Town of Norwich, Vermont

CHARTERED 1761

Neil R. Fulton
Town Manager

August 25, 2015

VIA FIRST CLASS MAIL AND ELECTRONIC SUBMISSION

Department of Environmental Conservation
Rivers Program
One National Life Drive – Main 2
Montpelier, VT 05620-3522

RE: Town of Norwich Pool Dam Reconstruction, Stream Alteration Permit Application

Ladies and Gentlemen:

Enclosed for submission please find the Town of Norwich's Stream Alteration Individual Permit Application. In support of the Application, I have attached the following documents:

1. Application with attached list and map of adjoiners;
2. Application Narrative, Appendix A with exhibits;
3. Norwich Pool Fill and Drain Plan Procedures and Operations; and
4. Project Plans – 2 sets.

Copies of the Application and supporting materials are being forwarded to the Norwich Selectboard and the Norwich Town Clerk, and to the adjoiners on the attached list. It is my understanding that as a municipality Norwich is exempt from the filing fee.

Please let me know as soon as possible if you require any additional information to process the Application.

Sincerely,

Neil Fulton

Neil R. Fulton
Town Manager

cc: Norwich Selectboard
Norwich Town Clerk
Attached Project Abutters list
Phil Dechert, Zoning Administrator
Jeff Tucker, PE
Chandler Engel, PE
Phil Downey, Ph.D.
Nate Stearns, Esq.

VERMONT AGENCY OF NATURAL RESOURCES

STREAM ALTERATION INDIVIDUAL PERMIT APPLICATION

10 VSA, CHAPTER 41, SUBCHAPTER 2

Agency Use Only
Project # ______
Receipt Date ______

Applicant Name: Town of Norwich, Vermont - Neil Fulton, Town Manager

Mailing Address: 300 Main St., PO Box 376

Phone: (802) 649-1419 Cell: N/A Email: NFulton@norwich.vt.us

Project Location: Town: Norwich Stream: Charles Brown Brook Lat: N 43.724995

Nearby town highway or state route: Beaver Meadow Road **ATTACH MAP** Long: W 72.322249

Project Description:

Magnitude (length, volume, etc.): Repair approximately 180 foot long existing dam, Install new 24 foot wide removable dam section, reconstruct approximately 350 feet of stream channel and beach area.

Purpose: Repair Breached Dam

Construction Procedure: Install control of water measures, construct removable dam foundation, repair existing embankment dam and concrete spillway, reconstruct stream channel, remove control of water

Erosion/Sediment/Water Control Procedure: Install temporary water control measures around work area

ATTACH 2 COPIES : layout plan, typical or surveyed cross sections, stream profile and pertinent hydraulic or hydrologic information

Consultant/Project Supervisor: DuBois & King, Inc. Phone: 728-3376 Email: jtucker@dubois-king.com

Duration of in-stream construction (anticipated): 8 Weeks

Name and addresses of landowners and/or abutters adjacent to or across the stream from the project: Signatures are necessary if you intend to work on adjacent property or if the project will directly affect the property of others. Attach extra sheet, if needed.

Name ______ Address ______

Name ______ Address ______

Name ______ Address ______

APPLICANT MUST FILE COPY OF THIS APPLICATION WITH TOWN CLERK AND ADJOINERS

CERTIFICATION: I hereby certify that the information on this application is, to the best of my knowledge, true and accurate and that I have forwarded a copy of this application to the selectboard and town clerk of the town in which this project is to occur and to each landowner adjoining or across the stream from the project area as required in the Vermont Stream Alteration Rule. I recognize that by signing this application I am giving consent to employees of the State to enter the subject property for the purpose of processing this application and for ensuring the compliance with subsequent agency decisions relating to the project.

Print Full Name: NEIL R. FULTON

Signature of Applicant: [signature] Date: August 25, 2015

NOTE: A PERMIT MAY BE REQUIRED FROM THE US ARMY CORPS OF ENGINEERS. For information contact: US Army Corps of Engineers, VT Project Office, 11 Lincoln St - Rm210, Essex Jct VT 05452 802-872-2893

ENCLOSE $225.00 APPLICATION FEE PAYABLE BY CHECK OR MONEY ORDER TO THE "STATE OF VERMONT"
MUNICIPALITIES ARE EXEMPT FROM FEE

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Print Full Name ______

Signature of Applicant ______ Date ______

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US Army Corps of Engineers, VT Project Office, 11 Lincoln St - Rm210, Essex Jct VT 05452 802-872-2893

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MUNICIPALITIES ARE EXEMPT FROM FEE

INSTRUCTIONS

STREAM ALTERATION INDIVIDUAL PERMIT APPLICATION

(1) This application is for use by anyone proposing to alter by excavation, movement or fill of greater than 10 cubic yards any watercourse with greater than 10 square miles of watershed at the point of alteration. The limits of a watercourse extend from the top of the streambank to the top of the opposite streambank. If you have any questions regarding the jurisdiction of the statute call the Rivers Program at 802-490-6195.

(2) Submit the application at least 2 – 3 weeks before working dates.

(3) Submit your application to:

Department of Environmental Conservation
Rivers Program
One National Life Drive – Main 2
Montpelier, VT 05620-3522
ANR.WSMDRivers@state.vt.us

(4) Provide the applicant's name and contact information. Applicant can be landowner, municipality, contractor or other.

(5) Describe location by town, stream, nearby roads and latitude/longitude (if known). Provide a map. See: http://www.watershedmanagement.vt.gov/rivers/htm/rv_management.htm

(6) Describe the purpose of your project (what you wish to accomplish), its physical extent (size), the anticipated construction procedure and the erosion, sediment and water control plan.

(7) Provide plans necessary to adequately depict the proposal. Include plan view, typical or surveyed cross sections, stream profile and any other pertinent hydraulic, hydrologic, structural or property boundary information. Provide copies of FEMA flood maps wherever any floodway encroachment is anticipated. Provide two (2) copies of all design plans, elevations, sections, etc.

(8) Include name, phone number and email of consultant and/or project supervisor. Project participants may be required to participate in a project review meeting or site and/or subsequent pre-construction conference.

(9) Note anticipated in-stream construction duration.

(10) The names and addresses of property owners and abutters must be provided on the application. **Signatures are preferred** and will be considered to indicate consent to the project.

(11) Applicant must file a copy of the application with the selectboard and town clerk of the town in which the project is located and with each abutting owner upstream, downstream and across the stream from the project location.

(12) Sign and date the application. Recognize that your signature certifies that the information provided is true, that you have sent copies to the Town Clerk and to adjoiners and that you have consented to on-site inspections by State employees.

(13) Enclose application fee (no cash) $225.00 payable to "State of Vermont". Municipal projects are exempt.

(14) If the project involves work below USGS el. 95.5 in a tributary of Lake Champlain or USGS el. 682 in a tributary of Lake Memphremagog, a permit may be required under 29 V.S.A. Chap. 11. Contact Lakes and Ponds Section of the Vermont Department of Environmental Conservation at 802-490-6100.

(15) Concurrent federal jurisdiction may be exerted under Section 1 of the Rivers and Harbors Act or Section 404 of the Clean Water Act. Contact US Army Corps of Engineers, Essex VT at 802-872-2893.

NORWICH POOL PROJECT ABUTTERS

p_name1	p_name2	p_addr_a	p_city	p_state	p_zip	p_911num	p_911loca	p_taxmap
SOFRONAS DEMOSTHENES	SOFRONAS GEORGIA	P.O. BOX 405	NORWICH	VT	05055	82	GLEN RIDGE RD	10-013.000
CAVIN HELEN E		PO BOX 207	NORWICH	VT	05055	80	GLEN RIDGE RD	10-014.000
CRANDELL NATHAN	CRANDELL CHRISTINE	64 GLEN RIDGE ROAD	NORWICH	VT	05055-0484	64	GLEN RIDGE RD	10-015.000
TRACY CARL A	MCDONALD MARLENE M	44 GLEN RIDGE RD	NORWICH	VT	05055	44	GLEN RIDGE RD	10-016.000
YOUNG MARIE ELISE		319 BEAVER MEADOW RD	NORWICH	VT	05055	319	BEAVER MEADOW RD	10-020.100
LUFKIN DOUGLAS J.	GNAEDINGER ELLEN A.	313 BEAVER MEADOW RD	NORWICH	VT	05055	313	BEAVER MEADOW RD	10-020.200
NORWICH RECREATIONAL COUNCIL		PO BOX 376	NORWICH	VT	05055-0376	335	BEAVER MEADOW RD	10-021.000
JORDAN FRANCIS B	JORDAN ANITA	393 BEAVER MEADOW RD	NORWICH	VT	05055	393	BEAVER MEADOW RD	10-023.000
NORWICH FIRE DISTRICT		PO BOX 777	NORWICH	VT	05055-0777	417	BEAVER MEADOW RD	10-024.000
BOYER WILLIAM	BAHNG AIMEE	386 BEAVER MEADOW RD	NORWICH	VT	05055	386	BEAVER MEADOW RD	10-035.000
MCDONNELL TERRANCE P		15 BRIGHAM HILL RD	NORWICH	VT	05055	15	BRIGHAM HILL RD	10-036.000
GRIGGS PETER W	SMITH SYDNEY E	256 DUTTON HILL	NORWICH	VT	05055	256	DUTTON HILL	20-064.200

CLIENT:

TOWN OF NORWICH
P.O. BOX 376
NORWICH, VT 05055

DuBois & King inc.
ENGINEERING • PLANNING
MANAGEMENT • DEVELOPMENT

PARCEL BOUNDARIES
NORWICH POOL DAM

TOWN OF NORWICH VERMONT
WINDSOR COUNTY

DESIGNED BY:	-
APPROVED BY:	
DRAWN BY:	CJK
CHECKED BY:	-
PROJECT NO:	921651L1
DATE:	8/11/15
FIGURE NO.	

Norwich Pool Dam
Town of Norwich, VT
Stream Alteration Individual Permit Application
Appendix A, Narrative
August 14, 2015

The following narrative is intended to provide additional information and clarification in support of the Town of Norwich's application to reconstruct the Norwich Pool.

1. Project Purpose.

The purpose of this project is to repair the Norwich Pool Dam which failed during Tropical Storm Irene. The repairs are intended to meet the following objectives:

- The repaired structure will be capable of safely impounding the Norwich Pool each year for an approximately 10-week period, from mid-June through late August, plus the time to fill and drain the pool. In addition, the repaired structure is designed to safely pass the 0.2% probability of annual exceedance (a.k.a 500-year flood event).

- The existing deteriorated section of Charles Brown Brook which runs through the pool area will be restored by reestablishing a single stream channel with natural substrate, bed forms, channel velocities and habitat features.

- During the approximately 42-weeks when the pool is drained, Charles Brown brook will be a free-flowing stream, and will function in its natural condition, with continuity in bed form, channel velocities and sediment transport. The repaired Norwich Pool Dam will be operated in a manner where there will be no significant damage to fish life or wildlife.

2. Background and Existing (baseline) Conditions.

The Norwich Pool Dam was originally constructed in a narrow section of the Charles Brown Brook in 1944, and was continuously maintained by the Town until it was damaged in Tropical Storm Irene. The dam created an approximately 0.6-acre surface area pool, with a maximum depth of approximately 8-ft at the dam. The drainage area of Charles Brown Brook, at the Norwich Pool Dam site is approximately 5.6 sq. miles.

The dam was partially breached by Tropical Storm Irene on August 28, 2011. The main portion of the dam remained intact and it was the right abutment (looking downstream) that eroded and caused the loss of the pool. Approximately 125-ft of the 160-ft long dam remains in place. The dam was closed each year for approximately 10 weeks to impound the pool by the placement of stop logs across an approximately 4'11" wide opening.

The Norwich Pool impoundment extended approximately 340-ft upstream of the dam. The reservoir area (currently drained) is full of sediment, silt and debris deposited from Tropical Storm Irene. A 70-ft long stone dam has been placed over the past several years by people unknown and without authorization by the Town, presumably by local people in an attempt to reestablish a swimming area.

Tropical Storm Irene deposited a significant amount of sediment, silt and debris in the pool area, which has resulted in stream braiding and shallow depths of flow. The poor condition of the stream in the pool area has resulted in discontinuity of the stream form, has reduced the quality of fish habitat, and has limited fish movement for the species which inhabit Charles Brown Brook including: brook trout, black nose dace, slimy sculpin, and longnose sucker (longnose dace, creek chub, and white sucker may also be present but have not been reported recently).

Early fall brook trout populations have been sampled periodically in Charles Brown Brook and Blood Brook (Charles Brown Brook empties into Blood Brook approximately 0.3 miles downstream of the Norwich Pool impoundment). (See Table in Exhibit 1, appended hereto) In 1998, VTDEC sampled the brook trout population in Blood Brook upstream and downstream of the Charles Brown Brook confluence. When the fish density data was collected in 1998, the Norwich Pool had been annually impounded for over 50 years. The 1998 VTDEC sampling found 414 fish/mile upstream of the confluence and 654 fish/mile downstream of the confluence. VTDEC has also sampled the downstream Blood Brook station twice (in 2013 and 2014) since the dam breached in 2011. The brook trout population measured at the downstream Blood Brook station, following the dam breach, is comparable with the values measured prior to the breach (with pre-breach densities numerically greater) at 237 fish/mile (2013) and 444 fish/mile (2014). This suggests that the brook trout density in the reach of Blood Brook below the dam has remained relatively stable between 1998 and 2014, before and after the 2011 flood.

Although there are no available data on the brook trout densities in Charles Brown Brook prior to the breaching of the dam in 2011, Charles Brown Brook communities were sampled at three locations in 2013 and 2014. Generally, the highest brook trout populations were observed immediately upstream of the Norwich Pool (1100 fish/mile in 2013 and 1059 fish/mile in 2014) while the lowest densities were found in the braided reach within the pool area (160 fish/mile in 2014—no data from 2013). The brook trout densities below the Norwich Pool were intermediate and similar to the average densities observed in Blood Brook below the confluence with Charles Brown Brook (424 fish/mile in 2014—no data from 2013). The intermediate densities observed are similar to the statewide average density for brook trout as reported by Kratzer in "Biologist Report, What makes a good brook trout stream?", dated March 27, 2012.

3. **10 V.S.A, Chapter 41, Regulation of Stream Flow, Subsection 1023(a)(1) evaluation criteria.**

   The following addresses the evaluation criteria required under 10. V.S.A, Chapter 41, Regulation of Stream Flow, Subsection 1023(a)(1), as it relates to the Town of Norwich's intention to make repairs to the Norwich Pool Dam.

   - The repairs to the dam are designed to pass the 0.2 percent annual exceedance probability flood event (a.k.a 500-year flood event) without compromising its structural integrity. This is in excess of the 1 percent annual exceedance probability (100-year flood event) as required by ANR in its June 3, 2014 letter to the Town. A detailed hydrologic and a HEC-RAS hydraulic analysis has been conducted for this project which reflects 1) existing conditions, 2) proposed conditions with the pool drained and the stream in a free-flowing condition and 3) the pool impounded.

   - The HEC-RAS output provides detailed hydraulic design information for the 0.2-percent storm event (as well as the other flow frequencies modelled) such as depth and velocity of water at critical locations at the dam. This information is used in conducting the stability analysis and in the design of the structural components of the dam.

   - The dam is designed in accordance with nationally accepted design criteria. For example, loading conditions will be based on the Federal Energy Regulatory Commission

(FERC), Guidelines for the Evaluation of Hydroelectric Dams, Chapter 3, Concrete Gravity Dams.

- In general, the structural components of the ability of the dam, looking downstream from left to right are described below. These components are illustrated on the attached design plans.

    1. Left Auxiliary Spillway: structural steel sheeting will be driven to bedrock or 20-ft (whichever is encountered first). The purpose of this sheeting is to prevent head cutting and erosion that could potentially occur during a design storm within the auxiliary spillway. Erosion and associated head cutting would be stopped at the steel sheeting and prevented from propagating into the pool area and preventing failure of this area. A 5-ft wide, 2-ft deep stonefill wall, designed in accordance with the US Army Corps of Engineers' method of riprap sizing as documented in Engineering Manual 1110-2-1601 will be placed on the downstream side of the steel sheet piling as an additional erosion barrier and protection of the auxiliary spillway crest.

    2. New Concrete Spillway: This new 35-ft long spillway will consist of a concrete gravity dam placed on bedrock. Prior test pits indicate bedrock is located approximately 5-feet below the channel bottom. The design intent is to excavate to this bedrock and place the concrete directly on it. The new concrete will be pinned to the bedrock using reinforcing steel downed into the bedrock and extending into the new concrete to prevent sliding or overturning.

    3. New Removable Stoplog Section: This new, 24-ft long removable stoplog section will be placed on a new concrete sill at the invert of the stream. This concrete sill will be placed on and pinned to the bedrock, similar to the concrete spillway discussed above. Each ends of the stop logs will be fixed to new concrete abutment walls, which in turn will be pinned to bedrock. The stop logs themselves are designed by a structural engineer and are structurally capable of supporting hydrodynamic loads from the 0.2-percent frequency design flood and for seismic loadings. The structural design is conducted in accordance with the International Building Code (IBC) which considers hydrostatic, hydrodynamic and debris impact forces as defined in ASCE 7: Minimum Design Loads for Buildings and Other Structures. The vertical support posts, bracing, stop logs and the concrete foundation installed in the removable dam section will be designed to withstand the depth of overtopping associated with the design flood in a passive mode, i.e. no removal of the stop logs will be necessary prior to a flood event.

    4. Right Abutment Area: A steel sheeting wall will be installed under the right abutment area, similar to the left auxiliary spillway area to prevent erosion and head cutting of this area. The steel sheeting will extend to the right valley wall.

10 V.S.A. § 1023 (a) (2), (Will not significantly damage fish life or wildlife):

The following address VANR's comments in its letters to the Town of Norwich dated June 3, 2014 and December 12, 2014.

1) Improvement of Habitat and Connectivity

Under existing conditions, the channel of Charles Brown Brook through the pool area is braided with significant depositions of sediment, silt and debris. This braiding not only reduces stream continuity and corresponding fish movement in both a downstream and upstream direction but also is of lower quality habitat than upstream and downstream segments for the fish species present in Charles Brown Brook. Since Tropical Storm Irene in August 2011, channel adjustments in the pool area have progressed very slowly and four years later the brook remains in a significant state of disequilibrium running braided and shallow, providing poor habitat for fish and other aquatic and riparian wildlife, as evidenced by the fish sampling of 160 fish/mile in 2014.

This project includes a significant stream and riparian bank restoration component that the Town believes will result in improved habitat in the Pool area during free-flowing conditions compared to existing conditions and will achieve connectivity requirements established by VANR. This restoration component is consistent with suggestions provided by VANR in their June 3, 2014 letter to the Town, including "Achieving No Significant Loss or Degradation of Riverine Habitat" (page 3 of this letter).

The Town has incorporated VANR's suggestions into the project as outlined below and illustrated in the attached project plans.

- The Town intends to operate the pool at its historic water level by setting the spillway crest of the replacement dam at the existing crest elevation of 607.30 ft. The footprint of the dam will be minimized to the extent practical but at the same time, be designed to pass the 0.2-percent Annual Exceedance Probability (a.k.a 500-year) flood event.

- The stream restoration plan will establish a single thread channel with geometry and bed material compatible with the reach both up and downstream of the impoundment. The detailed hydraulic analysis developed for this project demonstrates the restored reach through the impoundment is able to direct and maintain flows into this single channel under drawn-down conditions.

- The restoration plan includes placement of both immobile and mobile bed materials to create a stable, flood resilient channel with a mobile bed component to allow the natural development of instream habitat features.

- The restoration plan also incorporates rock vane features along the restored banks to promote the natural development of a sinuous stream thalweg and encourage the formation of scour holes for refuge.

- The restoration plans also calls for planting of new native shrubs along the right bank of the stream in the vicinity of the Pool area. Under existing conditions, the bank is exposed and unstable with active erosion of silts and sediments into the stream. The plantings will provide stability of the bank through a new root system and will provide increased shade to the riverine system and a new food and cover source for wildlife.

The Town believes the restoration component of this project provides a high level response to improve the habitat and connectivity, versus the alternative of leaving the reach in its currently impaired state and waiting for infrequent events over the course of a generation or more to eventually improve conditions for fish life and wildlife.

The Town recognizes that given enough time, the natural geomorphic processes will reorganize the sediment deposited in the impoundment by Tropical Storm Irene. However, given the large size of much of the deposited material, it will only be remobilized and redistributed by statistically infrequent high flood flows, which will require years if not decades of adjustment before beginning to resemble a reference reach. As an example, channel modifications made below the dam following a major flood in 1972 resulted in geomorphic instabilities which are still actively playing out today more than 40 years later, as described in the 2007 Stream Geomorphic Assessment report and the 2008 Watershed Corridor Plan for Blood Brook.

2) **Development of a Single Channel, Fish Stranding and Sediment Accumulation**
VANR's June 3, 2014 letter suggests the establishment of a single channel through the pool area, but VANR's December 12, 2015 letter expresses concern with the establishment of a single thread channel due to the potential for fish stranding and mortality during drawdown and due to the potential for sedimentation during the period of impoundment.

The geometry of a single thread channel is consistent with the stream geometry upstream of the pool and provides significantly improved habitat conditions as compared to currently existing conditions.

The issue of potential fish stranding is addressed in the Filling and Draining Plan, which is appended to the Stream Alteration application. Upon draining the pool in the late summer, the sluice gate will be opened slightly, drawing down the water surface incrementally over the course of several days. In addition, the proposed grading of the restored pool area will provide direct and positive flow into the single thread channel, without the presence of depressions or areas which could become disconnected from the main pool at some point during the drawdown. The slow drawdown will prevent stranding and as a result, will prevent significant damage to fish life due to the draining activity .

Furthermore, the Town has included in its Filling and Draining Plan, a requirement that the Monitor in charge of draining the pool shall physically walk the area of the pool as it is being drained and net and release any fish that may become stranded.

Sediment may accumulate in the Pool during the period of impoundment as mobile material enters the impounded waters and settles. The extent and rate of sediment deposition is a function of the frequency and duration of storm events that occur while the pool is impounded. Little to no settlement is expected under normal summer time flows. Flood events, similar to Tropical Storm Irene, can result in significant deposition throughout the watershed, including the Pool area.

Charles Brown Brook was classified as a B or C type channel as part of a Stream Geomorphic Assessment of the Blood Brook watershed conducted in 2007. B and C channel types are characterized by a bed comprised predominately of cobble sized and larger material and typically carry a relatively low sediment load except when bank erosion processes are active. Generally bank erosion and significant sediment transport processes in these channels are associated with relatively high flow events, such as bankfull discharges.

The timing of expected sediment mobilizing events was evaluated using data from the nearby USGS stream gage on the East Orange Branch in Orange Vermont. The gage has a period of record from 1958 to present at its location in a 9 square mile drainage area. A review of the record shows that approximately 78% of the 56 recorded annual peak discharge events at that gauge occurred in months outside of the June through August window when the Norwich Pool would be impounded. In addition, of 229 recorded daily mean flows which exceeded half of the estimated bankfull discharge, more than 96% were recorded outside of the June through August window. In summary, based on historical data, the majority of sediment mobilization events are expected to occur while the dam is not forming an impoundment. This indicates that the limited amount of sediment that does accumulate while the pool is present, for approximately 10 weeks per year, will be mobilized and redeposited during seasonal high flow events when the brook is free-flowing, precluding the need for annual dredging.

Under normal summer time operating conditions, any small deposition of sediment will be remobilized and transported throughout the reach in a natural manner once the pool is drained and the impoundment converted to a free-flowing condition. In the event that a more significant sediment mobilizing flood does occur during the period of impoundment, the Town is prepared to remove up to 10 cubic yards of annual accumulated sediment from the channel, as allowed by 10 V.S.A. § 1021. The Town is committed to coordinate with VANR for consultation and to obtain any necessary permits following more rare events that result in significant amounts of deposition.

3) Temperature

The primary contributor to a potential increase in impoundment temperature is solar insolation from the sun radiating on the pool surface. This influx is offset by energy losses from the pond including heat loss due to evaporation, longwave radiation from the pool into the air, absorption of energy by the bottom of the pool, and discharge of water offset by inflows. Although all water bodies are subject to solar radiation, the proposed Norwich pool receives much less direct sunlight than an impoundment constructed in the open, such as some snow making ponds in Vermont. This is due to the fact that the pool is sited in a narrow valley with significant shading provided from surrounding terrain, trees and other vegetation. The valley walls and seasonal foliage present during the period of the impoundment significantly limits the duration that the pool receives direct sunlight over the course of the day.

Currently, an ongoing temperature study has indicated that (1) the temperature of Charles Brown Brook fluctuates diurnally and (2) water temperatures increase as waters travel downstream in 'natural' (no Pool operations) conditions. The diurnal fluctuation monitoring suggests that warming of the waters does occur throughout the Charles Brown Brook during the daytime of sunny days in all stations monitored. However, waters at each of the stations cool off substantially during the evening/night time resulting in temperatures nearly equal to the previous day's temperatures during the late night/early daylight hours. For example, comparison of temperatures at the stations both above and below the proposed Norwich pool site varied by nearly 7 F from 8:30am to4:30pm (8/3/15; Upstream 60.4 F to 67.0 F; Downstream 60.8 F to 67.7 F, respectively). (See Table in Exhibit 2 appended hereto).

Average temperatures during the first week in August (2^{nd}-7^{th}) did display an overall average temperature difference of +0.5 F above and below the proposed Pool site. It is important to note that these temperature differences occurred in the absence of the proposed Norwich pool impounding.

Water temperature monitoring is also being conducted above and below the Town's non-operational drinking water withdrawal dam located several miles above the Pool on Charles Brown Brook. This area is open with less shading and with average water depths less than anticipated for the Pool which suggests that the upstream reservoir may be more susceptible to water temperature increases based on solar radiation during the day. The July 2nd through August 7th average water temperatures above and below this shallower open area created by the old drinking water withdrawal dam yielded an average temperature difference of +0.7° F below the dam compared to the water temperatures measured upstream of the old water withdrawal dam. This difference is well below the 1.0° F standards in the Vermont Water Quality Standards for cold water fisheries.

Although water temperatures do vacillate substantially throughout Charles Brown Brook (including in the Pool site) in existing conditions, the town proposes to mitigate solar radiation effects within the proposed Pool and Charles Brown Brook downstream of the Pool. The Town proposes to plant additional shade trees along the south and east bank of Charles Brown Brook to enhance riparian habitat and shading in that area. Data collected on selected locations (open and shaded locations) in the Charles Brown Brook during 2014, suggest that shading is expected to reduce luminance heating by 85-90 percent.

Also, the design of the dam's passage of low flows during the summer includes withdrawal of cooler water from the bottom of the impoundment with discharge directly below the removable dam section. These base flows should provide cooler water to maintain the CBB habitat downstream of the proposed dam.

During normal operations, the detention time in the pool is on the order of hours due to the small pool volume. The rapid mass flux alone does not practically permit enough residence time for significant pool warming as inflows are constantly buffering the pool temperature. However, when the 7Q10 flow (0.1 cubic feet per second per square mile of drainage) is applied as an inflow to the 2 acre-foot pool, the detention time is only approximately 2 days. This is still a relatively rapid turnover of volume. Given that the site is in a naturally cool, shaded area, all baseflows will be coming off the bottom of the pool, where the lowest water temperatures are expected. Since even during an extreme drought scenario half of the pool volume is replenished each day, it is reasonable to assume the pool will have little effect on downstream water temperatures. Dubois & King has calculated that under 7Q10 low flow conditions, the expected temperature increase is a maximum of 0.3 degree Fahrenheit in a 24 hour period See Exhibit 3 appended hereto. This amount of temperature fluctuation is consistent with the naturally occurring, daily temperature fluctuations measured in Charles Brown Brook, and is not expected to have any impact on fish life or cause significant damage to fish life or wildlife.

Historically during Norwich pool impoundment, the pool provided reliably cool temperatures, which is supported by an overwhelming number of accounts by local residents. Historical accounts, existing stream conditions coupled with the proposed mitigation measures (shading and pool bottom water withdrawals) in the current plan supporting the Town's belief that creating a summertime seasonal impoundment will not significantly change the diurnal thermal regime the Norwich pool or downstream in Charles Brown Brook.

4) **Pool filling and draining procedures:**

The Town has prepared a Norwich Pool Dam Fill / Drain Plan Procedures, which is attached to this stream alteration permit application.

The operational procedures were developed with consideration given to maintaining the minimum summer base flow of 2.8 cfs during filling. This calculated flow (See Exhibit 4 appended hereto) is based on the US Fish and Wildlife Service's base flow method adopted by VANR in the "Agency Procedure for Determining Acceptable Minimum Stream Flows".

To fill the dam at the beginning of the 10-week impoundment season, the sluice gate controlling discharge will be partially closed and the reservoir will begin to fill with the accumulation of flow in excess of the minimum base flow. If actual base flow is less than or equal to the minimum base flow, the pool will not be allowed to fill and all flow will be discharged at the rate that it enters the pool. As a point of reference, approximately 1 cfs of flow in excess of the base flow will fill the reservoir in one day. A review of regional stream flow statistics (See Exhibit 4 appended hereto) shows more than 90% of the time flows will be sufficient to fill the pool while maintaining minimum base flow in less than 1 day. In abnormally dry years, the pool will simply take longer to fill.

The operational procedures for draining at the end of the impoundment season results in a controlled, slow release of the pool impoundment at a draw down rate of approximately 1 vertical foot per day. This gradual draw down rate will allow fish ample time to move into the stream channel. The operational procedures include a requirement for Town personnel to daily physically monitor the exposed bottom of the reservoir during the draw down for stranded fish and to place any into the stream. A combination of this monitoring and the proper grading of the reservoir restoration (discussed above) are expected to result in no fish mortality during the annual draw down.

In addition, the gradual draw down limits the excess discharge above the base flow of the stream to a very manageable low value, on the order of less than 1 cfs. By contrast, the normal range of stream flows in Charles Brown Brook in late August to early September is between 1 cfs and 10 cfs. Therefore, the contribution of less than 1 cfs of additional flow to the base flow is well within the range of natural variation associated with seasonal low flows.

The potential for scour or other negative effects downstream as a result of the additional flow during pool draw down is not significant. This is because the total expected stream flow (base flow plus a maximum of 1 cfs of draw down flow) is well below flows that would be expected to cause scour or other negative effects.

5) Hydraulic Connectivity

The proposed design and associated restoration of the project complies with VANR connectivity standards as demonstrated below.

- First, the removable stop log section of the repaired dam will result in Charles Brown Brook being in a free-flowing state during the period when the pool is dewatered.

