SOLMAX

INSTALLATION GUIDELINE | AMERICAS

MIRAFI H_2Ri moisture management system

Contents

1. GENERAL

This document is intended as a general installation guideline only and should not be construed as engineering advice. Final decision regarding proper installation details shall be written into the project specifications and is the responsibility of the project engineer. If you have questions regarding a specific project or encounter conditions other than those described herein, contact Solmax.

Geosynthetics must be identified, handled, stored and installed in such a way that its physical property values are not affected, and the design conditions are ultimately met as intended. This document does not account for every possible construction scenario. However, this document contains information consistent with generally accepted practices of identifying, handling, storing and installing geosynthetic materials for most roadway applications

2. MATERIAL IDENTIFICATION, STORAGE AND HANDLING

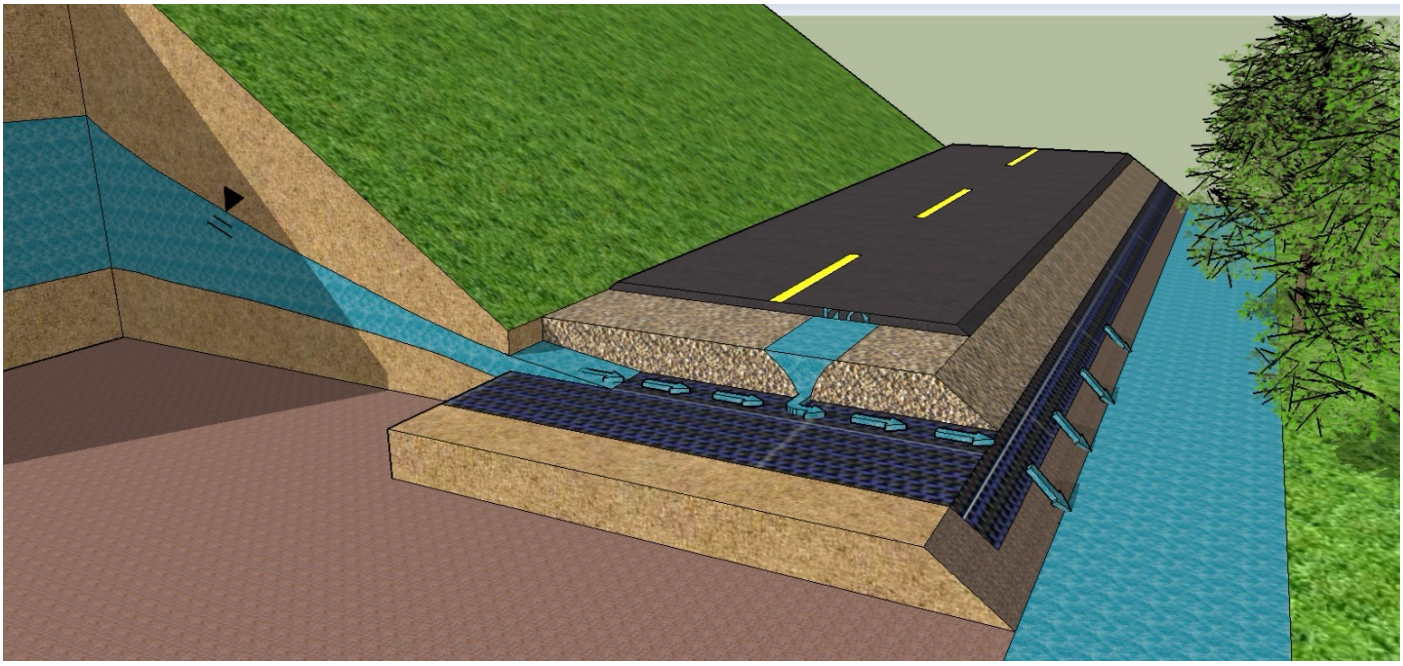
The geosynthetic shall be rolled on cores having sufficient strength to avoid collapse or other damage from normal use. Each roll shall be wrapped with a plastic covering to protect the geosynthetic from damage during shipping and handling. Each roll shall be identified with a durable gummed label or the equivalent, clearly legible on the outside of the roll wrapping. The label shall indicate the manufacturer's name, the style number and the roll number. Upon delivery, check the **MIRAFI®** H_2Ri roll labels to verify the correct product has been received.

Immediately inspect the geosynthetic to ensure it is free of any flaws or damage that might have occurred during shipping or handling. While unloading or transferring the geosynthetic from one location to another, prevent damage to the protective wrapping, core, label or the geosynthetic itself. If the geosynthetic is to be stored for an extended period, the geosynthetic shall be located and placed in a manner that ensures the integrity of the wrapping, core and label as well as the physical properties of the geosynthetic, in accordance with ASTM 4873.

The product is shipped in a heavy plastic bag or covering to help prevent moisture adsorption before installation. **MIRAFI** H_2Ri has an affinity for water, making roll weights increase drastically if the plastic wrap is compromised and exposed to rain or moisture, making installation more difficult. The geosynthetic should be stored indoors or elevated off the ground on dunnage, while ensuring that it is adequately covered and protected from precipitation or other moisture, ultraviolet radiation, chemicals, fire or flames including welding sparks, temperatures in excess of 140° F (60° C), and human or animal destruction.

3. PRODUCT OVERVIEW

MIRAFI H_2Ri continuous moisture management geosynthetic was introduced in February 2012. It has the unique ability to wick water laterally out of unsaturated soils through capillary action (suction) in its fibers. Since its introduction, engineers have sought this moisture movement capability to solve a myriad of problems, such as reducing the moisture content in soils related to capillary rise, high moisture conditions, frost heave and surficial water intrusion. To stay abreast of new information, engineers should stay in contact with their local Solmax representative.



