slopes of sediment basins should be selected based on safety issues commensurate with the degree of hazard.

VII. Plans and Specifications

A. Plans and specifications for installing sediment basins shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

1. Location of sediment basin
2. Schedules and sequence of installation and removal
3. Standard drawings and installation details
4. Control structure detail and layout
5. Sizing of sediment storage area
6. Maintenance requirements

B. All plans, standard detail drawings, or specifications shall include sequence for installation, inspection, and maintenance requirements. The responsible party shall be identified.

VIII. Operation and Maintenance

Sediment basins shall, at a minimum, be inspected weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24-hour period.

A. Sediment shall be removed to maintain the three foot depth of the treatment surface area as measured from the invert of the principal outlet. Sediment may need to be removed more frequently.

B. If the outlet becomes clogged it shall be cleaned to restore flow capacity.

C. Provisions for proper disposal of the sediment removed shall be made.

D. Maintenance shall be completed as soon as possible with consideration to site conditions.

IX. References

Chapter NR 333, Dam and Design Construction.

Hann, Barfield, and Hayes. Design Hydrology and Sedimentology for Small Catchments. Academic Press Inc., 1994.

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USDA, Natural Resources Conservation Service, Ponds – Planning, Design, Construction. Agriculture Handbook No. 590, Revised September 1997.

WDNR Conservation Practice Standard 1001 Wet Detention Basin.

X. Definitions

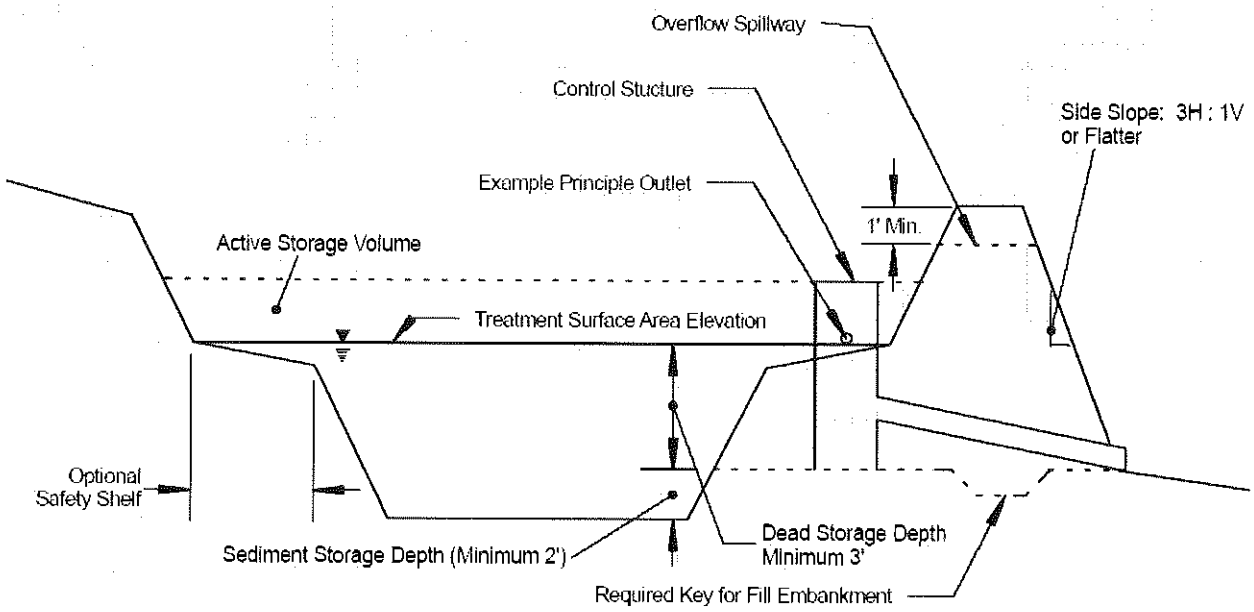
Active Storage Volume (V.B.3) – Is measured from the invert of the lowest outlet to the invert of the emergency spillway.

Stabilized (III) – Means protecting exposed soil from erosion.

Treatment Surface Area (V.B.1) – Is the surface area of the sediment basin measured at the invert of the lowest outlet.

Figure 1:

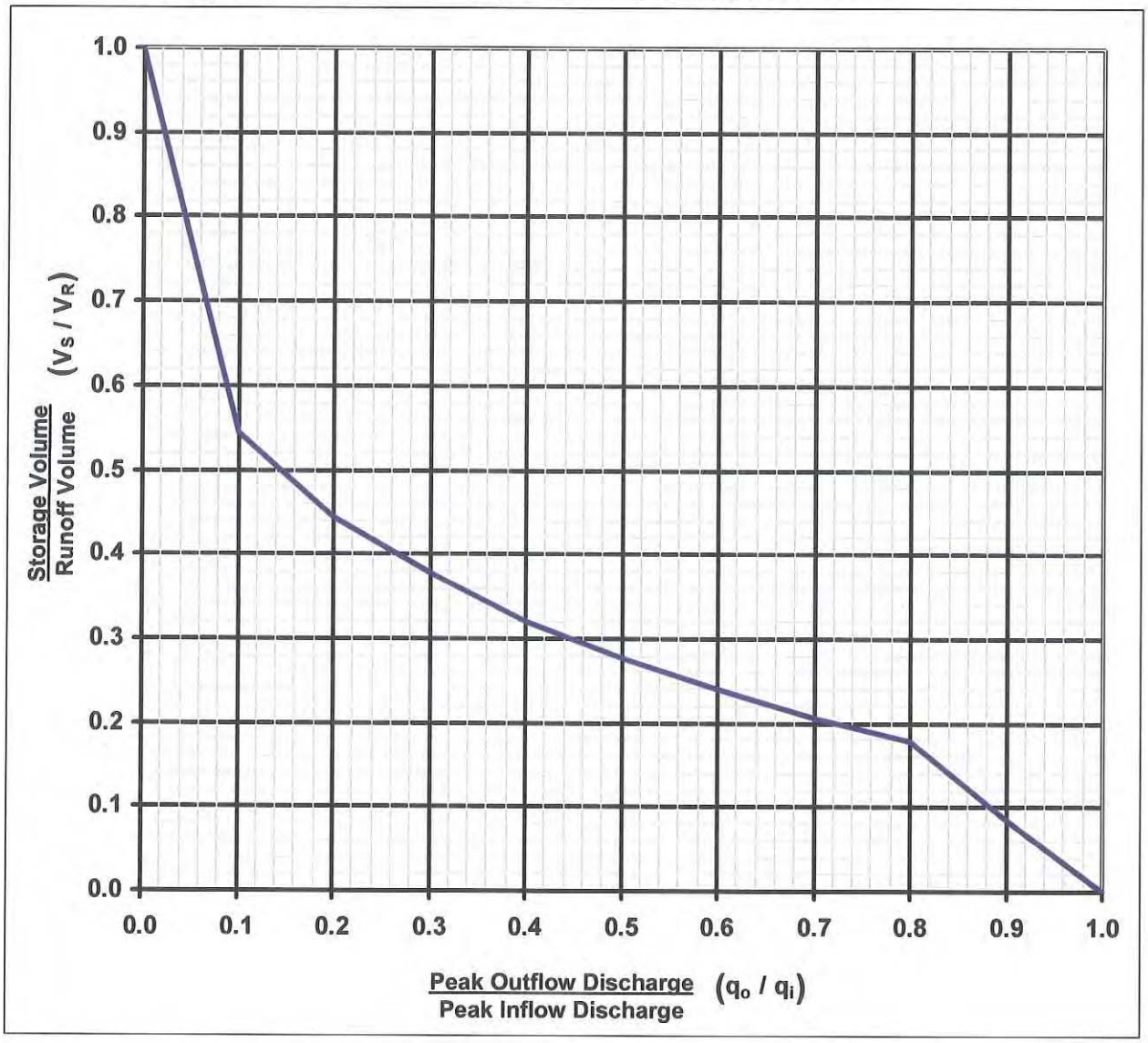
Clarification of Sediment Basin Terminology



Note: Features illustrated are for the purpose of defining terms used in the standard. The Drawing is not to scale.

Figure 2:

Approximate Detention Basin Routing for Type II Storms



Source: Technical Release 55, United States Department of Agriculture, Natural Resources Conservation Service. Washington D.C. 1988.

Rainfall Quantities:

Table 1 provides a summary of the 1-year, 24-hour rainfall totals using NRCS mandated TP-40 which has not been updated since 1961. Table 2 provides a summary of more current data from the Rainfall Frequency Atlas of the Midwest published in 1992. Local requirements may dictate the use of one dataset over the other.

Table 1 - Rainfall for Wisconsin Counties for a 1 - year, 24 - hour Rainfall[1]

Inches of Rainfall	County
2.1 in.	Door, Florence, Forest, Kewaunee, Marinette, Oconto, Vilas
2.2 in.	Ashland, Bayfield, Brown, Calumet, Douglas, Iron, Langlade, Lincoln, Manitowoc, Menominee, Oneida, Outagamie, Price, Shawano, Sheboygan
2.3 in.	Barron, Burnett, Dodge, Fond du Lac, Green Lake, Marathon, Milwaukee, Ozaukee, Portage, Racine, Rusk, Sawyer, Taylor, Washburn, Washington, Waukesha, Waupaca, Waushara, Winnebago, Wood
2.4 in.	Adams, Chippewa, Clark, Columbia, Dane, Dunn, Eau Claire, Jackson, Jefferson, Juneau, Kenosha, Marquette, Pepin, Pierce, Polk, Rock, St. Croix, Walworth
2.5 in.	Buffalo, Green, Iowa, La Crosse, Monroe, Richland, Sauk, Trempealeau, Vernon
2.6 in.	Crawford, Grant, Lafayette

[1]TP - 40 - Rainfall Frequency Atlas of the United States, U.S. Department of Commerce Weather Bureau.

Table 2 - Rainfall for Wisconsin Counties for a 1 - year, 24 - hour Rainfall[2]

Zone	Inches of Rainfall	County
1	2.22	Douglas, Bayfield, Burnett, Washburn, Sawyer, Polk, Barron, Rusk, Chippewa, Eau Claire
2	2.21	Ashland, Iron, Vilas, Price, Oneida, Taylor, Lincoln, Clark, Marathon
3	1.90	Florence, Forest, Marinette, Langlade, Menominee, Oconto, Door, Shawano
4	2.23	St. Croix, Dunn, Pierce, Pepin, Buffalo, Trempealeau, Jackson, La Crosse, Monroe
5	2.15	Wood, Portage, Waupaca, Juneau, Adams, Waushara, Marquette, Green Lake
6	1.96	Outagamie, Brown, Kewaunee, Winnebago, Calumet, Manitowac, Fond Du Lac, Sheboygan
7	2.25	Vernon, Crawford, Richland, Sauk, Grant, Iowa, Lafayette
8	2.25	Columbia, Dodge, Dane, Jefferson, Green, Rock
9	2.18	Ozaukee, Washington, Waukesha, Milwaukee, Walworth, Racine, Kenosha

[2]Bulletin 71: Rainfall Frequency Atlas of the Midwest, Midwest Climate Center and Illinois State Water Survey, 1992.

Attachment 1:
Sample Sediment Basin Design Problem

The proper sizing and design of a sediment basin will often require iterative calculations. The technical standard for sizing sediment basins was written to give the designer as much flexibility as possible in designing the basin while meeting water quality requirements. The governing equation relates the surface area of the sediment basin to the outflow and critical particle settling velocity. The larger the sediment basin outflow, the larger the surface area required to settle the particle. As the outflow is reduced, a smaller surface area is required however the required storage volume dictates how small a surface area can become through the storage depth or hydraulic head acting on the outlet.

The particle settling velocities are listed in the standard requiring the designer to either start with a desired outflow based on an outlet size or an estimated starting surface area. The sample equation below starts with an estimated surface area.

Sample Problem:

A 10 acre site is being developed into condos. Eight acres of the site are being disturbed while 2 acres of forest are remaining undisturbed. The dominate soils on the site are silt loam. The 1-year, 24-hour design storm is 2.25 inches.

Step 1: Calculate runoff volume and peak using TR-55 or approved method.

From TR-55 the curve number (CN) for the disturbed area is 86 and the CN for the forested area is 55 resulting in a composite CN of 80. Using TR-55, the runoff volume calculated for the 1-year 24-hour design storm is 0.7 inches (0.6 acre-feet for the entire 10-acre site). The time of concentration was calculated as 0.4 hours resulting in a peak flow of 6 cfs.

Step 2: Begin sizing sediment basin using Equation 1. The technical standard lists silt loam under particle class 2 with a settling velocity of $7.3*10^{-5}$ ft/sec. We are also going to assume a starting surface area of 0.25 acres (10,890 ft^2). An alternative approach is to assume an outflow velocity.

$SA = 1.2 * (q_{out} / v_s)$
Solve for q_{out}: $10{,}980\ ft^2 = 1.2 * (q_{out} / 7.3*10^{-5}\ ft/sec)$
$q_{out} = 0.67$ cfs

Step 3: Using Figure 2: Approximate Detention Basin Routing for Type II Storms determines the volume of storage (V_S) needed.

$q_{out} = 0.67$ cfs (calculated in Step 2)
$q_{in} = 6.0$ cfs (peak flow calculated using TR-55 in Step 1)
$V_R = 0.6$ acre-feet (volume of runoff calculated using TR-55 in Step 1)
$q_{out} / q_{in} = 0.67$ cfs / 6.0 cfs = 0.11. Using Figure 2 with a $q_{out} / q_{in} = 0.11$, the V_S/V_R is determined to be 0.54. Therefore the $V_S = 0.54 * 0.6$ acre-feet = 0.324 acre-feet (14,113 ft^3)

Step 4: Check configuration: Calculate maximum head on outlet using surface area and volume.

SA = 10,890 ft^2 and a $V_S = 14{,}113\ ft^3$ we get a depth (H) of 1.29 feet = 14,113 ft^3 / 10,890 ft^2

Step 5: Size Outlet: Assuming an orifice type outlet calculate the size needed to meet the q_{out} calculated in Step 1 and the H calculated in Step 4.

Using the orifice equation: $q_{out} = C*A*(2gH)^{1/2}$ with C=0.6 (coefficient) , A = Area = ft^2, g = 32.2, and H = hydraulic head expressed in feet.

$q_{out} = 0.6*A*(2*32.2*H)^{1/2}$ so $0.66 = 0.6*A*(2*32.2*1.29)^{1/2}$ therefore A = .12 ft^2

An area of 0.12 ft^2 corresponds to an orifice outlet of 4.7 inches in diameter.

Step 6: Iteration: While the above solution works, the sediment basin has not been optimally sized and we have an orifice diameter that is not a standard pipe size. An iterative approach can be used to reduce the surface area of the sediment basin and obtain a more common orifice diameter. We can assume a 4-inch orifice since it is close to diameter calculated in Step 5 and we can start with the depth we calculated in Step 4. The iterations below each represent Steps 2 through 5.

Iteration 1:

$q_{out} = 0.43\ (H)^{1/2} = 0.43\ (1.29)^{1/2} = 0.48$ cfs which is less than the 0.66 cfs calculated in Step 1. Therefore, we can go back to Step 1 and repeat the sizing procedure and downsize the sediment basin.

$SA = 1.2 * (q_{out} / v_s) = 1.2 * (0.48\ cfs / 7.3*10^{-5}\ ft/sec) = 7{,}890\ ft^2$

Using Figure 2:
$q_{out} = 0.48$ cfs
$q_{in} = 6.0$ cfs (peak flow calculated using TR-55 in Step 1)
$V_R = 0.6$ acre-feet (volume of runoff calculated using TR-55 in Step 1)

$q_{out} / q_{in} = 0.48$ cfs / 6.0 cfs = 0.08. Using Figure 2 with a $q_{out} / q_{in} = 0.08$, the V_S/V_R is determined to be 0.62. Therefore the $V_S = 0.62 * 0.6$ acre-feet = 0.372 acre-feet (16,204 ft^3)

SA = 7,890 ft^2 and a $V_S = 16{,}204\ ft^3$ we get a depth (H) of 2.05 feet = 16,204 ft^3 / 7,890 ft^2

$q_{out} = 0.43\ (H)^{1/2} = 0.43\ (2.05)^{1/2} = 0.61$ cfs which is more than the 0.48 cfs we used so iterate.

Iteration 2:

$SA = 1.2 * (q_{out} / v_s) = 1.2 * (0.61\ cfs / 7.3*10^{-5}\ ft/sec) = 10{,}027\ ft^2$

Using Figure 2:
$q_{out} = 0.61$ cfs
$q_{in} = 6.0$ cfs (peak flow calculated using TR-55 in Step 1)
$V_R = 0.6$ acre-feet (volume of runoff calculated using TR-55 in Step 1)

$q_{out} / q_{in} = 0.61$ cfs / 6.0 cfs = 0.10 Using Figure 2 with a $q_{out} / q_{in} = 0.10$, the V_S/V_R is determined to be 0.54. Therefore the $V_S = 0.54 * 0.6$ acre-feet = 0.324 acre-feet (14,113 ft^3)

SA = 10,027 ft^2 and a $V_S = 14{,}113\ ft^3$ we get a depth (H) of 1.41 feet = 14,113 ft^3 / 10,027 ft^2

$q_{out} = 0.43\ (H)^{1/2} = 0.43\ (1.41)^{1/2} = 0.51$ cfs which is less than the 0.61 cfs we used so we are OK or we can iterate again until we have q_{out} that are almost identical.

After Iteration 2, we have a sediment basin with a SA = 10,027 ft^2 and a $V_S = 14{,}113\ ft^3$. We have a principal water quality outlet consisting of a 4-inch orifice. This design meets the water quality requirements of the technical standard.

Construction Site Diversion
(1066)

Wisconsin Department of Natural Resources
Conservation Practice Standard

I. Definition

A *temporary*[1] berm or channel constructed across a slope to collect and divert runoff.

II. Purpose

To intercept, divert, and safely convey runoff at construction sites in order to divert clean water away from disturbed areas, or redirect sediment laden waters to an appropriate sediment control facility.

III. Conditions Where Practice Applies

A. This practice is applicable to construction sites where temporary surface water runoff control or management is needed. Locations and conditions include:

1. Above disturbed areas, to limit runoff onto the site.
2. Across slopes to reduce slope length.
3. Below slopes to divert excess runoff to stabilized outlets.
4. To divert sediment-laden water to sediment control facilities.
5. At or near the perimeter of the construction area to keep sediment from leaving the site.

B. This standard does not pertain to permanent diversions. Refer to appropriate design criteria and local regulations when designing permanent diversions.

IV. Federal, State, and Local Laws

Users of this standard shall be aware of applicable federal, state, and local laws, rules, regulations, or permit requirements governing the use and placement of this practice. This standard does not contain the text of federal, state, or local laws.

V. Criteria

A. The diversion shall have stable side slopes and shall not be overtopped during a 2-year frequency, 24-hour duration storm. The minimum berm cross section shall be as follows:

1. Side slopes of 2:1 (horizontal:vertical) or flatter.
2. Top width of two feet.
3. Berm height of 1.5 feet.

B. Sediment-laden runoff from disturbed areas shall be diverted into a sediment control practice. For typical sediment control practices see WDNR Conservation Practice Standards Sediment Trap (1063) or Sediment Basin (1065) for design criteria.

C. When diverting clean water the diversion channel and its outfall shall be immediately *stabilized* for the 2-year frequency, 24-hour duration storm. Build and stabilize clean water diversions before initiating down slope land-disturbing activities.

D. Diversions shall be protected from damage by construction activities. At all points where diversion berms or channels will be crossed by construction equipment, the diversion shall be stabilized or shaped appropriately. Temporary culverts of adequate capacity may be used.

E. For diversions that are to serve longer than 30 days, the side slopes including the ridge, and down slope side the diversion shall be stabilized as soon as they are constructed. The diversion channel should be stabilized (i.e. erosion mat) or a larger sediment control practice shall be needed. For diversions serving less than 30 days, the

[1] Words in the standard that are shown in italics are described in IX. Definitions. The words are italicized the first time they are used in the text. Definitions apply to concepts found in this document and may not apply in other situations.

down slope side of the diversion shall be stabilized as soon as constructed.

VI. Considerations

A. The channel cross section may be parabolic, v-shaped or trapezoidal. The use of "V" channels is generally discouraged due to potential erosion problems.

B. Ditch checks may be used to enhance sediment removal. Ditch checks shall be designed in accordance with WDNR Conservation Practice Standard Ditch Check (1062).

C. For diversion berms consider designing an emergency overflow section or bypass area to limit damage from storms that exceed the 2-year frequency 24-hour duration storm. The overflow section may be designed as a stabilized weir with riprap protection.

VII. Plans and Specifications

A. Plans and specifications for installing diversions shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. The plans and specifications shall address the following:

1. Diversion location.
2. Channel grade or elevations.
3. Typical cross section.
4. Channel stabilization if required.

B. All plans, standard detail drawings, or specifications shall include schedule for installation, inspection, and maintenance. The responsible party shall be identified.

VIII. Operation and Maintenance

A. Diversions shall, at a minimum, be inspected weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24-hour period.

B. Maintenance shall be completed as soon as possible with consideration to site conditions.

C. Accumulated sediment shall be removed when it reaches one half the height of the diversion berm. Properly dispose of any sediment removed from the diversion.

D. Diversions shall be removed and the area stabilized according to construction plans.

IX. Definitions

Temporary (I): an erosion control measure that is utilized during construction and grading operations prior to final stabilization.

Stabilized (V.C): means protecting exposed soil from erosion.

Operation & Maintenance Plan

1064 Sediment Basins

1. Measure bottom elevation of pond and log elevation to chart rate of sediment fill on an annual basis or after signs of major erosion in the contributing area.

2. Plan depth is 5 feet. When depth below outlet is 3.5 feet or less restore basin to plan grades.

3. Check the elevation of the emergency spillway after the first year and every two years thereafter for signs of settlement and restore to plan elevation.

4. Inspect inlets and outlets for signs of erosion. Repair as necessary. Inspect emergency spillway after any event where water passes.

5. Ensure a healthy turf establishment on the slope inside and outside of the basin.

6. Mow embankment to prevent the establishment of woody vegetation. Do not plant trees on the embankment. Inspect annually for animal burrows. Fill in burrows after eliminating vermin. Inspect for slumping, rilling, subsidence, or other signs of failure on side slopes and embankments. Repair as necessary.

7. Do not use fish as an agent for mosquito control. Consult with DNR before employing any mosquito control program. The following EPA website has information on mosquito control: http://www.epa.gov/pesticides/health/mosquitoes/larvicides4mosquitoes.htm.

8. Remove accumulated trash or debris to prevent plugging of outlet.

9. Inspect for and repair slumping, rilling, subsidence, or other signs of failure on side slopes and embankments.

1066 Construction Site Diversions

1. Diversions shall, at a minimum, be inspected weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24-hour period.

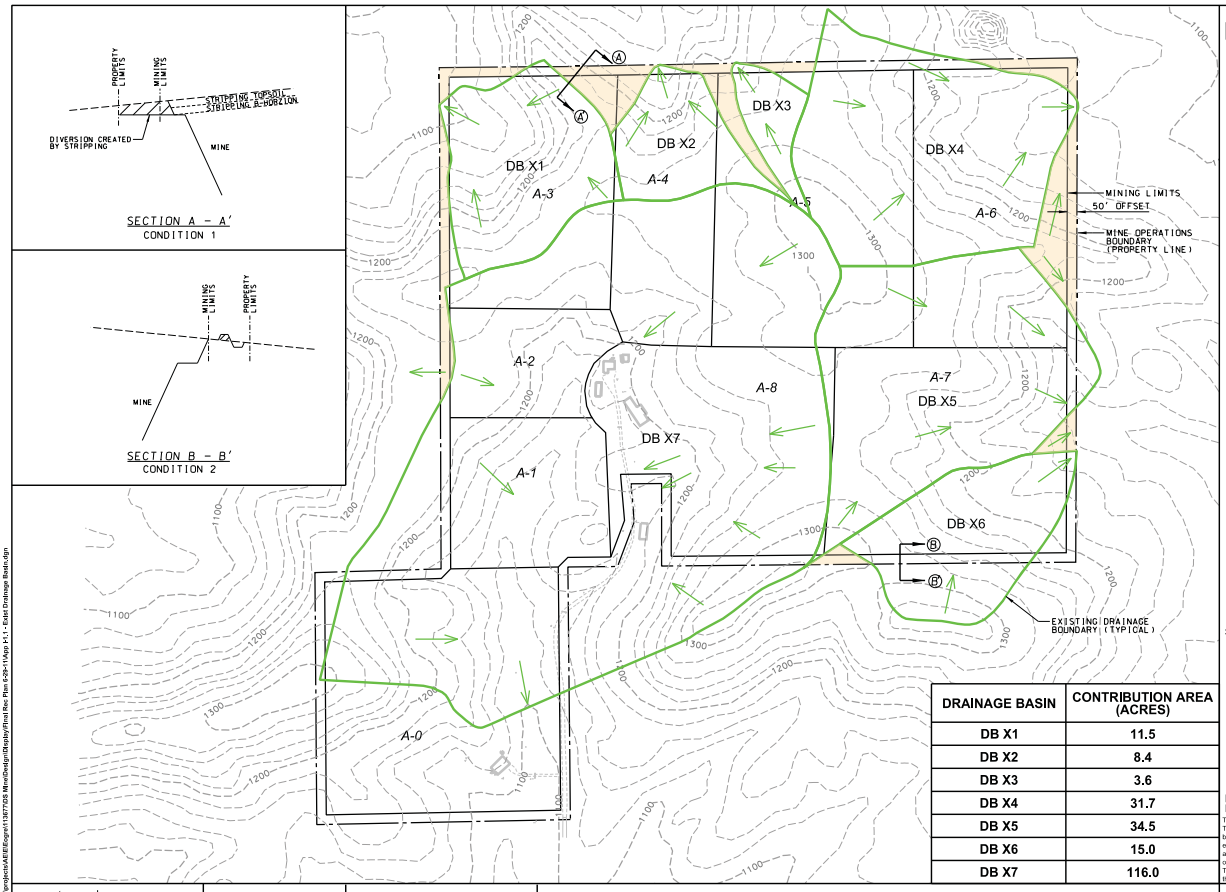
2. Maintenance shall be completed as soon as possible with consideration to site conditions.

3. Accumulated sediment shall be removed when it reaches one half the height of the diversion berm.

4. Properly dispose of any sediment removed from the diversion.

5. Inspect for and repair slumping, rilling, subsidence, or other signs of failure on side slopes and channel. If persistent erosion prevents stabilization, re-evaluate the liner and upgrade to a more erosion resistant system.