- The single thread channel to be constructed through the pool area as part of this project has a bank full width of 32-feet., which is consistent with the bank full width in other reaches of the brook upstream of the dam. By comparison, the computed bank full width (for the drainage area of 5.6 sq. miles) from the VANR Vermont Regional Hydraulic Geometry Curves (Jan. 2006) is 28-ft.

- The hydraulic analysis (HEC-RAS) conducted as part of this project indicates a top width of approximately 32-ft along this single thread channel during Q2 flows, which is very consistent with the widths of Charles Brown Brook immediately upstream of the pool area.

- The clear width of the stream at the dam, when the stop logs are removed and the pool drained, is 24-ft. This width matches the existing conditions effective clear width at the dam and does not create any additional constriction at this location.

- The foundation sill of the removable stop logs at the dam will be set slightly below the stream channel invert to allow upstream alluvial material to mobilize, covering the sill and creating a continuous stream bed. This will result in a channel bed condition that is indistinguishable from the natural habitat in the upstream and downstream reaches.

- The HEC-RAS model results indicate, during a bank full event (Q2) for existing and proposed conditions (pool drained), the restoration of the pool clearly creates a more consistent, laminar and stable flow condition through the restored pool area as compared to existing conditions.

- For example, under existing conditions, the top width of the flow varies from a low of 34-ft at the pool inlet, but increases to up a maximum of 85-ft within the pool area, which is reflective of the braided and unstable condition. The velocities range from 3.5 feet per second (fps) to 6.5 fps. In addition, there are several hydraulic jumps where the Froude Number in the channel oscillates between values greater than 1 (super critical flow) and less than 1.0 (subcritical flow). This is consistent with the existing conditions which is unstable and braided.

- For this same bank full flow (Q2) under proposed (restored) conditions, the variation in the top width is much less, between 32 and 49 feet and a much more consistent velocity, with values ranging between 4.8 and 6.1 fps. Further, flow remains laminar (subcritical) with the Froude number ranging between 0.65

- The depth and velocity of water downstream of the dam is exactly the same from existing to proposed conditions.

6) Fish Passage Structure

The Town initially proposed a fish passage structure to be incorporated into this project. In their December 12, 2014 letter, VANR expressed concerns with a fish ladder and question its effectiveness if fish would use it. The Town concurs with VANR and believes the smaller sized fish in this stream would not likely look utilize a fish ladder during the periods of impoundment, primarily because the fish species in this brook are not in a migratory pattern during the summer months. Fish biology in the low flows of summer normally results in fish moving only over short distances and preferring to remain in local reaches as further discussed below.

The pool will be impounded during a period of the year when the target fish (primarily brook trout, but also blacknose dace, slimy sculpin, and longnose sucker) are not migrating for spawning. Brook trout typically spawn from late September to early November in Vermont (Langdon et al. 2006). The Vermont Dept. of Fish and Wildlife document (2009) "Guidelines for the Design of Stream/Road Crossings for Passage of Aquatic Organisms in Vermont" list instream construction for road crossings for brook trout streams from June 1 to October 1, presumably based on the low potential impact on habitat and spawning of brook trout. This is the time period is slightly longer and overlaps the period when the pool will be impounded.

The need for a fish ladder was intensely investigated by the Town to determine the need and efficacy of a ladder during the summer when the pool is operational. Since unimpeded fish movement would exist between the upstream reach of CBB and the Norwich pool, the need for passage focused on summer time migration into the Norwich pool and potentially beyond from individuals downstream of the proposed pool.

As noted by Adams et al. (2000) who citing numerous other authors, upstream movements of brook trout older than age 0 are generally more common and more extensive that downstream movements during the summer. Although they found that age 0 brook trout movements were highly variable, Adams et al. found little indication that any of these smaller fish movements were longer than 67m in either direction. They also found that small brook trout (<100mm) movement was minimal in either direction. Since brook trout populations in Charles Brown Brook consists of a high percentage (50% or more) of smaller individuals (<100mm), significant movement of these brook trout would be expected to be minimal during the summer.

As such, the Town concludes that no significant number of brook trout would utilize a fish ladder during the approximately 10-week summer period due to the population size composition and fish behavior. The absence of a fish ladder during the summer would not result in significant impact on Charles Brown Brook trout population as the barrier which the ladder would mitigate will not be in place during critical spawning or migration times.

EXHIBIT 1

FISH POPULATION SAMPLING

Table 1. Reported densities and size categories for Brook Trout for selected locatioı in Charles Brown and Blood Brook. (Note that all data for VTFW represents a two-pass sample while Aquatec represents a single-pass sample.

Charles Brown Brook (CBB)

Location Relative to Previous Impounded Reach	Date	Total/Mile	Source
Upstream	10/1/2013	1100	VTFW
Upstream	9/30/2014	1059	VTFW
Previously Impounded	10/30/2014	160	Aquatec
Downstream	10/30/2014	424	Aquatec

Blood Brook (BB)

Location Relative to CBB confluence	Date	Total/Mile	Source
Upstream	10/13/1998	414	VTFW
Upstream	10/1/2013	792	VTFW
Upstream	9/30/2014	820	VTFW
Downstream	10/13/1998	654	VTFW
Downstream	10/1/2013	237	VTFW
Downstream	9/30/2014	444	VTFW

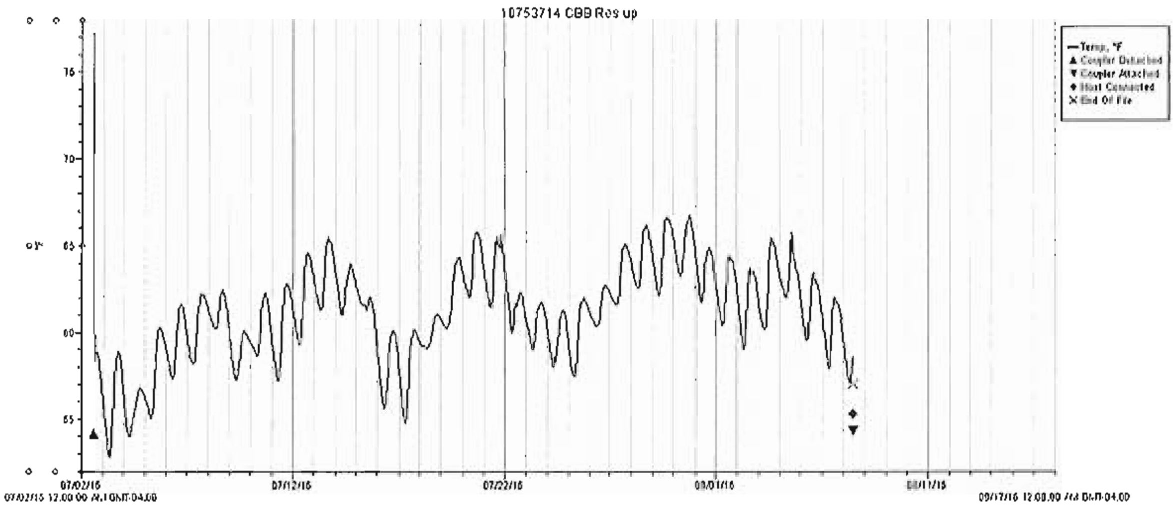
	Total/Mile**
Average	**440**
Min	0
Max	1725

**Source: Kratzer 03/27/2012. Biologist Report: What makes a good brook trout stream?.

EXHIBIT 2

DAILY TEMPERATURE FLUCTUATIONS

IN CHARLES BROWN BROOK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08/11/15
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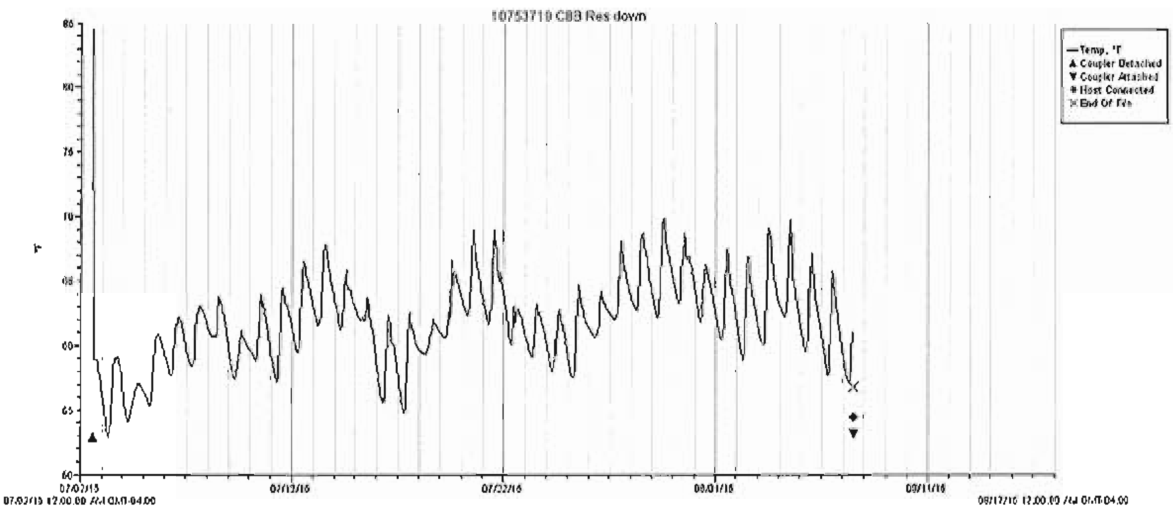
08/17/15 12:00:00 AM GMT-04:00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°F
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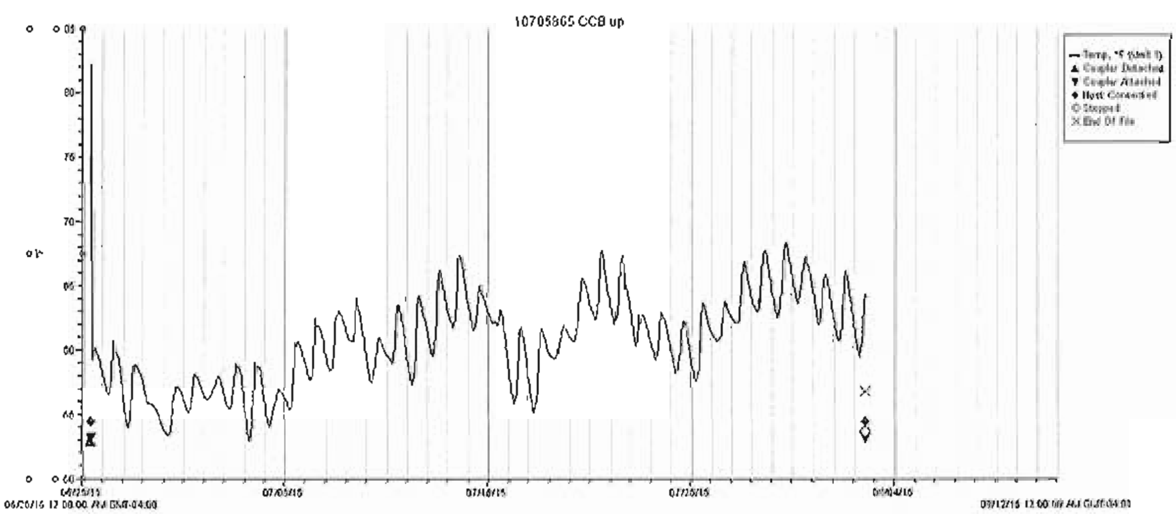
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°F
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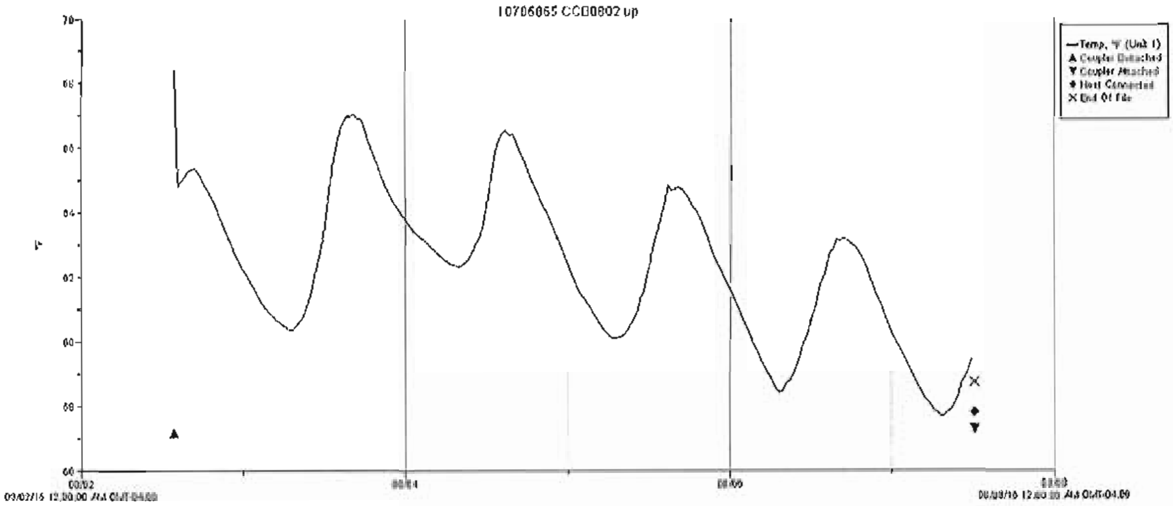
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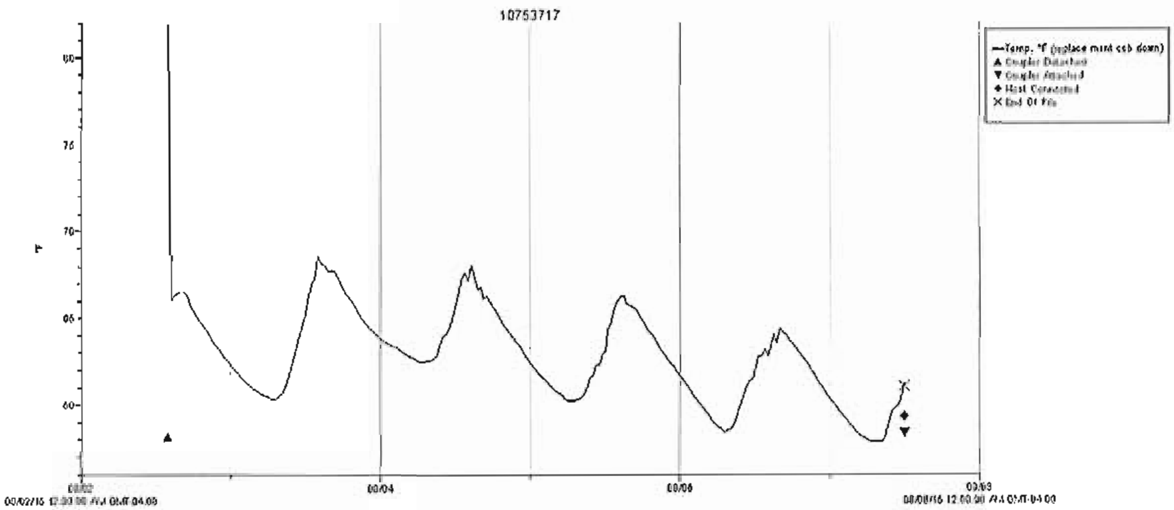
08/06
08/08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End Of File
80
75
70
65
60
08/02
08/04
08/06
08/08

EXHIBIT 3

TEMPERATURE CALCULATIONS

DuBois & King inc.
☐ Randolph, VT 05060 (802) 728-3376
☐ Nashua, NH 03063 (603) 883-0463
☐ Rutland, VT 05495 (802) 773-7016
☐ Williston, VT 05495 (802) 878-7661
Engineering ✪ Planning ✪ Development ✪ Management

JOB: Norwich Pool Dam
SHEET NO. 1 OF 5
CALCULATED BY: CSE DATE: 8/19/15
CHECKED BY: JWT DATE: 8/21/15
SCALE:

Potential Pool Temperature Increases During 7Q10

Assumptions:

Solar Insolation:	7	kWh/m²/day	Source: NREL Resource Assessment Program (attached)								
Specific Heat of Water:		4.193	kJ/kg-K	(at 10C)							
Density of Water:		999.8	kg/m³	(at 10C)							
Pool Surface Area:	0.6	Acres	=	2428	m²						
Pool Volume:	2.0	Acre-ft	=	2467	m³						
7Q10 Flow Rate:	0.1 csm	→	5.6	mi²	drainage	x	0.1	csm	=	0.56	cfs

Full Mixing: Stream Inflows mix with pool volume instantly and pool is 1 discrete temperature

Iterative approach used, starting with very conservative model, added energy loss processes individually

Heat Transfer Budget Assumptions — Solar Gain Only - No Shading

Included?	Process
Yes	Insolation (Gain): No reflection - all available solar energy is absorbed into the pool water volume
No	Conduction (Loss): Typically a loss ~1% of total heat transfer*
No	Longwave Radiation (Loss): Conservative, typically a large source of net cooling on clear days*
No	Evaporation (Loss): Conservative, typically a large source of net cooling when air is not saturated*
No	Convection (Loss or Gain): Heat exchange occurs at the water-air boundary. Under still air conditions water-air temperature difference at the boundary is usually small, translating to a small heat transfer and minimal component of heat budget.*
No	Mass Flux (Loss): Heat lost through mass leaving the system, replaced with mass at baseline temp

*see Woolley J, et al., 2013 - Attached

Pool Mass

Pool Volume		x	Water Density		=	Pool Mass	
2467	m³	x	999.8	kg/m³	=	2,466,470	kg

Energy to the Pool

Surface Area		x	Solar Insolation		=	Total Solar Energy at Pool Surface	
2428	m²	x	7	kWh/m²/day	=	16,997	kWh/day
					=	61,188,523	kJ/day

Temperature Increase with No Inflow

Delta Temp		=	Available Energy		/	(Specific Heat of Water		x	Pool Mass)	
5.9	K	=	6.12E+07	kJ/day	/	4.193	kJ/kg-K	x	2.47E+06	kg
= 10.6	°F	With no Inflow								

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Heat Transfer Budget Assumptions — Solar Gain and Mass Flux - No Shading

Included?	Process
Yes	Insolation (Gain): No reflection - all available solar energy is absorbed into the pool water volume
No	Conduction (Loss): Typically a loss ~1% of total heat transfer*
No	Longwave Radiation (Loss): Conservative, typically a large source of net cooling on clear days*
No	Evaporation (Loss): Conservative, typically a large source of net cooling when air is not saturated*
No	Convection (Loss or Gain): Heat exchange occurs at the water-air boundary. Under still air conditions water-air temperature difference at the boundary is usually small, translating to a small heat transfer and minimal component of heat budget.*
Yes	Mass Flux (Loss): Heat lost through mass leaving the system, replaced with mass at baseline temp

*see Woolley J, et al., 2013 - Attached

Mass Flux from Inflow during 7Q10

Inflow: 0.56 cfs = 1370 m^3/day = 1,369,807 kg/day

1,369,807 kg/day = 56% of pool mass

Temperature Attenuation from Mass Flux

56% of Pool Mass Discharged/Replenished in one day
(56% of the pool turns over in a 24-hr period during the 7Q10)

56% of stored heat is released, replaced with water at baseline temp, resulting in an equal temperature attenuation

10.6 °F x (1 - 56%)

= **4.7 °F** Potential Temperature Increase Including Attenuation from Mass Flux

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Heat Transfer Budget Assumptions — Solar Gain and Mass Flux - With Shading

Included?	Process
Yes	Insolation (Gain): No reflection - available solar energy reduced by percent shading
No	Conduction (Loss): Typically a loss ~1% of total heat transfer*
No	Longwave Radiation (Loss): Conservative, typically a large source of net cooling on clear days*
No	Evaporation (Loss): Conservative, typically a large source of net cooling when air is not saturated*
No	Convection (Loss or Gain): Heat exchange occurs at the water-air boundary. Under still air conditions water-air temperature difference at the boundary is usually small, translating to a small heat transfer and minimal component of heat budget.*
Yes	Mass Flux (Loss): Heat lost through mass leaving the system, replaced with mass at baseline temp

*see Woolley J, et al., 2013 - Attached

Shading

Thus far, the calculated temperature increase has been estimated assuming the pool is in an open area capable of receiving 100% of available solar insolation. The Norwich Pool is in a narrow shaded valley, and a significant reduction in available solar insolation is expected.

The table below shows the potential increase in water temperature including the effects of reduction of available sunlight over a range of shading values.

Percent Shading	Available Daily Solar Energy (kJ)	Potential Temperature Increase Over 24 Hours (°F)
0%	6.12E+07	4.7
70%	1.84E+07	1.4
75%	1.53E+07	1.2
80%	1.22E+07	0.9
85%	9.18E+06	0.7
90%	6.12E+06	0.5

The above calculations demonstrate, applying conservative assumptions, that the Norwich Pool Dam temperature would be expected to rise between 0.5 to 1.4 °F during a typical 24-hr June-August period, coincident with a 7Q10 period of drought.

DuBois & King inc.

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☐ Williston, VT 05495 (802) 878-7661

Engineering ⚬ Planning ⚬ Development ⚬ Management

Heat Transfer Budget Assumptions — Solar Gain, Mass Flux and Evaporation - With Shading

Included?	Process
Yes	Insolation (Gain): No reflection - available solar energy reduced by percent shading
No	Conduction (Loss): Typically a loss ~1% of total heat transfer*
No	Longwave Radiation (Loss): Conservative, typically a large source of net cooling on clear days*
Yes	Evaporation (Loss): Conservative, typically a large source of net cooling when air is not saturated*
No	Convection (Loss or Gain): Heat exchange occurs at the water-air boundary. Under still air conditions water-air temperature difference at the boundary is usually small, translating to a small heat transfer and minimal component of heat budget.*
Yes	Mass Flux (Loss): Heat lost through mass leaving the system, replaced with mass at baseline temp

*see Woolley J, et al., 2013 - Attached

Evaporation

Evaporation is an energy intensive process which can be a significant source of heat loss from an open body of water. The flux rate of evaporation can be estimated using an empirical evaporation equation which is a function of the humidity ratio in saturated air at the pool surface temperature, and the humidity ratio of ambient air.

$$g_s = \Theta A (x_s - x) / 3600$$

Source: http://www.engineeringtoolbox.com/evaporation-water-surface-d_690.html

g_s =	water flux (kg/s)				
Θ =	(25 + 19 v) evaporation coefficient	=	25		
v =	velocity of air above water surface (m/s)	=	0		Assume Still Air (conservative)
A =	Area of Pool (m^2)	=	2428	m^2	given page 1
x_s =	Humidity Ratio in Saturated Air	=	0.0106	kg/kg*	Surface Water Boundary 59°F (15°C)
x =	Humidity Ratio in Ambient Air	=	0.0099	kg/kg*	Relative Humidity 50% @ 77°F (25°C) - Drought

*See Mollier Diagram, Attached

g_s = 0.012 kg/s   Latent Heat of Evaporation: 2270 kJ/kg

Energy required to evaporate water at calculated rate: 26.8 kJ/s

Daily Evaporation Energy: 2.31E+06 kJ/day

Assuming all energy comes from water:

delta T = Evaporation Energy / (Specific Heat of Water x Pool Mass)

0.22 K = 2.31E+06 kJ/day / 4.193 kJ/kg-K x 2.47E+06 kg

= 0.40 °F Reduction in Pool Temperature from Evaporation

85% shading rise without evaporation - evaporation losses: 0.7 °F - 0.40 °F = 0.3 °F

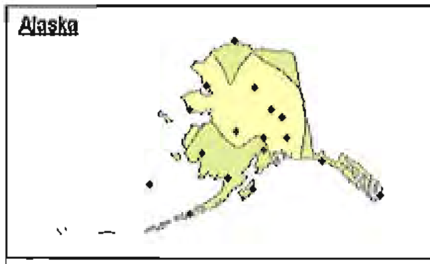
0.3 °F Total expected pool temperature rise, assuming 85% shading, including evaporation

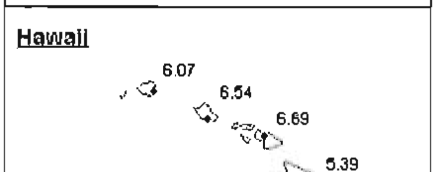
Conclusion

The approach used in this analysis was to begin with a very conservative model of the thermodynamics of the Norwich Pool and iteratively apply assumptions about heat losses to the system to bound the expected temperature rise in the pool during the extreme 7Q10 drought event.

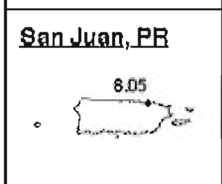
The calculations demonstrate, applying conservative assumptions, that the Norwich Pool water temperature would be expected to rise 0.3°F or less over a typical 24 hour June-August period during a 7Q10 period of drought. The potential for a rise in temperature is mitigated by the rapid turn over of water in the pool due to the small pool volume, and the significant topographic and vegetative shading present at the site.

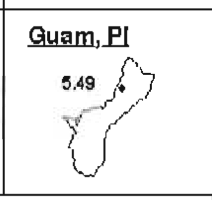
It is important to note that losses from longwave radiation, which is the primary night-time cooling mechanism, have been left out of the calculations for simplicity. Were those losses included, the expected rise would be even less than these calculations show.





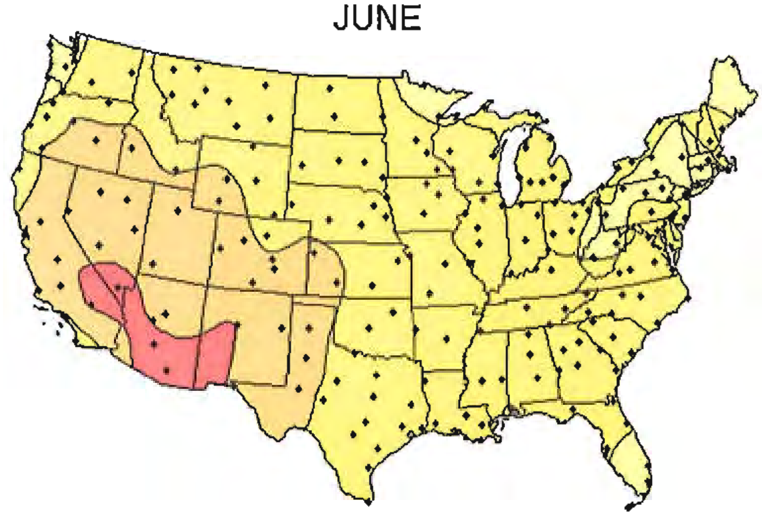
Hawaii, Puerto Rico, and Guam are not shaded.





Average Daily Solar Radiation Per Month

JUNE



Horizontal Flat Plate

Collector Orientation

Flat-plate collector facing south on a horizontal surface: This map shows how much solar radiation is received by a horizontal surface such as a solar pond.

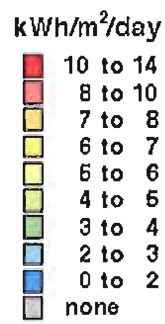
This map shows the general trends in the amount of solar radiation received in the United States and its territories. It is a spatial interpolation of solar radiation values derived from the 1961-1990 National Solar Radiation Data Base (NSRDB). The dots on the map represent the 239 sites of the NSRDB.

Maps of average values are produced by averaging all 30 years of data for each site. Maps of maximum and minimum values are composites of specific months and years for which each site achieved its maximum or minimum amounts of solar radiation.

Though useful for identifying general trends, this map should be used with caution for site-specific resource evaluations because variations in solar radiation not reflected in the maps can exist, introducing uncertainty into resource estimates.

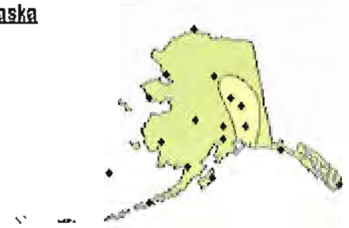
Maps are not drawn to scale.

National Renewable Energy Laboratory
Resource Assessment Program

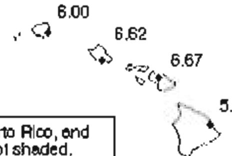


FT00A06-318

Alaska



Hawaii



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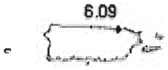
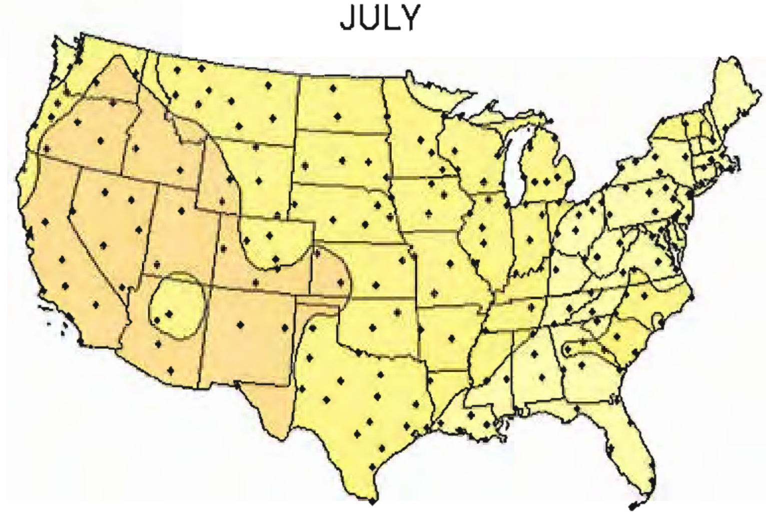
San Juan, PR



Guam, PI

Average Daily Solar Radiation Per Month

JULY



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NREL

National Renewable Energy Laboratory
Resource Assessment Program

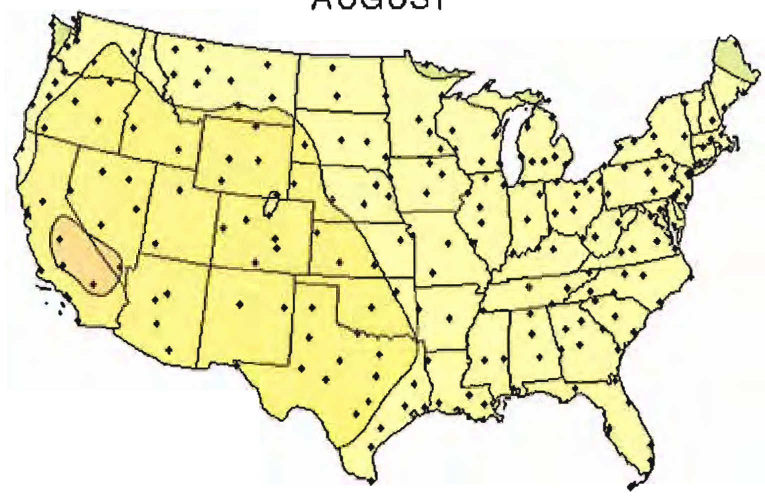
kWh/m²/day

- 10 to 14
- 8 to 10
- 7 to 8
- 6 to 7
- 5 to 6
- 4 to 5
- 3 to 4
- 2 to 3
- 0 to 2
- none

FT00A07-319

Average Daily Solar Radiation Per Month

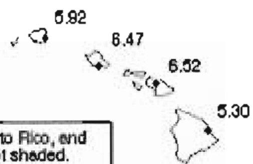
AUGUST



Horizontal Flat Plate

Alaska

Hawaii



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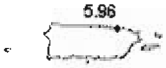

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Flat-plate collector facing south on a horizontal surface: This map shows how much solar radiation is received by a horizontal surface such as a solar pond.

