STATEMENT OF WORK (SOW)
REMOVAL DESIGN/REMOVAL ACTION (RD/RA)
J.R. SIMPLOT COMPANY'S
SMOKY CANYON MINE

1.0 INTRODUCTION

This Statement of Work (SOW) for the Smoky Canyon Mine Site (the Site) outlines the tasks necessary to complete the removal design and implementation of a Removal Action at the Pole Canyon Overburden Disposal Area (ODA) as outlined in the United States Department of Agriculture, Forest Service (Forest Service) Action Memorandum (Forest Service 2006) and as defined by the Administrative Settlement Agreement and Order on Consent/Consent Order for Non-Time-Critical Removal Action (Settlement Agreement) between the J.R. Simplot Company (Simplot) and the Forest Service, the United States Environmental Protection Agency (EPA) and the Idaho Department of Environmental Quality (IDEQ). A map of the Site showing the major features is provided as Figure 1.

The work is comprised of two basic elements:

1. Surface water management at Pole Canyon ODA, including construction of :
    - a pipeline to convey diverted Pole Canyon Creek flow around the Pole Canyon ODA;
    - an infiltration basin to direct residual Pole Canyon Creek flow into the Wells Formation aquifer upgradient of the ODA; and
    - a run-on control ditch adjacent to the northern edge of the ODA to direct run-on from the adjacent slopes into Pole Canyon Creek below the ODA.
2. Implementation of a water quality monitoring program to provide information necessary to evaluate the effectiveness of the Removal Actions at the Pole Canyon ODA.

The Removal Action at the Pole Canyon ODA was identified in the report entitled "Engineering Evaluation/Cost Analysis, Smoky Canyon Mine, Caribou County, Idaho" (EECA) (NewFields, 2006) as a priority non-time critical Removal Action to provide significant environmental benefit in terms of reducing selenium transport from the ODA. The monitoring program will provide data to support evaluation of the Pole Canyon Removal Action performance over the long-term.

2.0 REMOVAL DESIGN FOR SURFACE WATER MANAGEMENT AT THE POLE CANYON ODA

This section identifies the scope and objectives for the Pole Canyon ODA water management element of work and describes the reports, plans, and actions necessary for completion of the Removal Design/Removal Action (RD/RA) process.

The EECA (NewFields, 2006) and the Action Memorandum (Forest Service, 2006) identified control of ongoing releases of selenium from the Pole Canyon ODA as the highest priority for achieving Site-wide Removal Action Goals (RAGs) for surface water and groundwater. Isolation of the Pole Canyon ODA from Pole Canyon Creek flows is predicted to provide a large reduction in selenium transport to the alluvial groundwater system and Wells Formation aquifer (and subsequent transport to surface water). Inclusion of both a diversion pipeline and an infiltration basin will allow for ongoing management of creek flows and delivery of clean surface water to Sage Valley and clean recharge to the Wells Formation aquifer. Surface water run-on controls combined with potential future actions that could include soil amendment/replanting or an engineered cover placed on the Pole Canyon ODA surface may further reduce infiltration and resultant leaching of selenium from the overburden.

Appendix C of the EECA, entitled "Upper Pole Canyon Creek Diversion/Infiltration Analysis," is included as Attachment 1 and provides the initial foundation for additional analyses and design. Simplot provided a pipeline alignment that follows the northern edge of the Pole Canyon Creek riparian area diverging north along contour then turning south across the fill to follow the southern edge of the fill. The pipeline then departs the southern edge of the fill in a plunge to the valley floor downstream of the fill. Additional topographic and other surface data were collected to support a decision for this alignment. The infiltration basin is designed for location immediately upgradient of the ODA (see Figure C-3 in the attached EECA Appendix C

(Attachment 1) for a conceptual layout). The purpose of the basin is to infiltrate non-diverted creek flow into the Wells Formation without contacting overburden. Finally, controlling surface water run-on from the slopes adjacent to the northern edge of the ODA is managed with the installation of a run-on control ditch that will direct the run-on into Pole Canyon Creek below the ODA.

2.1 Work Components and Objectives

The RD/RA element of work for surface water management at the Pole Canyon ODA consists of the following four components:

- Construction of a pipeline to convey diverted Pole Canyon Creek flow around the Pole Canyon ODA;
- Construction of an infiltration basin to direct residual Pole Canyon Creek flow into the Wells Formation aquifer upgradient of the ODA;
- Construction of a run-on control ditch adjacent to the northern edge of the ODA; and
- Surface and ground water monitoring to assess the effectiveness of the Removal Action.

The objective of the work is to reduce Pole Canyon Creek flow into and run-on of surface water onto the Pole Canyon ODA. Design plans/reports, schedule, and implementation issues associated with the above work components, including the collection of any additional supporting information, are discussed in the following subsections.

2.2 Deliverables (Design Plans, Work Plans, Reports)

All plans and reports will be prepared and submitted in draft form for Forest Service review and comment consistent with Sections VIII (On-Scene Coordinator/Project Coordinator) and IX (Work to be Performed) of the Settlement Agreement. Upon incorporation of Forest Service and

Support Agencies' (Agencies) comments and approval, Simplot will submit Final reports and plans as outlined below. As these documents are prepared, Simplot will participate in working sessions with the Agencies to facilitate communication, discuss the Agencies' comments on interim work products, and to ensure that the RD/RA activities are properly focused. All design-related work will be conducted and/or overseen by a civil engineer licensed in the State of Idaho (hereinafter, the "Design Engineer").

A. Simplot will prepare and submit a Pole Canyon ODA Water Management Removal Design Report (RDR), providing a detailed topographic map of the project area, a hydrologic analysis of the upper Pole Canyon Creek watershed, a description of operation and maintenance (O&M) requirements, and an estimate of costs for construction and management. The RDR will provide the specific design information listed below, including complete drawings and specifications:

- For the diversion pipeline:
  - The proposed alignment, including the diversion point and the location at which diverted flows are re-introduced to Pole Canyon Creek;
  - The design maximum flow rate for the diversion and its basis;
  - An analysis of substantive permit requirements (e.g., U.S. Army Corps of Engineers 404 permit);
  - Draft drawings and specifications for the diversion pipeline and its inlet and outlet works, including a sedimentation pond and trash rack at the upper end, and an energy dissipation structure at the lower end;
  - Operations and maintenance requirements; and
  - Preliminary construction considerations.

- For the infiltration basin:
  - The location at the upstream end of the Pole Canyon ODA;
  - The design maximum residual flow in Pole Canyon Creek below the diversion point;
  - The likely range of expected infiltration rates in the pond floor and its basis;
  - An estimate of the storage capacity of the infiltration basin and its basis;
  - An analysis of any water rights issues associated with infiltrating the residual Pole Canyon Creek flows rather than allowing them to remain in the stream channel;

- An analysis of substantive permit requirements (e.g., U.S. Army Corps of Engineers 404 permit);
- Draft drawings and specifications for the infiltration basin including dimensions, depth, liner details, overflow spillway details, upstream sediment collection pond with discharge weir, etc.;
- Operations and maintenance requirements; and
- Preliminary construction considerations.

o For the run-on control ditch:

- The location on the north side of the Pole Canyon ODA;
- The design maximum flow rate to be transmitted by the channel;
- Draft drawings and specifications for the channel, including channel geometry, slope, potential riprap areas, and outlet details.
- Operations and maintenance requirements; and
- Preliminary construction considerations.

B. Simplot will prepare and submit a Removal Action Implementation Work Plan (RAIWP) that provides a detailed discussion of the general construction plan presented in the Final RDR. It is intended to serve as a field reference for both Simplot and Forest Service personnel as the Removal Action is implemented. The RAIWP will include:

- Implementation approach and final construction schedule;
- Names and contact information for key personnel for Simplot, the Agencies, and their respective contractors;
- Summary information for best management practices that are expected to be required;
- Summary of relevant quality assurance/quality control processes;
- An operations and maintenance (O&M) plan;
- Other information vital to the successful implementation of the Removal Action; and
- Health and Safety Plan (HASP).

C. Simplot will prepare and submit an Effectiveness Monitoring Plan (EMP) that provides a detailed description of the monitoring activities necessary to assess the effectiveness of the Removal Action. The EMP will include:

- A Sampling and Analysis Plan;
- Quality Assurance Project Plan; "Regulations for Quality Assurance Project Plans, (EPA-QA/R-5)" and "EPA Guidance for Q/A Project Plans (EPA-QA/G-5);"

- Data Quality Objectives (DQOs);
- Duration of the monitoring program;
- Monitoring locations;
- Monitoring frequencies;
- Flow measurement methods;
- Analyte lists for surface water and ground water;
- Implementation schedule; and
- Reporting requirements.

D. Upon preliminary project completion, the Forest Service will conduct a Construction Inspection. The Forest Service will identify and document outstanding construction items. Within 30 days of the inspection, Simplot will submit a Construction Inspection Report (CIR) to include:

- Outstanding construction items;
- Actions required to resolve outstanding items; and
- A proposed construction completion date, which shall be subject to Forest Service approval.

E. Within 90 days of completion of the outstanding items identified by the Construction Inspection, Simplot will submit a Construction Completion Report (CCR) that conforms, at a minimum, with the requirements set forth in Section 300.165 of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 C.F.R. 300.165) entitled "OSC Reports", and includes the following:

- A certification by the Design Engineer that the construction is complete and that the constructed works are consistent with the approved plans and specifications;
- A synopsis of the construction work;
- A brief description of how outstanding inspection issues were resolved;
- An explanation of any modifications made during the implementation of the Removal Action to the design and why these changes were made;
- As-built drawings;
- "Difficulties encountered" i.e. a list of items that affect the response action;
- "Good Faith" estimate of total costs or a statement of actual costs;
- Recommendations for additional Removal Actions at the Pole Canyon ODA, if any, i.e., means to prevent recurrence of release and improvement of response action.

F. Simplot will prepare and submit a Post-Removal Site Control (PRSC) Plan. The PRSC Plan will accompany the Construction Completion Report. The PRSC Plan will provide descriptions of the long-term O&M requirements for the Removal Action. The PRSC Plan will be consistent with the NCP Section 300.415(l) and OSWER Directive No. 9360.2-02. The plan will include:

- Identification of necessary O&M activities;
- Frequency of the expected O&M actions; and
- Criteria and monitoring requirements to evaluate the ongoing effectiveness and integrity of the Removal Action.

G. Monthly Progress Reports containing the following information will be provided by Simplot:

- A summary of all results of sampling and tests and all QA/QC data received or generated by Simplot or its contractors in the previous month;
- Identification of all deliverables required by the Settlement Agreement completed and submitted during the previous month;
- A description of all actions, including, but not limited to, data collection and implementation of work plans, scheduled for the next six weeks;
- Information relating to the progress of construction, including percentage of completion, unresolved delays encountered or anticipated that may affect the future schedule for implementation of the construction, and a description of efforts made to mitigate those delays or anticipated delays; and
- Any modifications to deliverables or schedules that Simplot has proposed to the Forest Service or that have been approved by the Forest Service.