I-1 – Water Quality Plan Figures



Legend

A = MINING AREA

DB = DRAINAGE BASIN

(⟵) = RUNOFF DIRECTION

(▭) = FLANK RUNOFF AREAS

N

500 250 0 500 Feet

Source:
USGS QUAD 20' CONTOUR INTERVAL
CHIPPEWA COUNTY PARCEL MAPS

DRAINAGE BASIN	CONTRIBUTION AREA (ACRES)
DB X1	11.5
DB X2	8.4
DB X3	3.6
DB X4	31.7
DB X5	34.5
DB X6	15.0
DB X7	116.0

Map by:
MJS

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DATE: 06/29/11

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DS MINE

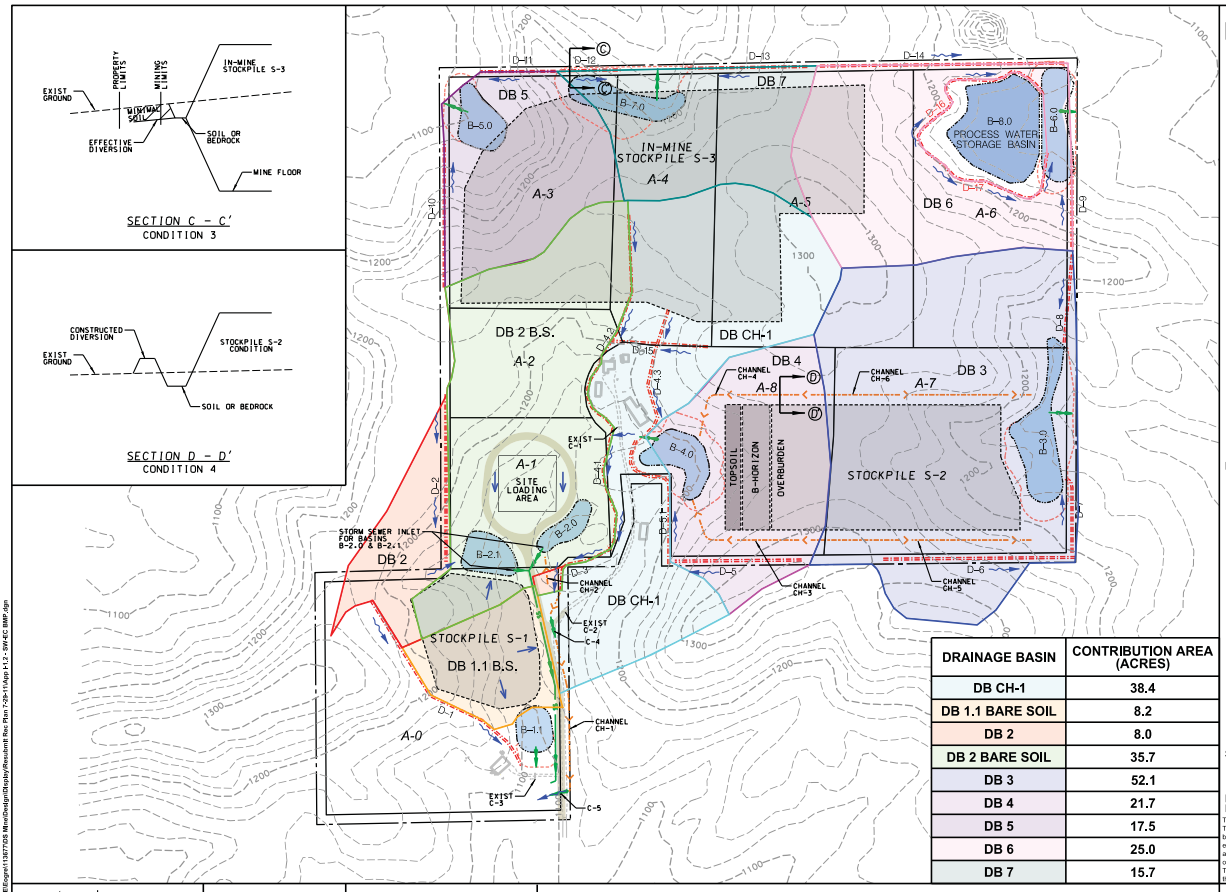
TOWN OF COOKS VALLEY, WI

EXISTING DRAINAGE BASINS

APPENDIX FIGURE

I-1.1

Map Document: I:\environ\projects\AEI\Edgar\113677\05 Mine\Design\Display\Final Rev Plan 6-28-11\Map I-1.1 - Exist Drainage Basin.dgn



Legend

A = MINING AREA

B = BASIN

(▭) GRAVITY FED TEMPORARY SEDIMENT BASIN WITH OUTLET

(▭) PUMP FED PROCESS WATER STORAGE BASIN NO OUTLET

C = CULVERT

CH = CHANNELS (---> --)

D = DIVERSION (=:=:=:=)

DB = DRAINAGE BASIN

S = STOCKPILE (▭)

= DIVERSION FLOW DIRECTION

= RUNOFF DIRECTION

-- SS -- = STORM SEWER

= SEDIMENT BASIN OUTLET

= APPROX. BASIN GRADING LIMITS

NOTES:

1. DIVERSION D-15 INSTALLED BEFORE STRIPPING COMMENCES IN AREA A-4.

N

500 250 0 500 Feet

DRAINAGE BASIN	CONTRIBUTION AREA (ACRES)
DB CH-1	38.4
DB 1.1 BARE SOIL	8.2
DB 2	8.0
DB 2 BARE SOIL	35.7
DB 3	52.1
DB 4	21.7
DB 5	17.5
DB 6	25.0
DB 7	15.7

Source:
USGS QUAD 20' CONTOUR INTERVAL
CHIPPEWA COUNTY PARCEL MAPS

Map by:
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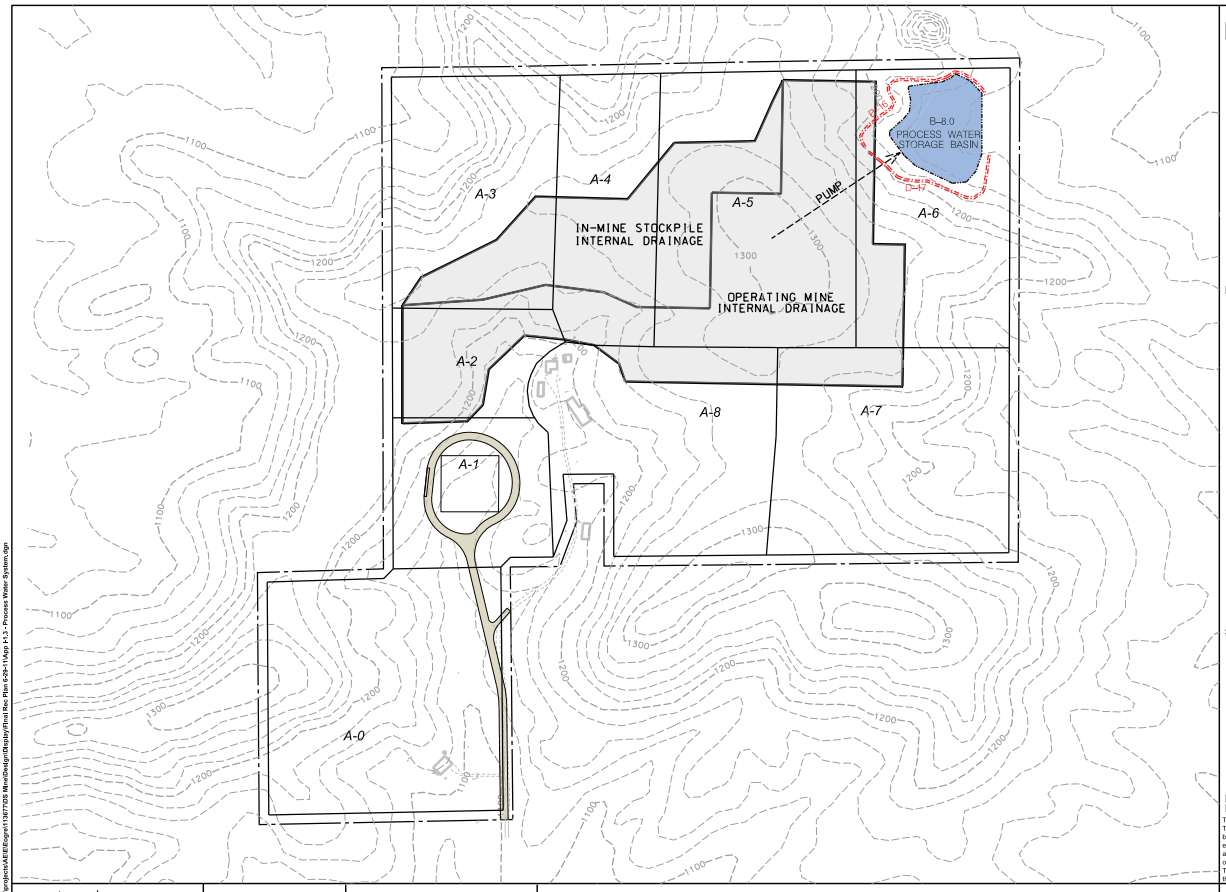
COMPOSITE WATER QUALITY CONTROL PLAN

APPENDIX FIGURE

I-1.2

Map Document: P:\AEE\Eogresl\113677\05 Mine\Design\Graphic\Renclaim\ Rec Plan 7-29-11\Maps I-1.2 - SW-EC BMP.dgn



Legend

A = MINING AREA

B = BASIN ( )

C = CULVERT

D = DIVERSION ( )

NOTES:

1. B-8.0 WILL BE INSTALLED IN ACCORDANCE WITH THE INITIAL SEQUENCE TABLE OF APPENDIX I. AS MINING ENCOMPASSES B-8.0 IT WILL BE REPLACED AS NECESSARY.

N

500 250 0 500 Feet

Source:

USGS QUAD 20' CONTOUR INTERVAL
CHIPPEWA COUNTY PARCEL MAPS

Map by:
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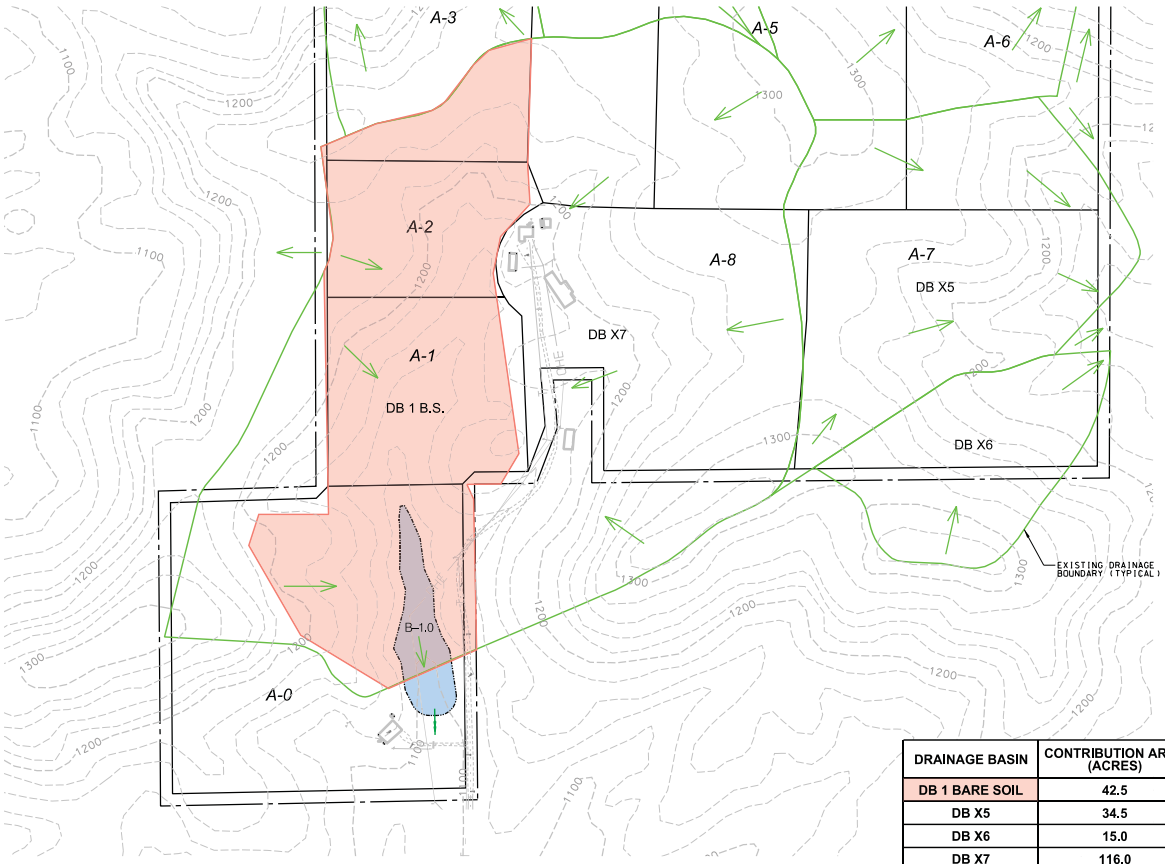
TOWN OF COOKS VALLEY, WI

PROCESS WATER SYSTEM

APPENDIX FIGURE

I-1.3

Map Document: I:\sehinfoprojects\AEE\Eogen\113677\05 Mine\Design\Display\Final Rev Plan 6-28-11\App I-1.3 - Process Water System.dgn



DRAINAGE BASIN	CONTRIBUTION AREA (ACRES)
DB 1 BARE SOIL	42.5
DB X5	34.5
DB X6	15.0
DB X7	116.0

Legend

A = MINING AREA

B = BASIN ( )

DB = DRAINAGE BASIN

NOTES:

GRADING CONTOURS ARE APPROXIMATE AND BASED ON USGS 20' INTERVAL CONTOURS. DETAILED ENGINEERING AND TOPOGRAPHIC SURVEY IS REQUIRED FOR FINAL DESIGN AND LAYOUT.

N

400 200 0 400 Feet

Source:

USGS QUAD 20' CONTOUR INTERVAL
CHIPPEWA COUNTY PARCEL MAPS

Map by:
MJS

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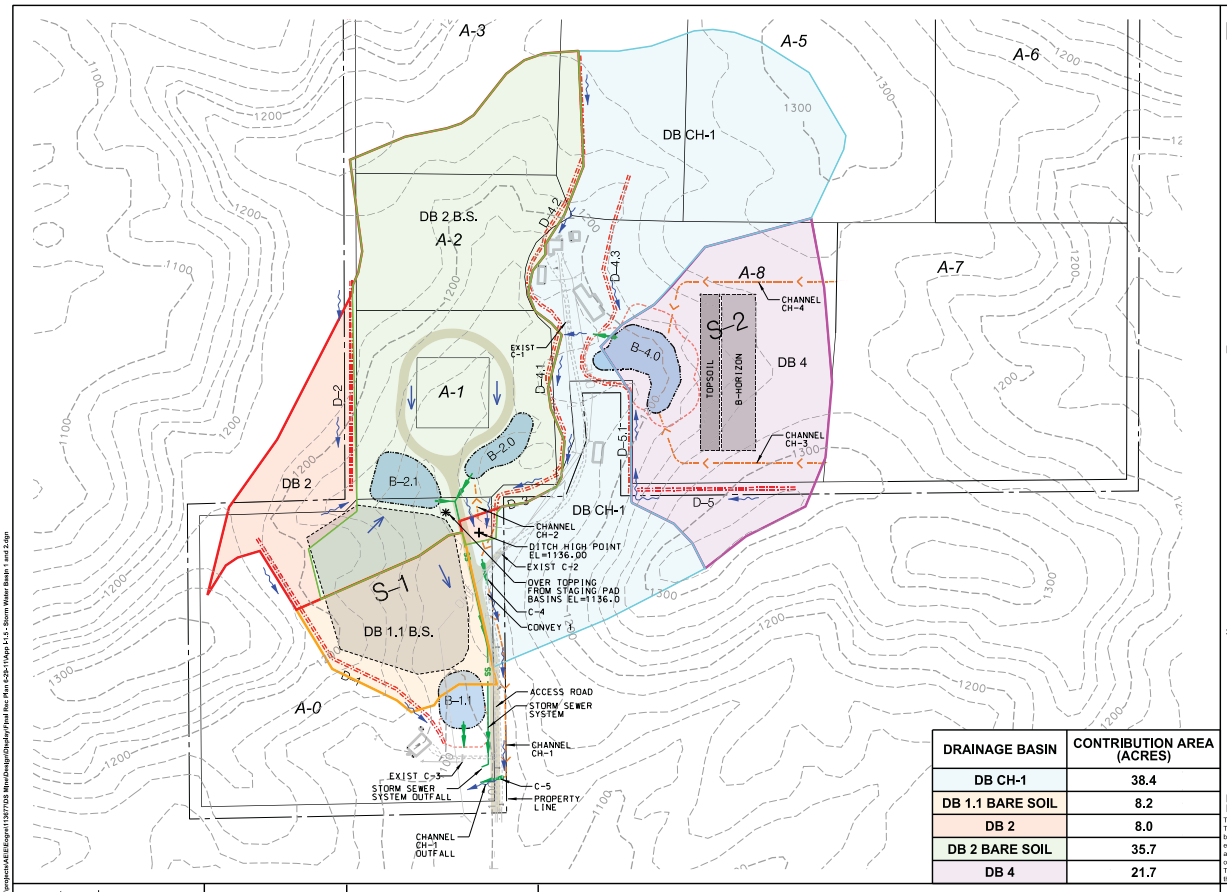
SEDIMENT BASIN B-1.0

APPENDIX FIGURE

I-1.4

Map Document: I:\sehinc\projects\AEE\Engen\113677\DS Mine\Design\Display\Final Rec Mon 6-28-11\App 1-1.4 - Storm Water Basin 1.dgn



DRAINAGE BASIN	CONTRIBUTION AREA (ACRES)
DB CH-1	38.4
DB 1.1 BARE SOIL	8.2
DB 2	8.0
DB 2 BARE SOIL	35.7
DB 4	21.7

Legend

A = MINING AREA
B = BASIN ( )
C = CULVERT
CH = CHANNELS ( )
D = DIVERSION ( )
DB = DRAINAGE BASIN
S = STOCKPILE ( )
= DIVERSION FLOW DIRECTION
= RUNOFF DIRECTION
= STORM SEWER
= APPROX. BASIN GRADING LIMITS

NOTES:

1. GRADING CONTOURS ARE APPROXIMATE AND BASED ON USGS 20' INTERVAL CONTOURS. DETAILED ENGINEERING AND TOPOGRAPHIC SURVEY IS REQUIRED FOR FINAL DESIGN AND LAYOUT.
2. SEE INITIAL SEQUENCE TABLE.

N

400 200 0 400 Feet

Source:
USGS QUAD 20' CONTOUR INTERVAL
CHIPPEWA COUNTY PARCEL MAPS

Map by:
MJS

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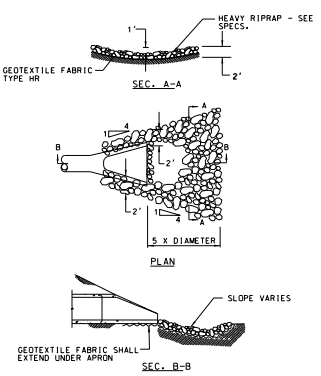
TOWN OF COOKS VALLEY, WI

SEDIMENT BASIN
B-1.1, B-2.0, B-2.1, & B-4.0

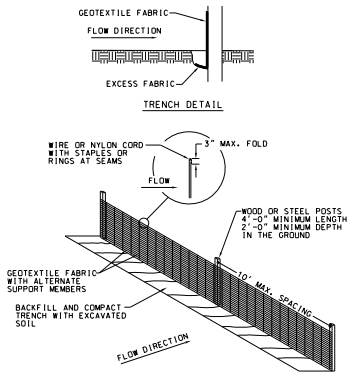
APPENDIX FIGURE
I-1.5

Map Document: I:\dwr\projects\AEE\Eogar\113677\05 Mine\Design\Display\psd Rec Mon 6-29-11\App I-1.5 - Storm Water Basin 1 and 2.dgn

I-2 – Typical Erosion Control Measures

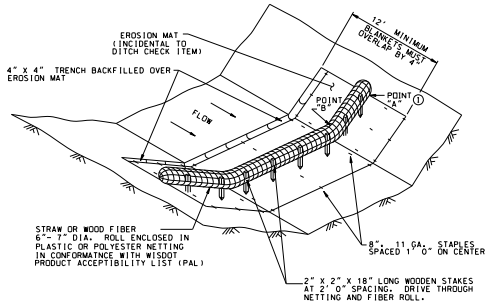


RIPRAP AT R.C.P. APRONS



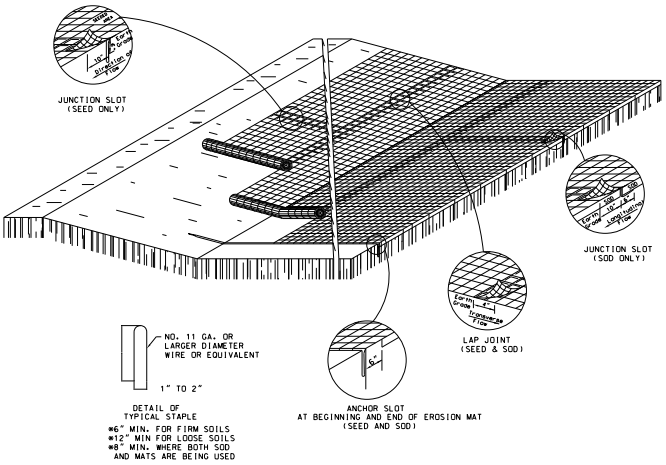
COMPLY WITH WDNR STORM WATER MANAGEMENT TECHNICAL STANDARD 1056.

SILT FENCE



① POINT "A" MUST BE 1' HIGHER (MIN) THAN POINT "B" TO ENSURE THAT WATER FLOWS OVER THE DIKE AND NOT AROUND THE ENDS.

EROSION LOG DITCH CHECK



EROSION CONTROL

GENERAL NOTES: DETAILS OF CONSTRUCTION, MATERIALS AND WORKMANSHIP NOT SHOWN ON THIS DRAWING SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF THE STANDARD SPECIFICATIONS AND THE APPLICABLE SPECIAL SPECIFICATIONS.

VARIATIONS IN THE DIMENSIONS OF MATERIALS SHOWN HEREON SHALL BE PERMITTED IF THEY PROVIDE EQUIVALENT PROTECTION AND MATERIAL STRENGTH AND IF PRIOR APPROVAL OF THE ENGINEER IS OBTAINED.

LAP JOINTS SHALL NOT BE PLACED IN THE BOTTOM OF V-SHAPED DITCHED.

JUNCTION SLOTS ON ADJACENT STRIPS OF MATTING SHALL BE STAGGERED A MINIMUM OF 4 FEET APART.

EDGES OF THE EROSION MAT SHALL BE IMPRESSED IN THE SOIL.

EROSION MAT SHALL BE MEASURED AND PAYED FOR IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.

EROSION MAT OVER SOD:
- A: ONLY JUTE FABRIC WILL BE PERMITTED OVER SOD.
- B: ROAD STAKES FOR THE SOD MAY BE OMITTED BY THE ENGINEER IF THE EXISTING SLOPE AND SOIL CONDITIONS SO WARRANT.
- C: THE WIDTH OF EROSION MAT SHALL ALWAYS EQUAL THE SOD WIDTH.
- D: SOD STRIPS MAY BE PLACED EITHER LONGITUDINALLY OR TRANSVERSELY TO THE FLOW LINE OF THE DITCH.

EROSION MAT OVER SEEDING: JUNCTION OR ANCHOR SLOTS SHALL BE AT MINIMUM INTERVALS OF 100 FEET ON GRADES UP TO AND INCLUDING 3 PERCENT, AND 50 FEET ON GRADES EXCEEDING 3 PERCENT.

COMPLY WITH WDNR STORM WATER MANAGEMENT TECHNICAL STANDARD 1052 AND 1053.

EROSION MAT AND SOD

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DATE: 06/29/11

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DS MINE

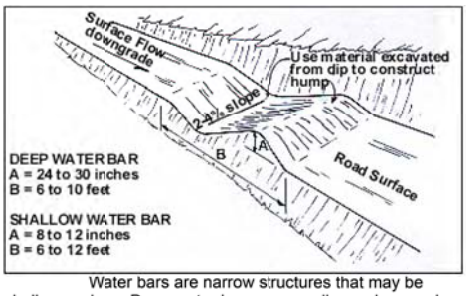
TOWN OF COOKS VALLEY, WI

TYPICAL EROSION CONTROL MEASURES

APPENDIX FIGURE

I-2.1

Map Document: I:\sfn\projects\AEE\Eogw\113677DS Mine\Design\Dhdsky\Final Rec Plan 6-29-11\App I-2 - Typ Eros Ctrl Measures.dgn



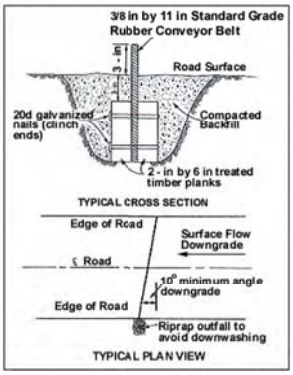
Water bars are narrow structures that may be shallow or deep. Deep water bars are usually used on roads that will be closed for extended periods.

Distance needed between water bars

Road grade (percent)	Distance (feet)
2	250
5	135
10	80
15	60
20	45
25	40
30	35

Source: Kochenderfer 1970, p. 28

SOURCE:
A LANDOWNER'S GUIDE TO BUILDING FOREST ACCESS ROADS: ROAD CONSTRUCTION
US DEPARTMENT OF AGRICULTURE - FOREST SERVICE
RICHARD L. WIEST
PUBLICATION NA-TP-06-98
RANDOR, PA - JULY 1998



SOURCE:
A LANDOWNER'S GUIDE TO BUILDING FOREST ACCESS ROADS: ROAD CONSTRUCTION
US DEPARTMENT OF AGRICULTURE - FOREST SERVICE
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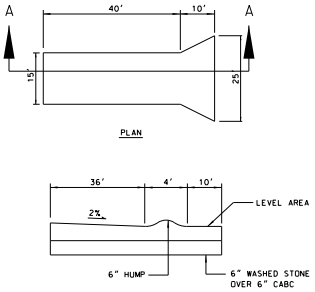


NOTE: MAINTAIN TRACKING PAD IN GOOD CONDITION TO PREVENT MUD OR SEDIMENT FROM LEAVING SITE. CLEAN UP & REMOVE ANY TRACKED MUD OR SEDIMENT LEAVING SITE IMMEDIATELY.