MIRAFI H_2Ri geotextile – transporting water from within the road section, outwards to the daylighted edge

4. PLACEMENT LOCATION(S)

Placing **MIRAFI** H_2Ri layer(s) at the appropriate elevation(s) within the structural cross section is project specific and depends on individual site conditions. The most common location is at the subgrade/base interface within a roadway structure. **MIRAFI** H_2Ri moves water by capillary action. The geosynthetic can transport water vertically without the assistance of gravity approximately 8 in (200 mm), depending on temperature, pressure, and humidity. Reliance on this uphill moisture movement should be avoided, but may occur because of inconsistencies in construction and/or as allowance result of low spots in the subgrade surface.

Generally, the **MIRAFI** H_2Ri should be placed at least 12 in (300 mm) above the adjacent ground water table or free water surface outside the installation. However, sites that experience flood events may locate the geosynthetic below the water line to allow faster drying of an aggregate and/or facilitate the opening of a road or airfield after water levels recede.

Some example application installations:

1. Enhanced lateral drainage/pavement reinforcement

Place the **MIRAFI** H_2Ri under the aggregate base course of a pavement structure as shown in Figure 1. This solution increases the drainage coefficient and/or applies a Hydraulic Influence Factor (HIF) for the aggregate base, significantly improving the modulus and service-life of the roadway.

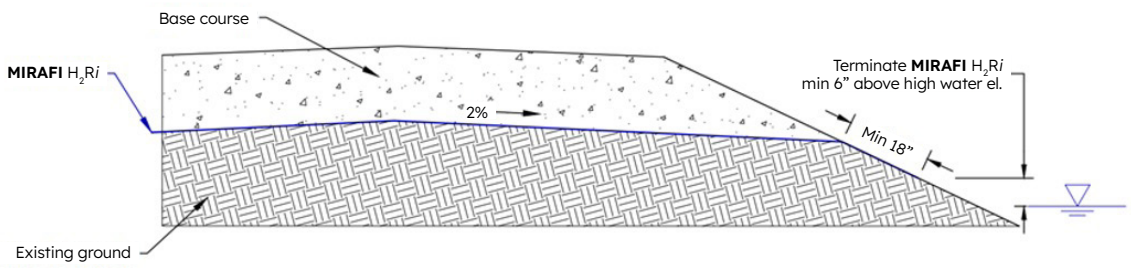


Figure 1: MIRAFI H_2Ri placed below base course

2. Frost heave

The **MIRAFI** H_2Ri should be placed below the sub base of the pavement section to reduce the moisture content, as shown in Figure 2. In some instances, multiple layers may be warranted. Several projects have been installed with **MIRAFI** H_2Ri above the frost line and are performing very well without heaves. Local design guidelines may not allow for a reduced design depth from a traditional structural cross section, so designers should check with their approving office prior to planning a material/layer thickness reduction.

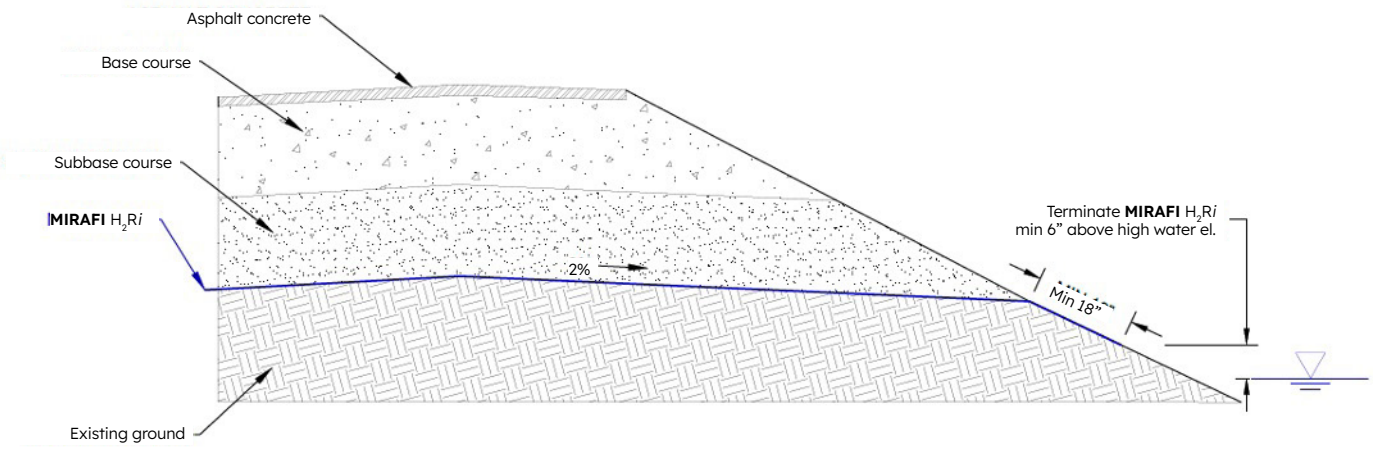


Figure 2: Subgrade interface

5. INSTALLATION/PLACEMENT

Image 1: MIRAFI H_2Ri installed parallel to planned traffic flow over a prepared subgrade

Clear, grub and excavate (as required) to the planned subgrade or undercut elevations, stripping topsoil, deleterious debris and unsuitable material from the site. Specialized equipment with low ground pressure, as directed by the engineer, may be required for very soft soils (CBR ≤ 1.0) or on "sensitive" subgrade soils to minimize disturbance. The surface of the subgrade should be relatively smooth and level, and depressions or humps greater than 6 in (150 mm) should be graded level (i.e., back bladed/back dragged).

The geosynthetic reinforcement shall be placed directly on the prepared subgrade, as shown in Image 1. The geosynthetic shall be rolled out flat and pulled tight, to reduce folds or wrinkles as much as possible (some small wrinkles are acceptable). Unroll the geosynthetic such that the cross-machine direction (axis across the roll width) is oriented in the direction of desired water flow.