2.3 Implementation

The Removal Action will be implemented in accordance with the specifications, plans, and schedule set out in the approved Final RDR. The following actions/reporting will also be required.

Notification Prior to Beginning Work

Simplot will notify the Forest Service's On-Scene Coordinator no less than 10 days prior to initiating construction activities, unless this is reduced by the Forest Service. Other notification may be requested by the Forest Service.

Construction Inspection

The agencies may inspect construction activities throughout project implementation. Upon preliminary project completion, Simplot will contact the Forest Service's On-Scene Coordinator for the purpose of scheduling a Construction Inspection. The inspection will consist of a walk-through of the entire project area by Forest Service's On-Scene coordinator, any support agency representatives, their project inspectors, and Simplot representatives, including the Design Engineer. The objective of the inspection is to determine whether construction is complete and consistent with the approved designs and specifications. Any outstanding construction items discovered during the inspection will be identified and noted on a punch list. Within 30 days of the inspection, Simplot will submit a Construction Inspection Report that outlines the outstanding construction items, resolution of the outstanding items, and the estimated construction completion date.

Agency Acceptance

When the Forest Service determines, after its Site Inspection and review of the Final Construction Completion Report, that all Removal Actions were fully implemented in accordance with this SOW (excepting any ongoing Effectiveness Monitoring and O&M activities, which are continuing obligations under the Settlement Agreement), it will provide a letter of acceptance stating so to Simplot, as provided by Section XXXII (Notice of Completion) of the Settlement Agreement.

2.4 Performance Standards

Simplot will be deemed as having fully performed its obligations, other than its continuing obligations, under the Settlement Agreement for this non-time critical Removal Action if the Pole

Canyon ODA water management Removal Design is found by the Forest Service to have been conducted in full conformance with the RDR and performance standards for the water management plan.

Performance standards for surface water management at the Pole Canyon ODA are as follows:

- Pole Canyon Creek diversion: The diversion pipeline will be constructed of the material and be of the diameter and length specified in the RDR. Flow measurements at the inlet and outlet of diversion pipe will be used to indicate that pipe can pass design flows of Pole Canyon Creek without significant loss due to leakage.

- Infiltration basin: the basin will contain all residual (non-diverted) flow in Pole Canyon Creek associated with up to a 100-year event without overtopping and introducing flow to the ODA overburden materials.

- Run-on control channel: the channel will be of the depth, width, and length, and include appropriate erosion control measures, as specified in the RDR.

- Establish a monitoring program to determine effectiveness of the combined Removal Action alternative(s) implemented.

Additional groundwater and surface water monitoring to evaluate the overall effectiveness of these Removal Actions will be conducted as described in Section 2.2C of this SOW.

2.5 Reporting and scheduled deliverables

The report submittal and work session schedule are summarized in Table 1.

Table 1

Pole Canyon ODA Water Management Removal Action

Deliverables/Work Session Schedule

Deliverable*/Activity	**Deadline**
Work Session #1 – to review new data and reach consensus on the fundamental design parameters	Complete: Work Session #1 was held on May 10, 2006 in Pocatello.
Draft RDR	Complete: A draft RDR was provided to the Agencies on July 13, 2006.
Work Session #2 – to discuss proposed report modifications in response to consolidated Agency comments on the draft RDR and gain concurrence on preparation of Draft Final RDR.	Complete: Work Session #2 was held on July 13, 2006 at the Smoky Canyon Mine Site.
Draft Final RDR	Complete: The Draft Final RDR was provided to the Agencies on August 7, 2006.
Final RDR	Within 7 days of receipt of consolidated Agency comments on the Draft Final RDR
Draft Removal Action Implementation Work Plan (RAIWP)	Complete: the Draft RAIWP was provided to the Agencies on August 16, 2006.
Final RAIWP	Within 7 days of receipt of consolidated Agency comments on the Draft RAIWP.
Draft Effectiveness Monitoring Plan (EMP)	Within 14 days of approval of the Final RAIWP.
Final EMP	Within 7 days of receipt of consolidated Agency comments on the Draft EMP.
Draft Construction Completion Report (CCR)	Within 90 days of completion of the outstanding items identified by the Construction Inspection,
Final CCR	Within 7 days of receipt of consolidated Agency comments on the Draft CCR.
Draft Post Removal Site Control (PRSC) Plan	Within 90 days of completion of the outstanding items identified by the Construction Inspection,
Final PRSC Plan	Within 7 days of receipt of consolidated Agency comments on the Draft PRSC Plan
Monthly Reports	By the 15th of each calendar month following the effective date of the Settlement Agreement.

* Deliverables in bold. Provide 8 copies to lead agency and 1 copy to each support agency.

APPENDIX C

Upper Pole Canyon Creek Infiltration Analysis

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1.0 INTRODUCTION

Under Alternative 3 and Alternative 4, Pole Canyon Creek would be diverted before entering the Pole Canyon Overburden Disposal Area (ODA). Stream flows accumulating in the drainage between the creek diversion and the ODA would be directed to an infiltration basin located at the upstream toe of the ODA. The purpose of this appendix is to analyze the feasibility of this approach. As discussed in Section 4.2, it may not be technically or administratively feasible to infiltrate all of the Pole Canyon Creek flows upstream of the ODA and, therefore, consideration of a diversion is necessary.

2.0 SUPPORTING INFORMATION

2.1 Setting

2.1.1 Topography

Except for the area immediately upstream of the Pole Canyon ODA, upper Pole Canyon is V-shaped with portions of the side slopes as steep as 1 horizontal (H):1 vertical (V). The total drainage area is approximately 920 acres. Pole Canyon Creek branches to the north and west approximately ¾ of a mile upstream of the ODA. The western branch flows perennially due to dispersed springs upstream of the fork while the northern branch only flows intermittently. The ½-mile section of Pole Canyon immediately upstream of the Pole Canyon ODA is more U-shaped with a bottom width of approximately 150 feet. The average lateral slope of the canyon floor toward Pole Canyon Creek is approximately 10H:1V while the canyon walls have a slope of approximately 1.5H:1V. Pole Canyon Creek flows down the approximate center of this U-shaped portion of the canyon with an average gradient of approximately 400 feet per mile.

2.1.2 Stratigraphy

Pole Canyon Creek flows over the Thaynes/Dinwoody/Woodside and Phosphoria formations before coming in contact with the Wells Formation at a point approximately 250 feet above the upstream toe of the Pole Canyon ODA. The bedding planes for all of these sedimentary formations dip to the west in the vicinity of the ODA (Figure C-1). The Wells Formation is unsaturated to approximately 250 feet below ground surface in this area based on water-level measurements from the lower Pole Canyon Creek area.

2.2 Hydrology

2.2.1 Hydrograph

Flow measurements of upper Pole Canyon Creek have been sporadically collected at sampling location UP, situated approximately ¼ mile upstream of the Pole Canyon ODA, over the past eight years (1997 – 2004). Most of the measurements were made monthly from May through November of each year. Figure C-2 is an estimated annual hydrograph for upper Pole Canyon Creek at location UP. During the majority of the year (seven months), the flow in upper Pole Canyon Creek is less than 0.5 cfs, while the spring runoff (May and June) has been measured at discharge rates as high as 10.6 cfs. It should be noted that the duration of the spring runoff peak is uncertain but is likely to be a week to a month long with a peak conservatively estimated at 13 cfs. Based on this estimated annual hydrograph, nearly 75 percent (735 acre-feet) of the annual runoff volume (977 acre-feet) reports to the upstream toe of the ODA in May and June of each year.

As discussed in Section 3.1 below, the potential Pole Canyon Creek diversion point is located approximately 250 feet below the stream fork some ¾ of a mile above the Pole Canyon ODA. Flow rates were measured near the potential diversion point (UP-F) concurrently with flow rates measured at UP during gain-loss surveys performed in 2002 and 2003. These flow measurements show that, at the diversion point, the measured flow varied from 106 percent (spring flows) to 144 percent (autumn flows) of the flow measured downstream at location UP (Figure C-3). Thus, there typically is a net loss in Pole Canyon Creek flow from the potential diversion point to location UP. The spring flow rates at UP are much higher than the autumn flow rates. Therefore, the spring flow rates are the most appropriate basis for establishing a design flow for the Pole Canyon Creek diversion. Spring flows near the diversion point are typically 104 percent of those measured downstream at location UP. Therefore, it is assumed that the UP hydrograph, scaled up by 10 percent, would be conservatively representative of typical spring flow conditions at the Pole Canyon Creek diversion point. This results in an estimated peak spring flow rate of 14.3 cfs at the diversion point.

Flow rates were also measured at the upstream toe of the Pole Canyon ODA (UP-H). The measurements at UP-H were made during the gain-loss surveys and sampling conducted in spring and summer 2004. These are summarized on Figure C-3. The flow rates varied from approximately 115 percent (spring flows) to 196 percent (autumn flows) of the flow measured at location UP. Thus, there typically is a net gain in Pole Canyon Creek flow from location UP to location UP-H. The spring flows at UP-H typically ranged from 115 percent to 130 percent of the spring flows at UP. Again, the much higher spring flow rates are more important from a design perspective than the lower autumn flow rates. Therefore, it is assumed that the UP hydrograph, scaled up 25 percent, would be representative of flow conditions at the upstream toe of the Pole Canyon ODA. This results in an estimated peak spring flow rate of 16.3 cfs at the upstream toe of the ODA.

If Pole Canyon Creek is diverted at the potential diversion point, the amount of water that would typically need to be infiltrated upstream of the Pole Canyon ODA is the estimated spring flow at the upstream toe of the ODA (16.3 cfs) minus the estimated spring flow at the potential diversion point (14.3 cfs). This difference is 2 cfs.

2.2.2 Storm Flows

Storm-flow estimates for 10-, 50- and 100-year recurrence intervals at the potential Pole Canyon Creek diversion point and the upstream toe of the Pole Canyon ODA were made using commercially available software (Win TR-55; see Appendix C-A). These estimates are summarized below.

Location	10-Year Flow (cfs)	50-year Flow (cfs)	100-year Flow (cfs)
Potential Diversion Point	2	40	86
ODA Upstream Toe (UP-H)	3	47	98

The WinTR-55 modeling for both the Pole Canyon Creek diversion point and the upstream toe of the Pole Canyon ODA predicts flows greater than 40 cfs lasting less than one hour for the 100-year storm and flows greater than 30 cfs lasting less than one hour for the 50-year storm (Figures C-4 and C-5).

2.3 Wells Formation Hydraulic Properties

Two recent test programs have been performed at the Smoky Canyon Mine to measure the hydraulic conductivity and potential infiltration rates for the Wells Formation. The first was a constant-rate pumping test conducted by NewFields personnel from May 18 to June 9, 2004. The test was performed as part of the groundwater investigation for the Smoky Canyon Mine Site Investigation. The second was a set of variable falling head tests performed by Intermountain GeoEnvironmental Services (IGES) on December 16 – 17, 2004. The second set of tests was performed as a part of the B Panel External Overburden Disposal Area Infiltration Study.