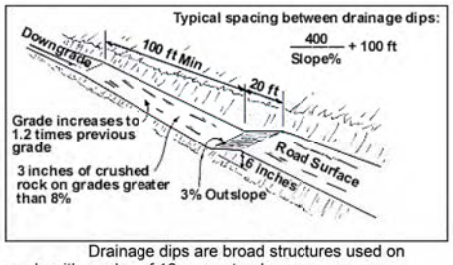
COMPLY WITH WDNR STORM WATER MANAGEMENT TECHNICAL STANDARD 1057.

TRACKING PAD

Distance needed between water bars

Road grade (percent)	Distance (feet)
2 - 4	300 - 200
5 - 7	180 - 160
8 - 10	150 - 140

Source: Kochenderfer 1970, p. 19, 25



Drainage dips are broad structures used on roads with grades of 10 percent or less.

SOURCE:
A LANDOWNER'S GUIDE TO BUILDING FOREST ACCESS ROADS: ROAD CONSTRUCTION
US DEPARTMENT OF AGRICULTURE - FOREST SERVICE
RICHARD L. WIEST
PUBLICATION NA-TP-06-98
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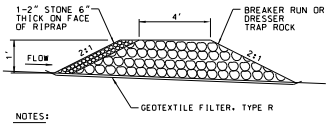
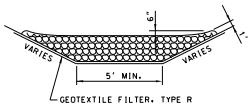


NOTES:

KEY DITCH CHECK INTO SIDE SLOPES AND BOTTOM OF DITCH

SPACE DITCH CHECKS SO THAT THE TOP OF THE DITCH CHECK MATCHES THE DOWNSTREAM TOESLOPE OF THE UPSTREAM DITCH CHECK



STONE DITCH CHECK

Map Document: \\Sehfs\projects\AEE\Eogsc\113677DS Mine\Design\Dhabay\Final Rec Plan 5-25-11\App I-2 - Typ Eros Ctrl Measures.dgn

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PROJECT: 113677

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DS MINE

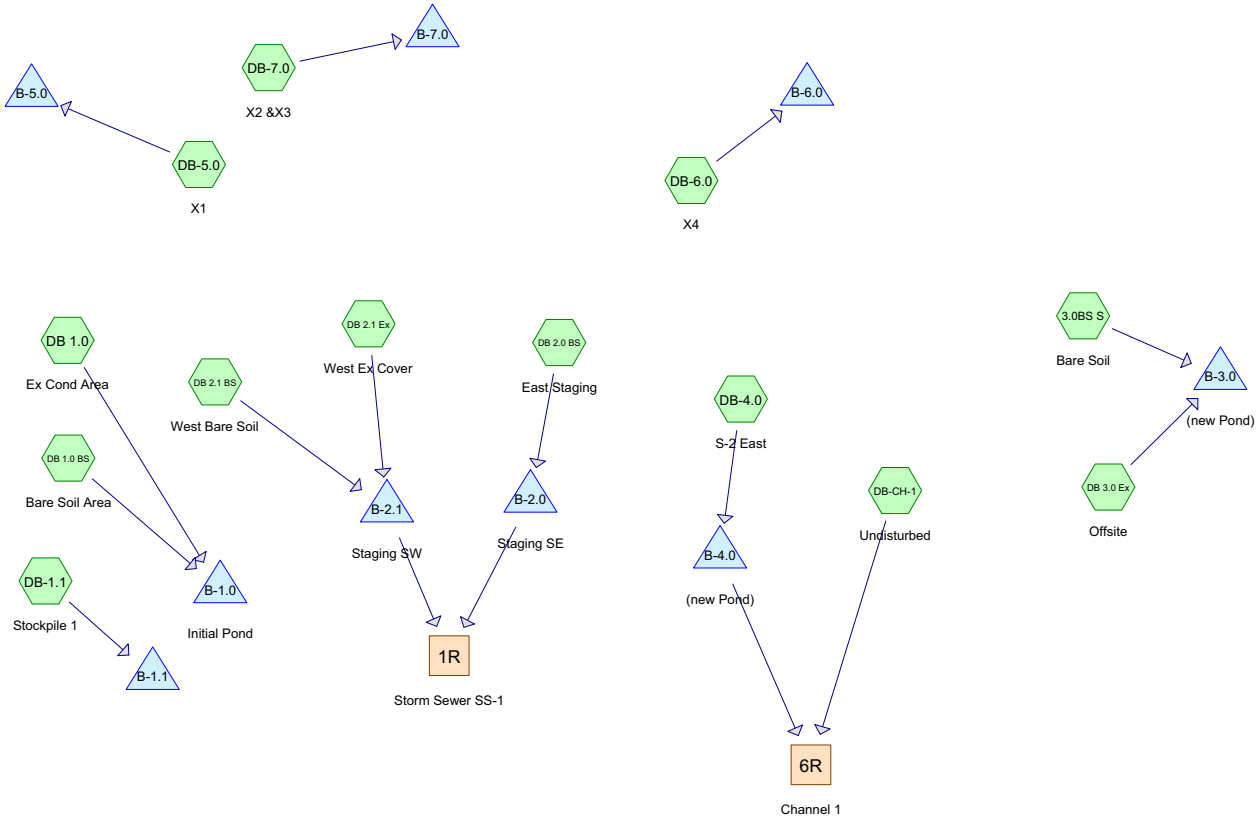
TOWN OF COOKS VALLEY, WI

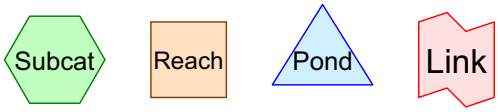
TYPICAL EROSION CONTROL MEASURES

APPENDIX FIGURE

I-2.2

I-3 – Calculations





Drainage Diagram for Treatment Pond Sizing
Prepared by SEH D|B, Printed 7/29/2011
HydroCAD® 9.10 s/n 00946 © 2009 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.320	30	Meadow, non-grazed, HSG A (DB 1.0)
9.450	30	Woods, Good, HSG A (DB 1.0, DB 2.1 Ex)
4.350	36	Woods, Fair, HSG A (DB 3.0 Ex)
3.270	43	Woods/grass comb., Fair, HSG A (DB-CH-1)
1.960	48	Brush, Good, HSG B (DB-CH-1)
1.020	55	Woods, Good, HSG B (DB 1.0, DB-CH-1)
3.000	58	Meadow, non-grazed, HSG B (DB 1.0)
7.760	67	Row crops, straight row, Good, HSG A (DB 1.0, DB-CH-1)
5.950	72	Legumes, straight row, Good, HSG B (DB-CH-1)
5.320	74	Farmsteads, HSG B (DB 1.0, DB-CH-1)
44.140	77	Woods, Good, HSG D (DB 1.0, DB 2.1 Ex, DB-CH-1)
25.640	78	Meadow, non-grazed, HSG D (DB 1.0, DB-CH-1)
5.950	78	Row crops, straight row, Good, HSG B (DB 1.0)
5.160	86	Farmsteads, HSG D (DB 1.0, DB-CH-1)
0.970	89	Row crops, straight row, Good, HSG D (DB 1.0, DB-CH-1)
58.200	94	(DB-5.0, DB-6.0, DB-7.0)
15.000	94	Bare Soil (DB 2.1 BS)
8.150	94	CCLC Bedrock (DB-1.1)
24.000	94	CCLC Runoff Management footnote 1 (DB 2.0 BS)
64.200	94	CCLC bedrock (DB 1.0 BS, DB-4.0)
2.500	94	Stockpile-CCLC bedrock (DB 2.1 Ex)
47.750	94	bare Soil (3.0BS S)
344.060		**TOTAL AREA**

Time span=0.00-32.00 hrs, dt=0.05 hrs, 641 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 3.0BS S: Bare Soil Runoff Area=47.750 ac 0.00% Impervious Runoff Depth=1.77"
Tc=10.0 min CN=94 Runoff=123.33 cfs 7.059 af

Subcatchment DB 1.0: Ex Cond Area Runoff Area=73.500 ac 0.00% Impervious Runoff Depth=0.44"
Flow Length=3,380' Tc=26.9 min CN=71 Runoff=22.91 cfs 2.708 af

Subcatchment DB 1.0 BS: Bare Soil Area Runoff Area=42.540 ac 0.00% Impervious Runoff Depth=1.77"
Tc=10.0 min CN=94 Runoff=109.88 cfs 6.289 af

Subcatchment DB 2.0 BS: East Staging Runoff Area=24.000 ac 0.00% Impervious Runoff Depth=1.77"
Tc=10.0 min CN=94 Runoff=61.99 cfs 3.548 af

Subcatchment DB 2.1 BS: West Bare Soil Runoff Area=15.000 ac 0.00% Impervious Runoff Depth=1.77"
Tc=6.0 min CN=94 Runoff=43.57 cfs 2.218 af

Subcatchment DB 2.1 Ex: West Ex Cover Runoff Area=10.540 ac 0.00% Impervious Runoff Depth=0.59"
Tc=6.0 min CN=75 Runoff=10.42 cfs 0.521 af

Subcatchment DB 3.0 Ex: Offsite Runoff Area=4.350 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=1,343' Tc=43.0 min CN=36 Runoff=0.00 cfs 0.000 af

Subcatchment DB-1.1: Stockpile 1 Runoff Area=8.150 ac 0.00% Impervious Runoff Depth=1.77"
Flow Length=905' Tc=5.1 min CN=94 Runoff=24.55 cfs 1.205 af

Subcatchment DB-4.0: S-2 East Runoff Area=21.660 ac 0.00% Impervious Runoff Depth=1.77"
Tc=10.0 min CN=94 Runoff=55.95 cfs 3.202 af

Subcatchment DB-5.0: X1 Runoff Area=17.500 ac 0.00% Impervious Runoff Depth=1.77"
Tc=10.0 min CN=94 Runoff=45.20 cfs 2.587 af

Subcatchment DB-6.0: X4 Runoff Area=25.000 ac 0.00% Impervious Runoff Depth=1.77"
Tc=10.0 min CN=94 Runoff=64.57 cfs 3.696 af

Subcatchment DB-7.0: X2 &X3 Runoff Area=15.700 ac 0.00% Impervious Runoff Depth=1.77"
Tc=10.0 min CN=94 Runoff=40.55 cfs 2.321 af

Subcatchment DB-CH-1: Undisturbed Runoff Area=38.370 ac 0.00% Impervious Runoff Depth=0.44"
Flow Length=1,343' Tc=11.3 min CN=71 Runoff=20.73 cfs 1.414 af

Reach 1R: Storm Sewer SS-1 Avg. Flow Depth=0.38' Max Vel=5.87 fps Inflow=3.38 cfs 4.540 af
42.0" Round Pipe n=0.013 L=1,144.0' S=0.0174 '/' Capacity=132.69 cfs Outflow=3.38 cfs 4.525 af

Reach 6R: Channel 1 Avg. Flow Depth=0.53' Max Vel=2.91 fps Inflow=22.96 cfs 4.244 af
n=0.040 L=500.0' S=0.0170 '/' Capacity=135.85 cfs Outflow=21.50 cfs 4.236 af

Pond B-1.0: Initial Pond Peak Elev=1,111.31' Storage=12.425 af Inflow=115.99 cfs 8.997 af
Primary=3.14 cfs 5.010 af Secondary=0.00 cfs 0.000 af Outflow=3.14 cfs 5.010 af

Pond B-1.1: Peak Elev=106.45' Storage=103,488 cf Inflow=24.55 cfs 1.205 af
Primary=1.03 cfs 1.103 af Secondary=0.00 cfs 0.000 af Outflow=1.03 cfs 1.103 af

Pond B-2.0: Staging SE Peak Elev=1,132.91' Storage=178,778 cf Inflow=61.99 cfs 3.548 af
Primary=1.30 cfs 2.091 af Secondary=0.00 cfs 0.000 af Outflow=1.30 cfs 2.091 af

Pond B-2.1: Staging SW Peak Elev=1,129.89' Storage=201,839 cf Inflow=53.57 cfs 2.738 af
Primary=2.10 cfs 2.449 af Secondary=0.00 cfs 0.000 af Outflow=2.10 cfs 2.449 af

Pond B-3.0: (new Pond) Peak Elev=1,162.53' Storage=11.591 af Inflow=123.33 cfs 7.059 af
Outflow=4.24 cfs 5.389 af

Pond B-4.0: (new Pond) Peak Elev=1,193.58' Storage=272,518 cf Inflow=55.95 cfs 3.202 af
Outflow=2.83 cfs 2.831 af

Pond B-5.0: Peak Elev=106.44' Storage=5.556 af Inflow=45.20 cfs 2.587 af
Outflow=2.65 cfs 2.323 af

Pond B-6.0: Peak Elev=106.80' Storage=7.064 af Inflow=64.57 cfs 3.696 af
Outflow=3.09 cfs 3.261 af

Pond B-7.0: Peak Elev=106.29' Storage=5.395 af Inflow=40.55 cfs 2.321 af
Outflow=2.45 cfs 2.071 af

Total Runoff Area = 344.060 ac Runoff Volume = 36.768 af Average Runoff Depth = 1.28"
100.00% Pervious = 344.060 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 3.0BS S: Bare Soil

Runoff = 123.33 cfs @ 12.01 hrs, Volume= 7.059 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr Rainfall=2.40"

	Area (ac)	CN	Description
*	47.750	94	bare Soil
	47.750		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB 1.0: Ex Cond Area

Runoff = 22.91 cfs @ 12.26 hrs, Volume= 2.708 af, Depth= 0.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr Rainfall=2.40"

Area (ac)	CN	Description
3.880	67	Row crops, straight row, Good, HSG A
5.950	78	Row crops, straight row, Good, HSG B
0.590	89	Row crops, straight row, Good, HSG D
8.150	30	Woods, Good, HSG A
0.510	55	Woods, Good, HSG B
26.500	77	Woods, Good, HSG D
2.660	74	Farmsteads, HSG B
2.580	86	Farmsteads, HSG D
0.320	30	Meadow, non-grazed, HSG A
3.000	58	Meadow, non-grazed, HSG B
19.360	78	Meadow, non-grazed, HSG D
73.500	71	Weighted Average
73.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.6	300	0.0730	0.30		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 2.80"
1.0	160	0.0880	2.67		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
1.6	209	0.0910	2.11		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.1	310	0.1130	1.68		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	65	0.0770	6.58	21.93	**Parabolic Channel,** W=10.00' D=0.50' Area=3.3 sf Perim=10.1' n= 0.030 Earth, grassed & winding
0.4	170	0.0880	7.03	23.44	**Parabolic Channel,** W=10.00' D=0.50' Area=3.3 sf Perim=10.1' n= 0.030 Earth, grassed & winding
0.3	211	0.1090	12.27	81.79	**Parabolic Channel,** W=10.00' D=1.00' Area=6.7 sf Perim=10.3' n= 0.030 Earth, grassed & winding
3.7	1,955	0.0390	8.81	58.71	**Parabolic Channel,** W=10.00' D=1.00' Area=6.7 sf Perim=10.3' n= 0.025
26.9	3,380	Total			

Summary for Subcatchment DB 1.0 BS: Bare Soil Area

Runoff = 109.88 cfs @ 12.01 hrs, Volume= 6.289 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr Rainfall=2.40"

	Area (ac)	CN	Description
*	42.540	94	CCLC bedrock
	42.540		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB 2.0 BS: East Staging

CHANGED FROM MIKES ORIGINAL (CMR 6-23-11) Drainage Area is set to match size of pond space available.
Should be excess when combined with Basin 2.1 for Staging area then can be shaped to drain to basin, Available for treatment of A-2 during initial stripping and overburden removal until it is reshaped such that it cannont drain into Area A-1.

Runoff = 61.99 cfs @ 12.01 hrs, Volume= 3.548 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr Rainfall=2.40"

	Area (ac)	CN	Description
*	24.000	94	CCLC Runoff Management footnote 1
	24.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB 2.1 BS: West Bare Soil

Runoff = 43.57 cfs @ 11.97 hrs, Volume= 2.218 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr Rainfall=2.40"

	Area (ac)	CN	Description
*	15.000	94	Bare Soil
	15.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment DB 2.1 Ex: West Ex Cover

Runoff = 10.42 cfs @ 11.98 hrs, Volume= 0.521 af, Depth= 0.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr Rainfall=2.40"

	Area (ac)	CN	Description
	1.300	30	Woods, Good, HSG A
	6.740	77	Woods, Good, HSG D
*	2.500	94	Stockpile-CCLC bedrock
	10.540	75	Weighted Average
	10.540		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Estimated**

Summary for Subcatchment DB 3.0 Ex: Offsite

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr Rainfall=2.40"

Area (ac)	CN	Description
4.350	36	Woods, Fair, HSG A
4.350		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.5	300	0.1900	0.22		**Sheet Flow, vegetated top** Woods: Light underbrush n= 0.400 P2= 2.80"
0.7	413	0.1230	10.41	104.11	**Channel Flow, Div D-6** Area= 10.0 sf Perim= 14.0' r= 0.71' n= 0.040
19.8	630	0.0950	0.53	0.05	**Channel Flow,** Area= 0.1 sf Perim= 10.0' r= 0.01' n= 0.040
43.0	1,343	Total			

Summary for Subcatchment DB-1.1: Stockpile 1

Stockpile S-1 is the primary contributing area along with access road

Runoff = 24.55 cfs @ 11.95 hrs, Volume= 1.205 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr Rainfall=2.40"

	Area (ac)	CN	Description
*	8.150	94	CCLC Bedrock
	8.150		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	300	0.0100	1.21		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.80"
0.1	165	0.4400	25.07	300.89	**Channel Flow, rock chute** Area= 12.0 sf Perim= 18.0' r= 0.67' n= 0.030
0.9	440	0.0700	8.57	171.45	**Channel Flow, Downslope to pond** Area= 20.0 sf Perim= 30.0' r= 0.67' n= 0.035
5.1	905	Total			

Summary for Subcatchment DB-4.0: S-2 East

Draft 4

Runoff = 55.95 cfs @ 12.01 hrs, Volume= 3.202 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr Rainfall=2.40"

	Area (ac)	CN	Description
*	21.660	94	CCLC bedrock
	21.660		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB-5.0: X1

Runoff = 45.20 cfs @ 12.01 hrs, Volume= 2.587 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr Rainfall=2.40"

	Area (ac)	CN	Description
*	17.500	94	
	17.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB-6.0: X4

Runoff = 64.57 cfs @ 12.01 hrs, Volume= 3.696 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr Rainfall=2.40"

	Area (ac)	CN	Description
*	25.000	94	
	25.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB-7.0: X2 &X3

Runoff = 40.55 cfs @ 12.01 hrs, Volume= 2.321 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr Rainfall=2.40"

	Area (ac)	CN	Description
*	15.700	94	
	15.700		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB-CH-1: Undisturbed

Unditurbed runoff from Area A-8 and Drainage Basin X7 to be diverted by D-4 and D-3 to Ch-1

Runoff = 20.73 cfs @ 12.05 hrs, Volume= 1.414 af, Depth= 0.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr Rainfall=2.40"

Area (ac)	CN	Description
3.880	67	Row crops, straight row, Good, HSG A
5.950	72	Legumes, straight row, Good, HSG B
0.380	89	Row crops, straight row, Good, HSG D
3.270	43	Woods/grass comb., Fair, HSG A
0.510	55	Woods, Good, HSG B
10.900	77	Woods, Good, HSG D
2.660	74	Farmsteads, HSG B
2.580	86	Farmsteads, HSG D
1.960	48	Brush, Good, HSG B
6.280	78	Meadow, non-grazed, HSG D
38.370	71	Weighted Average
38.370		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	300	0.0730	0.69		**Sheet Flow,** Cultivated: Residue<=20% n= 0.060 P2= 2.80"
1.0	160	0.0880	2.67		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
1.6	209	0.0910	2.11		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	310	0.1130	7.98	31.92	**Parabolic Channel,** W=12.00' D=0.50' Area=4.0 sf Perim=12.1' n= 0.030
0.9	364	0.0800	6.71	26.86	**Parabolic Channel,** W=12.00' D=0.50' Area=4.0 sf Perim=12.1' n= 0.030
11.3	1,343	Total			

Summary for Reach 1R: Storm Sewer SS-1

Storm Sewer from Manhole junction of Basin 2.0 and 2.1 outlet pipes to outfall

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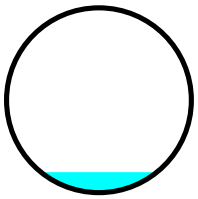
Inflow Area = 49.540 ac, 0.00% Impervious, Inflow Depth > 1.10" for 1 Yr event
Inflow = 3.38 cfs @ 13.98 hrs, Volume= 4.540 af
Outflow = 3.38 cfs @ 14.07 hrs, Volume= 4.525 af, Atten= 0%, Lag= 5.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.87 fps, Min. Travel Time= 3.2 min
Avg. Velocity = 4.57 fps, Avg. Travel Time= 4.2 min

Peak Storage= 658 cf @ 14.02 hrs
Average Depth at Peak Storage= 0.38'
Bank-Full Depth= 3.50', Capacity at Bank-Full= 132.69 cfs

42.0" Round Pipe
n= 0.013
Length= 1,144.0' Slope= 0.0174 '/'
Inlet Invert= 1,119.90', Outlet Invert= 1,100.00'



Summary for Reach 6R: Channel 1

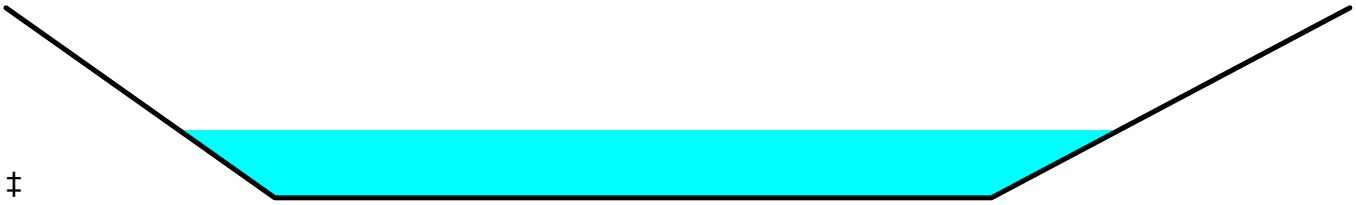
Channel Ch-1P
The east side ditch of the primary access road - minimum slope limiting capacity is at a slope of 1.7%

Inflow Area = 60.030 ac, 0.00% Impervious, Inflow Depth > 0.85" for 1 Yr event
Inflow = 22.96 cfs @ 12.06 hrs, Volume= 4.244 af
Outflow = 21.50 cfs @ 12.14 hrs, Volume= 4.236 af, Atten= 6%, Lag= 5.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.91 fps, Min. Travel Time= 2.9 min
Avg. Velocity = 1.00 fps, Avg. Travel Time= 8.3 min

Peak Storage= 3,708 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.53'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 135.85 cfs

12.00' x 1.50' deep channel, n= 0.040
Side Slope Z-value= 3.0 4.0 '/' Top Width= 22.50'
Length= 500.0' Slope= 0.0170 '/'
Inlet Invert= 90.00', Outlet Invert= 81.50'



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Summary for Pond B-1.0: Initial Pond

Preliminary Design Draft 5

Inflow Area = 116.040 ac, 0.00% Impervious, Inflow Depth = 0.93" for 1 Yr event
Inflow = 115.99 cfs @ 12.02 hrs, Volume= 8.997 af
Outflow = 3.14 cfs @ 18.35 hrs, Volume= 5.010 af, Atten= 97%, Lag= 380.1 min
Primary = 3.14 cfs @ 18.35 hrs, Volume= 5.010 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 1,107.50' Surf.Area= 1.324 ac Storage= 6.277 af
Peak Elev= 1,111.31' @ 18.35 hrs Surf.Area= 1.970 ac Storage= 12.425 af (6.148 af above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 462.1 min (1,294.6 - 832.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,100.00'	21.197 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,100.00	0.394	0.000	0.000
1,105.00	0.970	3.410	3.410
1,110.00	1.678	6.620	10.030
1,115.00	2.789	11.167	21.197

Device	Routing	Invert	Outlet Devices
#1	Primary	1,103.50'	**48.0" Round Culvert** L= 125.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 1,103.50' / 1,100.00' S= 0.0280 '/' Cc= 0.900 n= 0.015
#2	Device 1	1,107.50'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,111.50'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,113.00'	**30.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=3.14 cfs @ 18.35 hrs HW=1,111.31' (Free Discharge)
└─**1=Culvert** (Passes 3.14 cfs of 182.36 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 3.14 cfs @ 8.98 fps)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,107.50' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-1.1:

Preliminary Design Draft 5
10 cfs Base flow for 100 yr event represents overtopping across primary access road from Channel Ch-1 @ 1136 due to discharge exceeding capacity of Culver C-4

Inflow Area =	8.150 ac,	0.00% Impervious,	Inflow Depth =	1.77"	for 1 Yr event
Inflow =	24.55 cfs @	11.95 hrs,	Volume=	1.205 af	
Outflow =	1.03 cfs @	13.24 hrs,	Volume=	1.103 af,	Atten= 96%, Lag= 77.2 min
Primary =	1.03 cfs @	13.24 hrs,	Volume=	1.103 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 105.00' Surf.Area= 20,535 sf Storage= 71,834 cf
Peak Elev= 106.45' @ 13.24 hrs Surf.Area= 23,224 sf Storage= 103,488 cf (31,654 cf above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 350.8 min (1,143.8 - 793.0)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	370,099 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
100.00	11,287	0	0
104.00	15,597	53,768	53,768
105.00	20,535	18,066	71,834
115.00	39,118	298,265	370,099

Device	Routing	Invert	Outlet Devices
#1	Primary	101.00'	**42.0" Round Culvert** L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 101.00' / 100.00' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished
#2	Device 1	105.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	113.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	113.50'	**10.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=1.03 cfs @ 13.24 hrs HW=106.45' (Free Discharge)
└─**1=Culvert** (Passes 1.03 cfs of 101.54 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 1.03 cfs @ 5.27 fps)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=105.00' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-2.0: Staging SE

Preliminary Design Draft 5
Drainage Area is set to match size of pond space available.
Excess capacity exists when combined with Basin 2.1.
Available for treatment of A-2 during initial stripping and overburden removal until it is reshaped such that it cannont drain into Area A-1.
Secondary Discharge to west side of access road and B1.1

Inflow Area =	24.000 ac,	0.00% Impervious,	Inflow Depth =	1.77"	for 1 Yr event
Inflow =	61.99 cfs @	12.01 hrs,	Volume=	3.548 af	
Outflow =	1.30 cfs @	16.05 hrs,	Volume=	2.091 af,	Atten= 98%, Lag= 242.4 min
Primary =	1.30 cfs @	16.05 hrs,	Volume=	2.091 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 1,128.80' Surf.Area= 21,476 sf Storage= 70,748 cf
Peak Elev= 1,132.91' @ 16.05 hrs Surf.Area= 31,100 sf Storage= 178,778 cf (108,030 cf above start)