6. DIRECTIONAL OVERLAP

MIRAFI H_2R*i* must be designed into a structural cross section with the appropriate flow direction of **MIRAFI** H_2R*i* being indicated for installers to follow. Most geosynthetics do not require flow direction orientation and overlap details, leaving the installation up to the contractor's discretion. For a system that moves moisture like **MIRAFI** H_2R*i* , it is important to provide a detailed cross-section that clearly shows the overlaps and required gradients of the geosynthetic, to ensure proper installation and optimize performance. Overlapped layers of **MIRAFI** H_2R*i* should be shingled in a similar manner to roof tiles/shingles, to allow water to shed onto the adjacent lower layer(s). Adjacent rolls should be overlapped a minimum of 12 in (300 mm) and a maximum 36 in (900 mm) along their sides and ends as a function of subgrade strength as shown in table 1 (after AASHTO M288).

CBR ≥ 3%	12 in to 18 in (30-45 cm) overlap
1% ≤ CBR < 3%	24 in to 36 in (60-90 cm) overlap
0.5% ≤ CBR < 1%	36 in (90 cm+)
CBR < 0.5%	Contact your Solmax representative

* Please contact a **MIRAFI** representative for recommended sewing practices.

MIRAFI H_2R*i* is marked with "flow direction" on the packaging to aid in proper installation and placement orientation, as shown in Image 2.

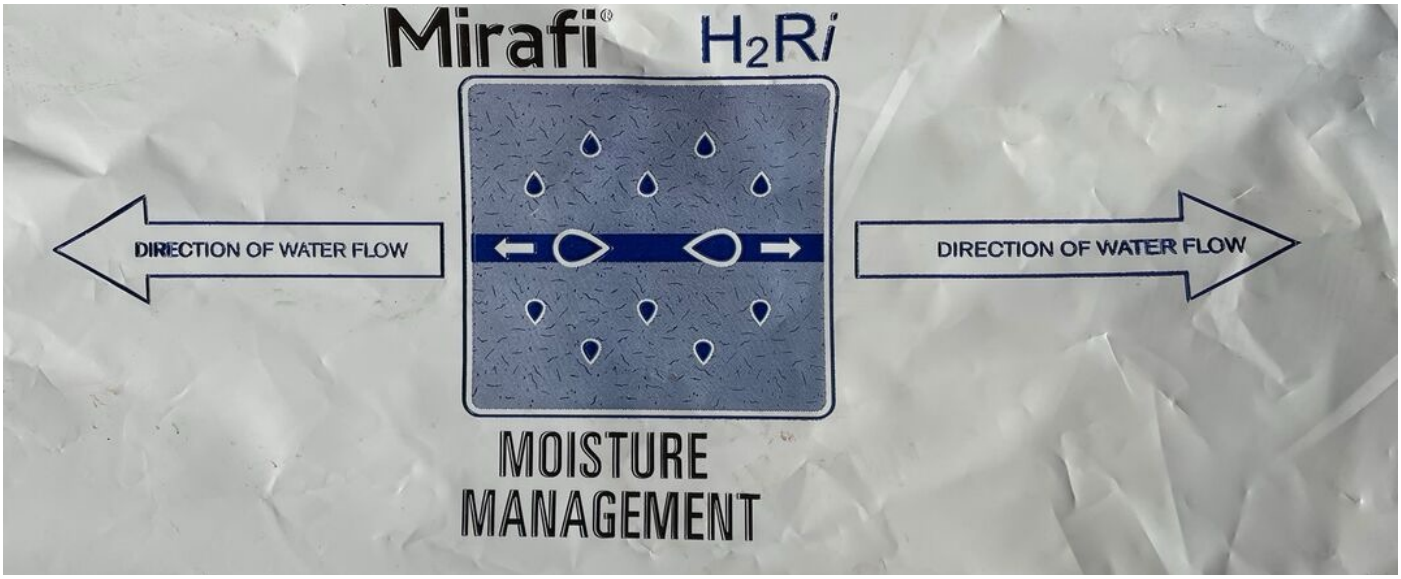


Image 2: Packaging to aid installation orientation

MIRAFI H_2R*i* is manufactured with laterally oriented drainage yarns that create flow channels to remove water along the cross-machine direction. Water enters these flow channels and moves laterally to the edge of the **MIRAFI** H_2R*i* panel, and then releases onto the shingled layer below at the overlap. Image 3 shows a typical center-crowned subgrade, with planned water movement outward from the center, to the left and to the right. Image 4 shows a superelevation on the left, with planned water flow from left to right.

Image 3: Center roll at the high point moving water to the left and right

Image 4: Super elevation on left, moving water from left to right

7. OBSTACLES (manholes, adjacent pavement, catch basins, foundations)

The **MIRAFI** H_2R*i* can be reoriented and pieced-in to promote water flow around obstacles such as bridge approaches and driveways, as shown in Image 5. Typically, the **MIRAFI** H_2R*i* can be terminated horizontally adjacent to a structure, e.g., adjacent pavement, manholes, catch basins, foundations, etc. However, if the adjacent vertical material is soil, or some deleterious material, the **MIRAFI** H_2R*i* can be folded up the side (as shown in Image 6) to provide separation and prevent material from piping into the aggregate overlying the **MIRAFI** H_2R*i*, and prevent the overlying aggregate from piping into the adjacent material.