2.3.1 Constant-Rate Pumping Test

The general set-up of a constant-rate pumping test includes a pumping well (in this case the Industrial Well) and at least one observation well (in this case the Culinary Well). Observation wells need to be within the zone of influence of the pumping well so that changes in water level during various pumping conditions (i.e., drawdown and recovery phases) can be measured. As a well is pumped, the water level is drawn down in an expanding cone around the well. The size of the cone and rate of water level change at various distances from the pumping well are dependent on the pumping rate and aquifer properties. The rate of water level change is used to estimate aquifer properties such as transmissivity and storage coefficient.

Data obtained from the three phases of the test (i.e., preparation drawdown, recovery, and final drawdown phases) indicate that, when pumped at a rate of 1,000 gpm, the Wells Formation aquifer in the vicinity of the test wells behaves in a confined to semi-confined manner with significant delayed yield (slow drainage) characteristics. Based on the analyses of data from both the Culinary Well and the Industrial Well, estimated transmissivity values range from approximately 0.8 ft^2/min to 1.9 ft^2/min (8,600 to 20,000 gpd/ft). The transmissivity values calculated using data collected from the Culinary Well, 1.7 ft^2/min to 1.9 ft^2/min, are about twice as high as the values calculated using the data from the Industrial Well, 0.8 ft^2/min to 0.9 ft^2/min.

The saturated thickness of the Wells Formation open to the test well is approximately 700 feet. Using this as the effective thickness of the aquifer and a transmissivity value of 1.8 ft^2/min (from Culinary Well data) results in an average hydraulic conductivity of 3.7 feet per day (44 in/day). This is at the upper end of hydraulic conductivities considered typical of limestone or sandstone aquifers (Freeze and Cherry, 1979).

The hydraulic conductivity estimated in this test is an average saturated hydraulic conductivity for the Wells Formation in the vicinity of the Industrial Well, located approximately two miles from Pole Canyon. Therefore, the actual saturated hydraulic conductivity could be different in the area of the proposed infiltration basin.

2.3.2 B Panel Infiltration Study

IGES performed variable falling head permeability tests in eight boreholes located in run-off recharge areas and seleniferous dump areas associated with the B Panel external ODA. Six of the eight boreholes were completed in weathered sandstone, one was completed in the "Center Waste" shale zone, and one was completed in highly fractured limestone of the Grandeur Member of the Wells Formation. The test performed in the Grandeur Member of the Wells Formation is most relevant for estimating infiltration rates above the Pole Canyon ODA due to the similar geologic setting.

The tests were performed by filling the boreholes with between two and six feet of water and allowing the water to infiltrate naturally. The water level was measured every one to three seconds until the borehole was emptied. Infiltration rates were then calculated using the smallest (i.e., most conservative) head change versus time results for each borehole and incorporating a safety factor of two. The final result for test IS-2, located in fractured limestone of the Grandeur Member, was an infiltration rate of greater than 2,000 inches per day (167 ft/day). The duration of this test was approximately one minute.

Since this test was performed in a geologic setting potentially similar to that near the Pole Canyon ODA, the results of this test are assumed to be representative of infiltration rates that could occur in the area of the proposed infiltration basin. The results of this test reflect unsaturated conditions under which the infiltration rate typically would be much higher relative to saturated conditions. The small scale of this test, a single borehole with less than one minute of testing, and the fact that the Grandeur Member is locally absent in the vicinity of the proposed infiltration basin, are limiting factors in the usefulness of the data.

3.0 POLE CANYON CREEK DIVERSION

The purpose of the Pole Canyon Creek diversion would be to divert the majority of Pole Canyon Creek's flow over the top of the Pole Canyon ODA rather than allowing continued movement of the flows through the base of the ODA. This would significantly reduce the amount of water available to mobilize selenium from wastes within the ODA. This section provides a general overview on the conceptual design of the diversion and also evaluates how much of Pole Canyon Creek's flow could be diverted.

3.1 Pole Canyon Diversion Conceptual Design

Waters diverted from Pole Canyon Creek will need to pass over the Pole Canyon ODA. The lowest elevation on the crest of the ODA, over which the diverted waters would need to pass, is 7,370 feet. A design slope of 1 percent is selected for the diversion. At this slope, and beginning at the low point on the ODA crest, the diversion would be approximately 5,500 feet long and would intersect Pole Canyon Creek at an elevation of approximately 7,425 feet (see EECA Figure 5-5). This would place the diversion point approximately 250 feet downstream of the fork in Pole Canyon Creek (near sampling location UP-F).

The selected design flow for the Pole Canyon Creek diversion is the average maximum spring flow. As described in Section 2.2.1, this flow rate is estimated to be 14.3 cfs at the potential diversion point. Flood flows significantly in excess of this design flow rate would overtop the diversion spillway and would travel downstream to the infiltration basin (see Section 4.2, below).

The diversion system would consist of an upstream settling basin to promote sediment removal, a trash rack to prevent debris from entering the diversion line, and an overflow spillway to prevent damage to the system during a flood event (Figure C-6). The water would be routed through a 30-inch diameter underground pipeline constructed of a reinforced concrete. A 30-inch diameter concrete pipeline on a one percent slope would transmit 14.3 cfs with a factor of safety of greater than two and up to 20 cfs with a factor of safety of two. The diversion would be a pipeline instead of an open channel due to the very steep slopes on the walls of Pole Canyon (as steep as 1.5:1 in this area). The steep side slopes would create problems with stabilizing the channel and would necessitate a very wide area of disturbance (>200 feet) as well. Burial of the pipeline would also eliminate potential damage due to vandalism.

The pipeline would follow the natural contour of the Pole Canyon hillside and maintain a one percent grade. Both the north and south hillside would be possible diversion routes, but the north hillside would require a longer pipeline and would therefore require a diversion point further upstream if a one percent grade is to be maintained. The pipeline would pass across the southern end of the Pole Canyon ODA, under the current mine haul road, and then down the eastern face of the Pole Canyon ODA (EECA Figure 5-5). The total length of the pipeline, from the diversion point to the outfall, would be approximately 9,500 feet.

High flow velocities would be developed within the diversion line as it descends the steep eastern face of the Pole Canyon ODA. An energy dissipation structure (e.g., a US Bureau of Reclamation Type III stilling basin) would therefore be required at the outfall of the diversion line to minimize erosion due to the high water velocity. Figure C-7 shows a typical Type III stilling basin. The energy dissipation structure would outfall to the original Pole Canyon Creek stream channel downgradient of the eastern toe of the ODA.

Periodic maintenance would need to be conducted on the diversion system. The trash-rack at the diversion inlet would need to be regularly cleared to prevent plugging of the inlet. Sediment would need to be periodically cleaned from the diversion line and the upstream settling basin. Other periodic maintenance could also be necessary in case of leaks or other problems with the pipeline.

4.0 INFILTRATION ANALYSIS

An infiltration basin could be used to address waters accumulating in the Pole Canyon drainage between the creek diversion point and the ODA. This concept is evaluated for feasibility as well as potential effectiveness in the following subsection.

4.1 Conceptual Design

Figures C-8 and C-9 show the conceptual design of the infiltration system. Stream flows would need to pass through one or a series of settling basins to remove sediment from the water prior to entering the infiltration basin. Sediment removal should reduce plugging of the infiltration basin which would reduce the overall infiltration capacity. An ancillary benefit of the settling basin(s) would be to moderate the stream flow and provide additional storage capacity during periods of spring run-off or during major storms. The settling basin(s) would be constructed either by excavating a pond or ponds in the existing stream channel, or by damming the stream in one or more locations. The basin(s) would need to be lined to prevent stream flows from entering the alluvial aquifer and surfacing in the ODA. The basin size would depend on the amount of area available and the desired retention time for the stream flow. Longer retention times would increase the sediment removal efficiency and correspondingly decrease maintenance requirements for the infiltration basin.

The water would flow from the settling basin(s) over a trapezoidal weir to regulate flows. The flow would then proceed down a shallow grassy slope to further filter the water before entering the infiltration basin. A barrier constructed of large rip-rap (ROM chert) would be constructed across the slope to act as an additional filter as well as to disperse the flow to increase infiltration efficiency and reduce erosive forces.

A gravel layer would be placed on the infiltration basin floor to act as a final filter. The sides of the infiltration basin would be lined to prevent water from entering the alluvial aquifer and the Pole Canyon ODA. During design, it may be determined that the side slopes of the basin need to be steeper than a naturally stable slope to maximize the contact area with the Wells Formation and therefore maximize infiltration rates. If this is the case, additional stabilization, such as a mechanically stabilized retaining wall or shotcrete, would be necessary.

4.2 Primary Design Factors

There are three primary factors that affect the design of the infiltration basin. The first is the incoming flow rate. As discussed in Section 2.2.1, the expected normal spring inflow rate to the proposed infiltration basin is approximately 2 cfs, assuming diversion of spring flows in Pole Canyon Creek father upstream. This flow rate would be expected only for a short period of time each year, with much lower flows during the remainder of the year. The second factor is the area of the contact surface with the Wells Formation. The final design factor is the infiltration rate into the Wells Formation aquifer.

The total area available to place an infiltration basin over the Wells Formation aquifer is slightly larger than one acre due to the steep side slopes of the canyon. The base of the infiltration basin would necessarily be smaller than one acre to allow for side slopes that are no steeper than 2(H):1(V) for long-term stability. Assuming that mechanical stabilization is not used on the side slopes and the Wells Formation is relatively close to the current ground surface, approximately 0.5 acres of infiltration area (basin floor) should be available for infiltration.

As discussed in Section 2.3 above, two testing programs have been implemented to assess the hydraulic properties of the Wells Formation. Based on the results of a small-scale, falling-head permeability test, the infiltration rate of the unsaturated fractured limestone of the Grandeur Member of the Wells Formation was estimated to be 2,000 in/day. Based on the results of a constant-rate pumping test, the saturated hydraulic conductivity of the Wells Formation was estimated to be 44 in/day.

If the fractured rock in the infiltration basin floor is initially dry, the infiltration rate will be high (i.e., closer to 2,000 in/day). The wetting front will move rapidly downward due to capillary forces. As the moisture content of the fractured rock increases, the capillary forces will diminish and the infiltration rate will decrease. If the material becomes fully saturated, the infiltration rate will approach the saturated hydraulic conductivity of the material (i.e., closer to 44 in/day). Thus, the infiltration rate can be affected by antecedent moisture conditions in the materials comprising the infiltration basin floor.