Plug-Flow detention time= 1,165.2 min calculated for 0.466 af (13% of inflow)
Center-of-Mass det. time= 474.8 min (1,272.3 - 797.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,123.00'	284,322 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,123.00	6,356	0	0
1,127.00	12,721	38,154	38,154
1,128.00	19,603	16,162	54,316
1,134.50	34,824	176,888	231,204
1,136.00	36,000	53,118	284,322

Device	Routing	Invert	Outlet Devices
#1	Primary	1,122.14'	**42.0" Round Culvert** L= 140.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,122.14' / 1,119.90' S= 0.0160 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets
#2	Device 1	1,128.80'	**5.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,133.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,135.50'	**10.0' long x 50.0' breadth Broad-Crested Rectangular Weir**

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=1.30 cfs @ 16.05 hrs HW=1,132.91' (Free Discharge)
└─**1=Culvert** (Passes 1.30 cfs of 109.84 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 1.30 cfs @ 9.51 fps)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,128.80' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-2.1: Staging SW

Preliminary Design Draft 5
Fixed Drainage area from existing cover to west, partial Stockpile 1 runoff, and potential staging area runoff. Used in combination with B-2.0

Inflow Area = 25.540 ac, 0.00% Impervious, Inflow Depth = 1.29" for 1 Yr event
Inflow = 53.57 cfs @ 11.97 hrs, Volume= 2.738 af
Outflow = 2.10 cfs @ 13.66 hrs, Volume= 2.449 af, Atten= 96%, Lag= 101.2 min
Primary = 2.10 cfs @ 13.66 hrs, Volume= 2.449 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 1,128.00' Surf.Area= 35,077 sf Storage= 131,213 cf
Peak Elev= 1,129.89' @ 13.66 hrs Surf.Area= 39,571 sf Storage= 201,839 cf (70,627 cf above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 371.5 min (1,180.9 - 809.4)

Volume	Invert	Avail.Storage	Storage Description
#1	1,123.00'	488,076 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,123.00	21,727	0	0
1,127.00	28,088	99,630	99,630
1,128.00	35,077	31,583	131,213
1,134.50	50,513	278,168	409,380
1,136.00	54,415	78,696	488,076

Device	Routing	Invert	Outlet Devices
#1	Primary	1,121.40'	**36.0" Round Culvert** L= 80.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 1,121.40' / 1,120.40' S= 0.0125 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets
#2	Device 1	1,128.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,132.50'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,135.50'	**10.0' long x 50.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60

Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=2.10 cfs @ 13.66 hrs HW=1,129.89' (Free Discharge)
└─**1=Culvert** (Passes 2.10 cfs of 102.89 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 2.10 cfs @ 6.01 fps)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,128.00' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-3.0: (new Pond)

Inflow Area = 52.100 ac, 0.00% Impervious, Inflow Depth = 1.63" for 1 Yr event
Inflow = 123.33 cfs @ 12.01 hrs, Volume= 7.059 af
Outflow = 4.24 cfs @ 14.04 hrs, Volume= 5.389 af, Atten= 97%, Lag= 121.9 min
Primary = 4.24 cfs @ 14.04 hrs, Volume= 5.389 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 1,160.00' Surf.Area= 1.728 ac Storage= 6.951 af
Peak Elev= 1,162.53' @ 14.04 hrs Surf.Area= 1.939 ac Storage= 11.591 af (4.640 af above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 446.0 min (1,243.5 - 797.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,155.00'	16.637 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,155.00	1.215	0.000	0.000
1,157.00	1.338	2.553	2.553
1,159.00	1.464	2.802	5.355
1,160.00	1.728	1.596	6.951
1,162.00	1.893	3.621	10.572
1,165.00	2.150	6.064	16.637

Device	Routing	Invert	Outlet Devices
#1	Primary	1,155.00'	**30.0" Round Culvert** L= 200.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 1,155.00' / 90.00' S= 5.3250 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished
#2	Device 1	1,160.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,162.50'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	1,163.50'	**50.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=4.05 cfs @ 14.04 hrs HW=1,162.53' (Free Discharge)
- **1=Culvert** (Passes 4.05 cfs of 74.05 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 3.82 cfs @ 7.00 fps)
  - **3=Orifice/Grate** (Weir Controls 0.24 cfs @ 0.58 fps)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-4.0: (new Pond)

Inflow Area = 21.660 ac, 0.00% Impervious, Inflow Depth = 1.77" for 1 Yr event
Inflow = 55.95 cfs @ 12.01 hrs, Volume= 3.202 af
Outflow = 2.83 cfs @ 13.26 hrs, Volume= 2.831 af, Atten= 95%, Lag= 75.1 min
Primary = 2.83 cfs @ 13.26 hrs, Volume= 2.831 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 1,192.00' Surf.Area= 51,246 sf Storage= 187,522 cf
Peak Elev= 1,193.58' @ 13.26 hrs Surf.Area= 56,574 sf Storage= 272,518 cf (84,996 cf above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 340.9 min (1,138.4 - 797.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,187.00'	486,634 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,187.00	30,347	0	0
1,191.00	40,482	141,658	141,658
1,192.00	51,246	45,864	187,522
1,194.00	58,005	109,251	296,773
1,197.00	68,569	189,861	486,634

Device	Routing	Invert	Outlet Devices
#1	Primary	1,187.00'	**30.0" Round Culvert** L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 1,187.00' / 1,185.00' S= 0.0200 '/' Cc= 0.900 n= 0.012
#2	Device 1	1,192.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,194.00'	**48.0" Horiz. Grated MH top** C= 0.600 Limited to weir flow at low heads
#4	Primary	1,195.50'	**10.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=2.83 cfs @ 13.26 hrs HW=1,193.58' (Free Discharge)
- **1=Culvert** (Passes 2.83 cfs of 68.19 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 2.83 cfs @ 5.19 fps)
  - **3=Grated MH top** (Controls 0.00 cfs)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-5.0:

Preliminary Design Draft 5

Inflow Area = 17.500 ac, 0.00% Impervious, Inflow Depth = 1.77" for 1 Yr event
Inflow = 45.20 cfs @ 12.01 hrs, Volume= 2.587 af
Outflow = 2.65 cfs @ 13.03 hrs, Volume= 2.323 af, Atten= 94%, Lag= 61.1 min
Primary = 2.65 cfs @ 13.03 hrs, Volume= 2.323 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 105.00' Surf.Area= 1.048 ac Storage= 4.016 af
Peak Elev= 106.44' @ 13.03 hrs Surf.Area= 1.097 ac Storage= 5.556 af (1.539 af above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 305.9 min (1,103.5 - 797.5)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	9.689 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
100.00	0.631	0.000	0.000
102.00	0.728	1.359	1.359
104.00	0.937	1.665	3.024
105.00	1.048	0.993	4.016
107.00	1.116	2.164	6.180
110.00	1.223	3.509	9.689

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**30.0" Round Culvert** L= 200.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 100.00' / 90.00' S= 0.0500 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished
#2	Device 1	105.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	107.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	108.00'	**30.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=2.65 cfs @ 13.03 hrs HW=106.44' (Free Discharge)
- **1=Culvert** (Passes 2.65 cfs of 67.28 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 2.65 cfs @ 4.86 fps)
  - **3=Orifice/Grate** (Controls 0.00 cfs)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-6.0:

Preliminary Design Draft 5

Inflow Area = 25.000 ac, 0.00% Impervious, Inflow Depth = 1.77" for 1 Yr event
Inflow = 64.57 cfs @ 12.01 hrs, Volume= 3.696 af
Outflow = 3.09 cfs @ 13.37 hrs, Volume= 3.261 af, Atten= 95%, Lag= 81.5 min
Primary = 3.09 cfs @ 13.37 hrs, Volume= 3.261 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 105.00' Surf.Area= 1.224 ac Storage= 4.795 af
Peak Elev= 106.80' @ 13.37 hrs Surf.Area= 1.292 ac Storage= 7.064 af (2.269 af above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 355.6 min (1,153.1 - 797.5)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	11.386 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
100.00	0.771	0.000	0.000
102.00	0.878	1.649	1.649
104.00	1.104	1.982	3.631
105.00	1.224	1.164	4.795
107.00	1.299	2.523	7.318
110.00	1.413	4.068	11.386

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**30.0" Round Culvert** L= 200.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 100.00' / 90.00' S= 0.0500 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished
#2	Device 1	105.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	107.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	108.00'	**30.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=3.09 cfs @ 13.37 hrs HW=106.80' (Free Discharge)
- **1=Culvert** (Passes 3.09 cfs of 69.62 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 3.09 cfs @ 5.67 fps)
  - **3=Orifice/Grate** (Controls 0.00 cfs)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-7.0:

Preliminary Design Draft 5

Inflow Area = 15.700 ac, 0.00% Impervious, Inflow Depth = 1.77" for 1 Yr event
Inflow = 40.55 cfs @ 12.01 hrs, Volume= 2.321 af
Outflow = 2.45 cfs @ 12.99 hrs, Volume= 2.071 af, Atten= 94%, Lag= 58.6 min
Primary = 2.45 cfs @ 12.99 hrs, Volume= 2.071 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 105.00' Surf.Area= 1.048 ac Storage= 4.016 af
Peak Elev= 106.29' @ 12.99 hrs Surf.Area= 1.092 ac Storage= 5.395 af (1.378 af above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 300.3 min (1,097.8 - 797.5)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	9.689 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
100.00	0.631	0.000	0.000
102.00	0.728	1.359	1.359
104.00	0.937	1.665	3.024
105.00	1.048	0.993	4.016
107.00	1.116	2.164	6.180
110.00	1.223	3.509	9.689

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**30.0" Round Culvert** L= 200.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 100.00' / 90.00' S= 0.0500 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished
#2	Device 1	105.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	107.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	108.00'	**30.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=2.45 cfs @ 12.99 hrs HW=106.29' (Free Discharge)
- **1=Culvert** (Passes 2.45 cfs of 66.32 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 2.45 cfs @ 4.50 fps)
  - **3=Orifice/Grate** (Controls 0.00 cfs)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=0.00-32.00 hrs, dt=0.05 hrs, 641 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 3.0BS S: Bare Soil Runoff Area=47.750 ac 0.00% Impervious Runoff Depth=3.42"
Tc=10.0 min CN=94 Runoff=228.94 cfs 13.618 af

Subcatchment DB 1.0: Ex Cond Area Runoff Area=73.500 ac 0.00% Impervious Runoff Depth=1.46"
Flow Length=3,380' Tc=26.9 min CN=71 Runoff=95.14 cfs 8.961 af

Subcatchment DB 1.0 BS: Bare Soil Area Runoff Area=42.540 ac 0.00% Impervious Runoff Depth=3.42"
Tc=10.0 min CN=94 Runoff=203.96 cfs 12.132 af

Subcatchment DB 2.0 BS: East Staging Runoff Area=24.000 ac 0.00% Impervious Runoff Depth=3.42"
Tc=10.0 min CN=94 Runoff=115.07 cfs 6.845 af

Subcatchment DB 2.1 BS: West Bare Soil Runoff Area=15.000 ac 0.00% Impervious Runoff Depth=3.42"
Tc=6.0 min CN=94 Runoff=80.63 cfs 4.278 af

Subcatchment DB 2.1 Ex: West Ex Cover Runoff Area=10.540 ac 0.00% Impervious Runoff Depth=1.74"
Tc=6.0 min CN=75 Runoff=31.99 cfs 1.530 af

Subcatchment DB 3.0 Ex: Offsite Runoff Area=4.350 ac 0.00% Impervious Runoff Depth=0.02"
Flow Length=1,343' Tc=43.0 min CN=36 Runoff=0.01 cfs 0.006 af

Subcatchment DB-1.1: Stockpile 1 Runoff Area=8.150 ac 0.00% Impervious Runoff Depth=3.42"
Flow Length=905' Tc=5.1 min CN=94 Runoff=45.40 cfs 2.324 af

Subcatchment DB-4.0: S-2 East Runoff Area=21.660 ac 0.00% Impervious Runoff Depth=3.42"
Tc=10.0 min CN=94 Runoff=103.85 cfs 6.177 af

Subcatchment DB-5.0: X1 Runoff Area=17.500 ac 0.00% Impervious Runoff Depth=3.42"
Tc=10.0 min CN=94 Runoff=83.91 cfs 4.991 af

Subcatchment DB-6.0: X4 Runoff Area=25.000 ac 0.00% Impervious Runoff Depth=3.42"
Tc=10.0 min CN=94 Runoff=119.87 cfs 7.130 af

Subcatchment DB-7.0: X2 &X3 Runoff Area=15.700 ac 0.00% Impervious Runoff Depth=3.42"
Tc=10.0 min CN=94 Runoff=75.28 cfs 4.478 af

Subcatchment DB-CH-1: Undisturbed Runoff Area=38.370 ac 0.00% Impervious Runoff Depth=1.46"
Flow Length=1,343' Tc=11.3 min CN=71 Runoff=80.21 cfs 4.678 af

Reach 1R: Storm Sewer SS-1 Avg. Flow Depth=1.50' Max Vel=12.82 fps Inflow=51.25 cfs 9.808 af
42.0" Round Pipe n=0.013 L=1,144.0' S=0.0174 '/' Capacity=132.69 cfs Outflow=50.04 cfs 9.789 af

Reach 6R: Channel 1 Avg. Flow Depth=1.16' Max Vel=4.53 fps Inflow=86.41 cfs 10.326 af
n=0.040 L=500.0' S=0.0170 '/' Capacity=135.85 cfs Outflow=83.25 cfs 10.315 af

Pond B-1.0: Initial Pond Peak Elev=1,112.90' Storage=15.842 af Inflow=248.84 cfs 21.093 af
Primary=72.15 cfs 16.349 af Secondary=0.00 cfs 0.000 af Outflow=72.15 cfs 16.349 af

Pond B-1.1: Peak Elev=107.76' Storage=135,515 cf Inflow=45.40 cfs 2.324 af
Primary=1.50 cfs 2.035 af Secondary=0.00 cfs 0.000 af Outflow=1.50 cfs 2.035 af

Pond B-2.0: Staging SE Peak Elev=1,134.09' Storage=217,124 cf Inflow=115.07 cfs 6.845 af
Primary=48.28 cfs 5.122 af Secondary=0.00 cfs 0.000 af Outflow=48.28 cfs 5.122 af

Pond B-2.1: Staging SW Peak Elev=1,132.02' Storage=291,511 cf Inflow=112.10 cfs 5.808 af
Primary=3.23 cfs 4.686 af Secondary=0.00 cfs 0.000 af Outflow=3.23 cfs 4.686 af

Pond B-3.0: (new Pond) Peak Elev=1,163.71' Storage=13.929 af Inflow=228.94 cfs 13.624 af
Outflow=72.00 cfs 11.472 af

Pond B-4.0: (new Pond) Peak Elev=1,194.57' Storage=330,671 cf Inflow=103.85 cfs 6.177 af
Outflow=21.78 cfs 5.648 af

Pond B-5.0: Peak Elev=107.45' Storage=6.689 af Inflow=83.91 cfs 4.991 af
Outflow=16.30 cfs 4.632 af

Pond B-6.0: Peak Elev=107.83' Storage=8.403 af Inflow=119.87 cfs 7.130 af
Outflow=34.93 cfs 6.545 af

Pond B-7.0: Peak Elev=107.30' Storage=6.516 af Inflow=75.28 cfs 4.478 af
Outflow=10.32 cfs 4.133 af

Total Runoff Area = 344.060 ac Runoff Volume = 77.149 af Average Runoff Depth = 2.69"
100.00% Pervious = 344.060 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 3.0BS S: Bare Soil

Runoff = 228.94 cfs @ 12.01 hrs, Volume= 13.618 af, Depth= 3.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Yr Rainfall=4.10"

	Area (ac)	CN	Description
*	47.750	94	bare Soil
	47.750		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB 1.0: Ex Cond Area

Runoff = 95.14 cfs @ 12.22 hrs, Volume= 8.961 af, Depth= 1.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Yr Rainfall=4.10"

Area (ac)	CN	Description
3.880	67	Row crops, straight row, Good, HSG A
5.950	78	Row crops, straight row, Good, HSG B
0.590	89	Row crops, straight row, Good, HSG D
8.150	30	Woods, Good, HSG A
0.510	55	Woods, Good, HSG B
26.500	77	Woods, Good, HSG D
2.660	74	Farmsteads, HSG B
2.580	86	Farmsteads, HSG D
0.320	30	Meadow, non-grazed, HSG A
3.000	58	Meadow, non-grazed, HSG B
19.360	78	Meadow, non-grazed, HSG D
73.500	71	Weighted Average
73.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.6	300	0.0730	0.30		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 2.80"
1.0	160	0.0880	2.67		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
1.6	209	0.0910	2.11		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.1	310	0.1130	1.68		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	65	0.0770	6.58	21.93	**Parabolic Channel,** W=10.00' D=0.50' Area=3.3 sf Perim=10.1' n= 0.030 Earth, grassed & winding
0.4	170	0.0880	7.03	23.44	**Parabolic Channel,** W=10.00' D=0.50' Area=3.3 sf Perim=10.1' n= 0.030 Earth, grassed & winding
0.3	211	0.1090	12.27	81.79	**Parabolic Channel,** W=10.00' D=1.00' Area=6.7 sf Perim=10.3' n= 0.030 Earth, grassed & winding
3.7	1,955	0.0390	8.81	58.71	**Parabolic Channel,** W=10.00' D=1.00' Area=6.7 sf Perim=10.3' n= 0.025
26.9	3,380	Total			

Summary for Subcatchment DB 1.0 BS: Bare Soil Area

Runoff = 203.96 cfs @ 12.01 hrs, Volume= 12.132 af, Depth= 3.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Yr Rainfall=4.10"

	Area (ac)	CN	Description
*	42.540	94	CCLC bedrock
	42.540		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB 2.0 BS: East Staging

CHANGED FROM MIKES ORIGINAL (CMR 6-23-11) Drainage Area is set to match size of pond space available.
Should be excess when combined with Basin 2.1 for Staging area then can be shaped to drain to basin, Available for treatment of A-2 during initial stripping and overburden removal until it is reshaped such that it cannont drain into Area A-1.

Runoff = 115.07 cfs @ 12.01 hrs, Volume= 6.845 af, Depth= 3.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Yr Rainfall=4.10"

	Area (ac)	CN	Description
*	24.000	94	CCLC Runoff Management footnote 1
	24.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB 2.1 BS: West Bare Soil

Runoff = 80.63 cfs @ 11.96 hrs, Volume= 4.278 af, Depth= 3.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Yr Rainfall=4.10"

	Area (ac)	CN	Description
*	15.000	94	Bare Soil
	15.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment DB 2.1 Ex: West Ex Cover

Runoff = 31.99 cfs @ 11.98 hrs, Volume= 1.530 af, Depth= 1.74"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Yr Rainfall=4.10"

	Area (ac)	CN	Description
	1.300	30	Woods, Good, HSG A
	6.740	77	Woods, Good, HSG D
*	2.500	94	Stockpile-CCLC bedrock
	10.540	75	Weighted Average
	10.540		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Estimated**

Summary for Subcatchment DB 3.0 Ex: Offsite

Runoff = 0.01 cfs @ 24.08 hrs, Volume= 0.006 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Yr Rainfall=4.10"

Area (ac)	CN	Description
4.350	36	Woods, Fair, HSG A
4.350		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.5	300	0.1900	0.22		**Sheet Flow, vegetated top** Woods: Light underbrush n= 0.400 P2= 2.80"
0.7	413	0.1230	10.41	104.11	**Channel Flow, Div D-6** Area= 10.0 sf Perim= 14.0' r= 0.71' n= 0.040
19.8	630	0.0950	0.53	0.05	**Channel Flow,** Area= 0.1 sf Perim= 10.0' r= 0.01' n= 0.040
43.0	1,343	Total			

Summary for Subcatchment DB-1.1: Stockpile 1

Stockpile S-1 is the primary contributing area along with access road

Runoff = 45.40 cfs @ 11.95 hrs, Volume= 2.324 af, Depth= 3.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Yr Rainfall=4.10"

	Area (ac)	CN	Description
*	8.150	94	CCLC Bedrock
	8.150		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	300	0.0100	1.21		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.80"
0.1	165	0.4400	25.07	300.89	**Channel Flow, rock chute** Area= 12.0 sf Perim= 18.0' r= 0.67' n= 0.030
0.9	440	0.0700	8.57	171.45	**Channel Flow, Downslope to pond** Area= 20.0 sf Perim= 30.0' r= 0.67' n= 0.035
5.1	905	Total			

Summary for Subcatchment DB-4.0: S-2 East

Draft 4

Runoff = 103.85 cfs @ 12.01 hrs, Volume= 6.177 af, Depth= 3.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Yr Rainfall=4.10"

	Area (ac)	CN	Description
*	21.660	94	CCLC bedrock
	21.660		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB-5.0: X1

Runoff = 83.91 cfs @ 12.01 hrs, Volume= 4.991 af, Depth= 3.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Yr Rainfall=4.10"

	Area (ac)	CN	Description
*	17.500	94	
	17.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB-6.0: X4

Runoff = 119.87 cfs @ 12.01 hrs, Volume= 7.130 af, Depth= 3.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Yr Rainfall=4.10"

	Area (ac)	CN	Description
*	25.000	94	
	25.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB-7.0: X2 &X3

Runoff = 75.28 cfs @ 12.01 hrs, Volume= 4.478 af, Depth= 3.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Yr Rainfall=4.10"

	Area (ac)	CN	Description
*	15.700	94	
	15.700		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB-CH-1: Undisturbed

Unditurbed runoff from Area A-8 and Drainage Basin X7 to be diverted by D-4 and D-3 to Ch-1

Runoff = 80.21 cfs @ 12.04 hrs, Volume= 4.678 af, Depth= 1.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Yr Rainfall=4.10"

Area (ac)	CN	Description
3.880	67	Row crops, straight row, Good, HSG A
5.950	72	Legumes, straight row, Good, HSG B
0.380	89	Row crops, straight row, Good, HSG D
3.270	43	Woods/grass comb., Fair, HSG A
0.510	55	Woods, Good, HSG B
10.900	77	Woods, Good, HSG D
2.660	74	Farmsteads, HSG B
2.580	86	Farmsteads, HSG D
1.960	48	Brush, Good, HSG B
6.280	78	Meadow, non-grazed, HSG D
38.370	71	Weighted Average
38.370		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	300	0.0730	0.69		**Sheet Flow,** Cultivated: Residue<=20% n= 0.060 P2= 2.80"
1.0	160	0.0880	2.67		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
1.6	209	0.0910	2.11		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	310	0.1130	7.98	31.92	**Parabolic Channel,** W=12.00' D=0.50' Area=4.0 sf Perim=12.1' n= 0.030
0.9	364	0.0800	6.71	26.86	**Parabolic Channel,** W=12.00' D=0.50' Area=4.0 sf Perim=12.1' n= 0.030
11.3	1,343	Total			

Summary for Reach 1R: Storm Sewer SS-1

Storm Sewer from Manhole junction of Basin 2.0 and 2.1 outlet pipes to outfall

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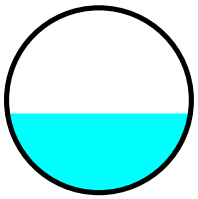
Inflow Area = 49.540 ac, 0.00% Impervious, Inflow Depth > 2.38" for 10 Yr event
Inflow = 51.25 cfs @ 12.16 hrs, Volume= 9.808 af
Outflow = 50.04 cfs @ 12.21 hrs, Volume= 9.789 af, Atten= 2%, Lag= 3.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 12.82 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 5.45 fps, Avg. Travel Time= 3.5 min

Peak Storage= 4,487 cf @ 12.18 hrs
Average Depth at Peak Storage= 1.50'
Bank-Full Depth= 3.50', Capacity at Bank-Full= 132.69 cfs

42.0" Round Pipe
n= 0.013
Length= 1,144.0' Slope= 0.0174 '/'
Inlet Invert= 1,119.90', Outlet Invert= 1,100.00'



Summary for Reach 6R: Channel 1

Channel Ch-1P
The east side ditch of the primary access road - minimum slope limiting capacity is at a slope of 1.7%

Inflow Area = 60.030 ac, 0.00% Impervious, Inflow Depth > 2.06" for 10 Yr event
Inflow = 86.41 cfs @ 12.05 hrs, Volume= 10.326 af
Outflow = 83.25 cfs @ 12.11 hrs, Volume= 10.315 af, Atten= 4%, Lag= 3.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.53 fps, Min. Travel Time= 1.8 min
Avg. Velocity = 1.27 fps, Avg. Travel Time= 6.5 min

Peak Storage= 9,296 cf @ 12.08 hrs
Average Depth at Peak Storage= 1.16'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 135.85 cfs

12.00' x 1.50' deep channel, n= 0.040
Side Slope Z-value= 3.0 4.0 '/' Top Width= 22.50'
Length= 500.0' Slope= 0.0170 '/'
Inlet Invert= 90.00', Outlet Invert= 81.50'

‡

Summary for Pond B-1.0: Initial Pond

Preliminary Design Draft 5

Inflow Area = 116.040 ac, 0.00% Impervious, Inflow Depth = 2.18" for 10 Yr event
Inflow = 248.84 cfs @ 12.03 hrs, Volume= 21.093 af
Outflow = 72.15 cfs @ 12.50 hrs, Volume= 16.349 af, Atten= 71%, Lag= 28.2 min
Primary = 72.15 cfs @ 12.50 hrs, Volume= 16.349 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 1,107.50' Surf.Area= 1.324 ac Storage= 6.277 af
Peak Elev= 1,112.90' @ 12.50 hrs Surf.Area= 2.323 ac Storage= 15.842 af (9.564 af above start)

Plug-Flow detention time= 470.1 min calculated for 10.056 af (48% of inflow)
Center-of-Mass det. time= 185.9 min (1,004.8 - 818.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,100.00'	21.197 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,100.00	0.394	0.000	0.000
1,105.00	0.970	3.410	3.410
1,110.00	1.678	6.620	10.030
1,115.00	2.789	11.167	21.197

Device	Routing	Invert	Outlet Devices
#1	Primary	1,103.50'	**48.0" Round Culvert** L= 125.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 1,103.50' / 1,100.00' S= 0.0280 '/' Cc= 0.900 n= 0.015
#2	Device 1	1,107.50'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,111.50'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,113.00'	**30.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=72.16 cfs @ 12.50 hrs HW=1,112.90' (Free Discharge)
└─**1=Culvert** (Passes 72.16 cfs of 205.80 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 3.78 cfs @ 10.84 fps)
  └─**3=Orifice/Grate** (Weir Controls 68.37 cfs @ 3.87 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,107.50' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-1.1:

Preliminary Design Draft 5
10 cfs Base flow for 100 yr event represents overtopping across primary access road from Channel Ch-1 @ 1136 due to discharge exceeding capacity of Culver C-4