Image 5: Bridge approach, routing water away from structure

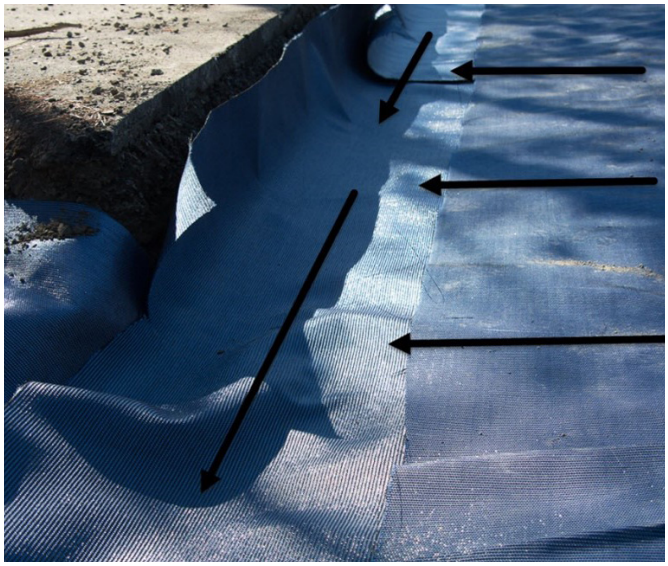


Image 6: Routing around residential driveway entrance

8. INTERSECTIONS

MIRAFI H_2Ri rolls should be installed across the entire intersection, with the cross-machine direction oriented in the direction of desired water flow. These perpendicular panels should be shingled (a min 24 in) to promote a directional gradient of waterflow out of the intersection, back to the main parallel running panels, as shown in Figure 3.

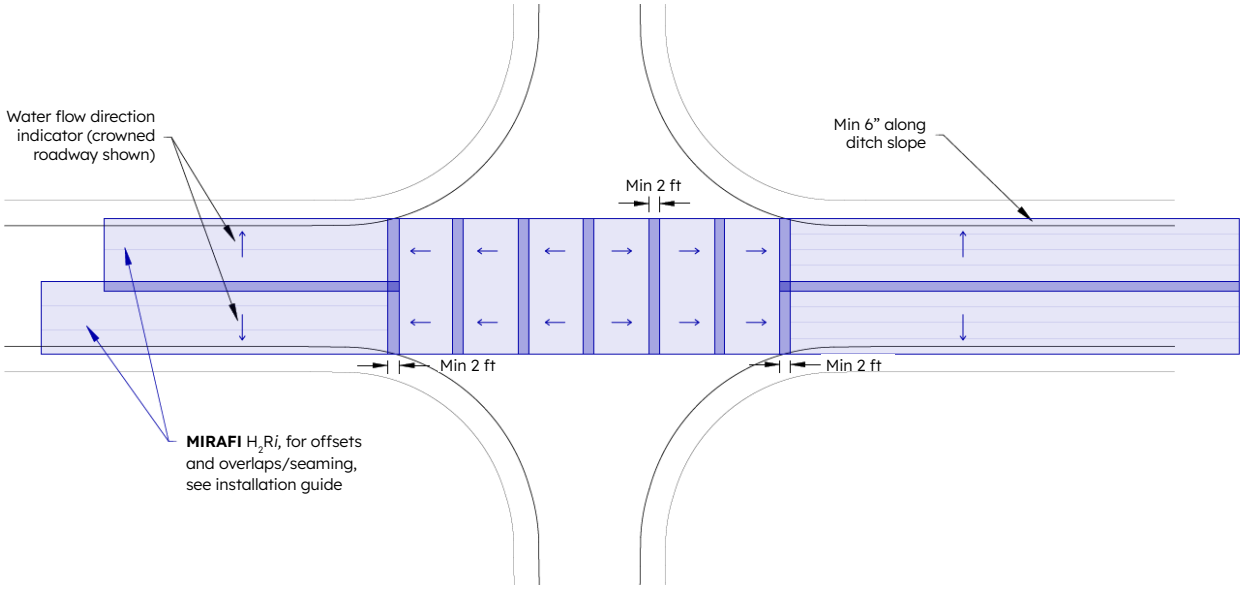


Figure 3: Typical installation roadway intersection

Alternatively, the **MIRAFI** H_2Ri rolls may be installed parallel to the roadway direction entirely through an intersection. Perpendicular oriented panels (cut across the roll width a min 24 in wide) should be shingled under the sides of the main panels. A directional gradient that drains water laterally and down towards these perpendicular panels should be utilized. These cut perpendicular oriented panels should span the entire width of the intersection, as shown in Figures 4a and 4b.