Figure C-10 shows the maximum flow of water that could be infiltrated for various pond sizes and infiltration rates. Using the maximum infiltration rate of 2,000 in/day and a contact surface of 0.5 acres, the basin would infiltrate approximately 42 cfs. This easily exceeds the expected normal peak spring flow of 2 cfs, assuming upstream diversion, as well as the spring flow without the diversion (16.3 cfs). If the material underlying the infiltration basin becomes saturated, the infiltration rate would approach the saturated hydraulic conductivity of 44 in/day. Under these conditions, the 0.5-acre infiltration basin would only be able to instantaneously infiltrate about 1 cfs, or about half of the expected normal peak spring inflow of 2 cfs, assuming upstream diversion. This also indicates that infiltration of all of Pole Canyon Creek above the ODA, without diverting most of the creek flows, would not be feasible because the Wells Formation below the infiltration basin would become saturated or near-saturated.

The infiltration basin would have a large storage capacity to temporarily hold the excess flow that cannot immediately be infiltrated. Assuming a 0.5 acre base, 2(H):1(V) side slopes, and a 20-foot depth, the total storage capacity of the basin would be approximately 16 acre-feet. This would provide approximately 8 days of storage for a 1 cfs flow (assuming half of the 2 cfs inflow continually infiltrates). Increasing the depth of water in the pond could also increase the infiltration rate by increasing the hydraulic head. The combination of storage capacity and increased infiltration rate should be enough to account for the entire remaining flow under most conditions.

During major storm events (i.e., 100-year storms) a large, short-term, pulse of water would enter the infiltration basin. This water would comprise runoff originating between the diversion and infiltration basin as well as overflow water from the diversion system. Measuring the area under the curve and above 20 cfs (the maximum amount of flow diverted upstream) of the 100-year hydrograph (Figure C-5) yields the total volume of water that would enter the infiltration basin during a 100-year storm. Assuming the upstream diversion is functioning (and diverting 20 cfs) the total volume of water that would enter the infiltration basin would be 6.5 acre-feet, which is less than the infiltration basin storage volume of 16 acre-feet, as discussed above. Thus, the infiltration basin should be capable of storing and infiltrating the estimated flows from a 100-year storm while the basin is empty and the upstream diversion is functioning.

If the basin is already full or partially full, which may be the case during peak spring flows, it is possible that the infiltration basin would overflow and some of the water would enter the Pole Canyon ODA. Assuming the basin is already full, the amount of water that would enter the basin during a 100-year storm would be approximately 7 acre-feet if the upstream diversion is functioning. The worst-case scenario would be for the diversion basin to be full and the upstream diversion to be inoperable. Under these circumstances, the total volume of water that would enter the ODA would be approximately 21 acre-feet (calculated by taking the total area under the 100-year storm curve). Compared to the current yearly volume of water that enters the Pole Canyon ODA (between approximately 720 and 1,300 acre-feet), this is a minor amount. The primary concern with major storms will be preventing damage from the large short-term flows.

Long-term maintenance would need to be performed on the infiltration basin. Fine-grained sediment would need to be regularly removed from the infiltration basin to maintain maximum infiltration rates. The upstream settling basin would also periodically need to be cleaned out to maintain storage volume. Also, after major flow events, some repairs may need to be conducted to repair erosion damage.

5.0 CONCLUSIONS

Based on currently available information it is feasible to prevent Pole Canyon Creek flows from entering the Pole Canyon ODA. The majority of the spring flow can be collected upstream of the Pole Canyon ODA and diverted over the ODA. The limited remaining flow would be infiltrated at the upstream toe of the ODA.

The design flow for the Pole Canyon Creek diversion is 14.3 cfs (the estimated typical peak spring flow at the diversion point). The diversion would consist of a 5,500 foot long, buried 30" concrete pipeline. The pipeline would follow the natural contour of the canyon wall and progress across the ODA at a one percent grade before descending the eastern face of the ODA into an energy dissipation structure at the outfall. This design configuration would transmit the 14.3 cfs peak spring flow with a factor of safety of greater than two.

The design flow for the Pole Canyon Creek infiltration basin is estimated to be 2 cfs (the amount of flow originating below the diversion structure). Based on the available information (i.e., the B Panel infiltration studies and the aquifer pump test), the infiltration basin should be able to transmit the 2 cfs flow to the subsurface Wells Formation. The infiltration basin, if empty, would be able to contain and infiltrate the excess storm flows (including a 100-year flood). If the infiltration basin is already full or partially full at the time of the storm (potentially the case during spring flows), some water would overflow basin and enter the ODA. Compared to the amount of water that currently enters the ODA, very short-term pulses (i.e., less than a few hours) of storm water are insignificant.

6.0 REFERENCES

Freeze, R.A., and J.A. Cherry. 1979. Groundwater. Prentice-Hall, Inc. Englewood Cliffs, New Jersey. 604 pp.

FIGURES

FIGURES

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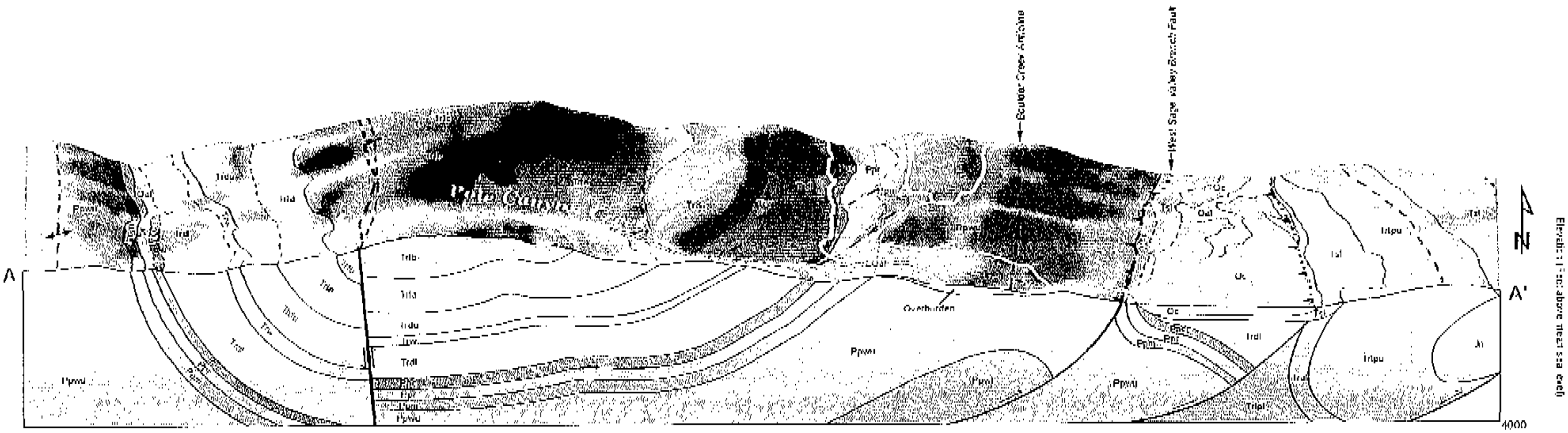
Pole Canyon Cross Section



Geologic Map Units and Symbols

Age	Formation	Map Symbol	Description
Quaternary		Qc	Colluvium
		Qal	Alluvium
Tertiary	Salt Lake	Tsl	Salt Lake Formation
	Unconformity		
Jurassic	Nugget Sandstone	Jn	Nugget Sandstone
Triassic	Thaynes	Trlpu	Upper Portneuf Limestone Member
		Tral	Ankareh Formation - Lanes Tongue
		Trlpl	Lower Portneuf Limestone Member
		Trtc	Thaynes C Member
		Trtb	Thaynes B Member
		Trta	Thaynes A Member
	Dinwoody	Trdu	Upper Dinwoody Formation
	Woodside	Trw	Woodside Formation
	Dinwoody	Trdl	Lower Dinwoody Formation
Permian	Phosphoria	Ppc	Cherty Shale Member
		Ppr	Rex Chert Member
		Ppm	Meade Peak Member
Pennsylvanian/Permian	Park City & Wells	Ppwu	Grandeur Member of Park City Formation and Upper Wells Formation
	Wells	Ppwl	Lower Wells Formation

Explanation

Note:
Subsurface geology has been interpreted from existing surface geologic maps produced by Conner (1980) and Montgomery and Cheney (1967)

Hydrology

Perennial Stream
Intermittent Stream

Mine Features

Areas of Mine Disturbance

Geologic Features

Contact (Dashed where inferred, dotted where buried)
Normal Fault (Dashed where inferred, dotted where buried)
Thrust Fault (Dashed where inferred, dotted where buried)
Syncline Axis
Anticline Axis

Location Map

J.R. SIMPLOT COMPANY
SMOKY CANYON MINE - EECA

FIGURE C-1

GEOLOGIC CROSS-SECTION OF SMOKY CANYON MINE AREA SECTION A - A'

PRJ: 0442-004-900.40	DATE: MAY 3, 2006	
REV 1	BY: MCP	CHECKED: KJT

NewFields

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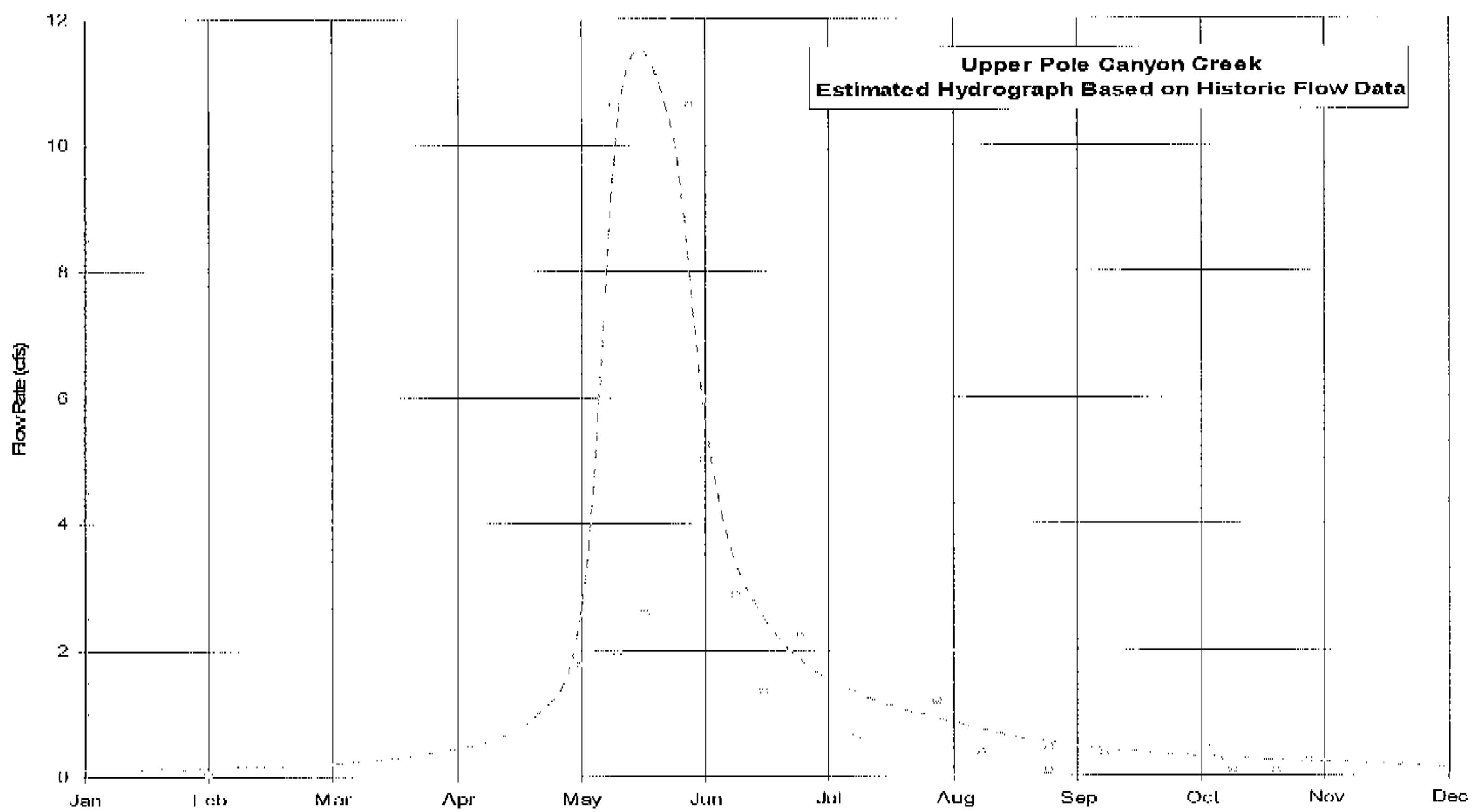