Inflow Area =	8.150 ac,	0.00% Impervious,	Inflow Depth =	3.42"	for 10 Yr event
Inflow =	45.40 cfs @	11.95 hrs,	Volume=	2.324 af	
Outflow =	1.50 cfs @	13.64 hrs,	Volume=	2.035 af,	Atten= 97%, Lag= 101.5 min
Primary =	1.50 cfs @	13.64 hrs,	Volume=	2.035 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 105.00' Surf.Area= 20,535 sf Storage= 71,834 cf
Peak Elev= 107.76' @ 13.64 hrs Surf.Area= 25,659 sf Storage= 135,515 cf (63,681 cf above start)

Plug-Flow detention time= 1,165.1 min calculated for 0.386 af (17% of inflow)
Center-of-Mass det. time= 424.6 min (1,199.7 - 775.1)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	370,099 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
100.00	11,287	0	0
104.00	15,597	53,768	53,768
105.00	20,535	18,066	71,834
115.00	39,118	298,265	370,099

Device	Routing	Invert	Outlet Devices
#1	Primary	101.00'	**42.0" Round Culvert** L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 101.00' / 100.00' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished
#2	Device 1	105.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	113.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	113.50'	**10.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=1.50 cfs @ 13.64 hrs HW=107.76' (Free Discharge)
└─**1=Culvert** (Passes 1.50 cfs of 122.05 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 1.50 cfs @ 7.62 fps)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=105.00' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-2.0: Staging SE

Preliminary Design Draft 5
Drainage Area is set to match size of pond space available.
Excess capacity exists when combined with Basin 2.1.
Available for treatment of A-2 during initial stripping and overburden removal until it is reshaped such that it cannont drain into Area A-1.
Secondary Discharge to west side of access road and B1.1

Inflow Area =	24.000 ac,	0.00% Impervious,	Inflow Depth =	3.42"	for 10 Yr event
Inflow =	115.07 cfs @	12.01 hrs,	Volume=	6.845 af	
Outflow =	48.28 cfs @	12.16 hrs,	Volume=	5.122 af,	Atten= 58%, Lag= 9.1 min
Primary =	48.28 cfs @	12.16 hrs,	Volume=	5.122 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 1,128.80' Surf.Area= 21,476 sf Storage= 70,748 cf
Peak Elev= 1,134.09' @ 12.16 hrs Surf.Area= 33,864 sf Storage= 217,124 cf (146,376 cf above start)

Plug-Flow detention time= 459.4 min calculated for 3.498 af (51% of inflow)
Center-of-Mass det. time= 214.9 min (994.5 - 779.6)

Volume	Invert	Avail.Storage	Storage Description
#1	1,123.00'	284,322 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,123.00	6,356	0	0
1,127.00	12,721	38,154	38,154
1,128.00	19,603	16,162	54,316
1,134.50	34,824	176,888	231,204
1,136.00	36,000	53,118	284,322

Device	Routing	Invert	Outlet Devices
#1	Primary	1,122.14'	**42.0" Round Culvert** L= 140.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,122.14' / 1,119.90' S= 0.0160 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets
#2	Device 1	1,128.80'	**5.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,133.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,135.50'	**10.0' long x 50.0' breadth Broad-Crested Rectangular Weir**

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=47.58 cfs @ 12.16 hrs HW=1,134.08' (Free Discharge)
└─**1=Culvert** (Passes 47.58 cfs of 116.75 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 1.48 cfs @ 10.84 fps)
  └─**3=Orifice/Grate** (Weir Controls 46.10 cfs @ 3.40 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,128.80' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-2.1: Staging SW

Preliminary Design Draft 5
Fixed Drainage area from existing cover to west, partial Stockpile 1 runoff, and potential staging area runoff. Used in combination with B-2.0

Inflow Area = 25.540 ac, 0.00% Impervious, Inflow Depth = 2.73" for 10 Yr event
Inflow = 112.10 cfs @ 11.97 hrs, Volume= 5.808 af
Outflow = 3.23 cfs @ 14.30 hrs, Volume= 4.686 af, Atten= 97%, Lag= 139.8 min
Primary = 3.23 cfs @ 14.30 hrs, Volume= 4.686 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 1,128.00' Surf.Area= 35,077 sf Storage= 131,213 cf
Peak Elev= 1,132.02' @ 14.30 hrs Surf.Area= 44,629 sf Storage= 291,511 cf (160,299 cf above start)

Plug-Flow detention time= 987.7 min calculated for 1.674 af (29% of inflow)
Center-of-Mass det. time= 441.8 min (1,234.9 - 793.2)

Volume	Invert	Avail.Storage	Storage Description
#1	1,123.00'	488,076 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,123.00	21,727	0	0
1,127.00	28,088	99,630	99,630
1,128.00	35,077	31,583	131,213
1,134.50	50,513	278,168	409,380
1,136.00	54,415	78,696	488,076

Device	Routing	Invert	Outlet Devices
#1	Primary	1,121.40'	**36.0" Round Culvert** L= 80.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 1,121.40' / 1,120.40' S= 0.0125 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets
#2	Device 1	1,128.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,132.50'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,135.50'	**10.0' long x 50.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60

Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=3.23 cfs @ 14.30 hrs HW=1,132.02' (Free Discharge)
└─**1=Culvert** (Passes 3.23 cfs of 118.58 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 3.23 cfs @ 9.25 fps)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,128.00' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-3.0: (new Pond)

Inflow Area = 52.100 ac, 0.00% Impervious, Inflow Depth = 3.14" for 10 Yr event
Inflow = 228.94 cfs @ 12.01 hrs, Volume= 13.624 af
Outflow = 72.00 cfs @ 12.20 hrs, Volume= 11.472 af, Atten= 69%, Lag= 11.2 min
Primary = 72.00 cfs @ 12.20 hrs, Volume= 11.472 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 1,160.00' Surf.Area= 1.728 ac Storage= 6.951 af
Peak Elev= 1,163.71' @ 12.19 hrs Surf.Area= 2.039 ac Storage= 13.929 af (6.978 af above start)

Plug-Flow detention time= 761.7 min calculated for 4.514 af (33% of inflow)
Center-of-Mass det. time= 246.7 min (1,026.5 - 779.8)

Volume	Invert	Avail.Storage	Storage Description
#1	1,155.00'	16.637 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,155.00	1.215	0.000	0.000
1,157.00	1.338	2.553	2.553
1,159.00	1.464	2.802	5.355
1,160.00	1.728	1.596	6.951
1,162.00	1.893	3.621	10.572
1,165.00	2.150	6.064	16.637

Device	Routing	Invert	Outlet Devices
#1	Primary	1,155.00'	**30.0" Round Culvert** L= 200.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 1,155.00' / 90.00' S= 5.3250 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished
#2	Device 1	1,160.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,162.50'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	1,163.50'	**50.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=71.58 cfs @ 12.20 hrs HW=1,163.71' (Free Discharge)
- **1=Culvert** (Passes 59.13 cfs of 80.67 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 4.76 cfs @ 8.73 fps)
  - **3=Orifice/Grate** (Weir Controls 54.37 cfs @ 3.59 fps)
- **4=Broad-Crested Rectangular Weir** (Weir Controls 12.45 cfs @ 1.21 fps)

Summary for Pond B-4.0: (new Pond)

Inflow Area = 21.660 ac, 0.00% Impervious, Inflow Depth = 3.42" for 10 Yr event
Inflow = 103.85 cfs @ 12.01 hrs, Volume= 6.177 af
Outflow = 21.78 cfs @ 12.26 hrs, Volume= 5.648 af, Atten= 79%, Lag= 14.9 min
Primary = 21.78 cfs @ 12.26 hrs, Volume= 5.648 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 1,192.00' Surf.Area= 51,246 sf Storage= 187,522 cf
Peak Elev= 1,194.57' @ 12.26 hrs Surf.Area= 60,028 sf Storage= 330,671 cf (143,149 cf above start)

Plug-Flow detention time= 965.2 min calculated for 1.341 af (22% of inflow)
Center-of-Mass det. time= 283.4 min (1,063.0 - 779.6)

Volume	Invert	Avail.Storage	Storage Description
#1	1,187.00'	486,634 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,187.00	30,347	0	0
1,191.00	40,482	141,658	141,658
1,192.00	51,246	45,864	187,522
1,194.00	58,005	109,251	296,773
1,197.00	68,569	189,861	486,634

Device	Routing	Invert	Outlet Devices
#1	Primary	1,187.00'	**30.0" Round Culvert** L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 1,187.00' / 1,185.00' S= 0.0200 '/' Cc= 0.900 n= 0.012
#2	Device 1	1,192.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,194.00'	**48.0" Horiz. Grated MH top** C= 0.600 Limited to weir flow at low heads
#4	Primary	1,195.50'	**10.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=21.70 cfs @ 12.26 hrs HW=1,194.57' (Free Discharge)
- **1=Culvert** (Passes 21.70 cfs of 74.29 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 3.86 cfs @ 7.07 fps)
  - **3=Grated MH top** (Weir Controls 17.84 cfs @ 2.48 fps)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-5.0:

Preliminary Design Draft 5

Inflow Area = 17.500 ac, 0.00% Impervious, Inflow Depth = 3.42" for 10 Yr event
Inflow = 83.91 cfs @ 12.01 hrs, Volume= 4.991 af
Outflow = 16.30 cfs @ 12.27 hrs, Volume= 4.632 af, Atten= 81%, Lag= 15.7 min
Primary = 16.30 cfs @ 12.27 hrs, Volume= 4.632 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 105.00' Surf.Area= 1.048 ac Storage= 4.016 af
Peak Elev= 107.45' @ 12.27 hrs Surf.Area= 1.132 ac Storage= 6.689 af (2.672 af above start)

Plug-Flow detention time= 1,111.7 min calculated for 0.615 af (12% of inflow)
Center-of-Mass det. time= 277.4 min (1,057.0 - 779.6)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	9.689 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
100.00	0.631	0.000	0.000
102.00	0.728	1.359	1.359
104.00	0.937	1.665	3.024
105.00	1.048	0.993	4.016
107.00	1.116	2.164	6.180
110.00	1.223	3.509	9.689

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**30.0" Round Culvert** L= 200.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 100.00' / 90.00' S= 0.0500 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished
#2	Device 1	105.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	107.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	108.00'	**30.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=16.16 cfs @ 12.27 hrs HW=107.45' (Free Discharge)
- **1=Culvert** (Passes 16.16 cfs of 73.57 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 3.74 cfs @ 6.87 fps)
  - **3=Orifice/Grate** (Weir Controls 12.41 cfs @ 2.19 fps)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-6.0:

Preliminary Design Draft 5

Inflow Area = 25.000 ac, 0.00% Impervious, Inflow Depth = 3.42" for 10 Yr event
Inflow = 119.87 cfs @ 12.01 hrs, Volume= 7.130 af
Outflow = 34.93 cfs @ 12.20 hrs, Volume= 6.545 af, Atten= 71%, Lag= 11.8 min
Primary = 34.93 cfs @ 12.20 hrs, Volume= 6.545 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 105.00' Surf.Area= 1.224 ac Storage= 4.795 af
Peak Elev= 107.83' @ 12.20 hrs Surf.Area= 1.330 ac Storage= 8.403 af (3.608 af above start)

Plug-Flow detention time= 908.0 min calculated for 1.750 af (25% of inflow)
Center-of-Mass det. time= 256.4 min (1,036.0 - 779.6)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	11.386 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
100.00	0.771	0.000	0.000
102.00	0.878	1.649	1.649
104.00	1.104	1.982	3.631
105.00	1.224	1.164	4.795
107.00	1.299	2.523	7.318
110.00	1.413	4.068	11.386

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**30.0" Round Culvert** L= 200.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 100.00' / 90.00' S= 0.0500 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished
#2	Device 1	105.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	107.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	108.00'	**30.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=34.81 cfs @ 12.20 hrs HW=107.82' (Free Discharge)
- **1=Culvert** (Passes 34.81 cfs of 75.75 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 4.07 cfs @ 7.47 fps)
  - **3=Orifice/Grate** (Weir Controls 30.73 cfs @ 2.97 fps)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-7.0:

Preliminary Design Draft 5

Inflow Area = 15.700 ac, 0.00% Impervious, Inflow Depth = 3.42" for 10 Yr event
Inflow = 75.28 cfs @ 12.01 hrs, Volume= 4.478 af
Outflow = 10.32 cfs @ 12.37 hrs, Volume= 4.133 af, Atten= 86%, Lag= 21.7 min
Primary = 10.32 cfs @ 12.37 hrs, Volume= 4.133 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 105.00' Surf.Area= 1.048 ac Storage= 4.016 af
Peak Elev= 107.30' @ 12.37 hrs Surf.Area= 1.127 ac Storage= 6.516 af (2.499 af above start)

Plug-Flow detention time= 1,480.4 min calculated for 0.116 af (3% of inflow)
Center-of-Mass det. time= 297.5 min (1,077.1 - 779.6)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	9.689 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
100.00	0.631	0.000	0.000
102.00	0.728	1.359	1.359
104.00	0.937	1.665	3.024
105.00	1.048	0.993	4.016
107.00	1.116	2.164	6.180
110.00	1.223	3.509	9.689

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**30.0" Round Culvert** L= 200.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 100.00' / 90.00' S= 0.0500 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished
#2	Device 1	105.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	107.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	108.00'	**30.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=10.29 cfs @ 12.37 hrs HW=107.30' (Free Discharge)
- **1=Culvert** (Passes 10.29 cfs of 72.66 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 3.60 cfs @ 6.60 fps)
  - **3=Orifice/Grate** (Weir Controls 6.69 cfs @ 1.79 fps)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=0.00-32.00 hrs, dt=0.05 hrs, 641 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 3.0BS S: Bare Soil Runoff Area=47.750 ac 0.00% Impervious Runoff Depth=4.01"
Tc=10.0 min CN=94 Runoff=265.81 cfs 15.965 af

Subcatchment DB 1.0: Ex Cond Area Runoff Area=73.500 ac 0.00% Impervious Runoff Depth=1.89"
Flow Length=3,380' Tc=26.9 min CN=71 Runoff=125.52 cfs 11.591 af

Subcatchment DB 1.0 BS: Bare Soil Area Runoff Area=42.540 ac 0.00% Impervious Runoff Depth=4.01"
Tc=10.0 min CN=94 Runoff=236.81 cfs 14.223 af

Subcatchment DB 2.0 BS: East Staging Runoff Area=24.000 ac 0.00% Impervious Runoff Depth=4.01"
Tc=10.0 min CN=94 Runoff=133.60 cfs 8.024 af

Subcatchment DB 2.1 BS: West Bare Soil Runoff Area=15.000 ac 0.00% Impervious Runoff Depth=4.01"
Tc=6.0 min CN=94 Runoff=93.56 cfs 5.015 af

Subcatchment DB 2.1 Ex: West Ex Cover Runoff Area=10.540 ac 0.00% Impervious Runoff Depth=2.21"
Tc=6.0 min CN=75 Runoff=40.13 cfs 1.940 af

Subcatchment DB 3.0 Ex: Offsite Runoff Area=4.350 ac 0.00% Impervious Runoff Depth=0.07"
Flow Length=1,343' Tc=43.0 min CN=36 Runoff=0.03 cfs 0.025 af

Subcatchment DB-1.1: Stockpile 1 Runoff Area=8.150 ac 0.00% Impervious Runoff Depth=4.01"
Flow Length=905' Tc=5.1 min CN=94 Runoff=52.67 cfs 2.725 af

Subcatchment DB-4.0: S-2 East Runoff Area=21.660 ac 0.00% Impervious Runoff Depth=4.01"
Tc=10.0 min CN=94 Runoff=120.57 cfs 7.242 af

Subcatchment DB-5.0: X1 Runoff Area=17.500 ac 0.00% Impervious Runoff Depth=4.01"
Tc=10.0 min CN=94 Runoff=97.42 cfs 5.851 af

Subcatchment DB-6.0: X4 Runoff Area=25.000 ac 0.00% Impervious Runoff Depth=4.01"
Tc=10.0 min CN=94 Runoff=139.17 cfs 8.359 af

Subcatchment DB-7.0: X2 &X3 Runoff Area=15.700 ac 0.00% Impervious Runoff Depth=4.01"
Tc=10.0 min CN=94 Runoff=87.40 cfs 5.249 af

Subcatchment DB-CH-1: Undisturbed Runoff Area=38.370 ac 0.00% Impervious Runoff Depth=1.89"
Flow Length=1,343' Tc=11.3 min CN=71 Runoff=104.78 cfs 6.051 af

Reach 1R: Storm Sewer SS-1 Avg. Flow Depth=1.90' Max Vel=14.27 fps Inflow=76.33 cfs 11.750 af
42.0" Round Pipe n=0.013 L=1,144.0' S=0.0174 '/' Capacity=132.69 cfs Outflow=75.11 cfs 11.730 af

Reach 6R: Channel 1 Avg. Flow Depth=1.40' Max Vel=5.05 fps Inflow=123.14 cfs 12.730 af
n=0.040 L=500.0' S=0.0170 '/' Capacity=135.85 cfs Outflow=117.96 cfs 12.717 af

Pond B-1.0: Initial Pond Peak Elev=1,113.44' Storage=17.110 af Inflow=299.65 cfs 25.815 af
Primary=88.18 cfs 20.311 af Secondary=23.65 cfs 0.713 af Outflow=111.83 cfs 21.024 af

Pond B-1.1: Peak Elev=108.21' Storage=147,223 cf Inflow=52.67 cfs 2.725 af
Primary=1.63 cfs 2.314 af Secondary=0.00 cfs 0.000 af Outflow=1.63 cfs 2.314 af

Pond B-2.0: Staging SE Peak Elev=1,134.46' Storage=229,837 cf Inflow=133.60 cfs 8.024 af
Primary=74.00 cfs 6.268 af Secondary=0.00 cfs 0.000 af Outflow=74.00 cfs 6.268 af

Pond B-2.1: Staging SW Peak Elev=1,132.63' Storage=319,224 cf Inflow=133.52 cfs 6.955 af
Primary=5.54 cfs 5.482 af Secondary=0.00 cfs 0.000 af Outflow=5.54 cfs 5.482 af

Pond B-3.0: (new Pond) Peak Elev=1,164.00' Storage=14.530 af Inflow=265.81 cfs 15.990 af
Outflow=126.89 cfs 13.718 af

Pond B-4.0: (new Pond) Peak Elev=1,194.84' Storage=346,732 cf Inflow=120.57 cfs 7.242 af
Outflow=35.76 cfs 6.678 af

Pond B-5.0: Peak Elev=107.70' Storage=6.975 af Inflow=97.42 cfs 5.851 af
Outflow=28.26 cfs 5.472 af

Pond B-6.0: Peak Elev=108.11' Storage=8.788 af Inflow=139.17 cfs 8.359 af
Outflow=55.70 cfs 7.734 af

Pond B-7.0: Peak Elev=107.53' Storage=6.778 af Inflow=87.40 cfs 5.249 af
Outflow=19.76 cfs 4.886 af

Total Runoff Area = 344.060 ac Runoff Volume = 92.262 af Average Runoff Depth = 3.22"
100.00% Pervious = 344.060 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 3.0BS S: Bare Soil

Runoff = 265.81 cfs @ 12.01 hrs, Volume= 15.965 af, Depth= 4.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Yr Rainfall=4.70"

	Area (ac)	CN	Description
*	47.750	94	bare Soil
	47.750		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB 1.0: Ex Cond Area

Runoff = 125.52 cfs @ 12.22 hrs, Volume= 11.591 af, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Yr Rainfall=4.70"

Area (ac)	CN	Description
3.880	67	Row crops, straight row, Good, HSG A
5.950	78	Row crops, straight row, Good, HSG B
0.590	89	Row crops, straight row, Good, HSG D
8.150	30	Woods, Good, HSG A
0.510	55	Woods, Good, HSG B
26.500	77	Woods, Good, HSG D
2.660	74	Farmsteads, HSG B
2.580	86	Farmsteads, HSG D
0.320	30	Meadow, non-grazed, HSG A
3.000	58	Meadow, non-grazed, HSG B
19.360	78	Meadow, non-grazed, HSG D
73.500	71	Weighted Average
73.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.6	300	0.0730	0.30		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 2.80"
1.0	160	0.0880	2.67		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
1.6	209	0.0910	2.11		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.1	310	0.1130	1.68		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	65	0.0770	6.58	21.93	**Parabolic Channel,** W=10.00' D=0.50' Area=3.3 sf Perim=10.1' n= 0.030 Earth, grassed & winding
0.4	170	0.0880	7.03	23.44	**Parabolic Channel,** W=10.00' D=0.50' Area=3.3 sf Perim=10.1' n= 0.030 Earth, grassed & winding
0.3	211	0.1090	12.27	81.79	**Parabolic Channel,** W=10.00' D=1.00' Area=6.7 sf Perim=10.3' n= 0.030 Earth, grassed & winding
3.7	1,955	0.0390	8.81	58.71	**Parabolic Channel,** W=10.00' D=1.00' Area=6.7 sf Perim=10.3' n= 0.025
26.9	3,380	Total			

Summary for Subcatchment DB 1.0 BS: Bare Soil Area

Runoff = 236.81 cfs @ 12.01 hrs, Volume= 14.223 af, Depth= 4.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Yr Rainfall=4.70"

	Area (ac)	CN	Description
*	42.540	94	CCLC bedrock
	42.540		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB 2.0 BS: East Staging

CHANGED FROM MIKES ORIGINAL (CMR 6-23-11) Drainage Area is set to match size of pond space available.
Should be excess when combined with Basin 2.1 for Staging area then can be shaped to drain to basin, Available for treatment of A-2 during initial stripping and overburden removal until it is reshaped such that it cannont drain into Area A-1.

Runoff = 133.60 cfs @ 12.01 hrs, Volume= 8.024 af, Depth= 4.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Yr Rainfall=4.70"

	Area (ac)	CN	Description
*	24.000	94	CCLC Runoff Management footnote 1
	24.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB 2.1 BS: West Bare Soil

Runoff = 93.56 cfs @ 11.96 hrs, Volume= 5.015 af, Depth= 4.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Yr Rainfall=4.70"

	Area (ac)	CN	Description
*	15.000	94	Bare Soil
	15.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment DB 2.1 Ex: West Ex Cover

Runoff = 40.13 cfs @ 11.97 hrs, Volume= 1.940 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Yr Rainfall=4.70"

	Area (ac)	CN	Description
	1.300	30	Woods, Good, HSG A
	6.740	77	Woods, Good, HSG D
*	2.500	94	Stockpile-CCLC bedrock
	10.540	75	Weighted Average
	10.540		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Estimated**

Summary for Subcatchment DB 3.0 Ex: Offsite

Runoff = 0.03 cfs @ 17.89 hrs, Volume= 0.025 af, Depth= 0.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Yr Rainfall=4.70"

Area (ac)	CN	Description
4.350	36	Woods, Fair, HSG A
4.350		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.5	300	0.1900	0.22		**Sheet Flow, vegetated top** Woods: Light underbrush n= 0.400 P2= 2.80"
0.7	413	0.1230	10.41	104.11	**Channel Flow, Div D-6** Area= 10.0 sf Perim= 14.0' r= 0.71' n= 0.040
19.8	630	0.0950	0.53	0.05	**Channel Flow,** Area= 0.1 sf Perim= 10.0' r= 0.01' n= 0.040
43.0	1,343	Total			

Summary for Subcatchment DB-1.1: Stockpile 1

Stockpile S-1 is the primary contributing area along with access road

Runoff = 52.67 cfs @ 11.95 hrs, Volume= 2.725 af, Depth= 4.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Yr Rainfall=4.70"

	Area (ac)	CN	Description
*	8.150	94	CCLC Bedrock
	8.150		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	300	0.0100	1.21		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.80"
0.1	165	0.4400	25.07	300.89	**Channel Flow, rock chute** Area= 12.0 sf Perim= 18.0' r= 0.67' n= 0.030
0.9	440	0.0700	8.57	171.45	**Channel Flow, Downslope to pond** Area= 20.0 sf Perim= 30.0' r= 0.67' n= 0.035
5.1	905	Total			

Summary for Subcatchment DB-4.0: S-2 East

Draft 4

Runoff = 120.57 cfs @ 12.01 hrs, Volume= 7.242 af, Depth= 4.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Yr Rainfall=4.70"

	Area (ac)	CN	Description
*	21.660	94	CCLC bedrock
	21.660		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB-5.0: X1

Runoff = 97.42 cfs @ 12.01 hrs, Volume= 5.851 af, Depth= 4.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Yr Rainfall=4.70"

	Area (ac)	CN	Description
*	17.500	94	
	17.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB-6.0: X4

Runoff = 139.17 cfs @ 12.01 hrs, Volume= 8.359 af, Depth= 4.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Yr Rainfall=4.70"

	Area (ac)	CN	Description
*	25.000	94	
	25.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB-7.0: X2 &X3

Runoff = 87.40 cfs @ 12.01 hrs, Volume= 5.249 af, Depth= 4.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Yr Rainfall=4.70"

	Area (ac)	CN	Description
*	15.700	94	
	15.700		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB-CH-1: Undisturbed

Unditurbed runoff from Area A-8 and Drainage Basin X7 to be diverted by D-4 and D-3 to Ch-1

Runoff = 104.78 cfs @ 12.04 hrs, Volume= 6.051 af, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Yr Rainfall=4.70"

Area (ac)	CN	Description
3.880	67	Row crops, straight row, Good, HSG A
5.950	72	Legumes, straight row, Good, HSG B
0.380	89	Row crops, straight row, Good, HSG D
3.270	43	Woods/grass comb., Fair, HSG A
0.510	55	Woods, Good, HSG B
10.900	77	Woods, Good, HSG D
2.660	74	Farmsteads, HSG B
2.580	86	Farmsteads, HSG D
1.960	48	Brush, Good, HSG B
6.280	78	Meadow, non-grazed, HSG D
38.370	71	Weighted Average
38.370		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	300	0.0730	0.69		**Sheet Flow,** Cultivated: Residue<=20% n= 0.060 P2= 2.80"
1.0	160	0.0880	2.67		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
1.6	209	0.0910	2.11		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	310	0.1130	7.98	31.92	**Parabolic Channel,** W=12.00' D=0.50' Area=4.0 sf Perim=12.1' n= 0.030
0.9	364	0.0800	6.71	26.86	**Parabolic Channel,** W=12.00' D=0.50' Area=4.0 sf Perim=12.1' n= 0.030
11.3	1,343	Total			