This map shows the general trends in the amount of solar radiation received in the United States and its territories. It is a spatial interpolation of solar radiation values derived from the 1961-1990 National Solar Radiation Data Base (NSRDB). The dots on the map represent the 239 sites of the NSRDB.

Maps of average values are produced by averaging all 30 years of data for each site. Maps of maximum and minimum values are composites of specific months and years for which each site achieved its maximum or minimum amounts of solar radiation.

Though useful for identifying general trends, this map should be used with caution for site-specific resource evaluations because variations in solar radiation not reflected in the maps can exist, introducing uncertainty into resource estimates.

Maps are not drawn to scale.

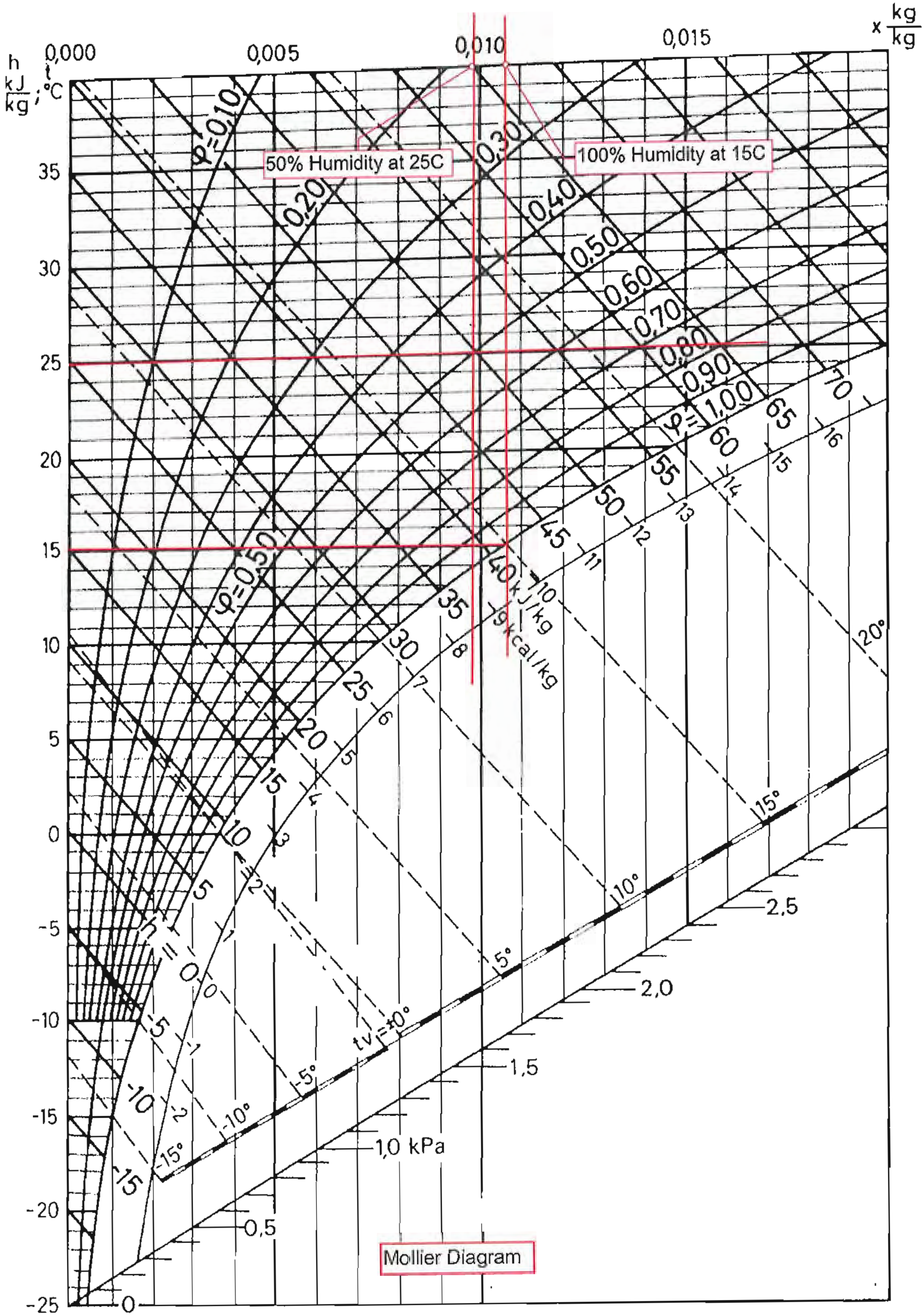
NREL

National Renewable Energy Laboratory
Resource Assessment Program

$kWh/m^2/day$

- 10 to 14
- 8 to 10
- 7 to 8
- 6 to 7
- 5 to 6
- 4 to 5
- 3 to 4
- 2 to 3
- 0 to 2
- none

FT00A08-320



h kJ/kg ; t °C
x kg/kg
0,000
0,005
0,010
0,015
50% Humidity at 25C
100% Humidity at 15C
φ=0,10
0,20
0,30
0,40
0,50
0,60
0,70
0,80
0,90
φ=1,00
φ=0,50
kJ/kg
kcal/kg
tv=±0°
1,0 kPa
0,5
1,5
2,0
2,5
Mollier Diagram

EXHIBIT 4

HISTORICAL FLOWS, DATA AND CALCULATIONS

DuBois & King inc.

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☐ Nashua, NH 03063 (603) 883-0463
☐ Rutland, VT 05495 (802) 773-7016
☐ Williston, VT 05495 (802) 878-7661

Engineering ⚬ Planning ⚬ Development ⚬ Management

JOB 921651L1
SHEET NO. ______ OF ______
CALCULATED BY: CJK DATE: 06/09/2015
CHECKED BY: ______ DATE: ______
SCALE: ______

Flood Flows Q2 to Q500

The inflows into Norwich Dam were developed using HydroCAD (TR20)

1. DA measured in Streamstats, total DA = 5.62 square miles (3596.5 ac)
2. NRCS soils (Hydrologic Group) measured in NRCS Web Soil Survey
3. TC based on summing travel times for sheet flow , shallow conc. flow and channel flow (flow path slope and length from Streamstats software)
4. Rainfall from NERCC web page

DA at Norwich Dam = 5.62 sq miles

Recurrence Interval	Flow (cfs)	Flow/sq mile (cfs/sq mi)
Q2	274	48.8
Q10	797	141.8
Q25	1321	235.1
Q50	1865	331.9
Q100	2553	454.3
Q200	3415	607.7
Q500	4859	864.6

State of VT - Agency Procedure for Determining Acceptable Minimum Stream Flows - July 14, 1993

In general, minimum flows adequate to maintain fisheries interest are sufficient to simultaneously maintain acceptable aesthetic qualities and recreational uses.

U.S. Fish and Wildlife Service [1] recommended minimum flows

Season	Min Flow (cfs/sq mile)	Min Flow at Norwich (cfs)	
Summer	0.5	2.8	June to Sept
Fall/Winter	1.0	5.6	Oct to Mar
Spring	4.0	22.5	April/May

[1] USFWS have determined that flow releases equal to historical median flows during the spawning and incubation periods will protect critical reproductive functions.

Guidelines for the Design of Stream/Road Crossings for Passage of Aquatic, March 2009

Spring Spawning - April Q2-20 = Abasin X (-41.15 + 0.000038 x Northing + 1.248 x P

April Q2-20 = 84.4 cfs for DA = 5.62 sq miles. (20% Probability of being exceeded for 2-days in April)

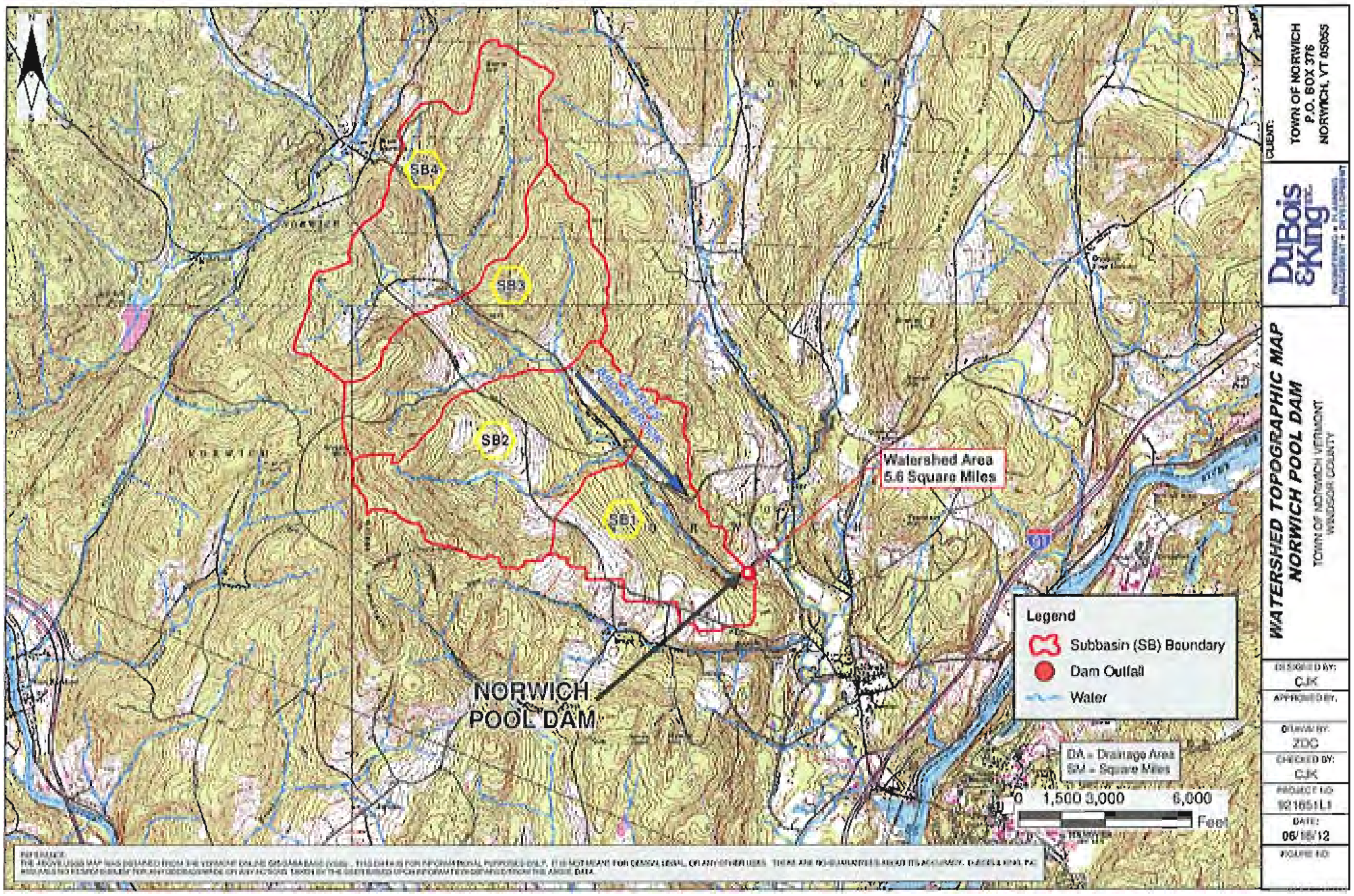
Fall Spawning - Nov Q2-20 = Abasin x (-13.709 + 0.4555 x P + 3.0855 x ln(1+Alakes)

Nov Q2-20 = 29.7 cfs for DA = 5.62 sq miles. (20% Probability of being exceeded for 2-days in November)

Low Fish Passage Design Flow (7Q2) = 0.139 cfs per sq mile = 0.78 cfs

Two-Year, Seven-day low flow

Print Date: 8/14/2015


SB4
SB3
SB2
SB1
Watershed Area
5.6 Square Miles
NORWICH
POOL DAM
Legend
Subbasin (SB) Boundary
Dam Outfall
Water
DA = Drainage Area
SM = Square Miles
0 1,500 3,000 6,000
Feet
CLIENT:
TOWN OF NORWICH
P.O. BOX 376
NORWICH, VT 05055
DuBois & King inc.
WATERSHED TOPOGRAPHIC MAP
NORWICH POOL DAM
TOWN OF NORWICH VERMONT
WINDSOR COUNTY
DESIGNED BY:
CJK
APPROVED BY:
DRAWN BY:
ZDC
CHECKED BY:
CJK
PROJECT NO:
921651L1
DATE:
06/15/12
FIGURE NO:

Bankflow Occurances by Month - East Orange Branch, Vermont

USGS Gage Number 01139800

Drainage Area: 9.0 sq miles

Period of Record: 1958 - Present

Location: N 44°05'34", W 72°20'10"

Notes:

This gage is locied approximately 25.5 miles north of the Norwich Pool Dam site. It was selected as a comparison site due to its proximity, the similar drainage aspect and comparable drainage size to the drainage above Norwich Pool.

Bankfull Discharge:

From ANR document: "Vermont Regional Hydraulic Geometry Curves", 2006. Table 3.

East Orange Branch Bankfull Discharge = 187 cfs

Top Mean Flows Compared with Peak Instantaneous Flows

Historical daily mean flows are readily available from the USGS. Bankfull discharge is generally described as an instantaneous flow. The following exercise is a comparison of top daily mean flows and peak instantaneous flows during the same storm. The relationship is used to find the approximate daily mean flow corresponding to the instantaneous bankfull flow reported by ANR.

Date	Daily Mean Flows		Peak Instaneous Flows			Mean / Peak (%)
8/28/2011	267	cfs	719	cfs		37%
5/4/1971	260	cfs	425	cfs	Peak 5/3	61%
4/1/1976	260	cfs	*	cfs		N/A
4/19/1969	247	cfs	299	cfs	Peak 4/18	83%
3/11/1992	245	cfs	433	cfs		57%
6/30/1973	242	cfs	672	cfs		36%
5/4/1972	240	cfs	413	cfs		58%
1/19/1996	225	cfs	626	cfs		36%
4/18/1969	204	cfs	299	cfs		68%
4/15/2014	203	cfs	541	cfs		38%
5/3/1972	200	cfs	413	cfs		48%
5/5/1972	190	cfs	*	cfs		N/A
4/29/2008	183	cfs	375	cfs	Peak 4/28	49%
4/2/1976	180	cfs	*	cfs		N/A
3/27/1992	179	cfs	*	cfs		N/A
4/23/1969	171	cfs	*	cfs		N/A
5/6/1989	171	cfs	256	cfs		67%
					Average:	53%

* Not annual peak - No Instantaneous Peak Value

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JOB: Norwich Pool Dam
SHEET NO. 2 OF 4
CALCULATED BY: CSE DATE: 8/12/15
CHECKED BY: DATE:
SCALE:

Bankfull Mean Daily Flow

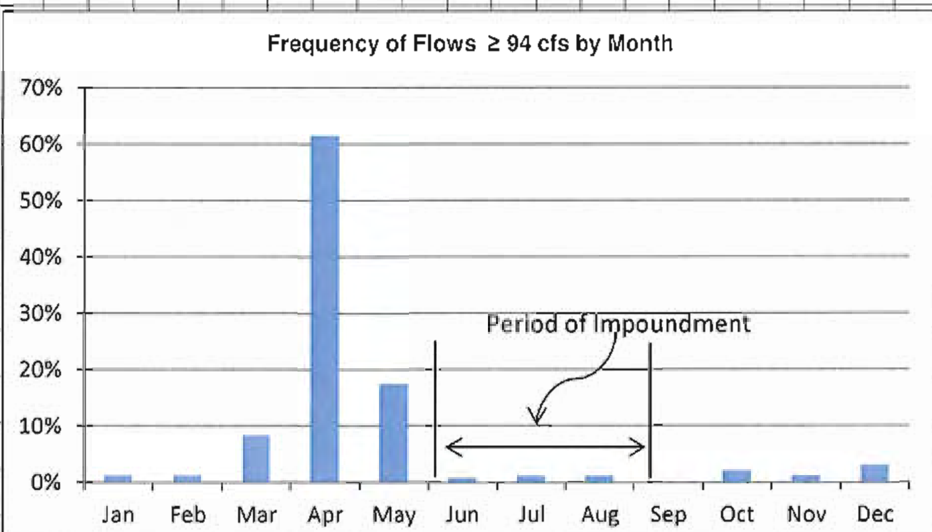
Using the relationship developed on the previous page, calculate the approximate mean daily flow associated with the bankfull peak instantaneous flow. (Ratio of mean/peak rounded to 50%)

Bankfull Flow (Instantaneous)	x	Mean/Instantaneous Ratio	=	Appx. Bankfull Flow (Mean Daily)
187 cfs	x	0.5	=	94 cfs

Events greater than 94 cfs from the historical mean daily flow record:

Total Recorded Observations:	20,826
Total Observations ≥ 94 cfs:	229
Total Observations ≥ 94 cfs Falling in June - August:	8

← 3.5% of flows ≥ 94 cfs occurred June-Aug



Daily Mean Flows ≥ 94 cfs Occuring June-Aug 1958 - Present		
8/28/2011	267	cfs
6/30/1973	242	cfs
6/27/1998	130	cfs
7/1/1973	120	cfs
8/7/1990	114	cfs
8/10/1976	112	cfs
7/2/1973	106	cfs
7/3/1973	98	cfs

Most large flows capable of moving a significant amount of sediment occurred in March, April and May

Of the 8 daily recordings greater than the mean daily bankfull flow, 4 were associated with sequential storm days, so the total of unique storm events is 5 .

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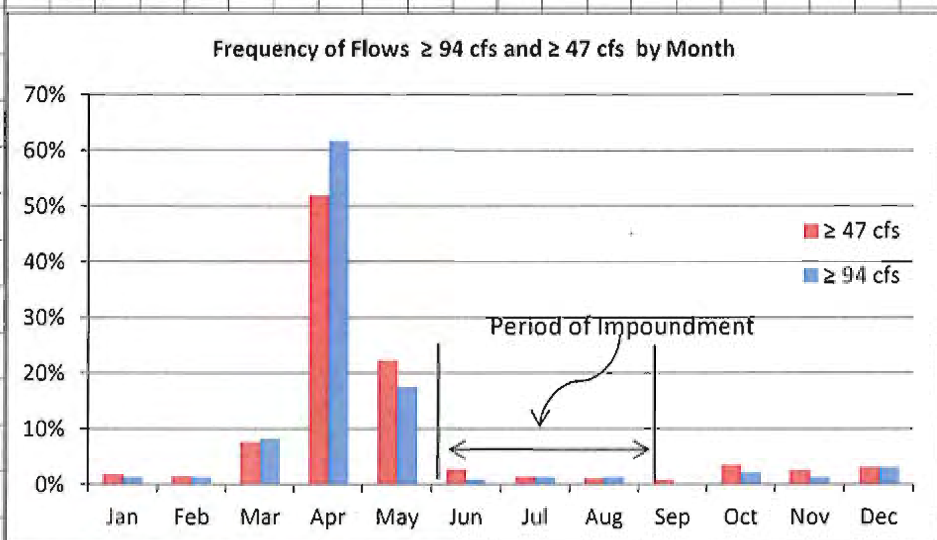
Extending the Trend

Bankfull flow is also referred to as a channel forming flow, due to the shear stresses that exist which mobilize bed material. Lower flows are also capble of moving material, albiet at a lesser rate. The following exercise is a sensitivity analysis to see if the trend identified for bankfull flows extends to lower flow rates - specifically a mean daily flow of 25% of the bankfull instantaneous flow.

Bankfull Flow (Instantaneous)	x	Reduction Factor		
187 cfs	x	0.25	=	47 cfs

Events greater than 47 cfs from the historical mean daily flow record:

Total Recorded Observations:	20,826	
Total Observations ≥ 47 cfs:	1,675	
Total Observations ≥ 47 cfs Falling in June - August:	84	← 5.0% of flows ≥ 47 cfs occurred June-Aug



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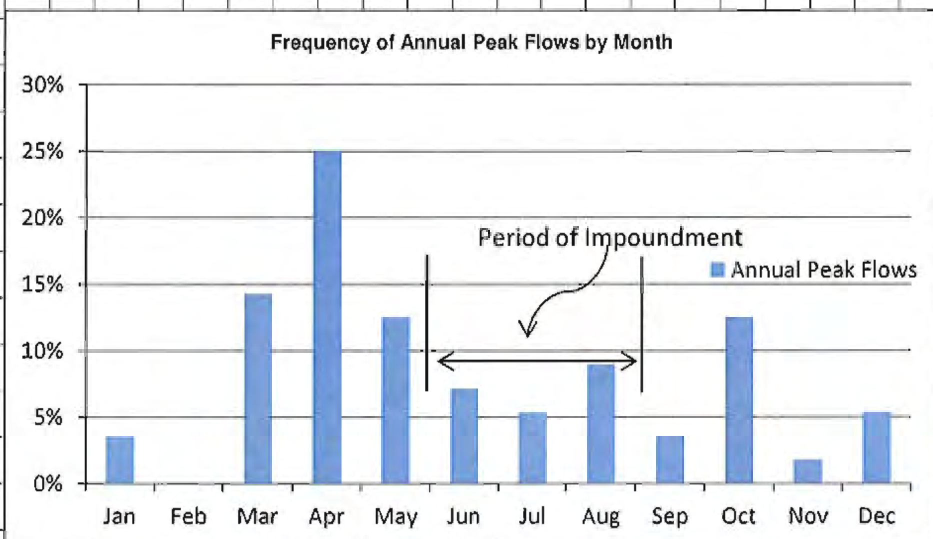
Extending the Trend to Peak Annual Flows

The Monthly occurance of annual peak flows at the East Orange gage are also investigated

Total Recorded Peak Annual Observations:	56		
Total Peak Observations Falling in Sept - April:	44	← 78.6%	Occurred Sept - April
Total Peak Observations Falling in June - August:	12	← 21.4%	Occurred June - Aug



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JOB ____
SHEET NO. ____ OF ____
CALCULATED BY: ____ DATE: ____
CHECKED BY: ____ DATE: ____
SCALE: ____

Norwich Pool Dam Flow Transposition

Calculation of Unknown Discharge on a Stream Based on Known Discharge in a Similar Gaged Basin

Reference: NRCS Part 630 Hydrology - National Engineering Handbook
Chapter 14, page 14-14, dated April 2012

Eq.14-19 $q1/q2 = \frac{A1^{(0.894/A1\text{^}0.048)-1}}{A2^{(0.894/A2\text{^}0.048)-1}}$

Equation 14-19 can be used to transpose a known flow between similar watersheds typically to sites within 50-150% of the known watershed area

East Orange Branch

Watershed Area at Gage: **9.0** mi^2 = A1

q1 = unit discharge A1
q2 = unit discharge A2

Charles Brown Brook

Watershed Area at Gage: **5.6** mi^2 = A2

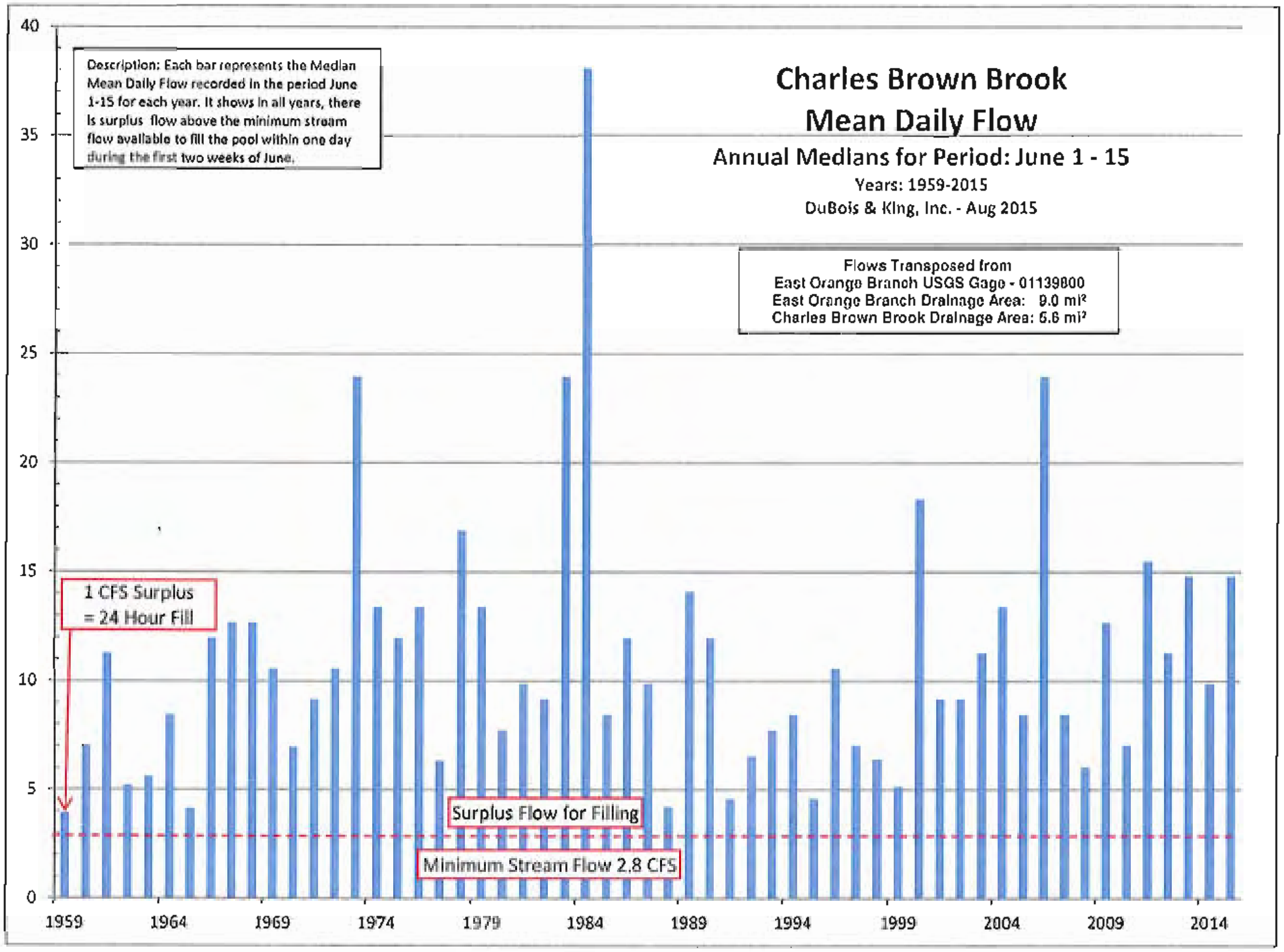
$\frac{A1^{(0894/A1\text{^}0.048)-1}}{A2^{(0894/A2\text{^}0.048)-1}} = \frac{0.650817812}{0.737234553} = \frac{q1}{q2} =$ **0.883**

$\frac{Q1/A1}{Q2/A2} = \frac{q1}{q2}$

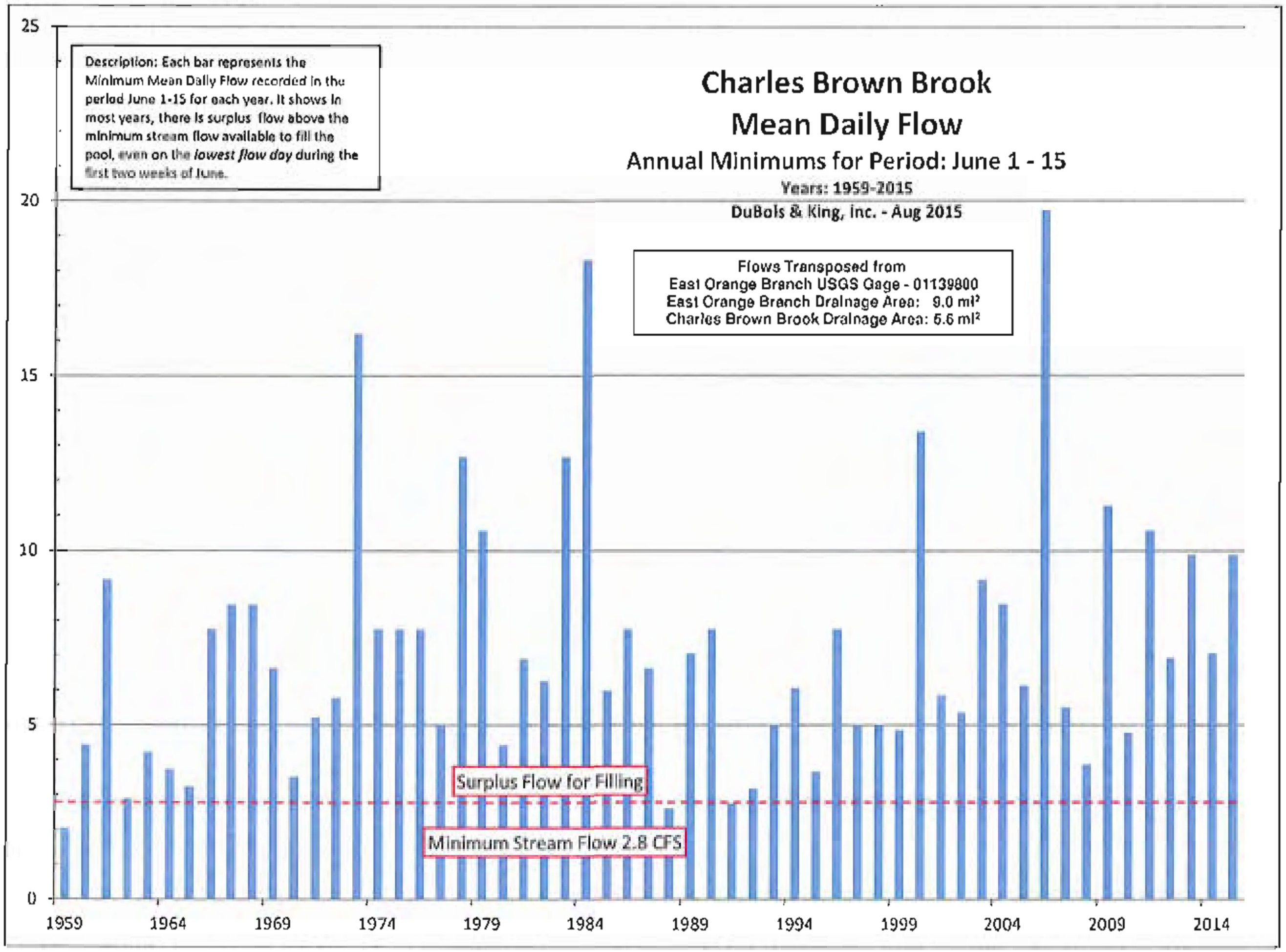
Given Q1:
Q2 = (Q1/A1)*A2*q2/q1
= Q1 x 0.705