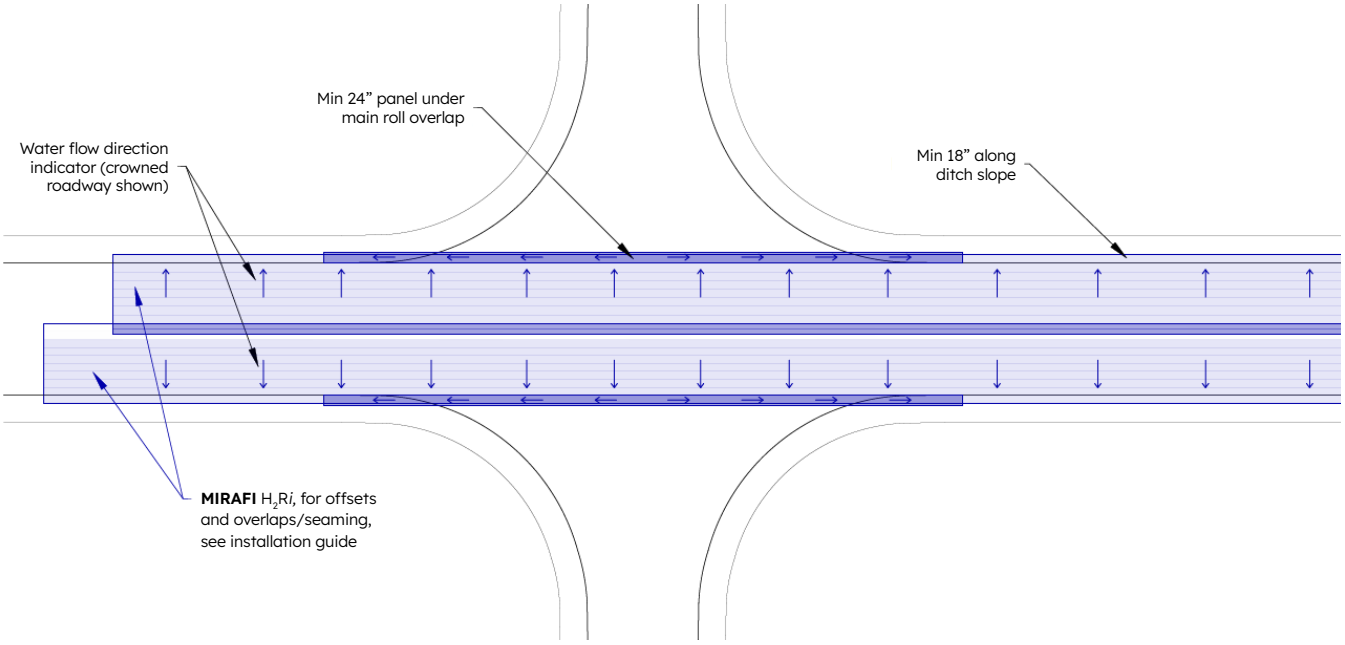


Figure 4a: Installation at roadway intersection detail

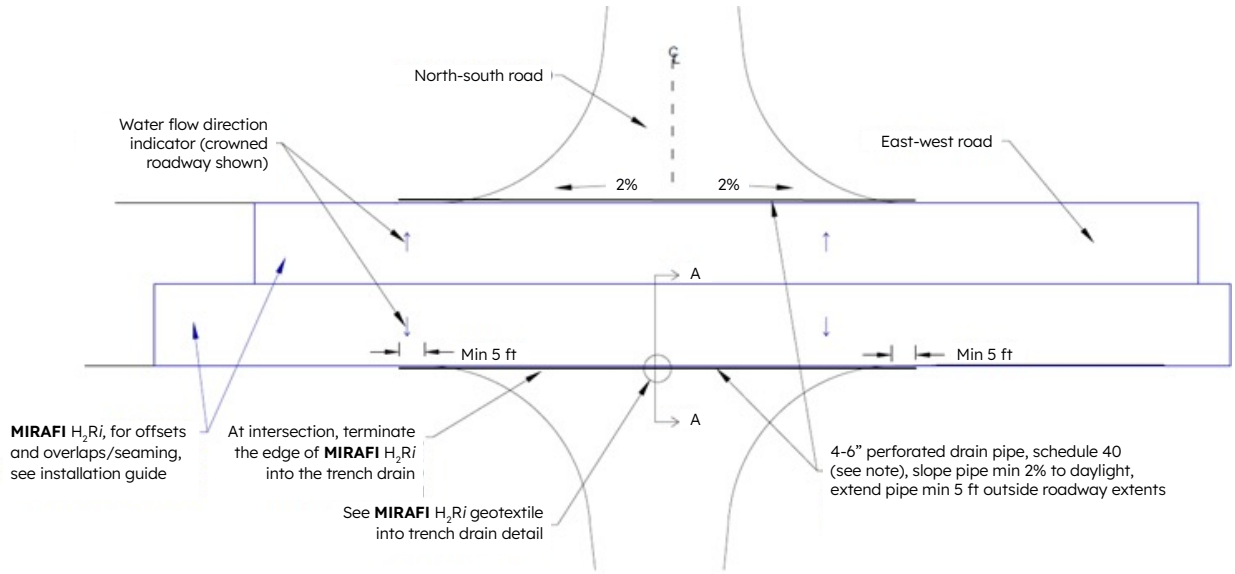


Figure 4b: Installation at roadway intersection detail

9. TERMINATIONS TO PROMOTE WATER REMOVAL

IMPORTANT! The termination details for **MIRAFI** H_2Ri are critical to the performance of the system. **MIRAFI** H_2Ri is a unique material that will wick water from high moisture conditions to low moisture conditions. If not properly detailed and installed, it is possible for **MIRAFI** H_2Ri to draw moisture into the system creating a negative effect.

Image 7: Traditional installation with no outlet

1. **Traditional – no outlet:** Best when the moisture content needs to be maintained and distributed evenly across the site subgrade, but not necessarily removed from the roadway cross section. The **MIRAFI** H_2Ri is installed like a traditional roadway geosynthetic, without leading into any drainage systems or daylighting the geotextile. Designers can use the directional component of the **MIRAFI** H_2Ri to spread out the moisture content uniformly, as shown in Image 7. Typically, moisture sensitive clay subgrade soils can be good candidates for this type of termination.

Image 8: Edge termination on side of embankment into ditch line (right side)

2. **Edge termination:** Best for roadway embankments that can allow water to flow out of the system at the edge, as shown in Image 8.

Alternatively, the **MIRAFI** H_2R*i* rolls may be installed parallel to the roadway direction entirely through an intersection. A directional gradient that drains water laterally and down towards the shoulder into large drainage rock (ballast or small riprap) should be incorporated with this approach, as shown in Figures 5 and 6. Please note that the **MIRAFI** 160N separation geotextile shown in Figure 6 is recommended when using small rip rap stone or very large ballast/drainage aggregate. If **MIRAFI** H_2R*i* is terminated above a shoulder drainage ditch, care and maintenance of the ditch should be maintained to ensure water does not back up to the level of **MIRAFI** H_2R*i*. This could include clearing and cleaning of the ditch to ensure proper drainage.