Summary for Reach 1R: Storm Sewer SS-1

Storm Sewer from Manhole junction of Basin 2.0 and 2.1 outlet pipes to outfall

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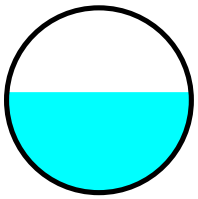
Inflow Area = 49.540 ac, 0.00% Impervious, Inflow Depth > 2.85" for 25 Yr event
Inflow = 76.33 cfs @ 12.13 hrs, Volume= 11.750 af
Outflow = 75.11 cfs @ 12.17 hrs, Volume= 11.730 af, Atten= 2%, Lag= 2.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 14.27 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 5.65 fps, Avg. Travel Time= 3.4 min

Peak Storage= 6,107 cf @ 12.15 hrs
Average Depth at Peak Storage= 1.90'
Bank-Full Depth= 3.50', Capacity at Bank-Full= 132.69 cfs

42.0" Round Pipe
n= 0.013
Length= 1,144.0' Slope= 0.0174 '/'
Inlet Invert= 1,119.90', Outlet Invert= 1,100.00'



Summary for Reach 6R: Channel 1

Channel Ch-1P
The east side ditch of the primary access road - minimum slope limiting capacity is at a slope of 1.7%

Inflow Area = 60.030 ac, 0.00% Impervious, Inflow Depth > 2.54" for 25 Yr event
Inflow = 123.14 cfs @ 12.06 hrs, Volume= 12.730 af
Outflow = 117.96 cfs @ 12.11 hrs, Volume= 12.717 af, Atten= 4%, Lag= 3.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.05 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 1.34 fps, Avg. Travel Time= 6.2 min

Peak Storage= 11,879 cf @ 12.08 hrs
Average Depth at Peak Storage= 1.40'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 135.85 cfs

12.00' x 1.50' deep channel, n= 0.040
Side Slope Z-value= 3.0 4.0 '/' Top Width= 22.50'
Length= 500.0' Slope= 0.0170 '/'
Inlet Invert= 90.00', Outlet Invert= 81.50'

‡

Summary for Pond B-1.0: Initial Pond

Preliminary Design Draft 5

Inflow Area = 116.040 ac, 0.00% Impervious, Inflow Depth = 2.67" for 25 Yr event
Inflow = 299.65 cfs @ 12.03 hrs, Volume= 25.815 af
Outflow = 111.83 cfs @ 12.42 hrs, Volume= 21.024 af, Atten= 63%, Lag= 23.5 min
Primary = 88.18 cfs @ 12.42 hrs, Volume= 20.311 af
Secondary = 23.65 cfs @ 12.42 hrs, Volume= 0.713 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 1,107.50' Surf.Area= 1.324 ac Storage= 6.277 af
Peak Elev= 1,113.44' @ 12.42 hrs Surf.Area= 2.442 ac Storage= 17.110 af (10.833 af above start)

Plug-Flow detention time= 372.2 min calculated for 14.747 af (57% of inflow)
Center-of-Mass det. time= 153.8 min (969.3 - 815.4)

Volume	Invert	Avail.Storage	Storage Description
#1	1,100.00'	21.197 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,100.00	0.394	0.000	0.000
1,105.00	0.970	3.410	3.410
1,110.00	1.678	6.620	10.030
1,115.00	2.789	11.167	21.197

Device	Routing	Invert	Outlet Devices
#1	Primary	1,103.50'	**48.0" Round Culvert** L= 125.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 1,103.50' / 1,100.00' S= 0.0280 '/' Cc= 0.900 n= 0.015
#2	Device 1	1,107.50'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,111.50'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,113.00'	**30.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=88.11 cfs @ 12.42 hrs HW=1,113.43' (Free Discharge)
└─**1=Culvert** (Passes 88.11 cfs of 213.03 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 3.98 cfs @ 11.39 fps)
  └─**3=Orifice/Grate** (Orifice Controls 84.13 cfs @ 6.69 fps)

Secondary OutFlow Max=23.10 cfs @ 12.42 hrs HW=1,113.43' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 23.10 cfs @ 1.78 fps)

Summary for Pond B-1.1:

Preliminary Design Draft 5
10 cfs Base flow for 100 yr event represents overtopping across primary access road from Channel Ch-1 @ 1136 due to discharge exceeding capacity of Culver C-4

Inflow Area =	8.150 ac,	0.00% Impervious,	Inflow Depth =	4.01"	for 25 Yr event
Inflow =	52.67 cfs @	11.95 hrs,	Volume=	2.725 af	
Outflow =	1.63 cfs @	13.78 hrs,	Volume=	2.314 af,	Atten= 97%, Lag= 109.5 min
Primary =	1.63 cfs @	13.78 hrs,	Volume=	2.314 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 105.00' Surf.Area= 20,535 sf Storage= 71,834 cf
Peak Elev= 108.21' @ 13.78 hrs Surf.Area= 26,493 sf Storage= 147,223 cf (75,389 cf above start)

Plug-Flow detention time= 1,066.7 min calculated for 0.665 af (24% of inflow)
Center-of-Mass det. time= 435.8 min (1,206.7 - 770.9)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	370,099 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
100.00	11,287	0	0
104.00	15,597	53,768	53,768
105.00	20,535	18,066	71,834
115.00	39,118	298,265	370,099

Device	Routing	Invert	Outlet Devices
#1	Primary	101.00'	**42.0" Round Culvert** L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 101.00' / 100.00' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished
#2	Device 1	105.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	113.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	113.50'	**10.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=1.63 cfs @ 13.78 hrs HW=108.21' (Free Discharge)
└─**1=Culvert** (Passes 1.63 cfs of 128.32 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 1.63 cfs @ 8.28 fps)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=105.00' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-2.0: Staging SE

Preliminary Design Draft 5
Drainage Area is set to match size of pond space available.
Excess capacity exists when combined with Basin 2.1.
Available for treatment of A-2 during initial stripping and overburden removal until it is reshaped such that it cannont drain into Area A-1.
Secondary Discharge to west side of access road and B1.1

Inflow Area =	24.000 ac,	0.00% Impervious,	Inflow Depth =	4.01"	for 25 Yr event
Inflow =	133.60 cfs @	12.01 hrs,	Volume=	8.024 af	
Outflow =	74.00 cfs @	12.12 hrs,	Volume=	6.268 af,	Atten= 45%, Lag= 7.0 min
Primary =	74.00 cfs @	12.12 hrs,	Volume=	6.268 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 1,128.80' Surf.Area= 21,476 sf Storage= 70,748 cf
Peak Elev= 1,134.46' @ 12.12 hrs Surf.Area= 34,732 sf Storage= 229,837 cf (159,089 cf above start)

Plug-Flow detention time= 378.0 min calculated for 4.644 af (58% of inflow)
Center-of-Mass det. time= 181.2 min (956.7 - 775.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,123.00'	284,322 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,123.00	6,356	0	0
1,127.00	12,721	38,154	38,154
1,128.00	19,603	16,162	54,316
1,134.50	34,824	176,888	231,204
1,136.00	36,000	53,118	284,322

Device	Routing	Invert	Outlet Devices
#1	Primary	1,122.14'	**42.0" Round Culvert** L= 140.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,122.14' / 1,119.90' S= 0.0160 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets
#2	Device 1	1,128.80'	**5.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,133.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,135.50'	**10.0' long x 50.0' breadth Broad-Crested Rectangular Weir**

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=72.08 cfs @ 12.12 hrs HW=1,134.43' (Free Discharge)
└─**1=Culvert** (Passes 72.08 cfs of 118.76 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 1.53 cfs @ 11.22 fps)
  └─**3=Orifice/Grate** (Weir Controls 70.55 cfs @ 3.92 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,128.80' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-2.1: Staging SW

Preliminary Design Draft 5
Fixed Drainage area from existing cover to west, partial Stockpile 1 runoff, and potential staging area runoff. Used in combination with B-2.0

Inflow Area =	25.540 ac,	0.00% Impervious,	Inflow Depth =	3.27"	for 25 Yr event
Inflow =	133.52 cfs @	11.97 hrs,	Volume=	6.955 af	
Outflow =	5.54 cfs @	13.40 hrs,	Volume=	5.482 af,	Atten= 96%, Lag= 86.1 min
Primary =	5.54 cfs @	13.40 hrs,	Volume=	5.482 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 1,128.00' Surf.Area= 35,077 sf Storage= 131,213 cf
Peak Elev= 1,132.63' @ 13.40 hrs Surf.Area= 46,080 sf Storage= 319,224 cf (188,012 cf above start)

Plug-Flow detention time= 907.4 min calculated for 2.470 af (36% of inflow)
Center-of-Mass det. time= 425.7 min (1,215.0 - 789.3)

Volume	Invert	Avail.Storage	Storage Description
#1	1,123.00'	488,076 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,123.00	21,727	0	0
1,127.00	28,088	99,630	99,630
1,128.00	35,077	31,583	131,213
1,134.50	50,513	278,168	409,380
1,136.00	54,415	78,696	488,076

Device	Routing	Invert	Outlet Devices
#1	Primary	1,121.40'	**36.0" Round Culvert** L= 80.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 1,121.40' / 1,120.40' S= 0.0125 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets
#2	Device 1	1,128.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,132.50'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,135.50'	**10.0' long x 50.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60

Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=5.48 cfs @ 13.40 hrs HW=1,132.63' (Free Discharge)
└─**1=Culvert** (Passes 5.48 cfs of 122.71 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 3.49 cfs @ 9.98 fps)
  └─**3=Orifice/Grate** (Weir Controls 2.00 cfs @ 1.19 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,128.00' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-3.0: (new Pond)

Inflow Area = 52.100 ac, 0.00% Impervious, Inflow Depth = 3.68" for 25 Yr event
Inflow = 265.81 cfs @ 12.01 hrs, Volume= 15.990 af
Outflow = 126.89 cfs @ 12.15 hrs, Volume= 13.718 af, Atten= 52%, Lag= 8.3 min
Primary = 126.89 cfs @ 12.15 hrs, Volume= 13.718 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 1,160.00' Surf.Area= 1.728 ac Storage= 6.951 af
Peak Elev= 1,164.00' @ 12.15 hrs Surf.Area= 2.064 ac Storage= 14.530 af (7.579 af above start)

Plug-Flow detention time= 594.3 min calculated for 6.756 af (42% of inflow)
Center-of-Mass det. time= 213.2 min (989.3 - 776.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,155.00'	16.637 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,155.00	1.215	0.000	0.000
1,157.00	1.338	2.553	2.553
1,159.00	1.464	2.802	5.355
1,160.00	1.728	1.596	6.951
1,162.00	1.893	3.621	10.572
1,165.00	2.150	6.064	16.637

Device	Routing	Invert	Outlet Devices
#1	Primary	1,155.00'	**30.0" Round Culvert** L= 200.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 1,155.00' / 90.00' S= 5.3250 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished
#2	Device 1	1,160.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,162.50'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	1,163.50'	**50.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=126.24 cfs @ 12.15 hrs HW=1,164.00' (Free Discharge)
- **1=Culvert** (Passes 78.99 cfs of 82.23 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 4.97 cfs @ 9.11 fps)
  - **3=Orifice/Grate** (Orifice Controls 74.02 cfs @ 5.89 fps)
- **4=Broad-Crested Rectangular Weir** (Weir Controls 47.25 cfs @ 1.90 fps)

Summary for Pond B-4.0: (new Pond)

Inflow Area = 21.660 ac, 0.00% Impervious, Inflow Depth = 4.01" for 25 Yr event
Inflow = 120.57 cfs @ 12.01 hrs, Volume= 7.242 af
Outflow = 35.76 cfs @ 12.20 hrs, Volume= 6.678 af, Atten= 70%, Lag= 11.6 min
Primary = 35.76 cfs @ 12.20 hrs, Volume= 6.678 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 1,192.00' Surf.Area= 51,246 sf Storage= 187,522 cf
Peak Elev= 1,194.84' @ 12.20 hrs Surf.Area= 60,962 sf Storage= 346,732 cf (159,210 cf above start)

Plug-Flow detention time= 798.6 min calculated for 2.370 af (33% of inflow)
Center-of-Mass det. time= 254.5 min (1,029.9 - 775.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,187.00'	486,634 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,187.00	30,347	0	0
1,191.00	40,482	141,658	141,658
1,192.00	51,246	45,864	187,522
1,194.00	58,005	109,251	296,773
1,197.00	68,569	189,861	486,634

Device	Routing	Invert	Outlet Devices
#1	Primary	1,187.00'	**30.0" Round Culvert** L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 1,187.00' / 1,185.00' S= 0.0200 '/' Cc= 0.900 n= 0.012
#2	Device 1	1,192.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,194.00'	**48.0" Horiz. Grated MH top** C= 0.600 Limited to weir flow at low heads
#4	Primary	1,195.50'	**10.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=35.69 cfs @ 12.20 hrs HW=1,194.84' (Free Discharge)
- **1=Culvert** (Passes 35.69 cfs of 75.68 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 4.09 cfs @ 7.49 fps)
  - **3=Grated MH top** (Weir Controls 31.60 cfs @ 3.00 fps)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-5.0:

Preliminary Design Draft 5

Inflow Area = 17.500 ac, 0.00% Impervious, Inflow Depth = 4.01" for 25 Yr event
Inflow = 97.42 cfs @ 12.01 hrs, Volume= 5.851 af
Outflow = 28.26 cfs @ 12.20 hrs, Volume= 5.472 af, Atten= 71%, Lag= 11.8 min
Primary = 28.26 cfs @ 12.20 hrs, Volume= 5.472 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 105.00' Surf.Area= 1.048 ac Storage= 4.016 af
Peak Elev= 107.70' @ 12.20 hrs Surf.Area= 1.141 ac Storage= 6.975 af (2.959 af above start)

Plug-Flow detention time= 881.0 min calculated for 1.454 af (25% of inflow)
Center-of-Mass det. time= 250.9 min (1,026.4 - 775.5)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	9.689 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
100.00	0.631	0.000	0.000
102.00	0.728	1.359	1.359
104.00	0.937	1.665	3.024
105.00	1.048	0.993	4.016
107.00	1.116	2.164	6.180
110.00	1.223	3.509	9.689

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**30.0" Round Culvert** L= 200.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 100.00' / 90.00' S= 0.0500 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished
#2	Device 1	105.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	107.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	108.00'	**30.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=28.17 cfs @ 12.20 hrs HW=107.70' (Free Discharge)
- **1=Culvert** (Passes 28.17 cfs of 75.05 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 3.97 cfs @ 7.28 fps)
  - **3=Orifice/Grate** (Weir Controls 24.20 cfs @ 2.74 fps)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-6.0:

Preliminary Design Draft 5

Inflow Area = 25.000 ac, 0.00% Impervious, Inflow Depth = 4.01" for 25 Yr event
Inflow = 139.17 cfs @ 12.01 hrs, Volume= 8.359 af
Outflow = 55.70 cfs @ 12.16 hrs, Volume= 7.734 af, Atten= 60%, Lag= 9.4 min
Primary = 55.70 cfs @ 12.16 hrs, Volume= 7.734 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 105.00' Surf.Area= 1.224 ac Storage= 4.795 af
Peak Elev= 108.11' @ 12.16 hrs Surf.Area= 1.341 ac Storage= 8.788 af (3.993 af above start)

Plug-Flow detention time= 741.7 min calculated for 2.934 af (35% of inflow)
Center-of-Mass det. time= 230.0 min (1,005.5 - 775.5)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	11.386 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
100.00	0.771	0.000	0.000
102.00	0.878	1.649	1.649
104.00	1.104	1.982	3.631
105.00	1.224	1.164	4.795
107.00	1.299	2.523	7.318
110.00	1.413	4.068	11.386

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**30.0" Round Culvert** L= 200.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 100.00' / 90.00' S= 0.0500 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished
#2	Device 1	105.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	107.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	108.00'	**30.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=54.75 cfs @ 12.16 hrs HW=108.10' (Free Discharge)
- **1=Culvert** (Passes 52.03 cfs of 77.35 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 4.31 cfs @ 7.89 fps)
  - **3=Orifice/Grate** (Weir Controls 47.72 cfs @ 3.44 fps)
- **4=Broad-Crested Rectangular Weir** (Weir Controls 2.73 cfs @ 0.87 fps)

Summary for Pond B-7.0:

Preliminary Design Draft 5

Inflow Area = 15.700 ac, 0.00% Impervious, Inflow Depth = 4.01" for 25 Yr event
Inflow = 87.40 cfs @ 12.01 hrs, Volume= 5.249 af
Outflow = 19.76 cfs @ 12.24 hrs, Volume= 4.886 af, Atten= 77%, Lag= 14.0 min
Primary = 19.76 cfs @ 12.24 hrs, Volume= 4.886 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 105.00' Surf.Area= 1.048 ac Storage= 4.016 af
Peak Elev= 107.53' @ 12.24 hrs Surf.Area= 1.135 ac Storage= 6.778 af (2.762 af above start)

Plug-Flow detention time= 1,029.1 min calculated for 0.868 af (17% of inflow)
Center-of-Mass det. time= 269.1 min (1,044.6 - 775.5)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	9.689 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
100.00	0.631	0.000	0.000
102.00	0.728	1.359	1.359
104.00	0.937	1.665	3.024
105.00	1.048	0.993	4.016
107.00	1.116	2.164	6.180
110.00	1.223	3.509	9.689

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**30.0" Round Culvert** L= 200.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 100.00' / 90.00' S= 0.0500 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished
#2	Device 1	105.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	107.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	108.00'	**30.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=19.66 cfs @ 12.24 hrs HW=107.53' (Free Discharge)
- **1=Culvert** (Passes 19.66 cfs of 74.04 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 3.82 cfs @ 7.00 fps)
  - **3=Orifice/Grate** (Weir Controls 15.84 cfs @ 2.38 fps)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=0.00-32.00 hrs, dt=0.05 hrs, 641 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 3.0BS S: Bare Soil Runoff Area=47.750 ac 0.00% Impervious Runoff Depth=5.10"
Tc=10.0 min CN=94 Runoff=332.99 cfs 20.288 af

Subcatchment DB 1.0: Ex Cond Area Runoff Area=73.500 ac 0.00% Impervious Runoff Depth=2.74"
Flow Length=3,380' Tc=26.9 min CN=71 Runoff=184.93 cfs 16.773 af

Subcatchment DB 1.0 BS: Bare Soil Area Runoff Area=42.540 ac 0.00% Impervious Runoff Depth=5.10"
Tc=10.0 min CN=94 Runoff=296.66 cfs 18.075 af

Subcatchment DB 2.0 BS: East Staging Runoff Area=24.000 ac 0.00% Impervious Runoff Depth=5.10"
Tc=10.0 min CN=94 Runoff=167.37 cfs 10.197 af

Subcatchment DB 2.1 BS: West Bare Soil Runoff Area=15.000 ac 0.00% Impervious Runoff Depth=5.10"
Tc=6.0 min CN=94 Runoff=117.13 cfs 6.373 af

Subcatchment DB 2.1 Ex: West Ex Cover Runoff Area=10.540 ac 0.00% Impervious Runoff Depth=3.11"
Tc=6.0 min CN=75 Runoff=56.28 cfs 2.734 af

Subcatchment DB 3.0 Ex: Offsite Runoff Area=4.350 ac 0.00% Impervious Runoff Depth=0.25"
Flow Length=1,343' Tc=43.0 min CN=36 Runoff=0.17 cfs 0.091 af

Subcatchment DB-1.1: Stockpile 1 Runoff Area=8.150 ac 0.00% Impervious Runoff Depth=5.10"
Flow Length=905' Tc=5.1 min CN=94 Runoff=65.93 cfs 3.463 af

Subcatchment DB-4.0: S-2 East Runoff Area=21.660 ac 0.00% Impervious Runoff Depth=5.10"
Tc=10.0 min CN=94 Runoff=151.05 cfs 9.203 af

Subcatchment DB-5.0: X1 Runoff Area=17.500 ac 0.00% Impervious Runoff Depth=5.10"
Tc=10.0 min CN=94 Runoff=122.04 cfs 7.435 af

Subcatchment DB-6.0: X4 Runoff Area=25.000 ac 0.00% Impervious Runoff Depth=5.10"
Tc=10.0 min CN=94 Runoff=174.34 cfs 10.622 af

Subcatchment DB-7.0: X2 &X3 Runoff Area=15.700 ac 0.00% Impervious Runoff Depth=5.10"
Tc=10.0 min CN=94 Runoff=109.48 cfs 6.671 af

Subcatchment DB-CH-1: Undisturbed Runoff Area=38.370 ac 0.00% Impervious Runoff Depth=2.74"
Flow Length=1,343' Tc=11.3 min CN=71 Runoff=152.53 cfs 8.756 af

Reach 1R: Storm Sewer SS-1 Avg. Flow Depth=2.51' Max Vel=15.51 fps Inflow=114.67 cfs 15.868 af
42.0" Round Pipe n=0.013 L=1,144.0' S=0.0174 '/' Capacity=132.69 cfs Outflow=113.62 cfs 15.848 af

Reach 6R: Channel 1 Avg. Flow Depth=1.85' Max Vel=5.74 fps Inflow=198.23 cfs 17.333 af
n=0.040 L=500.0' S=0.0170 '/' Capacity=135.85 cfs Outflow=190.30 cfs 17.319 af

Pond B-1.0: Initial Pond Peak Elev=1,114.19' Storage=19.021 af Inflow=395.76 cfs 34.848 af
Primary=103.53 cfs 25.578 af Secondary=103.35 cfs 4.412 af Outflow=206.88 cfs 29.991 af

Pond B-1.1: Peak Elev=109.01' Storage=169,139 cf Inflow=65.93 cfs 3.463 af
Primary=1.83 cfs 2.774 af Secondary=0.00 cfs 0.000 af Outflow=1.83 cfs 2.774 af

Pond B-2.0: Staging SE Peak Elev=1,135.21' Storage=255,993 cf Inflow=167.37 cfs 10.197 af
Primary=91.51 cfs 8.427 af Secondary=0.00 cfs 0.000 af Outflow=91.51 cfs 8.427 af

Pond B-2.1: Staging SW Peak Elev=1,133.14' Storage=342,819 cf Inflow=173.26 cfs 9.107 af
Primary=24.66 cfs 7.442 af Secondary=0.00 cfs 0.000 af Outflow=24.66 cfs 7.442 af

Pond B-3.0: (new Pond) Peak Elev=1,164.47' Storage=15.504 af Inflow=332.99 cfs 20.379 af
Outflow=209.95 cfs 17.938 af

Pond B-4.0: (new Pond) Peak Elev=1,195.28' Storage=373,690 cf Inflow=151.05 cfs 9.203 af
Outflow=63.73 cfs 8.577 af

Pond B-5.0: Peak Elev=108.11' Storage=7.438 af Inflow=122.04 cfs 7.435 af
Outflow=55.05 cfs 7.020 af

Pond B-6.0: Peak Elev=108.49' Storage=9.296 af Inflow=174.34 cfs 10.622 af
Outflow=105.97 cfs 9.926 af

Pond B-7.0: Peak Elev=107.93' Storage=7.233 af Inflow=109.48 cfs 6.671 af
Outflow=41.01 cfs 6.275 af

Total Runoff Area = 344.060 ac Runoff Volume = 120.681 af Average Runoff Depth = 4.21"
100.00% Pervious = 344.060 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 3.0BS S: Bare Soil

Runoff = 332.99 cfs @ 12.01 hrs, Volume= 20.288 af, Depth= 5.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Yr Rainfall=5.80"

	Area (ac)	CN	Description
*	47.750	94	bare Soil
	47.750		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB 1.0: Ex Cond Area

Runoff = 184.93 cfs @ 12.21 hrs, Volume= 16.773 af, Depth= 2.74"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Yr Rainfall=5.80"

Area (ac)	CN	Description
3.880	67	Row crops, straight row, Good, HSG A
5.950	78	Row crops, straight row, Good, HSG B
0.590	89	Row crops, straight row, Good, HSG D
8.150	30	Woods, Good, HSG A
0.510	55	Woods, Good, HSG B
26.500	77	Woods, Good, HSG D
2.660	74	Farmsteads, HSG B
2.580	86	Farmsteads, HSG D
0.320	30	Meadow, non-grazed, HSG A
3.000	58	Meadow, non-grazed, HSG B
19.360	78	Meadow, non-grazed, HSG D
73.500	71	Weighted Average
73.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.6	300	0.0730	0.30		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 2.80"
1.0	160	0.0880	2.67		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
1.6	209	0.0910	2.11		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.1	310	0.1130	1.68		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	65	0.0770	6.58	21.93	**Parabolic Channel,** W=10.00' D=0.50' Area=3.3 sf Perim=10.1' n= 0.030 Earth, grassed & winding
0.4	170	0.0880	7.03	23.44	**Parabolic Channel,** W=10.00' D=0.50' Area=3.3 sf Perim=10.1' n= 0.030 Earth, grassed & winding
0.3	211	0.1090	12.27	81.79	**Parabolic Channel,** W=10.00' D=1.00' Area=6.7 sf Perim=10.3' n= 0.030 Earth, grassed & winding
3.7	1,955	0.0390	8.81	58.71	**Parabolic Channel,** W=10.00' D=1.00' Area=6.7 sf Perim=10.3' n= 0.025
26.9	3,380	Total			

Summary for Subcatchment DB 1.0 BS: Bare Soil Area

Runoff = 296.66 cfs @ 12.01 hrs, Volume= 18.075 af, Depth= 5.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Yr Rainfall=5.80"

	Area (ac)	CN	Description
*	42.540	94	CCLC bedrock
	42.540		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB 2.0 BS: East Staging

CHANGED FROM MIKES ORIGINAL (CMR 6-23-11) Drainage Area is set to match size of pond space available.
Should be excess when combined with Basin 2.1 for Staging area then can be shaped to drain to basin, Available for treatment of A-2 during initial stripping and overburden removal until it is reshaped such that it cannont drain into Area A-1.