Example:

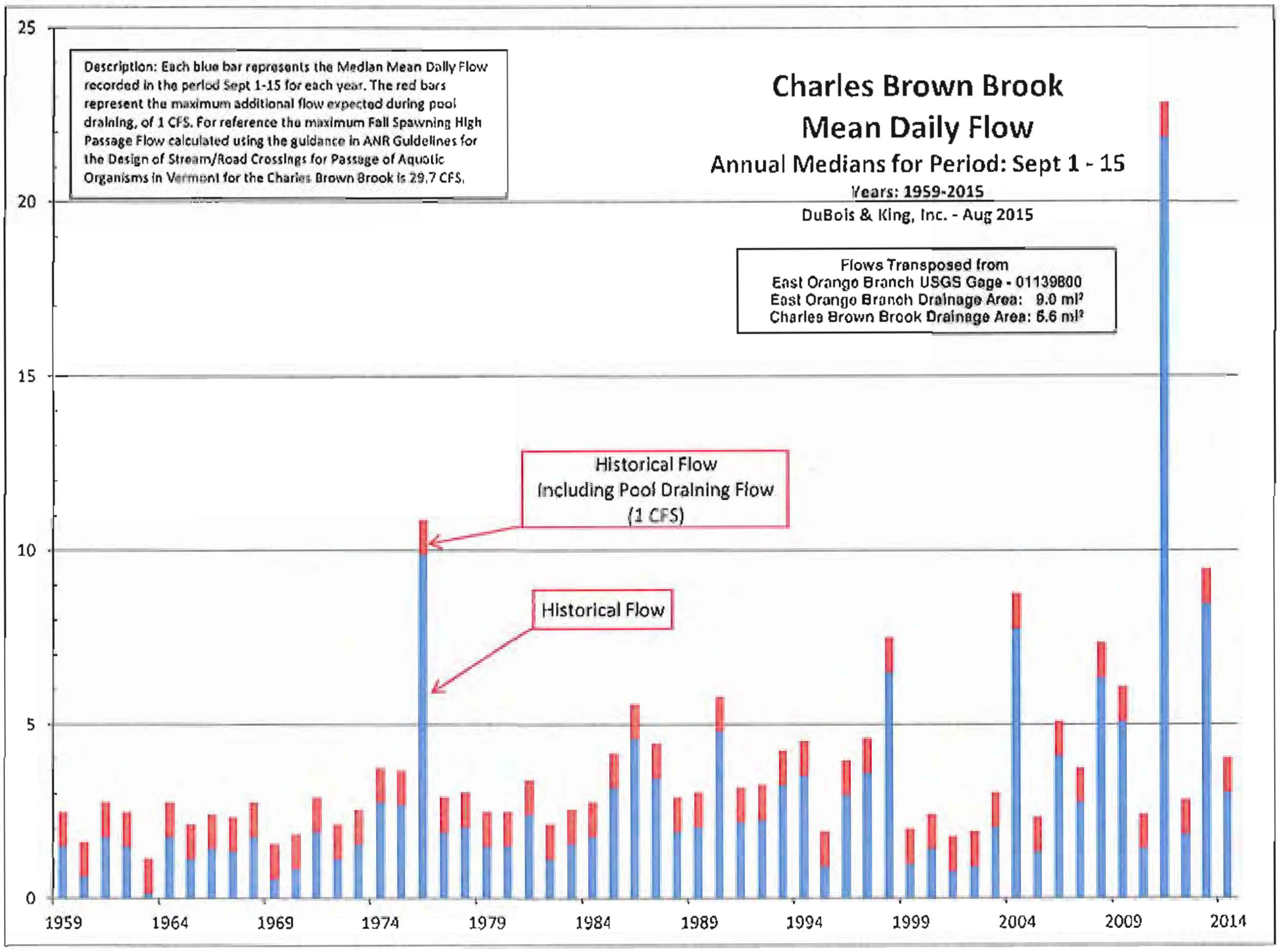
Q1 =	100	cfs	Drainage Area 1 (East Orange Branch)
Q2 =	70.5	cfs	Drainage Area 2 (Charles Brown Brook)



Charles Brown Brook
Mean Daily Flow
Annual Medians for Period: June 1 - 15
Years: 1959-2015
DuBois & King, Inc. - Aug 2015
Description: Each bar represents the Median Mean Daily Flow recorded in the period June 1-15 for each year. It shows in all years, there is surplus flow above the minimum stream flow available to fill the pool within one day during the first two weeks of June.
Flows Transposed from
East Orange Branch USGS Gage - 01139800
East Orange Branch Drainage Area: 9.0 mi²
Charles Brown Brook Drainage Area: 5.6 mi²
1 CFS Surplus
= 24 Hour Fill
Surplus Flow for Filling
Minimum Stream Flow 2.8 CFS
0
5
10
15
20
25
30
35
40
1959
1964
1969
1974
1979
1984
1989
1994
1999
2004
2009
2014



Charles Brown Brook
Mean Daily Flow
Annual Minimums for Period: June 1 - 15
Years: 1959-2015
DuBois & King, Inc. - Aug 2015
Description: Each bar represents the Minimum Mean Daily Flow recorded in the period June 1-15 for each year. It shows in most years, there is surplus flow above the minimum stream flow available to fill the pool, even on the *lowest flow day* during the first two weeks of June.
Flows Transposed from
East Orange Branch USGS Gage - 01139800
East Orange Branch Drainage Area: 9.0 mi²
Charles Brown Brook Drainage Area: 5.6 mi²
Surplus Flow for Filling
Minimum Stream Flow 2.8 CFS
25
20
15
10
5
0
1959
1964
1969
1974
1979
1984
1989
1994
1999
2004
2009
2014


Description: Each blue bar represents the Median Mean Daily Flow recorded in the period Sept 1-15 for each year. The red bars represent the maximum additional flow expected during pool draining, of 1 CFS. For reference the maximum Fall Spawning High Passage Flow calculated using the guidance in ANR Guidelines for the Design of Stream/Road Crossings for Passage of Aquatic Organisms in Vermont for the Charles Brown Brook is 29.7 CFS.
Charles Brown Brook
Mean Daily Flow
Annual Medians for Period: Sept 1 - 15
Years: 1959-2015
DuBois & King, Inc. - Aug 2015
Flows Transposed from
East Orange Branch USGS Gage - 01139800
East Orange Branch Drainage Area: 9.0 mi²
Charles Brown Brook Drainage Area: 6.6 mi²
Historical Flow
Including Pool Draining Flow
(1 CFS)
Historical Flow
25
20
15
10
5
0
1959
1964
1969
1974
1979
1984
1989
1994
1999
2004
2009
2014

Norwich Pool Dam
Fill / Drain Plan Procedures and Summer Time Operations

I: Initial Annual Filling Procedures: The following procedures shall be followed when filling the Norwich Pool at the beginning of the season.

1. Initial impoundment of the Norwich Pool shall begin after June 1 of any given year and shall be completed no later than June 20th of any year.

2. A minimum stream flow of 2.8 cfs (approx. 1,256 gallons per minute), or stream inflows, whichever is the lesser rate, shall be maintained through the sluice gate during filling of the Pool. Impoundment of water is not allowed when inflows are at or less than 2.8 cfs. At no time shall minimum stream flows be stopped or otherwise interrupted.

3. A permanent staff gage is installed at the sluice gate for Town to monitor stream flows. Refer to engineering plans for specifics on the staff gage.

4. At time of initial refilling, temporary sand bags shall be placed as shown on the appended drawing to divert stream flow into the sluice gate.

5. Once stream flow is diverted into the sluice gate, the concrete sill that supports the removable aluminum stop logs shall be cleaned by removal of accumulated streambed material, such as gravels and silts.

6. The removable aluminum stop logs shall be installed onto the concrete sill as outlined in the Set-up, Take-Down, and Storage Manual, which is attached to these procedures.

7. The sluice gate shall be partially closed to begin filling the Norwich Pool. The sluice gate shall be closed to the point where minimum stream flows are maintained. Sand bags shall be removed, cleaned and stored for the following year's use.

8. The staff gage shall be read on a daily basis by a properly trained individual. The date, time, depth of water at the staff gage shall be recorded in a log book which shall be maintained by the Town.

9. The Town shall have a portable pump available when the removable stop logs are being installed and the sluice gate is being adjusted as back up to ensure minimum stream flows are not interrupted.

10. Table 1 below provides an estimate of the time to fully fill the Pool during various inflow conditions. The Pool will take approximately 24-hours to fill when there is 1.0 cfs of excess inflow (resulting in a total of 3.8 cfs inflow).

II: End of Season Annual Draining Procedures: The following procedures shall be followed when filling the Norwich Pool at the beginning of the season.

1. Initial draining of the Norwich Pool will begin no later than Labor Day of any given year. The Pool shall be completely drained, the removable aluminum stop logs removed and stored and the brook placed in a free flowing condition no later than the second week of September of any year.

2. The first step in draining the Pool is to partially open the sluice gate to pass a maximum of 1 cfs (approximately 450 gallons per minute) through the sluice gate. The intention is to drain the water level by a maximum of 1.0-ft per day.

3. The staff gage shall be read on a daily basis by a properly trained individual. The date, time, depth of water at the staff gage shall be recorded in a log book which shall be maintained by the Town.

4. As the Pool water level is lowered by 2-ft, the Town shall remove the number of aluminum stop logs that are above the water level. The Pool is to be drained through the sluice gate, so at no time, shall stop logs that are below the water level be removed.

5. During drawdown, on a daily basis, Town staff shall walk and visually review the exposed reservoir area and net and place any trapped live fish back it the flowing stream.

6. The Town shall record on the same log book as referenced above the species, length and location of any trapped fish and note the number of live fish netted and placed into the flowing stream.

7. Open the sluice gate further as the Pool water level drops to maintain discharge at 1 cfs or less and remove stop logs as the water drops below them. Continue until all stop logs have been removed.

8. Once the Pool is completely drained, completely close sluice gate and ensure all stream discharge is free flowing through the removed stop log area.

9. The removable aluminum stop logs and the concrete sill area shall be prepared for storage as outlined in the Set-up, Take-Down, and Storage Manual, which is attached to these procedures.

10. The concrete sill and immediate area shall be examined for the suitability for fish passage. Any debris or fish barrier shall be recorded and corrected within the following 24 hours.

Table 1: Estimated Pool Fill and Drain Time

Stream Flow Frequency	Stream Flow (cfs)	Estimated time for Pool Filling (Hours)
7Q10	0.6	No Fill
Low June Flow (90% Exceedance Prob.)	3.3	48
Average June Flow	7.2	11.2

Set-up, Take-Down, and Storage Manual

Making your EKO Floodwall Easy to Install, Take Down, and Store

EKO FLOOD USA

2015

SET-UP, TAKE-DOWN, AND STORAGE MANUAL

Making your EKO Floodwall Easy to Install, Take Down, and Store

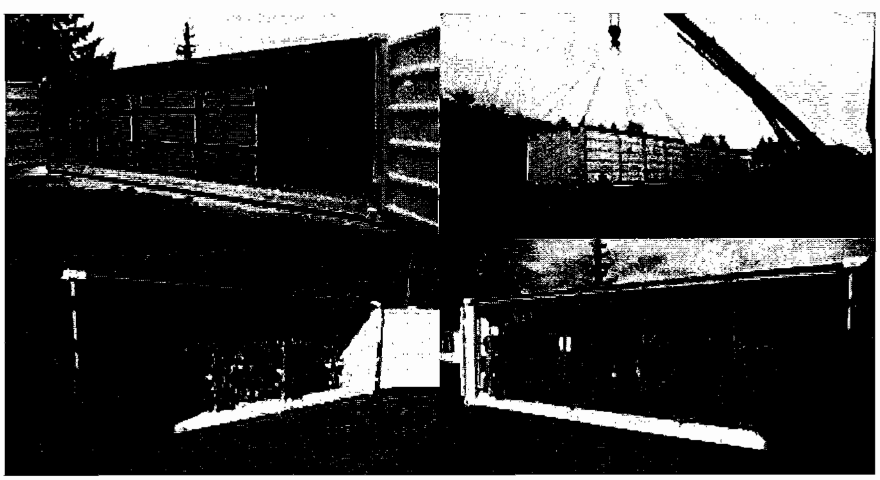
Introduction:

The EKO Removable Barrier Floodwall will perform dependably and reliably in the future. Each component has been carefully engineered to be easy to work with, handle and install. vAll the special tools, rubber mallet, wrenches and, Allen wrenches for cover plates are supplied. The components are all light enough that what heavy lifting and transporting is needed can be done with an average size forklift. The "spare parts" needed are supplied and included in the Storage Container.

The Storage Container:

The storage container is a "customized" standard 10, 20, or 40 foot cargo container with a large side opening for easy forklift access. It is well ventilated to provide air circulation to reduce interior temperatures. Special racking for the posts and beams is included to make storing easy and to make inventory checks easy and accurate. Everything has a place, clearly marked. Exterior locking pads are provided for the installation of whatever security system you prefer.

Each Container is clearly marked on the outside indicating the wall sections where the components in the container go. If the storage site is remotely located from the wall alignment, the container can easily be loaded onto a flatbed trailer and transported to the appropriate location along the wall alignment where it can be opened, the contents removed and positioned along the wall using a forklift.



Checking the Inventory in the Container:

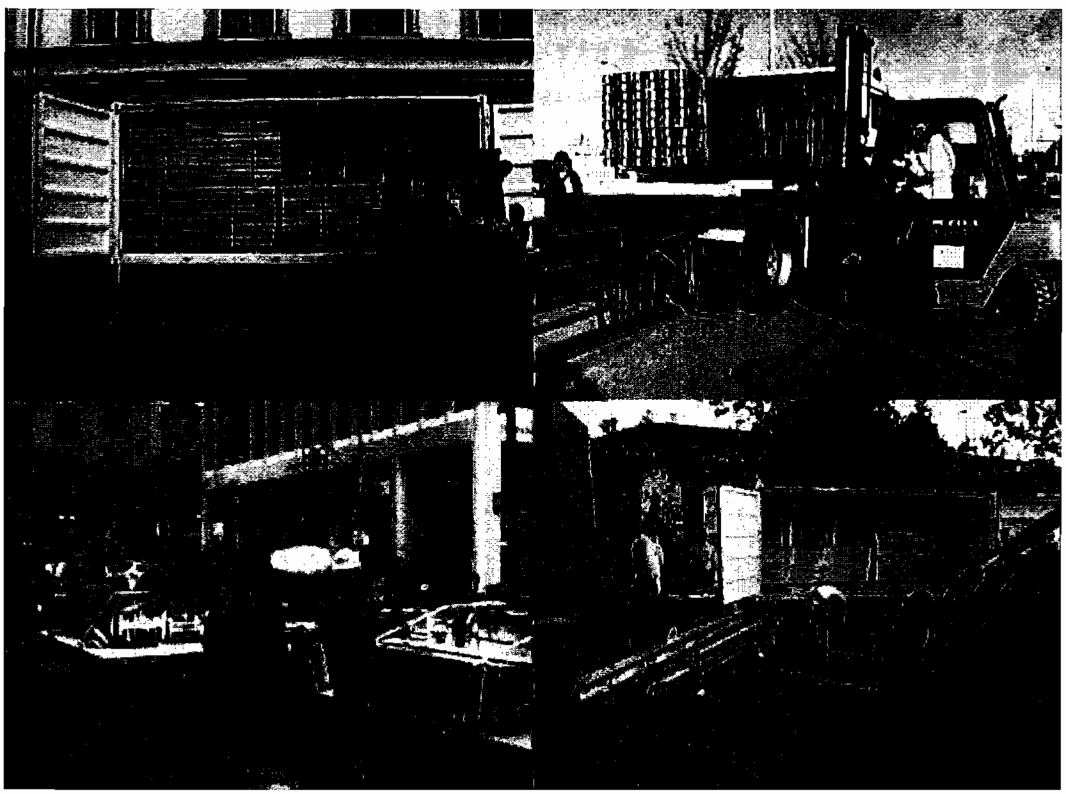
Check the components in the Container, the number of posts, beams, bolts and hold downs for each section against the Recorded Inventory to make sure when you transport it to the wall site for set up, all parts are there.
This is a double check against the Inventory recorded after the prior event or after a scheduled routine maintenance review. The Spare Parts Inventory is also part of this recording process.

Site Preparations:

This is a routine check of making sure access gates are open and walking the alignment. Remove any accumulated dirt or residue from the concrete sealing surfaces and post anchor plates with a pressure washer or broom. The cover plates on the wall end brackets should be removed as well as the post plate bolt access cover plates. This can be done with the appropriate size Allen wrench.

Transporting The Posts and Beams:

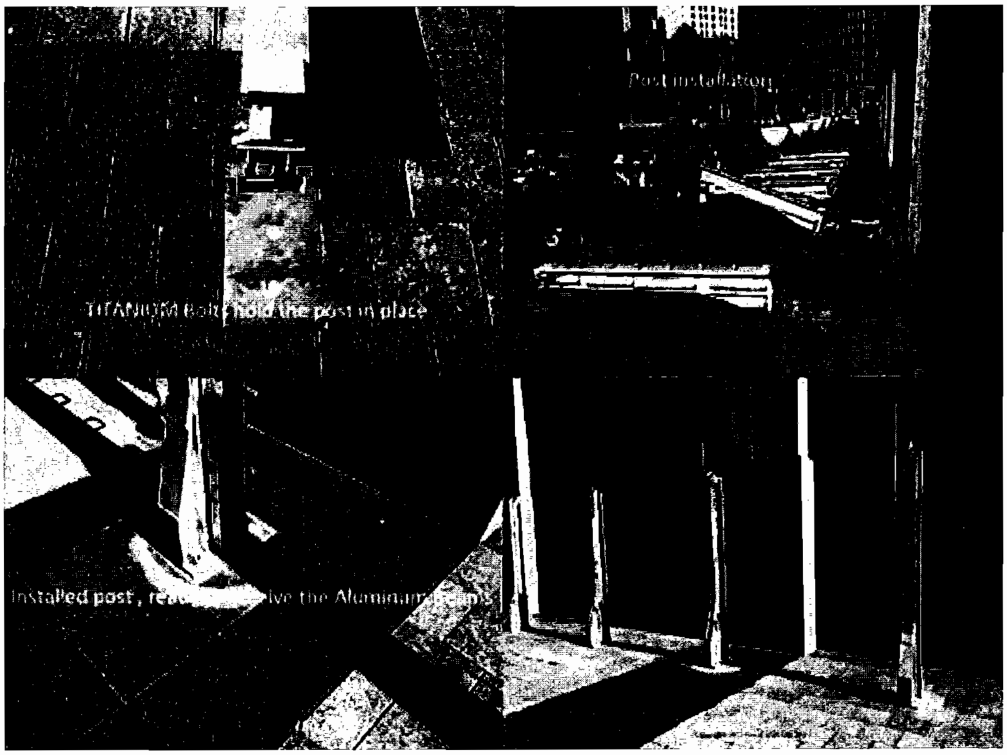
Transport the posts to the alignment on a forklift. Take the posts first. Doing so will let you have two or three workers immediately begin erecting the posts. Then transport the beams and the rest of the crew can place the beams and secure the hold downs.



Putting up the Posts:

The posts are not too heavy for two or three workers to tilt up into position on the post plate. If posts are taller, use a forklift to tilt them up and three workers can easily position the post.

First, check the post to make sure the vertical seals and the seals in the bottom of the post are in place. Tilt up the post. When they have tilted it up into position, one worker can kneel down and rotate the Titanium anchor bolts about 90 degrees until the anchor lug locks into place, then tighten the nuts using the supplied crescent wrench. This team can then move on to the next post and repeat the steps.



Securing the Braces:

On walls over 6 feet high, back braces are used to provide the needed support for the posts. Two or three men can easily position the brace. Tilt it up, then insert the connection pins and secure the pin locking retainers. The men can use a magnetic spirit bubble level as a guide while they adjust the Jackscrews assuring the post is plumb vertical and assuring the proper loading on the brace support pads. The braces are color coded to the posts to make installation foolproof.

Placing the Beams:

When a load of beams arrives via the forklift, two workers can begin positioning the beams in the retaining brackets in the wall end brackets and posts. First, raise the stop log guide bar in each post and side channel to the upper position.

Next, pick up one beam at a time with a worker at each end to make positioning easier and faster. All the workers do is lower the beam with the black gasket edge down, into place.

The first log to go in is the bottom log and must have the thick foam rubber bottom seal in place, inserted between the rubber seals on the log. Then, position the next logs, rubber edge seal down in between the post openings and side channels until you have them up to the required height.

Securing The Hold-Down Clamps:

When all the beams in a section have been properly placed, the hold down clamp can be attached to the post on the pins located in the top of the side channel. Spin the nut down and turn to tighten. A few turns of the hold-down clamp wing nut will provide adequate down pressure to firmly hold the beams in place and provide a watertight seal. This step should be repeated as you go down the length of the wall, section by section. And this is the last step in erecting the EKO Removable Barrier Flood Wall.

Monitoring the Wall:

When all the previous set up steps have been completed and the water begins to rise, there are no "operational adjustments" that need to be made. Nothing needs to be adjusted. All components have been put in place correctly and secured. As with any levee or floodwall installation during a flood event, normal monitoring, and observation is recommended.

Removing the EKO Barrier After the Flood Event

Release the Hold-Down Clamps And Remove the Beams:

This is the first step in removing the barrier components. Releasing the clamps will allow the workers to remove the beams and place them on the forklift for transport back to storage. Place the hold down clamps in the storage tub. Before placing the beams in their racks in storage, it is advisable to pressure wash the beams to remove any scum or residue. The beam gaskets should be checked for any signs of damage.

Remove The Posts and Braces:

Since the bolts are on the wet side of the post/ barrier, it may be necessary to pressure wash the posts while they are standing in order to remove any silt or residue buildup. This will make it easier to remove the anchor bolts. Place the posts on the forklift for transport to storage and place them in their racks.

Inventory The Contents:

As the components for each section are returned and placed in storage, an inventory count of beams, posts, anchor bolts and hold downs should be made and recorded on the Inventory Sheet. Any discrepancies should be noted, the sheet signed and dated. Any parts that appear to be damaged should be noted and replaced from the Spare Parts supply and replacements ordered immediately from EKO to maintain the proper Spare Parts inventory.

Replace The End Bracket and Post Anchor Cover Plates:

This is the final step in securing the wall installation for the next event. Simply screw them in place securely using the Allen wrench.

Maintenance:

A routine "maintenance" schedule can be established on an annual or semi-annual basis. These activities include checking the inventory counts of components for each section in storage, visually inspecting the gaskets and noting any need for replacement which can then be scheduled.
Gasket replacement is easily done. There are no adhesives, just use soapy water to make it easy to slip off the old gasket and slide or press on the new .Trim to length. This procedure is the same for the posts and for the end brackets. All use the same gasket.
Examine the posts visually inspecting the sealing strip which is the same material as the beam gaskets and can be replaced in the same manner if necessary.
On-site maintenance consists of removing the end bracket cover plates, removing any residue and visually inspecting the gaskets which are of the same material as the posts and beams and can easily be replaced if necessary in the same manner.

Replacement Components:

Any replacement components can be obtained by contacting Customer Service,
toby@ekofloodusa.com
Phone: 1-307-413.7744

EKO Flood USA
PO Box 7475, Jackson, Wyoming 83002

Checking the Inventory in the Container:

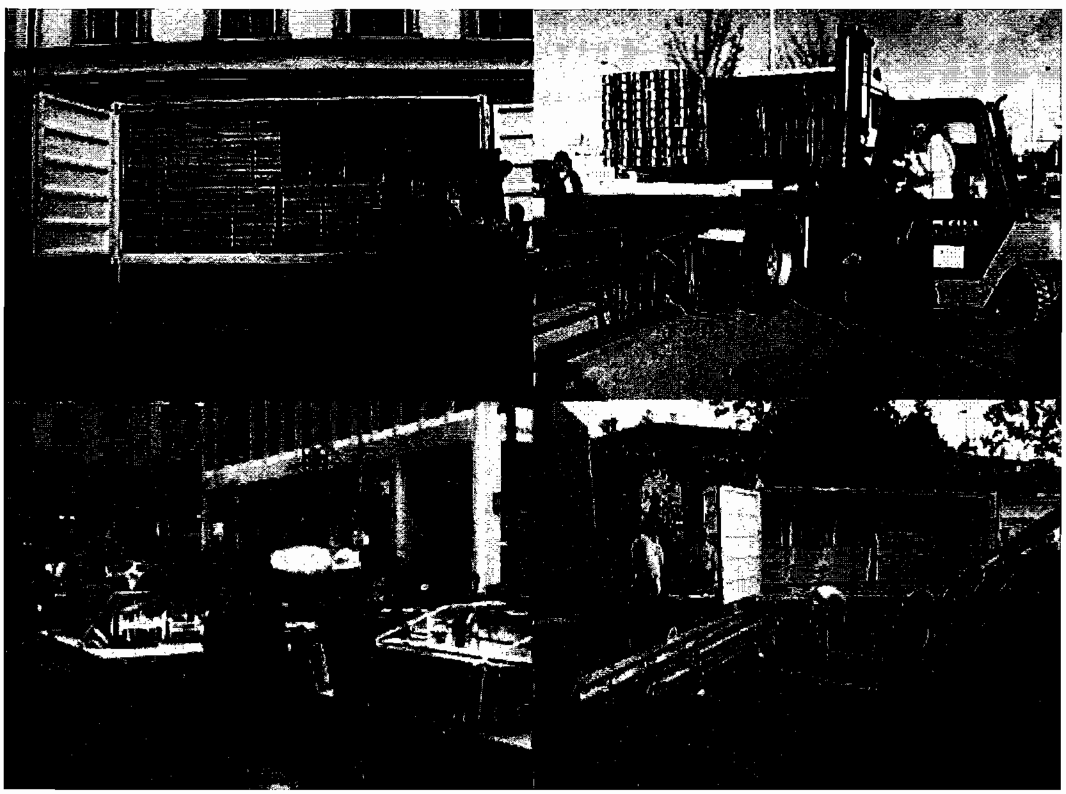
Check the components in the Container, the number of posts, beams, bolts and hold downs for each section against the Recorded Inventory to make sure when you transport it to the wall site for set up, all parts are there.
This is a double check against the Inventory recorded after the prior event or after a scheduled routine maintenance review. The Spare Parts Inventory is also part of this recording process.

Site Preparations:

This is a routine check of making sure access gates are open and walking the alignment. Remove any accumulated dirt or residue from the concrete sealing surfaces and post anchor plates with a pressure washer or broom. The cover plates on the wall end brackets should be removed as well as the post plate bolt access cover plates. This can be done with the appropriate size Allen wrench.

Transporting The Posts and Beams:

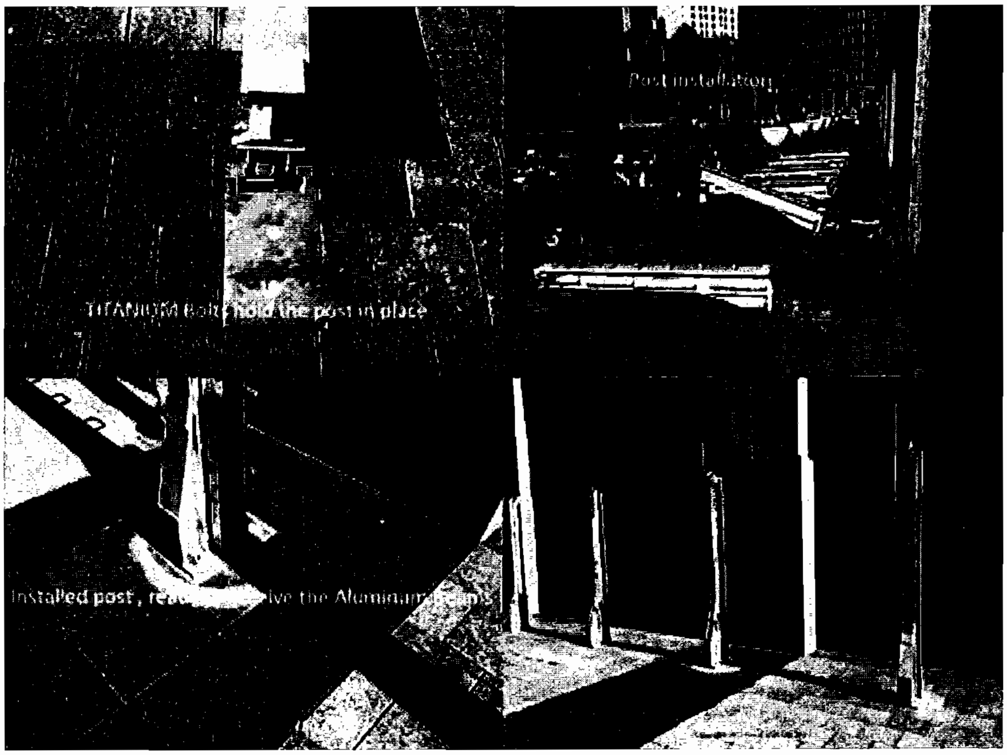
Transport the posts to the alignment on a forklift. Take the posts first. Doing so will let you have two or three workers immediately begin erecting the posts. Then transport the beams and the rest of the crew can place the beams and secure the hold downs.



Putting up the Posts:

The posts are not too heavy for two or three workers to tilt up into position on the post plate. If posts are taller, use a forklift to tilt them up and three workers can easily position the post.

First, check the post to make sure the vertical seals and the seals in the bottom of the post are in place. Tilt up the post. When they have tilted it up into position, one worker can kneel down and rotate the Titanium anchor bolts about 90 degrees until the anchor lug locks into place, then tighten the nuts using the supplied crescent wrench. This team can then move on to the next post and repeat the steps.



Securing the Braces:

On walls over 6 feet high, back braces are used to provide the needed support for the posts. Two or three men can easily position the brace. Tilt it up, then insert the connection pins and secure the pin locking retainers. The men can use a magnetic spirit bubble level as a guide while they adjust the Jackscrews assuring the post is plumb vertical and assuring the proper loading on the brace support pads. The braces are color coded to the posts to make installation foolproof.

Placing the Beams:

When a load of beams arrives via the forklift, two workers can begin positioning the beams in the retaining brackets in the wall end brackets and posts. First, raise the stop log guide bar in each post and side channel to the upper position.