J.R. SIMPLOT COMPANY
SMOKY CANYON MINE - EECA

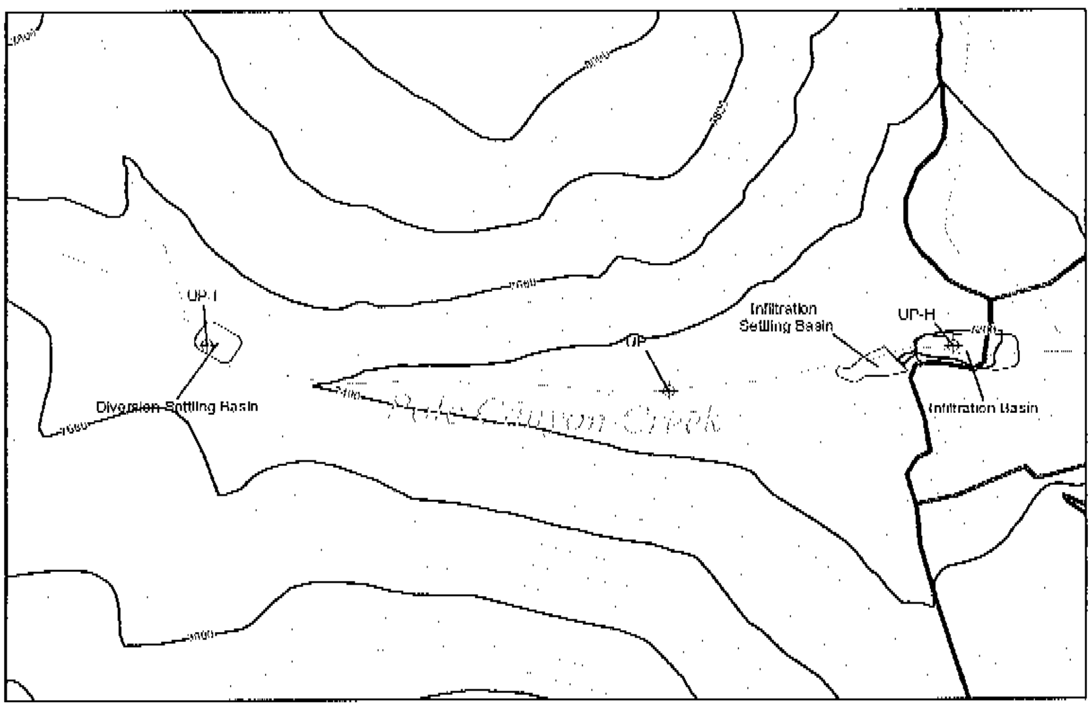
FIGURE C-2

UPPER POLE CANYON CREEK ANNUAL FLOW HYDROGRAPH

PRJ: 0442-004-900.40	DATE: MAY 3, 2006	
REV: 0	BY: JHP	CHK: BGH

NEWFIELDS

Date	UP-F	UP	UP-H	Percent Change in Flow		
	cfs	cfs	cfs	UP-F/UP	UP-F/UP-H	UP-H/UP
12/13/2002	0.05	-	0.05	-	114%	-
5/23/2003	2.73	2.57	3.28	106%	83%	128%
10/28/2003	0.07	0.05	0.09	144%	73%	196%
5/7/2004	-	1.75	2.01	-	-	115%
7/20/2004	-	0.43	0.70	-	-	163%



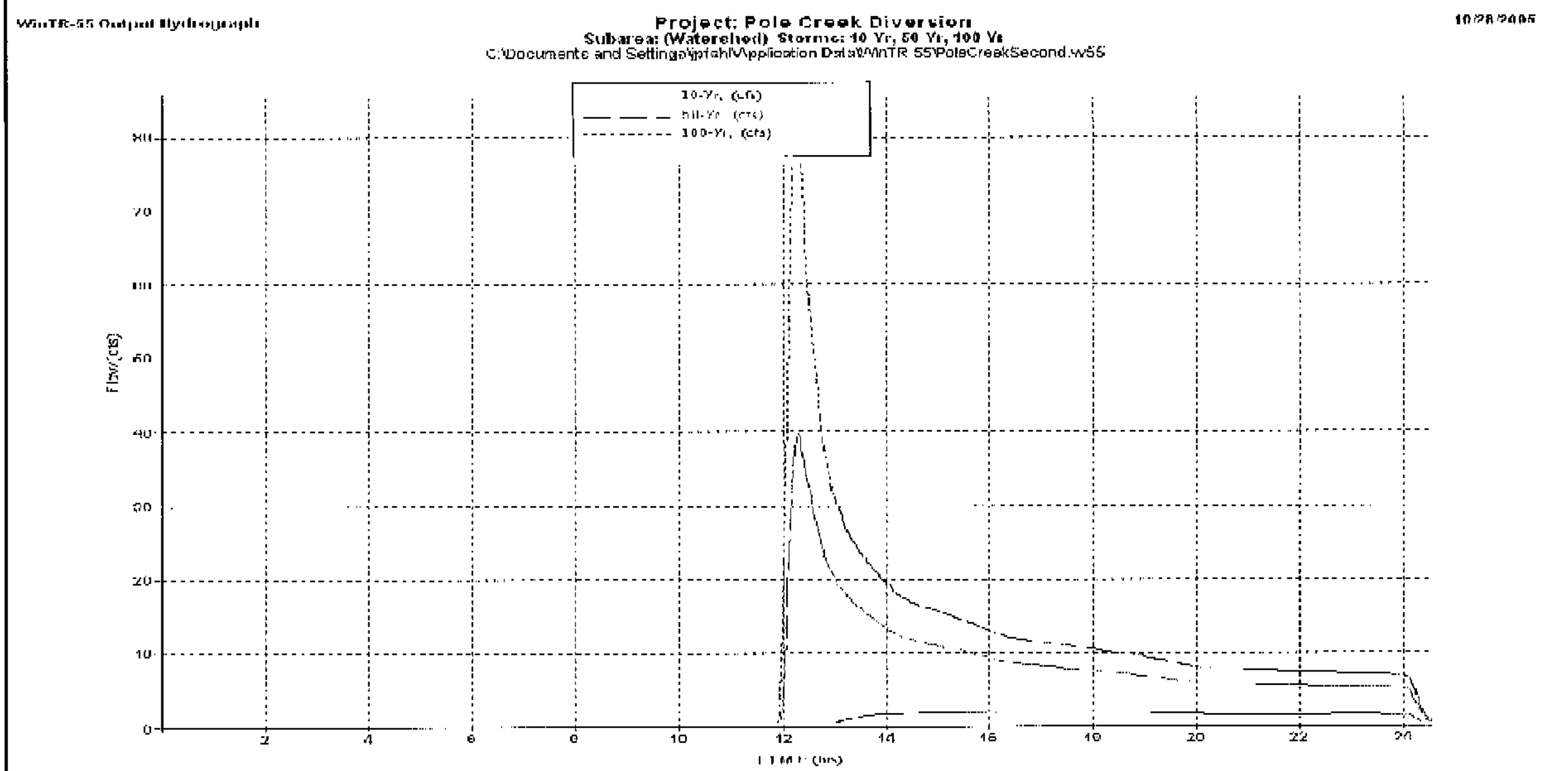
J.R. SIMPLOT COMPANY
SMOKY CANYON MINE - EECA