Runoff = 167.37 cfs @ 12.01 hrs, Volume= 10.197 af, Depth= 5.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Yr Rainfall=5.80"

	Area (ac)	CN	Description
*	24.000	94	CCLC Runoff Management footnote 1
	24.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB 2.1 BS: West Bare Soil

Runoff = 117.13 cfs @ 11.96 hrs, Volume= 6.373 af, Depth= 5.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Yr Rainfall=5.80"

	Area (ac)	CN	Description
*	15.000	94	Bare Soil
	15.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment DB 2.1 Ex: West Ex Cover

Runoff = 56.28 cfs @ 11.97 hrs, Volume= 2.734 af, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Yr Rainfall=5.80"

	Area (ac)	CN	Description
	1.300	30	Woods, Good, HSG A
	6.740	77	Woods, Good, HSG D
*	2.500	94	Stockpile-CCLC bedrock
	10.540	75	Weighted Average
	10.540		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Estimated**

Summary for Subcatchment DB 3.0 Ex: Offsite

Runoff = 0.17 cfs @ 13.02 hrs, Volume= 0.091 af, Depth= 0.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Yr Rainfall=5.80"

Area (ac)	CN	Description
4.350	36	Woods, Fair, HSG A
4.350		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.5	300	0.1900	0.22		**Sheet Flow, vegetated top** Woods: Light underbrush n= 0.400 P2= 2.80"
0.7	413	0.1230	10.41	104.11	**Channel Flow, Div D-6** Area= 10.0 sf Perim= 14.0' r= 0.71' n= 0.040
19.8	630	0.0950	0.53	0.05	**Channel Flow,** Area= 0.1 sf Perim= 10.0' r= 0.01' n= 0.040
43.0	1,343	Total			

Summary for Subcatchment DB-1.1: Stockpile 1

Stockpile S-1 is the primary contributing area along with access road

Runoff = 65.93 cfs @ 11.95 hrs, Volume= 3.463 af, Depth= 5.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Yr Rainfall=5.80"

Area (ac)	CN	Description
* 8.150	94	CCLC Bedrock
8.150		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	300	0.0100	1.21		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.80"
0.1	165	0.4400	25.07	300.89	**Channel Flow, rock chute** Area= 12.0 sf Perim= 18.0' r= 0.67' n= 0.030
0.9	440	0.0700	8.57	171.45	**Channel Flow, Downslope to pond** Area= 20.0 sf Perim= 30.0' r= 0.67' n= 0.035
5.1	905	Total			

Summary for Subcatchment DB-4.0: S-2 East

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Runoff = 151.05 cfs @ 12.01 hrs, Volume= 9.203 af, Depth= 5.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Yr Rainfall=5.80"

	Area (ac)	CN	Description
*	21.660	94	CCLC bedrock
	21.660		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB-5.0: X1

Runoff = 122.04 cfs @ 12.01 hrs, Volume= 7.435 af, Depth= 5.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Yr Rainfall=5.80"

	Area (ac)	CN	Description
*	17.500	94	
	17.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB-6.0: X4

Runoff = 174.34 cfs @ 12.01 hrs, Volume= 10.622 af, Depth= 5.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Yr Rainfall=5.80"

	Area (ac)	CN	Description
*	25.000	94	
	25.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB-7.0: X2 &X3

Runoff = 109.48 cfs @ 12.01 hrs, Volume= 6.671 af, Depth= 5.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Yr Rainfall=5.80"

	Area (ac)	CN	Description
*	15.700	94	
	15.700		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment DB-CH-1: Undisturbed

Unditurbed runoff from Area A-8 and Drainage Basin X7 to be diverted by D-4 and D-3 to Ch-1

Runoff = 152.53 cfs @ 12.03 hrs, Volume= 8.756 af, Depth= 2.74"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Yr Rainfall=5.80"

Area (ac)	CN	Description
3.880	67	Row crops, straight row, Good, HSG A
5.950	72	Legumes, straight row, Good, HSG B
0.380	89	Row crops, straight row, Good, HSG D
3.270	43	Woods/grass comb., Fair, HSG A
0.510	55	Woods, Good, HSG B
10.900	77	Woods, Good, HSG D
2.660	74	Farmsteads, HSG B
2.580	86	Farmsteads, HSG D
1.960	48	Brush, Good, HSG B
6.280	78	Meadow, non-grazed, HSG D
38.370	71	Weighted Average
38.370		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	300	0.0730	0.69		**Sheet Flow,** Cultivated: Residue<=20% n= 0.060 P2= 2.80"
1.0	160	0.0880	2.67		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
1.6	209	0.0910	2.11		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	310	0.1130	7.98	31.92	**Parabolic Channel,** W=12.00' D=0.50' Area=4.0 sf Perim=12.1' n= 0.030
0.9	364	0.0800	6.71	26.86	**Parabolic Channel,** W=12.00' D=0.50' Area=4.0 sf Perim=12.1' n= 0.030
11.3	1,343	Total			

Summary for Reach 1R: Storm Sewer SS-1

Storm Sewer from Manhole junction of Basin 2.0 and 2.1 outlet pipes to outfall

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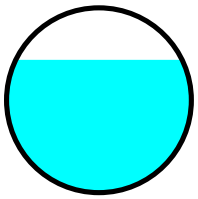
Inflow Area = 49.540 ac, 0.00% Impervious, Inflow Depth > 3.84" for 100 Yr event
Inflow = 114.67 cfs @ 12.15 hrs, Volume= 15.868 af
Outflow = 113.62 cfs @ 12.20 hrs, Volume= 15.848 af, Atten= 1%, Lag= 2.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 15.51 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 5.94 fps, Avg. Travel Time= 3.2 min

Peak Storage= 8,461 cf @ 12.17 hrs
Average Depth at Peak Storage= 2.51'
Bank-Full Depth= 3.50', Capacity at Bank-Full= 132.69 cfs

42.0" Round Pipe
n= 0.013
Length= 1,144.0' Slope= 0.0174 '/'
Inlet Invert= 1,119.90', Outlet Invert= 1,100.00'



Summary for Reach 6R: Channel 1

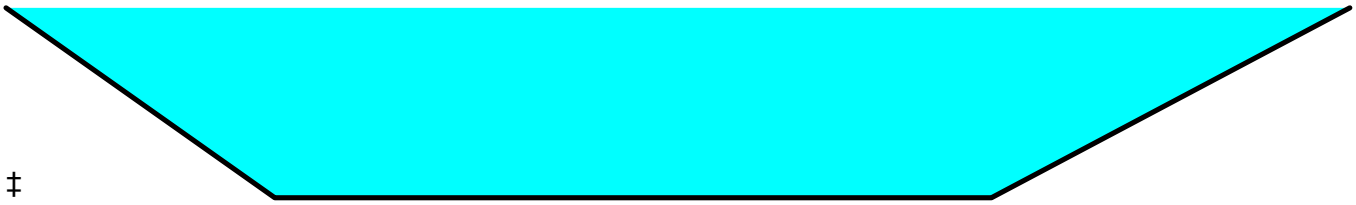
Channel Ch-1P
The east side ditch of the primary access road - minimum slope limiting capacity is at a slope of 1.7%

Inflow Area = 60.030 ac, 0.00% Impervious, Inflow Depth > 3.46" for 100 Yr event
Inflow = 198.23 cfs @ 12.06 hrs, Volume= 17.333 af
Outflow = 190.30 cfs @ 12.10 hrs, Volume= 17.319 af, Atten= 4%, Lag= 2.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.74 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 1.46 fps, Avg. Travel Time= 5.7 min

Peak Storage= 16,825 cf @ 12.08 hrs
Average Depth at Peak Storage= 1.85'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 135.85 cfs

12.00' x 1.50' deep channel, n= 0.040
Side Slope Z-value= 3.0 4.0 '/' Top Width= 22.50'
Length= 500.0' Slope= 0.0170 '/'
Inlet Invert= 90.00', Outlet Invert= 81.50'



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Summary for Pond B-1.0: Initial Pond

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Inflow Area = 116.040 ac, 0.00% Impervious, Inflow Depth = 3.60" for 100 Yr event
Inflow = 395.76 cfs @ 12.03 hrs, Volume= 34.848 af
Outflow = 206.88 cfs @ 12.32 hrs, Volume= 29.991 af, Atten= 48%, Lag= 17.4 min
Primary = 103.53 cfs @ 12.32 hrs, Volume= 25.578 af
Secondary = 103.35 cfs @ 12.32 hrs, Volume= 4.412 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 1,107.50' Surf.Area= 1.324 ac Storage= 6.277 af
Peak Elev= 1,114.19' @ 12.32 hrs Surf.Area= 2.610 ac Storage= 19.021 af (12.743 af above start)

Plug-Flow detention time= 279.3 min calculated for 23.676 af (68% of inflow)
Center-of-Mass det. time= 119.3 min (929.3 - 810.0)

Volume	Invert	Avail.Storage	Storage Description
#1	1,100.00'	21.197 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,100.00	0.394	0.000	0.000
1,105.00	0.970	3.410	3.410
1,110.00	1.678	6.620	10.030
1,115.00	2.789	11.167	21.197

Device	Routing	Invert	Outlet Devices
#1	Primary	1,103.50'	**48.0" Round Culvert** L= 125.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 1,103.50' / 1,100.00' S= 0.0280 '/' Cc= 0.900 n= 0.015
#2	Device 1	1,107.50'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,111.50'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,113.00'	**30.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=103.44 cfs @ 12.32 hrs HW=1,114.19' (Free Discharge)
└─**1=Culvert** (Passes 103.44 cfs of 222.93 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 4.24 cfs @ 12.14 fps)
  └─**3=Orifice/Grate** (Orifice Controls 99.20 cfs @ 7.89 fps)

Secondary OutFlow Max=102.53 cfs @ 12.32 hrs HW=1,114.19' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 102.53 cfs @ 2.88 fps)

Summary for Pond B-1.1:

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10 cfs Base flow for 100 yr event represents overtopping across primary access road from Channel Ch-1 @ 1136 due to discharge exceeding capacity of Culver C-4

Inflow Area =	8.150 ac,	0.00% Impervious,	Inflow Depth =	5.10"	for 100 Yr event
Inflow =	65.93 cfs @	11.95 hrs,	Volume=	3.463 af	
Outflow =	1.83 cfs @	13.98 hrs,	Volume=	2.774 af,	Atten= 97%, Lag= 121.5 min
Primary =	1.83 cfs @	13.98 hrs,	Volume=	2.774 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 105.00' Surf.Area= 20,535 sf Storage= 71,834 cf
Peak Elev= 109.01' @ 13.98 hrs Surf.Area= 27,988 sf Storage= 169,139 cf (97,305 cf above start)

Plug-Flow detention time= 982.1 min calculated for 1.125 af (32% of inflow)
Center-of-Mass det. time= 448.3 min (1,213.3 - 765.0)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	370,099 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
100.00	11,287	0	0
104.00	15,597	53,768	53,768
105.00	20,535	18,066	71,834
115.00	39,118	298,265	370,099

Device	Routing	Invert	Outlet Devices
#1	Primary	101.00'	**42.0" Round Culvert** L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 101.00' / 100.00' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished
#2	Device 1	105.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	113.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	113.50'	**10.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=1.83 cfs @ 13.98 hrs HW=109.01' (Free Discharge)
└─**1=Culvert** (Passes 1.83 cfs of 138.86 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 1.83 cfs @ 9.34 fps)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=105.00' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-2.0: Staging SE

Preliminary Design Draft 5
Drainage Area is set to match size of pond space available.
Excess capacity exists when combined with Basin 2.1.
Available for treatment of A-2 during initial stripping and overburden removal until it is reshaped such that it cannont drain into Area A-1.
Secondary Discharge to west side of access road and B1.1

Inflow Area =	24.000 ac,	0.00% Impervious,	Inflow Depth =	5.10"	for 100 Yr event
Inflow =	167.37 cfs @	12.01 hrs,	Volume=	10.197 af	
Outflow =	91.51 cfs @	12.12 hrs,	Volume=	8.427 af,	Atten= 45%, Lag= 7.0 min
Primary =	91.51 cfs @	12.12 hrs,	Volume=	8.427 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 1,128.80' Surf.Area= 21,476 sf Storage= 70,748 cf
Peak Elev= 1,135.21' @ 12.12 hrs Surf.Area= 35,378 sf Storage= 255,993 cf (185,245 cf above start)

Plug-Flow detention time= 299.2 min calculated for 6.792 af (67% of inflow)
Center-of-Mass det. time= 146.5 min (916.0 - 769.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,123.00'	284,322 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,123.00	6,356	0	0
1,127.00	12,721	38,154	38,154
1,128.00	19,603	16,162	54,316
1,134.50	34,824	176,888	231,204
1,136.00	36,000	53,118	284,322

Device	Routing	Invert	Outlet Devices
#1	Primary	1,122.14'	**42.0" Round Culvert** L= 140.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,122.14' / 1,119.90' S= 0.0160 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets
#2	Device 1	1,128.80'	**5.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,133.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,135.50'	**10.0' long x 50.0' breadth Broad-Crested Rectangular Weir**

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=90.93 cfs @ 12.12 hrs HW=1,135.18' (Free Discharge)
└─**1=Culvert** (Passes 90.93 cfs of 122.88 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 1.63 cfs @ 11.96 fps)
  └─**3=Orifice/Grate** (Orifice Controls 89.30 cfs @ 7.11 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,128.80' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-2.1: Staging SW

Preliminary Design Draft 5
Fixed Drainage area from existing cover to west, partial Stockpile 1 runoff, and potential staging area runoff. Used in combination with B-2.0

Inflow Area =	25.540 ac,	0.00% Impervious,	Inflow Depth =	4.28"	for 100 Yr event
Inflow =	173.26 cfs @	11.97 hrs,	Volume=	9.107 af	
Outflow =	24.66 cfs @	12.22 hrs,	Volume=	7.442 af,	Atten= 86%, Lag= 15.2 min
Primary =	24.66 cfs @	12.22 hrs,	Volume=	7.442 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 1,128.00' Surf.Area= 35,077 sf Storage= 131,213 cf
Peak Elev= 1,133.14' @ 12.22 hrs Surf.Area= 47,280 sf Storage= 342,819 cf (211,606 cf above start)

Plug-Flow detention time= 687.0 min calculated for 4.430 af (49% of inflow)
Center-of-Mass det. time= 326.7 min (1,110.2 - 783.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,123.00'	488,076 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,123.00	21,727	0	0
1,127.00	28,088	99,630	99,630
1,128.00	35,077	31,583	131,213
1,134.50	50,513	278,168	409,380
1,136.00	54,415	78,696	488,076

Device	Routing	Invert	Outlet Devices
#1	Primary	1,121.40'	**36.0" Round Culvert** L= 80.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 1,121.40' / 1,120.40' S= 0.0125 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets
#2	Device 1	1,128.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,132.50'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,135.50'	**10.0' long x 50.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60

Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=24.55 cfs @ 12.22 hrs HW=1,133.14' (Free Discharge)
└─**1=Culvert** (Passes 24.55 cfs of 126.01 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 3.68 cfs @ 10.55 fps)
  └─**3=Orifice/Grate** (Weir Controls 20.86 cfs @ 2.61 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,128.00' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-3.0: (new Pond)

Inflow Area = 52.100 ac, 0.00% Impervious, Inflow Depth = 4.69" for 100 Yr event
Inflow = 332.99 cfs @ 12.01 hrs, Volume= 20.379 af
Outflow = 209.95 cfs @ 12.11 hrs, Volume= 17.938 af, Atten= 37%, Lag= 6.2 min
Primary = 209.95 cfs @ 12.11 hrs, Volume= 17.938 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 1,160.00' Surf.Area= 1.728 ac Storage= 6.951 af
Peak Elev= 1,164.47' @ 12.11 hrs Surf.Area= 2.104 ac Storage= 15.504 af (8.553 af above start)

Plug-Flow detention time= 430.6 min calculated for 10.970 af (54% of inflow)
Center-of-Mass det. time= 172.9 min (943.7 - 770.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,155.00'	16.637 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,155.00	1.215	0.000	0.000
1,157.00	1.338	2.553	2.553
1,159.00	1.464	2.802	5.355
1,160.00	1.728	1.596	6.951
1,162.00	1.893	3.621	10.572
1,165.00	2.150	6.064	16.637

Device	Routing	Invert	Outlet Devices
#1	Primary	1,155.00'	**30.0" Round Culvert** L= 200.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 1,155.00' / 90.00' S= 5.3250 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished
#2	Device 1	1,160.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,162.50'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	1,163.50'	**50.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=206.92 cfs @ 12.11 hrs HW=1,164.45' (Free Discharge)
- **1=Culvert** (Inlet Controls 84.61 cfs @ 17.24 fps)
  - **2=Orifice/Grate** (Passes < 5.28 cfs potential flow)
  - **3=Orifice/Grate** (Passes < 84.54 cfs potential flow)
- **4=Broad-Crested Rectangular Weir** (Weir Controls 122.30 cfs @ 2.57 fps)

Summary for Pond B-4.0: (new Pond)

Inflow Area = 21.660 ac, 0.00% Impervious, Inflow Depth = 5.10" for 100 Yr event
Inflow = 151.05 cfs @ 12.01 hrs, Volume= 9.203 af
Outflow = 63.73 cfs @ 12.16 hrs, Volume= 8.577 af, Atten= 58%, Lag= 9.0 min
Primary = 63.73 cfs @ 12.16 hrs, Volume= 8.577 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 1,192.00' Surf.Area= 51,246 sf Storage= 187,522 cf
Peak Elev= 1,195.28' @ 12.16 hrs Surf.Area= 62,500 sf Storage= 373,690 cf (186,168 cf above start)

Plug-Flow detention time= 592.2 min calculated for 4.265 af (46% of inflow)
Center-of-Mass det. time= 217.0 min (986.5 - 769.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,187.00'	486,634 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,187.00	30,347	0	0
1,191.00	40,482	141,658	141,658
1,192.00	51,246	45,864	187,522
1,194.00	58,005	109,251	296,773
1,197.00	68,569	189,861	486,634

Device	Routing	Invert	Outlet Devices
#1	Primary	1,187.00'	**30.0" Round Culvert** L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 1,187.00' / 1,185.00' S= 0.0200 '/' Cc= 0.900 n= 0.012
#2	Device 1	1,192.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,194.00'	**48.0" Horiz. Grated MH top** C= 0.600 Limited to weir flow at low heads
#4	Primary	1,195.50'	**10.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=63.32 cfs @ 12.16 hrs HW=1,195.27' (Free Discharge)
- **1=Culvert** (Passes 63.32 cfs of 77.87 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 4.44 cfs @ 8.13 fps)
  - **3=Grated MH top** (Weir Controls 58.88 cfs @ 3.69 fps)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-5.0:

Preliminary Design Draft 5

Inflow Area = 17.500 ac, 0.00% Impervious, Inflow Depth = 5.10" for 100 Yr event
Inflow = 122.04 cfs @ 12.01 hrs, Volume= 7.435 af
Outflow = 55.05 cfs @ 12.15 hrs, Volume= 7.020 af, Atten= 55%, Lag= 8.7 min
Primary = 55.05 cfs @ 12.15 hrs, Volume= 7.020 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 105.00' Surf.Area= 1.048 ac Storage= 4.016 af
Peak Elev= 108.11' @ 12.15 hrs Surf.Area= 1.155 ac Storage= 7.438 af (3.421 af above start)

Plug-Flow detention time= 661.1 min calculated for 2.999 af (40% of inflow)
Center-of-Mass det. time= 216.5 min (986.0 - 769.5)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	9.689 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
100.00	0.631	0.000	0.000
102.00	0.728	1.359	1.359
104.00	0.937	1.665	3.024
105.00	1.048	0.993	4.016
107.00	1.116	2.164	6.180
110.00	1.223	3.509	9.689

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**30.0" Round Culvert** L= 200.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 100.00' / 90.00' S= 0.0500 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished
#2	Device 1	105.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	107.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	108.00'	**30.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=54.84 cfs @ 12.15 hrs HW=108.11' (Free Discharge)
- **1=Culvert** (Passes 52.08 cfs of 77.36 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 4.31 cfs @ 7.90 fps)
  - **3=Orifice/Grate** (Weir Controls 47.78 cfs @ 3.44 fps)
- **4=Broad-Crested Rectangular Weir** (Weir Controls 2.76 cfs @ 0.87 fps)

Summary for Pond B-6.0:

Preliminary Design Draft 5

Inflow Area = 25.000 ac, 0.00% Impervious, Inflow Depth = 5.10" for 100 Yr event
Inflow = 174.34 cfs @ 12.01 hrs, Volume= 10.622 af
Outflow = 105.97 cfs @ 12.12 hrs, Volume= 9.926 af, Atten= 39%, Lag= 6.5 min
Primary = 105.97 cfs @ 12.12 hrs, Volume= 9.926 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 105.00' Surf.Area= 1.224 ac Storage= 4.795 af
Peak Elev= 108.49' @ 12.12 hrs Surf.Area= 1.356 ac Storage= 9.296 af (4.501 af above start)

Plug-Flow detention time= 540.0 min calculated for 5.131 af (48% of inflow)
Center-of-Mass det. time= 195.2 min (964.7 - 769.5)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	11.386 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
100.00	0.771	0.000	0.000
102.00	0.878	1.649	1.649
104.00	1.104	1.982	3.631
105.00	1.224	1.164	4.795
107.00	1.299	2.523	7.318
110.00	1.413	4.068	11.386

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**30.0" Round Culvert** L= 200.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 100.00' / 90.00' S= 0.0500 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished
#2	Device 1	105.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	107.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	108.00'	**30.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=104.40 cfs @ 12.12 hrs HW=108.47' (Free Discharge)
- **1=Culvert** (Passes 78.03 cfs of 79.40 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 4.59 cfs @ 8.42 fps)
  - **3=Orifice/Grate** (Orifice Controls 73.44 cfs @ 5.84 fps)
- **4=Broad-Crested Rectangular Weir** (Weir Controls 26.37 cfs @ 1.86 fps)

Summary for Pond B-7.0:

Preliminary Design Draft 5

Inflow Area = 15.700 ac, 0.00% Impervious, Inflow Depth = 5.10" for 100 Yr event
Inflow = 109.48 cfs @ 12.01 hrs, Volume= 6.671 af
Outflow = 41.01 cfs @ 12.17 hrs, Volume= 6.275 af, Atten= 63%, Lag= 9.7 min
Primary = 41.01 cfs @ 12.17 hrs, Volume= 6.275 af

Routing by Stor-Ind method, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Starting Elev= 105.00' Surf.Area= 1.048 ac Storage= 4.016 af
Peak Elev= 107.93' @ 12.17 hrs Surf.Area= 1.149 ac Storage= 7.233 af (3.217 af above start)

Plug-Flow detention time= 756.2 min calculated for 2.255 af (34% of inflow)
Center-of-Mass det. time= 231.9 min (1,001.4 - 769.5)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	9.689 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
100.00	0.631	0.000	0.000
102.00	0.728	1.359	1.359
104.00	0.937	1.665	3.024
105.00	1.048	0.993	4.016
107.00	1.116	2.164	6.180
110.00	1.223	3.509	9.689

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**30.0" Round Culvert** L= 200.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 100.00' / 90.00' S= 0.0500 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished
#2	Device 1	105.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	107.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	108.00'	**30.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=40.41 cfs @ 12.17 hrs HW=107.92' (Free Discharge)
- **1=Culvert** (Passes 40.41 cfs of 76.30 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 4.16 cfs @ 7.62 fps)
  - **3=Orifice/Grate** (Weir Controls 36.26 cfs @ 3.14 fps)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Appendix J

WisDOT Standard Specifications for Highway and Structure Construction (2011 Edition)

J – 1 – Section 625: Topsoil and Salvaged Topsoil

J – 2 – Section 627: Mulching

J – 3 – Section 630: Seeding

J-1 – Section 625: Topsoil and Salvaged Topsoil

SECTION 625 TOPSOIL AND SALVAGED TOPSOIL

625.1 Description

(1) This section describes furnishing, placing, spreading, and finishing humus-bearing soil, adapted to sustain plant life, commonly known as topsoil, from locations the contractor furnishes beyond the limits of the right-of-way.

(2) This section also describes removing topsoil from the sites of proposed roadway excavations and embankments in amounts and depths available and necessary to cover the work slopes. This work also includes reclamation, placing, spreading, and finishing of this topsoil.

625.2 Materials

(1) Topsoil consists of loam, sandy loam, silt loam, silty clay loam, or clay loam humus-bearing soils adapted to sustain plant life, and ensure this topsoil is in a Ph range of 6.0 to 7.0.

(2) Salvaged topsoil consists of the loam, sandy loam, silt loam, silty clay loam or clay loam humus-bearing soils available from overlying portions of areas to be occupied by the completed roadway.

625.3 Construction

625.3.1 Preparing the Roadway for Topsoil

(1) Undercut or underfill all areas designated to receive topsoil to a degree that if covered to the required depth with topsoil the finished work conforms to the required lines, grades, slopes and cross sections the plans and drawings show.

625.3.2 Processing Topsoil or Salvaged Topsoil

(1) Mow topsoil procurement areas to a height of approximately 6 inches. Remove litter such as brush, rock, and other materials that will interfere with subsequent vegetation establishment.

(2) Strip off the humus-bearing soil. Take care to minimize removing the underlying sterile soil. Then stockpile the topsoil on the right-of-way or place it directly on the designated areas.

(3) Under the Salvaged Topsoil bid item, remove topsoil from excavation areas and the roadway foundation up to the quantity necessary to cover the slopes for the bid items of Salvaged Topsoil and Topsoil. Salvage topsoil from embankment areas outside the roadway foundation only if that additional material is required to cover the slopes.

(4) Use Salvaged Topsoil in excess of the contract quantity to replace contract quantities of Topsoil. Utilize excess topsoil on the project or dispose of as specified in 205.3.12.

625.3.3 Placing

(1) After preparing and finishing the areas designated for topsoil to the required lines, grades, slopes and cross section, place and spread the topsoil to a uniform depth as the plans show or the contract requires. If no depth is shown, place and spread the topsoil to a minimum depth of 4 inches in rural areas and a minimum depth of 6 inches in urban areas, or as the engineer designates.

(2) Break down all clods and lumps using the appropriate equipment to provide a uniformly textured soil.

(3) Where using either sod or seed mixture 40 ensure that, for the upper 2 inches, 100 percent of the material passes a one-inch sieve and at least 90 percent passes the No. 10 sieve.

(4) Remove rocks, twigs, foreign material, and clods that cannot be broken down. Dress the entire surface to present a uniform appearance. The engineer will not require rolling.

(5) If light sandy soils are covered with heavier clay bearing loam topsoil, then mix or blend the 2 types of soils to a more or less homogeneous mixture by using the appropriate equipment.

625.4 Measurement

625.4.1 Topsoil

(1) The department will measure Topsoil acceptably completed by the square yard or by the cubic yard, whichever the contract specifies.

(2) If the department measures by the square yard, the measured quantity shall equal the actual number of square yards of topsoiled area to the depth specified within the limits of construction designated on the plans, or in the contract, or as the engineer directs.

(3) If measured by the cubic yard, the department will measure material in the vehicle. If the contractor transports the material in vehicles not adapted for measurement, then the department will measure the

material in cubic yards of volume in its original position computed by the method of average end areas with no correction for curvature; or if the engineer elects, by the method of truncated prisms.

625.4.2 Salvaged Topsoil

(1) The department will measure Salvaged Topsoil by the square yard acceptably completed. The quantity measured for payment shall equal the actual number of square yards of area topsoiled to the depth specified within the limits of construction designated on the plans or in the contract, or as the engineer directs.

625.5 Payment

(1) The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
625.0100	Topsoil	SY
625.0105	Topsoil	CY
625.0500	Salvaged Topsoil	SY

625.5.1 Topsoil

(1) Payment for Topsoil is full compensation for providing, excavating, loading, hauling, and placing this material; and for undercutting excavations, or underfilling embankments necessary to receive this material. The department will make no allowance, adjustment, or measurement for payment under the Excavation bid items for undercutting cut sections, or underfilling embankments.