Next, pick up one beam at a time with a worker at each end to make positioning easier and faster. All the workers do is lower the beam with the black gasket edge down, into place.

The first log to go in is the bottom log and must have the thick foam rubber bottom seal in place, inserted between the rubber seals on the log. Then, position the next logs, rubber edge seal down in between the post openings and side channels until you have them up to the required height.

Securing The Hold-Down Clamps:

When all the beams in a section have been properly placed, the hold down clamp can be attached to the post on the pins located in the top of the side channel. Spin the nut down and turn to tighten. A few turns of the hold-down clamp wing nut will provide adequate down pressure to firmly hold the beams in place and provide a watertight seal. This step should be repeated as you go down the length of the wall, section by section. And this is the last step in erecting the EKO Removable Barrier Flood Wall.

Monitoring the Wall:

When all the previous set up steps have been completed and the water begins to rise, there are no "operational adjustments" that need to be made. Nothing needs to be adjusted. All components have been put in place correctly and secured. As with any levee or floodwall installation during a flood event, normal monitoring, and observation is recommended.

Removing the EKO Barrier After the Flood Event

Release the Hold-Down Clamps And Remove the Beams:

This is the first step in removing the barrier components. Releasing the clamps will allow the workers to remove the beams and place them on the forklift for transport back to storage. Place the hold down clamps in the storage tub. Before placing the beams in their racks in storage, it is advisable to pressure wash the beams to remove any scum or residue. The beam gaskets should be checked for any signs of damage.

Remove The Posts and Braces:

Since the bolts are on the wet side of the post/ barrier, it may be necessary to pressure wash the posts while they are standing in order to remove any silt or residue buildup. This will make it easier to remove the anchor bolts. Place the posts on the forklift for transport to storage and place them in their racks.

Inventory The Contents:

As the components for each section are returned and placed in storage, an inventory count of beams, posts, anchor bolts and hold downs should be made and recorded on the Inventory Sheet. Any discrepancies should be noted, the sheet signed and dated. Any parts that appear to be damaged should be noted and replaced from the Spare Parts supply and replacements ordered immediately from EKO to maintain the proper Spare Parts inventory.

Replace The End Bracket and Post Anchor Cover Plates:

This is the final step in securing the wall installation for the next event. Simply screw them in place securely using the Allen wrench.

Maintenance:

A routine "maintenance" schedule can be established on an annual or semi-annual basis. These activities include checking the inventory counts of components for each section in storage, visually inspecting the gaskets and noting any need for replacement which can then be scheduled.
Gasket replacement is easily done. There are no adhesives, just use soapy water to make it easy to slip off the old gasket and slide or press on the new .Trim to length. This procedure is the same for the posts and for the end brackets. All use the same gasket.
Examine the posts visually inspecting the sealing strip which is the same material as the beam gaskets and can be replaced in the same manner if necessary.
On-site maintenance consists of removing the end bracket cover plates, removing any residue and visually inspecting the gaskets which are of the same material as the posts and beams and can easily be replaced if necessary in the same manner.

Replacement Components:

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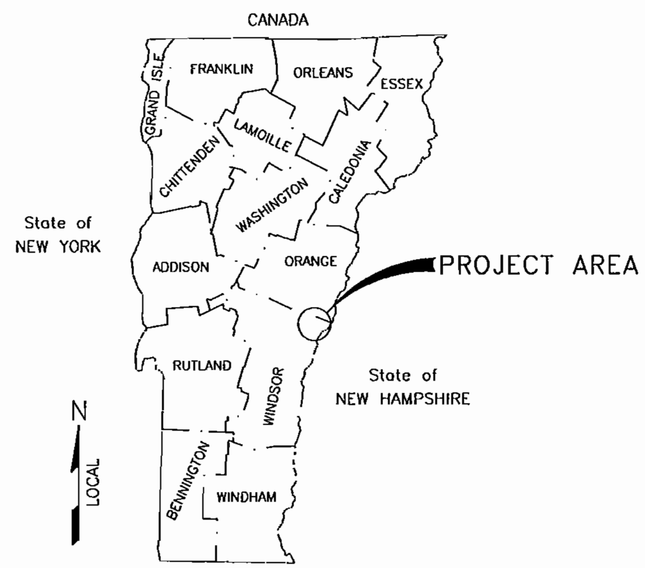
Phone: 1-307-413.7744

EKO Flood USA
PO Box 7475, Jackson, Wyoming 83002

eKO USA FLOOD SYSTEM

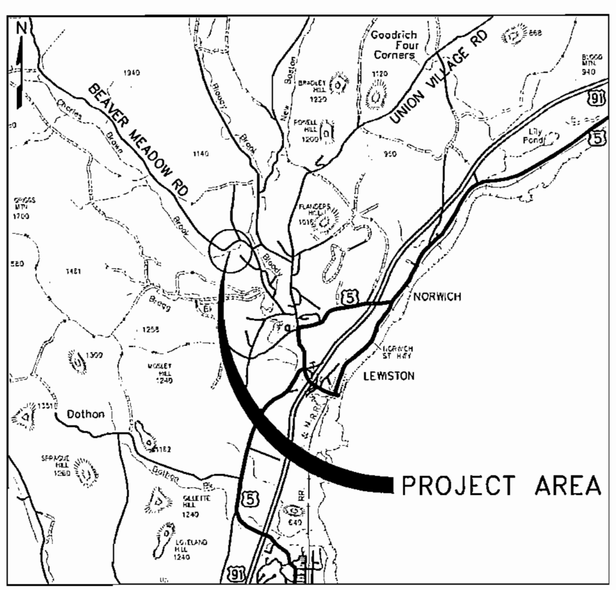


LOCATION MAP
NOT TO SCALE

TOWN OF NORWICH, VERMONT

NORWICH POOL DAM REHABILITATION PROJECT

AUGUST 14, 2015



LOCATION PLAN
SCALE: 1" = 5000' ±

engineering planning management development

LIST OF DRAWINGS

TITLE	SHEET NO.
TITLE SHEET	–
GENERAL NOTES	1
EXISTING CONDITIONS & BASELINE LAYOUT	2
GENERAL SITE RESTORATION PLAN	3
AUXILIARY SPILLWAY REPAIR PLAN AND ELEVATION	4
DAM SITE PLAN AND ELEVATION	5
TYPICAL CROSS SECTIONS	6–8
STRUCTURAL DAM PLAN AND ELEVATION	9
DAM DETAILS	10–11
CHANNEL DETAILS	12
EROSION PREVENTION AND SEDIMENT CONTROL PLAN	13
EROSION PREVENTION AND SEDIMENT CONTROL PLAN DETAILS	14

NOT FOR CONSTRUCTION
PERMIT PLANS (60% COMPLETE)

D&K ARCHIVE #

GENERAL PROJECT NOTES:

1. THE PURPOSE OF THIS PROJECT IS TO REHABILITATE COMPONENTS OF THE NORWICH POOL DAM.
2. THE PROJECT OWNER IS THE TOWN OF NORWICH, VERMONT. AN OWNER'S REPRESENTATIVE WILL BE APPOINTED PRIOR TO CONSTRUCTION TO REPRESENT THE OWNER DURING THE PROJECT.
3. TOPOGRAPHY SHOWN ON THE PLANS IS BASED ON FIELD SURVEY COMPLETED BY DUBOIS & KING ON AUGUST 8 2012.
4. WRITTEN DIMENSIONS HAVE PRECEDENCE OVER SCALED DIMENSIONS. IN CASE OF CONFLICT BETWEEN THIS PLAN SET AND ANY OTHER DRAWING AND/OR SPECIFICATION, THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY FOR CLARIFICATION.
5. THE CONTRACTOR SHALL BE FAMILIAR WITH THE EXISTING CONDITIONS OF THE SITE AND SURROUNDINGS PRIOR TO BIDDING ON OR PERFORMING THE WORK.
6. THE CONTRACTOR SHALL BID AND PERFORM THE WORK FROM A COMPLETE SET OF PLANS AND SPECIFICATIONS, AND SHALL NOTIFY THE OWNER'S REPRESENTATIVE OF ANY CONFLICTS WITHIN THE CONSTRUCTION DOCUMENTS.
7. THE CONTRACTOR IS RESPONSIBLE FOR THE MEANS AND METHODS OF CONSTRUCTION AND FOR CONDITIONS AT THE SITE. THESE PLANS, PREPARED BY DUBOIS & KING DO NOT EXTEND TO OR INCLUDE SYSTEMS PERTAINING TO THE SAFETY OF THE CONSTRUCTION CONTRACTOR OR THEIR EMPLOYEES, AGENTS OR REPRESENTATIVES IN THE PERFORMANCE OF THE WORK. THE SEAL OF THE SURVEYOR OR ENGINEER HERE ON DOES NOT EXTEND TO ANY SUCH SAFETY SYSTEMS THAT MAY NOW OR HEREAFTER BE INCORPORATED INTO THESE PLANS. THE CONSTRUCTION CONTRACTOR SHALL PREPARE OR OBTAIN THE APPROPRIATE SAFETY SYSTEMS, WHICH MAY BE REQUIRED BY THE U.S. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND/OR LOCAL REGULATIONS.
8. THE CONTRACTOR SHALL BID AND PERFORM THE WORK IN ACCORDANCE WITH ALL LOCAL, STATE, AND NATIONAL CODES, SPECIFICATIONS, REGULATIONS, STANDARDS, AND DETAILS.
9. SUBMIT SHOP DRAWINGS AND PRODUCT LITERATURE (MANUFACTURER'S LITERATURE, CUT SHEETS, APPLICATION PROCEDURES, ETC.) FOR ALL PRODUCTS FOR USE IN THE PROJECT, FOR APPROVAL BY THE ENGINEER.
10. A SET OF CONSTRUCTION PLANS AND TECHNICAL SPECIFICATIONS SHALL BE ON SITE AND IN GOOD CONDITION AT ALL TIMES DURING CONSTRUCTION ACTIVITIES.
11. NO DEVIATION OR DEPARTURE FROM THE DESIGN INTENT PRESENTED IN THE CONTRACT DOCUMENTS (PLANS AND SPECIFICATIONS) WILL BE ALLOWED UNLESS AUTHORIZED BY DUBOIS & KING, INC. (D&K).

CONSTRUCTION NOTES

1. LOCATE STAGING AREAS AWAY FROM SENSITIVE AREAS INCLUDING WETLANDS AND STREAM BUFFERS.
2. CONTRACTOR SHALL LAY OUT THE CONSTRUCTION BASELINES AND STAKE OUT LIMITS OF PROPOSED WORK PRIOR TO CONSTRUCTION.
3. THE CONTRACTOR IS RESPONSIBLE FOR ALL TEMPORARY SHORING, WATER DIVERSION, AND DEWATERING REQUIREMENTS NEEDED FOR THE PROJECT.
4. ALL WORK SHALL TAKE PLACE IN THE DRY. THE CONTRACTOR SHALL DEWATER ALL WORK AREAS PRIOR TO DISTURBANCE. WATER REMOVED FROM WORK AREAS SHALL BE DISCHARGED TO A FILTER BAG LOCATED GREATER THAN 100 FEET FROM ANY FLOWING NON-TURBID WATER.
5. SHOULD A FILTER BAG BE USED TO CONTROL SEDIMENT, A REPLACEMENT FILTER BAG SHALL BE ONSITE AT ALL TIMES. THE FILTER BAGS SHALL BE REMOVED FROM THE SITE ONCE USED.
6. ANY EXCESS MATERIAL SHALL BE DISPOSED OF OFFSITE AT NO ADDITIONAL COST TO THE OWNER UNLESS OTHERWISE APPROVED IN ADVANCE BY THE VT DEC.

MEETINGS, SUBMITTALS, AND REQUIRED INSPECTIONS

1. THE CONTRACTOR SHALL PARTICIPATE IN AN ON-SITE PRE-CONSTRUCTION CONFERENCE.
2. THE CONTRACTOR SHALL SUBMIT A CONTROL OF WATER PLAN TO THE ENGINEER FOR APPROVAL PRIOR TO CONSTRUCTION. AT A MINIMUM THE CONTRACTOR'S CONTROL OF WATER PLAN SHALL CONFORM TO SPECIFICATION SECTION 2401-DEWATERING AND FOLLOW THE GUIDANCE IN THE CONTROL OF WATER NOTES ON THIS SHEET.
3. THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER MATERIAL SLIPS FOR ALL MATERIALS AND ITEMS USED ON THE PROJECT PER THE SPECIFICATIONS SECTION 1300-SUBMITTALS.
4. THE CONTRACTOR SHALL PROVIDE THE ENGINEER 48-HOUR PRIOR NOTICE, FOR ANY PLACEMENT OF CONCRETE OR EMBANKMENT FILL.
5. THE ENGINEER SHALL BE GIVEN 48-HOUR NOTICE TO OBSERVE CRITICAL ASPECTS OF THE CONSTRUCTION. THE CRITICAL ASPECTS WILL BE IDENTIFIED AND DISCUSSED AT THE PRE-CONSTRUCTION CONFERENCE. FAILURE TO PROVIDE THE REQUIRED NOTICE MAY RESULT IN DELAYS TO THE PROJECT.

PERMITS

1. THE FOLLOWING PERMITS ARE BEING SECURED FOR THIS PROJECT:
   ANR STREAM ALTERATION INDIVIDUAL PERMIT
   US ARMY CORPS OF ENGINEERS SECTION 404 CLEARANCE
2. THE CONTRACTOR IS RESPONSIBLE FOR BEING FAMILIAR WITH THE REQUIREMENTS OF THE PERMITS PRIOR TO BIDDING, AND FOR COMPLYING WITH THEM DURING CONSTRUCTION.
3. A COPY OF THE PERMITS SHALL BE ON SITE DURING ALL CONSTRUCTION ACTIVITIES.

UTILITIES

1. THE LOCATION OF UTILITIES SHOWN ON THESE PLANS, IF ANY, IS APPROXIMATE, AND DUBOIS & KING MAKES NO CLAIM TO ITS ACCURACY OR COMPLETENESS.
2. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING AND DETERMINING THE LOCATION, SIZE, AND ELEVATION OF ALL UTILITIES PRIOR TO THE START OF CONSTRUCTION.
3. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING AND DETERMINING ALL UTILITIES (ABOVE AND BELOW GROUND) WITHIN THE PROJECT LIMITS, AND TO TAKE THE NECESSARY PRECAUTIONS TO PROTECT UTILITIES DURING CONSTRUCTION. CONTACT DIG-SAFE AT 1-800-DIG-SAFE (WWW.DIGSAFE.COM).
4. THE ENGINEER SHALL BE NOTIFIED IN WRITING OF ANY UTILITIES FOUND INTERFERING WITH THE PROPOSED CONSTRUCTION, AND APPROPRIATE REMEDIAL ACTION BE SHALL BE DETERMINED AND AGREED UPON BEFORE PROCEEDING WITH THE WORK.

RESTORATION OF SURFACES

1. THE CONTRACTOR MUST APPLY A COURSE OF CRUSHED GRAVEL TO THE CONSTRUCTION ACCESS DRIVES AND STAGING AREAS AS DIRECTED BY THE ENGINEER TO PREVENT RUTTING, EROSION, AND TRACKING OF MATERIAL OFFSITE. AT THE COMPLETION OF WORK, THE CONTRACTOR MUST REMOVE THE GRAVEL AND REGRADE, SEED, AND MULCH THE DISTURBED AREA.
2. AT THE COMPLETION OF WORK, THE CONTRACTOR MUST RESTORE ACCESS ROADS AND STAGING AREAS TO PRE-CONSTRUCTION CONDITION. RESTORATION MAY INCLUDE PLACEMENT OF GRAVEL ON EXISTING DRIVES AND / OR APPLICATION OF TOPSOIL, GRASS SEED, FERTILIZER, AND MULCH TO AFFECTED GRASSED AREAS.

PROPOSED CONSTRUCTION SEQUENCE

1. PREPARE STAGING AREA AND STABILIZE ACCESS ROAD TO DAM SITE.
2. INSTALL SILT FENCE AND EROSION CONTROL MEASURES AT DAM SITE. SEE SHEET C9.
3. ESTABLISH CONTROL OF WATER MEASURES.
4. CLEAR TREES AND SHRUBS FROM THE DAM EMBANKMENT AND WITHIN THE IDENTIFIED WORK AREA.
5. CONSTRUCT THE DESIGN ON THESE PLANS.
6. PLACE TOP SOIL, SEED AND MULCH. SEE SPECIFICATIONS SECTION 02483.
7. CONDUCT FINAL INSPECTION WITH THE OWNER AND ENGINEER.

MATERIAL NOTES

1. THE CONTRACTOR SHALL HAVE A SET OF THE TECHNICAL SPECIFICATION ON SITE DURING ALL CONSTRUCTION ACTIVITIES.
2. ALL MATERIALS USED ON THIS PROJECT SHALL CONFORM TO THE SPECIFICATIONS. FOR ANY DISCREPANCY BETWEEN THE PLANS AND MATERIAL SPECIFICATIONS, THE TECHNICAL SPECIFICATIONS SHALL TAKE PRECEDENCE OVER NOTES CONTAINED ON THESE PLANS.
3. ALL PRECAST CONCRETE UNITS SHALL BE CURED A MINIMUM OF 7 DAYS PRIOR TO DELIVERY TO THE SITE
4. ALL EARTHEN MATERIAL USED ON SITE SHALL BE PLACE AND COMPACTED IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS. NEW EARTHEN MATERIAL SHALL BE CONSISTENT WITH ON-SITE MATERIAL. THE CONTRACTOR SHALL RECEIVE PRIOR APPROVAL FROM THE ENGINEER BEFORE IMPORTING NEW EARTHEN MATERIAL TO THE SITE.

CONCRETE NOTES

1. NO BACKFILL SHALL BE PLACED AGAINST ANY NEWLY PLACED CONCRETE UNTIL THE ENGINEER HAS APPROVED THE WORK AND SHALL NOT OCCUR PRIOR TO SEVEN (7) DAYS AFTER BEING POURED OR ACHIEVES 85% OF THE SPECIFIED COMPRESSIVE STRENGTH.
2. THE CONTRACTOR, AT THE EXPENSE OF THE CONTRACTOR, SHALL REPAIR ANY DAMAGE TO NEWLY PLACED CONCRETE.
3. WHERE THE CONCRETE IS TO BE PLACED BY PUMPING, THE CONTRACTOR SHALL NOTIFY THE ENGINEER A MINIMUM OF ONE WEEK PRIOR TO PLACEMENT FOR REVIEW OF PROCEDURES TO BE USED. THE CONTRACTOR SHALL OBTAIN AND REVIEW ACI 304 - PLACING CONCRETE BY PUMPING METHODS. PROVISION FOR BACK-UP PUMPING EQUIPMENT SHALL BE MADE BY THE CONTRACTOR.
4. ALL EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED 1-INCH BY 1-INCH, UNLESS OTHERWISE NOTED.
5. JOINTS AND SCORE MARKS IN CONCRETE SHALL BE CONSTRUCTED AS INDICATED ON THE PLANS OR AS DIRECTED BY THE ENGINEER.
6. THE CONTRACTOR SHALL NOTIFY THE ENGINEER A MINIMUM OF 24 HOURS IN ADVANCE OF ALL CONCRETE OPERATIONS.
7. FOOTINGS SHALL BE PLACED ON CLEAN, SOUND BEDROCK. THE CONTRACTOR SHALL REMOVE ALL DELETERIOUS MATERIAL FROM THE BEDROCK SURFACE PRIOR TO CASTING CONCRETE.
8. THE BEDROCK SHOWN ON THESE DRAWINGS IS APPROXIMATE. THE ENGINEER WILL
9. IF THE EXISTING TOP OF BEDROCK IS LOCATED ABOVE THE BOTTOM OF THE FOOTING AS SHOWN ON THE DRAWINGS, THE ENGINEER MAY AUTHORIZE OVER BREAKAGE OF THE BEDROCK. ALL OVER BREAKAGE BELOW THE BOTTOM OF FOOTING SHALL BE REPLACED WITH CONCRETE, CLASS B.
10. IF THE TOP OF EXISTING BEDROCK IS WITHIN TWO (2) FEET OF THE BOTTOM OF FOOTING ELEVATION, THE FOOTING SHALL BE EXTENDED TO THE TOP OF COMPETENT BEDROCK AS SHOWN USING CONCRETE, CLASS B.
11. IF THE TOP OF EXISTING BEDROCK IS GREATER THAN TWO (2) FEET BELOW THE BOTTOM OF THE FOOTING, THE CONTRACTOR SHALL NOTIFY THE ENGINEER AND PREPARE AND SUBMIT A PROFILE OF THE BEDROCK SURFACE IN THE VICINITY OF THE FOOTING. THE CONTRACTOR SHALL NOT PERFORM ANY FURTHER WORK ON THE SUBSTRUCTURE UNTIL NOTIFIED IN WRITING BY THE ENGINEER.
12. ALL CONCRETE WORK SHALL COMPLY WITH THE LATEST ACI SPECIFICATIONS (ACI-350).
13. ALL CAST-IN-PLACE CONCRETE, INCLUDING THE CUT-OFF WALL, SPILLWAY TRAINING WALLS, AND SPILLWAY CHUTE APRON SHALL BE HIGH PERFORMANCE CLASS AA (4,000 PSI) CAST-IN-PLACE CONCRETE. SEE SPECIFICATIONS SECTION 03300.
14. REINFORCING STEEL SHALL CONFORM TO ASTM A615, GRADE 60.
15. CONTRACTOR SHALL SUBMIT REINFORCING SHOP DRAWINGS FOR REVIEW BY THE ENGINEER.
16. HOT WEATHER CONCRETE PLACEMENT SHALL BE IN ACCORDANCE WITH ACI 305R.
17. PVC WATERSTOPS SHALL BE GREENSTREAK, DUMBBELL TYPE, STYLE NO. 705, 724, OR APPROVED EQUAL.
18. HYDROPHILIC WATERSTOPS SHALL BE VOLCLAY, WATERSTOP-RX, TYPE RX-101, GREENSTREAK NO. 594 SWELL STOP, OR APPROVED EQUAL.
19. PROVIDE CONSTRUCTION JOINTS AT ALL LOCATIONS OF DISCONTINUOUS CONCRETE PLACEMENT.

EROSION CONTROL NOTES

1. TEMPORARY EROSION PREVENTION AND SEDIMENT CONTROL (EPSC) MEASURES ARE REQUIRED THROUGHOUT THE ENTIRE CONSTRUCTION PERIOD.
2. ALL EPSC ACTIVITIES SHALL CONFORM TO THE VT DEC LOW RISK SITE HANDBOOK FOR EROSION PREVENTION AND SEDIMENT CONTROL, 2006.
3. ALL EARTHWORK AND GRADING PERFORMED BETWEEN OCTOBER 15 AND APRIL 15 SHALL CONFORM TO APPROVED WINTER CONSTRUCTION PRACTICES, AS PRESENTED IN THE VT DEC LOW RISK SITE HANDBOOK FOR EROSION PREVENTION AND SEDIMENT CONTROL.
4. THE CONTRACTOR SHALL BE AWARE OF ALL DISCHARGE INTO THE OUTLET CHANNEL. SHOULD THERE BE VISUALLY DISCOLORED DISCHARGE ENTERING THE OUTLET CHANNEL THE CONTRACTOR SHALL DETERMINE THE SOURCE OF THE DISCOLORED DISCHARGE. IF THE CAUSE OF THE DISCOLORED DISCHARGE IS FROM CONSTRUCTION ACTIVITIES ALL OPERATIONS MUST CEASE UNTIL THE DISCHARGE IS NO LONGER DISCOLORED. ALTERNATIVE MEANS OF CONSTRUCTION SHALL BE ADMINISTERED AS TO AVOID ADDITIONAL RELEASE OF DISCOLORED DISCHARGE INTO THE OUTLET CHANNEL.
5. PRIOR TO CONSTRUCTION THE CONTRACTOR SHALL INSTALL SILT FENCING AND EROSION CONTROL DEVICES AS SHOWN ON THESE PLANS. EROSION CONTROLS SHALL BE LOGICALLY PHASED WITH CONSTRUCTION ACTIVITIES AND AS DIRECTED BY THE ENGINEER OR OWNERS REPRESENTATIVE.
6. THE EROSION CONTROLS SHALL BE INSPECTED DAILY PRIOR TO INITIATION OF THE DAY'S ACTIVITIES. MAINTENANCE SHALL TAKE PLACE AT THAT TIME.
7. THE CONTRACTOR SHALL TOPSOIL, SEED AND MULCH THE DISTURBED AREAS WITHIN 7 DAYS OF INITIAL DISTURBANCE. AFTER THIS TIME, ANY DISTURBANCE IN THE AREA MUST BE STABILIZED AT THE END OF EACH WORKDAY. ALL AREAS OF DISTURBANCE MUST HAVE PERMANENT STABILIZATION WITHIN 48 HOURS OF REACHING FINAL GRADE. THE FOLLOWING EXCEPTIONS MAY APPLY:
   A) STABILIZATION IS NOT REQUIRED IF THE EARTHWORK IS TO CONTINUE IN THE AREA WITHIN THE NEXT 24 HOURS AND THERE IS NO PRECIPITATION FORECAST FOR THAT SAME PERIOD OF TIME.
   B) STABILIZATION IS NOT REQUIRED IF THE EARTHWORK IS OCCURRING WITHIN A SELF-CONTAINED EXCAVATION, WITH A DEPTH OF 2 FEET OR GREATER AND NO OUTLET.
8. ALL SLOPES AND DISTURBED AREAS SHALL BE GRADED SMOOTH AND FREE OF POCKETS WITH SUFFICIENT SLOPE TO ENSURE DRAINAGE.
9. ALL SLOPES GREATER THAN 1V:2H SHALL BE TREATED WITH BIODEGRADABLE EROSION CONTROL BLANKET, TYPE S150BN AS MANUFACTURED BY NORTH AMERICAN GREEN OR APPROVED EQUAL. THE BLANKET SHALL BE STAPLED WITH BIODEGRADABLE STAPLES, OVERLAPPED, AND SHINGLED CORRECTLY RELATIVE TO WATER FLOW, AND INSTALLED IN GENERAL ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS AND SPECIFICATIONS.
10. PERMANENT STABILIZATION SHALL BE CONDUCTED ACCORDING TO THE TECHNICAL SPECIFICATIONS SECTION 02483.
11. REMOVAL OF EPSC MEASURES SHALL ONLY BE DONE FOLLOWING THE APPROVAL OF THE ENGINEER ALL DISTURBANCES CAUSED BY THE REMOVAL SHALL BE REPAIRED IMMEDIATELY.

CONTROL OF WATER NOTES

GENERAL REQUIREMENTS

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE CONTROL OF WATER THROUGHOUT THE DURATION OF THE PROJECT. ANY CHANGES TO THE CONTROL OF WATER PROCEDURE AS OUTLINED HEREIN WILL BE SUBJECT TO APPROVAL OF THE ENGINEER.
2. THE POOL SHALL BE FULLY DEWATERED THROUGHOUT THE CONSTRUCTION PERIOD.
3. COFFERDAMS WILL BE REQUIRED UPSTREAM AND DOWNSTREAM OF THE DAM TO CONTROL THE WATER INFLOW AND DEWATER THE EXCAVATION. IT IS ASSUMED THAT A STONE OR SANDBAG COFFERDAM WITH A WATER DIVERSION STRUCTURE, BY-PASS PUMPING OR SIMILAR METHOD WILL PROVIDE ADEQUATE PROTECTION AGAINST WATER INFLOW. SUMP PUMPING WILL BE REQUIRED TO ADEQUATELY CONTROL THE GROUNDWATER WITHIN ANY AND ALL EXCAVATIONS TO ONE (1) FOOT BELOW BOTTOM OF PROPOSED FOUNDATIONS.
4. THE CONTRACTOR SHALL NOT REGULATE DOWNSTREAM FLOWS NOR ALTER THE NATURAL FLOW REGIME EXCEPT WHEN NECESSARY FOR MAINTENANCE, INSPECTION, CONSTRUCTION, OR PROJECT SAFETY. DURING PERIODS WHEN DOWNSTREAM FLOW REGULATION IS NECESSARY, INCLUDING THE REFILLING OF THE POND, MINIMUM DOWNSTREAM CONSERVATION FLOWS, AS NOTED IN THE FOLLOWING TABLE, SHALL BE RELEASED UNLESS INFLOW IS LESS THAN THE SEASONAL CONSERVATION FLOW.

ANNUAL PERIOD	MINIMUM DISCHARGE, CFS	GPM
JUNE 1 TO SEPTEMBER 30	2.80	1,260
OCTOBER 1 TO MARCH 31	5.60	2,510
APRIL 1 TO MAY 31	22.50	10,100

NOTE: FLOWS NOTED CORRESPOND TO A 5.6 SQUARE MILE (3,584 ACRE) DRAINAGE AREA.

5. UNDER NO CIRCUMSTANCES SHALL DOWNSTREAM FLOWS BE INTERRUPTED.
6. DOWNSTREAM FLOWS SHALL BE MAINTAINED AT ALL TIMES. DURING THE INSTALLATION OF THE COFFERDAMS, BYPASS FLOWS SHALL BE ACHIEVED WITH THE USE OF PUMPS. UPON INSTALLATION OF THE COFFERDAMS AND DEWATERING OF THE WORK AREA, MINIMUM STREAM FLOWS WILL BE MAINTAINED. PUMPS CAPABLE OF MEETING MINIMUM STREAM FLOWS SHALL BE ON SITE AT ALL TIMES DURING CONSTRUCTION TO BE USED IN CASE OF EMERGENCY. DURING PERIODS WHEN THE CONTRACTOR IS USING PUMPS TO MAINTAIN MINIMUM FLOWS, BACKUP SYSTEMS SHALL BE ONSITE IN CASE OF FAILURE OF ANY ONE PUMP.

CONTROL OF WATER DURING CONSTRUCTION

7. DURING CONSTRUCTION, THE WORK AREA SHALL REMAIN DEWATERED BY MEANS OF DIVERSION, SIPHONING OR PUMPING. TURBID DISCHARGE SHALL BE PUMPED INTO FILTER BAGS IN AN APPROVED UPLAND AREA.
8. THE CONTRACTOR SHALL INSPECT THE COFFERDAMS AND BY-PASS EACH MORNING. MAINTENANCE SHALL TAKE PLACE PRIOR TO BEGINNING ANY CONSTRUCTION ACTIVITIES SCHEDULED FOR THAT DAY.