FIGURE C-3

UPPER POLE CANYON FLOW MEASUREMENTS

PRJ: 0442-004-900.40	DATE: MAY 3, 2006	
REV: 0	BY: JHP	CHK: BGH

NEWFIELDS



J.R. SIMPLOT COMPANY
SMOKY CANYON MINE - EECA

FIGURE C-4

STORM HYDROGRAPH
POLE CANYON CREEK
AT THE DIVERSION POINT

PRJ: 0442-004-900.40	DATE: MAY 3, 2006	
REV: 0	BY: JHP	CHK: BGH

NEWFIELDS

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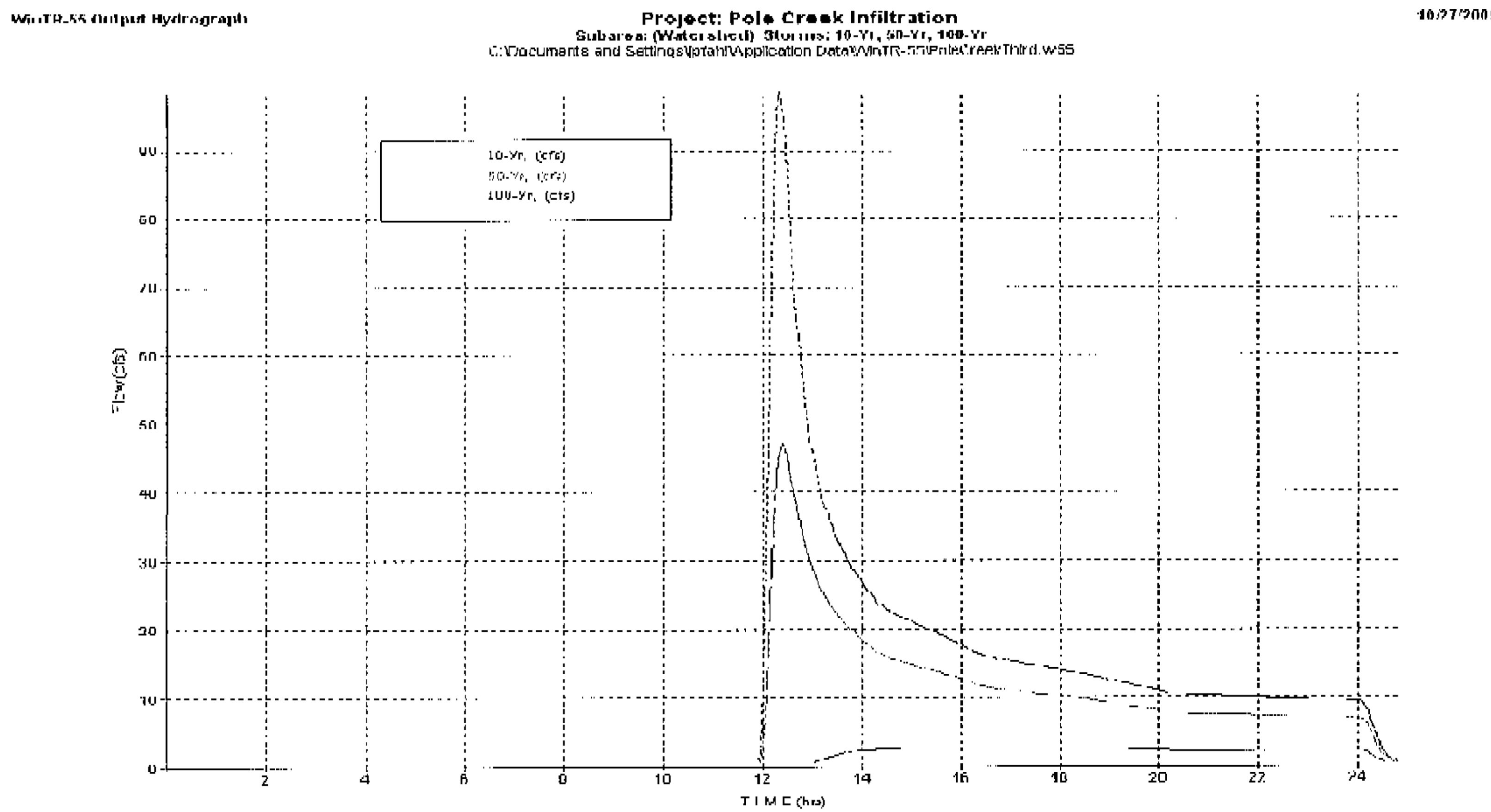


J.R. SIMPLOT COMPANY
SMOKY CANYON MINE - EECA

FIGURE C-5

STORM HYDROGRAPH
POLE CANYON CREEK
AT THE TOE OF THE ODA

PRJ: 0442-004-900.40	DATE: MAY 3, 2006	
REV: 0	BY: JHP	CHK: BGH

NEWFIELDS

Notes:

See EECA Figure 5 5 for basin location

Contours represent 5 foot changes in elevation

Total Basin depth is 20 feet

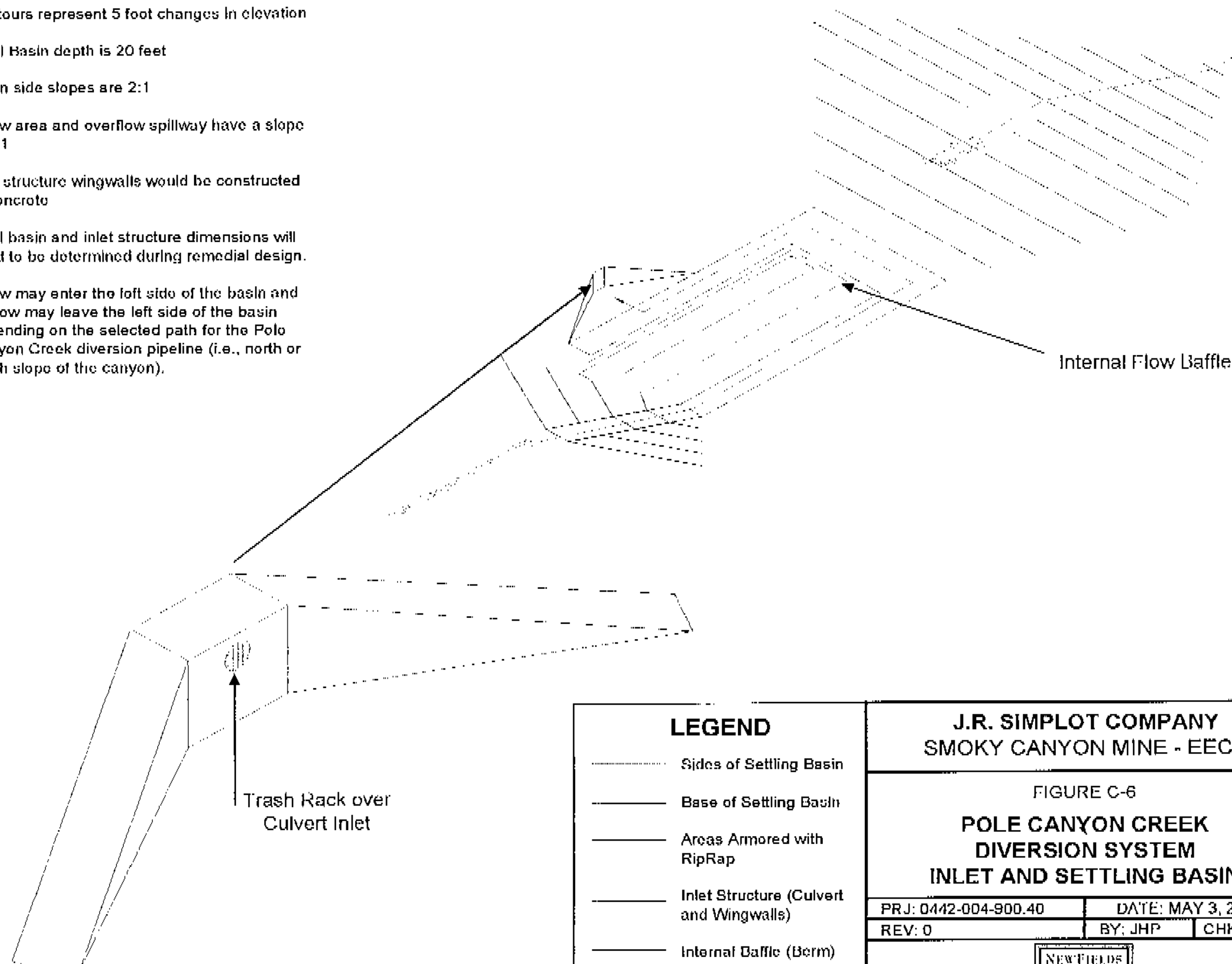
Basin side slopes are 2:1

Inflow area and overflow spillway have a slope of 3:1

Inlet structure wingwalls would be constructed of concrete

Final basin and inlet structure dimensions will need to be determined during remedial design.

Inflow may enter the left side of the basin and outflow may leave the left side of the basin depending on the selected path for the Polo Canyon Creek diversion pipeline (i.e., north or south slope of the canyon).



LEGEND

- Sides of Settling Basin
- Base of Settling Basin
- Areas Armored with RipRap
- Inlet Structure (Culvert and Wingwalls)
- Internal Baffle (Berm)

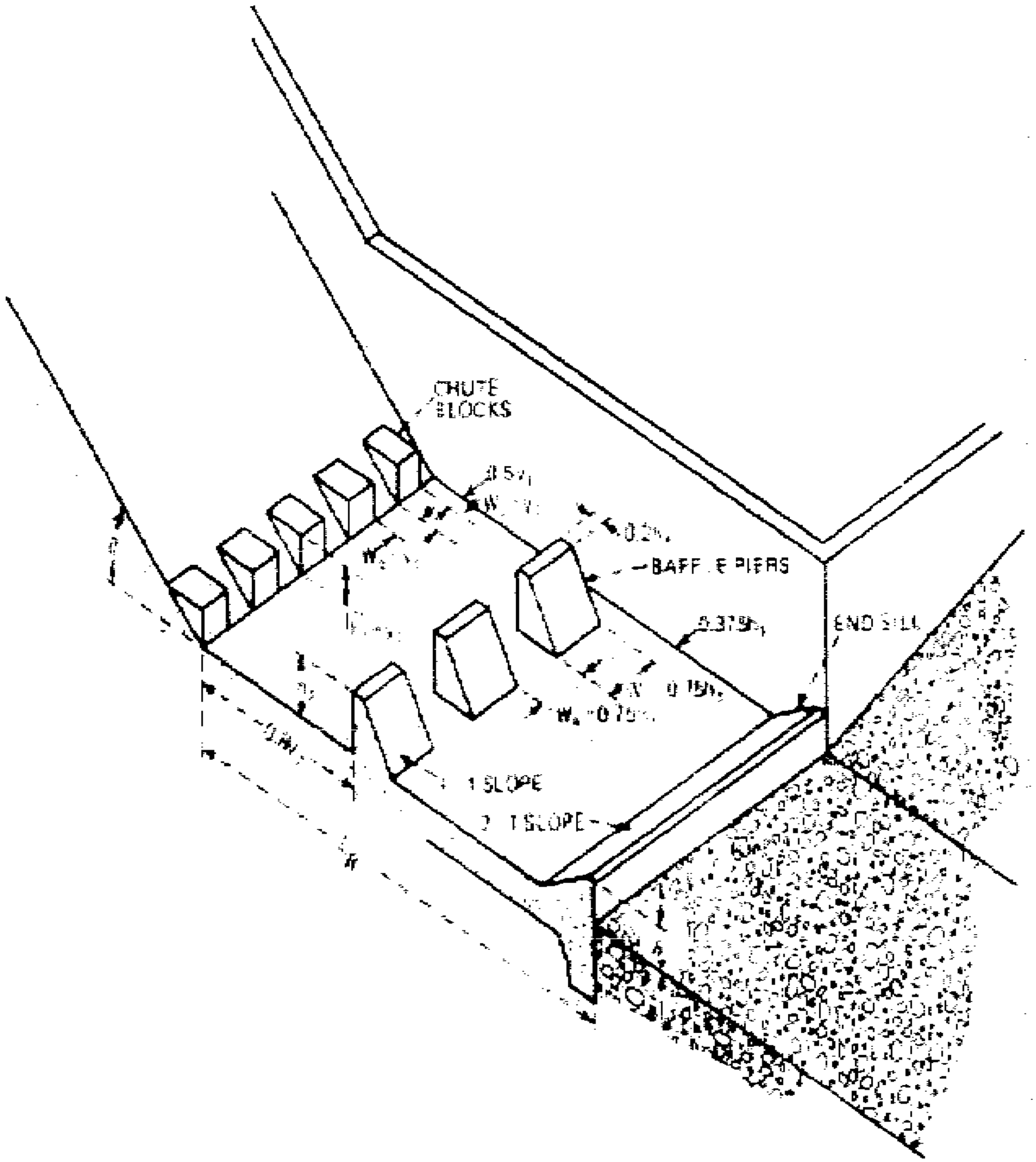
J.R. SIMPLOT COMPANY
SMOKY CANYON MINE - EECA

FIGURE C-6

POLE CANYON CREEK DIVERSION SYSTEM INLET AND SETTLING BASIN

PRJ: 0442-004-900.40	DATE: MAY 3, 2006	
REV: 0	BY: JHP	CHK: BGH

NEWFIELDS



Schematic from USDOT Federal Highway Administration, Hydraulic Design of Energy Dissipators for Culverts & Channels (HEC 14)