625.5.2 Salvaged Topsoil

(1) Payment for Salvaged Topsoil is full compensation for removing, stockpiling, reclaiming, hauling, and placing this material; and for undercutting excavations, or underfilling embankments necessary to receive this material. The department will make no deductions from the Excavation bid items for the quantities of Salvaged Topsoil material obtained from areas of cut sections. Additionally, the department will not measure or pay for the volumes of Salvaged Topsoil removed from sites of proposed embankments under the Excavation bid items, or make any allowance, adjustment, or measurement for payment under the Excavation bid items for undercutting cut sections, or underfilling embankments.

(2) If an area is damaged by erosion after partial acceptance, the department will pay for restoring topsoil in these areas at a unit price determined by multiplying the contract unit price bid for Salvaged Topsoil by 3, or absent that bid item in the contract, as the contract unit price bid for Topsoil multiplied by 3, The department will pay for restoration under the Restoration Post Acceptance Topsoil administrative item.

(3) The department will not pay for removing topsoil from outside the roadway foundation in embankment areas unless that material is necessary to cover the slopes.

J-2 – Section 627: Mulching

SECTION 627 MULCHING

627.1 Description

(1) This section describes furnishing, placing, and anchoring a mulch cover, usually in connection with seeding the surfaces of the roadway.

627.2 Materials

(1) Mulching material consists of straw or hay in an air-dry condition, wood excelsior fiber, wood chips, or other suitable material of a similar nature that the engineer approves, and is substantially free of noxious weed seeds and objectionable foreign matter.

(2) If using tackifier, the department will prequalify it before use. Select tackifiers from the department's erosion control product acceptability list (PAL). The contractor may obtain a copy of the PAL and the prequalification procedure for products not on the PAL from the department.

627.3 Construction

627.3.1 General

(1) Unless directed otherwise, place the mulch on the specified area within 2 days after completing the seeding.

(2) The contractor shall not perform mulching during periods of excessively high winds that might preclude proper mulch placement.

(3) Place the mulch loosely or open enough to allow some sunlight to penetrate and air to slowly circulate, but thick enough to shade the ground, conserve soil moisture, and prevent or reduce erosion.

(4) Maintain the mulched areas and repair all areas damaged by wind, erosion, traffic, fire or other causes before final or partial acceptance of the work.

627.3.2 Placing

(1) The contractor may perform the work as specified in one of the following ways: Method A, Method B, or Method C, or a combination of the 3, unless a specific method is specified in the contract.

627.3.2.1 Method A, Netting

(1) Uniformly spread the mulching material over the designated areas to a loose depth of 1/2 to 1 1/2 inches. Use a specific rate of application; dependent on the character of the material, that results in a cover conforming to the requirements specified above in 627.3.1. Loosen or make fluffy the mulch material from compacted bales before spreading in place. Unless directed otherwise, begin mulching at the top of the slopes and proceed downward.

(2) Securely anchor straw or hay mulch by using engineer-approved netting anchored to the ground with pegs or staples to prevent it from floating as the vegetation grows. Instead of this anchorage, the contractor may secure mulch by heavy biodegradable twine fastened by pegs or staples to form a grid with 6 to 10 feet spacing.

(3) The contractor may use department-approved erosion control mats, listed in the PAL, instead of separately applying mulch and netting.

627.3.2.2 Method B, Tackifier

(1) Treat straw or hay with a tackifier, blow from a machine, and uniformly deposit over designated areas in one operation. Place straw or hay uniformly over the area 1/2 to 1 inch deep, using 1/2 to 3 tons of mulch per acre. Mix and place tackifier according to the PAL. Within the above limits, the engineer will determine, on the job, the application rate of the mulch and the tackifier, and the engineer may vary the rates during mulching to produce the desired results. Use an engineer-approved machine to place the mulch that blows or ejects by constant air stream a controlled amount of mulch and applies a spray of tackifier to partially coat the straw or hay, sufficient to hold together and keep in place the deposited straw or hay. The contractor may apply the tackifier as an overspray in a separate operation after placing the straw or hay.

(2) Apply wood fiber, wood chips, or similar material with engineer-approved blowing machines, or other engineer-approved methods, that place a controlled amount of mulch uniformly over the area 1/2 to 1 1/2 inches deep. Treat areas receiving wood chip mulch, with one pound of available nitrogen per 1000 square feet before or after applying the chips.

(3) Throughout the process, feed the mulch material into the blowing machine to produce a constant and uniform ejection from the discharge spout, and operate in a position to produce mulch of uniform depth and coverage.

627.3.2.3 Method C, Crimping

(1) Spread the straw or hay mulch uniformly over the designated areas to a loose depth of 1/2 to 1 1/2 inches, using 1/2 to 3 tons of mulch per acre, by blowing from a machine, as specified in Method B, or by other engineer-approved methods.

(2) Immediately after spreading, anchor the mulch in the soil by using a mulch crimper consisting of a series of dull, flat discs with notched edges. Space the 20 inch diameter discs at about 8 inch centers. Equip the crimper with a ballast compartment to allow adjusting the weight for depth control.

(3) Impress the mulch into the soil 1 1/2 to 2 1/2 inches deep in one pass of the crimper. The department will not allow mulch crimpers to operate on slopes so steep that damage to the mulch, seedbed, or soil occurs. Anchor the mulch on these areas by one of the following methods: Method A or Method B. Equip and operate tractors to minimize disturbing or displacing the soil. This process may require more than one pass of the crimper to ensure adequate anchoring of the mulch.

(4) The contractor shall not use Method C if it cannot impress the mulch to a minimum of 1 1/2 inch.

627.4 Measurement

(1) The department will measure Mulching acceptably completed by the square yard or by the ton, whichever the contract specifies.

(2) If measured by the square yard, the measured quantity equals the number of square yards of surface area that the contractor applied the mulch.

(3) If measured by the ton, the measured quantity equals the number of tons of mulch provided, placed, and acceptably completed.

(4) Tackifiers or nitrogen used for treating mulch are incidental to the cost of the work.

627.5 Payment

(1) The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
627.0200	Mulching	SY
627.0205	Mulching	TON

(2) Payment for Mulching is full compensation for providing all materials, including tackifiers or nitrogen; for all hauling, treating, placing, spreading, and anchoring of the mulch material; and for maintaining the work and repairing all damaged areas.

(3) If the contractor opts to use department-approved erosion control mats instead of separately applying mulch and netting, the department will pay for it at the contract unit price for Mulching only.

J-3 – Section 630: Seeding

SECTION 63 SEEDING

63 .1 Description

(1) This section describes preparing seed beds and furnishing and sowing the required seed on slopes, appurtenances, and other areas, and on borrow pits and material disposal sites.

(2) This section also describes furnishing and sowing temporary seed mixture on the slopes and appurtenances of temporary embankments and roadways.

63 .2 Materials

63 .2.1 Seed

63 .2.1.1 General e uirements

(1) Conform to the Wisconsin statutes and Wisconsin administrative code chapter ATCP 20 regarding noxious weed seed content and labeling.

(2) Use seed within one year of the test date appearing on the label.

(3) Seed mixtures 70, 70A, 75, and 80 contain wild type forbs and grasses. Wild type is defined as seed that is derived directly from native, wild stock, including seed that was wild collected and placed into production or has been harvested directly from native stands.

63 .2.1.2 Purity and Germination

(1) Test seed according to the methods and procedures used for sampling and analyzing seed for purity, germination, and noxious weed seed content specified in the current edition of Rules for Testing Seed, published by the Association of Official Seed Analysts.

63 .2.1.3 Inoculation

(1) Inoculate legume seed (white clover, red clover, ladino clover, alsike clover, alfalfa, empire birdsfoot trefoil, partridge pea, purple prairie clover, Canada tick-trefoil, and lupine) unless it has been pre-inoculated by the vendor. Follow the inoculation instructions that come with the culture purchases. If applying the seed according to method B, 630.3.3.2, treat seeds requiring inoculation with 5 times the amount of inoculant recommended in the instructions.

(2) Avoid exposure of the culture or inoculated seed to the sunlight, and in no case shall any exposure exceed 1/2 hour.

63 .2.1.4 Storing Seed

(1) Store any seed delivered before use in a way that protects it from damage by heat, moisture, rodents, or other causes. Discard and replace any previously tested and accepted seed that becomes damaged.

63 .2.1.5 Seed Mi tures

63 .2.1.5.1 ight of ay

63 .2.1.5.1.1 Permanent

63 .2.1.5.1.1.1 Composition

(1) Seed mixtures for use on the right-of-way and easements shall, unless specified otherwise, be composed of seeds of the purity, germination, and proportions, by weight, as given in the Table of Highway Seed Mixtures and the Table of Native Seed Mixtures.

(2) Use seed of the species and varieties listed below. If no variety is listed, there will be no restriction on the variety furnished, except as follows:

1. Species composed of pure live seed (PLS) shall contain no named or improved varieties. PLS shall be grown in Wisconsin or northern Illinois, northeastern Iowa, or eastern Minnesota. Seed produced out-of-state must be grown in one of the following counties:

1.1 From northern Illinois:

Boone	Bureau	Carroll	Cook	De Kalb	Du Page	Grundy
Henry	Jo Daviess	Kane	Kendall	Lake	La Salle	Lee
McHenry	Ogle	Putnam	Rock Island	Stevenson	Whiteside	Will
Winnebago						

1.2 From northeastern Iowa:

Allamakee	Benton	Black Hawk	Bremer	Buchanan	Cedar	Chickasaw
Clayton	Clinton	Delaware	Dubuque	Fayette	Floyd	Howard

Jackson	Johnson	Jones	Linn	Mitchell	Muscatine	Scott
Winneshiek						

1.3 From eastern Minnesota:

Aitkin	Anoka	Carlton	Carver	Chisago	Dakota	Dodge
Fillmore	Goodhue	Hennepin	Houston	Isanti	Kanabec	La Sueur
Mille Lacs	Mower	Olmsted	Pine	Ramsey	Rice	Scott
Sherburne	Steele	Wabasha	Washington	Winona	Wright	

2. PLS for seed mixtures 70, 70A, 75, and 80 shall be packaged separately by species and clearly labeled with the vendor's name, species common and botanical names, gross weight, percent PLS, year of harvest and any specialized treatments that have been applied to ensure or enhance germination. If PLS is not listed, determine PLS by multiplying the percent germination times the percent purity.

3. Minimum percent purity for native for species is 90 percent. If a listed species is not available, substitutions may be made with engineer's approval and must be documented.

(3) Mix native species at the project site. Clean and debeard seeds having awns or excessive hairs before mixing.

SPECIES COMMON NAME	SPECIES BOTANICAL NAME	ACCEPTABLE VARIETIES
Kentucky Bluegrass	Poa pratensis	Low Maintenance
Red Fescue	Festuca rubra	Creeping
Hard Fescue	Festuca ovina var. duriuscula	Improved
Tall Fescue	Festuca arundinacea	Improved turf type
Salt Grass	Puccinella distans	Fult's
	Puccinella distans	Salty
Redtop	Agrostis alba	
Timothy	Phleum pratense	
Canada Wild Rye[1]	Elymus canadensis	
Perennial Ryegrass	Lolium perenne	
Perennial Ryegrass	Lolium perenne	Improved Fine
Annual Ryegrass	Lolium multiflorum	
Alsike Clover	Trifolium hybridum	
Red Clover	Trifolium pratense	
White Clover	Trifolium repens	
Birdsfoot Trefoil	Lotus corniculatus	Empire
Japanese Millet	Echinochola crusgalli var. frumentacea	
Annual Oats	Avena sativa	
Alfalfa	Medicago sativa	
Bromegrass	Bromus inermis	
Orchardgrass	Dactylis glomerata	
Ladino Clover	Trifolium repens var. latum	Ladino
Agricultural Rye	Secale cereale	
Winter Wheat	Triticum aestivum	

[1] Pure live seed

TABLE O HIGH A SEED MI TU ES

SPECIES	PURITY minimum %	GERMINATION minimum %	MIXTURE PROPORTIONS in percent				
			NO.10	NO.20	NO.30	NO.40	NO.60
Kentucky Bluegrass	98	85	40	6	10	35	
Red Fescue	97	85	25		30	20	
Hard Fescue	97	85		24	25	20	
Tall Fescue	98	85		40			
Salt Grass	98	85			10		
Redtop	92	85	5				
Timothy	98	90					12
Canada Wild Rye		PLS[1]					10
Perennial Ryegrass	97	90	20	30			
Improved Fine Perennial Ryegrass	96	85			15	25	
Annual Ryegrass	97	90					30
Alsike Clover	97	90					4
Red Clover	98	90					4
White Clover	95	90	10				
Birdsfoot Trefoil	95	80			10		
Japanese Millet	97	85					20
Annual Oats	98	90[1]					20

[1] Substitute winter wheat for annual oats in fall plantings started after September 1.

TABLE O NATI E SEED MI TU ES

SPECIES		SPECIES BOTANICAL NAME	PURITY & GERMINATION minimum %	MIXTURE PROPORTIONS in percent			
				NO. 70	NO. 70A	NO. 75	NO. 80
FORBES	Canada Anemone	*Anemone canadensis*	PLS	2			
	Butterflyweed	*Asclepias tuberosa*	PLS		2		
	New England Aster	*Aster novae-angliae*	PLS	2	2		
	Partridge-pea	*Chamaecrista (Cassia) fasciculata*	PLS		2		
	Purple Prairie Clover	*Dalea (Petalostemum) purpurea*	PLS	2	2	4	
	Canada Tick-trefoil	*Desmodium canadense*	PLS	2			
	Flowering Spurge	*Euphorbia corollata*	PLS		2		
	Wild Geranium	*Geranium maculatum*	PLS	2			
	Western Sunflower	*Helianthus occidentaalis*	PLS	3	2		
	Rough Blazingstar	*Liatris aspera*	PLS		2		
	Prairie Blazingstar	*Liatris pycnostachya*	PLS	2			
	Lupine	*Lupinus perennis*	PLS		3		
	Wild Bergamot	*Monarda fistulosa*	PLS	2			
	Horse Mint	*Monarda punctata*	PLS		2		
	Yellow Coneflower	*Ratibida pinnata*	PLS	2	2		
	Blackeyed Susan	*Rudbeckia hirta*	PLS			1	
	Showy Goldenrod	*Solidago speciosa*	PLS	2	2		
	Spiderwort	*Tradescantia ohiensis*	PLS	2	2		
	Golden Alexanders	*Zizia aurea*	PLS	2			
GRASSES	Big Bluestem	*Andropogon gerardi*	PLS	15	15	10	
	Sideoats Grama	*Bouteloua curtipendula*	PLS	15	20	20	25
	Canada Wildrye	*Elymus Canadensis*	PLS	15	15	35	23
	Slender Wheatgrass	*Elymus trachycaulus*	PLS				20
	Junegrass	*Koeleria macrantha*	PLS		5		
	Annual Ryegrass	*Lolium multiflorum*	[1]			10	10
	Switchgrass	*Panicum virgatum*	PLS				10
	Salt Grass	*Puccinella distans*	[1]				2
	Little Bluestem	*Schizachyrium (Andropogon) scoparium*	PLS	15	20	10	10
	Indiangrass	*Sorgastrum nutans*	PLS	15		10	
ALTERNATE FORBES	Sky Blue Aster	*Aster azureus*	PLS	[2]	[2]		
	White Wild Indigo	*Baptisia leucantha*	PLS	[2]	[2]		
	Pale Purple Coneflower	*Echinacea pallida*	PLS	[2]	[2]		
	White Prairie Clover	*Petalostemum candidum*	PLS	[2]	[2]		
	Stiff Goldenrod	*Solidago rigida*	PLS	[2]	[2]		
	Hoary Vervain	*Verbena stricta*	PLS	[2]	[2]		

[1] Provide the minimum purity and germination specified in 630.2.1.5.1.1.1(3) in the table of highway seed mixtures.

[2] The contractor may, if the engineer approves, substitute an alternate forb for a required forb that is not available using the same percentage as specified for the required forb. Use a different alternate forb for each unavailable required forb. Provide documentation showing that a required forb is not available before using an alternate.

63 .2.1.5.1.1.2 Mi ture

(1) The contractor shall select a seed mixture or mixtures that meet with the engineer's approval, and unless specified otherwise in the contract, shall conform to the following:

1. Use seed mixture No. 10 where average loam, heavy clay, or moist soils predominate.
2. Use seed mixture No. 20 where light, dry, well-drained, sandy, or gravelly soils predominate and for all high cut and fill slopes generally exceeding 6 to 8 feet, except where using No. 70.
3. Use seed mixture No. 10 or No. 20 on all ditches, inslopes, median areas, and low fills, except where using No. 30 or No. 70.
4. Use seed mixture No. 30 for medians and on slopes or ditches generally within 15 feet of the shoulder where a salt-tolerant turf is preferred.
5. Use seed mixture No. 40 in urban or other areas where a lawn type turf is preferred.
6. Use seed mixture No. 60 only on areas, the contract designates or the engineer specifies. Use it as a cover seeding for newly graded wet areas or as a nurse crop for specified wetland seed mixtures. The contractor shall not apply it to flooded areas.
7. Use seed mixture Nos. 70 and 70A on slopes and upland areas the contract designates or the engineer specifies. Use seed mixture No. 70 on loamy soils and seed mixture No. 70A on sandy soils.
8. Use seed mixture No. 75 where native grasses are desired for erosion control.
9. Use seed mixture No. 80 on inslopes where a salt tolerant seed mix containing native grasses is desired.

63 .2.1.5.1.2 Temporary

(1) Under the Seeding Temporary bid item, use a temporary seed mixture conforming to 630.2.1.5.1.4. Use oats in spring and summer plantings. Use winter wheat or rye for fall plantings started after September 1.

63 .2.1.5.1.3 Nurse Crop

(1) If seeding bare soil with either mixture 70, 70A, 75, or 80, include the work under the Seeding Nurse Crop bid item.

63 .2.1.5.1.4 Borro Pits and Material Disposal Sites

(1) For seeding borrow pits and material disposal sites beyond the right-of-way, use seed mixtures conforming to seed mixture 10, 20, 70, 70A, or 75 of 630.2.1.5.1.1 or a borrow pit mixture composed of seeds of the species, purity, germination and proportions, by weight as given below:

PE MANENT

SPECIES	% MINIMUM PURITY	% MINIMUM GERMINATION
Alfalfa	98	90
Bromegrass	85	85
Orchardgrass	80	85
Timothy	98	90
Red Clover	98	90
Alsike Clover	97	90
Ladino Clover	95	90
Kentucky Bluegrass	98	85
Birdsfoot Trefoil	95	80

TEMPO A

SPECIES	% MINIMUM PURITY	% MINIMUM GERMINATION
Annual Oats	98	90
Agricultural Rye	97	85
Winter Wheat	95	90

NU SE C OP

SPECIES	% MINIMUM PURITY	% MINIMUM GERMINATION
Annual Oats	98	90

Annual Ryegrass	97	90
Winter Wheat	95	90

(2) For the borrow pit mixture use, by weight, 60 percent temporary species seeds and 40 percent permanent species seeds.

(3) For the temporary component, use any combination of temporary seeds listed in the table above.

(4) For the permanent component, use seeds from not more than 4 of the permanent species listed in the table above in any combination.

(5) When nurse crop is required for spring seeding before June 15, use annual oats. For fall seeding after October 15, use winter wheat, or annual ryegrass.

63 .3 Construction

63 .3.1 General

(1) If not protecting with a mulch cover, perform seeding, except Nos. 60, 70 and 70A mixtures at times of the year when temperature and moisture conditions are suitable for seeding, except during midsummer.

(2) Perform seeding, except Nos. 60, 70 and 70A mixtures, in conjunction with mulching as specified in section 627 at any time the engineer allows.

(3) The contractor may perform seeding of Nos. 60, 70 and 70A mixtures at any time soil conditions are suitable, except between June15 and October 15, unless the engineer allows otherwise.

(4) Perform seeding with the selected seed mixture, sown at the specified rate.

63 .3.2 Preparation of Seed Bed

(1) Complete grading, shouldering, topsoiling, and fertilizing, if part of the work under contract, before permanent seeding, except the contractor may place the fertilizer and seed mixture in one operation if using equipment designed for the purpose.

(2) Just before seeding, work the area being seeded with discs, harrows, or other appropriate equipment to obtain a reasonably even and loose seedbed. Place topsoil as specified in 625.3.3.

63 .3.3 So ing

(1) Select the method of sowing from either method A, method B, method C, or an appropriate combination of methods A, B, and C. Obtain the engineer's approval for the sowing method and specific procedures used for each seed mixture used before sowing that mixture.

63 .3.3.1 Method A

(1) Sow the selected seed mixture using equipment adapted to the purpose, or by scattering it uniformly over the areas to be seeded. Lightly rake or drag to cover the seed with approximately 1/4 inch of soil. After seeding, lightly roll or compact the areas using suitable equipment, preferably the cultipacker type, when the engineer judges the seedbed too loose, or if the seedbed contains clods that might reduce seed germination. The contractor shall not roll slopes steeper than 1:3.

(2) If scattering seed by hand, perform this work with satisfactory hand seeders and only when the air is calm enough to prevent seeds from blowing away.

63 .3.3.2 Method B

(1) Sow or spread the seed upon the prepared bed using a stream or spray of water under pressure and operated from an engineer-approved machine designed for that purpose. Place the selected seed mixture and water into a tank, provided within the machine, in sufficient quantities that when spraying the seed on a given area it is uniformly spread at the required application rate. During this process, keep the tank contents stirred or agitated to provide uniform distribution. Spread the tank contents within one hour after adding the seed to the tank. The engineer will reject seed that remains mixed with the water for longer than one hour. The engineer will not require dragging or rolling.

63 .3.3.3 Method C

(1) For spring seeding of seed mixtures 70 and 70A into existing ground cover, mow existing vegetation to 4 inches or less in height 2 to 4 weeks before seeding. Ten to 14 days after mowing, spray with vegetation control herbicide conforming to 632.2.12.

(2) For fall seeding of seed mixtures 70 and 70A into existing ground cover, mow existing vegetation to 4 inches or less in height 4 to 6 weeks before seeding. Ten to 14 days after mowing, spray with vegetation

control herbicide conforming to 632.2.12. Retreat with vegetation control herbicide 10 to 14 days after initial application if live vegetation persists.

(3) Seed with a rangeland type drill with one or more seed boxes that can be calibrated independently to deliver different sized seeds uniformly at the required rate and equipped with a rear-mounted press wheel for each seed drop tube. If seeding into existing vegetation or thatch, use a rangeland type drill equipped with a no-till attachment that can cut through the vegetation or thatch in front of the V disc and seed drop tube. If the configuration of the area to be seeded allows, apply seed at 1/2 the specified seed rate and apply the second 1/2 in a perpendicular direction.

63 .3.3.4 Borro Pits and Material Disposal Sites

(1) Seed borrow pits, and material disposal sites off the right-of-way, with the selected seed mixture specified in 630.2.1.5.1.4. Consult with the landowner or the landowner's agent when selecting the seed mixture.

63 .3.3.5 Seeding ates

63 .3.3.5.1 ight of ay

(1) Use the following sowing rate for seeds in pounds per 1000 square feet:

- Seed mixture No. 10 at 1.5 pounds
- Seed mixture No. 20 at 3 pounds
- Seed mixture No. 30 at 2 pounds
- Seed mixture No. 40 at 2 pounds
- Seed mixture No. 60 at an equivalent seeding rate of 1.5 pounds[1]
- Seed mixture No. 70 or 70A at 0.4 pounds
- Seed mixture No. 75 at an equivalent seeding rate of 0.7 pounds[1]
- Seed mixture No. 80 at an equivalent seeding rate of 0.8 pounds[1]
- Temporary seeding at 3 pounds
- Nurse crop seeding at 0.8 pounds

[1] Determine the actual seeding rate by multiplying the equivalent seeding rate by the sum of the unadjusted and adjusted percentages of the various species in the seed mixtures as sown.

(2) The unadjusted percentage equals the minimum percent of purity and germination specified in the table of seed mixtures contained in 630.2.1.5.1.1.1 for the applicable species.

(3) Obtain the adjusted percentage for each of the PLS species by dividing the specified percentage of the species by the product of the percent of purity and the percent of germination for each of the PLS species as delivered.

63 .3.3.5.2 Borro Pits and Material Disposal Areas

(1) For seeding borrow pits and material disposal off the right-of-way, sow the seed mixtures specified in 630.2.1.5.1.4 at the following rates per pound per 1000 square feet:

- Seed mixture No. 10 at 0.75 pound
- Seed mixture No. 20 at 1 pound
- Seed mixture No. 70 or 70A at 0.4 pounds
- Seed mixture No 75 at 0.7 pounds
- Borrow pit mixture at 1.5 pounds

63 .3.3.6 Esta lishment Period for Nati e Seeding

(1) During the growing season after planting seed mixture 70 or 70A, mow all seeded areas twice as the engineer directs. Mow vegetation back to 6 inches when it has reached a height of at least 12 inches.

(2) During the growing season after planting seed mixture 70 or 70A, eradicate the following species from the seeded areas as soon as they become evident:

SPECIES COMMON NAME	SPECIES BOTANICAL NAME
Musk thistle	Carduus nutans
Spotted knapweed	Centaurea maculosa
Canada thistle	Cirsium arvense
Bull thistle	Cirsium vulgare
Field bindweed	Convolvulus arvensis
Leafy spurge	Euphorbia esula
Sweetclover	Melilotus species
Wild parsnip	Pastinaca sativa

(3) Eradicate by hand pulling or by applying a vegetation control herbicide conforming to 632.2.12 to individual plants.

63 .4 Measurement

(1) The department will measure the Seeding bid items by the pound acceptably completed.

(2) The department will measure quantities based on net weights of seed shipments, or on quantities weighed on department-approved scales the contractor furnishes.

(3) The department will make deductions for all quantities wasted or not actually incorporated in the work according to the contract.

(4) The department will determine the equivalent pounds of seed furnished and applied by dividing the actual pounds of seed applied by the sum of the unadjusted and adjusted percentages of the various species in the seed mixture sown.

(5) The department will use the unadjusted and adjusted percentages determined in 630.3.3.5.1.

63 .5 Payment

(1) The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
630.0100 - 0199	Seeding (mixture)	LB
630.0200	Seeding Temporary	LB
630.0300	Seeding Borrow Pit	LB
630.0400	Seeding Nurse Crop	LB

(2) Payment for the Seeding bid items is full compensation for providing, handling, and storing all seed; for providing the required culture and inoculating seed as specified; and for preparing the seed bed, sowing, covering and firming the seed. If the landowner does not want the pit or material disposal site seeded, or seeded with any of the mixtures allowed, the department will not pay for fertilization or seeding of those areas.