DuBois & King inc.
ENGINEERING • PLANNING • MANAGEMENT • DEVELOPMENT
28 NORTH MAIN ST.
RANDOLPH, VT 05060
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FAX: (802) 728-7101
www.dubois-king.com
SO. BURLINGTON, VT
SPRINGFIELD, VT
BEDFORD, NH
LACONIA, NH

PROFESSIONAL SEAL

NOT FOR CONSTRUCTION PERMIT PLANS (60% COMPLETE)

NO.	DATE	DESCRIPTION	BY	CK'D

TOWN OF NORWICH
VERMONT
300 MAIN STREET
PO BOX 376
NORWICH VT 05055

NORWICH POOL DAM REHABILITATION PROJECT

NORWICH VERMONT

SHEET TITLE

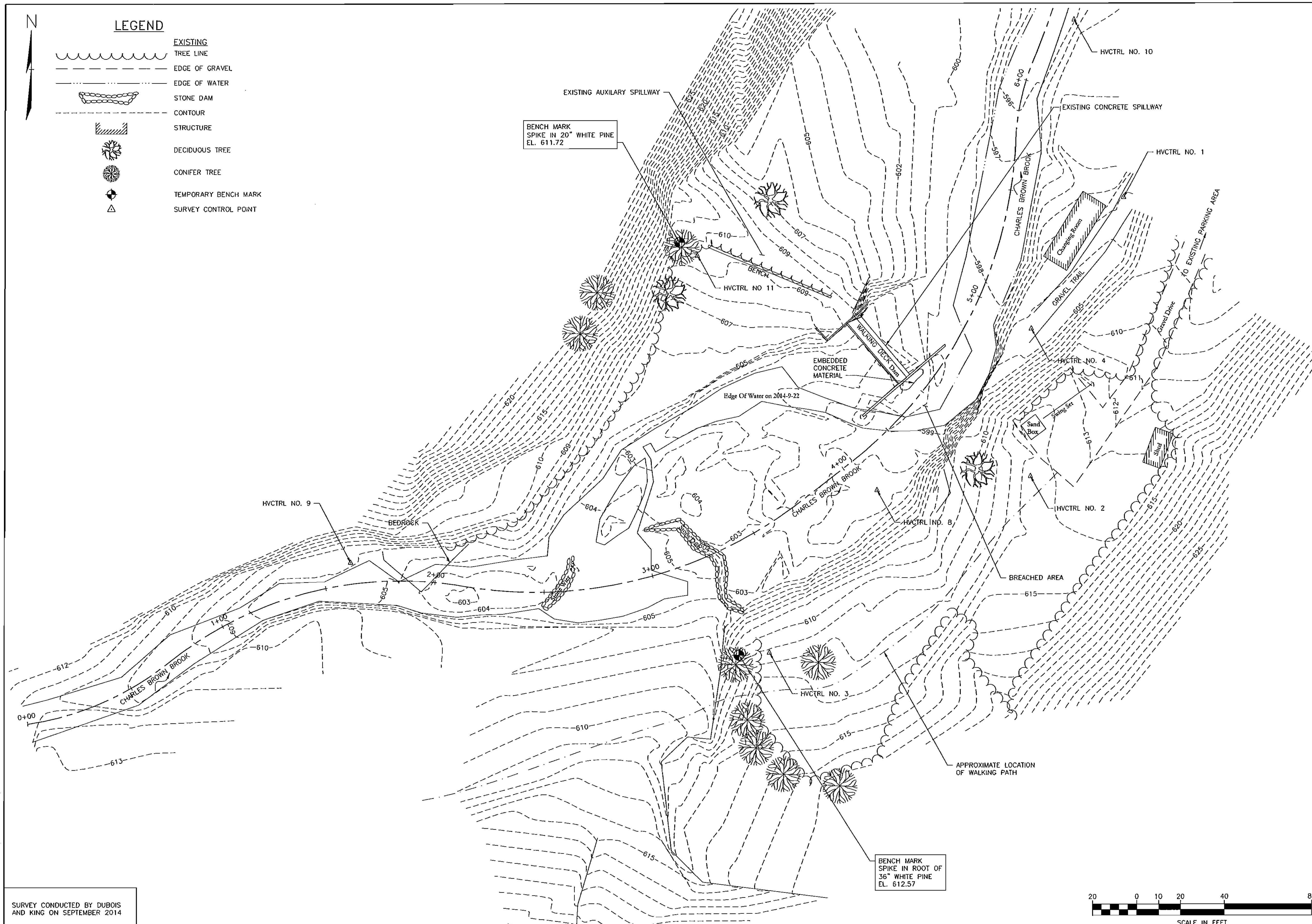
GENERAL NOTES

DRAWN BY	DATE AUG. 2015
CHECKED BY CSE	D&K PROJECT # 921651
PROJ. ENG. CSE	D&K ARCHIVE #

SHEET NUMBER

1

SHEET 1 OF 14



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TOWN OF NORWICH VERMONT
300 MAIN STREET
PO BOX 376
NORWICH VT 05055

NORWICH POOL DAM REHABILITATION PROJECT

NORWICH VERMONT

SHEET TITLE

EXISTING CONDITIONS / BASELINE LAYOUT

DRAWN BY	DATE
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SHEET NUMBER

2

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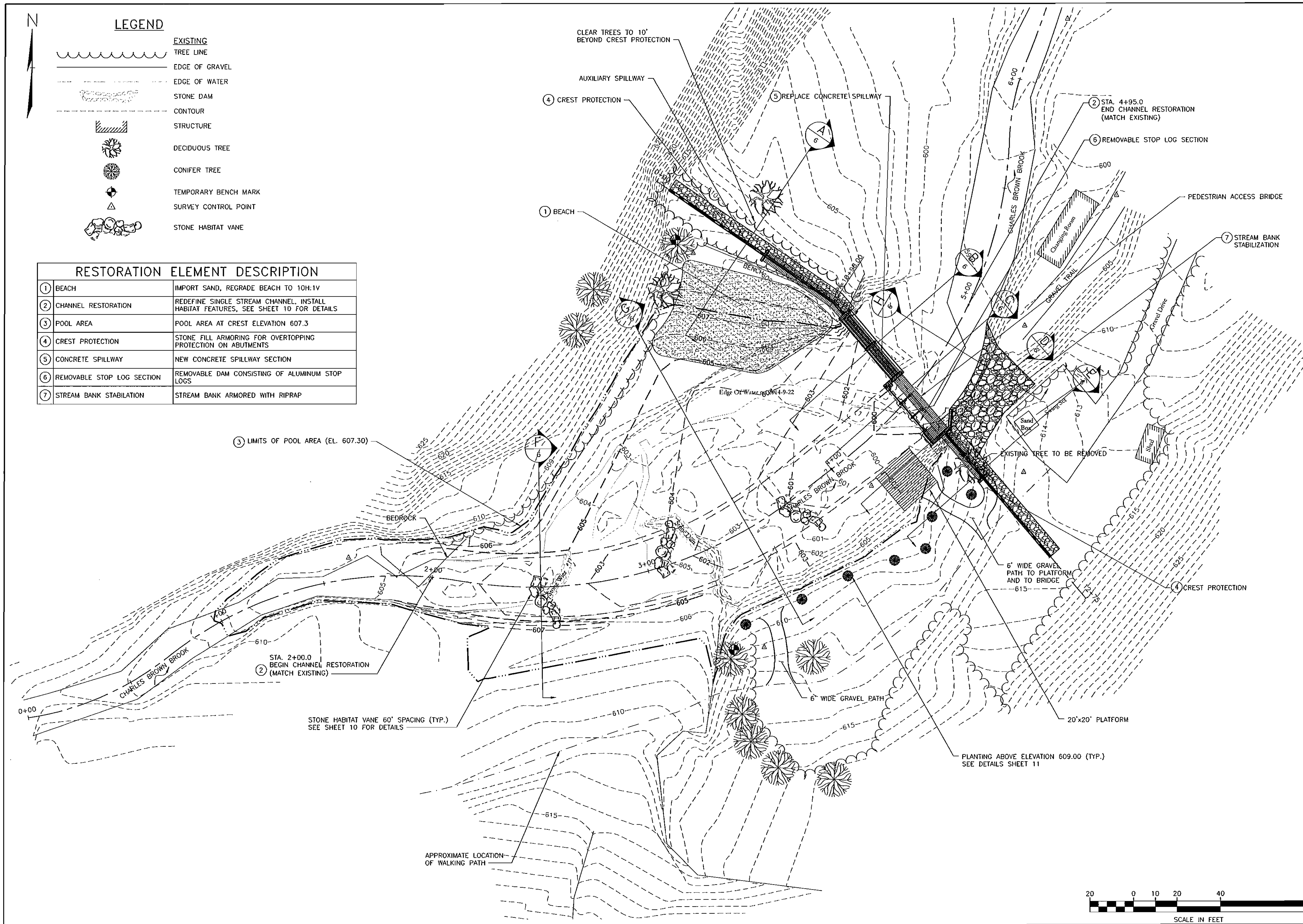
LEGEND

EXISTING

- TREE LINE
- EDGE OF GRAVEL
- EDGE OF WATER
- STONE DAM
- CONTOUR
- STRUCTURE
- DECIDUOUS TREE
- CONIFER TREE
- TEMPORARY BENCH MARK
- SURVEY CONTROL POINT
- STONE HABITAT VANE

RESTORATION ELEMENT DESCRIPTION	
(1) BEACH	IMPORT SAND, REGRADE BEACH TO 10H:1V
(2) CHANNEL RESTORATION	REDEFINE SINGLE STREAM CHANNEL, INSTALL HABITAT FEATURES, SEE SHEET 10 FOR DETAILS
(3) POOL AREA	POOL AREA AT CREST ELEVATION 607.3
(4) CREST PROTECTION	STONE FILL ARMORING FOR OVERTOPPING PROTECTION ON ABUTMENTS
(5) CONCRETE SPILLWAY	NEW CONCRETE SPILLWAY SECTION
(6) REMOVABLE STOP LOG SECTION	REMOVABLE DAM CONSISTING OF ALUMINUM STOP LOGS
(7) STREAM BANK STABILATION	STREAM BANK ARMORED WITH RIPRAP



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GENERAL SITE RESTORATION PLAN

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3

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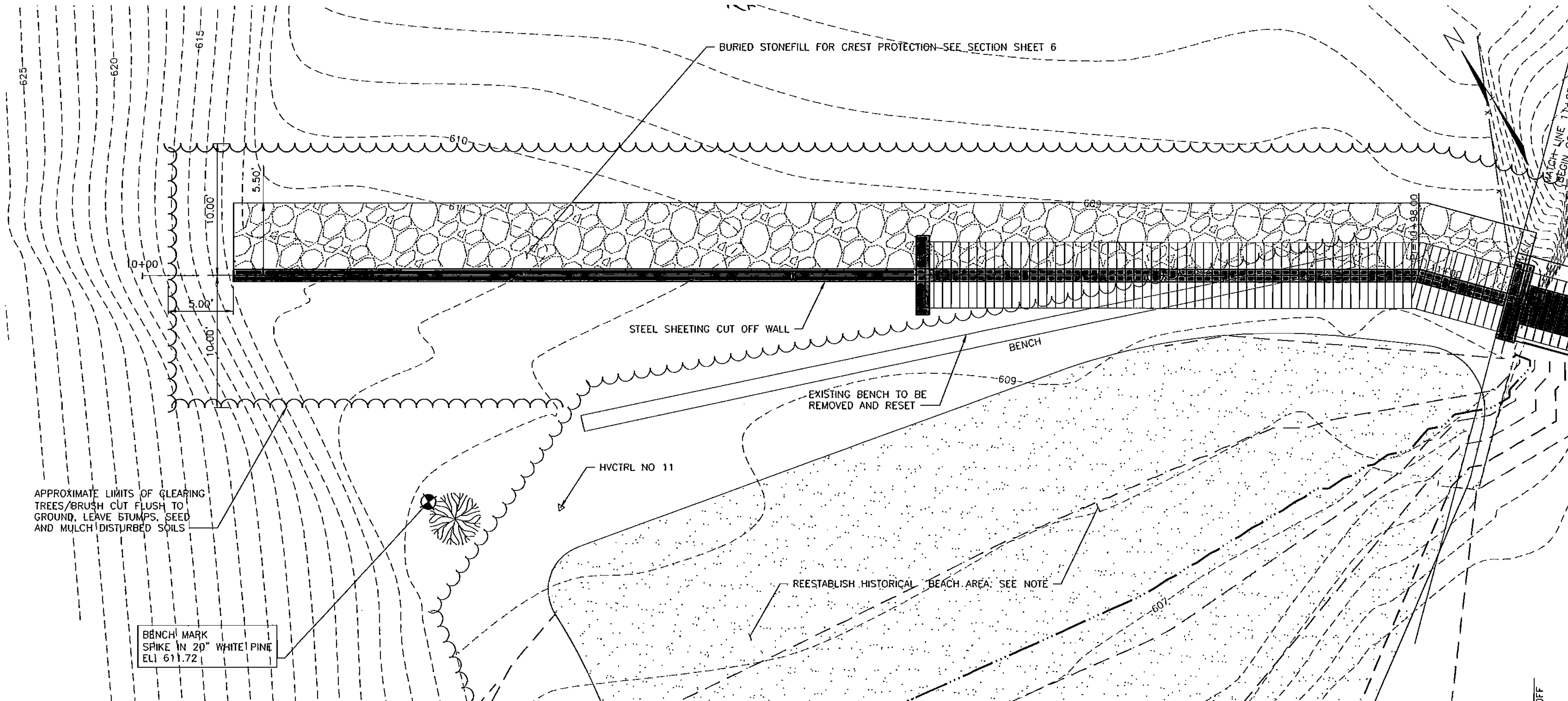
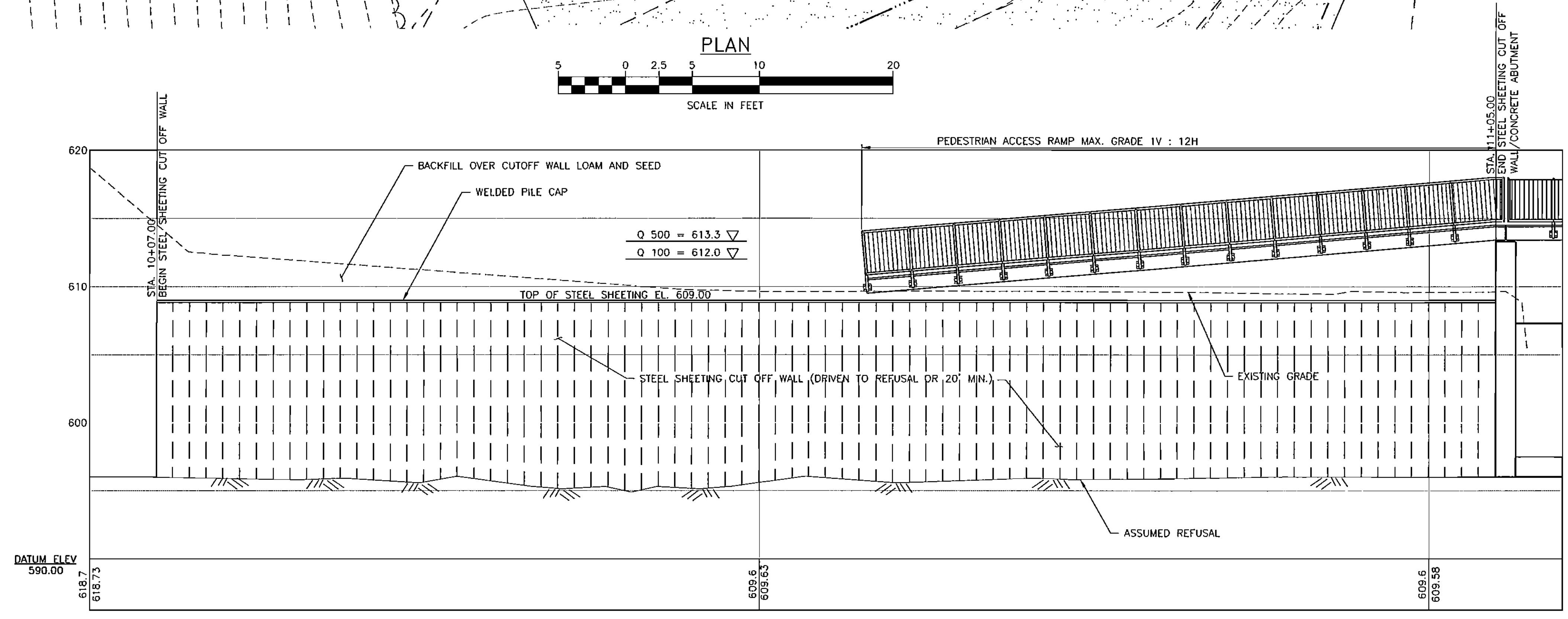


PLAN

SCALE IN FEET



ELEVATION

SCALE IN FEET

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NORWICH POOL DAM REHABILITATION PROJECT

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SHEET TITLE

AUXILIARY SPILLWAY REPAIR

PLAN AND ELEVATION

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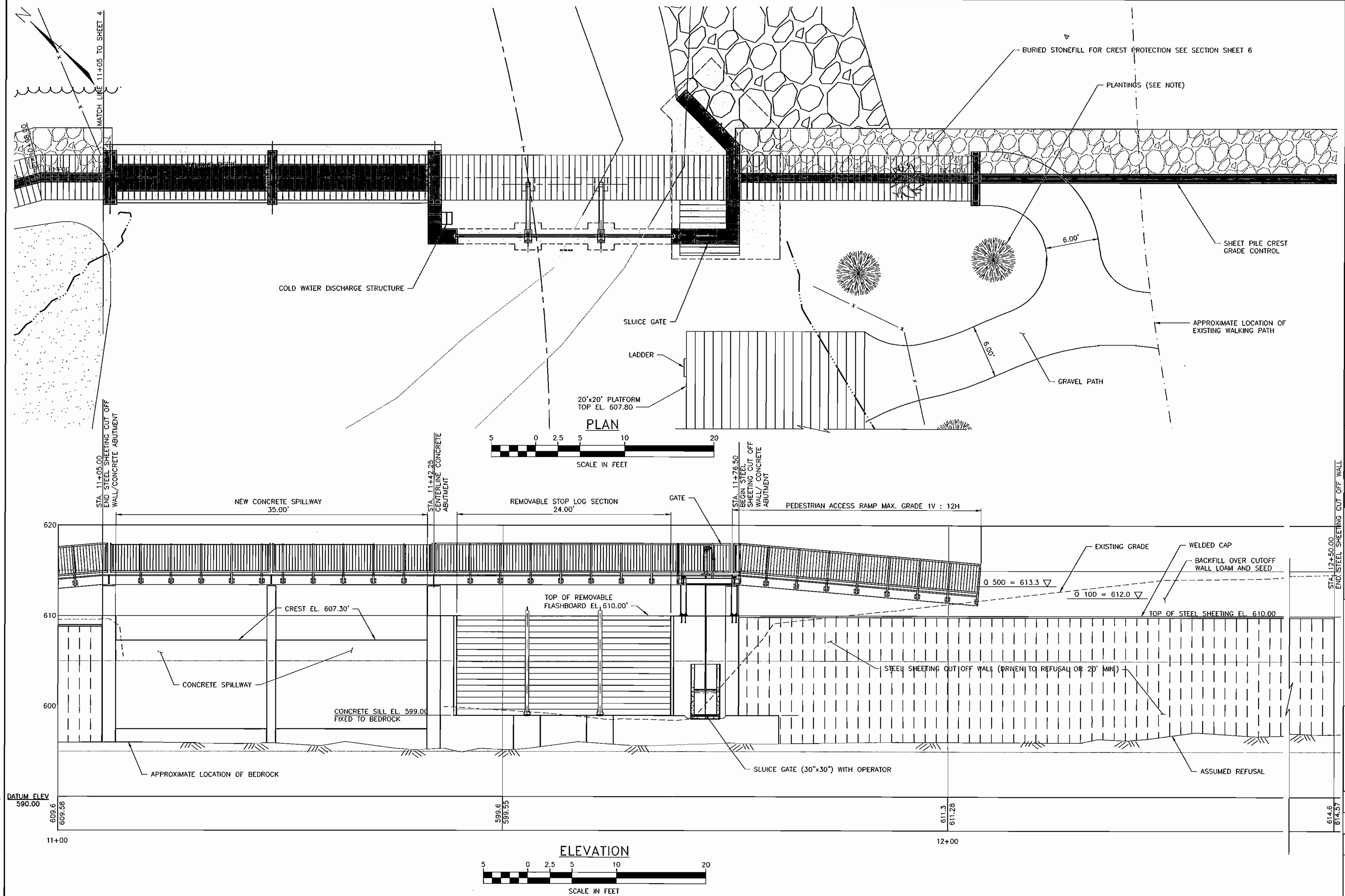
SHEET NUMBER

4



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SHEET TITLE

DAM SITE PLAN AND ELEVATION

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SHEET NUMBER

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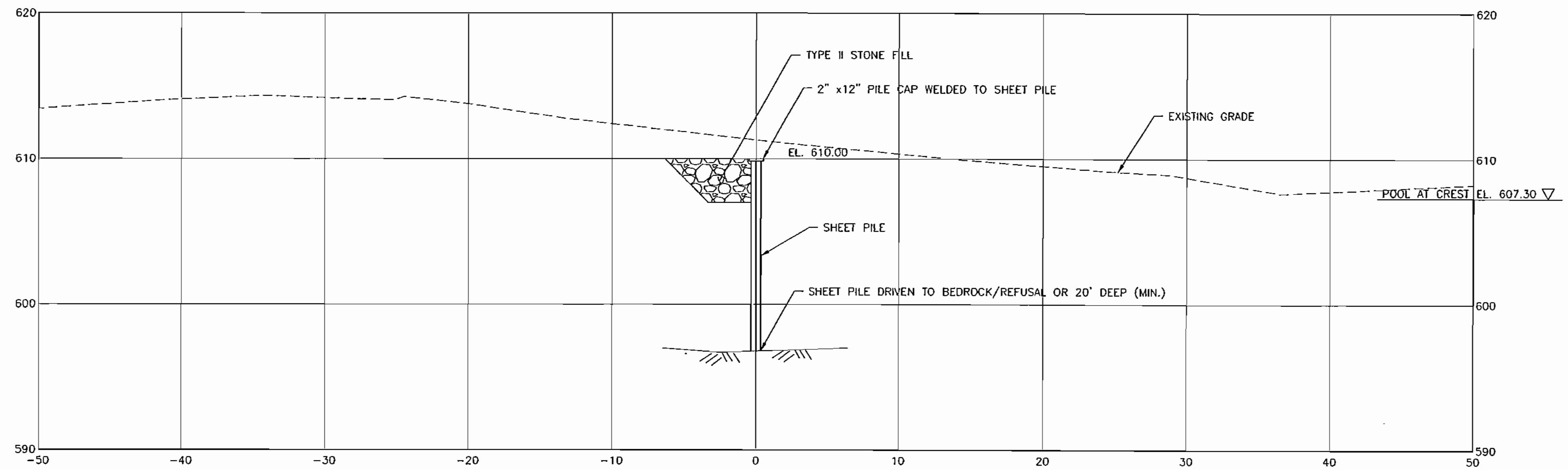
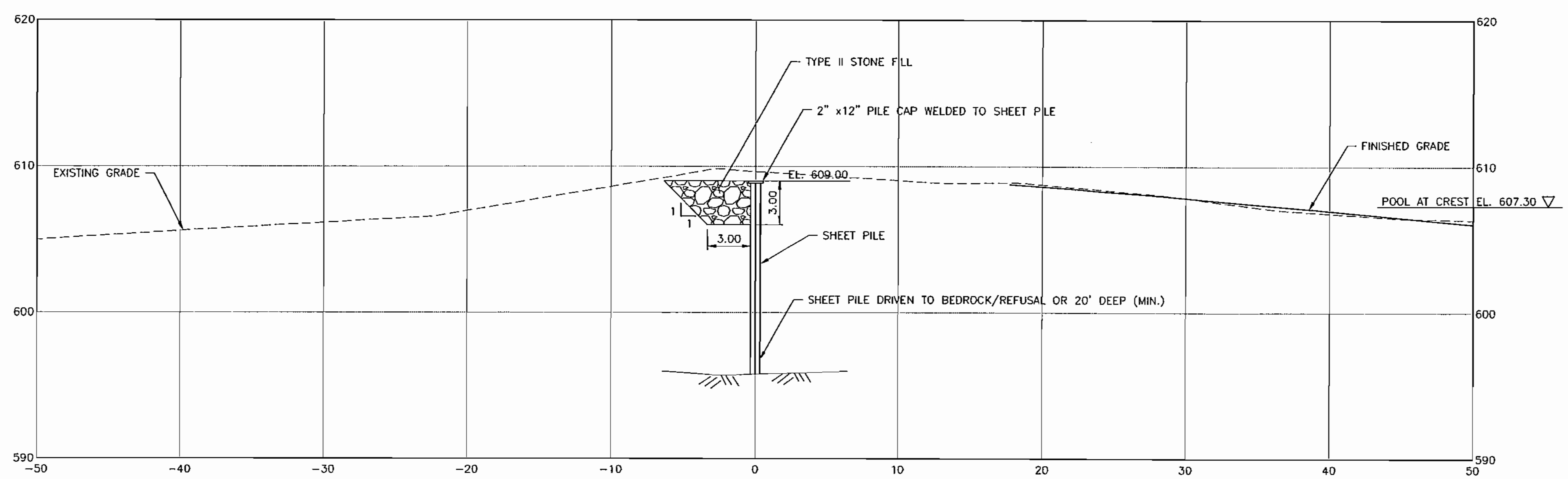


E/3 SECTION



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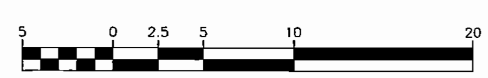

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SHEET TITLE

TYPICAL SECTIONS

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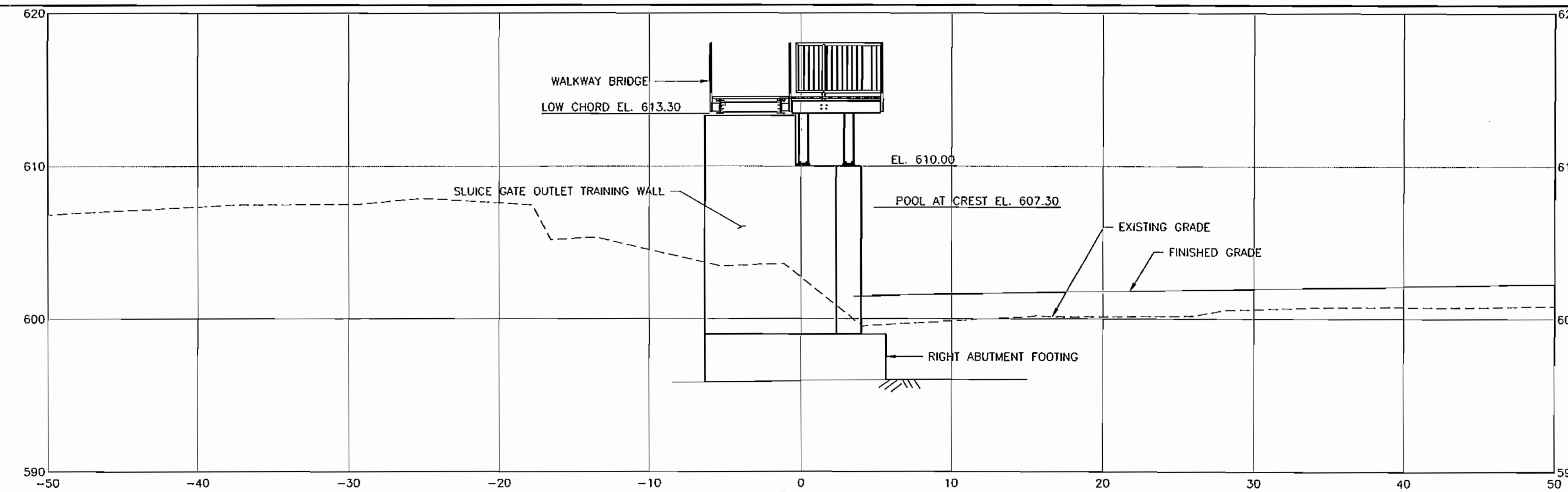
PROJ. ENG.: CSE	D&K ARCHIVE #:

SHEET NUMBER

6

SHEET 6 OF 14



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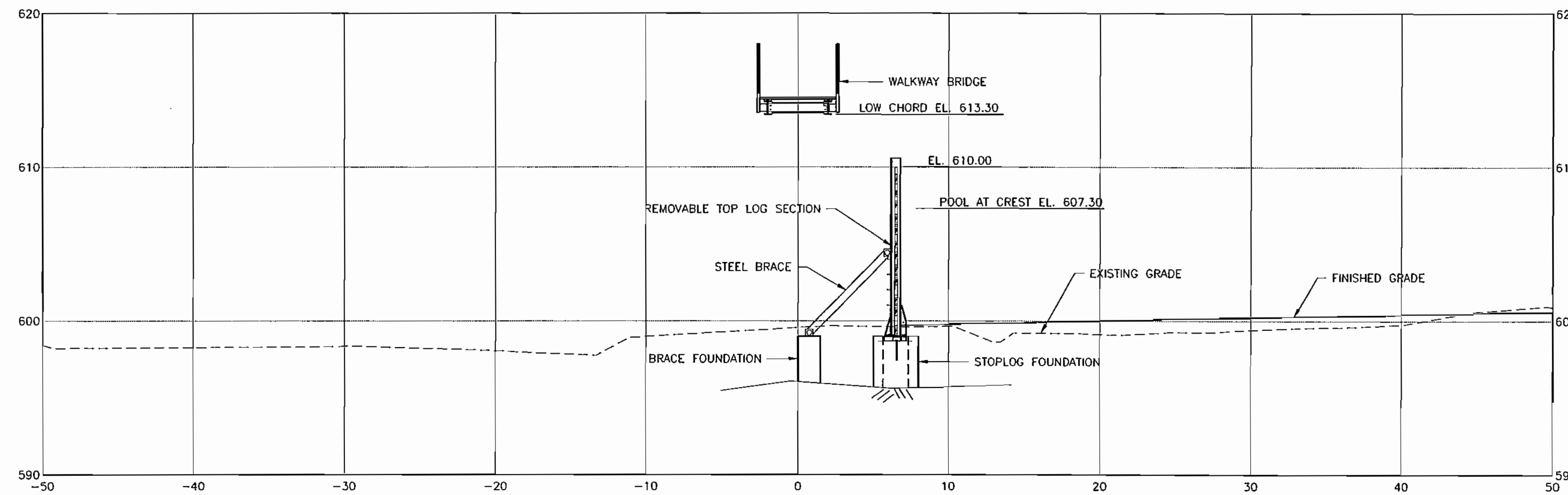