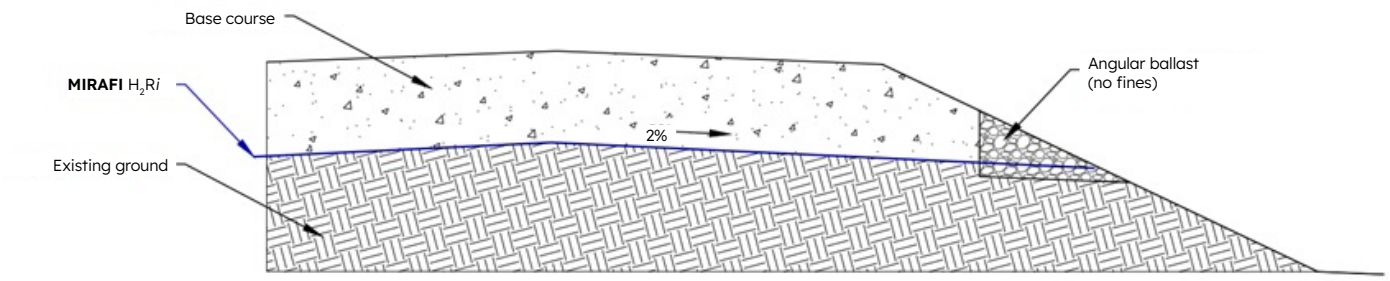


Figure 5: Embankment MIRAFI H_2R*i* daylight to angular ballast detail

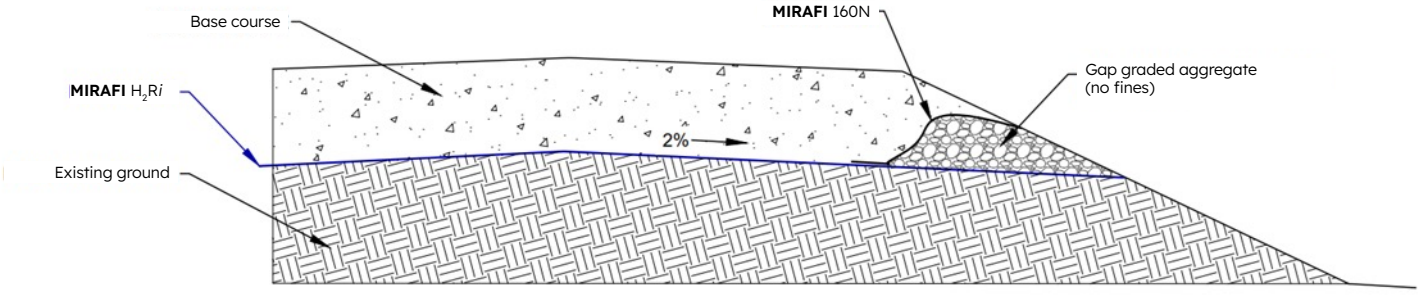


Figure 6: Embankment MIRAFI H_2R*i* daylight to edge drain alternate detail

3. **Daylighting** – Best for maximum water removal from a cross section. Evaporation at the exterior drives water movement outward from the interior. A directional gradient should be incorporated with this approach in combination with a minimum 18 in (458 mm) draped exposure of **MIRAFI** H_2R*i* at the exterior (along the ditch), as shown in Figure 7. If **MIRAFI** H_2R*i* is terminated above a shoulder drainage ditch, care and maintenance of the ditch should be maintained to ensure water does not back up to the level of **MIRAFI** H_2R*i*. This could include clearing and cleaning of the ditch to ensure proper drainage.

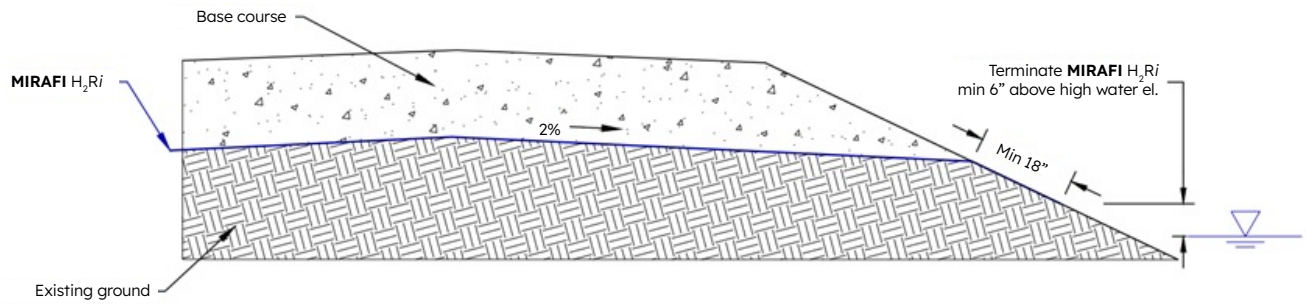


Figure 7: Embankment MIRAFI H_2R*i* daylight into ditch detail

A gap-graded or open graded drainage rock, ballast, or rip rap covering may be used to protect the material from UV degradation, as shown in Figures 8 and Images 9 and 10. However, this will increase the difficulty in mowing and other maintenance operations. This approach may not be the most effective in environments with very high or constant humidity.

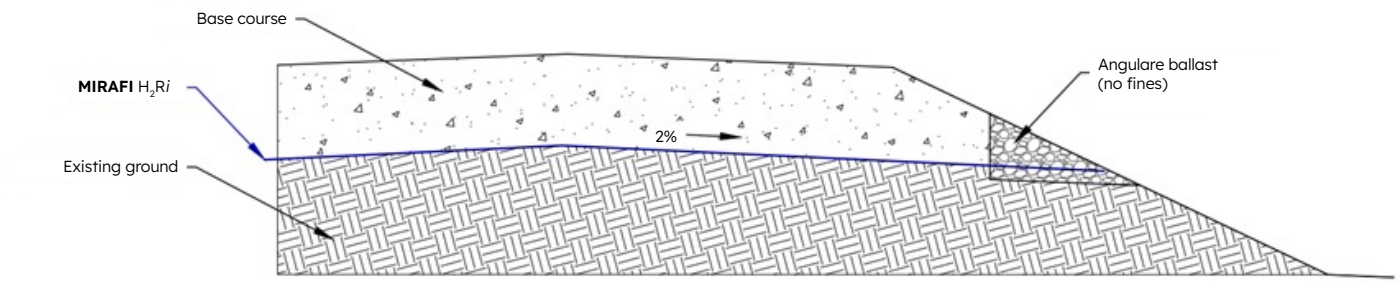


Figure 8: Embankment MIRAFI H_2Ri daylight to ballast or rock slope detail

Image 9: Daylighting installation using Rip Rap to cover the exposed edge of MIRAFI H_2Ri

Image 10: Water movement with edge termination

4. **Bio-wicking** – Relies on local vegetation to draw water from the system through their roots, away from the exposed edge of **MIRAFI** H_2Ri. Vegetation can be selectively planted on the sides of the road, as shown in Figure 9, to enable evapotranspiration. Local riparian based plants with a shallow root structures can be selected and planted after construction, or the use of existing on-site topsoil for native species plant growth, as demonstrated in Image 11.