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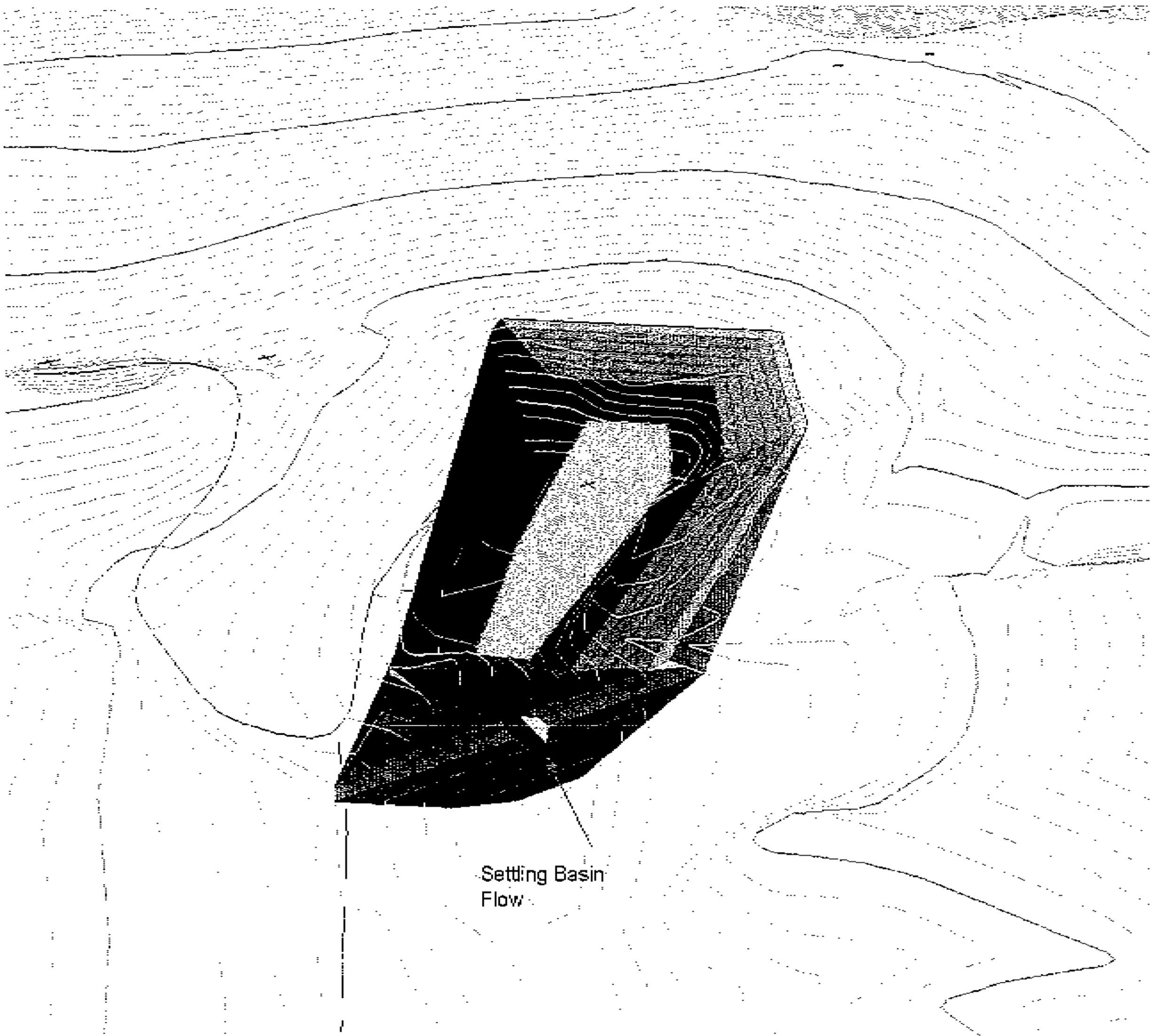
SMOKY CANYON MINE - EECA

FIGURE C-7

TYPICAL USBR TYPE III STILLING BASIN

PRJ: 0442-004-900.40	DATE: MAY 3, 2006
REV: 0	BY: JHP / CHK: SGH



Note: View is from the west looking down Pole Canyon Creek over the settling basin spillway into the infiltration basin.

Existing topography is from an aerial flyover performed Summer 2004.

LEGEND

- Infiltration Contact Area
- Lined Area
- Revegetated Disturbed Area
- Max Elevation of Settling Basin Water Surface
- Existing 5 ft Contour
- Existing 50 ft Contour

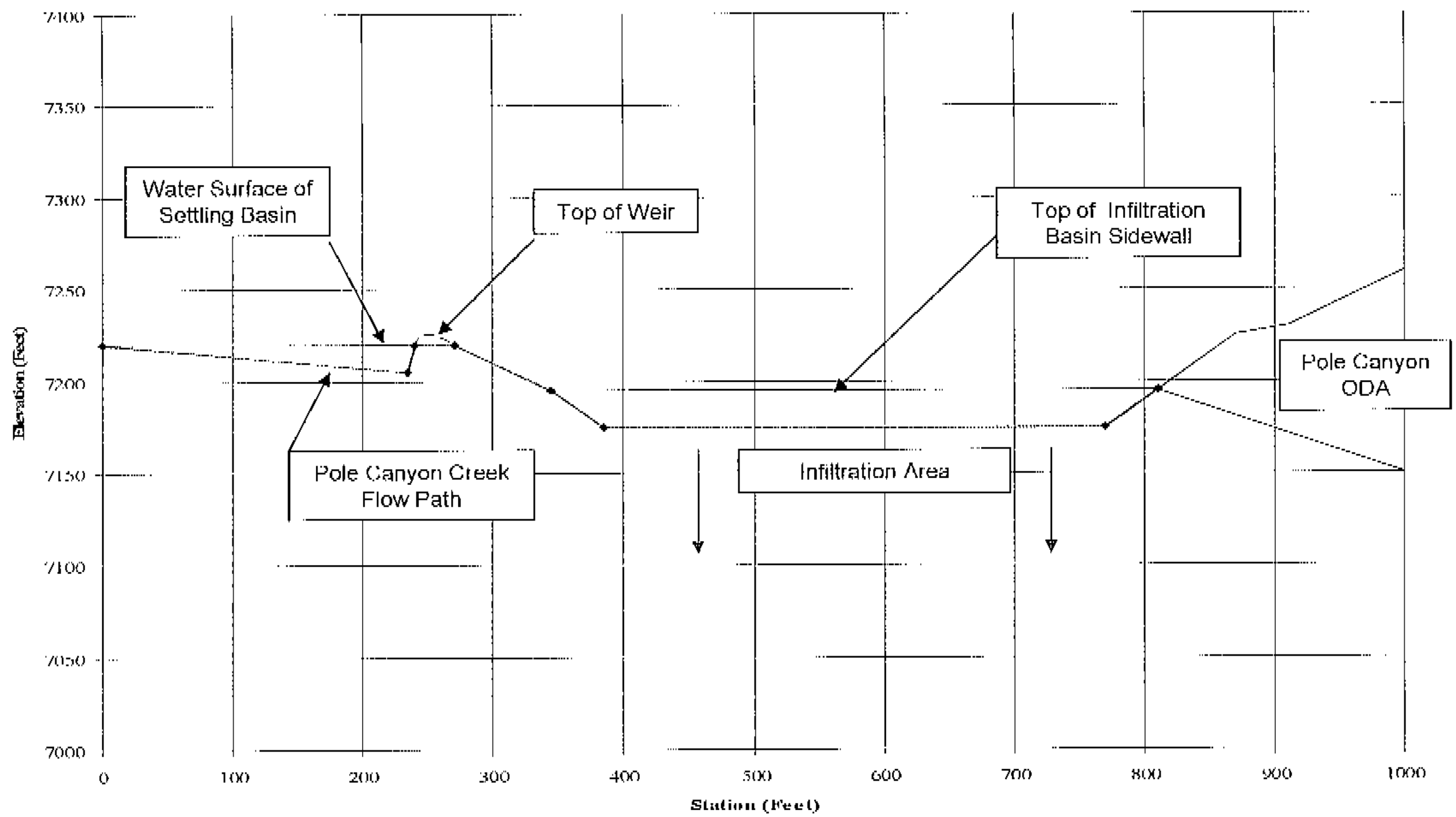
J.R. SIMPLOT COMPANY
SMOKY CANYON MINE - EECA

FIGURE C-8

POLE CANYON CREEK INFILTRATION BASIN CONCEPTUAL LAYOUT

PRJ: 0442-004-900.40	DATE: MAY 3, 2006	
REV: 0	BY: JHP	CHK: BGH

NEWFIELDS



J.R. SIMPLOT COMPANY SMOKY CANYON MINE - EECA	
FIGURE C-9 **Pole Canyon Creek Infiltration Basin Profile View**	
PRJ: 0442-004-900.40	DATE: MAY 3, 2006
REV: 0	BY: JHP · CHK: BGH
NEWFIELDS	

Note: This is a conceptual profile only. The actual design profile would be determined during remedial design.