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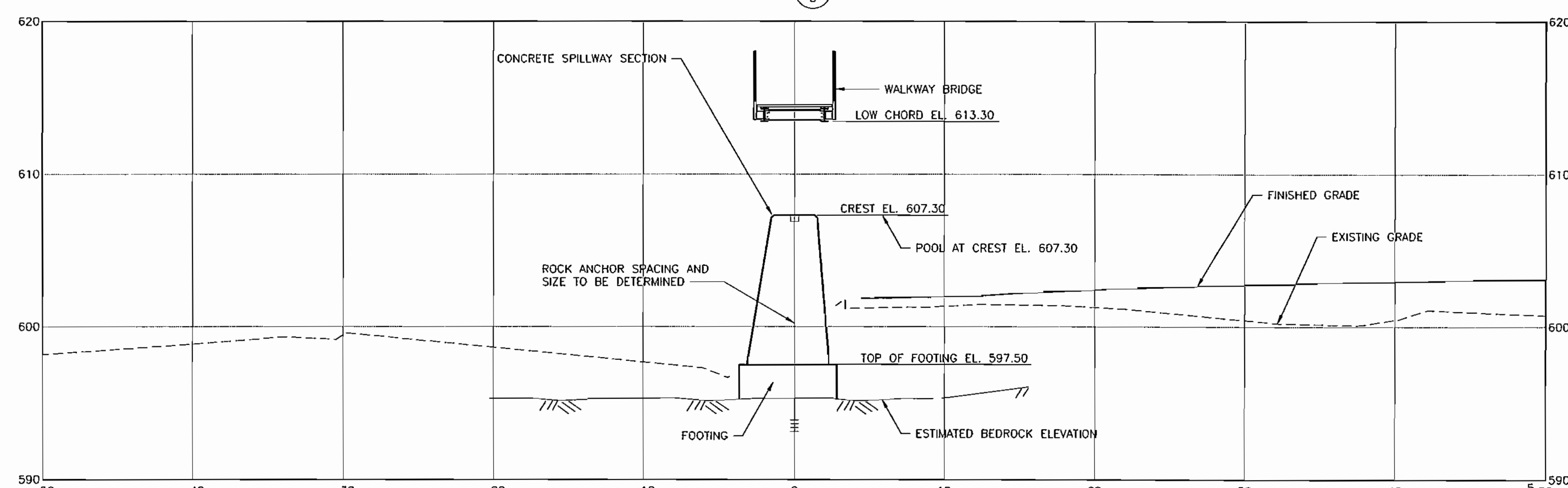

B/3 SECTION

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TYPICAL SECTIONS

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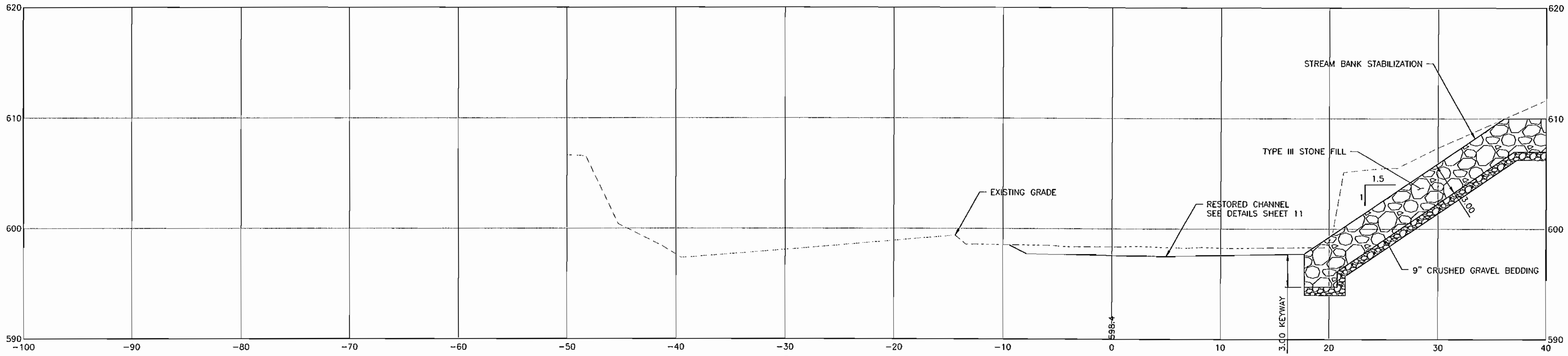
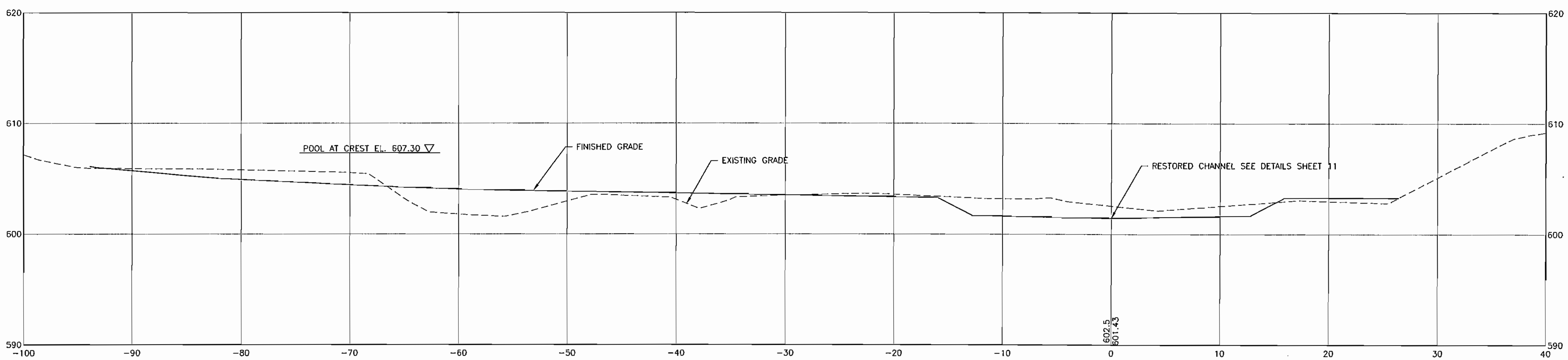


SECTION H/3



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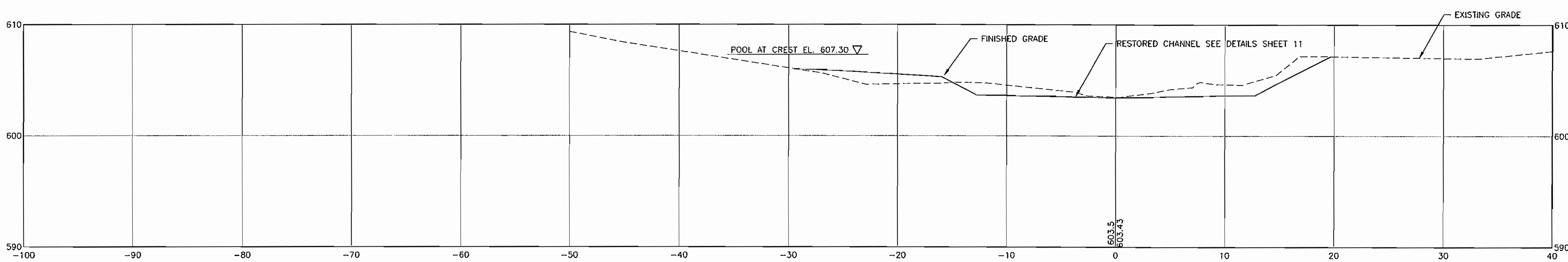

SECTION F/3

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SHEET TITLE

TYPICAL SECTIONS

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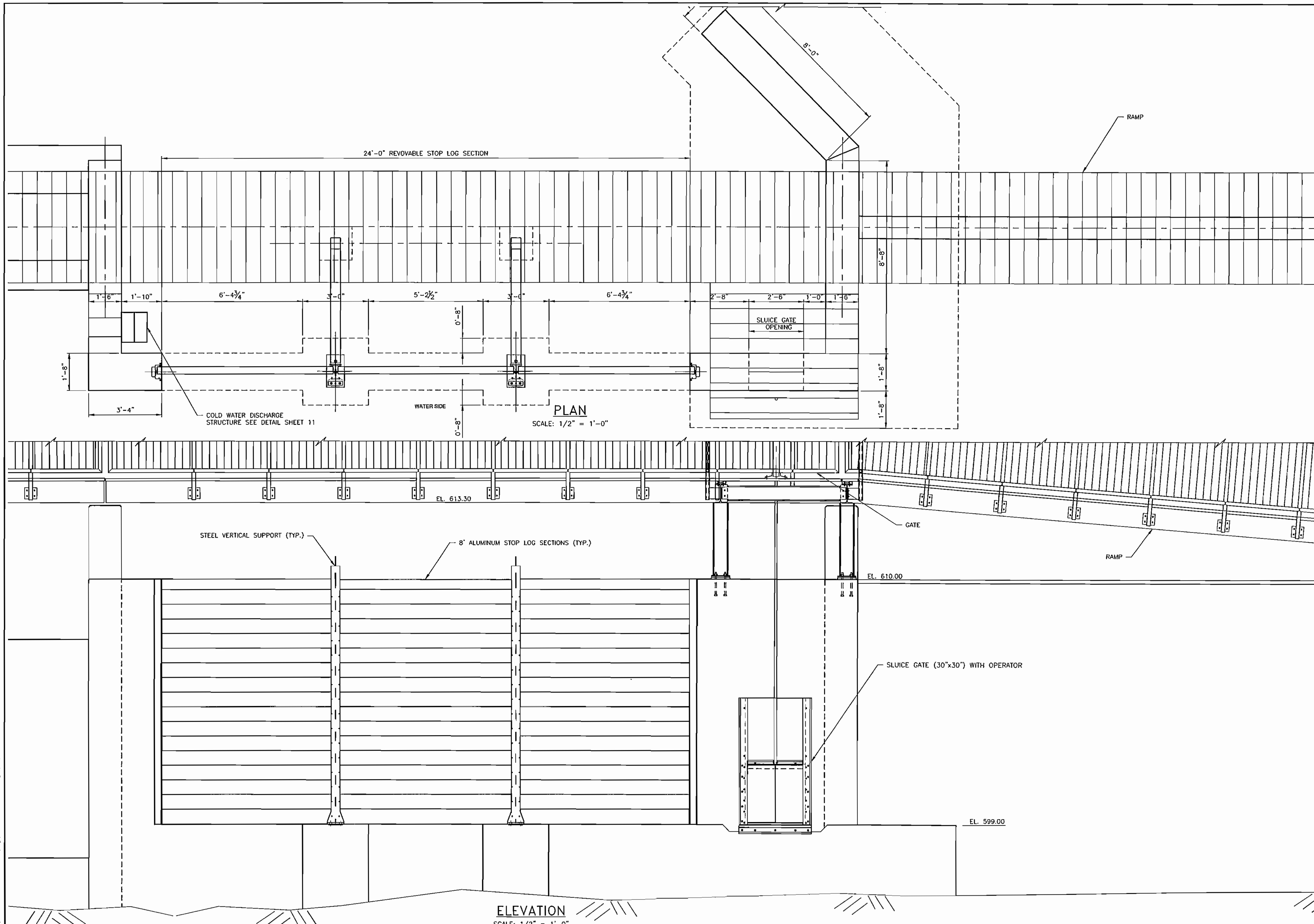

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SHEET TITLE

STRUCTURAL

DAM PLAN AND ELEVATION

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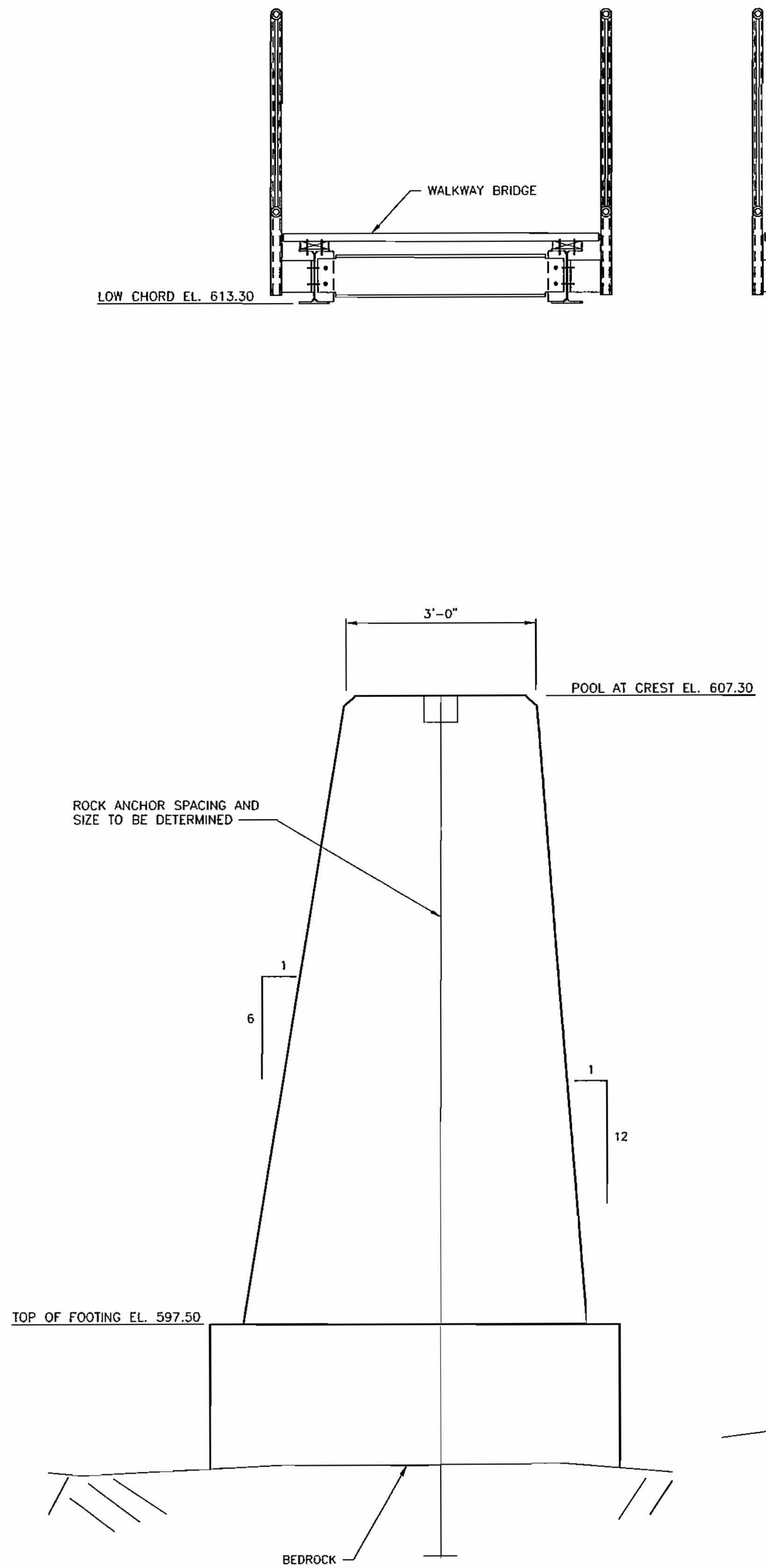
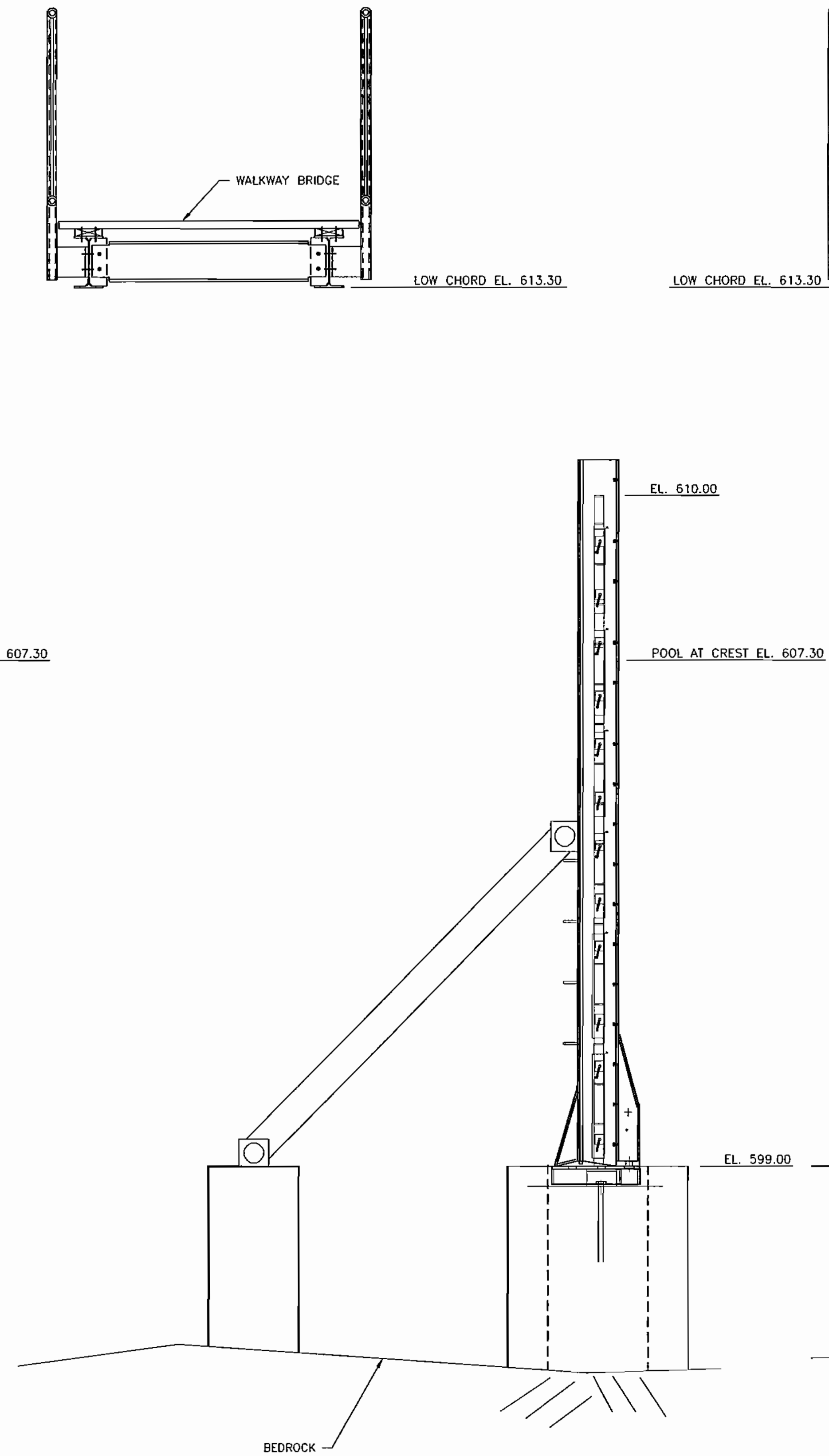
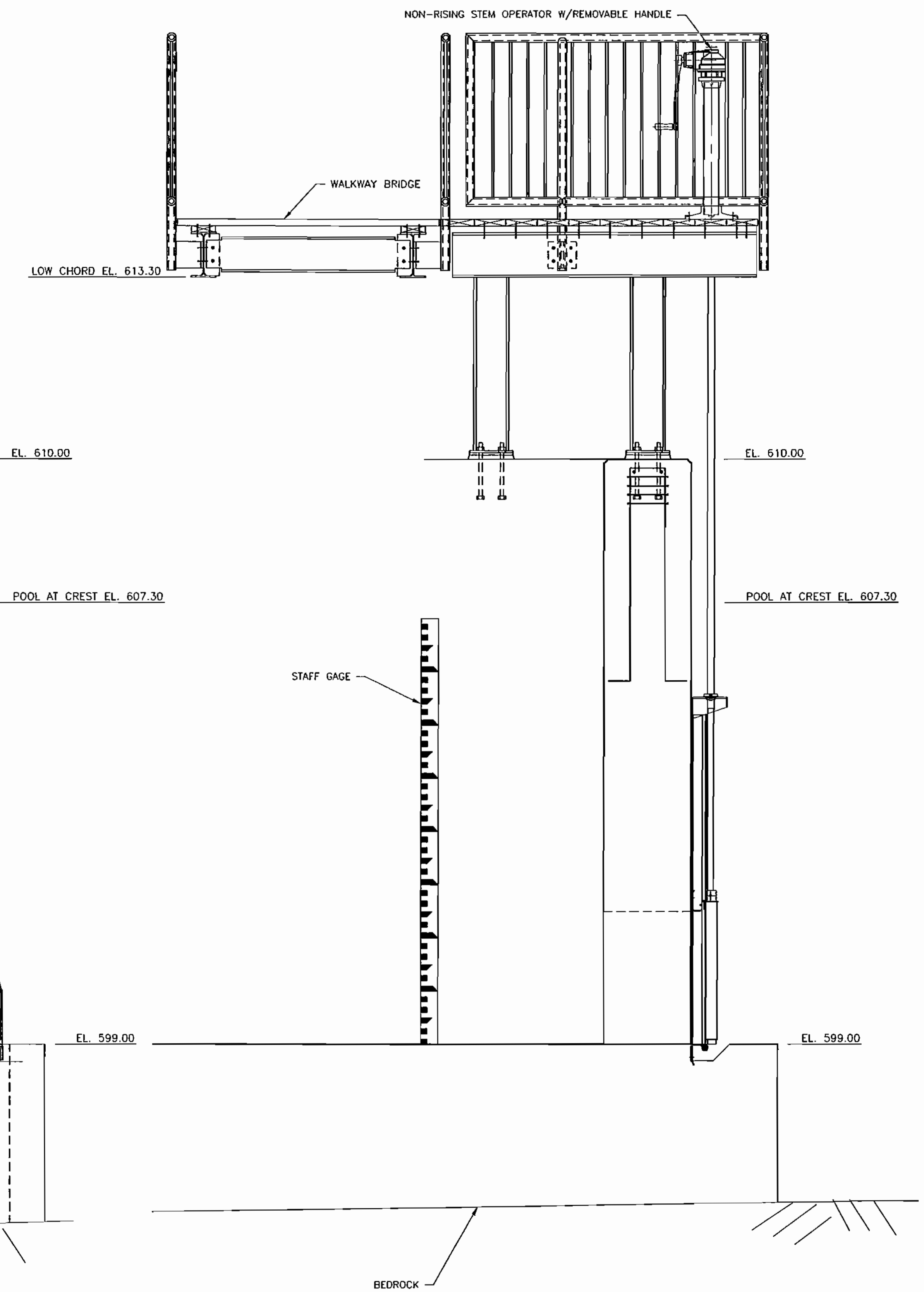


SECTION CONCRETE SPILLWAY DAM
SCALE: 3/4" = 1'-0"



SECTION REMOVABLE STOP LOGS
SCALE: 3/4" = 1'-0"



SECTION CUT OFF WALL
SCALE: 3/4" = 1'-0"

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DAM DETAILS

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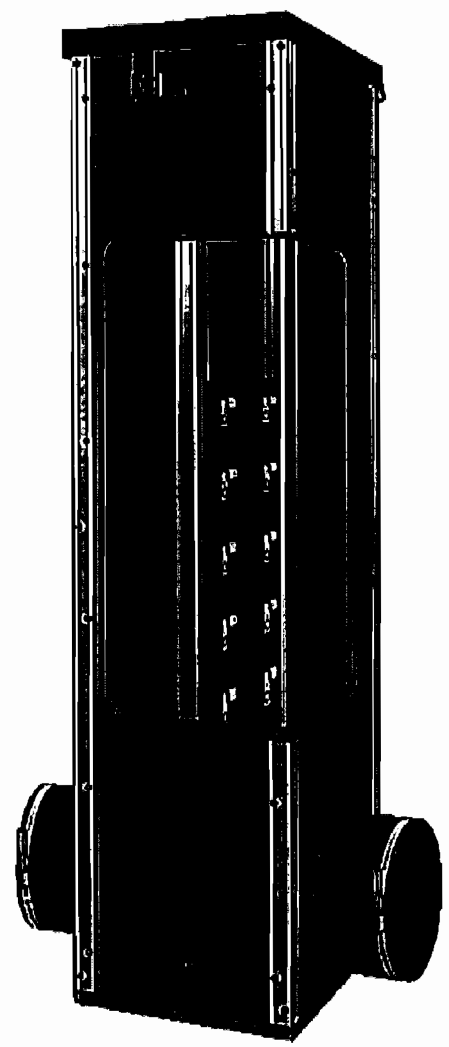
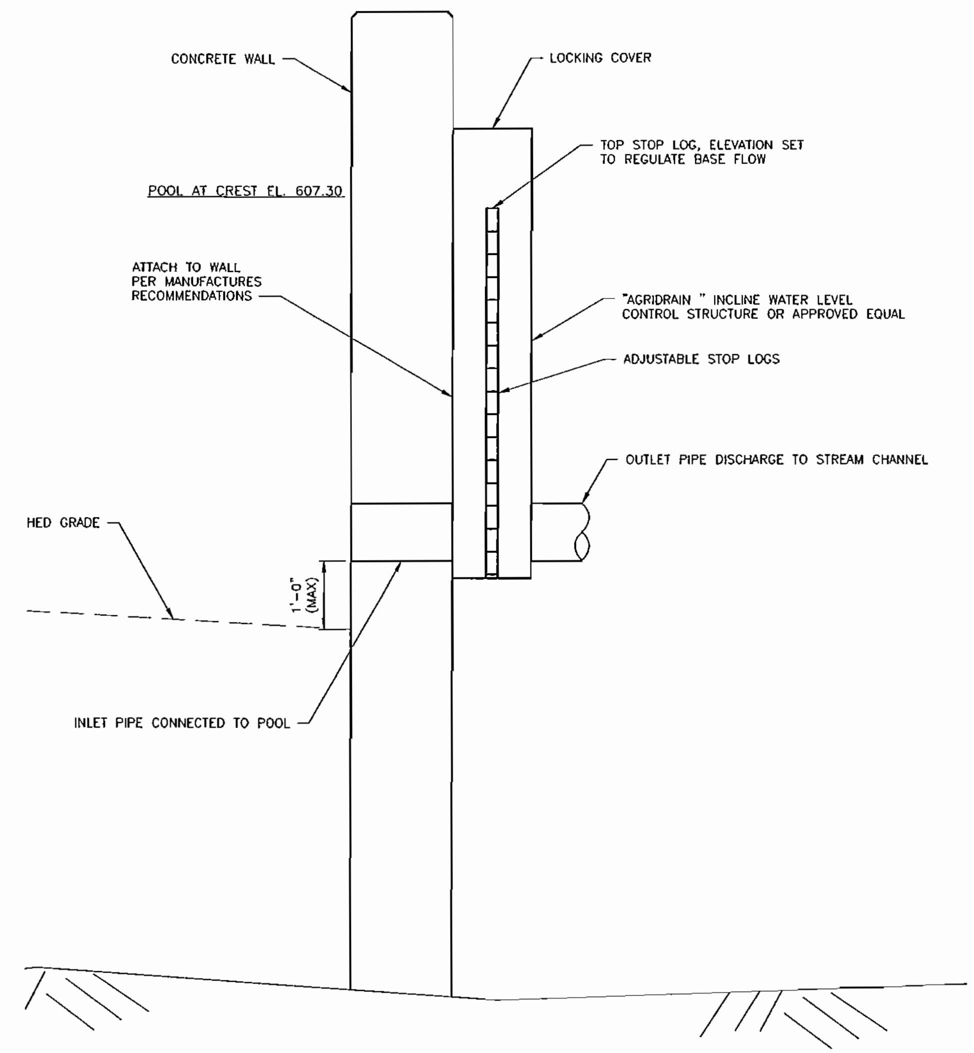


COLD WATER DISCHARGE STRUCTURE

NOT TO SCALE



SECTION COLD WATER DISCHARGE STRUCTURE

SCALE 1" = 1'-0"

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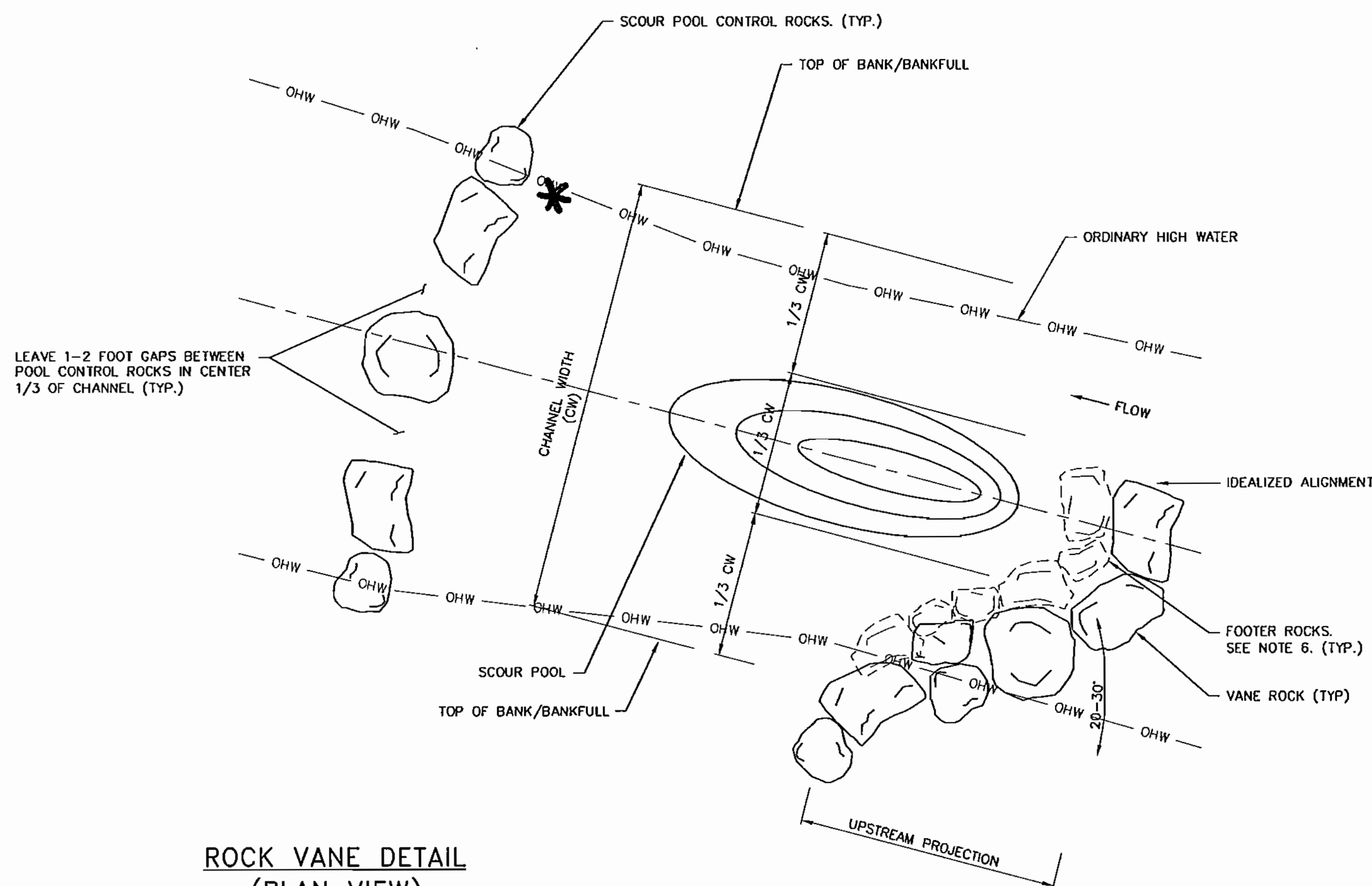
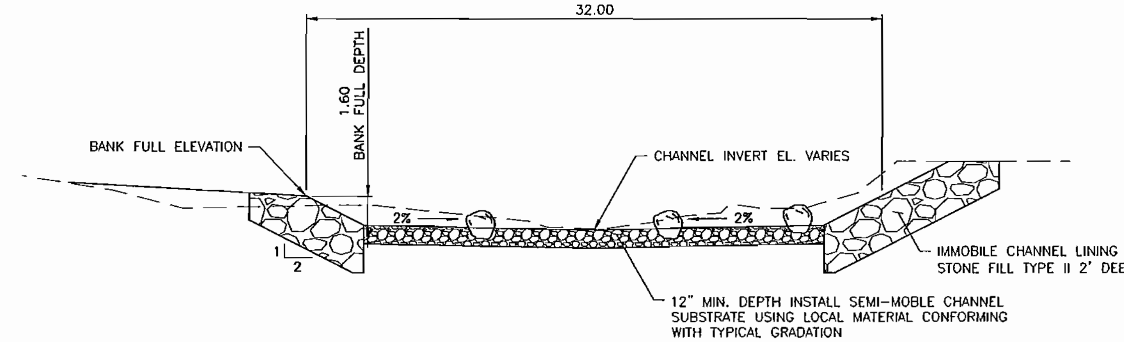