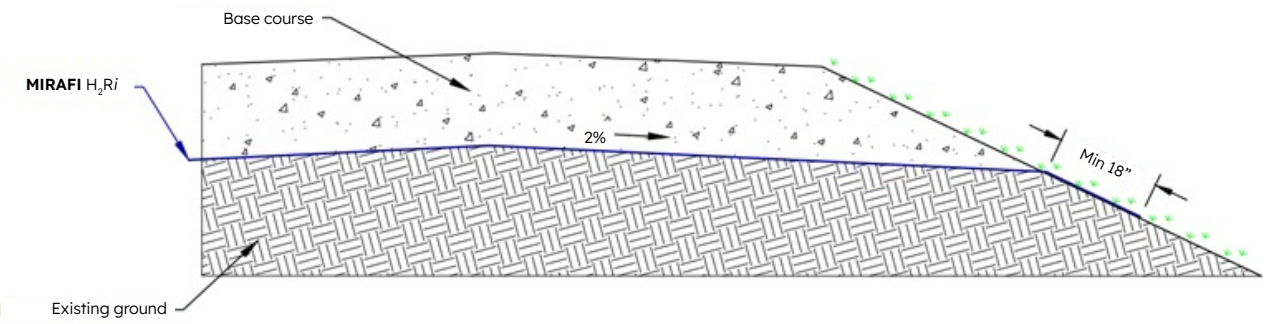
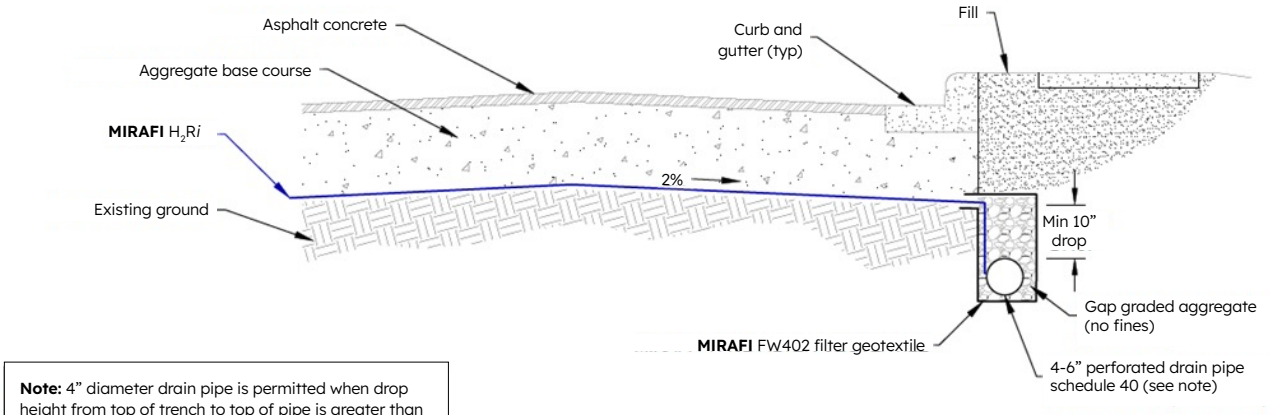


Figure 9: Embankment MIRAFI H_2Ri daylight to vegetated slope detail

Image 11: Native plants establishing the first season after installation

4. **Edge drain** – Best for designs with existing curb and gutter, or where the shoulder elevation is flat, edge drains are required to daylight water. In this approach the **MIRAFI** H_2Ri is terminated into a traditional trench drain with a perforated pipe (Image 12, Figure 10). A minimum 4 in (100 mm) diameter HDPE perforated drain pipe is recommended for use in these applications. A vertical drop of 10 in (250 mm) between the elevation of the geotextile and the top of pipe is recommended to initiate a siphon effect in the drainage channels, as shown in Figure 10 and Image 12. This amount of vertical gradient inhibits inward wicking back into the cross section, as the estimated maximum uphill moisture movement capability of **MIRAFI** H_2Ri is approximately 8 in (200 mm).

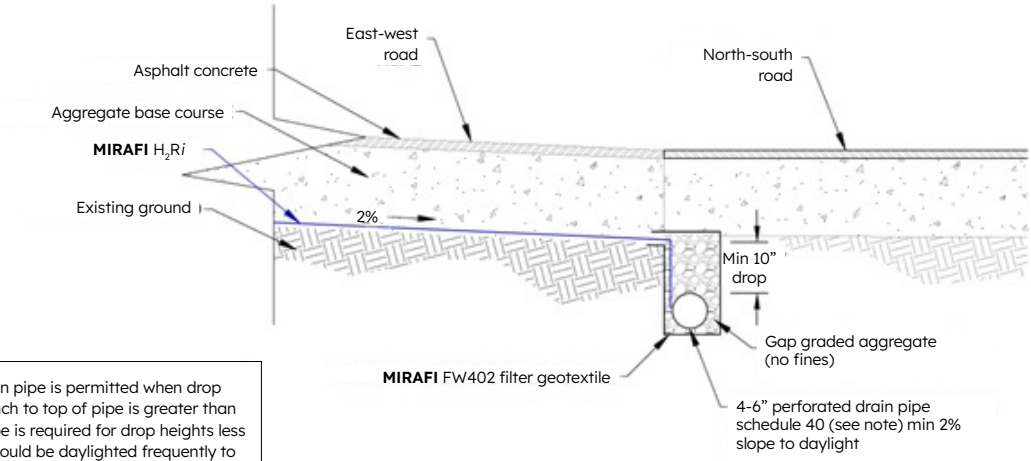


Note: 4" diameter drain pipe is permitted when drop height from top of trench to top of pipe is greater than 10". A 6" or greater pipe is required for drop heights less than 10". Drain pipe should be daylighted frequently to allow for increased airflow within the pipe.