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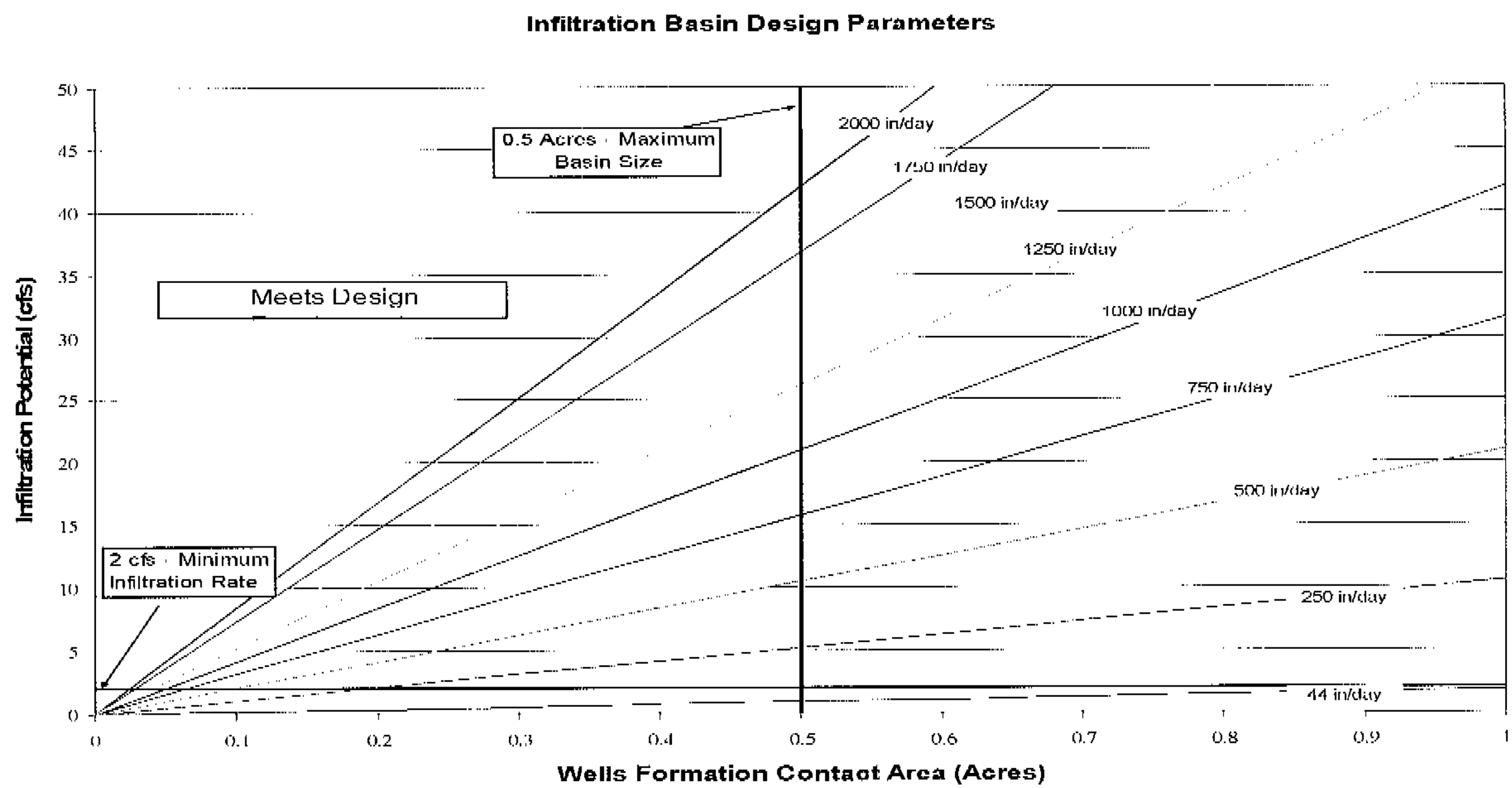

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SMOKY CANYON MINE - EECA

FIGURE C-10

POLE CANYON CREEK
INFILTRATION BASIN
DESIGN PARAMETERS

PRJ: 0442-004-900.40	DATE: MAY 3, 2006	
REV: 0	BY: JHP	CHK: BGH

NEWFIELDS

Appendix C-A

WinTR-55 Current Data Description

--- Identification Data ---

User: John Pfahl
Project: Pole Creek Diversion
SubTitle: Peak Flow Into Collection Point
State: Idaho
County: Caribou
Filename: C:\Documents and Settings\jpfahl\Application Data\WinTR-55\PoleCreekSecond.w55

Date: 10/28/2005
Units: English
Areal Units: Acres

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
Watershed	Watershed Above Dvrsn	Pole	690	60	0.419

Total area: 690 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
1.2	1.5	1.8	2.2	2.5	2.8	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type II
Dimensionless Unit Hydrograph: <standard>

John Pfahl

Pole Creek Diversion
Peak Flow Into Collection Point
Caribou County, Idaho

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 10-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
SUBAREAS			
Watershed	2.18	39.88	85.97
REACHES			
Pole	2.18	39.88	85.97
Down	2.18	39.88	85.97
OUTLET	2.18	39.88	85.97

John Pfahl

Pole Creek Diversion
Peak Flow Into Collection Point
Caribou County, Idaho

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
Watershed							
SHEET	100	0.3300	0.400				0.190
SHALLOW	500	0.1500	0.050				0.022
CHANNEL	1000	0.1000	0.200	6.00	4.00	3.086	0.090
CHANNEL	3000	0.0750	0.075	9.00	6.00	7.123	0.117
					Time of Concentration		0.419
							========

John Pfahl

Pole Creek Diversion
Peak Flow Into Collection Point
Caribou County, Idaho

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
Watershed	Woods - grass combination	(good)	C	345	72
	Sagebrush (w/ grass understory)	(good)	C	345	47
	Total Area / Weighted Curve Number			690	60
				===	==

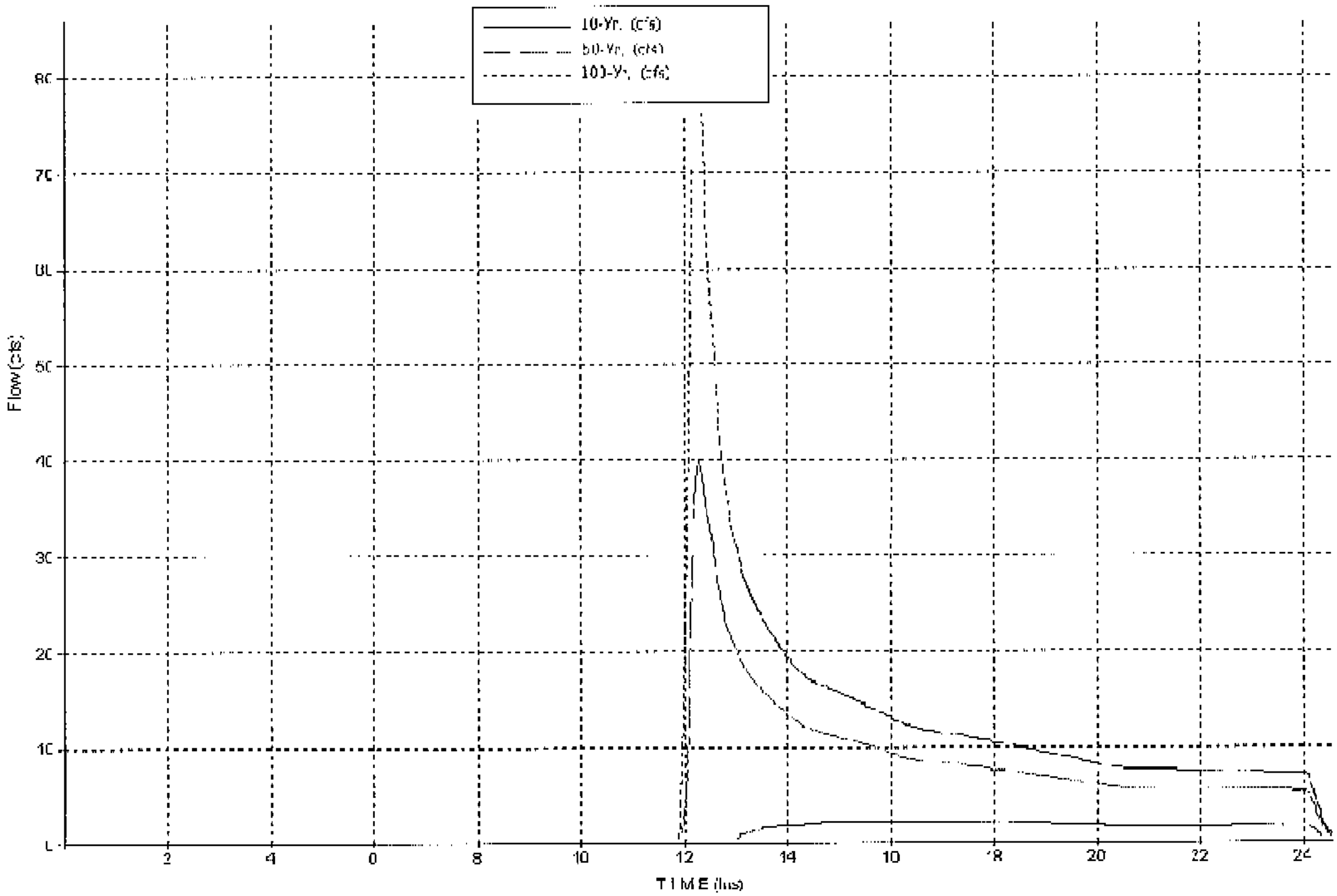
WinTR-55 Output Hydrograph

10/28/2005

Project: Pole Creek Diversion

Subarea: (Watershed) Storms: 10-Yr, 50-Yr, 100-Yr

C:\Documents and Settings\jpfahl\Application Data\WinTR-55\PoleCreekSecond.w55



WinTR-55 Current Data Description

--- Identification Data ---

User: John Pfahl Date: 10/27/2005
Project: Pole Creek Infiltration Units: English
SubTitle: Peak Flow at Upstream Toe of ODA Areal Units: Acres
State: Idaho
County: Caribou
Filename: C:\Documents and Settings\jpfahl\Application Data\WinTR-55\PoleCreekThird.w55

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
Watershed	Watershed Above ODA	Pole	920	60	.536

Total area: 920 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
1.2	1.5	1.8	2.2	2.5	2.8	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type II
Dimensionless Unit Hydrograph: <standard>

John Pfahl

Pole Creek Infiltration
Peak Flow at Upstream Toe of ODA
Caribou County, Idaho

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 10-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
SUBAREAS			
Watershed	2.91	47.01	98.37
REACHES			
Pole	2.91	47.01	98.37
Down	2.91	47.01	98.28
OUTLET	2.91	47.01	98.28

John Pfahl

Pole Creek Infiltration
Peak Flow at Upstream Toe of ODA
Caribou County, Idaho

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
Watershed							
SHEET	100	0.3300	0.400				0.190
SHALLOW	500	0.1500	0.050				0.022
CHANNEL	1000	0.1000	0.200	6.00	4.00	3.086	0.090
CHANNEL	6000	0.0750	0.075	9.00	6.00	7.123	0.234
					Time of Concentration		.536
							========

John Pfahl

Pole Creek Infiltration
Peak Flow at Upstream Toe of ODA
Caribou County, Idaho

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
Watershed	Woods - grass combination	(good)	C	460	72
	Sagebrush (w/ grass understory)	(good)	C	460	47
	Total Area / Weighted Curve Number			920	60
				===	==

Project: Pole Creek Infiltration

Subarea: (Watershed) Storms: 10-Yr, 50-Yr, 100-Yr

C:\Documents and Settings\jpfahl\Application Data\WinTR-55\PoleCreekThird.w55