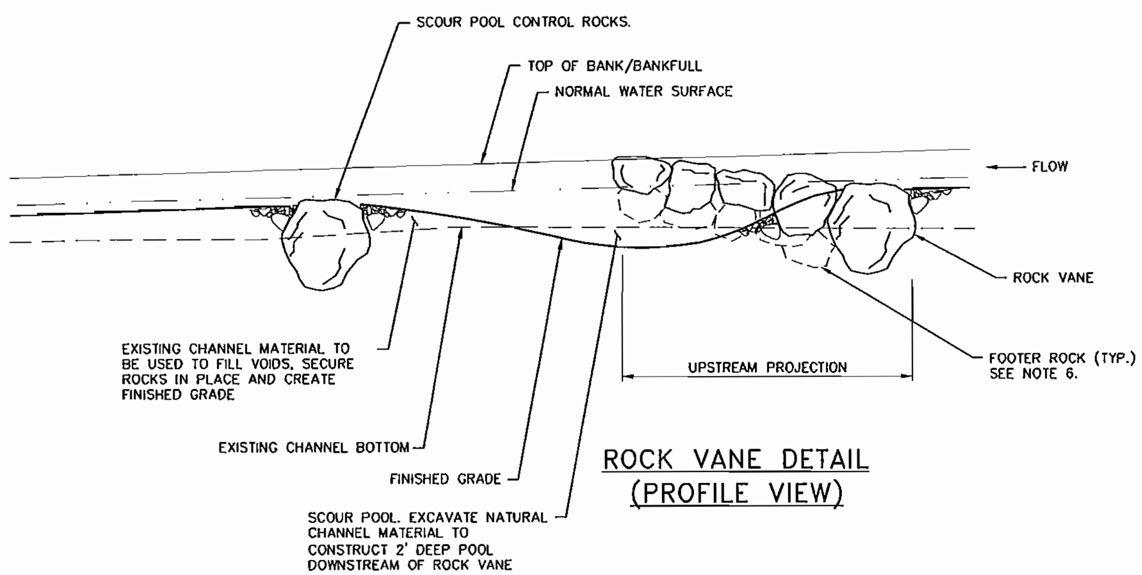
ROCK VANE DETAIL
(PLAN VIEW)



TYPICAL CHANNEL CROSS SECTION
STA. 2+00 TO STA. 4+95

CHANNEL SUBSTRATE TYPICAL GRADATION

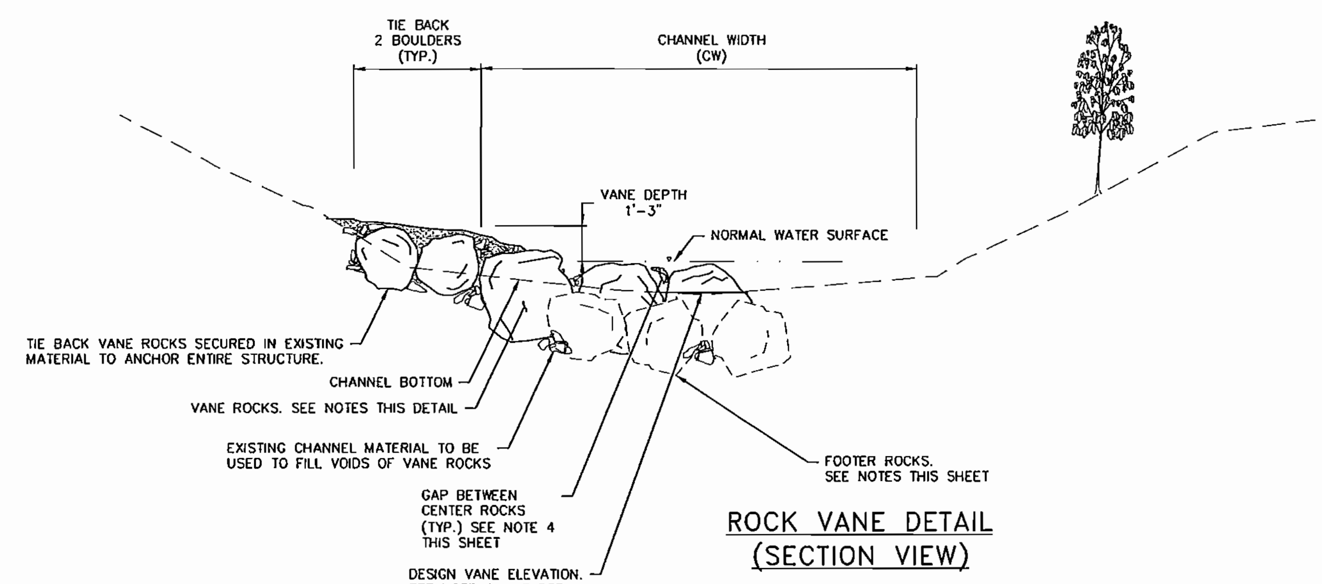
DESCRIPTION	SIZE (IN)	PERCENTAGE
BOULDERS	10.1 - 150	30%
COBBLES	7.5 - 10.1	30%
COARSE GRAVEL	0.63 - 7.5	20%
FINE GRAVEL	0.08 - 0.63	5%
SAND	< 0.08	5%



ROCK VANE DETAIL
(PROFILE VIEW)

ROCK VANE NOTES:

1. ALL VANE ROCKS AND FOOTER ROCKS SHALL BE SUB-ANGULAR AND HAVE AT LEAST TWO RELATIVELY FLAT FACES ON OPPOSING SIDES SO AS TO BE SUITABLE FOR STACKING. ROUND ROCKS ARE NOT ACCEPTABLE UNLESS APPROVED IN WRITING BY ENGINEER.
2. THE MINIMUM FOOTER ROCK DIMENSION SHALL BE 2FT AND THE MINIMUM LARGEST DIMENSION (I.E. WIDTH OR LENGTH) SHALL BE 3.5 FT.
3. THE MINIMUM VANE ROCK DIMENSION SHALL BE 1.5 FT AND THE MINIMUM LARGEST DIMENSION (I.E. WIDTH OR LENGTH) SHALL BE 3.0 FT.
4. GAPS OF 3-6 INCHES IN WIDTH AND DEPTH SHALL BE LEFT BETWEEN VANE ROCKS IN CENTER THIRD OF CHANNEL TO PROVIDE CONCENTRATED FLOW PATHS UNDER LOW FLOW CONDITION.
5. DESIGN VANE ELEVATION INDICATED ON PLAN OR PROFILE SHALL BE MEASURED AT BASE OF LOW FLOW GAP. VANE ROCKS WILL PROTRUDE 3-6 INCHES ABOVE THIS ELEVATION.
6. FOOTER ROCKS TO BE EMBEDDED IN CHANNEL MATERIAL. EMBED 1/2 HEIGHT OF VANE ROCK BEHIND FOOTER ROCK.



ROCK VANE DETAIL
(SECTION VIEW)

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CHANNEL DETAILS

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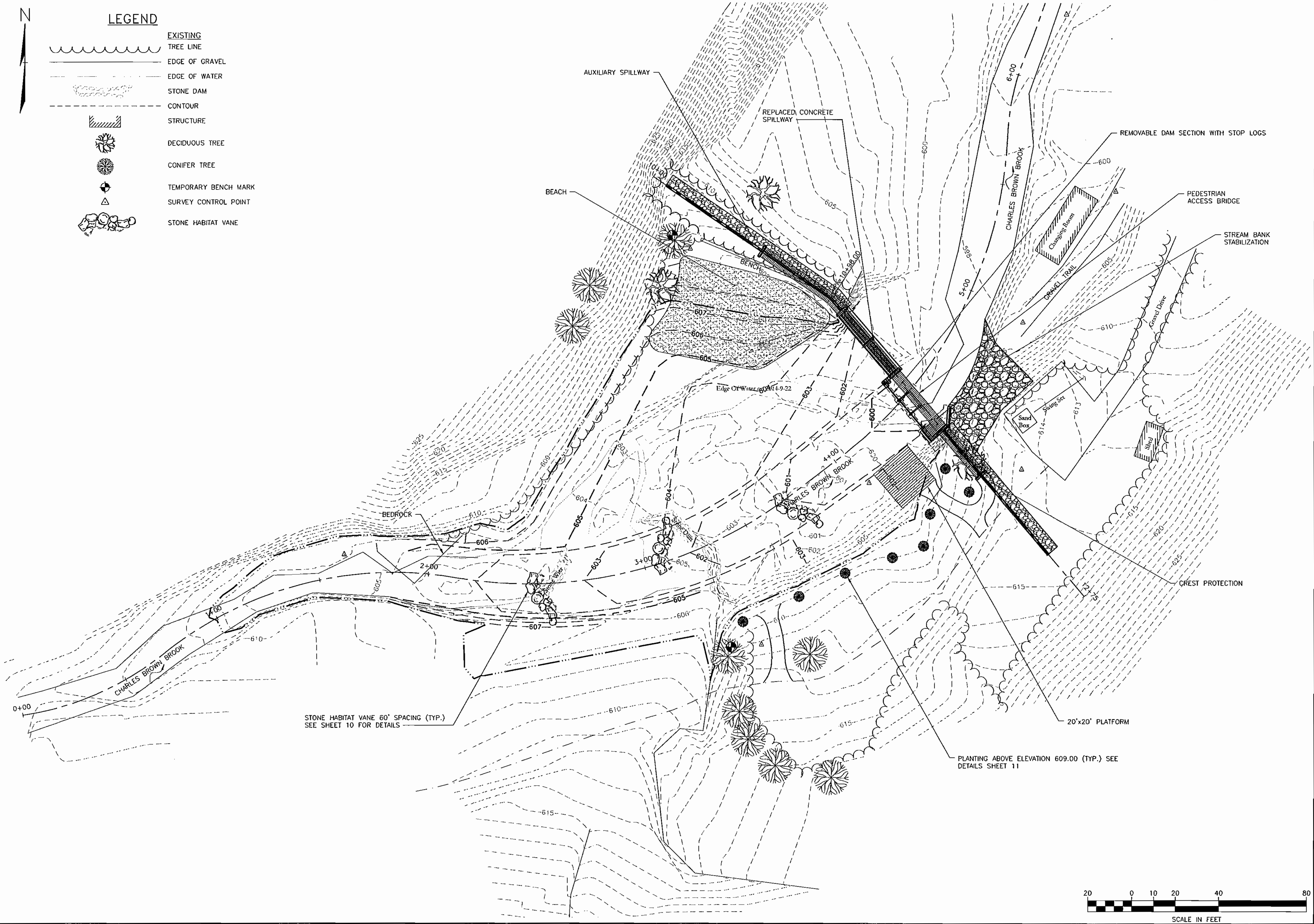

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SHEET TITLE

EROSION PREVENTION AND SEDIMENT CONTROL PLAN

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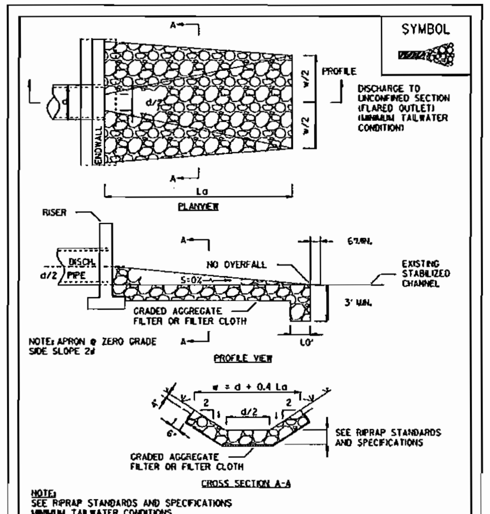
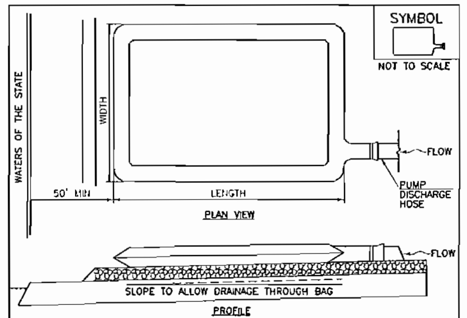


NOTE:
SEE RIPRAP STANDARDS AND SPECIFICATIONS
MINIMUM TAILWATER CONDITIONS

ADAPTED FROM DETAILS PROVIDED BY: NEW YORK STATE DEC ORIGINALLY DEVELOPED BY USDA-NRCS VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION	RIPRAP OUTLET PROTECTION EXAMPLE

NOTES:
REFER TO "THE VERMONT STANDARDS & SPECIFICATIONS FOR EROSION PREVENTION & SEDIMENT CONTROL -2006- " FROM THE VT AGENCY OF NATURAL RESOURCES FOR ADDITIONAL GUIDANCE.

THIS ITEM SHALL BE PAID FOR UNDER ITEM



CONSTRUCTION SPECIFICATIONS

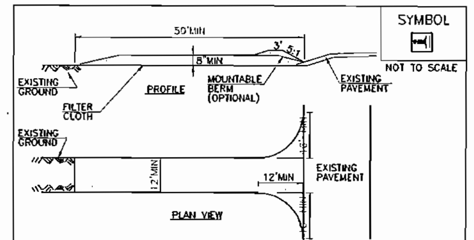
1. THE PRIMARY PURPOSE OF FILTER BAG IS TO RETAIN SILT, SAND, AND FINES DURING DEWATERING OPERATIONS.
2. FILTER BAGS SHALL BE INSTALLED ON A VEGETATED SLOPE GRADED TO ALLOW INCOMING WATER TO FLOW THROUGH THE BAG.
3. FILTER BAGS MAY ALSO BE PLACED ON COARSE AGGREGATE, STONE, OR HAYBALES TO INCREASE FILTRATION EFFICIENCY.
4. FILTER BAGS SHALL BE LOCATED A MINIMUM OF 50' FROM WATERS OF THE STATE UNLESS OTHERWISE APPROVED BY THE ENGINEER.
5. THE NECK OF THE FILTER BAG SHALL BE STRAPPED TIGHTLY TO THE DISCHARGE HOSE.
6. A FILTER BAG IS FULL WHEN IT NO LONGER CAN EFFICIENTLY FILTER SEDIMENT OR ALLOW WATER TO PASS AT A REASONABLE RATE.
7. FILTER BAG SHALL BE DISPOSED OF AS APPROVED IN THE EPSC PLAN OR AS DIRECTED BY THE ENGINEER.

FILTER BAG

NOTES:
REFER TO "THE VERMONT STANDARDS & SPECIFICATIONS FOR EROSION PREVENTION & SEDIMENT CONTROL -2006- " FROM THE VT AGENCY OF NATURAL RESOURCES FOR ADDITIONAL GUIDANCE

THIS WORK SHALL BE PERFORMED IN ACCORDANCE WITH SECTION 653 FOR FILTER BAG ~~(PAY ITEM 653.45) AND AS SPECIFIED IN THE CONTRACT.~~

REVISIONS	
MARCH 24, 2008	WHF
JANUARY 13, 2009	WHF



CONSTRUCTION SPECIFICATIONS

1. STONE SIZE- USE 1-4" STONE, RECLAIMED OR RECYCLED CONCRETE EQUIVALENT.
2. LENGTH- NOT LESS THAN 50' (EXCEPT ON A SINGLE RESIDENCE LOT WHERE A 30' MINIMUM LENGTH APPLIES).
3. THICKNESS- NOT LESS THAN 8".
4. WIDTH- 12' MINIMUM, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS. 24' IF SINGLE ENTRANCE TO SITE.
5. GEOTEXTILE MUST BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING STONE.
6. SURFACE WATER- ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED BENEATH THE ENTRANCE. IF PIPING IS IMPRACTICAL, A MOUNTABLE BERM WITH 5:1 SLOPES WILL BE PERMITTED.
7. MAINTENANCE- THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY, ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY.
8. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.
9. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED ACCORDING TO PERMIT REQUIREMENTS.

ADAPTED FROM DETAILS PROVIDED BY: NEW YORK STATE DEC ORIGINALLY DEVELOPED BY USDA-NRCS VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION	STABILIZED CONSTRUCTION ENTRANCE

NOTES:
REFER TO "THE VERMONT STANDARDS & SPECIFICATIONS FOR EROSION PREVENTION & SEDIMENT CONTROL -2006- " FROM THE VT AGENCY OF NATURAL RESOURCES FOR ADDITIONAL GUIDANCE.

THIS WORK SHALL BE PERFORMED IN ACCORDANCE WITH SECTION 653 FOR VEHICLE TRACKING PAD ~~(PAY ITEM 653.35) OR AS SPECIFIED IN THE CONTRACT.~~

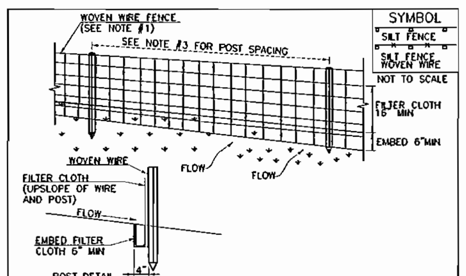
REVISIONS	
MARCH 24, 2008	WHF
JANUARY 13, 2009	WHF

CONSTRUCTION GUIDANCE

1. RURAL SEED MIX: USE AS INDICATED IN THE PLANS AND/OR FOR ALL ESTABLISHED UPLAND (NON WETLAND) AREAS DISTURBED BY THE CONTRACTOR.
2. URBAN SEED MIX: USE AS INDICATED IN THE PLANS AND/OR FOR ALL ESTABLISHED LAWN AREAS DISTURBED BY THE CONTRACTOR.
3. ALL SEED MIXTURES: SHALL NOT HAVE A WEED CONTENT EXCEEDING 0.40% BY WEIGHT AND SHALL BE FREE OF ALL NOXIOUS SEED
4. FERTILIZER AND LIMESTONE: SHALL FOLLOW RATES SHOWN ON PLAN OR AS DIRECTED BY THE ENGINEER
5. HAY MULCH: TO BE PLACED ON EARTH SLOPES AT THE RATE OF 2 TONS/ACRE, ACHIEVE 90% GROUND COVER OR AS DIRECTED BY THE ENGINEER.
6. TOPSOIL: TO BE USED WITH SEED AS INDICATED ON THE PLANS, OR AS DIRECTED BY THE ENGINEER.
7. HYDROSEEDING: ALTHOUGH GUIDANCE IS GIVEN ABOVE THE SITE CONDITIONS AND THE TYPE OF HYDROSEED WILL ULTIMATELY DICTATE THE AMOUNTS AND TYPES OF SOIL AMENDMENTS TO BE APPLIED
8. TURF ESTABLISHMENT: PLACING SEED, FERTILIZER, LIME AND MULCH PRIOR TO SEPTEMBER 15 AND AFTER APRIL 15 CAN BETTER ENSURE A VIGOROUS GROWTH OF GRASS.

ADAPTED FROM VTRANS TECHNICAL LANDSCAPE MANUAL FOR ROADWAYS AND TRANSPORTATION FACILITIES	TURF ESTABLISHMENT

REVISIONS	
JUNE 23, 2009	WHF
JANUARY 15, 2010	WHF
FEBRUARY 16, 2011	WHF



CONSTRUCTION SPECIFICATIONS

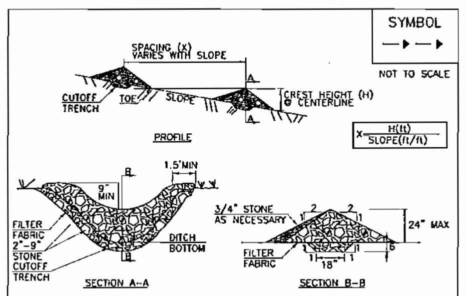
1. WOVEN WIRE REINFORCED FENCE IS REQUIRED WITHIN 100' UPSLOPE OF RECEIVING WATERS WHEN THE PROJECT FALLS UNDER A CONSTRUCTION STORMWATER PERMIT. WOVEN WIRE SHALL BE A MIN 14 GAUGE WITH A 6" MAX. MESH OPENING.
2. FILTER CLOTH SHALL BE EITHER FILTER X, MIRAFI100X, STABILINKA T140N OR APPROVED EQUIVALENT.
3. POST SPACING FOR WIRE-BACKED FENCE SHALL BE 10' MAXIMUM FOR FILTER-CLOTH FENCE. WHEN ELONGATION IS >50%, POST SPACING SHALL NOT EXCEED 4' AND WHEN ELONGATION IS <50%, POST SPACING SHALL NOT EXCEED 6'.
4. WOVEN WIRE FENCE IS TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES. FILTER CLOTH IS TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MID SECTION
5. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVER-LAPPED BY 6" AND FOLDED.
6. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN SEDIMENT REACHES HALF OF FABRIC HEIGHT.

ADAPTED FROM DETAILS PROVIDED BY: NEW YORK STATE DEC ORIGINALLY DEVELOPED BY USDA-NRCS VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION	SILT FENCE

NOTES:
REFER TO "THE VERMONT STANDARDS & SPECIFICATIONS FOR EROSION PREVENTION & SEDIMENT CONTROL -2006- " FROM THE VT AGENCY OF NATURAL RESOURCES FOR ADDITIONAL GUIDANCE.

THIS WORK SHALL BE PERFORMED IN ACCORDANCE WITH SECTION 649 AND AS SHOWN IN THE PLANS FOR GEOTEXTILE FOR SILT FENCE (PAY ITEM 649.51) ~~OR GEOTEXTILE FOR~~ SILT FENCE, WOVEN WIRE REINFORCED ~~(PAY ITEM 649.515).~~

REVISIONS	
MARCH 21, 2008	WHF
DECEMBER 11, 2008	WHF
JANUARY 13, 2009	WHF



CONSTRUCTION SPECIFICATIONS

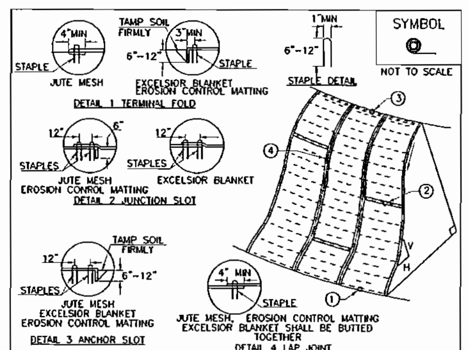
1. STONE WILL BE PLACED ON A FILTER FABRIC FOUNDATION.
2. CHECK DAMS SHALL BE SPACED SO THAT THE ELEVATION OF THE CREST OFTHE DOWNSTREAM DAM IS AT THE SAME ELEVATION AS THE TOE OF THE UPSTREAM DAM.
3. 3/4" FILTERING STONE MAY BE ADDED TO THE FACE OF THE CHECK DAM AS NECESSARY.
4. EXTEND THE STONE A MINIMUM OF 1.5' BEYOND THE DITCH BANKS TO PREVENT CUTTING AROUND THE DAM.
5. PROTECT CHANNEL DOWNSTREAM OF THE LOWEST CHECK DAM FROM SCOUR AND EROSION WITH STONE OR LINER AS APPROPRIATE.
6. ENSURE THAT CHANNEL APPURTENANCES SUCH AS CULVERT ENTRANCES BELOW CHECK DAMS ARE NOT SUBJECT TO DAMAGE OR BLOCKAGE FROM DISPLACED STONE.
7. MAXIMUM DRAINAGE AREA 2 ACRES.

ADAPTED FROM DETAILS PROVIDED BY: NEW YORK STATE DEC ORIGINALLY DEVELOPED BY USDA-NRCS VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION	CHECK DAM

NOTES:
REFER TO "THE VERMONT STANDARDS & SPECIFICATIONS FOR EROSION PREVENTION & SEDIMENT CONTROL -2006- " FROM THE VT AGENCY OF NATURAL RESOURCES FOR ADDITIONAL GUIDANCE.

THIS WORK SHALL BE PERFORMED IN ACCORDANCE WITH SECTION 653 FOR TEMPORARY STONE CHECK DAM, TYPE I ~~(PAY ITEM 653.25)~~

REVISIONS	
MARCH 21, 2008	WHF
JANUARY 8, 2009	WHF



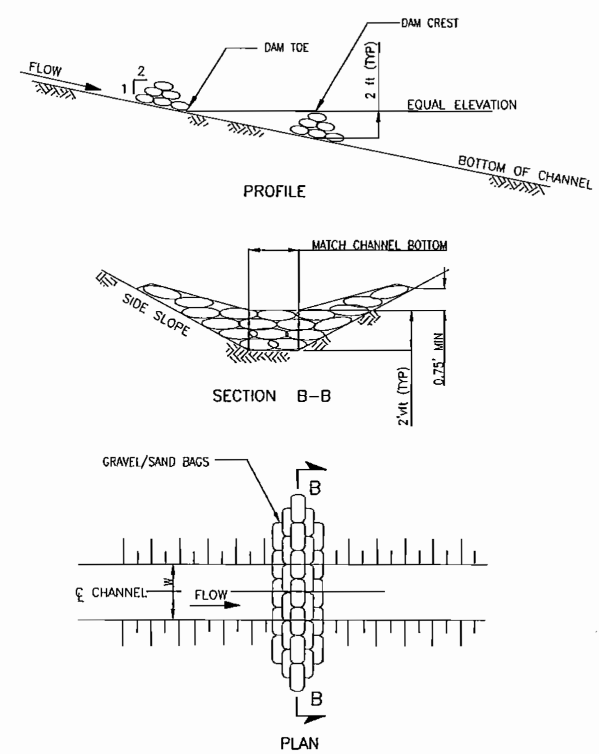
CONSTRUCTION SPECIFICATIONS

1. APPLY TO SLOPES GREATER THAN 3H:1V OR WHERE NECESSARY TO AID IN ESTABLISHING VEGETATION.
2. APPLY FERTILIZER, LIME SEED PRIOR TO PLACING MATTING.
3. STAPLES ARE TO BE PLACED ALTERNATELY, IN COLUMNS APPROXIMATELY 2' APART AND IN ROWS APPROXIMATELY 3' APART. APPROXIMATELY 175 STAPLES ARE REQUIRED PER 4'X225' ROLL OF MATERIAL AND 125 STAPLES ARE REQUIRED PER 4'X150' ROLL OF MATERIAL.
4. DISTURBED AREAS SHALL BE SMOOTHLY GRADED. EROSION CONTROL MATERIAL SHALL BE PLACED LOOSELY OVER GROUND SURFACE. DO NOT STRETCH.
5. ALL TERMINAL ENDS AND TRANSVERSE LAPS SHALL BE STAPLED AT APPROXIMATELY 12" INTERVALS.

ADAPTED FROM DETAILS PROVIDED BY: NEW YORK STATE DEC ORIGINALLY DEVELOPED BY USDA-NRCS VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION	ROLLED EROSION CONTROL PRODUCT (RECP) SIDE SLOPE

NOTES:
REFER TO "THE VERMONT STANDARDS & SPECIFICATIONS FOR EROSION PREVENTION & SEDIMENT CONTROL -2006- " FROM THE VT AGENCY OF NATURAL RESOURCES FOR ADDITIONAL GUIDANCE.
THIS WORK SHALL BE PERFORMED IN ACCORDANCE WITH SECTION 653 AND AS SHOWN IN THE PLANS FOR TEMPORARY EROSION MATTING ~~(PAY ITEM 653.20)~~ OR PERMANENT EROSION MATTING ~~(PAY ITEM 653.21).~~

REVISIONS	
APRIL 16, 2007	JMF
JANUARY 13, 2009	WHF



CHECK DAM - TEMPORARY
(GRAVEL BAG/SAND BAG)

NOTE:
SPECIFICATION SECTION REFERENCES ON THIS SHEET PERTAIN TO THE VERMONT AGENCY OF TRANSPORTATION 2011 STANDARD SPECIFICATIONS FOR CONSTRUCTION.

DuBois & King inc.
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BEDFORD, NH
LACONIA, NH

PROFESSIONAL SEAL

NOT FOR CONSTRUCTION PERMIT PLANS (60% COMPLETE)

NO.	DATE	DESCRIPTION	BY	CK'D

TOWN OF NORWICH VERMONT
300 MAIN STREET
PO BOX 376
NORWICH VT 05055

NORWICH POOL DAM REHABILITATION PROJECT

NORWICH VERMONT

SHEET TITLE

EROSION PREVENTION AND SEDIMENT CONTROL PLAN DETAILS

DRAWN BY	DATE
EBS	AUG. 2015
CHECKED BY	D&K PROJECT #
CSE	921651
PROJ. ENG.	D&K ARCHIVE #
CSE	

SHEET NUMBER

14

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