Figure 10: Geotextile into edge drain detail

Image 12: MIRAFI H_2Ri termination into edge drain

4. **Intersection trench drain** – Best for terminations that occur at an intersection. In this approach the **MIRAFI** H_2Ri is terminated into a traditional trench drain below the structural section with a perforated pipe at the edge of the intersection. A minimum 4 in (100 mm) diameter HDPE perforated drain pipe is recommended for use in these applications. A vertical drop of 10 in (250 mm) between the elevation of the geotextile and the top of pipe is recommended to initiate a siphon effect in the drainage channels, as shown in Figure 11.



Note: 4" diameter drain pipe is permitted when drop height from top of trench to top of pipe is greater than 10". A 6" or greater pipe is required for drop heights less than 10". Drain pipe should be daylighted frequently to allow for increased airflow within the pipe.

Figure 11: Geotextile into edge drain detail

10. FILL PLACEMENT

Aggregate fill should be placed directly over the geosynthetic in 8–12 in (20-30 cm) loose lifts. Typically, if the design section layer thickness is ≤ 16 in (40 cm), the entire section should be placed and compacted in one single lift to minimize further degradation of the subgrade. Although it is recommended to avoid trafficking vehicles directly over the **MIRAFI** H_2Ri, on relatively competent subgrades (CBR ≥ 4%), standard, highway-legal, rubber-tired vehicles (end dumps and belly dumps) may be driven over the exposed geosynthetic at slow speeds (less than 5 mph [8 km/hr]), and in straight paths. These vehicles can dump aggregate fill as they advance, provided this construction traffic will not cause significant rutting upon bare subgrade. Sudden braking, sudden starting/accelerating and sharp turning should be avoided. Tracked construction equipment must not be operated directly upon the exposed geosynthetic. A minimum aggregate fill thickness of 6 in (15 cm) is required prior to operation of tracked equipment on the geosynthetic. In addition, turning of tracked equipment should be kept to a minimum to prevent tracks from displacing the fill and damaging the geosynthetic. Over softer subgrades (CBR < 4%), aggregate fill should be end-dumped from the edge of the previously placed material, spreading from the middle outward.

11. COMPACTION

Image 13: Small smooth drum roller

Standard compaction methods may be used unless the soils are very soft (CBR ≤ 1.5). In such cases, static compaction with a light smooth drum roller is considered prudent (Image 13). Once a stable working platform has been achieved, compact aggregate fill to project specifications, after it has been graded smooth and before it is subjected to accumulated traffic.

Image 14: Fence posts used as end holders for unrolling

The use of a forklift or front-end loader to unroll the geosynthetic using chains and end holders as shown in Image 14, is a common installation practice.

Image 15: Clamps used to secure the material to the core

At the end of the roll, utilize clamps to secure the material to the core as shown in Image 15.

Image 16: Clamps used to secure the material to the core

Once the rolls are clamped, the rolls can be pulled taut by construction equipment, as shown in Image 16.

Image 17: Gate set to spread 1 in (25 mm) lift allowing a full spread over one roll

A small 1 in (25 mm) lift can be utilized if the subgrade is competent, as shown in Image 17. The contents of a standard dump truck will cover the length of a standard roll, 300 ft (91.44 m), allowing subsequent lifts to be placed with belly dumps. Sudden braking, sudden starting and sharp turning during these processes should be avoided.

12. AGGREGATE FILL CONSIDERATIONS

A preferred (not required) fill gradation for roadway applications is well-graded, crushed aggregate fill with a maximum particle size of 1½ in (40 mm) and less than 10% fines (passing #200 sieve). For unpaved road applications, most clean granular fills, including sands are acceptable, but may affect the performance of the roadway.

13. INSTALLATION AND REPAIRS FOR UTILITY CUTS OR DAMAGED AREAS

Repairs to the system can be made in the field by placing a repair panel or patch over the damaged area. If the area of the patch is sloping, the patch should be placed under the existing fabric on the upslope side and over the existing fabric on the downslope side to shingle the waterflow down slope. If the area of the patch is horizontal, the patch can be placed on top of the existing **MIRAFI** H_2R*i*. The repair panel should extend a 1–3 ft. (0.3–0.9 m) beyond the edges of the damaged geosynthetic. Pullout and/or direct sliding calculations should be performed by the project engineer to verify the minimum required overlap length to meet a specific project's requirements.

About Solmax

Solmax is a world leader in sustainable construction solutions, for civil and environmental infrastructure. Its pioneering products separate, contain, filter, drain and reinforce essential applications in a more sustainable way – making the world a better place. The company was founded in 1981, and has grown through the acquisition of GSE, TenCate Geosynthetics and Propex. It is now the largest geosynthetics company in the world, empowered by more than 2,000 talented people. Solmax is headquartered in the province of Quebec, Canada, with subsidiaries and operations across the globe. To find out more, contact infoasia@solmax.com.

Uncompromised quality

Our products are manufactured to strict international quality standards. All our products are tested and verified at our dedicated and comprehensive laboratories which maintain numerous accreditations. We offer our partners a wide scope of testing according to published standards to ensure products delivered to sites meet specified quality requirements.

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